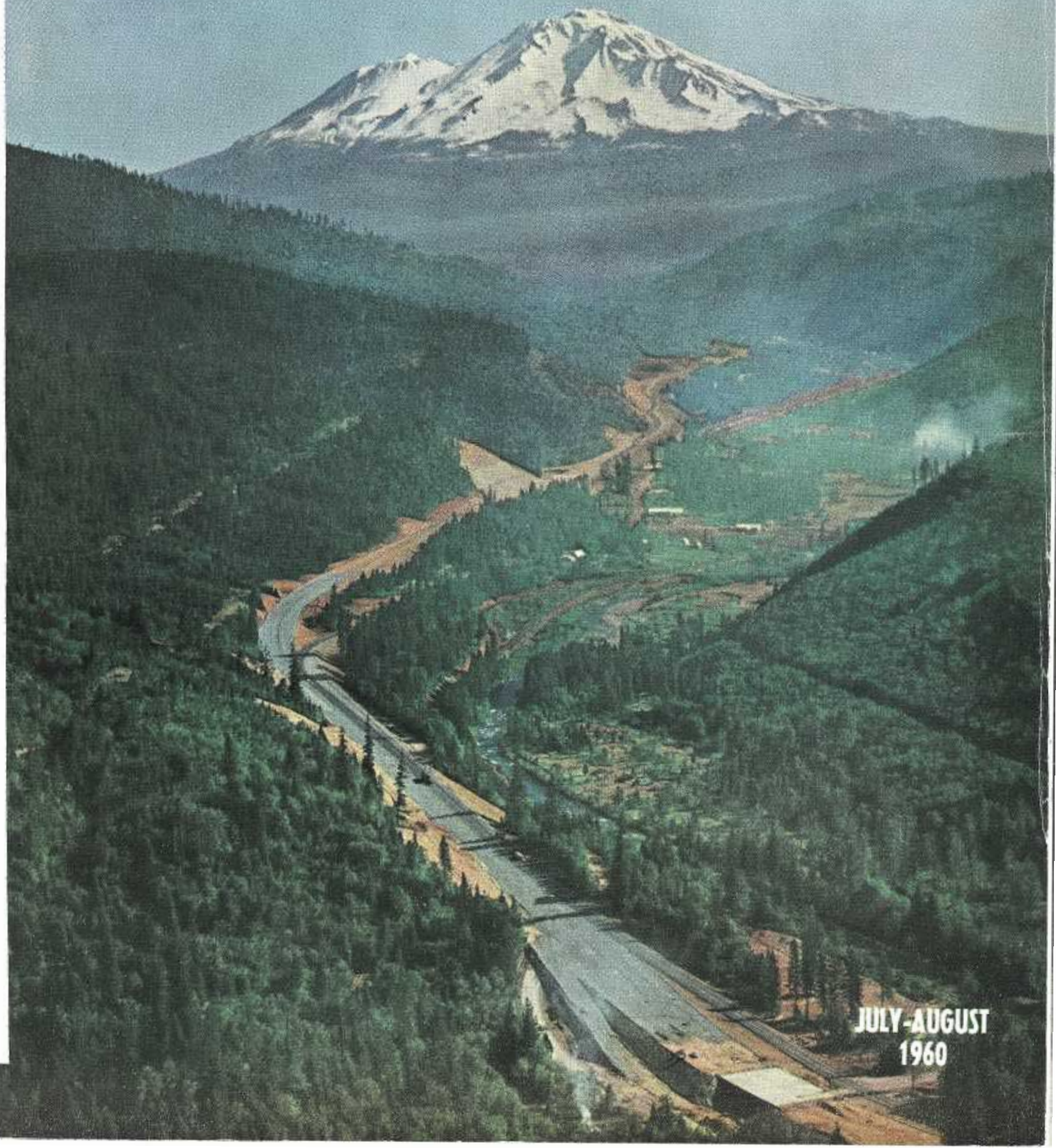
# CALIFORNIA Highways and Public Works

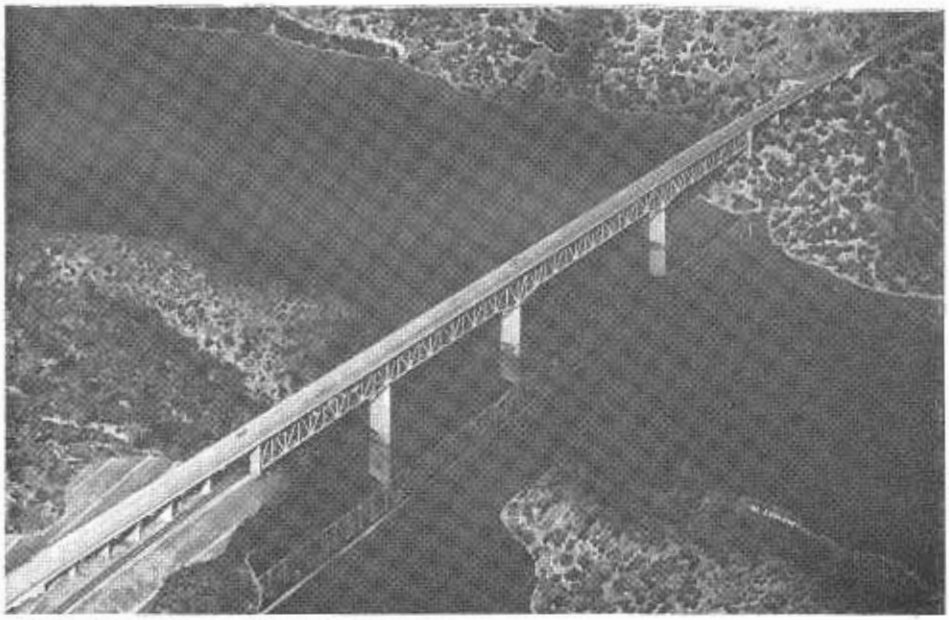


JULY-AUGUST
1960

# Highways, Water and Planning

By ROBERT B. BRADFORD, Director of Public Works

From the very beginnings, California's system of major vehicular transportation arteries has been developed on the basis of sound long-range engineering planning on a statewide scale. This planning process has started with the Legislature, which has authorized the studies. It has continued with the work of eminently qualified engineers. And it has subsequently, after explanation, discussion and review, been translated by the Legislature into action.



*Artist's drawing of the combination railroad-highway bridge on U.S. Highway Alternate 40 across the West Branch appear after completion of the proposed Oroville Dam. The bridge, costing an estimated $9,200,000, is now under construction, to be completed in the summer of 1962.*

The result has been a developing system of modern highways which has served as a model for many other states and which is generally conceded to be meeting the growing traffic needs of California with maximum efficiency and as rapidly as available funds permit.

The culmination of this planning process was the California Freeway and Expressway System established by the Legislature in 1959 after a two-year study. California has thus become the first state to undertake its major highway development in accordance with an integrated master plan looking 20 years ahead and providing for updating and revision as needed.

The philosophy that is working so well for our highway development should certainly be practical in dealing with another principal byproduct of California's fantastic population growth—the water problem.

The studies leading to the development of the California Water Plan were undertaken several years ago, while the State's water resources agency was still a division of the Department of Public Works. These studies have been characterized by the same combination of practical engineering analysis and bold imaginative foresight as our highway planning. They represent the consensus of the best available professional thinking as to how best to meet California's increasingly critical water needs.

But in the case of the California Water Plan the Legislature cannot carry the whole burden of official action. It is necessary to submit the plan to the people of the State as a whole, since a general obligation bond issue is involved. Incidentally, the amount of the bond issue may appear large from some points of view, but it amounts only to about three years' expenditure on the State Highway System.

There are other parallels between the water program and the highway program beyond the fact that failure to plan and execute either program effectively could cripple the economy of the State.

One parallel is that in neither case can all the detailed answers be known in advance. Because we went ahead with our highway program, we have spent 15 years in constantly improving our freeways and other highways as we have built—the modern freeway is certainly better from the standpoints of safety, capacity and efficiency than the ones we envisioned 15 years ago. We have been able to give the public consistently more highway for its tax dollar.

In the case of the water plan, all details have not been and cannot be fully worked out ahead of time. But that is no reason to delay the start of a necessarily long-term construction program to meet the needs which are confronting us right now. We have the same high quality of engineering and administrative talent in our water agency as we do in our highway agency. It can be relied on to give us the most water for our money.

The lack of detailed answers right now is naturally the basis for controversy about some aspects of the water program. It was also the basis for controversy about the highway program at the time of the Collier-Burns legislation in 1947.

If we had postponed action on the highway program in 1947 while we waited for all the arguments to be settled, we would not have today the transportation facilities which have contributed so much to the economic growth of our State. Our economy would have been strangled by hopelessly inadequate roads.

The people of this great State might consider a present and similar opportunity facing them in the field of water.

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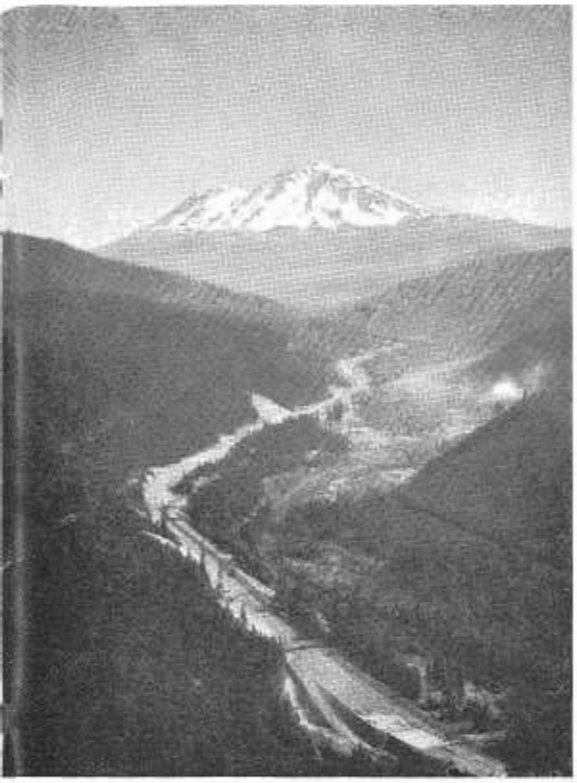

*FRONT COVER—Freeway construction on US 99 in the rugged Sacramento River Canyon looking north from Castle Crags State Park to towering Mt. Shasta in the background. The deep cut in the foreground is on Kettlebelly Ridge. The freeway passes to the left of the City of Dunsmuir which can be seen in the upper portion of the canyon. (See the article "Dunsmuir Freeway" in this issue.)* *Photo by M. R. Nickerson*

*BACK COVER—A photo of the reconstructed Mission Valley interchange which connects US 80 (upper level) with US 395 (lower level) in San Diego. The view, taken from the high ground south of the interchange, is northwestward. (See the article "US 80-395" in this issue.)* *Photo by Bill Ruland*

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# US 80–395

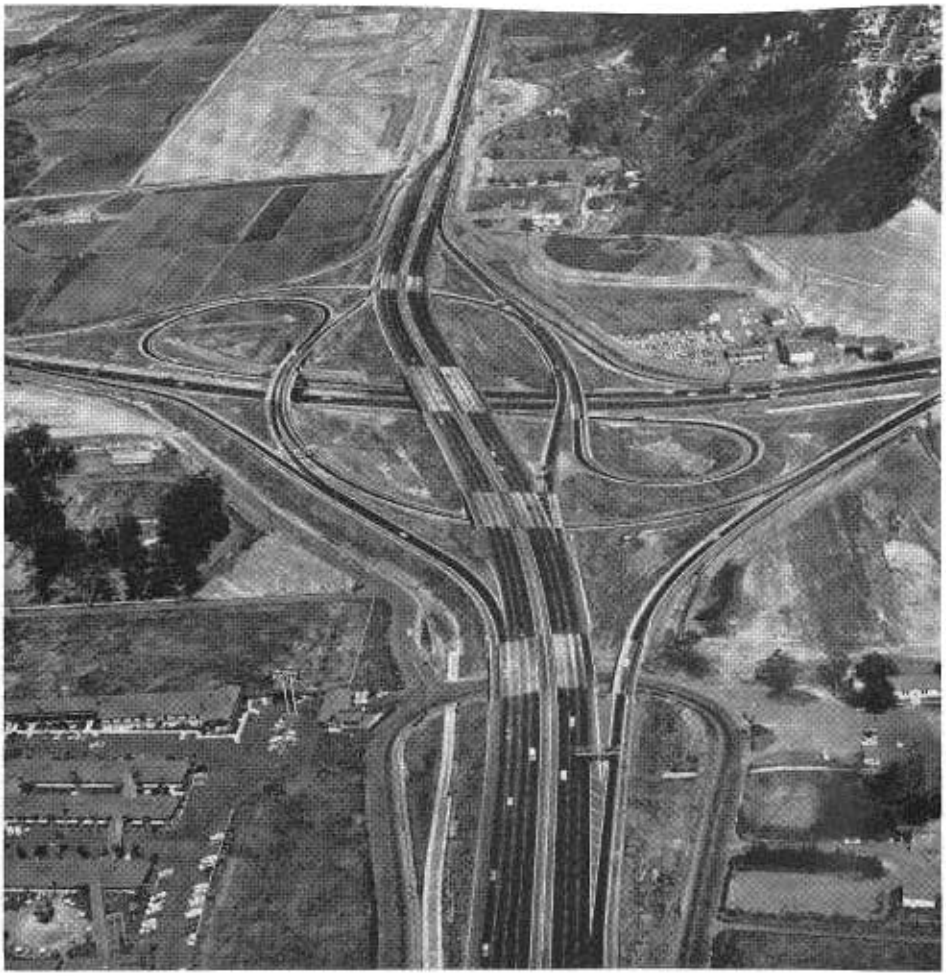
## *Mission Valley Interchange Reconstructed Under Heavy Traffic*

By J. R. CROPPER, Resident Engineer

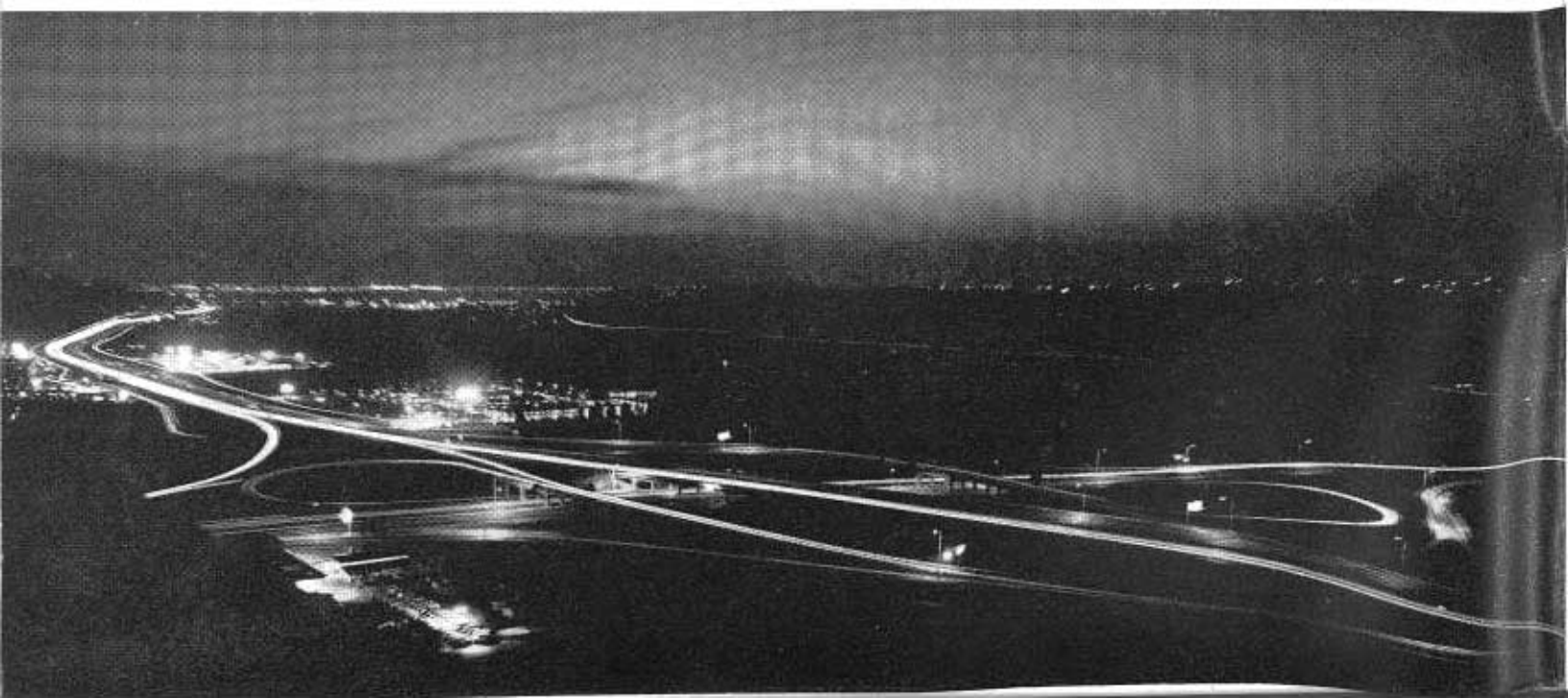

THE CONSTRUCTION of any interchange on a freeway is a difficult task, but when an existing interchange with an average daily traffic of over 90,000 vehicles has to be reconstructed under traffic and still maintain a freeway type of traffic flow through the work, the task assumes entirely different aspects.

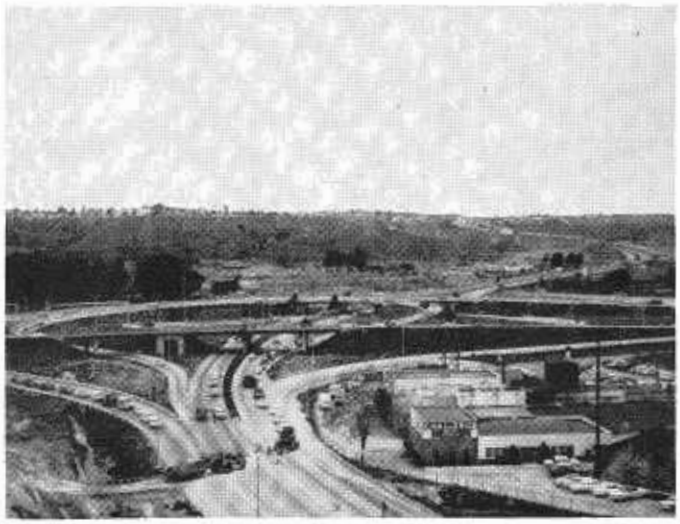
The original interchange, completed in April of 1948, was constructed as part of the Cabrillo Freeway (US 395) and separated Mission Valley Road and US 395. In June of 1953, Mission Valley Road was adopted as a portion of US 80 and a freeway resolution covering the newly adopted route was immediately passed. It was anticipated that Mission Valley Road (Now US 80) would be developed into an eight-lane freeway as soon as design could be completed and funds be made available.

The original directional interchange contained four semidirect as well as four direct connections and was designed for an hourly volume of 3,360 vehicles of mixed traffic. By 1957 the



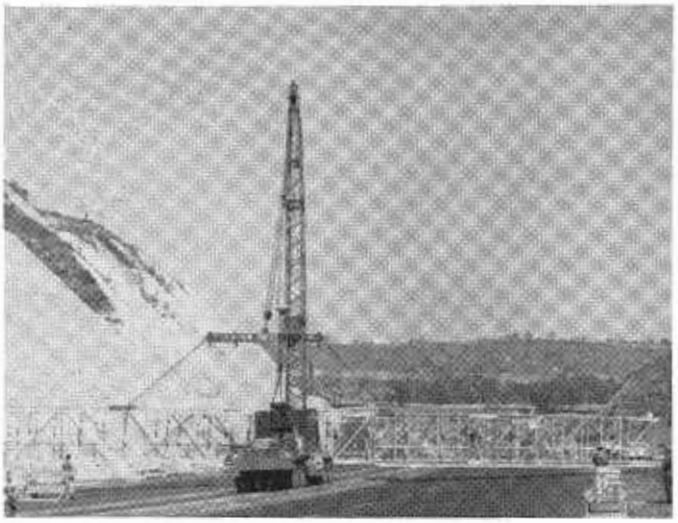
*ABOVE—An aerial view of the reconstructed US 80-395 Interchange in San Diego looking eastward along US 80. BELOW—A photo of the US 80-395 Interchange taken at night. The view is westward.*



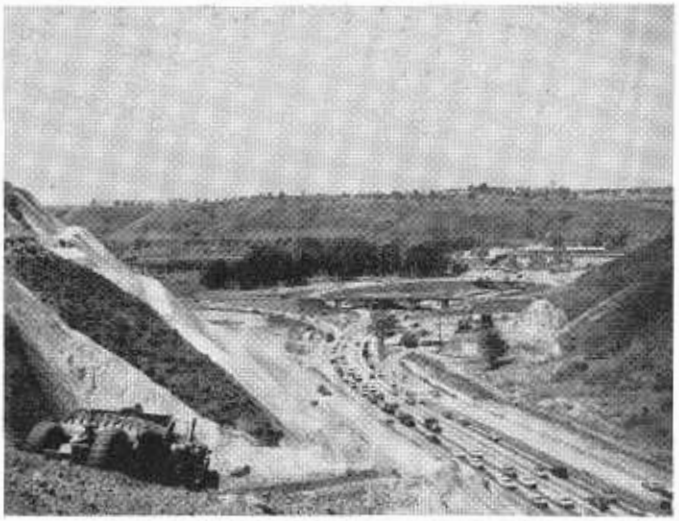


*This photo taken during the reconstruction of the US 80-395 Interchange shows equipment crossing US 80 under traffic control.*

*A view of the construction area looking south along US 395 showing more equipment being taken across the roadway under traffic control.*



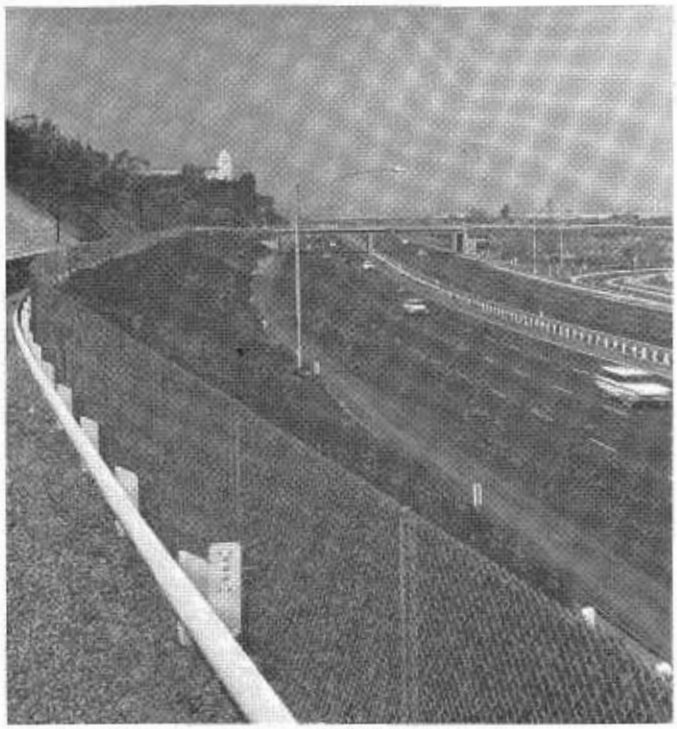
*A crane erects a huge sign bridge that will span the US 395 roadway in the interchange area.*



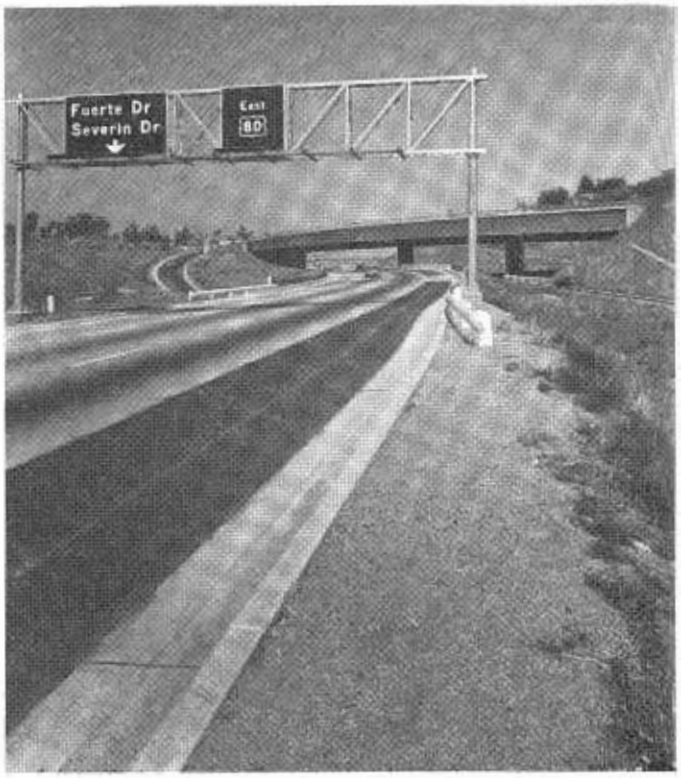
*This northward view along US 395 shows heavy grading adjacent to the traffic lanes.*

*A photo showing typical traffic density during the construction of the US 80-395 Interchange.*

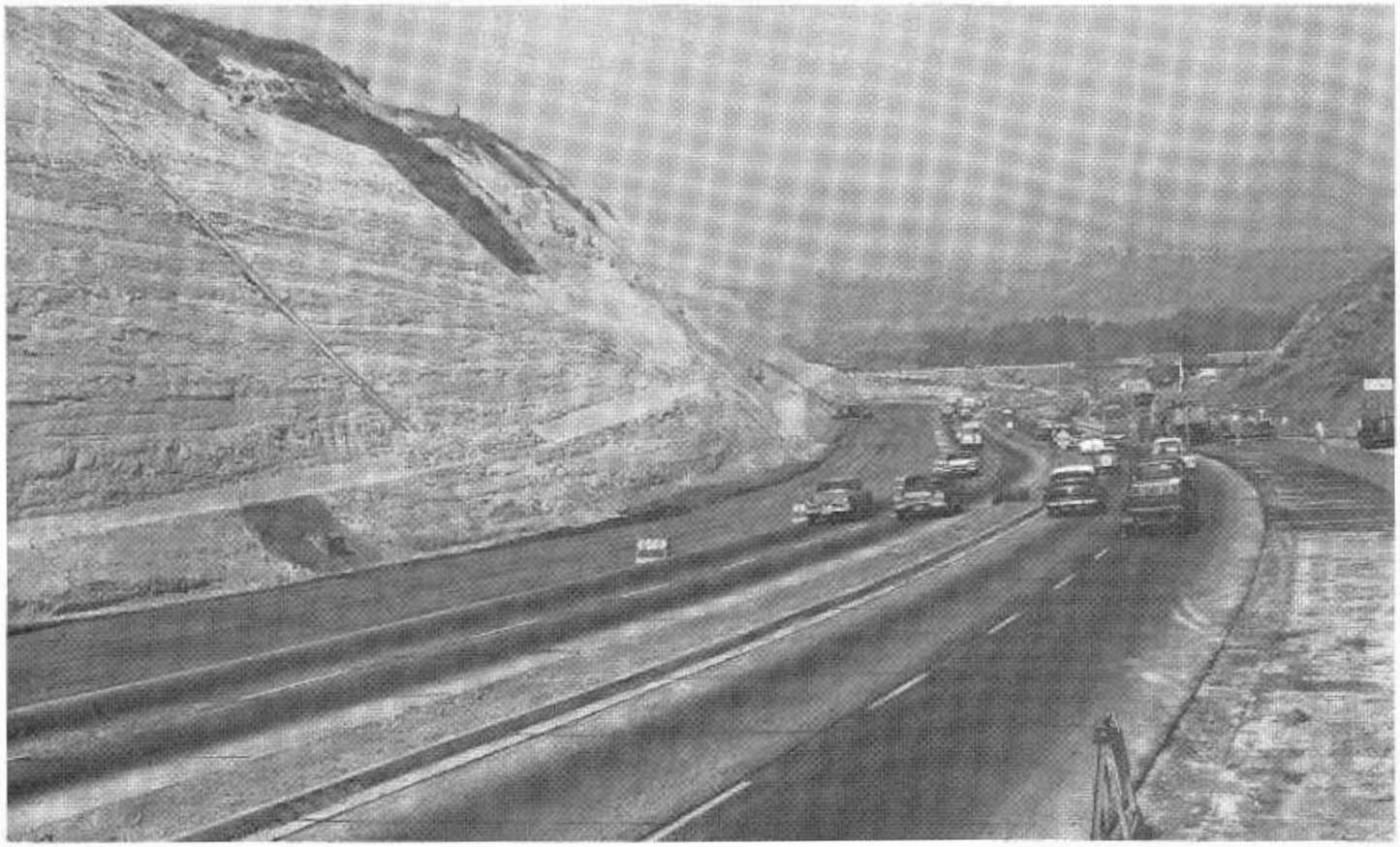
*A southward view during the construction of the interchange showing completed bench cuts in the background.*



*This westward view shows the recently completed section of US 80 west of the US 395 Interchange. The white building in the distance is the Serra Museum. Separation structure in the foreground is the Presidio Park Overcrossing.*




*A section of Sign Route 67 in the Grossmont Summit section just south of US 80.*



*Looking north along US 395 during reconstruction showing concrete base operations adjacent to traffic.*

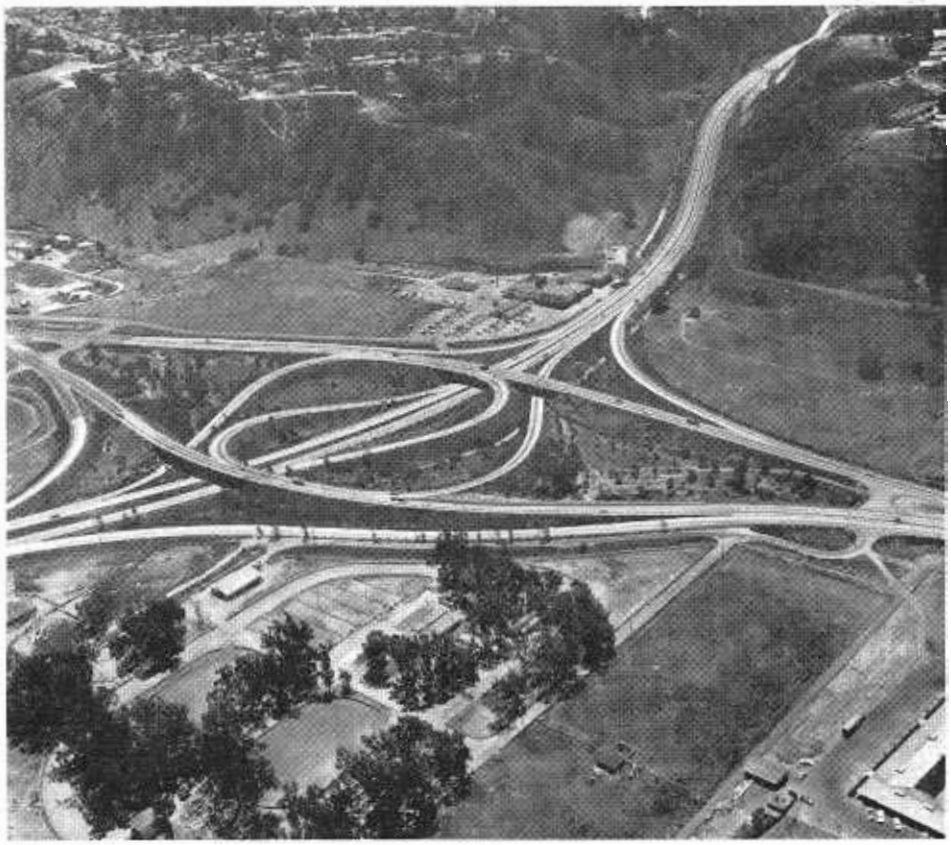
actual counts had increased to 4,400 vehicles at peak hours.

#### Interchange Contract Awarded

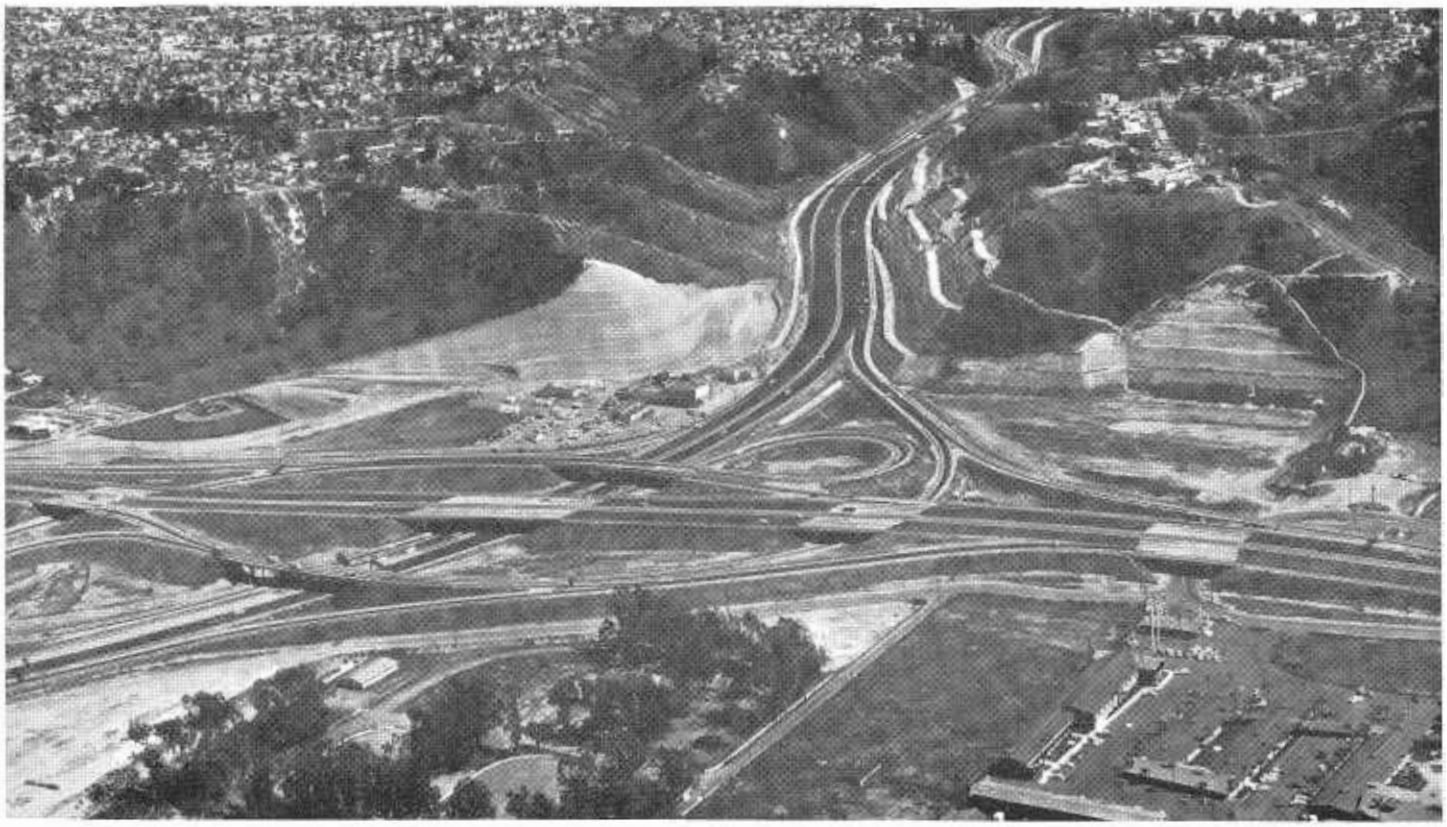
On November 20, 1957, a contract was awarded to the Griffith Company of Los Angeles for reconstructing the existing Mission Valley interchange at the junction of US 80 and US 395. All lanes and ramps of the completed project were opened to traffic in October 1959.

The work of reconstructing the original interchange involved grading and paving one six-lane freeway and one eight-lane freeway, constructing five bridges, partially removing and reconstructing two bridges, widening one bridge, and constructing and removing one temporary bridge.

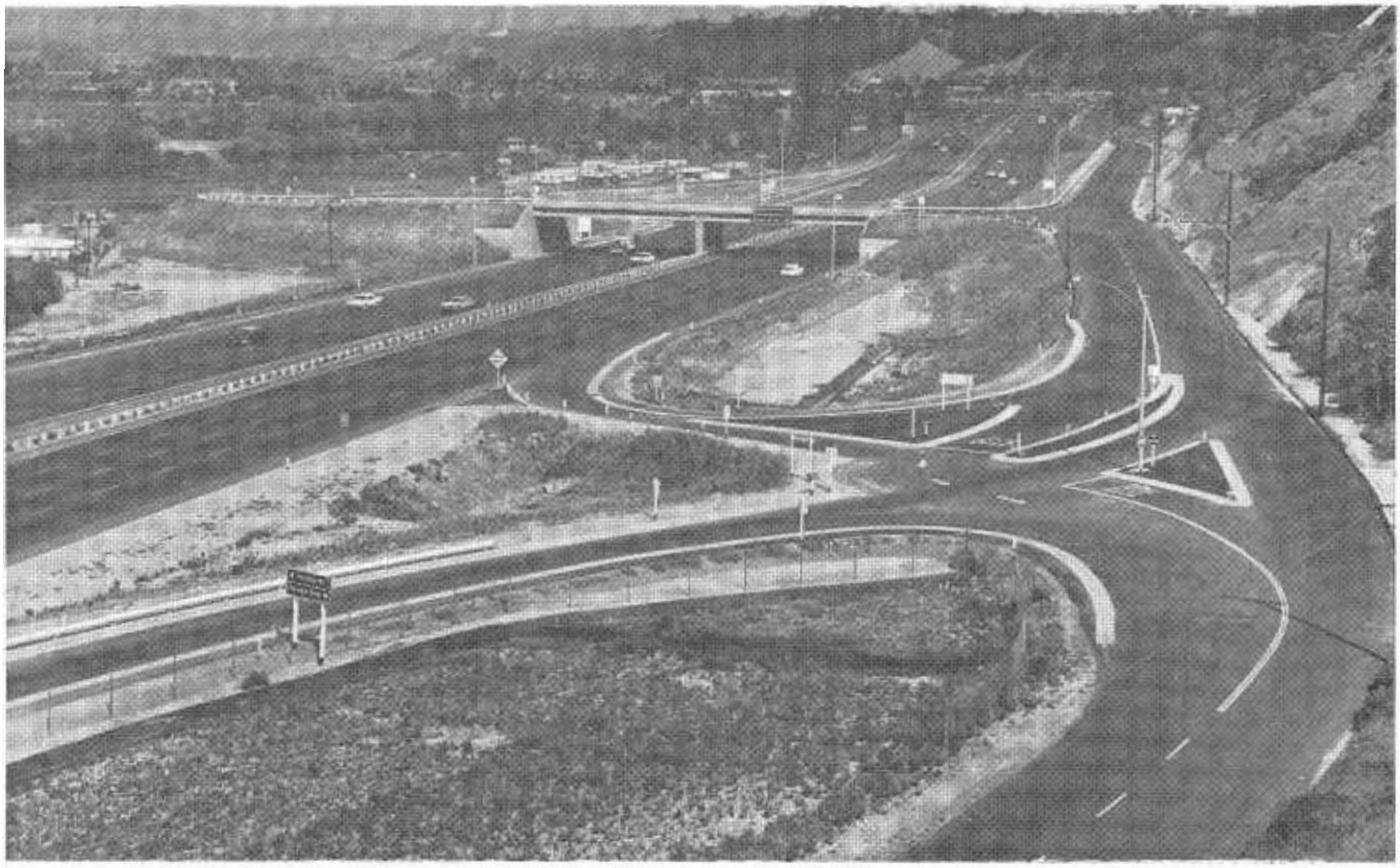
In order to keep a smooth flow of freeway traffic through the area, the work schedule was set up in four stages with two to three phases in each stage and 4 to 15 operations in each phase. Included in these various stages and phases was the construction and removal of 18 detours. These detours were constructed to high struc-



*An aerial of the old US 80-395 Interchange before start of construction. The view is southwest.*



*An aerial view of the new US 80-395 Interchange looking south along US 395.*



*Another photo of the new section of US 80. The view is eastward toward the US 395 Interchange in the background.*

tural and geometric standards because of the large traffic volumes. The main US 80/395 separation structure was constructed of prestressed concrete girders in order to prevent any inconvenience or interruption to the freeway traffic on US 395.

#### Roadway Excavation Moved

In addition to the ever-present dangers of working alongside high-speed traffic, it was necessary to move large volumes of roadway excavation across various traveled ways to new embankment areas. This was accomplished with large scrapers, which crossed the traveled ways at equipment crossings controlled by flagmen. The contractor was required to suspend all operations that would interfere with public traffic between 6 a.m. and 8.30 a.m. and 3.30 and 6 p.m., which were the peak traffic hours.

To illustrate the difficulties encountered and the degree of scheduling required by the contractor, it was necessary to distribute the placing of 14,650 cubic yards of portland cement concrete base pavement over 72 different working days. This is an average of only 200 cubic yards per day, which is only 20 percent of normal expectations for production on this type of work.

The existing lighting system of 64 street lights (or their temporary or permanent replacements) were kept in operation throughout the entire time of construction. This entailed the use of 17 temporary poles and numerous temporary services and circuits.

#### Traffic Is Detoured

One of the most difficult problems to be faced was the switching of traffic from old pavement to detours and from detours to completed work. This required precise timing between the contractor, state engineers, and the state traffic stripe painting crew. All possible signing, striping, etc., was performed before each traffic change, thus leaving only a minimum of work at the last minute. It usually proved most satisfactory to stop all traffic in the area concerned for a minute or two and make the necessary signing adjustment, then have the flagmen give oral instructions to the first few vehicles before directing them to the newly opened pavement.

Another interesting feature of the work was the installation of the 143-foot span sign bridge over nine lanes of US 395. During the period of erection, for safety reasons no vehicles could be allowed on this section of the roadway. It was also obvious that to stop traffic a few hundred feet each side of the sign area for any extended length of time would create a severe traffic jam.

After consulting with the San Diego Police Department, it was decided to divert traffic to alternate routes at predetermined locations that would cause as little confusion as possible to the traveling public. With the aid of the police department's radio patrol cars, contractor's flagmen, advance notice in the newspapers and on radio and television, and special detour signing, the plan was put into operation.

# Fresno Freeway

## *Northern Extension Eliminates Last Three-lane Section on Highway 99*

By NELSON E. HUMISTON, Resident Engineer

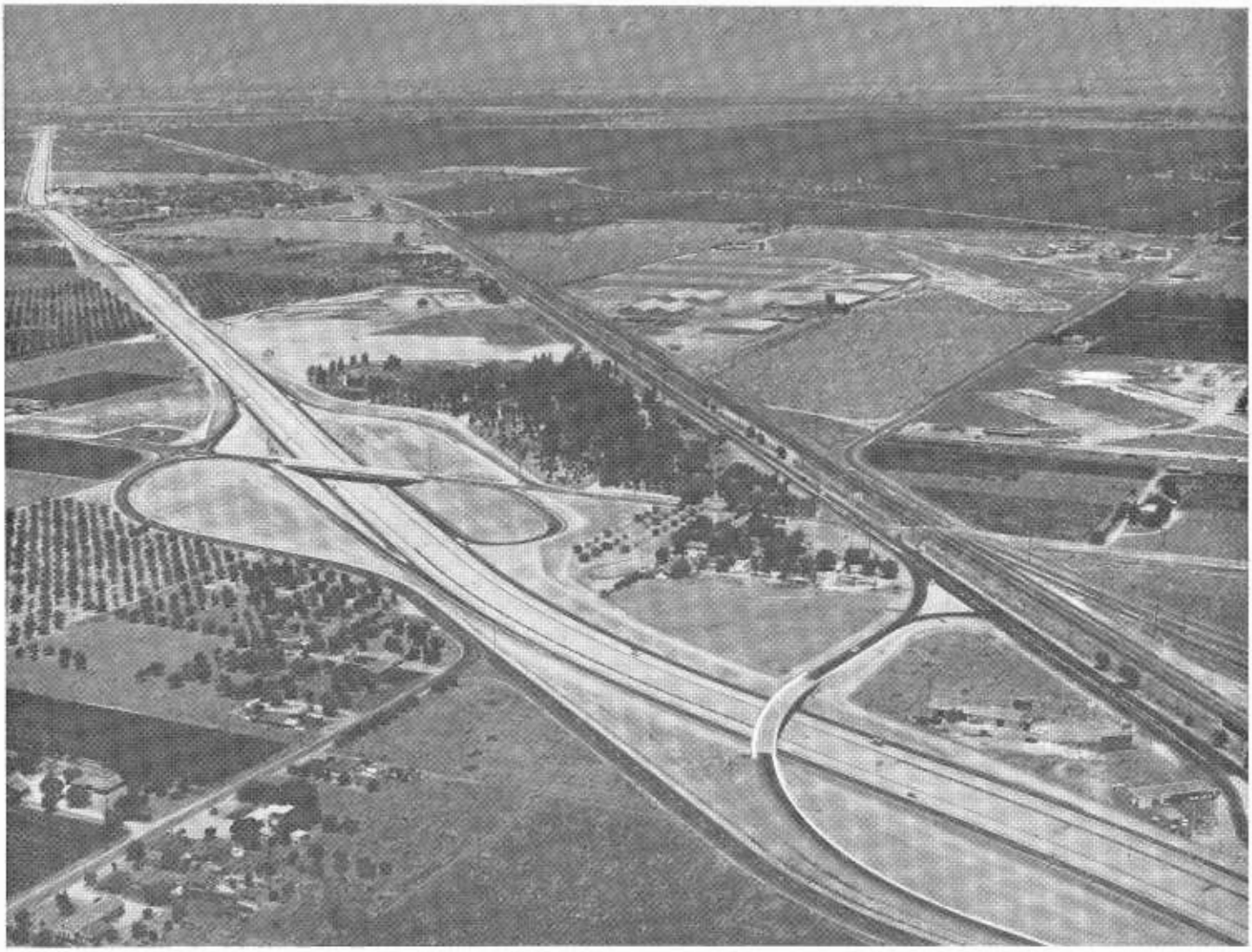

ON FRIDAY, May 13, 1960, six pretty Fresno State College coeds defied superstition to form a living barrier across the northbound lanes of the seven mile northerly extension of the Fresno Freeway between Clinton Avenue and the San Joaquin River at the Madera county line on US Highway 99.

The occasion was the dedication ceremony conducted by the Fresno City and County Chamber of Commerce, held at a site on the new route between Dakota and Ashlan Avenues.

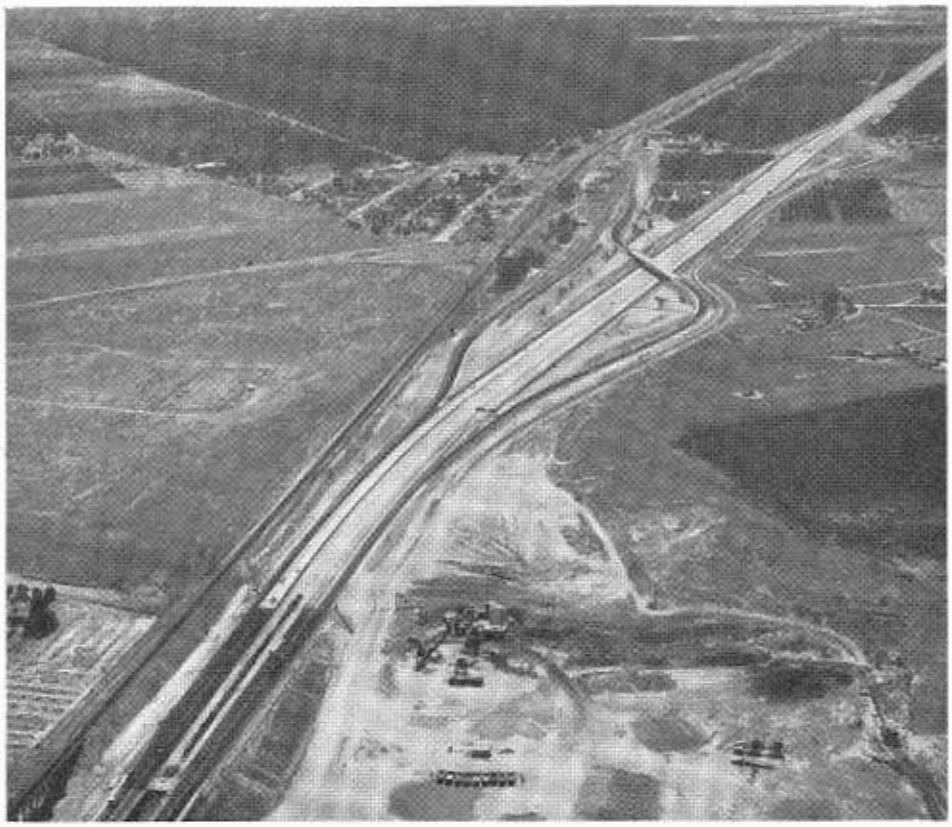
Chester H. Warlow of Fresno, vice chairman of the California Highway Commission, Assemblyman Bert DeLotto, Assemblyman Charles B. Garrigus, Supervisor Norman Foley of Fresno County, and Oliver M. Jamiesen, president of the Chamber of Commerce, were the principal speakers. Assistant Director of Public Works T. F. Bagshaw and other state and county officials also took part in the ceremony. At its conclusion the pretty barrier chain swung to one side and traffic began to pass through the project.

### Becomes County Road

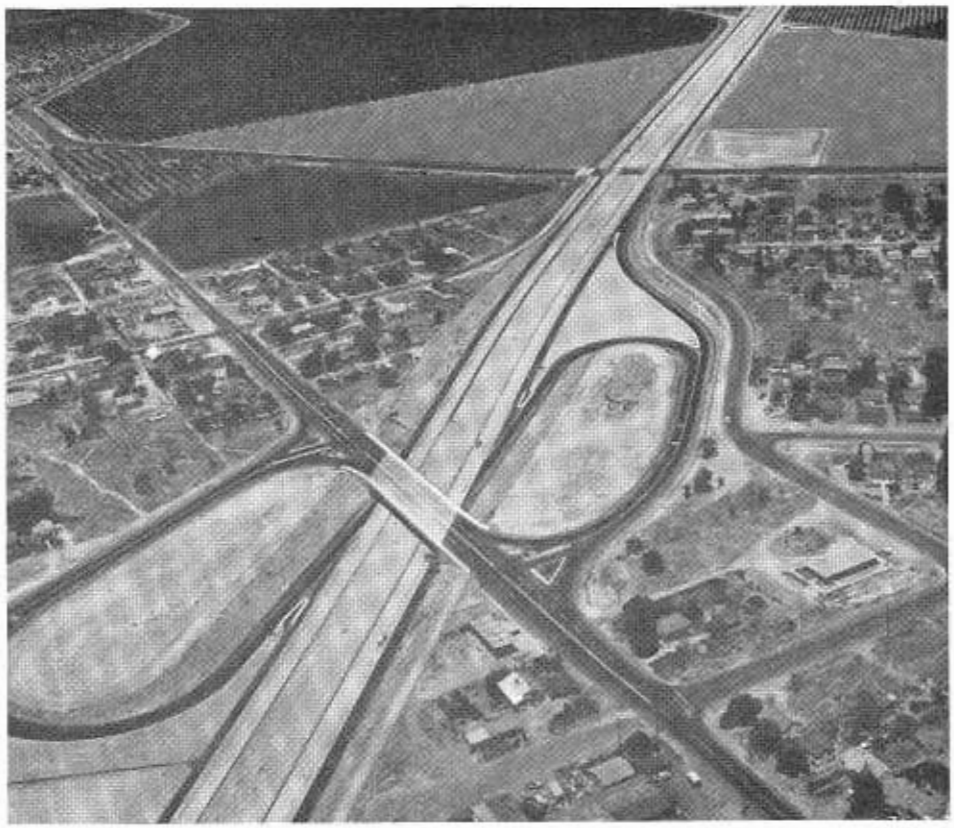
With the opening the last remaining piece of three-lane highway on US 99



*This aerial view northward shows the Tower Overcrossing and Ashlan Avenue Interchange on the new freeway section of US 99. Old highway at right.*



*This view southward shows the Herndon Avenue Overcrossing, at the north end of the project. Old highway at left.*



*Looking north along the new US 99 freeway section at Highway City. Shaw Avenue interchange in the foreground.*

in the State of California was relegated to the status of a county road.

In 1916 motorists heading north from Fresno faced a sign that read, "Motorists attention! You are on your honor. Fresno County has no speed cops. Drive so they will not be needed. Speed limits 30 miles per hour." Unfortunately since that time the numbers and behavior of the motorists traveling the route had made the sign obsolete. The three-lane highway constructed in the early 1930's had become just as obsolete.

Planning for its replacement started during World War II and a considerable amount of the necessary right-of-way at each end of the route had been purchased. Lack of construction funds caused construction to be deferred and the plans were revised to provide for a full freeway on a route some distance to the west of the existing.

#### Pipe Crossings Installed

The new route runs generally through one of the major fig producing areas of the world. So that the large fig groves could remain in operation, it was necessary to construct a considerable number of irrigation pipeline crossings. Some of these facilities were built by right-of-way contracts prior to the beginning of construction on the freeway itself. The remainder was built concurrently with construction of the freeway.

The project provided for interchanges at the three major county roads, Ashlan Avenue, Shaw Avenue and Grantland Avenue. A double overhead carries the freeway over the Biola Branch of the Southern Pacific Railroad. Braid-type overcrossings were constructed at Herndon Avenue and at Dakota Avenue to permit local traffic to have access to and from the existing highway which now serves as a frontage road lying to the east of the freeway. In addition, bridges were constructed over the Herndon Canal of the Fresno Irrigation District.

#### Flooding Safeguards

Drainage fields were constructed near the depressed areas at Ashlan and Shaw Avenues to provide storage for

*The electronically controlled and guided slip form paver in action.*

*The "monster" achieved a production rate on cement-treated subgrade of 6.4 cubic yards a minute.*

the runoff of storm waters. Eight 48-inch drain wells were constructed in the Ashlan Avenue drain field to provide additional capacity.

The major portion of the items involved in the project were constructed conventionally. The contractor requested and received permission to place concrete pavement with the slip form paver that was described in Mr. Leigh Spickelmire's article in the January-February 1960 issue of *California Highways and Public Works*. This was the first such operation in this district.

Use of this electronically controlled and guided paving machine enabled the contractor to achieve a high production rate on cement-treated subgrade since the elimination of the conventional paving header-boards enabled the cement treatment to proceed without delay due to their placing. In order to expedite this work some unusual methods and equipment were improvised.

#### Base Is Laid

Control stakes were placed left and right of the proposed edge of pavement at a uniform elevation below the plane of the pavement surface. From these stakes, "blue tops" were placed by the contractor to closely control his subgrade construction. After construction of the dirt subgrade an initial 4" x 24' layer of untreated rock base was placed and compacted. Upon this surface, an 8⅔ cubic foot per lineal foot windrow of untreated base was spread using a shop modified spreader box. The volume of material placed was very closely controlled by weight based on the in-place weights determined from the preceding layer. The windrow of material was placed as far in advance as the capacity of the plant would permit.

Immediately prior to mixing, a distributor truck deposited cement on top of the rock. The windrow was then mixed with a shop-built mixer affectionately dubbed "Monster."

The "Monster" was constructed by the contractor in his shop from parts salvaged from many other construction machines. The chassis was 11 feet wide and 25 feet long and was mounted on three axles. The front axle came from a self-propelled crane carrier and the others were salvaged from Mack dump trucks.

#### Hydraulic Elevator

The front of the machine consisted of a hydraulically controlled bucket elevator which picked up the entire windrow of material and discharged it onto an enclosed belt conveyor that in turn fed the material to the pugmill.

The pugmill mixer was a double-shafted unit 7 feet wide and 10 feet long. It was provided with twin tubular mixer shafts rotating at 78 rpm. Two diesel engines were mounted to supply the necessary power. One motor powered the elevator and drove the mixer down the road; the other drove the belt conveyor and the pugmill.

After mixing, the processed material was deposited on the roadbed in two windrows. Three motor graders then handled the final spreading of the material. No segregation of any extent resulted from the use of this method. Two pneumatic rollers and a 12-ton three-wheeled steel roller provided compaction. Final trimming of the subgrade was performed by a motor grader equipped with an electronically controlled mold board. The compacted material was trimmed to the tops of the "blue tops." Profile index runs on the subgrade so constructed indicated a profile index of less than 10 inches per mile.

The contractor on the project was Griffith Company of Los Angeles. Mr. Hal McGregor and Mr. Ernie Arant were project superintendents for the contractor. The work was performed under the supervision of District Engineer W. L. Welch. Mr. J. M. McDowell was Construction Engineer. Final construction cost was $3,325,000.

# San Jose Freeways

*Major Interchange, Other Jobs Described*

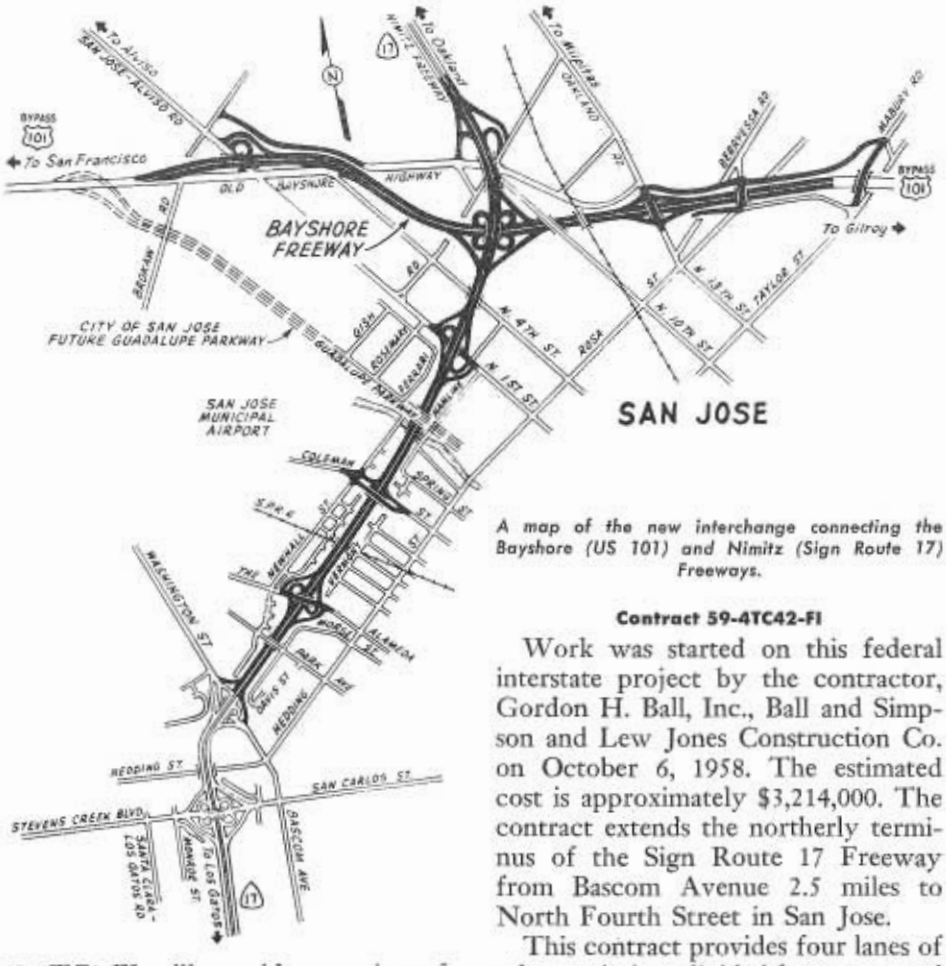
By HAIG AYANIAN, Assistant District Engineer—Construction


THE SAN JOSE area of Santa Clara County is demonstrating an explosive growth. Subdivisions are replacing the orchards of prunes and apricots at a bewildering rate. The traffic generated by such growth has created enormous headaches for local governments in this area much as it has in many other areas of California. This condition has been aggravated by the addition of through traffic heading for the hinterlands or the beach.

The days of sluggish and tortured traffic along the old San Jose-Los Gatos Road are gone, much to the gratification of Bay area motorists. No longer must they endure a two-lane highway, cluttered by numerous fruit stands, crossed by a myriad of country and residential streets, and jammed by a seemingly unending stream of vehicles. Bay area motorists bound for the popular summer resort of Santa Cruz can now travel unimpeded through the San Jose area.

The last link in the 75-mile Sign Route 17 Freeway between Oakland and Los Gatos was provided on June 21, 1960, by the opening of Contract IV-59-4TC42-FI from Bascom Avenue to North Fourth Street in San Jose together with the simultaneous opening of a portion of Contract IV-60-4TC2-FI from North Fourth Street to a connection with the Nimitz Freeway at Bayshore Highway (US 101 Bypass). These and previously completed projects, totaling approximately $15,000,000 excluding rights-of-way, provide freeway connections through San Jose to south of Los Gatos.

In addition to the newly opened leg of SSR 17, the September completion of the remainder of Contract IV-60-4TC2-FI will provide a section of Bayshore Freeway on new alignment through San Jose with a cloverleaf interchange at the intersection of the Nimitz and Bayshore Freeways.




*A map of the new interchange connecting the Bayshore (US 101) and Nimitz (Sign Route 17) Freeways.*

Between this project and the $3,465,000 Contract IV-60-4TC1-FP, completed in May from the San Mateo county line to Stierlin Road in Mountain View, two contracts have recently been awarded which will complete Bayshore Freeway from San Francisco to San Jose. These two projects, Contract IV-60-4TC71-F and Contract 61-4TC10-FP, will cost approximately $10,000,000 and will cover a total length of 11.9 miles between Stierlin Road and Brokaw Road.

A more detailed review of these recent and current projects follows:

**Contract 59-4TC42-FI**

Work was started on this federal interstate project by the contractor, Gordon H. Ball, Inc., Ball and Simpson and Lew Jones Construction Co. on October 6, 1958. The estimated cost is approximately $3,214,000. The contract extends the northerly terminus of the Sign Route 17 Freeway from Bascom Avenue 2.5 miles to North Fourth Street in San Jose.

This contract provides four lanes of a future six-lane divided freeway paved with portland cement concrete and includes seven major structures, with frontage roads and ramps. These structures are: the Park Avenue overcrossing, a reinforced concrete box girder with a length of about 159 feet; the Guadalupe Parkway overcrossing, consisting of two parallel bridges, each about 182 feet long and constructed of welded steel girder spans; the Guadalupe River bridge, consisting of two parallel bridges approximately 205 feet long, also constructed of welded steel girders and a concrete deck; the US 101 (El Camino Real) separation, a reinforced concrete box-girder bridge about 200 feet long; the Laurel Street overhead, a pair of parallel, precast, prestressed and reinforced con-

crete girder bridges each consisting of three spans totaling about 208 feet; the Coleman Street overcrossing, a single reinforced concrete girder bridge approximately 288 feet long; and the North First Street undercrossing consisting of two parallel welded steel girder bridges each about 172 feet long.

All these structures are founded on concrete piles. At two of them, pumping plants were constructed to provide drainage for the depressed sections.

The general route of this project traverses a cross section of the City of San Jose. Portions of it pass through residential, agricultural and industrial areas. Part of the freeway which is depressed below the surrounding area, exposed an underlying stratum of a highly plastic clay. It was necessary to overexcavate this clay in order to provide a suitable base for the roadbed. Construction problems were further aggravated by the fact that this region has been sinking over a period of years, presumably due to the lowering of the water table by intensified pumping for irrigation purposes.

The contractor was represented on the job by Superintendent Hadley E. Bacon and the State by Resident Engineer W. S. Smith and Bridge Department Representative P. N. Olson.

#### Contract 60-4TC2-FI

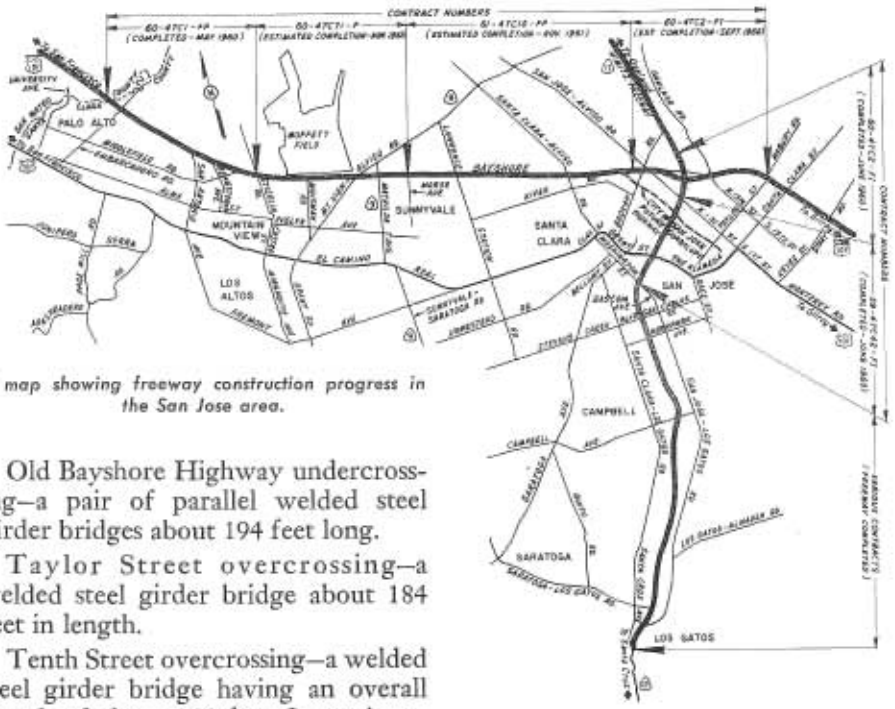
The same contractor was the successful low bidder and started work on February 9, 1959. The cost of this 4.1-mile project will be approximately $4,350,000. The contract provides in general for a four-lane, ultimate six-lane, freeway with nine major structures. The freeway consists of concrete pavement with necessary ramps and frontage roads.

The major structures are as follows:

North First Street undercrossing—a pair of similar parallel welded steel girder bridges with an overall length of about 214 feet.

North Fourth Street undercrossing—a pair of welded steel girder bridges, each with an over-all length of about 135 feet.

Sign Route 17/Bayshore Freeway separation—a pair of similar parallel welded steel girder bridges each having an overall length of about 197 feet.




*A map showing freeway construction progress in the San Jose area.*

Old Bayshore Highway undercrossing—a pair of parallel welded steel girder bridges about 194 feet long.

Taylor Street overcrossing—a welded steel girder bridge about 184 feet in length.

Tenth Street overcrossing—a welded steel girder bridge having an overall length of about 244 feet. In conjunction with this structure a pumping plant was constructed to provide for the drainage of the depressed section of freeway in this area.

North San Jose underpass—a riveted structural steel girder bridge of two spans, each having a length of about 59 feet, carrying the Southern Pacific railroad lines over the freeway.

Oakland Road/Bayshore Freeway separation—a welded steel girder bridge with an overall length of about 188 feet.

Berryessa Road overcrossing—a welded steel girder-type bridge having an overall length of about 185 feet.

In conjunction with the construction of the depressed section of the Bayshore Freeway on this contract, it was necessary to make extensive use of temporary detours in order to handle the existing traffic with as little inconvenience as possible.

The plastic stratum mentioned previously was encountered to an even greater degree in this area, and an extra foot of subbase material was placed.

The Berryessa spur of the Southern Pacific railroad was completely relocated as a part of this project to eliminate several grade crossings. The State's contractor graded the roadbed and the tracks were laid by Southern Pacific forces.

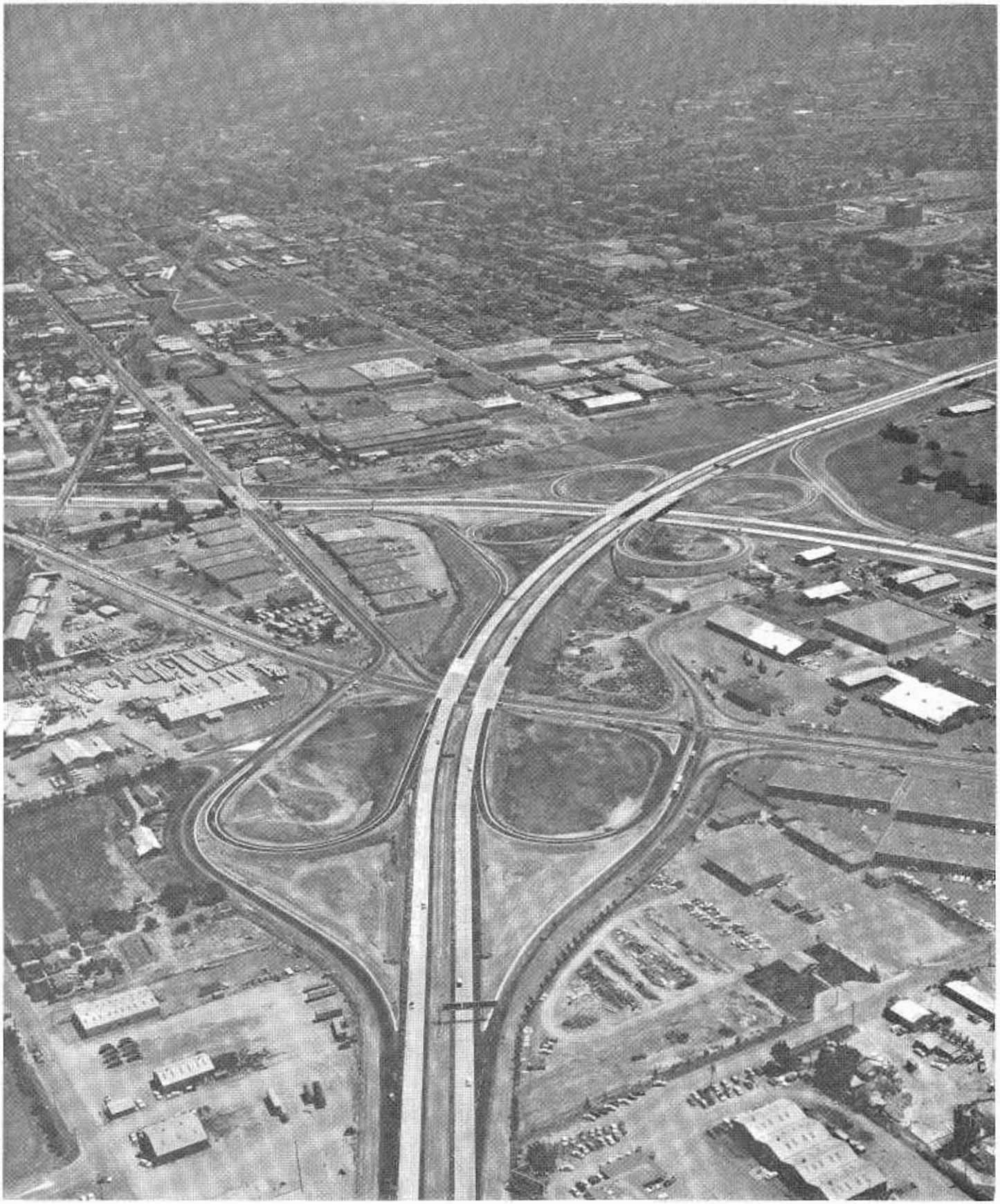
The concrete pavement work on both of these contracts was performed by the same crew as one project. This was done by means of a slipform paver, the first use of this equipment in District IV. Details of this slipform paver have been discussed previously in other issues of this magazine.

Hadley E. Bacon also represented the contractor on this project. L. A. Anderson was the State's resident engineer for the greater portion of the contract and the Bridge Department representative was M. H. Jacobs.

#### Contract 60-4TC71-F

Recently awarded Contract 60-4TC71-F will carry the Bayshore Freeway from Stierlin Road to Morse Avenue, a length of 5.9 miles. The work includes the construction of three new lanes of concrete pavement paralleling the existing highway and carrying the traffic eastward toward San Jose. The existing lanes will be resurfaced to carry traffic to San Francisco on three lanes and an additional future lane each way will be provided for. There are six major structures, including the Sign Route 9 separation.

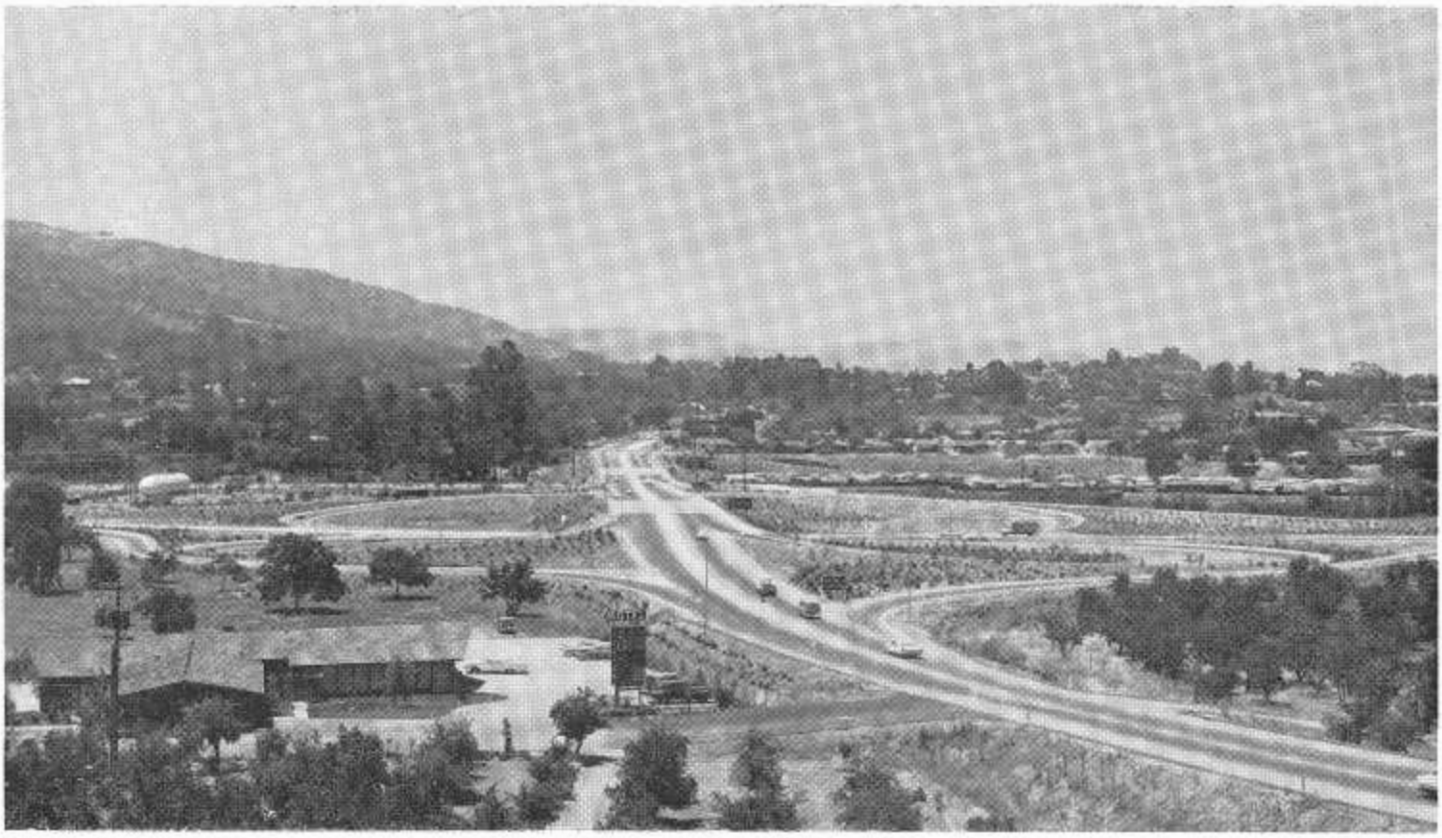
This project is along the Moffett Field Naval Air Station and will entail



*An aerial of the new Bayshore-Nimitz Freeways interchange in San Jose. The view is southward along the Nimitz Freeway (Sign Route 17). The old Bayshore Freeway (US 101 Bypass) crosses the photo nearest the camera. Beyond is the new Bayshore Freeway completed as part of the interchange construction.*

*Looking westward on US 101 (Bayshore Freeway) toward the new interchange with the Nimitz Freeway (left background).*

*Looking north on Sign Route 17 (Nimitz Freeway) with the Bascom Avenue-Washington Street Interchange in the foreground.*



*A westward view of the Sign Route 17 Interchange in Los Gatos. Sign Route 17 extends horizontally across the middle of the photo passing under the separation structure at the center.*

the relocation of many of the Navy's facilities. A major item is the relocation of the Southern Pacific and U.S. Navy rail facilities which serve the air station. Approximately 4,500 feet of track will be required for relocating a portion of the spur. The Navy has given the State permission to use considerable quantities of used 95-pound rail which it has in stockpile. It will thus be possible to perform track work with a minimum of interruption of rail service to the Navy station.

It is estimated that the work will cost approximately $4,150,000 and will be completed late in the fall of 1961.

The contractor, L. C. Smith & Concar Ranch & Enterprises, is represented on the project by Anthony Bruno. The resident engineer for the State is E. W. Strandberg, assisted by R. L. Vance as Bridge Department representative.

**Contract 61-4TC10-FP**

This contract, also recently awarded, entails the construction of the final link of the Bayshore Freeway between San Francisco and San Jose and extends from Morse Avenue to Brokaw Road, a length of 6.1 miles. This contract calls for the construction of a six-lane, future eight-lane freeway from Morse Avenue to the Guadalupe Parkway now under construction by the City of San Jose and planned for concurrent completion with Bayshore Freeway. Again, the existing pavement will serve as one roadway and three lanes of concrete pavement will be constructed for the other. The portion from the parkway to Brokaw Road will be four lanes with provision for six in the future. Ten major structures will be constructed to provide a full freeway. The 125 contract items are estimated to cost $5,779,000 and the estimated completion is about November 1961.

W. G. Remington is the resident engineer assigned to the contract, and M. H. Jacobs is the Bridge Department representative. The contractor is the Allen M. Campbell Company of Santa Ana.

A co-operative agreement with the Santa Clara County Water Conservation and Flood Control District provides that the State, as a part of these two projects, will realign and widen the existing Guadalupe River channel. The State will obtain all channel material in excess of that required to fill in the old channel and reconstruct dikes. This provides a considerable source of the necessary borrow required for the roadway embankments.

The special provisions for both of the last two contracts allow the use of slip-form paving. It is anticipated that this method will be used and will involve the placing of different slab thicknesses. The two outer lanes of each roadway are designed to be 9″ in thickness and the other is 8″. The method of slip-form paving chosen by the contractor will be of considerable interest.

The completed contracts on S.S.R. 17 have been or are currently being landscaped. Oleanders in the median will provide an aesthetic and effective screen against headlight glare. The areas outside the shoulders and interchange areas will be further beautified with redwoods and other trees, shrubs and ground cover.

## Planting Pleases City

CITY OF MENLO PARK
Menlo Park, California
San Mateo County
July 15, 1960

Mr. J. P. Sinclair
Asst. State Highway Engineer
P.O. Box 3366, Rincon Annex
San Francisco 19, California

Dear Mr. Sinclair:

The City Council has asked me to express its appreciation of the attractive landscaping of the Bayshore Freeway—Willow Road Interchange area. We had been advised that the project would be an excellent one, and it has certainly turned out as predicted.

The city is interested in planting the areas on both sides of the frontage roads and will soon submit plans for your landscape division's approval.

Very truly yours,

JOHN R. JOHNSON
City Manager

## Freeway Planner B. W. Booker Dies

B. W. (Barney) Booker, who as Assistant State Highway Engineer in District IV was in a large measure responsible for the concept and construction of the highway and freeway system in the San Francisco Bay area, died July 18. He had retired in May 1959. He was 68 years old.

To the time of his retirement Booker had served 28 years with the Division of Highways, the last seven of which were as Assistant State Highway Engineer in charge of District IV. During those seven years of his administration highway improvements costing many millions of dollars were effected.

These included completion of the James Lick Memorial and Bayshore Freeways from the San Francisco-Oakland Bay Bridge to Palo Alto; completion of the Nimitz Freeway between San Jose and Oakland; virtual completion of US 40 as a freeway connecting to the new parallel Carquinez Bridge, and construction on many other routes.

In all, Booker spent more than 16 years in District IV, having been appointed assistant district engineer in 1942 and promoted to district engineer in charge of operations in 1947. Five years later he became Assistant State Highway Engineer upon the retirement of the late J. H. Skeggs.

He was born in Topeka, Kansas, and came to California in 1899. He was educated in the San Francisco public schools, Polytechnic High School and the University of California.

Booker leaves his wife, Leota; a daughter, Mrs. Barbara Riffel of Stockton, Kansas; two grandchildren, and two sisters, Miss Niara Booker of Oakland and Mrs. Clara Stone of New York. A son, Lt. Robert Booker, was killed in action in World War II.

Booker made his home in Oakland.

# Dunsmuir Freeway

## *Canyon Section Poses Engineering Challenge*

By GEORGE E. BERRY, District Construction Engineer, and CHARLES R. YOUNG and MARK E. CESSNA, Resident Engineers


ON AUGUST 6, 1958, ground was broken for the Dunsmuir Freeway, the first portion of full interstate freeway to be let to contract in District II. By mid-August the contractor, McCammon Wunderlich Company and Wunderlich Contracting Company, had most of his larger operations well under way.

**EDITOR'S NOTE:**

This article describes some of the special engineering problems encountered in converting US 99 in the Sacramento River Canyon to Interstate freeway standards. It deals specifically with current construction work in the Dunsmuir-Castella area, near the Siskiyou-Shasta County line.

Other phases of the over-all Sacramento Canyon improvement between Shasta Lake and north of Dunsmuir, have been described in previous issues of this magazine, including a comprehensive background article in the May-June 1956 issue.

On June 13, 1960, the Department of Public Works awarded a $7,454,833.85 contract for the construction of six miles of freeway between Shotgun Creek and just south of Castella. This project, to be completed in 1962, will be the final link in 30 miles of continuous freeway and expressway through the Canyon on which full-scale construction was begun in 1954.

*Slide removal operations on the Dunsmuir Freeway section of US 99. The Panorama Undercrossing is in the foreground. Mount Shasta in background.*

The terrain through which this project is being built presents a challenge to construction forces. The work consists of constructing a multi-lane freeway along the steep, unstable westerly wall of the narrow Sacramento River Canyon, which in many places has a natural ground slope that is as steep as 1½ : 1.

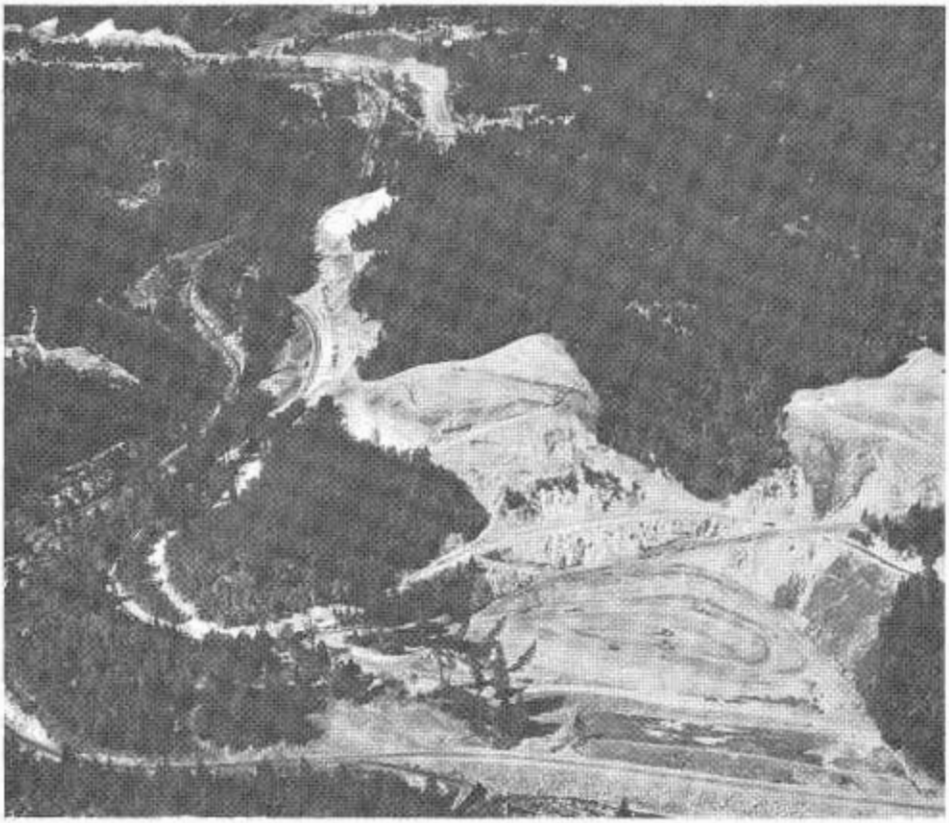
To further complicate matters the Southern Pacific Railroad is in many areas directly below the new construction; and in the case of the Dunsmuir Freeway there is an additional problem of building, for the most part, through an urban area.

As originally planned the designer envisioned the construction of two fill stabilization trenches, but as soon as the project got under way it became apparent that at least two and possibly four more of these trenches would be necessary.

A fill stabilization trench is a deep trench excavated in the original ground. This excavation is as deep as can be practicably drained. The sides and bottom are covered with a pervious gravel blanket, perforated pipe is placed to drain off the underground water, and the water is disposed of by means of an outlet trench. The trench is then backfilled with good local materials. Thus the trench forms a deep keyway of stable material to support the roadway embankment.

### Ground Unstable

In several locations on the Dunsmuir project the ground was considered too unstable even to construct embankment stabilization trenches; therefore, a relatively new method of tapping off the excess moisture was used. This method consists of installing vertical drainwells and intercepting these with horizontal drains. Where it was not



*An aerial of excavation operations on the "Big Fill." The existing highway curves through the fill area near the center of the picture; the railroad realignment is in the foreground.*

*An aerial of the "Big Cut" at the north end of Dunsmuir. The slide area still to be removed can be seen in the right foreground.*

practical to siphon off the drainwells with horizontal drains, drainwells acted as risers to siphon off the water by means of a gravel blanket. This relieved the area in question of its excess moisture, which is the largest factor in the problem of subsurface instability.

The drainwells are 30-inch-diameter vertical holes drilled to a maximum depth of 48 feet, with a 6-inch-diameter perforated metal pipe placed in the center of each hole and then backfilled with drain rock. The drainwells are located in two rows and are spaced in 10 feet, center to center.

Outlets for the drainwells were provided by drilling horizontal drains into the general area of the vertical drainwells to intercept and drain off the water.

The effectiveness of the vertical and horizontal drainage combination was checked by repeated drawdown and outflow measurements.

#### Drainage System Checked

Both the well system of drainage and the stabilization trenches were checked to see that they functioned properly in collecting subsurface waters before fill operations were started. With the relief of the excess moisture these areas have become stable enough to allow the roadway embankments to be constructed. The cost of the stabilization work is approximately $600,000 which will constitute 15 percent of the contract, a small price to pay to insure against future embankment failures.

The grading in general consisted of excavating two large cuts. The location of one of these is at Gobbler's Knob, just south of the Castle Crags Avenue Interchange at the southerly end of the project. The other is the Penthouse, or Stonehenge, cut at the north end of the project. The maximum cut at Gobbler's Knob is approximately 212 feet, and at Stonehenge the maximum cut is 360 feet to main line and another 40 feet to the northbound off-ramp.

The origin of the name Gobbler's Knob seems to be in doubt, but the name Penthouse comes from the excellent view from the top of this cut.

The many large boulders encountered in this excavation, when stacked on the main roadway in preparation for shooting, were reminiscent of the monoliths at Stonehenge on the Salisbury Plain. This cut therefore also became known as Stonehenge.

#### Slide Problem

As in all the jobs in the Sacramento River Canyon, many slides have occurred. Over 90 percent of the cuts throughout the project have slid at least once. The resulting increase in roadway excavation due to slides will be about 15 percent, that is, about 250,000 cubic yards.

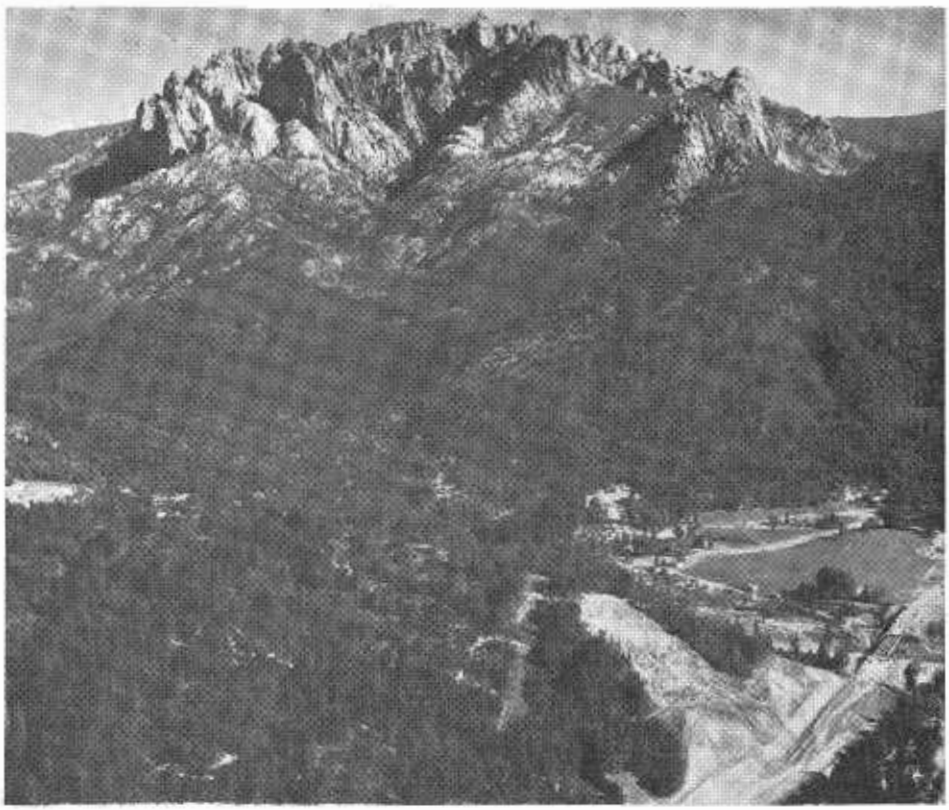
Several thousands of feet of horizontal drains have been installed in the uphill cut faces throughout the project in an attempt to arrest the problem of sliding. These have been partially successful, but generally the slides on this particular project have been the result of slip planes of serpentine clay. In these cases, it is not a problem of excess moisture but one of support. When the support is removed during grading operations down comes the cut, and the only corrective measure that can be taken is either to replace the support or to remove the slide to the slip plane. Since the highway could not be constructed if the former method were used, it has been necessary to resort to the latter.

At the present time all of the embankments have proved to be stable. This is a tribute to the previous jobs recently completed in the Sacramento River Canyon in which invaluable information was gained in the field of stabilization work in this type of terrain.

#### New Paving Method

Another feature of this project is that it is the first project to be paved with Portland Cement Concrete in District II in almost 20 years. The subcontractor for this portion of the work, Gordon Ball, anticipates that he will use a slip-form paving method, which is a relatively new method of placing concrete pavement that does away altogether with header boards, thereby reducing the contractor's staff almost to half that necessary when using conventional methods.

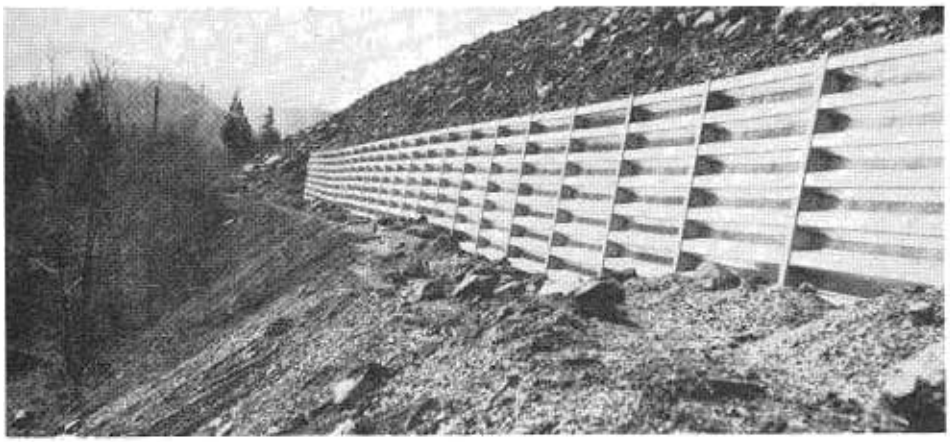
*Slide removal operations on the Castella section of the freeway, adjacent to the "Big Fill" area. View is northward.*



*Clearing operations (right foreground) on the slide at Castle Creek with Castle Crags in the background. New Castle Creek bridge, now under construction, can be seen on the right.*

*This is a photo of typical slide conditions encountered in the Sacramento River Canyon.*

*A typical horizontal drain installation. Notice the ice at the outlet. The photo was taken in January.*



*A typical bin wall installation used along this section of the freeway.*

The completed project will consist of a four-lane divided freeway constructed to interstate standards. There will be three trumpet-type interchanges to facilitate on and off traffic. In addition, three other undercrossings are being constructed which will carry local traffic under the freeway to and from town. Upon completion of this project portions of the existing highway needed to carry local traffic will be relinquished to the county.

A portion of the existing highway will be buried under approximately 40 feet of embankment. It is interesting to note that at this location where the old highway is buried under the high fill, the old road was situated 50 feet up the steep hillside above the main line of the Southern Pacific Railroad. In order that the new embankment could be constructed it was necessary to erect extensive bin walls on the old road. Since their erection some settlements have occurred due to moisture and the consolidation of the underlying strata. In order to arrest these settlements, horizontal drains were installed under the bin walls.

#### Work Nearly Completed

Owing to the unusual length of the 1958 and 1959 construction seasons for this area the contractor is ahead of schedule with approximately 76 percent of the work completed. Barring unseasonable weather the project should be finished this year.

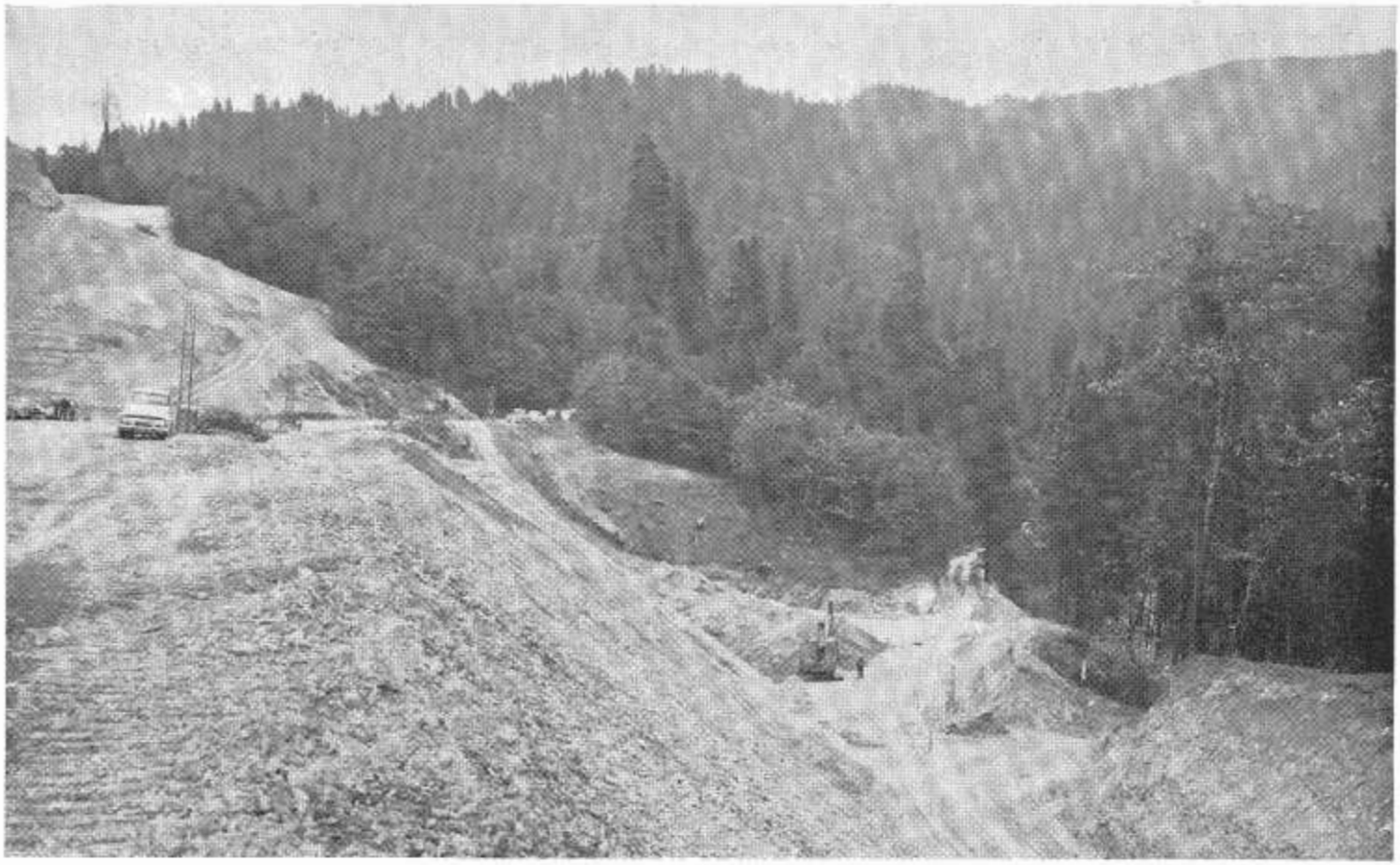
The second contract on the portion of US 99 which is being reconstructed to full freeway standards lies immediately south of the project under construction through Dunsmuir and passes through the small town of Castella and the easterly edge of the adjacent Castle Crags State Park.

North and south of Castella the narrow canyon, with its steep and unstable slopes, has hereto presented difficult problems to the road builder. Natural features did not create all of the problems, however. Where formerly there seemed to be only room for the Southern Pacific Railroad and the present two-lane highway, space had to be made for a four-lane divided roadway while keeping the other two facilities open to traffic.

The contractor, Gibbons & Reed Company, through judicious planning has been doing an excellent job. So well in fact, that during the past season 68 percent of the work was completed in 38 percent of the allotted time. This included moving over three million cubic yards of roadway excavation.

#### Construction Offers Problem

The maintaining of traffic through construction has been a problem of work scheduling and not essentially one of engineering. However, stage construction planned during the design stage of the project facilitated traffic movements with a minimum of delay. The engineering problem most bothersome was one of stability—how to construct the freeway above the present highway, above the railroad,



*A typical stabilization trench used in construction of the freeway. The outlet trench is in the center foreground.*

and above the river, and how to keep them there in that order.

Intensive studies and investigations were made by our laboratory to determine what measures would be required to stabilize the embankment foundations sufficiently to hold the heavy fills that would be necessary to construct this roadway to the required high standards of alignment and grade.

As a result of these investigations and upon laboratory recommendations of both district and headquarters, extensive systems of stabilization trenches, drainwells, and horizontal drains were constructed to obtain maximum fill support. The cost of all this hidden plumbing has averaged about $250,000 per mile over a distance of about 4⅓ miles.

Essentially all of the grading operation was completed during the past construction season. The fill stabilization treatment has apparently been very successful, as no noticeable settlement has occurred during the winter months.

**Slides Add to Excavation**

We seem to have learned how to keep the highways from sliding down the hills, but our success in keeping the hills from sliding down on the highways has not been so rewarding. Slides have added approximately 600,000 cubic yards to the total amount of excavation on this project. This is an increase of almost 25 percent over the planned roadway excavation.

To give an example of the type of terrain encountered, between Castella and Dunsmuir at one location within a centerline distance of only 1,200 feet, the highway passes from a cut section over 200 feet deep to a fill over 200 feet high and back into a cut which is approximately 250 feet deep. The "Big Fill," though only 600 feet long, contains over one million cubic yards of material. This fill has been constructed over what once was a loop in the channel of the Sacramento River. The river was diverted to another channel, of course, before the fill was constructed. This move also involved a realignment of the Southern Pacific Railroad. The depth of the deeper cut mentioned above is subject to change—it grows with each new slide. As a note of interest, during grading operations a tree standing upright was encountered in this cut approximately 40 feet below the surface of the existing ground, and the abrupt changes in the soil types encountered gave striking evidence that this was an area of old slides. This condition had previously been determined by borings, and it had been planned to stabilize the area by placing horizontal drains in the face of the cut slope and thereby tap off excess water that could cause instability. Sliding occurred before the stabilization treatment could be completed, however.

The first year of construction has seen the virtual completion of all of the grading operations. Paving will soon follow, and by the fall of this year the traveling public will be able to enjoy a few more miles of freeway driving.

# New Toll Bridge

## San Pedro-Terminal Island Structure Gets Under Way


CONSTRUCTION is expected to be fully under way this fall on the San Pedro-Terminal Island Bridge in the Los Angeles Harbor area, Southern California's first toll bridge project.

Preliminary construction work actually got under way in May, with groundbreaking ceremonies at the bridge approach site in San Pedro on May 28th.

The next step was taken by the California Toll Bridge Authority on June 6th, when it authorized the issuance of $7,000,000 in revenue bonds toward financing of the project, which is estimated to cost approximately $20,000,000 in all.

The final obstacle to advertising for bids on the bridge structure was the granting by the U.S. Navy of an easement for construction. This easement was received on June * * * and the call for bids issued promptly thereafter. Bids were scheduled to be opened on August * * * for the substructure and on August * * * for the superstructure work.

Bids were also solicited on the revenue bonds. These bids were scheduled to be opened August * * *.

The planned schedule for further construction provides for the start of approach construction in the summer of 1961, with the entire project to be opened for traffic in the summer of 1963.

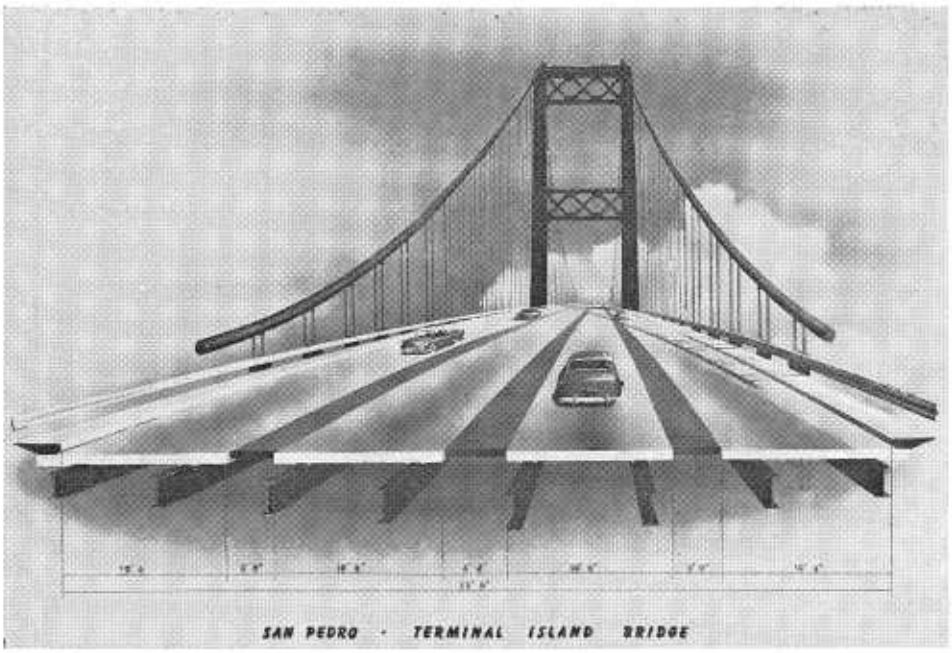
The balance of the financing, in addition to the revenue bonds which will be redeemed out of bridge tolls, includes $2,000,000 each from the City of Los Angeles and Los Angeles County shares of highway user tax funds, as provided by legislation enacted in 1958; plus an estimated $9,000,000 in state highway funds.

*This drawing superimposed on an aerial photo by a Division of Highways artist shows how the new San Pedro-Terminal Bridge will appear after completion.*

*Signalling the start of actual work on the San Pedro-Terminal Island Toll Bridge project, Governor Edmund G. Brown (left) and Assemblyman Vincent Thomas of San Pedro wield the traditional ornamented shovels at the project site on May 28. The two closest observers are (left to right) State Senator Richard Richards of Los Angeles County and Lieutenant Governor Glenn M. Anderson, who also took part in the open-air ceremonies attended by several hundred spectators.*

*Another artist's conception of the new bridge looking in the opposite direction from that on the preceding page.*

The bridge will be located near the west end of Terminal Island, slightly north of the present route of the Terminal Island ferry which it will replace. The route of the bridge and approaches was recently adopted as a freeway by the California Highway Commission. The bridge will serve as part of a connecting link, designated by the Legislature, between the Harbor and the Long Beach Freeways.




*This sketch shows the lane widths on the San Pedro-Terminal Island Bridge.*

The toll project will be about 7,400 feet long. This includes about 4,000 feet of approach structure, 900 feet of approach fill, a 1,500-foot span between the two main suspension towers, and two 500-foot side spans between the main towers and the anchorages on either side.

The bridge will have four traffic lanes. It will have 185 feet of vertical clearance above mean high water.

On the San Pedro side, the bridge approach will cross over and connect with Harbor Boulevard near Regan Street. It will also connect with Pacific Avenue near Front Street. Provision will also be made for a direct connection with the present southerly terminus of the Harbor Freeway at Battery Street.

On Terminal Island, where the toll plaza will be located, the project will end on the south side of Seaside Avenue near Mormon Street.

# US 101—Trinidad

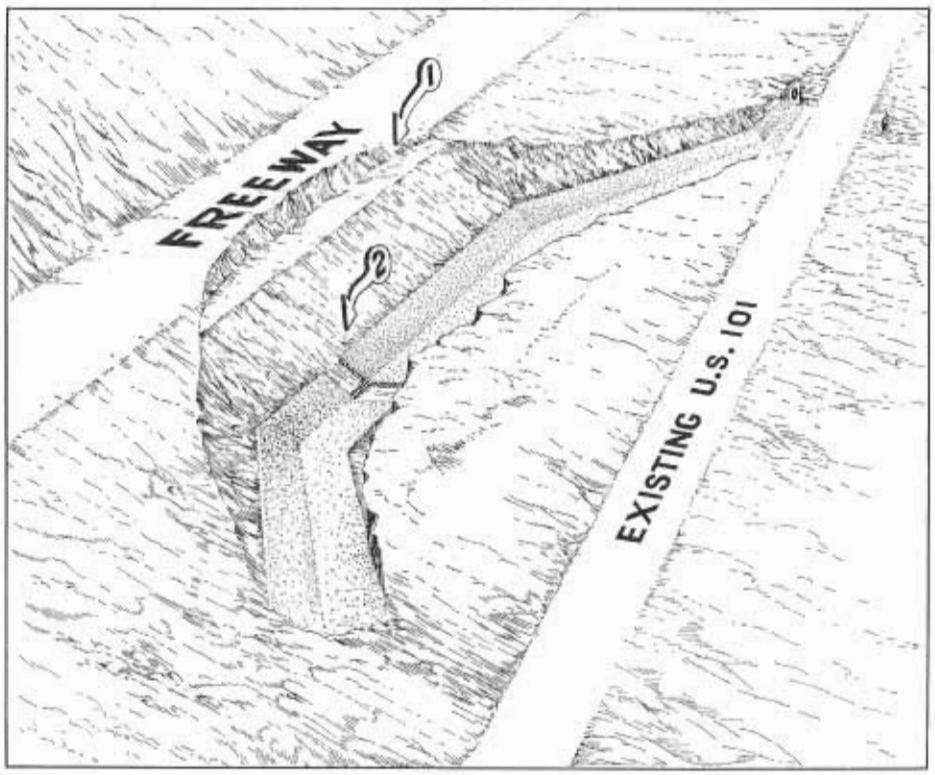
## *Drainage, Slipouts Are Problem On North Coast Freeway Job*

By R. C. WARNER, Resident Engineer


AFTER 40 YEARS, the tortuous portion of the Redwood Highway, US 101, between Little River and Trinidad in Humboldt County is being replaced by four miles of modern freeway. This new freeway is a complete relocation easterly and above the old highway. Construction work is moving into the final stages after the stabilization of a large slide which damaged three expensive homes that were within the area of movement, and the rebuilding of a major fill, all in addition to the many items of planned work. Many men and machines were used in the heavy clearing, the moving of over 1½ million cubic yards of earth, the building of three grade separations and interchange structures, three reinforced concrete arch culverts and the installation of several miles of underdrain pipe.

The construction work is being done under a single contract to John Delphia, Fred J. Early, Jr., Co. Inc., and L. A. and R. S. Crow, a joint venture. Estimated final cost of the project is $2,400,000.

The project is another link in the development of the Redwood Highway to a modern four-lane freeway. The northerly end of the project is 0.3 mile north of the City of Trinidad which is located 20 miles northerly of Eureka and overlooks the Pacific Ocean, Trinidad Bay, and Trinidad Head, a prominent coastal land mark. The name "Trinidad" resulted from a visit by early Spanish explorers during Trinity Sunday in June 1775.




*Schematic illustration of slipout and corrective treatment on US 101 freeway construction near Trinidad, Humboldt County. Arrow 1—With new roadway almost to grade a slipout occurred. Arrow 2—Underground water undetected during preliminary investigations lubricated new embankment and underlying natural ground. Material was excavated to solid substrata. Perforated metal pipe was placed at the toe of the slipout area and then a blanket of filter material.*

### Good Alignment

The relocated highway will be a full freeway with two complete interchanges and one interchange providing for two main movements. The alignment will provide for maximum allowable speeds. The roadway will be a standard four-lane 60-foot all paved section with curbed medians through interchange areas.

The portion of Redwood Highway to be superseded was built in 1921 with horse drawn wagons and scrapers and the oldtime steam shovels. The 22-foot roadway was notched out of the bluffs bordering the Pacific Ocean and is a continuing series of curves having radii as low as 70 feet, many reversing, and the remainder separated by only short lengths of straight road.

The existing road provides many wonderful views of the Pacific Ocean, but any enjoyment of the vistas by the operator of a moving vehicle is precluded by the need for continuous scrutiny of the road ahead due to curvature and the type of traffic.

This portion of the Redwood Highway probably carries more logging and lumber trucks than any other road in the State. Loads of logs or lumber are spilled regularly on two particularly sharp curves on the existing road.

On the new freeway four deep canyons are crossed on large fills after the new line leaves the beach and bluff area near the beginning of the project at the mouth of Little River. Two major fills were also constructed in the climb from the beach area. The largest fill, crossing Luffenholz Creek,

contains 260,000 cubic yards of embankment and is 90 feet deep. Luffenholz Creek is carried in a large 14-foot reinforced concrete arch culvert 396 feet long.

The first large fill in the climb from the beach has its foundation on the ocean beach at the mouth of Little River and is protected from the erosive action of the ocean by heavy stone riprap. This riprap received and passed its initial trial during the heavy seas that pounded the shore during February 1960. Some of these seas carried drift across the existing highway at two locations within the limits of the project.

#### Subsurface Water Drained

In order to build roads in this coastal area of heavy rainfall, large quantities of subsurface water must be drained away from fill areas and subgrade. On this project 25,000 lineal feet of eight-inch perforated metal pipe, 90,000 cubic yards of stripping of fill areas and 65,000 tons of filter material were involved in providing for subsurface drainage and stabilization of fill foundation.

On all large projects unexpected situations are encountered, and on this project situations of some magnitude developed.

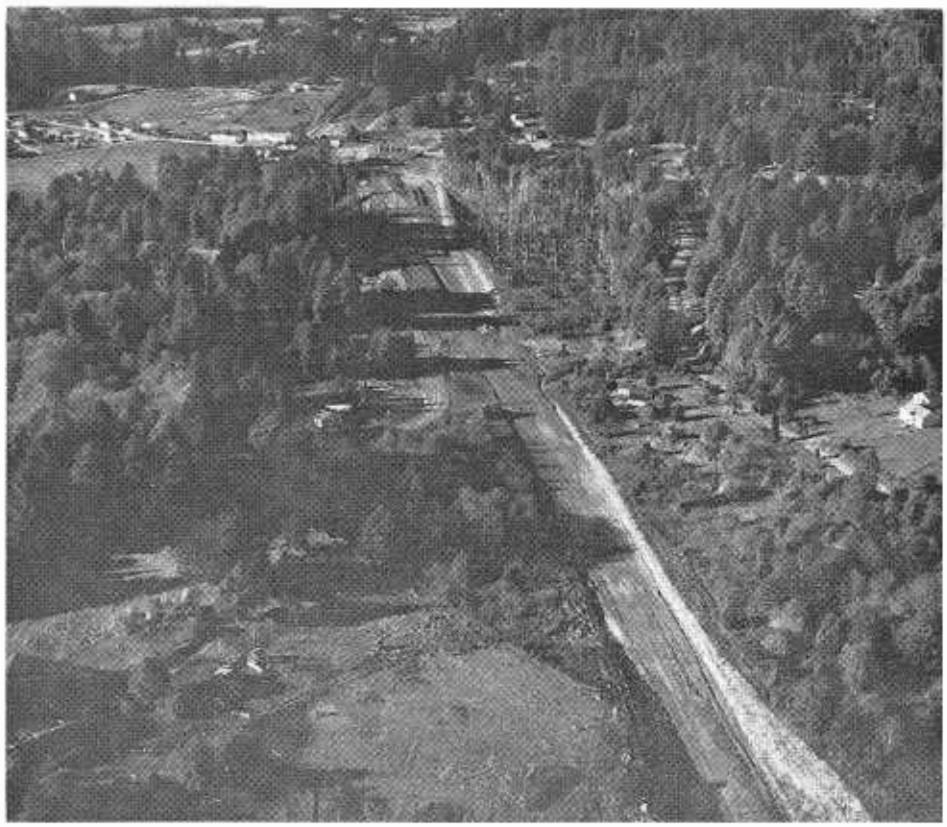
Three homeowners above a new high roadway cut on the freeways discovered cracks developing in their yards and driveways early in July 1959. As heavy equipment continued to remove earth from this cut, the cracks at the residences above continued to grow and extended through concrete floor slabs in the house. Doors became hard to open, indicating earth movement in the area.

Investigations soon revealed that the construction of this cut was activating a large, old landslide. It also became evident that any large movement of the slide would endanger other expensive homes in the area and a county road, as well as having a detrimental effect on the freeway cut.

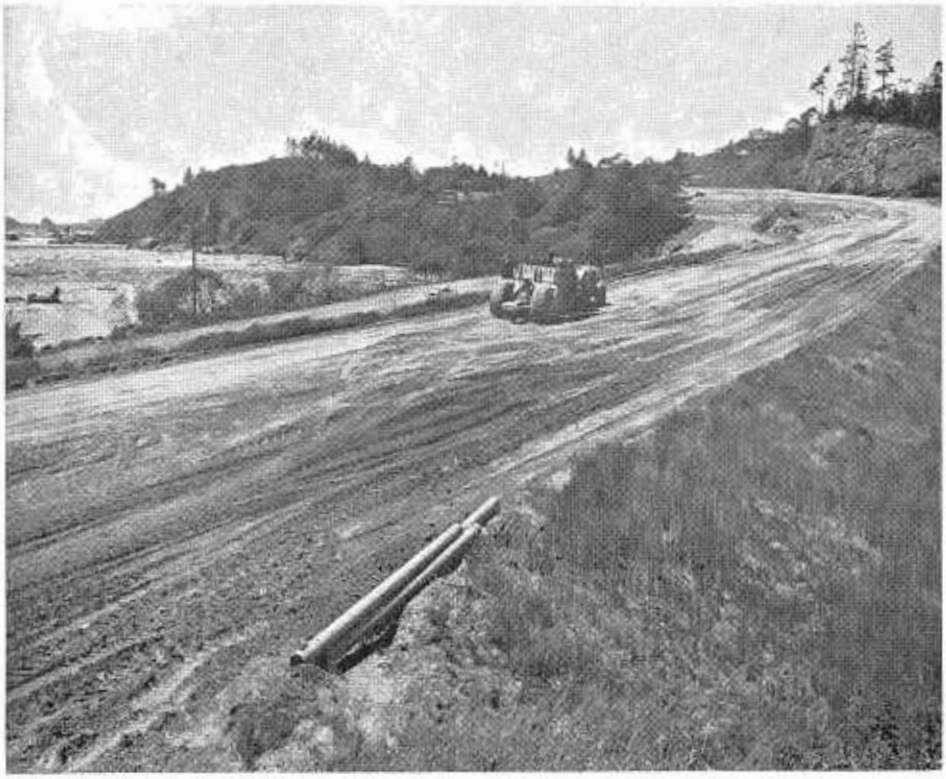
#### Investigation Made

The earthmoving operations were quickly halted while a complete investigation was undertaken and remedial measures determined. The slide

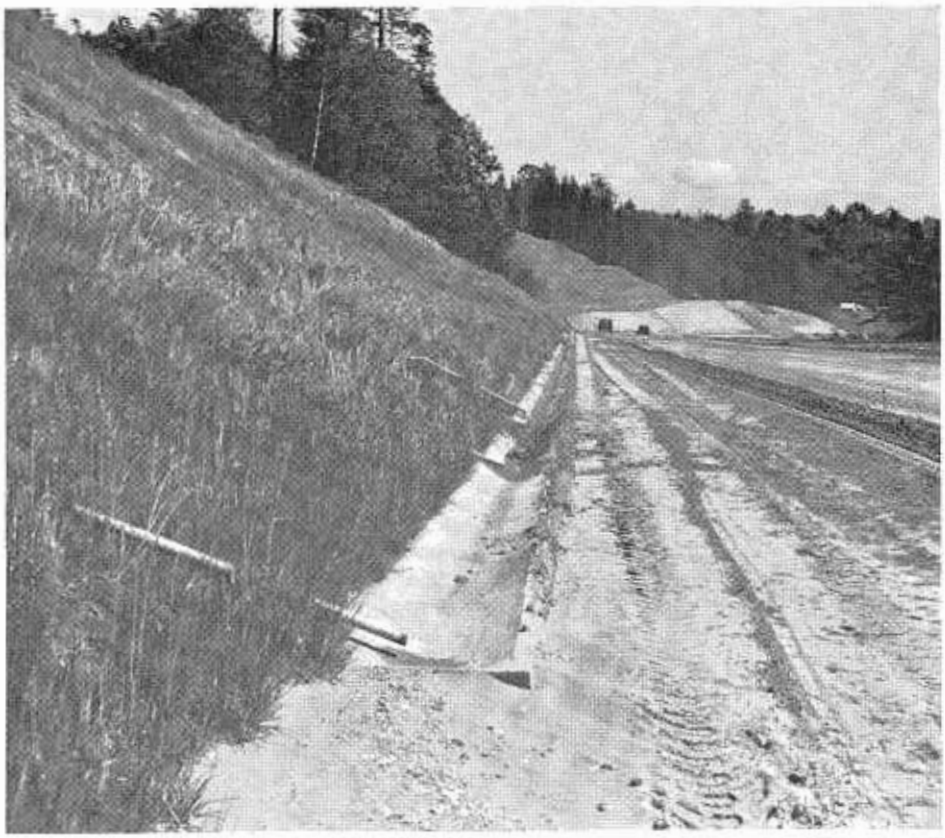
*This view is looking north from the beginning of the project above Little River. Communities in the background are Moonstone Beach (left of highway) and Westhaven (middle background).*



*A northward view of the project with the Trinidad Interchange under construction in the background.*



*A photo of the freeway under construction with Little River Beach to the left. Note the heavy growth of grass on the planted slopes resulting from winter rains in Humboldt County.*



*The big slide mentioned in the accompanying article was drained with horizontal drains, two outlets of which are shown in the above photo. The paved gutter prevents erosion of the cut slopes by water from the drains. The slopes were seeded and the heavy growth of grass protects the cut slopes from erosion.*

appears to have been stopped after a maximum movement of only inches by the following treatment. The grade of the freeway was raised a total of 15 feet to provide a buttress against the sliding movement, and a number of horizontal drains were installed to drain the subsurface water in the area which was lubricating the slide mass.

As a result of the damage to the houses, the property was purchased by the State in connection with right-of-way acquisition. The houses were subsequently sold at public auction in the usual manner and the successful bidders have now removed the improvements from the area and are relocating them on other sites.

Shortly after the slide stabilization work had been undertaken, further construction difficulties were indicated when a portion of a major side hill embankment to the north of the slide began to slip away. The fill was just being brought to grade when the slipping was discovered. Instability of the original ground supporting the new embankment was the cause of the slipout. Original investigation of the area did not disclose the existence of a 20-foot layer of a plastic blue clay overlaying a stable sand formation. Unfortunately, preliminary borings apparently encountered some float rock and visual evidence did not indicate any foundation problem.

A stabilization trench was constructed along the lower edge of the fill keying into the stable sand, and the fill reconstructed with the handling of 90,000 cubic yards of earth involved in the repair work. The control and disposal of subsurface water was provided for by a drainage system consisting of filter material and perforated metal pipe. The stabilization trench was typical of those used on many projects in District I where unstable embankment foundations are encountered.

#### Sands Vary in Depth

The soils within the job limits are predominately fine cohesionless sands originating from beach deposits. Small quantities of beach gravels and float rock were also encountered. The sands vary in depth from approximately 100 feet to only a few feet

deep at the northerly end of the project. The underlying material is blue clay with rock fragments. Some hard rock is exposed at different locations through the project and some was encountered in cuts.

The large slide, described earlier, extended 1,200 feet along the centerline of the new freeway and back of the slope lines 100 to 300 feet. The slide mass consisted of sand 50 to 60 feet in depth lying on the blue clays. The blue clays had a steep pitch toward the ocean. The sand was saturated from the contact with the clay to several feet above the clay. Undoubtedly the slipping was taking place in the saturated sand or on the contact plane between the sand and clay or was a combination of these movements.

Attempts to install horizontal drains and produce a flow of subsurface water proved to involve more than the ordinary problems encountered in horizontal drain installations. It was not difficult to drill the holes to intercept the water bearing materials, or to install the drainpipe. However, the wet sand and silt mixture had the consistency of a thin grout. Once the pipes were installed the wet sands would flow through the perforations of the pipe and along the pipe for varying distances then stop, forming a very good plug.

The successful installations, producing a satisfactory flow of water, resulted from cleaning the pipes with a water jet. Water was carried to the sand in the pipes by a ½-inch galvanized pipe inserted into the horizontal drain. Jetting was continued until the end of the horizontal drainpipe was reached by the ½-inch pipe jet and the volume of sand being washed out decreased. Some of the drains had to be jetted a number of times before any flow was obtained. No water was obtained from two or three of the installations because the sand continued to enter the drainpipe as fast as it could be washed away.

#### Pipes Become Clogged

Another problem in the jetting operation was to keep the ½-inch pipe from sanding in and blocking the flow. One jetting pipe did get sanded in and was salvaged only after the entire installation was pulled.

A flow of water was obtained from about two-thirds of the drains installed, with three or four of the 20 drains installed apparently disposing of the majority of the subsurface water in the area. A peak flow of 30,000 gallons per day was obtained. This flow dropped to 3,400 gallons per day in February 1960 and then increased to 12,000 gallons per day in March 1960.

Drains installed varied in length from 100 to 220 feet. It was found best to use 20 to 40 feet of perforated two-inch pipe with the balance solid pipe. Any greater length of perforated pipe caused a jetting problem. Two five-foot-long wellpoints were tried and the sand did not come into the wellpoint, but very little water did either. Jetting apparently cleared a cavern around the pipe which collected the water.

Horizontal drilling was tried with both an auger type drilling machine and a type using water as a circulating medium. Even bentonite mud was used to line the drill hole. The auger type proved to be more satisfactory.

At this writing the grading is practically complete.

The surfacing and paving operations should be expedited somewhat by the fact that all the necessary aggregates were produced during the winter and stockpiled at the jobsite and at a nearby commercial paving plant. At the jobsite very sizeable stockpiles have resulted from the production and hauling of 144,000 tons of subbase, base and cement-treated base aggregates. At the commercial plant 34,000 tons of asphaltic concrete aggregates await mixing and placing on the project.

It is anticipated that the project will be completed during the latter part of the summer providing a long-needed modern freeway to adequately serve present day traffic.

The old section of highway with its beautiful vistas of the rugged ocean shoreline will revert to the County of Humboldt. It will serve many properties along its route as well as providing a scenic ocean drive which can now be enjoyed at leisure.

## Womack is Elected WASHO Vice Pres.

State Highway Engineer J. C. Womack was elected vice president of the Western Association of State Highway Officials on June 24 at the closing session of the association's 39th annual conference, held in Portland, Oregon.

WASHO will be headed for the ensuing year by G. Bryce Bennett, State Highway Engineer of Idaho. He succeeds Fred C. Quinnell, Jr., State Highway Engineer of Montana, as president of the 14-state organization.

Forrest Cooper, Deputy State Highway Engineer of Oregon, was elected secretary-treasurer. Named to the executive committee were T. D. Sherard, director and chief engineer of the Alaska Division of Highways; D. B. Dixon, chief highway engineer of New Mexico; Joseph J. Marsh, Colorado highway commissioner; and Ernest J. Ketcham, chairman of the Washington State Highway Commission.

## IN MEMORIAM

**District IV**

Gerald V. Cole, Junior Civil Engineer, 6-13-60.

**District VIII**

Edward H. Cable, Hwy. Equip. Oper. Lab., 6-2-60.

Lloyd T. Fish, Highway Foreman, 5-16-60.

**District X**

Frank A. Rodemer, Hwy. Equip. Oper. Lab., 5-4-60.

**District XI**

James D. McCain, Hwy. Equip. Oper. Lab., 6-14-60.

**Headquarters Shop**

Albert L. Zindel, Skilled Laborer, 6-21-60.

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A major fire in the Town of Knights Landing necessitated the closure of US 40 Alternate for some 18 hours starting at 3 p.m. on June 5, 1960.

# State Route 283

## *City, County, State Co-operate in Developing Important Freeway*

By R. J. DATEL, City-County Projects Engineer


THE CALIFORNIA Freeway and Expressway System established by the State Legislature in 1959 added several new routes to the State Highway System within the San Diego metropolitan area. These were selected as a result of co-ordinated planning by city, county and state officials responsible for providing an adequate integrated transportation system for the area.

An example of this co-operative effort, not only in planning, but in financing, design and construction as well, is illustrated by a brief review of past, current and proposed activities along one of the new routes now designated as State Highway 283. Route 283 is described in the statutes as being located between the following termini:

(a) From Route 241 (an unconstructed Interstate Highway) near the north city limit of National City to Route 2 (US 101) and

(b) From Route 2 to Route 77 (US 395) near the United States Naval Air Station Miramar.

### Route Not Adopted

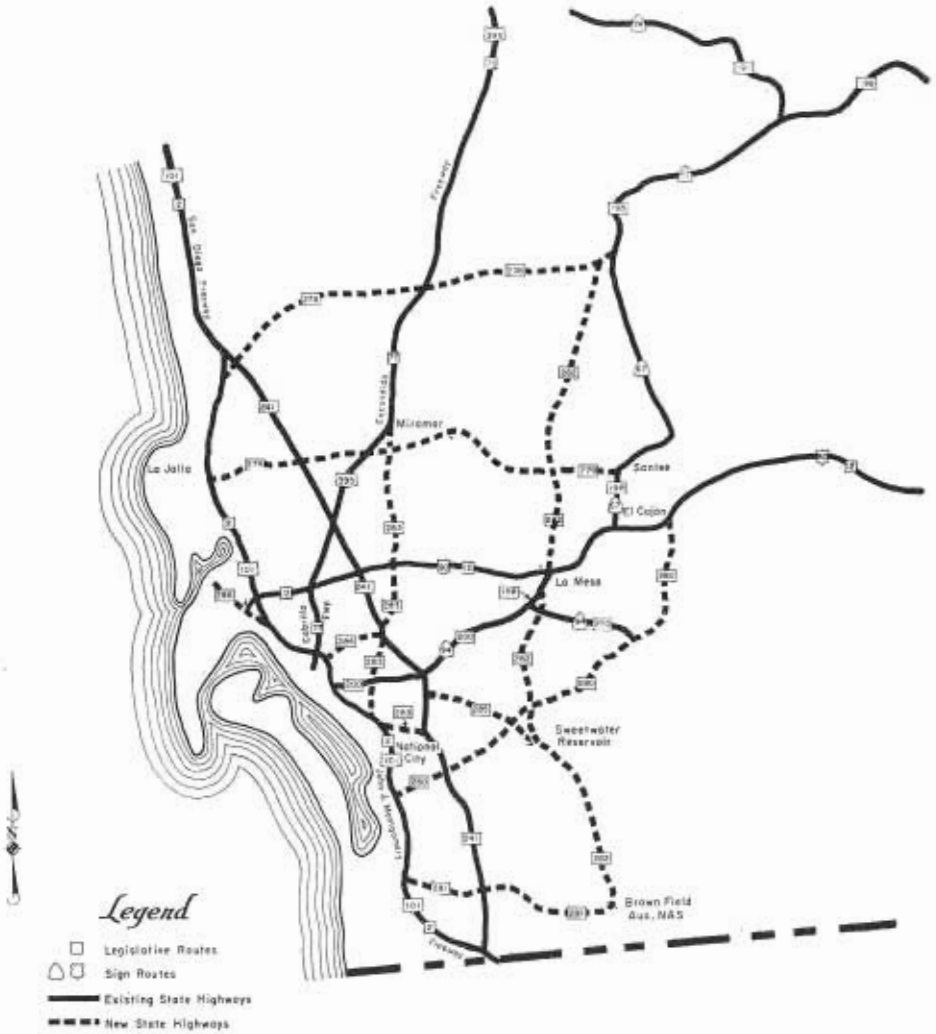
The latter portion of the route between US 101 and US 395 will be discussed here. It should be emphasized that the adoption of a specific location for this highway between the above termini by the California Highway Commission has not yet been accomplished. However, advantages including traffic service and use of existing rights-of-way and constructed facilities could result in the adoption of a route which basically coincides with the location discussed below.

As early as during World War II the City of San Diego realized the importance of providing for a high-volume, north-south traffic artery from the National City area through east San Diego to military installations along US 395 on Kearny Mesa because of the direct access that such a route would provide to naval facilities at either end. Shortly after the war the city council adopted Wabash Boulevard, 40th Street and Ward Road as part of its major street and highway plan, and also designated these streets as major city streets, thus qualifying them for improvement from the city's share of state gas tax funds.

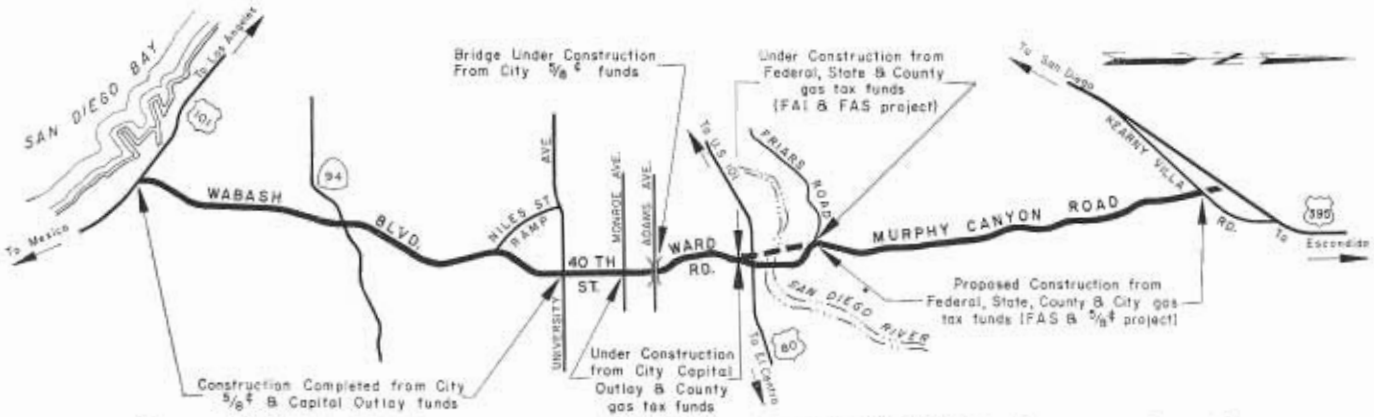
The locations of these streets coincide with the north-south portion of Route 283 between US 101 and US 80 of the adopted California Freeway and Expressway System.

### In Master Plan

The County of San Diego also recognized the importance of the route and the board of supervisors included Murphy Canyon Road as part of the county master plan of highways as adopted in 1952. This road between US 80 and US 395 was placed in the federal-aid secondary road system, which permitted the use of federal




*The above map shows the system of existing and proposed state freeways and expressways in the San Diego area.*




*This map of State Route 283 in the San Diego area shows the location of the projects discussed in the accompanying article.*

*The photo looking north along Wabash Boulevard, shows the new Sign Route 94 Interchange. The original interchange built by the city included the eastbound bridge on Sign Route 94 (dark surfaced structure near center of photo) and a portion of the cloverleaf and right-turn ramps. State construction of Sign Route 94 as an eight-lane freeway necessitated expansion of the interchange as shown in this photo.*

and state funds to help the county finance future improvements.

In 1948 the City of San Diego began a long-range improvement program with gas tax funds. Wabash Boulevard and 40th Street between US 101 and Monroe Avenue, a distance of approximately 5.5 miles, was included. The sum of $175,000 was budgeted for preliminary engineering and right-of-way acquisition, followed in 1950 by $1,182,000 for construction. Additional money was later provided for this project, resulting in a total expenditure of preliminary engineering, right-of-way acquisition and construction between 1948 and 1955 of approximately $3,968,000. These funds financed the existing four-lane divided, limited-access facility between US 101 and 40th Street, and increased traffic capacity by the widening of 40th Street to University Avenue. Between University Avenue and Monroe Avenue, 40th Street functions as a four-lane, undivided city street.

#### City Designs Project

Engineering, including surveys, design, inspection, right-of-way acquisition and administration of construction contracts, was performed by the city in accordance with the laws and procedures relating to the expenditure of five-eighths-cent gas tax funds. Under this arrangement the Division of Highways approves budgets and plans and specifications, in addition to providing technical advice and assistance to cities.

The City of San Diego has long recognized the need for adequate planning, programming and financing of its major city streets in order to keep pace with the city's rapid population and motor vehicular growth. This growth can be vividly illustrated by comparing the 1950 city population of 334,387 with the 1960 city population of 555,000.

The city's positive program of providing adequate major street facilities includes:

1. Long-range planning of transportation needs integrated with other metropolitan area cities, the county and the State.
2. The annual preparation of a six-year capital improvements program listing major city street projects by priority.
3. The budgeting of 100 percent of its annual allocation of gas tax funds for major construction projects; (the law allows the use of a maximum of 40 percent of gas tax funds for maintenance of city streets, if a city so desires).
4. The annual provision for major street construction projects from city capital outlay funds in an amount approximately equal to the gas tax allocation.

The work described above on Wabash Boulevard and 40th Street included financing from capital outlay funds in the approximate amount of $189,000 plus the construction of the Nile Street ramp which has provided an additional connection between University Avenue and Wabash Boulevard.

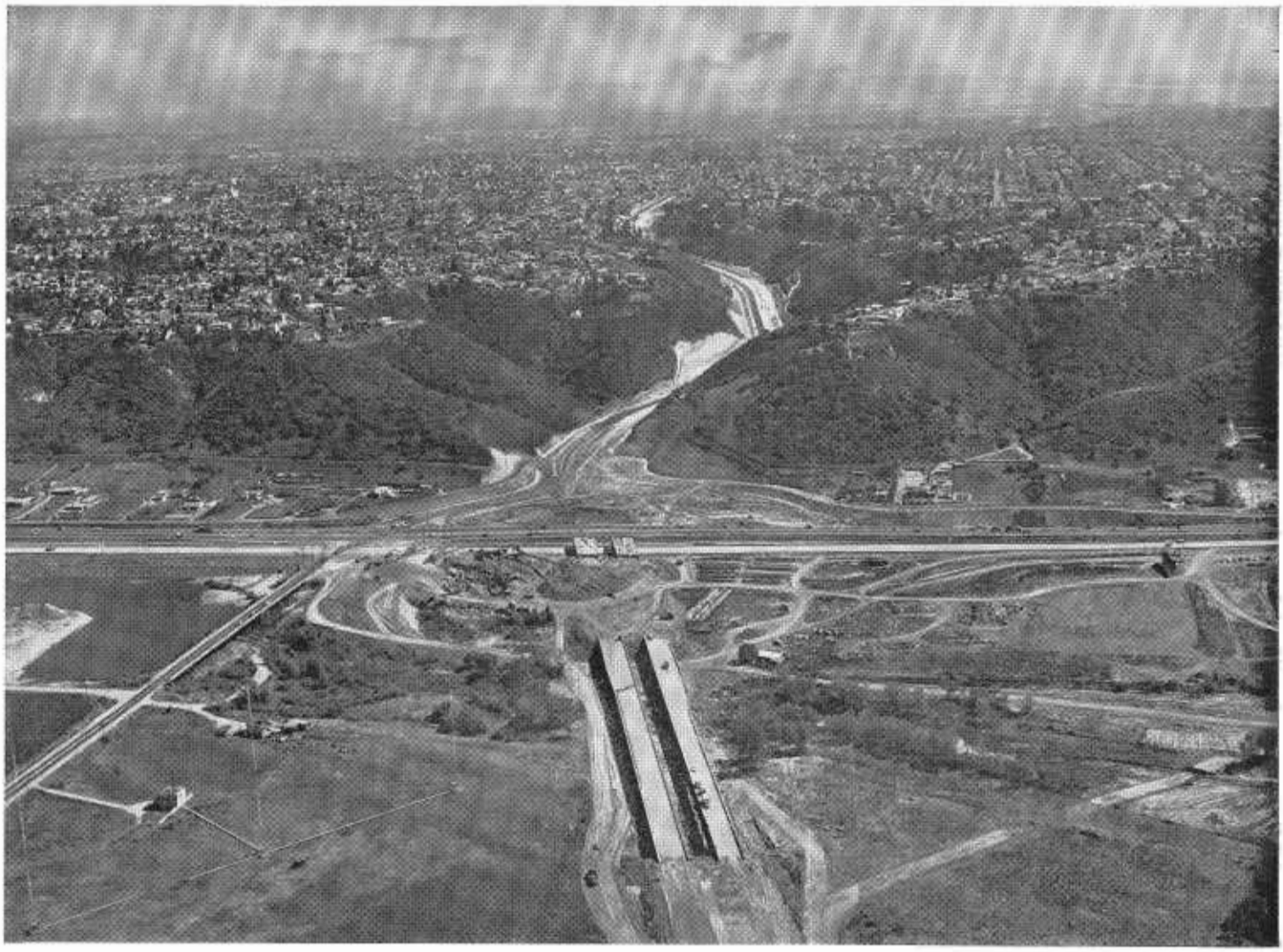
#### Co-operative Agreements

Current construction extends from Monroe Street, about 1.5 miles south of US 80, to Friars Road, about 0.6 mile north of US 80, under three separate contracts, resulting from three different types of co-operative agreements.

The first of these is the Adams Avenue overcrossing project which will carry city street traffic over Ward Road two blocks north of Monroe Street. This bridge is financed from $300,000 gas tax funds and is, therefore, included in the regular City-State 5/8-cent Memorandum of Agreement and is being constructed as a city contract.

The second project now opened to traffic, is the improvement by city contract of Ward Road, between Monroe Street and US 80. This divided, four-lane, access-controlled facility is the result of a co-operative agreement between the City and County of San Diego. The northerly portion of this project is located in the county. This job is financed from city capital outlay funds in the amount of $808,000 and from county gas tax funds in the amount of $180,000. Unlike city gas tax procedures, the expenditure of county gas tax funds is not administered by the Division of Highways. This city-county co-operative project does not, therefore, formally involve the State.

*This aerial, looking northward along Murphy Canyon Road, shows US 80 running east and west through the center of the picture and Friars Road running east and west in the background.*



*The above photo is looking south along Murphy Canyon Road and Ward Road, with US 80 running horizontally through the center of the picture. New bridges over the San Diego River are in the foreground. Construction on Ward Road is a city-county financed project.*

**County-State Agreement**

The last of the three projects currently under way is covered by a standard FAS county-state construction agreement executed for each county federal-aid secondary project, the financing of which normally includes federal, state and county funds. In accordance with state law in California, 87½ percent of the federal-aid secondary funds apportioned to California are reapportioned to the counties for expenditure on the county FAS highway system. The statutes also provide for state highway funds to be apportioned to the counties to help match these federal funds.

This particular project across the San Diego River at the mouth of Murphy Canyon is being constructed as part of a state highway contract on US 80. At the time plans were being prepared by the State for the US 80 project, the county requested that a second two-lane bridge be provided over the San Diego River to Murphy Canyon Road in addition to the one planned as a replacement for the existing two-lane bridge. It was agreed that the State would include the second bridge and add two lanes to the original design of Murphy Canyon Road from the river bridges to the north end of the project at Friars Road, and that the additional facilities would be financed as a county federal-aid secondary project. This $354,000 project is financed from $189,000 federal-aid secondary funds, $135,000 state matching funds, and $30,000 county funds.

**City Uses Own Gas Funds**

Construction planned for the immediate future is on Murphy Canyon Road, between Friars Road and Kearny Villa Road near US 395, a distance of 4.3 miles. This single project will include all three types of agreements just discussed. Basically the job is a co-operative city-county effort, with each local agency paying for the improvement located within its jurisdiction. The city has elected to finance its share from ⅛-cent gas tax funds, hence the need for a memorandum of agreement with the State, and the county's decision to use FAS financing for its portion will result in a county-state FAS construction agreement.

The construction of this portion of the route as an FAS project will result

in a limited-access facility built to state highway standards, both structurally and geometrically, from US 80 north to Kearny Villa Road. Proposed construction is for six-lane grading with an ultimate 22-foot median. The outside four lanes are to be paved with asphalt concrete over aggregate base and subbase. This improvement would permit this portion of the route to be adopted and used as a state highway without additional expenditures for many years to come.

#### Informal Contracts Occur

The processing of any county FAS project, from the planning stage to the final acceptance of the completed work, involves a great deal of co-operation among federal, state and county personnel. Although the federal government has delegated to the State the responsibility for the successful completion of county FAS projects, many informal contacts with U.S. Bureau of Public Roads' officials occur. The county is urged to do the required preliminary and construction engineering with its own forces. If requested by the county, the State will perform any engineering functions which the county is not equipped to handle.

All preliminary engineering for the Murphy Canyon Road project is being handled by the county, except materials investigation, testing and preparation of the materials report. After plans, specifications and engineer's estimate have been approved by the State, the county FAS projects are advertised, awarded and constructed as state highway contracts. Construction engineering forces consist chiefly of county personnel with help from state engineers, if required.

#### Bid Call This Summer

It is anticipated that the call for bids will be made on the Murphy Canyon Road project late this summer with construction beginning this fall. Financing of this job includes $570,000 ⅜-cent (city) gas tax funds, $335,000 county gas tax funds, $225,000 state matching funds, and $551,000 federal-aid secondary funds, totaling in all $1,681,000.

By way of summary, the completed, under way, and proposed improvements, which have all been initiated by local jurisdictions, along the 12.1 mile section between US 101 and US 395 will result in a limited-access, four-lane divided facility for a distance of 11.0 miles and a four-lane city street facility for 0.9 mile. The north 0.2 mile of this route is not planned for immediate improvement, because future traffic interchanges involving three state highway routes will eventually be constructed in this area.

The table below summarizes the financing made available to date for the right-of-way acquisition and construction of this route. The figures in the table are approximate only and are for the purpose of showing the magnitude of the overall project and the various types of financing used.

As previously pointed out, the above improvements have been a result of long-range planning many years before a state highway was considered through the area, yet financing and construction of projects has continued by the city and county even after the State Legislature designated a state highway to exist along the approximate route of these local roads and streets. It is anticipated that the existing traffic volumes which vary from 9,000 to 26,000 ADT along this route will increase to a range of 50,000 to 80,000 ADT by 1985.

Providing a usable, continuous traffic facility capable of moving large volumes of traffic through a metropolitan area over a long period of time with financing available to local jurisdictions and with improvements that basically could be utilized in the future as part of the California Freeway and Expressway System is a tribute to local legislative bodies and to the skill, foresight and co-operative spirit of administrators, engineers and planners of all jurisdictions engaged in furnishing the public with street and highway facilities.

The co-operative planning and constructing of this route is not unique in the San Diego metropolitan area. It is cited not as an unusual occurrence, but as a typical example of the collective effort expended by city, county and state officials in attempting to provide integrated transportation facilities for the area's exploding population.

This is the time when much is being written about the most effective means of governing the complex metropolitan areas of today and tomorrow, and terms such as federated cities, city-county consolidation, and regional government frequently appear in this literature.

The intergovernmental relationships, both formal and informal, discussed here show what is being accomplished in one phase of one metropolitan area by the use of existing tools and common goals.

| *Limits* | *Length in miles* | *R/W or constr.* | *½¢ funds (City gas tax)* | *City Capital Outlay funds* | *County gas tax funds* | *State matching funds* | *Federal-aid sec. funds* | *Total* |
|---|---|---|---|---|---|---|---|---|
| **COMPLETED** | | | | | | | | |
| Wabash Blvd. & 40th St. from US 101 to Monroe Avenue | 5.5 | R/W | $751,000 | $34,000 | ..... | ..... | ..... | $785,000 |
| | | Constr. | 3,098,000 | 155,000 | ..... | ..... | ..... | 3,253,000 |
| **UNDER CONSTRUCTION** | | | | | | | | |
| Ward Road from Monroe Avenue to US 80 | 1.5 | R/W | ..... | 475,000 | $3,000 | ..... | ..... | 478,000 |
| | | Constr. | 300,000 | 333,000 | 177,000 | ..... | ..... | 810,000 |
| **UNDER CONSTRUCTION OR FINANCED** | | | | | | | | |
| Murphy Canyon Road from US 80 to 0.2 mile south of US 395 | 4.9 | R/W | 70,000 | ..... | 75,000 | ..... | ..... | 145,000 |
| | | Constr. | 500,000 | ..... | 290,000 | $360,000 | $740,000 | 1,890,000 |
| Total Funds | — | — | $4,719,000 | $997,000 | $545,000 | $360,000 | $740,000 | $7,361,000 |

# Third Tunnel

## *New Parallel Bore Through Berkeley Hills is Planned*

By O. H. DEGENKOLB, Senior Bridge Engineer


THE BROADWAY low-level tunnels are through the Berkeley hills between the City of Oakland and Contra Costa County. They consist at the present time of two 3,000-foot long tunnels which are parallel to each other and approximately 100 feet apart. The end portions are curved and join each other in single large portal buildings at each end.

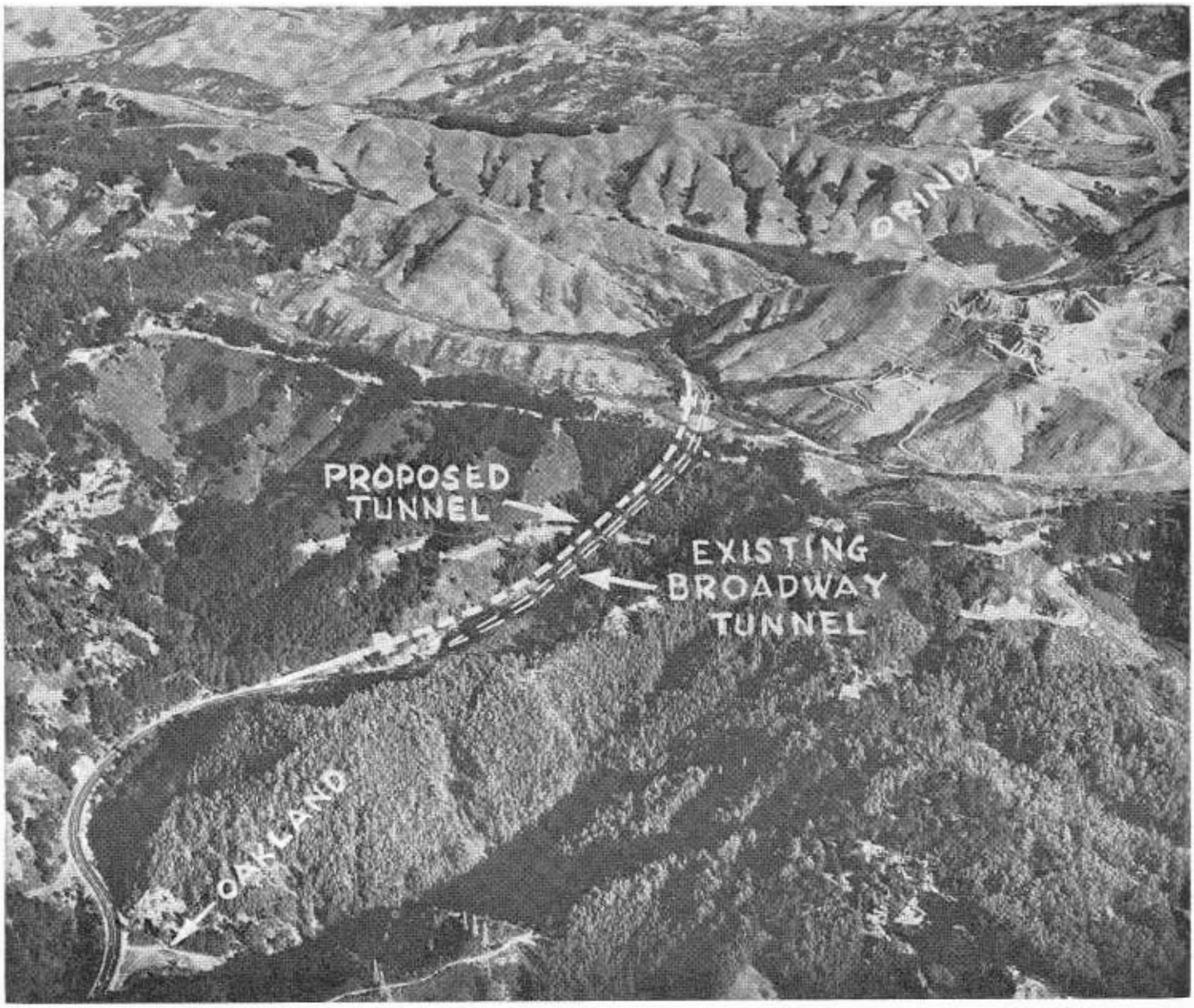
The first tunnel through these hills was constructed in 1904 almost directly above the two existing tunnels. This early high-level tunnel was approximately 1,000 feet long, timber-lined, dark and narrow.

**The 1960-61 State Highway Budget provides $10,000,000 for the Broadway Tunnel project. Bids are scheduled to be opened in Sacramento early this fall.**

The first official action to provide a means of constructing a low-level highway through the Berkeley hills was taken in November 1926 in the form of an agreement between the City of Oakland and the counties of Alameda and Contra Costa. A Joint Highway District (No. 13) comprising the two counties was organized in 1929 to carry out the necessary engineering studies, design, legal functions, financing and construction of the project. The two present tunnels were completed and opened to traffic in December 1937 and have been in continuous service since.

At its 1960 session the California Legislature by concurrent resolution officially designated the Broadway

*This artist's sketch shows how the Oakland approach to the Broadway Tunnel will look after completion of the new bore. The view is eastward, with the existing bores at the right and the new one at the left. The new portal building above the new tunnel will house the controls for all three bores, and will be reached by the new service roads shown in the sketch.*




*An aerial of the Berkeley Hills looking from eastward showing the location of the existing and proposed tunnels.*

low-level tunnel as the Caldecott Tunnel, in honor of the late Thomas E. Caldecott. Mr. Caldecott was an Alameda County Supervisor and president of the Joint Highway District when the original tunnel was built.

#### Strata Are Fractured

The geology of the location of the tunnels consists of shale, sandstone and chert, which are highly fractured, and soft dikes which exist in great numbers. Despite the use of very heavy timber supports two serious cave-ins occurred during the construction of the two existing bores. The first cave-in occurred at a point where there was nearly 100 feet of rock above the tunnel and killed three workmen. The caving extended all the way to the surface and left a large depression in the side of the hill. The second cave-in occurred at a point beneath the highest point of the hill and caused considerable damage to the unfinished tunnel and equipment.

The proposed third bore will be 150 feet north of the existing northerly tunnel and will be approximately 500 feet below the summit of the ridge. It will be on a 4 percent grade descending from the Orinda end down toward Oakland. Both ends will be on curves in order to provide smooth alignment into the canyons at each end.

The existing tunnels have 22-foot roadways with a 3-foot sidewalk on the left and one-foot-wide curb on the right of traffic. They have a minimum vertical clearance of 14′-10″ above the roadway surface. The new tunnel will have a 28-foot roadway with a 4-foot sidewalk on the right of traffic and 2½-foot curb on the left with 17 feet vertical clearance. The existing 22-foot roadways are undesirably narrow for carrying the heavy volume of fast moving traffic which now uses the tunnel.

When all three tunnels are completed, the southerly existing tunnel will be used for traffic from Oakland to Orinda and the new third tunnel will carry traffic from Orinda to Oakland. The traffic in the center tunnel will be one-way but the direction will be changed to accommodate the heavier direction of travel at peak hours.

#### Tunnels Are Connected

Three adits, small tunnels four feet wide by seven feet high, will be constructed to connect the third bore and the nearest existing tunnel. These small tunnels will be a safety feature and construction aid during the driving of the third bore and will facilitate maintenance and emergency operations after the tunnels are in use.

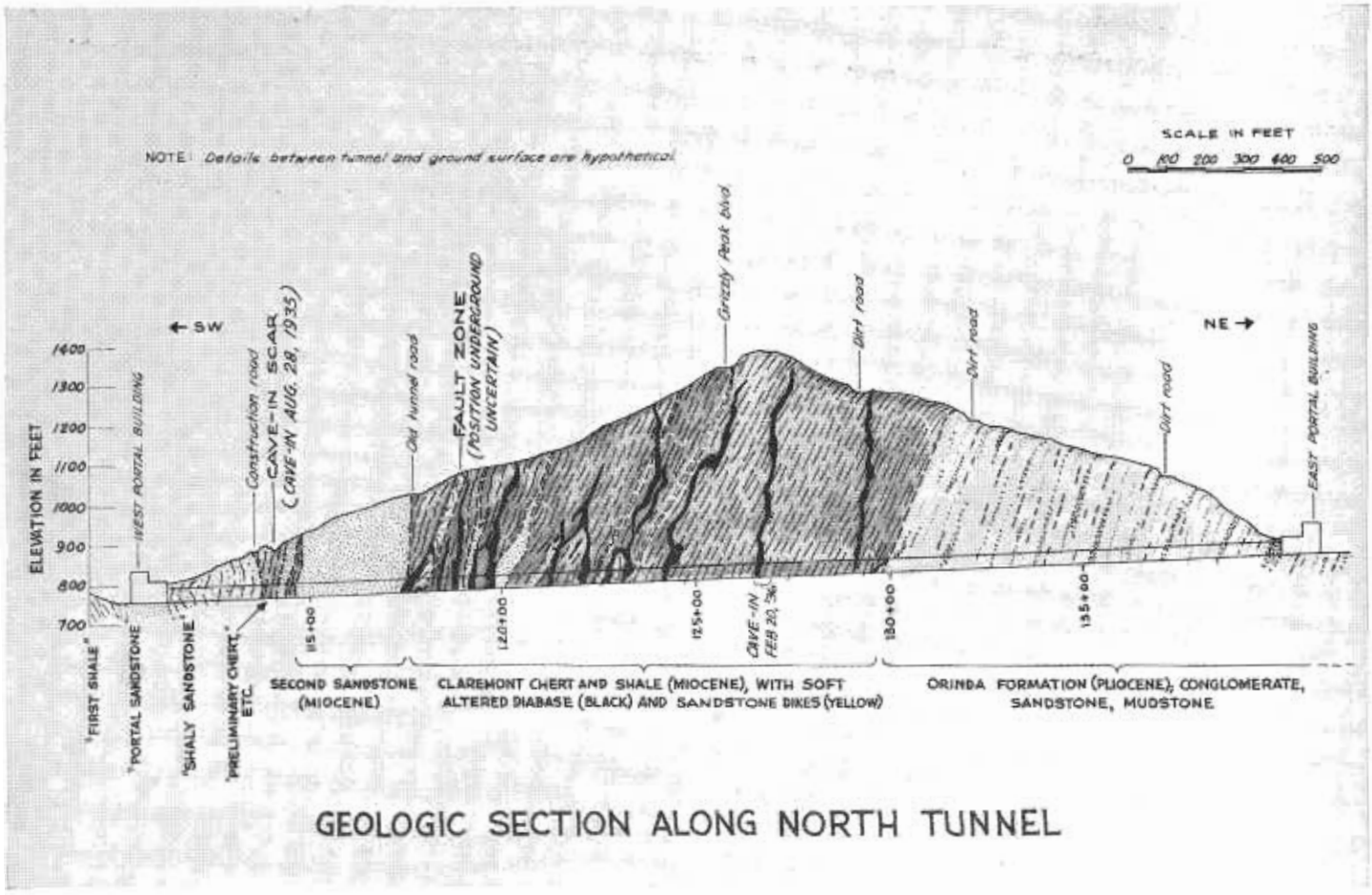
At the completion of the construction of the third bore it is planned to refurbish the existing two bores. All three of the tunnels, and ultimately all four, will be operated from the new westerly portal building.

The fact that the proposed bore is much larger than the two existing ones will present additional problems in tunneling. However, with the experience gained in the driving of the existing bores, more modern tunneling equipment which is now available, the fact that structural steel is being specified for most of the temporary tunnel support and will be paid for as a contract item, and the requirement that the concrete lining be placed as close as practical to the front face of tunnel excavation, construction difficulties should be more readily anticipated and overcome.

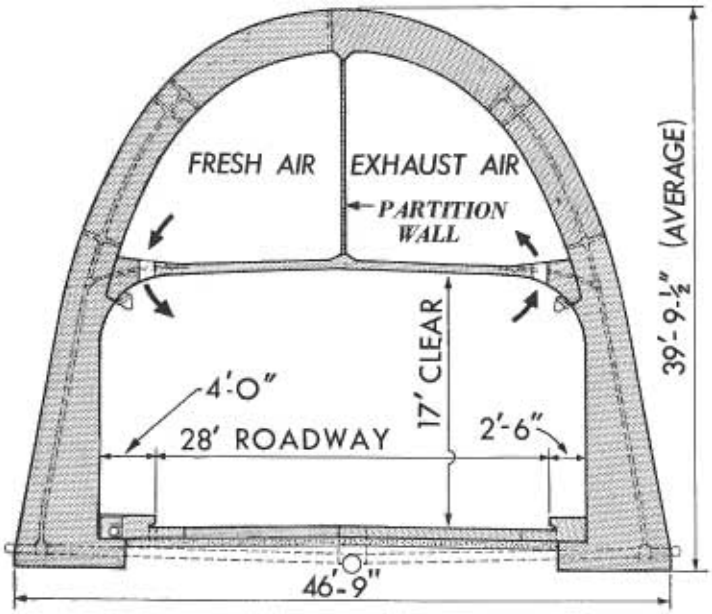
#### Tunnel Ventilation

The largest single auxiliary feature of these tunnels is the ventilation. The roadway section of the third bore will be ventilated wtih one-half million cubic feet of fresh air per minute. Fresh air will be introduced at the portal building and blown down one side of the upper portion of the tunnel. Air in these ducts will be blown into the roadway section through openings at 15-foot centers in the ceiling of the roadway section. The exhaust gases will then be sucked out of the roadway section through openings in the ceiling into the exhaust duct on the opposite side of the upper portion of the tunnel. The exhaust gases will be carried to the portal buildings and blown vertically up through the roof.

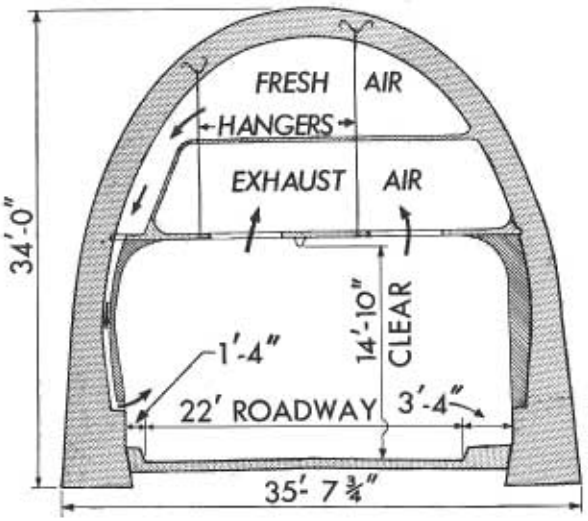
This method of ventilating, called the transverse system, is considered superior to the longitudinal system, used in shorter tunnels, in which air is introduced at one end of the roadway section and blown directly through the length of the tunnel. The old Broadway Tunnel bores also use the transverse system but the new type is less costly to construct and is expected to be at least as efficient, if not more so. In case of gasoline or other fires in the tunnel, the transverse system of ventilation confines the fire to one location, whereas the longitudinal system could create a blowtorch effect and undoubtedly cause considerable harm to vehicles and personnel in the tunnel.




GEOLOGIC SECTION ALONG NORTH TUNNEL




**PROPOSED TUNNEL**




**EXISTING TUNNEL**

#### Air Blowers Used

All of the ventilating of the new tunnel will be done from the new westerly portal building by means of two fresh air and two exhaust air blowers. The blowers are of the vane-axial type, seven-foot inside diameter and powered with 100 horsepower motors.

Continuous lines of fluorescent lights will be placed at each side of the roadway section throughout the entire length of the tunnel. In order to accustom the driver's eyes to the relatively small amount of light in the tunnel when entering from the bright sunlight, the transition sections of 300 feet at the ends of the tunnel will have extra tubes to give a varying brightness. The sides and top of the roadway section will be lined with light green-tinted tile to give a better reflective surface and facilitate cleaning.

Television cameras will be placed on the portal buildings to scan the entrances and exits of the three bores. By watching the incoming and outgoing traffic on the monitors within the control rooms of the portal buildings, the tunnel operator will be able to speed up the fans before heavy smoke-producing vehicles enter the tunnels. Experience in the existing tunnels has proved that better ventilation is maintained if the operator can speed up the fans before heavily loaded vehicles or a large group of vehicles enter the tunnel, rather than waiting for the instruments to detect the increase in carbon monoxide.

#### Safeguard Against Gases

Carbon monoxide gas is poisonous, odorless, colorless and tasteless. With the small concentrations of it normally found in tunnel exhaust gases, the average person would have to breathe it for a great number of hours before suffering any noticeable ill effects. On the other hand, smoke particles in the exhaust gases are not normally toxic but are visibly noticeable and cause irritation of the eyes and nose. A considerable amount of smoke causing physical discomfort does not necessarily indicate that a harmful amount of carbon monoxide is present. Detectors will make a continuous record of the amount of carbon monoxide in the exhaust air taken from the tunnels and, when the percentage reaches any specified amount, the fans will be sped up automatically.

It is anticipated that television cameras will be placed at critical positions throughout the lengths of the tunnels at some later date to provide better traffic control, ventilation and quicker detection of emergencies. The performance of television equipment which works at such low light levels is being improved so rapidly at the present time that it is not considered wise to contract for such equipment until all other work has been completed.

Fire extinguishers will be placed within the tunnel at 125 foot intervals. Fire alarm and telephone systems will be spaced at 250 foot intervals along the tunnel for emergency use. A standby generator will be installed to furnish a limited amount of emergency power during critical periods when the primary electrical source might fail. Service road bridges will be built over the roadways at the westerly portal so that maintenance and emergency vehicles can have access to any one of the tunnels without interfering with the fast moving traffic entering or emerging from the tunnels. The working conditions for the tunnel operators will be greatly improved over those now provided.

The new tunnel will be modern in every respect and will be a welcome facility to the daily commuters between Oakland and Contra Costa County.

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Statisticians figure the Division of Architecture construction program will require more than 2,900,000 man days of labor by construction trades, plus more than 2,000,000 man days of labor to manufacture the construction items to be used.

# Bay Bridge

## *First Phases of Reconstruction For Added Capacity Completed*

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

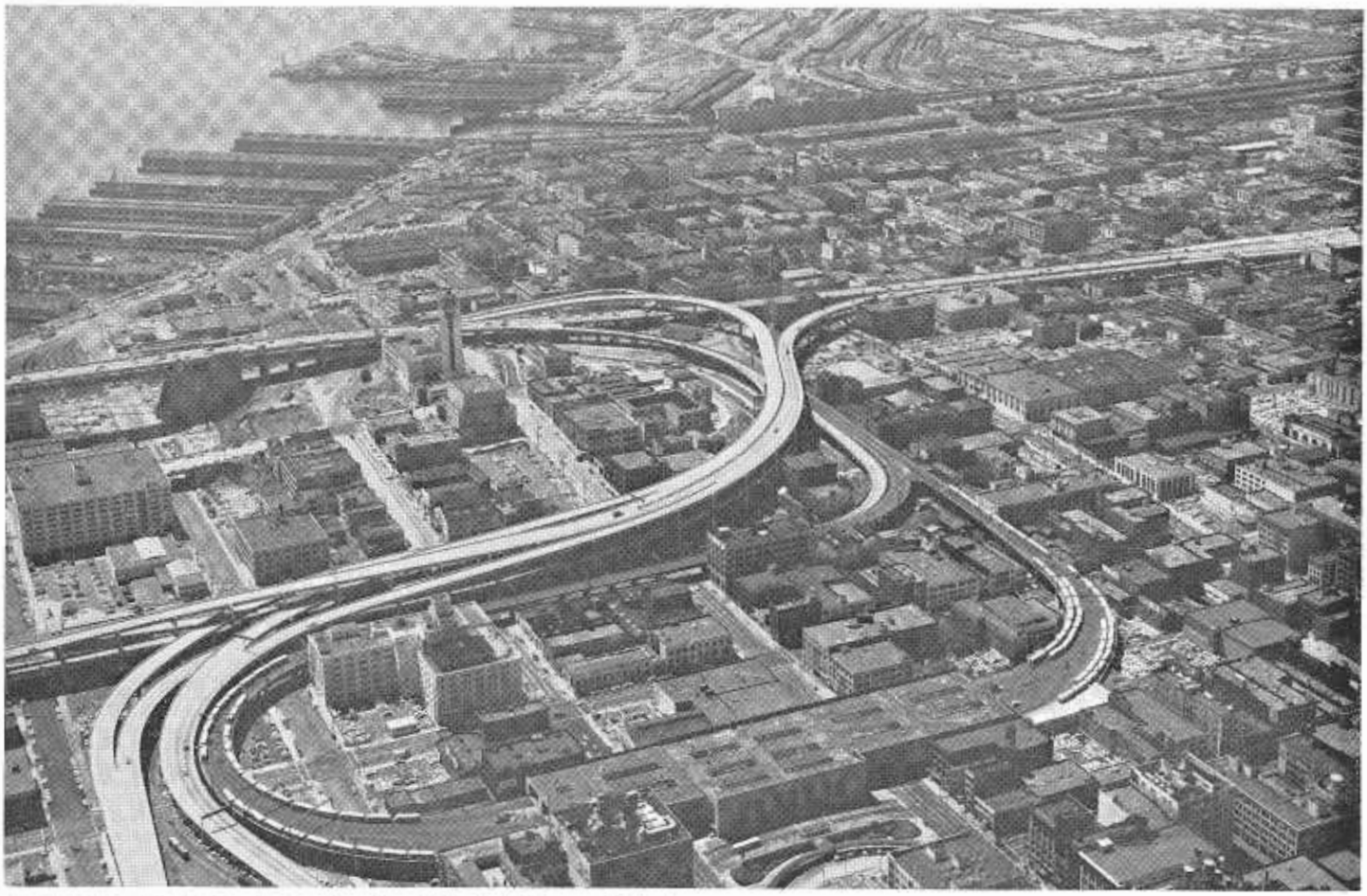
THE SAN FRANCISCO-OAKLAND Bay Bridge was opened to vehicular traffic on November 12, 1936, and from that time to the present there has been an ever increasing volume crossing the structure. The daily average in 1937 was slightly less than 25,000 vehicles; today it is over 100,000.

On May 9, 1937, the first bus lines were started, which were followed by the interurban electric trains on January 15, 1939.

At the time the bridge railway was opened to the public, three lines utilized the rail facilities on the lower deck. They were the Interurban Electric, the Sacramento Northern, and the Key System. Although good, economical transportation was offered the public, the first two companies had to abandon their lines over the bridge within the following two years due to the lack of patronage. The Key System converted a portion of its passenger transportation operation to motor coaches, paralleling in some cases the service provided by the transbay electric trains. The change was primarily brought about to effect operating economies.

Patronage on the trains steadily declined from a maximum of 37,334,000 in 1945 to 6,113,000 in 1957 and as a result the Key System, in 1955, petitioned the Public Utilities Commission for permission to abandon its rail lines and inaugurate motor coach service. A ruling of the commission ordered this change, and on April 20, 1958, mass transit by motor coaches across the Bay Bridge became effective. The rails were no longer in use.

At the time the Key System was seeking relief from its train operation, the California Toll Bridge Authority, in its meeting of December 12, 1956, passed a motion with respect to the financing of any necessary reconstruction of the San Francisco-Oakland



*An aerial showing the Transbay Transit Terminal (foreground) in downtown San Francisco with the bus loop connection to the Bay Bridge, and approach ramps from the Embarcadero and Bayshore Freeways.*

*A ground view of the front of the Transbay Transit Terminal.*

Bay Bridge, anticipating the abandonment of rail service.

#### Legislature Votes Money

In order to provide for this emergency, legislation was enacted and money appropriated by Chapter 27, Statutes of 1957, for studies to be made as to the ways and means of converting the lower deck and the Transbay Transit Terminal, with approaches thereto, for exclusive use of vehicular traffic.

The report of the Division of San Francisco Bay Toll Crossings, dated March 1957, outlined a means of financing the $35,000,000 reconstruction over a four-year period; funds for which were to be obtained from Bay Bridge revenues. Subsequent legislation was enacted, Chapter 2316, Statutes of 1957, approving the plan of construction and method of financing.

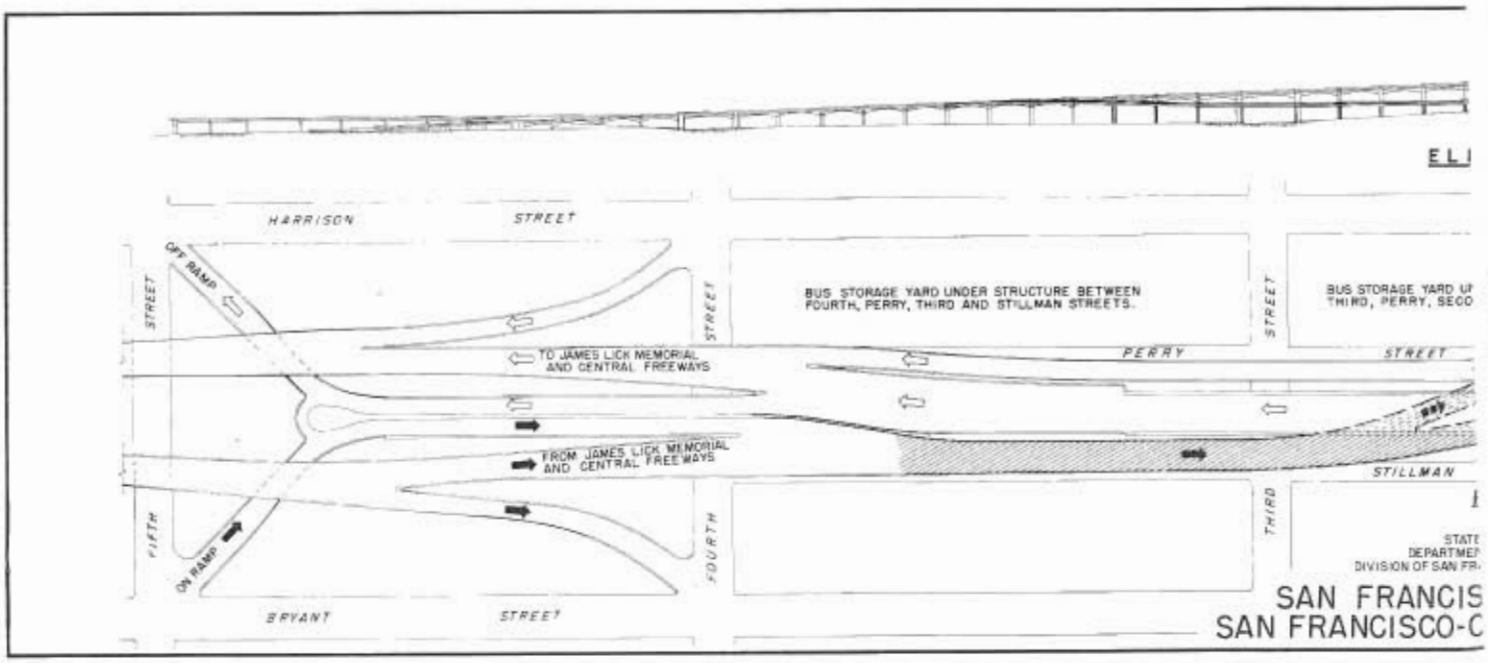
Prior to the start of any construction, it was necessary to evaluate the existing street, highway, and freeway conditions on both sides of the Bay, and proceed with construction in the area where the greatest relief could be obtained in the shortest time.

It was apparent, from existing conditions, that all construction should start on the west end of the crossing and proceed eastward. Contracts were then prepared requiring that all track and rail equipment be moved over the bridge railway and stock-piled in the East Bay Storage Yard, thereby eliminating any additional traffic on the lower deck truck and bus lanes caused by our construction equipment.

#### Transbay Transit Terminal

The redevelopment of the transportation system for transbay commuter traffic was immediately started by the State of California under its Department of Public Works after the last train crossed the bridge, on April 20, 1958. This, in general, consisted of removing the tracks; paving the vacated areas; and remodeling the Transbay Transit Terminal for the accommodation of bus service.

Besides the immediate emergency construction and changes required in the physical properties in and around the Terminal Building and on the bridge proper for the changeover from trains to busses without interruption of service, there was the long-range planning and construction re-



quired to alleviate the added traffic congestion resulting from the additional busses loading, unloading, and traversing the city streets of San Francisco.

This required the removal of all railway trackage and appurtenances from the bridgehead to the Terminal Building and paving the area. While construction was still in progress, three of the 14 bus lines were routed through the building six months after rail service ceased, or on October 19, 1958. All lines were operating from the terminal by July 12, 1959. On February 1, 1960, Western Greyhound Lines started operating 25 busses in and out of the building each day to the Lafayette, Walnut Creek, and Concord areas.

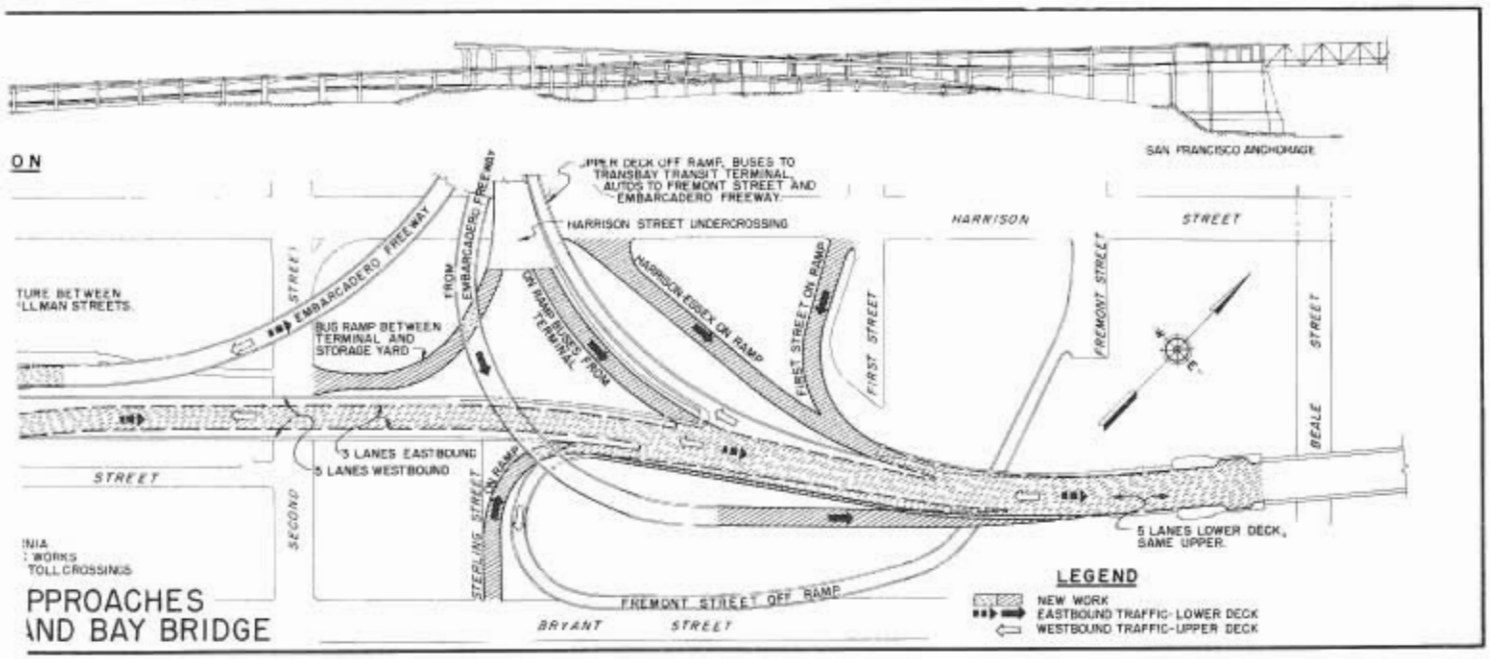
The Transbay Transit Terminal is a four-level structure, having a garage in the basement, waiting and concession areas on the first floor, passenger concourse with ticket offices on the mezzanine, and bus facilities on the upper level. The upper portion of the building is 700 by 164 feet in dimension and is built over both Fremont and First Streets in San Francisco.


*Passengers board one of the San Francisco-Oakland buses in the remodeled Transit Terminal.*

#### Roadway Is Widened

Formerly, there were six tracks running through the terminal in pairs of two, separated by columns supporting the roof. Tracks were removed, the columns placed on the offside platforms, and the area paved, giving a roadway width of 25 feet which provides sufficient room for a moving bus to pass another at the curb.

There is a longitudinal movement of busses through the building and coach stops are spaced two bus lengths apart, 10 in each roadway, giving a total of 30 for the three roadways. A traffic treadle is located at each stop. The right front wheel of the coach, upon arriving, stops on the treadle, and the driver is notified as to his position by a telltale light on the left curb. At the same time the letter of the busline of the arriving coach is lighted on large indicator boards on the first floor and lobby by the depressed treadle under the coach. Passengers take the escalators or stairways to the mezzanine where smaller indicator signs direct them to the proper ramp or stairways leading to the loading platform. Directly over the bus,



there are lighted indicators giving the letter of the coachline.

In a total blackout, the indicator system is switched to a direct current line which will provide sufficient illumination to guide passengers to the proper busses.

At present, there are two bus companies using the terminal facilities, operating 690 coaches in and out each weekday with about one-half this number on Saturdays, Sundays, and holidays. On workdays, there are approximately 27,000 passengers transported each way.

Since cessation of train operation, there has been a slight increase in bus patronage, somewhat less than one percent over the same months of the previous year. There should be an even greater increase after the Transbay Transit Terminal and grounds are completely rehabilitated and the public becomes better acquainted with the services offered.

#### San Francisco Approaches

The reconstructed bridge will have five traffic lanes on the upper deck to San Francisco, with the same number running in the opposite direction on the lower deck. The choice of direction was determined by the amount of rearrangement needed to the existing roadway connections to the present structure. It was readily apparent that to effect a westbound movement of traffic on the upper level would require a minimum amount of reconstruction consisting of the partial removal and lowering of only one of the present ramps.

The lower deck of the bridge with its 31-foot, three-lane roadway, had but one connection in the City of San Francisco, located at the intersection of Essex and Harrison Streets. There are now six roadways leading to the lower deck, which include the James Lick Memorial Freeway and the Terminal bus loop. The number of lanes required for each of these ramps was determined from traffic counts. The traffic pattern as described herein will undoubtedly change somewhat after the project has been completed, and travel habits become established.

Generally speaking, about 48 percent of the eastbound traffic to the bridge is generated west of Second Street and uses the freeway as an approach. The new connecting ramp has four lanes between Fourth and Third Streets and three lanes from Third Street to the lower deck.

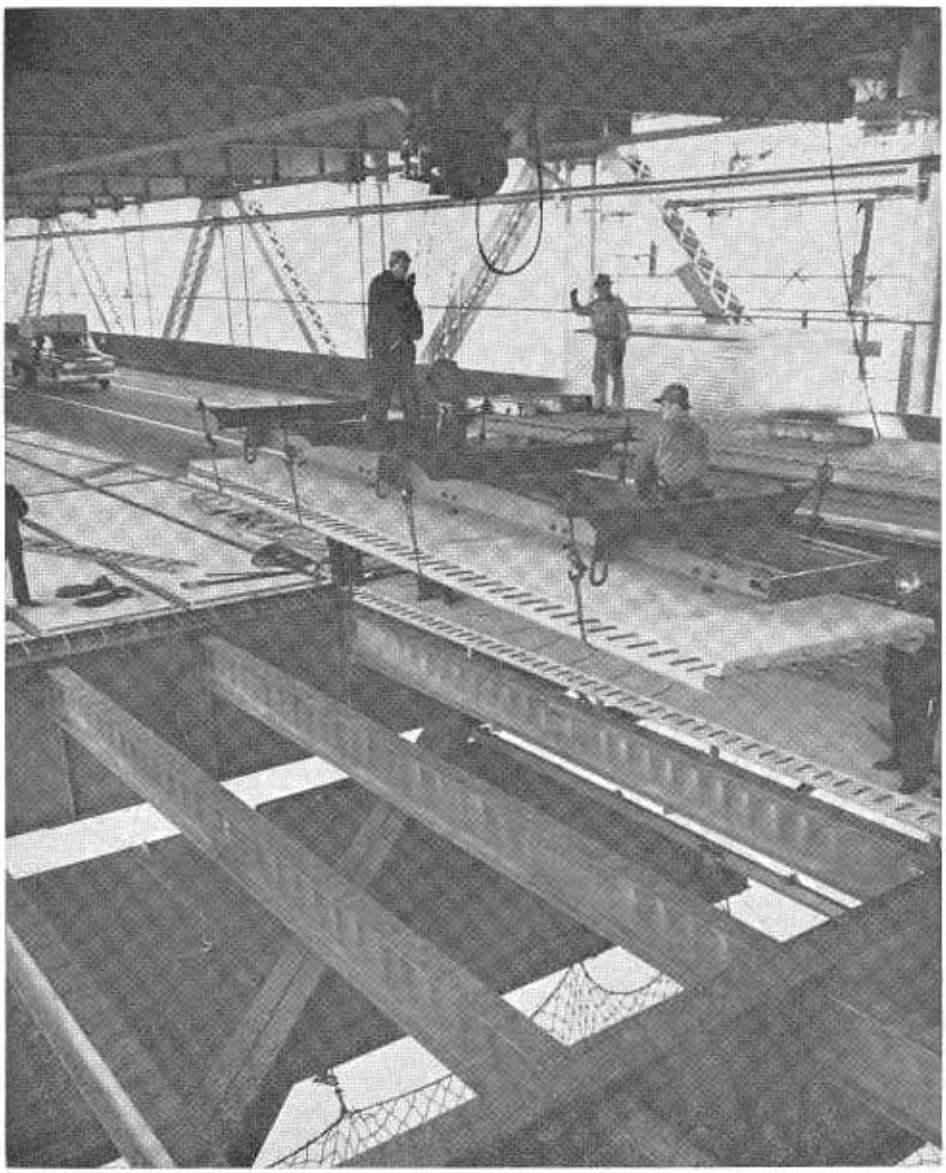
An emergency ramp using Sterling Street with a two-lane roadway under the upper deck was immediately constructed to relieve the Essex-Harrison Street connection during the peak hours between 4.30 and 6.00 p.m. when automobiles are allowed to use the lower level.

A permanent Sterling Street ramp has been completed, which will handle mainly truck traffic originating in the southern part of the city. This traffic has been estimated to be about two percent of the total eastbound peak load. It can serve as an emergency entrance to the bridge in case of tie-ups on the freeway.

The present Essex-Harrison ramp will handle only five percent of the evening peak when one-way operation is put into effect. This traffic will consist mainly of trucks and buses using Folsom and Essex Streets due to the better grades.

#### Ramp Has Free Lane

The new First Street connection is estimated to handle 20 percent of the afternoon peak hour load. Vehicles



*Lower deck reconstruction on the San Francisco-Oakland Bay Bridge. A slab is swung into position across one of the lower deck bays by a special overhead crane. Some 1,400 of these precast concrete slabs, weighing up to nine tons, were used in paving the rail-bed area from San Francisco to Yerba Buena Island. (Photo by "This Earth" magazine.)*

using this roadway along with the Essex-Harrison ramp will have a free lane leading onto the north side of the bridge.

The two bus lines using the Terminal Building for their San Francisco station have an evening peak of about two percent of the total eastbound traffic. There would be much less congestion on the lower deck during the afternoon rush hours if more commuters would use the public transportation provided. Buses average 22 persons per trip and closer to 40 during the rush, while the average for the private vehicle is a little less than two persons per trip.

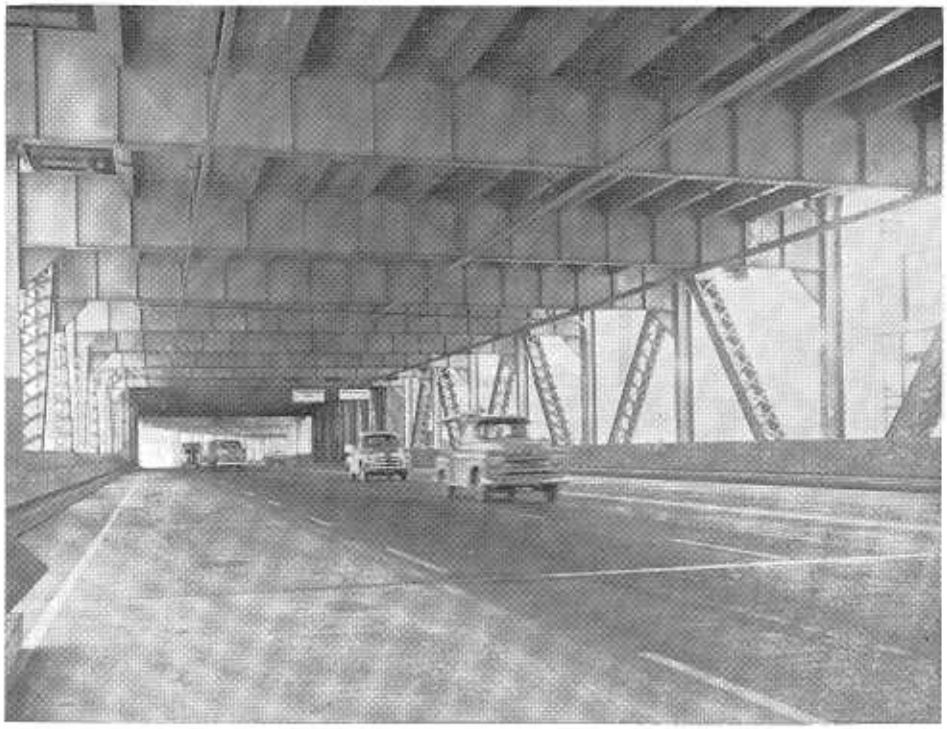
The only ramp that required alteration in San Francisco to provide for the ultimate one-way traffic pattern derives its traffic from the Embarcadero Freeway and handles about 23 percent of the evening load. The major part of this traffic originates in the downtown area and uses the Beale-Mission Street entrance to the bridge. There is a clear lane on the south side of the crossing to accommodate this evening rush.

Another ramp on the San Francisco end of the bridge and not used for vehicular movement across the Bay is the two lane roadway from the Harrison Street undercrossing to Second Street and used by buses going to storage after their morning commuter run. In the latter part of the afternoon the parked buses are moved out of storage to pick up the evening load. The coaches are stored in two lots between Second and Fourth Streets and under the San Francisco approach.

#### Lower Deck Paving

The work involved in constructing two additional vehicular lanes on the lower deck to provide a 58-foot, five-lane roadway, consisted of removing the two tracks and appurtenant equipment; removing the railway stringer bracing which is no longer needed; removing and relocating the barrier which separated train and highway traffic to the south curb of the structure; and the placing of the precast paving slabs.

All removed material was transported via the bridge railway and into the East Bay Storage Yard where it is periodically sold by contract in lot amounts to the highest bidders.



*A view of the completed five-lane lower deck roadway of the San Francisco-Oakland Bay Bridge.*

The existing three lanes on the lower deck are required to handle the morning and evening peak hour traffic. The contractor performing the redecking work was not allowed the use of any of the three lanes between the hours of 4.30 p.m. and 8 a.m. This restriction and other details peculiar to the structure dictated the use of precast deck slabs which were transported to a section of the Bridge prepared for placing.

The slabs are a little less than 30 feet long by six feet wide and six inches thick. Four are placed transversely in a 30-foot panel and are supported by the four railway stringers, providing a paved width of 28 feet. Lightweight concrete, averaging 107 pounds per cubic foot, is placed in steel forms along with the steel truss reinforcing bars at the casting yard. After receiving their initial set they are steam cured until a strength of 2,000 pounds per square inch has been reached when they are then removed from the forms. A cycle of 24 hours is required for a set of slabs.

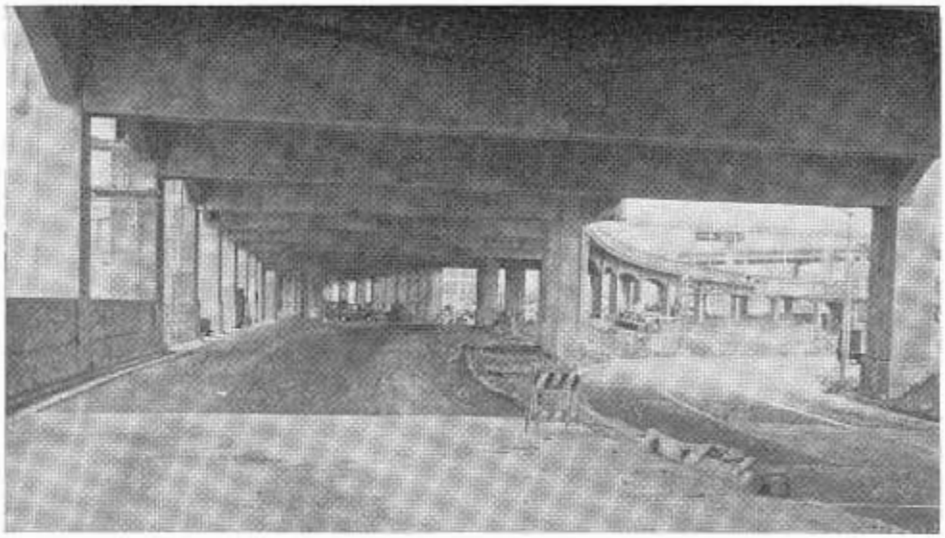
#### Crane is Suspended

The four slabs per panel are positioned by an air-operated traveling crane suspended from the upper deck floor system and are held in place and adjusted to proper elevations above the stringers by surface operated screw jacks. The two ends of the four slabs are brought to the proper elevation by measurements from straight edges. One end of the straight edge rests on the existing roadway slab while the other is placed at the grade elevation marked on the curb. Certain of the slab reinforcing bars are welded to the top flanges of the steel stringer, after which the jacks are removed; the sides are then formed and quick setting concrete is placed in the joint space around the lapped reinforcing steel projections to unite the slabs into a monolithic pavement.

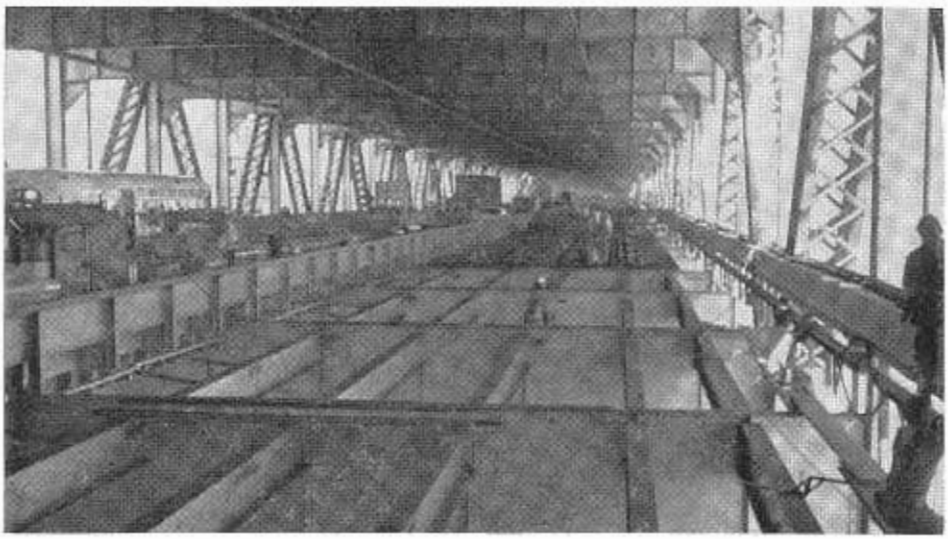
The finished roadway deck is then striped for five lanes; the south lane is barricaded for contractor's operations, leaving four lanes for lower deck traffic, two in each direction, during the construction period.

#### Upper Deck—Concrete Approach

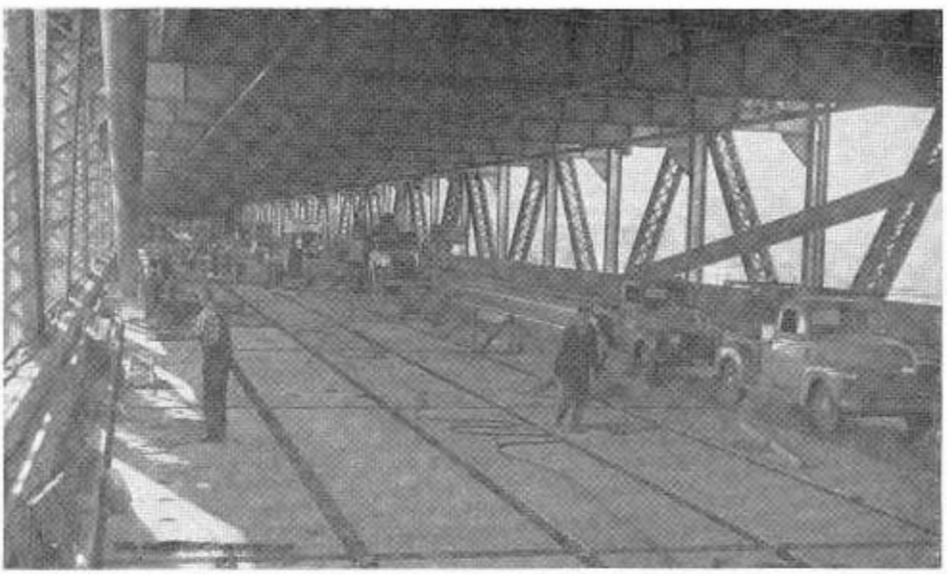
Probably the most exacting part of the reconstruction so far completed has been the strengthening of the present concrete upper deck approach to the bridge from Fourth to Sterling Streets. Also, the removing of the center columns of the three column bents



*Looking east toward the lower deck approach of the Bay Bridge from the Bayshore Freeway.*



*A section of the lower deck of the Bay Bridge during reconstruction with the railway tracks removed.*



*Deck slabs in place ready for pouring of concrete into the joints.*

supporting the upper deck from Sterling Street to the San Francisco anchorage.

The present upper deck roadway is 58 feet from curb to curb and is striped for six lanes of traffic, three in each direction. The upper deck floor system was not designed for heavy commercial vehicles.

All structural floor system members found deficient were strengthened by prestressing, as were the floor beams which had the center columns removed.

As all state-owned toll bridges carry property damage as well as use and occupancy insurance, and as the reconstruction was a deviation from the ordinary maintenance and repairs to the structure, the insurance brokers for the Toll Bridge Authority require an extra premium on the coverage during the construction period. They also stipulated that the time for the use and occupancy insurance to become effective be increased from 7 to 14 days.

#### Concrete Is Tested

Two checks were made to observe and verify the results of the stressing of the concrete member, which were by the retensioning of the strands to observe if they still retained their initial stress and the other, the running of precise levels over the upper deck benchmark before and after tensioning. Periodic measurements are to be taken over an extended period of time to observe any movement.

At the present time only a small amount of construction has been accomplished on the upper deck and only in those locations where work on the lower level required an upper deck revision. Several refuge bays were constructed and an acceleration lane for the present Fremont Street onramp to the upper deck was provided. When the project is completed, this structure becomes an offramp and the new widened length performs the function of a deceleration lane. This widening of the upper roadway and spreading of the columns supporting it provided the necessary roadway for the Sterling Street approach.

#### Bridge Traffic Capacity

Various individuals connected with highway planning and traffic have ex-

*A view of the Transbay Transit Terminal and connecting loop viaduct looking eastward with the Bay Bridge in the background.*

pressed some concern as to the estimated increase of from 25 to 35 percent in the traffic-carrying capacity of the bridge when completed for a unidirectional flow on each level. They have based their opinions on data contained in the "Highway Capacity Manual," Bureau of Public Roads, pertaining to streets, highways, freeways, and short structures.

They failed to recognize that this six-mile structure, with six lanes of restricted roadway, three in each direction, having few provisions for vehicular turnouts in case of emergencies, is not a freeway and a stalled vehicle must be immediately handled to maintain the roadway capacity.

Studies for the reconstruction of the Bay Bridge analyzed eight different lane channelization arrangements as to their traffic carrying capacities. The one selected for five unidirectional lanes on each deck was the only arrangement that more nearly satisfied the requirements of providing freeway standards with the maximum of safety and freedom of movement.

From the time the structure was opened to motor vehicles, on November 12, 1936, records indicate that there have been an average of 28 stalled vehicles per day, which has remained somewhat uniform, requiring the services of a tow truck or other maintenance equipment. An average of five stalls occur during the peak hours, one-half of which are in the lanes serving the major direction of traffic.

**The Congestion Problem**

In 1949 it took an average of 8 minutes (the equivalent of 75,000 vehicles per day) to clear the obstruction; however, in 1957 it took 13 minutes (95,000 vehicles per day). The longer time is presumably due to the greater degree of congestion, making it more difficult for emergency vehicles to reach the scene of the accident. Average recorded counts show that there is an average of 2,850 vehicles per hour passing a stalled vehicle in the two remaining lanes. During the peak hours, two free flowing lanes should have a capacity approaching 4,000 cars. A potential capacity of 2,000 vehicles per lane becomes more realistic with four passing lanes instead of two, resulting from a car stalled in the curb lane.

The bridge reconstruction program includes unidirectional travel on each deck, wider lanes, additional refuge bays, curb lane control signal system, and more frequent intervals between modern call and fire alarm boxes.

About 70 percent of the service calls are for minor causes, such as flat tires and empty fuel tanks. More refuge bays should reduce the number of stalled cars using traffic lanes awaiting emergency vehicles.

The wider lanes and signal control system will provide freer access for vehicles proceeding to the obstruction and more space to perform the necessary operations, thereby reducing the time to clear the lane.

With unidirectional traffic on each deck, the accident record of the bridge, although good, should be greatly improved. Head-on collisions, which result in the most fatalities, should be entirely eliminated.

The theoretical increase in traffic carrying capacity which would be provided by these improvements is 30 percent which could, under favorable conditions and with no breakdowns occurring, reach 35 percent, and could go as low as 25 percent under unfavorable conditions.

#### Maintenance Facilities

Accompanying the structural work required in the reconstruction are the installation of electrical and mechanical facilities that have been planned to provide a more effective and efficient maintenance and operation procedure.

There is now being installed water, electrical power, compressed air, and communication service across the bridge. It is also planned that the electrical energy, required in the operation of the facility, will be metered on both sides of the Bay with an automatic switch-over if failure occurs on either end.

Spotted at convenient intervals along the south truss of the structure are service platforms, access to which can be had from the lower deck or by ladders from the upper level. From these platforms the various connections can be made to the water, electrical power, compressed air or communication service needed. The latter system will be used by the maintenance crews. The tow car and fire alarm service will be connected to this multiple conductor cable from each level.

The water supply will be metered from Yerba Buena Island and flow by gravity to each end of the bridge. Water is provided for fire protection and for steam cleaning; however, the amount used is small.

The Sterling Street Substation, which was formerly used to transform and supply electrical energy to the trains when crossing the Bay, has been rearranged to receive and meter the energy from the power source, transform it to the proper voltages, and then feed to various outlets. Also located in this building are the electric driven air compressors used for maintenance cleaning, operating air tools, and fog horns. Stations similar to this will be located on Yerba Buena Island and at the east bridgehead.

The installation of these permanent maintenance facilities and the providing of additional movable platforms under the upper and lower decks, together with movable gantries along the outside of the trusses of the bridge, should keep all roadway lanes relatively free of maintenance vehicles.

#### Roadway Lighting

As the minimum clearance between the lower deck pavement and the floor system of the upper level has been maintained at 16 feet throughout the length of the bridge, it will require a somewhat unusual roadway lighting system to adequately supply a high level of illumination without the usual lamp glare and the alternate bright and dark spots on the roadway.

The lower deck with its 24 hour Yerba Buena Island tunnel lighting will offer another problem; however, if all the roadway lighting for the lower deck is properly located and constructed to give a high level light output, vehicular traffic should be able to negotiate the length at a somewhat higher average rate of speed with added safety.

These facilities, together with the wider, unidirectional roadway lanes, should provide a safer, freer, and possibly faster transit over the structure. The opening of the completed portion of the lower deck to four lanes has already demonstrated the greater comfort in driving on that section of the bridge.

(This article will be followed soon by another on the construction from Yerba Buena Island to the Toll Plaza in Oakland and for the revisions to the upper deck.)

## Fair-bound Drivers Will Note Changes

The State Fair in Sacramento is a summer season highlight for thousands of Californians, and recent improvements on highways leading to the state capital will make this year's trip to the fair even more enjoyable than in the past.

The 1960 California State Fair and Exposition will be held August 31 through September 11. Fair officials predict the 1960 event will be the biggest and best ever with new entertainment features added to the usual long list of headliner attractions.

Motorists enroute to the fair will find that every main state highway leading to Sacramento has been improved to some extent in the past year, and new sections of freeway are open in several places.

Between the San Francisco Bay area and Sacramento, US 40 is all freeway and expressway, except two four-lane undivided sections north of Vallejo and on the Yolo Causeway.

New sections of freeway will be evident on this route at Richmond and in the vicinity of Davis. Freeway projects will be under construction near Fairfield.

Motorists who take the US 50-99 route from the Bay area to Sacramento will also encounter long stretches of continuous freeway and expressway. There have also been improvements on US Highways 40 and 50 in the mountains and foothills east of Sacramento.

Nearly 40 miles of new freeway have been opened between Sacramento and Nevada since State Fair time last year.

On US Highway 99E traffic is now using the new Yuba River Bridge at the south city limit of Marysville.

Reconstruction and widening on a section of Sign Route 24 in Sacramento County has been completed in the past year. Motorists will also notice that landscaping and planting work has been carried out on several freeway sections on routes leading to Sacramento.

# Maintenance

## *Lighting, Landscaping Costs On Freeways Are Big Factors*

By F. E. BAXTER, Maintenance Engineer

THE Federal-aid Highway Program of 1956 has focused attention on the nation's highways, and highway costs. This has also brought to the public's attention the problem of financing such a monumental undertaking, and of equal importance in this tremendous task of constructing the Interstate System of some 41,000 miles of multilane highway, is the problem of maintaining such a complex highway system.

The multilane highway of today, with its extensive rights-of-way; wide medians between opposing lanes of traffic; complex interchanges with on and off ramps; numerous dry land bridges for carrying cross traffic over or under the main arterial; wide shoulders; for all weather service to the motorist for emergency parking; multilanes of high type pavement to accommodate the heavy flow of traffic; extensive lighting and signing facilities at critical points to provide added safety to the motorist on these high speed multilane freeways, have increased maintenance costs accordingly.

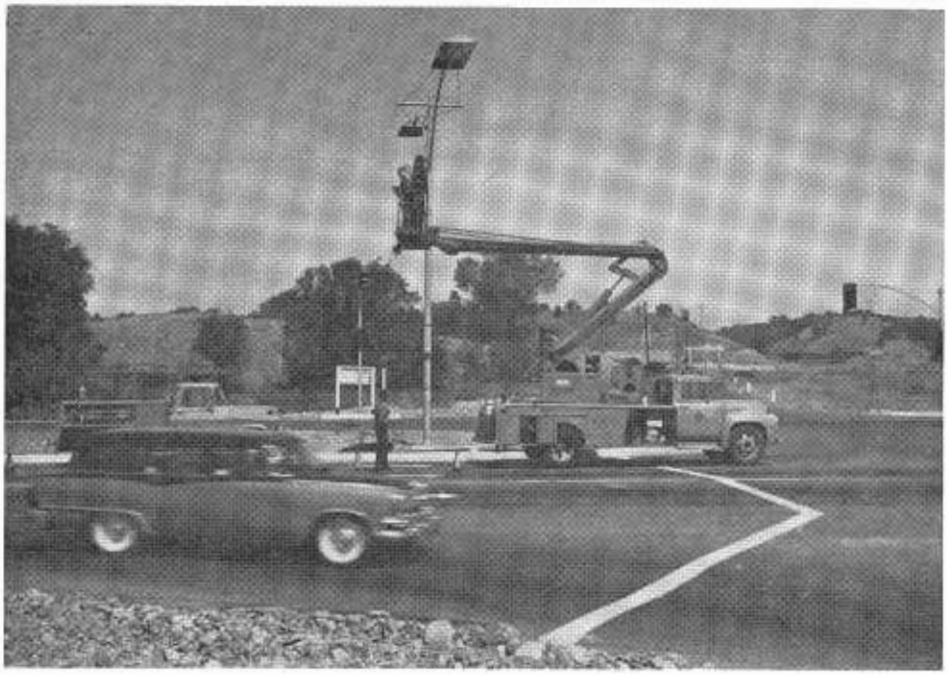
This article is the text of a paper presented by the author before the Maintenance Operations Section at the Western Association of State Highway Officials Conference in June at Portland, Oregon.

### Problems Not New

The problems encountered in maintaining multilane freeways are not new to the California Division of Highways Maintenance Engineers and field crews, for this change has been taken in stride over the past two decades, and assimilated as a part of our routine operation.

The capital investment being placed in the Freeway System of Highways warrants a high standard of maintenance. The cost of maintaining a modern freeway has caused much discussion among maintenance engineers due to the increased cost of this highway, as compared to the old conventional two-lane road.


*Cleaning a sign on the Harbor Freeway in Los Angeles. This late model sign has a catwalk for the use of maintenance personnel.*



*Another increasing function in freeway and expressway maintenance is the installation and repair of lights such as this one on US 50 east of Sacramento.*

The following summary shows a comparative analysis of costs between a rural two-lane highway, a four-lane rural expressway, and a multilane freeway.

**SUMMARY OF COSTS**

| Function | Two Lane Rural | Multilane Rural | Multilane Urban |
|---|---|---|---|
| A.D.T. | 3,500-6,500 | 6,000-20,000 | 75,000± |
| 1. Traveled way | 69.1% | 34.7% | 13.0% |
| 2. Roadside | 22.1% | 46.6% | 62.0% |
| 3. Signs | 0.1% | 5.8% | 2.5% |
| 4. Lights | – | 4.8% | 19.6% |
| 5. Stripe | 5.5% | 3.7% | 1.5% |
| 6. Structures | 3.2% | 4.4% | 1.4% |
| Total | 100% | 100% | 100% |

The two-lane study covered 155 miles located in four separate areas of California, where climatic conditions are comparable to those areas encountered on the multilane sections. Snow and slide removal are not factors in this analysis. The maintenance costs on the rural two-lane sections are the weighted average costs over the last five years ending June 30, 1959. The average costs on the multilane sections cover a three-year period ending June 30, 1959.

Traveled way maintenance costs on the two-lane highway consume 69.1 percent of the maintenance dollar, which is high when compared to the multilane sections. This is due to the fact that a majority of California's two-lane highways are over 25 years old and, in many cases, are old county roads that have been modernized over the years with an occasional base and resurface job.

The pavement widths vary from 18 to 22 feet, with no improved shoulders, except in isolated areas. Base and subbase on these old highways are not adequate to withstand the heavy loads that modern traffic imposes on them.

Considering the basic structural deficiencies of inadequate base and subbase, narrow pavement, and lack of improved shoulders, the net result is a high cost for traveled way.

#### Costs Can Be Traced

These costs can be traced to the following field operations. Base repairs are quite often due to poor drainage, or lack of base. Excessive shoulder maintenance due to dual tires on heavy trucks riding on pavement edge and displacing fines from the adjacent unimproved shoulder, thus requiring constant blading of the shoulder. Traveled way maintenance consists of "pothole" patching in inclement weather, and short ½-inch bituminous patches, crack-pouring on old P.C.C., and plantmixed surface pavement.

Added manpower for flagging is required in performing this work due to high speed and density of our traffic on these inadequate highways.

Traveled way costs on the multilane highways vary from 13 percent to 34.7 percent of the maintenance dollar. This is 50 percent less than the two-lane road, and due to the following facts.

Most of California's expressways and freeways have been constructed within the last 10 to 12 years. With emphasis on alignment, drainage, and structural section, the maintenance of this modern facility has changed from that used on the old two-lane highway of the early 20's or 30's.

Patrol maintenance is an essential phase of our operation. A traveled way free of "potholes," rough pavement, and an occasional box or some other obstruction, is necessary to prevent accidents. Street sweeping on curbed sections is a function not found on two-lane roads. Rough pavement repairs are usually corrected by placing bituminous plantmixed surfacing with motorgrader.

#### Additional Manpower Needed

The multilane highway with its high traffic density and speed, requires additional manpower for flagmen to protect the men who are working. This added phase of maintenance operations increases the costs in proportion to the actual work accomplished, but is essential to the safety of the motorist and the maintenance man.

Roadside maintenance of the two-lane highway, contains several functions; i.e., maintenance of native trees, and shrubs; firebreaks in national and state forests; control of noxious weeds adjacent to agricultural and other critical areas; and mowing of adjacent roadside. The right-of-way widths on the two-lane highways are quite narrow in comparison to the four-lane multilane highways and, consequently, require only 22.1 percent of the maintenance dollar. Roadside costs on the multilane highway range from 46.6 percent on the rural areas to 62 percent on the urban areas. Maintenance costs of planted areas for the first three years of the establishing period are approximately 35 percent to 40 percent of the initial capital outlay. Maintenance costs for the ensuing

years will average 25 percent of the capital outlay thereafter.

The care and maintenance of the multilane highway on the Freeway System with the large number of interchanges that are to be found in both the urban and rural areas, together with the wide right-of-way required on the Freeway System, run into large sums of money. We are then confronted with the care and maintenance of considerable increased width of roadside and median strips which are subject to noxious weed and fire hazard control, together with litter cleanup. Also included, will be planted areas for erosion control, screen planting for noise and sight abatements, or screen planting for headlight glare in the median strip. Some landscaping may also be included.

#### Cleanup Costs Increase

Litter cleanup and sweeping costs show a marked increase on freeways, because of the many additional curb miles to be swept and wide right-of-way to be cleared of rubbish.

Sign maintenance on the two-lane highway requires 0.1 percent of the maintenance dollar, while the rural expressway demands are 5.8 percent, and the urban freeway 2.5 percent, respectively.

Sign maintenance costs are low on the two-lane highways, due to use of standard signs that have been in use these many years. An occasional sign replacement and routine washing, account for the low cost of this maintenance.

Sign maintenance on the rural expressway shows a decided increase over the two-lane highway, and in percentage, the urban freeway appears lower than the expressway. This is misleading, due to the wide variation in total costs between the expressway and freeway.

On our modern Freeway System where high speed prevails, advance warning signs are a must. Illumination of these signs is a factor during inclement weather, and warns the motorist of approaching intersections, etc. The average number of signs on a typical cloverleaf interchange is 31 directional signs and 12 regulatory signs. This includes various signs approaching the intersection, as well as signs for 2-sign bridges, and all signs for on and off ramps. A standard intersection of two main highways at grade, would require 8 directional signs and 2 regulatory signs, or a total of 10 signs, as compared with some 43 signs for the same intersection on a Freeway System.

#### Factors Reflect Increase

The above factors, along with the substantial increase in size of the freeway signs, reflect the increase of sign maintenance of multilane highways over the two-lane highway.

The cost of lighting on the two-lane rural highway is, according to our records, very small, because we have very few installations.

Lighting costs on the rural expressway and urban freeway are 4.8 percent and 19.6 percent, respectively, of the maintenance dollar.

The increase in lighting of the multilane highway of today, over the two-lane road, is due to its interchanges, on and off ramps, and appurtenances, and requires complete illumination to keep traffic moving at an even pace to avoid congestion and to eliminate accidents.

In a recent study of the annual maintenance costs of signalized intersections, lighted signs, and safety lighting, it was determined as follows:

#### Traffic Signal Intersections

Annual costs vary from $680 to $890 per intersection, depending upon the complexity of the intersection; however, in a 12- to 15-head intersection, the average cost per head was $58.

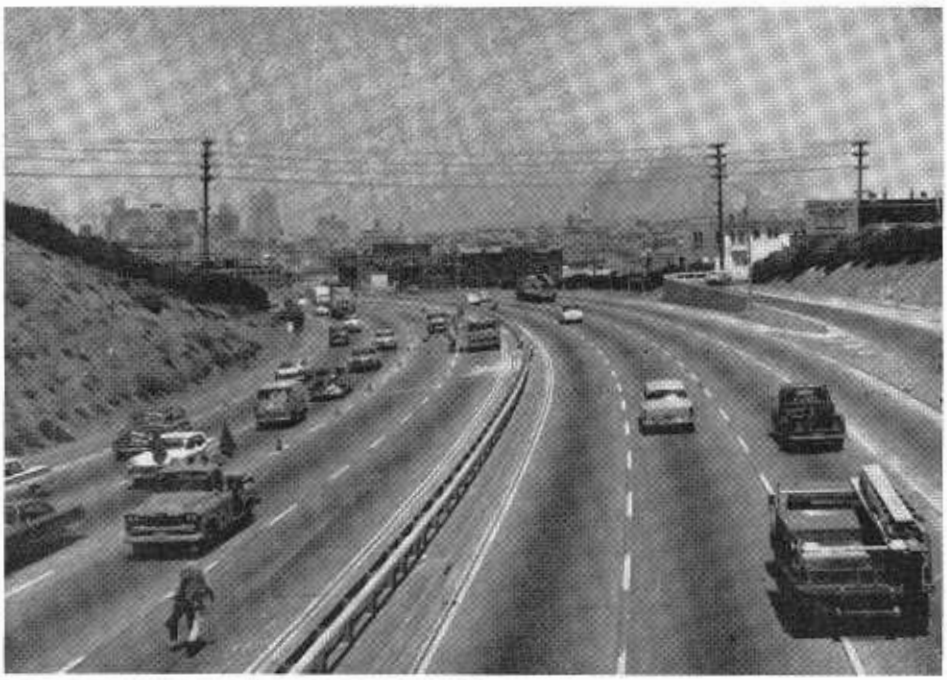
#### Illuminated Signs

The annual cost of maintaining the electrical facilities of a lighted sign, including energy charges and replacement of lamps, was found to vary from $130 to $190 per sign, depending on its size.

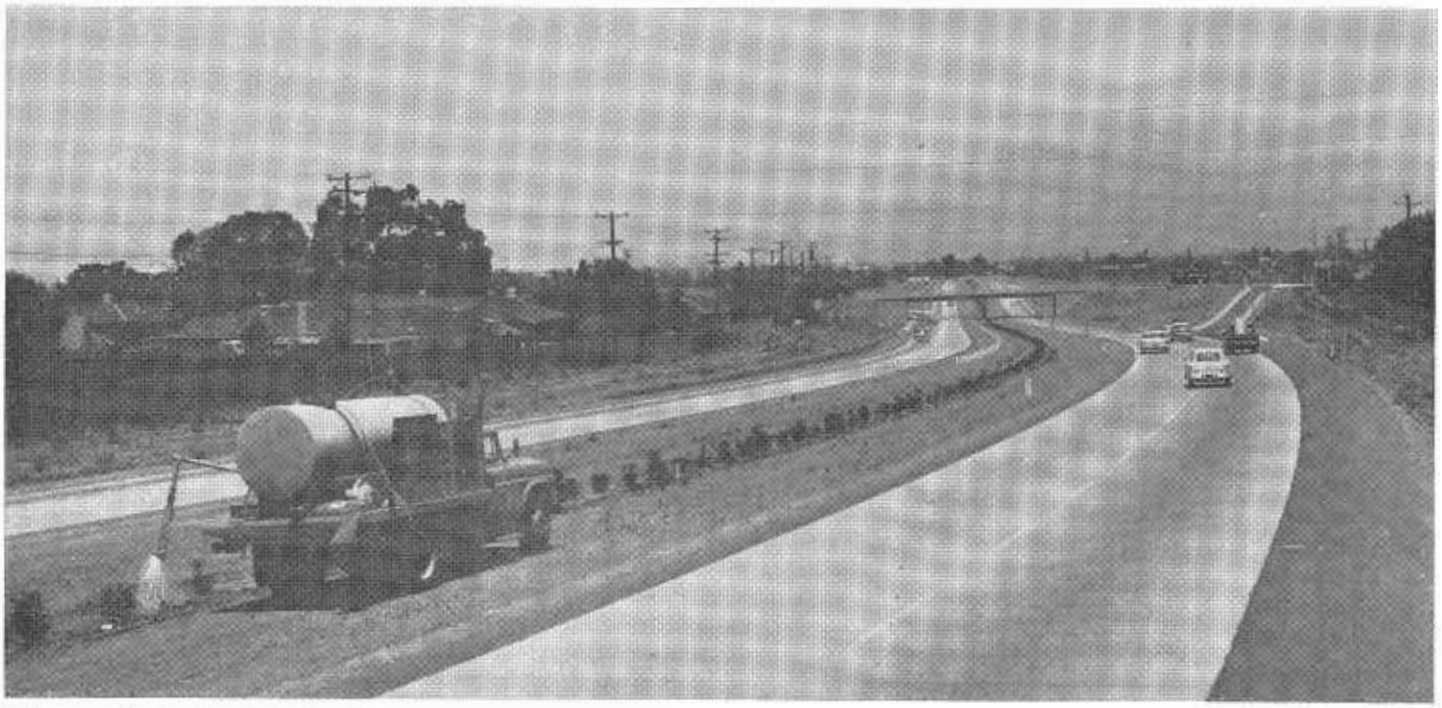
#### Highway Lighting

The annual maintenance cost of a highway light was found to vary between $62 and $73.50. The main items included are energy costs and lamp replacements at two-year intervals.

The interchange, which is an integral unit of a full freeway, with its service connections, means a continued increase in this function of highway maintenance costs. As added multilane mileage is taken over for maintenance,



*Work on heavily traveled highways is another problem that must be faced constantly by maintenance forces. Here a crew begins work on a section of the Bayshore Freeway in San Francisco.*



*Maintenance duties also include the upkeep of roadside planting. Here a maintenance truck waters young oleanders along the median strip of Sign Route 17 north of Los Gatos.*

the increase in this important maintenance function will continue.

Traffic stripe and pavement markings on the two-lane highway require 5.5 percent of the maintenance dollar, and appear high when compared to the 3.7 percent and 1.5 percent of the maintenance dollar for the same function on rural and urban multilane highways respectively.

The differential in cost between the two-lane and multi-lane highway is due to stripe replacement. The narrow pavement lanes on the two-lane highway vary from 18′ to 22′ in width, and due to traffic density, causes much crossing back and forth over the centerline stripe, resulting in excessive wear and deterioration, whereas on multilane highways, with the heavy traffic volume, lane driving is the pattern, rather than weaving between lanes. Our records show that traffic stripe replacement on the Hollywood Freeway is required approximately every two years. While on the two-lane highway, restripping occurs every six to nine months and at least once a year. This is reflected in our costs records.

In summarizing safety devices, which include "signs," "lights," and "stripe," the rural two-lane highway costs 5.6 percent of the maintenance dollar, as compared to 14.3 percent and 23.6 for multi-lane rural and urban highways, respectively.

Maintenance cost on structures on two-lane roads requires 3.2 per cent of our total expenditures. This is not excessive when compared to 4.4 percent for multilane rural and 1.4 percent for urban freeways. The low cost factor for the urban freeways is due to the large number of relatively new structures that have, up to now, required a minimum of maintenance, as compared to the two-lane and multilane rural highways which have been in service much longer, with resultant increase in maintenance costs.

#### Maintenance Standards Are High

The large volume of high speed traffic that uses the expressways requires that the maintenance of the structures be of the highest caliber. The deck must be smooth riding and free from any skidding tendency, the drainage must function properly, the expansion details must be kept in good condition, and the approach roadway kept smooth and to the proper grade at all times. These items all require constant maintenance.

The volume and speed of traffic using freeways and expressways cause considerable maintenance in the way of repairing traffic damage. The majority of such damage is caused by vehicles striking the railing, or by structural members being hit by overheight loads. The maintenance costs resulting from such traffic damage are appreciable. Such damage must be repaired promptly both for safety and appearance.

There is but one inference to be drawn from this discussion—that maintenance costs on freeway systems are going to increase as the systems are completed. With the heavy traffic volume on these facilities, the maintenance cost per vehicle mile will compare favorably with the old two-lane road.

In conclusion, the problems presented in maintaining freeway-type highways do not vary greatly from those encountered in maintaining roads of other categories. However, they are multiplied by reason of having a much larger facility, and also by reason of providing a more complete service to the motorist. The traveling public will also expect a higher standard of maintenance on these highly publicized roads.

# 5/8c Gas Tax

## *Policies and Practices Governing State Funds for City Streets Explained*

By M. H. WEST, City and Co-operative Projects Engineer, and
H. H. HOOVER, Senior Highway Engineer

THE TOTAL annual expenditure for street and highway purposes within the limits of California's 366 incorporated cities is approaching the half-billion-dollar mark.

In the 1958-59 fiscal year this expenditure amounted to $455,000,000, of which nearly one-half—$219,000,000—consisted of expenditures by the Division of Highways for the improvement and maintenance of state highways within cities. Most of this money was spent for rights-of-way and construction on new multilane freeways.

The accompanying "pie chart" shows the sources of the various funds from which expenditures were made by the State, the cities and others on city streets and highways. In terms of dollars for the 1958-59 fiscal year, here is where the money came from:

- As mentioned above, $219,000,000 from state and federal highway user taxes, for state highways within cities.
- From the State Highway Fund (⅜ cent per gallon of the gasoline tax, and other highway user taxes) $32,300,000 for construction on major city streets not on the state highway system and for maintenance and engineering.
- From other state funds, $6,700,000.
- From funds made available by other governmental agencies, $24,300,000 (including about $10,000,000 made available to cities by some counties as a resubvention of their 1⅜-cent-per-gallon gasoline tax money).
- From various city sources, including sale of street bonds, street taxes, general fund, traffic safety fund, etc., $104,400,000.
- From private investments and improvement acts (such as in new subdivisions), $64,500,000.
- Carryover balance from preceding year, $3,400,000 (of which 72 percent was derived from State Highway Fund sources).

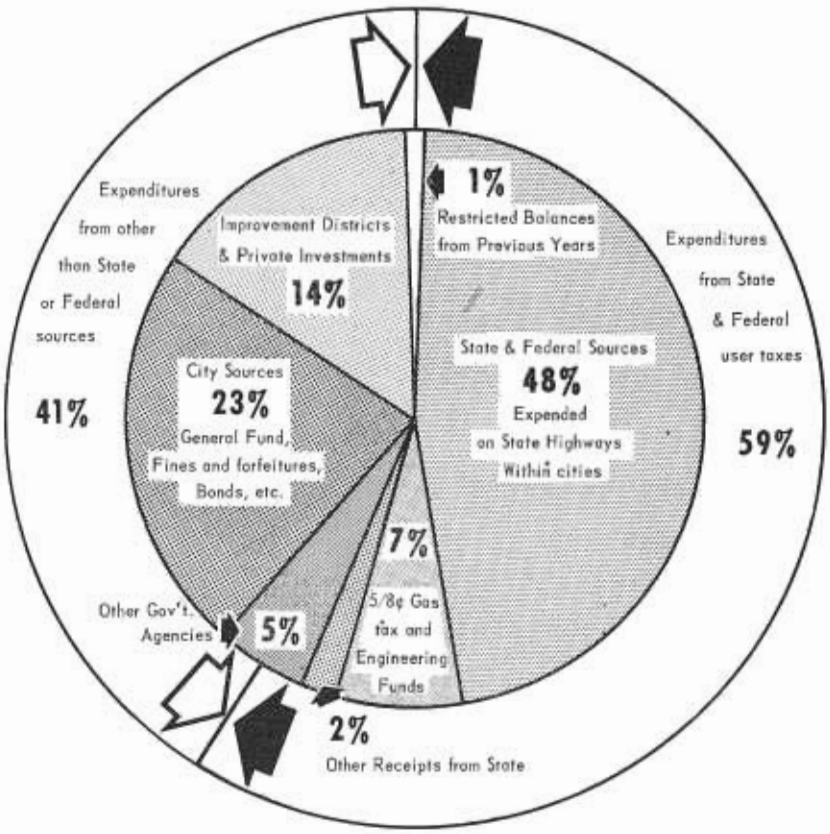
In addition, there was about $51,000,000 made available to cities in 1958-59 from the "in lieu" tax on motor vehicles which is collected by the State coincident with vehicle registration. However, only a small fraction of this money is used by the cities for street purposes, and is included in the $6,700,000 noted above.

### Type of Service Is Key

The use of funds from several sources conforms to the general practice throughout the State of financing the cost of maintenance and improvement of certain classes of street and highway systems with certain kinds of tax levies. For example, it is the consensus in most quarters that the cost of street and highway improvements be assessed the taxpayer somewhat in accordance with the type of service afforded him by the particular street system.

Thus, the cost of the state highway system, which affords inter- and intra-city travel, is assessed in most part to the street and highway user who pays the gas tax. The major if not the full cost of the purely local roads whose sole function is to provide access to immediately adjacent land is assessed against the property owner. In between, the street and highway user *and* the property owners on a city-wide basis are assessed the cost of the community vehicular traffic service facilities, that is, streets of greatest general city importance.

It is upon this system of streets that the revenue from the ⅜-cent gas tax supplements citywide tax levies. Inasmuch as revenue from the ⅜-cent gas




Sources of funds expended for Street & Highway purposes within California cities 1958–1959 F.Y.

*BEFORE AND AFTER—The photo (left) shows a section of Main Street (Sign Route 20) in Grass Valley before reconstruction. Photo (right) shows the street after the work was completed. This is an example of a co-operative project in which the city participated in improvement of a state highway, using ⅝-cent gas tax funds.*

tax is a levy imposed upon the user, it is imperative that this revenue be expended so as to benefit the user to the maximum extent possible.

#### Legislative Controls—⅜-Cent Gas Tax Expenditures

Many questions have arisen concerning the controls and restrictions placed on the use and expenditure of ⅜-cent-per-gallon gas tax and the engineering subvention to the cities.

One of the questions asked most often is: "Why does the Division of Highways exercise considerable direction in the use and expenditure of these funds?"

Section 2107 of the Streets and Highways Code provides that "A sum equal to five-eighths of one cent ($0.00625) per gallon tax under the Motor Vehicle Fuel License Tax Law shall be transferred to the State Highway Fund for expenditure in cities as provided in Section 194." Under Section 195, it is provided that at least three-fifths of this sum shall be expended for construction of streets contained in the major city street system.

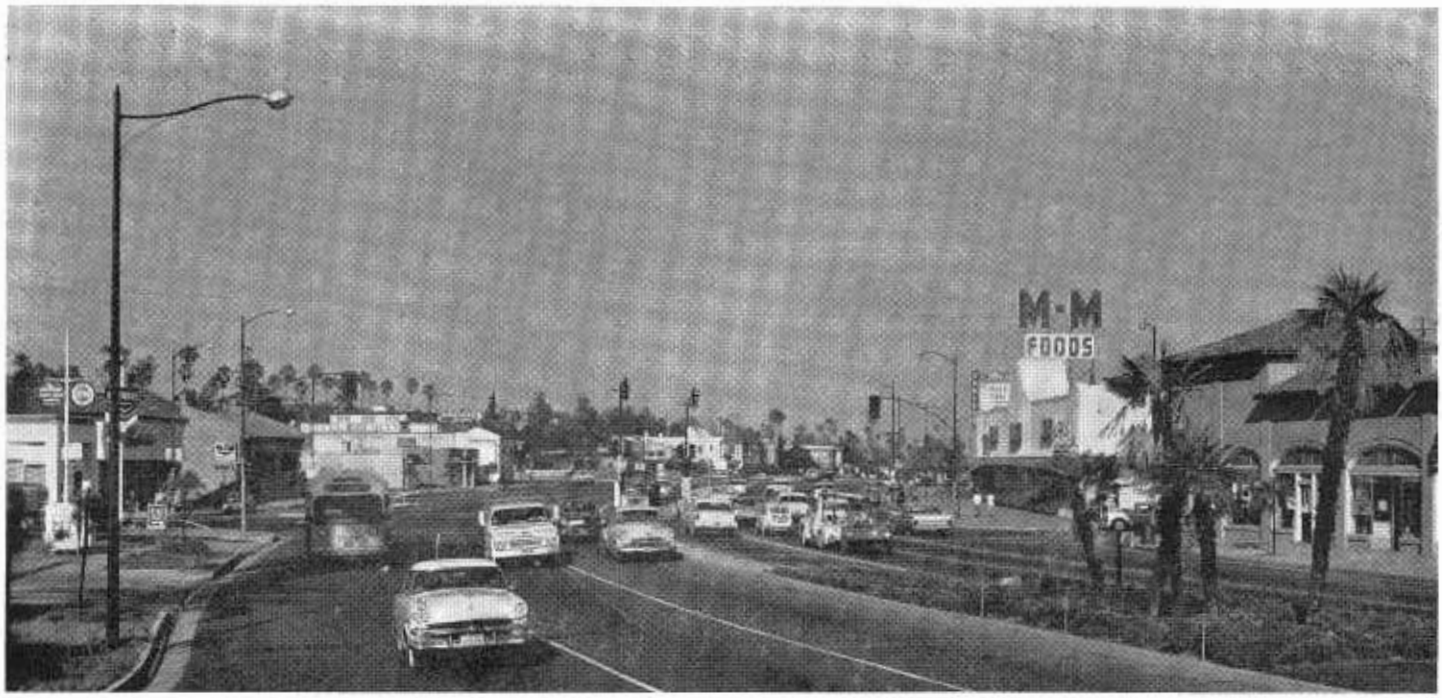
Section 2107.5 provides for annual payments to the cities from the State Highway Fund "for expenditure exclusively for engineering costs and administrative expenses in respect to city streets." These payments vary in nine steps from $1,000 for the smallest cities to $20,000 for the largest cities.

Sections 194 to 202 and 2050 to 2054 of the Streets and Highways Code provide that expenditure of gas tax funds be under the control and supervision of the State Department of Public Works. (The department has delegated this responsibility to the Division of Highways.)

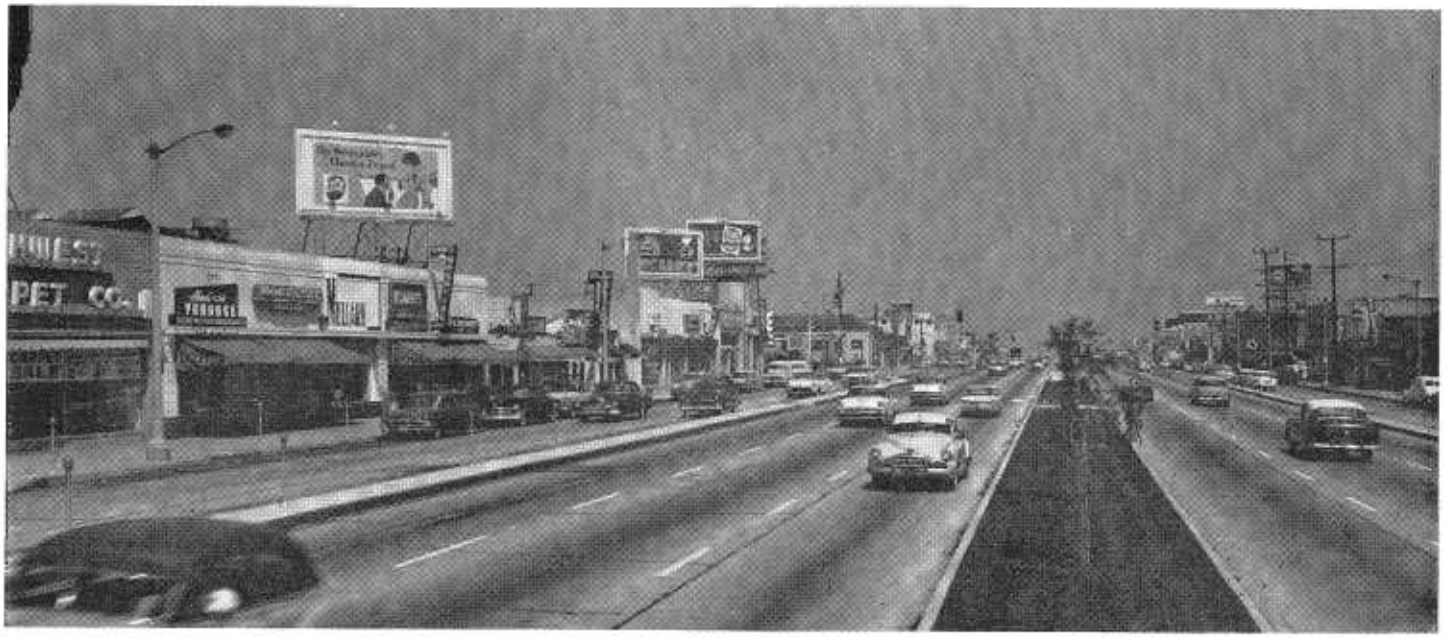
#### Not 'Shared Revenue'

The State Attorney General on November 7, 1952, rendered an opinion that clarifies the department's obligations and responsibilities as follows:

"It seems to us that highway subventions do not belong to a political subdivision at all . . . It has been suggested that the gasoline tax money is




*A photo of Huntington Drive in South Pasadena after it was widened to six traffic lanes, two parking lanes and an 18-foot median strip.*



*Crenshaw Boulevard in Los Angeles was widened to six traffic lanes, with a 12-foot median and frontage streets on either side of the main roadway.*

not a subvention, not a grant-in-aid; that it consists of funds which are centrally collected and locally shared for specific purposes, subject to state approval. The suggestion is self-defeating, because it calls into question the constitutional basis for the distribution of the revenue to cities . . . The constitutional basis for the imposition and distribution of gasoline taxes was that these were state revenues, imposed for state purposes and distributed in part to local governments, to be spent by them for state purposes only.

"The adoption of Article XXVI of the Constitution in 1938 did not change the nature of the gasoline tax. It still remained what it was in 1923—a state tax imposed for state purposes. Consequently, we must reject the suggestion that the money in the city's Special Gas Tax Street Improvement Fund is 'shared revenue.'

"The character of the money as state money is emphasized by the fact that it is not distributed directly to the cities. It is made available to the State Department of Public Works for expenditure in cities. The Streets and Highways Code indicates plainly that the city makes its expenditure as the delegee, or agent, of the Department of Public Works, only when the department has delegated the expenditure and only for projects approved by the department (Secs. 194-201)."

The ⅛-cent gas tax funds are State Highway Funds included in the State Highway Budget submitted annually by the department to the Governor. The prime responsibility for the expenditure of these funds rests, according to statute, in the department. Expenditures of such funds may be delegated to the governing body of a city *only* if and when the department is satisfied such city is "equipped to conduct the particular work to be delegated in an efficient and economic manner and if the city has set up by ordinance a 'Special Gas Tax Street Improvement Fund.'"

The statutes not only clearly establish the responsibility of the department in the administration and supervision of the 5/8-cent gas tax funds expenditures, they also set forth various restrictions on the use of such funds. These various restrictions may be separated into four principal subdivisions as follows:

1. **Prebudget requirements.**
   - **(a) Fund establishment.**
   - **(b) Selecting the major city street system.**
2. **Budget preparation and execution.**
3. **Preparation and approval of plans, specifications and estimates of cost.**
4. **Filing of annual and final reports.**

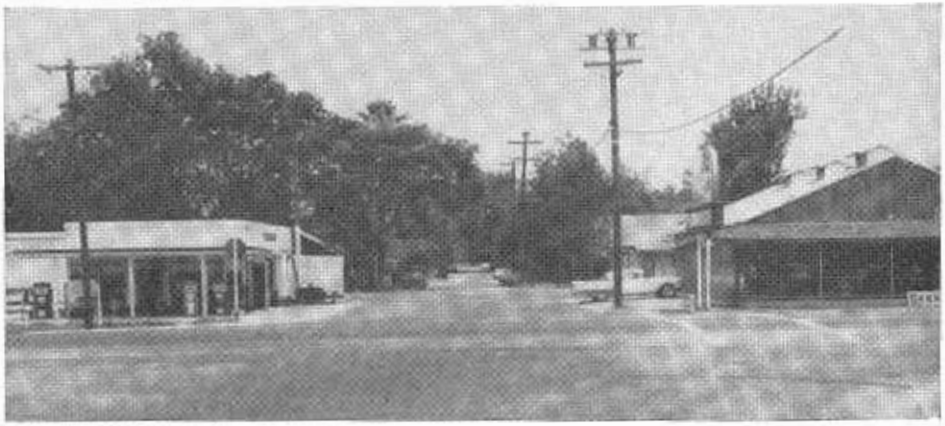
#### Prebudgeting

A newly incorporated city must establish a special gas tax street improvement fund and file certified copies of such ordinances establishing the fund with the department. This action is also necessary to qualify for payments under the Section 2107.5 engineering funds.

Before a city may budget any funds other than for maintenance, a major city street system must be selected by the city council and approved by the department as provided in Sections 2050 to 2054. Except for the City and County of San Francisco, no percentage or mileage limitation is prescribed for the major city street system. However, the legislative intent is clear in Section 2052: "The system of major city streets shall be selected by the city council on the basis of greatest general city importance subject to the approval of the department." Exclusions and inclusions necessary to update the system are provided for under Section 2053.

Public officials at all governmental levels have the responsibility of planning and providing for road, street, and highway improvements in a manner that will afford the public the best possible highway transportation service at the least cost.

*Part of the work in widening Colfax Avenue in Grass Valley from 25 to 40 feet involved installation of this new culvert.*



*This photo shows a portion of 15th Street in Live Oak, Sutter County, after it was improved.*

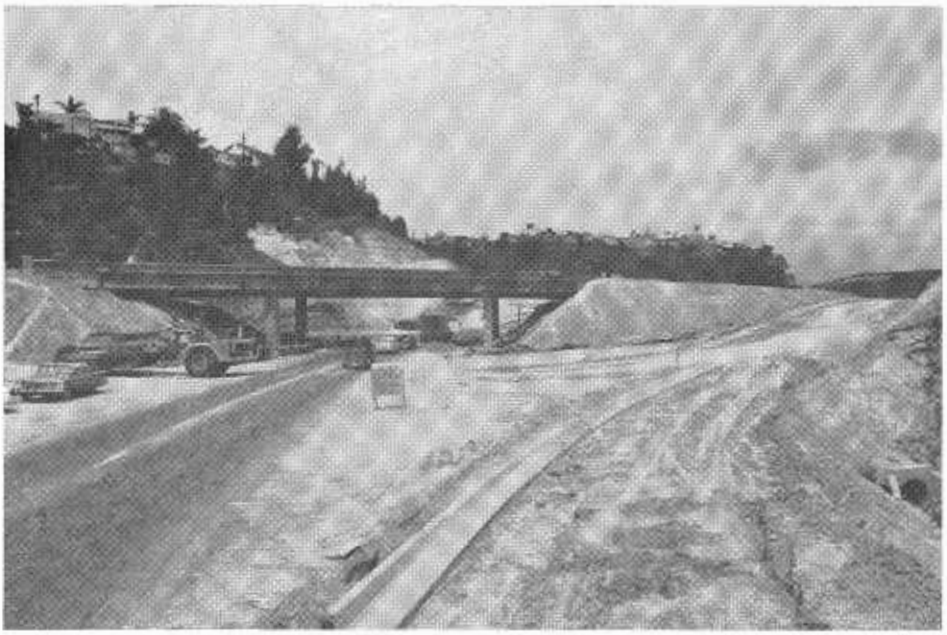
There is increasing recognition that a valuable aid in exercising this responsibility is a public policy expressed in a master plan which includes the traffic circulation element. The traffic circulation element generally includes state highways (freeways, expressways, or conventional high-type arterials), major arterials and collector streets.

A major city street system that generally conforms with or is included within the framework of an up-to-date circulation element of a city's master plan provides a city council with a sound basis for planning improvements with the use of 5/8-cent gas tax funds. In many rapidly growing cities, there is an increasing recognition and utilization of the advantages of this basis of planning. These cities realize that a static major street system cannot reflect changes in traffic patterns caused by changing land use and by other effects.

#### Budget Preparation and Execution

Section 197 of the statutes provides, "It shall be the duty of the legislative body of each city, on or before the first day of June of each year, to prepare and to submit to the department a budget on such forms as the department may specify, showing the estimated expenditure of such funds recommended to be made during the ensuing fiscal year."

*One end of a widening project on Compton Boulevard in the City of Compton. Right-of-way is being purchased to continue the widening.*



*A view of the Aldine Drive Undercrossing now under construction on Fairmount Boulevard in San Diego.*

Such budgets may provide for the expenditure of the total estimated apportionment or for a portion thereof for the fiscal year. In general, projects should be budgeted to the extent funds are available even though some improvements will necessarily be deferred until a later date when funds have been accumulated and are sufficient to accomplish the projects. Expenditures for maintenance are limited by statute to 40 percent of the annual gas tax funds and may include maintenance of both major and secondary city streets. A minimum of 60 percent of the gas tax funds shall be expended only for construction of streets included in the major city street system. Cities may, with department approval, limit maintenance expenditures to less than 40 percent of the funds in order to provide a greater portion for construction on the major city street system. Project statement forms are furnished to the cities to expedite the submission of the budgets.

The Department of Public Works by this same statute is authorized to disapprove any such budget or any item thereof if in the opinion of the department:

(a) The proposed work or expenditures do not comply with the requirements of the statutes as to the purposes for which such funds may be expended.

(b) If the proposed expenditures are excessive for the work to be done.

(c) If adequate provision has not been made to serve traffic on streets where previous expenditures of gas tax funds have been made.

#### Limited to Traffic Purposes

As to the purposes for which gas tax funds may be expended, Section 195 limits the expenditures to the portion of the street available for use by vehicular traffic, for pedestrian underpasses or pedestrian overhead crossings, installation and maintenance of traffic control devices including safety lighting, and the replacement of sidewalks and trees removed or damaged by construction. The code specifically excludes expenditures of such funds for these purposes: Street lighting, construction or maintenance of sidewalks (except as above) or the construction or maintenance of any facility in, over or under the street which is not of direct and primary service in providing a way for vehicular traffic.

Thus, the statutes clearly set forth the responsibility of the department to carefully check the proposed budgets as to purposes, to amounts, and to be certain that the expenditures are not scattered over many city streets without properly completing work started previously on other major city streets.

This usually is the first opportunity of the department to consider the work proposed by the city during the fiscal year. At this point, questions may be raised regarding the proposed structural and geometric sections.

#### How Wide Should It Be?

As a guide to these considerations, several authorities have set forth desirable street widths for various conditions. Excellent examples are included in "A Policy on Arterial High-

*A view of Washington Street in San Diego after completion of a widening project.*

ways in Urban Areas," American Association of State Highway Officials (AASHO), 1957; "Minimum Design Standards for Subdivisions" as adopted by the Public Works Officers Department of the California League of Cities; and "Engineering Standards and Instructions for County Road and City Street Deficiency Surveys," Joint Interim Committee on Transportation Problems of the California Legislature, September 26, 1956.

For a curbed two-lane major street with parking on both sides, these references recommend a minimum of 40 feet between the curb faces. This will provide 12-foot width travel lanes and 8-foot parking lanes. Likewise, a desirable minimum width for four-lane streets is 64 feet between the curb faces. The AASHO reference cited above gives desirable widths for medians, turning lanes and curb clearances.

In the case of streets located on side hills and in built-up areas where widening to meet these recommended street widths would prove too costly to be practicable, lesser widths are approved by the department if the city decides to prohibit parking on either one or both sides of such streets as necessary so as to provide clear travel lanes of 12-foot minimum width. In cases where attainment of the 12-foot lane width is considered impractical, a lesser width may be considered for approval.

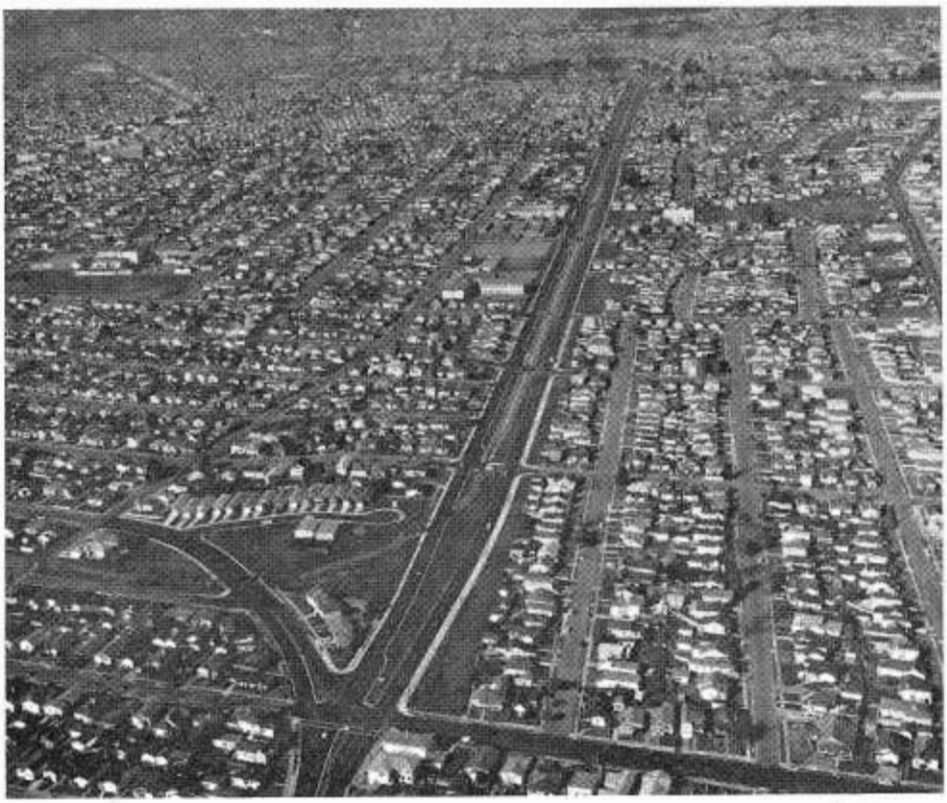
#### Parking Problem

All authorities agree that the practice of angle parking takes up a large percentage of the street width. Such parking materially reduces the ability of the street to efficiently handle moving traffic. Furthermore, the practice of angle parking creates greater hazards to moving traffic as well as to pedestrians in crosswalks. For obvious reasons, therefore, the department usually does not favorably consider street improvements with gas tax funds where the practice of angle parking is to be permitted after the street is improved. Where cities permit angle parking on city streets and consider such parking essential and of more importance than moving vehicular traffic, cities may of course finance the cost of the construction and improvement with other than gas tax funds.

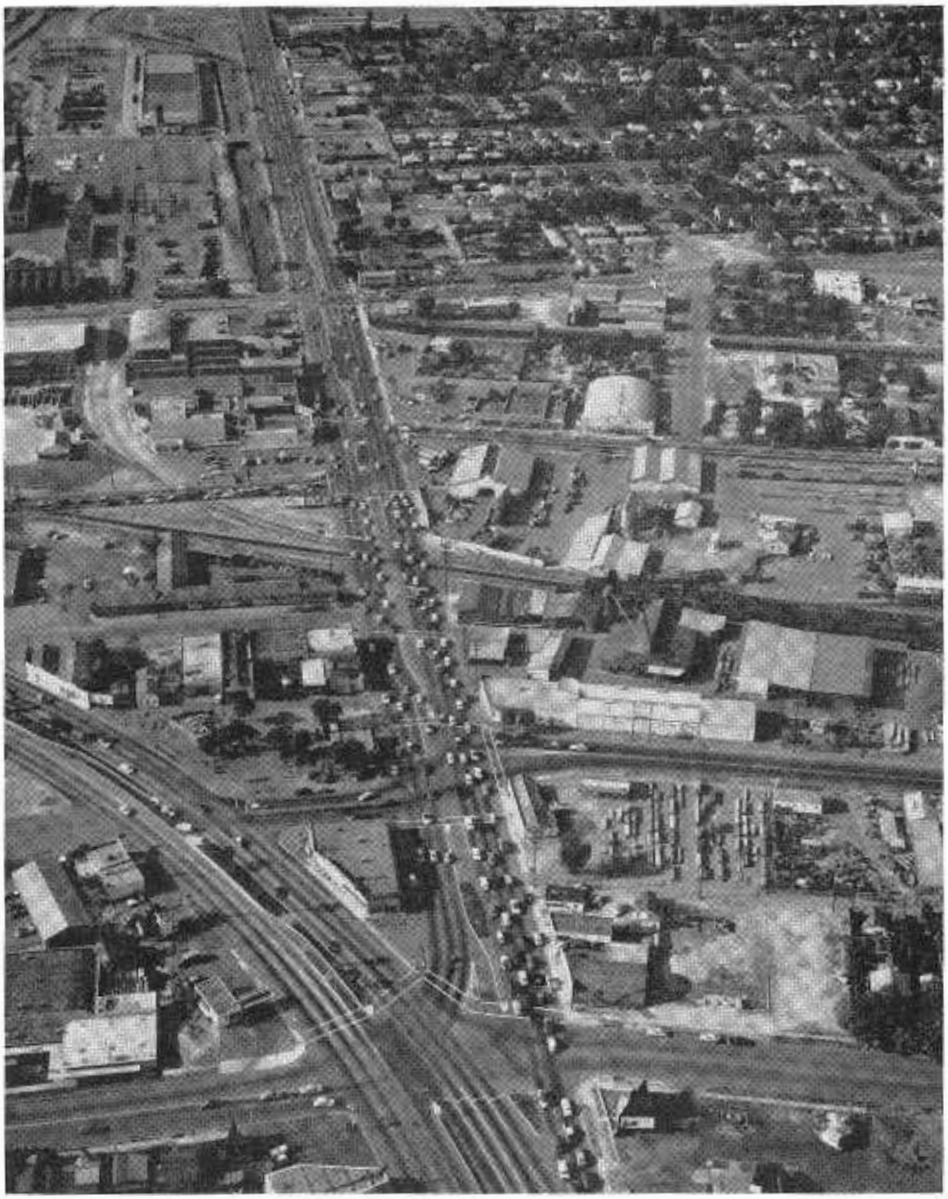
In many cases the objection to curb parking arises only during the peak hours, the volume during other parts of the day being insufficient to fully utilize all lanes. A logical and effective method for expediting such peak hour traffic flow is for the city to effect a restriction of curb parking, on one or both sides, to the extent that such parking be prohibited during peak hours. This results not only in extra traveled way width when most needed, but also in increased efficiency of operation. To some extent "no stopping" regulations also may be required, since the stopping of occasional vehicles produces various interferences when all through lanes are being used. The use of parking controls is a major item in the conversion of a local street to an arterial facility to meet current highway needs, but the need for expanded traffic facilities for the future also should be kept in mind.

Although the design may not be fully developed during the budgeting period, it is good practice to consider the traffic needs and general design at this point, rather than to leave all such consideration until the detailed plans and specifications have been submitted by the cities. Any serious discrepancy between this proposed design and the final plans and specifications may cause delay in the final approval.

The memorandums of agreement as prepared by the department, executed first by the city and then by the department, constitute approval of the budget and provide the basis on which quarterly payments may be made to that city. Although the revenue received by the department from the Highway Users Tax Fund is apportioned to the cities quarterly, payments may be made only to those cities which have an approved budget, and such payments shall not exceed the total amounts budgeted at that time by such cities. Payments from previously accumulated funds are made in addition to the quarterly apportionments when covered by approved budgets. Where payments cannot be made to a city due to insufficient budgeting, such funds ac-



*This aerial shows the completed widening and reconstruction of Bancroft Avenue in Oakland.*



*This aerial shows Union Avenue in Bakersfield after it was widened. The highway joining Union Avenue from the left foreground is US 99.*

cumulate in the State Highway Fund to the credit of that city.

#### Plans, Specifications and Estimates

As required by Section 199 of the Streets and Highways Code, the city must furnish to the department for approval adequate plans, specifications and estimates of cost for the proposed street improvement before expending any gas tax funds for construction. On gas tax projects, the city may not advertise for bids or perform work by day labor prior to the approval of the plans and specifications by the department. Nor may the city award any gas tax financed contract for an amount in excess of the engineer's estimate of cost or to other than the low bidder without first receiving the written consent of the department. Also, the amount of any item specified in the budget for maintenance or acquisition of any real property may not be exceeded prior to obtaining the written consent of the department.

The plans and specifications are thoroughly checked by department engineers experienced in urban street design to ensure conformance with legal requirements and principles of modern urban design, as well as for practicability and workability. The department acts as an advisory and regulatory agency to ensure compliance with the law and to verify that gas tax funds are being used to the greatest advantage for vehicular traffic.

In this phase of responsibility, the department renders a vital service to the cities by providing a final check which may occasionally uncover errors or omissions. Serious legal and financial difficulties to a city, as well as a reduction in the benefits, may result if these errors or omissions are not corrected.

The review includes a check on the structural design of the base and surface, as well as the geometrical features such as width, crown, curb height, and in some cases in city design—sight distance.

Bridge and drainage structures are checked structurally by experienced structural engineers to ensure that they meet the requirements for adequately carrying the design load. Traffic signals and safety lighting plans and specifications are checked by experienced traffic and electrical engineers.

The specifications are reviewed to ensure that they are comprehensive as well as sufficiently restrictive to provide a satisfactorily completed project; also to make certain that all necessary legal requirements are included therein.

Any obvious omissions or errors that are discovered in the review of the plans and specifications are called to the attention of the city engineer. Any differences of opinion regarding the design are discussed and a solution reached which is mutually satisfactory. Arbitrary attitudes by the department are avoided, as it is realized that city engineers are proficient in their field and are probably more aware of local conditions which may affect the proposed designs.

#### Annual and Final Reports

Section 201 requires of each city the filing of an annual report at such times as the department may designate, showing all expenditures made for maintenance in such detail as the department may require. All transactions within the cities concerning gas tax

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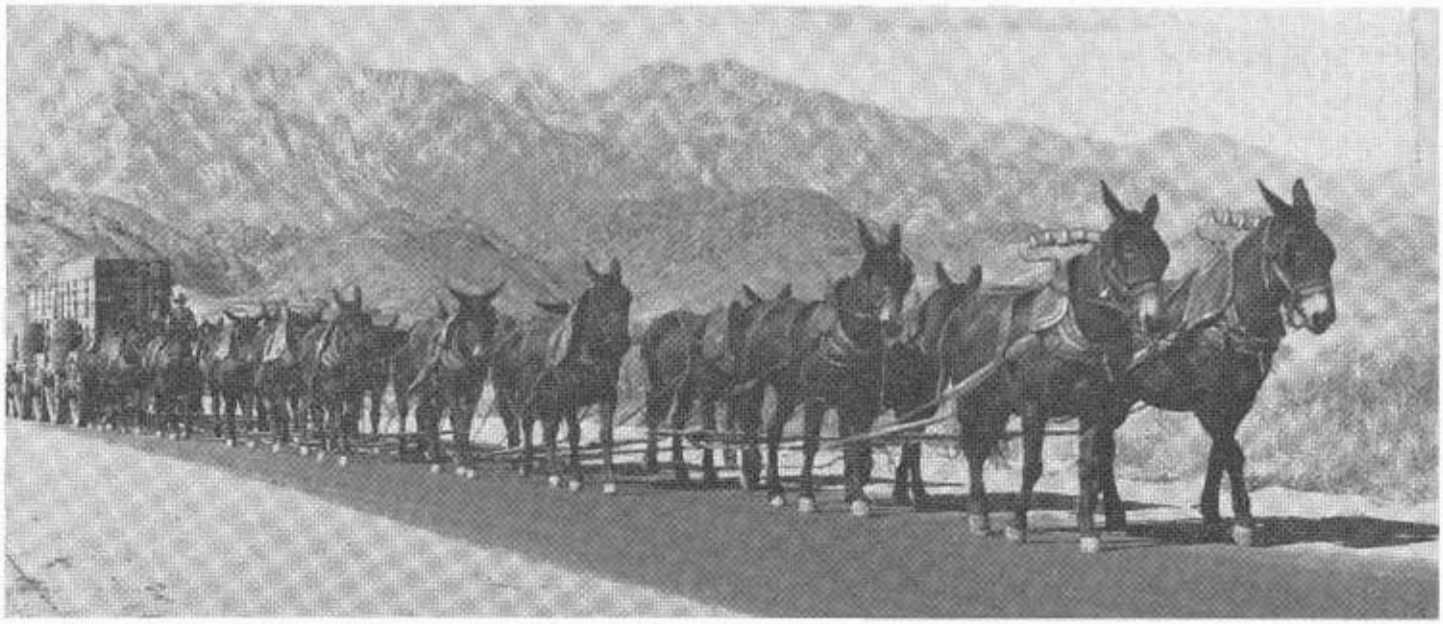


*A genuine 20-mule team and borax wagons on US 395 near Lone Pine.*

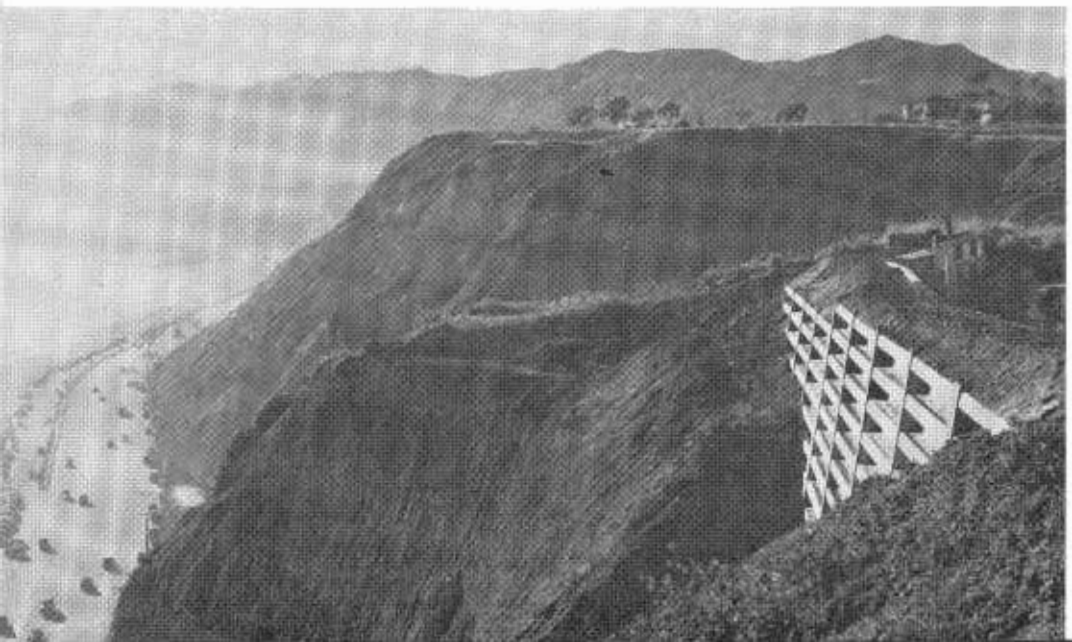
*Cuesta Grade on US 101, San Luis Obispo County, as it looked in the late 1920's. Below: In 1940, as today, slides were a problem on the Palisades near Santa Monica. Below at right: A 1941 view of the eastern approach to Yosemite National Park via Tioga Pass.*

## THREE DECADES

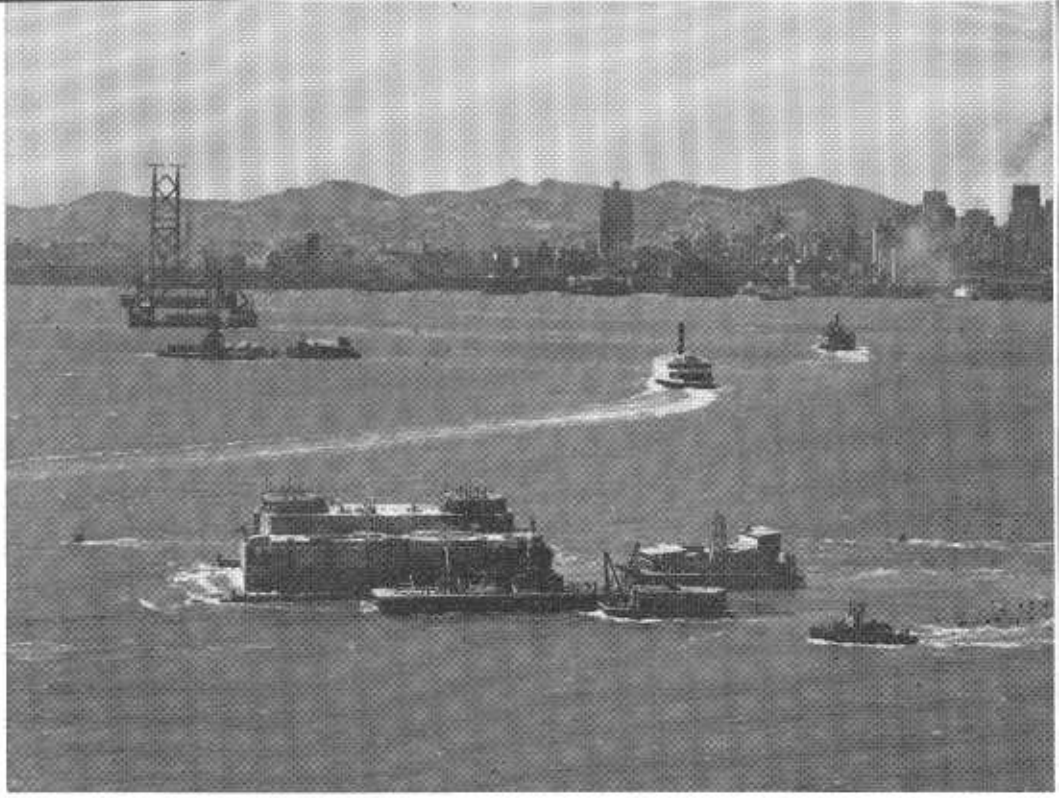
For more than 30 years Merritt R. Nickerson, the Division of Highways' Supervising Photographer, has traveled up and down California photographing state highways. At the time of his retirement, it seems worthwhile to look again at some of the photographs he has made over these more than three decades.

When "Nick" first started taking pictures of California highways, the Model-T was the mainstay of automobile traffic in the state, and most of the highways were built for its slow speed, short turning radius, and

*. . . Continued on page 56*

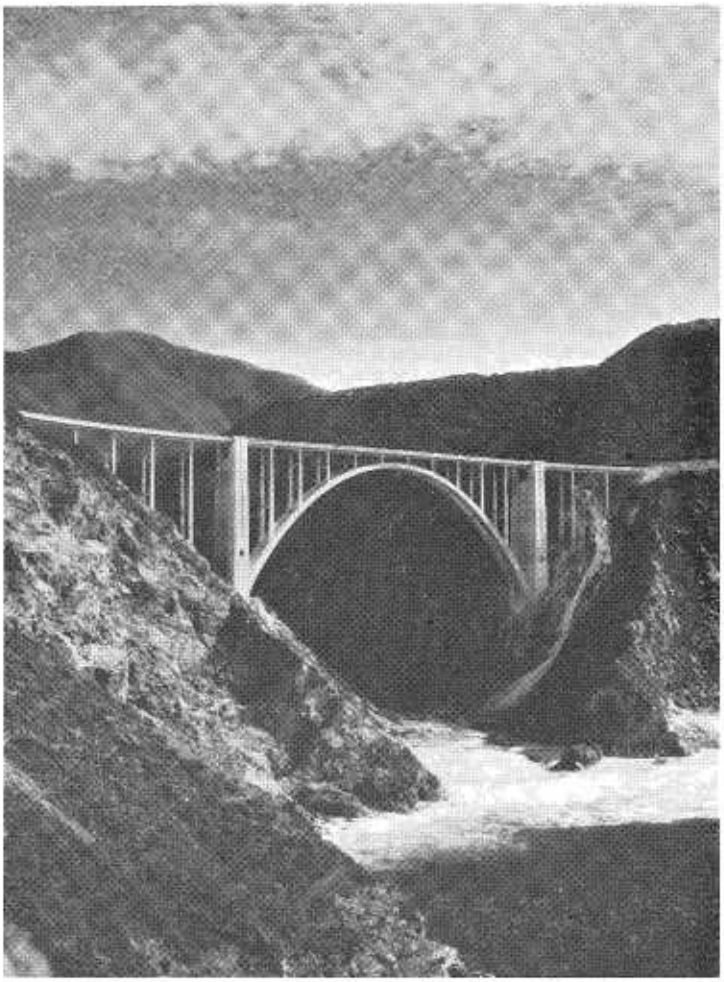


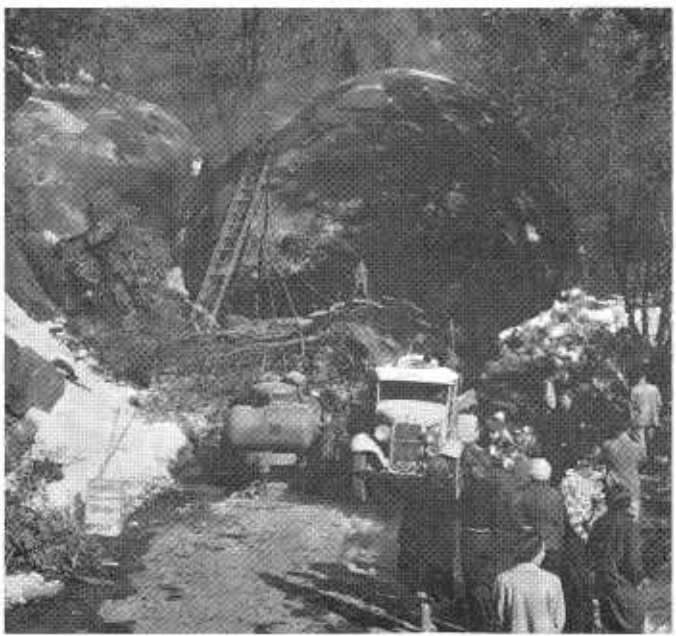
Construction in the early 1940's on the access road to General Grant National Park.



1934 view of San Francisco and construction on the San Francisco-Oakland Bay Bridge taken from Yerba Buena Island.

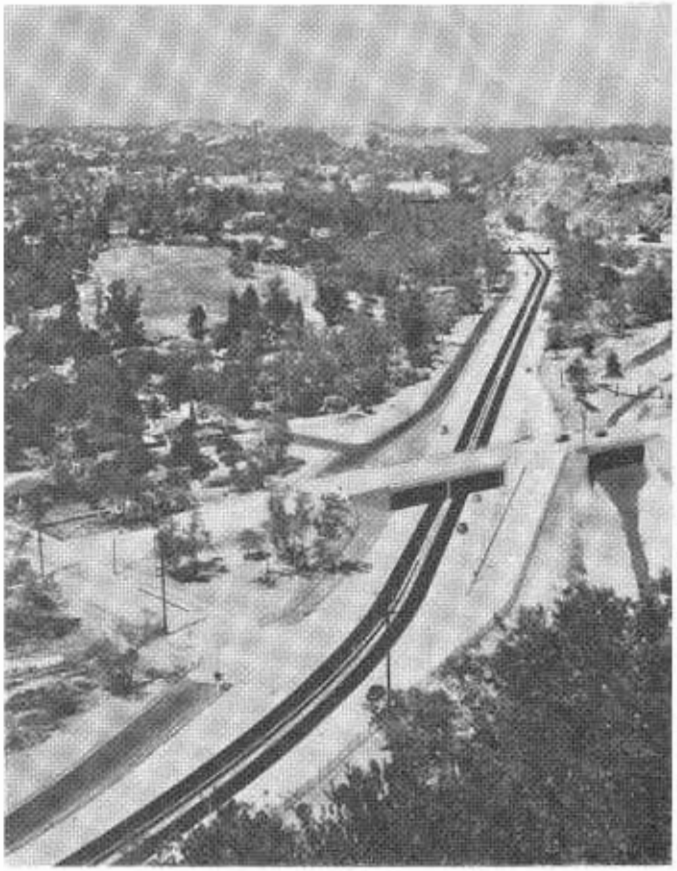
Rebuilding US 50 over Myers Grade, 1940.



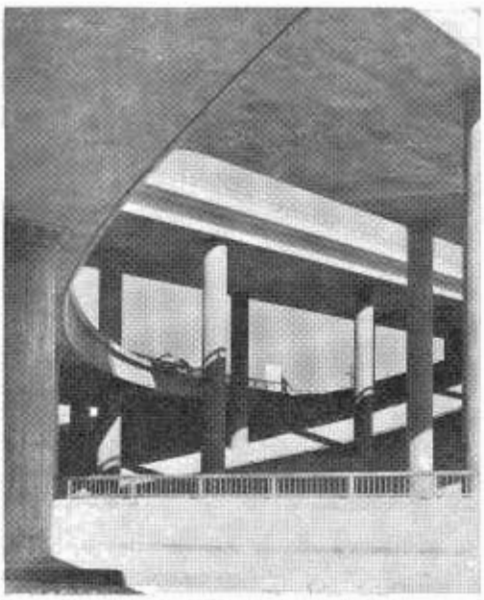


Above: Bixby Creek Bridge, State Sign Route 1, Monterey County.
At left: A falling boulder closes US 50.

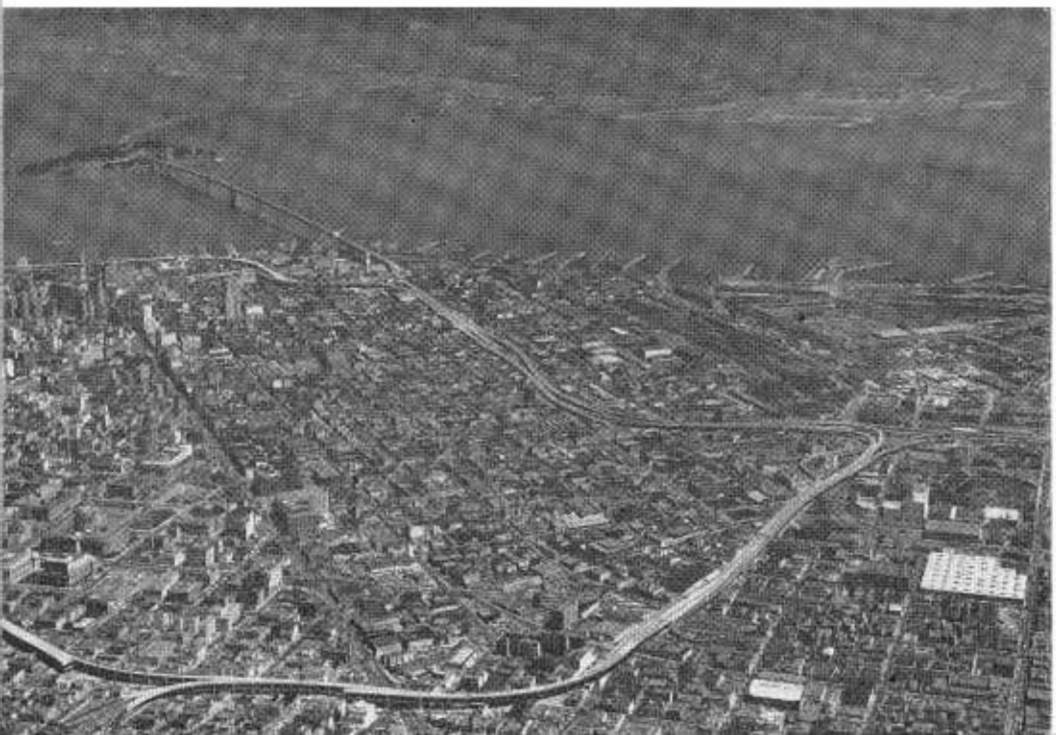
*The Feather River levee which broke at Yuba City in the disastrous 1955 floods. State highway damage alone was more than $10,000,000.*



*First section of Pasadena Freeway (then called Arroyo Seco Parkway), now part of the Los Angeles Freeway System. Completed in 1940, this was California's first freeway.*



*Study of 4-level interchange in Los Angeles when nearly completed. This photo impossible today as cars are constantly crossing camera viewpoint. Below: San Francisco freeway system, Bay Bridge, East Bay cities in background.*



## THREE DECADES

*Continued from page 54 . . .*

high clearance. Today California's highway engineers are world famous for their freeways.

M. R. NICKERSON

Nickerson was born in Nevada City in 1897, and now lives with his wife in Carmichael. He first worked for the state as a clerk in the Department of Education in 1915, but left this job to enlist in the Army in World War I.

After his return from overseas in 1919, "Nick" worked as a chainman and rodman on survey crews in the Dunsmuir area in District II, but in 1923 left the state to work for a Sacramento commercial photography studio. With this firm he began photographing highways on a contract basis a few years later, then returned to full time state service as a photographer with the Department of Public Works in 1932. More recently, Nickerson has confined his photography mainly to aerial.

# US 40-Richmond

*Final Section Completed From Jefferson Ave. to El Cerrito*

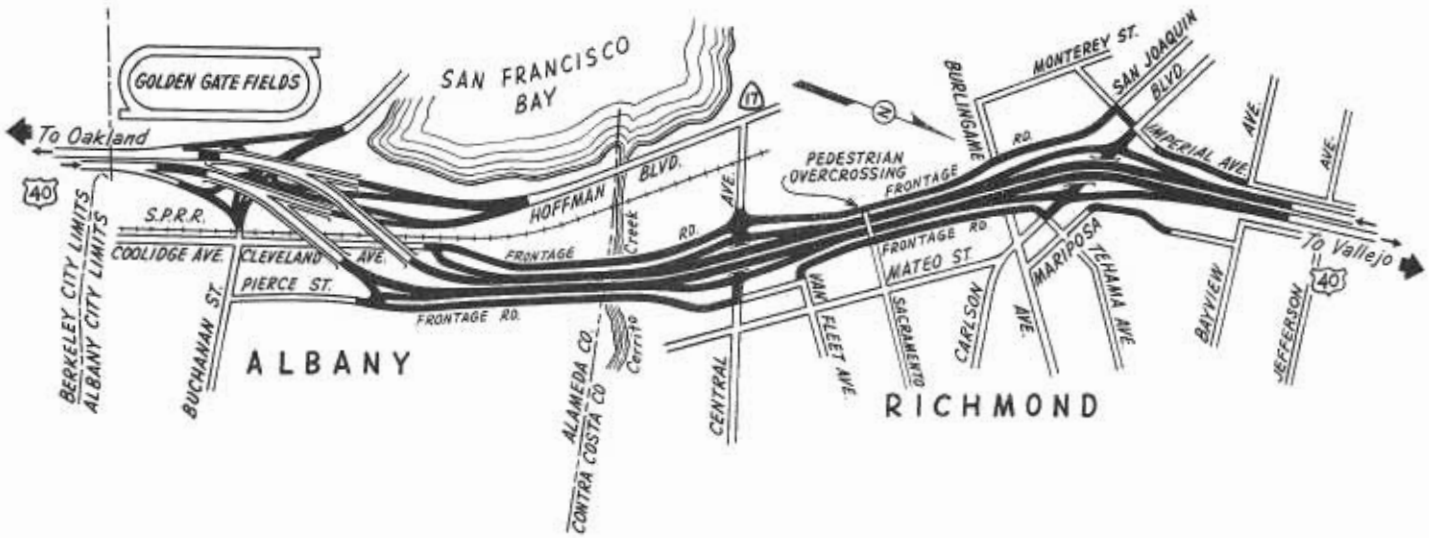
By SPENCER F. ALLEN, Resident Engineer


US 40 TRAFFIC has said goodbye to 2.5 miles of obsolete and inadequate undivided highway and gained full use of the final portion of US 40 in District IV to be improved to freeway standards. Mainline traffic began using the new freeway section on May 10, 1960.

This portion of six-lane freeway on US 40 completes a long-range highway project in District IV between the Distribution Structure at the east end of the San Francisco-Oakland Bay Bridge and Vallejo. The first of the eight contracts for this highway improvement was awarded in 1952 and the total construction costs for the facility will exceed 36½ million dollars, not including expenditures for the acquisition of right-of-way.

US 40 is the major interstate connection (Interstate Route 80) linking the San Francisco Bay area with points east and more directly with Sacramento and the North Valley regions. Except for this 2.5-mile section between Jefferson Avenue in Richmond and the El Cerrito Overhead, it has been possible, for some time, to drive from Sacramento to San Jose, stopping only at one signal in the vicinity of Fairfield, and at the Carquinez Bridge to pay toll. The final 2.5-mile section of highway is of particular interest to local commute traffic since there have been full freeway facilities at each end of the project since early 1957.

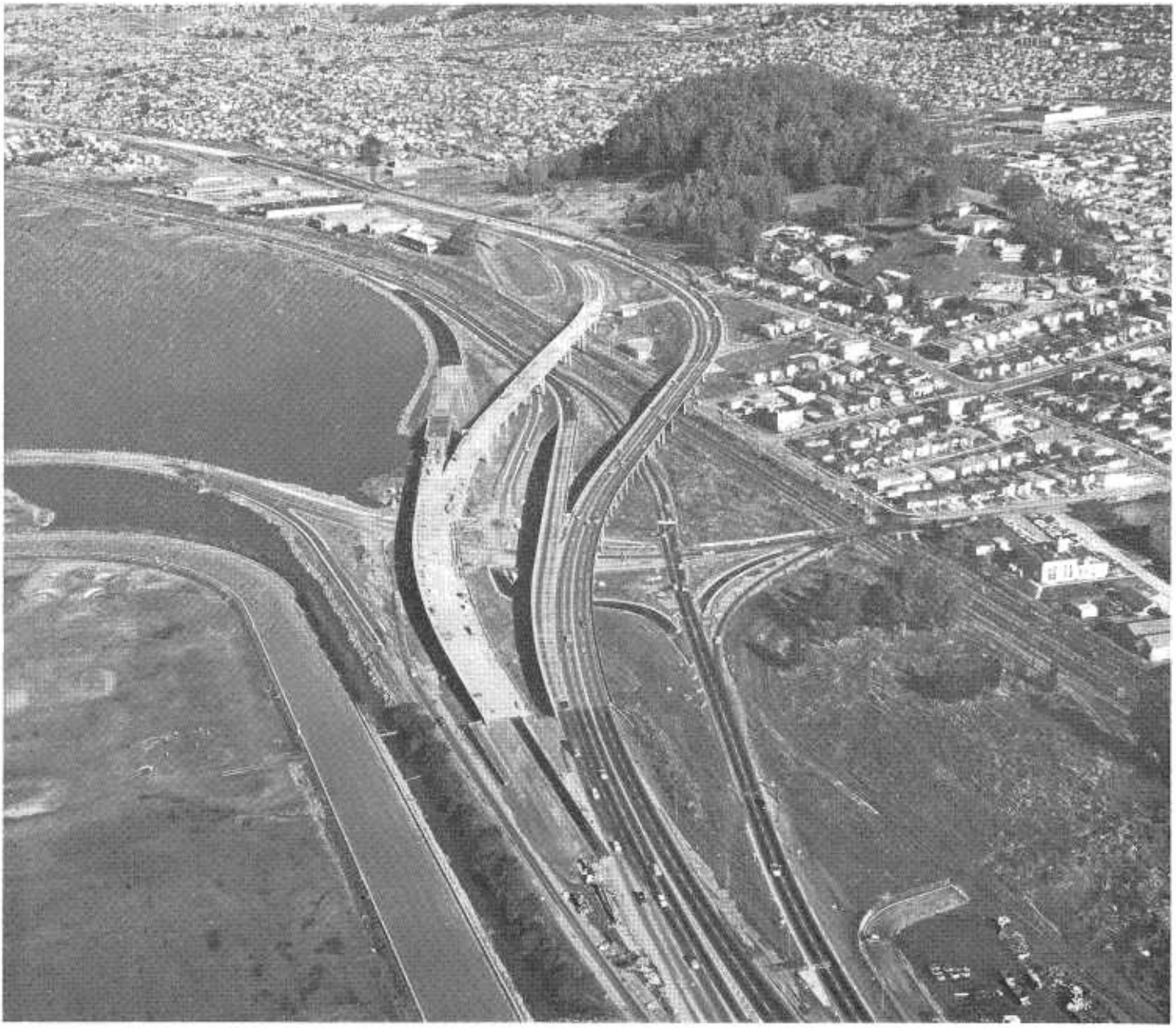
*This photo taken during the final phases of construction shows the offramp at Carlson Boulevard for southbound traffic.*




FINAL LINK U.S. 40 (EASTSHORE FREEWAY)


*Provision was made to handle Eastshore Freeway traffic while construction on the El Cerrito overhead was underway. The view is southwest.*


*The arrows on this diagram of the new El Cerrito overhead show the direction of traffic flow on the main roadways and ramps.*



*Looking northward at construction of the El Cerrito overhead showing tree-covered Albany Hill and (lower left) a portion of the racetrack at Golden Gate Fields.*

#### Traffic Problems Created

The rapid growth of the Bay area and its spread to the outlying areas have created prodigious transportation problems. The commuter and the long-distance traffic have combined to result in a 30 percent increase since the annual traffic counts in 1954. The merging of US 40 with State Sign Route 17 on the structures at the south end of the project and the periodic invasion of fans to the adjacent Golden Gate Fields racetrack further complicates the traffic situation in this densely populated area.

The new improvement replaces the old four-lane undivided highway which was constructed in 1936 in time for the opening of the San Francisco-Oakland Bay Bridge. Subsequent channelization and signal installations at Central Avenue and Carlson Boulevard helped for a while, but became inadequate for the traffic needs during the past several years.

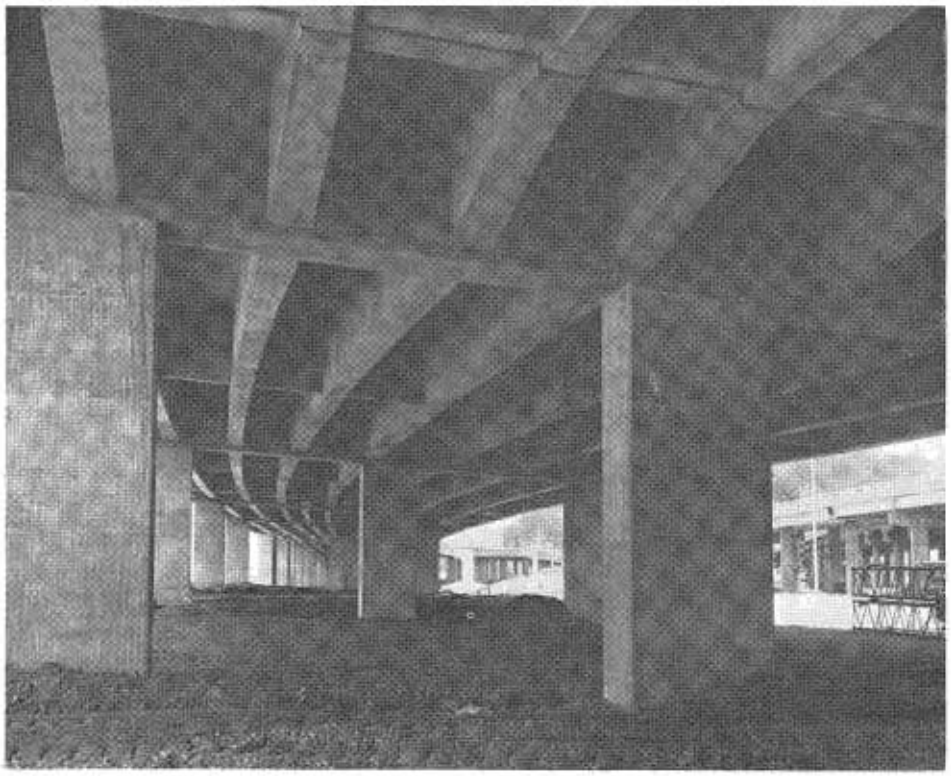
The contract was awarded on April 8, 1959, to the joint venture consisting of Piombo Construction Co., M & K Corporation and Connolly-Pacific Co., at a contract item cost of $5,169,810. The project has been administered by Piombo Construction Company which has its offices in San Carlos.

#### No Other Routes Available

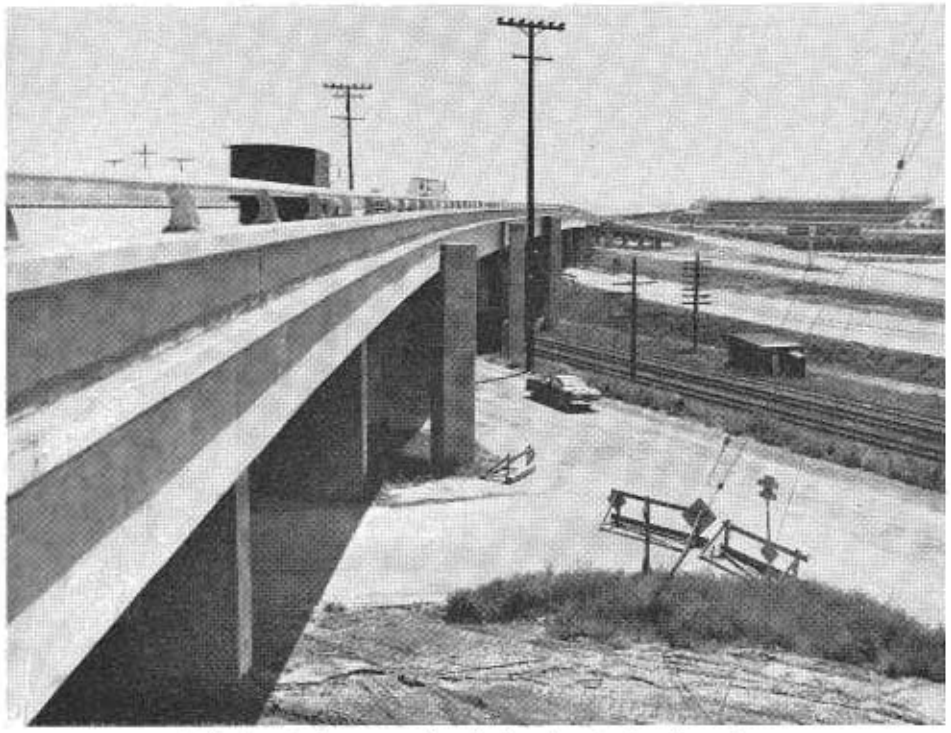
As is usually the case where highway improvements are being made in built-up urban areas, there were no alternate routes available to accommodate the passage of traffic around contruction. Consequently, the project was designed using the original alignment and was divided into six stages of construction, in order to present as little inconvenience as possible to the traveling public.

The work consisted of constructing a six-lane concrete roadway; frontage roads and street connections; structure ramps; extensive sewer and storm drainage systems, and four structures.

Included in the work was an item for predredging the lagoons in the vicinity of the El Cerrito Overhead. Subsequent to the predredging, a 40-foot fill was placed over the exposed hardpan in preparation for the bridge abutments and roadway approaches. Underground work was complicated by the general slope of the area across the freeway proper, causing some storm drains and sewer installations to be placed in four separate operations as a function of the stage construction. Obviously, considerable effort went into maintaining the old systems through two winter seasons until the final connections could be accomplished.



*A photo taken under a new portion of the El Cerrito overhead and interchange showing the tee-beam construction*



*A side view of the same tee-beam bridge shown in the photo above.*

#### Costs Are Compared

Comparison of right-of-way costs versus construction costs resulted in the inclusion of nine retaining walls representing 1,800 cubic yards of concrete. The 476-foot retaining wall adjacent to the Southern Pacific railroad tracks was completely covered by imported borrow in Stage I in the summer of 1958 in the process of detour construction and was not exposed until Stage VI in the summer of 1960. Concrete paving for the through lanes was used except at one location south of Central Avenue where the roadways pass over Cerrito Creek. Soil tube borings in the area revealed the presence of mud to depths of forty feet. Consequently, a flexible type pavement was adopted for the portion of the construction in the vicinity of Cerrito Creek where the old roadway has had a history of excessive subsidence.

A large quantity of local borrow was necessary for embankment construction. Over 200,000 cubic yards of imported borrow was hauled a distance of six miles from future interchange developments at Hilltop Avenue in El Sobrante, and 70,000 cubic yards was hauled from stockpiles placed by preceding contracts adjacent to the project. The nature of the staging necessary on the project divided the concrete pavement operation into four separate stages. The contractor felt that the number of equipment moves on and off the project for this paving operation justified using a central mixing plant and transit mix trucks to deliver the premixed concrete to the project.

#### Structures Are Described

The bridgework consisted of the construction of three major structures,

a pedestrian overcrossing, and the revision of an existing bridge to accommodate realignment and access ramps. The new structure at the US 40-State Sign Route 17 merge at El Cerrito consists of a tee-beam reinforced concrete and structural steel bridge across the Southern Pacific railroad tracks, 2,122 feet long and providing a 40-foot roadway. The south end widens to four lanes for the two-lane onramp from Sign Route 17. The widest portion of the structure at the merge is 17 feet between curbs.

The existing structure has been widened at the north end to improve substandard alignment and to provide access ramps for City of Albany traffic. The south end has been widened for the State Sign Route 17 offramp to Richmond and the Richmond-San Rafael Bridge.

The Central Avenue undercrossing is a prestressed concrete girder bridge about 200 feet long. A two-inch minimum plant-mix surfacing blanket placed on the structure is integral with the plant-mix surfacing portion of the mainline roadwork in the vicinity of Cerrito Creek.

#### Pedestrian Crossing Built

The Carlson Boulevard undercrossing is a reinforced concrete box girder bridge about 131 feet long which provides a roadway width of 88 feet between curbs with an eight-foot median. In addition, a precast reinforced concrete girder pedestrian overcrossing about 184 feet long is constructed across the freeway proper at the Sacramento Avenue cut, which serves schools on the easterly side of the freeway.

Involved in the new and reconstructed structures are a total of 54 spans varying in length from 40 feet to 107 feet. Included also are two welded steel girders over the Southern Pacific railroad tracks and four rolled wide-flange steel beams matching the construction on the existing structure.

It is of considerable satisfaction to the Division of Highways, the Highway Patrol and the contractor to note that the accident frequency within the limits of the project has shown a constant decrease since the beginning of construction. Highway Patrol records show that formerly 25 percent of all recorded accidents on their 25-mile beat north from the San Francisco-Oakland Bay Bridge occurred within the limits of this 2.5-mile project. In the ensuing 1½ years, in spite of stage construction and detours, the number of accidents within the project limits has been reduced to 8 percent of this total.

*An aerial looking southward along the new section of US 40 in Richmond toward the Eastshore Freeway. The Carlson Avenue interchange is in the foreground.*

The author was resident engineer, acting under general supervision of G. L. Beckwith, District IV Construction Engineer.

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The California Highway Commission will hold public hearings in Southern California on October 27 and 28, 1960, on two freeway route locations. On October 27 the hearing will be held in the State Building in Los Angeles in connection with a routing for 5.7 miles of State Sign Route 134 in Glendale and Eagle Rock. On the following day the hearing will be in the Chino area, and will concern 13.5 miles of US 60 between State Sign Route 71 and Mira Loma.

## NEW 'PER AXLE' TOLLS SPEED BRIDGE TRUCK TRAFFIC

*This photo, taken before the new "per axle" tolls went into effect, shows truck traffic backed up at the toll gates of the San Francisco-Oakland Bay Bridge waiting to be weighed.*

Truck movement over the San Francisco-Oakland Bay Bridge has visibly improved since May 1, 1960, when toll collection was changed from a tonnage basis to a flat charge per axle, according to State Highway Engineer J. C. Womack.

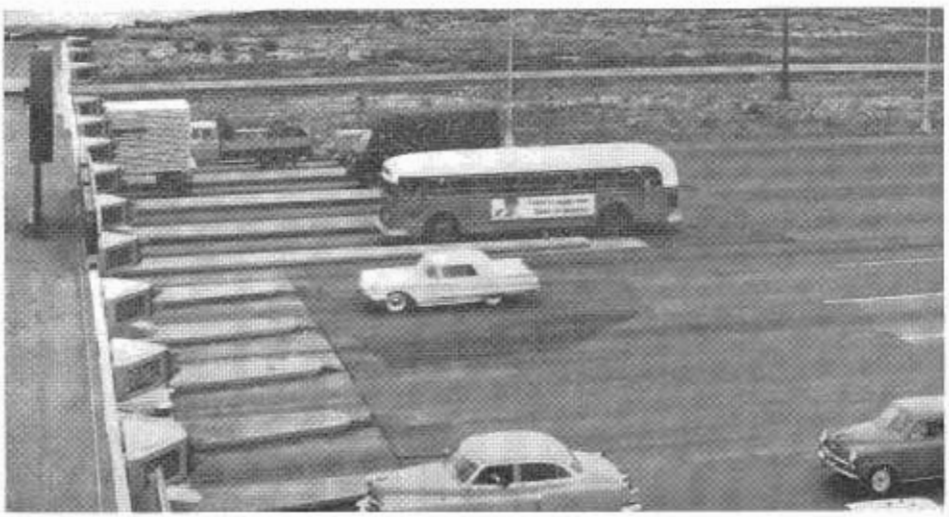
"Traffic flow has been so improved that we have received numerous favorable comments in the two months we have been operating under the new system," Womack commented.

The change was instituted following authorization by the California Toll Bridge Authority at its April 1 meeting.

Delays on the bridge are now rare and should be almost completely eliminated when the reconstruction work on the bridge itself and on the south side of the toll plaza approach is completed. Work on the toll plaza entails changing all collection lanes so that toll may be collected only from the driver's side.

Contributing to the smoother flow of truck traffic is the simple toll charge which is in 25-cent increments, thereby allowing the driver to know in advance the exact change to have available.

Since trucks are no longer weighed, there is no need to use special lanes, and trucks may mix with other traffic for passage through the toll plaza. The former time-consuming positioning on the scales having been completely eliminated. Spacing between trucks is approximately comparable to that between private passenger vehicles.



*A photo of the Bay Bridge toll gate area taken after the "per axle" tolls went into effect. Note the great decrease in the backed-up truck traffic.*

## Asst. Comptroller Bert Sellier Leaves

Bert Sellier, assistant comptroller of the Department of Public Works for nearly 15 years, retired on August 1 after 32 years of state service, all of it with the department.

BERT SELLIER

Born in Foresthill, Placer County, July 28, 1895, Sellier attended the University Farm School at Davis and the Chaffey School of Agriculture at Ontario, engaged in farm work, and served in World War I with the 159th Infantry (40th Division). He was employed temporarily as a clerk in the accounting section of the Division of Highways in 1924, but did not receive a permanent appointment until 1928, when he became a senior clerk.

He advanced through the accounting ranks and was appointed assistant comptroller in 1945.

In this position Sellier assisted in all phases of the administration of the accounting operations of the Division of Highways, currently involving receipts and expenditures of more than $600,000,000 a year. He was closely identified with the preparation of district and field office accounting manuals, and the preparation of instructions regarding budgetary, cost accounting and related procedures, and provided considerable guidance for the various district chief clerks.

His areas of direct responsibility have included the disbursing office, the internal audit section and the headquarters accounting office, including the section which processes the vouchers for federal aid reimbursement.

Sellier and his wife, the former Salome Eleanor DeWitt, have a son, William E. Sellier of Palo Alto, and two grandsons.

# Personnel Management

## *Governor's Policy Emphasizes Effective Use Of Human Resources in Carrying On State Work*

The attainment of a sound and progressive personnel management program requires the co-ordinated efforts of the chief executive, of agency management, of central staff agencies, and of all other individuals and groups charged with the management of state government. It calls for the co-ordination of prescribed constitutional and statutory personnel management responsibilities with the basic responsibility of agency management for the effective use and development of agency manpower.

**EDITOR'S NOTE**

The personnel management policy statement adopted by Governor Edmund G. Brown for all state agencies is published here in full as a matter of interest and information to all officials and other citizens interested in the state highway program as well as to employees of the Department of Public Works. State Highway Engineer J. C. Womack has called the policy statement to the particular attention of Division of Highways staff members who are engaged in any phase of management.

EDMUND G. BROWN
GOVERNOR

**State of California**
GOVERNOR'S OFFICE
SACRAMENTO

April 15, 1960

Honorable Robert B. Bradford
Director of Public Works
Public Works Building
Sacramento 14, California

My dear Director:

One of the most important and complex tasks which you have, as a State department head, is the management of personnel. While we must make good use of our physical and financial resources, our use of human resources can have an even greater effect on the quality of service we give to the people of California.

It shall be my policy, as Governor of the State, to provide for those personnel programs which are necessary both to obtain and develop a competent, responsible work force and to use that work force effectively. The attached statement develops this policy more fully by defining the responsibility for personnel management in State service and by describing the major elements of a sound personnel management program.

I want you to know the importance I attach to personnel management in State service. It deserves your earnest and continuous attention because it is one of your primary responsibilities as a manager, and because it will promote and sustain an effective career service to carry out the functions of State government.

This policy statement should provide a broad framework within which you can develop and maintain a personnel management program appropriate to the needs of your department.

Sincerely

Edmund G. Brown

EDMUND G. BROWN, Governor

Enclosure

An effective statewide personnel management program requires:

1. A management in each agency that actively exercises its responsibility for personnel management and continuously evaluates its personnel management program against established standards.
2. Policies and programs that facilitate the selection, utilization and development of the people required to carry out the functions of state government.
3. Adherence to the merit principles that are expressed in the Constitution and statutes.
4. The provision of personnel management services by the State Personnel Board and their utilization by state agencies.
5. The maintenance of channels of communication to keep the Governor informed of personnel activities and problems.

### Responsibility for Personnel Management

I. *Management Responsibility.* The essential purpose of the management of each state agency is to organize, direct and motivate employees to the end that the agency's goals are attained. This necessitates the fulfillment of the basic respon-

sibilities of management, including the planning of programs and policies; the development of an organization structure and budget and fiscal controls; the assignment of responsibilities; the setting of work standards; and the direction and co-ordination of the work force. It also requires a personnel management program in each agency which contains the following essential elements:

A. *Planning.* Work planning, including the setting of job and performance standards, provides the essential foundation upon which the orderly planning of personnel needs can be based. Personnel planning should give consideration to immediate and long-range staffing requirements.

B. *Personnel Utilization.* Available manpower must be utilized with maximum effectiveness. Work should be assigned in keeping both with human needs and the highest level of employee skill; the relationship between the job and the person as it affects employee performance and growth should be recognized in planning work assignments. Full use must be made of technological advances as a supplement to available human talent.

C. *Servicewide Career Opportunities.* Full recognition should be given to the "one state service" concept by supporting such measures as servicewide career opportunities, interagency rotation, and liberalized transfer practices.

D. *Training.* A planned program is required to develop the employee knowledges and skills necessary to meet the needs of the agency and of state service, and to keep abreast of constant advances in science and technology. Particular attention must be given to developing the managerial talent necessary to cope with the increasingly complex functions of state government.

E. *Performance Appraisal.* All employees should be made aware of the extent to which their work meets performance standards for the job, and should be given special recognition when their performance substantially exceeds such standards.

F. *Employee Incentives.* Management should provide incentives and recognition for agency employees and should encourage employee participation in such interagency activities as the merit award and work improvement programs.

G. *Communications.* Effective systems of communications must be maintained to and from the employees of an agency, with other agencies, and with the Governor's office. Within an agency, this can be accomplished through meetings and conferences and by the effective use of supervisory bulletins, agency newsletters, and procedure manuals. Communications between state agencies can be further improved through organized interagency groups with common managerial and technical responsibilities and through training activities that cross departmental lines. Communications with the Governor's office will continue to be maintained through the Governor's departmental secretary, and through participation in meetings of the Governor's Council, and the specialized committees which supplement the council.

H. *Grievance Process.* The grievances of employees should be discussed and resolved at the lowest possible level.

I. *Discipline.* Through effective supervision, high standards of employee conduct should be established and maintained. Disciplinary problems should be dealt with promptly and whenever possible they should be resolved without the need for formal action.

J. *Safety.* Continuous attention should be given to the improvement of working conditions as they relate to employee safety and to the development of safe working habits and attitudes.

K. *Inspection and Evaluation.* Overall reviews or audits of the personnel management program should be made periodically by each agency, making full use of the knowledge and experience of line supervisors.

Top management must provide overall leadership and followup in personnel management so that all concerned will be aware of the importance of that function to the successful achievement of agency goals.

II. *State Personnel Board Responsibility.* The State Personnel Board has the responsibility for maintaining a comprehensive merit system program and for assisting management in administering its personnel management program, consistent with merit principles. This requires that the Board:

A. Provide support and assistance to the agencies in carrying on effective personnel management programs.

B. Perform those personnel services best accomplished on a centralized basis.

C. Administer an equitable state salary program within the funds appropriated by the Legislature.

D. Facilitate the fair and uniform application of statewide personnel policies and standards in fulfilling its constitutional and statutory responsibilities.

E. Convey and exchange information on matters relating to the State's personnel program, provide information to the Legislature and remain responsive to the attitudes of the public and of employees and employee organizations.

F. Report to the Governor on activities, functions, proposals and developments as they relate to the State's personnel program.

## GAS TAX

*Continued from page 53 . . .*

funds are audited by the State Controller's office.

Within 60 days after the completion by any city of a delegated gas tax financed project for real property acquisition or construction or improvement of any street, such city must file with the department a final report in such detail as the department may require. As provided in the Streets and Highways Code, quarterly payments of gas tax funds are withheld from any city which is delinquent in the filing of the reports required by the statutes.

The joint responsibility placed upon the cities and the State by the Streets and Highways Code requires wholehearted and harmonious relations between the officials of the cities and the department in order to obtain the greatest amount of benefit from the expenditure of the gas tax funds and to provide for the motorist maximum value for each tax dollar he pays. The state representatives endeavor at all times to work harmoniously with city officials.

**Summary**

1. Generally, the "rules" to be used with this subvention are as follows:
   (a) The Special Gas Tax Street Improvement Fund must be established.
   (b) A realistic major city street system should be selected by the city council on the basis of greatest general city importance, subject to the approval of the department. The proposed major city street system should be in accord with the city's master plan.

   The system should be reviewed for possible revisions at regular intervals.

2. In order to serve the planning function as well as the fiscal requirements, each city is required to submit a budget of the estimated expenditure of gas tax funds recommended to be made during the ensuing fiscal year. No payment of gas tax funds can be made to a city until its budget has been approved.

3. A maximum of 40 percent of the yearly allocation may be expended for maintenance. At least 60 per cent will be expended for construction or right-of-way on the major city street system.

4. At the time of the preparation of the budget, the general design is usually considered; however, the proposed geometric design should be in sufficient detail to determine its adequacy.

5. The statutes limit gas tax expenditures to that portion of the street available for use by vehicular traffic, with certain exceptions, and to structures in, over, or under the streets which are of direct and primary service for vehicular traffic.

6. Surveys, plans, specifications and estimates of cost must be submitted to and approved by the department before gas tax expenditures may be made for street construction or improvement.

The function of the department's review of the plans and specifications is to insure their legality, practicability, economy and conformance with accepted design principles. As street parking materially decreases capacity, impedes traffic flow and increases traffic hazards, consideration should be given to the restricting or prohibiting of curb parking where such practice restrict the safe and orderly movement of traffic.

7. Authority must be granted by the department before a city may advertise for contract or perform work by day labor.

8. Department approval must be received before a contract may be awarded by the city to other than the low bidder or to the low bidder if such bid exceeds the engineer's estimate.

9. Cities must file with the department annual and final reports covering expenditures of gas tax funds in such detail as the department may require.

10. Cities delinquent in the filing of annual or final reports are ineligible for quarterly payments of gas tax funds until such reports are filed.

**Section 2107.5. Funds for Engineering Aid to Cities**

Since its establishment by the 1955 Legislature, this subvention has been of considerable assistance to all cities, especially the smaller ones. The payment for the 1958-59 fiscal year under this subvention was $1,150,000. The obvious intent of this legislation was to furnish additional engineering services to the cities, not to replace other funds previously used. Thus, many smaller cities are able to provide for the first time the adequate engineering services, including advance planning, necessary to insure the economic expenditure of their construction funds.

In most California cities, the various available revenues are insufficient to finance the improvement of community service traffic facilities. Revenue from the much needed ⅛-cent gas tax has been provided by the legislation to help the cities finance the cost of improving the streets of greatest general city importance.

The services of the Division of Highways are available at all times to help in the formulation of street improvement programs and budgets so that the cities and their people may achieve the greatest possible benefit from use of the ⅛ cent gas tax funds.

## BIDDING CAPACITY OF CONTRACTORS INCREASES

Although the number of contractors prequalified to bid on state highway projects decreased during the 1959-60 fiscal year, the bidding capacity of those listed increased. On June 30, 1959, there were 1,045 prequalified contractors with a combined bidding capacity of $2,115,174,500. On June 30, 1960, 987 contractors were prequalified with a combined bidding capacity of $2,363,226,000.

## 42 HIGHWAY PROJECTS ADVERTISED DURING JUNE

During June the Department of Public Works advertised for bids on 42 highway projects with an estimated value of $16,997,100. Since January 1, 1960, projects worth $235,260,300 have been advertised. Ninety-one contracts for $67,982,300 were awarded during June and 36 contracts for $21,448,000 were completed. At the end of June, 309 contracts were under way with a total value of $432,599,500, establishing a new all-time high.

## Highway Commission Urges Advancing of Interstate Schedule

The California Highway Commission has gone formally on record in support of expediting the completion of the national system of interstate and defense highways under the established federal-state partnership.

At its meeting in San Diego on June 20, the commission unanimously adopted the following resolution:

**WHEREAS,** The 41,000-mile system of interstate and defense highways originally scheduled for completion in 1972 will provide great and needed service to the public and to interstate trade and commerce,

**WHEREAS,** This great public works program contributes so strongly to full employment and to general economic productivity throughout the country,

**WHEREAS,** Upon completion of this interstate and defense highway system, built to modern standards, highway accidents and highway fatalities throughout the system will be materially reduced,

**WHEREAS,** Federal-state partnership has been most productive in promoting the above benefits, and

**WHEREAS,** Since time is important in producing and even increasing these benefits to the people of all states,

**NOW THEREFORE BE IT RESOLVED,** That this system of interstate and defense highways shall be continued to completion and, because of the urgency of this program and the importance of its economic and social benefits, the time schedule shall be advanced to the maximum extent possible without departing radically from the present needs formula and without departing from the present federal-state partnership relationship.

Copies of the resolution have been sent to interested agencies and organizations, and to members of Congress and other legislators.

The resolution was adopted on motion of Commissioner James A. Guthrie, seconded by Commissioner Robert E. McClure.

## Cost Index Takes 2d-Quarter Upturn

An expected upturn in the California Highway Construction Cost Index took place during the second quarter of 1960. Costs in this quarter began to reflect the actual increases in wages, materials and cost of financing which occurred during the last year. The index now stands at 251.6, an increase of 31.8 points or 14.5 percent over the first quarter of 1960.

A prime cause in raising the index to its present level was the increase in the unit price of roadway excavation. The determining factor for this increase was a bid price of $1.70 per cubic yard for roadway excavation on one US 40 project in a hard rock area of the Sierra Nevada Mountains. However, the index still would stand at 233.6 or 6.3 percent above that of the previous quarter if this project were to be eliminated from the cost index computation.

The number of bidders per project on all projects during the second quarter dropped from 7.5 to 5.8, while, on the 20 projects of over $1,000,000 each included in the second quarter's computations, the average number of bidders dropped from 10.5 to 6.5. Increases in costs had not previously become apparent in unit prices due to the keen competition among contractors, which had been more than sufficient to offset the upward pressures.

### FREEWAY CONTRACT AWARDED

The State Department of Public Works has awarded a $3,806,235.40 contract to Peter Kiewit Sons' Co., San Francisco, for construction of 1.1 miles of eight-lane freeway on the MacArthur Freeway (US 50) between San Pablo Avenue and Broadway, Alameda County.

Included in the project is construction of nine traffic separation and ramp structures including bridges which will take the freeway over Webster Street, Telegraph Avenue, Grove Street, West Street and Market Street.

## Judges Crack Down On Sign Vandalism

The courts in the San Joaquin Valley are taking an increasingly stern attitude towards persons who maliciously destroy traffic signs, judging from two recent incidents in which the boys who knocked down and damaged highway signs were given severe penalties, including jail sentences.

In Kings County, two 20-year-old youths were recently sentenced by Judge Walter W. Wilson of Hanford to 45 days in the county jail for knocking over with their car or pulling out 15 road signs on various roads between Lemoore and Hanford, including State Highway 198. They also were apprehended stealing hubcaps and part of the sentence was for that offense.

The signs they removed or damaged included a speed limit sign, five railroad crossing warning signs and nine stop signs, all important traffic safety devices, the absence of any one of which could cause a fatal accident.

Judge Wilson sentenced each youth to 225 days in jail on 15 counts of malicious mischief, with 210 days suspended on the condition that they pay an estimated $208 for the cost of the damaged signs. The signs were the property of the State, the County of Kings, the City of Hanford and the Southern Pacific Railroad Company.

In Fresno, Municipal Judge George W. Huffman recently imposed an even more severe penalty on three 18-year-old Fresno County youths who wrecked SCHOOL signs, STOP signs and YIELD signs at seven intersections and damaged seven mailboxes. Two of the youths received sentences of 120 days in jail, while the third was sentenced to 30 days.

In addition, each defendant was given a 180-day suspended sentence on each of three counts, placed on three years' probation, ordered to make restitution and had his driver's license suspended for two years. A fourth youth's case is still pending in the juvenile court.

The State Division of Highways has called for bids on a 13.3-mile freeway job on U.S. Highway 99 south of Bakersfield in Kern County.

## 'Tempus Fugit' Corner

Twenty-five years ago. The following items appeared in the July and August 1935 issues of *California Highways and Public Works.*

### DRASTIC RESTRICTIONS

On June 3, $15,234,290 for work on roads and highways was apportioned to California out of the $4,800,000,000 Emergency Relief Apportionment Act of 1935. . . Federal regulations are so drastic that an entirely new type of construction procedure must be adopted if the federal money is to be used in highway construction. . . . Regulations received to date require a maximum of $1,400 per year per man for labor, materials, and incidentals (Division of Highways studies show cost per year per man is two and one-half to three times this limit); further, 90 percent of all labor employed must be taken from relief rolls in the vicinity of the work, which limits the amount of skilled labor that may be used, and projects must be selected from localities where relief labor is available.

#### Building Fill By Blast . . .

Engineers have saved the State $20,000 by moving granite ledge rock into Partington Canyon on the Carmel-San Simeon highway instead of building a bridge or culvert. Large pieces of rock blasted from the present road in 1923 formed a porous fill which permitted the peak runoff of the stream to pass through the interstices.

It was therefore conceived that with much more of this ledge rock available when excavating for the new road, it would be advisable to raise this present rockfill some 25 feet and place thereon the ordinary roadway embankment fill material.

The result was entirely successful. Some 25,000 cubic yards of ledge rock was blown loose, most of which was catapulted to position below. The balance, lying on the present road, was broken further and moved to position.

## Commission Tours North, San Joaquin

The regular monthly meetings of the California Highway Commission for May and June were extended by two days and four days, respectively, in the form of inspection tours of state highways in northeastern California and the San Joaquin Valley.

"The commission feels these inspection trips are very educational," said Director of Public Works Robert B. Bradford, chairman of the commission. "We not only get a firsthand look at the routes on which planning and financing are under consideration, but we also benefit by personal visits with local officials and civic leaders who are in the best position to express the needs and desires of their communities."

After completing the regular agenda in Sacramento on May 25, the commission left for a trip to Plumas, Lassen and Modoc Counties. The trip covered portions of US 395, US Alternate 40, State Sign Route 89, State Sign Route 36, US 299, State Sign Route 139 and US 99E.

The commission met with local officials and community leaders at Portola, Quincy, Susanville, Alturas and Mineral.

Following its June meeting in Sacramento, the commission headed south on US 99 on the afternoon of June 24 for a seven-county tour of the San Joaquin Valley.

The commissioners stopped in Modesto, Merced and Madera during the afternoon for brief meetings with chamber of commerce groups and were guests of the Fresno County and City Chamber of Commerce at a dinner meeting in that city.

The Saturday schedule included stops in Firebaugh, Coalinga, lunch at the Lemoore Naval Air Station (Lemoore and Hanford Chambers of Commerce), Visalia, and Giant Forest in Sequoia National Park (dinner). Most of Sunday was devoted to a trip along State Sign Route 180 to Cedar Grove and other points of interest in the Kings River Canyon.

The tour ended on Monday in Bakersfield, after a midmorning stop in Porterville. The final event was a luncheon meeting with the Greater Bakersfield Chamber of Commerce.

Arrangements for the San Joaquin Valley tour were made by Chester H. Warlow of Fresno, vice chairman of the highway commission. The commissioners were accompanied by several members of the Division of Highways staff.

## Stuart R. Davies

Stuart R. Davies, Supervising Electrical Engineer with the Division of Architecture died on June 23 from injuries suffered in an auto accident. Mrs. Davies, who was also injured in the accident, died on June 26.

Davies, 64, joined the division as a junior electrical draftsman on August 27, 1919. In 1923 he moved to Los Angeles where he worked for a year as an electrical engineer for the Allied Architects Association.

He then worked for several years with the Latourette-Fical Company in Sacramento and in the Bay area. During the depression era he worked for various contractors and architects doing electrical engineering work.

In August 1935 he returned to the division for six months during which time he performed the electrical work on the old Motor Vehicles Building and the Public Works Building.

Except for a short leave of absence prior to World War II, Davies was with the division continuously since May 1936. In 1938 he was appointed assistant electrical engineer.

It was at that time that he did the electrical plans for the Business and Professions Building. He made all the drawings, prepared the estimates and wrote the specifications.

He was appointed supervising mechanical and electrical engineer on December 1, 1949, recently retitled supervising electrical engineer.

Mr. and Mrs. Davies are survived by a daughter, Mrs. Eleanor Bryant of Sacramento, and two grandchildren.

Andrew Louargand, senior electrical engineer, has been named acting head of the Electrical Section, Sacramento office.

# FOREIGN ENGINEERS STUDY DIVISION OPERATIONS


*Part of the 40-man British team of municipal traffic engineers and representatives of the British Ministry of Transportation pause for a photo before taking off on a bus tour of Los Angeles freeways. District VII personnel who conducted the tour were (beginning extreme left) E. T. Telford, Assistant State Highway Engineer, A. L. Himelhoch, District Engineer (Operations), Jack Eckhardt, Assistant District Engineer (Traffic), and George A. Hill, District Engineer (Planning).*

Officials and engineers from Great Britain and the Philippines were among those who inspected and studied the construction activities of the Division of Highways during the past three months.

A 40-man team of municipal traffic engineers, officials and representatives of the British Ministry of Transport visited District VII headquarters in Los Angeles on May 3 as part of a two-week United States tour. The group was under the sponsorship of the British Cement and Concrete Association, London. The team was briefed by District VII engineers and taken on a tour of freeways in the Los Angeles area.

Felix C. Codilla, Staff Civil Engineer, for the Philippines Department of Public Works and Communications, was with the Division between November 5, 1959 and June 1 of this year. He spent most of his time in Los Angeles consulting with engineers on advance planning, traffic, design, construction, maintenance and equipment. He also conferred with the District IV staff in San Francisco.

During May Codilla visited the headquarters office in Sacramento where he consulted with engineers and Department of Public Works administrators on the statewide aspects of the highway program. He sat in on a Highway Commission meeting and discussed administrative problems with the other agencies of the department which included the Divisions of Architecture, Contracts and Rights of Way and San Francisco Bay Toll Crossings.

*Deputy State Highway Engineer C. E. Waite (left) greets Felix C. Codilla, Staff Civil Engineer for the Philippines Department of Public Works and Communications during the latter's stay in Sacramento.*

## Supervising Agent Trenholm Retires

July 1, 1960, District VII Supervising Right-of-way Agent Kenneth Merrill Trenholm retired from state service, culminating a 15-year career with the Division of Highways.

K. M. TRENHOLM

Trenholm was born in Nova Scotia on March 14, 1904 and came to California in 1911. Following early schooling at Los Angeles Polytechnic High School, he began working at the Title Guarantee and Trust Company of Los Angeles in 1923 and held such positions as engineer, searcher, title examiner and unit officer. He joined the Title Insurance and Trust Company in December 1942 when the two companies merged. Later he became assistant manager of the Land Department of Pacific Western Oil Corporation. On July 1, 1945, he entered state service with the Los Angeles office of the Division of Highways.

One of Trenholm's first jobs with the Division's Right-of-way Department was the acquisition of properties for the Terminal Island Freeway. Since that time he has been engaged in extensive land purchases hand in hand with District VII's huge freeway building program. During the past 10 years, both as senior right of way agent and supervisor under Metropolitan District Right-of-Way Agent Harold Leonard, he and his present staff of 50 agents have been responsible for right-of-way expenditures amounting to between $50,000,000 and $75,000,000 annaully.

Kenneth and his wife, Ruby Bickford Trenholm, a veteran employee of more than 32 years' service with various state agencies, reside in Arcadia. They have one son, Warren Kenneth Trenholm, of El Monte. Following their double retirement, the Trenholms plan to travel the United States in a trailer.

# A. D. GRIFFIN RETIRES . . . WITH STATE 45 YEARS

When A. D. Griffin, Assistant District Engineer and Executive Assistant to Assistant State Highway Engineer Edward T. Telford of District VII, retired on August 1, 1960, he terminated a career with the Division of Highways that began more than four decades ago, in 1915.

A. D. GRIFFIN

His tenure of service spans the critical years of highway development in the State of California from the second $15,000,000 road-building bond issue of 1915 to the present pay-as-you-go highway budget amounting close to $600,000,000 annually. In his time, California's motor vehicle registration has soared from 163,795 in 1915 to 8,000,000 in 1960; state highway mileage from roughly 3,000 to 14,000; state population from 2,500,000 to more than 15,000,000.

A. D. Griffin was born in Attleboro, Massachusets in 1892 and came to California as a young man in 1910. In 1917 he graduated with the bachelor of arts degree in civil engineering from Stanford University after a brief period of employment with District VII of the State Division of Highways in 1915 (then Division VII of the California Highway included the counties of Los Angeles, Ventura, Orange, San Diego, and eastern Kern County south of Mojave). Subsequently he held positions in Division V at San Luis Obispo (1917-19), in Oregon with the Highway Commission (1919-21), and in California, again in District VII (1921 and thereafter).

Early in his career Griffin was resident engineer on a day-labor project at Point Mugu on the Pacific Coast Highway in Ventura County; the famed Hauser Contract in the vicinity of Big Sycamore Canyon, in 1923 the second largest roadbuilding project ever attempted in the State of California (see "The Spectacular Hauser Contract" by A. D. Griffin, *California Highways*, Oct. 1924); the Camarillo-Ventura Reconstruction Project (see "Some Interesting Problems Solved on Ventura County Reconstruction Project," by A. D. Griffin, *California Highways*, Sept. 1926); the Oxnard Coast Route (Oxnard to Hueneme Road), an experimental pavement project (see "Experimental Pavement Sections on Oxnard Route," by A. D. Griffin, *California Highways*, March 1927); and a paving job through the City of Laguna Beach (1927). Called in from the field in the latter year, he was assigned to direct charge of the district's plan preparation program for highway and freeway construction until 1947. From 1947 to date he has had general administrative duties, including responsibility for publicity and public information contacts.

He is particularly interested in the problem of "backlash" injuries resulting from rear-end collsions. He has studied the value of head and neck supports on the backs of automobile seats, and has made several experimental models for his own car.

Combining the rarely related talents of engineer and journalist, Griffin has been uniquely successful in translating the technicalities of highway engineering into clear expository prose. Periodicals ranging through the trade magazines, general circulation newspapers, technical and engineering journals, bulletins, brochures and pamphlets, press releases, and the *California Highways and Public Works* magazine, contain hundreds of articles authored or edited by Griffin. A representative few would be the following, from *California Highways and Public Works: Sidewalk 'Supers,'* May-June 1952; *Hollywood Freeway*, Sept.-Oct. 1954; *Proposed Arroyo Seco Parkway Extension to Los Angeles Business Center Through Elysian Park*, October 1940; *Major Construction Under Way on Coast Highway Through Malibu Ranch*, March 1938; *Opening of Newport Overhead Solves Bad Traffic Problem*, January 1937; *Newport Beach Grade Separation Plan Includes Two Bridges and Ramps*, February 1936; and *Hospital Chief Says Improved Highway Has Ended Accidents*, July-August 1933.

It is not surprising that Griffin's interests run to literature and books because of his writing background. He is a bibliophile and collector of incunabula, with his main interest lying in Californiana. Among his library of 2,000 volumes are several which he treasures above all the others. These are worthy of mention. General J. C. Fremont's *Memoirs*, 1887; Herbert Hoover's translation of Agricola's *De Re Metalica*, 1912, together with an original Latin edition of 1561; and a Latin-text Bible printed by Nicolaus Kesler, 1487.

With his retirement and the many leisure hours before him. A. D. Griffin will continue his current researches into safe driving, a subject he has written many articles on of late, and will do some free-lancing. With his wife, the former Bessie Ramsey, whom he married in 1919, he will maintain his two residences at 411 S. Westmoreland Avenue in Los Angeles, and 1863 Carmelita Street in Laguna Beach.

The Griffins have two sons, A. D. Griffin, Jr., and Bill Griffin, both engineers.

## Associate Engineer J. C. Adams Retires

John C. Adams, Associate Highway Engineer with District V in San Luis Obispo, has retired after 31 years with the State.

Adams entered Civil Service in 1928 as an assistant resident engineer with the Division of Highways, District III, with headquarters in Sacramento. While there he worked on asphalt concrete projects in North Sacramento and at Clear Lake in Lake County.

He transferred to District V in 1929, became assistant highway engineer in 1930 and was appointed associate highway engineer in 1936.

Adams was resident engineer on the first four-lane divided highway in District V. This was known as the Montecito Parkway and extended between San Ysidro Road and Olive Mill Road on US 101 in Santa Barbara County.

Mr. Adams' main hobby is trout fishing which he intends to pursue actively after his retirement.

## Division Announces Recent Retirements

**Headquarters Office**

Martin A. O'Brien, Highway Signing Supervisor, 26 yrs.

Katherine I. Reid, Delineator, 16 yrs.

**District I**

James A. Giacomini, Associate Highway Engineer, 6 yrs.

**District II**

Roy C. Cormick, Highway Engineering Technician, 11 yrs.

George Sanderson, Assistant Highway Engineer, 20 yrs.

**District IV**

LeRoy R. Cardwell, Carpenter I, 25 yrs.

Ira G. Pearsall, Highway Leadingman, 29 yrs.

Risto J. Spremo, Groundsman, 12 yrs.

**District VI**

Carl W. Hurlbut, Highway Foreman, 31 yrs.

**District VII**

Gerald Dowling, Senior Delineator, 31 yrs.

Edward Owens, Hwy. Equip. Oper. Lab., 27 yrs.

Peter V. Rodriguez, Laborer, 31 yrs.

Rafael L. Verdugo, Associate Right-of-Way Agent, 27 yrs.

**District VIII**

Hilton V. McDonald, Highway Foreman, 31 yrs.

Drury P. Wieman, Highway Foreman, 27 yrs.

**District X**

Merrill E. Jones, Laborer, 32 yrs.

**District XI**

Philip DiGruttola, Laborer, 15 yrs.

Adolphus E. Hopkins, Hwy. Equip. Oper. Lab., 30 yrs.

**State-owned Toll Bridges**

Alexander Robertson, Structural Steel Painter, 20 yrs.

Thomas R. Shannon, Structural Steel Painter, 20 yrs.

**Headquarters Shop**

Thomas F. Doud, Heavy Equipment Mechanic, 24 yrs.

# PAINTING BRIDGES GREEN COMBINES BEAUTY, UTILITY

Many of the steel bridges on California's highways will soon be painted green to present a more pleasing appearance and to blend with natural colors of adjacent terrain and foliage.

This announcement was made by Governor Edmund G. Brown at his June 6 press conference on the basis of a report from Director of Public Works Robert B. Bradford. Bradford said the Division of Highways has adopted specifications for new green paints, which unlike previously used greens, will be durable enough for California's varied climate.

Frequent and costly repainting has been required with green paints used in the past, which is why they have been used so seldom, Bradford said.

"After extensive tests by our Bridge and Materials and Research Departments," he reported, "we have concluded that the new paints will be satisfactory from a cost and maintenance standpoint, and we are sure the new color will be an eye-pleasing change for both motorists and nearby residents.

"We are very pleased," he added, "to be able to combine beauty and utility in our bridge maintenance program."

In coastal regions, where bridges are subject to attack from salt-laden moisture, a new vinyl-type green paint will be used. In the interior of the State, steel bridges will be painted with a new green paint similar to that used in the past but with revised pigment components.

Nearly all of California's steel highway bridges are now painted with an aluminum paint which is a silver color.

The following nine bridges in widely separated areas of the state will be painted green this year under the regular bridge maintenance program:

The Noyo River Bridge on Sign Route 1 south of Fort Bragg, the Mad River Bridge on US 101 north of Arcata, the Salinas River Bridge on the Monterey-Salinas Highway near Hilltown, the Beaumont Overhead on US 60-70-99 near Beaumont, the Kaiser Road Overhead on the San Bernardino Freeway east of Colton, two Santa Ana River Bridges on Sign Route 38 near Redlands, and two Clear Creek Bridges on US 99 south of Redding.

Bradford said other bridges will be painted green in subsequent years as protective painting becomes necessary.

Most of the new bridges now on the drawing boards, or those on which improvements are planned, will also be given green finishing coats. Among these are the San Pedro-Terminal Island suspension bridge which will be Southern California's first toll bridge, and the Sacramento River Bridge on U.S. Highway 99 at Redding, which is being widened.

In addition to satisfactory durability characteristics and improved appearance qualities, the new paint offers advantages in the application process.

The only really satisfactory method of applying leafing aluminum paints is spraying, Bradford said. Spray application is difficult on heavily traveled highways or in major population centers, he explained, because of the danger of paint damage to vehicles and adjacent buildings and property. The new paints, however, can be applied by brush or roller as well as by spraying.

## Commission Adopts Two Sierra Routings

The California Highway Commission at its July meeting in San Diego adopted freeway routings on two Sierra Nevada highways.

One adoption covers a 9½-mile relocation of the Carson Pass Highway (Sign Route 88) between 2.9 miles east of Picketts, Alpine County and the Nevada state line.

The other covers a new routing for 27 miles of the Sonora Pass Highway (Sign Route 108) in Tuolumne County between one mile east of Sonora and McCoy Saddle.

A public meeting on the Carson Pass routing was held by the Division of Highways at Markleeville in January; a similar meeting on the Sonora routing was held in March at Twain Harte.

## District V Marks Dolliver Retirement

William S. Dolliver, City and Co-operative Projects Engineer for District V, San Luis Obispo, retired June 30 after nearly 33 years of service with the California Division of Highways.

W. S. DOLLIVER

Associate Highway Engineer Del Roberts, also of District V, has been promoted to the post vacated by Dolliver.

Born in Helena, Montana, Dolliver attended local grammar schools, spent two years at the University of Wisconsin and received his degree in agriculture from the University of Montana in 1917. He received a commission in the Coast Artillery Corps the same year and served with the A.E.F. until March of 1919.

DEL ROBERTS

Upon his return from France, Dolliver worked in Montana for the Bureau of Public Roads and the National Park Service on location and construction work, and various land appraisal and irrigation projects.

In 1923 he came to work for the California Division of Highways as a draftsman for a short time, and, except for two years spent with the Bureau of Public Roads, he has served with the division since 1925. He progressed from draftsman to locating engineer, resident engineer, to his present assignment as City and Co-operative Projects Engineer for District V.

The Dollivers have two sons, James and Roger. James received his Ph.D. from Cornell University this year and Roger is a first lieutenant in the U.S. Air Force.

Retirement plans for the Dollivers call for relaxation at their mountain retreat at Lake Coeur d' Alene in Idaho on their 160 acre ranch. Also on the agenda for the next few years are a trip through the United States and Mexico and a tour of Spain.

Roberts has worked in District V since 1953 as resident engineer on freeway construction projects and as supervisor of a freeway design section. He previously worked in the Surveys Department of District VII, Los Angeles, and had prior experience with the Colorado and Nevada State Highway Departments.

# TWENTY-FIVE-YEAR AWARDS

**Employees who received twenty-five-year awards since those listed in the May-June Edition of *California Highways and Public Works***

**Headquarters Office**
Doris Weaver

**District I**
George D. Hanson
Mathew A. Koskela
Bernard A. Whittaker

**District II**
Byron F. Clarke

**District IV**
Charles P. Della Maggiora
Philip Antonio Karst

**District V**
Russell H. Massengale

**District VII**
Robert Wendell Anderson
Charles E. Dresser

**District VIII**
Evan G. Bower
Ralph Setser
George C. Sommer

**District XI**
Taft Macias

**State-owned Toll Bridges**
Harold A. Wood

**Headquarters Shop**
Manuel Anderline
Albert U. Mullnix

**Shop 11**
Edward G. Schutt

### DUMBARTON BRIDGE TOLLS COLLECTION IMPROVED

Another improvement in the collection of tolls has been put into effect at the Dumbarton Bridge. Heretofore tolls were collected from one small booth situated in the center of the roadway at the lift span. Now a temporary toll plaza with three toll booths has been constructed at the east approach so that two toll booths can be operated in one direction during peak periods.

Whenever a lift is made for navigation, the lift span operator notifies the toll plaza and all three toll booths are manned to take care of the subsequent surge of traffic. Response from commuters has been favorable.

### ARCHITECTURE JOB TOTAL FOR YEAR $73,200,000

Construction projects authorized by the Division of Architecture during the 1959-60 fiscal year totaled $73,200,000, including $4,100,000 for which plans were developed by private architects. Approximately 2.7 percent of the above program was for day labor, including several large commitments for restoration of historical monuments. This small percentage of day-labor work is in line with the policy of maximum allocations to contract construction which was established several years ago. Also, during the 1959-60 fiscal year $88,300,000 of contracts were accepted by the director. These contracts involved change orders of less than $1,000,000 —percentage-wise less than 1.1 percent of the total.

Public school construction applications submitted to the Division of Architecture in June totaled $23,600,000, bringing the 1959-60 fiscal year total to $313,200,000, the second largest year recorded since the inception of the Field Act.

# STATE OF CALIFORNIA

EDMUND G. BROWN, *Governor*

## DEPARTMENT OF PUBLIC WORKS

PUBLIC WORKS BUILDING — 1120 N STREET, SACRAMENTO

ROBERT B. BRADFORD . . . . . Director

FRANK A. CHAMBERS . . . . Chief Deputy Director
RUSSELL J. COONEY . . Deputy Director (Management)
HARRY D. FREEMAN . . Deputy Director (Planning)
T. F. BAGSHAW . . . . . Assistant Director
JOHN H. STANFORD . . . . . Assistant Director
S. ALAN WHITE . . Departmental Personnel Officer

### DIVISION OF HIGHWAYS

J. C. WOMACK . . . State Highway Engineer, Chief of Division

CHAS. E. WAITE . . . Deputy State Highway Engineer
J. P. MURPHY . . . Deputy State Highway Engineer
J. W. TRASK . . . Assistant State Highway Engineer
J. A. LEGARRA . . Assistant State Highway Engineer
LYMAN R. GILLIS . Assistant State Highway Engineer
J. E. McMAHON . . Assistant State Highway Engineer
E. R. HIGGINS . . . . . Comptroller
FRANK E. BAXTER . . . . Maintenance Engineer
L. L. FUNK . . . . . Planning Engineer
MILTON HARRIS . . . . . Construction Engineer
F. N. HVEEM . . . Materials and Research Engineer
H. B. LA FORGE . Engineer of Federal Secondary Roads
GEO. LANGSNER . . . . . Engineer of Design
SCOTT H. LATHROP . Personnel and Public Information
H. C. McCARTY . . . . . Office Engineer
E. J. L. PETERSON . . Program and Budget Engineer
F. M. REYNOLDS . . . . Planning Survey Engineer
EARL E. SORENSON . . . . . Equipment Engineer
G. M. WEBB . . . . . Traffic Engineer
M. H. WEST . Engineer of City and Co-operative Projects
A. L. ELLIOTT . . . . Bridge Engineer—Planning
L. C. HOLLISTER . . . Projects Engineer—Carquinez
I. O. JAHLSTROM . . . Bridge Engineer—Operations
DALE DOWNING . . Bridge Engineer—Southern Area
R. R. ROWE . . . Bridge Engineer—Special Studies

***Right-of-Way***

FRANK C. BALFOUR . . . Chief Right-of-Way Agent
E. F. WAGNER . . . Deputy Chief Right-of-Way Agent
RUDOLF HESS . . . . . Assistant Chief
R. S. J. PIANEZZI . . . . . Assistant Chief
E. M. MacDONALD . . . . . Assistant Chief

***District IV***

J. P. SINCLAIR . . Assistant State Highway Engineer

***District VII***

E. T. TELFORD . . Assistant State Highway Engineer

***District Engineers***

SAM HELWER . . . . . District I, Eureka
H. S. MILES . . . . . District II, Redding
ALAN S. HART . . . . . District III, Marysville
L. A. WEYMOUTH . . . . District IV, San Francisco
R. A. HAYLER . . . . . District IV, San Francisco
A. M. NASH . . . . . District V, San Luis Obispo
W. L. WELCH . . . . . District VI, Fresno
A. L. HIMELHOCH . . . . District VII, Los Angeles
GEORGE A. HILL . . . . District VII, Los Angeles
C. V. KANE . . . . . District VIII, San Bernardino
E. R. FOLEY . . . . . District IX, Bishop
JOHN G. MEYER . . . . . District X, Stockton
J. DEKEMA . . . . . District XI, San Diego
HOWARD C. WOOD . . . . . Bridge Engineer
State-owned Toll Bridges

### CALIFORNIA HIGHWAY COMMISSION

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CHESTER H. WARLOW, Vice Chairman Fresno
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ARTHUR T. LUDDY . . . Sacramento
ROGER S. WOOLLEY . . . San Diego
JOHN J. PURCHIO . . . . Hayward
JACK COOPER, Secretary . . . Sacramento

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

ROBERT E. REED . . . . . Chief Counsel

GEORGE C. HADLEY . . . . . Assistant Chief
HOLLOWAY JONES . . . . . Assistant Chief
HARRY S. FENTON . . . . . Assistant Chief

### DIVISION OF SAN FRANCISCO BAY TOLL CROSSINGS

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

### DIVISION OF ARCHITECTURE

ANSON BOYD . . . State Architect, Chief of Division

HUBERT S. HUNTER . Deputy Chief, Administrative
EARL W. HAMPTON
Deputy Chief, Architecture and Engineering

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WILLIAM R. VICK
Principal Architect—Project Management
IAN LEE WATSON . Supervisor of Project Co-ordination
THOMAS CHINN . Supervisor of Scheduling and Control
WILLARD E. STRATTON
Supervisor of Professional Services
HENRY R. CROWLE . . Administrative Service Officer
CARLETON L. CAMP . . . . . Principal Architect
CLIFFORD L. IVERSON . Chief Architectural Draftsman
EDWARD G. SCHLEIGER . . . . Principal Estimator
GUSTAV B. VEHN . . . . Chief Specification Writer
ALLEN H. BROWNFIELD . Supervising Structural Engineer
O. E. ANDERSON . . Supervising Mechanical Engineer

LOS ANGELES OFFICE

TOM MERET . . . . . Assistant State Architect
THOMAS LEWANDOWSKI
Supervisor of Project Management
JAMES A. GILLEM . . . . . Principal Architect
CHARLES PETERSON . . Principal Structural Engineer
RAYMOND J. CHEESMAN . Chief Architectural Draftsman
ROBERT J. PALEN . . . . . Supervising Estimator
HENRY C. JACKSON . . Supervising Specification Writer
CHARLES W. RHODES
Supervising Mechanical and Electrical Engineer

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J. WILLIAM COOK . . . . . Area II, Sacramento
CLARENCE T. TROOP . . . . Area III, Los Angeles

AREA STRUCTURAL ENGINEERS
SCHOOLHOUSE SECTION

MANLEY W. SAHLBERG . . . . Area I, San Francisco
M. A. EWING . . . . . Area II, Sacramento
ERNST MAAG . . . . . Area III, Los Angeles

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**"ROLLER SKATING ON THE STATE HIGHWAY"**

"Press dispatches report that 'skating rinks in San Mateo County are doomed to a natural death, judging from the avidity with which the young folk of the peninsula towns have taken up the fad of utilizing the new state highway for roller recreation. Moonlight skating parties are quite the common thing on the new smooth surface of El Camino Real. A party of young people from South San Francisco skated six miles to Easton one evening, built a big bonfire and served coffee and cake'."—from *California Highway Bulletin*, May, 1913.

Easton was incorporated into the City of Burlingame in 1916, so the skaters must have travelled over the section of paving in San Bruno shown in this 1914 picture. Highway surfaces in those days were better for roller skating, because the practice of deliberately roughening them to lessen skidding had not yet been adopted. Looking at the 1960 view of this same spot, skating obviously would be out of the question on this road today.

1960