

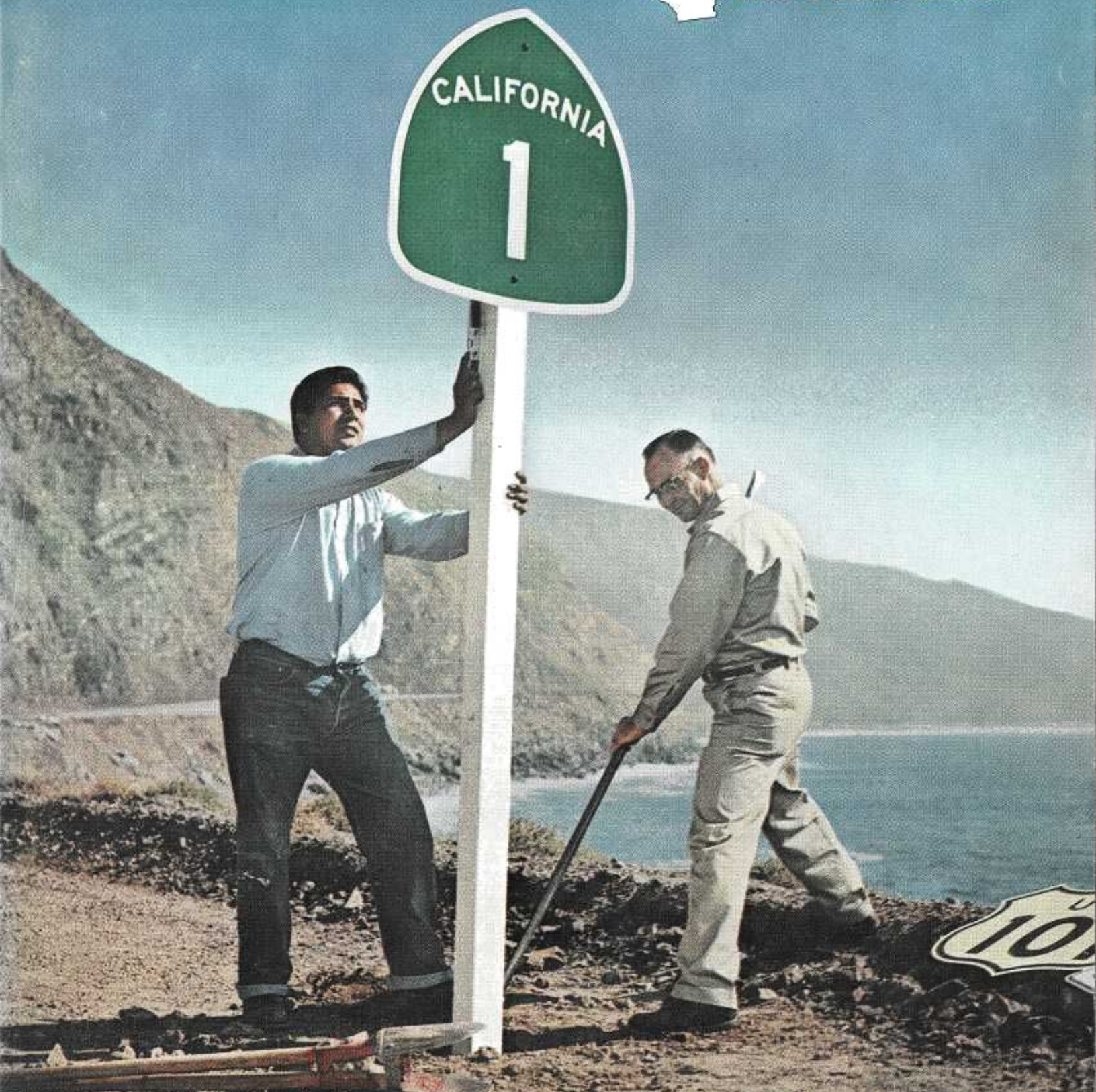
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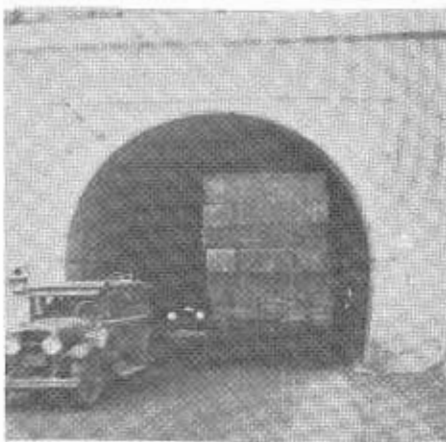
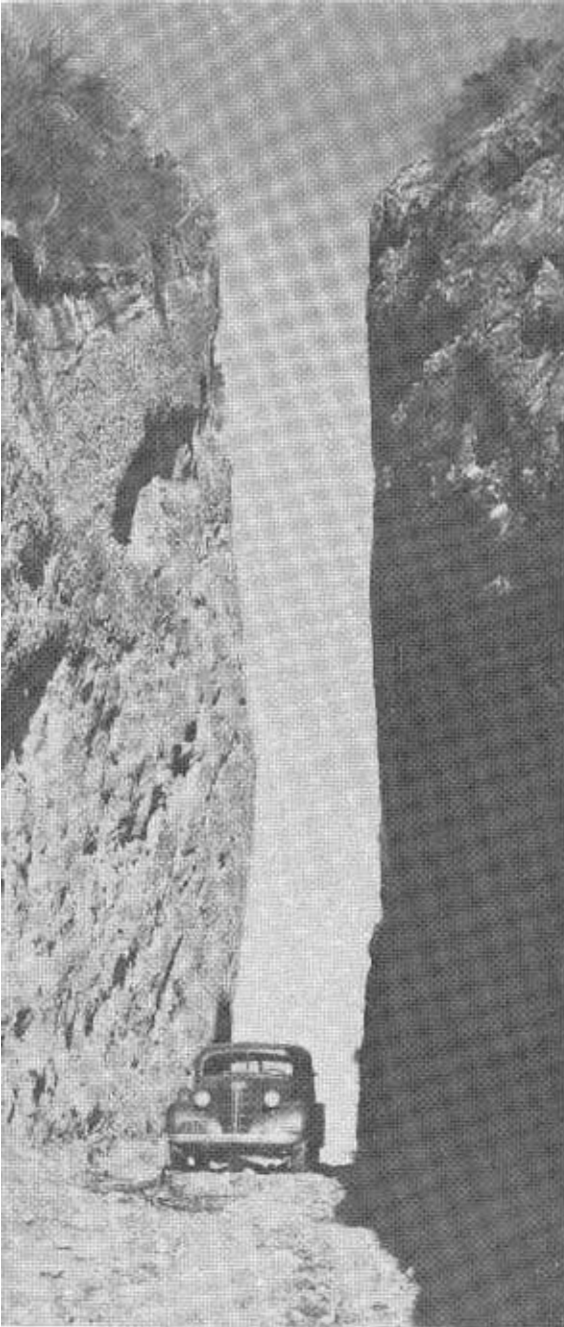
CALIFORNIA  
**Highways**  
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MARCH-APRIL  
1964

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DOCUMENTS





At left is photo in recent times of old San Fernando Pass. Walls are remarkably stable. Once a toll road, charges were \$2.50 for a 12-horse team, 25 cents for a horse and rider, 10 cents for miscellaneous arrivals, and 4 cents each for sheep. Above and below are pictures of various traffic problems experienced in negotiating old Newhall Tunnel, which was only 17½ feet wide and 17 feet high at center. Dark, low, and narrow, it was difficult for trucks—virtually a one-way proposition—and fearsome for passenger cars which sometimes turned out heavily on weekends for wildflower viewing or other recreation.



## EVOLUTION OF A PASS

According to the *Southern California Historical Society Quarterly*, the first cut was made in the old San Fernando Pass in 1854 to improve a wagon road of sorts, and it was cut deeper in 1858 for the Butterfield Stages. It was further deepened in 1862 by General E. F. Beale, owner of the huge Rancho Tejon, who repaired the route and reopened it as a toll road between the San Fernando and San Joaquin Valleys. With the completion of the railroad in 1870, wagon traffic fell off rapidly, and the county fell heir to the road in 1883.

The first automobile went over the pass in 1902, an "Autocar" driven by Los Angeles dealer Ralph Hamlin, accompanied by the new owner from McKittrick, who had come by train to pick up his car. The grade was so steep gasoline would not flow to the carburetor and they had to climb in reverse, both men leaping out and chocking the wheels with rocks each time the engine stalled.

In 1904, to lessen the grade, men with picks and shovels once more laboriously deepened the cut, and the

*(Continued on inside back cover)*



# California Highways and Public Works

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



FRONT COVER: As the new numbering system for California State Highways goes into effect, Francis (Mickey) Johnson (right), Highway Maintenance Man III, and Blas Gonzales, Highway Maintenance Man I, both from District VII Sign Maintenance Station, raise new sign shield on coastal route just south of Point Mugu in Ventura County. Route, once known as "The Roosevelt Highway," was previously numbered U.S. Highway 101 Alternate, is now a part of State Highway Route 1. See "Route Renumbering," page 11. (Photo by Peter Asano.)

BACK COVER: View of Santa Barbara and newly completed freeway section of U.S. 101 angling in from upper left. Santa Barbara Yacht Harbor in foreground, with city center and State Street right center. City owns virtually entire waterfront, and preserves it as a public park. Dark mass extreme right center is famous Morston Bay Fig, largest of its species in U.S. Freeway routing passes just to north of it. See "Santa Barbara Freeway" page 2. (Photo by Robert Rose.)



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# Santa Barbara Freeway

By J. M. STURGEON, District Construction Engineer



Santa Barbara, with its Spanish background and character, has been regarded as a city blessed with an abundance of scenic ocean and mountain views, an excellent climate,

and widely accepted as the center of a resort and retirement area that is among the best California offers.

While still considered a resort center, Santa Barbara, with 64,000 people,

is now classed as one of the 11 "urbanized areas" in the State.

Santa Barbara has become an education center with the Goleta Campus of the University of California adjacent to its west city limits, Santa Barbara City College inside the city, and Westmont College just south of the city in picturesque Montecito.

#### Growth of Industry

Research centers for a number of industries have established themselves in and around Santa Barbara, as have a number of electronic and space age industries.

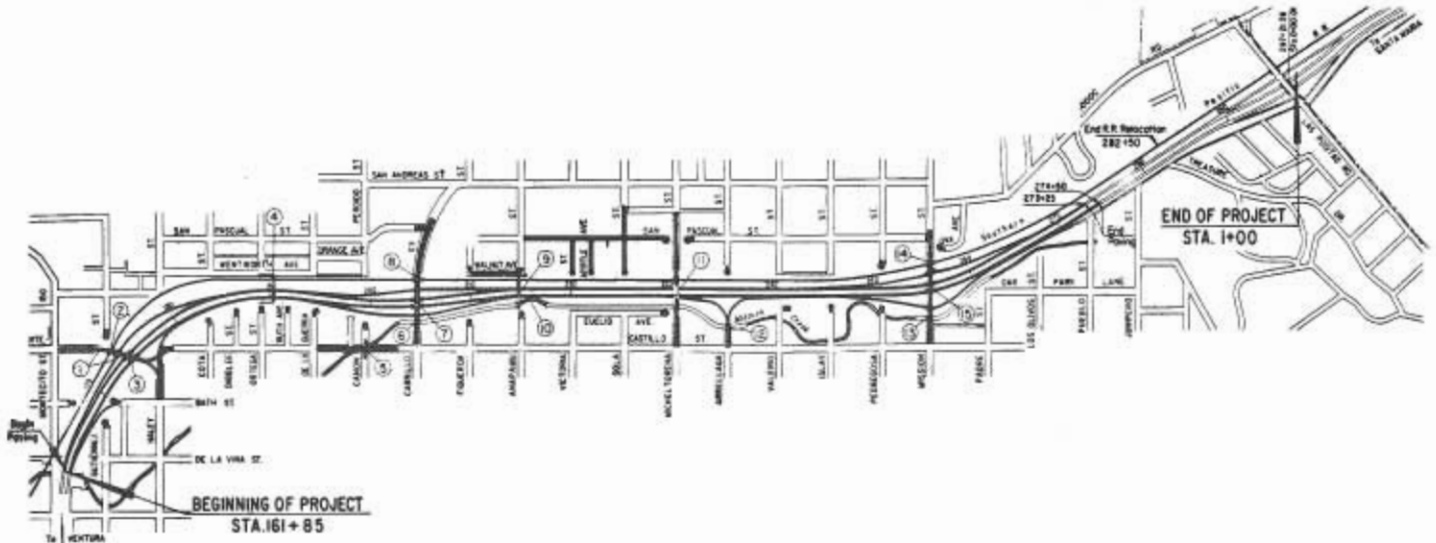
Since World War II, realignment, reconstruction, upgrading and improvement projects have followed each other in a steady procession in and around Santa Barbara on U.S. 101 to meet ever-changing traffic needs caused by the growth and development of this area.

By the fall of 1961, this highway had been constructed to full freeway or well-developed expressway standards from the junction of the Ventura-Santa Barbara county line to the town of Buellton in the Santa Ynez Valley, some 50 miles north of Santa



*This aerial of the Castillo Street undercrossing (near completion) shows the routing of traffic to the northbound lanes while the southbound lane is being finished. It also shows some of the railroad relocation in the curve at the left.*





This project map from the specifications book shows the routing followed by the freeway through the City of Santa Barbara. Numbers refer to various structures.

Barbara, except for a very significant 2½-mile stretch running along the west side of downtown Santa Barbara.

There, between the intersection of De La Vina and Montecito Streets to the southeast and Pueblo Street on the west, traffic was still using a narrow four-lane facility built in 1934. Though some shoulder paving and widening have been accomplished since to provide four full-traffic lanes, the 40-foot-wide original construction was no match for the traffic it had to handle.

#### Big Traffic Increase

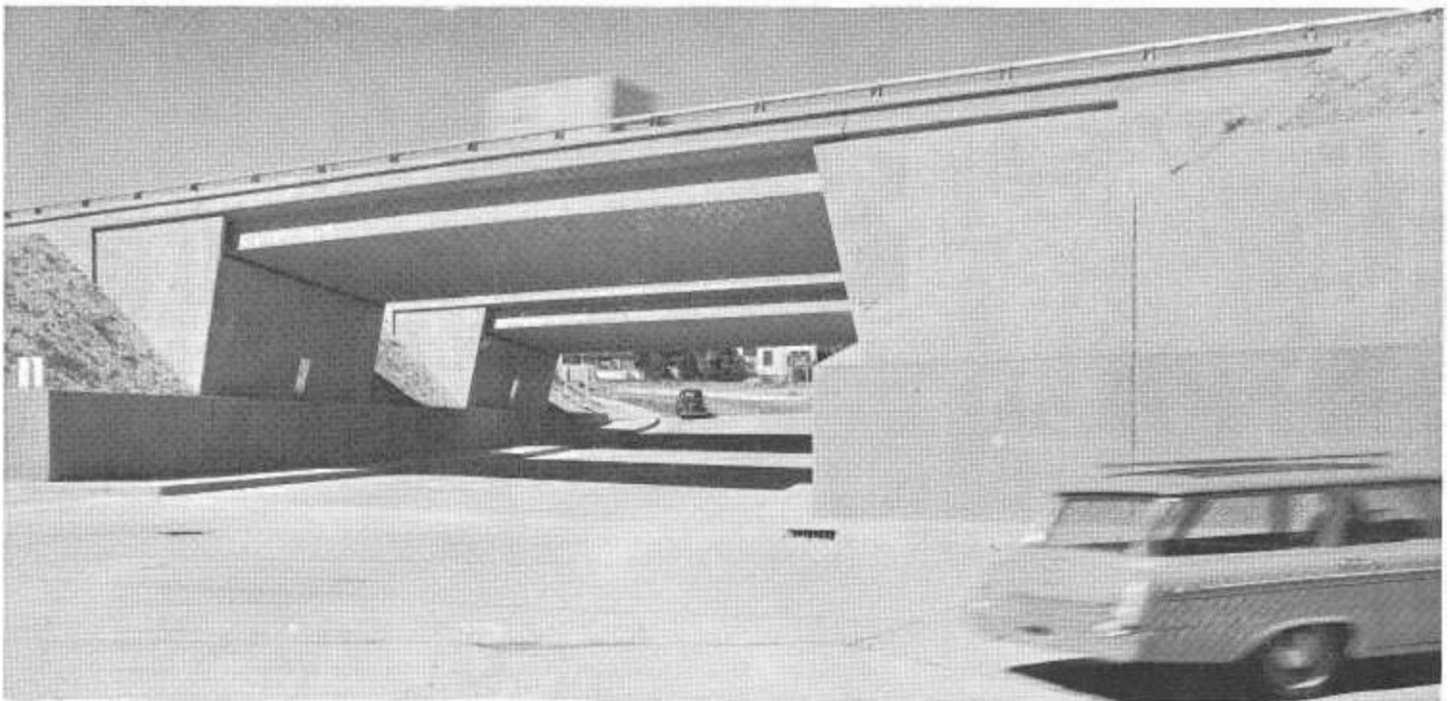
In the eight years between 1954 and 1962 peak traffic on this section of highway jumped 85 percent, with figures now indicating better than 39,000 vehicles per day. Traffic congestion increased to the point that cross traffic, which had also increased considerably in volume, could no longer be handled efficiently even through signalized intersections. Delays and hazards increased beyond tolerable limits.

Freeway design plans that had been developed for some time were quickly

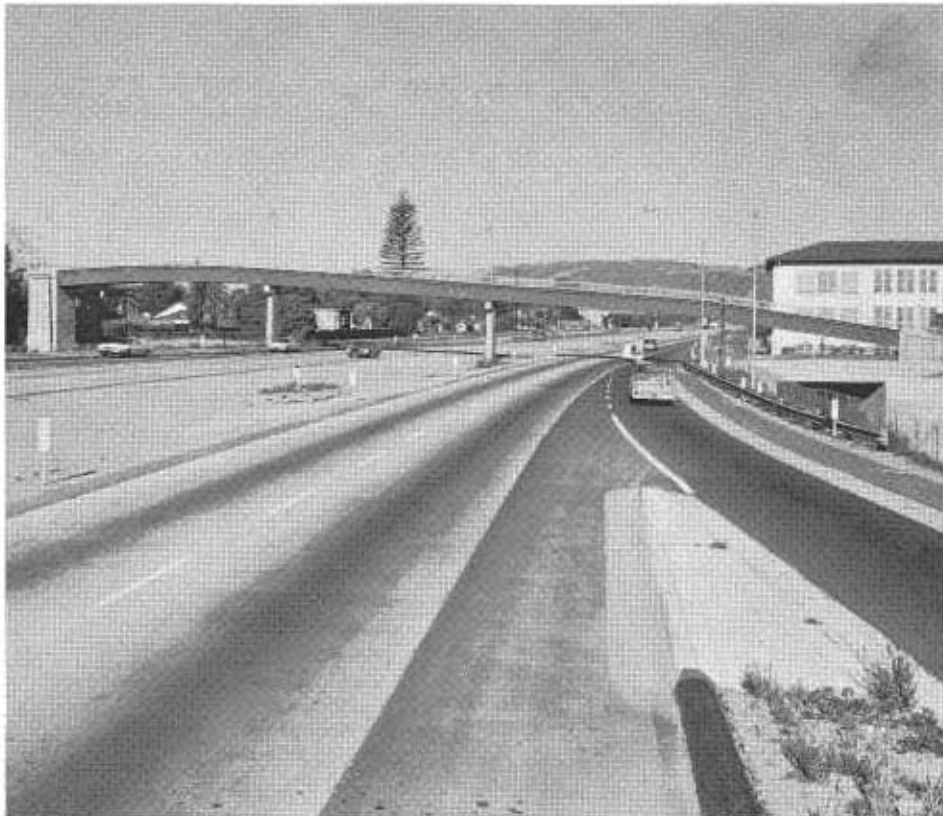
brought to completion, bids were called for, and on November 9, 1961, work on this \$5,000,000 project was begun by Gordon H. Ball, Gordon H. Ball, Incorporated, and Talbot D. Bailey, Incorporated, contractors operating as a joint venture.

The contractors were faced immediately with some serious problems of how to phase their construction work.

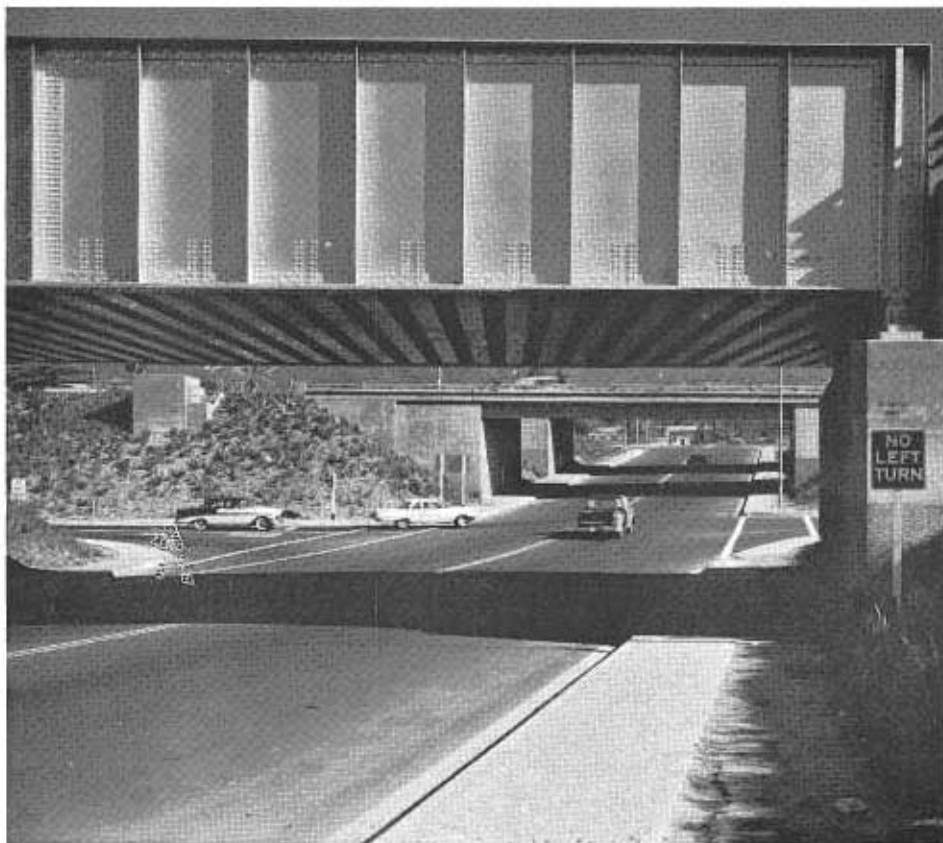
The entire alignment to be constructed was complicated by controls and restrictions that were a designer's dilemma. To the south the main line



The Castillo Street undercrossing, giving a detailed view of the "boot" section described in the article.



Looking west at the Anapamu pedestrian overcrossing in front of the Wilson Elementary School.



The Mission Street railroad bridge (foreground) and the undercrossing (background) looking in the direction of the City of Santa Barbara.

of the Southern Pacific Railroad's coast route restricted expansion. On the north, Mission Creek, the main drainage channel for the older section of Santa Barbara, paralleled the existing alignment.

After considerable study, it was finally determined that portions of both Mission Creek and the railroad would have to be relocated to provide space for the fully developed freeway needed in this area.

Even though room was provided for the freeway, there still was not sufficient area to build the project without inconvenience to traffic. For example, new lanes had to be constructed over existing lanes in many places, with traffic maintained on existing lanes until the new lanes were completed.

#### Extensive Studies Made

During the planning stage, extensive studies had been made evaluating the idea of detouring traffic over city streets while freeway construction was underway. These studies showed that this would be extremely costly, and in addition, would have spread congestion and accompanying traffic hazards over a distance three times the length of the construction project. It was concluded that the least cost and inconvenience to the traveling public would occur under the conditions providing for traffic to be narrowed down to two of the existing lanes in the construction area, then to construct two new lanes, transfer traffic to them, construct the second pair of new lanes, and then split traffic to the four completed lanes.

Stage construction and traffic shifts did not stop then, however. Construction of interchange structures involved cross streets, either over or under the railroad tracks as well as over and under the freeway itself. In two instances, underpass construction meant that a "shoofly" had to be constructed to detour railroad traffic around the proposed excavation area. The cross street then had to be excavated and a new railroad bridge built. After that, the "shoofly" was eliminated, railroad traffic routed over the new bridge, and the remainder of the excavation and interchange construction completed.





*An aerial of the freeway area through Santa Barbara. The sand dredge is in the foreground with the Marina to the left. The Moreton Bay fig tree is right middle ground with the central business district beyond and to the right of the tree.*



The Mission Creek channel change parallels the freeway to the right beginning left foreground. The Southern Pacific Railroad is on the other side of the freeway. The view is westward toward the Micheltorena Street overcrossing.

#### Stage Construction

All these stage construction requirements eliminated any possibility of high production rates in connection with any of the contract items. Consequently, it is of interest to note that the contractor elected to mix and place the portland cement concrete pavement with a Gunnert-Zimmerman slip-form paver in combination with tilting-drum transit mixers. Contractor Gordon H. Ball has been a pioneer in the development and use of this specialized equipment which has proven so successful in rapid discharge of low-slump concrete. Figures indicate that with the relatively short runs that were possible at any time, and even though two complete "move-ins" and "move-outs" of equipment were involved, this was the contractor's most economical alternative.

The job feature that may be of greatest interest to both design and construction engineers involves the Castillo Street Interchange near the southeasterly end of the project. Design and space limitations required

that Castillo Street go under the freeway and adjacent railroad tracks, even with the knowledge that a high water table existed in this area.

As a solution to this high water table problem, it was decided to construct a "boat section" which in effect meant construction of a concrete boat in place that would neither float up nor sink as the water table rose and fell.

Final plans called for Castillo Street under the freeway area to be held down in the area of deepest excavation by some 500 piles driven in place.

#### Ramps Weighted Down

In addition, for approximately 150 feet outside the area locked in place with the piles, Castillo Street and the interchange ramps were weighted down with extra-thick concrete pavement, sometimes as much as five feet thick, and at the ends of the sections at least one foot thick.

This meant that all excavating, pile driving, concrete work and other operations had to be carried on within

an extensive system of well points that were under continuous pumping to assure a dry working area.

With all these problems, the contractor remained on schedule and the project was completed on January 3, 1964, some 30 years after the completion of the highway it replaced.

Key personnel included Jay Row, project superintendent for the joint venture; Talbot Bailey, Jr., project engineer; Al Banducci, bridge superintendent; and William Appel, paving superintendent. J. Arthur Case, Santa Barbara County flood control engineer, represented county interest on the Mission Creek realignment work, and W. W. Wills, public works director for the City of Santa Barbara, worked closely with state and contractor's representatives through all phases of the work.

J. B. Popnoe was resident engineer for District V, and P. G. O'Halloran was Bridge Department representative, State Division of Highways.



# Morongo Canyon

New Freeway Section Has  
Rest Area and Fountain

By C. F. "BING" JOHNSON, Resident Engineer



Few people in the United States, or even in California, had heard of Morongo Valley until 1909.

In that year in Banning, a 25-year-old Piute Indian, Willie Boy, kidnaped his sweetheart, Isoleta Boniface, after having put a bullet through her father's head, and dragged her into Morongo Valley in an attempt to escape the law. The newspapers all over the country carried the story of this manhunt in their headlines. Willie Boy realized that Isoleta was slowing down his progress in keeping ahead of the sheriffs of two counties and their posses, so he killed her and pushed on alone. For two weeks, he hiked through the rugged mountains of the high desert from Banning nearly to Ludlow, 70 miles northeast of Banning, and back to the Morongo Valley area 25 miles northeast of Banning, but the expert trackers following were too much for him. They found his body near what is now Pioneer Town, where he had shot himself with his last round of ammunition.

#### First White Settler

The first white settler in Morongo Valley, Curtis Christiansen, came in 1874 and fashioned a crude home for his family in Little Morongo Canyon. Prior to this date, Morongo Valley had been inhabited only by Piute and Morongo Indians.

Christiansen and his family saw occasional Spanish missionaries and prospectors use the road through the canyon. The road at that time consisted of two wagon wheel ruts worn in the sand.

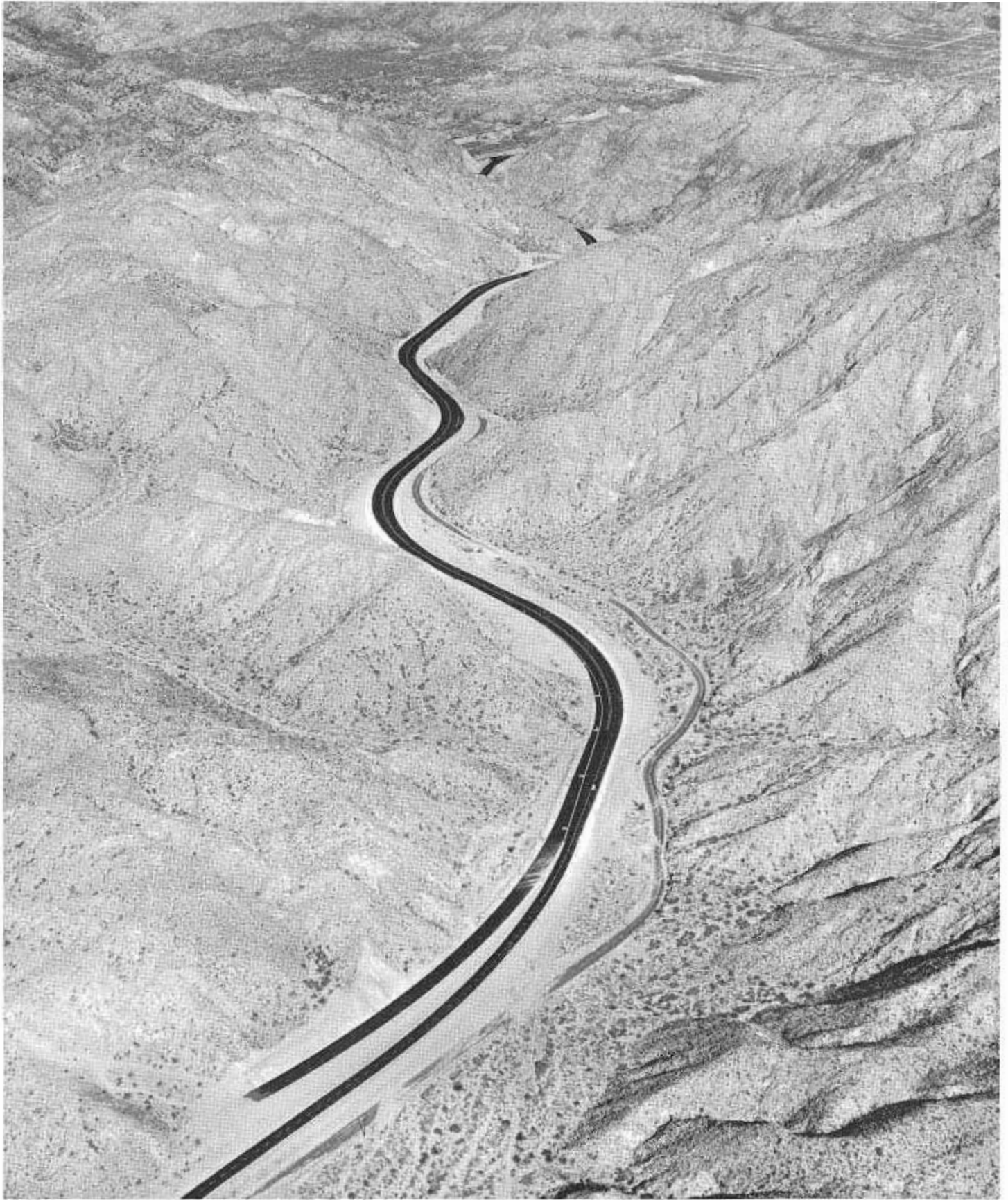
More settlers followed Christiansen into the valley and started raising sheep and cattle. The ranchers and local freighters drove their teams and



The new Morongo Canyon Freeway with the old road and creek bed to the right.



A safety rest area and drinking fountain along the freeway.



Aerial view of the new freeway looking north up the canyon. Note the beginning of the project in the lower left. The community of Morongo Valley is in the background.



wagons over the trail through Dry Morongo Wash. This trail was located on the easterly edge of the canyon. From this point northerly to the community of Morongo Valley, the old trail was about a quarter of a mile west of the alignment of the new roadway. It passed near the old Hole-in-the-Wall Spring one mile south of Morongo Valley, where travelers used to stop and water their horses and rest a bit.

The Hole-in-the-Wall Spring is an old mine tunnel which extended from the face of the decomposed granite hillside into the hill 60 feet. When the opening to the tunnel was dammed up, the water stood about two feet deep in it and it formed a nice underground storage reservoir.

#### **Flood Danger**

The road through Dry Morongo Canyon and Morongo Valley was a hot dusty trail most of the time, but during the summer season when those white billowing clouds known as thunderheads began to gather in the sky, prudent teamsters waited at Morongo Valley or at the mouth of the canyon until the clouds had blown away or until the floodwater had all run out of the canyon. It would have been disastrous to be trapped in the canyon with a five-foot stream of water flowing swiftly down it because there was no place to escape up the steep rocky canyon walls with a team of horses and a wagon.

The old wagon trail remained in existence until 1937 when it was paved with road-mixed asphalt surfacing. During the flood in the spring of 1938, the water ran five feet deep down the canyon, according to long-time residents in the area, and washed out most of the new asphalt surfacing. It was replaced and it remained with only minor maintenance until construction of the new roadbed in 1963.

#### **Selected Rock Gives Protection**

The new roadbed was constructed on the westerly side of the canyon with the finished grade a minimum height of five feet above the flowline of the canyon; however, throughout most of the canyon the height is 10 feet or more. The entire right side of the roadbed embankment from 1,000



*Approaching the safety rest area about halfway through the canyon.*



*An aerial view of the freeway looking southeast down the canyon. Note the bridge in the foreground.*

#### Flash Flood

On the evening of August 7, 1963, a sudden two-inch rain caused a flash flood in the canyon, which pushed 6 to 12 inches of rocks and sand upon the old road in some places and washed out the shoulders two to three feet deep in other places. Traffic was quickly switched onto the uncompleted new road under pilot car control for a night and a day while the debris on the old road was cleaned up.

No damage resulted on the new roadway from the flash flood.

On the afternoon of August 29, 1963, the old road was again closed, due to a vehicle accident which damaged the falsework under the bridge. It took a week for the contractor to untangle the wreckage under the bridge and remove all of the damaged falsework so that he could get traffic back on the old road and proceed with completion of the new road. It had been his plan to leave all of the falsework under the bridge intact until after the traffic had finally been switched to the new roadbed permanently. The falsework could then have been removed with no interference with the public traffic on the detour through the falsework under the bridge.

The project developed 50,000 cubic yards of excess roadway excavation over the 707,000 cubic yards which would have been required for construction of the planned embankments. Some of this excess material was used to widen the shoulders in four locations, in addition to the four locations called for on the plans, from four feet to eight feet in order to provide additional emergency parking off the traveled way. The remainder of the excess material was disposed of on the right and left sides of the roadbed one-quarter mile north of the bridge. These widened areas were then paved to provide for emergency parking and safety roadside rest areas. A drinking fountain with a hydrant for filling water cans was constructed on each of the safety roadside rest areas on the steep mountain grade. Water for the fountains comes from the Hole-in-the-Wall Spring referred to above.

Two additional paved emergency parking areas were developed by daylighting cuts.



An aerial view northward across the community of Morongo Valley. The bridge can be seen left foreground and just beyond, the safety rest area and drinking fountain.

feet north of the beginning of the project to the bridge at the county line is lined with selected rock slope protection obtained from the rock cuts. The selected rock slope protection was placed on the outside edge of the fill slope five feet thick from a depth five feet below the existing sandy floor of the canyon to a planned profile grade which was 5 feet to 10 feet above the elevation of the canyon floor.

At particularly vulnerable locations on inside curves where a heavy flow of storm water with high velocity would be directed toward the embankment, the selected rock slope protection was "beefed up" with additional thickness of rock above the existing ground line in order to provide increased protection against extreme flash floods.

The contractor, E. L. Yeager Company, began work on January 8, 1963, and his fast progress kept the work well ahead of schedule on the 175-day contract until August.

During construction, traffic was kept on the old road through the canyon portion of the job. At the county line, traffic was detoured westerly under the Dry Morongo Wash Bridge while the bridge was under construction, and thence to the connector road which was constructed early in the contract in order to get the traffic out of the way of new construction between the bridge and Station 45+00. The connector road will now become a county road to serve residents in Dry Morongo Wash. From there on northeasterly through the community of Morongo Valley, traffic was carried through new construction.



# Route Renumbering

New Green Markers Will Replace Old Shields

New white-on-green route markers are replacing the familiar black and white shields along some of California's state highways.

Fewer than 50 routes will be affected in the immediate future, although a general renumbering of state highways has taken place in accordance with legislation (Senate Bill 64, Collier) that became effective on September 20, 1963. Where possible, state highways have retained their posted numbers, so that many existing black-on-white markers will remain in place for a while.

## Confusion Possible

Some confusion on the part of drivers traveling reposted roads is expected for the next several months. The primary reason is the fact that automobile clubs and the commercial map-makers, whose products are dispensed by oil companies and others, could not note the new route numbers on maps printed prior to this time. Maps being prepared now will coincide with the new signs.

Another source of possible confusion stems from the fact that the federal government has designated some highways in California by numbers already in use by the State. The State immediately changed its numbers to avoid duplication. Again, maps now on drawing boards will note the changes.

## Spade Design Retained

The new markers, like the old sign route shields, are in the shape of the spade used in the gold fields by California's 49er miners. Designed to last for many years, they are cut from aluminum. Their white numerals and translucent green background are developed through a reverse screening procedure. The combination is designed to retain a high degree of visibility at night and in hazy weather.

The colors were decided upon after a panel of engineers had checked various color combinations in over-the-road tests. Blue and gold were strong contenders but lost out when it was

discovered the gold had a tendency to appear muddy at night while the white and green retained their true hues.

With the advent of the white-on-green signs some long-familiar numbered routes are being lengthened (Route 1's southern terminus will be Capistrano Beach, Orange County, instead of Las Cruces, Santa Barbara County); some are being shortened (Route 99's new temporary terminus will be Los Angeles instead of the Mexican border at Calexico); and some will be eliminated (U.S. 399).

## History of Route Markers

The black-and-white color combination was first adopted by the federal government in 1926 but the first route markers did not appear along California highways until January 1928. However, the Division of Highways was not assigned responsibility for signing highways until 1934, and during the intervening six years two major automobile clubs carried out the program at their own expense.

The California State Automobile Association placed signs in the 45 northern counties, and the Automobile Club of Southern California provided similar service in the 13 southern counties. This work was undertaken along U.S. highways, state highways, county roads and city streets.

The first road to be marked in the north was U.S. 40 from Berkeley to the Nevada state line. In the south, U.S. 101 from Los Angeles to San Diego was marked at the same time. The black-on-white signs were rectangular in shape.

A short time after the automobile clubs began installing signs, the American Association of Highway Officials published the *Manual on Uniform Traffic Control Devices*. The manual established standards in the marking and positioning of U.S. route markers. When the Division of Highways undertook the responsibility of signing highways, it was decided to examine the routes signed by the auto clubs

and bring their signing to conformance with AASHO standards.

Because U.S. highway markers were not appropriate for marking state routes, Division of Highways engineers met with representatives of the two automobile clubs to adopt a route marker for state highways. After examining a wide range of suggested designs, the group selected the "bear shield" which resembled a miner's spade and displayed a grizzly bear taken from the California Bear Flag.

## Numbering Systems Vary

As the state highway network grew and existing roads became longer, each new segment was given its own number by the Legislature then in session. As a result, some state highways acquired as many as 13 different legislative route numbers along the way. To minimize these complications for the motorist, the Division of Highways established the state sign route system that identified each road from one end to the other by a single number. This system supplemented the U.S. shield numbers which are assigned by the federal government on the recommendation of AASHO.

The new system parallels the sign route method in that one road calls for only one number when possible.

## Sign Installation Schedule

Some of the new route signs are already in place, and Division of Highways plans call for almost all those which will identify the renumbered highways to be installed by July 1, 1964.

More signs will be posted during the next two or three years. Damage and age will necessitate future replacement of present black-on-white markers. And where highway construction is underway or will begin in the near future, state officials believe it impractical to post new signs along a right-of-way until construction is nearly complete.

Another important facet of the operation is the removal of black-and-white shields. In the past, portions

of many California highways have been marked with the shields of multiple routes because those particular stretches were incorporated into a combination of two or more state and federal highways. This practice, which complicated travel for unwary drivers unacquainted with the procedure, will almost be eliminated when the "one number equals one highway" project is complete.

#### **Interstate Route Signs Differ**

Routes that make up the California portion of the National System of Interstate and Defense Highways are locations where the new numbers will receive a prominent display but on red, white and blue shields instead of white on green. Typical examples are Interstate Route 80 between San Francisco and Reno (formerly U.S. 40), and Interstate Route 10 between Los Angeles and Indio (formerly U.S. 70, 99, and portions of 60).

These multilane full freeways and other interstate routes will proclaim their route numbers in red, white and blue on route signs that resemble the federal shield. The variations in color and design will make any road that is part of the national interstate system easy to identify as such.

Not all the black-on-white federal shields will disappear from national highways in California, for the red, white and blue shields will mark only interstate routes. Those U.S. highways (U.S. 101, for example) which are not included in the national interstate system will retain their present black-on-white shields.

Nor will the blue-and-gold shields that identify county roads by letter and number be eliminated. The county networks were not included in the 1963 legislative act and therefore will retain their present identities and shields.

#### **Renumbered State Highways**

The following list includes all California state highways where new signs will be posted over any portion of their length prior to July 1, 1964.

*Route 1*—742 miles, from Interstate Route 5 at Capistrano Beach, Orange County, via San Luis Obispo, San Francisco and Jenner to Fernbridge, Humboldt County. Incorporates former U.S. 101 Alternate from Capis-

trano Beach, Orange County, to north of Oxnard, Ventura County.

*Route 2*—89 miles, from Route 1 in Santa Monica to Route 138 near Cajon (north of San Bernardino). Incorporates portion of former U.S. 66 between Santa Monica and Pasadena.

*Route 4*—209 miles, from Interstate Route 80 near Hercules, Contra Costa County, via Angels Camp, Calaveras County, to Route 89 at Woodfords, Alpine County. Incorporates former Route 24 from Concord, Contra Costa County, to Antioch Bridge, Contra Costa County.

*Route 7*—33 miles, from Route 11 (Harbor Freeway) in San Pedro, Los Angeles County, to Interstate Route 210 in Pasadena. Incorporates former Route 15 for length of Long Beach Freeway.

*Route 11* (Harbor and Pasadena Freeways)—33 miles, from San Pedro, Los Angeles County, to Route 248 in Pasadena. Incorporates former U.S. 6 from San Pedro to Los Angeles and former U.S. 66 from Los Angeles to Pasadena.

*Route 14*—141 miles, from Route 1 northwest of Santa Monica to Route 395 near Inyokern, Kern County. Incorporates Antelope Valley Freeway and former U.S. 6 from junction with Route 395 at Tunnel Station (north of San Fernando, Los Angeles County) to near Inyokern. (Santa Monica to Tunnel Station not yet constructed.)

*Route 26*—56 miles, from Route 99 near Stockton to West Point, Calaveras County. Incorporates former Route 8 from near Stockton to Mokelumne Hill.

*Route 29*—107 miles, from Interstate Route 80 near Vallejo, via Calistoga, Napa County, to Route 20 near Upper Lake, Lake County. Incorporates former Route 53 from Middletown to Lower Lake, Lake County.

*Route 33*—315 miles, from Route 101 near Venture via Coalinga, Fresno County, to Interstate Route 205 near Tracy, San Joaquin County. Incorporates former U.S. 399 from Ventura to Taft, Kern County.

*Route 35*—52 miles, from Route 17 near Holy City (Santa Cruz—Santa Clara county lines to Route 280 in San Francisco). Incorporates former Route 5 from Saratoga Gap, Santa Clara County, to San Francisco.

*Route 37*—32 miles, from Route 17 near Nicasio, Marin County, to Interstate Route 80 north of Vallejo, Solano County. Incorporates former Route 48 from junction with Route 37 at Sears Point, Sonoma County, to junction with Interstate Route 80. (Novato to Nicasio not yet constructed.)

*Route 38*—59 miles, from Interstate Route 10 near Redlands, San Bernardino County, to Route 18 at west end of Big Bear Lake, San Bernardino County. Incorporates former portion of Route 18 from west end of Big Bear Lake to Big Bear City.

*Route 41*—188 miles, from Route 1 near Morro Bay, San Luis Obispo County, via Fresno to the south boundary of Yosemite National Park. Incorporates portion of U.S. 466 from near Morro Bay to Atascadero, San Luis Obispo County. (See Route 46.)

*Route 46*—119 miles, from Route 1 at Cambria, San Luis Obispo County, to Route 99 at Famosa north of Bakersfield. Incorporates portion of U.S. 466 from point near Shandon, San Luis Obispo County, to Famosa. (See Route 41.)

*Route 58*—240 miles, from Santa Margarita, San Luis Obispo County, via Bakersfield, to Interstate Route 15 near Barstow, San Bernardino County. Incorporates portion of U.S. 466 from point near Bakersfield to Barstow.

*Route 69*—44 miles, from junction with Route 198 (near Exeter), Tulare County, to Sequoia National Park (north of Badger). Replaces Route 65.

*Route 70*—182 miles, from Route 99 (about 4 miles southeast of Nicolaus), Sutter County, to Route 395 near Hallelujah Junction, Lassen County. Incorporates former Route 24 from near Sacramento to Marysville and U.S. 40 Alternate from Marysville to Hallelujah Junction.

*Route 82* (El Camino Real)—57 miles, from Route 101 at Ford Road (south of San Jose), Santa Clara County, to San Francisco. Incorporates former portion of U.S. 101 from Ford Road to San Francisco.

*Route 86*—89 miles, from junction with Route 111 (east of Heber), Imperial County, to junction with Route 10 near Indio, Riverside County. In-



incorporates former portion of U.S. 99 from near Heber to near Indio.

*Route 91*—63 miles, from Route 1 near Hermosa Beach, Los Angeles County, to Route 395 near Riverside, Riverside County. Incorporates former Route 14 from Hermosa Beach to Route 5, former portion U.S. 91 from near Route 5 to Route 395.

*Route 111*—129 miles, from Mexican border at Calexico, Imperial County, to Interstate Route 10 near Whitewater, Riverside County. Incorporates former portion of U.S. 99 from east of Heber, Imperial County, to Calexico, Imperial County.

*Route 113*—60 miles, from Route 12 northwest of Rio Vista, Solano County, to Route 99 south of Yuba City, Sutter County. Incorporates former U.S. 40 Alternate from Interstate Route 80 near Davis, Yolo County, to south of Yuba City.

*Route 116*—47 miles, from Route 1 near Jenner, Sonoma County, to Route 121 near Schellville, Sonoma County. Incorporates former portion of Route 12 from Jenner to Schellville.

*Route 119*—34 miles, from Route 33 in Taft, Kern County, to Route 99 at Greenfield, Kern County. Incorporates former portion of U.S. 399 from Taft to Greenfield.

*Route 121*—34 miles, from Route 37, Sonoma County, to Route 128 north of Napa, Napa County. Incorporates Route 37 from junction with Route 48 at Sears Point to junction with Route 128 north of Napa.

*Route 138*—113 miles, from Interstate Route 5 near Gorman, Los Angeles County, to Route 18 near Crestline, San Bernardino County. Incorporates former portion of Route 2 from its junction with Route 138 east of Wrightwood to junction with Route 18 near Crestline.

*Route 154*—32 miles, from Route 101 near Buellton, Santa Barbara County, via San Marcos Pass, to Route 101 near Santa Barbara. Incorporates former portion of Route 150 from Santa Ynez to Route 101 near Santa Barbara.

*Route 160 (River Road)*—61 miles, from Route 4 near Antioch, Contra Costa County, to Interstate Route 80

## ILLUMINATED SIGNS WARN OF FOG, LOW VISIBILITY

Signs which can be illuminated to warn motorists to reduce their speed to variable maximums at times of limited visibility, such as fog, have been installed at a test site on the Elvas Freeway (U.S. 99E) in Sacramento.

Ultimately, six signs on this freeway segment between Arden Way and south of the American River Bridge will be used to carry out part of the intent of Senate Resolution No. 33 (1963 session).

In this resolution, the Highway Transportation Agency was asked to initiate a "study which will determine possible means of giving advance warning to drivers of motor vehicles of the need for greater alertness and caution when driving during periods of reduced visibility." A report of survey findings will be submitted to the Legislature early in 1965.

The signs, electrically powered and comparable to the familiar time and temperature signs, will be in effect whenever weather conditions warrant reduced speed limits. Traffic engineers from the State Division of Highways will operate the signs in cooperation with the California Highway Patrol,

near Sacramento. Incorporates former portion of Route 24 from Antioch to near Sacramento.

*Route 175*—38 miles, from Route 101 near Hopland, Mendocino County, to Route 29 near Middletown, Lake County. Incorporates former portion of Route 29 from Middletown, via Hobergs, to 5 miles south of Kelseyville.

*Route 246*—35 miles, from Surf, Santa Barbara County, to Route 154 near Santa Ynez, Santa Barbara County. Incorporates former portion of Route 154 from Surf to near Santa Ynez.

*Route 299*—307 miles, from Route 101 near Arcata, Humboldt County, to Nevada state line near Cedarville, Modoc County. Extends former U.S. 299 for 43 miles from Cedarville to the junction with Route 395 at Alturas, Modoc County.

and in turn survey their effectiveness in alerting the public to special hazards ahead.

The Senate resolution was enacted in an attempt to cope with accident statistics. Approximately 3 percent of automobile accidents in 1961 were attributed to conditions of reduced visibility. Moreover, 14 percent of 1961 accidents involving four or more cars happened under like conditions, and 1962 statistics showed that such accidents were increasing.

Variable speed signs are only one of the methods to be tested. Other devices and techniques being studied include increased patrol activity, concentrated public information dissemination, use of reflective wedge-shaped pavement markers, use of white shoulder stripings, and use of colored reflective shoulder and lane striping at on- and off-ramp locations.

State agencies involved in the study project are the Division of Highways, the California Highway Patrol, the Department of Motor Vehicles, and the Institute of Transportation and Traffic Engineering at the University of California's Richmond field office. The latter institution has made available their fog chamber for evaluating devices to be used in the study.

## Hveem, Zube, Skog Win Emmons Award

Three Division of Highways engineers were recipients of the W. J. Emmons Award of the Association of Asphalt Paving Technologists.

They are F. N. Hveem, recently retired chief of the Materials and Research Department, Ernest Zube, supervising materials and research engineer, and John B. Skog, senior materials and research engineer.

The award was for the best paper presented at the 1963 meeting which was held in San Francisco.

Title of their paper was "Proposed New Tests and Specifications for Paving Grade Asphalts."

Zube and Skog also received honorable mention for a second paper presented at the same meeting.

# District VII Progress

430 Miles of Freeway Now  
Open in Los Angeles Region

By E. T. TELFORD, Metropolitan District Engineer



In 1963 District VII completed and placed in service a record 54 miles of freeways, which added significantly to the effectiveness of the system in Los Angeles, Orange and Ventura Counties.

With 430 miles, or 27 percent of the planned network, in operation, gaps are being closed, longer continuous stretches of freeway are in use, traffic is spread more widely, and drivers have more choices of alternate routes. As the system grows, driving becomes easier and safer. This evolution will become more apparent each year until the entire 1,570-mile network is completed in 1980.

Although 1963 was a year of important freeway completions, there were some notable starts also, particularly the beginning of construction on the Pomona Freeway.

Some of the events that highlighted the year's work were:

—Completion of 54 miles of freeways, including 27 miles of interstate routes.

*Two important Interstate freeways converge in the bare hills north of San Fernando: the San Diego Freeway (Interstate 405) upper, and the Golden State Freeway (Interstate 5), and continue as Interstate 5 into the Tehachapi Mountains. This section of the Golden State and the connection with the San Diego were completed in 1963.*





—Opening of the Vincent Thomas Toll Bridge linking San Pedro and Terminal Island.

—Completion of the San Diego Freeway for 43 miles from the northern terminus near San Fernando to Atlantic Avenue, southeast of the Long Beach Freeway.

—Completion of the Golden State Freeway for 25 miles from East Los Angeles Interchange through the San Fernando Valley to a junction with the San Diego Freeway near San Fernando.

—Completion of the Ventura Freeway through the City of Ventura.

—Santa Monica Freeway under construction from completed section at Vermont Avenue to western terminus in the City of Santa Monica.

—First 14.4 miles of the Antelope Valley Freeway opened.

—Start of construction on Pomona Freeway.

—San Gabriel River Freeway under construction for 12 miles between the San Bernardino and Santa Ana Freeways.

For the sake of simplicity and convenience, commonly used names of freeways are used in this report, although all are not official names. Route numbers used are those of the revised numbering system which becomes effective July 1, 1964.

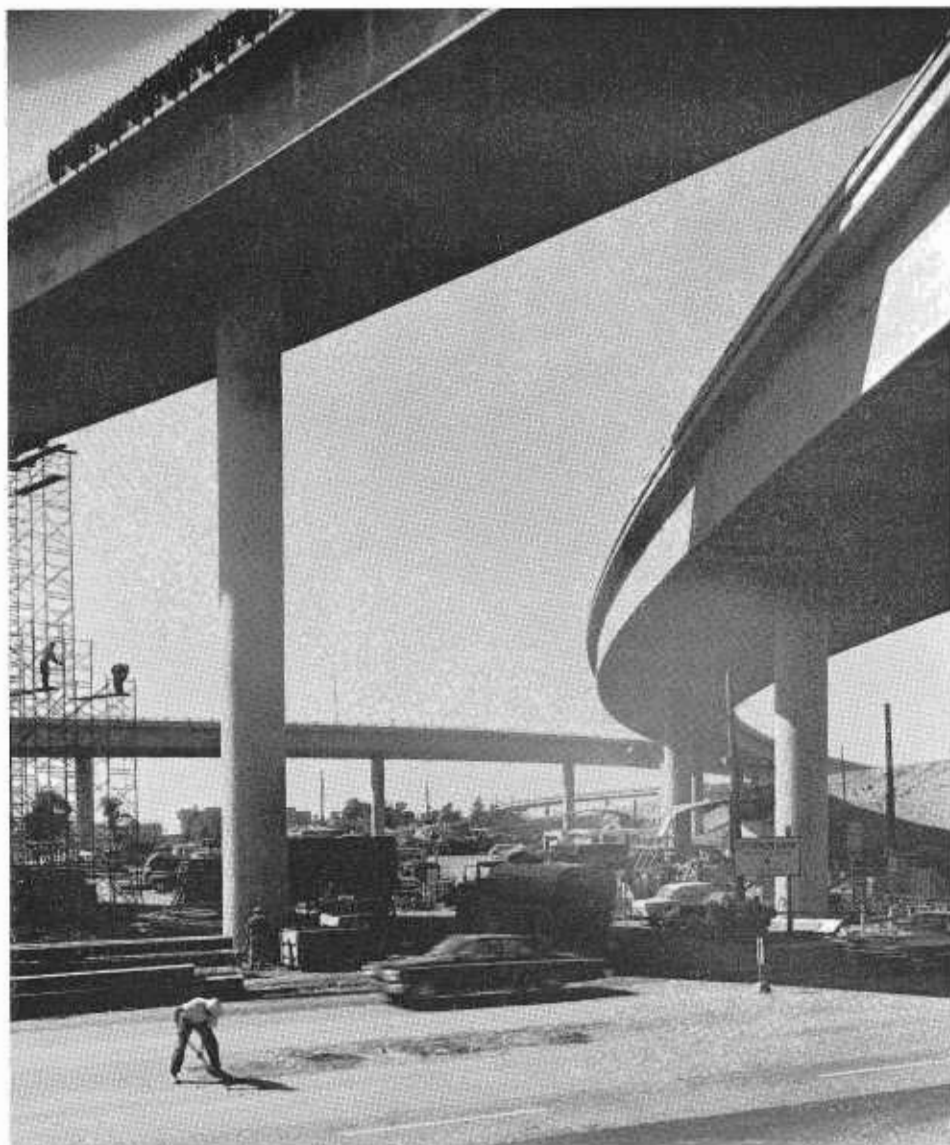
#### Interstate System

Half of the 54 miles of freeway completed in District VII during 1963 was on routes of the interstate system. These 27 miles represented a construction cost of \$70,200,000.

Emphasis on early completion of the interstate system will continue in coming years. The district planning program for the 1964-71 fiscal years includes \$354,000,000 for construction and \$166,700,000 for acquisition of right-of-way to complete the remaining miles of new construction and 31 miles of widening on existing interstate freeways.

The seven interstate routes in District VII total 325 miles, of which 210 miles, or 64 percent, have been completed. There are 34 miles now under construction, of which 17.8 miles will be completed in 1964.

All interstate routings in the district have been adopted except for two sections of the Foothill Freeway, on



*Elevated roadways frame construction activity in the San Diego-Santa Monica Freeway interchange area. The Santa Monica Freeway, under construction from Los Angeles westward to Santa Monica, is expected to be completed to this point early in 1965.*

which public hearings will be held before midyear.

#### Traffic Benefits

Completion of important links in the San Diego Freeway, Interstate Route 405, created a majestic sweep of 43 miles of continuous freeway from east of the Long Beach Freeway, through the Bay area, West Los Angeles and the San Fernando Valley to the junction with the Golden State Freeway, north of San Fernando. Of great importance also, was the completion of the Golden State Freeway, between Osborne Street and the San Diego Freeway, allowing continuous travel of some 25 miles, from the East

Los Angeles Interchange to its junction with the San Diego Freeway.

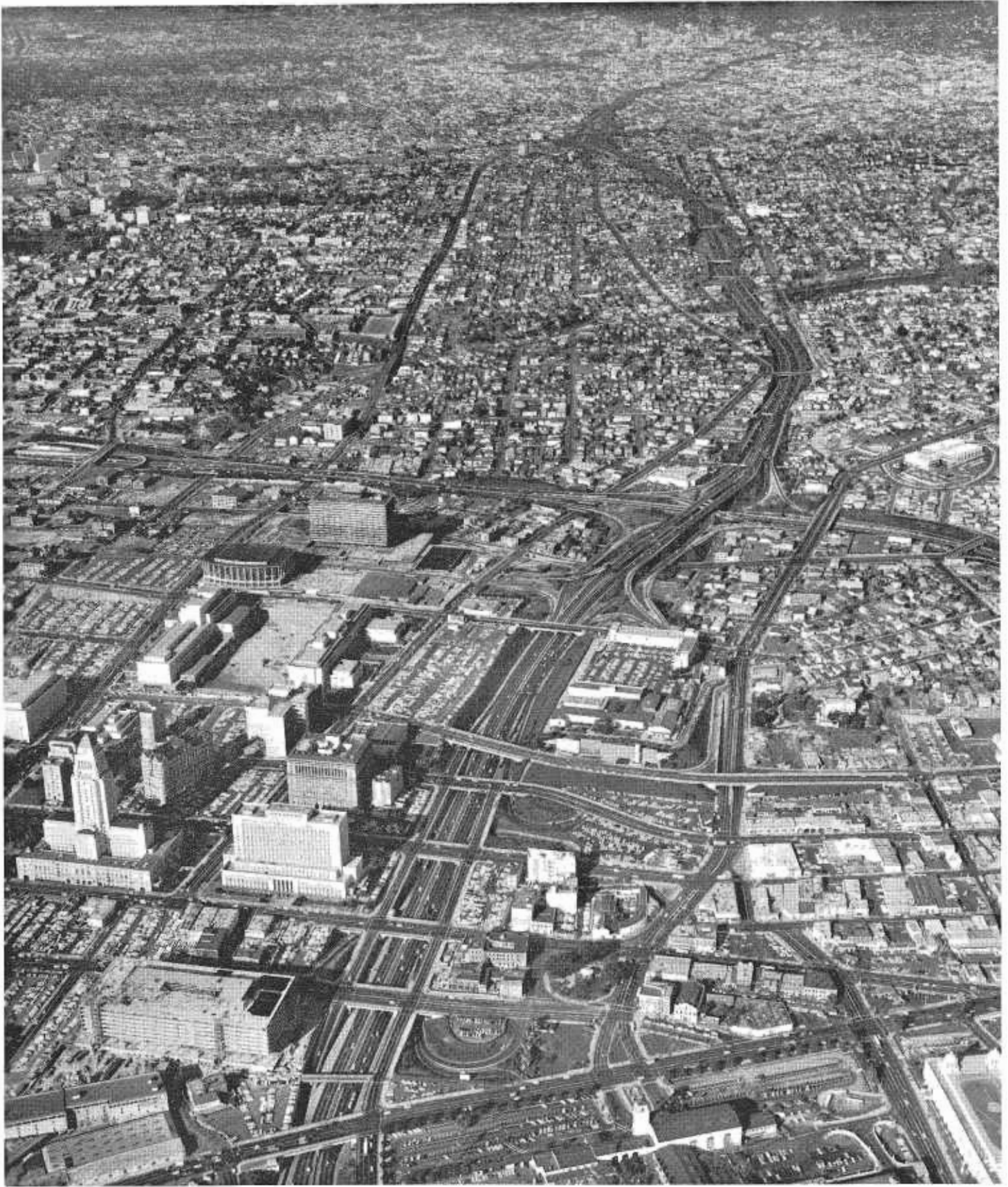
Travel time savings as a result of these freeway openings are substantial. For example, a drive from Long Beach, via the Pacific Coast Highway and Sepulveda Boulevard, to the Golden State Freeway near San Fernando, formerly required 90 minutes. Using the San Diego Freeway, this same off-peak-hour trip can be made in only 55 minutes of comfortable and scenic driving on the almost 50 miles of freeway. Peak-hour travel time is about 72 minutes.

Although the last segment of the San Diego Freeway was not opened



*The public building program in the Los Angeles civic center during the past 10 years has made some dramatic changes in the appearance of the area. For comparison, the above photograph was taken December 1953 and appeared in CALIFORNIA HIGHWAYS AND PUBLIC WORKS in the September-October 1954 issue. (See next page.)*





*This photo, taken January 15, 1964, shows the addition of buildings in the mall area, which will extend up the hill from the city hall to the Department of Water and Power Building and the Music Center (left center). Along the sides of the mall are the County Hall of Administration and the County Courthouse. The area between them is being excavated for construction of an underground parking facility. (See previous photo.)*



until late in 1963, its traffic volumes are in excess of 100,000 vehicles a day for the 32-mile stretch from the Harbor Freeway north to the Ventura Freeway.

The two completions on the Golden State Freeway, from Lankershim Boulevard to Osborne Street, and from Osborne to the San Diego Freeway, afforded time savings and badly needed relief to the streets in the San Fernando area. With 20,250 of the previous 31,200 vehicles per day removed from San Fernando Road, local service is improved, and through traffic moves unimpeded on the freeway.

Portions of the new district freeway mileages were so recently added that the full impact of the added com-

munity benefits are only beginning to be realized. New subdivision activity adjacent to newly opened freeway segments indicates again that fast, timesaving, economical and safe freeway routings are a paramount factor in the economic growth of an area.

The 4,000,000 vehicles in Los Angeles, Orange and Ventura Counties traveled approximately 13 billion vehicle-miles on state highways during 1963; almost 8 billion of these miles were logged on freeways, at tremendous savings to the public. Freeway travel affords relief and safety of such magnitude that these 8 billion miles of vehicle travel create a saving in operating costs of \$85,000,000, \$16,500,000 in accident costs, and \$275,000,000 in time savings.

#### Traffic Diversion

The now familiar pattern of large volumes of traffic diverted from parallel streets to freeways came into being in a rather more complex fashion than previous years in the case of the San Diego Freeway, many miles long in the current completed phase, with the gaps closed in calendar year 1963.

By virtue of its length, it passes through diverse areas, i.e., industrial and residential, as well as the semi-rural mountainous area through the Sepulveda Pass. Additionally, this freeway travels generally in an east-west direction in the harbor area, but south to north past the International Airport, through West Los Angeles and the San Fernando Valley.



The wide variations in changes of street volumes are shown as follows: Near International Airport the San Diego Freeway runs parallel to Sepulveda Boulevard about one mile to the east. Prior to the freeway opening 55,000 vehicles per day passed through the Airport Tunnel; subsequent counts at the same point indicated 43,000 cars per day are still passing through. The relatively small difference is due not only to the considerable distance between Sepulveda Boulevard and the freeway, but also because of its proximity to a major airport and a highly developed industrial area.

Conversely, in the San Fernando Valley, north of Vanowen Street, the freeway is located approximately one-half mile west of Sepulveda. When the

freeway was completed, traffic volumes on Sepulveda dropped from a previous 45,400 per day to 15,100 vehicles per day. In this case not only is the freeway relatively close to Sepulveda Boulevard, but, in this area a relatively large portion of the traffic consists of commuter trips. Such traffic is, of course, readily divertible.

#### Truck Traffic

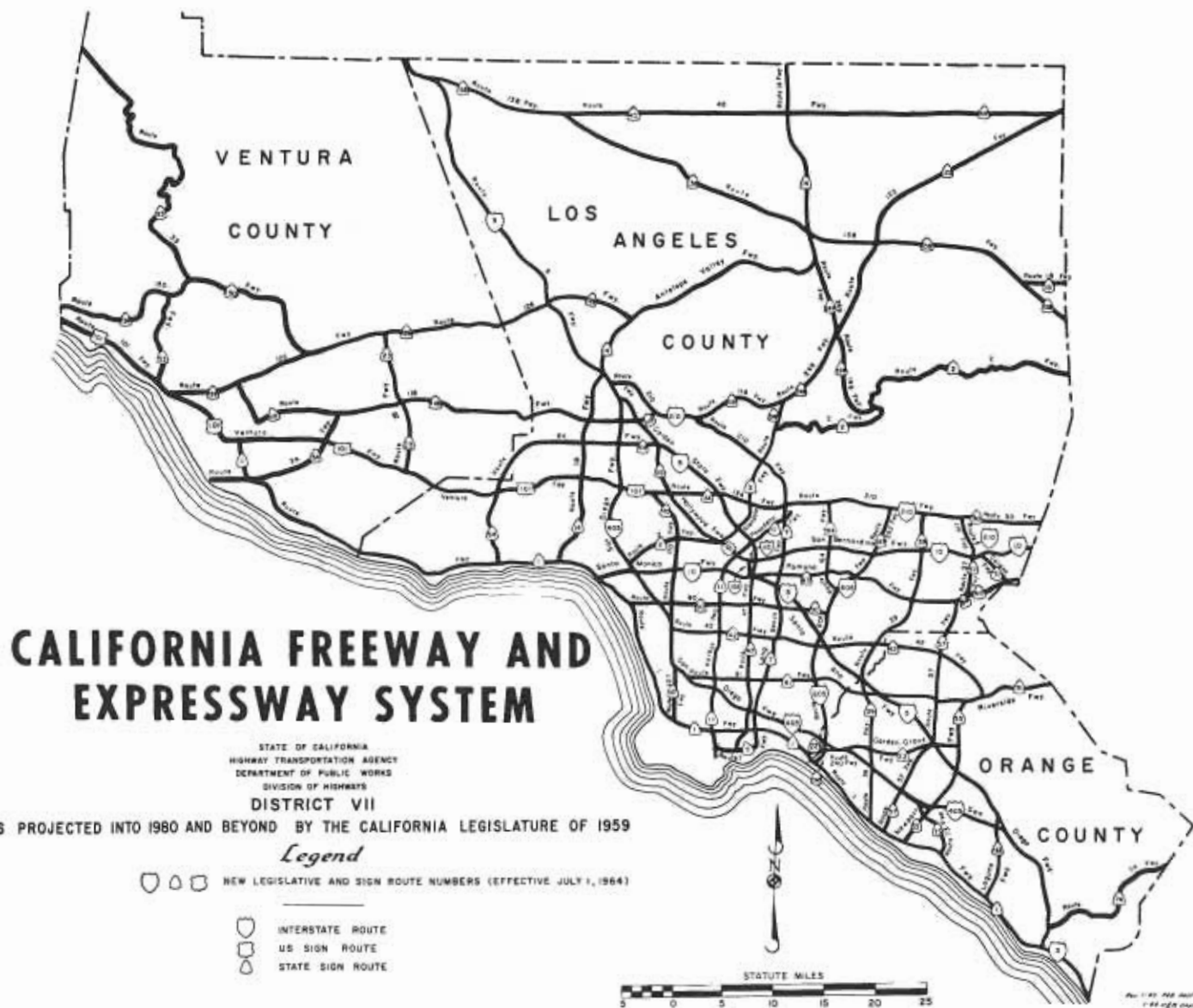
Truck classification counts were made in 1963, the first since 1960. Although there are considerable differences in the truck volumes, these are generally attributable to realignment of highways, rather than to large changes in area development and traffic patterns.

This is to be expected since commercial truck traffic, in general, di-

rectly reflects economic growth rather than population relocation or expansion.

Currently observed truck percentages are as follows: Hollywood Freeway, 4 percent; Ventura Freeway (west of Hollywood Freeway), 6 percent; San Bernardino Freeway, 10 percent; Santa Ana Freeway, 8 percent; Harbor Freeway, 5 percent; Santa Monica Freeway, 5 percent; Golden State Freeway south of Tunnel Station, 10 percent; north of Tunnel Station, 20 percent; Long Beach Freeway, 10 percent; and San Diego Freeway, 6 percent.

Average daily traffic volumes of the District VII freeway network during 1963 indicated a general 4-percent increase over 1962.



The breakdowns at key locations on the various routes are as follows:

**1963 AVERAGE DAILY TRAFFIC**

<i>Hollywood Freeway</i>	
(Westerly of Four-Level Structure) .....	185,000
(South of Ventura Freeway) .....	98,000
<i>Harbor Freeway</i>	
(South of Four-Level Structure) ..	188,000
(At 30th Street Overcrossing) .....	193,000
(At Century Boulevard) .....	136,000
(At San Diego Freeway) .....	63,000
(At Pacific Coast Highway) .....	28,500
<i>San Bernardino Freeway</i>	
(East of Long Beach Freeway) ..	158,000
(West of Golden State Freeway) ..	78,000
<i>Santa Ana Freeway</i>	
(East of Rosemead Boulevard) .....	112,000
(West of Long Beach Freeway) .....	180,000
<i>Pasadena Freeway</i>	
(North of Four-Level Structure) ..	92,000
(North of Golden State Freeway) ..	86,000
<i>Santa Monica Freeway</i>	
(Santa Ana Freeway to Harbor Freeway) .....	112,000
<i>Ventura Freeway</i>	
(East of Hollywood Freeway) .....	50,000
(West of Hollywood Freeway) .....	157,000
(West of San Diego Freeway) .....	133,000
<i>Golden State Freeway</i>	
(West of Pasadena Freeway) .....	130,000
(North of East Los Angeles Interchange) .....	116,000
(North of Ventura Freeway) .....	95,000
<i>Long Beach Freeway</i>	
(At Pacific Coast Highway) .....	57,000
(South of Santa Ana Freeway) .....	89,000
(South of San Bernardino Freeway) .....	48,500
<i>San Diego Freeway</i>	
(West of Long Beach Freeway) .....	74,000
(At Harbor Freeway) .....	84,000
(At Olympic Boulevard) .....	125,000
(At Ventura Freeway) .....	105,000
<i>Colorado Freeway</i>	
(At Linda Vista) .....	28,000
<i>Glendale Freeway</i>	
(At Golden State Freeway) .....	35,000
<i>Riverside Freeway</i>	
(At Santa Ana Freeway) .....	50,000
Using Four-Level Structure during a 24-hour weekday .....	333,000

Average daily traffic figures do not tell the full story of high traffic volumes that occur on peak days or weeks. For example, the 1963 average daily traffic on the Harbor Freeway at the 30th Street Overcrossing was 193,000, but during the week of June 16-22 the average was 203,000, and on the peak day, June 21, the traffic count at that point reached the total of 225,780.

**Bridge Projects**

Highlight of the year was the opening of the Vincent Thomas Bridge across the entrance to Los Angeles Harbor between San Pedro and Terminal Island. It is the third largest suspension bridge in California, 6,060 feet long, and 185 feet above the water of the channel, completed at a cost of \$21,000,000.

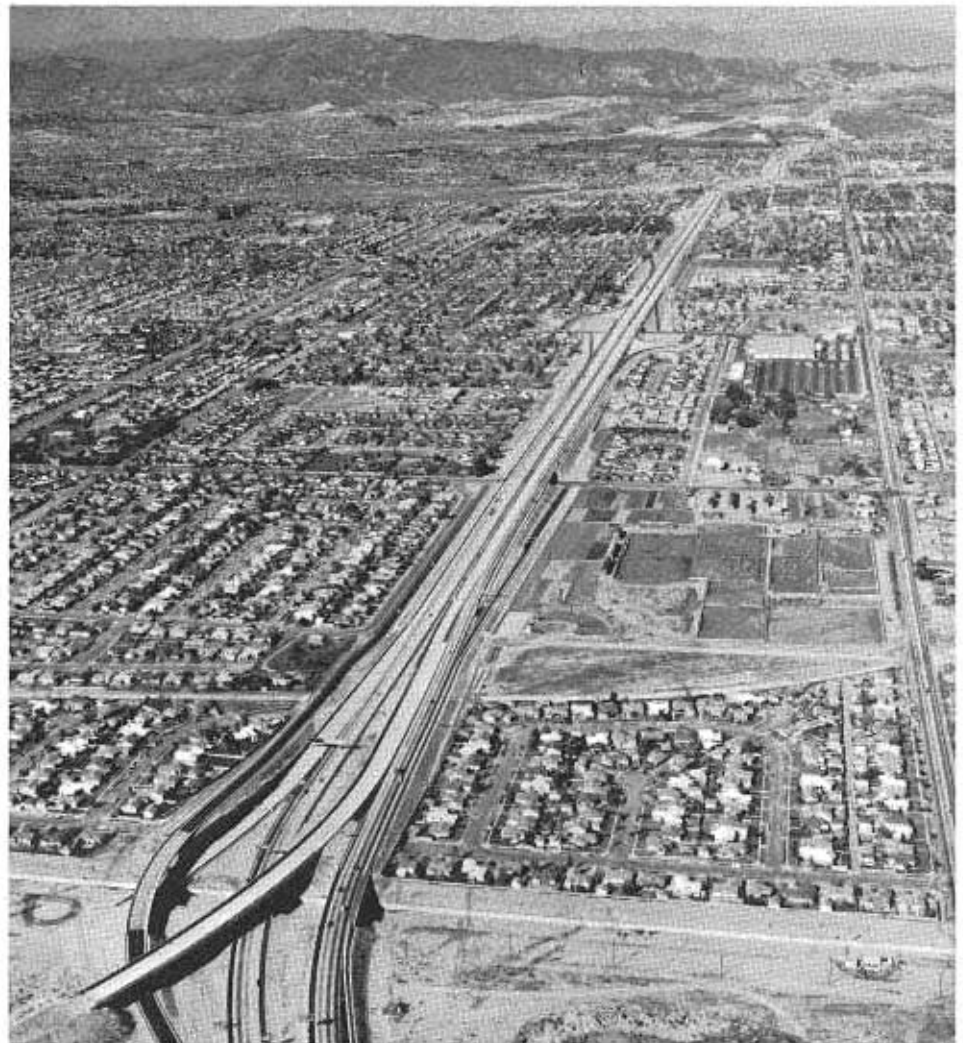
At 9.15 p.m., November 14, 1963, the Terminal Island ferry made its last scheduled trip, then a party of invited guests, including many public officials, went aboard for a tour of the harbor. At 12.01 a.m., November 15, a caravan of more than 100 automobiles crossed the bridge and returned to San Pedro, in celebration of the opening. Riding in the first car, and paying the first 25-cent toll was Assembly-

man Vincent Thomas of San Pedro, for whom the bridge was named in recognition of his many years of activity on behalf of the crossing.

The Vincent Thomas structure was designed by the Bridge Department, California Division of Highways, and construction was in charge of the department's southern office in Los Angeles.

This office works closely with District VII in providing cost analyses of structures for route location studies. More than 2,200 such cost estimates were made in 1963. In the design stage, where more detailed information becomes available, estimates were given on 240 structures.

More than 190 highway structures were completed in the district during the year at a cost of \$35,000,000.



This section of the Golden State Freeway, completed in 1963, forms a junction with the San Diego Freeway, upper right, and continues over the Tehachapi Mountains to the San Joaquin Valley. At the lower left is the connection for the Hollywood Freeway Extension, which will be built to this point within the next few years.



### Route Planning

Approximately 380 miles of freeways, estimated to cost \$2,270,000,000 for construction and right-of-way, were under active study for route adoption at the beginning of 1964. These projects include the only two segments of the interstate system in this district that remain to be adopted. Both are on the Foothill Freeway (Interstate Route 210). Public hearings are planned before mid 1964 on these sections:

Foothill Place to Hampton Road, 10.5 miles.

Pasadena area, including an interchange of the Pasadena, Foothill, Colorado and Long Beach Freeways, 3 miles.

Noninterstate routes under study include:

*Beverly Hills Freeway* (Route 2), from the San Diego Freeway to Ardmore Avenue, near the Hollywood Freeway; public hearing held April 22-23.

*Pacific Coast Freeway* (Route 1) from Malibu Canyon Road to terminus of Santa Monica Freeway in the City of Santa Monica, 13 miles. The 22.5-mile section of this freeway from Malibu Canyon Road north to Point Mugu is under consideration by the California Highway Commission for route adoption, following a commission hearing on February 25, 1964. Other unadopted portions of this route in Ventura, Los Angeles and Orange Counties are under study.

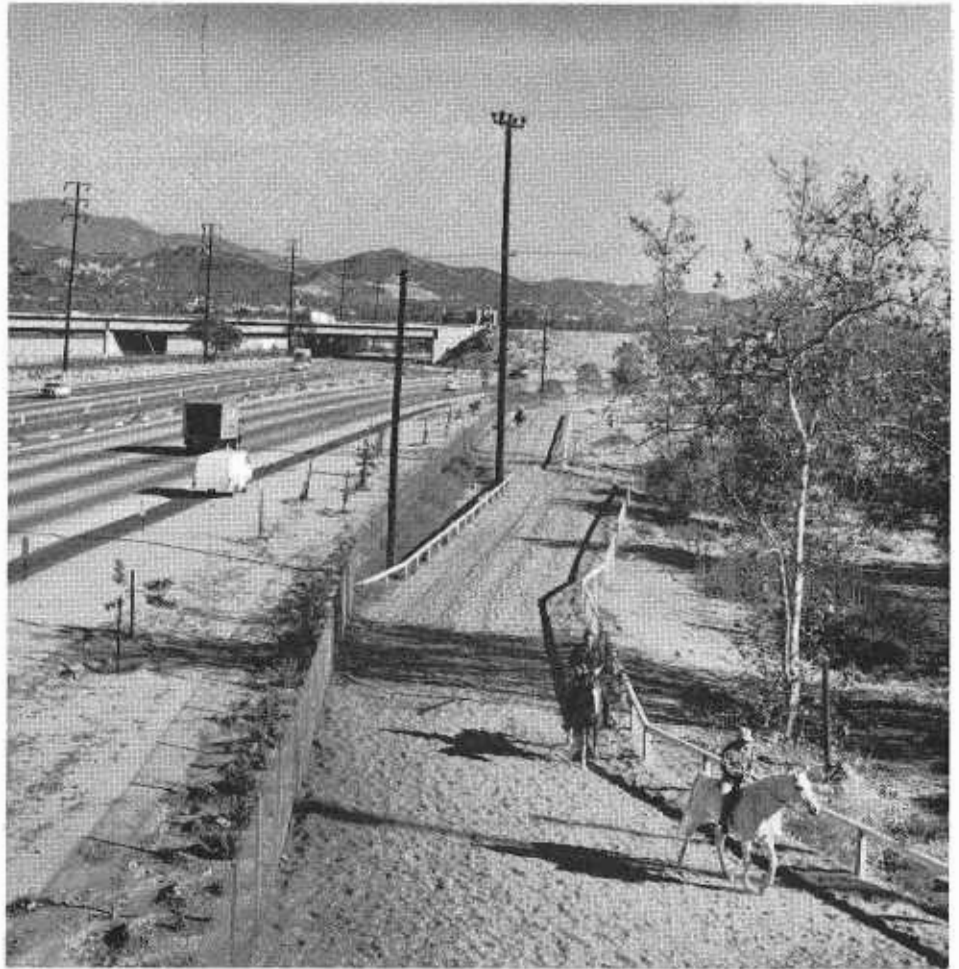
*Simi Valley Freeway* (Route 118) from DeSoto Avenue to the proposed Foothill Freeway (public hearing held January 9, 1964); and from the Route 126 Freeway near Saticoy to First Street near Moorpark.

*Century Freeway* (Route 42) from Pacific Coast Freeway to Santa Ana Freeway, public hearing held June 5, 1963.

*Route 126 Freeway* from Santa Paula city limit to the Los Angeles county line, public hearings held June 26, 1963, and January 15, 1964.

*Oxnard Bypass*, public hearings held September 18, 1963, and January 15, 1964.

*San Gabriel River Freeway* (Route 240) from the Garden Grove Freeway to Pacific Coast Freeway in Seal Beach.



Riders follow the bridle path alongside the Golden State Freeway near Griffith Park, Los Angeles. Trees recently planted inside the freeway fence will add to attractiveness of the area in future years.

*Long Beach Freeway* (Route 7) from the Foothill Freeway, Route 134 and Long Beach Freeway Interchange to Norwich Avenue.

Portions of three freeway routes were adopted during the year, totaling 22.3 miles and representing an estimated cost of \$109 million. Routes adopted were:

—On January 23, a 2.7-mile section of the Glendale Freeway from Ardmore Avenue to Glendale Boulevard, estimated to cost \$27.5 million.

—On May 22, a portion of the Pacific Coast Freeway in Orange County, from 0.8 mile south of MacArthur Boulevard to 0.2 mile north of Adams Boulevard, 10.2 miles, estimated to cost \$63.4 million.

—On June 26, a 9.4-mile section of the Route 126 Freeway between the Golden State and Antelope Valley Freeways, estimated to cost \$18 million.

In District VII the Highway Commission has now adopted 832 miles, or 53 percent, of the 1,570 miles of the California freeway and expressway system in the district. It is anticipated that the adopted mileage will be considerably increased in 1964, on the basis of a number of route studies nearing completion. The year got off to a fast start with the holding of three public hearings on freeway routes in the first 15 days.

### Construction Progress

There were continued developments in the field of portland cement concrete paving construction during the year. On two projects on the Santa Monica Freeway a turbine-type mixer was used in the concrete batch plant. This unit proved successful in producing a consistent, well-mixed concrete for structure work, and the contractor plans to use it for pavement concrete during 1964.



An interchange between the Golden State Freeway and the future Route 126 Freeway is under construction at Castaic, on the Ridge Route north of San Fernando. The project is part of a program to improve the Golden State (Interstate Route 5) to full freeway standards between San Fernando and the Kern county line.



The Route 126 Freeway is under construction northeastward from Saticoy to Santa Paula through the Santa Clara River valley in Ventura County. This 8.5-mile project, under contract for nearly \$7,000,000, will be completed in mid-1965. This view is westward along the completed section toward Ventura.

A low-profile batch plant has been installed on a San Diego Freeway contract near Long Beach, consisting of two eight-cubic-yard mixers which will be charged through the use of belts. Production has not yet started, but it was reported that a similar unit was successful in another district.

Also during the year a slip-form paving machine was used for the first time in this district on a freeway widening project. The machine is currently being used successfully on a Santa Ana Freeway contract, and the contractor plans to use it on a similar job in the near future.

The construction industry is working to develop equipment capable of placing plastic strips to form the transverse joints in concrete paving and thereby eliminate the need of sawing joints. A similar method of forming the longitudinal joints in multilane paving operations has been successfully used for some time. Transverse joints were placed in this manner on one section of the San Diego Freeway, and the finished product was of fairly good quality. Suppliers are continuing to develop techniques and equipment.

Another experimental project was started to determine the value of expansive-type cement in the portland cement concrete pavement construction and to employ plastic sheeting as a curing agent. This experiment, conducted on the Antelope Valley Freeway, will evaluate the effect, if any, of expansive cement upon the placement, curing and cracking of portland cement concrete pavements. Transverse joints were eliminated in this experiment and the slab was allowed to crack at random. To date no significant effects have become evident.

Experiments in slope stabilization were started during the year, using new types of mulch to control severe erosion due to ocean fogs and winds. One special mulch consisted of processed garbage and refuse; another was a wood pulp derivative. Grass seed was introduced into the stabilizing material and the mulches were sprayed on a test slope. No major problem was encountered in the application of the materials; but conclusive results of the experiment are not yet available.





Within the right-of-way of the famous freeway interchange, the Four-Level Structure in downtown Los Angeles, plantings have created parklike areas to beautify this part of the city.

#### Maintenance

Maintenance costs in District VII continued to increase as added highway mileage resulted in a greater volume of work. Expenditures in the 1962-63 fiscal year totaled approximately \$9,700,000, about 18 percent more than the preceding year.

The district maintained 1,527 centerline miles of roadway, equal to approximately 2,336 miles of comparable two-lane roadway. Included in the total were 559 conventional two-lane miles and 671 miles of four or more lanes, with an additional 448 miles of ramp and collector roads. Other major items covered in the year's operations were 196 miles of guardrail, 130 miles of cable chain link median barrier fence, 30 miles of blocked-out metal beam median barrier, and 2,774 curb miles of sweeping.

District forces also cared for 1,453 acres of landscaping, 4,654 acres of roadside, and nearly 50,000 trees.

Cost of clearing state highway routes of debris continued to increase.

In the 1962-63 fiscal year sweeping and trash pickup by state forces cost \$749,121, and cities spent \$286,606 on city-maintained routes, for a grand total of \$1,035,727.

#### Median Barriers

Installation of median barriers as a safety feature on freeways continued in 1963, and at the yearend there were 145 miles of cable chain link barriers and 30 miles of blocked-out metal beam barriers in District VII.

Repairs to these barriers, resulting from accidents, cost \$362,627 during the year. Of this amount, \$309,760 was collected or considered collectible from 85 percent of the known motorists responsible for the damage. Expense to the State was \$52,867 in cases where responsibility could not be fixed or where damages could not be collected. Cost of repairing the cable chain link fence averaged \$2.75 per foot. Median barrier repairs constituted about 90 percent of the loss reports filed in the district each month. A working force of 40 men, 35 of

them full time, was required to maintain the barrier fence.

Early in 1964 a five-mile section of cable chain link barrier was being installed on the Ventura Freeway west of Reseda Boulevard in the San Fernando Valley, which will complete the barrier on this freeway almost to the Ventura county line. A special feature of the project is the provision for removal of a 40-foot section of the barrier to permit the crossing of huge rocket boosters being transported in the vicinity. The barrier design was modified to expedite the removal and replacement of the posts for this purpose.

#### Right of Way

During the year the district invested \$64,229,000 in 2,104 parcels of property required for the freeway program, an average price of \$30,527 per parcel. Some of the larger right-of-way expenditures were for the following freeways:

Artesia .....	\$10,560,000
Colorado .....	8,504,000

San Gabriel River.....	\$5,544,000
Foothill .....	4,274,000
Garden Grove .....	3,691,000

Property appraisers noted that real estate values have continued to increase until the cost of right-of-way required for freeway projects in the metropolitan area now exceeds construction costs by as much as 50 to 300 percent. There has also been a considerable rise in suburban property values. As a result, right-of-way costs, more than ever before, are controlling factors in freeway route location.

The Right of Way Department appraised 1,496 parcels of property having a total appraised value of \$42,500,000.

For the Route Planning and Design Departments, 196 estimates of property values were made, on 87,581 parcels, valued at \$3,600,000,000.

Sales of excess lands and buildings resulted in a gross return of more than \$5,000,000, most of it from the sale of 452 parcels of property at public auction.

Rental of state-owned property averaged 3,000 active accounts during the year, and resulted in revenue of approximately \$3,000,000. The leasing of 31 parking areas located beneath the viaduct section of the Santa Monica Freeway in downtown Los Angeles brought in approximately \$15,000 a month, or \$180,000 a year.

The program of relocation advisory assistance was actively carried on during the year to help families required to vacate state-owned property. Assistance in finding new homes is offered directly to those affected, and the State also works indirectly by coordinating its efforts with the city agencies concerned.

One phase of the program is to disseminate information to community groups and public agencies by speakers. More than 1,100 information letters were sent, and reports were made to cities, redevelopment agencies and other organizations.

#### Landscaping

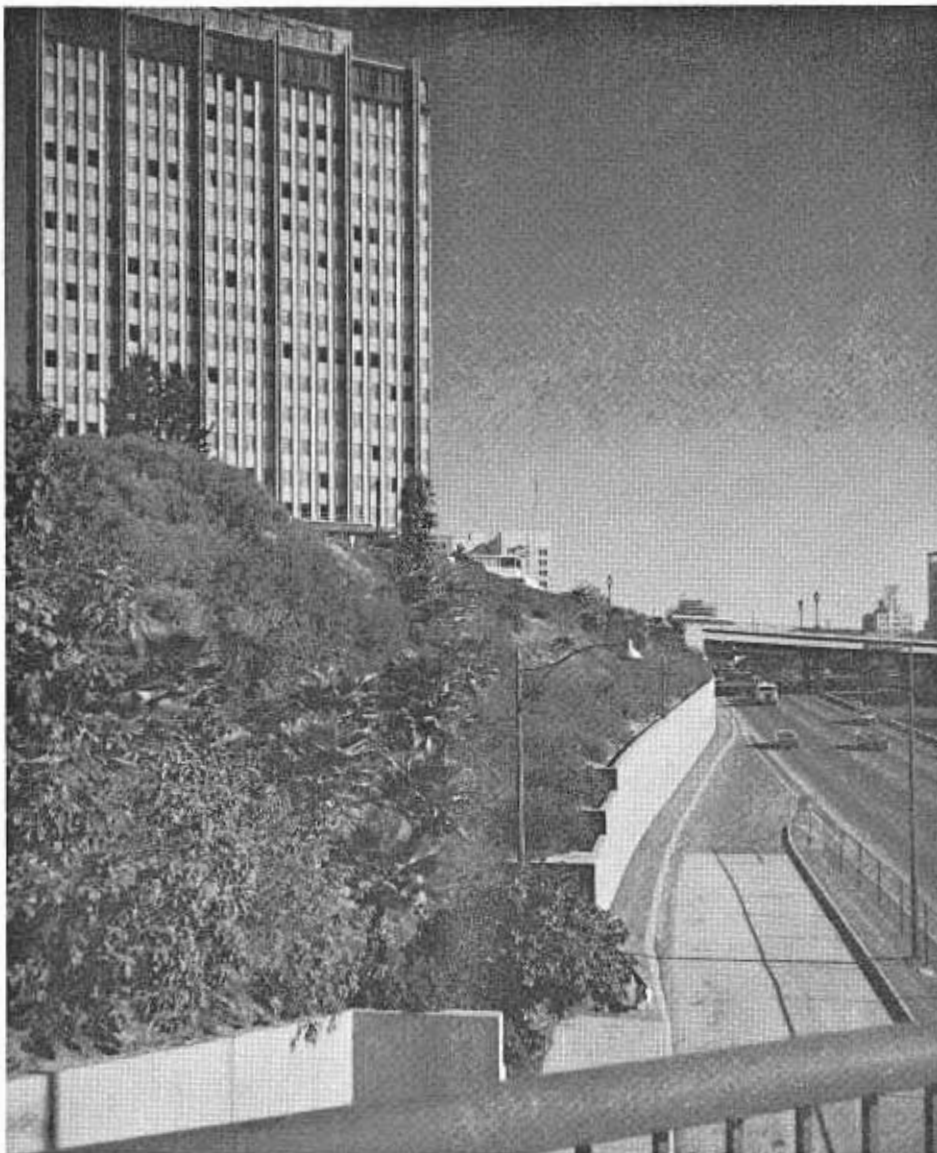
Roadside beautification takes on added significance each year as the freeway network expands. In District VII, 13 contracts were awarded in 1963 for landscaping, functional and tree-planting work, at a cost of \$1,300,000. These projects included 33 miles, or 244 acres of plantings.

One example of the year's activity was the landscaping of the recently completed Ventura Freeway in the City of Ventura. This illustrated the purposes of such development: to make the freeways attractive to motorists, to contribute to the esthetic values of the community, to maintain or enhance the values of adjacent properties, and to prevent erosion of slopes. As a result of the project in Ventura, the drive through the city is considered one of the most scenic in Southern California.

Elsewhere in District VII, the landscaping of the Pasadena-Golden State Freeway interchange was completed; work was started in the Santa Monica-Harbor Freeway interchange; planting in the Hollywood-Ventura Freeway interchange area was completed and extended to the temporary end of the Hollywood Freeway at Magnolia Boulevard. Planting was done in the San Diego-Ventura Freeway interchange area, and there was a seven-mile tree planting project on the Newport Freeway between the Santa Ana and Riverside Freeways.

#### Transportation Study

Along with the planting, design and construction of the California freeway and expressway system, the Division of Highways is coordinating the



Landscaping beautifies the space between business buildings and the right-of-way along the Harbor Freeway in downtown Los Angeles. The view is northward toward the Four-Level Interchange.



Los Angeles Regional Transportation Study. The LARTS project, underway since January 1960, is moving forward with the cooperation of the U.S. Bureau of Public Roads, U.S. Housing and Home Finance Agency, the five counties of Los Angeles, Orange, Ventura, San Bernardino, and Riverside, and 122 cities in these counties.

It was organized along the same lines as other successful state-local studies, with an advisory committee of local officials from public and private agencies. Its purpose is to determine the present and future needs for moving people and goods in the greater Los Angeles area by relating these movements to distribution of land uses, population, employment, and other factors affecting travel. The study has been established as a continuous planning operation utilizing new data and methods in an orderly program of updating.

Steps are now being taken to insure LARTS' compliance with the 1962 Federal Highway Act. To qualify for federal highway funds, each urban area of over 50,000 population must have a continuous comprehensive transportation planning process in operation by July 1965. There are 11 such areas in California, three of them in the LARTS study area.

The first major phase of the study, *LARTS Base Year 1960 Report*, has been completed. An article summarizing these results appears in this issue of *California Highways and Public Works*.

The report contains four chapters and a separately bound appendix. The first chapter, an introduction and summary, includes a brief statement of the problem, the purpose, the study strategy, the results, and the success of the study thus far. The second is a discussion of the organization and financing of the study. The third gives the present and historical background of the LARTS study area, including topography, climate, transportation, and a review of its people and economy from 1770 to 1960. Chapter four describes the methods, reliability, availability, and use of results. The appendix is primarily a technical discussion of methods and results, with



Completion of the Ventura Freeway through the City of Ventura last June relieved traffic congestion on city streets and gave motorists a scenic drive along the shore. This view is southeast along the new freeway, with the Ojai Freeway curving off to the left.



This scenic spot on the Ventura Expressway (Route 101) at the Ventura-Santa Barbara county line, is planned for conversion to full freeway. The planting in the median complements the natural growth in this seaside area.



District VII's first freeway opening of 1964 was a 1.8-mile segment of the San Diego Freeway between the Long Beach Freeway and Atlantic Avenue in Long Beach, on January 15. From Atlantic Avenue (center of photo) the freeway is under construction to the Orange county line, a distance of 5.4 miles, with completion expected in the latter part of this year. Further construction is in progress across Orange County as far as Beach Boulevard in Westminster.

emphasis on the adjustments and modifications required.

The results contained in this report serve to illustrate the methods, demonstrate the relationships between land use and transportation which provide the basis for projecting future traffic, and exemplify the types and extent of detailed information available to the study participants. The next report, due later this year, will contain projections to 1980 of population, employment and land use, and an analysis of the resulting travel patterns.

#### Current Outlook

District VII is working to provide a highway transportation system for Los Angeles, Orange and Ventura Counties to serve a population which is now 7,895,000 and which seems likely to double by 1980. More than 4,400,000 motor vehicles of all types are now in operation, and there will be twice as many in 1980.

While these increases are taking place, the California freeway and express system in the district will be expanded from the present 430 miles, built at a cost of \$1,400,000,000, to

1,570 miles, representing an investment of \$5,200,000,000.

Late in January, 1964, going contracts in the district totaled \$148,000,000, of which about \$132,000,000 was for construction of 58 miles of freeways. It is estimated that about 22 miles of the system will be completed in 1964, of which more than 17 miles will be on interstate routes. The drop in completed mileage from one year to the next does not indicate a smaller program, but merely means that project completion dates may or may not fall within a given year.



The annual highway improvement program, as indicated by the 1964-65 fiscal year budget, is \$173,000,000, of which \$100,000,000 is for construction and \$73,000,000 for acquiring right-of-way. The size of the program is expected to increase in coming years as it progresses toward completion of the interstate system routes by 1972, and completion of the entire California freeway and expressway system by 1980.

#### INTERSTATE FREEWAYS

##### San Gabriel River Freeway (Interstate 605)

Construction work is being pushed on this north-south route which will connect two other interstate routes, the San Bernardino and San Diego Freeways, in southeastern Los Angeles County and a corner of Orange County. Construction is underway for 12 miles from the San Bernardino Freeway in El Monte south to 166th Street in Dairy Valley. There are four going contracts, amounting to more than \$24,000,000, with completion dates falling between mid-1964 and late 1965. One project includes an interchange with the Santa Ana Freeway.

Three more projects, totaling nearly \$23,000,000, will be started later this year, extending construction for another nine miles to the Orange county line, and including an interchange with the future Artesia Freeway.

Within this nine-mile stretch, one first-stage contract, for an overcrossing and approaches at 195th Street and Centralia Road, is due to be finished in May 1964.

The northerly extension of the San Gabriel River Freeway, 5.4 miles in length, between the San Bernardino Freeway and the future Foothill Freeway, is being designed and right-of-way is being acquired. This section, not on the interstate system, is now designated as Route 243. Construction is about four years in the future.

Similarly, the southern extension, from the San Diego Freeway to the Pacific Coast Highway, is noninterstate. It is now designated as route 240. Studies leading to adoption of the route are in a preliminary stage.

When completed, the San Gabriel River Freeway will represent an investment of more than \$128,000,000 for construction and rights-of-way.

##### Foothill Freeway (Interstate 210)

Public hearings will be held by mid-1964 on two segments of this route in the expectation of completing adoption of the entire 53 miles within Los Angeles County this year. The portions under study are a 10.5-mile section in the Sunland-Tujunga, Montrose and La Canada communities between Foothill Place and Hampton Road, and a short piece in Pasadena which will be part of an interchange of the

Pasadena, Foothill, Colorado and Long Beach Freeways.

A two-mile section north of Pasadena between Hampton Road and Montana Street is constructed, and the route has been adopted from the Golden State Freeway east to Foothill Place near Hansen Dam, and from Michillinda Avenue in Arcadia to the San Bernardino Freeway near the county line. These adopted sections, totaling about 40 miles, are being designed. Ultimate cost of the route will exceed \$243,000,000.

A freeway agreement has been signed with the City of Pasadena for the route between Marengo Avenue and the east city boundary near Eaton Wash. A freeway agreement also has been completed with the City of Arcadia for the section between Michillinda Avenue and Fifth Avenue. Acquisition of right-of-way has started in Pasadena, and is well along in the Arcadia area. Construction in this area is expected to start in about five years.

The main line of the Atchison, Topeka and Santa Fe Railroad is to be depressed alongside the freeway between Marengo Avenue and Wilson Avenue, and throughout the section between Eaton Wash and Santa Anita Avenue in Arcadia the railroad will be relocated in the median area of the freeway. This will not be a longitudinal encroachment as the railroad right-of-way will be excluded from the free-



Motorists crossing the Vincent Thomas bridge spanning Los Angeles Harbor have this view of San Pedro as they pass the toll plaza on Terminal Island. This \$21,000,000 structure was dedicated September 28, 1963, and opened to traffic November 15.



The heart of the freeway network in Orange County, the Santa Ana-Garden Grove-Orange Freeway Interchange, will be completed in the latter part of this year. Looking east, the Santa Ana and Garden Grove separation is at top right of photo. The completed section of the Garden Grove Freeway (left center) will be extended westward across Orange County. The Orange Freeway will be constructed in this area later.



This 1.5-mile section of the Garden Grove Freeway in Orange County between Garden Grove Boulevard near Knott Avenue and Newland Street will be completed late in June this year. It now appears to be isolated, but work will soon be in progress to connect this section with the rest of the route. View is eastward. Garden Grove Boulevard at left.

way right-of-way. The tracks will be depressed between Marengo and Wilson Avenues to avoid railroad grade crossings immediately adjacent to ramp connections to city streets. Relocation of the railroad to the median area is to facilitate design of the Rosemead Boulevard interchange. Steps are being taken to move the old Santa Anita railroad station, once used by Lucky Baldwin, to the State and County Arboretum property.

#### **Santa Monica Freeway (Interstate 10)**

All of the uncompleted part of this freeway, about 12 miles between Vermont Avenue in Los Angeles and the western terminus in the City of Santa Monica, is under construction. Work began early this year on the last contract, covering 3.6 miles between Sawtelle Boulevard in West Los Angeles and the Pacific Coast Highway. The four contracts now under way amount to more than \$33,000,000.

The freeway is completed for 4.3 miles eastward from Vermont Avenue to the East Los Angeles Interchange, including an interchange with the Harbor Freeway.

The most extensive construction project now in progress is the interchange with the San Diego Freeway in West Los Angeles, which will be completed early in 1965. It may be possible, however, to open the freeway to traffic from Vermont Avenue west to La Cienega Boulevard in the latter part of this year. Completion of the entire 17-mile route between Los Angeles and Santa Monica, at a cost of about \$202,000,000, is expected late in 1965 or early in 1966.

#### **San Diego Freeway (Interstate 405)**

This important Interstate route extends for 93.6 miles in District VII from the Golden State Freeway north of San Fernando to the San Diego county line at San Clemente. It is completed for about 43 miles from its northern terminus to Atlantic Avenue, east of the Long Beach Freeway, and is under construction southeastward to Beach Boulevard in Westminster.

Construction will start soon on a first-stage embankment contract for portions of the route between Beach Boulevard and Harbor Boulevard in Costa Mesa. Construction on the 17.5-mile stretch from Beach Boulevard to



the Santa Ana Freeway will be accomplished in four projects, expected to start progressively during the next four fiscal years.

The freeway is completed southward from its junction with the Santa Ana Freeway near Irvine to the county line. This 22-mile stretch will be widened to eight lanes, starting in the next two or three years. When completed, this freeway will represent an investment of approximately \$372,000,000.

#### **Santa Ana Freeway (Interstate 5)**

Continuing a program that has been in progress for several years, this freeway is being widened for a distance of about 10 miles, between Main Street in Santa Ana and Laguna Canyon Road. This work, being done in two contracts, will be completed in the late spring of this year. The widening will be continued in coming years to the junction of the San Diego Freeway near Irvine.

Work on the Santa Ana-Garden Grove-Orange Freeway interchange, heart of the freeway network in Orange County, is scheduled to be finished in September at a cost of almost \$11,000,000. The principal contract covers 1.5 miles on the Santa Ana Freeway between the Santa Ana River and Main Street, and about one mile on the Garden Grove Freeway from Bristol Street to Main Street. This \$7,201,100 job started in August 1962. The interchange complex includes 16 bridge structures. There is a separation for the Santa Ana and Orange Freeways, another for the Santa Ana and Garden Grove Freeways, and a third at Main Street and the Garden Grove Freeway. The Orange Freeway is expected to be constructed in this area by 1970.

Another contract in the interchange area, including 0.8 mile of the Garden Grove Freeway, four bridges and widening of the existing Santa Ana River bridge, was completed in mid-1963 at a contract cost of \$3,620,000.

#### **Golden State Freeway (Interstate 5)**

This Interstate route was completed through the San Fernando Valley when the 6.2-mile link from Osborne Street in Pacoima to the junction with the San Diego Freeway north of San Fernando was opened to traffic last



*The Yorba Linda Freeway, opened in February 1963, serves a rural area in northern Orange County where new homes are being built among citrus orchards and small farms. This 2.3-mile section of freeway extends from Orangethorpe Avenue, lower left, to the Yorba Linda community, top center. Orangethorpe is only one mile from the east-west Riverside Freeway.*

November 8. The route is now in operation as a freeway for 27.7 miles from the East Los Angeles Interchange to the San Diego Freeway, and continues as an expressway north to the Kern county line. Total distance in this district is 73 miles.

Conversion of the expressway mileage to full freeway standards is in progress. Work started last June on a \$5,646,609 project covering 3.7 miles in the Castaic area. The job also includes 0.8 mile of the Route 126 Freeway and an interchange, to be finished in early 1965. This project is the first of 14 planned to convert the Golden State to an eight-lane freeway.

A contract for widening a 1.3-mile segment of the freeway in Burbank and Glendale from six lanes to eight lanes started early this year.

#### **San Bernardino Freeway (Interstate 10)**

This major east-west route extends from the Golden State Freeway near the East Los Angeles Interchange across Los Angeles County to the San Bernardino county line. The mileage in this district is 30 miles, on which more than \$63,000,000 has been expended.

The route, which has been in service for a number of years, has been widened for a considerable distance as traffic increased, and other such projects are planned. The 1964-65 fiscal year budget includes \$660,000 for reconstruction of part of the Vincent Avenue interchange in West Covina.

#### **NON-INTERSTATE FREEWAYS**

##### **Antelope Valley Freeway (Route 14)**

The first section of this freeway, which will bring the high desert country of northern Los Angeles County closer to the metropolitan area, was opened to traffic last October. This 14.4-mile segment, between Solemint and Red Rover Mine Road, was completed in two contracts totaling \$14,786,000.

Work is in progress on another 7.9 miles which will extend the freeway northward to a junction with the Angeles Forest Highway near Vincent. This \$4,978,887 contract also includes widening the existing Sierra Highway to four lanes for about 0.7 mile between the Angeles Forest Highway and the Pearblossom Highway. This job is due for completion



These massive columns will support a structure of the interchange between the Santa Ana and San Gabriel River Freeways, now under construction in the Santa Fe Springs area.

in the spring of 1965. The next step, for which \$5,100,000 is budgeted, will be to construct the freeway to Avenue P-8 in Palmdale.

(For details on this freeway see article in *California Highways and Public Works*, January-February, 1964.)

#### Artesia-Riverside Freeway (Route 91)

The westerly portion of this route, sometimes called the Artesia Freeway, extends 21.6 miles between the Santa Ana and San Diego Freeways. It is constructed as a four-lane and six-lane expressway for 4.8 miles between Normandie Avenue and Alameda Street. This is to be converted to a freeway in six or seven years. From Normandie Avenue to the San Diego

Freeway the route has not been adopted.

From Alameda Street east to the Santa Ana Freeway the freeway is being designed in five sections, and construction is expected to start in the 1965-66 fiscal year and be completed by 1970. It is planned as a six-lane and eight-lane facility.

The Riverside Freeway extends 19 miles from the Santa Ana Freeway to the Riverside county line, and beyond, in another district, to the City of Riverside. From the Santa Ana Freeway to Harbor Boulevard, a distance of 5.7 miles, the route is full freeway; the remaining mileage in this district is expressway, which will be converted to freeway.

By the middle of this year a \$1,400,000 project will be started to construct an interchange at Dowling Avenue in Anaheim. At this location the four-lane expressway will be converted to six-lane freeway.

Early in 1965 it is proposed to widen the expressway to six lanes between Lemon Street and Placentia, and to convert to six lane freeway from Placentia to Newport Freeway, all included in a \$5,100,000 project covering 5.8 miles. Some time after 1970 the full freeway will be extended all the way to Riverside County.

#### Route 134 Freeway

This route has been known unofficially as the Colorado Freeway.

Design of the portion which will form an eastward extension of the Ventura Freeway from the Golden State Freeway through Eagle Rock to the future Foothill Freeway in Pasadena, is well underway.

First work, expected to start late this year, will be construction of a bridge at Jackson Street in Glendale, preparatory to extending Monterey Road a short distance westward. A project including an interchange with the Golden State Freeway and bridges across the Los Angeles River for a connection to San Fernando Road is expected to be budgeted the following year. The next project probably will extend the freeway east of San Fernando Road to the vicinity of Glendale Avenue. Most of the right-of-way for these three projects has been acquired.

In the Glendale area this freeway will interchange with the north-south Glendale Freeway. The section between the Glendale Freeway and Avenue 64 is generally on a side hill overlooking the Eagle Rock district. Design is proceeding on the basis of split-level roadways and the use of bin-type retaining walls to avoid unsightly cuts.

The section between Avenue 64 and Orange Grove Avenue, built some years ago as a four-lane facility, will be reconstructed to eight lanes. Consideration also will be given to widening the existing Pioneer Bridge over the Arroyo Seco in Pasadena without interfering with the old Colorado Street Bridge.



(A report on the effect of this proposed freeway on land values and real estate activity in Glendale appears elsewhere in this issue.)

#### **Garden Grove Freeway (Route 22)**

This freeway is being built as an east-west route to connect the Pacific Coast Highway in Los Angeles County with the Santa Ana and Newport Freeways in Orange County, a distance of about 15 miles. A short section of about 0.8 mile in the vicinity of the Santa Ana Freeway was completed last August.

Construction is underway for 1.5 miles between Garden Grove Boulevard near Knott Avenue and Newland Street, to be completed in mid-1964 at a cost of \$3,744,806. Work will start early this year on a one-mile section from Haster Street to Manchester Avenue, and by the middle of the year it is expected that three more contracts will be in progress, covering a distance of 4.7 miles from Haster Street to Newland Street.

It is anticipated that funds to complete the freeway to its eastern terminus at the Newport Freeway will be provided in the 1965-66 budget. Construction of the westernmost two miles between the Pacific Coast Highway and the San Diego Freeway probably will start after 1970.

#### **Glendale Freeway (Route 2)**

The Glendale Freeway, a part of the new Route 2, will extend for a distance of 12.2 miles from the Hollywood Freeway through the Silver Lake District of Los Angeles and through the City of Glendale to a connection with the proposed Foothill Freeway (Interstate 210).

The existing six-lane 2.4-mile section between the Los Angeles River and Avenue 36 will be widened to eight lanes at an estimated cost of \$1,500,000.

Design work is in progress on two portions of the route totaling 9.1 miles. The section from the Hollywood Freeway to Glendale Boulevard will include an interchange with the Hollywood Freeway near Vermont Avenue. The other section extends from Avenue 36 to Foothill Boulevard.



Looking south along the San Gabriel River Freeway under construction. Rose Hills Road crossing is in center, and Whittier Narrows Dam is at the left.



Interchange begins to take shape at Valley Boulevard as the San Gabriel River Freeway construction is being pushed in southeastern Los Angeles County.

Freeway agreements have been executed with the City of Glendale for a portion of an interchange between the Glendale and Colorado Freeways. Other necessary agreements are expected to be executed by mid-1964.

#### **Harbor Freeway (Route 11)**

This freeway, which connects downtown Los Angeles with the harbor district, was completed in 1962 from the Four-Level Structure to San Pedro, a distance of 22 miles, at a cost of \$104,600,000.

Design of a project to widen a four-lane section between Battery Street and Pacific Coast Highway to six lanes is nearing completion.

An interchange between this freeway and the Long Beach Freeway to the west of the recently completed Vincent Thomas Bridge is being designed.

#### **Hollywood Freeway (Route 101-170)**

The Hollywood Freeway, completed from Spring Street in downtown Los Angeles to Magnolia Boulevard in North Hollywood, will be under construction in 1964 toward its junction with the Golden State Freeway in Pacoima. First work to start will be construction of embankment from Laurel Canyon Boulevard to the northern terminus, a cooperative project in which the Los Angeles City Department of Water and Power will supply 1,250,000 cubic yards of earth from its Tujunga Spreading Grounds.

The next step, to be started later in the year, will be the construction of the 2.5-mile freeway section between Magnolia Boulevard and Victory Boulevard. A later contract will cover the construction from Victory Boulevard to the Golden State Freeway.

Preparations are being made to widen the Hollywood Freeway from six lanes to eight lanes in the Hollywood area, from Sunset Boulevard to the Pilgrimage Bridge. The first project will be to add one outbound lane in the two-mile section from Franklin Avenue to the Pilgrimage Bridge, for which \$800,000 is budgeted.

#### **Huntington Beach Freeway (Route 39)**

Route location studies were started in 1958 on this north-south route which is planned to connect the Pacific Coast Highway and the Foothill

Freeway in the general vicinity of the existing Beach Boulevard. A public hearing is expected to be held in the latter part of 1964 on the portion of the route between the Pacific Coast Highway and the Garden Grove Freeway. Studies on the northern part of the route will be presented at a later public hearing.

#### **Long Beach Freeway (Route 7)**

The Long Beach Freeway, in operation for several years between the City of Long Beach and the San Bernardino Freeway, will be extended north to the Foothill Freeway in Pasadena, and southwest to the Harbor Freeway in San Pedro. The section between Long Beach and San Pedro, including the completed Terminal Island Bridge, formerly was referred to as the Seaside Freeway.

Construction started late in 1963 on a one-mile extension of the freeway north from the San Bernardino Freeway to Valley Boulevard. The route has been adopted for another 1.1 miles to Huntington Drive, and is under study north to Foothill Boulevard. This latter section, on which a public hearing will be held this spring, will include an interchange of the Long Beach, Pasadena, Colorado and Foothill Freeways in the Pasadena area. Construction of this interchange will be a major step in linking the freeways of the district into a smoothly operating system, and will provide many new alternate routes of travel.

Meanwhile there are plans to start next year on the job of widening the freeway from six to eight lanes for a distance of 13.4 miles between the Santa Ana and San Diego Freeways, at an estimated cost of \$4,500,000.

#### **Marina-Slauson Freeway (Route 90)**

The new Route 90 Freeway will combine the old Marina Freeway which was a part of former Route 60, and the Slauson Freeway, former Route 221. Route 90 is planned to extend for a distance of 22.2 miles between the Pacific Coast Freeway, and the San Gabriel River Freeway. The westernmost 2.6 miles, between Lincoln Boulevard and the San Diego Freeway, has been adopted, design work is in progress, and right-of-way has been acquired. Funds are budgeted

for construction of part of an interchange with the San Diego Freeway. The exact western terminus of the route depends on the location ultimately selected for the Pacific Coast Freeway in the area.

Location studies are in progress on the eastern part of the route between the San Diego and San Gabriel River Freeways.

#### **Newport Freeway (Route 55)**

This north-south route in Orange County is completed from the Riverside Freeway to the Santa Ana Freeway, a distance of 6.6 miles, and is under construction south for another two miles to Warner Avenue. This section is due for completion late in 1964, and construction is expected to start early in 1965 on a 3.9-mile project from Warner Avenue to Bristol Street-Palisades Road. When completed, this freeway will be 17.7 miles in length, extending southward to the Pacific Coast Freeway, and carrying traffic on four lanes, with provision for widening to six lanes.

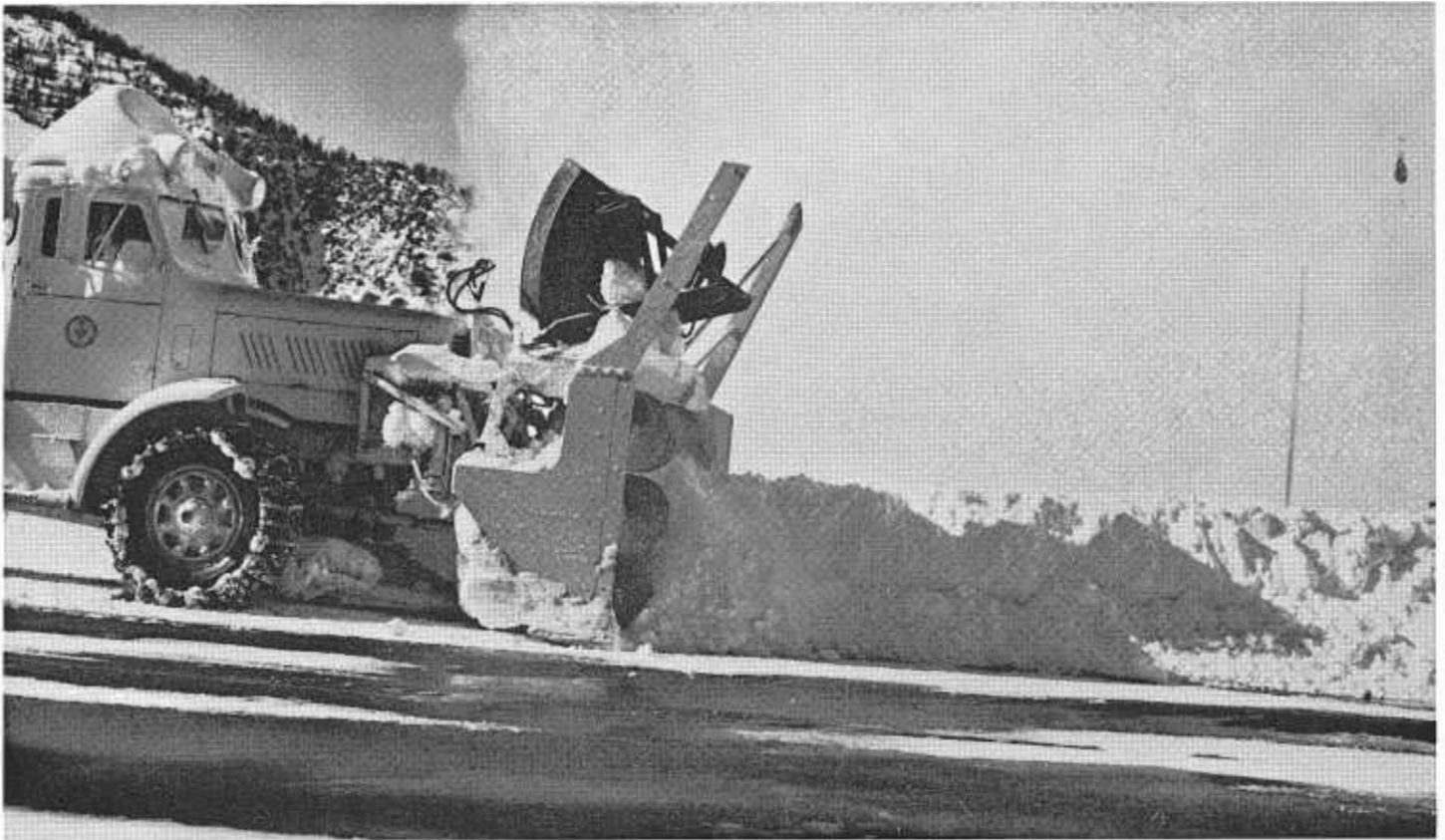
#### **Ojai Freeway (Route 33)**

This freeway is completed for four miles north of Ventura to Mills School. An interchange with the Ventura Freeway was opened in June 1963. The route is adopted for 11 miles from Mills School to Cozy Dell Canyon, northwest of Ojai, and this section is being designed. Location of the remainder of the route in this district, extending to the Santa Barbara county line, has not been adopted.

#### **Orange Freeway (Route 57)**

This proposed north-south route will be important to eastern Los Angeles and Orange counties. It will extend south from the Pomona Freeway crossing the proposed Yorba Linda Freeway and the existing Riverside Freeway, passing through the Santa Ana-Garden Grove interchange, and continuing south to the Pacific Coast Highway. The route has been adopted for a distance of about 20 miles between the Pomona and Santa Ana Freeways. The route between the Santa Ana and Pomona Freeways is being designed in six sections, with construction several years in the future.





*Division of Highways snow removal equipment keeps mountain roads open during the winter months as thousands of snow sports enthusiasts drive to recreation areas in Los Angeles County. One of the popular routes is the Angeles Crest Highway, pictured here as it was last December.*

#### **Pacific Coast Freeway (Route 1)**

This is the longest freeway planned in District VII; it will extend about 113 miles from the Ventura Freeway north of Oxnard to Serra Junction at Capistrano Beach, in Orange County. The only portions constructed to date are a 6.8-mile section south of Oxnard and a connection between the Pacific Coast Highway and the San Diego Freeway in Capistrano Beach. Adopted portions of the route total 31 miles.

Briefly, the status of the route, from north to south in the district, is as follows:

**El Rio to Oxnard:** location of the route is being considered in connection with the Oxnard Bypass, on which two public hearings have been held.

**Oxnard to Calleguas Creek,** 6.8 miles constructed in 1957.

Conversion of the existing three-lane Pacific Coast Highway to freeway standards in the vicinity of Point Mugu Naval Station is planned for the future.

**Calleguas Creek to Malibu Canyon Road:** California Highway Commis-

sion hearing on adoption of route, about 22 miles, was held in Santa Monica February 25, 1964, and two district hearings were held in 1961.

Malibu Canyon Road to terminus of the Santa Monica Freeway in the City of Santa Monica: In addition to conventional inland locations, route location studies on this 13-mile section are considering the possibility of locating all or part of the freeway on a causeway offshore in the ocean; an alignment along the existing shoreline on a widened beach; or various combinations of causeway and shoreline locations.

In 1961 the U.S. Army Corps of Engineers was engaged by the Division of Highways to study the feasibility of the marine locations. A report of this study, received in November 1963, is being reviewed by the division and by other interested state agencies. This report covers only the marine phase of the project. Conventional land locations are being studied by the division.

The Corps of Engineers investigated nine alternate offshore and onshore

freeway alignments involving earth fills and embankments, beach widening and structures. Initial costs were estimated at from \$121,000,000 to \$408,000,000. The report concluded that:

1. It is engineeringly feasible to construct the proposed freeway on a marine alignment.

2. A joint highway-recreational facility extending from Santa Monica to Malibu would enhance the recreational potential of the area.

3. Maintenance and sand bypassing operations in connection with each of the plans considered are feasible.

4. It is not expected that building any of the considered projects would pose insurmountable problems to the construction industry.

From Santa Monica south to the end of the route, location studies are being made except in the following areas: 10 miles in Orange County (Huntington Beach-Newport Beach) already adopted; 14 miles between El Segundo and the Harbor Freeway in Wilmington; and about 3 miles between the Marina del Rey and Olym-

pic Boulevard on the Santa Monica Freeway.

The Division of Highways is carrying on a program of improvements to existing Pacific Coast Highway facilities in Orange County to provide better traffic facilities in the interim before the freeway is built. The general objective is to provide a four-lane divided highway with median wide enough for left-turn pocket lanes, wider shoulders, improvements to the signal system. Some of these projects are financed in part by the cities concerned.

#### **Pomona Freeway (Route 60)**

Construction started late in 1963 on the Pomona Freeway, an eight-lane east-west facility that will link Los Angeles and Pomona by 1970. As U.S. 60 it will extend eastward beyond District VII to Riverside to connect with routes going north, south and east. At the Los Angeles end it ties into the Santa Monica, Santa Ana and Golden State Freeways. Ultimate cost of the 30-mile freeway is estimated at \$93,000,000.

The first segment, to be completed in about two years at a cost of more than \$8,000,000, will take the freeway 2.2 miles east from the East Los Angeles Interchange to Third Street near Downey Avenue. Excess embankment material from this project is being placed along the route between Findlay and Markland Avenues in the Montebello-Monterey Park areas.

Another project started recently will extend freeway construction to Woods Avenue, including a four-level interchange with the Long Beach Freeway. Widening of the Long Beach Freeway between Third Street and Olympic Boulevard also is part of this \$10,000,000 project.

The Pomona Freeway is budgeted for the four-mile section from Arroyo Drive in the South San Gabriel area to the San Gabriel River Freeway, and is expected to be opened to that point late in 1966. Substantial traffic relief to the San Bernardino Freeway and parts of the Santa Ana Freeway is anticipated.

Embankment work is in progress in the vicinity of the Atlantic Boulevard interchange, using excess material

from the Long Beach Freeway construction project.

Design work is progressing for the easterly portion of the Pomona Freeway through Puente Hills, Hacienda Heights, Puente and Diamond Bar Ranch to the San Bernardino county line near Riverside Drive. The easterly portion of the route will include interchanges with the future Huntington Beach, Orange and Corona Freeways.

#### **Route 126 Freeway**

This 51-mile freeway is planned to connect the Ventura Freeway at Ventura and the Antelope Valley Freeway near Solemint, via the Santa Clara River Valley. The first five-mile section, from Ventura to Saticoy, was opened to traffic in April 1963, and another 8.5 miles extending northeastward through the City of Santa Paula is under construction and will be completed in mid-1965.

A public hearing was held in Fillmore January 15 on the location of 22 miles of this freeway between Santa Paula and the Los Angeles county line. From there to the Antelope Valley Freeway the route has been adopted. An interchange with the Golden State (Interstate 5) Freeway is under construction in the Castaic area as part of a freeway conversion project.

#### **Simi Valley Freeway (Route 118)**

First construction on this east-west route, to serve the rapidly growing Simi Valley, is planned for the 1965-66 fiscal year. A five-mile section between Kuehner Drive in the eastern end of the valley and Santa Susana Avenue in the west San Fernando Valley, including the Santa Susana Pass, will be the first project started. An estimated \$12,000,000 will be required to finance the work.

The adjoining three-mile segment between Kuehner Drive and Tapo Street is tentatively scheduled for construction starting in the 1966-67 fiscal year. The two projects are timed for completion at the same time, thus providing traffic service to the community of Santa Susana at the earliest possible date. Completion of the route five miles farther west to Madera Road is anticipated by 1970, at which time the entire Simi Valley will be served by this freeway.

Location of the route between De Soto Avenue and the route of the future Foothill Freeway in the vicinity of Hansen Dam, about 11 miles, was the subject of a public hearing January 9. A hearing is planned early this year on location of the westernmost part of the route, from Madera Road to the Route 126 Freeway near Saticoy, about 16 or 17 miles.

It is estimated that total outlay for construction and right-of-way on this 47-mile freeway will amount to approximately \$132,000,000 by 1980.

Pending construction of the freeway, a number of intersections on Los Angeles Avenue, the existing facility, are being improved to help relieve traffic congestion in the valley. First of these projects was completed last May at Tapo Street in Santa Susana, where the intersection was widened to four lanes, left turn lanes provided, and traffic signals installed. A similar improvement, with signals, is planned for Sycamore Drive. Improvements without signals will be made at five other intersections.

#### **Ventura Freeway (Route 101)**

The most important event of the year on this freeway was the opening of a 2.7-mile section which completed the route through the City of Ventura. This project, and an adjoining section opened a year earlier, eliminated a traffic bottleneck of long standing by taking through traffic off several miles of city streets. Traffic on Thompson Boulevard decreased 50 percent after the freeway opened.

The latest construction included an interchange with the Ojai Freeway and a short section of that route to connect with previously completed mileage.

North of Ventura a 10-mile section of four-lane highway and expressway extending to the Santa Barbara county line is under design as freeway.

Progress continued during the year in converting expressway portions of this route to freeway. Within the next few years the entire 75 miles from Glendale to Ventura will be freeway. The most recently completed project was the Chesebro Road interchange, costing \$530,000.

Seven projects for the construction of interchanges, overcrossings, front-



age roads and other elements required for conversion of the expressway are underway or planned to start in the first half of this year. Several others are in the design stage.

The last large freeway conversion project, extending for 3.6 miles between Vineyard Avenue in El Rio and the completed freeway section near Telephone Road in Montalvo, is financed and will start early in 1965. The work, to cost approximately \$7,500,000 will require two years to complete. It will include three interchanges, an overhead crossing of railroad tracks, an additional bridge across the Santa Clara River, paralleling the existing structure, and five other bridges.

#### Yorba Linda Freeway (Route 42)

The first part of this freeway, 2.3 miles between Orangethorpe Avenue and Yorba Linda Boulevard, was completed in February 1963. One mile of expressway connects the south end of the section to the Riverside Freeway. Ultimately the Yorba Linda Freeway will extend northwestward across Orange County, then west across the proposed Huntington Beach Freeway to a junction with the Santa Ana Freeway in the Norwalk area, a distance of about 20 miles.

## Robert M. Haynie Appointed to CTBA

Governor Edmund G. Brown appointed Robert M. Haynie, 49, San Francisco building contractor, to the California Toll Bridge Authority on March 16, 1964.

He succeeds James F. Thacher, who resigned to accept appointment to the Trustees of the California State Colleges.

Haynie, a native of Virginia, attended Randolph-Macon Military Academy there. He was graduated from Tulane University in New Orleans with an LL.B. degree and was admitted to the Louisiana State Bar.

He is a partner in the corporation of Haas and Haynie in San Francisco.

He is a former member of the board of directors of the San Francisco Chamber of Commerce, is a director of Columbia Park Boys Club, and a member of the board of governors of Bay Area Council.

## San Diego Will Host June WASHO Meeting

Highway leaders from Texas to Alaska and Hawaii will gather in San Diego in mid-June for the 43d annual conference of the Western Association of State Highway Officials.

The conference, which will take place at the El Cortez Hotel from June 15 through June 18, will bring together highway commissioners, administrators, staff engineers, legal and right-of-way experts from the 14 states whose highway departments and federal bureaus comprise the association, along with automobile club leaders and representatives of the highway construction industry.

The western states' progress in constructing their share of the national system of interstate highways is expected to be a major topic of discussion, along with the outlook for highway improvement after 1972, when the current federal aid program is scheduled to reach completion.

Association President Forrest Cooper, State Highway Engineer of Oregon, will convene the opening session at 2 p.m. on Monday the 15th.

Among the principal speakers scheduled to appear at the general sessions are:

U.S. Undersecretary of Commerce Clarence D. Martin, Jr.; Federal Highway Administrator Rex M. Whitton; Executive Director D. Grant Mickle of the Highway Research Board; California State Senator Randolph Collier; J. Burch McMorran, Superintendent, New York State Department of Public Works, and President of the American Association of State Highway Officials; and Executive Secretary A. E. Johnson of AASHO.

Following the general sessions Monday afternoon and Tuesday morning there will be a series of committee sessions through Thursday morning. Committee activity will be in the fields of construction, maintenance, design, administration, forest roads and legal and right-of-way.

Principal WASHO officers in addition to Cooper are: vice president, John C. Myatt, Chief Engineer, Hawaii Division of Highways; and secretary-treasurer, C. Taylor Burton,

## Kofman Renamed to Highway Commission

Governor Edmund G. Brown has reappointed Abraham Kofman, publisher of Alameda *Times-Star* and San Leandro *Morning News* to the California Highway Commission for a four-year term.



ABRAHAM KOFMAN

Kofman was first appointed by Governor Brown in 1961. A native of Brockton, Massachusetts, he has been in the newspaper business since he was 16. He is a member and former director of the California Newspaper Publishers Association and belongs to the Masons, the Shrine, Elks and Eagles. He is past president of the Jewish Welfare Federation of Alameda and Contra Costa Counties and of the Oakland Lodge of B'nai B'rith.

He acquired the Alameda *Times-Star* in 1939 and founded the San Leandro *Morning News* in 1950.

He and his wife, Sara, have three sons. The family home is at 1940 Franciscan Way, Alameda.

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Director of Highways, Utah State Department of Highways.

J. C. Womack, California State Highway Engineer and a past president of WASHO, is chairman of the host state committee arranging the conference. California last hosted the WASHO Conference in 1951, in San Francisco.



Chairman Alfred J. Stern of the State Park Commission addresses the joint commissions and the audience; at his right is Robert B. Bradford, Administrator of the State Highway Transportation Agency; At Mr. Stern's left is Charles DeTurk, Director of Parks and Recreation, and beside him is John Elsbach of the Park Commission. In the upper row, left to right, is Roger S. Woolley, Highway Commission; Margaret Owings, Park Commission; John Erreca, Director of Public Works; Sterling Cramer, Park Commission, and Karl Wray, Vice Chairman, Park Commission.

Staff members followed meeting intently. Shown here, foreground to background, are J. C. Womack, State Highway Engineer; John A. Legarra, Deputy State Highway Engineer; James Warren, Deputy Chief, Parks; Edward F. Dolder, Director of the Division of Beaches and Parks; Earl Hanson, Deputy Chief, Parks; Carl Anderson, park ranger V, Eureka.

# JOINT MEETING

The California Highway Commission and the California State Park Commission met in joint session on January 24, 1964, for the purpose of discussing problems of highway location in and near California state parks. Many members of the staffs of both divisions also attended, as did an audience of about 100 interested citizens.

Below: Another view of joint commissions at meeting. Mr. Womack of Highways in foreground, and at extreme right, (not visible above) is Franklin Payne, Highway Commissioner.

Below: Audience included Joseph Pollard of Los Angeles County; Newton B. Drury, ex-Chief of the Division of Beaches and Parks; Charles L. Howard of Oakland; and State Senator John C. Begovich of Jackson.





In his opening speech, Park Commission Chairman Alfred J. Stern, who presided, said the Park Commission in the past year had adopted a policy resolution which in part says: "Land acquired for the use and enjoyment of the people is preserved for this and future generations as state parks, scenic and scientific reserves, historic units, recreation areas and state beaches. These lands shall be firmly held against the pressures of expediency, that is, for use for highways, school sites, parking lots, public buildings, utilities, or other nonconforming uses. . . ."

On behalf of the Highway Commission, of which he is chairman, Transportation Agency Administrator Robert B. Bradford said: "We have the objective of locating routes and spending highway money in the greatest public interest as we see it . . . We never adopt a route . . . without talking to the public and holding hearings and inviting comments. . . ."

"So far as parks are concerned, . . . our objective has been and will continue to be to avoid parks altogether at all levels of government if we can do it—state parks, county parks, regional parks, city parks—and if we can't avoid a park altogether, our objective has been and will continue to be to minimize any damage. . . ."

An important result of the meeting was the appointment of a permanent committee of two members of each commission for better liaison in the future between the commissions. Bradford appointed Highway Commission members Whitehurst and Woolley; Stern appointed Park Commission members Owings and Fleharty (latter not present).



*Clockwise from center right: Harry Freeman, Deputy Director, Public Works; Carl Anderson, Beaches and Parks, and Fred Meyer, State Parks Forester; James Warren, Beaches and Parks; Dr. Ralph Chaney, University of California, professor emeritus, discoverer of "dawn redwood" in China.*



*Below: Overall view. Highway Commissioner William S. Whitehurst (upper row right) has joined meeting. Men in foreground are members of press. Above, right: Commissioner Elsach answers question by pointing to Division of Beaches and Parks exhibits on wall.*



# LARTS Program

Phase One Completed On  
9,000-square-mile Area

By J. W. SHAVER, Assistant District Engineer—Advance Planning



The greater Los Angeles area extends over some 9,000 square miles, encompassing three counties, a portion of two others, and 122 cities. Within this area live well over 7½ million

people, whose collective transportation needs, both now and in the future, establish the pattern from which planners develop tomorrow's transportation facilities.

To determine what that pattern is—and why—is the mammoth undertaking of the Los Angeles Regional Transportation study, one of the largest cooperative efforts of its kind between federal, state, county, and city governments ever attempted. Under the general coordination of the Division of Highways, the study has been in progress since January, 1960, with the Bureau of Public Roads, the Housing and Home Finance Agency, the State Office of Planning, the Counties of Los Angeles, Orange, Ventura, San Bernardino, and Riverside, and the 122 cities within the area participating. The study will furnish valuable information about what the area's traffic needs will be in 1965, 1970, 1975, and years beyond. From these data, transportation planners on all levels of government will be able to develop transportation facilities to meet these needs and to integrate their plans with those of the other jurisdictions.

## First Phase

Phase one of the LARTS program—a detailed examination of the area as it existed in 1960—has just been completed. In the process of analyzing 1960, the LARTS staff also undertook the basic job of developing and testing methods through which future vehicular movement can be predicted.

Through postcard questionnaires and interviews with the area's motor-



Visual renderings of LARTS data help transportation planners survey a situation at a glance. Looking over some LARTS maps here are District VII personnel (left to right) R. E. Deffenbach, District Engineer—Planning; Metropolitan District Engineer E. T. Telford, who is LARTS Study Director; John W. Shaver, Assistant District Engineer—Advance Planning; Gibson Fairman, District Planning Engineer—LARTS.

ists at home, in the office, and on the roadside, the LARTS staff compiled information concerning present movement of people and goods in terms of origins, destinations, frequency, and lengths of vehicle trips. (This data-gathering process is described in a previous article on LARTS, *California Highways and Public Works*, January-February 1961.) To this were added socioeconomic details, including housing types, number of vehicles owned, and family income. Next came an inventory of residential, industrial, agricultural and other land uses throughout the area. Finally, the location and length of each segment of the freeway, highway, and major street network were determined, as well as the travel speed on each.

These raw data, when coded for electronic processing, filled 600,000

punchcards. If placed end to end, these cards would stretch 70 miles, or, if stacked, would reach the approximate height of a 35-story building.

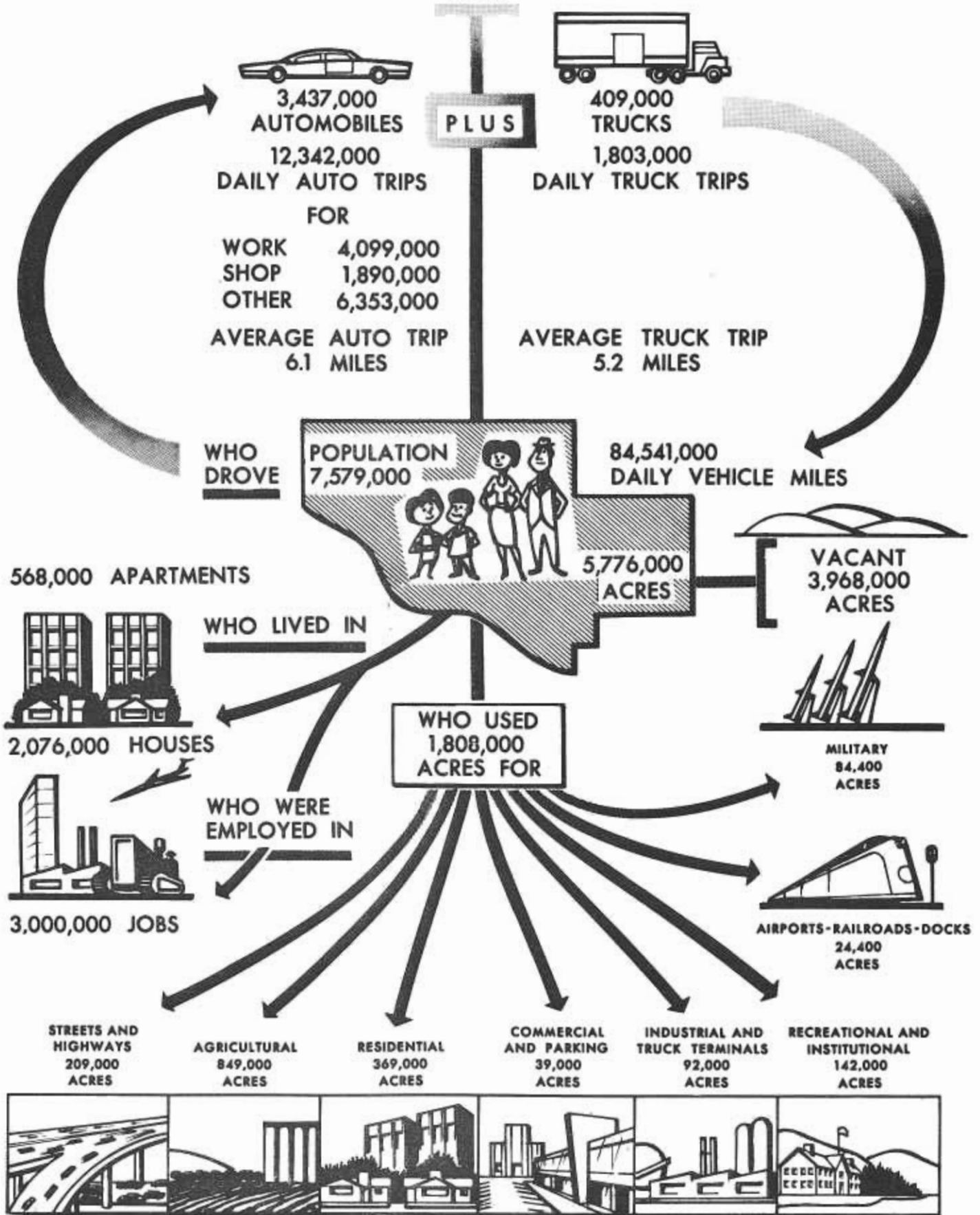
## Formulas Produced

From the analysis of this vast storehouse of facts, mathematical relationships between movements of people and land use were developed, and these formulas, collectively, are known as the "transportation model."

The transportation model is by no means a simple assemblage of traffic counts and origin and destination studies that show where people are going and in what volumes at what times. Rather it also scrutinizes the socioeconomic factors which induce people to travel and which influence the number, length, and purpose of their trips.



# FACTS ABOUT LARTS STUDY AREA 1960



An apartment house, for instance, generally produces fewer auto trips per day per unit than a single-family residence, the study shows. Areas housing lower income families generally produce fewer auto trips per household than areas of higher family income. As might be expected, the number of automobiles owned per family has the greatest influence on the number of auto trips made. Among other findings regarding length and purpose, it was found that the average shopping trip was considerably shorter than the journey to work. These and many other conclusions which were known or at least suspected qualitatively before have now been measured and quantified—and, more important, have been interrelated in a manner which is useful in predicting future traffic.

#### Auto Trips Analyzed

The LARTS transportation model analyzes automobile trips by five general types: home-work, home-shop-

ping, home-other, work-other, and other-other. The three home-based types of trips account for 67.2 percent of all auto trips. The home-work trip, of course, accounts for most of the peak hour traffic. The "other" category includes trips which begin and/or end some place other than home, such as trips taken for business, recreational, medical, educational, or social reasons. Of all auto trips, LARTS discovered, 30.3 percent are of the home-other type, 21.7 percent of the home-work type, 21.5 percent of the other-other type, 15.2 percent of the home-shopping type, and 11.3 percent of the work-other type. Detailed information about the length, number and direction of these trips can be of value not only to transportation planners, but to other planners as well.

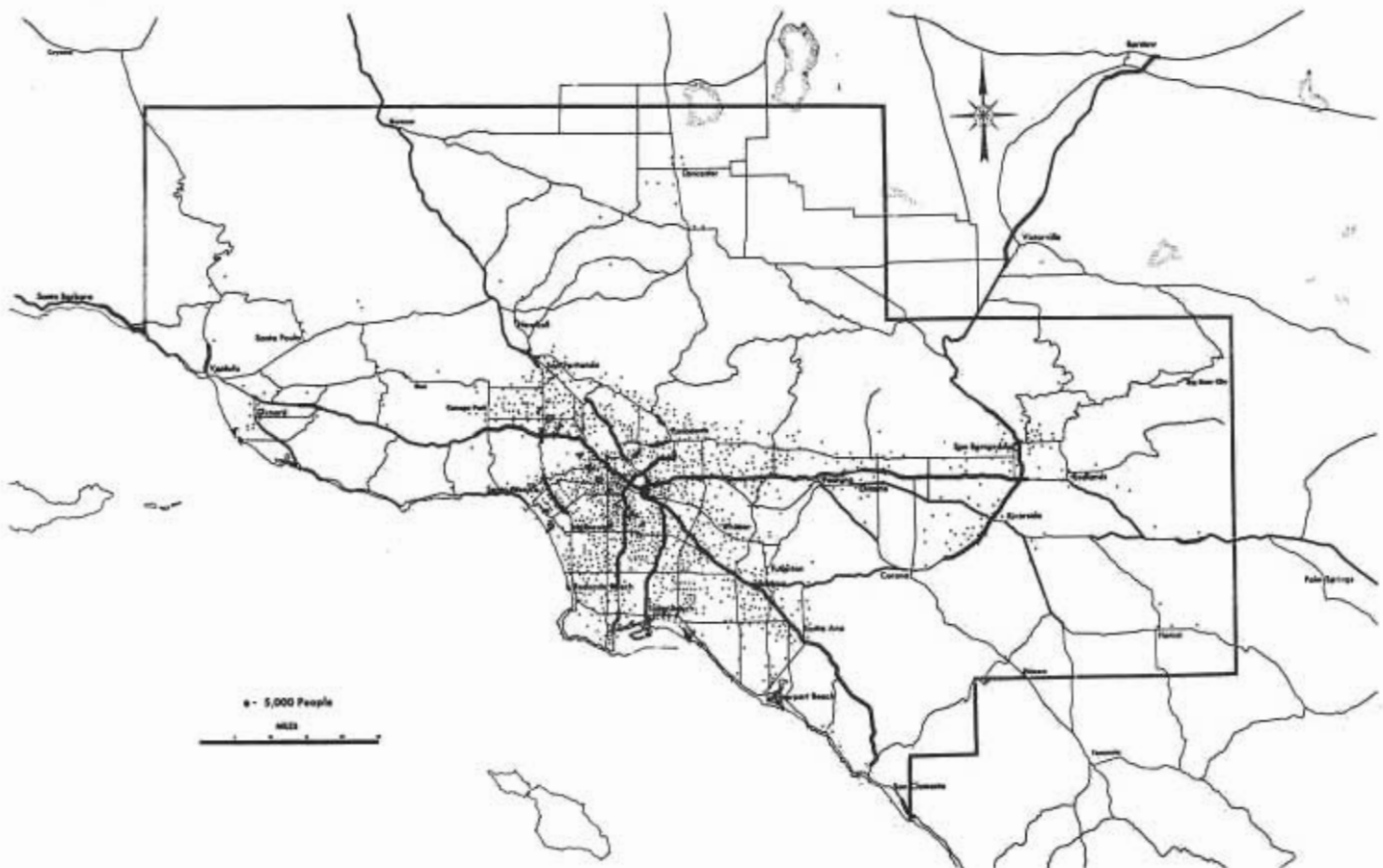
Another aspect of the transportation model important to planners is its ability to show the sphere of influence a particular business, shopping or residential area has in attracting traffic. When travel desires to and from a

given area are plotted on a map, the visual result is a star-shaped pattern with beams spreading asymmetrically to show the number of drivers, the distances they travel, and the directions from which they come for various trip purposes (see illustration page 41). From such volume and direction patterns, transportation planners can quickly assess traffic needs.

#### Techniques Tested

The validity of these techniques and of the many others that make up the LARTS transportation model was tested to insure that the model would be a useful predictive tool. Ground traffic counts were taken along nine screenlines in the LARTS area and were compared with the traffic that had been computed mathematically. The computed counts average only 7 percent higher than the actual counts, indicating a good level of accuracy for the model.

The model, however, is not to be treated as static. If, for example, trip lengths become longer or shorter in



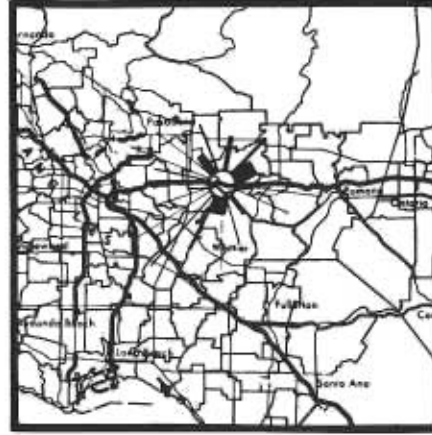
Concentration of population in the LARTS study area is shown in the above map.



## AUTO DRIVER TRAVEL DESIRE PATTERNS FOR A RESIDENTIAL ZONE



WORK TRIPS



SHOPPING TRIPS



TOTAL TRIPS

the future, or if higher incomes and shorter workweeks prompt fewer business trips and more social or recreational trips, these trends will be incorporated.

With a workable model at hand, the LARTS staff is now beginning phase two of the program—the allocation of population, employment and land use for 1980 to traffic zones from information provided by the participating cities and counties.

While the primary objective of phase one was to establish a sound predictive tool, a valuable byproduct to government planners was the detailed analysis of the LARTS area as it existed in the 1960 base year. In that year, the study area contained about half of California's population and over 4 percent of the nation's population. Nearly 90 percent of the area's population was in Los Angeles and Orange Counties, and the population had more than doubled during the previous decade.

Over 23 percent of the families in the area had annual incomes over \$10,000. By comparison, less than 22 percent of California's and about 15 percent of the nation's families were in this category in 1960. As might be expected, LARTS maps show a striking similarity in the geographic distribution of family incomes and number of cars owned.

### 'Old People' Theory Exploded

It is sometimes thought that the average age of Southern Californians is much higher than the rest of the nation's, but LARTS findings do not confirm this. While milder climate does attract older people, the study suggests that increased economic activity has caused immigration of large numbers in the family-forming, child-bearing age brackets between 18 and 35. In 1960, median age in the LARTS area was only 30.6, which is not much higher than the national median of 29.5, or the California median of 30.0. Further, the LARTS percentage of population over 65 was 8.9, a notch lower than the national average of 9 percent and a notch higher than the California average of 8.8 percent.

Of 5,776,000 acres in the study area, approximately 69 percent or 4,000,000 acres were vacant, of which 2,800,000 are probably unusable. About 850,000 acres were devoted to agriculture, 87,000 to recreational facilities, 39,000 to commerce, 92,000 to industry, and 369,000 to residential use.

### Population Density

The net population density was about 20.5 persons per acre of residential land, excluding streets. With residential streets included, the density drops to 16.5 persons per acre. Single-family housing accounted for over 75 percent of all housing units. In recent years, however, the percentage of new multiple housing units has increased

sharply. In 1958, for example, the net increase of multiple units in Los Angeles County exceeded the net increase of single family dwellings for the first time.

Average miles traveled on a weekday in LARTS area were 88,100,000 in 1960. "Long" trips, those exceeding 26 miles, were 4.2 percent of total trips, but accounted for 19 percent of the miles driven.

LARTS findings reiterate that freeways can handle more traffic at higher speeds than conventional highways. This is reflected in the fact that freeways, which are only 5 percent of the total lane miles in the LARTS area, carry 24 percent of the total vehicle miles, at an average speed of 49.7 miles per hour in comparison with average nonfreeway speeds of 28 miles per hour.

Statistics such as these are only a small portion of the 1960 data available to participating local governments right now. Much other detailed information on land use, employment, trip production, trip distribution, traffic volumes and other categories is also available, together with staff assistance in the interpretation of them. And within the next year and a half, when the study's second phase is tentatively scheduled for completion, LARTS will become even more important to transportation planners on all levels of government as it supplies a forecast of 1980 transportation requirements.

# Glendale Report

Preconstruction Study Shows Freeway Benefits

Summation By STUART L. HILL, Headquarters Right-of-way Agent



Real estate activity in Glendale has doubled since the adoption of a route for the Ventura Freeway through the city. Even though the freeway isn't built yet, properties close to

the proposed route have increased in value by 40 percent since 1959; by comparison, properties in the rest of the town have only increased 20 percent. This price increase reflects the development of an intense demand for property along the proposed route—a demand which anticipates the benefits of freeway construction by many years.

The Glendale study reveals that (1) older and well-established suburbs benefit as much from freeways as the new suburbs on the urban fringe, and (2) as soon as a route is adopted, the community begins to experience the economic benefits that are associated with freeways.

The beneficial effect of freeways upon real estate activity in the urban fringe has long been recognized. In Southern California, the urbanization of Orange County and the San Fernando Valley are classic examples of the economic benefits that accompany improvements in the transportation system. Freeways here have meant new homes, new apartments, new shopping centers, new industry, new recreational uses. Freeways have provided the means for extending the whole gamut of urban land uses to areas which were formerly too remote to play a role in our midcentury population explosion.

### Some Changes Overlooked

While we have concentrated our attention upon the spectacular changes that have occurred in areas such as Orange County, we have overlooked some equally spectacular changes that



Location of the proposed freeway through Glendale is shown in the above map. For purposes of study the community was divided into six bands or zones designated as Areas A, B, C, S, D, and E proceeding from south to north.

have been occurring in the older suburban areas, such as Glendale, which are much closer to the central city. To the casual observer these changes don't appear to be as spectacular. We don't see vacant land transformed—almost overnight—to new subdivisions, supermarkets, schools. The changes are less perceptible because they occur in an area that is already devoted to urban uses.

The adoption of the Ventura Freeway (Route 134) through the City of Glendale has offered the Division of Highways a unique opportunity to study and understand some of these

changes. Glendale is an excellent community to study because it is relatively homogeneous and neighborhood patterns tend to be very well defined.

Twenty years ago, Glendale was often referred to by radio comedians as a conservative, if not stodgy, town that rolled up its sidewalks at nine o'clock every night. Today, however, this town is taking very progressive and vigorous steps to cope with the modern problems of an urban community.

Glendale has always been essentially a residential community with



the vast majority of its residents commuting the 8 to 10 miles to Los Angeles daily. Nearly everyone lived in and owned their own home. Glendale's character was set during a time when home ownership was much more difficult to achieve than it is today. The town had an excellent school system and took pride in having more churches and fewer bars per capita than most comparable communities. In an era of "classiness" Glendale offered an attractive atmosphere for the average middle-class family seeking a stable environment.

#### Population Increase

The population of Glendale in 1963 is estimated to be 129,187, up about 8 percent from the 1960 census figure of 119,442. The 1950 census counted 95,702 people in the city limits. Glendale, today, is the third largest town in Los Angeles County, and, if present trends continue, its 1980 population may approach 190,000.

The commercial center of the town is traditionally located at Broadway and Brand, although it has tended to gravitate one block north in recent years to Brand and Wilson. Brand Boulevard is the prime retail street. Central Avenue, Glendale Boulevard, Broadway and Colorado Boulevard also have many retail outlets which vary from neighborhood stores to multimillion-dollar enterprises such as Robert Wian's "Bob's" drive-in restaurant and food industry complex. There are numerous other retail stores scattered about the remainder of the city serving local trade. Manufacturing is generally confined to the strip along San Fernando Boulevard and on the site of the former Grand Central Airport just north of the Golden State Freeway.

In a very general manner, excepting the portion around the "old" and "new" downtown, the residential portion of the community has developed in bands from south to north. The most striking line of demarcation is "The Wash" which generally parallels Glenoaks Boulevard. (The northern line of area "S" on the map approximates this line.) North of this line most of the homes were built from 1938 to 1950. South of this line, most of the homes were built prior to 1935.

#### Marketability Affected

The general small size and increasing age of the homes south of "The Wash" created a problem for the continued development of the community. The ease of owning new and modern homes in the more remote suburbs severely affected the marketability of these homes. They could not attract a sufficient number of new residents to renew the vitality of the area, and the homes and the area began to deteriorate.

The City of Glendale, anticipating this trend, sought to renew the area by zoning most of the properties south of "The Wash" for multiple residential use. Zoning itself, however, wasn't enough to turn the tide. Some new investment occurred, but it was on a very small scale, insufficient to generate much further investment. During this period even the best real estate salesmen went through some very long, dry spells.

However, in February 1961, with the adoption of a freeway location for Route 134, several blocks south of and parallel to "The Wash," the real estate investment picture in Glendale changed radically. Sales activity increased 100 percent; the number of new multiple units constructed doubled. The transition that the community looked for began to take place, and the entire town entered a new period of rejuvenation.

#### Investors Anticipate Benefits

Almost immediately the Division of Highways began to follow the changing pattern of activity. Our experience has indicated that shortly after route adoption *the benefits of freeway construction are anticipated by private investors*; frequently, by the time actual construction is completed, the effects have become so diffuse that an analysis before and after construction does not completely reveal impact. The Glendale study is a long-range study, then, beginning two years before route adoption; it will end several years after the facility is opened to traffic—sometime in the early 70's. This progress report will cover changes in the real estate market which have occurred in 2½ years after route adoption, i.e., up to July 1963.

#### Study Zones Described

For the purposes of study the community was divided into six broad bands or zones which roughly correspond to zoning and clusters of similar neighborhoods. These are shown on the accompanying map designated as Areas A, B, C, S, D and E, proceeding from south to north.

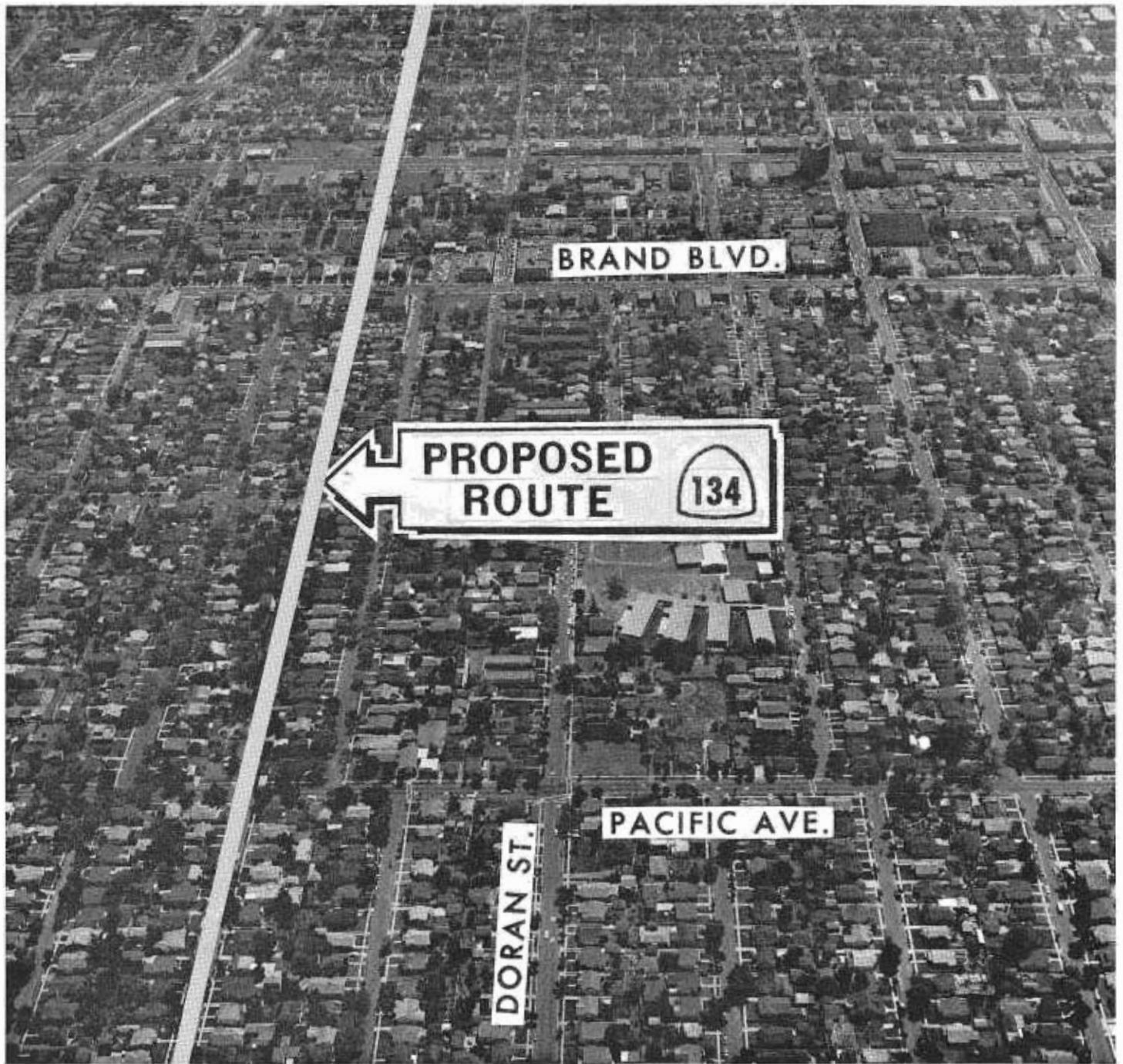
Area S is a special study area which generally parallels the adopted freeway route two blocks on either side. Except for study purposes, this area is the same as Area C. Areas B and C are predominantly older frame or Spanish style single family residences but zoned for multiple residential (R-3 and R-4).

Some portions of Area A are similar to Areas B and C, but the majority of this area is composed of a residential area known locally as "Adams Hill." This portion of the area is zoned for single-family dwellings only (R-1), and is not likely to change use in the foreseeable future.

Area D is the prime R-3 and R-4 area. This area is principally improved with multiple dwellings and has been a good investment area for 20 years. Its strategic location next to a prime R-1 residential area (Area E) has always made it a desirable location for rental property.

Area E is the prime residential area in the city. Zoned for single-family dwellings, this area has been very desirable since its development in the late 30s. Along the foothills on the north, the area becomes quite exclusive, and a good many celebrities live or have lived there.

Area F (not shown) is separated from the rest of the town by a manufacturing zone. This area is so small, its character so different and sales so few, that it was eliminated from the study at this time. There are other areas within the city limits that have been excluded from the study. For example, all neighborhoods north of Mountain Street were eliminated. These are essentially high-value neighborhoods, some approaching estate size. Generally, the study only considered those single-family dwellings with a value below \$36,000—confining itself to the "middle class" homes that are more subject to the vagaries of the real estate market. In the neigh-



The location of the proposed freeway through Glendale has been indicated in the above aerial by a white line.

borhoods north of Mountain Street, it was felt that the bulk of the homes would exceed this arbitrary mark. This cutoff line eliminates neighborhoods known locally as Rossmoyne, Verdugo Woodlands and the "Annex" north of the Verdugo Mountains. It is felt that this elimination does not significantly affect the results of the study.

Through the cooperation of the City of Glendale and local realtors,

principally La Chasse Realty, we were able to collect over 2,000 individual sales of residential parcels that had occurred between January 1959 and July 1963. Analysis of these sales has revealed the startling pattern of freeway impact.

The 2,000 sales collected are those properties that were sold through the multiple listing service and represent approximately 50 percent of all the residential sales that occurred within

the community. Approximately one-third of the sales collected occurred during the 2-year "before" period; while the remaining two-thirds occurred in the 2½-year "after" period. Since multiple listings have tended to remain at a fairly constant proportion of total sales, this indicates, roughly, the change in activity that followed route adoption.

Although changes in sales prices of apartment houses will be indicated,



this study will concern itself principally with changes in value of single-family dwellings—and those primarily on R-3 and R-4 lots.

#### Average Sales Compared

Comparing the average sales price during the before period to the after period reveals that the average home in Glendale was selling for a price 11.5 percent greater during the after period. Additionally, comparing the average sales price in 1959 to the average sales price during the first half of 1963, we find that the average home increased in value by better than 20 percent.

Graph 1 shows how the various areas have changed; comparing the average sales price during the entire before period to the average sales price during the entire after period, this chart shows the percent increase during the after period. Note that the area which showed the greatest relative increase in Area S, our study area extending two blocks on either side of the proposed freeway. In the before period the average home in Area S was selling for \$15,900—in the after period it was selling for \$18,850, an increase of better than 18 percent. Combining the two areas on either side of Area S, i.e. Areas C and D, we find that in the before period the average home was selling for \$15,700 and increased to \$17,650 in the after period—a change of 14 percent. In other words, homes in the study zone were worth an extra \$1,000 after the route adoption.

Even more startling, comparing the average sales price in Area S in 1959 to 1963, we find an increase of better than 40 percent—double the rate of increase in the rest of the community. For example, again combining Areas C and D, the '59 to '63 increase is only 15 percent.

#### Apartments Replace Older Homes

These relative price gains reflect the changes that are now taking place in the City of Glendale, and the freeway effects that the residents there have long since recognized. The older homes in Area S are now being torn down to make room for new apartment buildings. Construction activity in this area has increased at a tremendous rate. As a matter of fact, when

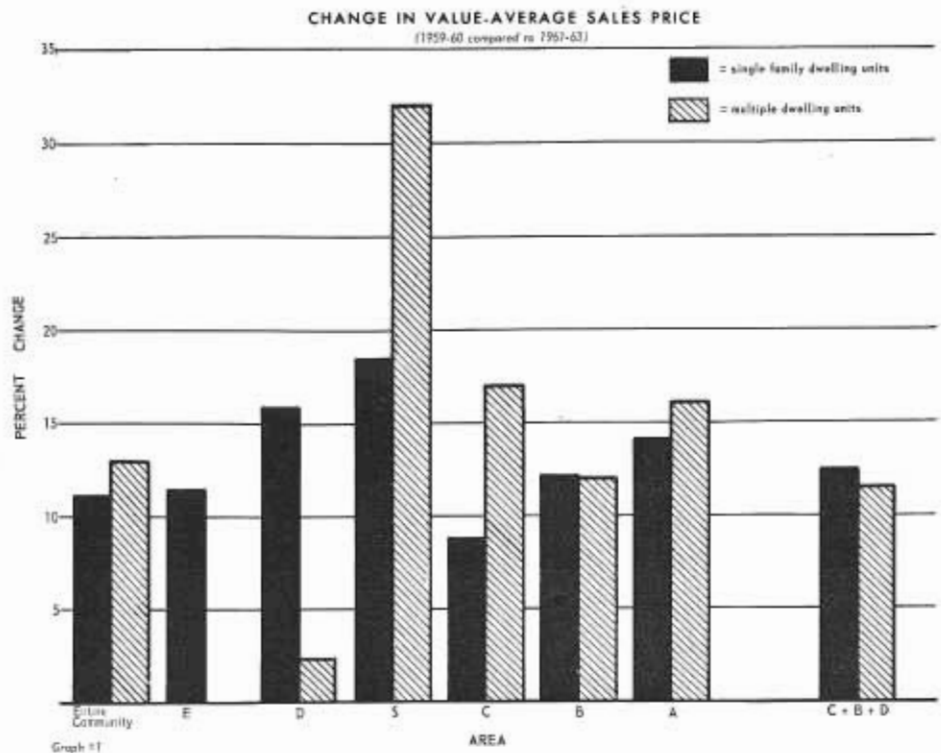


TABLE I

BUILDING ACTIVITY IN GLENDALE  
Multiple Dwellings Containing Three or More Units per Site

Year	Number of permits issued	Number of family units not available	Total value of permits
1959	87	not available	\$5,000,000
1960	84	992	5,600,000
1961	145	1700	12,600,000
1962	199	2265	18,000,000
1963 (first half)	100	989	8,800,000

these older properties are advertised in the newspaper for sale, they are no longer listed as *houses* for sale, but in the section carrying ads for *lots*.

An indicator of this change is the number and value of building permits for new multiple dwelling units during the before and after period. Table I shows the change that has occurred in this activity. Note especially that the value of permits issued in 1961 was double the value of permits issued in 1960 and the value was another 40 percent greater in 1962. Note, also, that the number of family units involved in the first half of 1963 was as large as the number of units during the entire year of 1960.

Generally, the variation in the average price of multiple units shown on Graph 1 reflects this activity also. The

increase in Area S shown on this chart is a reflection of the sale of new apartment buildings—buildings that didn't exist in the before period. The greatest increase is shown in Area S because the greatest number of new multiple units have been constructed within this area.

#### Sales Are Compared

Our analysis of the sales also revealed another relationship which tended to describe the transition in Area S. Graph 2 shows the change in average price in the various areas comparing the before period to the after period. It also shows the 68 percent range. That is, 68 percent of the properties sold within the range indicated by the length of the line. It is interesting to note that, consistently, the high point of the range increased at a

greater rate than the mean or low points—and the low point of this range increased at the slowest apparent rate. This tendency was confirmed by an analysis of double sales, i.e., properties that sold twice or more during the study period. There was a definite tendency for higher value properties to increase in value at a faster rate than lower value properties.

This tendency is related to the transition of the area to multiple residential. For example, higher valued properties, where the house has little economic utility, are, generally, the larger parcels—over 7,000 square feet. The lowest valued properties tend to be under 4,000 square feet. The larger parcels which will hold the larger, and more economically operated, apartment houses, have therefore been in greater demand and show a greater relative increase in value. The highest demand for such parcels, and hence, the greatest value increase, has occurred in Area S, the study area adjacent to the freeway.

The freeway, then, has significantly benefited the City of Glendale. It has helped the community fulfill the goals that it set for itself when it zoned the residential area south of "The Wash" for apartments. While the area adjoining the proposed facility was in transition prior to freeway route selection, it did not really come into its own until the freeway route was adopted.

#### Effect on Established Community

The Glendale study has thrown some light on another problem area—the effect of a freeway upon an established community. On occasion at public hearings prior to route adoption, residents of a community will express the opinion that a new freeway through the community will "spoil" the entire town. If it is a well-established middle class, residential community such as Glendale, the residents are especially anxious. Having lived in the town a good many years, they may feel that a change such as a freeway is too drastic for their community to withstand. Sometimes, statements are made in this context which indicate that the residents feel that the value of property in the entire town will decrease as the result of the freeway and the new environment which it creates.

In Glendale we have the opportunity to investigate this fear—at least in regard to the period immediately following route adoption when the "look" of the freeway is still unknown and may cause irrational fears. Area E is in close proximity to the proposed freeway. In some cases it even abuts the route. This area, as we have stated, is a substantial and well-established group of neighborhoods composed almost entirely of single-family dwellings.

In 1959 the average home in this area was selling for \$20,640; 68 percent of the home sold within the range of \$16,000-\$25,200. In the first half of 1963, two years after the route adoption, the average home was selling for \$24,875 while 68 percent of the homes, sold within a range of \$20,250-\$29,450—an increase in average value of 20.47 percent. (Within this range it is apparent that our arbitrary elimination of homes and neighborhoods over \$36,000 may have tended to lower the mean and real average—e.g., in 1959 in neighborhoods where sales over \$36,000 were collected but eliminated, sales in this category

amounted to 3.14 percent of the total—in 1963 they amounted to 9.0 percent.)

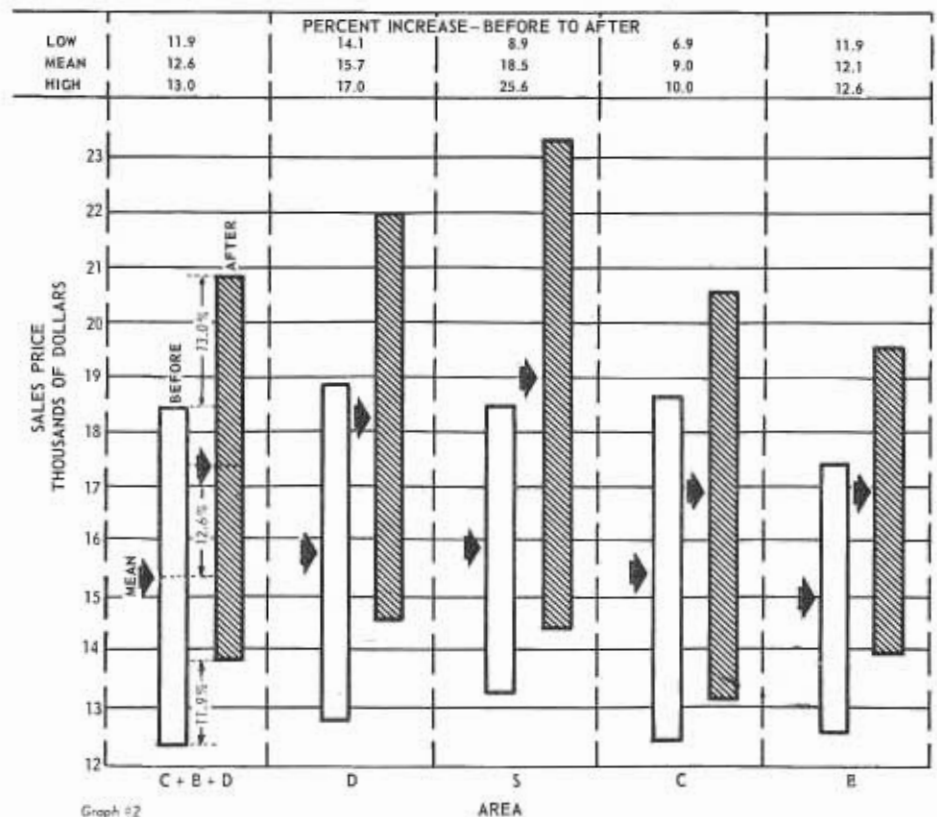
#### No Panic Selling

In Glendale, then, there was no panic selling at lower prices, but, on the contrary, a 20 percent increase in value in 4½ years. The contention that freeway proximity may ruin substantial middle class neighborhoods seems to be untrue.

In order to further refine our measurement of freeway effects, however, it is necessary to have some sort of control area to compare, as we had for Area S. In other words, how much of the increase can be ascribed to the proposed freeway? Does this growth rate represent a benefit to the area through potential improved accessibility, or does it represent a disbenefit through proximity? The test is a comparison to another similar area. If the other area is growing faster, then there is a disbenefit; if it is growing at a slower rate, then there is a benefit.

The control area in this case is Area A, the R-1 portion known as Adams Hill. The area is generally middle class, and although many

AVERAGE AND RANGE OF SALES PRICES — GLENDALE  
(Single Family Dwellings on Lots Zoned for Multiple Dwelling Units)





homes on the hillside have views, is not considered quite as desirable as Area E. This area is roughly two miles south of the proposed freeway, and consequently closer to Los Angeles. Since the freeway will not serve to bring the Adams Hill area in closer proximity to the central area, it should be out of the area of freeway influence.

#### **Average Value Increase**

Considering only those properties zoned for single family residential use, in 1959 the average home in Area A sold for \$16,540; 68 percent of the homes sold within a range of \$13,500-\$19,550. In 1963 the average home was selling for \$19,925, while 68 percent of the homes were within a range of \$15,300-\$24,000. This represents an increase of 20.52 percent in average value.

Since both areas have increased their values 20 percent we conclude that the freeway has had no effect upon single-family residential neighborhoods in Glendale. There is neither a benefit nor a disbenefit apparent at the present time.

The Glendale study, as an analysis of the effects of a freeway through a suburban residential community, is not complete. It cannot be complete until several years after the freeway is opened to traffic. Only then will we have the opportunity to evaluate the effects of actual construction—the improvement in accessibility. Nevertheless, at this preliminary stage we have gained valuable information.

It is generally agreed that the value of a parcel of land depends, among other things, upon its accessibility to a community economic center. The improvement of accessibility, such as by construction of a freeway, has inevitably increased the value of abutting land in suburban areas. In the case of Glendale, accessibility has not yet been improved. Nevertheless, there has clearly been an increase in land values which can only be attributed to the proposed freeway. It is clear that investors anticipate the change of accessibility that follows freeway construction. Money begins to be invested, and demand increases many years prior to actual construction.

#### **Area Ripe for Investment**

In the case of Glendale the area immediately surrounding the freeway was ripe for new investment. The homes themselves had depreciated in value beyond economic utility, the property was properly zoned for upgrading the use, and the adoption of a freeway route promised future benefits to the area in terms of accessibility. The freeway served as a tool for the acceleration of a change in land use. There is little doubt that the change to multiple residential use would have occurred eventually, but the freeway acted as the catalyst to set the change in motion at a faster pace and at an earlier date.

The freeway in Glendale has had the same general effect upon that community as the Santa Ana Freeway has had in Orange County. It has increased the intensity of use of the land. The population density has increased, but on a different scale and through a different land use. It is clear that the major difference between the established suburbs such as Glendale and the newer areas such as Orange County is that in Glendale where some sort of transportation system preexists, investors do not have to depend upon the actual construction of the route to attract new people. The mere adoption of a route and a tentative construction date in a proper zoning environment is sufficient stimulus to benefit the community and to effect the changes indicated here.

#### **Future Studies Indicated**

Furthermore, it is equally clear that our continuing analysis of this community will present us with some difficult problems. With the passage of time, the new apartment construction will tend to have an impact of its own—to attract other new investments to areas contiguous to it. The effect will slowly spread through the entire R-3 and R-4 area. (A preliminary look at the data for the second half of '63 seems to confirm this impression.) Our future studies will find it difficult to locate control areas and to sort out the effect of the freeway after construction. If we had confined this study to two years before and two years after actual construction, we would have been hard pressed to find

## **Drilling Crew Saves Home in Glendale**

A Materials and Research Department foundation drilling crew working in the Glendale area aided a potential fire victim in saving his home from a fire raging in the area on the morning of March 16.

The crew, consisting of Floyd Strickler, drilling foreman, Henry A. Williams, James T. Lupo, and Rupert E. Day, foundation drillers, were core drilling in the Glendale area for information on cut slopes.

The crew were at breakfast when they first heard of the fire and hurried to the drill site, arriving about 6.45 a.m. They began packing equipment and preparing the drill rig and all vehicles for travel. By the time they had traversed a dirt road through the brush to a cleared area, the air was hot and smoky. At that time the fire was burning at the edge of this cleared area.

Observing a man attempting to wet down the house nearest to the cleared area with a garden hose, the crew used a hose from their drilling equipment, connected it to a fire hydrant and sprayed the house until the nearby brush had burned itself out. The only fire loss was some lawn furniture. In the process of fighting the fire, the crew suffered severe eye irritation from smoke and cinders, which necessitated medical treatment.

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any effect at all. By the time the freeway is actually open for traffic, most of the development and change to multiple residential will have already occurred and a study initiated at that late date might show only imperceptible and inconclusive changes.

We will continue, however, to collect data on Glendale and to probe the changes that occur until after the route is opened for traffic. It is clear that the results of this study and a more intense evaluation of the data collected will ultimately prove to be a valuable tool in planning future transportation improvements.

# Bay Bridge Reconstruction

By E. R. FOLEY, Chief Engineer, Division of Bay Toll Crossings

The reconstruction of the San Francisco-Oakland Bay Bridge to provide five lanes of one-way traffic on each deck has been the subject of two previous articles in *California Highways and Public Works*. They appeared in the July-August 1960 and January-February 1962 issues.

This article describes the final phase of structural modifications before one-way traffic movements could be instituted. It covers strengthening of the upper deck on the East Bay spans; construction of refuge bays; resurfacing of the upper deck; additional reconstruction on the approaches; lower deck lighting; and signs.

## Upper Deck Strengthening

The upper deck of the Bay Bridge was originally designed to carry passenger automobiles and light commercial vehicles on six traffic lanes, three in each direction. In the East Bay spans, defined as that portion of the bridge east of Yerba Buena Island, the floor system consisted of a reinforced lightweight concrete roadway slab six inches in depth and 58 feet wide. This was supported on transverse joists at six-foot centers which in turn rested on four longitudinal stringers spaced at 16-foot centers. These longitudinal stringers were framed into floor beams having variable spacings as indicated in the following tabulation:

Type of span	Spacing, feet
288-foot and 292-foot deck trusses	36
504-foot through trusses	42
Cantilever-anchor arm	48
Cantilever-cantilever arm	55
Cantilever-suspended span	58

Analysis of this floor system indicated that all of its elements, that is, the roadway slab and its supporting structural steel members were inadequate to carry the heavier live load that would be imposed when unidirectional traffic movements were put into operation. A strengthening method had to be devised which

would not interfere with passage of the more than 110,000 vehicles using the bridge each day. After consideration of many different plans and alternatives, the upper deck floor system of the East Bay spans was strengthened in the manner described in the following paragraphs.

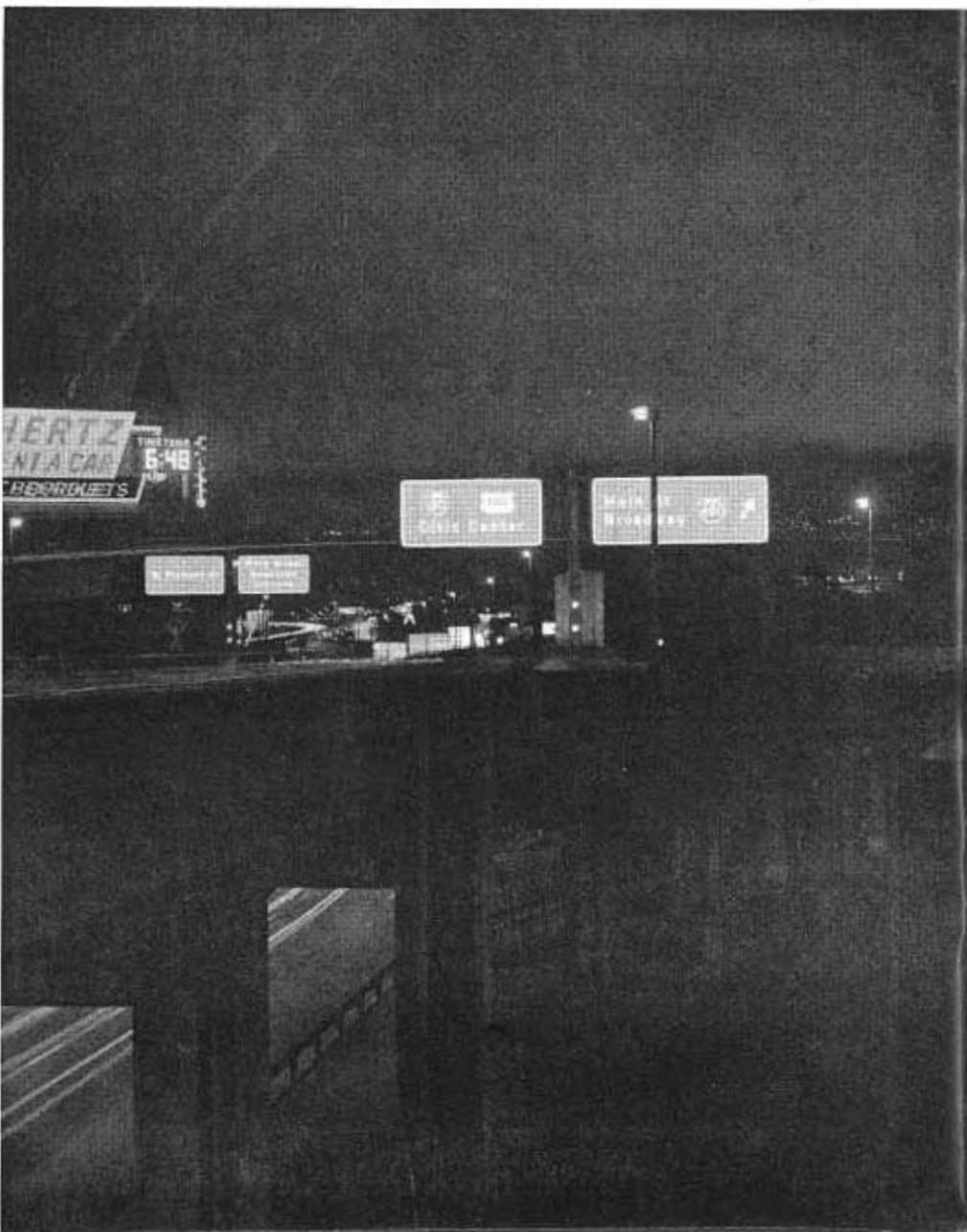
## Roadway Slab and Transverse Joists

To reduce the span of the roadway slab and the load carried by each of

the existing joints, intermediate joists were installed at six-foot centers midway between the existing joists. The new joists are 10WF sections of A440 high-strength steel.

The rolled sections were threaded in one piece through the space between the existing longitudinal stringers and the concrete slab. The joists were preloaded at the third points of the spans between

*These internally lighted directional signs on the San Francisco end of the bridge have proven quite effective for nighttime visibility. The color scheme used corresponds to that established by interstate highway standards.*





stringers and at the ends of the joists to insure their full participation in carrying the live loads. High-strength bolts were used to connect each joist to the top flange of the stringer. The void between the joist and slab, varying between one-half to one inch, was filled with a 1:3 grout mixture, applied as air-blown mortar. The grout contained an admixture to prevent shrinkage.

#### Stringer Strengthening

The load-carrying capacity of the existing longitudinal stringers was increased by the addition of understringers. Both rolled and welded sections were used.

Sections were fabricated in such a manner that either their natural camber or a specified camber could be erected upwards.

The understringers were lifted and clamped into position. Then, using the predrilled holes in the understringer as a template, holes were drilled through the bottom flange of the original stringers. High-strength bolts,  $\frac{7}{8}$ -inch in diameter, were installed and tightened in a sequence progressing from the ends of the understringer towards the center to complete erection.

#### Floor Beam Strengthening

The floor beams of the East Bay spans were strengthened in the same manner as those on the West Bay spans. A high-strength steel plate was bolted to the bottom flange of each beam after the plate had been stressed to a predetermined amount. Using this method of strengthening, the tensioned cover plate induces an initial compressive force on the bottom flange, thereby reducing the existing dead load tensile stresses. Thus, a greater portion of the strength of the original section is made available to carry increased live load.

The procedure for installing these cover plates was similar to that described in the article of January-February 1962.

#### Minimum Traffic Interference

In the preparation of construction contracts, serious consideration was given to details which would offer the least interference to the movement of bridge traffic. On the East Bay work,

## Hump Looks Good In Retrospect

Reprinted from the San Francisco Examiner of January 17, 1964

The new one-way traffic patterns on the Bay Bridge, in effect since mid-October, have more than proved in practice the expectations of the State Division of San Francisco Bay Toll Crossings.

Traffic smoothed out quickly and flowed faster after the changeover, made possible by converting each deck to a one-way street. Notable, too, is the fact that no fatalities have occurred on the bridge since the changeover. Credit this to elimination of head-on collisions. The old two-way routing had a sanguine history.

All these facts stand out impressively against the background of abuse heaped on the division, and particularly on the division chief at the time, Norman C. Raab.

The beating Raab took from angry commuters and caustic critics during the days of "The Hump" seems in retrospect, and in the light of subsequent usefulness of the project, to have been of shallow substance. The Hump was necessary to permit raising of the upper deck to give adequate clearance to heavy vehicles. Commuters were discommoded. Construction delays were numerous. Tempers wore thin, as did public patience.

But disruption and inconvenience were unavoidable. The only alternative would have been to close the bridge.

We suspect a lot of people would like to take back the harsh things said about Norman Raab in connection with irritations caused by The Hump. Raab stepped down as division chief last July 31, after 40 years of state service, including many important contributions to California's system of bridges. The Hump was one of several thorns in his side accumulated over the years—the least deserved one, as experience with the one-way traffic on the Bay Bridge is proving every day.

the State's traveling scaffolds were available for use by the contractor. These were augmented by his own scaffolds. Also, the contractor was permitted to use the south lane as a working area. This arrangement caused a minimum of inconvenience to traffic while reconstruction of the East Bay spans was accomplished.

As a result of strengthening the upper deck floor system in the East

Bay spans the entire upper deck is now capable of carrying five lanes of H20-S16 traffic with maximum stresses not exceeding those allowable in the current edition of the American Association of State Highway Officials Standard Specifications for Bridges.

#### Refuge Bays

The capacity of a long structure, such as the San Francisco-Oakland Bay Bridge, is directly related to the continued movement of traffic. Thus any stalled or disabled vehicle reduces its capacity. To keep the large volume of traffic on the bridge moving, refuge bays have been constructed wherever possible. In the East Bay spans these were built in the curved sections of the bridge: first, in the area west of the cantilever span, and second, just east of the 504-foot truss spans. These refuge bays were built by moving the existing curb back and paving the area with lightweight concrete.

#### Upper Deck Resurfacing

Resurfacing of the upper deck was considered necessary for two reasons. First, after nearly 27 years of use the concrete surface was beginning to show signs of wear, particularly in the curb lanes. The degree of deterioration was such that it was considered advisable to repair the deck before heavier loads were imposed upon it. Second, it was necessary to cover the 4" x 4" tiles which had been embedded in the concrete roadway to delineate the six traffic lanes.

Since the amount of dead load that could be added to the structure was limited, investigation was concerned with a lightweight material, that would provide a long, serviceable life. An epoxy coal tar compound met these requirements; it weighed 15 pounds per square yard at a  $\frac{1}{8}$ -inch thickness, its serviceability was considered good, and it could be easily applied.

#### Resurfacing Operations

A total of 26 lane-miles of resurfacing was accomplished on the upper deck. The first step in the resurfacing process was to patch cracks and deteriorated areas with epoxy grout, followed by a sandblast cleaning of the deck. After this a special tank truck spread the epoxy coal tar compound



*The completed upper deck strengthening as seen from below on the lower deck showing the additional transverse joists, understringers, floor beam coverplate and typical lower deck lighting installation.*



*Upper deck traffic after change to one-way operation.*

on the deck. The resin was filled immediately with a fine, hard, dust-free aggregate, which resulted in a nonskid surface. The aggregate was shoveled from trucks in the adjacent lane.

The distributor truck was provided with separate tanks to hold the two components of the epoxy coal tar compound. Volume and temperature controls were both critical. The distributor was especially designed to handle the mixture used.

#### **Traffic**

As was the case in all other work performed on this project, disruption of the heavy Bay Bridge traffic was held to a minimum. To avoid hindrance to morning and evening peak hour movements, the contractor's operations were limited to the hours between 8.30 a.m. and 4 p.m. After the morning rush hour, the two lanes required for the contractor's operations were blocked off. Before the evening rush, all equipment was removed from the deck, with only that portion of the roadway surfaced that day closed to traffic. About one lane-mile of deck was surfaced each day. It required from 3 to 12 hours for the epoxy coal tar mixture to set, depending upon the temperature. The paved area was opened to traffic the next day, after the excess aggregate had been removed and temporary lane stripes installed. The resurfacing operations on the upper deck caused little inconvenience to the traveling public, and the resulting improvement will benefit the users for many years to come.

#### **Lower Deck Lighting**

The lower deck, as originally constructed, was divided for use by two different types of transportation. The northerly portion was surfaced for motor vehicles. The southerly portion carried railroad tracks for electric trains. Sodium vapor lights, similar to those on the upper deck, were in place on the northerly side. No lights were installed in the area where the electric trains operated.

Since the existing lighting was inadequate for the new traffic pattern, it was decided to install a modern highway lighting system that would complement the new lower deck roadway.





Lower deck lighting on the West Bay spans.

Fluorescent lighting was selected for the following reasons:

1. The existing sodium vapor lights and fixtures are obsolete and are no longer manufactured except on special orders and at premium prices.
2. Fluorescent lamps are economical with respect to (a) initial cost, (b) operating costs, and (c) lamp life (up to 10,000 hours).

The new lower deck lighting consists of two lines of fluorescent fixtures installed in alternate panels. In the West Bay spans the fixtures are attached to the stringers while in the East Bay spans they are fastened to the floor joists.

The new lighting on the lower deck of the Bay Bridge is in accordance with the latest practice for highway lighting. The average illumination is approximately three foot-candles as compared to 0.5 foot-candle on the upper deck.

#### Approaches

Before one-way traffic could be instituted it was necessary to provide some means for buses to reach the Transbay Transit Terminal from the

upper deck of the bridge. This access was provided by raising the existing Fremont Street off-ramp to the same grade as the Terminal roadway.

To accomplish this required the demolition of a portion of the existing structure and construction of a ramp at the new elevation. It was extended to cross over First Street and terminates at Fremont Street. This change permitted traffic leaving the bridge to move into the one-way pattern on Fremont Street, which leads directly into San Francisco's financial and business districts. It also eliminates a traffic light on First Street, a cross-town, one-way artery.

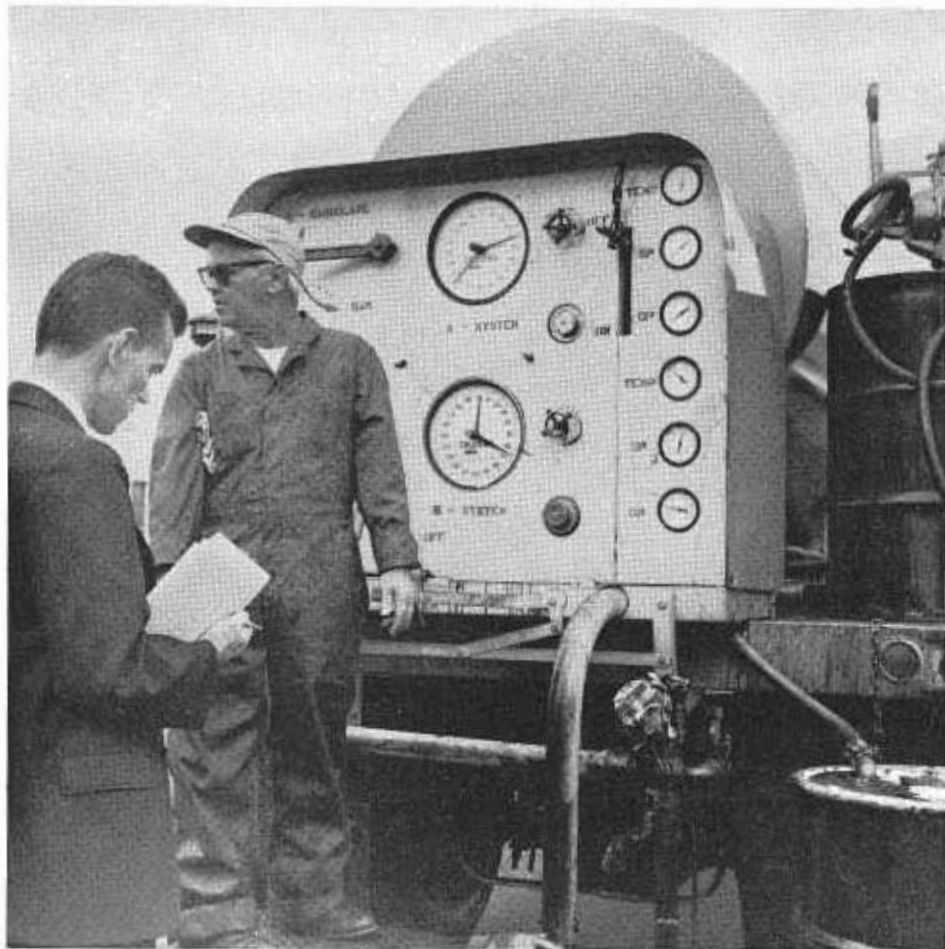
#### Yerba Buena Island Approaches

The existing approaches on the west side of Yerba Buena Island were constructed as a part of the access roads to the Golden Gate International Exposition, which was held on Treasure Island in 1939 and 1940. They were considered temporary and were to be removed at the conclusion of the Exposition.

With the advent of World War II and the establishment of the Navy base on Treasure Island, the approaches continued in use over the intervening years. However, these temporary approaches were inadequate for today's usage, particularly the ramp leading from the upper



Lower deck lighting on the viaduct section of the East Bay spans looking west toward the tunnel.



The control panel of a special truck for placing epoxy coal tar material. Gauges indicate pressures and temperatures of each mixture as well as the mixing chamber.



Equipment train for resurfacing the upper deck. The special truck for placing 1/8-inch-thick epoxy coal tar is in the lead followed by fine aggregate truck.

deck. A new steel structure with concrete deck was built to allow San Francisco-bound traffic to reach the upper deck. Access from the lower deck for eastbound traffic was constructed at grade.

#### Overhead Signs

The newly reconstructed bridge, with one-way traffic on each deck, required the installation of adequate signs to inform the motoring public. Internally illuminated overhead signs were chosen. Selection of the type of structural framework and the style of the signs was based primarily on aesthetic considerations. Colors used for the panels conform to standards for the interstate highway system.

Locations were carefully selected, particularly on the West Bay spans, where the effect on the view from the bridge into the City of San Francisco was of major importance. The internally illuminated signs present a pleasing addition to the bridge, especially at night.

#### One-way Traffic Instituted

On October 12, 1963, unidirectional traffic movements were put into effect. This was almost five years after the beginning of reconstruction on the San Francisco approaches, and one month less than 27 years following the opening of the bridge to vehicular traffic on November 12, 1936.

During the short period in which one-way movements have been in operation, there is ample evidence that motorists are now enjoying a faster and safer trip. The speed limit has been raised from 35 on the lower deck and 40 on the upper deck to 50 miles per hour, and traffic has been flowing evenly, secure in the knowledge that head-on collisions are no longer a major hazard on the bridge.

The California Highway Patrol recently issued a statement that statistics indicate that accidents have decreased by 32 percent, with 52 percent fewer injury accidents and no fatalities. Added to this is the comfort experienced in using the wider traffic lanes. The driver is relieved of the tension that was brought about by negotiating the narrow nine-foot eight-inch lanes that formerly existed on the upper deck.

. . . Continued on page 59



# Bellevue Road

Merced County FAS Route  
Is Widened, Bridge Replaced

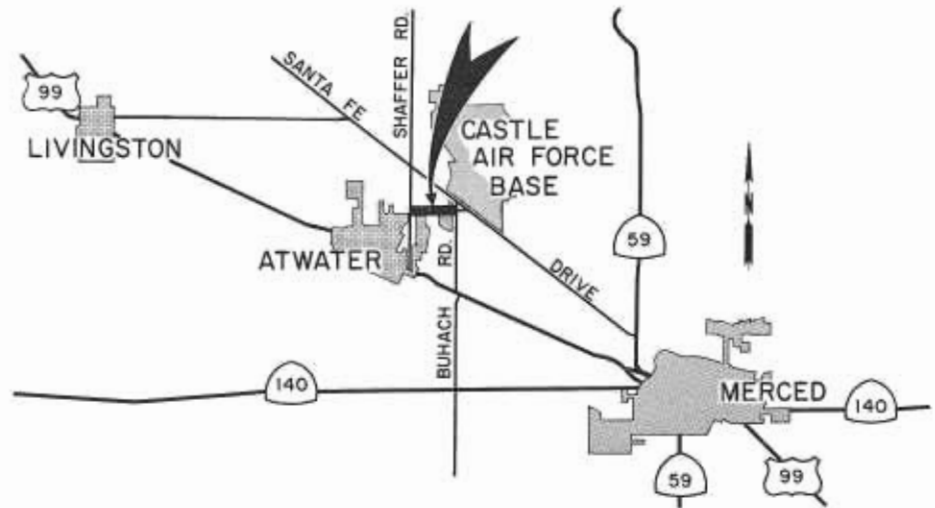
By VERNE L. DAVIS, Road Commissioner, Merced County



Castle Air Force Base, present home of the Strategic Air Command's 93rd Air Bombardment Wing, was activated in December 1941. With the growth of the Air Base, the surrounding

area, including the Cities of Merced, Atwater and Livingston, also grew at a rapid rate because of the proximity of this vital defense installation.

During the past 20-plus years, many of the roads leading to the air base have been reconstructed and improved to satisfy the demands of the traffic volumes generated by the defense installation.



The Bellevue Road project is located between Atwater and Castle Air Force Base.



Looking east along the completed Bellevue Road improvement at the Livingston Canal crossing.



*The east end of the project at the intersection with Buhach Road. The view is westward.*

#### **Work Completed**

On July 1, 1963, work was completed on the reconstruction of Bellevue Road, FAS Route 1354, the most recently improved artery to the air base. The start of this construction culminated 18 months of coordinated negotiations, planning and design work between the City of Atwater, the County of Merced and the Division of Highways.

The length of the completed project is 1.05 miles, with the westerly portion from Shaffer Road to the west bank of Livingston Canal being within

the City of Atwater. The existing narrow two-lane road and the bridge across Livingston Canal were entirely inadequate for the traffic volumes. High peak hour volumes required additional traffic lanes; therefore, a four-lane undivided 64-foot roadway between concrete curbs, within an 84-foot right-of-way was constructed.

#### **Bridge Replaced**

The substandard timber bridge across Livingston Canal was replaced with a concrete structure of full roadway width plus five-foot sidewalks and steel railing on each side.

Rights-of-way were acquired by the city and the county in their respective areas.

The total cost of the improvement was approximately \$179,000, financed with federal aid secondary and state matching funds, City of Atwater  $\frac{3}{8}$ -cent gas tax funds, and County of Merced funds.

Personnel from both the county and the State provided construction engineering and inspection under the direction of Melvin B. Rowan, resident engineer. Standard Materials Company of Modesto was the contractor.

# Collier-Unruh Act

*Added Funds Are Provided  
For Local Roads, Streets*

By C. T. LEDDEN, City and County Projects Engineer

*Editor's note:* This analysis of S.B. 344 and description of the administrative procedures involved was presented at the street and highway conference in Berkeley on January 31, 1964.

Senate Bill 344 was the parent legislation which resulted in the "Collier-Unruh Local Transportation Development Act" added to the California statutes during the 1963 legislative session. The following is a discussion of the act itself with particular emphasis on its administration and the procedural policies which have been developed for its implementation.

Basically, the Collier-Unruh Act is a tax measure sponsored by the cities and the counties of California to provide additional funds for improvement of city and county transportation systems.

The act embodies two major provisions: one relates to the financing of public rapid transit; the other pertains to the financing and improvement of city streets and county roads.

Provisions which refer to rapid transit are contained in the two following provisions:

(1) The board of supervisors of each county is authorized to pass an ordinance increasing the present fee on motor vehicles (in-lieu tax) by one-half of 1 percent—this increase to be used exclusively for planning, acquiring, constructing, operating and/or maintaining a rapid transit system. It may also be used for making contributions to another district or agency duly constituted for this purpose.

(2) Any city or county is authorized to spend for the same purposes described above the moneys which it presently receives from existing motor vehicle (in-lieu tax) fees.

These provisions of the act which refer to rapid transit are the responsibility of, and will be administered by the Department of Motor Vehicles.

## Remaining Provisions

The remaining provisions of the act which pertain to the financing and improvement of city streets and county roads will for the most part be administered by the Department of Public Works through the Division of Highways.

To assist in this administration the department has prepared and distributed a "Procedural Manual" to guide the cities and the counties as well as the division's staff in implementing the various provisions and requirements. It should be emphasized that these administrative procedures have resulted from cooperative effort by representative committees appointed by the League of California Cities, the California Association of County Supervisors, and the State. They represent, in fact, a compromise position. They are, however, workable and are mutually acceptable as a starting base with the added understanding that they are subject to modification where necessary for clarification or to effect a better statewide program.

As to the new street and road provisions of the act, it is estimated that for the 1964-65 fiscal year approximately \$74,800,000 in additional funds will be made available to the cities and counties for street and road purposes. This additional revenue will be derived from a 1-cent increase in gasoline tax, a 1-cent increase in liquefied petroleum fees and 19 percent across-the-board increase in commercial weight fees. About 71.1 percent of this increase or \$53,300,000 will be apportioned to cities; the remainder of 28.9 percent or about \$21,500,000, will go to counties. All apportionments will be in accordance with statutory formulas.

## Road Programs Affected

Three existing street and/or road programs are affected by the act, and one new street and road program is created by the act. Two of the exist-

ing programs involve cities only; one involves counties only. The new program involves both cities and counties.

The old  $\frac{3}{8}$ -cent gas tax program available to cities for construction of major city streets and general street maintenance has been increased by 0.1 cent; this now becomes a  $7\frac{1}{4}$ -mill or 0.725-cent program. The act changes the percentages of these funds which can be spent for construction and maintenance; at least 40 percent must now be expended for construction, and a maximum of 60 percent may be spent for maintenance. The construction must be on a select system of streets; the maintenance may involve any street within the city.

The 0.1-cent increment which became effective with the November (1963) apportionment is estimated to amount to approximately \$6,600,000 in the 1964-65 fiscal year, increasing the cities' allocation under this program for this period to an estimated \$47,205,060. This program will be administered by the department generally under the same statutes which covered the old  $\frac{3}{8}$ -cent program. The only change in administrative procedures under this program is that projects may henceforth be given a field review by the department during construction.

The second program involving cities only which is affected by the act is that which provides gas tax funds for engineering or administrative purposes. This program is continued—the only change being that accumulated funds which are three years or older, if converted by a city to use for construction, must be spent on the select system of streets instead of on the old major street system. Administration of this program will continue as the responsibility of the department.

## For Counties Only

The third existing program affected by the act pertains to counties only.





Looking north along Santa Anita Avenue in the City of Arcadia, at the intersection of Camino Real Avenue. This is the type of local improvement which will be accelerated under the Collier-Unruh Act.

Previously, the counties received under various statutes the equivalent of the revenue from  $1\frac{1}{8}$  cents of gas tax, amounting to approximately \$81,000,000 in the 1962-63 fiscal year. They also renewed an additional amount which varied from year to year according to vehicle registrations. In the 1962-63 fiscal year this additional amount approximated \$14,000,000, bringing the total to approximately \$95,000,000.

Under provisions of the act, the statutes are simplified to the extent that effective January 1, 1964, the counties will receive apportionments equivalent to the revenue from  $1\frac{1}{8}$  cents gas tax. Under the new simplified formula some counties will receive more and some will receive less than they did previously; statewide, however, overall apportionments under the new formula are estimated to be somewhat greater.

#### **Old System Abolished**

The old county primary road systems are abolished in favor of a select system of roads, and the act stipulates that at least 20 percent of the new  $1\frac{1}{8}$ -cent funds must be spent for construction on right-of-way on this select system. The portion of the program involving these 20-percent funds will be administered by the department to the extent of verifying that the required expenditures are

made in accordance with directives of the act. The remaining portion of this program will continue to be administered by the office of the State Controller as in the past.

The new program created by the act, and which involves both cities and counties, is often referred to as the 1-cent program. Actually the act provides that the revenue from 1.04 cents of gas tax shall be made available to the local agencies beginning January 1, 1964. It is estimated that this new revenue will amount to about \$67,715,000 during the 1964-65 fiscal year. These funds will be allocated annually by the California Highway Commission and apportioned and paid monthly by the department.

Apportionments and payments will be made to eligible cities and counties in accordance with statutory directives. First of all, each eligible city will be entitled to a monthly grant of \$400 and each eligible county a monthly grant of \$800. The remainder of each monthly allocation will then be divided among the various counties on the basis of relative vehicle registrations. The amounts thus computed will constitute the "base sum" for each county. Each county's "base sum" is then divided between incorporated and unincorporated areas on the basis of assessed valuations. The "incorporated" areas' share is then divided between the cities making up that area on the basis of relative populations.

#### **Eligibility**

To become eligible for apportionments, each city and county must by official action adopt a resolution stating that it approves of the imposition of the additional gas tax and desires to participate in the resulting street and road improvement program. A copy of such resolution must, also, be filed with the department.

The act recognizes that the designated three-way formula for apportionment of funds may not in every instance adequately meet the local needs, particularly with respect to distribution within a county according to relative assessed valuation. To permit adjustments in this portion of the formula, the act authorizes local agreements between a county and any of its

cities for purposes of effecting a different basis for distribution of the county's "base sum" allocation. The department is required to verify such agreements prior to making the adjusted apportionments.

The funds thus received by each city and county must be expended for construction or acquisition of rights-of-way on a select system of streets and roads. Such expenditures must be used primarily for benefiting vehicular traffic on that select system; they must also be made in accordance with designated geometric and structural standards—the same standards used in preparation of the local street and road deficiency studies made for the Legislature in 1959 pursuant to Senate Concurrent Resolution No. 62. For sufficient cause the department is authorized to permit deviations from these standards.

#### **Intended to Supplement**

The select system of streets and roads upon which the funds are to be expended is, generally speaking, intended to supplement, from a traffic standpoint, the state highway system. A mileage limitation is established for each city and county select system equal to 50 percent of the total public highway transportation system, less the mileage of state highways. Selection of each local system is the responsibility of the individual city or county. This selection is guided by designated criteria and is subject to review and approval or modification by the Highway Commission. For purposes of permitting the expenditure of 1.04 cents or "matching" funds on cooperative projects on state highways, the act provides for their inclusion in the select system.

In order to provide local participation in the program the act requires "matching" expenditures by each city and county. This "matching" is on an annual basis, rather than a project by project basis, except that an opportunity is provided to accumulate "matching" credit for 10 years ahead. The "matching" funds must derive from sources other than the Highway Users Tax Fund or the State Highway Fund and they must be expended on the same select system and in accordance with the same standards as the

gas tax funds. The designated matching ratio which reaches a 1:1 basis after seven years starts with a 1:2 basis ("1"—local agency funds, and "2"—gas tax funds) for the initial four-year period.

#### **Matching Credit**

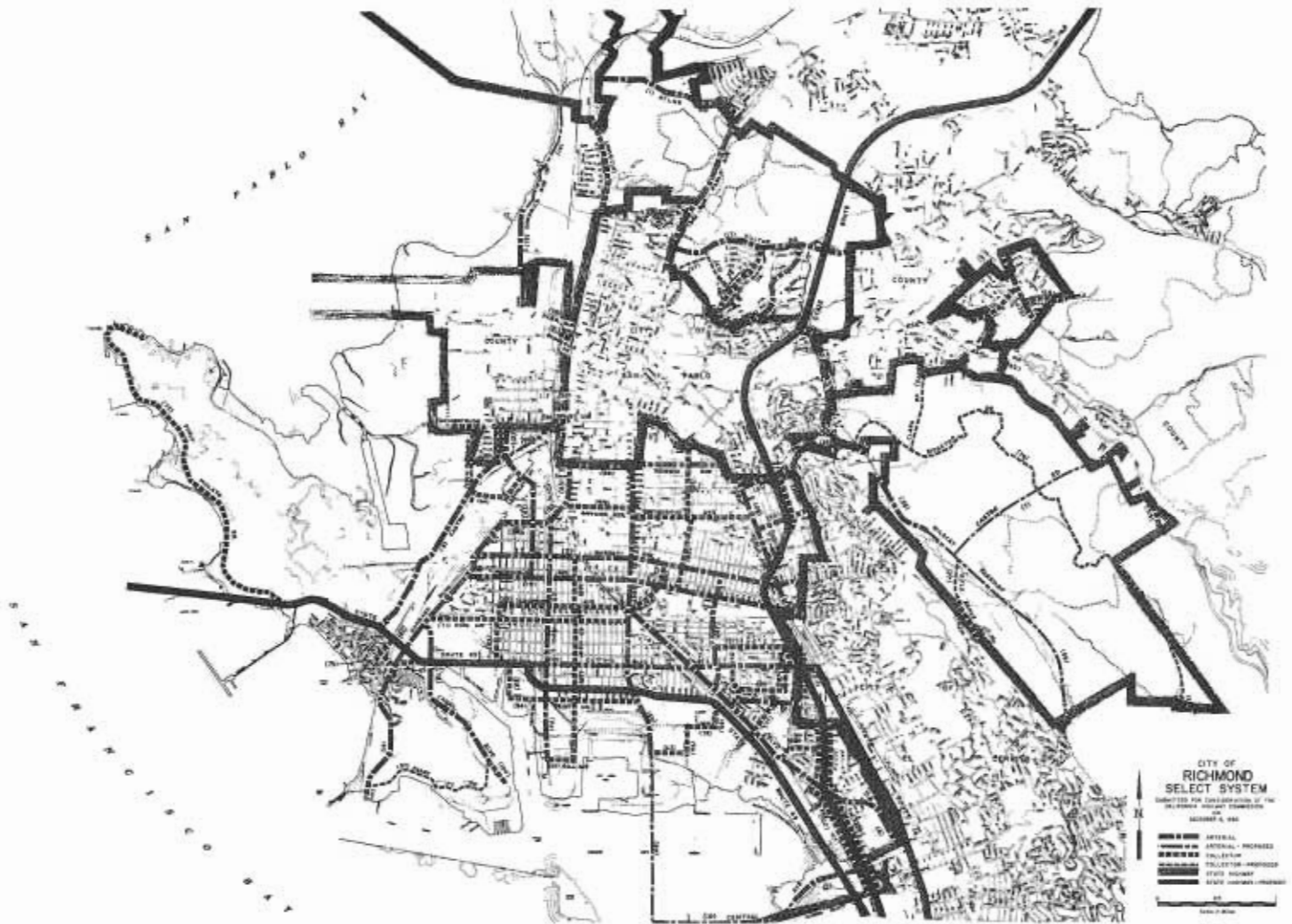
To permit the use by a city or county of certain local contributions for "matching" credit the act provides that expenditures by a subdivider, under the direction of a city or county, for construction or right of way acquisition on the select system shall be considered as expenditures made by that city or county.

The act provides that a report shall be submitted annually to the Legislature by the department covering expenditures by the local agencies on the select system. Fiscal information for this report is to be prepared by the cities and counties and forwarded to the department in two separate reports: one to be submitted by July 15 each year covering expenditures of "matching" funds, and the other to be submitted by September 1 each year covering detailed expenditures, in general. Information for the report covering actual construction of the select system roads and streets is to be obtained by the department by review and inspection of work in progress, or by audit and inspection of the work following completion.

#### **Penalties Listed**

To assure compliance of the new street and road improvement program with requirements, the act provides that for any one of four causes a city or county must forfeit by way of penalty the apportionments or portions thereof to which it would otherwise be eligible. These causes are:

- (1) Failure to submit the original resolution concurring in the imposition of the additional gas tax and expressing a desire to participate therein.
- (2) Failure to expend the allotted 1.04-cent gas tax funds within a specified (five-year maximum) period.
- (3) Failure to expend sufficient "matching" funds in any fiscal year when "matching" credit has not previously been established.



A typical map showing the new select system of roads and streets, this one for the City of Richmond.

(4) Failure to construct an improvement project in accordance with designated standards or approved deviations therefrom.

Funds withheld from future apportionments by the department for causes (1), (2), and (3), above are automatically redistributed to the other cities and counties. Funds withheld for reason (4) are held in suspense by the department pending correction of the deficiency by the city or county. If this correction is not made within a specified period (four-year maximum) the funds are reapportioned to the other cities and counties.

Administratively, the most important responsibility given to the department under terms of the act involves verification of compliance of expenditures under the act with the numerous provisions of the act, and the possible

withholding of funds from future apportionments for noncompliance.

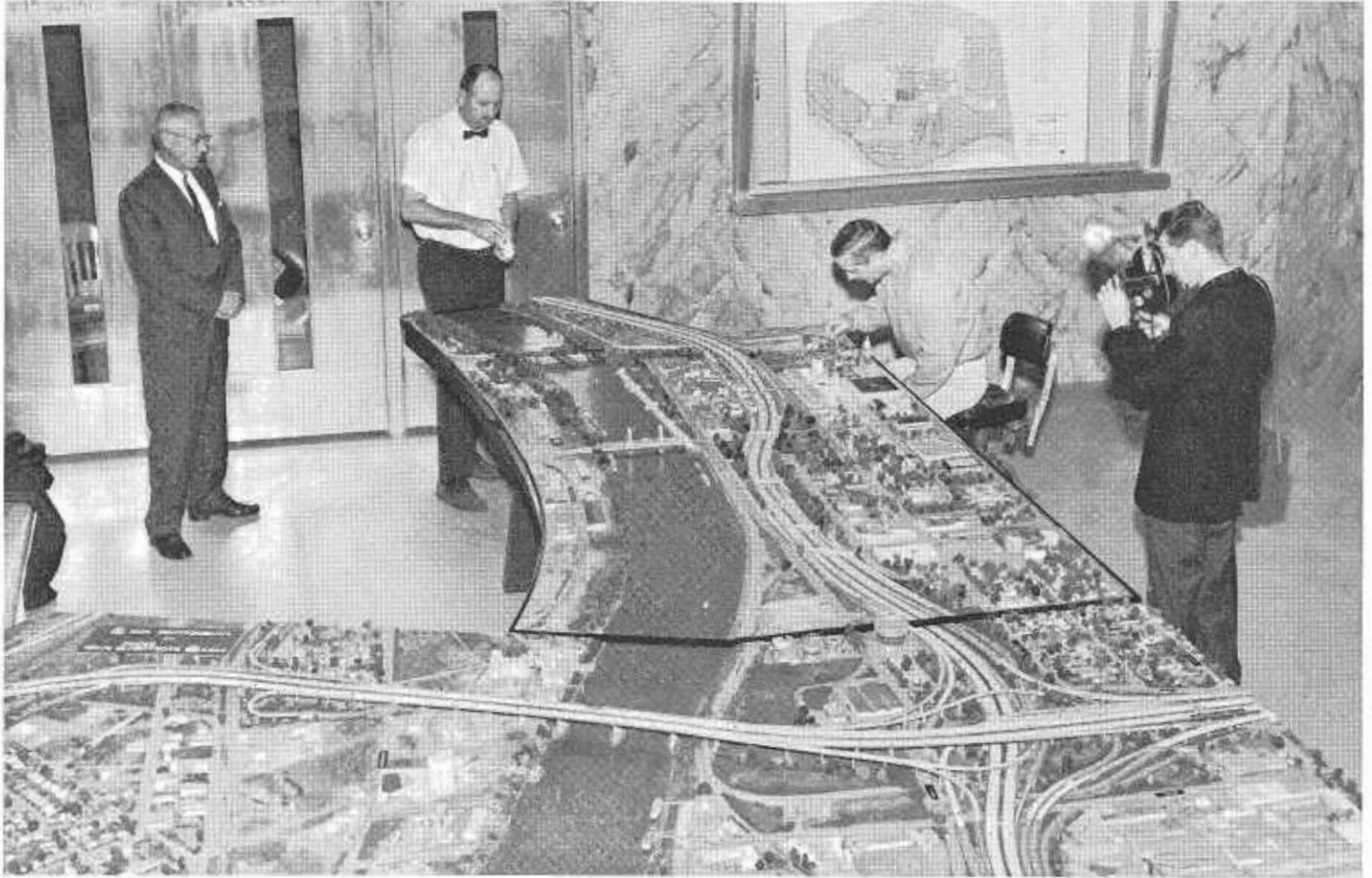
The act does not require a city or county to submit any program, nor any plans or specifications. In order to facilitate administration, however, the department is requesting that each local agency where possible submit annually a brief outline of its proposed work schedule, a set of plans and estimate of quantities if available when a project is advertised, and a notice of when a project is started and when it is completed. It is felt by the department that compliance with this request will result in greater benefits to a city or county than any inconvenience that may be caused. Also, while not required by the act, in order to be of maximum assistance to the cities and counties, and in an effort to minimize possible nonconformance of projects with designated standards and

criteria, the department will be available to give prior review and comment regarding any plans when so requested by a city or county.

In summary, it can be said that the act specifies three distinct levels of responsibility: one by the California Highway Commission, one by the Department of Public Works, and one by the local city and county governments. Further, the act enumerates four separate conditions under which a city or county must forfeit by way of penalty the apportionments or portions thereof to which it would otherwise be eligible. As a cooperative undertaking by governments of the State, it should be incumbent on all three levels of responsibility to see that the necessity for penalty forfeitures does not arise and to strive together to make this a successful as well as a workable gas tax program.



# Sacramento Freeways Model Exhibited in Capitol



Two large three-dimensional models of a portion of the freeway complex planned for Sacramento went on display in January in the east wing lobby of the State Capitol. The models, prepared by the Bridge Department's architectural section, had been on display separately in various locations, and were joined together for the Capitol exhibit. The Sacramento River is shown in the center, with the Interstate 80 freeway bridge (now under construction) in the foreground, as it will appear by 1967. The north-south freeway paralleling the river is Interstate 5. It swings away from the river just north of the Tower Bridge to fit in with the Sacramento Redevelopment area and historic landmark plans. Shown putting finishing touches on the model before the clear plastic cover was fitted over it are Louis Baker (standing) and William H. Tuthill (seated) of the bridge architectural section. At left is Assistant District Engineer H. F. Sherwood of District III, and at right is a Sacramento television cameraman recording the installation of the display. The exhibit remained in the Capitol until early in March and was then moved to location in downtown Sacramento.

Continued from page 52 . . .

The AC Transit System has cut time schedules of their transbay buses and have attributed the time savings to the completion of improvements on the bridge.

Reconstruction of the bridge has also provided the additional capacity to handle increased traffic which has been developing during the intervening years. In November of 1963, a new high of 145,046 vehicles crossed the bridge without incident in a single 24-hour period. The average daily traffic for the calendar year 1963 was 119,506 vehicles. In 1958, the year reconstruction was started, the volume was 99,295.

N. C. Raab, projects engineer, was in overall charge of reconstruction of the San Francisco-Oakland Bay Bridge from the inception of the project in 1957 until his retirement in July 1963. Construction was supervised by Ben Balala, principal bridge engineer, and his assistant, Howard C. Whitty. Design was accomplished under the direction of Howard F. Topping and Vernon J. Richey.

There still remains some mechanical and electrical work to be done, including the installation of additional call boxes to increase the ease with which motorists can call for assistance when in difficulty. The lower deck is to be resurfaced under a contract

which will be started this spring, and new equipment to help maintenance forces will be installed. These contracts along with some minor items, will finally complete the rehabilitation of the Bay Bridge. However, the major goal has been reached—that of transforming the structure to unidirectional traffic.

The Department of Public Works has awarded a \$1,739,000 contract for constructing 1.2 miles of six-lane freeway on State Sign Route 22 (Garden Grove Freeway) between Harbor Boulevard and Garden Grove Boulevard in Orange County.

# Critical Path Method

By RICHARD V. POTTER, Systems Research Engineer

In December of 1962 a two-day management conference was held in Sacramento for division personnel of principal grade and up, covering a review of electronic data processing methods and procedures. At this session two hours were devoted to an explanation of critical path method and the application of this scheduling technique to various phases of highway work. For a few present this was the second introduction to CPM, the first having been at a regional conference on improved highway engineering productivity held in San Francisco in March of 1962 under auspices of the U.S. Bureau of Public Roads.

## Elements Demonstrated

The Sacramento discussion of CPM was basic. Elements of the process, nomenclature, explanation of terms, arrow diagramming and computer applications were demonstrated by a representative of the Sacramento office of the IBM Corporation. This introduction was followed by a projector exhibit and step-by-step explanation of a CPM network for a hypothetical single-span bridge construction project (Figure 1). The network of diagrammed construction operations illustrated how restraints of time throughout the project could be visually appraised and decision-making helped in the economical assignment of men and equipment on the simulated bridge construction project.

The CPM network and material used for this explanation were taken from an article by L. R. Schureman of the U.S. Bureau of Public Roads in the April 1962 issue of *American Highways* magazine. This acknowledgement is mentioned to point up the then existing situation that although several articles depicting the use of CPM in the building industry and in missile production had appeared, very few articles relating critical path procedures to highway operations or couched in terminology



A workshop photo, showing the instructors, R. C. Tennent (left) and L. R. Schureman (right) of the Bureau of Public Roads.

readily understandable by highway people had been published.

The Sacramento management conference discussion concluded with a display and explanation by Raymond K. Sweet, program and budgets engineer, District VII, of model or typical CPM networks applicable to highway planning and design work which were then under study in the district.

## Interest Stimulated

This indoctrination to the multiple uses of CPM in highway work stimulated interest in the subject in the division and led to a decision to arrange for training on the subject for selected personnel from district and Headquarters units.

In October 1963, the division was fortunate in obtaining L. R. Schureman and R. C. Tennent of the Bureau of Public Roads to conduct a two-day workshop seminar in Sacramento covering basic principles of CPM technique and its application to highway work. The Bureau of Public Roads was at the time undertaking a comprehensive study of CPM as it relates to diversified functions of highway work. It subsequently has sponsored publication of an illustrated procedural manual for applying the critical path method to highway department

engineering and administrative functions. Copies of this manual have been requested for distribution in the division.

A staff engineer in Headquarters Design, Ebert Jung, was designated in 1963 for liaison on the subject of CPM with the districts and coordination of CPM applications in various functional areas of highway effort. At this writing a moderate backlog of CPM networks has been obtained together with explanatory material. The networks and related information are available to the districts upon request.

## Varied Experience

Experience of the districts in application of CPM technique is varied and a few instances are mentioned.

Using the planning program as a basis, District I has developed a production control chart for all projects, extending these data to the year 1967. Control dates related to all major preconstruction activities between inception and advertising, for each project, are then transferred to a master critical path diagram. The district coordinator furnishes department heads with copies of this diagram and reschedules functional activities where conflicts in planning or work overloads occur.

For greater detail at the project engineer level, District I uses an advance planning critical path network and a design department critical path diagram.

District III has networked three design projects on interstate and federal aid routes, two having about 100 activities and the third having 240 activities. Time data from these networks were listed on input forms furnished by Headquarters and computer print-outs obtained tabulating the activities which fell on the critical path. The district found the data valuable in scheduling manpower and predicting areas susceptible of delay. In each instance the so-called LESS program (least-cost estimating and scheduling) was used to computerize the network data. The PERT program (program evaluation review technique) has also been taped in the division's data processing center and is available for use in producing tabulations based on utilizing the "pessimistic", "average" and "optimistic" time factors predetermined for the activities.

#### Advantages Summarized

District IV recognized that networking the contractor's job operations would provide means for the design project engineer to become more knowledgeable about the sequence of construction operations from the contractor's point of view and concurrently furnish a way to confirm the estimate for number of working days in a contract furnished in the preliminary report. Advantages of contract time analysis by CPM have been summarized by District IV as follows:



Staff engineers work out a CPM exercise at the workshop session.

1. Factors such as utility relocation controls, traffic handling, stage construction, ordering and fabricating time allowances, settlement periods, specified order of work, practical sequence of construction operations, etc. can better be analyzed with respect to their effect on overall construction time requirements.

2. A comprehensive, clear, visual diagram of the entire job is provided. The Construction Department and Headquarters can better determine exactly what the designer considered in arriving at the recommended time limit.

3. Controlling items can be clearly recognized and identified, allowing the consideration of the effect of changes or modifications toward either lengthening or shortening the overall time as the individual case requires.

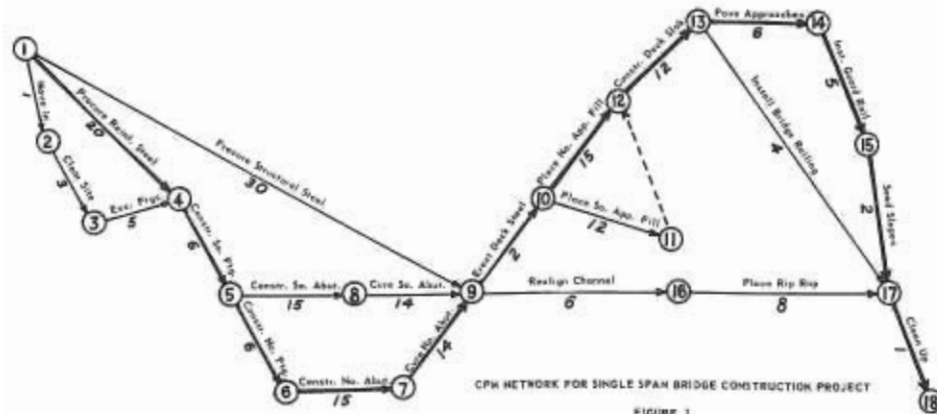
4. Network preparation encourages the designer to think logically and systematically, thereby eliminating many possible oversights and omissions.

5. The method has the capability of allowing computer application if the project variables and controls are complex.

The district's instructions require that, in addition to including in the preliminary report the usual bar chart (Form R-147) for estimate of construction time, a CPM network analysis of the construction operations also be prepared and submitted in the preliminary report for corroboration of the estimated number of working days.

#### Departmental Training

Departmental training on CPM in District IV is handled by the district's programs and budgets department with the greatest activity so far being in application of the technique to pre-construction work. Network analyses have been used in 22 design projects to arrive at more realistic plan completion dates and to better insure meeting significant intermediate dates. The PERT and LESS computer programs have been used in some of these projects. The district observes that better project coordination has resulted as intermediate dates involving service departments are determined ahead of time and these departments are then in a position to evaluate their work loads and prepare themselves to meet the required target dates.



CPM NETWORK FOR SINGLE SPAN BRIDGE CONSTRUCTION PROJECT

Figure 1. Sample CPM network for single-span bridge construction project. Heavy line illustrates the critical path.



District IV considers that the project engineer is the key man in preparing a CPM analysis on a particular project. Since such an analysis requires a wide knowledge of procedures and activities to complete a project in design, every department in District IV has prepared a flow diagram of its activities and operations involved for a hypothetical large Interstate freeway project. These departmental diagrams materially aid the project engineer in the preparation of the CPM network.

#### Further Studies

In addition to its pioneer work in developing CPM networks for use by project planning and design engineers, District VII is currently studying means to schedule the district's entire planning program on a CPM network to the degree that progress of the

principal functional stages of each project in the overall program can be monitored.

In the processing of contracts the division does not include in the special provisions any requirement for submission of critical path networks by bidders. In this area, however, contractors on highway construction in California have voluntarily programmed their operations on the basis of CPM and other public agencies in the State such as the U.S. Corps of Engineers and the Department of Water Resources have advertised work specifying submission of CPM networks by successful bidders.

Critical path networking can alert management to areas where program conflicts exist. Overload departmental situations can be detected and a visual means furnished for adjustment with a probability of success. The tech-

nique provides an excellent means of scheduling manpower by names and dates, reporting progress and communicating status of work to supervisors and subordinates. The disciplined thinking required for scheduling a complex project from inception to final completion results in orderly planning and job coordination.

The scheduling of highway work in the planning, design, right-of-way, construction and maintenance phases of the division's work by critical path technique is optional. It is the prerogative of each district or divisional unit to develop networks applicable to its methods of project development, taking into consideration the talent available in the district for network development, the cost and the practical benefits to be derived from the scheduling undertaken.

## Scenic Highway Advisory Committee Holds Meeting



The Governor's newly appointed Scenic Highway Advisory Committee met in Sacramento on February 19. Those attending were (seated around table beginning left): Edwin S. Moore, member, executive vice president of the California State Automobile Association; Robert Grunwald, member, landscape architect from Hanford and currently president of the California Chapter of the American Institute of Planners; Dee W. McKenzie, member, Chief of the Design Section, Highway and Bridge Division of Sacramento County; Senator Fred S. Farr of Monterey County, sponsor of the legislation creating the committee; John Erreca, State Director of Public Works; Harry P. Schmidt, committee chairman, County Supervisor of Merced County from Gustine; Richard M. Leonard, member, an attorney from Berkeley; Nathaniel Owings, committee vice chairman, partner in a San Francisco architectural firm whose home is in Big Sur; and C. Perry Walker, member, an engineer now also serving as city councilman of Manhattan Beach and who is past president of the League of California Cities. Seated against the map in right background between Leonard and Owings is Lawrence E. Larsen, assistant design engineer for the State Division of Highways.

# ITTE Meeting

Street, Highway Conference  
Stresses 'Broader Picture'

Many of the nearly 500 street, road, highway and traffic experts of city, county, state and federal government who attended the 16th annual street and highway conference sponsored by the Institute of Transportation and Traffic Engineering at the University of California, Berkeley, January 30-February 1, remarked that several of the speeches reflected great changes in California's highway picture.

"I never thought the head of the Bureau of Public Roads (Rex M. Whitton, Federal Highway Administrator) would fly to California to tell us that increased costs can be justified in locating and designing highways to improve their appearance," one said, "or that the Chairman of the Senate Transportation Committee (Senator Randolph Collier) would devote half of his speech to airport development." "Even though Senate Bill 344, which Ledden (Charles T. Ledden, City and County Projects Engineer, California Division of Highways) explained to

us, will increase our workload," a county road commissioner added, "it will go a long way toward making our streets, roads and highways a smoothly integrated system."

#### Whitton Urges Aesthetics

Whitton appeared as the first speaker after the welcoming address by Dean George Maslach of the University's College of Engineering. Urging increased attention to aesthetics, Whitton said that highway engineers in the past may have underestimated its desirability or overestimated its possible added costs. He praised the increasing tendency toward enlisting landscape architects and city planners to assist in highway location and design.

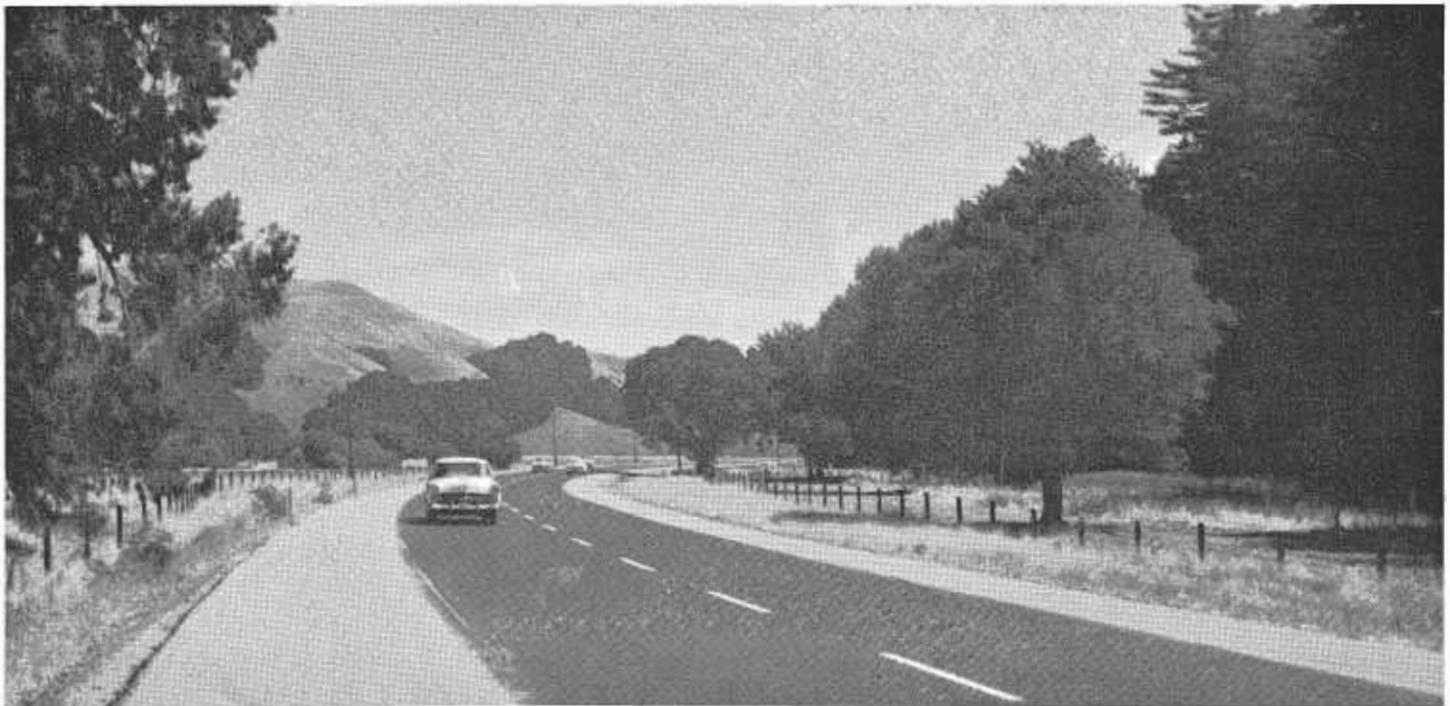
"Note that I include location as well as design," Whitton said "Aesthetics must be an important consideration from the beginning; it is not a trimming to be tacked on after the location is settled and the design details are half done."

The Federal Highway Administrator pointed to the 41,000-mile interstate highway system, 80 percent of which is on new location, as causing the greatest single impetus to the blending of aesthetics and engineering.

He suggested that engineers inventory scenic points of interest which might affect route location and take advantage of any breathtaking vistas for locating safety-rest areas.

Later in the program, Harry D. Freeman, Deputy Director for Planning, California Department of Public Works, told attendees that the Legislature gave serious and sympathetic attention to the conservation of natural scenery and the need for aesthetics and recreation at its last session.

Freeman used color slides to illustrate views of the scenic corridors along the routes of the "master planned" scenic highway system provided by Senate Bill 1467, and outlined steps that must be taken by local governmental bodies to protect them.



This section of Sir Francis Drake Boulevard (Federal Aid Secondary County Road 608) in Marin County northwest of San Rafael illustrates the point made by the speakers at the recent Street and Highway Conference that highways should be aesthetically pleasing as well as functional.

### **Tribute to Collier**

The Chairman of the Assembly Committee on Transportation and Commerce, Tom Carrell, preceded Senator Collier on the program, and paid tribute to him as the man nationally known as "Mr. California Highways," and to "a forward-looking Highway Commission."

Part of California's success in new and better highway facilities, he indicated, "has been accomplished largely through the recruitment of the nation's finest group of planners, designers, engineers, land acquisition experts and technical personnel."

He added, "California's highway problems are unique by reason of the State's size, population growth rate, and the great extent to which we have become a people dependent upon automotive transportation."

Assemblyman Carrell referred to two measures introduced by him in the 1963 General Session of the Legislature to relieve traffic congestion and promote safety. One provided for the channeling of slow-moving traffic into the right-hand lanes of multiple-lane highways. The other provided for increasing the maximum speed limit on certain freeway stretches to 70 miles per hour where, in the opinion of both the Division of Highways and the Highway Patrol, it is safe to do so.

Senator Collier had addressed last year's streets and highways conference in Los Angeles on the need for support for legislation he had sponsored for obtaining financing for proposed select systems of city streets and county roads.

He told the delegates at this session that, "Obviously, all of you did your homework, and, when the chips were down, Senate Bill 344 went through both houses with exceptionally strong votes and provided about \$70,000,000 annually for city streets and county roads."

### **Senator Reviews Legislation**

The Senator reviewed the legislative intent of the 1947 Collier-Burns Act and subsequent laws aimed at the efficient administration of State provided funds.

"The Legislature has an interest in local streets and roads because of their fundamental importance in the overall highway system. The Legislature also

has an obligation to insure that local road departments are operated efficiently, because it is the Legislature that imposed the taxes to finance the road program."

Referring to the increased attention to highway aesthetics, he said, "We must attempt to direct the efforts for these facilities (programs for scenic highways, roadside safety rests, elimination of billboards, etc.) so that a reasonable amount of money is allocated to these 'nonproducing functions,' and also to see that the maximum aesthetic value is received for each dollar so allocated."

Senator Collier devoted the last half of his talk to legislative studies in progress to protect and preserve existing airports from encroachment and to finance improvements in facilities for general aviation.

Division of Highways City and County Projects Engineer Charles T. Ledden discussed the procedural policies which have been developed for the implementation of Senate Bill 344 as it relates to the financing and improvement of county roads and city streets.

These administrative procedures, he emphasized, resulted from cooperative effort by representative committees appointed by the League of California Cities, the County Supervisors Association of California, and the State.

### **Select System Explained**

"The select system of streets and roads upon which the funds are to be expended, generally speaking, is intended to supplement, from a traffic standpoint, the state highway system," Ledden said.

He advised city and county delegates of the four ways in which apportionments may be forfeited (see article, "Collier-Unruh Act," page 55) and promised that the staff of the Division of Highways is available when requested by cities and counties to review plans to minimize possible non-conformance of projects with designated standards.

Charles G. Beer, urban planning engineer, Division of Highways, outlined the requirements of the Federal Aid Highway Act of 1962 for projects in urban areas of more than 50,000 population to be eligible for federal funds after July 1, 1965.

All such projects, he said, must be based on a continuing comprehensive transportation planning process carried on cooperatively by the State and local communities.

The eighth metropolitan areas affected by this legislation are those covered by the Los Angeles Regional Transportation and San Francisco Bay Area Transportation studies, and the San Diego, Sacramento, Fresno, Bakersfield, Stockton and Santa Barbara areas.

"The Division of Highways is seeking the active support of local governments in these metropolitan areas," Beer said, "to make certain that the benefits of the federal aid highway funds are not lost to the State."

Beer declared the act's provisions reflected the impatience of the American people with piecemeal transportation planning.

Pointing out that the federal government requires a formal procedure, supported by a written memorandum of understanding or agreement between the State and the governing bodies of local communities, he added, "the basic agreement is a matter of high priority, and to provide for the necessary reviews, we believe it should be executed by July 1, 1964. This will allow one year in which to secure any modifications considered necessary and any supplemental agreements on essential subject matter areas."

### **Other Speakers**

Other speakers at the conference's general sessions included Leland J. Deverman, office of the State Controller, who spoke on the new uniform budget and road accounting procedures, and Lee N. Glaeser, Controller, Santa Clara County, who commented on Deverman's remarks; Robert C. Lynch, Deputy County Counsel, Los Angeles County, who explained recent developments in public liability; and Arnold Olitt, Vice President, Woodward, Clyde, Sherard and Associates, Oakland, who discussed the structural design of roads and streets.

Harmer E. Davis, director, Institute of Transportation and Traffic Engineering, made several predictions



concerning future transportation patterns and closed the conference.

The luncheon meeting at the Claremont Hotel, Berkeley, on the final day was addressed by R. H. Minor and Arthur Leinwohl of the management systems, Lockheed Missiles and Space Company, Sunnyvale, who analyzed the effect of the national population explosion on the supply of raw materials and the future role of transportation.

Following the morning general meetings, delegates attended workshop sessions on the opening day of the conference on right-of-way problems, the geometric design of roads and streets, street and highway maintenance, planning for moving traffic, guardrails and median barriers, avoiding legal liabilities in public works, construction job controls and changed conditions, and planning for parking.

#### Other Subjects Discussed

The second day's workshops considered soil stabilization and drainage, problems of mass rapid transit, purchasing specifications, getting the most out of limited right-of-way, the use of continuous left-turn lanes, the critical path method for preconstruction scheduling, engineering and construction procedures for San Diego streets, maintenance agreements between state and local agencies, and traffic safety techniques and equipment.

Richard F. Lovejoy, City of Richmond Director of Public Works; A. C. Keith, Road Commissioner, Riverside County; and J. P. Sinclair, Assistant State Highway Engineer, District IV, San Francisco, were chairmen and vice chairman, respectively. Robert E. Cron, Jr., of the Institute of Transportation and Traffic Engineering, served as general secretary, and Wayne H. Snowden, also of the Institute, was in charge of publications.

A \$5,868,000 contract was awarded by the Department of Public Works on April 6 for grading and paving 4.5 miles of freeway on U.S. 299 between Mad River and Blue Lake in Humboldt County and grading an additional mile north of Blue Lake for future freeway.

## 'Tempus Fugit' Corner

The following items appeared 25 years ago in *California Highways and Public Works*.

### NEW SEPULVEDA LINK OPENED

The formal acceptance by the State on November 30, 1938, of the 3.66-mile paving contract connecting San Fernando Road, just northerly of San Fernando, with Brand Boulevard, marked the opening to through traffic of a direct route (via Sepulveda Boulevard) between the Ridge Route Alternate and the Los Angeles Harbor and West Coast beach cities, including the communities of Santa Monica, Ocean Park, Venice, El Segundo, Manhattan Beach, Hermosa Beach, Redondo Beach, Long Beach, and points southerly.

Traffic from the San Joaquin Valley formerly was required to pass through downtown Los Angeles or the congested Hollywood district in order to reach the harbor or West Los Angeles and the beach cities.

Federal requirements in connection with grading this section provided that grading work be done by hand labor methods. About 350,000 cubic yards of roadway excavation were removed in this manner at a cost of \$488,613.72. The project afforded employment amounting to 486,316 man-hours of labor.

### MOUNTAIN SPRINGS GRADE PROBLEMS

Since construction was started in October on the upper portion of the Mountain Springs Grade, the contractor has made very good progress on this difficult piece of highway construction, according to E. E. Wallace, district engineer.

In the development of both railway and highway transportation between the agricultural areas of the Imperial Valley, southwestern Arizona and San Diego's favorable shipping and harbor facilities, the mountain range along the San Diego-Imperial county border has always been the major barrier.

The contract item of roadway excavation involves the movement of approximately 100,000 cubic yards per mile. The excavation consists, for the

most part, of granite rock, and in consolidating this rock into the embankment sections it is proposed to use 13,000,000 gallons of water. This large amount of water will be used to flush the fine material down through the voids in the rock, and thus consolidate the embankments to prevent future settlement. The contractor has installed a water line, and is pumping water from Jacumba, 5½ miles westerly from the project.

The roadway section must be constructed through a section of high, steep, rocky slopes, and in order to retain the embankment, and to prevent the fill material from spilling far down these slopes, metal cribbing is to be installed. . . . The new roadway will be 36 feet wide.

The Mountain Springs Grade section of U.S. Highway 80 has gradually developed from an old wagon stage road, rising from the desert below sea level to the summit of the Coast Range. It extends from El Centro, 44 feet below sea level, to an elevation of 3,240 feet at the summit near the county line.

### WESTERN STATE HIGHWAY OFFICIALS MEET

The annual meeting of the Western Association of State Highway Officials was held at San Francisco March 6, 1938. The meeting was purposely scheduled at that time so that it might run concurrently with the national convention of the American Road Builders' Association and the national convention of the Associated General Contractors.

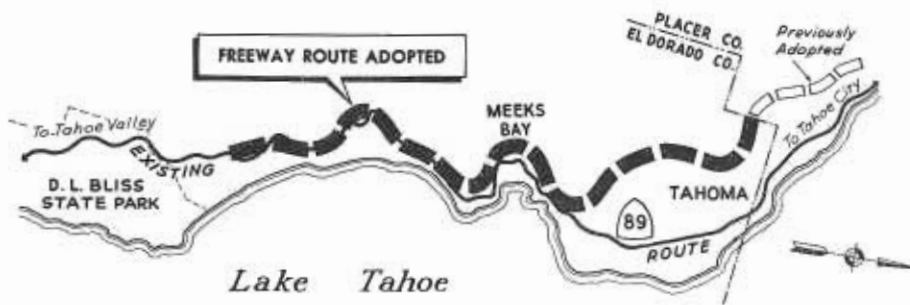
At the opening session the delegates were welcomed by C. H. Purcell, State Highway Engineer, representing Director of Public Works Frank W. Clark.

On Thursday morning the meeting was devoted to a discussion of soil studies led by T. E. Stanton, Materials and Research Engineer of the California Division of Highways.

A \$2,595,000 contract has been awarded by the Department of Public Works for constructing four miles of four-lane freeway on U.S. 101 between North Main Street in Salinas and Espinosa Road in Monterey County.

# New Routes

Another 30 Miles of  
Freeways Are Adopted



Lake Tahoe

The California Highway Commission adopted nearly 30 miles of freeway routings on three existing and one planned route in the year's first two months, including a 4.6-mile stretch in San Francisco and San Mateo Counties and a six-mile scenic parkway type routing in the Meeks Bay area of Lake Tahoe in El Dorado County.

The other freeway routings were in San Joaquin, Calaveras, and Trinity Counties.

Additionally, the commission adopted a 2.9-mile improved routing of State Sign Route 36 in Humboldt County, a conventional highway.

#### Hunters Point Freeway

The San Francisco-San Mateo routing was for what is known locally as the Hunters Point Freeway between a connection with the Bayshore Freeway (US 101) in Brisbane, three-fifths mile south of the San Francisco county line, and the junction of the future extensions of the Embarcadero

and Southern freeways near Evans Avenue in San Francisco.

The commission conducted a public hearing on the matter on December 11, 1963.

The adopted route, the "D-C" line discussed at earlier hearings held by the Division of Highways, crosses the tidelands area in a northeasterly direction to east of Candlestick Park, continues on a northerly alignment across the western portion of South Basin, then extends north and east of the P.G. & E.'s station into India Basin before turning northwesterly to the northern project limit.

Noting that the adopted routing is longer, more costly, and will have fewer user benefits than the one recommended by the State Highway Engineer, the commission said its choice was based on the superior overall effect of the adopted route on the social, economic and general welfare of the community.



The adopted route was favored by various local authorities and community organizations.

#### Supervisors Endorse Route

The adopted route in El Dorado County was endorsed by the county board of supervisors and recommended by the State Highway Engineer. It generally follows the existing alignment of State Sign Route 89 from one-half mile north of the D. L. Bliss State Park to the El Dorado-Placer county line where it will connect with a freeway routing to the north adopted by the commission in March 1963.

State Highway Engineer J. C. Womack said that the scenic parkway-type facility will have a screen of natural vegetation between the highway and adjacent homes and will take advantage of the scenic corridors off the freeway's right-of-way.

The new, freeway routing for 14.7 miles of State Sign Route 8 runs generally north of and parallel to the existing highway, eliminating sharp curves and dips, between the Calaveras River near Bellota in San Joaquin County and State Sign Route 12 near Valley Springs in Calaveras County.

#### Scenic Highway Route

Weaverville-Scott Mountain Road (Federal Aid Secondary County Road 1089) in Trinity County, a route between U.S. 299 at Weaverville and U.S. 99 at Yreka, was included in the state scenic highway system enacted by the Legislature in 1963. It will be known as State Route 3.

The adopted freeway routing generally will traverse the eastern portion of the Trinity River Valley between Coffee Creek and Ramshorn Road, a distance of 4.6 miles.

The improved routing of 2.9 miles of State Sign Route 36 in Humboldt County between 8.8 miles east of Bridgeville and the South Fork of the Van Duzen River will replace the present 20-foot-wide treated gravel facility that has little or no shoulder and is subject to flooding during rainy periods.

The start of construction of all of the newly adopted routes will depend upon the availability of future highway funds.

## IN MEMORIAM

### District II

Paul A. Myers, Highway Maintenance Man II.

### District III

Lester E. Hunt, Highway Foreman; Harold C. Altic, Janitor.

### District IV

Donald Anderson, Assistant Highway Engineer.

### District VII

Alvin Chaney, Garage Attendant; Ina Sebastian, Supervising Clerk II; Richard Withers, Assistant Highway Engineer.

### District X

Joseph B. Bland, Highway Foreman.

### District XI

Louis Celerio, Highway Landscape Leadingman.

## Spec Section Loses J. W. "Wes" Coghill

John W. "Wes" Coghill, a 42-year employee of California Division of Highways, retired December 31, from his position with the division's Specifications Section.

During the past six years, Coghill has been responsible for issuing weekly progress reports indicating status of current highway projects throughout the state, keeping current records of budgeted projects, and many related duties.

His Highways career began in 1921, as clerk in the division's accounting section, then located in the Forum Building. After two years he became assistant chief clerk in the Headquarters Shop, 34th and R Streets, where he later became cashier and timekeeper. In 1928 he went to the District VI office in Fresno, as equipment clerk. He returned to Headquarters in Sacramento in 1947

## Baumgart Retires From Records Section

Walter M. Baumgart, records management analyst for the California Division of Highways, retired on February 13 after 33 years in state service.

A native of Princeton, Indiana, Baumgart also attended grade and high school there. He worked as an accountant for a bank and private businesses before joining the Division of Highways in 1931 as chief of its headquarters files and mail unit in Sacramento.

Baumgart was one of the first employees to be assigned to the division's record management section, which was created in 1957 to reorganize and streamline its voluminous files. This streamlining has since been carried on through destruction of obsolete material, elimination of record duplication and transfer of infrequently used records to low-rent space in warehouses, all resulting in a substantial savings in office space.

Baumgart's assignments have taken him statewide both within the division and on loan to other divisions within the Department of Public Works. He has also participated in the training of other state personnel in records management procedures.

Baumgart's contribution to the records program has been especially valuable because of his wide knowledge of the contents and procedures of the existing files.

Baumgart and his wife have a son and a daughter and three grandchildren.

He is a charter member of the California State Employees' Association and of the State Employees Credit Union (he holds Passbook No. 16).

to work in the accounting section; and in 1956 transferred to the Specifications Section.

Coghill was born in Cincinnati, Ohio, coming to California in 1909. He graduated from Sacramento High School and attended business college.

He is affiliated with the Masonic Lodge at Clovis.



# Bridge Costs

1963 Average Remains  
Same as Previous Year

By HARRIS K. MAUZY, Senior Bridge Engineer and  
WILLIAM J. YUSAVAGE, Associate Research Analyst

The general level of bridge construction costs during 1963 were essentially unchanged from the level established in 1962. The annual average index for both years was 274. The corresponding annual average index for 1961 was 264 or one which indicates that the net increase in bridge construction costs over the past two years was of the order of 3.8 percent. It is of some interest to note that except for the year 1960 when the level of costs dropped to an average index of 248 all other values back to 1956 have clustered about a value of 270.

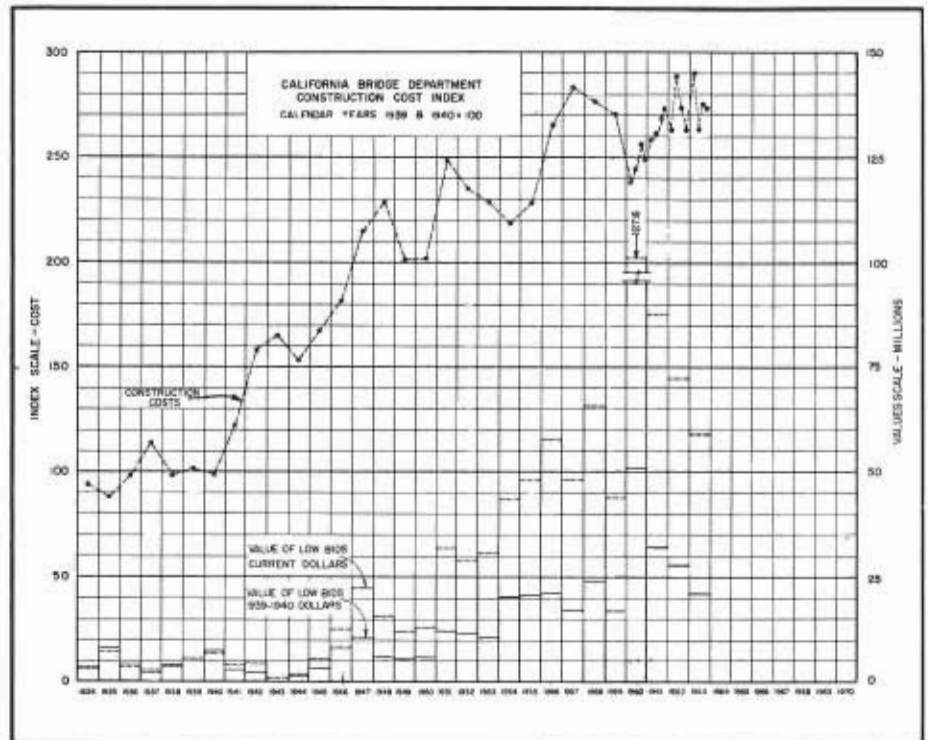
The general trend of construction costs as well as the trends of other relevant construction data are presented in the accompanying chart which summarizes the data of California bridge construction activity since 1934.

## Construction Activity

During 1963 bids were received for 133 projects which included 422 bridges and a total value for bridge work of \$59,388,693. The corresponding value for bridge construction during 1962 was about \$72,000,000. The value for 1964 is expected to approximate \$85 million.

## Bidder Activity

Bidder activity, which was significantly curtailed during all of 1961 and the first three quarters of 1962, increased only moderately during the five succeeding quarters. The total number of bids submitted for 133 projects in 1963 was 843 for an average of 6.3 bidders per project. The corresponding averages for the four years, 1959 through 1962, were 8.8, 7.3, 5.8, and 6.0. The averages reveal a very definite correlation between strong competition and falling prices during late 1959 and all of 1960, and the subsequent stability in both the level of construction costs and the average rate of bidding.



## Average Unit Prices

The weighted average unit price of most bridge construction items in 1963 showed only moderate variations from the corresponding prices of 1962. The general trends of the more significant items follow.

**Class A Portland Cement Concrete.** The amount expended annually for structural concrete represents about 45 percent of the total expenditures for all bridge items. The general trend of unit costs for concrete shows a downward movement from 1957 to 1960 with the cost moving from \$58 to \$50 per cubic yard. The trend reversed in 1961 when the unit price increased to \$56 per cubic yard. The upward trend has continued into 1962 and 1963 with prices of \$59 and \$61 per cubic yard.

**Bar Reinforcing Steel.** The unusual downward trend of unit prices for bar reinforcing has continued

through 1963. The weighted average unit prices for 1958 and 1959 were \$0.124 and \$0.113 per pound. In 1960 the price dropped to \$0.097 per pound. During the subsequent years of 1961, 1962, and 1963, the corresponding unit prices were \$0.094, \$0.092, and \$0.091 per pound.

**Structural Steel (Plate Girder).** The summary unit price of structural steel now includes the quoted prices of A-36 and A-441 steels as well as A-7. The previously specified A-373 type of steel has been deemphasized and the higher strength A-36 steel is now favored. The inclusion of the costs of the higher strength steels will exert a slight upward bias on weighted average structural steel prices but since the dominant addition will consist of A-36 which has been quoted and found costing about 4 mills additional per pound, the overall distortion will be minimal.

Weighted average unit prices of steel have been relatively stable over the past five years; average unit prices for the years 1959 through 1963 were \$0.163, \$0.169, \$0.173, \$0.184, and \$0.172 per pound for the five years respectively. In recent months there have been several quotations which dropped to as low as \$0.15 per pound but these are rare; the largest number of quotations continue to fall generally within the limits of \$0.17 to \$0.185 per pound.

**Prestressed Concrete.** The summary unit price of prestressed concrete is expressed in terms of the price of a composite cubic yard of prestressed concrete in place. The unit price accordingly includes the cost of concrete, reinforcing steel, stress steel, anchorages, prestressing operations, as well as the cost of erection.

The corresponding weighted average prices per composite cubic yard of prestressed concrete for the years 1955 to 1962, inclusive, are \$135, \$163, \$165, \$145, \$135, \$139, \$150, and \$146. During 1963 the price increased to \$166.

The large variations in the cost of the item arise partly from the composition of the kinds of prestressed concrete work for any given year. A weighted average price of \$166 per composite cubic, for example, is indicative of the greater proportionate use of the higher priced precast prestressed "I" girder, whereas a price of \$150 is indicative of the greater proportionate use of the less expensive cast-in-place prestressed type of construction.

#### Conclusion

The last few years have been characterized by an unusually protracted period of stability in construction costs. During the past three years bridge construction costs have fluctuated within a range of variation of about 4 percent and during the last two years there has been no change in the level of construction costs. Concomitantly, bidder activity also has been constant—at an average rate of about six bidders per project. The pattern of bidders as well as the level of bid prices during the first weeks of 1964 indicate that the established pattern is continuing into the new year.

## Neil Dunham Named Computer System Head

Establishment of a new position of computer systems engineer for the California Division of Highways and the appointment of A. N. Dunham to the post have been announced by State Highway Engineer J. C. Womack.

Dunham, who joined the Division of Highways in 1946, is being promoted from assistant engineer of design.



NEIL DUNHAM

He will be responsible for all electronic data processing operations of the Division of Highways.

The highway engineering applications of electronic data processing by means of computers have expanded in recent years, Womack said, far beyond the original uses of traffic data coding and a few types of engineering calculations. They now include earthwork quantity calculations, structural analysis for pavements and bridges, right-of-way calculations, profile grade and elevation data, and traffic analysis. The entire state highway accounting operation has now been converted to electronic data processing.

Establishment of a computer systems unit separate from the urban planning activity was recommended by the Division of Highways management consultants, Price-Waterhouse and Company, in 1963.

Although born and raised in San Diego, Dunham received his civil engineering degree in 1947 from the University of Illinois where he had studied under the U.S. Navy college training program. He held various engineering assignments of increasing responsibility in the San Diego district until March 1961, when he was promoted to supervising highway engineer and transferred to division headquarters as assistant engineer of design.

Dunham and his wife Joyce have three children. He is a member of the American Society of Civil Engineers.

## Bay Toll Crossings Loses Edwin F. Levy

Edwin F. Levy, senior bridge engineer with the Division of Bay Toll Crossings, retired on February 29, completing a 32-year career with the San Francisco-Oakland Bay Bridge.

Levy was born in San Francisco. He attended grade school and was graduated from Lowell High School there. He graduated from the University of California in 1927 with honors.

The first five years of his engineering career was spent on dam and building construction with contracting firms in the Bay area.



EDWIN F. LEVY

He joined the design organization of the Bay Bridge in 1932 and played an important part in the design of the

bridge and the Transbay Transit Terminal.

In 1948 he was advanced to division office engineer and for the next two years supervised studies for a second bay bridge and southern crossing. Since 1950 he has been in charge of design and maintenance for the operating agency of the Bay Bridge and other state toll bridges. When the Dumbarton and San Mateo-Hayward Bridges were purchased from private owners, Levy supervised the effort of converting to state ownership, and acted as manager for those bridges during the initial period of State operation.

Levy's contribution to the operating function of the State's toll bridges has been especially valuable because his experience, combined with his intimate knowledge of the design, construction and maintenance problems of the San Francisco-Oakland Bay Bridge, make him a leading authority on the subject.

Levy is a fellow of the American Society of Civil Engineers. He is also a registered structural engineer and a member of the Commonwealth Club.

He and his wife, Jeanette, plan to embark soon on a six-month world tour.

# STATE OF CALIFORNIA

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RUSSELL J. COONEY . . . Deputy Director (Management)  
T. F. BAGSHAW . . . Assistant Director  
HARRY D. FREEMAN . . . Deputy Director (Planning)  
C. RAY VARLEY . . . Assistant Director  
JUSTIN DuCRAY . . . Departmental Management Analyst  
S. ALAN WHITE . . . Departmental Personnel Officer

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J. A. LEGARRA . . . Deputy State Highway Engineer  
GEO. LANGSNER . . . Deputy State Highway Engineer  
LYMAN R. GILLIS . . . Assistant State Highway Engineer  
J. E. McMAHON . . . Assistant State Highway Engineer  
FRANK E. BAXTER . . . Assistant State Highway Engineer  
GEORGE A. HILL . . . Assistant State Highway Engineer  
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A. N. DUNHAM . . . Computer Systems Engineer  
J. F. JORGENSEN . . . Construction Engineer  
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C. T. LEDDEN . . . City and County Projects Engineer  
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E. L. TINNEY . . . Maintenance Engineer  
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J. E. WILSON . . . Traffic Engineer  
A. L. ELLIOTT . . . Bridge Engineer—Planning  
R. J. IVY . . . Bridge Engineer—Special Projects  
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SAM HELWER . . . District Engineer

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H. S. MILES . . . District Engineer

#### District III, Marysville

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#### District IV, San Francisco

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R. A. HAYLER . . . District Engineer  
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C. F. GREENE . . . District Engineer

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W. L. WELCH . . . District Engineer

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

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JOHN ERRECA . . . Administrative Officer  
and Director of Public Works  
JACK COOPER, Secretary . . . Sacramento

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#### District IX, Bishop

C. A. SHERVINGTON . . . District Engineer

#### District X, Stockton

JOHN G. MEYER . . . District Engineer

#### District XI, San Diego

JACOB DEKEMA . . . Assistant State Highway Engineer

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EMERSON RHYNER . . . Deputy Chief (Sacramento)  
HOLLOWAY JONES . . . Deputy Chief (San Francisco)  
REGINALD B. PEGRAM . . . Deputy Chief (Los Angeles)

### DIVISION OF BAY TOLL CROSSINGS

E. R. FOLEY . . . Chief Engineer

BEN BALALA . . . Planning and Construction  
CHARLES L. SWEET . . . Operations

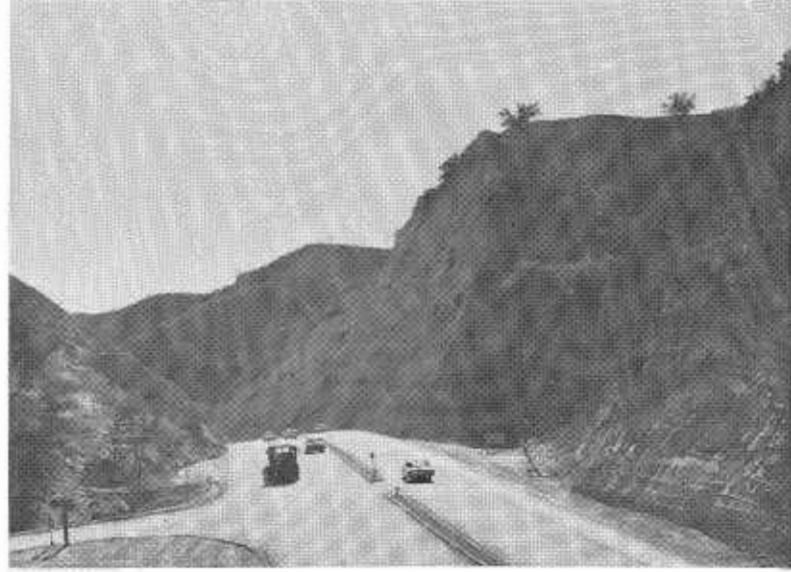
### DIVISION OF AERONAUTICS

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





In 1938 a cut was made straight through the ridge and the troublesome old tunnel removed.



View of section today where tunnel once was situated. Road has been widened to four lanes with raised median, is slated for conversion to full freeway.

*(Continued from inside front cover)*  
roadbed was graded and oiled. But it was still steep, and it became the custom for San Joaquin automobile customers who bought their cars in Los Angeles to refuse to take delivery unless the car could make the Newhall Grade.

Automobile traffic had so increased by 1910 that one man made a comfortable living waiting at the pass with a

team of horses ready to pull any car over, but he was forced out of business when the County of Los Angeles opened a tunnel through the ridge in October 1910, eliminating the terrors of the old grade.

The Newhall-Saugus route became a state highway in 1917, and carried all the U.S. 99 traffic until 1930, when the Weldon Canyon route to the west was opened.

Both routes now have been widened to four lanes. The U.S. 6 section will become full freeway soon as an extension of the Palmdale-Lancaster route, and the Weldon Canyon route is slated for eight lanes of freeway as part of Interstate 5. Mr. Hamlin while struggling over the summit in 1902 couldn't have realized what he was starting.

Aerial view of San Fernando Pass area. U.S. 99 is visible passing across photo at top, U.S. 6 (new Route 14) in foreground. Tunnel was in cut area, extreme lower right, and old pass is plainly visible lower left.



Interchange area, U.S. 99 and U.S. 6 (new Route 14). Old tunnel area is in upper center, old pass visible as light streak just to right of it. Old pass is easily accessible to sightseers.





