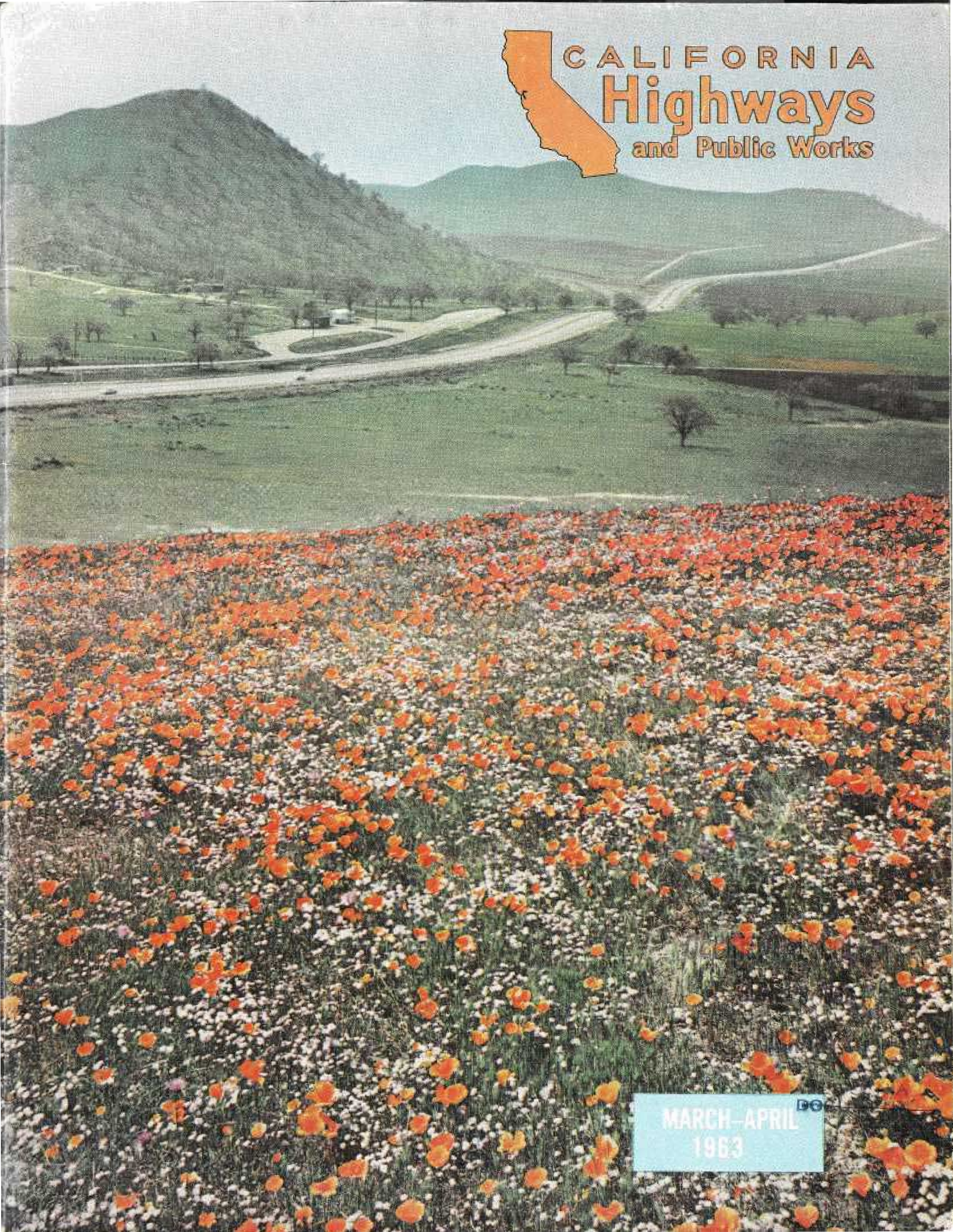
CALIFORNIA Highways and Public Works



MARCH–APRIL
1963

The Ventura Freeway in the City of Ventura. The view is westerly, with the Ojai Freeway interchange top left. *(See "District VII Freeways" beginning page 20.)*

California Highways and Public Works

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

FRONT COVER: Because it is spring and once again the wildflowers are blooming in California, this month's cover pays homage to that part of the State which is famous for its displays of color at this time of the year. Our cover patch of wildflowers was found by Division of Highways photographer John Meyerpeter, in the Kern County foothills near the Arvin turnoff on U.S. 466.

BACK COVER: Traffic flows freely and happily over the new section of the San Diego Freeway across Sepulveda Pass in Los Angeles County. Bridge in center carries Mulholland Drive. Small loop of old route is seen at extreme left, about 2½ inches up from bottom of photo. Aerial photography by Robert Dunn. (See "District VII Freeways," page 20.)

Vol. 42 March-April Nos. 3-4

CONTENTS

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CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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SACRAMENTO, CALIFORNIA

U.S. 40 Progress in Sierra

By ALAN S. HART, Assistant State Highway Engineer

The spectacular job of converting the high Sierra portion of U.S. 40 to an interstate freeway—Interstate 80—has entered its final phases and the new facility is expected to be ready for traffic by the end of 1964.

A brief look at the entire 120-mile route between Sacramento and the Nevada state line shows that approximately 100 miles are now four or more lanes, and all, except for about 14 miles northeast of Auburn, are full freeway. That expressway section requires about a dozen structures and interchanges to eliminate intersections at grade.

Special Cold Weather Mix

The entire mountain section from Colfax to the state line is or will be paved with portland cement concrete. A six-sack mix containing an air-entrainment agent was employed due to freezing winter temperatures and the extensive use of salt to control icy pavements and early clearing of snow pack.

Although no additional projects have been completed since our last report in the January-February 1962 issue of this magazine, work is well underway on the two remaining stretches in the upper Sierra Nevada range.

One is between Emigrant Gap and Hampshire Rocks and the other is over Donner Summit.

The 11½-mile Emigrant Gap to Hampshire Rocks section is being built under two contracts. The 5.4 miles from Emigrant Gap to the junction of State Sign Route 20 was started in July 1961 under an $8,000,000 contract with Guy F. Atkinson Company of South San Francisco. It is currently about 65 percent complete and is expected to be finished by the end of 1963.

Hundred Working Days Annually

Reason for the seemingly long elapsed time required for construction is that contractors can count on only about 100 working days per year in the high snow country. Most operations are limited to June through October or November. Elevation ranges from 5,300 to 7,200 feet.

The 1962 season's work on this job included paving a 2½-mile piece of the future westbound lanes to the east of Emigrant Gap. Two-way traffic is now being routed over this completed section. Portions of the old road will be reconstructed and become the new eastbound lanes.

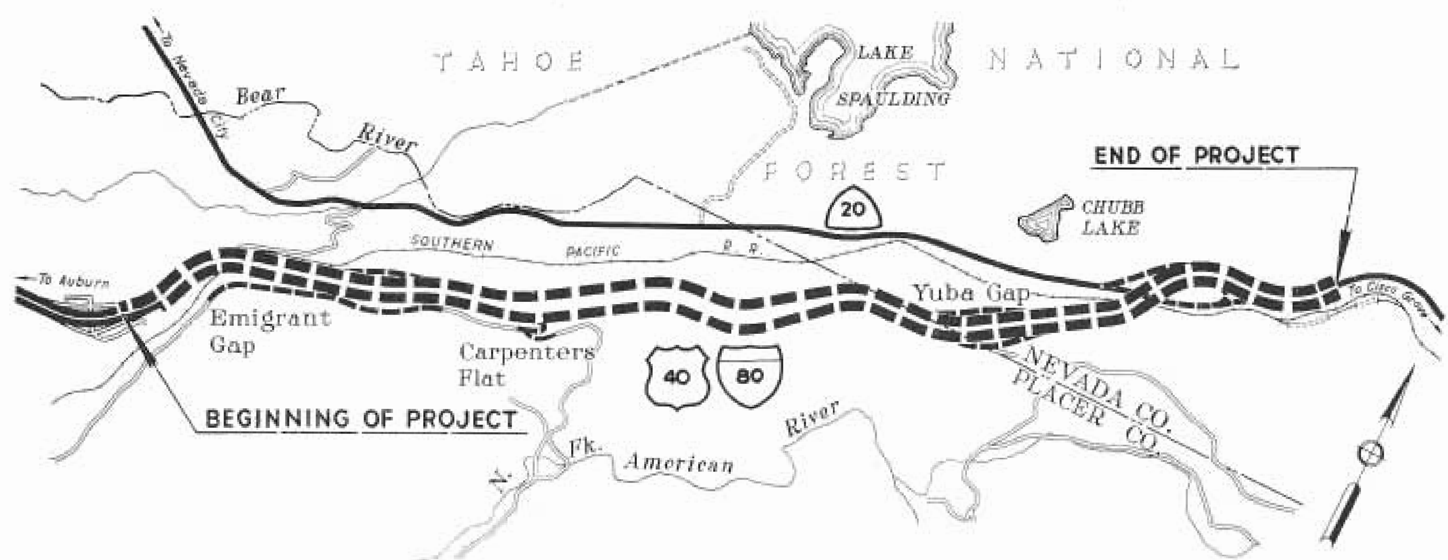
As with the other high Sierra freeway projects, this one will feature what is actually two separate roadways. Opposing lanes will be built on independent vertical and horizontal alignments with widely varying median widths to conform to the terrain and to provide adequate room for snow throw.

Narrow Hogback

Trickiest from the design and construction engineering angle was the area in the vicinity of Emigrant Gap where the freeway and a double-track railroad necessarily cross each other on a narrow hogback ridge.

Compounding problems in this extremely limited space was the fact that underground transcontinental

General alignment of the Emigrant Gap-SSR 20 project is shown by heavy dashed lines. Narrower dashed lines indicate frontage roads and interchanges to be constructed. Observation point will be located on north side of freeway near Emigrant Gap.



Heavy broken line shows general alignment of the SSR 20-Hampshire Rocks project. Narrow broken line shows access roads to recreational areas and interchanges. Solid line is existing highway, most of which will be preserved as frontage road. Frontage road and South Fork Yuba River run down median at two locations. Hampshire Rocks Campground is located near east end of project.

utility lines must also occupy part of the ridge. Extensive planning, design, timing, and liaison were required to dovetail construction phases without interrupting highway, rail, or utility traffic. During this time the affected companies co-operated fully with the contractor and resident engineer.

Ordinarily in this heavy snow region a minimum median of 100 feet is employed to give plenty of room for disposal of snow. In this section the 10-foot asphalt-paved shoulders on both inside and outside will serve to store snow windrowed by push plows until the rotaries can move in and toss it clear.

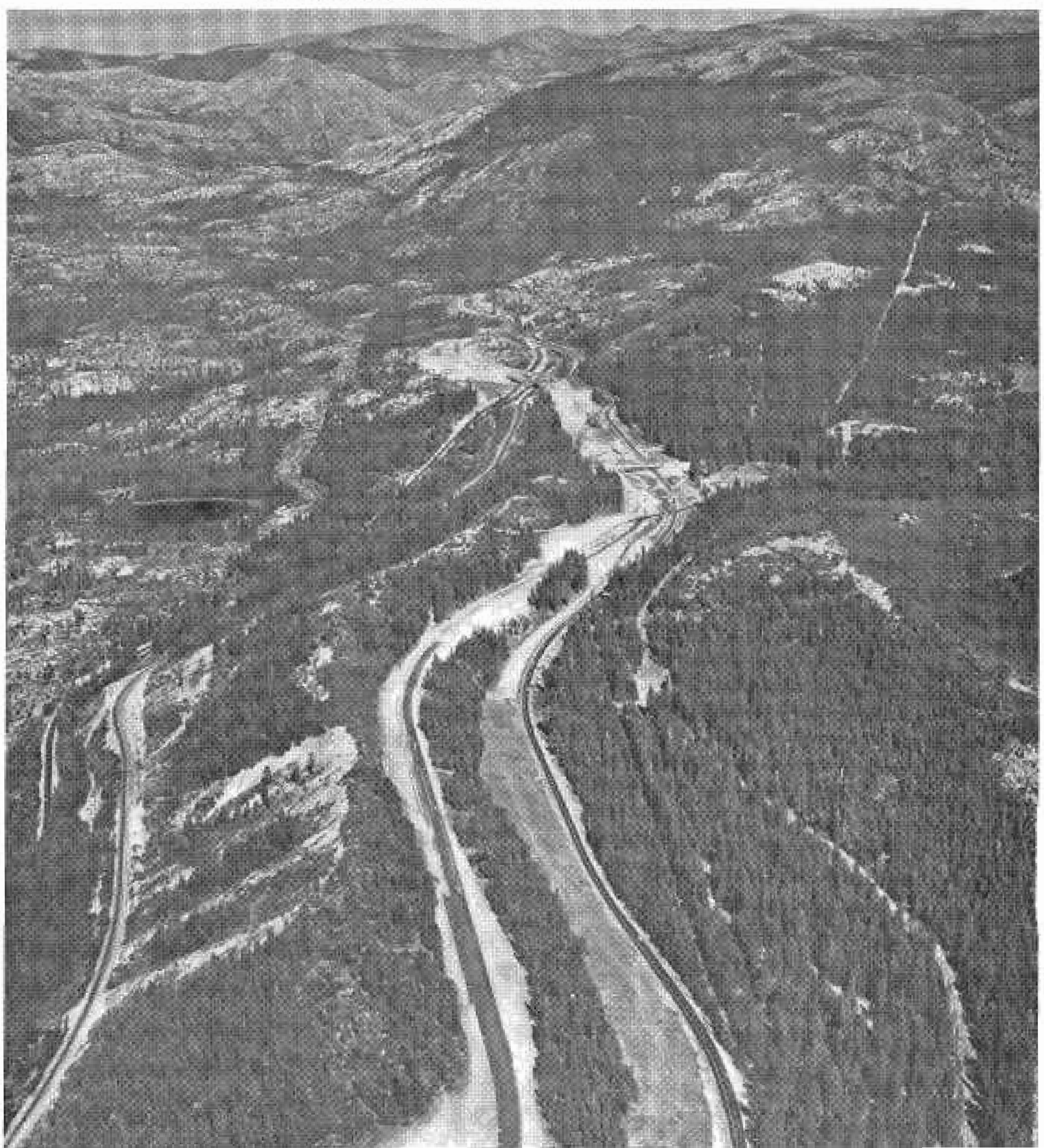
Interchanges for local traffic and access to adjacent recreational areas are being built at Carpenter's Flat, Yuba Gap, and at the SSR 20 junction. Near Emigrant Gap an observation point and parking area will be provided for a leisurely view of the Bear Valley and Lake Spaulding north of the freeway.

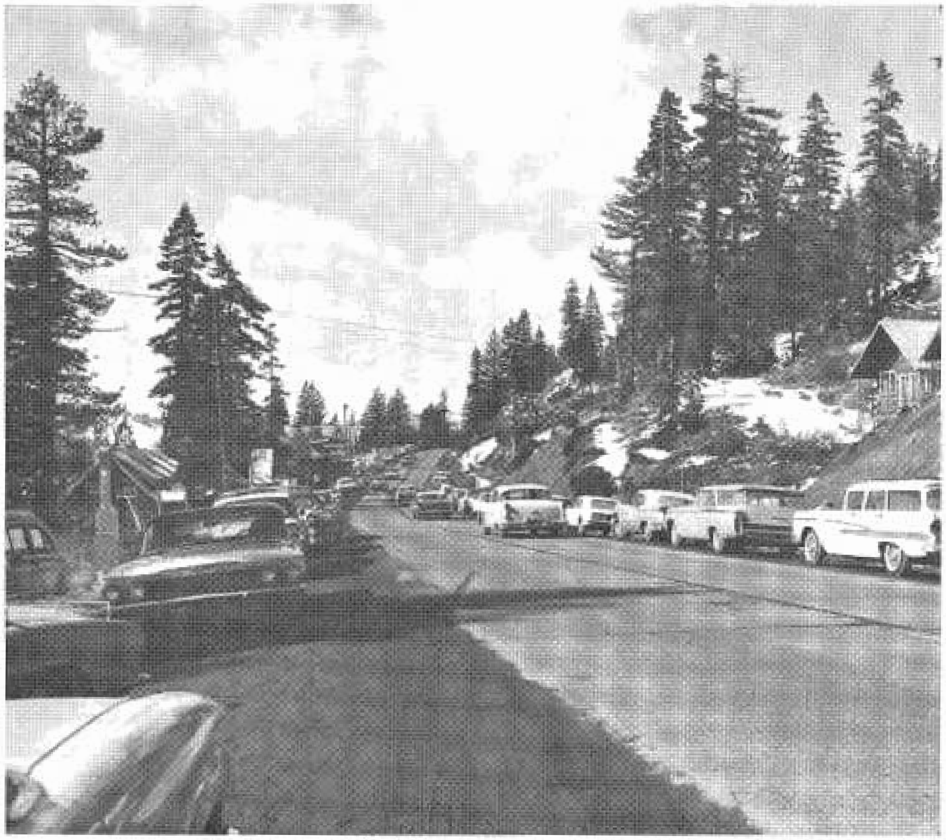
Roadway excavation for this job will run an estimated 2,500,000 cubic yards—much of it granite with some breccia, and most of it being handled with scrapers and power shovels.

Cisco Grove—Hampshire Rocks

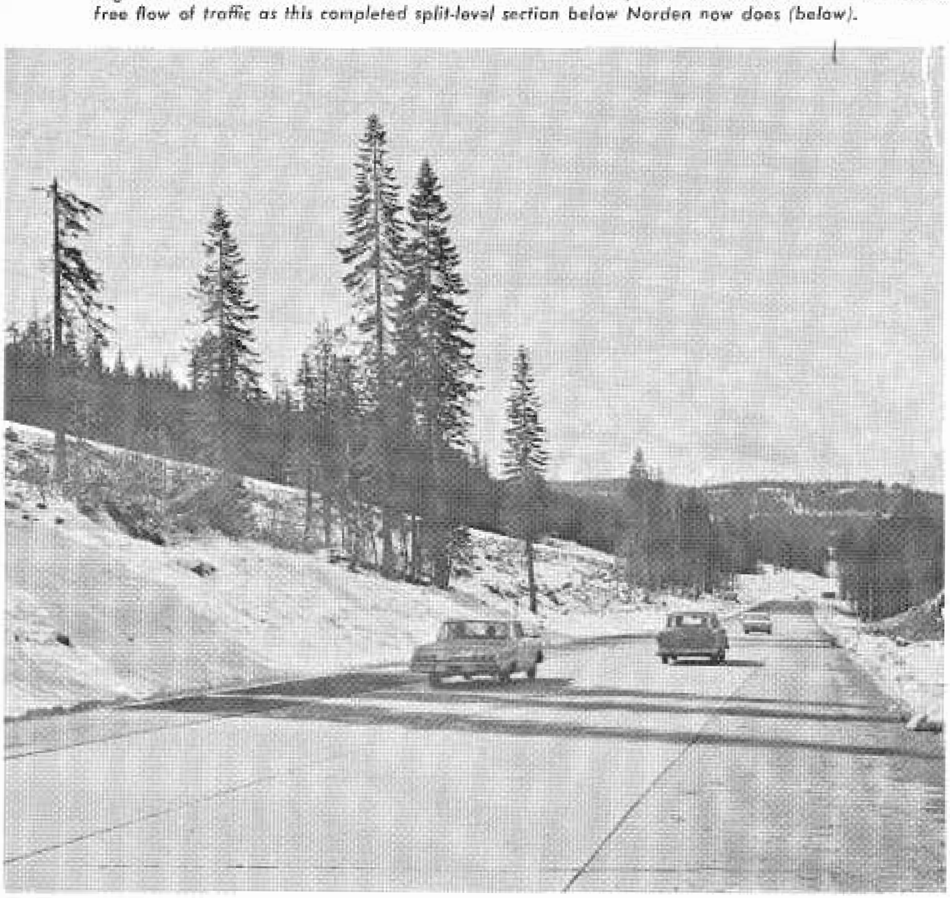
On the 6.3 miles from the SSR 20 junction through Cisco Grove to Hampshire Rocks, work started in

Below. Aerial, looking easterly, with site of future State Sign Route 20 interchange upper center. SSR 20 is ribbon farthest left. Southern Pacific tracks are a little farther up the ridge. Just over the right side of the ridge will be future westbound lanes, and farther to the right is the existing highway which will be reconstructed into eastbound freeway lanes.





ABOVE. Old section of U.S. 40 still in use at Soda Springs is congested with weekend ski traffic. With summit realignment old section will be retained for recreational use, and new summit route will allow free flow of traffic as this completed split-level section below Norden now does (below).



late June of 1962 under an $11,000,000 contract with the joint venture firm of Fredrickson & Watson and Granite Construction Company of Oakland. It is the largest contract ever awarded in District III, the Emigrant Gap-SSR 20 job having been the previous high.

Work is about 38 percent complete and should be finished by the end of 1964. However, it could run into 1965 depending on weather or unusual circumstances.

This project is a monumental undertaking with an estimated 2,225,000 cubic yards of roadway excavation through predominantly solid granite and other type hard rock requiring drilling, blasting, and removal by shovel.

Median width between the completely independent roadways will vary up to 1,000 feet at one point in the Yuba River canyon. In this area are places where unique conditions provide that not only will the river flow between opposing lanes, but the frontage road and even private property will be within the median.

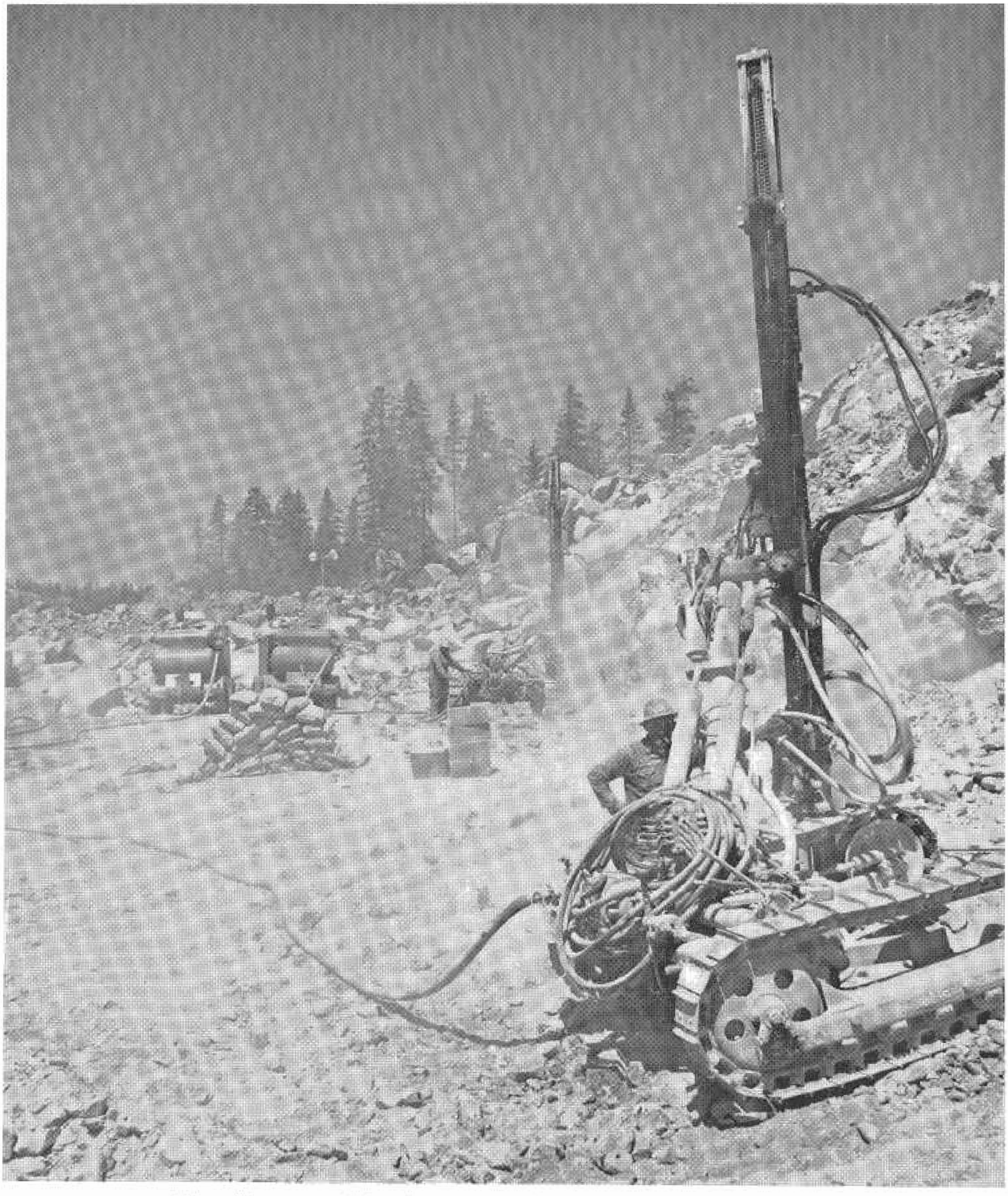
To provide access to residental and recreational areas, interchanges will be located at Indian Springs Road, Cisco Grove, and Hampshire Rocks. In addition, five bridges across the Yuba River are required due to the alignment being confined to the canyon proper.

A major portion of the existing two-lane conventional highway will be preserved for access to summer homes and the year-round recreational facilities along the route.

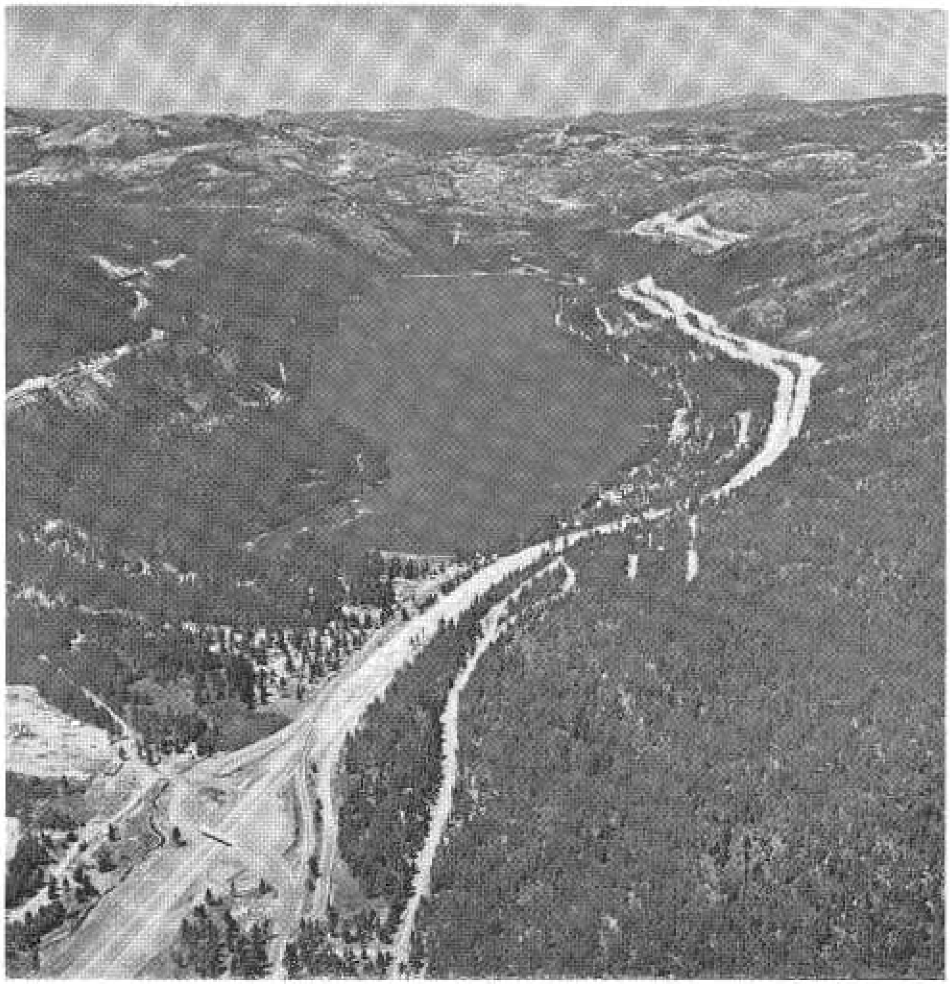
Donner Summit Section

The most dramatic project of all is the new 10½-mile crossing of Donner Summit. Linking completed freeways at Soda Springs and the east end of Donner Lake, this massive job has been divided into three separate units, adding up to a construction cost of some $15,000,000.

The first two were for grading and structures on the new alignment, which will swing as much as 1½ miles to the north of the existing summit highway. Work on the west slope approaching the 7,239-foot pass was finished in October 1962 at a cost of $2,400,000 by the Atkinson firm. (The



Self-propelled pneumatic drills here shown in operation have been used in dozens of places on summit jobs to build road through sheer granite.



Looking west from point above outskirts of Truckee, view along contract east of summit. Old route passes close to shore of Donner Lake in center of photo, then climbs cliff face distant center over Donner Pass. New summit is visible as light spot upper right. Section in left foreground is already completed.

One of five shovel-and-haul operations last summer on east slope of Donner Summit relocation. Huge trucks do not seem large, but each carries 38 tons.

present summit road peaks at 7,135 feet.)

Grading and structure work on the eastern side is about 95 percent complete and after being resumed this spring should wind up by September. Operating on a $7,400,000 contract, the prime contractor is a joint venture of J. W. Briggs, J. N. Conley, and G. D. Dennis & Sons, Incorporated of Redding.

Bids were opened February 6, 1963, for the third contract which calls for subbase, base, and paving of the entire 10½ miles. Depending mainly on weather, work is expected to get underway by May 1 and traffic should be rolling over the new route by the end of 1964. Again, however, weather or other delays in the unpredictable Sierra could push completion into the 1965 construction season.

Drill, Shoot and Shovel

Mainly drill-shoot-and-shovel operations, the two initial contracts involve an estimated total of 4,000,000 cubic yards of roadway excavation—mostly solid rock or boulders with some scraper work on the lower east slope.

In these two jobs there is also included construction of interchange structures about one-half mile west of Soda Springs, at Castle Peak near the summit, and above the west end of Donner Lake.

In replacing the scenic, although narrow and circuitous route which winds up the steep eastern escarpment of the Sierra, the new alignment will have a maximum 5 percent upgrade and 6 percent downgrade. Each opposing set of lanes will in effect be separate highways with varying grades and medians. Throughout maximum uphill sections a third lane with little or no superelevation will be provided for slow-moving vehicles such as transcontinental truck-and-trailer rigs.

On the east slope, viewpoint areas for each set of lanes will offer a sweeping scene of Donner Lake, the craggy face of the Sierra, and the Truckee Valley. Near the summit there will be two safety rest areas.

The 1961 summit area traffic census indicated an average daily traffic of 6,500 to 8,200 vehicles with peak-day averages—Saturdays and Sundays during July, August, and September—of 9,700 to 12,600 vehicles. Trucks and buses comprise 12 percent of the total. Hourly volumes of commercial vehicles are unusually uniform throughout the day with 75 percent of total volumes occurring within a 12-hour period.

Maximum Snowfall 65 Feet

Records show that over the past 50 years at the summit average annual snowfall has been 35 feet and the recorded maximum 65 feet. The snowpack annually averages 10 feet, but in 1952 it was 26 feet and in 1924 less than 4 feet. Temperature ranges from 27 degrees below zero to 87 above. Winds in excess of 90 miles per hour have been recorded above the present summit highway.

Snow and wind conditions were given primary consideration in the location and design of the freeway. Although 100 feet higher than the existing route, the new road will be more sheltered from the high winds which cause serious snowdrift problems. Wind velocities here are only 15 percent to 25 percent of those along the old road.

To further minimize snow removal difficulties, flat cut slopes in drift areas are used with sufficient right-of-way and median width to permit at least a 100-foot throw either right or left of both sets of lanes.

This design will eliminate many winter traffic tieups and delays such as those caused by skidding vehicles, jackknifing truck-trailers, and by vehicles unable to move after stopping.

Nevertheless, some traffic delays and even possible closures can be expected at times because of the absolute lack of visibility during blizzards. Even though the district's experienced and well-trained snow removal crews may be able to maintain passageway to reach and clear drifts, it will at times be necessary to keep traffic off the highway until visibility permits safe driving.

Probably by End of 1964

Barring unforeseen delays, then, by the end of 1964 a continuous four-lane freeway over the rugged Sierra-Nevada will be a reality. As a matter of fact, motorists will enjoy the advantages of safer, faster travel over freeway and expressway all the way from San Francisco to the Nevada line without a single stoplight, except for the portion through Sacramento. The slow, tortuous waits in long queues of stalled vehicles will be a memory of the times before modern progress, equipment, and engineering know-how tackled the treacherous Sierra.

Looking east in reverse to photo on opposite page. Split-level roadways climb side of ridge on steady, easy grade, eliminating steep, tortuous climb up east face of Donner. Additional lane will be provided on upgrade roadways for slow-moving vehicles.

(Incidentally, by the end of 1964 work is expected to be underway on at least part of the Interstate 80 route through Sacramento.)

It has been said that the engineers who planned, designed, and are building this trans-Sierra interstate freeway were much too close to the picture to fully realize the immensity of their undertaking. To the engineer the total project was largely just more yards of excavation, more tons of base rock, and more yards of concrete. It has taken the lay person at large to impress upon us the terrific magnitude of this remarkable highway project even though it is not yet fully completed.

It was a source of particular pride to the district that this project was nominated for the Outstanding Civil Engineering Achievement of the Year (1962)—an annual award made by the American Society of Civil Engineers.

Scenic Highways *Inter-Agency Report Recommends Conservation of 'Scenic Resources'*

The Legislature should designate nearly 5,000 miles of California roads as "state scenic highways" as part of a campaign to preserve the State's natural beauty, an interagency committee said in a report submitted to the Legislature on March 15, 1963.

Calling protection of California's natural resources "a matter of statewide concern," the committee said it deserves priority consideration in all of the State's public works programs.

The committee said that the "quality of the living and working environment and access to natural beauty are playing a significant role in industrial plant location and long-range investment decisions . . .

"It follows . . . that few, if any, programs can have a greater impact on these resources than highways, and that few programs offer a greater potential for guaranteeing their long-term enjoyment," the committee said.

The interagency committee based its report on a study made at the request of the 1962 legislature. Senators Fred Farr and Randolph Collier sponsored the legislation which led to the study.

Governor Edmund G. Brown praised the committee for its "significant contribution in our struggle to conserve California's beauty" and gave the report his "full support."

"I hope the Legislature will act on these recommendations without delay," he said.

Senator Farr called the report "bold and imaginative" and said he hopes the plan will be translated into action at once.

"If we hesitate, our scenic areas will be devastated by the inexorable lava-flow of urban sprawl, billboards, and the sleazy succession of hamburger-hot dog emporiums that constantly pour from our erupting metropolitan centers," Senator Farr said.

Citizens' Committee Participates

The Department of Public Works co-ordinated the study, in collaboration with the Departments of Conservation, Parks and Recreation, and Water Resources and the State Office of Planning. A seven-member citizens' advisory committee, headed by Dee W. MacKenzie of Sacramento, participated. Thirteen local workshop sessions were held in various parts of the State.

The general conclusions of the report also include:

"That the Division of Highways bear responsibility for successful execution of the program for that part of the scenic corridor within the highway right-of-way;

"That the Resources Agency, acting through the Department of Parks and Recreation in particular, bear a major share of the responsibility for scenic conservation within the corridor but beyond the right-of-way;

"That local governments accelerate and improve their planning efforts aimed at conservation of scenic resources in the areas traversed by the recommended scenic routes.

"There are only three ways," the committee continues, "in which these resources can be safeguarded through state action:

"First, state agencies can acquire rights and interests in lands that require scenic protection.

"Second, the various state agencies can apply skilled planning and design talent to their programs and achieve maximum co-ordination of scenic conservation efforts.

"Third, at the local level the state government could encourage and provide guidance in the control of land use and development."

"Scenic Highway" Defined

The report defines a scenic highway as a portion of the state highway system which fulfills the usual requirements of traffic safety and capacity, which "traverses areas of outstanding scenic beauty," and whose location, design and construction "receive special attention in terms of impact on the landscape and visual appearance." Cities and counties are encouraged to establish scenic routes on local roads and streets not under state jurisdiction.

A scenic corridor is described as generally adjacent to the highway right-of-way extending as far "as is reasonably required to maintain effective control of the scenic appearance of the landscape as viewed by the motorist."

With regard to costs the report states:

"There is absolutely no presumption on the part of the study group that gas tax funds would be used for any other purposes than those permitted by existing constitutional or statutory provisions. One of the central facts about the proposed program is that these provisions in no way inhibit proper planning, design, and construction of high-quality scenic routes.

"The remaining question concerns the cost of acquiring the fee or lesser interests or rights in real property for scenic protection-conservation purposes beyond the right-of-way. This question can be answered easily. Whether the Division of Highways or another state agency performs this function, the funds must come from federal sources, the General Fund, or from bond funds. There is also the possibility that gifts or dedications might come from other sources. The study group and the advisory committee consider that acquisition expenditures for scenic conservation purposes fall into the same category as land acquisition for other recreation and conservation purposes."

Recommendations Listed

The report contains the following recommendations for action:

1. The Legislature should formally designate the state highway routes shown on the accompanying map as "state scenic highways," the designation be reviewed quadrenially in the same manner and concurrently with the required four-year review of the

California freeway and expressway system. Designation action should be accompanied by an appropriate statement of legislative policy and intent, setting forth the social and economic development objectives sought through establishment of the scenic highway program, and providing a clear set of policy guides.

2. The state government acting through the several departments directly involved, should be given comprehensive and explicit authorization to acquire the fee or any lesser interest or right in real property for scenic conservation purposes.

3. Existing legislation governing the control of outdoor advertising along state highways should be strengthened to permit more effective and consistent control of such advertising in scenic areas.

4. The Department of Public Works should explore the possibilities for using funds available under the provisions of Section 319, Title 23, U.S. Code, for scenic conservation purposes along federally aided highways. The department should formally ask the Bureau of Public Roads for a policy determination and establishment of procedure respecting use of these funds.

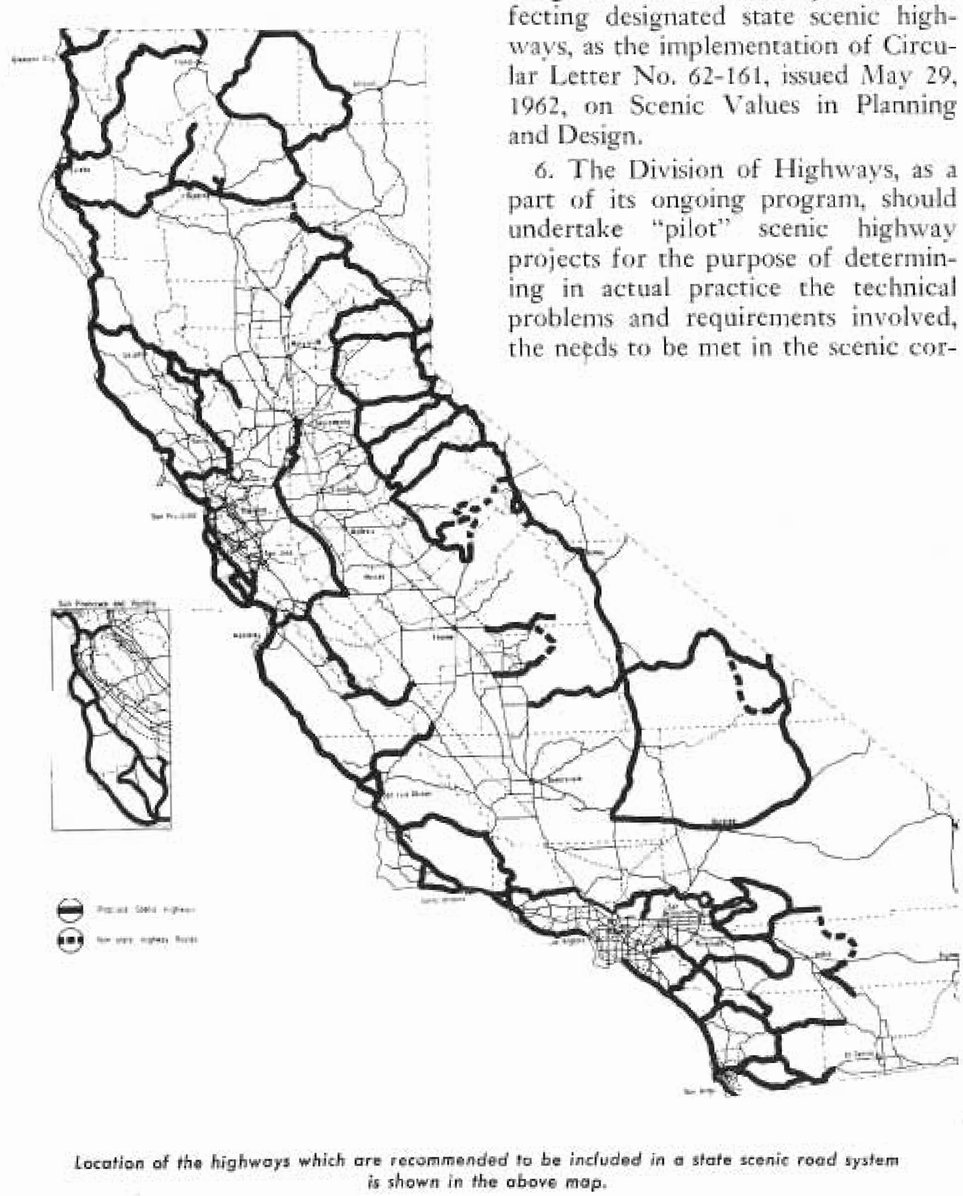
5. The Division of Highways should develop any necessary standards and procedures, as experience may indicate, to guide location, planning, design and construction operations affecting designated state scenic highways, as the implementation of Circular Letter No. 62-161, issued May 29, 1962, on Scenic Values in Planning and Design.

6. The Division of Highways, as a part of its ongoing program, should undertake "pilot" scenic highway projects for the purpose of determining in actual practice the technical problems and requirements involved, the needs to be met in the scenic corridor by other state agencies, and to identify effective areas of needed cooperation between state and local government with regard to protection of the corridor.

7. The Legislature, by concurrent resolution, should request counties and cities to review their planning programs and their zoning and other regulatory procedures with the objective of developing adequate planning and regulatory measures for control of land use and development within the scenic corridors abutting state scenic highways.

8. The Department of Parks and Recreation should undertake two efforts: (a) it should develop complementary procedures for identifying and analyzing scenic resources and for specifying the nature and extent of conservation measures to be undertaken outside the highway right-of-way; and (b) it should develop a plan and program for both the development of specific "wayside" or "strip" parks, and for the integration of its larger proposed projects with scenic routes.

9. Because of the great importance of local planning and land use regulation for the success of the scenic highway program, the State Office of Planning should provide technical assistance to, and should urge the participation of, local governments in the preparation of general and precise plans and in the development of measures for carrying out such plans.



Location of the highways which are recommended to be included in a state scenic road system is shown in the above map.

$4,000,000 Damage By January Storms

Favorable weather following the storms in late January enabled maintenance forces, assisted by contract labor, to restore traffic through the many damaged sections of state highways in February. Preliminary estimates indicate a total damage of $4,000,000 to highways in Northern California.

All damaged sections have been reopened for normal traffic with the exception of several one-way locations on U.S. 40 Alternate along the Feather River and at Spanish Creek near Quincy; on State Sign Route 49 west of Downieville; and on State Sign Route 1 south of Big Sur.

Webster St. Tube

Underwater Crossing Completed in East Bay

By W. C. NAMES, Resident Engineer, and
WILLIAM F. WOLFSON, Assistant Resident Engineer

Following dedication ceremonies at 12 noon on February 13, 1963, the Webster Street Tube was placed in service as a new underwater vehicular crossing between Oakland and Alameda.

With the opening of the new tube, its precedessor and neighbor, the 35-year-old Posey Tube, was shut down for modernization. Late in 1963 the Posey Tube will be reopened and then each tube will carry two lanes of unidirectional traffic. The result will be a much freer flow of traffic between the two cities; a single two-lane tube will no longer be required to carry up to 30,000 vehicles a day.

The Webster Street Tube cost approximately \$17,000,000 to construct, spread over a period of 3½ years.

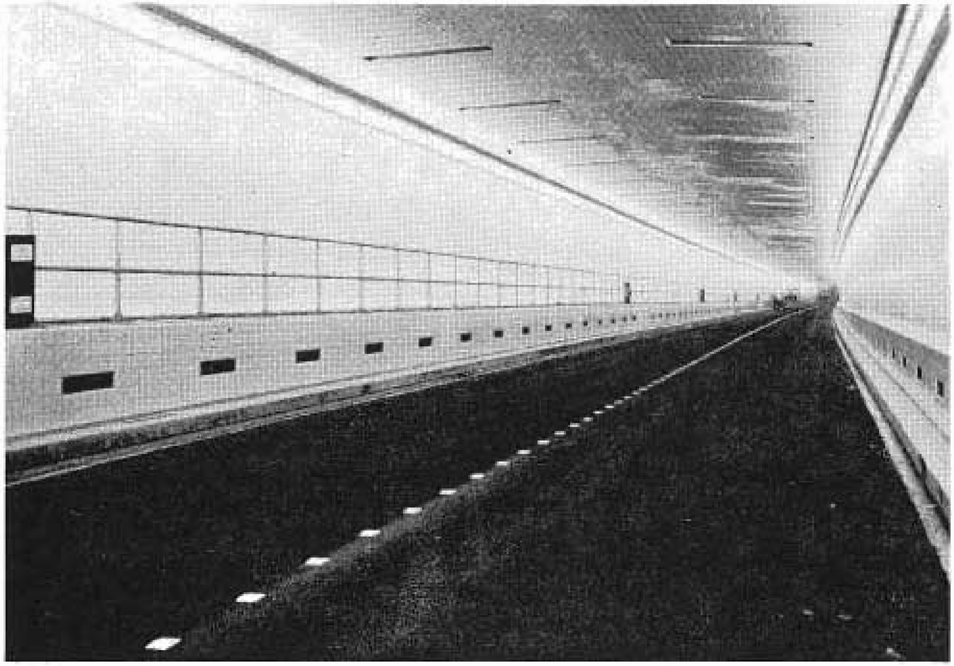
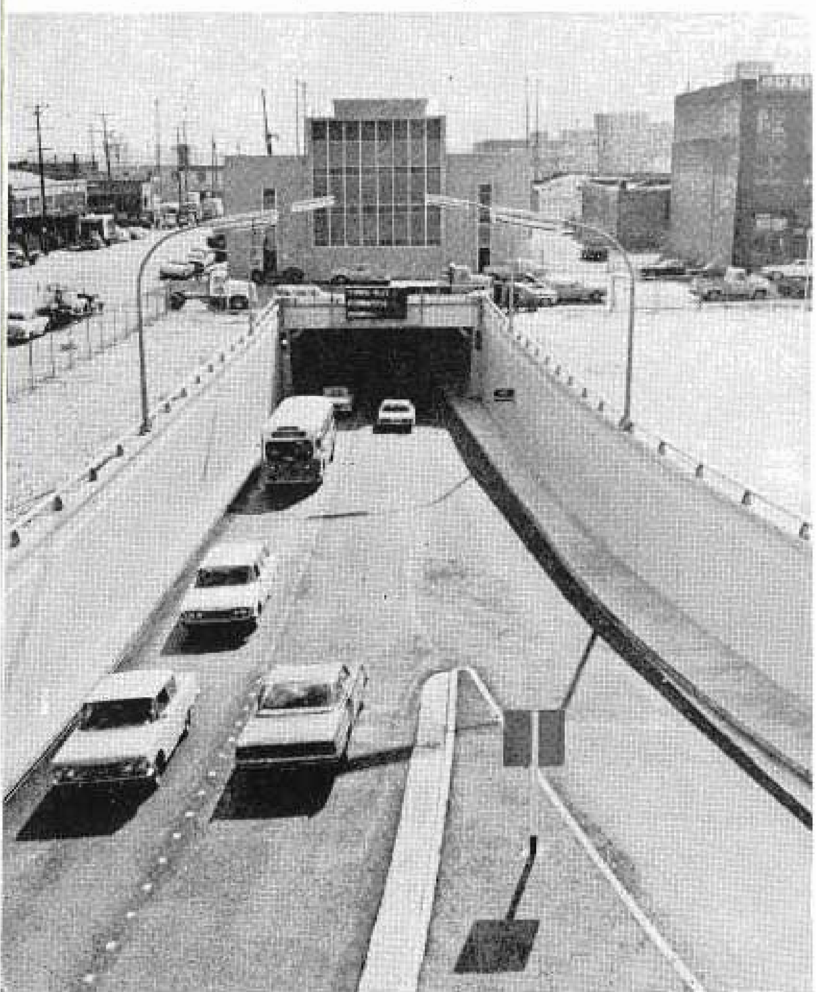


PHOTO ABOVE. A section of the completed subway just before it was opened to traffic. BELOW LEFT. The tube portal from the Oakland side. BELOW RIGHT. The tube portal looking from the Alameda side toward downtown Oakland.



Other "vital statistics" include: tube segments, total of 12, each weighing 11,000,000 pounds; 67,000 cubic yards of concrete; maximum roadway depth, 72 feet below mean sea level; length, including approaches, 5,923 feet; roadway width, 24 feet; vertical clearance, 15 feet.

Previous articles in *California Highways and Public Works* described the design of the tube (March-April 1960) and the first stages of construction, including the precasting of the tube segments (January-February 1961).

This past year has seen the completion of the placement of the tube segments and the construction of connecting cast-in-place section between the Oakland portal building and the last precast segment.

Installation of the control and ventilation equipment was completed in the portal buildings. Final items of work involved completing the tube interior, placing tile and fluorescent lights, constructing the approaches to city streets and final testing of the control and ventilation equipment.

Placing Tube Segments

Of special interest are the methods used in placing the tube segments. The Alameda portal building had to be completed before the first tube segment could be placed.

Segment placement started at the Alameda portal building and proceeded north toward Oakland. To position the segments the south end was coupled to the north end of the previously placed segment. The north end was positioned on two groups of four piles each. These were 20-inch pipe piles about 130 feet long driven to approximate position by barge rig using a double-acting steam hammer.

The piles were cut off and an insert with a sharp pin facing upward was placed in the pile. This insert was used to make an indentation on a timber template which served as a guide for the construction of the timber and steel crushing block and support frame which was placed on the piles to support the tube collar.

A bottom tremie form, consisting of a four-foot deep steel tub with rolled edges, was placed at the center of the joint adjacent to the support frame.

GEORGE GREENE RETIRES

On January 1, 1963, George A. Greene, resident engineer on the Webster Street Tube project, retired after 32 years of service with the California Division of Highways.

Greene was born in Great Falls, Montana, in 1898 and attended elementary school in Seattle, and high school in San Pedro, California, where he moved with his family in 1913. After graduation from high school, he attended the California Institute of Technology and the University of California, where he received his bachelor of science degree in civil engineering in 1931.

GEORGE A. GREENE

After working a year as a surveyor with the Los Angeles Harbor Department, Greene began his state career as assistant resident engineer on bridge construction. With the start of work on the San Francisco-Oakland Bay Bridge in 1933, he was assigned as chief of party for primary triangulation and later was in charge of caisson-setting and cable-spinning operations. Greene's later assignments included a four-year period as project designer on major bridge projects and several years as resident engineer on bridge construction throughout Northern California.

In 1953 he was promoted to senior bridge engineer and was assigned as bridge construction supervisor for bridges in District III. During the ensuing six years, he was at various times responsible for supervision of bridge construction in Districts II, III, V, VI and X.

In 1959 he was assigned as the state's resident engineer on the construction of the Webster Street Tube—an 18 million dollar subaqueous tunnel beneath the Oakland Estuary between Oakland and Alameda. He served in this capacity until his retirement.

The ballasted tube was given final cleanup, the collars and ring seal cleaned of mud, the anchoring and rigging lines attached, and submersible pumps installed in the ballast tanks.

Scheduled in Advance

Tube placement had to be scheduled accurately in advance as the channel was closed to ship traffic on placement day to prevent any water surges due to the ship's wash or wave action. Smaller craft were allowed to pass at reduced speed.

The Army Engineers and the Coast guard required two weeks' notice prior to the closing of the channel. Therefore, once a target date was set and permits received for the channel closing, the schedule had to be met. On occasion this meant working overtime and on weekends to make up time, but all scheduled placement dates were met.

The contractor shifted the channel as his excavation and tube placement required. The manholes and access pipes were designed at different ends of the segments to facilitate the shifting of the channel as the various phases of work progressed across the channel.

The steel H-beam dolphins used in positioning the segments had to be removed in conjunction with channel shifts. The contractor had the channel tied up for a period of two years with a restricted width for seven months.

Four tugs brought each segment into position for final ballasting and transfer to the derrick barges which were used for lowering of the tube.

Water Ballast

Water ballast was pumped into the bulkhead space beneath the roadway slab by a 6-inch diesel driven pump mounted on a barge. Water ballast was removed when required with the submersible pumps in each compartment (tank). About 600 tons of water was pumped into the end tanks and approximately 150 tons was sprinkled through spray pipes over the sand ballast on the roadway. This operation took place on the day of placement and required nearly half a day. This ballasting provided a 50-ton negative bouyancy uniformly distributed from end to end.

A derrick barge at the north end and a barge crane at the south end secured the tube with wire slings. The derrick barges were positioned on tight wires either to shore, to anchors, or to steel H-beam dolphins driven specifically for this purpose. With the barges in position, guy wires from the segment were run ashore or to steel dolphins from the tube to assure accurate horizontal position. These wires were controlled by winches on the shore or on the dolphin platforms.

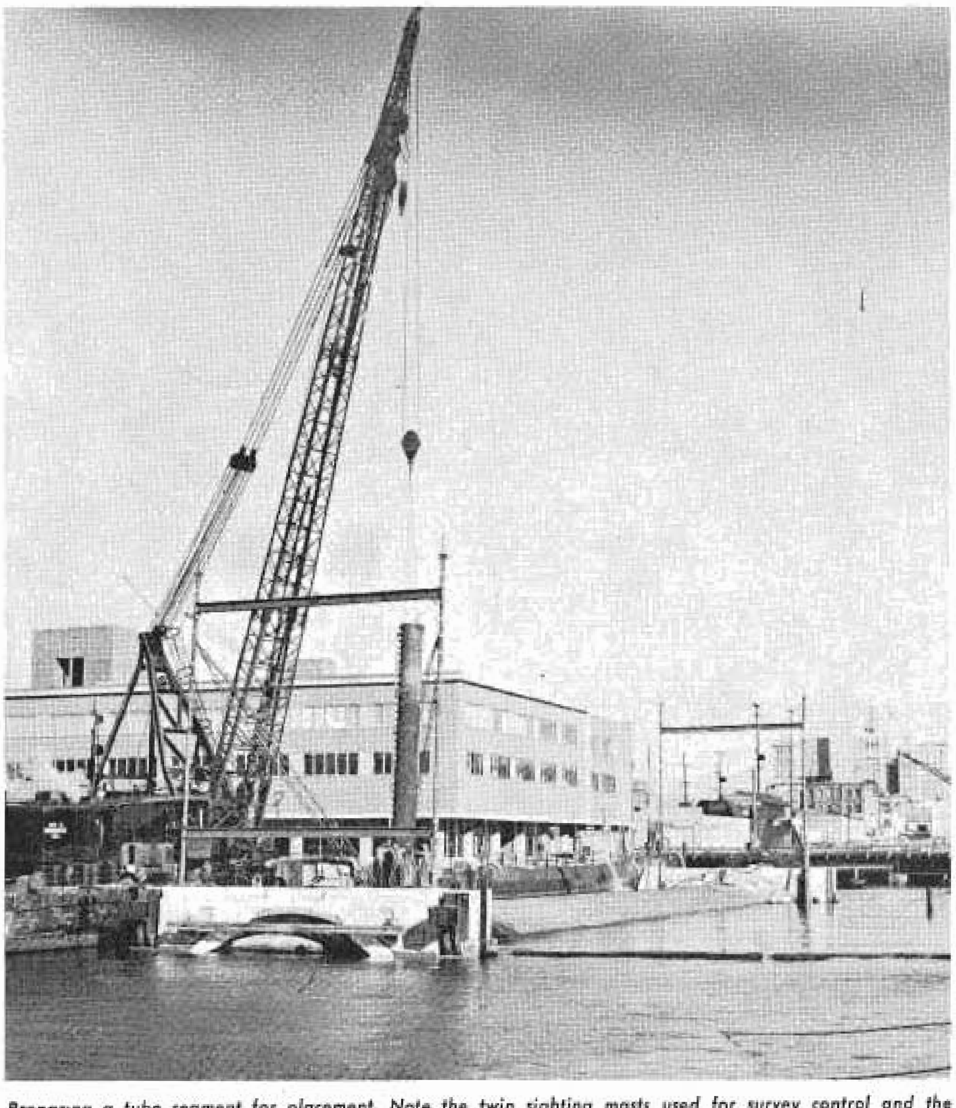
The segment was lowered in a level position until it neared the coupler slots, then the north end was raised 15 feet, very slowly, then the lowering resumed. As the coupler arms entered the guide slots, lowering was stopped. A continuous check was made on the tube's elevation and alignment by instrumentmen on transits and levels checking the relationship of sighting masts to obtain and maintain position control. Two-way radios were used to co-ordinate the work.

Divers Check Position

Divers descended to check the position at the joint and made sure that the rubber seal ring had slipped over the rim of the positioned tube and that the couplers were seating properly.

With the couplers engaged, the north end was lowered until it rested on the crushing block pads, the final alignment being made by adjusting the tension on side breast lines to move the segment one way or the other while it was being lifted by the derrick crane. Alignment and elevations being satisfactory, the final position was noted and additional ballast pumped to completely fill the tanks and saturate the roadway ballast. The negative loading was thereby increased to about 300 tons. The load on the previously positioned tube was reduced to avoid overloading the temporary support piles.

In placing segments 11 and 12, on the Oakland side, the working room was restricted to a 100-foot width between the Haslett Warehouse bulkhead and the steel H-beams and sheet pile wall on the east edge of the excavation. The room at the north edge of segment 12 was limited by the 105-inch sewer and the Water Street railroad bridge.



Preparing a tube segment for placement. Note the twin sighting masts used for survey control and the manhole used for access and ventilation being lowered into position by the crane.

Floated in Excavation

Segment 12 had to be floated into the excavation and tied off before segment 11 could be placed. Segment 11, when placed, would be too shallow for segment 12 to float over it.

Lack of room prevented the derrick barge from being in its normal position and the segment was lowered with the derrick barge facing sideways or backed over the segment after it had been submerged below the barge's waterline.

Survey control during placement consisted of a level set up to read the elevations on four corners of the segment, and a transit set on a line parallel with the centerline of the segment which was able to line up the points on the north and south sighting masts. These same points were used to check for tube settlement after the segment was placed.

Considering the difficulty of the work involved and the potential dangers and number of things that could go wrong, the placement of the segments was one of the most efficient and smoothly controlled operations of the project.

Steel Forms Installed

After placing the segments and prior to placing the sand bed at the joints, steel tremie forms were installed at the sides of the joints of the joining tubes. These were half-cylinders, 8 feet in diameter and 42 feet long with edges of split sheet piling to mate with the other half of the sheet piling previously attached to the collars of the segments. These were lifted vertically and slid down in interlock until the bottom of the cylinder rested on the projecting semicircular end of the tremie form previously placed under the segment joint.

Before a tube segment could be bedded, the next segment had to be in place. Tube beds were prepared by placing backfill sand from a hopper dredge under the tube.

Backfill sand was placed under the tube by a terminal barge with movable sections of 12-inch steel pipe, which had a long "nozzle" which could be lowered alongside the tube. Its end was bent to direct sand underneath the barrel of the tube. Additional turbulence was provided by a two-inch high-pressure water jet.

Tight-packed Sand Base

The action of the water jet combined with the tidal movement created a tightly packed base of sand under the segment. All segments were bedded into the sand by increasing the ballast to 600 tons or more. This loading was sufficient to fail the temporary supports if they received the full load after a settlement of four inches. Continual settlement checks showed the segment settlements varied from three-fourths inch to three inches before the sand picked up the load.

After each segment was bedded and survey checks confirmed vertical stability, the joint at the south end of the previous tube was prepared for concrete tremie seal.

Prior to placing the concrete the joints were cleaned of sand and mud by use of an air lift pump. Water jets were used to move sand to an accessible location and for cleaning marine growth from the tube collars. Any openings in the tremie forms were caulked with burlap or sandbags.

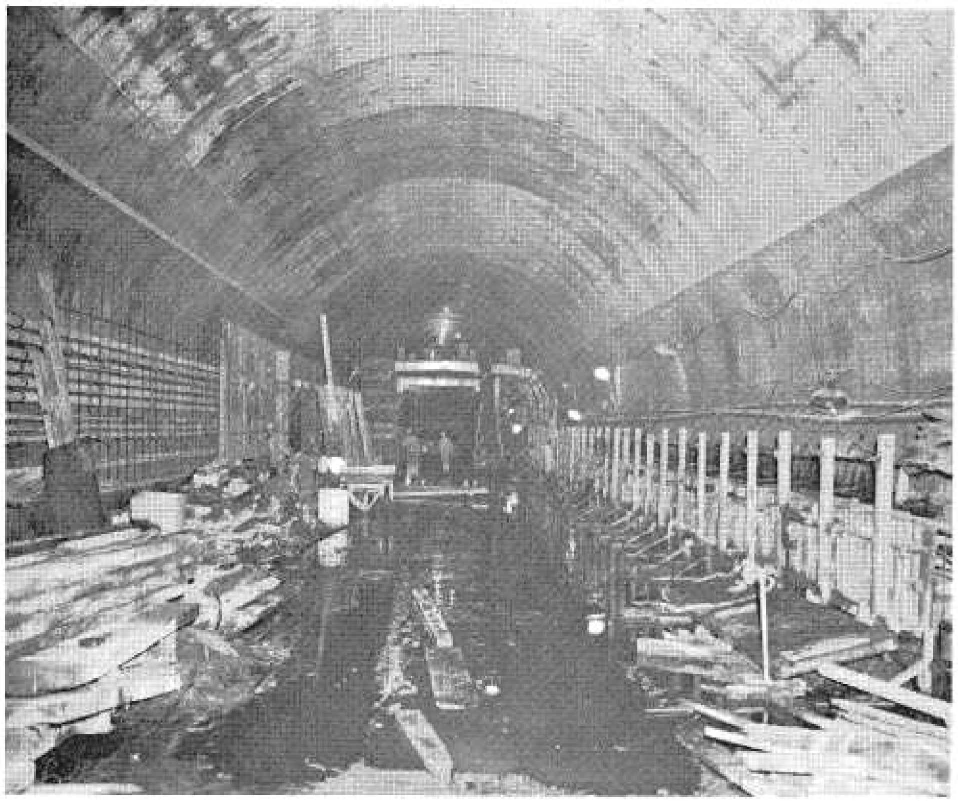
A special frame was constructed to support the tremie pipes. It was equipped with a small gas engine and winch utilizing a pully system to raise or lower the tremie pipes.

The tremie frame was supported by steel pipe legs which rested on the collars.

Derrick Barge Used

The tremie concrete for joints 1-2 through 5-6 was placed by using a derrick barge and a two-cubic yard concrete bucket swung from the Alameda shore to the segment joint. Joints 6-7 through 8-9 were placed by transporting the concrete buckets via tugs or landing craft scows to the joint where it was placed by derrick barge. The balance of the joints were placed by derrick barge from the Oakland shoreline.

Tremie pipes ran down each side of the joint. Concrete placement started



The subway interior work in progress with the wall, walk and ceiling forms in place. The 10 ducts inside the wall form are for telephone cables. Note the limited working space and the difficult access conditions.

Placing the ceiling tile in the tube segments from above. Gummed paper is laid on the ceiling form, the paper moistened, and the tile placed face down on the paper. Next, the slab reinforcing steel is placed and then the concrete, including an inch of grout cover over the tile. The paper is then removed, exposing the tile.

on one side, the concrete was designed to flow under the segment and allowed to build a lift of about 12 feet on the opposite side from that where concrete placement started. At this point the tremie is about 12 feet higher on the starting side. Concrete placement is shifted to the other side, the lifts balanced and the placement continued using both tremie pipes. The pipes were raised and the segments removed as the placement progressed.

During the placement of concrete the divers laid sandbags along the top of the collar to direct the flow of concrete toward the center of the segment and to retain the concrete within the tremie area.

As the concrete cleared the top of the collars it had developed a crust which was helpful in directing the flow toward the center of the segment. Concrete placement continued until the concrete flowed under the sandbags at the center of the joint. A center pipe was available if the concrete broke over the side prior to flowing to the center.

Backfill Operation Started

The backfill operation was started after allowing adequate time for the tremie joints to obtain strength.

Sand used for backfill material was the same as that used for bedding the segments. Sand backfill used over segments 1 through 12 was dredged by the hopper dredge *Sand Piper* off Angel Island. Most of the sand used at lower elevations under water was of a medium grading, some coarser sand was used in the Alameda fill area behind the bulkhead line over segments 3, 4, and 5. The dredge used had a capacity of 1,150 cubic yards and except for maintenance and shutdowns, was capable of three shifts per day.

Segments 7, 8, and 9 are in the center of the channel and require the maintenance of a 40-foot-depth clearance for ships.

To provide adequate ballast and prevent uplift of these segments a five-foot layer of heavyweight iron ore rock was placed uniformly over the segments.

Upon completion of heavyweight placement, a two-foot layer of sand was spread uniformly over the heavyweight material.

Subway Interior Work

Subway interior work began as soon as the segment joints had been sealed.

It consisted of work required for the completion of the subway interior between the covered section of the subways (including portal buildings). Work included removal of bulkheads and ballast, placing of all reinforcing steel, PCC, embedded items, tile, electrical, ventilating, plumbing, lighting systems, and other miscellaneous items of work.

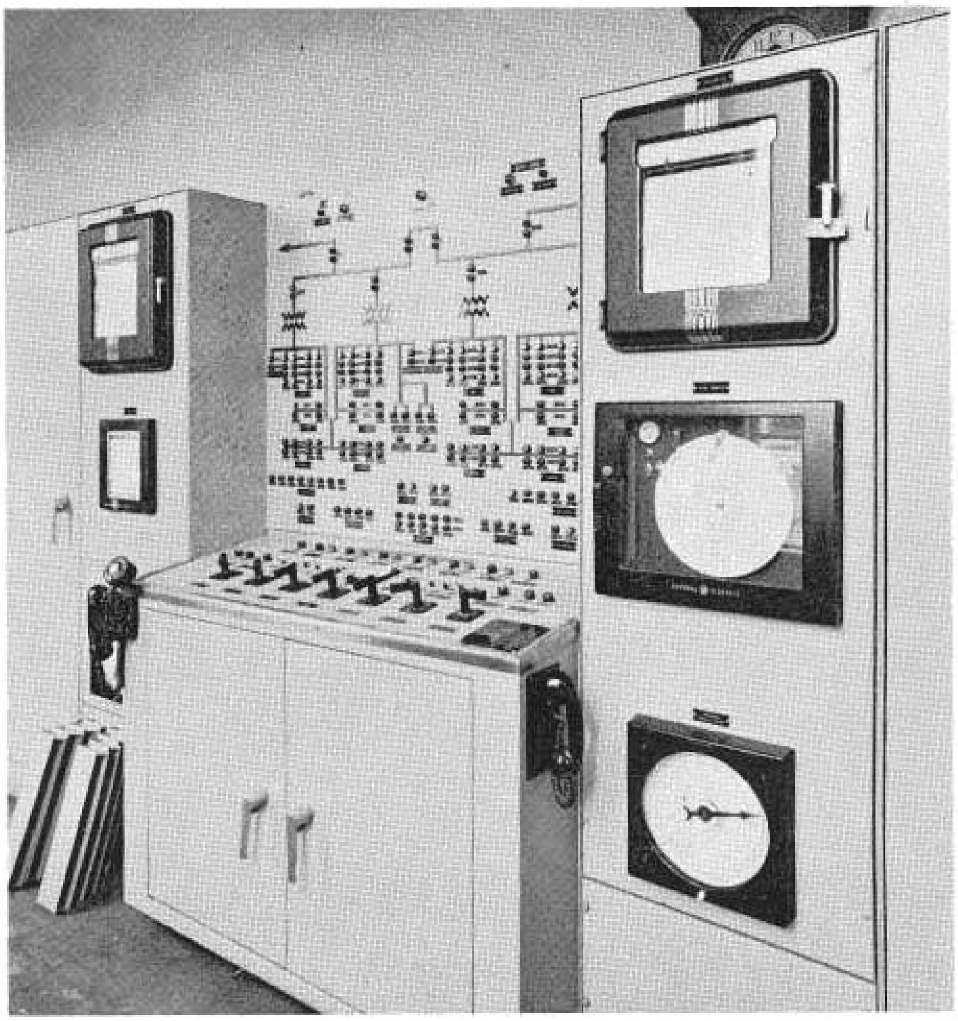
Work within the precast segments, beginning at the Alameda portal building, began at each joint with the removal of temporary end bulkheads.

The chamber between the ends of the segments, on the opposite side of the tremie concrete and adjacent to the rubber seal ring, was pressure grouted after steel plates were welded to the curved embedded angles. The grout consisted of a 4:1 mix by volume with special admixtures and was placed under an average pressure of 100 psi. In a few joints grout seeped out under the embedded angles. Seepage areas were later chipped out and patched with a mixture of cement and an accelerating agent.

The concrete fill in pours between the joints were placed by using sections of the same forms used in casting the tubes.

Sand Ballast Removed

Ballast equipment, catwalk, and water and sand ballast were removed from the roadway slab after sufficient backfill was placed over the segments. Sand ballast was removed from the roadway slab with rubber-tired loader and hauled out in flatbed or dump trucks.



The completed control panel for both tubes in the old Posey Tube control room.

Some of the exhaust ventilation ducts in one of the portal buildings.

Curb and side concrete was placed using wood forms.

Forms for the ceiling slab were constructed of steel and consisted of heavy channel sections supporting steel plate and plywood decking spanning the widths of the subway. Forms provided a surface for placing the ceiling tile by the upside-down method and provided support for the ceiling slab concrete. Legs of each unit (10, 40, or 50-foot sections) of the forms rested on the ledge or sidewalk and was anchored to the sides with form bolts. Forms were moved and set in position by means of a form traveler, which moved on rails (on timber pads) resting on the roadway slab. Forms for 210 linear feet of ceiling slab was available.

Portland cement concrete for the ceiling slabs was generally placed by "buggying" concrete over previously poured sections of the slab and on runways in the section being poured from hoppers set under the access manholes at one of the segments. Concrete was discharged into chutes set at the top of the access manholes outside the tube. In a few instances a conveyor was used to fill a hopper placed on the form traveler set outside of the pour area.

Placing of ceiling form reinforcing steel followed placing of the upside-down tile. Concrete was placed directly on freshly placed grout spread over the tile. The concrete contained 0.5 percent of calcium chloride to accelerate setting time for finishing purposes. Pours were made weekly (two-week cycle) usually in lengths of 95 to 105 feet until the forms could not be moved ahead.

Final interior work consisted of placing the wall and side tile—1,600,000 pieces—and installing the light fixtures.

The use of continuous fluorescent light fixtures in conjunction with the light green tile presents a most attractive and appealing subway. The roadway is paved with plant-mix asphalt and is an interesting contrast.

Electrical, Mechanical Equipment

Necessary for the efficient and proper operation of a modern subway is a ventilation system capable of producing fresh air in adequate amounts as needed, and an electrical system which can control it automatically.

The Webster Street Tube supplies up to 1 million cubic feet of air per minute and is controlled by both traffic evaluators and carbon monoxide indicators.

The ventilation equipment and electrical control system were installed during the past year. Final wiring and the elimination of minor operational "bugs" from the system required about four months time. The testing and final checkout of the system brought the Webster Street Tube construction to an end.

Sacramento Bridge Construction Starts

Initial phases of construction have started on the substructure of the new Sacramento River bridge west of W Street.

Test piles have been driven and cofferdam assembly is underway in the contractor's workyard.

Early in March the contractor moved onto the site and set up a field office and equipment house, and stored sheet piling. Existing docks are being removed or revised for use during construction.

This initial project includes building three reinforced concrete piers, protective fenders, and a navigation lights system. Under a $1,500,000 contract to Fruin-Colnon Contracting Co. and Le Boeuf Dougherty Contracting Co. of Burlingame, the job is expected to take a year or more to complete.

Resident engineer for the Division of Highways is R. N. Brink of Sacramento.

The eight-lane superstructure plus slightly over a mile of freeway approaches to the span will be built with the $11 million included in the fiscal 1963-64 highway construction budget.

Overall, this first section of the future east-west Interstate 80 freeway through the central Sacramento area will extend from the Sacramento Northern tracks in West Sacramento to Fifth Street between W and X Streets in Sacramento.

Adjacent sections will be advertised for bids after funds are made available, probably in the next year or two.

The bridge and freeway approaches will be on a completely new alignment south of the present U.S. 40 route into Sacramento and will not affect traffic during construction.

Conway Grade

Important Summit Section Completed in Three Work Seasons

By GENE J. SNYDER, Resident Engineer

On October 25, 1962, after three seasons of work, the Conway Summit project was completed in District IX. The new alignment in Mono County, between the foot of Conway Grade and 0.5 mile north of Conway Summit, aproximately 4.2 miles in length, eliminated one of the most serious bottlenecks on the Three Flags Highway (US 395) between Canada and Mexico.

The old Conway Grade was originally built in 1921 and 1922 by State Contract No. 300 which was awarded to the Nevada Contracting Company for 19.1 miles of grading work between Lee Vining and Bridgeport. Previous to this project the road from Lee Vining to Bridgeport digressed easterly around Mono Lake then through Bridgeport Canyon to reach Dogtown south of Bridgeport, thus avoiding the formidable Conway Summit.

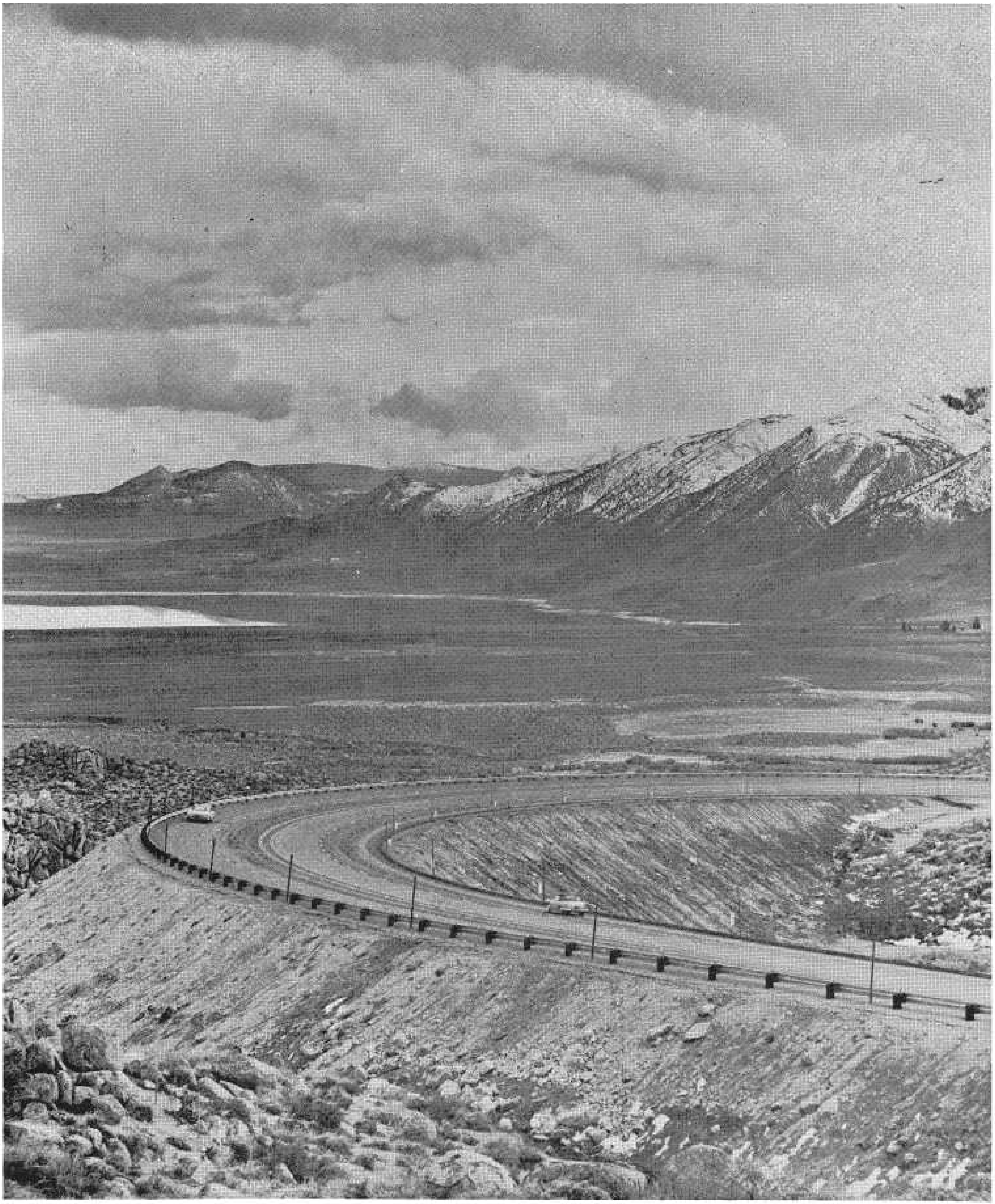
Contract No. 300 struck boldly out from Lee Vining and went up and over Conway Grade in a venturesome project for the time. This project completed in the summer of 1922 was by far the largest project ever let in Mono County at the time and in fact its final cost of $234,742 was considerably greater than all the money spent for highway construction in Mono County from that time back to the beginning of the state system.

Oiled Earth Surface

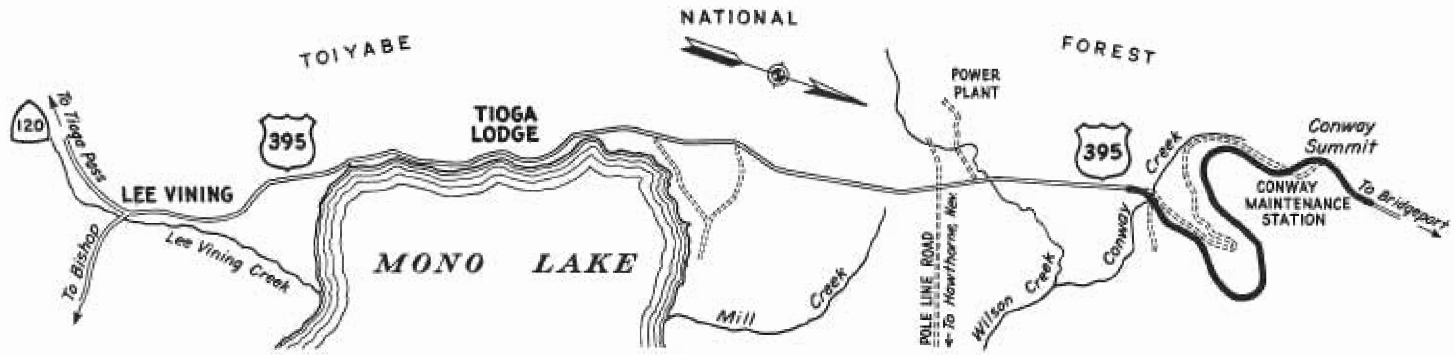
The old Conway grade was widened and paved with an 18-foot oiled earth surfacing in 1931 and until construction of the present project the only improvements made to the grade have been the application of some light bituminous blankets, seal coats and the construction of some guardrail.

A section of the new highway over the 8,136-foot-high Conway Summit. Note the southwest cuts on the left laid back for maximum exposure to the sun.

This photo, taken during construction, shows the five-bench cut near the summit.



A portion of the Conway Summit project looking out over Mono Lake with the snow-capped eastern slopes of the Sierra beyond.



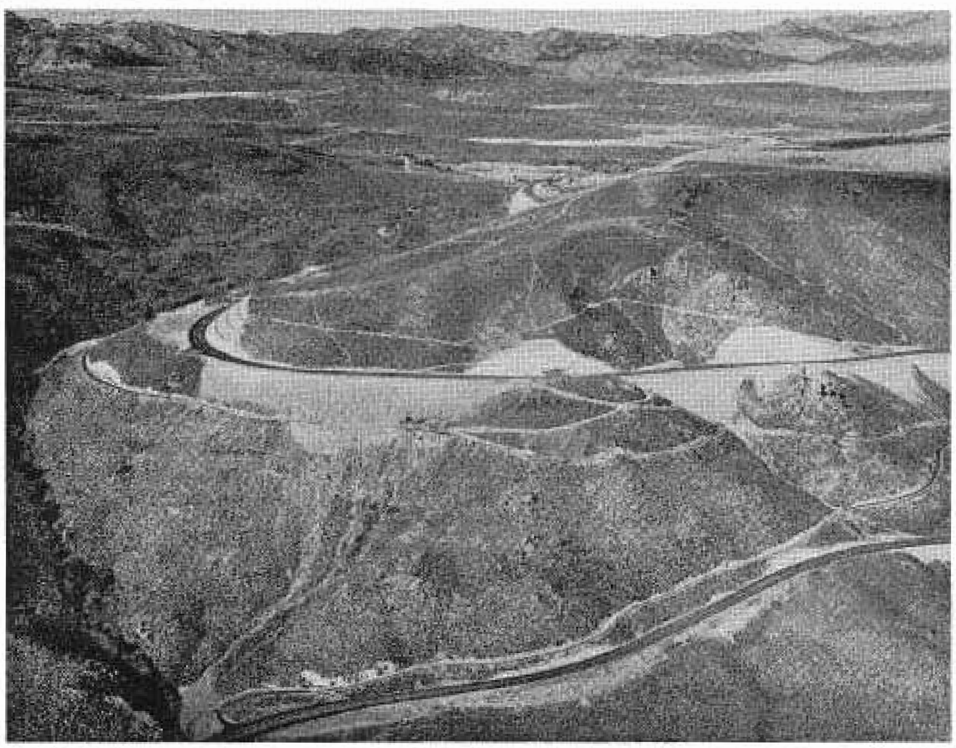
A map showing the location of the Conway Summit area on U.S. 395 in Mono County.

The need for major improvement has long been apparent, but costs could not be met. In 1938 a field review of this project was made and a "reconnaissance report" was submitted discussing four possible alternates for improvement. Funds were allocated for engineering reports in 1945 and 1948. Finally, in 1953, a project report and aerial surveys were authorized which resulted in adoption of the new route by the State Highway Commission in August of 1956. Funds for the construction of this project were made available by the commission in October of 1959 and the last big hurdle had been cleared for a long overdue modernization of Conway Grade.

New Alignment

The new alignment has been located primarily to the east and right of the old grade. The minimum radius of curve is 850 feet and the maximum grade is 6 percent. The new alignment includes 13 curves compared to 63 on the old grade. The standard 60-foot four-lane all-paved section was used throughout. The structural section provided for 0.25 feet of type B asphaltic concrete on 0.50 feet of class 2 aggregate base.

An interesting feature of the design was the construction of a low 10-foot wide bench in the cuts for snow storage and slope ravelling. The cut slopes on the southerly sides were laid back for maximum exposure to the sun. Conway Summit at an elevation of 8,136 feet is the highest point on U.S. 395, and snow removal is a major problem. At two locations on the grade, additional lanes were constructed on each side of the roadbed to provide parking space for vehicles installing and removing tire chains in the winter months. At approximately one mile below the summit a parking area with acceleration and deceleration lanes was constructed to provide southbound motorists a safe place to stop and enjoy or photograph the spectacular view of Mono Basin and Mono Lake.

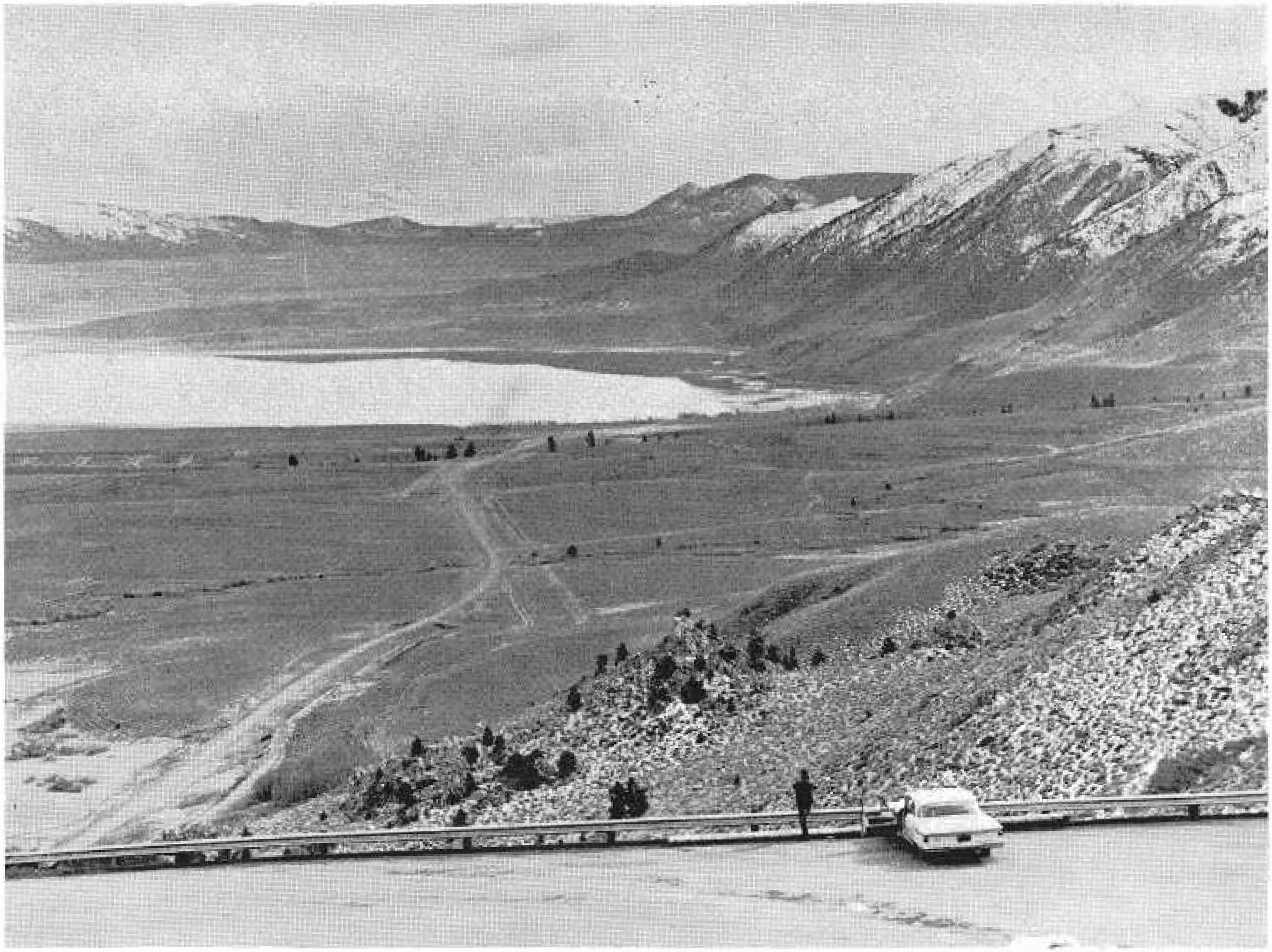


Looking northwest above the Conway Grade. The Conway Summit Maintenance Station can be seen in the middle background.

Contract Awarded

The contract for construction of this project was awarded to Ball and Simpson, Contractors, in April of 1960. The work was scheduled to be completed in two seasons, as 300 working days were allowed. However, due to the extremely rugged terrain and encountering roadway material that was very difficult to excavate and compact, the project took three seasons to complete even though the contractor worked his grading crews two shifts most of the time. The final cost of the work was $2,084,000, the largest ever undertaken by the State in the Inyo-Mono area.

The fills on the summit end of this project were constructed of a glacial moraine material excavated from cuts in the last mile and a half of the new alignment. During the winter suspensions of work the surfaces of fills constructed of this material slumped and eroded quite severely. It appears that as the snow melts in the late winter or spring, particularly on the fills with



The view southward from the observation point located a mile south of the summit.

southerly exposure, a layer of surface material becomes saturated and small slumping occurs, starting at the toe of the slope. The slumps were rather small, usually not more than 10 or 20 feet in diameter and extending in depths from one to three feet below the surface. The slumps progressively occurred up the face of the fills and considerable erosion occurred at the same time. Debris from the slumps and erosive action traveled several hundred to several thousand feet from the points of origin.

Corrective Measures

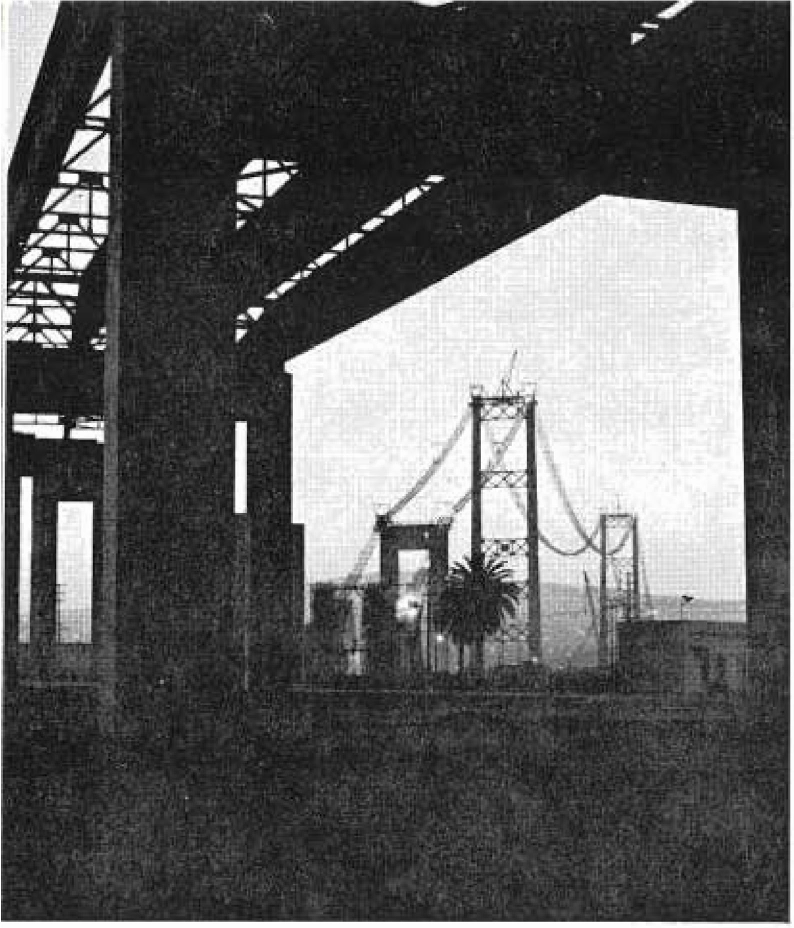
The slumps that occurred in the fills approached the shoulder of the roadbed but in no case have these slumps actually encroached in the top of the fill. Corrective measures taken to date consist of backfilling the numerous slumped areas in the upper 40 to 60 feet of the fills with granitic material.

Although the new alignment is slightly longer than the old, travel time for a passenger car has been nearly cut in half. The savings in time, reduction in driving fatigue and traffic congestion will multiply through the years to come and the savings in cost to the motorist will soon repay the initial investment in this modern highway.

During the period of construction of the Conway Summit project three engineers on the District IX staff, under District Engineer C. A. Shervington, successively held the position of resident engineer. They were Charles H. Jackson, Robert F. Yeager, and Gene J. Snyder. J. R. Jarvis is district construction engineer and the contracting firm, Ball and Simpson, was represented by Superintendent Russell G. Webster.

LOOP TRAFFIC STUDY

A traffic study of the loop portion of the Santa Monica Freeway between the Santa Ana and Harbor Freeways has been made by the Division of Highways office in Los Angeles. It reveals that the new freeway section has caused a drop of 25,000 vehicles per 24 hours on the Santa Ana Freeway between San Pedro and Alameda Streets, and a reduction of 47,350 vehicles at locations on Washington, First, Sixth, Seventh, Olympic and Venice, all major paralleling surface streets.



The Terminal Island Bridge. Towers are 365 feet high; the center span 1,500 feet long.

District VII Freeways

By EDWARD T. TELFORD
Metropolitan District Engineer

On the opening to traffic of the San Diego Freeway through the Santa Monica Mountains last December 21, San Fernando Valley realtors took a full-page ad in the Santa Monica *Evening Outlook*, heralding in effect the travel time savings and increased accessibility between San Fernando Valley communities, West Los Angeles, Santa Monica and the bay cities. Public response to the new facility was instantaneous as 82,000 motor vehicles diverted from paralleling mountain routes to the new facility in the first full day's operation. Sepulveda Boulevard, which had been carrying an average daily traffic of 42,000, dropped to 3,000. Peak-hour travel time was cut in half, from 14 minutes on Sepulveda Boulevard to 7 minutes via the freeway.

Similarly, across the three counties of Orange, Ventura and Los Angeles, together comprising District VII of the State Division of Highways, public reaction was equally enthusiastic as critical new sections of freeway were added to the expanding transportation network in this part of Southern California, providing connecting links and alternate routes where previously there had been gaps and incomplete projects. Thus, the 45.6 miles of new freeway opened to traffic in the district during 1962 brought about far-reaching highway user benefits. The trucker and the motorist could now, more than ever before, travel to their destinations via a combination of continuous routes with increased speed, economy and safety.

The 4,000,000 plus motor vehicles in Orange, Ventura and Los Angeles Counties logged 5,800,000,000 vehicle miles over the freeway system during 1962 alone, equalling more than 31 round trips to the sun. As a result of freeway driving, these motorists saved $63,000,000 in operating costs, $12,000,000 in accident costs and $221,000,000 in time savings.

Among the significant freeway completions contributing to the above-mentioned highway user benefits during last year, were the downtown freeway loop, portions of the Golden State and Santa Monica Freeways skirting downtown Los Angeles; the Harbor Freeway between Pacific Coast Highway and 190th Street, completing the route throughout from the four-level structure in the Los Angeles Civic Center to Battery Street in San Pedro; the San Diego Freeway through the Santa Monica Mountains to a connection with the Ventura Freeway, and between the Long Beach Freeway at Signal Hill to Hawthorne Boulevard in the City of Hawthorne; and the Ventura Freeway between the Hollywood Freeway and Golden State Freeway.

Traffic Diversion

Shifting traffic patterns are characteristic of new freeway construction, both from freeway to freeway and surface street to freeway, resulting in diversion or diffusion of traffic volumes.

A notable example of vehicular diversion took place with the completion of the four-mile Santa Monica Freeway viaduct portion of the downtown loop as far west as the Harbor Freeway in March of 1962. This freeway link absorbed substantial percentages of traffic from the Santa Ana Freeway "slot" and relieved local city street congestion in the area.

Paralleling east-west routes from the Santa Ana Freeway on the north to Washington Boulevard on the south diverted 87,050 motor vehicles to the new facility. In the "before" period the Santa Ana Freeway had a traffic volume of 185,000 as against 160,000 in the "after" period; Olympic Boulevard 24,100 as against 19,150; and Washington Boulevard 27,650 as against 20,100. Traffic count decreases were also noted as far south as Santa Barbara Avenue, though in diminishing degree.

On the other hand, induced traffic showed a gain of 18,000 vehicles or a 6.5 percent increase on all routes in the area, so that generally improved traffic flow and higher level of service were conclusive.

Similar diversions were observed on the Ventura Freeway from the Hollywood Freeway to the Golden State Freeway. Riverside Drive, the old state highway supplanted by the freeway, had carried 17,000 vehicles per day but dropped to 4,500 when the freeway was constructed.

The extension of the Golden State Freeway northward into the San Fernando Valley reduced truck volumes using the Hollywood Freeway by 15 percent, while raising truck traffic on the Golden State Freeway by 40 percent. Current truck traffic percentages of total vehicular volumes on various freeway routes are as follows: Hollywood Freeway 6 percent, Ventura Freeway (west of Hollywood Freeway) 7 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) 11 percent, (north of Tunnel Station) 20 percent, Long Beach Freeway 10 percent, and San Diego Freeway 6 percent.

Average daily traffic counts over the District VII freeway network during 1962 indicated a general 3 percent rise over the previous year. The breakdown at key locations on the various routes follow:

The Coliseum and Sports Arena with the Harbor Freeway in the background. All events here were attended by a total of 2,574,000 people last year who used 400,345 automobiles and 10,000 buses. Most came via the freeway network.

The Central Manufacturing District, 3,750 industrial acres with more than 750 major industries in the City of Commerce. The area is eight miles from downtown Los Angeles and, in addition to heavy truck movements, 75,000 people travel in and out every day by automobile. The view is eastward.

1962 Average Daily Traffic

Hollywood Freeway	
Westerly of four-level structure	185,000
South of Ventura Freeway	115,000
Harbor Freeway	
South of four-level structure	185,000
At 30th Street Overcrossing	175,000
San Bernardino Freeway	
At Long Beach Freeway	140,000
West of Golden State Freeway	77,000
Santa Ana Freeway	
At Long Beach Freeway	182,000
East of Rosemead Boulevard	107,000
Pasadena Freeway	
North of four-level structure	85,000
North of Golden State Freeway	85,000
Santa Monica Freeway	
Santa Ana to Harbor Freeway	110,000
Ventura Freeway	
West of Hollywood Freeway	130,000
West of San Diego Freeway	128,000
Golden State Freeway	
West of Pasadena Freeway	115,000
North of East Los Angeles Interchange	115,000
North of Ventura Freeway	108,000
Long Beach Freeway	
At Pacific Coast Highway	63,000
South of Santa Ana Freeway	90,000
South of San Bernardino Freeway	42,000
San Diego Freeway	
At Olympic Boulevard	57,000
Colorado Freeway	
At Linda Vista	25,000
Glendale Freeway	
At Golden State Freeway	36,000
Riverside Freeway	
At Santa Ana Freeway	42,000
Using four-level structure	326,000

Time Savings

The critical test of any transportation system is the ability to move people and goods rapidly as well as safely from point of origin to point of destination. The freeway system, as has been seen in the foregoing discussion of traffic diversions and traffic volumes, is providing this service on a mass transportation basis.

As this system continues to develop into an integrated network of through superarterials, the demands put upon it and the services it will render will multiply as California continues to forge ahead of all the other 49 states in population and motor vehicle registration. Conservative projections into the year 1980 hold that California will be populated by some 30,000,000 persons with 17,000,000 motor vehicles.

As of December 31, 1962, the State of California numbered 9,873,806 motor vehicle registrations of all classifications, 4,308,997 of which were in District VII. Los Angeles County alone had 3,686,325 registrations.

The Automobile Club of Southern California, in independent tests conducted in 1957, 1960 and 1962, revealed marked gains in peak-hour travel times between employee residences and the headquarters office at Adams Boulevard and Figueroa Street in Los Angeles. The new study was released in May 1962 and recorded time and distance traveled at various points on test trips. Automobile club personnel traveled to and from all sections of the Los Angeles metropolitan area during the busiest times of day. Their routes and driving behavior were typical of Los Angeles commuters. As in previous studies, the survey was scheduled prior to school vacation and at a time free of special events which could influence the result.

The findings of the peak-hour study indicated travel time reduction on the majority of the routes traveled. The average peak speed was 30.5 miles per hour, as against 26 miles per hour in 1960 and 24 miles per hour in 1957.

Completion of important segments of the freeway system provided the greatest increase in travel speeds. The most significant of these was the Downtown Freeway Loop, composed of the Golden State and Santa Monica Freeways. Construction of the loop relieved the traffic burden on the four-level interchange, reducing congestion in that vicinity. Completion of portions of the Golden State Freeway greatly increased the use of that route, relieving the Hollywood Freeway particularly through the reduction of truck traffic. A third important completion took place when the Long Beach Freeway was extended to connect the San Bernardino and Santa Ana Freeways. Twenty-three miles of freeway were completed in the Los Angeles metropolitan area in the two-year period between the 1960 and 1962 studies.

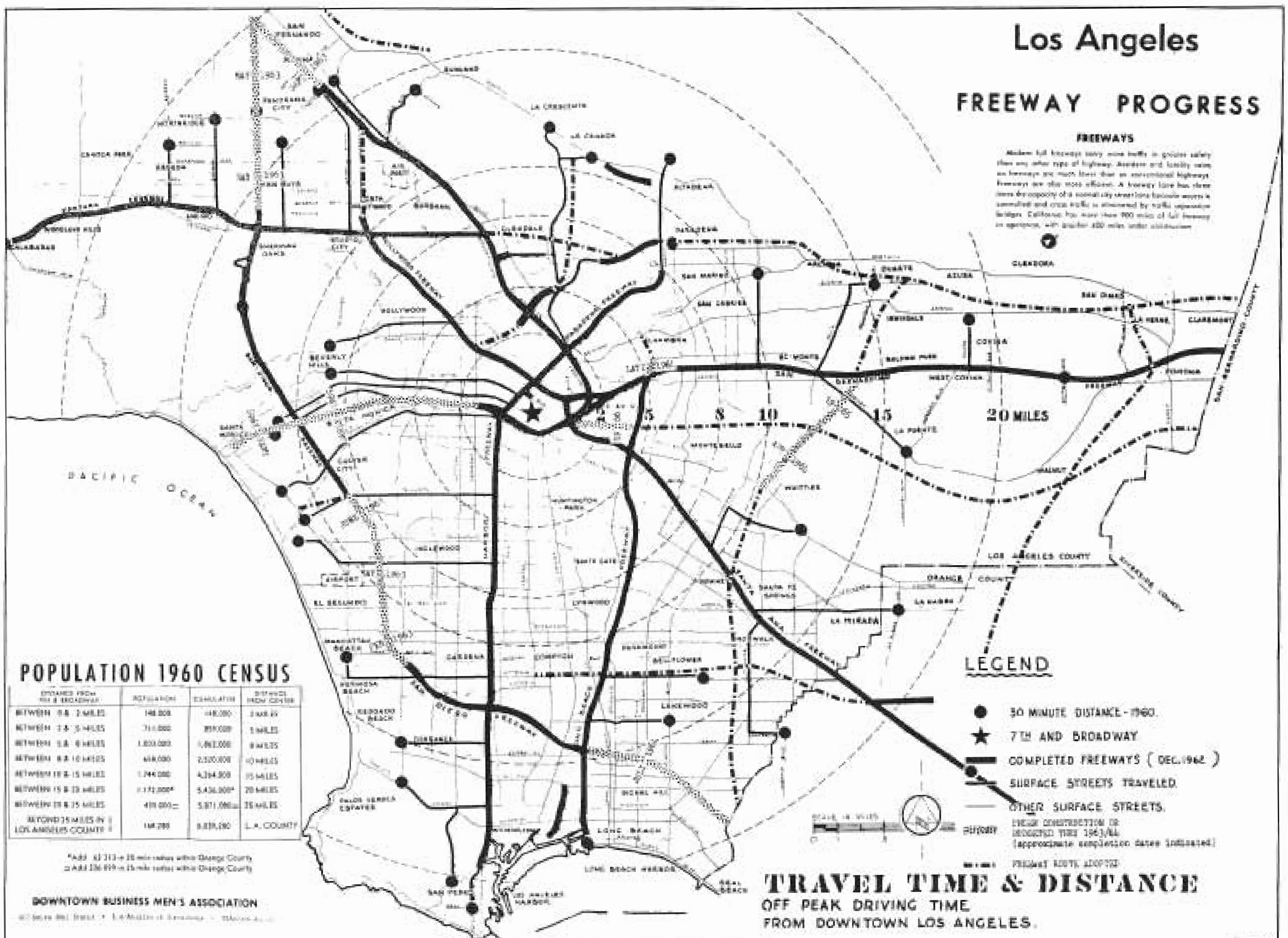
The completion of the Golden State Freeway permitted an increase in peak-hour driving speeds on that route from 30 miles per hour in 1960 to 38 miles per hour in 1962. The peak-hour travel time for the 28-mile trip from San Fernando to the club was reduced to just 44 minutes in 1962 as compared to 52 minutes in 1957.

Completion of a segment of the Glendale Freeway, coupled with the Golden State Freeway improvement resulted in a drastic reduction in travel time to Glendale, from 38 minutes in 1960 to 24 minutes in 1962. The average peak-hour speed increased from 19 to 31 miles per hour.

Improvement to surface streets on the Los Angeles County and local road systems reduced travel times in the southeast quadrant of the metropolitan area. Widening, channelization and signal improvements on Imperial Highway near Whittier, and on Telegraph and Leffingwell Roads, had the most notable effect. Travel time to Whittier was reduced four minutes and to La Habra, 18 minutes.

Persons-Tonnages

It has been shown that time savings is a critical factor in transportation, but in order to serve a high-density urban complex such as the Los Angeles area the mode of transportation

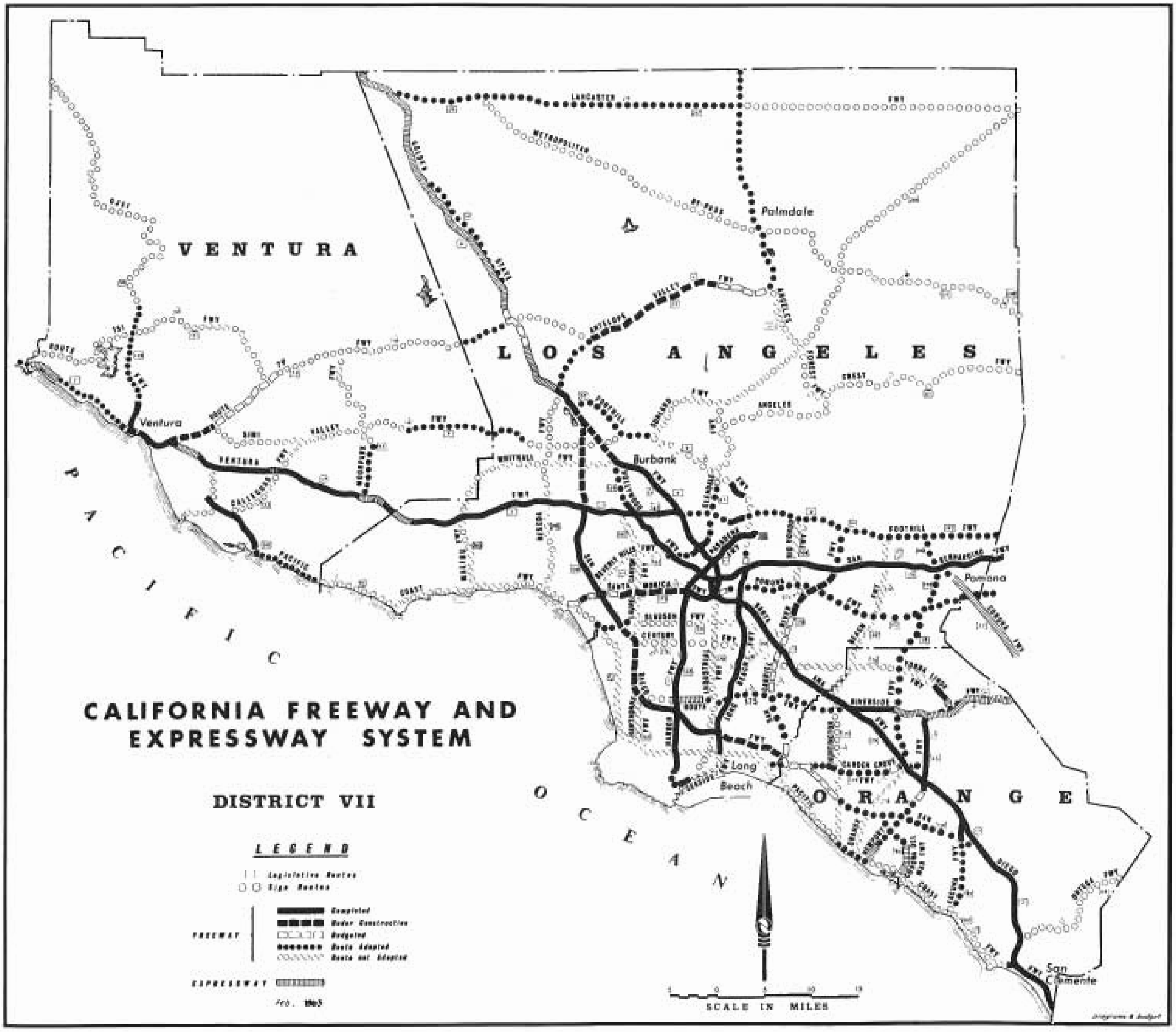


must be flexible and capacious enough to accommodate millions of persons and tons of goods simultaneously. To what extent the present freeway system is accomplishing this gigantic feat is graphically told in the accompanying tables, listing numbers of persons and commodity tonnages at selected onfreeway locations. For the seeker of novel comparisons, 60-ton railroad boxcar and 10,000-ton Liberty Ship equivalents are given in the first table.

Daily Number of Persons and Tons of Goods Moved at Selected Sites on Various Freeways in the Los Angeles Metropolitan Area in 1962

Location	*Persons (per day)*	*Tons of goods (per day)*	*Boxcars*	*Liberty Ships*
Hollywood Freeway Vicinity of Glendale Boulevard	300,000	48,000	800	5
San Bernardino Freeway Vicinity of Soto Street	240,000	110,000	1,830	11
Santa Ana Freeway Vicinity of Indiana	280,000	70,000	1,170	7
Harbor Freeway Vicinity of 30th Street	300,000	30,000	500	3

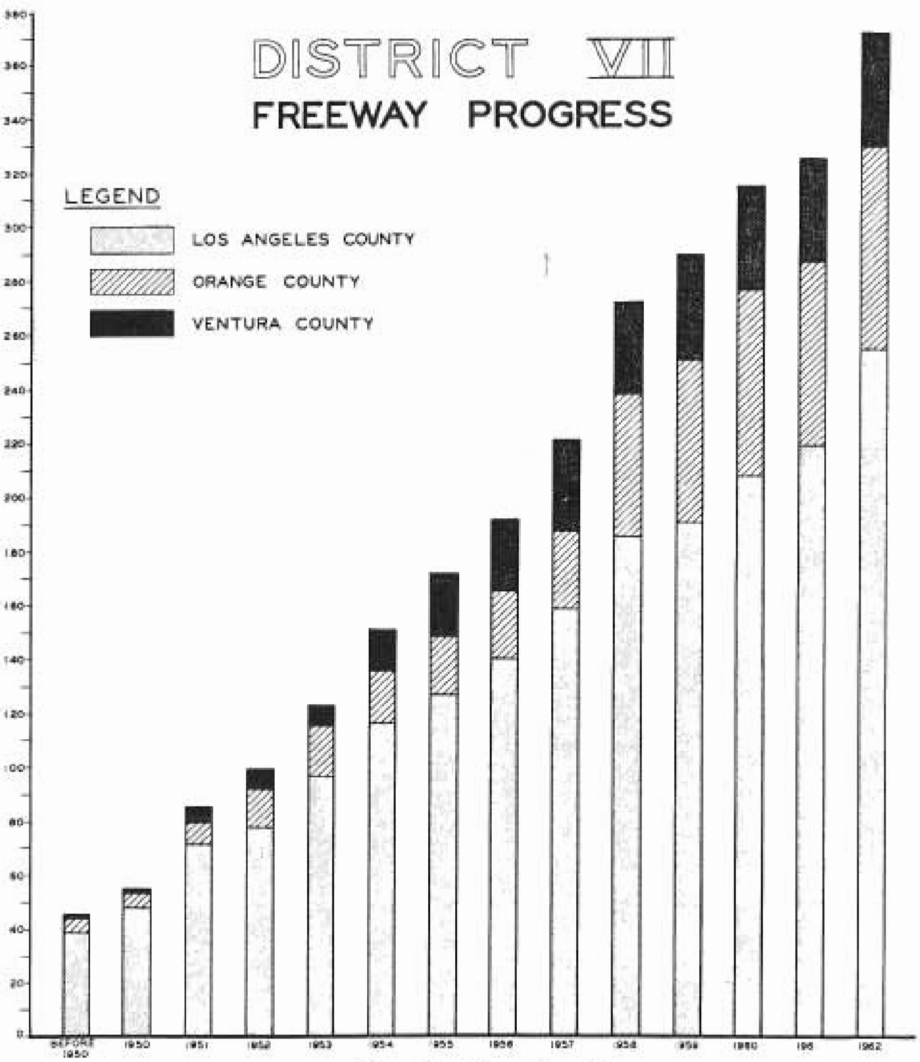
The following tabulation indicates the heavy concentration of persons and goods in the central city. The succeeding tabulation ranges beyond these confines, illustrating the connecting nature of the freeway system and the constant high-level transportation stream into outlying areas. Significant here is the fact that the freeway system is not purely local, as in the case of rapid transit, but extends as a continuum to serve areawide traf-



Daily Number of Persons and Tons of Goods Moved at Selected Sites on Various Freeways in and Surrounding the Los Angeles Metropolitan Area in 1962

Location	*Persons (per day)*	*Tons of goods (per day)*	*Miles distant from Los Angeles central business district*
Hollywood Freeway			
Vicinity of Glendale Boulevard	300,000	48,000	1
San Bernardino Freeway			
Vicinity of Soto Street	240,000	110,000	3
Vicinity of Los Angeles-San Bernardino county line	75,000	34,000	33
Vicinity east of Banning (U.S. 60-70-99)	26,000	26,700	85
Santa Ana Freeway			
Vicinity of Indiana Street	280,000	70,000	5
Vicinity of Tustin Avenue	61,500	14,800	34
Harbor Freeway			
Vicinity of 30th Street	300,000	30,000	3
Vicinity of Victoria Street	45,000	6,000	15
Golden State Freeway			
Vicinity of Castaic Junction	22,500	18,000	36
Ventura Freeway			
Vicinity of Moorpark Road	28,000	10,500	40

fic needs. Note the figures for Banning and the Los Angeles-San Bernardino county line, which points are served by the San Bernardino Freeway and lie 85 miles and 33 miles distant from the Los Angeles central business district, respectively.



Trucks

Tonnages of raw and finished products immediately bring to mind the ubiquitous truck.

The economy of the Greater Los Angeles area and indeed of the nation rests heavily on the millions of trucks traveling the highways and freeways, keeping the urbanized population pools supplied with stocks of commodities ranging from cranberries to oil drilling equipment. Again, the trucks are making greater use of the developing freeway-expressway system because of its flexibility, speed and door-to-door service. It is said that if truck traffic were suspended in this area for a period of 72 hours, the economy would be paralyzed.

California's 1,271,299 trucks constitute 12 percent of the total motor vehicle registration. Annually, intrastate for-hire truckers haul 24,500,000 tons of goods in the Southern California Counties of San Diego, Imperial, Riverside, San Bernardino, Orange and Los Angeles. If tonnages were available from private trucking and interstate carriers, this figure would be multiplied many times over. Intrastate trucks serve 1,153 communities and towns, of which 717 depend entirely on trucking for their livelihood.

The more than 500,000 registered trucks in the six-county area outnumber the combined registration of the following commercial and industrial centers outside of California: the five boroughs of New York (New York City), Cook County of Illinois (Chicago), Wayne County of Michigan (Detroit), Philadelphia County of Pennsylvania (Philadelphia), Cuyahoga County of Ohio (Cleveland) and Allegheny County of Pennsylvania (Pittsburgh).

Only Texas and New York State number more truck registrations than these six Southern California counties. Nine and six-tenths percent of all the trucks registered in the United States are registered in California; 4.57 percent of all the trucks registered in the United States are registered in these six counties.

Retouched photo showing the shape of the Santa Monica Freeway at its west terminus in the City of Santa Monica (foreground). The freeway begins to merge with Olympic Boulevard at Lincoln Boulevard (center). It will be in use in 1965.

Freeway Progress

During 1962, 45.6 miles of new freeway were added to the existing freeway system in Ventura, Orange and Los Angeles Counties, at a construction cost of $158,400,000, bringing the grand total of actual miles in operation to 372.

This represents a total obligated investment at the close of the year of $1,300,000,000 since the freeway program was first initiated in 1940.

By coincidence, in 1950 the 6,710 square mile area of District VII had only 45.6 miles of freeway constructed, so that in the relatively short space of a dozen years the system has expanded eightfold. Sound legislative planning and financing at the federal and state levels has been able to achieve more in a single year than had been achieved in the decade preceding 1950.

Construction contracts in progress on freeway and highway projects of all types in 1962, fluctuated from an all-time high of $251,000,000 in February, to a low of $167,000,000 in October, for a monthly average of $209,000,000. There were 161 major and minor contracts awarded and 180 completed.

The California Highway Commission adopted the 1963-64 state highway budget in October 1962. Of $554,600,000 allocated for all state highways in California, $92,493,000 in construction funds, and $71,500,000 in right-of-way funds, went to District VII.

Right-of-Way

For the year 1962 there were 3,151 properties acquired at a total cost of $62,113,940, or an average value per parcel of $19,712. The most active projects, from the standpoint of money expended, included the following:

Freeway	*Amount*
Foothill	$5,400,000
Colorado	9,275,000
San Gabriel River	4,375,000
Pomona	8,000,000
Santa Monica	8,263,000
Artesia	8,915,000

There were 3,252 parcels of property appraised at a value of $77,900,000.

The number of rental accounts, or state-owned property, amounted to 4,942 building units; 1,500 of this number were sold at public auction and removed, and 1,233 units were demolished, leaving a balance of 2,209 units being rented as of January 1, 1963. A total rental income of $2,042,000 was received and returned to the State Highway Fund from these units.

An additional $11,450 per month was collected for the rental of parking areas beneath the Santa Monica Freeway viaduct. California became the first state in the nation to lease parking areas under viaduct structures on interstate routes. Presently, there is available for lease under the Santa Monica Freeway viaduct, an area of 3,500,000 square feet, space sufficient for parking 10,000 automobiles at an estimated annual income of $260,000.

In the course of the year, the district auctioned off, or otherwise sold 300 parcels of excess land, or 131 acres, for the sum of $4,000,000. Additional income was realized through sale of building improvements to be moved from freeway right-of-way; 1,500 such improvements were sold for $1,600,000. Other buildings with a nominal salvage value were demolished at a cost of $527,000, as part of the right-of-way clearance program.

Route Planning

The district has a tentative schedule for the first half of 1963 which estimates that there will be eight district hearings and two commission hearings concerning route locations. There may well be an equal number of hearings in the latter half of 1963.

Projects closest to the public hearing stage are: the Century Freeway, between California Avenue in South Gate and the Los Angeles International Airport; Pacific Coast Freeway, between the south side of the Los Angeles International Airport and the Marina Freeway; Route 79 Freeway, between the Golden State Freeway and the Antelope Valley Freeway (hearing held March 7, 1963); the Simi Valley Freeway, between DeSoto Avenue and the Foothill Freeway near Hansen Dam; the Beverly Hills Freeway between the San Diego Freeway and the Hollywood Freeway; the Pacific Coast Freeway, serving Oxnard in Ventura County; the Sign Route 126 Freeway, between Santa Paula in Ventura County and the Los Angeles county line; the Simi Valley Freeway in Ventura County, between the Sign Route 126 Freeway near Saticoy and Madera Road east of Moorpark; the Pacific Coast Freeway, between Point Mugu in Ventura County and Malibu Canyon Road in Los Angeles County; the Pacific Coast Freeway in Orange County, between Huntington Beach and the southern limits of the City of Newport Beach (Highway Commission hearing held March 14, 1963); and the Huntington Beach Freeway in Orange County, between Pacific Coast Highway and Chapman Avenue in Stanton.

The year 1962 saw the adoption of 112 miles of freeway having an estimated total cost of $306,000,000, when developed, bringing the district's total of adopted freeway and expressway routes to 809.5 miles, which is 51.4 percent of the California freeway and expressway system within the district.

During 1962, District VII conducted 16 public hearings, and participated in five commission hearings concerning route location. Approximately 100 informal meetings were held with representatives of cities and counties.

At the present time, approximately 365 miles of additional freeway routes are under study with an estimated cost of $2,000,000,000. Expectations are that approximately $300,000,000 of this total will be adopted during 1963.

Bridges

Construction of the Vincent Thomas Bridge between San Pedro and Terminal Island progressed very well in 1962. The substructure contract started in mid-1961 and was completed in July 1962. By the end of the year 60 percent of the superstructure was complete and 90 percent of the work on approaches and toll collection facilities was completed. It is expected that the facility will be open to traffic in October of 1963 with completion of the entire project scheduled for early 1964.

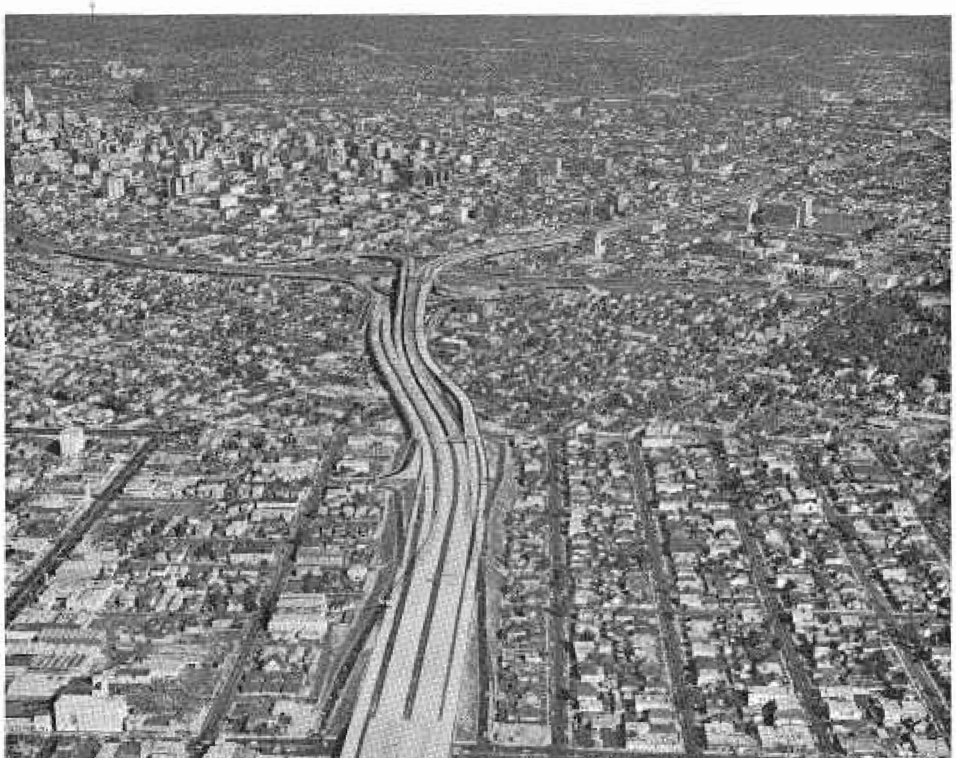
When completed, this graceful suspension bridge will capture the harbor skyline. Its towers rise 365 feet above the water, and the 1,500-foot center span will provide a navigation vertical clearance of 185 feet. The two cables carrying the suspended spans are 13⅝ inches in diameter and each contains over 4,000 individual wires, which, if placed end to end, would extend a distance of 5,000 miles.

The entire structure is supported on piles, which is unique for a suspension bridge. Both beauty and economy in the approach spans and towers were achieved through the employment of the latest welding techniques in fabricating structural steel. The $21,000,000 facility will provide a four-lane traffic link between the proposed Harbor Freeway extension in San Pedro and the southern terminus of the Long Beach Freeway. Both shores of the harbor basins will be easily accessible.

In the construction of other highway facilities in the district area, 186 bridges were built at a total cost of $54,769,729. Some appreciation of the volume of this work can be had by visualizing the quantities of the principal materials used. Over 500,000 cubic yards of structural concrete were required. Incorporated in the concrete were 142,000,000 pounds of reinforcing steel. The amount of structural steel used was 26,870,000 pounds.

Among the principal structures completed during the year was the western end of the Santa Monica Viaduct from Harbor Freeway to Vermont Avenue. Also completed during the year were the Pasadena Freeway-Golden State Freeway interchange structures. The Elysian Viaduct in this interchange, crossing the Los Angeles River, railroad yards, and Pasadena Freeway, contains 11 acres of roadway surface.

By incorporating progressive ideas in the design concepts of freeway structures, it has been possible to furnish facilities considered to be some of the most pleasing in the nation.



Looking east along the completed portion of the Santa Monica Freeway from Vermont Avenue (bottom) toward the Santa Monica-Harbor Freeway interchange (center).

Maintenance

As annual freeway mileages climb and new sections of freeway are landscaped, maintenance costs are proportionately on the increase. Some of these costs for District VII are itemized as follows: Districtwide maintenance costs for fiscal 1961-62 totalled $9,226,504 or $1,492,151 above the previous year. Total costs of repairs to state highways was $240,560, 70 percent of which was recoverable, representing a loss to the State of $72,494. The loss figure for the 1960-61 budgetary year was $113,567. Construction cost of all types of guardrail and median barrier installed was $747,752 while maintenance and repair costs were $219,736. Maintenance of signals, safety lighting and signing rose from $923,015 in 1960-61 to $1,098,979 in 1961-62, an increase of 19 percent.

In the five year period ending with the 1961-62 fiscal year, $3,519,927 was spent by state and state-paid city forces in clearing the highways of all kinds of debris. Antilitter laws coupled with stricter enforcement are apparently unable to cope with this senseless waste of public funds.

Functionally planted and fully landscaped freeways, 1,113 acres in all in July 1962, required the expenditure of $1,325,366 as against $1,218,438 in 1960-61.

Construction

Significant in the past year's operations were the many changes experienced in connection with portland cement concrete paving work. Most of the contracts went to the new method of central-mixed concrete, whereby the concrete was mixed at a central mixing plant and transported to the placing site in modified dump type trucks. The slip-form method of paving is now quite common and only one job in the district last year utilized the old style conventional method of single lane paving between headers. Several jobs still paved between headers but on a 24-foot width, using the central-mixed method.

One job in Ventura County, through the City of Ventura, was paved on a monolithic 36-foot width by the slip-form method. Griffith Company was the contractor on the project.

The slip-form technique in paving has now progressed to the point where less and less grinding of the completed surface is needed. One job in Orange County was completed without any grinding whatever. This was the contract on the Newport Freeway through the City of Tustin, completed by the Gordon H. Ball Company.

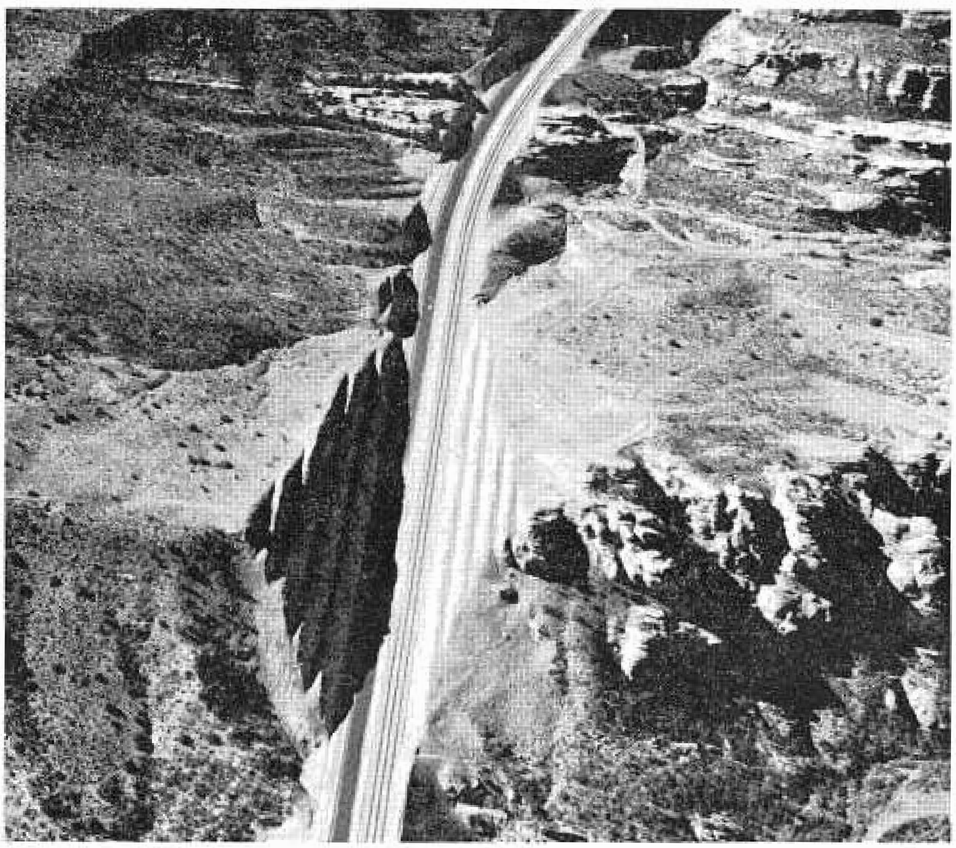
Another new operation connected with paving during the year was inaugurated by the Gordon H. Ball Company on the Sign Route 126 Freeway in Ventura County, whereby the concrete was transported in transitmix trucks with a tilt bed type dump so that a dryer mix could be used in transitmix trucks and dumped therefrom into the slip-form paver.

Also, during the year, 249,200 linear feet of cable chain link barrier fence, and 225,600 feet of metal beam barrier, were installed on freeways at a cost of $2,348,000 for the protection of traffic. At the end of 1962 there were 123 miles of median barrier completed in District VII.

Finally, a changing technique in portland cement concrete indicated a new trend in cases where headers are still being used. They are now placed on top of prepared coment-treated base rather than cement treating between headers as has been done in the past. This new technique is a workable improvement due to better control and finished grade on cement-treated base operations.

Major earth moving operations in the district included a large grading job on the Antelope Valley Freeway in north Los Angeles County. Grading was also completed on the 13,000-000-cubic-yard project on the San Diego Freeway section through the Santa Monica Mountains in West Los Angeles.

A slide situation which developed on the Ventura Freeway project westerly of the City of Ventura was corrected by laying back the slopes, and this grading job was nearing completion at the end of the calendar year. The slopes were further stabilized by anchoring wire mesh on the slope



The famed Vasquez Rocks area where the early California bandit, Tiburcio Vasquez, is said to have holed up. The Antelope Valley Freeway is under construction here at Escondido Canyon and will be completed this year.

faces to retain rolling boulders from crashing to the roadway below.

On the major contracts in District VII during the calendar year, major dirt-moving operations amounted to 33,200,000 cubic yards, representing a cost of over $16 million.

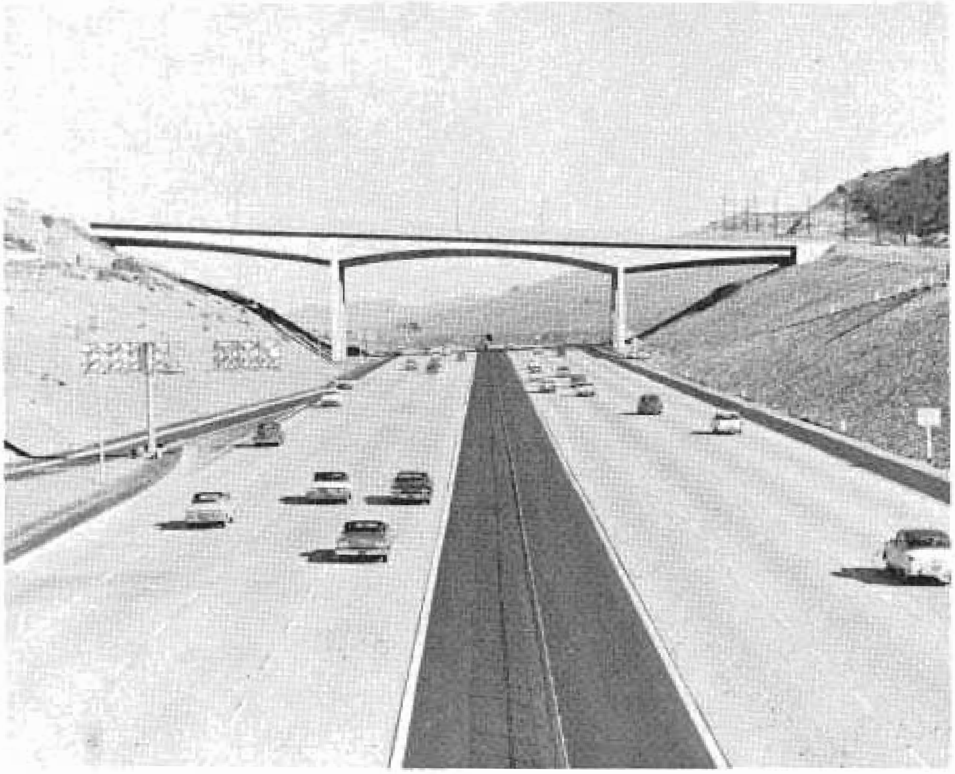
Antelope Valley Freeway

The Antelope Valley Freeway, US 6, has been adopted by the California Highway Commission for its entire 54.5-mile length, beginning at the Golden State Freeway just north of the City of San Fernando to the Kern county line, approximately eight miles north of the community of Lancaster.

The freeway is to be constructed throughout its length for four lanes, the exceptions being where passing lanes are required due to sustained grades. The design includes features for expansion to six and eight lanes as future traffic requires.

Construction began in December of 1960 on a 10-mile section beginning east of Solamint Junction to Escondido Canyon Road and was completed in October of 1962. The construction consisted of drainage, one bridge structure, frontage roads and freeway grading, costing a little over $7,000,000. In October of 1961, a second contract was let for approximately $6,200,000 to pave these 10 miles and to grade, pave, and construct 10 bridges for an additional six miles to Ward Road. It is expected that this

PHOTO ABOVE. Motorist in distress uses emergency call box to summon aid. BELOW. The Santa Monica Freeway viaduct completed last year performs dual service for motor vehicles traveling on top and parked below. The State has been leasing parking space under the four-mile-long structure.



Looking north along the recently completed San Diego Freeway through the Santa Monica Mountains with the Mulholland Bridge spanning the freeway.

The San Diego Freeway at the Long Beach Freeway Interchange and the Los Angeles River. This section is under construction to California Avenue in Signal Hill and will be completed in December.

project will be complete in the fall of this year.

Plans for an eight-mile segment of the freeway have been completed from Ward Road interchange to Angeles Forest Highway. This section is financed with an item of $5,300,000 in the 1963-64 fiscal year construction budget. The project includes grading, paving and seven bridge structures.

Artesia Freeway

The Artesia Freeway, State Sign Route 14, will when completed extend 21.6 miles from the San Diego Freeway to the Santa Ana Freeway. The six- and eight-lane facility, estimated to cost $83,000,000 for rights-of-way and construction, is being designed in six units. The individual units, with mileages and construction cost estimates, follow from west to east: Normandie Avenue to Alameda Street, 4.5 miles, $6,800,000; Alameda Avenue to Lakewood Boulevard, 4.8 miles, $18,000,000; Lakewood Boulevard to Studebaker Road, 2.7 miles, $5,800,000; Studebaker Road to Valley View Avenue, 4.5 miles, $9,000,000; Valley View Avenue to Beach Boulevard, 2 miles, $3,500,000; and Beach Boulevard to Santa Ana Freeway, 1 mile, $4,000,000. The earliest construction on the Artesia Freeway is expected on the Lakewood Boulevard-Valley View Avenue segment, with the balance of the route following. Route location studies for this freeway west from Normandie Avenue to its ultimate connection with the San Diego Freeway have not yet been initiated.

Colorado Freeway

The Colorado Freeway, State Sign Route 134, is an easterly extension of the Ventura Freeway from the Golden State Freeway to the Foothill Freeway. A portion of this route between Avenue 64 in Los Angeles and Holly Street in Pasadena was constructed to four- and six-lane standards some years ago (and is being considered for future widening). The 6.6-mile segment between the Golden State Freeway and the existing constructed route is being planned as an eight-lane facility, passing through Glendale and Eagle Rock. Cost of the entire route will be approximately $79,000,000 for rights-of-way and construction.

Corona del Mar Freeway

The Corona del Mar Freeway extends seven miles between Pacific Coast Highway and the San Diego Freeway in Orange County. It will originally be a six-lane facility with provision for an ultimate eight lanes. Design is in initial stages and future construction and right-of-way costs will approach the $17,500,000 mark.

Foothill Freeway

The Foothill Freeway (Interstate 210) extends from the Golden State Freeway north of the City of San Fernando and more or less parallels Foothill Boulevard across Los Angeles County to the San Bernardino county line, a distance of 52.7 miles. Portions of this route have been adopted, notably from the Golden State Freeway to Foothill Place at Hansen Dam and from Michillinda Avenue in Arcadia to the San Bernardino county line in Pomona. These portions are now in active design and together measure almost 40 miles.

The balance of the route, with the exception of a two-mile link previously constructed between Hampton Road and Montana Street, is being studied for future adoption. These studies are being made between Pasadena on the south and Hansen Dam on the north, a distance of 11 miles. When fully completed the Foothill Freeway will represent a right-of-way and construction investment of some $243,600,000.

The Foothill Freeway is being designed in several sections: Golden State Freeway to Foothill Place, 9.4 miles, with a construction cost estimate of $13,340,000; Colorado Freeway to Michillinda Avenue, 5.3 miles, with a construction cost estimate of $18,300,000; and Michillinda Avenue to the San Bernardino county line, 21.6 miles, with a construction cost estimate of $52,300,000.

Garden Grove Freeway

The Garden Grove Freeway, State Sign Route 22, connects the Pacific Coast Highway in Los Angeles County with the Newport Freeway in Orange County, a distance of some 15 miles.

Two stage construction projects, anticipating full freeway development, were completed in 1959 and 1961 between Los Cerritos Channel and Knott Avenue, and between Studebaker Road and the San Diego Freeway, at a combined cost of $1,773,000.

Work is now in progress at the interchange of the Garden Grove, Santa Ana and Orange Freeways, under two contracts worth $10,821,100 which will be completed in the summer of 1964. Another contract is underway between Knott Avenue and Newland Street, 1.8 miles, at a cost of $3,744,800 and will be completed by mid-1964.

Financing is available for continuing construction this year from the San Diego Freeway to a point east of Bolsa Chica Road. This project will include work on the San Diego Freeway, as well, and $8,350,000 has been allocated for both projects. Another $1,400,000 is budgeted for freeway construction between Haster Street and Garden Grove Boulevard and Placentia in Orange, a distance of one mile.

The remaining portions of the freeway are being designed, looking toward early completion of the route between the San Diego and Santa Ana Freeways. Total cost of the Garden Grove Freeway is estimated at $47,573,000.

Glendale Freeway

The Glendale Freeway, State Sign Route 2, 9.5 miles in total length, is completed from Glendale Boulevard at Duane Street to Fletcher Drive near Avenue 36. This 2.4-mile link was built at a cost of $8,100,000 under three separate contracts, the last of which, from Riverside Drive to Glendale Boulevard, was opened to traffic in March, 1962.

On August 23, 1962, the California Highway Commission adopted the freeway northerly of Avenue 36 to Verdugo Boulevard, 6.3 miles. Design studies are underway on this section,

Construction on the San Diego Freeway north of the Imperial Boulevard interchange (foreground). Three jobs now under construction will complete the freeway from Hawthorne Boulevard to Jefferson Boulevard by mid-1963.

which is estimated to cost $22,400,000 for construction.

The route for the connecting link of the Glendale Freeway between the Hollywood Freeway at Vermont Avenue and the southerly end of the constructed Glendale Freeway at Glendale Boulevard, was adopted by the California Highway Commission on January 23, 1963. The length of the newly adopted section is 2.7 miles, with an estimated construction cost of $12,000,000. Included in this portion of eight-lane freeway is an interchange with the Hollywood Freeway that will require extensive revision of the existing Hollywood Freeway from Virgil Avenue to Normandie Avenue.

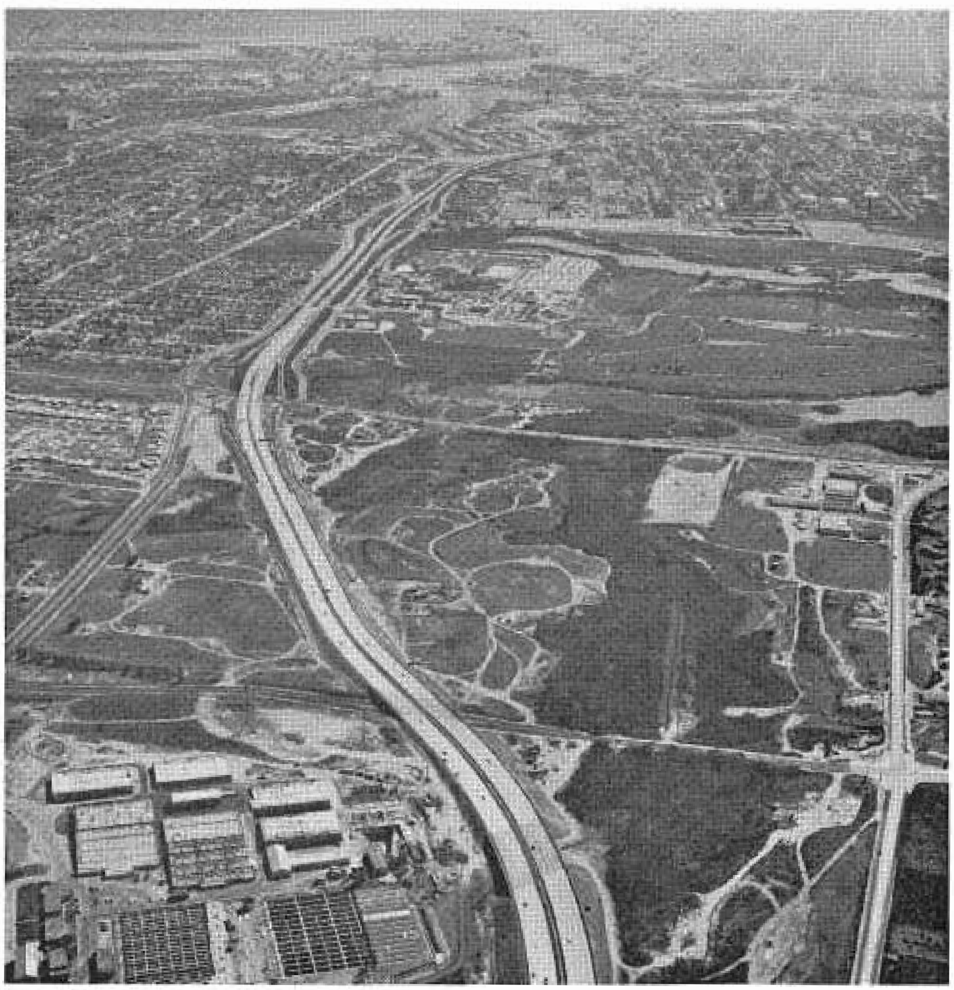
Golden State Freeway

The Golden State Freeway, U.S. 99 (Interstate 5) begins at the East Los Angeles Interchange at Seventh and Soto Streets in Los Angeles and continues for more than 73 miles as freeway-expressway to the Kern county line, where it enters District VI.

During 1962 the route was pushed to completion to full freeway standards from Pasadena Avenue to Glendale Boulevard, filling in the missing link between jobs completed on the south and on the north. This was accomplished at a construction cost of almost $19,000,000.

On January 15, 1963, the Lankershim Boulevard-Osborne Street extension, 2.4 miles, was added at a cost of $4,739,000, making the route continuous from the East Los Angeles Interchange to Osborne Street in the Sun Valley area.

At present a single 5.6-mile, $13,383,600 contract remains to be completed from Osborne Street to the San Diego Freeway north of San Fernando (together with a portion of the San Diego Freeway), and the route will be complete throughout. It is expected that traffic will be using this last segment by the fall of 1963.



The last link of the Harbor Freeway was completed in 1962. The view is toward the harbor area and the San Pedro-Terminal Island Bridge.

Plans are in the making for conversion of the Golden State route to full freeway standards from San Fernando Road to the Kern county line. It is now an expressway. The first conversion project will go to contract this year from $5,950,000 in funds available in the 1963-64 construction budget. The project will provide three miles of eight-lane freeway in the Castaic area and will also add almost a mile to the intersecting Sign Route 126 Freeway on the west.

Other conversion projects under design and construction are planned progressively in ensuing years. Design includes conversion of the existing highway along the five-mile grade northerly of Castaic to one direction of travel, with construction of a new roadway for the opposite direction of travel. From Paradise Ranch to the State Highway Maintenance Station, about 11 miles, the freeway will be located east of the present expressway section.

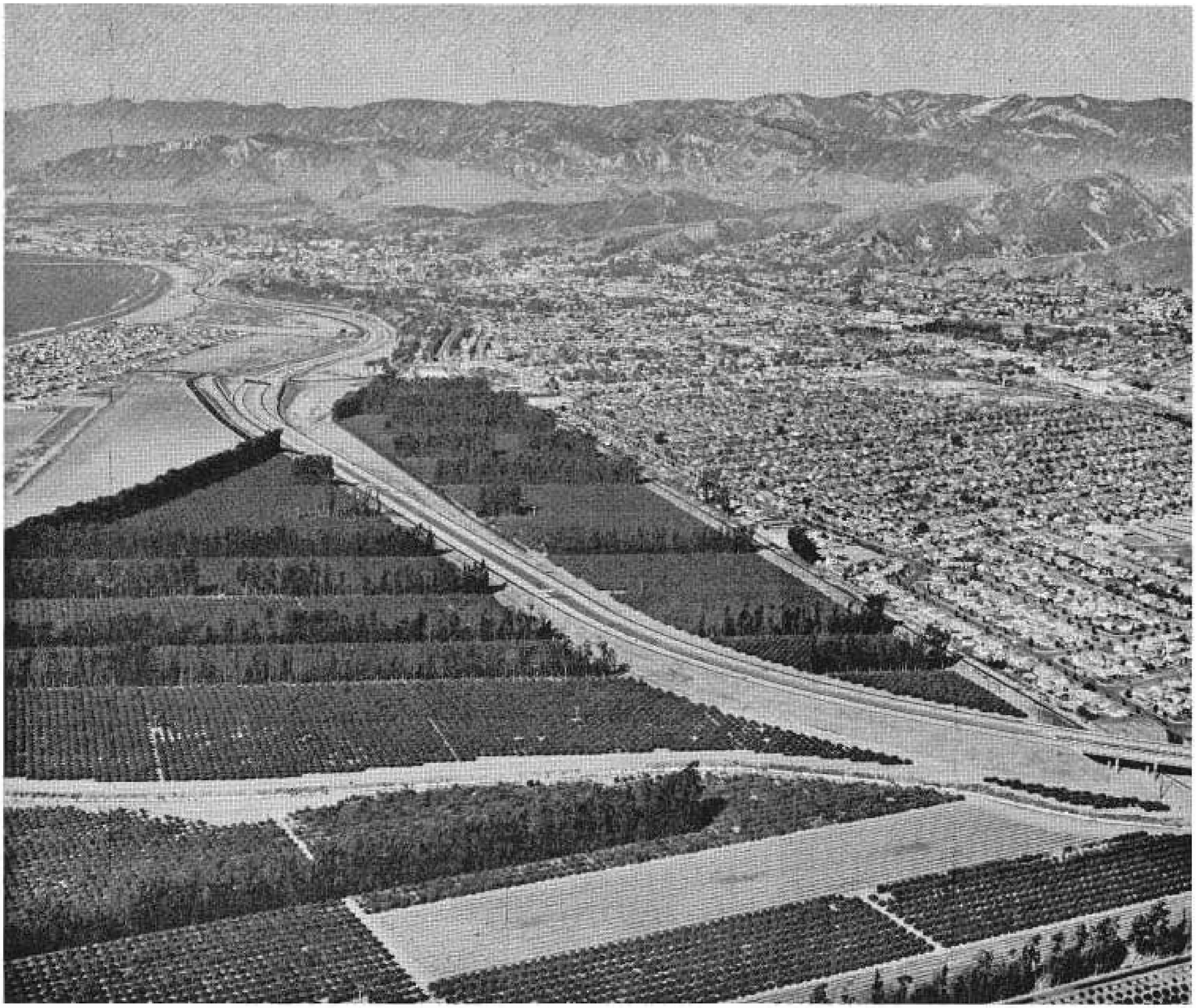
Harbor Freeway

The Harbor Freeway, State Sign Route 11-U.S. 6, was completed throughout in 1962, with the opening to traffic of a four-mile, $6,035,000 project between 208th Street and Pacific Coast Highway on October 2. It is now open between the four-level structure in the Los Angeles Civic Center and Battery Street in San Pedro, 22 miles. A total of $104,590,000 has been expended on this route to date.

Further improvements of the Harbor Freeway are in the planning stage. These include widening of the freeway to six lanes for 2.3 miles between Pacific Coast Highway and Battery Street, estimated to cost $660,000; and extending the freeway one mile from Battery Street to Elberon Avenue, a route for which was adopted by the California Highway Commission in May, 1960, at an estimated construction cost of $2,700,000.

The Route 167 Freeway-Seaside Freeway, State Sign Route 15, is related to Harbor Freeway development. It is an adopted route between the Harbor Freeway and Harbor Boule-

The Golden State Freeway reaches into the San Fernando Valley. This portion, to Osborne Street, was opened to traffic in January.



Orchard and ocean flank the completed section of the Ventura Freeway in the City of Ventura. The view is westward.

vard and will provide access to the Terminal Island Bridge now under construction. The 0.6-mile link will cost about $1,300,000 to build.

The foregoing improvements of the Harbor Freeway and Seaside Freeway are among many projects awaiting financing in District VII, and construction hinges on the future availability of funds.

Hollywood Freeway

The Hollywood Freeway, U.S. 6, was extended 0.7-mile between Vineland Avenue and Magnolia Boulevard in North Hollywood, on July 16, 1962 with traffic using it as far as Magnolia Boulevard. Completion of the $2,815,000 project made the route 11.6 miles long from Spring Street in downtown Los Angeles to the temporary terminus at Chandler Boulevard, bringing the total cost of right-of-way and construction to $74,149,000.

Six miles of the Hollywood Freeway are being designed to a junction with the Golden State Freeway at Truesdale Street. Estimated to cost $15,572,000 for construction, these projects may be financed in the near future.

An existing six-lane section of the Hollywood Freeway in Hollywood, now carrying 140,000 vehicles per day, is being considered for widening from Sunset Boulevard to Pilgrimage Bridge, two miles. The project will cost an estimated $4,700,000 for right-of-way and construction. Adding a lane in each direction and widening the bridge structures will make the freeway a uniform eight lanes from the Los Angeles Civic Center to the San Fernando Valley.

Traffic flow on the Hollywood Freeway has already been facilitated through construction of the Golden State Freeway, a paralleling alternate route to the east and referred to as the downtown freeway loop.

Long Beach Freeway

The Long Beach Freeway, State Sign Route 15, is completed as a state highway from Pacific Coast Highway in Long Beach to the San Bernardino Freeway near Alhambra, 19.7 miles. The total obligated cost of the freeway at the close of 1962 was $56,-524,000.

North of the San Bernardino Freeway $3,400,000 is budgeted for construction to Valley Boulevard, a distance of one mile. From Valley Boulevard the freeway route is adopted to Huntington Drive, from which point it is under study for seven miles to a junction with the Foothill Freeway. Studies on this northernmost section will be concluded in 1964 at which time public hearings will be held.

Widening improvements on the previously constructed route of the Long Beach Freeway from Rosecrans Avenue to the Santa Ana Freeway, and from Rosecrans Avenue to the San Diego Freeway, are being planned. The freeway will be widened from six to eight lanes for the 13-mile length and will require the expenditure of some $4,500,000.

Marina Freeway

The route of the Marina Freeway was adopted by the California Highway Commission on December 16, 1959. The 2.6-mile link will connect the San Diego Freeway with Lincoln Boulevard in the Culver City area and interchange with the Pacific Coast Freeway in the vicinity of Marina del Rey. The easterly continuation of this route is referred to as the Slauson Freeway, which is now under study.

Preliminary design has begun on the Marina Freeway and $1,794,000 has been expended on the needed right-of-way. The estimated construction and right-of-way cost will be in excess of $17,000,000.

Newport Freeway

The Newport Freeway, State Sign Route 55, is 17.7 miles long from the Pacific Coast Highway to the Riverside Freeway in Orange County. Two contracts totalling $9,082,000, and 6.6 miles, were completed and opened to traffic in 1962 joining the Santa Ana Freeway with the Riverside Freeway. South of the Santa Ana Freeway, two miles of the Newport route is financed to Warner Avenue and construction on the $2,137,500 project will begin soon. Construction plans are being readied between Warner Avenue in Santa Ana and 19th Street in Newport Beach, 6.5 miles, with an estimated construction cost of $7,600,000.

Ojai Freeway

The Ojai Freeway, U.S. 399, begins at the Ventura Freeway in Ventura and continues to the Santa Barbara county line, 57 miles distant. Development of the route at this time centers about the southerly end where a section is under construction between the Ventura Freeway and Prospect Avenue, 0.3-mile, in connection with the Ventura Freeway, which will be opened to traffic in June 1963. The freeway was completed from Prospect Street to Mills School, in 1956, 3.6 miles, at a construction cost of $1,-736,000.

The route has been adopted from Mills School to Cozy Dell Canyon, northwest of Ojai, 11 miles, and is now under active design. The construction cost estimate for this mileage is $12,700,000.

PHOTO BELOW LEFT. An eastward view of the Ventura Freeway in Toluca Lake from Pass Avenue overcrossing (bottom left). Upper right, Griffith Park. PHOTO BELOW RIGHT. Looking easterly at construction in progress on the Sign Route 126 freeway from Victoria Avenue Overcrossing at Ventura city limits. Project has recently been opened to traffic as far as Mills Road.

Orange Freeway

The Orange Freeway (State Sign Route 57) is adopted in Orange and Los Angeles Counties, from the Santa Ana Freeway on the south to the San Bernardino Freeway on the north, 19.8 miles. When the route is ultimately extended to a junction with the Pacific Coast Highway at Huntington Beach, it will total nearly 31 miles and will cost about $122,000,000.

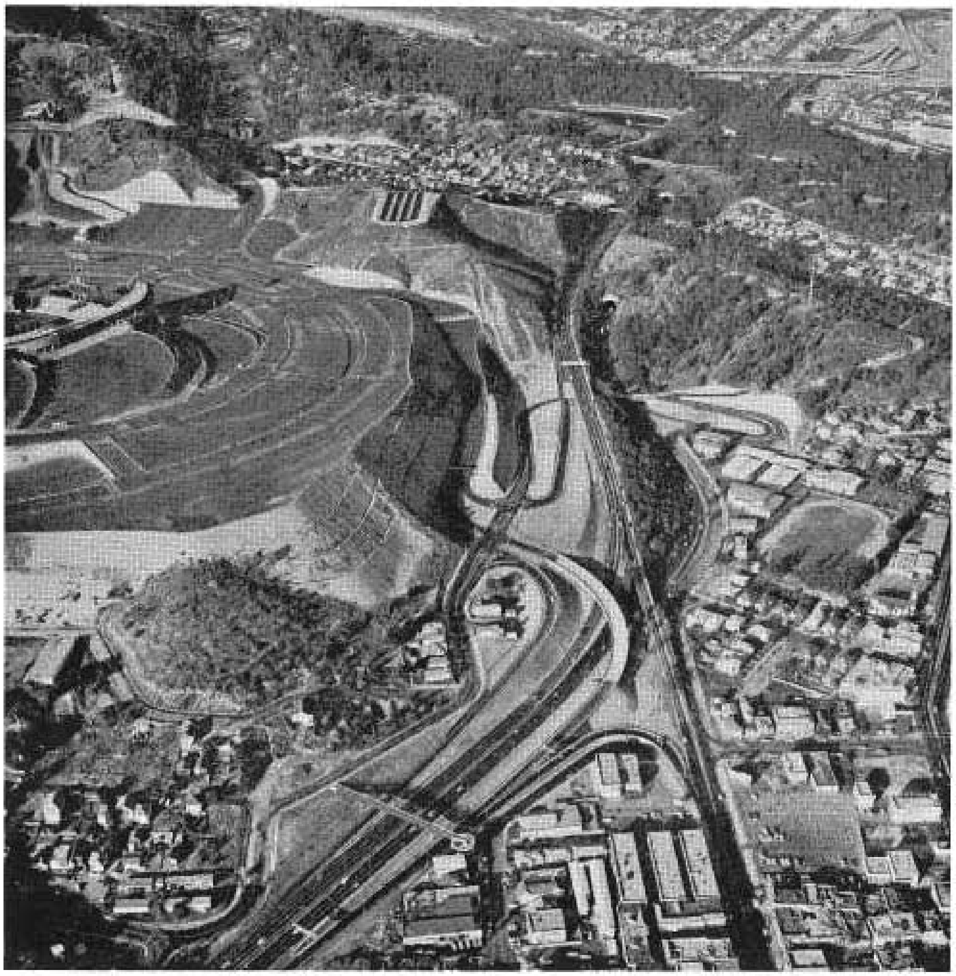
The only project under construction at this time on the Orange Freeway is at the Orange-Santa Ana-Garden Grove Freeway Interchange, where two contracts worth almost $11,000,000 will be completed in the summer of 1964.

Pacific Coast Freeway

Route location studies on the Malibu unit of the Pacific Coast Freeway (U.S. 101 Alternate) have been completed. Study data are in the hands of the State Highway Engineer, who will make a recommendation to the California Highway Commission pending re-evaluation of the studies in the light of scenic highway needs, in the near future.

The freeway is described as extending from Malibu Canyon Road to Point Mugu, a distance of 22.5 miles. There were nine basic lines with variants under consideration, and the estimated cost curve, between the most economical line and the most expensive, ranges from $30,000,000 to $150,000,000, including rights-of-way and construction. Freeway studies in the area first began in 1958.

The most interesting feature of studies on the Malibu Canyon Road-Santa Monica unit of the Pacific Coast Freeway, measuring 12 miles, is the marine location concept being explored by the U.S. Army Corps of Engineers under a $135,000 contract to the State. These explorations will be completed in May 1963, at which time a report will be submitted setting forth the results.



The Dodger Stadium (left) is now served by new pedestrian and vehicular connections at the Pasadena Freeway (foreground). Baseball games last year attracted 4,500,000 people in 1,250,000 automobiles.

The corps has been examining the ocean floor and underlying bedrocks, including wave action peculiar to Santa Monica Bay. The corps study is along the lines of two concepts: (1) a marine location at distances of one-half to one mile from the shore, on causeway (bridge) or solid fill, with recreational facilities, seaward and inland beaches and parking facilities. This plan would extend over the entire 12 miles or sections thereof. (2) A shore location, with widening of the existing beach from 400 to 1,500 feet, including freeway connections to parking areas and other facilities.

The district is studying a third concept, a conventional location inland of the existing highway. The ultimate plan could contain elements of each of the three concepts.

Route location studies are in progress for almost the entire length of the Pacific Coast Freeway from El Rio in Ventura County to the vicinity of San Juan Capistrano in Orange County, about 112 miles. Public hearings leading to adoption will be scheduled as study data are developed. The freeway is constructed for 6.8 miles in Ventura County between Calleguas Creek and Date Street in Oxnard at a cost of $2,413,000. Nineteen miles of the route are adopted in Ventura County and 5.4 miles in Orange County.

Pomona Freeway

The Pomona Freeway, U.S. 60, begins at the East Los Angeles Interchange and continues for almost 30 miles to the San Bernardino county line in this district. Completion of this route will require the expenditure of approximately $93,000,000 in right-of-way and construction funds.

Construction of the first unit of the Pomona Freeway is included in the 1963-64 fiscal year budget, with an allocation of $8,400,000. This 2.4-mile project will extend easterly from the East Los Angeles Interchange to Third Street near Downey Road, and will provide an eight-lane freeway.

Design work is progressing for the easterly extension of the Pomona Freeway in order that construction may be started as funds become available. The freeway will include interchanges with the Long Beach Freeway in the Belvedere Park area, the San Gabriel River Freeway near the confluence of the San Gabriel River and San Jose Creek channels, and the Huntington Beach and Orange Freeways.

Riverside Freeway

The Riverside Freeway, State Sign Route 14-18 and U.S. 91, has been constructed throughout as freeway and expressway from the Santa Ana Freeway to the Riverside county line, 19 miles. So far, $15,179,000 has been invested in the development of this route and plans are afoot to convert the existing expressway portions to full freeway, with the first project being readied between Placentia Avenue and the Newport Freeway, 3.7 miles.

San Bernardino Freeway

The San Bernardino Freeway, U.S. 60-70-99 (Interstate 10), 30.5 miles in length, has been in service for a number of years between the Santa Ana Freeway at Los Angeles River and the San Bernardino county line.

About $63,538,000 has been obligated on this heavily travelled route so far, including widening projects at several locations which have added additional traffic lanes: San Dimas Avenue to San Bernardino county line, $1,033,000 completed in 1960; Rosemead Boulevard to Puente Avenue, $1,319,000 completed in 1961; vicinity of Golden State Freeway interchange, $800,000 completed in 1961; Eastern Avenue to Rosemead Boulevard, $2,025,000 completed in 1961; and Holt Avenue to San Dimas Avenue, $902,000 completed in 1962.

One more widening project is planned between the Golden State Freeway and the Long Beach Freeway and will cost an estimated $9,000,000.

San Diego Freeway

The San Diego Freeway (Interstate 5 and 405) stretches 93.6 miles in District VII, between the San Diego county line at San Clemente and the Golden State Freeway north of San Fernando in Los Angeles County. The year 1962 was significant for the number of completed miles added to this route: Valley Vista Street to Casiano Road across the Santa Monica Mountains, 5.7 miles, $20,150,000, opened to traffic on December 21, 1962; Hawthorne Boulevard to the Harbor Freeway (two contracts), $10,912,000, 4.5 miles, opened to traffic on August 29, 1962; Harbor Freeway to Alameda Street (two contracts), $11,525,000, 4.6 miles, opened to traffic on July 16, 1962; and Alameda Street to Long Beach Freeway, $5,129,000, 1.1 miles, opened to traffic on January 25, 1962.

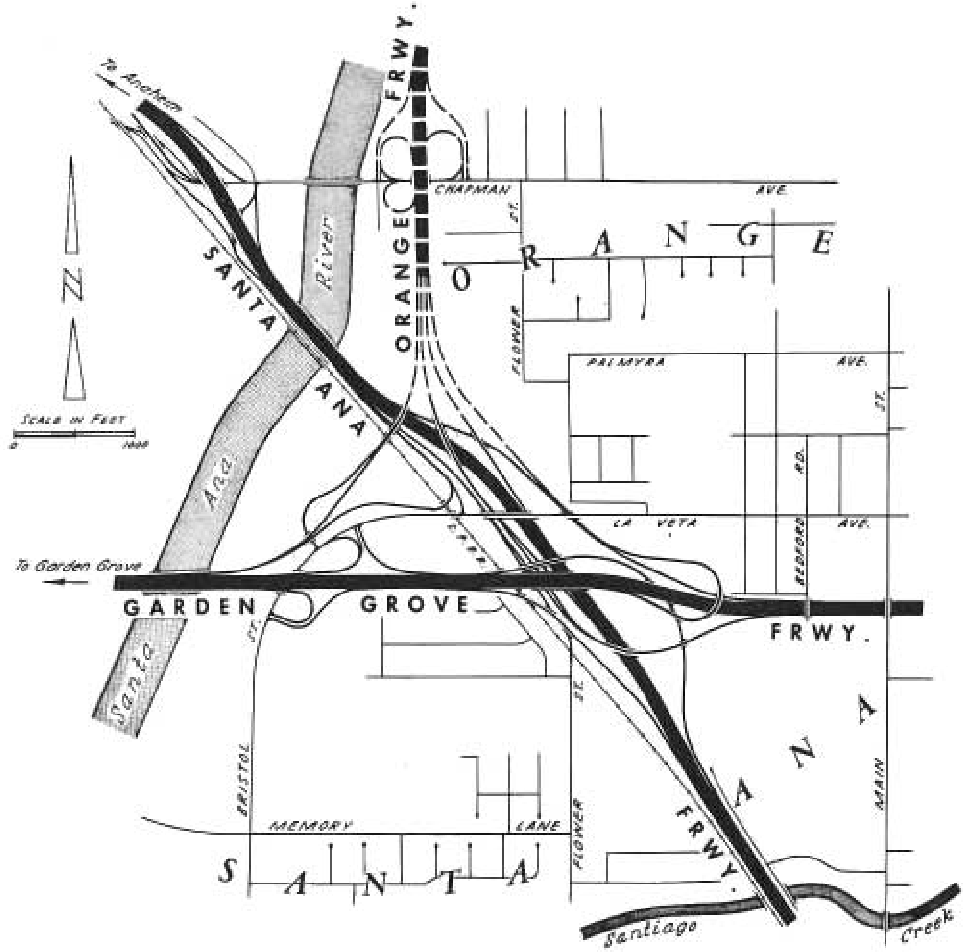
At the close of the year other contracts on intervening sections were underway: Golden State Freeway to Nordhoff Street, $3,234,000, 3.9 miles, and an adjacent section, from Nordhoff Street to Burbank Boulevard, $5,005,000, 4.5 miles, both sections opened to traffic April 19, 1963; Jefferson Boulevard to La Tijera Boulevard, $3,276,000, 1.6 miles, estimated opening to traffic May 1963; La Tijera Boulevard to 137th Street, $11,576,000, 4.7 miles, estimated opening to traffic May 1963; 135th Street to Hawthorne Boulevard, $4,435,000, two miles, dedicated and opened to traffic early in April of 1963; Long Beach Freeway to California Avenue, $7,820,000, 1.6 miles, estimated opening to traffic December 1963, and Atlantic Avenue to the Orange county line, $11,875,000, 5.7 miles, estimated opening to traffic summer, 1964.

There were also other bridge and structure contracts underway along various sections of the route, part of stage construction preparatory to full freeway development.

The construction budget of the past and present fiscal years allocates $17,250,000 for nine miles more of the San Diego Freeway from the San Gabriel River Freeway to Newland Street in Westminster and Huntington Beach. These two projects will be underway this year,

The remaining unconstructed portions of the San Diego Freeway in Orange County are in design. Three projects will carry construction as far as the Santa Ana Freeway at El Toro, a distance of 17 miles, at an estimated construction cost of $33,000,000. In addition, the existing freeway from Capistrano Beach to El Toro is scheduled to be widened to six lanes.

Looking north along the completed Newport Freeway from the Santa Ana Freeway (foreground). New link, opened in September 1962, links Santa Ana with Riverside Freeway in Orange County.



The design plan of the Garden Grove-Santa Ana-Orange Freeway interchange. (See photo next page).

San Gabriel River Freeway

The San Gabriel River Freeway, State Sign Route 35 (Interstate 605), is presently adopted between the Foothill Freeway and the Garden Drove Freeway in Orange County, a distance of 28 miles.

One project on the San Gabriel River Freeway has been completed at Peck Road, under $649,000 contract, providing facilities for the interchange of traffic between the existing San Gabriel River Parkway and Peck Road and connects Peck Road with Workman Mill Road. Elsewhere the freeway is under construction under two contracts worth nearly $11,000,000 for seven miles between Whittier Boulevard and the San Bernardino Freeway. Both contracts will be completed in 1964.

The 1963-64 highway budget includes additional construction financing, $24,750,000, to continue the freeway south to 166th Street in Dairy Valley, more than eight miles. Also financed is a 2.4-mile link in Orange County, between Katella Avenue and the San Diego Freeway, the budget item for which is $5,500,000. A $650,000 item in the current budget will build overcrossings and approach roadways at Centralia Road and at 195th Street, in advance of future freeway construction. All of the foregoing projects will go to construction in 1963.

Contract plans are now being prepared for the 5.3-mile section of the San Gabriel River Freeway from 166th Street to the Orange County line, estimated to cost $13,650,000. Also being planned are connections to the Garden Grove Freeway, 0.7-mile, which will cost about $1,250,000.

On the north end of the freeway, design is progressing between the San Bernardino Freeway and the Foothill Freeway, 5.4 miles. Construction will cost an estimated $14,200,000.

Santa Ana Freeway

The Santa Ana Freeway, U.S. 101 (Interstate 5), is 42.8 miles long from Spring Street in Los Angeles to the San Diego Freeway at El Toro in Orange County. Investments in this route as of December 31, 1962, were $83,348,000.

A widening project was completed in 1962 between South Street and Santa Ana River in the Santa Ana area at a cost of $1,336,000. Other widening projects are planned between Main Street in Santa Ana and Laguna Canyon Road, 10 miles, and between Laguna Canyon Road and the future San Diego Freeway, two miles. The former project (in two units) is budgeted $2,900,000 in the present fiscal year and the latter, estimated to cost $350,000, is awaiting financing.

Median barriers were installed on the freeway between the Harbor Freeway in Los Angeles and Grand Avenue in Santa Ana, costing $731,000; and the Santa Ana Freeway portion of the Newport Freeway was constructed for $356,000.

Under construction at the present time, under two contracts totaling almost $11,000,000, is the Santa Ana-Orange-Garden Grove Freeway interchange, which will be completed in 1964.

Santa Monica Freeway

The Santa Monica Freeway, State Sign Route 26 (Interstate 10), measures 17 miles from the East Los Angeles interchange to the Pacific Coast Highway in Santa Monica. Last year three contracts worth $21,823,000 were completed and opened to traffic, extending the four-mile long Santa Monica Freeway viaduct to Vermont Avenue.

Early in 1963 five more contracts valued at $26,750,600 were in force as far west as La Cienega Boulevard, including the Santa Monica-San Diego Freeway interchange. Two final construction projects were to be advertised soon, filling in the gaps between La Cienega Boulevard and Overland Avenue, 2.6 miles, $6,731,500, and between Sawtelle Boulevard and Ocean Avenue, 3.7 miles, $7,500,000.

It is expected that the Santa Monica Freeway will be opened to traffic to the San Diego Freeway late in 1964 and into Santa Monica by the end of 1965.

Simi Valley Freeway

The Simi Valley Freeway, State Sign Route 118, begins at State Sign Route 126 near Saticoy and proceeds easterly across Ventura County to connection with the Foothill Freeway in Los Angeles County, a distance of some 47 miles.

A 12.5-mile portion of the route between Los Angeles Avenue at Madera Road in Ventura County and De Soto Avenue in the City of Los Angeles was adopted by the California Highway Commission last year. The remaining portions to the west and to the east of this adopted segment are currently under planning study with a target date for adoption late this year.

First construction is planned for a five-mile unit of the adopted route between the easternmost end of Simi Valley and De Soto Avenue in the West San Fernando Valley. An estimated $12,000,000 will be necessary to finance this construction.

Ventura Freeway

The Ventura Freeway, U.S. 101, is constructed to freeway and expressway standards from the Golden State Freeway at Griffith Park in Los Angeles to Palm Street in the City of Ventura.

Two important openings during 1962 made the route continuous from the Hollywood Freeway to the Golden State Freeway. These were projects between the Hollywood Freeway and Buena Vista Street, and between Buena Vista Street and the Golden State Freeway, five miles, completed at a combined construction cost of $10,436,000.

A third project was completed and opened to traffic in the City of Ventura, from Telephone Road to Palm Street, 4.5 miles, at a cost of $9,248,000. A major project is still under $7,757,400 contract, including connections to the Ojai Freeway, and will carry the freeway west from Palm Street to the Ventura overhead, 2.7 miles. This link is set for June 1963 completion.

From the Los Angeles city limits to Conejo Summit, the Ventura Freeway is being initially converted from a four-lane expressway to a four-lane freeway by the construction of interchanges. Six-, and ultimate eight-lane development, will follow as funds become available.

The most recent bridge structures completed are the following: Las Virgenes Road, $493,000; Borchard Road to Conejo Grade Summit, $587.000; Moorpark Road Interchange and improvements of Moorpark, $1,574,884. Projects under contract and scheduled for 1963 completion were Geneve Street Interchange, $432,300 and Chesebro - Lewis Road Interchange, $529,300.

Budgeted interchanges ready for construction are from Los Angeles city limits to Las Virgenes Canyon Road, $1,200,000; Las Virgenes Canyon Road to Chesebro Road, $690,000; Triunfo Road to Moorpark Road, $675,000; Moorpark Road to Borchard Road, $750,000; Old Conejo Road, $470,000; Los Angeles county line to Triunfo Road, $515,000; Lewis Road to Kanan Drive, $620,000; and Vineyard Avenue to Wood Road, $1,054,000.

From the Ventura Overhead at Emma Woods State Park to a point south of the Santa Barbara county line, 10 miles of the Ventura Freeway are in design stages. The freeway here is estimated to cost $1,515,000 for right-of-way and $9,000,000 for construction and will be programmed in future fiscal years.

(For details on the Ventura Freeway and other freeways in Ventura County, see "Ventura County Freeways," *California Highways and Public Works*, September-October 1962).

Route 126 Freeway

The Sign Route 126 Freeway will be a 51-mile route originating at the Ventura Freeway in Ventura and terminating at the Antelope Valley Freeway near Solamint in Los Angeles County. On the westerly end the freeway was dedicated and opened to traffic in mid-April 1963. The section

Looking east along construction on the Garden Grove-Santa Ana-Orange Freeway interchange. The Garden Grove Freeway bridging the Santa Ana River is in the foreground. The diagonal roadway at top is the existing Santa Ana Freeway. (See plan previous page.)

extends from the Ventura Freeway to Wells Road, five miles, and has been under $4,158,950 contract. Construction is about to start on the next link from Wells Road to Santa Paula, 8.5 miles, at a cost of $7,200,000.

The Sign Route 126 Freeway is under study for possible adoption in 1964 from Santa Paula to the Los Angeles county line, 22 miles. From the county line the route is adopted to the Golden State Freeway and a small segment will be constructed at the Golden State Freeway interchange this year.

A public hearing was held on the easterly 10-mile section from the Golden State Freeway to the Antelope Valley Freeway on March 7, 1963 preparatory to route adoption.

Other Freeways

The Yorba Linda Freeway in Orange County, 2.3 miles, was opened to traffic on February 8, 1962, at a construction cost of $1,242,000.

On the Pasadena Freeway in Los Angeles, pedestrian and vehicular connections to the Dodger Stadium were completed at a total cost of $2,257,000.

Industrial and Slauson Freeway route location studies were initiated at the beginning of 1963, and studies on the Beverly Hills and Century Freeways were nearing completion for public hearings by midyear. Studies were also underway on the Malibu-Whitnall Freeway, anticipating adoption after public hearings sometime in 1964.

Transportation Study

Hand in hand with the planning, design and construction of the California freeway-expressway system, the Division of Highways is co-ordinating the Los Angeles Regional Transportation Study. This study was begun in January 1960 and has been described by Highway Transportation Agency Administrator Robert Bradford as perhaps the largest scale major co-operative state-local transportation study ever conceived.

The LARTS study is being conducted under the general co-ordination of the Division of Highways with the co-operation of the U.S. Bureau of Public Roads, the U.S. Housing and Home Finance Agency, the five Counties of Ventura, Los Angeles, Orange, San Bernardino, and Riverside, and 116 cities in these counties. It was organized along the same lines as other successful state-local studies by operating 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. This is being done by relating these movements to the 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.

The 9,000-square-mile LARTS study area includes most of the land lying between Santa Barbara and San Diego and inland for an average distance of 75 miles. Nearly 8,000,000 persons move about in 4,000,000 motor vehicles now. By 1980 the population will be almost twice as great while motor vehicles will have more than doubled.

The goal of LARTS is to express this tremendous growth in terms of transportation needs which state and local officials can use in planning vital community services such as sewers, water and freeways on a priority basis. Among other things, it will serve as a basis for review of the California freeway and expressway system which was adopted by the State Legislature as Senate Bill 480.

Looking north from above the Peck Road Interchange which will bridge the San Gabriel River Freeway now under construction on both sides of the interchange. The San Gabriel River is top left.

Work is underway in the division to develop the best methods for using LARTS results and methodology in highway and freeway planning problems. Data from the completed 1960 land use inventory and other basic LARTS material have already been utilized by a few other government agencies. Many local road and planning departments have changed previous planning procedures in preparation for making the best possible use of LARTS information.

The first report of major results of the Los Angeles Regional Transportation Study is ready to be published. It will be in two volumes—one for 1960, the other for 1980. Publication of these volumes follows a year of intensive processing and analysis involving millions of pieces of data and hundreds of hours of computer time in division headquarters office. It also reflects the continuing high level of working cooperation between the division and all of the other agencies participating in LARTS.

Freeway Call Boxes

On November 1, 1962, the world's first solar-powered emergency call system was installed on 10 miles of the Hollywood, Harbor, Santa Ana and San Bernardino Freeways in the City of Los Angeles. The boxes, painted traffic yellow and with a reflective surface so as to be visible at night, are mounted on light standards at spacings of approximately one-fourth mile.

The self-contained and self-generating call boxes are linked by radio to the Los Angeles Police Department dispatching office so that no communications lines need be run from the boxes to the central station.

Many interesting results have been obtained with the system. From a technical standpoint it has performed very well, particularly in view of the fact that it is the first system of this nature to be installed anywhere in the world. The central station equipment has been in continuous operation 24 hours a day since last November to run up over 2,000 hours of operating time since then, with only two hours of shutdown due to system inoperativeness during the entire period.

There has been, on the average, one call for assistance by a motorist through the system every two hours, day and night, since the system began its operation. During the first month of operation, the system was used by the motorist to carry 70 percent of his requests to the police department for assistance.

Future Prospects

Freeway construction continues to keep pace with California's expanding economy and swelling population, which at the beginning of January 1963 was 7,662,358 in Ventura, Orange and Los Angeles Counties. With annual apportionments for right-of-way and construction standing at about the $163,000,000 mark, expectations are that the freeway-expressway system will be substantially developed by the target year of 1980.

In 1963 almost 53 miles of new freeway will be thrown open to public use, which will mean a record year for freeway construction in the tri-county district. The construction cost will be $93,585,000.

The planning program for fiscal years 1964-71 shows that $356,297,000 in construction funds and $164,969,000 in right-of-way moneys will be required to finance new construction (114 miles) and widen existing routes (31 miles) on the interstate freeways. The remaining 805 miles of the California freeway-expressway system will add $1,758,000,000 in construction and $1,300,000,000 in right-of-way expenditures.

The grand total investment in all routes comprising the District VII freeway and expressway network will exceed $5,000,000,000. In terms of actual freeway in use in the next two decades, Los Angeles County will have 1,064 miles, Orange County 248 miles, and Ventura County 263 miles.

BLIND CENTER BIDS RECEIVED

The Division of Architecture received bids from 27 contractors in March for the construction of an orientation center for the blind in Albany. Intended to train blind persons in techniques needed for functioning in competition with seeing people, the center will have a 40-unit, 2-story dormitory, a 1-story administration and classroom building, and a combination recreation and dining-kitchen unit.

E. Withycombe Made A.S.C.E. Life Member

Life membership in the American Society of Civil Engineers has been awarded to Earl Withycombe, Sierra County Supervisor and retired Assistant State Highway Engineer of the California Division of Highways. Withycombe retired from his job with the State in 1957, but has remained an active member of the local section of A.S.C.E. He was elected a Sierra County Supervisor in 1962.

Withycombe was appointed a special assistant to the State Construction Engineer in 1924, and traveled over the entire State inspecting road contract work. The standards he required to be maintained are considered by many to have been an important factor in making the paving on California highways outstanding in the United States.

He was born in Portland, Oregon, in 1892, and received his degree in engineering from the University of Oregon. His father, James Withycombe, was Governor of Oregon from 1915 to 1919. In 1921 Withycombe joined the California Division of Highways as a resident engineer, and rose to head the Construction Department for the entire State in 1947. In 1950 he was promoted to Assistant State Highway Engineer, Operations, the position from which he retired.

COST INDEX INCREASES

The California Highway Construction Cost Index for the first quarter of 1963 stands at 250.4, an increase of 17.8 points or 7.6 percent over the fourth quarter of 1962.

Projects started during this quarter are well distributed over the entire State representing a cross section of typical highway jobs.

The number of bidders per project during the first quarter averages 6.3, an increase of 0.2 over the previous quarter.

GOVERNOR APPOINTS ERRECA PUBLIC WORKS HEAD

John Erreca, of Los Banos, is sworn in as Director of Public Works by State Highway Transportation Administrator Robert B. Bradford.

Governor Edmund G. Brown has appointed John Erreca, 51, of Los Banos Director of Public Works to succeed Robert B. Bradford, who will assume his duties as Administrator of the Highway Transportation Agency full-time. Erreca's appointment was effective April 15.

"The increasingly complex and urgent questions of transportation which face our growing State demand the full-time effort of an experienced and energetic administrator," the Governor said. "No one fills that bill better than Bob Bradford, who has distinguished himself as one of the finest Directors of Public Works in California's history."

"I am delighted that John Erreca has consented to serve as his successor," the Governor said. "His experience in public service, on the Highway Commission, and in the League of California Cities will be of great benefit to him and to the department."

Erreca, a farmer and cattleman, is a native of Los Banos. He attended public schools there and was graduated from St. Mary's College.

He was a member of the Los Banos City Council from 1938 until 1961 when Governor Brown appointed him to the Highway Commission. He was Mayor of Los Banos from 1944 to 1961.

In 1953, Erreca was elected to the board of directors of the League of California Cities and served as its president in 1959. In 1960 he was chairman of the league's highway committee.

He is a past president of the Merced County Livestock Association and president of the board of directors of the Merced County Spring Fair.

His post, in which he serves at the pleasure of the Governor, pays $22,050 a year.

Erreca and his wife, Ida, have two daughters and a son.

IN MEMORIAM

District III

Johnie R. Dowden, highway maintenance man III.

District IV

Maurice F. Lynch, assistant highway engineer.

Vernon A. Kagg, highway maintenance man II.

District VI

Manuel C. Villalovos, highway landscaping leadingman.

District VII

Peter E. Kay, senior delineator.

Howard F. Long, bookkeeping machine operator II.

George F. Stransky, highway maintenance man III.

District VIII

Robert L. Swarens, assistant highway engineer.

District X

Ferrell S. Clark, highway maintenance man II.

Spencer J. Sparks, senior right of way agent.

Headquarters Office

Edna L. Norheim, intermediate typist-clerk.

Bridge Department

James D. Vernon, engineering aid II.

Robert D. Gardner, highway engineering technician I.

Forrest H. Starr, senior delineator.

State-owned Toll Bridges

Carver Westbrook, toll collector.

Headquarters Shop

Wallace L. Carpenter, auto mechanic.

Shop 1

George N. Bruun, highway equipment mechanic.

Urban Planning

Need for Co-ordination Stressed at Conference

California mayors, councilmen, supervisors, and city and county planners and engineers were put on notice that federal funds will not be available for highway projects in urbanized areas of more than 50,000 after July 1, 1965, unless they are based on a continuing, co-ordinated and comprehensive urban transportation plan.

This warning was presented at the first Regional Urban Transportation Planning Conference to be held in the West by the opening and next-to-closing speakers, State Highway Engineer J. C. Womack and City and County Projects Engineer C. T. Ledden of the Division of Highways.

The conference, sponsored by the American Association of State Highway Officials, the National Association of Counties and the American Municipal Association, was held at the Hotel Senator, Sacramento, February 25 and 26. Also in attendance were officials of state and federal governments and organizations involved in transportation.

"After the '65 date," Womack said, "such planning is mandatory under the terms of the Federal Aid Highway Act of 1962.

"It is not only desirable to co-operate fully in the development of urban planning—it is a *must* if we are to receive federal-aid financing for highway projects in affected communities."

He added that the forthcoming street and highway needs study required by the Streets and Highways Code must be useful to all rather than be "just another study," and said, "We expect this conference to indicate some ways to make the needs studies more useful to our urban areas."

Pointing out that $240,703,000 in federal funds will be expended in 10 of the State's larger metropolitan areas in fiscal 1963-64, Ledden said:

"Figures such as these should be impressive not from the standpoint that our city, county and State will be so much better off for having received these moneys, but because they represent moneys that our city, county or State is entitled to but may not receive if we do not comply with the comprehensive planning requirements of the Federal Aid Highway Act of 1962."

Senator Collier Speaks

State Senator Randolph Collier, chairman of the Senate Transporta-

A. S. Koch, road commissioner of Orange County and president of the County Engineers Association, addresses the Regional Urban Transportation Planning Conference in Sacramento, February 25. Others, left to right, are: Elton Andrews, planning officer, State Office of Planning; John Bergin, councilman, City of Riverside, and vice president of the League of California Cities; Robert Boles, supervisor, Calaveras County, and chairman of the Highway Committee, County Supervisors Association; Robert McCabe, regional director, U.S. Housing and Home Finance Agency, San Francisco; Robert B. Bradford, Administrator, State Highway Transportation Agency; and Sheridan Farin, regional engineer, U.S. Bureau of Public Roads, San Francisco.

tion Committee, welcomed the delegates and reported on pending legislation affecting transportation. He spoke of increasing traffic congestion and, while expressing favor for planning various means of moving people and goods, said that major stress must be placed on highway improvement.

Financial Assistance Explained

Tracy B. Augur, assistant to the Commissioner (Urban Planning), U.S. Housing and Home Finance Agency, explained the types of federal financial and advisory assistance available to metropolitan areas from the Urban Planning Assistance Program, Section 701 of the Housing Act of 1954.

Augur differentiated between the types of assistance for urban transportation planning offered by the U.S. Housing and Home Finance Agency (701 funds) and the U.S. Bureau of Public Roads.

"It is obviously desirable to have the planning of future transportation systems and the planning of future land uses and community facilities carried on as parts of a single operation aimed at producing a convenient and attractive city," Augur said. "Recognizing that fact, the two agencies of the federal government that are in the best position to help such co-ordinated planning have, in a sense, pooled their resources."

The Chief of the Urban Planning Division, U.S. Bureau of Public Roads, G. E. Marple, followed Augur to the rostrum and admitted the difficulties caused state and local planning bodies by lack of firm definitions of the terms of the new highway act. He estimated that the "ground rules" would be promulgated in approximately two months.

Federal Officials Attend

Other federal officials on the conference program were John Nolen, director of transportation planning, Housing and Home Finance Agency, Washington, D.C., and the San Francisco regional chiefs of the Bureau of Public Roads and the Housing and Home Finance Agency, Sheridan Farin and Robert McCabe, respectively.

Nolen spoke on planning public mass transportation, while Farin and McCabe outlined federal responsibilities for developing a comprehensive planning process.

Comprehensive Program Important

Robert B. Bradford, administrator, State Highway Transportation Agency, said that a comprehensive planning program was important for the whole State and promised state attention to rural areas as well as urban.

Bradford added that California was the first state to adopt a 20-year master plan for freeways and expressways and that comprehensive urban transportation planning in several of its larger metropolitan areas was well advanced.

The Planning Officer, State Office of Planning, Elton Andrews, spoke of the importance of the urban planning process being on a continuing basis and defined state responsibilities to cities and counties.

Research Economist Richard Zettel, Institute of Transportation and Traffic Engineering, University of California, hailed a new trend toward "policy makers becoming involved in the comprehensive planning process."

John Bergin, councilman, City of Riverside, and vice president of the League of California Cities, stressed the importance of legislators not making concessions in zoning regulations which would weaken adopted plans. He was followed by Supervisor Robert Boles, of Calaveras County, chairman of the highway committee of the County Supervisors Association, who termed the problems of urban transportation planning as so complex as to warrant an interdisciplinary approach. He urged the hiring of "top level" personnel.

Los Angeles Study Described

A massive, interdisciplinary attack on urban transportation planning, the Los Angeles Regional Transportation Study (LARTS), was described by John McDonald, director of engineering and technical services, Automobile Club of Southern California. The LARTS area embraces the five Counties of Los Angeles, Ventura, Orange, San Bernardino and Riverside, over 118 cities in these counties, and several public and private transportation organizations.

Since the City of San Diego has been engaged in comprehensive transportation planning since 1954, and as early as 1956 was selected by the National Committee on Urban Transportation as one of seven "pilot" cities in the nation, the report of the city's transportation planning engineer, Keith Gilbert, proved of great interest.

Gilbert, as did several other speakers, emphasized the need to build public understanding through many communications media.

Outstanding Example

Speaking of the pilot city program, Richard C. Cowdery of the American Municipal Association, Washington, D.C., cited the one in Madison, Wisconsin, as an outstanding example of how it can be used to train planners from surrounding cities. Karl Noerr, the traffic planner of Madison, made a slide presentation of his city's progress at a luncheon session.

Curtis Nagel, councilman, and M. J. Carozza, director of public works, City of Fresno, described the Fresno-Clovis Metropolitan Area Project, and Fritz Zapf, city engineer of Pasadena, pointed out the contribution of the Los Angeles Metropolitan Transportation Engineering Board in establishing the LARTS project.

Data Use Enlarged

David Speer and William Jones, road commissioners of San Diego and Solano Counties, respectively, recommended that in the 1964 needs study, by adding information to the data processing cards, the information developed could also serve the comprehensive planning requirements of the Federal Aid Highway Act of 1962.

A. S. Koch, road commissioner of Orange County, and D. J. Steele, division engineer, Bureau of Public Roads, Sacramento, presided over the afternoon sessions.

The California Division of Highways served as conference co-ordinator, with C. G. Beer, urban planner, assisted by Charles Zell, senior highway engineer, in charge of arrangements.

Pacheco Pass

Highway Relocation Includes 11,400,000-cubic-yard Fill

By LOUIS G. KROECK, District Design Engineer

Constructing a fill as high as a 25-story building, moving 11,400,000 cubic yards of earth and rock, and designing an embankment to be inundated for 115 feet of its height—these are just a few of the unusual problems encountered by the engineers of the Division of Highways as a result of the creation of the San Luis Unit of the Central Valley Project.

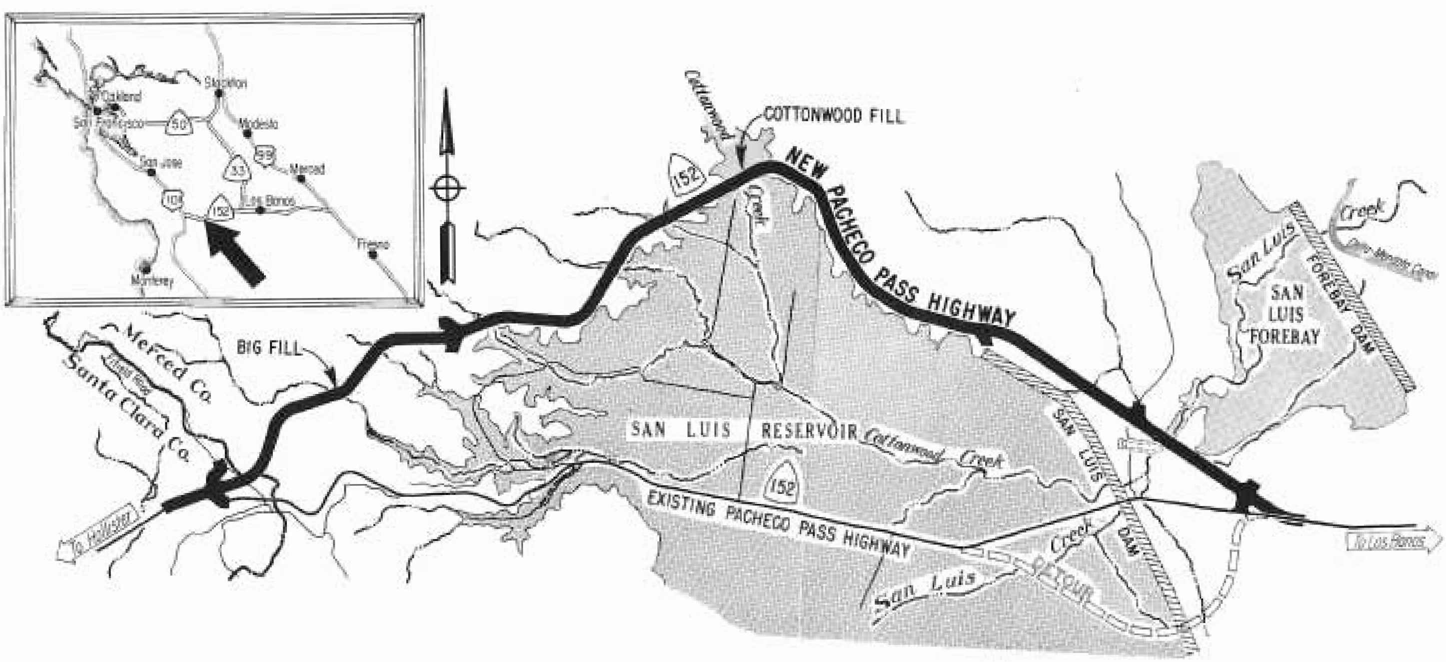
That portion of the San Luis Gonzaga land grant known as the San Luis Flat has for many years been a quiet valley dotted with grazing cattle. This valley lies east of the Diablo Range about 12 miles west of the Town of Los Banos. At present, the valley is divided by State Sign Route 152 (the Pacheco Pass Highway).

Over the next few years, this valley will be buzzing with activity as construction of both the San Luis Dam and the new Pacheco Pass Highway progresses. The San Luis Reservoir, formed by construction of the new dam, will provide the only lake of any significant size on the west side of the San Joaquin Valley. When the reservoir is filled, it will cover more than 13,000 acres and will have a capacity of over 2,000,000 acre-feet of water. Boating, fishing, picnicking, and aquatic sports will be the objectives of a vigorous recreational program. With this recreational program, the expected traffic volume on the Pacheco Pass Highway will be greatly increased. The awarding of the highway and dam contracts marked the epoch of activity for this once pastoral valley.

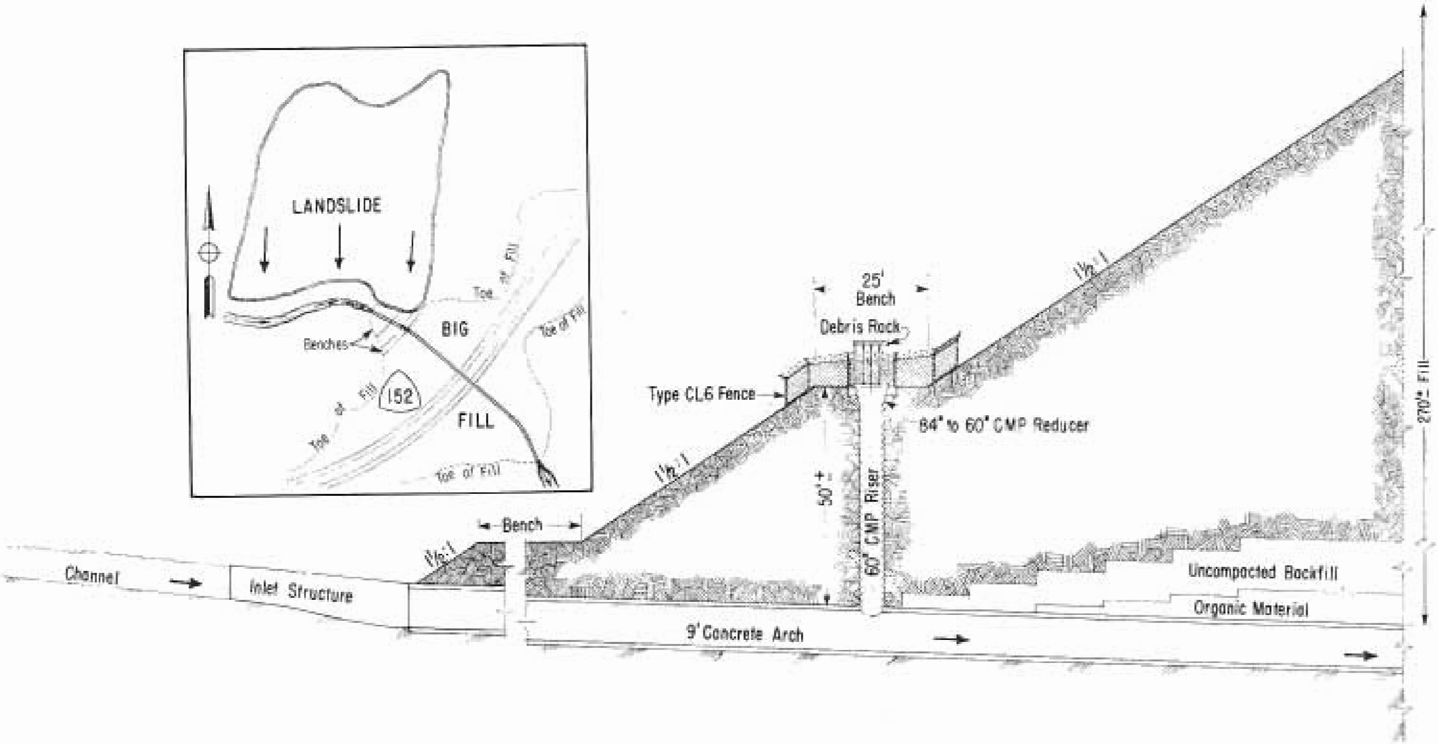
Federal-state Co-operation

The San Luis unit is a major addition to the sprawling Central Valley Project and will also become an essential link in the giant State of California Water Plan. The federal government and the State of California join hands to become partners in this vast water development program. With the construction of the San Luis Dam and Reservoir comes the necessity of relocating a major portion of the Pacheco Pass Highway. Work on the 12-mile relocation is rapidly getting under way. As the federal government and the State have co-operated in the financing of the San Luis Dam, so is the highway relocation being jointly financed by the Federal Bureau of Reclamation, the State Department of Water Resources, and the State Division of Highways. Design and construction of the $12,000,000 project is under the direction of the State Division of Highways, District X in Stockton.

Since the beginning of design work on this highway project, time has been a very critical factor. In order not to delay the progress on the major phase of the water project, the relocated Pacheco Pass Highway must be able to carry at least two lanes of traffic by



The locations of the present and future relocated sections of Sign Route 152 are shown in the above map. The shaded area indicates the land that will be covered by the San Luis reservoir. The inset map shows the general location of the project.



THE BIG FILL. The above sketch shows the arch culvert entrance and its secondary inlet.

January 1965. With a bid opening in January 1963, less than two years are available to move approximately 11,400,000 cubic yards of earth and rock, pave the 12 miles, and construct two 560-foot-long bridges.

Problems in Design

In general, the existing highway follows a ridge down into the floor of the valley. This is a natural location that required very little earthwork. Although the standard of alignment of the existing highway is far below our present criteria, the terrain is such that relatively high standards could now easily be obtained with modern earthmoving equipment.

The new location skirts the north edge of the proposed San Luis Reservoir, crossing deep draws and high ridges. In general, the terrain is steep and rough and normal to the alignment. None of the many locations studied were easily adaptable to highway location. In few places has it been possible to take advantage of a sidehill location. After design was well advanced, a detailed ground survey by the geologic section disclosed an old but potentially dangerous slide area almost centered on our proposed alignment. This dismal picture was complicated by two faults that appeared to intersect just below the slide mass, plus the action of an intermittent stream that will continue to erode the toe of the slide and increase its instability. Recent slumping of the slide mass was evident at several locations. It appeared that the extent and volume of this slide was more than could be overcome, in view of its proximity to our highway; consequently, one of our few sidehill locations was abandoned in favor of "jumping" a canyon 280 feet above the stream. Thoughts immediately turned to a bridge. This site would require a bridge 1,200 feet long and the terrain dictated that it be on a 1,500-foot-radius curve. Economic comparison was made and it was concluded that a 280-foot-high fill would not only be more economical, but also would save time in design and construction.

Size of Fill

If conditions for a successful fill of this magnitude had not been nearly ideal, the only alternative would have been the construction of the more expensive structure. To give some idea of the size of the fill required, the width across its base equals more than three average city blocks. The height will approximately equal the San Gabriel No. 2 Dam or the Don Pedro Dam. It will be higher than the Morena Dam, the Lake Spaulding Dam, or the Folsom Dam. It will be only 70 feet shorter than the largest Pyramid of Egypt. The huge San Luis Dam itself will be only 40 feet higher.

The terrain is a steep canyon over which the highway crosses at approximately right angles. The hills on each side of the canyon are competent rock with only a light overburden. Large cuts within easy haul consist of broken sandstone, which will provide enough material for the lower half of the "big fill." The remainder of the fill will consist primarily of metasandstone, phyllitic shale, with some softer material from the north cuts that have been interbedded with the harder rock. This fill is unique and will bear close watching, both during construction and for several years thereafter.

Another distressing fill problem developed at Cottonwood Creek, when it was again determined that a fill would be more economical than a bridge. This fill is over 2,000 feet in length and has a maximum height of approximately 125 feet. The size of this fill was, in itself, a problem. The problem, however, mounted when it was determined that this fill would be subjected to inundation by the fluctuating water levels planned for the San Luis Reservoir. At planned high water level, the embankment will be completely inundated except for the designed freeboard of 10 feet. At low water level, the embankment will be completely above the water in the reservoir. This embankment will, therefore, be subjected to the most critical case for slope stability; that is, a fully saturated embankment exposed to a rapid drawdown of the water level in the reservoir.

Drawdown Rate

The rate of drawdown of this reservoir could be as much as two feet per day. At this rate, the water surface will be lowering much more rapidly than the water can drain out of the embankment.

To increase the problem, soil tests showed that the cuts on each side of this fill will produce clay materials with expansive characteristics. This material could be used only for the core of the fill. The outer zones of the fill must be constructed of a free draining material selected from other cuts. This outer core, in conjunction with a 10-foot facing of rock slope protection, must provide enough weight to prevent sloughing of the clay core.

Thirteen other fills on this project will also be subjected to inundation of various depths. All the fill slopes that are to be inundated were designed with a 2:1 slope.

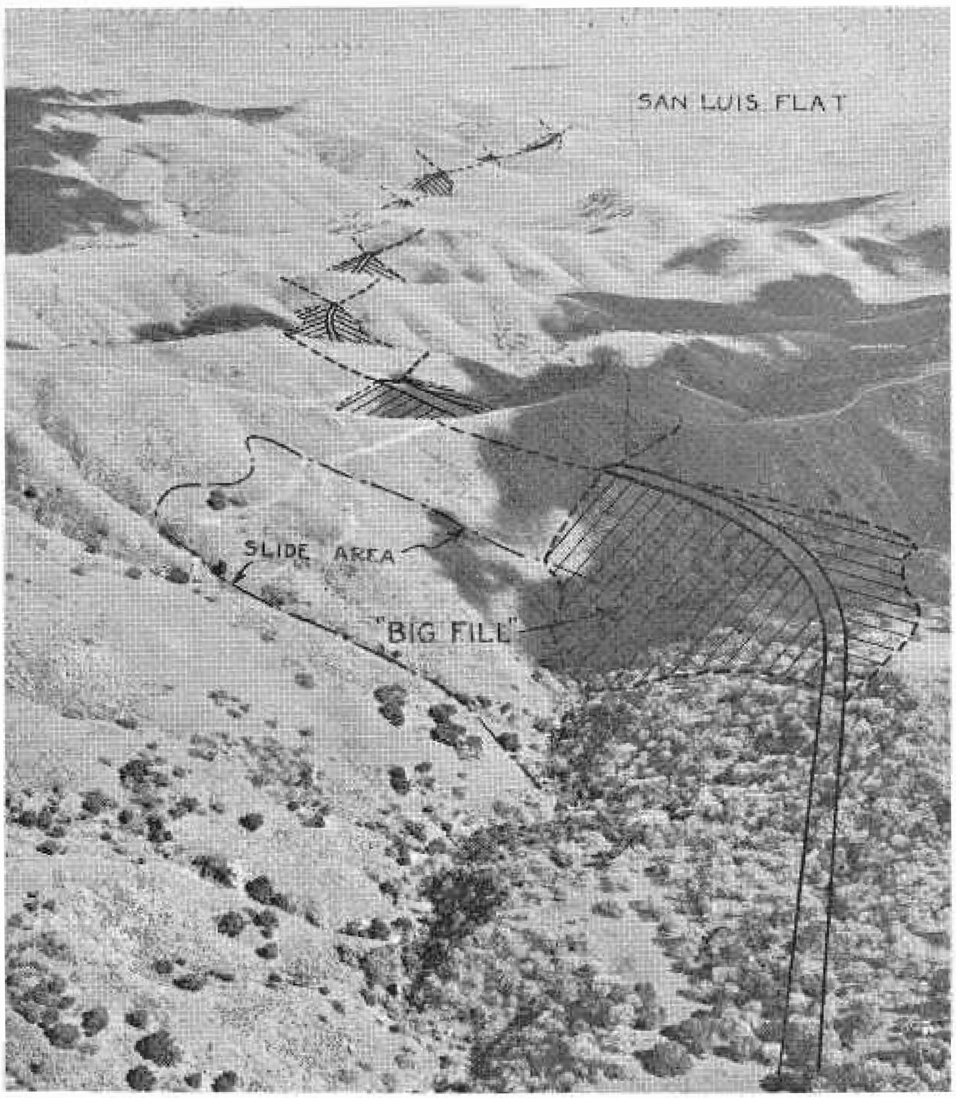
In the vicinity of Station 133, the proposed line crosses the approximate center of a long narrow landslide. The mass of this slide is at a low angle, indicating a fluid condition. Due to the terrain, the location could not be economically altered. The borings were wet and indicated the depth of the slide mass to be approximately 50 feet. The volume of the material involved in this slide made removal unfeasible.

To cope with this problem, stability trenches are to be constructed up to 50 feet in depth, and a system of filter pipes is to be installed which should effectively drain and stabilize the mass prior to construction of the proposed fill. After the installation of the filter system, little difficulty in this area is expected. In normal highway designs, this problem would have been considerable, but on this anomalous project, was so minor as to become almost lost in the magnitude of the unusual.

Special Attention for Culvert

Another problem requiring special attention is the culvert at the bottom of the 280-foot-high fill. This culvert must be capable of carrying 1,700 cubic feet of water per second during the design storm. After much study and consultation with the Bridge Department, a nine-foot concrete arch was determined to be the most feasible. A culvert this small could be used only if we could increase the velocity of flow. A "dropdown," or accelerator, was designed at the entrance which will increase the design velocity to almost 30 feet per second. This acceleration is simply a warped inlet structure 40 feet long that drops the water eight feet on a smooth transition.

For 130 feet ahead of the inlet structure, a channel flare is shaped out of solid rock on an approximate 10-percent grade to give the flow a primary acceleration. The water will further accelerate within the culvert. All this, of course, requires special design of a discharge structure to decelerate the water before its release into its original channel. This energy dissipator consists of a flared channel constructed of an eight-foot layer of two-ton rocks grouted in place to provide as rough a channel as possible. This flare



The superimposed drawing on the above photo shows the future location of the big fill.

The proposed realignment drawn over this photo of the existing terrain shows location of the cut and fill portions. The present highway can be seen in the upper part of the photo.

is 65 feet long and ties into the solid rock bed of the natural waterway.

The total length of this nine-foot arch is 1,042 feet with the middle 625 feet of heavy design to withstand the static load imposed by the high fill. A six-foot depth of compressible organic material, plus a 12-foot-thick layer of uncompacted backfill material will be placed on top of the arch to allow for settlement of the large fill. Instrumentation will be placed in this arch in order to learn more about the forces involved under a fill of this magnitude. There is much to learn regarding stresses in structures under high fills, and, for this reason, the designs are probably overly conservative. It is hoped that the instrumentation in this installation will add to our knowledge and result in more economical designs in the future.

Landslide Danger

Another unusual problem encountered at this culvert location was the possibility of the entrance being partially or totally blocked by the same landslide that forced us into constructing the 280-foot fill. The canyon upstream from the fill rises rapidly, providing little water storage capacity. Unfortunately, a storm severe enough to fill the canyon could very possibly reactivate the landslide and dump as much as half a million cubic yards of rock and clay over the entrance to the nine-foot arch culvert. This, of course, could be disastrous, since there is no alternate route for traffic for many miles, and the failure of this fill could take many months to repair.

After considering several possible solutions, we chose to provide a secondary inlet to the nine-foot arch 50 feet above the top of the culvert and at a location clear of the effects of the slide. This secondary inlet consists of a vertical corrugated metal pipe 60 inches in diameter with its inlet located on a bench. The entrance is protected by a heavy debris barrier plus a high chain-link fence to prevent curious hunters from the 50-foot vertical drop. Fifty feet of water should have little detrimental effect on this 280 foot fill.

Entrance Capacity Increased

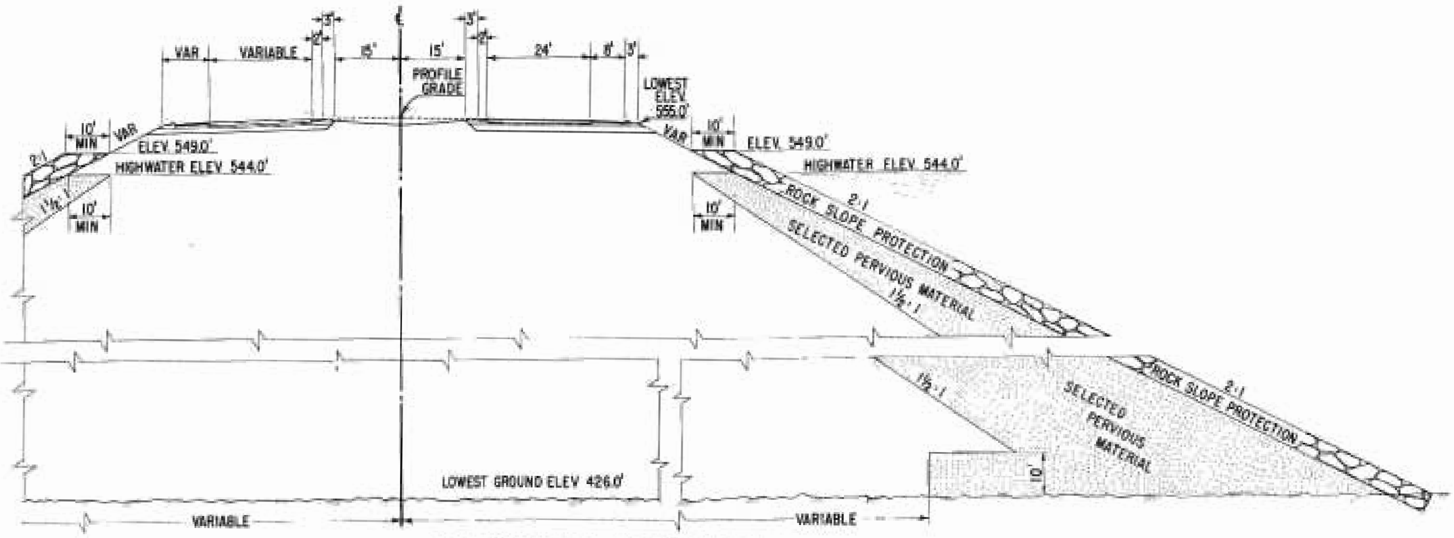
The capacity of this secondary entrance is increased by the use of a standard 84-inch to 60-inch reducer which will allow the flow of water to accelerate before it is restricted to the 60-inch-diameter pipe. Corrugated metal pipe was chosen at this location because of its inherent ability to yield as the fill settles. To prevent any appreciable force from being imposed on the concrete arch by the vertical pipe, a slip-joint is provided at the junction of the metal pipe with the arch. We hope that the secondary inlet will never be needed, but until the time it falls into desuetude, it will stand as a safeguard beside the gigantic fill.

At eight locations on this project, the fills crossing the ravines are of such magnitude that it was necessary to provide service roads down to the entrances of the culverts, furnishing access for our maintenance forces. It is too much to expect even the most energetic and dedicated members of our maintenance forces to descend and climb back up the face of these high fills. The service roads consist only of a 16-foot-wide graded roadbed on a maximum gradient of approximately 22 percent. Although the standards of these roads are low, we are sure that many times in the future the maintenance force will appreciate the forethought of the designers. Since it is anticipated that these roads will be used by the contractor for haul during the life of the contract, we feel that the added cost is nominal.

Consideration was also given to ease of maintenance during the design of the many benches in the cut sections. In all the major cuts, at least the first bench has access from the highway.

Truck-climbing Lanes

This new portion of the Pacheco Pass Highway rises only 1,100 feet in the 12 miles; however, due to the topography, there are several locations where grades up to 6 percent are necessary. Since this route is a main link between the San Francisco area market and the lush farming areas of the southern San Joaquin Valley, it is used



COTTONWOOD CREEK FILL

heavily by trucks. Because of this heavy truck usage, an additional lane for the climbing trucks has been provided on all grades of 5 percent or over. The maximum superelevation provided on this lane will be 5 percent since the trucks will be moving very slowly. The total length of climbing lanes to be provided will be 4.3 miles.

Testing

After the district materials department had made several borings along the line, it was obvious that a more extensive study would be required. The foundation section of the materials and research department was called upon for assistance. The primary purpose of the additional investigation was to obtain information pertinent to cut slope design and foundation stability. This investigation consisted mainly of taking cores with a 2⅞-inch double-tube rotary core barrel with either a diamond bit or a tungsten carbide bit. A heavy drilling mud was the circulating medium in all rotary holes.

A total of 1,520 feet of coring was removed from the ground, and a total of a mile of holes was drilled in our efforts to obtain a knowledge of the natural subsurface structure and the hydrologic problems that might be encountered. In addition to the cores, use was made of a 12-channel refraction seismograph, using explosives for the wave source.

The rocks in this area are of Franciscan formation and are predominantly deeply weathered metasandstone and interbedded phyllitic shale. Chert is also in evidence along the line. The Franciscan rocks have been strongly folded into a complex structure, and there is indication of a complex system of faulting. Landslides and earth slumping have occurred in many places in the area. In general, the type of material and the rapidity with which it changes does not lend itself to ease of slope determination, especially where cuts of over 100 feet in depth are common. Thanks to the ability of our foundation section, we were guided out of trouble at several locations.

Co-operation

The design of this project was accomplished in record time. Only the complete co-operatiion of everyone involved made this possible. The Department of Water Resources and the Bureau of Reclamation were very helpful. Special mention must be made of the excellent service rendered by the materials and research department and the bridge department. They were ever ready at a moment's notice to lend a helping hand in a consultant capacity.

Use of Area

Since the entire reservoir is owned by the State, the contractor is not restricted to operate within the right-of-way limits. In this rough terrain, this fact will be a definite aid to the contractor's operation, and for this reason, the contract does not call for the construction of the freeway fence until the last order of work.

Some idea of the size of this project can be obtained by the following quantities:

Roadway excavation	11,400,000 cubic yards
Selected pervious materials	523,000 cubic yards
Overhaul	223,000,000 station yards
Portland cement	117,000 barrels
Permeable material	73,000 tons
Perforated pipe	26,500 feet
Rock slope protection	180,000 cubic yards
Fence	139,000 feet

The contractor for this project is McNamara and Mannix. The project should be completed in the spring of 1965 at a cost of over $12,000,000.

As the average motorist rides over this new highway enjoying his view of the placid waters of the reservoir, little will he know of the difficulties encountered by the engineers in the design and construction of this project. Little will he care that he is traveling over the highest embankment ever constructed by the Division of Highways.

Editor's Note: After completion of this project, a "followup" article will appear on the actual construction of this unusual project.

Mojave River Bridge

New Structure Spans Victorville Narrows

By R. W. AUSTIN, Project Engineer

On December 21, 1962, the improvement of State Sign Route 18 through Victorville, including a new 447-foot bridge across the Mojave River and the A.T.&S.F. railway at the Victorville Narrows, was completed, thereby eliminating a narrow hazardous crossing. This four-lane highway project between one mile east of Victorville and the Barstow Freeway, in addition to the bridge construction, consisted of the widening to a 64-foot all-paved section through the business district of Victorville and a four-lane divided facility easterly of the Mojave River.

Safety Is Improved

This construction improves the safety and capacity of Sign Route 18 for traffic from the Apple Valley area to the Victorville, Oro Grande, George Air Force Base and Adelanto areas.

The westerly approach to the old steel box girder arch bridge and plate girder overhead was on a short radius curve and had inadequate superelevation. These substandard geometric features combined with the 20-foot curb-to-curb width on the bridge resulted in a high frequency of accidents at this location.

Truck Traffic

The Victorville Lime Rock Products Plant, located westerly of and adjacent to the old bridge, generated a considerable amount of truck traffic. This traffic, predominantly semi-truck and trailer combinations of which many negotiated a left turn into the plant area, further contributed to the traffic problem.

Old Bridge Retained

The original intent had been to demolish the old bridge; however, in the latter stages of design of the project, it was realized that by retaining the picturesque old bridge and a portion of a superseded county road, the trucks hauling ore to the plant would have a separate corridor to the plant and would not enter the state highway.

The Mojave River Bridge and Overhead at Victorville Narrows, looking eastward. The recently completed bridge carrying Sign Route 18 traffic is on the right. The old arch bridge on the left now serves as a haul road for ore trucks to a lime rock products plant.

New Connection

Trucks hauling the finished limestone products are routed to the plant via a new connection for the county road (Stoddard Wells Road) which has channelized median storage and turning lanes. In this manner, the formerly hazardous left-turn condition has been virtually eliminated.

Negotiations Are Required

The decision to retain the old bridge and provide a separate corridor to the truck traffic required negotiations and agreements with the A.T.&S.F. railway; the County of San Bernardino which agreed to accept maintenance of the old bridge and approach, the Victorville Lime Rock Products Company, and the State of California. The net result has been a source of satisfaction to all parties concerned.

Project Cost

The new $550,000 bridge was built by Osburn Constructors, a subcontractor to the Gibbons and Reed Company who constructed the overall project between the community of Desert Knolls and the Barstow Freeway. The overall project, 2.7 miles in length, was constructed at a cost of $1,210,000 under the supervision of W. S. P. Griffith, resident engineer.

Sign Route 1

Morro Bay, Cambria Sections Are Realigned and Widened

By JAMES M. STURGEON, District Construction Engineer

One of the most scenic and highly publicized highways in California is that section of State Sign Route 1 between Morro Bay and Monterey, often referred to locally as "Wonderful One."

At Morro Bay, the famous Morro Rock stands as sentinel over the southerly beginning of this scenic route. The highway continues through Cayucos on peaceful Estero Bay and then winds its way through the foothills of the Santa Lucia Mountains to Cambria and Cambria Pines. These communities attract many tourists each year, especially summer vacationers from the Central Valley.

Then the route follows the coastline northward, passing the enchanted castle of William Randolph Hearst at San Simeon, now a state historical monument visited by several hundred thousand persons each year.

Road Follows Steep Slopes

North of San Simeon the highway travels along through sparsely populated areas as it climbs the seaward cliffs of the Santa Lucia Mountains. The roadbed clings to the steep slopes and crosses the deep canyons of this wild and spectacular area, passing several campgrounds including the popular Big Sur State Park and resort area. It continues to Carmel, site of Mission San Carlos Borromeo de Monterey, and the historic City of Monterey, original capital city of California.

In a book titled "California Highways" written in 1920 by Ben Blow, manager of the Good Roads Bureau of the California State Automobile Association, the comment is made (concerning the then-proposed Carmel-San Simeon Highway).

"The country through which the road would run is so rugged in character as to try out the climbing qualities of a rocky mountain goat, but of glorious scenic attraction. . . . It is to be a shoreline road hung high above the breakers and is intended purely for a touring road . . ."

First Money in 1919

This "touring road" was originally conceived by a physician in Monterey, the late Dr. John L. D. Roberts. In 1917 he walked the coastal area from San Simeon to Big Sur just to prove to his own satisfaction that such a road could be built. Subse-

PHOTO BELOW. A scenic view of Sign Route 1 in Monterey County with Big Creek Bridge visible in the distance.

A map showing the location (dotted lines) of the recent highway construction on Sign Route 1 near Morro Bay and Cambria.

quently, Dr. Roberts joined forces with the late Senator Rigdon of Cambria to sponsor the "Coast Highway" in the newspapers, the State Capitol, and half the county seats in California. As a result, in 1919 the State Bond Act for Highways contained a provision for a new road between Carmel and San Simeon.

The original allocation for construction of this road was $1,500,000. Construction was continued over a period of years using both convict labor and private contractors. Fnally in 1937, after expenditure of more than $15,000,000, the "Coast Road" was completed and opened to traffic.

Construction Continuous

However, construction and reconstruction of this scenic coastal section has never really stopped and the end of work to preserve this scenic route is not yet in sight.

In addition to resurfacing the roadbed, repainting bridges, replacing guardrail and other types of routine maintenance, the Division of Highways has in the last five years let eight separate contracts for replacement of a considerable number of the original redwood crib-type retaining walls. New concrete crib-type retaining walls afford longer-lasting protection to the existing roadway by preventing the roadbed from slipping.

Two of these contracts cost more than $300,000 each and the total five-year expenditure for this purpose alone has amounted to over $1,400,000. More of such protection work is planned during the next few years.

In this same five-year period, substandard and overage timber bridges at Dolan Creek, Anderson Canyon, Willow Creek, and Villa Creek were replaced by attractive, permanent reinforced concrete bridges, with better designed approaches. A $370,000 contract is now underway for replacement of the existing timber bridge at Hot Springs Canyon; similar replacement of another timber bridge at Vicente Creek is scheduled to begin later this spring. As funds permit in the future, five more such bridges will also be replaced in order of priority of need.

These efforts are part of a continuing planned program to preserve the highway in this most rugged terrain while maintaining its scenic qualities and improving traffic safety.

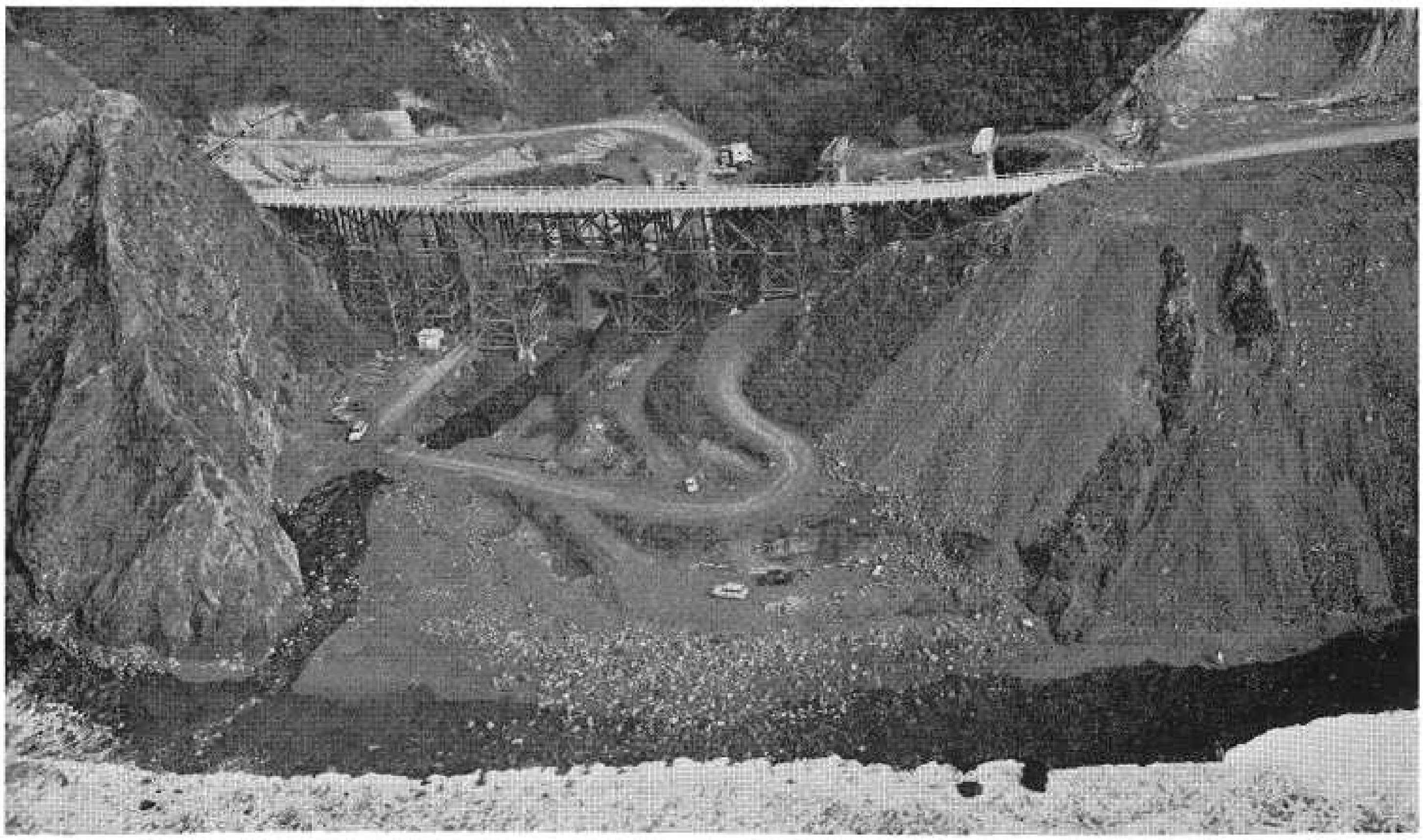
Many Scenic Bridges

There are many beautiful bridges spanning the gorges along this section of Highway 1, the most spectacular being the Bixby Creek Bridge. This concrete arch structure can be seen from both north and south as the traveler approaches Bixby Creek Canyon and it presents a breathtaking vista. The roadway is 260 feet above the tiny stream that empties into the ocean on a beautiful stretch of sandy beach. The arch span is 330 feet in length, making this one of the highest and longest structures of its type in the country. It is one of the most photographed structures on the coast.

This section of State Sign Route 1 between Carmel and San Simeon is now under study as part of proposed statewide scenic highway system whereby every effort would be made to preserve the natural scenic beauty and minimize the encroachments of civilization.

At the southern more densely populated section of the Cabrillo Highway population growth and business expansion have been typical of a rapidly growing state.

A view of some of the extensive cribbing construction just north of Salmon Creek.



This 1961 photo shows construction of a new bridge at Willow Springs Creek directly behind the existing bridge.

To accommodate this community growth, recent extensive changes have been made on State Sign Route 1 and more work is in progress.

Twelve Miles Realigned

In November 1962, construction was completed on realignment of some 12 miles which had consisted of narrow roadbed on very poor alignment, with even worse sight distance. This route between Cayucos and Cambria was a slow, dangerous road to travel as it had 83 curves, the majority of which had a radius of 500 feet or less. Also, over the entire 12-mile route only 10 percent of the total highway length was safe for passing.

The recently completed $2,000,000 realignment of this route provides a still scenic, but safe, well-aligned highway that reduces the strain of driving and increases the pleasure of the trip along the coastline of Estero Bay and through the surrounding coastal farming lands.

Madonna Construction Company, contractor on the project, had to overcome a series of earth slides and slipouts in addition to routine problems common to most construction projects.

In December 1962 the same contractor began a 4.5-mile two-lane controlled access project beginning at the north end of the recently completed project, then bypassing the Town of Cambria to the southwest and ending north of Cambria, joining the existing highway just south of San Simeon Creek.

As in the case of the project between Cayucos and Cambria, sufficient rights-of-way on the Cambria Bypass were acquired for future expansion to a four-lane divided expressway when anticipated increased traffic requires the additional lanes.

Construction Under Way

Construction of the initial two lanes on improved alignment is now well under way and it is hoped this $1,300,000 project can be completed and opened to traffic by September 1963.

A. J. Jorge was the State's resident engineer on the Cayucos to Cambria project, and he is also the resident engineer on the Cambria Bypass job.

A view of the recently completed two-lane highway between Cayucos and Cambria (far background). Compare the new alignment to that of the old highway to the right.

Between Morro Bay and Cayucos, 6½ miles of four-lane expressway construction is nearing completion. At the southern end of this project the route follows new alignment, bypassing Morro Bay on the north, then joining and following the existing route to the end of the new construction, approximately one mile south of Cayucos. By using this alignment the majority of the existing highway will serve as a frontage road for the benefit of local traffic.

Created Drainage Problems

This project passes through extensive and expanding residential and roadside business developments. The resident engineer, J. W. Robertson, has found that the rapid and continuous development of property adjacent to the new facility has created a series of drainage problems as streets, curbs, and storm drains replace sand dunes and sloughs.

On this project the contractor, also Madonna Construction Company, has been free of slide problems, but has been involved in a series of unusual circumstances that have hampered work.

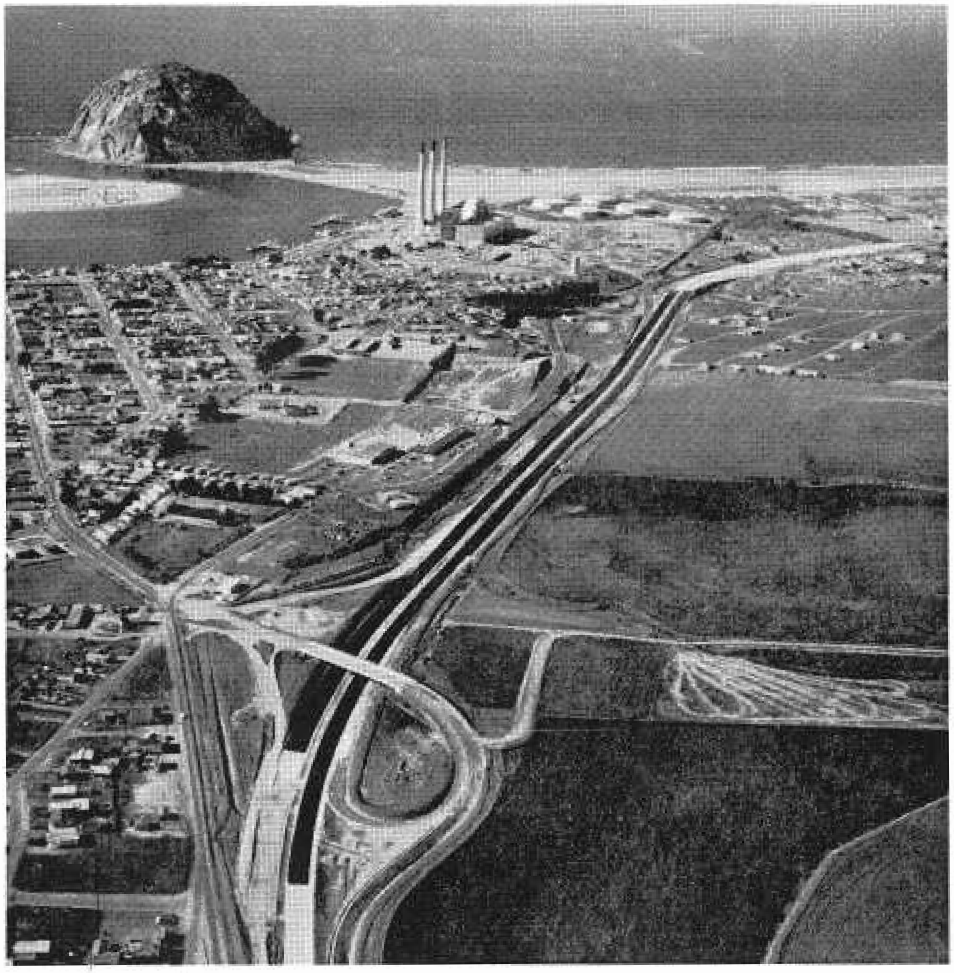
Find Archeological Site

First, the material site selected for subbase material turned out to be an old Indian campsite of unusual archaeological interest. Production of construction materials was stopped while archaeologists carefully excavated, reconstructed the area as it had been originally used, photographed and catalogued their finds, packed them up and left the area so that highway construction could continue. This work was financed by the Pacific Gas and Electric Company, owner of the property involved.

Large Stockpile

Also a large stockpile of base material, crushed and processed at considerable expense to the contractor and complying with every applicable specification of the contract, at the time it was produced, turned out to be a "quick weathering" material that further testing indicated could not be used in the structural section of the roadbed.

Barring further complications, this long-awaited $2,050,000 project should be open to public travel by June 1963. Immediately thereafter, functional planting for erosion control and tree planting for highway beautification is planned.



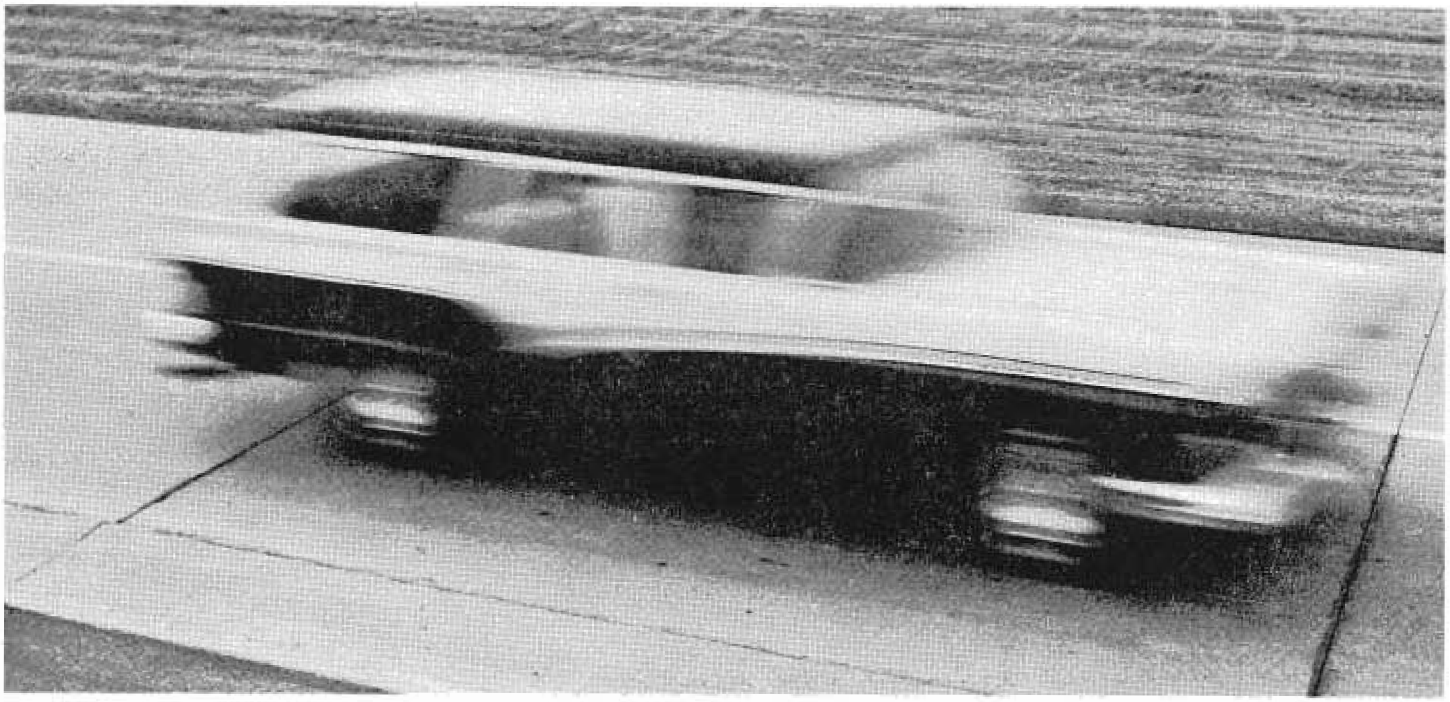
The southern end of the project between Morro Bay and Cayucos. Town of Morro Bay is in center left. Morro Rock stands in the background and P.G. & E. Power Plant in center background.

Connecting Link Planned

As a connecting link between this project and the recently completed Cayucos to Cambria project, construction is planned this year of a four-lane expressway bypassing the resort community of Cayucos on its eastern fringe. This will eliminate the present heavy traffic congestion in the center of Cayucos, particularly in summer. It will provide additional safety to all traffic by eliminating restricted sight distance in many locations, and a narrow hazardous roadway constructed in the 1920's. This project will be approximately 2.8 miles in length and will cost an estimated $3,000,000 to construct.

With completion of all these freeway and expressway projects, the growing coastal communities will find relief from the present irritating and hazardous traffic congestion. In addition, California's citizens and tourists everywhere will find an easy access from San Luis Obispo to the beach resort areas, Hearst Castle, and the State Parks and camping areas along the way.

Highway 1 is still the "touring road" dreamed of in the 1920's. Visitors should realize that the "Coast Road" from Carmel to San Simeon has many curves and grades that are almost as spectacular as the scenery. Highway 1 is still meant for meandering, for stopping and taking photographs, for observation and enjoyment. It is not made for the driver intent on setting speed records or for making a standard number of miles on a long trip.



Contraction Joints

Change in Spacing Follows 'Bounce' Study

For 20 years the California Division of Highways has been building highways with contraction joints at 15-foot intervals, but recently drivers of some late model cars have complained of a rhythmic bouncing effect on certain sections. Preliminary studies showed this was a characteristic of a number of the newer models, because of smaller wheels, softer springing, and higher speeds. Determined to provide the smoothest possible ride for California motorists and truckers, the Design Department of the Division of Highways made a series of more detailed studies of the bouncing problem, and possible ways to eliminate it.

From a theoretical standpoint, it appeared reasonable that variable spacing would tend to prevent the buildup of a rhythmic bouncing motion in softly sprung cars and particularly in commercial vehicles. There was not only the regularity of the impulses to be considered, but also the lengths of wheelbase, the springing systems, and the circumference of the tires. As all of these factors vary from car to car and from year to year, it seemed that a system of irregular joint spacing would be most likely to minimize the role of pavement joints as a contributing factor to rhythmic car motion.

Intensive Study

In co-operation with the design department, the materials and research department engaged in an intensive study of the factors which produce the riding qualities of a highway. They also developed instrumentation to be installed in various models of cars to give numerical values to comfort of ride. This work is continuing and should lead to further future improvements.

The construction department also co-operated in this project and constructed random spacing on several contracts using a sequence of 13, 17, 14, 16 feet and repeat. On one contract a pattern of 13, 14, 17, 16 feet was used with the joints sawed diagonally. There was a self-imposed limitation that the joint spacing should remain close to 15 feet and that the pattern should repeat every 60 feet.

It was believed by many observers that these patterns produced an improvement in ride, but there was no noticeable reduction in harmonic vibration and bounce in the particular cars most susceptible to this unpleasant motion.

Using these experiments as a departure point, the design department continued its studies in a conjunction with the materials and research department, exploring the problem further on a theoretical basis rather than an empirical one. Eventually, electronic data processing machines indicated a randomized joint spacing of 13, 19, 18, and 12 feet could be expected to provide optimum results.

Co-operative Effort

An arrangement was made with a major automobile manufacturer to correlate this design work with the riding characteristics of present-day automobiles, as well as the automobile of tomorrow now on the drawing board. The University of California's Institute of Transportation and Traffic Engineering was also asked to help in the tests.

A portion of the Newport Freeway near Tustin in Orange County was selected as a test roadway, and test sections were laid out as follows:

A. On the northbound traffic lanes beginning at the southerly end of the project, these joint systems were installed:

Length	*Joint interval*	*Type of pattern*
1 mile	13, 17, 14, 16	Diagonal
(Repeating random pattern)		
1 mile	13, 17, 14, 16	Transverse
(Repeating random pattern)		
1 mile	15-foot uniform interval	Transverse

B. On the southbound traffic lanes beginning at the northerly end of the project, the joint spacing was as follows:

Length	*Joint interval*	*Type of pattern*
1 mile	15	Transverse
1 mile	13, 19, 18, 12	Transverse
1 mile	13, 19, 18, 12	Diagonal

When the contract was completed, the riding qualities of the pavement were thoroughly tested by the Los Angeles branch of the I.T.T.E. from U.C.L.A., by the car manufacturer, and by the headquarters materials and research department with heavily instrumented equipment. Many makes and models of cars were tested and profilograms recorded.

The Newport Freeway pavement is exceptionally smooth with a profile index of 1.7, and therefore most of the cars performed very well on all of the test sections. The vehicles most susceptible to rhythmic motion obviously were affected least by the calculated pattern of 13, 19, 18, and 12 feet.

In view of the benefit to large numbers of vehicles now using the highways, the weakened plane joint spacing of 13, 19, 18, 12 feet and repeat has been adopted. Where paving operations permit, all joints will be constructed on a slight diagonal so the vehicle wheels strike the joint at different times as this also has been found to further improve both the ride and pavement performance as well. The paving details in the standard plans have been revised to incorporate this change and changes are being made, where possible, in going contracts in the continuing endeavor to provide the best possible ride for the road user.

Newport Freeway in Orange County, shown above from an overcrossing and below from the air, was chosen for tests because it was new, and also had very good profile index. Joints show clearly in above photo; scene is close to junction with Santa Ana Freeway, intersection with which shows in aerial.

Freeway Guardrail

Installation Made Where Genuine Hazard Exists

By ROGER T. JOHNSON and THOMAS N. TAMBURRI, Assistant Traffic Engineers

In recent years the public has shown considerable interest in the subject of guardrail on freeways where private improvements are located immediately adjacent to the freeway right-of-way. A possible problem exists where vehicles run over a freeway embankment, endangering the lives and property of persons on adjacent private property.

On many occasions, property owners have requested that guardrail be installed to protect them and their property. Guardrail has been installed at several of these locations where a genuine hazard exists. But, in the main, the danger to life, limb, and property in these situations is more apparent than real.

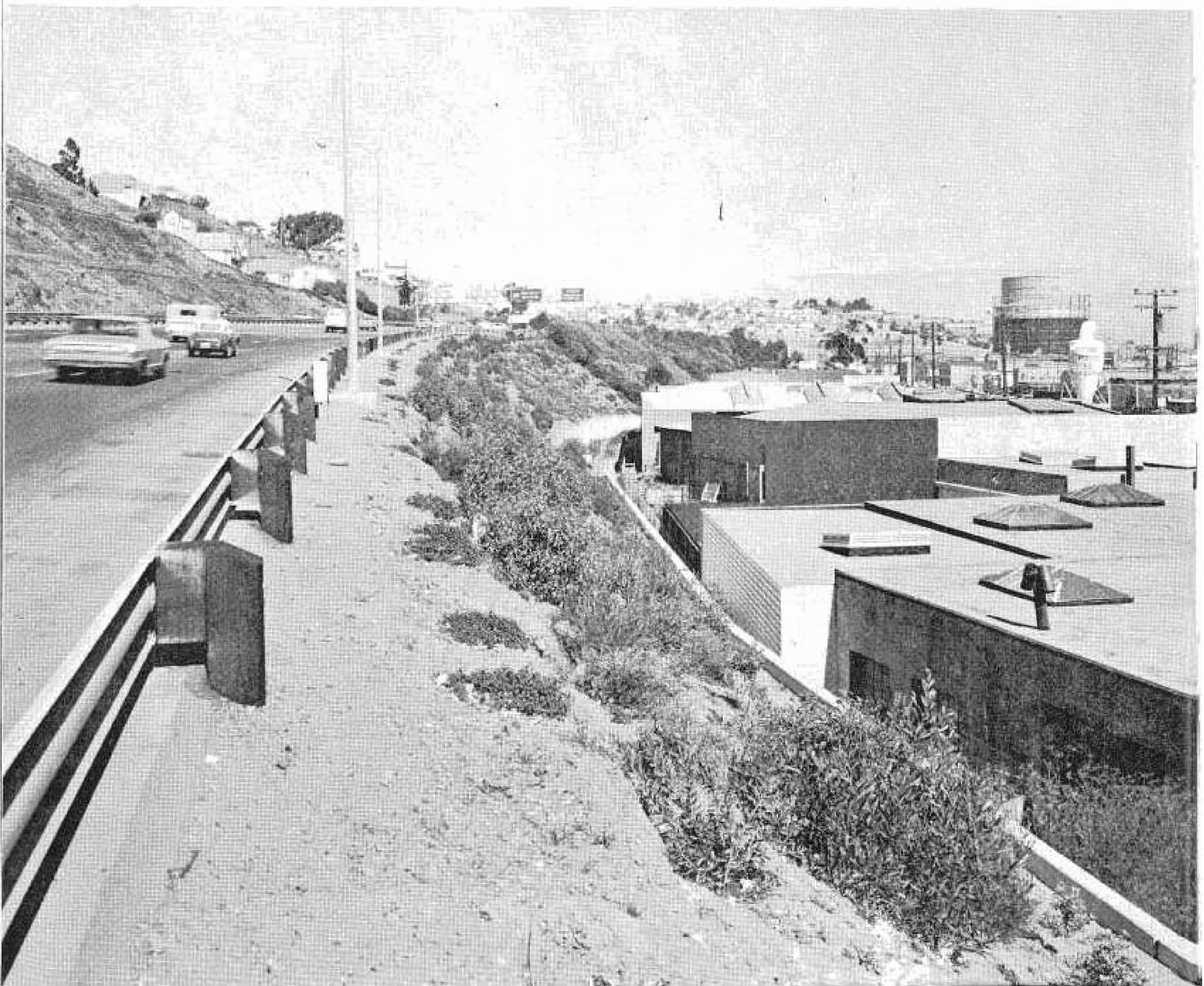
Investigations were made in the Los Angeles and San Francisco areas to determine the magnitude of any such problems.

In the San Francisco area a field survey was made of all freeway locations without guardrailing, meeting both of the following conditions:

1. Embankment 10 feet or more in height, and
2. Improved property immediately adjacent to the freeway right-of-way without an intervening ramp or frontage road.

At the time of this study, there were 3.15 miles of freeway meeting

A typical condition were guardrail is warranted (a section of the Bayshore Freeway near Courtland Street in the San Francisco area). Note the vertical dropoff of several feet from the top of the retaining wall at the right-of-way line.



A location (this one a section of U.S. 50 in Alameda County) where guardrail is not considered warranted.

the above conditions. The accident record for a four-year period is shown in Table I. There have been 25 offshoulder accidents in the 3.15 miles with nine accidents causing damage to the right-of-way fence. There were no fatalities. No private property was damaged and no persons on private property were injured. There were no points of offshoulder accident concentration.

Los Angeles Survey

In the Los Angeles area a field survey was made of all freeway locations without guardrailing, meeting both of the following conditions:

1. Cuts of three feet or less and all embankments, and

2. Improved property immediately adjacent to the freeway right-of-way without an intervening ramp or frontage road.

There were 30.50 miles of freeway meeting these conditions. The offshoulder accident records for 1959 and 1960 are shown in Table II. There were 29 offshoulder accidents in the 30.50 miles with two of these accidents causing damage to private property.

Continuous guardrail makes some routine maintenance operations difficult and more expensive because it renders certain areas inaccessible to mechanized equipment. Guardrail increases the hazard of stopping on shoulders of eight-foot width or less, whether by enforcement officers, highway personnel, or the motorists. It forces vehicle occupants to dismount from the left or traffic side. To fix a flat tire on the left, the motorist encroaches on the travelled way; and to fix a flat on the right, the vehicle encroaches on the traveled way to allow working room on the right.

Table I

SAN FRANCISCO AREA

ACCIDENTS WHERE PRIVATE IMPROVEMENTS ABUT THE FREEWAY RIGHT-OF-WAY

(Locations where embankments heights exceed 10 feet)

Route	County	Freeway	Mileage	Accidents: Total	Accidents: Off-shoulder	Accidents: Damaging state fence	Period covered years
5	Ala	MacArthur	0.31	5	4	1	4
5	SCl		0.09	5	0	0	1½
7	CC	East Shore	0.45	16	1	1	4
68	SF	Bayshore	0.91	111	13	5	4
69	Ala	Nimitz	0.15	19	0	0	4
75	CC		0.18	3	1	0	4
107	CC		0.28	0	0	0	4
228	Ala		0.78	19	6	2	
		Total	3.15	178	25	9	

Table II

LOS ANGELES AREA

OFFSHOULDER ACCIDENTS FOR 1959 AND 1960 WHERE PRIVATE IMPROVEMENTS ABUT THE FREEWAY RIGHT-OF-WAY

Route	County	Freeway	Case *	Mileage	Offshoulder accidents: Injuries	Offshoulder accidents: PDO	Offshoulder accidents: Total
2	Ora	San Diego	B	0.00			
			C	0.23	0	0	0
2	Ora	Santa Ana	B	1.93	3	0	3
			C	0.16	0	0	0
2	LA	Santa Ana	B	4.01	0	2	2
			C	0.76	0	1	1
2	LA	Hollywood	B	0.79	0	0	0
			C	2.27	1	0	1
2	LA	Ventura	B	1.10	0	2	2
			C	2.58	2	3	5
4	LA	Golden State	B	0.06	0	0	0
			C	0.70	0	0	0
9	LA	Foothill	B	0.06	0	0	0
			C	0.00			
26	LA	San Bernardino	B	5.41	3	2	5
			C	1.71	3	0	3
60	LA	Pacific Coast	B	0.00			
			C	0.00			
77	LA	Corona	B	0.39	0	0	0
			C	0.00			
138	LA	Ojai	B	0.09	0	0	0
			C	0.00			
158	LA	San Diego	B	0.25	0	0	0
			C	0.40	0	0	0
161	LA	Colorado	B	0.10	0	0	0
			C	0.00			
162	LA	Glendale	B	0.15	0	0	0
			C	0.00			
165	LA	Harbor	B	0.26	0	0	0
			C	1.14	2	0	2
167	LA	Long Beach	B	2.56	3	0	3
			C	0.48	0	0	0
175	LA	Riverside	B	1.72	1	0	1
			C	0.55	0	0	0
205	LA	Pasadena	B	0.32	0	0	0
			C	0.42	0	1	1
		Subtotals	B	19.20	10	6	16
			C	11.30	8	5	13
		Total		30.50	18	11	29

*B—Three-foot cut to ten-foot fill.
C—Over ten-foot fill.
No fatal accidents occurred off the shoulder on the above freeways.
Of the 29 accidents, two involved damage to private property.

Accident Conversion

Another factor to be considered is that guardrail does not eliminate offshoulder accidents. It converts these accidents (which in the case of flat side slopes may cause little or no damage) to guardrail accidents, which may be more severe.

A summary of the data gathered discloses the following:

1. There are no points of concentration of accidents involving cars running off the roadway and damaging private property.

2. There have been 0.48 offshoulder accidents per mile per year in the Los Angeles area and 2.07 offshoulder accidents per mile per year in the San Francisco area at locations where improved property is immediately adjacent to freeway lanes.

3. In four years there were 25 offshoulder accidents in the San Francisco area. Nine of these caused right-of-way fence damage.

4. In two years there were 29 offshoulder accidents in the Los Angeles area and two caused damage to private property.

5. No fatalities or personal injuries have occurred on private property.

6. There has been very little damage to private property.

In conclusion, the incidence of offshoulder accidents is so small, scattered and unpredictable that no blanket policy of installing guardrail where improved properties exist immediately adjacent to freeway lanes is warranted. However, guardrailing should be installed at locations where concentrations do develop and at locations where the combination of superelevation, curvature, embankment height, slopes, and type of improvements are such as to indicate a potentially hazardous situation.

Among the 25 offshoulder accidents:

1. No fatalities occurred.

2. No one on private property was injured.

3. No private property was damaged.

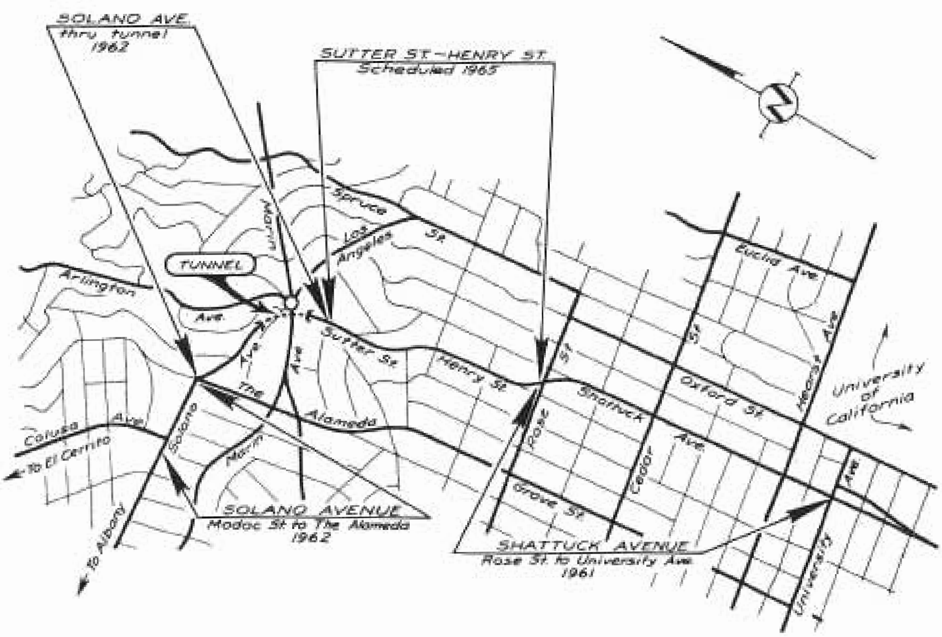
Solano Avenue

Former Railroad Tunnel Converted to City Street

By JAMES L. MARTIN, Director of Public Works, City of Berkeley

On December 15, 1962, the City of Berkeley inaugurated traffic service on a new major city street link—the extension of Solano Avenue through the historic Northbrae Tunnel.

For over 50 years, the tunnel has been an important factor in providing transportation service to the North Berkeley-Albany area. At the opening ceremonies this tradition was represented by both antique automobiles and the latest in passenger buses, and as the symbolic act of opening the street to public use, Berkeley's mayor, the Honorable Claude B. Hutchison, cut a chain connecting two lengths of railroad rail.

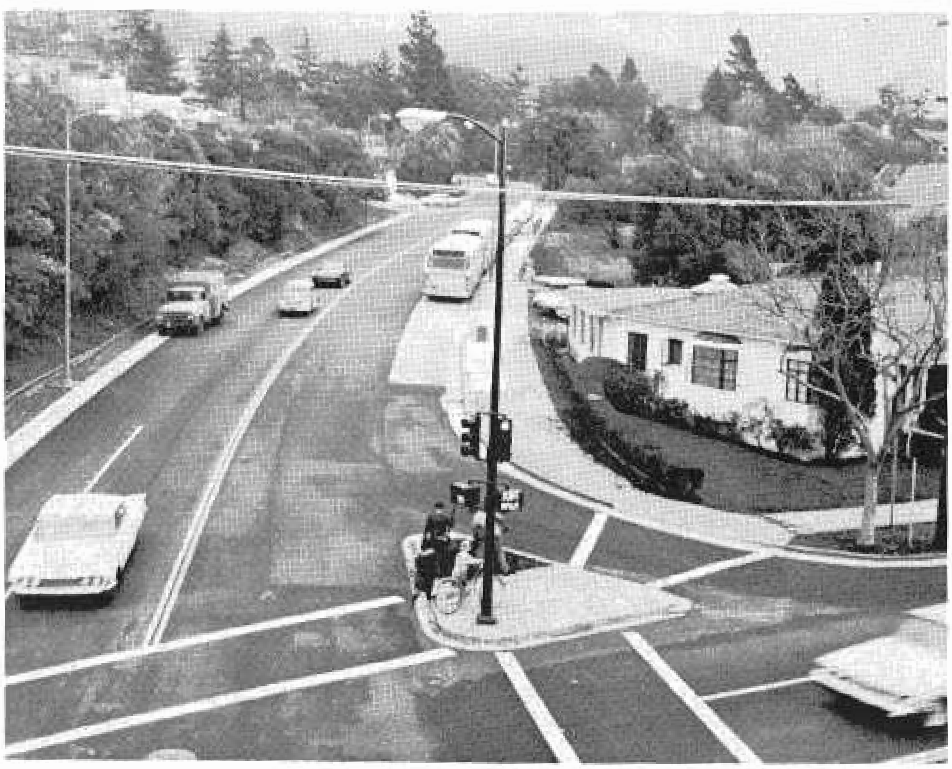


Location of the tunnel conversion project in Berkeley is shown in the above map.

Early Interurban Construction

In the early part of the 20th century, electric interurban railroads were being constructed in many areas to compete for passenger traffic with the steam lines. At that time, highway vehicles were not sufficiently developed to offer any threat to the lucrative rail traffic. Simultaneously, the East Bay area was undergoing a great expansion in population and real estate development. In 1903 the San Francisco, Oakland and San Jose Railway (later the Key System) obtained extensive franchises in Oakland and Berkeley for what was then a rapid transit system. Their electric trains were soon providing swift, comfortable service for commuters connecting with ferry service for the Bay crossing to San Francisco.

The Southern Pacific Railroad, which had provided steam commuter service in Oakland, Berkeley and Alameda since the 1860's, was faced with the choice of meeting the competition or completely losing the traffic to the Key System. As a result, the Southern Pacific obtained franchises for an ex-



View easterly from the west end of the project. Note the landscaping and the bus area. Tunnel is beyond the curve in the distance.

tensive interurban system, reaching from Berkeley to San Leandro. In certain cases, the new lines utilized existing railroad rights-of-way, but many of the routes followed public streets or new private rights-of-way to directly tap the main residential area.

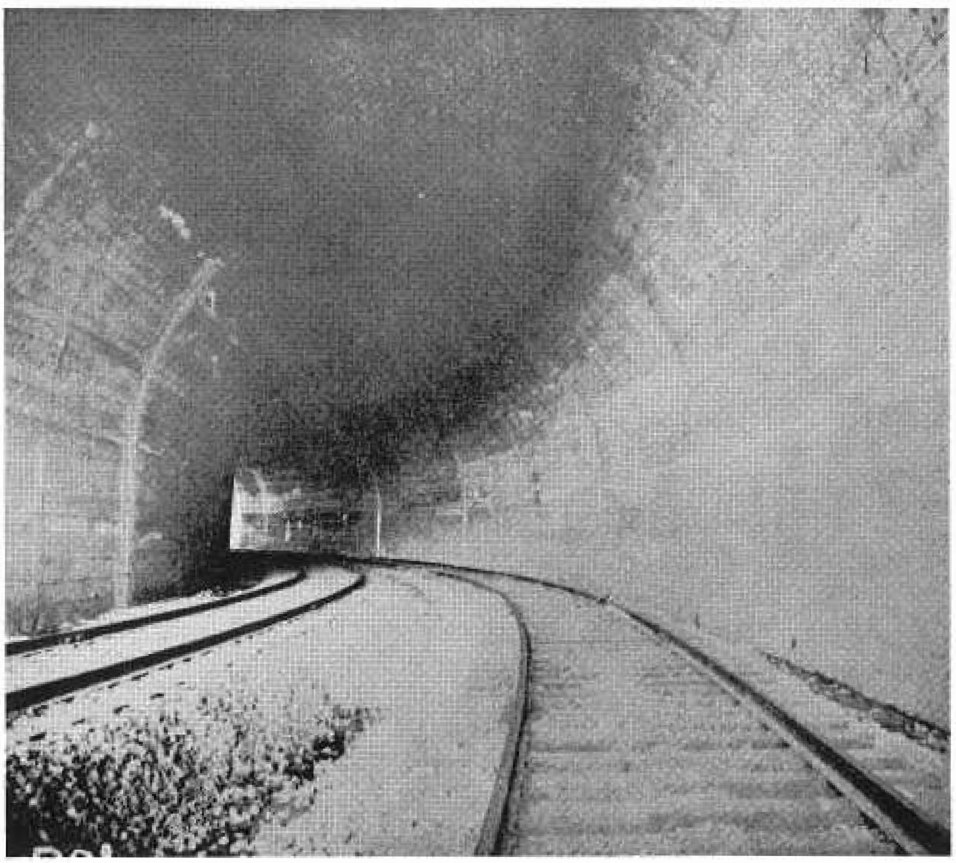
Junction Was Planned

In North Berkeley, a junction of three lines was planned at Thousand Oaks station, near the intersection of Colusa Avenue and Solano Avenue. Difficulties were encountered, however, in location of the line connecting Thousand Oaks with downtown Berkeley. Adverse topography near Marin Avenue, and an existing Key System franchise, precluded the following of the natural contour along public streets.

Location engineers therefore designed a 464-foot double-track tunnel under the Marin Avenue Circle to connect Sutter Street on the south with a private right-of-way leading to Solano Avenue at The Alameda. The construction was by the cut-and-cover method, using nonreinforced concrete. The tunnel has walls two feet thick, with a floor one foot thick. The roof arch has a radius of 15½ feet, and the overall clearance from the floor to the crown of the arch is approximately 25 feet. The tunnel was completed in 1911 and service was inaugurated shortly thereafter.

For many years, riding the "Red Trains" to San Francisco was a North Berkeley tradition. Until 1939, the trains connected with ferries at the Oakland Mole. After completion of railroad tracks on the San Francisco-Oakland Bay Bridge, the electric trains operated directly into San Francisco, terminating at First and Mission Streets.

In 1941, the Southern Pacific gave up its electric service since traffic had declined due to increasing automobile competition. At this time, the Key System took over some of the Southern Pacific lines for operation with their streamlined interurban equipment. The tunnel was continued in use as a portion of the "F" line, with the terminus now being at Solano Avenue and The Alameda.



THEN. Interior view of tunnel shortly after completion in 1911.

Service Abandoned

In 1958, the Key System also abandoned train service and switched to bus operation for the transbay commuter traffic. The tunnel and private right-of-way were donated to the City of Berkeley. Studies indicated that a valuable street connection was possible, using the tunnel, and the project was scheduled in the Capital Improvement Program for 1962 construction.

The Solano Avenue extension project is actually one of a series of projects designed to greatly improve traffic circulation between the North Berkeley-Albany-El Cerrito area and the downtown Berkeley-University of California area.

Three are major city street projects, using ⅝-cent gas tax funds augmented with some gas tax moneys granted by Alameda County. They are: (1) the reconstruction of Shattuck Avenue from University Avenue to Rose Street, completed in 1961 under a $120,000 contract; (2) the reconstruction and widening of Sutter Street and Henry Street, from Rose Street to the southerly tunnel entrance, scheduled for 1964-65; $185,000 is included in the capital improvement program for this work; and (3) the Solano extension through the tunnel.

In early 1962, Solano Avenue was widened westerly from The Alameda and also provided with new street lighting, using $10,000 from the city general fund. Four moving lanes are provided on Shattuck, Henry, and Sutter, with two moving lanes on Solano itself. As a preliminary to the Solano Avenue projects easterly and westerly of The Alameda, a $99,500 storm drain was installed. This replaced a deficient existing drain, and was financed from a drainage bond issue.

Funds Scheduled

In accordance with Berkeley's capital programing policy, funds were also scheduled for the Solano project for street lighting and landscaping. Over the years, a luxurious growth of trees and bushes had become established along the open portions of the railroad right-of-way. We felt that the community value of this planting should be enhanced by pruning and shaping of the existing growth, supplemented by planned installation of new trees and shrubs. The wisdom of this has been shown by favorable public reaction. It even appears that a number of drivers choose to drive Solano Avenue in preference to more direct routes simply to enjoy the beauty of the drive.

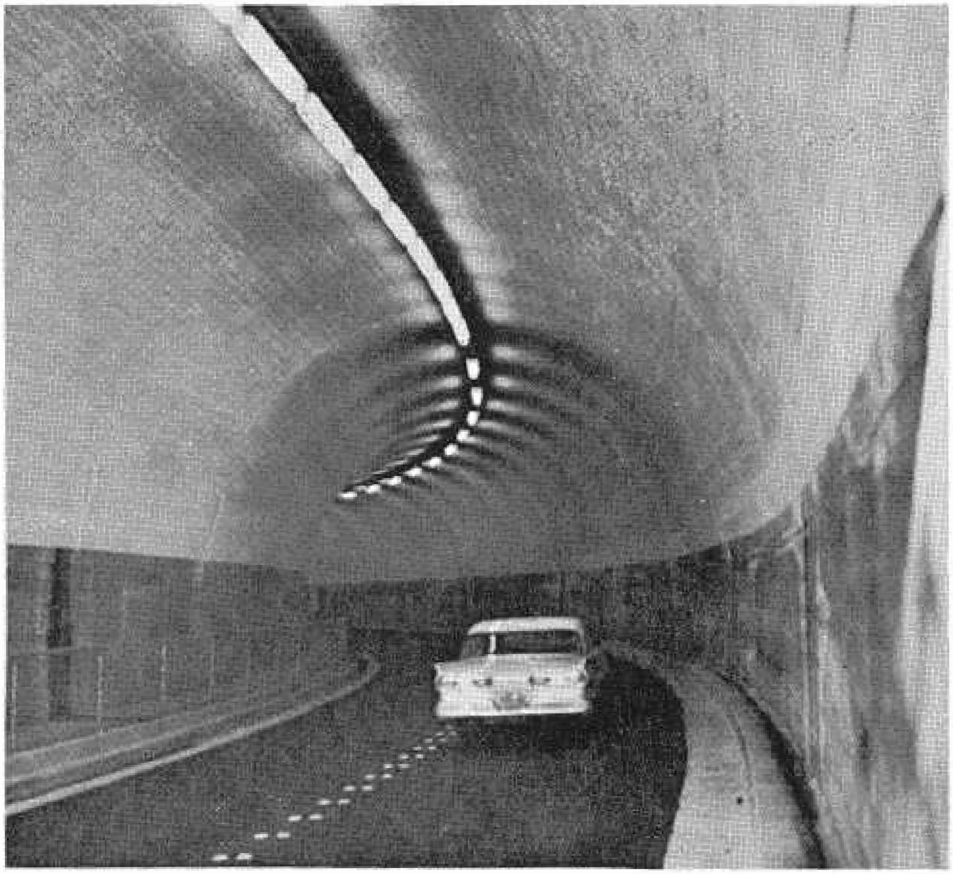
In design of the tunnel project, prime consideration was given to vehicle and pedestrain safety. A sidewalk is provided on the entire length both for neighborhood convenience and for an emergency walkway for drivers of stalled vehicles. The curvature of the tunnel and the unusual length of roadway between intersections called for carefully planned street lighting, traffic signs, pavement markings, and other safety features. There is an existing street directly above the north tunnel portal which had only an ancient iron fence separating traffic from from a sheer drop. The old fence was replaced by standard metal guardrail with an 8-foot chain link fence attached.

After soil investigation, the structural section of the roadway was determined to be 4 inches of asphalt concrete, 10 inches of untreated base, and 5 inches of salvaged railroad ballast. The roadway is 24½ feet between curbs in the tunnel. The pavement was widened on the westerly end to permit a right-turn lane on the north side, and a bus loading and parking lane on the south side. The total length of the project is 1,900 feet.

Superelevation Given

Since the tunnel is on a curve, with a centerline radius of 350 feet, the roadway was given a superelevation of 5½ percent. By careful adjustment of grades, it was possible to maintain standard height clearances throughout. The 3½-foot sidewalk was placed on the inner side of the curve for safety, and additional pedestrian protection was provided by a special barrier curb and a three-foot chain link fence along the top of curb.

The tunnel is in an area of high ground water table, and there were many points of seepage at the construction joints. The cracks were sealed and pipe drains were installed in the wall at a number of points to conduct the seep water to the roadway gutter. Prior to the paving, the tunnel and abutments were sandblasted to remove the accumulation of grime and loose mortar. The arch was then painted with two coats of standard white traffic paint. This paint proved to be inexpensive and easy to apply and gives a good reflective surface for the lighting.



NOW. Interior view of tunnel, December 1962. Note the use of reflectorized buttons, fluorescent lighting fixtures and pedestrian protection fence.

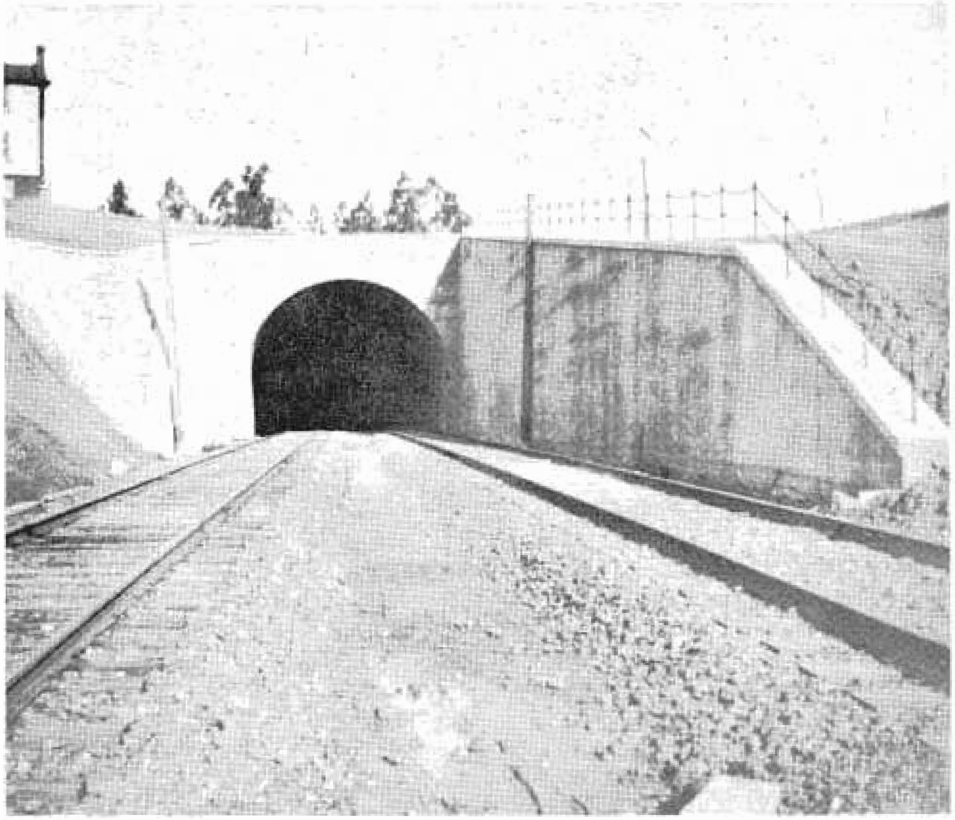
Along the open section of the roadway, lighting is provided by 23,000-lumen mercury vapor units on 30-foot metal poles. Within the tunnel, two-tube fluorescent fixtures with plastic covers are mounted longitudinally along the crown of the arch. A day-night switching arrangement gives greater light near the entrances during the day in order to form a transition. At night, the average light intensity on the pavement within the tunnel is 25 foot-candles, giving a very inviting appearance to the approaching driver.

Additional Safety

For additional driver safety, the double center line was formed with pairs of reflectorized yellow buttons, spaced three feet apart longitudinally. While the reflectorization is diminished by the lighting intensity, the buttons provide a valuable tire sound feature if a car crosses the centerline, and, in the event of a power failure, will give a very striking delineation of the roadway alignment.

The average daily traffic has been over 5,000 vehicles per day since the opening. This traffic consists primarily of automobiles and buses. Due to the lack of developed frontage along the route, the prima facie 65 miles per hour limit would apply. However, a traffic study was made as soon as traffic began using the road and the speed limit has now been established at 25 miles per hour.

By using Solano Avenue, the Alameda-Contra Costa Transit District has been able to cut three to four minutes from the schedule of both the



THEN. Southerly end of tunnel in 1911. Railroad trolley wire not yet installed.

NOW. Southerly end of Solano Avenue project at Sutter Street. The raised reflectorized buttons have proved effective in channeling traffic into the proper lane. Note extensive landscaping.

Number 33 Oakland Express and the "F" transbay bus service. The former bus route involved several sharp turns and a layover stop in a congested professional office area.

Simultaneously with the street construction, traffic signals were installed at Solano Avenue and the Alameda at the westerly end of the project. This is a fixed-time signal, with "WALK-DON'T WALK" heads, and will be interconnected later in 1963 with the remainder of the signals along the Alameda and Grove Street.

The $63,000 street contract was performed by C & H Contractors, of Richmond. The traffic signal was installed by city forces, using $4,100 in ⅝-cent gas tax funds. The tunnel painting was financed with $10,000 granted to the city by the County of Alameda; the painting contractor was R. W. Reade of Berkeley. The lighting was also installed by city forces, using general funds in the amount of $12,800.

Design and construction was under the direction of William J. Dabel, supervising civil engineer. The resident inspector was Darrell S. Nall. The city electrical superintendent is D. D. O'Leary. Berkeley City Manager John D. Phillips directed interdepartmental co-ordination. The historical photographs were made available through the courtesy of Mr. Vernon J. Sappers, of Oakland.

$9,000,000 SIERRA CENTER

The State Department of Public Works has awarded five architecture contracts totaling $9,291,324.10 for construction of the new Sierra Branch Conservation Center near Sonora in Tuolumne County.

Companion center to the huge California Conservation Center near Susanville, Lassen County, the Sierra center is the second step in Governor Edmund G. Brown's accelerated conservation camp program for the rehabilitation of prison inmates and the conservation of the state's natural resources.

Sierra's 1,216-inmate capacity plant will be located on the 240-acre McCormick Ranch about 11 miles southeast of Sonora.

Santa Rosa North

Two-lane U.S. 101 Section Is Converted to Freeway

By V. S. YODER and HAROLD W. KEELER, JR., Resident Engineers

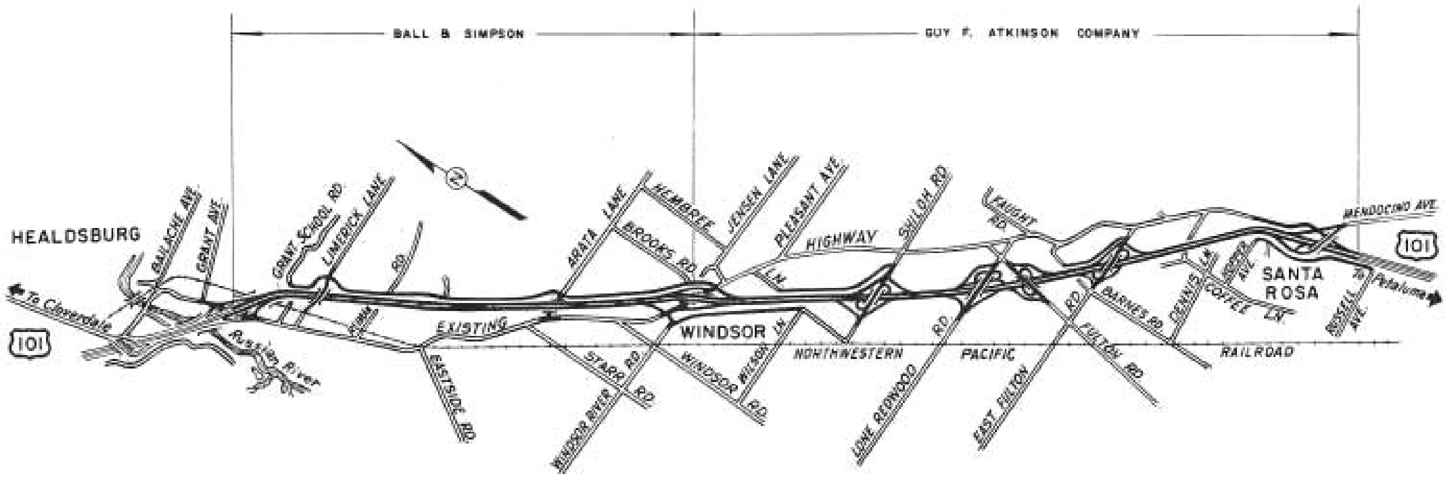
In 1913 the State of California constructed an up-to-date portland cement concrete highway traversing the valley between Santa Rosa on the south, and Healdsburg on the north. This 15-foot-wide "super highway" of the past served as an artery for traffic headed for the vineyards, the redwoods, and the Pacific Northwest. Later designated as U.S. 101, the road crossed the fertile flood plain of the Russian River for a few miles, and bridged the river on the southerly outskirts of Healdsburg.

In 1926, in answer to the demands of progress, the Division of Highways refurbished the highway by resurfacing and widening to 20 feet. The area alongside built up with businesses, orchards were planted, and still the traffic grew. By 1960, traffic on this major north-south artery had begun to back up in the first symptoms of a grinding halt. Drastic action was required, and so two contracts were let to replace the now obsolete facility.

Join Existing Expressway

These two contracts joined the existing four-lane divided expressway at

PHOTO ABOVE. Fulton Road and Lane Redwood Road interchanges on the recently completed portion of U.S. 101 between Santa Rosa and Windsor. Mark West Creek in center. MAP BELOW. The freeway construction extended from Santa Rosa to south of Healdsburg.



Approaching Healdsburg from the south—Limerick Lane overcrossing in the foreground.

the northern outskirts of Santa Rosa with the recently completed four-lane freeway near Healdsburg, and were built on completely new and slightly skewed alignment with relationship to the old road. The first contract, let to the Guy F. Atkinson Company of San Francisco, started at the Santa Rosa end, and was located west of the old road to a northerly junction with the second contract near Windsor. At this point, the new freeway was separated from the old road by the Windsor Undercrossing, and the second contract was let to Ball and Simpson of Berkeley, who completed the freeway from that point to the Healdsburg end on the east side of the old road.

Now, after two years of construction, these two contracts have opened to traffic within a month of each other, and a severe bottleneck has been eliminated.

Santa Rosa-Wheeler

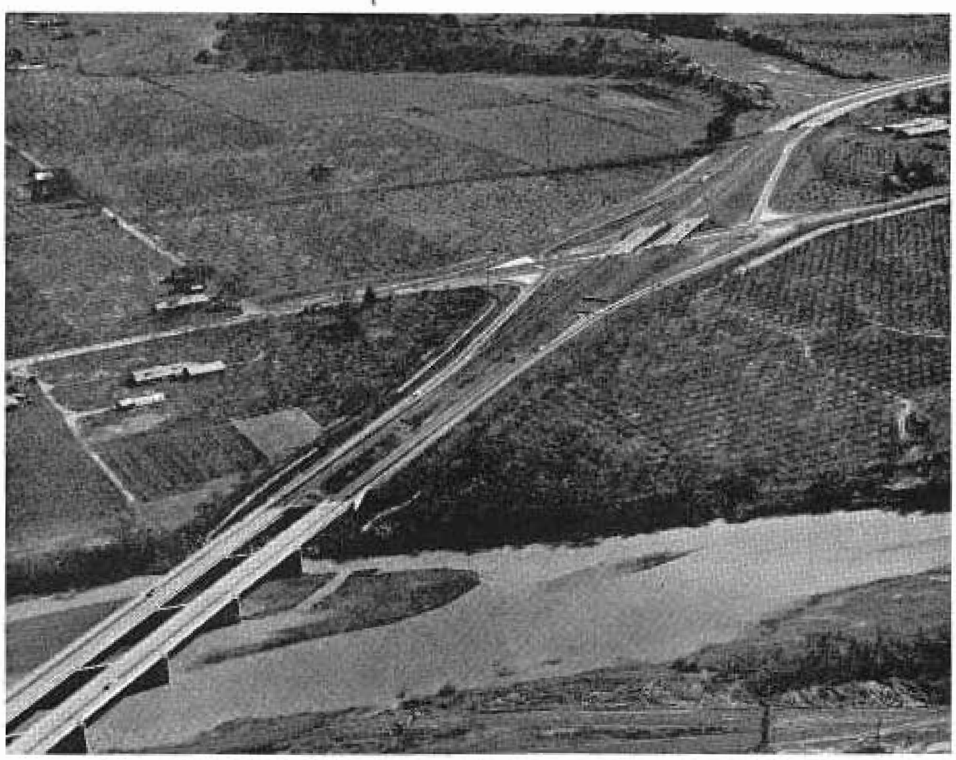
This contract for the construction of 6.3 miles of four-lane divided freeway, was awarded to the Guy F. Atkinson Company on August 2, 1960. Plans called for four lanes of portland cement concrete complete with appurtenant asphalt concrete frontage roads, and ramps. Interchange facilities were to be constructed at Mendocino Avenue, East Fulton Road, Fulton Road, Redwood Road, Shiloh Road and Windsor Road. There were additional structures included in the contract, bringing the total required to 14.

Work was somewhat complicated by the necessity of obtaining imported borrow for the approach fills to separation structures. This material came from excavation within the roadway prism cut through a hill located midway of the next contract to the north.

Difficulties were encountered in curing a troublesome slide which interfered with construction in the vicinity of Mendocino Avenue, and a protracted strike during the early part of 1962 had an adverse effect on this job, as it did on all work in Northern California. In consequence of these troubles, contract time was extended and the job completed on December 5, 1962. The total construction cost of the work was $4,530,000.

On this contract the portland cement concrete pavement was placed by the slip-form paving method. The types of equipment and the construction methods used were similar to those described in the September-October 1962 issue of *California Highways and Public Works* in the article entitled "Slip-form Job Fresno," with two exceptions.

First, the class 2 aggregate subbase was placed in windrows at a predetermined rate from bottom dump truck



Looking southerly to the newly constructed Grant Avenue Undercrossing and Grant Overhead. The Russian River is in the foreground.

and trailers, spread to grade with motor graders, and finally trimmed to a true grade with an "automatic road-builder." This machine made a path approximately 12 feet wide and operated from an automatic controlling device guided by an offset wire set to grade line. The subsequent passes made were controlled from the first pass by means of a control arm guided by a pilot wheel which rode on the grade previously cut.

Second, in constructing the portland cement concrete pavement, a recently adopted finisher was used, following from 100 to 150 feet behind the two transverse trailing bump cutters. This finisher was nearly identical with the first two transverse bump cutters attached to the paver, with the exception that it was self-propelled.

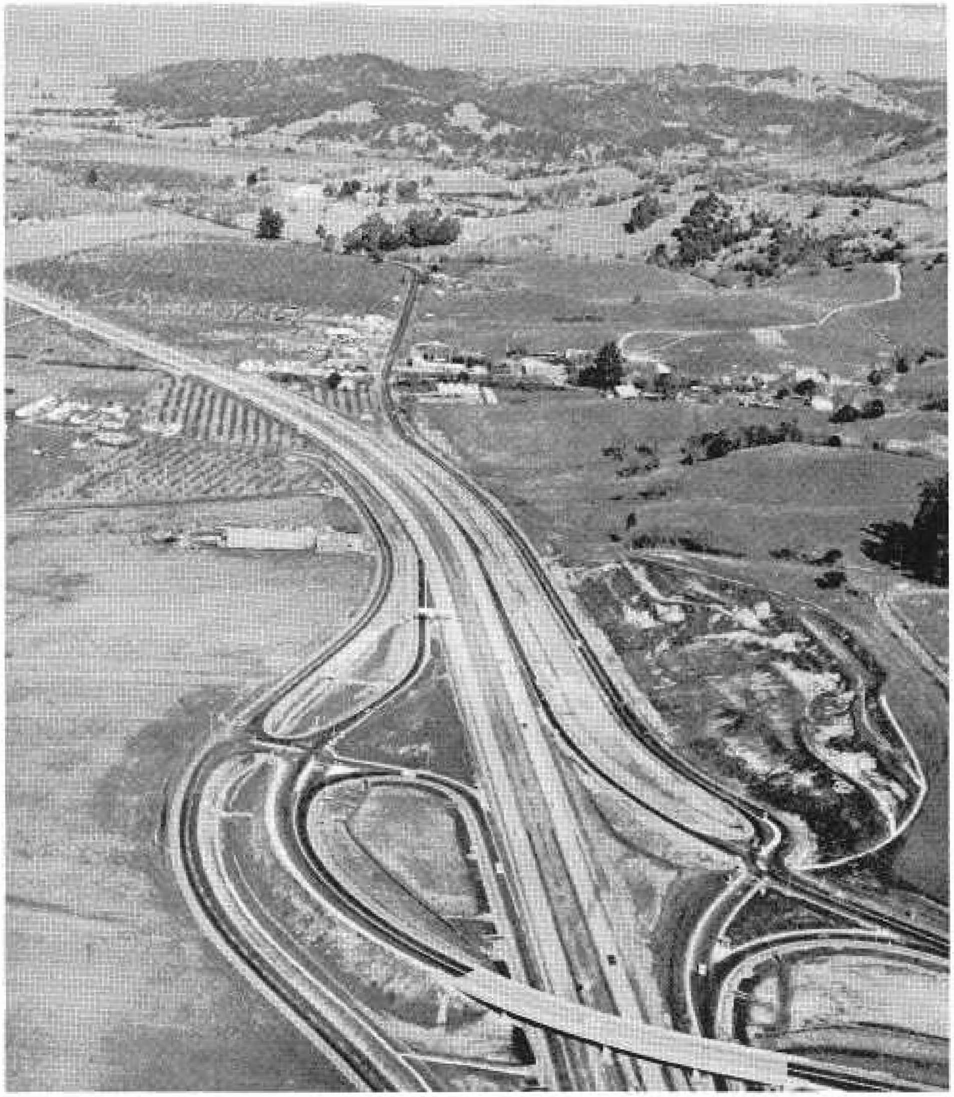
The average profile index on this contract was well within specifications and a very satisfactory riding surface was achieved with moderate grinding.

Windsor-Healdsburg

The second of the two contracts was awarded on December 27, 1960, to Ball and Simpson of Berkeley. Construction features were similar to the first contract except that only nine bridges were to be constructed.

This contract extended the freeway for another four miles. Methods differed somewhat, however, as both subbase and cement-treated base were cut to grade with an "automatic road-builder." The paving machine which spread and finished the portland cement concrete was also automatic and operated off two taut piano wires held at predetermined offset line and grade from the edges of the concrete slab. As on the adjoining contract, a pair of six-inch light aluminum floats were manually operated behind the paver to improve finished smoothness. Exceptionally smooth riding surface was achieved with practically no grinding except on hand-finished plugs at bridge approaches where the automatic equipment could not operate.

Soft foundation materials were indicated in the preliminary borings in Grant Undercrossing area and the contract required surcharging the abutment fills at this site with 10 feet of additional embankment which was to remain in place for a maximum of 90 days. The full period was utilized and nearly three feet of settlement in the embankments was recorded on the settlement devices which were the water-level type.

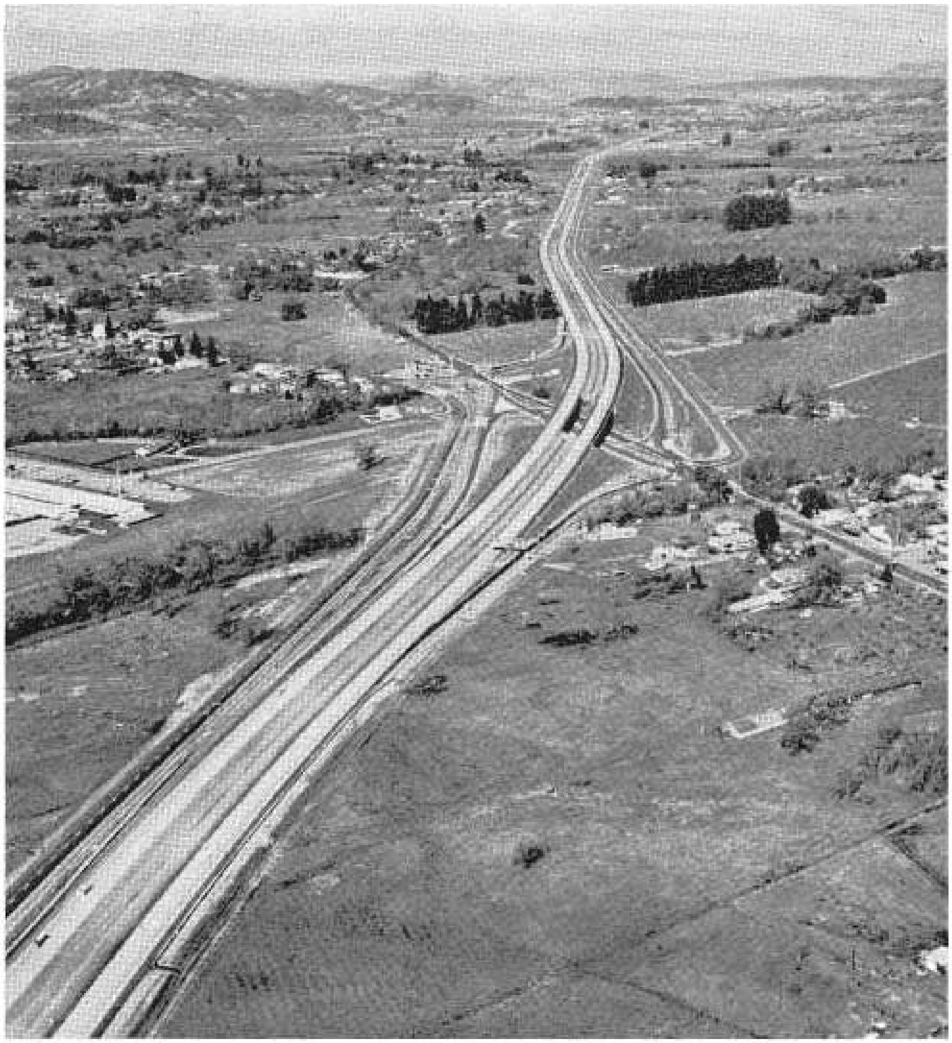


Looking north to Bell Mountain and Bald Hills from the Mendocino Avenue Interchange—Unstable hill mass on right has been stripped to forestall maintenance problems.

This area was a portion of the prehistoric Russian River bed and a frequent flood plain in recent times. As much as eight feet of water over the old highway during floods is recalled by local residents. Nearly 30 feet of soft loam overlies denser layers of gravel and sand. The loam acted as a sponge and compressed under fill loading. No "rebound" was noted upon surcharge removal.

Two Interchanges Included

Only two interchanges were included in this contract, one at Windsor Undercrossing where the freeway crossed to the east over the old highway between historic East and West Windsor and again at Grant Undercrossing where the freeway crossed back over west of the old highway again. Local residents east of the freeway were served by a continuous new frontage road nearly four miles long extending from just north of Limerick Lane southerly past Arata Lane to which it connected and thence to the old highway at Windsor. Limerick Lane was carried over the freeway and maintained connection to the old highway. The Arata Lane connection to the old highway was continued by constructing the freeway over this county road.



Northwesterly to Healdsburg from Windsor. The old Redwood Highway passes under the freeway at Windsor Interchange.

Ball and Simpson started their contract on January 4, 1961 and completed it on November 9, 1962, at a total cost of $2,831,000.

The two contracts discussed above in this article are actually the last two units of four used to provide full freeway from north of Healdsburg to Santa Rosa.

The first, completed in May, 1959, provided a new crossing over the Russian River bypassing the old inadequate structure upstream nearer town. The second unit, a bypass of Healdsburg, was completed in December 1960. The last two units provided full freeway between Healdsburg and Santa Rosa. In all, approximately $11,343,000 was spent for construction alone in providing for this 16.5 miles of freeway in Sonoma County.

The south project with Guy F. Atkinson Company had several superintendents. John Skeels was the last to be assigned and completed the work. State's resident engineers also changed during the project with Philip D. Auchard in charge at the beginning of the work and Harold W. Keeler, Jr., at the end.

The north project with Ball and Simpson also had several superintendents. Frank Fries started the project and G. Bruce Casten completed it. Vincent S. Yoder was resident engineer for the project.

Both projects were under the general supervision of George Beckwith until his retirement late in 1961 when Hal K. Taylor assumed his position as construction engineer.

Traffic Expert Webb Will Retire May 1

George M. Webb, Traffic Engineer for the California Division of Highways for nearly 10 years, will retire from state service on May 1, 1963.

From May 1953 until December 1962 Webb was in charge of traffic engineering functions for the Division of Highways. In December he was succeeded as traffic engineer by George A. Hill and was assigned to new duties in charge of special research projects.

GEORGE M. WEBB

Webb achieved national prominence in the traffic engineering profession through service on numerous nationwide committees. He is the author or coauthor of more than a score of widley published articles and reports.

For each year of this service as traffic engineer, California won or tied for first place in traffic engineering achievement in the nationwide inventory of traffic safety activities sponsored by the National Safety Council.

Born in Prineville, Oregon, Webb was educated in that state and went to work for its highway department in 1919.

He joined the California Division of Highways in 1928. From 1929 to 1937 he was resident engineer on projects in north central and northeastern California.

From 1938 to 1942 Webb was assigned to District I in Eureka. He then transferred to Sacramento, where, except for 2½ years as an officer in the Army Transportation Corps during World War II, he served in the Traffic and Planning Departments until his promotion to traffic engineer in 1953.

Webb is a member of the Institute of Traffic Engineers and an Associate Member of the American Society of Civil Engineers. His fraternal affiliations include the Masons and Shrine.

Road Conference

I.T.T.E. Meet Stresses Research, City Problems

The problems of increasing urbanization and the compelling need for accelerated and expanded research were the most frequently discussed themes at the 15th Annual Street and Highway Conference, sponsorde by the Institute of Transportation and Traffic Engineering, at the University of California, Los Angeles, January 24-26.

The conference was attended by approximately 550 street, road and traffic engineers of cities and counties, by state and federal highway experts, and by representatives of consulting firms, material suppliers, automobile associations and transit organizations.

New Approach Needed

The first speaker, Burton W. Marsh, director, traffic engineering and safety department of the American Automobile Association, Washington, D.C., said that the days of satisfactory rule of thumb, trial-and-error attack on highway problems have gone forever.

Referring to the growth in traffic volumes and city populations, Marsh told attendees that highway officials must grow in knowledge with the problems that confront them and "be prepared with more mature, more complex and more sophisticated solutions."

Senator Randolph Collier, Chairman of the Senate Transportation Committee, who followed Marsh, spoke of the urgency of obtaining financing for proposed select systems of city streets and county roads during the present session of the Legislature.

The select systems would provide connections between major traffic generators and freeways and lateral movement between freeways, and would afford substantial traffic relief to state highways.

Study Areas Described

California State Highway Engineer J. C. Womack described the accomplishments and study areas of the American Association of State Highway Officials research program. Womack is immediate past president of AASHO.

1964 List Prepared

The list (of research projects for 1964) which is now being prepared for submission to the member state highway departments for balloting consists of 19 project proposals grouped into seven problem areas.

"It is interesting and significant," Womack said, "that the proposed 1964 program includes a total of eight proposals directly related to urban transportation."

He also outlined the problem areas that will be studied in 1963 and promised that the benefits of the research program would be shared with officials of cities and counties, principally through the day-to-day working relationships between the district offices of the Division of Highways and the street and highway departments of local governments.

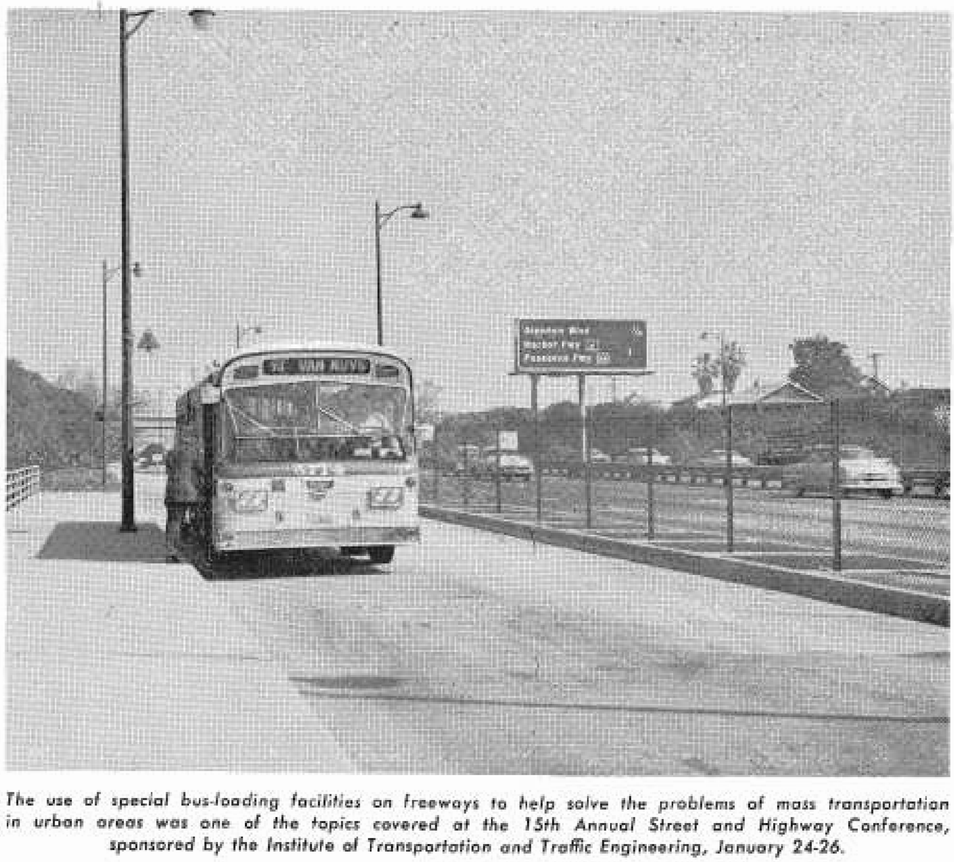
Unit Renaming Significant

Indicative of the urbanization taking place throughout California, said State Director of Public Works Robert B. Bradford, is the fact that the section of the Division of Highways formerly known as Highway Planning Survey has been renamed the Urban Planning Department.

"The broad problem of urban transportation is rapidly becoming as familiar to the highway engineer as the problem of getting out of the mud used to be," Bradford said.

"Every week of the year there are conferences among state highway planners, city traffic engineers, county engineers and road commissioners, and the several public and private transit engineers and planners.

"Increased capacity of streets and highways and increased capactiy of mass transit are both 'musts' in California. Neither the private automobile,



The use of special bus-loading facilities on freeways to help solve the problems of mass transportation in urban areas was one of the topics covered at the 15th Annual Street and Highway Conference, sponsored by the Institute of Transportation and Traffic Engineering, January 24-26.

nor the bus, nor the train, is the sole and exclusive answer to our transportation needs. Only the rank amateur or the special pleader in the transportation field would argue otherwise."

1980 Predictions

Predicting 17 million motor vehicles in the state and a total of 200 billion vehicle miles of travel by 1980, Bradford claimed that there will be less traffic congestion on the freeway and expressway system then than exists today.

The U.S. Bureau of Public Roads was represented at the conference by Robert F. Baker, director of the Office of Research and Development, who hailed the trend toward a true interdisciplinary approach to highway problems.

"Any self-respecting researcher has always looked to other areas of science for assistance," he said. "However, the mushrooming highly technical, highly specialized nature of our understanding of people, machines, and nature makes it increasingly more necessary to enlist the help of specialists.

Researchers Becoming Aware

"Highway researchers are also becoming more aware of the need of psychologists and their understanding of human behavior. Our present geometric design principles do not directly relate to the capabilities and limitations of the human. Furthermore, the tremendous variations between drivers and between the same drivers at different instances in time suggest the difficulties in achieving geometrically accurate grades and curves."

Former U.S. Commissioner of Public Roads Ellis Armstrong, now a consulting engineer, expressed his confidence in the wisdom of Mr. John Q. Public when he is given the facts upon which to act. He stressed the public relations need of keeping him informed and cautioned highway officials to listen and react constructively to his opinions.

Other Speakers

Other speakers at the general sessions were James Bell, professor of Government and Public Administration, Sacramento State College, who spoke on the "Human Side of Management"; Thomas Fletcher, city manager, San Diego, whose topic was "Decision Making in Government"; and William Hurd, deputy assistant administrator for transportation, U.S. Housing and Home Finance Agency, "Mass Rapid Transit in Urban Areas."

"Each community must study, decide and express for itself," said Hurd, "its goals, its program for community development, its preference for arrangement, and its desired system for balanced transportation to serve its growing and changing population. This planning process, to meet the standards of both current and contemplated federal programs of urban assistance, must be communitywide or regional in scope—not piecemeal nor unrelated to comprehensive planning."

Joseph Havenner, general manager, Automobile Club of Southern California, and C. M. Gilliss, executive director, Los Angeles Metropolitan Transit Authority, discussed the points raised by Hurd.

Community Desires Stressed

Havenner criticized the stressing of "balanced" transportation planning. He said that the proper role of the urban planner is to fulfill the desires of those in the community and to protect the community from those few who would exploit it.

Gilliss asked for clarification of the terms, "rapid" and "mass" transportation and "carrying capacities," as used in federal directives. He added that the amount of money from federal sources for mass transportation in Los Angeles County would be but a very small fraction of the money needed for the 58-mile system of rail rapid transit proposed by the Los Angeles MTA.

The conference ended at a luncheon meeting at the Hollywood Roosevelt Hotel which was addressed by William Randolph Hearst, Jr., chairman of the President's Committee on Traffic Safety, who urged the adoption of uniform traffic rules throughout the nation.

Workshop Sessions

Following the morning general meetings, delegates attended workshop sessions on street and highway planning, design, construction, financing, materials testing and traffic control.

Division of Highways personnel who were members of workshop panels or who presented papers were Charles T. Ledden, engineer of city and county projects, and H. H. Deardorff, assistant engineer of design (Street and Highway Standards; Design and Classification); Travis W. Smith, assistant materials and research engineer (Aggregates: Availability, Durability and Beneficiation); Roy W. Matthews, assistant traffic engineer (Control of Signalized Intersections Adjacent to Railroads);

R. J. Israel, assistant traffic engineer (Organizing for Uniform Application of Signs, Signals and Markings); George B. Sherman, assistant materials and research engineer (Report on AASHO Road Test); A. L. Himelhoch, district engineer for operations, District VII (Critical Path Method of Scheduling);

Patching, Sound Studied

Herbert A. Rooney, senior chemical testing engineer (Use of Epoxies for Patching); M. L. Bauders, city and county project engineer, District VII (Efficient Use of Existing Widths of Streets and Highways); Louis Bourget, acoustics engineer (Sound Emanation from Highways);

William G. Weber, Jr., associate materials and research engineer (Nuclear Devices for Determination of Moisture and Density); Francis N. Hveem, materials and research engineer (Records Sampling); Richard F. Stratfull, associate materials and research engineer (Field Methods of Detecting Corrosive Soil Conditions) and Karl Moskowitz, assistant traffic engineer (Traffic Clinic).

Other workshop sessions studied assessment districts, the construction of the much-talked-about Pomona Mall, materials laboratories for smaller cities and counties, and the planning of a pavement maintenance program.

83-Mile Route

Newly Adopted Freeway Locations Include Long Stretch in Desert

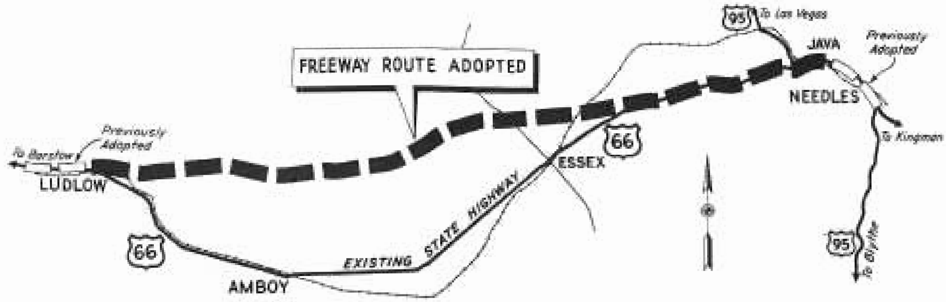
During its January and February meetings the California Highway Commission adopted freeway routings for 12 sections of highway in various parts of California totaling 166.6 miles. The longest route adopted was for 83 miles of U.S. 66 in San Bernardino County.

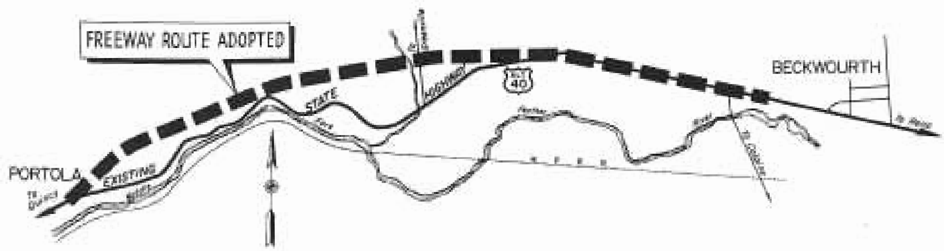
Three of the freeway route adoptions were on the basis of public hearings held by the commission. In two of these, a route for State Highway Route 229 in San Mateo County and a portion of the Glendale Freeway in Los Angeles, the commission followed the recommendation of State Highway Engineer J. C. Womack. In the third, a route for 8.1 miles of U.S. 99W in Colusa County, the commission adopted a route differing from that recommended.

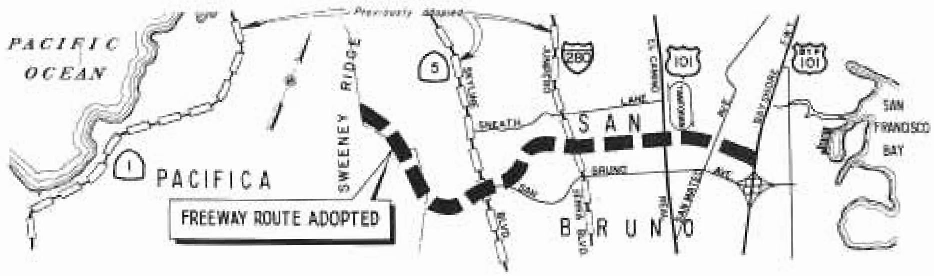
The commission also adopted conventional highway routings for a section of Sign Route 36 in Trinity County, a portion of State Highway Route 35 in Trinity County and for a short portion for Sign Route 20 in Willits to connect existing U.S. 101 with a new freeway routing for that highway.

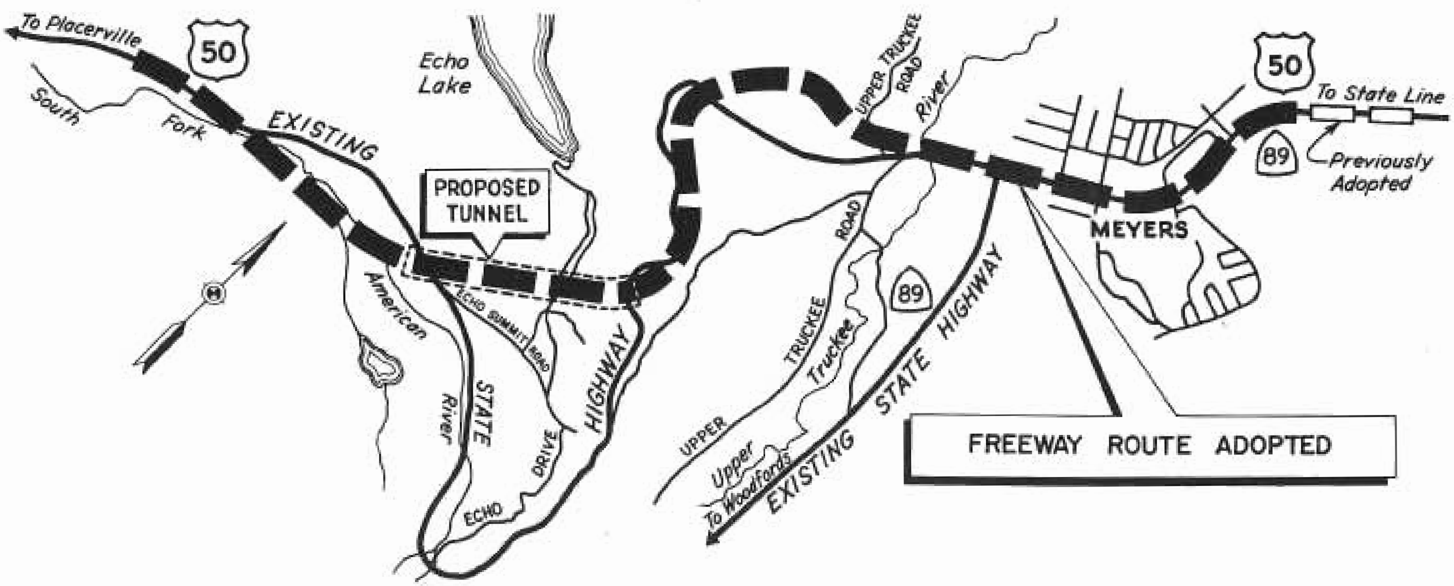
Freeway routes adopted:

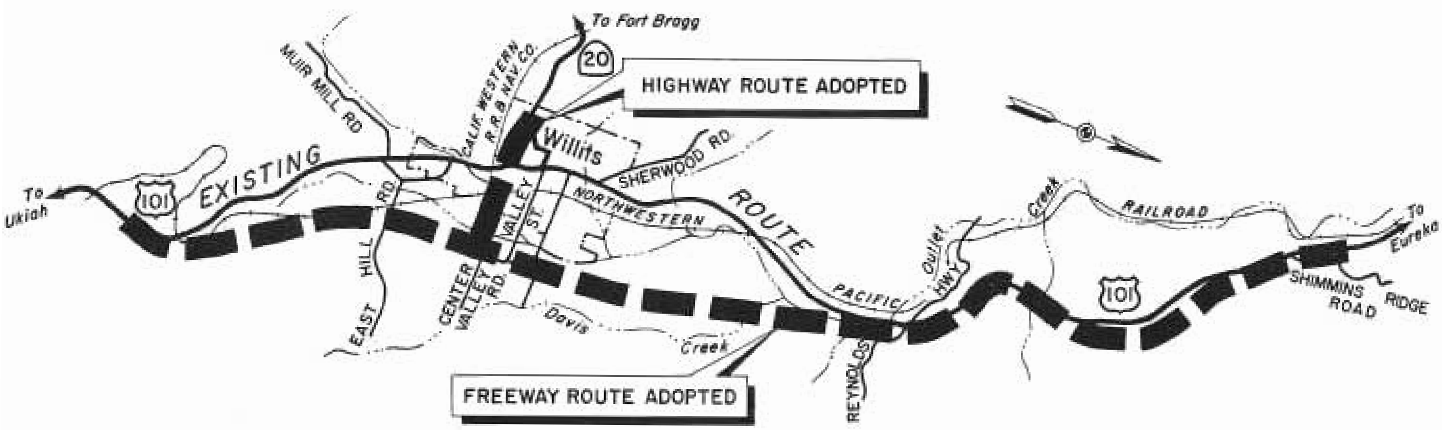
Colusa County—for 8.1 miles of U.S. 99W (Interstate 5) between the

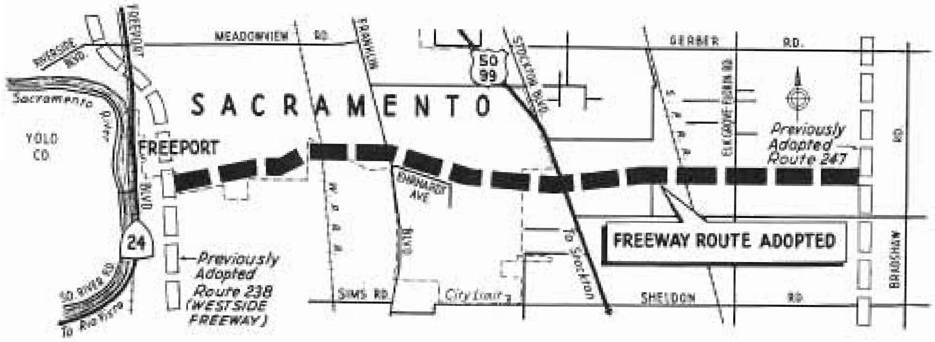


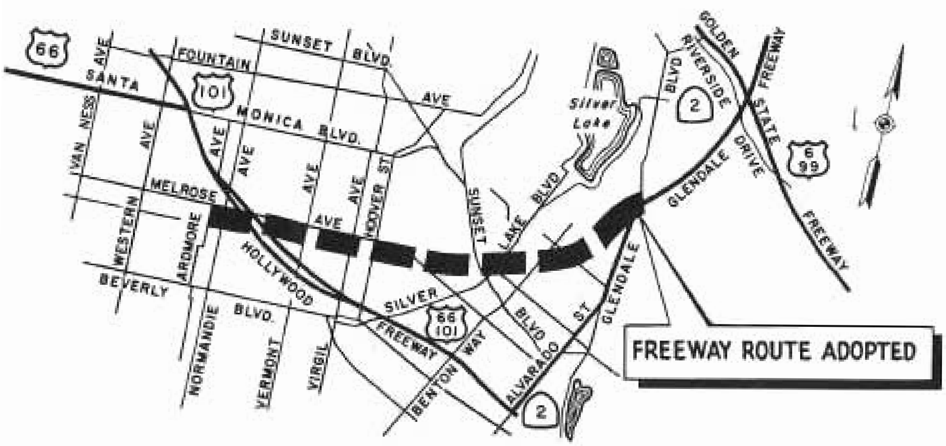


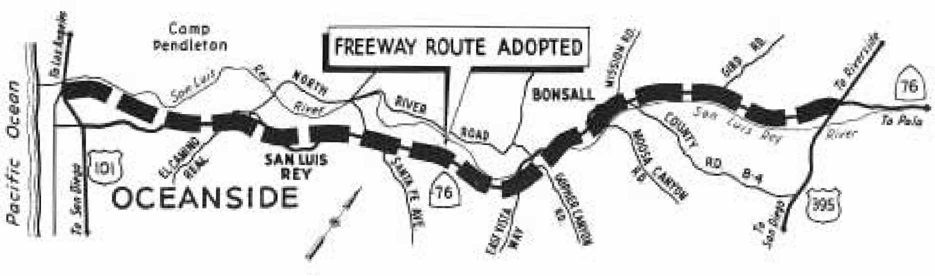












adopted freeway route for Sign Route 20 near Williams and Colusa-Maxwell Road.

El Dorado County—for 5.7 miles of U.S. 50 in the Echo Summit area between 0.5 mile east of Phillips and Meyers.

Inyo County—for 14.2 miles of Sign Route 190 between Panamint Springs and the west boundary of Death Valley National Monument.

Los Angeles County—for 2.7 miles of the Glendale Freeway (State Highway Route 162) in the City of Los Angeles between Ardmore Avenue and Glendale Boulevard.

Mendocino County—for 12.2 miles of U.S. 101 (Redwood Highway) between 0.5 mile north of the Northwestern Pacific railroad crossing south of Willits and 0.4 mile north of Reeves Creek.

Plumas County—for U.S. 40 Alternate (Feather River Highway) between the east city limit of Portola and 0.7 mile west of Beckwourth.

Plumas County—for five miles of Sign Route 89 between 1.3 miles northwest of Almanor and Sign Route 36.

Sacramento County—for 9.1 miles of State Highway Route 248 (South Belt Freeway) in and near the southern part of Sacramento between the adopted route of the Westside Freeway near Freeport and the adopted route for State Highway Route 247 northeast of Elk Grove.

San Benito County—for two miles of Sign Route 156 between U.S. 101 and 0.3 mile west of San Juan Bautista.

San Bernardino County—for 83 miles of U.S. 66 between two miles east of Ludlow and Java, just east of Needles.

San Diego County—for 16.8 miles of Sign Route 76 between U.S. 101 in Oceanside and U.S. 395 near the San Luis Rey River.

San Mateo County—for four miles of State Highway Route 229 in Pacifica and San Bruno between Sweeney Ridge and the Bayshore Freeway.

Bridge Costs

1962 Average Shows Moderate Increase

By H. K. MAUZY, Senior Bridge Engineer and
W. J. YUSAVAGE, Associate Research Technician

The annual average level of bridge construction costs increased moderately during 1962. The construction cost level at the close of 1961 was 273 and, during the subsequent four quarters, showed successive quarterly values of 264, 288, 274 and 264, or an average annual value of 274. The corresponding annual average value for 1961 was 264, or one which indicates that bridge construction costs increased by 3.8 percent during 1962.

The array of successive quarterly values, 264, 288, 274 and 264, indicates that the tendency toward a greatly accelerated rate of increase in construction costs was especially strong during the second and third quarters and diminished perceptibly during the fourth quarter.

The level of 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

The annual outlay for bridge construction attained a maximum value of 128 million dollars during 1960, a year during which a large backlog of projects was carried forward from the previous year. During 1961 the value of expenditures dropped to the more "normal" level of about 85 million dollars. The value of bridge construction was reduced to $72 million during 1962. The value of expenditures for bridge construction during 1963 is expected to rise to within the more "normal" range of $85 million.

Bidder Activity

Bidder activity was significantly curtailed during 1961 and during the first three quarters of 1962. A resurgence in bidder activity developed during the fourth quarter of 1962 when an average of 7.1 bidders competed for 28 projects. The total number of bids submitted for 125 projects in 1962 was 750 or an average of 6.0 bidders per project. The corresponding figures for 1959, 1960, and 1961, were 8.8, 7.3 and 5.8. The averages show that the intensity of competition was decidedly falling off during the past three years and that there was only a slight improvement noted during 1962. Declines in the rate of bidder activity are generally associated with rising bridge construction costs. Bridge costs followed this pattern during 1961 and 1962; they increased by about 6.5 percent in 1961 and 3.8 percent in 1962.

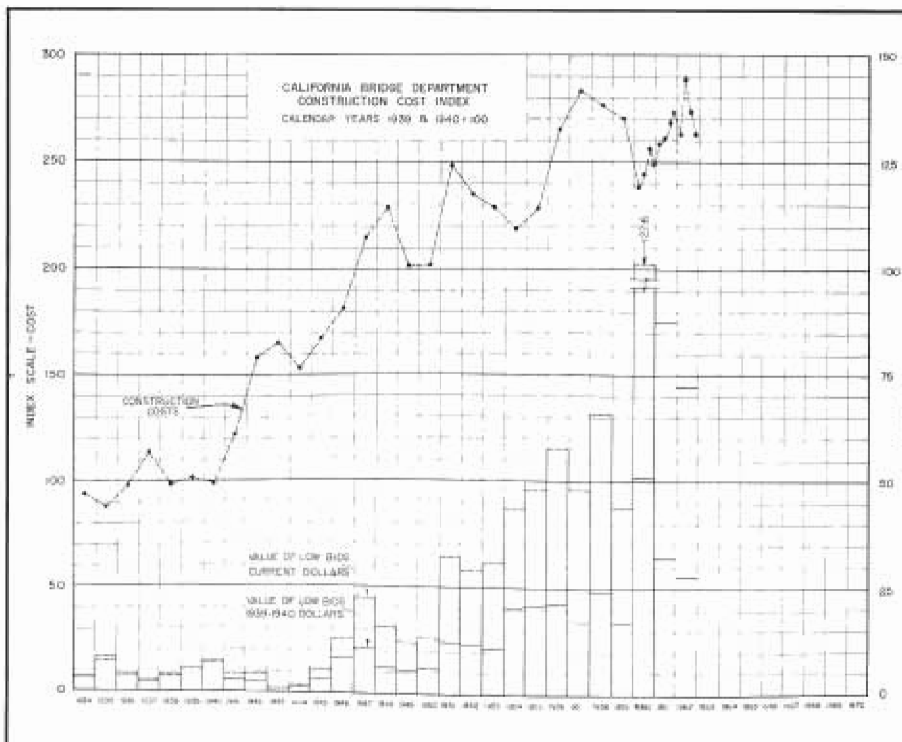
Average Unit Prices

The weighted average unit price of most bridge construction items increased moderately during 1962. The prices of a few of the more significant items have developed trends which are described as follows:

Class A Portland Cement Concrete. The weighted average unit price of the item was in decline for the three years following 1957 when it reached a peak of $58 per cubic yard. The price dropped to $55 per cubic yard in 1958, to $52 in 1959, and to $50.60 in 1960. The trend was sharply reversed in 1961 when the unit price increased to $56 per cubic yard. The trend was then carried forward to 1962 with a further increase to $59.15 per cubic yard.

Bid quotations for class A concrete during 1962 were generally in the range of $55 to $65 per cubic yard.

Bar Reinforcing Steel. The trend of unit prices for bar reinforcing steel prices is unique in that it dropped to early 1950 levels in 1960 and has shown no appreciable change from the reduced level. The weighted average unit prices during 1958 and 1959 were $0.124 and $0.113 per pound. During



1960 the price dropped to $0.097 per pound and, in 1961, dropped further to $0.094 per pound. The weighted average unit price during 1962 was $0.092 per pound.

Structural Steel (Plate Girder). The weighted unit average price of structural steel has shown a slow but persistent creep upward. The corresponding unit prices for the four years 1958, 1959, 1960 and 1961 were $0.164, $0.163, $0.169 and $0.173 per pound. During 1961 the average unit price increased to $0.184 per pound. The foregoing average prices reflect the cost of plate girders with A-7 or A-373 structural steel. Other types of structural steel such as A-441, A-36 and A-242 have not been used at a frequency which would yield sufficient price data to develop a reliable average unit price.

Prestressed Concrete. The summary unit price of prestressed concrete is expressed in terms of the price of a composite cubic yard 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 1961, inclusive, are $135.27, $163.03, $164.48, $144.74, $134.94, $138.97 and $150.22. During 1962 the weighted average unit price fell off moderately to $145.96 per composite cubic yard. The foregoing average prices reflect the cost of the various forms of prestressed construction including precast prestressed members such as the "I", "T", and box girder, and the cast-in-place post-tensioned type of construction. An analysis of the average unit prices of the "I" girder which is the most frequently used type of prestressed construction shows a weighted average cost of about $170 per composite cubic yard with a plus and minus variation of about 25 percent. The corresponding cost of cast-in-place post-tensioned construction is about $130 per composite cubic yard.

In combination the foregoing items comprise about 75 percent of the total annual cost of bridge construction. At the current rate of demand a change of 3 percent in the weighted average unit cost of the four items implies a gain or loss to the bridge construction program of about 1.7 million dollars. The advantage of competition is clearly demonstrated in the example of the item, bar reinforcing steel, which during the past three years was sold at about $0.02 per pound less than the going rate of 1959. During these three years the bridge program required about 580,000,000 pounds of reinforcing bars which, at the reduced rate, afforded an economic advantage to the program of about $10 million.

Summary

An analysis of the general trend of bridge construction costs for the two years since 1960 shows a net increase of about 10 percent, with 6 percent of the increase occurring in 1961 and 4 percent in 1962.

Ferry "Real McCoy" Will Be Converted

The Department of Public Works has awarded a contract for $84,170 to Colberg, Inc., Stockton, for converting the ferry *The Real McCoy* from cable-operated to free running. The ferry which operates on Cache Slough from the mainland near Rio Vista to Ryer Island, was named after former State Highway Engineer G. T. McCoy.

Conversion of the vessel is necessary so that the cable now used across Cache Slough can be removed for operation of the Sacramento - Yolo Port District Deep Water Channel which is scheduled to open July 1. The cost will be met by the Port District under agreement with the Department of Public Works.

Ferry service will be maintained during the conversion period by the ferry *Scooter*, a reserve cable-operated vessel.

The Real McCoy will be diesel-powered, steered and driven by propellers amidship on both sides. It will be equipped with modern appurtenances, including radar.

Architecture Loses Construction Chief

Charles M. (Tex) Herd, 55, for nine years chief construction engineer for the State Division of Architecture, will retire April 30.

Herd heads the division's construction supervisory forces and is responsible for the review and approval of plans for structural adequacy of all public school buildings erected throughout the State.

State building projects worth nearly $700 million have been constructed under Herd's supervision.

CHARLES M. HERD

This is about two-thirds of the Division of Architecture's capital outlay program of public works during its entire 56-year history.

He was a supervising structural engineer in the Los Angeles and San Francisco offices of the schoolhouse section for a year and then principal structural engineer in charge of the San Francisco operation.

Herd is a native of Mangum, Oklahoma, where he attended grade school. He gets his nickname, "Tex", from high school days in Weslaco, Texas.

He came to California in 1925. He attended the California Institute of Technology for two years and then the University of Southern California, graduating in 1931 cum laude with a B.S. degree in civil engineering.

During World War II Herd served six years—three in the South Pacific—with the U.S. Navy Civil Engineers Corps. He is now a captain in the Naval Reserves.

Herd is a member of Tau Beta Pi, the American Society of Military Engineers, and the American Society of Civil Engineers.

In 1956 he served as president of the Structural Engineers Association of California.

Herd and his wife, Gladys, have a daughter, Mrs. Carol Herd deVallejo, who lives in Riobamba, Ecuador.

The Herds will live in San Francisco after his retirement.

29 Palms Interchange

New Construction Eliminates Intersection

By J. E. WALSH, Project Engineer

On December 29, 1962, the Twentynine Palms Highway interchange, which connects the Twentynine Palms Highway (Legislative Route 187) with a high-speed, high-volume interstate highway (Interstate Route 10), was opened to traffic, thereby eliminating another at-grade intersection from the state highway system in California.

Increased Traffic Volumes

Traffic volumes have increased on Twentynine Palms Highway in recent years due chiefly to the expansion of the "high desert" communities, along with the shuttling of military convoys between Camp Pendleton marine base at San Diego and the marine training center northerly of Twentynine Palms. Interstate Route 10 traffic volumes have also increased due to increased interstate travel and truck traffic transporting produce from the Imperial Valley to Los Angeles markets.

Ultimate Freeway Conversion

As Interstate Route 10 and Route 187 will both ultimately be converted to freeway standards, this interchange was developed to provide the high standards necessary for the transferring of traffic between freeways. Numerous alternate geometric designs were studied, with major consideration being given to the freeway-to-freeway traffic movements, economy, and land development.

Because they begin on long, straight, downhill sections, interchange ramps taking eastbound Interstate 10 traffic on to Route 187 northbound and southbound Route 187 traffic on to Interstate 10 westbound are designed for speeds in excess of 60 miles an hour.

Contour Grading

To add to the general appearance of the interchange, contour grading plans were prepared to provide for flat, well-rounded slopes blending in with the rolling desert terrain.

Interim Connections

Access to and from Interstate Route 10 for the adjacent lands was accomplished by designing frontage roads with an interim connection to Interstate Route 10 at the easterly terminus of the project. This connection will be eliminated and the frontage roads extended easterly when Interstate Route 10 beyond the limits of this project is converted to a full freeway.

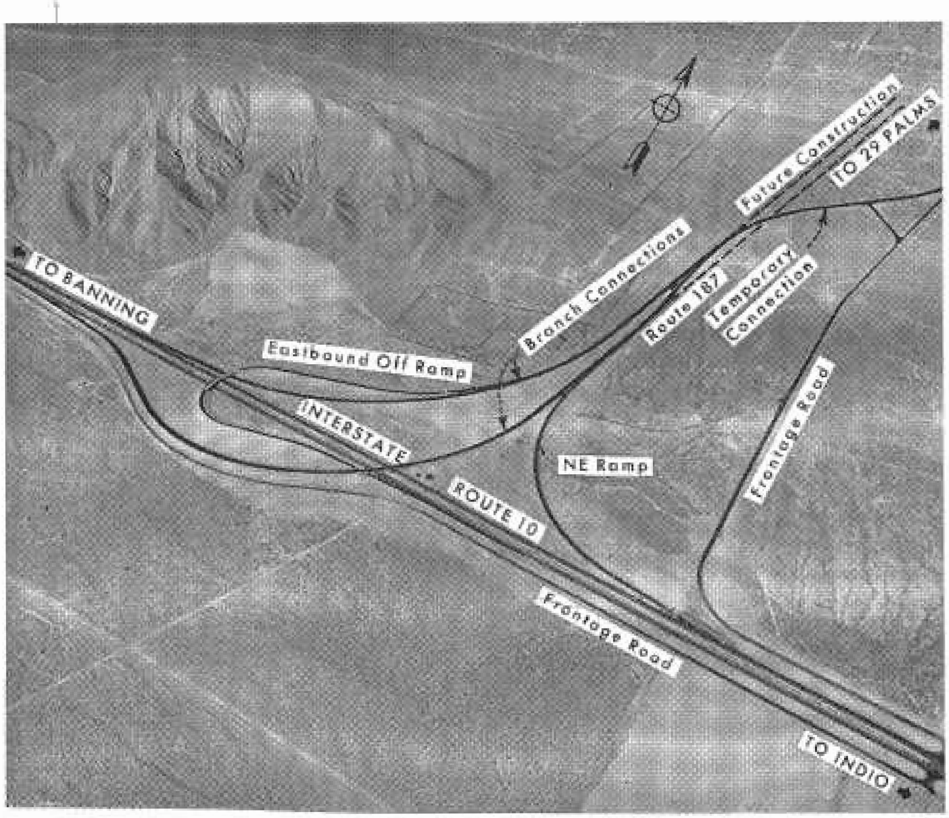
Temporary Connection

A temporary connection with existing Route 187 was provided for at the northerly limits of the project, with the future roadbeds "stubbed off," thereby providing for the future construction of Route 187 roadbeds without interfering with traffic. Plans are now being prepared for extending Route 187 on an expressway basis between the northerly terminus of this project and Dry Morongo Canyon.

Will Reduce Accidents

With the opening of this interchange to traffic, the high-standard, freeway-to-freeway connections should reduce, if not eliminate, the accident rate attributed to this location.

This project was constructed by the Massey Sand and Rock Company, Indio, under the supervision of J. O. Erwin, resident engineer, at a cost of $1,220,000, a portion of this cost being financed with interstate highway funds.



This aerial photo with superimposed text shows the design of the new interchange.

Sierra Sam

He Loses His Head During Test Crash

From Materials and Research Department's "Random Samples"

The first confirmed fatality in the structural materials section in the line of duty occurred Thursday, January 10, to an old and respected employee. This faithful civil servant had survived 30 passenger vehicle collisions and 2 bus collisions with no more severe injuries than multiple lacerations of the face and scalp, concussion, a squashed rib cage, fractured leg, shoulder, and arm, torn buttocks, third degree acid burns, and a broken heart.

Many Awards

For his services to the State of California above and beyond the call of duty and for accepting his responsibilities, he has received the following awards:

June 1958, Hero Medal; July, August, September 1958, Hero Medal Clusters; July 1960, Stubborn Medal with palms; June 1962, Idiot Medal; and January 1963, the coveted bronze Non Compos Mentis Medal, posthumously awarded.

Road to Success

For Sierra Sam the road to success in research has been beset with frustration (three aborted runs), jubilation (the success of the cable chain link barrier), and terror (the first 80 m.p.h. run on a bridge rail).

Sam's ancestry dates back to 1949 when the first semiarticulated anthropometric dummies were developed by the Air Force Aero-Medical Laboratory for highspeed seat ejection sled tests. Sam was born in January 1958, when he weighed in at 200 pounds and was certified for appointment from a personnel board list of two in May 1958.

Driver 'Disappointed'

The other eligible on the list for the position of senior crash car driver was Elvin "Kess" Kessinger, a bridge department employee who had driven the crash cars for the 1953 curb test series. "Kess" was at first disappointed that the Personnel Board bypassed him

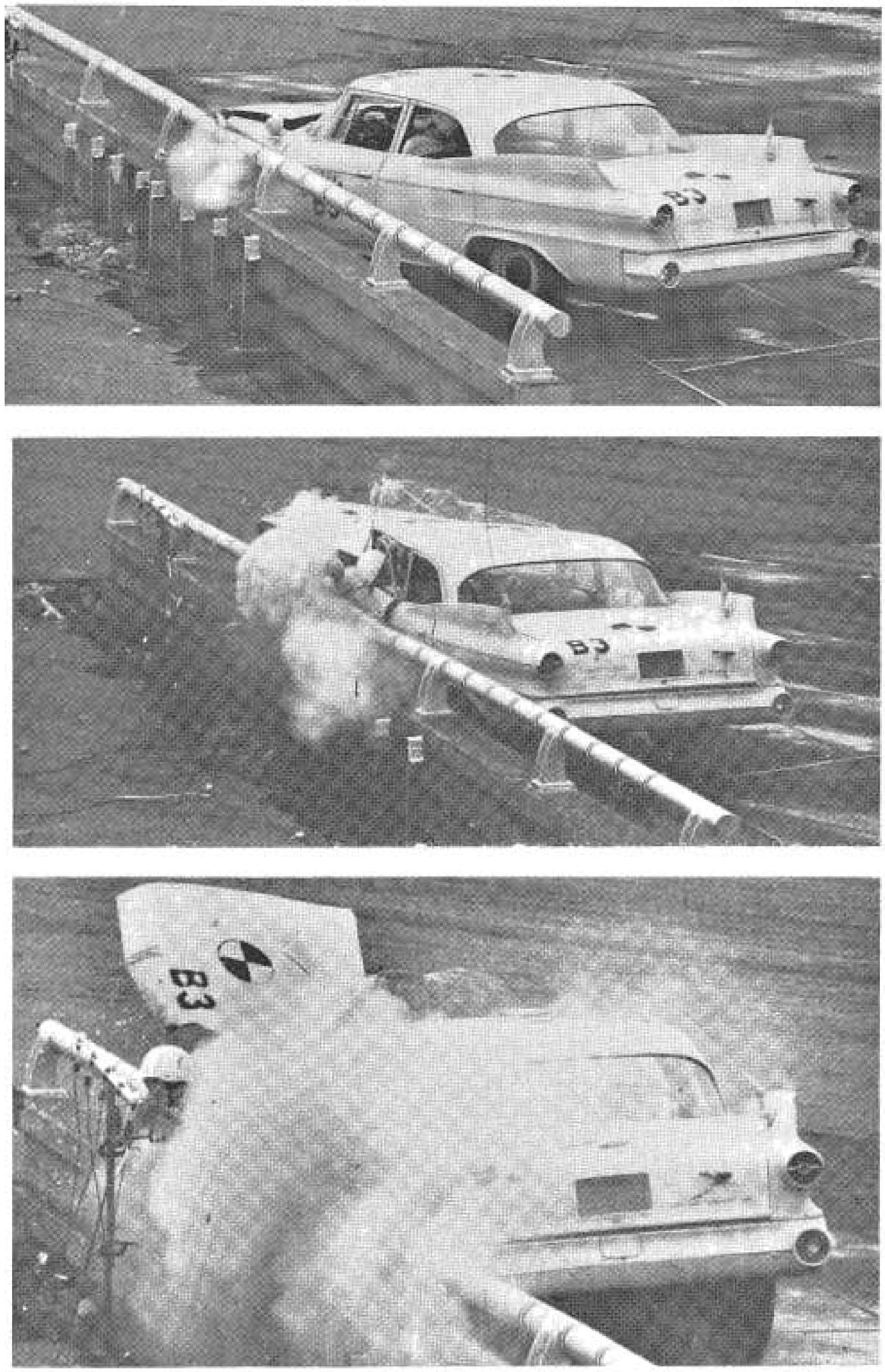


PHOTO SEQUENCE ABOVE of Sam's fatal ride shows him at point of impact (TOP), head protruding from window (MIDDLE) and head broken off and on its way at left of collision cloud (BOTTOM). Photos by Robert Souza.

in favor of Sam for this new high-speed series; however, he was more reconciled after witnessing the first collision test at 60 m.p.h. that resulted in a rollover and serious head injuries to Sam. On checking the Personnel Board records we find no evidence of "Kess" reapplying for this position.

Fine Figure of Man

Sam is anthropomorphic (features and body contours conforming in shape to those of the human counterpart) as well as anthropometric (weight distribution and locations of each part of the anatomy are correct for a 200-pound standard man).

No Remorse

There is no remorse that Sam lost his head (literally and figuratively) during the January 10 bridge rail test. His skull, protected by a new type Highway Patrol helmet, traveled over 100 feet airborne and rolled another 100 feet before comming to rest on the side of the test site runway.

Wounds Described

Other than decapitation (three high-strength steel bolts sheared in his neck joint), he suffered (rather his head suffered) only minor abrasions of the chin and nose.

Under the talented wrench of Dr. Don "Kildare" Hughes and the artistic brush of plastic surgeon Dr. Chuck "Casey" Ledbetter, Sam is once again intact, smiling, ready and able for the forthcoming bridge rail tests.

Reasons Sought

At this time we are unable to determine the exact cause of the decapitation; however, the two most logical contributing factors were the high deceleration (in excess of 40 g's) and the diagonal cross-chest shoulder harness restraint.

We feel sure the human counterpart would have sustained a broken neck under similar collision conditions.

Let this be a warning—Sam is repairable—*you* might not be!

A recent survey shows that California has 11 percent of all vehicles registered in the United States, 9 percent of the nation's population of driving age (16 and over).

H.R. 381 Study Groups Hold Region Meetings

Advisory study groups on motor vehicle and highway operations held regional meetings in March and April as one phase of a comprehensive study of the interrelationship of the citizen, his motor vehicle, and state government.

The meetings took place in San Diego, Los Angeles, San Francisco and Sacramento.

The overall study was initiated by the Legislature in 1959 as House Resolution 381. Part one, the factfinding phase of the study, was completed in January 1961 and describes how the State manages its highway "plant," how it regulates drivers and their vehicles, and how it enforces traffic laws.

In part two, the analysis and evaluation phase, study groups are meeting to consider five functional areas: motor vehicle registration and title, financial responsibility, driver licensing, highway patrol functions, and the operations of the Division of Highways.

At each regional meeting, registration and title, including occupational licensing and business regulation, were covered between 9 a.m. and noon of the first day, while financial responsibility and highway traffic operations were the subjects for the afternoon session (1.30 to 4.30). On the second day, the entire program was devoted to driver licensing. The final day covered the supervision and services of the California Highway Patrol.

Technical consultants and state officials were present at the regional meetings to take part in detailed discussions in each area of interest. The consultants and officials previously attended study guidance group meetings held in Sacramento during the winter.

Technical consultants for the various study areas are as follows: *Driver Licensing*—John C. Kerrick, Director of Driver Licensing Programs for the American Association of Motor Vehicle Administrators, Washington, D.C., Glenn V. Carmichael, Co-ordinator of Programs for the Traffic Institute at Northwestern University, Evanston, Illinois, and Anthony Antony, Research Analyst for the Automotive Safety Foundation, Washington, D.C.; *Financial Responsibility* — Milo W. Chalfant, Michigan State University; *Highway Patrol*—Robert E. Raleigh, Citizens Traffic Safety Board, Chicago; *Highway Traffic Operations*—David W. Schoppert of Alan M. Voorhees and Associates, Washington, D.C.; and *Registration and Title*—Louis R. Morony, Director, Laws Division, Automotive Safety Foundation, Washington, D.C.

Frank B. Cressy Leaves District VII

Assistant District Engineer Frank B. Cressy retired April 1, ending a career of nearly 36 years with the Division of Highways. All of his service has been with District VII, most of it in construction.

FRANK B. CRESSY

A native of San Francisco, Cressy joined the District in 1927, following his graduation from the University of California. During the next 14 years he was an assistant resident and a resident engineer on construction projects.

During World War II he served with the Navy in the Pacific theater. In 1948, he was promoted to captain in the Naval Reserve.

Cressy returned to Highways in 1946 as construction engineer. The following year he was promoted to supervising highway engineer.

Cressy and his wife, Opal, have a married daughter, Diane, two teenage sons, Frank B. and Richard S., and two grandchildren. The Cressys recently built a home in Thermal, California, near the Salton Sea.

He served as a director of the La Habra Heights Mutual Water Company from 1949 until 1956 and was a member of the advisory council, Calavo Avocado Growers, for several years.

Twenty-five-year List

The following employees received their 25-year awards during January, February and March:

Headquarters Office

Vivian E. Brady
George H. Ebenhack
Arthur E. Mertens
Robert L. Zehrbach

Bridge Department

James G. Standley, Jr.
Herbert W. Gee

State-owned Toll Bridges

Clair Gibson
Edith Thoms Harrell

District I

William Z. Hegy
George W. Lockwood
Howard L. Nelson

District II

Laures H. Fretts

District III

Eldon C. Patchell
Clyde F. Moeckly

District IV

Charles P. Carter
Ralph B. Keller
E. J. Stewart, Jr.

District VII

Alfred R. Finch
Chester W. Gish
Wasson E. LaBrande

District VIII

George E. St. Jean

District IX

Pete Minaberry, Jr.

District X

Hannah M. Henderson
Maxine A. Nolton

District XI

Jacob Dekema
Samuel Solomon
Hubert B. Whitnall

New Transbay Study Shows Bridge Need

Additional bridges to connect San Francisco with Alameda and Marin Counties are urgently needed, according to Norman C. Raab, chief of the Division of San Francisco Bay Toll Crossings.

Raab's report, addressed to the State Director of Public Works, had been requested by the Legislature in 1961.

The report was based on extensive origin and destination studies conducted in 1961 and on projected traffic increases that will cause the San Francisco-Oakland Bay Bridge to reach its maximum capacity in 1965 and the Golden Gate Bridge in 1967.

Although specific routes for the two bridges were not proposed, the report considered for study purposes a Potrero Point crossing from the foot of 20th Street in San Francisco to Alameda, and a bridge from near Telegraph Hill in San Francisco to the Tiburon Peninsula in Marin County via Angel Island.

The report also considered a Sierra Point crossing from the San Mateo county line near Brisbane to Alameda County near Hayward, but found that it offered far inferior traffic service than the more northerly one from 20th Street.

The report based on analysis of traffic data by Coverdale and Colpitts, consultants, stated that if the new crossings are not constructed, many vehicles will be diverted to the Dumbarton and San Mateo-Hayward bridges when the San Francisco-Oakland Bay Bridge reaches its 45 million annual vehicle limit in 1965. The Dumbarton Bridge will reach its maximum capacity in 1970 and the San Mateo-Hayward Bridge in 1980. Many motorists will then choose to drive the freeway route around the south end of the San Francisco Bay.

He added that the Golden Gate Bridge's annual capacity of 25 million vehicles will be exceeded by 3.4 million by 1980.

"KIDPROOF RAILINGS" PRAISED

March 2, 1963

Editor
California Highways and Public Works
P.O. Box 1499
Sacramento, California

Dear Sir: Your publication has been very valuable to me in my teaching. Last year when I was studying the highways of California with my fourth-grade class, I found, in my back issues of *California Highways*, pictures to illustrate all phases of highway construction. This made a most meaningful experience for my students as we were able to consider the complicated process of highway construction from the first planning to the road dedication.

Recently I found good use for the article called "Kidproof Railings" which appeared in the September-October 1962 issue of the magazine. It served as the basis for a lesson with my students regarding respect for public property and our responsibility in regard to taking care of this property. The author of that article, by the way, should be congratulated for the interesting and lively way in which he presented his cause! He certainly aroused my sympathies and he might be interested to know that my students were quite shocked and very sympathetic when told of this problem and as we discussed others of its kind.

I am now in the process of preparing some materials for use by other teachers, and wonder if I might have two more copies of that issue of the magazine so that I can mount the pictures for study.

Sincerely,

Mrs. James H. Fretz
Valley View School
East Whittier City
School District
Whittier, California

The Department of Public Works advertised for bids in March for 55 highway projects with an estimated value of $18,990,300. There were 36 contracts awarded for $30,609,700 and 33 contracts for $19,088,600 completed.

Recent Retirements From Division Are Listed

Headquarters Office

Edward F. Carter, senior highway engineer, 43 years; William B. Carter, assistant highway engineer, 25 years; William S. Cully, assistant comptroller, 32 years; Charles V. Gay, associate statistician, 26 years; Guliano Evangelista, laborer, 11 years; Merle A. Lapham, senior file clerk, 15 years. Lewis Ora Holsey, laborer, 10 years.

Bridge Department

George A. Greene, senior bridge engineer, 32 years; Loretta Turpen, supervising account clerk I, 32 years; Carroll C. Winter, supervising bridge engineer, 32 years.

Materials & Research Department

Harry F. Kuhlman, associate steel inspector, 33 years; William E. Haskell, associate materials and research engineer, 24 years.

Headquarters Shop

Thomas A. Mendenhall, highway equipment superintendent I, 41 years; Earl E. Sorenson, principal equipment engineer, 34 years; Edgar M. Burgess, heavy equipment mechanic, 23 years; Paul G. Howard,* supervising machine parts storekeeper I, 14 years.

District II

Virgil B. Cade, highway maintenance man II, 25 years; Clyde F. Robinson, highway maintenance man II, 14 years; Mortimer E. Beaty, associate highway engineer, 21 years.

District III

George I. Stancil, highway maintenance man II, 29 years; Henry R. Vierra, highway maintenance man III, 36 years; Ernest P. Hay, associate highway engineer, 35 years; Clarence C. Knee, janitor, 11 years.

District IV

Alice R. Beard, intermediate account clerk, 13 years; William T. Byroads *, highway maintenance man II, 41 years; Leo E. Murray, highway foreman, 29 years; Leo Rinne, assistant highway engineer, 7 years; Albert J. Rogers, highway maintenance man II, 24 years; Anton M. Kiser, highway foreman, 37 years; Oleg V. Prasalov, assistant highway engineer, 11 years; Florence Shaughnessy *, intermediate stenographer, 11 years; Arthur B. Burger, highway maintenance man II, 34 years; Julius Hyland, highway maintenance man II, 28 years.

District V

Russell H. Massengale, janitor foreman I, 28 years; James R. Jensen, highway foreman, 32 years; Claude H. Hixson, highway superintendent, 29 years; Paul A. Beyer, junior civil engineer, 6 years; John E. Maryfield, groundsman, 4 years.

District VII

Dewey C. Aderson, highway foreman, 38 years; Emmett Bush, laborer, 36 years; Fern B. Fleharty, senior accountant clerk, 5 years; Ellsworth R. Talmon, associate highway engineer, 29 years; Earl H. McBroom, senior highway engineer, 33 years; Bertha A. Newton, delineator, 12 years; John H. Powell, groundsman, 6 years; Frank B. Cressy, supervising highway engineer, 36 years.

District VIII

Thomas G. Duff, associate highway engineer, 11 years; Harold Lienav, highway foreman, 28 years; Josephine G. Park, reproduction machine operator, 10 years; Henry E. Maynard, highway foreman, 33 years; Ralph Setser, highway maintenance man II, 28 years; Glenn E. Bridgman, senior clerk, 13 years.

District IX

Burton F. Moore, assistant highway engineer, 33 years; H. Earl Wise, assistant highway engineer, 8 years; Thomas Buckley, highway maintenance man I, 18 years.

District X

Henry J. Cox, senior highway foreman, 33 years; Gage Treganza, highway maintenance man II, 30 years.

District XI

Henry Box, highway maintenance man II, 27 years; Dick Elder, highway foreman, 31 years; Vernon J. Decker, highway foreman, 31 years.

* Disability.

Buellton Road Super C. H. Hixson Retires

Claude H. Hixson, highway superintendent, retired February 15, 1963, after more than 29 years of service with the State of California. Hixson began his service in September 1933 as a highway road laborer. He was promoted to highway maintenance leadingman in January 1940 and to highway maintenance foreman in July 1942. He was promoted to his present position of highway superintendent in April 1950. Hixson worked in District III from September 1933 until April 1950 when he was promoted and transferred to District V. He has worked out of the Cambria and Buellton maintenance stations while in District V.

CLAUDE H. HIXSON

Hixson enjoys hunting and fishing as hobbies. He and his wife "Gussie" are presently traveling, a pastime they will engage in more extensively after his retirement.

DAY USE FOR GEODIMETER

A special converter device is now being installed on all its geodimeters by the Division of Highways making possible the daytime use of these instruments. (See "Meet The Geodimeter," *California Highways and Public Works*, May-June 1962).

Daytime operation will not only result in substantial money savings but will eliminate hazards connected with nighttime use of the equipment.

State-owned Toll Bridges

Ambrose W. Koziol, structural steel painter, 15 years; Harry E. Schaumburg, structural steel painter, 10 years; Genevieve E. Rohl, supervising clerk I, 35 years.

Shops

Cleone M. Meachem, intermediate typist clerk, 29 years; Harry I. Overstreet, heavy equipment mechanic, 20 years; John C. Bening, automobile mechanic, 39 years.

STATE OF CALIFORNIA

EDMUND G. BROWN, *Governor*

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

T. F. BAGSHAW . . . . Assistant Director
JOHN H. STANFORD . . . . Assistant Director

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

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CHAS. E. WAITE . . . . Deputy State Highway Engineer
J. P. MURPHY . . . . Deputy State Highway Engineer
J. A. LEGARRA . . . Deputy State Highway Engineer
LYMAN R. GILLIS . . Assistant State Highway Engineer
J. E. McMAHON . . . Assistant State Highway Engineer
GEO. LANGSNER . . . Assistant State Highway Engineer
FRANK E. BAXTER . . Assistant State Highway Engineer
J. C. BURRILL . . . . Comptroller
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R. V. POTTER . . . . . Systems Research Engineer
E. L. TINNEY . . . . Maintenance Engineer
W. L. WARREN . . . . Engineer of Design
G. M. WEBB . . . . Traffic Engineer—Special Studies
A. L. ELLIOTT . . . . . Bridge Engineer—Planning
L. C. HOLLISTER . Bridge Engineer—Special Projects
I. O. JAHLSTROM . . . . Bridge Engineer—Operations
DALE DOWNING . . . Bridge Engineer—Southern Area

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DEXTER D. MacBRIDE . . . . Assistant Chief
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R. S. J. PIANEZZI . . . . Assistant Chief
JACQUES T. ZEEMAN . . . . Assistant Chief

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SAM HELWER . . . . District Engineer

District II, Redding

H. S. MILES . . . . District Engineer

District III, Marysville

ALAN S. HART . . . Assistant State Highway Engineer

District IV, San Francisco

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

District V, San Luis Obispo

E. R. FOLEY . . . . District Engineer

District VI, Fresno

W. L. WELCH . . . . District Engineer

District VII, Los Angeles

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JACOB DEKEMA . . . Assistant State Highway Engineer

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CHARLES L. SWEET . . . . Bridge Engineer

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HOLLOWAY JONES . . . . Assistant Chief
HARRY S. FENTON . . . . Assistant Chief

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

DIVISION OF ARCHITECTURE

EARL W. HAMPTON . . . . Acting State Architect, Chief of Division

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

ARTHUR F. DUDMAN . . . . Assistant State Architect (North)
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CHARLES M. HERD . . . . Chief Construction Engineer

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

83448 3-63 52,800

printed in CALIFORNIA STATE PRINTING OFFICE

EDMUND G. BROWN
GOVERNOR

State of California

GOVERNOR'S OFFICE

SACRAMENTO

California is happy to join with our sister states and the Federal Government in the third annual observance of National Highway Week, May 26-June 1, 1963.

Nearly every week is a "highway week" in some part of California as we extend by some 200 miles a year our network of modern freeways. Last year we opened more than 50 miles of major freeways in the Los Angeles metropolitan area alone.

This accomplishment is the end result of sound long-range planning, cooperative State-local teamwork, skilled engineering, and efficient construction methods. It adds up to greater ease and safety for the movement of our people and our products--amounting to the staggering total of more than 70 billion vehicle-miles per year.

This year, in addition to pausing to take note of our continuing highway progress, I hope the people of California will make National Highway Week a week of especially safe driving. Our freeways save more than 300 lives a year, but we are still killing and maiming too many of our people in needless traffic accidents.

Let us make our driving worthy of our highways.

Edmund G. Brown

EDMUND G. BROWN, Governor