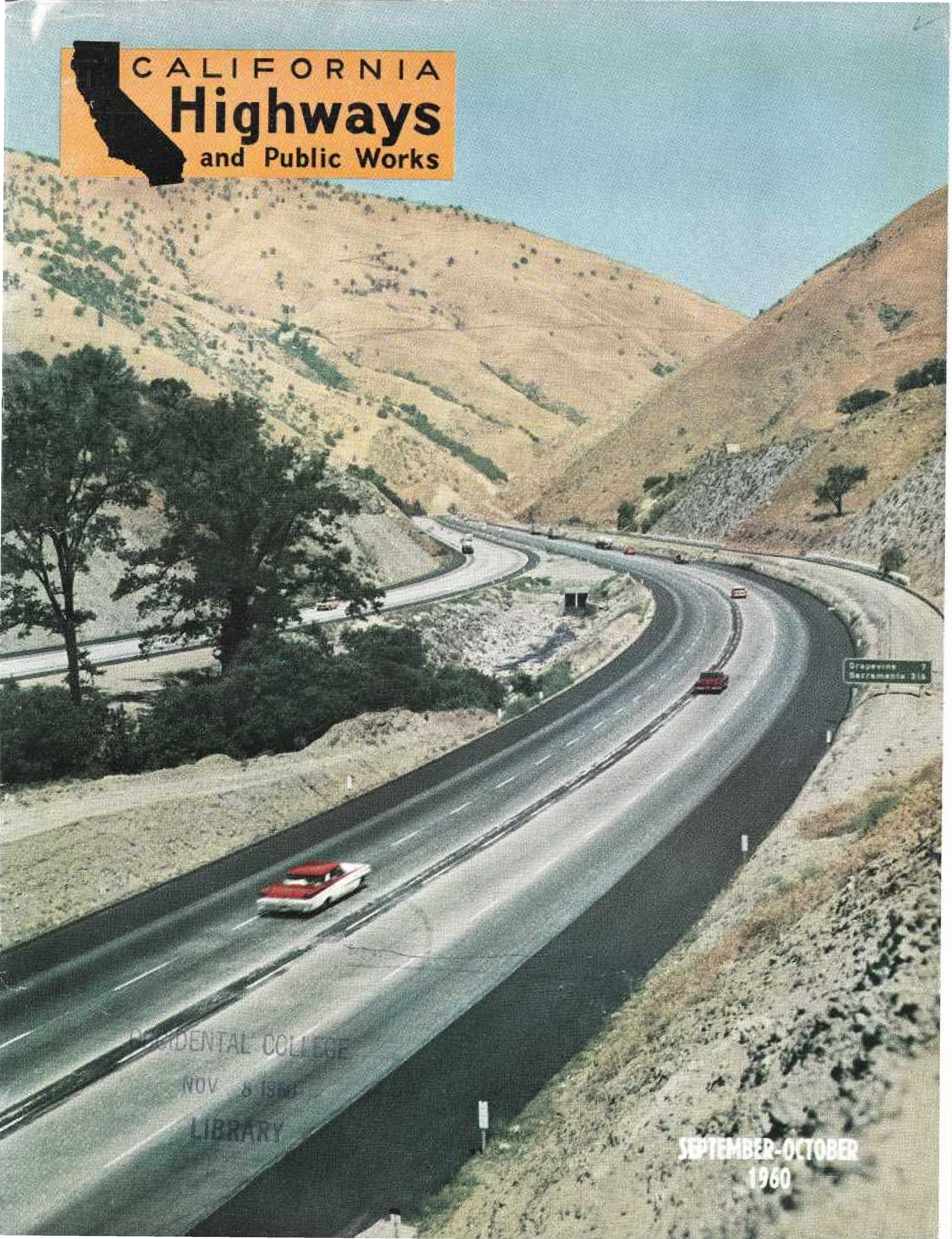
CALIFORNIA Highways and Public Works



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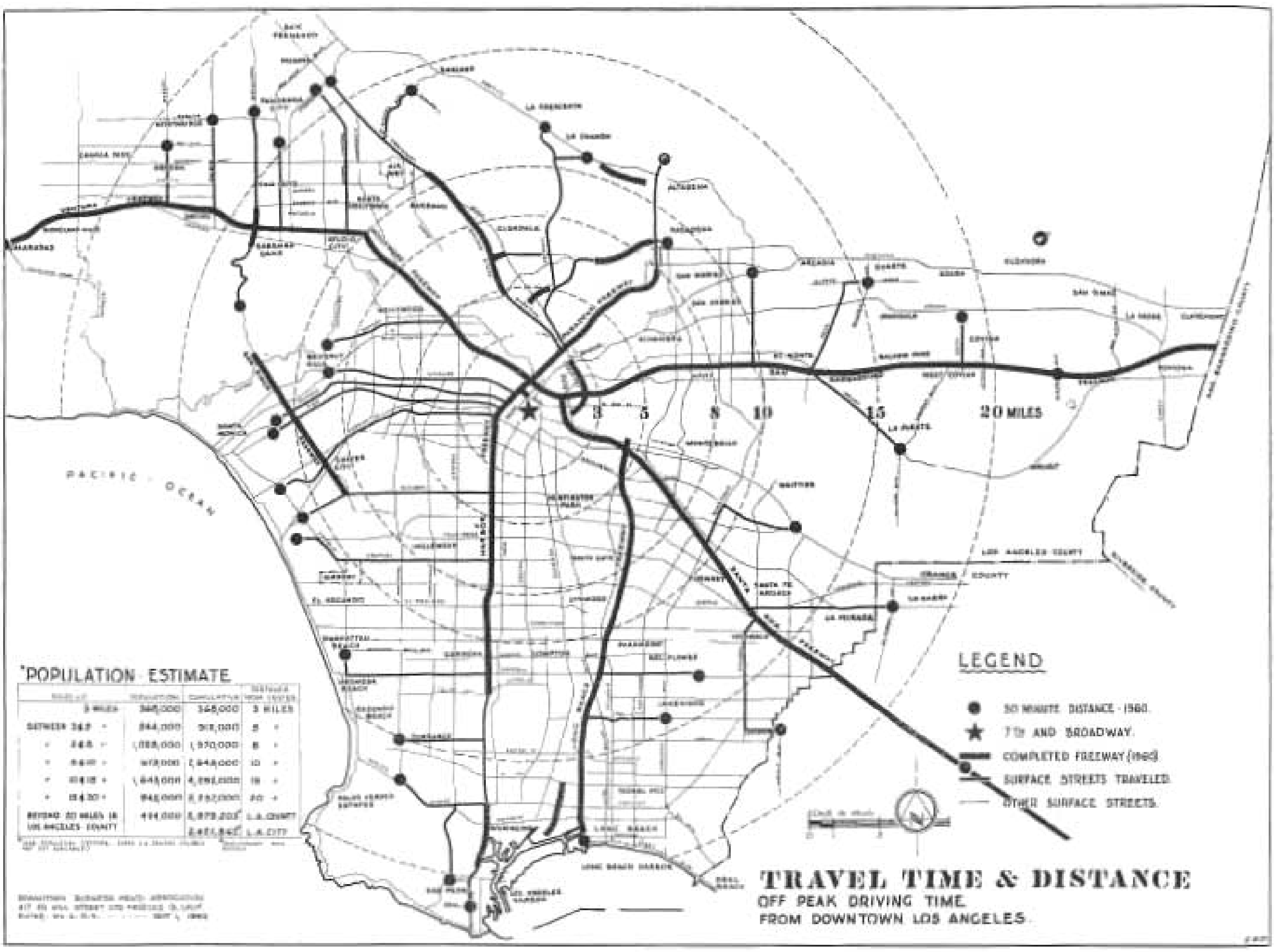
NEW FREEWAYS SHORTEN PEAK-HOUR TRAVEL TIME



Freeways are shortening travel times despite steadily increasing vehicle registration in the Los Angeles Metropolitan area, a recent Automobile Club of Southern California travel time study reveals.

Although there has been an 11 percent increase in the number of vehicles in the area since 1957, it is somewhat easier to drive around now than it was three years ago, thanks largely to the addition of 47.5 miles of freeway to the system.

The five-day study, conducted by the auto club's engineering department in June, covered 342 miles of surface streets and freeways over 17 routes from various suburban areas to downtown Los Angeles. Test runs were made during morning and evening peak hours.

Overall average speed was found to be 26 miles per hour as against 24 m.p.h. when a similar test was made over substantially the same routes during June 1957.

Most striking gains in average speeds were recorded in areas served by the Ventura, Harbor and Long Beach freeways. One route utilizing 27 miles of the Ventura and Hollywood freeways permitted an average speed of 33 m.p.h. This compares with an average speed of only 22 m.p.h. over a comparable route in 1957.

Another route utilizing 19 miles on the Harbor Freeway and Figueroa Street permitted an average speed of 42 m.p.h. in 1960 as against 33 m.p.h. in 1957.

"In approximately 18 months to 2 years motorists can look forward to even more relief and still better travel time with the completion of the freeway loop bypassing the four-level interchange," points out John McDonald, auto club engineer. "The loop formed by the Golden State and Santa Monica freeways is now entirely under construction, with two links completed."

California Highways and Public Works

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

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FRONT COVER—A downhill view of the new eight-lane freeway through historic Grapevine Canyon on US 99 south of Bakersfield. The black streak down the center of the northbound lanes is the result of a divider strip used during the final stages of construction when all traffic was placed on these lanes for a five-month period. In the center Grapevine Creek can be seen entering a section of the 9,000-foot-long concrete conduit constructed to offset excessive roadway excavation costs. On the right is a section of the old four-lane highway which is now serving as a utility bench, in which several large oil and gas lines were located. It is also used as a cattle trail and service road for the oil companies. (Story on page 5)
Photo by Jack Meyerpeter

BACK COVER—Looking northward over Folsom Lake State Park's Mormon Island unit situated on the south shore of the main lake. Earlier this year the Division of Highways supervised construction of the entrance road, kiosk, parking area and the launching ramp for the Division of Beaches and Parks. The remainder of the wooded point is equipped with picnic facilities. The vicinity retains the name of an island in the American River now submerged. At the bottom is Green Valley Road (Federal Aid Secondary Route 1096) which leads left to the dam, one mile; City of Folsom, three miles; right to Placerville, 20 miles. (Story on page 61)
Photo by M. R. Nickerson

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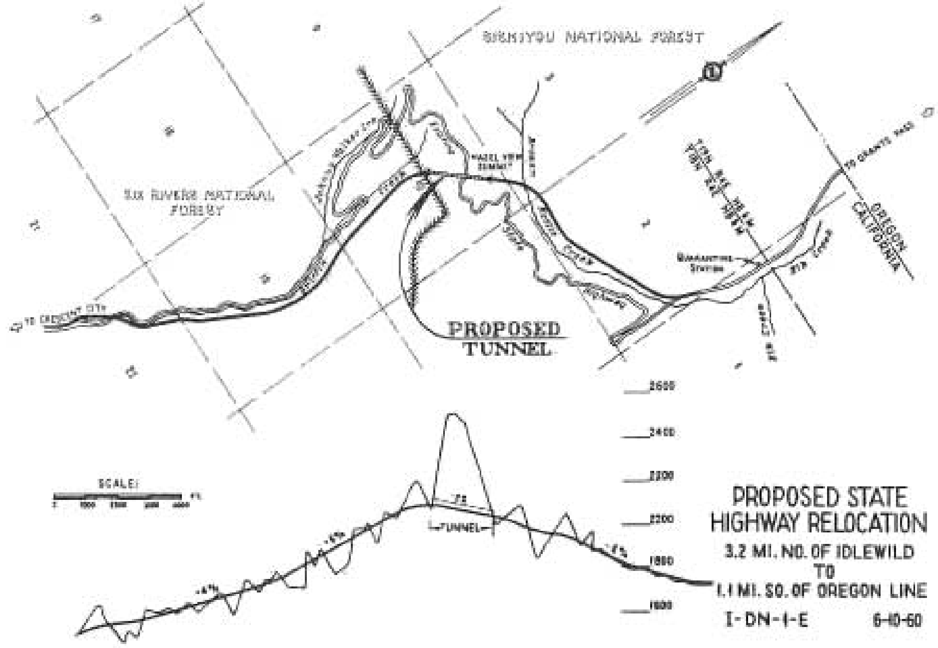
Hazelview Tunnel

Groundbreaking Marks Start of US 199 Job

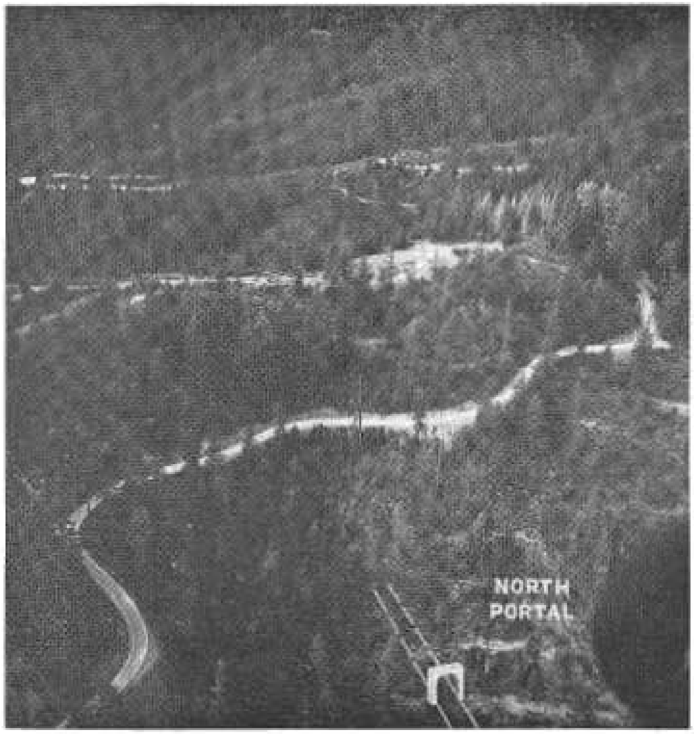
By L. R. REDDEN, Design Engineer

SIGNALING the start of a combined road and tunnel project, ground was broken, on July 8 near Hazelview Summit in Del Norte County, for a 4.3-mile unit of the Redwood Highway. Many state and local dignitaries from three states—Nevada, Oregon and California—took part in the ceremony. The actual "ground breaking" was performed atop the mountain through which the tunnel will pass.

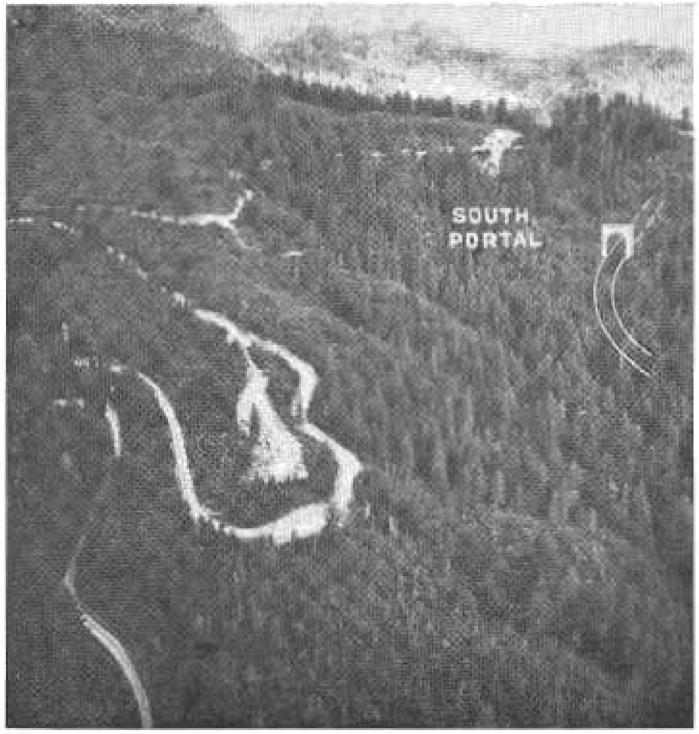
To California's State Senator Randolph Collier went the honor of turning the first shovelful of symbolic dirt, assisted by Assemblyman Frank Belotti. The blade of the ceremonial



Some 500 people attended the groundbreaking ceremony which was preceded by an old-fashioned barbecue. The tunnel passes through the ridge about 450 feet directly below where the ceremony was held.



The existing State highway in the foreground crosses the ridge at the right center and descends to the south by way of the numerous hairpin turns that are partly visible. The North Portal of the tunnel has been superimposed on the photo.



The approach to the tunnel will lie on the precipitous eastern slope above Griffin Creek. The existing State highway reaches the summit through numerous hairpin turns or switchbacks located on the west canyon wall of the creek. Above and to the left of the superimposed South Portal, the cut bank at Hazelview Summit is visible on the present road.

shovel used by the Senator was made of chrome and nickel from Del Norte County, myrtlewood from Oregon and silver from Nevada. The symbolic dirt, a portion from each of the three states, was contained in an old Wells-Fargo express box that had made the trip between Crescent City and Grants Pass by stage coach over the pioneer roads of the 1870's.

Cavemen Participate

The Oregon Cavemen enlivened the celebration with a demonstration of how surveys were done in prehistoric times. The "transit" was a hollowed marrowbone supported on a forked stick; the "chain" was a series of marrowbones strung on a thong; and the level rod was a large piece of bark with a hole in it. It should be evident that the "accuracy" of the survey was somewhat less than 20th century requirements. Nevertheless, the cavemen were able, after much gesturing and unintelligible hollering, to finally locate where the ceremonial box of dirt should be placed—in front of the speaker's stand.

The project is located on US 199 between 35.3 and 42.4 miles northeast

In this view of the existing road, taken in the late 1920's, four legs of the switchbacks are visible (one leg barely visible in the lower right just left of the penned-in title). Note the line of wheelbarrows immediately ahead of the parked car apparently engaged in a ditch cleaning operation.

The north approach to the tunnel will be on the far side of the canyon near the bottom just above the logging road. The present road is visible on the hillside near the right center of the photo. The view is northeastward.

The new road will ascend from Broken Kettle Creek (foreground) up the side canyon and enter the tunnel approximately 150 feet above the creek bed and about 900 feet to the south. The fill across the creek valley will be about 110 feet high.

of Crescent City; the north end is just 1.1 miles south of the Oregon state line. Grants Pass, Oregon, on US 199, is 43 miles north of the state line.

The new facility will replace a highly inadequate section of highway, 7.1 miles long, characterized by narrow road, sharp curves (some 80- and 200-foot radius or less), switchbacks, difficult snow removal, and continuously steep grade. The south approach of the old road to the summit rises 950 feet in 4.1 miles.

The entire project is to be constructed in three separate contracts. The initial work, placed under contract during July, consists of grading the northerly 1.4-mile approach to the tunnel. The tunnel will be advertised for bids during the fall. It is hoped, subject to available financing, that grading of the south 2.5-mile approach, together with base and surfacing for the entire project, can be advertised early in 1961.

The facility is being designed as an initial two-lane road, with an additional lane for slow-moving traffic on steep upgrades. Additional graded width of roadbed is being provided to serve as a ravel catcher for all cut slopes 60 feet or more high.

Designed curvature is based on a 60-m.p.h. speed; and with the tunnel some 340 feet lower than the present road summit, the length of steep grade is reduced by some 2½ miles. The new facility will be 2.8 miles shorter than the present route of travel.

Has Warning System

The tunnel, 1,835 feet long, is to be 26 feet wide between curbs, with two-foot safety sidewalk or refuge areas on either side. It will be both lighted and ventilated, with telltale ventilation-warning installations.

Right-of-way for the approaches is being acquired for an ultimate four-lane facility and an additional tunnel.

The entire project is estimated to cost 7.4 millions, including about 3.9 millions for the tunnel. The initial contract, for the north approach, is held by Gibbons and Reed, who bid $446,400 for the 1.4-mile unit.

It is expected that the entire project will be completed by the fall of 1962.

Grapevine Grade

Historic Route Made Eight-lane Freeway

By NORMAN L. LAMBETH, Resident Engineer, and JOHN C. PUTZER, Senior Right-of-way Agent

WITHOUT ceremony, the most expensive and complex project in the history of District VI was opened to traffic on June 28, 1960. This project converted the old four-lane highway, with its concrete parabolic divider, to an ultramodern eight-lane divided freeway, winding up through narrow Grapevine Canyon, on US 99, between Bakersfield and Los Angeles.

The construction of the project was handled by the Guy F. Atkinson Company and was greatly complicated due to the fact that it was necessary, for a two-year period, to maintain passage for 9,700 passenger cars and 4,050 trucks on an average day. Construction was accomplished by doing the work in three major stages, so that it would be possible for four lanes of traffic to be available to the traveling public at all times.

The problem was worked out by constructing all possible uphill lanes on the westerly side of the canyon and tying them into the existing pavement so that all traffic was traveling on the westerly portion of the canyon. It was then possible to construct all of the northbound, or downhill lanes to completion. When the northbound lanes were completed, traffic was shifted to the easterly side of the canyon and the reconstruction of the remaining sections of the old highway was made possible to complete the project.

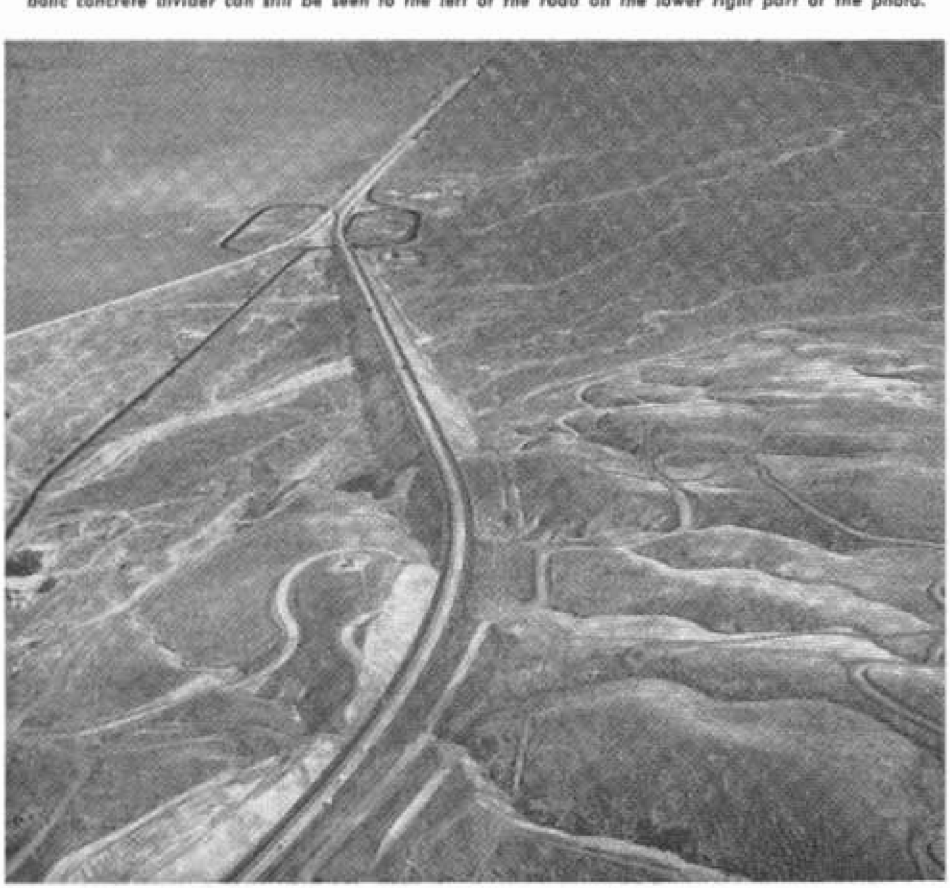
Precautions Taken

Before traffic was permitted to use the completed northbound lanes, every precaution was taken to make passage as safe as possible. One of the greatest hazards, for years, had been the problem of runaway trucks. To minimize this hazard, a temporary truck inspection area was constructed at the top of Grapevine Grade, near old Fort Tejon. This inspection area was manned 12 hours a day by the California Highway Patrol, between 1 p.m. and 1 a.m., the period of maximum truck volume through the canyon. Each truck was inspected for adequate brakes and other safety requirements.

Of major concern was the fact that there was no divider strip, and it was decided to narrow the lane widths slightly and paint two double stripes about four feet apart. Maintenance Superintendent William C. Bastian, who is in charge of the district's special crews, which includes traffic striping, made a suggestion that a half-

Looking north through the canyon toward the San Joaquin valley. Portions of the Grapevine Creek conduit are visible between the lanes.

A temporary bridge was constructed over the highway for earth hauling purposes. Part of the old parabolic concrete divider can still be seen to the left of the road on the lower right part of the photo.



Looking north from the canyon toward the Grapevine Undercrossings. A portion of the old twisting 1914 road is visible on both sides of the northbound lanes of the new freeway.

inch blanket of plant mix surfacing be laid over the concrete in the divided portion, and that the two double lines be placed upon this. Upon completion of the project the plant mix surfacing could be easily scraped off thus eliminating the costly time-consuming job of sandblasting the paint off the concrete. It also provided a contrasting surface between the white concrete lanes and more effectively delineated the division.

After removal, the plant mix did leave a streak down the center of the northbound lanes, but this is not noticeable to motorists using this section of the highway. This stripe will probably wear off in a couple of years.

Several 'Firsts'

There were several construction features that were used for the first time in the district. Approximately 9,000 feet of blocked-out metal beam barrier railing was installed on both sides of the northbound roadway, where a tremendous fill, 107 feet high and containing one and a half million cubic yards of material, carries traffic to the valley floor. About 5,100 feet of cable chain link barrier fence was installed in the median strip in the upper end of the canyon where the roadways closely parallel each other. Both of these barriers resulted from extensive tests conducted by the Division of Highways Materials and Research Department. These crash tests were covered in a previous issue of this magazine.

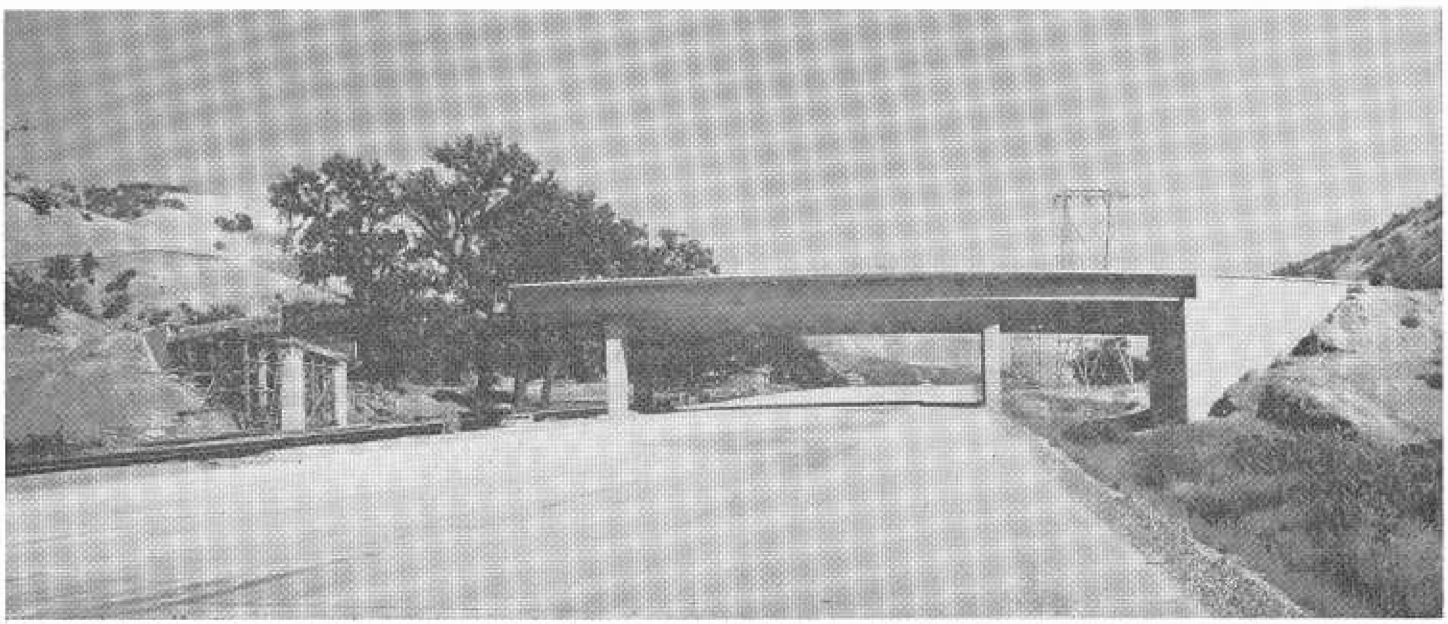
The continuous 6 percent upgrade and almost continuous curves with superelevations between 4 percent and 8 percent created conditions far from ideal for concrete paving operations. The grade limited the speed of the batch trucks to 20 miles per hour and required batch truck operators to ease gently into the skip to avoid capsizing at full elevation of the bed.

New Machines Used

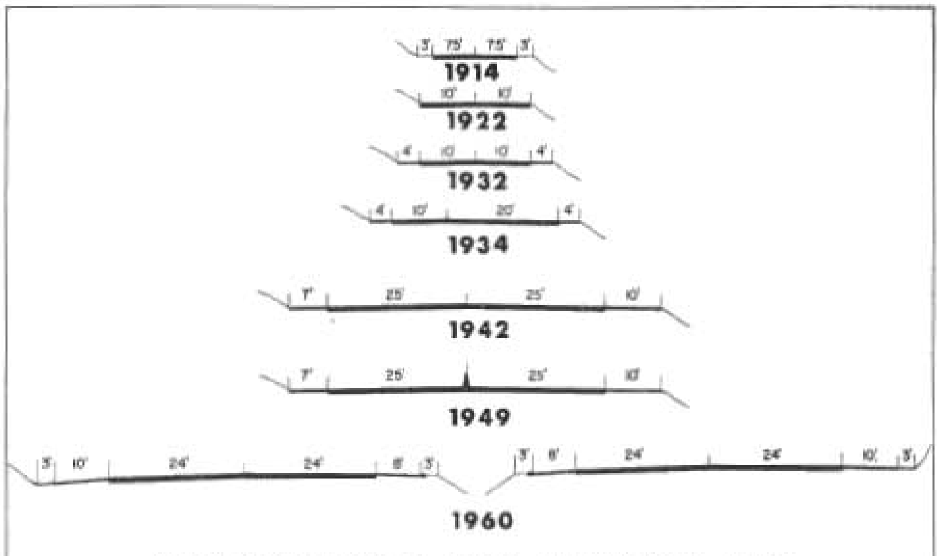
The first two units were paved in 24-foot widths using two Worthington dual drum mixers using street headers and a 24-foot finishing machines. On the final four-mile unit the contractor used, for the first time on the West Coast, a three-drum mixer. It obtained a production rate up to

Looking north from the south end of the project toward Fort Tejon Overcrossing with Old Fort Tejon in left middleground of the picture.

Looking south into the canyon from the north end of the project. The new Wheeler Ridge truck scales and inspection area can be seen at the right. Grapevine Interchange is at the foot of the grade in the background.



The Fort Tejon Overcrossing under construction. The view is southward.



EVOLUTION OF PAVEMENT WIDTHS ON GRAPEVINE GRADE

200 cubic yards per hour as compared to 135 cubic yards for the dual drum type.

During the final stage of construction, as an experiment to provide a roughened surface for the truck lanes on this four-mile uphill section of pavement, small chips (⅜" minus) were spread on the fresh surface just ahead of the burlap drag. The chips were hand broadcast from the float. The burlap drag pulled the chips over the surface with a scoring effect.

Excavation Needs Reduced

In addition to providing for the roadways, it was also necessary to carry Grapevine Creek in this narrow canyon. If it had been left to follow an open channel the excavation costs for the roadway would have been enormous. About 9,000 linear feet of closed conduit and 2,000 feet of concrete flume were constructed to minimize the amount of roadway excavation required. The conduit consisted of a 10-foot by 8-foot reinforced concrete box culvert, and is capable of carrying 3,000 cubic feet per second with an allowance for a debris load of six cubic yards per second.

The contractor began work on May 13, 1958, and the contract was accepted on July 22, 1960. The project is 6.6 miles in length and the total construction cost was $7,430,000. It is the first completed project in District VI on the Interstate Highway System.

Acquisition of rights-of-way for this project was no less complicated than the construction. Approximately 350 acres of new area, plus the underlying fee in the existing road was required. Because of widths of traveled ways, terrain and slopes, right-of-way widths throughout the project ranged from a minimum of 330 feet to a maximum of 860 feet. In addition to the right-of-way for the highway, certain replacement easements for the relocation of public utilities outside of the right-of-way area were required.

Appraisal a Challenge

The acquisition affected a total of only 10 owners, but the variety of land uses for areas within the proposed right-of-way and the surrounding lands made the appraisal work challenging and more than routine.

An aerial photo of the overall project possibly indicates mountainous and convoluted terrain suitable only for grazing cattle. A closer inspection on the ground, however, reveals many different types of land use within the area of the proposed right-of-way. Included among these types are the following:

Rocky hillside; marginal grazing land; level lush grazing meadows; fairly level foothill grain land; irrigable agricultural land; small residential sites; a picnic ground area studded with large oak trees and leased by a large oil company, with parking and picnic facilities to handle crowds of 3,000 people; three commercial sites containing many types of improvements catering to the needs of the highway travelers; three oil line pumping plants, and one use not very noticeable to the casual observer—the location of many underground pipelines transporting oil and gas from the oil fields of San Joaquin Valley to the Los Angeles area. Also included is a private water line transporting this vital, scarce commodity from the top at Lebec to various locations along the canyon. In addition, crisscrossing the old highway through the length of the canyon were overhead telephone lines and transmission power lines sagging between high steel towers.

Utility Costs

The cost of utility relocations, for which final payments are still being processed, is approximately $1,300,000. Involved in the relocation were the following:

Two eight-inch oil lines, 8,300 feet long; one 26-inch gas line, 7,500 feet long; one 26-inch gas line, 7,000 feet long; one 10-inch oil line, 8,500 feet long; one 16-inch oil line, 11,000 feet long; approximately four miles of overhead power lines and also aerial telephone lines of short distances.

In order to keep the pipelines on the same relative elevation they previously had so that additional pumping facilities and maintenance costs would not be necessary, a utility bench was constructed adjacent to the roadway. This bench of approximately 27.5 feet in width was backfilled with 5 feet of select material to facilitate trenching operations by the pipeline companies. The surface of this utility bench further serves as off-highway access for the utility companies and also as a cattle trail road for the some 15,000 to 20,000 cattle of the Tejon Ranch Company which travel back and forth between the higher and lower elevations for winter and summer grazing.

Land Types Vary

The largest property owner, the Tejon Ranch Company, owns some 277,000 acres on both sides of the existing highway through Grapevine Canyon. Approximately 98 percent of the right-of-way involved this owner. Every type of land use involved in the acquisition was included in this ownership. It was necessary to evaluate all the types of land involved as well as to determine the effect of the full freeway on the cattle operation. Three cattlepasses were established beneath the traffic lanes which connected to the aforementioned cattle trails, enabling the ranch to utilize its land on both sides of the highway.

Due to the short interval between planning this project and the construction advertising date there was insufficient time to appraise and negotiate for the right-of-way prior to the scheduled commencement of construction. Consequently, it was necessary to secure a right of entry from the Tejon Ranch Company before the appraisal of the property was even begun.

Negotiations Carried Out

Negotiations were carried out on the basis of this right of entry for approximately two years. Because of various lessees' interests which required legal determination condemnation action was instituted. It is anticipated that negotiations will be concluded shortly for the entire project.

The right-of-way requires the acquisition and/or bypassing of commercial improvements which have served the traveling public along the old highway. Now that construction of the new freeway is complete, it is probable that more and better facilities will be constructed on the frontage roads at the two interchanges, one opposite Fort Tejon and one close to the foot of Grapevine Grade. Installation of these new, modern functional commercial improvements are already planned by the owners of the adjoining property. In addition to the eight-lane divided full freeway enabling the traveling public to traverse between San Joaquin Valley and the Los Angeles area faster, safer, and more comfortably, the services offered for their welfare and needs will be provided at more suitable locations and reached with greater ease and safety and fewer traffic conflicts.

The view southward from the top of the grade with the Fort Tejon Interchange at the center of the picture.

Division Engineer Receives 700-Dollar Award

The State Merit Award Board has authorized an additional award of $700 to James T. McWilliam, Assistant Highway Engineer with the Division of Highways Planning Survey in Sacramento. McWilliam played the major role in designing a drafting projector which is now in use in all highways drafting offices and which resulted in substantial savings to the division.

The new projector makes it possible to change map scales in a shorter time and with a greater degree of accuracy than equipment used previously.

Reorganization

Third Deputy Position Created; Engineers Promoted, Reassigned

A REGROUPING of headquarters engineering and administrative functions in the California Division of Highways, including the appointment of a third Deputy State Highway Engineer, has been announced by State Highway Engineer J. C. Womack.

J. W. TRASK

The new organizational pattern, the first major revision in the Division of Highways staff structure since the second deputy position was established in 1955, is designed to improve the division's efficiency in handling a highway program which has increased in size and complexity since federal legislation accelerated highway planning and construction nationwide four years ago.

California's expenditures for state highway purposes are now about double the size of the 1955 program.

The following promotions and assignments became effective September 1, 1960:

J. W. Trask, promoted from Assistant State Highway Engineer–Operations to the position of Deputy State Highway Engineer–Planning.

J. P. Murphy, Deputy State Highway Engineer–Engineering, assigned as Deputy State Highway Engineer–Operations.

C. E. Waite, Deputy State Highway Engineer–Administration and Management, position retitled Deputy State Highway Engineer–Administration.

George Langsner, promoted from Engineer of Design to Assistant State Highway Engineer–Administration.

Lyman R. Gillis, Assistant State Highway Engineer – Administration, transferred to Assistant State Highway Engineer–Operations.

Willard L. Warren, Assistant Engineer of Design, promoted to Engineer of Design.

Each of the three Deputy State Highway Engineers will be responsible for specific groups of functions, providing for clear administrative lines of reporting and action.

Waite, as Deputy for Administration, will oversee the work of the administrative departments under Langsner, including the functions of the Office Engineer, Federal Secondary Roads, City and Co-operative Projects, Service and Supply and Management Analysis; the Accounting Dement; and Personnel and Public Information.

GEORGE LANGSNER

Murphy, as Deputy for Operations, will be concerned with the functions of Construction, Maintenance, Equipment, and Materials and Research, grouped under Gillis' direction; and the Bridge Department, headed by Assistant State Highway Engineer J. W. McMahon.

WILLARD L. WARREN

Includes Advance Planning

Trask's areas of responsibility as Deputy for Planning will include the Advance Planning, Traffic, Planning Survey, Programs and Budgets, and Design departments which report to Assistant State Highway Engineer J. A. Legarra; and the Right-of-way Department.

Trask, the new Deputy for Planning, has been with the Division of Highways since 1928, starting as a junior bridge engineer. He worked on bridge and tunnel construction for most of his early career, and then on administrative assignments. He moved to District II (Redding) in 1943 as office engineer and became District Engineer in 1950. In 1956 he was transferred in the same capacity to District III (Marysville), and was promoted to Assistant State Highway Engineer—Operations in February 1957.

Trask was born in Lincoln, Kansas, was raised in Denver, and is a graduate of Utah State University. He served in the U.S. Army Engineers in World War I.

Langsner, who steps up to Assistant State Highway Engineer—Administration, joined the Division of Highways in 1931 upon graduation from the California Institute of Technology. He served in the Los Angeles district (District VII) in positions of increasing responsibility, including design and other work in planning the Los Angeles metropolitan area freeway system, and became District Engineer there in 1955. He was transferred to Sacramento headquarters office in 1957 as Engineer of Design. He is currently chairman of the Committee on Design of the American Association of State Highway Officials.

He is a native of Brooklyn, New York.

Ten Years With Department

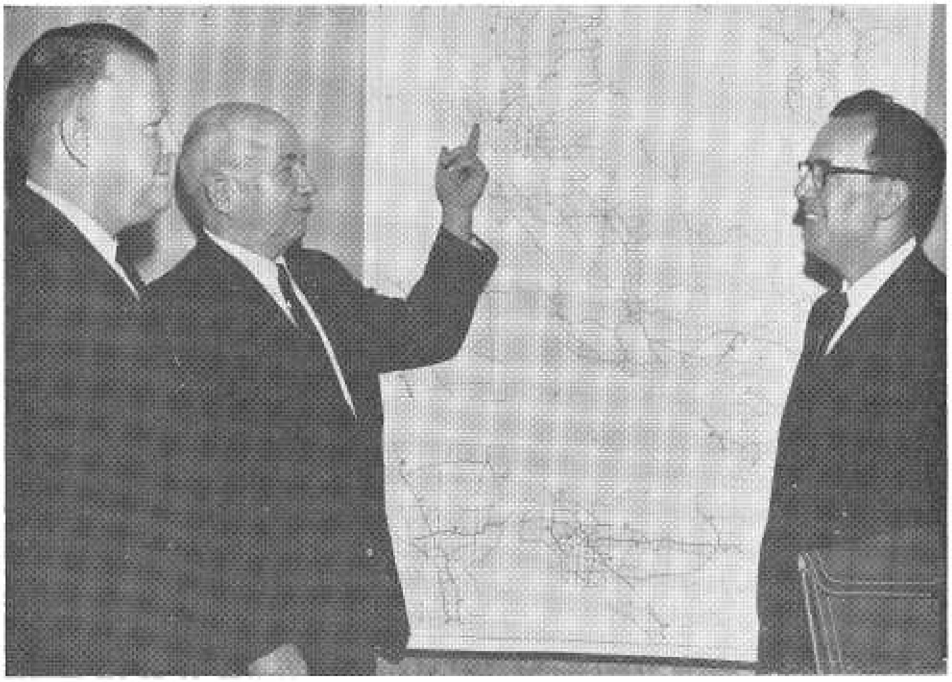
Warren, as the new Engineer of Design, will head the department with which he has been associated for the past 10 years, most recently as chief assistant to Langsner.

He was born in Kentucky. After studying engineering at the University of California, he served with the Nevada Highway Department from 1936 to 1942, then worked for the Army Corps of Engineers during World War II. In 1946 he joined the California Division of Highways in the Marysville District (District III) and was resident engineer on construction projects in Sacramento and Yolo Counties.

Warren's recent work has included the development of pavement design and studies of pavement performance. He developed the system of economics for pavement design and operation now in use by the Division of Highways.

Two new cities have become incorporated. They are Temple City, Los Angeles County, population 37,758, and Sand City, Monterey County, population 360.

PROGRESS REPORT FOR CALIFORNIA'S CONGRESSMEN



To keep California's 30 Congressmen and two United States Senators better informed on the progress of Interstate and other freeway planning and construction in the State, the Division of Highways recently prepared a special large size map in which the status of the various routes and projects is shown in color. Explaining the principal features of the map to Representative Jeffery Cohelan (right) of Alameda County is State Highway Engineer J. C. Womack-with State Director of Public Works Robert B. Bradford at far left. Congressman Cohelan is secretary of the California Congressional delegation.

HIGHWAY EMPLOYEES 25-YEAR AWARDS ANNOUNCED

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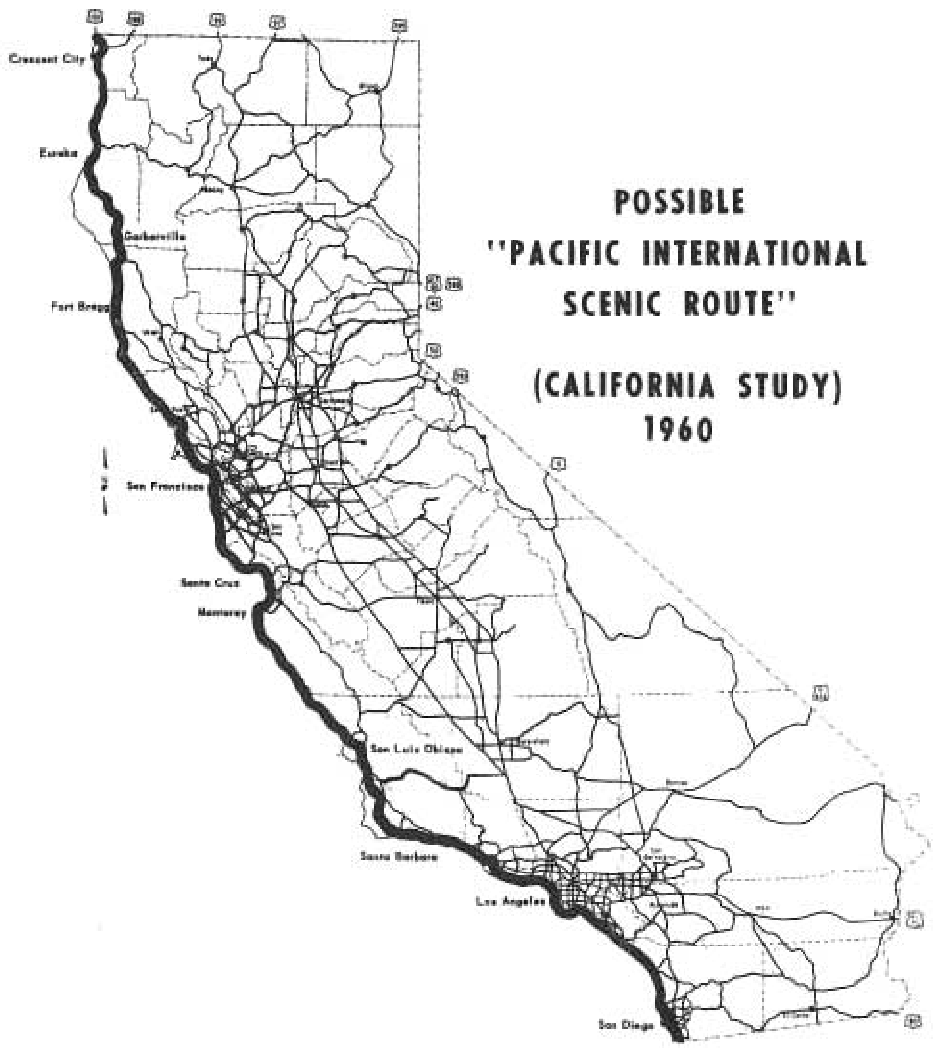
A record high for one day of 56,973 vehicles crossed Carquinez Bridge on Saturday, July 2. The previous high record was 54,557 vehicles on May 30. The San Francisco-Oakland Bay Bridge also reported a new record. An average of 110,411 vehicles a day crossed the bridge during the month of June, the highest daily average for any month since it was built.

The State Department of Public Works has awarded a $16,237,675 contract to Guy F. Atkinson Company, Long Beach, for construction of 7.4 miles of eight-lane freeway (San Diego Freeway) between 0.3 mile south of Casiano Road and 0.3 mile north of Valley Vista Boulevard, south of the Ventura Freeway, in Los Angeles.

CALIFORNIA'S SCENIC DRIVE STUDY IS COMMENDED BY WESTERN GROUP

California's preliminary studies and proposed future study looking toward a "Pacific International Scenic Drive" from the Mexican to the Canadian border are serving as an example for similar studies by other Pacific Coast states.

The proposal is also being expanded to extend into British Columbia and Alaska.



As reported in the May-June issue of *California Highways and Public Works*, the proposal was submitted to Governor Edmund G. Brown on April 20, 1960, by his Standing Committee on Public Works and Natural Resources. It envisions a 1,030-mile route in California following, in general, the coastal area of the state.

The California study and outline for an extension of the coastal scenic drive through Oregon and Washington was presented to representatives of those states, plus others from British Columbia and Alaska, at a meeting in Seattle on July 20. The meeting was called by Governor Albert Rosellini of Washington. Governor Brown was represented by State Senator Randolph Collier of Yreka, chairman of the Senate Committee on Transportation, assisted by Deputy Director of Public Works Harry D. Freeman.

The representatives of the three other states and British Columbia commended the California report and agreed to consider it as a guide for their own studies of a scenic route.

Further discussion on the proposal will take place at a meeting scheduled for some time in October in Victoria, B. C.

Freeway Design Is Subject of Report

A review of freeway design and its effect on traffic is the subject of a 22-page report by George A. Hill, formerly Assistant Engineer of Design for the Division of Highways and now District Engineer—Planning of District VII in Los Angeles.

Entitled "Designing Better Freeways," the report is based on a talk given by Hill before the Institute of Traffic Engineers Seminar at Santa Barbara in June 1959 and at Denver in November. Through the use of some 30 photographs and diagrams the report presents major problems involved in the designing of freeways and freeway interchanges and how they are being alleviated through research and advanced design practices.

Some of the features of freeway design considered by the report are: on and off ramps, weaving traffic, shoulders and median strips as refuges for stalled vehicles, advance signing, proper location and spacing of interchanges, speed change lanes and channelization. Specific examples are cited and illustrated from the California Freeway and Expressway System.

Some important factors in freeway design are summarized at the end of the report.

SAN LUIS ROUTE ADOPTED

A freeway route for the relocation of 14 miles of State Sign Route 152 (Pacheco Pass Highway) around the proposed San Luis Reservoir in Merced County was adopted at the August meeting of the California Highway Commission. A total of 28.5 miles of freeway routes was adopted at the meeting, bringing the total mileage of such routes to 5,294.

Utility Moving

Huge Clearing, Relocation Problem on San Diego Project

By J. R. CROPPER and D. S. SHEPARD, Resident Engineers

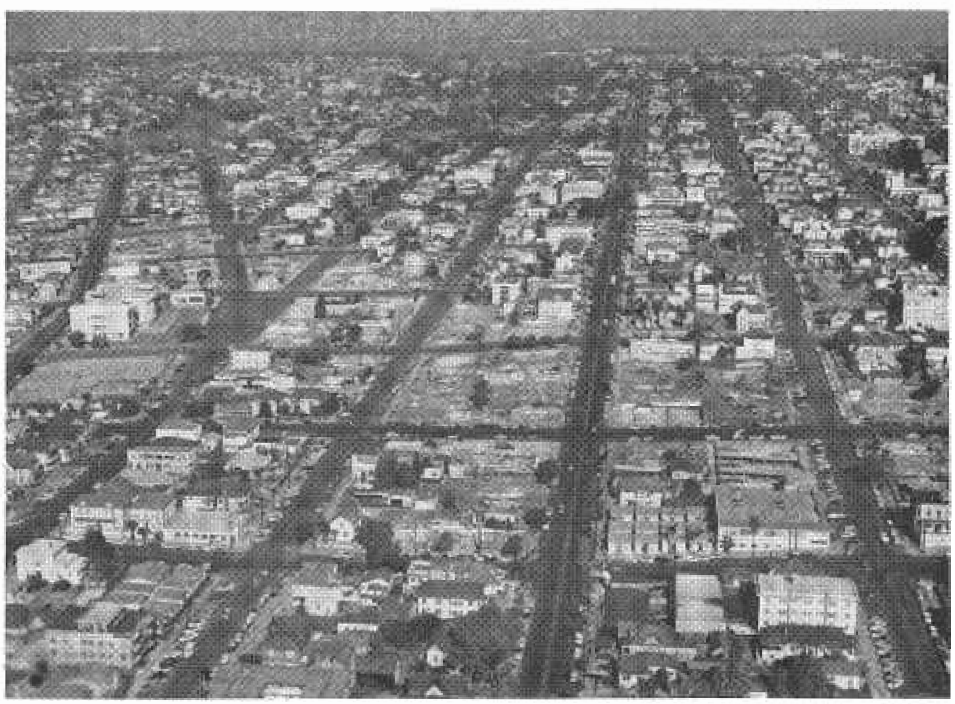
PROBABLY one of the least publicized problems of freeway construction is the relocation of utility facilities. This is especially true when a freeway is to be constructed through a metropolitan area. Unnoticed to the average motorist are the miles of underground water, sewer, gas and telephone lines. There is even only minor recognition given to the overhead power and telephone lines.

In the majority of instances these utility lines are not of record-breaking size or carry any special significance, other than to perform the utilitarian duty of providing service to the homes, offices and improvements in the immediate vicinity. The freeway design can be as effective in severing this utility system as if it had been cut with a knife.

District XI has just completed plans for the construction of a portion of the San Diego Freeway (US 101) through the center of the more heavily populated section of San Diego. The improvement in general consists of the construction of an eight-lane freeway with appropriate interchanges and separations. For construction convenience the project was divided into several units. Unit one encompasses mainly the construction of the US 101-US 395 interchange. Figure (1) shows a model of this interchange which was constructed by the Division of Highways Bridge Department.

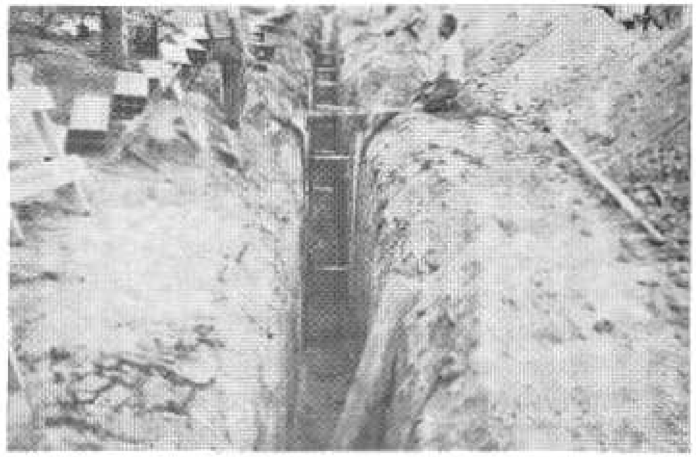
Unit two joins unit one at Sixth Avenue and extends one mile and a quarter northerly to Palm Avenue. A low bid of $5,219,340 for construction of this unit was submitted on August 25 by the R. E. Hazard Company of San Diego in joint venture with the W. F. Maxwell Company of Fontana.

Cleared areas for freeway construction in San Diego can be seen in the above photo beginning lower right and ending upper middle.



Cleared areas start at right center and curve toward upper left portion of the above photo.

Water line relocation at Ninth and Ash Streets in San Diego.



Underground telephone conduit installation on H Street.

Underground telephone lines were temporarily detoured by leading them out of the ground and suspending them between poles as in the above photo taken at Sixth Avenue.

A view of the Cabrillo Freeway before clearing operations began.

Breakdown of Costs

The total cost of utility relocations for these two projects is $802,500, of which the utility companies are paying $244,400 and the State is paying $558,100. This breakdown of cost is made by giving recognition to betterment of facilities and in accordance with the statutes relating to the Division of Highways, Department of Public Works. Included in this utility relocation work are 2.5 miles of water lines, 1.75 miles of sewer lines, 1.15 miles of gas mains, 2.0 miles of electric power lines, 3.6 miles of telephone cables and 1.7 miles of fire alarm cables.

As much work as possible or practical is performed before the contract work is started. This includes the relocation of utility lines and abandonment of existing utilities within the immediate work limits of the contract. In numerous cases the utility line cannot be relocated to its final position until some portion of the contract work is finished. In these cases a temporary detour of a utility line will have to be constructed and used until such time as it can be located in its ultimate position.

It has been proven from past experience that construction and relocation of the sewer and water lines which cannot be completed in advance of highway construction can be handled with more overall efficiency if the work is made a part of the highway contract. This eliminates to some extent the delays which would occur due to waiting for an opening in the work schedule of another agency. Of course, improvements belonging to private agencies, such as telephone, electric power and gas lines have to be handled by their forces.

Cables Are Removed

A typical example of the problems to be encountered are the existing telephone lines in the vicinity of Fourth, Fifth and Sixth Avenues. The existing cables carry the main trunk and television lines supplying San Diego, and are buried in the streets. To avoid conflict with the new structures, the existing cables have been taken out of the ground and placed on temporary poles over the structure area (Figure 2). After the structures have been completed, the cables will be installed through the inside of the structure girders and the temporary pole lines removed. It is anticipated that approximately 10,000 man-hours of splicing will be required to relocate the telephone facilities in Fourth, Fifth and Sixth Avenues alone.

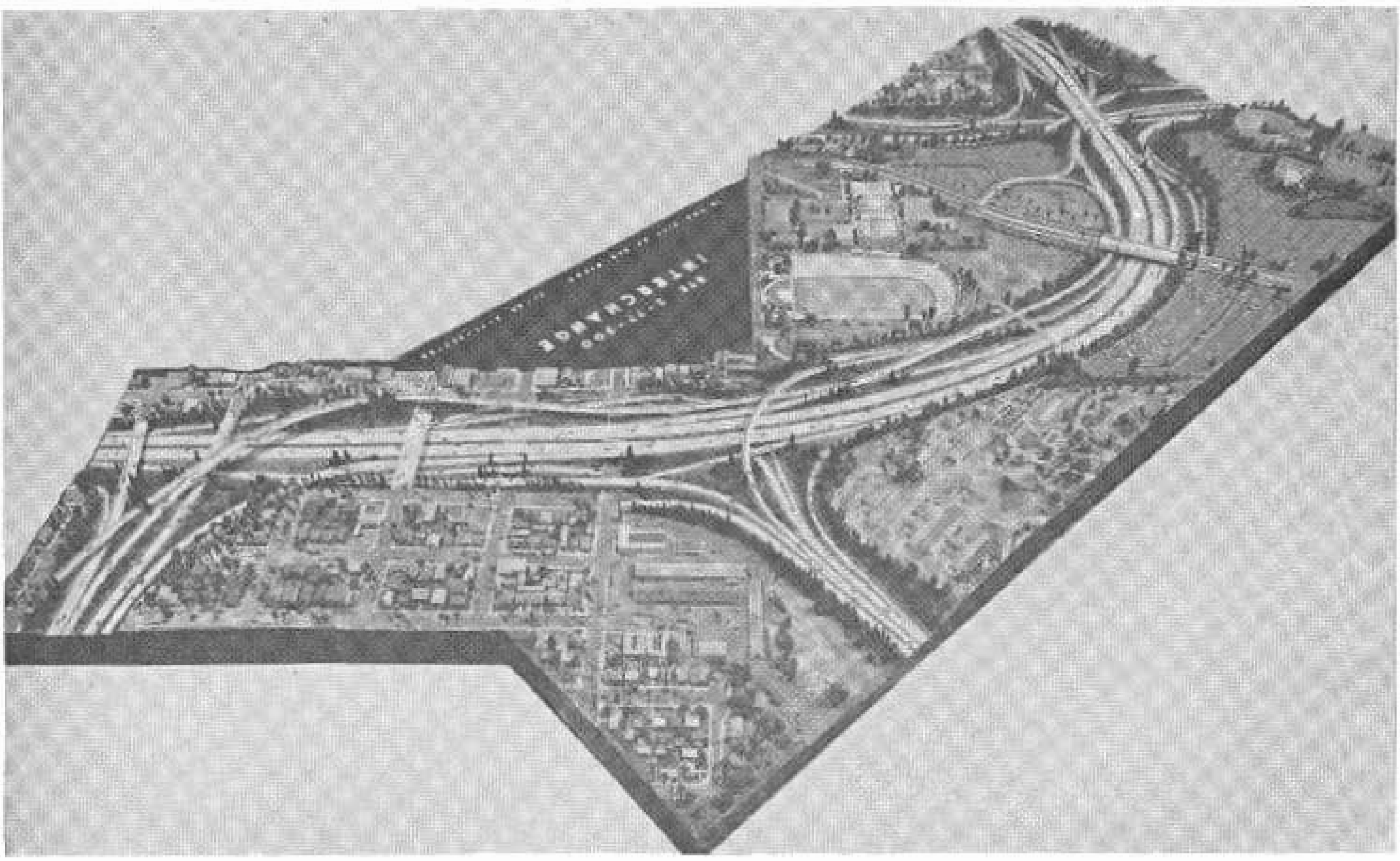
Other examples of how some of the utility relocations affect the contractor's operation are the water and gas lines in Unit No. 1.

An existing 12-inch high-pressure gas line crosses the freeway where a deep cut is planned. To avoid the deep trenching that would be necessary to lower this line before freeway construction, the highway contractor will be required to stay clear of the gas line until he is down to grade at the new location of the gas line approximately 250 feet to the east. At that time the relocated utility can be placed with relatively little trenching. Also a 24-inch water line passes through the heart of the project. To avoid having additional contractoral delay this line was placed in a temporary location adjacent to the above mentioned gas line. It then will be handled similarly to the gas line and at the same time.

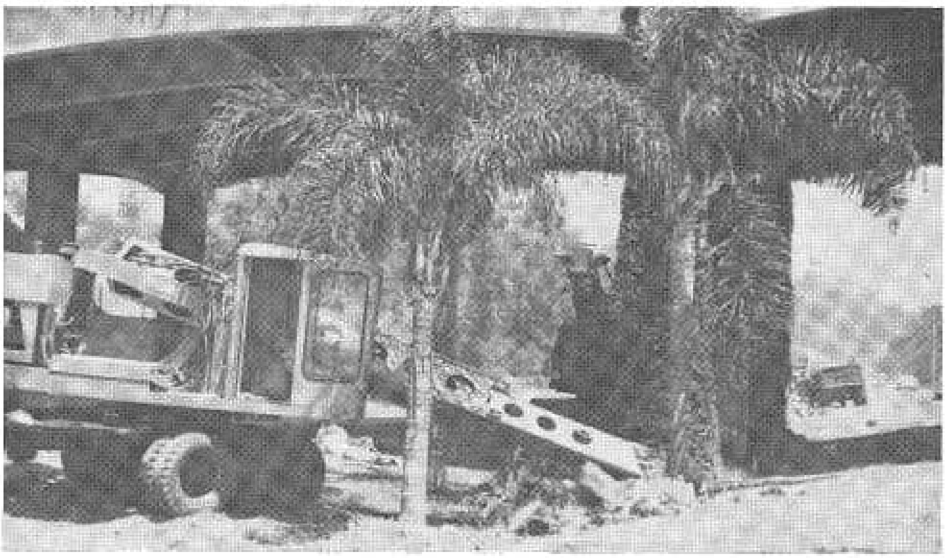
Contract Is Awarded

Following closely on the heels of utility relocation is the advertisement and award of the highway construction contract. Unit No. 1 was awarded to the Daley Corporation and R. M. Price Construction Co. on June 10, 1960. Bids are currently being asked for Unit No. 2 and the contract award should be made early in September.

The contractor's first order of work is usually clearing and grubbing. The clearing of a freeway in the San Diego metropolitan area usually consists of some heavy dozer work with an occasional assist from a crane and headache ball to clear the jumble of building remains, walls and pavements that occur on a downtown freeway right-of-way. Unit No. 1 presented a somewhat different situation. A major portion of this unit fell within San Diego's famed Balboa Park. This area contained trees of several types ranging in size up to 125 feet tall with a butt diameter of 60 inches. Among the types found were cypress, spruce, fir,



This model of the US 101-395-Sign Route 94 interchange in San Diego shows how the structure will appear following its completion.



The start of excavating operations to salvage a palm tree from the median strip of the Cabrillo Freeway.

A crane lifts the salvaged palm and swings it toward the truck.

The palm is lowered into the truck for hauling to a tree storage lot.

pine, redwood, eucalyptus, acacia and sycamore. The proximity of the growth in the rest of the park prevented felling and burning of the trees in place. This gave the contractors, Daley Corporation and R. M. Price Construction Co., a chance to practice logging.

The trees were dropped using chain saws and dragged to the nearest available road by a tractor. Here rubber-tired equipment took over and hauled the debris to a disposal area at the southeast end of the project. At this point the local lumber yards took over. To further complicate the situation, many of the trees were in a 54-foot median on the existing Cabrillo Freeway (US 395). As the contract specifically prevents the contractor from interrupting the flow of traffic on this high speed freeway, the removal method had to be changed. The trees were trimmed before felling as a safety precaution and the trunks loaded on trucks. The branches were fed to a machine known as the chipper, which almost instantaneously would reduce a large branch to a small pile of chips. Most of these trees in the median were sycamore up to 30 feet high that were planted as part of the landscaping of the Cabrillo Freeway in 1948.

Easy to Transplant

Among the trees within the right-of-way were 25 palms of various types. As this type of tree is relatively easy to transplant and fits nicely into freeway landscaping, the palms were moved into a nearby lot for future use. The transplanting was by extra work costing $3,500 which added to the contract price for clearing and grubbing, gave a total clearing cost of $65,000 for Unit No. 1. All of these clearing costs added to the utility relocation work show that it will cost almost $900,000 to prepare the site for actual highway construction. This cost is of course exclusive of the costs for the real property purchased.

Unit No. 1 is scheduled for completion in February of 1962 and Unit No. 2 for August of the same year.

County Plan

Co-ordinated Program Puts Road Funds Where Need Is Greatest

By A. S. KOCH, Surveyor and Road Commissioner, Orange County

It is generally recognized that the existing formulas for the distribution of highway financing creates many inequitable situations throughout the various levels of government. Whether it is recognized as a fact or not, it would be virtually impossible to formulate an equitable distribution of gas tax funds statewide, since the situation in each of our counties is essentially unique.

There is a tendency on the part of local governments to complain that the proportional split of the gasoline tax between the cities and the counties is inequitable. Equity can be based only on need, however, and any other basis of complaint is just as arbitrary as the original division of gas tax funds itself. The gasoline tax is intended to serve the motoring public as a whole. Consequently, where local inequities occur, and they will always occur, they should be recognized and a redistribution of funds worked out locally to suit the local situation.

County Should Equalize

Orange County's contention is that county government is the agency which should equalize such a redistribution program. County government is in a position to co-ordinate a program between the county and the cities involved. County government represents all the people and should be equally interested in the citizens of the incorporated areas, as well as those outside such areas. County government, therefore, is in a position to see that the funds available are spent to the best advantage of the county as a whole.

Maximum benefit is obtained from the highway tax dollar by improving the most important streets and roads where the need is greatest. A program based on these principles can, and should be worked out locally, and in the end is probably the best method of solving the equity problem. It could finally eliminate the allocation fight that has prevailed for many years.

Such a program implies the necessity for an overall plan which expresses the communities' ultimate needs. Such a plan of course is a master plan of the circulation element of the community's general plans.

> The author of this article, in addition to being very active in the County Engineers Association, has participated in highway matters at the state level for some time. He was a member of the Advisory Committee to the Department of Public Works in connection with the county road and city street deficiency study (SCR 62) reported elsewhere in this issue; and in 1957-58 he was on the Technical Advisory Committee for the California Freeway System study (SCR 26).
>
> The article was reviewed and concurred in unanimously by the entire board of supervisors of Orange County: C. M. Featherly (Chairman), William H. Hirstein, Claire M. Nelson, William J. Phillips and Willis H. Warner.

In Orange County, we began working on this phase of the problem in 1954. The tremendous expansion that has taken place in Orange County and which continues at a tremendous pace had just started to become evident. The necessity for the development of a master plan of arterial highways became obvious.

Responsibility Accepted

At the request of the board of supervisors, the Associated Chambers of Commerce, an organization representing all chambers of commerce throughout the county, accepted the responsibility of sponsorship for the development of the master plan. This organization's committee, working closely with the county planning commission and the county road department, sponsored the many meetings which were necessary with all governmental agencies and community organizations which were interested in the problem.

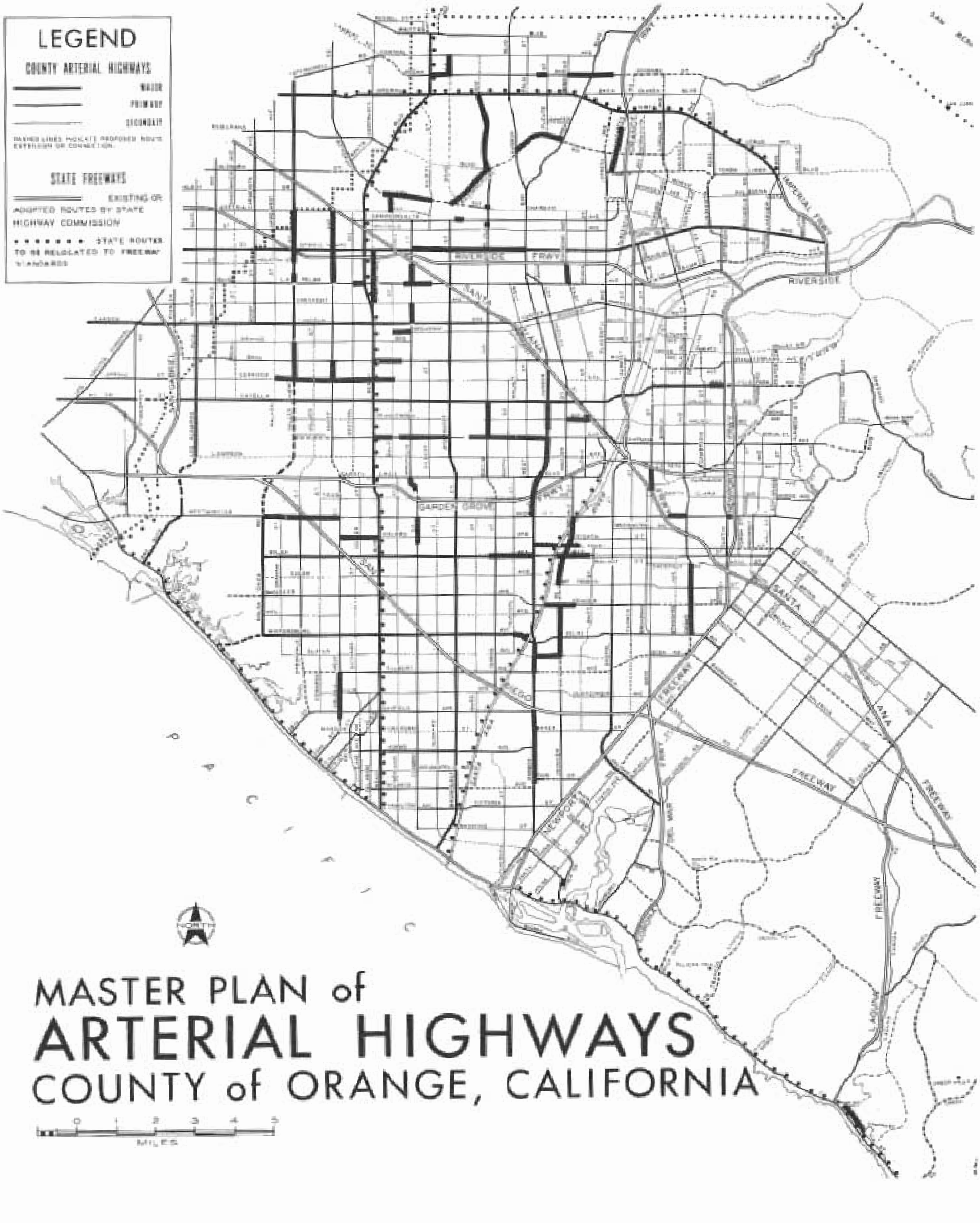
After 18 months of very hard work on the part of the county departments and the sponsoring association, a plan was developed in which was incorporated the overall reasoning of all of our community. It had the basic agreement of all the cities throughout the county. The plan gave us a good basic groundwork on which to build until we were able to approach the final phases of our co-operative program. That program is one of 100 percent co-ordination between all governments on a countywide basis for the development of highways and streets.

The second phase of development of the plan consisted of the establishment of those tools of government which would make it possible to eventually develop the overall road system. These tools consist of such accomplishments as setback ordinances, geometric standards, and establishment of access control, under the constant surveillance of the board of supervisors and the planning commission.

A setback ordinance which has been in existence in Orange County for many years was updated to provide for the practical standards which had been established for the arterial highway system. Such a setback ordinance provides basically for the preservation of ultimate rights-of-way in order that roads can be expanded as needed.

Access Is Minimized

Access control to the arterial highways is gained primarily by requiring subdivisions and commercial developments to recognize the principles of modern design in order that vehicular access to our main thoroughfares can be minimized. The Orange County


LEGEND
COUNTY ARTERIAL HIGHWAYS
MAJOR
PRIMARY
SECONDARY
STATE FREEWAYS
EXISTING OR ADOPTED ROUTES BY STATE HIGHWAY COMMISSION
STATE ROUTES TO BE RELOCATED TO FREEWAY STANDARDS
RIVERSIDE FRWY
SANTA ANA
GARDEN GROVE FRWY
SAN DIEGO
NEWPORT
FREEWAY
LAGUNA
RIVERSIDE
P A C I F I C
NORTH
MASTER PLAN of
ARTERIAL HIGHWAYS
COUNTY of ORANGE, CALIFORNIA
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subdivision ordinance provides that in the development of a new subdivision the subdivider must dedicate the vehicular access rights to the public except at intersecting streets in order to preserve the integrity of the arterial highway system. Fortunately, this concerted action on the part of the community as a whole has created much interest on the part of the cities in the development of similar conditions for the development of a good highway system.

These efforts on the part of all levels of government in the county then brought us to the third phase of our overall county co-operative program. This phase was of course the development of a financing program which would make it possible for the county as a whole to realize the ultimate development of this system of highways and to eliminate the chaos which generally has prevailed in the past in the development of such an ultimate program. This co-operative highway financing program was agreed upon by the board of supervisors and the Orange County League of Cities in October, 1958. It has since been referred to as the arterial highway financing program.

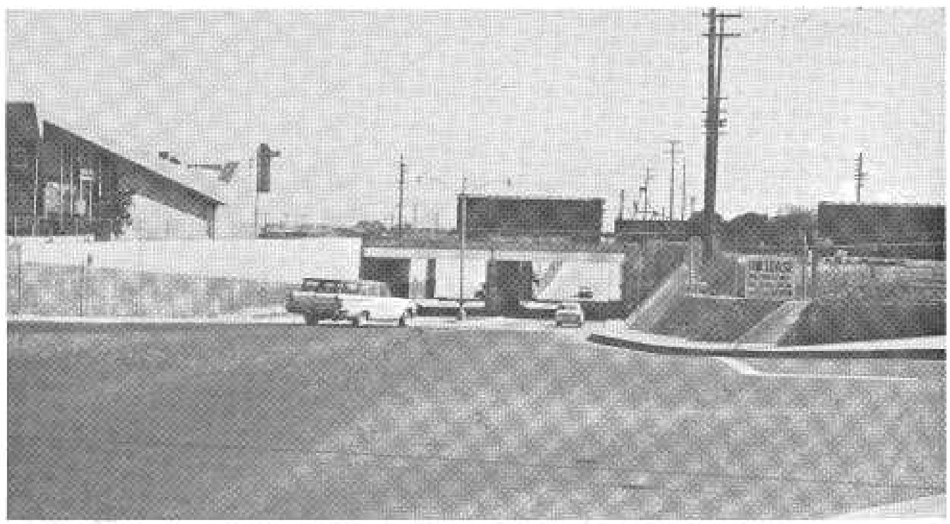
The program is designed to satisfy the greatest traffic needs on the county arterial highway system. It is this theme which we ask the reader to follow as we discuss the details of the program now in operation.

Basic Concept

The basic concept of the program is for the county to furnish financial assistance to the cities in order that the arterial highway system may be developed equitably throughout the county. First, in order to participate, the agreement provides for three very definite actions on the part of all participants. At present 18 of the 22 cities and the county have qualified by the accomplishment of these three factors. They are:

1. A mutually satisfactory master plan of arterial highways must be approved.
2. Mutually satisfactory uniform structure setback lines to protect the ultimate rights-of-way must be adopted by ordinance.

Harbor Boulevard (between the Cities of Santa Ana and Costa Mesa) was built cooperatively as a Federal Aid Secondary highway using the Arterial Highway Financing Plan.



The Nicolas Avenue Underpass (in the City of Fullerton) was built cooperatively by two railroads, the State and the Arterial Highway Financing Plan.

The Nicolas Avenue extension (between the Cities of Fullerton and LaHabra) is being built on a new alignment, financed through the Arterial Highway Financing Plan.

3. Mutually agreeable provisions for the limitation of access to the arterial highway system must be established in order to protect the integrity of the system.

These three points are fundamental and are the three basic factors which will make it possible to ultimately construct a satisfactory arterial highway system throughout the county.

We have agreed, of course, on other factors. Among them, the county has agreed that the program shall apply only to the arterial highway system as master planned. The county has agreed that its highway users taxes which are collected from the highway users as a whole will be spent only on that county arterial highway system. Of course, cities are already limited in spending gasoline taxes on their major street system as far as construction is concerned. It remained then only for them to agree that the major street system in each city will coincide with the approved arterial highway master plan wherever practical.

Obviously, certain exceptions are necessary. The smaller cities which are relatively unconcerned with the arterial highway system can qualify major city streets for financial assistance whether or not these are part of the master plan.

In addition to the foregoing factors, it has been agreed that standards for all routes on the master plan of arterial highways will be established. This can be a long-drawn-out process and for that reason we are at present limiting the standards to the consideration of traffic-carrying capacity only.

Funds Are Matched

The program as set up is a mutual program in all respects. It is a matching program in that highway users tax funds apportioned to the county and expended in the cities under the program must be matched by the city involved if it is financially possible to do so. Thus, the city's yearly program of arterial highway development can be effectively doubled by the arterial highway financing program. However, the program recognizes the possibility that a smaller city may have an extremely high priority project from a countywide standpoint and yet be unable to finance it. In this event, assuming that there is an unobligated balance in the program funds, it has been agreed that the county may finance part or all of a project. This has already been done on certain links in the arterial highway system which were considered of as much importance to all surrounding cities as to the city in which the project was constructed.

An advisory committee, composed of three elected officials appointed by the Orange County League of Cities and two elected officials appointed by the board of supervisors, has been formed to advise the board of supervisors on the establishment of the fiscal program and to co-ordinate the general advancement of the arterial highway financing program. A technical staff, composed of the county road commissioner and five city engineers, works under the advisory committee. The primary duties of the technical staff are to administer the arterial highway financing program, to collect and evaluate technical data, and to make such recommendations as required by the advisory committee.

It is the board of supervisors which ultimately determines the projects that will receive allocated funds. With the assistance of the advisory committee, it determines which projects among those applied for by the cities each fiscal year are of the most importance to the county as a whole and funds are provided for the construction of these. Projects not of the greatest importance are deferred, to be considered at a later date.

Limitation on Funds

As the county does not have unlimited funds with which to participate in such a program, it is necessary that some limitation be placed on the funds available for each year. The board of supervisors annually allocates to this program a portion of its highway users taxes. The amount is determined by the ratio of the mileage on the arterial highway system in the incorporated areas to the total arterial highway mileage in the county after first deducting the amounts required for administration and maintenance of its own arterial highway mileage. Thus the cities and the counties share the funds available for construction, on the basis of their arterial highway mileage alone.

It should also be of interest that it has been agreed that funds allocated in any fiscal year that are not committed to an advertised project by the end of the fiscal year revert to the county highway program. The idea behind this procedure was to insure that the highway funds available to the counties and the cities be put into roads and not kept in the bank.

We are now in the third fiscal year of the program. In both preceding fiscal years, all funds have been committed by the cities and no funds have reverted to the county. We believe that this fact alone speaks well for the enthusiastic reception of the program throughout the local jurisdictions of the county.

In these three fiscal years, we have allocated funds to 72 individual projects in incorporated areas. The total moneys involved including the city and county contributions on these projects will be well over $5 million. Of the 72 projects, 40 were for widening two-lane streets to a modern four-lane standard; 12 were for projecting new roads through areas of new development where arterial highways are required and are a part of the master plan.

We have consistently rejected projects of a maintenance nature regardless of the standard definition of maintenance. Any application for a project that resembles maintenance rather than a definite development of traffic carrying capacity of the arterial highway system has been turned down.

Many advantages have accrued from our master plan other than just the development of adequate streets and highways. Our plan has readily gained state recognition. The State Division of Highways has recognized the plan in the planning of freeways and in the development of freeway agreements. Many of the streets which are not now in existence have been recognized in the planning of freeways and at the time of construction we are able to develop in advance the interchanges or separations which will

. . . Continued on page 56

SCR 62 Report

Road Needs of Cities, Counties Inventoried at $12 Billion Plus

There are 100,000 miles of county roads and city streets in California which will need improvement over the next 20 years at a total cost of about $12,750,000,000.

These estimates were contained in a report submitted to two legislative committees in the State Capitol on September 6 by the Department of Public Works after a year-long study conducted by the Division of Highways in co-operation with all 58 counties and 361 cities.

The study was authorized by Senate Concurrent Resolution No. 62 of the 1959 Session, introduced by Senator Richard Richards of Los Angeles, as a basis for analysis of the need for accelerated financing of city street and county road improvement.

The report does not specifically recommend a gasoline tax increase or other financing measures. It pointed out that the legislative committees and the public should first have a chance to study the engineering data.

As submitted to the Senate Fact-finding Committee on Transportation and Public Utilities, of which Senator Randolph Collier of Yreka is chairman, and the Assembly Interim Committee on Transportation and Commerce, of which Assemblyman Lee M. Backstrand of Riverside is chairman, the report contains a county-by-county and city-by-city estimate of road and street needs for four successive five-year periods beginning in 1960 and ending in 1980.

Nearly $2 billion worth of improvement is needed right now to make the local roads and streets adequate for present-day traffic, the report shows. Looking ahead to 1980 and its estimated traffic needs, the total cost would amount to $12.75 billion.

> Copies of the SCR 62 report on California County Road and City Street Deficiencies are available to interested persons, although the supply is somewhat limited.
>
> Those who would find a copy of the report useful may request one by addressing Mr. F. M. Reynolds, Planning Survey Engineer, California Division of Highways, P. O. Box 1499, Sacramento 7.

Improvement is or will be needed on 25,220 miles of the 42,765 total city street mileage, present and planned; and on 74,974 miles of the 102,677 total county road mileage, present and planned.

Studies of possible financing approaches are being carried on by Richard M. Zettel, staff director for the Senate committee. Among the alternatives under preliminary consideration are a one-cent per gallon increase in the gasoline tax or a $1 per $100 valuation increase in the "in lieu" tax on motor vehicles, paid at registration time.

Both State Director of Public Works Robert B. Bradford and State Highway Engineer J. C. Womack, in forwarding the report emphasized the high degree of state-city-county co-operation that produced it, and the value of the technical advisory committee which helped to chart the course of the study.

Womack said that the study "developed what we believe to be the most complete, practical and representative estimate of present and future city street and county road needs that has ever been prepared for legislative review."

This view was also taken by the advisory committee. In a statement submitted by its chairman, Supervisor Francis E. Dunn of Alameda County, the committee termed the report "the most realistic report of critical deficiencies on city streets and county roads which has ever been prepared."

The report contains numerous tabulations of street and road deficiencies as prepared by the local agencies and audited by the Division of Highways on a uniform basis.

The county roads are analyzed according to the required expenditures for rights-of-way and for construction

SUMMARY OF NEEDS

	System miles	Deficient miles	Estimated right of way and construction costs ($1,000) 1960	1965	1970	1975	1980	Total
CITIES								
Major arterials	5,570.5	3,164.9	470,625	511,165	403,466	243,111	146,760	1,775,107
Collector streets	4,807.8	3,051.5	213,648	232,290	196,696	133,145	122,599	898,378
Local streets-existing	22,612.2	9,482.4	216,314	239,055	231,473	172,413	166,119	1,025,374
Local streets-future	9,774.8	9,521.6	——	482,118	417,785	263,855	267,423	1,431,181
Total Cities	42,765.3	25,220.4	900,587	1,464,628	1,249,400	812,524	702,901	5,130,040
COUNTIES								
Primary roads	17,487.5	15,196.1	467,594	381,614	442,537	289,644	227,229	1,808,618
Secondary collector roads	14,413.2	12,697.8	260,531	195,478	252,705	157,401	143,734	1,009,849
Other secondary roads—existing	40,513.1	17,527.9	355,943	102,976	119,038	87,976	87,566	753,499
Other secondary roads—future	30,262.8	29,551.9	——	687,101	731,854	781,482	1,849,540	4,049,977
Total Counties	102,676.6	74,973.7	1,084,068	1,367,169	1,546,134	1,316,503	2,308,069	7,621,943
TOTAL CITIES AND COUNTIES	145,441.9	100,194.1	1,984,655	2,831,797	2,795,534	2,129,027	3,010,970	12,751,983

in each county, for each of the four five-year periods, in each of four categories: primary roads, secondary collector roads, other secondary roads (existing), and other secondary roads (future).

City street deficiencies are similarly summarized for each separate city, except that the four categories are somewhat different: major arterials, collector streets, local streets (existing) and local streets (future).

Among the findings and results cited in the report are a pattern for continued future interagency co-operation in similar efforts, a definite boost for local planning, and "the development of an integrated system of highways, roads and streets on a statewide basis."

The report includes a recommendation that the city and county street and road deficiency reports be brought up to date every four years, to coincide with a periodic review of state highway needs.

The study was carried out by the Highway Planning Survey Department of the Division of Highways, under the direction of F. M. Reynolds, Planning Survey Engineer, with members of the planning staff in each of the State's 11 highway districts working closely with the cities and counties in their areas.

Members of the advisory committee appointed by the Legislature, in addition to Chairman Dunn, were:

E. A. Fairbairn, Vice Chairman and Secretary
City Engineer
City of Sacramento

Harry V. Cheshire, Jr.
General Counsel
Automobile Club of Southern California

Ira J. Chrisman
Mayor
City of Visalia

Kenneth Kendricks
Vice President and Regional Manager
Standard Oil Company

A. S. Koch
County Road Commissioner
Orange County

William McIntosh
County Road Commissioner
Lassen County

Edwin S. Moore
Executive Vice President
California State Automobile Association

Claude Minard
General Counsel
California Railroad Association

John A. Morin
City Engineer
City of Oakland

Lyall A. Pardee
City Engineer
City of Los Angeles

Victor W. Sauer
Director of Public Works
Contra Costa County

Wade Sherrard
Managing Director
California Trucking Associations, Inc.

C. Clarke Williams, Director
Highway and Transportation Department
State Chamber of Commerce

RECENT RETIREMENTS FROM DEPARTMENT ARE LISTED

Public Works—Administration

Bert Sellier, Assistant Comptroller, 33 years

Headquarters Office

Merritt Nickerson, Supervising Photographer, 33 years

District I

Oney Harmon, Highway Foreman, 40 years

William Hickox, Highway Equip. Oper.-Lab., 33 years

Neil E. Kemp, Assistant Highway Engineer, 33 years

John V. Maciel, Highway Equip. Oper.-Lab., 31 years

Charles P. Sweet, Supervising Highway Engineer, 38 years

District II

Victor Lammers, Highway Equip. Oper.-Laborer, 25 years

Francis Noel, Associate Highway Engineer, 26 years

Roy Thorpe, Highway Foreman, 33 years

District III

Dewey Gamlin, Highway Equip. Oper.-Laborer, 34 years

District IV

William E. Chatfield, Assistant Highway Engineer, 6 years

Dorothy R. Frank, Supervising Steno.-Clerk I, 31 years

Charles A. Weber, Highway Leadingman, 25 years

District V

Henry C. Anderson, Laborer, 25 years

William S. Dolliver, Senior Highway Engineer, 35 years

* Ralph Sterling Leeds, Sr., Carpenter I, 12 years

Thomas D. Slankard, Highway Equip. Oper.-Laborer, 26 years

District VI

John Adams, Associate Highway Engineer, 32 years

Harry M. Payne, Highway Foreman, 28 years

Forest W. Pfrimmer, Highway Equip. Oper.-Laborer, 27 years

District VII

Albert D. Griffin, Supervising Highway Engineer, 41 years

Kenneth M. Trenholm, Supervising Right of Way Agent, 15 years

District VIII

Morris Krieger, Assistant Right of Way Agent, 10 years

District X

Fred R. Holm, Associate Highway Engineer, 37 years

District XI

John J. Lieb, Highway Engineering Technician, 2 years

Grace L. Mullins, Accounting Technician II, 29 years

Bridge Department

Warren B. James, Associate Bridge Engineer, 34 years

Headquarters Shop

Paul F. Younggren, Heavy Equipment Mechanic, 17 years

Shop 1

Edgar R. Quintrell, Highway Mechanic Foreman, 36 years

Shop 2

Robert S. Moss, Automobile Painter, 32 years

* Disability.

Several sections of the state highway system were closed for varying periods of time during August as the result of forest fires.

DIRECTIONS FOR THE TRAVELER

By GEORGE M. WEBB, Traffic Engineer and
R. J. ISRAEL, Assistant Traffic Engineer

FOR HUNDREDS of years, signposts have guided the traveler on his way, whether he be a pilgrim traveling on foot or a motorist on an eight-lane freeway.

A traffic sign nearly 300 years old is located in England at an intersection in the Cotswolds. This is believed to be the oldest signpost in Britain. It is carefully preserved by the British highway authorities. Four iron arms point the ways to Worcester, to Oxford, to Warwick, and to Gloucester.

When a traveler wanted to know how far it was to any one of these towns, he consulted the side of the appropriate arm. It is known as the Cross-Hands.

Pioneer Signs on US 50

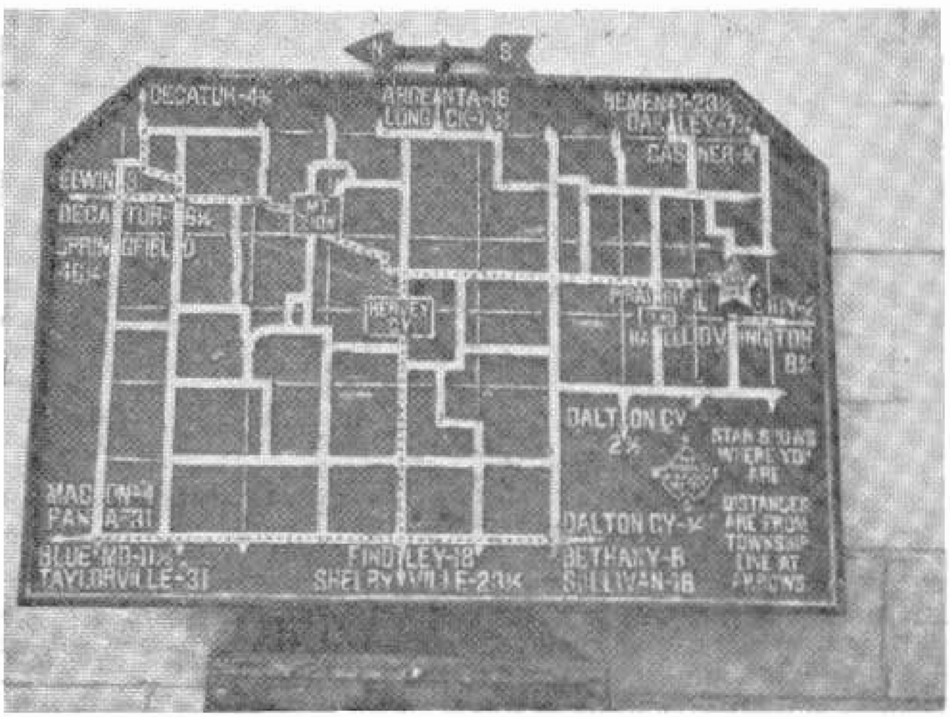
Travelers along modern US 50 between Placerville and Lake Tahoe can still glimpse some of the stone mileposts on which have been engraved the distance easterly from Placerville.

In Central Illinois, rural road markers of a generation ago consist of a map cast in iron, with the location of the particular marker indicated by a star. Thus, by careful and leisurely inspection, the traveler could determine his location and his route.

These signs of bygone days would be of little value with present-day speeds and traffic volumes. Today, traffic signs are recognized as an integral part of a modern highway—essential to its operation and to the safe, orderly, and smooth flow of traffic.

The Division of Highways continually studies and improves signing techniques to keep pace with the ever-increasing traffic demands and to provide California motorists with superior signing service. Signposting has changed throughout the years along with other highway features, but its purpose — to guide the traveler — remains the same as in olden times.

This marker on US 50 in El Dorado County shows the distance to Placerville.



An iron "map" served as a guide to travelers in the early days of motoring in Central Illinois. (Photo courtesy of Macon County Road Department.)

Auto Increased Travel

When the automobile came into popular use, people traveled farther and faster than ever before. Longer trips over new roads were commonplace, and there were more people using strange roads far from their homes. This increased travel, particularly travel for long distances, created a strong demand for legible signs. As highways and automobiles improved, speeds increased, and so did the need for adequate highway signs that could be read from a moving car.

Types of Signs and Uniformity

There are three general types of traffic signs in use today:

1. *Warning* signs to caution drivers of the need for added alertness or reduction in speed;

2. *Regulatory* signs to inform motorists of regulations governing movement;

3. *Guide* signs for guidance and directional information.

Obviously, traffic signs of all types should follow uniform standards and be placed in accordance with uniform practice so they will have the same meaning and result in the same action on the part of motorists wherever encountered. Statewide uniformity on county roads, city streets, and state highways minimizes drivers' confusion and contributes materially to the safe, orderly, and expeditious movement of traffic.

National uniformity is likewise important. California follows the general standards of the Manual on Uniform Traffic Control Devices for Streets and Highways approved by the American Association of State Highway Officials, Institute of Traffic Engineers, and the National Committee on Uniform Traffic Laws and Ordinances; and the A. A. S. H. O. Manual for Signing and Pavement Marking of the National System of Interstate and Defense Highways. Statewide uniformity on county roads and city streets, as well as state highways, is encouraged by membership and active participation in the deliberations of the California Sign Committee and other professional groups, including national committees concerned with signing standards.

A diamond-shaped yellow sign indicates a warning; reflectorized arrow specifically warns of curve to right ahead.

Speed limit signs are the most familiar examples of regulatory type sign.

Rules for Use of Signs

Signs are essential where special regulations apply, where unusual conditions are not self-evident, and to furnish directional information. They should be used wherever there is a real need but not profusely. Too many warning or regulatory signs detract from the effectiveness of those necessary for safety and guidance.

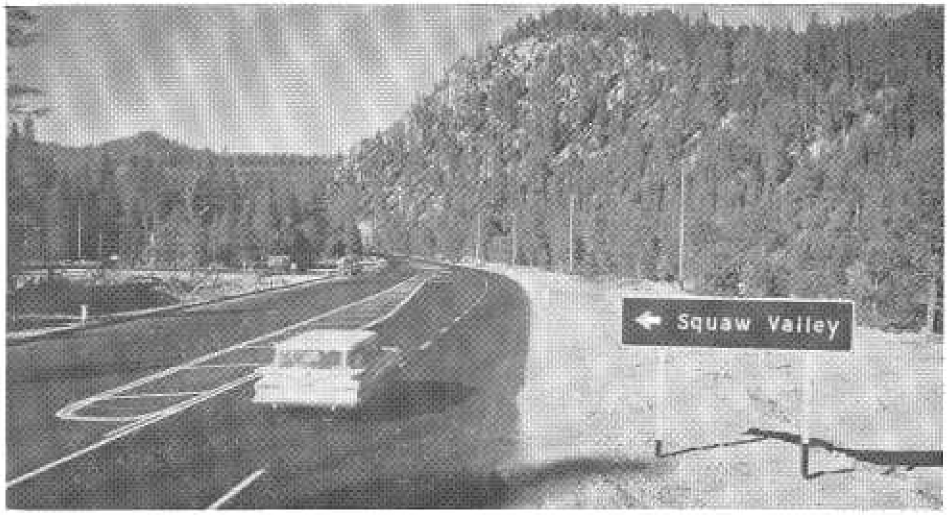
Well-known rules of the road or general provisions of the Vehicle Code are not generally required on traffic signs. Drivers are expected to know the rules for safe operation of their vehicles, and a multiplicity of needless signs with long messages would be distracting and serve no useful purpose.

Guide Signs

Except for the foregoing general comments, this discussion is limited to guide signs. The function of guide signs, as the name implies, is to guide motorists along routes and to destinations of their choice; to inform motorists of intersecting routes; to direct to cities or towns; and, to a lesser extent, to furnish information and to identify locations not readily apparent.

The modern highway with adequate visibility and easy curvature to accommodate all normal driving speeds reduces the need for warning and regulatory signs. However, the increased width and higher speeds, and the necessity for making decisions far in advance of turnoffs or intersections greatly increases the importance of the guide signs. This is particularly true on freeways. Practically no warning signs are needed on freeways except on ramps and connections at interchanges.

Like the early day traveler, the motorist on present-day conventional highways takes advantage of familiar scenes, landmarks, buildings, and geographical features for information as to his whereabouts and the location of intersections and points where choice of direction is made; but on the freeways, with wider rights-of-way and no business or buildings of any kind fronting directly on the highway, identification of location may be more difficult. This further brings out the need for guide signs of adequate legibility placed a considerable distance in advance of turnoffs.



Directional information is the purpose of guide signs.

This sign once guided travelers in Southern California but would obviously be impossible to read and digest from a vehicle driving on a modern highway at normal speed.

It has been frequently said that directional signs were needed only for the infrequent user or the complete stranger on a highway. This is not true on the modern highway with access completely controlled and no intersections at grade. Even frequent users need signs to identify locations and turnoffs.

Statewide Problem

The extensive highway improvement program now under way in many cases removes traffic from congested business streets. This traffic is diverted to the newly constructed routes, generally freeways, which bypass the main business district. This makes the subject of adequate directional signing of great interest to many communities and areas throughout the State as well as to the motorist. The statewide scope of the problem requires that it be treated on a uniform statewide basis.

The statewide signing practice of the Division of Highways has evolved through the years in meeting changing conditions, increased traffic, and the growth of communities along the expanding network of modern state highways.

The adoption of a uniform system of signing for interstate highways in 1958 had a major influence on signing practices in this State and throughout the nation. California had a sizable influence in the development of the Interstate Sign Manual and is now participating in the further development and the broadening of these national standards.

California Sign Committee

Current state highway signing practice, while it is the responsibility of the Division of Highways, was not developed by this division alone. Much of it stems from the studies and consultations of the California Sign Committee which was organized to promote orderly, safe, and consistent signing throughout the State. Members of the Sign Committee are the State Division of Highways; California State Automobile Association; Automobile Club of Southern California; County Supervisors Association of California; League of California Cities; Institute of Transportation and Traffic Engineering of the University of California; and the California Highway Patrol. The individuals who represent these organizations on the committee are directly concerned with highway signing.

All matters pertaining to type, size, color, positioning, and use of signs are agreed upon only after considerable study by this committee, and the sev-

A sign bridge spanning both roadways of a modern freeway.

eral members observe these agreements very closely. Although this organization is advisory only, it has been very effective in securing uniformity on California roads, streets, and highways. Informal meetings of this committee are held as needed, generally several times a year.

Basic Principles and Standard Practice

Certain principles must be followed if signing is to achieve the best results in guidance and safety. One such principle is that the number of place names which can be used effectively on a single sign is distinctly limited. Except under very unusual conditions, the number should not exceed three. Because of the higher speeds on freeways, the maximum number of destinations on primary directional signs is restricted to two. Drivers of vehicles moving at present-day speeds are unable to read a long list of place names and directional arrows. Neither can they stop or slow down without hazard to traffic.

These principles are confirmed in a study by the Institute of Transportation and Traffic Engineering of the University of California which indicated that the number of drivers' errors in reading signs increases sharply if the number of names on a sign exceeds three. This study also indicated that a dividing line between destinations in opposite directions is of great benefit in reducing drivers' errors in reading signs. As a result, it has now become standard practice of the Division of Highways to use the dividing line between such destinations on new standard directional signs or replacements.

On high-standard roads, in particular, signs must be both located and proportioned so that motorists may recognize the messages, comprehend the meaning, make decisions, and direct their vehicles into the proper lane without a reduction in speed.

Reassurance Signs

To reassure motorists that they are on the right road and to tell them how far it is to points along the route, reassurance guide signs are placed facing outbound traffic at the outskirts of cities or towns and just beyond principal highway junctions. These signs generally show (1) the next town, (2) the next county seat, road junction, or important city, and (3) the end of the route. All of the towns named are on the route being traveled. Where the road divides, locations in each direction may be shown, and cities designated as the termini may be alternated on the bottom line of successive signs. Distances are shown to the nearest mile for each destination.

On interstate freeways, reassurance signs will appear at more frequent intervals, but these signs will show only two destinations, the next town and the terminal city of most general interest.

Early thinking in respect to this sign was that it did not need to be very prominent because it does not call for immediate action by the driver. Many small, nonreflectorized reassurance signs are still providing service on the older conventional highways. However, the size of the message on reassurance signs has been constantly increased in line with increases in speed and traffic volumes.

PHOTOS ABOVE—Guide signs include divider when they have destinations in different directions.

Reflectorization of this sign has been standard for some five years and size of the message on current and future installations will approach that of the major guide signs on the route.

Freeway Driving

When driving a freeway for the first time, a motorist should always consult a map to find out which exit will lead to his destination. A single exit in a metropolitan area generally leads to many city streets and destinations. Only the name of the street to which the ramp connects and one place name can be shown on the sign; so the motorist must know the name of the exit where he wants to turn off. In other words, a driver must know in advance where he wants to go if he expects to get there without confusion or mistakes.

The main purpose of highway guide signs is to tell the motorist how to reach his destination by the shortest and most efficient route. Any message on a sign which would tend to influence the motorist's decision or to encourage him to turn off the highway at a particular road or area is not within the scope of proper highway signing.

State, US and Interstate Markers

On any route, there are nearly always a great number of possible destinations and connecting highways, and it has been found impracticable to place signs along highways or at turnoffs naming all possibilities. As a statewide practice, it has been found advisable to restrict the naming of locations on a given route to those actually on the route.

Obviously, it would be impossible to place a sufficient number of signs on the highways to enable a motorist, without knowledge of the general direction or local geography, to find his way merely by looking for place names on traffic signs.

Consequently, as a matter of primary guidance, considerable use is made of state and US highway route markers. Under present-day conditions in California, a motorist unfamiliar with a geographical area needs the assistance of a road map, and road maps are readily available. Studies show that most motorists rely upon such assistance and that the route markers in use provide generally adequate directional information.

PHOTOS ABOVE—Reassurance signs are larger and reflectorized for easy nighttime as well as daytime reading.

US Numbered Routes

The importance of a nationwide system of numbered highways was recognized in the early twenties, and the American Association of State Highway Officials (AASHO) requested the Secretary of Agriculture, under whose offices the Bureau of Public Roads at that time operated, to name a committee for the purpose of formulating a plan or system of numbered highways. The association was asked by the Secretary of Agriculture to develop such a system. This system was developed and officially adopted in 1926. The American Association of State Highway Officials is made up of all the state highway departments, those of Puerto Rico and the District of Columbia, and the US Bureau of Public Roads.

The selection of US sign routes and the assignment of numbers is a function of the Executive Committee of AASHO. Over the years, this committee has developed a set of policies for the purpose of facilitating travel on a nationwide basis over the shortest routes and best roads.

AASHO Policies

In accordance with these policies, it has been the practice of the Division of Highways to request that the best route from a traffic service standpoint be designated as the basic US route. Therefore, when a highway is reconstructed to higher standards on new alignment, either through or around a city or community, this new routing is signed as the basic numbered route.

Included in the established policies of AASHO is the provision that "No additional road shall be added to the US numbered road system, and no existing US road shall be extended except where there is a definite showing of an adequately improved highway carrying an established and necessary line of interstate traffic not otherwise provided for by existing US routes and for which adequate traffic service cannot be provided by state route numbers.

"Extension of present US numbered routes may be made only when the proposed extension is in the general direction of the present route.

"Proposed extensions shall not be made when to do so, it is necessary to duplicate US routes already established, unless the duplication is for a short distance and the routes then diverge, ending in different terminal points."

There is obvious need for these well-established policies because designation of inadequate routes not providing the best traffic service would discredit the entire system of US numbered routes. Also, extensive or unwarranted use of alternate or business routes would result in confusion and lack of confidence in numbered routes on the part of motorists.

For the sake of uniformity, AASHO sign route policies are also followed in the establishment of California state sign routes insofar as they apply.

The route numbers are used extensively by the makers of road maps. Businesses that cater to the traveler use route numbers to tie in the location of their businesses in their advertising.

Interstate Route Numbers

The routes comprising the 41,000-mile National System of Interstate and Defense Highways are being marked with distinctive route marker shields on the basis of a numbering system that is separate and distinct from the US numbered system. The Interstate system marking and numbering is not intended to replace that of the US system, but is, in reality, a separate system of a limited mileage of modern limited access highways to accommodate traffic between the nation's major traffic generating areas, and the two numbered systems will complement each other. Much of the Interstate system is developed on new location. Those sections where the Interstate system is developed over an existing U. S. numbered route will have both the U. S. and the Interstate system shields and route numbers.

Large and prominently displayed sign directs the traveler from the freeway to the business route.

The red, white and blue Interstate shield is beginning to appear in many locations throughout the State. It is too early in the development of the Interstate system for these shields to provide an effective touring aid at the present time. However, the program is moving at a rapid pace in all states and it may not be many years before segments are connected to provide route continuity for considerable distances across the nation.

Business Districts and Business Routes

With the extension of the freeway system resulting in no businesses fronting directly on the highway, it becomes more and more important to designate to motorists where services normally required by the traveler may be found. On directional signs, this is accomplished by designations such as *central district*, *business district*, *downtown*, or *civic center*, and sometimes the name of a district or area within a city.

It is frequently found desirable to designate a "business" route on a section of former state highway which is relinquished when the community which it serves is bypassed by a new freeway. Proposed US business routes must be submitted for approval to AASHO. These business routes are principally within the corporate limits of a city and provide the traveling public with the opportunity to travel through the business section.

The new large interstate shield catches the motorist's eye, but route numbers are equally readable on the smaller U.S. highway shield below.

In cases of this type where a business route would be of benefit to the

UPPER—Signs directing the traveler to a small community also tell him the services are available. LOWER—The inclusion of "Downtown" in the freeway signing through a major city indicates the proper turnoff to reach the central business area.

motorist, and local authorities are in accord and agree to maintain the necessary signs, it is the division's practice to recommend approval to AASHO. When a business route is approved, all directional signs on the state highway directing to the business route are installed and maintained by the Division of Highways.

The use of the business route is a convenient and logical way to direct a stranger so that he can easily find his way to the business section, transact his business, and then proceed to find his way back to the main highway by following the route shields.

The Division of Highways recognizes that the business centers of bypassed communities and along old routes provide needed services to the highway user, and every effort is made to give recognition to these business districts in a manner consistent with the principle of providing the best possible signing for all highway users.

Either overhead illuminated or reflectorized signs are installed where practicable at the connections with the road leading to the business district and the main highway. In addition, where there are other connections from the freeway to the business district, supplementary signing is also provided.

Frontage Roads and Roadside Business

When the construction of a new freeway separates developed property from the existing local road or street system and leaves no suitable connection to the freeway, it is frequently necessary to provide access to the property by construction of a local service road parallel to the freeway. This type of road is designated as a frontage road. In the case of new construction, they are parallel to the freeway. Often the old highway, or portions of the old highway, roughly parallel to the new freeway, will serve as a frontage road. Frontage roads have proven to be advantageous locations for businesses, especially those which provide necessary services for motorists.

The problem of providing adequate directional signs to roadside businesses on frontage roads or on old roads bypassed by construction of freeways developed about 1949. Signs with various wordings were considered, such as *roadside services*, *roadside business*, *roadside business area*, *roadside motels*, etc.

Roadside Business

The sign reading *roadside business* was adopted with the approval of the Motor Hotel Association of California. This sign indicates all types of services and accommodations and is consistent with our present signing practice of placing *business* signs with route markers to indicate business routes not on the main highway and providing direction to business districts.

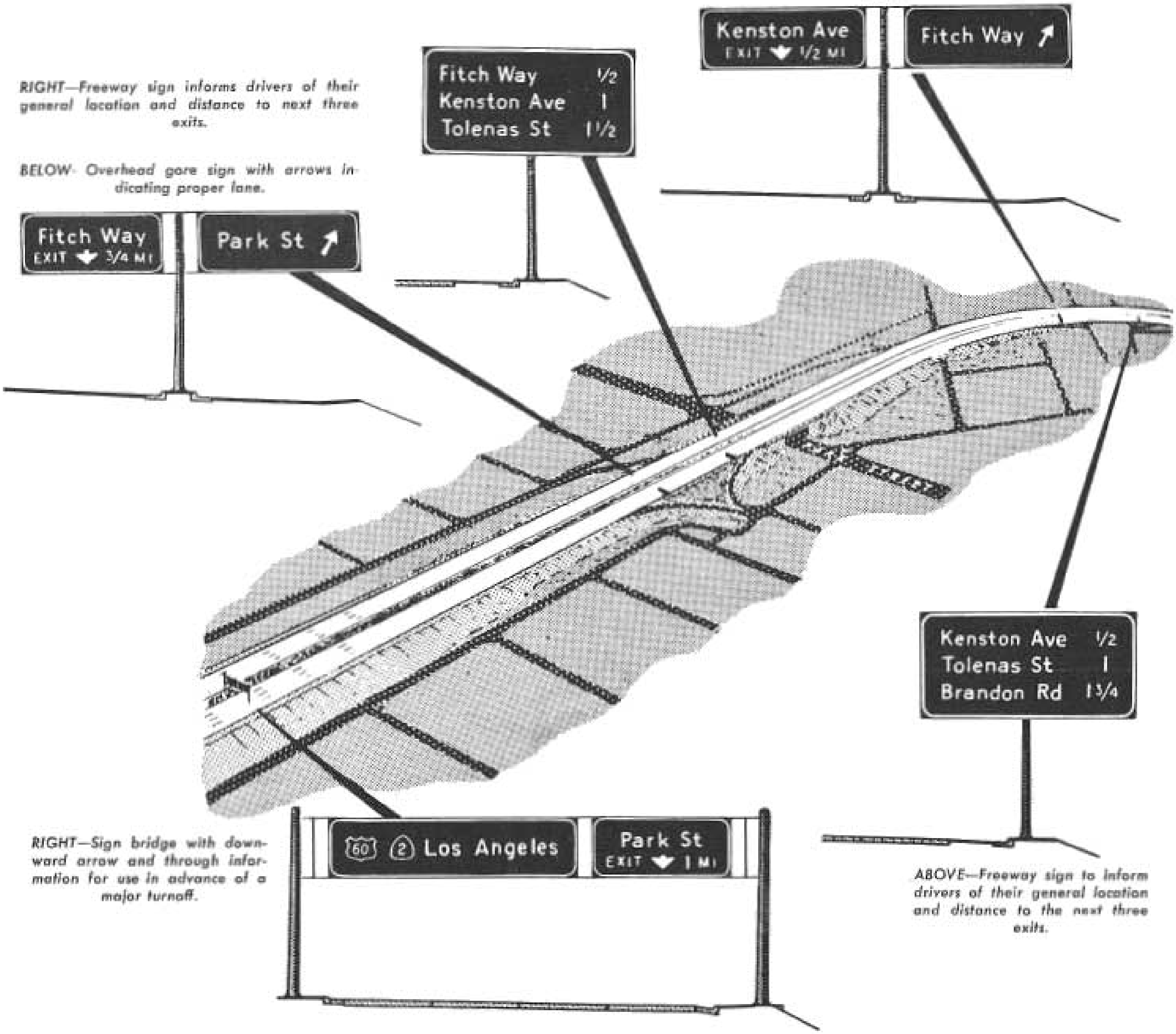
One of the important factors in the development and use of the sign reading *roadside business* was that the use of a uniform standard sign to designate these businesses would soon cause it to become known by the public. Motorists, when they recognized such a sign, would know that roadside services were available.

A survey was made by the Division of Highways Right-of-way Department on the effect of bypassing roadside business. Operators of motels, restaurants, etc., were contacted and appeared satisfied with the wording of the signs, but expressed concern regarding their placement and visibility. As a result of this survey, the signs were placed farther in advance of the intersection and the *roadside business* signs were reflectorized for night visibility.

One of the most important factors in the statewide use of uniform standard signs reading *roadside business* is that their continued and consistent use will further increase their effectiveness.

Freeway Signing

It is a long step from the first roads and streets used by automobiles to the present-day six- and eight-lane freeways in the large metropolitan areas.



BELOW—Gore sign with arrows indicating proper lane.

RIGHT—Freeway sign informs drivers of their general location and distance to next three exits.

BELOW—Overhead gore sign with arrows indicating proper lane.

RIGHT—Sign bridge with downward arrow and through information for use in advance of a major turnoff.

ABOVE—Freeway sign to inform drivers of their general location and distance to the next three exits.

Likewise, it is a long step from the early signing to that which is now required on these freeways which carry a tremendous traffic load.

Signing cannot be separated from the freeway because it is an integral part of it. Adequate signing is essential to completeness and satisfactory operation of the modern freeway. The high volumes carried by this type of facility greatly increase the signing requirements.

For example, traffic volumes which preclude changing lanes at will on the approach to an exit make it necessary

Typical freeway sign listing next three exits and their distances.

PHOTOS ABOVE—Sequence signing in advance of a freeway junction under crowded urban conditions.

to provide much greater advance notice of the turnoff. There was a time when 50 feet in advance of an intersection was adequate. Later, the distance increased progressively to several hundred feet, to one-quarter mile, to one-half mile, and now one mile or more is considered a desirable distance for the first indication of a turnoff from a freeway. This desirable distance is not always obtainable, due to limitations on design and the need for frequent connections to provide proper traffic service in highly developed areas.

Positive indications of the lane to use for different exits are very necessary. Drivers also need to know the approximate distance to the offramp they expect to use.

New System of Signing

After careful study of this problem by traffic engineers of the Division of Highways, a new system of signing for metropolitan freeways was developed early in 1956. This system has been subsequently modified in line with signing requirements on the Interstate System. The advantages of these later revisions were to develop uniformity of signing on all California freeways and attain basic uniformity with major freeway signing on a national basis. The features of the newer freeway signing most apparent to the motorist are the green rather than black backgrounds on guide signs and the upward sloping arrow at exits from the freeway instead of a down arrow over the offramp. The main features of freeway signing are:

Metropolitan Freeways

In order to inform drivers of their general location and the distance to the exit which they are seeking, signs are placed indicating the next three exits and the distance thereto in miles and fractions of miles. These signs are located as soon as practicable after passing an exit and list the next three exits. As soon as an exit is passed, its name is dropped from the top line and the second line moves up to the top position. A new exit name and distance is then added on the bottom. The names for the exits are street names, road names, route numbers, or any other name which best fits local conditions. These signs are frequent reminders to motorists so that they will be prepared to turn off when they reach the exit that will take them to their destination.

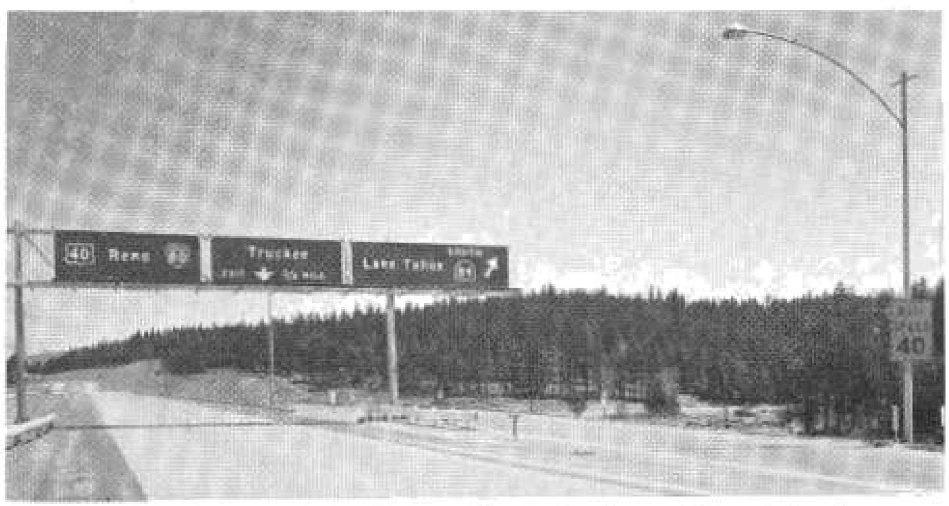
Overhead illuminated signs are placed at exits in the gore; that is, in the triangular area between the turnoff and the main freeway lanes. These signs carry the name of the offramp, positioned directly over the offramp with an upward sloping arrow pointing in the direction of the exit movement. The other side of the sign will normally be over the outside freeway lane, and will carry the name and distance to the next exit ahead, with an arrow pointing downward to the approximate center of the outside lane. At major turnoffs, a sign bridge may be erected over the freeway lanes which will carry through traffic information in addition to the name of the next exit. The through information is usually a prominent city on the route together with appropriate route shields. Advance sign bridges carrying full information are always placed in advance of a freeway junction. With this system of signing, the names of all major exits will generally be indicated three times, at least twice on overhead illuminated signs.

Downward pointing arrows assign traffic to the appropriate lane in advance of turnoffs or branch connections. Down arrows are also used over the connecting roadways at freeway to freeway interchanges. The upward sloping arrow is now used only at the exit from the freeway and will direct to city streets or other local roads. With the complex of freeways now developing in urban areas, a high percentage of local trips will involve not one, but a system of freeways. The concept that down arrows keep you on the freeway system and an up arrow takes you off should provide a valuable aid to the motorist.

Rural Freeways

On rural freeways, overhead signs are generally restricted to gore installations at important turnoffs. They are primarily used at junctions of state or national sign routes and to direct to bypassed communities over the best connection for each direction of travel.

It was found that when a freeway bypasses a community formerly on



PHOTOS ABOVE—These signs give repeated notice of an important sign route turnoff.

PHOTOS ABOVE—Approaching a turnoff to a community from a major rural freeway, the motorist is notified repeatedly.

the sign route, and still so indicated on small-scale road maps, a considerable segment of the motorists turn off at the prominently displayed city name in the belief they are following the route. For this reason, it is now standard practice to show a prominent through destination, together with the route shield, on the left panel of a butterfly sign when the right panel directs to a bypassed community.

Although traffic volumes are usually not comparable to urban freeways, the greater speeds of rural travel make advance notice of turnoffs equally important. First notice is provided by a large ground-mounted sign carrying turnoff information in 16-inch capital and 12-inch lower case letters, together with the distance to the exit, usually one mile. Additional notice is provided by lane-indicating signs placed midway between the first advance sign and the exit. These, together with a sign at the gore, again provide three notices of the turnoff.

It is a well-known fact that drivers, through inattention or distraction, frequently pass even a prominently placed sign without comprehending it. The repetition of the exit names and lane indications should reduce this problem to the minimum.

Sign Modernization

Highway designs, including signing, are continually being improved. It is not economical or practical to go back and revise all previous designs and installations whenever a new and better way of signing is developed. However, the effectiveness of modern signing has resulted in many demands for the re-signing of older freeways. In this respect, a systematic program is now under way in which those higher traffic areas having the most critical deficiencies in signing receive the first priority for modernization.

California has taken the lead in developing overhead illuminated freeway signs and rates high nationally in the field of traffic control. Uniformity, so vitally necessary for effective signing, is obtained by an up-to-date looseleaf manual setting forth uniform standards and policies for signs and other traffic control devices used on state highways. Uniformity and adequacy of signing on California county roads and city streets is, with a few exceptions, very good, largely through the activities of the California Sign Committee.

The driver must not be left out of the picture. The best signs in the world are no positive assurance that a few drivers won't make mistakes or take a wrong turn occasionally. Drivers must take their share of the responsibility. They should study a map when using a highway or metropolitan freeway for the first time so they will know what routes to follow and where to turn off to reach their destination, and above all be alert and courteous, and follow the rules of the road at all times. Careful, competent driving, combined with safe highways and adequate traffic signs, will surely contribute substantially to smooth, safe and orderly traffic flow.

F.A.S. Expressway

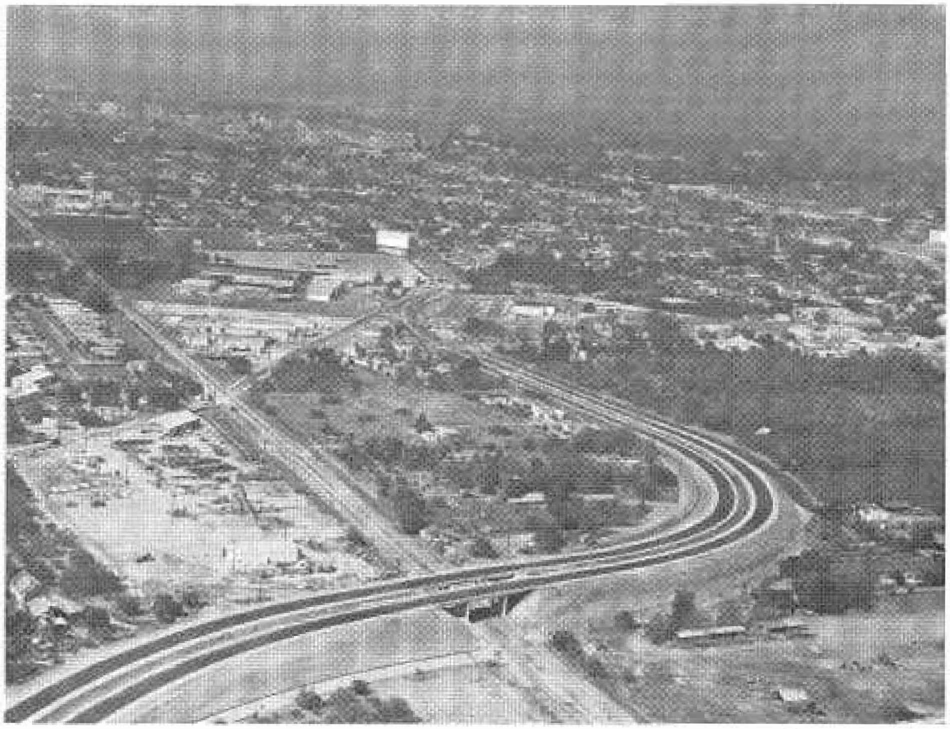
First Unit of Almaden Job Is Completed in San Jose

By JAMES B. ENOCHS, Director of Public Works, Santa Clara County

In mid-November 1959, the first unit of the Almaden Expressway was opened to traffic, eliminating one of the most serious bottlenecks to the movement of traffic in and out of the City of San Jose.

The "expressway," so called to distinguish it from a full freeway, involved the construction of a four-lane divided highway and railroad overcrossing on a new alignment to bypass the existing narrow two-lane undercrossing at the Southern Pacific Railroad main line to Los Angeles.

Almaden Road has a long history, dating back to the days of the Indians when it was used as a trail to get to the area where red rocks furnished the natives with dyes to paint their faces. Later it served as a road for the early Spanish settlers (who had received land grants from the Mexican governor) to get to and from the mission and settlement at San Jose. In the period from 1850 to 1886 when the railroad was extended to the new Almaden quicksilver mines, approximately $40,000,000 in quicksilver was hauled over the road in wagons and mule trains, rendering the road ankle deep in dust in the summer and axle deep in mud in the winter, until it was graveled by the county and sprinkled in summer for its entire length.



An aerial of a section of the new Almaden Expressway south of San Jose constructed by Santa Clara County under the Federal-aid Secondary Highway Program. Note the narrow railroad underpass on the old road at the left.

First Surfacing

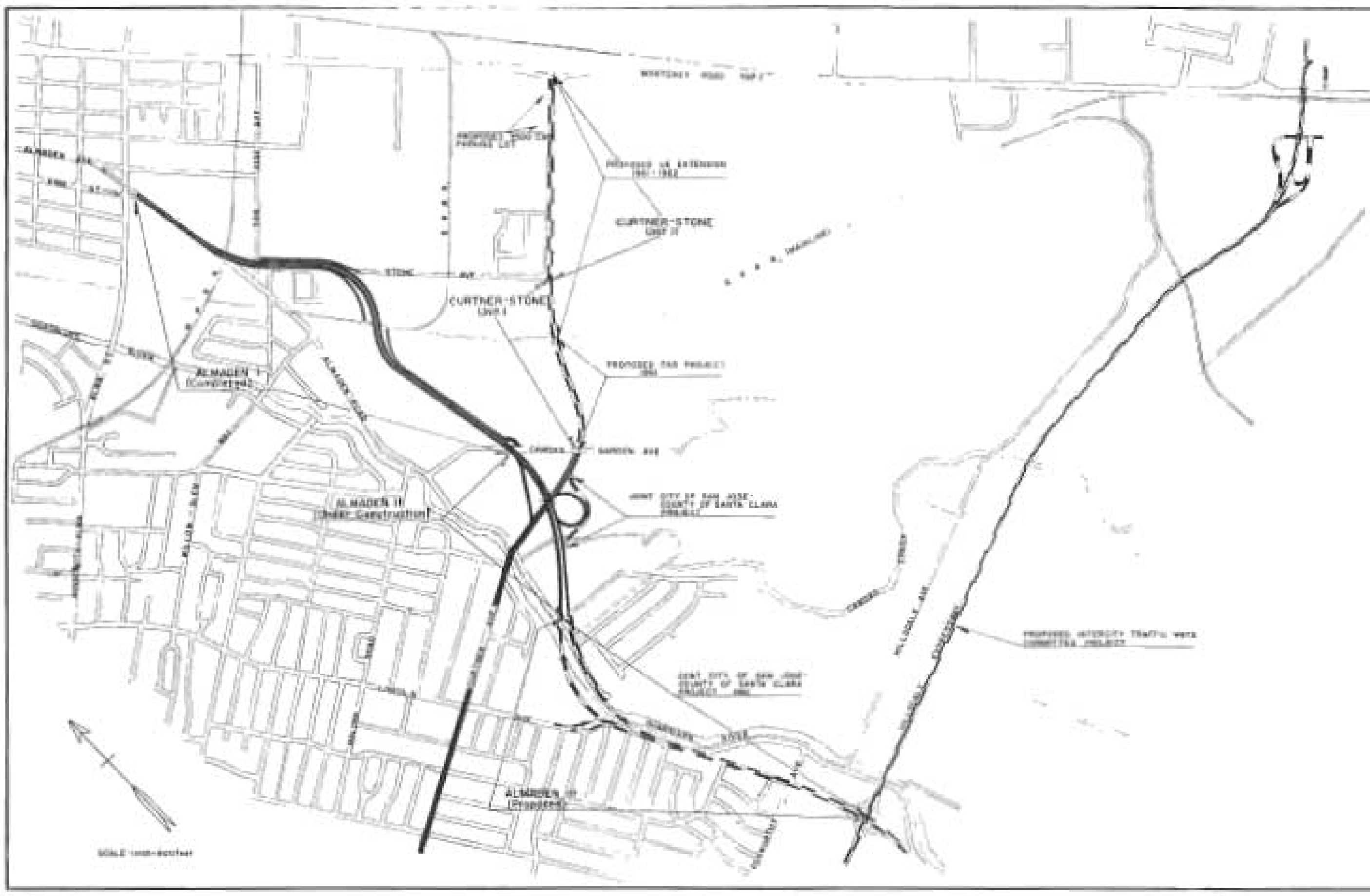
In the period 1920 to 1925 the road was surfaced with asphalt paving, and in 1935 an undercrossing was constructed at the main line of the Southern Pacific Railroad. By the early 1950's the rapid growth of the area to the south of the City of San Jose made it obvious that an alternate route would have to be constructed, or the existing undercrossing widened.

Cost studies of the alternates by the Santa Clara County Engineer's Office indicated that the bypass could be constructed for approximately $300,000 less than widening the existing undercrossing, and in 1957 planning was begun for the bypass. All agencies, county, city, state and federal, contributed funds for the project, and on November 18, 1958, a contract was awarded to Edward Keeble Construction Company of San Jose for the construction of the first unit (1.25 miles) of the Almaden Bypass. The construction cost, exclusive of right-of-way and engineering, was approximately $915,000.

The roadway section chosen consisted of four inches of plant mix surfacing over eight inches of Class A cement-treated base, over six inches of imported select material. Only two grade crossings remain, and the one at Canoas Garden Avenue will be eliminated by the construction of Unit 2 of the bypass. The other, at San Jose Avenue, a real "problem" intersection now, will be eliminated when the Curtner-Stone Extension has been completed to the Monterey Road (Highway 101). Although the expressway does not have full freeway status, the areas adjoining are served by frontage roads on both sides for almost the full length of the project.

Settlement Problem

A settlement problem, somewhat unexpected at this distance from San Francisco Bay, developed as placement of the overcrossing approach embankments progressed. Ultimate settlement of the natural ground beneath the embankments, as measured by settlement platforms was found to be approximately 2.2 feet for the northerly approach embankment, but only 1.2 feet for the approach immediately across the Southern Pacific Railroad right-of-way. The settlement subsided to zero in February of 1960, and no difficulty



A map of the Almaden Expressway project showing units already constructed, those now under construction and those proposed for future construction.

has been experienced with either the structure or the approach pavement.

The second unit of the bypass is now being constructed by Leo F. Piazza Paving Co. of San Jose under a $385,000 federal aid secondary contract awarded in December 1959 and will be open to traffic this fall. It consists of construction of a plate girder overcrossing at the Curtner-Stone Extension, construction of a portion of the Curtner-Stone Extension, and extension of the expressway approximately 0.5 mile southerly to Redbird Drive where it tapers into the existing alignment near the Guadalupe River Bridge.

Plans are being prepared by the county for unit 3 and construction work should begin on this joint Santa Clara County-City of San Jose project by mid-1961. In addition, plans for unit 4 (Curtner-Stone Extension to Highway 101) are well along, and a federal aid secondary contract will be awarded in 1961 for this link to serve the rapidly growing industrial areas along Highway 101 south of San Jose.

Application has been made to aid this Curtner-Stone project with urban extension funds as well as FAS funds.

Hillsdale Project

The only remaining project of immediate concern for this area is the connection of the Almaden Expressway with the new Hillsdale Expressway being constructed as a joint project by the City of San Jose and the County of Santa Clara to serve east-west traffic south of the city. However, it is hoped that the Almaden Expressway can be extended south to serve the area as fast as the buildup of population demands.

Design and construction engineering was done by Santa Clara County personnel under the direction of James B. Enochs, Director of Public Works. Olaf A. Bue was resident engineer on the first unit, and Jack M. Williams is resident engineer for the unit now under construction. Valuable assistance was and is being given by the California Division of Highways including the Bridge Department during the course of the project.

The excellent co-operation between the City of San Jose and the County of Santa Clara in working out mutual problems of design and construction of the four units presently contemplated for the Almaden Expressway gives hope that all political jurisdictions of Santa Clara County can join to secure a successful election in March 1961 for the $70,000,000 first stage of a comprehensive countywide expressways system.

A record high for one day of 58,520 vehicles crossed Carquinez Bridge on Sunday, August 14. This was nearly 2,000 more vehicles than crossed the bridge on the previous high day, July 2, 1960, when 56,973 vehicles were counted.

Cable Relocation

New Technique Used, Savings Total $240,000

By WARREN B. JAMES, Associate Bridge Engineer, and
A. H. MUNGER, Highway Engineering Associate

The construction of the Golden State Freeway extending from Mission Road to Pasadena Avenue, Road VII-LA-4-LA, was completed and opened to public traffic on March 18, 1960. This portion of the Golden State Freeway consists of eight lanes on new alignment 1.2 miles in length in the City of Los Angeles, and it was constructed by the contractors, J. C. Boespflug Construction Co. and J. L. McLaughlin, at a total construction cost to the State of $2,800,000.

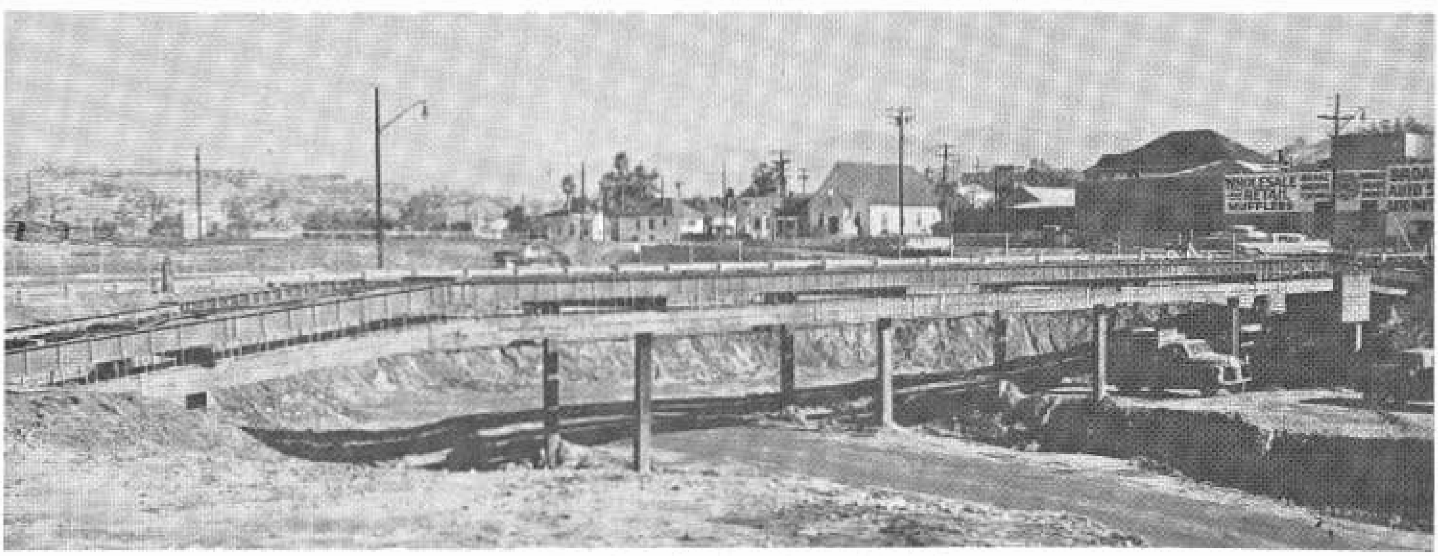
This freeway construction included an overhead bridge structure on North Broadway, which involved an engineering problem because of the large number of Pacific Telephone cables existing in this city street. Clearing the area in advance of bridge construction would normally have required the relocation of the existing 40 underground multiple tile ducts containing 26 cables with each cable containing hundreds of wires for message transmission. In one unit there were 24 ducts 16 feet southerly of which there were two units of eight ducts each located approximately five feet apart. These ducts were on the north side of North Broadway extending across the freeway location. According to usual accepted standard practice, relocation of these telephone facilities by the "shoofly method" would have required two moves; the first being to locate in the detour roadway around the bridge and the second to place in the final location in the deck of the bridge structure.

New Technique Employed

The procedure used on this freeway contract called the "supporting in place method" departed from the old standard "shoofly method" of placing the telephone cables in a detour around the bridge construction site. The new method substituted a temporary arrangement of steel beams supporting the existing telephone cables in place until the lower slab and stems of the box girders could be constructed. Slots were left in the bridge diaphragms and abutments to permit the lowering of the ducts into final position. By this new procedure uninterrupted service of the telephone cables was maintained. The top slab of the box girders was formed and poured in the normal manner.

Savings Are Listed

Running simultaneously with the state highway contract, there was a telephone company contract amounting to approximately $60,000. The telephone company estimated that the placing, cutting-in and splicing of shoofly cables would have required approximately six months' time with an additional six months to restore the lines to normal use. This 12 months' allowance for relocation work plus normal loss of cable use during cutovers was estimated conservatively to cost the sum of $300,000. Subtracting the $60,000 telephone contract, net savings from use of the new "supporting in place method" compared to the old "shoofly method" amounted to $240,000, of which $120,000 would have been the cost assessable to the



An overall view of the telephone ducts supported from the girders by steel straps shortly after excavation work on the bridge began.

State in accordance with existing utility relocation contract. This did not take into account money losses resulting from possible interruptions in TV, radio and other coaxial trunk line services had the "shoofly method" been employed. Of the 26 cables, three were TV, radio and long distance toll lines to the east coast and the remainder were main trunk lines between city telephone exchanges. Further, if the "shoofly method" had been used the State's freeway contractor would have had serious interruptions to his work, first while the telephone bypass cable was being installed in the detour and again during the permanent cable installation in the new bridge structure.

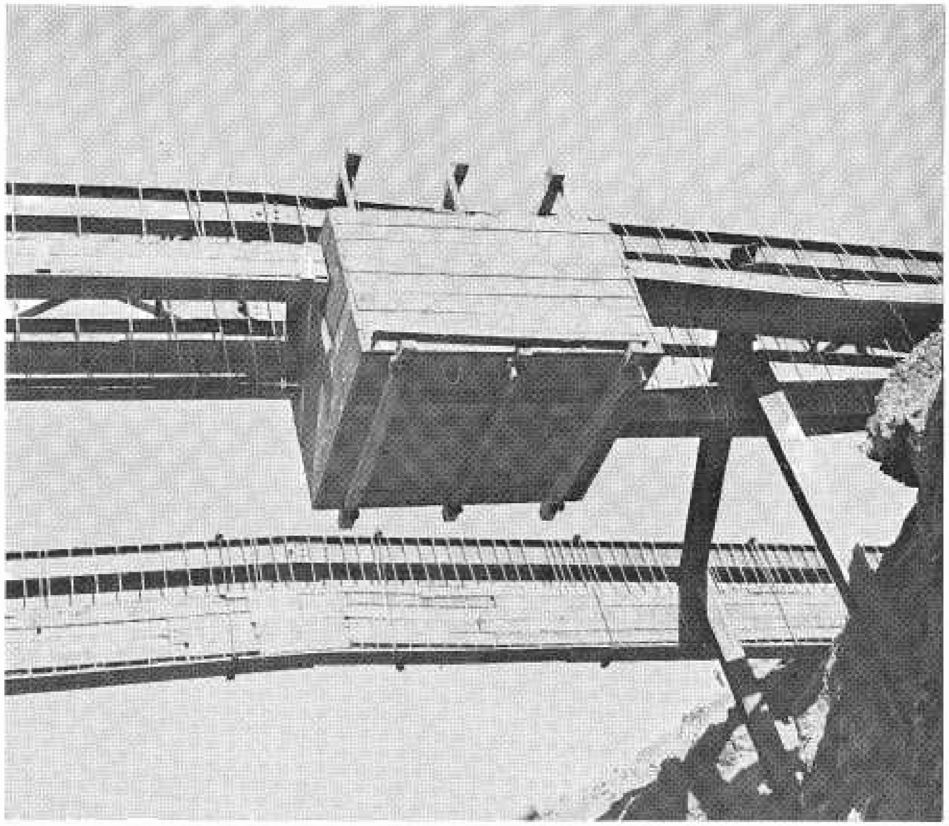
Construction Methods

The contract plans originally called for the steel beams carrying the cables to be supported on islands of earth left between cribbed excavations for abutments and piers. After study by The Pacific Telephone and Telegraph Company and under an agreement between the contractor and State, the earth islands and the cribbing for excavations were eliminated and in their place welded steel bents were erected, spaced about 20 feet on both sides of the abutments and piers. This change in contract involved a change order which resulted in a savings of $2,700 to the State. The telephone company, using its own contract forces, furnished and erected the main steel beams, and strapped the cables and ducts protected by timber plank sheeting to the beams and handled the raising and lowering of the cables.

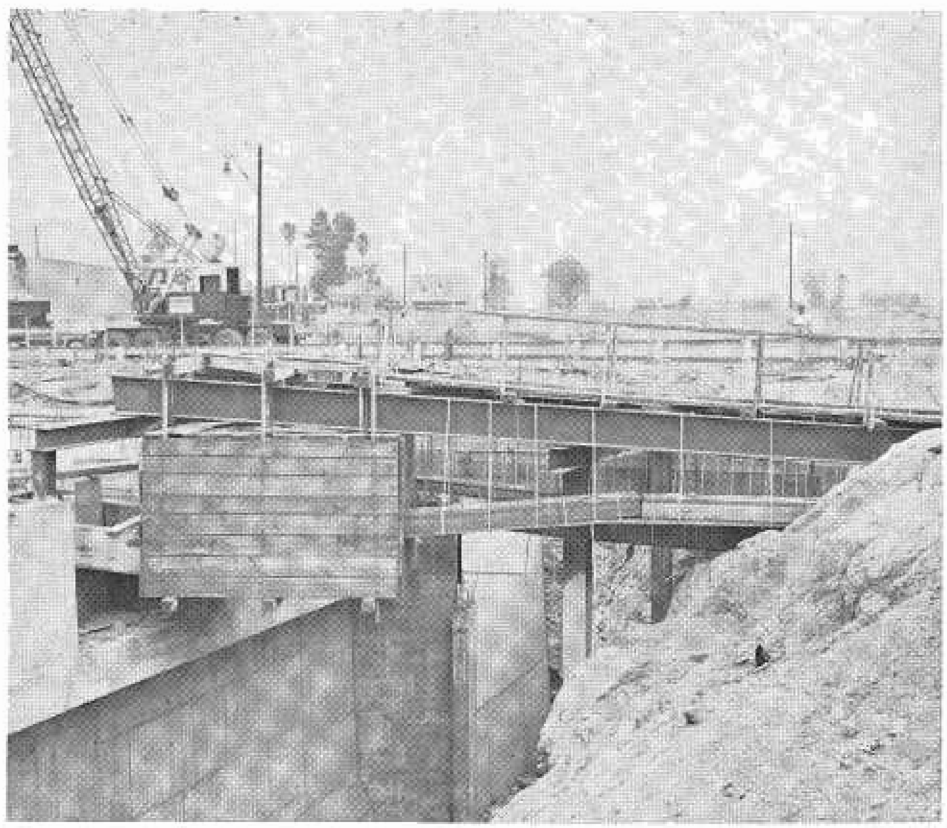
The work performed by the State's contractor consisted of both structural and roadway excavation under the cables and in placing the temporary supports for the cables during these operations. This method of placing required that holes be drilled in the existing ground after the telephone conduit had been exposed, for placing the legs of the steel bents.

Holes Drilled

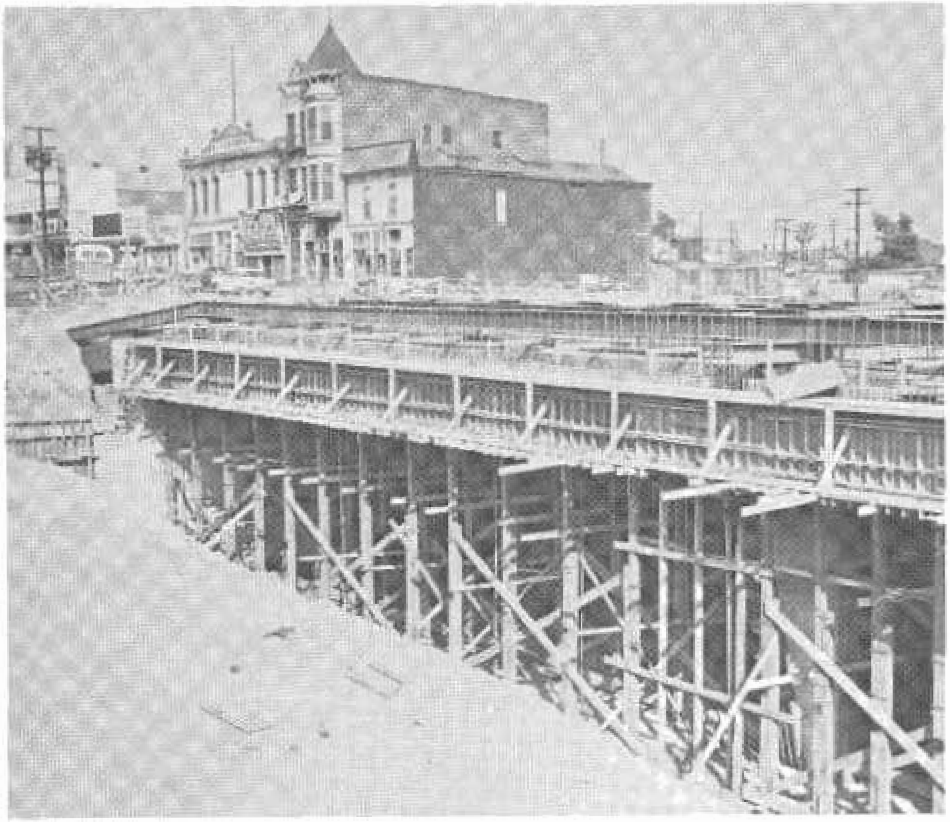
Two-foot-diameter holes for the bent legs were drilled from the surface of ground to the elevation of the bottom of the footings, a depth of approximately 34 feet from ground sur-



A view from below of the telephone manhole contents and ducts protected by timber planks and supported above the bridge "glory hole" prior to the construction of the bridge abutment.



A side view of the telephone manhole contents and ducts shown above, after construction of the bridge abutment.



A photo of the project after the falsework was constructed showing the telephone ducts supported from the steel girders.

Workers prepare to release the steel straps and lower the ducts into their final position inside the concrete girder.

face. Then 12-inch, 53-pound steel H-bearing piles were placed in the holes and the bottom 10 feet encased in concrete. The bent caps were left off temporarily until the supporting beams with the conduit strapped to them were raised to grade. The 12-inch steel bent caps were then placed to support the longitudinal beams and were welded to the legs.

The detailed construction steps employed in sequence consisted of exposing the telephone ducts containing the cables, encasing the ducts in protective timber plank sheeting, placing longitudinal 18-inch WF70 26-beam supports above the ducts and hanging the ducts and cables to the beams by means of steel straps. The I-beams were raised with jacks approximately four feet to provide a two-foot clearance between the ducts and the lower slab of the box girders. At this stage the caps of the steel bents were inserted under the I-beams and the loads were then transferred to the steel bents.

No Interference

The excavation for the abutments and piers were made using heavy excavation equipment, without interference from timber cribbing originally required by the specifications. The two abutments and the center pier were constructed in the excavation to bridge seat elevation. Short WF-beam columns to serve as legs for a second set of temporary column supports were placed in the abutments and center pier. The cable load was transferred to these column supports and the first temporary steel bents removed. The supporting I-beams were then at the maximum 75-foot span for which they were designed. After the first temporary bents were removed, the balance of the earth under the bridge was excavated. Deck falsework and forms were erected and the lower bridge slab and stems of the box girder poured.

The process of lowering the ducts and cables onto the lower concrete slab was started as soon as possible. These telephone ducts were finally placed on the lower slab while it was still supported by forms and falsework. The lowering was accomplished by employing long threaded vertical

The telephone ducts shown in their permanent position inside the concrete box girder.

bolts through yokes supporting the ducts. The ducts were anchored in their final position by partial encasement in lightweight concrete. The top slab forms of the box girder were then placed and the top slab poured.

At Bridge Abutment No. 3, a telephone cable manhole was incorporated with the abutment to give access to existing splices in the cables. This is shown in a photograph illustrating this story.

The problem of finding the required four inches of slack in the cables to allow for the four feet of vertical lift was not too difficult since some slack existed in adjacent manholes on both sides of the freeway. However, great care was exercised by the telephone company to be sure that the cables were not overstressed by pulling. The telephone company kept its own inspector on the job during the critical stages of the work, which were completed as planned without serious difficulties.

Method Is Successful

This new "supporting in place method" for taking care of existing telephone ducts during bridge construction as carried out on this job proved to be a successful construction method satisfactory for widespread use.

The vast savings in utility relocation costs further warrants the employment of this method for similar situations where a large number of telephone cables are involved with a bridge structure. The method should also be considered where a smaller number of cables are involved when it is more economical than installing an overhead line or a temporary "shoofly" installation in the bridge detour to clear the bridge construction area.

The District VII Right of Way Clearance Department staff wishes to acknowledge the co-operation of The Pacific Telephone and Telegraph Company representatives for their contribution in the successful development of this new "supporting in place method" for handling telephone cables during construction. Special appreciation is extended to Mr. William G. Cook of the Los Angeles office of the Pacific Telephone Company for his assistance.

STATE CHAMBER MAKES HIGHWAY RECOMMENDATIONS

The California State Chamber of Commerce made its annual full-dress appearance before the California Highway Commission in Sacramento on August 31, presenting the results of highway project studies in all 58 counties of the State.

The 86-page report of the state chamber's statewide highway committee was the distillation of discussions and recommendations made by local officials and civic leaders at a series of 50 meeting held throughout the State during the spring and summer.

The 747 projects recommended for commission consideration were grouped into three categories, county by county: those where construction could be undertaken very shortly, those for which additional planning and rights-of-way were indicated, and those on which long-range planning should be started or continued.

Following the presentation, the Highway Commission acknowledged the state chamber group's service in the following resolution:

WHEREAS, For many years the California State Chamber of Commerce, through its Transportation and Highway Department, has annually arranged and conducted public meetings in the various counties of the State, providing an opportunity for local public officials, civic organizations and individuals to express their views and recommendations on highway matters; and

WHEREAS, This activity has become a valuable aid to the California Highway Commission in administering California's highway program; and

WHEREAS, The policy whereby a state agency, through a statewide civic organization, goes into local communities to solicit advice and guidance in the development of a state highway program is unique among states of the nation; and

WHEREAS, It is recognized that this activity of the State Chamber of Commerce is a distinct service not only to the California Highway Commission but to every citizen of California; now, therefore be it

In this view of the California Highway Commission hearing room in Sacramento on August 31st, Chairman F. W. Tarr of the Statewide Highway Committee of the California State Chamber of Commerce is turning from the lectern to call on one of the regional committee chairmen to present project recommendations. Members of the Highway Commission are seated on the platform, rear of photo.

Resolved, That the California Highway Commission commends the State Chamber of Commerce for this fine public service and by this means expresses its appreciation for the co-operation and assistance rendered by the staff and committee members in the development of this program in the public interest; and be it further

Resolved, That a copy of this resolution be sent to the officers and directors of the State Chamber of Commerce and to Edmund G. Brown, Governor of California.

Adopted this first day of September 1960 by unanimous vote of the California Highway Commission.

Bid Opening Set for Yerba Buena Tunnel

The State Division of San Francisco Bay Toll Crossings will advertise for bids shortly on a project to reconstruct the Yerba Buena Island Tunnel portion of the San Francisco-Oakland Bay Bridge.

The project is another step in conversion of the bridge to provide for five lanes of one-direction traffic flow on each of its two decks.

A total of approximately $4,000,000 in Bay Bridge revenue funds is available for the tunnel reconstruction work. Bids will be opened at 2 p.m. on October 11, 1960, in the division's office at 151 Fremont Street, San Francisco.

The project involves removal of the Key System rails on the lower deck through the tunnel; lowering the level of the lower deck, one-half the deck width at a time, in order to maintain continuous traffic flow; removal of the center columns supporting the upper deck through the tunnel; and then lowering of the level of the upper deck.

The level of the upper deck must be lowered 16 inches throughout the tunnel, it was explained by Norman C. Raab, Division Chief, in order to accommodate the trucks which will be using the upper deck as well as the lower when the whole reconstruction job is completed.

The upper deck will be lowered without noticeable interference with traffic by means of specially designed movable ramps, Raab explained.

The project will also involve revision of electrical, mechanical and other facilities and the construction of bus lanes and passenger platforms on both upper and lower decks.

Special Body Made for Profilograph Truck

PHOTO LEFT—Among the 8500 equipment units administered by the Division of Highways Equipment Department are many requiring specialized design and construction. The component parts of these units are manufactured by the Department in its Headquarters Shop in Sacramento. They are not available on the open market.

Such a unit is a special body mounted on a 1-ton truck between the truck chassis and a surveyor's type body. This body was built for the Materials and Research Department for special use in connection with studies of pavement smoothness.

Deflectometer

Semiautomatic Unit Speeds Surface Deflection Measurement

By F. N. HVEEM, Materials and Research Engineer

Engineers must think about or take into account many different phenomena relating to the behavior of the things they build, and among these is the question of how much movement occurs when a material or structure is under load. Most engineering works are required to sustain loads or resist forces, but in the process of sustaining these loads virtually all structural members yield or deflect slightly. Thus, tall buildings sway or bend under high wind pressures and the floors of buildings and decks of bridges deflect and rebound measurably under moving wheel loads.

Movement under transient vehicle loads is not confined to bridges as it can be shown that all highway pavements deflect under heavy axle loads to a greater or lesser degree depending upon several factors or conditions. One common factor is the magnitude of the load, but there is another variable that influences the deflections of pavements that is not involved in bridge decks; namely, the nature of the underlying support. A bridge deck must be strong enough to carry the design loads across the span between piers or abutments, but pavements are not expected to span any appreciable distance or area and therefore the nature of the subgrade support becomes a major consideration when studying the performance of pavements under load.

Established Procedure

The design of a reinforced concrete or steel beam which will sustain a given load is a well established engineering procedure, and here the strength elements are confined solely within the beam. While many engineers regard a highway pavement as a sort of "beam" actually the pavement itself is no more than the upper layer or "crust" of a "beam" which is of considerable depth but with no clearly defined lower boundary. The

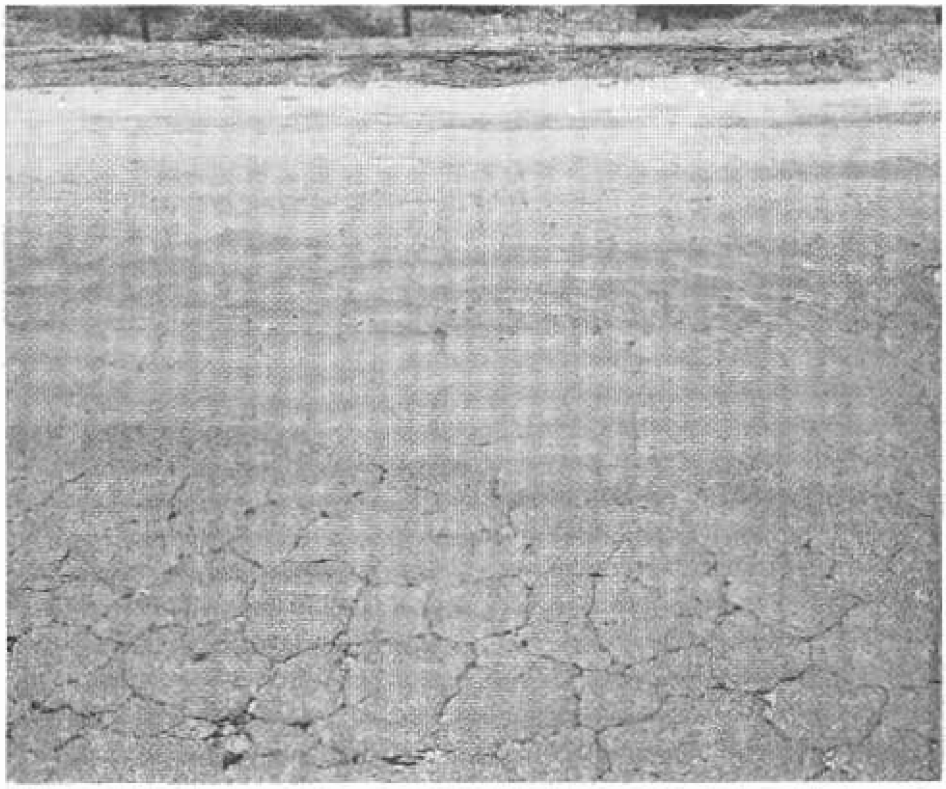


Figure 1. Fatigue cracks, generally known as "alligator" cracks.

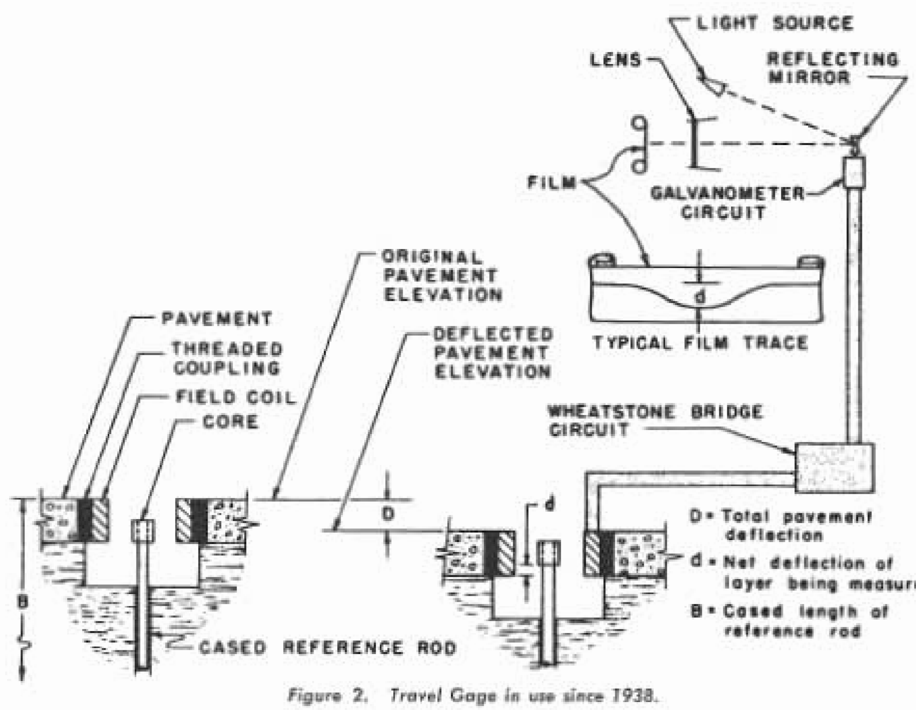


Figure 2. Travel Gage in use since 1938.

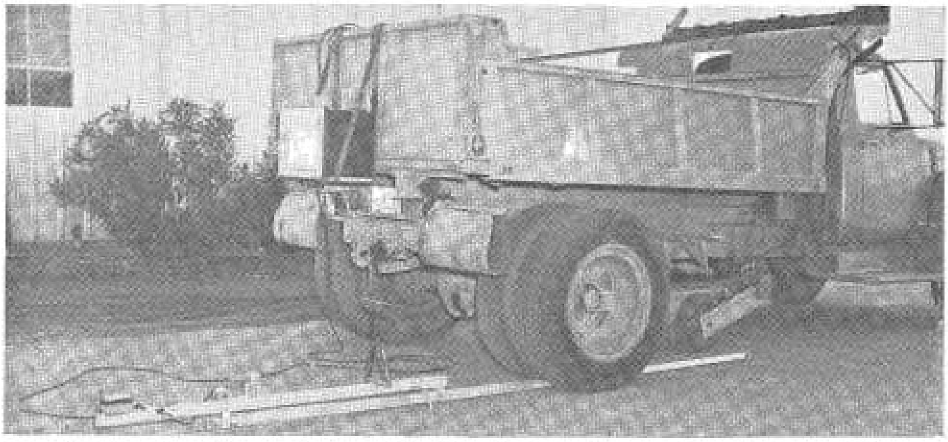


Figure 3. Benkelman Beam used under a loaded truck wheel. The recorder and odometer wheel were added by California.

Figure 4. Traveling Deflectometer.

Figure 5. Traveling Deflectometer: In the recording cycle the probes and their traverse assembly remain stationary on the road while the truck moves forward.

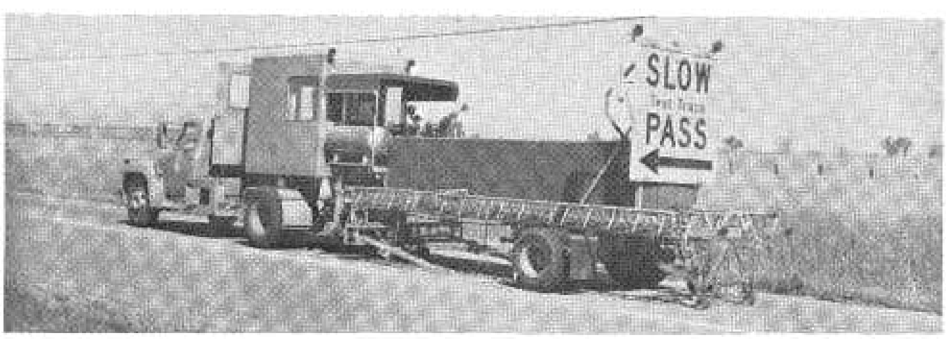


Figure 6. Traveling Deflectometer: The traverse assembly is picked up by a pneumatic operated track and carried ahead and dropped on the road to repeat the cycle.

amount of deflection which the more or less hard and brittle upper layer must undergo as the underlying soil is compressed with each passing wheel load is a matter for concern as sufficient alternate bending and flexing will ultimately lead to cracking of the pavement surface. These cracks are of the type known as fatigue cracks, Figure 1.

The measurement of pavement deflections has been carried on in California for a number of years. In 1938, the laboratory secured a General Electric travel gage which was used in investigations both on state highways and on airfield pavements during the war years. In 1951, an organized study of California pavements was undertaken and results reported.* This instrument still remains one of the most accurate methods for measuring pavement deflections, Figure 2. It has the disadvantage, however, of requiring considerable time and expense for the installation of units as five-inch diameter holes must be drilled in the pavement, and cased reference rods driven to the desired depth.

Device Is Developed

During the operation of the WASHO test road in Idaho, A. C. Benkelman developed a device, Figure 3, now known as the Benkelman Beam, which makes it possible to measure the surface deflections of pavements without the necessity for cutting holes and installing gaging units. The use of the Benkelman Beam has speeded up the process of measuring pavement deflections. However, the measurement of deflections over a long stretch of road is still a relatively slow process, and in order to obtain a greater amount of data for a given expenditure of time the Materials and Research Department has developed a semiautomatic device called the traveling deflectometer. This instrument is shown in Figures 4, 5, and 6. The principle is illustrated by the sketch, Figure 7. The deflectometer combines a truck trailer unit which carries the test load on the rear wheels of the trailer with means for measuring the pavement deflections under both

* "Pavement Deflections and Fatigue Failures," Highway Research Board Bulletin 114 (1955) By F. N. Hveem.

wheels simultaneously. Essentially, this is an electromechanical device capable of measuring pavement deflections under a single axle wheel load at 12½-foot intervals uniformly and continuously as the vehicle moves steadily along the roadway at one-half mile per hour. The deflections are measured to the nearest 1/1000 inch by means of a probe arm resting on the pavement, Figure 8, and permanently recorded on chart paper. (To visualize the sensitivity of this instrument, an ordinary cigarette paper is 1/1000 of an inch thick.) The load on the semitrailer may be readily shifted from front to rear, thus making it possible to vary the axle load from 12,000-lb. to 16,000-lb. simply by means of a switch in the control cab. The great advantage of this deflectometer is that it can be used to quickly scan random spots on long stretches of roadway or make measurements at close intervals where desired.

Purposes Outlined

It is expected that the traveling deflectometer will be useful for the following purposes:

1. To check the condition of lightly constructed highways during the spring wet period or "spring breakup" in order to judge whether load restrictions should be imposed during the time when the pavements are susceptible to damage. (Many highway departments in the northern states have been forced to ban heavy traffic during the critical period to protect the public investment, but the problem of producing test data to prove that a given pave-

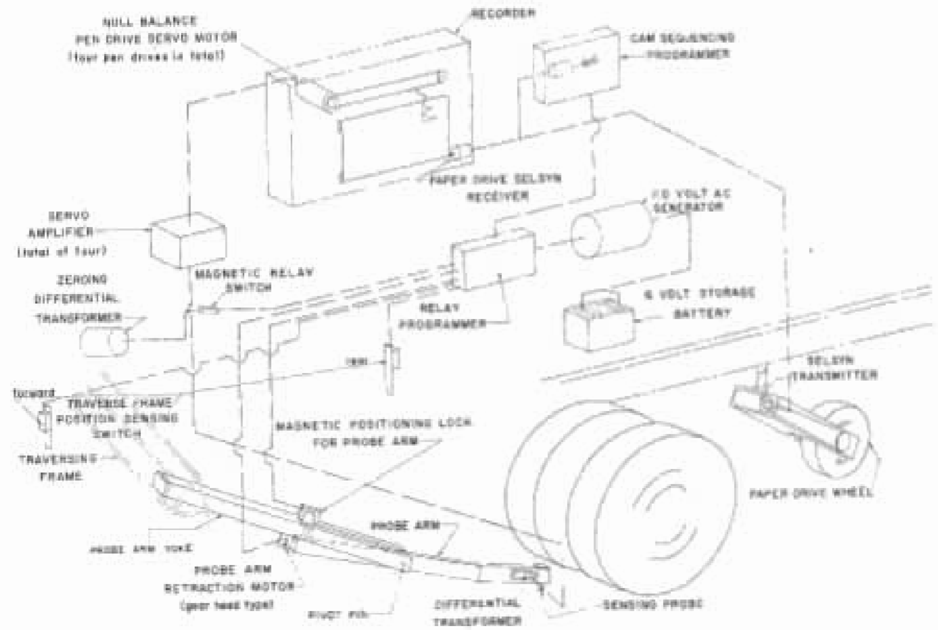


Figure 7. Schematic arrangement of the deflection sensing and recording system.

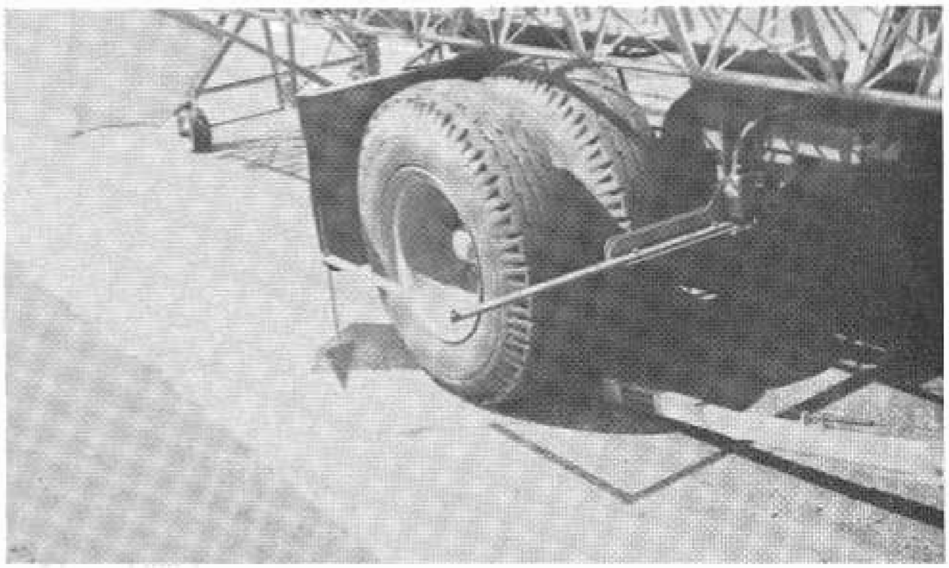


Figure 8. Sensing probe being straddled by dual tires. The truck drives at a constant speed near ½ mile per hour. After being passed by the wheel the probe is automatically lifted and traversed forward to take readings at 12-foot intervals.

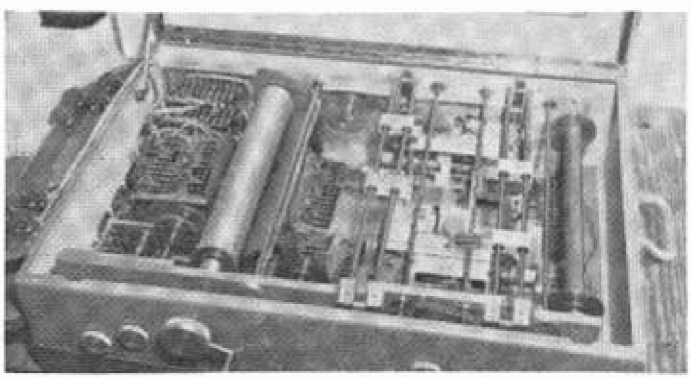


Figure 9. Chart recorder constructed for the Deflectometer. Space for four recording pens on the right. Manual controls on left of console.

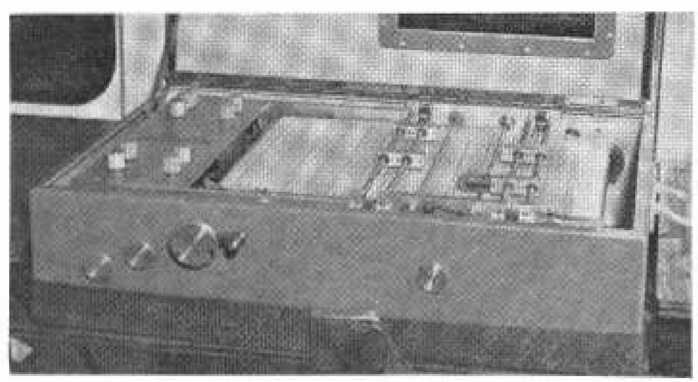


Figure 10. The working parts of the recorder exposed. This unit can record four sets of deflector measurements in one operation.

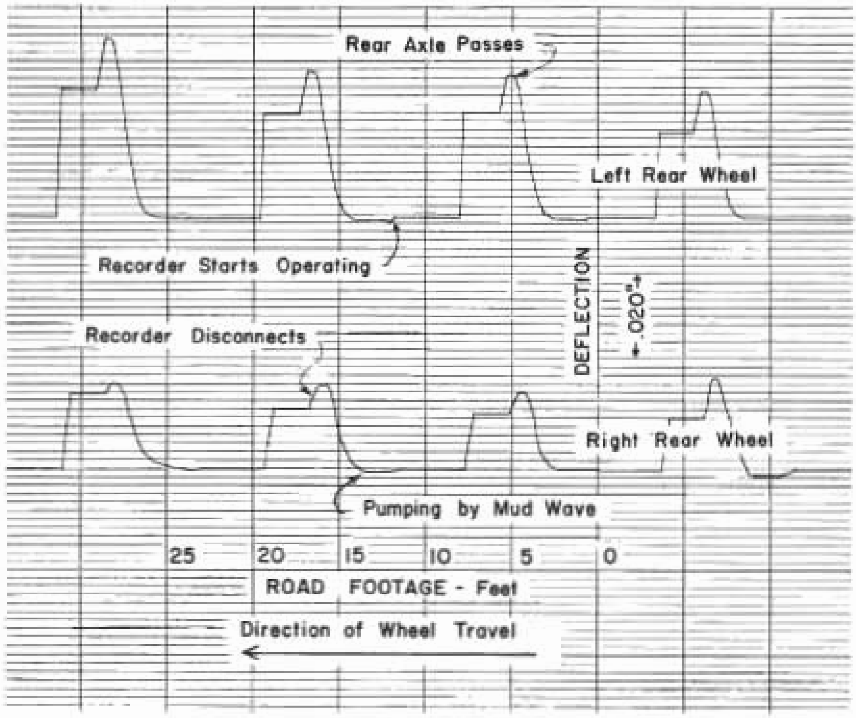


Figure 11. Trace produced by the Deflectometer recorder showing action under both wheels of the loaded trailer. The chart paper feeds from the right. Thus, compared to most graphs, this chart is read backwards. The operational cycle starts about five feet ahead of the axle and, as the dual wheels approach and straddle the sensing probes, a slight plastic heave may precede the downward deflection of the pavement. The deflection continues due to visco-elastic effects until the tire lifts from the pavement, at which time elastic rebound occurs. The right angle "step portion" of the curve is produced by the automatic zero reset and does not represent any movement of the pavement.

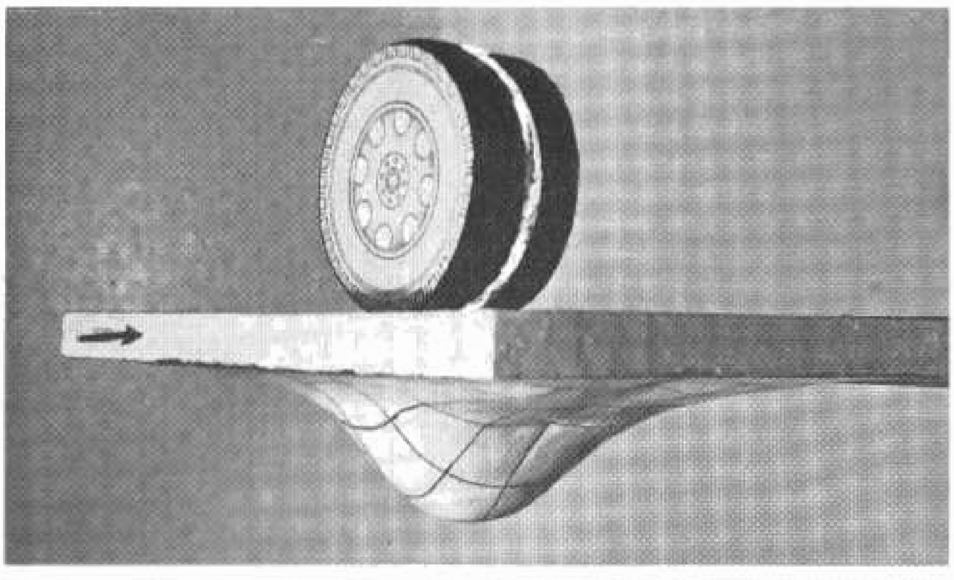


Figure 12. Model showing typical deflection of a flexible pavement under a heavy wheel load. Deflection is about 0.020". The vertical scale is greatly exaggerated on this model.

ment is vulnerable has always been most difficult.)

2. Evaluate existing roadways, both pavements and shoulders, to determine whether reinforcing or overlays are necessary and, if so, what thickness of surfacing may be required. The use of deflection measurements will enable engineers to plan maintenance and reconstruction work more precisely.

3. Permit a periodic checkup on existing pavements so that potential distress may be anticipated. A careful analysis of roadway deflections will make it possible to predict whether or not distress is imminent unless remedial action is taken.

Can Determine Length

Figures 9 and 10 are pictures of the chart recorder. Figure 11 shows some of the deflection records obtained with this instrument. It will be noted that it is possible to determine the length of pavement which is involved in the "deflection area." Figure 12 is a photograph of a model constructed to illustrate the shape of a typical depression under a wheel load on an asphaltic pavement. The length and depth of this depression varies with local conditions and the deflectometer trace indicates both the length of the axis of the oval-shaped area and the maximum depth of the depression.

The deflectometer was designed, developed and constructed jointly by the Materials and Research Department and the Headquarters Equipment Department. The trailer, load-shifting device, cab, etc., were constructed in the equipment shop. The sensing elements, electronic units and circuits were designed by laboratory personnel and constructed in the laboratory shop. Many individuals have been associated with the design and construction among whom are L. S. Hannibal, Senior Mechanical Engineer, and J. C. Eagan, Assistant Physical Testing Engineer. R. E. Wilhelmy supervised all of the machine shop work.

PROGRAM EXCEEDS $115 MILLION

The state building program of the Division of Architecture will exceed $115,000,000 during the fiscal year July 1, 1960, through June 30, 1961. The program is divided into $74,000,000 of Northern California projects and $41,000,000 of Southern California projects.

This is a reversal of trend in the division of work which a year ago was divided about equally between the two areas. Principal reason for the increase in Northern California is because of several major building programs.

Treated Subgrade

Smoothness, Uniformity Key To Good Slip-form Paving

By JAMES L. NEEDHAM, Senior Resident Engineer

THE CEMENT treatment of subgrade under portland cement concrete pavement is not a new idea. Its value and long-range economy have been and are being proven through the performance of roadways under severe conditions of traffic and climate. The methods of construction of cement treated bases and subgrades have been covered in articles in previous issues of *California Highways and Public Works* with particular reference to the article by Earl Withycombe in the July-August 1951 issue.

With the advent of the use of slip-form paving methods for placing portland cement concrete pavement, some new problems have been added to those already existing in the cement treated subgrade operations. This discussion is confined to that particular operation, and a description of what was done on a recent contract in District VII.

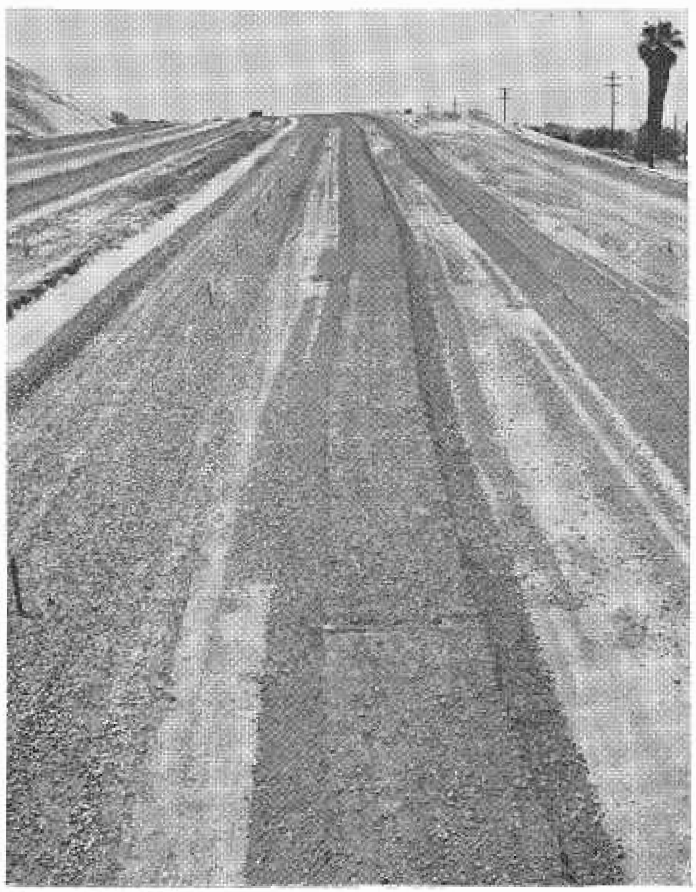
This project is being constructed by the Guy F. Atkinson Company with C. R. "Duke" Fowler as superintendent. It is located on US 101 in Orange County between 1.4 mile south of Sign Route 74 at San Juan Capistrano and Avenida Ramona in San Clemente. It is 7.77 miles in length and the approximate cost will be $6,200,000.

Paver Used

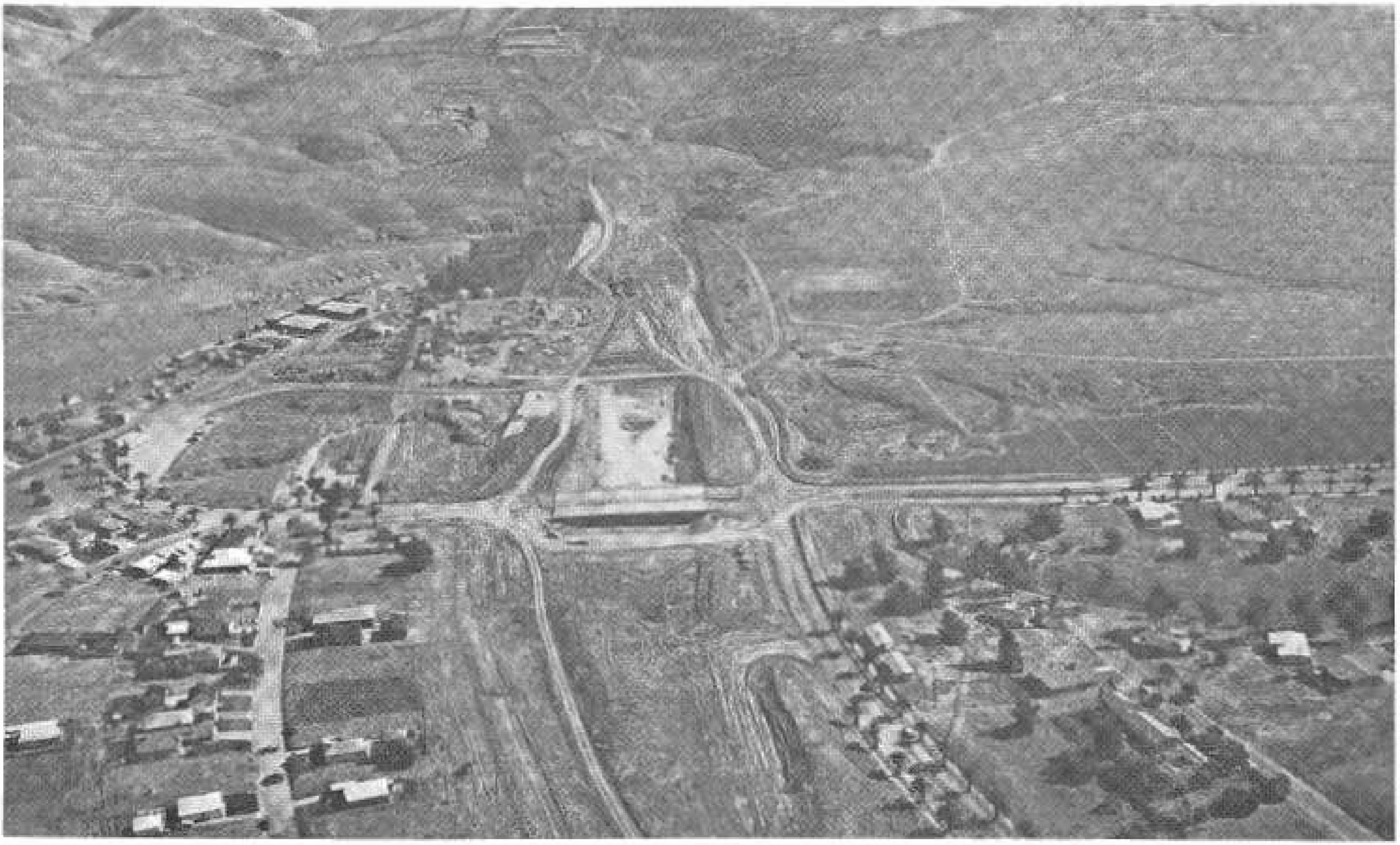
Portland cement concrete pavement was placed with a slip-form paver of the type that travels on the completed subgrade and places a specified thickness of pavement thereon. Its operation and the comparative results obtained have been described by R. I. Innis in his article in the May-June issue of this magazine.

The material to be cement treated on this contract consisted of untreated base material, 1½-inch maximum size, which was obtained from a commercial source near the job. The contract plans and specifications

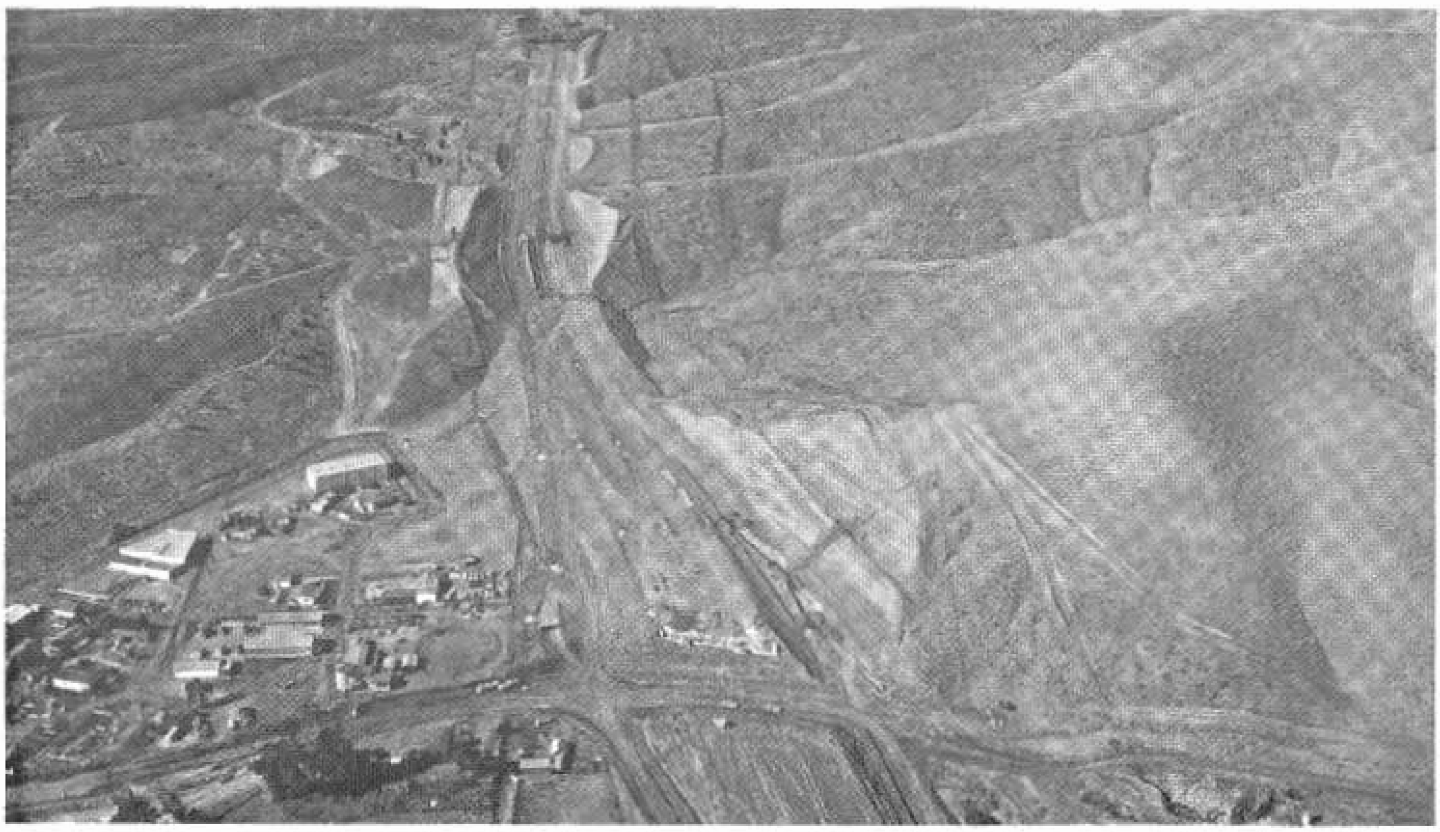
Automatic road building machine cuts subgrade on untreated base. Stakes carrying the grade wire are on the left in front of the machine.



This photo shows sized windrows of untreated base material for four-inch-thick layer of cement treated subgrade.



Construction on the San Diego Freeway (US 101) between San Clemente and Capistrano. Camino de Estrella overcrossing is in the foreground.



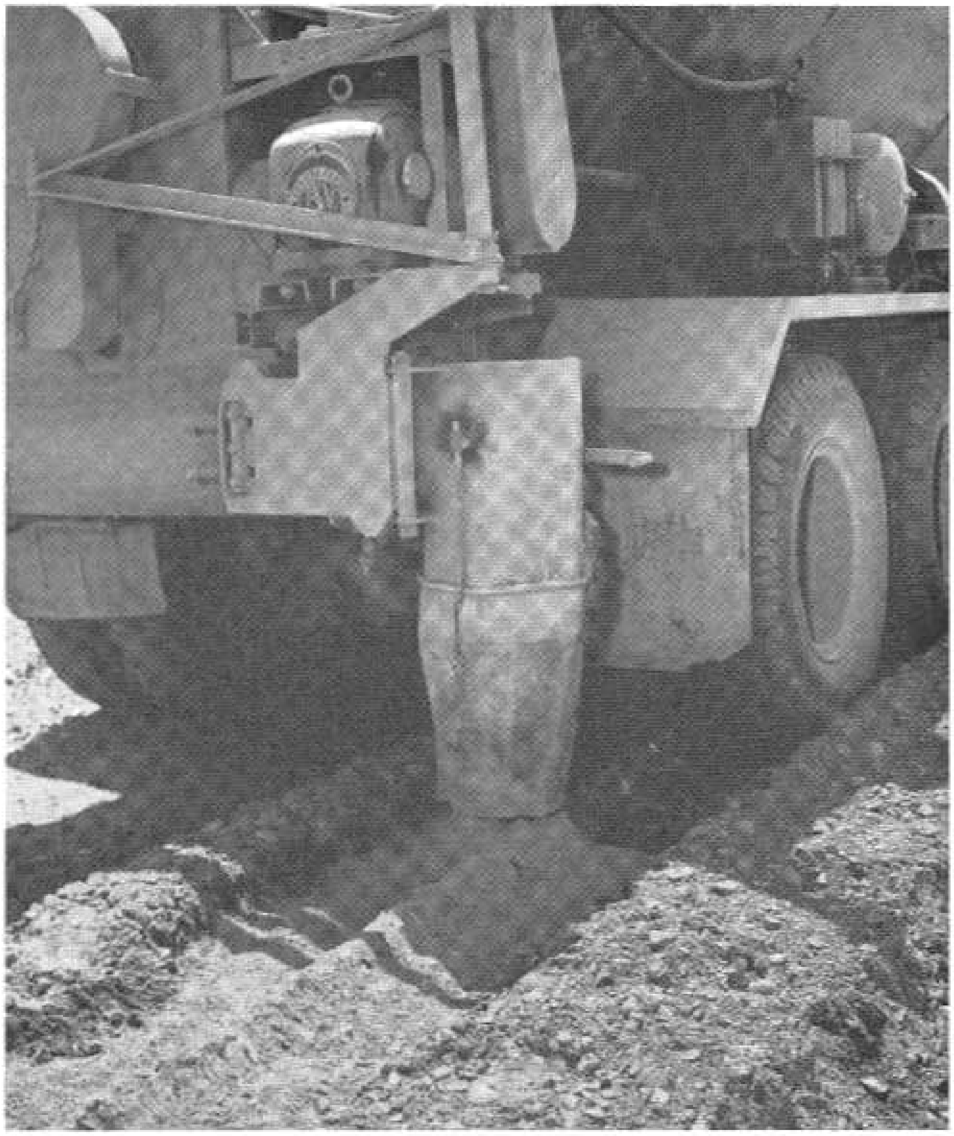
Construction on the San Diego Freeway (US 101) between San Clemente and Capistrano, looking northwest toward Capistrano.

called for an eight-inch layer of this base material under the concrete pavement with the top four inches to be cement treated. The requirements of the Standard Specifications covering the use of side forms were modified by contract change order to permit the use of slip-form paving methods. The contractor elected to place the upper four-inch layer of material in windrows, cement treated by road mix methods and then spread and compacted to a specified grade and cross section.

In order to insure that required thickness of the completed cement treated subgrade will be maintained true to grade and cross section, it is necessary that a very accurate grade be made on the top of the first four-inch layer of untreated base material prior to placing the windrows of material to be cement treated. Grade stakes, referenced to the finished surface of the completed cement treated subgrade were set on five-foot offsets from each edge of pavement on the initial 24-foot width placed by the slip-form paver. These stakes were set at 50-foot intervals on tangents and at 25-foot intervals on horizontal and vertical curves. A minimum width of 26 feet was cement treated in order to provide a transition from the riding area to the shoulder.

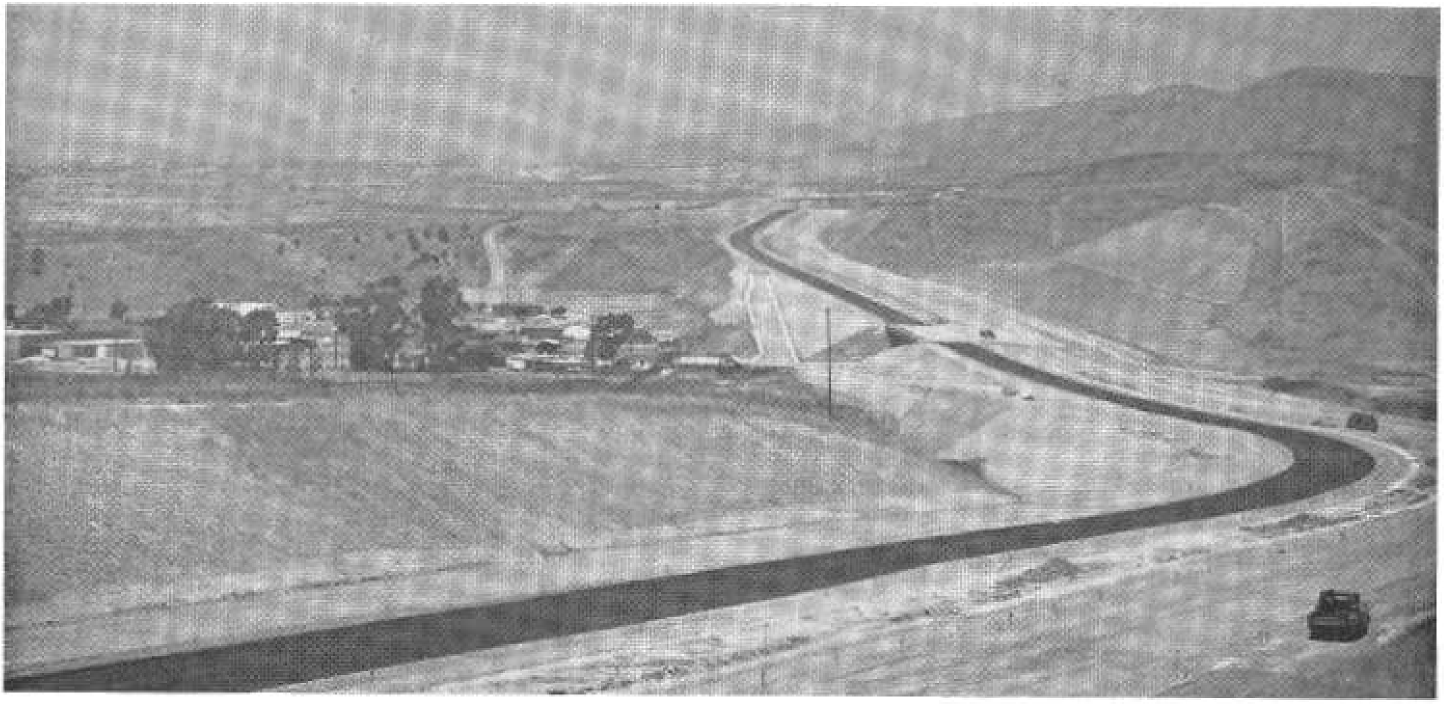
Subgrade Is Cut

The contractor used an automatic road building machine to cut the sub-



A cement distributor truck spreads cement on a windrow of untreated base material.

Cement treated subgrade operations showing the road mixing and the initial rolling.



Cement treated subgrade in the vicinity of the Avenue Pico Undercrossing ready for placing of a 24-foot width of portland cement concrete pavement.

grade on the top of the bottom four-inch layer of untreated base material and the five-foot offset for placing of stakes was chosen to accommodate this machine. This is a comparatively new machine which is being developed for construction work.

The top four-inch layer of untreated base material was placed in two windrows of predetermined size on the prepared subgrade by means of a spreader box.

Cement was added to the windrowed material by means of a bulk cement distributor truck, equipped with a metering device, to accurately control the amount of cement discharged.

Mixing was accomplished with a road mixer operating on the subgrade.

The mixed material was then spread to grade and cross section and thoroughly compacted. A motor grader equipped with an automatic blade control device was used for the final spreading and trimming operation with steel wheel tandem and pneumatic-tired rollers being used for compacting to the required density.

Smooth Subgrade Best

Now, let us again consider the slip-form paver. The machine used on this contract operates directly upon the surface of the cement treated subgrade. The smoothness of the pavement is almost directly proportional to the smoothness of the subgrade under the tracks of the paving machine. Variations in the subgrade are reproduced in the pavement surface. It can therefore readily be seen that it is important to obtain a smooth, uniform grade, particularly in the track paths of the slip-form paver. The subgrade must also be true in cross section between the track paths of the paving machine, without any crown, because high subgrade will result in less than minimum permissible thickness of pavement.

During the process of spreading the cement treated material with motor graders to hubs or stakes set to finished subgrade elevation, a wavy or undulating grade line is usually developed. Profilograph readings taken on the completed subgrade show that this condition exists, with the length of the waves or undulations conforming to the staked grade points. The maximum variation occurs at the edge of the cement treated subgrade over the hub or stake line. If these waves or undulations are very large, they will show as excess roughness in profilograph readings.

Profile Index

Contract specifications required that the profile index of the completed subgrade as measured by the profilograph in accordance with methods in use by the Materials and Research Laboratory of the Division of Highways, should not exceed the rate of 10 inches per mile for any one-tenth-mile section along any line parallel to the edge of pavement. Any deviations which produced a greater profile index rate were reduced by additional trimming.

The profilogram obtained on the completed subgrade was used to locate rough spots and holes in the track paths of the slip-form paver. These spots were then smoothed out by padding with a dry pack mixture of sand and cement to provide a uniform surface for the tracks of the paving machine.

The care and precision with which this padding operation was done was immediately reflected in the smoothness of the concrete pavement placed by the slip-form paver.

Much of the grade line control previously obtained by the use of side forms for concrete paving and cement treated subgrade operations is no longer present in slip-form paving methods.

Westside Freeway

A Progress Report on Interstate Planning *

By GEORGE LANGSNER, Assistant State Highway Engineer, and M. E. CORNELIUS, Assistant Project Engineer

INTERSTATE Route 5 is the most westerly north-south highway which is to become a part of the National System of Interstate and Defense Highways (Plate 1). Interstate Route 5 (including 5E) will span California from south to north from the Mexican border south of the City of San Diego to the Oregon line north of the City of Yreka, a distance of 796 miles.

From the Mexican border through San Diego to Los Angeles, this Interstate Highway will follow portions, or relocations, of US 101. Through Los Angeles and over the Tehachapi Mountains to Wheeler Ridge at the south end of the San Joaquin Valley some 40 miles southerly of the City of Bakersfield, it will follow US 99. At Wheeler Ridge, Interstate 5 leaves US 99 to follow new alignment for approximately 315 miles until it joins US 99W near the City of Woodland about 2.0 miles northwest of Sacramento. From Woodland north to the Oregon line, it will be on US 99W and US 99, or their relocations.

This paper is confined to those portions of Interstate Route 5 in California which are on completely new alignment between Wheeler Ridge on US 99 south of Bakersfield to Woodland northwest of Sacramento. As this road will traverse the west side of the San Joaquin Valley, it is known locally as the Westside Freeway.

Route Adoption Status

In California, the legislative description of a route is quite general; it defines the route termini, with possibly one or two intermediate controls. The California Highway Commission, an appointive seven-man body serving fixed terms, under powers delegated by the Legislature, adopts the location of State Highway routes between the designated termini. The State Highway Engineer and his staff are advisers on route matters to the California Highway Commission.

The long-established route adoption procedure of the California Highway Commission conforms to the require-

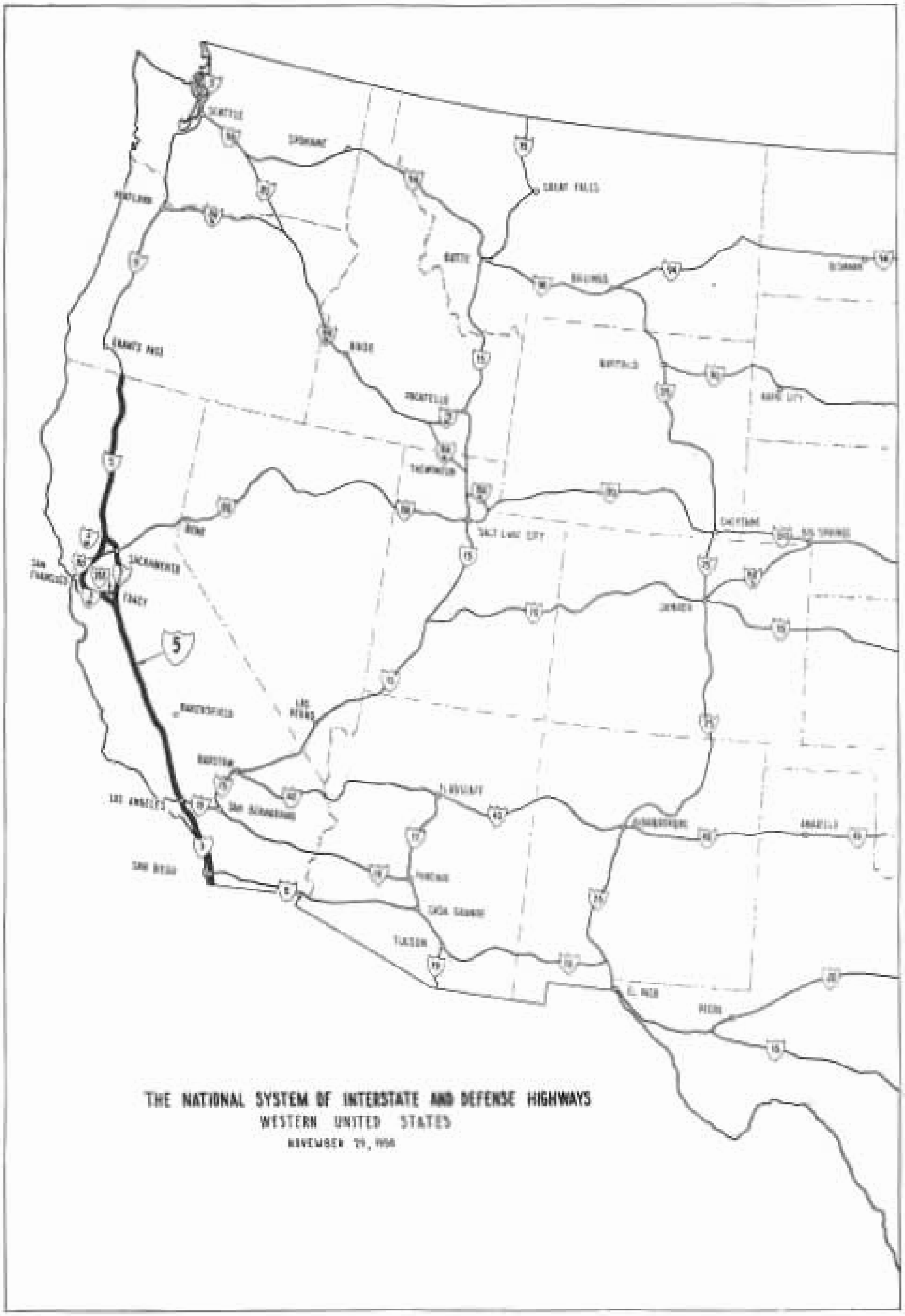


Plate 1. Interstate Route 5 is the most westerly north-south route in the National System.

* This paper was presented at the Reno Convention of the American Society of Civil Engineers Highway Division Session June 23, 1960.

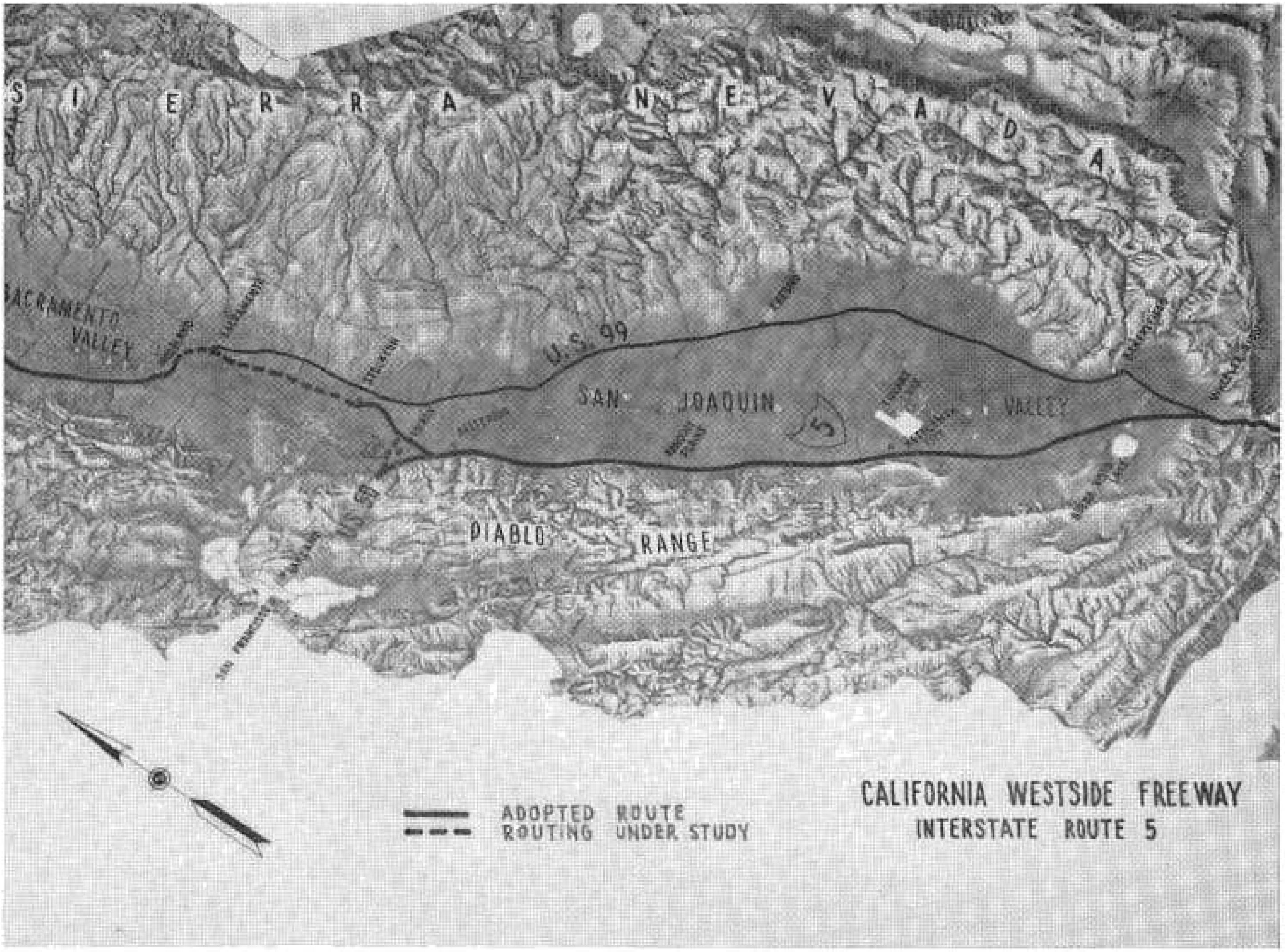


Plate 2. The California Highway Commission has adopted 256 miles of the Westside Freeway from its south terminus near Wheeler Ridge to just north of Stockton.

ments of the 1956 Federal Aid Highway Act. Briefly, it calls for conferences with local technical and planning staffs prior to and during route studies; well-publicized public meetings at which pertinent data are presented and on which comments are made by local people; a recommendation to the commission by the State Highway Engineer for adoption of a route and its declaration as a freeway; consideration of the recommendation by the commission and the notification to local governing bodies that the route is before the commission; and, finally, the holding of a public hearing by the commission if requested by a city council or county board of supervisors or on the commission's own motion. After a hearing, if held, and further consideration the commission adopts the freeway route.

Meetings Are Held

As of June 1, 1960, nine well-publicized public meetings have been held on the locations for the Westside Freeway. Preceding these public meetings, public information meetings were held with local governing bodies and interested local groups together with public displays of maps showing the numerous alternates considered. The map displays were shown at most of the incorporated cities located along or near the alternates under study. Following these public meetings, three public hearings were held by the California Highway Commission on portions now adopted.

As of June 1, 1960, the commission has adopted 256 miles of the Westside Freeway from its southerly terminus near Wheeler Ridge to just north of the City of Stockton (Plate 2). It also has adopted 16 miles of the routing of the connection for Interstate 5W to existing US 50 west of Tracy, which connection is considered a part of the Westside Freeway. Present indications are that the commission should be able to consider adoption of an additional 32 miles of the Westside Freeway between Stockton and south of Sacramento sometime late in the summer or early fall of 1960. The next 20 miles through and adjacent to the City of Sacramento is under study. The last seven miles of this freeway to its terminus at its junction with US 99W near Woodland has been adopted.

Future Traffic

Most of the travel through the San Joaquin Valley presently passes through the largest cities in the valley, which are on US 99. The anticipated

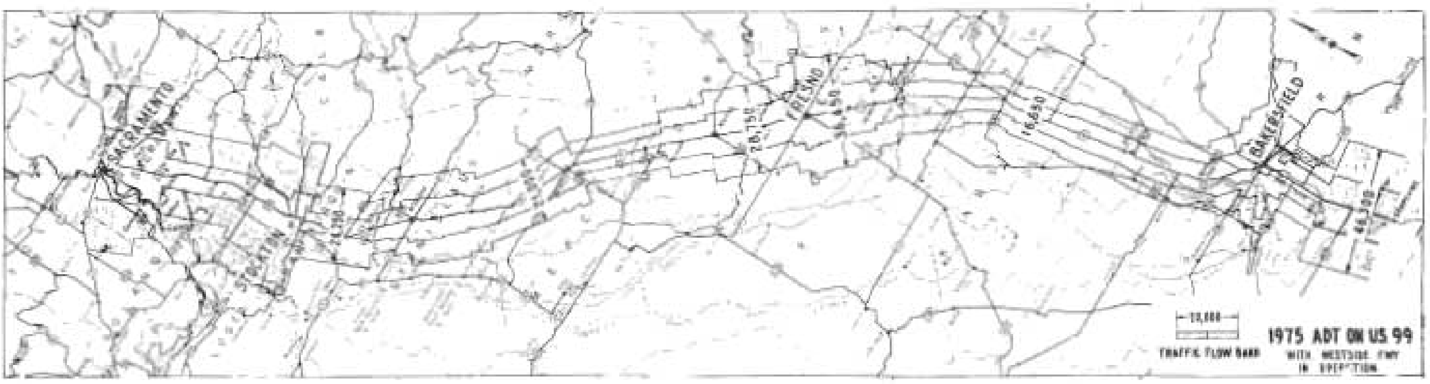


Plate 3. The anticipated 1975 average daily traffic which will be using US 99 after the Westside Freeway is completed is shown above.

1975 average daily traffic which will be using both facilities after the Westside Freeway is constructed is shown on Plates 3 and 4. Both US 99, sometimes called the Golden State Highway, and the new Interstate 5, the Westside Freeway, are necessary to provide the additional traffic capacity needed through the valley to keep pace with the population growth and agricultural and industrial development of California.

When the Westside Freeway is completed, it will afford a substantial distance savings to through traffic. For travel between the San Francisco-Oakland metropolitan area and the Southern California metropolitan area, the approximate distance savings of the Westside Freeway over use of US 99 and US 50 will be 20 miles and over use of US 101 will be 43 miles. Between Los Angeles and Sacramento the driving distance will be reduced six miles over the present US 99.

The distance savings to through traffic which will be afforded by the Westside Freeway, combined with the rural character of the route, will encourage its use by heavy through trucking. Studies indicate that approximately 25 percent of the traffic on this route will be trucks, with 60 percent having five axles.

First Study

The first formal overall study of a route similar to the Westside Freeway was made in 1950, in response to a directive of the Legislature that the Division of Highways investigate the feasibility of a toll road between Los Angeles and San Francisco to be financed by the issuance of toll revenue bonds. The division's report to the Legislature concluded that a toll road between Los Angeles and San Francisco was not financially feasible at that time. Primarily, this was because such a toll road would be faced with the competition of free parallel routes which were being converted to freeways.

The data accumulated during this toll road study proved helpful when the division was directed by the 1956 Legislature to investigate the feasibility and cost of constructing a high-speed highway on the west side of the San Joaquin Valley between Woodland and the Grapevine (the Grapevine Grade at the south end of the valley). This report concluded that such a highway was feasible and would cost approximately $261,000,000. The 1957 Legislature then added the route to the state highway system. Immediately, the division commenced detailed route location studies to determine highway user costs and savings, construction costs, and pertinent community factors on various alternates for the California Highway Commission's consideration in determining the precise location.

Location Controls

The relief map, Plate 2, illustrates how the Westside Freeway fits into the topography and shows the location which the commission has adopted from Wheeler Ridge to north of the City of Stockton.

From the south end of the new alignment at Wheeler Ridge to near Patterson, about 35 miles south of Stockton, the location problem was

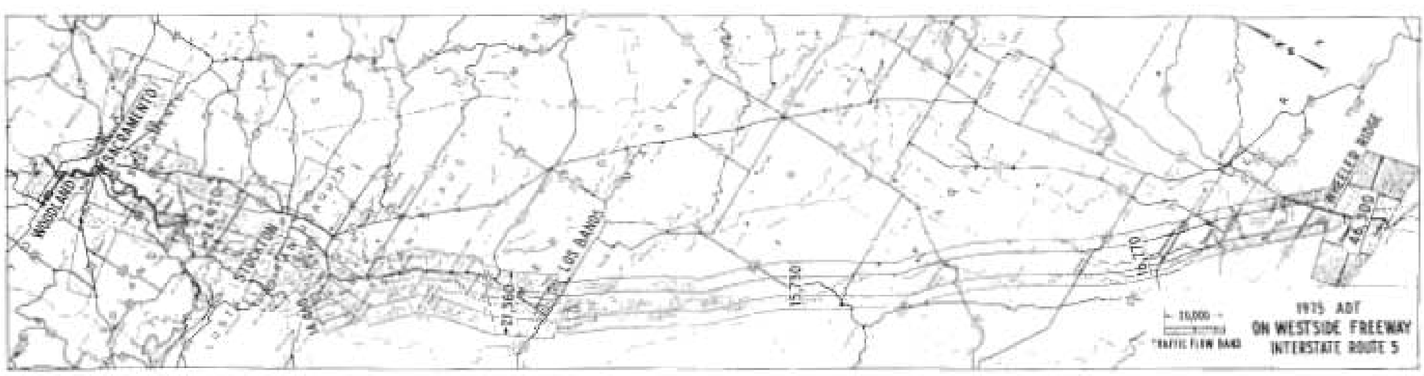


Plate 4. The anticipated 1975 average daily traffic which will be using the Westside Freeway following its completion is shown above.

one of selecting a route for but one major highway. From Patterson north to Stockton the problem was one of determining the best plan for a system of interstate and state highways in a large area centering about the City of Tracy. Through the City of Stockton the problem was one of selecting a routing which would fit into an overall transportation and master plan for the City of Stockton. The remaining routes from Stockton through Sacramento are under study. The varying nature of the route location problem necessitated a route location study for each of these three general areas.

The Diablo Mountain Range, shown on Plate 2, serves as a westerly control in the vicinity of Patterson and in the areas northerly and southerly of the Panoche Plains. It also illustrates the location of the Kettleman Hills, westerly of Kettleman City, which are an important terrain control. From Kettleman City south, the flood beds of the Kern River, of which Buena Vista Lake and Tulare Lake are a part, influenced the route location.

Various Routings

Most of the various routings and combinations of routings which were studied from Patterson south are shown on Plate 5. The Diablo Mountain Range and the Crows Landing Naval Air Station, just south of Patterson, restricted the routing selection to a narrow corridor in this area. The Diablo Range is also a westerly control in the area southerly of Los Banos, and in the area northerly of Coalinga. The Kettleman Hills previously mentioned lie between Kettleman City and Avenal. The Kern River headwaters in the Sierra Nevada Mountains north and easterly of Bakersfield and its channel passes just north of that city. In seasons of flood the Kern River empties into Buena Vista Lake, located some 25 miles southwesterly of the City of Bakersfield. When Buena Vista Lake fills and overflows the waters flow northward through a broad flood channel to Tulare Lake, easterly of Kettleman City.

The direct routing alternate designated as Line 1 would require approximately 29 miles of six- to eight-foot high embankment to cross this flood plain. The Line 4 alternate which passes closer to the town of Lost Hills requires like embankment construction for only four miles to cross the flood plain and is 0.3 mile longer than Line 1. All factors considered, Line 4 is the most economical location between Wheeler Ridge and Kettleman City and is the route adopted by the California Highway Commission. Other lines and combinations that were studied are also shown on this plate.

Other Factors

While the mountains and inundation areas already mentioned were major physical controls, there were other factors which influenced the determination of the route adoption. Among these factors were: (1) the location of existing major utility lines; (2) the projected location of the future Feather River Aqueduct to Southern California; (3) shallow subsidence areas; and (4) the local economy of the area traversed.

Numerous large oil, gas and power transmission lines parallel the general routing of the Westside Freeway along the west side of the San Joaquin Valley. These facilities present no unusual problems but quite naturally influenced the detailed position of the routes studied in many areas to minimize utility relocation.

A major and fundamental part of the California Water Plan is a proposed canal along the west side of the San Joaquin Valley for the transport of Feather River water to the lower San Joaquin Valley and to the metropolitan areas of Southern California. Engineering responsibility for this facility rests with the California Department of Water Resources.

The Division of Highways of the Department of Public Works and the Department of Water Resources have co-operated closely in the location and design studies for both the Westside Freeway and the Feather River Canal so as to minimize conflict, cost and right of way damages where the two facilities will be close together. Land acquisition by one agency for both facilities will be done wherever possible.

Subsidence

Because the freeway alignment is not controlled by grade in relatively flat terrain, the Division of Highways can avoid much of the subsidence problem which is of great concern to the Department of Water Resources in areas such as the Panoche Plains. Referring again to Plate 5 the westerly swing of the adopted line (Line 4-B) through the Panoche Plains area was made to skirt irrigated lands in this area of known subsidence.

There are two types of land subsidence which have occurred and are

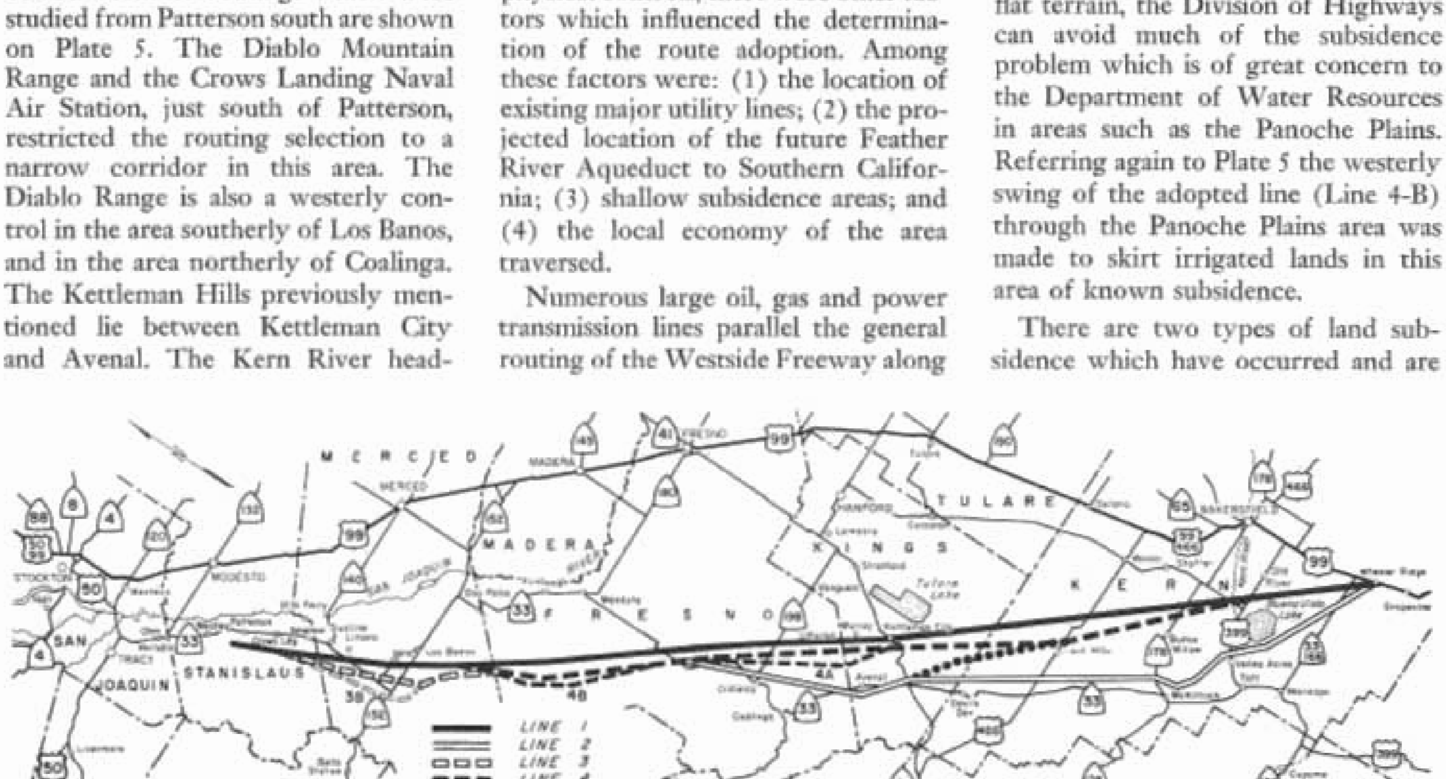


Plate 5. The various routings and combinations of routings which were studied from the Patterson area south are shown above.

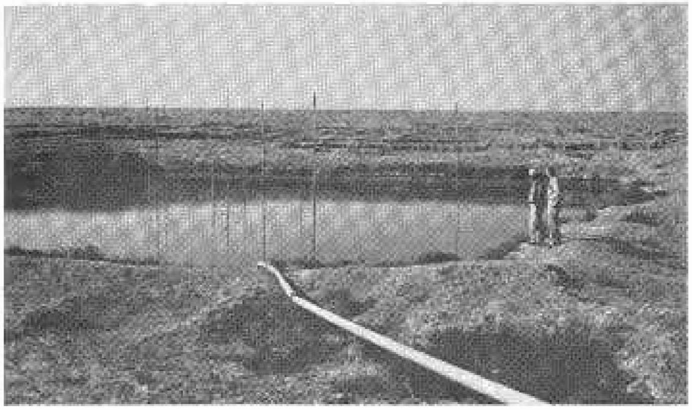


Plate 6. The Department of Water Resources subsidence test pond after 14 months of operation.

Plate 7. The Department of Water Resources subsidence test plot after six months of operation.

occurring in the San Joaquin Valley.* One type is known as deep subsidence and is occurring because of the continuing extraction of ground water from below the water table. This type of subsidence affects a large area and is quite gradual. The second type, shallow subsidence, occurs above the water table and progresses from the ground surface down. It is relatively more localized and results from the consolidation of loosely compacted native soils above the water table by the addition of surface water.

The native silts of the Panoche Plains have been deposited in such a loosely consolidated natural state that they readily consolidate upon application of water. The two photographs of Plates 6 and 7 illustrate the nature of shallow subsidence. These pictures are of subsidence test plots of the California Department of Water Resources. The first photograph is of a test pond after 14 months of operation at which time the vertical displacement was more than nine feet. The second photograph is of a test plot six months after water was added to the vertical reservoir pipe just visible in the bottom of the subsidence hole.

* An interagency committee to study land subsidence in the San Joaquin Valley was established in 1954, representing:
(a) Federal Agencies
Bureau of Reclamation, Geological Survey, Coast and Geodetic Survey, Corps of Engineers, U. S. Soil Conservation Service.
(b) State Agencies
California Department of Water Resources, California Department of Public Works—Division of Highways.
(c) Universities
University of California—Davis, Stanford University.

Subsidence Phenomenon

The two photographs of Plates 8 and 9 illustrate this subsidence phenomenon when it is induced by more "natural" causes. The subsidence observed in the upper photograph resulted from the flow of water in the now abandoned irrigation ditch delineated by the row of trees. The lower photograph illustrates the subsidence occasioned by surface irrigation of the land on the right. When this photograph was taken the field to the right had been under surface irrigation for four seasons. The five-foot difference in elevation noted in the photograph is due only to shallow subsidence—no land leveling or earth removal by man was done.

Shallow subsidence in the Panoche Plains area is a problem of considerable magnitude which the staff of the Department of Water Resources is now solving. The Division of Highways is somewhat more fortunate. By bowing the Westside Freeway to the west so as to be higher and closer to the foothills across the Panoche Plains, most of the areas of known shallow subsidence could be avoided. The California Highway Commission adopted this location. Wherever the freeway is not entirely clear of suspected subsidence areas, additional width of right-of-way will be purchased so as to increase the distance from the roadway when and if the adjacent lands are brought under irrigation.

Agricultural Economy

California leads the nation in the value of agricultural products produced. $3.6 billion in 1959, the eight

Plate 8. Shallow subsidence occasioned by a new abandoned irrigation ditch.

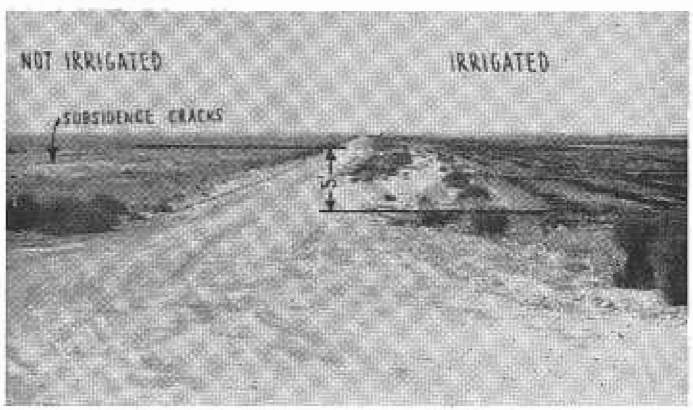
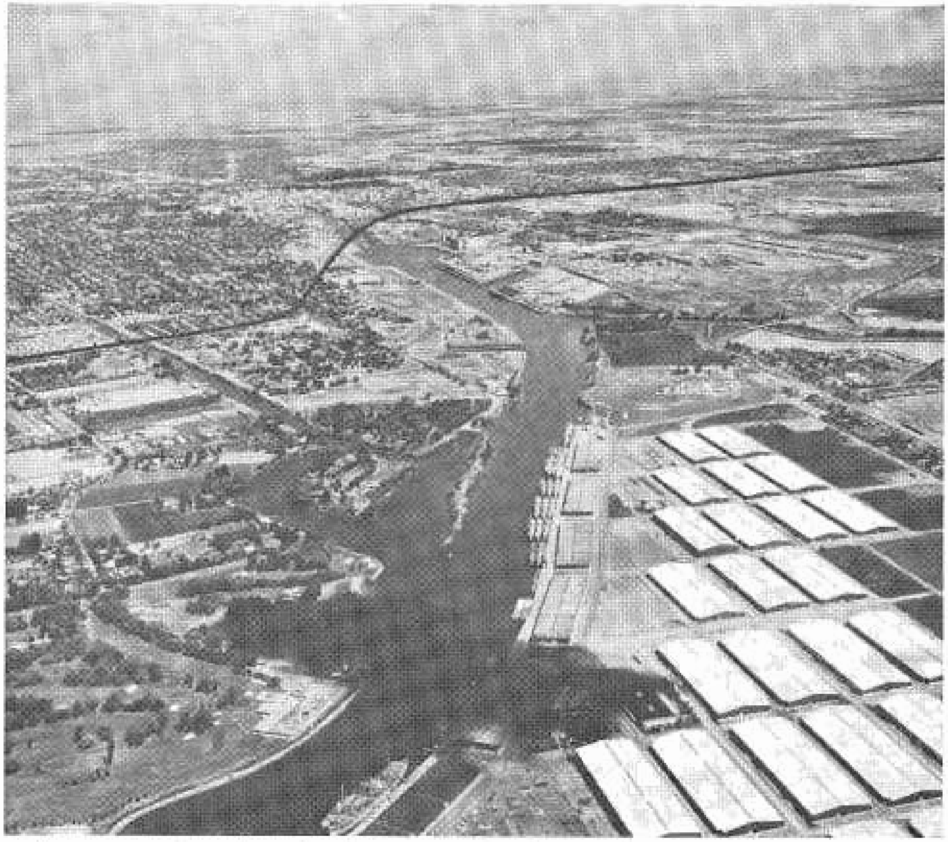
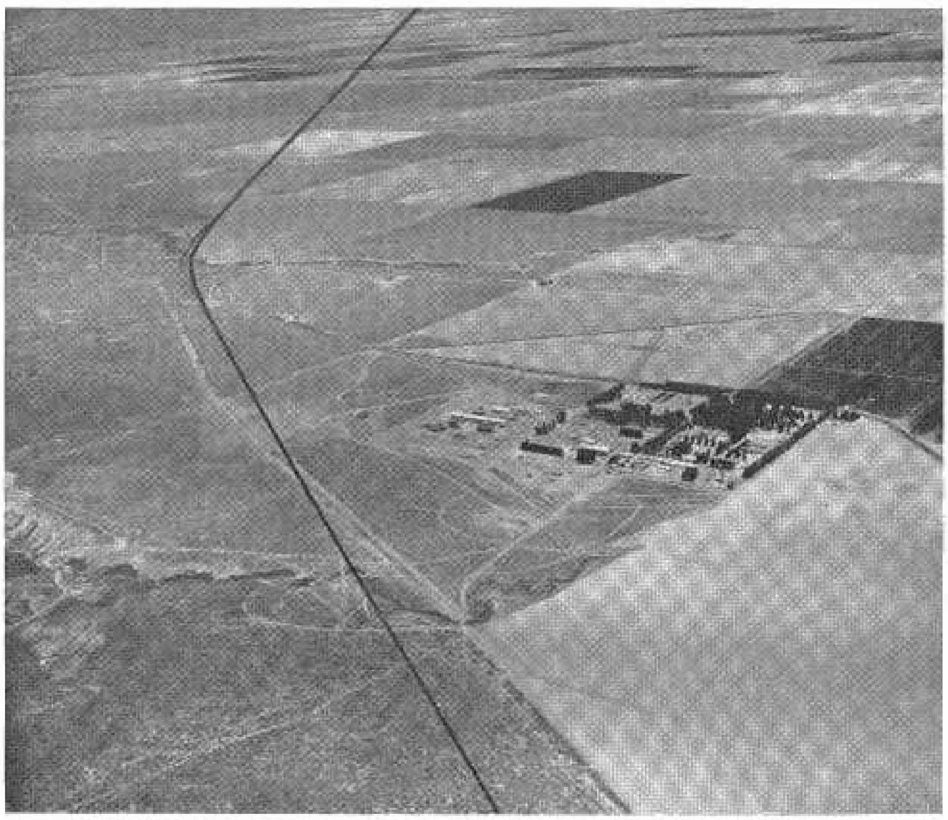


Plate 9. An example of shallow subsidence due to surface irrigation.



Looking east toward Stockton. The adopted routing for the Westside Freeway is shown by the superimposed line.



Adopted Westside Freeway routing. Looking north from the junction of Lassen Avenue and Avenal Cutoff Road.

counties through which the Westside Freeway passes, $995 million. The San Joaquin Valley contributes more to the State's total than any other agricultural region of the State. The diversified crops which are grown on the irrigated lands of the central valleys of California include many varieties of vegetables, fruits, melons and seed crops, as well as staples such as cotton, grains, alfalfa and other feed crops. The counties of this area are also heavy producers of livestock, meats and dairy products. The following tabulation indicates the importance of agriculture in the counties which are traversed by the Westside Freeway:

County (south to north)	Value of agricultural production (1959) *	State rank * (58 counties)	National rank * (3,102 counties)
Kern	$210,000,000	2	2
Kings	72,000,000	15	21
Fresno	260,000,000	1	1
Merced	93,000,000	12	17
Stanislaus	126,000,000	7	9
San Joaquin	125,000,000	5	6
Sacramento	55,000,000	19	31
Yolo	54,000,000	20	35

* Data furnished by the California State Department of Agriculture.

The adopted route across the Panoche Plains also kept at a minimum the area of developed and irrigated lands to be taken or severed by the freeway.

The long westerly swings in the adopted line west of Los Banos and east of Coalinga were made to reduce the effect of the freeway on the agricultural economy in these areas.

These two line swings added 0.7 mile and 0.5 mile respectively to the travel distance through the San Joaquin Valley partly compensated for by a slight reduction in overall estimated initial cost. These line swings are in areas where the proposed Feather River Canal is not expected to bring on development through irrigation of lands lying westerly of presently irrigated lands.

Skirt Agricultural Areas

The limits of irrigated lands indicate the relation between the adopted route and the westerly limits of agricultural lands. The decision to skirt these agricultural areas was influenced by a study of the effects of these factors on the economy of the region made by the division's Right-of-Way Department.

The many factors that were considered during the route location studies which preceded route adoptions in the Tracy and Stockton areas and which are being considered in the route location studies from Stockton through Sacramento to Woodland will be discussed briefly. In the complex Tracy and Stockton areas the various traffic desires were determined and considered along with the varied physical features; such as the location and size of navigable waterways in the San Joaquin-Sacramento Rivers Delta area, the ship turning basin at the Port of Stockton and the location of military installations, state institutions and other major public improvements. These and other factors had to be weighed against the effect on agriculture in the rural areas and the local community needs in Stockton, a city of 90,000 people. The location within the city was tied in closely with the traffic phase of the local master plan.

The overall length of the adopted route between US 99 near Wheeler Ridge to US 50 west of Tracy is 240.8 miles. It is 1.5 miles longer than the shortest practical route and 3 miles longer than the great circle distance. It can be constructed at less initial cost than the shortest practical route.

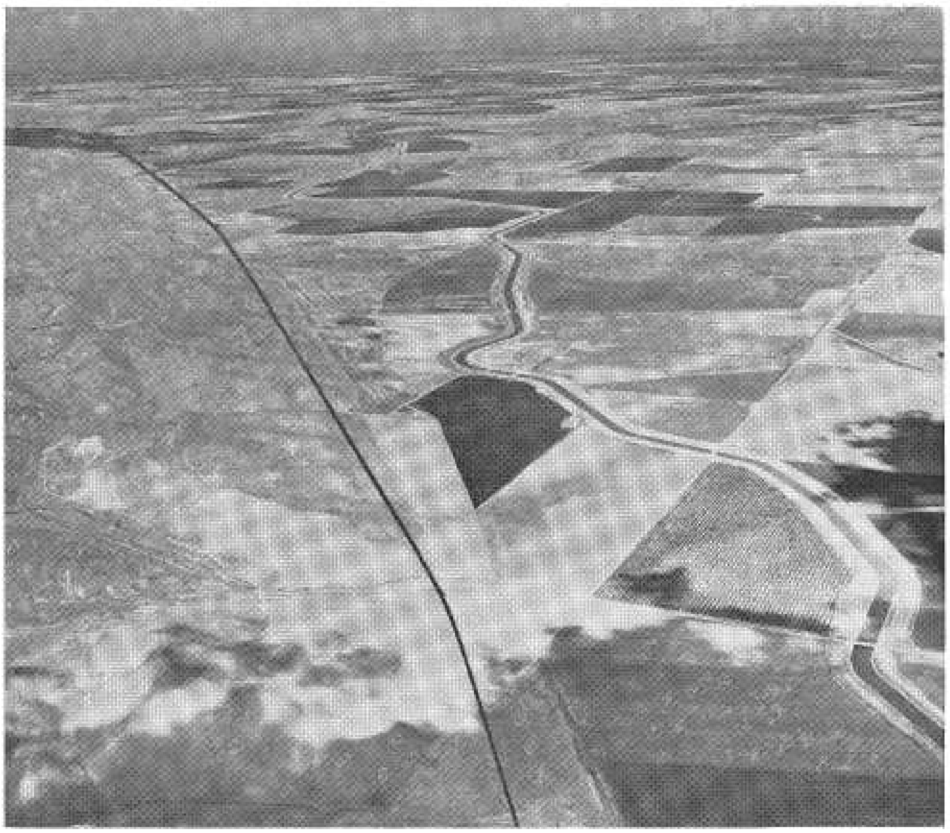
Design Mapping

Following adoption of all the route segments by the California Highway Commission for this 241-mile portion between US 99 near Wheeler Ridge and US 50 west of Tracy, the work of preparing plans and specifications for large scale (1 inch = 50 feet) photogrammetric design mapping was started. Seven mapping contracts, varying in length from 25 miles to 52 miles, were awarded and have been completed.

Design mapping specified covered a width of 1,300 to 1,400 feet, with two-foot contours and/or spot elevations. There were some interesting procedures developed for this design mapping which the following two examples illustrate.

First, it was possible, from the USGS maps used in the planning studies, to equate the projected freeway centerline for the 241 miles to

Adopted Westside Freeway routing. Looking east from above the junction of the Fresno-Coalinga Road and State Sign Route 33.



Adopted Westside Freeway routing. Looking north from Del Puerto Canyon Road, Delta-Mendota Canal at right.

the three zones of the California Co-ordinate System crossed. Some 170 miles of this 241 miles is over comparatively flat terrain where spot elevations were specified to adequately depict the ground surface for earthwork determination. In these areas it was therefore feasible to specify a cross section pattern of spot elevations to center on the previously co-ordinated and stationed centerline. As a consequence, earthwork terrain data for electronic computer input can and is being keypunched directly from prints of the resulting design maps.

Section Corner Data

Second, the methods developed to obtain data for the some 1,200 land section corners located along the 241 miles of the route which has been mapped.

To control the primary ground surveys for the mapping along centerline, basic horizontal control monuments were established by state forces at intervals of from two to five miles using electronic distance measuring equipment. The mapping contractors were required to set semipermanent monuments in the immediate vicinity of the proposed centerline at intervals of from 1,000 to 2,000 feet, and to fix their positions by second order traverses. As they would have personnel and equipment in the area to set and position these second order "mile monuments" it was advantageous to require the contractors to co-ordinate many existing specified monuments located along the mapped strip, both inside and outside the map limits.

These "existing specified monuments" were generally section corner monuments found by a two-man state crew or were temporary monuments set by these state forces in the vicinity of section corners which could not be found during the initial search. These provided a convenient co-ordinate tie point to aid in further search. To avoid confusion with true corners, these temporary monuments were destroyed after use in the return search for the corner by the division's engineers.

These two examples are illustrative of several that have been employed during the planning and mapping phases for this highway to minimize the amount of work and time required during actual design. The Westside Freeway project is particularly well suited to the development and application of improved methods similar to the above.

Four-lane Construction

Design work on the 241 miles which have already been mapped for design purposes between US 99 and US 50 is well under way. Initial construction will be four lanes with a minimum 84-foot median width. Some 16½ miles of independent alignments for the two roadbeds are used where they best fit the terrain. The minimum radius of curvature will be 5,000 feet.

Independent grade lines for the two roadbeds will be used throughout. In general, and with few exceptions, such as at railroad overheads, maximum ascending grade rate will be two (2) percent and descending will be three (3) percent.

Construction of this route will depend on the availability of Interstate financing. The acquisition of right-of-way will start after July 1, 1960, as basic design features to ascertain right-of-way needs are nearing completion on the 241 miles south of Tracy.

Development of the Westside Freeway is unique from the standpoint of the California Division of Highways, as it is the longest single project on entirely new alignment ever undertaken. The foregoing at least provides a bird's-eye view of the nature of this project and the progress that has been made on it to date.

COUNTY PLAN

Continued from page 20 . . .

ultimately be necessary for the preservation of a good local traffic pattern.

During the development of the SCR 26 study and the SCR 62 study, the existence of a master plan has greatly simplified the planning phases of these two far-reaching surveys. The mere fact that we had an overall plan for Orange County made the SCR 62 study much easier and assured the co-ordination of the study on a county-wide basis.

Similarly the arterial highway financing program has developed many advantages for Orange County. Not only have we improved intergovernmental relationships on the city-county level, but we believe that the program has definitely developed a more efficient expenditure of highway users taxes than by any other method that so far has been proposed. Our program is designed to serve the public as a whole and disregards arbitrary boundary lines, which the average motorist does not recognize.

Bridge Bids Called; Completion in 1963

The State Division of Highways has called for bids on construction of the San Pedro-Terminal Island Bridge over the main channel of Los Angeles Harbor.

Bids on the substructure contract were opened at 2 p.m. September 27 in Sacramento. The superstructure bids were opened at 10 a.m. September 28.

Total estimated cost of the entire San Pedro - Terminal Island Bridge Project, including financing, right-of-way and approach roadway costs, is $20,000,000 of which approximately $13,000,000 is budgeted for the bridge.

The project will be financed in part from $7,000,000 in Toll Bridge Authority revenue bonds. The bonds will be placed on the market next month.

The remaining money for the project will be provided from state highway funds and from state gas tax funds available to the City of Los Angeles and Los Angeles County.

The bridge will be Southern California's first state toll bridge. The suspension type structure with steel girder approach spans will be 6,010 feet long.

The bridge will have the third longest span in California, exceeded only by the Golden Gate and San Francisco-Oakland Bay Bridges. The main span will be 1,500 feet between towers.

The bridge towers will rise 370 feet above the water line. Vertical clearance for ships in the main channel will be 185 feet. The bridge deck will provide four traffic lanes.

Plans call for the start of approach roadway and toll plaza construction next summer. The entire project is due for completion in the summer of 1963.

The bridge will be located near the west end of Terminal Island.

Survey Controls

City, State Co-operate on Terminal Island Project

By ALLAN WHITLOCK, Assistant Highway Engineer

RECENTLY the District VII Survey Section of the State Division of Highways received valuable co-operation from the City of Los Angeles Engineering Department Surveys and Geodetic Sections in establishing initial survey controls for the San Pedro-Terminal Island Bridge construction. Preliminary engineering studies covering this bridge, for which Governor Edmund G. Brown, Assemblyman Vincent Thomas and others officially broke ground on May 28, 1960, were carried out by Supervising Bridge Engineer John W. Green, who recently retired from state service.

The bridge will span the Los Angeles Harbor main channel in the vicinity of Boschke Slough on 350-foot height suspension towers. The main span of the bridge has a water clearance of 190 feet so that the largest ships afloat can go under it. The sweeping suspension cable span with main towers 1,500 feet apart will become a major landmark for the Port of Los Angeles. The bridge will be an integral part of the freeway system linking San Pedro with Long Beach.

Accurate control of alignment for construction of the bridge, in this area of known subsidence and earth movement, requires careful engineering procedures. Because of close tolerances in the erection and assembly of components in a bridge structure of this type, precision of survey control must be of a degree which will preclude even minor accumulative errors.

Looking southwest at the site of the future San Pedro-Terminal Island Bridge showing locations of precise control survey stations.

Tellurometer slave station operator Bob Barron, Los Angeles City Engineering Department.

Barron reading Tellurometer data to recorder.

Project Is Co-operative

As a part of the joint co-operative effort by city and state forces, the City of Los Angeles Engineering Department has fielded a triangulation and Tellurometer team to establish mutually beneficial control monuments during the initial phases of this undertaking. The city's vital interest in this precise control net is very fortunate for the State. The City Surveys and Geodetic Section forces have extensive familiarity with the Los Angeles Harbor area and their current surveying practices have attained a high degree of accuracy as is most necessary in this area of frequent earth movements. Mr. Benjamin O. Badgley, Engineer of Surveys of the City of Los Angeles Survey Division, appointed Messrs. Henry Beitler, Senior Survey Supervisor; Alfred Boysen, Senior Geodetic Survey Supervisor; William Brackett, Geodetic Survey Supervisor; and Ben Pratt, San Pedro Office Survey Supervisor, to supervise the setting of four triangulation and traverse stations in this area. These points were established at strategic positions on the mainland and on the island from which distance observations have been made with the Tellurometer during daytime, and angular measurements have been obtained at night with a T-3 theodolite.

Four Stations Set Up

Control stations were placed at the intersection of Keel Street and Swinford Street, on Dock Street west of Altoona Place, on Dock Street at the westerly projection of Bayonne Place and on the southwest parapet porch of the American President Lines clock tower at the foot of Neptune Avenue. These points were tied into the existing city survey network for more extensive first order control on the island and on the mainland. This control network expansion by the city will enable the State to determine, by periodic observations, the amount of movement of the abutment piers as well as assist in the actual layout and fabrication of the bridge structure. The city intends to use these same stations for future checking of subsidence and earth movements.

It is common practice in geodetic surveying to name the stations in a net-

Bob Barron of Los Angeles City Engineering Department operating Tellurometer. Al Whitlock of State Division of Highways recording at Station "Keel."

work with some appropriate and locative title or nickname. In the case of the Island bridge control point, Station "Keel" seemed nautical enough and was located on Keel Street. Station "Hank" was named for the two Henrys who were instrumental in getting this work done, Hank Compagnon of the Division of Highways and Hank Beitler, City Engineer's Department. "Greensfolly" was the name jokingly tacked on to the major station on the Island, honoring John W. Green and his sense of humor, and Station "Hi Boy" is up on the parapet porch of the clock tower, American President Lines, 150 ± above the water.

Appreciation Expressed

In carrying out this survey control procedure, the State Division of Highways was represented by Assistant District Engineer A. D. Mayfield, District Chief of Surveys A. K. Goldin, Bridge Department Construction Engineer George Laird, Senior Bridge Engineer John Curran, Survey Supervisor Henry Compagnon, Survey Party Chief Eldon Thompson and the author. It is their considered opinion that the true meaning of the word cooperation has been demonstrated by the manner in which Los Angeles City and State of California forces worked together on this project with everyone striving for best possible results with least possible cost. It is their sincere belief that a few words of appreciation and thanks are due the engineers and officials of the City of Los Angeles for their invaluable contributions in solving this complex problem of survey control.

BUREAU ASSIGNED RESPONSIBILITY FOR NEW FEDERAL DRIVER REGISTER

Secretary of Commerce Frederick H. Mueller has designated the Bureau of Public Roads, under the direction of Federal Highway Administrator Bertram D. Tallamy, to establish and maintain the Driver Register authorized by Congress and approved by President Eisenhower on July 14. The register will serve as a clearing house to identify for the states those motor-vehicle drivers whose licenses have been revoked because of driving while intoxicated or conviction of a traffic violation resulting in loss of life.

Mueller emphasized that the federal government is not entering either the driver-licensing or traffic-law-enforcement fields. By terms of the enabling legislation, the register will be operated as a voluntary state-federal enterprise. Those states that participate will furnish the Bureau of Public Roads with identifying information on drivers whose licenses are being revoked for the specified causes, and may request the bureau to check new license applicants against the register for a record of previous revocation.

'Tempus Fugit' Corner

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

WORLD'S LARGEST BORE

A novel safety method of excavating Yerba Buena Island tunnel, the world's largest bore tunnel, was conceived by Chief Engineer Purcell of the San Francisco-Oakland Bay Bridge and his staff, the novelty of which consists chiefly in that they first build the tunnel and then dig it out.

Three bores were drilled through the island for the tunnel. The three bores, two at either lower side and one in the crown, are blocked out into a horseshoe-shaped excavation through the rocky island. This horseshoe-shaped excavation is then concrete and steel lined from three to five feet thick before the inside or core of the tunnel is dug out.

With the tunnel completely lined for more than 350 of its 540-foot length, a power shovel enters the portal to remove the thousands of cubic yards of rock within this 58 by 76-foot bore. Through this bore a four-story building could be pulled upright.

CONSTRUCTION BUDGET

The revised state highway budget for the 87th-88th fiscal years, July 1, 1935 to June 30, 1937, provided $21,545,370 for major project construction throughout the State during the biennium.

MUD FLOW

Fed from a glacier on the north slope of Mt. Shasta, Whitney Creek (also known as Midnight, or Inconstant), 10 miles northeast of Weed on US 97, flows only when the weather is warm enough to cause the melting of the glacier. During this period the flow generally reaches the highway about 5 p.m. and stops about 2 a.m., depending on the temperature.

On August 28, a warm thunder storm on the glacier caused the snow and ice to melt and the resulting flow soon assumed the proportions of an avalanche. A torrent carrying mud, rocks, and trees damaged Whitney Creek bridge, washed out 1,000 feet of S. P. track, and covered US 97 with four feet of rocks and mud.

Equipment was rushed to the scene the same night and the road again opened to traffic on August 30. G. H. Nutting was the maintenance superintendent.

THOMAS CALDECOTT HONORED IN TUNNEL RENAMING

The twin-bore Broadway Low Level Tunnel has been officially renamed Caldecott Tunnel in honor of the late Thomas E. Caldecott of Berkeley, who, as chairman of the Alameda County Board of Supervisors and President of the Alameda-Contra Costa County Joint Highway District 13 was instrumental in pushing through the ¾ mile long bore which is the longest highway tunnel in the state and one of its most heavily travelled four-lane sections. Participating in the unveiling of the sign on August 18th are, from left, rear row—J. P. Sinclair, Assistant State Highway Engineer; Assemblyman Don Mulford; Supervisor Kent Pursel of Berkeley; and Superior Judge Thomas E. Caldecott and Attorney Chester E. Caldecott; sons of the late supervisor. Front row—from left—Mrs. Chester Caldecott, Sally, 12; Mrs. Thomas E. Caldecott, widow of the supervisor; and Tommy, 9. Sally and Tommy are children of Chester Caldecott and grandchildren of the man honored by the renaming. The tunnel, completed in 1937, at a cost of $3,600,000 carries from 40,000 to 50,000 cars a day and soon is to be supplemented by a third bore for which $12,500,000 has been budgeted by the California Highway Commission. The renaming ceremony was under the auspices of the Oakland Chamber of Commerce, William A. Sparling, General Manager. A description of the new tunnel project appeared in the July-August issue of Californa Highways and Public Works.

Folsom Park

State Agencies Co-operate in Improvement of Beach Area

By E. L. MILLER, Assistant District Engineer—Operations

ONE example of the frequent co-operative enterprises between state agencies was the completion earlier this year of $300,000 in construction and improvements at Folsom Lake State Park by District III-Marysville for the Division of Beaches and Parks.

Four additional recreational units were either built or improved at this popular family play area situated roughly 25 miles northwest of Sacramento, or about five miles north of US 50 through the City of Folsom.

Two of the projects were let to contract, and two were undertaken by the district as day labor jobs.

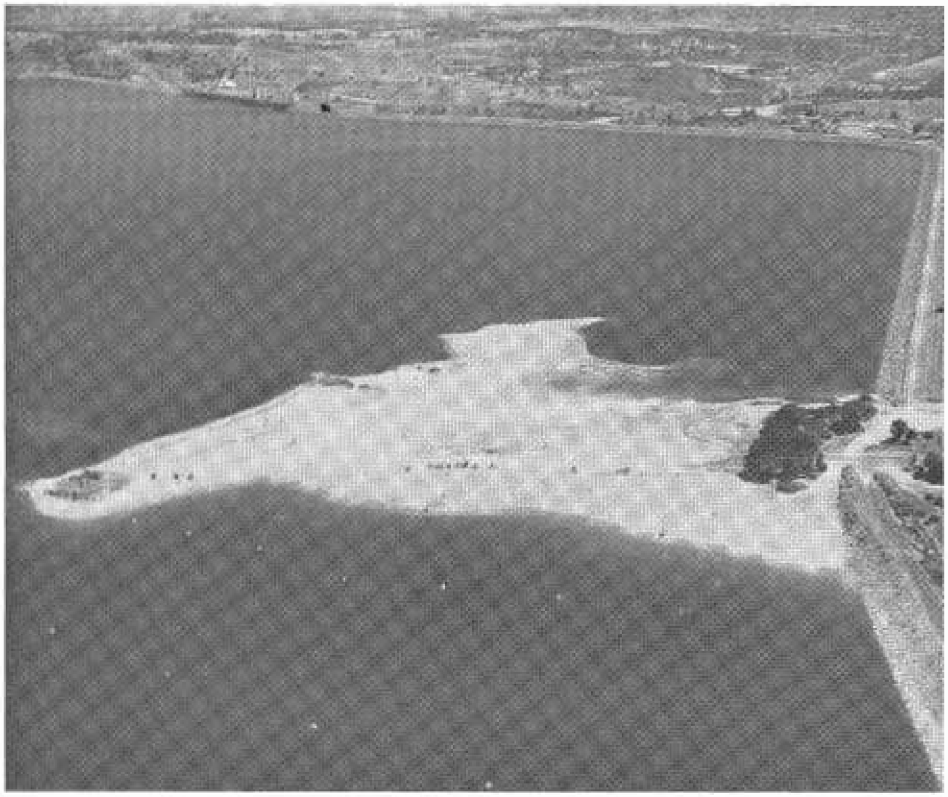
Fed by the American River on its way from the high Sierras in Placer and El Dorado Counties to its confluence with the Sacramento just north of the City of Sacramento, Folsom is one of the many man-made lakes that have made possible the spectacular boom in water sports in recent years.

Previous improvements had made the area increasingly favored by boating and water skiing enthusiasts as well as swimmers and picnickers. The 19,000-acre water playground became a focal point for the summer recreation of Northern California families.

More Funds Allocated

As a result of the growing inadequacy of the existing facilities, Beaches and Parks allocated funds for more

Looking south at Granite Bay facilities during near high water mark in June. This year's improvement of the swimming area (lower center) extended usable beach by placement of local decomposed granite below the visible beach in the photo to an area roughly bounded by the outer ring of buoys making the former rugged, rocky surface safer and more usable during low water. Entrance and connector roads, some ramps and initial beach were constructed for the Division of Beaches and Parks in 1958 under a Division of Highways contract.



Beals Point with Folsom Dam in the background. The State prison is barely visible upper right. The beach in the foreground, shown at high water, was extended to accommodate swimmers during lower lake level later in the season. The former island (extreme left) originally separated from the shore, was connected with fill. Several persons had drowned in the past while trying to swim the gap. Future plans call for paved parking space in the center and boat launching ramps on the cove at the far side of the point.

boat launching ramps, improved beaches, parking space, and public conveniences, and asked Highways to develop plans, administer the contracts, and supervise construction.

The agreement was executed.

Completion of the newest units has caused an even more than usual yearly increase in park visitors. In fact, Folsom ranked first in popularity over all the 150-plus units in the state park system during this year's Fourth of July holidays with a total attendance of 35,000.

The number of persons using all Folsom's recreational areas this year is well over that of last, and, if the trend continues, the season should wind up with a record-smashing 3,000,000 using the park's public facilities. Last year's total was slightly over 2,000,000.

These figures and estimates, supplied by former Park Supervisor Richard L. Brock, include the entire park area--both the developed and undeveloped regions.

Largest Project

Largest of the four newest projects was the $135,000 installation at the Lake Natoma unit located approximately two miles downstream from the dam and main lake. The job included four boat ramps, access roads, parking lots for cars and trailers, and a kiosk-type office building. Previously the area was undeveloped and covered with cobbles from former gold dredging operations. Brighton Sand & Gravel Company of Sacramento was the contractor. Harold J. Levernier was the resident engineer.

The Mormon Island unit on the main lake shore received a ramp, roadways, parking, and an office building at a cost of $92,000. Claude C. Wood of Lodi was the contractor, and Levernier the resident.

At the other two locations on the main lake, the terrain was graded and shaped to extend existing beaches and swimming areas. The work at Beals Point included approximately 30 acres, and at Granite Bay about 12. Both were handled by the district using hired labor and rented equipment. Potentially hazardous conditions were eliminated by smoothing irregularities on the beach and lake floor. A sand blanket was applied where required at several locations. Frank Gau was resident engineer for both projects.

Robert E. Biggs was construction engineer for all four jobs.

Work was undertaken beginning in the fall of 1959 to take advantage of the natural low level of the lake and achieve maximum effectiveness of the improvements.

An unusual sidelight on the construction of the ramps at the Lake Natoma unit was the dovetailing, through the co-operation of the U.S. Army Corps of Engineers, of the release of water from two major dams 150 air miles apart: Folsom, and Shasta Dam north of Redding, the controlling agent of the Sacramento River.

Minimum Discharge

A minimum amount of water is released daily from Folsom which results in a normal, constant variation of about six feet in Natoma, the storage reservoir behind Nimbus Dam five miles farther downstream just north of US 50. However, this was not enough to permit ramp construction to a level sufficiently low to accommodate boat launching trailers.

In order to lower Natoma, water had to be released from Nimbus and withheld at Folsom, resulting in a less than minimum discharge into the American River below Nimbus.

Beforehand, this action had to be co-ordinated by the Corps of Engineers at both Folsom and Shasta so that additional release at Shasta would tend to make up for the deficiency in the Sacramento below their confluence. At that point the American ends and the Sacramento continues south and west into the rich delta agricultural region, joins the San Joaquin and together empty into San Francisco Bay by way of the Carquinez Straights and San Pablo Bay.

Besides administering the recreational units at Folsom, the park headquarters office under the direction of Park Supervisor Glenn A. Jackson is also charged with enforcement of water safety regulations.

Richard H. Wilson

Richard H. Wilson, retired Assistant State Highway Engineer of the Division of Highways, died on August 14 following a short illness.

An engineer of wide experience, Wilson was in charge of the administrative functions of the division at the time of his retirement in 1957 which included those of city and city cooperative projects, county and county co-operative projects, service and supply and office engineer.

Born in Leitchfield, Kentucky, he attended George Washington University and received his degree in civil engineering from the University of Michigan in 1912. Wilson came to work for the California Division of Highways in 1912 as a resident engineer in Willits. From 1915 to 1927 he was with the Washington State Highway Department, first as resident and later as district engineer. During World War I he served with the 20th Engineers, rising from private to first lieutenant.

Wilson returned to the California Division of Highways in 1927 as Maintenance Engineer in District I (Eureka). After serving as Office Engineer and Principal Highway Engineer in the Sacramento Headquarters Office, he was appointed Assistant State Highway Engineer—Administration, in 1947.

Wilson was a committeeman of the American Association of State Highway Officials. He was also a member of the Western Association of State Highway Officials, the American Society of Civil Engineers and the American Concrete Institute. He was a member of the Chanters, Ben Ali Temple, American Legion Post No. 61 and Phi Kappa Sigma fraternity.

Wilson is survived by his wife, Agnes, a daughter, Betty Jo, of Sacramento, a son, Jack, of Los Angeles, and a granddaughter.

August tabulations of the Right of Way Department of the Division of Highways showed that during the month of July 590 parcels of land were acquired at a cost of $6,597,893.

CALIFORNIA WINS 10th I.T.E. AWARD IN 12 YEARS

Presentation of a national award to California for excellence in traffic engineering during 1959 was made in the office of Governor Edmund G. Brown on September 2. Participants are, left to right, State Highway Engineer J. C. Womack; Governor Brown; Ross T. Shoaf of San Francisco, past president of the Western Section, Institute of Traffic Engineers; Traffic Engineer George M. Webb of the Division of Highways; and State Director of Public Works Robert B. Bradford.

For the 10th time since 1948, California has received an award from the Institute of Traffic Engineers for excellence in its traffic engineering program.

The latest certificate, presented to Governor Edmund G. Brown on September 2, 1960, by Past President Ross T. Shoaf of the I.T.E.'s Western Section, was one of two such national awards for achievement during 1959. Michigan was the other recipient among the large states.

The award was voted by a committee of judges representing the I.T.E. on the basis of reports submitted by the various states in the annual inventory of traffic safety activities conducted by the National Safety Council.

"The continued high level maintained by your Division of Highways in the performance of the traffic engineering function must be a great satisfaction to you," Edward G. Wetzel, president of the institute, wrote the Governor. "We compliment the State of California for its efforts in this area so important to the safety and convenience of the motorists using California's highways."

U.C.L.A. Will Host Job Study Group

Universally applicable problems in engineering and management will be considered by a universal audience of engineers and managers for 10 days beginning January 23d on the UCLA campus.

University of California Extension has issued invitations to representatives of every major country in the world and the 1961 conference will mark the seventh year that the course has been given.

According to the co-ordinator, Reno Cole of the University Engineering Department, participants will have a choice of 23 subjects being taught by 30 professors, industry specialists and managerial consultants.

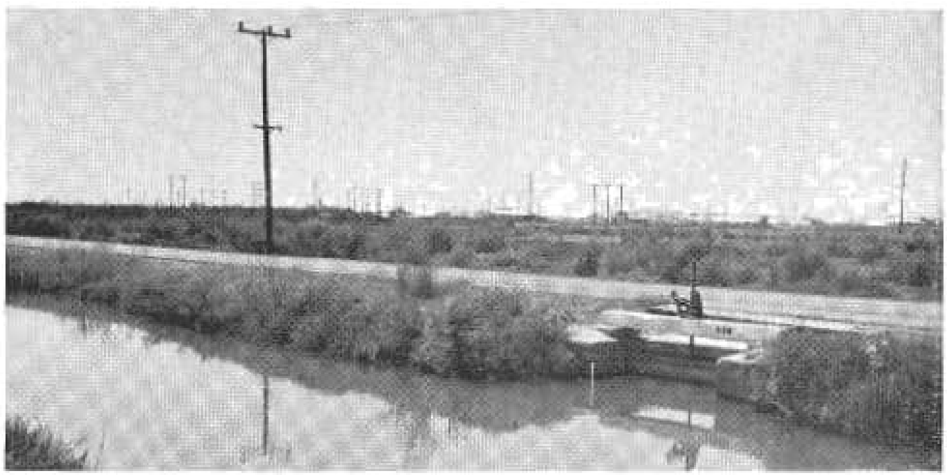
Dogwood Road

Modern 16-mile Highway Replaces Graveled Road in Imperial County

By D. E. PIERSON, Road Commissioner, Imperial County

The recently completed project on Dogwood Road concludes the improvement of this 16.5-mile Imperial County highway between the community of Heber, located six miles southeast of El Centro on US 99, and the City of Brawley.

This County Federal-Aid Secondary Route, 1262, was constructed over a two-year period as two separate FAS contracts. The first of these, completed in June 1959 at a total cost of $411,720, includes the southern 3.5 miles and the northern 4.0 miles of the route. The central 9.0 miles cost approximately $442,800 and was completed in June of this year.



Looking southwest toward the City of El Centro with Dogwood Canal in the foreground paralleling Dogwood Road.

Dogwood Road is a north-south facility traversing the heart of Imperial County's irrigated valley. The area served is devoted to extensive agricultural crops including sugar beets, lettuce, carrots, tomatoes, melons and alfalfa. Since Dogwood Road provides access from adjacent farms to the two largest Imperial County Cities, El Centro and Brawley, the construction of this route truly qualified as a "farm to market" FAS improvement.

Had Gravel Surfacing

Prior to construction this route existed as a partially graveled road, 22 to 28 feet wide, on generally tangent alignment and level grades, and at an elevation approximately equal to adjacent fields. The improvement made along the existing traveled way consists of road-mixed surfacing over imported base and subbase for a total structural section thickness of 21 inches, and a width of 24 feet for the northern 8.5 miles and 26 feet for the southern 8.0 miles. Graded roadbed width is 32 and 34 feet respectively.

An irrigation canal exists adjacent to Dogwood Road over a large portion of the route and the resulting seepage from the canal presents a problem in providing a stable roadbed. This problem has been minimized consistent with economy by designing the grade of Dogwood Road 2 to 2½ feet above adjacent fields. The need for raising the grade as high above existing ground as practical necessitated importing nearly all the roadbed materials. High quality aggregates are not available in the irrigated portion of Imperial County so it was necessary to haul materials from the desert areas 20 to 30 miles to the project.

It is the practice in this county to advertise FAS projects during the fall so that most of the work can be accomplished during the winter months, the period of most favorable weather in the Imperial Valley. A great deal of competitive bidding has resulted from fall advertisements the past several years as northern California contractors are often interested in winter jobs.

Goes Through El Centro

One and one-half miles of the nine-mile project just completed passes through the easterly edge of the City of El Centro. The city agreed to help finance the portion of the project located within the city limits, and $50,000 was provided from ⅝-cent gas tax funds for this purpose.

The completion of this FAS route was therefore the result of co-operative effort by city, county, state and federal officials. Surveys and plans were made by the county over the 16.5-mile route with joint city effort for the 1.5 miles within El Centro. Materials investigations and tests, and construction engineering were accomplished by state personnel at county expense. US Bureau of Public Roads officials acted in an advisory capacity and assisted in processing of the projects.

The approximate cost of the improvement of this FAS route is summarized below:

Imperial County gas tax funds	$84,881
City of El Centro gas tax funds	50,000
State matching funds	276,816
Federal-aid secondary funds	442,823
Total	$854,520

The completion of this 16.5-mile county highway through one of the nation's richest agricultural areas serves as an illustration of the accomplishments of the FAS program in Imperial County, a program which includes co-operation among all levels of government as one of its inherent features.

At the end of July, 306 state highway contracts totaling $460,678,000 were under way, an all-time high.

Dogwood Road Reconstruction (see previous page). An aerial looking south along Dogwood Road from above Brawley. Plaza Park is in the foreground. The Southern Pacific Railroad tracks cross Dogwood Road diagonally in the background.

Mobile Lab

New Truck Unit Facilitates On-the-spot Field Tests

By F. H. KREFT, Highway Engineering Associate, District XI

"One test is worth a thousand expert guesses" . . . This quotation is generally attributed to Dr. August von Wassermann but how well it describes the valuable role of testing in the construction of our highways.

One of the most important phases of this role is in the field of quality control. Those persons associated with the inspection of materials being produced for today's highways know that this field has had increased demands. To quote C. E. Walcott, District XI Construction Engineer, "The high rate of production of the present-day contractor places a moral responsibility upon the engineer to review the contractor's plant and procedures in advance and to organize his inspection so that the question of costly corrective action due to nonspecification material does not arise."

The problems of quality control are most difficult in those instances where the material is close to borderline on a particular specification. In these cases, repeated and accurate testing is the only method of determining whether a material meets specifications or does not.

Control Difficulties

The difficulties of quality control are further complicated by the type of operation required in freeway construction. Often the production runs are short in duration because of the limited amount of roadway that can be constructed at any one stage of operation. This means that testing facilities placed at any plant on a semipermanent basis get very little use and a considerable amount of moving of testing equipment is required.

With the above impressions in mind, District XI has acquired a mobile laboratory to perform its needed tests. It has not been an easy task because the equipment department does not handle a vehicle as such. It was finally decided to use a two-ton truck with a line utility body for the basic needs. This is the type of truck that normally accompanies a district drilling rig and has numerous compartments and sections for storage. Most of these compartments have been used to hold the testing equipment that has been placed in the truck.

This equipment includes an air compressor, portable electric generator, sand shaker, sand equivalent shaker, butane range and tanks, moisture teller, field extractor, 25-gallon water tank, and a stainless steel sink. A counter has been built into the interior of the truck and with the existing facilities, it provides two work counters—24 inches deep and 10 feet long. By providing the apparatus and tools necessary, this amount of work area will allow two men to perform field testing when need be.

Radio Communication

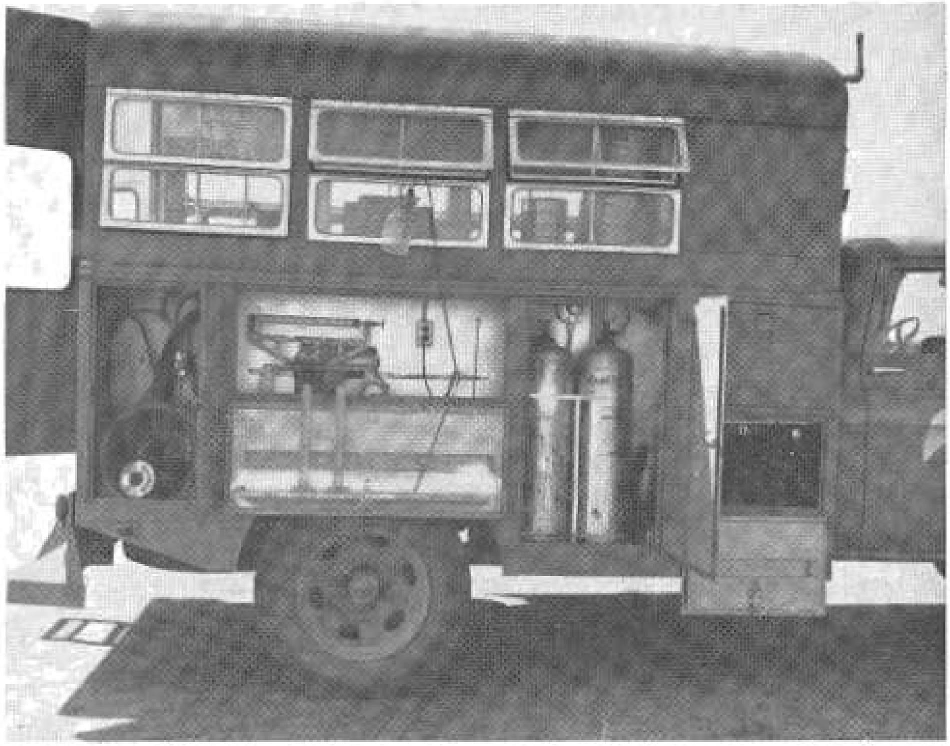
A radio has been ordered for the vehicle to provide communication between the plant inspector and the resident engineer.

According to the Headquarters Equipment Department who assembled the unit, the truck literally takes the laboratory to the field, replacing the necessity of bringing in field samples to the laboratory. Special consideration was given to clearances, weight

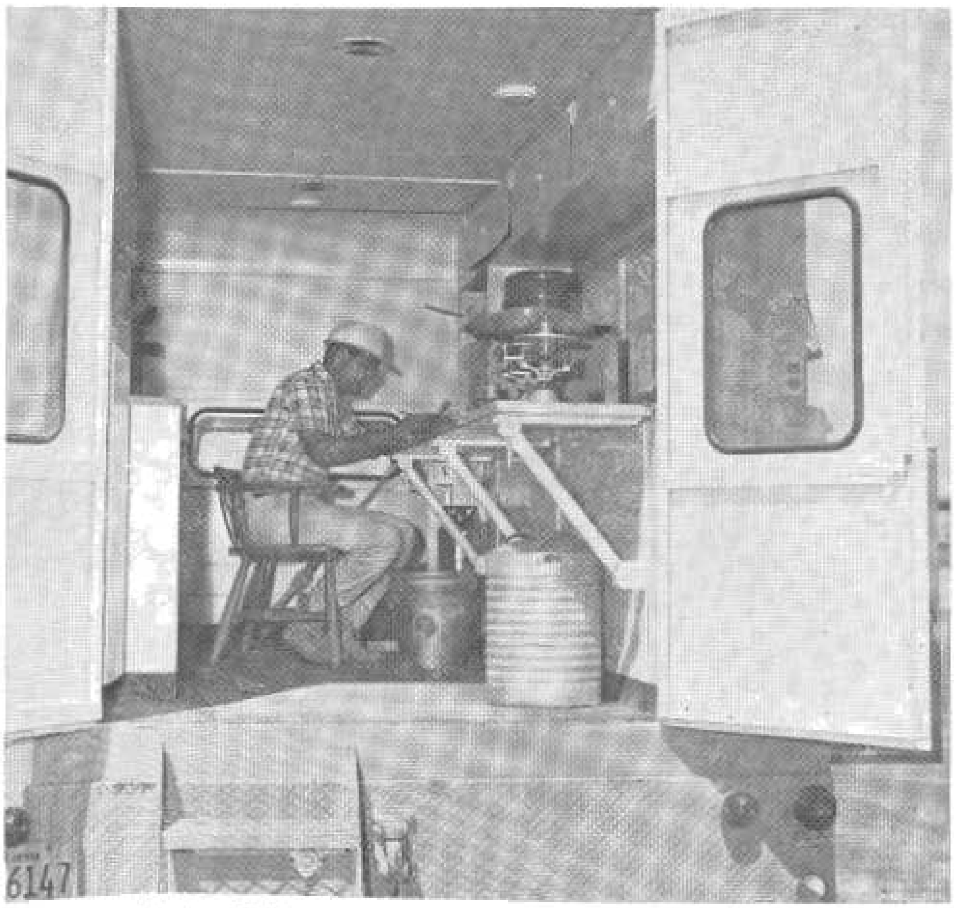
View of interior of mobile laboratory and with generator compartment door on left side of vehicle down.

distribution, and the terrain over which the unit will operate. Spaces were provided to accommodate specialized equipment necessary to operate the unit and still be within a proper weight distribution. A unit such as this special laboratory truck must have every available cubic foot properly utilized so that it may have all the necessary items on hand to do its job.

One piece of testing equipment has required special placing—the sand equivalent shaker. It was discovered that any amount of movement inside the body of the truck effected the Sand Equivalent Test results. Therefore, it was decided to place the shaker in an outside compartment. A small shelf was built on the door of the compartment for the stabbing and washing portion of the test and the bottle of working S.E. solution is hung three feet above the shelf. Upon



View of right side of mobile laboratory with compartments open, showing air compressor, butane tanks, sand equivalent test area and equipment, and storage for hoses and electrical cords.



View of interior of mobile laboratory showing work area and plant inspector performing calculations.

completion of the washing of the test sample, the S.E. cylinders are placed on an express truck bed or a small table for the 20 minute undisturbed settlement portion of the test. By placing the cylinders away from the Mobile Lab, other work can be accomplished within the lab during this 20-minute interval.

Tests Performed Rapidly

All the field control tests described in the Construction Manual can be accomplished in this vehicle as well as the determination of cement content in cement treated aggregate by the method of titration (Calif. 338A) and the determination of asphalt and moisture content of bituminous mixtures (Calif. 310-A). Furthermore, the tests are performed quickly and dependably at any location. At present, our Mobile Laboratory is working in Painted Gorge in Imperial Valley at a R.M.S. aggregate plant, many miles from power and water. It has been moved over 100 miles overnight with no particular hardship and been ready for performance the next day.

Talking About Highways — *Comments from Here and There*

The following quotes and comments about highways appeared recently in various California newspapers or were taken from other sources:

"B. W. Booker, Engineer"

"B. W. (Barney) Booker, who died of a heart ailment this week (July 18, 1960), was the highway engineer in charge of construction of most of the Bay area's existing freeway system.

"During the seven years prior to his retirement last year, Mr. Booker was Assistant State Highway Engineer for the nine Bay area counties. In all, he worked 38 years with the Division of Highways.

"Along with talent for handling the precise factual problems of engineering, his job called for the exercise of considerable political skill in dealing with touchy route location matters.

"On occasion, Mr. Booker put his own opinions bluntly. But he respected the right of others to voice their opinions, even when they were plainly wrong. He and his staff specialized in giving everyone a fair hearing.

"Mr. Booker was one of those few professional men who are called upon to adapt the democratic process to new sorts of public projects—and whose success bears heavily upon our continued freedom. We hope never to see the last of his breed."—Palo Alto *Times*.

* * *

"Mass Transportation"

"Our freeways (in Los Angeles) actually constitute a modern, mass transportation system, since they provide for the movement of literally millions of people every 24 hours. The Pasadena and San Bernardino Freeway carry about 120,000 vehicles a day, the Santa Ana 140,000, the Hollywood and Harbor Freeways over 200,000 and 350,000 vehicles use the four-level interchange daily. Even with only one or two persons per vehicle, the four-level interchange (in downtown Los Angeles) accommodates over half-a-million Los Angeles area travelers each day of the year."—Address by *J. W. McDonald, Manager, Engineering Department, Automobile Club of Southern California.*

* * *

Co-operative Planning

An editorial in the *Stockton Record* pointed out that the first annual report of the State Planning Office praised as "a very significant accomplishment" the close co-ordination of the city with the district office of the Division of Highways in planning streets and highways.

The annual report noted that a state recommended route for the Westside Freeway coincided with the alignment recommended in the Stockton General Plan. Much of this route has now been adopted by the California Highway Commission.

"Stockton has reason to point with pride," the editorial concluded, "at this official recognition of its long-range blueprint for development encompassing the entire metropolitan area. Between the lines can be read the earnest co-operative effort of city planners and state highway engineers to achieve agreement on freeway alignment."

* * *

"Excellent Highway Plans"

The *National City Star News* reported that plans for the US 101 Beltline route in the San Diego area were presented to the four local governments concerned.

"The need for the road has been so well sold and apparently so well planned," the *Star-News* commented, "there was a minimum of difficulty in obtaining preliminary approval by all four agencies.

"Also, there has been sufficient prepublicity so that the citizenry had plenty of opportunity to fully understand some of the major problems which are faced when selecting a location for a 201-foot-wide, six-lane highway. This is indeed no small task in a region which is growing and developing as fast as San Diego County. And, it is especially true in a state where highways are built on a pay-as-you-go plan and running from five to ten years behind need.

"The lack of confusion is also evidence that the public has been well informed and is testimony to the fact that when nothing is withheld, the public as a whole is always most understanding. It is also a star in the crown of district engineer Jake Dekema of the California Division of Highways."

* * *

Bayshore Freeway

Work is now in progress on a project which will complete freeway development on the Bayshore Freeway (US 101 Bypass) between San Francisco and San Jose. The opening of bids on this job inspired these editorial observations in the *San Mateo Times*:

" 'Arterial' is perhaps the best word to apply to the (Bayshore) Freeway because it is, in very truth, an artery along which flows the lifeblood of commerce and transport for all the cities of the Peninsula . . .

"Without it the Peninsula, including San Francisco, would suffer from a sort of anemia. With it, a state of good health has been preserved.

"It has become somewhat fashionable in some quarters to decry freeways . . . and to overlook their obvious benefits. This is a completely unrealistic attitude, but not an unnatural one on the part of those who have in some way been inconvenienced by the progress which freeways represent. Fortunately, these persons have not been able to appreciably delay the ultimate construction of freeways where they are needed by the bulk of the population.

"There are more freeways to be built on the Peninsula, but it is likely that the Bayshore will remain 'The Freeway' in the minds of most of the present generations. Like the roads that brought greatness to Rome, the Bayshore Freeway has already played a significant role in the advancement of the Peninsula."

Value, Not Price, Is Question

In an editorial entitled "High, Yes, But Worth It," the Tulare *Advance-Register* takes this view of the current advertising campaign calling attention to gasoline taxes:

"Being as how we pay out good money for the newspaper in which the question appeared, we would guess that we're entitled to put in our two cents worth of answer. And so the answer is: 'No, indeed!'

"The question? It appeared in something of an outsize ad inserted in a Los Angeles newspaper yesterday morning, and it read this way: 'Today, many people throughout this State think that gasoline taxes are too high. What do you think?'

"Sure, we all think that 10 cents a gallon is a pretty stiff price to pay. But are we getting our money's worth? That—and not just a simple 'Do you think that gasoline taxes are too high?'—is the real question.

"To that question, our answer—and we'd guess yours too—just has to be 'Yes, indeed.' If you're in doubt, just take a drive through California (a pretty big assignment in itself). Take a look at the fine highways, the fine secondary roads and even the fine major city streets that these gas tax moneys have financed for your convenience and driving pleasure.

"We Californians are a car-happy lot. Our State is so constructed that we just couldn't get very far in it (even if we wanted to) without one or more cars per family.

"And the very fact that all of these cars are rolling over our highways and byways every day means just one thing: Our highway building and maintenance program must go on and on and on to meet the demands made by California's motorists.

"So, what better way to finance this highway construction and upkeep than through the gasoline tax? After all, the people who pay the gasoline tax—and in sums commensurate with the amount of use they give their cars—are the ones who have brought this need for always bigger and better highways in California."

Schoellkopf Named Assistant Comptroller

Appointment of Andrew B. Schoellkopf as Assistant Comptroller of the State Department of Public Works has been announced by Robert B. Bradford, director of the department.

Schoellkopf has been on the accounting staff of the Division of of Highways for most of his 23 years of service with the State. His latest promotion, effective August 1, 1960, fills the vacancy created by the retirement of Bert Sellier, who had been Assistant Comptroller since 1945.

A. SCHOELLKOPF

In his new post, Schoellkopf's responsibilities will include Division of Highways disbursement procedures, internal audit, administration of the headquarters accounting office, and various other functions of the Department of Public Works as well as the Division of Highways under the direction of Comptroller E. Roy Higgins.

Schoellkopf is widely known in state circles as the recipient of the largest merit award for an employee suggestion ever accorded in California. In 1959 he was presented with a check for $11,808 as a result of his proposal, resulting in enabling legislation, that state funds placed in deposit by courts in condemnation cases be made available for investment by the State Treasurer. The first year his suggestion was in effect saw a gain in interest earnings to the State of more than $140,000.

He was born in San Bruno in March 1915 but has lived most of his life in Sacramento, and holds an associate in arts degree from Sacramento City College. He is a licensed public accountant.

Schoellkopf came to work for the Division of Highways as a file clerk in September 1937. In 1942 he moved to the accounting department as an intermediate clerk and moved up through the promotional ranks. He was appointed an accounting officer III in March 1957.

He is a veteran of European service with the 84th Infantry Division in World War II.

Schoellkopf and his wife, Bernice, live at 5316 Sandburg Drive, Sacramento. They have two children.

He has been active in various civic organizations, and is a past president of the River Park Improvement Association. He is a director of the California State Employees Credit Union No. 1.

F. H. 'Fair' Young Retires in L. A.

F. H. "Fair" Young, Chief Accounting Officer for District VII in Los Angeles, retired on August 1. He had been with the Division of Highways since 1936 when he came to work as a timekeeper clerk on a construction project on the Ridge Route.

F. H. YOUNG

Young was responsible for many innovations in the district's accounting setup including the present system for handling the large rental collections from state highway property in the Los Angeles area.

Young was born in Salt Lake City, Utah, and attended schools there and in Portland, Oregon, moving to California in 1930.

After coming to work for the division, Young was assigned to the District Maintenance Department in 1938 where he handled the co-ordination of the office and budget work of the maintenance field offices. He was appointed district chief clerk in 1948.

A World War I veteran, Young served with the 148th Field Artillery in France and Germany.

Young and his wife, Ethelyn, plan to do some traveling following his retirement.

As certified in July to the State Controller, total mileage of county-maintained roads increased during the 1959-60 fiscal year from 69,078 to 69,442.

AVENUE OF GIANTS PARKWAY OPENED ON HIGHWAY 101

The Avenue of the Giants, a parkway through the redwoods of Humboldt County designated by the 1960 Legislature, was dedicated August 27 with ceremonies held at High Rock.

Governor Edmund G. Brown was the principal speaker. Participating was a large contingent of state and local officials and civic leaders

The Avenue of the Giants is a section of present and former US Highway 101 extending from about Miranda on the south to the Englewood interchange of the new freeway on the north. It is nearly 25 miles in length.

When freeway work is completed the Avenue of the Giants will be maintained as a parkway by the State Division of Beaches and Parks. Heavy, fast traffic will use the freeway, permitting leisurely driving through the scenic area for appreciation of the natural magnificence of the redwoods.

(Eureka Newspapers photo)

R/W Deputy Chief E. F. Wagner Retires

Elton F. Wagner, Deputy Chief Right-of-Way Agent for the Division of Highways in Los Angeles, retired on October 1 after 31 years of service with the State.

Wagner began his state career with the design section of the division's Los Angeles office in 1929. He was appointed Deputy Chief of the Right-of-Way Department for the whole division in 1949.

E. F. WAGNER

Wagner has achieved national recognition for his work in the fields of right-of-way education and training. He served on the Educational Committee of the American Right-of-Way Association and was chairman of the Standing Committee on Education for the Right-of-Way Department of the Division of Highways. Known as one of the outstanding right-of-way technicians in the nation, he has distinguished himself by his contributions to the development of policies and procedures relative to advance purchases of highway rights-of-way.

Wagner was born in Great Falls, Montana, attended schools in Butte and later studied at the Montana State School for Mines. He spent the first seven years of his professional career in civil engineering work for hydroelectric projects in Montana and the next 2½ years on railroad location and construction in Colombia, South America, after which he joined the California Division of Highways.

Wagner is a charter member of the American Right-of-Way Association Chapter 1 of which he is now president.

Newest Highway Research Board Committee Will Acquaint Public With Latest Findings

A new committee to better acquaint the public with important findings in highway research has been established by the Highway Research Board, National Academy of Sciences-National Research Council, Washington, D.C.

Pyke Johnson, chairman of the board, has announced that John W. Gibbons, Director of Public Relations for the Automotive Safety Foundation, will serve as chairman of the newly formed Committee on Public Dissemination of Research Findings. Major duty of the committee will be to provide public information media with major results of the research reports presented to the board.

The Highway Research Board will issue nearly 100 publications this year, containing reports on several hundred research projects.

In announcing the new committee, Mr. Johnson said:

"A great many dedicated men in highway research are advancing the frontiers of knowledge in this field. In economics of highway transportation, in development of new equipment and materials for highway construction, in design of urban expressways with high capacity, in safety, in traffic control, and many, many other areas, they are producing more and more of the information this country needs in order to build better, safer highways.

"The desire of the press, we know, is to take such findings another step—that is, to interpret their significance to the particular readership they represent. We hope that the new committee can be helpful to them."

John Webb Retires, Ritz Is Appointed

John C. Webb, District Right-of-way Agent for the California Division of Highways in San Diego, retired on August 31 after 20 years with the State.

JOHN C. WEBB

John H. Ritz, Senior Right-of-way Agent in the San Diego district, has been named to succeed Webb.

Born in Duluth, Minnesota, Webb attended schools in St. Paul and then worked for various engineers as a rodman and chainman. He began his right-of-way activity with the Road Department of the County of Los Angeles in 1927. In 1940 he was appointed an assistant right-of-way agent with the Division of Highways in Fresno.

JOHN H. RITZ

From 1945 to the present time, Webb has been a district right-of-way agent in San Diego. He has been responsible for right-of-way acquisition in San Diego, Imperial, and portions of Riverside Counties, involving over 5,000 real estate transactions valued in excess of $50,000,000.

Webb is a long-time member of the American Right-of-Way Association, being a charter member of Chapter No. 1, Los Angeles. He was co-founder of the San Diego club affiliate, and helped to form San Diego Chapter No. 11 in 1955, becoming its first president. He later served as a national director in 1958 and 1959.

Webb is married and has two daughters. He plans to work as a real estate consultant in El Cajon, following his retirement.

Ritz, who succeeds Webb, is a native of Atlantic City, New Jersey, and a graduate of George Washington University in Washington, D.C.

He worked for the Federal Bureau of Investigation in Washington, D.C., from 1935 to 1940 and was an investigator for an aircraft company and for the Los Angeles District Attorney's Office between 1940 and 1947. He served as the Deputy Mayor of the City of Santa Monica from 1945 to 1946. During World War II he served with the U.S. Air Force.

Ritz is married and has a daughter.

IN MEMORIAM

District III

Leland L. Myers, Highway Landscaping Supv. I.

District IV

William Minear, Laborer.

District V

Margaret L. Hansen, Senior Stenographer-Clerk.

District VI

Martha J. Varnum, Highway Engineering Technician.

District VII

Eugene E. Blohm, Highway Equipment Oper.-Lab.; William L. Bolstad, Senior Right of Way Agent; Leopold V. Chacanaca, Highway Equipment Oper.-Lab.; Yoshito T. Inouye, Engineering Student Trainee; E. Joyce LeBell, Delineator.

District X

Charles M. Howitt, Engineering Aid I; Martin G. McIntosh, Accounting Technician III.

District XI

Audley W. McCoy, Laborer.

Shop 10

Gordon F. Geil, Fusion Welder.

The new roadway on the lower deck of the Bay Bridge has been completed and is now in use from San Francisco to Yerba Buena Island. All freeway and street connections to the lower deck have been constructed.

During the month of July, the Department of Public Works apportioned $8,163,145 to the 366 incorporated cities in California.

William Bolstad

William L. Bolstad, Senior Right-of-way Agent with the Division of Highways in Los Angeles, died on August 15 as the result of an accident.

Bolstad came to work for the division as a draftsman in the San Bernardino office in 1925. In 1927 he became Division Right-of-way Engineer for the Missouri Highway Department. In 1937 he accepted a similar post with the Kentucky department.

He rejoined the California Division of Highways Right-of-way Department in 1948 and was promoted to Senior Right-of-way Agent in 1951. Bolstad supervised right-of-way acquisition for many important freeway projects in the Los Angeles area.

A native of Deerfield, Wisconsin, Bolstad attended schools in Detroit Lakes, Minnesota. He also studied at Luther College in Decorah, Iowa, and the University of Southern California.

Bolstad was a member of the American Right-of-way Association and a Mason.

He is survived by his wife and a son, William, now employed by the division in Los Angeles.

Leo S. Fahy

Leo S. Fahy, Disbursing Officer for the State Division of Highways, died on August 15 after a short illness.

A veteran state employee with 38 years service, Fahy was in charge of payments to highway contractors which totaled $300,000,000 a year.

Fahy started his career with the State as a junior clerk with the Division of Highways in 1922. He became chief clerk of the Bridge Department in 1925 and was moved up to the disbursing officer post in 1943.

Born in Roselle Park, New York, Fahy attended schools in Newark, New Jersey. He later studied at Walton School of Commerce in Chicago and Sacramento Evening College.

Fahy served with the 56th Engineers' medical detachment during World War I.

He is survived by his wife, Grayce, who is secretary to the Assistant State Highway Engineer—Bridges.

STATE OF CALIFORNIA

EDMUND G. BROWN, *Governor*

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J. W. TRASK . . . Deputy State Highway Engineer
J. A. LEGARRA . . Assistant State Highway Engineer
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R. S. J. PIANEZZI . . . . Assistant Chief
E. M. MacDONALD . . . . Assistant Chief

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J. P. SINCLAIR . . Assistant State Highway Engineer

District VII

E. T. TELFORD . . Assistant State Highway Engineer

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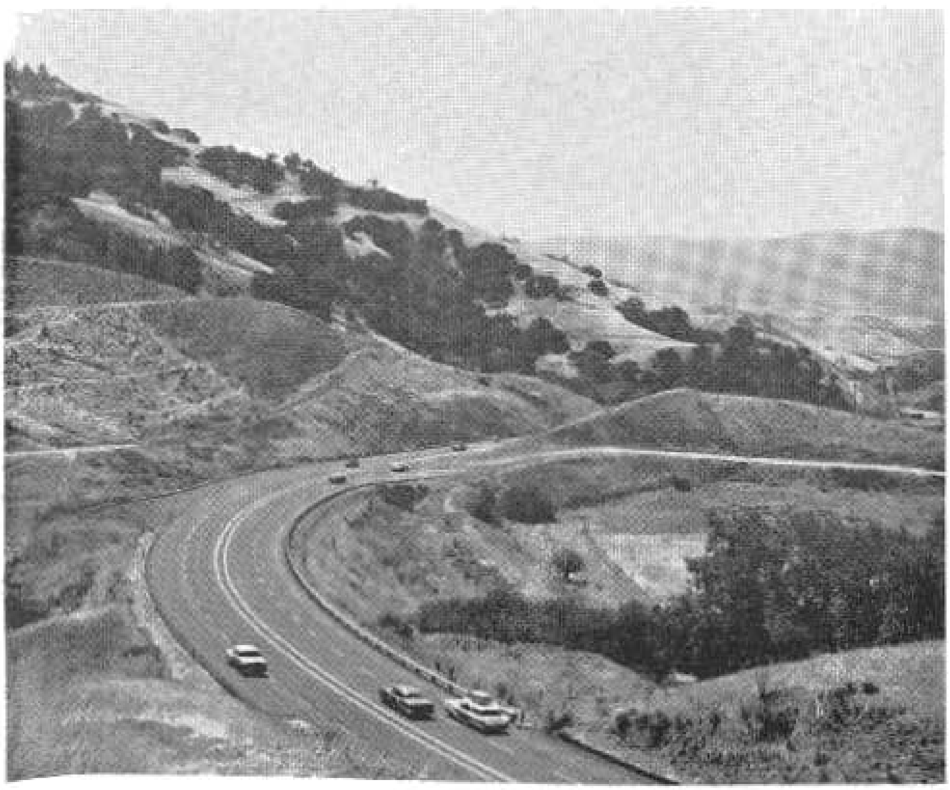
The famous Cuesta Grade on US 101 just north of San Luis Obispo is one of California's most historical routes. Fra Junipero Serra used the pass in establishing his line of missions, and about this time the Spanish named it "Paso Cuesta." "Cuesta" means "hill" in Spanish.

The first work on the road was by the padres in 1800, but it was not until 1858 that the California "Court of Sessions" voted $1,000 for improvements. In 1876 San Luis Obispo County voted $20,000 for further improvements, and in 1895 the State Highway Commission voted to take the route into the state highway system.

In 1916 Cuesta was given its first oil surface—and in 1922 a contract was let for concrete paving. The photos show the road as it looked about 1915 before it was oiled, again as it looked in 1936, and as it looks today.



CUESTA GRADE