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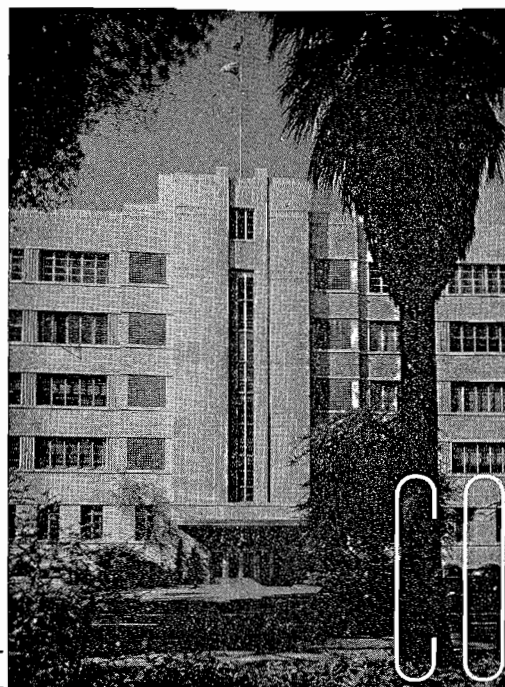
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San Francisco Bayshore

Five Separate Contracts
Now Are Under Way

By WEBB HITE, Resident Engineer, and
A. C. BIRNIE, District Budget Engineer

Freeway Progressing

ON JUNE 1, 1951, the first completed unit of the Bayshore Freeway within the City of San Francisco was officially opened to traffic. That unit extends from Augusta Street to 25th Street and is 1.3 miles long.

Five separate contracts, now in progress, will extend the completed freeway from 25th Street to Seventh Street, a total length of 2.0 miles, and will include construction of an elevated connection between the freeway and Mission Street, approximately 0.7 mile long.

The Wye viaduct, which is a portion of the Division Street Interchange, is financed in the 1953-54 Fiscal Year Construction Program. It is contemplated that this project will be advertised for bids in April, 1953. The amount budgeted for construction is \$1,015,000.

Millions for Project

Also financed in the 1953-54 Fiscal Year Construction Program is the portion between Hester Avenue and Alemany Boulevard, 1.7 miles long, which extends the freeway southerly from the completed portion to south of Third Street where an extensive interchange providing for a major diversion of traffic is to be provided. Advertising of this project is contemplated for early this year. The amount budgeted for construction is \$3,350,000.

Only the southernmost and northernmost units of the freeway within the city remain to be financed. These are the portions between the south city limits and Salinas Avenue, 1.0 mile in length on the south, and on the north from Eighth Street to the San Francisco-Oakland Bay Bridge, 0.8 mile in length. Most of the right of way for these units has already been acquired. It is estimated that approximately \$8,500,000 will be required to complete right of way acquisitions and for construction of these remaining units. Construction is contemplated as soon as

limitations of financing and timing of construction will allow.

Open Water Unit

The time for construction of the unit between the south city limits and Salinas Avenue is dependent on the financing and constructing of the earth fill relocation across a portion of San Francisco Bay in San Mateo County generally referred to as the "Open Water Project." That project is of prime importance to the proper functioning of the Bayshore Freeway in eliminating severe congestion at the gateway to the city. Some construction has been done on this section in the form of experimental fills. When all units within the city are completed, there will be a six- and eight-lane freeway facility, on new location, from the south city limits of San Francisco through severely congested residential, industrial, and business areas, to the San Francisco-Oakland Bay Bridge. Adequate provisions for the expeditious, convenient and safe distribution of traffic to various destinations along the route and within the heart of San Francisco are being provided. The total construction cost will approximate \$26,000,000. The cost of right of way and right of way clearance through developed areas such as this require very large expenditures in addition to the construction cost. The problems of right of way clearance are understandably complex and entail months and sometimes years of cooperative planning and negotiation with affected property owners.

Many Major Problems

Many major problems typical of freeway construction within a metropolis have been encountered on the various contracts to date. Comprehensive planning at an early date has been necessary in the acquisition of right of way and in the relocation of public utilities in order to keep construction delays to

a minimum. Considerable work has been involved during construction in the removal of foundations and basements from the right of way. All types of utilities are being relocated including railroad tracks, sewer lines, water mains, power and telephone facilities. One of the most difficult being handled by contractor's forces is the relocation of the city's high pressure water lines which range in diameter from 10 inches to 20 inches and which are used only for fire prevention. The work is slow and tedious and involves careful planning as, due to serious fire hazards, the lines may be shut off for short periods only. In general, most of the utility installations have been altered by the utility company's own forces, and here again, careful planning and coordination is involved.

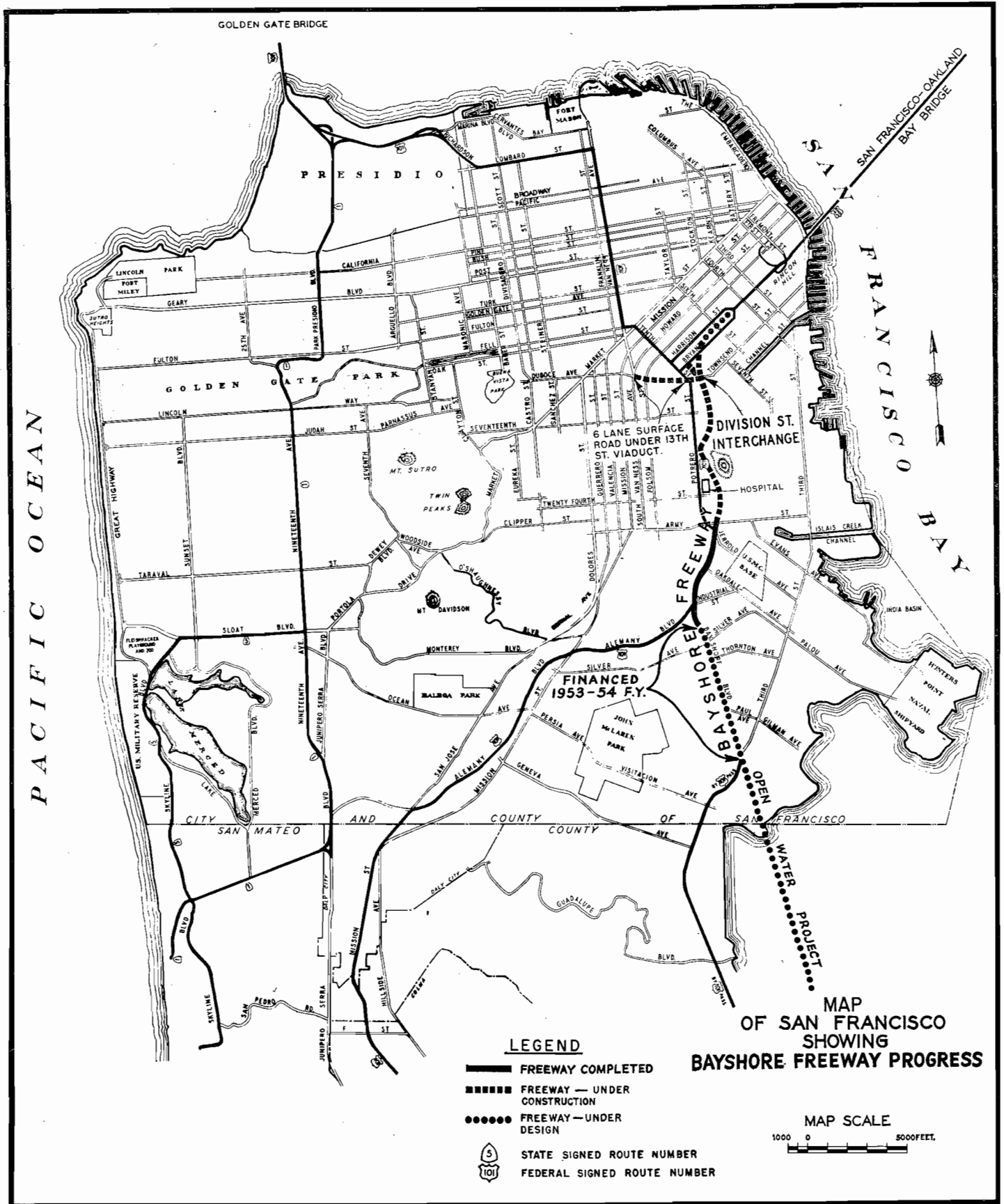
Other Units

The unit between Army Street and 17th Street is being constructed by the Fredrickson and Watson Construction Company and the M. & K. Corporation. It is 1.3 miles long and is scheduled for completion in the early summer of 1953. The construction cost will be approximately \$1,600,000.

Completion of this project and opening of traffic will be coordinated with the opening of the northerly unit from 18th Street to 9th and 10th Streets at Bryant Street, thus providing the next usable unit at the same time.

Structures on this project consist of pedestrian overcrossings at 25th, 22d and 18th Streets, and a vehicular and pedestrian grade separation structure at 23d Street.

The 23d Street overcrossing is a closed abutment type structure with steel girders and a reinforced concrete deck consisting of a 42-foot roadway and two five-foot sidewalks. The nine girders required for this all-welded overcrossing consist of 50-inch by $\frac{3}{4}$ -inch web plates and 16-inch by 2 $\frac{1}{2}$ -inch



flange plates. Each girder was fabricated and assembled in three sections in the shop, hauled to the site, welded together, and the full span of 124 feet lifted into position. The 42-foot concrete deck was placed in one continuous pour, the concrete being lifted into position by a truck crane direct from transit mixers.

Underdrains Constructed

Upon making field investigations during grading operations, and prior to embankment operations, considerable subsurface water was found at various locations throughout the project. This problem was overcome by

placing perforated metal pipe underdrains and draining the water into the city storm drains. Approximately 1.7 miles of these underdrains were placed on this contract alone.

Northerly of 17th Street, the freeway is to be composed of elevated structures. Off and on ramps will connect to 9th and 10th Streets at Bryant Street, these streets being planned for one way traffic.

This project is being constructed by Charles L. Harney, Inc. It is approximately 0.7 mile long and the construction is estimated to cost approximately \$3,000,000. It will serve traffic between the central portion of the downtown

area and the freeway southerly of Division Street.

Connection with Bay Bridge

Also under construction is the unit between 17th Street and 7th Street. Guy F. Atkinson Company is the contractor. Completion is scheduled for early in 1954. Construction cost is estimated at \$3,000,000. This is the northeasterly extension of the freeway toward its connection with the San Francisco-Oakland Bay Bridge approaches.

The separation of grades between the two foregoing units for the diversion of traffic to Bryant Street constitutes

View looking northerly across 17th Street showing steel superstructure under construction. Site of Division Street interchange in background.





View looking southerly showing freeway under construction between Bryant Street and Army Street in San Francisco. Steel for Ninth and 10th Streets off ramps in foreground. Portion of completed freeway visible in background.

a portion of the Division Street Interchange.

Also under construction is a unit providing for the interchange of traffic between the freeway south of Division Street and Mission Street via 13th Street (13th Street Viaduct). This unit constitutes two contracts both of which are being performed by Charles L. Harney, Inc. Completion of this unit is anticipated during the summer of 1954 and the estimated cost is \$3,500,000. In addition to State work being performed on the elevated freeway, the city is reconstructing 13th Street on the ground level from a two-lane to a six-lane facility.

The Wye Viaduct

The final unit of the Division Street Interchange is the "Wye Viaduct" which is 0.2 mile long and is financed in the 1953-54 Fiscal Year Construction Program. Advertising for bids on this project is contemplated early in 1953. It provides an interchange for traffic between the 13th Street Viaduct and the freeway northeast of Division Street, toward the San Francisco-Oakland Bay Bridge.

The design and planning of the foregoing units encountered many difficult problems in the crossing of many railroad tracks, the bypassing of many large buildings, and also the avoiding

of an interlocking tower at the intersection of the Southern Pacific and Western Pacific Railroads. These facilities could not be relocated and complete service was required to be maintained during construction.

The elevated structures composing these units are similar in design and consist of welded steel plate girders and stringers supported on reinforced concrete abutments and steel bents. The roadways vary from 26 feet to 50 feet in width.

The Division Street Interchange, when completed, will be the longest all welded highway overpass in the United States. These structures incor-

porate some of the methods of welding which were used on Germany's famed autobahns, but which have seldom been used in this country. The overhead structures and columns will contain no rivets. Accordingly, approximately 15 percent of the amount of steel ordinarily used is saved. Also, undetermined amounts of time and money in fabrication and erection are saved. Due to the importance of the welding, all welders are subjected to tests by the State. As a further precaution, completed welds are X-rayed so that possible defects are determined and corrected.

Major Items

An appraisal of the magnitude of the work now under way may be obtained from the following tabulation of the approximate contract quantities of some of the major items involved in the several projects now under construction.

Concrete removal	40,000 cubic yds.
Roadway excavation	442,000 cubic yds.
Structure excavation	80,000 cubic yds.
Cl. "A" portland cement concrete	33,000 cubic yds.
Structural steel	37,000,000 lbs.
Piles	210,000 lin. ft.
Reinforcing steel	4,660,000 lbs.
Misc. iron and steel	323,000 lbs.

Resident engineers in charge of construction engineering on the aforementioned projects are G. W. Thompson for the bridge work and W. C. Hite for the road work.

The bridge work is under the general supervision of Assistant State Highway Engineer F. W. Panhorst and the road work and right of way acquisition and clearance under the general supervision of Assistant State Highway Engineer B. W. Booker.

Looking northerly from Army Street showing progress of freeway construction from Army Street to 17th Street. Twenty-fifth Street pedestrian overcrossing and 23d Street vehicular overcrossing visible in foreground. Steel viaduct construction now in progress is visible in background.



Eastshore Freeway

Construction on Unit, San Jose and Warm Springs, Under Way

By L. A. MARKS, Resident Engineer

CONSTRUCTION is now well under way on the 9.85 mile section of the Eastshore Freeway (Routes 5 and 69) in Santa Clara and Alameda Counties, between San Jose and Warm Springs. The completion of this unit will be another step forward in forming the long needed modern traffic artery between the San Jose-Santa Clara Valley area and the East Bay metropolitan area centered around Oakland. Not only will it provide a much safer uninterrupted flow of traffic than the present congested facilities for heavy commercial and passenger traffic between Oakland and San Jose, but it will be an aid to national defense in serving the many military installations in this area.

Existing Highway Inadequate

The project is on new location which utilizes no portion of any existing highway and when completed will replace the long outmoded section of Route 5 between San Jose and Warm Springs. The existing highway from San Jose to Warm Springs is seriously deficient from the standpoint of capacity and safety features. The average daily traffic on Route 5 between these

termini in 1951 was 11,800 vehicles south of Milpitas, which is considered the average for this section, rendering the two and three lanes, which the present Route 5 provides, inadequate to a very undesirable degree. This volume is expected to increase to 23,000 by 1970.

In addition to the lack of proper width the existing Route 5 also has three railroad crossings at grade. One of the crossings located just northerly of Milpitas is a particularly dangerous one, as it is located between two reversing highway curves having radii of approximately 500 feet and affording very limited vision.

Unit Under Two Contracts

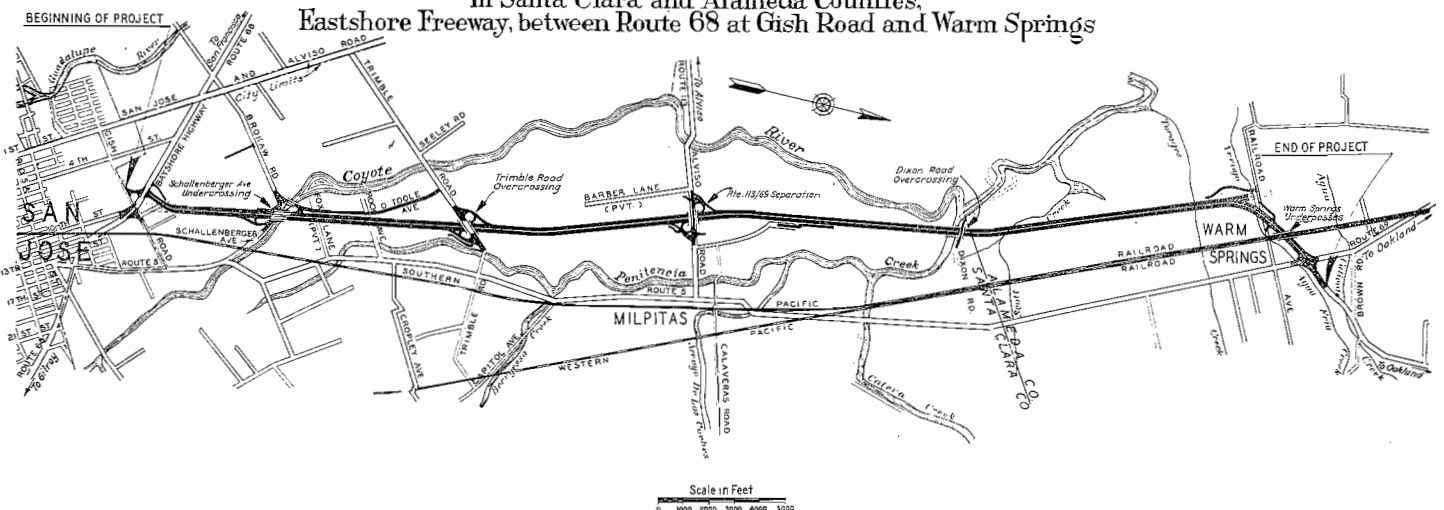
The construction of this section is under two separate contracts. A section 1.8 mile in length, between 0.9 mile north of Route 68 and 0.2 mile north of Trimble Road, was awarded to Fredrickson and Watson Company and M & K Corporation at a contract price of \$1,261,000. Work on this section was begun on January 31, 1952, and is scheduled for completion in the summer of 1953. This section of road has its beginning or southerly terminus

just south of Brokaw-Schallenger Roads which are two-lane asphalt surfaced county roads. The northerly terminus of the project is just north of Trimble Road, also a county road. Access to the freeway will be provided by two two-quadrant interchanges, one at Brokaw-Schallenger Road and the other at Trimble Road, both of which are connected by the same frontage road. This section of the project will serve limited local traffic and provide an important haul bridge for construction of the second section.

Second Section

The second section of the project between Route 68 at Gish Road to 0.9 mile north of Route 68 and from north of Trimble Road to Warm Springs, 8.1 miles in length, is under contract to Granite Construction Company of Watsonville. Work on this section was begun on August 23, 1952, at a contract price of \$2,500,000 and is scheduled for completion in the spring of 1954. This section will have its southerly terminus at the junction of Route 68, Bayshore Highway, with a temporary channelized intersection at this junction and which

In Santa Clara and Alameda Counties,
Eastshore Freeway, between Route 68 at Gish Road and Warm Springs





This photograph shows construction at Trimble Road overcrossing

will later be replaced by an interchange under a future contract. The northerly terminus of this section will have a temporary channelized connection at the present junction of existing Route 69 and Route 5 and which will also be replaced by an interchange under a future contract.

Work to Be Done

The road work on both projects consists of grading a four-lane divided highway together with road connections, road approaches and frontage roads. Freeway pavement will be portland cement concrete with plant mixed surfacing on the shoulders and on the various connecting roads and ramps.

There are four major structures in another contract, all of which are of reinforced concrete construction.

To allow Trimble Road to cross the freeway, an overcrossing 256 feet long consisting of four reinforced concrete slab spans and two reinforced box girder spans, supported on reinforced concrete abutments and bents with concrete pile foundations, is being constructed.

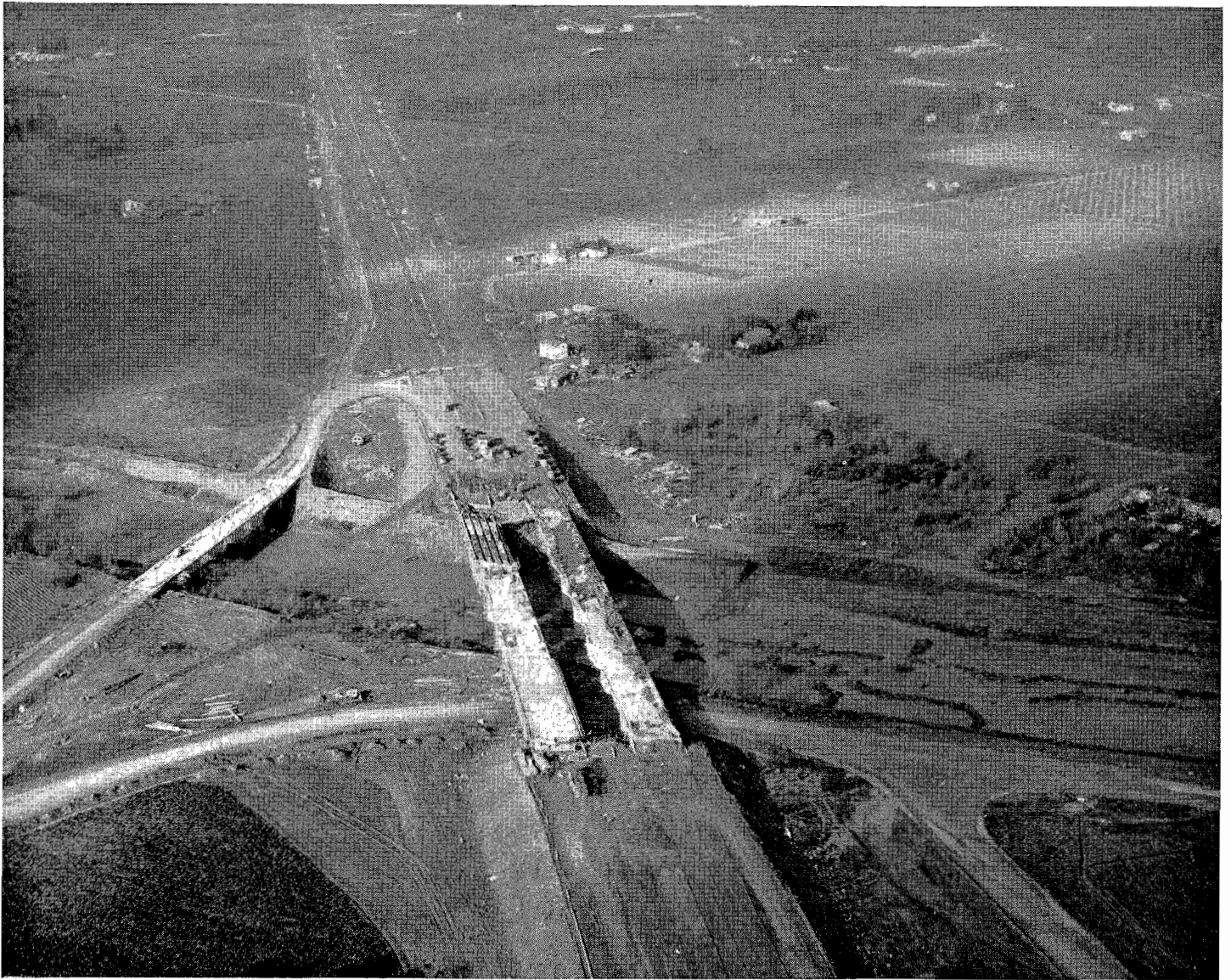
A bridge about 282 feet in length consisting of seven reinforced concrete slab spans, supported on concrete pile bents, providing a clear roadway width of 26 feet is being constructed at the Coyote Creek frontage road.

Coyote Creek Bridge

The main line bridge at Coyote Creek is composed of two parallel structures. One structure is about 501 feet in length consisting of nine reinforced concrete girder spans and the other structure is 464 feet in length consisting of eight reinforced concrete girder spans. Each structure will provide a clear roadway width of 28 feet.

Major structures in a separate contract consist of an underpass, two overcrossings, and a bridge across Penetencia Creek.

An underpass consisting of two structural steel plate girder bridges with steel plate decks about 114 feet



Looking north on freeway at Shallenberger-Brokaw Road, showing Coyote Creek Bridge, Coyote Creek frontage road bridge and freeway under construction.

in length, composed of two spans supported on reinforced concrete abutments and a center pier with concrete pile foundations, will carry the tracks of the Southern Pacific and Western Pacific Railroads over the freeway.

A reinforced concrete slab bridge about 134 feet long, composed of two spans supported on reinforced concrete abutments and a center bent with concrete pile foundations will carry State Route 113 over the freeway, while a similar bridge 109 feet long will carry Dixon Road over the freeway.

To allow the freeway to cross Penetencia Creek, a reinforced con-

crete slab bridge about 95 feet long consisting of two parallel structures composed of five spans supported by concrete pile bents, is to be constructed.

Grades and Alignment

The freeway alignment in the first contract consists of a single long tangent and traverses an almost level plane necessitating the use of very flat gradients. Grades for the freeway proper in this section vary between 0.06 percent minimum and 0.31 percent maximum except at the crossing of the Coyote Creek near the beginning of the project where 3 percent grades are used.

There is no excavation between the limits of this section with the entire freeway being built on low embankments throughout its entire length, the only exception being the approaches to the structure crossing Coyote Creek. Maximum embankment height at these approaches will be approximately 18 feet, whereas finish grade averages approximately four feet above original ground throughout the remainder of this section.

The alignment provided in the second contract differs somewhat from the alignment of the first contract in that there are three large radius curves within its limits. This section is also

constructed on low embankments and it employs the use of flat gradients comparable to those used in the first section.

Major Construction Items

Major construction items in the first contract include 360,000 tons of imported borrow; 80,500 cubic yards of channel excavation; 5,619 cubic yards of Class "A" Portland cement concrete; 10,500 cubic yards of Portland cement concrete pavement and 21,770 feet furnishing concrete piling.

The imported borrow for embankment was obtained from a borrow pit about four miles from the project and was hauled at a rate of about 3,500 tons per day.

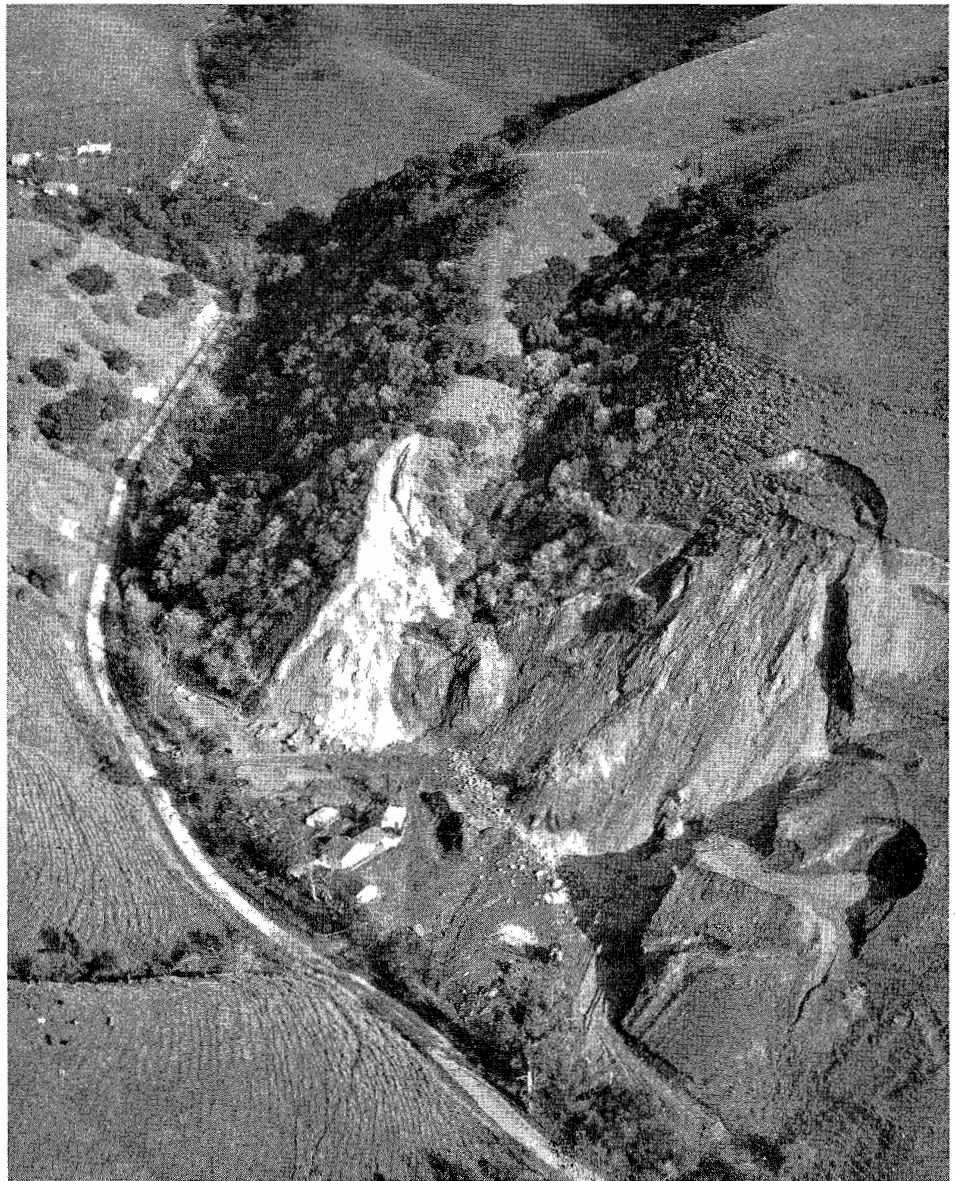
The major construction items in the second contract include 937,000 tons of imported borrow; 137,000 tons of imported subbase material; 122,000 tons imported base material, 24,500 tons plant mixed surfacing; 42,000 cubic yards of Portland cement concrete pavement; 17,400 feet concrete piling; 4,100 cubic yards of Class "A" structure concrete; and 12,000 feet of reinforced concrete pipe of various sizes.

The imported borrow for this contract is being obtained from a borrow pit about two miles from the project and is being hauled in two shifts at a rate of about 5,000 tons per day.

Before construction could begin on the second contract, the relocation of several major public utility facilities was necessary. It was necessary to relocate The Pacific Telephone and Telegraph Company's coaxial cable carrying transcontinental radio programs, before work could be started on the railroad underpass and shoofly trestle at Warm Springs. It was also necessary to relocate a Pacific Gas and Electric Company 20-inch gas main and encase a 34-inch gas main before work on the roadway could be started. These public utility facilities were relocated at State expense by The Pacific Telephone and Telegraph Company and Pacific Gas and Electric Company, respectively.

This contract is financed with state and federal funds while the first contract is financed wholly from state funds.

Construction is under the supervision of Assistant State Highway En-



Winterbauer pit located 2.5 miles east of the job. It was the source of 360,000 tons of imported borrow.

gineer B. W. Booker and Assistant District Engineer R. P. Duffy, with the author as Resident Engineer, and R. C. Colley, Bridge Department Representative.

General Superintendent for Fred-

rickson and Watson and M & K Corporation on the first contract is Bernard Fredrickson. General Superintendent for Granite Construction Company on contract No. 2 is J. L. Farrell.

Heavy Traffic Toll in South

AN AUTOMOBILE killed someone in the southland every four and one-half hours during 1952, it was reported today by the Public Safety Department of the Automobile Club of Southern California.

In the 13 counties of Southern California, 1,990 persons were killed as the result of motor vehicle accidents last

year. This is 7 percent above the 1951 fatality toll and 22 percent more than in 1950. Last year's southland casualty count was the fourth worst in history. The highway death toll in five of the counties was the highest on record. The five counties are Imperial, Kern, San Bernardino, San Diego and Santa Barbara.

Gaviota Tunnel

Limited Access Freeway Section on
U. S. 99 Is Nearing Completion

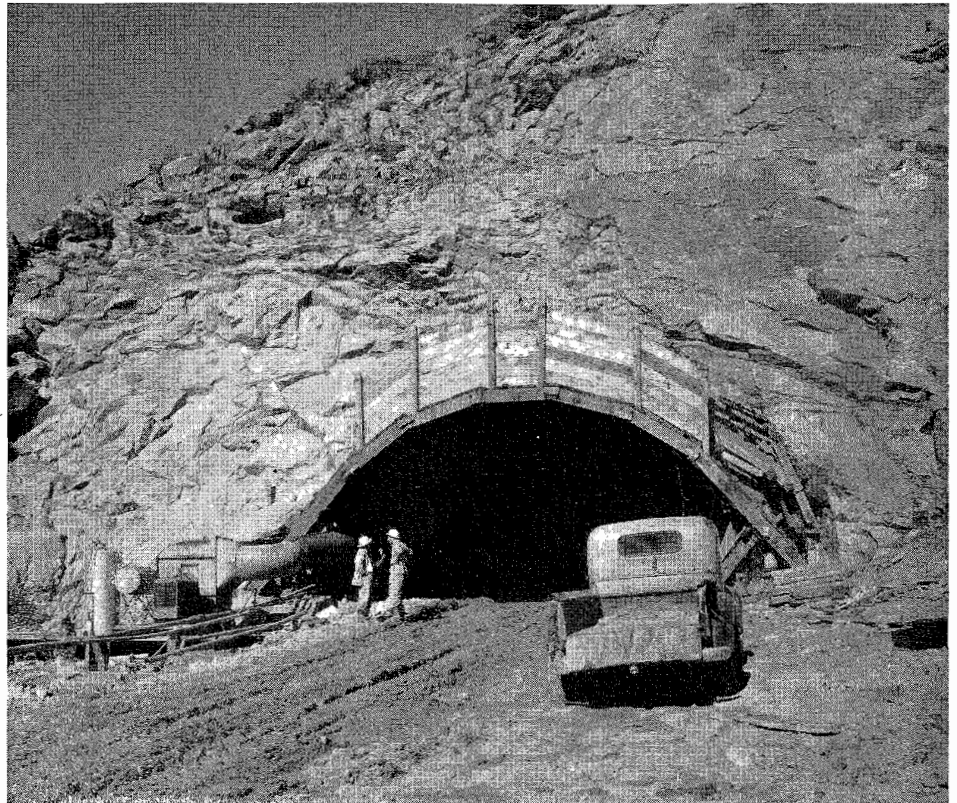
By JOHN E. WITTE, Resident Engineer

CONSTRUCTION of the Gaviota Pass Tunnel in Santa Barbara County is approaching completion. The remaining work, consisting of placing the Portland cement concrete tunnel lining, portal structures, and paving will be completed early this year.

This project is one of a series of contracts which, when completed, will provide a limited access freeway between Gaviota and one mile north of Nojoqui Summit, a distance of approximately 8.3 miles. The work on this section was begun in May, 1950, and is scheduled for completion in the fall of 1953 at an estimated cost of \$3,300,000.

The major part of the realignment lies on the east side of Gaviota Canyon, traversing the Santa Ynez Range from north to south. Geological reports indicate this mountain range was the result of an uplift along the Santa Ynez fault and the new road alignment crosses near the northern end of this formation with the range rising abruptly south of the fault to an elevation of 2,500 feet and then sloping seaward. The down cutting of the sedimentary formation by Gaviota Creek, along with differential erosion, have combined to form Gaviota Canyon with its steepest walls at Gaviota Gorge.

It was here on Christmas Day in 1846 that natives and soldiers from the Presidio of Santa Barbara lay in ambush for Lt. Col. John C. Fremont and his battalion marching south for the purpose of engaging the California forces in the deciding battle of the Mexican War. Advised of the plot to ambush his forces in the narrow gorge, Fremont, guided by an American rancher, Benjamin Foxen, flanked the Californians by crossing the Santa Ynez Mountains at San Marcos Pass instead of at Gaviota Pass and went on to capture Santa Barbara and assist in the fall of Los Angeles to the American Army.



South portal showing completed heading section. Blower for removing powder fumes is shown at left of the portal. Bulkhead above the portal is to prevent falling rock from hitting workmen and equipment.

Tunnel Method Chosen

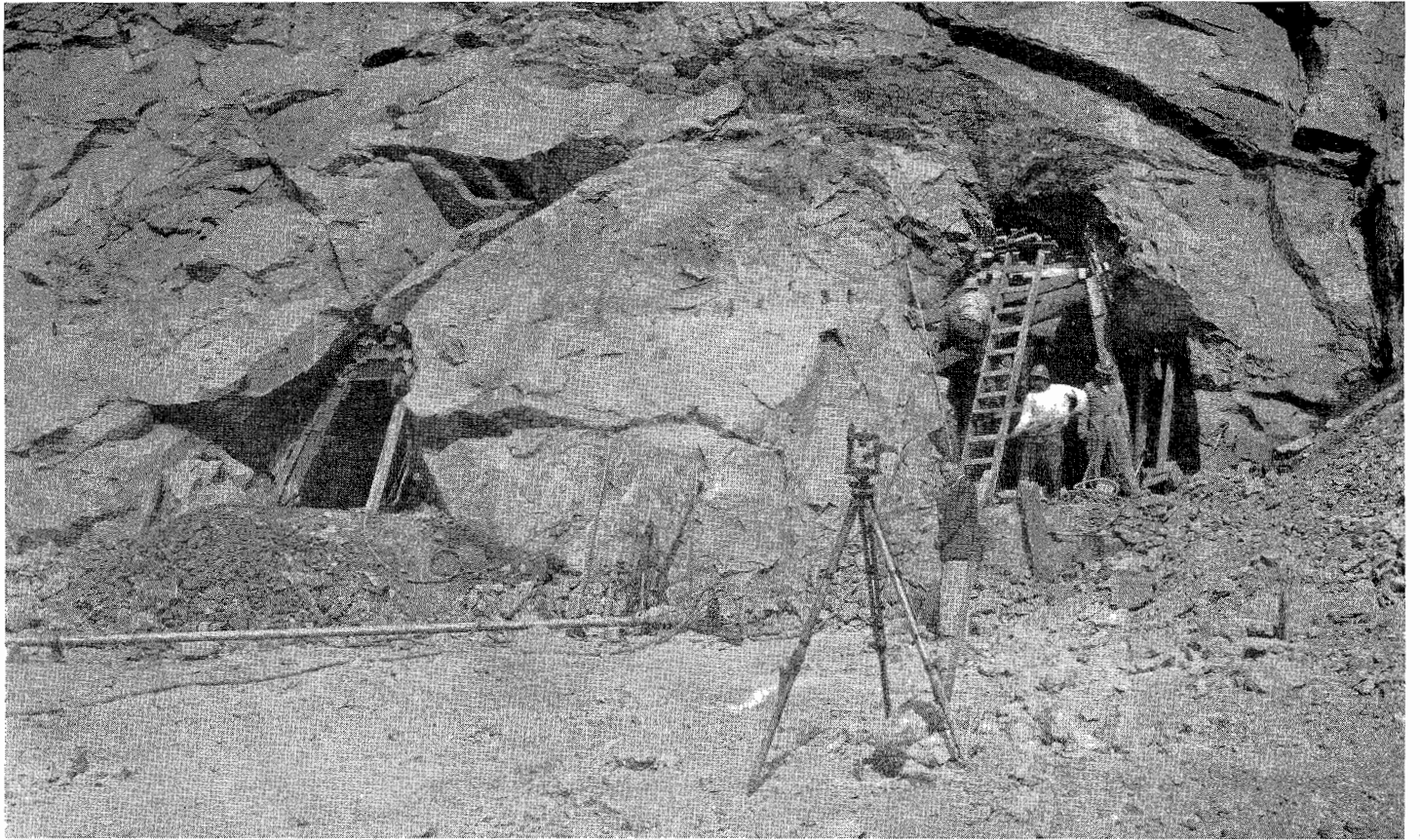
In order to provide for a four-lane limited access freeway through the narrow gorge it became necessary to choose between two methods of providing the required roadway areas. The first alternate was to construct an open cut through the east side of the gorge. This posed two problems, the first being that it would involve the removal of approximately 400,000 cubic yards of rock for which there was not sufficient waste area within the limits of economical haul.

The second problem presented by the construction of the open cut was that it would destroy not only the rugged beauty of the gorge, but also a landmark prominent in California's history.

The second alternative was to drive a tunnel through the eastern flank of the gorge. Since this method would preserve the beauty of the gorge and the historical landmark and also provide the most economical route, it was decided that the driving of the tunnel would be the better means of providing an expressway through the gorge.

Contract Awarded in 1951

A contract was entered into with the Rhoades-Shofner Construction Company of Los Angeles on July 2, 1951, for construction of a Portland cement concrete lined tunnel 435 feet long, including grading and paving of 0.1 mile of roadway. Clearing and grubbing of the roadway area was started July 18th while



UPPER—South portal showing the timbered left and right wall plate drifts. Unstable rock above the right drift necessitated the construction of two oversize square sets. LOWER—Scene at the face of the heading showing the drill jumbo in the center. To the left of center can be seen the wall plate upon which the steel segment is secured. Miner at left is setting up to drill the left wall plate drift.

initial drilling operations began on August 7, 1951.

The first stage of construction required the establishment of a working face at the south portal site from which to begin the tunneling operations. In order to establish this face it was first necessary to construct a through cut which required the removal of 8,000 cubic yards of weathered sandstone.

Because of its close proximity to the traveled way, the construction of the through cut required a method which would minimize the delay to heavy summertime traffic due to blasting operations. The method used involved the construction of a series of five benches of a size to control the amount of material removed during blasting and excavating procedures. The construction of a typical bench was accomplished by drilling 198 holes, averaging 16 feet in depth with Ingersoll-Rand J-50 jackhammers, loading the holes with three quarters of a pound of Atlas 40 percent dynamite per cubic yard of rock to be removed, and detonating the charge with Atlas Rockmaster electric detonators by use of a 115-volt blasting circuit. The broken material was bulldozed down to the roadway level where it was loaded into 10 cubic yard Euclid dump trucks by means of a Lorain 77, 1½ cubic yard diesel shovel and hauled to one of the two embankment areas south of the tunnel site. In order to prevent conflict with highway traffic the contractor's trucks used a haul road approximately 20 feet in width, which was constructed between the two fill areas east of the present traveled way.

Problem of Fault

With the removal of the material from the south portal cut studies were made to determine the stability of the formations which might be encountered at the face of the portal. A fault zone encountered directly above the portal indicated that the sandstone layers had been subjected to considerable movement, leaving little cohesion between the blocky, unstable layers.

During the excavation of the south portal cut, cracks began show-

ing in the face of the newly-exposed rock to the right above the planned portal. When the clay seams between the steeply bedded sandstone layers allowed slippage to take place, the cross-bedding became evident throughout the right side of the portal face. This movement was aggravated by air slacking of the exposed rock surface. Since this unstable rock face constituted a hazard to workmen, equipment and future traffic, an additional 3,000 cubic yards of material was removed from above the south portal.

Geological data indicated that the tunnel was to be driven through the middle member of the Gaviota formation, consisting of fine- to medium-grained concretionary sandstone, bedded in layers varying in thickness from a few inches to several feet. The Gaviota Gorge is the center of numerous faults, the largest being the Santa Ynez which causes the rock structure through which the tunnel was to be driven to be shattered, blocky, seamed, and fissured.

Heading and Bench Method

With this information in mind and from studies of the formations encountered during the excavation of the portal cut, it was decided that the tunnel could be driven with less difficulty and with greater safety by use of the heading and bench method of tunnel excavation. The choice of this method was based upon the knowledge that the rock to be encountered during the driving of the tunnel would be of an unstable nature, and would in all probability require the use of tunnel supports for at least the first 120 feet. The heading and bench method provides for the removal of the heading from the crown to the spring line as the first excavation cycle and the removal of the bench from the spring line to the floor as the second excavation cycle. The method offers the advantage of providing the bench as a convenient work platform for the placing of the arch supports while allowing the mucking to proceed simultaneously. Due to the fact that steel products were not readily available, mine grade timber was used for tunnel supports.

Tunnel Bore Semi-circular

The tunnel bore is semicircular above the spring line with the sides continuing in an arc until they intersect the sidewalks which are nine inches above the concrete pavement. The pavement is on a 10 percent superelevation. The use of the heading and bench method required that the upper 15 feet of the bore, which is the heading, first be removed for the entire length of the tunnel after which the lower 10 feet, the bench, was removed, thus completing the planned section. The south portal heading was established by driving two wall plate drifts 24 feet in depth, for the purpose of placing 12-inch x 12-inch timber wall plates to serve as a base for the timber tunnel supports.

Actual construction of the tunnel bore was begun on November 3, 1951, in the left wall plate drift. The drifts were five feet wide at the top, seven feet wide at the base and seven feet high, with the outer edges 20 feet from the tunnel centerline.

To support the unstable sandstone during the driving of the wall plate drifts, temporary timber sets were installed consisting of 8-inch x 8-inch posts and 3-inch x 12-inch lagging. Alternation of drilling and shooting with "muck" removal facilitated simultaneous work on the two drifts. With the removal of the natural support in the right drift, cracks developed over the portal requiring installation of two oversize square timber sets at the entrance to the portal.

Wall Plate Drifts

After the wall plate drifts were advanced to a depth of approximately 24 feet, provision was made to install the permanent 12-inch x 12-inch timber wall plates; however, some difficulty was encountered due to the tunnel being on a 1,200-foot radius curve.

The two wall plate drifts were connected by driving a stope along the periphery of the tunnel arch in order that two nine-segment timber arch sets could be installed. The removal of the remaining arch material back to the south portal was carried on from the south face of the stope, which was removed in four-foot rounds. This procedure was followed until only



UPPER—Transition from timber to steel tunnel supports. The frill jumbo is shown in the background. LOWER—Photo showing the nine-segment timber tunnel support in the heading section. Steel supports are shown in the background. Note that the steel supports require less excavation and therefore less concrete lining thickness than the timber supports. Thirty-inch blower line is shown at left center.



Jumbo in operation showing general position of drills at face

four feet of rock wall remained between the north face of the stope and the outside face of the portal. In order to prevent the unstable face rock from being displaced, holes of a size approximately two feet square were shot through the remaining wall and 8-inch x 8-inch timber crown bars at three-foot centers were extended through from the sets previously placed to a point beyond the portal face. After the crown bars were placed and blocked the number one timber arch was placed at the south portal. With the removal of the core material below the timber arch sets to the level of the wall plates, the south portal was established and the driving of the heading was begun.

Drilling Operations

Advancement of the heading was accomplished by driving the wall plate drifts on either side ahead of the core and placing the nine-segment timber arch as the excavation progressed. These drifts were of the same size as that of the portal, but did not require the use of timber sets as the unweathered sandstone possessed more stability. The material in the drifts was drilled, shot, and then removed from the heading by means of a Pacific slusher operated from an Ingersoll-Rand air tugger.

The main heading, with a cross-section area of approximately 400 square feet, was advanced in five-foot rounds by drilling with five Ingersoll-

Rand pneumatically operated drills mounted on a jumbo. Three drills were operated from a cross bar on the bottom deck while two drills, mounted on Chicago pneumatic jibs, worked off the top deck. The number of holes in the heading round varied from 60 to 120, depending on the condition of the rock. Depending upon the amount of overbreak and the fragmentation of the material affecting the efficiency of the mucking operation, the average progress varied from 5 to 10 feet per round.

Fumes Removed

Blasting fumes and fouled air were removed from the tunnel heading with a 25,000 C.F.M. Seracco No. 6 turbine

... Continued on page 38

New Bridges

Modern Structures Built on
Route Traveled By 49ers

By ROBERT M. BARTON, Associate Bridge Engineer

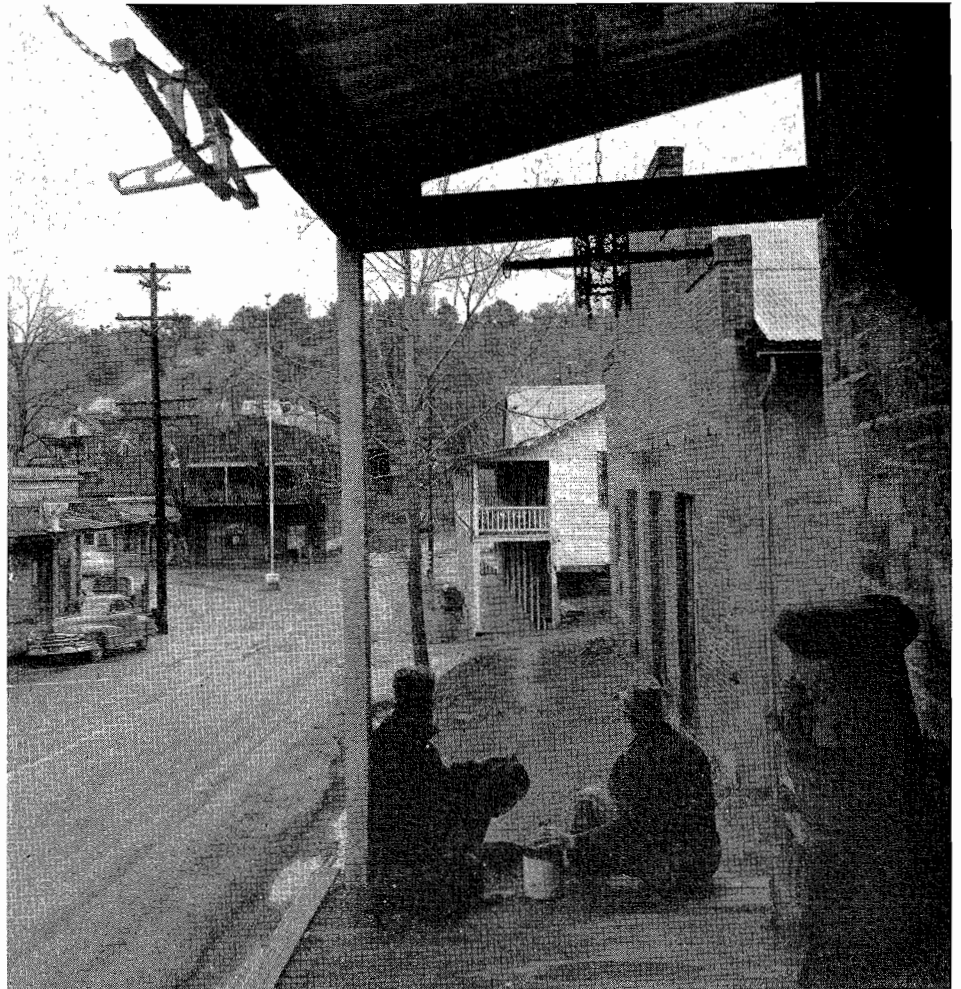
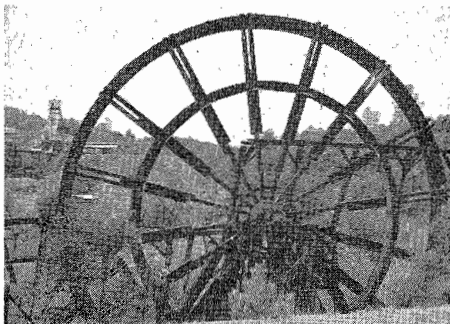
ONE OF California's most interesting and picturesque tourist attractions is Sign Route 49—the "Mother Lode" or "Golden Link" Highway. Beginning at the junction with State Sign Route 89 in Sierra Valley north of Lake Tahoe, it crosses Yuba Pass at an elevation of 6,701 feet, then descends the Yuba River and swings south, traversing the scenic oak-covered foothills of the Sierra Nevada.

In its 272-mile length it connects almost all of the important historical Gold Rush communities—from Downieville, Nevada City, Grass Valley, and Auburn of the "Northern Mines"; through Coloma, the gold discovery site, and Placerville (Old Hangtown); to Sutter Creek, Jackson, San Andreas, Angels Camp, Columbia (now a state historical monument), Sonora, and Coulterville of the "Southern Mines." It terminates at Mariposa on Sign Route 140—the "All Year Highway" to Yosemite National Park. The road is one along which the leisurely traveler can find many ivy-covered ruins and landmarks to recall the days when the quest for gold caused large mining camps to spring up and then disappear almost overnight. This is the country which Mark Twain and Bret Harte used as the locale of many of their fascinating tales.

Celebrated Mines

Between Camptonville and Downieville the highway passes along the edge

One of enormous wooden wheels used by miners decades ago to hoist slickens



View of main street of historic Amador City

of the enormous canyon-like Depot Hill hydraulic mine. Near Sutter Creek, Amador City, Tuolumne Hill, and Jackson the tipples, drifts, and dumps of deep hard rock (lode) and placer mines can be seen in all directions. Here are such celebrated mines as the Keystone, Central Eureka, Argonaut, Kennedy, and Morgan. About one mile north of Jackson still stand four enormous wooden wheels, each about 50 feet high, which were used several decades ago to hoist slickens (pulverized material from crushing mills) into a tailings pond. Near Co-

lumbia the white bedrock exposed by early mining operations forms an unusual topographic feature.

During the past century, however, the economy of the Mother Lode region has gradually shifted from mining to agriculture, logging, water resources and hydroelectric developments, and recreation. The highway passes immediately alongside the Moccasin Creek power plant, one part of San Francisco's giant Hetch Hetchy water supply system. And at Melones the highway crosses the upper arm of the reservoir formed behind

Melones Dam on the Stanislaus River. Today the trash burners of lumber mills probably exceed in number the mine tipples found along this highway.

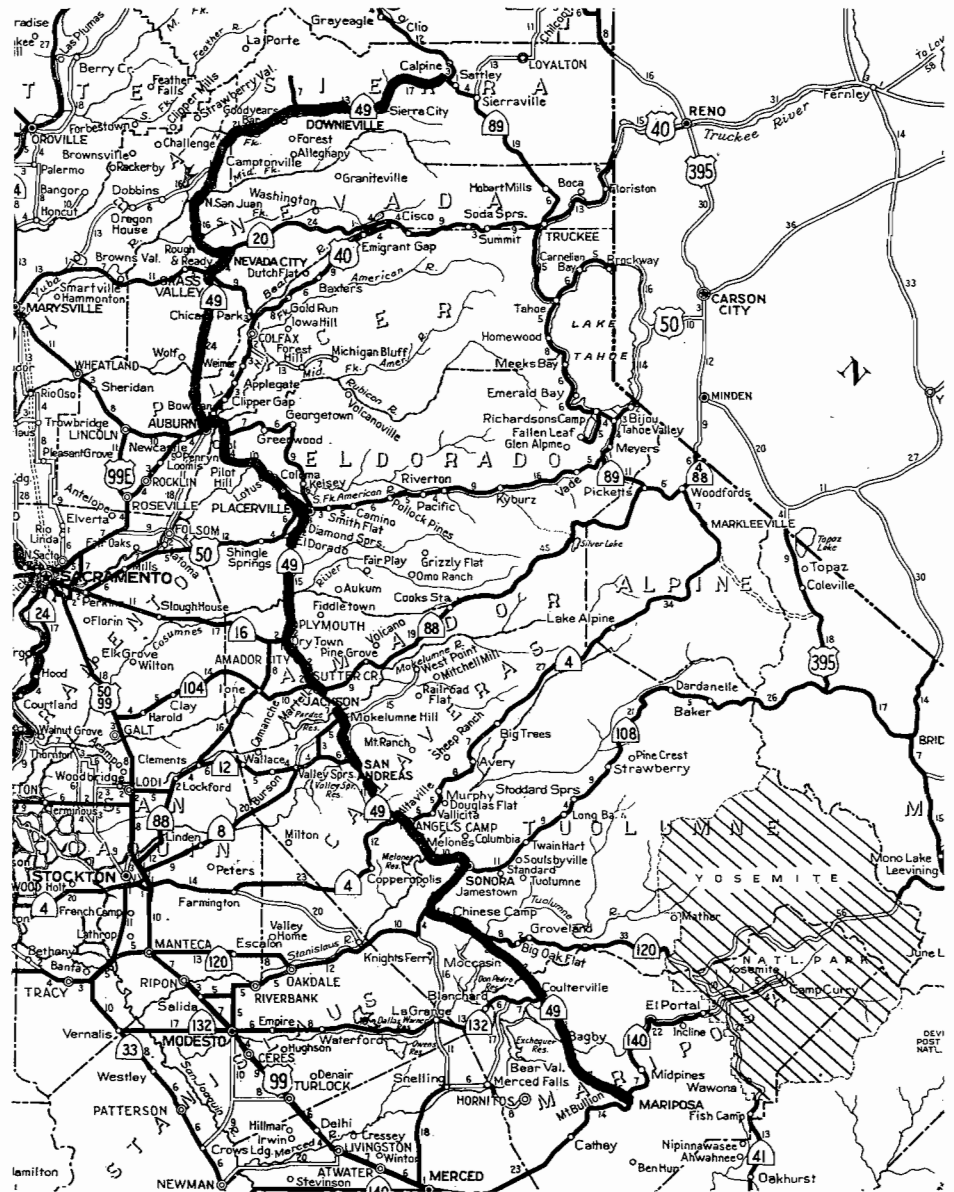
So whether the motorist is looking for hydro plants, crumbling masonry walls, evidences of early day mining operations, modern logging activities, or jumping frog contests, he will find much along Route 49 to interest him. The highway well deserves its reputation as an enjoyable and rewarding recreational road.

Construction Problems

To the highway engineer, however, the route poses many difficult and costly construction problems, since it crosses all of the important rivers draining the Sierra Nevada Mountains through the gold country—the Yuba, Bear, American, Cosumnes, Mokelumne, Calaveras, Stanislaus, Tuolumne, and Merced Rivers. Indeed, the highway may be described as consisting of an alternating series of stream crossings and ridge crossings. Across one river—up the opposite ridge, and down the other side—across another river—up a second ridge, and down again—another river—and so on in almost monotonous repetition. At times the motorist may believe the distance he is traveling up and down exceeds that in the horizontal direction. Many of the rivers are in deep canyons, and the problem of road building is made more difficult because heavy mountain-type construction is often necessary as the highway descends the precipitous slopes leading down into these canyons.

Flood Dangers

To construct bridges across the swift and occasionally raging waters of these Mother Lode streams has required the constant efforts of bridge builders for more than a century. Since 1850, when Little built a wooden toll structure across the South Fork of the American at Coloma (where James W. Marshall made his epoch discovery of the yellow metal only two years earlier), there probably has been scarcely a day when someone in the Mother Lode country has not been busy either building or repairing a bridge across one of these streams.



The Mother Lode, or Golden Link, highway shown on this map as Sign Route 49

For the racing torrents of recurring floods have carried away countless structures, and decay, vehicular accidents, and the need for widening and realignment have also taken their toll.

However, during the past five years there has been an unusual spurt of bridge building activity on the Mother Lode Highway. The growth of logging in the area, new hydroelectric developments, and the increased growth of tourist traffic all made it necessary at the end of World War II for the Division of Highways to undertake the progressive replacement of practically all of the major bridges on Sign Route 49. Today this program is well under way, with a number of new bridges completed and others under construction. More new bridges are planned

for the near future. The new structures are all wider, stronger, and on better alignment than their predecessors, and will afford permanent protection against bridge washouts at the crossings of the turbulent Mother Lode streams.

New Stanislaus River Bridge

At the present time the most important new structure being built on this highway is across the Stanislaus River at Melones, on the boundary between Calaveras and Tuolumne Counties, between Angels Camp and Sonora. It replaces a handsome but very narrow concrete arch, built over 40 years ago, which was undermined and fell into the river in January, 1951.

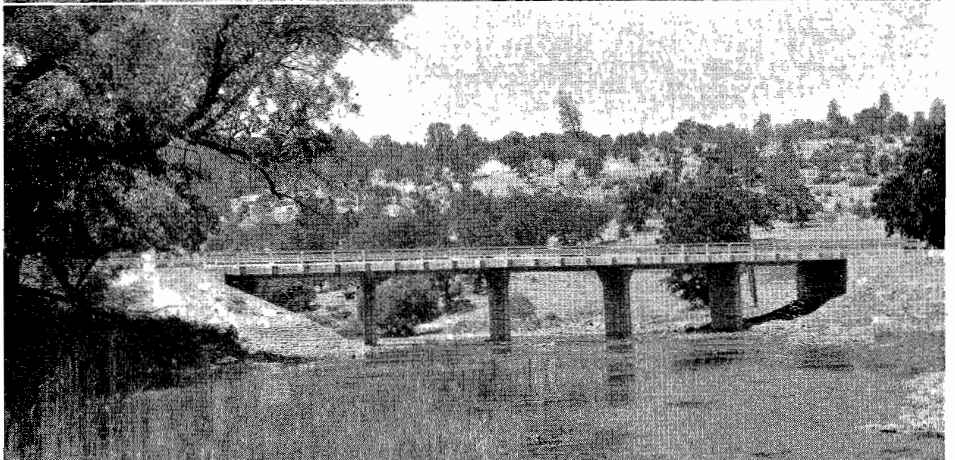
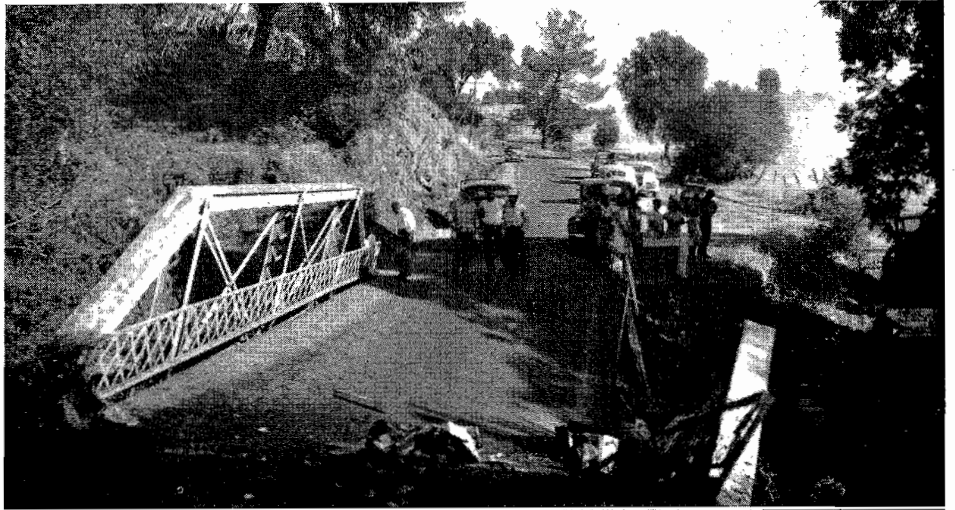
The severe floods last winter, it is believed, eroded the honeycombed concrete in the center pier, and caused the tired old structure to collapse.

The new bridge is a concrete box girder structure about 400 feet long, and is located only a few yards from the site of the destroyed arch. It cost about \$280,000. In the meantime state highway traffic is detouring on county roads via Columbia and the Parrott Ferry Bridge while the new Melones Bridge is being built. It is hoped the new bridge will be completed by July of this year.

New Mokelumne River Bridge

Just a few months ago a new reinforced concrete box girder bridge across the Mokelumne River was completed. Located about five miles south of Jackson, the new bridge is 365 feet long and cost about \$140,000. It is situated just a few miles downstream from the famous Electra hydroelectric development of the Pacific Gas and Electric Company. The Mokelumne River, after having passed through several P. G. & E. powerhouses in its descent from the Sierra, flows beneath Route 49 to be impounded behind the great Pardee Dam of the East Bay Municipal Utility District, where it is stored for use of the Cities of Oakland, Alameda, Berkeley, Richmond, and other East Bay communities.

Incidentally, the old bridge across the Mokelumne River was probably one of the most unique collections of junk on the Pacific Coast. Originally built as a one-way toll bridge, reportedly about 1911, it later was purchased by the county. The main span across the river consisted of a very weak and often battered steel "pony" truss, which in recent years had been propped up with secondhand railroad bridge girders butt-welded together. The approach trestle was supported partly by wooden bents, partly by steel bents, and partly by some old steel or cast iron penstocks which originally had seen service in a now forgotten hydro development. (The foundations of one of California's first hydroelectric plants, that of the Blue Lakes Water Company, built in 1897 as a predecessor of the Electra plant, can still be seen a short distance upstream, and it is possible the penstock



UPPER—Typical of the many narrow bridges which were once found along the Mother Lode Highway was this steel pony truss across Murray Creek in Calaveras County. Demolished in a 1949 truck accident, it has since been replaced with a bridge of adequate width. CENTER—New concrete box girder bridge across the Cosumnes River near Plymouth, completed 1952. The old timber truss built in 1930 can be seen on the left, the timber trestle approaches having been removed at the time this photo was taken. LOWER—New bridge across the North Fork of the Calaveras River near San Andreas. Completed in 1952, it replaces an old, tumble-down timber trestle.

columns may have come from that project).

The wooden stringers and deck of the old bridge had reached such an advanced state of deterioration and decay that it was feared the wheels of a heavily loaded truck might punch through the deck at any moment. During the floods two years ago some of the timber bents of the approach trestle were swept away, making it necessary to close the bridge to traffic for several days. In short, the old structure was in precarious physical condition. Also, it was one of the last one-way bottlenecks on a highway that is rapidly being developed to modern two-lane standards.

Other Recent Bridges

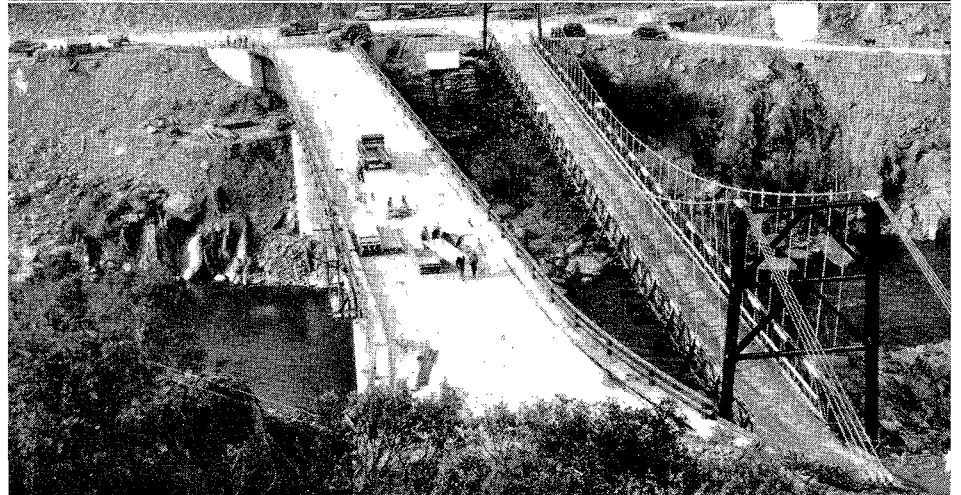
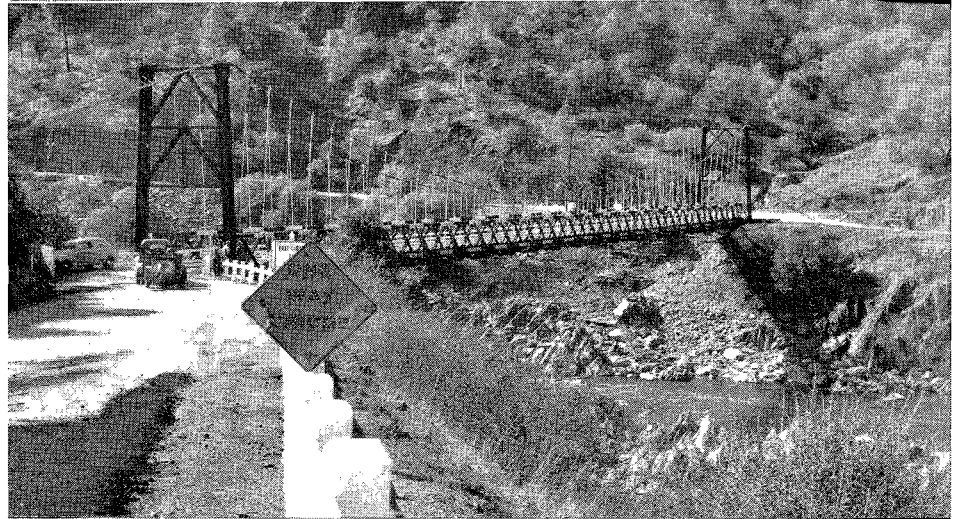
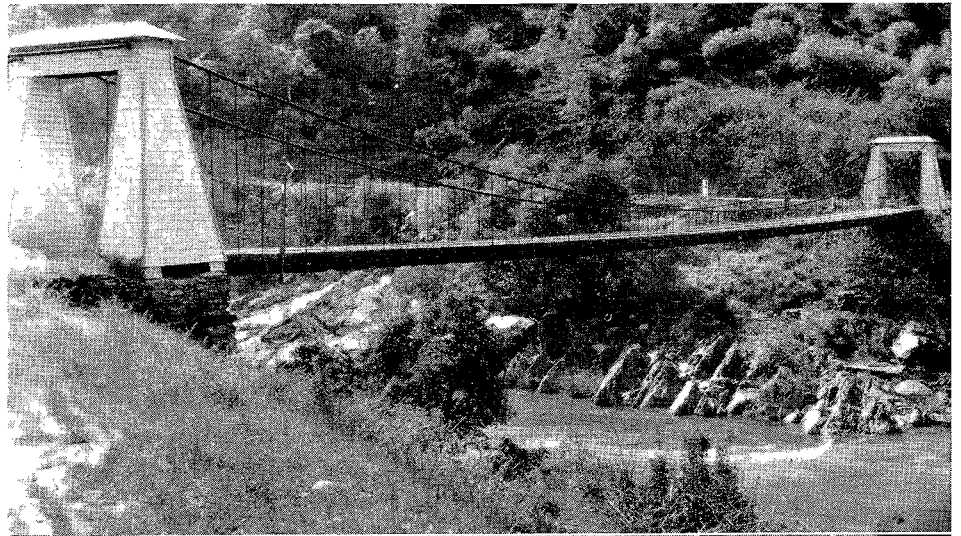
The first important bridge constructed on Route 49 following the end of the war was a \$270,000 steel girder structure across the North Fork of the American River near Auburn. This bridge, completed in 1948, replaced a temporary, one-way suspension bridge that, at the time, was feared to be in imminent danger of collapse. As a precautionary measure, school children were required to get out of their school bus and walk across the bridge until the new structure was opened to traffic.

The following year saw the completion of a new steel truss bridge costing \$190,000 across the Tuolumne River at Stephens Bar, between Sonora and Moccasin Creek. The bridge also carries Sign Route 120, the Big Oak Flat road to Yosemite National Park. The new bridge replaced a rusty old one-way steel truss, which was so weak that passenger cars only were allowed on it, with trucks being required to ford the river.

The new steel girder bridge across the South Fork of the American River at Coloma, the gold discovery site, was completed in 1951. This bridge, costing \$200,000, shortened the route distance between Auburn and Placerville by almost one-half mile, and replaced a narrow wooden truss that was in an advanced state of decay.

Consumnes River Bridge

This past year three important new structures have been completed. The new box girder bridge across the Mo-



North Fork American River near Auburn. Three bridges have stood at this site during the past ninety years. The first structure (top) was erected in 1865 using cables that had originally been employed at another location. Dismantled in 1929, it was replaced by the suspension bridge shown in the center illustration. (Lower) The present bridge, built in 1948, is shown during construction, with the second bridge on the right, and the abutments of the 1865 structure between.

kolumne River between Jackson and Mokelumne Hill has been mentioned.

The second new structure is at Plymouth, between Jackson and Placer-

ville, where an old wooden truss across the Cosumnes River has been supplanted with a \$200,000 concrete box girder. The third is a new concrete slab bridge across the North Fork of the Calaveras River, between Angels Camp and San Andreas. It replaces an old tumbledown timber trestle.

Also worthy of mention are two structures completed in 1948 at Auburn, one an underpass carrying the highway beneath the tracks of the Southern Pacific Railroad, and the other a separation structure, carrying Route 49 beneath four-lane U. S. 40.

A number of other smaller structures have also recently been erected on the Mother Lode Highway. North of Nevada City a handsome new culvert across Willow Creek has been built by the U. S. Bureau of Public Roads as a forest highway project to replace a narrow old concrete bridge. Near Downieville a culvert across Indian Creek replaces another narrow old concrete structure. Several small, narrow structures near Sonora have been widened or replaced with culverts.

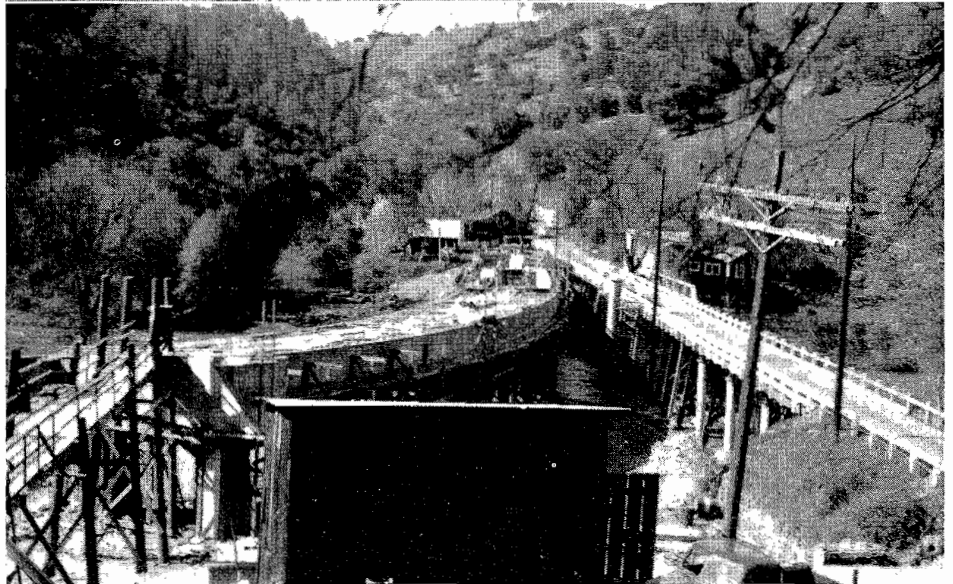
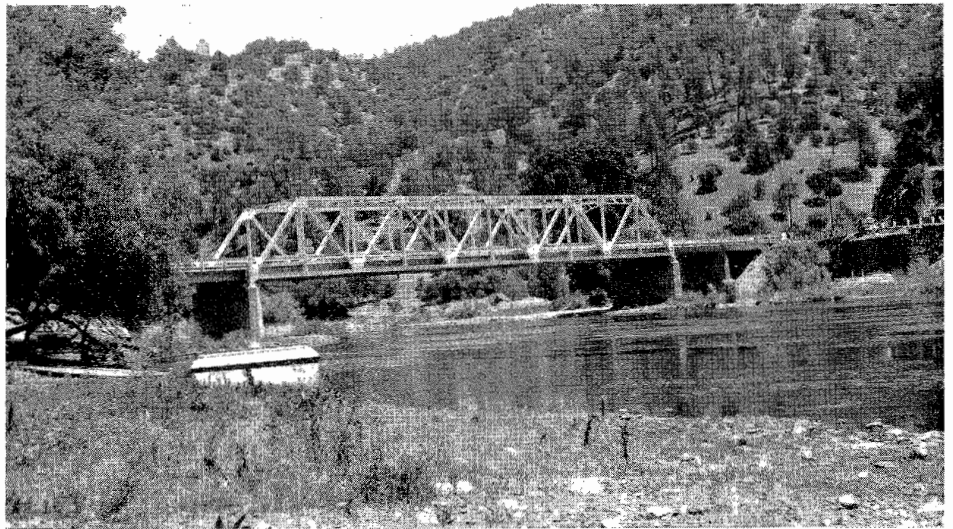
Another new bridge just completed is located at Moccasin Creek in Tuolumne County and replaces a rickety old steel truss which is so narrow that two cars could not pass at one time. The new bridge is of reinforced concrete and is noteworthy because of its unusual inclined or buttress-type bents.

More New Bridges Planned

As a continuation of the improvement program on Route 49, it is planned to build a new structure within the next few years across the North Yuba River in Sierra County. The present bridge is on extremely poor alignment, with a sharp right angle turn at one end; it is of substandard strength; and it is dangerously narrow, having a width of less than 16 feet. Trucks attempting to drive onto the span now must maneuver very slowly and carefully to avoid hitting the end of the bridge.

Road Now Greatly Improved

As a result of the numerous improvements completed by the Division of Highways since it assumed jurisdiction over the Mother Lode High-



UPPER—New steel truss bridge across the Tuolumne River at Stephens Bar, between Sonora and Mariposa. Completed in 1949. Trucks formerly were required to ford the river at this point. LOWER—Construction of new Mokelumne River bridge near Jackson. Old bridge on right.

way in 1921, motorists do not have to be intrepid adventurers as was once the case. Tortuous roads dating from the 1860's have been replaced by modern sweeping highways; steep grades have been reduced; flimsy and narrow bridges have been replaced by wide, modern ones; and travel through the narrow streets of the Mother Lode communities has been greatly expedited. Highway and bridge improvements totaling almost 7 million dollars in value have been undertaken on various portions of the route since the end of World War II, and more will be spent within the next several years. Part of the route (between

Grass Valley and Nevada City) is even to be developed within a few years into a four-lane divided freeway—a far cry indeed from the first wagon trails built in the Mother Lode region just over a century ago.

Of the improvement work accomplished to date, most has been financed from the State Highway Fund, supplemented by Federal Aid Secondary and county sources. However, between Nevada City and Downieville about \$1,700,000 of the work has been financed by the Federal Government, since this portion of Route 49 is classified as a forest highway. Design and supervision of construction of

McCurry Is Elected New CSAA President

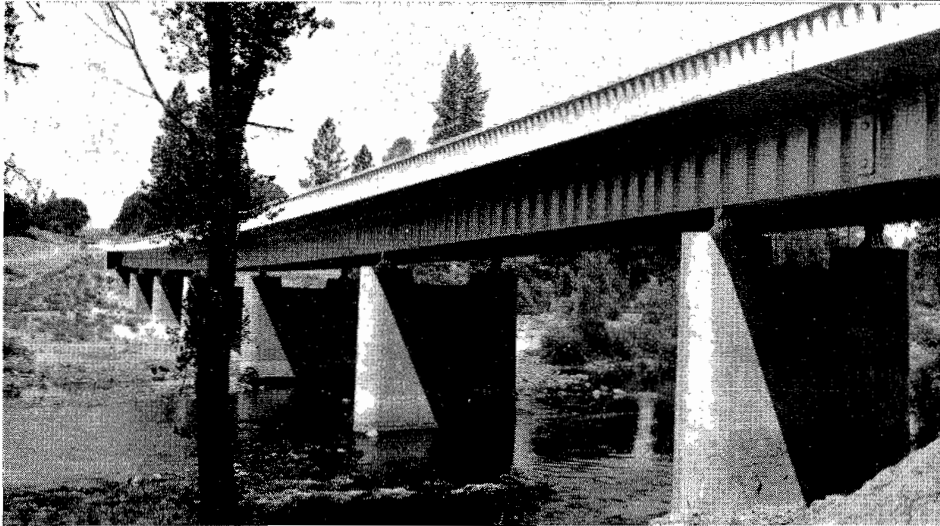
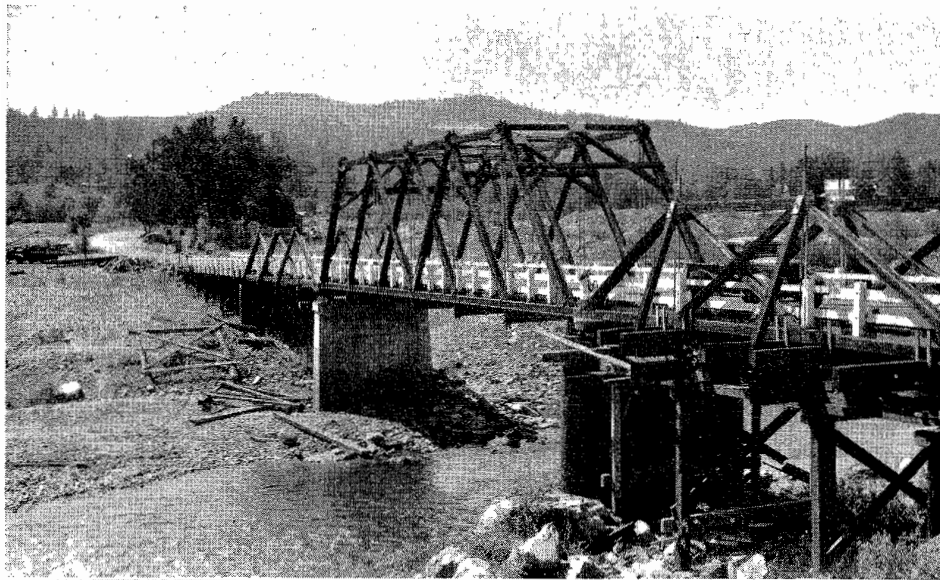
HAROLD J. McCURRY, Secretary-Manager of the Retail Merchants Association of Sacramento, is the new President of the California State Automobile Association. He was elected by the association board of directors at its annual meeting on January 15th in San Francisco.



HAROLD J. McCURRY

McCurry was for many years an official of the California State Fair, supervising press and radio activities. He gave up this civic work about a year ago when he retired as a vice president of the Bank of America, continuing as a member of the bank's advisory board in the State Capital.

Other officers elected for 1953 were Edward H. Peterson, San Francisco, and Charles G. Bird, Stockton, vice presidents; Fred J. Oehler, San Jose, treasurer; D. E. Watkins, secretary and general manager; Edwin S. Moore, assistant secretary and general manager. Eight directors were elected at the association membership meeting to new three-year terms on the CSAA board. They are: Clyde W. Rann, Redding; Irving H. Kahn, Oakland; Porter Sennon, San Mateo; J. J. Krohn, Arcata; H. R. Basford, San Francisco; John R. Graham, Merced; Norman S. West, Modesto; and J. B. Rice, San Rafael.



South Fork of American River at Coloma (bottom). Completed in 1951 at a cost of \$189,000. This new bridge is near Coloma, the gold discovery site. It replaces a timber truss built in 1928, which in turn replaced an earlier wooden bridge which had been completely destroyed by fire. The new structure is on improved alignment and saves approximately one-half mile over the former crooked line. (Top) The old wooden truss.

projects south of Nevada City have been handled by the Division of Highways, while most projects be-

tween Nevada City and Downieville have been under the jurisdiction of the U. S. Bureau of Public Roads.

Do You Follow These Driving Rules on Road?

What makes a good driver? Lightning-fast reflexes? Exceptional eyesight? Cool thinking in the face of danger? Yes, these are attributes which may help to make a good driver even better but there are others which are essential.

The judgment to drive no faster than traffic conditions warrant.

The practice of giving clear, correct hand-signals.

The habit of not taking chances when driving—however small.

The courtesy of yielding the right of way in any questionable situation.

It is often true that a person of 50 or 60 is a far better driver than a youth in his early twenties because the adult possesses these essential qualities of good driving which are lacking in the younger person.

Rio Hondo Bridge

*Santa Ana Freeway Structure
Calls for Unusual Construction*

By J. M. CURRAN, Associate Bridge Engineer

LOCATED southeast of the City of Los Angeles and now under construction is the Rio Hondo Bridge, one of the comparatively few river bridges on our Southern California freeways. Considered along with the many undercrossings, overcrossings, and various other freeway structures,

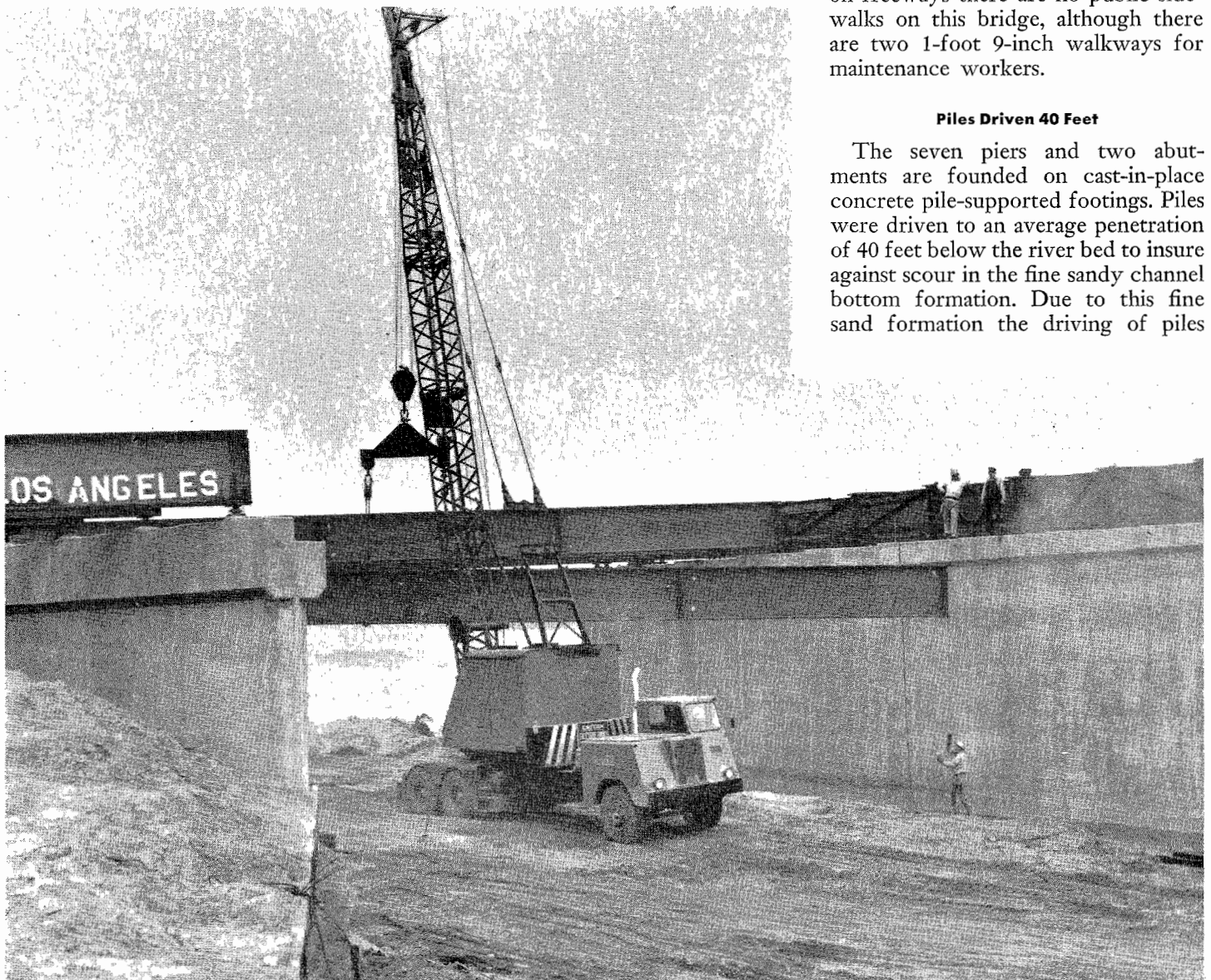
this bridge has the unusual distinction of carrying the Santa Ana Freeway over a river.

One-half of the bridge is on tangent, the other half is on a 3,000-foot radius curve. All piers are parallel to the ultimate alignment of the improved Los Angeles County Flood Control

channel of the Rio Hondo and, as a result, the piers are skewed approximately 26 degrees.

The bridge is a steel girder structure 635 feet long consisting of seven 83-foot spans and one 52-foot span. A bridge roadway 88 feet wide provides two 40-foot wide roadways, and an 8-foot median or dividing strip, to carry the six traffic lanes of the freeway. Since pedestrians are not allowed on freeways there are no public sidewalks on this bridge, although there are two 1-foot 9-inch walkways for maintenance workers.

Erecting steel beams on span seven. Photo by Ray Graham, Los Angeles Times



Piles Driven 40 Feet

The seven piers and two abutments are founded on cast-in-place concrete pile-supported footings. Piles were driven to an average penetration of 40 feet below the river bed to insure against scour in the fine sandy channel bottom formation. Due to this fine sand formation the driving of piles



Erecting steel beam in span seven. Photo by Ray Graham, Los Angeles Times

was very difficult and jetting of piles was required for almost their entire penetration.

The designers of the bridge specified unusual welding methods to meet the design requirements of the 83-foot long spans by using transformed rolled steel beams rather than by using conventional fabricated steel plate girders. Plate girder utilization would have been more expensive and would have required a greater amount of critical steel. Standard 36-inch WF 280-lb. rolled steel beams were split horizontally along the centerline of the beam, the two sections were then spread apart and a 12-inch-wide filler

plate was then welded between the two sections, and a 48-inch depth of beam resulted.

Cutting and Welding Beams

The process of cutting and welding the beams is of particular interest and shows careful planning on the part of the engineers of the Union Steel Company. The rolled sections are first laid flat on a table jig. A radiograph cutting torch, guided from the flanges, then moves from one end of the beam to the other behind a water bath, splitting the beam accurately down the centerline in two T sections. Frequently the releasing of "locked in" stresses during

splitting operations caused the two longitudinal sections to spring apart as much as eight feet at one end while remaining closed at the other, or the same operation would cause the beam sections to bow apart at the center while remaining closed at the ends, or in some cases no apparent deformation took place.

After the beams are split they are then placed on a specially designed jig carriage where the two sections are realigned with clamps and jacks and the 12-inch plate is inserted and tackwelded into proper position. Splices in the filler plate are made at the quarter points of the beam. The

jig carriage then passes at a predetermined speed beneath a two-arc automatic welding machine using 5/32-inch rod in the submerged melt welding process.

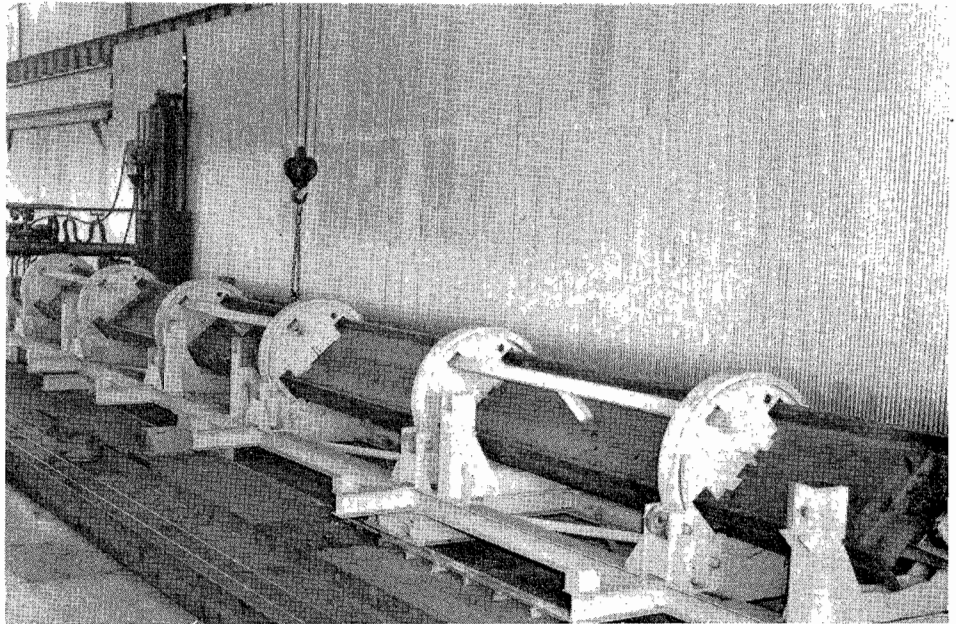
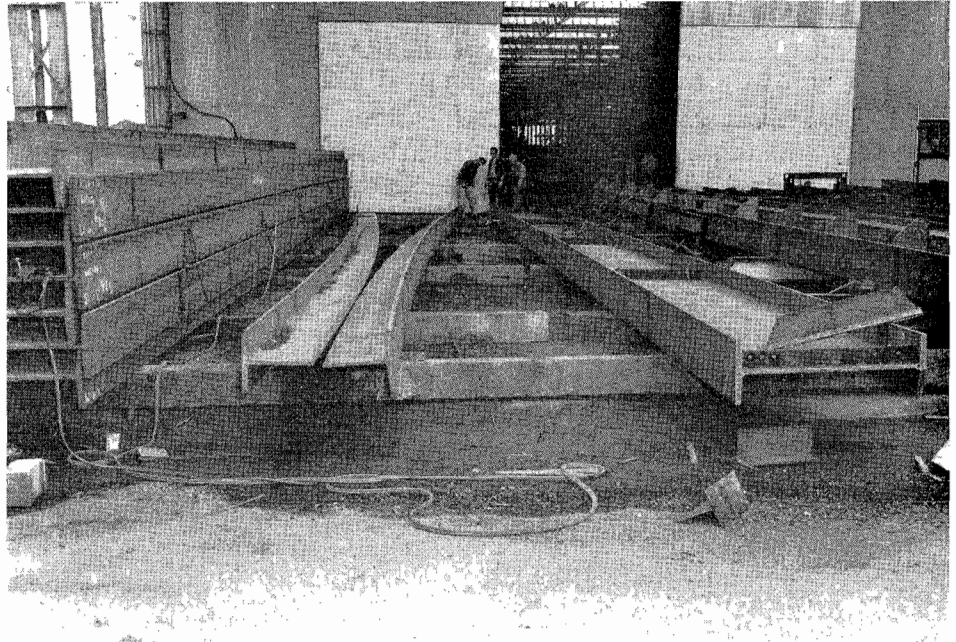
Jig Carriage

The jig carriage is so designed that when the double weld has been completed on one side, the upper gates of the circular holding devices on the rig are closed and locked and the whole carriage is rotated through 180 degrees so that the other side of the girder flange is up. The carriage then returns under the welding machine, repeating the welding process previously used, thus completing the weld on the second side. The welds are then X-rayed to determine the quality and penetration of the weld before moving the beams from the shop to the bridge site. Steel fabrication and X-ray inspection of the welds were under the supervision of Ross Clinton of the Materials and Research Department of the State Division of Highways.

Truck and trailer combinations moved the beams from the shop of the Union Steel Company to the bridge site where truck-mounted cranes moving across the river bottom, which is dry except during storm periods, lifted the beams into final position on the piers. A simple diaphragm and stiffener system, riveted in place in the field, insured a rigid steel floor system. Forms for the reinforced concrete roadway deck, which are now in the process of being fabricated in place, are supported from the lower flanges of the steel beams in a conventional manner.

This bridge was designed and is being constructed by the Bridge Department of the State Division of Highways under the general supervision of F. W. Panhorst, Assistant State Highway Engineer, Bridges, with J. W. Green, Southern Bridge Department Representative, J. M. Curran, Bridge Department Representative on the project, and J. C. Allison, principal assistant.

It is being constructed at a cost of approximately \$734,750 as a part of the highway and bridge contract totaling \$2,537,790 awarded to United Concrete Pipe Corporation on August 21,



UPPER—Deformation of beam sections caused by release of "locked in" stresses during splitting operations. LOWER—Jig carriage closed and being revolved to turn beam over so other side can be welded. Photos by R. J. McDonald of Union Steel Co.

1951. The Contractor's Project Manager is Jack Yount, the Superintendent is Carl Rice, and the Structures Superintendent is Charles Leedham. Steel fabrication and erection were per-

formed under subcontract by the Union Steel Company of Los Angeles with Peter Delabout, Vice President in charge of production and Hal Lees, Chief Engineer.

DRINKING AND DRIVING

Drinking when planning to drive is a serious violation of both common sense and common decency. Alcohol when taken into the system even in small quantities can cause drivers to take those long chances that so often lead to serious accidents.

FOREIGN CAR RECORD

A grand total of 3,374,920 motor vehicles entered California through state border quarantine stations during the year 1952, reports the National Automobile Club. Of this total, 3,067,554 were automobiles, 266,977 were commercial trucks, and 40,389 were busses.

Anderson Study

Retail Business on Frontage Road Shows an Increase of 61 Percent

By JOHN F. KELLY, Headquarters Right of Way Agent

THE FIRST economic study of a frontage road where there has been an opportunity to make a direct comparison within the same community between two separate retail areas has been completed by the Right of Way Department, Division of Highways.

Although their physical appearance differed because of the arrangement of the buildings, both retail areas were subjected to the same general economic influences. The construction of the new expressway through Anderson, Shasta County, in 1950, required one of these retail areas to be moved and placed on a frontage road, whereas the other area was unaffected by the new highway construction.

The accompanying chart shows the layout of the town in relationship to the retail and residential areas. It will be noted the highway and the railroad divide the town of Anderson into an east and west side, and that residential and retail development lie on both sides of the division. This plan shows the expressway and frontage road as they exist today.

Before the construction of the frontage road on the west, retail outlets on that side had unrestricted access to the through highway and had the appearance of a typical highway ribbon development. There were no established setbacks or designated parking areas, and the highway shoulder acted as a parking strip for shoppers as well as a sidewalk for pedestrian traffic.

Highway construction made a tremendous change in the appearance of the community and it is of particular interest because this transition took place entirely on the west side and did not alter the appearance, size or location of the business and residential areas on the east side.

Lumber Industry

Anderson has existed for many years as a small agricultural center with dairy farming providing the chief source of

PREVIEW OF STUDY

ANDERSON

Location— 12 miles south of Redding on U. S. Highway 99 in Shasta County
Population— 2,200
Two Retail Areas— U. S. Highway 99 (now an expressway and frontage road)
East Center St. (unaffected by new highway)

NEW EXPRESSWAY

Completed— June, 1950
Type— Four-lane divided expressway with a 32-foot frontage road on west side. Length 3,800 feet. Major intersections—north and south streets.
Property Affected— 23 parcels

ECONOMIC STUDY

Purpose— To determine economic effect of controlled access and frontage road construction in the community.
Scope— Comparison of two years before with two years after expressway completed.

the center of Anderson and parallel with the west side of the Southern Pacific Railroad right of way. In addition to widening the existing highway alignment, a 32-foot frontage road was constructed along the west side and for the entire length of the expressway through Anderson. This frontage road extends a distance of 3,800 feet from South Street, the southerly limits of the town, to Briggs Street, the northerly termini of Anderson.

Attractive Improvement

Highway motorists and the local residents can readily see that the construction of the new expressway and frontage road have greatly improved the physical attractiveness and parking facilities along the old highway route. However, the final and most important test of the new highway improvement as far as the property owners and the community are concerned is whether the change has "paid off." Has it proved to be a worthwhile and profitable benefit to the property owners and merchants affected?

This economic study utilizes all of the available facts pertinent to a determination of the actual monetary effect on the town of Anderson by the elimination of direct access from properties adjacent to and fronting on U. S. Highway 99.

The largest available source of factual data was found relating to retail business. This one phase of the study is actually conclusive enough to use as the sole barometer for measuring the benefits of the highway change. It is the phase or activity in which the majority of affected property participates. It follows that the gains or losses made by the greatest number will produce a more reliable basis for analysis than the activity of only a few properties. However, all other available facts, regardless of how meager or fragmen-

income to the community. The location of the town along the main route of the Southern Pacific Railroad and its close proximity to a large lumber empire has recently attracted a number of lumber enterprises to locate in the vicinity of Anderson. This industry has brought a new wealth into Anderson and it is becoming one of the primary sources of income to the community. Today Anderson boasts of 16 lumber mills which are employing between 1,900 and 2,300 people with some seasonal variation. The population of Anderson has grown from 1,200 in 1948 to 2,200 at the present time.

The growth of the community and increased highway traffic between Red Bluff and Redding necessitated the improvement of the highway conditions along this route. A four-lane divided expressway was constructed along the existing highway alignment through

tary, have been made a part of this report so that nothing is omitted which might have an influence on the accuracy of this frontage road study.

RETAIL BUSINESS SURVEY

The retail business survey section of this study utilized the sales tax returns on gross retail sales as reported by each retail outlet to the State Board of Equalization. These returns are submitted to the State Board of Equalization over the sworn statements of the merchants as to their accuracy. With these reliable figures a "before and after" comparison was made to determine the percent of gain or loss. To obtain the relative effect of the gain or loss, it was then necessary to weigh these figures against a comparable situation for a like period of time.

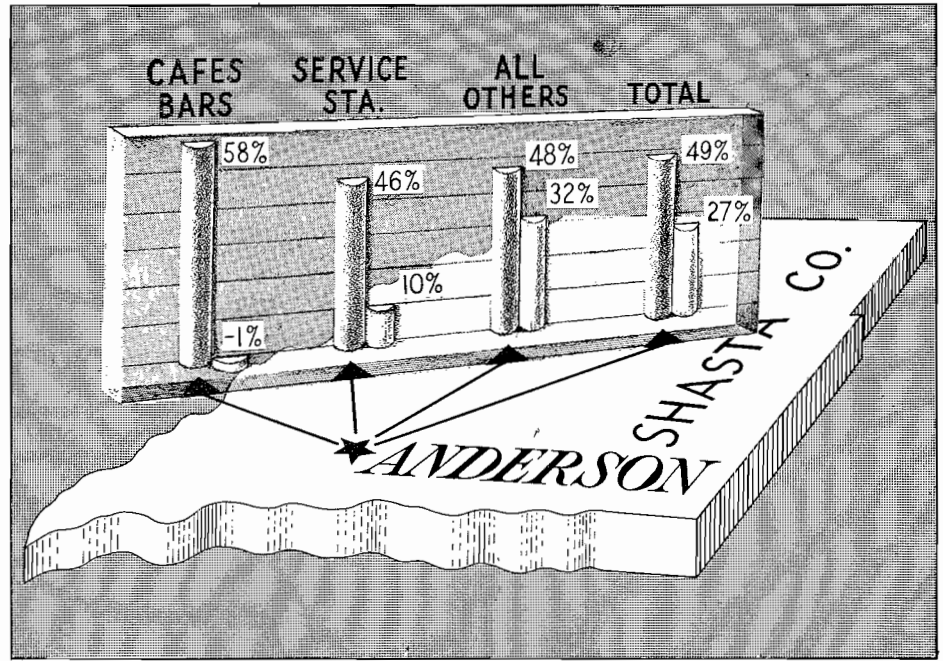
In this study two distinct comparisons were made. First, reported sales returns of all retail outlets in Anderson were compared with the sales reported by all retail outlets in Shasta County. This comparison was designed to show whether the retail business in Anderson is performing higher or lower than the average expectancy as indicated by the county. Second, in addition to the town and county comparison, this study offered the unique and interesting possibility of comparing all of the retail outlets of Anderson which were directly affected by the new highway with the retail outlets in the remainder of the town which were unaffected.

Study Covers Four Years

The time period for this economic study covered a total of four years, permitting a comparison of two years before the completion of the new expressway with the two years following that date. June 30, 1950, has been used as the highway completion date. It coincides closely with the date the new highway was dedicated and it is the most convenient date for analyzing the sales tax returns.

All sales tax figures have been calculated to the nearest one hundredth, but for discussion and exhibit purposes, the nearest whole figure has been used.

The percentages of gains or losses in the two charts showing retail business activity reveal the amount of gain or loss for the two years following the



The percentage increase or decrease in gross volume retail sales made during the two years after the expressway completion as compared with the two previous years in Anderson and Shasta County. Anderson sales shown on the left and Shasta County on the right in each pair of columns.

completion date of the new expressway as compared with the sales activity for the two previous years. For example, the accompanying chart shows two columns for total business activity. The Anderson column is marked 49 percent. This means that business in Anderson was 49 percent better during the two years after the expressway completion date than during the two years before.

Segregation by Class

A segregation by class has been made because there are certain types of retail outlets such as cafes, bars, and service stations, which can be operated to derive a great deal of their business from the traveling public.

Making a separate study of those retail outlets which are most likely to be patronized by the highway motorist, we are able to see what the effect of the new highway construction has been upon this class.

The remainder of the retail outlets are grouped together under the title "all others." The retail outlets in this class are the ones which serve the needs of the community such as the grocery, drug, clothing, hardware, appliance and furniture stores.

ANDERSON ON TOP

Facts show Anderson gross sales higher than Shasta County for all types of retail outlets.

	Anderson	Shasta County
Total	49% gain	27% gain
Cafes and bars	58% gain	1% loss
Service stations	46% gain	10% gain
All others	48% gain	32% gain

The percentages in this table are shown in the above chart to portray the notable difference in volume of retail business performed by Anderson and Shasta County during the same period of time.

The pair of columns in the chart depicting total business activity reveal that all retail business in Anderson was 49 percent better during the two years after the opening of the new expressway as compared with the two years before. During this same period of time all retail business in Shasta County made gains amounting to 27 percent. Provided there are no unusual circumstances influencing the county sales activity, we can assume the increase in the volume of retail business of Shasta County is indicative of anticipated gains to be made by all retail business in this general area. From a percentage-wide standpoint, the business

gains made in Anderson were 79 percent greater than the gains made in Shasta County. This percentage does not appear on the chart, but has been calculated only to show how far the business gains in Anderson exceeded the gains of the county.

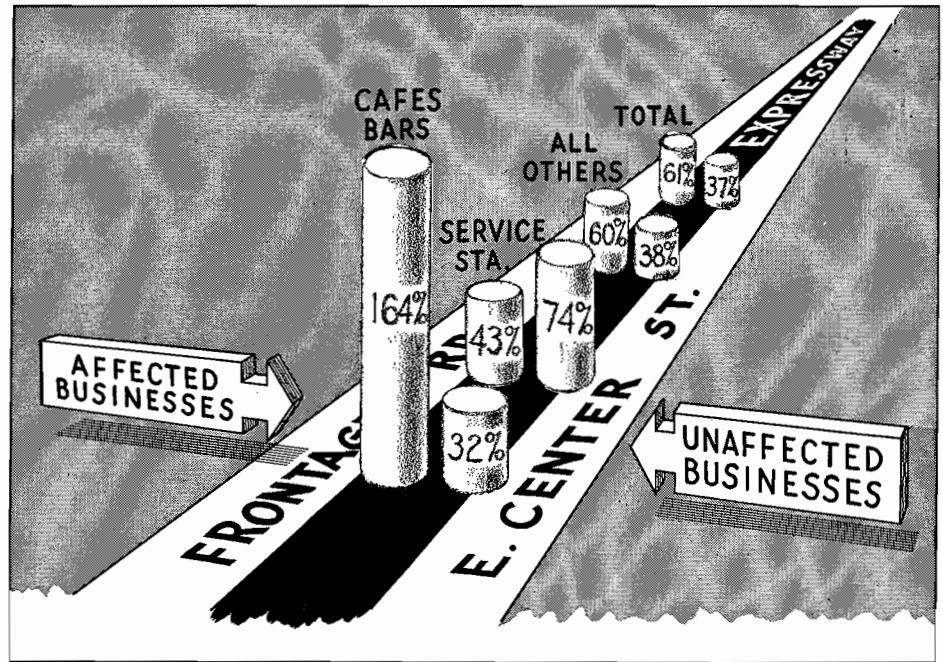
Purpose of Study

The active new lumber industry in Anderson has contributed a great deal to the retail gains made by this community. However, we cannot overlook the fact that other communities in Shasta County have also benefited by the growth of new industrial enterprises. Exactly how much these new industries are adding to the wealth of each community is not within the realm of this study. The purpose of this economic study is to determine how much the *new highway* has influenced the community and that property which is directly affected.

It may be questioned that the use of a direct comparison between Anderson and the County of Shasta is unwise for the reason that the new wealth brought to the community by the lumber industry is the major contributing factor and applies mostly to the town of Anderson. However, by the use of the second comparison which compares all of the retail business adjoining and directly affected by the new highway with the remaining business which was entirely unaffected, it is clearly reasonable to assume that both sections of Anderson would be subject to and affected by all contributing influences in a similar manner, and the major difference would be the highway influence.

Comparisons

If the near-by lumber industry increased the gross sales returns of the east side of Anderson, it follows that the west side would also enjoy this increase. The same condition would also apply to land values, in that if economic changes within the community created a greater demand for land on one side of Anderson it would create a similar demand on the other side. However, before going further into this comparison of one side of Anderson with the other, let us first review the comparison of the town of Anderson and Shasta County.



The percentage increase in gross volume retail sales during the two years after the expressway completion as compared with the two previous years on both sides of the highway in Anderson. The four columns on the right side of the chart along East Center Street reveal sales increases on the unaffected side and the four columns on the Frontage Road show the percentage increase on the affected side of the highway.

The facts reveal that the cafes and bars in Anderson made an increase in gross retail sales of 58 percent, whereas this same class of business throughout Shasta County suffered a loss of 1 percent in gross volume of retail business during the two years after the expressway completion date.

Service Stations Benefit

Going further into the activity of retail outlets most likely to be patronized by the highway motorist, let us look at the business gains made by service stations. The chart shows that in Anderson the service stations enjoyed a 46 percent increase in gross business. During the same two years after the expressway completion date, all service stations in Shasta County made a gain of 10 percent.

The wide range existing between Anderson and Shasta County in the retail sales activity of cafes, bars and service stations indicates that the change in the design of the highway through Anderson did not discourage the highway motorist from patronizing these businesses which cater to highway traffic.

“All Other” types of business in Anderson made retail gains amounting to

48 percent. This same group of retail outlets throughout Shasta County made an increase of 32 percent in the gross volume of retail sales.

In a final review of the chart, we see something that is as impressive as the increased volume of retail sales. The over-all high business gains were not brought about by the spectacular or unusual activity of a small number of retail outlets; instead we find almost a uniform gain for all types of retail outlets, which is a healthy sign for the business activity of the community.

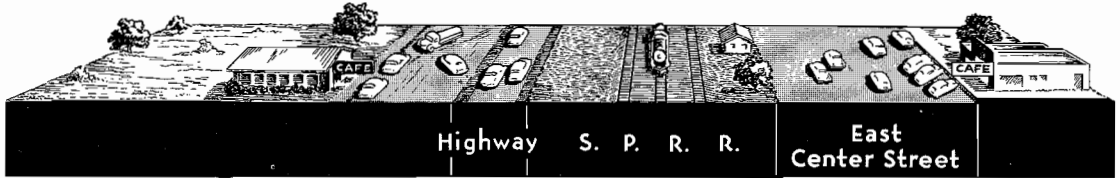
HIGHWAY INFLUENCE ON BUSINESS

Gross business volume of retail outlets on new frontage road makes an excellent record compared with similar properties which are unaffected by new highway construction.

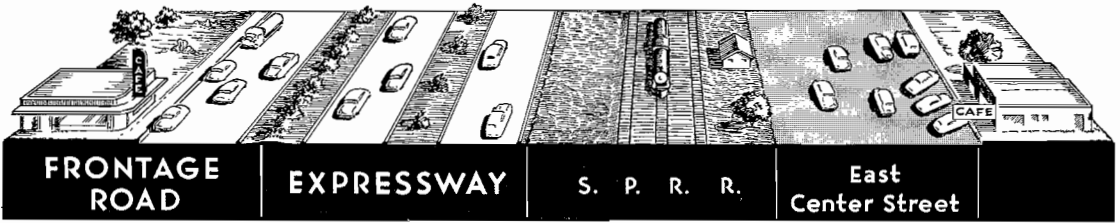
	Affected business	Unaffected business
Total	61% gain	37% gain
Cafes and bars	164% gain	32% gain
Service stations	43% gain	74% gain
All others	60% gain	38% gain

To emphasize the differences in the gains made in gross volume of retail business, the percentage increases are shown on the accompanying chart.

BEFORE →



AFTER →



The above perspectives of Anderson clearly illustrate the highway improvement on the west side of the railroad

East Center Street marks the location of those retail outlets which have been unaffected by the new highway construction. The four columns shown on this street depict the percentage gains made by all of the retail outlets; cafes and bars; service stations; and all other types of retail outlets. Frontage road shown on the left side of the chart marks the location of those retail outlets which were directly affected by the new highway construction. The percentage gains made by those retail outlets are shown on the four columns along the left side of the chart on the frontage road designation.

Effect of Access Restriction

This phase of the study gives a clear picture of exactly how much economic effect the restriction of access and the construction of the frontage road has had on those properties affected. The volume of gross business performed by

the retail outlets on the frontage road is compared with their performance when they had full access on a through highway. The difference in performance of those retail outlets is compared with the before and after sales activity of all other retail outlets in the community which are unaffected by the new highway construction. The measure of benefit which has been added by reason of being on the new frontage road is the difference in the gains made by these two groups of retail outlets.

Retail Business Increase

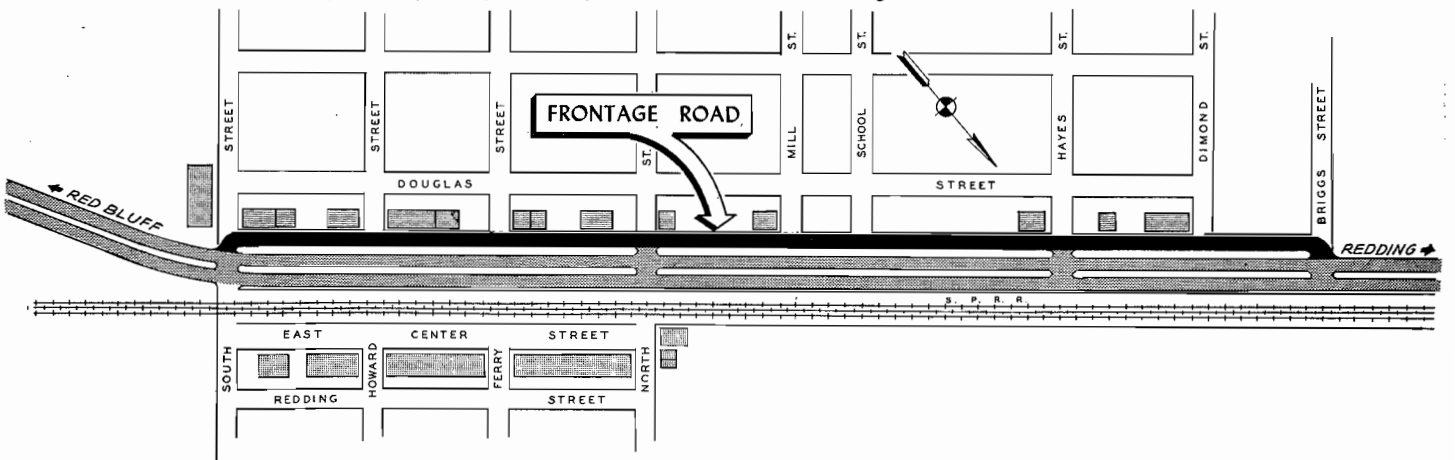
There are 21 retail outlets on the frontage road and 24 on the unaffected side which report sales tax returns to the State Board of Equalization. Barber shops, dry cleaners, and other personal services do not report sales tax returns, so they are not included in this study.

The facts reveal that the total gross volume of retail business on the front-

age road increased 61 percent during the two years following the opening of this new road. During the same period of time the retail outlets on East Center Street made a total increase in gross sales amounting to 37 percent. The differences in the gains made between the affected and unaffected sides show that retail business on the frontage road excelled by 63 percent the gains made by retail business which was subjected only to the normal economic influences of the community.

The chart shows that cafes and bars along the frontage road enjoyed an increase in gross retail sales amounting to 164 percent. At the same time, cafes and bars on the unaffected side had business increases amounting to 32 percent. The sales increases of the cafes and bars along the frontage road indicate that this particular type of business has benefited considerably from the new frontage road location.

This plan shows the new highway improvement through the center of Anderson. Shaded squares mark location of retail outlets on Frontage Road and East Center Street. Note four openings from expressway to Frontage Road and two railroad crossings at North and South Streets to East Center Street.



What Chart Shows

The service stations on the frontage road made an increase in total retail sales of 43 percent. The single service station on the unaffected side shows an increase of 74 percent in gross retail sales. This is the only example of the entire study where the retail gains made on the frontage road have been lower than the gains on the unaffected side. It is also the only comparison between a group and a single retail outlet. An

analysis of the service station sales is covered in the section of this study entitled "Service Station Survey."

The remainder of the retail outlets classified as "all others" on the chart show an increase in gross retail business amounting to 60 percent on the affected side and 38 percent on the unaffected side. This group of retail outlets represents the majority of the number of retail outlets and dollars spent within each particular retail area.

The activity of this group of retail outlets more accurately portrays the status of business than any other group of retail outlets.

SERVICE STATION SURVEY

The factual study of retail sales volume which included service stations has been supplemented by a survey of the gallonage sales of all service stations in Anderson. These records reveal that gallonage sales of the six stations on the

UPPER—East Center Street in Anderson before new highway construction. LOWER—Same thoroughfare after completion of freeway.



frontage road have made an average increase of 16 percent during a six-month period of time after the completion of the new highway. The gallonage sales of the single service station on the unaffected side show an increase of 23 percent during a similar six-month period of study.

The six-month time base was used because it provided the greatest length of time that all service stations were in full operation for the same seasons of the year before and after construction of the new highway.

Although the time base is relatively short, it provides an accurate and interesting comparison of the gallonage sales for those stations formerly having unlimited access to the through lanes of traffic.

The single station on the unaffected side precludes the opportunity of making a fair comparison. Management, brand of gas, site distance, and a host of other factors have such a strong influence that any variation along these lines would upset the comparative base. This fact is obvious when a review of the gallonage sales along the frontage road reveals that one station had a gallonage increase of 4 percent and another gained 28 percent. It is only by having a sufficient number of outlets that a reliable average can be developed.

The 16 percent increase in gallonage sales by the six service stations on the frontage road is a very significant gain when compared with the 7.8 percent increase in gallonage sales made by all service stations throughout the State during the same six-month study period.

PROPERTY VALUATION

There has been very little real estate sales activity along the highway route through Anderson since the Division of Highways purchased the right of way for the new expressway and frontage road in late 1948 and early 1949. At that time, the State purchased a 63-foot strip of land across the front of 23 parcels adjoining the west side of U. S. Highway 99. This acquisition reduced the depth of the lots from 150 feet to 87 feet. Subsequently, the county abandoned 10 feet from the street in the rear of these parcels, thereby increasing the remaining lot depth to 97 feet.

There are not a sufficient number of sales to permit a definite analysis on exactly how much the real estate market has changed since the construction of the frontage road. However, a review of a few known facts leaves little doubt with respect to the confidence the local citizens have in the future of property along this street.

1. Highest price paid for a single piece of real estate in Anderson in the past two years was for a property located on the frontage road.
2. The few real estate sales on the frontage road have been in line with or slightly higher than sales of comparable property in the community.
3. There have been no sacrifice sales on the frontage road.
4. There have been several examples of property owners preferring to lease rather than to sell.
5. Smaller percentage of vacancies among improved properties on frontage road than on East Center Street.
6. Six new businesses have started on the frontage road since its construction.
7. No business failures since frontage road was built.

One definite conclusion can be made; property on the frontage road has not decreased in value.

ASSESSED VALUES

Although assessed values may not in some instances indicate the market value of real estate, they do reflect the opinions of value of the local authorities responsible for land valuation for tax purposes. It is therefore significant that the present assessed values of the land abutting the frontage road was increased 14 percent over and above the increase of similar properties on East Center Street.

The retail lots on East Center Street have a depth of 150 feet. The assessed value of inside lots having a 50-foot frontage on this street is 57 percent higher in 1952 than in 1948.

The retail lots on the frontage road had a depth of 150 feet in 1948; they have a depth of 97 feet in 1952. The assessed value of inside lots having 50 feet frontage on the frontage road is 71 percent higher in 1952 than in 1948, although they possess 33 percent less area than in 1948.

Because of the variation in the opinion of the values on corner lots, we did not use them for comparative purposes in this analysis. However, the corner lots on the frontage road would show a higher increase percentagewise in assessed value than the inside lots.

TRAFFIC

With the present highway facility the citizens are hardly aware of the growing traffic in their vicinity. Traffic counts indicate that on U. S. Highway 99 in 1947, 4,540 vehicles per day were passing through the Anderson area, whereas the counts in 1952 indicate a daily traffic count of 6,300. In other words, there is an increase of 38.8 percent of traffic since 1947. If this increase of traffic was using the former two-lane highway, the businesses facing the frontage road would now be in the same dilemma as many of California's cities in attempting to solve their traffic congestion problem.

It has been thoroughly proven that there is no direct relationship between the amount of traffic and the amount of business transacted. The only possibility of transacting business is when it is possible for the motorist to park his car to do his buying. With the frontage road, the businessmen of Anderson are now able to offer their buying public parking space and protection. Without the frontage road the motorist would not feel safe in stopping and would be subject to the usual high percentage of accident potential wherever conflicting traffic movements exist.

CONCLUSION

The factual information in this study clearly indicates that this frontage road is a benefit to the property affected and to the entire community.

Three important conclusions from this study are:

1. Retail outlets on the frontage road showed highest business gains in the community.
2. Frontage road has not been a detriment to property values; there are indications of an increase.
3. New frontage road improves the appearance of the community. Adequate area remaining on frontage road for future retail growth with no interference from increasing highway traffic.

California Bridges

Cost and Volume of Bridge Construction: 1934-1952

By J. S. McCLELLAND and W. J. YUSAVAGE
Junior Research Technicians, Bridge Department

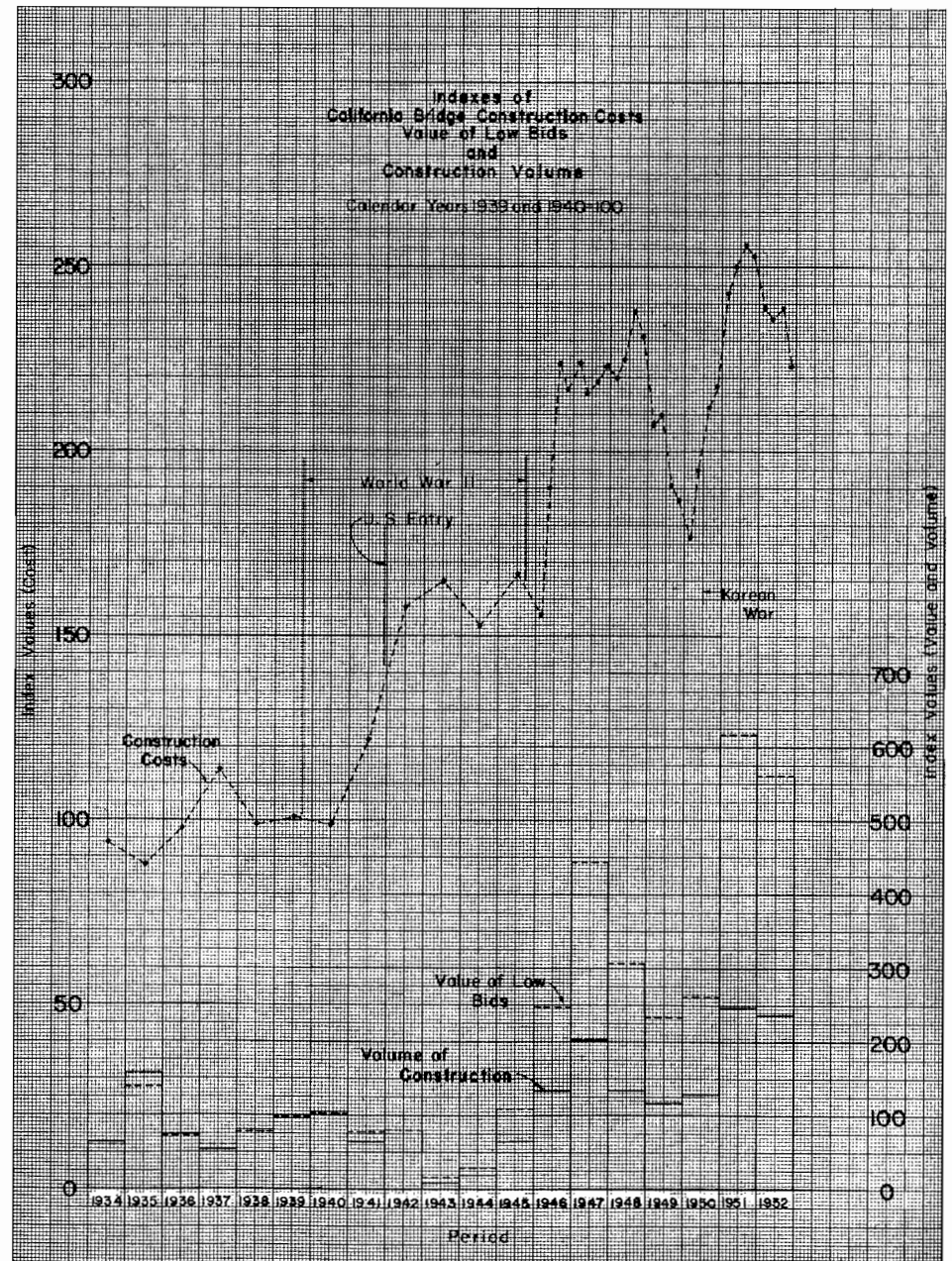
The following article deals in detail with California highway bridge costs. For total highway costs of which bridge costs are but a portion, the reader is referred to a series of articles entitled *Highway Costs*, by R. H. Wilson, H. C. McCarty, R. R. Norton, and J. D. Gallagher in the January-February, 1949; July-August, 1950; March-April, 1951; July-August, 1951; November-December, 1951; May-June, 1952, and July-August, 1952, issues of *California Highways and Public Works*.

NATION-WIDE building and construction costs have undergone an almost continuous increase during the past 20 years. As reported in various construction cost indexes this upward trend varies with the general type of activity represented as well as the source and treatment of the underlying cost information.

The increasing importance of bridges—particularly freeway structures—in the state highway construction program has stimulated interest in the effect inflationary pressures have had locally upon the cost of this specific type of construction activity. As a result, a study of the actual costs to the State for bridge construction during the past 20 years was undertaken recently in the Bridge Department of the California Division of Highways. This study furnished the index values shown in the accompanying chart which indicates the relationship of California bridge construction costs during each calendar year 1934-45 and during each subsequent calendar quarter to the level of costs during the base period, the calendar years 1939 and 1940.

Determination of Costs

The cost to the State for bridge construction during a given period is measured by the cost of predetermined



quantities of 14 contract items of work—employing weighted averages of the item unit prices found in all bids accepted during the given period. The cost of this fixed schedule of work dur-

ing the period 1939-40 is assigned the index value 100 while the cost during each other period is expressed in an index value reflecting percent of the cost during the base period.

Each index value represents a level of costs for the entire period to which it relates. Following the common custom these values are joined in the chart by a "trend line" which, of course, does not serve to indicate the day to day movements of costs. The 14 items of work, which are listed in Table I, account for approximately 80 percent of the periodic outlay by the State for contracted bridge construction; the remaining 20 percent is accounted for primarily by lump sum items which are not adaptable to accurate periodic comparison. The contract item quantities of the fixed schedule represent actual usage during the base period; data for the two years 1939 and 1940 were employed in order to obtain a representative quantity relationship among the 14 items of work. These item quantities are reported in Table I along with the total cost of each item during the base period and the resulting weighted average item prices.

Value of Volume

In conjunction with the index of the cost of California bridge construction, two indexes of the value of awarded bridge work are shown in the chart. Total value of low bids on work pro-

posals is reported in one index, while the value of low bids deflated to figures which would result from the use of base period prices is shown in the other. The latter serves in effect as an index of the volume of awarded bridge construction. Index values for the three indexes plotted in the chart are shown in Table II. Columns III, IV, and V report index values for the indexes of cost, value, and volume respectively, while Column VI reports the periodic dollar values of all low bids on bridge construction, including work not considered in the cost index.

Although the chart reports only yearly value and volume information, the indexes of these two measures were designed with a view to permitting comparison of information relating to periods of unequal length. This was carried out by basing the indexes upon the average quarterly information of the two-year base period, with which average quarterly information for other periods of one or more quarters can be readily compared. In these indexes the average quarterly information for the years 1939 and 1940 is given the index value 100; the index value for each other period is obtained from the ratio of average quarterly given period

information to average quarterly base period information. The volume of bridge construction for a given period, as shown in the index reporting this information, is merely the ratio of the dollar value of low bids to the cost of bridge construction during the same period, presented in index form.

Trend Components

The effect of those general economic conditions which direct the course of nation-wide construction costs can be seen clearly in the trends of California bridge construction costs. Local conditions, however, contribute minor trends and influence the course of those trends introduced by the general situation. One such local condition is the volume of general construction activity in the State. The two peaks and the intermediate low point in the cost of California bridge construction during the period 1948-1951 are found to occur at the time of similar high and low points in the local volume of general construction activity. The seasonal trend of costs also agrees with the strong seasonality in the volume of local construction. This cost seasonality, although partially hidden by sharp general trends, is characterized by a peak of costs during the third quarter of each calendar year, a low during the first quarter, and a lesser tendency for the fourth quarter level to exceed that of the second quarter.

General Trend

The effect of nation-wide economic factors is shown in the index by the sharp rise of California costs at the onset of World War II which ended a period of stability in costs. By the end of 1942 costs had risen 60 percent from the prewar level to a point which marks the approximate center of fluctuations of costs during the remainder of the war. The very sharp rise of costs early in 1946 tells the story of the resumption of general construction activity following the removal of construction controls. In a period of six months costs went up nearly 40 percent to a level which held for approximately two years. A sudden peak occurring late in 1948 was followed by a decline in costs which did not halt until early in 1950 when, with the start of hostilities in Korea, the trend was reversed

TABLE I
TOTAL QUANTITIES, WEIGHTED AVERAGE PRICES, AND DOLLAR AND RELATIVE VALUES OF
LOW BIDS FOR 14 PRINCIPAL ITEMS OF WORK IN CALIFORNIA BRIDGE
CONSTRUCTION CALENDAR YEARS 1939 AND 1940

Items of work	Total base period contract quantities	Weighted average prices	Dollar values of base period low bids	Relative values
Structure excavation	156,286 cubic yards	\$1.56	\$244,398.00	3.24%
Class "A" portland cement concrete (structure)	176,634 cubic yards	18.42	3,252,837.00	43.13
Class "A" portland cement concrete (footing block)....	12,774 cubic yards	12.04	153,745.00	2.04
Structural steel				
(plate girder)	5,810,000 pounds	.077	450,221.00	5.97
Structural steel (rolled beam)	4,953,000 pounds	.063	310,900.00	4.12
Structural steel (truss).....	7,884,000 pounds	.099	782,269.00	10.37
Miscellaneous iron and steel	766,630 pounds	.138	105,639.00	1.40
Bar reinforcing steel.....	35,958,000 pounds	.040	1,440,424.00	19.10
Furnishing steel piling.....	79,329 linear feet	1.79	142,168.00	1.88
Furnishing concrete piling ...	146,861 linear feet	1.60	235,477.00	3.12
Driving steel piling.....	2,313 each	25.29	58,490.00	.78
Driving concrete piling.....	3,781 each	40.84	154,411.00	2.05
Steel bridge railing.....	21,709 linear feet	5.93	128,798.00	1.71
Concrete bridge railing.....	42,976 linear feet	1.91	82,190.00	1.09
			\$7,541,967.00	100.00%

and in a period of 18 months costs rose nearly 45 percent to an all time high of 256 on the index scale. Since the peak during the third quarter of 1951, California bridge construction costs have undergone a significant decline—a decline which can be attributed largely

to local conditions in view of the continued upward trend, reported by the Bureau of Public Roads, in the nationwide cost of highway structures.

Inspection of cost data for the 14 items of work entering into the computation of California bridge construc-

tion costs shows that the contract item portland cement concrete (structure)—the item accounting for the greatest outlay—has had the greatest inflationary effect upon bridge construction costs. Reinforcing steel and structural steel, in that order, have shown lesser increases in cost, while furnishing and driving steel and concrete piling have, among the major items, shown the smallest increases. Although information obtained from the contract prices of proposed work items does not lend itself to a consideration of the underlying elements of cost, it may be noted that the greatest increases in cost are found in those items of work requiring the greatest relative amount of labor in the field.

Prospects

As of the fourth quarter of 1952, California bridge construction costs stand at a level approximately 13 percent below the 1951 peak. The significant decline of costs during the past 15 months has carried the present level somewhat below that of the temporary 1948 peak. This decline, occurring without benefit of comparable reductions in the cost of materials and labor, has accompanied the appearance of a stronger competitive attitude as well as increased confidence in the possibility of avoiding undue hindrance from intangible factors such as the delays in obtaining materials, the scarcity of experienced labor, and the general uncertainty about future conditions which accompanied the first year of the Korean War. The local situation at present offers little evidence of an immediate resumption of the strong upward trend, barring a sharp increase in construction activity or other unforeseen conditions on the national level.

PHOTO BY NICKERSON

8 San Miguel Drive
Chula Vista, California

Editor

DEAR SIR: I find the magazine highly interesting and valuable. The cover photos are always attractive but I thought the November-December cover by Mr. Nickerson was especially outstanding.

Yours very truly,

H. W. ROCHE

TABLE II
INDEXES RELATING TO CALIFORNIA BRIDGE CONSTRUCTION AND PERIODIC DOLLAR
VALUES OF LOW BIDS ON CALIFORNIA BRIDGE CONSTRUCTION

I Year	II Quarter	III Index of the cost of California bridge construction (1939-1940=100)	IV Index of the value of California bridge construction (1939-1940=100)	V Index of the volume of California bridge construction (1939-1940=100)	VI Dollar value of low bids on California bridge construction (in millions of dollars)
1934		94	60 *	64 *	3.1
1935		88	138 *	157 *	7.1
1936		98	72 *	73 *	3.7
1937		114	60 *	53 *	3.1
1838		99	78 *	79 *	4.0
1939		101	99 *	98 *	5.1
1940		99	101 *	102 *	5.2
1941		122	78 *	64 *	4.0
1942		158	80 *	50 *	4.1
1943		165	16 *	9 *	.8
1944		153	29 *	19 *	1.5
1945		167	109 *	65 *	5.6
1946	1st	156	247 * { 342 295 148 202	133 * { 219 155 66 93	12.7 { 4.4 3.8 1.9 2.6
1946	2d	190			
1946	3d	224			
1946	4th	217			
1947	1st	224	443 * { 280 629 450 412	202 * { 125 291 206 185	22.8 { 3.6 8.1 5.8 5.3
1947	2d	216			
1947	3d	219			
1947	4th	223			
1948	1st	220	307 * { 233 365 381 249	134 * { 106 162 160 108	15.8 { 3.0 4.7 4.9 3.2
1948	2d	225			
1948	3d	238			
1948	4th	231			
1949	1st	207	233 * { 186 342 194 210	117 * { 90 163 102 112	12.0 { 2.4 4.4 2.5 2.7
1949	2d	210			
1949	3d	191			
1949	4th	187			
1950	1st	177	262 * { 124 357 171 396	129 * { 70 183 81 182	13.5 { 1.6 4.6 2.2 5.1
1950	2d	195			
1950	3d	212			
1950	4th	218			
1951	1st	243	617 * { 528 948 598 396	247 * { 217 379 234 157	31.8 { 6.8 12.2 7.7 5.1
1951	2d	250			
1951	3d	256			
1951	4th	253			
1952	1st	239	561 * { 396 1,017 652 179	237 * { 166 431 273 80	28.9 { 5.1 13.1 8.4 2.3
1952	2d	236			
1952	3d	239			
1952	4th	223			

* Average quarterly information.

In Memoriam

HERBERT L. COOPER

The passing of Herbert L. Cooper and his wife, Margaret, was received with deep regret and shock by their many friends following a head-on collision on the highway in the vicinity of San Ardo, Monterey County, on December 29, 1952.

The Coopers had been visiting during the Christmas holidays in the San Luis Obispo area where, in serving the Highway Department for many years in responsible supervisory capacities, he had enjoyed the respect and friendship of not only his co-workers, but also of many residents in the community.

Herb, while born in Chicopee, Mass., and graduating from Lehigh University, moved to California shortly after World War I and soon joined the State Division of Highways where, over the years, he worked in several parts of the State and advanced to important assignments which he carried out with honor to himself and the department.

For the last seven years before his retirement in August, 1952, he represented headquarters throughout the several districts and was always a welcome source of assistance and information to the many with whom he came in contact. As a vindication of Herb's sterling character, he had suffered poor health for many years, however, his physical discomfort was never a source of complaint nor did he allow it to affect his work or associations with others, which were manifested by his ever cheerful and friendly disposition.

"Herb" and "Peg" Cooper made a host of friends wherever they went throughout the State, and these friends have been deeply saddened and shocked by their sudden passing.

In Memoriam

SPENCER W. LOWDEN

Death has taken Spencer W. Lowden, one of the pioneer engineers of the Division of Highways. Mr. Lowden died in San Bernardino, which was his headquarters as District Engineer of District VIII, on January 13th. Death was preceded by a heart attack.

Mr. Lowden was born at Lowden's Ranch, Trinity County, April 27, 1888, the grandson of California pioneers who crossed the plains from Illinois to Sacramento in 1848-49.

After studies at St. Mary's College and Vander Naillen's School of Engineering in Oakland, he engaged in engineering work on roads and railroads in Northern California.

He entered the service of the California Highway Commission on April 3, 1912, at Redding, as rodman, and rose through the ranks to the position of District Maintenance Engineer of District II, with headquarters at Redding.

On September 8, 1933, he was promoted to Acting District Engineer and subsequently to District Engineer of District IX, with headquarters at Bishop. At that time he assumed responsibility for the improvement and maintenance of 824.7 miles of state highways in Inyo and Mono Counties and the eastern portion of Kern County, including 338 miles of county roads added by the Legislature to the State Highway System in the district that same year, many of which were dirt or gravel roads.

For the next 17 years he continued to improve the state highways which are the lifeline of the region, and which now total 954.6 miles for the district. Among the mountain passes traversed by the state highways in the district is Conway Summit on U. S. 395, the highest (8,136 feet) pass kept open all year round by the State Division of Highways.

Mr. Lowden worked successfully with the people of his district and with their local governmental agencies, and became a community leader in his home town of Bishop, where he was an active member of the Elks and Masonic Lodges and the Rotary Club.

On October 1, 1950, he was transferred to larger responsibilities as District Engineer of District VIII, San Bernardino, where he continued to serve until his death. In the past few years in District VIII he was in charge of the development of U. S. 395 to multilane divided standards, the planning and construction of the eastern portion of the Ramona Freeway, and the improvement of many routes serving the communities of San Bernardino County and the western half of Riverside County.

He is survived by his wife, Mrs. Mildred Lowden of San Bernardino; by his daughters, Mrs. Margaret Young of Reno and Miss Patricia Lowden of San Bernardino; by his son, Earl Lowden of Bishop; and by three grandchildren, Vicki, Jacqueline, and Robert Lowden of Bishop. He is also survived by three brothers, P. R. Lowden of Marysville; Henry Lloyd Lowden and E. H. Lowden, both of Redding; by two sisters, Mrs. Marian Gilfillan of Visalia and Mrs. Kathleen Roberts of Claremont; and by his aunt, Mrs. Nellie Hollingsworth of Redding.

McNeely Takes Over District Post of Spencer Lowden

STATE Highway Engineer George T. McCoy on January 15 appointed L. R. McNeely Acting District Engineer of District VIII of the Division of Highways pending the naming of a permanent successor to the late Spencer W.

Lowden. District VIII, with headquarters in San Bernardino, administers state highways in San Bernardino and part of Riverside Counties.

Mr. Lowden, a long-time employee of the Division of Highways, died Jan-

uary 13 after a brief illness. McNeely served under him as Assistant District Engineer in charge of operations.

Funeral services were held for Mr. Lowden in Redding, Shasta County, on Monday, January 19.

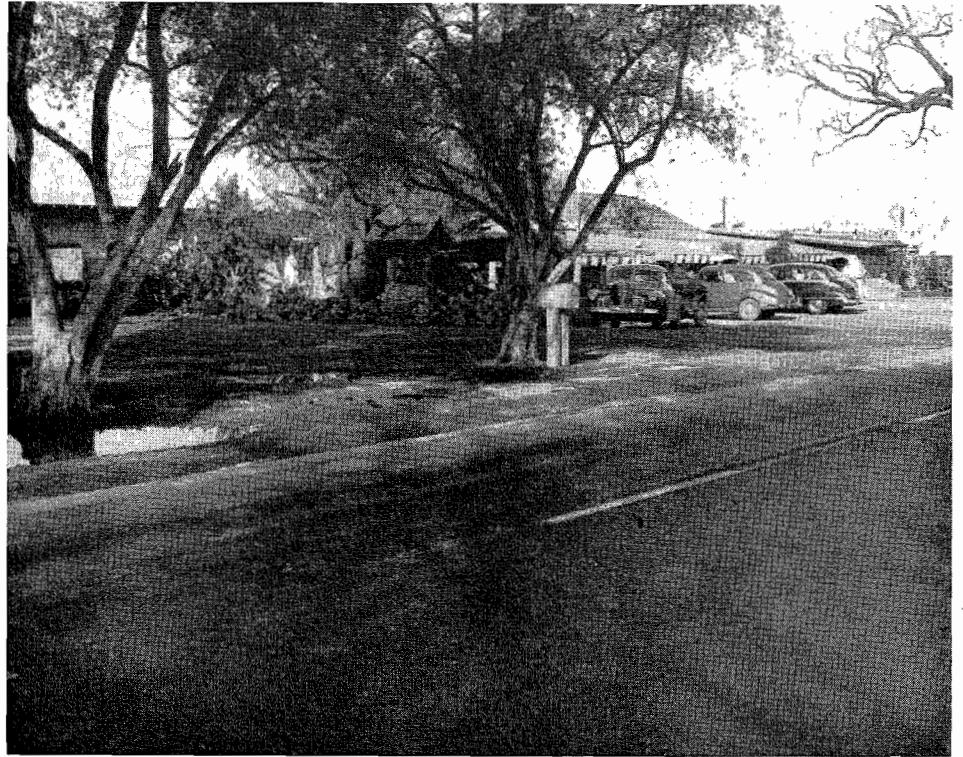
Uncontrolled Access

Control Eliminates
Serious Accidents

THE ACCOMPANYING before and after accident diagrams show the very favorable results obtained by the elimination of uncontrolled access at the Nut Tree Restaurant near Vacaville, on U. S. Highway 40 in Solano County.

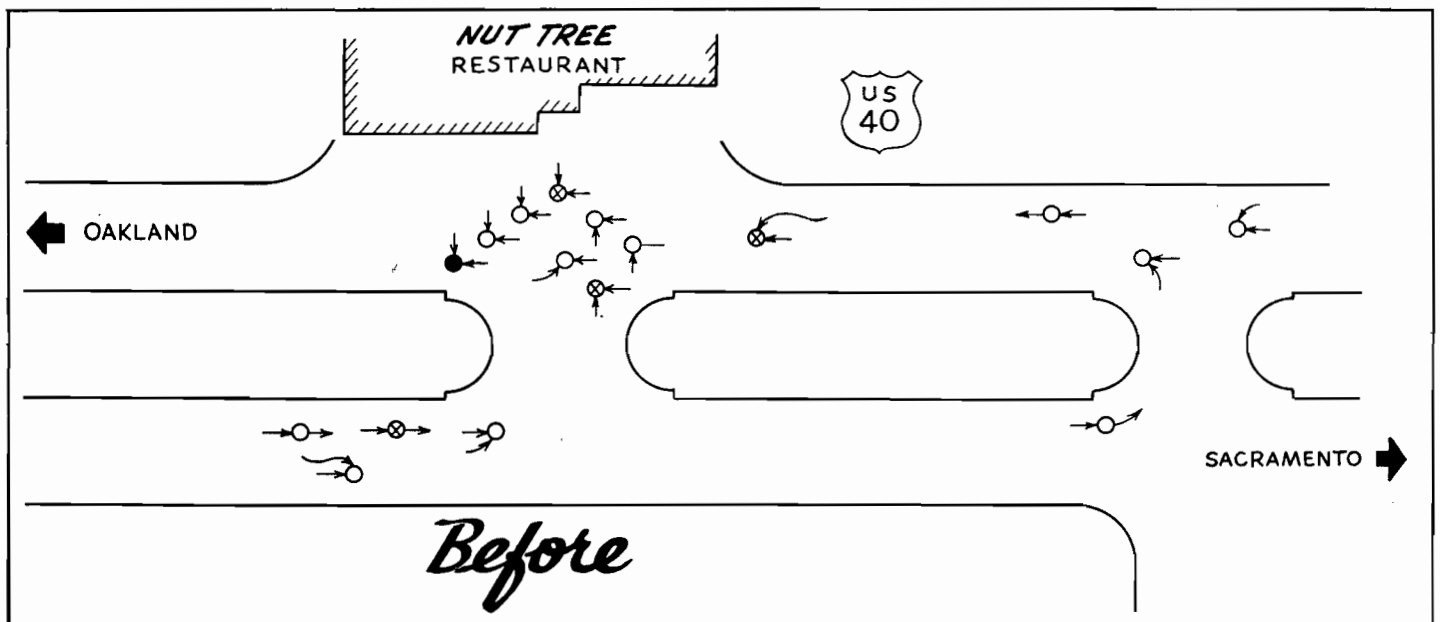
In the two years preceding the improvement, there was a total of 17 accidents at this location. This total included one fatal and four other injury accidents. The majority of the accidents were due to indiscriminate parking and careless movements to and from these parked positions. The numerous trees which obscured the view of the entrance and crossover were a contributing factor. A sudden decision to stop when opposite the restaurant, accompanied by a quick deceleration or lane change, was the cause of five accidents pictured.

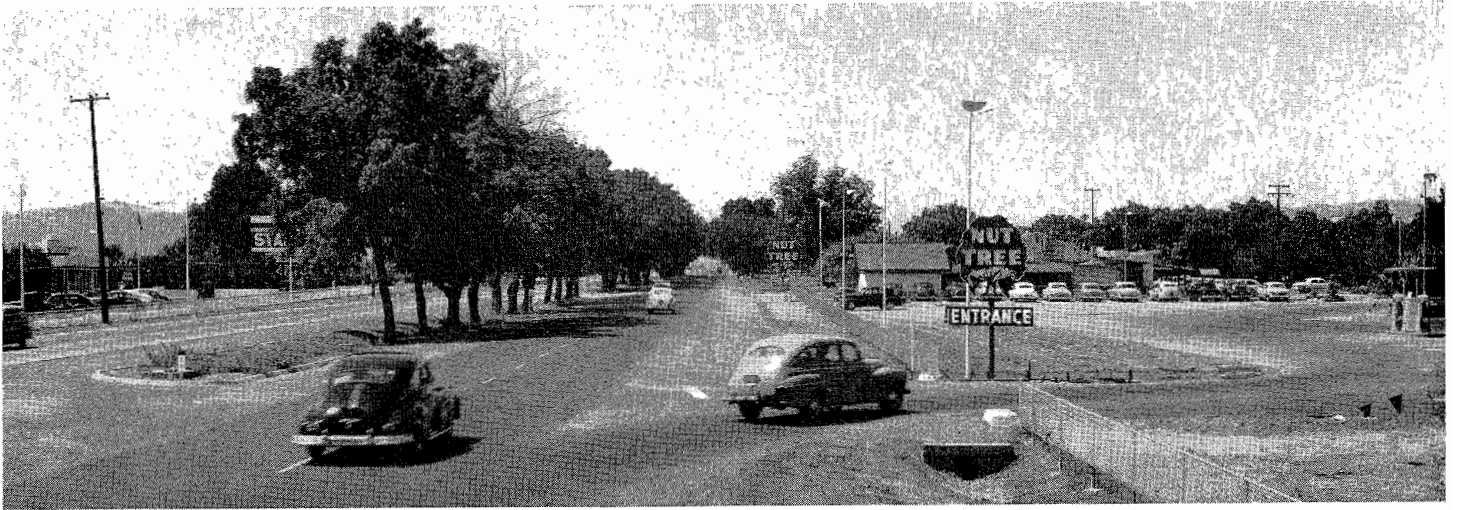
The improvement consisted in the construction of a frontage road with cyclone fencing to separate parking maneuvers from the through traffic lanes. The existing crossover was closed



This photo shows haphazard parking movements at Nut Tree adjacent to U. S. 40 before improvement

This accident diagram is for two years before June 17, 1951. Each arrow represents a vehicle and its direction of travel. Each open circle is a property damage accident; crossed circle, an injury accident; and filled circle, fatal accident.





Photograph of completed project, showing control of entrance and exit movement

and new entrances were provided approximately 500 feet on either side.

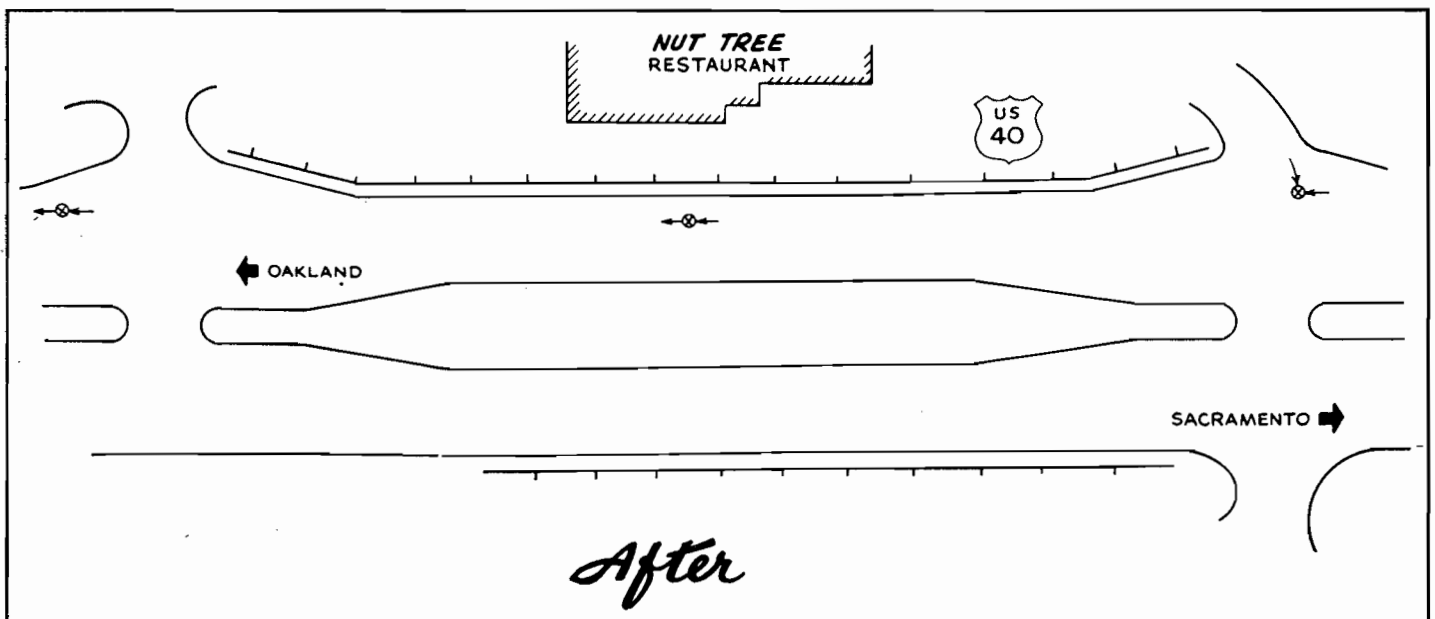
In the year and one-half since the completion of the improvement on June 17, 1951, there has been only one accident involving access to the Nut

Tree. The two rear-end accidents shown occurred within the project limits but involved only through vehicles on the highway.

Total cost of the project was \$28,845. Savings to the traveling public due

to the sharply reduced accident rate have to date, by any yardstick, approximated this cost. Expanding traffic volumes in the years ahead should reap increasing benefits from this improvement.

Accident diagram for 1½ years after June 17, 1951. Each arrow represents a vehicle and its direction; each crossed circle is an injury accident.



Cost Index

California Highway Construction
Costs Show Small Variations

By RICHARD H. WILSON, Assistant State Highway Engineer; H. C. McCARTY, Office Engineer;
JOHN D. GALLAGHER, Assistant Office Engineer

Highway construction costs in California at the end of 1952 were 7.8 percent lower than during the last quarter of 1951 as indicated by the California Highway Construction Cost Index, even though there was a rise of 2.3 percent during the fourth quarter of 1952.

A year ago the index had reached an all-time high of 245.4 (1940 = 100) during the fourth quarter of 1951.

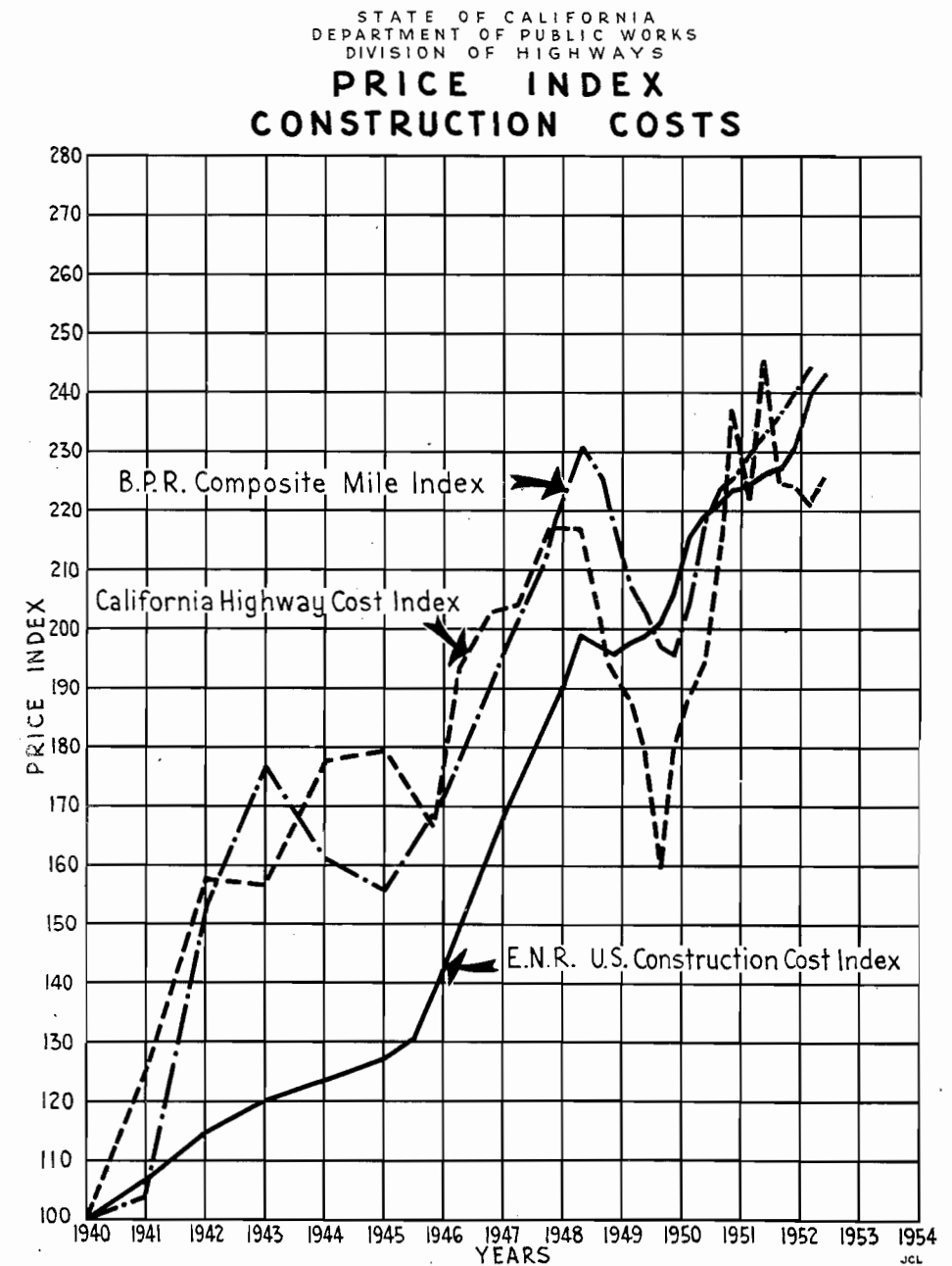
During the first quarter of 1952, however, the index fell off to 224.8, a drop of 8.4 percent.

During the second and third quarters it stood at 224.4 and 221.2 respectively. The 221.2 in the third quarter was the low for the year (9.9 percent below the last quarter of 1951) as the index rose 2.3 percent during the fourth quarter of 1952 to 226.2, which is only slightly higher than the first quarter of the year.

The static condition of highway construction costs in California during the entire year of 1952 may be the result of local trends, as on a nation-wide basis both the Engineering News-Record Construction Cost Index and the U. S. Bureau of Public Roads Composite Mile Index held to a slow but steady rise throughout the year.

It is felt that the limitation in down and up variations of the California Index during 1952 may be an indication that the upward spiral of highway construction costs has slowed down, but, with continuing increases in labor and materials costs, there appears little possibility of declining costs. However, many economic analysts throughout the nation are predicting in periodicals and on the air that prices will be lower in 1953.

There is nothing in the movements of the California Index during 1952 to support this opinion. It is anticipated that in the first quarter of 1953 the California Highway Construction Cost Index will drop slightly, but as



contracts are put under way during subsequent quarters it is expected the Index will rise.

The accompanying graph shows the comparative fluctuations of the California Highway Construction Cost

Index, the Engineering News-Record Construction Cost Index and the Bureau of Public Roads Composite Mile Index all reduced to a common base of 1940 = 100.

The following tabulation shows the

FIRST SECTION OF LONG BEACH FREEWAY OPENED TO TRAFFIC



Ribbon cutting. From left to right: County Supervisor Raymond V. Darby; Paul O. Harding, Assistant State Highway Engineer in charge of District VII; Spencer Cortelyou, Assistant State Highway Engineer, retired; R. M. Gillis, Deputy State Highway Engineer; Harrison R. Baker, member California Highway Commission; Burton W. Chace, Mayor of Long Beach; Albert G. Davis, President Long Beach Chamber of Commerce; H. R. Klockslem, Assemblyman; W. S. Grant, ex-Assemblyman

Year	Cost Index	Year	Cost Index
1940	100.0	1950 (2d quarter)	180.0
1941	125.0	1950 (3d quarter)	189.2
1942	157.5	1950 (4th quarter)	194.8
1943	156.4	1951 (1st quarter)	215.4
1944	177.8	1951 (2d quarter)	238.3
1945	179.5	1951 (3d quarter)	221.9
1946	179.7	1951 (4th quarter)	245.4
1947	203.3	1952 (1st quarter)	224.8
1948	216.6	1952 (2d quarter)	224.4
1949	190.7	1952 (3d quarter)	221.2
1950 (1st quarter)	160.0	1952 (4th quarter)	226.2

California Highway Construction Cost Index by years from 1940 to 1949 and by quarters from 1950 through 1952.

The accompanying tabulation of average contract prices for the eight construction items on which the California Index is based covers the same period as the tabulation of the index itself.

CALIFORNIA DIVISION OF HIGHWAYS AVERAGE CONTRACT PRICES

	Roadway excavation, per cu. yd.	Crusher run base, per ton	Plant mix surfacing, per ton	Asphalt concrete pavement, per ton	PCC pavement, per cu. yd.	PCC structures, per cu. yd.	Bar reinforcing steel, per lb.	Structural steel, per lb.
1940	\$0.22	\$1.54	\$2.19	\$2.97	\$7.68	\$18.33	\$0.040	\$0.083
1941	0.26	2.31	2.84	3.18	7.54	23.31	0.053	0.107
1942	0.35	2.81	4.02	4.16	9.62	29.48	0.073	0.103
1943	0.42	2.26	3.71	4.76	11.48	31.76	0.059	0.080
1944	0.50	2.45	4.10	4.50	10.46	31.99	0.054	0.132
1945	0.51	2.42	4.20	4.88	10.90	37.20	0.059	0.102
1946	0.41	2.45	4.00	4.68	9.48	37.38	0.060	0.099
1947	0.46	2.42	4.32	5.38	12.38	48.44	0.080	0.138
1948	0.55	2.43	4.30	5.38	13.04	49.86	0.092	0.126
1949	0.49	2.67	4.67	4.64	12.28	48.67	0.096	0.117
1st quarter, 1950	0.34	2.22	3.65	3.74	-----	40.15	0.077	0.081
2d quarter, 1950	0.40	2.13	4.48	3.74	10.86	43.03	0.080	0.105
3d quarter, 1950	0.41	2.32	4.25	5.50	10.91	44.34	0.093	0.131
4th quarter, 1950	0.42	2.81	4.64	4.61	12.55	43.18	0.098	0.120
1st quarter, 1951	0.45	3.07	4.06	5.22	11.71	46.38	0.103	0.206
2d quarter, 1951	0.63	3.88	4.56	4.63	12.93	51.50	0.105	0.166
3d quarter, 1951	0.56	2.88	4.59	3.90	12.41	46.14	0.107	0.165
4th quarter, 1951	0.66	2.91	5.66	4.89	12.71	49.38	0.105	0.169
1st quarter, 1952	0.56	3.25	4.88	4.77	14.25	47.46	0.094	0.152
2d quarter, 1952	0.53	3.19	5.29	4.13	14.20	49.12	0.091	0.143
3d quarter, 1952	0.55	2.61	5.49	4.60	12.80	48.21	0.094	0.132
4th quarter, 1952	0.66	2.68	4.97	-----	12.53	48.45	0.094	0.128

THE FIRST section of the Long Beach Freeway was officially put in operation the morning of December 10, 1952. Being 2.3 miles long, running from Pacific Coast Highway to 223d Street, the first section will relieve part of the congestion in Long Beach.

Separation structures have been built at Pacific Coast Highway and at Willow Street on the new highway. The City of Long Beach is building a connecting link from Pacific Coast Highway to its waterfront.

Contracts have been let for the building of structures and the grading and paving of the second section—which should be opened late in 1953.

HIGHWAY GAMBLERS

Many drivers would be offended if they were told they were gamblers, says the California State Automobile Association. Yet the chances they take in traffic are clear examples of betting with their lives for a slight advantage. It doesn't pay to take chances in the traffic game where life or death may be at stake. Take it easy and live longer.

Gaviota Tunnel

Continued from page 14 . . .

blower. An average round resulted in approximately 80 cubic yards of rock being removed from the face of the heading, which was loaded into Euclid dump trucks by means of an Eimco 1½ cubic yard overshot loader and hauled to the embankment areas. Upon completion of the mucking operation, the nine-segment arch was erected.

The timber sets were tied together with 6-inch x 8-inch collar braces and ¾-inch tie bolts to provide a stable support. The tie bolts will remain to replace reinforcing steel in the concrete arch lining while the collar braces will be removed prior to the lining operation.

After the heading was advanced for a distance of approximately 120 feet, the formation encountered indicated the tunnel would require supports throughout. In order to decrease the amount of excavation and the time required for placing of the supports, it was decided to take advantage of a supply of 42-pound 10-inch x 10-inch steel "H" bearing piles made available by the California Division of Highways. Instead of the nine-segment timber arch sections used in the first 120 feet, the steel arch sections were fabricated in two segments, each 25 feet in length along the arch.

Steel Supports Used

Driving of the tunnel continued in the above described manner with the wall plate drifts being advanced ahead of the main heading for the purpose of placing the new steel wall plates. The bottom flange of the steel arch sections was bolted to the steel wall plates as were the two segments at the crown of the tunnel.

The use of steel instead of timber supports resulted in substantial saving of tunnel excavation and lining due to the fact that the steel could be incorporated in the concrete lined section whereas the timber sets were placed outside of the lined area. Erection of the steel sets on five-foot centers could be accomplished in approximately half the time required to install the timber sets on four-foot centers.

Driving of the tunnel was completed for the timber and steel supported sec-

tions in much the same manner. For the entire length of the 385-foot heading, three locations were encountered where the formation was sufficiently stable to permit elimination of the wall plate drifts for an accumulated distance of 83 feet. Two hundred thousand board feet of lagging timber and 20,000 wedges were used in the process of construction.

Left Drift Holed Through

On February 6, 1952, the left drift was "holed through," an occasion which was duly celebrated by the traditional "holing through" party.

The fact that the tunnel bore intersects the north portal face at a 60-degree angle necessitated the erection of the steel supports in a fan pattern. The supports are secured to the wall plates at one-foot centers on the left and at five-foot centers on the right, an arrangement requiring the use of fillets or "dutchmen" to span the greater distance between the individual arch segments.

The bench section was removed in three operations. The center of the bench for a width of 26 feet was excavated for the entire length of the tunnel while the two remaining side benches were removed in 5- to 10-foot sections in order that the plumb posts could be placed under the wall plates. The posts on the left side were 12 feet long and on the right, 10 feet long—the difference in length being due to the 10 percent super-elevation in the tunnel floor. The central section of the bench was removed by drilling vertical holes at four-foot centers, blasting and removing the material as before. Air for the pneumatic equipment was supplied by one Gardner-Denver 500 C.F.M. and two Ingersoll-Rand 500 C.F.M. compressors operating at 100-pound pressure. Electricity was supplied by one Caterpillar and one LeRoi, 25 K.W. generator. Water for the drilling operations was supplied from an artesian well 600 feet deep located at the south portal.

Day and Night Shifts

The typical crew for both heading and bench shifts consisted of one walking boss, one shifter, five miners, five chucktenders, one tool nipper, one

mucking machine operator, two dump truck operators, one compressor operator, and one light plant operator.

The day shift was augmented by a tunnel superintendent, one powder man, two timbermen, one bulldozer operator, and a bull gang consisting of a foreman and three laborers.

The tunnel operations were conducted around the clock for six days per week between November 3, 1951, and March 5, 1952, at which date operations were carried on for two eight-hour shifts until March 31st, when the work was put on one eight-hour shift.

The construction of the Gaviota Gorge Tunnel is under contract by the Rhoades-Shofner Construction Company of Los Angeles, of which A. A. Mathews is Chief Engineer and W. A. Ripley is Project Superintendent. The contract is being administered by the Division of Highways, District V, E. J. L. Peterson, District Engineer, and C. I. Brown, Assistant District Engineer (Operations). The author is the Resident Engineer under the supervision of G. T. McCoy, Jr.* District Construction Engineer.

* Mr. McCoy resigned September 1, 1952, to work for a private contracting firm.

ENGINEER WANTS MAGAZINE

COUNTY OF LOS ANGELES
Road Department

DEAR SIR: I am presently employed by the Los Angeles County Road Department as a civil engineer assistant in the Location and Design Section of the Construction Division.

I've recently had the pleasure of seeing a copy of your publication, *California Highways and Public Works*, and was very greatly enthused by the wealth of valuable information it contains.

I would appreciate it if you would consider me for your mailing list because I'm sure that I will find your magazine very instructive and applicable to a great deal of my work. It is certainly one of the finest sources of information that I've seen in the field of highway and road design.

Very sincerely,

J. RAMIREZ

Photogrammetry

Specifications and Practices *
For the Use of Aerial Surveys

By EDWARD T. TELFORD, Traffic Engineer, and
L. L. FUNK, Assistant District Engineer

AERIAL PHOTOGRAPHY applied to mapping is not particularly new but recent years have seen phenomenal development, largely because older methods of mapping have proved too slow and expensive to meet certain present day needs. The highway engineer, faced with demands for surveys and plans expanding at a rate much greater than could be met by expansion of conventional methods and organization, has turned to aerial photogrammetry for help. We have found that aerial mapping methods, modified to suit the needs of the highway engineer and properly combined with conventional ground surveys, will permit us to develop plans more rapidly and at a substantial saving in cost over older methods.

The success of aerial surveys applied to highway engineering depends upon the highway engineer's understanding of the possibilities, as well as the limitations, of photogrammetry. Conventional photogrammetric methods must be properly combined with conventional ground survey methods and the selection of the best combination of methods must include consideration of the problems and requirements of the particular highway engineering job.

California Practices

In California we have developed certain practices which appear to have outstanding value, and it is proposed to devote this paper to those practices to the exclusion of others which may be either better known generally or less important in our experience.

The effect of these developments has been to tie photogrammetric mapping to highway surveys, with the result that on suitable terrain we can now complete preliminary surveys

with a large part of the work done from the air. The combination of old and new methods in their proper relation has developed great savings of time and cost in the planning and design.

The most important developments in our practice may be summarized as follows:

(1) Control surveys are made to modified second order accuracy generally tied to California Coordinate System with control net extended for highway use.

This must be carefully planned by the highway engineer and it will generally include control not essential for strictly mapping use.

(2) Permanent points in the control net. These may be either key property corners, existing monuments, or new points selected for later use.

(3) Complete notes of observation and adjustment furnished by the mapping organization to the highway engineer.

Results Obtained

These developments in practice have given us maps from which it has been possible to project a located line with computed ties to points of known position in the control net, complete design, compute quantities, write deed descriptions for right of way, and go to contract with a minimum of additional field survey work. In some cases the located line is not being run in the field until the right of way itself has been purchased and completely cleared. With key property corners and other permanent monuments selected by the highway engineer tied into the primary control net of the survey, and the entire survey tied to the California Coordinate System, the located line as finally run in the field has closed without difficulty.

One of the most obvious advantages to us in the use of these methods is the possibility of completing the survey and design with a minimum of disturbance to the local community.

Contracts Based on Maps

During the past two years the California Division of Highways has awarded contracts for topographic maps from aerial photographs for over 200 miles of highway. The type of highway facility to be located or designed from these maps ranges from two-lane secondary roads to four-lane divided freeways through urban areas. Map scales have been 400, 100, and 50 feet per inch with contour intervals of 10, 5, and 2 feet. On several of the projects it is planned to acquire the rights of way and award the construction contracts on the basis of these maps supplemented by a very minor amount of ground surveys by the division.

Successful use of aerial contour maps, particularly their use in the final stages of design, requires careful planning, adequate specifications, and a reliable mapping contractor. The planning must be done by a highway engineer who is familiar with all phases of location and design, and has sufficient knowledge of photogrammetry and its limitations to specify what is required without incurring excessive costs. Mapping contractors are usually willing to assist in the planning of a project but their knowledge of highway engineering is limited, and in the final analysis it is the highway engineer who must decide what he wants for each specific project.

Suitability of Project

As the first step in planning it is necessary to determine the suitability of the project for this type of mapping and the purpose for which the maps are to be used. For reconnaissance studies and the evaluation of alternate routes satisfactory maps for almost any project can be made by aerial surveys. A high degree of accuracy is not required and, unless the ground is obscured by

* This paper was presented at the meeting of Committee on Design, American Association of State Highway Officials, December 12, 1952.

very tall timber, a specification that the contours be within half the height of the ground cover should result in maps which are adequate for preliminary studies. The specifications for horizontal and vertical control should be broad enough to allow the contractor to take full advantage of his equipment in bridging control across several models.

Where a strip of topography wider than one-half mile is required it will frequently be more economical to obtain a preliminary map at 400 feet per inch with 10-foot contours for the initial studies, to be followed by a larger scale map of a narrow strip along the selected route for use in final location and design. For maps at 400 feet per inch a single strip of photographs will generally cover a width of $2\frac{1}{2}$ to 3 miles.

Several Limitations

Where contour maps from aerial photographs are to be used for final location and design work, there are several limitations which must be known and considered. Most important of these is the extent of the ground cover and its effect on aerial mapping. If the ground is completely obscured the best that can be expected from the stereoplotting equipment is that the contours will be within half the height of the cover. If greater accuracy is required, and it usually is for design work, it must be obtained by supplemental field surveys. The extent to which these field surveys are required will usually determine the suitability of the project for aerial mapping. If the mapping contractor is required to undertake field completion surveys in certain areas where the ground is obscured the extent of this work must be clearly defined in the specifications.

Use of Aerial Contour Maps

A second limitation is the extent to which an existing highway is to be used as a part of the proposed facility. It is obvious that aerial contour mapping is not suitable for a widening project and it follows that its greatest usefulness is on entirely new locations. It will, however, prove satisfactory for some reconstruction projects where a four-lane divided facility is proposed which utilizes the existing highway for two of the lanes, provided the median has suf-

ficient width that tight grade controls are not required.

It is doubtful if the cost of an aerial contour map would be justified across flat terrain where drainage conditions control the grade line to within a few tenths and where earthwork quantities are very light. With this type of terrain in urban areas a large scale planimetric map from aerial photographs has been obtained at a lower cost than a contour map. Another solution is the use of rectified aerial photographic enlargements at 50 feet per inch. These could be tied together for control by a ground survey and used in the field for obtaining spot elevation at road connections, drainage channels, etc. Cultural detail could be traced on the construction plans from the enlargements.

Standards of Accuracy

Having determined that aerial contour maps are practicable for a specific project, the next step is the determination of scale and contour interval and the standards of accuracy to be specified. Our experience in California indicates that for complex highway facilities such as multilane, divided freeways, or expressways where traffic interchanges, ramps, frontage roads, and other features are involved, a scale of 50 feet per inch and a contour interval of 2 feet are the most advantageous. This is particularly true where construction contracts are to be awarded on the basis of the topographic maps without making a final location survey in the field. In such cases the only field survey work prior to award of the construction contract will be for the location of underground utilities, additional property corner ties if required, and elevations to the nearest 0.01 foot where connections are made to improved streets.

In Mountainous Terrain

For the location and design of less complex highway facilities and through undeveloped or mountainous terrain we are generally using a scale of 100 feet per inch and a contour interval of five feet. Here again only a minor amount of field survey work will be required prior to award of the construction contract provided the ground is not obscured to the extent that accurate contours cannot be

plotted from the photographs. On projects where aerial contour mapping at 50 feet or 100 feet per inch is obtained we have previously selected the route of the highway facility within rather narrow limits either from small scale aerial photographs, U. S. G. S. quadrangle sheets or other available maps combined with field reconnaissance. Consequently the contour maps are confined to a width sufficient to allow for minor adjustments in location and to permit the layout of traffic interchanges, road connections, etc. This width generally ranges from 600 feet to 2,000 feet as compared to the 200 feet to 500 feet usually obtained from ground surveys.

Requirements

Our most recent specifications conform to the National Standards of Map Accuracy which have been adopted by the major governmental mapping agencies. These standards require that 90 percent of the contours be within one-half the contour interval and that 100 percent be accurate to the full contour interval. For horizontal positions of well defined features they require that 90 percent be within one-fortieth inch and all be within one-twentieth inch of their true position at the final map scale. With detailed topographic maps to these accuracies and covering a strip 600 feet to 2,000 feet in width, the designer has far more information at his disposal than is available from conventional field surveys, and he can develop the final position of the highway and its appurtenances with assurance that no possibilities are being overlooked.

Ground Control Survey

One of the most important factors in the planning and preparation of specifications for a satisfactory aerial mapping project is the ground control survey. Several types of stereoplotting equipment in use today are capable of bridging horizontal control across several photographic models. The mapping contractor will naturally wish to take advantage of this feature to reduce the extent and costs of the ground control surveys. However, a spacing of several miles between monumented control points will not allow the highway engineer to realize the full

potential value of the mapping even though it may comply with the specified standards of accuracy. Additional monuments are required for future staking of the projected center line and right of way lines, for making ties to property and subdivision corners and for obtaining various other information during the course of design work.

Monuments Important

In California we have found it generally advisable to specify such monuments at intervals of 1,000 to 2,000 feet in urban areas and not more than one-half mile in rural sections. The location of these monuments must be carefully planned by the highway engineer to avoid additional and unnecessary survey work in the future. Their location is usually indicated on maps accompanying the contract and specifications. The monuments may be set

as arbitrary points for future use or they may be existing property corners or street or subdivision monuments.

Figure 1 shows a section of map as delivered by the contractor in which just this has been done. Not only are the subdivision monuments shown, but property lines may also be confirmed by the fence lines and fragments of fence lines.

On several projects in urban areas we have indicated a sufficient number of property corners to be tied in by the mapping contractor so that deeds may be prepared without additional survey work on our part. In such cases it will not be necessary to run the projected center line in the field until buildings and other obstructions have been cleared from the right of way immediately prior to construction. The value of an adequate number of properly positioned monuments as an

adjunct to the aerial survey cannot be too strongly emphasized.

Specifications

Where the aerial contour maps are to be used for design work we specify that the contractor's primary survey network shall be based on and adjusted to first or second order triangulation stations of the U. S. Coast and Geodetic Survey, and that they shall be made by second order triangulation or by modified second order traverse. We further specify that the surveys shall be adjusted by standard methods and that horizontal positions of all monuments shall be based on adjusted data and expressed in rectangular coordinates of the California state-wide system of plane coordinates. Control points, monuments, and coordinate grid lines are shown on the maps with an accuracy to the nearest 0.01 inch.



In addition to the horizontal position of all monuments, the contractor is required to furnish the original field notes of his ground control surveys, together with a tabulation showing all measured and adjusted bearings and distances. As a result we have, in addition to the maps, an accurate well-monumented survey network which can be used as the basis for all future survey work on the project.

Figure 2 (which is the same section as that illustrated in Fig. 1) shows the survey coordinate grid, to which the highway centerline is referenced, added to the base map. The ties between monuments on the ground and the "L" line are made in just the same way that ties are made between the "P" and "L" lines in ordinary route surveys.

Vertical Control

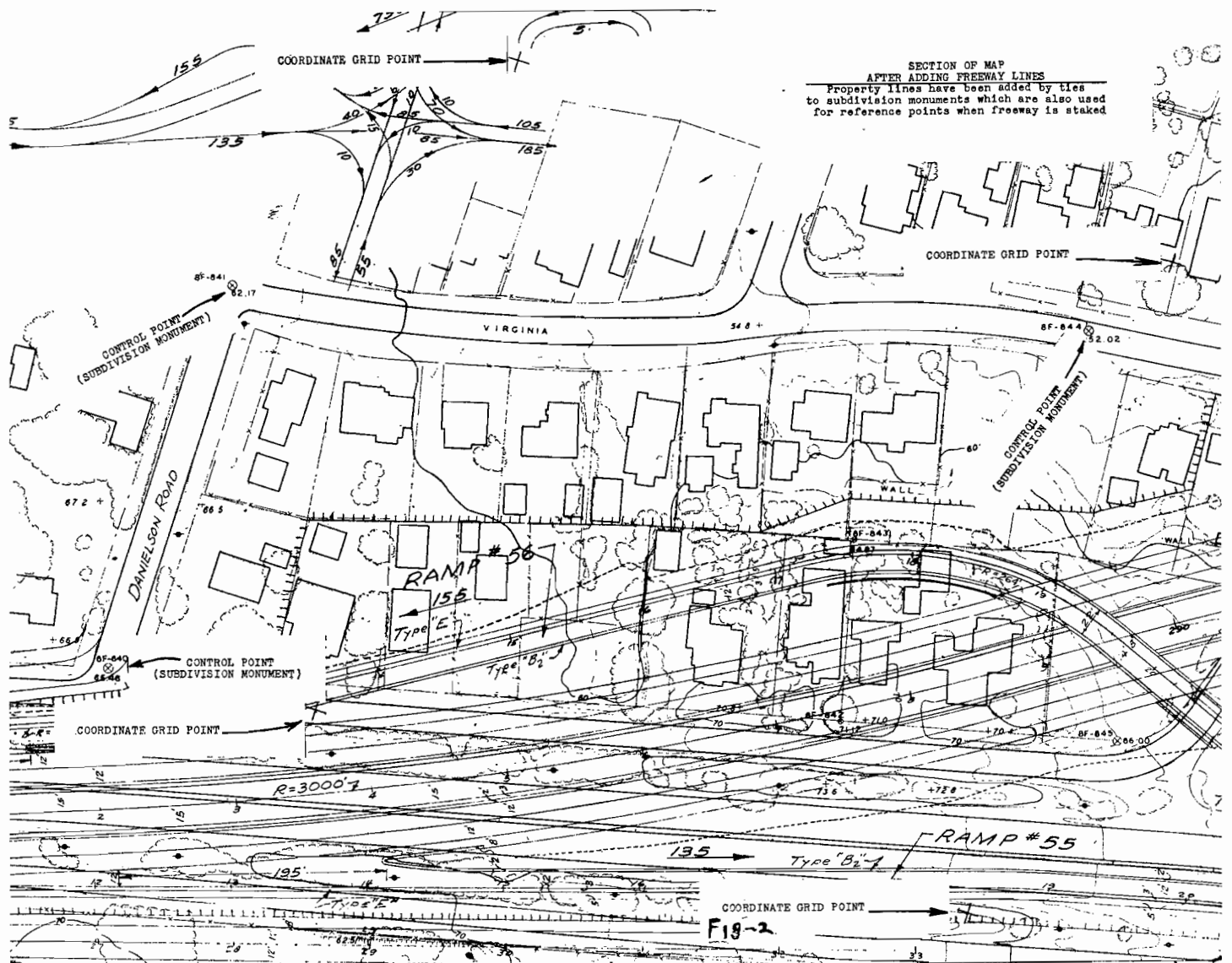
The extent of vertical control to be established will vary with the individual project. Quite frequently a level line of the U. S. Coast and Geodetic Survey is parallel or closely adjacent to the project. In such cases a specification requirement that all vertical control points set by the contractor shall have an accuracy of one-tenth the contour interval is considered sufficient.

In view of the wide variety of stereo-plotting equipment used by reliable mapping organizations, it is not considered desirable or feasible to require specific equipment or to write a rigid specification as to methods of procedure. In lieu of this we prefer to specify the accuracies required in the final maps and give the contractor wide latitude as to the method of producing

them. As a means of evaluating proposals submitted by different mapping firms and to have some measure of control over the contractor, we require that each proposal be accompanied by a statement showing experience in similar work, equipment proposed for the project and scales, operating ratios, and methods of procedure to be used in various phases of the work. This statement also includes the extent of horizontal and vertical control proposed in addition to the monuments we have specified.

Tabulation of Equipment

The following tabulation shows the equipment, scales, and operating ratio proposed by four reliable nationally known mapping organizations for various large-scale mapping projects in California within the past two years.



The number and variety of proposals shown for the 100 feet and 50 feet per inch scales are sufficient to be considered a resume of current mapping practice at these scales.

Advantages

The advantages most frequently cited for the use of contour maps made from aerial photographs in highway location and design are savings in time, money, and manpower, and the added width of the band of topography at the disposal of the designer. The latter feature enables the engineer to see possibilities which might otherwise have been overlooked and could very easily result in either savings in construction costs or an improved facility, or both. This is particularly true of superhighways where interchange facilities and frontage roads are involved in the design.

As a measure of cost comparison, the following tabulation has been prepared to show the contract price on a number of recent aerial mapping projects in California.

EQUIPMENT AND SCALES FOR AERIAL CONTOUR MAPPING

Stereoplotting equipment	Flight height	C factor	Flight scale	Map compilation scale
Maps at 1" = 50' 2' contours				
Stereoplanigraph	2,450'	1,200	1" = 400'	1" = 50'
Kelsh Plotter	1,500'	750	1" = 250'	1" = 50'
Kelsh Plotter and/or Wild A-5	2,000'	1,000	1" = 333'	1" = 67'
Kelsh Plotter	2,000'	1,000	1" = 333'	1" = 70'
Maps at 1" = 100' 2' contours				
Kelsh Plotter and/or Wild A-5	2,000'	1,000	1" = 333'	1" = 67'
Kelsh Plotter	2,000'	1,000	1" = 333'	1" = 70'
Stereoplanigraph	2,450'	1,200	1" = 400'	1" = 50'
Maps at 1" = 100' 5' contours				
Kelsh Plotter and/or Wild A-5	5,000'	1,000	1" = 833'	1" = 167'
Kelsh Plotter	3,000'	600	1" = 500'	1" = 100'
Stereoplanigraph	4,900'	1,000	1" = 800'	1" = 100'
Kelsh Plotter	5,000'	1,000	1" = 833'	1" = 167'
Maps at 1" = 400' 10' contours				
Kelsh Plotter and/or Wild A-5	10,000'	1,000	1" = 1667'	1" = 333'
Kelsh Plotter	10,000'	1,000	1" = 1667'	1" = 350'
Stereoplanigraph	9,800'	1,000	1" = 1600'	1" = 200'

REPRESENTATIVE COSTS OF AERIAL SURVEYS

Map scale	Contour interval	Terrain	General width of mapping	Miles	Average cost per mile
1" = 50'	2'	Semi-urban—rolling	600'-1500'	15	\$1,630
1" = 50'	2'	Rural—rolling	700'-1300'	11	1,410
1" = 100'	2'	Rural—rolling	700'-1500'	12	1,210
1" = 100'	5'	Rural—rolling	500'-1600'	9	935
1" = 100'	5'	Rural—rolling to mountainous	1000'-2000'	60	930
1" = 400'	10'	Rural—rolling	5000'-9000'	15	485

Representative Costs

The costs shown in the tabulation can be considered representative of contracts totaling 20 miles or more in length. Frequently costs can be reduced by combining several short highway projects in one mapping contract. The saving in time is dependent on the work load of the various mapping contractors and the urgency of the project. A premium price is usually paid for a rush job and results are not always satisfactory. As a general rule, if a project is over five miles in length, and if only one survey party is available, a saving in time can be made by using aerial surveys. The time saving will increase rapidly with the size of the project.

As previously discussed, the shortage of engineering manpower will probably outweigh the other advantages afforded by aerial survey methods for several years to come. Any highway organization confronted with this problem should give serious consideration to a wider use of aerial photographs and aerial survey methods.

PEDESTRIAN SAFETY

When a pedestrian steps from the curb at a crosswalk, he has started to cross the street and the right of way is his. By giving the pedestrian the breaks as well as the brakes motorists can easily cut accidental injuries and fatalities.

In Memoriam

HARVEY P. OATES

Harvey P. Oates, 57, foreman in the Division of Highways Maintenance Department, died on December 7th while working with his crew on Freeport Boulevard (State Sign Route 24) near the airport south of Sacramento. Oates' death was believed due to a heart ailment.

Oates was a native Sacramentan with over 30 years' service as an employee of the Division of Highways. He started work with the division on June 6, 1922, and became a maintenance foreman on October 14, 1932, a post he held until his death.

All of Oates' service was in District III. Previous to being assigned to the Sacramento area, Oates was foreman of the Yuba Gap section on U. S. 40 and also of the Echo Summit section on U. S. 50.

Oates is survived by his wife, Mary, his son, Thomas, his mother, Julia, and six brothers and sisters.

Early Days

*Minutes of First Highway Commission
In 1914-15 Make Interesting Reading*

By R. C. (CASS) KENNEDY, Secretary, California Highway Commission

(Continued from last issue)

THE FIRST entry in the minutes of January 19, 1914, is that the California Highway Commission convened at 2 p.m., and present were Commissioners Charles D. Blaney, N. D. Darlington, and C. F. Stern.

The secretary reported that at the meeting of the Advisory Board held in San Francisco on December 31st, Governor Johnson stated that for some weeks past he had held the resignation of Burton A. Towne, Chairman of the Commission, which he very reluctantly had consented to accept, and the Governor announced that he had appointed Charles Frank Stern, of Eureka, to the position of commissioner vacated by Towne.

Inventory of Equipment

You will remember that in the latter part of 1913 the Board of Control had asked the commission for an inventory of all the equipment under its control, and had authorized the Highway Engineer to furnish the Board of Control such inventory. This inventory was accepted by the commission, ratified and approved, and accepted as the inventory of the commission. The amount of the inventory was \$50,000.96. Incidentally, Blaney was acting chairman at this meeting.

At the meeting on the twenty-first of January, a long resolution was read into the minutes regarding the resignation of Towne and the appointment by the Governor of Stern. The Advisory Board proceeded to appoint Stern on the commission to take the place of Towne.

Practically all of the afternoon of the 21st was taken up in reading into the record the resolutions passed by the Advisory Board. There are 15 pages of resolutions the Advisory Board had passed approving acts of the commission. The last notation in the minutes for January 22, 1914, showed that on a motion duly made

by Commissioner Darlington, and seconded by Commissioner Stern, Commissioner Blaney was declared elected chairman.

Mission Bell Guideposts

The El Camino Real Association of California appeared before the commission and asked that it be allowed to erect Mission Bell guideposts on the state highway approximately one mile apart. This was to begin at Station 0 on U. S. 101, at a point 14 miles from Los Angeles Plaza and ending at the Ventura County line. The precise locations of the guideposts were to be fixed by the Division Engineer.

These guideposts have been seen by many motorists who have traveled the Coast Route between Los Angeles and San Francisco. They were a pole with a yoke on it, holding a bell, with the letters "El Camino Real" cast into the sides of the bell. The bell was flat—it was not a bell that could be rung or anything like that. This is probably the first case where mementos such as this were allowed on the state highways.

Yolo Causeway

On February 12th, the commission passed a resolution regarding the Yolo Basin Causeway, which proposed approximately 14,000 feet of concrete bridgework and about 2,000 feet of timber trestle. It was stated that the causeway was an integral, essential link in the State Highway System and the construction of it was deemed imperative in order to care for trans-continental as well as local traffic by the shortest possible distance from Sacramento to San Francisco.

The commission went on to say that although this construction lay wholly within Yolo County, and the mandate of the State Highways Act placed the interest burden of cost of this construction of approximately \$450,000 on Yolo County, it would

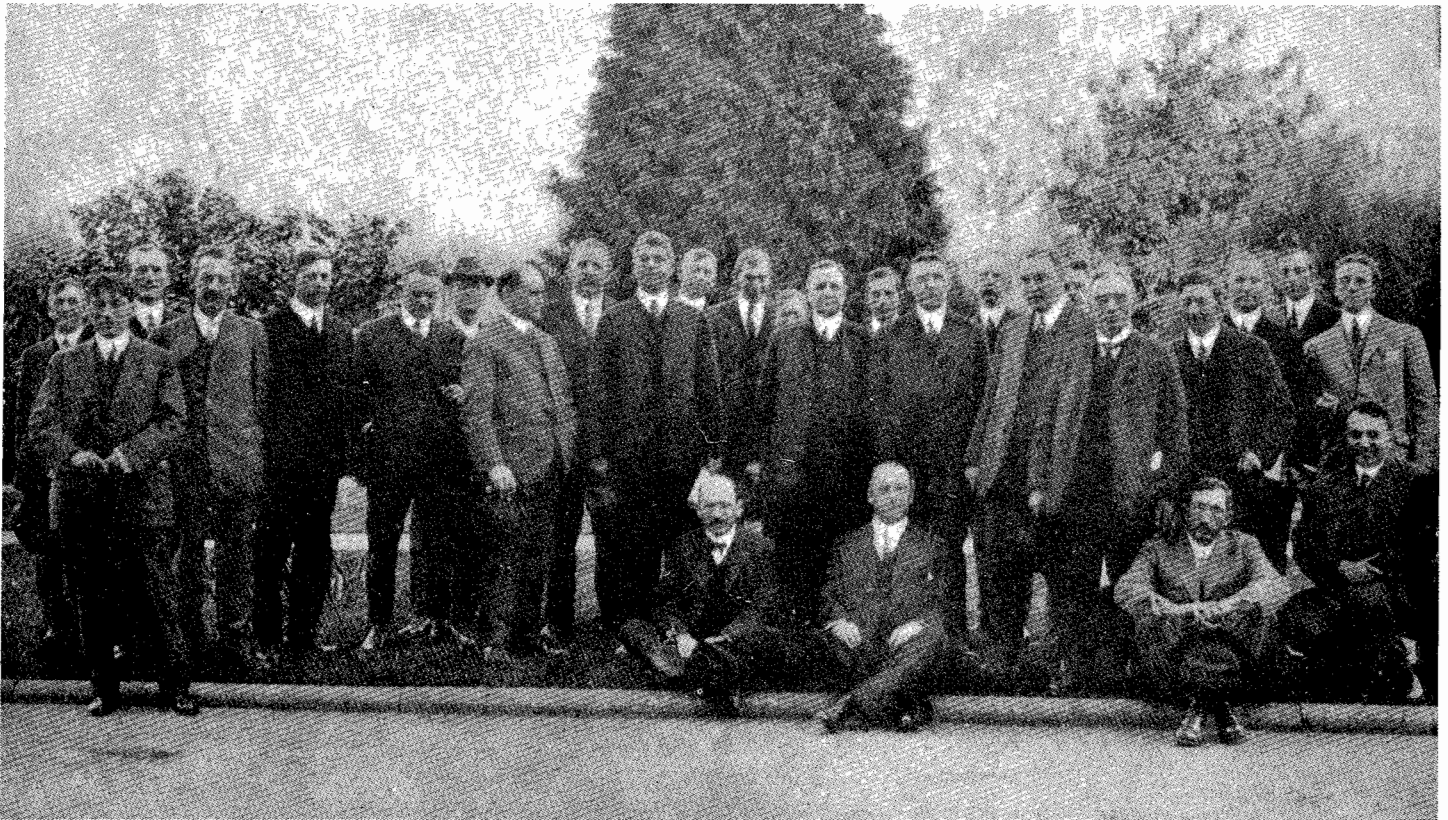
resolve that it was the sense of the California Highway Commission that Yolo County should be relieved by special legislation from this burden.

The commission also stated that this burden properly belonged to the State at large and the commission pledged itself to institute and recommend appropriate legislation to such end.

New Money Voted

On February 26th, the commission was evidently running short of money as it passed a resolution, and the advisory board also passed it, that the State sell \$3,000,000 of state highway bonds so that work could continue. Also read into the records was a resolution passed by the advisory board that the Motor Vehicle Act provided that the moneys accruing to the State by virtue of such act shall be expended under the sole direction of the Department of Engineering for the state highway maintenance. It was, therefore, resolved that the California Highway Commission was to take full control and disposition of five-sixths of the money accruing to the State for the maintenance of the state highways from the revenues of the Motor Vehicle Act, and that it was to take full charge of the maintenance of the state highways contemplated to be maintained by the State Highways Act, and perfect such organizations as might be deemed necessary.

So, here was the formation of our Maintenance Department of the Division of Highways. Also, on this date, the commission decided that joint meetings of the seven Division Engineers, with the Highway Engineer and the commissioners, at intervals of not more than 120 days, would be highly desirable. It was recommended that such meetings be inaugurated as a permanent feature of the highway work, and that the first meeting was to be held on March 26, 1914.



The builders of California's State Highways in 1914: Left to right, R. H. Stalnaker, C. C. Carlton, S. V. Cortelyou, W. Lewis Clark, T. E. Stanton, R. K. West, W. C. McClure, State Engineer; Austin B. Fletcher, F. G. Somner, Charles F. Stern, J. B. Woodson, F. W. Haselwood, E. B. Osburn, N. D. Darlington, S. S. Stahl, Charles D. Blaney, W. S. Caruthers, George B. Harrison, A. B. Cleveland, W. R. Ellis, R. E. Dodge, A. E. Loder, J. H. Small, W. C. Howe. Sitting, left to right, George R. Winslow, H. L. Warren, T. A. Bedford, George Mattis.

Meeting of Engineers

March 26th was the day that had been set aside to hold the meetings with all the Division Engineers at headquarters, along with the Highway Engineer and the commission. The entire program of the meeting, which started at 9 o'clock in the morning, continued all day and was followed by a dinner at the Sutter Club that night.

On May 25th a notation is in the minutes that Secretary Ellis was granted a leave of absence for five months without salary. There was also a vote taken that the Publicity Department be instructed to arrange for an issue of the *Highway Bulletin* as soon as practicable, and be authorized to incur the necessary expenses for cuts. It was also voted that George B. Harrison be given the official title of Editor of the *Highway Bulletin*.

The next day the commission met and the first order of business was to

appoint Charles C. Carleton, the attorney for the commission, to serve as Acting Secretary of the commission during the absence of Ellis.

On May 27, 1914, it was voted that the commission hold semimonthly meetings in Sacramento on the Mondays prior to the advisory board meetings. So that established a definite time for the Highway Commission to meet.

Helen Hawkins Appointed

Along in June, 1914, the commission seemed to be getting automobile conscious, for it voted that an automobile be procured for the Second Assistant Engineer so that he could travel over his territory more easily. Also, in June, a harvester down in Fresno County had damaged our highway, and the commission passed a long resolution to "The Honorable District Attorney of Fresno County" calling attention to the importance of this case, and

requesting him to most vigorously press the charges against the defendant and to "call upon the commission, or its employees, for such appropriate evidence as he may require to fully present the cause of the people of the State of California." It would seem that some farming machinery had damaged the highways and the commission decided that it was going to be repaid for it.

In July, the commission appointed Helen Hawkins for a temporary term as Special Assistant Secretary and Special Assistant Disbursing Officer. Miss Hawkins was appointed as a stenographer on June 22, 1912, at headquarters office, salary \$50 a month. She received various raises, voted by the commission, and on September 1, 1918, she was getting \$115. At the time she left, she had the title of Assistant Secretary and Assistant Disbursing Officer, having been appointed to

that position January 1, 1919. She went back with the Division of Highways briefly in 1925, and for a number of years had been secretary to the State Printer.

More Room Needed

During the August meeting, the commission apparently was expanding as it passed a vote that it would rent four more rooms in the Forum Building, Sacramento. Also, at the August meeting, notes say that the Highway Engineer reported 17 appointments from certified lists of eligibles that had been registered with the State Civil Service Commission. This is the first notification, or rather the first notice, in the minutes of the commission that the State Civil Service was furnishing lists of eligible people for employment by the Highway Department.

Placer County Request

In October, 1914, the commission voted that the Placer County Chamber of Commerce be permitted to place Lincoln Highway signs, not to exceed six in number, along the line of the state highway between the Sylvan School and Roseville. These signs were to be painted on the fences along that portion of state highway. The State still is sticking to the idea of not erecting any signs except directional signs on the rights of way of state highways.

In November, troubles had begun to hit the commission. The Graff Construction Company had the contract for building the Yolo Causeway, and on November 10th, it was brought to the attention of the commission that a strike had been called by the Federated Trades Council against this construction company. The commission immediately offered itself as a volunteer friendly mediator representing the State. Its interest was only to see that the construction work on the Yolo Basin Causeway should proceed without unnecessary difficulty or delay.

Also, on November 10th, reference is made to the matter presented by Right of Way Chief Harrison, in his letter dated October 26th, as to the recommendations of the Automobile Club of Southern California that the

commission take action to prohibit the placing of advertising signs and billboards along the state highways. Attorney Carleton was requested to draw up a bill for submission to the coming Legislature prohibiting such signs on all state highways.

Lincoln Highway Signs

At the December 7th meeting, there was a request from a Mr. Cuyler Lee, who was a representative of the Packard Motor Car Company of Oakland, to place mile posts along the boulevard in Alameda County bearing the Lincoln Highway sign. With this communication were sketches of the proposed mile posts bearing "One Mile From Packard Garage, Oakland, etc.," but the commissioners voted against this and refused to establish any precedent of a character that would be implied by granting the above request. In other words, they didn't want advertising of any kind on the state highway rights of way. That still is in effect.

At the December 22, 1914, meeting, the commission boosted the salary of Mr. Carleton, the attorney, from \$250 to \$300 per month. This was to be effective on December 16, 1914, until further order of the commission.

The foregoing were the most important things that happened during the year 1914, as I see them. There may have been other things that transpired that were not written up in the minutes, but from the minutes you can see that by now the commission was "getting into the groove," as it were. Its meetings were becoming regular—twice a month—and it was transacting much routine business.

In looking over the minutes of 1915, I find that the majority of them pertain to routine matters alone. It seemed that every permit that was granted to erect a telephone pole or a light pole or a sewer under the highway, or a water pipe, or anything else, had to be voted and the commission had to sign them.

I may have mentioned this before, but it seems that every time the commission decided on a route, or if it let a contract, or did anything else, its actions had to be ratified by the entire Advisory Board of the Engineering Department of the State of California,

and this entailed taking up a lot of space in the minutes with the resolutions passed by the advisory board after the commission had decided on something.

Need for More Money

In January, 1915, the commission suggested to the advisory board and the Board of Control that it should have a million dollars more of bonds sold so that it could continue its work. There was also a notation that Mr. Harrison, who was acting as Chief of the Right of Way Department, and also as Editor of the *Highway Bulletin*, be relieved of his duties in the Right of Way Department and be stationed in Sacramento under the immediate direction of the Highway Engineer.

In February of 1915, the Highway Engineer was authorized to proceed with the construction of a booth for the commission's exhibit at the San Francisco Panama-Pacific Exposition. The plan had been prepared by the State Architect, and the Highway Engineer was authorized to spend not more than \$775 for the erection of a booth and an exhibit therein.

In setting up the commission, the Legislature evidently provided for the use of a revolving fund, and voted certain moneys to be kept in it. It laid down a certain number of rules, amongst others that all sums as were paid out of the State Treasury to the Highway Commission for use as a revolving fund should be deposited in a bank in Sarramento. It authorized all officers and employees of the commission then authorized to sign checks, to sign checks on the revolving fund. The Highway Engineer was empowered in his discretion to pay to the division offices such sum or sums as he deemed to be required from time to time for the payment of wages of day laborers. Any funds like that were to be known as the "Division Revolving Fund."

The Division Engineers were authorized, with the approval of the Highway Engineer, to designate two officers, or employees, in each division office; one to be known as the cashier and the other, as the assistant cashier. No check would be considered valid unless it was signed by either the cashier or the assistant cashier.

Permits for Dredgers

In August of 1915, traffic on the road between Sacramento and Folsom had a new vehicle to contend with. Permit No. 81 was issued to the Natomas Company of California, with headquarters in Sacramento. This permit granted the Natomas Company permission to excavate across the state highway for a width of 300 feet for the purpose of allowing a dredger to pass over from one portion of its property to another. Of course, it was understood that the Natomas Company would maintain a good and sufficient roadway for all purposes during the time the highway was torn up and that after the dredger passed over, the highway was to be replaced in as good condition as before.

In September, the commission decided that there was no reason to initial every permit that was issued. These permits were becoming more regular and the waiting until the Highway Commission met to have them initialed by the commission was holding up some of the work. So, on September 17, 1915, the commission voted that the initialing of permits be dispensed with. It gave the power to the secretary, with the approval of the Highway Engineer or the First Assistant Highway Engineer, to issue any and all permits. This took a great deal of work off the individual commissioners and put a bit more work on the secretary.

In December of 1915, Permit No. 153 was issued to the Wilkes-Barre Dredging Company. This firm was given permission to excavate a channel across the state highway between Station 58+0 and Station 60+0 on the road between Sacramento and Folsom. This was for the purpose of moving another dredger across the highway. Two dredgers in one year!

There is nothing much of extra curricular duties that the commission seems to have done during 1915, except to keep up the good work that it had started in 1911.

All during this year, new routes were being adopted and new contracts were being let; new contracts

In Memoriam

ARCHIBALD C. IRISH

Archibald C. Irish, Highway Superintendent at Nevada City, in District III, passed away at the Community Hospital in Grass Valley on December 9, 1952.

Arch, as he was known by all of his friends and acquaintances, was born in Cloverdale, California, on April 17, 1895.

He and his family moved onto a ranch in the vicinity of Placerville in the early 1900s where he attended the local schools.

Arch first went to work for the Division of Highways on May 10, 1917, as a rodman. He was a mechanic in the Air Force in World War I from July, 1917, to about July, 1919. He returned to work for the Division of Highways in September, 1919, as a rodman and continued in that classification until January, 1920. He was employed by the Western States Gas and Electric Company as an instrumentman for the next several months and again returned to work for the Division of Highways in March, 1921. He had been continuously employed by the division since that time and had been a highway superintendent since January, 1944.

Practically all of his service has been in District III where he had wide and varied experience on preliminary and location surveys, construction and maintenance.

Arch trained many young employees during his career and will be sorely missed by them as well as by numerous other friends and acquaintances.

He is survived by his wife, Ruth, a son, William, and a brother, Russell.

In Memoriam

WILBURN H. IRISH

Funeral services for Wilburn H. Irish, 56, Supervising Highway Engineer for the State Division of Highways, were conducted December 17th at 3 p.m. in the Church of the Recessional at Forest Lawn, Glendale.

A native son, born in Placerville and receiving his early training in that vicinity, Mr. Irish started his civil engineering career with the State Division of Highways on March 31, 1916, in District III with headquarters at Sacramento. He worked up through the various field positions from Rodman to District Location Engineer. In this latter position Mr. Irish had charge of survey parties on highway and freeway location in the Los Angeles District from 1933 to 1947. In 1947 he was promoted to the position of Supervising Highway Engineer, working out of Sacramento Headquarters Office and visiting all parts of the State in supervising highway location projects.

Mr. Irish died suddenly of a heart attack on December 12, 1952, at the home of his brother, Arch Irish, in Grass Valley where he had come to attend his brother's funeral. The brother, Arch, had died four days before, also of a sudden heart attack.

Mr. Irish is survived by his wife, Amelia F. Irish, and his 19-year-old son, Wilburn H. Irish, who is an engineering student at the California Institute of Technology. Mr. Irish maintained the family home at 419 Arcade Place in Glendale for many years, where his wife and son are now residing. He was very interested in youth activities and for many years served in the Glendale Boy Scout's Council.

TOO MUCH ECONOMY

Although it is not a sin of which many motorists are guilty, there is such a thing as overdoing the economy of a lean carburetor mixture. Beyond a certain point it is bound to result in a loss of power. Moreover, the chances of backfiring are increased with the greater likelihood of causing a fire if the engine is covered with an oily waste in the vicinity of the carburetor.

(To be continued)

Retirements *from* Service

GORDON ZANDER

On January 1, 1953, Gordon Zander, Assistant State Engineer in charge of water rights administration, ground-water investigations and quality of water studies for the Division of Water Resources, retired after 39 years of service. His service had been under eight governors, from Hiram W. Johnson to Earl Warren.



GORDON ZANDER

Mr. Zander was born in San Rafael, California, on December 10, 1890, and grew up in Oakland, where he attended the public schools. He graduated with a civil engineering degree from the University of California with the class of 1913. During World War I, he served with the U. S. Corps of Engineers in France as a second lieutenant.

He began his public service with the State Highway Commission on April 1, 1914, as an assistant civil engineer. In July, 1916, he transferred to the State Water Commission, which was the forerunner of the present Division of Water Resources in the

... Continued on page 49

ALBERT F. WRIGHT

Albert F. Wright, stationary fireman at the Yuba Gap Maintenance Station in District III, retired from state service on January 1st last, after 18½ years of service.

Pop, as he is known to all, was born in Mattoon, Illinois, June 19, 1887, and moved to Sacramento in 1907, where he was employed by the Buffalo Brewing Company and the Capital Ice Company until the fall of 1933.



ALBERT F. WRIGHT

On December 13, 1933, he was employed as a stationary fireman in Truckee; and, except for temporary assignments at other stations in District III, he worked continuously in the Truckee-Yuba Gap area as stationary fireman.

For almost 15 years Wright had at Yuba Gap Maintenance Station an infallible winter weather prophet in the form of a nondescript tomcat, appropriately named Tom. Scientifically constructed barometers had nothing on Tom when it came to predicting a heavy snowfall.

"Many, many times," Wright says, "it would start snowing but Tom would take off for Emigrant Gap, Fulda or Lake Spaulding and we always knew that we did not have to get our snowplow equipment ready for a battle with the elements. If it started to snow and Tom holed up in the cookhouse, we knew we were in for a bad snowstorm. He never failed us. He must have made thousands of trips up and down the highway without being hit by a passing auto. A housewife at Emigrant Gap tired of Tom's nocturnal caterwauling, blasted

... Continued on page 49

MABEL PERRYMAN ROWLAND

MRS. MABEL PERRYMAN ROWLAND, of the Division of Water Resources, State Department of Public Works, retired from state service on January 1, 1953. She came to the employ of the State of California in May, 1926.

Prior to that time she was employed locally for a number of years—first in



MABEL PERRYMAN ROWLAND

the business office of The Sacramento Union, and later as secretary to the district sales manager of the Standard Oil Company.

For two years, 1926 to 1928, Mrs. Rowland was a hearing reporter for the State Real Estate Department, working in Sacramento and San Francisco. In March, 1928, she transferred to the Division of Engineering and Irrigation, now the Division of Water Resources, as supervising clerk and secretary to State Engineer Edward Hyatt, retired, remaining in that position to the present time under State Engineer A. D. Edmonston.

... Continued on page 49

GORDON ZANDER

Continued from page 48 . . .

matter of the administration of water rights in the State.

Progressive Water Laws

He has successively served as associate, senior, supervising and principal hydraulic engineer, and for the past year has held the position of Assistant State Engineer. During his engineering career Zander has seen the water law and the water rights administrative procedure in California develop from the time when there was practically no control over the use of water, to the present time when over 9,000 appropriative water rights are under state permits, and there are some 40 stream systems and groundwater basins on which the water rights have been adjudicated or are in the process of adjudication through the Division of Water Resources. At present there are also 15 "watermaster service areas" in which diversions of water are being administered by the State Engineer through the agency of watermasters.

One of the most important jobs under Zander's supervision in recent years has been the division's investigation and report as referee for the superior court in the case of *California Water Service Company v. City of Compton, et al.* These proceedings involve over 300 rights to pump water from the West Coast Basin in Los Angeles County, a heavily industrialized area in which the total assessed property values are around a quarter of a billion dollars. This is the first adjudication that the division has undertaken where sea water intrusion into the basin was an important factor.

Helped Form CSEA

Mr. Zander took an active part in the formation of the California State Employees' Association in 1931, and served on its board of directors from 1932 to 1935. He was chairman of the association's civil service committee in 1932 and 1933 and chairman of its legislative committee in 1935. He has always been a strong advocate of the "merit system" in state employment, which was something new in the early

ALBERT F. WRIGHT

Continued from page 48 . . .

him with a shotgun one night, and we lost an excellent pal and perfect weather prophet."

During his years on the hill, Pop made numerous friends as was demonstrated at a farewell party held at the Rancho Sierra Inn near Yuba Gap in his honor when 80 fellow employees and friends gathered to present him with a radio and to extend their best wishes on his retirement.

Wright will make his home in Sacramento with his daughter and hopes that his many friends will visit him.

MABEL PERRYMAN ROWLAND

Continued from page 48 . . .

On Friday, December 19th, members of the staff of the Division of Water Resources entertained Mrs. Rowland and her husband at a luncheon in the Hotel Sacramento. Director of Public Works Frank B. Durkee presented her with the 25-year California State Service Pin and Certificate; State Engineer A. D. Edmonston and Mrs. Isabel Nessler presented gifts to her on behalf of the staff members and friends.

Mrs. Rowland and her husband will continue to make their home in Sacramento.

"thirties," but is now a firmly established policy in California.

He was active in Masonic work in his earlier years, and is at present a member of Ben Ali Temple of the Shrine, of the Sutter Club in Sacramento, and of the California Club in Los Angeles.

In retirement, Zander plans to devote a portion of his time to his farming interests in Sutter County. He and Mrs. Zander plan to do some traveling, including a trip to Palm Springs soon after the first of the year, and a trip to Europe a little later on. He also expects to do a limited amount of consulting work in the field of water right problems and water litigation. He plans to maintain his residence in Sacramento permanently.

C. M. Gilliss Accepts Post With Director

C. M. (Max) Gilliss, who resigned from the office of the County Surveyor and Road Commissioner in Riverside County has assumed the duties of Special Representative of the Department of Public Works under appointment by Director Frank B. Durkee.



C. M. GILLISS

Gilliss was born and reared in Oklahoma. He took his college training at Riverside College, University of California at Los Angeles, and Oklahoma A. & M. at Stillwater, Oklahoma. In 1942 and 1945 he attended engineering and sales schools with International Business Machines Corporation, Endicott, New York. He is a licensed public accountant in California.

Gilliss went to work in 1937 at Riverside for the California Electric Power Corporation as operator and chief operator of its IBM accounting systems. In November, 1946, he first entered public service as a systems expert for Riverside County and chief of its central IBM accounting section. This work brought him in intimate contact with the functions and purpose of many local governmental units including the offices of county assessor, sheriff, auditor and clerk and the de-

. . . Continued on page 64

Crow Canyon Road

Reconstructed by
Alameda County

By FRED E. THOMPSON, Resident Engineer

IMPORTANCE of the route now known as Crow Canyon Road in Alameda County has been recognized since January of 1856, when the board of supervisors appointed Messrs. Hayward, MacDonald and Miller as road viewers in answer to a petition. The signators to this petition stand high on the roster of Alameda County pioneers, and it was their request that a road be laid out and opened between an existing road in Contra Costa County and the Stockton Road, now U. S. 50, through Castro Valley, near Hayward. The route was declared a public highway by the board of supervisors in August of 1861.

Then, as now, this road provided one of the few east-west routes traversing the barrier ridge lying between Alameda and Contra Costa Counties, and carried much of the coach and commercial vehicle travel between the southern portion of the two counties. It originally was a narrow earth and gravel road, with the multicurve and steep gradients characteristics usually found in such roads designed or developed for wagon travel through rough terrain. Reconstruction and improvement to the alignment and section existing prior to the current improvement produced an oiled surface of from 15 to 18 feet in width and shoulders varying from zero to five feet in width, and was accomplished during the period 1926 to 1933 inclusive. The funds for that work were provided from county, CWA, and WPA sources.

Heavy Traffic

During the past several years, particularly during World War II and subsequent years, traffic over this road has greatly increased both in total volume and in percentage of heavy commercial vehicles; with particular respect to tank trucks operating between the petroleum refineries, in the Martinez area, and the State Highway System in the vicinity of Hayward. As a result, the old oiled surface was rough and broken

CALIFORNIA HAS 1,000 MILES OF MULTILANE DIVIDED ROADS

California now has 1,000 miles of multilane divided road on the State Highway System—well, almost.

State Director of Public Works Frank B. Durkee reports that at the beginning of 1953 the exact mileage of completed State highway of four or more lanes divided was—999.9.

The entire State Highway System comprises 13,715 miles of constructed road. A recent engineering report indicates that improvement is needed on 12,067 miles, of which at least 3,374 should be made four or more lanes.

The growth of the multilane divided highway network in California is shown by the following figures: on July 1, 1945, 329 miles; on July 1, 1947, 481.3 miles; and one year ago, 947 miles.

Another 144.8 miles of multilane divided highway are now under construction.

Most of the multilane divided mileage is of the expressway type, with some intersections, entrances and crossovers at grade. Only about 100 miles of full freeway—with access only by means of designated ramps and with all intersecting streets carried over or under the highway—have been completed or are under construction.

throughout the length of the project, and costly and constant maintenance was necessary to permit reasonably safe travel.

The section for the current improvement was designed on the basis of a traffic index of 6.36 and a resistance ("R") value of 18 for the basement soils. On this basis, the following section was adopted: three inches of plant-mixed surfacing, six inches of crusher-run base, and nine inches of imported subbase material. The pavement width is 24 feet from U. S. 50 to mile 3.6, and

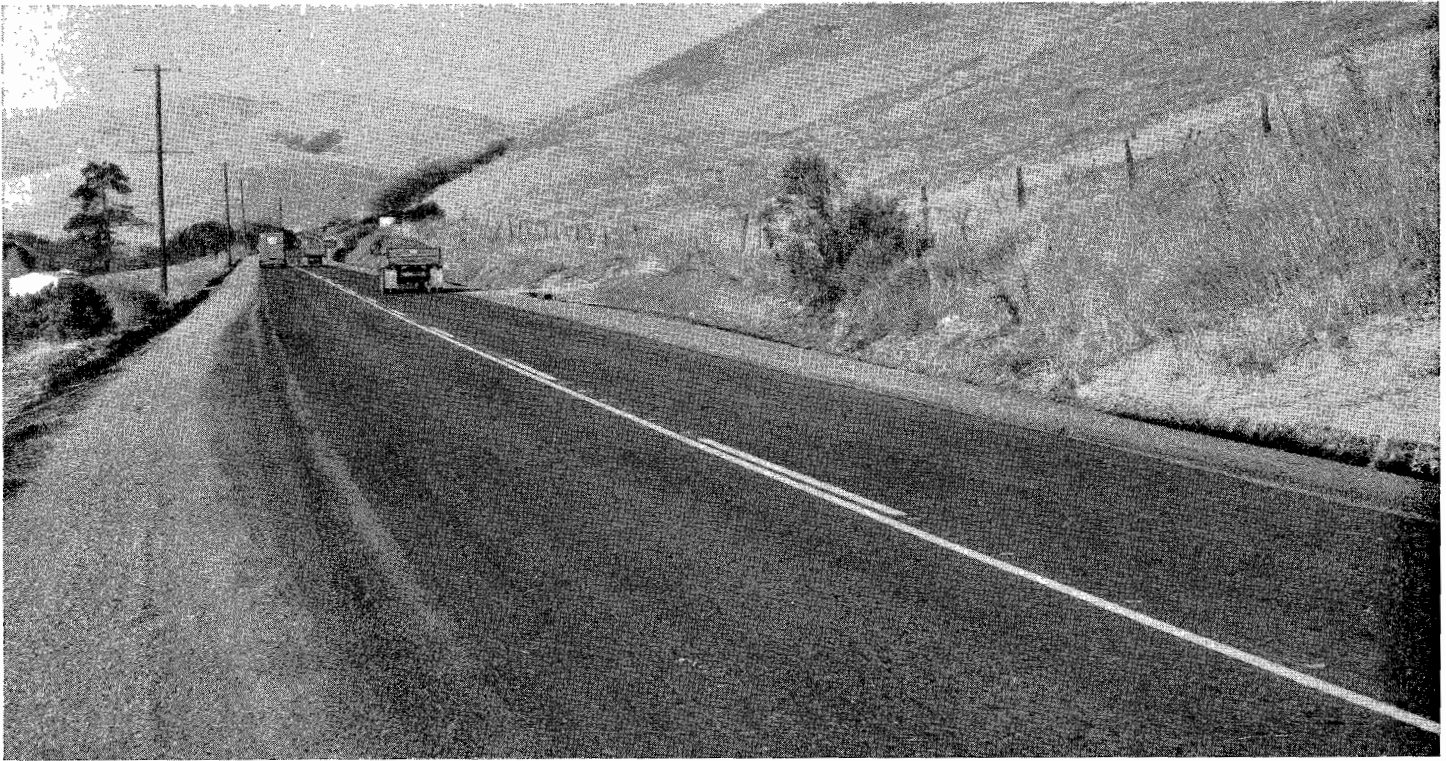
22 feet for the remaining 3.1 miles; with shoulder widths varying between three and seven feet, the average width being six and one-half feet.

Alignment and Grade

Several factors influenced the design of alignment and grade. Chief among those factors is the consideration of Crow Canyon for a future reservoir site, as part of the water resources plan of the State Division of Water Resources. For this reason radical relocation was deemed inadvisable and an alignment was selected that followed the existing alignment, except for minor changes at the approaches to bridges and in the vicinity of the Norris Canyon intersection. Curvature was held to an average radius of 600 feet; and grade was held as nearly as possible to eighteen inches above the existing surface, to keep roadway excavation at a minimum and to take advantage of the bearing capacity of the existing road. With the exception of one short length having a 7.44 percent grade, gradient is less than 5 percent. Humps and sags in the old road were levelled to allow satisfactory sight distances and provide good riding qualities.

A number of recurrent slide areas exist on this road. Due to prohibitive cost required to completely correct the conditions, slide control effort was limited to flattening the cut slopes where sufficient right of way existed. It is estimated that the maintenance cost in removing slides will be more economical than major slide prevention work at the time of construction.

Design and construction engineering for the project was provided at county expense and by personnel operating under the direction of Wallace B. Boggs, County Surveyor and Road Commissioner of Alameda County. The contract for the project was let by the Department of Public Works, Division of Highways, to Frederickson & Watson Construction Company of



Two views of Crow Canyon Road in Alameda County after reconstruction with county and Federal Aid Secondary funds

Oakland on July 9, 1952. Work was begun on July 14th and continued until completion on November 14th, under Mr. Carl Poss as representative for the contractor and general supervision by

engineering personnel from District IV, Division of Highways. Fred E. Thompson was Resident Engineer for Alameda County on the project.

The cost of this work amounted to

approximately \$427,000, of which approximately \$124,000 was allocated from Federal Aid Secondary Funds and the balance advanced by Alameda County.

AN UNUSUAL BOX CULVERT INSTALLATION

By M. L. CARDWELL, Highway Superintendent

A DRAINAGE problem at the intersection of Stowell Road with U. S. 101 at the southerly limits of the City of Santa Maria, caused in the main by development of new subdivisions whereby the erection of new homes and the paving of numerous streets funneled storm waters into drainage ditches already taxed by waters diverted from natural drainages by land leveling in connection with farming operations, was recently remedied to a major degree by the installation of a 3 foot by 1 foot by 88 foot reinforced concrete box culvert which was installed adjacent to a similar structure in place under U. S. 101 at that location.

U. S. 101 north of this intersection becomes a city street section 48 feet wide between curbs. At the north side of the intersection this width is reduced

to a net 42 feet by the existence of gutter inlet structures on each side. Due to this restricted width it would be extremely difficult to build a new structure in place and satisfactorily handle the traffic load of approximately 14,000 daily vehicles of which 10 percent are heavy trucks. Normal operations would result in considerable congestion and traffic would have had to be detoured for a period of at least three weeks.

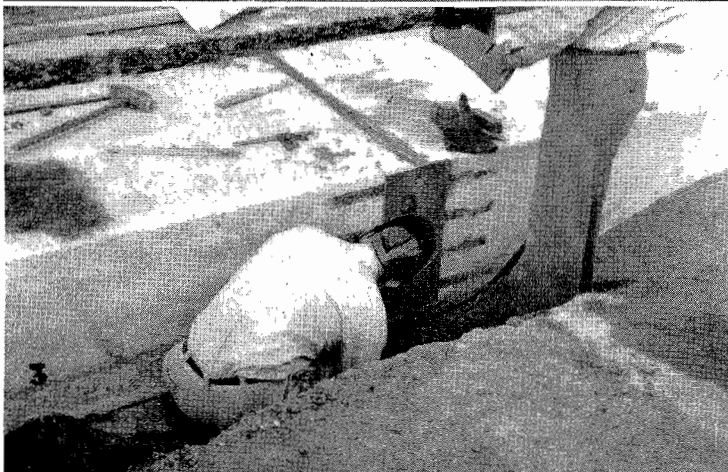
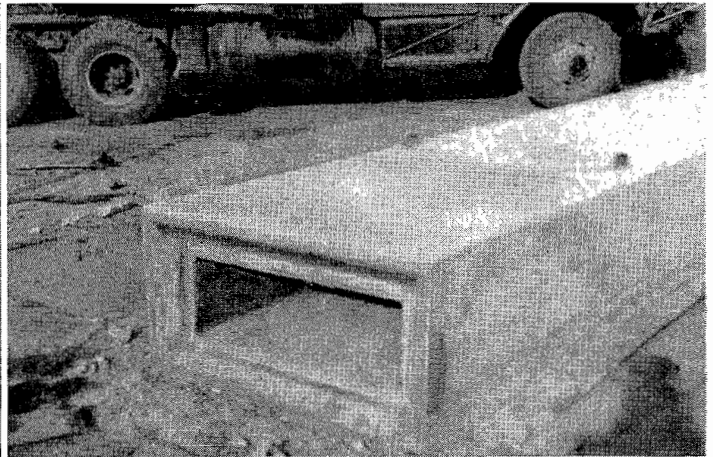
Structure Precast

In order to avoid this lengthy disruption of traffic it was decided to precast the structure in four units, each 22 feet in length, and make the entire installation in one day's time. The structure was accordingly designed and fabricated for field assembly at the Santa Maria Maintenance Yard.

Lifting eyes (*Photos 1, 2, and 4*) were made from 1 inch round mild steel with welded eyes at one end and 1 inch malleable iron washers welded to the other end for an anchor. These rods extended through the sidewalls and into the floor of the structure 3½ inches. They were placed at a slight angle to provide a straight pull from the lifting cables (*Photo 1*).

To secure the joints nine pieces of ¾-inch by 2-inch by 2-inch angle iron 10 inches in length were placed at joint ends of each section, four pieces in the sidewall and five pieces in the top. One leg of the angle secured with dowels made of ½ inch reinforcing steel was placed in the wall and the other leg placed flush with the outside of the wall (*Photo 3*).

... Continued on page 64



RIBBON CUTTING CEREMONY MARKS OPENING OF ORANGE GROVE AVENUE BRIDGE IN PASADENA

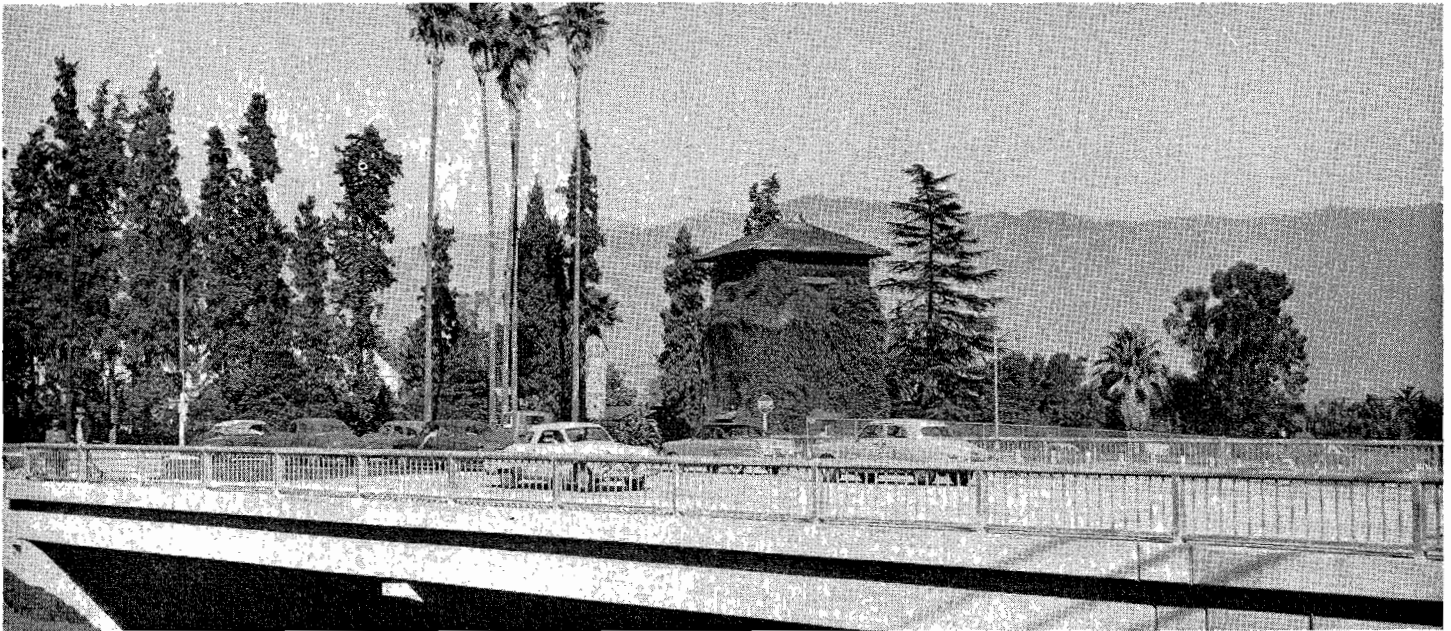
ON DECEMBER 22, 1952, at 10 a.m. the Queen of the Tournament of Roses, Leah Feland, cut the ribbon that stretched across the roadway of the newly completed Orange Grove Avenue Bridge in Pasadena. This was a very important occasion because the completion of this bridge structure across the Colorado Freeway took out of use a curving detour around construction and made the traffic handling

Splendid Cooperation

This bridge is just east of the \$5,-000,000 Colorado Freeway Arroyo Seco Bridge, both of which State Division of Highways contracts are with the Guy F. Atkinson Company. This company has completed the Orange Grove Avenue Bridge in record time, with the splendid cooperation received from the various Pasadena city departments and from the Southern Cali-

Bridge and connecting approaches is August, 1953.

At the ribbon cutting ceremony the contractor was represented by the following: Guy F. Atkinson, chairman of the Board of Directors; J. J. Draine, Assistant Area Manager; William T. Colwell, Chief District Engineer; Robert Boyd, Project Manager; and Don Snyder, Administrative Assistant.



This is the new Orange Grove Avenue Bridge in Pasadena, opened to traffic on December 22, 1952

problem much easier for the Pasadena Tournament of Roses and the football game in the Rose Bowl on January 1, 1953.

The new Orange Grove Avenue Bridge provides a roadway 64 feet wide between curbs with two 12-foot wide sidewalks, to carry the traffic on this important north-and-south Pasadena arterial over the Colorado Freeway. The total length of the bridge is 110 feet. It is of reinforced concrete box girder type, with provision within the deck for gas pipes, water pipes, telephone cables, and electric power cables.

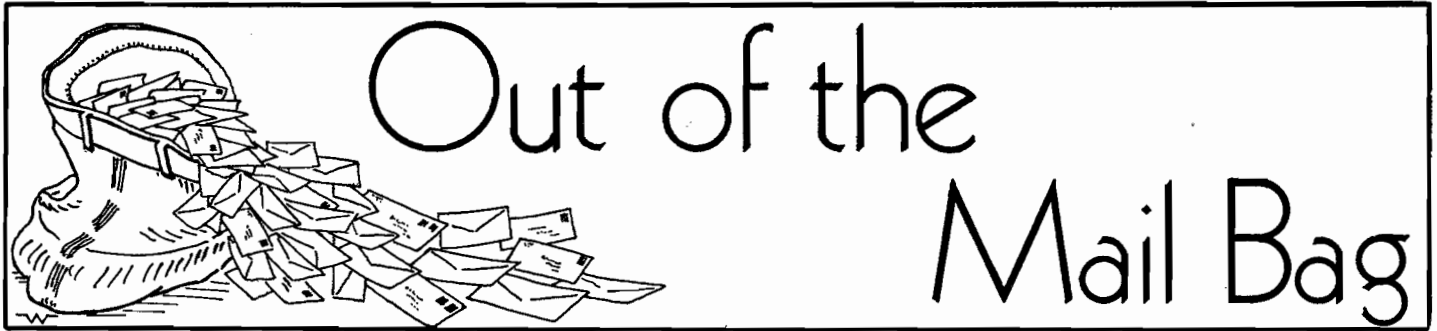
fornia Gas Company and Pacific Telephone and Telegraph Company. The total contract allotment for the Orange Grove Avenue Bridge is \$257,800.

The contract not only includes the bridge construction but also a section of the Colorado Freeway and reconstruction on Holly Street. Public traffic, however, will not be able to utilize this completed portion of the Colorado Freeway until the adjoining contract to the west, including the bridge over the Arroyo Seco, has been finished. The estimated date for final completion of the Arroyo Seco

Officials Attend

The entire Pasadena Board of City Directors was present at the ribbon cutting ceremony. Those members of the board present but not identified in the accompanying photograph are: A. Ray Benedict, Milton S. Brenner, Warren M. Dorn, Seth Miller, and Ray G. Woods. Also attending the ribbon cutting ceremony on behalf of the City of Pasadena were: City Manager Don McMillan; Robert M. McCurdy, Assistant City Manager; William Allen, Administrative Assistant City Manager; Douglas Mackenzie, City Engi-

... Continued on page 55



FROM MANILA

MARC DONNELLY & ASSOCIATES, INC.
El Hogar Filipino Bldg., Juan Luna
Manila, Philippines

*Editor, California Highways and
Public Works*

DEAR SIR: We have received several copies of your excellent publication through our associate, Mr. Howard Weber, who is now visiting the U. S. A. to observe modern construction methods.

Your publication has been of value to us on several occasions and to insure our keeping abreast of happenings in California and the construction field we would sincerely appreciate having our name added to your mailing list. After the various contractors we deal with finish looking at your magazine it is turned over to one of the local colleges having courses in engineering and I am confident it has been of value therein and will help create a better American-Far East relationship.

Yours very truly,

MARC DONNELLY & ASSOCIATES, INC.
By: MARC DONNELLY

THE O'BRIEN ARTICLE

EDWARD J. DE KORT
San Francisco 12, California

MR. KENNETH ADAMS, *Editor*

DEAR SIR: I wish to express my thanks to you and Mr. M. A. O'Brien for the two fine articles of the "History of United States Numbered Highways." The facts set forth so clearly by Mr. O'Brien have indeed answered many of the questions of highway designations.

Your magazine is a pleasure to read and absorb. I am grateful for being on your mailing list.

EDWARD J. DE KORT

ILLINOIS COMPLIMENT

ILLINOIS DIVISION OF HIGHWAYS
Office of District Engineer
Chicago 1

MR. KENNETH C. ADAMS, *Editor*

DEAR SIR: I would like to have my name placed on the mailing list for your fine highway magazine. I feel that it will be a valuable addition to the group of publications which we receive in our district office each month.

Since the State of California is quite a bit farther advanced in expressway work than we are in Illinois, we feel that this magazine will be of particular value in this field.

Yours very truly,

WILLIAM F. BAUCH, JR.
Expressway Traffic Engineer

DIRECTIONAL SIGNS

THE RICHKRAFT COMPANY
Oakland, California

MR. KENNETH C. ADAMS, *Editor*
*California Highways and Public
Works*

DEAR MR. ADAMS:

We have just returned from a trip to Denver, Colo., and you don't know how much we appreciate the work our State Highway Department has done. One particular item—my wife mentioned that she had never noticed the directional signs in California until she got out of the State and noticed the lack of them. For myself, I wish to compliment the State on, not only its new construction, but the maintenance of the present highways.

Sincerely yours,

THE RICHKRAFT COMPANY
C. A. COOK
Vice President—Western Manager

WE ARE GLAD TO HELP

UNIVERSITY OF SAN FRANCISCO
San Francisco, California

KENNETH C. ADAMS, *Editor*,

DEAR MR. ADAMS: I am certainly grateful to you and to your staff for assembling the fine file of your valuable publication. I consider these volumes a real acquisition to our Californiana section in our Gleeson Library here at the university. I have asked our librarian to add his official lines of thanks to these more personal lines, and I know that he will do so.

Thank you again for doing this very fine thing for us and I do appreciate it. The volumes will be used in various research projects in our history program.

Very sincerely yours,

(REV.) JOHN B. MCGLOIN, S. J.
Assistant Professor, History
Department, University of
San Francisco

LETTER FROM AUSTRALIA

19 Langford St., Surrey Hills
Melbourne, Australia

MR. KENNETH C. ADAMS, *Editor*

DEAR MR. ADAMS: I take pleasure again in thanking you for the privilege of receiving your journal. Its widespread distribution makes a valuable contribution to better world relations. The high standard of photography is to be commended. In particular the yuccas on cover of May-June, 1952, were a delight.

The reality of your progress in highways and public works is very stimulating. It encourages us to aim higher in our own spheres of endeavor. We look forward to your further achievement.

Yours truly, ARTHUR O. GYLES.

APPRECIATIVE READER

DEAN P. BECKWITH
Los Angeles 31, California

Editor,
California Highways and Public Works Magazine

DEAR SIR: Sunday papers and current magazines were laid aside for the better part of the day while I perused the pages of *California Highways and Public Works*.

Most of us busy citizens are aware of the small portion of the highways with which we are particularly familiar, but have little conception of the magnitude of the entire State Highway System or the enormous amount of detail required in its planning, construction and maintenance.

The marvel is not "where all the money goes," but rather "how so much can be done with the funds available." Perhaps, nowhere in public affairs are public funds so well authenticated.

Permit me to express to you, personally, a taxpayer's and a motorist's appreciation for a fine job of informative publicity in the bimonthly visits in word and picture.

Very cordially yours,

DEAN P. BECKWITH

HIGHWAYS PRAISED

THE UNION METAL MANUFACTURING CO.
Canton 5, Ohio

January 6, 1953

Mr. KENNETH C. ADAMS, Editor

DEAR MR. ADAMS: The feature story in the December issue of our publication *The Monotube* was that of the California freeways. We believe you will be interested in reading our article, therefore are sending a copy of the magazine.

We are very grateful to *California Highways and Public Works* for the helpful information which we were able to glean from reading that publication. You Californians are to be congratulated on your fine highways.

Very truly yours

M. E. MILLER
Advertising Department

UNUSUAL LETTER

El Monte, California.
January 5, 1953

MR. FRANK C. BALFOUR
Chief Right of Way Agent
Division of Highways

DEAR MR. BALFOUR: As you know, our home is being purchased for the Ramona Freeway, much as we've wished it would miss us. We were hoping to receive more money for it, however the zoning didn't allow for our office on this property, so we did receive a fair settlement.

Instead of writing the Governor or going to court as some have threatened, we are writing this letter to express our appreciation of the manner in which we've been treated by the men in your department.

Mr. Riley, your appraiser, was very courteous and considerate, and Mr. Walter Routery, your negotiator, has been most courteous, thoughtful and helpful. He has extended every consideration possible. It seems he has the most difficult job of all—informing property owners what they are going to receive—or not receive. He has the quality of being very kind as well as competent, and in our circumstances it is more than appreciated.

So, we thought we'd like to send a little praise along for him instead of a complaint. In other words it's a nasty operation, but he's done it with the least possible pain.

With best wishes for the New Year,

Sincerely,

T. C. RAMELLI
JEANNE RAMELLI

REQUEST GRANTED

MARYSVILLE-YUBA COUNTY CHAMBER
OF COMMERCE

January 19, 1953

Mr. Kenneth C. Adams, Editor

DEAR MR. ADAMS: For several years the Marysville-Yuba County Chamber of Commerce has enjoyed and profited by reading your outstanding publication which so accurately and colorfully depicts the activities of the Public Works and Division of Highways De-

partments. We want to take this opportunity of complimenting you, and your staff, for what is truly an outstanding publication.

We know that you, and members of your department, are anxious to more effectively and thoroughly send your message to those people who are interested in both the present and contemplated activities of the Division of Highways. Because of this, we are taking this opportunity to suggest that you add one more name to your mailing list.

During recent months we have re-activated many of the committees of this chamber of commerce. Our most recent addition to our hard working crew of committees, and committee chairmen, is Mr. Hartley G. Weichert, who will serve as chairman of our highways committee.

Mr. Weichert has asked that I secure for him, late reports and information on highway matters throughout the Northern California area. This we have done. Having read your publication, *California Highways* for the past six years, I believe that this particular publication would be of invaluable assistance to Mr. Weichert in getting a more complete picture of the problems and progress of highways, not only in our particular area, but throughout the State of California.

ROGER B. MCGINNIS
Secretary-Manager

Ribbon Cutting

Continued from page 53 . . .

neer; Duncan Blackburn, Chief Engineer of the Water Department; Henry Garwood, head of the Park Department; and Chief of Police Clarence Morris. Randolph Richards, president, and Guy Brink, chairman of the community development committee, represented the Chamber of Commerce.

Assisting Miss Leah Feland, acting in her official capacity as Queen of the Tournament of Roses in the cutting of the ribbon, were Harrison R. Baker, State Highway Commissioner, and Mayor Abernethy of Pasadena.

Immediately after the cutting of the ribbon the bridge was thrown open to public traffic.

Essential

Public Knowledge of Traffic Engineering Measures Important

By JOHN P. MURPHY, Principal Highway Engineer

PUBLIC KNOWLEDGE of traffic engineering measures is one of the most essential ingredients in developing an adequate street and highway system.

Public acceptance of advances in traffic engineering are as necessary as the technical skills required to develop the devices, measures or designs. Unpopular measures have little chance of achieving the results intended.

These self-evident facts are recognized by public officials, engineers, and enforcement authorities—but in varying degrees—depending usually on the number of sad experiences of the highway official where adequate explanation had not been given the public.

Information to Public

Although every advantage may be taken to utilize the latest products of science, the variables of traffic conditions and human behavior are not completely expressible in engineering terms.

Road building is not an exact science, nor is it a static science. The continuously expanding knowledge in the field, coupled with the rapid increase in traffic problems, makes it mandatory that we maintain a flow of intelligent information to the public.

This does not mean that a popular vote must be taken—though in the last analysis that may be what actually occurs. The answer to the problem is a well-informed public.

Contrary to some evidence disclosed by traffic habits, the general public does not lack ability to comprehend basic traffic data.

Some Examples

Let me cite some examples. Where a heavily traveled main highway route intersects an important crossroad carrying considerable traffic volumes for short periods each day, there often is a local hue and cry for a traffic signal. Many of the requested installations would mean establishment of an isolated signalized crossing. Traffic engi-

neers know that an isolated traffic signal, presenting an unexpected interruption of traffic flow, often results in an increase in serious rear-end collisions in the main traffic stream, with no appreciable decrease in other types of accidents at the intersection. Well-prepared explanations of this situation have proved acceptable to local authorities in several instances. The fact that the explanation sometimes has not been completely understood or accepted by a community presents a further challenge to us—it does not mean that the public is unwilling to understand or incapable of comprehending.

Evidence of Public Knowledge

In recent months a specific evidence of public knowledge of traffic engineering data was demonstrated at a community meeting with state highway representatives. To show the need for complete reconstruction of a stretch of highway to divided multi-lane standards with access control, rather than just adding a lane on each side of the existing highway, a tabulation of accident rates was projected on a screen, showing the California accident rates for two-lane, three-lane, undivided four-lane, multilane divided expressways, and for full freeways. It had been intended to use the tabulation only to show the decrease in accident rates when a median strip and access control are included in the design.

Surprisingly, the audience of some 70 people, typical of a group interested in highway development but not what you might consider technically informed, asked that the chart be retained on the viewing screen while a number of very appropriate questions were asked. There appeared to be no confusion as to the meaning and numerical significance of accident rates and fatality rates. Particular comprehension and appreciation were expressed of the average daily traffic figures for each type of facility.

Period of Greater Interest

This reaction was especially surprising to the state highway participants in view of previous experiences where citing a vehicle-mile figure as a measure of highway usage and economy in comparing highway routings had resulted only in loss of audience attention.

Apparently we are in a period of greater interest and desire to understand highway needs. Everywhere there are indications that people are willing and able to discuss not only the problems about the highways in front of their businesses and homes but also have shown a definite interest in the larger state-wide problems. We should not fail this opportunity to provide a clear explanation of what we propose to do, why we propose to do it and how the work will be financed.

The public is entitled to know how carefully the highway revenues are being expended. To the many individuals who make up the public this can best be demonstrated by the engineer's sympathetic and never-ending consideration of each local problem—no matter how small.

Public Desires to Be Informed

Probably there is no other field of engineering where public knowledge is so important. This is due not only to the fact that street and highway engineers are generally in the direct employ of the public, but also to the previously mentioned current interest in highway improvement.

You will find that the basic reasoning behind our modern highway designs are as intelligible to the public as they are to us. The public merely desires that it be informed of these factors which the engineer uses in his determinations.

The man behind the wheel of an automobile can appreciate the need of adequate side and vertical clearance at structures; he realizes that grade separation structures are both necessary and

costly; he can understand the dangers of uncontrolled parking and entrance to main traffic lanes; he knows that a median strip contributes to his driving safety and comfort; he is grateful for improved shoulders; it is obvious to him that oversigning can be confusing; it seems to him to be sound economy and an added safety feature to have a periodic replacement program for incandescent lights; the provision of median strip screening against headlight glare appears proper to him, and the erosion control features to prevent slides and slipouts are completely acceptable to him.

Publicity on Speed Zones

All he asks is that he be reminded occasionally of where all of these items pertain so that he can be assured in his own mind that proper weight is being accorded these various elements in the highway designs.

Increased publicity is now being given to establishment of speed zones to advise interested citizens of action taken on a type of request often initiated by a community. The fact that a speed limit much below the normal traffic pace is unenforceable and impractical makes as much sense to the average layman as it does to the engineer. The stressing of that principle is meeting with increased acceptance, and apparently is satisfactory to local groups which have advocated more drastic speed reductions.

In discussions of local traffic problems, particularly where there is an accident history, there is always the danger that negative recommendations of the engineer will appear to argue statistics against human life, dollar economy against bodily injury. These are the most difficult explanatory issues. Feelings and emotions run high and the utmost care must be exercised in the discussion period.

School Crossings

The most critical instance of this type is the ever-recurring request for pedestrian push-button signals at school crossings.

A very fine response by parent-teacher groups has been noted in many instances where an adequate explanation has been given of the inherent drawbacks and accident potential of

such installations. The more secure advantages of an adult-supervised crossing guard and the possible too-quick reaction of school children to self-operated pedestrian signals are readily appreciated. The most important factor in these discussions is the sincerity of the engineer in presenting the facts, dissociated as far as possible from the matter of cost.

The item of cost cannot be entirely eliminated from the discussion as payment of adult crossing guards, which cannot be financed from highway funds, is a burden on local budgets. Some assistance in that respect can be given by the engineer, through consultations, to concentrate the permissive crossing locations for children at each school.

Safety for School Children

Some very fine work has been done by the engineers in discussion with school authorities regarding the boundaries of school districts. Where governmental jurisdiction permits a shift in boundaries, it has been possible to minimize the number of school children crossing main highways.

Another instance of acceptable advice from the engineers concerns the location of new schools. We are all familiar with the tendency of authorities to establish new schools adjacent to or near a main thoroughfare. Yet the same authorities will protest most vigorously the routing of a new major highway development in the proximity of a school. This contradictory attitude has been and should continue to be pointed out to affected communities. Satisfactory solution depends on comprehensive planning, with each party being fully advised of the other's problems.

Nonpassing Zones

Despite the many examples of increased public knowledge of traffic engineering measures through explanatory efforts of engineers, there remain many untouched or scarcely touched fields.

One of the most flagrant and dangerous driving practices probably reflects in part a lack of knowledge of the engineering represented. I am referring to the striping of nonpassing zones on two-lane highways. On California state

highways the traffic stripe code gives the motor vehicle operator definite information as to the sight distance and passing opportunity ahead. From observation and questioning of many drivers I am convinced that very few have any conception of the care which has been taken to establish this passing delineation nor of the extreme gamble when the special striping is disregarded. Even if the group of reckless drivers is discounted, there still remains a great need for education on this problem.

Rural Traffic Congestion

A further challenge to the explanatory efforts of the engineer is presented currently by proposals being received from thoughtful civic groups and individuals concerned with rural traffic congestion. It has been suggested that immediate traffic relief and accident reduction can be obtained if occasional short sections were constructed to permit vehicles operating at normal speeds to pass slow-moving vehicles.

For many years the policy of the State has been in agreement with the general nature of these suggestions. The main differences between the suggestions and the practice are in the length of section considered worth while and in the location and cost of the sections to be improved.

Most of the suggestions assume that accelerated construction of short sections can be integrated with ultimate design, and without increase in cost.

Clear Thinking Required

The facts are that the congested sections are usually the ones involving large cost, and interim measures on short sections will only in rare instances fit the ultimate reconstruction.

Here is a situation which will require the clearest thinking and the ablest demonstration of conveying essential information to the public.

In the final analysis, public acceptance is based on demonstrated worth of traffic engineering measures. This includes all phases from the broadest planning conceptions to the details with which every motorist has daily experience. In most instances public opinion will reflect the validity of the facts and the ability of the engineers to explain them.

Unsung Heroes

Chief Bridge Engineer Pays
Tribute to His Helpers

By F. W. PANHORST, Assistant State Highway Engineer, Bridges

Now that the annual football season is a thing of the past and the heroes of the various bowl games are lauded for their great ball carrying feats how often do you hear of their "blockers"—the men who ran interference, the players who possibly did the work which made the heroes heroes?

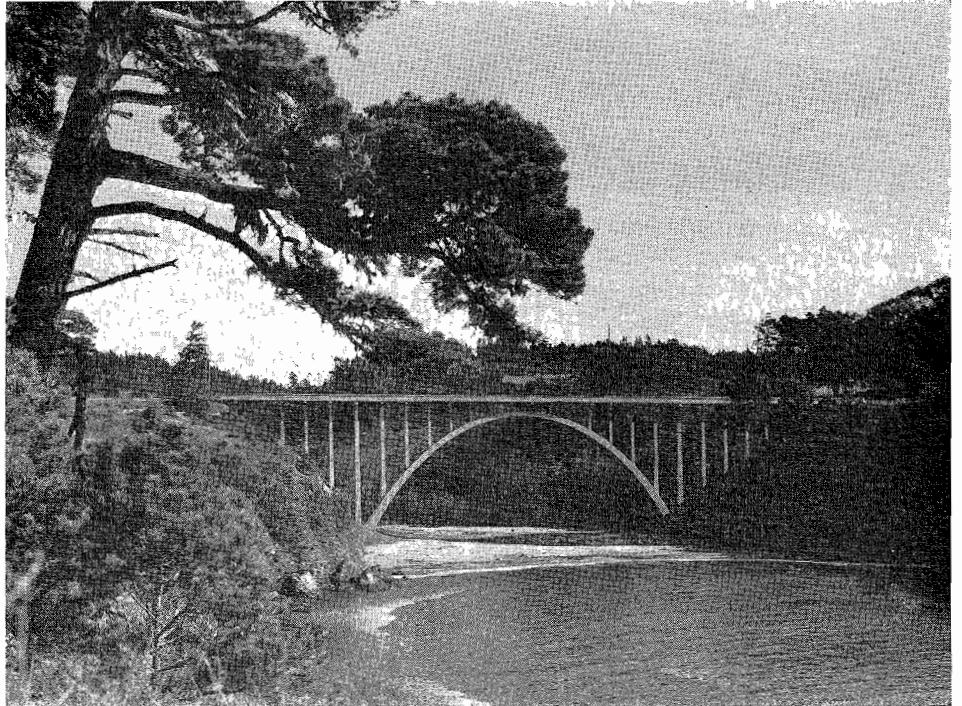
The "blockers" who clear the way and do the hard work that makes heroes of others are frequently, maybe almost always, in most large undertakings and organizations. It would seem these unsung heroes should at least rate a pat on the back.

Just before Christmas 23 members of the Bridge Department were presented with "Twenty-five-year-service Awards" honoring them for 25 years, or more, honorable service with the State of California. Among these was Henry Kuphal, Associate Bridge Engineer, who is being picked out as one of the typical—but not the only—unsung heroes in state service you seldom hear of but who has done much in building our great State.

Designed Four-level Structure

Henry was born in Montana—many years ago—graduated in engineering from the Montana School of Mines and started designing structures when some of us still wore short pants. Most of these years were in the Bridge Department of the Division of Highways and after more than 25 years of service retired four years ago and in December received a large framed certificate with a gold seal, the Governor's signature and others to attest to his faithful service.

While in the Bridge Department Henry designed many of the outstanding structures on the Highway System, the most outstanding one being the four-level structure in Los Angeles which distributes traffic at the intersection of the Arroyo-Secco, Hollywood, Harbor and Santa Ana Freeways. So far as is known, this is the



Russian Gulch Bridge, considered the most beautiful on California State Highway System

only four-level highway distribution structure built to date.

Many Play Parts

No one man can take full credit for any large undertaking. Those who secure the necessary funds play an important part since no funds, no job. He who visualized the general layout of intersecting highways played a most important part, as did the men who secured the rights of way, the field engineers who constructed various parts at a time and then made them all fit in the final pattern and the contractor and his workers who really transformed the plans into a workable structure. But the designer who put all the grades, curves, and alignment together with a structure of satisfactory appearance with each member as strong as it should be and none stronger than necessary with the resultant structure the most pleasing in appearance and economical cost for the purpose

intended is certainly deserving of a pat on the back if for not other reason than that he secured the best possible structure for the least money for the State thereby saving many thousands of dollars which otherwise could have been lost—and who would know the difference?

The four-level structure was most difficult to lay out since there were four intersecting highways—two straight and two curved. Try to lay out such arrangement without having a column land in the middle of the highway. Where would you place the expansion joints which are so necessary? How large would you make the columns and what shape? How would you calculate the strength of the curved and twisted beams and girders? Think of these things the next time you ride over or under the structure. I think you will admit Henry did an outstanding job.

... Continued on page 60

HIGHWAY BIDS AND AWARDS

November, 1952 (Continued)

FRESNO COUNTY—At Weber Avenue in the City of Fresno, a prestressed concrete girder bridge to be constructed and about 0.24 mile of approaches to be graded and surfaced with plant-mixed surfacing on untreated rock base and signals and lighting system to be relocated and revised. District VI, Route 4. Tumblyn Co., Bakersfield, \$99,962; Trewhitt-Shields & Fisher, Fresno, \$111,795; Norman I. Fadel, North Hollywood, \$113,888; L. H. Hansen & Sons, Fresno, \$166,856; Volpa Brothers, Fresno, \$187,818. Contract awarded to Thomas Construction Co., Fresno, \$91,363.90.

LOS ANGELES COUNTY—Between 1.0 mile and 0.6 mile southerly of Castaic Junction, truck scales to be installed, a scale house constructed and approaches constructed thereto. District VII, Route 4, Section A. A. Edmondson, San Fernando, \$41,951; FEPCO, Los Angeles, \$43,866; Byerts & Sons, Geo. K. Thatcher, Los Angeles, \$45,179. Contract awarded to Jesse S. Smith, Glendale, \$41,463.40.

LOS ANGELES COUNTY—In and adjacent to the cities of Torrance and Redondo Beach, at the intersection of Hawthorne Avenue with 182d Street, semitraffic actuated signal system and highway lighting to be furnished and installed. District VII, Route 164. Electric & Machinery Service, Inc., South Gate, \$7,716; Westates Electrical Construction Co., Los Angeles, \$7,816; Fischbach & Moore, Inc., Los Angeles, \$8,152; C. D. Draucker, Inc., Los Angeles, \$8,365. Contract awarded to Ed Seymour, Long Beach, \$7,640.

LOS ANGELES COUNTY—Los Angeles River Freeway between 223d Street and south junction of Atlantic Avenue, about 3.8 miles in length, to be graded and surfaced with Portland cement concrete pavement on cement treated subgrade, and five bridges and a retaining wall to be constructed. District VII, Route 167. Webb & White and W. J. Disteli, Los Angeles, \$2,695,752; Griffith Company, Los Angeles, \$2,783,642; Guy F. Atkinson Company, Long Beach, \$2,871,198; Gordon H. Ball and San Ramon Valley Land Co. and Ball & Simpson, Berkeley, \$2,892,067; Winston Bros. Company, Monrovia, \$2,948,738; A. Teichert & Son, Inc., Sacramento, \$2,984,314. Contract awarded to Ukropina-Polich & Kral, San Gabriel, \$2,559,019.

MONO COUNTY—Constructing cottage at Crestview Maintenance Station. Joseph A. Schlapp, Bishop, \$11,537. Contract awarded to George A. Jarvis, Bishop, \$10,835.

SACRAMENTO COUNTY—Between north end of American River Bridge and Route 3 near Swanton Road, about 1.4 miles, roadbed for a four-lane divided highway to be graded and placing untreated rock base on imported subbase material and constructing four reinforced concrete bridges. District III, Routes 98, 3, Sections B.B. Lord & Bishop, Sacramento, \$737,113; Fredrickson & Watson Construction Co.—M & K Corp., Oakland, \$768,940; A. Teichert & Son, Inc., Sacramento, \$777,637; Trewhitt-Shields & Fisher, Fresno, \$779,244; Fredrickson & Kasler, Sacramento, \$794,881; Tumblyn Co., Bakersfield, \$801,095; Fredrickson Bros. & Bates & Rogers Construction Corp., San Francisco, \$818,959; George Pollock Co., Sacramento, \$849,388; H. Earl Parker, Inc., Marysville, \$857,437; John C. Gist, Sacramento, \$961,976. Contract awarded to Ukropina-Polich-Kral, San Gabriel, \$728,138.50.

SAN BERNARDINO COUNTY—In the City of San Bernardino at the intersections of E Street with 7th Street, 8th Street, 9th Street, 10th Street and Base Line Street, fixed-time traffic signal systems and highway lighting to be furnished and installed and modified. District VIII, Route 43. Drury Electric Co., San Bernardino, \$19,977; Westates Electrical Construction Co., Los Angeles, \$21,184. Contract awarded to Fishbach and Moore, Inc., Los Angeles, \$19,786.

SAN DIEGO COUNTY—In the City of San Diego, at Friar's Road and near Mission Valley

Interchange, existing reinforced concrete pipe culverts to be cleaned and drainage structures to be constructed. District XI, Route 77. Eimer Bros., Inc., Escondido, \$18,882. Contract awarded to N. M. Saliba Company, Los Angeles, \$18,313.

SUTTER COUNTY—At the north end of the Sutter Causeway, about five miles northwest of Tudor, about 0.2 mile, to be graded and surfaced and a portion of existing causeway adjusted to new grade. District III, Route 87, Section B. Clements & Co., Hayward, \$53,682; B. S. McElderry, Berkeley, \$59,856; Harms Bros., Sacramento, \$65,430; J. Henry Harris, Berkeley, \$68,446. Contract awarded to Rice Brothers, Inc., Marysville, \$46,736.16.

F. A. S. County Routes

HUMBOLDT COUNTY—Between Freshwater and Kneeland Post Office, about 2.2 miles, portions to be graded. District I, Route 971. Claude L. Youngs, Sacramento, \$66,220; Humboldt Constructors, Inc., Eureka, \$74,799. Contract awarded to J. L. Conner, Jr., Eureka, \$51,909.

INYO COUNTY—Between Brown's Camp and Rovana, about five miles, to be graded and surfaced with road-mixed surfacing. District IX, Route 1071. Ball & Simpson, Berkeley, \$107,088; R. P. Shea Co., Riverside, \$122,819; Pike & Hill, Corey Bros. & Bailey, San Rafael, \$131,359; Norman I. Fadel, North Hollywood, \$175,113. Contract awarded to Eaton & Smith, San Francisco, \$103,971.

MERCED COUNTY—On Santa Fe Drive, between Alaska Station and State Route 123, about 1.6 miles, to be graded and surfaced with road-mixed surfacing and a reinforced concrete bridge to be constructed across Black Rascal Creek. District X, Route 912. Fredrickson & Watson Construction Co., Oakland, \$109,642; Thomas Construction Co., Fresno, \$114,443; Karl C. Harmeling, Stockton, \$116,834; Standard Materials, Inc., Modesto, \$126,122; Huntington Bros., Napa, \$126,348; Ted Schwartz, Grass Valley, \$126,899; L. B. Wells Construction Co., Visalia, \$128,776; Harms Bros., Sacramento, \$131,935; B. S. McElderry, Berkeley, \$132,437; J. Henry Harris, Berkeley, \$148,707; Norman I. Fadel, North Hollywood, \$161,384. Contract awarded to P. J. Moore & Son, Tracy, \$103,071.70.

SAN BERNARDINO COUNTY—On Milliken Avenue, between Mission Boulevard and Valley Freeway, about 2.4 miles, to be graded and surfaced with plant-mixed surfacing on imported base material. District VIII, Route 697. Vernon Paving Co., Los Angeles, \$153,098; Cox Bros. Construction Co., Stanton, \$159,546; R. A. Erwin, Colton, \$167,540; Match Brothers, & Match Brothers Paving Co., Colton, \$171,750; E. L. Yeager Co., Riverside, \$171,851. Contract awarded to George Herz & Co., San Bernardino, \$144,685.

SAN BERNARDINO COUNTY—On Alabama Street-Palm Avenue, between State Route 26 and Base Line, about four miles, to be graded and paved with plant-mixed surfacing on imported base material. District VIII, Route 713. George Herz & Co., San Bernardino, \$211,377; R. A. Erwin, Colton, \$243,323. Contract awarded to Match Brothers & Match Brothers Paving Co., Colton, \$206,630.

SAN BERNARDINO COUNTY—On Yucaipa Boulevard, between State Route 26 and Bryant Street in Yucaipa, about 5.2 miles, to be graded to provide additional width and surfaced with plant-mixed surfacing on cement treated base and on existing pavement. District VIII, Route 715. R. A. Erwin, Colton, \$348,394; George Herz Co., San Bernardino, \$359,192. Contract awarded to Match Brothers & Match Brothers Paving Co., Colton, \$324,629.

SAN DIEGO COUNTY—On Sweetwater Valley Road, between Highland Avenue and Bonita Bridge, about 2.9 miles, to be graded and surfaced with plant-mixed surfacing on cement treated base. District XI, Route 640. Daley Corp., San Diego, \$374,360; Cox Bros. Construction Co., Stanton, \$376,806. Contract awarded to Griffith Company, Los Angeles, \$339,743.20.

December, 1952

BUTTE COUNTY—Across Western Drainage Canal, about 13.3 miles south of Chico, substructure of a bridge to be repaired. District III, Route 3, Section B. C. C. Gildersleeve, Grass Valley, \$7,500; Ted Schwartz, Grass Valley, \$9,580; R. E. Hertel, Sacramento, \$10,731; Rice Bros., Inc., Marysville, \$11,533; K. S. Scheyer, El Cerrito, \$12,775; B. S. McElderry, Berkeley, \$13,495. Contract awarded to Tricon Construction Corp., San Rafael, \$6,425.

LOS ANGELES COUNTY—Eleven buildings to be repaired, painted and reroofed at 510 North New Hampshire Avenue. District VII, Route 2. Johnson Company, Altadena, \$6,889; Williamson Bros., Pacoima, \$8,550; Fowler Construction Co., Los Angeles, \$8,860; Carl Orn, Los Angeles, \$9,680. Contract awarded to O. B. Phillips, Jr., Long Beach, \$6,658.

LOS ANGELES COUNTY—On the Santa Ana Freeway, between Eastman Avenue and Todd Avenue, about four miles, roadside areas to be prepared and planted and a watering system installed. District VII, Routes 2, 166, Sections D, A. Jannoch Nurseries, Altadena, \$93,872; D & M Sprinkler Co., Long Beach, \$95,456. Contract awarded to Justice-Dunn Co., Oakland, \$87,832.35.

LOS ANGELES COUNTY—On Ramona Freeway, between Evergreen Avenue and Helen Drive, about 1.5 miles, roadside areas to be prepared and planted with ground cover, trees and shrubs, and plant-mixed surfacing to be placed over median areas. District VII, Route 26, Section LA, D. Justice-Dunn Co., Oakland, \$25,183; Jannoch Nurseries, Altadena, \$26,863; Kieth E. Card, Long Beach, \$27,934; D & M Sprinkler Co., Long Beach, \$38,888. Contract awarded to Henry C. Soto Corp., Los Angeles, \$24,445.75.

LOS ANGELES COUNTY—On Harbor Freeway between 11th Street and Second Street, highway lighting and illuminated sign system to be furnished and installed. District VII, Route 165. Fischbach and Moore, Inc., Los Angeles, \$127,675; A. S. Schulman Electric Company, Los Angeles, \$128,604. Contract awarded to C. D. Draucker, Inc., Los Angeles, \$126,911.

LOS ANGELES COUNTY—On Santa Ana Freeway, between Pioneer Boulevard and 0.3 mile southeasterly of Rosecrans Avenue, about 2.1 miles, to be graded and surfaced with Portland cement concrete pavement on cement treated subgrade, street connections, frontage road, inlets and outlets and acceleration and deceleration lanes to be surfaced with plant-mixed surfacing on untreated rock base; and five bridges and one pedestrian overcrossing to be constructed; to provide a freeway with a four-lane divided roadway. District VII, Route 166, Section A. Webb & White, Los Angeles, \$2,499,065; Winston Bros. Company, Monrovia, \$2,566,564; Griffith Company, Los Angeles, \$2,762,075; Peter Kiewit Sons' Co., Arcadia, \$2,915,260.60. Contract awarded to Ukropina, Polich, Kral, John Ukropina, San Gabriel, \$2,476,702.40.

LOS ANGELES COUNTY—Between Garvey Avenue and Valley Boulevard, about 1.4 miles, roadside areas to be prepared and planted. District VII, Route 168, Section C, EMte. Justice-Dunn Co., Oakland, \$18,344; D & M Sprinkler Co., Long Beach, \$19,242; Keith E. Card, Long Beach, \$20,988; Henry C. Soto Corp., Los Angeles, \$21,350; Stephen L. Vistica, San Mateo, \$23,044. Contract awarded to Jannoch Nurseries, Altadena, \$17,911.55.

LOS ANGELES COUNTY—In and adjacent to the cities of Long Beach and Compton, on Los Angeles River Freeway, between 223d Street and Atlantic Avenue, highway lighting and illuminated sign systems to be furnished and installed. District VII, Route 167. Ets-Hokin & Gavin, Wilmington, \$113,346; Electric and Machinery Service, Inc., South Gate, \$113,571; C. D. Draucker, Inc., Los Angeles, \$113,987; Fischbach and Moore, Inc., Los Angeles, \$118,517; A. S. Schulman Electric Company, Los Angeles, \$118,640. Contract awarded to Westates Electrical Construction Co., Los Angeles, \$111,731.

LOS ANGELES COUNTY—At the intersections of Lakewood Boulevard with Gallatin School House Road and Norwalk Boulevard with Washington Boulevard, traffic-actuated signal systems and highway lighting to be furnished and installed. District VII, Routes 168,170, Sections B.A. Fischbach and Moore, Inc., Los Angeles, \$28,977; C. D. Draucker, Inc., Los Angeles, \$29,971; Electric & Machinery Service, Inc., South Gate, \$31,465. Contract awarded to Westates Electrical Construction Co., Los Angeles, \$28,111.

LOS ANGELES COUNTY—In the City of Los Angeles, in North Hollywood, at Shop 7 Yard, shop grounds to be graded and paved with plant-mixed surfacing. District VII. Schroeder & Co., Sun Valley, \$15,101; A. A. Edmondson, San Fernando, \$16,069; McGinnis & Gautier, Inc., North Hollywood, \$17,817. Contract awarded to Griffith Company, Los Angeles, \$14,094.50.

MENDOCINO COUNTY—City of Ukiah, at the intersections of State Street with Perkins Street and Standley Street, interconnected semitraffic-actuated signal systems to be furnished and installed. District I, Route 1. L. H. Leonardi Electric Construction Co., San Rafael, \$14,799; R. Flatland, San Francisco, \$15,482; Underground Electric Construction Co., Oakland, \$16,597; Karl F. Stolling, Santa Rosa, \$16,714; Arthur B. Siri, Inc., Santa Rosa, \$19,875. Contract awarded to Sacramento Electric Works, Sacramento, \$14,698.65.

MERCED COUNTY — Between Gerard Avenue and Parsons Street, about 0.4 mile, a frontage road to be graded and surfaced with plant-mixed surfacing on untreated rock base and reinforced concrete bridge to be constructed. District X, Route 4, Section A. Volpa Brothers, Fresno, \$52,467; A. A. Edmondson, San Fernando, \$52,961; P. J. Moore & Son, West Sacramento, \$53,366; Friant Construction Co., Fresno, \$54,925; L. B. Wells Construction Co., Visalia, \$55,896; Fredrickson Bros., Emeryville, \$57,936; Karl C. Harmeling, Stockton, \$57,982; Louis Biasotti & Son, Stockton, \$59,081. Contract awarded to Fredrickson & Watson Construction Co., Oakland, \$51,931.30.

SAN BERNARDINO COUNTY—At the District VIII Office Building in the City of San Bernardino, landscaping building area. F. A. Tetley & Son, Corona, \$9,284. Contract awarded to Charlton Nurseries, San Bernardino, \$6,242.65.

SOLANO COUNTY—Across Napa River at westerly city limits of Vallejo, the existing bridge to be repaired. District X, Route 208, Section A. Severin Electric Company, San Francisco, \$22,779; Buzzell Electric Works, San Francisco, \$23,818. Contract awarded to Enterprise Electric Works, San Francisco, \$20,185.

YUBA COUNTY—At the District III Office Building in the City of Marysville, landscaping. Sam E. Hall, Berkeley, \$3,803; Capitol Nursery Co., Sacramento, \$5,126. Contract awarded to Dana R. Tyson Co., Sacramento, \$3,419.75.

YUBA COUNTY—In the City of Marysville, at the intersection of "B" Street with 12th Street, furnishing and installing traffic signal system and highway lighting. District III. L. H. Leonardi Electric Construction Co., San Rafael, \$13,058; Westates Electrical Construction Co., Los Angeles, \$13,059; Reliable Elevator Works, Sacramento, \$13,522; T. L. Rosenberg Co., Marysville, \$13,966. Contract awarded to Sacramento Electric Works, Sacramento, \$12,342.

F. A. S. County Routes

CONTRA COSTA COUNTY — On Byron Highway, between Alameda County Line and 1.6 miles southeast of Byron, about 3.6 miles, to be graded and surfaced with plant-mixed surfacing on crusher-run base. District IV, Route 610. Clements & Co., Hayward, \$197,988; Louis Biasotti & Son, Stockton, \$199,242; M. J. B. Construction Co., Stockton, \$204,761; Fredrickson & Watson Construction Co., Oakland, \$205,567; Volpa Bros., Fresno, \$218,376; Munn & Perkins, Modesto, \$221,088; Fredrickson Bros., Emeryville, \$223,112; J. Henry Harris, Berkeley, \$230,962; A. Teichert & Son, Inc., Sacramento, \$234,449; Brown-Ely Co., Contractors, Corte Madera, \$247,036; O. C. Jones & Sons, Berkeley, \$256,050; Eugene G. Alves, Pittsburg, \$259,954; Leo F. Piazza Paving Co., San Jose, \$266,440. Contract awarded to Stephens Trucking Co., French Camp, \$197,950.20.

HUMBOLDT COUNTY—On Alliance Road, between north city limits of Arcata and 1.4 miles northwesterly, existing roadbed to be graded and surfaced with plant-mixed surfacing on imported base material. District I, Route 969. J. P. Breen, Sacramento, \$57,786. Contract awarded to Mercer, Fraser Co. and Mercer, Freser Gas Co., Inc., Eureka, \$50,453.40.

LOS ANGELES COUNTY — Across San Gabriel River and over Southern Pacific Railroad tracks on Washington Boulevard, about 2.5 miles west of Whittier, two reinforced concrete bridges and about .34 mile of approaches to be constructed. District VII, Route 635. Oberg and Cook, Gardena, \$392,078; John Strona, Pomona, \$395,755; Byerts & Sons and Geo. K. Thatcher, Los Angeles, \$397,775; Fredrickson & Kasler, Sacramento, \$405,382; Lars Oberg, Los Angeles, \$413,830; J. A. Thompson & Son Contractors, Inglewood, \$421,019; W. J. Disteli, Los Angeles, \$424,940; Norman I. Fadel, North Hollywood, \$426,930; Charles MacCloskey Co., San Francisco, \$442,835; Griffith Company, Los Angeles, \$448,294; Guy F. Atkinson Company, Long Beach, \$473,471. Contract awarded to Ulkropina-Polich-Kral, San Gabriel, \$388,580.

PLACER COUNTY — On Auburn-Folsom Highway, between 6.3 miles and nine miles north of Sacramento County Line, about 2.7 miles, to be graded, untreated rock base to be placed and penetration treatment and seal coat to be applied. District III, Route 768. Ted Schwartz, Grass Valley, \$116,789; Harms Bros., Sacramento, \$117,930; J. R. Reeves, Sacramento, \$119,899; J. Henry Harris, Berkeley, \$134,050; Claude C. Wood Co., Lodi, \$159,409. Contract awarded to Paul E. McCollum and C. L. Cypher, Richmond, \$116,558.

RIVERSIDE COUNTY—On Lovekin Boulevard, between 18th Avenue and Chanslor Way, about 3.1 miles, to be graded and a bituminous surface treatment applied to imported base material. District XI, Route 735. Basich Bros. Construction Co. and N. L. Basich and R. L. Basich, San Gabriel, \$117,691; R. A. Erwin, Colton, \$123,545; George Herz & Co., San Bernardino, \$125,212; A. A. Edmondson, San Fernando, \$126,766; James E. Roberts, San Bernardino, \$127,523; R. P. Shea Company, Riverside, \$128,715; Hubbs Equipment Co., Colton, \$131,112. Contract awarded to E. C. Young, San Fernando, \$95,374.

Unsung Heroes

Continued from page 58 . . .

Russian Gulch Bridge

Mr. Kuphal designed many other major structures on the Highway System. In the writer's opinion the most beautiful bridge on our, or any other highway system, is the Russian Gulch Bridge, a concrete arch, on the Coast Highway a few miles south of Fort Bragg. Every consideration was given to simplicity of construction details as well as appearance. Henry deserves special credit for this structure not only because it is the most beautiful structure but the most economical that could be built at that particular location.

There are many "Henrys" in the Division of Highways but they are so busy and interested in their work they pay little or no attention to seeking honor, glory or adulation but maybe they acquire a warm feeling of per-

In Memoriam

WILLIAM LEWIS MEGO

District I received a shocking blow with the sudden passing of William Lewis (Lew) Mego, highway foreman at Garberville, on December 28, 1952, at the age of 53.

Lew, as he was affectionately known, started with the Division of Highways away back in the uncertain days of 1922 with intermittent employment until 1928. Since then and until his death he was continuously employed in progressive positions. His appointment as highway foreman came in 1931. The last 17 years of his service were spent in Garberville, except for a stretch with the Seabees in 1945.

He was a member of American Legion Post No. 494 of Garberville and C.S.E.A., Mt. Konocti Chapter No. 19.

Survivors include his wife, Mrs. Velma Mego, Garberville; children, Mrs. Pansy Mercer, Alameda; Miss Patricia Mego, Garberville; Lewis Paul Mego, in the U. S. Navy, stationed at Port McGu; Jack Lee Mego, Garberville; his mother, Mrs. Sarah Thomas, Ukiah; and two grandsons, Billy and Bobby Mercer, of Alameda.

Funeral services were held on December 31st at Fortuna under the auspices of Garberville Post No. 494, American Legion.

The district will miss this valuable employee who has for so long discharged his duties with such credit to himself as to reflect a measure of that credit on the entire Department of Public Works in the eyes of the public.

sonal satisfaction in seeing their efforts, thoughts and study grow from a lot of calculations and blueprints into a real, useful, economical, beautiful and personally satisfactory structures to be used to the benefit of all the people of our State.

These unsung heroes do a lot of running interference and blocking for other better known heroes. It seems that they should at least once in their life get a public pat on the back for a job well done.

Gas Tax to Cities

*Review of Laws and Rulings
Governing These Allocations*

By L. V. CAMPBELL, Engineer of City and Cooperative Projects

THE DEPARTMENT OF PUBLIC WORKS is organized into divisions and the administration of the gas tax allocations to cities has been assigned to the Division of Highways. The Division of Highways headquarters in turn is organized into functions and the various operations of the division are assigned to engineers of the headquarters staff. Each district office in turn is organized on the same pattern as the headquarters office. The field work is carried on by the local district offices which make the direct contacts with the cities.

The expenditure of gas tax revenue on city streets other than state highways was first authorized by the Legislature in 1935. This act authorized the apportionment of one-fourth cent per gallon tax on gasoline among the various incorporated cities in the State on the basis of their population as shown by the last preceding federal census.

Population Basis

Provision was also made to allow for the increase in population of a city by reason of annexation of unincorporated territory, or to determine the population of a city incorporated subsequent to the last preceding federal census by multiplying the number of registered electors residing therein by three. A separate act was passed in 1943, when populations were increasing by leaps and bounds due to the influx of war workers, authorizing the determination of the population by a special federal census. I wish to call attention to the requirement of the act that a certified copy of the certificate issued by the director of the census be filed with the Department of Public Works and with the State Controller.

Unless the certificate is filed with the department, we have no means of

knowing that a special census was taken or what the population is. Sometimes a publicity release is filed with the department. Even though it is certified by the city clerk, a publicity release does not comply with the law and is therefore unsatisfactory. I mention this requirement as many times it is overlooked and then the city wonders why it did not receive credit for its increase in population. Much thought and careful study must have been given to the drafting of the original bill. It is remarkably clear in its text and free from what we might call "bugs," or more properly, those parts which ordinarily precipitate arbitrary or controversial opinions. There were scarcely any amendments or additions to the act until the amendment of the Collier-Burns Highway Act of 1947.

Collier-Burns Act Changes

The Collier-Burns Act made two important changes in the allocation of the gas tax revenue to cities. The first, and perhaps the most important, was to increase the allocation from one-fourth cent to five-eighths cent per gallon tax on gasoline. The second important change was to provide that not more than 40 percent of the annual revenue shall be expended for maintenance and that the remainder shall be expended for the acquisition and construction of streets included in the system of major city streets. While the entire one-fourth cent under the original act could be expended for maintenance, it could only be expended for maintenance on major city streets, or as they were called "streets of major importance." Under the present provisions of the act the 40 percent allocated for maintenance can be expended both on major city streets and on secondary city streets. This is a liberalization of the

use of gas tax funds for maintenance of city streets.

Expenditures Limited

The act limits the expenditure of gas tax revenue to that portion of the streets available for use by vehicular traffic. It permits such funds to be expended for pedestrian underpasses, or pedestrian overhead crossings, and for the installation and maintenance of traffic control devices. The act forbids the expenditure for street lighting, except for so-called safety lighting, or for the construction or maintenance of sidewalks, or, except as expressly authorized, for the construction or maintenance of any structure or facility, in, over, or under the street which is not of direct and primary service in providing a way for vehicular traffic. Sidewalks may be constructed with such funds on bridges, and sidewalks may be constructed and trees may be planted to replace those removed or damaged by construction or improvement of the street. The above prohibitions and permissions are specified in the code.

Gas tax funds likewise may not be used for setting out, and for the care and watering of sidewalk trees and plantings. While these may be desirable, they may not be considered of primary service in providing a way for vehicular traffic.

It is quite apparent that the intent of the Legislature was to limit the expenditure of gas tax revenue for the exclusive benefit of the motorist who pays the tax. Structures which do not contribute directly to providing a way for traffic may be constructed when such structures are removed or damaged by new construction. That is the principle which guides the department in determining whether an expenditure is proper or not.

To be continued ...

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Unusual Box Culvert

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Installation Started

Precasting was completed October 9, 1952, and the structures cured under damp mats for seven days after which the mats were allowed to dry.

Installation was started at 6 a.m. Wednesday, November 5, 1952, by placing construction and detour signs and traffic was routed over the detours (one each for north and southbound vehicles) at 6.30 a.m.

Work at the jobsite was started at 7 a.m. with a pavement breaker to cut the asphaltic concrete surfacing. This was followed by a clam shell which excavated a trench approximately 0.2 foot below desired grade. This was dressed up with hand shovels and tamped with a pneumatic tamper after which a cushion course of clean sand was placed and screeded to grade.

The box sections were lifted with a truck crane loaded on a truck and semitrailer and hauled to the jobsite, then lowered into the trench with the same crane.

Short Detour Period

Installation was started at the inlet end and proceeded toward the outlet. The second section was lowered into the trench and placed about 1 foot away from the first section. While concrete mortar was being placed on the joints a line from the winch on the transport was placed through the two sections and secured to an 8-inch by 8-inch block placed across the end of the second section. This section was then lifted with the crane to just clear

the bottom of the trench and pulled into a snug joint connection by the winch which held a strain until a ½-inch by 10-inch plate was welded to the angle iron inserts on the side (Photo 3). The line was then released and a similar plate welded to the top inserts. Procedure was the same with the two succeeding sections.

Pneumatic tamped backfill of clean sand, crusher run base rock and plant-mixed surfacing was started as soon as the first two joints were coupled and kept pace with the box installation (Photo 4).

The road was opened to traffic at 7 p.m. after a total detour time of 12½ hours. The principal difficulty encountered was lack of boom clearance for the crane caused by two telephone cables approximately 18 feet high which cross the road directly above the new installation (Photo 1).

No comparative costs for a structure of this size and type constructed in place are available but it is believed that additional cost, if any, would be small especially considering the inconvenience to traffic that would have been occasioned by three weeks of detour.

C. M. Gilliss

Continued from page 49 . . .

partments of schools, welfare, purchasing, flood control and road and survey. With the advent of the Collier-Burns Act of 1947, he was named administrative assistant and attached to the Riverside Road and Survey Department.

He represented Riverside County officials and the county board of supervisors before local and state agencies, taxpayer groups, state and local chambers of commerce, conventions, and legislative hearings.

Gilliss assumed his new duties December 1, 1952. His wife, Alene, and daughters Charlene, age 11, and Donna, age 8, have joined him in Sacramento. He will make public appearances for Director Durkee and the department, with particular attention to representation before the Legislature.

MAKE CAR SAFE

Have your brakes, tires, steering mechanisms, and lights checked frequently. A safe car helps make a safe driver.

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EARL WARREN
Governor of California

FRANK B. DURKEE
Director of Public Works

HIGHWAY COMMISSION

HARRISON R. BAKER Pasadena
H. STEPHEN CHASE Sacramento
JAMES A. GUTHRIE San Bernardino
F. WALTER SANDELIN Ukiah
CHESTER H. WARLOW Fresno
CHARLES T. LEIGH San Diego
R. C. KENNEDY, Secretary Sacramento

DIVISION OF HIGHWAYS

GEO. T. MCCOY State Highway Engineer

R. M. GILLIS Deputy State Highway Engineer
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EARL WITTHCOMBE Assistant State Highway Engineer
F. W. PANHORST Assistant State Highway Engineer
J. W. VICKREY Assistant State Highway Engineer
R. H. WILSON Assistant State Highway Engineer
F. N. HVEEM Materials and Research Engineer
GEORGE F. HELLESOE Maintenance Engineer
J. C. YOUNG Engineer of Design
E. T. TELFORD Traffic Engineer
DON G. EVANS Construction Engineer
H. B. LA FORGE Engineer of Federal Secondary Roads
L. V. CAMPBELL Engineer of City and Cooperative Projects
EARL E. SORENSON Equipment Engineer
H. C. McCARTY Office Engineer
MILTON HARRIS Service and Supply Engineer
J. C. WOMACK Planning Engineer
J. P. MURPHY Principal Highway Engineer
F. M. REYNOLDS Principal Highway Engineer
E. J. SALDINE Principal Highway Engineer
I. O. JAHLSTROM Principal Bridge Engineer
STEWART MITCHELL Principal Bridge Engineer
E. R. HIGGINS Comptroller

Right of Way Department

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

District IV

B. W. BOOKER Assistant State Highway Engineer

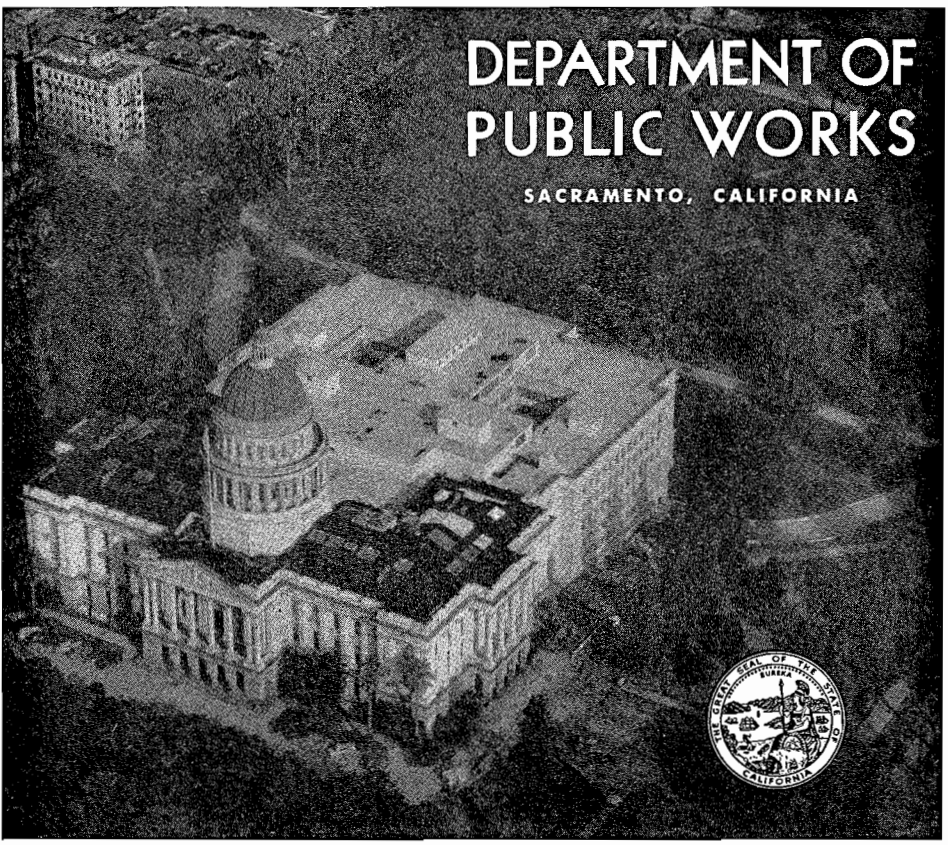
District VII

P. O. HARDING Assistant State Highway Engineer

DIVISION OF HIGHWAYS

District Engineers

C. V. KANE District I, Eureka
J. W. TRASK District II, Redding
A. M. NASH District III, Marysville
J. P. SINCLAIR District IV, San Francisco
L. A. WEYMOUTH District IV, San Francisco
E. J. L. PETERSON District V, San Luis Obispo
E. T. SCOTT District VI, Fresno
W. L. FAHEY District VII, Los Angeles
M. E. CESSNA District VII, Los Angeles
L. R. McNEELY (Acting) District VIII, San Bernardino
ALAN S. HART District IX, Bishop
JOHN G. MEYER District X, Stockton
E. E. WALLACE District XI, San Diego
HOWARD C. WOOD Bridge Engineer
State-owned Toll Bridges



**DEPARTMENT OF
PUBLIC WORKS**

SACRAMENTO, CALIFORNIA



**DIVISION OF CONTRACTS AND
RIGHTS OF WAY**

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ROBERT E. REED Chief
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HOLLOWAY JONES Attorney

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WADE O. HALSTEAD Principal Estimator of Building Construction
EARL W. HAMPTON Construction Budgets Administrator
CARLETON PIERSON Supervising Contracts Writer

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A. F. DUDMAN Principal Architectural Designer
CARL A. HENDERLONG Principal Mechanical and Electrical Engineer
C. L. IVERSON Chief Architectural Draftsman
JOHN S. MOORE Supervisor of Special Projects
WALTER E. LORD Supervising Specifications Writer
JAMES A. GILLEM Supervisor Area III (Los Angeles)

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F. A. JOHNSON Principal Structural Engineer
NATE W. DOWNES Supervising Engineer of Maintenance and Operations

Area Construction Supervisors

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J. WILLIAM COOK Area II, Sacramento
FRANK R. AUSTGEN Area III, Los Angeles

**Area Structural Engineers,
Schoolhouse Section**

C. M. HERD Area I, San Francisco
M. A. EWING Area II, Sacramento
H. W. BOLIN Area III, Los Angeles

**DIVISION OF SAN FRANCISCO
BAY TOLL CROSSINGS**

NORMAN C. RAAB Projects Engineer

DIVISION OF WATER RESOURCES

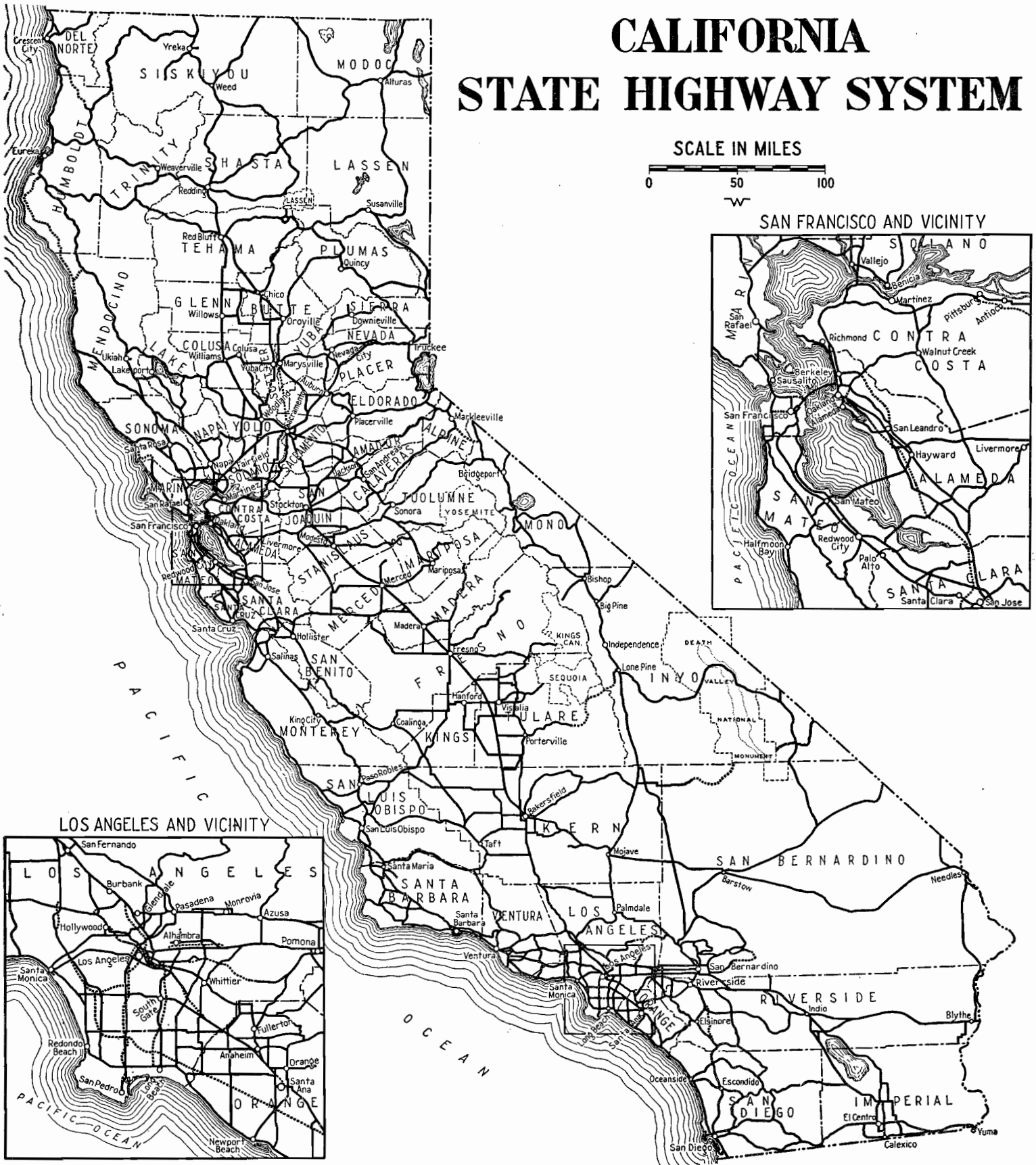
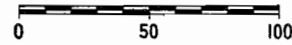
A. D. EDMONSTON State Engineer, Chief of Division
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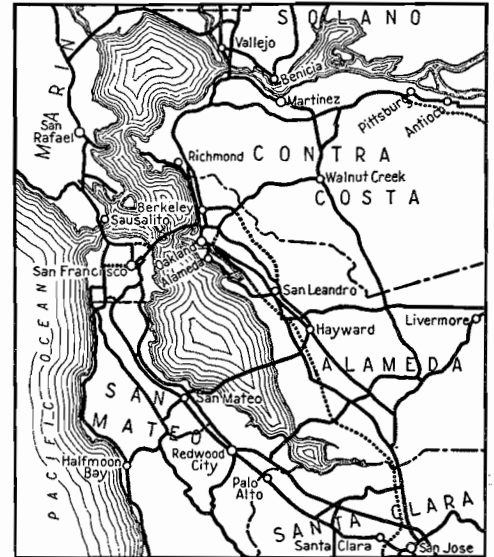
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CALIFORNIA STATE HIGHWAY SYSTEM

SCALE IN MILES



SAN FRANCISCO AND VICINITY



LOS ANGELES AND VICINITY

