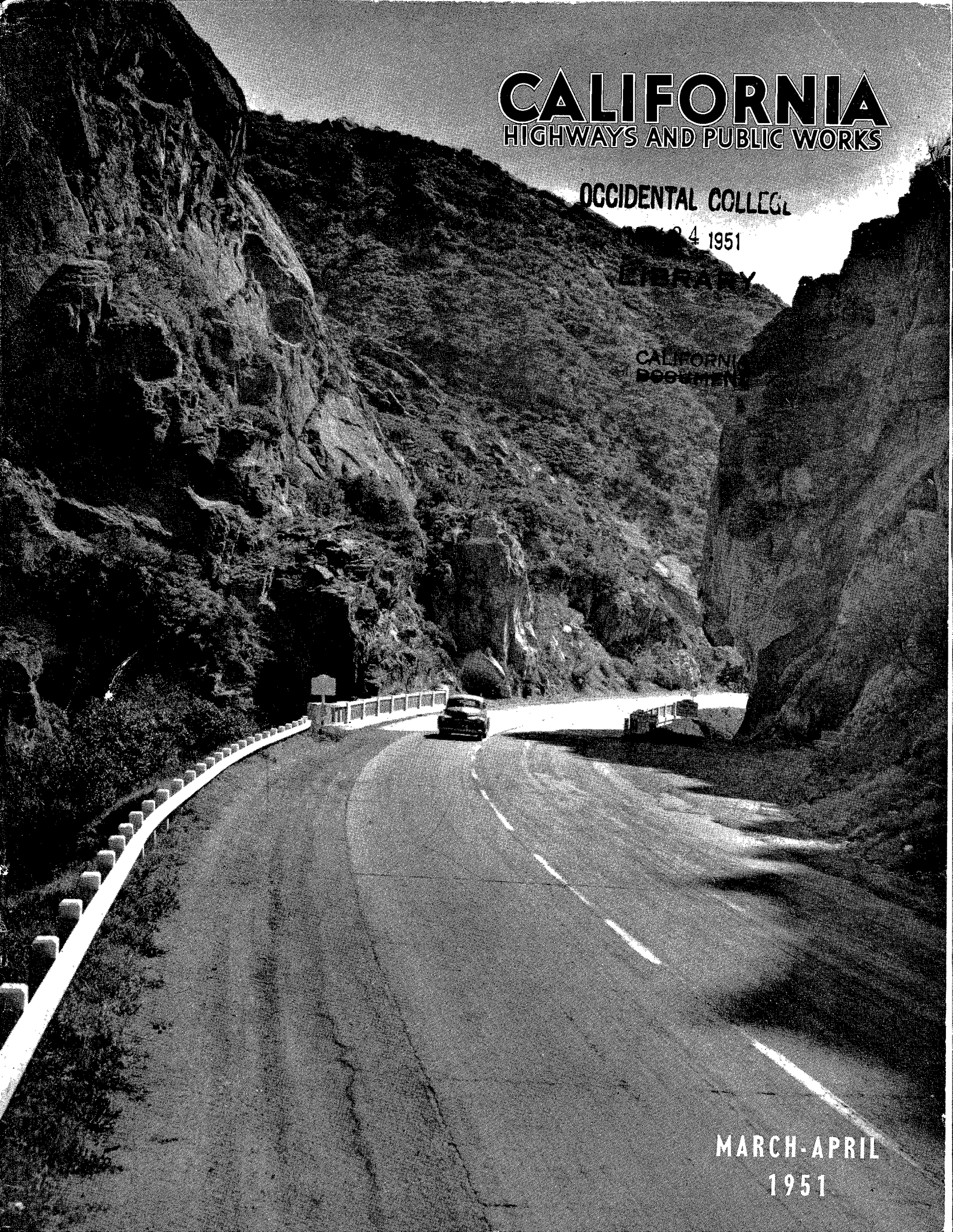

# CALIFORNIA
## HIGHWAYS AND PUBLIC WORKS



MARCH-APRIL
1951

# California Highways and Public Works

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# Prestressed Bridge

## *First of Its Kind in State Is Built in Los Angeles*

By ROBERT M. BARTON, Associate Bridge Engineer

SUCCESSFUL hoisting of two giant prestressed concrete girders across the Arroyo Seco flood channel in Los Angeles on March 9th-11th marked an important step forward in bridge construction on the Pacific Coast. The bridge, first of its type in the West, makes use of the new engineering principle called "prestressing," said to be one of the most noteworthy advances in concrete construction since the invention of Portland cement.

### Attracts Nation-wide Attention

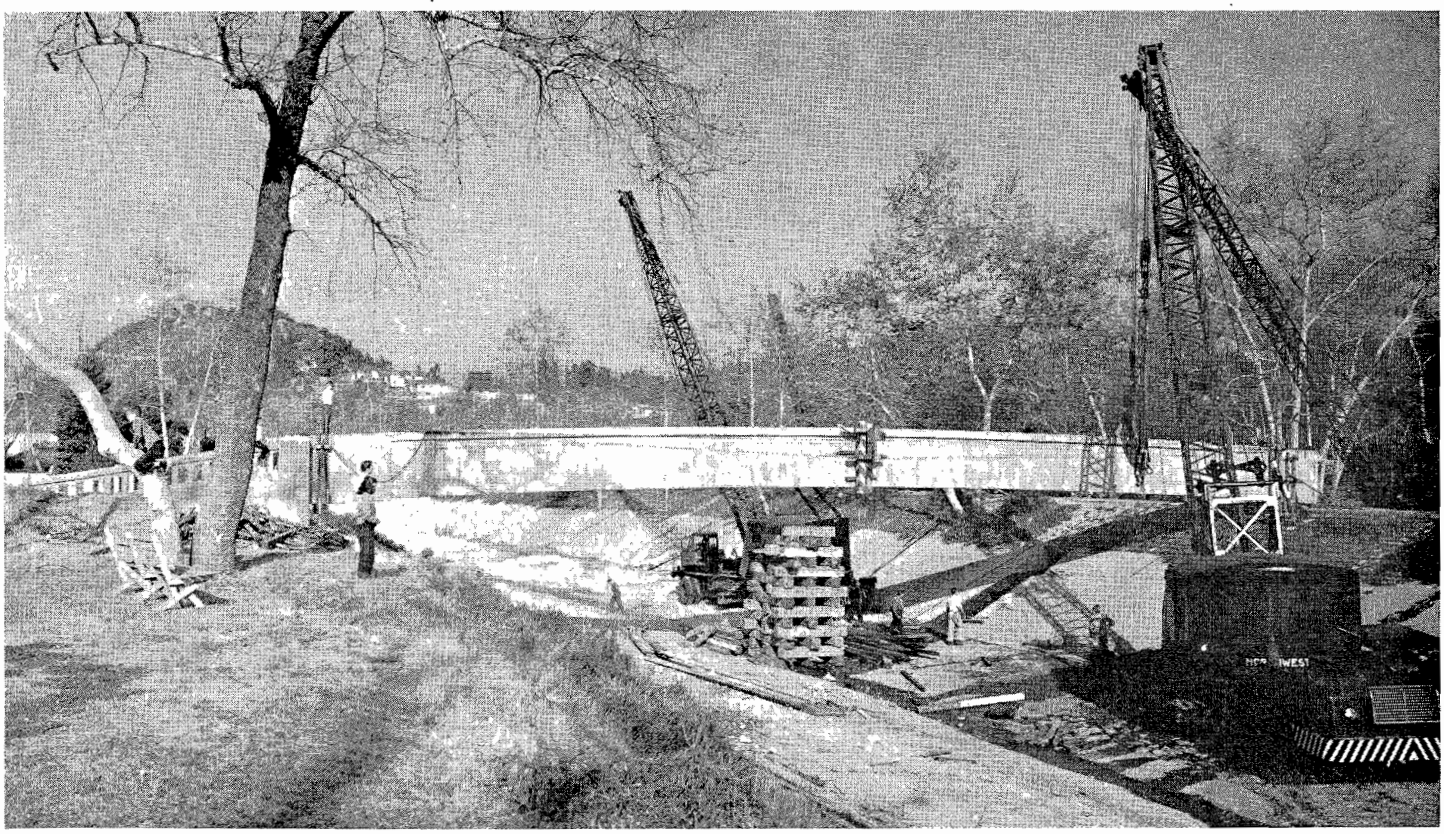
The actual hoisting operations, beginning on Friday, March 9th, and continuing until Sunday night, March 11th, were witnessed by many distinguished engineers from various Southern California points. Motion pictures were taken, and the event was widely reported by newspapers throughout Los Angeles County. The bridge has been the subject of numerous technical articles in such engineering magazines as *Engineering News-Record*, *Civil Engineering*, *American Concrete Institute Journal*, *Western Construction*, and others—in short, its construction has attracted greater technical interest than perhaps any other bridge recently built in California.

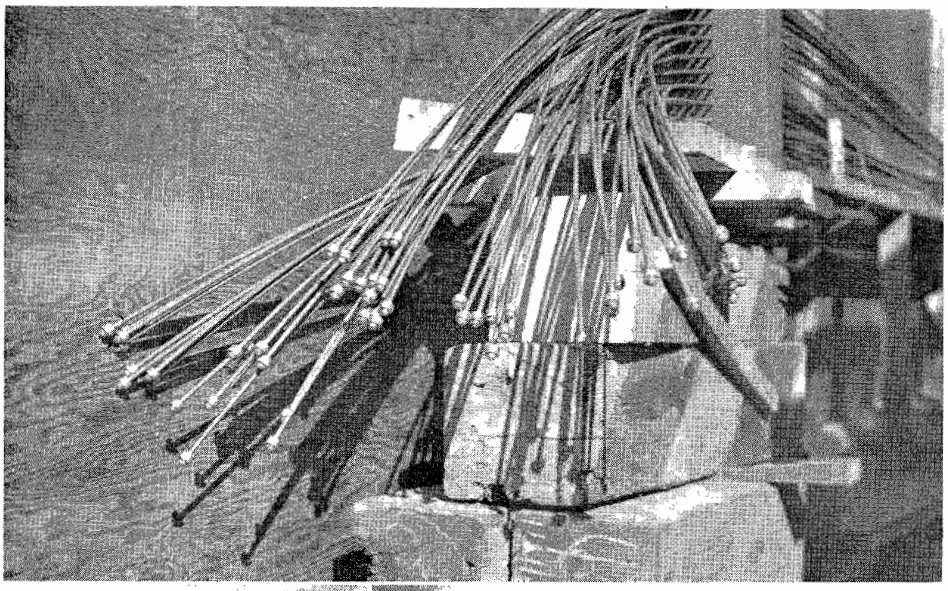
The bridge, located in Arroyo Seco Park near the South Pasadena city limits and within sight of the Arroyo Seco Freeway, connects two portions of the park which were previously separated by the flood channel. It carries pedestrians only.

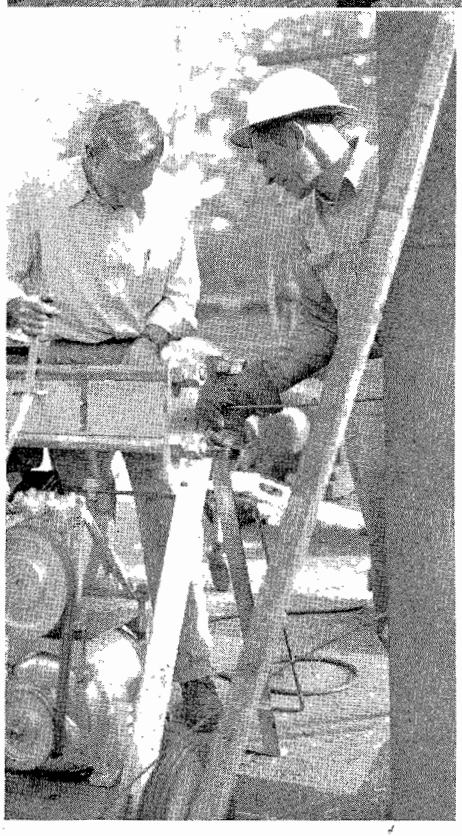
### Radical Departure

Nation-wide attention was attracted because the prestressed design is a radical departure from previous types of conventional concrete bridges, such as those recently completed across the new Hollywood, Ramona and Santa Ana freeways. Prestressed concrete, a development of European scientists, is still in its infancy in this Country, and each new bridge constructed is an engineering curiosity. Only two or three prestressed bridges have been constructed previously in the United States, and these are all located east of the Mississippi. However, the general design of the Arroyo Seco bridge involved no significant departures from prestressed structures previously built in Europe, since prestressed pedestrian overcrossings of similar dimensions have been built as long as a decade ago in France.

*Arroyo Seco Channel Pedestrian Bridge in Los Angeles. Prestressed girder shown has just been hoisted into final position on abutments. Temporary steel cables on exterior of girder for rigging purposes only.*







*ABOVE—High-tensile wires with button-heads applied. LEFT—Portable machine used for squeezing button-heads on ends of wires.*

**Lifting of Huge Girders Unprecedented**

The bridge consists essentially of two simply supported girders, each 113 feet long, with a clear span of 110 feet. These two girders, one on each side, support the eight-foot wide pedestrian walkway, and also serve as handrails. These concrete girders were constructed in a parking lot alongside the channel, and were lifted by four giant truck cranes onto their permanent abutments after all prestressing operations had been completed. It is believed the hoisting of girders of this size and weight—each girder weighing over 50 tons—was unprecedented in western bridge construction.

After the two girders were placed on the abutments, the concrete walkway was cast-in-place between them.

**Reinforcement Is High-Tensile Wire**

The two concrete girders are very similar to conventional concrete in external appearance, but the reinforcement is altogether different. Instead of the deformed mild steel reinforcing bars of about one-inch diameter used in ordinary bridges, the Arroyo Seco girders are each reinforced with 125 high-tensile steel wires, each wire having a diameter of only one-quarter inch. The wires, carried in tunnel-like cavities which extend through the interior of the girders for the full 113-foot length, were tensioned by hydraulic jacks after the concrete had hardened. The total tension which was applied in each girder was 715,000 pounds.

In other words, at the end of each girder there is a force of about 360 tons acting to squeeze it or compress it in the longitudinal direction. (This force is roughly equivalent to the weight of about 200 passenger automobiles.) As a result of this tremendous permanent pressure exerted on the ends of each girder, the entire T-shaped cross section (1 foot 8 inches wide at the top, 10 inches wide at the bottom, and 5 feet 8 inches deep) is placed in a permanent state of compression.

**Divided Into Two Groups**

The 125 wires in each girder are divided into two groups, one group of 65 wires and one group of 60 wires. Each group is carried in a separate sheet metal enclosure. The groups are arranged into rows of five wires each, each row being connected to a separate steel block for purposes of tensioning. After the wires were threaded through drilled holes in these stressing blocks, their ends were upset to form button-shaped heads. A special portable machine was developed by the prestressing subcontractor to form these heads at the job site.

The wires were stressed five at a time by a specially designed hydraulic jack after the concrete girders had been cast and after the concrete had attained the specified 5,000 psi test cylinder strength. When fully tensioned, the total stretch in each of the wires was five and one-half inches. After the wires had been stressed, steel spacers were placed between the heavy steel anchor plates and the steel stressing blocks to maintain the five and one-half-inch stretch. The jacks were then removed, and the tunnel-like cavities were pressure grouted to bond the wires firmly to the surrounding concrete and to protect them from corrosion.

Since this was the prestressing subcontractor's first bridge job, certain "bugs" developed in his tensioning and wire-heading apparatus. Some of the machine parts had to be redesigned. However, during the course of construction these difficulties were eventually ironed out, and the prestressing method is now regarded as satisfactory by all parties concerned.

**Type of Prestressing Equipment Used Optional**

Since the principal commonly-used methods of prestressing and of anchoring the wires are subject to patent restrictions, the contract plans were drawn and the special provisions were worded to allow the contractor complete freedom to choose the type of

prestressing equipment and anchorage devices to be used. Thus, all types of prestressing equipment were fully competitive, and this was reflected in lower bid prices.

The amount, diameter, and quality of wire furnished was also more or less optional with the contractor. The principal requirement was that a total prestressing force in each girder of 715,000 pounds, using a working stress of 60 percent of the ultimate wire strength, had to be obtained. Thus, the contractor had the choice of furnishing a large number of very small diameter wires, for a lesser number of larger diameter wires. This also gave him the incentive to furnish wire with a higher ultimate tensile strength, since a lesser amount of such wire would be required than if a wire with a lower tensile strength were supplied. Thus, no one particular proprietary system of prestressing or any one brand of wire was dictated, yet adequate control over materials and workmanship was maintained by the State to insure that a first class structure would result.

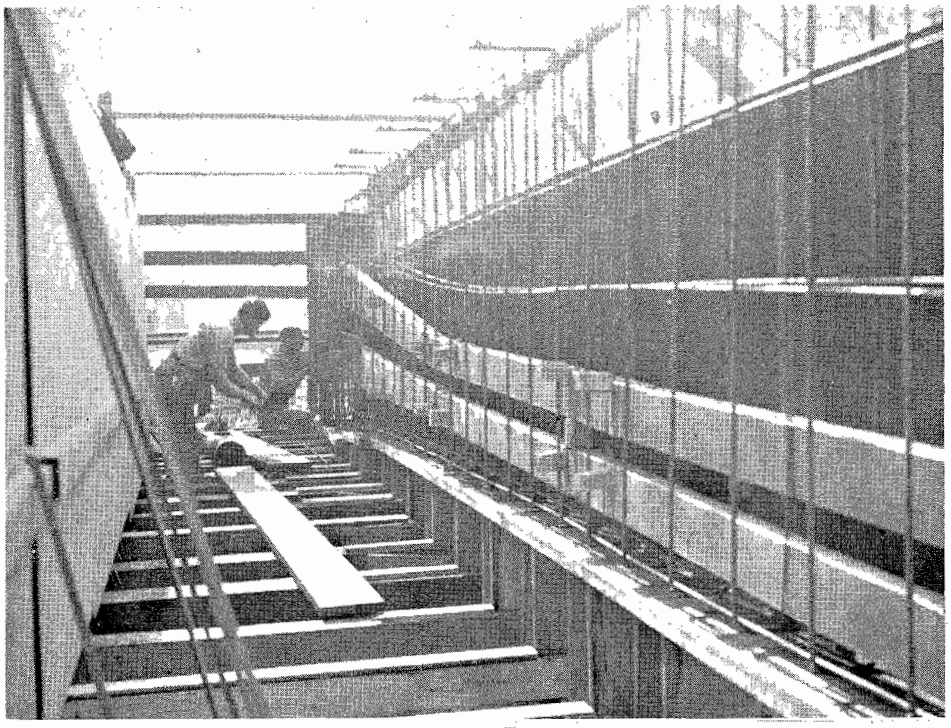
#### Loads and Working Stresses

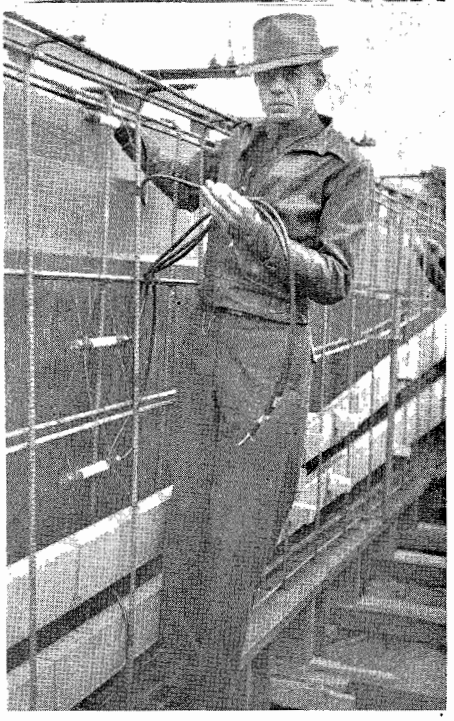
The bridge was designed for a live load of 55 pounds per square foot on the sidewalk surface.

The maximum working stress for the concrete was 1,700 psi, for concrete with a cylinder strength of 5,000 psi. The 5,000 psi concrete specified was obtained with a standard Division of Highways concrete mix design. Cement content was six sacks per cubic yard, and no admixtures were used. Thus, the concrete used is identical to that employed in numerous highway structures in the Los Angeles area.

The maximum allowable initial stress in the high tensile wires was specified at 0.6 of the ultimate strength. The contractor elected to furnish a wire with an ultimate tensile strength of 220,000 psi, the allowable working stress in which case being 132,000 psi. However, since this is an experimental structure, the contractor decided to restrict his initial stresses to 120,000 psi, or less than 6,000 pounds in each individual wire.

Allowances were made in the design for a total loss of the initial prestress in the wire of 15 percent, due to shrinkage creep, plastic flow, and other causes. Thus, the initial prestress of 120,000 psi in the wire will gradually decrease to 102,000 psi over a period of time.



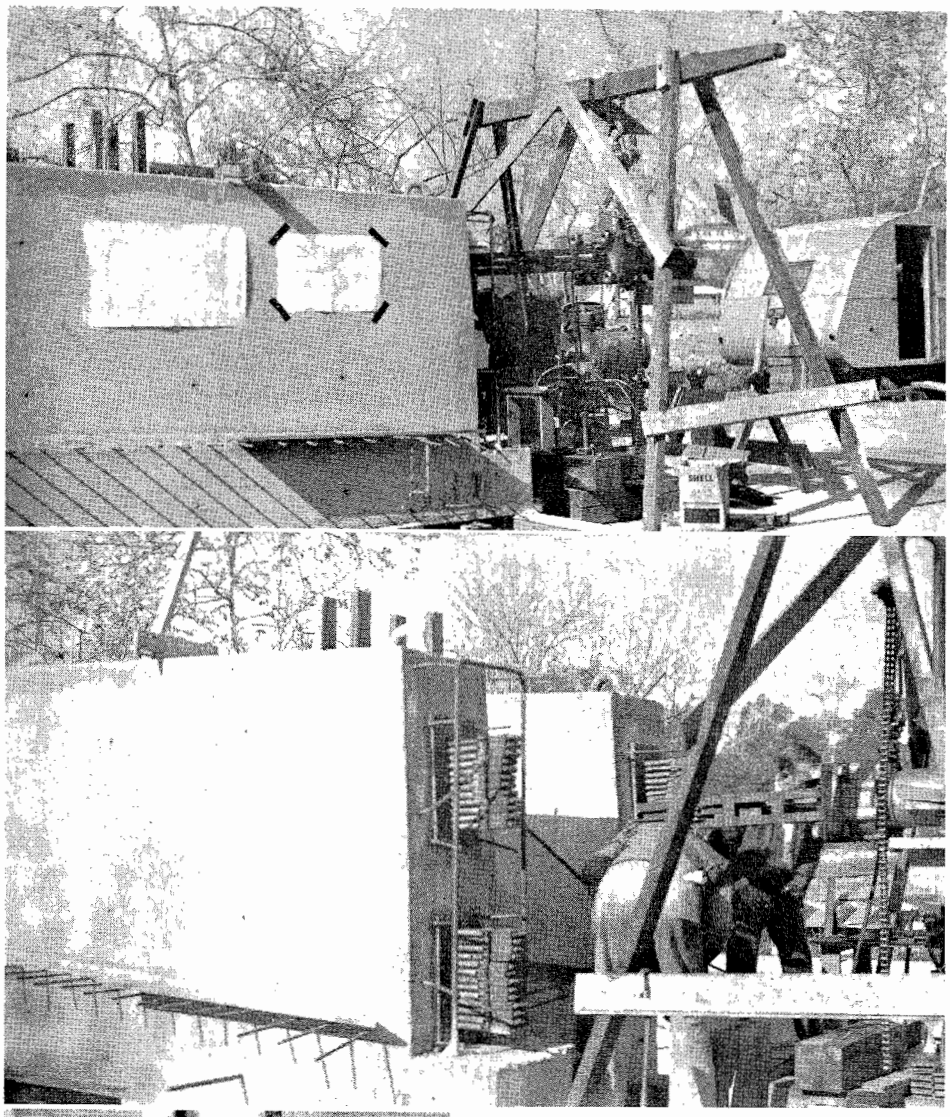


*ABOVE—Interior of girder form, showing sheet metal cable enclosures, before sides of form brought together. RIGHT—Resident Engineer Jack Sylvester holding leads to Carlson electrical resistance strain gages. Note sheet metal enclosures built around wire cable groups in lower part of beam to form tunnel-like cavities.*

#### Differences Between Conventional Concrete and Prestressed

There is little similarity between conventional reinforced concrete and prestressed concrete. Since plain concrete that is not reinforced has little tensile strength, it must be reinforced by steel bars embedded in the lower portions of the beam to enable long distances to be spanned. Until the falsework is removed and the beam is loaded, these bars are not subjected to any stress. As a conventional concrete beam is loaded progressively, the concrete in the bottom of the beam reaches the tensile strength limit and cracks. As soon as the cracks occur, the load is transferred to the steel reinforcement, and the steel stretches gradually as it assumes its share of the load. This time-honored system has proved highly satisfactory; the countless concrete bridges and buildings to be seen everywhere are designed in accordance with this principle, although sometimes the cracks mentioned become quite obvious and cause concern to persons who do not understand their function.

In a prestressed beam, on the other hand, the steel is placed in tension and stretched to its working stress before the beam is subjected to either dead load or highway loads. The concrete is thereby compressed, and under ordinary highway traffic loading this compression remains permanently in the concrete. Consequently, it does not



*TOP—General view of prestressing equipment; stressing jack in operation. MIDDLE—Hydraulic wire-stretching jack in operation. Tensioning of wires in left girder has been completed. BOTTOM—Each protruding stressing block anchors five wires which have been fully tensioned. Rows not protruding are not yet tensioned. Note steel spacers to hold stretch.*

crack except under excessive overloads. If cracks do occur, they close up again as soon as the overload is removed.

To understand how a prestressed concrete girder functions, it is helpful to imagine a shelf of library books. By pressing firmly on the ends of the row of books, they can be lifted from the shelf. However, if this external pressure is released, the books all fall to the floor. A prestressed concrete bridge acts exactly like a shelf of books; in fact, some prestressed bridges are actually made of separate concrete blocks, analogous to the individual books.

#### Prestressing Permits Savings

One of the advantages of prestressed concrete as compared to ordinary concrete is that the prestressed material is much more efficient, since all of the concrete assists in supporting loads. In ordinary girders, the concrete is only partially effective for supporting highway traffic. Because of the more effective use of concrete, less material is required when prestressing is utilized.

As an illustration of this saving, a conventional reinforced concrete bridge of approximately the same span was designed for the Arroyo Seco site prior to World War II. Due to shortages of material, construction was deferred until after the war. It was then decided to experiment with the prestressed design.

The following tabulation shows a comparison of the amounts of material required for the girders of the two different designs:

| | Conventional design | Prestressed design |
|---|---|---|
| Cubic yards concrete | 88 | 50 |
| Pounds steel wire (hi-tensile) | ..... | 5,000 |
| Pounds reinforcing steel | 40,000 | 7,000 |
| Total steel (pounds) | 40,000 | 12,000 |

It should be emphasized that no attempt was made in the design of the prestressed structure to achieve the ultimate economy of material theoretically possible. Although a smaller concrete section with less dead load and requiring less steel wire and concrete could have been used, it was considered more practical to experiment with a cross-section which would not involve unusual types of formwork, and which would not entail unusual difficulty in the placing of the concrete. It is hoped, however, that as a result of the many valuable lessons gained from the pioneer Arroyo Seco structure, further economies in material requirements may be made.

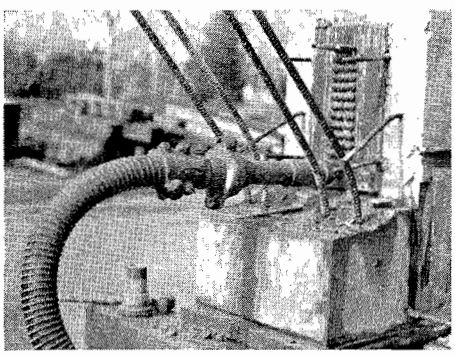
#### Accurate Cost Comparison

Although the original design was never built, bids submitted by contractors on similar types of work permit a reasonably accurate cost comparison to be made between the two types of construction. This comparison indicated the contract cost of the prestressed structure was approximately the same as the conventional structure would have been. However, as contractors gain further experience with

*Downstream girder being hoisted onto abutments; upstream girder still in parking lot in background*

prestressing, it is believed prestressed concrete will prove less expensive than conventional reinforced concrete.

*Nozzle used to force grout into interior of cable enclosures at anchor end of girder after prestressing completed*



Also prestressed girders may be shallower, lighter, and stiffer and still carry the same load as deeper, heavier, more flexible girders of conventional design. For this reason prestressed concrete appears to be ideally suited for use on freeway separations where overhead clearance limitations are a primary consideration.

#### Prestressed Concrete May Be Answer to Steel Shortage

Prestressed concrete was originated in Europe, where the conservation of scare steel supplies is of utmost importance. European engineers discovered that prestressed concrete required only a fraction of the reinforcing steel needed for conventional concrete. In this country, this saving of steel may become important if supplies of iron and steel earmarked for highway purposes are curtailed by defense allocation authorities.

However, the Arroyo Seco Bridge is an experimental project, and it is expected certain refinements will be necessary in the prestressing technique before it can be applied for general highway use.

#### Girders Precast

As has been described, the Arroyo Seco girders for the bridge were built in a nearby parking lot, and were then hoisted across the channel. This is another important advantage of the lighter prestressed design, since bridge girders can be constructed at a convenient location and then hauled to the job site. It was not necessary to erect the usual temporary timber falsework across the channel to support the concrete while it was being placed. Furthermore, only one set of wooden forms was required for the two girders, the one set being used twice. These two features—the elimination of falsework and the 50 percent saving in formwork—saved an estimated $5,000 on this project.

Also, all possible risk and delay from floods was avoided by casting the girders in the parking lot. Regulations of the Los Angeles County Flood Control District prohibit falsework in Arroyo Seco Channel during the winter and spring. Consequently, construction of the bridge would have been delayed several months if precasting, made possible by prestressing, had not been practicable.

#### Bridge to Be Tested

A pedestrian bridge was chosen for the initial prestressing venture primarily because experiments can be carried out safely, conveniently, and without delay to vehicular traffic. In addition, there is little hazard a pedestrian bridge will be subjected to unregulated loads that greatly exceed the design live load; a vehicular structure, on the other hand, often carries illegal overloads of fantastic weight. Also, this type of bridge allowed the engineers to observe the practical problems and difficulties connected with prestressing and erecting long bridge girders.

*. . . Continued on page 28*

# Gaviota Pass

*Historical Landmark Will Be Preserved by Highway Engineers*

*View of Gaviota Gorge looking south. The natural beauty will be maintained by boring through the massive sandstone ledge and minimizing the removal of surface rock.*

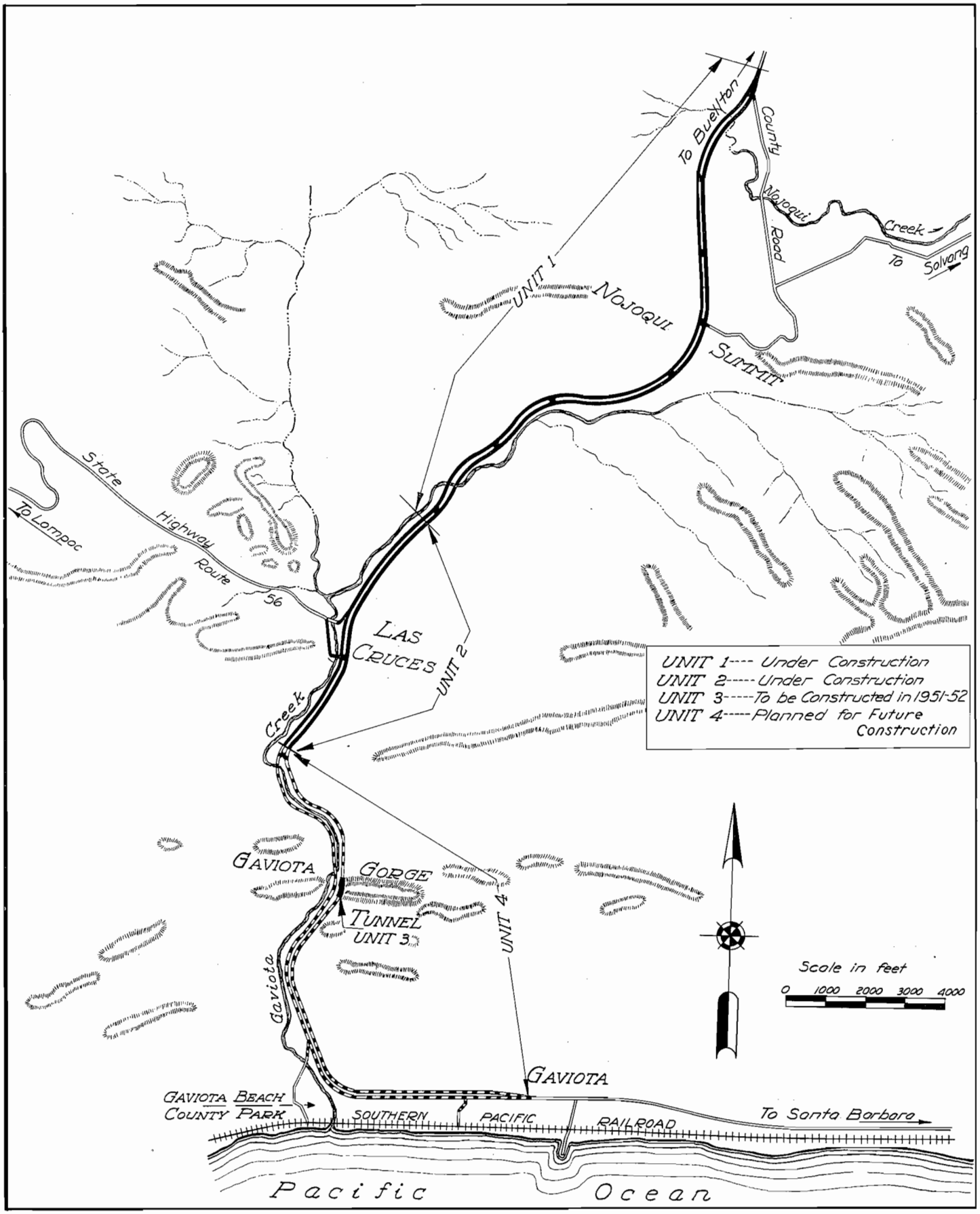
TWO CONTRACTS for an additional two lanes of U. S. 101 covering the 5.14-mile section between Gaviota Gorge, originally called Gaviota Pass, where in December, 1846, General John C. Fremont and his battalion of 500 men marching on Santa Barbara narrowly escaped annihilation, and one mile north of Nojoqui Summit are actively under way.

Plans are complete and early construction is anticipated on a tunnel through the narrowest portion of the gorge; and plans for the construction of the final unit of this new four-lane divided highway, which will start south of the town of Gaviota and join with the present construction at the north end of the gorge proper, are nearing completion.

When completed the four-lane freeway through this historical section of Santa Barbara County will be about 8.2 miles in length and construction costs will approximate $3,000,000.

Tunnel construction through the narrowest portion of the gorge was decided upon so that the natural scenic beauty of this historical landmark could be preserved. When the project is completed the two existing lanes through the gorge will carry southbound traffic, and northbound traffic will use the two lanes through the tunnel. From Gaviota Gorge to Nojoqui Summit, now known as Gaviota Pass, improvement will be on freeway standards.

The 1951-52 highway budget has set up $420,000 for tunnel construction.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UNIT 2
Creek
UNIT 1---- Under Construction
UNIT 2----- Under Construction
UNIT 3-----To be Constructed in 1951-52
UNIT 4-----Planned for Future
Construction
GAVIOTA
GORGE
TUNNEL
UNIT 3
UNIT 4
Gaviota
Scale in feet
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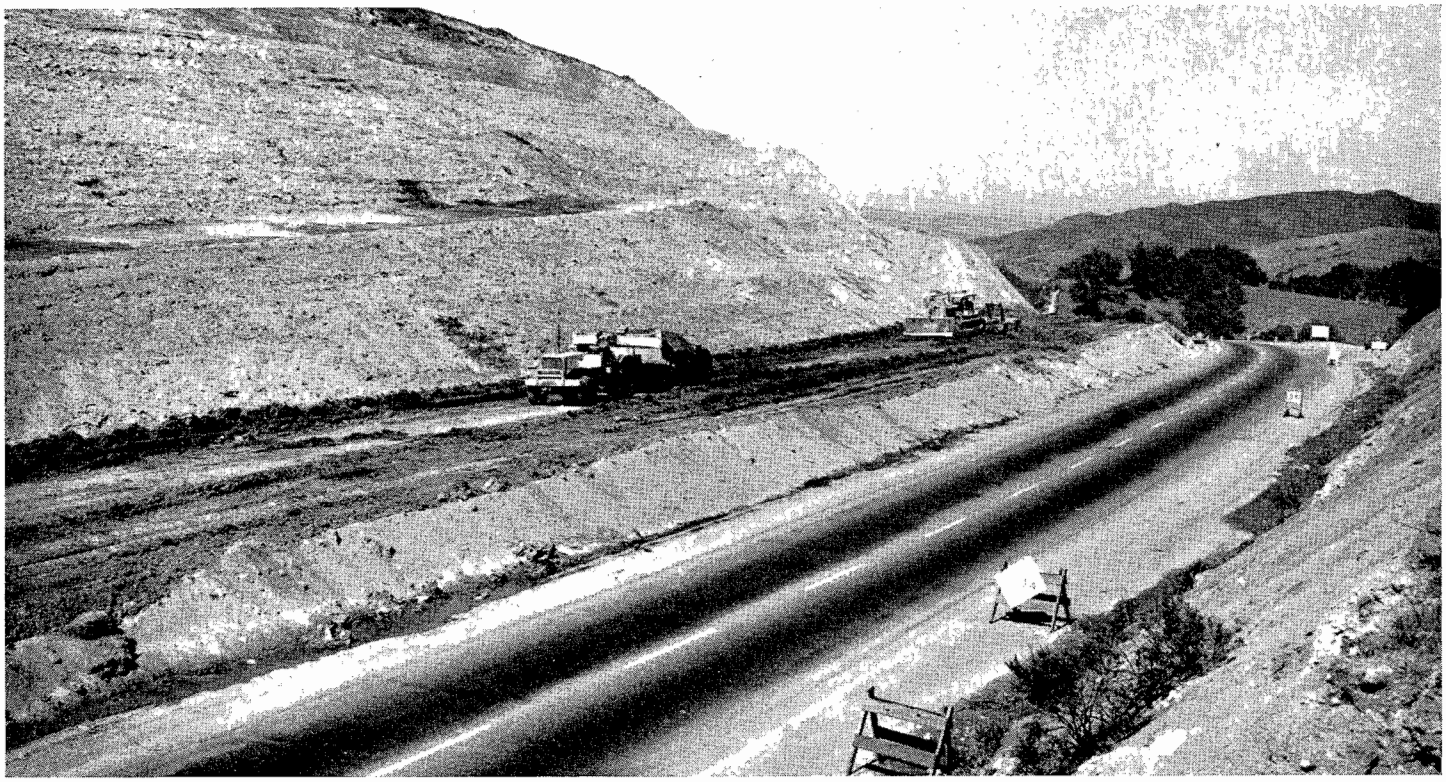


*Grading operations in progress at Nojoqui Summit. The view is looking north with the Santa Ynez Valley in the distance.*

En route to Santa Barbara where he expected to do battle with the Californians, Fremont encamped on the Rancho Tinaquaic, near what is now the town of Los Olivos, owned by Benjamin Foxen, an Englishman by birth, who had married Senorita Eduarda Osuna. Fremont and Foxen became friends. Allied by marriage to the Californians, Foxen had taken no part in the war for California.

One night in late December, 1846, Fremont confided to his friend that he proposed to march on Santa Barbara.

"By way of Gaviota we can be in Santa Barbara in two days," Fremont said.

Foxen was disturbed. He knew that he would be considered a traitor by his wife's people if he aided Fremont. He was aware that the Californians had massed at Gaviota planning to trap Fremont in the narrow defile. They planned to blast down tons of rock, closing both ends of the pass, after Fremont and his men had entered it and then slaughter them.

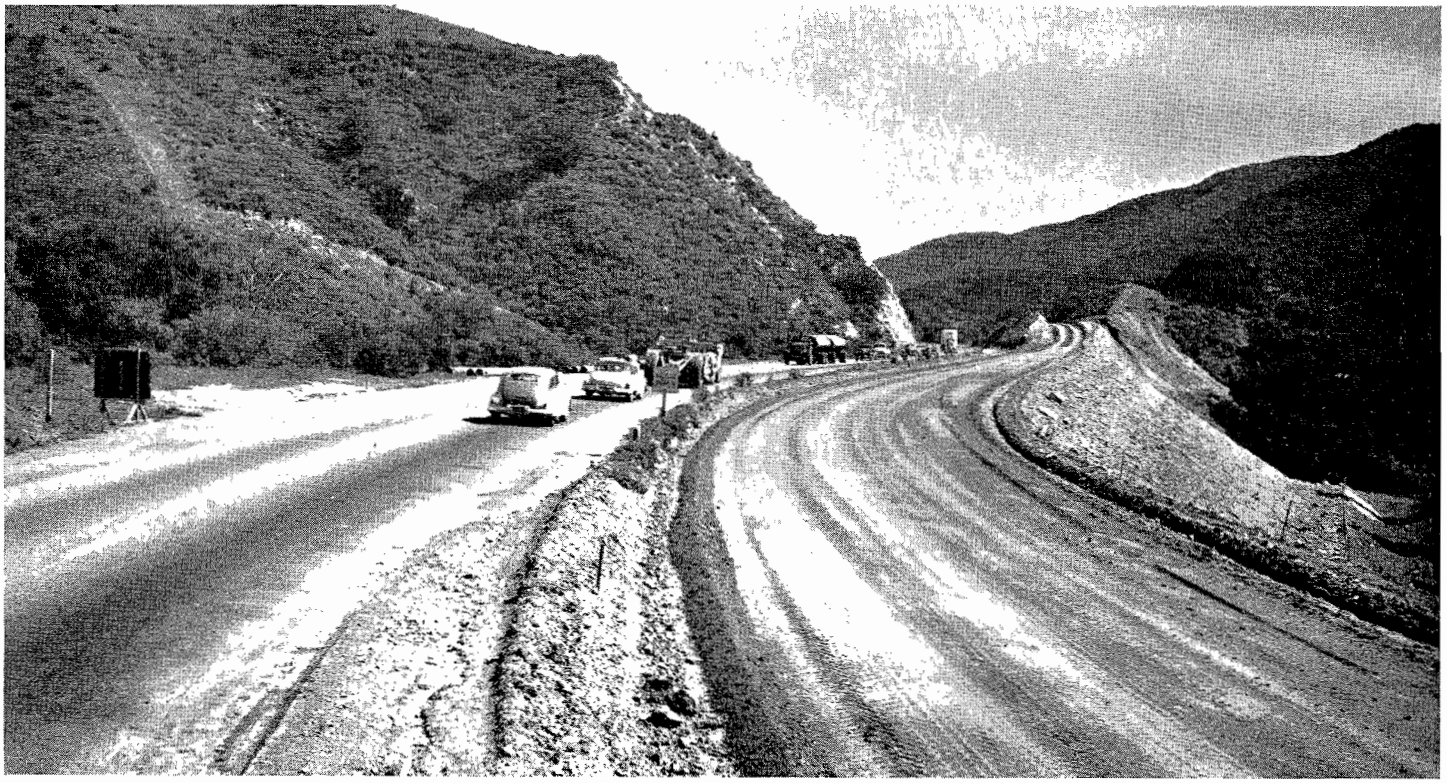
The Englishman suddenly made up his mind. He warned Fremont that he could not get through Gaviota. He offered to guide him over San Marcos Pass by a trail known only to himself. This he and his son, Guillermo, did. The Californians, confident of success, waited at Gaviota.

On December 27th, Fremont and his battalion marched into a deserted Santa Barbara and captured it without bloodshed. As Foxen had predicted, the male population was assembled with arms at Gaviota Pass.

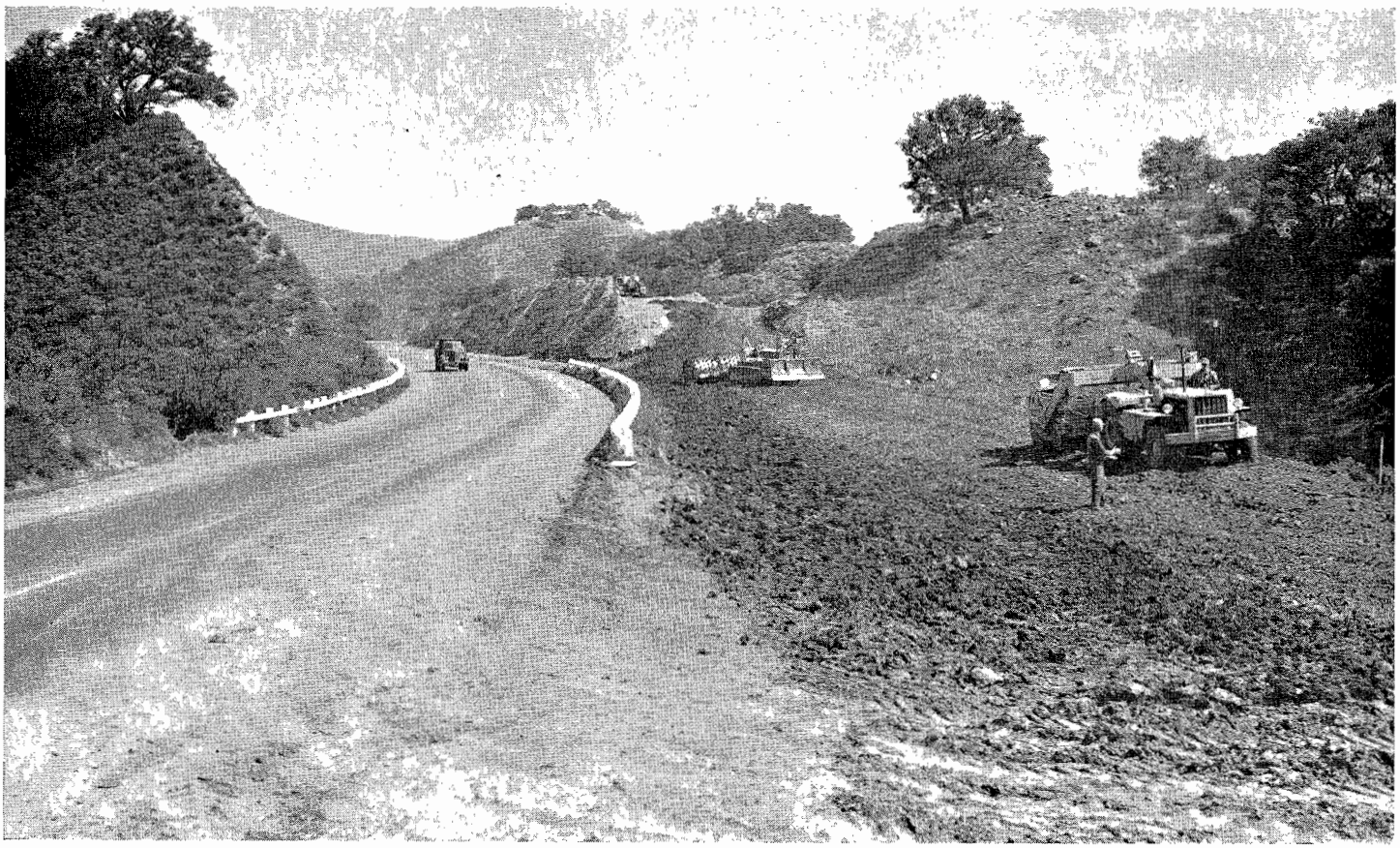
Somewhere offshore two British men-of-war were heading for Santa Barbara, and historians say that negotiations had been entered into between the Californian leaders and the English for the surrender of Santa Barbara and California. It is difficult to overestimate the disaster to American ambitions that would have resulted had Fremont and his men been annihilated in Gaviota Pass.

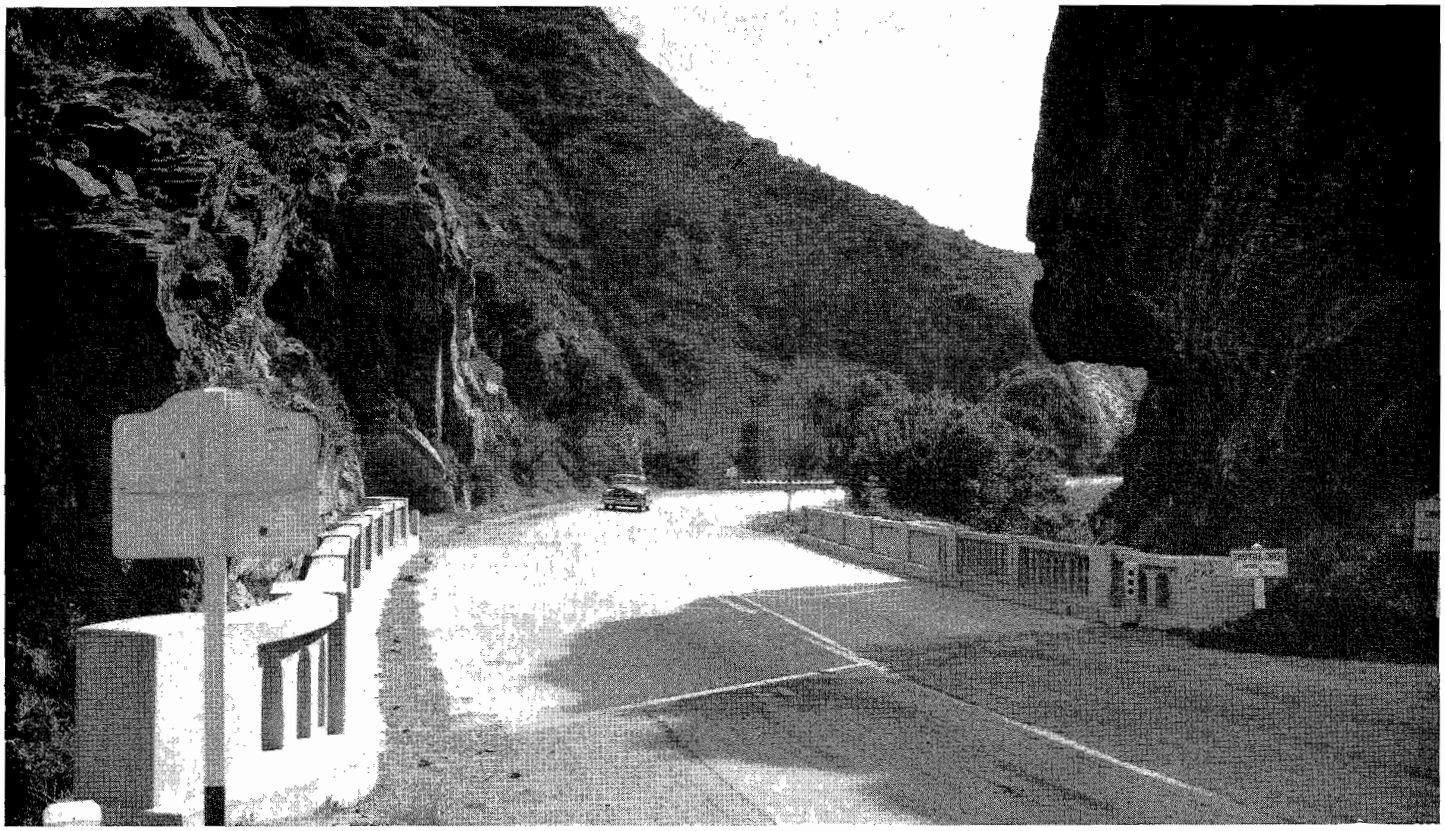
Of the many thousands of motorists that each year travel over El Camino Real, the Coast Highway between San Francisco and Los Angeles, and the San Marcos Highway, few give a thought to the historical importance of Gaviota Gorge, "The Pass of the Gulls," and of San Marcos Pass, which was the salvation of Fremont and, perhaps, of California.

Fewer still realize that a few miles from these two great roads is the little gray church of Sisquoc and its cemetery where rest Benjamin Foxen and many of his kinsfolk and friends of long ago, and that nearby is a monument of enduring granite erected in honor of the memory of General Fremont and Foxen.

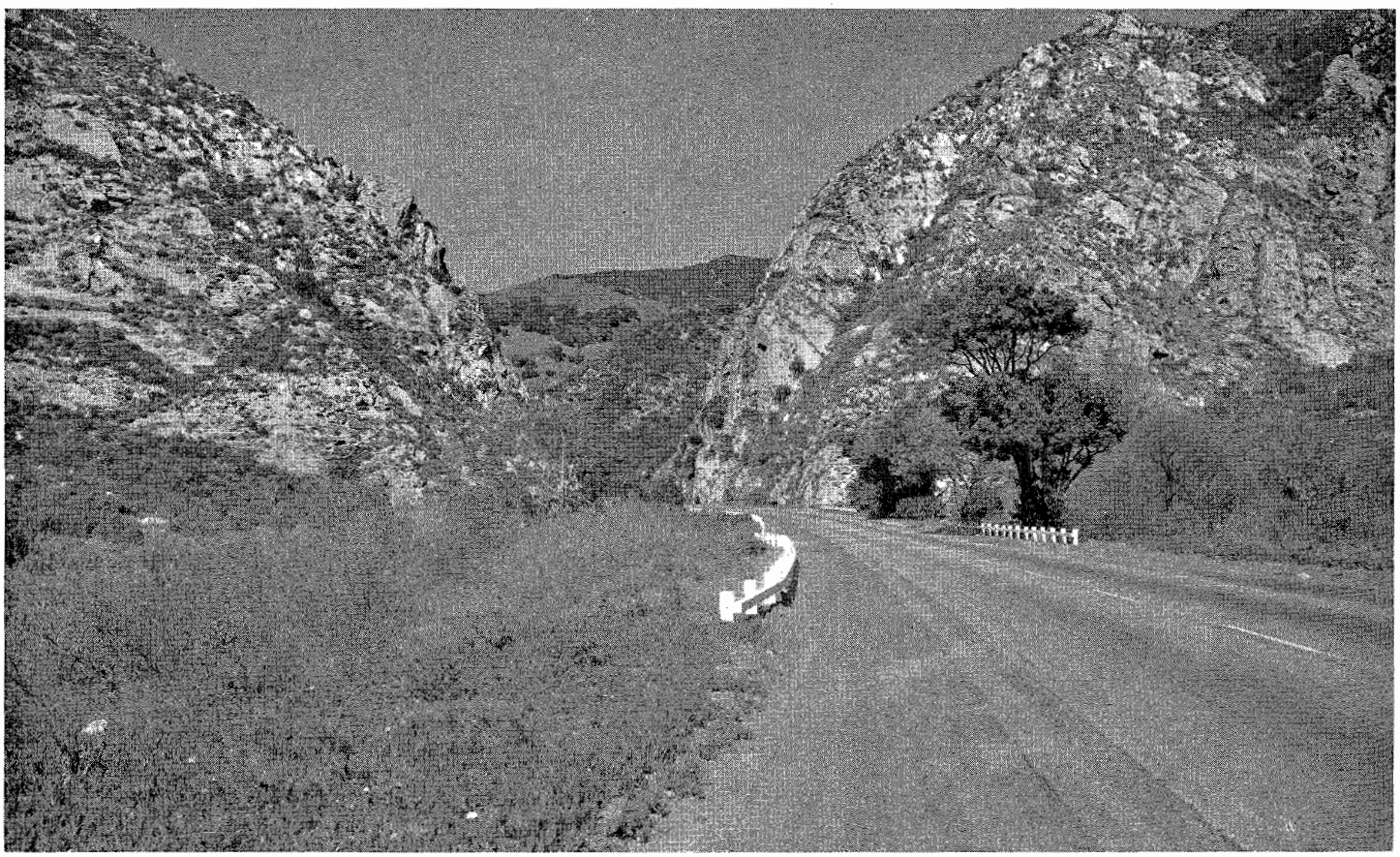


*UPPER—Nojoqui Grade showing inadequacy of existing roadway. The new four-lane highway which will be developed from existing two-lane highway will eliminate hazardous conditions on this grade. LOWER—Construction operations in progress on Nojoqui Grade just south of the summit.*





*UPPER—Bridge over Gaviota Creek at Gaviota Gorge. Existing lanes will be retained as southbound lanes. The tunnel will be through sandstone ledge at left.*
*LOWER—View of Gaviota Gorge looking north. South portal of tunnel will be just beyond trees to right of center.*



# Harbor Freeway

*Progress Report on Multi-Million Dollar Project in Los Angeles*

By P. O. HARDING, Assistant State Highway Engineer

HARBOR Freeway, in Los Angeles, as a southerly extension of the Arroyo Seco Parkway, had its inception over 20 years ago when governmental organizations and civic minded people in the Los Angeles area recognized the need for a new traffic artery connecting the downtown business area of the city with the San Pedro Harbor district. The first publications which carried maps indicating the Harbor Freeway, designated the portion of it going around the main downtown business district as the "West Bypass." This location was shown as being a short distance westerly of Figueroa Street, which is the location now generally followed by the part of the Harbor Freeway as designed between Temple Street and 23d Street.

Figueroa Street, which is present State Highway Route 165, is a very important traffic artery, but for many years it has become so badly congested because of heavy traffic and the business development of the street frontage that its efficiency as a traffic carrier has been greatly reduced. From 23d Street southerly to 190th Street, the location of the Harbor Freeway is on the easterly side of Figueroa Street. From 190th Street to the southerly end of Figueroa Street at the intersection with Wilmington-San Pedro Road, the Harbor Freeway location is on the westerly side of Figueroa Street and it follows along the west side of Wilmington-San Pedro Road to a connection with Gaffey Street at Battery Street in the San Pedro district.

#### Six to Eight Lanes

Design of the Harbor Freeway is going forward on the basis of providing six lanes or eight lanes for the freeway traffic. Traffic studies indicate that eight lanes will be needed from Slauson Avenue northerly and that six lanes will be required from that point southerly. For the northerly portion of the Harbor Freeway, adjoining the downtown Los Angeles business area, collecting and distributing roadways are necessary part way on both sides and a comprehensive system of on and off ramps is required. These have been designed on the basis of making most of the Los Angeles city east and west cross streets between Temple Street and Olympic Boulevard one-way streets. As of the present time two of these streets, Fifth and Sixth Streets, are operating as one-way streets with considerable success. It is anticipated that other streets in this vicinity will be made one-way streets before this portion of the Harbor Freeway has been completed. In any event, it will be necessary for one-way street operation to be put into effect as planned at the time the freeway has been completed and opened to traffic.

#### Freeway Agreements

Freeway agreements covering the entire length of the Harbor Freeway have been entered into between the City of Los Angeles, the County of Los Angeles, and the State. Prior to the execution of these freeway agreements, considerable opposition arose on the part of groups of affected property owners to some sections of the proposed location for the Harbor Freeway, and figures were released to the local press showing fantastic numbers for the homes and families that would be interfered with by the freeway construction. By actual count, it was determined that the following were the facts of the situation as to buildings and families interfered with for the portion of the Harbor Freeway from Olympic Boulevard in the City of Los Angeles to Battery Street in the San Pedro district of the Los Angeles Harbor:

| | |
|---|---|
| Commercial buildings | 140 |
| Residential buildings | 2,643 |
| Total buildings | 2,783 |
| Total number of families | 5,402 |

Public hearings relative to the Harbor Freeway have been held locally by the City Council of the City of Los Angeles and in Sacramento by the State Highway Commission.

#### Right of Way Acquisition by State

Members of the District VII Right of Way Staff are actively engaged in right of way acquisition for the Harbor Freeway from Temple Street southerly to Exposition Boulevard. Between Temple Street and Olympic Boulevard, the most northerly mile and a half section where active construction is under way, about 95 percent of the property required for construction has been obtained and cleared. For the most part, the private property needed for freeway right of way has been obtained by negotiation. In very few instances has it been necessary for the State to proceed with eminent domain proceedings in order to acquire property that is needed.

One of the condemnation suits that had to be initiated by the State involved a large holding that was operated as a miniature golf course. The State originally offered $283,000 to the owners of this property, who were asking $600,000. After a 23-day trial, the award was $278,608.75. The results of this condemnation trial, with the award being less than the State's offer, indicated that the State's methods of appraisal of property to determine its fair market value were just and fair to the property owners.

#### Statler Center Hotel Affects Traffic Pattern

The Statler Center Hotel project, just east of the Harbor Freeway between Wilshire Boulevard and Seventh Street, is of great importance to the City of Los Angeles and has a very considerable effect on the traffic pattern of the Harbor Freeway because of its proximity thereto. The construction work on this hotel was started July 5, 1950. The contractor is Robert E. McKee of Los Angeles, the same contractor as constructed the District VII State Division of Highways Building.

The estimated cost of construction is $20,000,000, and the date for completion is June, 1952. In this hotel, 1,275 guest rooms are planned and there will be 70,000 square feet of floor space available for shops.

The future effect of traffic concentrations in this vicinity by reason of the hotel operation has been studied, and the construction designs for the Harbor Freeway with its system of distributor roads and traffic interchange ramps and the reconstruction of existing city street layouts have been worked out taking this feature into account.

#### Fourth Street Tunnel, a Los Angeles City Project

Fourth Street is now a discontinuous east and west street because of the steep hill easterly of the Harbor Freeway between Flower Street and Olive Street. In order that the Harbor Freeway may function efficiently in picking up and distributing traffic to and from the Los Angeles downtown area, it is necessary that Fourth Street be developed as a through traffic artery for one-way eastbound traffic. The Los Angeles City Council recently took action approving the City Engineer's design for this proposed tunnel, with the easterly portal just west of Olive Street and the westerly portal half way between Flower Street and Hope Street. This tunnel is planned 850 feet long, with a 50-foot bore, providing a 43-foot width of roadway, with one 5-foot sidewalk for pedestrians. The westerly end of the tunnel will connect with the viaduct planned to carry eastbound Fourth Street traffic and traffic from the Harbor Freeway off ramps over Flower Street and Figueroa Street.

The estimated cost of the tunnel construction is $3,000,000, and steps are now being taken by the city authorities to provide necessary funds so that this project can be advertised for construction very soon. It is anticipated that the completion date will be sometime during 1953.

#### Design in Progress

Design of plans for construction of the Harbor Freeway is under way in three different locations. In the Sacramento office of the Bridge Department, detailed design plans are in progress for grade separation structures and also the heavy retaining walls that are required in freeway construction. Designs for reconstruction of city facilities such as for reconstruction of existing city streets, street lighting systems, sanitary sewers and storm drains, are being prepared in the office of the Los Angeles City Engineer. District VII is responsible for the over-all planning of the Harbor Freeway, for the acquiring of all rights of way, for the coordination of the design work being done by other agencies, and for preparing the detailed contract plans for all road work. The wholehearted cooperation which the State Division of Highways has had

*Looking northerly showing Harbor Freeway construction with steel in place for bridge deck of Third Street overcrossing grade separation in front foreground. The curving ramp bridge for traffic entering the Harbor Freeway southbound is shown in middle foreground. In background to the left is the four-level grade separation.*

*View from Temple Street looking southerly along cleared right of way for Harbor Freeway showing in middle foreground completed First Street and Second Street underpass grade separation bridges. The city street to the left is Fremont Avenue and in the background is the steel framework of the Statler Center Hotel.*

from the staff of the Los Angeles City Engineer's Office engaged in the preparation of freeway designs, has resulted in early advertising and awarding of construction contracts on the Harbor Freeway.

The design work on the Harbor Freeway has been substantially completed between Temple Street and Olympic Boulevard. Design work is currently under way between Olympic Boulevard and Exposition Boulevard, and at the southerly end from Battery Street to Lomita Boulevard. It is very important that designs be worked out and right of way acquisition started for the southerly portion of the Harbor Freeway, which is through relatively open country, as quickly as possible before further development of private property takes place.

#### Construction Completed and in Progress

The November-December 1949 issue of *California Highways and Public Works* on pages 52 and 53 carries illustrations of the proposed Harbor Freeway that were prepared by Mr. Van der Goes of the Sacramento office of the Bridge Department. These perspective drawings show the portion of the Harbor Freeway upon which active construction is now in progress under state highway contracts and the completed construction at the northerly end where the Harbor Freeway intersects the Hollywood Freeway at the four-level grade separation structures.

The three bridges comprising the Temple Street undercrossing of the Harbor Freeway and two interchange roadways were completed December 22, 1948, at a cost of $382,000. The contractor on these bridges was James I. Barnes Construction Company.

The undercrossing bridges at First Street and Second Street were completed January 18, 1951, at a cost of $450,000. Oberg Brothers were the contractors.

The two overcrossing bridges at Third Street, contractor Charles MacClosky, are 75 percent complete. The contract allotment is $339,000.

The Fourth Street overcrossing bridge, W. J. Disteli, contractor, is 35 percent complete. The contract allotment is $545,500.

The two overcrossing bridges at Fifth Street and Sixth Street, Winston Bros. Company, contractors, contract allotment $1,010,800, are 10 percent complete. This contract was awarded December 8, 1950.

A contract has recently been awarded to Webb & White of Los Angeles, for the construction of an overcrossing bridge at Wilshire Boulevard. The contract allotment is $380,000.

#### Multi-Million Dollar Project

The sum total of construction work on the Harbor Freeway, completed and in progress, is $3,107,300. This latter figure does not include any of the $1,500,000 which was the cost of the four-level grade separation structure at the intersection of the Harbor Freeway with the Hollywood Freeway and the Arroyo Seco Parkway.

The Harbor Freeway, from its northerly terminus at its intersection with the Hollywood Freeway at the four-level grade separation structure to

... Continued on page 24

# Factual Studies

## *Indicate No Damages From Property Access Restrictions*

By W. S. YOUNG, Headquarters Right of Way Agent

THE PROBLEM of estimating the value of access rights to the through lanes of traffic for commercial properties results in greater variances of opinions among appraisers than any other type of valuation estimate. Fundamentally, the value of any property, like any other commodity, is contingent upon the relationship of the supply to the demand. Likewise, the value of any right in the ownership of real property is contingent upon the effect of the removal of this right upon the relationship of the supply and demand for this type of property when placed in competition on the open market with properties still retaining the particular property right being restricted or acquired.

Since access rights are regarded as a property right which may affect the value of the total remaining property rights when exposed for sale on the open market, the measure of the value of this right of access is recognized as being the difference between the amount which reasonably might be received for the property, including all the rights, and the amount which might be received for the property after the access rights have been limited as proposed.

### Test of Value of Access Rights

The test of the value of access rights logically may best be applied by reference to similar properties which have been sold on the open market prior to the acquisition of their access rights and again following restriction of the access rights.

Since the construction of highways to which abutting properties have only limited or no rights of access is relatively new, examples of properties which qualify under this ideal test are very limited. However, inasmuch as the amount of business transacted—in other words, the earning power—is one of the principal factors in determining the relationship of the demand to the supply, a comparison of the amount of business transacted previous to the limitation of access rights to the volume of business transacted following restriction of these rights obviously is an accurate indicator of whether or not payment should be paid for the limitation of direct access to a business property.

Following in line with this reasoning, the Division of Highways has analyzed the sales tax returns of some 20 highway businesses in two locations where access to the through lanes of traffic have been eliminated by placing these businesses on frontage roads.

### MILK FARM

One of these roadside business developments is located approximately 20 miles westerly of Sacramento on U. S. Highway 40 and includes three businesses, the best known of which is the Henderson Milk Farm Restaurant, operating on the frontage road having more than 1,500 feet between openings to the main traffic lanes.

These businesses, which include a service station and a soft drink stand in addition to the Milk Farm Restaurant, operated for several years with unlimited access to traffic in both directions. Since November of 1948 their patrons have enjoyed the safety and attractiveness of a chain link fence and planting strip which separate the highway from the frontage road the full 1,500 feet between the access openings.

Shortly after opening of the frontage road, Mr. Henderson, owner of the Milk Farm Restaurant, addressed a letter * to Mr. G. T. McCoy, State Highway Engineer, expressing his complete satisfaction with, and appreciation of the many benefits of operating somewhat removed from the main traveled lanes. This letter was written at a time when all the competitive establishments along this section of U. S. Highway 40 between Sacramento and the Bay area had unlimited access from the main traveled lanes.

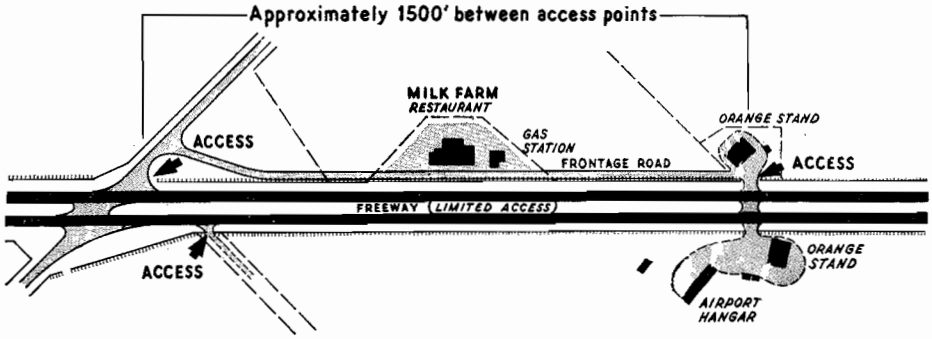
### No Adverse Effects

The approximately two years of elapsed time since the opening of the frontage road to traffic has enabled us to make a before and after comparison of the retail business volume of the Milk Farm Restaurant to the business volume of the five other first class restaurants situated on this highway between Sacramento and Vallejo. This comparison has indicated that the judicious limiting of access to this highway business did not have any adverse effects.

Comparing the business volume of the Milk Farm during the year following its being placed on a frontage road to its business volume of the year immediately preceding this arrangement, we find that the restaurant enjoyed a

* See January-February, 1949, issue of *California Highways and Public Works.*

*This engineering sketch illustrates the type of success enjoyed by the restaurant, service station and soft drink stand which were moved back to abut upon a frontage road on U. S. Highway 40 near Dixon, California*



25.1 percent gross increase. During this same period the five other first-class restaurants along this section of highway, while having unlimited access to the through lanes of traffic, realized only an average increase of 9.3 percent.

#### Service Station Benefits

Further evidence that access restriction at this location did not damage business is found in the comparison of business volume transacted by the service station also located on this frontage road. During the year following the moving back of the service station from the through lanes, the service station disclosed an increase of 17.7 percent in retail business. Gasoline gallonage increased 5 percent over a comparable preceding period. Like Mr. Henderson, owner of the restaurant, Mr. Higby and Mr. Clark, operators of the service station, have acclaimed the benefits of the frontage road location.

While service station business at this location was on the increase, service stations throughout Solano County average a decrease of approximately 9 percent.

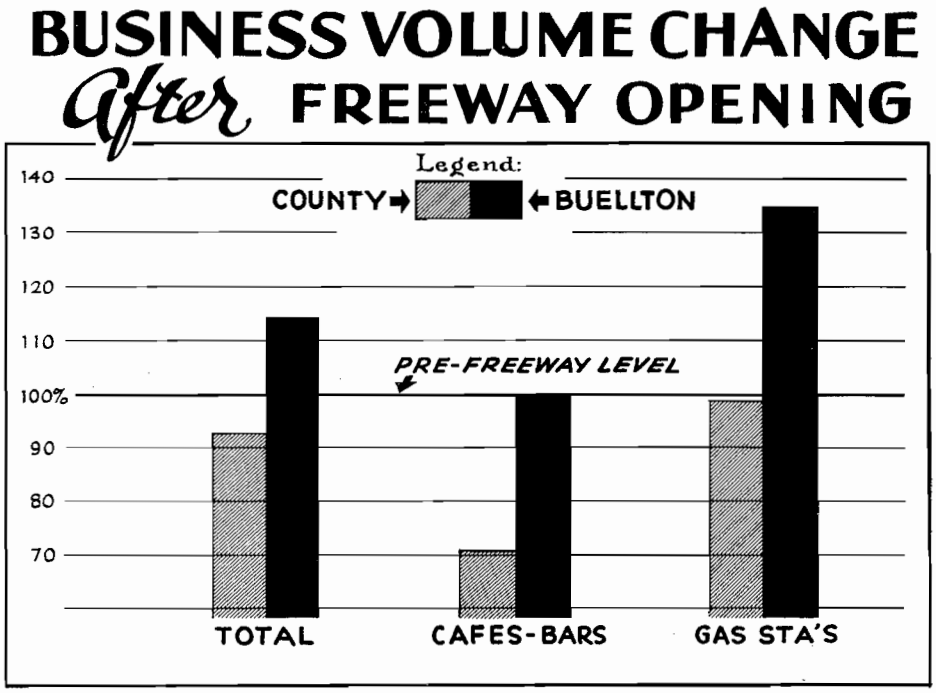
The third business operating on the frontage road, an orange drink stand owned by Mr. Ballinger for several years, enjoyed an 8.5 percent increase in business volume.

Although there have been no before and after real estate transactions along this section of frontage road, this has been because the property was not for sale. Offers well above the appraised value of the property at the time it had unlimited access to the highway have been refused.

### BUELLTON

Another well-known frontage road development where retail business comparisons clearly indicate no adverse effects resulting from the limitation of access rights to commercial properties is the town of Buellton, located about 44 miles north of Santa Barbara on the Los Angeles to San Francisco section of U. S. Highway 101. This is another example of a location where businesses formerly afforded unlimited access to the main traveled lanes were moved back to abut upon a frontage road with no direct access.

In this town of approximately 250 inhabitants, depending almost entirely upon the support of highway patronage, all types of roadside businesses enjoyed substantial benefits through the alleviation of congestion and the increased safety to customers.




*Graphic comparison of retail business volume by type in Buellton to Santa Barbara County businesses during the year after the Buellton businesses began operating on a frontage road*

The nine service stations located along this section of frontage road average an increase of 34 percent in volume of retail business above the last year in which they enjoyed unlimited access. This was during the period when service stations throughout Santa Barbara County suffered a decrease of 11 percent in volume.

#### Buellton Restaurants Helped

The three restaurants in Buellton averaged a 0.2 percent increase, while Santa Barbara County restaurants dropped off 23 percent.

The comparison of over-all business volume in Buellton to Santa Barbara County business volume indicates the increasing popularity of this roadside development along a frontage road. Buellton business averaged an increase of 14 percent following completion of the highway improvement, while retail business generally in Santa Barbara County suffered a decline of 7.3 percent.

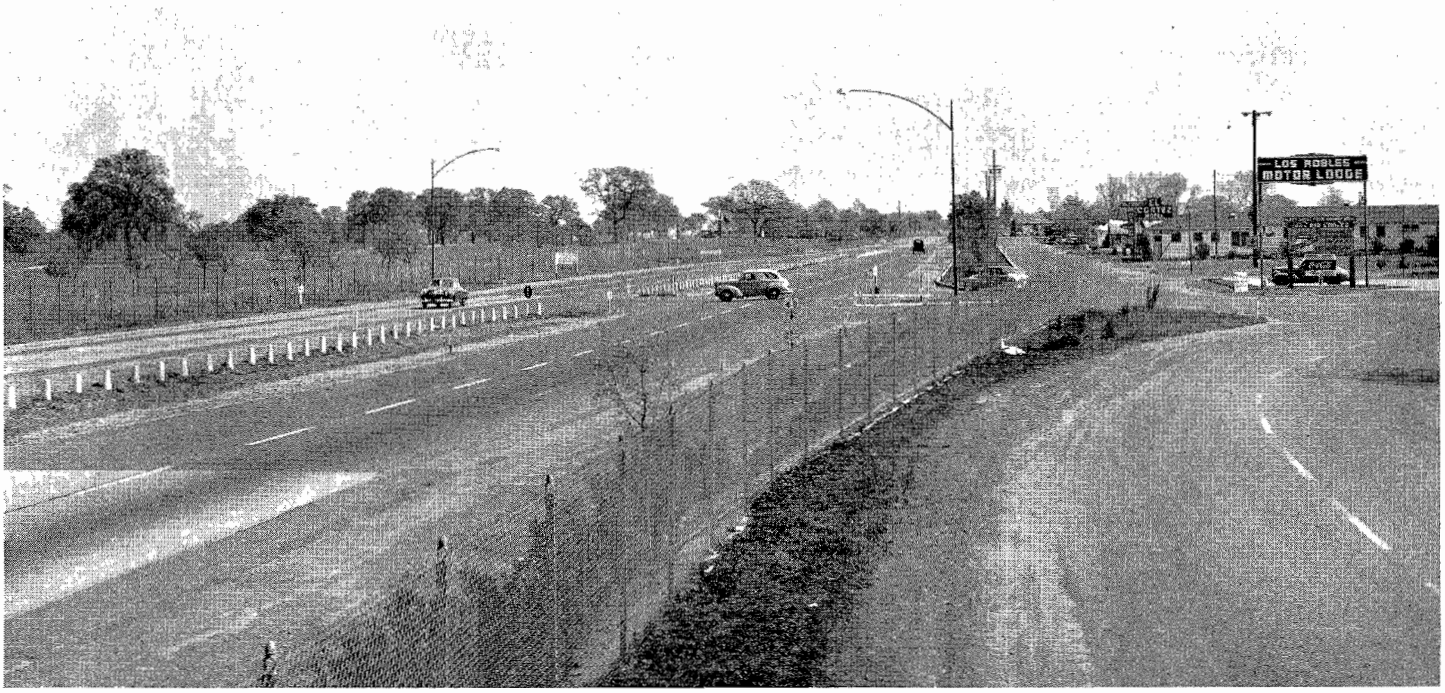
Like the foregoing Solano County frontage road development, no before and after sales of the same property were registered in Buellton. However, here also the accepted front foot value has increased approximately five times over the previous existing values. Assessed values of the land have increased approximately 350 percent.

While increased retail business volume at a given location unquestionably results in greater values in the subject properties because of an immediate increase in demand, actual examples of before and after sales of properties where access rights have been restricted provide us with the best evidence of the lack of damages resulting from judicious access restrictions to commercial developments.

### HOTELS

An analysis of the histories of two motel properties located near the northerly end of the North Sacramento Freeway on U. S. Highway 99E and 40, delineates for us the effects of placing these businesses on a frontage road at a time when competitive businesses along the same section have unrestricted access.

Inasmuch as the highway requirements from one of these properties were acquired in condemnation, this analysis suggests that the lack of factual data concerning the effects of access restriction is costing California taxpayers a considerable sum of money in unmerited damage payments. In the




*View of the frontage road facilities at the northeasterly end of the North Sacramento Freeway along which are situated the two motel properties discussed herein*

case of these properties also, a frontage road having more than 1,500 feet between openings was provided to link them with the through lanes of traffic.

#### North Sacramento Freeway

The North Sacramento Freeway was completed in the fall of 1947, but the right of way acquisition from the two subject motel properties was not completed until 1948, at which time both were operating along the frontage road. By this time the motel business throughout the State had dropped off drastically from the 1947 high as a result of the tremendous increase in number of units thrown on the market by new construction and premiums above the cost of new construction were seldom being paid for operating motels.

One of these motels, several years old and consisting of 20 units and living quarters for the operator, was purchased in December of 1946 for $88,000, which was above the estimated replacement cost new at that time. The land consisted of a 220-foot frontage by a 453-foot depth, the motel being constructed on the westerly 110 feet of the property.

The State's right of way requirements were the access rights to the freeway and a 40-foot strip off the front of the property needed for the construction of a frontage road adjacent to the freeway and serving four existing motels and several vacant properties.

Because no agreement could be reached between the State and the property owner as to the amount of damages due to the access restriction, the matter was settled in a condemnation trial in May of 1948. The court award was $25,000 for damages to the remaining property.

#### Court Awards

This award of $25,000 damages influenced the settlement by stipulation of a pending litigation on a neighboring motel property on the same frontage road. The amount of damages paid in this latter transaction was $9,000.

Both these motels were sold in the latter part of 1950, having been in operation with access to the freeway by means of the frontage road since 1947 in competition with many other motels along the same highway with access as yet unlimited.

Despite the lack of direct access to the highway, and despite the fact that sales of motels in the Sacramento vicinity generally have indicated a downward trend in values of approximately 20 percent during the past five years, or an average depreciation of 4 percent per year, the 20-unit motel abutting the North Sacramento Freeway brought a price of $85,000 in October of 1950. This sale included only one-half of the land obtained in the 1946 purchase price of $88,000. By adding the $10,000 accepted fair market value of the remaining 110-front feet of vacant property (now listed for sale at $16,000) to the $85,000 received for the motel, we find there was a net gain in total valuation amounting to $7,000. The land values of this frontage have doubled since construction of the freeway.

#### Values Increased

Further emphasizing the costly lack of factual data on access limitation effects is the history of the other motel which sold in 1950 after doing business for approximately four years on the frontage road.

This motel was built by the individual who owned it at the time of the state right of way acquisition, hence no previous selling price was available. Also, since the operator performed most of the construction work himself, no actual building costs for it are available.

The five-year-old masonry motel, which contains 10 units and living quarters for the operator and has 150 feet of frontage, sold for $52,500. This amount also is greater than the estimated replacement cost new of the property at the time of the freeway construction.

An analysis of this sale after verification by the buyer and seller indicates a land value of $13,635 at the rate of $90.90 per front foot, furnishings valued at $2,500 and the building improvements valued at $36,356, which is approximately $3,636 net per unit. This value per unit was found to be somewhat above average values per unit being obtained for first-class motels in the market in this vicinity.

The fact that land values along the frontage road are commonly accepted as being more than double the same land values existing prior to the freeway construction and considerably greater than nearby highway frontage where access has not been as yet restricted establishes that none of the properties were damaged by the limitation of their access rights, as reflected in the real estate market. The commercial highest and best use at this location has remained constant for several years.

**CONCLUSIONS**

The foregoing analysis of these commercial properties whose access rights have been restricted by placing them on frontage roads leads us to the conclusion that the means of access to a commercial property from a highway frequently is grossly over-weighted in comparison to the many other factors contributing to the success or failure of a highway business venture.

The several distinct advantages of frontage road service for commercial enterprises, coupled with progressive merchandising practices, have more than offset any detrimental effects of circuity of travel.

These advantages include: safer, unhurried entrance to the property; improved attractiveness inherent in a uniform setback; and greatly extended economic lives of the commercial enterprises because of the guaranteed permanency of freeway construction. In the case of the motel properties, being farther removed from highway noises has proved a much commented on advantage.

Apparently because of the discovery of the many advantages to the motorist, these frontage road developments have found their already high repeat customer business to be on the increase.

In considering the progress of highway development and the resulting trends in highway users' habits, it appears that the beneficial effects of properly designed control of access to commercial properties will in time become common knowledge.

## EDUCATIONAL VALUE

PACIFIC RUBBER COMPANY
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MR. KENNETH C. ADAMS, *Editor*
*California Highways and Public Works*
*Sacramento, California*

DEAR MR. ADAMS: It is a pleasure to request to be continued on the mailing list of *California Highways and Public Works.*

This magazine has a high educational value, serving to promote good will and a better understanding between the Highway Commission and the public with the commission's problems.

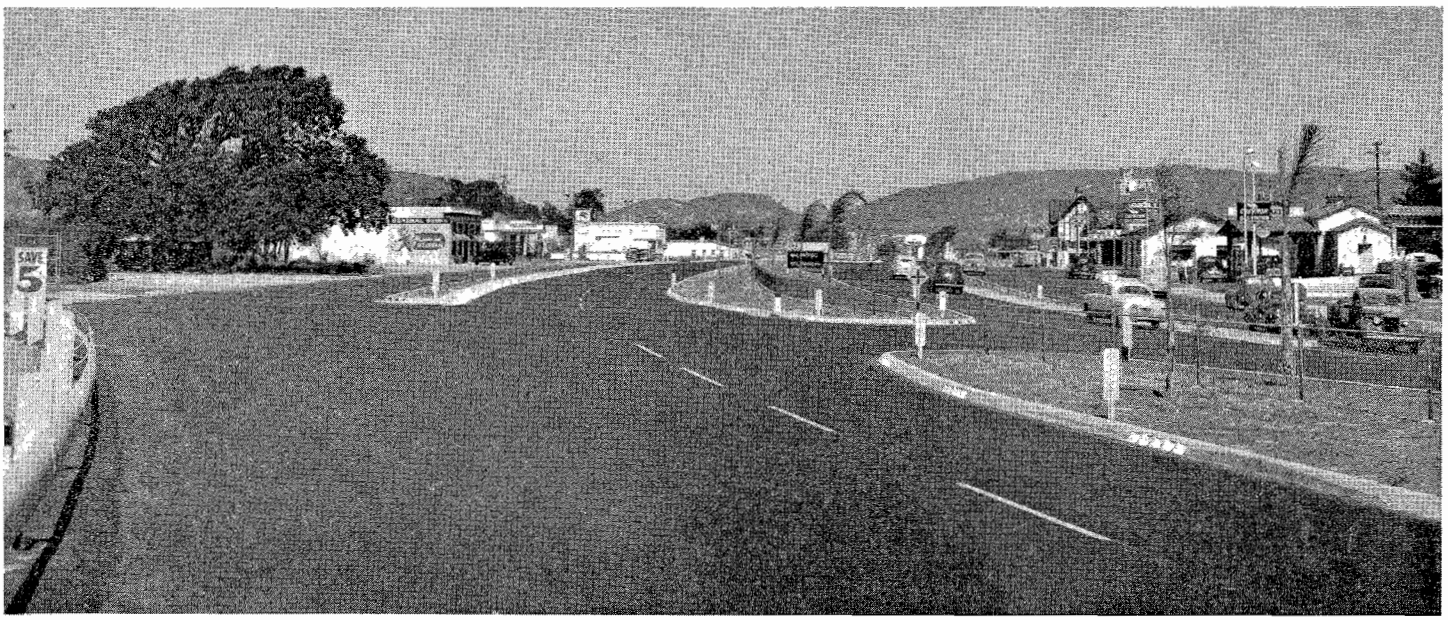
Our San Joaquin River Club boasts over 900 active, dues paying members, and we leave the magazine available to the members until the next issue arrives; then the old one is placed on the magazine table here in the lobby of the rubber company, where it creates considerable interest.

Thanking you for a good periodical, for including us on your mailing list and for this opportunity to express our appreciation.

Yours very truly,

E. F. HILLENDAHL

*View of the business section of Buellton showing the manner in which businesses formerly reached directly from the through traffic lanes now are served by frontage roads connected to the highway at cross street intervals*



# Arnold Highway

## *Third Link of Industrial Route In Contra Costa County Being Built*

By D. M. YOUNG, Resident Engineer

COMPLETION of the third link of the Arnold Industrial Highway, State Route 75, Sign Route 4, in northern Contra Costa County will be accomplished this summer.

Work on the project from the junction of Port Chicago Road to Railroad Avenue at the southern outskirts of Pittsburg was begun by Parish Bros. on March 13, 1950, and is still under construction. This section of road, four and one-half miles in length, will be a four-lane divided limited freeway, consisting of plant-mixed surfacing on cement treated base.

Easy grades and direct alignment were afforded this portion due to the slightly rolling terrain and lack of realty development. The maximum grade is 4 percent, the average being 1¼ percent. The total curvature is 65 degrees and the minimum radius is 2,400 feet.

### Overhead Structure

An overhead structure is constructed at the junction at the west end of the job which will provide for the free merging of west bound traffic. At the Bailey Road intersection where cross traffic is light a channelized grade connection will serve until future conditions warrant the construction of a grade separation structure. Both of these connections will be provided with illumination. The connection at the east end of the project will be a temporary grade crossing, including a detour to provide for the routing of traffic during construction of an interchange structure on a future contract.

The geometric section consists of four 12-foot lanes with 8-foot outside shoulders and a curbed division strip varying in width from a minimum of 6 feet in the curbed area to 42 feet in the uncurbed area. The surfacing is four inches of plant mixed material, using paving asphalt, placed on twenty inches of imported base material of which the top eight inches is treated with cement.

The use of cement for treating imported base materials, or selected materials, on road projects has become prevalent in this locality due to insufficient deposits of adequate untreated roadbed materials.

### Utilities Relocated

Under the Collier-Burns Act, numerous utilities relocated their facilities at state expense, including a power line owned by the Pacific Gas and Electric Co. Under contract work reinforced concrete encasement was provided for the double sixty-inch pipes of the Mokelumne aqueduct. This aqueduct, owned and operated by the East Bay Municipal Utility District, provides a daily supply of approximately 100

*Ribbon development and 25-mile zoning of existing route presents a bottleneck for peak hour traffic*

million gallons of water to the East Bay area from the Sierra Nevada mountains.

Due to unseasonal heavy rains, progress on this project, like many others, was temporarily halted during the winter season. It is anticipated that the completion date of this project will be about July, 1951.

A fourth project is programmed for the immediate future, which will extend the four-lane limited freeway to "A" Street at the southern outskirts of Antioch. This unit, when completed, will have extended the Arnold Industrial Highway to include the limits of the Pittsburg-Antioch industrial area, and will afford much needed traffic relief for northern Contra Costa County.

#### Other Projects Planned

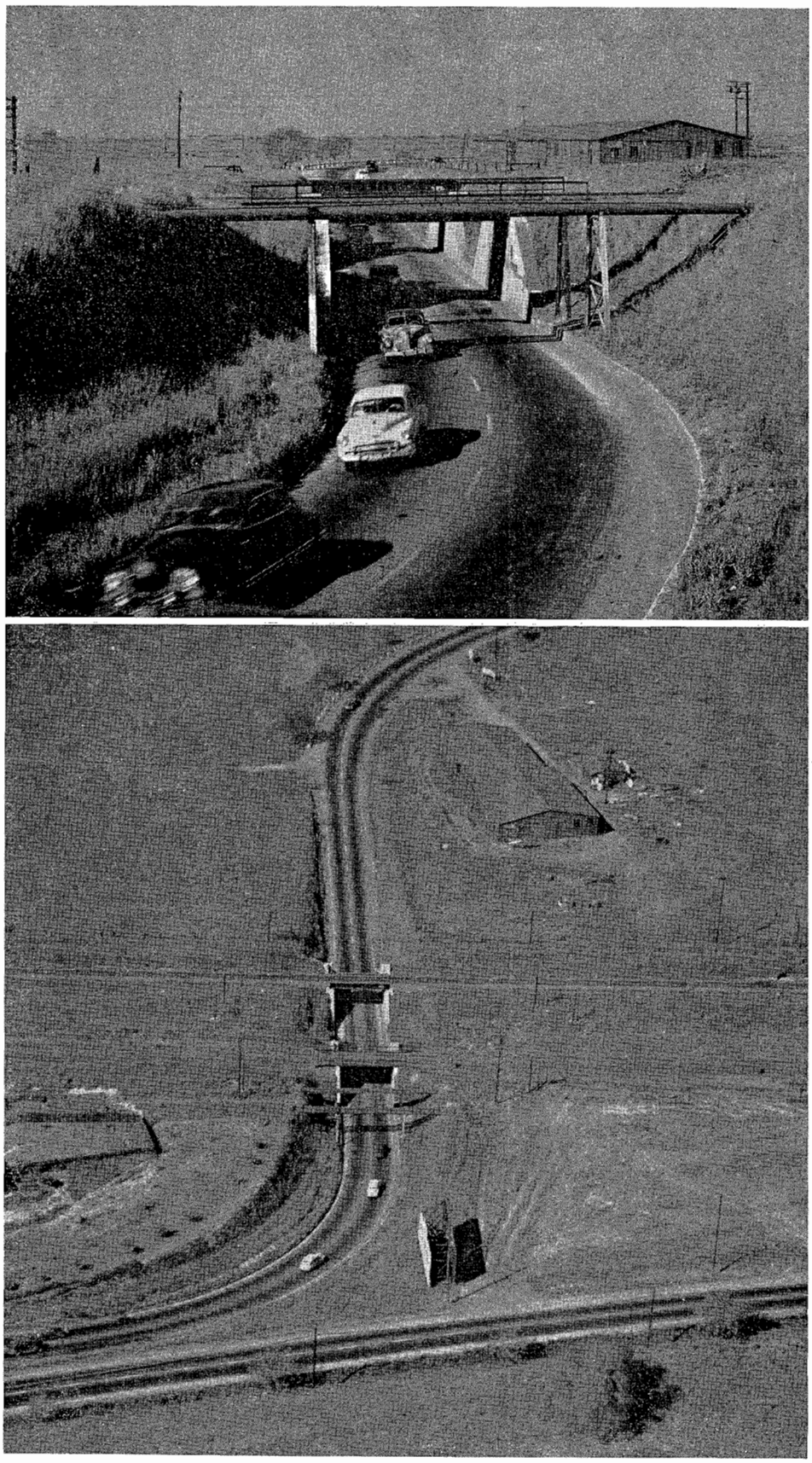
Other projects planned for the future will extend this highway to a junction with Bridgehead Avenue leading to the Antioch Bridge and beyond; across the Contra Costa San Joaquin County line to Stockton.

The present project is financed by state gas tax and Federal Aid funds. The work is under the general supervision of Assistant State Highway Engineer Jno. H. Skeggs, with the author as Resident Engineer on the current project.

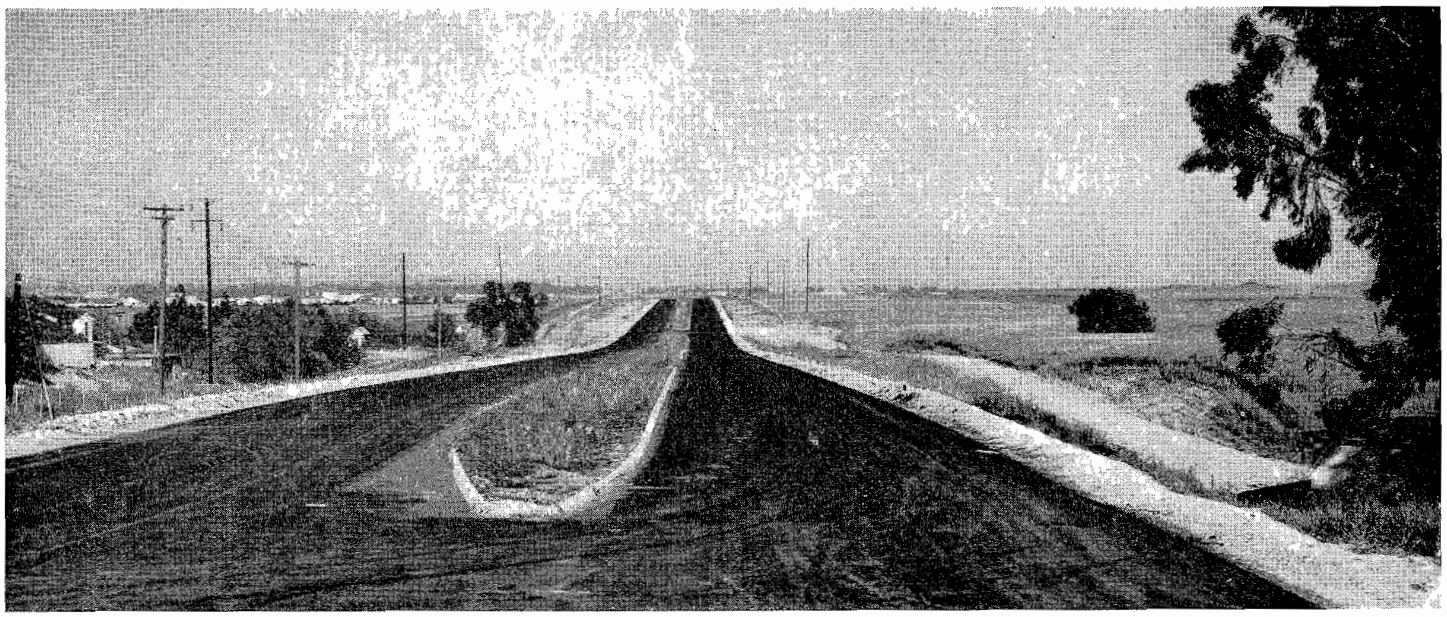
Need for this east-west route was given impetus by the opening in 1925 of the Antioch Bridge across the Sacramento River near Antioch, thereby offering a shorter route from Sacramento and the neighboring delta lands to the San Francisco Bay area. At that time traffic was served by a devious route following along the waterfront of Suisun Bay through Martinez via Franklin Canyon to Pinole and the East Bay district. An alternate road, Sign Route 24, was from Antioch through Concord and Walnut Creek by way of the old Broadway Tunnel.

#### Roads Were Inadequate

These roads were inadequate in structural design, alignment and width to cope with the traffic which even then foreshadowed its present high level. In addition, no direct route was available to serve the ever-increasing farm produce, transportation and freight from the expanding Pittsburg-Antioch industrial developments. Today this sector includes plants of the Columbia Steel Co., Fibreboard Products, Dow



*UPPER—Curving approaches to narrow subway on existing highway are both hazardous and delaying to modern traffic. LOWER—Aerial view of underpass with new highway in immediate foreground.*



*Completion of surfacing in this area. Direct alignment and easy grades are major features of this project.*

Chemical and a generating station of the Pacific Gas and Electric Co., with an attendant increase in commuter traffic. The Army staging area, near Pittsburg, for the San Francisco Port of Embarkation contributes to the congestion, as do refineries of Shell, Associated and Standard Oil Companies.

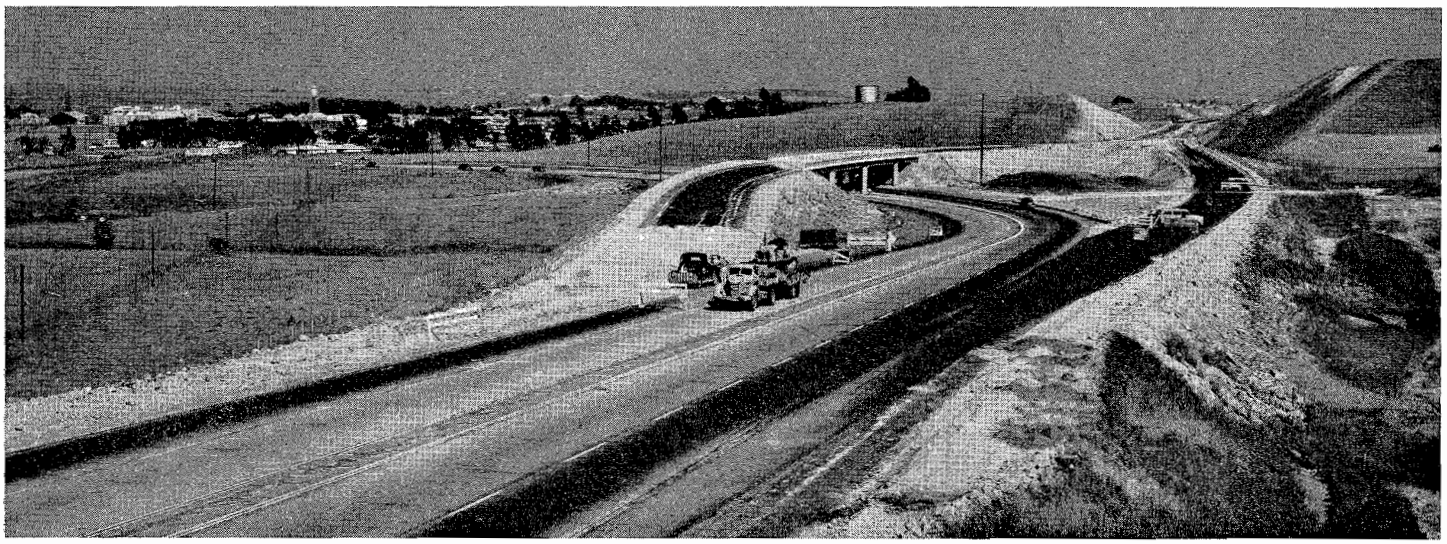
In 1930 Mr. Ralph R. Arnold, pioneer highway builder and then county surveyor for Contra Costa County, conceived a plan for a direct route from Pinole on Highway 40 to Stockton, intercepting traffic from the Antioch Bridge and passing along the outskirts of the intervening towns. This plan was presented to the various Chambers of Commerce, the Contra Costa Board of Supervisors and the Division of Highways, following which favorable consideration was accorded the plan by all bodies.

On August 27, 1938, ground breaking ceremonies were performed dedicating initial construction of the "Arnold Industrial Highway." This first project, completed in August, 1939, provided a modern two-lane highway from Muir Station to a junction with Highway 24 at the west end of Willow Pass. Muir Station, one mile south of Martinez, was the homesite of John Muir, early California writer and naturalist. This project, constructed by Macco Construction Co., is eight miles in length through rolling hills, consisting of plant-mixed surfacing over soil cement base. The alignment is excellent and affords a considerable saving in time and mileage over the old "Waterfront" Road.

The second project, completed in August, 1947, provided a four-lane divided freeway through Willow Pass to the junction of the Port Chicago road, four miles west of Pittsburg. This section constructed by Harms Bros. of

*. . . Continued on page 30*

*Connection to Port Chicago Road at beginning of project. Grade separation structure provides for the free merging of westbound traffic.*



# New Approach

## *Reliable Method of Aggregate Gradation Control Is in Use*

By MAURICE E. CORNELIUS, Assistant Highway Engineer

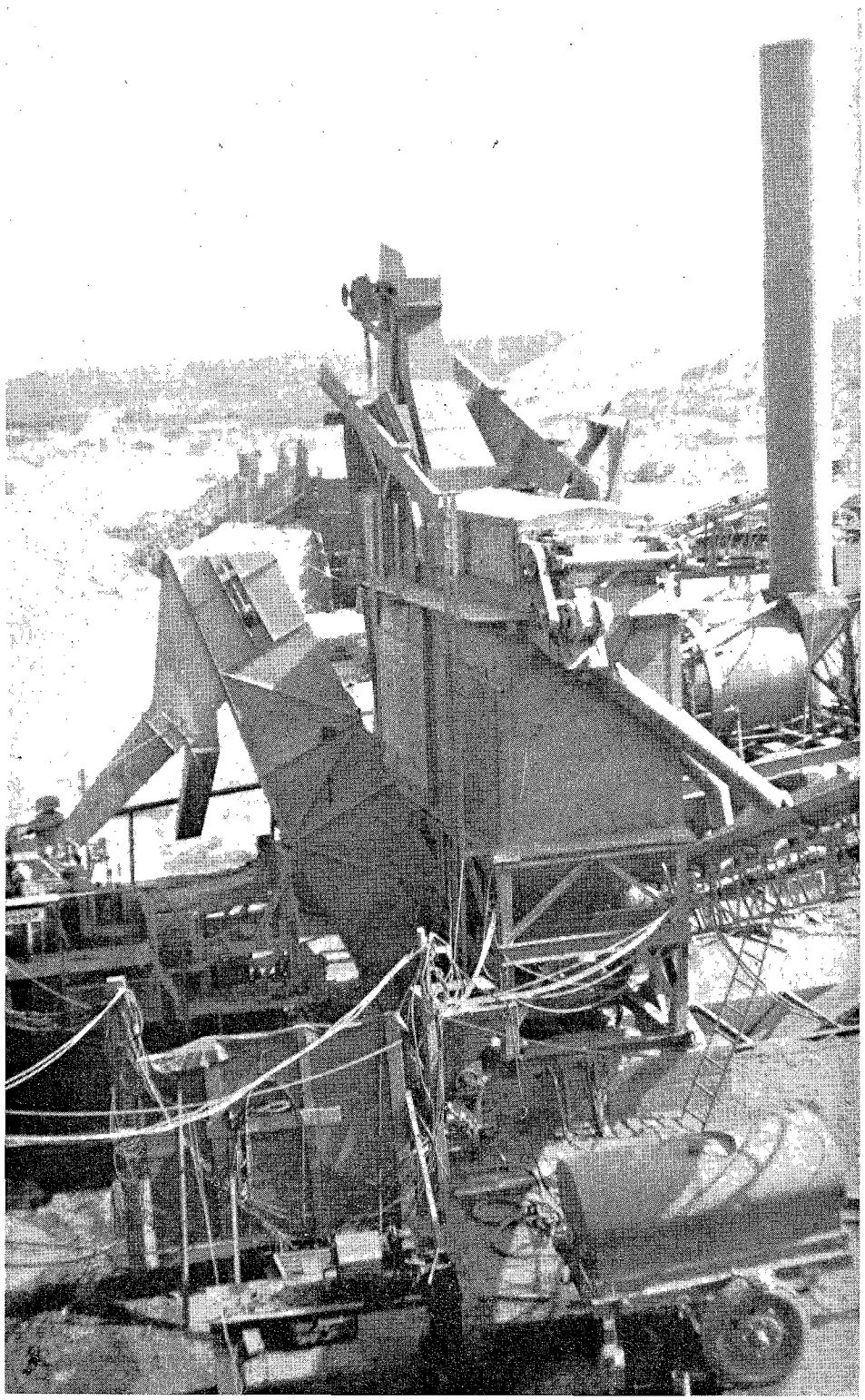
A FEASIBLE and reliable method of aggregate gradation control was installed on a continuous mixing plant for the production of plant-mixed surfacing by the Cox Brothers Construction Company on recent contracts in District XI. Continuous mixers proportion aggregate on a volumetric basis and have always presented problems in production control.

The aims of production control in the mixing of heavy duty asphaltic paving mixtures are (1) to obtain uniform grading of the aggregate, (2) to obtain uniform and proper proportion of bituminous binder to this aggregate, (3) to maintain proper and even temperatures of the mixture and its ingredients, and (4) adequate mixing of aggregate and asphalt. Uniform grading of the aggregate is essential for proper laying and compacting operations and it is also essential in maintaining the correct proportions between the aggregate and the asphalt binder.

### Aggregates Proportioned

Grading of the total aggregate is obtained by proportioning aggregates of different size groups; i.e., sand, pea gravel, rock, etc.; the proportions so chosen so as to provide total aggregate within specified grading limits and, further, to obtain a grading within these limits which will produce as little waste material as possible.

To secure a given final grading of aggregate it is necessary to know the gradings of the separate materials being used. In order to acquire these gradings samples of each bin are secured and tested—see footnote at end of article. Continual sampling and testing of the bins is necessary to obtain uniform grading in the final product. Bin grad-



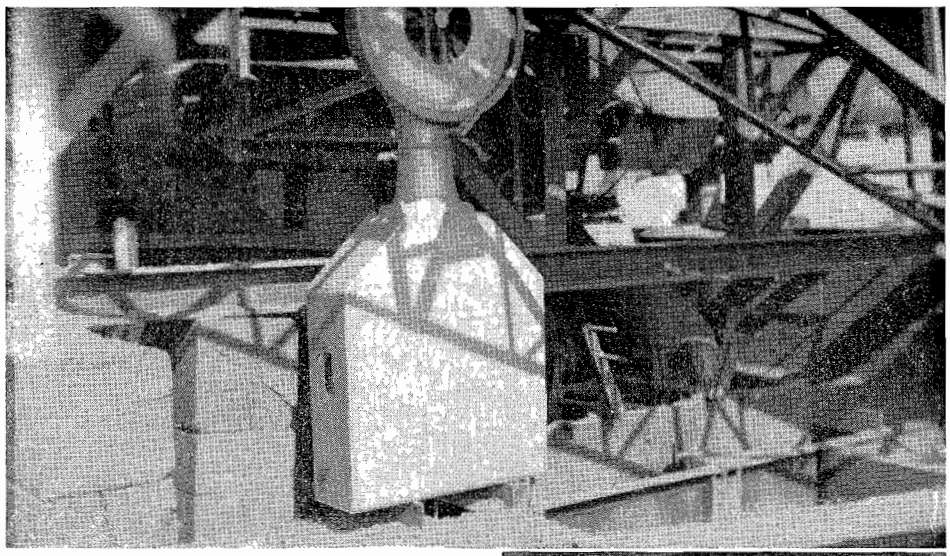
*Taken from product hopper tower. On the left is one end of the mixer. The mixer is fed by the closed bucket conveyer in the picture's center. This conveyor is in turn fed by endless belts feeding material from the bins through calibrated gates.*

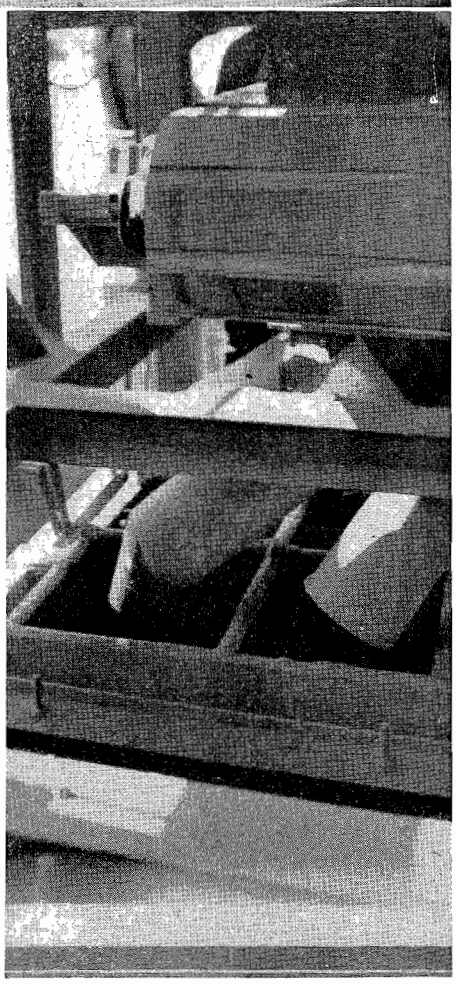
ings will vary with production rates and with depth and location in the stockpile. Testing will also disclose defects in the screening operation, such as plugged screens causing excessive carryover, overloaded screens, plugged overflow chutes, or broken screens. The proportions chosen for the bins will depend upon the gradings obtained by test.

**Different Operations**

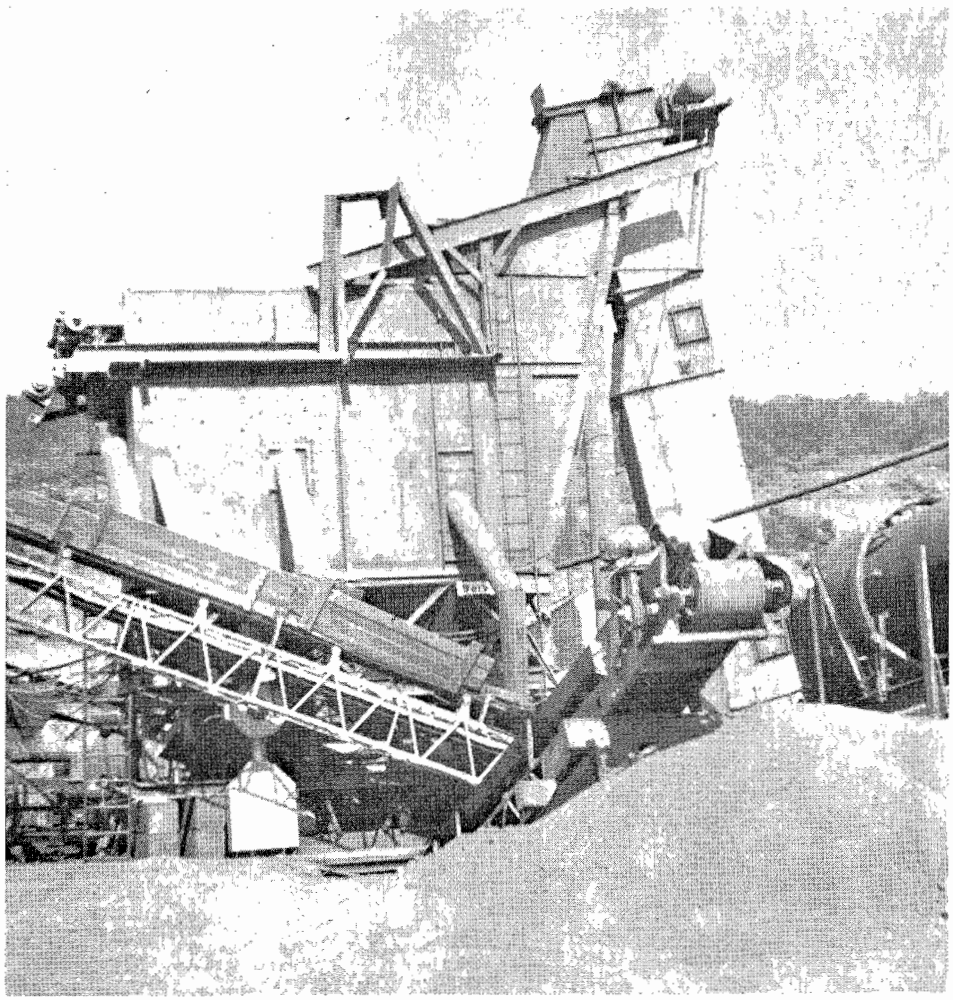
In batch plant mixing one batch at a time is mixed, proportioning being accomplished by weighing out each ingredient of the batch. All ingredients are then dumped into the mixer and mixed. The mixer is then emptied and the process repeated. Gradation control is accomplished by setting the weights desired of each aggregate bin.

In continuous plant operation, mixing is a continual process with unmixed material entering one end of the mixing chamber at the same rate mixed material is leaving the other end. Proportioning is accomplished by allowing the various aggregates to flow from





*Taken from the side opposite the mixer. Note dial scale and the conveyor belt leading from under the four-compartment weighing hopper.*



*ABOVE—Showing arrangement of weighing hopper under the gradation control unit. The control handle visible above and to the right of center is the control for diverting the material from the feed belts to the weighing hopper. It is shown in position to allow the material to go up the bucket conveyor to the mixer. The cleated belt to the left of the dial scale feeds three- and four-bin materials. BELOW—Showing chute arrangement. One chute and one weighing compartment is provided for each bin. The belt in the foreground feeds one- and two-bin materials.*

their reservoir hoppers through gates at a constant rate. Gradation control is achieved by setting these gates on openings which will permit a given weight per unit time to pass from each bin into the mixer. Herein lies the crux of the problem. How is the proper gate setting for each bin to be determined and how may the flow through these gates be checked from time to time as the plant is operating?

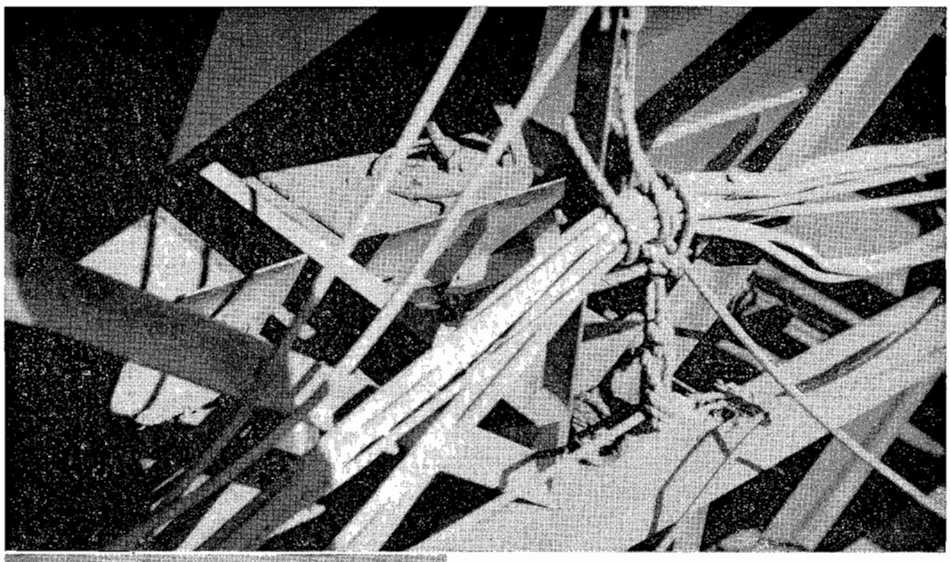
#### Calibration of Gates

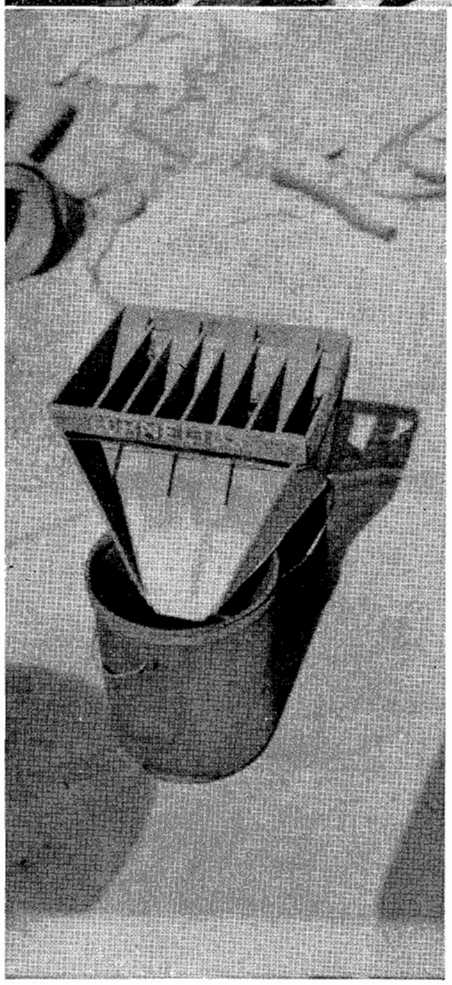
With most mixers of this type the belt or belts which feed the material from the bins through the gates empty directly into the mixing chamber. Hence, the only way to calibrate these gates is to work with one at a time by closing off the others. Calibration is accomplished by setting this gate at various openings, say two, four and six inches, and determining the pounds per feed belt revolution for each setting by running the plant and passing the material through the mixer and thence to weighed trucks. By again weighing the trucks the total weight passed can be determined and the pounds per belt revolution is computed by dividing this figure by the number of revolutions the belt turned during the test. Before making a test the plant must be run for a sufficient length of time to assure the material leaving the plant is identical to that entering through the gate. When three points have been determined for a gate, a graph of output versus gate opening can be made.

This is essentially the method practiced in calibrating the aggregate gates on most continuous mixing plants. It is a costly time-consuming process with other disadvantages. Among these disadvantages, is the difficulty encountered in securing representative samples of the material being drawn from each bin in order to check the screening efficiency. Also, as the grading in each bin may vary from time to time as mentioned above, the weight passing through a given gate may vary for a set opening. Although the total pounds of aggregate per belt revolution can be determined during production the contribution of any one gate is still in doubt.

#### Gradation Control Unit

The manufacturers of continous mixing equipment have provided a gradation control unit as the answer to the problem. Essentially this unit provides means of tapping and diverting to individual large sampling buckets the material from the bins just as it leaves the gates. The buckets can then be moved and weighed. A revolution counter reading to hundredths of a revolution is provided; a refinement made necessary by the relatively small capacity of the buckets. This method provides means of calibrating all gates at the same time and provides opportunity to check each gate's output during production. This also supplies samples of each bin material as desired.



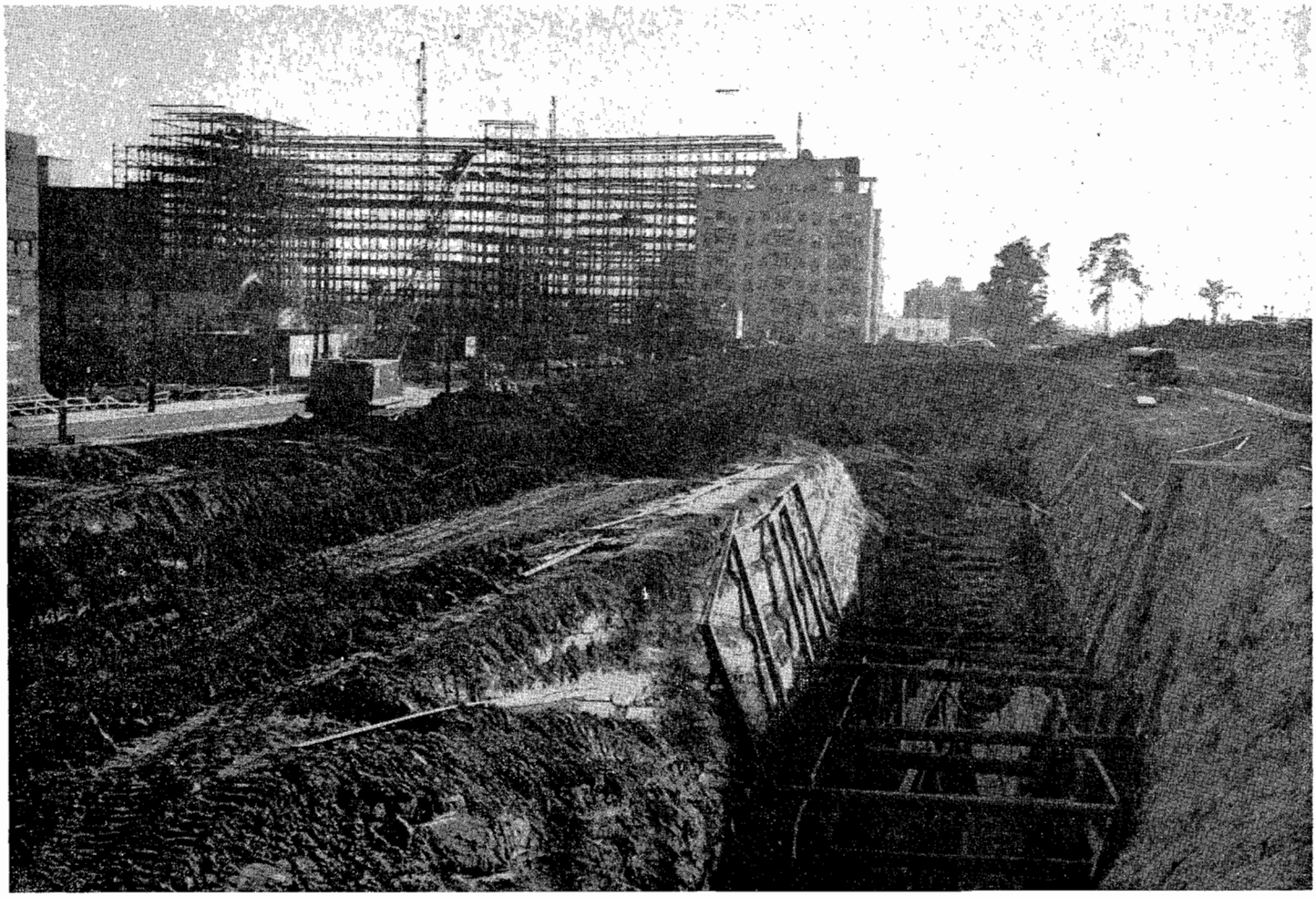


*ABOVE—Showing the control gate for one of the bins (upper center of picture). LEFT—Sample reduction device mentioned in the text's footnote.*

This unit is the big step in securing close control, but it is subject to some criticism. First, it is questionable if one is justified to base production calculations for productions as high as two hundred tons an hour on a short sampling period, normally about three seconds, which includes starting and stopping, even though the revolutions turned can be accurately determined. Second, the buckets must be wrestled from under the unit, the inspector usually being subject to dust and bouncing hot rocks from the reject chutes and belts. This method of control was used in the production of plant-mixed surfacing for the freeway contract between the north city limits of San Diego and Miramar, and provided workable results.

#### Refinement in Method

A more stringent control, however, was desired for the production of asphaltic concrete for the City of San Diego and the Cox Brothers Construction Company made a further refinement in the method. They installed a four-compartment weighing hopper and scales with 10,000-pound capacity under the gradation control unit and



*Looking southerly on Harbor Freeway showing in foreground excavation for east abutment of Sixth Street overcrossing grade separation. To the left is shown the steel framework of the Statler Center Hotel.*

hence replaced the buckets with a much greater capacity more conveniently situated. Each compartment was supplied with a means of emptying, so the weights from each bin could be determined, using but one dial scale. The compartment outlets opened upon a conveyor belt which carried the material up and away from the unit for return to the stockpile. Good samples were readily secured by cross-cutting the outfall of this belt as the individual compartments were emptied. These samples will naturally represent a much larger cross section of each bin.

This new adaptation was used for the first time in the production of plant-mixed surfacing for the state frontage roads between Couts Street and Rosecrans Street on Highway 101 in San Diego. The pounds per revolution as determined by pay scale weights showed agreements consistently within one-half of 1 percent of the pounds per revolution as determined by this control method.

The contractor is to be commended upon this development. He has pointed the way to a thoroughly reliable method of aggregate gradation control on continuous mixing plants.

Footnote: Samples of each bin are usually taken large enough to assure that representative cross section of the bin has been secured. These samples are generally too large for convenient testing and must be reduced to a smaller sample which will still possess all the characteristics of the larger specimen. This reduction is generally accomplished through the use of a quartering canvas. This is a time-consuming task which has lead to the development of devices to facilitate the operation. A photograph of one such device is appended. This simple tool is easily made from wood or sheet metal, and it will readily split samples as the material is windrowed across the vanes.

## Harbor Freeway

*Continued from page 13 . . .*

the southerly terminus at Battery Street in the San Pedro district, is 22.8 miles in length. The total estimated cost is $117,000,000, of which $18,000,000 has been spent or allocated for right of way acquisition and for construction. No estimate can be made as to the time schedule for completion of the entire project because this is dependent upon various factors, one of which is the availability of funds for freeway construction in the Los Angeles area. Present and anticipated allocations of funds indicate that it will be possible for the most northerly portion of the Harbor Freeway from the Hollywood Freeway to 18th Street near Washington Boulevard to be completed and opened to traffic by the end of 1953 or early in 1954.

# In Memoriam

### THOMAS EASTMAN

With the death of Thomas Eastman on January 23, 1951, at Fresno, at the age of 61, the Division of Highways lost a loyal and valuable long-time employee, and his many friends and acquaintances were saddened at his passing, following a heart attack suffered December 28, 1950.

He was a native of Kansas but finished his formal education in engineering at California State Polytechnic College, San Luis Obispo, to which city his parents and family had moved. In 1912 he entered the State Highway Department service in District V working in various capacities, including duties up to resident engineer. In 1926 he accepted employment in District VI out of Fresno, from which time his employment in that district was continuous. During a break in service prior to 1926 for several months he worked for a private engineering firm and was engaged in making location surveys for portions of the Santa Maria to Maricopa Road, now State Highway Route 57.

In District VI, Tom will be chiefly remembered for his work in the District Maintenance Department to which he contributed many novel ideas in adapting equipment to the changing highway maintenance needs, many of which received statewide recognition and adoption.

A son, Major Thomas F. Eastman, U. S. Air Force in Japan and Korea, arrived on January 22d on emergency leave. Other surviving relatives include a sister, Miss Corra F. Eastman of San Luis Obispo, and four brothers—Charles of Los Angeles, Philip of Northfork, Gus of Mariposa and Richard of San Luis Obispo.

# James A. Stauff Earns Retirement

Highway Foreman James A. Stauff will retire on April 30th at the age of 70. He first went to work for the State Division of Highways in March, 1912, as an axman on a survey party. Later in the same year he was promoted to rodman at a salary of $65 per month. During these long past years he worked on the original surveys of what are now some of our most important state highways. One of these was the Ridge Route, where the survey party set the stakes for the first highway contract over the hills.

Jim later worked in Imperial County on a survey party and resigned from state service in 1916 for other employment. Returning to the State in 1918, he worked as sub-foreman at Bostonia in San Diego County. In 1926, he moved to the Los Flores Maintenance Station, near Santa Monica, and worked there until 1933 as Maintenance Foreman. The next 11 years were spent at Ojai in Ventura County, and the past seven years at the Glendora Maintenance Station in Los Angeles County.

Jim was married in August of 1950 and has since purchased a home in Glendora and a new house trailer. After retirement, he plans to enjoy a leisure life in his new home during the winter months and to travel around the country, living in his trailer, during the summer months.

*JAMES A. STAUFF*

The best wishes of the entire department go with Jim upon his well-earned retirement, and we hope that he and Mrs. Stauff will enjoy life for many years to come in their new home and their new trailer.

### LIKES MAGAZINE

Alameda, California

*California Highways and Public Works*
*Sacramento, California*

Gentlemen: I have been receiving your valued publication, *California Highways and Public Works*, for several years and regard it as the most important and interesting of all the publications that I receive. I never delay in reading it from cover to cover. Even do I take trips to see, enjoy and appreciate the highway improvements mentioned therein.

Very truly yours,

Elbridge F. Russell

### THANK YOU

Estherville, Iowa
March 28, 1951

Mr. Kenneth C. Adams, *Editor*
*California Highways and Public Works*
*Sacramento, California.*

Dear Mr. Adams: I wish to commend you on your publication which is the most interesting of any technical publication I receive. From limited freeways to shovel specifications, all is ably and interestingly presented.

My copies are filed for reference and used at various times, and I look forward to each new issue with interest.

Sincerely yours,

Neil K. Brown

# Weed Control

## *Soil Sterilization to Limit Fire Hazard Is Proving Successful*

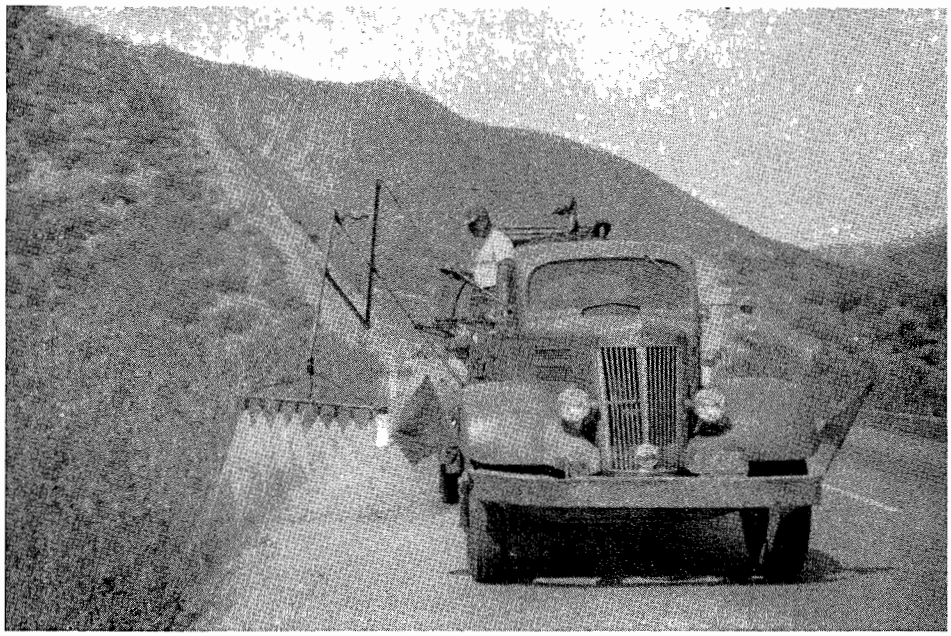
By HAROLD M. BARNES, Highway Superintendent, District VIII

Soil sterilization by use of a solution consisting of 25 percent sodium chlorate and 75 percent borax has been used in District VIII, San Bernardino and Riverside Counties, for fire hazard weed control since the 1949 season. Thirty tons of the soil sterilization agent have been applied each season under a progressive program, based on the assumption that two successive seasonal treatments would provide sufficient sterilization of the soil so that only spot treatment would be required the third year. The results have permitted an increase in the total mileage treated this season.

Since the treatment has been satisfactory, it is anticipated that the mileage can be increased again next season without increasing the amount of material used per year. The seasonal rainfall has been subnormal during the past three years, however, the treatment appears to be just as effective at the higher elevations, where the precipitation is greater, as at the lower elevations.

### Materials Satisfactory

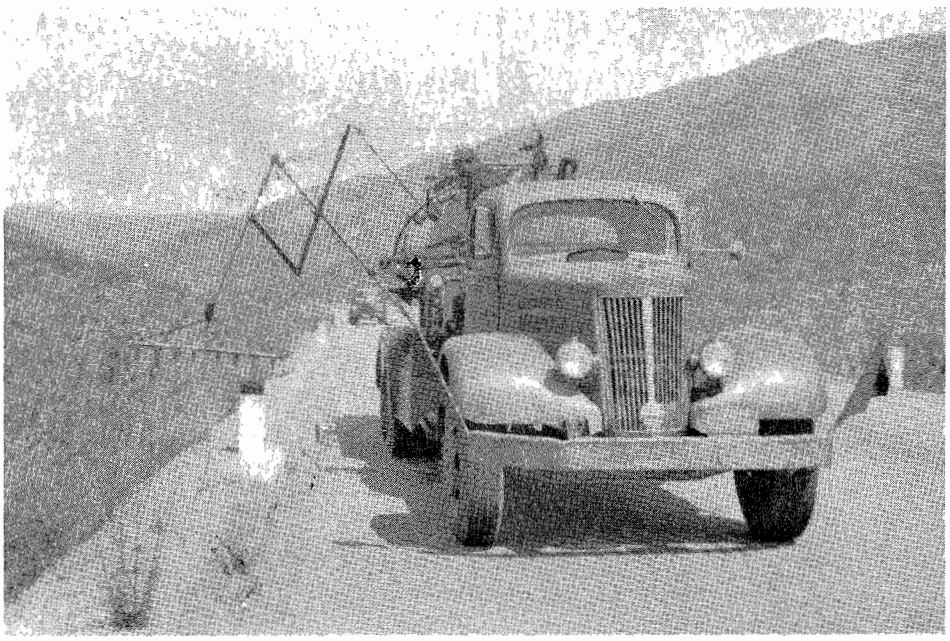
The blended chemical materials have been satisfactory both in regard to application and results. The material is packaged in paper bags, 100 pounds per unit. Spraying should be done early in the year and completed before the growing season is hardly begun. This allows the use of the spraying equipment during the off season when it is not needed for oil spraying or watering of trees. The single application per season has the advantage over petroleum sprays in which retreatment is necessary as the season advances and new growth starts. Spraying at this season eliminates fine grass and weed tinder under brush. The brush will die and the leaves and smaller portions will blow off before fire season, in most instances leaving the brush much less inflammable than when green.



*City Creek highway. Second seasonal application at top of fill slope.*

The spraying equipment used consists essentially of a three-axle, 2,000-gallon capacity tank truck with an internal agitator and a one-inch pump.

*City Creek highway. Showing results of single seasonal applicational at beginning of second season.*

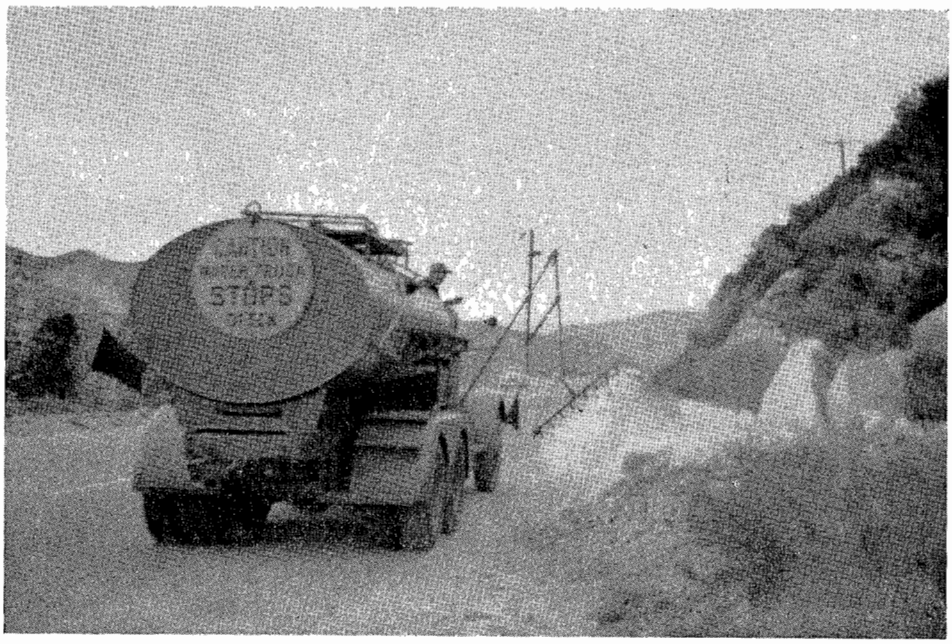


The agitator and pump are powered by a two cylinder air-cooled engine. The power is transmitted through a unit with a main clutch and separate dog clutches so that the agitator and pump can be operated simultaneously or seperately as desired. The engine is equipped with a tachometer and an adjustable governor. The truck engine is also equipped with a tachometer to allow control of the rate of application. A pressure gauge is provided on the pressure side of the pump. The spray bar is side mounted with an arrangement of swivel joints, pulleys and springs which gives the operator complete control of its position. The bar is mounted behind the cab on the right side, and a platform is provided for the operator between the cab and the auxiliary engine. The bar can be raised, lowered, extended out, pulled in, or tipped by means of ropes running through pulleys. By this mechanism striking obstructions such as signs and posts is avoided and the reach kept parallel to the area to be sprayed, whether it is a cut slope, fill slope, berm or ditch. No harm is done if the bar should strike an obstruction as it is held in position fore and aft with springs which return it to a normal position.

The spray bar itself is a little over four feet long, equipped with eight Vee Jet spray tips, and sprays a six foot width evenly. The gauge registers 35 pounds per square inch pressure while spraying. Any obstruction in the tips or of the intake screen causes the gauge reading to vary. Handrails and a platform are provided on the tank with adjustable safety rails around the platform. The dome on the tank has a small hinged inspection cover in a large hinged cover. The large opening is used in recharging.

#### Light Truck Used

A light truck is used in the operation to haul a supply of material. This truck has red flags, and a "Watch for Equipment" sign displayed on the left rear of the truck. It follows the tank truck at an interval of three to five hundred feet or more, depending on the alignment or traffic conditions. The material truck is usually kept in a position well to the right of the roadway and is stopped while the slow moving tank truck is working around a curve or at a location where sight distance is limited. The tanker is recharged in the field wherever water is available, using material hauled on the light truck.




*North of San Bernardino, State Route 31. Difficult location for hand hoeing or grading. Is easily accessible for spraying.*

#### Duties of Crew

The crew consists of the tank truck driver, spray bar operator and auxiliary truck driver. Their duties, in addition to spraying, are maintaining the warning signs as mentioned above, flagging traffic where required, recharging the tank, cleaning and flushing the tank after each day's run, and servicing the equipment.

Water is started flowing into the tank and the blended chemicals added with the agitator operating. Foaming occurs when some mineralized water is used. The foaming can be controlled by adding five gallons, or less, of kerosene or gasoline. The strongest practical solution has been found to be 2,600 pounds of blended chemicals in the 2,000-gallon tank. The tank is filled to the top after all the blended chemicals are in and foaming of the material if any has been controlled. The above amount of material will be completely dissolved when properly agitated and no undissolved residue will be left in the tank when the liquid has been exhausted.

In general, the solution is applied at the rate of one-sixth gallon per square yard of surface. This may have to be reduced on heavy soils, particularly, if there is considerable moisture in the soil. This rate conforms with the recommendation of the manufacturer printed on the bags. An average of about two or three 2,000 gallon loads per day is applied, depending, of course, on availability of water, distance to job, and continuity of the areas to be sprayed.

The cost of the blended chemicals this season, including tax and freight, was approximately $0.0732 per pound. The average total cost, including material, labor, equipment rental, operation costs, and supervision per six-foot width of treatment was approximately $75 per mile.

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### ERRATUM

On page 11 of the January-February issue of this magazine the captions under Fig. 5 and Fig. 6 accompanying the article on sign legibility were transposed. The caption "Lower case, night" belongs under the right-hand center drawing, and the caption "Capitals, night" belongs under the left-hand, center drawing.

## Prestressed Bridge

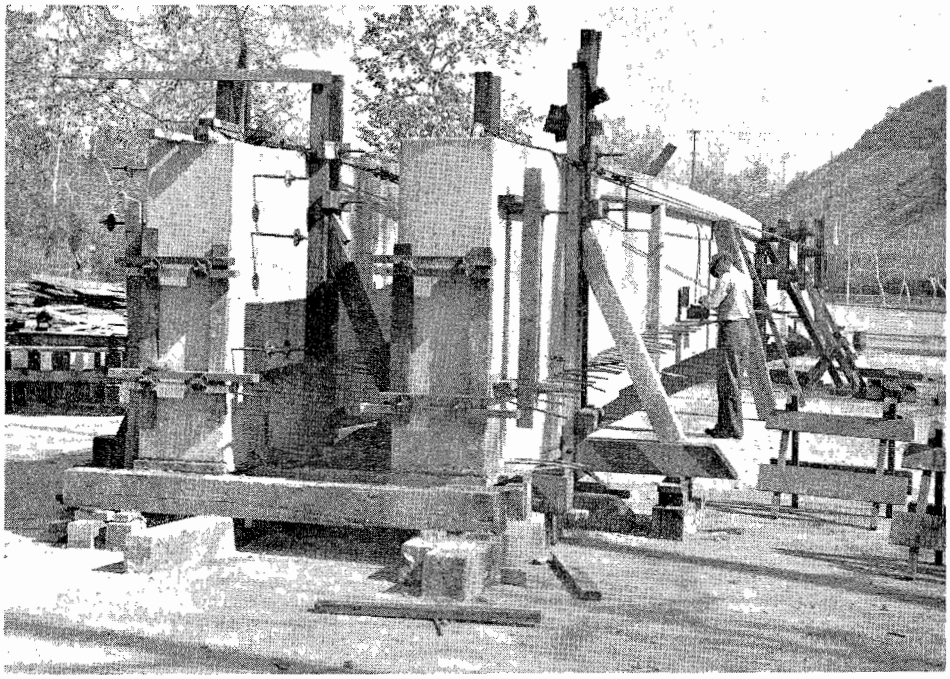
*Continued from page 5 . . .*

In order that designers may learn whether or not their design assumptions were valid, a testing program is being undertaken by the University of California's Institute of Traffic and Transportation, in cooperation with the Division of Highways. Electrical resistance strain gauges embedded in the concrete will permit the actual stresses in the concrete to be determined at various points under different loadings.

**Walter Kaucher, Contractor**

The contractor on the bridge was Walter Kaucher of Los Angeles. The Prestressed Concrete Corporation of Kansas City, Missouri, furnished the high-tensile wire and performed all prestressing operations as a subcontract. The bridge was designed by W. J. Jurkovich, Associate Bridge Engineer (now on military leave in Alaska), under the direction of F. W. Panhorst, Assistant State Highway Engineer—Bridges. Jack Sylvester was Resident Engineer on the project for the Bridge Department. The cost of the project, not including engineering, was slightly under $24,000.

*Completed girders ready for hoisting. Resident Engineer taking strain gage readings. Anchorages encased in concrete.*



## Bayshore Highway to Be Freeway

The California Highway Commission has taken preliminary action toward establishment of a portion of the Bayshore Highway as a freeway on new location between Fourth Street and 13th Street in San Jose. The commission requested State Highway Engineer G. T. McCoy to ascertain if the officials of the City of San Jose and the County of Santa Clara desire any further information prior to final action of the commission. This procedure in establishment of freeways has been followed by the Highway Commission since 1948.

The proposed relocation of this portion of the Bayshore Highway is a part of the program to develop it to freeway standards, with structures to carry cross traffic at separate grades and with full control of access. Initial improvement as a four-lane divided freeway is proposed, with provision for ultimate development of six traffic lanes.

After final agreement is reached on the proposed routing, preparation of detail plans will be ordered by the California Highway Commission so that purchase of rights of way and construction may be undertaken when funds become available.

The development of the Bayshore Highway is a problem of primary importance to the San Francisco Bay region and to motorists from other parts of California. The planning has required close cooperation between city, county, and state authorities.

**FROM DR. MOYER**

UNIVERSITY OF CALIFORNIA
Institute of Transportation and Traffic Engineering
*Headquarters:* Berkeley 4, California

*Mr. Kenneth C. Adams, Editor*
*California Highways and Public Works*
*Sacramento, California*

DEAR MR. ADAMS: I am enclosing your post card indicating that I wish to continue to receive the California Highway Magazine.

Permit me to take this occasion to commend you and the Division of Highways on the high quality of your magazine. I consider it to be one of the best references which I have been using continually in my teaching and research work in highway engineering at Iowa State College and at the University of California during the past 15 years. The articles are written in an interesting style, are well illustrated, and are highly informative in regard to all the latest highway developments in California.

I shall look forward with pleasure to receiving future copies of *California Highways.*

Yours very truly,

RALPH A. MOYER
Professor of Civil Engineering and Research Engineer, Institute of Transportation and Traffic Engineering

# Westlake Community

## *Excellent Example of Cooperative Planning*

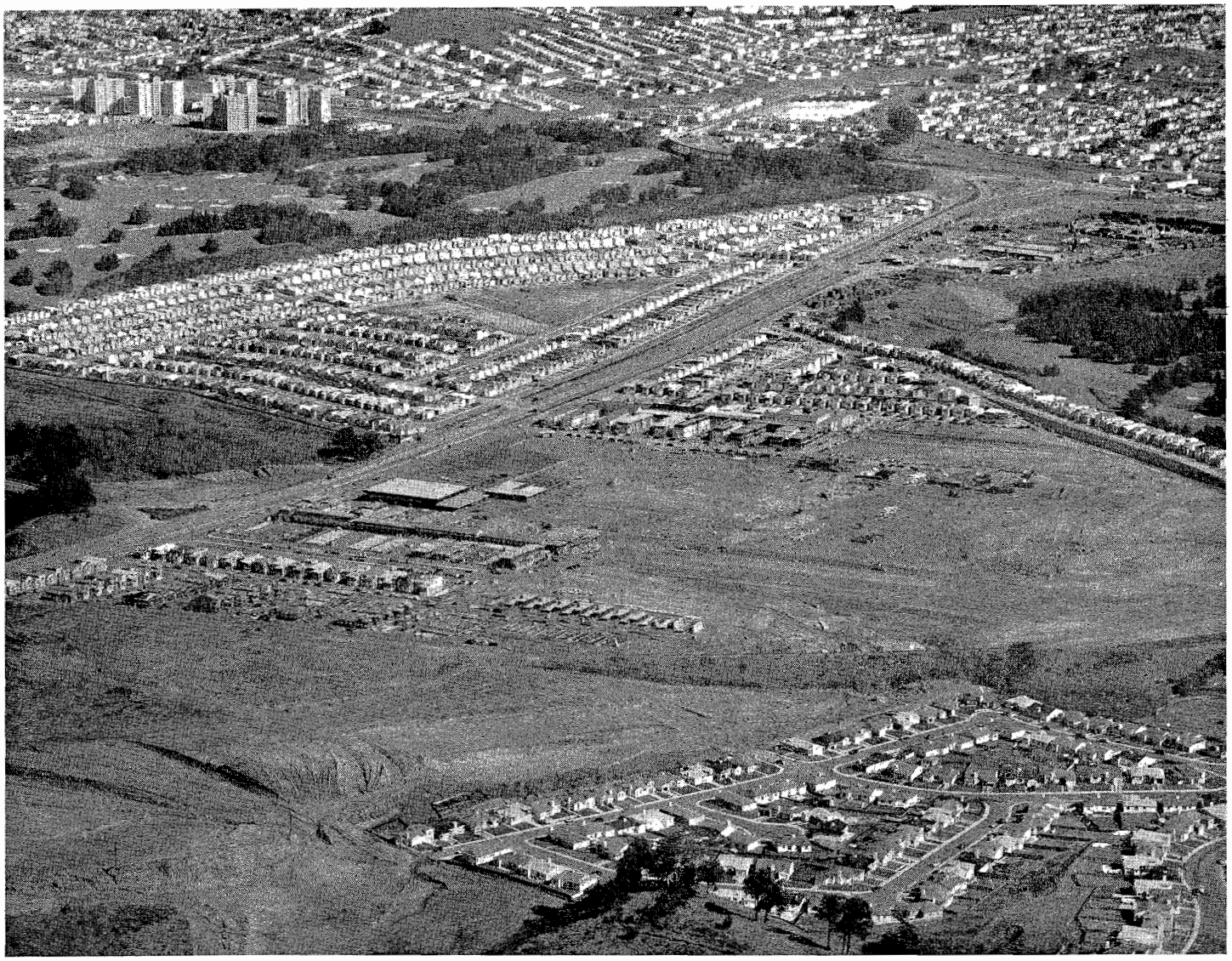
By GEO. S. PINGRY, Assistant Chief Right of Way Agent

WESTLAKE Town and Country Community is an excellent example of modern residential and shopping area planning. This development lies on both sides of State Highway Sign Route 1 immediately south of the San Francisco city limits line and connects Junipero Serra in Daly City with Skyline Boulevard. When construction on this highway was completed in the fall of 1935 the adjacent lands were used for truck gardening.

It is interesting to drive over this highway today and note the transition from truck gardening to a thriving community, due to the efforts of Henry Doelger, a far-sighted builder and subdivider. He has accomplished this transition by building an organization that is doing all things necessary for the creation of this community including the planning and building of 8,000 homes, a $25,000,000 shopping center and a 1,100 unit country club apartment on an area of 1,000 acres. The steps involved in carrying out the project range from the moving of 12,000,000 cubic yards of earth for the developing of pleasing land contours to the

... Continued on page 31

*This aerial photograph shows the scientific development of the Westlake Town and Country Community just south of the San Francisco city limits*



# THIS BUSINESS GREATLY BENEFITED BY EXPRESSWAY

### By RUDOLF HESS, Headquarters Right of Way Agent

LETTERS like the one received from Mr. George M. Siggins of Ripon, California, who operates a fruit and vegetable stand on U. S. Highway 99, approximately 18 miles south of Stockton, are very gratifying to the Division of Highways because they prove that the many benefits of expressway construction to the traveling public and to roadside businesses are not lost to the small highway businessman.

Mr. Siggins has written as follows:

"I am writing you this letter in regard to the four-lane expressway through Ripon. At the time the highway was being built, I was afraid that it was going to hurt my business, but I have found that I am doing more business than when the highway was only two-lane.

"Last night a car stopped at my business, and the people remarked that they had seen my display while driving south, and decided to stop on the way back. It seems that people driving on a four-lane highway have more of a chance to look around, since there are no cars coming towards them.

"I have been in business on a two-lane highway for 12 years, and on a four-lane highway for more than three years. During the time while on the two-lane highway I noticed that traffic was so heavy that southbound cars could not cross the highway, and northbound cars didn't want to break line.

"It is my feeling that the four-lane highway is much better for business than the two-lane highway."

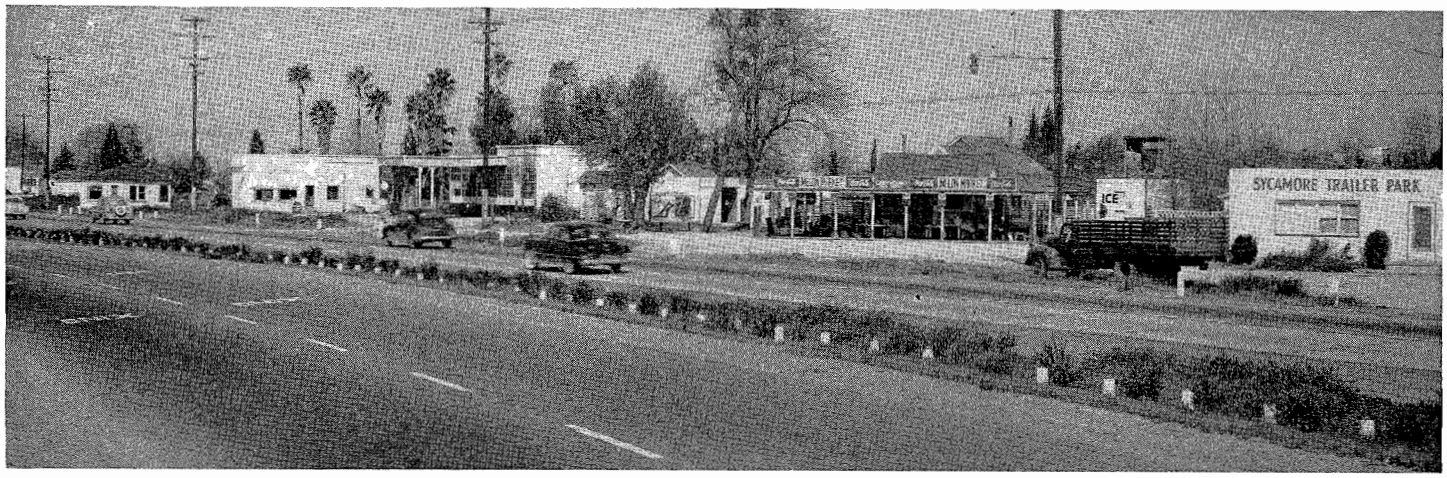
Since our Land Economics Section has been making use of retail sales tax returns to the State Board of Equalization to determine the effects of access limitation on abutting businesses in various locations throughout the State, we took the liberty of analyzing the sales tax returns reported by Mr. Siggins during the past six years.

In view of the fact that the single ownership of this business and the uniform management practices over the period of many years establish the highway improvement as the predominate business influence, the actual gross volume comparison of the three years since the opening of the expressway to the three years immediately preceding its opening is particularly significant.

Since the expressway was completed in August of 1947, Mr. Siggins has enjoyed a business volume averaging 52.5 percent per year above the average he transacted along the conventional highway.

It is interesting to note that at the time construction of the highway to expressway standards was proposed, Mr. Siggins, like many other businessmen along this section, was very much opposed to the access limitation and the installation of a central division strip separating the opposing lanes of traffic. They expected this installation to reduce their business drastically by limiting patronage to traffic in one direction only.

We thank Mr. Siggins for recognizing the interest that the Division of Highways has in the effects of the limiting of access and the installation of central division strips on roadside businesses. Such information is very useful in answering the many inquiries received from areas where future freeways are contemplated.




*View of section of four-lane divided expressway through Ripon in San Joaquin County*

## Arnold Highway

*Continued from page 20 . . .*

Sacramento is 2.6 miles in length. The structural section provided four lanes of concrete pavement on cement stabilized base. The previous narrow two-lane road through this area, with its sharp turns and steep grades, acted as a serious bottleneck to the smooth flow of traffic.

# HARRY C. DARLING RETIRES AFTER 38 YEARS OF STATE SERVICE

AFTER 38 years of service with the Division of Highways, Harry C. Darling, Senior Highway Engineer, District IV, retired on March 1, 1951. He immediately left on a trip to the great southwest in order to indulge in his favorite hobby of photography in the colorful desert region.

Harry Darling embarked on a civil engineering career in 1904. Between the years of 1904 and 1912, he alternately pursued his engineering courses at the University of California and various field engineering assignments with which he furthered his education at the university. He completed his college work in 1912.

Harry's service with the division began on February 15, 1912, when he reported for duty in District III under Walter C. Howe, District Engineer, as instrumentman on surveys north of Sacramento. He became chief of party shortly afterwards.

From 1914 to 1916, he was assigned to construction projects in District III.

From August, 1917, to March, 1919, he served in World War I as a first lieutenant in the Engineers, U. S. Army, spending a year of that period in France. Upon his return from service, he again reported for duty in District III and was in charge of location surveys. He was also in charge of construction work in the Truckee River area, serving as Resident Engineer.

*HARRY C. DARLING*

In 1925 he transferred to District IV and for 25 years has been in charge of highway location in this district. During that period he has successfully met the challenge offered by the many complex problems of modern highway location, and the many outstanding highways of this district are testimony to his skill as a locating engineer.

Harry's many friends within the district will always remember and appreciate his years of unselfish devotion to duty and his sympathetic regard for the welfare of his coworkers.

At a party held in Harry's honor on February 23d in San Francisco, approximately 100 fellow employees gathered to tender their best wishes upon the occasion of his retirement. He was presented with a movie camera projector and other accessories calculated to assist him in pleasantly pursuing his hobby of photography, which he has been fervently anticipating for some time and which a well-earned retirement will now make possible for him to enjoy.

*Harry Darling, seated right, with Division of Highways survey crew near Dunnigan, Yolo County, in 1914*

## Westlake Community

*Continued from page 29 . . .*

installation of finish hardware in the buildings.

**Transportation Problem**

In the initial stages of planning a community of this size one of the first problems is that of transportation. The basic fact is that a community cannot live and prosper without a convenient, safe and uninterrupted method of transportation.

In the solution of this problem one fact is paramount: That the prospective occupants of the community, along with other Californians, will use mass transportation only as a last resort. It follows that the answer to the problem is to plan the use of the property adjacent to the highway in such a manner that it will not diminish in any degree the capacity of the highway to handle through traffic. With this thought in mind it becomes clear that allowing direct access to the highway from the abutting properties requires the highway to perform the duties of a city

*. . . Continued on page 33*

# Grant Line Road

## *Reconstruction of San Joaquin County Route Big Improvement*

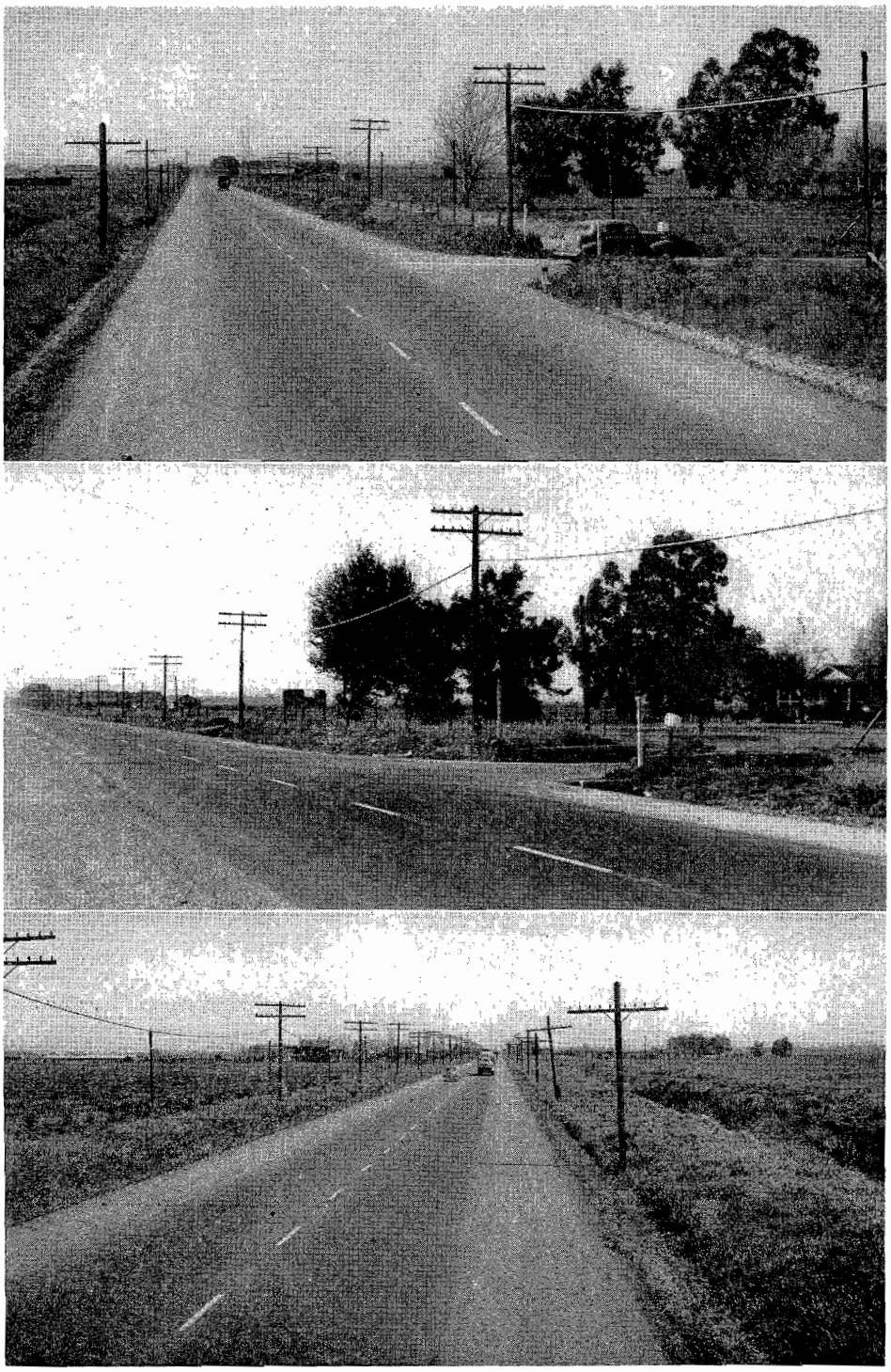
By CLEMENT A. PLECARPO, Resident Engineer, San Joaquin County Highway Department

On October 20, 1950, Grant Line Road, Federal Aid Secondary Route 908, between U. S. 5 northwest of Tracy and the Holly Sugar Company Spur, was reopened to traffic. The road had been closed to through traffic since June 21, 1950, to allow for complete reconstruction by the county with Federal Aid Secondary and county funds.

The plans, specifications and estimate for the project were prepared and all engineering work was done by San Joaquin County Highway Department engineering forces under the supervision of Julius B. Manthey, County Road Commissioner, and Clyde V. Jones, Deputy County Road Commissioner. The author was Resident Engineer and Elmo Ward was Assistant Resident Engineer.

The work was done under a contract to P. J. Moore & Son of Sacramento at a cost of $104,624.55, exclusive of construction engineering.

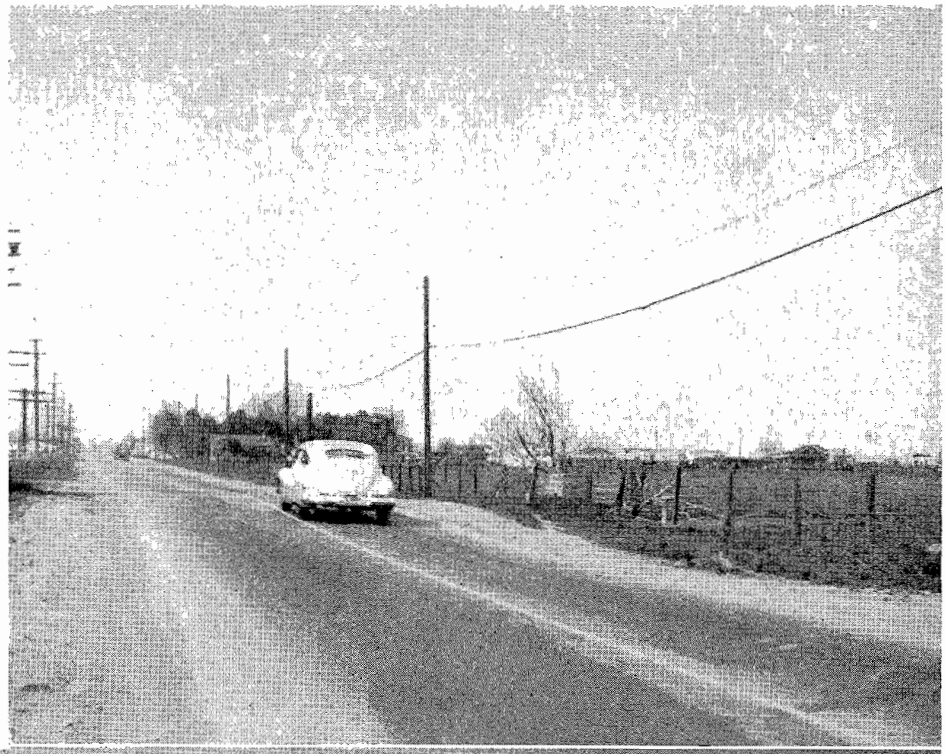
Grant Line Road, a county road, begins at the westerly end of the divided section of U. S. 50 northeast of Tracy and runs westerly, by-passing the City of Tracy, to a connection with U. S. 50 northwest of Tracy. The traveled way, prior to reconstruction, was in very poor condition. The pavement was narrow and had an excessive crown and the shoulders were in poor condition. Traffic counts indicated that even with the poor riding conditions more than 4,000 passenger cars and trucks used the road daily. A large portion of this traffic is generated by those drivers desiring to by-pass Tracy.

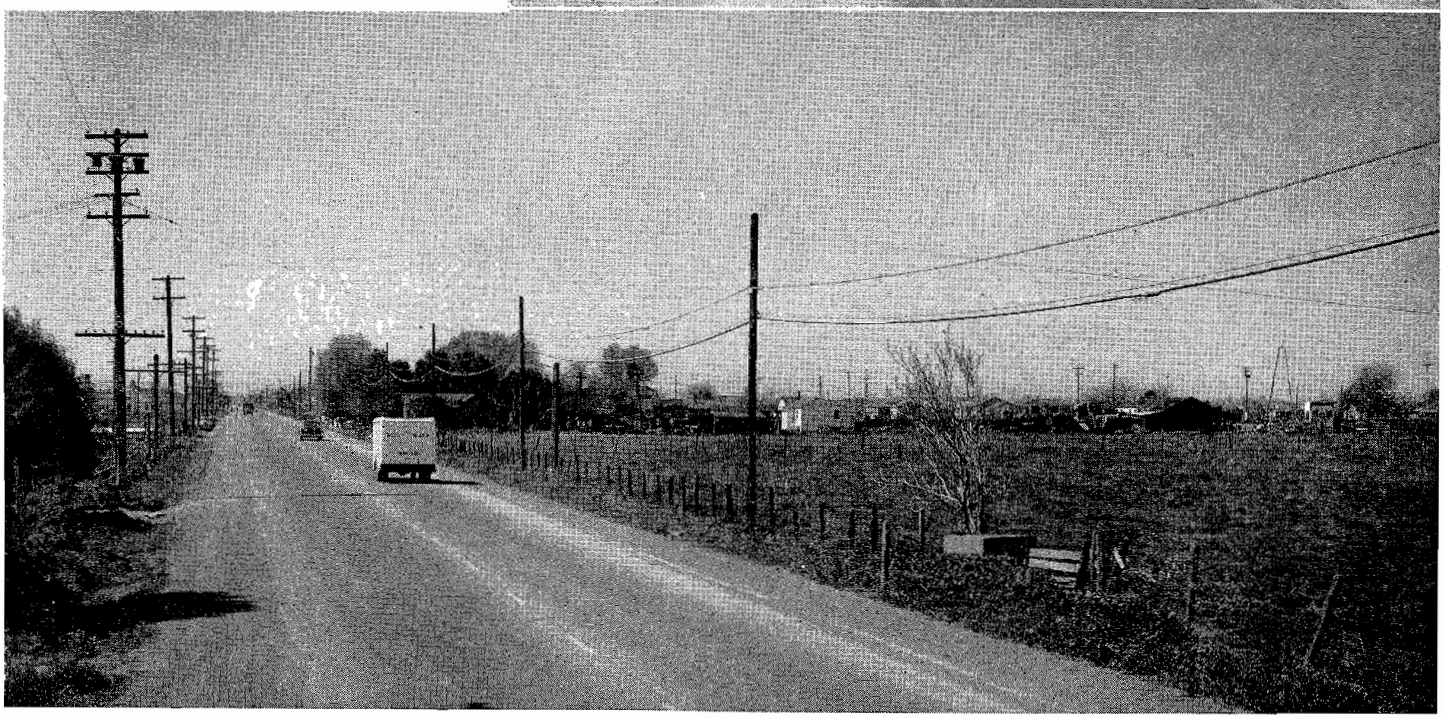


*UPPER—Grant Line Road looking west from Fremont Road after improvement. CENTER—Same section of road before improvement. BOTTOM—New Grant Line Road looking east from Fremont Road.*

The road, as reconstructed, consists of a graded roadbed 38 feet wide, an untreated rock base having a minimum thickness of six inches and a width of 24 feet, and a plant-mixed bituminous surface three inches in thickness and 22 feet in width. Untreated rock shoulders with a Class "C-Medium" seal coat were constructed eight feet in width by four inches in thickness over "high-bearing" imported borrow.

Although the entire road is nearly seven miles in length, only the 3.72-mile westerly section was reconstructed inasmuch as the easterly portion was in better condition and because sufficient funds were not available. It is anticipated that when additional funds are available, the balance of the road will be reconstructed.





*LOWER—Section of Grant Line Road looking west after improvement. RIGHT—Same section before improvement.*

# Westlake Community

*Continued from page 31 . . .*

street, and thereby reduces its potential as a traffic artery. This condition will be created whether the abutting use is residential or commercial but, of course, is greatly accelerated if commercial.

**Frontage Road Effective**

It was Mr. Doelger's considered opinion after thorough study that the most effective way to control access was by the construction of a frontage road. In this manner the efficiency and life of the highway could be preserved, by the elimination of the possibility of conflicting traffic movements, and the reductions of potential congestion, accidents and driving hazards. In addition, the esthetic appearance of the entire community in approaching from the highway would be immensely improved and guaranteed for all time. Besides the immediate benefits in the protection of the highway, the safety

*. . . Continued on page 37*

# Pacheco Pass

## *Portions of Historic Road Realigned To Meet Important Industrial Needs*

By G. W. LEVIER, Resident Engineer

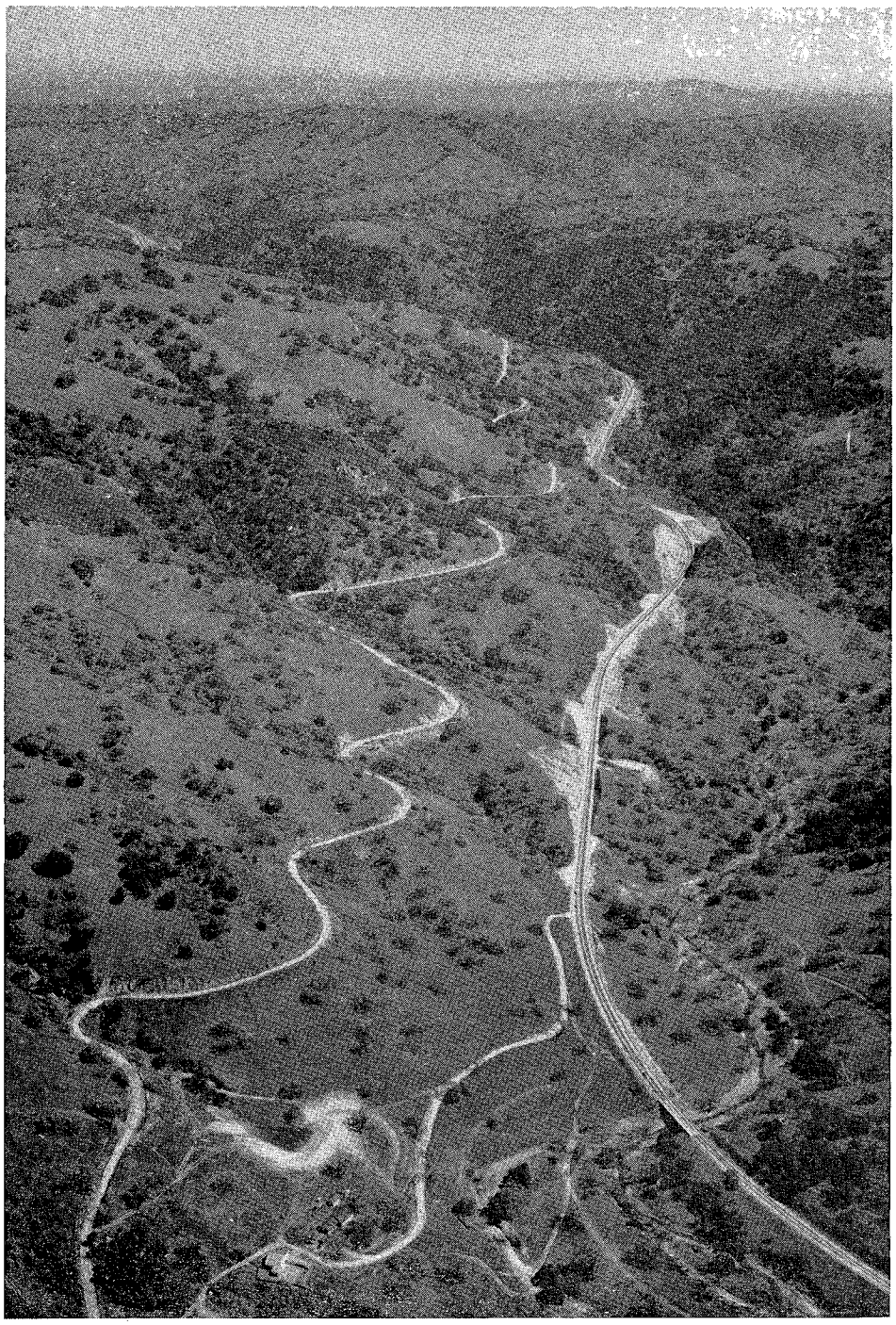
STATE Sign Route 152 is a highway which negotiates one of the few passes through the coast range of mountains separating the Santa Clara and San Joaquin Valleys; its destiny is therefore fixed as one of the important highways, especially in regard to industrial service.

The Indian trail that led through this pass was the one most used by the San Joaquin Indians in going to and from the coast. It was first explored by Lieutenant Gabriel Moraga in 1805 on his way to the San Joaquin Valley in search for new mission sites. It later became known as Pacheco's Pass through the acquisition of extensive land grants throughout the length of the pass by Don Francisco Pacheco. It was first traversed by a road in 1857, when Andrew D. Firebaugh constructed a toll road in order to bring patronage to his ferry. Over this toll road, from 1858 to 1860 ran the Butterfield Overland stages in their long journey from San Francisco to St. Louis, Missouri.

In October, 1858, a Butterfield Overland Stage coach delivered the first United States mail in San Francisco over the overland route from St. Louis. The trip required 23 days, 23 hours and a half. From southern California, Butterfield mail coaches followed a route up the San Joaquin Valley to Fresno City, thence to Firebaugh's Ferry over the Pacheco Pass to Gilroy, thence to San Jose and up the peninsula to San Francisco.

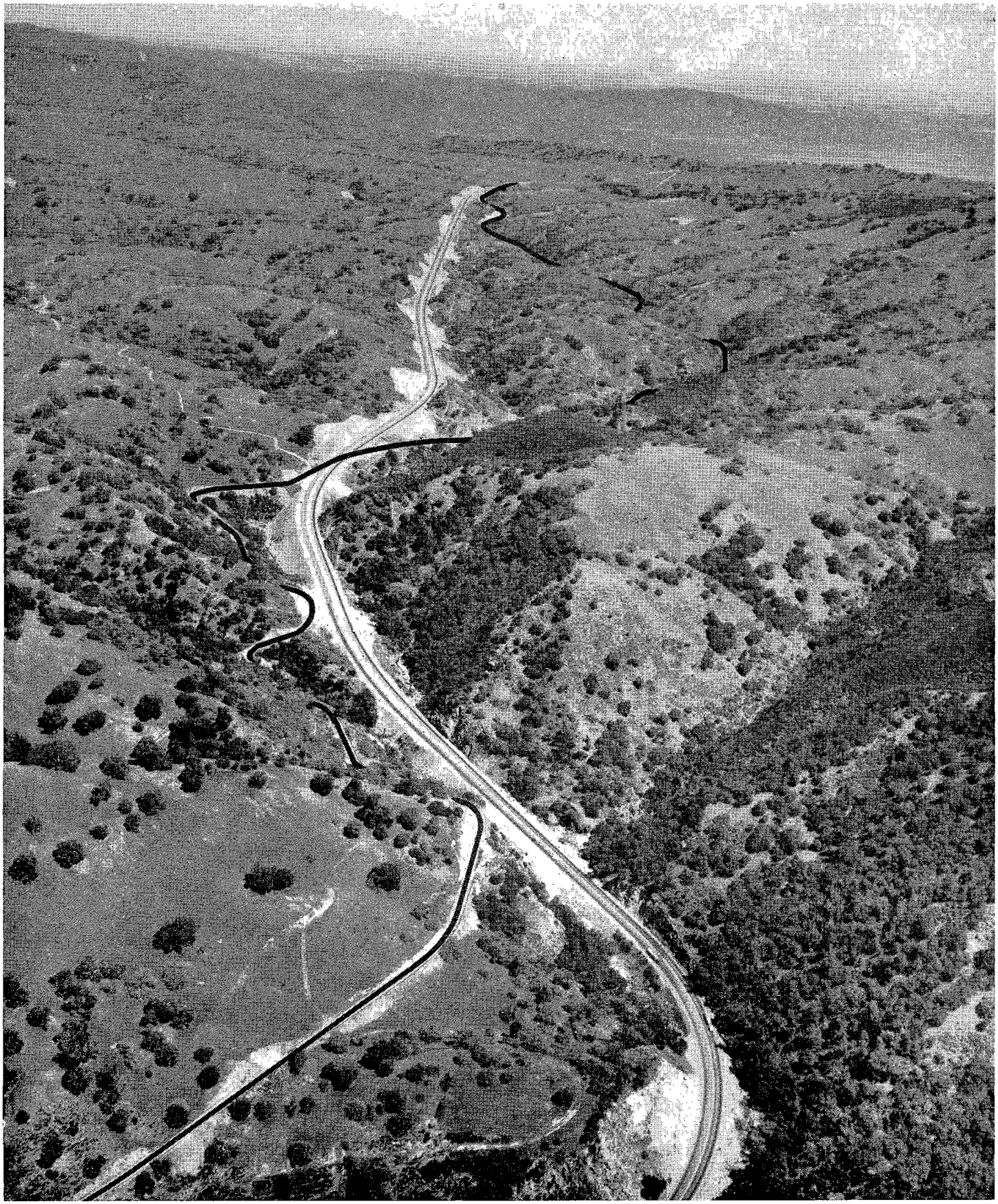
Joaquin Murietta, legendary bandit, had a favorite hideout on the Rancho San Luis Gonzaga on the San Joaquin Valley side of Pacheco pass. He probably used the pass as he was very active in Salinas and this was the main route over the mountains.

Another bandit, Tiburcio Vasquez, used the pass too. For some time he had headquarters in San Benito County. He was active on both sides of the mountains.



*Adjoining section of previous construction on Pacheco Pass Highway with the new alignment on right and the old roadway on left*

*This aerial photograph shows benching of cuts and embankment toe protection on new highway*



*This aerial view of Pacheco Pass Highway shows the contrast between the new construction and old alignment which is marked in ink*

### Dates Back to 1879

In 1879 the Counties of Santa Clara and Merced purchased the "Old Grade," Firebaugh's toll road, constructed a new road and declared it a public highway. This route was made a part of the State Highway System along with the Bond Issue Act of 1915.

In 1923 the State constructed the third road through this pass, known as the "Yosemite-to-the-Sea" highway.

In May, 1949, that portion of this route from the Merced County line to one mile east of Bell Station was declared a freeway by action of the California Highway Commission. With the letting of Contract 1-4TC94F in October, 1949, to the contracting firm of Eaton and Smith of San Francisco, a section of new highway of modern freeway design was brought to this historic route.

This contract provides for the improvement of a portion of this road between Cape Horn and the Merced County line, a distance of 3.26 miles on a new alignment departing a maximum of 1,800 feet from the old road. A combination of narrow roadbed, numerous sharp curves, and gradients as steep as 7 percent had rendered the old section obsolete. Slow moving vehicles such as trucks ascending and descending the steep grades, where passing sight distance was not available, caused considerable congestion and created potential accident hazards. The military value of the road was demonstrated by the large volume of military traffic using this facility during the last war.

### New Road Modern Design

The new road is of modern design, consisting of a four-lane divided section paved with three inches of plant-mixed surfacing on six inches of cement-treated base over 15 inches of selected material. The total width is 74 feet between shoulder points, comprised of a six-foot division strip with raised bars, and 26 feet of pavement and an eight-foot paved shoulder on each side. Plant-mixed dikes were constructed on the fill sections and plant-mixed gutters through the cuts to control surface drainage.

The topography in this vicinity is generally mountainous, some of the cuts and fills being over 80 feet in height. There is a difference of 328 feet in elevations within the limits of the project, 750,000 cubic yards of excavation being required to perform the roadway grading which was of a rocky nature. The higher cuts were benched at varying heights of 39 feet to 48 feet above profile grade as protection against future slides. By judicious use of blasting methods, no overbreak occurred and all rock cut slopes are uniform.

A widened area was provided left and right of the road at the summit near the easterly end of the project where trucks can pull off the road for mechanical inspection prior to descending the sustained grades on either side of the mountain range.

It required 30,000 cubic yards of channel excavation to redirect the run-off of the main watershed, a branch of the South Fork of Pacheco Creek, and its tributaries. This is a section of heavy run-offs due to the steep natural slopes and sparse vegetation.

The structure work on the contract consisted of extending reinforced concrete arches to pass the main tributary of the South Fork of Pacheco Creek as it meanders across the road at the beginning of the project. There were also two 10-foot x 10-foot cattle passes constructed under this work item to serve the cattle ranges on both sides of the road.

The surfacing and base materials were produced by subcontractors Clements and Company of Hayward from the gravel in Pacheco Creek, about five miles west of the job site. The total quantities required for the work were 38,000 tons of imported base material, which was cement-treated by road-mixing methods, and 23,000 tons of aggregate for plant-mixed surfacing which was mixed at this site in the subcontractor's 3,000-pound asphalt plant.

The contract, in the amount of $888,192.90, was awarded on October 28, 1949. Work started on the project on November 3, 1949, and proceeded normally with an estimated completion date of about December 31, 1950.

The work is financed by gas tax and Federal Aid funds, and is being constructed under the general supervision of Assistant State Highway Engineer Jno. H. Skeggs, with the author as Resident Engineer.

## Westlake Community

*Continued from page 33 . . .*

and convenience to the motorist, and the esthetic appearance, the contributing effect towards the retention of real estate values over an extended period of time more than offsets any possible additional expense in the original installation.

### Shopping Needs Served

The accompanying photograph depicts a portion of the residential area now under construction and clearly shows the first completed section of 2,835 feet of frontage road on the north side of the highway and the 4,185 feet on the south side. The development when completed will provide frontage road over the entire length between Junipero Serra and Skyline Boulevard, a distance of one and one-half miles, with the allowance of only four openings to the through lanes of traffic.

To provide for the shopping needs of the area an intergraded retail center is being built at a location sufficiently removed from the highway to allow adequate customer parking and controlled shopper circulation. This discarding of the Main Street pattern of retail business development in itself contributes greatly to the protection of the highway.

Mr. Doelger has exhibited a clear conception of the economics involved in highway planning and construction and has been extremely cooperative with the Division of Highways in its effort, by the control of access, to protect the investment of the people of California in their highway system.

### BABY SHOES

Junior's baby shoes or other objects may be a precious memento, but they are out of place dangling from the rear-view mirror of your car. Present-day driving is hazardous enough without intentionally adding to the danger, warns the California State Automobile Association.

**HALF DOME**

Thousands of amateur and professional photographers have taken pictures of the famous Half Dome in Yosemite Valley. *California Highways and Public Works* considers the one herewith reproduced, which was taken by Paul Dunckhorst, Assistant Bridge Engineer, Division of Highways, one of the most striking.

"The clouds had been closing in on the valley during the late afternoon, and while driving along we noticed that the lights and shadows playing on Half Dome suggested interesting possibilities," Dunckhorst said.

"I set up my camera near the bank of the Merced River and waited a half hour. The photo was made early in June at 5.30 p.m. with 4 x 5 Speed Graphic; 135 mm. Optar lens with G filter on Isopan."

## Awarded Silver Star

Chief Warrant Officer Russell J. Waggoner, automobile mechanic on leave from District IV of the Division of Highways, has been awarded the Silver Star for service at the front in Korea.

Waggoner received the Silver Star, fourth highest U. S. service medal, for "conspicuous gallantry in action against an armed enemy * * *" The citation states that his actions contributed materially to the successful breakthrough of United Nations troops in the Chosin Reservoir area. He is serving with the First Marine Division. Waggoner's wife, Ela, and their two children live at 198 Boye Road, Concord.

**SLOW IN SCHOOL ZONES**

Always obey the signs that warn of a school zone. Many school crossings are patrolled by police, as well as School Safety Patrols, but it is impossible to have an officer at every intersection. Be especially careful at school crossings and cooperate with the School Safety Patrols.

# Bonner Grade

## *Historic Road in Modoc County Rapidly Being Modernized*

By H. H. HOOVER, Associate Highway Engineer

CULMINATING over a century of road building, a modern high-speed highway over the Warner Range is at last a reality. This range was a principal barrier to the northern route of the Emigrant Trail which followed across northern Nevada, over the Warners, and down to the upper Sacramento Valley at Vina, near Red Bluff. This route was used extensively in 1849 by the gold seekers.

The Warner Range has the distinction of being a secondary continental divide as the west slope drains into the Pacific Ocean while the run-off from the east slope flows into undrained desert basins and evaporates.

Surprise Valley in eastern Modoc County, on the east slope of the Warners was settled in the 1860's and comprises some of the richest farming land in the State, with stockraising as the principal occupation. Hunting is excellent, and every fall this area is a mecca for deer hunters from all over the State.

### Indian Uprising

The last Indian uprising and massacre took place near Surprise Valley in 1911. Four cattlemen were killed by a small band of renegade Indians under the leadership of Shoshone Mike. The ranchers were shot when they caught the Indian raiding party rustling cattle. Upon discovery of the murders a posse was formed and after a 270-mile chase across northern Nevada the outlaws were caught and killed in a fierce battle. Only one girl and three papooses of the raiding party survived.

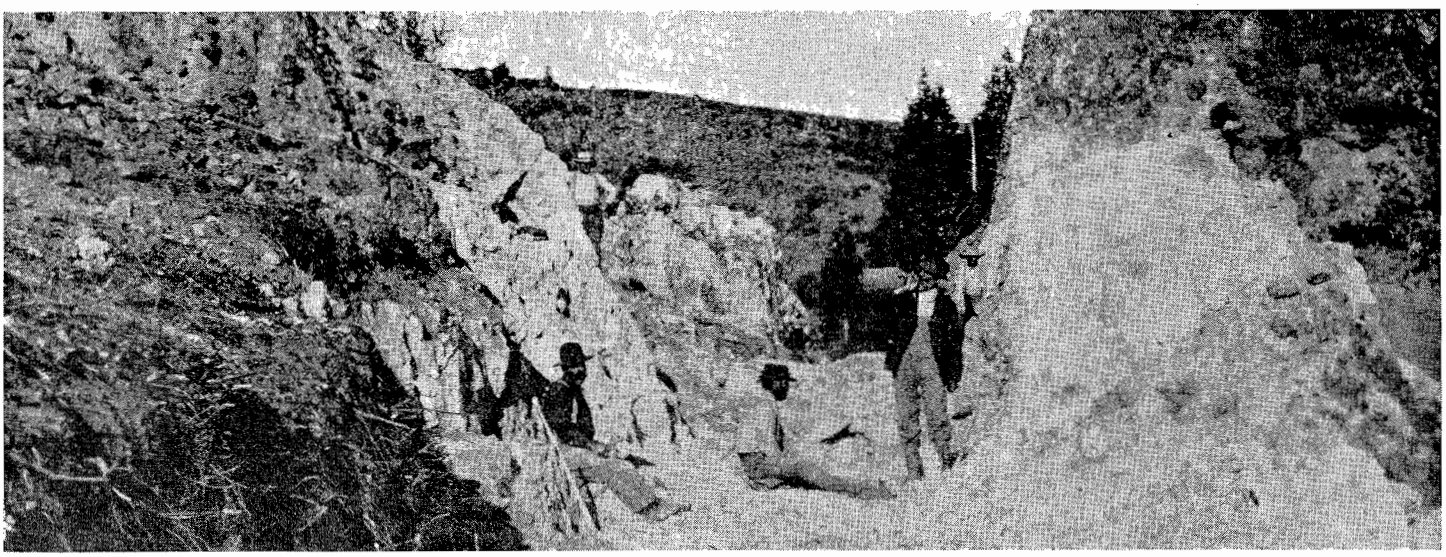
Modoc County was once part of the State of Deseret, then a part of Utah, later a part of Nevada, and in California as a part of Siskiyou County before attaining its present status. Deseret was never recognized by the United States.

Cedarville, which is now the largest town in the valley, was settled while a part of Siskiyou County. The road over the Warners was 15 miles north of the present route and was little more than a trail. The citizens of Cedarville petitioned the Board of Supervisors of Siskiyou County to have the road relocated and improved. Because of remoteness of this section and general lack of funds the supervisors refused this request. Then the enterprising people of this small community took matters into their hands and in 1869 built a road over Cedar Pass. Maintenance was carried on by these progressive pioneers for several years until the supervisors at Yreka accepted the road. John Bonner was one of the leaders in the construction of this road and in his honor the route was made an official state historical monument under the name of Bonner Grade.

### State Gives Aid

Bonner Grade was used for many years with very little improvement and would become impassable during the winter months. During bad weather a block and tackle was necessary to pull the heavy freight wagons over these grades. In 1905 the State of California in a cooperative effort appropriated $7,000 for reconstruction of portions of this road. The County of Modoc appropriated $3,000 to further the work.

The greater part of this money was spent near the summit. On the west side an 18 percent grade and several



*This photograph of early construction on the Alturas and Cedarville Road through a lava rock cut was taken in 1906*

*This picture graphically illustrates the rugged terrain in which bulldozers had to work on new alignment*

sharp curves were eliminated. When finished, these areas had an 8 percent maximum grade and few curves under 50-foot radius. The work was accomplished by use of horse-drawn plows and a road grader.

#### Labor Trouble

"Portal to portal" pay trouble was experienced even then as described in the following paragraph from the final report by H. S. Smith, Superintendent:

"Later is was found necessary to dismiss several of the men, as they thought they were being worked too hard, having the idea that as this was public work they ought to have a sort of picnic, and because they were compelled to put in eight hours per day on the work (which did not include their going and coming to and from the camp), some made it quite unpleasant for the entire crew, consequently the change referred to was made."

Further construction was done in 1921, 1924, and 1936, with frequent surfacing done as needed.

Economically, this road had much to offer to Northern California. In the absence of a modern route to the west, Surprise Valley and northwest Nevada, residents would haul their products south to Gerlach and Reno, Nevada, over a graveled road. This graveled road is being improved yearly by the State of Nevada and will undoubtedly draw trade from this area. Bonner Grade was also one of the weakest links in the "Winnemucca to the Sea" Highway. This highway west from Winnemucca to Eureka would be invaluable in the case of a national emergency as many miles could be saved between Northern California and the East as well as providing a low level pass through a relatively light snow area.

#### Road Being Modernized

Modernization and resurfacing of California's portion of this vital highway is progressing rapidly and in the event Nevada improves its portion an enormous increase in through traffic can be expected.

The status of Bonner Grade in 1946 was poor. There were 60-foot radius curves, 7 percent grades and many icy and frosty areas. During the winter, snowstorms would close the road for short periods. High winds and drifting snow made snow removal a very difficult task, and as there wasn't any hospital in Surprise Valley, it was imperative that the road to Alturas be kept open.

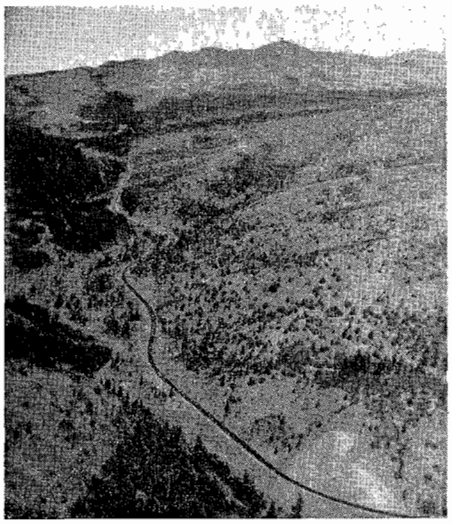
In 1947 and 1948 surveys were made over Bonner Grade. The new road was 5,500 feet shorter and contained 110 less curves than the old route. A sustained grade of 6 percent was maintained on the new project where as the old road had short stretches of 7 and 8 percent grades.

#### Work Completed Last January

In the spring of 1949 a contract was let for the grading to R. B. Guerin and Co. It was planned to finish this contract in 1949 and then do the surfacing

*Heavy grading on Bonner Grade near Division of Highways maintenance station*

*Near the summit of Bonner Grade after grading operations. This is the same section as shown in the photo on page 39*



*Aerial view of the completed Bonner Grade project*

in 1950. However, the heavy grading and rocky cuts proved to be too difficult to complete in the short working season and the work was suspended in December, 1949, and resumed in March, 1950.

The surfacing contract was let in the spring of 1950 to Rand Construction Co. The work consisted of a six-inch cement treated base and three inches of plant-mixed surfacing.

The two contracts were pursued concurrently during 1950 and the work was finally accepted January 19, 1951. The approximate final costs of the contracts was $640,000 for the grading, and $305,000 for the surfacing.

A small curb and gutter contract was let by the State in Cedarville during the summer of 1950. This work expedited the drainage and facilitated parking along the last 2,200 feet of the project. The contract was performed by Rand Construction Co. in conjunction with its paving in that area.

Thus, a road was built, which, although at present lacking in traffic count, will prove invaluable in the future and is now indispensable to this isolated section which is truly one of the "Last Frontiers" of the Old West.

The author was resident engineer on the project, under the direction of H. C. Amesbury, District Construction Engineer, and J. W. Trask, District Engineer.

## CARBURETOR OVERHAUL

When overhauling the automobile engine, it is advisable to include a carburetor overhaul. Carburetor parts become worn and the jets sometimes become clogged with foreign substances. Since modern carburetors are not adjustable, they must be overhauled by competent mechanics occasionally to insure good gas mileage and proper car performance.

## ONE LETTER OF MANY

**Department of Commerce**
**Civil Aeronautics**
**Administration**

District Airport Engineer
206 Appraisers Building
630 Sansome Street
San Francisco, California

*Mr. Kenneth C. Adams, Editor*
*California Highways and Public Works, Sacramento, California*

DEAR MR. ADAMS: As we have been interested in the possibility of reworking and salvaging bituminous pavements, we have noticed among other interesting articles in your November-December, 1950 edition of California Highways and Public Works, the article entitled "An Experiment, Illustrated," by Mr. Earl Whithycombe, Assistant State Highway Engineer.

The California Highway and Public Works Department is to be congratulated for its foresightedness in seeking a method by which old asphalt pavements may be salvaged, as it offers unlimited possibilities and savings to the taxpayer and public works departments over the United States.

Inasmuch as the method offers the same possibilities to airports, we would like to obtain five more copies of the issue so that we may keep our region and other districts abreast of the process.

Very truly yours,

C. G. HAND
District Airport Engineer

## FROM MICHIGAN

ANN ARBOR, MICHIGAN

*California Highways and Public Works*
*Sacramento, California*

GENTLEMEN: I have read several issues of your magazine with great interest and enjoyment. The fine articles describing California solutions to highway and traffic problems are especially significant. However, I find myself enjoying also parts which would seem—on the surface—to be of slight concern to a nonresident of your State. It is a very inspiring publication.

Very truly yours,

ALGER W. LUCKHAM, JR.

# An Order

## *Public Works Director Defines Incompatible Employment*

***Statement and determination of the Director of Public Works respecting employments, activities, or enterprises found to be inconsistent, incompatible, or in conflict with the duties of officers and employees of the Department of Public Works, pursuant to Section 19251 of the Government Code, Chapter 474, Statutes of 1949.***

TO ALL Officers and Employees of the Department of Public Works:

For the protection of the integrity of the California state service, the law includes standards of conduct with which state officers and employees are expected to comply.

**Section 19250 of the Government Code requires that:**

"Every state employee shall fulfill to the best of his ability the duties of the office or position conferred upon him and shall prove himself in his behavior inside and outside the service worthy of the esteem which his office or position requires. In his official activities the state employee shall pursue the common good, and, not only be impartial, but so act as neither to endanger his impartiality nor to give occasion for distrust of his impartiality."

**Section 19251 of the Government Code requires that:**

"A state officer or employee shall not engage in any employment, activity, or enterprise which has been determined to be inconsistent, incompatible, or in conflict with his duties as a state officer or employee or with the duties, functions or responsibilities of his appointing power or the agency by which he is employed.

"Each appointing power shall determine and prescribe, subject to approval of the board, those activities which, for employees under his jurisdiction, will be considered inconsistent, incompatible or in conflict with their duties as state officers or employees. In making this determination the appointing power shall give consideration to employment, activity or enterprise which: (a) involves the use for private gain or advantage of state time, facilities, equipment and supplies; or the badge, uniform, prestige or influence of one's state office or employment or, (b) involves receipt or acceptance by the officer or employee of any money or other consideration from anyone other than the State for the performance of an act which the officer or employee, if not performing such act, would be required or expected to render in the regular course or hours of his state employment or as a part of his duties as a state officer or employee or, (c) involves the performance of an act in other than his capacity as a state officer or employee which act may later be subject directly or indirectly to the control, inspection, review, audit or enforcement by such officer or employee or the agency by which he is employed.

"Each state officer and employee shall during his hours of duty as a state officer or employee and subject to such other laws, rules or regulations as pertain thereto, devote his full time, attention and efforts to his state office or employment."

In accordance with the requirements of Section 19251 of the Government Code of the State of California, the Director of Public Works has determined and prescribed, and with the approval of the State Personnel Board does hereby determine and prescribe, that the following employments, activities, or enterprises, for officers and employees under the jurisdiction of the Department of Public Works and the particular divisions thereof hereinafter listed, are inconsistent, incompatible, or in conflict with their duties as such officers or employees of the State of California:

*A. General (Applicable to officers and employees of the director's office and of all divisions of the department).*

(1) Providing confidential information to persons * to whom issuance of such information has not been authorized by the director or the chief of the division in which the individual is employed;

(2) Providing or using, unless authorized by the director or such division chief, the names of persons from office records for a mailing list;

(3) Directly or indirectly furnishing estimating services, or any other services or information not available to all prospective bidders, to any person bidding on, or who may reasonably be expected to bid on, a contract with the Department of Public Works or any division thereof;

(4) Engaging in any outside employment on a regular basis which will prevent prompt response to a call to report to duty in an emergency. Exemptions from this rule may be granted in special cases where the employee's regularly assigned duties do not call for off-hour work;

(5) Engaging in any outside employment, the working hours of which prevent the employee from securing adequate rest, and thereby result in lowered efficiency for state work;

(6) Directly or indirectly entering into, or engaging in, any partnership, profit sharing, employment or other business arrangement with any person who has, or thereafter attempts to obtain, a contract or contracts with, or who sells, or may reasonably be expected to sell, equipment or supplies, or services, to the department or any division thereof. Exemptions from this rule may be granted in special cases, where the nature of the particular employee's state work is such that he cannot possibly influence the amount of business done by such person with the department;

(7) Directly or indirectly engaging in the sale of any article or service for profit where the use of state time, facilities, equipment or supplies is in any way involved;

(8) Soliciting or accepting personal loans of money or property from any person, other than a bank or other financial institution, who does business with or performs services for the department or any division thereof, whether under contract or otherwise;

*B. Division of Highways*

(1) Directly or indirectly to rent or loan privately-owned tools or equipment to a contractor. Exemptions from this rule may be granted by the employee's department head, or by a district engineer, in special cases where the nature of the particular employee's duties are such that he cannot control quantities of work done, or judge the qualities of workmanship, of any contractor.

* Wherever used in this statement, the terms "person" or "persons" includes individuals, firms, partnerships, corporations, associations and all other forms of organization for business or other purposes, and their agent or agents.

*C. Division of Architecture*

(1) Directly or indirectly entering into any agreement, partnership, profit sharing or employment arrangement, including consulting services, with an architect or engineer to engage in the design of any school building, the construction of which is subject to supervision by the division under the requirements of Sections 18191, et seq., of the Education Code.

*D. Division of Contracts and Rights of Way*

(1) Directly or indirectly entering into any arrangement with any person which may in any way involve a conflict of interest with the duties and obligations of an attorney representing the State of California.

The limitations, activities, employments or enterprises herein set out do not attempt to specify every possible limitation on activities of officers or employees that might be determined and prescribed under the authority of Section 19251 of the Government Code. If later experience shows a need for additions to, deletions from, or clarification of the limitations stated above, the Director of Public Works will request the approval of the State Personnel Board in making such changes as he may determine necessary. Upon such approval, the above listing will be amended. Nothing in this statement or listing shall be construed by any officer or employee as the sole provisions of law and administrative rules which must be observed by each state officer and employee of this agency.

It is not the desire of the Department of Public Works or any of its divisions to inquire into the private affairs of its employees. We do ask the cooperation of all employees in avoiding any activity that may reasonably be expected to cause embarrassment to the department or the State of California. An employee who is engaging in, or plans to engage in, any employment, activity, or enterprise which conceivably might be inconsistent or incompatible or interfere in any way with his duties as a state employee is asked to consult with his supervisor.

Each and every officer and employee of the Department of Public Works is hereby notified of their right to object to any provision of the foregoing statement and determination by filing a notice thereof with the Director of Public Works, and of their right to file an appeal with the State Personnel Board relative to any action of the director taken with respect to any objection so filed, or with respect to the foregoing statement and determination as a whole.

The determination of the Director of Public Works respecting incompatible employment of employees of the Department of Public Works, dated December 29, 1949, and approved by the State Personnel Board by John F. Fisher, Executive Officer, on January 23, 1950, is hereby rescinded.

Dated at Sacramento this twenty-fourth day of January, 1951.

C. H. PURCELL
Director of Public Works

# Tom Bedford Enjoying Retirement in Hemet

THOMAS A. BEDFORD, one of the original seven District Engineers employed by the California Highway Commission in 1911, retired from state service on July 15, 1939. Since his retirement, nearly 12 years ago, "T. A." has spent considerable time galavanting between Mexico, Texas and California. He spent some time on his ranch in Merced County, but has spent the greater portion of the last three years in Hemet.

Approaching his eighty-second birthday, Tom is still the wiry, active man he always has been, retaining a keen interest in highway and engineering matters.

Many of Tom Bedford's host of friends may have lost contact with him during recent years of hectic construction programs and Tom would appreciate hearing from state highway employees who worked with him during his 28 years of service. His address:

Thomas A. Bedford
Hemet, California

# In Memoriam

## WILLIAM H. SPIRZ

THE EMPLOYEES of the San Francisco-Oakland Bay Bridge and of other units of the Division of Highways deeply mourn the sudden death of William H. Spirz of the Bay Bridge engineering staff on February 16, 1951.

Mr. Spirz was born in San Francisco on May 21, 1902. He received his formal education in the schools of that city and in the University of California, from which he was graduated in 1931 with the degree of Bachelor of Science in Civil Engineering.

During his college years, Mr. Spirz spent his vacations on various engineering jobs. Immediately after graduation, he was employed by the National Park Service, and in 1933 he went to work for the San Francisco-Oakland Bay Bridge on which construction had just started. He spent about five years on engineering office and field work on the Bay Bridge and was transferred to the Bridge Department of the Division of Highways in August, 1938.

With the accelerated war preparedness program, Mr. Spirz was called into active service in the Army in April, 1941, as a First Lieutenant. He received his discharge from the Army in 1945 and immediately returned to the Bay Bridge staff, where he continued his work on the various engineering problems of bridge operation and maintenance until his untimely death in February.

He was an associate member of the American Society of Civil Engineers.

Mr. Spirz is survived by his widow and three brothers, to whom his many friends in the state service extend sincere sympathy.

# California Highways

*Their Importance in the National Defense Effort*

On March 1, 1951, Governor Earl Warren sent to Charles E. Wilson, Director, Office of Defense Mobilization, Washington, D. C., a letter urging that special consideration be given to California in making provision for the allocation of necessary steel and other materials for highway construction in order that the State may make its full contribution to the national defense program. Governor Warren wrote:

THE SERIOUS international situation facing the United States today, imposes a tremendous responsibility on all public officials and private citizens. Every endeavor must be directed toward increasing the production of materials and providing the manpower necessary to expand all phases of the national defense as rapidly as possible.

Attainment of this prime objective is absolutely necessary to the very existence of this Nation.

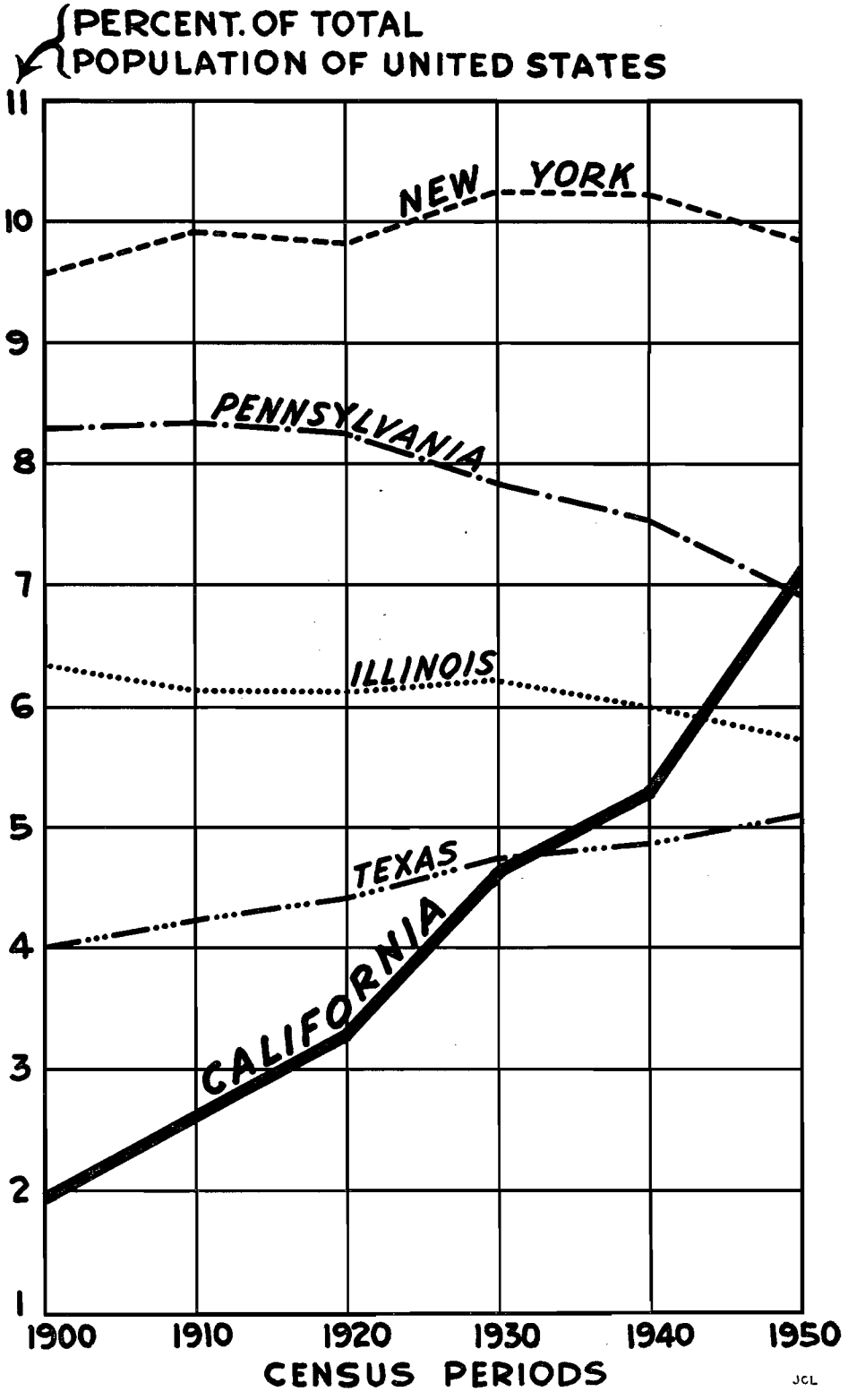
**California's Position**

The Korean War and threat of further Asiatic and European conflict spotlight California's unique position from a geographic, climatic, and strategic standpoint.

Military establishments and industrial defense plants located in California during the recent war effort evidence the vital part played by California in World War II. Many of these were developed further after the war and now many are being reactivated. The present defense program will undoubtedly increase the number and size of such establishments.

These many defense establishments must be served by highways.

California's highways are traveled by 10,586,000 people. California's highways carry over 5,000,000 motor vehicles—highest in the Nation.



California's highways are one integrated system of access roads essential to the defense effort.

In fact, California's highways are a major portion of the United States' defense and assembly lines.

**Provision must be made for the allocation of necessary steel and other material, equipment and manpower to carry on a continued program of highway construction if California is to participate effectively in the Nation's defense.**

There is advanced herewith factual data supporting the recommendation that California be accorded preferential treatment to continue the State's highway modernization program.

#### California Is Unique Among the States

Geographically, economically, industrially, and in transportation California is unique among the states. In area it is the second largest state, exceeded in size only by Texas. Its shore line comprises over one-half the Nation's coastal boundary on the Pacific Ocean, thereby making California the principal gateway to the vast Pacific Basin. Its terrain is such as to lay down definite controls for agricultural and urban development and for location of lines of transportation. Over much of its area mild climatic conditions are most favorable to year-round activities unhampered by meteorological extremes.

In the western expansion of the Nation, the sum total of these and other desirable features have attracted large numbers of people to the Pacific slope. One hundred ten years ago, California was merely the name of the last western frontier, surrounded by legendary yarns of subtropical climate, arid deserts, and snow-capped mountains. Today, a bare century since the days of those legends, California's 1950 population of 10,586,000 is second only to the State of New York. This century of growth from a handful of Indians and native Californians, plus a few dozen Americans, to 10½ million people, is probably unprecedented for any similar area in the world. The population of this State in 1860 was less than 400,000; passed the million mark in 1890; was 3½ million by 1920; 5,677,000 by 1930; 6,907,000 by 1940, and now 10,586,000. It should be noted that the population increase of 3,678,000 during the last decade was by far the largest rise in any 10-year period; 53.3 percent over the 1940 population.

California's population increase in terms of percentage of the national population, compared to that of other large states since 1900, is shown on the accompanying chart.

## Purcell Writes MacDonald

COINCIDENT with Governor Warren's letter to Director Wilson, Office of Defense Mobilization, Director of Public Works C. H. Purcell sent the following letter to T. H. MacDonald, Commissioner of Public Roads, Department of Commerce, Bureau of Public Roads, Washington, D. C.:

DEAR MR. MACDONALD: "Information reaching me regarding mobilization conferences in Washington has indicated that highway officials need take a miltant attitude, if the states are to be accorded treatment which will allow the continuation of highway construction and maintenance programs.

"I know that you are undoubtedly burdened with the task confronting you in your effort to secure material allocations, to enable the states to prosecute their present highway construction work.

"I believe California is destined to play a vital role in any international crisis that may develop. California, in World War II, was a stronghold of military establishments and industrial defense plants vital to the Nation's war effort. Today those same defense plants and military establishments are being reactivated and in many cases expanded.

"California's highways are a large part of the State's defense and assembly lines.

"I wish to impress upon you that California has the greatest stake of any of the states in the need for continuing highway development during a war period.

"I have prepared, and direct to you herewith, a report emphasizing the importance of California's highways in the national defense effort. I should appreciate your using this material to urge that California be given special consideration in the allocations of necessary steel and other materials, to permit a continued highway construction program in this State."

#### California's Phenomenal Transportation Development

A factor of greatest importance in the story of California's phenomenal growth is the corresponding story of transportation development. The great increases in population in this State came after the era of railroad expansion and during the period of contraction of rail facilities. In fact, as far as California is concerned, railroad development never approached eastern and midwest standards commensurate with equivalent population.

The result has been that, ever since the days of the gold rush, the entire economic life of California has been more dependent upon road and highway transportation than any comparable eastern or midwest area. During the past 30 years appreciable reductions in California's meager rail facilities have accentuated this economic and social dependence upon the State's highways.

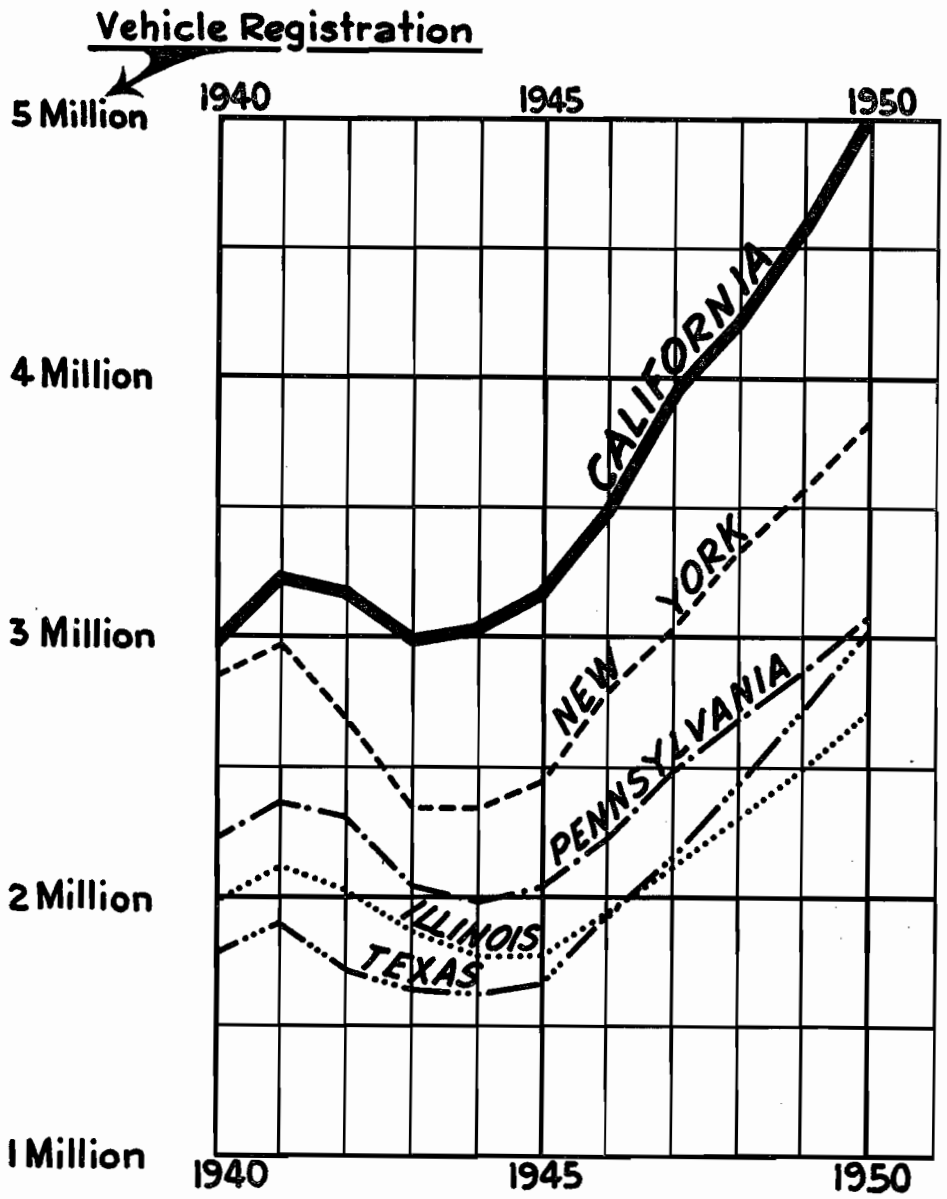
With each decade this dependence upon highway transportation was emphasized by the accelerating growth of population. The rapid development of automotive transportation placed further emphasis on the need for highway facilities. In 1920 there were 604,000 vehicles registered in California; by 1930, the number was 2,136,000; by 1940, it was 2,990,000; and today it has passed the 5,000,000 mark. Considering the 10½ million population, 5,000,000 vehicles means one vehicle to every two persons. Thus the highest total registration and highest per capita registration of any state are in California, where economic life and defense activities are vitally dependent upon highway transport.

The accompanying chart of motor vehicle registration clearly indicates California's position during the past 10 years in relation to states of comparable size. California's dependence upon motor transportation was brought into sharp focus by activities in World War II.

Some of the reasons why California is the Nation's most heavily motorized state may be found in a detailed examination of the services rendered by the highway transportation system to certain basic industries, to government and to city life. During times of emergency these services become vital.

#### Agriculture

**One of the fundamental reasons for establishing and maintaining road systems is to serve the needs of agriculture. The farmer's ability to produce and to distribute his products in support of the de-**




**DEFICIENT MILEAGE TO BE COMPLETED AFTER 1951-52 FISCAL YEAR ON PRINCIPAL STATE ROUTES**

| | Miles |
|---|---|
| U. S. 99 | |
| Los Angeles to Sacramento | 239 |
| U. S. 101 | |
| Mexican Border to San Francisco | 442 |
| Includes Santa Ana Freeway | 45 miles |
| Includes Hollywood Freeway | 3 miles |
| U. S. 60, 70, 99 | |
| Ramona Freeway (Los Angeles to Colton) | 43 |
| U. S. 6 | |
| Harbor Freeway (Los Angeles to San Pedro) | 22 |
| U. S. 50 | |
| San Francisco to Stockton | 55 |
| State Rt. 14-69-5 | |
| Carquinez Bridge-East Shore Freeway-San Jose | 51 |

**AVERAGE DAILY TRAFFIC ON PRINCIPAL STATE ROUTES**

| Route Section | ADT |
|---|---|
| U. S. 99 (Rt. 4) | |
| Sacramento-Stockton | 8,000 |
| Stockton-Modesto | 8,500 |
| Modesto-Fresno | 10,500 |
| Fresno-Bakersfield | 9,000 |
| Bakersfield-Los Angeles | 8,500–11,000 |
| U. S. 101 (Rt. 2) | |
| San Francisco-Palo Alto (Bay Shore) | 30,000+ |
| Palo Alto-San Jose | 16,000 |
| San Jose-Salinas | 10,500 |
| Salinas-Santa Barbara | 4,500– 5,000 |
| Santa Barbara-Ventura | 5,000–11,000 |
| Ventura-Camarillo | 6,000 |
| Camarillo-Calabasas (Los Angeles City Limit) | 9,000 |
| Hollywood Freeway | 73,000 |
| Los Angeles-San Diego | 14,000–20,000 |
| U. S. 66 (Rt. 26) | |
| Ramona Freeway | 40,000 |
| Rt. 165 | |
| Harbor Freeway | 84,000 Est. |
| U. S. 40 (Rts. 69 and 14) | |
| Carquinez Bridge-East Shore Freeway | 28,000–60,000 |
| U. S. 50 | |
| San Francisco-Stockton | 10,000 |

fense effort is directly dependent upon the availability of good highway transportation.

This is particularly true in California, the richest agricultural state in the Union, where large-scale farming operations are highly mechanized and high-volume production of many crops is the rule. The arable lands of the State, together with the climatic condition and water to make them productive, constitute the foremost of the State's natural resources. Its 133,000 farms embrace an area of 30,500,000 acres, of which about 7,000,000 are suitable for crop production, with 5,000,000 acres under irrigation. Value of these farms exceeds two and one-half billion dollars.

The principal crops—fruits and nuts, field crops, vegetables, livestock and poultry—weigh some 30,000,000 tons annually. All this moves on wheels at some part of the journey to markets, canneries, warehouses, railroad sidings, airports, processing plants or points of consumption. Some of it is handled only once, but much of it requires several handlings.

As the output of California farms has grown consistently through the years, highway transportation has demonstrated its capacity to expand as increasing demands have been made upon it. The role of the highways in handling the movement is reflected in the rapid increase in the number of trucks in service during the period. Thirty percent of the 500,000-plus trucks registered operating in this State directly serve agriculture.

Perhaps the most critical service rendered to agriculture by the motor truck is in the case of perishable products, which must be moved quickly and at the proper time to prevent loss. Here the mobility of the motor vehicle is an essential factor.

The fact that highways form a network connecting every community in the State, and tie into interstate routes, is of basic significance to agriculture, because producing areas are spread over almost every part of the State's 156,803 square miles, with the exception of extreme mountainous sections and the unirrigated parts of the southeastern desert. Farm products may be

hauled to any desired marketing or shipping point.

**This dependence of agriculture on the highways will be accentuated as the Central Valley Project, Imperial Valley canals and other irrigation developments bring more land under cultivation.**

In California, 84 percent of all rural dwellings are directly served by improved roads, and 97 percent are within one mile of surfaced highways.

#### Industrialization of California

Industrialization of California was proceeding at a rapid pace even before the tremendous impetus provided by World War II. Value of the State's manufactured products multiplied more than eight times between 1904 and 1939, and in the latter year, California ranked seventh in the Nation in this respect. By 1943, with war production in full swing, the value of her manufactured products was 10½ billion dollars, or three and three-fourths times that of 1939. In the face of the present crisis, with California's population up to 10½ million, an equivalent additional increase is anticipated.

Development of transportation facilities was a factor in the changing character of manufacturing as industrialization proceeded. Forty years ago manufacturing was largely the processing and fabrication of products of the region. Now half the activity consists of products for the local, regional and national market fabricated from raw or semifinished material imported into the State.

The extent to which highway transportation contributed to this industrial development was brought sharply into focus at the time the Nation's resources were marshalled for World War II production. As plants were established or expanded, many of them depended entirely or in large part upon roads for the movement of raw materials and finished products. Even if rail or water connections were available, there was considerable dependence upon trucks. At the present time this dependence had increased.

Location and size of plants were determined to a considerable extent by the availability of automobile transportation for workers. In the Los Angeles area, one of the Nation's greatest war production centers, 80 percent of the half-million war plant employees got to work by automobile. One large aircraft plant found that 92 percent of its personnel rode an average of 11 miles daily from home to work in their own cars. A continuing shortage of housing in industrial areas makes it necessary for thousands of workers to live beyond the limits of districts served by public transit systems.

As California goes forward into a new period of industrial development and defense production, highways will become increasingly important as arteries of commerce. Every type of motor vehicle will play a part in the transporting of raw materials, equipment and personnel to the factories, and in the distribution of manufactured goods. Trucks must be used to haul freight to and from the waterways, railroads and airports. Distribution of commodities to the door of the consumer is almost entirely the job of the motor vehicle, which, in turn, is dependent upon adequate roads and streets for efficient operation.

**Industries vital to defense production, while more concentrated in metropolitan areas, are, nevertheless, widely spread. Relatively few of such industries are situated so as to rely upon means other than highways for access.**

#### Production of Petroleum and Natural Gas

The production, refining and marketing of petroleum and natural gas constitute one of California's most vital defense industries. California has approximately one-sixth of the Nation's oil reserves and a substantial proportion of the natural gas. Petroleum products are high on the list of the State's exports, both in volume and in value.

Oil and gas are the principal fuels used by industry in the State, and will increase in importance as defense manufacturing develops, particularly since California has no large coal deposits. Petroleum also is the basic material for thousands of products of the chemical and allied industries.

Unlike other oil-producing areas in the Nation, production, refining and marketing in California are carried on within the same areas in some parts of the State, particularly in the southern counties. This reduces the dependence on long-distance transportation of the products by pipe line and tank car and increases the importance of transportation by truck. Thus highway transportation in California performs a vital service to the oil industry, particularly under defense conditions.

## MacDonald Writes Purcell

DIRECTOR of Public Works C. H. Purcell was encouraged by a letter he received from Thomas H. MacDonald, Commissioner of Public Roads, Washington, D. C., commenting on the report Purcell made to him urging that there be no curtailment of critical materials required to continue California's program of highway construction for national defense.

"Your report," MacDonald wrote, "portrays in a very comprehensive and effective manner the vital necessity of providing for a continuing large-scale program of highway construction and maintenance if California's highways are to be improved and preserved in a condition to adequately take care of the defense and civilian economy needs.

"You may rest assured that every reasonable effort is being made by those of us who are constantly in contact with the situation here, to stress the vital importance of highways to the National defense and the essential civilian activities without which the success of the defense effort would not be possible. Conferences have been held frequently with representatives of the Defense Production Administration and National Production Authority in an endeavor to make certain that the necessary materials and equipment will be made available to take care of highway requirements.

"The National Production Authority expects to have a controlled materials plan in operation by July 1, 1951. It is hoped that when the plan is put into effect a definite allocation will be made of the necessary materials for carrying on an adequate highway construction and maintenance program. Until then, however, it is necessary to submit each individual project to the National Production Authority for consideration on its own merits. We have been quite successful, to date, in obtaining priority assistance when adequate supporting data have been submitted to show a definite relationship to the National defense or that severe hardship would result if the project were not completed."

#### Mining

Mining was the industry responsible for California's initial prosperity after gold was discovered nearly one hundred years ago, and some of the State's first roads were built to accommodate ore wagons and stages carrying gold dust and bullion.

Mining has continued through the years to be an important factor in the State's economy. The output in 1941 weighed approximately 79 million tons, and as almost all of it was transported by truck at some stage of its processing, the tonnage is a rough index of the dependence of the industry on the highway system. California produces commercially a greater number and variety of mineral products than any other state, many of which are necessary to defense production.

#### Lumbering

Particular importance attaches to California's forest resources in the present critical period of heavy demand for building materials by the construction industry. California produces over 4 billion board feet of lumber annually. Lumbering operations now are conducted largely on a selective basis, with available timber existing in small, scattered tracts rather than in large stands. This makes it economically impractical for private enterprise to construct logging railroads, as was the practice in the past, to move timber from forest to sawmill.

In recent years increasing use has been made of tractors and trucks, both for hauling logs to the mills and in transporting lumber to the point of use or export. Thus highways and access roads are an important factor in determining the State's output of lumber.

#### California Highly Urbanized

It is significant that California has become a highly urbanized state during the period in which motor vehicles have come into widespread use and modern highways have developed.

The current expansion of California's cities into adjacent outlying areas is predicated to a large extent on the mobility of highway transportation. Many workers now reach central business and manufacturing districts easily from suburban residential areas.

In 1900, 52 percent of California's population was urban, and by 1940 it was 71 percent. Changes resulting from the war have made the percentage of metropolitan dwellers even higher.

The State's seven metropolitan districts—Los Angeles, San Francisco-Oakland, San Diego, Sacramento, San Jose, Fresno, and Stockton—are quite widely separated. It is the function of the highway system to provide a convenient means of travel between them, and to give their residents easy access to rural areas of the State. Food, raw materials for manufactures, and most other commodities necessary for maintaining the life of the cities flow in over the highways. Manufactured goods move out to markets.

California cities are heavily dependent on highways for their supplies of food. Trucks bring in six billion pounds annually, completely supplying the needs of Los Angeles, San Francisco, San Diego, Sacramento and other communities, large and small.

Even as early as 1941, trucks carried more than 85 percent of the fruits and vegetables sold in the Los Angeles market, and more than 69 percent of the total consumed in San Francisco.

#### Inadequacy of Mass Transportation Facilities

One hundred California cities, constituting 60 percent of those over 2,500 population, are not served by local mass transportation systems. In such cities, residents rely heavily upon automobiles. In cities where mass transportation systems operate, they handle only 20 to 40 percent of the total travel.

Out of 48 major local transit systems, 41 use busses exclusively, one is all rail, and six use both bus and rail. Nearly half of all transit system passengers are carried by bus. This ratio is increasing as street railways are gradually being abandoned in favor of more modern and efficient motor transportation.

The high per capita ownership of motor vehicles in California cities is a significant index of the dependence of the cities on this type of transportation.

#### Highways in an Emergency

Within a city the administration of police and fire protection, schools, public works, courts, health and welfare services is largely dependent upon the convenient transportation afforded by streets and highways. If because of an emergency, such as atomic or conventional bombing attack, a city's street system temporarily ceases to function, chaotic conditions may result.

Networks of highways, by tying together the scattered elements of each unit of local, state and national governments, make it possible to provide public services affecting almost every phase of human activity. Highways and streets bring the government to the people.

#### Highways and the Federal Government

While many functions of the Federal Government also involve the Nation's highway transportation system, the most important example is national defense. Roads are essential for transporting troops and supplies to strategic locations, and for maintaining forts, camps, air fields, harbor defenses and all other types of military installations. Rural delivery of mail, a federal responsibility which is discharged via highways, provides a regular and reliable means of communication for even the most isolated farm. Movement of mail within the cities from train and airport to post offices is largely accomplished by trucks.

Throughout the West, and particularly in California, administration of national forests, parks and monuments, grazing districts, reclamation projects, Indian reservations, power development and navigation involve large-scale federal activity, all concerned with the development and maintenance of roads to serve areas of operation.

#### California's Interstate Traffic

Interstate traffic, while a relatively small proportion of the total in California, is increasing rapidly, and the effect of World War II on that phase was most notable. During the five years of the war, the number of foreign cars entering California increased 64 percent, and the number of foreign trucks increased 42 percent; however, foreign busses increased 124 percent and bus passengers increased 225 percent.

# A LUCKY DRIVER AND A HARDY TRUCK

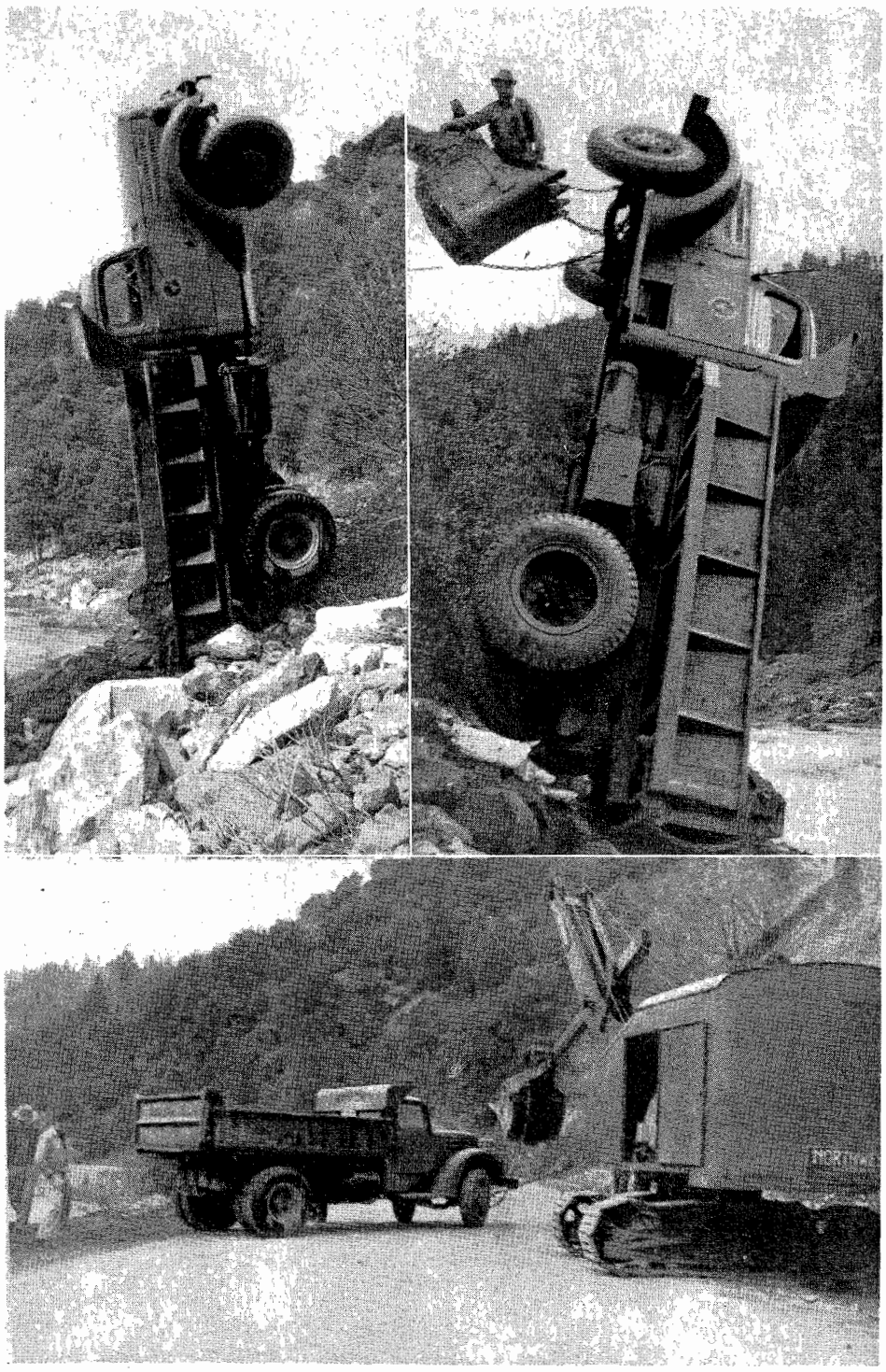
THE ACCOMPANYING photographs graphically depict an unusual accident which occurred on Sign Route 49 near Ramshorn Creek about eight miles from Downieville in Sierra County on February 14th, last.

A Division of Highways truck operated by J. P. Poggi was hauling fill material from a three-quarter cubic yard power shovel to restore embankment lost during the heavy November storms. The edge of the embankment gave way before the truck was in position to be dumped. The driver stepped off as the truck went over backwards.

As indicated by the photographs, the truck came to rest on its tailgate on a small ledge of rock. The truck was in such a precarious position that it was necessary to use extreme care in attaching a tow line. The bucket of the shovel was used to carry Highway Foreman Chester Butz out to attach the tow line. A high line was rigged and two loaded trucks were used to assist the shovel in salvage operations.

The only damage to the truck was a broken headlight lens, which damage was caused by the tow cable during salvage operations.

The photographs were taken by Highway Superintendent A. C. Irish.



*UPPER LEFT—Truck lands on its tailgate on small ledge of rock. UPPER RIGHT—Foreman Chester Butz attaches tow line. LOWER—Undamaged truck is ready to resume operations.*

**California, Bridgehead to the Far East**

During World War II California's position from the defense standpoint of any war involving the Pacific Basin was clearly indicated. California, being the bridgehead to the Far East, immediately became the preferred location for sites not only of military and naval establishments, but also a wide variety of defense industries. This fact was one of the prime factors in the State's phenomenal growth during the past year.

**Today the Korean war and threat of further Asiatic and European conflict spotlight California's unique position from a geographic, climatic, and strategic standpoint.**

Military establishments were scattered throughout the State and in case of current and future defense preparation, the reactivation of these establishments, plus a considerable percentage of increase is an obvious conclusion. Access to these establishments is almost entirely by highways.

*. . . Continued on page 61*

# Traffic Interchange Design

By SAM HELWER, Assistant Engineer of Design

*This is the third and last of three articles by Mr. Helwer—Editor.*

### 1. A. A. S. H. O. Minimum Safe Radii Table

In the design of all freeway ramp connections, California practice makes use of the A. A. S. H. O. table for minimum safe radii for various speeds. It

**A. A. S. H. O.**
**Min. Safe Radii for Various Speeds**

| Turning Speed (V) | 20 | 30 | 40 | 50 |
|---|---|---|---|---|
| Design Coeff. of Friction (F) | .54 | .43 | .33 | .25 |
| Assumed Superelev. (E) | 0 | .05 | .10 | .10 |
| Min. Safe Radii | 50 | 130 | 250 | 500 |

$E+F=.067\frac{V^2}{R}$

will be noted that the friction factor varies from 0.54 at 20 m.p.h. and a radius of 50 feet to 0.25 at 50 m.p.h. and a radius of 500 feet. For conventional highway design, California has always used a friction factor of 0.16 for speeds between 20 and 60 m.p.h. The use of the higher friction factors have been questioned by some authorities, including Professor Ralph A. Moyer, whose original tests were used by the A. A. S. H. O. in the development of this table.

Although it is reasonable to assign a higher friction factor for the lower speed range, it appears that factors of 0.54 and 0.43 are too high. To show the increase in radii with reduced friction factors, the A. A. S. H. O. table has been recalculated here using a friction factor of 0.16 with 12 percent superelevation. The increase in radii is from a 50-foot to a 100-foot radius at 20 m.p.h. and from a 500-foot to a 600-foot radius at 50 m.p.h.

### Effect on Design

Assuming that we were to change our friction factor for ramp design, what effect would this have on design? For the 40 and 50 m.p.h. ramps, the change in right of way and construction costs would usually only be nominal. In many cases there would be *no* change, because wherever possible, the designer already uses radii larger than the minimum for each design speed classification.

**Minimum Safe Radii for Various Speeds**

.....FOR COMPARISON PURPOSES ONLY. CALCULATIONS BASED ON 0.16 FRICTION FACTOR AND 0.12 SUPERELEVATION.....

| TURNING SPEED (V) | 20 | 30 | 40 | 50 |
|---|---|---|---|---|
| ASSUMED FRICTION (F) | .16 | .16 | .16 | .16 |
| ASSUMED SUPERELEV. (E) | .12 | .12 | .12 | .12 |
| CALCULATED SAFE RADII | 100 | 215 | 385 | 600 |
| A.A.S.H.O. RADII | 50 | 130 | 250 | 500 |

For the 20 and 30 m.p.h. designs, however, there would be complications. In the first place, these lower design speeds are only selected because of critical topography and right of way limitations. An increase in radius here could increase costs materially. If the radius cannot be increased, the other alternative would be to increase lengths of speed change lanes.

Exact calculations showing what these increases would be are not available, but enough investigation has been made to show that these increases would be small. The greatest increase would be on an acceleration lane for the 50-foot radius. With a 0.16 friction factor and no superelevation, the safe speed for a 50-foot radius is 11 m.p.h. Therefore, an acceleration lane for a 50-foot radius would have to be long enough to go from 11 m.p.h. to 42 m.p.h., instead of 20 m.p.h. to 42 m.p.h. The difference, which is the distance to go from 11 m.p.h. to 20 m.p.h., is in the neighborhood of 100 feet. On the deceleration lane, the increase in length would be materially less.

On the basis of the relatively small increase in speed change length required by using a lower friction factor, and the fact that there are several assumptions and variables in the original calculations of speed change lanes, it does not appear necessary at this time to change our design standards. Furthermore, actual operation on many completed projects has not yet demonstrated the need for revision. We have had some difficulties on short radius off-ramps which should be expected at any location where a transition from a high standard facility to a much lower design standard is necessary.

### Avoid Minimum Design Standards

The preceding discussion of friction factors has been made for one particular purpose. Although it appears there is no serious error in assigning relatively high friction factors for the determination of safe radii for ramp speeds, it is essential that the designer realizes the recommended radii are *absolute minimums.* Absolute minimums should be used only where absolutely necessary. As an example, if it is not possible to obtain 30 m.p.h. (130′ R) design on a given ramp, it should not be necessary to drop to a 50-foot radius in going down to a 20 m.p.h. ramp. The largest radius possible under 130 feet should be used instead.

### Lengths of Speed Change Lanes

The lengths of speed change lanes for various ramp design speeds have been standardized as shown in the following table. These lengths are essentionally the same as the recommendations contained in the A. A. S. H. O. pamphlets.

The assumptions made in setting up the lengths for acceleration lanes should be clearly understood. These auxiliary lanes are designed strictly on the basis of accelerating from the safe speed of the ramp to the assumed merging speed of the freeway. It is assumed

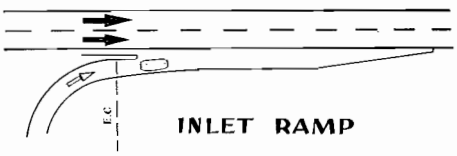
**SPEED CHANGE LANES AND TAPER (LENGTHS)**

| | | HIGHWAY DESIGN SPEED (V) mph | | | | |
|---|---|---|---|---|---|---|
| | | 30 | 40 | 50 | 60 | 70 |
| Av. Speed of Travel (0.7V) | | 21 | 28 | 35 | 42 | 49 |
| | | TAPER (feet) | | | | |
| Deceleration..... | | 90 | 120 | 150 | 180 | 210 |
| Acceleration..... | | 150 | 180 | 240 | 270 | 300 |
| Ramp Speed | Min. Radius | DECELERATION LANE, Including Taper | | | | |
| 20 | 50 | 90 | 140 | 225 | 295 | 395 |
| 30 | 130 | 90 | 120 | 150 | 235 | 315 |
| 40 | 250 | | 120 | 150 | 180 | 240 |
| 50 | 500 | | | 150 | 180 | 210 |
| | | ACCELERATION LANE, Including Taper | | | | |
| 20 | 50 | 150 | 180 | 410 | 750 | 1180 |
| 30 | 130 | 150 | 180 | 240 | 510 | 950 |
| 40 | 250 | | 180 | 240 | 270 | 550 |
| 50 | 500 | | | 240 | 270 | 300 |

that a merging vehicle will be able to enter the through traffic stream when the merging speed is reached. As the traffic volumes build up, both on the ramp and the through facility, it may become necessary to provide additional length for merging. This additional length will be a function of traffic volumes. More research and data are necessary in this field before we can change our acceleration lanes to merging lanes, which is actually the function they must perform.

#### 2. Freeway Inlets

Some of the most important features of a freeway ramp, are the shape and width of the ramp throat at its connection to the through lanes. From observation of traffic behavior, it has been determined that an inlet ramp throat must be designed in such a manner that it will be easier for the driver to use the acceleration lane which has been provided than it would be to cut directly into the freeway lane ahead



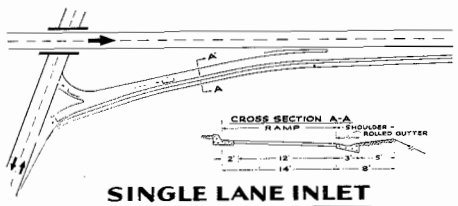

INLET RAMP

of the inlet nose. This is accomplished by designing ramp alignment which brings the entering vehicle into a position on the acceleration lane parallel to the through traffic lane.

The throat width of an inlet ramp should permit only single lane operation because acceleration lanes are designed to accommodate only single lane operation. The inlet throat is that point on a freeway inlet where the ramp proper ends and the acceleration lane begins. Two-abreast operation at an inlet throat would necessitate direct entry into the freeway lanes by one of the vehicles without proper acceleration. This would result in confusion and hazard to all traffic.

#### Single Lane Operation

This desired single lane operation pertains to the entire length of the inlet ramp except at the connection to the city street. At the connection to the city street, provision should be made for both right turns and left turns from the city street, where the interchange layout permits such turns. A well-designed inlet ramp can handle up to 1,500 cars per hour by actual count, which is a higher volume of traffic than most city streets can funnel into such a ramp. In the past, we have constructed some two-lane inlet ramps which were choked to one lane at the inlet throat. This has proven to




**SINGLE LANE INLET**
WITH EMERGENCY PARKING SHOULDER
Widened at Street Connection to Permit Simultaneous Left and Right Turns

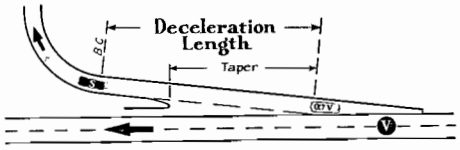
be undesirable because of the inevitable racing for position at the inlet throat, resulting in the fender-denting type of accident at the point of constriction.

Although it is desirable to induce single-lane operation on an inlet ramp, it is also necessary to provide additional width for emergency passing of a stalled vehicle. The most effective way to provide this emergency parking shoulder is by use of a three-foot rolled gutter design on the right of a 14-foot traffic lane. The rolled gutter, plus an additional five-foot width of treated shoulder, provides an all-weather parking shoulder, and yet discourages two-lane operation on the ramp.

The rolled gutter emergency parking shoulder is generally used in urban areas and particularly on metropolitan freeways. In rural areas the emergency parking shoulder on the right of a ramp traffic lane usually consists entirely of a treated shoulder.

#### 3. Freeway Outlets

The shape and width of an outlet ramp must also be given careful consideration. In our earlier designs, it was accepted practice to provide a decelerating lane parallel to the through pavements. Observations on completed projects quickly demonstrated that

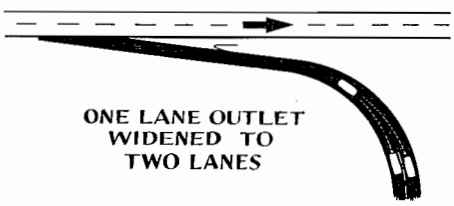



V= Freeway Design Speed
S= Safe Speed of Ramp

traffic will not pull over into a parallel lane to decelerate, but will instead take the most direct path into the outlet ramp throat. The standard outlet ramp design now being used takes traffic from the freeway in a straight line into the ramp throat.

The width of an outlet ramp throat should also accommodate only single lane operation, and this single lane movement should be induced from the right-hand freeway lane. If a ramp throat is wide enough to accommodate two-lane operation, traffic may be induced to turn from the left and center lanes as well as the right-hand lane, resulting in a hazardous conflict with through traffic.

The capacity of a well-designed single-lane outlet ramp will also accommodate about 1,500 vehicles per hour. This volume is in excess of the volume which can be handled on an ordinary city street. For this reason, where outlet volumes are high, it is frequently necessary to widen an outlet ramp to two lanes beyond the ramp throat to



ONE LANE OUTLET WIDENED TO TWO LANES

provide storage room for vehicles waiting to enter the city street or local road and in order to prevent the backing up of traffic on the freeway lanes.

#### 4. Ramp Grades and Vertical Sight Distance

The successful and safe operation of any inlet or outlet ramp is also greatly dependent on the grade line and vertical sight distance of the ramp. Inasmuch as the inlets and outlets of a freeway are the points of concentration of all turning movements to and from the freeway, it is highly necessary that adequate sight distances be provided. Sight distances should not only be adequate for safe stopping maneuvers, but should also provide an advance view of the interchange facilities to aid the driver in selecting the proper interchange connection.

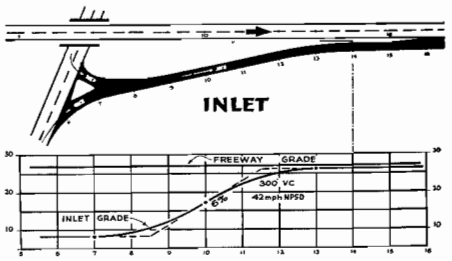
Ramp grades generally should not exceed 6 percent. In special cases, they may be as high as 8 or 10 percent. The grade rate of a ramp, however, is usually not as critical as the sight distance at each end of the ramp.

The grade of an outlet ramp usually ascends or descends relative to the through pavement lanes. If the ramp departs from the through pavement on an ascending grade, there usually is no problem of sight distance at the point of departure of the ramp. The ramp takeoff, and the ramp itself, is clearly visible to approaching traffic for a sufficient advance distance to be impressed on the vision of the driver. The ramp pavement lying in plain view of the driver is a more effective visual aid than any directional sign which might be erected.

#### Descending Outlet Ramp

Outlet ramps which depart from the through pavement on a descending grade are a different problem. In designing the grade line of a descending outlet ramp, it is advisable not to start the vertical curve so close to the outlet nose that the entire ramp pavement is hidden from view of the driver until he is within two or three hundred feet of the ramp throat. Instead, the ramp grade line should be designed so that the ramp pavement and the through pavement are in about the same plane for a reasonable distance beyond the outlet nose, before starting the downward roll off the ramp.

Sight distance at freeway inlets may also be critical if the through traffic and the entering traffic are not visible to each other for some distance preceding the inlet throat. An inlet ramp that brings entering traffic up to the level of the through lanes in the manner of an express elevator can have a disconcerting effect on both through and entering traffic. The ramp grade should be designed to permit the two lines of traffic to run alongside of and in full view of each other for a short distance before reaching the inlet nose. Ramps constructed in this manner, with a 100-200 foot parallel portion of ramp pavement ahead of the inlet nose, are




operating very smoothly. This permits the two streams of traffic to pace each other and gives the entering traffic an added distance to select a space gap in the through traffic for safe merging.

#### 5. Left-side Connections

No discussion of speed change lanes and ramps is complete without mentioning left-side connections. Left-side interchange connections have been a controversial feature of design. Some authorities on interchange design have recommended against designs which take interchange traffic from the through lanes on the left side, or which bring entering traffic into the through lanes on the left side.

Two arguments have been presented to support this viewpoint. The first is that the left lane of a freeway is the high-speed lane while the right lane is the slow-speed lane. The other is that all connections to freeway lanes should be made on the same side of the freeway for the sake of uniformity of design and development of uniform driving habits.

Limited observations of the relative speeds on California freeways on the left, center and right lanes have not been conclusive. Speed checks by lanes on the Arroyo Seco Parkway during peak hours indicate there is no appreciable difference in speed on any of the three lanes. Speed, however, is directly related to distribution and volume of traffic, and will necessarily vary as the volumes vary. On freeways nearing practical capacity there is apparently little difference in speed on the various lanes, while facilities whose capacities are not yet approached may show higher speeds in the left lanes.

*Example of ascending outlet on Arroyo Seco Parkway between Los Angeles and Pasadena*

#### Uniformity of Design

Uniformity of design and development of uniform driving habits is a highly desirable goal which has not yet been reached. It is also doubtful that complete uniformity of design will be achieved in the near future, except insofar as uniformity of a particular interchange design type is concerned. Because of economic reasons, all of the various interchange types now being used have a definite place in the freeway system.

While it might be desirable from the standpoint of uniformity to make all connections to a freeway on the right side, there are locations where the more economical, more natural and more direct characteristics of a left-side connection outweigh the theoretical disadvantage of a departure from uniformity of design. This is particularly true of the direct type interchanges; in fact, it is the single characteristic that distinguishes a direct interchange from an indirect interchange.

There are more than a few examples of existing left-side connections on the California Freeway System. Some of them are constructed to design standards that are now obsolete but, in spite of this, are operating safely under heavy traffic volumes. As an example, there are three left-side off-connections on the Arroyo Seco, all within a short distance of the tunnel section on this parkway. They are the Castelar, Riverside and Figueroa off-ramps.

From the experience records of existing left-side connections, it is reasonable and safe to say they have a definite and useful place in freeway design, particularly as a part of a direct interchange.

#### EMERGENCY PARKING SHOULDERS

The necessity of providing emergency parking shoulders on structures and ramps, particularly on one-way one-lane roadways, has been discussed in preceding paragraphs. Similarly, it is highly desirable to provide continuous emergency parking shoulders on the right of the freeway traveled ways. As stated previously, a vehicle stalled in a traffic lane not only introduces traffic hazards, but also reduces traffic capacity.

At the time the Arroyo Seco Parkway was constructed, no shoulders of any kind were provided. The right edge of the traveled way was curbed continuously with an eight-inch barrier type curb. Due to difficult topographic controls, right of way widths were extremely critical. In general, the parkway parallels the concrete-lined channel of the Los Angeles River, and in some instances the edge of the outbound pavement is less than shoulder width from the top of the river channel.

Operation on this parkway has clearly demonstrated the need for emergency parking shoulders. The district has carefully studied this parkway, and wherever possible, has removed the barrier curb on the right and provided emergency parking bays. Although these bays are placed at irregular intervals and are of irregular lengths, observations indicate they are being used and are effective.

As a general rule, the emergency parking shoulders on an urban or metropolitan freeway should consist of a three-foot rolled P. C. C. gutter plus additional width of treated all-weather shoulder. In rural areas the emergency shoulders should generally omit the P. C. C. rolled gutter and substitute full width treated shoulders.

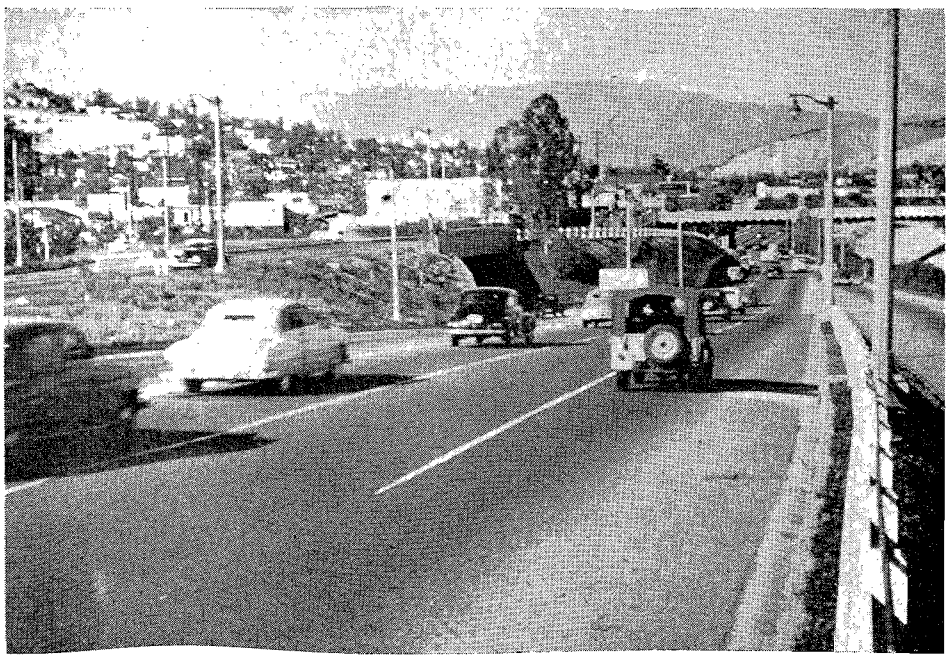
#### FREEWAY SIGNS

Another very important feature of any completed traffic interchange is proper signing and striping. Due to the high speeds on a freeway, it is essential that directional signs be large enough to be easily noticed and read both day and night. The message should be simple and direct, and, wherever possible, should indicate not more than two choices of direction.

The geometric layout of an interchange should include a signing layout before final approval is made. It is possible that the signing requirements may disclose a design deficiency that would not show up until later. If a layout cannot be signed properly, operating difficulties will result.

Advance warning signs are extremely important on a freeway to aid in segregating the traffic into its proper lanes before reaching a point of interchange. At present, interchange signs are placed at three locations. The first set of signs is placed one-half mile in advance of the off-ramp, one on each side of the freeway. Eight-inch, uppercase reflectorized letters on a black background are used. The next sign

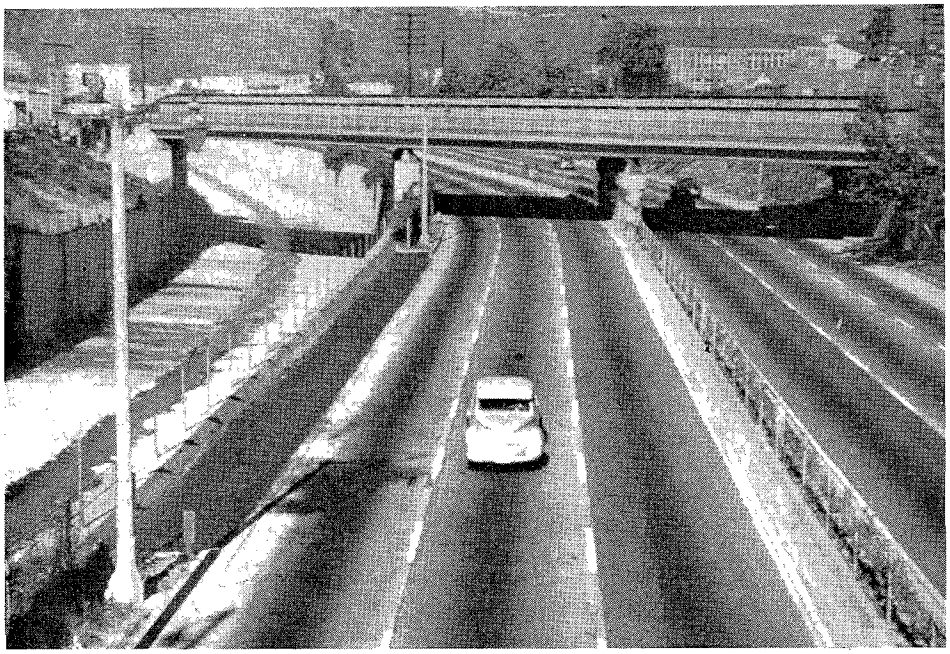
*Left-side Figueroa off-ramp on Arroyo Seco Parkway*



of the group is a single sign on the right side of the freeway placed one-fourth of a mile from the turnoff. The last sign of this group is located just ahead of the beginning of the deceleration lane and has 12-inch lower case white letters on a black background.

5. Indirect types are suitable at intersections with roadways of secondary importance.

6. The choice of a particular design type must be based on an analysis of traffic service and cost. The simplest design may be the best design.



*This photo shows emergency parking bay on Arroyo Seco*

**SUMMARY**

The items of major importance that have been raised in this paper are briefly summarized as follows:

1. A freeway or expressway development furnishes the most important warrant for a grade separation or traffic interchange. Application of this warrant must consider community service, land use and local street circulation.

2. A complete traffic analysis is mandatory prior to beginning the design of an interchange.

3. A freeway centerline should not be definitely located until the interchange problems have been carefully studied and evaluated along with other factors influencing location. Intersections of more than two roadways should be avoided if alternate location of center lines is at all possible.

4. Direct type interchanges should be designed at major intersections. They should be simplified if possible by sacrificing minor movements at the interchange site to provide direct movements for the major movements.

7. Interchange structures should be carefully studied from the standpoint of traffic service, cost and appearance. Changes in horizontal alignment and roller coaster grade lines on the structure should be avoided.

8. The design of the speed change lanes and ramp connections is of primary importance because these facilities must transfer the traffic loads to and from the freeway with a minimum amount of confusion and congestion at the connections to the local streets. Minimum design standards should be applied only after a careful consideration of traffic service and cost. Adequate sight distance cannot be overemphasized.

9. Left-side ramp connections are warranted if traffic analysis indicates the need and cost studies are favorable, particularly for direct type interchanges.

10. Emergency parking shoulders should be provided wherever practical on structures, ramps and adjacent to main traveled ways.

11. The successful operation of any high-speed facility is dependent to a great extent on adequate, simple and direct signing. The signing should provide advance warning and be easily read both day and night.

**CONCLUSION**

The Division of Highways has made excellent progress in the relatively new field of interchange design in the past few years and will continue to do so. There is yet much factual data to be gathered on the operating characteristics and capacities of the various types of interchanges. These facts will be gathered as they become available through experience. Observation of completed facilities under operating conditions will undoubtedly point the way to continual improvement.

In conclusion, the importance of interchange design should be stressed. The traffic interchange represents a substantial percentage of the expenditure on freeway construction and is the key to the successful operation of the freeway. The traffic interchange is the mechanism that makes the freeway possible. The freeway, in turn, with its characteristics of relief from delay, congestion and hazard, is the answer to the overcrowded and restricted conditions on many of our outmoded conventional type highways. The freeway removes all these irritations and inconveniences from the community through which it passes and binds the community together again with its grade separations and interchange facilities.

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## APPRECIATIVE MOTORIST

ABEGG & REINHOLD CO.
LOS ANGELES, CALIFORNIA

*California Highways and Public Works*
*Sacramento, California*

GENTLEMEN: I would not want to miss *California Highways and Public Works*. It has been a pleasure looking forward to it every other month.

Returning recently from an extended trip through the Midwest it was a pleasure to enter our State and enjoy driving on fine highways. Our State Department of Public Works is to be congratulated for the fine job it is doing and the taxpayers for money well spent.

Yours very truly,

W. H. SPIRI

# Oldest Swing Bridge

## *Span Built 70 Years Ago To Be Replaced*

By ROBERT M. BARTON, Associate Bridge Engineer

THE OLDEST movable bridge on the State Highway System, and possibly the oldest of its type in the State, is to be removed and replaced during 1951. This structure, known as the San Leandro Bay Bridge, is an obsolete swing span which connects the City of Alameda with Doolittle Drive, the Oakland Airport, and the Bay Farm Island residential district of Alameda. It has three trusses; the center truss originally separated the carriage and wagon way on one side of the bridge from a narrow gage railroad on the other. However, both sides are now used for highway traffic.

On April 18th, bids on the new bridge were opened and the Duncanson & Horrelson Co. and Stolte, Inc., Richmond, were low bidders with a proposal of $1,631,057.80.

The material used in the bridge is believed to be wrought iron and was fabricated 70 years ago by the Detroit Bridge and Iron Works. The original drawings, the oldest in the files of the Bridge Department, bear the dates 1880 and 1881. The structure was completed in the latter year. Originally, the bridge was opened and closed by manpower, but when the era of labor-saving devices arrived, an electric motor was installed.

The structure was first built at Webster Street (now the location of the Posey Tube), and was moved to its present site in 1898, being replaced at Webster Street by a more substantial swing bridge. (The latter served until it fell into the estuary following a collision with a Dollar liner in 1925. The subsequent bridge, which carried traffic until the completion of the Posey Tube, is now located across the mouth of the American River at Jibboom Street in Sacramento.)

### Relic of South Pacific Coast Railroad

The present San Leandro Bay Bridge is a relic of one of California's most interesting but almost forgoten railroads, the South Pacific Coast Railroad (not to be confused with Southern Pacific Coast Lines), a narrow gage line that operated from Alameda through Newark and San Jose to Santa Cruz. In the 1880's it was a favorite route for visitors to Santa Cruz and the redwoods. A ferry connection was maintained between Alameda and San Francisco.

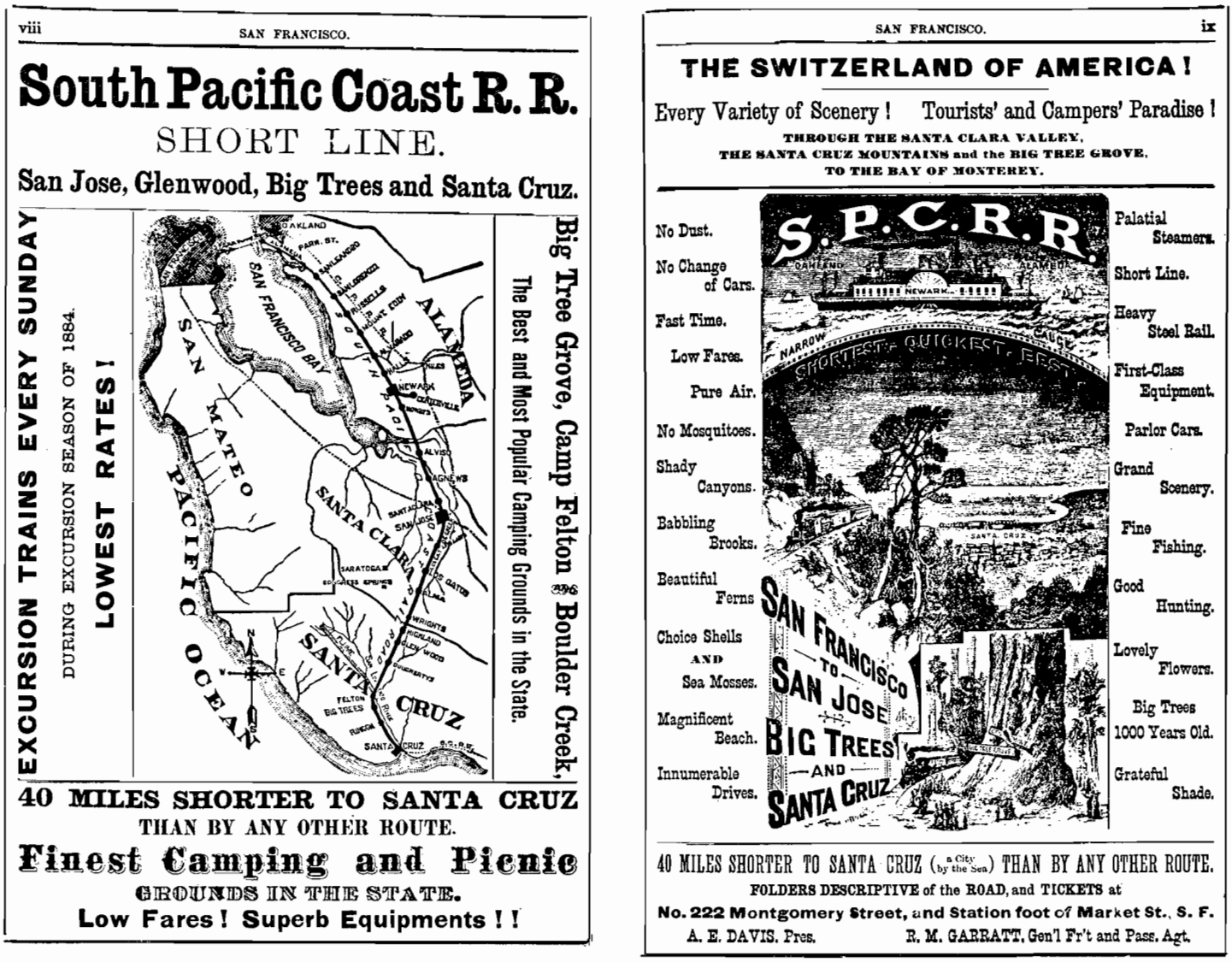
This narrow gage railroad, although small, had large-scale ambitions, for it planned to build southwesterly from Santa Cruz, thence over the Coastal Ranges, and ultimately to connect with the Denver and Rio Grande, a narrow gage line which was extending its lines towards the west from Pueblo, Colorado. However, these plans never materialized.

Since the Central Pacific ferries had a monopoly on ferry service between Oakland and San Francisco, a public clamor arose in Oakland for the South Pacific Coast to build a connection across San Antonio Creek, now known as the Oakland Estuary, so that a competitive San Francisco commute service would be available to Oakland residents. Accordingly, the South Pacific Coast obtained rights to a then existing vehicular county bridge across the estuary at Webster Street, tore it down, and at that time built the swing bridge which is the subject of this article.

### Gala Festivities at Bridge Opening

The first train chugged across the new bridge on the evening of May 30, 1881, and there was a "hot time" in Oakland that night. The *Alta California* reported, "Webster Street was brilliantly illuminated . . . for the entry of the narrow gauge railroad. Houses along the street were decorated and illuminated, cannons, fire-arms, and fireworks were discharged, whistles were blown, and a general rejoicing was had." The *Oakland Times*, in its

*Originally built by a narrow gage railroad in 1881, this San Leandro Bay Bridge is the oldest of its type in the State*




*This advertisement, taken from an 1884 San Francisco directory, shows on the left the route of the South Pacific Coast Railroad*

report of the festivities, also mentioned Chinese lanterns and bonfires.

The four-wheel coaches of the South Pacific Coast were regarded as very swank indeed. They were constructed at the company's shops in Newark, were finished in prima vera and black walnut, and the seats were upholstered in red plush and had *cushioned* bottoms.

The South Pacific Coast must have proved a strong competitor to the Central Pacific, for the reported travel time to San Francisco from Oakland via the South Pacific's Webster Street Bridge and Alameda Mole route was several minutes faster than via the Central Pacific's Oakland Mole route. It is not surprising, therefore, that the Central Pacific-Southern Pacific interests leased the South Pacific Coast in 1887, thereby restoring its monopoly.

#### Rail Disaster at Webster Street

On May 30, 1890, a sensational railroad disaster occurred at the San Leandro Bay Bridge, it still being then at its Webster Street location. The bridge had been opened to allow a yacht to pass, and all proper danger and warning signals were posted. The yacht cleared the structure, and the bridge had almost returned to its normal position, when a local passenger train on the narrow gage line, then operated by the Southern Pacific, disregarded the signal, and plummeted into the estuary. Luckily, a coupling on the train broke, so only the locomotive and one coach dropped into the water, two other coaches remaining on the track. Thirteen passengers, trapped in the sunken rail coach, drowned. The engineer, who managed to extricate himself from his submerged cab, was charged with manslaughter for failing to heed the stop signals, but prudently disappeared before any action could be taken.

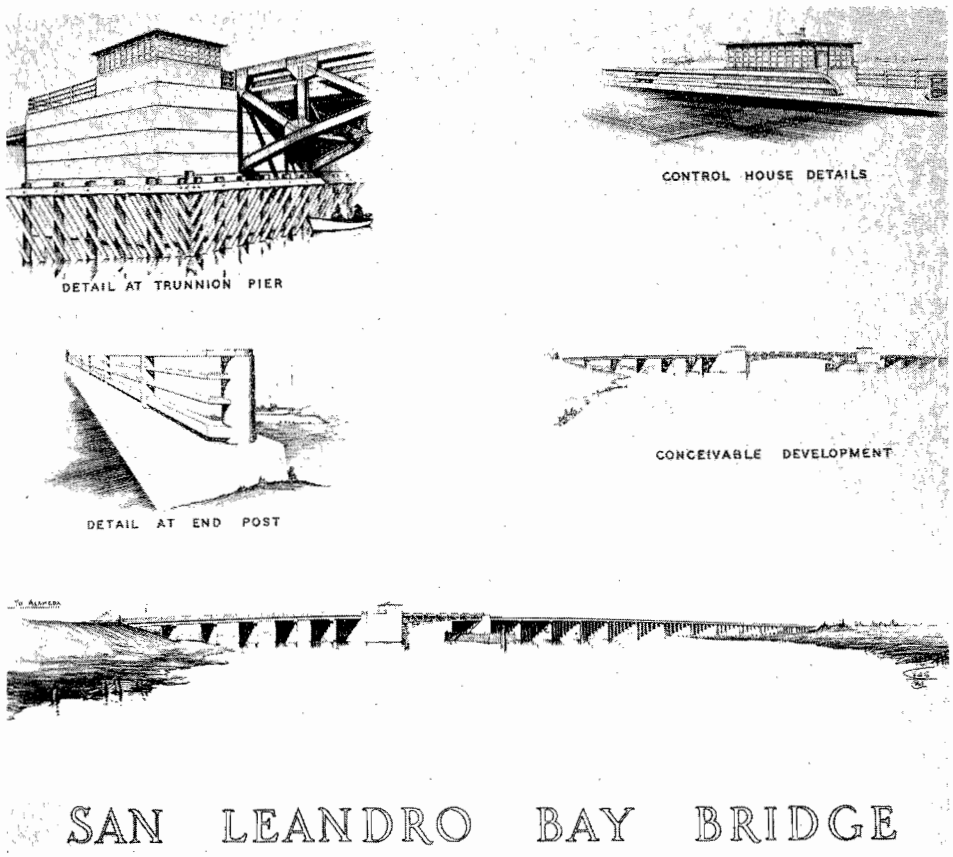
#### Old Bridge Now Obsolete

The San Leandro Bay Bridge, now approaching its 70th anniversary, is antiquated and has long since passed the point of economical service. It is on poor alignment, and the two traffic lanes provided by the bridge are totally inadequate for the 10,000 vehicles which cross the bridge each day. Consequently, acute traffic congestion often occurs at this bottleneck. The

trusses are very badly rusted throughout, and scaling and deep pitting of the metal are evident over the entire structure; in a few places the webs of the truss members have rusted completely through. The machinery which opens the bridge is not dependable, and has on occasion broken down. The piling supporting the structure are subject to rapid destruction by marine borers (worms). Due to the insatiable appetite of the latter, emergency substructure repairs costing almost $20,000 were necessary in 1949 to prevent the dilapidated bridge from toppling into the Bay when the center pier displayed evidences of tipping.

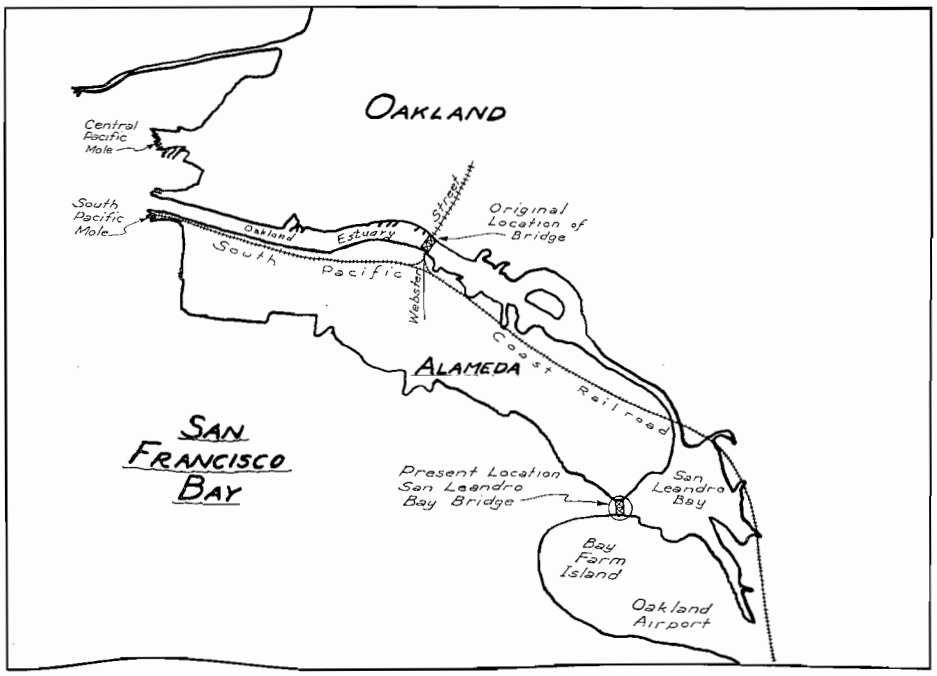
**Bridge Posted**

Owing to the deteriorated condition of the bridge, it has been necessary to post the bridge for gross loads of 12 tons and the speed limit for vehicles weighing over 10 tons is restricted to 10 mph. The truss in the center of the roadway has been a contributing factor in several automobile accidents; also, automobile mishaps have occurred as a result of loose deck planking. Furthermore, the present bridge, which limits the clear channel width to 71 feet, constitutes a serious obstruction to the ultimate development of San Leandro Bay as planned by the Port of Oakland. In consideration of all of these various factors, it may be concluded that there is no other bridge in the entire State that has as many outstanding qualifications for relegation to the junk heap.




*Architect's drawing of new bridge to be built in1951*

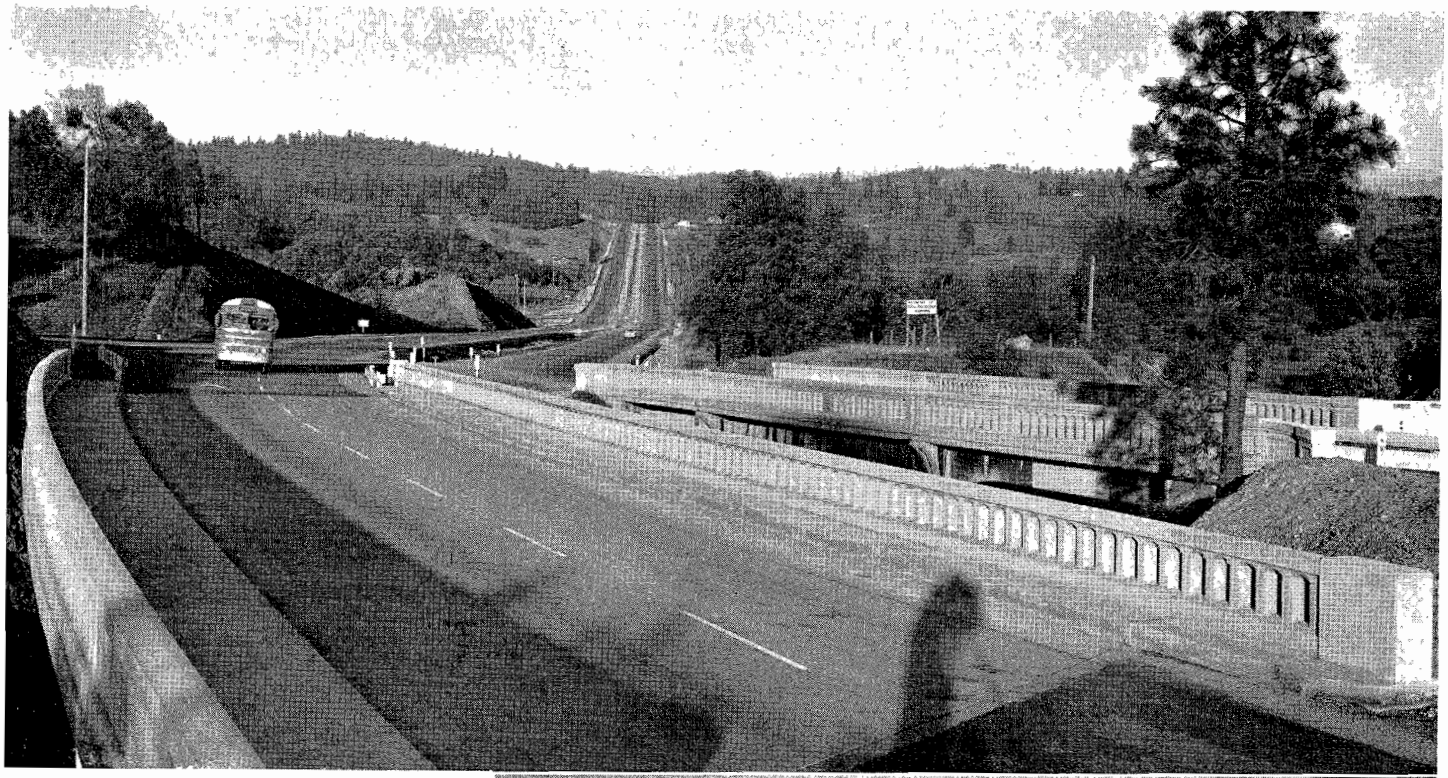
*Map of Alameda, showing original location and present location of San Leandro Bay Bridge*




**New San Leandro Bay Bridge**

The new San Leandro Bay Bridge will be a four-lane divided, single-leaf bascule, of modern design and pleasing appearance. In anticipation of the ultimate development of the Oakland harbor, provisions are being made for the future addition of second leaf to provide a 200-foot width of channel for vessels entering San Leandro Bay. However, for the immediate future, the 92-foot-wide channel provided by the single leaf will be adequate for the small boats which presently use the opening. The vertical clearance for water craft will be unlimited. The roadway width on the bridge will be 58 feet with a six-foot division strip.

It is estimated that the new bridge, together with the approaches, will cost in the neighborhod of $1,500,000. It is expected that construction of the new bridge will begin late in the spring of 1951. Further information regarding the new bridge will be published in a later issue of this magazine.



# A RELIEF

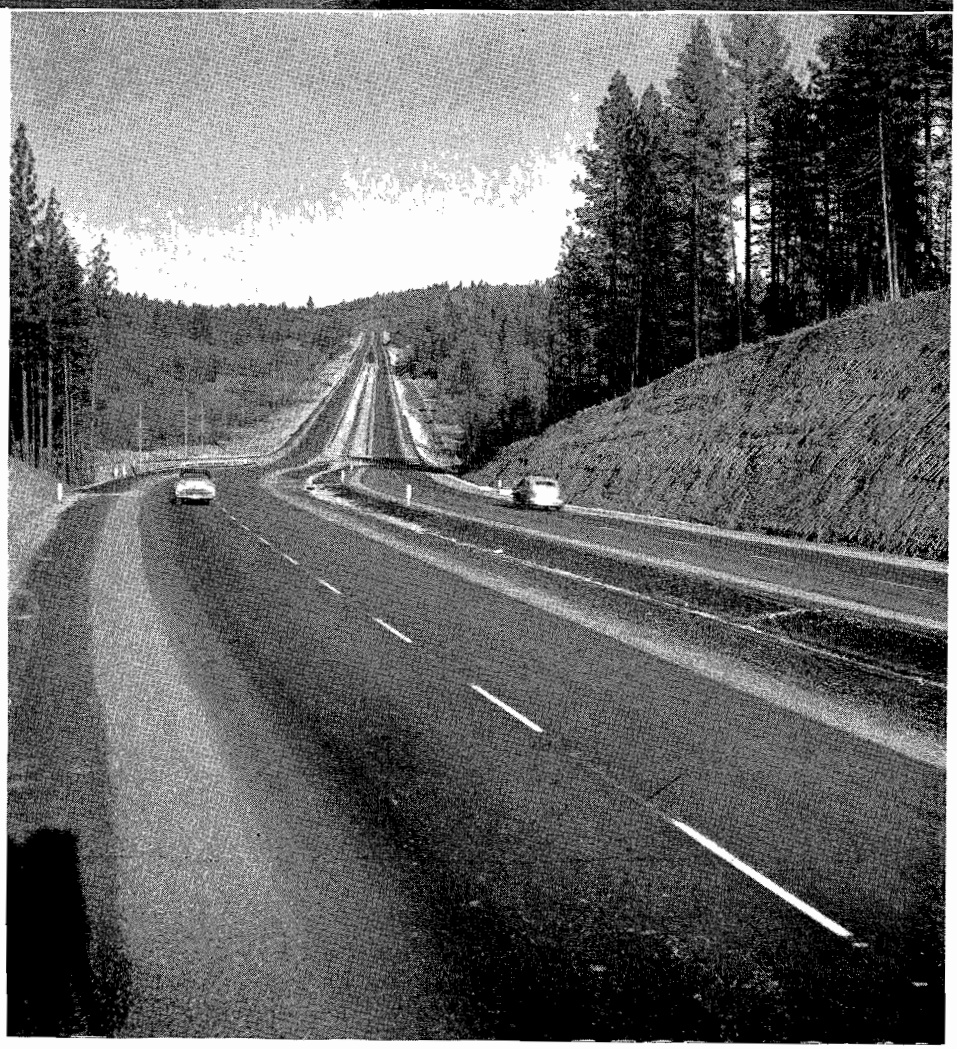
MOTORISTS traveling U. S. 40 between Auburn and Applegate in Placer County find it a relief to encounter only 14 curves on the 6.1 miles-section of the new freeway between these points instead of the 56 curves which existed on the old highway.

The completed project now in use joins the freeway one mile east of Auburn and extends easterly to one mile west of Applegate. There are two overhead crossings of the Southern Pacific Railroad at Bowman.

The choice of location of this realignment made possible the use of light grades and the maximum of 6 percent has been reached on only two sections, each of which is less than 2,000 feet in length. On the old highway grades were as high as 7 percent.

Pavements are 24 feet in width and shoulders eight feet and five feet wide in each roadbed with a division strip 36 feet wide.

Grading and structures for the new highway cost approximately $1,470,000 and the paving cost $345,500.



*UPPER—Bowman Overhead structure near beginning of project. New structure on left, old structure on right, which is now used for eastbound traffic only. LOWER—Looking east on new four-lane divided alignment near east end of project.*

# HIGHWAY BIDS AND AWARDS

## January, 1951

ALAMEDA, CONTRA COSTA COUNTY—In the Cities of Berkeley and Richmond, at the intersections of Eastshore Highway with University Avenue, Central Avenue and Carlson Boulevard, a full traffic actuated signal system and highway lighting system to be furnished and installed at one intersection, modification of traffic signal systems at two intersections and channelization to be constructed at three intersections. District IV, Route 69. J. R. Armstrong, El Cerrito, $30,292; J. Henry Harris, Berkeley, $34,066. Contract awarded to Lee J. Immel, San Pablo, $30,052.

FRESNO COUNTY—At the intersection of U. S. 99 and Church Avenue at the south city limits of Fresno, a traffic signal system. District VI, Route 4. Clinton Electric Corp., Burbank, $13,746; L. H. Leonardi Electric Construction Co., San Rafael, $14,825; Robinson Electric, Fresno, $15,000. Contract awarded to Westates Electrical Construction Co., Los Angeles, $12,546.

LOS ANGELES COUNTY—In the City of Burbank, on Front Street and Providencia Avenue, from 200 feet westerly of Olive Avenue to San Fernando Boulevard, about 0.6 mile, paving portions with asphalt concrete over untreated rock base and resurfacing portions wihh plant-mixed surfacing over existing pavement. District VII, Route 4. Boddum and Peterson, Long Beach, $58,850; Peter Kiewit Sons Co., Arcadia, $59,867; M. S. Mecham and Sons, South Gate, $61,345; Schroeder and Co., Sun Valley, $62,802; J. E. Haddock, Ltd., Pasadena, $63,041; Nappe Construction Co., Inc., Burbank, $63,981; Griffith Co., Los Angeles, $67,413. Contract awarded to Jesse S. Smith, Glendale, $57,920.

LOS ANGELES COUNTY—In the City of Los Angeles, between Virgil Avenue and Beaudry Avenue, about 2.3 miles of roadside areas to be prepared and planted. District VII, Route 2. Stephen L. Vistica, San Mateo, $42,802; James E. Boothe, Lynwood, $47,786; Henry C. Soto Corp., Los Angeles, $49,856; Huetting, Schromm and Bennett, Palo Alto, $59,215. Contract awarded to Jannoch Nurseries, Altadena, $40,876.01.

LOS ANGELES COUNTY—In the City of Los Angeles, on Pacific Coast Highway at Sunset Boulevard and Chautaugua Boulevard, portions about 0.7 mile, the existing pavement to be widened by constructing plant-mixed surfacing on untreated rock base and widening the existing reinforced concrete bridge across Santa Monica Storm Drain extension. District VII, Route 60. J. E. Haddock, Ltd., Pasadena, $66,913; George Savala, Studio City, $67,816; Boddum and Peterson, Long Beach, $67,956; McClain Construction Co., Inc., Hawthorne, $68,483; Griffith Co., Los Angeles, $72,014. Contract awarded to Jesse S. Smith, Glendale, $66,028.50.

LOS ANGELES COUNTY—On Hollywood-Santa Ana Freeway in the City of Los Angeles between Grand Avenue and Los Angeles Street, about 0.5 mile to be graded and paved with Portland cement concrete and asphalt concrete and reinforced concrete outer highway overcrossing to be constructed. District VII, Route 2. J. E. Haddock, Ltd., Pasadena, $923,972; Guy F. Atkinson Co., Long Beach, $956,561; Griffith Company, Los Angeles, $984,511; Clyde W. Wood and Sons, Inc., North Hollywood, $1,508,128. Contract awarded to Webb and White, Los Angeles, $902,792.80.

LOS ANGELES COUNTY—In the City of South Gate, on Firestone Boulevard at Rayo Avenue, full traffic actuated signal system with highway lighting to be furnished and installed and channelization to be constructed. District VII, Route 174. Vido Kovacevich Co., South Gate, $20,279; Electric and Machinery Service, Inc., South Gate, $21,131; Boddum and Peterson, Long Beach, $24,772. Contract awarded to Fischbach and Moore of California, Los Angeles, $19,883.50

LOS ANGELES COUNTY—In and adjacent to the City of Pasadena at the intersection of Rosemead Boulevard with Foothill Boulevard, traffic signal system and highway lighting to be furnished and installed. District VII, Routes 9, 168. Westates Electrical Construction Co., Los Angeles, $11,572; Electric and Machinery Service, Inc., South Gate, $12,149; C. D. Draucker, Inc., Los Angeles, $12,794. Contract awarded to Fischbach and Moore of California, Inc., Los Angeles, $10,725.

LOS ANGELES COUNTY—On Hollywood Freeway at Holly Drive, in the City of Los Angeles, a reinforced concrete bridge to be constructed. District VII, Route 2. Webb and White, Los Angeles, $288,163; J. E. Haddock, Ltd., Pasadena, $292,238; Lars Oberg and R. R. Bishop, Los Angeles, $323,076; Bongiovanni Construction Co., Los Angeles, $323,345; Charles MacClosky Co., San Francisco, $323,808; Fredericksen and Kasler, Sacramento, $325,980. Contract awarded to George W. Peterson and Jack W. Baker, Los Angeles, $286,090.

LOS ANGELES COUNTY—In the City of Inglewood at the intersection of La Brea Avenue with Kelso Street and with Hardy Street and Manchester Boulevard with West Boulevard, 11th Avenue, Crenshaw Boulevard, Seventh Avenue and with Fifth Avenue, furnish and install fixed-time traffic signal systems at five intersections and furnish and install modifications to fixed-time traffic signal systems at two intersections. District VII, Routes 164, 174. Fischbach & Moore of California, Inc., Los Angeles, $13,543; Westates Electrical Construction Co., Los Angeles, $16,089. Contract awarded to Electric & Machinery Service, Inc., South Gate, $13,237.

MARIN COUNTY—Between Ignacio and Forbes Overhead, a length of about 5.5 miles, to be graded and surfaced with plant-mixed surfacing on cement-treated base; construct two reinforced concrete bridges and repair one bridge and install a traffic signal system and highway lighting systems. District IV, Route 1, Section A. A. G. Raisch Co., San Rafael, $1,047,926; Harms Brothers and Charles MacClosky Co., Sacramento, $1,111,786; Fredrickson and Watson Construction Co., Oakland, $1,154,773; Eaton and Smith and Clements and Co., San Francisco, $1,192,771; Charles L. Harney, Inc., San Francisco, $1,259,109. Contract awarded to Granite Construction Co., Watsonville, $1,032,455.

ORANGE COUNTY—Between Sea Scout Base and south city limits of Newport Beach, about 3.7 miles to be widened and surfaced with plant-mixed surfacing on untreated rock base and the existing pavement. District VII, Route 60, Section B. Sully-Miller Construction Co., Long Beach, $160,921; John J. Swigart Co., Torrance, $167,422; Peter Kiewit Sons Co., Arcadia, $174,340; M. S. Mecham and Sons, South Gate, $174,990; Basich Brothers Construction Co., R. L. Basich-N. L. Basich, San Gabriel, $180,069; Baker and Pollock, Ventura, $181,377; Roland T. Reynolds, Anaheim, $184,340; Griffith Co., Los Angeles, $193,255. Contract awarded to Cox Brothers Construction Co., Stanton, $155,960.

SACRAMENTO COUNTY—In the City of Sacramento on N Street between 10th Street and 13th Street, curbs and gutters to be constructed. District III, Route 6. A. Teichert & Son, Inc., Sacramento, $6,675; Brighton Sand & Gravel So., Sacramento, $10,065; McGillivray Construction Co., Sacramento, $10,577. Contract awarded to J. R. Reeves, Sacramento, $6,075.50.

SAN BERNARDINO COUNTY—On Foothill Boulevard at San Bernardino Road, about 0.3 mile, constructing a graded roadbed for a channelized intersection and constructing plant-mixed surfacing on imported borrow and the existing pavement, apply seal coats and install highway lighting system. District VIII, Route 9, Section A. E. L. Yeager Co., Riverside, $30,013; George Herz and Co., San Bernardino, $32,050; R. A. Erwin, Colton, $33,932. Contract awarded to Boddum and Peterson, Long Beach, $21,997.50.

SAN DIEGO COUNTY—On Route 12 at intersections with East La Mesa Boulevard, Fuerte Drive, and Murray Avenue, a full traffic actuated signal system and highway lighting to be furnished and installed at one intersection and highway lighting to be furnished and installed and channelization to be constructed at two intersections. District XI, Route 12, Section B. Griffith Co., Los Angeles, $47,082; Cox Brothers Construction Co., Stanton, $47,305; V. R. Dennis Construction Co., San Diego, $48,288. Contract awarded to R. E. Hazard Contracting Co., Inc., San Diego, $43,934.70.

SAN DIEGO COUNTY—In the City of San Diego, at the intersection of El Cajon Boulevard with 56th Street and with 59th Street and Market Street with Kettner Boulevard, full traffic actuated signal system with highway lighting at one intersection and semitraffic actuated signal systems with highway lighting at two intersections to be furnished and installed. District XI, Routes 12, 200. Ets-Hokin and Galvan, San Diego, $22,790. Contract awarded to California Electric Works, San Diego, $21,850.

SAN MATEO COUNTY—In the City of Menlo Park, on El Camino Real, furnish and install semitraffic actuated signal systems at the Valparaiso Avenue and Oak Grove Avenue intersection, modify the existing traffic actuated signal systems at the Santa Cruz Avenue and Ravenswood Avenue intersection and interconnect the four intersections. District IV, Route 2, Section MIP. R. Flatland, San Mateo, $26,568; R. Goold and Son, Stockton, $27,076; Central Electric Co., Inc., San Francisco, $27,951. Contract awarded to L. H. Leonardi Electric Construction Co., San Rafael, $23,920.25.

SANTA BARBARA COUNTY—Between San Julian Ranch and 1.8 miles north of Ytias Creek, about 3.2 miles to be graded and surfaced with plant-mixed surfacing on cement-treated imported base material. District V, Route 56, Section A, B. Basich Brothers Construction Co., R. L. Basich-N. L. Basich, Garvey, $249,112; Clyde W. Wood and Sons, Inc., North Hollywood, $253,992; Granite Construction Co., Watsonville, $258,957; Dimmitt and Taylor, Monrovia, $262,322; Madonna Construction Co., San Luis Obispo, $274,667. Contract awarded to Valley Paving and Construction Co., Pismo Beach, $242,144.50.

SANTA CLARA COUNTY—At Mathilda Avenue in Sunnyvale, about 0.1 mile to be graded and surfaced with plant-mixed surfacing on crusher run base. District IV, Route 114. Leo F. Piazza Paving Co., San Jose, $22,312; A. J. Raisch Paving Co., San Jose, $22,616. Contract awarded to Edward Keeble, San Jose, $21,167.

TULARE COUNTY—Between 1 mile north of Goshen and Traver, about 6.3 miles to be graded and paved with Portland cement concrete on cement treated subbase and five reinforced concrete bridges to be constructed. District VI, Route 4, Section E. United Concrete Pipe Corporation, Baldwin Park, $678,496; Guy F. Atkinson Co., South San Francisco, $684,484; Peter Kiewit Sons' Co., Arcadia, $705,817; M. J. B. Construction Co., Stockton, $738,661; Ball and Simpson, Berkeley, $751,183; Cox Brothers Construction Co. and J. E. Haddock, Ltd., Pasadena, $787,867. Contract awarded to Griffith Co., Los Angeles, $660,552.

## F. A. S. County Routes

KERN COUNTY—On Weed Patch-Wheeler Ridge Road, between David Road and Wheeler Ridge, about 6.9 miles, plant-mixed surfacing to be placed over existing surfacing on portions of the project and over cement-treated base on the remainder of project. District VI, Route 574. Griffith Co., Los Angeles, $90,831; Hensler Construction Corp., Sun Valley, $92,972; G. W. Ellis Construction Co., North Hollywood, $97,430; James L. Miller and Sons, Los Angeles, $102,322; Ball and Simpson, Berkeley, $110,430; A. Teichert and Son, Inc., Sacramento, $112,645; Dicco, Inc., Bakersfield, $112,737. Contract awarded to Oilfields Trucking Co., and Phoenix Construction Co., Inc., Bakersfield, $87,447.10.

## February, 1951

LASSEN COUNTY—Between Slate Creek and Grasshopper Valley Ranch, about 1.8 miles to be graded and surfaced with road-mixed surfacing on gravel base. District II, Route 988, Section J. H. D. No. 14. Baker Trucking Co., Hamilton City, $41,-567; M. W. Brown, Redding, $42,965; H. Earl Parker, Inc., Marysville, $52,289; O'Connor Brothers, Red Bluff, $61,457; J. Henry Harris, Berkeley, $68,407. Contract awarded to W. H. O'Hair Co., Colusa, $39,602.80.

LOS ANGELES COUNTY—Between north city limits of Los Angeles, near Tunnel Station bridge, and Pico Canyon Road, about 5.1 miles to be graded and surfaced with Portland cement concrete pavement and plant-mixed surfacing. District VII, Route 4, Section F. Peter Kiewit Sons' Co., Arcadia, $1,-067,364; Cox Brothers Construction Company and J. E. Haddock, Ltd., Pasadena, $1,094,038; United Concrete Pipe Corp. and Ralph A. Bell, Baldwin Park, $1,148,644; Clyde W. Wood and Sons, Inc., North Hollywood, $1,150,154; A. Teichert and Sons, Inc., Sacramento, $1,168,182; Griffith Co., Los Angeles, $1,190,352; Ball and Simpson, Berkeley, $1,219,123; Basich Brothers Construction Co., R. L. Basich-N. L. Basich, Garvey, $1,341,349; Bressi and Bevanda Constructors, Inc., North Hollywood, $1,356,706. Contract awarded to Claude Fisher Co., Ltd., Los Angeles, $1,025,284.

LOS ANGELES COUNTY—On Ramona Freeway between 0.2 mile east of Helen Drive and Hellman Ave., about 1.5 miles to be graded and paved with Portland cement concrete on cement-treated surface and with plant-mixed surfacing on imported base material; and four bridges to be constructed; to provide a six-lane divided highway with frontage roads. District VII, Route 26, Section D, L. A., Alh. United Concrete Pipe Corp., and Ralph A. Bell, Baldwin Park, $1,879,725; Griffith Co., Los Angeles, $1,903,571; Guy F. Atkinson Co., Long Beach, $1,-923,206. Contract awarded to J. E. Haddock, Ltd., Pasadena, $1,769,134.60.

LOS ANGELES COUNTY—On state highway in the City of Burbank, between Burbank Boulevard and Magnolia Boulevard, constructing chain-link fences. District VII, Route 4, Section Brb. Pacific Fence Co., Los Angeles, $4,048; Los Angeles Fencing Co., Inc., Los Angeles, $4,228; Crown Fence and Supply Co., Ltd., Pasadena, $4,233; Henry C. Soto Corp., Los Angeles, $4,295; Alcorn Fence Co., Los Angeles, $4,635; Cyclone Fence Div., Glendale, $4,909. Contract awarded to American Chain Link Machine Co., Los Angeles, $3,795.

LOS ANGELES COUNTY—On Hollywood Freeway, at Hollywood Boulevard in the City of Los Angeles, a reinforced concrete box girder bridge for an overcrossing to be constructed. District VIII, Route 2. J. E. Haddock, Ltd., Pasadena, $327,072; Charles MacClosky Co., San Francisco, $331,643; Bongiovanni Construction Co., Hollywood, $331,743; Webb and White, Los Angeles, $344,028; George W. Peterson and Jack W. Baker, Los Angeles, $377,368. Contract awarded to Fredericksen and Kalser, Sacramento, $320,942.58.

MARIN COUNTY—Near the southerly end of the San Rafael Viaduct, constructing pump house and pump sump and installing drainage facilities. District IV, Route 1. Contract awarded to S and Q Construction Co., San Francisco, $24,500.

ORANGE COUNTY—Between Peralta School and Riverside County Line, about 6.1 miles to be graded and surfaced with plant-mixed surfacing on cement treated base. District VII, Route 43, Section B. Peter Kiewit Sons Co., Arcadia, $932,523; Griffith Co., Los Angeles, $938,979; Cox Brothers Construction Co., J. E. Haddock, Ltd., Pasadena, $1,033,338; United Concrete Pipe Corp. and Ralph A. Bell, Baldwin Park, $1,074,033; Hess Construction Co., Inc., Long Beach, $1,082,016; Fredericksen and Kasler, Sacramento, $1,109,616; E. L. Yeager Co., Riverside, $1,155,849; Arthur H. Famularo and Roland T. Reynolds, Anaheim, $1,234,103; Basich Brothers Construction Co., R. L. Basich-N. L. Basich, Garvey, $1,319,149. Contract awarded to A. Teichert and Son, Inc., Sacramento, $917,600.50.

PLUMAS COUNTY—Near Blairsden, mineral aggregate to be furnished and stockpiled. District II, Route 83, Section A. M. W. Brown, Redding, $22,-500; Allen and Reddy, Red Bluff, $24,800; Harms Brothers, Sacramento, $28,000; Boyce Construction Co., Tahoe Vista, $30,000. Contract awarded to Rice Brothers, Inc., Marysville, $14,800.

SAN BENITO AND SANTA CLARA COUNTIES—At Pajaro River about 5.3 miles southeast of Gilroy, about 0.4 mile, approaches to be graded and surfaced with plant-mixed surfacing on cement-treated imported base material and a reinforced concrete bridge to be constructed. District V, Route 119, Section F, A. Thomas Construction Co., Fresno, $102,353; Dan Caputo, San Jose, $110,703; Eaton and Smith, San Francisco, $114,492. Contract awarded to Fredrickson and Watson Construction Co., Oakland, $98,782.95.

SAN BERNARDINO COUNTY—Installation of drainage improvements at the intersection of I Street and Highland Avenue. District VIII, Route 190 SB. Lloyd R. Johnson, Rialto, $11,965. Contract awarded to George Herz and Co., San Bernardino, $10,-398.50.

SAN BERNARDINO COUNTY—In the City of San Bernardino, on Highland Avenue at Mt. Vernon Avenue, Cajon Boulevard and at "I" Street, traffic signal systems and highway lighting to be furnished and installed and traffic island, curbs and pavement widening to be constructed. District VIII, Route 31, 190. Paul R. Gardner, Ontario, $25,219; Westates Electrical Construction Co., Los Angeles, $25,295. Contract awarded to Fischbach and Moore of California, Inc., Los Angeles, $24,887.

SAN DIEGO COUNTY—Across San Diego River in the City of San Diego, a bridge extension to be constructed and about 0.5 mile detour and bridge approach to be graded and surfaced. District XI, Route 2. Bent Construction Co., Los Angeles, $344,-126; M. H. Golden Construction Co., San Diego, $380,773; Charles MacClosky Co., C. G. Willis and Sons, Inc., and R. E. Hazard Contracting Co., San Francisco, $392,714; J. E. Haddock, Ltd., Pasadena, $396,892. Contract awarded to Guy F. Atkinson Co., Long Beach, $341,163.

SANTA CRUZ COUNTY—Construction of a 500-foot line change approximately one-half mile north of Boulder Creek. District IV, Route 116. Leo Cardwell Construction Co., Santa Cruz, $14,062; Carey Brothers Construction, San Anselmo, $14,543; J. Henry Harris, Berkeley, $22,560; Elmer J. Warner, Stockton, $25,751; Edward Keeble, San Jose, $27,-028; Eugene G. Alves, Pittsburg, $31,666. Contract awarded to Granite Construction Co., Watsonville, $12,916.

SOLANO COUNTY—At the Nut Tree and at Alamo Creek, about 0.7 mile frontage road to be graded and surfaced with plant-mixed surfacing on untreated rock base. District X, Route 7, Section C, D. Frederickson Brothers, Emeryville, $37,537; J. Henry Harris, Berkeley, $43,402. Contract awarded to Harms Brothers, Sacramento, $30,324.

VENTURA COUNTY—At the intersection of Ventura Avenue with Main Street, Park Row Avenue, Center Street and Ramona Street in the City of Ventura. Traffic signal systems to be furnished and installed and modified. District VII, Route 138. Fischbach and Moore of California, Inc., Los Angeles, $13,356; Electric and Machinery Service, Inc., South Gate, $13,529; Westates Electrical Construction Co., Los Angeles, $14,175. Contract awarded to Clinton Electric Corp., Burbank, $12,431.

### F. A. S. County Routes

RIVERSIDE COUNTY—Across Coachella Valley Storm Drain, near Thermal, a reinforced concrete slab bridge on concrete pile bents to be constructed. District XI, Route 734. E. G. Perham, Los Angeles, $69,879; Tumblin Co., Bakersfield, $70,708; E. L. Yeager Co., Riverside, $73,026; Anderson Co., Visalia, $75,854; C. B. Tuttle Co., Long Beach, $76,-496; Griffith Co., Los Angeles, $77,935; Fredericksen and Kasler, Sacramento, $80,607; E. H. Thomas Co., Las Vegas, $80,925; Penn Construction Co., Baldwin Park, $81,785; Norman I. Fadel, North Hollywood, $93,606. Contract awarded to F. Fredenburg, Temple City, $69,425.

## March, 1951

LOS ANGELES COUNTY—On Santa Ana Freeway, between 0.2 mile southeast of Washington Boulevard and Todd Avenue, about 1.5 miles to be graded and portions to be surfaced with Portland cement concrete on cement treated subgrade; interchange roadways, acceleration and deceleration lanes and outer highways to be surfaced with plant mixed surfacing on untreated rock base; two grade separation structures and a pedestrian overcross structure to be constructed to provide a freeway with a six-lane divided roadbed. District VII, Route 166, Section A. Griffith Co., Los Angeles, $1,519,806; Bongiovanni Construction Co., Hollywood, $1,543,048; Guy F. Atkinson Co., Long Beach, $1,563,572; J. E. Haddock, Ltd., Pasadena, $1,620,787; Contract awarded to United Concrete Pipe Corp. and Ralph A. Bell, Baldwin Park, $1,396,954.30.

LOS ANGELES COUNTY—Over Harbor Freeway at Wilshire Boulevard, in the city of Los Angeles, a reinforced concrete box girder bridge to be constructed and road connections to be graded and paved. District VII, Route 165. Winston Brothers Co., Monrovia, $378,046; Charles MacClosky Co., San Francisco, $389,311; George W. Peterson and Jack W. Baker, Los Angeles, $399,878; J. E. Haddock, Ltd., Pasadena, $439,049; Bongiovanni Construction Co., Los Angeles, $447,250; Contract awarded to Webb and White, Los Angeles, $361,144.00.

LOS ANGELES COUNTY—On Colorado Freeway in the city of Pasadena, between San Rafael Avenue and Orange Grove Avenue, three bridges and approaches and alterations for an existing bridge to be constructed. District VII, Route 161, United Concrete Pipe Corp., Ralph A. Bell, B. J. Ukropina, T. P. Palich and Steve Kral, Baldwin Park, $3,561,-831; Winston Bros. Company, Monrovia, $3,785,536; Peter Kiewit Sons Co., Arcadia, $3,853,677; Rhoades-Shöfner Construction Co., Inc., and Grafe-Callahan Construction Co., Los Angeles, $4,299,992; Guy F. Atkinson Co., Long Beach, $3,389,650.00.

LOS ANGELES COUNTY—On Hollywood Freeway, at Cahuenga Boulevard, in the city of Los Angeles, a reinforced concrete box girder bridge for an undercrossing to be constructed. District VII, Route 2. Lars Oberg, Los Angeles, $278,075; Bongiovanni Const. Co., Hollywood, $291,736; Charles MacClosky Co., San Francisco, $294,306; J. E. Haddock, Ltd., Pasadena, $298,663; George W. Peterson and Jack W. Baker, Los Angeles, $310,651; Griffith Co., Los Angeles, $350,808; Contract awarded to Oberg Brothers Const. Co., Inglewood, $277,204.

LOS ANGELES, KERN, VENTURA COUNTIES—On Route 4 between Route 59 and Fort Tejon and Newhall-Pico Road; and on Route 2 between Trionfo Road and ½ mile west of Moorpark Road, highway lighting system to be furnished and installed. District VII, Route 4, 2. Section J, D, A, F, A. Westates Electrical Construction Co., Los Angeles, $27,-182; Fischbach and Moore Inc., Los Angeles, $27,666; Contract awarded to Electric and Machinery Service Inc., South Gate, $26,581.

MERCED AND STANISLAUS COUNTIES—Between Merced River Bridge and Turlock Overhead about 5.6 miles to be graded and paved with Portland cement concrete on cement treated subgrade. District X, Route 4, Section D, A. Guy F. Atkinson Co., South San Francisco, $693,448; M. J. B. Construction Co., Stockton, $724,262; Ball and Simpson, Berkeley, $728,343; Harms Brothers, Sacramento, $737,034; Fredrickson and Watson Construction Co., Oakland, $898,979; Contract awarded to United Concrete Pipe Corp., Baldwin Park, $617,724.30.

SACRAMENTO COUNTY—Across American River at H Street near easterly city limits of Sacramento, the existing bridge to be widened with timber, reinforced concrete and structural steel construction. District III, Route 98, Section A. H. W. Ruby, Sacramento, $136,988; Dan Caputo, San Jose, $138,750; George Pollock Co., Sacramento, $149,489; Chittenden and Chittenden and B. S. McElderry, Auburn, $159,635; Contract awarded to Lord and Bishop, Sacramento, $121,746.50.

SANTA BARBARA COUNTY—Between Gaviota Gorge and 0.5 mile north of Las Cruces, about 2 miles to be graded and surfaced with plant-mixed surfacing on cement treated base. Roland T. Reynolds and A. H. Famularo, Anaheim, $667,803; Cox Brothers Construction Co., Stanton, $670,300; Ball

and Simpson, Berkeley, $733,266; Contract awarded to Granite Construction Co., Watsonville, $630,-699.00.

SAN DIEGO COUNTY—Between Elm Avenue in Palm City and "G" Street in Chula Vista, about 3.8 miles to be graded and surfaced with plant-mixed surfacing on cement treated base and reinforced concrete bridges to be constructed. District XI, Route 2, Section G. Charles MacClosky Co., R. E. Hazard Contracting Co., and C. G. Willis and Sons, San Francisco, $1,378,898; Basich Brothers Construction Co., N. L. and R. L. Basich, Garvey, $1,392,840; Fredericksen and Kasler, Sacramento, $1,499,685; Cox Brothers Construction Co., Stanton, $1,503,147; Contract awarded to Griffith Co., Los Angeles, $1,-221,641.90.

SAN DIEGO COUNTY—In the City of Oceanside, between ¼ mile south of Mission Avenue and San Luis Rey River, about 1 mile to be graded and paved with Portland cement concrete pavement on cement treated subgrade to provide a 4-lane divided highway. Frontage roads are to be graded and surfaced with plant-mixed surfacing on selected material, ramps and connecting city streets are to be graded and surfaced with plant-mixed surfacing on cement treated base and 3 reinforced concrete box girder grade separation structures are to be constructed. District XI, Route 2. Griffith Co., Los Angeles, $968,-066; Guy F. Atkinson Co., Long Beach, $1,032,000; Basich Brothers Construction Co., R. L. Basich and N. L. Basich, Garvey, $1,042,799; Contract awarded to Cox Brothers Construction Co., Stanton, $967,-355.35.

SAN FRANCISCO COUNTY—On Harbor Pier No. 24; repairing, revising, and installing a portion of an automatic sprinkler system. District IV, Route 68. George M. Robinson and Co., Oakland, $1,435; Viking Automatic Sprinkler Co., San Francisco, $1,470; Contract awarded to Grinnell Co. of the Pacific, San Francisco, $1,300.00.

STANISLAUS COUNTY—Between 10.5 and 5.0 miles west of Modesto, about 3.5 miles to be surfaced with plant-mixed surfacing on untreated rock base. Beerman and Jones, Sonora, $129,920; Louis Biasotti and Son, Stockton, $134,954; Thomas Construction Co., Fresno, $143,581; United Concrete Pipe Corp., Baldwin Park, $144,950; M. J. B. Construction Co., Stockton, $161,089; Frank B. Marks, Jr., Newman, $171,430; Contract awarded to M. J. Ruddy and Son, Modesto, $120,890.

YUBA COUNTY—At the District III Office for constructing parking sheds and chain link fence. District III. R. Taylor Willis, Napa, $9,200; Commercial Construction Co., Marysville, $9,220; McDaniel Construction Co., Marysville, $9,220; Contract awarded to Robert Taylor, Oroville, $9,163.55.

### F. A. S. County Routes

FRESNO COUNTY—On Manning Avenue, between Zediker Avenue and Kings River Bridge, about 3 miles to be graded and surfaced with plant-mixed surfacing on cement treated base. District VI, Route 817. Volpa Brothers, Fresno, $99,750; Gene Richards, Fresno, $103,490; Oilfields Trucking Co., and Phoenix Construction Co., Inc., Bakersfield, $104,-089; Roland T. Reynolds and Thomas Construction Co., Fresno, $107,623; G. W. Ellis Construction Co., North Hollywood, $126,084; Contract awarded to Baun Construction Co., Fresno, $93,326.00.

LOS ANGELES COUNTY—Across San Gabriel River, on Beverly Boulevard, a combination reinforced concrete and structural steel bridge to be constructed. District VII, Route 845. George W. Peterson and Jack W. Baker, Los Angeles, $274,970; John Strona, Pomona, $295,126; J. E. Haddock, Ltd., Pasadena, $335,337; Macco Corporation, Paramount, $344,390; Contract awarded to Charles MacClosky Co., San Francisco, $273,820.00.

SAN BERNARDINO, RIVERSIDE COUNTIES—On Riverside Drive between Los Angeles County Line and State Route 19, about 11.7 miles to be graded and surfaced with plant-mixed surfacing and the existing reinforced concrete and structural steel bridge across Chino Creek to be widened. District VIII, Route 693. M. S. Mecham and Sons, South Gate, $408,875; Matich Brothers and A. S. Hubbs, Colton, $412,058; R. A. Erwin, Colton, $416,436; Hensler Construction Corp., Sun Valley, $435,295; Basich Brothers Construction Co., R. L. Basich and N. L. Basich, Garvey, $467,164; Griffith Co., Los Angeles, $476,400; Cox Brothers Construction Co., Stanton, $477,544; Peter Kiewit Sons' Co., Arcadia, $493,472; Hess Construction Co. Inc., Long Beach, $497,528; Contract awarded to E. L. Yeager Co., Riverside, $390,745.40.

SAN LUIS OBISPO COUNTY—On Calf Canyon-Huer Huero Road, between Creston-Highland Road and 0.85 mile east of State Route 137, about 4.3 miles to be graded and a reinforced concrete bridge to be constructed. District V, Route 676. Edward Keeble, San Jose, $151,524; John F. Blakemore, El Monte, $153,195; Chittenden and Chittenden, Auburn, $178,268; Kirst and Sons, Altadena, $187,857; Fredericksen and Kasler, Sacramento, $196,447; Roland T. Reynolds and Thomas Construction Co., Fresno, $196,762; M. J. B. Construction Co., Stockton, $196,856; E. S. and N. S. Johnson and E. G. Young, Fullerton, $198,413; M. S. Mecham and Sons, South Gate, $201,615; Rexroth and Rexroth, Bakersfield, $212,126; Hess Construction Co., Inc., Long Beach, $217,074; Anderson Co., Visalia, $221,175; Granite Construction Co., Watsonville, $227,850; Pacific Contracting Co., Newport Beach, $232,088; Contract awarded to Fred McKinley, Paramount, $130,920.50.

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# George C. Hanson Retires After 39 Years In State Service

GEORGE C. HANSON, Assistant Highway Engineer in the office of City and Cooperative Projects, Division of Highways, retired from state service on March 1, 1951, after 39 years continuous service.

Born in Silverton, Colorado, August 26, 1887, he was educated in the public schools of Colorado and Kansas and came to California with his parents in 1905. His first job in California was with the Sacramento Division of the Southern Pacific Maintenance of Way Department from 1907 to 1912, where he rose to the position of Chief Draftsman. On March 1, 1912, he went to work with the Division of Highways as Chief Draftsman in Division III. When Division III was divided into District III and District X in 1927, he was assigned to District X as Statistical Engineer and moved with the district to Stockton in September, 1933, where he remained until March, 1936, when he transferred to the office of City and Cooperative Projects in Headquarters at Sacramento.

Hanson's hobby is photography and he looks forward to spending many happy hours pursuing his favorite pastime.

# California Highways

*Continued from page 49 . . .*

### Future Military Operations

Modern mechanized warfare calls for the use of every type of civilian vehicle, plus others designed for specialized military requirements. Because of California's strategic location and the extensive operations conducted by the Army and Navy, it is probable that military traffic on the highways during the war was heavier than in any other state.

Although peacetime military use of the highways constitutes only a small percentage of the total traffic, it continues to be heavier than before the war, due to the large number of permanent installations maintained within the State. It is a primary function of any public road system to accommodate military traffic, and this must be considered in administering highway programs. Provision must be made, in particular, for unusually large and heavy vehicles.

**In the event of an emergency, it must be expected that California's highway system will be called upon to assume heavy military burdens with little time for advance preparation.**

### California Highways in the Crisis Ahead

The result of these facts substantiates the previous statement that to all intents and purposes the California State Highway System is an integrated access road network.

During World War II restrictions imposed by the Federal Government drastically curtailed construction of vitally needed improvements on the State Highway System. These restrictions were so drastic that for all practical purposes they effectively stopped the construction of new or improved facilities on the State Highway System. Most of the work done by the Division of Highways during the war years was the minimum maintenance of existing highways and the construction of access roads and flight strips for the Federal Government.

These federal restrictions were imposed at a very unfortunate time. The highway modernization program was just beginning to overcome the effects

of the depression years that had caused a slowdown due to lack of revenue. In other words, when California was about to make some progress in correcting deficiencies that existed, the war restrictions stopped all modernization activities for four years.

Thus it should be pointed out that these two factors alone: (1) the State Highway System was considerably below acceptable standards in 1941, and (2) there were practically no modern improvements made in the four war years, were enough in themselves to create a compounding of highway needs that was enormous.

To these two factors was added the damage caused to the State Highway System by war-induced heavy trucking and the enormous increase in population caused by the war effort. All of these factors together added up to the deficiencies at the end of World War II. In 1945 and 1946 these deficiencies were compiled. The estimated cost of correcting the deficiencies that existed at that time was approximately $1,500,000,000, based on a 10-year period of construction, and based on construction costs that were expected to decline after the war. At that time many experts believed that considerable portion of the population growth in California during the war was only temporary. This deficiency list was therefore based on rather conservative estimates of future population growth.

#### Highway Deficiencies

During the latter part of 1950 a reappraisal was made of the deficiencies of the State Highway System as of January 1, 1951. This report shows that the present estimated cost of bringing the State Highway System up to modern standards adequate for traffic is over $3,000,000,000, or twice the 1946 estimated cost. This doubling of the deficiencies has occurred during the period when the Division of Highways has had under way the greatest highway construction program in its history. In the five-year period from July 1, 1947, to June 30, 1952, 93 percent of the available construction funds, or over $420,000,000, were expended or budgeted for correction of deficiencies on the 1946 list.

This extremely critical situation may be stated in another way. In spite of the all-out effort that has been made in the postwar period to modernize the State Highway System with the funds available, the deficiencies have increased over previous estimates at a rate of $300,000,000 per year.

By far the greatest deficiencies that exist are those chargeable to inadequate traffic capacity, or lack of highway space on which to move traffic safely and efficiently.

In 1946, major routes of our rural State Highway System carried an average daily traffic of 1,700 vehicles. Today, on these same rural routes, the count is 3,000—nearly a 100 percent increase in less than five years. It is imperative that California complete at the earliest possible date the multilane facilities necessary to handle this traffic. Deficiencies in this category, as well as many of the structural deficiencies, are directly attributable to the unprecedented growth in population and vehicle registration in California.

#### Highway Work Must Not Slow Down

There are 14,000 miles in the State Highway System, of which 11,300 miles, or 81 percent, was deficient in some respect on January 1, 1951.

There is every reason to believe that the pattern of a large population increase in California induced by defense activities in World War II will be repeated. Undoubtedly nearly all of the defense plants will again be producing materials of war and most of the military establishments will be reactivated. In addition there will probably be many new defense industries and military establishments.

Thus the motivating forces behind the highway problem that exists today—too rapid expansion of population and vehicle registration—will continue as long as an all-out defense effort is being made.

A continual increase in deficiencies on the State Highway System can have only one end result: the gradual strangulation of transportation in California. This would have a chaotic effect on the defense effort in California, where every operation, both industrial and military, is more completely dependent upon highway transportation than in any other part of the United States.

The fact that highway improvements made to benefit the defense effort also are a benefit to the State's economy proves that the two interests are inseparable.

Any restriction by the Federal Government, in the name of national defense, that would in any way slow down the rate of improvement to the State Highway System would be a very costly mistake that would defeat its own purpose. The present rate of progress in correcting the critical deficiencies on the State Highway System is much too slow at the present by any conceivable standards of measurement. Further retardment of this rate of progress would be disastrous.

California's Highway System is essentially a great military and industrial access road system and should be considered in that light by the Federal Government when means of accelerating the defense effort are under consideration.

## Suggestion to Merit Award Board Worth While

THE FIRST merit award made to a Department of Public Works employee, carrying both cash and merit award, was presented by Frank Durkee, Deputy Director of Public Works, on March 30, in San Diego.

The award winning development is a copy holder attachment which adapts the copy holder for use with the Remington Rand bookkeeping machine in the District XI office in San Diego.

When the new Remington Rand Model 685-D bookkeeping machine was received in District XI, it was found that the regulation copy holder could not be used satisfactorily, although it had worked with the old type machine. Mrs. Aurelia Rinderneck of the Bookkeeping Department, A. L. Anderson, Chief Clerk, and Ed Malloy, Mechanic Foreman at Shop 11, collaborated in the design and construction of an attachment for the copy holder so that it could be used with the new machine. It has been estimated that the device is saving the State approximately $620 per year in the Division of Highways alone. The board, therefore, recommended that in addition to the Certificates of Merit an award of $21 be made to each of the three.

# Highway Costs

*They Have Increased 10.6 Percent During the First Quarter of 1951*

By RICHARD H. WILSON, Assistant State Highway Engineer; HENRY C. McCARTY, Office Engineer, and RICHARD R. NORTON, Assistant Office Engineer

THE COST of state highway construction in California has increased 10.6 percent in the first quarter of this year and 34.6 percent during the past year.

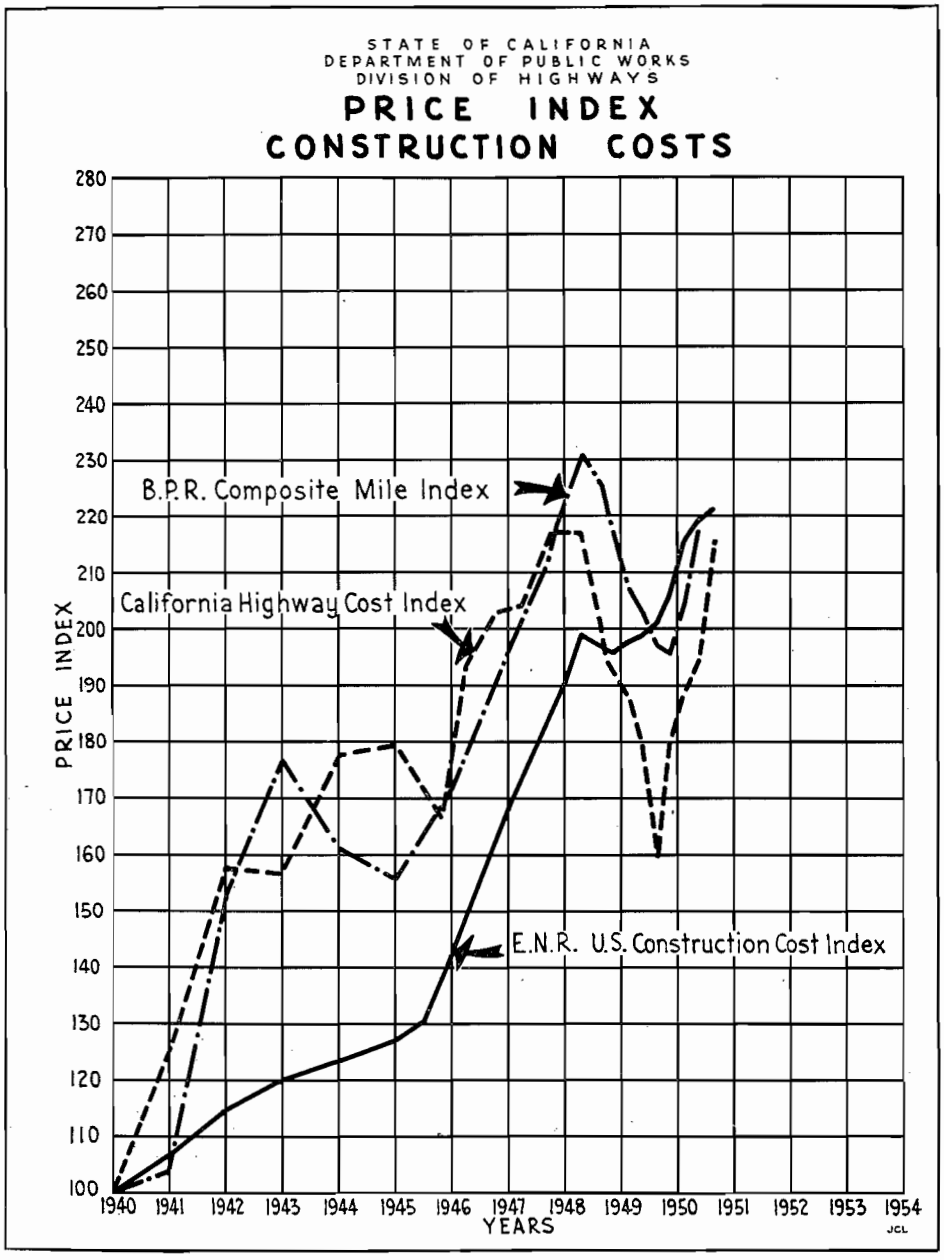
Highway costs are measured by the California Highway Construction Cost Index, with the year 1940 taken as a base of 100. This index climbed during World War II and the postwar period to a peak of 216.8 in the first half of 1948. After 1948 there was a decline to 160.0 in the first quarter of 1950. From this point on there has been a very rapid rise. he second quarter of 1950 was 12.5 percent above the first quarter, the third quarter was 5.1 percent above the second quarter, the fourth quarter fas 3.0 percent above the third quarter and the index reached 215.4 in the first quarter of 1951 which was 10.6 percent above the fourth quarter of 1950. There are no indications at the present time that this upward trend will not continue.

As high as these costs appear, they are well below the national average, as measured by the Bureau of Public Roads Composite Mile Index. The BPR index is recognized as the standard of measurement for nation-wide highway construction costs.

The BPR index reached a peak in the postwar period of 230.9 (1940 = 100) compared to the 216.8 peak reached by California index. The BPR index peak was 14.1 points or 6.5 percent higher than the California index peak.

After the first postwar peak in 1948, both indexes turned downward until 1950. The low point reached in the second quarter of 1950 by the BPR index of 195.5 was 35.5 points or 22.2 percent higher than the low of 160.0 reached by the California index.

In the fourth quarter of 1950 (the latest period for which BPR index figures are available) the BPR index of 217.5 was 22.7 points or 11.7 percent higher than the California index of 194.8 for the same period.




Following is a tabulation showing a comparison of the Bureau of Public Roads and California indexes in the postwar period:

| Year | California Index (1940=100) | Bureau of Public Roads Index (1940=100) | Difference Points | Difference Percent |
|---|---|---|---|---|
| 1946 | 179.7 | 171.6 | —8.1 | —4.5 |
| 1947 | 203.3 | 196.1 | —7.2 | —3.5 |
| 1948 | 216.6 | 220.9 | +4.3 | +2.0 |
| 1949 | 192.8 | 213.3 | +20.5 | +10.6 |
| 1950 | 181.0 | 203.4 | +22.4 | +12.4 |

These figures show a very significant trend in California highway construction costs as compared to nation-wide costs. California highway costs were higher than the national average in 1946 and 1947. In 1948 California costs were lower, and in 1949 and 1950 the difference increased in California's favor.

The Engineering News-Record Construction Cost Index, converted to 1940 = 100, is shown also on the accompanying chart to show its relationship to the California and BPR indexes. The ENR index is an index of labor and material prices only and is not a contract price index as are the California and BPR indexes. For this reason the ENR index does not show the rapid fluctuations that the contract price indexes have in the postwar period. However the long-term trend has been similar. In the first quarter of 1951 the ENR index was 221.2, compared to 215.4 for the California index.

The rapid fluctuations in highway construction costs that have taken place in the postwar period have created many serious problems in budgeting future construction programs. For instance, the projects now being placed under contract were budgeted one year ago. In that period highway costs have increased 34.6 percent. Obviously estimates based on prices a year ago are not valid today.

These changes in the price structure require constant revision of estimates and adjustment of projects to attempt to keep abreast of changing economic conditions. Unless and until more stable world conditions prevail it will probably be impossible to forecast changing costs accurately enough to prevent the necessity for these adjustments. The Korean War was certainly not foreseeable a year ago.

A constant study of economic trends to determine their effect on both sources of revenue and construction costs is made by the engineers of the Division of Highways to keep budget adjustments to a minimum.

### FAST BRAKING

Braking the car to a sudden stop is as wasteful of engine power as a fast start. Let built-up momentum carry the car forward to a stop without needless wear on brakes and tires.

# VETERAN STATE EMPLOYEES WILL BE RECOGNIZED

PRESENTATIONS of certificates to state employees in recognition of 25 years of service, as authorized by the 1949 Legislature, began in March. Deputy Director of Public Works Frank B. Durkee was chairman of the committee of the Deputy Directors' Conference to which was delegated the work of designing a suitable memento and drafting the details for official presentation of the certificates.

The State Printing Office printed 2,500 certificates which now are available to all state departments and agencies. They are embellished on the borders with sketches of the Capitol dome, golden poppies, the official California flower, the Bear flag, quail, the California game bird, a miner's pan, pick and shovel and redwood trees, for which California is famous, all in color. The art work was done by J. J. Ralph of the Division of Highways.

Through the efforts of Harold P. Norton, Special Representative of the Department of Public Works, and Tom Dennis, Maintenance Superintendent of the Division of Highways, retired, a bill was enacted by the Legislature in 1949 authorizing the printing and awarding of the certificates which will be given to each state employee who has served for 25 years or more.

Each certificate will be signed by Governor Earl Warren and will bear the signature of the Secretary of State and the Great Seal of California. Future Governors and Secretaries of State will sign the awards as the years go by.

Durkee has recommended to Daniel H. Blood, President of the Deputy Directors' Conference, that the existing law be amended so as to provide certificates to retired state employees who had 25 or more years of service at the time of their retirement. The following served with Durkee on the Deputy Directors' Conference Committee: George E. Hogan, Department of Education, and W. C. Jacobsen, Department of Agriculture.

# Mission Accomplished

WHILE WILLIAM H. HAMBLIN, now on military leave with the Navy as supply officer on the *U.S.S. Menard* in Pacific waters, was assistant to Director of Public Works C. H. Purcell he learned much about the close cooperation that exists between the Division of Highways, California Highway Patrol and Department of Motor Vehicles. This kowledge came in handy recently as he relates in the following note:

"A few days before we were to leave the United States, we found that one of our men, George Frazee, seaman, of Santa Ana was on leave and could not be reached. We learned that he was driving about the State enjoying his leave, which would not be over until after we were to sail. It occurred to me that he might be located with a little help from the Division of Highways, the Highway Patrol and Motor Vehicle Department. I telephoned District Highway Engineer E. E. Wallace at San Diego and asked him to get Frazee's car license from Motor Vehicles. Mr. Wallace went to work on the matter, the Highway Patrol issued an all-points bulletin to pick up Frazee and give him the word to get back to his ship. In less than half an hour he was located and within a couple of hours was aboard ship and ready for sea."

### FROM EGYPT

AHMAD KARIN
Roads and Bridges Department
CAIRO, EGYPT

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

DEAR MR. ADAMS: I hope you are enjoying good health and a happy life.

There is no doubt that your magazine is a valuable one. It is considered international. We hope that we shall continue to receive the magazine in the future.

Best wishes, kindest regards.

Yours very truly,

A. KARIN

Certificates may be obtained by State agencies from A. Earl Washburn, Deputy Director of Finance.

EARL WARREN
*Governor of California*

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CHARLES H. PURCELL
*Director of Public Works*

•

FRANK B. DURKEE
*Deputy Director*

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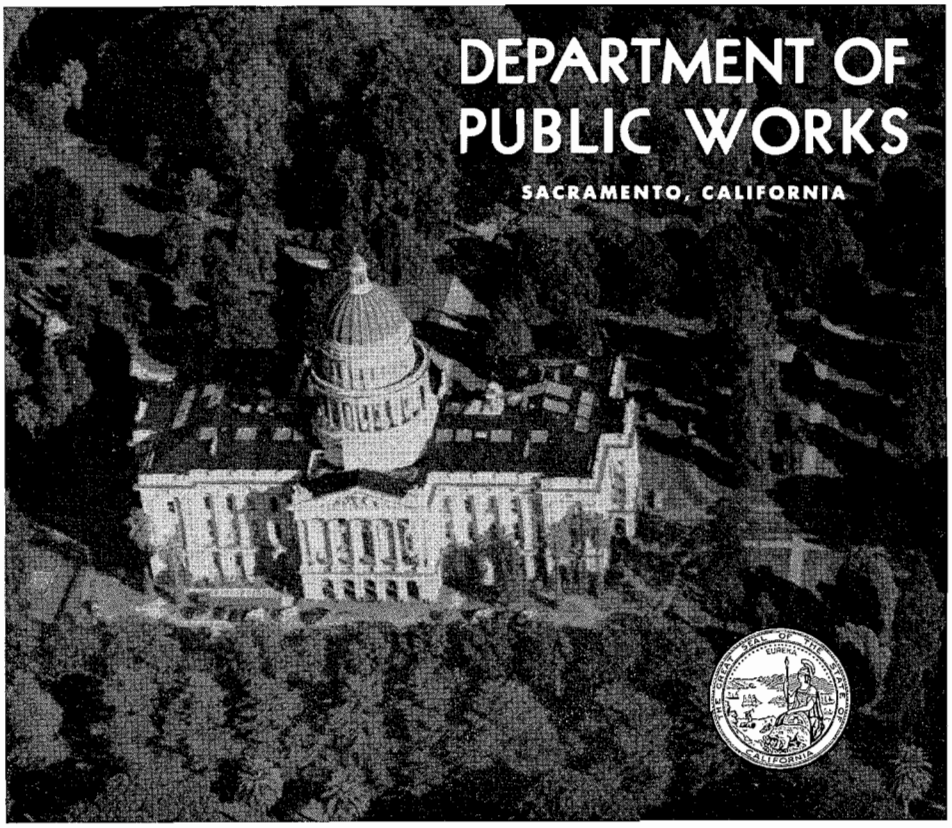


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