

# CALIFORNIA

HIGHWAYS AND PUBLIC WORKS

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# California Highways and Public Works

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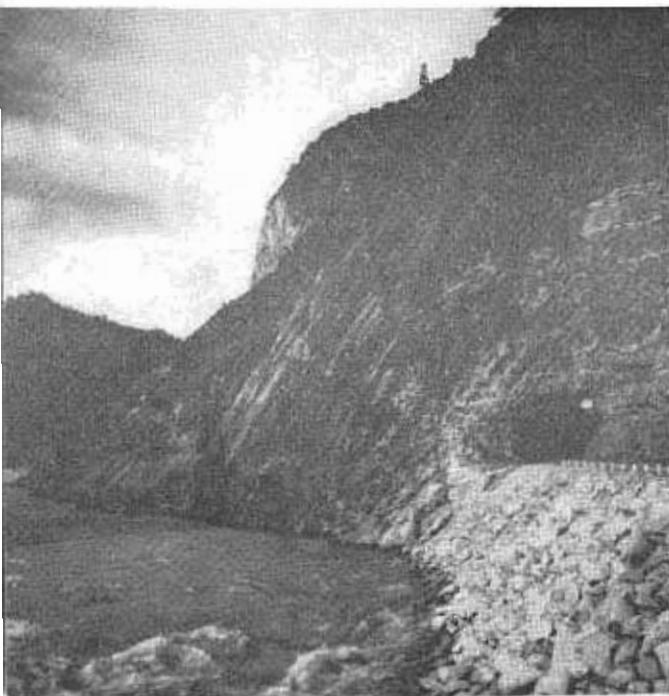
Nos. 4-5



## FRONT COVER

The rich foliage of the redwoods frames a section of US 101 at Bridges Creek in northern Mendocino County. The highway runs through miles of the stately trees, many of which were already 10 centuries old when Julius Caesar ruled in Rome.

—Photo by Robert Munroe



## BACK COVER

US 40 Alternate follows a picturesque path beside the turbulent waters of the Feather River in Plumas County. Elephant Butte Tunnel is in the foreground.

—Photo by Robert Munroe

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*Published in the interest of highway development in California. Editors are invited to use information contained herein and to request prints of any black and white photographs.*

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# More Highways Less Paper

By  
JOHN H. STANFORD  
Management Analyst

*Headquarters Records Center showing low-cost storage of semiactive records which have not yet reached date for disposal*

IMAGINE a row of 5,800 five-drawer filing cabinets full of administrative records. The row would be over  $1\frac{1}{4}$  miles long. It would contain about 87,000,000 pieces of paper—correspondence, reports, legal documents, accounts, requisitions, authorizations, hundreds of different kinds of records.

Now imagine that you have to plan and organize the contents of these 29,000 file drawers\* for an organization with 13,000 employees and an annual budget of more than \$450,000,000, operating through a Sacramento headquarters office and 11 district offices from San Diego to Eureka, so that:

\* Not all of these records, of course, are kept in file drawers. The term "file drawers" is used throughout this article to indicate quantities of records in an easily visualized measure. It means  $1\frac{1}{2}$  cubic feet of records or about 3,000 pieces of paper, regardless of how they are stored.

(1) Anyone can get information he needs from the records when he needs it;

(2) New records are added promptly, in the right places;

(3) Old records are kept as long as they are needed, but no longer; and

(4) All of this is done at the least possible cost for personnel, equipment and space.

This is the recordkeeping job of the California Division of Highways. It is a big job, and getting bigger as our statewide traffic problem grows and the division's work grows with it. Fortunately, however, it is a job to which the Division of Highways is applying the same modern tools of records management that are proving effective in other large-scale business and government enterprises.

## **Rapid Progress**

Here are the encouraging first results of the intensified records management program launched by the State Highway Engineer in 1957. They show that Headquarters Departments and District Offices throughout the division are making rapid progress in reducing and bringing under better control their administrative records (records other than maps and plans) through this co-ordinated effort.

*The contents of about 5,000 file drawers, more than one-sixth of those 29,000 file drawers, are being destroyed or sold as waste paper because they are no longer necessary. Nearly half of these already have been discarded and the balance soon will be. This is eliminating about 15,000,000*

... Continued on page 2



Public Works Building  
Twelfth and N Streets  
Sacramento

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## MORE HIGHWAYS

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pieces of paper and cutting nearly one-quarter mile off that theoretical row of five-drawer file cabinets.

About 5,400 file drawers of other records are being moved from high-cost office space to low-cost record center type storage because, although necessary, they are used infrequently. Nearly 4,500 of these have already been moved.

In summary, 10,400 file drawers or 35 percent of all division records other than maps and plans (which are excluded from all of these figures and which will be the subject of a separate study) are being transferred or destroyed, including 2,400 file drawers already destroyed and 4,500 drawers already moved out of offices.

The value to the Division of Highways of this breakthrough in the battle against unnecessary paper is about \$180,000 a year, as explained later in this report.

How was this program developed? By what methods have these results been obtained?

The answer starts several years back, for the Division of Highways has for some time been concerned with the problem of controlling the growth of records which has naturally accompanied the growth of the highway program. Large quantities of records, particularly field accounting records and duplicate records in districts and field offices, have for some time been destroyed each year.

### Joint Survey

In 1954, the Service and Supply Department and the Accounting Department jointly undertook a survey of the storage and use of records in all division offices. By 1956, this work had progressed to the point where it was decided to call in a private consulting firm of records management specialists to make a broader study of paperwork problems and to develop an overall records management program proposal.

The division contracted with the National Records Management Council for this work and provided several employees from Service and Supply Department to assist. During 1956,

this group inventoried records in Headquarters Office and in District III (Marysville) and District VII (Los Angeles), and submitted proposed schedules for the retention and disposal of records in these offices. During this period the Service and Supply Department, with the advice of the council, established a Records Center at the Sacramento Warehouse location for more efficient and lower-cost storage of inactive records.

**Report Submitted**

In March, 1957, the NRMC survey group submitted its report, including a proposed program of comprehensive paperwork analysis and records management. In addition to a division-wide survey program to apply the tentative schedules for the retention, transfer, and disposal of records in the offices covered and to develop schedules for all other offices, the council outlined programs for developing an improved filing plan and file classification system, an improved circular letter system, a vital and historical records protection program, a forms and

The Management Section discussed in the accompanying article was established in July, 1957. John H. Stanford, Management Analyst for the Department of Public Works, was assigned at the request of the State Highway Engineer to serve as Division Management Analyst and to organize, develop, and direct the Management Section.

The purpose of the section is to help division officials by making assigned studies, developing recommendations, and providing advisory services on administrative and management problems, both in Headquarters and in the districts. The first major project assigned the section was to help carry out the records management recommendations submitted by the National Records Management Council after its survey for the Division of Highways.

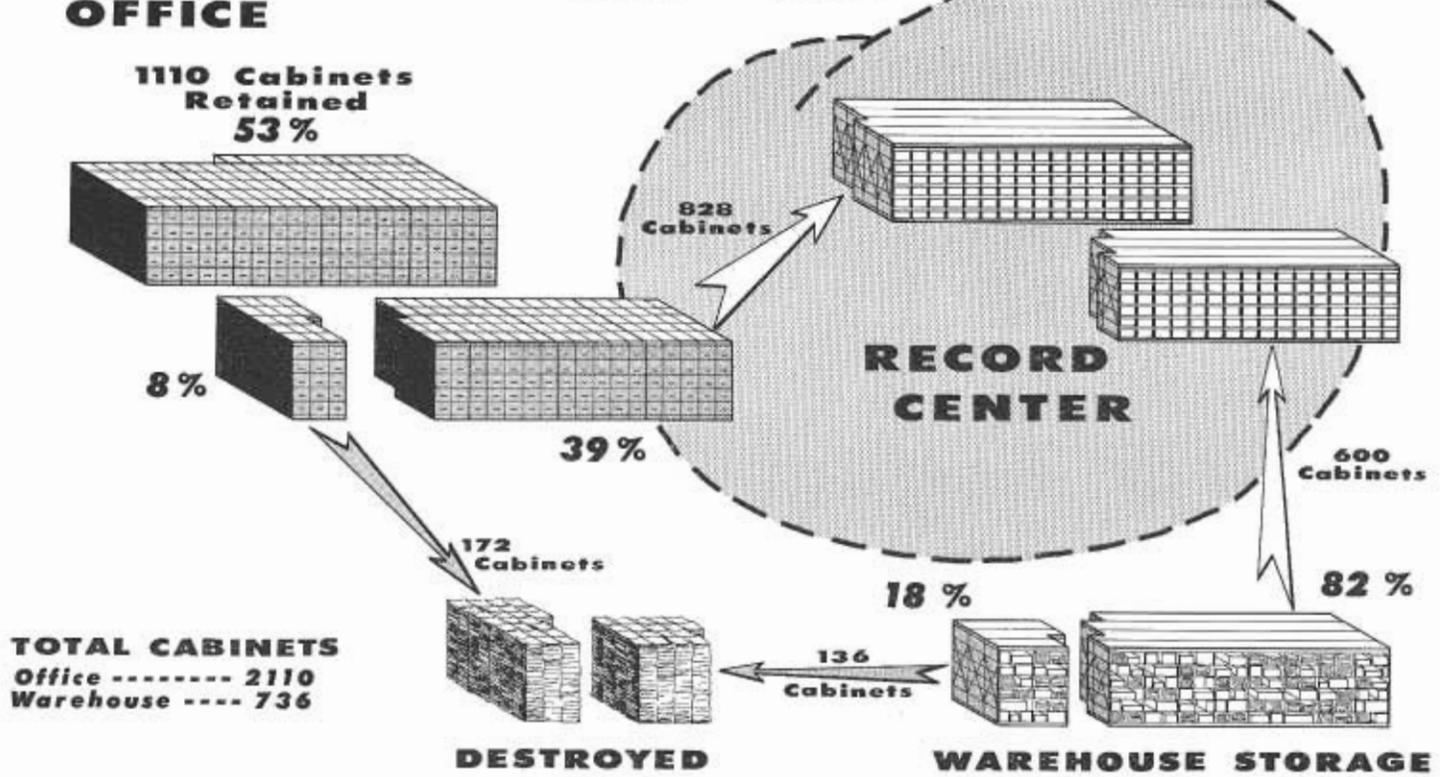
reports analysis program, and a correspondence simplification program.

In July, 1957, the State Highway Engineer approved this long-range

program. The task of planning, coordination, and assistance was assigned to the newly established Management Section. The Service and Supply Department continued to operate the Records Center facility. Four division employees who had worked with the council on the survey were transferred to the Management Section. Two administrative analysts were later added to the Management Section.

The plan and procedures established were designed both to expedite disposal of records no longer needed and to guard against unauthorized or ill-advised destruction of essential records. The most basic feature is that each department, section, and office initially reviews its own specific records and on the basis of its own direct knowledge and needs proposes for each record series the length of time the record will be needed in the office, needed in storage, and the period after which it may be discarded. Some general guides, developed in Headquarters Office and in similar offices, are made available, but are not mandatory.

**HEADQUARTERS OFFICE  
RECORDS MANAGEMENT PROGRAM  
1957 - 1958**



#### Obsolete Records Destroyed

Once the schedule has been developed for the retention and disposal of all records, office by office, no further authorizations are necessary. Both continuing authority and continuing responsibility are delegated to departments and districts for application of the schedules in the future. Records can be destroyed as they become obsolete, unless some change in the schedule should be needed.

Each District Engineer has designated a records officer to review and approve on his behalf all requests from district offices for authority to destroy records. In the Headquarters Office all such requests are reviewed by the Comptroller and by the department concerned with the subject matter. They are given final approval by the Assistant State Highway Engineer, Administration, who is records officer for the Division of Highways. He is responsible for obtaining necessary clearances from the Department of Finance and the Secretary of State's Office.

Since July, 1957, first the Headquarters Departments and then each of the district offices have been engaged in an initial "housecleaning" program to place all administrative records on the systematic plan of scheduled retention, transfer, and disposal, and to apply approved schedules to accumulated records. All offices have schedules completely in effect, submitted for approval, or actively in preparation.

Following are some highlights of the results obtained by various offices so far:

*Headquarters Office.* 5,000 file drawers of records moved out of office space—47 percent of the records which were in offices. In addition, 18 percent of the records in warehouse storage were destroyed, the remaining 82 percent being transferred to the records center. (The accompanying chart shows these results graphically and in more detail.)

*District III (Marysville).* 23 percent of all records transferred or destroyed, a total of 203 file drawers.

*District IV (San Francisco).* 484 drawers destroyed and 298 moved from office space, totaling 31 percent of district records. Improved district record center facilities established.

*District X (Stockton).* 25 percent of records discarded, mostly from basement storage. Improved district record center facilities established.

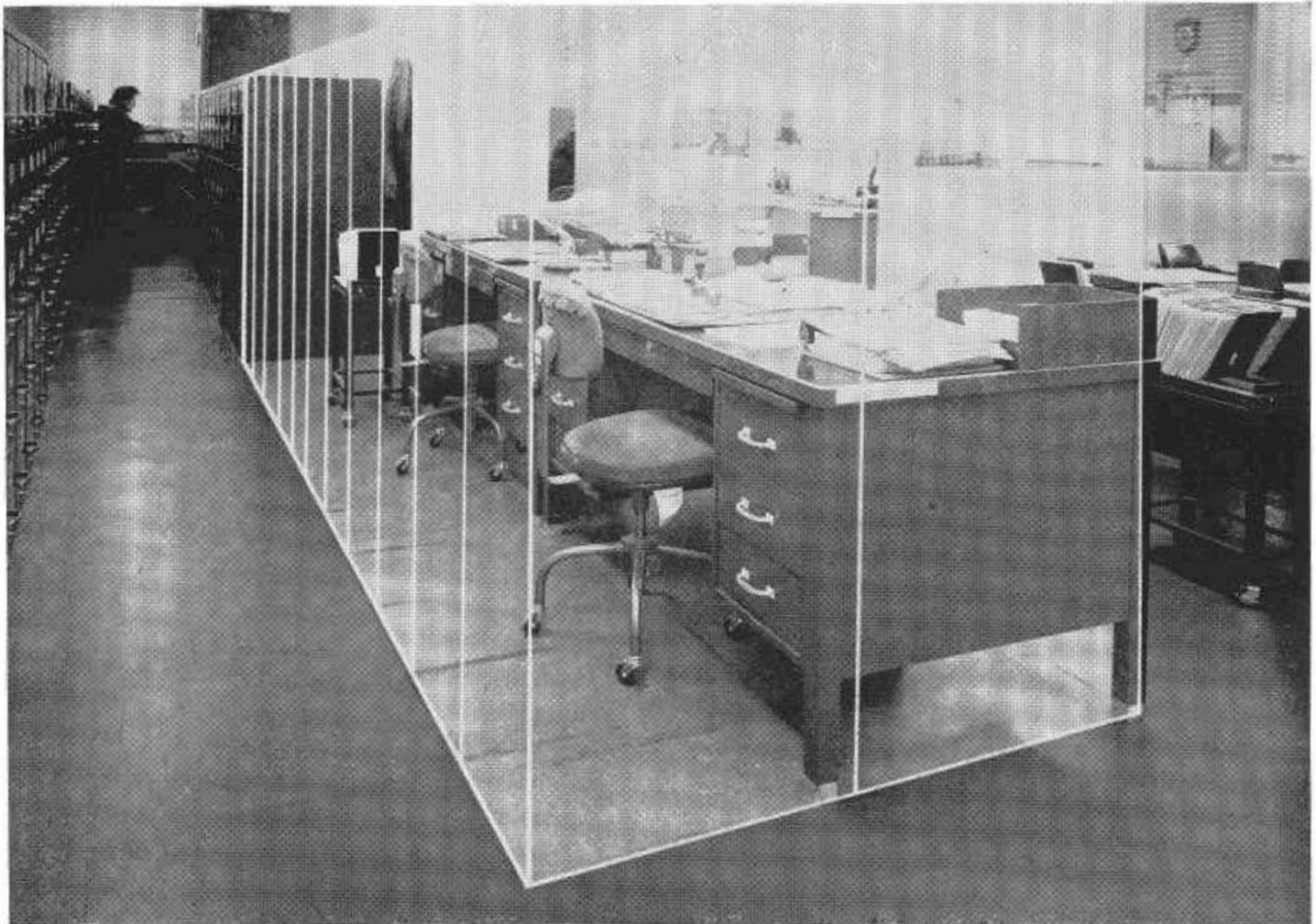
*Bridge Department—Bay Bridges.* Retention schedules submitted. 72 percent of office records will be moved (249 drawers transferred and 158 drawers destroyed) when new schedules are approved. In addition, 75 percent (322 drawers) of records now in storage will be destroyed. Total of 73 percent of all records to be transferred or destroyed.

*District II (Redding).* Schedules submitted. Of a total of 953 drawers of records, 41 percent will be discarded and 12 percent will move into storage.

*District V (San Luis Obispo).* Schedules submitted. Of a total of 1,048 drawers of records, 31 percent



Headquarters Records Center showing a portion of the tons of records marked for disposal as a result of applied schedules



The white lines sketched on this photo of the Headquarters General Files Office represent the "ghosts" of former filing cabinets. The records once occupying the delineated space have been transferred or disposed of in accordance with a regular schedule under the Records Management Program, making space available for two workers' desks.

will be discarded, mostly from basement storage.

*District VI (Fresno).* Schedules submitted. Of a total of 972 drawers of records, 21 percent will be discarded. Improved district record center facilities have been established.

*District VII (Los Angeles).* Schedules submitted. 368 drawers will be destroyed and 235 drawers moved from office space, totaling 19 percent of district records. Record center being established at Southern Warehouse by Service and Supply Department, primarily to serve District VII.

*Districts I, VIII, IX, XI.* Inventory of records in progress. Schedules being developed. Results expected to be similar to those in other districts.

The disposal and transfer of records already completed benefits the Division of Highways by an estimated

\$133,000 a year from now on. An additional \$47,000 may be expected from work now under way in the districts, which will bring the total benefits to \$180,000 a year.

This estimate is based upon generally accepted estimates that it costs about \$25 a year to maintain a drawer of records in the office (personnel, space, and equipment) and about \$1.50 a year to keep the same quantity in record center storage. Estimating \$25 a year per file drawer destroyed from the office, \$23.50 a year per file drawer moved from the office to storage, and \$1.50 a year per drawer destroyed from storage gives the above rough estimates, which are considered conservative.

With the first or "housecleaning" phase of the records management program well on its way to comple-

tion attention is being given to other phases of the long-range records management program.

In the field of filing systems review, representatives of each Headquarters Department who are directly responsible for departmental files met in March and April, 1958, for six weekly training conferences, including description and analysis of filing systems, under the leadership of Mrs. Doris Weaver of the Management Section staff. A six-month statistical study has been made of the sources and uses of Headquarters General Files material. The circular letter system has been studied. Preliminary data on vital records have been collected. Each of these subjects and others will in the future receive further attention as the division records management program moves ahead.



# Report From

*North Area Builds First  
Section of Full Freeway*

By H. S. MILES  
District Engineer

# District II

THE SEVEN counties of northeastern California that comprise District II, Lassen, Modoc, Plumas, Shasta, Siskiyou, Tehama and Trinity, occupy 27,500 square miles. Highway transportation is provided for this area principally through a network of 1,438 miles of state highways supplemented by a feeder system of 740 miles of federal aid secondary routes under county jurisdiction.

The population density is relatively low as the result of having little more than 1 percent of the State's population with 17.5 percent of the total area. Nevertheless, progressive improvement of the road systems is of vital importance to the economy of the area and to the general welfare of the State as a whole.

Access to areas that otherwise would have remained inaccessible was spurred

a full century ago by extensive mining operations, supplemented by lumbering. While mining has dropped to a relatively minor role in recent years, lumber production is now the leading industry with the seven counties in this district accounting for 30 percent of the entire output of the State.

Changes in the lumber industry have added to highway transportation needs. Improved management of lands and the cutting of saw logs on a sustained yield basis have expanded the zone of operations from small concentrations to large areas. The progress that has been made in converting into useful pulp or pressed board products the 50 percent of the tree that was previously wasted is resulting in a similar trend. Logs are now hauled greater distances to integrated processing centers or sawmill waste is transported as a raw material to manufacturing plants.

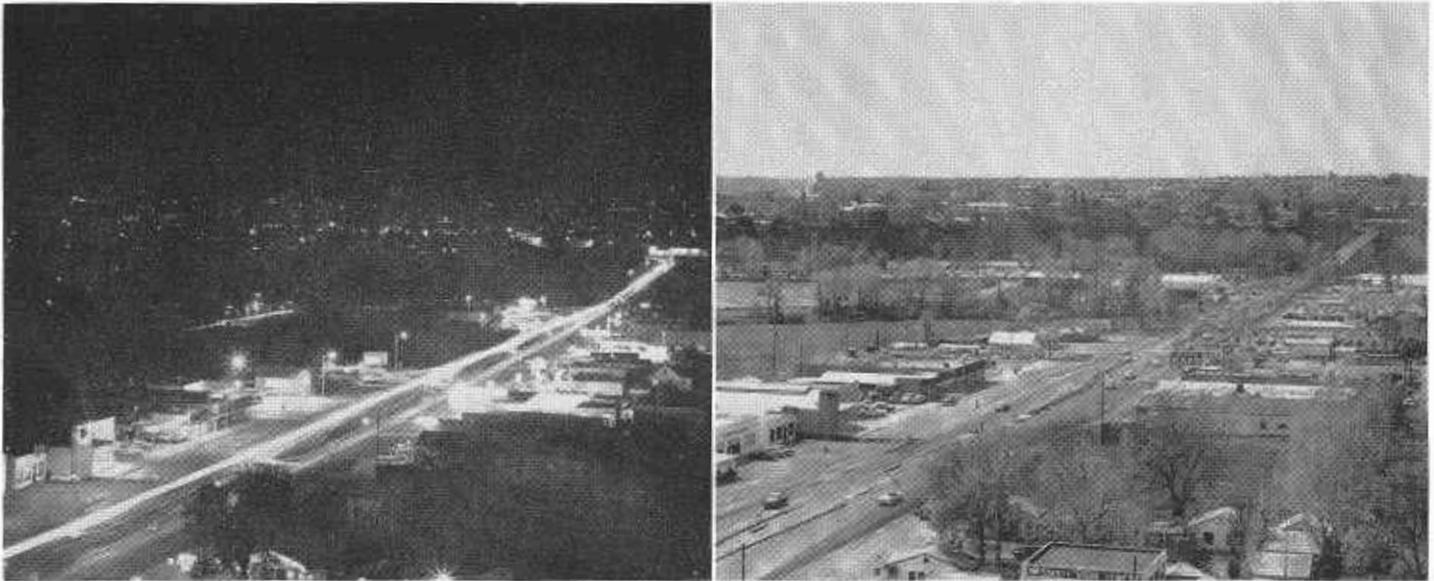
Use of recreational resources in this northeastern county area is directly related to highway transportation. Because of the scenic, climatic and other

natural attractions recreational activity has become second in importance in the local economy. Highway routes which traverse six national forests afford access to mountain scenery and a variety of weekend and vacation pastimes, including winter sports. The many rivers and streams add to the multiplicity of resources that encourage travel.

In recent years boating has gained in popularity as a form of recreation and today it heads the list. The rivers and lakes of the area attract many pleasure boats because of the accessibility through the use of boat trailers. For example, during one weekend last summer it was estimated that 5,000 boats were in use on Shasta Lake alone. With the completion of Trinity Dam which is now under construction, there will be a further increase of boat trailer travel on the highways of this area.

Increased travel coupled with growth of population in the larger communities has caused congestion at

PHOTOS AT TOP OF PAGE. LEFT—West approach to Cedar Pass (US 299) between Alturas and Cedarville in Modoc County. RIGHT—Completed expressway north of Dunsmuir on US 99. Mt. Shasta in the background.



*NIGHT AND DAY. Two photos taken from the same location showing the median island and four-lane construction at the north entrance to Redding on US 99*

locations where lack of traffic capacity was relatively minor a few years ago. Expressways and freeways already constructed, under construction, or now being planned will remedy this and other deficiencies in our highway network.

The designation of Route US 99W and its northerly continuation, US 99, as a part of the interstate system will result in this main line artery being developed as a multiple-lane freeway. On the lateral routes construction of the initial two lanes of an ultimate four-lane expressway makes it possible to provide improved service for low volumes of present traffic.

The résumé that follows covers projects recently completed in District II as well as current activity.

**US 99W and US 99**

Route US 99W enters District II at the Glenn-Tehama county line about 8.5 miles south of Corning and extends northerly to Red Bluff. It then continues northward as Route US 99 through Tehama, Shasta and Siskiyou Counties to the Oregon border about 21.5 miles north of Yreka.

The last major work on this route in Tehama County was a relocation from six miles north of Red Bluff to the Shasta county line, a distance of 7.12 miles completed in 1947.

In Shasta County practically all of this route has been realigned or relo-

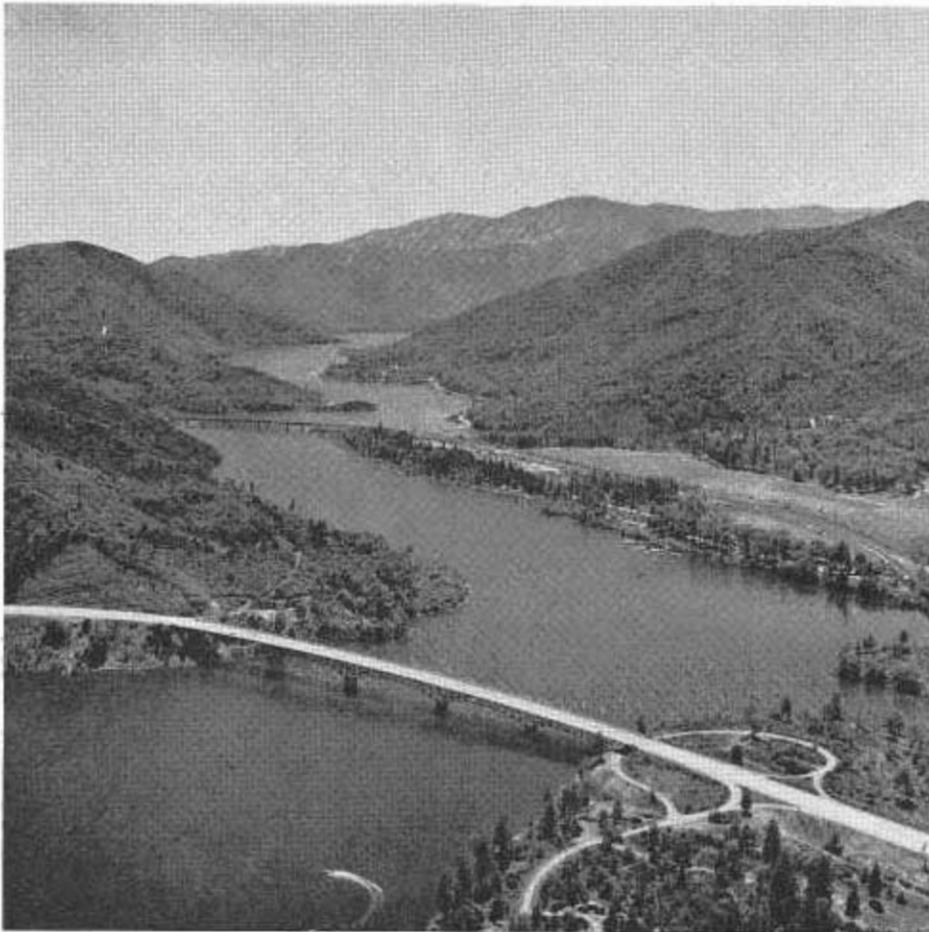
cated or is in the planning stage for construction in the near future.

In 1949 a modern two-lane highway was completed from the Shasta county

line to Anderson, a distance of five miles. In 1950 a four-lane expressway was constructed from Anderson to Clear Creek, a distance of 5.78 miles,



*A section of new expressway on US 99 in Siskiyou County. Castle Crags are in the background.*



The Antler Bridge on US 99 spans the Sacramento River arm of Shasta Lake. The Southern Pacific Railroad Bridge is in the background. The connection to the U. S. Forest Service Antler Campground is in the lower right.

connecting with a four-lane expressway already completed into Redding.

North of Redding, under several contracts between 1952 and 1956, a four-lane expressway has been completed from the bottom of Sulphur Creek Hill to Bass Hill, a distance of 11.8 miles. The contractors were Fredrickson and Watson Construction Company of Oakland and Rice Brothers of Marysville. The cost was \$3,500,000. At present a contract is under way to extend the four-lane highway southerly to the Sacramento River Bridge and to construct a one-way street couplet in Redding—Contractor W. H. Darrough & Sons, Yuba City.

From Bass Hill to Crespos, a distance of 16 miles, this highway was relocated in the early 1940s to bypass the lake resulting from the building of Shasta Dam on the Sacramento River.

Beautiful views of the new Shasta Lake are visible along this route and the Pit River arm is crossed by a two-level bridge 3,588 feet in length. This bridge carries the Southern Pacific tracks on the lower level and a four-lane highway on the upper level. The Shasta Dam can be reached from a highway taking off from US 99 at Project City. Thousands of visitors view this dam yearly and most visitors take an interesting conducted tour through the dam. Numerous campgrounds have been built along the lake by the United States Forest Service.

Construction of the long-planned four-lane divided highway through the Sacramento Canyon north of Shasta Lake is well under way. Two road contracts and one bridge contract totaling 6.1 miles in length were completed in 1956 between Crespos and 0.5 mile north of La Moine at a cost of \$5,300,000. The two road contractors were Piombo Construction Company of San Carlos and Guy F. Atkinson Company of South San Francisco. The bridge contractor was Ukropina, Polich, Kral & Ukropina of San Gabriel. A contract for 6.9 miles between 0.5 mile north of La Moine and 0.8 mile north of Shotgun Creek is now under way and should



An improved section of US 40 Alternate in Plumas County a few miles west of Spring Garden. In the center is the Williams Loop on the Western Pacific Railroad Feather River Route with an overhead crossing in the foreground.

be completed this year. The cost is about \$6,000,000 and the contractor is Gibbons and Reed, Salt Lake City, Utah.

#### First Full Freeway

The first section of full four-lane freeway with separations and interchanges to be built in District II will be opened for bids this spring. It will extend from 1.0 mile south of the Shasta-Siskiyou county line to the Sacramento River bridge in Dunsmuir, a distance of 3.7 miles. The budget allocation for construction is \$4,600,000.

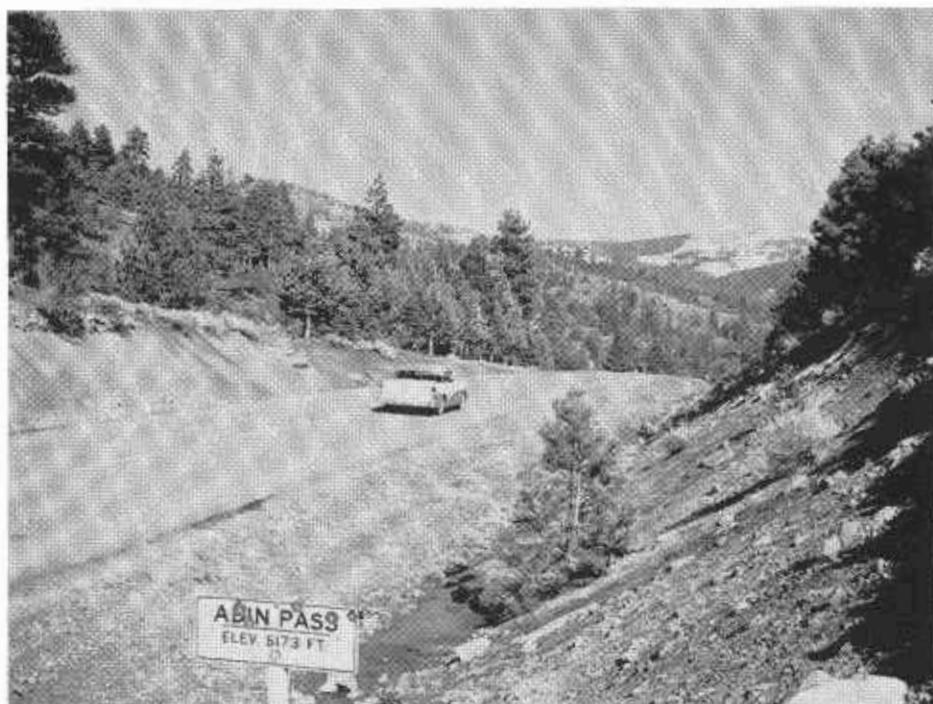
For the 10.3-mile gap between 0.8 mile north of Shotgun Creek and 1.0 mile south of the Shasta-Siskiyou county line, plans are being completed and right-of-way is being acquired.

Beginning at the Sacramento River bridge in Dunsmuir and extending five miles north to Big Canyon, contracts were completed in 1954 for widening the bridge to four lanes and constructing a four-lane divided expressway for about 3.5 miles to the north then two-lane for 0.8 mile. The roadway cost was \$2,100,000 and the bridge cost was \$700,000. The bridge contractor was Charles MacCloskey, San Francisco, and the road contractor A. Teichert & Son, Inc., Sacramento.

From Dunsmuir on, Mt. Shasta, which reaches a height of 14,162 feet, comes prominently into view. At Mt. Shasta City the Everitt Memorial Highway leads from US 99 along a newly built scenic route up the mountain to a ski lift and a lodge which will be ready for use this next winter. This is expected to become a very popular ski resort as it has so many natural advantages for the enjoyment of this winter sport. At Weed the highway skirts the base of Mt. Shasta.

From Big Canyon north to the Oregon state line the only recent construction other than resurfacing was completed at the following locations:

From Spring Hill north of Mt. Shasta to Weed, a distance of 8.0 miles, a modern two-lane highway with an overhead over the Southern Pacific tracks was completed in 1951. The construction cost was \$882,000. The contractors were Harms Brothers and F. Fredenburg of Sacramento



UPPER—Adin Summit on US 299 in Modoc County. Note the damage to the sign which has evidently served as a rifle target for vandals. LOWER—New construction on US 299 in Trinity County with the Trinity River on the right and the old highway on the left.

and Rand Construction Company of Bakersfield.

From 4.7 miles south of Yreka to Jefferson Street in Yreka, a distance of 4.7 miles, the initial two lanes of a future four-lane expressway were completed in 1957 under two contracts at a total cost of \$1,082,000.

The contractor was M. W. Brown of Redding.

Between Camp Lowe and Bailey Hill, a distance of 7.8 miles, a modern two-lane highway realignment was completed in 1949 at a construction cost of \$1,013,000. The contractor on the grading was Fredrickson and



An improved section of US 299 east of Weaverville in Trinity County. A section of the old highway can be seen in the right foreground.

Watson Construction Company, Oakland, and the contractor on the base and surfacing was A. Teichert & Son, Sacramento.

#### US 99E

US 99E enters District II at the Tehama-Butte county line about 12.5 miles north of Chico and joins US 99 at Red Bluff.

Since 1947 all this route has been reconstructed to a modern two-lane standard partially on old alignment and partially on new alignment. A number of bridges have been widened and a number of new bridges have been built. Total cost of these projects was \$1,700,000 for the roadway and \$1,000,000 for the bridges.

The two latest contracts were completed in 1954 and 1955. Fredrickson and Watson Construction Company of Oakland completed the section between Los Molinos and Mill Race Creek in 1954 and Clements and Company of Centerville completed the section between the Butte county line and Mill Race Creek. The bridge widenings had been completed previously by the bridge department.

#### US 40-Alternate

US 40-Alternate leaves District III and enters District II in Butte County about six miles southwest of Pulga, passes through the scenic Feather River Canyon and joins US 395 about eight miles east of the Nevada line. Two major realignment projects on this

route have been constructed in recent years. A forest highway project was completed under the jurisdiction of the Bureau of Public Roads in October, 1956, from plans furnished by the Division of Highways for 2.6 miles of two-lane highway between seven miles east of Quincy and 0.7 mile west of Spring Garden with an overhead over the Western Pacific Railroad tracks. Contractor Carl M. Halvorson, Inc., of Portland, Oregon, constructed this project at a cost of \$800,000.

An adjoining 5.2-mile unit from 0.7 mile west of Spring Garden to Sloat is now under contract and should be completed this year. This project is for the initial two lanes of a four-lane expressway. The estimated construction cost is \$1,200,000 and the contractor is O. K. Mitty & Sons, Gardena.

Plans are under way for the section between Sloat and Blairsden.

#### US 97

US 97 begins at Weed in Siskiyou County, branching off from US 99, and leads in a northwesterly direction toward Klamath Falls, Oregon, leaving California about three miles north of Dorris. Wonderful views of Mt. Shasta are seen from this highway as it skirts the base of the mountain on the north side. This route has become a popular route to northern Oregon and Washington as it is shorter than US 99 and traverses fewer cities.

The only major realignment project on this route in recent years is the completion in 1954 of a realignment from Dorris to the Oregon state line, a distance of three miles. Clements and Company of Hayward was the contractor and the cost was \$410,000.

Work has been started by Dorman Construction Company on a heavy-duty asphalt pavement on the 17.2-mile section between Juniper Station and 0.1 mile north of Dorris. Also resurfacing with plant mix is under way between 8.3 miles north of Weed and Grass Lake, a distance of about 13 miles. M. W. Brown is the contractor.

#### US 299

US 299 enters District II from District I along the Trinity River about 26 miles west of Weaverville, passes through Weaverville, Redding, Burney and Fall River Mills, and ends at Alturas.

There has been no recent construction on this route west of Weaverville except for storm damage restoration and resurfacing.

From Weaverville to Douglas City under a number of contracts between 1950 and 1957, the entire section has been reconstructed to a modern two-lane standard with greatly improved alignment and new bridges, the cost being about \$1,600,000. A new 0.2-mile approach to the Trinity River Bridge is to be contracted this year.

From Vitzthums, which is 2.6 miles east of the bridge, to 1.0 mile east of



*A new section of US 395 south of Ravendale in Lassen County presents an interesting study in perspective for the cameraman*

Tom Lang Gulch, a distance of three miles, a contract was completed in 1957 for a relocation of a narrow, winding stretch of mountain road. Plans are being prepared for further relocation to the summit of Buckhorn Mountain.

In Shasta County between 1947 and 1949, 9.9 miles of highway were relocated between Tower House and Shasta. The building of the dams for the Trinity River development will create a lake in the neighborhood of Whiskeytown which will necessitate an extensive relocation of this highway.

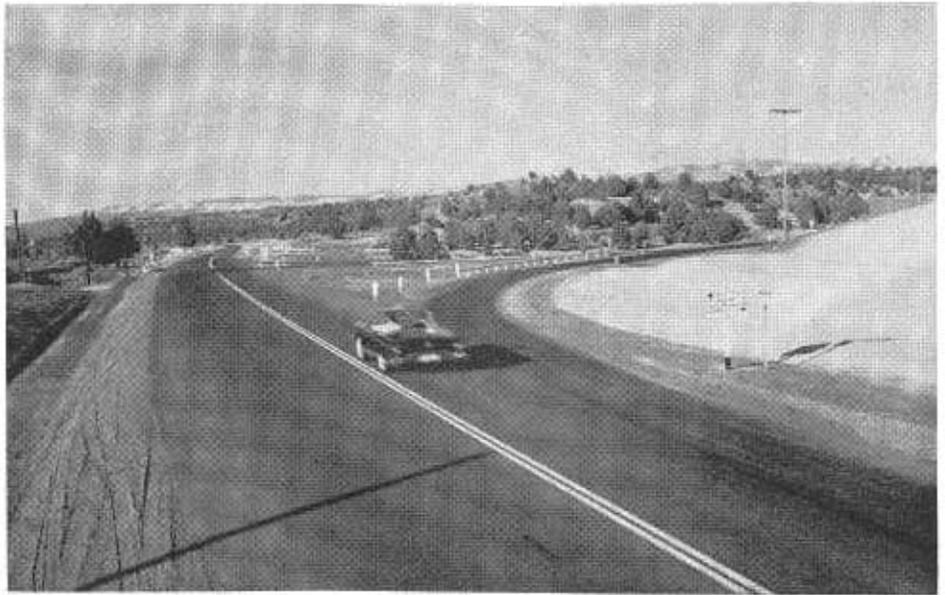
From just east of the west Redding city limits to the Southern Pacific overhead, a contract was completed in 1956 for a four-lane highway and street. The work was performed by Fredrickson and Watson Construction Company of Oakland at a cost of \$312,000. A contract has been let to Stolte, Inc., Oakland, for a new four-lane overhead over the railroad. This should be completed by late fall.

On Market Street in Redding this route coincides with US 99 to the top of Sulphur Creek Hill then proceeds in a northeasterly direction to Alturas.

Contracts were completed in 1955 on a relocation of a four-mile stretch of highway between Montgomery Creek and 0.2 mile east of Hillcrest and on a realignment of a 3.6-mile stretch between Deb's Place and Hatchet Mountain Summit. The contractor on the former was Eaton and Smith of San Francisco and on the latter was Fredrickson and Watson Construction Company of Oakland. The cost for the two projects was \$1,700,000.

Work is scheduled to start this year on a construction job that will include completing the 1.4-mile gap between the above projects as well as a 3.9-mile relocation on the east slope of Hatchet Mountain. This is covered by a budget allocation of \$1,450,000.

Recent work on this route in Lassen County consists of extensive resurfacing. In Modoc County, realignment between 1.0 mile east of Canby and Chambers Ranch was completed in 1954 at a cost of \$500,000. The contractor was Peter Kiewit Sons' Company of San Francisco.



US 395 five miles east of Alturas at the junction with Route 28 to Cedarville

This highway extends from Alturas to the Nevada state line as Legislative Route 28. It follows US Route 395 north of Alturas for a distance of six miles then branches to the east over Cedar Pass and through Cedarville to the Nevada state line.

Honor Camp forces in 1955 and 1956 graded a section 7.9 miles in length from the junction of US 395 east, at a cost of \$330,000. In 1957 a plant-mixed surfacing was placed on this section at a cost of \$130,000. The contractor was Clements and Company of Centerville.

In 1951 a realignment of an 8.9-mile section between Toms Creek and Cedarville and going over Cedar Pass was completed to a modern two-lane standard at a cost of \$1,100,000.

#### US 395

US 395 enters the State in Sierra County about 16 miles northwest of Reno and traverses Lassen and Modoc Counties to the Oregon border about 40 miles north of Alturas. Alturas is the only city through which it passes.

In Sierra County and south of Johnstonville in Lassen County no construction has been done in recent years except for surfacing.

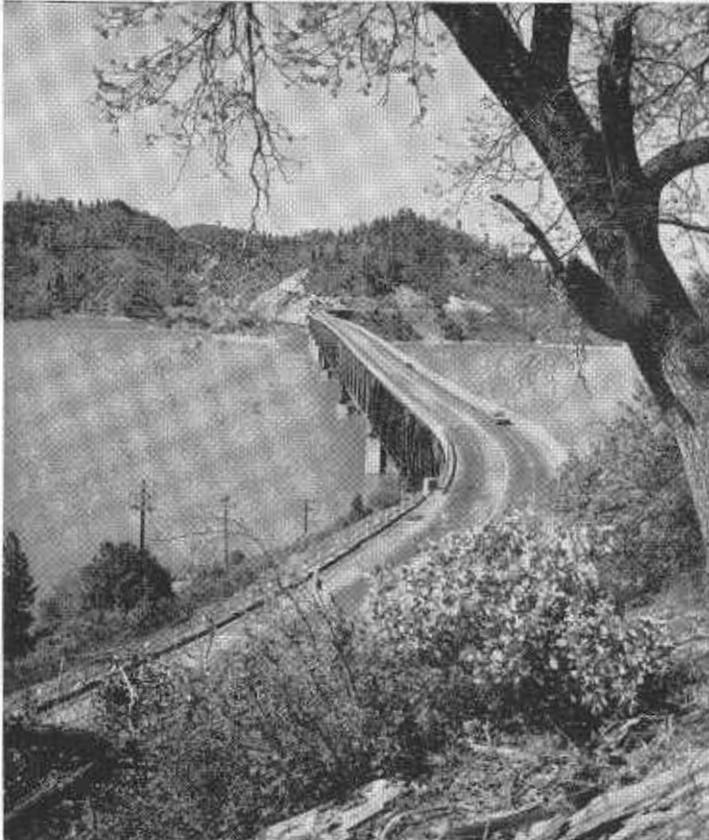
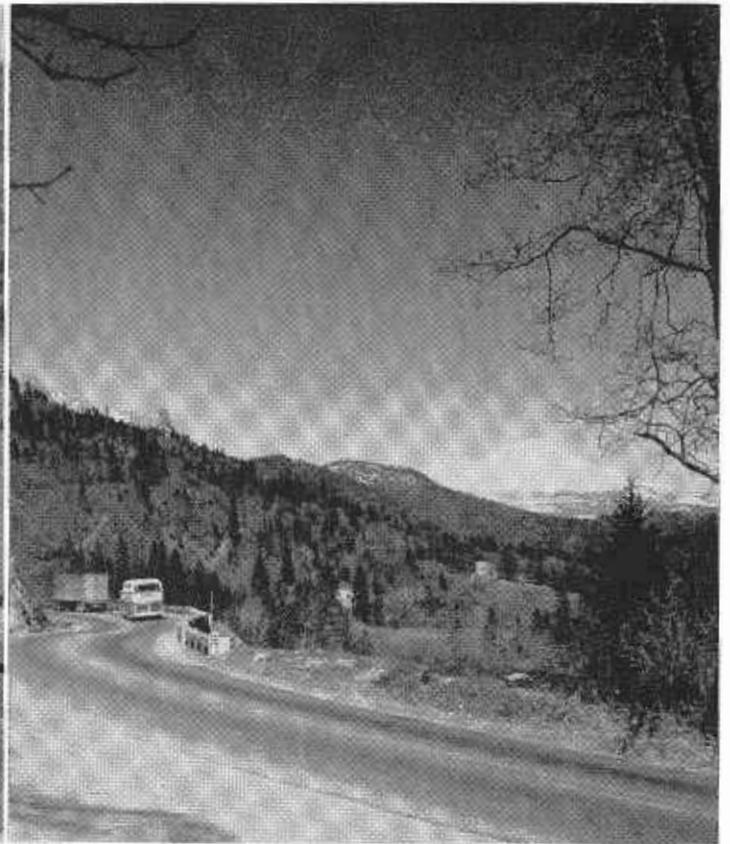
North of Johnstonville since 1953, contracts have been completed by the Division of Highways and by the Bureau of Public Roads which have

made the major portion of this route in Lassen County an adequate, modern two-lane highway. The main contractors were Harms Brothers of Sacramento and A. Teichert & Son, Inc., of Sacramento. The cost was \$2,300,000. With the completion of a surfacing contract this year between Ravendale and Madeline the traveling public will have a smooth, wide two-lane highway through Lassen County.

Between Alturas and the Oregon state line in Modoc County the complete distance of 38.4 miles was graded by Honor Camp forces between the years 1946 and 1956. The cost was \$2,500,000. In 1957 a surfacing contract was completed over this stretch of highway. The cost was \$600,000 and the contractor was J. C. Compton of McMinnville, Oregon.

#### State Sign Route 89

State Sign Route 89 enters District II at the Sierra-Plumas county line and runs north 8.7 miles to a junction with US 40-Alternate about 8.9 miles west of Portola. It follows along US 40-Alternate to a point about 11 miles north of Quincy; branches to the right through Crescent Mills and around the west side of Lake Almanor to a junction with State Sign Route 36 about three miles southwest of Chester. It follows along Route 36 to a point four miles west of Morgan Springs; branches to the right to the



UPPER LEFT—Route 82 entering the City of Fort Jones from the south. UPPER RIGHT—The section of US 99 in the Sacramento River Canyon near Castella scheduled for reconstruction soon. LOWER LEFT—The Pit River Bridge across Shasta Lake on US 99. LOWER RIGHT—An aerial view of the new Scott Valley highway (Route 82) in Siskiyou County southwest of Yreka. Sections of the old winding road it replaced can be seen in the foreground.

south entrance of Lassen Volcanic National Park.

Through the park is a scenic park road which passes hot springs and reaches the height of 8,512 feet from which it is an easy climb to the top of Mt. Lassen at 10,453 feet. The road runs through the devastated area from the last eruption in 1915 and skirts trout-filled lakes.

From the north entrance of Lassen Park Route 89 continues north at times along a beautiful trout stream, Hat Creek, and crosses US 299 about five miles east of Burney. 5.5 miles north of the junction on the left is the entrance to the McArthur-Burney Falls State Park, which has an awe-inspiring falls that attracts many visitors. Camping facilities are available. The route now turns to the northwest and passes through McCloud and ends at a junction with US 99 about two miles south of Mt. Shasta City. It is from this route that the new ski lift road up Mt. Shasta begins.

Recent work on this route south of US 40-Alternate includes the building of bridges with approaches over Sulphur Creek, Frazier Creek, Graeagle Creek and the Middle Fork of the Feather River. The cost was \$435,000.

Between US 40-Alternate and State Sign Route 36 improvements have been made at Greenville and Almanor Dam.

In Shasta and Siskiyou Counties, \$244,000 is budgeted for the replacement this year of a bridge across Hat Creek and six other minor structures.

#### **State Sign Route 32**

State Sign Route 32 enters District II in Butte County about 22 miles northeast of Chico and ends at a junction with State Sign Route 36 about 13 miles west of Chester in Tehama County. This route is a shortcut from the south to the Lassen Volcanic National Park and for trout fishing areas.

The only recent work on this route was a contract completed in 1952 for a bridge and approaches over Deer Creek about 48 miles northeast of Chico. Contractor R. E. Hertel of Sacramento performed the work at a cost of \$95,000.

#### **State Sign Route 36**

State Sign Route 36 enters District II at Peanut in Trinity County,

touches a corner of Shasta County near Beegum, traverses Tehama County through Red Bluff and over Morgan Summit, crosses a small portion of northern Plumas County and ends at the junction with US 395 east of Susanville in Lassen County. Near Mineral, State Sign Route 89 connects this route to the southern entrance of Lassen Volcanic National Park.

In the vicinity of the Trinity-Shasta county line a five-mile section of this route was relocated on improved alignment by the Bureau of Public Roads under the Forest Highway Program.

In Tehama County west of Red Bluff plans are in progress for im-

provement of the most deficient sections. A critical section between Tedoc Road and Dry Creek has been realigned for a distance of 8.8 miles under two contracts, one in 1954 and the other in 1957. The contractors were Eaton and Smith of San Francisco and Jess Harrison of San Ardo. The cost was \$930,000.

East of Red Bluff from 1.5 miles east of Lassen Camp to Mineral, work on a contract for 4.9 miles of the initial two lanes of an ultimate four-lane freeway will be completed this fall. The contractor is Stolte, Inc., of Oakland with a construction cost of \$1,300,000.



*A typical scene on Sign Route 89 between Burney and the Lassen Park boundary*



*The new highway over Scott Mountain between Yreka and Fort Jones (State Route 82)*

In Plumas and Lassen Counties several recent resurfacing projects have improved the riding qualities of this route.

It might be interesting to note that at one time during last winter this route over Morgan Summit was the only Northern California east-west route that remained open while Routes 40, 50 and 40-Alternate were blocked by slides and snow.

#### **State Sign Route 44**

State Sign Route 44 extends from the junction of Route US 99 in Redding to the north entrance of Lassen Volcanic National Park. The park containing the only mountain in the United States which has had an active volcano eruption in recent years attracts a great many visitors yearly.

In the City of Redding a new bridge was built across the Sacramento River and the road improved from the junction of US 99 to 1.5 miles east. The cost of these improvements was \$1,100,000. Other recent work includes the construction of several bridges west of Millville. This year replacement of two bridges across Churn

Creek is scheduled with a budget allocation of \$164,000.

#### **State Sign Route 96**

State Sign Route 96 enters District II in Siskiyou County about 18.5 miles southwest of Happy Camp and follows the Klamath River to a junction with US 99 about nine miles north of Yreka.

Honor Camp No. 41 was established eight miles southwest of Happy Camp in 1956 for the purpose of grading all of the stretch between the district boundary and the Town of Happy Camp. A budget of \$491,000 is allotted to the camp each year.

The Bureau of Public Roads last year completed a two-lane highway for a distance of 6.4 miles between Happy Camp and the foot of Cade Mountain for a cost of \$884,000, under the forest highway program.

In 1957 the Division of Highways completed a contract for 4.5 miles to 5.4 miles east of Hamburg at a cost of \$150,000. The contractor was Peter Kiewit Sons' Company of Portland, Oregon.

In addition to many recent minor improvements that have been made

along this route, last year an improved connection with US 99 also was constructed.

#### **State Sign Route 139**

State Sign Route 139 starts at the junction with US 299 at Canby and runs northwesterly through Tulelake to the Oregon border about 27 miles southeast of Klamath Falls. Two roads lead off this route to the Lava Beds National Monument which is noted for the spectacular lava flows and also as a historical monument commemorating battles of the Modoc Indian War.

Recent work on this route includes major resurfacing and the reconstruction of the Perez Overhead 21 miles southeast of Tulelake.

#### **Legislative Route 35**

Legislative Route 35 enters District II at Peanut in Trinity County and runs through Hayfork to a junction with US 299 at the south end of the Trinity River Bridge near Douglas City.

The Bureau of Public Roads since 1949 has completed to a modern two-lane standard the 24.7 miles of highway

between 1.0 mile south of Hayfork and Douglas City as a Forest Highway improvement.

#### Legislative Route 82

Legislative Route 82 extends from Etna in Siskiyou County through Ft. Jones and over Forest Mountain to a junction with US 99 about two miles south of Yreka; follows along US 99 to Yreka and then branches to a terminus at Montague.

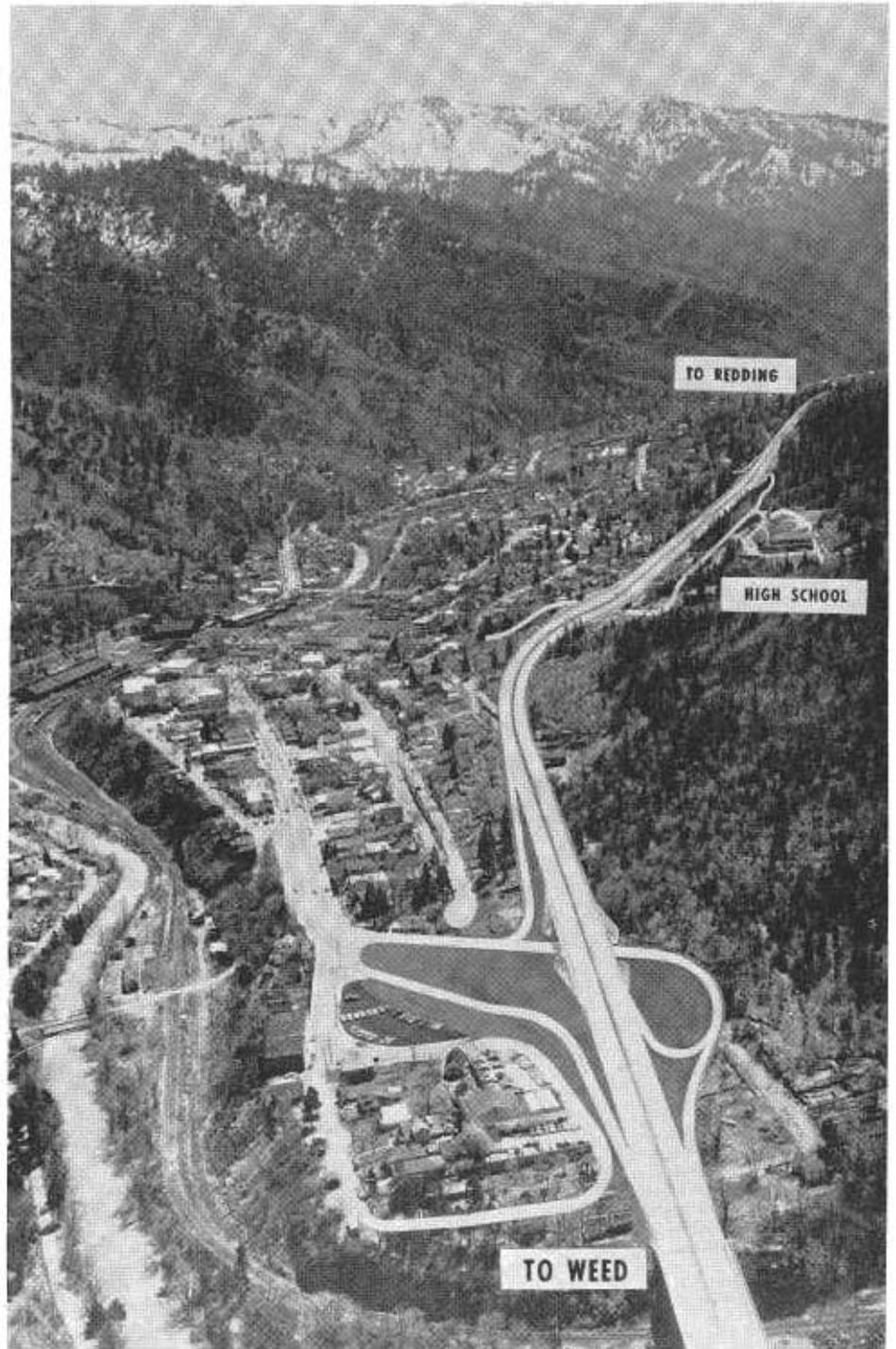
Between 1954 and 1957 contracts were completed for a modern two-lane highway under four contracts for 13.1 miles between 0.4 mile south of Kidder Creek to 1.0 mile east of Forest Mountain Summit. The cost was \$2,650,000. The contractors were Eaton and Smith of San Francisco, Peter Kiewit Sons' Company of Portland, Oregon (two contracts), and Clements and Company of Hayward. A gap of 2.9 miles between Greenview and 1.8 miles east of Ft. Jones will be let to contract this year.

The section between Yreka and Montague, a distance of 5.9 miles, was completed in 1953. The cost was \$277,000 and the contractor was Harms Brothers of Sacramento.

This leaves only two stretches not yet budgeted for building to modern standards; a 5.5-mile stretch from Etna to 0.4 mile south of Kidder Creek and a 5.5-mile stretch from 1.0 mile east of Forest Mountain Summit to the junction of US 99. Preparation of plans and acquisition of right-of-way is in progress for these remaining sections.

Since the Collier-Burns Highway Act was passed by the Legislature in 1947, substantial improvements have been completed on our road network. This progress has benefited highway users in the form of added safety and convenience. It is now commonplace to measure distance by the length of time required to travel between two points. In this northeastern area of the State where mileage to destinations is generally large for most of the trips, distances have been shortened notable amounts.

On the lateral routes where two lanes provide sufficient capacity for present traffic the construction of a single roadway of a future divided espressway has been followed. This pro-



An artist's drawing superimposed on this photograph shows the future interstate freeway location through the City of Dunsmuir. The interchange in the foreground will connect the new freeway with the present US 99 which is also the main street of the city.

vides a means of progressing with an orderly program with assurance that the current investment in the highway plan will continue to serve the public in the ultimate development. Recent provision that has been made for building a system of interstate highways has

given impetus to freeway construction in this area. While much remains to be done, we can look ahead to the day when the main north-south route, which is the economic life line of this region, will be completed to freeway standards.

# Loleta Bypass

Redwood Highway Improvement  
Continues in Humboldt County

By H. A. DAVIS, Resident Engineer

COMPLETION of a 4.6-mile section of expressway between Fernbridge and Beatrice, and passing easterly of Loleta, marks another milestone in the program to modernize US 101, the Redwood Highway, in Humboldt County.

The new expressway replaces a 5.1-mile section of substandard two-lane highway over Loleta Hill, also referred to as Table Bluff Hill, approximately 10 miles to 15 miles south of Eureka.

The new facility is the first unit in a planned development of 13.5 miles of the Redwood Highway between the north city limits of Fortuna and Elk River, just south of Eureka.

Of the section of the old highway that was replaced, two miles were constructed in 1927, with the remaining 3.1 miles being constructed in 1930-31. The average daily traffic and accident rate for the past four years is shown in the table on the following page.

A number of these accidents occurred at an underpass of the NWPRR at Loleta where highway alignment is a 400-foot to 1,000-foot radius (dog-legged) reverse curve, having clearance of 28 feet between concrete piers.

## Many Slow Trucks

Proceeding northerly over the section known locally as Loleta Hill to Table Bluff Summit, steep grades and substandard alignment caused a definite bottleneck to traffic movements as a result of the large number of slow-moving trucks common to this stretch of highway.

As the new expressway is on completely new alignment, this superseded section of highway will be maintained as a county road.

The new expressway is a four-lane divided section having a 22-foot median. Surfacing is plant-mix with open graded seal, all on cement treated base. At two locations where terrain features made it necessary to go to 6 per-



An aerial view looking north along the newly completed bypass. The road crossing in the foreground connects the new expressway with Loleta to the left.

cent grades, the 10-foot-wide shoulders were reinforced with cement treated base to provide for slow-moving trucks, which frequently use the shoulders.

The design provides for an ultimate full freeway and the only two initial grade intersections will be replaced by traffic interchanges at some later date. Lighting of the intersection serving the Town of Loleta was necessary as the sight distance at the intersection is often restricted by very dense fog.

The new facility results in a considerable saving of time to the daily user and, in addition, due to its location on high lands above Loleta, adds further to the scenic splendor of the Redwood Highway by providing a panoramic view of the Eel River as it snakes through the bottom land and empties into the Pacific Ocean.

#### Two-stage Construction

This unit was constructed in two stages. The first stage, consisting of grading, structures, and drainage, was described in H. W. Benedict's article in the March-April, 1957, issue of *California Highways and Public Works*.

The second-stage contract consisting of surfacing and subgrade drainage was awarded to Mercer, Fraser Company, Inc., and Mercer, Fraser Gas Company, Inc., of Eureka on a low bid of \$659,028.50.

The subgrade drainage consisted of installation of 20,400 lineal feet of 8" perforated metal pipe placed longitudinally along the low side of the roadbed, in the cut sections, in "V" ditches having a depth of two feet below subgrade. The entire roadbed in the cut sections received a one-foot blanket of type "C" filter material. In addition to the filter material, the typical section consists of 0.50 foot of imported subbase material, 0.83 foot of base (0.67 foot of which is cement-treated under the traveled lanes), 0.25 foot of type "B" PMS, and 0.05 foot of open-graded PMS on the traveled lanes.



An aerial view taken at the north end of the Loleta Bypass. The road extending southward to the right of the new freeway is the old highway.

#### Survey Conducted

Before placing the base materials, E. Dewing, Senior Highway Engineer of Headquarters Materials and Research Department, conducted a survey of deflections of the subgrade as recorded by the Benkleman beam deflection tester. Areas showing excessive deflection were recorded and additional base was added. Successive tests were made at various levels of the base with the final test on the completed surface showing deflections well below the maximum allowable for type "B" plant-mixed surfacing. This is the first project where the Benkleman beam test was conducted from the subgrade through the completed surfacing. Analysis of the data gathered by this survey will be a defi-

nite asset in determining required thicknesses of base materials for future projects.

Although the grading contract was not completed until September 30, 1957, the surfacing contractor was able to start on the completed portions on July 24, 1957.

The surfacing contractor made excellent progress, and completed the project on February 3, 1958, utilizing only 70% of the contract time allotted.

The structures of Unit II of the freeway development program southerly from Unit I to Fortuna are now under construction with the grading and surfacing scheduled to be completed during the 1958-59 season.

The project was under the supervision of District Engineer Sam Helwer, Operations Engineer C. P. Sweet, and Construction Engineer M. O. Clemens. The writer was resident engineer on the project, and the superintendent for contractor Mercer, Fraser Company was Fred O. Bott.

Daily Traffic and Accident Rate  
Number of Accidents

Year	Property				Accident rate MVM	A.D.T.
	Damage	Injury	Fatal	Total		
1954	17	10	2	29	2.60	6400
1955	21	14	0	35	2.92	6900
1956	26	11	3	40	3.06	7500
1957	20	12	4	36	2.65	7800

# Pacifica Freeway

New Section Bypasses  
Old Coastal Highway

By LESLIE M. PETERSEN, District Design Engineer

THE CITIZENS of the new City of Pacifica on the Pacific coast south of San Francisco will celebrate this spring the opening of the new freeway from Skyline Boulevard to Manor Drive near the south end of their city. This project bypasses the old state highway along Thornton Bluffs, which has been one of the most difficult sections of state highway to keep open.

The old state highway along Thornton Bluffs was constructed in 1936. It was established generally along the location of the abandoned Ocean-shore Railroad and for the most part consisted of a bench section along the face of a precipitous slope about 150 feet above the ocean. The aerial photograph included with this article shows the situation much more clearly than words can tell. The continued slip-outs resulting from erosive wave action along the base of the bluffs and slides from the unstable slopes above made the maintenance of the road progressively more difficult and costly over the years.

## Many Closures

The road was closed a total of 17 times during the seven winters between 1950 and 1957. These closures

ranged from a period of one hour to a period of 120 days. The road was closed a total of 174 days during this time. During these periods of closure, the two county roads leading from Sharp Park and Edgemar to Skyline Boulevard served as detours. A third, Manor Drive, was extended to Skyline Boulevard in 1956. The closures resulted in considerable inconvenience and delay to the motorists involved.

The cost of correcting the slides and slipouts during this seven-year period was about \$425,000 or an average of about \$60,000 per year. This cost is in addition to normal maintenance expenses.

In addition to maintenance difficulties, it was obvious many years ago that the road along Thornton Bluffs would soon be deficient from a traffic standpoint. A four-lane roadway would soon be needed to accommodate the traffic to the fast-growing communities along the coast. The close proximity to San Francisco and the scenic beauty of the area have been attractions to thousands of prospective homeowners. Because of rugged terrain the area, until recent years, has been sparsely settled. The increased demand for housing has

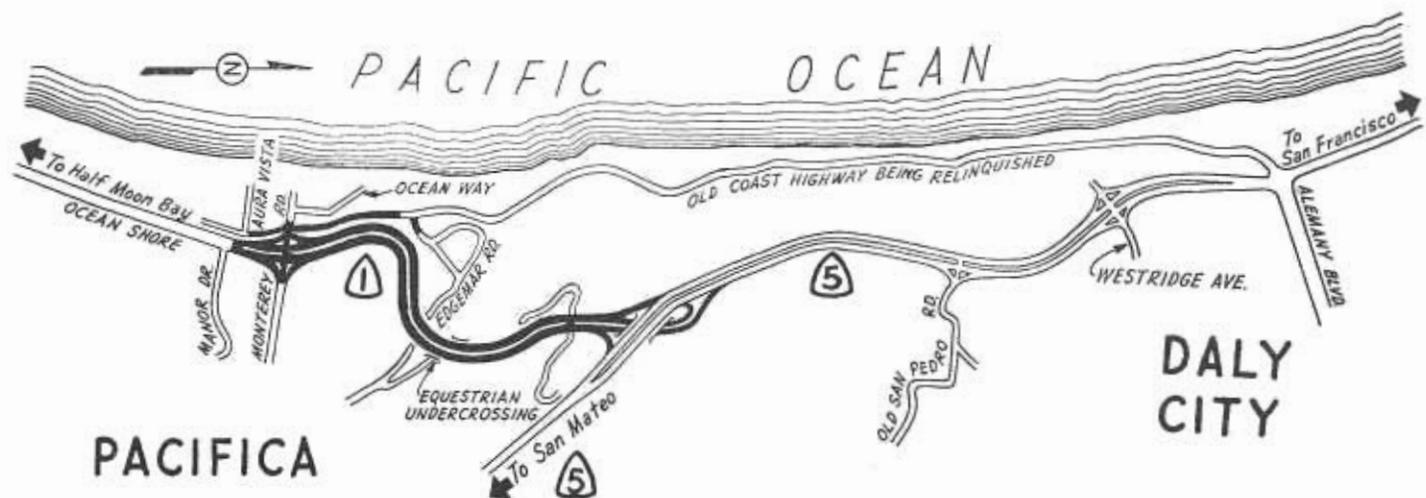
made it economically feasible to do the large-scale grading necessary to develop the hill areas into residential subdivisions.

## New Road Built

The State Highway Commission adopted a new route bypassing this section on November 17, 1952. Construction of Route 55 on Skyline Boulevard between Edgemar Road and Alemany Boulevard was completed in December, 1954, at a cost of \$630,000. This was constructed as a four-lane expressway with provisions for six lanes. Edward Keeble of San Jose was the contractor.

The contract for the section nearing completion was awarded to McCammon, Wunderlich & Wunderlich Contracting Company of Palo Alto on May 3, 1957. Their low bid was \$1,291,659.

This project was principally an earth-moving job with over 1,000,000 yards of roadway excavation required. The deepest cut was about 140 feet and the highest fill was about 100 feet. There were two bridges constructed as part of the interchange at Skyline Boulevard and an equestrian crossing was constructed near the center of the





*This aerial view shows the interchange under construction connecting the new freeway with Skyline Boulevard (State Sign Route 5)*

job to provide for a State Beaches and Parks horse trail.

This project was constructed as a four-lane divided expressway. The typical section consisted of four 12-foot lanes with a 10-foot dividing median and two eight-foot shoulders. An interchange was constructed with Skyline Boulevard and two channelized public road grade crossings were provided. Private access was restricted to new frontage roads or existing local roads.

The area traversed was largely undeveloped, and right-of-way problems were minor with one exception. A portion of the Globe Wireless overseas transmitting antennas had to be relocated. This was financed through right-of-way negotiations and relocated by the Globe Wireless Company.

#### Fault Area

This project is almost entirely within the San Andreas fault zone. The principal faultline appears to be in the draw about the center of the job on which the highest fill was placed. After a geological investigation, it was decided the only provision that need be made for seismic conditions was to provide flatter slopes on the fill across the main fault and provide extra material near this faultline to provide correction for future vertical or horizontal shift.

The principal design problem was to make the 530-foot difference in elevation from the top of the hill at Skyline Boulevard down to the beach area at Edgemar. A sustained 7 percent grade and reversing 750-foot radius curves were used to provide enough distance to make the difference in elevation.

The superintendent for contractors McCammon, Wunderlich & Wunderlich was Elmo Campbell. The Division of Highways was represented by Resident Engineer E. L. Raymond with J. W. Beck as Bridge Department representative.

The State Highway Commission adopted a 4.8-mile southerly extension of this freeway through the new City of Pacifica to Pedro Valley on January 22, 1958. Design of this section is now under way.



UPPER—An aerial view of the south end of the new freeway. The old road parallels the new freeway on the left before taking out around the Thornton Bluffs in the distance. LOWER—Looking south over part of the Thornton Bluffs showing the old highway (middle foreground) and the new freeway curving up the slope to the left.

# County Highway

*Three-mile Section Improved  
Along Tuolumne-Sonora Road*

By CHARLES D. HOF, Road Commissioner

A RECENTLY completed project in District X is a three-mile section of the Tuolumne-Sonora Road, which is Tuolumne County Federal-aid Secondary Route 954. This route begins approximately two miles easterly of Sonora, on State Sign Route 108 and ends at Tuolumne, a total length of 7.20 miles.

FAS Route 954 is the main artery between the City of Sonora and the Town of Tuolumne. The road serves an area devoted to stock and turkey farms, dairies, and apple orchards in addition to the mills of the West Side Lumber Company at Tuolumne and the Pickering Lumber Corporation at Standard, both of which are large operations that involve trucking of logs and finished lumber products over this road.

The original road was constructed about 1928 and consisted of asphaltic concrete approximately 15 feet in width retained by redwood header

boards. As far as it may be determined, little or no base was provided under the surfacing. Since the original construction, county forces widened the surface by asphalt penetration of the shoulders and improved some of the curves. By present-day standards, with a traffic count of 1,200 vehicles per day, the old road was very inadequate.

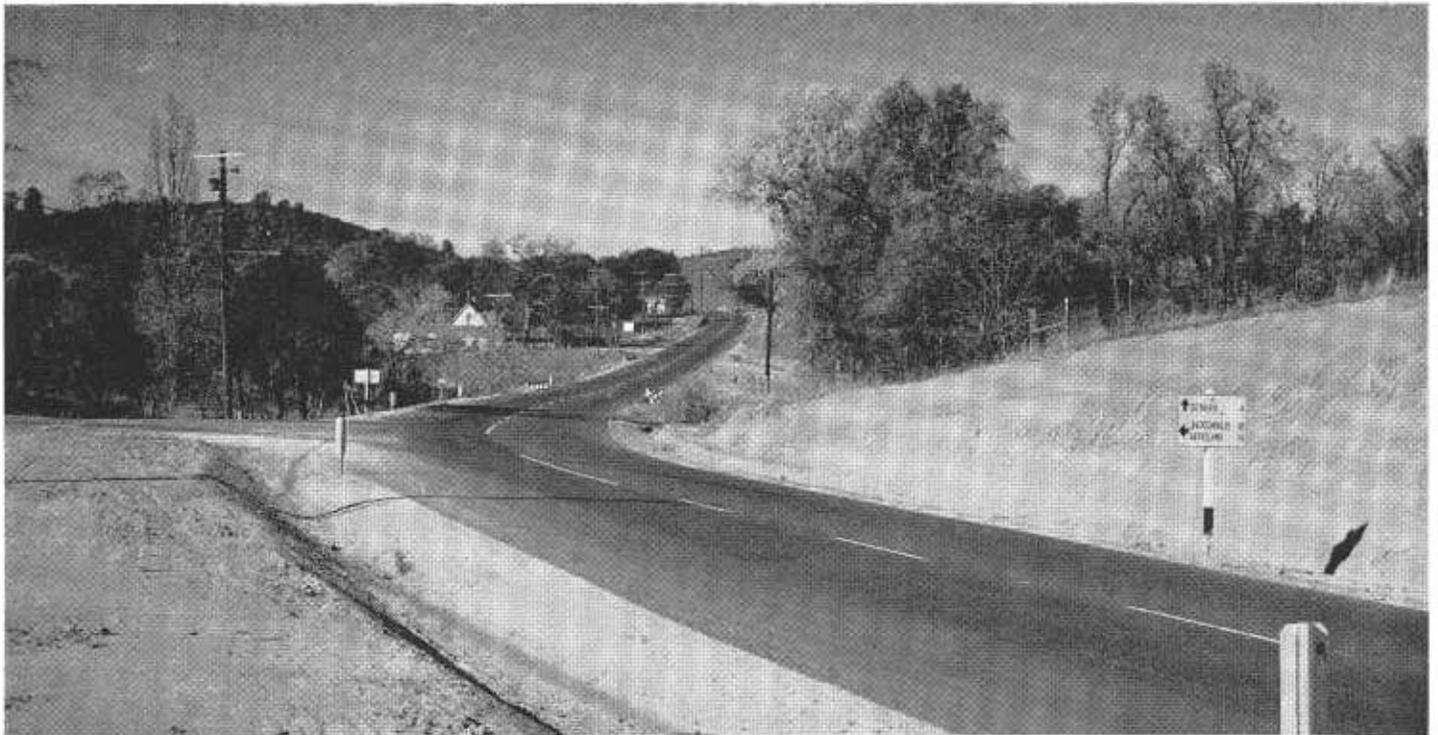
The completed three miles was designed by the county and constructed under a Division of Highways contract as a part of the federal-aid secondary highway program in co-operation with the U. S. Bureau of Public Roads. The new construction has a 32-foot-wide all-paved roadway with 1,150-foot minimum radius curves. Maximum grades are 6 percent and sight distances on vertical curves have been greatly improved. All engineering work, except construction staking and construction inspection, was performed by county forces under the direction of

Mr. Howard Emrich, assistant road commissioner. Mr. Emrich also completed all right-of-way negotiations.

With crushed aggregates being costly in mountainous areas it was determined that the most economical material available was a decomposed granite located at Standard, California. This granite was used for imported base material and as mineral aggregate for the cement-treated base. The contractor, M. J. Ruddy & Son, hauled the plant-mixed surfacing a distance of approximately 30 miles from a plant near Oakdale, California.

Total construction cost was \$196,000, financed from federal, state and county funds.

Plans are presently in process for the next two and one-half miles of this route. The new project is located in a more mountainous area with an existing 12 percent grade to overcome and a switchback to correct with improved alignment.



*A section of the recently completed Tuolumne County Federal Aid Secondary project shows the Wards Ferry Road connection on the left*

# Still Tops

*Bay Bridge Wins ASCE  
'Seven Wonders' Award*

A PLAQUE citing the San Francisco-Oakland Bay Bridge as one of the "seven civil engineering wonders of the United States" was presented to the State of California on March 17th.

C. M. Gilliss, State Director of Public Works, received the plaque on behalf of Governor Goodwin J. Knight at a luncheon held in San Francisco by the American Society of Civil Engineers.

Louis R. Howson of Chicago, president of the society, presented Gilliss with the bronze plate which is the symbol of the society's designation of the San Francisco-Oakland Bay Bridge as "a unique overwater steel structure."

The California State Department of Public Works built the Bay Bridge and operates it.

After the luncheon presentation of the plaque, Gilliss and Howson were joined by other ASCE and state officials in a brief ceremony at the Bridge Toll Plaza. A permanent display of the plaque will be arranged later, probably at the toll plaza.

The seven civil engineering wonders selected by the society included the Grand Coulee-Columbia Basin development, the Empire State Building, the Colorado River-Los Angeles Aqueduct, the Panama Canal, the Hoover Dam, the Southwest Sewage Treatment Plant of the City of Chicago, and the San Francisco-Oakland Bay Bridge.

#### **Unique Features Considered**

The San Francisco-Oakland Bay Bridge was selected as the greatest among the many fine suspension bridges of the country, primarily because its construction included unique features not found elsewhere. It was cited as outstanding due to its total length of steel over water, about 6 miles, its twin suspension spans built end to end, each 2,310 feet in length, and the exceptional appeal of its graceful lines.



*State Director of Public Works C. M. Gilliss accepts a bronze plaque from Louis R. Howson of Chicago, National President of the American Society of Civil Engineers, designating the San Francisco-Oakland Bay Bridge as one of the "Seven Civil Engineering Wonders of the United States"*

The society also referred to the great center anchorage pier between the twin suspension spans which it called one of the most remarkable examples of foundation and pier construction the world has ever seen. Praising the unique construction methods involved, Howson said, "The foundation was carried to the unprecedented depth of 240 feet below the water surface. The huge caisson for this pier (the largest ever used—92' x 197') was floated into position and sunk in a hundred feet of water in an area subjected to swift tidal currents. In order to avoid difficulties experienced in keeping smaller caissons in a vertical position an ingenious plan of providing buoyance was adopted by which the 55 dredging wells were used either for excavation or as air chambers as needed. Thus the huge cellular box was held in a level position while being sunk to

sound material 140 feet below the bottom of the bay.

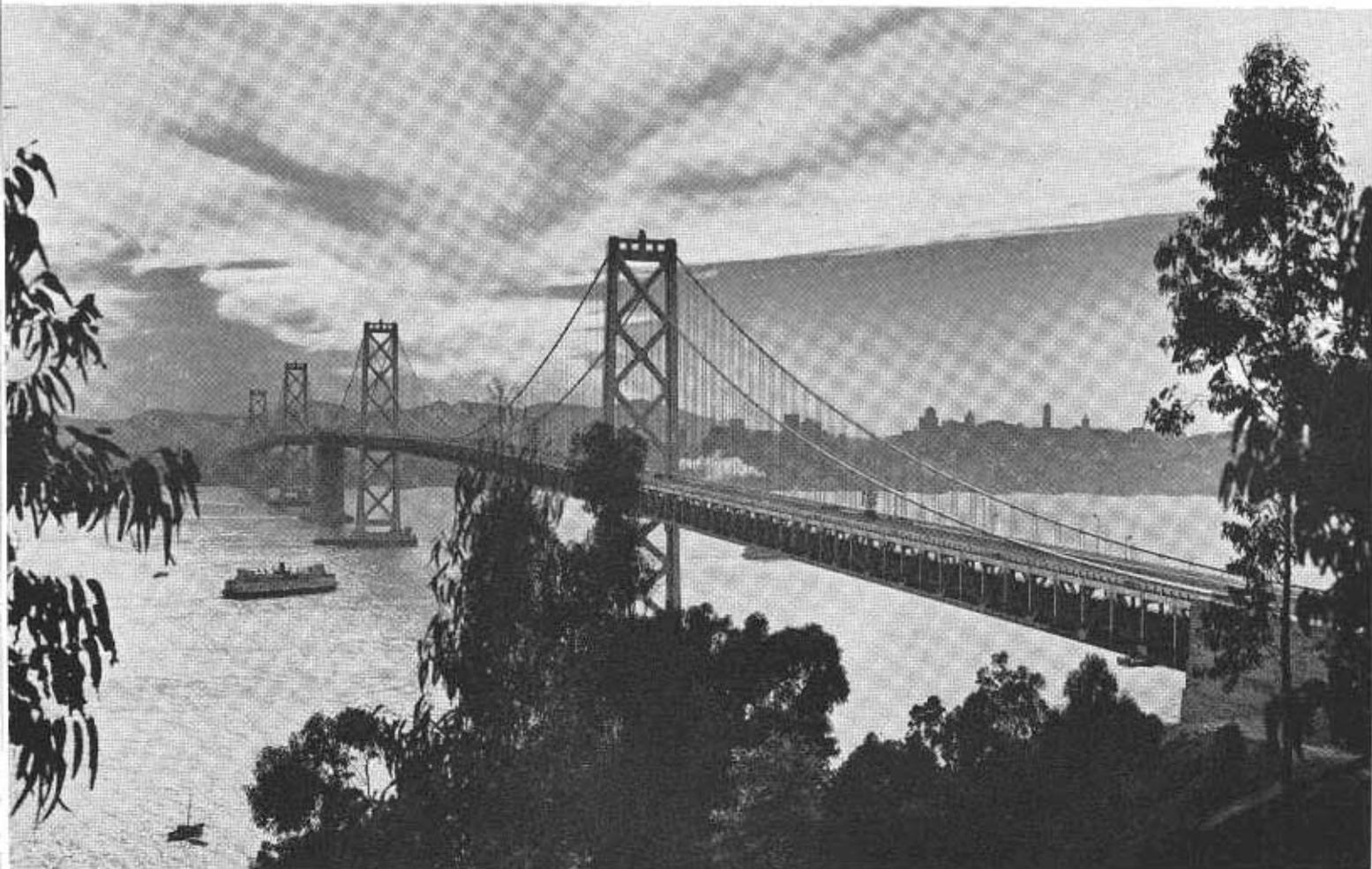
#### **Notable Features**

"The San Francisco-Oakland Bay Bridge superstructure can always be seen and admired but only the top of great central pier, which determined the selection of this bridge from many others as the greatest suspension bridge of our country, is visible to remind us of one of the most notable features of its construction.

"The boldness of conception of the great center anchorage pier, the ingenuity with which the work was carried out, and the success with which this most difficult undertaking was done attest to the careful planning of civil engineers and those associated with them in the work."

Howson said that the society began its study to determine the "seven civil engineering wonders of the United States" about two years ago.

# The Seventh Wonder

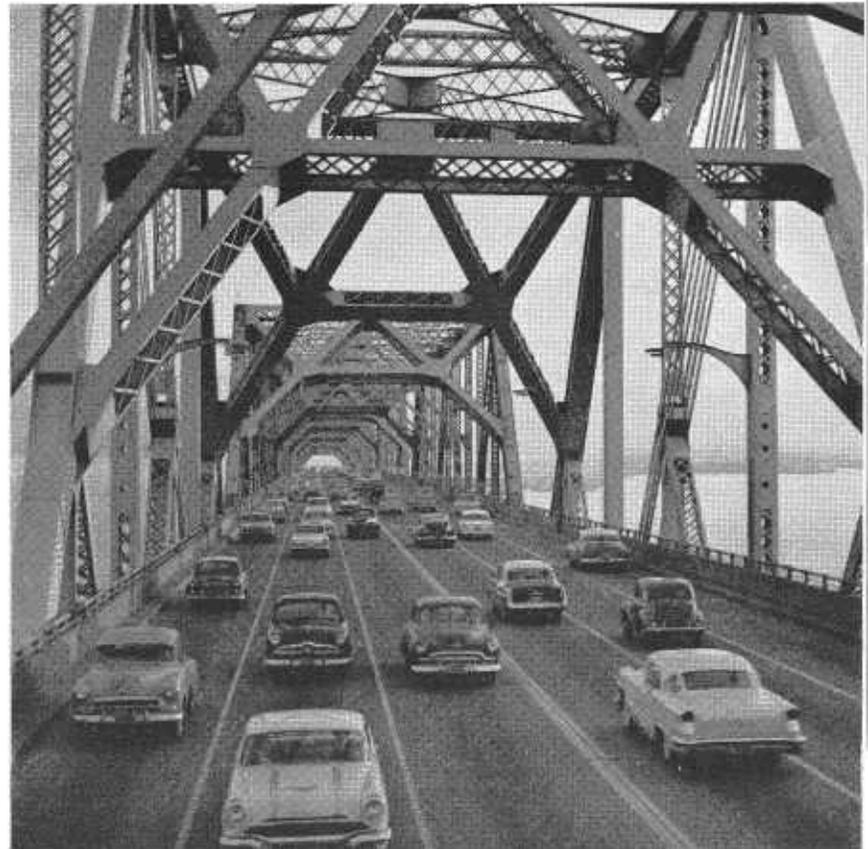
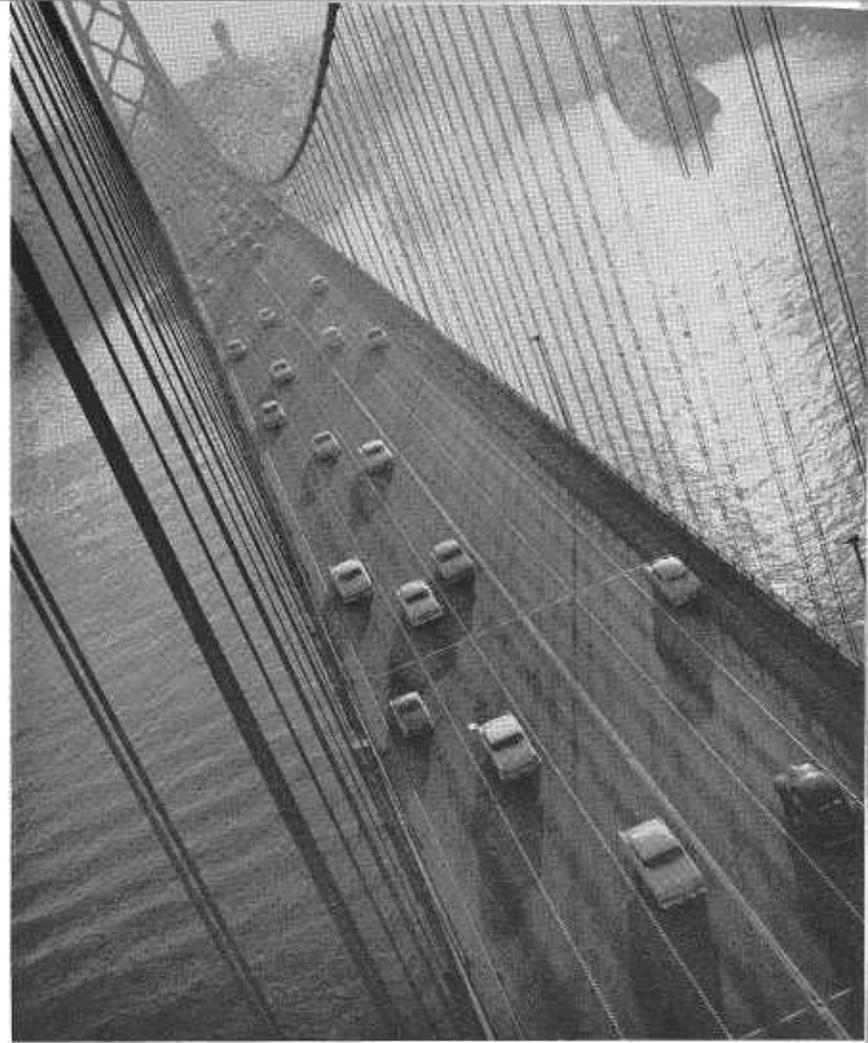


*" . . . its spans and foundations, the elevation of its towers, the dimensions of its cables and their composition are staggering . . . The assembly of these materials into this beautiful structure which contributes so much to human welfare is a civil engineering feat of the first magnitude."*

—LOUIS R. HOWSON, National President of the American Society of Civil Engineers, San Francisco, March 17, 1958.



Included among the "seven civil engineering wonders of the United States" chosen by the American Society of Civil Engineers is California's own San Francisco-Oakland Bay Bridge. Here she is, captured in some of her moods over the past 22 years by Division of Highways cameramen.



# Restoration

*Old Capitol at Benicia  
Becomes State Monument*

THE STATE CAPITOL at Benicia, reconstructed to its grandeur of a century ago, was accepted as a historical monument in the State Park System on April 15th at official ceremonies attended by many notables including Governor and Mrs. Goodwin J. Knight and Members of the Legislature.

Lieutenant Governor Harold J. Powers, members of the State Park Commission, state department chiefs and local officials were among the estimated 2,500 people who took part in the dedication ceremonies.

Many of those present, including the Governor and his wife, were in period dress of one hundred years ago.

After opening ceremonies, the Legislature convened briefly in the old Capitol.

The restoration was supervised by the State Division of Architecture. The Division of Beaches and Parks maintains the monument.

During the past century the old Capitol has been used for many local functions and for various civic activities. At times it has been the Benicia city hall, a church, a school, a theater, a dancehall, a skating rink, the city library and the police station.

The building was in a deplorable condition before restoration; neglected and timeworn, its second story had become a home for pigeons. An engineer of the Division of Architecture reported in 1953 that "There may be buildings in use for human occupancy in as poor structural shape as this building, but in my experience I have seen no worse. The building has been so weakened by neglect that very little factor of safety remains."

Such was the problem that confronted the Division of Architecture; namely, to make the building structurally safe and strong by present-day standards and, at the same time, to preserve its original appearance of more than a century ago.



*Governor and Mrs. Goodwin J. Knight and State Park Commissioner Leo Carrillo (left) headed a large group of notables taking part in the dedication ceremonies of the old Capitol at Benicia*

### **Authenticity Preserved**

One of the most difficult things of any restoration work is to resist the strong tendency toward "make believe." The preservation of authenticity—making sure that the work is honest and genuine—is a prime essential. True restoration work always demands subordination of individual imagination to correctness of design. This can be achieved only through scholarly research and the study of tangible, on-the-job evidences discovered during restoration.

The division's sources of information in working on the Benicia Capitol project were (1) printed and pictorial records found in libraries and archives; (2) reports of old-time residents of Benicia who were able to give firsthand accounts or data handed down from previous generations; and (3) evidence discovered throughout the structure and within the building frame as the work progressed. Important evidence was also gathered through careful study of other buildings erected in the 1850's at Benicia.

Research disclosed that, as the building was variously occupied after March, 1854, additions and many alterations to the original structure were made. There was also evidence of extensive alteration to the original design due to maintenance repairs over the years. Most of this work differed greatly from the original and had to be completely done over. Damaged original materials were restored with like materials where practicable. To guide the division's construction forces, 21 large sheets of blueprints were carefully prepared to secure exactness of the construction details. Many of these details were drawn as the work progressed and new data was revealed to the architects.

### **Reinforcing Concealed**

The exterior brick walls of the building are constructed of underburned brick, called salmon brick. In restoring the building, these walls were reinforced from the inside with concrete, leaving the exterior brickwork as originally laid in 1852. The foundations were similarly backed and underpinned with reinforced concrete. The new concrete frame and founda-

tions support the building by transferring the building weight from the weakened brick walls.

The method of reinforcing old structures in this way was devised by the Division of Architecture and first used several years ago in restoring the Wells-Fargo Building at Columbia, Tuolumne County, for the Beaches and Parks Division. At both buildings, it was possible to preserve the texture of the brickwork in its original state and in all its charm. Also, a layer of exterior plaster was removed from the foundations in order to expose the original stonework.

The roof of the building had been replaced several times during the past 100 years and had to be removed entirely during restoration. Rebuilt with new roof trusses, the roof has a standing seam tin roof covering that conforms to the original. This detail was determined by examination of a painting of the building made in 1860. The so-called "tin" roof is actually made of sheet iron plates coated with a composition mixture of lead and tin. In the early days this metal was a product of Wales and was called "terneplate."

The original floor joists throughout the structure are mortised, hand-squared crossbeams. These timbers were found to be in as good condition as the day the carpenters first set them, free from rot or other defects. The interior wood columns are original and were made from hand-shaped masts of abandoned sailing vessels.

The floors are laid with new random width floor planks that faithfully reproduce the original pattern of flooring. All rooms were reconstructed during restoration to follow the floor plans of the building when it was built in 1852.

### **Stairs Reconstructed**

The inside stairways adjacent to the main entrance are authentically reproduced to coincide with trace marks of the original winding stairs found on the plaster lathing.

Doors and windows are restored and are authentically designed as reproductions of the original work.

Cornice moldings are mostly hand-shaped. Cut "square" nails instead of wire nails were used throughout the restoration work, as in the old days.

The hardware in the building consists of original items secured from other buildings of the period. The front door lock and key, however, are the original and were donated to the State.

The lighting fixtures include a number of midcentury oil lamps, procured after long search up and down the State. The more elaborate fixtures in the legislative chambers, however, could not be found and replacements were specially designed for the building from documented information.

Interior paint colors were determined by analysis of the paint found on original surfaces, the many layers of newer paint having been removed down to the first color.

The architecture of the Benicia Capitol has that quality that lifts it out of the class of the ordinary building. The grace and charm of this art work set it apart from other buildings of the era. Early photographs show that the Benicia Capitol was entirely of a different quality than its neighboring buildings of the growing town of Benicia.

It has often been asked, "How, in the early days of 1852, in a frontier settlement, does a work of architecture such as this come about?" The answer is found in the local carpenter-architects' study of books such as Lefevre's 1833 "Modern Builder's Guide." These books were used much the same as house plan books are used at the present time. Ideas, source material and "how-to-do-it" information were all in the books.

### **Greek Temple Effect**

The builders of the Capitol chose the simplest design that would give the effect of a Greek temple—getting the "mostest for the leastest." The carpenter-architect was not concerned with the imaginative development of space utilization, nor had he come in contact with ideas relating to the climate of creative living. He chose the Greek temple form solely because it was the fashion of the time in capitol structures, a trend started by Thomas Jefferson in 1789 when he designed the Virginia State Capitol at Richmond in the form of a classical temple. The



Visitors, some of them in period dress of a century ago, through the steps of the reconstructed Capitol. Renovation of the building required extensive research by the staff of the State Division of Architecture and Division of Beaches and Parks to insure that it would be an exact replica of the structure as it appeared just after its completion in 1853.

vogue for domed capitols came later with the completion of the dome of the National Capitol during Civil War days. Thus, the Benicia Capitol has its place in historical lineage.

Architecturally, the building is described as a distyle temple with *portico in antis*: a temple form with a two-column porch set flush with the front elevation of the building instead of projecting.

The builders of the Capitol were Rider and Houghton, who contracted for construction of the building based on their low bid of \$24,800. The structure was erected in a great hurry in order to be ready for the 1853 Session of the Legislature. Three months of actual building time sufficed. This was possible because the time-consuming installation of modern-day plumb-

ing, heating, ventilating and lighting was not required. Then, too, there was no eight-hour day for anyone working

on the project. The underburned brick was used because there wasn't time to bake it longer.

LAHORE, WEST PAKISTAN

*Editor, California Highways  
and Public Works*

SIR: I acknowledge with thanks receipt of the August and October issues of your excellent publication and have enjoyed them through and through. These issues have been read with great interest by all the research and materials engineers working in this laboratory. The articles on "Operations and Activities of the Materials and Research Department" were found to be very informative, educational and enlightening.

Having worked for one month in the Sacramento Laboratory and in District IV of the Highway Division I particularly feel attached to the persons and places mentioned in these magazines.

I will be looking forward to your subsequent issues and thank you again for your courtesy in transmitting these magazines to us.

Yours truly,

MIAN M. HANIF  
Assistant Research Officer  
Buildings and Roads  
Research Laboratory

# Accident Study

Types of Collisions Made  
Subject of Special Research

By G. M. WEBB, Traffic Engineer

GREATER traffic safety is being achieved through modern engineering as the Division of Highways moves ahead in its extensive statewide program of highway construction and improvement.

Consistent and often spectacular reductions in accident rates are resulting as new highways and freeways are constructed, trouble spots are revised and modernized, and design is constantly improved.

These reductions are recorded from accident reports which are received from the California Highway Patrol and from some of the cities through which state highways pass. The reports are plotted and coded so that before-and-after comparisons can be made, points of high accident frequency determined, and patterns of recurring accident types isolated.

An important use of these data is in designing revisions and improvements for locations which show a large number of accidents. Some 300 spot improvements of this type are completed by the division each year.

One of these trouble spots, for example, was a sharp curve on State Sign Route 20 at Woodruff Lane in Yuba County, between Marysville and Grass Valley. A 25-month record of accidents at this location revealed a total of 20 accidents—16 property damage and four injury. Most of these mishaps resulted from vehicles failing to negotiate the curve. A correction might consist of more warning signs or an easier curve. In this case, it was possible to construct an easier curve.

As a result, not one accident was reported at this location in the 25 months following the improvement. (See before-and-after collision diagrams of this location.)

## Left-turn Accidents

Another of these problem locations was on Sign Route 29 at the intersection with Rio Del Mar in Napa County. Here reports listed a total of six accidents in a year—five property damage and one injury. According to collision diagrams, vehicles that stopped to make left turns were in-

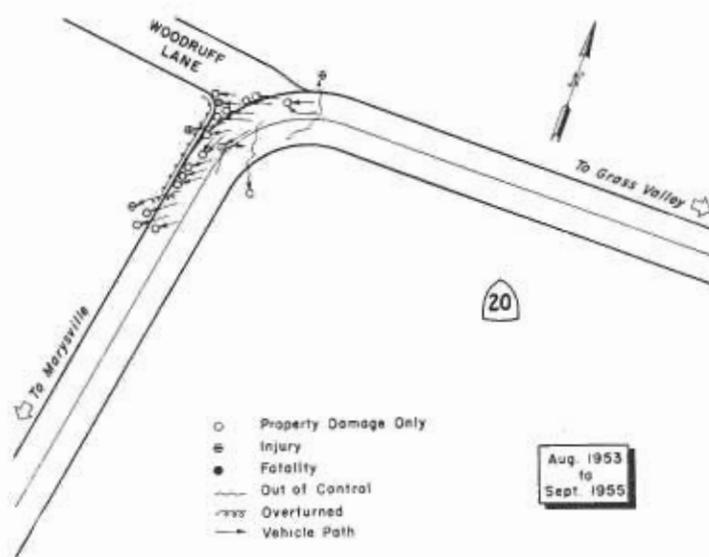
involved. To remedy the situation, the dividing strip opening was widened, a left-turn lane constructed, and signs installed.

In the year following the improvement not one accident was reported. (See before-and-after collision diagrams.)

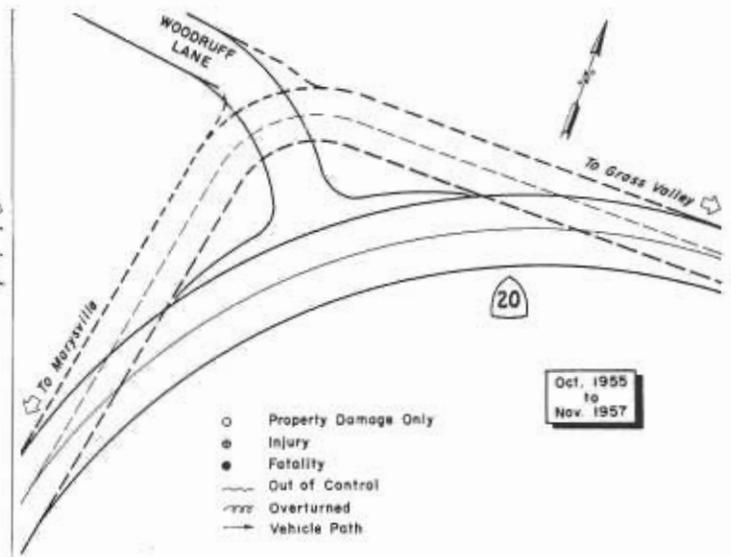
These examples show the benefit derived from the study of specific accident locations. Such corrections contribute very substantially to statewide traffic safety.

Going beyond these accident concentration points to take a look at the State Highway System as a whole, an overall analysis shows that accidents arise from many causes, but the pattern will generally fit one of the following categories:

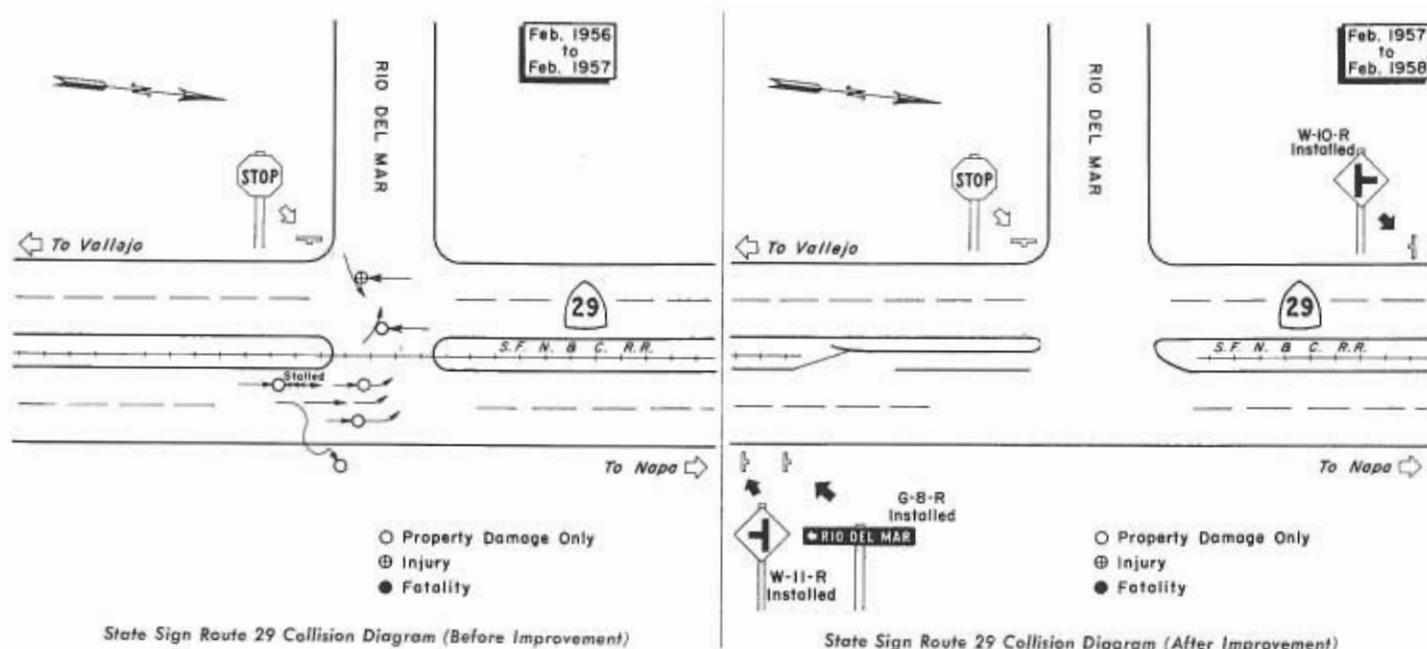
1. Conflict between vehicles traveling in opposite directions.
2. Conflict between vehicles traveling in the same direction.
3. Conflict between vehicles at intersections.



State Sign Route 20 Collision Diagram (Before Improvement)



State Sign Route 20 Collision Diagram (After Improvement)



4. Side conflict or conflict between vehicles entering or leaving the roadway from parking spaces or driveways.
5. Vehicles striking fixed objects, running off the roadway or overturning.
6. Conflict between vehicles and pedestrians.

As traffic volumes increased over the years and the need developed for highways with more than two lanes, these conflicts became greater. One of the first of these problems to receive attention was the conflict between vehicles traveling in opposite directions.

#### Medians Effective

This conflict, which frequently resulted in head-on collisions, was reduced by the construction of divided highways; that is, highways with a median or neutral area separating the opposing lanes of travel. This design proved effective, but did not entirely eliminate occasional spectacular and severe accidents resulting from vehicles crossing the divider, particularly on the high-volume highways.

These cross-median accidents have been the subject of intensified study by the Division of Highways for many years. The number of accidents of this type is not large; however, they are of particular concern to the division

because of their severity and the fact that they occur on the safest and best highways—full freeways.

One of the earliest attempts to solve this problem was the construction of a median barrier on the Grapevine Grade on U. S. Highway 99 south of Bakersfield, where the divider was quite narrow and there was a high rate of approach-type accidents.

The results were very disappointing in that accidents of all degrees of seriousness increased sharply after the barrier was installed.

Primarily, this increase resulted from cars and trucks striking the barrier and from rear-end collisions. The barrier restricted the freedom of the motorist in maneuvering to avoid trouble.

#### Four-lane Study

Since this indicated that a barrier would not be satisfactory under all conditions, an extensive study of the safety record of all four-lane divided highways in existence in 1947 was initiated.

The study showed, at least for the lower-volume roads of that time, that highways with medians free from physical obstructions had better safety records than those with median barriers or other physical features to prevent crossing.

However, there was also an indication that on higher-volume roads bar-

riers might prove beneficial. In line with this indication, a barrier of back-to-back metal plate guard railing was installed on a section of the San Bernardino Freeway which had an unfavorable record of cross-median accidents. A similar installation was later made on the Bayshore Freeway in San Francisco.

Results of a before-and-after study covering the San Bernardino Freeway installation were also disappointing.

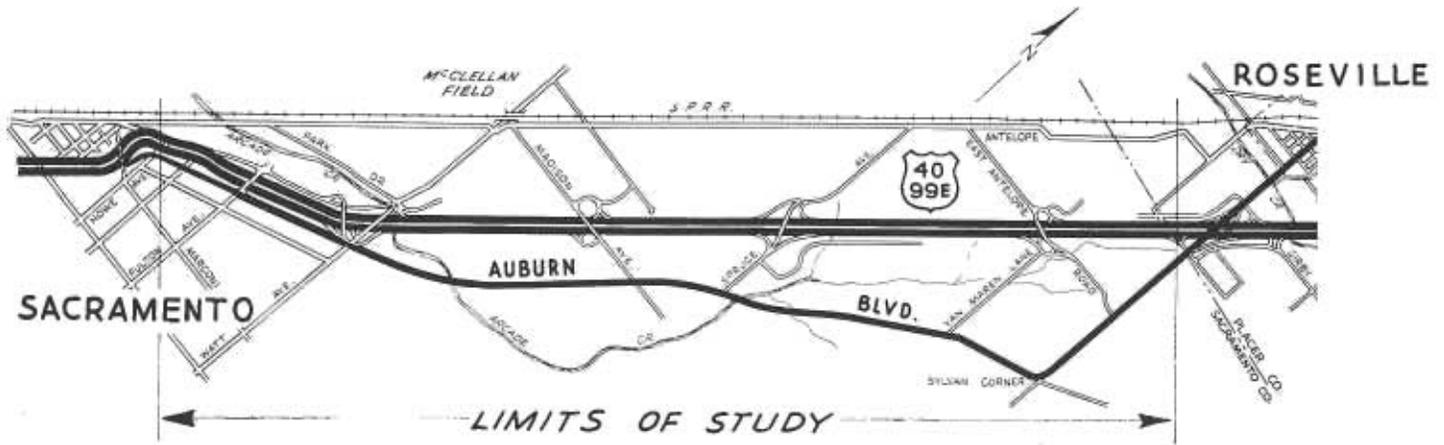
During the "after" period, the total accident rate increased three-fourths and the total casualty rate doubled. That the seriousness of accidents was not reduced was indicated by an increase of 10 percent in the number of vehicles involved per accident, and an increase of 30 percent in the number of casualties per accident.

Although the traffic volume climbed from 65,000 to 86,000 vehicles a day during the four-year study, congestion was not a factor in the accident rate increase. The accident rate for the peak hours of travel actually went down.

A similar study of the Bayshore Freeway barrier installation is being made.

#### Extensive Survey

In accordance with a long-standing practice of analysis and research to improve highway design, an extensive



statewide survey of highways with various types of medians is now in progress. This study covers about 280 miles of highway with traffic volumes of more than 15,000 vehicles a day, including 45 miles where barriers are in place.

Even though barriers have not yet proven effective in the promotion of overall safety at the locations where they have been installed, the division will continue its investigations of their safety possibilities. Barriers will be constructed where engineering studies and judgment indicate that they will bring about an improvement in the accident picture.

At present, about 16 miles of barriers are budgeted or under construction with an additional 15 miles under consideration. Each of the barrier segments will be carefully studied to determine the influence of the barrier on safety.

In addition, full-scale crash tests will soon be made, using radio-controlled cars and dummy occupants to determine the most effective barrier design.

Although divided highways have greatly reduced the danger of cross-median accidents, they are a direct attack on only one of the accident-producing traffic conflicts. To show an even better safety benefit, a highway must reduce all types of these conflicts.

**Accident Rate Reduced**

This is successfully accomplished by modern, properly designed freeways. That freeways are effective can be seen by the fact that the freeway accident

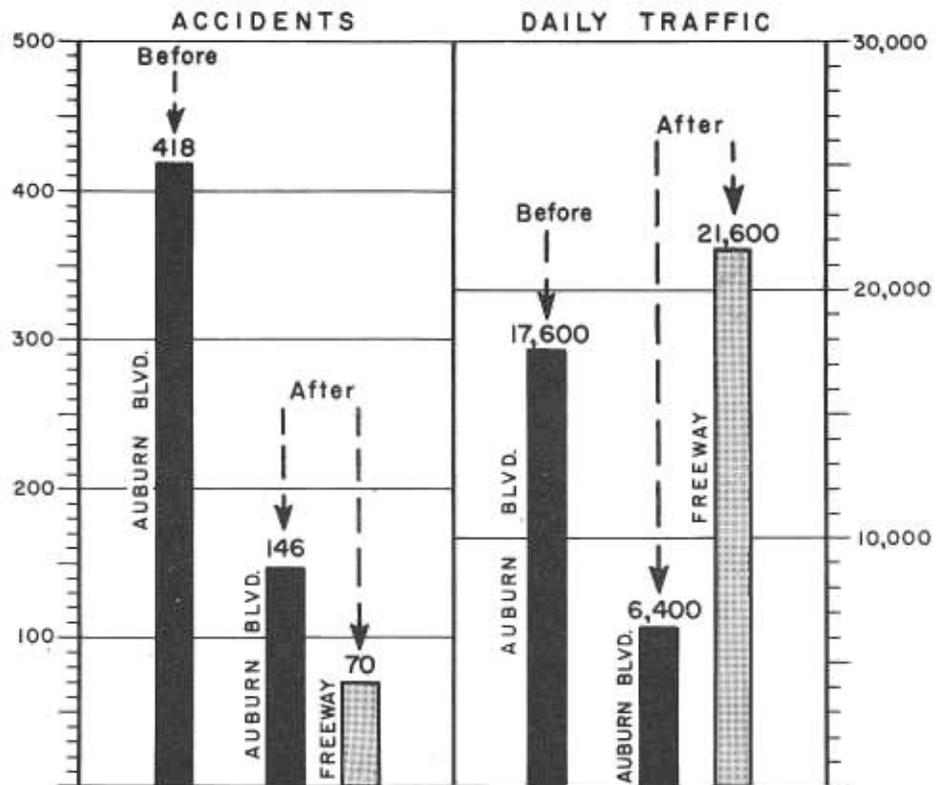
rate is about one-half the rate for conventional highways, and the fatality rate is about one-third the conventional highway figure.

The superiority of freeways over conventional highways is illustrated by the effect of construction of a 10.5-mile freeway between Sacramento and Roseville.

In a 22-month period immediately preceding the opening of the freeway,

there were 418 accidents. Only 70 accidents were reported during an equal period after the freeway was opened, even though the traffic volume increased from 17,600 to 21,600 vehicles a day. (See location map and chart of accidents.)

In addition, the combined volume of traffic on the old road and the freeway was 60 percent greater than the volume prior to the opening of the



This chart covers equal periods before and after constructing US 40 Freeway between Sacramento and Roseville

freeway. Even with this increase, the combined accident total on the old road and the freeway in the "after" period was about half the number that occurred on the old road before the freeway was completed.

This is another striking example of added traffic safety through engineering.

#### Highways Improved

California now has a full 500 miles of freeways in operation with another 209 miles under construction. In addition, most of the State's 916 miles of expressways, which have some intersections at grade, are designed for future conversion to freeway status. Also constructed in recent years have been a number of miles of "two-lane freeways," planned-access highways with two lanes initially and with design and right-of-way provisions included for an ultimate multilane freeway.

Successful spot revisions and low accident rates on freeways are the bright side of the picture, but what about the accidents that do occur?

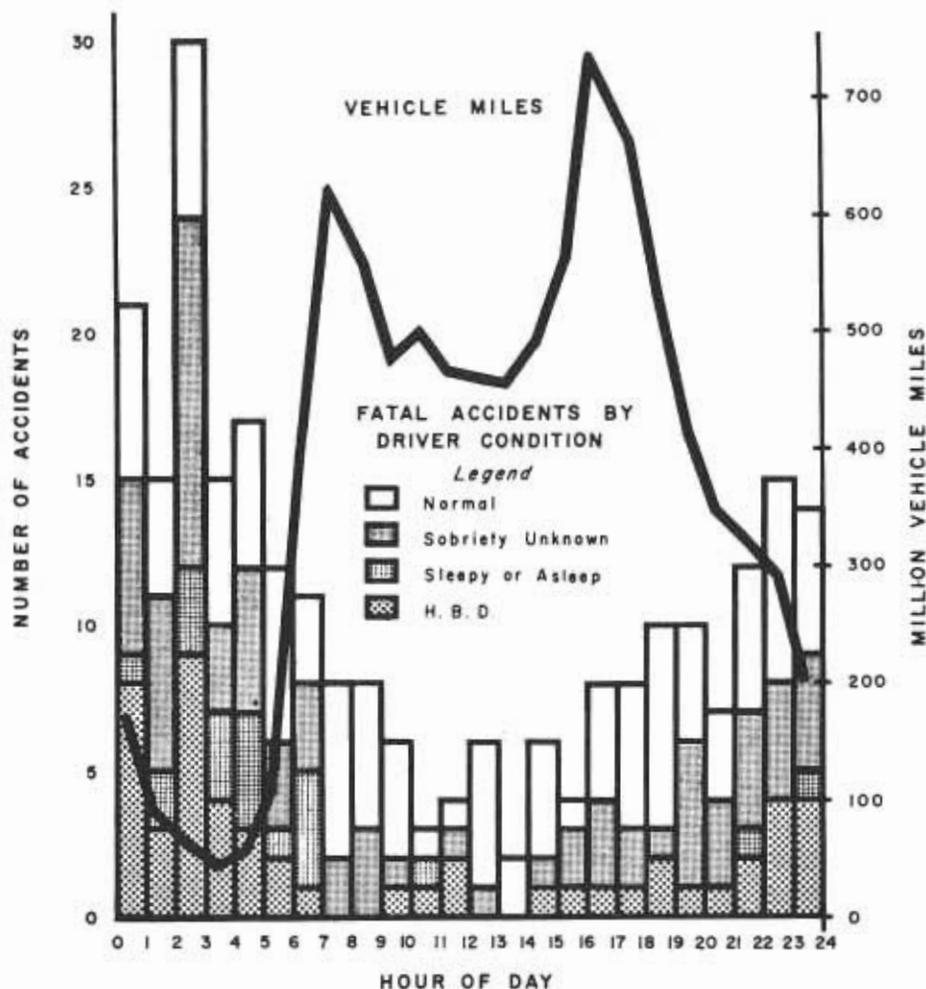
In an attempt to find answers to this problem, a study was made of fatal accidents on freeways in 1956 and 1957. (See chart showing accident frequency and traffic flow by hours.)

One finding of significance was that the hours from midnight to 5 a.m. produce 40 percent of the fatal accidents while accounting for only 5 percent of the traffic. A large number of the drivers involved in these early-morning crashes, it was found, had been drinking, were fatigued or asleep. In many cases the condition of the driver was unknown, but could have been a contributing factor.

An overall review of fatal accidents on freeways confirms the general observation that driver condition or attitude is an important factor in a very large number of accidents. In fact, during 1956 a traffic violation or the condition of the driver were contributing factors in 90 percent of all accidents on rural state highways. Drinking was reported in 28 percent of the fatal accidents.

This points to a means of improving highway safety which goes beyond engineering; that is, developing a safety-minded attitude and a feeling of

### 1956 & 1957 FULL FREEWAY



responsibility on the part of drivers. The division will continue to make available engineering experience and knowledge to any group attempting to deal with this phase of the problem.

From an engineering standpoint, the extensive statewide program of highway construction and improvement will be pushed ahead as rapidly as possible,

according to a long-range plan of orderly development based on priority of needs and availability of funds.

Meanwhile, there appears to be an acute need for a similarly effective approach to the social and psychological problems, the human failings, that play such a tragically important role in the great majority of traffic accidents.

SANTA BARBARA, CALIFORNIA

State Division of Highways  
Maintenance Station  
Buellton, Calif.

SIRS: During the past season of rain, fog, wind, and occasionally snow, I, like many others from this area, have had to drive over the San Marcos Pass regardless of weather, and often late at night.

Although it was frequently necessary to use great caution in driving due to slippery mud and falling rocks, I always drove with confidence, knowing that the staff from the Maintenance Station were working day and night to keep the road as safe as was humanly possible. They put in long hours of hard labor against heavy odds and did a wonderful job.

Yours very truly,  
MRS. GEORGE A. YARNELL

# California Bridges

Costs Hit Peak  
and Decline

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

**B**RIDGE construction costs rose to an unprecedented index value of 292 during the first quarter of 1957 and then declined to a value of 281 at the conclusion of the calendar year. The index value, 292, represents a 10 percent increase over the average level of costs during the year 1956 and the year's end index value of 281 represents a 4 percent decrease from the cost level of the first quarter of 1957.

In terms of average annual index values, the cost level has risen for the third consecutive year. Bridge construction costs hit a low point of 219 in the recession year 1954 and then in the subsequent years of 1955, 1956, and 1957 rose to the successively higher values of 228, 265, and 283. The values represent successive annual increments of 4.1 percent, 16.2 percent, 6.8 percent, or an overall increase for the three-year period of 33.3 percent. During the same three years, the Bureau of Public Roads Cost Index for structures shows an overall increase of about 17 percent, a rate which suggests that economic conditions in California are more volatile than those in most of the other states.

The level of costs for successive periods is presented graphically in the accompanying chart which summarizes the course of California bridge construction costs since 1934.

## Bridge Construction

Bridge construction activity continued at the high rate established in 1954, the year the additional increase to the state highway budget voted by the State Legislature took effect. During the past three years, the rate has been about 10 times that of the base (1939-40) period in terms of current dollars and just under four times that of the base period in terms of constant (1939-40) dollars. The differences in the two rates, 10 to 4, is accounted for by the rise in bridge construction costs since 1939-40.

TABLE 1

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

I Year	II Quarter	III Index of the cost of California bridge construction (1939-1940=100)	IV Index of the value of California bridge construction (1939-1940=100)	V Index of the volume of California bridge construction (1939-1940=100)	VI Dollar value of low bids on California bridge construction (in millions of dollars)
1934	..	94	*60	*64	3.1
1935	..	88	*138	*157	7.1
1936	..	98	*72	*73	3.7
1937	..	114	*60	*53	3.1
1938	..	99	*78	*79	4.0
1939	..	101	*99	*98	5.1
1940	..	99	*101	*102	5.2
1941	..	122	*78	*64	4.0
1942	..	158	*80	*50	4.1
1943	..	165	*16	*9	.8
1944	..	153	*29	*19	1.5
1945	..	167	*109	*65	5.6
1946	..	182	*247	*133	12.7
1947	..	215	*443	*202	22.8
1948	..	229	*307	*134	15.8
1949	..	201	*233	*117	12.0
1950	..	202	*262	*129	13.5
1951	..	248	*617	*247	31.8
1952	1st	{ 239	{ 396	{ 166	{ 5.1
1952	2d	{ 236	{ 1,017	{ 431	{ 13.1
1952	3d	*235 { 239	*561 { 652	*237 { 273	28.9 { 8.4
1952	4th	{ 223	{ 179	{ 80	{ 2.3
1953	1st	{ 243	{ 140	{ 58	{ 1.8
1953	2d	{ 224	{ 707	{ 315	{ 9.1
1953	3d	*229 { 231	*522 { 893	*227 { 387	26.9 { 11.5
1953	4th	{ 235	{ 350	{ 149	{ 4.5
1954	1st	{ 221	{ 691	{ 313	{ 8.9
1954	2d	{ 217	{ 1,196	{ 551	{ 15.4
1954	3d	*219 { 220	*870 { 1,002	*399 { 455	44.8 { 12.9
1954	4th	{ 213	{ 590	{ 277	{ 7.6
1955	1st	{ 217	{ 1,039	{ 477	{ 13.3
1955	2d	{ 237	{ 500	{ 211	{ 6.4
1955	3d	*228 { 228	*930 { 1,047	*408 { 461	47.9 { 13.4
1955	4th	{ 237	{ 1,148	{ 484	{ 14.7
1956	1st	{ 245	{ 833	{ 715	{ 25.1
1956	2d	{ 284	{ 1,083	{ 232	{ 7.8
1956	3d	*265 { 260	*1,117 { 604	*422 { 381	57.5 { 13.9
1956	4th	{ 273	{ 1,952	{ 213	{ 10.7
1957	1st	{ 292	{ 680	{ 232	{ 8.8
1957	2d	{ 283	{ 2,007	{ 709	{ 25.8
1957	3d	*283 { 275	*972 { 460	*343 { 167	48.0 { 5.9
1957	4th	{ 281	{ 740	{ 263	{ 9.5

\* Average annual information.

The indexes are designated as value and volume indexes in the accompanying charts where the course of the rates are given for all periods since 1934.

General economic trends are roughly reflected in the changing patterns of bidder activity. When the economy is running at a high level, the average number of bidders per

project is four or five; as the economy becomes depressed, the average number of bidders per project rises. In the depressed year of 1954, an average of 9.9 contracting firms submitted bids for bridge projects.

For state projects which included bridge work, the average number of bidders per project was 9.9, 6.7, 5.3, and 7.7 for the years 1954, 1955, 1956, and 1957, respectively. The data clearly reflect the depressed economic level of 1954, the rising level through 1955 and 1956, and the recessive trend which was evident in the last three quarters of 1957. Bidder activity was high during January of 1958, indicating that the recessive economic trend is continuing.

#### Unit Prices Trends

Unit prices for the various bridge items follow the general trend of the summary index of bridge construction costs; certain of the items may rise or fall faster than others but in the long run these differences are canceled and all items show roughly the same proportionate relationship to base year prices.

Three major items, Class A portland cement concrete, bar reinforcing steel, and structural steel, account for about 75 percent of the total value expended for bridge construction. The changes in the unit prices of these items exert a preponderant influence on the general trend of costs.

The average unit price for Class A portland cement concrete is currently running at about \$58 per cubic yard or at a rate of about 4 percent below that of the first quarter of 1957. Bar reinforcing steel costs continue at a high average level of \$0.127 per pound. The unit price for structural steel (plate girder) fell off sharply from the average price of \$0.234 per pound of the first quarter of 1957 to an average price per pound of \$0.176 in the fourth quarter of 1957, or a reduction of 25 percent. The reduction is counterbalanced by the increase in the cost of plate girder steel from an average price of \$0.176 per pound in the third quarter of 1956 to the peak price of \$0.234 in the first quarter of 1957.

The dramatic fluctuations in the price of structural steel is indicative

This article is the sixth of an annual series dealing with California bridge construction costs. The most recent article appeared in the March-April, 1957, issue.

Overall highway construction costs in California are given in the article entitled "Cost Index" on page 37 of this issue. These articles appear regularly in *California Highways and Public Works*.

of the fast-changing demand for this item. Steel plates were in relatively short supply and in heavy demand during 1955, 1956, and the first half of 1957. The coupling of the two factors of short supply and heavy demand gave rise to a price spiral which reached a climax in the first quarter of 1957. In the third quarter of 1957, demand apparently fell off sharply and steel prices receded to a substantially lower level.

Prices received for projects let to bids in January, 1958, suggest that

unit prices will stabilize at somewhat lower levels than those reached in the latter part of 1957.

#### Cost Outlook

The foregoing analysis has taken into consideration the economic trend from the previously depressed period of 1954 to the recessive period which began in the second quarter of 1957 and which shows signs of continuing into the forthcoming year. The recession from the peak first quarter costs of 1957 appears to be mild; it is, however, somewhat clouded by a change in the pattern of allocation of project funds due to the emphasis placed upon the completion of major portions of Highway 40 in time for the 1960 Olympic Games at Squaw Valley.

Prior to the fourth quarter of 1957, the major portion of the total value of all projects was allocated to the relatively low-cost metropolitan and urban areas and only about 10 percent of the project funds were allocated to the relatively high-cost remote loca-

... Continued on page 48



# Mendocino Coast

*F. A. S. Highway Project  
Features Large Cuts*

By J. K. RICHARDSON, Mendocino County Surveyor

A RECENTLY completed federal-aid secondary highway project in Mendocino County offered several interesting sidelights and features never before encountered on F. A. S. projects in this county.

The project was located on the Westport-Leggett Valley Road, F. A. S. Route 504, now State Highway Route 56 and State Sign Route 1, between one mile south of Juan Creek and Hardy Creek, a distance of one

and one-half miles, and is generally referred to as the "Juan Creek Bluffs."

In the fall of 1955 steps were taken by the county to include this project in its federal-aid secondary highway construction program being conducted in co-operation with the United States Bureau of Public Roads and the California Division of Highways.

#### **Aerial Survey Used**

The route traverses the rugged and scenic coastline of Mendocino County and the terrain in this area made it particularly adaptable to aerial surveying, so on December 5, 1955, the board of supervisors entered into a contract with C. O. Greenwood, civil engineer in Sacramento, to prepare aerial maps to a scale of 1" = 50' with a contour interval of five feet for a total cost of \$4,400.

In January, 1956, the first work sheets were ready and on March 26th the last contour map was completed. Since this was Mendocino County's first experience in designing from aerial contour maps, the District I F. A. S. projects engineer worked closely with county personnel whenever requested.

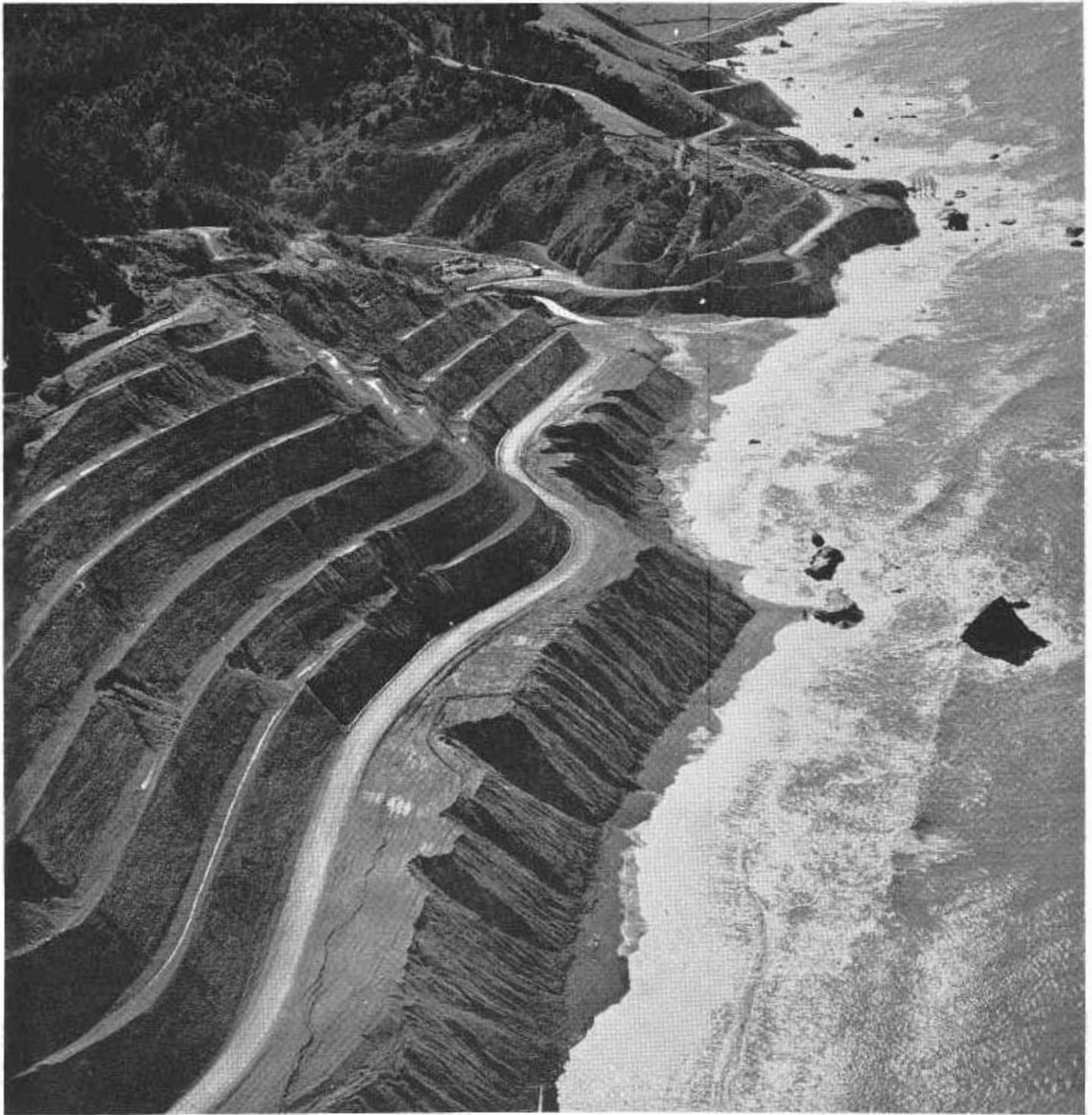
Design work proceeded through the summer and winter of 1956, slowed somewhat by the numerous flood damage projects resulting from the "Big Storm" of 1955-56. In April, 1957, the plans and preliminary report were completed.

#### **Many Bids Received**

On May 31, 1957, the project for grading and draining was advertised by the State Department of Public Works, and on June 26th 14 bids were received. Rockport Redwood Company, the low bidder, was awarded the contract for \$344,394 on July 24, 1957, and work began the following day.



*This view looks north along the reconstructed portion of State Sign Route 1 between Westport and Leggett Valley in Mendocino County. The Juan Creek Bluffs are in the left background.*



*This aerial view of State Sign Route 1 in Mendocino County shows the giant cuts made in the Juan Creek Bluffs as part of the reconstruction of the highway by the county under the Federal-aid Secondary Highway Program*

Although the Legislature had designated this route as a state highway several years ago, it was with the condition that the State would not be required to maintain it until the road had been constructed to state highway standards. During the past few

years the county completed numerous betterment projects using its own forces and equipment, and in the spring of 1957 the State Highway Commission passed a resolution requesting the Department of Public Works, Division of Highways, to

assume the maintenance of this portion of State Highway Route 56, effective July 1, 1957.

Even though it was known that this route would be a state highway before the contract was awarded, the county

... Continued on page 43

# Cost Index

Construction Costs Down  
in First Quarter of 1958

By J. P. MURPHY, Assistant State Highway Engineer  
H. C. McCARTY, Office Engineer  
LLOYD B. REYNOLDS, Assistant Office Engineer

THE CALIFORNIA highway construction cost index resumed the downward course started in the second quarter of 1957 after a 1957 fourth quarter interruption when a sharp rise was experienced. The index now stands at 241.8 (1940 = 100), which is 20.3 index points or 7.7 percent below the fourth quarter of 1957. It is also 35.9 index points or 12.9 percent below the alltime high established in the similar period last year.

The items of roadway excavation and Class "A" concrete (structures) were the principal items in lowering the index during this quarter. The average unit price of roadway excavation for this quarter is \$0.52 per cubic yard, compared to \$0.68 for the fourth quarter of 1957. The average unit price of Class "A" Concrete (structures) is \$55.21 per cubic yard, compared to \$59.76 for the fourth quarter of 1957.

Bidder competition during the quarter had its effect upon lowering the index figure. The average number of bidders per project stands at 9.3, while the previous quarter average stood at 8.8, with 7.0 for the same period last year. The average number of bidders per project exceeded 10 for three of the brackets. In several instances more than 20 bidders submitted proposals for individual projects during this period.

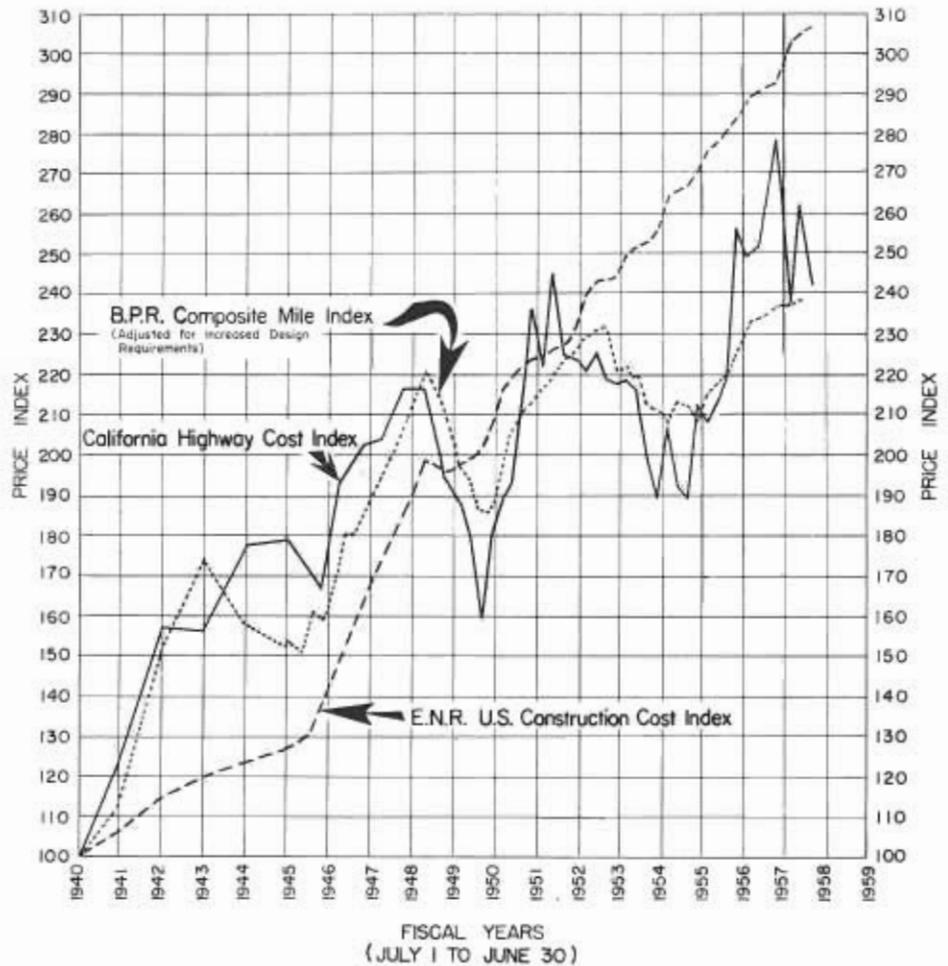
The 88 representative statewide projects for which bids were opened during this quarter and which provide the data for preparation of this quarter's index are distributed as shown in opposite columns.

The total value of the above projects is \$49,776,894.

Four of the seven items used in the preparation of the index show lower average prices than the fourth quarter of 1957, two items were slightly higher and one item was equal in

## PRICE INDEX CONSTRUCTION COSTS

1940 = 100



Range	Number of projects	Value of projects
Under \$50,000	35—40.0%	\$805,315— 1.6%
\$50,000 to \$100,000	15—16.9%	1,076,785— 2.2%
100,000 to 250,000	15—16.9%	2,501,832— 5.0%
250,000 to 500,000	5— 5.7%	1,933,957— 3.9%
500,000 to 1,000,000	7— 8.0%	5,520,220—11.1%
1,000,000 to 2,500,000	5— 5.7%	8,111,404—16.3%
2,500,000 to 5,000,000	3— 3.4%	10,174,644—20.4%
Over \$5,000,000	3— 3.4%	19,652,737—39.5%

value. The four items with lower average prices are roadway excavation; portland cement concrete pavement; class "A" concrete, structures; and bar reinforcing steel. The two items showing an increase are untreated rock base and structural steel. The average price for asphaltic and bituminous mixes remains unchanged. The following table shows average unit prices for the items used in the preparation of the index.

Unit prices received for roadway excavation ranged from \$0.21 to \$0.88 per cubic yard for the major projects during the quarter. A few small projects having little effect upon the index value were bid at prices above \$1 per cubic yard. The several large projects for which excavation prices under \$0.50 per cubic yard were received are situated in areas subject to a minimum of traffic interference due to construction on new alignment. Two large projects situated high in the Sierra Nevada furnished prices in the 80-90-cent range, but their effect upon the quarterly average was offset by two large freeway projects in the Los Angeles area where prices below \$0.50 per cubic yard were received. During the last three quarters the

**NUMBER AND SIZE OF PROJECTS, TOTAL BID VALUES AND AVERAGE NUMBER OF BIDDERS**  
(January 1, 1958, to March 31, 1958)

Project volume	Up to \$50,000	\$50,000 to \$100,000	\$100,000 to \$250,000	\$250,000 to \$500,000	\$500,000 to \$1,000,000	Over \$1,000,000	All projects
<b>Road projects</b>							
No. of projects.....	33	13	13	5	6	3	73
Total value*	\$720,326	\$910,102	\$2,130,634	\$1,933,957	\$4,678,599	\$6,693,587	\$16,967,205
Avg. No. bidders.....	7.5	7.5	11.1	16.2	11.0	10.3	9.1
<b>Structure projects</b>							
No. of projects.....	2	2	2			3	9
Total value*	\$84,989	\$166,683	\$371,198			\$4,684,993	\$5,307,863
Avg. No. bidders.....	9.5	8.0	15.0			8.7	10.1
<b>Combination projects</b>							
No. of projects.....					1	5	6
Total value*					\$941,621	\$26,560,205	\$27,501,826
Avg. No. bidders.....					14.0	10.2	10.8
<b>Summary</b>							
No. of projects.....	35	15	15	5	7	11	88
Total value*	\$805,315	\$1,076,785	\$2,501,832	\$1,933,957	\$5,520,220	\$37,338,785	\$49,776,894
Avg. No. bidders.....	7.6	7.6	11.6	16.2	11.4	9.8	9.3

\* Bid items only.

**Total Average Bidders by Months**

	January	February	March	Average for first quarter
1958.....	11.4	9.2	7.6	9.3
1957.....	7.1	7.3	6.7	7.0

number of projects in progress has gradually decreased while the total contract value has remained at a high

level. There is reason to believe that the winter reduction in going projects has contributed to the lowering of excavation prices because of idle equipment being immediately available for use.

The increase in average price for untreated rock base in this quarter amount to only \$0.07 per ton.

Quantities of asphaltic and bituminous mixes required during this period are about normal and the project distribution is such that little or no change in average price was to be expected.

Bid prices for portland cement concrete pavement ranged between \$12.35 and \$19.36 per cubic yard. It is believed that the low bid prices for some of the projects are the result of construction on new alignment without interfering traffic and also aggregate costs favorable to low unit prices.

The average unit price for Class "A" concrete structures changed from \$59.76 to \$55.21 per cubic yard. This is the lowest quarterly average since the first quarter of 1956 but monthly averages determined during some of the recent months have approached

**CALIFORNIA DIVISION OF HIGHWAYS AVERAGE CONTRACT PRICES**

	Roadway excavation, per cu. yd.	Untreated rock base, per ton	Plant-mixed surfacing, per ton	Asphalt concrete pavement, per ton	Asphaltic and bituminous mixes, per ton	PCC pavement, per cu. yd.	PCC structures, per cu. yd.	Bar reinforcing steel, per lb.	Structural steel, per lb.
1940.....	\$0.22	\$1.54	\$2.19	\$2.97	--	\$7.68	\$18.33	\$0.040	\$0.063
1941.....	0.26	2.31	2.84	3.18	--	7.54	23.31	0.053	0.107
1942.....	0.36	2.81	4.02	4.16	--	9.62	29.48	0.073	0.103
1943.....	0.42	2.26	3.71	4.76	--	11.48	31.76	0.069	0.080
1944.....	0.50	2.45	4.10	4.50	--	10.46	31.99	0.054	0.132
1945.....	0.51	2.42	4.20	4.88	--	10.90	37.20	0.059	0.102
1946.....	0.41	2.45	4.00	4.68	--	9.48	37.38	0.060	0.099
1947.....	0.46	2.42	4.32	5.38	--	12.38	48.44	0.080	0.138
1948.....	0.55	2.43	4.30	5.38	--	13.04	49.86	0.092	0.126
1949.....	0.49	2.67	4.67	4.64	--	12.28	48.67	0.096	0.117
1950.....	0.40	2.28	4.26	3.75	--	11.11	43.45	0.079	0.094
1951.....	0.49	2.62	4.34	5.00	--	12.21	47.22	0.102	0.159
1952.....	0.66	2.99	5.00	4.38	--	13.42	45.08	0.098	0.150
1953.....	0.51	2.14 <sup>1</sup>	5.31	4.58	--	12.74	50.59	0.093	0.133
1954.....	0.45	2.13	4.50	4.86	--	14.41	48.42	0.094	0.124
1955.....	0.39	2.22	4.93	--	--	13.35	45.72	0.095	0.142
1st quarter 1956.....	0.40	2.08	5.40	6.50	--	14.05	52.51	0.105	0.166
2d quarter 1956.....	0.51	2.06	6.27	--	--	14.64	57.13	0.113	0.219
3d quarter 1956.....	0.52	2.27	6.12	--	--	15.57	56.32	0.121	0.178
4th quarter 1956.....	0.52	2.21	-- <sup>2</sup>	-- <sup>2</sup>	-- <sup>2</sup>	14.95	59.63	0.112	0.197
1st quarter 1957.....	0.63	2.10	--	--	5.94	17.28	61.14	0.129	0.235
2d quarter 1957.....	0.63	2.10	--	--	6.18	15.59	58.61	0.119	0.204
3d quarter 1957.....	0.42	2.34	--	--	5.10	14.34	58.68	0.130	0.200
4th quarter 1957.....	0.68	1.78	--	--	5.45	16.88 <sup>3</sup>	59.76	0.129	0.177
1st quarter 1958.....	0.62	1.85	--	--	5.45	14.96	55.21	0.118	0.192

<sup>1</sup> The item of crusher run base was used before 1953.

<sup>2</sup> Asphalt concrete pavement combined with plant-mix surfacing in fourth quarter 1956, and will be identified as asphaltic and bituminous mixes in the future.

<sup>3</sup> Two projects with six-sack mix adjusted to five-sack basis.

... Continued on page 44

# US 101 North

Work Progress Detailed on  
First Unit of Redwood Bypass

By NORMAN G. LARSEN, Project Designer

IN THE September-October, 1957, issue of *California Highways and Public Works*, H. W. Benedict, Resident Engineer on the first unit of the Redwood Freeway on the Redwood Highway at Dyerville in Humboldt County, told the story of the problems on this rather spectacular project relative to the construction of a 480-foot-high cut.

The start of construction on this eventual 47 miles of the Redwood Freeway is the consummation of a number of studies dating back to the early thirties. The new freeway route has been adopted so as to pass through the region of the Redwood Groves with the least possible disturbance to these last remaining extensive groves of the old and stately trees.

Past studies indicated the complex problems in determining routing and design details, even for the provision of a modern two-lane facility in the redwood groves area. This was amplified when the recent routing studies were undertaken on a four-lane freeway basis, and detailed design work started.

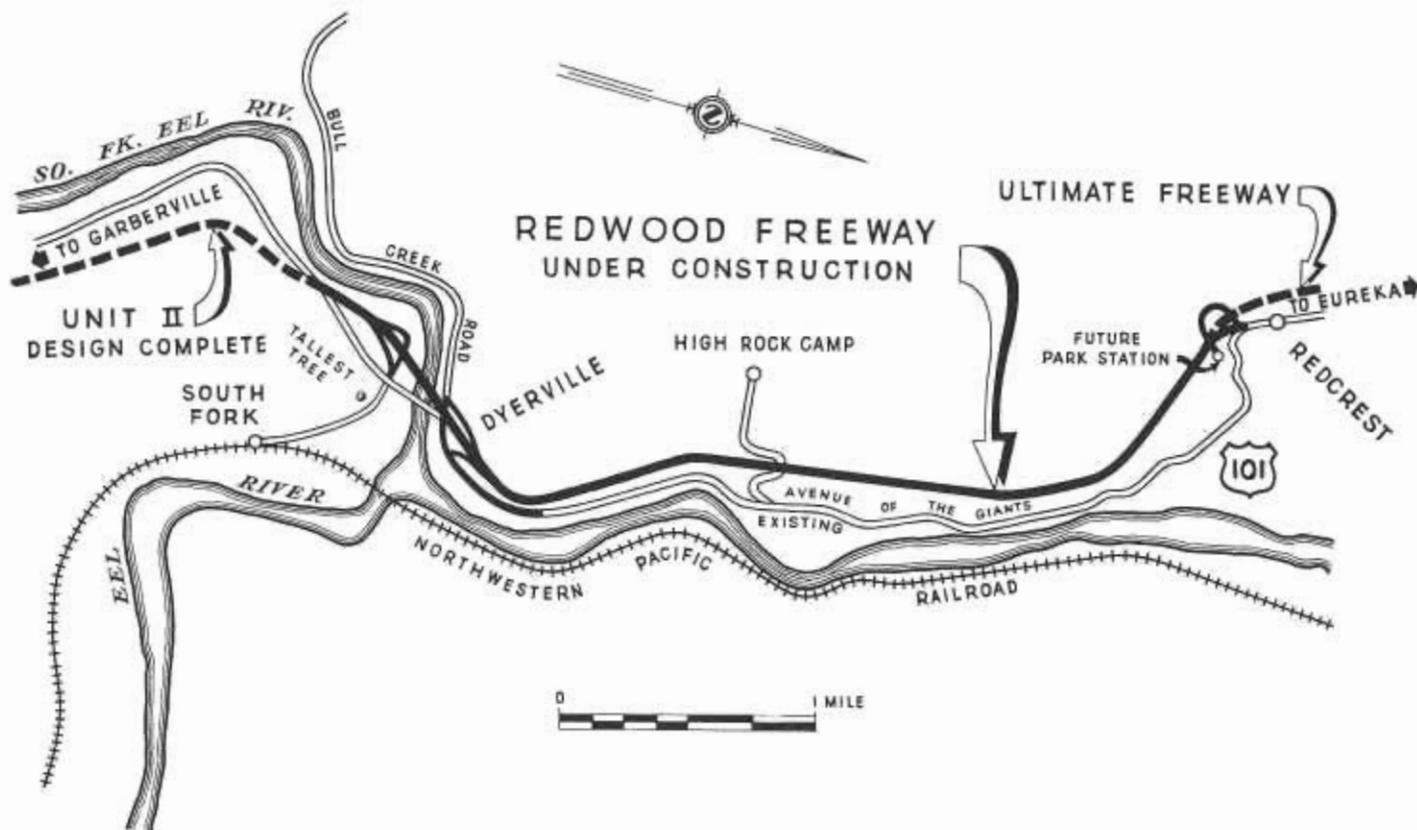
It is thought that the story of the design work will prove to be of interest to the people directly connected with highway construction and all who have traveled or will travel the Redwood Highway.

#### Follows Eel River

A project report providing for full freeway construction of US 101, the Redwood Highway, between the

Mendocino county line and Jordan Creek, about four miles south of Scotia, in Humboldt County, was approved in January of 1956. This area includes approximately 50 miles of highway of varying degree of obsolescence as US 101 follows the meandering South Fork of the Eel River through some rugged mountain country and peaceful redwood groves.

This section of US 101 has undergone limited improvement since initial construction in the 1920's; largely because of the restricting influence of the redwood groves. It was necessary to chop away portions of some redwoods at the edges of the traveled way to provide even 18 feet of roadway during initial construction. Limited funds available for construction



The first unit of the Redwood Freeway is now under construction between one mile south of Dyerville and the Englewood Park Station. The highest cut in the history of California road building is located at the southern end of the project where the new route crosses existing US 101.



*This existing bridge spanning the South Fork of the Eel River at Dyerville will become part of a future interchange. The proposed new structure is rising from the gravel bar right of the limits of this picture to cross the existing road near the left extremity of this picture. US 101 disappears into the Redwoods at the site of the Founder's Tree, tallest tree in the world. The tree cannot be detected because its neighbors are only a few feet short of the record 364 feet.*

have prevented serious consideration of any major relocation projects, although, as previously stated, studies have been undertaken at various times in years past.

Immediately upon approval of the project report, the first construction unit was selected. The portion between one mile south of Dyerville and Englewood was chosen because it includes some of the least desirable combinations of alignment and grade on US 101, and bypasses some of the prime redwood groves of the world. Both the "Avenue of the Giants" and Founder's Grove, which contain the world's tallest tree, are included within the 4.4 miles of this project.

The route, as adopted by the Highway Commission on March 21, 1956, was designed to avoid the flatter terrain, the location of the redwood groves. This forced the new route to utilize the higher, less stable, partially logged-over country. A ground survey was initiated immediately, as it was recognized that the ground cover would limit the use of aerial photography in achieving the desired results

in the time permitted, if a contract was to be let within a year.

Eight days after the route was approved, the entire design chain of command met with representatives of the Division of Beaches and Parks and Headquarters Design Section from Sacramento to review the preliminary survey line on the ground.

#### **Key to Fast Design**

This meeting proved to be the key to successful completion of the surveying, design, and advertising stages within one year. The first few hundred feet of preliminary line covered by the review party presented a pretty dark outlook for all concerned. The line was located on steep sidehill country where even a 1½:1 fill slope would wipe out a beautiful stand of redwood. A section designed all in cut or cribbed on one side would indeed be expensive. The party scattered and literally "took to the hills" with a "there must be a way attitude." A little pass that was completely concealed by redwoods was discovered. It afforded access to a higher, flatter, partially logged-over route. When the

Beaches and Parks' representatives were assured that the line would be relocated, a co-operative atmosphere was established that prevailed throughout the design period.

This co-operation was essential, since the Division of Beaches and Parks has responsible charge of the state park lands traversed, and will develop existing US 101 as a park road for visitors to the groves.

#### **Advance Site Maps**

On May 11, 1956, an advance site map for the crossing of the south fork of the Eel River at Dyerville was submitted to the Bridge Department. The district specified only an approximate line and grade, and requested the Bridge Department to submit its desired line and grade with the preliminary report. Since long spans would obviously prove most economical, only tangent alignment free of vertical curves and super transitions was considered.

The suggested bridge line forced an "off" ramp into an unstable mountain, with prospects of creating a 700-foot-high sliver cut to obtain a suitable

slope. Two retaining walls with a maximum height of 30 feet proved to be more economical than forcing the new four-lane structure to cross over the existing two-lane span. The existing span had to be retained to carry park traffic and to function as an integral part of a split diamond interchange serving communities of South Fork and Bull Creek and extensive redwood groves in the State Park System.

#### Big Cut Required

With the Bridge Department working on the project's major structure, district attention was focused about one-half mile southerly where existing US 101 was only a 20-foot niche in the side of a mountain reaching

over 500 feet upward from the South Fork of the Eel River on a  $1\frac{1}{3}$ :1 slope. The situation was further complicated because the river channel in this area was constricted to a minimum area and was bordered on the opposite bank by 300-foot redwoods. The project report anticipated a causeway type of structure along the easterly bank, but the disastrous flood of December, 1955, coupled with further analysis of the economics, resulted in the decision to take a 480-foot cut.

With river discharges and velocities, such as were demonstrated in December, 1955, an elaborate and costly drift protection system was indicated as necessary to be included in the design of any structure to protect the

piers from the destructive efforts of the river, debris, and drift logs traveling at 20 m.p.h. All factors considered and a final economic analysis made, the big cut with the slide potential was favored, although these things defy exact analysis.

The cut was designed to provide a four-lane, 60-foot all-paved freeway, and a 30-foot roadbed for park and local traffic. A design slope of 1:1 with 20-foot benches at 60-foot vertical intervals, was agreed upon by all concerned. Headquarters Materials Department brought in the equipment necessary to bore 150-foot vertical exploration holes from the top and horizontal holes of the same depth from halfway down the face. An investigation of this type was considered



The South Fork of the Eel River shows none of the fury it unleashed in December, 1955, when it rose from elevation 110 feet to about 168 feet, overtopping existing US 101 in the right-hand portion of this picture. The projected cut failed to "catch" short of the top at elevation 650 feet.



Equipment at work on the Big Cut. Steepness of the slope made it necessary to draw equipment to the top by the use of steel cable and winches.

necessary to determine the bedding planes and slide potential of the proposed cut. Although the 1,400,000 cubic yards of excavation involved may not be a record, it is understood that the height of 480 feet is a record for California highway construction.

#### **Cut Material Used**

Once the decision to take the cut was made, the problem of what to do with 1,400,000 cubic yards of material was solved by using half to construct a fill with grade line above the high water of the '55 flood along the east bank of the South Fork channel northerly of the "Big Cut." Here the channel is wide enough to permit this type of construction and still leave sufficient waterway for the maximum anticipated discharge. The remainder

was designed to be hauled across the South Fork to be used as fill for the freeway proper, two ramps, and the park road, which are adjacent to the westerly bank of the formidable Eel River. Needless to say, considerable bank protection was involved in this "man versus rivers" phase of the project. Combinations of heavy stone rip-rap, grouted rock, slope paving, and timber pile jetties were designed to protect new fills and turn back the rivers at points of impingement.

#### **Remainder Is Routine**

When the problems of the South Fork-Main Eel River confluence area were solved to the mutual satisfaction of Highways and Parks representatives, the rest of the job settled down to concentrated effort on the part of

the Materials Department to complete its report. A design crew worked as much as 12 hours a day completing the 1" = 50' contour maps and preparing sufficient projections to allow for all of the anticipated difficulties the materials report might point out. In spots that were recognized as "trouble" on numerous field expeditions, as many as three lines were carried through the calculation stage and held ready for use.

When the materials report was submitted on October 8th, it indicated that what the "oldtimers" say is probably true: "Where you find the redwoods, you find water, lots of it." The proposed 140-foot centerline fill near the center of the project was approved without a hitch, but the

... Continued on page 47

## Letter Explains Britain's Highway Program



Traffic on the Great North Road through Stamford

### BRITISH ROAD FEDERATION LIMITED

26 Manchester Square, London W1

Editor, *California Highways and  
Public Works*

SIR: In your excellent publication, which you very kindly send us, I was intrigued to see the illustration on page 61 in the current issue of the "Great" North Road where it passes through Stamford in Lincolnshire. The situation depicted is as it is today except that the street stalls are only there on market days, not that it could make the position much worse if they were there every day!

In view of your interest I thought you might like to have the enclosed photograph [reproduced herewith—*Ed.*] of Stamford to add to your collection. This is the town which has a notice on the highway when you approach from either direction which reads "This Is Stamford—Stay Awhile Amidst Its Ancient Charm." It is somewhat superfluous as you frequently have no choice!

However, I would not like you and your readers to form the impression that nothing is being done to provide proper highways.

The government has a road programme under which road schemes which will cost some \$1.2 billion (£430 million) will be authorized by 1962. Included in the projects will be about 415 miles of freeways.

Further, there are a number of major cross river schemes including a suspension bridge with a span of 3,300 feet across the Firth of Forth, tunnels under the Rivers Thames, Clyde and Tyne. In addition to these works a great number of others are to be carried out throughout the whole country in the form of bypasses, removal of bottlenecks, grade separations and improvement generally.

I would like you to know that I look forward to receiving your publication. I make a practice of showing the breathtaking, to me, illustrations of your road schemes whenever an appropriate occasion arises. What impresses me is the objective way in which you tackle your problems and the results which follow from this approach. I can only say I am green with envy.

Yours sincerely,

M. FRANCIS

### MENDOCINO COAST

*Continued from page 36 . . .*

agreed that it would perform the construction engineering under state supervision.

#### Traffic Problems

The big problem facing the contractor was maintaining traffic through that portion of the job between Juan and Hardy Creeks, where within a distance of 3,000 feet it was necessary to excavate 700,000 cubic yards of earth and rock or about 79 percent of the project total. The depth of the cuts in this area ranged up to 326 feet with six benches running a length of approximately 1,000 feet. The contractor solved this problem by reconstructing the original county road over the top of the bluff area, into an acceptable detour.

With the traffic problem thus solved, the contractor put eight huge tractors on the benched area and soon had this difficult section down to grade.

No detour was available for the remainder of the project and the contractor was required to maintain a published schedule of openings for the convenience of the traveling public.

#### Rapid Completion

The contract was completed in 77 working days (60 percent of the allotted time) and accepted by the Director of Public Works on November 27, 1957.

Of the \$395,262.91 total payment to the contractor, \$347,310.60 was for 890,540 yards of roadway excavation at \$0.39 per yard. This final pay quantity was based on cross sections taken by county personnel while slope-staking the project prior to the start of work.

Contractor's personnel on the project were Jack Douglass, General Superintendent, Construction Division, Rockport Redwood Company; Frank Gibbs, Project Superintendent; assisted by Ray Wallace and Dick Gunningham, Grading Foremen.

The county was represented by W. B. Severance, Road Commissioner; J. K. Richardson, County Surveyor, and D. M. Yttreness, Resident Engineer, working in close co-operation with Sam Helwer, District Engineer, and B. D. Van Zandt, District F. A. S. Engineer. Close co-operation between all personnel involved allowed the job to progress smoothly to a satisfactory completion.

Not only has this been Mendocino County's first job designed from aerial photography, it is also its largest F. A. S. project to date. Since the inception of the program following the end of World War II, Mendocino County has completed over \$2,000,000 worth of federal-aid secondary projects, and preliminary work is under way on two more estimated to cost in the vicinity of \$700,000.

### NEW BRIDGE RECORD

The record for a single day's traffic on the San Francisco-Oakland Bay Bridge now is 113,433.

The new traffic total was reached on Friday, May 2d, exceeding the previous high by nearly 1,000 vehicles. The old record was 112,575, set on the day after Thanksgiving last year.

No difficulty in handling the record traffic load was reported to the State Department of Public Works.

## A. A. Lernhart Ends Long State Service

Albert A. Lernhart, veteran Bridge Department engineer, retired on April 30, 1958, after almost 35 years state service. He was one of the few employees remaining of the 24 in the "expanded Bridge Department of 1924.



ALBERT A. LERNHART

Lernhart was born in Virginia City, Nevada, in 1897, raised in Napa, California, studied civil engineering at Stanford University and served in the U. S. Navy during World War I. After

release from the service he was a bridge design draftsman and a highway construction inspector in the Napa County Road Department for over three years. Next there followed employment with several private firms and the U. S. Bureau of Public Roads as estimator and surveyor. He went to work for District III of the California Division of Highways as a draftsman on October 16, 1923.

Lernhart transferred to the Bridge Department in Sacramento on March 4, 1924, when the Bridge Department was authorized to supervise construction as well as to design state highway bridges. This accounted for the "big" expansion to a total of 24 employees.

Lernhart worked alternately as a bridge designer and resident engineer on bridge construction projects in Northern California. He was one of the original bridge resident engineers assigned to construction projects. The Van Duzen River concrete arch bridge on the Redwood Highway and the Feather River steel arch span at Pulga were two of the major structures built under his supervision.

He has been with the Bridge Maintenance Section as an associate bridge engineer since that unit was formed in 1934.

Lernhart has maintained his home in Napa and will retire there with his wife where he will now be able to devote more time to his ranch. He is an ardent trout fisherman and deer hunter.

## COST INDEX

Continued from page 38 . . .

the current figure. Several large projects on new alignment free from traffic interference affected the lowered cost of this item. It is possible that lower aggregate costs have contributed to the reduction in average prices. The replacement of timber falsework by tubular steel, together with construction of forms permitting repeated use, is contributing to the trend toward lower structure concrete prices.

The decrease of \$0.011 per pound for bar reinforcing steel in this quarter is the direct result of one project requiring an extremely large quantity of reinforcement at a bid price of \$0.106 per pound. Otherwise an increase in average price would have occurred in this period.

The upward change of \$0.015 per pound in the average price for structural steel during this quarter results from requirements being to a great extent confined to isolated regions.

The California Highway Construction Cost Index may continue its downward trend into the next quarter but increased seasonal construction activity and the basic controls of labor and material costs make it doubtful that the trend would continue throughout the second quarter. On the contrary a moderate increase in the cost index would be anticipated.

The California Highway Construction Cost Index, the Engineering News-Record Construction Cost Index, and the United States Bureau of Public Roads Composite Mile Index, all reduced to the base 1940 = 100, are shown on the accompanying graph. The latter two indexes are based on nationwide construction costs.

The Engineering News-Record Cost Index, which now stands at 307.4, again shows a rise over the fourth quarter of 1957. It is up 2.6 index points or 0.9 percent from the fourth quarter.

The Bureau of Public Roads Composite Mile Index for the fourth quarter of 1957 at the level of 238.3, which is the latest available, was up 1.0 index point or 0.42 percent over the third quarter of 1957.

## THE CALIFORNIA HIGHWAY CONSTRUCTION COST INDEX

Year	Cost Index
1940	100.0
1941	125.0
1942	157.5
1943	156.4
1944	177.8
1945	179.5
1946	179.7
1947	203.3
1948	216.6
1949	190.7
1950	181.2
(1st quarter 1950—160.6)	
1951	225.0
(4th quarter 1951—245.4)	
1952	225.9
1953	215.2
1954	193.5
(2d quarter 1954—189.0)	
1955 (1st quarter)	189.3
1955 (2d quarter)	212.4
1955 (3d quarter)	208.6
1955 (4th quarter)	212.6
1956 (1st quarter)	219.5
1956 (2d quarter)	255.9
1956 (3d quarter)	249.1
1956 (4th quarter)	252.1
1957 (1st quarter)	277.7
1957 (2d quarter)	266.9
1957 (3d quarter)	237.5
1957 (4th quarter)	262.1
1958 (1st quarter)	241.8

### OUR ERROR; WE'RE SORRY

BEVERLY HILLS, CALIFORNIA

*Editor, California Highways and Public Works*

SIR: We would like to congratulate you upon the fine color photograph on the back cover of your January-February, 1958, edition. The fine warm colors and sharpness of the reproduction certainly capture the feeling of the high California desert.

However, we would like to remark that the description is slightly in error. The photo was taken in the heart of Apple Valley, 15 miles distant from the Lucerne Valley.

As representatives of Apple Valley we would appreciate anything you could do to clarify this inaccurate caption.

Sincerely,

SHERMAN MULLE

## P. T. Poage Concludes Long Career With State

P. T. Poage, whose third of a century as Assistant State Architect saw state building construction under his charge mount to a total of \$1,000,000,000, will retire this summer.

His decision to retire effective August 1st was announced today by C. M. Gilliss, State Director of Public Works.



P. T. POAGE

Poage has worked in the Division of Architecture of the State Department of Public Works for 36 years. After his first four years in architectural designing positions, he became Assistant State Architect in charge of design and planning, a title he has retained since 1926.

Gilliss said that Poage "during his years supervising California's building program, developed better and less expensive ways of building the State's different correctional and mental institutions, office facilities, colleges, and fairs, as well as lesser works."

Poage was also credited by Gilliss with "a big share in establishing the techniques California now uses in determining the scope of building projects, in programming space requirements, and in controlling costs of planning and building."

Projects which make up the billion-dollar total Poage has supervised have ranged from building a bleacher for an athletic field to developing a \$20,000,000 new plant for a state institution.

Poage was born in Bolivar, Missouri, January 28, 1896, and came to California in 1907. He received his bachelor of arts degree in architecture at the University of California at Berkeley in 1918.

After a short period in the Army, he did architectural work in Oakland, San Francisco, and Hawaii before joining the State's Division of Architecture.

Poage was married to Marguerite Bennett in Berkeley in 1923. They have a daughter, Mrs. Ellen Doermer

## TWENTY-FIVE-YEAR AWARDS

Employees who received twenty-five-year awards since those listed in the November-December, 1957, issue of California Highways and Public Works.

### District I

Mills, Odell

### District II

Cardoza, Wallace P.

Delano, Edward R.

Gould, Cyril B.

Huck, Ray

### District III

Davis, Elbert B.

Haskell, Arthur S.

### District IV

Cowgill, Paul

Dale, Roy H.

Evans, Sylvester

Freitas, Reuben E.

Hartley, Dave

MacKenzie, Hugh F.

Pimentel, George

Russell, Wilfred W.

Sinclair, Joseph P.

### District V

Perdew, Harlan

Permasse, Jean M.

### District VI

Stewart, Joseph M.

Stewart, Walter P.

### District VII

Beebe, John Edward, Sr.

Hileman, Joe B.

Kleinhen, Russell

Lander, Guy A.

May, Howard D.

Nauslar, Jack L.

Oberg, Donald

Robinson, Van D.

Royal, Harry

### District IX

Compton, W. Earl

Fischer, Merle E.

Goforth, P. A.

McGee, James W.

### District X

Atherstone, Harold E.

Barrett, Clifford

Fairbanks, Earl L.

Greenwood, Clinton D.

Piccolo, Ernest J.

Sola, James T.

Stewart, Donald M., Jr.

Treganza, Gage

### District XI

Elder, Dick

Parker, James N.

Portis, Laurin

### Bridge Department

Kay, Alton F.

Woodridge, C. J.

### Headquarters Shop

Cardona, Thomas S.

Peck, Emory Earl

Todd, Clarence T.

### Shop 3

Clifton, Eugene R.

### Shop 7

Tracy, Charles W.

of Sacramento, and a son, Bennett Poage, who is associated with a Sacramento paving and grading firm.

After retirement, Poage plans to move his home from Sacramento to an oceanside area near Fort Bragg. He plans then to add geology and oceanography to his hobby interests, which now include old clocks, furniture, branding irons, early churches, books, and people.

Poage's fellow employees will honor him at a farewell dinner June 4th in the Empire Room of the Hotel Senator. He will leave his desk June 6th for nearly two months' terminal leave.

No successor to Poage has been named.

Nearly 27 percent of United States drivers involved in 1957 traffic fatalities were under 25 years of age.

# Federal Aid

*Moneys From New 1958 Act  
Put to Work Without Delay*

SIXTEEN highway projects estimated to cost a total of more than \$20,000,000, all of them scheduled for an early start and for completion within 18 months, have been added to the 1958-59 State Highway Budget by the California Highway Commission at its April meeting.

Financing of the new jobs came chiefly from the additional money provided in the recently enacted Federal Highway Act of 1958 and partly from savings on recent projects where contractors' bids ran below budget estimates, according to Director of Public Works C. M. Gilliss, chairman of the commission.

The new federal law included additional 1958-59 apportionments to California of \$11,600,000 for interstate system highways and \$21,900,000 for other federal aid highways. This amounted to an increase of about 10 percent in the State's highway construction budget.

Gilliss said the additional interstate funds would be used for acquisition of additional rights-of-way in preparation for a further augmentation of interstate construction in the 1959-60 Fiscal Year as also provided for in the 1958 federal measure.

The \$21,900,000 earmarked for immediate construction on other federal aid routes included approximately \$4,500,000 for eligible projects on county federal aid secondary roads. The commission combined the remainder of this added federal apportionment with available state funds to add the 16 projects to the 1958-59 budget.

The principal criterion which the newly budgeted projects had to meet was that they be under contract by December 1, 1958, and completed by December 1, 1959. This requirement was contained in the "antirecession" features of the 1958 federal act, which provided special financing arrangements for such projects.

"In other words," Gilliss said, "on these jobs the plans and specifications are ready to go and the right-of-way has been acquired and cleared, so that they can be advertised for bids very soon. We expect all these projects to be under contract this summer. Also, this means that motorists will be using these new sections of highway or other improvements within the next 18 months."

The new projects in the 1958-59 budget and their estimated costs are as follows:

**COLUSA COUNTY**, State Sign Route 20, between five miles west of Williams and U. S. 99W in Williams, grade, surface and structures (widening), 5.9 miles, \$400,000.

**CONTRA COSTA COUNTY**, State Sign Route 24, Orinda Road to Sunnybrook Drive, grade, pave and structures for six-lane freeway, 2.1 miles, \$4,000,000. (Completion of this project will mean continuous full freeway from Orinda to north of Walnut Creek).

**ORANGE COUNTY**, State Sign Route 14 (Riverside Freeway), from 0.4 mile west of Spadra Road to 0.2 mile east of Placentia Avenue, grade, pave, and structures for four-lane freeway, 2.7 miles, \$3,300,000. (This project will connect with previously constructed expressway on the east and current freeway construction on the west.)

**ORANGE COUNTY**, U. S. 91-State Sign Route 18 (Lincoln Avenue), from State Sign Route 39 (Stanton Avenue) to the Santa Ana Freeway, grade, pave and structures for four-lane divided highway, 3.4 miles, \$900,000.

**SACRAMENTO COUNTY**, U. S. 50-99, from 1.8 miles south of the Cosumnes River to two miles south of Elk Grove Road, grade, pave and structures to reconstruct the southbound lanes of a four-lane freeway, 5.6 miles, \$1,100,000.

**SACRAMENTO COUNTY**, State Sign Route 12, from junction of State Sign Route 24 at east end of Rio Vista Bridge to the Mokelumne River, grade and surface for relocation across Andrus Island, 5.5 miles, \$1,000,000.

**SAN BENITO COUNTY**, US 101 and State Sign Route 156, from 0.5 mile south of Little Merrill Road to 0.3 mile south of Anzar Road, grade, surface and structures to provide interchange at San Juan Bautista Intersection plus related work, 2.5 miles, \$425,000.

**SAN BERNARDINO COUNTY**, State Sign Route 71, from Junction of Route 192 (Euclid Avenue) to Merrill Avenue (near Chino), grade, pave and structures for initial two lanes of future four-lane freeway, 5.3 miles, \$1,100,000.

**SAN DIEGO COUNTY**, State Sign Route 94, 0.1 mile west of 56th Street to College Avenue, revise freeway ramps, \$95,000.

**SAN JOAQUIN COUNTY**, US 99, between 0.2 mile south of Mariposa Road and 0.2 mile north of Farmington Road (portions), three interchange structures to convert southerly portion of Stockton Bypass from expressway to full freeway, 0.9 mile, \$1,000,000.

**SAN LUIS OBISPO COUNTY**, State Sign Route 41, two continuous projects extending from two miles east of Estrella River to 0.4 mile west of Lucy Brown Road and from there to Palo Prieto Road, grade and surface for initial two lanes of future four-lane expressway, 11.2 miles, \$1,850,000.

**SAN LUIS OBISPO COUNTY**, US 466, from Junction of State Sign Route 41 to Kern county line, grade and surface for initial two lanes of future four-lane expressway, six miles, \$1,100,000.

**SANTA BARBARA COUNTY**, US 101, from Ortega Hill to Miramar Avenue in Montecito and from Park Place to Salsipuedes Overhead in Santa Barbara, grade, pave and structures to convert four-lane highway and four-lane expressway sections to full freeway, 2.5 miles, \$1,340,000.

**SANTA BARBARA COUNTY**, State Sign Route 1, from 1.8 miles north of Yrias Creek to Jalama Road (south of Lompoc), grade and surface (realignment), 2.9 miles, \$1,080,000.

**SHASTA COUNTY**, US 299, between 0.2 mile east of Hillcrest and three miles west of Burney (portions), grade and surface for initial two lanes of future four-lane expressway (completes realignment over Hatchet Mountain), 5.3 miles, \$1,450,000.

The Division of Highways reports that the regular traffic counts for April, 1958, show a decrease of 5.9 percent under April, 1957, and an increase of 3.4 percent over March, 1958. Comparing April, 1958, with April, 1957, passenger vehicles show a decrease of 6.9 percent and freight vehicles show a decrease of 0.6 percent. Freight vehicles represented 17.3 percent of the total weekday traffic.

## Vaughn O. Sheff

DEATH TOOK Vaughn O. Sheff, highway superintendent, March 31, 1958, as he and a state highway maintenance crew worked around the clock to clear a slide at Santa Monica Canyon and US 101 - Alternate. Sheff was caught in one of the landslides.

A scholarship in memory of Sheff has been established at Los Angeles State College by Highway Chapter 101 of the California State Employees' Association. The Sheff Memorial Scholarship will be awarded to students in engineering and business administration who meet requirements established by Chapter 101 and the scholarship and loan committee of Los Angeles State College.

Sheff was born in Cloquet, Minnesota, August 18, 1900, and educated in the Cloquet public schools.

He served with the 1st U. S. Engineers during World War I with the Army of Occupation in Germany.

Sheff went to the State Division of Highways February 1, 1929, from the Los Angeles County Flood Control District.

His experience with the Maintenance Department started in February, 1948, when he was assigned as assistant to E. A. Penrose, superintendent of the Venice maintenance territory. Sheff worked as his assistant until December, 1952, when he transferred to District I in Eureka as maintenance superintendent. He remained in District I for approximately five months, at which time he returned to District VII to succeed Penrose. He was considered one of the outstanding superintendents in District VII, the only one holding a California license as civil engineer.

He is survived by his wife, Ruby, who lives at 3655 Colonial Street, Venice; a stepdaughter, Mrs. Opal Pink; two grandsons, Robert and Gary; and five sisters and four brothers.

Passenger cars were involved in over 78 percent of all United States traffic fatalities in 1957, and in 86 percent of traffic injuries.

## Pioneer State Highway Economist Retires

KENNETH A. MacLACHLAN, highway economist and a pioneer in the adaptation of tabulating and computing machines for highway engineering purposes, retired on May 1, 1958, after 28 years of service with the Division of Highways.



KENNETH A. MacLACHLAN

MacLachlan was born in New Haven, Connecticut, and obtained his education in England and at the University of California, graduating with a B.S. degree in 1921. He served with the Navy in World War I and then with the U. S. Bureau of Public Roads.

Early in his state career MacLachlan was one of the group who formulated a definite highway signing policy as the first step toward California's present well-defined system of warning, regulatory, and directional signs.

Soon afterward he was assigned supervision over the California Highway Transportation Survey of 1934. He was instrumental in initiating the use of punched card equipment for tabulating and analyzing the vast amount of information produced by the survey. The Division of Highways' order for supplying and later processing 6,000,000 cards was the largest single order of its kind placed up to that time with the leading business machine concern involved.

In 1936 MacLachlan was given responsibility for organizing the California Highway Planning Survey, at that time under the direction of Maintenance Engineer T. H. Dennis. He continued as a member of the planning survey staff, now a part of the Planning Department, until his retirement.

Under his supervision the Division of Highways was the first agency of its kind to use punched card equipment to analyze highway accidents and detect problem locations; to use the co-ordinate system of analysis for traffic data; to depict the results of origin and destination surveys in the

## US 101 NORTH

Continued from page 42 . . .

stabilization work for the project was going to cost in the neighborhood of \$600,000. That is quite a neighborhood, even for a project in District I where plenty of water falls, and most of it collects below ground to plague highway engineers.

### Unusual Project

The rest is history now. Design under the general supervision of Mr. Alan S. Hart, then District Engineer of District I, was completed on schedule and forwarded to Headquarters in early December. When the bids were opened, it was obvious that contractors had a million dollars more respect for the project than anticipated. Coupled with another "unusually tough" job on US 40, the cost index got quite a jolt when a contract was awarded to the Guy F. Atkinson Co. for an estimated final cost of \$6,800,000.

Since then, a man has died hauling material down off the "Big Cut," and one construction season has changed the face of the country considerably. It has been demonstrated that, with a lot of co-operation, there is a way to move mountains, rivers, and some of the redwoods to provide a full freeway through some of the most scenic country in the world, and still preserve the natural beauty of the redwood groves.

Fifty-three thousand Americans were injured in car-bicycle mishaps in 1957.

form of "trip desire line" contours; and to adapt gyroscopic equipment for highway survey purposes by means of a specially equipped vehicle.

MacLachlan is a member of the American Statistical Association, Henry Morris Stephens Lodge of the Masons, and the Institute of Traffic Engineers; and has been a member of the Highway Research Board committees on Origin and Destination Studies and on Speed Studies in Urban Areas.

He and his wife, Florence, will continue to live at their home in Sacramento.

## Freeman C. Witt

Freeman C. Witt, Highway Superintendent for the State Division of Highways in Imperial County for the past 17 years, died March 19 following a serious illness.

Witt, who was born in Poway, California, November 11, 1890, moved to Escondido when he was 15 years old. Subsequent to his graduation from the University of California and while in business as a civil engineer, he was quite active in civic affairs, serving as a member of the city council and as mayor of Escondido.

Witt first became associated with the State Division of Highways in 1935 and had been continuously in the State's employ in Escondido and the Imperial Valley. Witt was a registered engineer as well as a licensed surveyor in the State of California.

Survivors include his widow, Frances; a son and daughter, Eugene and Margaret; a brother, Mark; and six grandchildren.

## CALIFORNIA BRIDGES

*Continued from page 34 . . .*

tions. This pattern was changed in the fourth quarter of 1957, however, when between 20 and 25 percent of the total value of bridge projects was allocated to the high-cost areas of Highway 40. This shift to the high-cost areas raised the normal level of bridge costs by a small but indeterminate amount. A more reasonable estimate of the reduction of costs from the first to the fourth quarter of 1957 is therefore probably closer to 6 percent rather than to the 4 percent given by the indexes.

Bids received in January, 1958, indicate that the recessive trend is continuing into 1958. Bidders per job are running at an average of 10-12 and unit prices for bridge items are generally lower than were those during most periods of the past three years.

The ultimate trend of costs for the coming year, however, is obscured by the uncertainties which exist on the national level. The current trend for business in general is downward and it is reasonable to assume that this

## Toll Authority Orders South Crossing Report

An informational report on all San Francisco Bay Southern Crossing studies to date was ordered by the California Toll Bridge Authority at its April 30th meeting in Sacramento.

The State Department of Public Works will make the report public as soon as it is completed, Public Works Director C. M. Gilliss told the authority, " \* \* \* so that when the authority meets again on this subject we'll have the benefit of advice of an informed citizenry."

The report will form a basis for further studies which the authority is expected to order after late July, when survey funds voted by the special session of the Legislature become available.

Gilliss explained that the informational report will "bring together the essentials of all the studies made on possible crossings south of the present San Francisco-Oakland Bay Bridge, so that the authority may know which direction to go later for further study."

A companion report, giving details of the status of financing of all of the authority's bay bridges, will be made to the authority by the Department of Public Works.

The department also was asked by the authority to comment, in its report, on the request of the San Francisco Bay Area Rapid Transit District that the authority give first consideration to an underwater tube near the Bay Bridge in determining the nature and location of the next crossing to be built.

trend will be maintained during at least the first half of 1958. The actions of Congress during the present session will undoubtedly bear heavily on the degree and duration of the current recession but since some time will be required before legislative enactments take effect, it is likely that the current trend will continue into the third quarter and then return to some as yet unpredictable level. In the interval, however, the State of California may realize a substantial saving in bridge construction costs.

## C. W. W. Abbott

Clinton W. W. Abbott, Associate Bridge Engineer who had served nearly 20 years in the Division of Highways, died on March 17th, in Sacramento.

Abbott began his state service as an engineering aide with Division of Highways in District IX at Bishop in 1937. After a few months in Bishop he moved to the Bay Bridge where he served as chief of party laying out control points for the intricate East Bay structures.

In April, 1938, he was transferred to the Bridge Department in Sacramento where he served as a surveyor in the preliminary surveys. In 1954 he transferred to the Bridge Research Section where he was working at the time of his death.

He was born in Washington, D. C., in 1905, and lived in South Dakota during his early years. Later he moved to Hollywood, California, where he attended high school. He studied civil engineering at Oregon State College.

He began his engineering career as a surveyor with the City of Los Angeles on powerline surveys in Owens Valley. He was active in the Sacramento Camp Fire Girls as a board member and chairman of the camp committee, the Sacramento Photographers Club, Sacramento Junior Museum, and folk dancing clubs for a number of years. He was a member of the American Society of Civil Engineers, American Geophysical Union, American Congress of Surveyors and Mappers, and a registered civil engineer.

He is survived by his wife, Nancy, of Sacramento, two daughters, Virginia Todd and Jo, a brother, John G. Abbott of San Leandro, and a sister, Kay Barnett of Los Angeles.

Weekends are the most dangerous time to be on United States highways. In 1957, more than 55 percent of all fatalities occurred on Fridays, Saturdays, and Sundays.

During 1957, there were 1,300 fewer highway traffic fatalities than in the previous year.

**GOODWIN J. KNIGHT**  
Governor of California

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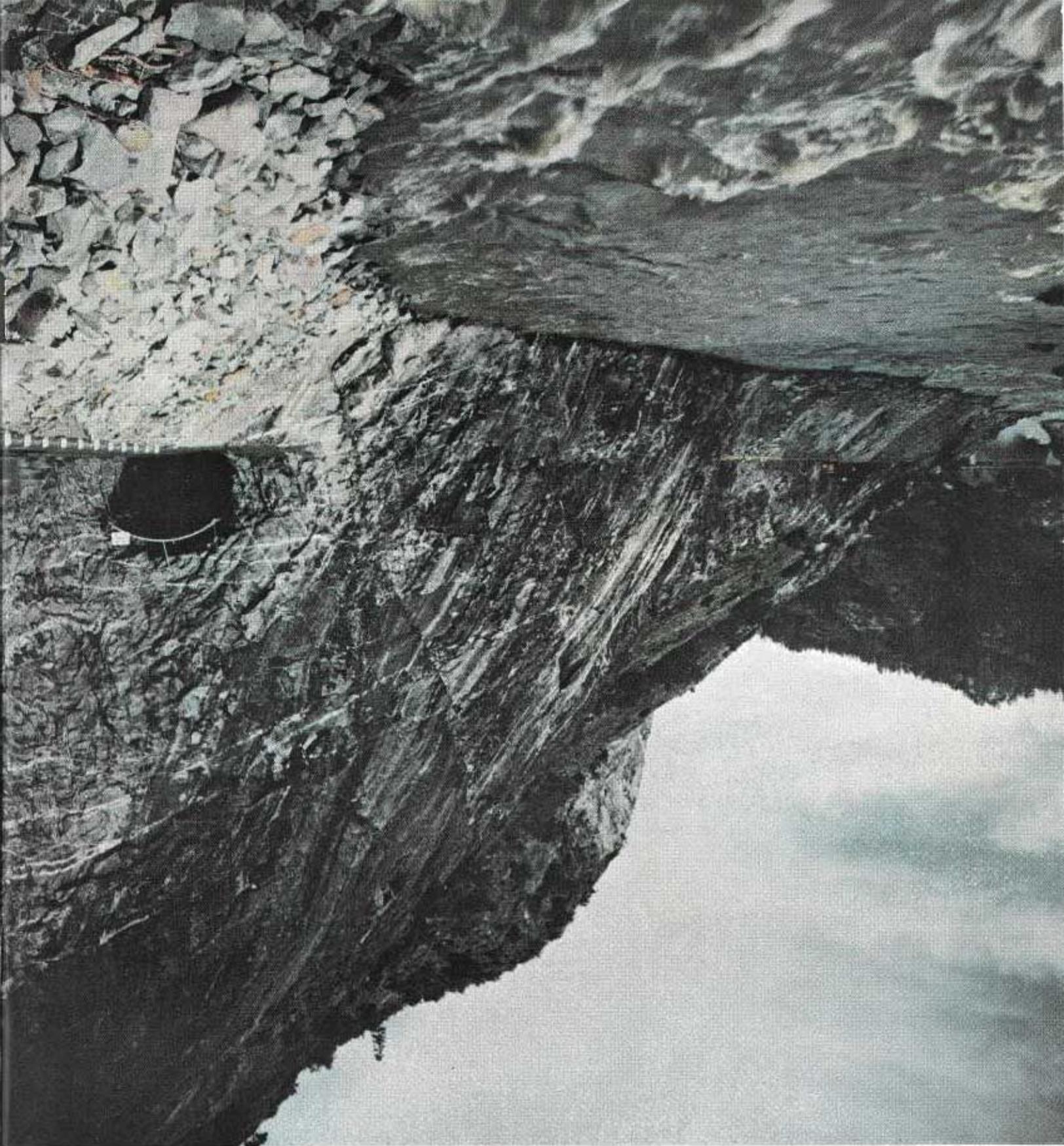
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