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HIGHWAYS AND PUBLIC WORKS

September — October, 1951

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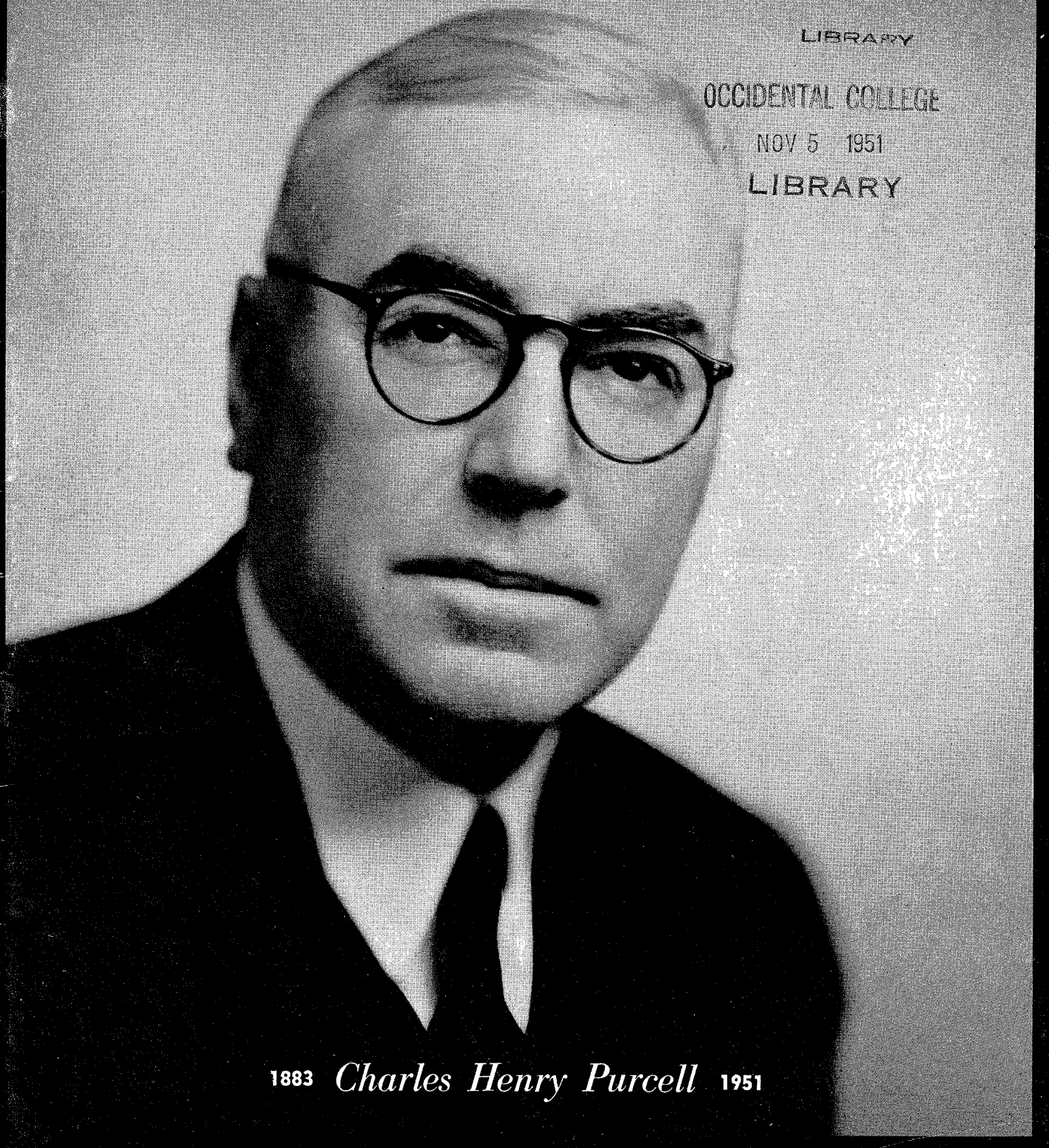

1883 *Charles Henry Purcell* 1951

California Highways and Public Works

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

FRANK B. DURKEE, *Director*
GEORGE T. McCOY, *State Highway Engineer*
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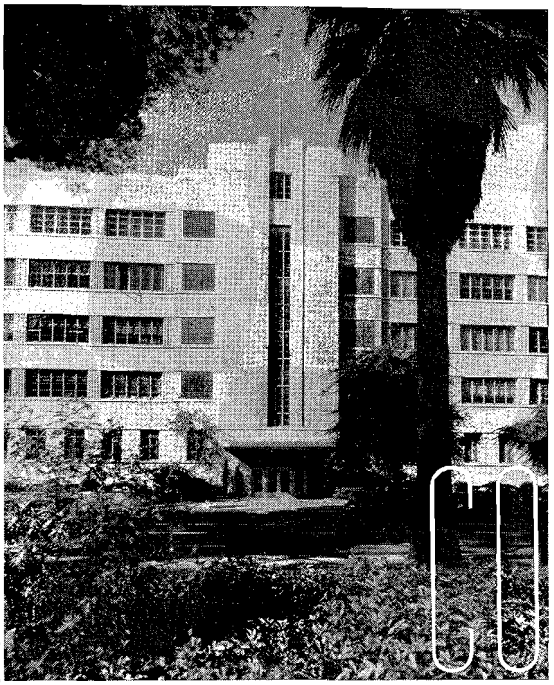


Public Works Building
Twelfth and N Streets
Sacramento

CHARLES HENRY PURCELL

California Highways and Public Works dedicates the cover page of this issue to the revered memory of Charles Henry Purcell. Mr. Purcell, who retired as Director of Public Works on July 31, 1951, died suddenly from a heart attack in his home in Sacramento on September 7th.

Informed of Mr. Purcell's death, Governor Earl Warren epitomized the deep feeling of loss of the people of California in the following tribute:

"He was a great citizen. He devoted his entire life to public service and eventually gave his life to his State. But the great public works he planned will be a lasting monument to his memory."

CONTENTS

Manpower

Division of Highways Personnel Informed of Future Program

By CHAS. E. WAITE, Assistant State Highway Engineer

FOLLOWING World War II California entered into a tremendous program of highway development, unprecedented in state and national history. The program required a large increase in the Division of Highways' engineering organization and associated personnel. With the continuing engineering manpower shortage following World War II and because of the present unsettled world conditions which have caused further attrition of engineers, the division has been hard pressed to meet the planning and construction schedule for state highways.

Believing that highway transportation is the backbone of the nation's defense, the Division of Highways has felt compelled to proceed with correction of its most critical highway deficiencies. In the event that material shortages and other events result in a slow-down of highway construction, the division proposes to revise its program, and will utilize available funds for completion of plans and purchase of rights of way for future projects.

Manpower Situation

To relieve the uncertainty in employees' minds concerning the immediate future highway program and also to inform all employees of the engineer manpower situation, two letters, dated March 28, 1951, and September 25, 1951, which are published herewith for wider dissemination, were addressed to the department heads and district engineers.

It is believed the information in the letters is of interest to all persons concerned with California highway development.

To: Department Heads and
District Engineers

Because of the possibility of some curtailment of construction as a result of the defense program, many questions have arisen concerning our manpower needs and the possibility of a reduction in our personnel.

In order that all of our employees may be fully informed concerning our policy on this important matter, you may inform them that in the event construction work is curtailed or reduced we will proceed to step up our planning and right of way programs to the fullest extent.

Our experience along these lines during the last war clearly indicated the need of all of the available personnel we had or were able to recruit. The advantages of having plans prepared well in advance are recognized by all.

We will continue our recruitment program to be prepared for any contingency. Although there may be a curtailment of construction work, we plan to utilize our entire forces and no layoff of personnel can be considered in the foreseeable future.

G. T. McCOY
State Highway Engineer

To: Department Heads and
District Engineers

Our recent recruiting experiences, coupled with published information concerning the number of engineering graduates who will be available during the next few years, indicate that it will be increasingly difficult to secure as many junior civil engineers as we need. As a result, it will be necessary for all supervisors to make every effort to see that the best possible use is made of all engineering personnel and that as many functions as possible are performed by employees in other classifications.

The last two junior civil engineer examinations, which were given on a nation-wide basis in March and June of this year, resulted in lists of 927 and 373 names. Out of these 1,300 eligibles, a total of 675 were appointed to positions. Of these, 476 were new to the organization and 199 were promoted from lower grades. While the number of new recruits obtained from these examinations was above average, it was still about 250 less than the number for which we have requests.

Employment Records

An analysis of employment records for the first seven months of this year indicates that the turnover rate for junior civil engineers is now between 25 percent and 30 percent per year. While it is expected that the rate for such a beginning professional class will be higher than the 5 percent or less for which industry strives, this figure is high enough to raise the question of whether we as employers are doing everything possible to retain men in this grade.

Current articles on the availability of new engineers (all types) during the next few years emphasize the 1951 report of the Engineering Manpower Commission of the Engineers' Joint Council, which states that the number of engineering graduates is expected to drop from the high of 52,000 in 1950 to between 12,000 and 17,000 in 1954. Nothing much can be done to improve the 1954 figure, nor the 25,000 and 19,000 figures for 1952 and 1953, since these classes already are in college. To make matters worse, if present draft policies continue, out of the 12,000 graduates in 1954, only 6,000 (not just civils—all types!) may be available to fill all of industry's needs.

Discouraging Figures

These figures are very discouraging, particularly when it is realized that the present shortage of new engineers is estimated to be 60,000 and that 30,000 per year are required for normal replacement and growth at the present rate. Aggravating the situation is the fact that the ratio of engineers to production workers is increasing steadily so that the number of new engineers needed each year is increasing more rapidly than total employment.

A national program for alleviating the shortage as soon as possible has been developed by the U. S. Labor Department, in cooperation with the Engineers' Joint Council and other interested groups. This program includes several points, among which are the following: (1) Making maximum use of engineers already employed, (2) making better use of supporting non-engineering personnel, (3) making more exhaustive use of training facilities.

In order to maintain our organization as well as possible it is planned to continue an active recruiting program on a nation-wide basis. Training and rotation of engineering personnel must be given more emphasis in order to reduce the turnover rate. In addition, it will be necessary for all supervisors to be alert at all times to any opportunities for making better use of engineering personnel or substituting other classifications.

CHAS. E. WAITE
Assistant State Highway Engineer

Footpath to Freeway

U. S. 99 in Siskiyou Gets Improvements

By P. F. DUFFY, Assistant Highway Engineer

FROM A FOOTPATH to a freeway, would in a few words tell the story of the Pacific Highway, U. S. 99, through Northern California. More than a hundred years of travel mark this route, on which plans are being completed for 4.92 miles of reconstruction in southern Siskiyou County between Spring Street in the Town of Dunsmuir and Big Canyon.

The trappers of the 1830's blazed the way for what was to become one of the routes of the California-Oregon Trail. The pack trains and ox carts of the pioneer settlers wore deep the ruts that marked the way of this major interstate route, traveled today by a continual stream of passenger cars and trucks. The design standards employed at the time the present highway was constructed are far short of those required for the volume and type of traffic daily using the highway, and the planned reconstruction has long been needed.

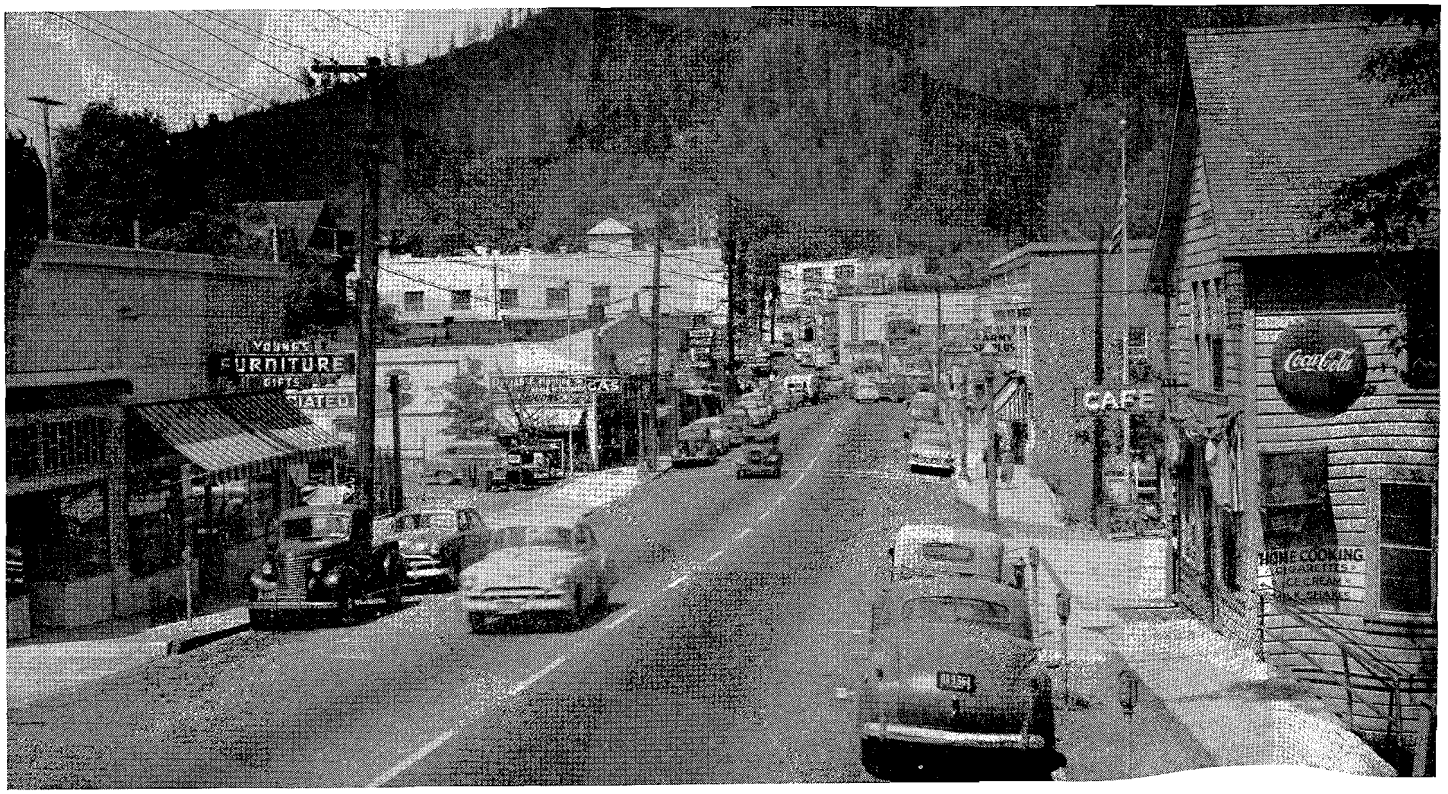
First Road in 1860

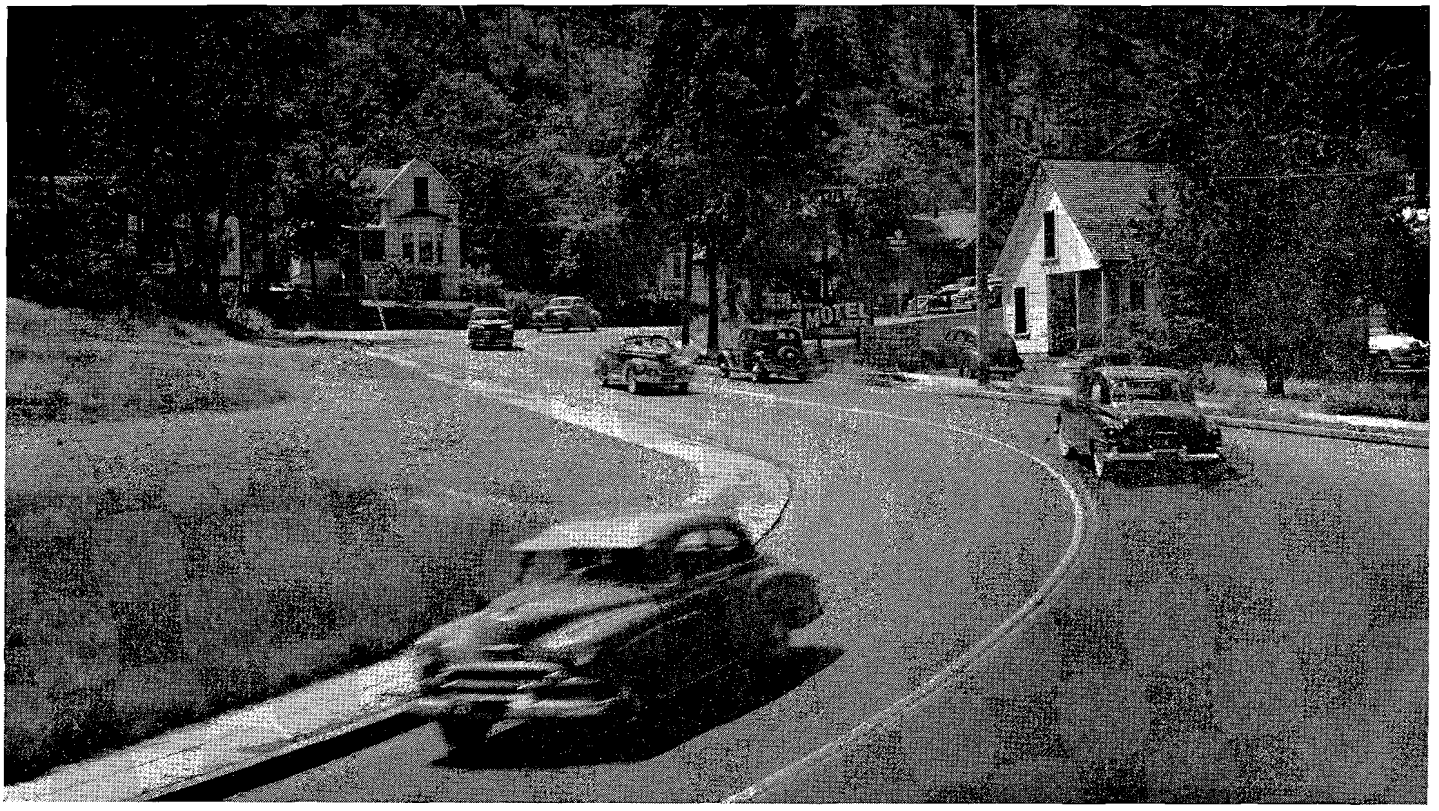
The Pacific Highway leaves Redding at the head of the Sacramento Valley to cross over mighty Shasta Lake near the junction of the Pit and McCloud Rivers and thence ascend the rugged Sacramento River Canyon to Dunsmuir. Beyond Dunsmuir the highway passes through Upper Soda Springs and Shasta Retreat to Shasta Springs, and northward past Big Canyon and along the westerly slope of Mount Shasta, on into Oregon..

The first effort at a road through this area was in 1860 when a stage road was completed from Yreka in northern Siskiyou County to Upper Soda Springs, and from there down the Sacramento River Canyon. With the coming of winter floods, the bridges through the Sacramento Canyon were carried away and it was not until 1870 that stage travel became permanently established through the entire length of the Sacramento Canyon.

Upper Soda Springs, which served as the terminus for the stage line from Yreka, is located on the north bank of the Sacramento River, just a short distance upstream from the present highway bridge at Dunsmuir. A part of the old stage road is still in existence and can be seen crossing underneath the bridge in the background of the accompanying photograph. The old toll bridge crossed the river just a few feet downstream from the present highway crossing.

Improvement of traffic congestion in Dunsmuir slated as future project





Realignment of U. S. 99 will begin one block south of this curve in Dunsmuir

Old Freight Station

Upper Soda Springs gained its name from the springs rising along the river bank, and was once a campground of Hudson's Bay Company trappers. The ancient soda springs with their health-giving waters were a rendezvous for the Indians long before the coming of the first settlers. Here Ross and Mary McCloud first settled in 1855, and the freight station which they built in 1864 remained a popular resort until the early 1920's. The old freight station still stands, and descendants of these early settlers still own and live on the property.

Approximately two miles north of Dunsmuir, midway of the portion of highway to be reconstructed, is Shasta Springs and beautiful Mossbrae Falls. Surrounded by towering pines and cooled by gentle breezes, Shasta Springs Resort was for many years a noted stopping place. The property was purchased by the Saint Germain Foundation in 1950 and has been closed to the public.

A celebrated carbonated water, high in content of iron and magnesia, is bottled and distributed from here. Nearby Mossbrae Falls differ from all others in California, their waters rising amid ferns and moss to cascade down the green mountainside.

Dunsmuir, founded in 1886 with the coming of the railroad, has for many years been a division point for the Southern Pacific Railroad.

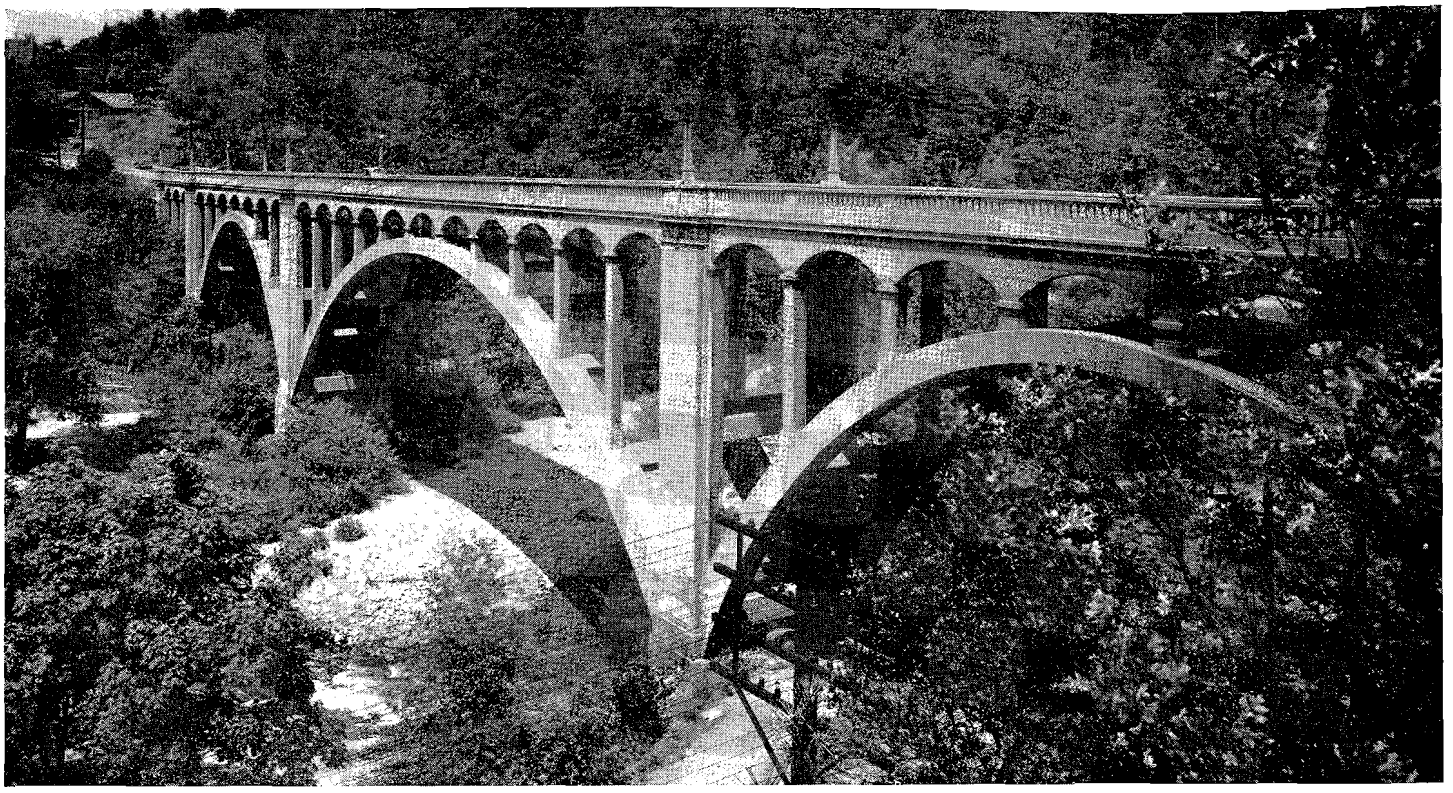
Dunsmuir was named for Alexander Dunsmuir, a wealthy coal baron from British Columbia. Passing through in 1886 when the town was little more than a railroad siding and station house, Dunsmuir said he would give them a fountain if they would call the place Dunsmuir. They did, and the fountain erected in a plot adjoining the railroad station still remains.

The town draws its chief support from railroad employment, as well as being a supply center for hunters and fishermen who throng this region which abounds with fish and game. For many years development was principally on the westerly slope above the river, centered about the railroad station and engine roundhouse.

High Level Bridge

In 1915 the highway improvement and construction of a high level bridge across the Sacramento River opened the way to development of a new area across the river to the north. Development is nearly continuous along the highway for about a mile north of town. The municipal swimming pool and baseball field are located along the highway, as well as a number of motels and tourist resorts and other commercial enterprises. Westerly from the highway, overlooking the river, is a large residential area. Most of the present improvements are in this section.

In 1896 the State Bureau of Highways, created the year previous by act of the Legislature, mapped out a proposed State Highway System of which the main north-south artery was what is now U. S. 99, extending through the length of California from Calexico on the International Boundary Line of Mexico to the Oregon state line north of Yreka. The stage road of 1870 was gradually improved as a county road and remained in use until 1915. In that year the portion of U. S. 99 between Dunsmuir and Weed, a distance of 16.67 miles, was graded on new alignment, and the following year the present bridge across the Sacramento River



Existing portion of old stage road referred to in accompanying article may be seen in background

at Dunsmuir was constructed to replace the old county bridge which crossed the river approximately one-half mile downstream.

Steady Traffic Increase

The highway was maintained as a graveled road until 1922, when 18-foot wide concrete pavement was constructed, the contract being performed by Henry J. Kaiser. This road is in use today, and, except for minor widening, there has been no improvement to bring it up to the standards needed for present traffic demands.

In July of 1914 the report prepared by T. A. Bedford, then district engineer for District II, tells us "traffic consists principally of the summer tourists passing north and south through the country and some light pleasure vehicles between the towns along the line." By 1921 traffic had increased to where it was estimated to be 500 vehicles per day, but still remained principally passenger vehicles, tourists, and local traffic. Even at that late date little did anyone anticipate that traffic through this mountainous region would increase by leaps and bounds, and that the highway built to accommodate the tourists and intercity travelers would be called upon to carry huge trucks loaded with logs and lumber, freight, and produce, the wealth of California's hills and valleys flowing to the market centers. Traffic counts taken in July, 1951, at a point just slightly north of Big Canyon, indicate an average daily traffic of approximately 4,000 vehicles, of which some 16 percent are trucks or buses. This would mean that combined with the flow of passenger cars are trucks and buses spaced at approximately two-minute intervals.

Much Needed Improvement

The need for improvement on U. S. 99 has long been recognized. The need is not confined to this section being designed, but extends from Crespo's at the upper limits of Shasta Lake to the town of Mount Shasta, a distance of some 36 miles. Between Dunsmuir and Big Canyon was determined as being the more critical portion for here the highway combines sharp curves with short intervening tangents and a sustained grade, nearly one-half mile of which is 7 percent.

Hazardous in themselves, these conditions become even worse during the winter months when the highway is subject to ice and snow. The steep grades cause trucks to travel at low speed, and the winding alignment causes long lines of traffic to collect behind the trucks. All too frequently some foolhardy driver, becoming impatient with the delay, swings out to attempt to pass the line of traffic, endangering both himself and others, for the winding road does not permit a clear picture of what onrushing traffic may be just ahead. Trucks descending the grade are warned by signs to shift to low gear, but even so there are repeated cases of trucks going out of control and crashing off the highway.

Dunsmuir Traffic Congested

Within the town of Dunsmuir traffic travels along the main business street, only 40 feet in width with some 16 feet of this width devoted to parking area. One can readily visualize the congestion when through traffic is increased by a heavy local traffic, and further inconvenienced by traffic entering from the many intersecting streets.

... Continued on page 64

Freeway Values

Abutting Properties Show Exceptional Gains

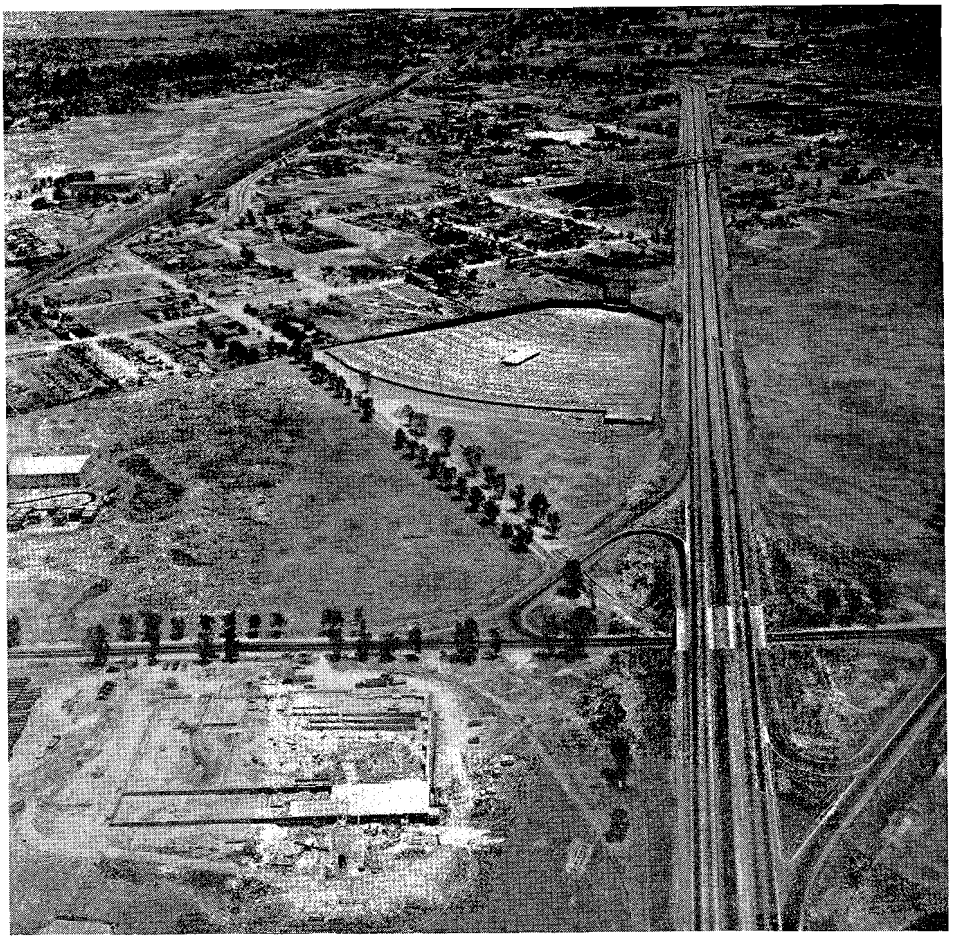
By W. STANLEY YOUNG, Headquarters Right of Way Agent

WHAT ARE the effects of a by-pass on property values?

This question has been answered pretty conclusively in the several studies published in previous issues of this magazine. In these studies we learned of the substantial benefits to both property values and retail businesses by such a segregation of through and local traffic. (See January-February, 1950 issue of *California Highways and Public Works.*)

But what are the effects of the freeway on the properties through which it is built—properties on which severance damages have been frequently demanded in the past?

The nationally known Continental Baking Company's acquisition of the seven-acre site on which to build its new $1,600,000 plant adjacent to the North Sacramento Freeway is a pretty good indicator of the answer to this question. This property has no access to the highway, but is served directly only by an intersecting county road connected to the freeway by means of a traffic interchange structure.



Aerial photograph looking northeasterly along the North Sacramento Freeway, shows the $1,600,000 Continental Baking Plant under construction in the left foreground

Striking Example

This slightly more than seven acres, as a part of larger holdings, was worth only about $600 per acre as late as 1947. About two years after the freeway opened, slightly less than 42 acres, including the baking plant site, was grabbed by a very astute local land developer for approximately $1,100 per acre.

Only one year later seven acres of the larger property were purchased for the baking company by one of the Nation's leading property appraisal and acquisition agencies, specializing in large commercial and industrial locations. The price paid for this property, considered in competition with all other available industrial sites in the Sacramento area, of which there are many, was approximately $7,100 per acre.

Value Now $10,000 Per Acre

The question may be raised as to whether or not this is an isolated example not characteristic of the rise in values of properties adjacent to the freeway. Indicative of the answer is the fact that property just north of the Continental Baking Plant site, visible in the left center of the accompanying aerial photograph, is presently for sale at the rate of $10,000 per acre. It may be seen in the photograph that this property does not adjoin the freeway but yet has the valuable advantages of the excellent transportation facilities and advertising value of visibility to more than 40,000 motorists per day, as well as the rail facilities which existed in the years prior to the freeway when the land was only worth a fraction of its present value.

Unquestionably the freeway was the principal reason for the rapid rise in property values in this area. Only in areas served by the freeway have similar general value increases been registered in the Sacramento area.

Advertising Value

Some indication of the advertising value of visibility from the freeway

. . . Continued on page 58

Siskiyou Job

New Section of U. S. 99 Between Spring Hill and Weed Opened

By H. CLYDE AMESBURY, District Construction Engineer

CELEBRATING completion of a project on U. S. 99 between Spring Hill and Weed in Siskiyou County, brief dedicatory ceremonies opening the new stretch of highway to traffic were held on September 17th at a scenic spot near Black Butte.

The new highway, which is eight miles in length, and for which surveys were started 10 years ago, fulfills a critical need and culminates a development proposed by citizens of Siskiyou County and state highway officials. The cost of the project was $1,114,150.

Senator Randolph Collier, heading a group of citizens, community leaders and industry representatives, formally opened the project with the remark, "In the name of the taxpaying public of the great State of California, we add this new link to the State Highway System."

Started in 1944

Preparation of plans for the work was undertaken in 1944 as a proposed postwar project but funds to construct did not become available until augmented revenues were obtained following passage of the Collier-Burns Highway Act in 1947.

In 1949 a contract for grading the 4.4 midsection miles and constructing the Black Butte Overhead was awarded to Harms Bros. and F. Fredenburg and was completed that year at a cost of $383,489.

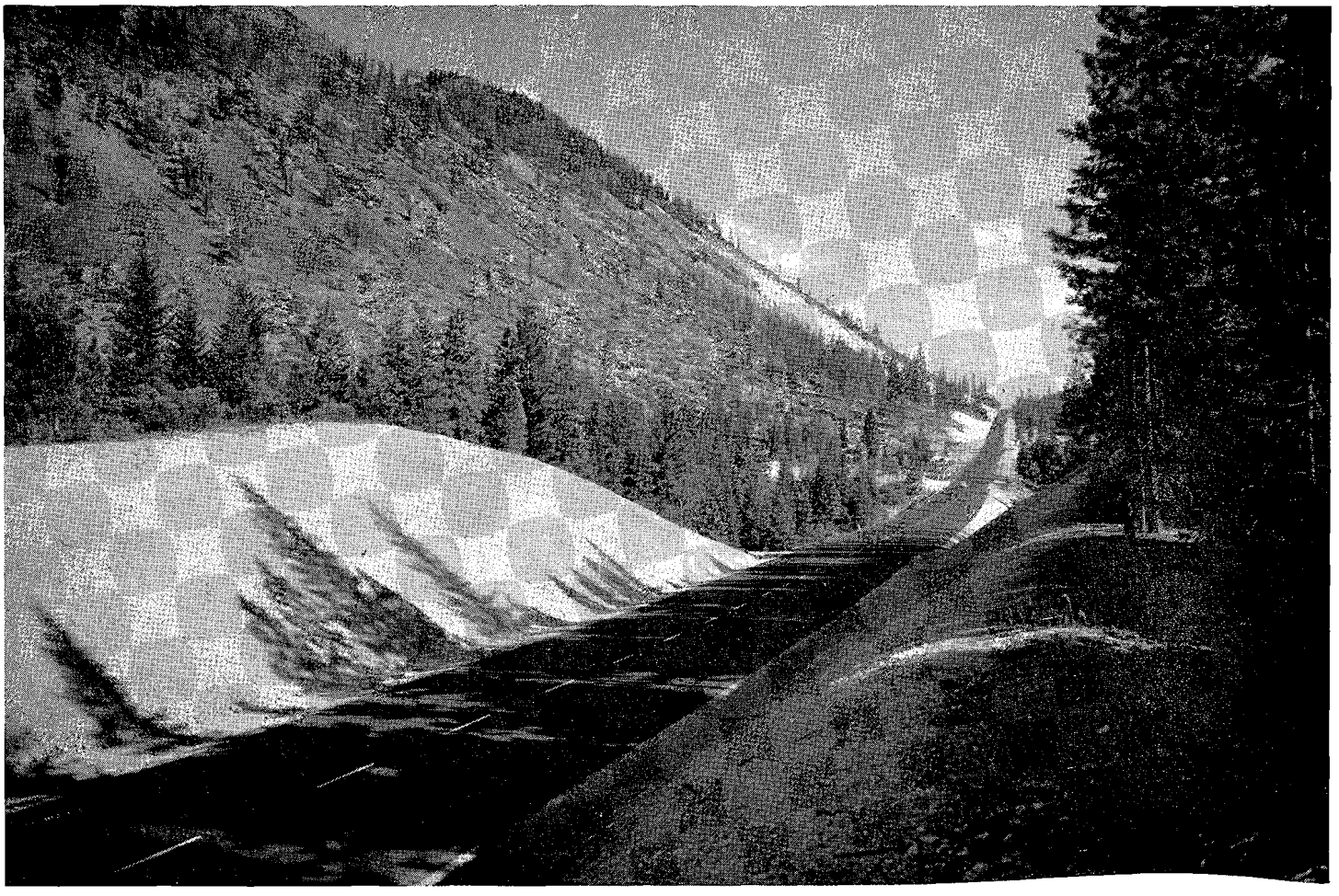
A contract for $448,728 was awarded to the Rand Construction Co. in 1950 to complete the grading on both ends of the previous contract and to pave the entire length. The construction schedule which contemplated completion prior to the 1950-51 winter season was not met, necessitating a second construction season to complete.

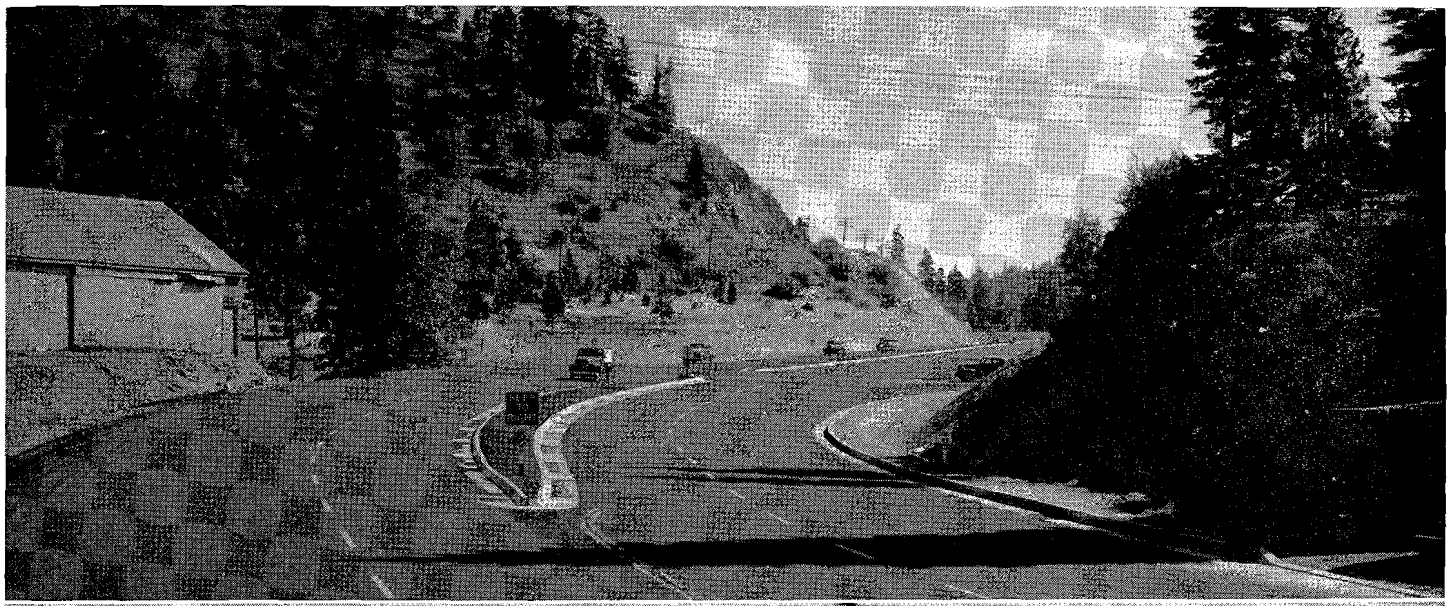
New Alignment

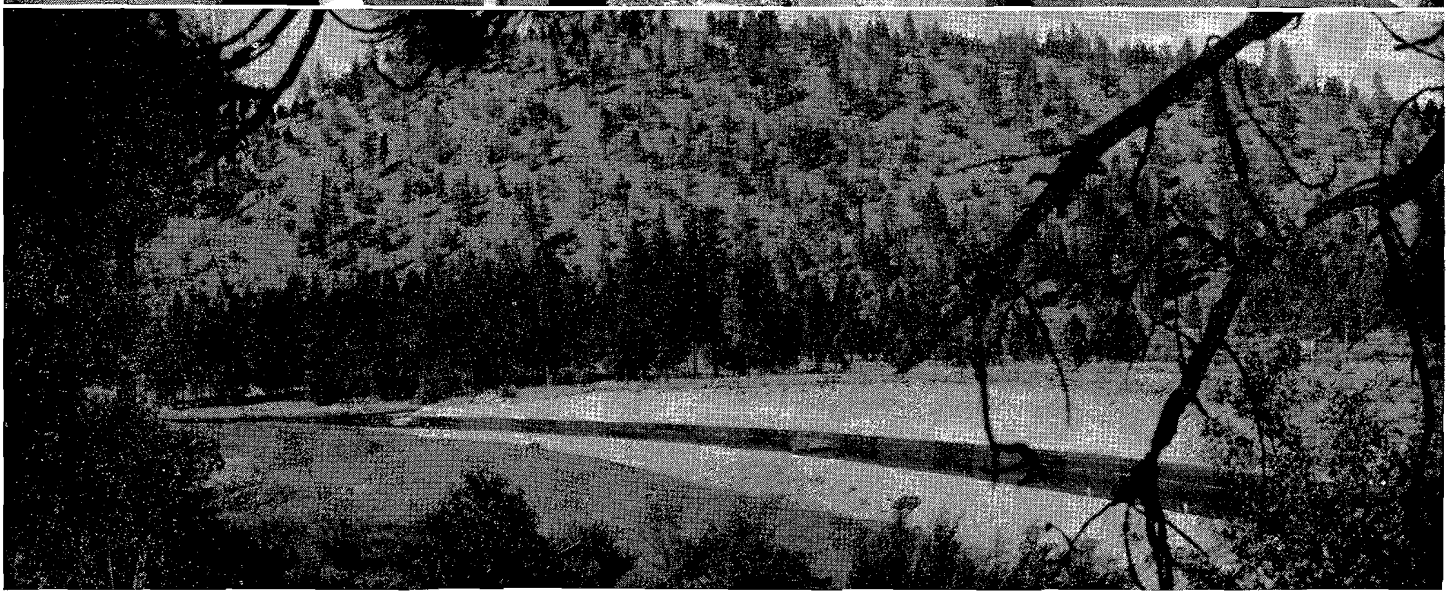
The new road, mostly on new alignment, has a driving surface 40 feet

. . . Continued on page 64

Black Butte realignment between Shasta City and Weed, looking south past Black Butte







UPPER—This section of Black Butte realignment is looking south from Weed. CENTER—Ribbon-cutting participants, front row, left to right: Mrs. L. Sobarbra, Mrs. O. Apperson, Mrs. Dom Siriano, Mrs. C. B. Rippon, F. W. Haselwood, former District Highway Engineer; Senator Randolph Collier, Louis Sobarbra, Dom Siriano. BOTTOM—Construction here was across sawdust dump.

Redding-Red Bluff

Highway Expenditures Now Total $3,337,222

By J. W. TRASK, District Engineer

To Redding, Shasta County, more than most communities, transportation has always been of vital importance. In fact, a change in means of transportation caused Redding to come into existence.

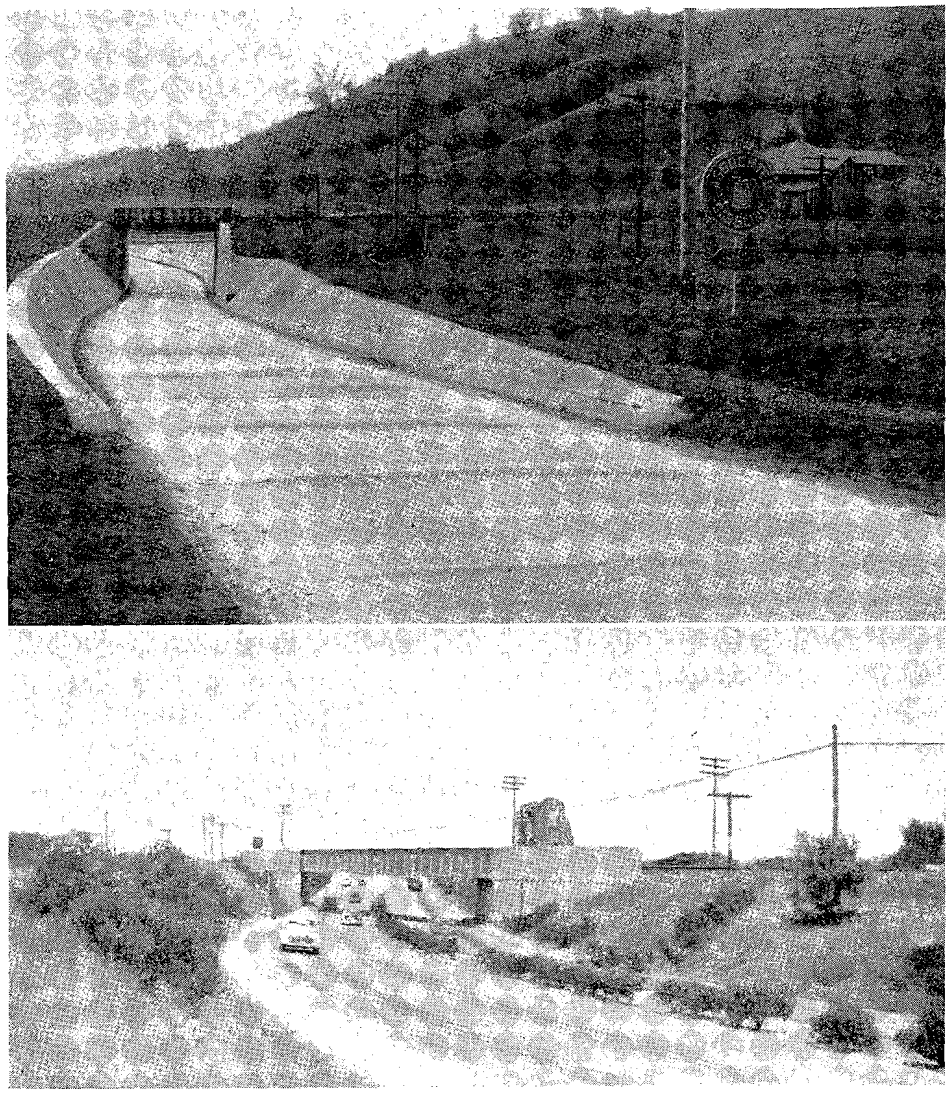
More than a hundred years ago, there were just four main towns in the State.

J. W. TRASK
District Engineer

These were San Francisco, Sacramento, Marysville, and Shasta. Shasta while not the largest probably had the most brick buildings. Los Angeles was only a little Mexican pueblo.

Shasta was located at the place where wagon trains delivered their goods to waiting pack trains that transported the merchandise to Weaverville, Hayfork and communities clear up to Oregon.

Then the Southern Pacific Railway came through. It established a town site and caused the train to stop at "Reading," but the name was misspelled and Redding was born. Shasta never recovered from this blow.



These are the old and new South Redding underpasses

Far-Sighted Plan

This year has seen the completion of a far-sighted plan on the part of the Division of Highways to complete the first phase of the new Redding-Red Bluff Highway. The entire section has been realigned and reconstructed and a four-lane divided highway has been built from Redding as far as one-half mile south of Anderson.

The first step toward this accomplishment occurred in 1937 when the Division of Highways awarded a contract to N. M. Ball Sons for $196,839 which covered the construction of the present South Redding underpass and about one-half mile of four-lane divided concrete paving. This project was a Bridge Department contract. M. Fredericksen, now Assistant Office Engineer at Sacramento, had charge of grading, paving and minor structures. In the light of existing traffic, the structure and divided highways looked pretty optimistic. Travel coming to and leaving the structure got along

comfortably on a single lane of 15-foot concrete pavement built by Henry J. Kaiser. The vision that justified the size has been amply proven. The improvement is still adequate.

Rains Made Going Tough

In 1940 the division awarded a contract for a four-lane partially divided highway from Hill Street in Redding to the section that had been completed near the underpass. Fredrickson and Westbrook were the contractors and the contract amounted to $125,841. Fred Drinkhall, since deceased, was the Resident Engineer.

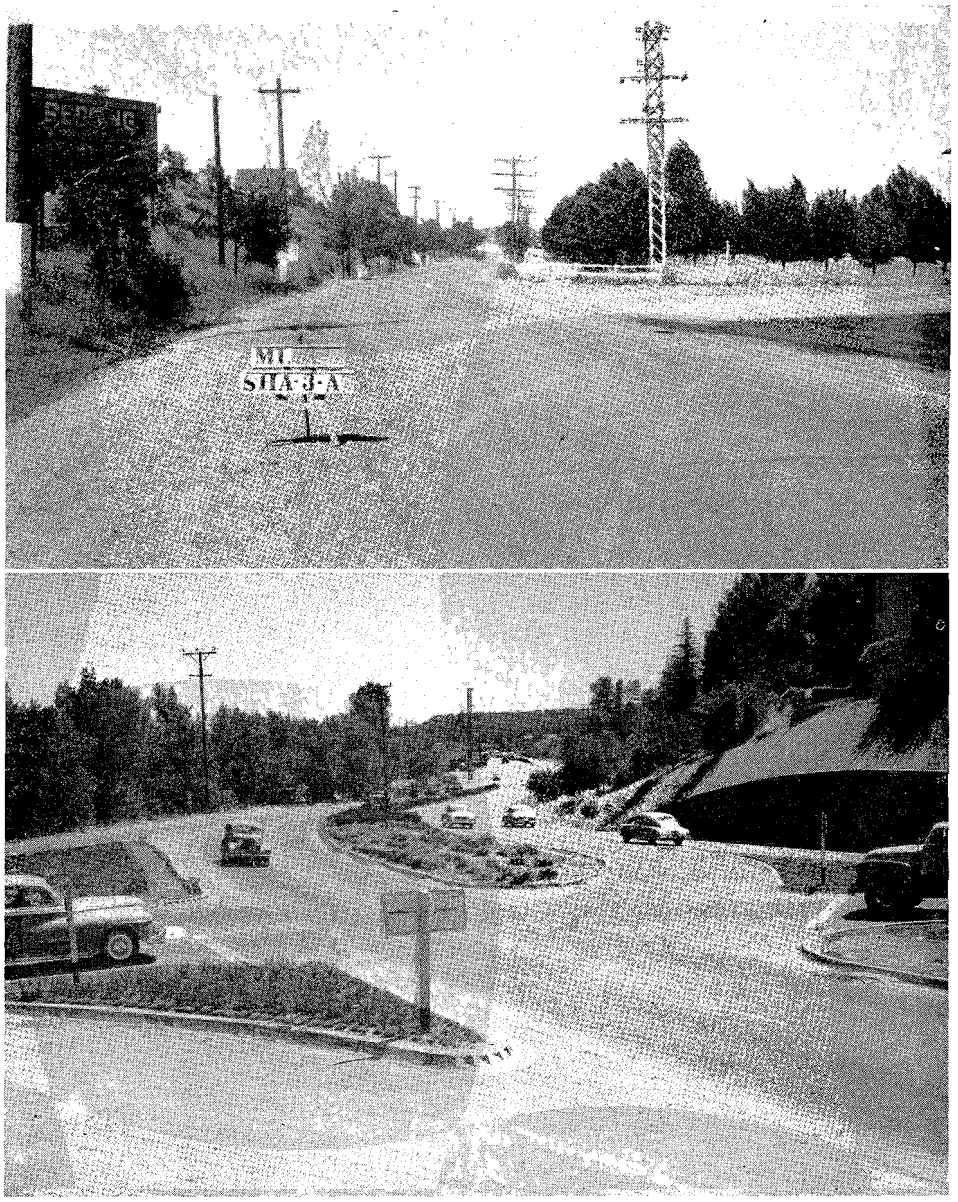
The contractors succeeded in completing the south-bound concrete lane before the winter rains began. Northbound traffic was carried over the gravel base. That winter we had 63 inches of rainfall. Sometimes travelers felt that "floated" more nearly described their passage over the unpaved portion. None of those connected with the construction nor those who had to travel it are likely to forget that project. It was finally completed the next summer. The balance of the islands which were necessary to make it a divided highway were placed in 1950 under the contract just completed.

Clear Creek Project

Then a contract was let for a southbound lane from the underpass to one-half mile south of Clear Creek in 1943. This was awarded to A. Teichert & Co. for $232,931. C. I. Brown, now Supervising Engineer in District V, was Resident Engineer. Large quantities of water were encountered in this construction. The adequacy of the corrective measure taken by the engineers is proven by the fact that no failures have ever occurred in this section.

In 1948 Fredrickson & Watson received a contract for five miles of work between Anderson and Cottonwood for $611,709. J. H. Creed, now Engineer of Surveys & Plans in District IX, was the Resident Engineer.

In 1949 a contract was let to Fredrickson & Watson for constructing the westerly or southbound lane from Anderson to Clear Creek. H. B. Milner was Resident Engineer until he was promoted to Assistant Design Engineer at Sacramento. The amount was $796,-



UPPER—Old intersection of U. S. 99 and State Route 44 in Redding. LOWER—The new intersection.

464. The contract also covered the moving of all the buildings on the west side of the street in Anderson and the construction of a service road in this location.

Building Removal Project

This was a situation that was practically forced upon the Division of Highways. It was necessary to move these buildings to arrange for the southbound lane. If they were moved back only enough to allow for this construction, all development would be hampered by the knowledge of owners that, before too long, they would face another upheaval and a move further back. To acquire two parcels from the same frontage would appear to be devoid of real planning as well as costly. It was therefore decided to make one operation, whereby required right of way was secured at one time and a completed improvement made through Anderson.

The result has been gratifying. The type of buildings and the amount of improvement has been much above that which existed previously.

The rest of the contract was only out of the ordinary in respect to the amount of water encountered. Even the Caterpillar tractors became mired almost daily in the grading operations.

The engineers raised grade through some areas, installed miles of drainage pipe and took other measures where necessary and were successful to the extent that the second year of heavy traffic has revealed no weak spots.

Canal Moved

Under this contract, with a real assist from the weather, the contractor moved back and lined two portions of the A. C. I. D. Canal. This work had to be done between the time that irrigation water could be turned out of the canal and the time that winter rains began. By doubling up his equipment and working overtime he was able to get their work completed.

In 1950 the contract that was just completed was awarded. Fredrickson & Watson through having their equipment and paving plant on the ground were low bidders for $646,601. W. Z. Hegy, now Maintenance Engineer in District II, was Resident Engineer. Besides the grading and paving of the northbound lane from Anderson to Girvan, the work included a new Clear Creek Bridge and widening the existing Clear Creek, A. C. I. D. Canal, Spring Creek, Oregon Gulch bridges and installation of islands in the pavement north of the underpass to provide a divided highway. No particular difficulties were encountered in any of this construction.

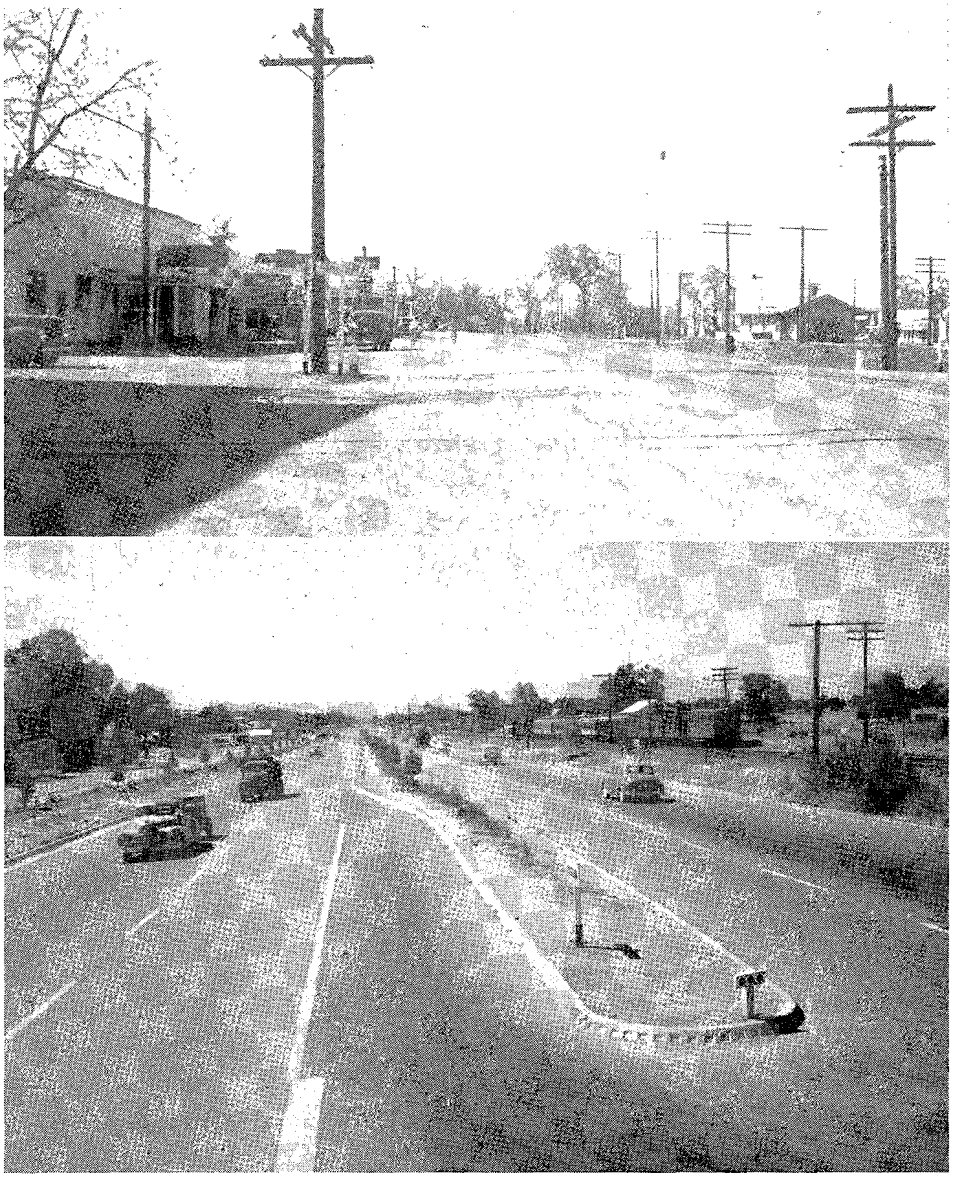
Total Expenditures in Shasta

The total expenditures in Shasta County since the realignment and reconstruction of the highway between Redding and the southerly Shasta County line is as follows:

1937	$196,839
1940	125,841
1943	232,931
1948	611,709
1949	796,464
1950	646,601
Total	$2,610,385

On the Tehama County end, work was performed under two contracts. In 1940 Jones and King received an award for $218,000 to complete about six miles immediately north of Red Bluff. R. R. Norton, now Assistant Office Engineer at Sacramento, was Resident Engineer. In 1946 the Phoenix Construction Company and Oilfields Trucking Company secured a contract for the next 7.1 miles for $508,837. F. S. Saunders, now Office Engineer District II, was the Resident Engineer.

There was nothing particularly noteworthy about either of these contracts. In the aggregate they called for handling 773,000 cubic yards of red dirt that disintegrated into very offensive dust during the summer and lost all bearing value just as soon as the rains hit it. They called for hauling in 228,000 tons of gravel and placing 41,000 tons of paving. Just all in the day's work as far as modern contract firms are concerned.



UPPER—View of Anderson before construction of divided highway. LOWER—After improvement.

Expenditures in Tehama

Total expenditures in Tehama County.

1940	$218,000
1946	508,837
Total	$726,837

This gives a total expenditure in Shasta and Tehama Counties of $3,337,222 on the Redding-Red Bluff highway since the realignment and reconstruction was begun in 1937.

This highway is a link of the north and south interstate highway. Eventual improvement to at least four lanes of divided highway is even now visioned for its entire length. Additional lanes

. . . Continued on page 56

State Buys Spans

San Mateo-Hayward and Dumbarton Bridges Purchased for $8,250,000

SIMPLE flag raising ceremonies on both spans at 10.50 a.m., September 12th, signalized the taking over by the State of the San Mateo-Hayward and Dumbarton bridges across southern end of San Francisco Bay. A celebration in which officials and citizens of Alameda, San Francisco, San Mateo and Santa Clara Counties were to have participated under sponsorship of the Hayward Chamber of Commerce was called off out of respect to the memory of the late Charles H. Purcell, Director of Public Works, who died suddenly in Sacramento on September 7th.

Official recording of the deeds for the bridges took place simultaneously by the California Pacific Title Company headquarters in Redwood City and by the Oakland Title and Insurance and Guarantee Company in Oakland, while at the same time in Sacramento Governor Warren handed over checks of $6,000,000 for the San Mateo-Hayward structure and $2,250,000 for the Dumbarton span.

Immediate result of state acquisition of the bridges was a reduction in tolls for automobiles from 50 cents to 35 cents on the San Mateo-Hayward Bridge and from 45 cents and 5 cents per passenger to 35 cents on the Dumbarton Bridge.

On September 11th in Los Angeles, Director of Public Works Frank B. Durkee had signed 8,350 bonds, representing the issue of $8,350,000 of revenue bonds authorized by the California Toll Bridge Authority for state purchase of the bridges. On August 15th, the authority had sold the bridge bonds to a syndicate headed by Blyth & Company of San Francisco and the First Boston Corporation, which took the 25-year bonds at an average interest rate of 2.3629 percent.

E. R. Higgins, Comptroller of the Department of Public Works, estimated that the bonds could be paid off

. . . Continued on page 57

Flag-raising ceremony on San Mateo - Hayward Bridge. Left to right, Toll Sergeant Harry V. Burke, Joshua Pyle, Toll Sergeant Chas. L. Smith.—Courtesy San Mateo Times.

Ramona Freeway

Report of Accomplishments In Los Angeles County

By P. O. HARDING, Assistant State Highway Engineer

THE RAMONA FREEWAY is the local name that has been given to the development of that portion of State Highway Route 26 extending from the City of Los Angeles to the City of Colton in San Bernardino County. This important east and west traffic artery west of Pomona has the unique distinction of carrying three U. S. highways designated by the numbers 60, 70 and 99. This fact indicates how vital a link the Ramona Freeway is in the U. S. Interregional Highway System.

The Ramona Freeway, when completed, will render all of the basic services that are required of highway transportation. It will be used for interstate travel to and from the southern and eastern states by way of Arizona. It will be the main connection between the Los Angeles Metropolitan Area and the Imperial Valley, directly serving agriculture and industry. It will also be extensively used by recreational traffic between the metropolitan area and the many scenic and resort centers in the mountains and deserts of Riverside, San Bernardino and Imperial Counties. Its most important use is for carrying the heavy morning and evening peak loads of commuter traffic characteristic of a large metropolitan area.

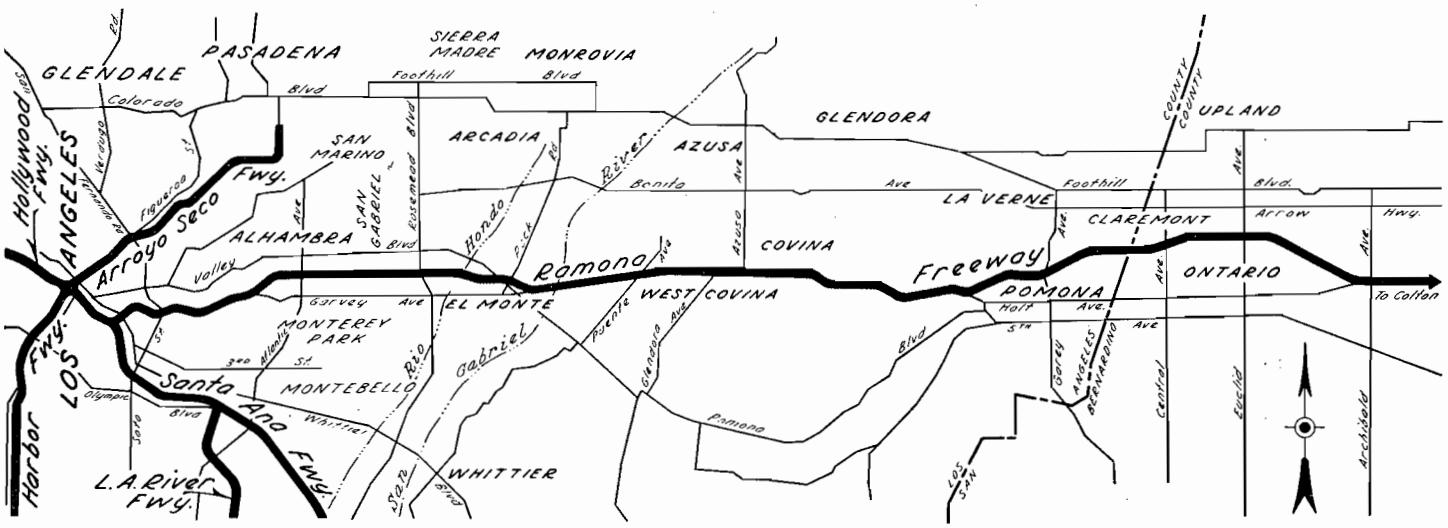
Major Arterial

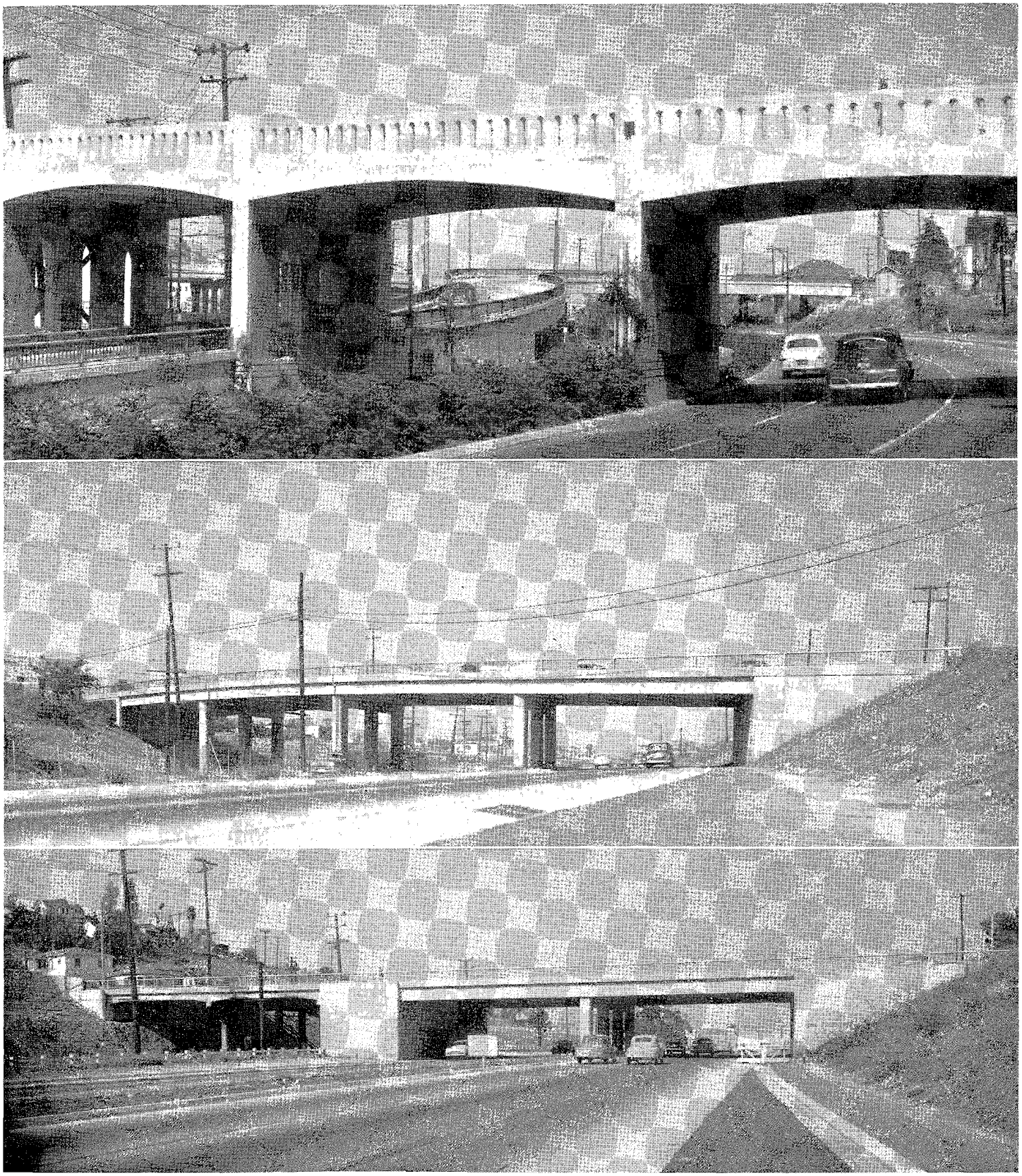
Within Los Angeles County, the Ramona Freeway is the major east-west arterial through the San Gabriel Valley, directly connecting the rapidly expanding cities of Los Angeles, Alhambra, Monterey Park, El Monte, and West Covina with Pomona and Claremont. In addition to many important city streets and county roads, seven state highway routes (2, 4, 62, 77, 167, 168 and 170) will be intersected and at these locations grade separations and interchange ramp connections with the freeway will be provided. When completed, the freeway will also serve a number of communities not directly traversed, such as Pasadena, San Gabriel, Temple City, Arcadia, Monrovia, Baldwin Park, Puente, Covina and Glendora. Although the development of the San Gabriel Valley is predominantly residential, there is a corresponding expansion of local business areas and there is also considerable development of new industrial areas particularly along the main line Southern Pacific Railroad.

TRAFFIC STUDIES

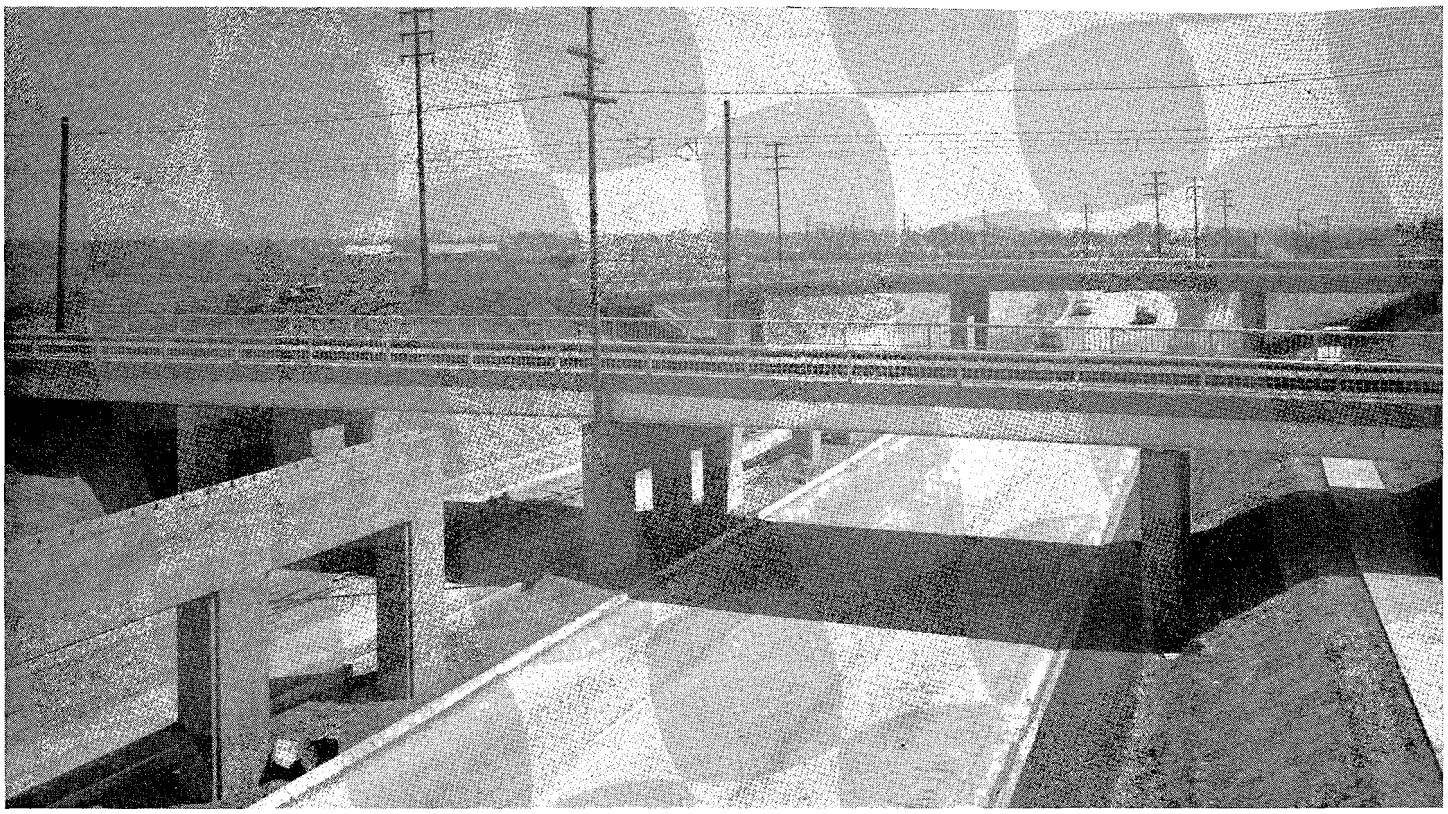
Present average daily traffic volumes on the completed portion of the Ramona Freeway range from 37,000 at the junction with Santa Ana Freeway in Los Angeles to 42,000 at the east city limits of Los Angeles at Indiana Street. Peak flows on the freeway reach about 3,200 vehicles per hour in one direction at present, inbound in the morning and outbound in the evening. East of the City of Los Angeles, Garvey Avenue now carries a large part of the traffic which will move on the Ramona Freeway when it is completed. Garvey Avenue now has an average daily traffic of 29,000 at Atlantic Boulevard, 31,000 at Rosemead Boulevard, 24,000 east of Valley Boulevard, and 14,000 over the Kellogg Grade between West Covina and Pomona.

Traffic surveys indicate that Valley Boulevard and other routes more or less parallel to Garvey Avenue will also contribute substantially to the traffic expected on the Ramona Freeway, so that the 1951 average daily traffic which would be using the freeway if it were now available, is 26,000 at Atlantic Boulevard, 35,000 at Rosemead Boulevard, 45,000 east of Valley Boulevard, and 15,000 over the Kellogg Grade. The rapid rate of growth throughout this area will increase these figures each year.





UPPER—Looking easterly along Ramona Freeway showing the Eastern Avenue overcrossing which also spans the double-track Pacific Electric Railway. CENTER—Looking easterly showing completed Herbert Avenue overcrossing bridge. BOTTOM—Looking easterly showing Cornwell Street Bridge in foreground, the curving Pomeroy Avenue on ramp bridge and Marengo Street and Soto Street bridges in background.



Looking southerly along Rosemead Boulevard, showing recently completed construction for underpass with Pacific Electric Railway and Ramona Freeway

GENERAL LOCATION

The routing of the Ramona Freeway is shown on the accompanying index map. From the junction point with the Santa Ana Freeway at Aliso Street and Mission Road, the most logical and economical routing for the Ramona Freeway was along the tracks of the Pacific Electric Railway San Bernardino main line as far easterly as Rosemead Boulevard. From this point on easterly the location leaves the Pacific Electric Railway, and cutting southeasterly to Garvey Avenue, follows along Garvey Avenue through West Covina and easterly over the Kellogg Grade. After passing the Kellogg Grade, the location has been established northerly of Holt Avenue (existing State Highways Route 26) through Pomona and Claremont.

LOCATION THROUGH CITY OF POMONA

Studies and negotiations with city authorities regarding the location of the Ramona Freeway through Pomona were brought to a successful conclusion on May 16, 1950, when the Pomona city officials passed the necessary resolution authorizing Mayor Alan G. Orsborn to execute the freeway agreement with the State Division of Highways. The routing through the City of Pomona as finally agreed upon is considered as the ideal one for the best interests of the traveling public and also as the best possible routing to serve the present and the future requirements of the City of Pomona.

In reporting the brief ceremony held on May 19, 1950, upon the occasion of the visit of the California Highway Commission to Pomona, the *Pomona Progress Bulletin* stated in part as follows:

New Era of Progress

"The visit of the Highway Commission and other officials of the State of California to Pomona this morning marked not only a gesture of good will to the Pomona City Council, Pomona Chamber of Commerce and the community as a whole but the beginning of a new era of development and progress, according to the opinion of many who witnessed the informal but very significant ceremony.

"Each passing month will make more graphic the debt of gratitude which Pomona owes to the California State Highway Department. Already only three days after the signing of the freeway agreement the three-year economic coma which has held dormant the growth of Pomona is beginning to break. Plans for construction of new subdivisions and apartment houses are in preparation. Investment agencies are checking the territory. Three industries have reopened consideration of Pomona as a possible plant location city."

Since that time the American Brake Shoe Company and the Consolidated Vultee Aircraft Corporation have begun property acquisition and active construction for plants in the Pomona area.

LOCATION THROUGH EL MONTE

For a period of approximately twelve years studies have been in progress and negotiations under way with City of El Monte officials for the location of the Ramona Freeway through the City of El Monte. These studies involved a distance of approximately

four miles between Rosemead Boulevard and the San Gabriel River. On August 15th a public hearing relative to this matter was held in Los Angeles by the State Highway Commission. The commission, in its final deliberations, resolved the problem into a choice between two lines, the one designated "Line 4" as recommended by the State Division of Highways, and the other designated as "Line 7," a location straddling the Pacific Electric Railway tracks and calling for depressing both the freeway and the railroad, as advocated by the officials of the City of El Monte. All of the evidence developed by the State Division of Highways in the studies of the several routes through El Monte indicated the recommended Line 4 routing to be the most serviceable and economical for both through and local traffic.

The commission in adopting this routing issued a public statement to the effect that its conclusion had been rendered only after one of the most thorough investigations ever accorded a state highway routing and that the commission was satisfied that both state-wide traffic and local traffic will be best served by the adopted route. The commission further stated that it was prepared to budget funds to undertake right of way acquisition and ultimate construction as soon as freeway agreements may be made with the local governing bodies.

PREVIOUSLY COMPLETED CONSTRUCTION

The first items of construction to be completed in the development of the Ramona Freeway were the grade separation bridges for cross streets between Aliso Street and Indiana Street in Los Angeles City. Construction first started on these bridges during 1933. Road construction followed bridge construction, providing four 10-foot traffic lanes for a length of two miles. This pavement was completed and opened to traffic in 1935. In 1941 the State Division of Highways completed a construction contract widening the existing four-lane pavement to two 35-foot roadways with variable width median. The utility of this two-mile portion of the early Ramona Freeway was very greatly increased in August, 1944, when the City of Los Angeles completed its Aliso Street viaduct over Mission Road and the Los Angeles River, providing interchange connections with the Ramona Freeway. Later in 1947, a direct connection with the Santa Ana Freeway was made for the convenience of eastbound traffic when the first section of the Santa Ana Freeway was completed and opened to traffic from Aliso Street to Soto Street.

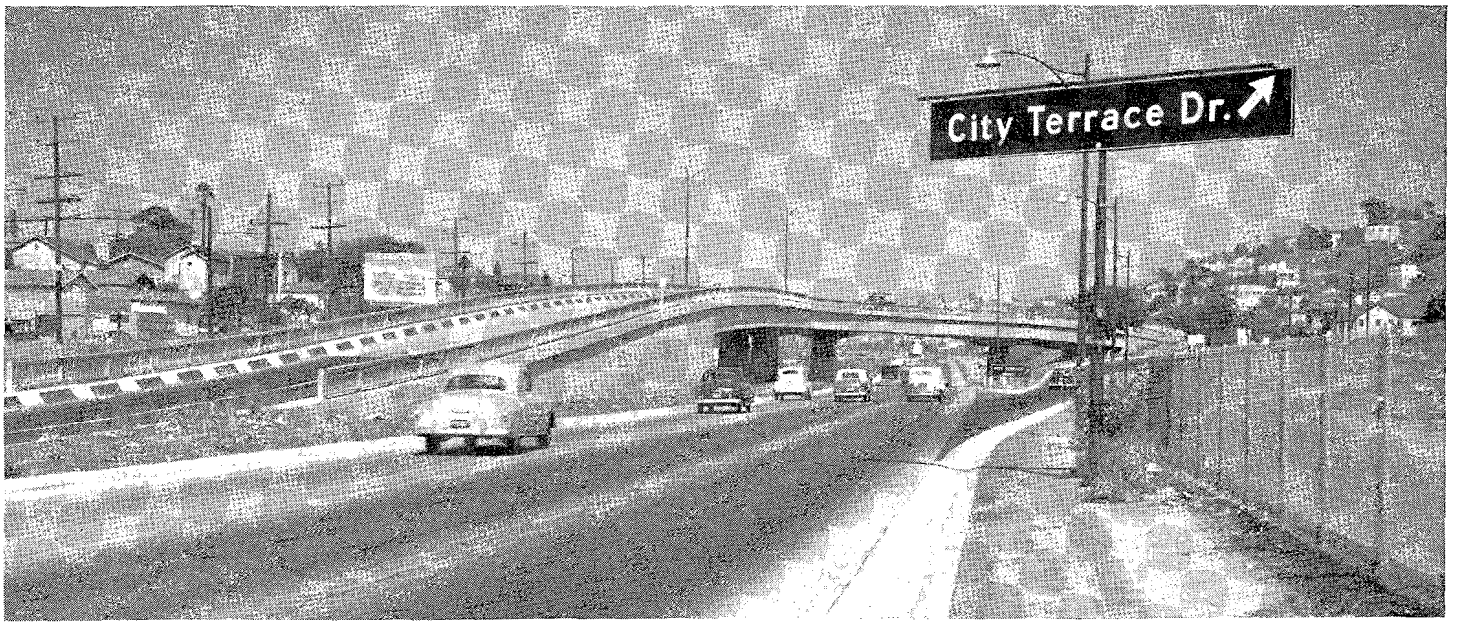
In 1949, a contract was let for a 1.8-mile extension from the Los Angeles City Limits in an easterly direction of the Ramona Freeway from Indiana Street to Helen Drive. This construction was completed April 20, 1951. As of the present time, 3.8 miles of construction on this freeway has been completed at a total cost of about $4,000,000.

CONSTRUCTION NOW IN PROGRESS

On February 9, 1951, a contract was awarded to J. E. Haddock, of Pasadena, for the construction of a 1.5-mile easterly extension of the Ramona Freeway from Helen Drive to Hellman Avenue in the City of Alhambra. The estimated cost of this construction is $2,000,000. As of the present time, this contract is 30 percent completed. The estimated date of completion is November, 1952. There are four bridge structures included in this contract, one of which is the undercrossing for Fremont Avenue.

A contract for another very important unit of construction known as the Murphy Avenue connection, was awarded on May 31, 1951, to J. E. Haddock, of Pasadena. This contract includes the construction of a grade separation bridge under the Pacific Electric Railway tracks to provide full interchange between the freeway and Eastern Avenue which is a very important traffic artery serving industrial sections of the East Los Angeles area. The estimated cost of this construction is $200,000, the work is 30 percent completed and the estimated date of completion is July 23, 1952.

Looking easterly along completed Ramona Freeway at the east city limits of Los Angeles showing curving City Terrace on ramp bridge



$1,500,000 Contract

A contract was awarded on June 28, 1951, to the Griffith Company of Los Angeles, for a 0.9-mile length of the Ramona Freeway from Hellman Avenue to Eighth Street in Alhambra. This construction includes three bridges, one of which is the undercrossing and interchange. The estimated cost of this construction contract is $1,500,000. The estimated date for completion is March 23, 1953.

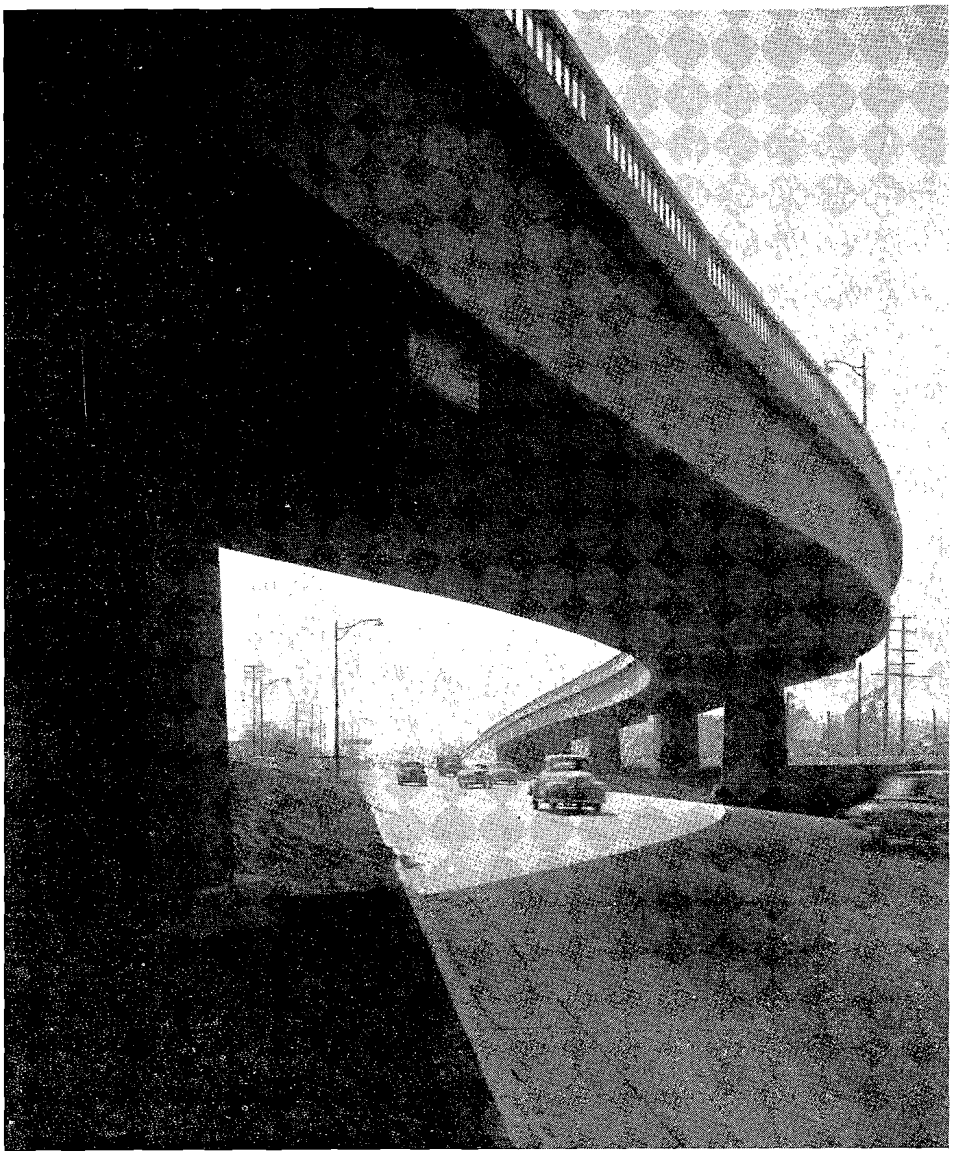
On September 6, 1951, bids were opened in the District VII office in Los Angeles for the construction of another unit 1.7 miles of the Ramona Freeway from Eighth Street in the City of Alhambra to Jackson Avenue, a short distance easterly of the Alhambra city limits. This contract includes the construction of four grade separation bridges at Sixth Street, Garfield Avenue, Almansor Avenue, and New Avenue. The Griffith Company of Los Angeles was the low bidder for this proposed construction, and the total of the contract items was $2,381,-815.10.

At this time almost 100 percent completed and now ready for acceptance is the $855,000 contract of Vido Kovacevich Company that provides separation of grades with Rosemead Boulevard (State Route 168) passing under the Ramona Freeway and Pacific Electric tracks.

FUTURE CONSTRUCTION

Considering the 30.4 miles of the Ramona Freeway in Los Angeles County there has been spent and budgeted thereon for construction and right of way acquisition to date a total of about $18,000,000.

Plans have been completed and rights of way obtained so that an additional two-mile construction contract can be advertised and let in late 1951 to extend the Ramona Freeway from Jackson Avenue to Rosemead Boulevard. This will be the last of the construction on the Freeway that can be carried out with funds that have been budgeted for the 1951-52 Fiscal Year, and subsequent construction will have to wait until additional funds can be budgeted. In line with the current construction program, providing there are no serious delays due to restricted steel allocations, it is expected that we will have the six-lane Ramona Freeway completed in full, with all grade separations, interchanges and frontage roads, and opened to traffic for the entire 10 miles between the westerly junction with the Santa Ana Freeway at Aliso Street in Los Angeles and Rosemead Boulevard (State Highway Route 168) during 1953.



Looking westerly along completed Ramona Freeway, showing eastbound traffic under curving City Terrace Drive bridge

RECOMMEND LIGHTFOOT DRIVING

A light foot on the accelerator pedal will go a long way toward preventing engine knocks caused by the lower octane gasoline due to reach the Nation's service stations within the next few weeks, the California State Automobile Association advises.

A cut recently ordered by the National Production Authority in the amount of primary metallic lead that may be used in civilian motor fuel is responsible for the drop in the octane rating of gasoline.

Many automobiles, especially those with regular compression engines, will be bothered very little by the new gasoline because the octane rating of motor fuel, in normal times, is much higher than needed for the average passenger car anyway. Owners of automobiles with high compression engines, however, will be more likely to experience engine knocks.

New Link

Two Additional Miles of Hollywood Freeway Opened

By R. C. KENNEDY, Secretary, California Highway Commission

TUESDAY, September 25, 1951, saw the official opening of another link of the Hollywood Freeway in Los Angeles.

Two miles of freeway, from Silver Lake Avenue to Western Avenue, were opened to traffic at 10.30 a.m. Immediately preceding the removal of the barriers, dedication ceremonies were held at the foot of the Santa Monica on-ramp under the direction of John B. Kingsley, President of the Hollywood Chamber of Commerce.

Kingsley opened his remarks by stating that inasmuch as Hollywood was one of the most important sections of Southern California it was only right and fitting that it have one of the most important freeways. He stressed the fact that this was to be a short and snappy dedication and speakers were to be limited to one minute.

The opening speaker was Lt. Governor Goodwin Knight, followed by Mayor Fletcher Bowron, Supervisor Roger Jessup, and Oscar Trippet, President of the Los Angeles Chamber of Commerce. Neil Petree represented the California State Chamber of Commerce on the speakers' list.

Assistant State Highway Engineer Harding speaks at dedication

Harding Gives Credit

Then came a number of rapid-fire introductions of prominent people who took a bow when their names were called.

Paul O. Harding, Assistant State Highway Engineer, in charge of District VII, was called on to speak and was given a little extra time by the master of ceremonies. Harding used all his time in telling the large crowd who of the city and state engineers had been instrumental in the completion of this portion of the highway. Harding ended his list by naming the different contractors and their representatives who were present.

Highway Commissioner Harrison R. Baker was introduced and extended his greetings to the public officials and the

State Highway Commissioner Harrison Baker and John Kingsley, Manager of Hollywood Chamber of Commerce, wielding the shears that cut the ribbon. In the picture to the left of Baker is Lieut. Governor Goodwin Knight and City Councilman Cronk, who is Chairman of the State, County and Federal Affairs Committee, and to the right of Kingsley is State Highway Commissioner James Guthrie.

officers of different civic organizations who were instrumental in developing the freeway program in Southern California.

Baker paid tribute to the late Director of Public Works Charles H. Purcell, for his part in the development of the State Highway System, and assured the audience that if Mr. Purcell were still with us he would be in attendance, as the completion of these freeways were very close to his heart.

Example of Cooperation

The commissioner stated that this section, although comparatively short, was forging another link in the chain of basic freeways in the Los Angeles metropolitan area; this section was linking together the Hollywood area with the Los Angeles civic center and the central business district. The welcome of the freeway into the boundaries of Hollywood was, he said, significant of the appreciation of local communities of the value of freeways as a community asset.

Baker called attention to the fact that this was an outstanding example of cooperation between the State of California and local public officials and civic organizations and he went on to name the different officials and civic organizations that were, and are, instrumental in the development of the freeway system.

MAYOR FLETCHER BOWRON OF LOS ANGELES

The speaker said that while the length of this section was but two miles, it had cost approximately $10,000,000 and that half of it was for right of way and half for construction. Attention also was called to the fact that 7.6 miles of the Hollywood Freeway were now open and in use and that the approximate length of the total project was about 10 miles.

The only uncompleted sections are from Western Avenue to Highland Avenue and from Grand Avenue to Spring Street in the civic center.

"There are 17 construction contracts now under way on the Hollywood Parkway, totaling $9,000,000," Baker said, "The next sections to be opened will be from Grand Avenue to Alameda Street, through the civic center, about December, 1951, and Western Avenue to Highland Avenue some time in 1953, depending a great deal on the steel situation."

He called attention to the fact that late in 1953 the completion date of the Hollywood Freeway would coincide very closely with the completion of the Harbor Parkway from the four-level structure to beyond Olympic Boulevard and the Santa Ana and Ramona Parkways from civic center to Rosemead Boulevard.

. . . *Continued on page 57*

View of completed Hollywood Freeway looking southerly from Santa Monica Boulevard, showing caravan using northbound roadway

In San Diego

Three Major Highway Contracts Now Are Nearing Completion

By J. F. JORGENSEN, Assistant District Engineer

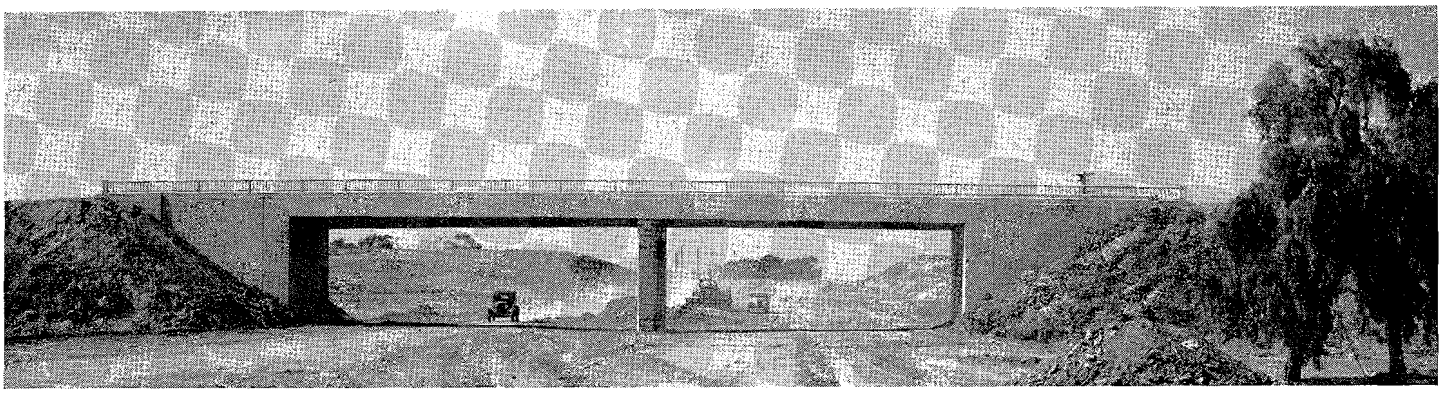
THREE CONTRACTS on the Montgomery Freeway in the south bay area of San Diego have been completed and a fourth to cost $1,278,300 is well under way; grading and paving of a realigned section of U.S. 80 between the Willows and four miles east in San Diego County at a cost of $420,000 is nearing completion and a $370,000 steel girder bridge across Sweetwater River between Descanso and Alpine in southern San Diego County is approaching completion.

The Montgomery Freeway will connect Harbor Drive in National City with the Mexican Border, and the work now in progress will complete the facility as far as Palm City. This highway will become U. S. 101 upon completion.

The first unit, between Seventh and 14th Streets, in National City, was completed in October, 1950. The second contract for construction of separation structures at H Street in Chula Vista and Main Street near Palm City was completed in April, 1951. The latest work completed on this freeway and now ready for acceptance by the Director of Public Works, extends from 14th Street in National City to G Street in Chula Vista. This project was discussed in the January, February, 1951, issue of *California Highways and Public Works.*

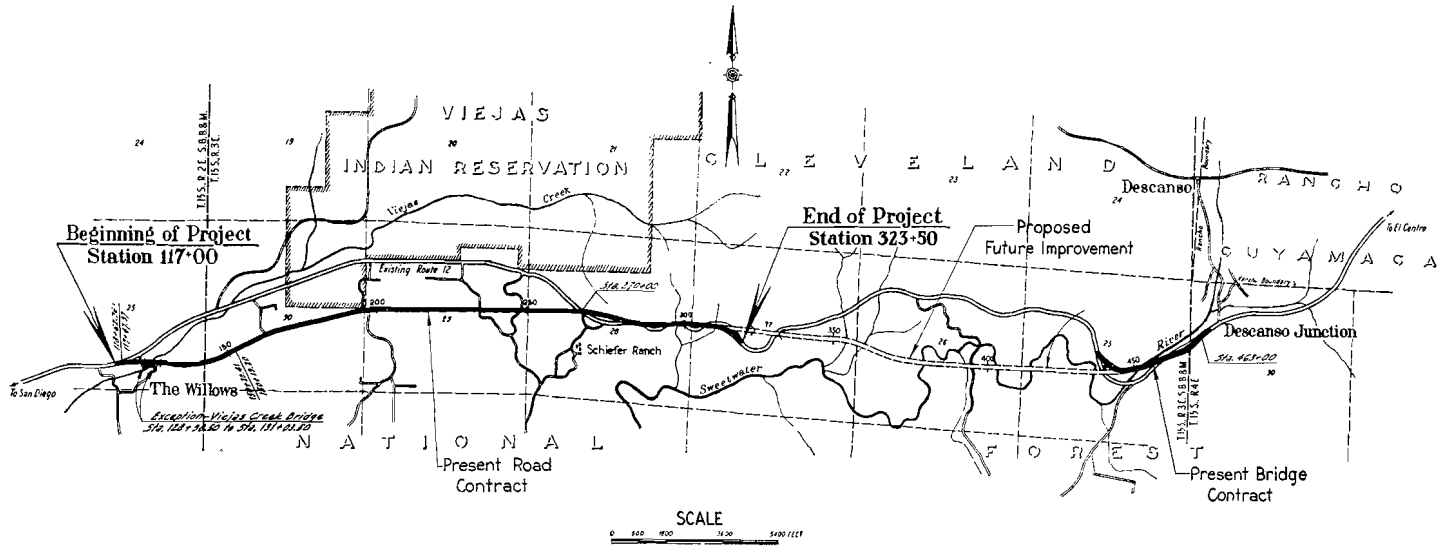
Separation Structures

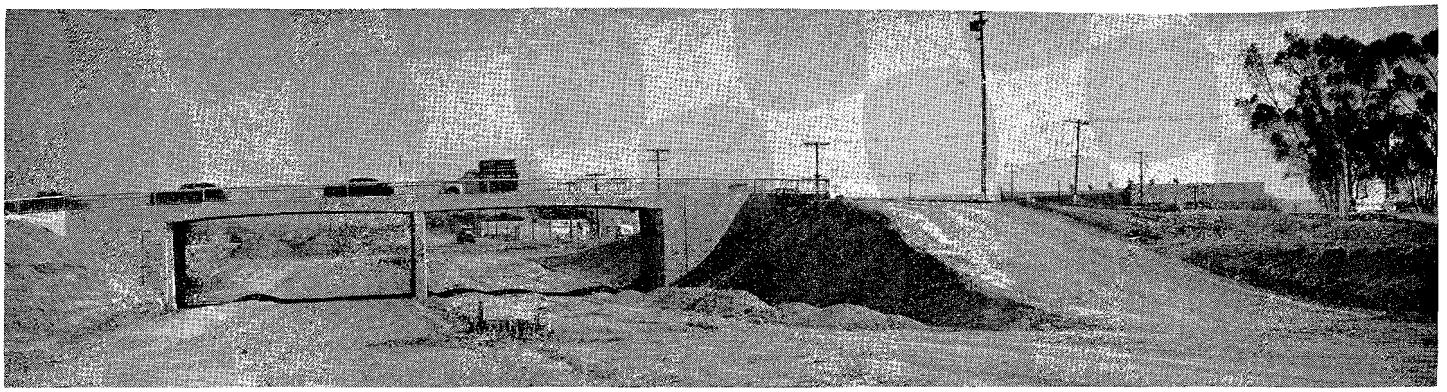
All important crossings south of 13th Street in National City have been or will be made on separation structures. Frontage roads are being provided where necessary to serve local traffic. Multiple separation structures have been provided to separate local traffic from both freeway and railroad traffic at 18th and 24th Streets. At E and H Streets in Chula Vista, local cross-traffic passes over the freeway (which is de-



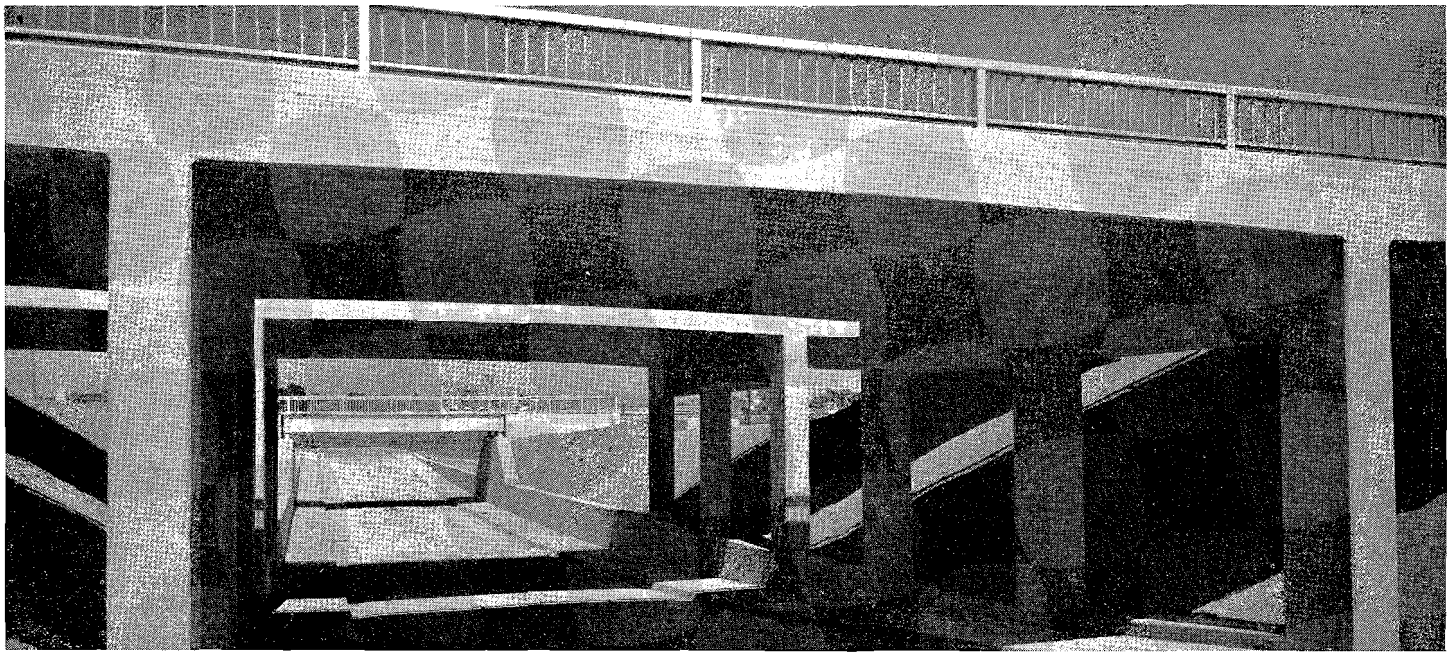
Main Street overcrossing under construction

In San Diego County, between The Willows and Descanso Junction

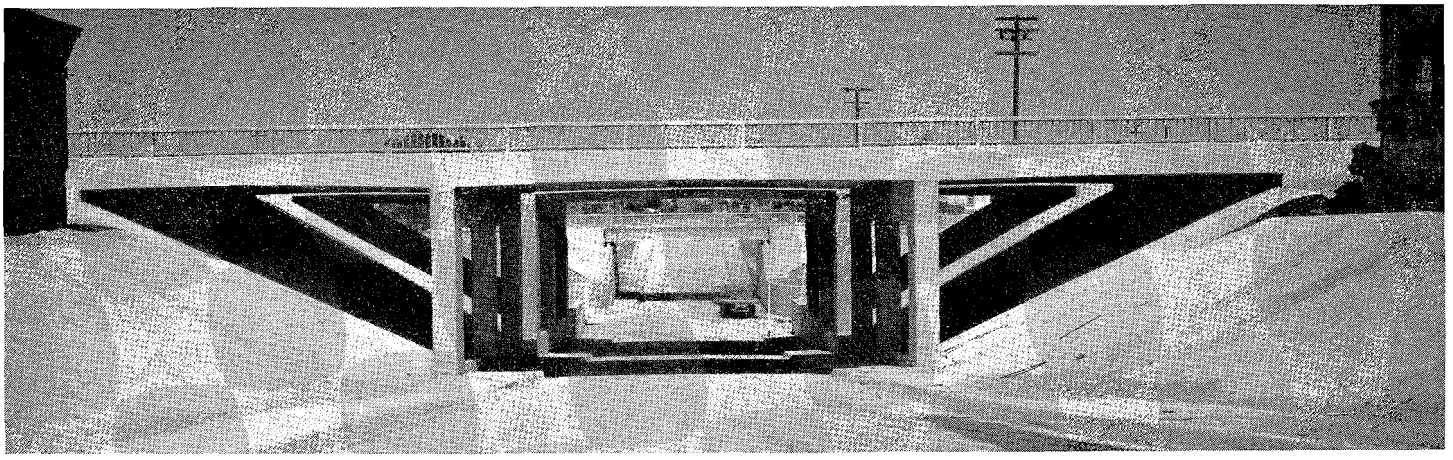




H Street overcrossing under construction



This is the completed 24th Street bridge



These are completed 18th Street bridges

pressed) on concrete separation structures.

At F Street a spur line of the S. D. & A. E. Railroad also crosses over the freeway. At Main Street a separation and interchange is provided for traffic entering and leaving the Otay area, in which are located several aggregate producers, with an accompanying heavy flow of commercial vehicles. At Palm Avenue in Palm City, near the southerly terminus of the present work, a three-level interchange is provided to accommodate heavy flows of traffic to and from the Coronado area in which are located the U. S. Naval Air Station and Amphibious Base.

Design of Project

All of the construction of this freeway is plant-mix surfacing on cement treated base, with sub-base of natural or processed select material, of varying thicknesses, depending on basement soil quality. An exception is at H Street where about 600 feet of portland cement concrete pavement on a four-inch thickness of cement treated base, supported by a pervious rock blanket, one foot thick, is being placed. This design is being employed at this location since ground water is within approximately two feet of profile grade where the roadway is depressed. It was determined that the rock blanket, together with a subdrainage system of rock and tile, would be more economical than the heavy "boat" section of reinforced concrete that is often necessary.

In addition to the major structures previously mentioned, twin bridges are provided at the Otay River and Otay Overflow Channel. Bridges were constructed on the new southbound or westerly lanes at the North and South Sweetwater Channels and structures on existing Bay Boulevard, which becomes the northbound lanes, were lengthened to provide adequate capacity for flood flows.

In constructing the new work unsuitable muck in varying depths up to eight feet was removed in the Sweetwater flats, and filled with select material. Check levels on subsidence in this area indicate that after nearly a year, subsidence is still in progress, although at a diminishing rate, the total maximum amount being, at this time, about 11 inches.

SUMMARY OF CONTRACTS

A summary of contract amounts for construction of this freeway, between Seventh Street in National City and Elm Avenue in Palm City follows:

Limits	Contractor	Const. Cost (Excl. Engr.)	Status
Seventh to 14th Sts., NatC	R. E. Hazard	$122,600	Completed
Structures at H and Main Sts.	Chas. MacClosky Co.	147,700	Completed
14th St., NatC to G St., ChV	MacClosky-Hazard & Willis	1,421,500	Completed
G St. to Elm Ave., Palm City	Griffith Co.	1,278,300	Under Construction

The work was supervised by W. T. Rhodes as Resident Engineer for District XI, and A. K. Gilbert and W. V. Cryderman as Resident Engineers for the Bridge Department.

U. S. 80 REALIGNMENT

Work on a 3.9 mile grading and paving contract in San Diego County between the Willows and four miles east is presently being completed by Clyde W. Wood and Sons. This project includes the realignment of a portion of the Viejas Grade on U. S. 80.

Principal improvements of this work over the existing road will be reduced total curvature, longer radius curves, flatter grades, and wider roadbed. Whereas the existing road has grade rates up to 7 percent and curves with radii as low as 300 feet, the new facility provides a maximum of 4 percent grades and minimum radii of 2,000 feet.

Grading operations were partially completed by convict labor at Prison Camp 40, but the camp was moved elsewhere before completion. The Wood contract provided for the completion of grading operations, some 263,000 cubic yards of rock and decomposed granite, as well as the construction of a 24-foot concrete pavement on a bituminous treated subgrade, with bituminous shoulders and other miscellaneous items of work.

Skew Joint Experiment

The subgrade treatment consisted of the application of approximately one gallon of SC-4 to the subgrade material and road mixing. As an experiment, on one-half mile of the work, the "dummy joint" strips of premoulded material in the pavement were placed on a skew of 2½ feet, in 12 feet. This skew joint was found to be no more difficult to place than the usual joint, and it is expected

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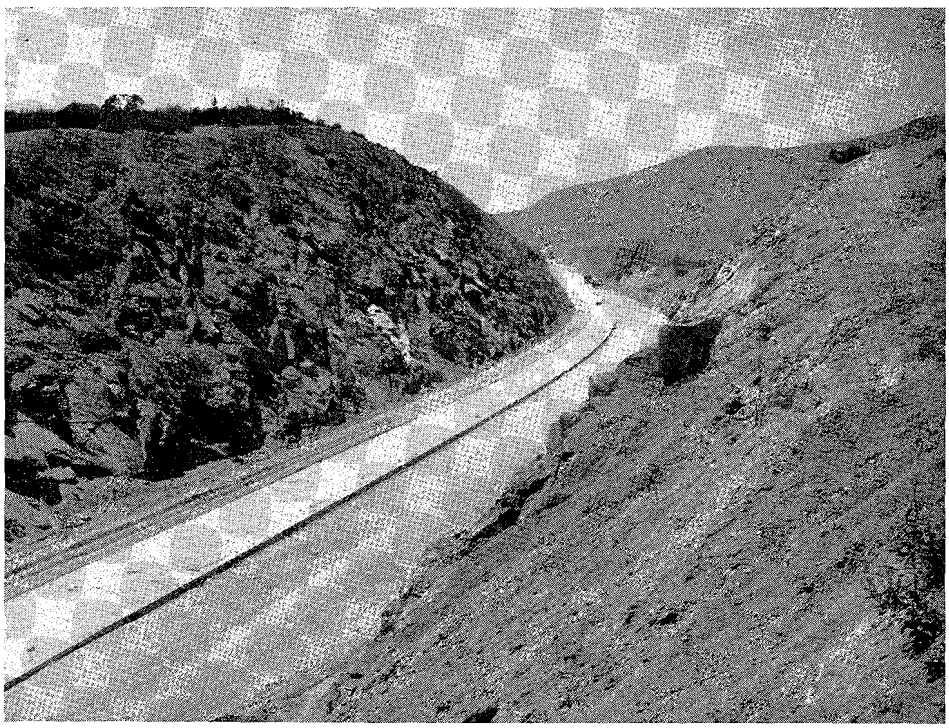
New alignment of U. S. 80 east of Alpine. Construction and paving operations.



BRUSH DISPOSAL

By A. A. MILLER
District Maintenance Engineer

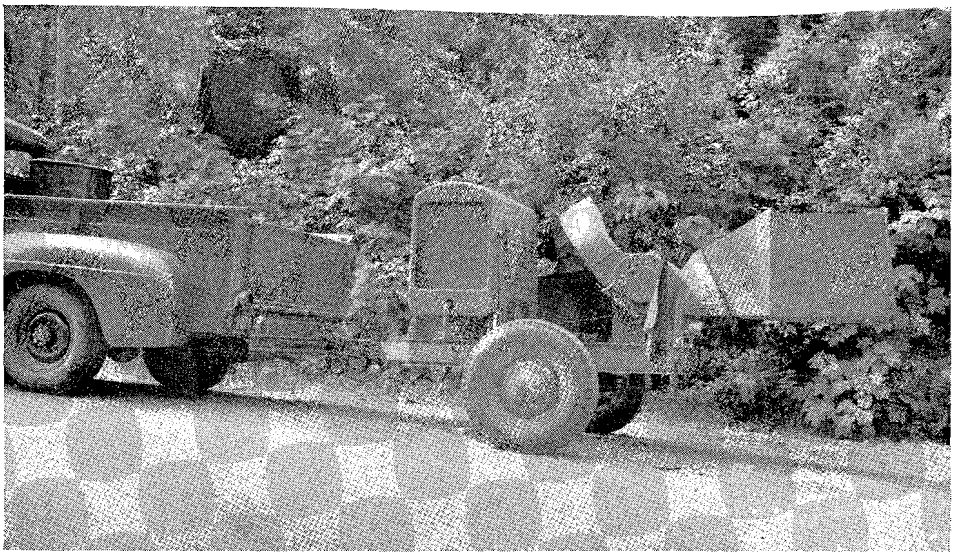
SUBSEQUENT to the article on "Vegetation Control" in the March-April, 1950, issue of *California Highways and Public Works*, District I has supplemented the heavy-duty brush cutter with a brush chopper to facilitate the disposal of brush removal.

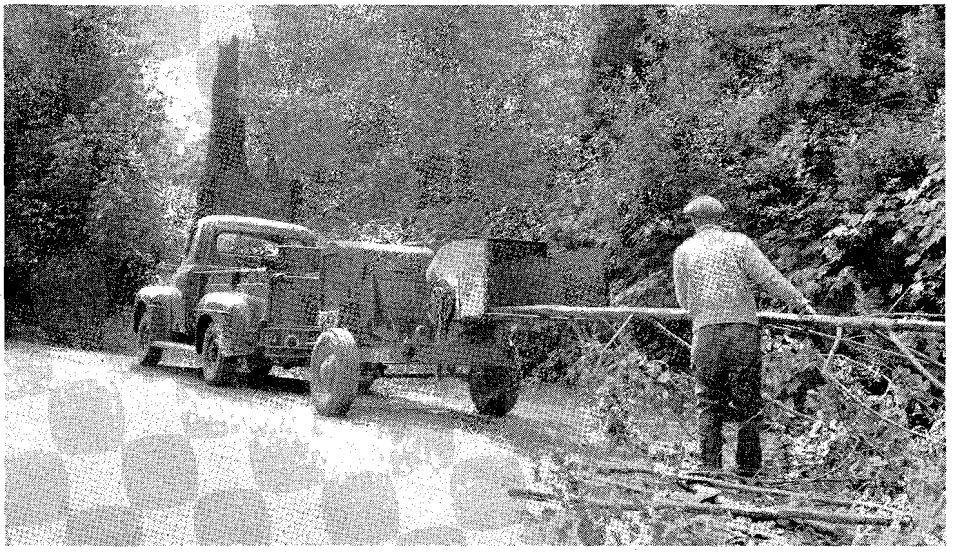
The brush chopper, which consists of a special planer head revolving at approximately 4,000 r.p.m. is powered with a fifty-horsepower gasoline motor. The speed at which the planer head revolves is sufficient to make it self-feeding, and at the same time discharge the chips and shavings for a distance of from 20 to 30 feet.

The machine is capable of disposing of brush and trees up to six inches in diameter as fast as two men can throw the material into the hopper. The hopper is so designed that it is almost impossible for a man to have his fingers come in contact with the planer blades, as the distance from the edge of the hopper to the planer blade is considerably more than the average mans' reach.

The chopper is mounted on a two-wheel trailer normally pulled by a pickup truck, which travels at variable speed, depending upon the amount of brush to be disposed of.

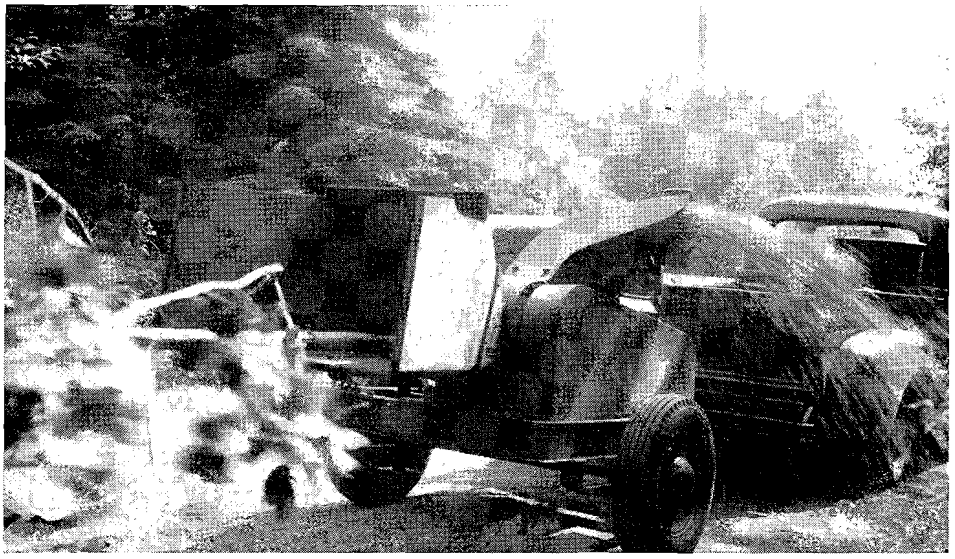
The chopper has been used to a considerable extent in the State Parks in Humboldt County, and local park officials have no objections to the resultant chips and shavings being discharged on the cut slopes. In the event the machine was being used in an area where such disposal was objectionable, the chute may be extended and the material discharged into a truck.





UPPER—Side view of brush chopper attached to truck. CENTER—Rear view of chopper. BOTTOM—Feeding trees into chopper.

The chopper has decreased the cost of brush removal over the previous method of loading on trucks and hauling to a disposal site. It has been estimated by the district tree foreman that he now disposes of the same amount of brush with the same crew in one day which previously required four days.

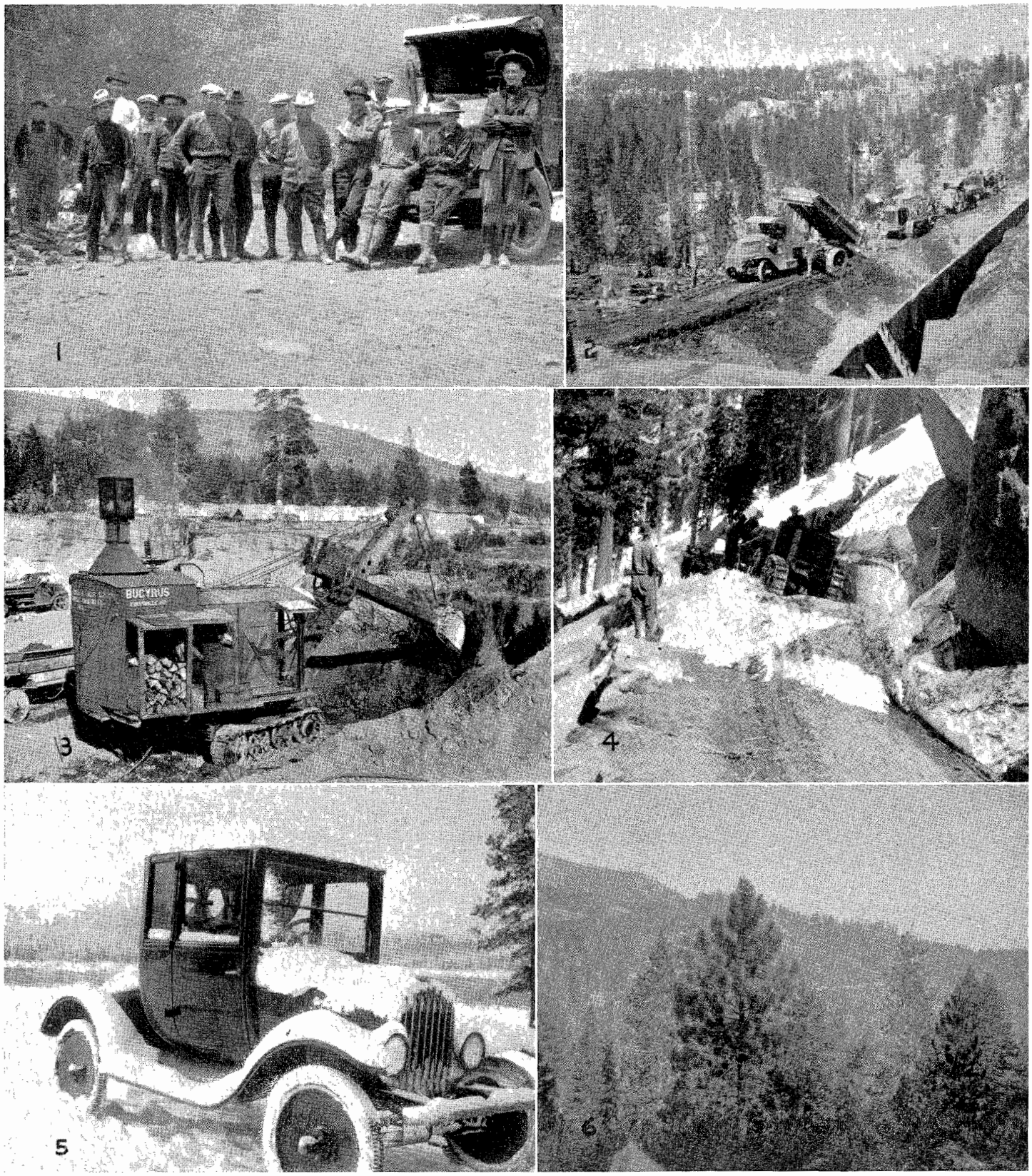


UPPER—Chopper drawing brush into hopper.

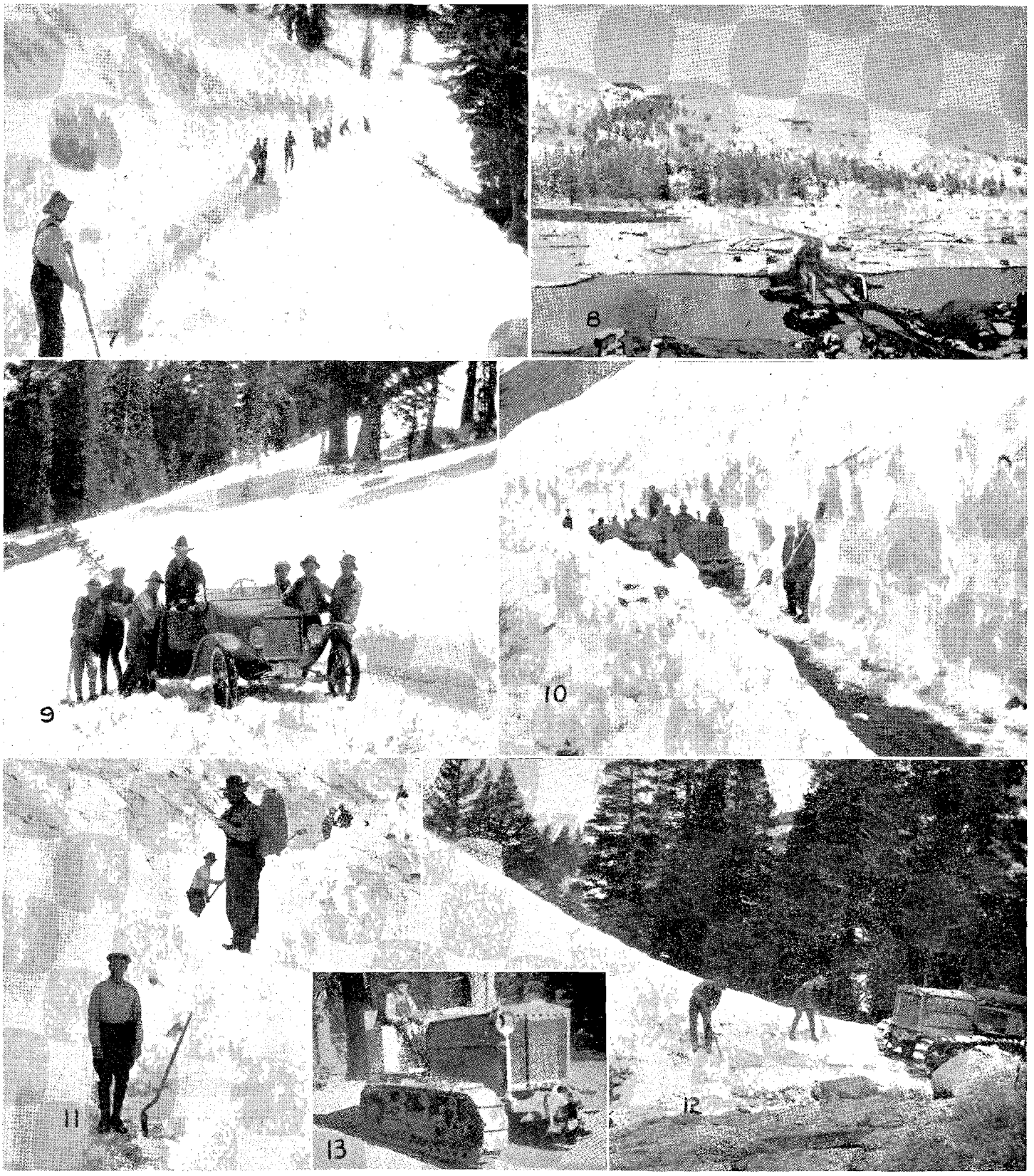
CENTER—Chopped material being expelled.

BOTTOM—Chips and shavings after expulsion.

The operating and maintenance cost of this piece of equipment is not high, requiring only the necessary gasoline and oil required for the 50-horsepower motor and resharpening the four planer blades once a week, which costs approximately three dollars a set.



Every time Tom Healy, Sacramento businessman sees a rotary snowplow or snogo in action he is reminded of the days he and a construction crew cleared snow off Sign Route 88 and Red Lake Grade in Alpine County with hand shovels. These photos are from Mr. Healy's Album. (1) Construction crew on Red Lake grade, Sign Route 88, in the summer of 1923, left to right, O. P. Brown, now Sheriff of Alpine County; Dick, the cook, fireman, shovel runner; Tom Brown, Gustafferson, shovel operator; Bill Giffin, Harry Slater, Lew Sackett, Tom



Healy, Bill Martindale. (2) Top of Twin Lakes Dam. (3) Power shovel used on project. (4) Summit of Carson Pass. (5) This Model T had rough going during construction. (6) Looking toward Twin Lakes from Kit Carson Pass. (7) Clearing snowdrift on Red Lake Grade June 24, 1923. (8) Old Twin Lakes bridge now at bottom of lake. (9) First automobile over road, close to Kit Carson Pass. (10) Opening of road on June 26, 1925, on Red Lake Grade. (11, 12) Clearing roadway with hand shovels. (13) Tom Healy operates tractor on job.

Headquarters Shop

Parts Department Expands To Meet Requirements

By EARL E. SORENSON, Equipment Engineer, and
JAMES A. FOLLINE, Machine Parts Storekeeper, Grade II

HEADQUARTERS Equipment Department of the Division of Highways operates a Parts Department at each of its shops, as an important function of its activities. The one at Headquarters Shop has recently been moved into larger quarters, and is now being reorganized along modern lines.

The expanding operations of the Equipment Department have been reflected in a demand for additional floor space for each subdepartment including administrative, accounting, service, stores, and the several shops. The truck repair shop has been moved into a newly completed structure of 12,261 square feet floor space. The administrative structure has been enlarged by 2,800 square feet. Several other shops have been relatively enlarged.

The expansion, over a period of time, of the numerous shop repair facilities, resulted in compressing the Parts Department from an original area of 4,420 square feet, into an area of 2,100 square feet. These expansions in turn were reflected in a demand for a greater volume of materials and supplies from the stores. As the Parts Department area was utilized "to the ceiling," it was necessary to spread out "all over the lot." This was neither efficient nor economical for the over-all function of Headquarters Shop as a whole unit.

Department Modernized

To bring the Parts Department into line with the other departments, it was moved to a covered area of 8,400 square feet, entirely separate but centrally located between the old shop and new truck shop buildings. Many improvements were installed in the new area. Equipment, materials, and supplies were transferred to new bins, shelves and racks. A modern Parts Department office enclosure of 400 square feet was provided.

After providing adequate quarters for the Parts Department, additional functions were instigated, accounting procedures were mechanized, and personnel increased. In order to better illustrate the growth of the Parts Department and its increase in space and personnel it would be well to remember that for June, 1941, the stock on hand at Headquarters was valued at $31,877, whereas June, 1951, showed a total valuation of $260,441. For the whole state-wide Equipment Department the materials and supplies inventory has increased from $153,700 in June, 1941, to $750,923 in June, 1951.

Growth of Stock Items

There has also been continued growth in the types of items carried in stock. At the present time there are 84 stock cards for new tires alone. These tires range in size from 3.00 x 7", 2-ply, costing $2.41 each, to 14.00 x 20" tires, 14-ply, costing $192 each. A few examples of the items carried in stock, showing the wide variance in values and types, are listed below:

Fan shaft for Snogo	$43.26	each
Joint cork seal for 1949-1950 Ford V-8	.015	each
Shaft 11T for Caterpillar tractor	30.90	each
Chrome Moly. steel, 2-inch square	.1153	lb.
Electrical tachometer and flexible shaft	109.00	each
Lacquer	1.50	qt.

Next it was found that though we had much more floor space, our increased activity demanded that it be most efficiently utilized. To accomplish this, the old storage bins are being reconstructed into more efficient and modern shapes. To these changes, 19 Rotabins, two cabinets, one 90-drawer small parts cabinet, 1 rotary drill cabinet, and a 16-section bulk rotary bin have been added. To these will be added eight 3-deck tire racks, 10 feet high and 15 feet 6 inches long, which will provide 372 lineal feet of tire storage space. These tire racks were designed by the Parts Department and are under construction at this time.

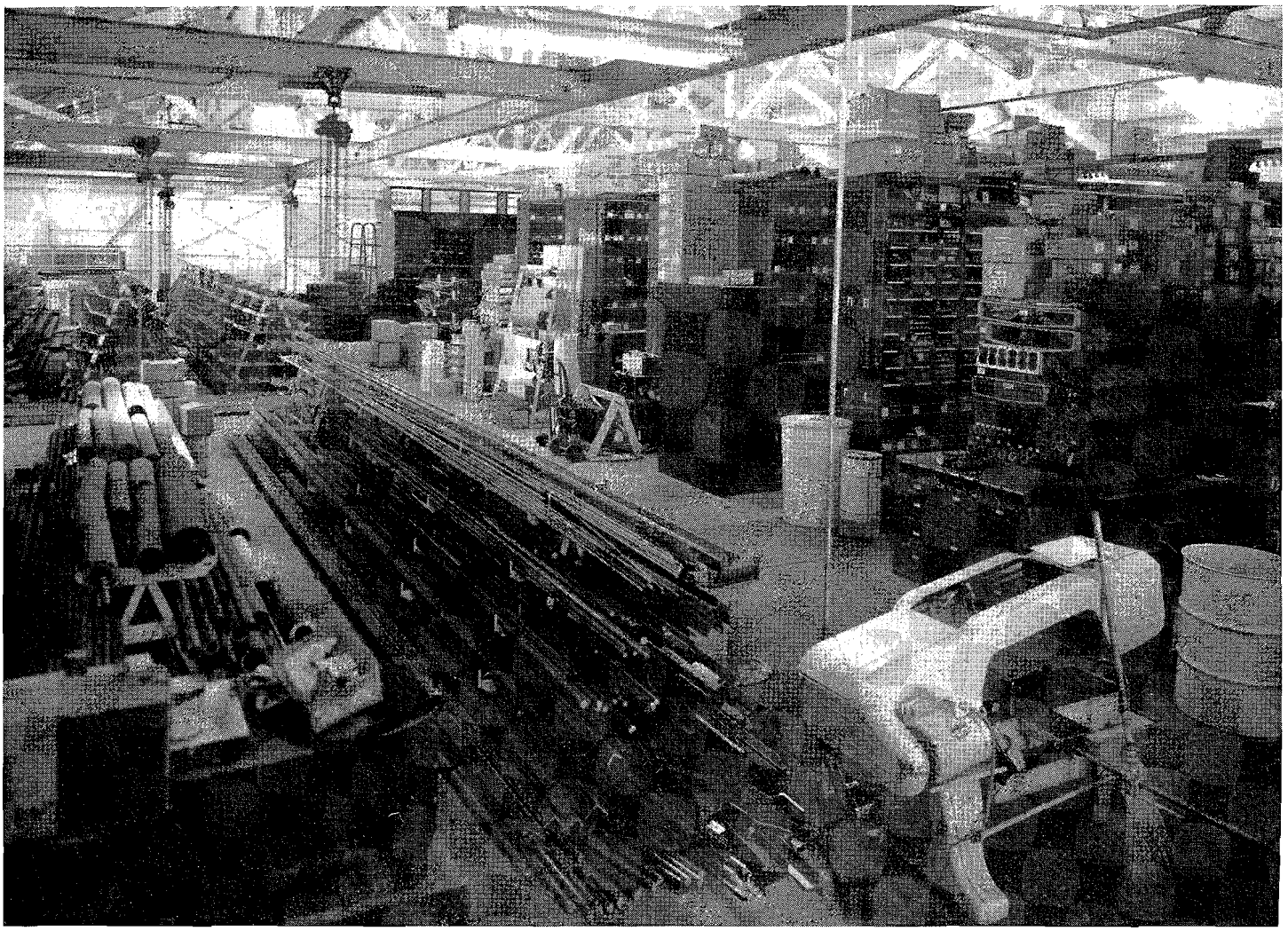
Increased Demand

To supply the increased demand for materials and supplies, it was necessary to order and maintain much larger quantities of individual items which require larger individual storage spaces. This in turn meant storing items further from the issue window and causing undue delay in servicing requests. To overcome this disadvantage rotary bins and cabinets have been installed close to the issue window and only a week's supply, or less, of all fast-moving items have been "binned" within 20 feet of the service window. This represents better than 90 percent of the fast-moving stock items and supplies, and effects great economy in time for issuing.

Each bin is located by a bin number, which is recorded on the stock records. Most of these "token bins" have a much larger "over-stock" bin further back from the service area. These "over-stock" bins, in turn are located, numbered, and noted on the "token bin" tags. This cross-numbering provides a simple and fast means of replenishing any "token bin" in short supply.

Items Grouped

Because the number of individual items was becoming so great and the resulting number of stock cards and volume of paper work increasing proportionately, it was necessary to group items of like kind and of equal value, to minimize the detail work. Items of small value or items issued in measurements of less than a standard unit are purchased against a permanent job number and designated as "miscellaneous small purchases" (M. S. P.). Once a month the accumulated value in this job number is cleared by credit and



Interior of Parts Department dispensing stockroom, Headquarters Shop, Sacramento

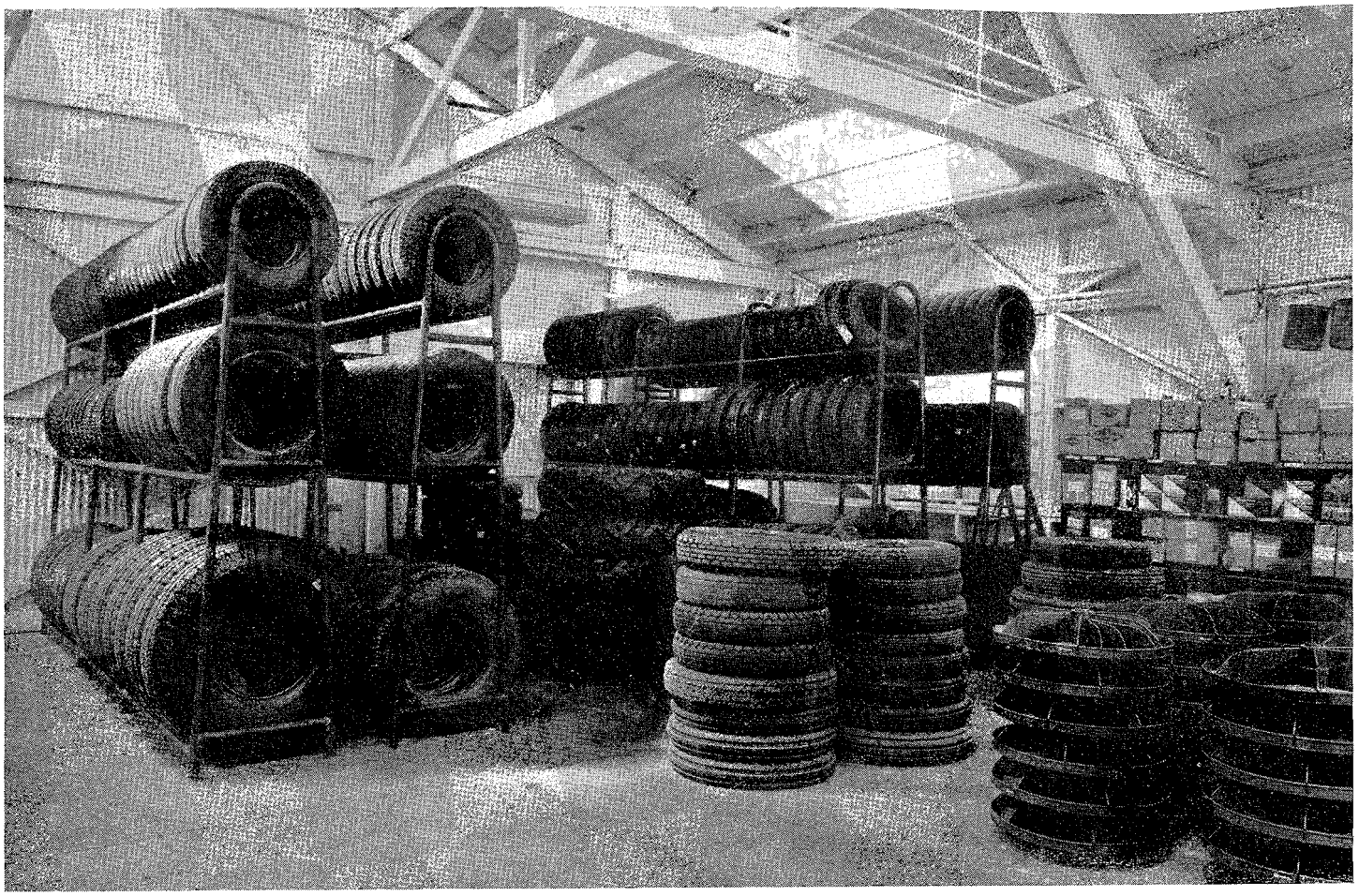
debited in one lump sum to "stock" on a card designated as "MSP." This eliminates a large volume of detailed posting on the stock card. This "MSP" stock is disbursed by the issue window clerks, at an equitable rate that maintains a controlled value of $2,500 to $3,000 in this account. Steel, bronze, spark plugs, etc., more or less of equal grade, shape, or value, are likewise grouped and disbursed in set units of measurement and value.

Keeping Records

The department was also confronted with the problem of keeping adequate records to properly control operations down to the smallest item. After a thorough study, it was decided to install rotary card files, each capable of filing over 6,000 stock record cards. This type of rotary filing wheel takes up a minimum of space, is easily operated, and makes a maximum number of records cards available to the operator with the least amount of effort. Two of these filing wheels have been installed at Headquarters Shop Parts Department. One wheel is handled by the issue window clerks. This stock record system involves the use of two different stock record cards, each type of card having two colors—buff and salmon. The buff cards denote the item is to be charged for, and the salmon cards denote the article to be "MSP" or no-charge. This color scheme has been adapted for use throughout the records and stock bin tags.

Permanent Master Record

Another wheel will be kept in the Parts Department Office to carry a permanent master record. These cards are designed to record by coded description, location, unit of measure, model, application, cross index of application, amounts received, issued, and balance, amount ordered, requisition number, date, purchase order number, vendor's name, and amounts received. In addition, these cards are designed to cover specifications, minimum and maximum stock to be carried, amounts and units of purchase, references and other essential information. These cards are as near a complete Parts Department record as can be set up on one card and they also eliminate the "want book" and "local request" form. Specification standards, to be used for reordering, will also be carried on these cards. It will then be a simple matter to compile a complete and accurate requisition with items separated as to like kind and designated Purchasing



Equipment Department constructed five racks for storage of tire inventories

Department buyers. They will, in effect, be a complete catalog of parts and materials carried in stock and of maintenance supplies regularly purchased. Anyone knowing the classification or name of any given item can immediately ascertain its location, vendor, price, technical description or any other information desired.

New Forms Created

Several additional records have been designed to expedite Parts Department operations. Form 106 has been created to expedite the taking of inventory and is used in the bookkeeping machines the same as Whiz Register Form S-104, to immediately adjust any discrepancies. A materials tracer postal card with three copies has been placed in use—original, vendor; duplicate, purchasing division; triplicate, storekeeper; quadruplicate, schedule clerk. These tracer cards are made up as one-time carbon snap-out forms. They are mailed out once each week and have proven very successful in expediting deliveries. Other changes in procedure and record forms are now under consideration.

A change in the method of storing and handling steel has been instituted. Storage racks have been installed, under cover, with overhead trolley chain lifts to facilitate handling of the steel. All requisitions for steel are filled in sizes cut to exact measurement. To accomplish this a metal-cutting band saw running in fluid cutting compound has been installed. Steel handling when expedited in this manner requires the time of only one Parts Department employee permanently assignd to this operation.

New Equipment Records

Receiving, checking, and transferring of new equipment is handled by two members of the Parts Department staff. Forms S-57, S-157 "Equipment Check Sheets" and Form S-82, "Equipment Data Card" have been revised to more readily record the many details in modern equipment. These revisions have been so designed that the sequence of recorded information will be the same on each form. It is the Parts Department responsibility to see that each transfer of rental equipment to a district shop superintendent be accompanied with accurate check sheet, data card, and other necessary documents. This will eliminate or cut to a minimum the time necessary for the district shops to receive new equipment on transfers. This operation is handled by two members of the Parts Department staff who also receive, handle, and disburse tires, oils and fuels.

A service station with one permanent attendant is maintained by the Parts Department. The usual services are rendered and a monthly average of 6,500 gallons of gasoline is dispensed.

... *Continued on page 55*

Maintenance

Highways Are Not Good Highways Without It

By C. F. WOODIN, Supervising Highway Engineer, Maintenance

It is the intention of this brief discussion to reverse the famous radio quiz program by providing 20 answers to the query: "What does the Maintenance Department of the Division of Highways do?"

Before presenting the direct answers, it is proposed to comment on some of the factors providing serious problems to the organization in the fulfillment of its operations.

Referring to the chart in *Fig. 1*, a ready comparison may be made between the California Highway Cost Index (see also *California Highways and Public Works*, March-April, 1951), and annual maintenance expenditures during the decade, 1940 to 1950. It will be noted that maintenance expenditures increased at a much lesser rate than the cost index in spite of the fact that:

1. The average wage increased from $146 per month in 1941 to $303 in 1950,
2. Equipment rentals have likewise increased appreciably,
3. A large portion of the field forces has reached an average age of 45 or better.

Some Factors

Although *Fig. 2* shows a reduction in field personnel from 3,495 in 1941 to 2,384 in 1950, the average monthly pay rolls for the same years aggregated $510,000 and $715,000, respectively.

Other factors which place a strain on the physical and financial resources of the maintenance organization include (1) the doubling of traffic lanes and right of way acreage when existing highways are transformed through reconstruction from 2-lane rural roads into 4-lane divided freeways; (2) the increase in landscaped areas; and (3) the widespread installation of traffic signals and intersection illumination made necessary by the extraordinary upsurge of traffic since World War II.

To meet the conditions described, it has been necessary to expand to a greater degree the use of equipment or to substitute methods which more exclusively utilize various types of equipment. This planned revision in procedure is reflected in the results illustrated in *Figs. 1 and 2*.

Now, what does this organization do? What are the activities which contribute most toward the expenditure of more than $20,000,000 annually? The following answers are necessarily brief but it is hoped that they may furnish a clearer perception of the scope and versatility of this close-knit section of the Division of Highways.

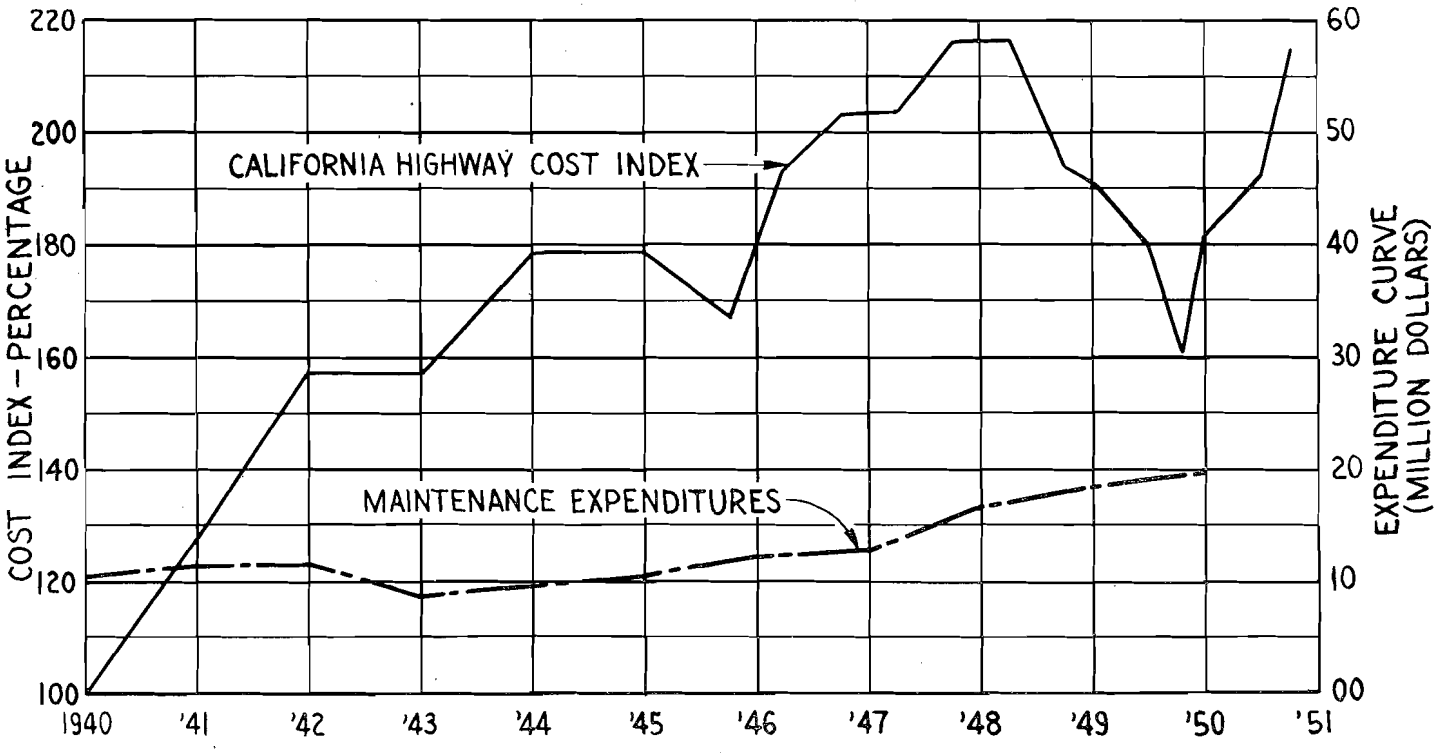


FIGURE 1

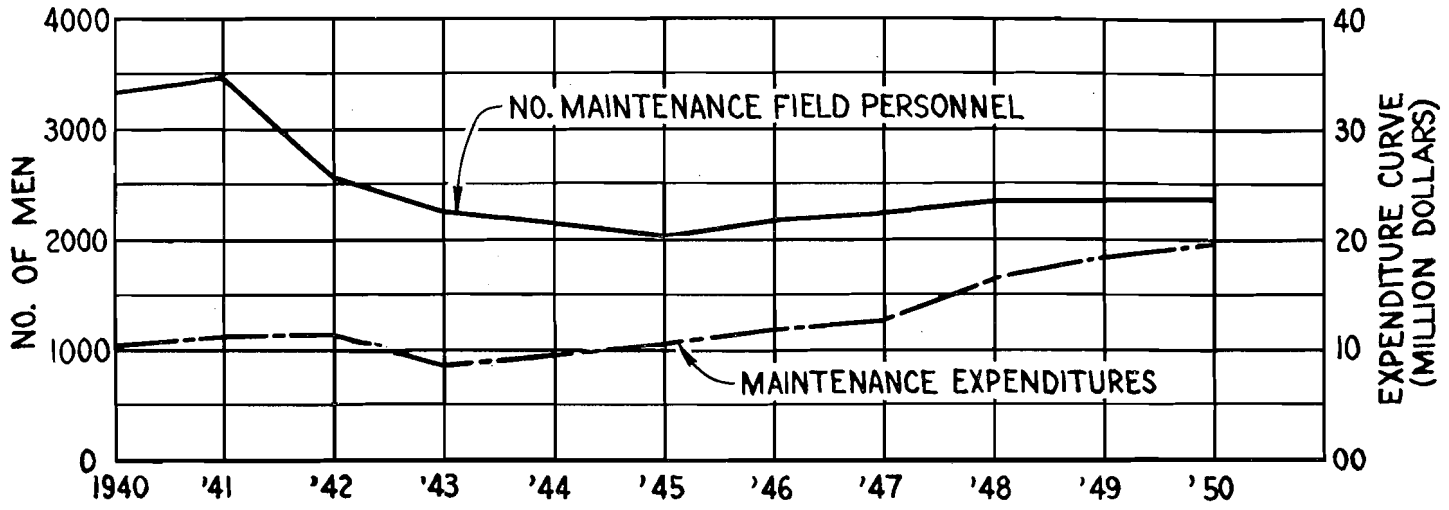
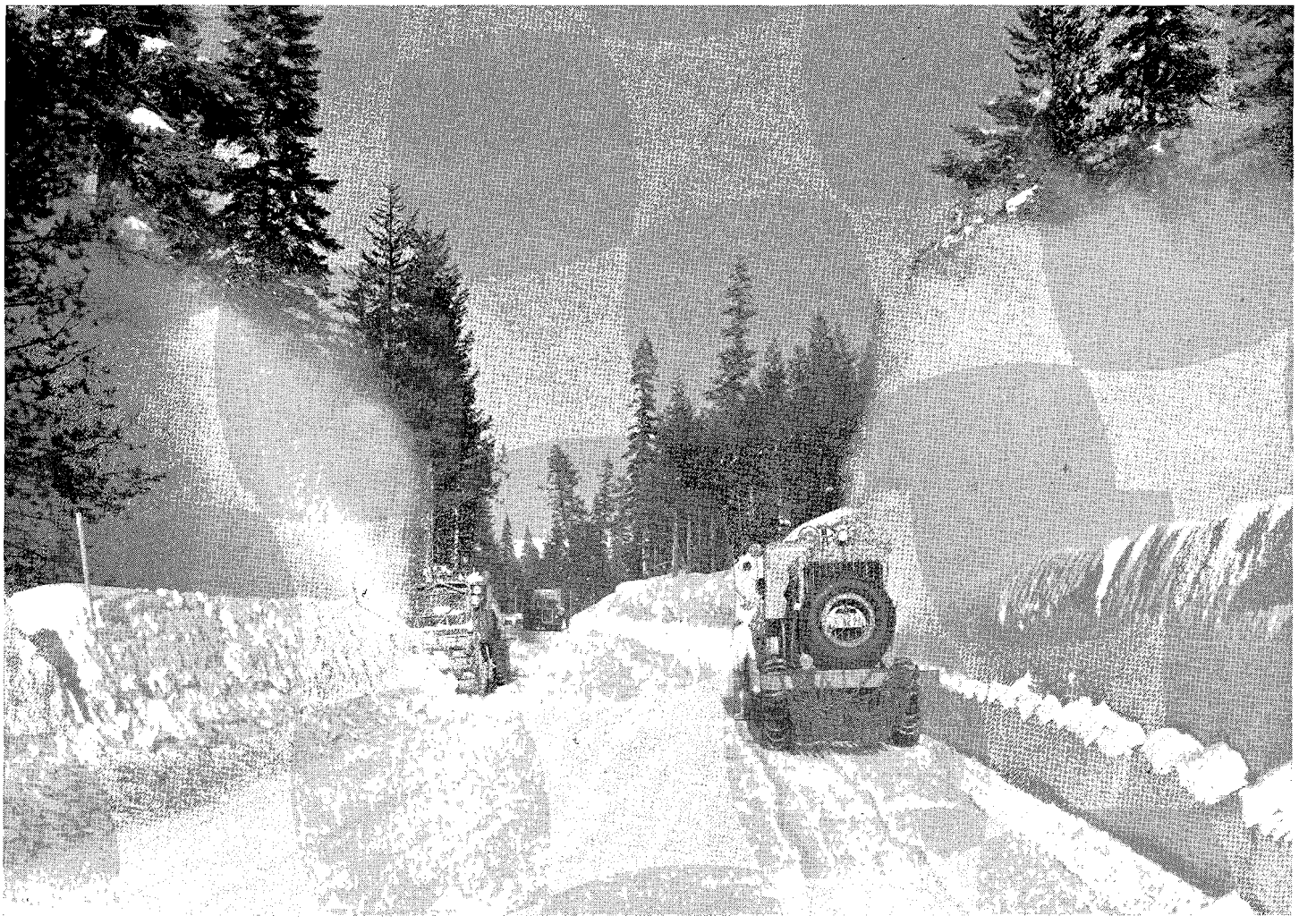


FIGURE 2

Rotary plows dispose of snow remaining after heavy push-plow operations



SNOW REMOVAL AND DRIFT CONTROL

For the romantic and adventurous, this phase of maintenance operation has particular appeal. To them, snow is associated with beautiful scenery in a calm, quiet setting where the young can toboggan and ski and the oldster can contemplate the view. In the removal of snow the picture changes in aspect. First, it is a 24-hour job. Second, the work must proceed whether in blizzard or sunshine, daylight or dark. And last, the job must continue until the road is reasonably traversable and traffic has resumed its normal progress.

However, in spite of the rugged demands made upon the crews assigned to this activity, there is a spirit of enthusiasm in their work that is difficult to match in any other maintenance endeavor. In the bunkhouse between shifts, stories of current incidents are swapped and the succeeding crews report to their assignments with added fervor.

Drift control is a dry weather activity. Permeable type fences are located to the windward after careful study of prevailing wind directions and winter drifting conditions. At many locations, the drift fence is the economical factor determining whether the road can be kept open continuously with the available snow removal equipment.

Snow removal, sanding icy pavements and drift control cost $868,000 during the 1950-51 Fiscal Year. This and all other cost figures shown hereinafter do not include general expense items which are pro-rated as a final accounting procedure.

STORM DAMAGE REPAIR

The past winter has furnished spectacular examples of storm damage amounting in the aggregate to approximately $4,300,000, and for which $670,000 was expended from maintenance funds. In addition, these funds furnished $1,676,000 to cover the cost of ordinary slide and storm damage repair, which figure is in excess of the previous year's expenditure for like repair by $378,000.

Notable among the instances of unusually heavy damage was the All-year Highway in the Merced Canyon between Briceburg and the Yosemite National Park boundary. A contract has been recently let for the repair and restoration of the highway and the placement of slope protection along this 18-mile stretch at a cost in excess of $1,200,000. Prior to this, in order to carry traffic safely through the affected area, maintenance forces spent some $42,000 constructing detours around two washouts, shifting the road into the bank at narrowed sections, placing stone rip rap protection at vulnerable spots, and installing the usual signs, lights and barriers for traffic safety.

Emergency replacement and protection at washout on U. S. 40 east of Truckee last winter. First consideration is for the safety and resumption of traffic.

Other similar damage occurred along the Smith River in Del Norte County, in the Kern River Canyon east of Bakersfield, and along the East Walker, Truckee, Carson and Yuba Rivers in the Sierras.

EROSION CONTROL

Erosion control is linked very closely with storm damage repair and in some instances may be identical. It may involve the repair or extension of existing installations or the placement of new units. Repairs or extensions are not necessarily made in kind. Sack concrete rip rap is very adaptable for this purpose and is an economical type wherever an abundant supply of suitable creek- or bank-run gravel is available. Recently failed seawalls which had served for many years were replaced or reinforced with extra heavy stone rip rap. With the continued disintegration of the seawalls, it is expected that similar repairs will be required in the near future.

Erosion occurring from rainwater falling or flowing on fill or cut slopes has been effectively reduced with artificially established vegetative ground cover combined with straw, wire mesh or brush layers. The greatest vulnerability of this type of protection occurs during storms before the plantings have become sufficiently established. Repairs may consist of the replenishment of eroded soil and plantings or, in the case of fill slopes not in view of the road, a gravel blanket or backfill may be used to replace eroded areas or to stabilize the entire slope.

SLIDE PREVENTION AND CORRECTION

It can generally be stated that the cause of most slides is the presence of water within the slide mass. Any practical and economical means of intercepting and removing that water before it has saturated or lubricated the potential slide, should prevent future slippage. However, such procedure is not always practical and unless the earth mass is too large, unloading the slide at the top and intercepting surface water from the slide area has been successful.

At larger locations, exploratory vertical borings are made to determine the location of the water-bearing strata. Benching of the slide area and the driving of horizontal drains to tap the water wherever it may be found are frequently combined as a corrective method. Smaller slides are sometimes supported and retained at the road level

with crib bulkheads or may be removed entirely to the slippage plane. Slipouts —those slides which are entirely below the roadway—most seriously interfere with traffic. Usual treatment consists of complete or partial removal to the slippage plane, installing subsurface drainage and backfilling with a material less susceptible to slipping. Some slopes slump through saturation of the earth either from surface water, subsurface water or from the rise and fall of an adjacent stream. Lateral support by means of cribbing is the usual remedy for this condition.

TRAFFIC STRIPING

Some 11,500 miles of state highways are striped at a cost of over $600,000. Glass beads are applied to improve night visibility and, in addition, to increase the service life of the stripe. Considerable research continues with various lacquer ingredients in an effort to eliminate those materials which are imported and in short supply or unavailable during periods of emergency.

Striping is applied by special crews in each district using machines designed by the Equipment Department. The striping machines are highly automatic and when once adjusted will place a single, double or triple line either continuously or dashed as conditions may require. The machine also applies the glass beads simultaneously with the traffic lacquer.

In some districts, depending on the organizational set-up, pavement markings such as pedestrian crossings, "Stop" or "RR Xing" signs may be applied by the district-wide striping crew or by others assigned within a superintendent's territory.

REPAIR OF BRIDGES AND STRUCTURES

The Bridge Department has assigned several engineers to make periodic inspection of state bridges. Their reports provide a statement of condition and recommend the need of any repairs or improvement. On the basis of the recommendations, the necessary work is done either by contract or state forces. Bridge maintenance costs were approximately $650,000, of which $345,000 was expended for bridge painting.

Movable span bridges entail additional expense due to their operation

Incessant hammering by the ocean and other natural forces require vigilance and ability to cope with such problems as this

requirements. With the exception of the Petaluma Creek bridges, they are located principally over the lower Sacramento and San Joaquin Rivers and in the delta region above the confluence of these two major streams. Two ferries operate near Rio Vista.

About 50 operators are required for both bridges and ferries and the cost of operation amounted to $250,000 for the 1950-51 Fiscal Year.

PAVEMENT REPAIR

The usual popular conception considers highway maintenance to be confined principally to patching pavements. It should be noted that although it is an important function of the Maintenance Department, there are other operations which, in the aggregate, occupy a larger portion of the field crews' time and effort.

Pavement repair includes several suboperations such as patching small failed areas with bituminous-mixed material, restoring base and surface in isolated areas, scarifying and remixing bituminous surfaces and placing seal coats or plant-mixed blanket courses of limited thickness.

Over $3,600,000 was spent during the 1950 oiling season in the resurfacing, reprocessing and seal-coating of both pavement and improved shoulders. This figure does not include the patching and repair accomplished as ordinary maintenance procedure.

SUBSEALING

This is a relatively recent development in the treatment of concrete pavements. Displacement at the joints, called "faulting," is a result of the loss of subgrade material through the pumping action of heavy loads traversing the pavement during wet weather.

First experiments in California were conducted in 1944 and 1945 and consisted of forcing low penetration asphalt beneath the pavement to fill the void formed by the loss of material. Such good results were obtained that the treatment has been continued until now there have been expended over one and one-quarter million dollars for the purpose. Exclusive of the work done under construction, subsealing work during the past year cost in excess of $161,000.

PAVEMENT JOINT AND CRACKFILLER

This operation has been in force for many years, its principal object being to exclude surface water from entering the subgrade through the joints or cracks. At first, low penetration air-blown asphalts were used but because they became very brittle in cold weather and lost their adhesive qualities, they were blended with a slow-curing material with somewhat improved results. However, the softer blends, although adequate at low temperatures, tended to run out of the joints during the summer and were lost.

The harder blends were equally unsatisfactory in winter.

Through research and experimentation in cooperation with the Testing Laboratory, there has now been developed an asphaltic latex emulsion which when handled according to specifications has given very promising results, although it is yet too early to determine its service life. Further development has been made in cleaning and preparing the joints for filling. There is now in general use a mechanical pavement joint cleaner, power-driven, to remove the old oxidized filler and insure a better bond between the pavement and the new material.

STATE PARKS

Provision has been made in the Streets and Highways Code (Section 186) to maintain highways in state parks. Bridges are inspected and maintained as for state highways and general maintenance of the main public roads, excluding parking and camping areas, is performed as required. Improvement work is done under service agreements issued by the Division of Beaches and Parks.

SIGNS

The maintenance of warning, directional and informational signs requires the full time of 20 men equipped with 17 trucks having bodies especially designed for this work. These crews also make installations of new signs on construction projects. The annual cost of maintaining signs approximates $200,000.

SIGNALS AND ILLUMINATION

There are 1908 signalized intersections on state highways throughout the State. Of this number 921 are maintained by the State, the remaining 987 being maintained by a few of the larger cities for which the State is billed for its pro rata share based on the number of entering roads which are a part of the state system. The maintenance of the 921 signals operated by the State requires the services of 45 men. In the two metropolitan areas, Los Angeles and San Francisco, highly specialized crews are on call on a 24-hour basis. Intersection illumination has expanded appreciably and requires constant maintenance in their operation. The annual cost of maintaining signals and lighting amounts to approximately $380,000.

RADIO COMMUNICATION

Radio initially was limited particularly to the snow routes, U. S. 40 over Donner Pass and the Pacific Highway (U. S. 99) north of Redding. Later, it was expanded to the northeasterly portion of Modoc County and east of the Sierras in Mono and Inyo Counties. The next expansion was to include the San Bernardino Mountain area and the Ridge Route in Kern and Los Angeles Counties. Installations are now in progress for the remaining districts in the State.

Combination loading and breaking equipment picks up and pulverizes hardened bituminous pavement in the process of remixing and stabilizing

Road information reports are published each work day during the winter and early spring and are available to all automobile clubs and key radio broadcasting stations or wherever the dissemination of such information will benefit the traveling public.

MISCELLANEOUS TRAFFIC PROTECTION AND SAFETY

When emergencies arise, quick and accurate decisions are in order. An extraordinary slide, a flooded roadway or a washout can be a disaster or a minor incident depending on the dispatch with which the maintenance personnel places warning signs, barricades and flagmen. Delay in establishment of detours may cause a traffic jam which may take hours to disentangle. In this regard, the Maintenance Department are proud of their record and the men who made that record possible. With the more extensive use of radio, such situations should and will be met with greater dispatch.

TREES AND LANDSCAPING

With the rapid development of urban freeways and the resultant increase in landscaped areas from 1946 to 1951, the crews required to handle this specialized phase of maintenance have experienced a 200 percent expansion from 68 to a total of 203 men over the same period. The watering, pruning and general upkeep expense cannot be avoided if a desirable standard of appearance is to be preserved. The annual maintenance cost of this phase of operation has now reached $930,000.

FIRE HAZARD CONTROL

The spraying and burning of roadside vegetation to provide a firebreak has been an annual program, with portions of the work being done cooperatively with various counties, the State Division of Forestry and the U. S. Forest Service.

Several methods are in use to prevent the spread of fires originating in the highway area. Spraying a strip between the roadway and the right of way line with a light application of diesel oil while the vegetation is still immature and later burning the deadened growth before adjacent vegetation has developed to the inflammable stage is one of

the earliest methods and is still being used with success. Depending on climatic and local conditions, chemicals such as sodium or other chlorates are used for their sterilizing effect. This treatment is of particular value around guard rails, bridges and sign- and guideposts. Mechanical methods by discing, blading, mowing or early burning each have their peculiar advantage under certain favorable conditions. Approximately $192,000 was the Division of Highways' share of the cost of this work for the year ended June 30, 1951.

PERMITS

Legal limitations are defined in various state codes as to use of the highways. These include dimensions and weights of vehicles and loads, the routes upon which excess loads may not operate, the placing of signs within or adjacent to a highway, the planting or injuring of any vegetative growth within the right of way, and the establishment of openings or other encroachments within a highway. Under certain conditions, the limitations may be modified through the issuance of a permit after due consideration has been given to the protection of highway traffic and to the highway itself.

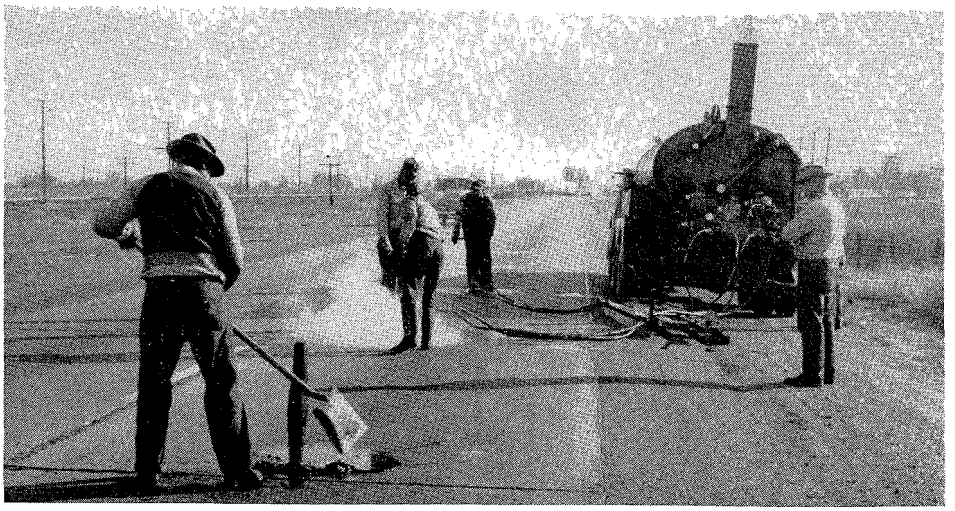
For the Fiscal Year 1950-1951, over 55,000 permits were issued, with nearly one-half issued in the Los Angeles and San Francisco areas.

EQUIPMENT COORDINATION

In order to secure the optimum use of state-owned equipment, a coordinator has been assigned in the larger districts. His work is especially valuable during the busy summer months, when the oiling program activities must be scheduled in order to utilize the limited available equipment to its greatest capacity. This operation has been instrumental in reducing costs and increasing efficiency.

RESEARCH AND SPECIAL INVESTIGATIONS

Without research and studies of special problems, little progress or improvement could be made. Involved in this activity through the years have been joint-filling and traffic stripe material studies, as well as methods of pavement repair and slide prevention. Additives in bituminous materials to increase their resistance to stripping,



By increasing capacity of asphalt heating unit, subsealing can be done by two nozzlemen simultaneously

subsealing materials and methods, and erosion control have also been subjects of special study.

In 1937-38, special investigations in connection with the heavy flood damage of that winter were made in cooperation with the Design, Construction and Bridge Departments. A manual, "California Culvert Practice," was the result of cooperative study with the same departments. Participation in a joint research, investigation and study of bank protection, shore protection and erosion control is now in progress with the publishing of a manual covering the design and construction of bank protection installations as its principal objective.

STATE HIGHWAYS IN CITIES

Since January 1, 1948, the maintenance of state routes through cities has been a responsibility of the Division of Highways. If a city is properly organized to handle various phases of the work, such work is delegated to them through a special agreement. In general, the larger cities are equipped to handle complete routine operations while in the smaller cities, the assignment consists mainly of cleaning and sweeping.

Maintenance funds were expended for the 1950-51 Fiscal Year as follows:

Work done by cities	$1,527,567
Work done by State	1,514,669
Total	$3,042,236

Outdoor advertising, the foster child of the Maintenance Department, is self-supporting through license and permit fees which are required for each advertising sign placed in rural areas under the Outdoor Advertising Act. Among other restrictions, advertising signs may not be placed or worded so as to confuse highway traffic, obstruct the view at curves or intersections, nor are they permitted to direct traffic or to simulate an official sign or signal.

Because of their distribution throughout the State, maintenance men and their families are a composite part of their respective communities. Their participation in service clubs, P. T. A.'s and other community betterment projects helps to promote good public relations. During pavement operations or emergencies, the maintenance man's first consideration is the care of traffic with a minimum of delay. The flagman courteously answers questions, informs the traveler why the delay is necessary and cautions him as to the hazardous conditions which might be ahead. Further public contact occurs through the maintenance superintendents and foremen in their daily routine, whether it be with adjoining property owner asking for a drainage improvement or requesting a permit for the paving of his driveway.

The result of these contacts influences greatly the opinion that the general public forms concerning the Division of Highways in particular and the State Government in general. The over-all result in this regard has been gratifying.

Mountain Road

City Creek Highway in San Bernardino Officially Opened

COMPLETED by stage construction of five units costing a total of $3,900,400, the 15-mile City Creek Highway connecting the City of San Bernardino with mountain recreational areas officially was opened to traffic for its entire length on August 19th.

A two-day celebration marked the occasion and attracted 8,000 persons. Dedicatory ceremonies were held at Running Springs, where Lieutenant Governor Goodwin J. Knight officiated at a ribbon-cutting.

New City Creek Highway is a far cry from the original City Creek Toll Road, built for only $52,000 in 1891 as an access road by the Highland Lumber Co. The county, under an act by the State Legislature, bought the road in 1903 and widened it with the aid of prison labor. It was not until 1935 that the State took it over as part of the State Highway System and designated it as Route 207.

Describing the celebration at Running Springs, Lew Barrett, writing in the San Bernardino *Daily Sun*, said:

"City Creek Highway, officially opened to the public at Running Springs yesterday, was cited by Lieutenant Governor Goodwin J. Knight as one of the reasons why 300,000 Southern California residents make vacation trips every summer month to San Bernardino Mountains.

"The elaborate ceremony climaxed a two-day celebration at Running Springs which attracted 8,000 persons for Saturday night's show featuring Ina Ray Hutton, Dan Dailey and Geraldine Mapes.

"Following the ribbon cutting at 11.45 a.m., the Acting Governor of California, his guests, Members of the California Highway Commission and 2,000 spectators attended a western barbecue and vaudeville show.

"Lieutenant Governor Knight congratulated members of the county board of supervisors, Sheriff Eugene L. Mueller and members of the mountain community for their efforts to get the freeway completed. He said:

Beautiful Highway

" 'It is a beautiful highway connecting San Bernardino Valley to the vacation land of pines, clear blue sky, no fog, no smog, and such highways as these are the reasons why many thousands are planning to come to your mountains this summer and why 300,000 every month have visited them in the past.'

"Two members of the highway commission were honored guests. They were James A. Guthrie, editor and president of the Sun Co., and Harrison R. Baker of Pasadena. Mr. Guthrie thanked the Acting Governor for his kind words and then said:

" 'This highway climaxes 20 years of hard work and it represents one-fifth of all the state funds spent on highways in San Bernardino County since the close of World War II, or $3,900,000.'

Tribute Paid

"Mr. Baker paid tribute to Mr. Guthrie and other fellow members of the Highway Commission for their efforts which brought about California's excellent highway system.

"Others who spoke words of greeting and congratulation were State Senator James E. Cunningham, Sheriff Mueller, District Attorney Lowell E. Lathrop, H. George Cunningham, supervisor; S. W. Lowden, district engineer, and Ted Meyers, radio announcer who served as master of ceremonies.

"In his invocation, the Rev. Fr. Michael O'Duignan, pastor of the Lake

. . . Continued on page 52

Highway Opened—Lieut. Governor Goodwin J. Knight snips ribbon to officially open City Creek Freeway to the public at Running Springs. Left to right are State Senator James E. Cunningham, James A. Guthrie, Highway Commissioner and Editor and President of The Sun Co.; Lieut. Governor Knight, Harrison R. Baker, Member of the Highway Commission, and Lloyd Soutar, Running Springs businessman, who was chairman of the celebration.

HIGHWAY DESIGN AND THE BUSINESS COMMUNITY

This paper was delivered by E. T. Telford, Engineer of Design, Division of Highways, at the 22d annual meeting of the Institute of Traffic Engineers, a national organization, in Los Angeles, September 23-27. It is recommended reading for all employees of the Division of Highways and for all civic groups and individuals who are interested and concerned with our highway problem.

IN ANY APPROACH to the problem of the relation between highways and the business community, one of the first things to define is the business community. All too frequently the highway engineer finds himself involved in a serious design problem which involves a small concentration of retail business. A repetition of these problems leads to the impression that the business community is a thing apart, a special case as it were of specialized local interest represented by owners of motels, service stations and retail businesses.

Look at Broad Picture

If we will stand back a reasonable distance from our immediate problems and look at the broad picture, we find that the business community includes *production* in the form of agriculture, mining, lumbering, manufacturing, etc, *distribution*, both wholesale and retail, including the super-market or the corner grocery where your wife buys coffee and other items of your breakfast. We have also the miscellaneous field of news, entertainment, travel, etc., as well as the business of administration including the financial fields of banking and all the related fields which go into this business community All are mutually supported parts of the whole economy and are tied together by the business of transportation and communications. Communications might be termed the transportation of ideas and information. Of course, we have the business of government, local, state, and national, with its civil and military operations and responsibilities. It, too, functions effectively to the extent that transportation and communications in all their forms operate freely and adequately.

Importance of Highways

The importance of highways to the business community has been recognized by the action of legislative bodies at all levels in providing funds for highways and legal basis for organization to handle administration of those funds to provide the facilities demanded by traffic.

Our particular task is that of providing a safe, smooth and comfortable path for operation of motor vehicles engaged in the transportation of persons and goods. The purpose of this transportation is as varied as the lives of the individuals concerned, from an afternoon shopping tour to the transcontinental movement of heavy freight.

The professional responsibility of the highway engineer includes not only the administration of existing highways but the continued development of new and better ideas and the translation of these ideas into safer and stronger highways.

Congested Traffic

Highways wear out due to increased loads, and the passage of time. They also become obsolete and lose their usefulness when local roadside development reduces traffic capacity.

During the past years of increasing traffic congestion, engineers and administrators sought for some remedy for the creeping paralysis which transformed a high speed, relatively safe newly constructed traffic artery into a congested business street with a slow moving mixture of local and through traffic fighting for passage or parking.

This led to the idea of controlled access with separation of conflicting traffic movements. This idea was put into effect under various names, as parkway, expressway, freeway, etc., in various parts of the country, and in 1939 California gave legal sanction to the freeway idea. This was followed in 1947 by the Collier-Burns Act which provided additional funds, thus making possible an effective start on the actual modernization of portions of the State Highway System.

Milestone in Design

These two legislative acts are milestones in highway design in the State of California. They provide in the first case a basis of legal authority for the California Highway Commission to declare a state highway a freeway and in the second the money to at least make a start on the job that faces us.

Today the highway engineer is called upon to prepare plans that will guide the transformation of vast sums of tax money into roads which will provide for rapid, safe, and convenient movement of motor vehicles in numbers and at speeds unheard of a few years ago.

The people using these vehicles are footing the bill through various motor vehicle taxes. They are the customers we in the highway business serve directly.

Purposes of Highway

To serve these people we must design a highway which will:

(1) Gather and Distribute Local Traffic. Here we provide direct contact between business and transportation. This is the origin and the destination of traffic, the farm, the mine, the factory, the store or office. Without these, there would be no traffic.

(2) Provide a Safe Roadway to Destination. This involves all the factors of alignment, grade and sight distance, together with width of roadway and quality of pavement, which together provide for safe operation at reasonable speeds for the volume of traffic which may be expected to use the road. Detailed requirements will vary with the density of traffic, the terrain traversed, and the type of service contemplated, that is, a local road, a major arterial, or a freeway. Under this heading of safety comes, of course, the matter of separation of conflicting traffic movements. We have found that on heavily traveled routes, intersections at grade are the source of a very high percentage of accidents and that under some conditions traffic control devices such as channelization, signals, lighting, etc., are not effective in reducing that accident rate. Conditions such as these can only be remedied as funds become available and in the interim it appears that only vigorous enforcement of restricted speeds can reduce the accident rate.

(3) The Highway Should Retain Its Capacity to Handle Traffic. In the past we have had many examples of well-designed and well-constructed highways which rapidly lost their capacity to handle traffic due to the development of local business along the highway. These highways were constructed for the purpose of handling through traffic and while the abutting property undoubtedly benefited to some extent the motorist who paid the bill found that he had invested in a highway which did not serve him. Consequently, from his standpoint this represented a definite loss in our highway investment. On the other hand, we have the example of the Arroyo Seco Freeway which, due to its freeway characteristics, has retained its capacity to handle traffic and for that reason may be regarded as an excellent investment of highway funds. I believe it is safe to state that in our experience to date our only regrets in design are due to those few cases where for one reason or another design standards were reduced and consequently service to traffic and the business community is not as good as we now design for.

Lack of Understanding

In the past few years the specialized field of small town and roadside business has been most critical of the designer. Much of this criticism has stemmed from a mutual lack of understanding.

The small town or roadside businessman could see the reason for a freeway when he wanted to get through some other town but not in his own community. The designer with his head ringing from the verbal assaults of a vociferous minority frequently felt that the entire community was against him and compromised his design to secure agreement from the objectors. This generally added some hazard and frequently the objectors were the first to complain about the result.

Effect of Freeways

The strenuous objections voiced by representatives of many business communities led the Division of Highways to make studies of the actual effect of freeway development on local business. This has been carried on by a Land Economics Section in the Headquarters Office of the Right of Way Department of the Division of Highways. These studies have thoroughly supported the conclusion that freeways do not destroy real estate or business values. As a matter of interest and information, I have appended to this talk a tabulation of certain information compiled in the course of this study. The data supporting this and all of the conclusions of the Land Economics Section are available to interested parties in the Headquarters Office of the Division of Highways.

Community Asset

All of this simply points up the fact that a properly designed freeway is a community asset despite the fact that during the period of construction some painful readjustments may be necessary.

The highway engineer charged with the responsibility of design has all of this background of experience and general information available to him but before any highway can be designed there is certain specific information which the traffic engineer must furnish. The importance of the varied details of this information will depend upon the volume and type of traffic to be served, the location and class of the highway.

The questions the designer will ask of you, the traffic engineer, will cover a very large field but in general they will be:

Traffic density;
Classification of traffic;
Origin and destination of traffic;
Turning movements;
Accidents, including rates, points of high accident occurrence, type and general cause of accidents;
Special local problems.

Design Policy

Before the highway engineer can make the necessary basic decisions on design policy, he must have from you some reasonably accurate estimate of the traffic situation as covered by the above items. He is not concerned with hair-splitting refinements in the forecast of traffic movements but he must know the seriousness of the present traffic congestion and accident rate and certainly some realistic estimate of the daily and peak hour volume of traffic he is to serve, together with the desired origin and destination in sufficient detail to enable him to provide for it. The more reliable this information is the better will be our ultimate design.

The designer and the traffic engineer should jointly observe their completed handiwork. In recent years many designs were obsolete in some respects by the time they were constructed but worked surprisingly well. A few others have not worked so well. If we study the principles involved and endeavor to learn the primary reason for any deficiencies or failures to properly serve the traffic, we will probably improve the quality of our future work. In this the traffic engineer and the design engineer must work very closely and both must maintain close contact with other highway departments and with the local community in order that a more complete understanding of our mutual problems may be had.

Conclusions

In conclusion I wish to emphasize the following points:

(1) The business community includes the entire economy of the Nation.

(2) It is tied together by communication and transportation.

(3) Adequate highways are an absolute essential to the motor transportation of persons and goods.

(4) Our ability to design and construct continually better highways has brought about increased traffic demand with consequent increased cost and revenue.

(5) This increase in traffic has made freeways essential in order that large volumes of traffic may be moved rapidly and safely, separated from the conflict with local movements.

(6) The designer needs information. Much of that information must come from the traffic engineer.

(7) We must work for a more widespread understanding of the varied problems of moving traffic. To accomplish this we must work closely not only within our engineering group but with those concerned in the operation of vehicles and the enforcement of traffic laws.

Land Economics Section Accomplishments During 1950-51 Fiscal Year

During the past year the Land Economics Section completed the first phase of its studies dealing with the effects of freeway by-passes on real estate values and retail business condi-

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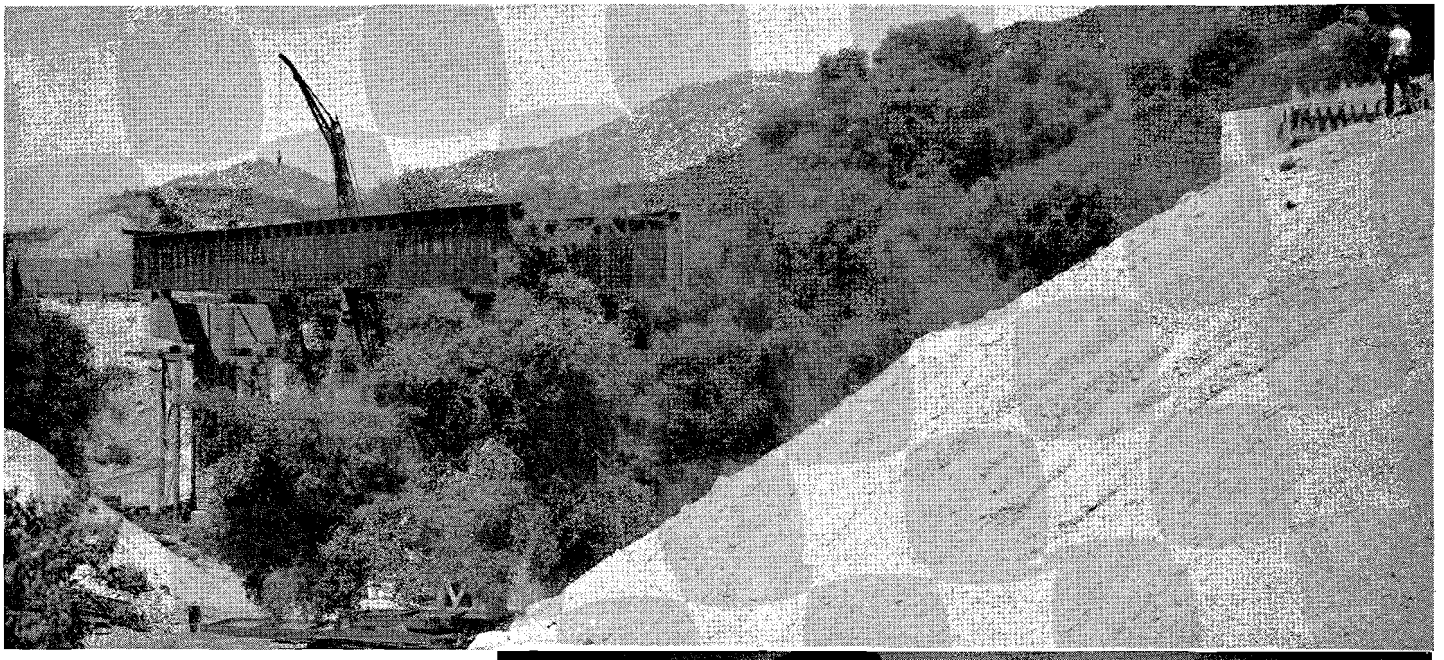

In San Diego

Continued from page 21 . . .

to result in a smoother riding job since wheels of a vehicle will not cross the joint simultaneously, as with the conventional joint.

Future plans provide for extension of this new work easterly towards Descanso Junction on entirely new alignment to join the new crossing over the Sweetwater River. Right of way for the entire work has been acquired on a limited access basis.

Contract amount for the project now under way is $420,000. The contract is being supervised by Leo G. Cline, Resident Engineer.

Bridge Project

Another project in this area, well on the way towards completion is for the construction of a steel girder bridge, and approaches, across the Sweetwater River in the vicinity of Descanso Junction, at a cost of $370,000.

This project, also being constructed by Clyde W. Wood & Sons, will replace the existing narrow bridge which has sharp curvature at the approaches, inadequate sight distances and insufficient superelevation. The old structure has been the scene of many serious accidents.

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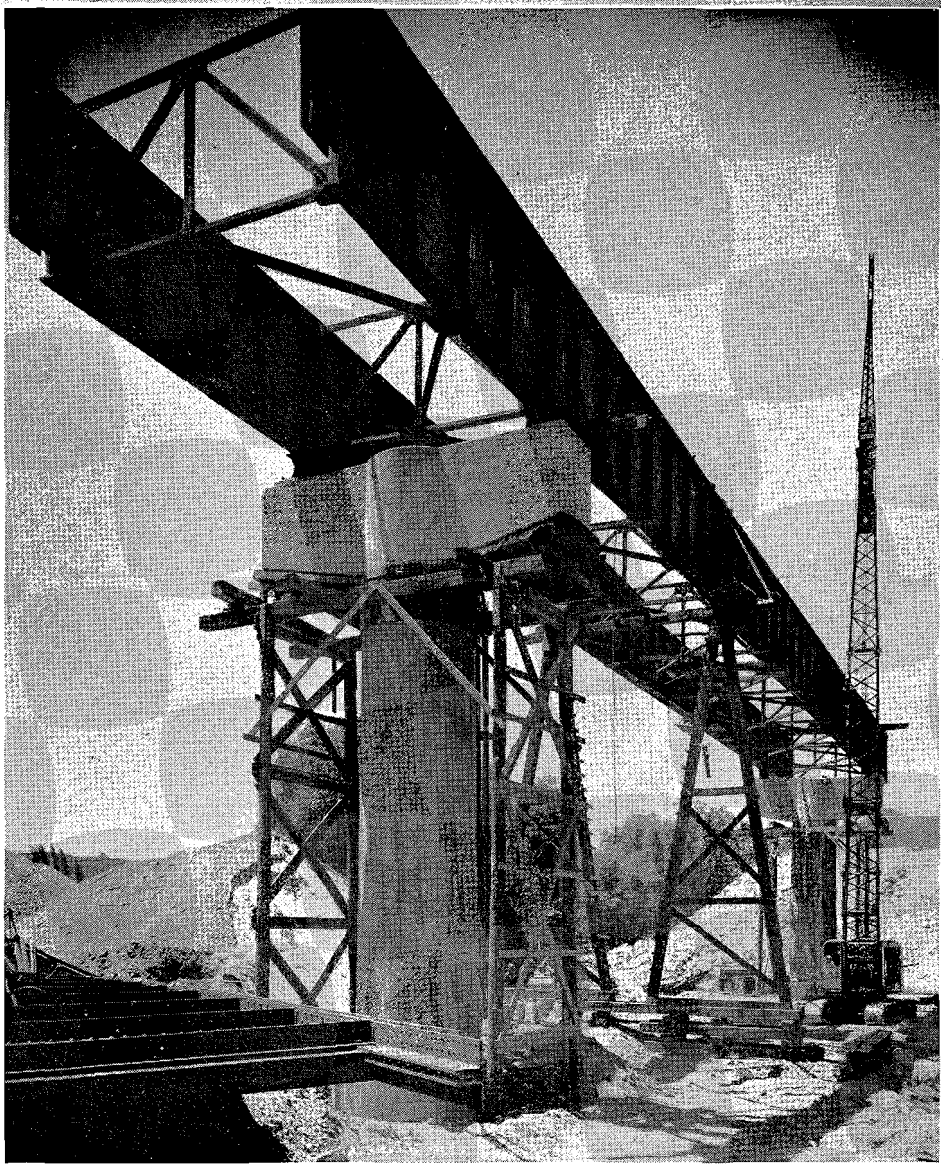


Bridge construction across Sweetwater River east of Alpine. UPPER—Erecting steel girders. LOWER—Looking up at steel superstructure.

AN EXAMPLE OF THE DEVELOPMENT OF A TEST METHOD AND ITS PRACTICAL CONSEQUENCES

By W. E. HASKELL, Associate Materials and Research Engineer

The following article by Mr. W. E. Haskell of the Materials and Research Department, Division of Highways, is intended as a description of a laboratory development, i.e., to illustrate a process rather than to impart new information. The technical aspects of the particular development have been well covered many times in previous papers and reports.

—Editor

ENGINEERS who specalize in the study of structural materials must be able to adopt, discover or develop small-scale or laboratory tests that are directly and quantitatively related to the performance of the materials in actual structures. Such test methods are not always easy to devise, since the need for simplicity and economy must also be considered; as complicated procedures and expensive equipment invariably limit the number of tests that can be performed. When, on occasion, a simple and inexpensive test method is contrived, its applicability and usefulness is often found to be astonishingly large, and may constitute a point of departure for exploration into unknown territory.

Special Test Methods

The records of the Materials and Research Department of the California Division of Highways cover the development of many such special test methods. It is the purpose of this paper to describe an excellent example of how such a method was discovered, how it was found to "tie in" with field observations, how it was proved to be a specific test for a specific thing and how it made, and is still making, valuable contributions to Portland cement and concrete technology. Much of this subject matter has appeared in the technical journals but it is believed that the general facts will be of interest to those who are less familiar with research or its particular vocabulary but who do use our highways and contribute to their support.

The example is part of a research project conducted by Thomas E. Stanton, formerly Materials and Research Engineer of the California Division of Highways and his co-workers, and has come to be known as the cement alkali-aggregate reaction, for reasons which will appear at a later stage.

Research Initiated

This research was initiated some years ago as a result of several failures in concrete structures and highways located in Southern California, all of which failures were characterized by the excessive expansion and map cracking of the Portland cement concrete. A search for the causes was complicated by the observation that in some prior cases, the same concrete aggregates which were used in the failed concrete had functioned satisfactorily. Also prior to the work of the California Division of Highways, the affected structures had been examined by other authorities and their condition had led to various theories, presumptions, and conclusions which were not always in agreement and which were, in most cases, unsupported by sufficient factual data.

When the problem was passed to the Materials and Research Department, it was evident that the first steps toward a solution would have to be:

(1) The discovery of a way to reproduce the expansion and map cracking in the laboratory.
(2) To make such a method quantitative if possible.
(3) To do it economically.

Test Specimens

In order to comply with item (3) it was decided to make test specimens in the form of small bars which could be accurately measured for expansion and to submit them to such treatment as might be typical of field conditions. This treatment consisted of exposure to the air of the laboratory, soaking in water, and alternate wetting and drying cycles, since these are some of the conditions to which structures are subjected. The bars were fabricated of Portland cement-sand mortar using a number of sands with both good and poor service records and with all of the California cements together with some sands and cements from out-of-state localities. Some of the wet mortars were also molded into small 2-inch by 4-inch tin cans which were sealed and stored away for future observation.

After some months of exposure, it was found that the problem of duplicating the phenomena observed in the field was not so easy as it had appeared to be. The small bar test specimens with "the innate cussedness peculiar to inanimate objects" refused to expand or crack in the manner expected of them, regardless of their composition or condition of exposure. Fortunately, however, it was observed upon stripping one of the 2-inch by 4-inch mortar cylinders that "the specimen * * * was covered with blotches fringed with a white efflorescence * * * and in a short time the entire specimen became covered with cracks * * *."

"It was apparent that when test specimens were kept in sealed containers or at least protected from the atmosphere and any drying out but at the same time prevented from any leaching of salts from constant immersion or from alternate wetting and drying, a chemical reaction was going on which caused an excessive expansion of the mortar with ultimate failure."

Significant Discovery

This more or less fortuitous discovery was of course significant but it did not mean the solution of the problem by any means. It did, however, sug-

gest that the small bar specimens might be induced to duplicate field behavior if they were stored in ordinary covered or sealed vessels containing only a small amount of water. This almost ridiculously simple but *hitherto unthought-of procedure* was to prove exceedingly fruitful as will be seen in the following paragraphs.

When submitted to these new storage conditions, a series of measurements and visual observations now brought to light three additional and important facts.

(1) That some of the test bars till refused to crack or to expand to an appreciable extent.

(2) That some mortar bars made with certain sands would expand and crack with some cements but not with others, and that the magnitude and rate of expansion differed among the several sands and cements.

(3) That this behavior was similar to the observed condition of certain structures and pavements.

Tentative Hypothesis

These findings were sufficient to justify a tentative hypothesis to the effect that a chemical reaction was taking place between one or more of the components of some of the cements, and one or more of the components of some of the sands.

Here again a highly significant discovery was made as a direct result of the simple laboratory method of storing test specimens in sealed containers with a small amount of water. It was, moreover, a quantitative method since magnitudes and rates of expansion could be measured and differentiated. However, it was still not a complete answer to the problem.

Some of the more obscure factors were cleared up by applying the methods of chemistry and petrography.

For some time a suspicion had existed that the alkalis of the cement (that is, the sodium and potassium oxides which are present to a greater or lesser degree in all cements) might be the offending component of the cement, and all of the cements used in the tests had been chemically analyzed. Notwithstanding the fact that these alkalis are present in very small amounts, generally less than 1 percent, it was found that the bar specimens which had expanded and cracked were invariably those in which a high alkali cement had been used. Furthermore, a chemical analysis of the exuding gel-like efflorescence from actual structures had showed it to be an impure sodium and potassium silicate almost certainly formed by the interaction of the cement alkalis with some form of silica present in the sand portion of the mixture.

Petrographer Examination

An examination of the sands by the petrographer revealed that the sands in the affected mortar bars contained grains of chert, shale or a peculiar siliceous magnesian limestone of Miocene age, and more particularly that these rock fragments contained the mineral opal, which is an amorphous silica and which was known to be somewhat soluble in alkali solutions with the formation of alkali silicates.

As heretofore noted, a large number of sands had by this time been tested with both high and low alkali cements and an extensive background of data had been accumulated. The source of the shales, cherts and limestones had been traced from the river gravels to deposits in the surrounding mountains and samples of these materials collected. Synthetic mixtures of these rocks had been made up and tested and the results when translated into terms of larger units indicated that in some cases it was perfectly possible that a concrete mixture weighing about 4,200 pounds per cubic yard could show a deleterious expansion if the cement component contained as little as six or seven pounds of the alkalis and the aggregate contained 30 or 40 pounds of the reactive sand particles.

Alkali Limitation

Quantitatively, it had been found with reasonable certainty that cements low in alkali (less than 0.6 percent) would in all probability prove to be satisfactory for use with reactive aggregates and hence it was reasonable to place an alkali limitation on all cements which were to be used with reactive aggregates. This was done and the results up to the present time have proved to be satisfactory.

The publication of these findings by Mr. Stanton in the technical press gave further impetus to the work of other agencies who had also attacked the problem and the sealed container test was adopted by all of them. The work of the California Division of Highways was abundantly verified and in a short time many other facts and some theories were placed in the literature. One of the oddest of these facts is the principle of the "pessimum" * amount which was reported by Mr. Stanton in another paper. The word "pessimum" was coined by him in describing a fact which is paradoxical in the extreme.

Reactive and Nonreactive Material

In nontechnical terms, it means that an aggregate may be so bad that it is good; that if it contains enough reactive material it then becomes *nonreactive* with respect to expansion and cracking. If the aggregate contains more or less than a certain "pessimum" amount of reactive particles, the expansion will *decrease* in proportion to the excess or deficiency over or under the "pessimum" amount. The expansion may be practically nil when the reactive material is present; perhaps to the extent of 70 to 100 percent and the "pessimum" amount may be determined by test to be as low as 5 or 10 percent.

It is actually and demonstrably possible to take a *mildly* reactive sand and render it *strongly* reactive by diluting with a *nonreactive* sand.

Inhibitive Properties

The term "pessimum" may also be applied to the grain size of the reactive particles. In general, the smaller size fractions are the most reactive until a rather fine state of subdivision is reached when another interesting and paradoxical phenomena occurs. As an example, a reactive aggregate containing about 5 percent of a certain opaline chert when submitted to the sealed container test will expand and crack in a relatively short time when a high alkali cement is also used.

If, however, about 10 percent of the cement is replaced by the same amount of the same shale which has been ground to a fine powder, the expansion and cracking are definitely inhibited thus attesting the truth of the old adage about the "hair of the dog that

* Meaning the reverse of optimum as there is no favorable connotation in the sense used.

bit you." This inhibitive property is not confined to opaline cherts alone but is a characteristic of several other rocks and minerals when properly prepared. These materials belong to a class that are known as "pozzolans."

Answers to Tests

It is now readily apparent that the discovery of the simple sealed container test method was a very essential step in solving a major problem and that the answers were:

(1) A chemical reaction takes place between the alkalis of Portland cement and certain aggregate constituents.

(2) That this constituent in observed cases was certainly the mineral opal.

(3) That the reaction causes expansion and cracking in a concrete structure or pavement when the amount of alkalis in the cement are sufficiently great and when the opaline rock particles are present in a quantity approximating the "pessimum" amount.

(4) That high alkali cements can be used without danger with nonreactive aggregates.

(5) That cements with less than 0.6 percent of alkali are generally safe to use even with reactive aggregates.

Confirmations

The simplicity of this test and its relatively minor cost had also enabled the laboratory to assemble such a mass of actual test data that the findings were virtually indisputable and the publication of the method permitted any interested party to make such tests themselves. Indeed, one of the first confirmations of the Division of Highways results was given by a cement manufacturing company whose product was normally high in alkali. Needless to say, confirmations of this kind were very gratifying.

All of the California cement manufacturers soon devised operating procedures whereby they were able to produce low alkali cement when necessary and also without prohibitive expense. With respect to the sand and gravel producers, the answer was equally agreeable since it did not rule out the use of their material which was otherwise satisfactory, but did indicate a way to avoid failure in future work.

Cost of Tests Small

Since the test method was on a small scale, simple and easy to follow, and permitted a large volume of work to be done with a minimum of labor, the cost of the project was small in comparison with the cost of restoring faulty pavements or questionable structures.

It has been noted that the publication of Mr. Stanton's first paper, and then of several others on this subject, had assisted many other agencies and individuals in carrying on work along the same lines. Many of them were in the United States but a considerable number were in foreign countries. The California Division of Highways was also continuing the work and among them all, other facts speedily emerged. In enumerating the investigators, chronological order and priority of publication will not be attempted but an incomplete list would include:

Cement manufacturers
Sand and gravel producers
Universities and colleges
U. S. Bureau of Reclamation
U. S. Army Engineers
Portland Cement Association
State highway departments
Bureau of Public Roads
National Bureau of Standards

and many other individuals and agencies.

Extensive Investigations

A large proportion of the investigators used the sealed container test at some point in their investigations.

In addition to the opaline shales, cherts, and limestones, other rocks were found to be reactive. All of them were identified and included certain glassy acidic igneous rocks and a metamorphic rock called phyllite.

Extensive investigations were also made on the use of the finely ground materials called "pozzolans" mentioned in a previous paragraph. These materials in addition to being inhibitors, display other useful properties when used in certain types of construction.

An extensive series of tests on commercial aggregates from many areas in the State of California were made and their reactive properties determined. Other agencies conducted similar tests in other states.

Sealed Container Test

A short and useful chemical test for reactivity was developed by the research workers of the U. S. Bureau of Reclamation who used as a comparison our old friend the sealed container test. In an excellent paper, they pointed out that their test requires less elapsed time to obtain an answer than does the sealed container test, but some investigators express doubt as to its certainty in borderline cases. It is not to be inferred that the sealed container test is perfect or infallible and this chemical test may in time supersede it.

Two theories with respect to the mechanism involved in causing cracking were advanced by W. C. Hansen in the U. S. and by H. E. Vivien in Australia.

Many Investigations

The foregoing paragraphs do not include all of the work that has been done with the aid of that useful tool, the sealed container test. A recent bibliography of the papers on the subject of chemical reactions of aggregates requires 12 pages to list titles and authors alone. Sufficient has, however, been said to make the point that a good and simple laboratory test may open the way to many developments and also to other perplexing situations

At the time of the discovery of this test method, agencies other than the California Division of Highways were also working on the same problem and it is possible that the same or some other equally useful test method would have eventually been discovered by one or more of them although the second possibility seems to be small

It is clear that circumstances or good fortune were favorable when the cracking was observed in the small cylindrical specimen (fortune oftentimes does reward the observing), but the development of the method and the subsequent conclusions were entirely a rational and scientific piece of research in which analysis, synthesis and intuition all played a part.

It is an excellent example of how a new tool may assist in finding the answer to a serious and practical problem involving substantial amounts of money, and at the same time contributes to the erection of a rather imposing structure of scientific fact.

New Overhead

San Bernardino Grade Crossing Eliminated in Railroad Joint Project

By HOWARD M. EICHSTAEDT, Associate Bridge Engineer

WITH THE OPENING to traffic of the I Street Overhead on September 10, 1951, motorists and pedestrians were able to look down upon the trains and switch engines which formerly blocked Fifth Street in San Bernardino so much of the time. Although construction on the $386,000 project was started by contractor K. B. Nicholas of Ontario, last November, the project has been under consideration for the past 20 years.

The huge yards and shops and busy main line tracks of the Atchison, Topeka & Santa Fe Railway (also used by the Union Pacific Railroad) have always presented a serious traffic problem to the citizens of San Bernardino and to motorists traveling through the city. Road VIII-SBd-9, carrying U. S. 66 and State Sign Route 18, formerly crossed the Santa Fe yards on the Mt. Vernon Avenue viaduct, and increased the already heavy traffic on Third and E Streets in the heart of the downtown business section. During business hours, left turns were prohibited at Third and E, making it impossible for through motorists to follow the posted route.

Construction of Pier 4 shaft adjacent to Santa Fe main track. Piles were driven and footings poured without delay to trains.

Unusual Barrier

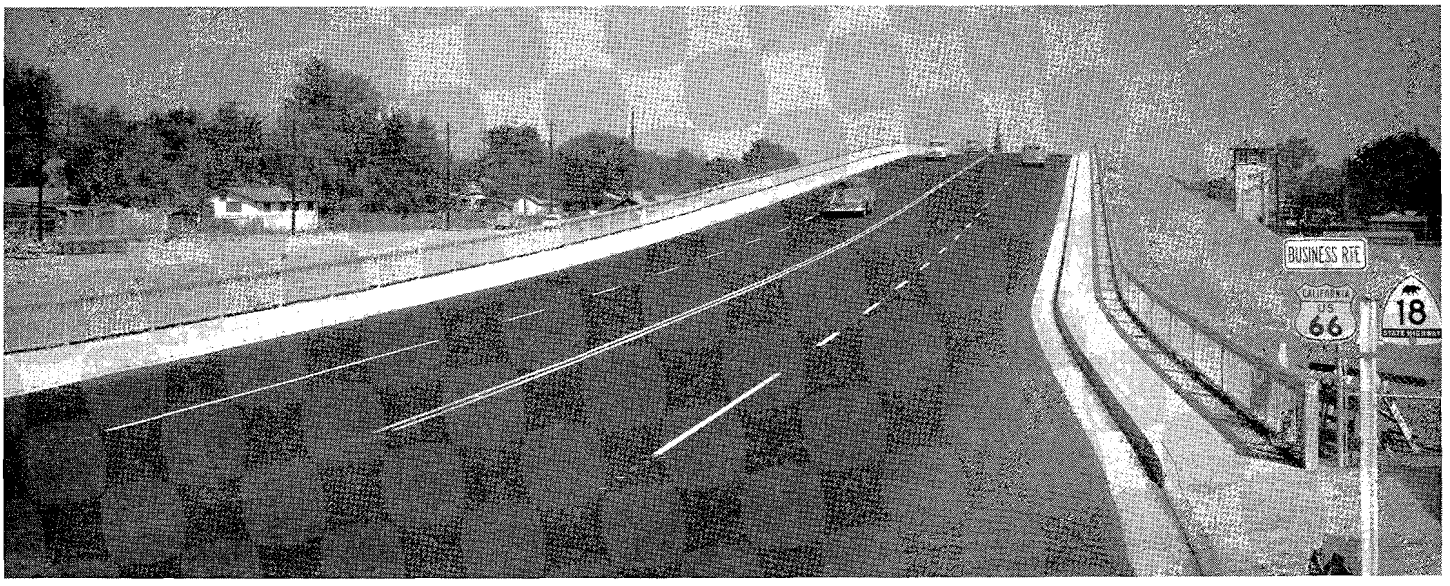
The Santa Fe tracks paralleling I Street provided an unusual barrier to traffic between the northwest and central portions of the city. Long, slow-moving freight trains entering the yards frequently blocked every east-west street between Third and 16th Streets, and there were innumerable switching movements across Fifth and Sixth Streets. In addition to the vexing delays to automobile traffic, conditions were a hazard to school children, interrupted bus schedules and handicapped ambulance, police and fire department services.

A survey by the City of San Bernardino in 1948 revealed that the Fifth Street Crossing was blocked an average of 4¾ hours in a 15-hour period. In some hours the gates were down for a total of 40 to 48 minutes.

City Funds Used

Meeting the problem, Mayor W. C. Seccombe of San Bernardino appeared before the California Highway Commission in April, 1948, with the city's request that Route 9 be changed from Third to Fifth Street, between the west

New I Street overhead in San Bernardino



city limits and E Street. The city agreed to use city funds to widen this portion of Fifth Street to 64 feet, and to contribute $200,000 towards the project. The commission adopted Fifth Street as Route 9 on May 19, 1948, and plans and negotiations began to take form.

In an agreement with the State, the Santa Fe Railway contributed $105,000 towards the grade crossing elimination, including its work relocating one switching track and placing telephone and telegraph lines underground to clear construction.

Overhead Structure

A steel overhead structure was selected for the separation because it could be erected with a minimum of interference with railroad traffic, and would provide maximum railroad clearance with minimum rise in grade on Fifth Street. The cost of caring for rail traffic during construction of a subway more than offset the savings in right-of-way requirements. Property fronting Fifth Street on both sides, for two blocks from H to J Street was acquired. It consisted principally of older residences.

The bridge is a symmetrical structure of three 64-foot and two 50-foot spans, providing a 52-foot roadway and two 50-foot sidewalks. A 24-foot clearance is maintained over the tracks and I Street. Abutments are founded upon steel piles driven through the fills. Raymond concrete piles were used under the pier footings. Unusual W-shaped steel bents cantilever the deck structure out from a concrete pedestal width of only 26 feet.

Box girder pier caps, 5 feet x 2 feet x 61 feet support the 36-inch WF beams carrying a concrete deck. Wrought iron blast plates were used over the two main line tracks. Erection and riveting crews moved on and off the job in 10 days, despite the difficulties, of working over the railroad. Structural steel was fabricated and erected by Consolidated Western Steel Corp. of Los Angeles, with shop inspection by H. Ross Clinton, of the Division of Highway Laboratory.

Approach Fills

Approach fills were constructed with 68,000 yards of imported borrow and paved with 3 inches of plant-mixed surfacing on 6 inches of crusher run base. Steel bridge railing is continuous on both fills from H to J Street. The terraced fills are provided with top soil and straw cover, and the entire right-of-way area is sprinklered. Delay in obtaining steel poles has postponed completion of the lighting system which covers the entire project.

Eastbound Fifth Street traffic blocked. Surveys showed these gates were down almost one-third of the time before overhead was built.

Excellent cooperation between the contractor and the railroad has produced a record of not one train delay, and an absolute minimum of delay to the contractor.

Under the terms of the City-State agreement, certain construction features preparatory to landscaping were provided in the state contract. However, all of the future development and maintenance of the landscaping is to be done by the City of San Bernardino at city expense, as a portion of the city's park system.

The graceful structure and landscaping treatment of the roadway will provide an outstanding example of the pleasing appearance it is possible to attain with an elevated roadway through a metropolitan area.

The overhead was designed by the Bridge Department under the direction of F. W. Panhorst, Assistant State Highway Engineer. District Engineers E. Q. Sullivan, retired, and S. W. Lowden of District VIII supervised design and construction of the roadway portions. H. M. Eichstaedt was Resident Engineer, and V. D. Dickinson was District Representative on construction. Mr. E. L. MacDonald, Division Engineer, represented the Santa Fe.

SIGN LEGIBILITY

UNITED STATES
DEPARTMENT OF THE INTERIOR
National Park Service
Region Two, Omaha, Nebraska

JUNE 11, 1951

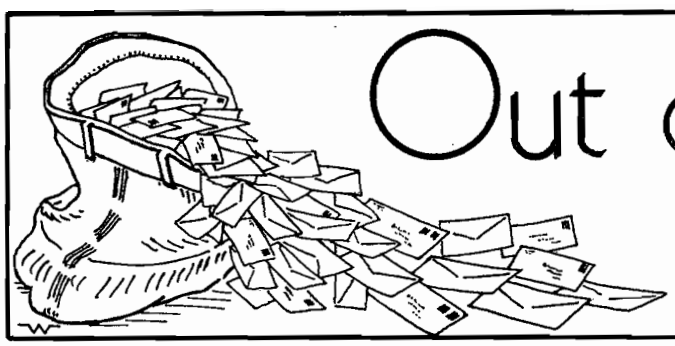
GEORGE T. McCOY, *State Highway Engineer*
California Highways and Public Works
Post Office Box 1499
Sacramento, California

DEAR MR. McCOY: Thank you very much for the courtesy shown in sending us the twelve copies of the January-February, 1951, issues of *California Highways and Public Works.*

We are presently undertaking a thorough study of the sign programs in the various national park areas administered by this office and the article, "Sign Legibility" by Karl Moskowitz, contained in the magazine will prove very helpful in developing new alphabets and sign legibility.

Sincerely yours,

ROBERT G. HALL
Assistant Regional Director
Chairman, Sign Committee



Out of the Mail Bag

WE THANK YOU

MINISTRY OF TRANSPORT
Divisional Road Engineer (North Eastern)
21, Park Square South, Leeds, 1

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

DEAR MR. ADAMS: Following my visit to California in 1949 during my highway study tour of the United States you were kind enough to place me on your mailing list for *California Highways and Public Works.*

I must congratulate you on the sustained excellence of your publication. Each issue is invariably full of interest and my colleagues and I obtain great pleasure and profit from our study of the magazine.

Thank you for the service; I look forward to receiving future copies,

Yours sincerely,

J. G. SMITH

FROM SPAIN

MANUEL MATEOS
Canteras Graniticas y Microgranitícas
(Spain) Avila

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

DEAR MR. ADAMS: I wish to express my sincere thanks for your kindness in mailing me the January-February and March-April issues of your useful magazine *California Highways and Public Works.* I have always found it extremely helpful for my interest in its questions. I know how your Country is in the vanguard about highways, and I would be pleased to continue receiving copies.

Yours truly,

MANUEL MATEOS

HIGH PRAISE

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

GENTLEMEN: Kindly place my name on your mailing list for *California Highways and Public Works.*

I would like to take this opportunity to commend you on your fine publication which is to me the most interesting of all highway magazines that have come to my attention. The well-written articles and the many illustrations present an excellent picture of the outstanding accomplishments of the Department of Public Works and the Division of Highways.

Yours very truly,

MELVIN CHOW
U. S. Bureau of Public Roads
Flood Building, San Francisco 2

FROM PASADENA

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

DEAR SIR: I don't make enough money to pay you for the information or the enjoyment I derive from your magazine. If and when the time ever comes when you deem it essential to formalize the periodical on a subscription basis you can count on me as (I hope) one of many thousands to support you.

Thanks again and please continue the fine magazine you produce.

Yours sincerely,

NOEL MORAN,
752 Herkimer St.,
Pasadena 4

CAN EXPECT MAGAZINE

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

DEAR SIR: As a citizen of the State of California and a motorist for 45 years I wish to express my appreciation for the privilege of receiving your interesting and informative publication on highways.

It is my opinion that the remarkable progress in quality highway construction in our State has been a large contributing factor in the development of California.

I consider it a mark of distinction for my name to appear on your mailing list and hope it will continue there for many years to come.

Very truly,

JOSEPH HARRISON BINNS
Box 500, Johnson Avenue
Los Gatos, Calif.

FROM AUSTRALIA

158 Balwyn Road, Balwyn, E 8
VICTORIA, AUSTRALIA

THE EDITOR

California Highways and Public Works
Sacramento, California, U. S. A.

DEAR SIR: I have just received my copy of your Journal Vol. 30, Nos. 1 and 2, for which please accept my thanks.

I am very grateful for your kindness in sending me this magazine which I have been receiving regularly for many years.

Yours faithfully,

J. C. BROUGH

FROM AN EDITOR

ENGINEERS' HALL NEWS
Los Angeles 46

MR. KENNETH C. ADAMS, *Editor*
California Highways and Public Works
Post Office Box 1499,
Sacramento

DEAR EDITOR ADAMS: I want to let you know how a citizen feels about your publication.

I think it is an outstanding public service and that other departments of our government could improve their public relations by doing likewise. That human interest item about the kid with his toy shovel at the groundbreaking for the Colorado Street Bridge in Pasadena was a honey. When a kid starts thinking at the age of four he is likely to be ahead of his grandparents.

The analyses on the effects of bypassing a town or city (in its volume of business) are very interesting as relatives of mine in eastern states write me of their woes when their state bypasses them. I mail the copies of your bulletin to them so they may see how to survive.

When I first arrived in California Hi Johnson was stumping the State for $10,000,000 in highway bonds to improve the roads. It was a Herculean task to wake the people up to the *future* needs when for years they had only been taught to think of their *present* wants. Hiram had what it takes and he could make his enemies scuttle for cover like scared rabbits. From that time on it was easier to get money for roads.

Safety must be stressed more and more and I believe that the weeding out of unfit drivers should be carried on more vigilantly. The tests for drivers licenses should include a co-ordination test same as the major trucking companies and cities and counties put their drivers through. This could be softened by limiting the slow ones with a license that would be revoked if they drove above a speed that the test showed safe.

Many thanks and keep up the good work.

Sincerely,

E. F. JACKSON.

GOOD INVESTMENT

FORD MOTOR COMPANY
LONG BEACH 1

MR. R. M. SHILLITO
Special Assistant to Director
Department of Public Works
Sacramento, California

DEAR BOB: I want to thank you for the Centennial Edition of *California Highways and Public Works*. I look forward to each succeeding issue and never fail to find them interesting. Since I use up so much of the highway system, I really appreciate the effort and planning that goes into making the California highways so pleasant for driving. The $150 a year I spend on gasoline taxes probably brings me more value per dollar than any other similar expenditure I can think of.

Sincerely,

LOWELL L. LEWIS
Service Representative
Ford Division
Ford Motor Company

PRAISE FROM TEXAS

STATE HIGHWAY DEPARTMENT
Sacramento, California

GENTLEMEN: Today I am fulfilling a promise to myself which was made during my trip across your State recently. Every time I go away from home I make the same promise that when I return, I will write the Highway Department to thank you for the wonderful roads that you have provided for us.

Since the coming of the automobile, approximately three decades ago, you have apparently met a great challenge which this industry has placed upon you. Wherever we went in California, it was smooth riding and your officers were most courteous to us.

We want to thank you for making our trip a pleasant one.

Sincerely yours,

MRS. CARL L. BOYLES
4021 Gulf Street
Houston 17, Texas

FROM A BANKER

BANK OF AMERICA
San Diego Main Office

MR. KENNETH C. ADAMS, *Editor*
California Highways and Public Works
Post Office Box 1499
Sacramento, California

DEAR MR. ADAMS: I should like to go a little bit further than simply returning the postal card in indicating my interest in receiving *California Highways and Public Works*. Many years ago I read the magazine regularly. Upon moving to San Diego in 1946, I somehow failed to receive it, but Ed Wallace kindly put my name back on the list last year. I always found the magazine interesting and instructive, but there has been a very outstanding improvement in the publication as compared with some years past.

I know that it is an expensive magazine to produce, but I feel the State Highway Department has a job that is more far reaching than simply laying out and building highways. Some of us have been in the midst of controversy over highway locations, and I believe we have become impressed with the fact that the department has a public relations and selling job to do. Through the magazine, especially in articles such as the ones relating to Temecula and Escondido in the current issue, a lot is being done and this material in the hands of some of us does provide good background material for public talks and discussions. If some way could be devised where this information could reach an even larger number of people, it might minimize the problems we all have in attempting to work out highway locations.

About a year ago when the new section of Highway 395 was opened, Mr. Purcell, Mr. Baker, Mr. Leigh and myself discussed this subject at some length, and I know of the public relations job which the department is doing.

I appreciate very much the opportunity to continue seeing the publication.

Very truly yours,

GRAYDON HOFFMAN
Vice President and
Manager

Unusual Fill

Stabilizing a Highway Over an 80-Foot Depth of Mud

By PERCY A. MAIN, Assistant Highway Engineer

DURING the past two construction seasons, the California Division of Highways has reconstructed a section of State Highway Route 15 (State Sign Route 20) across Tule Lake, about three miles west of Upper Lake, Lake County, where the road grade located below normal high water was often flooded.

History

The existing road crossed low-lying terrain drained by Bachelor Creek. During periods of high runoff, however, water backs up in nearby Scotts Creek, into which Bachelor Creek empties, resulting in flooding the terrain during maximum floods to a depth of 14 to 15 feet or to an elevation 1,339.0 at the highway crossing, thereby forming Tule Lake.

After the water in Tule Lake recedes to its normal level in the late spring, the local reclamation district pumps the balance of the water into Clear Lake so that the lake bottom can be farmed.

The original highway was contructed across Bachelor Creek Valley in 1922 to approximate elevation 1,335, which was approximately 10 feet above the ground surface. Between 1922 and 1950 the fill subsided continuously, approximately five feet in that time. This vertical settlement was accompanied by considerable lateral displacement in the surrounding mud.

Road Raised Above High Water

In order to eliminate this flooding of the road and its resultant closure to traffic during winter storms, requiring the detour of traffic over a county road, which added 1.6 miles to the route, a decision was made to remedy the situation by raising the grade to an elevation above high water. To accomplish this would require raising the old fill approximately 12 feet. Construction to this grade would require an increased fill of approximately 17 feet total height above the adjacent ground surface.

The unstable character of the foundation soil was evidenced by the continuous settlement of the relatively low existing embankment. An investigation was made to determine the feasibility of the proposed fill and the stabilization treatment necessary to obtain a stable roadbed.

Deep Borings Made

Four power borings were made; the depths varying from 67 feet to 100 feet. Moisture and density determinations were made on all retained cores, and numerous grain size analyses were made. Consolidation and shear tests were made on undisturbed samples taken at various depths.

These test data were used in analyzing the stability of the foundation soil, computing settlement, and comparing various methods of fill treatments.

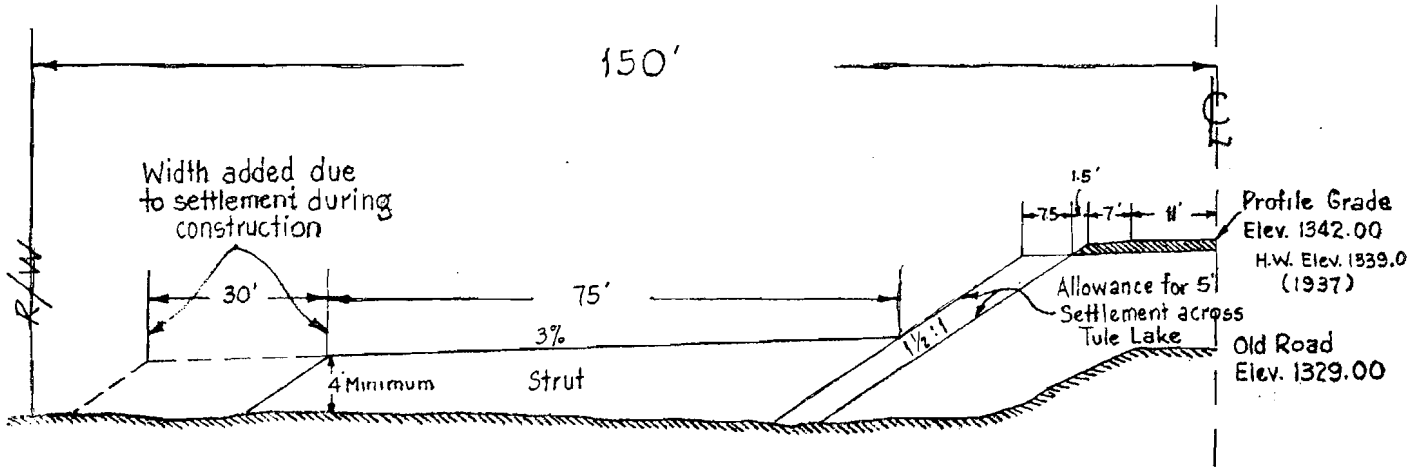
Borings indicated that Tule Lake is a filled bay of Clear Lake with soft, gray, silty clay extending to a depth of approximately 85 feet. This soft mud is underlain by relatively firm material, ranging from clayey sand to gravel.

The moisture content of the silty clay varied from 63 percent to 86 percent in the cores tested, with unit wet weights of from 88 to 112 pounds per cubic foot. (*See summary Chart 1.*)

Alternate Methods

Following is a description and comparison of the several alternate methods of embankment construction with special consideration of the probable subsequent stability and subsidence of the fill.

(a) Construction of embankment without any treatment and with no counterweight struts was considered to be unsafe. The computed factor of safety would be less than unity, and fill failure during construction could be expected. Such a design was not considered feasible.



½ Typical Section Across Tule Lake Bottom

Two views of Tule Lake fill, looking west

Toe Support Fills

(b) The analyses indicated that, by carefully controlling the rate of embankment placement and by constructing counterweight or "toe support" fills, it might be possible to construct the fill without excessive lateral displacement of the underlying mud. However, the computed factor of safety was approximately unity so that the fill would have to be brought up slowly. The subsequent settlement would continue for many years, and after about five years would be sufficient to necessitate additional fill if the grade line were to be kept above high water.

(c, d) Construction of a fill with sand drains to a depth of 50 feet, without or with counterweight strut fills, would entail costs which would be prohibitive. The subsequent settlement would be much less than for the embankment without sand drains; the subsidence due to consolidation of the foundation soil after construction would probably be less than two feet in 10 years, so that no major reconstruction would be required to maintain the grade above high water for 10 years or so.

Sand Drain Treatment

(e) The other alternative studied was sand drain treatment for the full depth of mud. To minimize the danger of fill failure during construction by lateral displacement of the mud and to permit more rapid placement of the fill, a counterweight fill was included in this design. The subsidence due to consolidation after construction would be relatively slight, probably less than a foot in the first 10 years and almost negligible thereafter.

Considering all the factors, it was concluded that the design for minimum ultimate cost of construction and maintenance would be the construction of the embankment to a nominal height above high water with no special treat-

This is another photograph of Tule Lake fill, looking east

ment except the counterweight fills and controlled rate of placement. Additional increments of embankment and surfacing would be necessary at intervals of perhaps five years in order to maintain a grade above high water, but would eventually reach stability.

After these studies of foundation stability, fill settlement and economic comparisons, a decision was made to construct an embankment and toe support fill without foundation treatment, with careful control of rate of fill placement. The drainage structures were to be placed on a blanket of gravel. Although this method would require periodic additions to the fill as settlement occurred, economic comparisons indicated it would be cheapest in over-all ultimate cost.

Stability Safeguards

Before the fill was started, 4 foot x 4 foot timber settling platforms with ¾-inch vertical pipe indicators were placed at three locations on the centerline of the old fill and on the original ground 105 feet right and left of centerline. Iron pins were driven in the ground at 50-foot intervals out to 250 feet from centerline. Elevations were taken of these points daily, and settling or heaving was noted.

In order to guard against a too rapid placing of the fill that would result in an accumulation of pore pressure in the underlying soil, well points were installed at depths of 14, 30, and 45 feet below original ground line. These well points were placed at the right toe of the old fill and connected by copper tubing to pressure gauges placed outside the limits of the road fill.

The pressure registered on these gauges was recorded daily and plotted on a chart. The chart was important, as the rate of change was probably more significant than the actual value.

The rate of fill placement was further controlled by a clause in the specifications specifying that not more than ⅛-inch lift be placed in any 24-hour period.

Construction

The contractor started placing the embankment on June 15, 1950, and the rough grading was completed on October 3, 1950, with 120,000 cubic yards of embankment used in the fill.

The counterweight or strut fills were constructed first, leaving the old roadway for the use of traffic. After the strut fills were completed, traffic was routed over the left strut, and the main roadway prism was constructed as specified. 0.75 feet of imported base was placed between October 4 and 13, 1950. Then 0.50 feet of road-mixed imported base cement (2 percent) treated was placed between October 16 and November 4, 1950. One-half inch of road-mixed surfacing was placed November 24 and 27, 1950, as a maintenance course for the wet winter suspension period.

The balance (2½ inches) of road-mixed surfacing was placed June 11, 1951.

Behavior of Fill

The behavior of the pressure gauges was in some respects disappointing or at least difficult to interpret.

The well points as stated above were placed at depths of 15, 30, and 45 feet. The 30- and 45-foot depths were selected because of the width of the fill which, including the struts, was 250 feet wide. It was assumed that the bulb of pressure caused by the weight of fill would extend to approximately 50 feet during the construction of the

struts and to a considerably lesser depth for the balance of the fill.

The pressures measured for the 30- and 45-foot depth confirmed the original assumption; however, significant pressures were never obtained on the 15-foot depth.

Plastic Flow

The failure to record any pressure at the 15-foot depth is hard to explain in view of the plastic flow which occurred, particularly at Station 316+50. The increased rate of settlement at this location was accompanied by heaving at 150 feet from centerline. Further evidence of plastic flow was lateral movement of the newly constructed property fence and cracks which appeared in the strut fill.

Additional well points which were installed as a check on the original installation indicated no pore pressure.

The settling platforms indicated that the mud subsided at a uniform rate as was originally estimated with the exception at centerline Station 316+50 between August 29 and 31, 1950, 1.3 feet subsidence was recorded. This sudden subsidence at this one station has gone unanswered, as it cannot be correlated with any sudden change in pressure gauge readings or in heave point readings.

Strut Fills Widened

When this sudden subsidence occured, a decision was made not to place any more embankment across the unstable area until September 18, 1950, and then to widen the strut fills to the right of way lines before the roadway prism embankment was completed. The strut fill embankments were completed on September 26, 1950, and the roadway embankment on September 30, 1950.

Between June 6, 1950, and October 14, 1950, while embankment was being placed, a maximum subsidence of 4.3 feet was recorded at centerline Station 316+50.

Between October 14, 1950, and May 29, 1951 (date of last elevation taken), the embankment has subsided a maximum of 2.3 feet or a total of 6.6 feet.

Personnel

The project was carried out in District I, California Division of Highways; A. M. Nash, District Engineer; C. P. Sweet, District Construction Engineer; W. R. Lovering, District Materials and Testing Engineer. Field operations were under the immediate direction of the author, who was Resident Engineer.

The contract was carried out by Contractor M. W. Brown, Redding, California, on a bid of $191,432.60. V. M. Dwyer was the contractor's superintendent on the job.

SETTLEMENT DUE TO CONSOLIDATION
Ultimate for 80-Foot Depth Mud

Type of fill construction	Profile grade of const.	d= 60′	d= 80′	One yr.	Five yrs.	Ten yrs.	Factor of safety
(A) No treatment	1,344	8	10	2	3.5	4.3	0.7
(B) No drains, 5′ x 75′ counterweights	1,344	8	10	2	3.5	4.3	1.1+
(C) Sand drains 50′ deep, no counterweight	1,341	8	10	7.6	8.4	9.0	Over 1
(D) Sand drains to solid, no counterweights	1,341	8	10	8.5	9.0	9.3	1±
(E) Sand drains to solid counterweights 5′ x 35′	1,341	8	10	8.5	9.0	9.3	Less than 1

Land Economics

Continued from page 37 . . .

tions. An analysis of all the pertinent facts concerning six by-passed cities, ranging in population from 1,700 to 6,500, has developed the conclusion that the diversion of through traffic by such highway construction is not detrimental, but is beneficial to real estate values and stimulates retail business activity.

The magnitude of the benefits to be derived from a freeway by-pass is directly proportional to the degree of traffic congestion created by the merging of excessive through traffic with local traffic.

Summary

A summary of the net effect of freeway by-passes on retail business volume in the six cities studied, computed by comparing the average volume change of the retail business establishments located along the by-passed streets with the average change in volume of similar business establishments generally in the vicinity during the same time period before and after the highway improvement, is as follows:

	Population	No. of businesses by-passed	Net effects on business by type: Cafes—Bars	Service stations	All others
North Sacramento	6,016	224	+11.5%	+25.5%	+21.5%
Auburn	4,577	74	+ 5.0%	+21.0%	0.0%
Fairfield	3,607	70	—24.4%	—23.0%	+14.1%
Folsom	1,706	36	+ 7.4%	+ 5.0%	— 1.0%
Imperial	1,736	21	+ 1.5%	+ 2.72%	+ 0.5%
Escondido	6,608	67	+11.95%	+25.6%	+12.7%

In addition to the development of conclusive proof of the beneficial effects of freeway by-passes, studies of the effects of frontage road installations have been completed up to the present time in four locations involving 61 businesses. These studies have indicated that the advantages of a local or frontage road for business purposes ordinarily exceed the detriments of some circuity of travel imposed by the separation of the through traffic lanes from direct access to abutting properties.

THAT'S THEIR JOB

BIG BEAR LAKE VALLEY CHAMBER OF COMMERCE

Big Bear Lake

Mr. S. W. Lowden
District Engineer, Division of Highways, District VIII, P. O. Box 231, San Bernardino

Dear Mr. Lowden: On behalf of the community the Big Bear Lake Valley Chamber of Commerce wishes to express its appreciation for the cooperation of the State Division of Highways in repairing the damages to the streets of the village and the highways in this area,

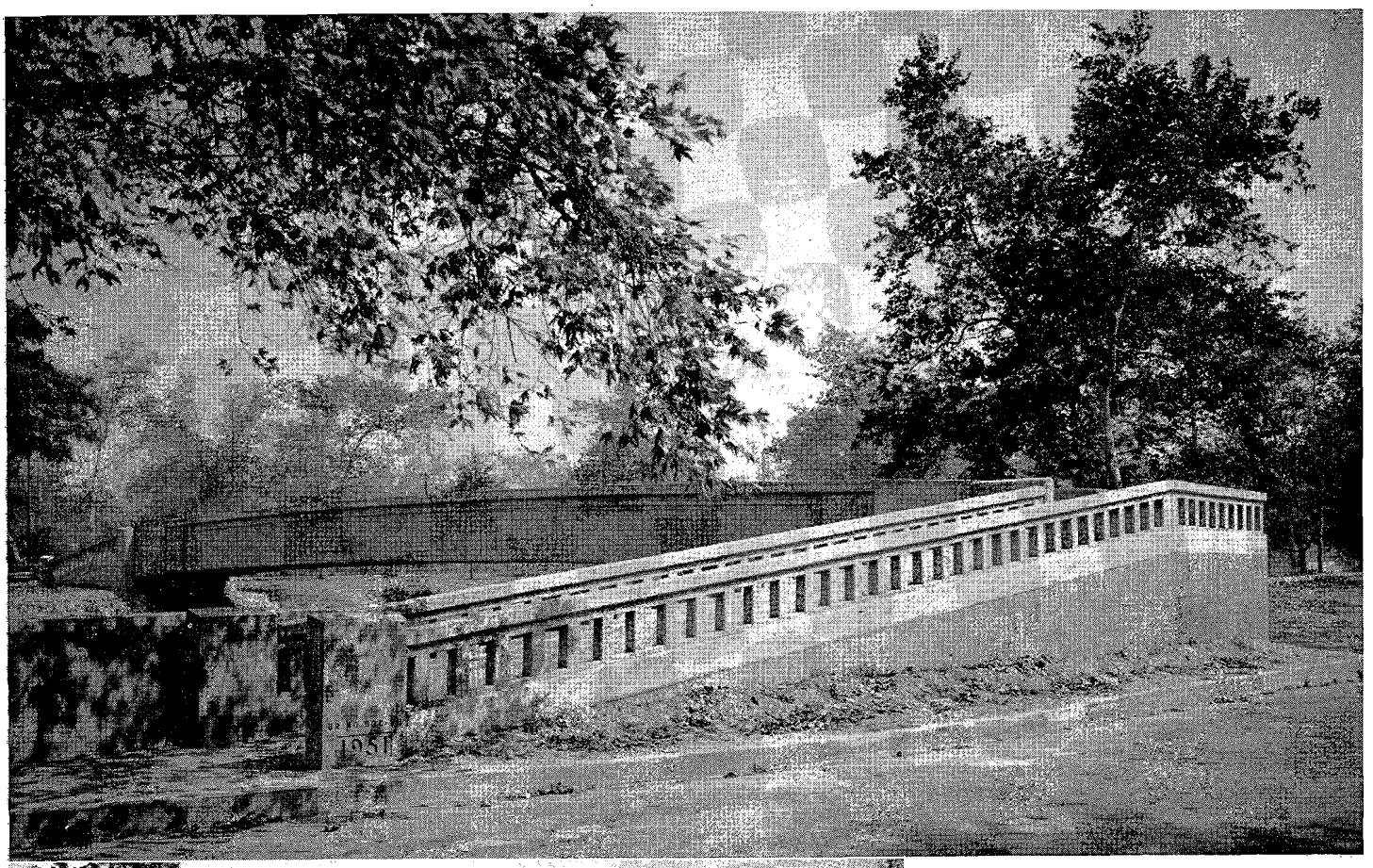
We fully appreciate the alertness of your division foreman and his crew and their readiness to meet an emergency. They were out with equipment to clear the highways of rocks and debris and to start the repair work as soon as the storms abated.

Our sincere thanks.

Very truly yours,

Big Bear Lake Valley Chamber of Commerce
William Kleinman, *President*

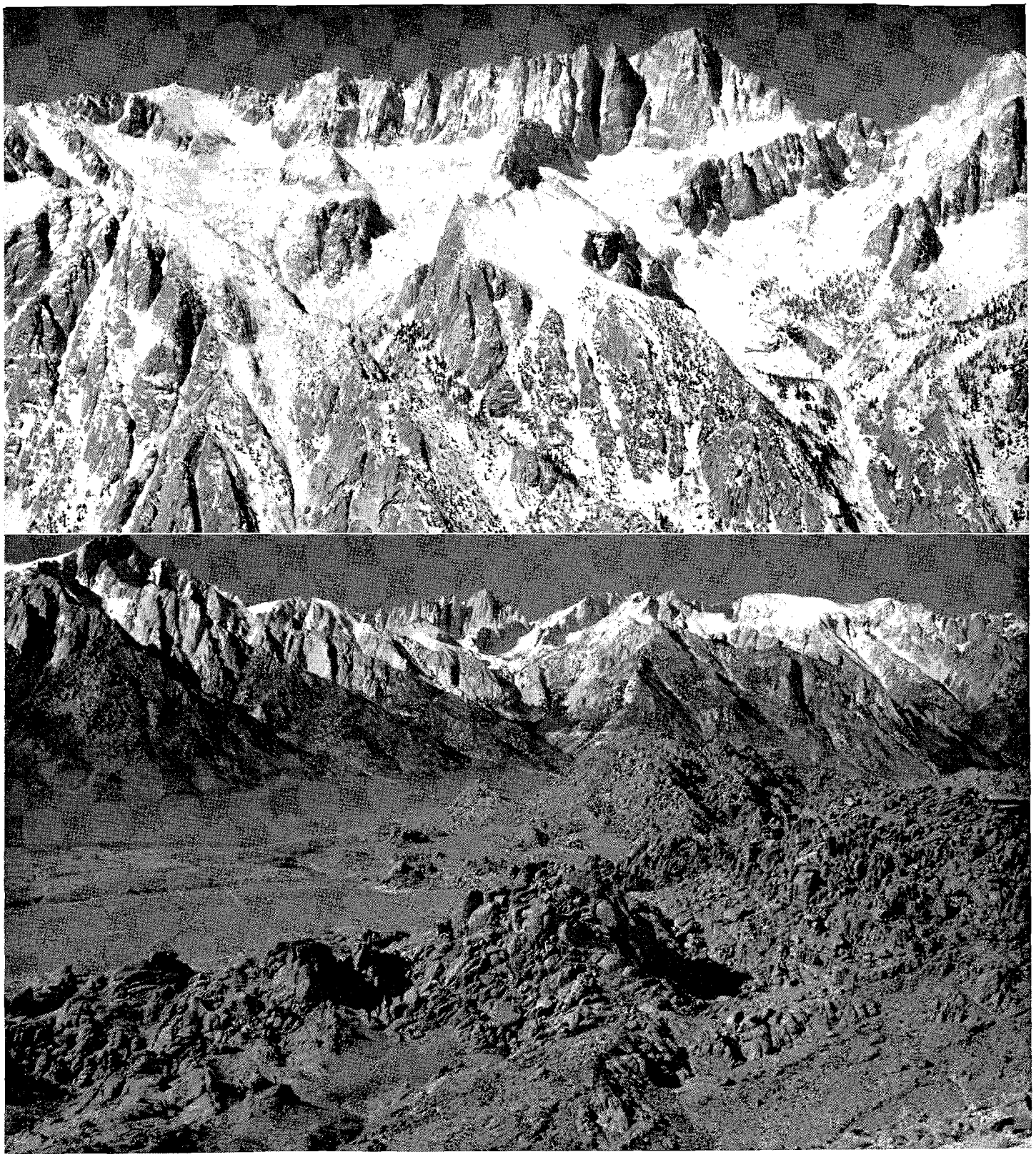
HERE IS HOW FIRST PRESTRESSED BRIDGE LOOKS COMPLETED



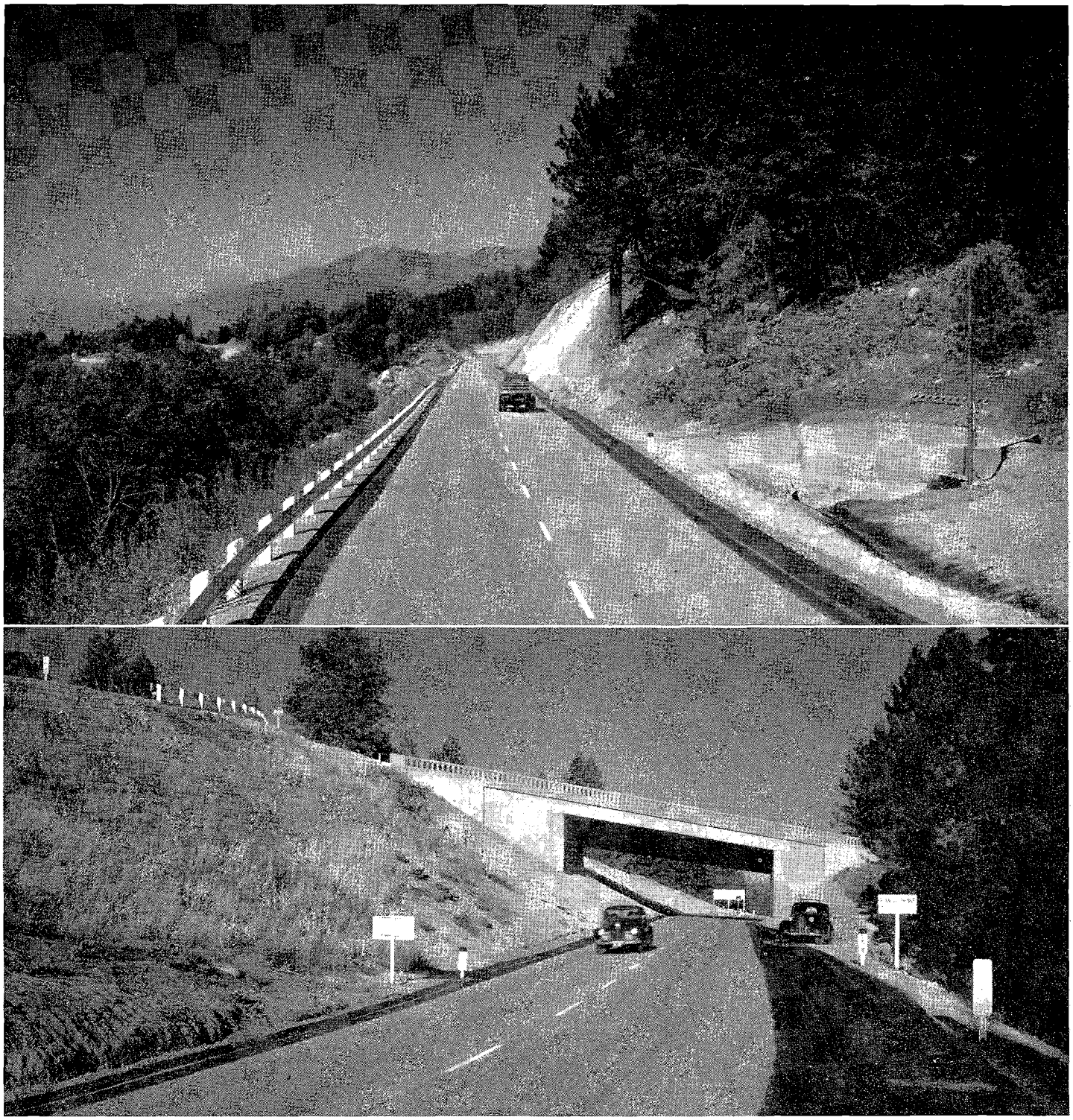
California Highways and Public Works has had many requests for photographs of the completed prestressed pedestrian bridge across the Arroyo Seco flood channel in Los Angeles. This is how the finished project looks.

The bridge, first of its type in the West, makes use of the new engineering principle called "prestressing," said to be one of the most noteworthy advances in concrete construction since the invention of Portland cement. Nation-wide attention was attracted because the prestressed design is a radical departure from previous types of conventional concrete bridges.

Prestressed concrete, a development of European scientists, is still in its infancy in this Country. A complete description of the structure appeared in the issue of this magazine for March-April, 1951.



This is the time of year when world-famous Mt. Whitney in Inyo County, California, begins to mantle itself in snow. Each summer thousands of tourists visit this shrine of lovers of Nature's magnificent and inspiring handiwork. The aerial view (top) was taken by Bob Symons of the Symons Flying Service, Bishop, at an elevation of 15,000 feet from the east side of Owens Valley. The lower photograph was taken by Harry Lee of Lone Pine and shows the Whitney Portals Road leading to the basin below the mountain and was shot from the Alabama Hills.



New City Creek highway. UPPER—This view is looking towards San Bernardino. LOWER—City Creek bridge at intersection of City Creek highway and State Route 43.

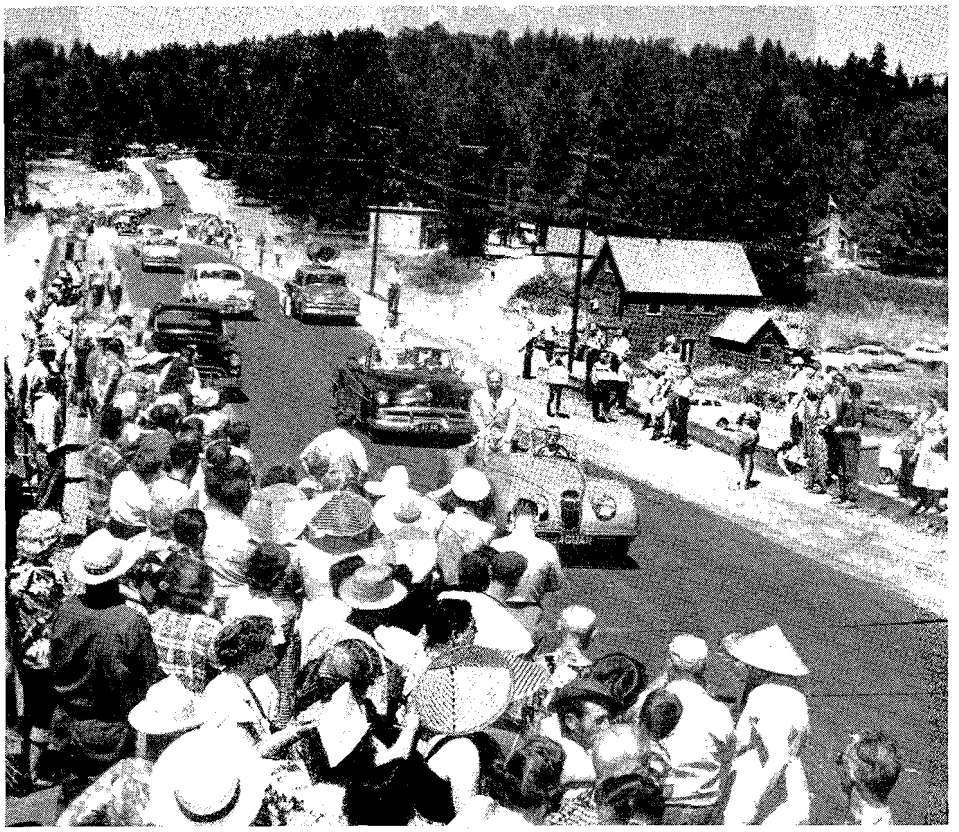
Mountain Road

Continued from page 35 . . .

Arrowhead Our Lady of the Lake Catholic Church, asked God to bless those who traveled the new highway, which, he said, 'is symbolic of that greater highway which all mankind is traveling on their way back to God.'

High Gear Road

"Mayor George C. Blair paid respects to the Highway Commission members who so patiently hear the complaints of those who would object to the progress of highways. Lt. Col. Earl R. Knauer, who represented Brig. Gen. E. C. Langmead, commanding officer of Norton Air Force base, referred to the City Creek Freeway as



Spectators crowd near the ribbon on the strip of the highway which goes through Running Springs as the parade approaches. In the lead car is Lieut. Governor Knight; behind him is State Senator Cunningham's car.

'another refund on the gas tax paid by those who use the highways.'

"The winding ribbon of pavement and bridges, laid through man-made cuts into the mountains, is strictly a high gear road even for older model cars. It was given a thorough test on its official opening day by thousands of automobiles, many drivers of which stopped off to admire the view back into San Bernardino Valley from the many observation points.

"Running Springs businessmen, led by Lloyd Soutar, welcomed Lieutenant Governor Knight and other guests. Serving on his committee were James Soutar and Don Henderson.

"The kiddie carnival opened activities Saturday. Prior to the first night show staged by Miss Hutton and her orchestra, the Arrowbear Music Camp, conducted by Fred Oldendorf, presented a concert."

CONTRACTS ON CITY CREEK HIGHWAY

Limits	Length, miles	Construction cost	Completion date	Contractor
1. Highland Avenue to City Creek Bridge	3.2	$783,000	4-12-48	Denni Investment Corp.
2. City Creek Bridge to Plunge Creek	4.3	892,700	10-27-48	Westbrook & Pope
3. Plunge Creek to Long Point	1.8	843,800	8-12-49	Claude Fisher Co. Ltd. and L. R. and R. S. Crow
4. Long Point to 1.3 miles west of Running Springs	4.0	934,900	11-15-50	Frederickson & Kassler
5. 1.3 miles west of Running Springs to Running Springs	1.7	446,000	9-14-51	Hess Const. Co., Inc.
Totals	15.0	$3,900,400		

CONCENTRATION

Put all other thoughts aside when you drive except those concerned with driving well. The motorist who thinks about business or domestic problems when driving can be a highway hazard.

SAFE WALKING HABITS

When you're walking where there's traffic, observe the signs and watch the lights. Help prevent pedestrian accidents by doing your part.

PROFESSOR WRITES

UNIVERSITY OF FLORIDA
College of Engineering

California Highways and Public Works
Sacramento, California

DEAR SIRS: This is to express my appreciation for your magazine *California Highways* which you have so kindly sent me while here at the University of Florida.

Your coverage of the work in the highway field is of vital interest to us in this field. The illustrations contained in all of your issues have been wonderful examples for presentation for class work. Our text "Highway Engineering" which has just been published by the Ronald Press Company of New York has a few examples from your state highway department and if we were not limited we would have liked to have more of them. In other words, we like your magazine very much and it finds a place in our work.

Yours very truly,

RADNOR J. PAQUETTE
Assistant Professor of
Civil Engineering

HE KNOWS HIGHWAYS

WOODROW MILLER HONEY COMPANY

MR. BALFOUR, *Chief Right of Way Agent,*
California State Highway Commisison

DEAR MR. BALFOUR: I want you to know that I appreciate the fine job the California State Highway Department is doing in providing roads in our State to meet the demands of the increased traffic. As you know, I have branches of my business scattered through other western states and in Nebraska. I do considerable driving over roads of other states that do not even approach the caliber of those of California and I constantly think of the good job our California State Highway Department is doing. Any little contribution that I can make to your efforts, it is a privilege for me to be called on to do so.

Only the best,

WOODROW MILLER

Cow Palace

New State Highways Make Travel To National Livestock Show Easy

MORE THAN $3,300,000 of improved thoroughfares in the immediate vicinity opened this year will make it possible to get to the Grand National Livestock Exposition at Cow Palace in San Francisco more easily than ever before.

The first improvement opened to the traveling public was the one-mile freeway between Army Street and Alemany Boulevard, an integral link of the Bayshore Highway. With its overpasses and expansive lanes for fast travel, this link was completed after nearly a year of work and the expenditure of more than $3,000,000.

More of the same is in the blueprint stage and eventually will be made a reality in an effort to handle the continually increasing travel safely and swiftly.

Another improvement that will be of particular advantage to those coming from the south and valley points is the added lane on each side of the Bayshore between the southern city limits of San Francisco and the northern limits of South San Francisco.

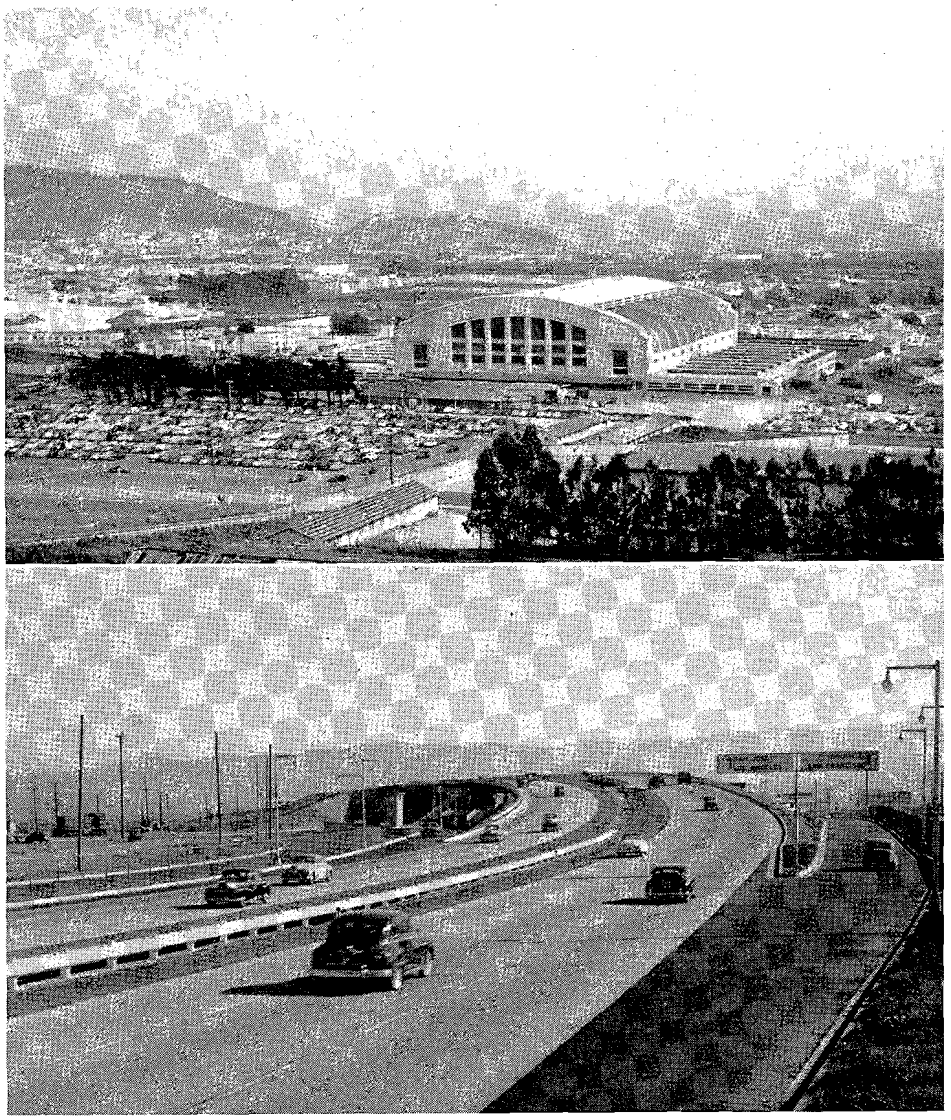
Now a six-lane highway for that distance, the work was done under Division of Highway supervision at an estimated cost of $300,000.

Opens October 26

Travel to the Cow Palace over these two new units will get under way long before the Grand National opens its 10-day run, October 26th. Livestock exhibitors by the hundreds, rodeo performers, horse owners and other participants in the impressive livestock and arena spectacle will van many of their entries to the Cow Palace several days in advance.

With an all-time high in premiums to be paid in the livestock division, this feature of the Exposition will be highlighted by Golden Gate National Hereford Show, an integral part of the Grand National this year.

This is the first time since 1939 that the American Hereford Association has held an officially approved show on the Pacific Coast.



UPPER—Famous Cow Palace in San Francisco. LOWER—Section of Bayshore Freeway which makes travel to the Cow Palace easy.

In 1939 the show was staged in connection with the Golden Gate International Exposition on Treasure Island.

A total of $20,000 in premiums will be offered in this one division alone. An additional $72,924 will be offered in premiums to owners of other beef cattle, dairy, dual purpose cattle, swine and sheep.

Big Arena Shows

Further highlights will be the arena shows to be presented 14 different times during the period, October 26th to November 4th, inclusive. Matinees will be staged on Saturday and Sunday, October 27th and 28th and on the following Saturday and Sunday, November 3d and 4th.

Dude Martin and His Roundup Gang will lend an air of color and song to the show never heretofore offered the public. He will offer "Roundup on the Range," a real life story as it was

... Continued on page 58

Equipment Operator Gets Merit Award Check

Another idea which will save money! Highway Maintenance Equipment Operator H. M. McAllister of Sacramento suggested that if mowers were equipped with tire repair kits delays by punctures would be shortened. Less idle time will mean a considerable saving to the State. The Merit Award Board thought well of the idea. District Maintenance Engineer R. I. Nicholson is shown above presenting a certificate of award to Mr. McAllister, together with a check for $25. Maintenance Superintendent Clyde W. Rust beams his approval.

Headquarters Shop

Continued from page 28 . . .

Cleaning operations of Headquarters Shop, with the exception of administrative and accounting offices, is a function of the Parts Department. This cleaning is done by a crew of five employees who also act as watchmen over the entire Headquarters area of the Equipment Department.

In order to accomplish its assigned tasks the Parts Department must use a number of automotive units in its pick-up and delivery service.

Automotive Equipment

Automotive equipment assigned to the Parts Department is composed of two pick-up trucks, one flatrack truck, one five-ton truck-tractor, and one 15-ton semitrailer. The pick-up trucks are assigned for use of Parts Department employees for emergency purchases, delivery and return of work to be performed on service orders and other transportation needs as required. The flatrack truck is used for general utility purposes. The large truck-tractor and semitrailer is used for "over-the-road" hauling of equipment, material, and supplies between Headquarters Shop, district shops, and other state agencies. One equipment operator-laborer, assigned to the Parts Department personnel, is regularly assigned to operate the large transport unit.

Parts Department functions have been broken down into four general classifications. Certain employees have been assigned to each classification on a rotation basis. The rotation of personnel and duties will preclude any possibility of a breakdown in operations due to any authorized absences or turnover of personnel.

District Shops

In addition to the Parts Department activity at Headquarters Shop, there are parts and stores carried in nine of the eleven district shops. The acquisition of repair parts for district shops 3 and 10 is handled through Headquarters Equipment Department. The District Shops Parts Department activities are staffed with a total of 26 employees composed on nine machine parts storekeepers I, and 17 assistant machine parts storekeepers. Twelve rotary card files have been purchased for use of district shops parts departments and will be installed with the various new types of records. All procdures and records are being standardized in all shop parts departments so that this phase of activity will be coordinated.

The following schedule lists parts department locations, number of employees, rotary files used, and stock cards maintained:

Shop	Location	Employees	Rotary files	Stock cards
HQ	Sacramento	22	2	7,000
1	Eureka	3	1	3,500
2	Redding	5	2	6,000
3	Marysville	--	--	*1,500
4	Fruitvale	2	1	3,500
5	San Luis Obispo	2	1	3,000
6	Fresno	4	2	5,000
7	North Hollywood	4	2	6,000
8	San Bernardino	2	1	3,500
9	Bishop	2	1	3,000
10	Stockton	--	--	*
11	San Diego	2	1	3,000
		48	14	45,000

* General shops are not maintained at Marysville or Stockton. Other than field repairs and maintenance, all overhauling of equipment is performed by Headquarters Shop. The stock cards listed for Marysville cover repair parts carried at Donner Summit Maintenance Station for emergency repairs made mostly to snow removal equipment.

The Parts Department is an important activity and its task of procuring needed parts and supplies for the repair and maintenance of equipment of prime importance. Its growth and expansion reflects the policy of the department to increase the number of services rendered and more efficiently perform the work of repairing equipment.

HEADLIGHT TIP

When starting on a trip that may require night driving, have the headlights checked and adjusted with the car fully loaded. The extra weight may direct the light beams too high for safe driving.

R. M. Shillito Resigns From Department

APPOINTED in May, 1950, by the late Director of Public Works C. H. Purcell to be his special assistant, Robert M. Shillito handed to Director of Public Works Frank B. Durkee his resignation to become effective October 1st.

Shillito gave up his post as director of the highway and transportation department of the California State Cham-

ROBERT M. SHILLITO

ber of Commerce to accept Mr. Purcell's appointment. Shillito has accepted a position as assistant general manager of the San Francisco Chamber of Commerce. He will be missed in the Department of Public Works.

Shillito is a graduate of the University of California at Los Angeles. During the war served in the South Pacific and the Pacific theaters as aircraft maintenance engineering officer with the 403d Troop Carrier Group of the 13th Air Force. In 1946, he was employed as Director of Public Relations for the Southern California Council of the California State Chamber of Commerce, with headquarters in Los Angeles. Subsequently he was assistant manager of the Southern California Council until 1948 when he became director of the State Chamber's Transportation and Highway Department in San Francisco.

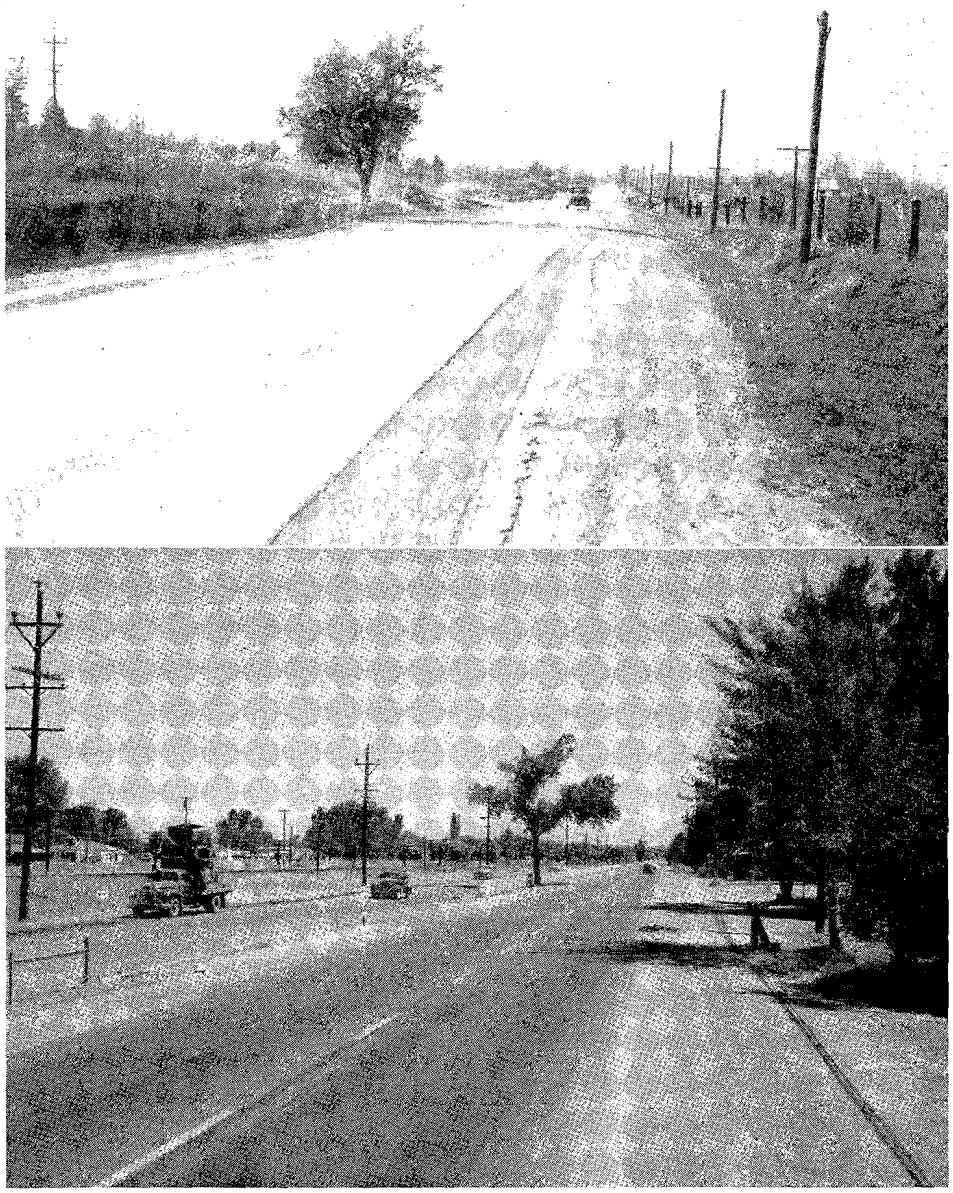
Redding-Red Bluff

Continued from page 10 . . .

will be required as traffic warrants, particularly adjacent to cities. Outside of cities it will be an expressway with controlled access openings.

All this work was performed under supervision of District II at Redding. F. W. Haselwood was District Engineer until his retirement in June, 1950. Since that time, J. W. Trask has been District Engineer. The writer was Construction Engineer on all the work.

Views of the old and new sections of highway south of Redding



State Buys Spans

Continued from page 11 . . .

in 14 years, after which the two bridges would become toll-free.

Following receipt of word that all the financial details had been completed, many of the old employees of the San Mateo-Hayward Bridge, who became state employees under the transfer, gathered around the flag staff near the toll bridge office as the Stars and Stripes and California Bear Flag were hoisted. Toll Sergeant Charles E. Smith, Vice President of the California State Employees' Association, pinned the official state badge on Toll Collector Wilbur Brown, one of the oldest employees of the former privately owned span.

A similar flag raising ceremony was staged at the Dumbarton Bridge, both events being supervised by Bridge Engineer Edwin Levy, who will have charge of the two spans for the Division of Highways.

A San Mateo man, R. A. Osten of 511 North El Camino Real, San Mateo, was the first to benefit by the toll reduction on the San Mateo-Hayward Bridge.

This machine enabled Frank B. Durkee, Director of the State Department of Public Works, to sign 20 bonds at once for the $8,350,000 issue to purchase the San Mateo and Dumbarton bridges across San Francisco Bay. There were 8,350 bonds to sign and the machine cut the time for signing from a week to two hours.

New Link

Continued from page 18 . . .

Referring to the growth in traffic, Baker stated that the section that was opened on December 27, 1950, from Grand Avenue to Silver Lake carried an average of 32,000 cars per day the first week after it was opened, and three months after it was opened it was carrying an average of 38,000. The last traffic count on the first section of the Hollywood Freeway taken in July, 1951, showed that an average of 44,000 cars per day were using the freeway.

STATISTICS

Here are statistics regarding the section of Hollywood Freeway between Virgil Avenue and Western Avenue in Los Angeles:

Length—1.7 miles
Total cost of right of way—$4,935,400
401 houses within right of way
392 houses moved
9 houses razed
9 commercial buildings within right of way
4 commercial buildings moved
5 commercial buildings razed
Total estimated construction cost—$4,893,300

Immediately following Baker's remarks, the ribbon across the freeway was officially cut by J. Kingsley and Baker with the help of Lt. Governor Knight and James A. Guthrie, Highway Commissioner from San Bernardino. A caravan of cars was immediately started and traveled the length of the new section to Silver Lake, returning to Western Avenue.

The entire dedicatory ceremonies were run off in rapid-fire order by Kingsley and took about 40 minutes from the beginning to the cutting of the ribbon.

PUBLIC PARKING AREA IN ROSEVILLE

By GILBERT MULCAHY
District Right of Way Agent, District III

IN A COOPERATIVE venture between the State of California and the City of Roseville, the parking situation in Roseville has been greatly improved by the utilization of some right of way not presently required, for an off-street public parking area under the management and control of the city.

Looking westerly across Roseville's free parking lot in the foreground one block from the center of the business district. The street bisecting the picture is the new section of U. S. 99E near the south ramp of the underpass across the railroad yards.

Construction of the Washington Street Underpass across the yards of the Southern Pacific Company in Roseville, completed May 10, 1951, created an additional parking problem in the business center of town by eliminating all the former parking available on both sides of Washington Street for two blocks.

Near the end of construction of the highway project through Roseville, disposal of surplus excavated material became a problem. The State had acquired an entire ownership of land westerly of Lincoln Street because of excessive damages to the remainder. The portion outside of the normal right of way, between Dry Creek and the Lincoln Street connection, was approximately 10 to 15 feet lower than Lincoln Street and the adjoining state highway. Some of the excess material was used to fill this area up to approximately the grade of Lincoln Street and the adjoining state highway.

Naturally concerned about the aggravated parking situation, Roseville officials, under the leadership of Mayor Harold T. Johnson, now State Senator, investigated the possibilities of using this level area only one block from the center of the city for public off-street parking. Since it was recognized that highway traffic and parking problems go hand in hand, an agreement was reached with the City of Roseville whereby the surplus land, comprising 1.62 acres was leased to the city for a free public parking area and public park at the nominal rate of $1 per year. Not all of the 1.62 acres had been filled in, and the city wished to use the portion adjoining Dry Creek to extend the deer runs of the adjoining Royer Park.

The public parking area was surfaced, signed, and put in operation by the City of Roseville about March of 1950. Lights have since been installed by the city and landscaping of the entire highway project through Roseville, now underway, is adding to the attractiveness of the site. With a capacity of 80 cars, this parking area absorbs the overflow from Vernon and Lincoln Streets, the two main business thoroughfares.

Roseville is justifiably proud of this public service which costs it a rental of only $1 per year and relieves the State Highway Department of maintenance costs until the property is used for the future highway which is planned.

Freeway Values

Continued from page 5 . . .

may be found in the comparison of the $7,000 to $10,000 per acre values just discussed to the highest price and most recent sale of industrial property in this immediate vicinity—served by the freeway, but not visible therefrom. This price was $5,000 per acre, in itself a considerable jump from the values existing prior to freeway construction.

Near the north end of the four-mile long North Sacramento freeway on the portion of U. S. Highway 99E still conventional highway, top land values indicated by various listings are $5,000 per acre, the best use being commercial.

All this brings us to the conclusion that the many advantages of a fast, safe uncongested highway facility, which are to be found only in freeways, have a pronounced beneficial effect on values of the abutting lands which they serve.

Cow Palace

Continued from page 54 . . .

lived by early day cowboys. The story will be emphasized in music and song to add further to the colorful life of the pioneer cowmen.

Two other new features that help to bear out the theme of newness throughout will be the Boom Town Quadrille, a cast of 18 horses and riders doing square dance numbers to the tunes reminiscent of early America, and the Wild Horse Stampede.

Horses that are just as wild as their names imply will be turned loose in the arena and 50 cowboys will have the task of riding them. They will have no rope, bridle or saddle to aid in this maneuver. Only the horses' mane will be available for their use in riding these mustangs.

The rodeo will culminate the 1951 season for the International Rodeo Association with points won at this meet determining the championship for he year.

HIGHWAY BIDS AND AWARDS

August, 1951

ALPINE COUNTY—Between 1.5 and 2.5 miles northeasterly of Woodfords, between Markleeville and two miles southeasterly thereof and across Silver Creek about 10 miles southerly of Markleeville, a total net distance of about 1.1 miles, roadbeds to be graded, I. B. M. to be placed, B. S. T. to be applied, the existing bridge over the East Carson River about 1.5 miles southeasterly of Markleeville to be repaired and a new reinforced concrete bridge to be constructed across Silver Creek. District X, Routes 23, 24, Sections C, C&D. R. P. Shea Co., Indio, $324,968.75. Contract awarded to Eaton & Smith, San Francisco, $255,113.

ALPINE COUNTY—Between 1.3 miles and 2.6 miles east of Picketts, about 1.3 miles to be graded, surfaced with roadmixed surfacing on imported base material and a reinforced concrete girder bridge across West Fork of Carson River to be constructed. District X, Route 23, Section E. Eaton & Smith, San Francisco, $281,760; R. P. Shea Co., Indio, $337,-514. Contract awarded to Harms Bros., Sacramento, $257,203.

CONTRA COSTA COUNTY—Over Refugio Creek and Hercules Powder Co. roads at Hercules, the existing timber trestle bridge to be repaired. District IV, Route 106, Section Her. B. S. McElderry, Berkeley, $21,964.50; Barton Construction Co., Oakland, $18,212.57; James H. McFarland, San Francisco, $15,707. Contract awarded to Bos Construction Co., Oakland, $14,854.

DEL NORTE COUNTY—Portions along the Smith River between 27.1 miles and 30.8 miles northeast of Crescent City, about 0.4 mile in net length, storm damage to be repaired at two locations. District I, Route 1, Section E. Mercer, Fraser Co. & Mercer, Fraser Gas Co. Inc., Eureka, $159,401; Fredrickson Bros., Emeryville, $177,929; Eaton & Smith, San Francisco, $214,424. Contract awarded to C. W. Peterson, North Hollywood, $148,638.

EL DORADO COUNTY—Between railroad crossing near west city limits and east city limits in Placerville, about 2.1 miles in length to be surfaced with P. M. S. and U. R. B., District III, Route 11, Section Plcr, D. M. J. Ruddy & Son, Modesto, $62,656. Contract awarded to Rice Bros., Inc., Marysville, $57,901.

HUMBOLDT COUNTY—Between one mile south of Scotia Post Office and North Scotia Bridge, about 1.4 miles in length to be graded and surfaced with P. M. S. on C. T. B. and reinforced concrete undercrossing structure to be constructed. District I, Route 1, Section E. L. A. and R. S. Crow, El Monte, $1,086,896.50; Eaton & Smith, San Francisco, $966,-184.65; Ball & Simpson, Berkeley, $903,044.20; Guy F. Atkinson Co., South San Francisco, $892,888.25. Contract awarded to Frederickson Bros., Emeryville, $879,444.40.

LAKE COUNTY—Between 5.2 and 5.5 miles north of Middletown, about 0.3 mile of roadway to be graded, I. B. M. to be placed, and surfaced with R. M. S. District I, Route 89, Section B. O'Connor Bros., Red Bluff, $65,884.60; Britt Pugh, Ukiah, $51,247.10; Louis Biasotti & Son, Stockton, $44,-626.80; Harold Smith, Saint Helena, $39,933.80. Contract awarded to Arthur B. Siri, Inc., Santa Rosa, $37,472.10.

LOS ANGELES COUNTY—On Santa Ana Freeway, between Todd Avenue and 0.2 mile southeasterly of Lakewood Boulevard, about two miles in net length to be graded and surfaced with P. C. C. pavement on cement treated subgrade; interchange roadways, acceleration and deceleration lanes to be surfaced with P. M. S. on untreated rock base; four grade separation structures and a bridge over the Rio Hondo to be constructed to provide a freeway with a six lane divided roadway. District VII, Route 166, Section A. Guy F. Atkinson Co., Long Beach, $2,764,951.35; J. E. Haddock, Ltd., Pasadena, $2,713,870.50; Griffith Co., Los Angeles, $2,660,855.45. Contract awarded to United States Concrete Pipe Corp., Baldwin Park, $2,537,790.25.

MENDOCINO COUNTY—About one and one-quarter miles north of Willits, truck scales to be installed and approaches to be constructed thereto. District I, Route 1, Section F. O'Connor Bros., Red Bluff, $35,530; Tom C. Latham, Bakersfield, $33,-745.70; Arthur B. Siri, Inc., Santa Rosa, $33,158; Pike & Hill, Carey Bros. & Bailey, San Rafael, $30,-320. Contract awarded to Harms Bros., Sacramento, $25,467.

MERCED, SAN JOAQUIN, STANISLAUS, NAPA, CONTRA COSTA, AND SANTA CLARA COUNTIES—Various locations, sealing pavement joints, District X. Concrete Pavement Maintenance Co., San Francisco, $42,246. Contract awarded to Dana R. Tyson Co., Sacramento, $38,748.

MODOC COUNTY—Between Toms Creek and Cedarville, about 8.9 miles in length, seal coat to be applied. District II, Route 28, Section C. O'Connor Bros., Red Bluff, $33,575; H. B. Folsom, Westwood, $17,725. Contract awarded to Morgan Construction Co., Redding, $15,550.

MONTEREY COUNTY—Town of seaside, at the intersection of Fremont Street with Broadway, a full traffic-actuated signal system and highway lighting to be furnished and installed and channelization to be constructed. District V, Route 56, Section I. Watsonville Electrical Appliance Co., Inc., Watsonville, $20,906.78; Fischbach & Moore, Inc., Los Angeles, $20,183; Ets-Hokin & Galvan, Monterey, $19,-558; L. H. Leonardi Electric Construction Co., San Rafael, $18,663.60. Contract awarded to Howard Electric Co., Gilroy, $17,962.25.

NEVADA COUNTY—Between Donner Summit and Donner Lake about 0.8 mile in total net length to be graded and surfaced with P. M. S. on untreated rock base. District III, Route 37, Section C. J. Henry Harris, Berkeley, $159,390.50. Contract awarded to Harms Bros., Sacramento, $129,658.50.

NEVADA COUNTY—Between Flycaster's and Mystic, a net distance of about 1.3 miles, roadway to be restored and surfaced with P. M. S. on C. R. B. District III, Route 38, Section A, B. Contract awarded to Harms Bros., Sacramento, $290,976.

ORANGE COUNTY—On Santa Ana Freeway from Broadway to First Street, highway lighting and illuminated sign systems to be furnished and installed. District VII, Routes 2, 174, Sections SA, C, SA. Ets-Hokin & Galvan, Inc., Wilmington, $109,-203; Fischbach & Moore, Inc., Los Angeles, $107,-006; Electric & Machinery Service, Inc., South Gate, $104,563. Contract awarded to Westates Electrical Construction Co., Los Angeles, $102,830.

RIVERSIDE COUNTY—In the City of Forona, between the east city limits and Main Street, a distance of about 2.4 miles. P. M. S. to be placed over existing pavement and portions of the roadbed to be widened with P. M. S. on imported base material. District VIII, Route 77. R. A. Erwin, Colton, $45,-666; Cox Bros. Construction Co., Stanton, $44,021. Contract awarded to E. L. Yeager Co., Riverside, $42,648.30.

SAN BERNARDINO COUNTY—In the City of San Bernardino, on "E" Street between Rialto Avenue and Fifth Street, traffic signal systems and highway lighting to be furnished and installed and modified. District VIII, Routes 43, 9. C. D. Draucker, Inc., Los Angeles, $23,592; Westates Electrical Construction Co., Los Angeles, $21,469; Paul R. Gardner, Ontario, $20,805. Contract awarded to Fischbach & Moore, Inc., Los Angeles, $19,867.

SAN BERNARDINO COUNTY—Between 0.6 mile north of Devore and 0.2 mile south of Gish Underpass about 9.3 miles to be graded and surfaced with P. M. S. on base material and four reinforced concrete bridges and two culverts to be constructed, to provide a freeway with four lane divided roadbed. District VIII, Route 31, Section B. Ball & Simpson, Erickson Phillips & Weisberg, and San Ramon Valley Land Co., Berkeley, $2,333,445.30; Granite Construction Co., Watsonville, $2,249,136; Chas. MacClosky Co., Geo. Herz & Co., & C. G. Willis & Sons, Inc., San Francisco, $2,248,472.44; L. A. & R. S. Crow, El Monte, $2,223,469; Peter Kiewit Sons Co., Arcadia, $2,193,553.10; J. A. Payton & Bent Const. Co., Los Angeles, $2,066,-949.20. Contract awarded to Fredericksen & Kasler, Sacramento, $2,007,473.60.

SANTA BARBARA COUNTY—Cleaning and painting a bridge over San Roque Canyon in the City of Santa Barbara. District V, Route 80. Timmons Painting & Engineering Co., Long Beach, $19,995.

SANTA BARBARA COUNTY—Between 0.5 mile east of Arroyo Parida and Ortega Hill, about 3.7 miles in length to be graded and paved with P. C. C. on cement treated subgrade, reinforced concrete bridges to be constructed across Arroyo Parida, Arroyo Parida (Frontage Road) and Toro Creek and a reinforced concrete pedestrian undercrossing to be constructed at Hollister Street, District V, Route 2, Sections H, J. United Concrete Pipe Corp., Baldwin Park, $1,203,377; J. E. Haddock, Ltd., Pasadena, $1,192,-047.55; Granite Construction Co., Watsonville, $1,189,369; Ball & Simpson, Berkeley, $1,112,090.30. Contract awarded to Griffith Co., Los Angeles, $1,023,574.95.

SANTA BARBARA, SAN LUIS OBISPO & MONTEREY COUNTIES—At Salsipuedes Street and between Bath Street and Junipero Street in the City of Santa Barbara; between Cayucos and 0.6 mile north; between Route 33 and Kern County line and between Spence Underpass and 2 miles south of Salinas, about 9.7 miles in length, seal coat to be applied, District V, Routes 2, 56, 125; Sections S.B., C, D, B. J. Henry Harris, Berkeley, $32,032. Contract awarded to Granite Construction Co., Watsonville, $30,042.50.

SANTA CLARA COUNTY—Between Llagas Creek and Gilroy, about 5.6 miles in length, P.M.S. to be placed over existing pavement and new shoulders constructed. District IV, Route 2, Section C. Granite Construction Company, Watsonville, $175,030; A. J. Raisch Paving Co., San Jose, $168,-573.90; M. J. Ruddy & Son, Modesto, $157,226.50. Contract awarded to Fredrickson & Watson Construction Co., Oakland, $154,840.

SANTA CLARA COUNTY—Between south city limits of San Jose and Tully Road, about 1.5 miles to be widened, and surfaced with plant-mixed surfacing on the existing pavement and cement treated base. District IV, Route 2, Section B. Leo. F. Piazza Paving Co., San Jose, $100,016.74. Contract awarded to A. J. Raisch Paving Co., San Jose, $99,-802.25.

SHASTA COUNTY—Reroofing of District II Office, Maintenance and Garage Buildings, in Redding, Shasta County. District II. B. W. Harlan, 1646 Tehama Street, Redding, $2,420; contract awarded to C. D. Rich, Redding, $2,313.78.

SISKIYOU COUNTY—At Weed Maintenance Station, a truck shed, gasoline and oil house, pump house, and fence to be constructed, plumbing and electrical facilities to be installed, clearing and grading to be performed and I. B. M. material to be placed. District II, Route 3, Section A. E. E. Myers, Chico, $44,963; A. J. McMurry Co., Yreka, $41,-723; Pike & Hill and Carey Bros., and Bailey, San Rafael, $41,600; Triangle Const. Company, Sacramento, $39,750. Contract awarded to R. Taylor Willis, Napa, $36,949.

SISKIYOU AND SHASTA COUNTIES—Cleaning and painting four bridges at Shasta River eight miles north of Yreka, at Scott River two miles east of Hamburg, at Oak Run Creek 14 miles east of Redding and over Southern Pacific Railroad at Redding. District II, Routes 3, 46, 20. R. W. Reade & Co., Berkeley, $12,852. Contract awarded to J. S. Morris Co., Berkeley, $7,990.

SONOMA COUNTY—Between Purple Draw and 0.9 mile east of Santa Rosa and between Cotati and Sebastopol (portions) about 4.9 miles, additional roadway widths to be graded and plant-mixed surfacing to be placed on existing pavement, cement treated base and crusher run base. District IV, Routes 51, 104, Sections C, SRo, A,C. A. G. Raisch Co., San Rafael, $239,924.70. Contract awarded to Arthur B. Siri, Inc. and E. A. Forde, Santa Rosa, $226,387.55.

VENTURA COUNTY—On Ventura Boulevard, from Santa Clara River Bridge through Montalvo, highway lighting to be furnished and installed. District VII, Route 2, Section C. Fischbach & Moore, Inc., Los Angeles, $8,324; Westates Electrical Const. Co., Los Angeles, $7,944. Contract awarded to Electric & Machinery Service, Inc., South Gate, $7,886.

YUBA COUNTY—City of Marysville, at intersections of Tenth Street with H Street and I Street and Ninth Street with B Street, traffic signal systems and highway lighting to be furnished and installed at 2 intersections and intersection improvement to be constructed at 1 intersection. District III, Routes 3, 15. Hall Sloat Electric Co., Inc., Oakland, $27,470. Contract awarded to L. H. Leonardi Electric Construction Co., San Rafael, $23,716.

F. A. S. County Routes

KERN COUNTY—On Airport Avenue between State Route 4 and Norris Road, a structural steel railroad underpass to be constructed and about 1.2 miles of 4-lane divided highway to be graded and surfaced with P.M.S. on U.R.B. District VI, Route 881. Ball & Simpson, Berkeley, $422,778.15. Contract awarded to Griffith Co., Los Angeles, $366,833.30.

LOS ANGELES COUNTY—Across Rio Hondo on Florence Avenue, a reinforced concrete and structural steel bridge to be constructed. District VII, FAS Route 838. O. B. Pierson, Bellflower, $271,022; Charles MacClosky Co., San Francisco, $292,660; K. B. Nicholas, Ontario, $296,286. Contract awarded to E. G. Perham, Los Angeles, $270,478.50.

LOS ANGELES COUNTY—Across Rio Hondo, on Beverly Boulevard, a combination reinforced concrete and structural steel bridge to be constructed. District VII, Route 845. Granite Const. Co., Watsonville, $427,379; K. B. Nicholas, Ontario, $425,381.70; Chas. MacClosky Co., San Francisco, $393,738.75. Contract awarded to John Strona, Pomona, $372,510.01.

LOS ANGELES COUNTY—Across San Gabriel River, on Center Street, a reinforced concrete girder bridge to be constructed, District VII, Route 835. E. G. Perham, Los Angeles, $249,446; Granite Construction Co., Watsonville, $248,131; Sharp & Fellows Construction Co., Los Angeles, $234,087.20; Chas. MacClosky Co., San Francisco, $219,128.20; Oberg & Cook, Gardena, $214,780.80; John Strona, Pomona, $214,426.50. Contract awarded to Lars Oberg, Los Angeles, $212,493.20.

LOS ANGELES COUNTY—Across San Gabriel River, on Imperial Highway, a reinforced concrete girder bridge to be constructed. District VII, Route 636. Byerts & Sons and Geo. K. Thatcher, Los Angeles, $250,217. Contract awarded to Charles MacClosky Co., San Francisco, $212,842.

MARIN COUNTY—On Point Reyes Station—Novato Road, between 10 miles east of Point Reyes Station and 6.2 miles west of Novato, about 2.3 miles of roadway to be graded, imported base material to be placed, and surfaced with plant-mixed surfacing. District IV, Route 879. Huntington Bros., San Anselmo, $133,656.25; E. A. Forde, San Anselmo, $101,110. Contract awarded to A. G. Raisch Co., San Rafael, $94,692.70.

MONO COUNTY—Between Alpine County line and U. S. 395, portions (about 6 miles north of Coleville) about 4 miles, to be graded and drainage structures to be installed on about 3.6 miles of existing roadbed. District IX, Route 959. Richter Bros., Oroville, $246,317.80; R. P. Shea Co., Indio, $210,473.42; L. A. & R. S. Crow, El Monte, $207,111; M. Malfitano & Son, Inc., Pittsburg, $202,482.60; Arthur B. Siri, Inc., Santa Rosa, $171,499; T. M. Montgomery, Auburn, $169,368; Eaton & Smith, San Francisco, $150,734.90. Contract awarded to C. V. Kenworthy, Stockton, $146,059.

ORANGE COUNTY — On Wright-Brookhurst Street between Wintersburg Avenue and Santa Ana Freeway, about 8.9 miles (portions) to be widened and plant-mixed surfacing placed over existing surfacing and new untreated rock base and the remaining portions to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VII, Route 747. Roland T. Reynolds, Anaheim, $269,866; M. S. Mecham & Sons, South Gate, $320,006.50; Vido Kovacevich Co., South Gate, $341,857.50; Griffith Co., Los Angeles, $349,093.05; Cox Bros. Construction Co., Stanton, $384,164.25. Contract awarded to Sully-Miller Contracting Co., Long Beach, $259,694.90.

PLUMAS COUNTY—At Indian Creek Bridge, about 0.8 mile south of Crescent Mills, about 0.6 mile to be graded and surfaced with R.M.S. on C.R.B. and reinforced concrete bridge to be constructed. District II, Route 1062. O'Connor Bros., Red Bluff, $190,184.90; Chittenden & Crittenden & B. S. McElderry, Auburn, $181,019.50. Contract awarded to M. A. Jenkins & R. E. Hertel, Sacramento, $177,903.

RIVERSIDE COUNTY—Across Santa Ana River, on Crestmore Road, near Riverside, a steel plate girder bridge to be constructed. District VIII, Route 1177. E. L. Yeager Co., Riverside, $345,214.50; Ralph A. Bell, Monrovia, $309,809.10; Chas. MacClosky Co., San Francisco, $296,792; K. B. Nicholas, Ontario, $289,900; Judson Pacific-Murphy Corp., Emeryville, $289,280; O. B. Pierson, Bellflower, $273,472. Contract awarded to C. B. Tuttle Co., Long Beach, $266,184.

SACRAMENTO COUNTY—On Greenback Lane, between Main Avenue, in Orangevale Colony and Folsom-Auburn Road, about 1.5 miles of roadway to be graded, imported subbase material and untreated rock base to be placed and surfaced with P.M.S. District III, Route 928. C. V. Kenworthy, Stockton, $212,941; San Ramon Valley Land Co., Berkeley, $185,940.40; Harms Bros. & M. W. Brown, Sacramento, $180,473; Brighton Sand & Gravel Co., Sacramento, $170,734; Louis Biasotti & Son, Stockton, $163,730.50; A. Teichert & Son, Inc., Sacramento, $160,390. Contract awarded to J. R. Reeves, Sacramento, $149,386.

SACRAMENTO COUNTY — Portions between S.P.R.R., near Walnut Grove, and Mokelumne River and between Locke and Franklin Boulevard, about 7.7 miles in length; Portion A, to be graded, imported subbase material and crusher run base to be placed and surfaced with P.M.S.; and Portion B to be surfaced with P.M.S. District III, Routes 900 and 539. McGillivray Construction Co., Sacramento, $163,253.50; A. Teichert & Son, Inc., Sacramento, $159,606; Claude C. Wood Co., Lodi, $151,127.95. Contract awarded to Brighton Sand & Gravel Co., Sacramento, $147,359.50.

SACRAMENTO COUNTY—On El Centro Road, between Elkhorn Road and Elverta Road about 2 miles of roadway to be graded, imported subbase material and crusher run base to be placed, and surfaced with armor coat. District III, Route 926. Louis Biasotti & Son, Stockton, $119,120.50; L. G. Lentz, Sacramento, $111,065.75; A. Teichert & Son, Inc., Sacramento, $108,802. Contract awarded to Brighton Sand & Gravel Co., Sacramento, $100,732.55.

SAN BERNARDINO COUNTY—On Sierra Avenue, between Valley Freeway and Highland Avenue, about 4.7 miles to be graded to provide additional width and surfaced with P.M.S. on cement treated base and on existing pavement. District VIII, Route 705. R. A. Erwin, Colton, $241,878.50; A. S. Hubbs and Hubbs Equipment Co., Colton, $234,131; Vernon Paving Co., Los Angeles, $224,934.50; E. L. Yeager Co., Riverside, $216,926.75; George Herz & Co., San Bernardino, $204,407.85. Contract awarded to Matich Bros. Paving Co., Colton, $193,703.

SANTA CLARA COUNTY—On San Jose-Stevens Creek Road, between Bascom Avenue and Saratoga Avenue, about 2.2 miles, to be graded and surfaced with P.M.S. on I.B.M. District IV, Route 1000. Edward Keeble, San Jose, $240,246; Leo F. Piazza Paving Co., San Jose, $223,249.34. Contract awarded to A. J. Raisch Paving Co., San Jose, $222,264.55.

SANTA CRUZ AND SANTA CLARA COUNTIES—On Summit Road, between State Highway Route 5 and Woodwardia, about 1.3 miles, to be graded, surfaced with crusher run base and prime coat and seal coat to be applied. District IV, Route 616. Louis Biasotti & Son, Stockton, $145,965.50; Elmer J. Warner, Stockton, $145,072.50; Guerin & Morgan, Los Gatos, $127,931; Eaton & Smith, San Francisco, $125,354; Edward Keeble, San Jose, $113,158. Contract awarded to Granite Construction Co., Watsonville, $109,483.

SIERRA COUNTY—Between 5.2 miles and 0.5 mile west of Loyalton, portions about 3.4 miles of roadway to be graded, I.B.M. to be placed and treated with lime, and penetration treatment to be applied. District III, Route 524. O'Connor Bros., Red Bluff, $137,457.40; Louis Biasotti & Son, Stockton, $123,772.90; Britt Pugh, Ukiah, $109,685.90; Lefever & Bing, West Sacramento, $107,416; C. W. Peterson, North Hollywood, $88,979.60. Contract awarded to Joe Chevreaux, Auburn, $76,172.

SONOMA COUNTY—On Petaluma-Valley Ford Highway between 1.0 mile easterly and 1.7 miles westerly of Valley Ford, about 19 miles west of Petaluma, about 2.7 miles to be graded and surfaced with I.B.M. on imported subbase material and surfaced with I.B.M. on imported subbase material and Class "B" Double sl. ct. and penetration treatment applied. District IV, Route 777. Arthur B. Siri, Inc., Santa Rosa, $193,388.50. Contract awarded to Pike & Hill and Carey Bros. and Bailey, San Rafael, $176.641.25.

STANISLAUS COUNTY—On McHenry Avenue between State Highway Route 13 and San Joaquin County line, about 1.7 miles, to be surfaced with P.M.S. on U.R.B. District X, Route 903. United Concrete Pipe Corporation, Baldwin Park, $41,202.50; Standard Materials, Incorporated, Modesto, $39,590. Contract awarded to M. J. Ruddy & Son, Modesto, $37,619.75.

VENTURA COUNTY—Across Santa Clara River at Santa Paula, a structural steel and reinforced concrete bridge to be constructed and about ¼ mile of approaches to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VII, Route 876. K. B. Nicholas, Ontario, $417,423; C. B. Tuttle Co., Long Beach, $428,826.60; Chas. MacClosky Co., San Francisco, $439,627.86; Granite Construction Co., Watsonville, $443,874; Judson Pacific-Murphy Corp., Emeryville, $443,966.50; Ralph A. Bell, Monrovia, $449,484; Norman I. Fadel, North Hollywood, $536,694.30. Contract awarded to O. B. Pierson, Bellflower, $397,890.75.

YOLO COUNTY—Between County Road 29 and County Road 27, about 6 miles south of Woodland, about 2 miles, the existing roadbed to be surfaced with P.M.S. on U.R.B. and penetration treatment applied to shoulders and road approaches. District III, Route 1167. A. Teichert & Son, Inc., Sacramento, $82,030. Contract awarded to W. C. Railing, Woodland, $69,825.

September, 1951

ALAMEDA COUNTY—In the City of San Leandro at the intersection of MacArthur Boulevard and Dutton Avenue, traffic signal system and highway lighting to be furnished and installed and drainage improvement to be constructed. District IV, Route 5. L. H. Leonardi Electric Construction Co., San Rafael, $12,939 Scott-Buttner Electric Co., Inc., Oakland, $13,373; Hall Sloat Electric Co., Inc., Oakland, $13,472. Contract awarded to R. Flatland, San Francisco, $12,456.

CONTRA COSTA COUNTY—At Franklin Creek near Glen Frazer, about 0.3 mile to be graded and surfaced with plant-mixed surfacing on crusher run base and imported subbase material and seal coats applied. District IV, Route 106, Section A. Lee J. Immel, San Pablo, $32,198; J. Henry Harris, Berkeley, $38,663. Contract awarded to Eugene G. Alves, Pittsburg, $29,293.20.

FRESNO COUNTY—At intersection of U. S. 99 with Central Avenue and with Chestnut Avenue, furnishing and installing highway lighting system. District IV, Route 4, Section B. Robinson Electric, Fresno, $4,340; McCrory Electric, Fresno, $4,718; Westates Electrical Construction Co., Los Angeles, $5,048. Contract awarded to Dale Electric Co., Fresno, $4,220.

FRESNO COUNTY—Across Big Dry Creek about 12 miles east of Academy, an existing combination timber trestle and reinforced concrete bridge to be widened. District VI, Route 76, Section B. Thomas Construction Co., Fresno, $13,961. Contract awarded to Volpa Bros., Fresno, $11,652.50.

KERN COUNTY—In East Bakersfield at intersection of Niles Street and Mt. Vernon Avenue, furnishing and installing traffic signal system and highway lighting. District VI, Route 57, Section E. Fischbach & Moore, Inc., Los Angeles, $12,793. Contract awarded to Westates Electrical Construction Co., Los Angeles, $12,124.

KERN COUNTY—Across East Side Canal, 0.8 mile east of Buttonwillow, a reinforced concrete bridge to be constructed and approaches thereto to be graded and surfaced with plant-mixed surfacing on untreated rock base. District VI, Route 58, Section K. Dicco, Inc., Bakersfield, $23,103; Ted Schwartz, Grass Valley, $29,086. Contract awarded to Thomas Construction Co., Fresno, $21,176.50.

LOS ANGELES COUNTY—On Ramona Freeway between Eighth Street and 0.1 mile east of Jackson Avenue, about 1.7 miles to be graded and paved with Portland cement concrete on cement treated subgrade and with plant-mixed surfacing on imported base material and four bridges and a pedestrian undercrossing to be constructed, to provide a six-lane divided highway with frontage roads. District VII, Route 26, Sections Alh, MonP, E. J. E. Haddock, Ltd., Pasadena, $2,517,882; United Concrete Pipe Corp., Baldwin Park, $2,628,920. Contract awarded to Griffith Co., Los Angeles, $2,381,815.10.

LOS ANGELES COUNTY—Between Palmdale and 2 miles east of Llano, about 3.5 miles to be graded and bituminous surface treatment applied and a reinforced concrete girder bridge to be constructed. District VII, Route 59, Sections H, I, J. Lowe & Watson and Lloyd R. Johnson, San Bernardino, $187,960; Jesse S. Smith and Service Construction Co. of Southern California, Burbank, $190,265; Dimmitt & Taylor, Monrovia, $190,598; L. A. & R. S. Crow, El Monte, $192,299; E. C. Young, San Fernando, $195,041; R. M. Price Co., Altadena, $198,381; A. S. Hubbs and Hubbs Equipment Co., Colton, $198,888; R. P. Shea Co., Indio, $209,313; E. L. Yeager Co., Riverside, $213,837; Roland T. Reynolds, and Thomas Construction Co., Anaheim, $214,340; Ralph A. Bell, Monrovia, $218,335; Matich Bros., Colton, $228,572; G. W. Ellis Construction Co., North Hollywood, $243,824. Contract awarded to Osborn Co., Pasadena, $187,907.50.

MARIN COUNTY—Between Myrtle Avenue in San Rafael and California Park Overhead, about 2 miles, highway ramps, a frontage road and highway roadbeds to be constructed, plant-mixed surfacing to be placed, an existing reinforced concrete bridge to be widened, a reinforced concrete bridge to be constructed and highway lighting facilities to be installed. District IV, Route 1. Granite Construction Co., Watsonville, $1,097,103; Guy F. Atkinson Co., South San Francisco, $1,189,990; Chas. L. Harney, Inc., San Francisco, $1,248,285; Eaton & Smith and Clements & Co., San Francisco, $1,248,796. Contract awarded to A. G. Raisch Co. and Lew Jones Construction Co., San Rafael, $1,056,885.25.

MARIN COUNTY—Between 0.6 mile north of Alto Intersection and Waldo, portions about 1.4 miles in length, placing plant-mixed surfacing on the existing pavement and cement treated base, constructing shoulders of crusher run base and applying seal coat. District IV, Routes 1, 56, Sections C, D, A. Brown-Ely Co., Contractors, Corte Madera, $202,790; A. G. Raisch Co., San Rafael, $205,692; Chas. L. Harney, Inc., San Francisco, $209,083. Contract awarded to Granite Construction Co., Watsonville, $192,282.

MONTEREY COUNTY — Across Burns Creek about 46 miles south of Monterey, an existing steel plate girder and steel truss bridge to be cleaned and painted. District V, Route 56, Section D. Contract awarded to R. W. Reade & Co., Berkeley, $19,844.

NAPA COUNTY—Between Lake County line and 1.5 miles north of Calistoga, about 7.2 miles to be surfaced with plant-mixed surfacing on untreated rock base. District IV, Route 49, Section A. Granite Construction Co., Watsonville, $227,408; M. J. Ruddy & Son, Modesto, $231,849; Mercer Fraser Co., Inc. & Mercer Fraser Gas Co., Inc., Eureka, $239,710. Contract awarded to Munn & Perkins, Modesto, $225,119.50.

ORANGE COUNTY—On Stanton Avenue between Garden Grove Avenue and Lincoln Avenue, about 4 miles, a new two-lane roadway to be graded and surfaced with plant-mixed surfacing on untreated rock base over imported subbase material; the existing roadbed to be widened and surfaced with plant-mixed surfacing on existing pavement and on untreated rock base; and seal coats to be applied to provide a four-lane divided highway. District VII, Route 171, Section B. M. S. Mecham & Sons, South Gate, $485,822; Sully-Miller Contracting Co., Long Beach, $487,955. Contract awarded to Roland T. Reynolds, Anaheim, $411,268.

SACRAMENTO COUNTY—At the intersections of Fulton Avenue with Arden Way and with El Camino Avenue, full traffic-actuated signal systems and highway lighting to be furnished and installed and Portland cement concrete curb to be constructed. District III, Route 98, Section A. Grason Electric Co., Sacramento, $24,298; L. H. Leonardi Electric Construction Co., San Rafael, $24,577. Contract awarded to R. Goold & Son, Stockton, $23,298.

SAN BERNARDINO COUNTY—City of Ontario, on A Street at Bon View Avenue and on Euclid Avenue at B Street, traffic signals and highway lighting to be furnished and installed. District VIII, Routes 26, 192. Paul R. Gardner, Ontario, $11,128; Fischbach & Moore, Inc., Los Angeles, $11,149; Westates Electrical Construction Co., Los Angeles, $12,119; Schurr & Finlay, Inc., Los Angeles, $18,260. Contract awarded to Electric & Machinery Service, Inc., South Gate, $10,873.

SAN DIEGO COUNTY—Between Buena Vista Lagoon and ¼ mile south of Mission Avenue in Oceanside, about 2.1 miles to be graded and paved with Portland cement concrete and a reinforced concrete bridge and grade separation structures to be constructed. District XI, Route 2, Section B, Ocn. Griffith Co., Los Angeles, $1,649,703; Cox Bros. Construction Co., Stanton, $1,655,528; United Concrete Pipe Corp., Baldwin Park, $1,725,398; J. A. Thompson & Son and Webb & White, Inglewood, $1,729,140; Guy F. Atkinson Co., Long Beach, $1,796,232; Clyde W. Wood & Sons, Inc., Chas. MacClosky Co. and R. E. Hazard Contracting Co., San Francisco, $1,811,811; Daley Corp., San Diego, $1,886,384. Contract awarded to J. A. Payton and Bent Construction Co., Los Angeles, $1,618,804.95.

SAN JOAQUIN COUNTY—Over the tracks of the Southern Pacific Co. at Tracy, across Paradise Cut (westbound) and across San Joaquin River at Mossdale (westbound), three steel bridges to be cleaned and painted. District X, Route 5, Sections A, B. D. E. Burgess Co., San Francisco, $30,356; H. C. McKern, San Jose, $37,310. Contract awarded to J. S. Morris Co., Berkeley, $22,945.

SAN LUIS OBISPO COUNTY—In the City of San Luis Obispo, at Santa Rosa Street, at Ida Street and at the Southern Pacific Railroad, two reinforced concrete bridges and an underpass to be constructed and streets to be graded and one street to be surfaced with plant-mixed surfacing on cement treated imported base material. District V, Route 2. Erickson, Phillips & Weisberg, Oakland, $554,212; Fredrickson & Watson Construction Co., Oakland, $581,367; Charles MacClosky Co. and Madonna Construction Co., San Francisco, $598,619. Contract awarded to Granite Construction Co., Watsonville, $529,169.

SAN LUIS OBISPO COUNTY—At the intersections of Spring Street with 12th Street and 13th Street in the City of Paso Robles, semitraffic-actuated signal systems and highway lighting to be furnished and installed at two intersections. District V, Routes 2, 33. Fischbach & Moore, Inc., Los Angeles, $16,441; Ets-Hokin & Galvan, Monterey, $17,311; L. H. Leonardi Electric Construction Co., San Rafael, $17,455; A-C Electric Co., Bakersfield, $17,965. Contract awarded to Howard Electric Co., Gilroy, $15,735.

SAN LUIS OBISPO COUNTY—Across Arroyo De La Cruz about 8.5 miles north of San Simeon, a timber trestle bridge to be redecked with a reinforced concrete slab. District V, Route 56, Section A. Ted Schwartz, Grass Valley, $26,902; B. S. McElderry, Berkeley, $27,809; James H. McFarland, San Francisco, $33,962; Laredon Construction Co., Los Angeles, $34,222. Contract awarded to Wm. Radtke & Son, Gilroy, $25,074.

SANTA BARBARA COUNTY—In the City of Santa Barbara between Montecito Separation and Park Place, about 0.5 mile additional widths to be graded and surfaced with plant-mixed surfacing on untreated rock base. District V, Route 2. Griffith Co., Los Angeles, $34,382. Contract awarded to Baker & Pollock, Ventura, $30,335.55.

SOLANO COUNTY—Between Cordelia Underpass and Ledgewood Creek, highway lighting and illuminated sign systems to be furnished and installed. District X, Routes 7, 8, Sections H, B, A. L. H. Leonardi Electric Construction Co., San Rafael, $22,607. Contract awarded to Underground Electric Construction Co., Oakland, $21,800.

F. A. S. County Routes

CALAVERAS COUNTY—Between 5.3 and 9.7 miles north of Mountain Ranch, about 4.4 miles, to be graded, imported subbase material to be furnished and placed and penetration treatment to be applied. District X, Route 953. M. Malfitano & Son, Inc., Pittsburg, $93,699; Lefever & Bing, West Sacramento, $123,916; Richter Bros., Oroville, $128,962. Contract awarded to Claude C. Wood Co., Lodi, $84,768.20.

FRESNO COUNTY—On Fresno-Coalinga Road, between Coalinga-Mendota Road and Ford Avenue, about 3.9 miles to be graded, imported base material to be placed and cement treatment and bituminous surface treatment to be applied. District VI, Route 809. Vega Engineering & Grading Co., Berkeley, $152,350; Gerald E. Brewster, Avenal, $167,366; John Delphia, Patterson, $171,987; M. J. Ruddy & Son, Modesto, $189,229; Vinnell Co., Inc., Alhambra, $191,024; T. M. Montgomery, Auburn, $199,836; Folsom & Folsom, Coalinga, $200,587; L. A. & R. S. Crow, El Monte, $203,853; Valley Paving & Construction Co., Inc., Pismo Beach, $217,212; R. P. Shea Co., Indio, $219,351; Close Building Supply, Inc., Hayward, $224,921. Contract awarded to Louis Biasotti & Son, Stockton, $140,152.40.

MERCED COUNTY—On Santa Fe Drive between Stanislaus County line and El Capitan Way, about 5.9 miles, to be graded and surfaced with road-mixed surfacing on untreated rock base. District X, Route 912. Standard Materials, Inc., Modesto, $83,457; T. M. Montgomery, Auburn, $83,973; Lefever & Bing, West Sacramento, $85,000; United Concrete Pipe Corp., Baldwin Park, $93,410; M. Malfitapo & Son, Inc., Pittsburg, $95,651; M. J. Ruddy & Son, Modesto, $100,864; Munn & Perkins, Modesto, $107,182. Contract awarded to Baun Construction Co., Fresno, $79,254.

MONO COUNTY—Across West Walker River, near Coleville, a steel girder bridge with reinforced concrete deck to be constructed. District IX, Route 1094. Eaton & Smith, San Francisco, $71,861; R. P. Shea Company, Indio, $83,535; Nomellini Construction Co., Stockton, $84,865. Contract awarded to E. H. Peterson & Son, San Pablo, $58,800.

NAPA COUNTY—On Silverado Trail, between Skellenger Lane and State Highway Route 102, about 1.9 miles, imported base material to be placed and bituminous surface treatment applied. District IV, Route 607. Harold Smith, Napa, $46,896; J. Henry Harris, Berkeley, $50,218. Contract awarded to E. A. Forde, San Anselmo, $43,871.

NAPA COUNTY—Imola Avenue West, between Napa State Hospital and 1.3 miles west, about 1.3 miles to be surfaced with plant-mixed surfacing on existing and new crusher run base. District IV, Route 776. A. G. Raisch Co., San Rafael, $33,325; J. Henry Harris, Berkeley, $36,539; Slinsen Construction Co., Napa, $36,949. Contract awarded to E. A. Forde, San Anselmo, $31,155.

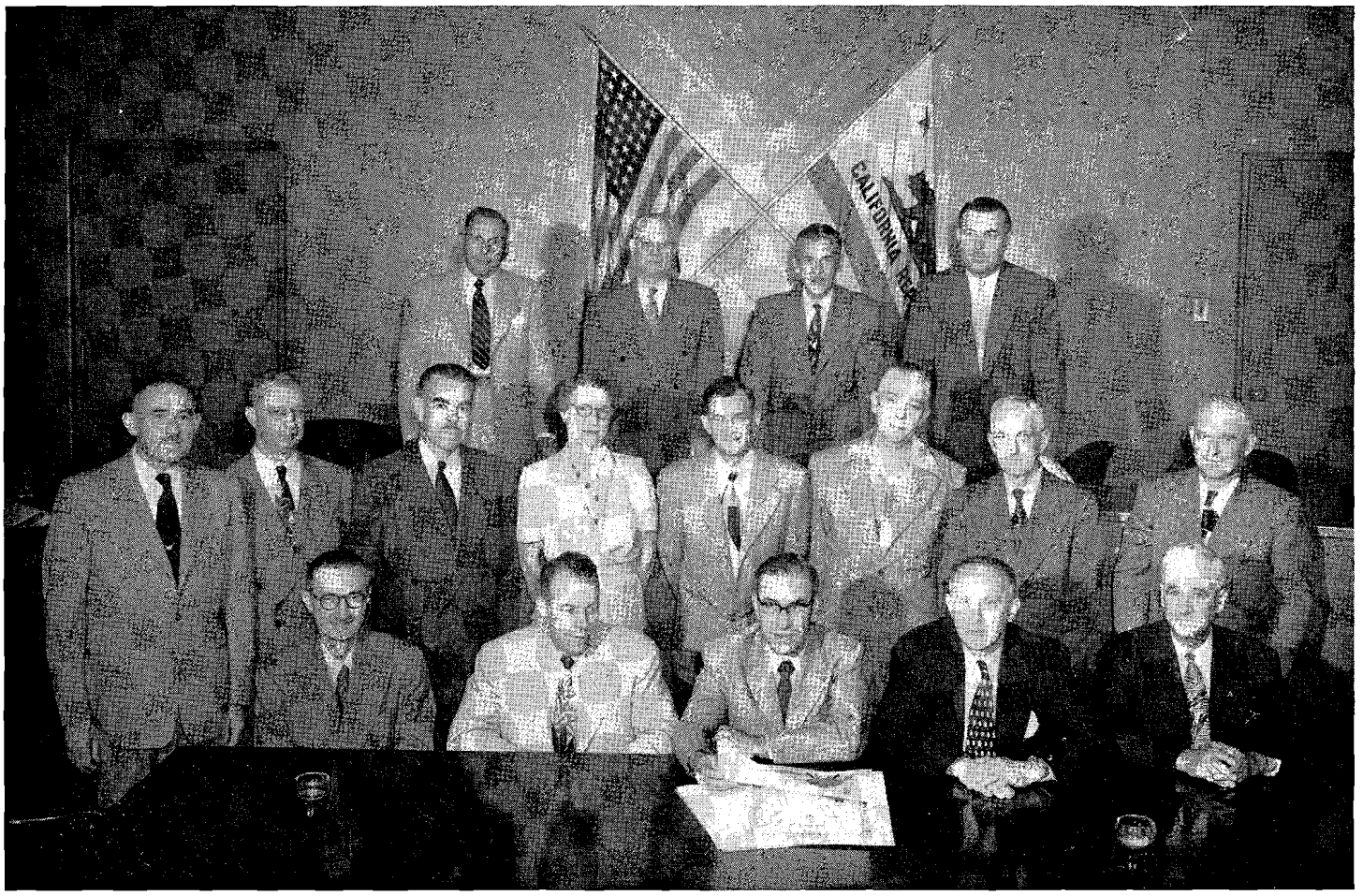
SAN JOAQUIN COUNTY—On Pacific Avenue, between F. A. S. Route 641 near the Five Mile House northwest of Stockton and Stockton city limits about 2.7 miles, existing pavement to be widened with untreated rock base, a four-lane highway to be graded and surfaced with untreated rock base on imported base material, penetration treatment and seal coat to be applied, a new bridge to be constructed and the railing of an existing bridge to be removed and new railing to be constructed. District X, Route 543. Nomellini Construction Co., Stockton, $168,076; Louis Biasotti & Son, Stockton, $178,597; M.J.B. Construction Co., Stockton, $182,381. Contract awarded to George Pollock Co., Sacramento, $159,188.

SANTA CRUZ COUNTY—On Watsonville-Santa Cruz Road between Freedom and Watsonville, about 1.1 miles to be graded and plant-mixed surfacing and seal coats to be placed. District IV, Route 1146. Leo F. Piazza Paving Co., San Jose, $101,366; Edward Keeble, San Jose, $101,858; Louis Biasotti & Son, Stockton, $122,025. Contract awarded to Granite Construction Co., Watsonville, $93,945.

SUTTER COUNTY—Between 1 mile south of Striplin Road and Striplin Road, about 1.1 miles to be graded, surfaced with lime treated imported base material and a penetration treatment and a seal coat applied. District III, Route 926. McGillivray Construction Co., Sacramento, $66,788; A. Teichert & Son, Inc., Sacramento, $73,509; O'Connor Bros., Red Bluff, $83,130. Contract awarded to P. J. Moore & Son, Tracy, $59,136.70.

TULARE COUNTY—About ¼ mile south of Porterville, across Tule River and Poplar Ditch, a reinforced concrete bridge to be constructed. District VI, Route 1127. C. K. Moseman, Redwood City, $182,738; C. B. Tuttle Co., Long Beach, $183,636; O. B. Pierson, Bellflower, $183,690; Charles MacClosky Co., San Francisco, $193,891; Thomas Construction Co., Fresno, $195,279; E. S. & N. S. Johnson, Fullerton, $205,096; Tumblin Company, Bakersfield, $216,953; Nomellini Construction Co., Stockton, $237,313. Contract awarded to Trewhitt, Shields & Fisher, Fresno, $180,618.80.

SERVICE AWARD CERTIFICATES PRESENTED EMPLOYEES



Officials of Public Works Department and recipients of service award certificates. FIRST ROW. LEFT TO RIGHT: Alfred Eichler, George Glacken, Earl Hampton, Carl Henderlong, George Kneppler. SECOND ROW—Walter J. Long, D. Harold McMillan, P. T. Poage, Mae Sullivan, Albert Strubinger, Oscar Vehn, W. B. Warren, D. C. Willett. THIRD ROW—Wes K. Daniels, Director of Public Works Frank B. Durkee, State Architect Anson Boyd, H. S. Hunter.

SIXTEEN EMPLOYEES of the Division of Architecture who have been in state service for 25 years and more were presented with Service Award certificates at a ceremony held in the board room of the Department of Public Works on September 27th and attended by Director of Public Works Frank B. Durkee and State Architect Anson Boyd.

The awards were the first to be presented in the Department of Public Works. Similar ceremonies will be held by the Division of Highways and Division of Water Resources. The 25-year service awards were authorized by the Legislature. Two employees, Frank Austgen and Harold E. J. Woodhams, in the Los Angeles office of the division later were given certificates.

The first certificate was handed to Wes K. Daniels, Assistant State Architect, Administrative, with 35 years of service, by Hubert S. Hunter, Deputy Chief of the division. Daniels in turn presented awards to the following:

Recipients	*Years*
Alfred Eichler, Staff Architectural Designer	25
George Glacken, Office Assistant to Assistant State Architect	27
Earl Hampton, Supervisor, Contract Architects	28
Carl Henderlong, Principal Mechanical and Electrical Engineer	36
George Kneppler, Carpenter Foreman	30
Walter J. Long, Senior Structural Engineer	31
D. Harold McMillan, Structural Engineer Associate	35
Carleton Pierson, Supervising Contract Writer	39
P. T. Poage, Assistant State Architect, Design and Planning	29
Leslie O. Shannon, Plumber	28
Mae Sullivan, Secretary to State Architect	28
Albert Strubinger, Senior Architectural Draftsman	30
Oscar Vehn, Electrician	25
W. B. Warren, Carpenter Foreman	31
D. C. Willett, Chief Construction Engineer	31

In San Diego

Continued from page 38 . . .

The new structure, a high-level crossing, consists of a three-span bridge totaling 455 feet in length, with a roadway width of 28 feet, curb to curb, and a one-foot, nine-inch sidewalk on each side, and will be on the permanent alignment, with temporary connections to the present road at either end.

The work is being supervised by the Bridge Department, with F. B. Donovan as Resident Engineer.

TURKISH ENGINEER STUDIES OUR HIGHWAY CONSTRUCTION

GREAT CHANGES brought about by the Marshall Plan upon highway construction methods in his homeland were described by a young Turkish engineer here on a one-year course of study of American highways made possible through arrangements between the Turkish Government and the United States. He has been in California two months under tutelage of the Division of Highways.

Fethi Komurcuoglu, who admits that his last name is a bit of a mouthful even in the Turkish language, said that until the end of World War II highway construction methods in Turkey remained slow and primitive. Excavation was done by pick and shovel and the dirt was transported by donkey back or hand cars pushed along small-gauge tracks.

"However," Fethi said, "the Marshall Plan began to change things in a hurry. We received shiploads of modern, American-made equipment, and groups of American highway engineers arrived in Turkey to take up positions as teachers and advisers."

Use American Equipment

Fethi explained that the impact upon the highway setup in Turkey was great. During the past four years the internal organization of the highway department has been completely revamped and streamlined to conform with American models. An up-to-date laboratory for testing materials has been constructed and is already under operation. Not only the Turkish Highway Department but even private contractors are now using the latest American equipment.

"The whole idea of modern construction is new in my country," Fethi continued. "Our equipment operators and mechanics need more experience. Turkish engineers don't have trouble with the theories of engineering, but they lack practical experience. My job in the United States has been to study the working methods employed by your highway personnel. In this respect my experience here has been invaluable."

FETHI KOMURENOGLU

Fethi said that since the war a nine-year highway construction program has been inaugurated in his country which will entail the building of 14,300 miles of two-lane roads throughout Turkey. About one-third of these will be paved with asphalt. When completed they will form the backbone of the whole Turkish Highway System.

After his arrival in the United States in October of last year, Fethi spent a month in Washington, D. C., with the U. S. Bureau of Public Roads, which agency is supervising the training program for highway students sent by foreign governments. Subsequently he spent eight months with the Arizona Highway Department. In July of this year he came to spend two months studying highway construction methods in California.

Fethi said that he found the traffic and financial problems in Arizona similar to those in Turkey; but that as far as climate, geographical conditions and types of soil are concerned, California comes much closer to matching those of his own country.

Has Engineering Record

In spite of his youth, Fethi already has an impressive engineering record. After obtaining his master's degree in civil engineering from the Technical University of Istanbul in 1943, he took a job as a superintendent of construction for a private contractor. He served two years with the Corps of Engineers in the Turkish Army, after which he was appointed to a position with the Directorate-General of Turkish Highways.

Between 1947 and 1950, he was in charge of construction, first of the Ankara-Konya Road and then of the Feyzi Pasa-Narli Road which is a part of the Iskenderon-Erzurum Highway. This highway and the spectacular and hazardous mountain country through which it was built formed part of an article on Turkey in a recent issue of the National Geographic Magazine.

Holds High Post

Just before leaving for the United States to carry on his studies, he was appointed to a post as Divisional Construction and Maintenance Engineer.

Fethi, who will soon leave Sacramento for Washington, D. C., where he will spend a month winding up his studies before returning to his homeland sometime in October, said that he was deeply impressed by the friendliness of the American people.

He said that employees in the U. S. Bureau of Public Roads as well as Highway Departments of both Arizona and California had gone out of their way to make his stay a pleasant one.

APPRECIATION

PALMDALE, CALIFORNIA

California Highways and Public Works
Sacramento

GENTLEMEN: Just an expression of appreciation for your fine magazine. It is read and enjoyed by all the family and our guests. We are very grateful to be on your mailing list.

Most sincerely,

Mr. and Mrs. John B. Sigrist
Rt. 3, Box 122
Palmdale, California

Siskiyou Job

Continued from page 6 . . .

wide. This eliminates the congestion caused by the many slow-moving trucks which in the past were a serious restriction to safe traffic flow on the previous winding alignment and steep gradients.

The old road constructed in 1923 by the Henry J. Kaiser Company was a concrete pavement 18 feet in width with shoulders five feet wide on each side. The new overhead at Black Butte, providing a separation of railroad and highway grades, replaces the old narrow structure which had sharp approach curves. The old alignment had 36 curves, whereas the new section has only nine and is 0.37 mile shorter.

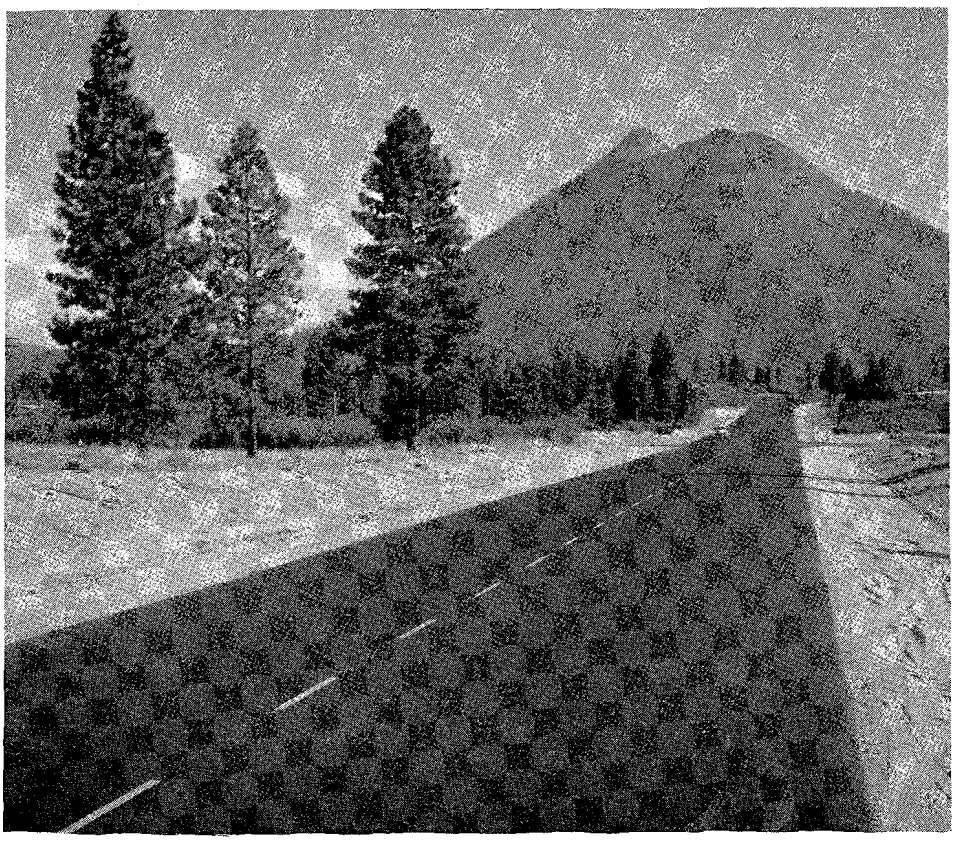
After the symbolic ribbon cutting, the group adjourned to the Fawn Club for a buffet supper.

Collier Speaks

Senator Collier gave a short talk which emphasized the gratification that Siskiyou County felt in having this project completed. He pointed out the local benefits besides those to interstate traffic. He also pointed out the needs of the county as reflected against current available funds and said that at the present rate it would require 33 years to meet the county's deficiencies. He voiced the hope for a billion-dollar highway bond issue in 1952 to be retired by additional gas tax revenues.

Other speakers included Principal Highway Engineer J. P. Murphy, representing State Highway Engineer George T. McCoy; and J. W. Trask, District Engineer, who spoke about progress on other pending projects in the county, particularly from Dunsmuir north. Several citizens from other communities spoke as well as representatives from Weed and Mount Shasta. The speakers from these two towns particularly gave favorable mention to Ellis Engle, Resident Engineer; A. A. Bigelow, in charge of paving, and other engineers connected with the work.

Both the Harms and Rand contracts were completed under District Engineer Trask. Ralph Twaddle was Resident Engineer on the Harms contract and Engle was Resident Engineer on the Rand contract. The writer was District Construction Engineer on the entire project.



Realigned section of U. S. 99, looking south towards Black Butte

Footpath to Freeway

Continued from page 4 . . .

Realizing the need for improvement, surveys were undertaken in 1939 for a study of possible relocation within the town of Dunsmuir and in 1945 a survey was made north to Big Canyon for relocation of that portion of highway. The 1945 survey was conducted to explore the feasibility of minor revisions using the basic alignment of the present highway.

It was found that any revision along the present road could only retain many of the faults of the existing highway, so a new survey was made in 1947 by-passing to the east as much as possible of the present highway and developed area from the Sacramento River Bridge northward.

Four Lane Highway and Bridge

The design being completed will provide a four-lane bridge and highway to Mott, approximately one mile south of Big Canyon, and will eliminate the two right-angle turns at the south approach to the Sacramento River bridge. From Mott to Big Canyon the highway will follow new alignment providing a 24-foot traveled way with 8-foot-wide surfaced shoulders.

The existing highway from the Sacramento River Bridge through the developed area for approximately one mile will, with some revision and improvement immediately north of the bridge, be utilized for an outer highway. From the north end of the bridge to Big Canyon the new route has been established as a freeway. The maximum grade on the new construction will be 5 percent and the number of curves will be reduced to eight, all of which have a radius of 1,000 feet or more.

This reconstruction is only the first step in a vast project aimed to bring our Pacific Highway through Shasta and Siskiyou Counties abreast of present-day standards. The district is still faced with the problem of relieving congestion through Dunsmuir itself and reconstruction of some 26 miles of outmoded highway between Dunsmuir and the upper reaches of Shasta Lake, where the road twists and turns as it follows along the walls of the Sacramento Canyon. Vast as it is, the entire project cannot be too long delayed, for traffic on our highways is increasing daily, and no one can safely predict when a peak will be reached.

EARL WARREN
Governor of California

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FRANK B. DURKEE
Director of Public Works

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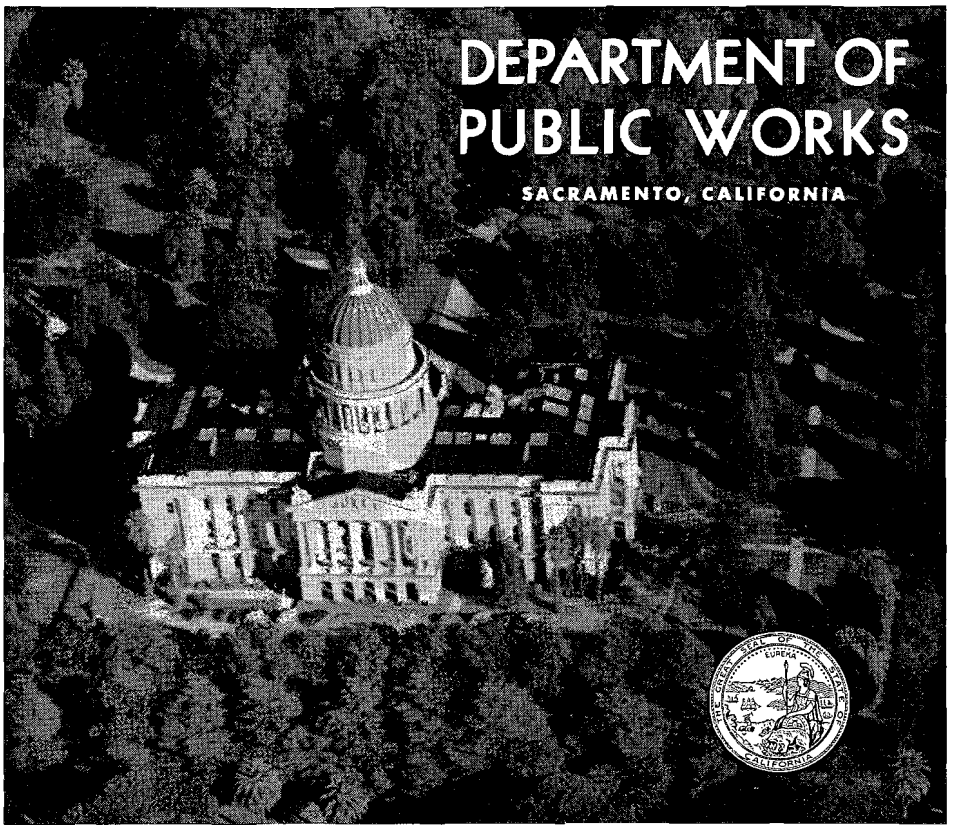

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