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CALIFORNIA

HIGHWAYS AND PUBLIC WORKS

STEEL CONSTRUCTION BEGINS ON FIT RIVER DOUBLE DECK BRIDGE, THE CLOSING LINK IN HIGHWAY AND RAILROAD RELOCATIONS AROUND SHASTA DAM RESERVOIR SITE (SEE ARTICLE IN THIS ISSUE)

MARCH
1941

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

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Damage to State Highways by February Storms Will Cost \$600,000 in Maintenance Funds

By T. H. DENNIS, Maintenance Engineer

STORM damage to California's rural State highways during the month of February totaled \$600,000. Two-thirds of this damage occurred in the 13 southern counties, one-third alone being in the Los Angeles district.

The present winter has offered few spectacles of washed-out roads or bridges; however, some 50 days of rain, almost without respite, has so saturated the underlying support of light type pavements that heavy expenditures will be required for their repair.

Damage was widespread, varying from mud flows to major slides of thousands of cubic yards of rock and earth. During February, there was hardly a major route which was not at some time closed for a short period while the maintenance crews labored to clear the highways or provide suitable detours.

Storm Damage to State Highways

District	Headquarters	Amount
I	Eureka	\$70,000
II	Redding	50,000
III	Marysville	10,000
IV	San Francisco	35,000
V	San Luis Obispo	160,000
VI	Fresno	30,000
VII	Los Angeles	200,000
VIII	San Bernardino	20,000
IX	Bishop	5,000
X	Stockton	10,000
XI	San Diego	10,000
Total		\$600,000

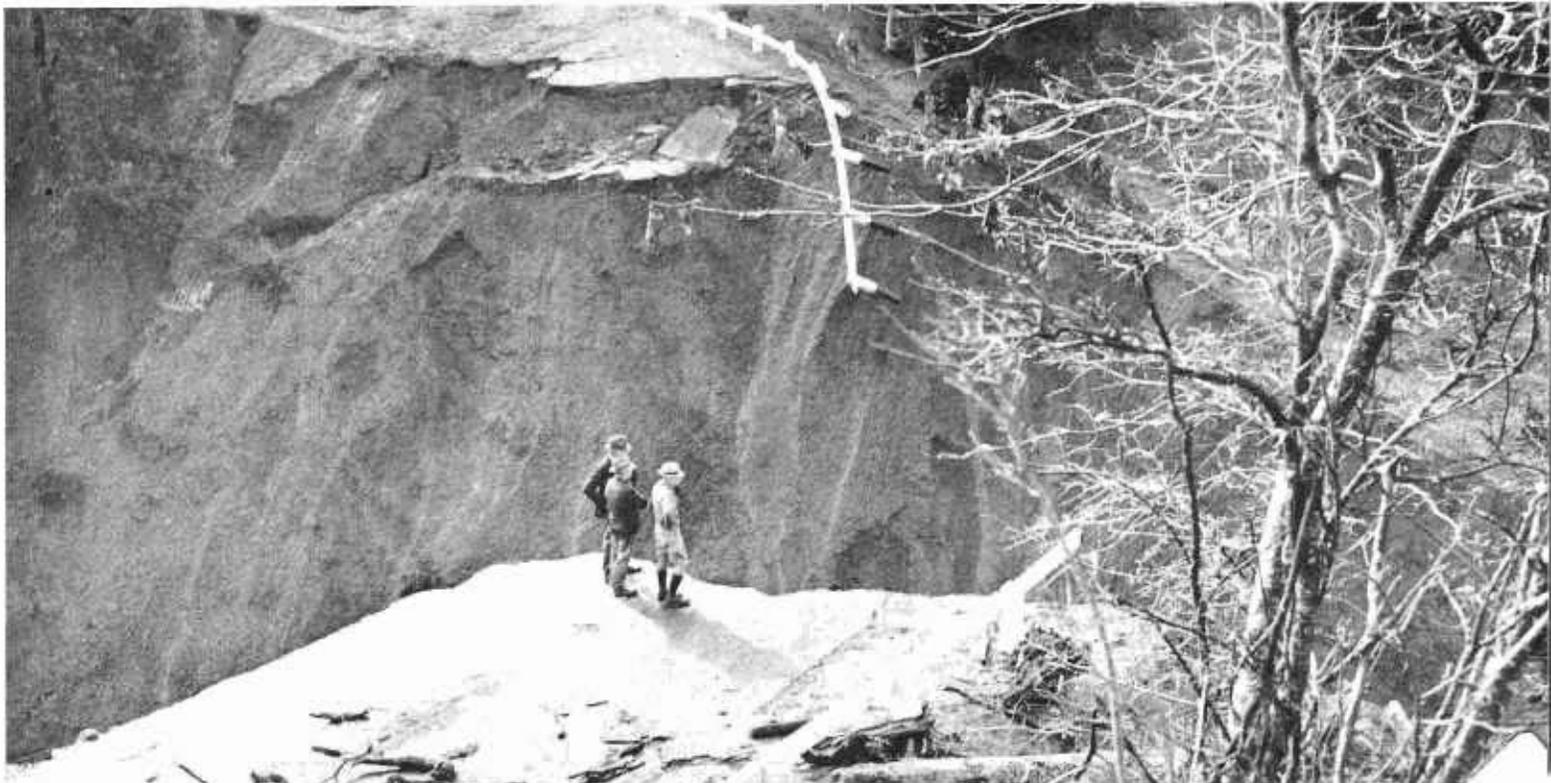
Many miles of highway were flooded. At locations where the water was not too deep, the highway was

outlined with stakes and lanterns, and flagmen placed to warn and slow traffic. On U. S. 99, south of Bakersfield, high velocity windstorms uprooted roadside trees, covered the highway with sand drifts, and so darkened the air that travel became hazardous.

A cloudburst along Willow Creek in Shasta County ripped out six heavy embankments, causing \$30,000 in damage and stopping all eastbound traffic from Weaverville.

The coast route west of Santa Monica was covered with mud flows and heavy slides, which in several instances trapped cars and trucks. One major slipout on this same route carried the embankment and pavement into the ocean and closed the highway for hours. Heavy run-off in the Topanga Canyon ate into the highway embankments at several locations, leaving only a trail.

Section of State highway between Redding and Weaverville in Shasta County ripped out by flood waters due to cloudburst





Section of Coast Road (U. S. 101) in Santa Barbara County washed out by flood due to blocked drainage

Blocked drainage on U. S. 101 in Santa Barbara County washed out sections of pavement, which closed the road for a period. These are but a few of the highlights of damage occasioned by the February rains. They fail, however, to mention the innumerable details and physical effort required to clear these highways.

Naturally, it would not be economical for the Division of Highways to own sufficient equipment to immediately clear all highways, as the work is varied and of comparatively short duration. It is therefore necessary

to secure competitive bids from private sources for much of the equipment required. The remarkable speed with which repair is undertaken speaks well for the districts' maintenance organizations, as well as the cooperativeness of the equipment contractor.

It is not generally realized that, since 1933, 17½ per cent of all maintenance money has been expended for the repair of storm damage. Since legally these funds can only be spent for restoration, obviously such expenditures do not add to the capital

investment in our State highways.

Actually, we often lose a portion of our capital investment, as funds are not always available for complete restoration. There is likewise a certain loss in work efficiency, since it is not always possible to choose the best working conditions if the highways are to be repaired at the earliest possible moment.

It is unlikely that slide expenditures will be reduced in the future in view of the insistent demand for high-speed, direct routings which, to

(Continued on page 27)

Flood waters rushing down Topanga Canyon to coast west of Santa Monica carried away huge sections of State Highway



Two Palo Alto Grade Separations Dedicated With Gala Ceremonies

THE City of Palo Alto and Stanford University joined hands on Saturday morning, March 8, to jointly celebrate the official dedication of Palo Alto's two newly completed highway underpasses which have brought a modern solution of traffic congestion on University Avenue and on El Camino Real.

For Stanford University, observing the 50th anniversary of its founding by Senator, afterwards Governor, Leland Stanford, the occasion was of particular importance. For Palo Alto the dedicatory ceremonies signaled the fruition of years of planning for highway betterment.

Governor Culbert L. Olson, with words of praise for the man who had been a predecessor in the gubernatorial office and who gave to California one of the world's outstanding institutions of learning, formally opened the two underpasses to the public.

COLORFUL PARADE

Federal, State and city officials participated in the ceremonies and San Jose, San Mateo, Burlingame, San Francisco and other peninsula communities assisted Palo Alto in staging one of the most colorful parades ever witnessed in Northern California.

The Southern Pacific Company, which elevated its railroad tracks through Palo Alto and erected a new depot in order to make possible the development, contributed its share to the celebration. As the noon streamlined Southern Pacific Daylight train en route from San Francisco to Los Angeles rolled into Palo Alto the ancient wood-burning locomotive, the J. W. Bowker, built in 1875, and hauling old wooden cars, puffed along on an adjacent track, offering a striking contrast.

The theme of the past and the present was also carried out in the parade in which were covered wagons, stage coaches, hand-pulled fire apparatus of the '80s from San Francisco, Palo Alto and San Jose, and 37 types of automobiles of early vintage spaced between modern motor transportation vehicles, 1941 models of automobiles

Cooperation in Costs

The Federal and State governments, the City of Palo Alto and the Southern Pacific Company participated in the two highway improvement projects.

FEDERAL FEEDER ROAD CONTRACT (Off State System)

University Avenue Under Main Line S. P. R. R. Tracks:

Fed. Grade Crossing Funds (1939).....	\$223,918	
WPA Grade Crossing Funds	163,263	
S. P. R. R. Funds (curb)	2,389	
		\$389,570 \$389,570

This contract, awarded to Paul J. Tyler on November 16, 1939, consists of an underpass, reinforced concrete structures, and steel beam track spans under the S. P. R. R.

STATE HIGHWAY CONTRACTS

On El Camino Real Under University Avenue:

(1) Structure—		
Fed. Aid Funds.....	\$18,002	
State Highway Funds	13,038	
1/4-Cent City Street Funds (Palo Alto)	19,834	
		\$50,874 \$50,874

This contract awarded to Earl W. Heple on July 15, 1940, consists of carrying State Highway (El Camino Real) under University Avenue at entrance of Stanford University.

(2) Highway (4-lane pavement divided)—		
Fed. Aid Funds.....	\$21,202	
State Highway Funds	15,353	
1/4-Cent State Route Funds	44,578	
1/4-Cent City Street Funds	21,100	
		\$102,233 \$102,233

(3) Landscaping—		
Bids to be opened March 20, 1940.....		8,000
Total.....		\$550,677

and up-to-the-minute fire department equipment.

Military units, the American Le-

gion, uniformed outfits of fraternal organizations and drum corps and bands added a picturesque touch to the parade.

NOTABLE LIST OF SPEAKERS

Governor Olson and President Ray Lyman Wilbur of Stanford University were the principal speakers among an imposing list of whom were Dr. L. I. Hewes, United States Public Roads Administration; Larry Barrett, chairman of the California Highway Commission; President A. D. McDonald of the Southern Pacific; Dean Samuel B. Morris of the Stanford School of Engineering; Henry S. Lyons, grand president of the Native Sons of California, and Mayor J. Byron Blois of Palo Alto.

The State Department of Public Works was represented by Director Frank W. Clark, Assistant Director Franz B. Sachse, a Stanford graduate, and Deputy Director Morgan Keaton. Col. Jno. H. Skeggs, District Highway Engineer in San Francisco, represented State Highway Engineer C. H. Purell.

Prof. Edwin A. Cottrell, former mayor of Palo Alto, was master of ceremonies on the speakers' platform. Dr. Augustine Jones delivered the invocation.

MC QUARRIE MURAL UNVEILED

Following the program of speeches, a luncheon was served in the Veterans' Memorial Building, with Governor Olson as guest of honor, after which a mural in the new Southern Pacific depot by John McQuarrie was unveiled. The mural depicts Governor Stanford's dream—the University of Stanford—and the cavalcade of pioneer days and transportation progress in California.

Mounted on a black charger and flanked by Mayor Blois and City Engineer L. Harold Anderson, whose efforts did much to bring about completion of the underpasses, Governor Olson led the parade through the downtown business district, thence through the University Avenue underpass to the El Camino Real underpass and then to the speakers' stand.



Leading the Palo Alto parade, Governor Olson is riding the black horse, with City Engineer L. Harold Anderson at left and Mayor J. Byron Blois at right

Dismounting at the entrance to both underpasses, Governor Olson cut chains of marigold stretched across the roadway, officially throwing the projects open to public use.

In an extemporaneous address which was broadcast Governor Olson took occasion to point out the celebration exemplified the difference between the free and democratic form of government existing in this country which makes possible such cooperative undertakings as the Palo Alto highway projects and the gala observance of their realization and the rule of dictators which impede rather than further the progress of civilization. The Governor said in part:

"All of California is interested in this day of dedication and celebration at Palo Alto. Interested, not merely because we celebrate and dedicate the modern facilities of transportation which are meeting the great needs for public convenience and safety in the underpasses now so splendidly completed with modern construction—not that we are merely enjoying and celebrating the completion of a new and modern up-to-date railroad station—but because all of this celebration and dedication typifies and further empha-

sizes the workings of our American democracy.

"We are also here today celebrating the 50th Anniversary of one of the foremost educational institutions in the United States, an institution of which all the people of the State of California are justly proud.

"Looking backward, we review the fifty years of development and growth of Palo Alto with the growth of that great institution devoted to higher education and scientific research. When we do this and see the people assembled in enthusiastic pride, in peace and in the democratic way of life, this community of Palo Alto and all the adjoining communities, and representatives of State and local governments elsewhere know that this is a classic example of the success of American democracy. * * * That this is the answer to all foreign ideologies for those who cherish the success of American democracy. Here is represented the progress we can and do make through the working of our democratic institutions.

"The developments we are dedicating today, these public improvements, required that cooperation, that spirit or sense of civic responsi-

bility on the part of community leaders and of the people as a whole in order to produce them."

"When we consider this development at Palo Alto—when we look with pride upon it as being one of the classic examples of American life and community interest and cooperation, we can point to more accomplishments than these modern construction conveniences portray. We can point to that cooperation—that successful cooperation and accomplishment by the people of Palo Alto for the economic welfare of those who are served by its public utilities.

"We have here in Palo Alto public ownership and operation of its public utilities, not only of water—but of power and light and gas which are so essential to modern living. And this has been accomplished against heavy odds and at the cost of long struggle to remove obstacles interposed by narrow private interests.

* * * * *

AN ENDLESS STRUGGLE

"Of course we know that to make such progress requires an everlasting struggle. There is no end to it. But it takes time, tolerance, devotion and sincerity of leadership and social



Top—General view of Palo Alto improvements. Center—University Avenue underpass beneath S. P. railroad. Bottom—El Camino Real (U. S. 101) underpass

mindedness in order that we may elsewhere in the State see communities accomplish what Palo Alto has accomplished to better serve the needs and welfare of the people by Government doing the things which Government can do best, and do most economically to advance the general welfare.

"Any philosophy of government that stands in the way of that, we know to be essentially reactionary. We know this because we can point to the progress made here at Palo Alto as the complete answer to all who doubt the efficiency and workability of democracy as a basic principle of government.

"You are particularly benefited and have reason to be happy here in Palo Alto in the birthday of this great university where the molding of the lives of so many of California citizens and leaders in our social, industrial and economic life has taken place—where is given the inspiration for the high ideals so necessary in these days when democracies everywhere are fighting to defend their very existence.

IDEALS OUR STRENGTH

"These ideals are weapons and give us that internal strength which is our greatest buttress against foes of democracy, whether they attack us by military force, or by propaganda, or through fifth columnists seeking to undermine the confidence of our citizens in our democracy.

"We know that we are just as strong internally as the faith of our citizens in our government—just as strong internally as their confidence in the ability not only for our own citizens to preserve their own democratic institutions, but the ability for our nation to supply world leadership toward a higher and higher civilization."

TWO NEW UNDERPASSES

No longer will traffic be delayed on University Avenue, a Palo Alto city street, by the passing and stopping of trains, nor will traffic be held up by traffic lights at the intersection of El Camino Real, U. S. 101 and University Avenue. The two new underpasses under construction but sufficiently completed to permit their use will eliminate all danger to traffic and pedestrians at those points.

During construction of these major structures, traffic has been detoured around the work causing a general

An Appreciation

1441 Roosevelt Ave.,
Redwood City, Calif.

January 14, 1941.

Governor Culbert L. Olson,
Sacramento, Calif.

Dear Sir:

We, Mrs. Foster and I, wish to express our appreciation of the splendid work being done by the Highway Department.

Last Wednesday we drove to Los Angeles via US 101 and returned Saturday via US 99. For the most part the weather was very stormy and numerous slides, rocks, etc., were encountered. At no time, however, did we find any major hazard not marked by flares or other warning. This was particularly exceptional since most of our driving on both parts of the trip was done at night.

To you, the personnel of the Highway Department and especially the numerous men we saw out in the storm placing the various warning signs, thank you.

Very truly yours,

JOHN W. FOSTER.

State of California
Governor's Office
Sacramento

January 17, 1941.

Mr. John W. Foster,
1441 Roosevelt Avenue,
Redwood City, California

Dear Mr. Foster:

I have your letter of January 14th and wish to express my appreciation for your kind words of commendation for the service of the Division of Highways.

Cordially yours,

CULBERT L. OLSON,
Governor of California.

but necessary inconvenience to those who had occasion to use these detours.

The structures now opened to traffic are the University Avenue Underpass separating street traffic on this busy

avenue from the equally busy railroad traffic on the Southern Pacific's lines and the underpass on El Camino Real separating main highway traffic from that on University Avenue.

University Avenue, in addition to being the main business thoroughfare of Palo Alto, serves as the main route between Palo Alto and Stanford University. Between the city proper and the university, this avenue crosses both the main line tracks of the Southern Pacific Company and U. S. Route 101.

GRADE SEPARATION STRUCTURES

The structure at the railroad crossing carries three tracks of the railroad with provision for a future fourth track. Immediately adjacent to the railroad structure, and on each side of it, are highway structures providing for carrying Alma Street traffic over University Avenue on the north side and a cross-over for University Avenue traffic en route to and from the Southern Pacific station on the south side.

University Avenue through traffic is carried through the underpass on two 25-foot traffic lanes separated by a six-foot dividing strip. The highway structure from Alma Street traffic provides a 45-foot roadway, while the highway structure for station traffic provides a 26-foot, two-lane roadway.

The railroad structure consists of continuous steel beam spans supported on concrete piers and abutments with creosoted timber pile foundations.

The adjacent highway structures are of the same construction as the railroad structure, except that their superstructures consist of continuous concrete slab types. Abutments are of double deck cellular construction with the upper decks used as pedestrian tunnels and the lower decks available as storage space for storm water during extreme rainfall conditions.

RAILROAD SHIFTED TRACKS

In order to carry University Avenue under the railroad tracks it was necessary to shift the tracks approximately 81 feet south of their original position and raise them five feet. This shift required extensive changes in railroad facilities at Palo Alto. In addition to the railroad work done in conjunction with the underpass construction, the Southern Pacific Company has spent in the neighborhood

of \$100,000 of its own funds for station modernization.

State Highway Route 2, or El Camino Real as it is more familiarly known, parallels the railroad tracks in the vicinity of Palo Alto and crosses University Avenue between the railroad and Stanford University. Traffic congestion at this intersection created the need for a separation of this main through highway down the San Francisco peninsula from University Avenue. To meet that need the underpass structure on El Camino Real and approach roadways were let to contract and are now nearing completion.

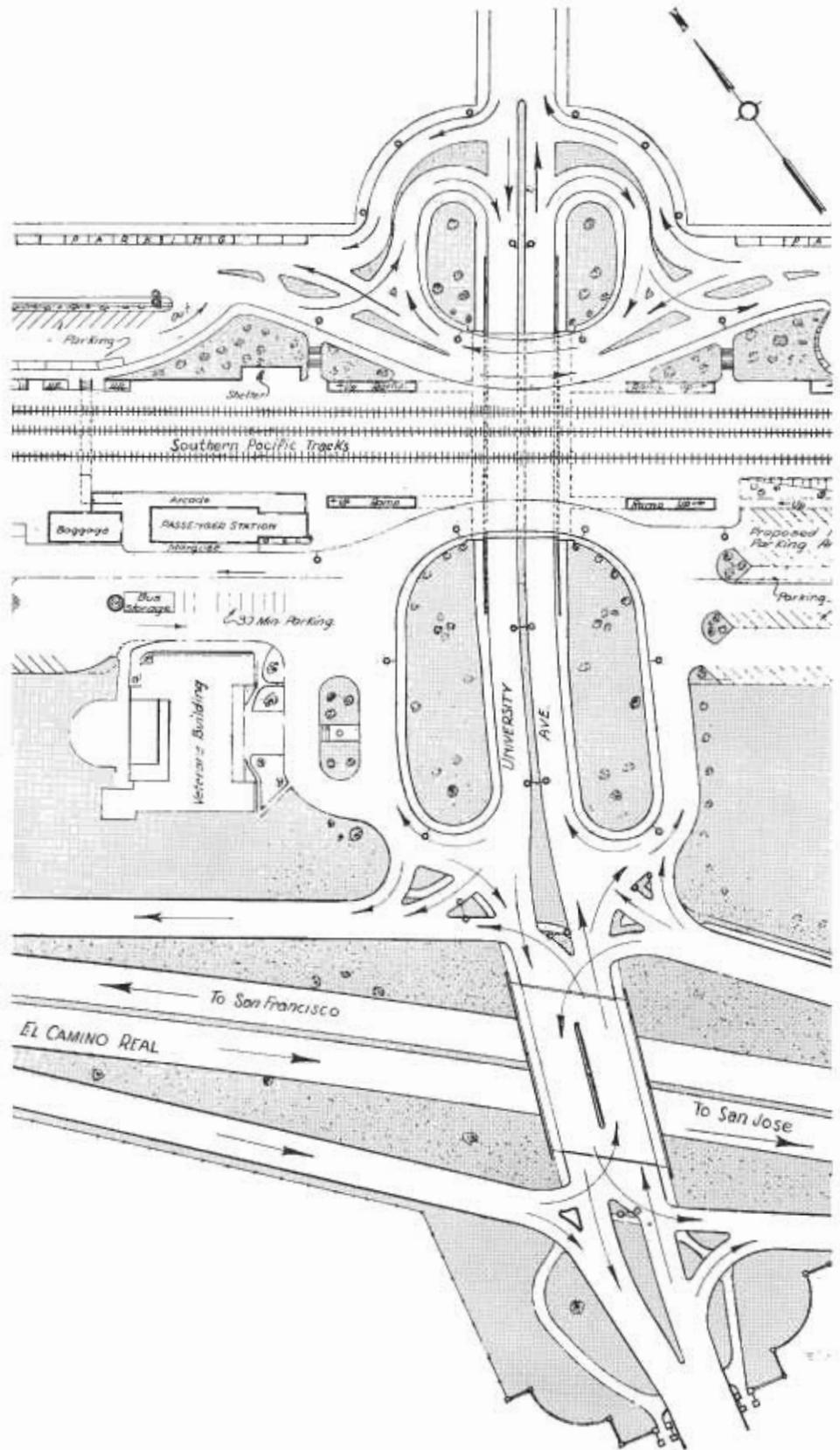
The El Camino Real underpass structure provides for carrying highway traffic under University Avenue on two 35-foot roadways separated by a six-foot dividing strip, and carries University Avenue traffic above on two 35-foot roadways separated by a four-foot dividing strip. Sidewalks are provided on each side of the roads, those on El Camino Real being four feet wide and those on University Avenue eight feet wide. The structure is of rigid frame concrete construction and is located 550 feet south of the railroad separation structure. Side roads of semicloverleaf form connect El Camino Real with University Avenue.

It is estimated that in the neighborhood of 600 vehicle minutes per day were lost at the railroad crossing alone due to the passage of approximately 80 trains daily. The loss of this time, together with an unestimated time loss at the El Camino Real-University Avenue intersection, will be saved to the motoring public. In addition to the saving of time, and of much greater importance, is the elimination of traffic hazards and the promotion of safety for motorists.

At the present time, the work of surfacing the approach roads, placing of top soil and grouting of electroliers at the railroad separation structure is being delayed because of the wet conditions resulting from the recent heavy rains, while at the El Camino Real separation structure minor work on the electrical and pumping systems remains to be done.

An amount of approximately \$18,000 has been expended in placing of top soil, irrigation pipes, and planting of trees and shrubs at the two separation structures to achieve an attractive and harmonious appearance.

It is anticipated that the final work



Sketch shows El Camino Real highway underpass in foreground and University Avenue grade separation under Southern Pacific tracks in Palo Alto with side roads of semicloverleaf design connecting El Camino Real with University Avenue

of constructing these two underpasses and landscaping the surrounding area

will be completed on or about April 1, 1941.

Acres of Concrete Riprap and Cribs Placed to Protect Trinity River Banks

By F. W. HASELWOOD, District Engineer

IN December 1937 and in March 1940 the Trinity River went on a rampage. Each time it broke all previous records for height of water and damage to adjacent improvements. There is no certainty that the record for total volume of run-off was broken in either case because the gold dredging of recent years has so built up and modified the channel and so affected the flow that exceptional flood levels at unusual locations were not surprising.

Regardless of the contributing factors the flood plane of 1937 was from 2 to 8 feet higher than any high water level that had been determined prior to then and the flood level of 1940 was from 2.5 to 4 feet higher than that of 1937.

In 1937 and in 1940 severe damage was done to portions of the highway adjacent to the Trinity River. The 1937 restoration was not always of a type to guarantee against future recurrence of damage since the intervals between such floods was believed to be very long. In some cases, therefore, the 1940 flood caused damage at the same locations as the 1937 flood. Some of the greatest damage in 1940, however, was on sections of road which had survived attacks of the river for twenty years or more.

TWO PROPOSALS OFFERED

After the 1940 experience, it became necessary to revise theories as to the frequency of recurrence of

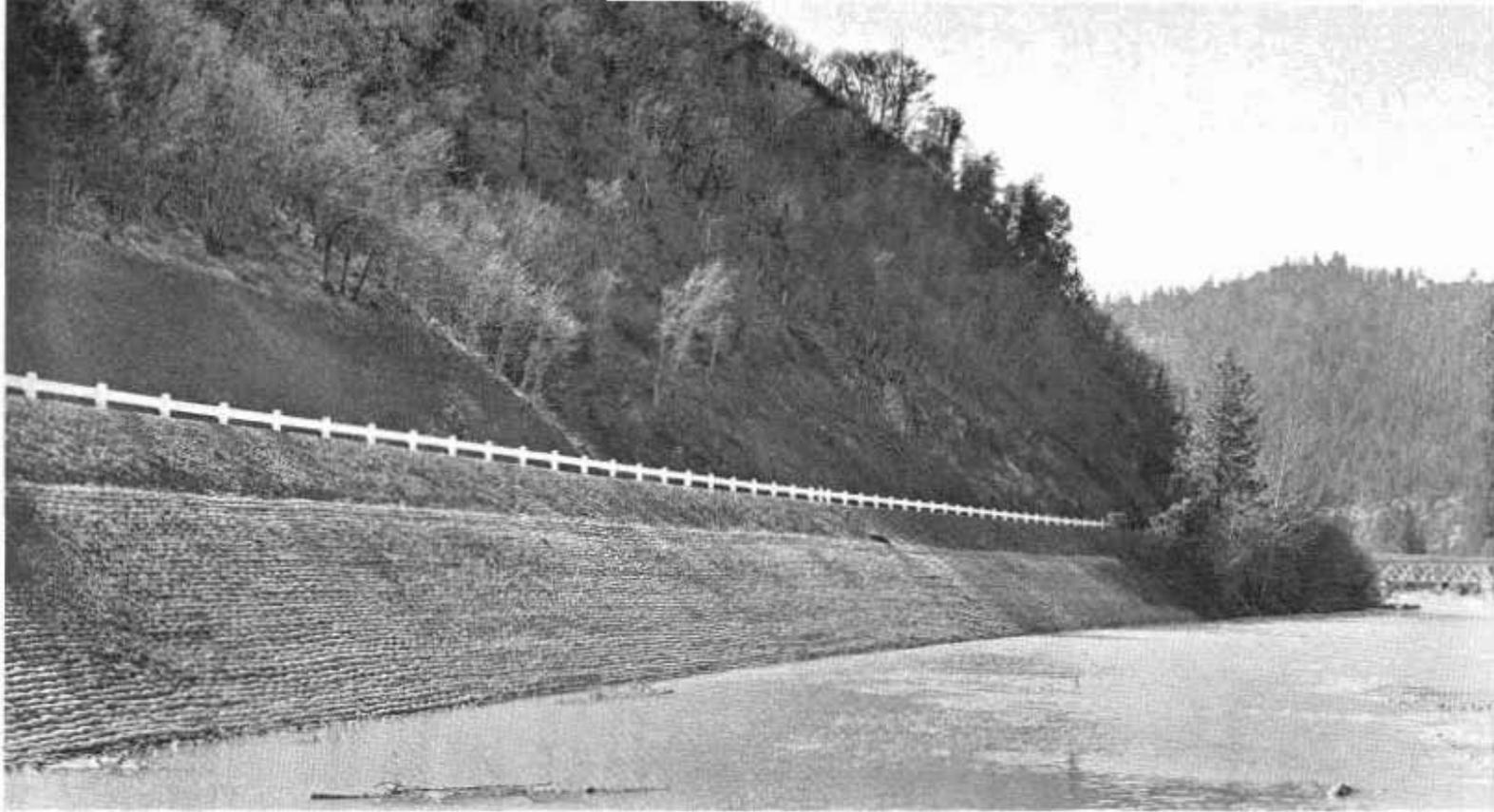
such flood levels and, therefore, to resort to more substantial designs for protection of the restored road.

Two general proposals were considered, one to shift the road away from the river into solid ground and the other to restore in its present location with adequate protection of fill slopes or a combination of the two. In some cases instability and steepness of the hillside made cutting more hazardous than encroachment on the river and in such cases elaborate measures to protect fills were necessary.

The 1937 damage was confined to the road along the river between Junction City and Big Bar. Some of the 1940 damage occurred on this same stretch of road and some on a



Workmen placing strip of wire and rock mattress in river bed at foot of riprap protected slope



The above pictures show portions of 25 acres of sacked concrete slope paving placed on the banks of Trinity River for protection of the highway at flood stages. A total of 148,029 sacks was laid, approximately one sack per square foot

section of road along the river for several miles east of Douglas City. This latter section was built about twenty years ago.

Included in the damage to this section was the partial destruction of two spans of the Douglas City bridge when an abandoned dredge broke from its moorings and floated down and struck the bridge and broke or damaged truss members of two spans. The damage to the bridge was repaired by contract handled by the Bridge Department in the Summer of 1940.

BANK PROTECTION MEASURES

When restoration by moving the road into the hill was not practicable, it was necessary to determine whether encroachment on the river side with protected fill slopes was practicable, and if not, to devise other means of restoration and protection. After a thorough study of local conditions and the availability and quality of local materials, it was decided that at those locations where encroachment on the river was impracticable, the concrete crib type of protection would be best.

At locations where encroachment on the river was practicable studies of the conditions at the various locations resulted in the use of three types of slope protection.

Where encroachment was small and fill slopes were parallel to the thread of the current, protection consisted of a slab of clean cobbles ranging from 4 to 8 inches or more in diameter. These were obtained from the waste from old placer mining operations. Where these cobbles were used in the 1937 restoration there was no loss in 1940.

Other fills of this nature were protected by a hand-placed rock fill slope comparable in its resistance to medium riprap. Rock for this purpose was obtained from locations where the road was moved into the hillside to avoid river encroachment.

At locations where the effect of the current on the fill slopes is more severe sacked concrete riprap was placed on the slopes and a strip of wire and rock mattress was placed in the riverbed at the foot of the slope. Concrete cribs were constructed from precast reinforced concrete members of several sizes, according to the depth of the crib. Unit prices applied to each size of crib member include the cost of fur-

nishing material, constructing the members, hauling and placing them and backfilling the interior of the cribs with porous material.

Concrete cribs were constructed by Clifford Dunn of Klamath Falls, who had the contract for restoration between Helena and Big Bar and by Prison Camp 25 between Junction City and Helena. Mr. Dunn placed a total of 4,284 crib members, the average cost of which in place was \$3.30 each.

15,000 CRIB MEMBERS

At Camp 25 approximately 15,000 crib members were made. At the time this is written the construction of the members is complete, but the placing is not. At the time of the latest cost analysis, the average cost of manufacture of 12,891 crib members was \$1.66 each and the average cost of placing 9,398 members was \$0.89. This indicates an approximate total cost of not over \$2.55 per member.

There were 1,009 cubic yards of Class "A" concrete in the 12,891 crib members. The total cost of manufacture of these members was \$21.23 per cubic yard of concrete required. Manufacture of these members was handled in a well organized and economic manner at Camp 25. Loading and placing was done by a specially constructed electrically operated hoist mounted on a two-ton truck.

On the unit east of Douglas City some three acres of sacked concrete riprap and about one acre of wire and rock mattress were placed in two units, one 350 feet long and one 2,500 feet long. For this riprap burlap sacks the size of ordinary barley sacks were used, each containing a cubic foot of concrete and were laid as headers, that is, the long dimension of the sack was at right angles to the slope.

148,029 SACKS LAID

A total of 148,029 sacks were laid of which 132,977 were on 133,696 square feet of fill slope and the balance were used in foundations and returns at the ends of the protection. One cubic yard of concrete covered 27.13 square feet of fill slope which is approximately one sack per square foot. The cost per square foot of such slope protection was 30.4 cents.

Wire and rock mattress consists of three longitudinal layers 8 inches thick and 4 feet 10 inches wide, of rock from 3 to 8 inches in diameter inclosed by substantial wire mesh

with tie wires between the top and bottom layers 8 inches apart each way. The layers are securely wired together forming a mattress about 15 feet wide, which is laid on a slight transverse slope on the bed of the river at the bottom of the slope paving and is anchored by the cables attached to dead-men, located at 10-foot intervals.

The filling material for this mattress was cobbles obtained from dredger tailings or gravel in nearby gravel bars. This mattress complete cost \$2.20 per square yard, or 24.4 cents per square foot. Work of restoring the section above Douglas City, including the construction of the sacked riprap and the wire and rock mattress was done under contract by Hemstreet & Bell. C. A. Potter was Resident Engineer on this as well as the Clifford Dunn contract. Crib construction at the Prison Camp was done by Superintendent H. L. Waste with R. E. Ward as Resident Engineer.

Since this article was started, another extreme flood in the Trinity River occurred with the water level about 3 to 5 feet below the 1940 level. Although much damage was done to other sections of road between Redding and Douglas City, the slope paving along the Trinity River stood up with no damage whatever. Between Junction City and Big Bar, the damage was very slight and almost entirely due to the fact that the bituminous surfacing had not yet been restored.

BRITISH MOTOR CLUBS STILL GIVE SERVICE

In the face of wartime conditions, British motor clubs are continuing to render full services to car owners, according to word received from London.

The British motorist, however, must comply with a number of restrictions. Gasoline is being carefully rationed. Lights must be shielded against visibility from overhead. Automobiles and motoreycles must be made incapable of possible enemy operation when left unattended, usually by a master switch in a secret place or by removal of some vital part of the mechanism. Motorists must be constantly alert for road barricades and challenges from sentries. Identity cards, driving licenses and insurance certificates must be carried.



Precast cribbing protection on Trinity River. Below—Making 15,000 concrete crib members at camp between Junction City and Helena

New Swing Span Bridge and Ferry To Replace Butte City Structure

By W. A. DOUGLASS, Associate Bridge Engineer

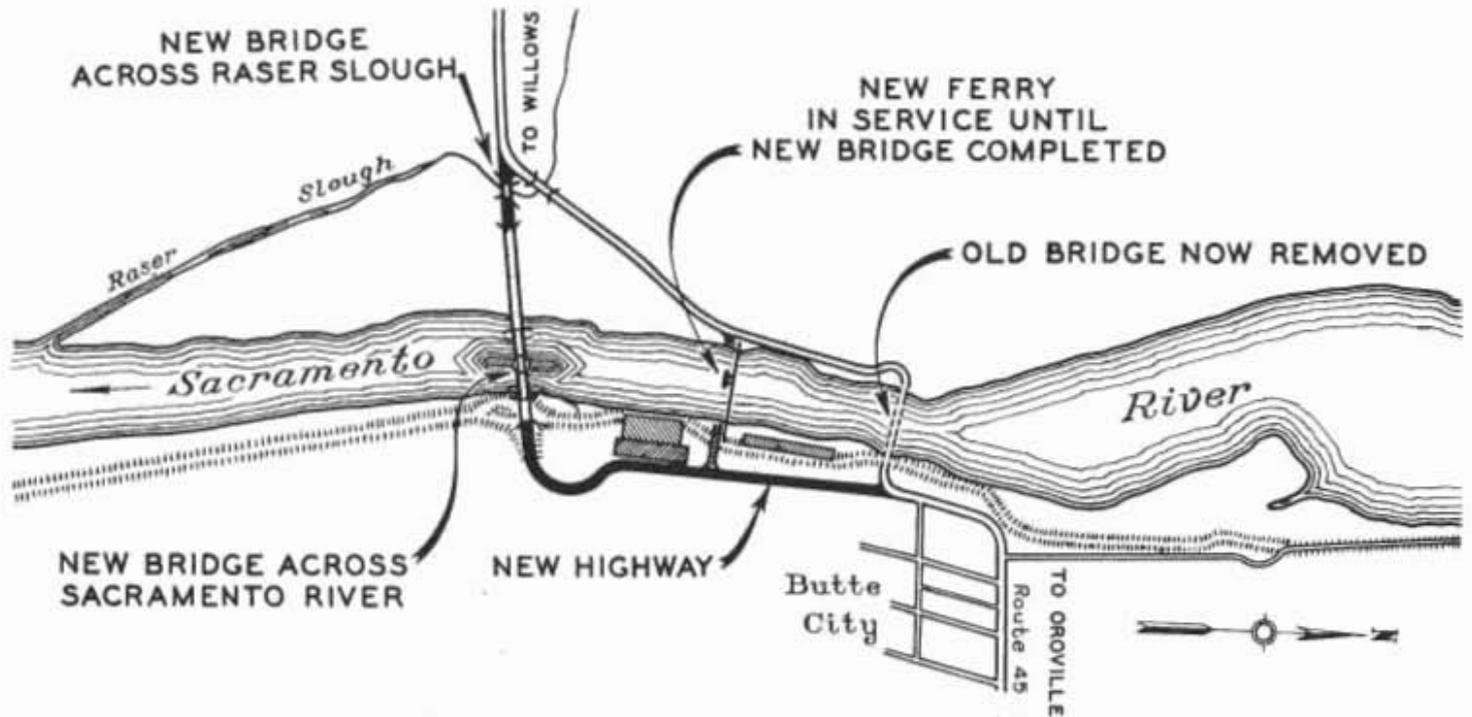
WITH the rapid development and growth of population in the Sacramento Valley during the "gold rush" era came the demand for improved routes of travel. River traffic was first of primary importance, taking thousands of tons of grain to the seaport of San Francisco and bringing miners and mining supplies to the upper reaches of the Sacramento in Tehama and Shasta counties.

high water, which lasted probably six months of the year.

In 1892 a bridge to handle traffic on this route was built across the Sacramento River at Butte City. Since the Sacramento is considered navigable as far as Red Bluff, a swing span was necessary to permit the passage of boats. Records of this early construction are not too complete, but apparently exceptionally high water caused the failure of the

span was founded on timber piles driven from 50 to 60 feet into the mud and extending from the mud line nearly 30 feet to the bottom of concrete just below the water surface. Submerged drift and rolling debris battered and damaged these timber piles, gradually weakening the supports for 30 years.

In 1934 it was noted that the swing span was slightly out of line, indicating a tipping of the pier. The



Sketch showing locations of old and new bridges, ferry and new highway at Butte City

As early as 1878 there were 200,000 tons of shipping on the river. Roads were necessary to and from the river landings and from one settlement to another. One such road was that connecting Glenn County with Marysville, Oroville and the east side of the Sacramento River.

At first low water fords and ferries provided the necessary stream crossings. This, of course, meant that the roads were closed during periods of

first structure almost as soon as it was built.

The second structure stood until 1904 when a boat collision dumped the swing span into the river. Glenn County rebuilt the bridge in 1905 and '06, and the approach spans were rebuilt in 1914. Although designed for freight wagons drawn by jerk-line teams, this bridge was maintained and kept in service until late in 1940.

The supporting pier for the swing

amount of tipping increased gradually, until in 1939 the swing span was nearly a foot from its original position with the rate of movement increasing rapidly.

Although every effort was made to save and maintain the structure as long as possible, the movement became so rapid and extensive that late last year it became unsafe and was closed to traffic. In fact the stability of the structure was so endangered

that the contract was let immediately for the removal of the bridge before high water in the winter of 1940-41, as it was feared the span might tip into the river and entirely block the stream for navigation.

STATE BUILDING FERRY

Although the traffic count on Highway Route 45 at this location is only about 500 vehicles per day, it is a very important crossing for a number of agricultural products to and from the warehouses and shipping points in that vicinity. It was, therefore, considered necessary for the State to go into the shipbuilding business and provide a ferry for use during the construction period of the new bridge. The ferry boat, machinery and connecting roads are now under construction, and it is expected the ferry will be in service within the next few weeks.

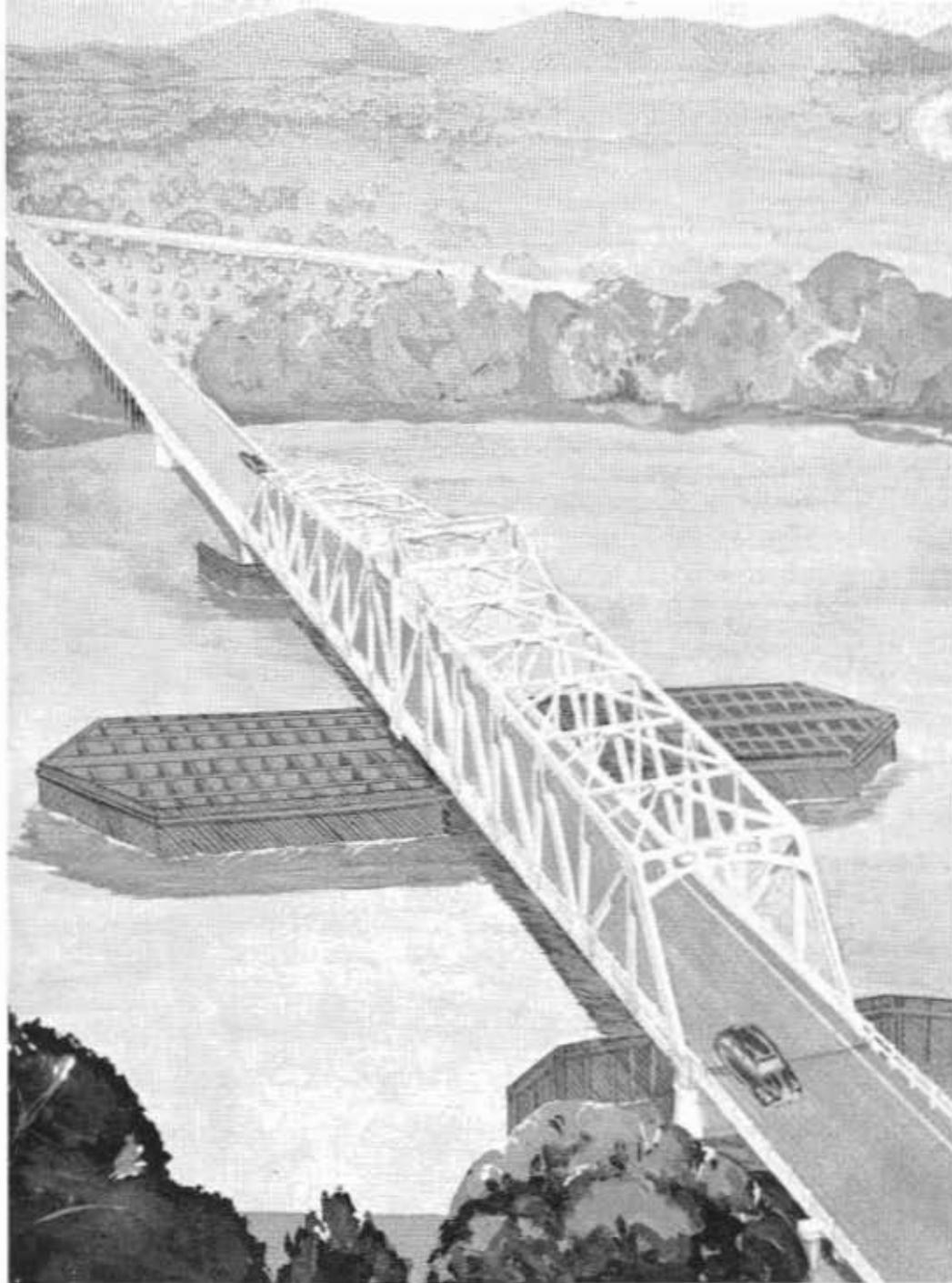
In the meantime traffic is being detoured by way of the Princeton Ferry some three or four miles downstream. This is a county ferry which serves traffic very efficiently, but was not designed or built for operation during extreme high water. It is planned that the new State ferry will remain in service during practically the entire winter season.

The ferry will carry a gross load of 15 tons, which will permit the movement of rice and other products without serious inconvenience. In the meantime the necessary steps are being taken to prepare for the construction of a modern bridge on improved alignment about 2,000 feet downstream from the original bridge.

SWING SPAN APPROVED

After a formal hearing the War Department issued a permit for the construction of a swing span, which provides over 100 feet clear width for navigation on either side of the center pier. The swing span is to be equipped with modern power and machinery for rapid opening and closing to avoid delay either to the river or highway traffic. The bridge will provide a 26-foot roadway on good alignment and easy grades so that the river crossing in either high or low stages will offer no obstacle to highway transportation.

The ferry together with necessary power plant, cables and ramps will cost about \$25,000. But this expenditure is justified by the saving in travel distance for the traffic using the highway; and after it has served



Drawing of proposed new swing span steel bridge across Sacramento River at Butte City and its highway approaches by J. D. R. Chamberlain, Division of Highways

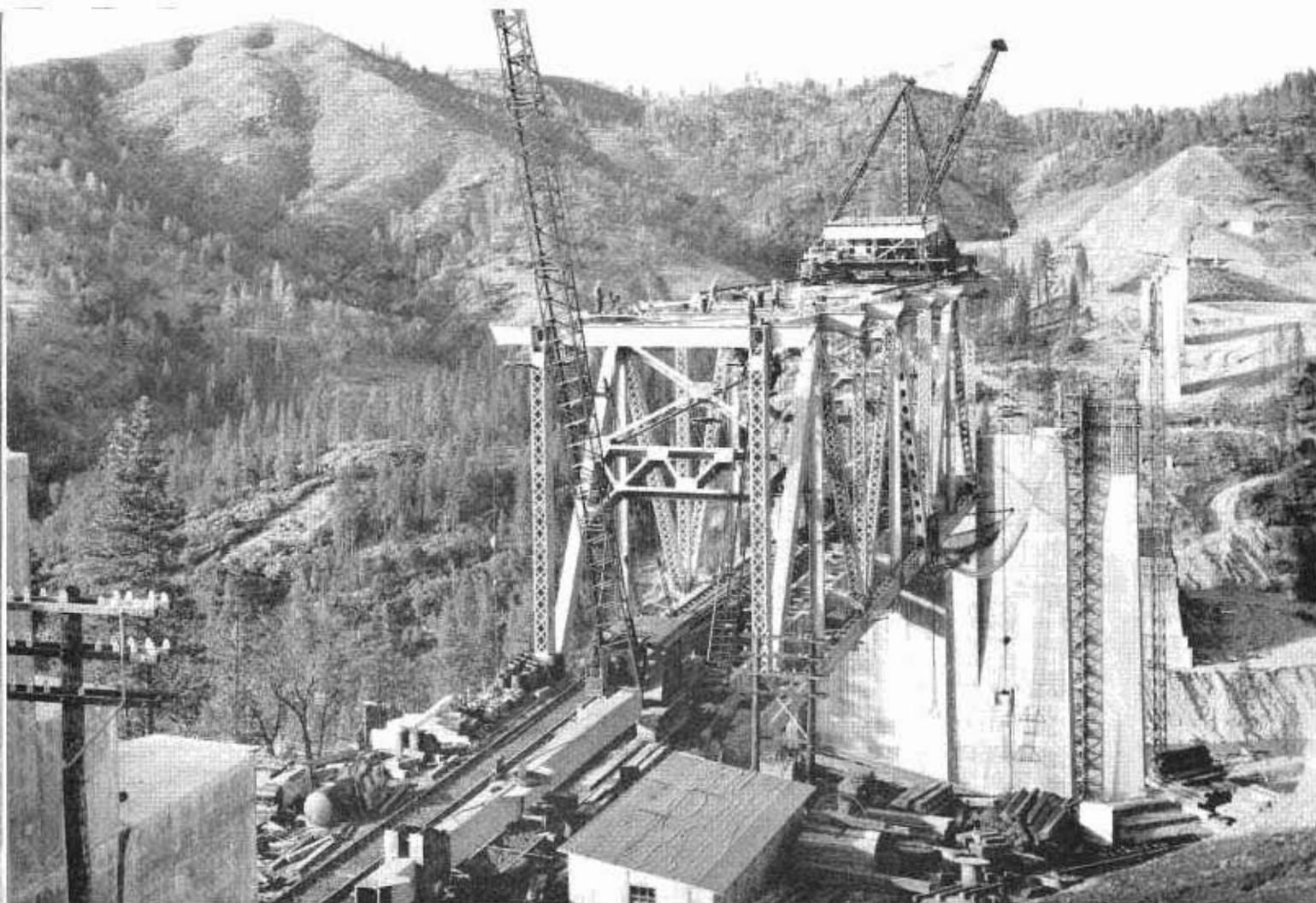
its purpose here, the ferry will be kept as reserve for other ferry crossings maintained and operated by the State.

IMPROVEMENT TOTALS \$400,000

The new bridge and approaches will cost approximately \$400,000 and will be of modern type of design similar to the bridge now being constructed over the Mokelumne River between Lodi and Rio Vista. Plans for this new structure are now practically complete, and it is expected construction will begin early in the

summer of 1941, as soon as contract funds provided in the 93d-94th Fiscal Year Budget become available.

Unless there is too much delay in the delivery of steel because of the present National defense demands on the steel industry, it is expected the structure should be completed within 12 to 15 months. That is by the late summer of 1942. In the meantime a gap in an important agricultural highway will be closed when the new ferry is put in service during the spring of 1941.



First steel construction on Pit River double-deck highway and railroad bridge across Shasta Dam Reservoir site

Pit River Bridge Construction

CONSTRUCTION progress on the five million dollar Pit River Bridge, the closing link in the railroad and highway relocations around the Shasta Reservoir site, indicates completion of this spectacular unit of the Central Valley Project early next fall.

While contracts for the great span awarded by the United States Bureau of Reclamation are being speeded up, the Division of Highways of the Department of Public Works is keeping pace in the building of 12½ miles of realignment of the Pacific Highway around an arm of the reservoir.

Erection of structural steel has started on the Pit River Bridge, the world's highest double-deck span. A 24-ton section of a 140-foot truss, part of the bottom chord on the right side extending from the south rail-

road abutment was the first piece of steel to be swung out over the canyon and into place on the huge concrete piers, most of which are completed. The first floor beam of the railroad deck which will carry the tracks of the Southern Pacific Railroad has also been erected.

The superstructure of the bridge will require 17,110 tons of steel fabricated in the plant of the American Bridge Company in Gary, Indiana, and now being shipped across the country to the Pit River Canyon, 14 miles north of Redding. Steel is being taken to Redding over a finished section of the relocated railroad and delivered to the material yards on the reservoir site.

Ralph Lowry, Construction Engineer of Shasta Dam, the Pit River Bridge and other Central Valley Pro-

ject features, has reported to Acting Supervising Engineer R. S. Calland that work is progressing on the concrete substructure of the bridge, with all piers and abutments completed except piers 3 and 4 in the center of the canyon which have risen more than two-thirds of their ultimate height of 350 feet, and will support a cantilever span 630 feet long.

In addition to the 630-foot central span there will be two 497-foot, three 282-foot, two 141-foot deck truss spans, one 150-foot and four 141-foot deck girder spans. The bridge will be 3,588 feet long.

Provision has been made for two railroad tracks through the trusses and for a four-lane highway over the top. At the end of the major spans, the railroad and the highway will go their own separate ways by a con-

struction design that separates them horizontally.

The upper deck of the bridge will be 500 feet above the present level of the Pit River and will carry four lanes of U. S. Highway 99. The lower deck will carry two tracks of the Southern Pacific's main line between San Francisco and Portland, Oregon. Northbound trains will pass directly on to the bridge from a half-mile tunnel bored through Bass Hill on the south side of the Pit River Canyon which will become a part of Shasta Reservoir.

The roadbed grading, all 12 tunnels and six of the eight major bridges on the 30-mile railroad relocation are completed with the track laid on about 25 miles of the new line. On the 15-mile highway relocation, a 2½ mile section contracted for by the Bureau of Reclamation has been opened and the remaining 12½ miles are under construction by the State of California.

On February 26th, bids were received by the Bureau of Reclamation in Sacramento for the construction of a centralized train traffic-control system and telephone and telegraph communication facilities in connection with the railroad relocation.

Acting Supervising Engineer Calland of the Central Valley Project said the work includes installation of a complete signal system for operation of the new Southern Pacific line between Redding, which is 12 miles below Shasta Dam, and Delta Station at the upper end of the reservoir area.

The contractor must furnish and install highway-grade crossing signals and other equipment for the protection of trains on the new route, as well as complete telegraph and telephone communication systems for the Southern Pacific Company and the Western Union Telegraph Company.

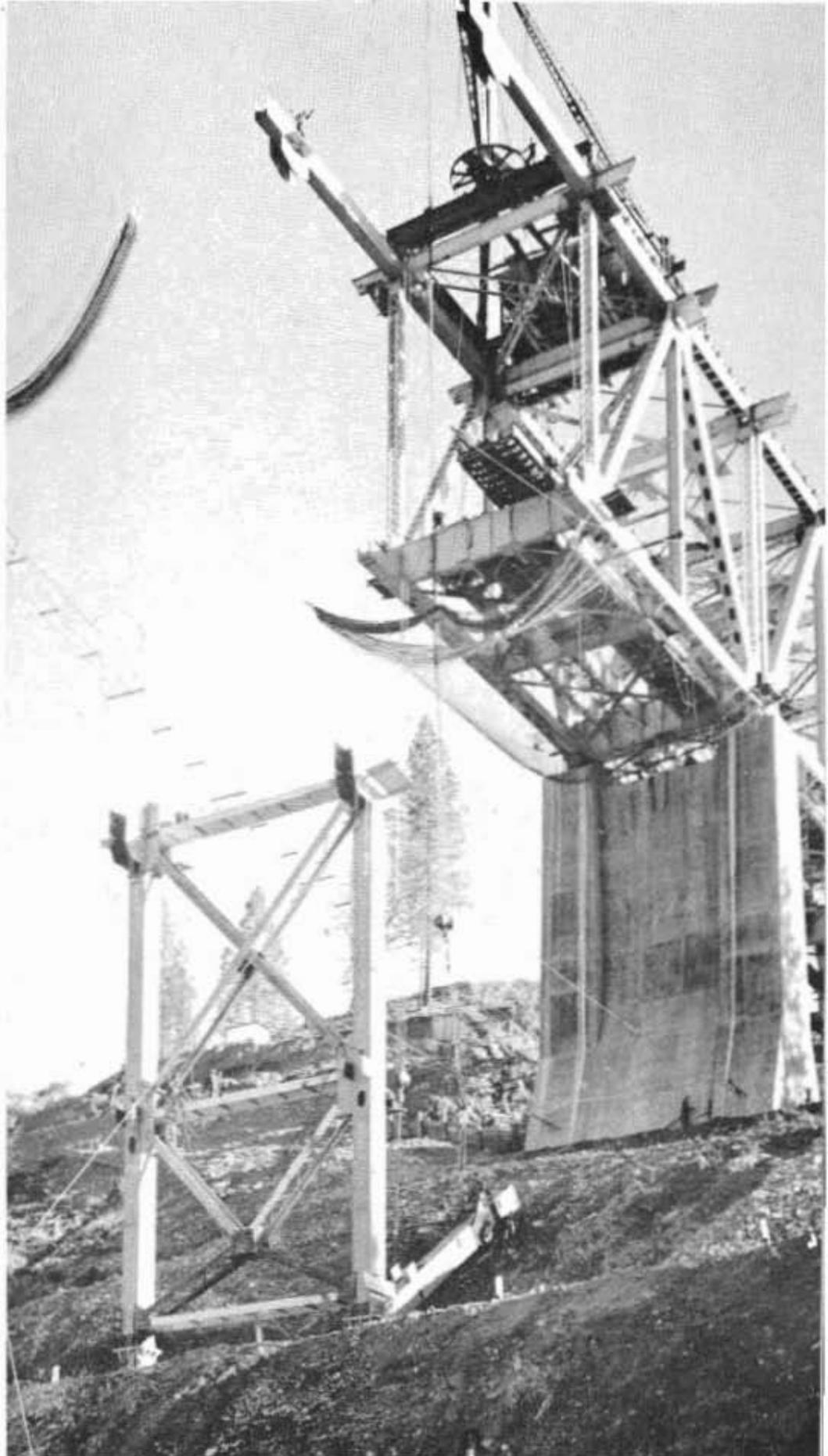
The successful bidder will be allowed 210 days to complete the work from the date a notice to proceed is received from the Bureau of Reclamation.

ONE WAY

Professor: "Can you give me an example of wasted energy?"

Student: "Yes, sir, telling a hair-raising story to a bald-headed man."

And the freshman engineer who thought that a slide rule is a regulation pertaining to baseball.



The workman on the top steel girder of the Pit River Bridge is 500 feet in the air. Steel safety nets are provided

Relocation of Pacific Highway Unit North of Red Bluff Completed

THE relocation of an obsolete section of U. S. 99, the Pacific Highway, in Tehama County north of Red Bluff, has been completed and opened to traffic. The new highway unit is six miles long, 34 feet wide and has a roadway 200 feet in width. It replaces a 20-year old highway of 15-foot pavement and eliminates many curves and grades on the old alignment.

The new road embodies the best standards that engineers now know for safe traffic and is designed to be perfectly adequate for military movements. The design provides for a free flow of traffic at all points at the present legal speed and with one short exception at speeds of 60 miles per hour.

RECORD VERTICAL CURVE

To cross a low, broad ridge beginning about a mile out of Red Bluff, the problem of securing the minimum sight distance of 2,200 feet offered a severe challenge and was finally solved by the use of a vertical curve 8,000 feet long, which is a record for length of any such curve on any highway.

For nearly half its distance, the highway relocation encroaches on the channel of Blue Tent Creek. This is one of those creeks that has a broad, gravelly bed, from 200 to 500 feet wide, with a small flow in normal winters that meanders back and forth in a poorly defined channel but in flood times covers almost the entire stream bed.

CREEK CHANNEL CHANGE

To provide assurance that this flow would not disturb the highway, which occupies portions of the old stream bed, a channel change 2.5 miles long was made taking the stream about 250 feet away from the road.

The highway relocation includes a bridge 135 feet long across Blue Tent Creek and another 160 feet long across Dibble Creek.

The new unit, which is virtually a long straight-a-way, has a cement stabilized base with a substantial and durable surface suitable for heavy

School Sends Thanks

GARDEN GROVE ELEMENTARY SCHOOL

Garden Grove, California
January 8, 1941

State Department of Highway
Maintenance
Santa Ana, California

Gentlemen:

Recently you applied some surfacing to the shoulder of the road in front of our Lincoln School, located just east of Garden Grove on Ocean Avenue.

This is very much used for the loading and unloading of children. During wet weather it has been very muddy. This piece of good work has proved very valuable in the rainy time thru which we have just passed, by keeping the children off the wet ground.

At a recent meeting of the board of trustees it was the unanimous action of the board that I write and express the sincere thanks of this body for the good work you have done.

Yours very truly,

(Signed) S. W. HOLT,
Clerk, School Board.

main line traffic. Gravel from the Blue Tent Creek channel change was spread over the entire width of grade to a compact depth of six inches. Additional gravel from the stream bed was crushed to one-inch maximum size and mixed in a large concrete mixer with 6 per cent of cement and sufficient water to provide optimum moisture and maximum compaction.

BITUMINOUS MIX SURFACE

This mixture was spread on the road to a width of 24 feet and to a compacted depth of six inches and rolled with a 12-ton roller and covered with one-fifth of a gallon of

asphaltic emulsion to a square yard to prevent evaporation during the curing period.

Over this stabilized gravel base was placed a plant-mixed, machine-spread surfacing of bituminous mix three inches thick and 22 inches wide. Bituminous mixed shoulders are five feet wide on each side. The entire cost of the project was \$225,000.

Two Engineers Retire From Service

A party is being arranged for the very near future by the Division of Architecture to honor two of its members who have recently retired after many years of service.

W. B. Rohl, Associate Engineer, General Construction, retired in February. He has devoted a very active life in the construction business in California and elsewhere, and since early in 1928 was in charge of various important construction projects at institutions throughout the State.

Oliver L. Morton, Supervising Engineer, General Construction, in the field forces of the Division of Architecture, will retire this month after approximately thirty-three years in the service of the State.

Mr. Morton's first assignment was the supervision of the construction of new buildings at the Preston School of Industry, where he introduced the manufacture of brick by inmate labor for construction of subsequent buildings at the institution.

Assignments at Mendocino and Stockton State Hospitals, and Humboldt State College followed until 1922, since which time he has been in charge of the Division's work in the Napa and Sonoma Districts, where he has ably represented the Division of Architecture in some of its most important projects.

Sailor: "You aren't getting seasick, are you buddy?"

Recruit: "Not exactly, but I'd hate to yawn."



Six mile relocation of U. S. 99 north of Red Bluff just completed includes a 160-foot concrete slab bridge on steel piles across Dibble Creek and a 135-foot bridge of same type across Blue Tent Creek shown in top and bottom photos

Cement Stabilized Base Used In 4-Lane Highway Construction

By A. EVERETT SMITH, Assistant Highway Engineer

A PORTION of highway on U. S. 99 extending from the junction with U. S. 60, at Beaumont, to Banning is nearing completion. This project is of especial interest as it will transform the existing road into a four-lane divided highway and is the first State highway project in this district to utilize a cement stabilized base.

The project, in general, was the construction of two new traffic lanes 6.12 miles in length adjacent to the existing two-lane paved road, thus providing a four-lane highway. Divisional strips have been constructed to

Also included in this work was channelization of traffic lanes at the intersection of U. S. Highways 99 and 60 at the west end of the project near Beaumont.

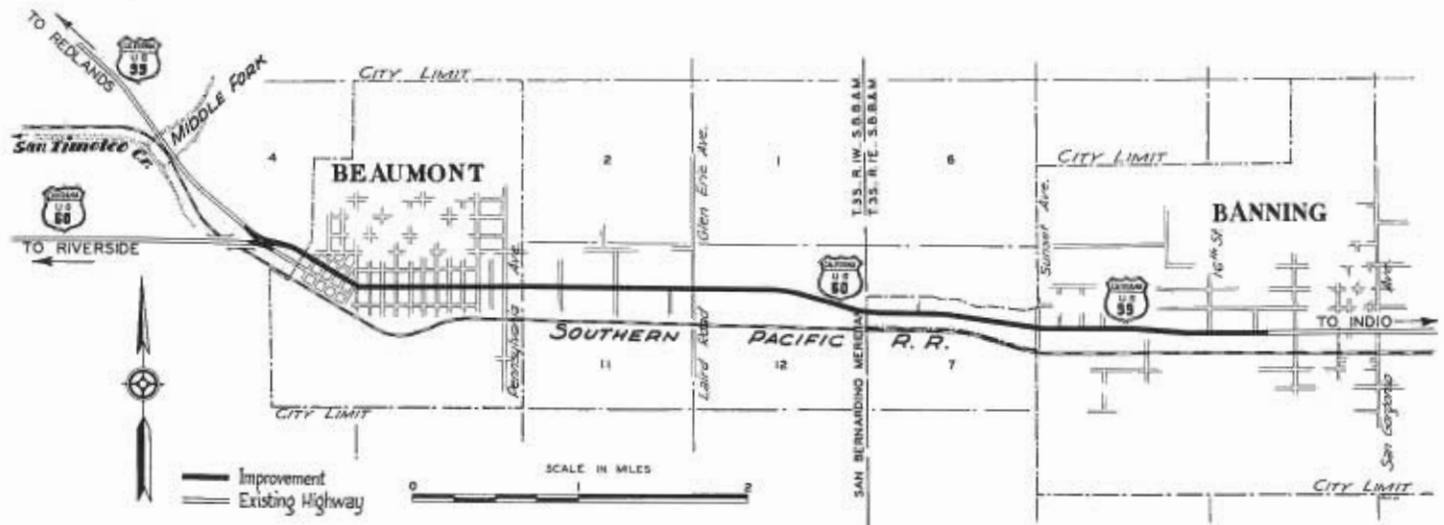
The cement stabilized base consists of selected material, Portland cement and water each in proportioned amounts mixed in a mixing plant, and placed on the roadbed, compacted and cured.

The selected material was excavated from the middle fork of San Timoteo Creek and mixed in the contractor's plant at the same location. The plant was an all steel portable type using a

specifications were made to conform closely to the screen analysis for this pit and the waste was negligible. Approximately 90% of the pit material passed the 4-mesh screen. The job was started using cement at the rate of 6% of the base material by weight. This was later increased to 7%.

Approximately 10% to 11% of water was required in the mix. This particular material was quite critical and necessitated close control.

The mixture was hauled to the street in dump trucks and placing was commenced at the point farthest from the plant.



Sketch showing section of U. S. 99 being transformed into 4-lane divided highway between Beaumont and Banning

separate opposing lanes of traffic. Through Beaumont and a portion of Banning a wide street section was graded and paved without installation of dividing strips.

The work on this project was quite extensive, consisting for the most part of grading; placing, rearranging and extending numerous drainage structures; constructing curbs, gutters, and driveways; installing a flashing light system in connection with termini of central dividing strips; placing cement stabilized base and topping the base with plant-mixed surfacing.

two yard capacity single shaft mixer.

Material was hauled from the creek bed with RD-8 tractors and carryall scrapers and dumped over a trap and by automatic feed was conducted to an elevating bucket line. It was screened by vibrating screens into bins from where it was drawn into the batch box and weighed by multi-beam scales. The minimum mixing time was 45 seconds.

At first, $1\frac{1}{2}$ yard batches were mixed. This was increased to the mixer's capacity of two yards.

As a point of economy, the grading

EXPERIMENTS IN METHODS

As the procedure of handling this type of base was new to contractor and engineers, considerable experimenting in methods of placing and compacting was done in order to obtain the best results.

Standard asphalt pavement spreader boxes were first tried in spreading the base material on the street. The required compacted thickness ranged from 6 to 9 inches. Due to a very high bulking property of this mixture, it was necessary to spread a thickness

of approximately 14 inches to obtain a compacted thickness of 9 inches. This required cutting an extra large outlet opening in the spreader box. Due to lack of sufficient rigidity in the box and difficulty in keeping the spreader box ends filled, it did not give a uniform spread.

As a trial method material was truck-dumped on the street and spread with a bulldozer. This also proved to be unsatisfactory.

SPECIAL BULLDOZER BLADE

After exhausting various methods for spreading the material, a bulldozer blade was equipped with steel wings extending forward about four feet from the ends of the blade. The forward ends of the wings were mounted on wheels and adjusted for elevation above grade. This worked quite well except that the mixture on being dumped from the truck, was partly consolidated by virtue of its mass, at the center and less consolidated near the ends of the blade. This resulted in a crown section after rolling.

To eliminate the crown in the finished base, adjustable steel plates were placed along the bottom of the bulldozer blade, and set to give a section that after compaction would be even and of the required thickness.

Trucks while dumping were pushed by the bulldozer and as much mix as possible was kept in front of the blade at all times. Some hand shoveling was necessary to keep the proper amount near the ends of the blade.

SPREADING AND COMPACTION

Spreading was accomplished one-half width at a time. Single spreads were advanced up to 50 or 75 feet; the other half was then brought up.

Compaction operations were first tried by using a sheepsfoot tamping roller, but due to the high per cent of fine material in the mix, the feet of the roller tore up the material to such an extent that it was unsatisfactory.

Compaction was accomplished by using a 12-ton, 3-wheel roller behind the spreader. This was followed by shaping with a motor grader having a 12-foot blade.

A 1600-gallon tank truck was used to apply a fine spray of water through a 12-foot spray bar, as necessary, to keep the exposed surface from becoming dry.

Tandem and three-wheel rollers used for finish rolling caused surface

(Continued on page 27)



At top—Truck dumping cement stabilized mix in bulldozer spreader box. Below—Bulldozer equipped with forward steel wings attached to ends of blade and wheels spreading mixture approximately 14 inches deep on roadway

First Link of 3-Lane Short Cut Highway to Watsonville Under Way

CONSTRUCTION of the new highway between Watsonville and Rob Roy Junction in Santa Cruz County is under way following official ground-breaking ceremonies held February 13th.

The work now under way consists of the first contract in a construction program which it is planned will eventually provide a modern thoroughfare from Watsonville and the Pajaro Valley to Santa Cruz.

This first contract will include the grading and installation of drainage structures on 6.2 miles from the northerly end of Main Street in Watsonville to a point 1.7 miles south of Rob Roy Junction. Plans and speci-

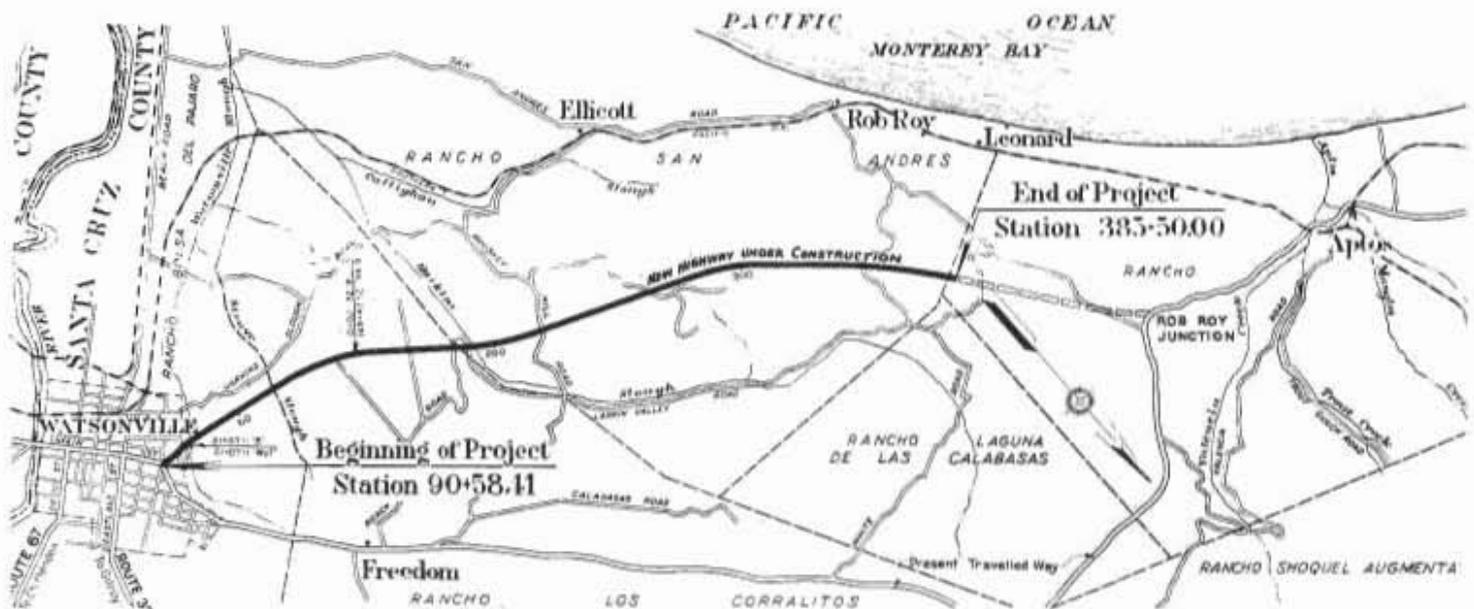
tion for structures, ditches and channels. While no major bridges will be required, culverts and headwalls will need 500 cubic yards of concrete and over 56,000 pounds of reinforcing steel. In addition to the reinforced concrete drainage structures, there will be nearly 5,000 lineal feet of corrugated metal pipe culverts and 4,000 feet of metal pipe underdrains.

One of the major problems confronting the engineers on this project involved the placing of heavy embankments over the marshy ground at both Watsonville Slough and Harkins Slough. The method being used to reduce the water in the underlying material to a point where that mate-

FUNDS BUDGETED FOR COMPLETION

The grading of this six miles of new highway will require about 11 months and the cost of this first stage of construction is estimated at about \$285,500, which is being financed from both State and Federal Aid funds. Its completion will have accounted for the most difficult portion of the program for improving the coastal road in this vicinity.

While the limited funds available during the current biennial period permitted only the beginning of the program, there is included in the highway budget for the coming biennium, adopted by the California



fications call for a roadbed 47 feet and 64 feet in width. The finished highway will be constructed three lanes in width with transitions to four-lane widths where provisions for safe passing make the extra lane necessary.

MILLION YARDS OF EXCAVATION

Grading of the roadbed will involve the excavation of nearly one and a quarter million cubic yards of earth, and a million yards of excavation is a big job at any location. There will be over 13,000 cubic yards of excava-

tion for structures, ditches and channels. While no major bridges will be required, culverts and headwalls will need 500 cubic yards of concrete and over 56,000 pounds of reinforcing steel. In addition to the reinforced concrete drainage structures, there will be nearly 5,000 lineal feet of corrugated metal pipe culverts and 4,000 feet of metal pipe underdrains. One of the major problems confronting the engineers on this project involved the placing of heavy embankments over the marshy ground at both Watsonville Slough and Harkins Slough. The method being used to reduce the water in the underlying material to a point where that material can support the weight of the embankment, will consist of placing numerous vertical sand drains through which the water in the subfoundation is forced to the surface by the weight of the fill. From the surface it is carried off by adequate drainage channels. This method of stabilizing embankment foundations has been found both adequate and rapid on several recent highway projects. It is estimated that on this project about 16,200 lineal feet of such drains, from 18 to 24 inches in diameter, will be required.

Highway Commission on December 31, 1940, the sum of \$350,000 for grading the remaining mile and three-quarters from the northerly end of the present contract to Rob Roy Junction and for surfacing the entire eight miles between Watsonville and the Junction.

Thus, within the next two years, construction of this one eight-mile section will save more than two miles in the travel distance between Watsonville and Rob Roy Junction, and it is anticipated that the program of reconstruction of the entire section

between Santa Cruz and Watsonville will quickly follow this beginning.

SHORE LINE ROUTE

When in 1933 the State Highway System was increased from some 7,200 miles to nearly 14,000 miles, there was included a route designed to extend the Carmel-San Simeon road which was then under construction, northerly along the shore of the Pacific, as a State route. In incorporating this shore line route into the State system, existing county roads were taken over by the Division of Highways as the basis for the ultimate coastal highway.

Immediately after these roads became part of the State system, surveys were begun over portions of the route from Carmel to San Francisco and, north of the bay, in Marin, Sonoma and Mendocino counties. As rapidly as available funds would permit, the poorer sections of these county roads have been reconstructed to alignment, grade and width compatible with the increasing traffic in the shore-line areas.

From San Francisco southward, major reconstruction has been advancing through Farallon City, Half Moon Bay and Tunitas in San Mateo County. In Santa Cruz County improvement has been made north of Santa Cruz from Davenport to Waddell Creek, and it is expected that these newly constructed sections will be connected during the coming two years by reconstruction between Tunitas and the northerly end of the improvements in Santa Cruz County.

TRAFFIC INCREASE MARKED

Included in this program of the State has been the major reconstruction of that portion of the route between Santa Cruz and Watsonville. Rapid development of beach properties and growth and expansion of both Watsonville and Santa Cruz have resulted in a marked local traffic increase along the old Watsonville road, which, when coupled with the increasing volume of through traffic, at times approaches congestion.

Reconnaissance surveys made from Watsonville northerly by State highway engineers indicated certain definite controls for the most economical location of line and grade compatible with modern standards of suburban highway construction, and upon the basis of these, the location was selected.

Bids for the new project were

Congress Committee Asks for Magazine

HOUSE OF REPRESENTATIVES,
UNITED STATES

Committee on District of
Columbia, Washington, D. C.

February 6, 1941

California Highways and
Public Works,

Sacramento, California.

Gentlemen: The District of Columbia Committee of the House of Representatives is making a study of the traffic conditions in the District of Columbia.

The Hon. Carl Hinshaw brought to the attention of the committee your publication, "California Highways and Public Works," October, 1940. The members of the committee had an opportunity to examine this issue only in a cursory manner, but found it most enlightening.

I will appreciate it if you could send me 10 copies of this issue. It would also be appreciated if you would place my name on the mailing list to receive further publications.

Yours very truly,

JENNINGS RANDOLPH,
Chairman.

opened by the Division of Highways on November 27, 1940, and on December 2, 1940, Director of Public Works Frank W. Clark awarded the contract for the work to N. M. Ball Sons of Berkeley, who submitted the lowest bid.

With the Kiwanis Club acting as host, the Watsonville Chamber of Commerce on February 13th tendered a luncheon to State, Federal, county and city officials and to the heads of the Santa Cruz Chamber of Commerce, preceding the ground-breaking ceremonies.

If you are bent upon a little private discipline wait until you are choking with thirst, then take a mouthful of cold water and spew it out again—and tell no man.—*Epicetus*.

Relationship of Road Officials to National Defense

IN HIS address at the last meeting of the American Association of State Highway Officials Thomas H. MacDonald, Commissioner of Public Roads, spoke significantly as follows:

"Every crisis in our national life presents the opportunity for intelligent readjustment of our public policies, and compels from all citizens, worthy of the name, a wholly voluntary rededication of their first loyalty to the best interests of our country. In this twenty-sixth annual meeting of the American Association of State Highway Officials we focus our deliberations upon the broad fields of highway development and highway utilization, but with a new emphasis over previous years.

"At no previous conference in the long life of this Association, or during the more than a quarter century of State-Federal cooperation in road building, has the relationship of highways to the National defense become such a vivid reality.

"While there is considerable substance to support the conclusion that the entrance into, and the scale of participation in a national highway program on the part of the Federal Government, were in a large measure products of the first world war, there was then no very clearly defined conception of the defense functioning of highways, and certainly in a relative sense, no important development of a motorized transport or a mechanized army.

"During these many years the national defense argument has been liberally and loosely used in support of Federal road building appropriations with a complete lack of precise analysis of the potentials of defense utility.

"So now grave necessity presses for the reaching of National understandings, in particular among the highway officials, and in general on the part of the public, upon this subject of defense highways. In a large measure it is a pioneer undertaking for which there are literally no precedents.

* * * * *

(Continued on page 31)

New Standard Specifications Issued by Division of Highways

By JOSEPH M. KANE, Assistant Office Engineer

THE printing of a new edition of Standard Specifications of the Division of Highways to control both highway and bridge work was completed in October, 1940. On November 15, 1940, this new edition was placed in effect and superseded the older Standard Specifications dated January, 1935, for all work initiated after November 15, 1940.

The first formal edition of Standard Specifications for use in California highway construction was issued in 1925 and since that time, revised editions have been published in 1927, 1929, 1930, 1935 and 1940. In the last two editions the size of the volume was changed from the original 8 1/2" x 11" book to the more convenient textbook size of 6" x 9".

Previous to 1925 all of the general specifications common to all contracts were included in the printed folder containing the proposal form in much the same manner as the special provisions are published today. This involved the inclusion of a large amount of material which was repeated in each contract and required reprinting many pages.

CONTRACTUAL REQUIREMENTS

The first 41 pages of the new 1940 Standard Specifications contain, in general, requirements defining the contractual relationship of the contractor to the State, methods of controlling material involving descriptions of test procedures, the relationships between the contractor and public traffic and also methods of measurement and payment for contract items of work.

Formerly before the issuance of a volume of Standard Specifications, all of these matters were covered by about 12 pages of printed matter in each contract form. Conditions have changed very materially over the last 15 years and the general requirements have become more stringent and considerably enlarged.

The Washington office of the Public Roads Administration, formerly the Bureau of Public Roads, recommended that all general specifications for the various States be included in one separate volume for convenience in reviewing plans and contract documents. That office issued instructions as to the form to be followed, the subjects to be covered and the order in which these subjects were to appear.

FOLLOWS WASHINGTON FORMULA

The underlying purpose of these instructions is to standardize the work as nearly as possible throughout the 48 States in order to reduce as much as possible the labor involved in reviewing plans and specifications for approval. It is, of course, impossible that the same set of Standard Specifications can be made to apply to all the States due to varying conditions of locality, climate, geographical features, etc. However, all of the States now issue Standard Specifications to control highway and bridge work, and in each instance the formula established by the Washington office is closely followed.

The Washington office of the Public Roads Administration also defines in general the order in which the sections defining the various types of construction shall appear in the bound volume of Standard Specifications. It is to be noted that the order of the sections in the 1940 Standard Specifications differs slightly from the order in the previous volume, having been changed to conform to requirements of the Washington office of the Public Roads Administration.

REQUIRED TWO YEARS STUDY

The preparation of the 1940 edition evolved a study of approximately two years. In order to compile the necessary data on which to base all of the revisions contained in this volume, it was necessary to obtain the suggestions from the heads of all depart-

ments and of the districts of the Division of Highways. It is obvious that all of these suggestions could not be followed, due principally to requirements affected solely by local conditions in some of the districts, and also because of various conflicts in ideas.

In preparing Standard Specifications, an earnest effort is made to include only such requirements as are generally applicable throughout the State and not to include various pet ideas, even though such ideas are justified in certain localities.

Many of the States issue addenda to their Standard Specifications from time to time in an attempt to keep the Standards up to date and to correct obvious errors. This practice has not been followed in California because it is considered dangerous practice to send out corrections because certain interested parties may fail to receive the corrections and thus not be informed as to the proper method to follow in bidding or in furnishing materials.

BOUND VOLUME PREFERABLE

On the basis of the same argument, it is also considered unwise to use loose-leaf volumes for Standard Specifications. With the use of a bound volume, no changes are possible except as outlined in the special provisions for individual contracts.

In the new volume of Standard Specifications, all references to commercial catalogues and rules of various producers in connection with their products and materials have been eliminated. The only references to other publications are to those issued by recognized national associations organized for research and testing, such as the American Society for Testing Materials and the American Association of State Highway Officials.

By such references, the necessity of including long specifications has been avoided. Our district offices have been furnished with the latest vol-

umes of the American Society for Testing Materials and the American Association of State Highway Officials, and material men and contractors are advised to purchase these books to complete the necessary references.

SOME STRIKING CHANGES

The volumes issued by these organizations are not available to outsiders through the State Division of Highways. The Standard Specifications of the American Society for Testing Materials can be purchased directly from that society located at 260 South Broad Street, Philadelphia, Pennsylvania; and the specifications for highway materials of the American Association of State Highway Officials can be purchased from that organization at 1220 National Press Building, Washington, D. C.

No definite attempt is made to describe all of the changes in the new 1940 edition because everyone concerned should become familiar with this book, and by so doing, will realize the differences. The most striking changes, however, involve the adoption of the U. S. square testing sieves for analyzing aggregates instead of the older types with round openings; the adoption of working days for determining the time limit of contracts; the inclusion of new specifications for paving asphalts and liquid asphalts; and complete new grading analyses for the various aggregates.

None of the older sections has been omitted and no new sections have been added.

Ten thousand copies of the last edition were printed, and since these specifications were put into effect last November, nearly half of this number has been distributed. The distribution includes not only the members of the California Division of Highways, but also the cities and counties of California, contractors, material men, producers of highway equipment, and also the States of the Union. Quite a number of copies have been forwarded to Mexico and South American countries. Many of the counties and cities of California who do not have specifications of their own, adopt the State Standard Specifications for their use. We are informed that the Territory of Hawaii has also adopted these as standards.

New methods of construction are constantly being developed, and new

Maintenance Engineers Discuss Their Problems

DISTRICT Maintenance Engineers and their assistants from the 11 Highway Districts in the State met with T. H. Dennis, Maintenance Engineer, and his Central Office assistants on February 17, 18 and 19 at Sacramento.

The bringing together of these engineers resulted in discussions of problems and procedure as it affected each district. Ideas were disseminated that provided answers to the other fellow's problems, as well as enlightened him as to findings or procedure elsewhere.

District VII provided interesting and constructive movies of Maintenance activities such as drainage corrections, comparisons of types and costs of loading equipment, pavement repairs and blanket surfacing, protection against erosion by pneumatic treatment, and traffic under both normal and abnormal conditions on the recently completed Arroyo Seco Freeway, between Los Angeles and Pasadena.

OTHER FEATURES EMPHASIZED

Director of Public Works Frank W. Clark and State Highway Engineer C. H. Purcell extended greetings from the Department.

Chas. Blood, Assistant City Engineer of Sacramento, presented a paper on an improved method, developed by him, of applying liquid asphalt into a pug mill for asphalt surface mixtures.

A. I. Rivett, Assistant Safety Engineer, spoke regarding personnel accidents and prevention. He stressed the importance of accurate and complete data for accident reports.

The program consisted of the following:

1. General discussion of personal problems, service agreements, expense

types of materials are being produced, requiring revisions in the methods of tests and inspection. As a result of these factors, it is difficult to establish definite standards which can be maintained without modification over a period of years. The necessary changes and modifications are made from time to time in the contract spe-

accounts, etc. By J. G. Standley, Principal Assistant Highway Engineer. Related legal matters by Robert E. Reed.

2. Discussion of Maintenance accounting procedure, and proposed simplification for handling work orders, purchase orders, etc. By E. R. Higgins and A. H. Henderson.

3. General discussion on recent developments and use of various types of liquid asphalt, sampling, testing, etc. By F. N. Hveem.

METHODS AND PROBLEMS

4. Discussion of methods used and results obtained last season on seal coats, pavement blankets, types of oil, aggregate gradings, and methods conducive to securing improved results. Photographs were projected of surface textures and equipment on seal coats, non-skid surfaces and blanket jobs.

5. Discussion of legal problems. By Mr. Reed.

(a) Procedure to follow for correction of drainage and seepage conditions from private property adjacent to the right of way.

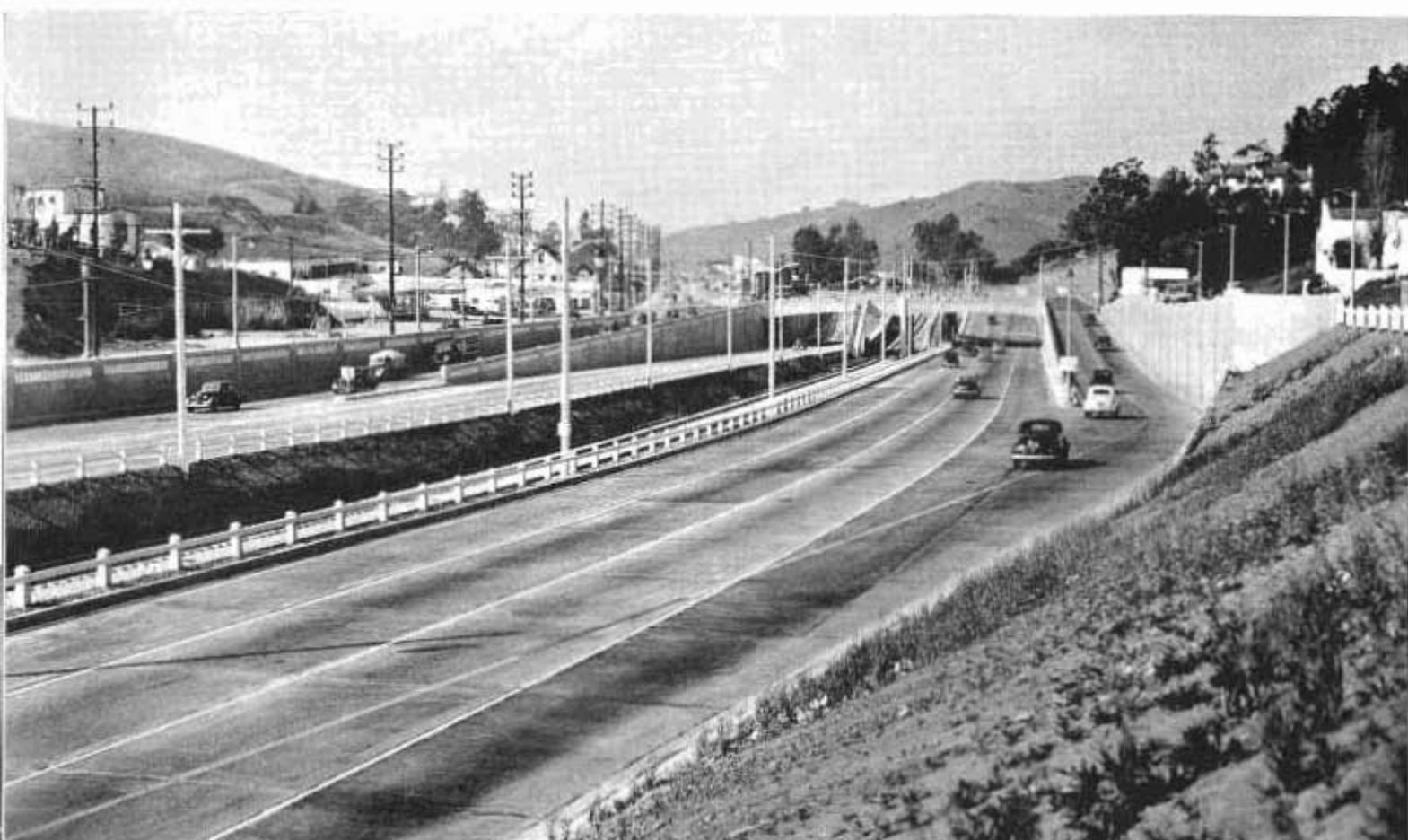
(b) Responsibility and procedure for correcting hazardous conditions resulting through operations of parties other than the Division of Highways.

6. Review of recent developments in subdrainage practice, using hydroauger equipment for slide and slipout correction. By O. J. Porter, supplemented with projected photographs and slides.

7. Equipment discussion with R. H. Stalnaker. State-owned versus rented equipment, etc.

cial provisions, thus providing the opportunity for proving the value of such changes on various contracts before they are adopted into the next issue of the Standard Specifications.

It is anticipated that the new edition of the Standard Specifications will remain in effect for several years before it is revised and republished.



New section of Cahuenga Pass looking north toward Barham overpass, showing two 4-lane highways separated by railroad tracks with ramps to service roads

Second Cahuenga Freeway Unit

By C. P. MONTGOMERY, Resident Engineer

WITH the completion of the second unit of its development as a Freeway, the Cahuenga Pass Highway, once a trail for Indian tribes of Southern California and the Franciscan padres of Father Junipero Serra, will enter the stage of final construction this summer.

Funds for its extension from Barham Road to Lankershim Boulevard in Los Angeles, which are provided for in the 1941-43 highway budget, will become available after July 1.

The first unit of this ultramodern highway project, constructed jointly by the Federal Government, the State and the City of Los Angeles, was opened to public traffic last June. It provided an eight-lane roadway separated by Pacific Electric tracks, an underpass at Highland Avenue, a pedestrian subway and overhead and the Mulholland Bridge.

Last December, the second unit carrying the Freeway from Mulholland Drive Bridge to Barham Road was completed. The third stage of construction will extend the new highway to Lankershim Boulevard.

The section finished last June was a little less than one mile in length; the second unit was 0.7 mile and the work to be started this summer will extend the highway about one mile.

Funds for contracts already completed were contributed as follows:

Federal Public Works Administration	\$763,000
State Highway Funds, 1½-cent Gas Tax Funds	690,000
1-cent State Highway Gas Tax, City of Los Angeles	196,000
County of Los Angeles Funds	25,000
City of Los Angeles Funds	32,000
Total	\$1,707,000

From the days when Los Angeles was a small pueblo, Cahuenga Pass

has been a main artery of traffic, being the only pass through the Hollywood Hills which separate the San Fernando Valley and the coastal plain. In 1910, a two-lane pavement was laid through the pass. Increasing motor vehicle traffic compelled widening the highway. Nevertheless, Cahuenga Pass became one of the worst "bottlenecks" in Southern California. It became necessary to modernize the highway to meet traffic demands and the splendid Freeway of today is the result.

The original paving was of oil macadam. The grade was steep enough to challenge the driver of those days to negotiate the climb without changing gears, and several sharp curves served as a check to safe speed of cars after they had passed the summit. Incidentally, the first wreck on this grade occurred when a steam roller got out of control



At top—General view of new Cahuenga Pass Freeway section looking south. Mulholland Drive overhead structure in foreground spans the old pass road retained as a service road on the right, the two 4-lane freeway roads, depressed railroad tracks and service road on the left. Lower picture shows scene during construction when railroad tracks were moved to a center position between freeway lanes

near the top of the grade and careened crazily down the pavement until it crashed into the cut bank half way down the hill.

As the Hollywood moving picture industry grew and the San Fernando Valley developed, the pavement which had been the source of so much pride in 1910 became inadequate to carry its increasing load. This section had become a part of the City of Los Angeles, and it was under the Engineering Department of the city that the pavement was rebuilt about 15 years ago.

The phenomenal growth on both sides of the pass, following this reconstruction, was responsible for the building, under the plans and supervision of the Engineering Department of the City of Los Angeles, of the Cahuenga Freeway. This Freeway was designed to collect and discharge the heavy flow of traffic to and from the converging streets at either end and carry it through the pass with the maximum speed and safety.

Traffic is carried on four-lane concrete roadways lined with concrete curbs and separated by the Pacific Electric railway. A long underpass serves as a grade separation for southbound traffic continuing on Cahuenga, while the two righthand lanes lead directly into Highland Avenue. Northbound traffic enters directly off Cahuenga Boulevard. At present the northern entrance to the Freeway is just north of Barham Road, directly from old Cahuenga Boulevard.

Concrete service roads allow access to the adjoining property and at Barham Road and above the Pilgrimage Bridge access to the Freeway.

Bridges span the Freeway, joining the service roads opposite the site of the Pilgrimage Play, at Mulholland Drive and Barham Road.

Access to and from the Pacific Electric railroad is provided by pedestrian tunnels under the Freeway just south of the Pilgrimage Bridge and north of the Mulholland Bridge.

The section of this Freeway from the Mulholland Bridge to Highland Avenue, including structures, was constructed under contract by J. E. Haddock, Ltd., Pasadena, and that section northerly from, and including the Mulholland Bridge, by Radich & Brown of Los Angeles. This construction was financed from State Highway and Quarter-Cent Funds in addition to a PWA grant from the Federal Government.

Three State-owned Bridges Report Steady Traffic Rise

A STEADY stream of traffic continued to flow across the three State-owned toll bridges throughout the month of February. The total for the San Francisco-Oakland Bay Bridge was 1,285,683 vehicles, or an average of 45,917 per day, representing an increase of 58 per cent over the daily average for the same month of the previous year.

At the Carquinez Bridge, the total

traffic for the month was 258,352 vehicles which exceeds the record for February, 1940, by almost 80 per cent.

The Antioch Bridge, while carrying a much lighter traffic than either of the other bridges, showed, nevertheless, a substantial increase over the previous year.

The total traffic for February on the San Francisco-Oakland Bay Bridge and the Carquinez and Antioch bridges is tabulated below:

	San Francisco-Oakland Bay Br.	Carquinez Bridge	Antioch Bridge
Passenger autos and auto trailers-----	1,174,900	235,801	9,703
Motorcycles and tricars-----	2,393	427	7
Buses-----	22,849	4,152	174
Trucks and truck trailers-----	63,007	17,797	1,712
Others-----	22,534	175	10
Total vehicles-----	1,285,683	258,352	11,606

Sponsored by the State and conducted by the Works Progress Administration an elaborate landscaping project looking to the beautification of this important entrance to Los Angeles is getting under way.

What Is a "Pleasure Car"?

During the early days of the automobile, passenger cars were called "pleasure cars." But that name no longer is descriptive, according to the U. S. Public Roads Administration. In a study of highway traffic in 25 States, the administration found that 55 per cent of passenger car mileage is used on business trips and that only 45 per cent is for purely recreational or social purposes. Farmers use their cars about two-thirds of the time for business. In the large cities use of passenger cars is approximately evenly divided between business and recreation.

It is estimated that one day's operation of a fleet of bombing and pursuit planes in Europe's mechanized forces necessitates the consumption of enough motor fuel to operate 3,000 American passenger cars for a full year.

A. R. B. A. Organizes Economics Service

The inauguration of a Highway Economics Division, the first "Highway Laboratory" of the nation, designed to gather and distribute information and data on highway construction and maintenance, is announced by the American Road Builders' Association.

"With the increasing need of more efficient highway programs throughout the country as an urgent factor in adequate national defense," says the announcement, "the ARBA executive committee and board of directors authorized the association's technicians to create a bureau long needed as a highway economics 'clearing house' for the road-building profession and industry.

"The new division will be looked upon to aid in stabilizing road expenditures in accordance with fluctuating amounts of Federal funds, gas taxes and registration fees. It is believed by ARBA officials that more comprehensive State highway programs will result, if accurate, up-to-the-minute information of this nature is available."



Washout on U. S. 299 West of Redding caused by February storms. Large sections of pavement were destroyed by undermining waters

Storm Damage to State Highways \$600,000

(Continued from page 2)

some extent, must disregard unfavorable topographical conditions. The present intensive preliminary investigations of underlying soil foundations and slope planes tend to reduce these necessary risks.

However, it is obviously uneconomical to construct every highway so that it would weather all storms. Such a policy would, if adopted, materially restrict the mileage of improved highways. It would likewise disregard the fact that hundreds of miles of highways as now built have suffered but nominal damage under the most severe storms.

There is one phase of storm damage, however, that demands early correction. I refer to the many locations on valley roads which are flooded each year, due to the blocking or elimination of former channels. It is imperative that adequate outlets be provided for this drainage, which now is a barrier on many of our main valley roads to civil traffic, and will in times of need seriously affect all military transport as well.

Why women are like newspapers: There is a bold face type, back numbers are not in demand, they have a great deal of influence, every man should have one of his own and not chase after his neighbor's.

Bomb Shelter on Property State Buys

Indicative of the trend in world affairs is a situation reported to the State Division of Highways by one of its Right of Way Agents in Los Angeles.

In a report to the Department of Public Works, the Right of Way Agent, who is engaged in obtaining property over which a highway improvement is to be made, writes:

"In addition to the concrete walls, the owner recently has installed a reinforced concrete bomb-proof shelter that was dug out of the sandstone hill. He is the first landowner I have run across who is prepared for the worst."

QUESTION OF TIMING

"I won't get married until I find a girl like Grandpa married."

"Huh! They don't make them like that these days."

"That's funny. He only married her yesterday."

ONE MORE

"The bravest man I ever knew," said the explorer, "was the chap who took a taxi to the bankruptcy court, and then, instead of paying his fare, invited the driver in as a creditor."

Cement Stabilized Base Used in 4-Lane Job

(Continued from page 19)

laminations and were eliminated from this operation. This was overcome by truck rolling, using pneumatic tires and a slight excess of moisture on the surface.

When laminations could not be eliminated by rolling, the high parts were cut off with a motor grader and wasted.

CURING SEAL APPLIED

Immediately behind the final rolling, an application of approximately $\frac{1}{2}$ -gallon per square yard of Liquid Asphalt RC-1 was applied, as a curing seal, using a power spray and hand operated nozzle.

At the beginning, the time cycle required in handling the mixture from the mixing plant to the finish rolling on the street was about three hours. As equipment and handling technique were developed, this was reduced to about $1\frac{1}{2}$ hours.

Recent experience on other projects shows that individual characteristics develop for different jobs regarding compressive strength, water control, and bulking when spread on street and difficulties encountered in consolidating and compacting.

The work is being done by Oswald Brothers, contractors. J. M. Hollister is the resident engineer.



Scene at end of present grading operations on Angeles Crest Highway showing mountainous terrain ahead to be penetrated by tunnels

Two Mountain Tunnels Necessary On the Angeles Crest Highway

By J. M. LACKEY, Asst. District Construction Engineer

TO THE north of Los Angeles an east and west range, known as the San Gabriel Mountains, forms a rugged barrier through which Angeles Crest Highway (Route 61) will be, upon completion, the only break in the 98 miles between Fremont Pass and Cajon Pass.

This scenic mountain highway, approximately 55 miles in length, extends from La Canada to Big Pines County Park and connects with the San Bernardino County portion of Route 61. Grading and surfacing have been completed from La Canada to Cedar Springs, a distance of 37 miles.

Throughout its length the highway

will pass through rugged mountains and, with the exception of the first two miles, is entirely within the Angeles National Forest, which is being maintained as a recreational area free of commercial establishments and residential buildings.

Development of roads and recreational facilities in these mountains has been slow, due to insufficient funds for the heavy construction necessary in a country which "stands on end." This route serves principally as a scenic drive and access road to a vast recreational area, important to the three million people living in the metropolitan area immediately to the south.

Several branch roads have been completed and are in use. From Red Box an excellent paved highway leads to the Mt. Wilson Observatory. Another road, leading from the same junction, serves resorts in the canyon of the West Fork of San Gabriel, and starting at Switzer's Saddle a county highway to the north forms a connecting link with the Mint Canyon Route (Route 23) and Antelope Valley.

West Islip Saddle, which will be a landmark on the new highway, will also be the northerly terminus of San Gabriel Canyon Road (Route 62), now open from Azusa on Foothill

(Continued on page 31)



The above pictures are typical views of the heavy construction necessary on State Route 61, the Angeles Crest Highway through a rugged mountain section of Angeles National Forest in Los Angeles County where a 30-foot graded roadway is being built

Mountain Tunnels Necessary on Angeles Crest Highway

(Continued from page 28)

Boulevard to Crystal Lake, leaving but four miles of construction to complete the connection. Completion of this connection and the project now under way on the Angeles Crest Highway will provide a scenic circular trip via Angeles Crest Highway, San Gabriel Canyon Highway and Foothill Boulevard.

The Cloudburst Summit area, 35 miles from La Canada, reaches an altitude of nearly 7,000 feet, and is now available for winter recreational purposes and thousands of cars pack the highway during week ends. However, this territory is at present generally too rugged for snow sports and much fine snow country on the higher ridges remains inaccessible, awaiting the construction of forest roads and trails by the National Forest Service.

The men from the CCC Camp at Chilao Flats have for several years been engaged in building forest roads, trails and camp sites and facilities for a limited number of people are now available. However, much work remains to be done before all of the recreational potentialities are developed.

SNOW SPORTS COUNTRY

Regarding the fine snow country mentioned above, the higher ridges are snow clad for three to four months each season and on their more gentle slopes facilities may be developed for thousands of winter sport enthusiasts.

Many trails have been constructed for hikers along the first 15 miles of the route and many more are possible. Camp grounds and picnic sites are not so easily developed due to scarcity of water.

Control of forest and brush fires, the most important work in flood control, has been greatly aided by the construction of this road. Transportation of men and equipment between distant points has been greatly speeded up.

Maintenance forces have had many problems to solve. Flash storms, summer and winter, tax drainage systems to the limit and often more. Sanding icy pavements is an almost continuous winter chore and snow removal a major operation.

Fires, caused by lightning and care-

States Have A Duty

The opening of the State Legislature brought with it two significant announcements — Governor Olson's declaration that he would recommend no new taxes and the statement of Director of Public Works Frank W. Clark that California is in need of \$161,000,000 for the construction of a strategic system of defense roads.

Governor Olson's message takes cognizance of the fact that in a period when the State's citizens are contributing more than one billion dollars in taxes — a large proportion of them for necessary defense expenditures—it is likewise a period for this State to call for a moratorium against multiplying the taxpayer's burden.

Such, likewise, was the conviction of Director of Public Works Clark. His request that the Federal Government furnish aid for the \$161,000,000 defense road program is one that will meet general approval. Inasmuch as such a construction program is one involving National defense, it is only fair that it should be considered a Federal responsibility, and not one to be borne by a single section of the California public — the motor vehicle owners. As a class, they are now taxed far in excess of any other group and even now contribute one out of every three tax dollars that go into the State Treasury.

—Red Bluff News.

less smokers, occur all too frequently, causing increased run-off of debris laden storm water which adds to the complications.

MOST DIFFICULT SECTION

Location and construction problems in building this highway have been numerous and difficult. Much of the country will remain almost inaccessible, even to surveyors, until trails are constructed. Many sections of

the roadbed must be excavated entirely in solid ground because of the steepness of the mountain slopes.

Now under construction is a 3.07 mile section from Cedar Springs to West Islip Saddle. This is probably the most difficult part of the entire route. There is very little soil and 80 per cent of the excavation must be blasted. Due to the steepness of the slopes, the fills must be held by retaining walls where the road crosses ravines. In keeping with the surroundings, rubble masonry is used for walls, drainage structures, spillways, paved channels, etc.

Near West Islip Saddle the country becomes so rugged that tunnels must be resorted to. Two inclined ridges, projecting from the face of Mt. Williamson, are too steep even for pioneer roads and two tunnels will be required; one 640 feet in length and one 460 feet, with an interval of 120 feet between portals. Construction must start at the first portal, because of the difficult terrain, and the entire work on the two tunnels done from one end.

TUNNEL CONSTRUCTION PLANS

Three of the four portal locations are on nearly perpendicular rock faces, 50 to 75 feet above the canyon floor, making it necessary to construct earth ramps before starting excavation. A pilot bore approximately 9 x 9 feet in size will be driven for the first tunnel, principally for ventilation and exploration. The pilot for the second tunnel will be 9 x 14 feet so that after completion of the first tunnel tractor bulldozers and other equipment may be passed through for pioneer work on the remaining portion of the line to Islip Saddle. The completed tunnel, a horseshoe type arch, will be lined with reinforced concrete throughout. The opening will be 32 feet wide by 20½ feet high. Portals will be constructed of rough stone.

Rock for concrete will be produced by crushing material taken from the tunnels. This is necessary because of the long, expensive haul over the mountain roads from commercial rock plants 60 to 70 miles distant. Finances will not permit the comple-

tion of this highway for several years, therefore, it is possible to proceed with tunnel construction at a moderate schedule, permitting a large saving in equipment cost, usually a major item in tunnel construction. It is estimated that all work on the bores will be completed in 13 or 14 months.

TWO YEARS TO COMPLETE

Cost of this 3.07 mile project, including tunnels, will be in excess of \$700,000 and will require over two years to complete. Grading on the first two miles from the southwesterly end of the job to the tunnel is over 50 per cent completed. Work on the third mile can not be started until equipment can be moved through the tunnels.

From West Islip Saddle the line runs along the northerly side of Mt. Islip and North Baldy Peak, following northerly mountain slopes with the Mojave Desert almost constantly in view. The grade will be slightly rolling, varying from 6,500 to 7,500 feet above sea level. The entire distance is through timbered country and on very steep slopes. Construction will be difficult and expensive and it will be several years before sufficient funds are available to complete the road to Big Pines.

Relationship of Road Officials to Defense

(Continued from page 21)

"The happiest personal reaction which I obtain from this great National undertaking, in which all of the States are participating with the Public Roads Administration, is found in the attitude I meet among the officials of the Highway Departments of professional sureness and confidence in their knowledge of the highway needs of their States, and the relative priorities of these needs.

"Thus, in the only way possible, the ideals of impartial and efficient service to the public have been lifted out of reach of selfish motives of both individuals and groups to a degree never before attained. The Highway Departments have now the facts, first to guide decisions, and second to support their decisions successfully before the all-important court of public opinion."

In Memoriam

Lester T. Harbey

Lester T. Harbey, Highway Maintenance Foreman on the San Francisco-Oakland Bay Bridge, passed away January 11, 1941, in Oakland, California.

Mr. Harbey was born November 21, 1896, in Colorado, Texas, later moving to El Paso where he attended the Bell Grammar School and Lamar High School.

In May, 1916, he enlisted in the U. S. Army and served with General Pershing in the Mexican Expedition and overseas after the United States entered the World War. He received his honorable discharge in June, 1919. He went into business for himself from 1919 to 1926 when he entered the employ of the J. E. French Company in Oakland.

He entered State service in the Department of Public Works, Division of Highways, in February, 1928, serving as Highway Maintenance Foreman in District III at Woodland, Williams and Courtland stations until November, 1936, when he transferred to the San Francisco-Oakland Bay Bridge and served in the same capacity until his untimely death.

Mr. Harbey was a member of Marja Lodge No. 596, A. F. and A. M. of Texas, and of the American Legion and Veterans of Foreign Wars. He was very active in C. S. E. A. affairs, joining the organization's Sacramento Chapter and later transferring to Bay Bridge Chapter No. 49 where he served as its president in 1938 and as regional director of District VI during 1940.

He is survived by his wife and a son, Douglas, and two brothers, Charles T. and George A. Harbey, and two sisters, Mrs. Rose E. Jones and Mrs. Englebright.

In his passing, the employees of the Bay Bridge have lost a true and trusted friend, whose chief concern was for the welfare of his fellow workers. The entire organization extends to his widow, his son, and relatives their deepest sympathy and consolation.

Motor Vehicle Peak Year

Motor vehicle production for the United States and Canada reached a peak in 1929 when 5,621,045 vehicles came off the assembly lines. The next highest year, according to the Automobile Club of Southern California, was 1937 when 5,016,437 vehicles were produced.

Teacher: "Now, Class, if you take five from eight, what's the difference?"

Voice from Back Row: "That's what I say. Who cares?"

Two Executives Of Public Works Rejoin U.S. Army

BRINGING to a total of forty-two the employees of the Department of Public Works who have been called into military service, Colonel Edward Jackson Murray, Assistant Bridge Engineer of the Division of Highways, and Captain George T. Gunston of the Division of Water Resources resumed active army duty on February 21st.

Colonel Murray is commanding officer of the 184th Infantry, California National Guard, and Captain Gunston is on the staff of Colonel Otto Sandman, 143d Field Artillery. Colonel Murray's outfit will encamp at the State Fair Grounds in Sacramento until March 15th, when it will go to San Luis Obispo. Captain Gunston will also go to San Luis Obispo.

ROSE FROM PRIVATE

Enlisting as a private in Co. G, 2d Infantry, National Guard on April 25, 1914, Colonel Murray attained the rank of Second Lieutenant, saw service on the Mexican border in 1916 and in September, 1917, went overseas as First Lieutenant, Co. G, 160th Inf. Following the war he was commissioned Captain in the National Guard and assigned to the 184th Inf., which he now commands. He entered State service with the Division of Highways on April 1, 1924.

When it appeared the United States would enter the last World War, Captain Gunston enlisted in the Washington National Guard in February, 1917. He was sworn into Federal service in June of that year and later was commissioned as Second Lieutenant. Discharged in December, 1918, Captain Gunston came to California, attended the University of California 1919-1920 and then transferred to the University of Washington.

From 1923 to 1926, Mr. Gunston was a Second Lieutenant, Finance Reserve. On June 14, 1926, he was commissioned First Lieutenant, Field Artillery, California National Guard and later was given command of Battery D, 143d Field Artillery.

(Continued on page 22.)

Highway Bids and Awards for February 1941

ALAMEDA AND CONTRA COSTA COUNTIES—Diesel oil to be applied to roadside vegetation for about 78 roadside miles. District IV, various locations. Hayward Building Material Co., Hayward, \$2,240; Lee J. Immel, Berkeley, \$2,348. Contract awarded to Pacific Truck Service, Inc., San Jose, \$1,920.

KERN COUNTY—Two bridges to be constructed at Bakersfield, one across Kern River, having a length of 630 feet, and one across Kern River Overflow, having a length of 100 feet. District VI, Route 58, Section L. A. Teichert & Son, Inc., Sacramento, \$96,366; Trewhitt-Shields & Fisher, Fresno, \$89,975; Werner & Webb, Los Angeles, \$102,363; Griffith Co., Los Angeles, \$104,077; Louis Biasotti & Son, Stockton, \$108,312; A. Soda & Son, Oakland, \$109,792; Martin & Schmidt Contractors, Long Beach, \$114,849; Carlo Bongiovanni, Los Angeles, \$122,969. Contract awarded to F. Fredenberg, South San Francisco, \$96,253.

MARIN, NAPA, SONOMA COUNTIES—Diesel oil to be applied to roadside vegetation for about 174 roadside miles. District IV, various locations. Edward A. Forde, San Anselmo, \$5,359; Close Building Supply, Hayward, \$5,359; Kupping and Pinkham, Lakeport, \$5,681; Lee J. Immel, Berkeley, \$5,704. Contract awarded to Pacific Truck Service, Inc., San Jose, \$4,969.

MERCED AND MARIPOSA COUNTIES—Furnishing and applying diesel oil to 121.6 miles of roadside vegetation. District X, various locations. Pacific Truck Service, Inc., San Jose, \$2,166; Claude C. Wood, Lodi, \$2,080; Sheldon Oil Co., Suisun, \$2,175. Contract awarded to Close Building Supply, Hayward, \$2,042.

SACRAMENTO AND CONTRA COSTA COUNTIES—At San Joaquin River about five miles north of Antioch, bridge fenders and dolphins to be repaired. District X, Route 11, Sections C and A. Bundesen & Lauritzen, Pittsburg, \$37,451; E. G. Perham, Los Angeles, \$43,292; Kiss Crane Service, Berkeley, \$44,217. Contract awarded to M. A. Jenkins, Sacramento, \$26,976.

SAN JOAQUIN COUNTY—Moving tender's cottage from Garwood Ferry Bridge to Potato Slough Bridge. District X, Route 75, 53, Sections A, C, H, W. Johnson, Stockton, \$1,185; J. R. Estes, W. Sacramento, \$962. Contract awarded to J. E. Fitzsimmons, Lodi, \$900.

SOLANO, SAN JOAQUIN, CALAVERAS AND AMADOR COUNTIES—Furnishing and applying diesel oil to 141.2 miles of roadside vegetation. District X, various locations. Pacific Truck Service, Inc., San Jose, \$2,854; Close Building Supply, Hayward, \$2,700. Contract awarded to Sheldon Oil Co., Suisun, \$2,406.

Bids and Awards for Jan., 1941

SACRAMENTO AND SAN JOAQUIN COUNTIES—Across the Mokelumne River about 5 miles west of Terminus, a steel truss swing bridge with 53 timber stringer and 2 steel stringer approach spans to be constructed and at the west approach to Little Potato Slough crossing at Terminus, a timber stringer ramp trestle to be constructed. District X, Route 53, Section C, C. Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$364,643; A. Soda & Son, Oakland, \$379,598; Ralph A. Bell, San Marino, \$392,235; C. W.

In Memoriam

Major Glenn H. Stough

Major Glenn H. Stough, 50, assistant hydraulic engineer in the Division of Water Resources, Department of Public Works, passed away at the Sacramento Emergency Hospital January 26, 1941, as the result of a heart attack.

Major Stough had been at work the day previous to his passing. Early the next morning he was stricken with a heart attack at his home at 2417 U Street and died en route to the hospital.

He was born in Woodson County, Kansas, December 15, 1890. He attended public schools in Chicago, graduated in engineering from the University of Illinois in 1913. He was a member of the Triangle Club and Tau Beta Pi, honorary engineering society.

In 1914 he joined the Illinois National Guard and entered active service with the guard in 1916 when it was sent to the Mexican border, at which time he applied for a reserve commission in the Engineer Corps. He attended the First Officers Training Camp and was commissioned a first lieutenant in the Engineer Corps with the Coast Artillery.

During the World War Lieut. Stough on active service rose to the rank of major, and following the war served with the U. S. Army Engineer Corps until his retirement in 1934.

Major Stough joined the staff of the Division of Water Resources in 1933 as assistant hydraulic engineer and was in charge of flood damage repair work in Siskiyou, Shasta, Trinity and Tehama counties. Recently he was working on flood damage repairs on the Van Duzen, Klamath, Eel and Mad rivers in Humboldt and Del Norte counties.

Military funeral services were held in the Presidio and interment took place in the San Francisco National Cemetery at the Presidio on January 29th.

He is survived by his wife, Mrs. Grace Lynch Stough; a daughter, Margia Jane; two sons, Glenn H., Jr., and James McKenzie Stough, and a sister, Mrs. E. D. Goodell of Newport Beach.

Caletti & Co., San Rafael, \$411,575. Contract awarded to Tavares Construction Co., Inc., Los Angeles, \$350,559.

SAN LUIS OBISPO COUNTY—At Toro Creek and at Old Creek, two reinforced concrete bridges to be constructed and about 1.6 miles of roadway to be graded and bituminous surface treatment applied. District V, Route 56, Sections D, C. Claude C. Wood & L. D. Tonn, Lodi, \$116,630; Piazza & Huntley and Trewhitt-Shields & Fisher, San Jose, \$118,273; Gibbons & Reed Co., Burbank, \$133,296; Ralph A. Bell, San Marino, \$151,366; J. E. Haddock, Ltd., Pasadena, \$153,152. Contract awarded to F. H. Gates, Santa Maria, \$109,017.

International Highway Completion Urged

Executives of 14 motorists' organizations attending the recent Western Conference of Automobile Clubs in Reno strongly indorsed the International Pacific Highway project. A resolution urging completion of the highway which contemplates connecting north-south routes in western United States with Alaska and with Central and South America was adopted unanimously.

The resolution declared: "Because of its economic value, its contribution to National defense, and its social significance, we, the Western Conference of Automobile Clubs, indorse the International Pacific Highway, and urge the American Automobile Association, National headquarters, and other interested organizations to continue their efforts to procure Congressional help in advancing this enterprise."

Two Executives of Public Works Rejoin U. S. Army

(Continued from page 21)

Captain Gunston entered the employ of the State on September 5, 1922, as Personnel Clerk and Assistant Secretary of the California Highway Commission. In July, 1923, he was appointed Disbursing Officer of the Department of Public Works and on October 26, 1937, was promoted to the post of Administrative Officer to Edward Hyatt, State Engineer.

Both Colonel Murray and Captain Gunston have been granted leaves of absence for the duration of the present emergency.

TUOLUMNE COUNTY—Between one mile south of Jamestown and Jamestown, about one mile to be graded and surfaced with road-mixed surfacing on gravel base. District X, Route 13, Section B. Louis Biasotti & Son, Stockton, \$55,591; Johnston Rock Co., Inc., Stockton, \$57,632; Fredrickson Bros., Emeryville, \$63,672; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$65,205; Poulos & McEwen, Sacramento, \$69,507; Scheumann & Johnson, Eureka, \$71,673. Contract awarded to Dan Caputo, San Jose, \$50,145.

VENTURA AND LOS ANGELES COUNTIES—Between Piru Creek and Los Angeles County line, about 5.7 miles to be graded and Portland cement concrete pavement and plant-mix surfacing to be placed. District VII, Route 79, Sections C, A. Oswald Bros., Los Angeles, \$279,928; Matich Bros., Elsinore, \$292,631; Griffith Co., Los Angeles, \$296,085; J. E. Haddock, Ltd., Pasadena, \$296,711; Clyde W. Wood, Los Angeles, \$296,724; Radlich & Brown, Burbank, \$332,814; Ralph A. Bell, San Marino, \$336,363. Contract awarded to Fredrickson & Westbrook, Sacramento, \$256,033.

State of California

CULBERT L. OLSON, Governor

Department of Public Works

Headquarters: Public Works Building, Twelfth and N Streets, Sacramento

FRANK W. CLARK, Director of Public Works

FRANZ R. SACHSE, Assistant Director

MORGAN KEATON, Deputy Director

CALIFORNIA HIGHWAY COMMISSION

LAWRENCE BARRETT, Chairman, San Francisco
LENER W. NIELSEN, Fresno
AMERIGO BOZZANI, Los Angeles
BERT L. VAUGHN, Jacumba
L. G. HITCHCOCK, Santa Rosa
WALTER T. BALLOU, Secretary

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G. T. McCOY, Assistant State Highway Engineer
J. G. STANDLEY, Principal Assistant Engineer
R. H. WILSON, Office Engineer
T. E. STANTON, Materials and Research Engineer
FRED J. GRUMM, Engineer of Surveys and Plans
R. M. GILLIS, Construction Engineer
T. H. DENNIS, Maintenance Engineer
F. W. PANHORST, Bridge Engineer
L. V. CAMPBELL, Engineer of City and Cooperative projects
R. H. STALNAKER, Equipment Engineer
J. W. VICKREY, Safety Engineer
E. R. HIGGINS, Comptroller

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F. W. HASELWOOD, District II, Redding
CHARLES H. WHITMORE, District III, Marysville
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L. H. GIBSON, District V, San Luis Obispo
E. T. SCOTT, District VI, Fresno
S. V. CORTELYOU, District VII, Los Angeles
E. Q. SULLIVAN, District VIII, San Bernardino
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R. E. PIERCE, District X, Stockton
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SAN FRANCISCO-OAKLAND BAY BRIDGE

RALPH A. TUDOR, Principal Bridge Engineer, Maintenance and Operation

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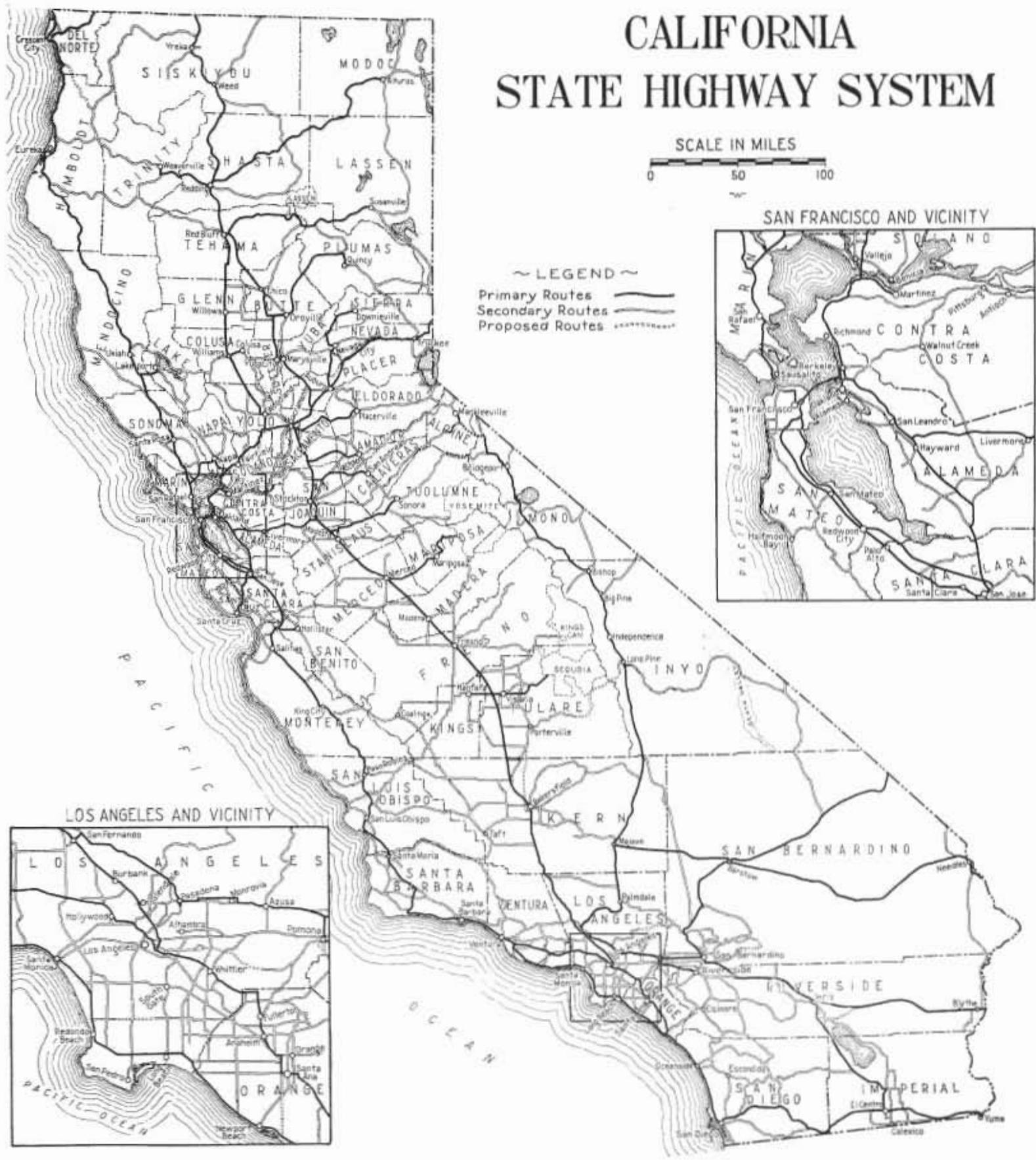
CALIFORNIA STATE HIGHWAY SYSTEM

SCALE IN MILES

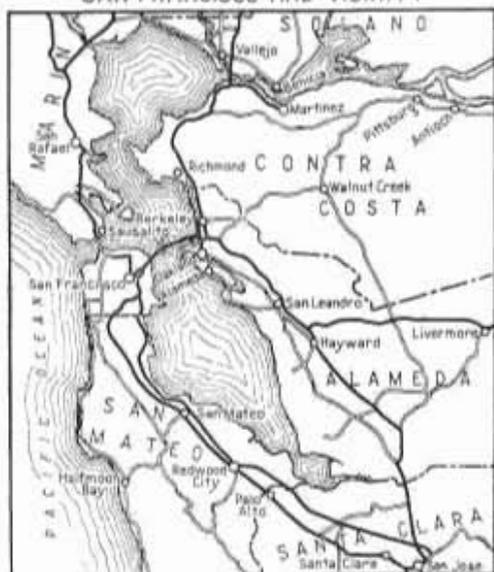


~ LEGEND ~

- Primary Routes
- Secondary Routes
- Proposed Routes



SAN FRANCISCO AND VICINITY



LOS ANGELES AND VICINITY

