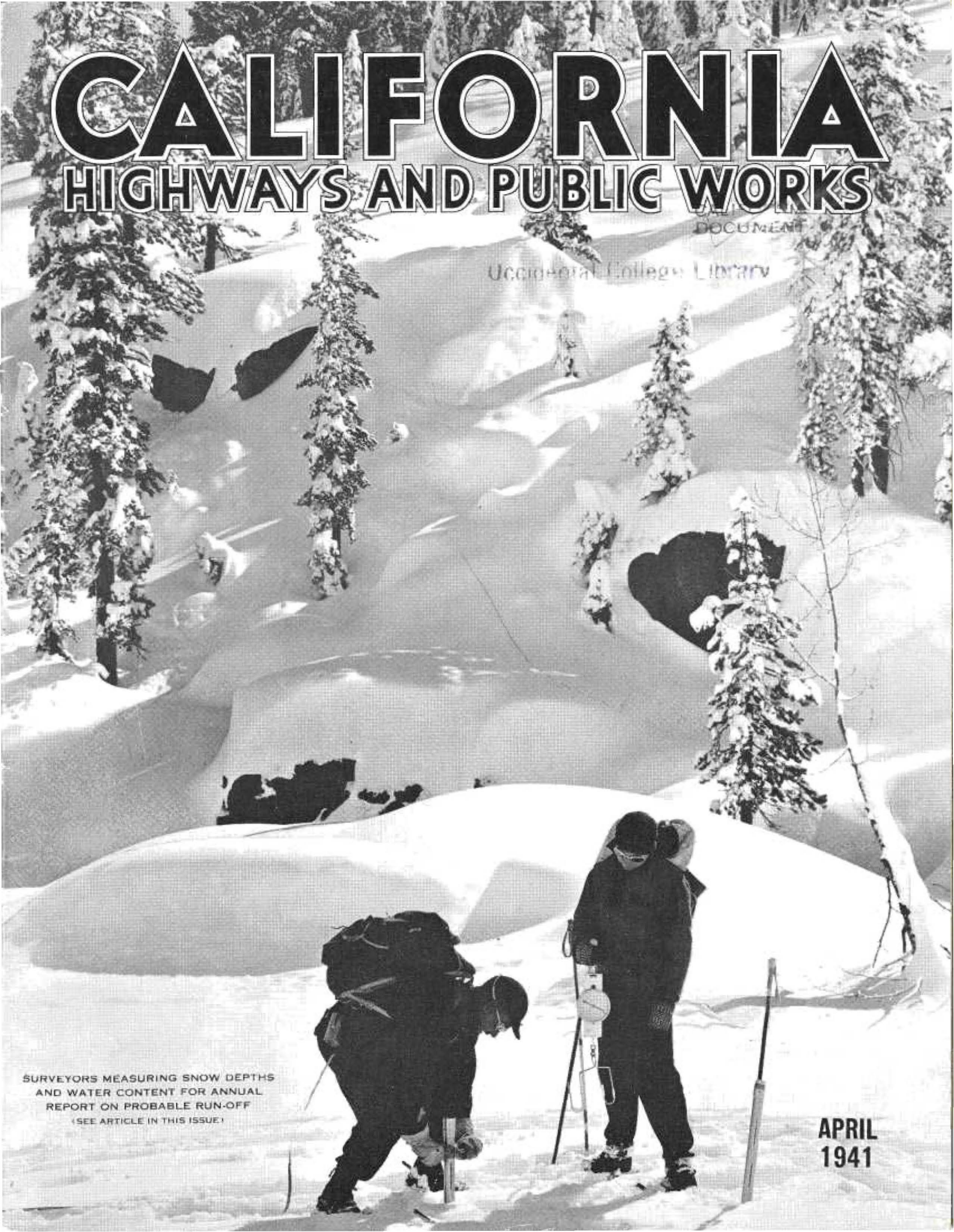
CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



SURVEYORS MEASURING SNOW DEPTHS AND WATER CONTENT FOR ANNUAL REPORT ON PROBABLE RUN-OFF
(SEE ARTICLE IN THIS ISSUE)

APRIL
1941

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

FRANK W. CLARK, Director C. H. PURCELL, State Highway Engineer J. W. HOWE, Editor K. C. ADAMS, Associate Editor

Published for information of department members and citizens of California. Editors of newspapers and others are privileged to use matter contained herein Cuts will be gladly loaned upon request. Address communications to California Highways and Public Works, P. O. Box 1499, Sacramento, California

Vol. 19 APRIL, 1941 No. 4

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Highway Commission Dedicates Three New Bridges on National Defense Highway System

THREE new highway bridges on U. S. 101, two in Humboldt County and one in Del Norte County, which meet all structural requirements of the War Department, have become available for National defense purposes.

The spans were dedicated during a two-day celebration on March 27-28. The Humboldt bridges will replace old, narrow, dangerous structures across the Eel River at North Scotia and at Robinson Ferry, one and one-half miles north of Scotia. The new Del Norte bridge crosses the Smith River north of Crescent City and takes the place of a span that has outlived its usefulness.

The three bridges while built primarily to supplant posted structures which have long been considered hazardous by the Division of Highways are of increasing importance at this time because they are located on the Redwood Highway, designated by the War Department as a link in the strategic network of military roads in California.

OLD BRIDGES OBSOLETE

Although adequate for the traffic of their day, the old bridges are too narrow for modern traffic needs and beyond rebuilding. The trio of new structures cost $1,128,898 representing State and Federal Aid funds.

Approach highway work and painting on the Robinson Ferry bridge was completed the middle of this month and the North Scotia span will be wholly completed next July. The Smith River structure is open to traffic.

Colorful dedicatory ceremonies were held at Scotia on Thursday afternoon, March 27th and at the Smith River bridge on the afternoon of the following day. In order to participate in the festivities, the California Highway Commission, headed by Chairman Larry Barrett of San Francisco, held its regular monthly meeting in Eureka on the morning of March 28th.

Bridge Statistics

ROBINSON FERRY BRIDGE

Cost	$480,000
Length	1,604 feet
Roadway width	26 feet
Alloy steel used	2,520,000 pounds
Bar reinforcing steel used	945,000 pounds
Concrete used	7,500 cubic yards

NORTH SCOTIA BRIDGE

Cost	$348,000
Length	1,137 feet
Roadway width	26 feet
Alloy steel used	1,950,000 pounds
Bar reinforcing steel used	680,000 pounds
Concrete used	4,735 cubic yards

SMITH RIVER BRIDGE

Cost	$243,225
Length	1,050 feet
Roadway width	26 feet
Structural steel used	1,065,000 pounds
Bar reinforcing steel used	625,800 pounds
Concrete used	2,500 cubic yards

CIVIC BODIES COOPERATE

Arrangements for the dedications were made by Clyde Edmondson, general manager of the Redwood Empire Association, with the cooperation of the boards of supervisors of Humboldt and Del Norte Counties, the Humboldt County Board of Trade, the Chambers of Commerce of Eureka, Smith River and Crescent City, and the Pacific Lumber Company of Scotia, which closed its huge mills for a half day on March 27th.

A crowd in excess of 1,500 persons witnessed a parade and heard a program of speeches at Scotia which preceded dedicatory ceremonies held at the southern approaches to the North Scotia and Robinson Ferry bridges in which the five members of the Highway Commision, State and county officials and officers of the Redwood Empire Association participated.

The Scotia band, the Fortuna band, and the a cappella choir of the Fortuna high school led a caravan of automobiles from the Mowatoc Hotel to the speakers platform at the south bridgehead of the North Scotia span. Acting as master of ceremonies, George G. Cloney introduced the following speakers:

NOTABLES IN ATTENDANCE

C. H. Demaray of Grants Pass, Oregon, president of the Redwood Empire Association; Clifford Bartlett, Marin County; Chairman George Cole of the Humboldt Board of Supervisors; Paul E. Mudgett, president Humboldt County Board of Trade and chairman of the Committee on Arrangements; Ed Haehl, chairman Mendocino Board of Supervisors; Elmer P. McKenzie, Scotia; Supervisor John Ratto, San Francisco; M. Goldman, Sonoma County, chairman of the Nine-Counties Highways Committee; Highway Commissioners L. G. Hitchcock, Santa Rosa; Iener W. Nielsen, Fresno; Amerigo Bozzani, Los Angeles; Bert Vaughn, Jacumba; Chairman Barrett; Morgan Keaton, Deputy Public Works Director, representing Governor Culbert L. Olson, and Director of Public Works Frank W. Clark.

Voicing the appreciation of the nine counties of the Redwood Empire, General Chairman Bartlett said:

"All of us are deeply grateful to the chairman and members of the California Highway Commission, the State Director of Public Works, the State Highway Engineer and their associates and staffs for these two new beautiful and modern bridges—this one in Scotia and the Robinson Ferry bridge north of here. We are also indebted to the United States

View of crowd at dedication of North Scotia Bridge shown in background with old span parelleling it

Public Roads Administration for Federal Aid funds.

IMPORTANT TO NATIONAL DEFENSE

"We are gathered here today to publicly honor these officials and to thank them for bringing to completion two more important projects so vital not only to the Redwood Empire, but to the State Highway System and the highways of the West and of the Nation. These bridges represent an important link in the Pacific Coast interstate system and are not only vital to the free, safe and dependable movement of tourist and commercial peace-time traffic but also to National defense."

Chairman Barrett of the Highway Commission described the engineering feaures of the two bridges and added:

"One of the greatest scenic assets of the State of California is the Redwood Highway. The Highway Commission is fully cognizant of the value of this highway and in the preparation of budgets the policy of the commission is to do all that is possible, with the funds that are available, towards the improvement of this and other highways throughout the scenic areas of California."

COLORFUL OPENING CEREMONY

At the conclusion of the speech making, Chairman Barrett led the official delegation to a barrier of redwood logs and greens stretched across the North Scotia bridge approach. At a signal from E. E. Yoder, General Manager of the Pacific Lumber Company, seven attractive Fortuna high school girls in sports costumes, swung the barrier open and Barrett, the other highway commissioners and State and county officials marched onto the span.

The girls, who added color to the occasion, were Phyllis Ingraham, Florence Willburn, Nita Murrish, Joyce Simmons, Julia O'Connor, Patricia Skiffington and Lorraine Zimmerman.

Following this ceremony, the official party entered cars and led a long caravan of automobiles over the new bridge to the Robinson Ferry bridge where brief dedicatory ceremonies were held.

The organizations which staged the celebration later tendered a dinner in the Mowatoc Hotel in Scotia to visiting officials and guests.

At the conclusion of their meeting on Friday morning, March 28th, the members of the Highway Commission and visiting officials were guests at a luncheon in the Eureka Inn tendered by the Humboldt County Board of Trade and the Eureka Chamber of Commerce following which they motored to the new Smith River bridge, 9½ miles north of Crescent City. Here dedicatory ceremonies were held in which men and women of the Klamath Tribe of Indians in full regalia and the Crescent City High School Band participated.

SMITH RIVER BRIDGE DEDICATED

President Demaray of the Redwood Empire Association, introduced by Vance Bolick of Smith River, initiated the speech making. In addition to the speakers who had appeared on the program at Scotia, the following were introduced for short talks: J. J. McNamara, chairman of the Board of Supervisors of Del Norte; Chairman Warren Shannon of the San Francisco Board of Supervisors; Clarence Westbrook, president, Del Norte Chamber of Commerce; Supervisor Ira L. Scott, representing Smith River Chamber of Commerce, and Joseph Oliver, president, Crescent

City Chamber of Commerce.

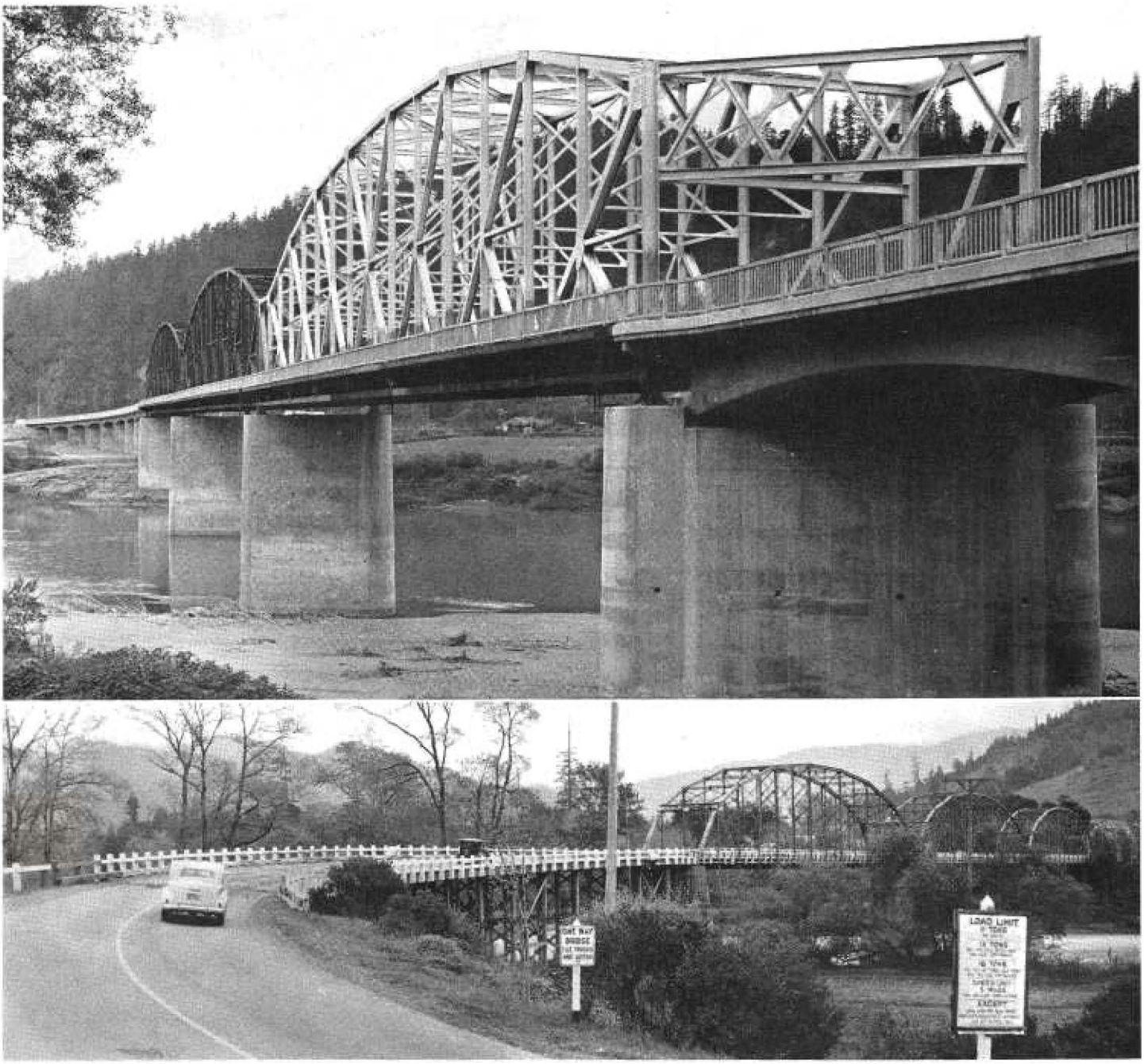
Following the address, the Indians and a group of Del Norte girls formed in two lines across the center of the bridge. Chairman Barrett then led his fellow commissioners and members of the official delegation through the "human barrier" and the Smith River bridge was officially dedicated to public traffic.

Later a buffet supper was served at the Oregon line with Supervisor McNamara and his board and the Chambers of Commerce of Crescent City and Smith River and the Chamber of Commerce of Del Norte acting as hosts.

Two years ago, in adoption of the State highway budget for the current biennium, the members of the Highway Commission selected as necessary improvements to the Redwood Highway, U. S. 101, the construction of several major bridges designed to forestall the possibility of bottlenecks restricting traffic flow over this popular route through the redwoods.

Included among these major structures were the bridges for the two crossings of the Eel River on both sides of Rio Dell, north of Scotia.

The Robinson Ferry bridge is the larger of these two structures across the Eel River, and is one of the most modern bridges on the State Highway System. Its overall length is 1,604 feet and, structurally, the bridge consists of three 300-foot steel truss spans, 12 reinforced concrete girder spans, totaling 676 feet, and two reinforced concrete cantilever spans of 12 and 16 feet respectively.



The massive structure shown above replaces unsafe Robinson Ferry Bridge across Eel River pictured below, posted for load limit

The spans are supported on reinforced concrete piers and bents. The roadway width of the concrete deck is 26 feet between curbs and the two sidewalks are each 4 feet in width.

NEW ALLOY STEEL USED

In the construction of both the Robinson Ferry bridge and the North Scotia bridge, Division of Highways Bridge Engineers effected considerable economy by the use of new and more scientific materials. The steel used in the large trusses of these bridges is a new structural alloy steel that has a strength one and one-half times that of ordinary structural steel and which is also much more rust-resistant. These factors mean economy in both construction and maintenance costs.

Approximately 2,520,000 pounds of this new structural alloy steel has gone into the trusses of the Robinson Ferry bridge. There are nearly 7,500 cubic yards of portland cement concrete and 945,000 pounds of bar reinforcing steel in the girders, piers, bents, and floor, and some 300 piles were driven for foundations of piers and bents.

$480,000 CONTRACT

The contract for the construction of this new crossing of the Eel was awarded by Frank W. Clark, Director of Public Works, on February 5, 1940, to the Engineers, Ltd., of San Francisco. The project has been financed by Federal Aid and State highway funds at a cost of about $480,000.

The North Scotia bridge is practically complete and is likewise a steel and concrete structure. In the case of this second crossing, the total length of the bridge is 1,137 feet, consisting of three steel truss spans with a combined length of 802 feet, seven reinforced concrete girder spans totaling 316 feet and two reinforced concrete cantilever spans with a length of 19 feet.

As in the case of the Robinson Ferry bridge the concrete deck of this structure is 26 feet between curbs and the sidewalks are each 4 feet wide.

$348,000 CONTRACT

The same structural alloy steel was used in construction of this bridge as in the larger one at Robinson Ferry. The three truss spans of the north Scotia bridge required 1,950,000 pounds of structural steel and the concrete portions of the structure include 4,735 cubic yards of Portland cement concrete and 680,000 pounds of bar reinforcing steel. There are 137 piles as foundation support to the concrete piers and bents.

The contract for construction of the North Scotia bridge was awarded by Director Clark on February 20, 1940, to the firm of A. Soda and Son of Oakland. The cost of this bridge will amount to about $348,000 and the structure will be completed three months in advance of schedule.

Construction operations on the approaches to the two bridges have been under way on the new line since June 20th, when a contract was awarded for grading and surfacing the permanent approaches and connections with the existing highway. There is included in the proposed budget, adopted by the Highway Commission on December 31st last and now pending before the State Legislature, a project providing $106,500 for grading and paving the 1.4 miles between the two bridges.

U. S. Highway 101 follows the

New North Scotia Bridge which supplants old span on the left that has been condemned as unsafe by Division of Highways

Contrasting views of new and old Smith River bridges exemplifying highway improvement in Del Norte County

Pacific shore line from Vancouver to the Mexican border and one of the most picturesque sections is that which lies along the rugged coast of Del Norte County.

Traffic over this route shows steady increases year by year and in keeping with the purpose of the California Highway Commission and the Division of Highways to steadily improve the portions located in Del Norte County, on January 11, 1940, Public Works Director Clark awarded to contractor Joseph Shaw a State highway contract for the construction of a steel and concrete girder bridge, together with the necessary approaches, across the Smith River, 9½ miles north of Crescent City.

ON REVISED ALIGNMENT

This new structure, placed on a revised alignment down stream from the old and narrow steel truss and timber trestle bridge, is a marked improvement to this section of U. S. 101.

The new structure is 1,050 feet in length and consists of four steel girder spans aggregating 660 feet, two cantilever steel girder spans with a total length of 90 feet, 12 reinforced concrete slab spans totaling 280 feet and four cantilever reinforced concrete slab spans.

The girders rest on reinforced concrete piers and bents on pile foundations and spread footings. The width of the concrete deck of the new bridge is 26 feet between curbs, which is a most decided improvement over the 16-foot width of the old bridge.

The construction of the bridge required 1,065,000 pounds of structural steel, and the 2,500 cubic yards of Portland cement concrete required 625,800 pounds of reinforcing bars.

Approaches to the new structure are three-tenths of a mile in length and the construction of the 30-foot roadbed necessitated the movement of 62,500 cubic yards of earth.

Some one told us that a C. E. ruined the mechanical calculator in the Drafting Room. He divided a number by zero and burned out the bearings.

First Maid: "How did you like working for that college professor?"

Second Maid: "Aw, it was a rotten job. He was all the time quarreling with his wife, and they kept me busy running between the keyhole and the dictionary."

Modern 4-Lane Divided Highway Evolved from Old 18-Foot Pavement

By A. EVERETT SMITH, Assistant Highway Engineer

IN West Riverside the existing crowded two-lane road has been transformed into a beautiful four-lane highway with a central dividing strip to separate opposing lanes of traffic. In modern standards, it is surpassed only by limited access highways or freeways.

This project is a portion of U. S. Highway 60 that extends westerly three miles from the bridge across the Santa Ana River at the west city limit of Riverside on Mission Boulevard. It is a part of the State Primary Highway System.

The present improvement has evolved from a portland cement concrete pavement constructed to a width of 18 feet in 1914. In 1925-26 this road was widened to 20 feet and topped with a wearing course of asphaltic concrete.

As the traffic on this road steadily increased, in 1935 shoulders were constructed and a road-mix surface treatment applied 6 feet in width on each side of the pavement.

The transformation just completed has consisted, in general, of utilizing the existing traveled way to provide dual lanes for east bound traffic, and constructing two additional lanes for west bound traffic.

Divided highway through West Riverside business district. New pavement on right

As the existing right of way was inadequate for carrying out this expansion plan, it was necessary to acquire additional right of way throughout the project. This involved setting back many dwelling houses and business establishments, especially through the West Riverside business district. Facilities of Public Utility Companies were also affected. Numerous irrigation and domestic water lines were encountered which had to be lowered, encased in concrete or otherwise rearranged.

Flashing beacon marks dividing strip island which has cross-overs at intersections

The new roadbed section consisted in general of constructing a subgrade of selected material 6 inches in thickness. Over this subgrade was placed a cement stabilized base 6 inches in thickness topped with 2½ inches of plant-mixed surfacing.

Material for the selected material subgrade and for cement stabilized base was obtained from roadway excavation near the west end of the job.

The specifications for the cement stabilized base, and the methods used in mixing and placing on the street

(Continued on page 15)

Large Palms and Eucalyptus trees that bordered the existing 2-lane pavement on the left were conserved in the division strip of the new divided highway and make it one of the most beautiful sections of U. S. 60 in Southern California

Extending Arroyo Seco Parkway Into Los Angeles Business Center

By JOHN G. MEYER, Assistant Office Engineer

FINANCED as a cooperative project by the Federal Government, the State of California and the City of Los Angeles, the work of extending the Arroyo Seco Freeway through Elysian Park southerly on Figueroa Street from Avenue 22 to Adobe Street in downtown Los Angeles is now under way.

The extension is necessary to relieve traffic congestion across the Los Angeles River Bridge, through the Riverside Drive intersection and in the four Elysian Park tunnels which has greatly increased since the completion of the Arroyo Seco Freeway.

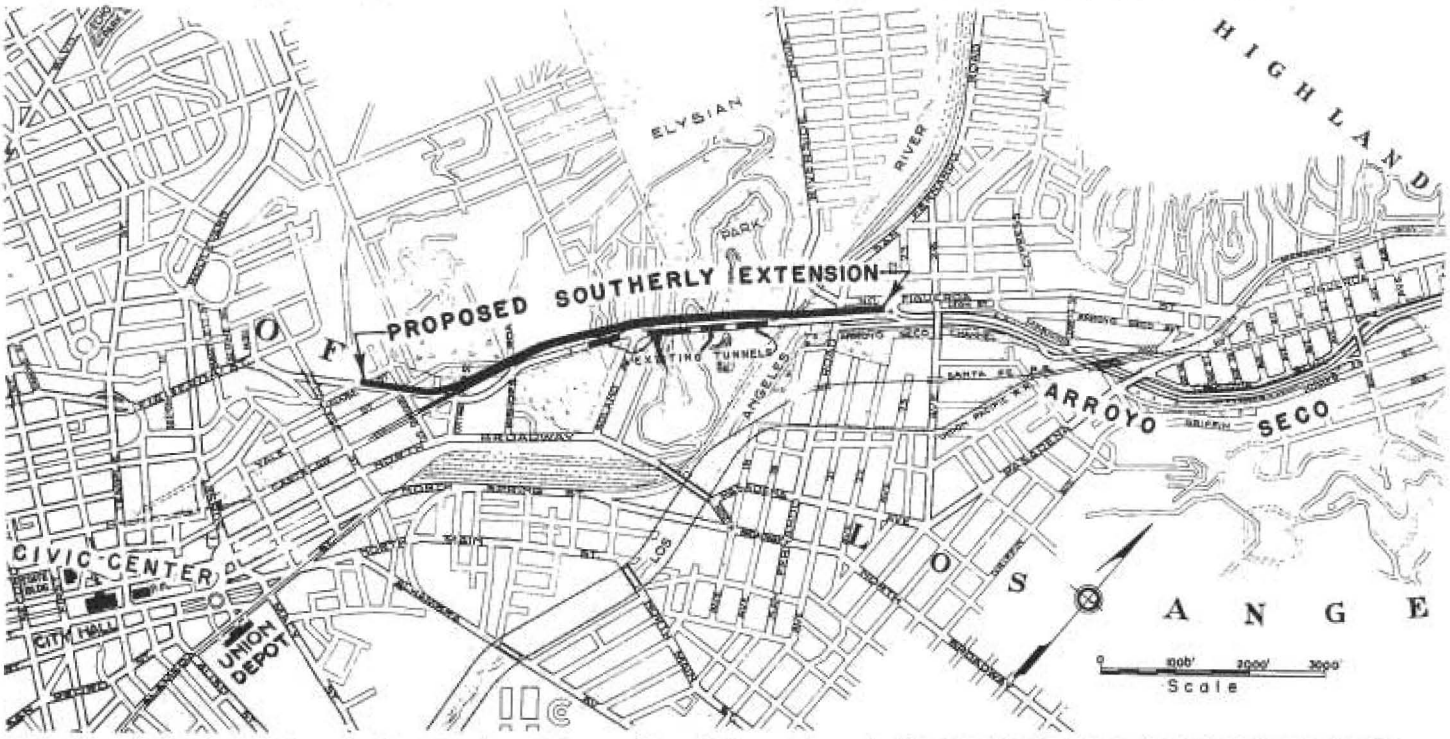
Approximately $2,437,000 of WPA, Federal Aid, State Highway and City of Los Angeles funds will be expended on the improvement.

The general plan for the extension calls for the use of the four existing Figueroa Street tunnels through Elysian Park and the roadway and bridge over the Los Angeles River between Castelar Street and Avenue 22 for northbound traffic only; construction of a four-lane roadway for southbound traffic through open cuts in Elysian Park on the westerly side of the existing tunnels and at a higher elevation to facilitate grade separations for traffic at Solano Avenue, Bishops Road and at Castelar Street; construction of an additional four-lane bridge for southbound traffic, across the Los Angeles River upstream from the existing bridge, but at a higher level. The grade of the southerly end of this bridge will be above Riverside Drive to permit northbound Riverside Drive traffic to turn left under the new bridge.

The new work on Figueroa Street from Avenue 22 to Adobe Street will be on a freeway basis.

The WPA is engaged at present in grading operations and the building of the substructures of the Los Angeles River and Solano Avenue bridges.

Contracts have been advertised for the Castelar Bridge to cost about $65,000. Bids for the Park Row Bridge to cost $30,000 were opened on April 3d. Bids will shortly be taken for the Bishop Road and Amador Street bridges and for the Los Angeles River and Solano Avenue bridge superstructures.



Map showing proposed southerly extension of Arroyo Seco Parkway through Elysian Park into Los Angeles business district

The grading work involves the excavation of 550,000 cubic yards of earth and rock requiring 20,000,000 station yards of overhaul. A considerable portion or about 400,000 cubic yards of excavation is not required in the fills and is to be used in filling some of the Elysian Park Canyon areas which will assist in the beautification and development of that park.

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View of open cut under construction through Elysian Park in Los Angeles for southbound traffic extension of Arroyo Seco Freeway

Open cut construction parallels existing Figueroa Street tunnels for northbound traffic seen at left. Large fill will be built in foreground

Rio Vista to Lodi Short-Cut and New Bridge Now Under Way

By R. E. PIERCE, District Engineer

CONSTRUCTION of a portion of the new highway between Rio Vista and Lodi in San Joaquin and Sacramento counties, which will facilitate travel between the San Joaquin Valley and Rio Vista, is under way following official ground-breaking ceremonies held March 15th.

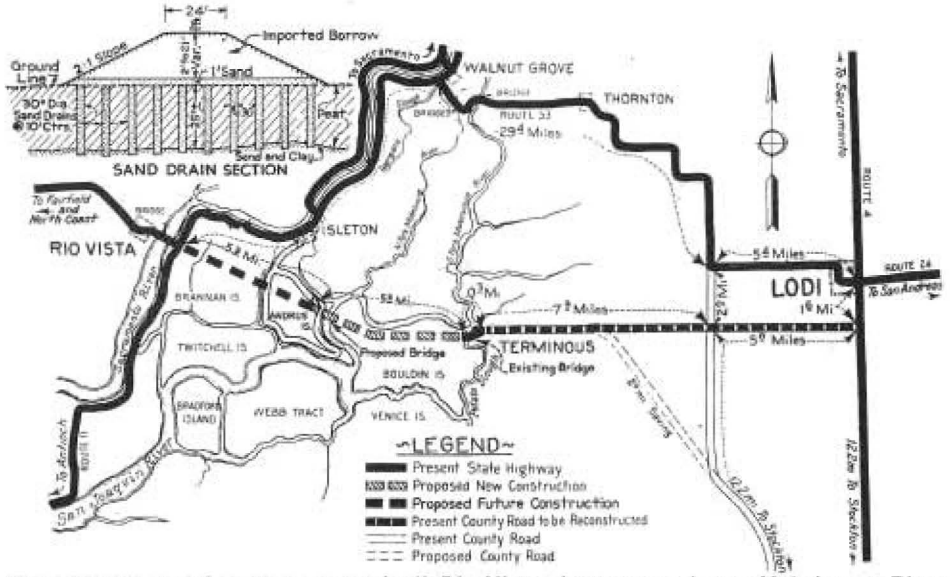
The work now under way consists of a bridge being built by contract over the Mokelumne River and a grading contract which will connect this new bridge with the bridge built several years previously across Potato Slough at Terminous, and a short section of highway west of the new bridge connecting with the county road leading to Isleton. From this intersection the present paved State highway from Isleton to Rio Vista will be used temporarily until funds are available to complete the direct route to Rio Vista.

The April, 1940, issue of CALIFORNIA HIGHWAYS AND PUBLIC WORKS carried an article on this road written prior to the completion of a test section on the west approach to the Potato Slough bridge, which included vertical sand drains placed under direct control of the highway laboratory personnel, and which was afterward covered by 40,000 cubic yards of fill material placed under contract.

The special provisions of the contract included strict control of placing the fill material, as was fully brought out in the article previously mentioned.

This fill has now been in place since the middle of last summer and has gone through a wet winter without showing any signs of displacing the natural material sideways as was the case in the fill built on the east approach to the Potato Slough bridge several years ago.

On the showing made by this experimental project the special provisions for the present grading contract includes an item for vertical sand drains under the approaches to the new bridge over the Mokelumne, and also provides that material in the roadbed



Map showing location of proposed Lodi-Rio Vista short-cut and new Mokelumne River Bridge

may be placed in layers not to exceed 4 inches of sand where rolling or tamping is not required, and not over 1 foot in any 24-hour period. The right is also reserved to restrict the rate of placing material or to suspend operations or both; suspension not to exceed 10 days on any one portion.

The bridge contract now under way includes a bridge across the Mokelumne River and a ramp trestle on the west approach to the existing bridge at Potato Slough. The bridge across the Mokelumne River consists of one through steel truss swing bridge approximately 287 feet long with two adjacent steel stringer spans, each approximately 51 feet long, with fifty-five 19 foot timber approach spans, making a total length of 1434 feet.

The ramp trestle structure on the west approach to the Potato Slough bridge consists of five 19 foot timber spans with concrete deck. Both structures have a clear roadway width of 26 feet.

The grading contract includes as principal items 548,000 tons of imported borrow; 48,500 lineal feet excavating sand drains; 5,400 tons filling material for sand drains; and several minor items including roadway excavation, culverts, etc.

The contract allotment for the bridge is $368,086.95
and for the grading 269,360.18

or a total of $637,447.13

The bridge contractor is Tavares Construction Company, and the grading contractor is Clyde W. Wood, both of Los Angeles. A. N. Lund will be the Resident Engineer in charge of the road work, and C. C. Winters will be Resident Engineer for the bridge.

When completed to Rio Vista, this project as mentioned in the previous article, will eliminate a road with low standards of width, alignment and pavement, which runs for several miles along the narrow, crooked Sacramento River levee, crosses three substandard bridges, which are narrow and weak and with right angle turns on the approaches, and has other numerous right angle turns.

The distance from Rio Vista to U. S. 99 near Lodi will be shortened 11.1

(Continued on page 22)

$2,500,000 Storm Damage to Highways in February and March

By T. H. DENNIS, Maintenance Engineer

THE Division of Highways storm damage bill for February and March totaled two and one-half million dollars. Lacking adequate funds, the major part of this work of restoration must be postponed until the next biennial period. Obviously if our capital investment is to be preserved this work must have priority over other demands.

The damage though widespread was particularly severe in the Los Angeles area where rainfall records of the past 50 years were broken. Continuous soaking rains saturated the roadbed and slopes, causing the movement of large masses of rock and earth and either weakened or destroyed the pavement. California, with its extremes in climate and faulted geological formations coupled with its large registration of trucks and automobiles, truly presents a difficult and costly maintenance problem.

BIG EQUIPMENT JOB

During the past two months practically all of the Districts' efforts have been devoted to maintaining a passable roadway for traffic. This service in the Los Angeles district alone, required the use of 20 power shovels, and equal number of bulldozers and 80 trucks. With the end of the storm periods, restoration is now under way.

Restoration of shattered cut slopes, though costly, offers no great problem to power shovels and trucks. This is not true where the underlying support of embankments has been destroyed through saturation, wave or stream action, with consequent slippage. These involve extensive as well as expensive measures of correction and protection. The Eureka District's estimate for thirteen such corrections is $270,000.

In particular cases it may be necessary to remove thousands of cubic yards of material well below the original ground to again reach a stable foundation upon which to rebuild. In other instances, stability may be secured through the release of excess water in the foundation soil through hydrauger borings. Every location, however, will entail an individual study and plan of correction.

$100,000 DAMAGE BY WAVES

Protection against wave action is always expensive, and sometimes impractical. A situation of this kind exists on Route 56 between Edgemar and Thornton just south of San Francisco. Here one and one-half miles of roadway niched in a sandy formation midway between the ocean and the top of the bluffs is continually undermined by the pounding of waves. Maintaining this location can only be accomplished by moving back into the bluff after each onslaught of storm action; in effect, continuous rebuilding. Restoration at this location for the recent storm will exceed $100,000.

Protection of embankments against stream attack is likewise expensive and its type is dependent upon the stability of the foundation support. Many proven methods are available for this kind of work, including heavy rock riprap, sacked concrete, metal and concrete cribbing, concrete slope paving, sheet piling as well as pipe and wire netting. Studies are now under way at many locations where this type of damage occurred.

Since this article was prepared, continuing storms during the first week in April have increased the highway damage toll. Showers of cloudburst proportions temporarily closed Route 56, the Marin Coast Road; Route 116, the Santa Cruz-Boulder Creek Road; Route 21, the Feather River Highway, and the Weaverville lateral.

It will be seen from the foregoing and the accompaning views on the following pages, that storm damage repair will occupy highway forces for a number of months to come.

High Praise for Maintenance Crew

Santa Barbara, California

California Highway Commission,
Sacramento, California.

Gentlemen:

I think it only fair that you know the appreciation of at least one of those who live in the mountains and depend upon the work of the maintenance crew located on the San Marcos Pass, Santa Barbara County.

First this crew was faced with a very serious forest fire. After the fire, came the resultant erosion caused by an all-time high rainfall record. During all of this trying winter the San Marcos maintenance crew has supplied to us who live in these mountains a service which must go beyond that imposed by regular line of duty. Time and again they have kept the road open when such a course did not seem possible.

If you have any sort of merit system, the men of the San Marcos Pass deserve to be on your honor roll. I have never met any of these men, excepting to wave as I pass them on the road. Rather than try to thank them, I thought the nicest thing might be to let their superiors, who are far away from the scene, know what splendid work they have done, and are doing, in maintaining the difficult San Marcos Pass road in Santa Barbara County.

Very truly,
Jack V. Wood.

1. Slides of mud and rock covered section of Coast Highway 56 in Monterey County.
2. A slide of huge rocks closed U. S. 399, State Highway 138, in Ventura County north of Ojai.
3. Swollen waters of Cottonwood Wash tore out section of State Highway 194 in Riverside County.
4. Section of U. S. 99 washed out by flood water of Clear Creek in Shasta County.
5. Section of State Highway Route 20, Trinity lateral, washed out near Douglas City, Trinity County.
6. Cholame Creek bridge on State Highway 33 closed by undermining of pier by flood waters.
7. Slip-out on San Marcos Pass Highway along Santa Ynez River on State Highway 80, Santa Barbara County.
8. Wash-out on Tahoe-Ukiah Highway in Lake County caused by slide on opposite side of creek, forcing stream against bank.

9. Section of Cottonwood Creek bridge washed out on State Highway 29 in Tehama County.

10. Large slide on State Highway 50 in Colusa County, estimated 20,000 cubic yards.

11. Slip-out on State Highway 14 between Carquinez Bridge and Martinez.

12. Wash-out on Hesperia road in San Bernardino County.

13. Big slide closed State Highway 61 in Los Angeles County. Detour road on right.

14. Fill settlement on Downieville road, State Highway 25, in Nevada County.

15. Wash-out on Capistrano-Elsinore road, State Highway 64 in Orange County.

16. Wash-out on Topango Canyon road, State Highway 156, Los Angeles County, took out 2.47 miles of road.

Equipment grading for relocation of State Highway (U. S. 99) through mountains north of Shasta Dam at south end of the Antler bridge across the Sacramento River in Shasta County. Abutment of bridge is seen at right of picture.

Heavy Grading Jobs in Relocation Around Shasta Dam Reservoir Site

GRADING work on the realignment of the Pacific Highway around Shasta Dam reservoir site involving some of the heaviest excavation ever undertaken in northern California, has progressed to a point where its completion early this summer is assured.

Reconstruction of 15.5 miles of the Pacific Highway is an integral part of the Central Valley Project. The State's share of the cost of relocating the highway approximates 10 per cent of the grading and surfacing costs and 23.5 per cent of the cost of a bridge across the Sacramento River near Antler.

When the work adjacent to the south end of the Antler bridge is finished, the contractors, Granfield, Farrar & Carlin, will have completed one of the roughest grading jobs the Division of Highways ever has let to contract.

Of the 15.5 miles of realignment, 2.5 miles was constructed by the United States Bureau of Reclamation in conjunction with the relocation of the railway lines of the Southern Pacific. The highway bridge across the Sacramento River at Antler and the joint highway and railway bridge across Pit River together represent 0.9 of a mile. The balance of approximately 12 miles is covered by current grading contracts being performed by Granfield, Farrar & Carlin.

Contracts for realignment involve a unit of 4.8 miles between Bass Hill and O'Brien Summit, southerly section of the relocation that lies on either side of the Pit River bridge. This contract called for the movement of about 1,164,000 cubic yards of excavation.

Another contract which will complete the grading for the highway realignment involves 8.1 miles from O'Brien Summit to a point near Antler and will require the movement of 1,393,000 cubic yards of excavation. The approximate cost of these two units is $416,238 and $393,737, respectively.

The cut adjacent to the south end of the Antler bridge is something over 175 feet from the ground elevation to highway grade. However, it is not as outstanding as heavy work on the contract as some other cuts which are as high or higher. There are two cuts running up to 232 feet and 275 feet and three fills of 185 feet, 220 feet and 289 feet.

The fill represented by one of these cuts required a quarter of a million yards to bring it to grade. The deepest cuts are adjacent to the highest fills and in some cases it was necessary to move the material from the highest point into the lowest part of the fills over very steep terrain. This required some very extensive pioneer operations.

The entire realignment section will require the moving of approximately 2,850,000 cubic yards of material. The heaviest cut and fill work is embraced within a one-mile stretch of the reclamation and necessities 725,881 cubic yards of excavation. In other words, about one-quarter of the excavation on the entire 12 miles occurs in this area alone.

When the grading contracts are completed this summer, contracts for surfacing will be let. The entire relocation will not be open for traffic until completion of the Pit River bridge, now being erected by the American Bridge Company under contract with the Bureau of Reclamation.

The surfacing of the new highway will consist of crusher run base and plant-mixed bituminous treated top, except through the Southern Pacific subway near Antler, where Portland cement concrete will be used. The estimated cost of this surfacing is $335,000.

Modern 4-Lane Divided Highway

(Continued from page 6)

are quite similar to those described in an article in the March, 1941 issue of this journal on the Beaumont-Banning four-lane highway construction. However, due to the excellence of the material available on this project, the water control was less critical and the operations of spreading and consolidating on the street presented fewer difficulties.

Through the commercial area of West Riverside standard curbs were placed near the property line. The central dividing strip was also curbed with a roll type curb and gutter placed monolithically. Through the balance of the project the new construction was at a different grade elevation from the existing pavement and the dividing strip was not curbed. Cross-overs were provided at all street intersections.

At each end of the project, at the termini of the dividing strip islands, flasher beacons were installed. These are to aid approaching drivers to observe the presence of the island.

The old existing roadway was for the most part bordered by large eucalyptus, pepper and palm trees. The location of the new improve-

(Continued on page 22)

Grading down steep mountainside for Antler Bridge approach

Factors Governing Selection Of Asphaltic Surface Types

By THOMAS E. STANTON*, Materials and Research Engineer

*** A discussion of a portion of the paper on "Factors Governing the Selection of Asphalt Surface Types" presented by Professor Lloyd F. Rader of the University of Wisconsin at the recent National Asphalt Conference.**

A NUMBER of factors must be recognized as having an influence on the choice of asphalt surface types. One of the most important of these factors is the personal equation or prejudice of the individual engineer for or against some particular design of bituminous surfacing, depending on his experience with the local materials and conditions under which he may be working.

In addition to the personal equation the more tangible factors influencing a selection are: climatic conditions; differences in soil and drainage; nature and condition of subgrade and base; variations in amount and weight of traffic; and (very important) limitation in funds.

The new California Standard Specifications adopted November 15, 1940, recognize the following types of bituminous surfacing:

1. **Penetration Oil Treatments**
2. **Seal Coats**
3. **Bituminous Surface Treatment**
4. **Armor Coat**
5. **Retread Surfacing**
6. **Non-Skid Surface Treatment**
7. **Road Mix Surfacing**
8. **Plant Mix Surfacing**
9. **Bituminous Macadam Surfacing**
10. **Asphaltic Concrete**

A brief description of the use of each type is as follows:

1. PENETRATION TREATMENT

This type of construction is similar to the so-called dust oiling (done as a temporary expedient to maintain the existing surface in a dustless condition) but it is often applied to imported borrow or selected materials on shoulders in new construction.

2. SEAL COATS

Seal coat construction as practiced in California consists of the application of a bituminous coating or coatings of any one of a number of grades and then covering with imported screenings uniformly graded from coarse to fine. This type of construction is used principally to restore or protect old surfaces which have a tendency to ravel or which need protection from surface water. Also used to reduce skid hazard. Type B heavy seal is used as a wearing surface over untreated bases where light traffic does not warrant a heavier surfacing.

3. BITUMINOUS SURFACE TREATMENT

This is a road mix treatment of the existing material in the roadway or with cheap imported select material it is used when the local material is suitable for mixing with oil and there are insufficient funds to cover the cost of a more expensive treatment.

4. ARMOR COAT

The armor coat type is usually constructed using liquid asphalts of the SC-6 grade or the penetration type asphaltic emulsions and is constructed to a greater thickness than the ordinary seal coat; three applications of the bituminous binder and screenings in addition to a seal coat being used. The crushed screenings in this case are in commercial sizes graded from coarse to fine, the maximum size being approximately $\frac{3}{4}$ inch. This type of construction is used where there is an excellent base which justifies the construction of a relatively expensive type of bituminous surfacing but does not justify the expense of adding additional imported material to a thickness of several inches of either the road mix or plant mix type. Frequently used on wooden bridge decks to accommodate flexure.

5. RETREAD SURFACING

This type of surfacing consists of bituminous binder and aggregate mixed, spread and compacted over the surface of an existing pavement which requires a light re-surfacing. It usually consists of two applications of rock and bitumen spread and mixed on the existing pavement followed by a seal coat. In effect, a mixed-in-place armor—advocated for leveling up old rough pavements which are otherwise structurally adequate.

6. NON-SKID SURFACE TREATMENT

This type of treatment consists of a single application of bituminous binder and special close graded screenings to the surface of an existing pavement which has become slippery from use. In this type of construction the bituminous binder is usually of the penetration type asphaltic emulsion. Quantity of binder is limited and screenings are of hard stone (5 to 20 L.A. rattler wear).

7. ROAD MIX SURFACING

This type of construction consists in importing select graded aggregate and mixing on the road with various grades of bituminous products to a depth of several inches and is used where an appreciable thickness is required and funds are available for the purpose. The road mix type of surfacing is specified or permitted in California where the job is of insufficient size to justify setting up and mixing the material in a central

mixing plant. Many contractors have elected to substitute plant mix construction even when road mixing is permitted.

8. PLANT MIXED SURFACING

This is the preferred type of low cost road construction in California and is of general use wherever the volume of traffic, funds available, etc., do not justify the construction of the more expensive asphaltic concrete type. The material is usually dried to low moisture content and mixed with bitumen at a central mixing plant and spread and compacted on the prepared base usually to a thickness of 2″ to 3″, although under special conditions the thickness may not exceed 1½″. Four inches is the maximum thickness approved for this type of construction.

9. BITUMINOUS MACADAM SURFACE

This type of construction is not extensively used in California primarily because of the difficulty of securing as smooth and dependable construction as with the plant mixed types. Few engineers today have had sufficient experience with this type of construction to guarantee satisfactory results. There are certain occasions, however, where the local commercially produced crushed aggregate particularly lends itself to the penetration macadam type of construction and contractors are available who thoroughly understand this method. Under these and some other conditions the bituminous macadam type has its place in the picture.

10. ASPHALTIC CONCRETE

The asphaltic concrete type is usually preferred wherever it is anticipated that the traffic will exceed 5,000 to 10,000 vehicles per day and it is at the same time necessary to use a pavement construction exceeding 3″ in thickness or thicknesses less than 3″ on a previously constructed high type pavement base.

It will be noted that there is no provision for the Sheet Asphalt Type in California specifications. This type has been omitted in favor of the dense graded coarser aggregate types which are considered as:

(a) Less expensive. (b) Normally more stable in the thicknesses constructed. (c) Less likely to become slippery through the flushing of excess bitumen to the surface or oil drippings from motor vehicles.

Highway Magazine Is Read In South Africa

UNION OF SOUTH AFRICA

Department of Agriculture and Forestry
Burlington House

Pretoria
February 21, 1941

Department of Public Works,
Sacramento, California.

Gentlemen:

I beg to acknowledge receipt of the publications forwarded under cover of your letter of December 30th, last, for which I thank you.

It would be appreciated if you could place the name of this Division on your mailing list to receive all issues of your Department magazine in the future.

Signed,

HANS FAUELDE,
Director of Forestry.

Through experience our ideas on the selection of pavement types have undergone a steady change. Economic pressure, that is demand for increased mileage accompanied by reduction in funds available per mile of road have tended to greatly stimulate the construction of low cost surfacing. The problem lies in keeping construction costs down without causing a disproportionate increase in maintenance costs. Naturally, the construction engineer is more likely to be attracted by a low initial cost while the maintenance engineer is more vitally interested in durability and low upkeep.

A survey of the California rural state highway system as of December 31, 1938, indicated a total mileage of bituminous surfacing distributed under the various types as follows:

Asphaltic concrete	**1,304**
Bituminous macadam	**999**
Plant mix gravel	**1,343**
Road mix gravel	**1,887**
Oiled gravel	**1,594**
Oiled earth	**2,644**

The preceding tabulation does not delineate the mileage of armor coat or "two shot" seal coat construction. This mileage is included in the oiled gravel section. Eliminating the mileage of oiled earth, which is largely in the form of dust oiling of existing country road surfaces, 63% of the bituminous surfaced mileage of California highways consists of a dense graded mixture of the road mix, plant mix, or asphaltic concrete type.

In selecting types of bituminous surfacing, the volume of traffic is most commonly cited in justifying some particular design of surface. Ten years ago it was almost universally agreed that the oil mix type of road, whether plant or road mix, was suitable only for roads carrying light traffic and its use was commonly justified on the grounds of stage construction; that is, to serve temporarily until funds were available for a so-called standard high type pavement.

At the present time, however, we are constructing plant mix surfacing using slow or medium curing liquid bituminous products as a binder on roads carrying materially in excess of 5,000 cars per day. The position of the various types of bituminous surfacing is not static so far as selection for certain traffic conditions is concerned and the trend is definitely toward a more extensive use of the low cost type to more heavily traveled roads.

A considerable mileage of concrete and asphaltic concrete pavement has been resurfaced with so-called armor coat. This is a type of construction found in most states but designated by various titles. It consists of two or more layers of clean stone held in place by successive applications of liquid asphalt. The size of stone, the number of applications, and the grade of asphalt binder used may vary considerably but the general principle is the same. This sort of construction has been quite satisfactory over good foundations and in areas where snow removal is not necessary. However, the armor type has not been consistently satisfactory in the presence of any base defects or in the high mountain regions where many failures have been caused by snow removal equipment or by destruction due to freezing and thawing.

The most generally satisfactory type has been the dense graded plant mix surface from two to three inches thick and preferably three inches.

(Continued on page 22)

Snow Survey Report Forecasts The Sierra R

Very High Water Stages Are Expected in the San Joaquin

AN ABUNDANT summer water supply for all of California is predicted in the annual forecast of stream run-off made by the Division of Water Resources on the basis of data collected through the California Cooperative Snow Surveys.

The preliminary estimate of run-off issued April 10th by the division shows that for streams in the Sierra as a whole the flow will be 20 per cent above normal.

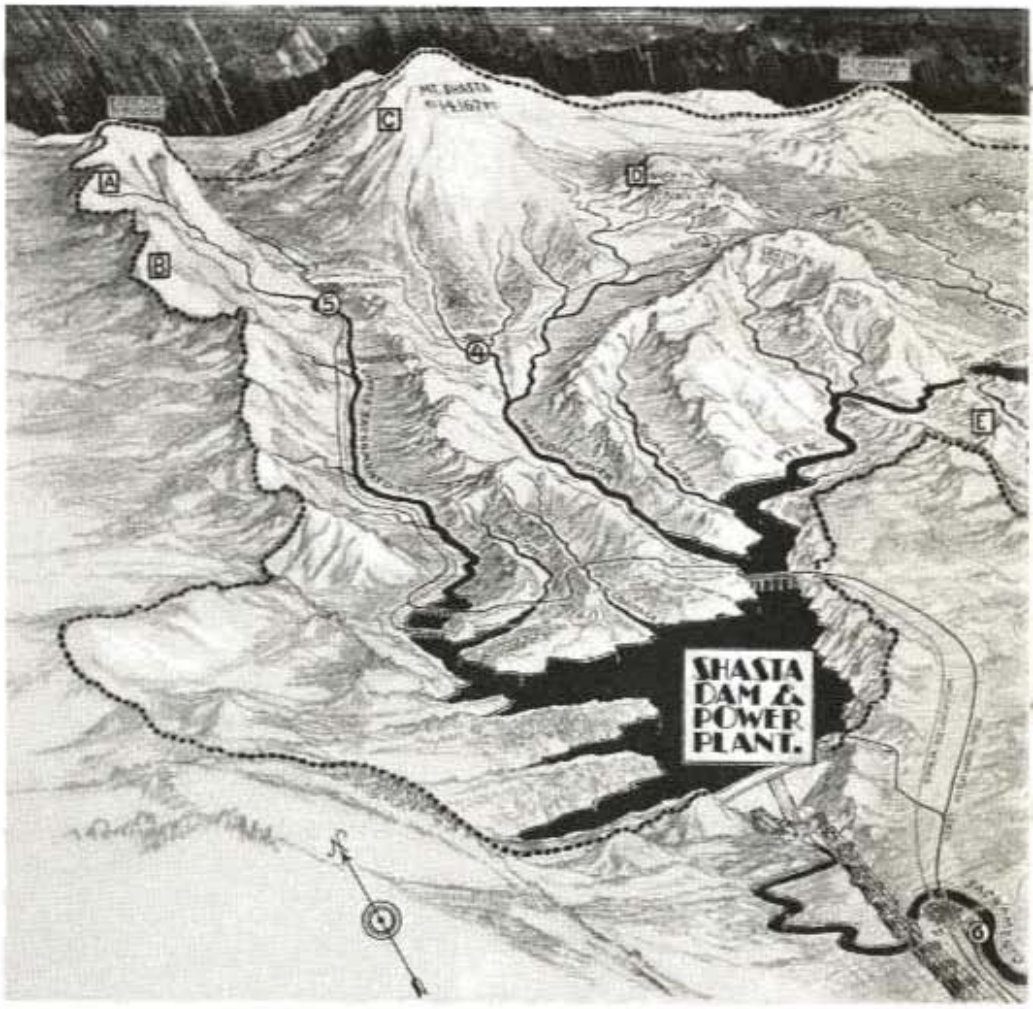
Although only slightly above average in the north and relatively lighter in the American River region, the snow surveys show that the snow pack increases rapidly to the south and is very heavy in all watersheds to the east of the San Joaquin Valley where it averages around 30 per cent above normal.

LIMITED STORAGE AREAS

In the San Joaquin River and all of its eastern tributaries the report predicts very high water stages can be expected during the usual hot spells of late May and early June. High water stages during the period of maximum run-off will be only nominal in the Sacramento River and its tributaries.

On the Kings, Kaweah, Tule, and Kern rivers the unregulated peak flows from melting snows will exceed the irrigation demands of districts supplied from these streams, and the surplus water will find its way into the Tulare Lake bottoms. The limited storage still remaining in the present flooded areas of Tulare Lake is inadequate to accommodate the surplus of run-off indicated by the snow surveys and the report says, "it appears that the inundation of additional areas is inevitable."

The forecast of watershed run-off for Sierra streams during the four months melting period, April 1st to July 31st, ranges from a low of 83 per cent of normal for the American to a high of 180 per cent for the Kern River.



SIERRA WATERSHED

The watershed tributary to Shasta Dam, which will supply the water for Shasta Reservoir, is shown in the above illustration. In this watershed the State conducts cooperative snow surveys on twelve snow courses and six precipitation stations. On data compiled from snow surveys and precipitation record, the State estimates the anticipated stream run-off for the summer season. These estimates will prove highly valuable in the operation of Shasta Reservoir.

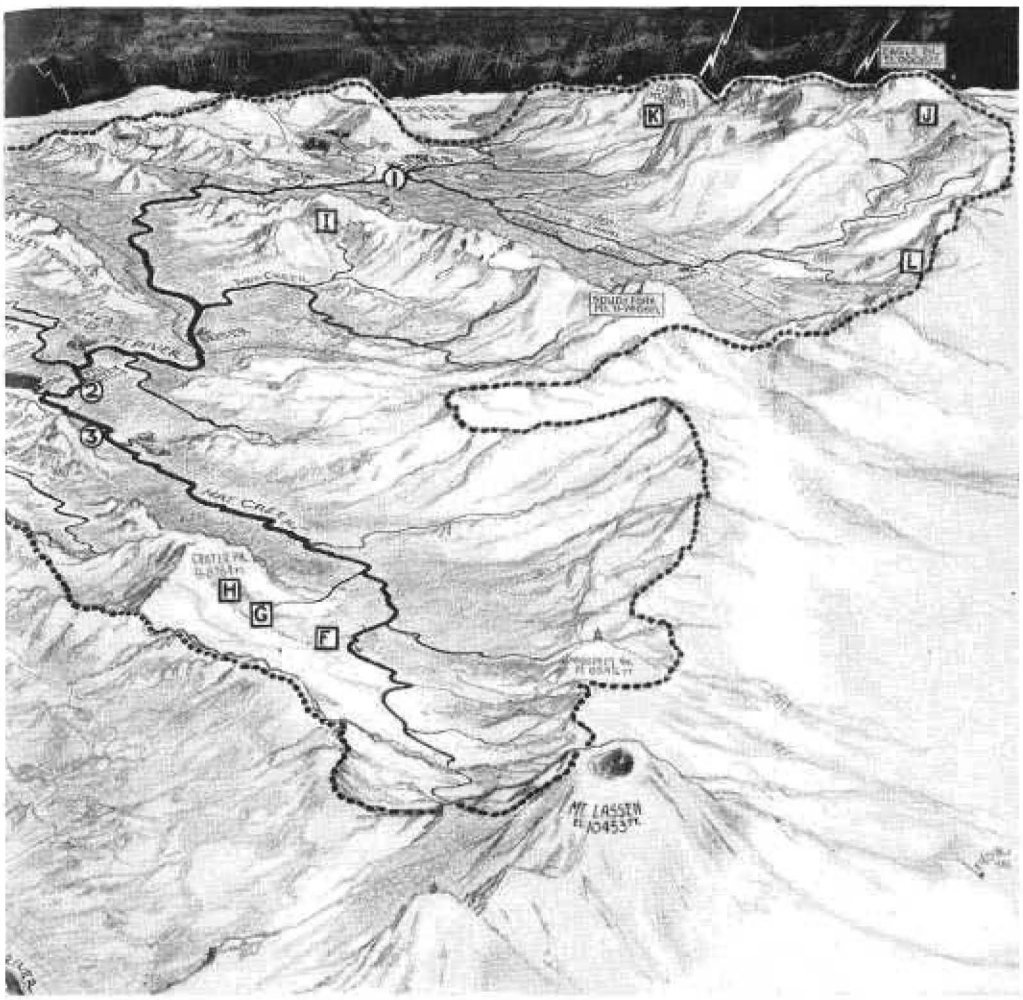
The snow courses are: A, Mt. Eddy; B, Grey Lock Lakes; C, Mt. Shasta; D, Buck Mountain; E, Snow Mountain; F, Big Springs; G, Logan Lake; H, McElroy Pass; I, Adin Mountain; J, Eagle Peak; K, Cedar Pass and L, Blue Lake. Precipitation stations are: 1. Alturas; 2. Fall River Mills; 3. Hat Creek Power House; 4. McCloud; 5. Mt. Shasta City and 6. Kennett (not shown in the illustration).

HIGH RUN-OFF STREAMS

The estimated per cent of normal run-off by streams is as follows: Sacramento River at Kennett, 124 per cent; Feather River near Oroville, 92 per cent; American River at Fair Oaks, 83 per cent; Mokelumne River near Mokelumne Hill, 101 per cent; Stanislaus River below Melones Power House, 107 per cent; Tuolumne River at La Grange, 132 per cent; Merced River at Exchequer, 139 per cent; San Joaquin River at Friant, 130 per cent; Kings River above Piedra, 132 per cent; Kaweah near Three Rivers, 134 per cent; Kern River near Bakersfield, 180 per cent.

The past season's heavy precipitations, the report shows, has had very uneven distribution throughout the State. All stations west of the Sierra

un-off Will Be 20 Per Cent Above Normal



Precipitation South of the Tehachapi is 65% Above Normal

crest report precipitation to date ranging from 10 per cent to 50 per cent greater than normal. South of the Tehachapi the excess precipitation is greater than in the north ranging from 40 per cent to 95 per cent above normal.

SNOW PACK PERCENTAGES

The actual snow pack distribution in per cent of normal for the Sierra as shown by the snow surveys is as follows:

Upper Sacramento, McCloud and Pit rivers, 105 per cent; Feather River, 108 per cent; Truckee, 74 per cent; Tahoe, 75 per cent; American, 77 per cent; Mokelumne, 104 per cent; Stanislaus, 112 per cent; Tuolumne, 113 per cent; Merced, 125 per cent; Upper San Joaquin, 124 per cent; Kings, 128 per cent; Kaweah, 125 per cent; Kern, 171 per cent.

The snow survey made in the watersheds of the Upper Sacramento, McCloud and Pit rivers—the tributary drainage area to Shasta reservoir—show that the high mountains of the Trinity Divide and also of Mt. Shasta to the east have a snow pack range from 7 to 19 feet in depth with an equivalent content of from 39 inches to 109 inches of water.

Snow depths over the high areas of the far-reaching Pit River watershed are not so heavy, but this winter's rains have, to a great extent, filtered into the lava beds in this section and will continue to supply the stream channels all next summer.

With regard to Shasta reservoir, the following assumptions may be made:

Records compiled by the United States Geological Survey of the monthly flow of the Sacramento River at Kennett show that had Shasta Dam been completed last October the run-off up to March 1 would have more than filled the reservoir to its flood control capacity. Shasta reservoir is designed to store 4,500,000 acre-feet of water. Of that capacity 500,000 acre-feet is reserved for flood control.

SHASTA RESERVOIR CAPACITY

Run-off figures compiled by the United States Geological Survey show that from October until March 4th, 4,457,100 acre-feet of water flowed past Shasta Dam site at Kennett. Between March 4th and April 1st, the Division of Water Resources has estimated from gauge height records that the run-off was an additional 780,000 acre-feet.

The snow survey bulletin, however, estimates that the run-off between April 1st and October 1st will amount to 2,500,000 acre-feet. Thus, with the water which has flowed past Shasta Dam site since October 1st, Shasta reservoir could have been filled to capacity more than one and one-half times during the present rainy season.

FUNDS INCREASED

President Roosevelt, on April 2d, submitted to House Appropriation Committee, a recommendation that Central Valley Project appropriation for this year be increased from $25,000,000 to $38,750,000.

The Budget Bureau statement submitted in connection with the recommendation stated the additional funds were needed to enable the Reclamation Bureau to accelerate during 1942 the construction of the project and to speed the availability of power and provide additional power facilities to meet an anticipated power shortage in the northern and central parts of the State.

The additional funds contemplate installation of a steam generating plant near Antioch of 150,000 K.W. capacity, additional transmission facilities and the start of construction on an afterbay dam and power plant at Keswick, together with the start of work on the Friant-Kern canal.

Final Work on Mountain Springs Grade Highway Is Under Way

THE award on March 13, 1941, of the contract for grading, surfacing and bridge construction, to the Denni Investment Corporation, marks the final step toward the completion to modern standards of the famous Mountain Springs Grade.

The latest contract is the third unit of construction to be let in traversing the 7.48 miles of the most rough and difficult mountain range between the Imperial Valley and San Diego. The first unit of construction covered a distance of 2.55 miles, starting at the top of the grade near Boulder Park. This first unit was let to the A. S. Vinnell Company and was accepted by Director of Public Works Frank W. Clark on August 28, 1939.

The second unit was awarded to the Denni Investment Corporation on July 11, 1940, construction of which is now under way and is scheduled for completion in July of this year. This unit is for a distance of 3.64 miles and begins near the old Mountain Springs Station, and extends easterly down the In-ko-pah Gorge.

The last unit most recently awarded, extends easterly from the second, a distance of 1.29 miles to a point near Millers and the foot of the grade.

The old alignment contained 79 curves having a combined curvature of 3,668 degrees. The minimum radius was 126 feet and there were 42 curves having radii of 300 feet or less. The new alignment has only 33 curves with a minimum radius of 600 feet and a combined curvature of only 1,555 degrees. In addition, the maximum grade has been reduced in excess of 1.1 per cent.

Because of the improved sight distance, due to decrease in curvature, and the change in grade, passenger cars are now able to travel the completed section at the top legal rate of speed, in place of the old slow safe speed of approximately 20 miles per hour.

The three contracts when completed will involve the movement of nearly 800,000 cubic yards of rock roadway and channel excavation requiring approximately 500 tons of dynamite. In compacting the embankments and flushing the fines down through the voids in the rocky embankments, approximately 42 million gallons of water will be used.

Thirty-five thousand cubic yards of imported borrow and 1,500 tons of liquid asphalt will be used in the road-mix surface treatment, and in providing for crossings over the main stream bed it will be necessary to construct eight large arch culverts and one 120-foot open spandrel type reinforced concrete bridge. These major structures will require the use of 3,700 cubic yards of concrete and 500,000 pounds of reinforcing steel.

When completed, these projects will represent an investment in the present reconstruction of approximately $963,000 exclusive of engineering costs.

Inasmuch as this route is the main connecting link between the Imperial Valley and San Diego, it has received considerable attention in the past few years. The completion in 1938 of the All-American Canal in the Imperial Valley has doubled the possible irrigable agricultural lands and in so doing has vastly increased the potential traffic over this road.

Modern engineering and construction accomplishments have done much to surmount the Mountain Springs barrier which has ever been an obstacle in railway and highway transportation plans.

Sketch map showing progress of improvement on Mountain Springs Grade Highway

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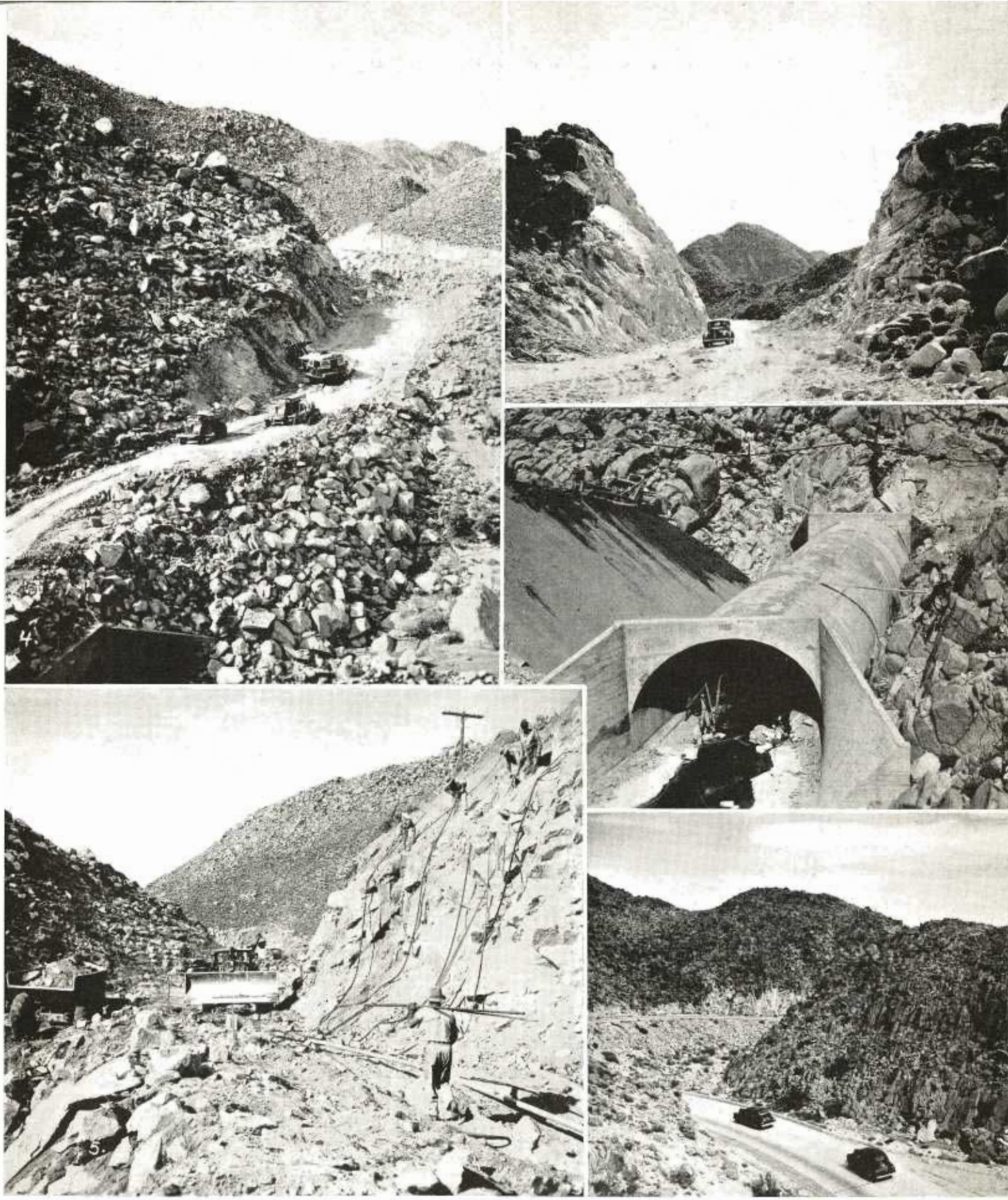
Football Coach (to players): "And remember that football develops individuality, initiative and leadership. Now get in there and do exactly as I tell you."



Highway operations on Mountain Springs grade in San Diego County. 1—Grading completed through cut. 2—Concrete arch culvert 21 feet wide. (Note figure of man.) 3—View of existing road showing extreme curvature. 4-5—Heavy grading and drilling scenes

Governing Selection of Surface Types

(Continued from page 17)

If properly designed and constructed, this type of surface is economical to place and lends itself readily to a variety of construction operations. In skillful hands the finished riding qualities and surface textures are second to no other type.

To summarize briefly the factors which influence the selection of the type of bituminous surfacing, the following items are most frequently given consideration:

1. Thickness of blanket course; 2. Type and quality of subgrade; 3. Availability of satisfactory aggregates; 4. Type of construction, whether new pavement or resurfacing; 5. Volume of traffic; 6. Type of traffic, percentage of trucks, etc.; 7. Type of adjacent pavement; 8. Economic considerations.

The present practice in California is to predicate design standards for alignment and pavement type on the estimated traffic for the year 1965. This estimate is commonly arrived at by doubling the 1938 count except where special local conditions indicate an unusually high or abnormally low expected increase.

NO FIXED RULES

There are no fixed standards or rules which establish mandatory requirements in choosing a definite type of surface for a given volume of traffic. Plant mix surface of a type which has proved satisfactory for traffic up to 5,000 cars per day in the arid regions of the state, has been constructed for $3,000 per mile while $10,000 a mile may be necessary to carry the same volume of traffic in the regions of heavy rainfall and poorer subgrade conditions.

Each problem is treated as a special case. While on the face of it selections may appear inconsistent, it is felt that this procedure is more intelligent and economical than trying to fit conditions to arbitrary rules.

It can be stated that in general:

Road mix surface treatment of local materials may be used for traffic up to 3,000 cars per day.

Road mix surfacing with imported graded aggregate may be used for 1,000 to 5,000 cars.

Plant mix surfacing may be used for traffic of from 1,000 to 12,000 cars.

Asphaltic concrete is commonly used on roads carrying more than 8,000 cars per day.

While the general trend is to use the heavier types of construction for roads carrying the greatest volume of traffic, there is nevertheless much overlapping; indicating that traffic alone is not the sole determining factor. The actual type selected results from a summation of all elements which can be evaluated.

Motor travel from coast to coast in Canada will soon be possible with completion late this year of the last link of an east-west highway. The final gap being closed is between Hearst and Geraldton in the northwest part of Ontario. It is being built through entirely virgin territory at a cost of about $6,000,000, it is stated.

Captain—Why didn't you shave this morning?

Private—I thought I did, sir, but there were twelve of us using the same mirror this morning and I must have shaved some other guy.

March Traffic on State Toll Bridges Shows Big Increase

DURING the month of March the traffic volume on the three State-owned toll bridges reached a high level, especially on week ends. The figures for March, 1941, exceed the records for the same month of 1940 by a wide margin. The daily average for the San Francisco-Oakland Bay Bridge for the month was 48,248 and the highest single day's traffic was 60,116, occurring on Sunday, March twenty-third.

On the Carquinez Bridge a new high schedule was established with an average of 10,055 vehicles per day.

The traffic over the Antioch Bridge showed an increase of more than one-third over the record of March, 1940.

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

	San Francisco-Oakland Bay Bridge	Carquinez Bridge	Antioch Bridge
Passenger autos and auto trailers	1,366,410	283,661	14,106
Motorcycles and Tricars	3,367	658	28
Buses	26,530	4,755	190
Trucks and truck trailers	73,497	22,405	2,727
Others	25,899	223	23
Total Vehicles	1,495,703	311,702	17,074

Rio Vista to Lodi Short-Cut and New Bridge Now Under Way

(Continued from page 10)

miles, and the distance from Stockton will be shortened 12.7 miles. A proposed change in the county road leading from Stockton will cut off another 2.0 miles making a total saving of 14.7 miles from Stockton to Rio Vista.

This road will be the most direct route from the Lodi-Stockton and south San Joaquin Valley to the area north of San Francisco Bay and to the Redwood Highway. It will also tap the rich delta agricultural area in this vicinity which at present has no direct road connection.

Modern 4-Lane Divided Highway

(Continued from page 15)

ment was so established that the northerly row of trees came within the confines of the dividing strip. In addition to their natural beauty, these trees add materially to decreasing headlight glare.

Landscaping was provided by placing top soil in the curbed areas and putting in a heavy planting of rose cuttings.

The work was performed by Matich Bros., Contractor. Mr. E. A. Bannister was the Resident Engineer.

Highway Bids and Awards for the Month of March, 1941

CALAVERAS, STANISLAUS, TUOLUMNE AND AMADOR COUNTIES—Furnishing and applying diesel oil to about 154 miles of roadside vegetation. District X. Various routes. Rotary Oil & Burner Co., Sacramento, $3,432. Contract awarded to Sheldon Oil Co., Suisun, $2,700.

FRESNO COUNTY—Between Selma and Fowler, about 4.7 miles to be graded, asphalt concrete pavement to be constructed and a bridge to be widened. District VI, Route 4, Section A. Few. Union Paving Co., San Francisco, $170,670; Griffith Co., Los Angeles, $175,987. Contract awarded to Pianta & Huntley, San Jose, $153,430.

IMPERIAL COUNTY—Between Mountain Springs and Millers, about 1.3 miles to be graded and bituminous surface treatment applied and a reinforced concrete bridge to be constructed. District XI, Route 12, Section A. Clyde W. Wood, Los Angeles, $299,677; Macco Construction, Clearwater, $325,195; Healey-Moore Co., Fredrickson & Watson Construction Co., Oakland, $366,-113; A. S. Vinnell Co., Alhambra, $406,921; Ralph A. Bell, San Marino, $415,810. Contract awarded to Denni Investment Corp., Wilmington, $294,193.

LOS ANGELES COUNTY—On Artesia Avenue, one mile east of Bellflower, a reinforced concrete bridge across San Gabriel River to be constructed and approaches about 0.4 mile long to be graded and surfaced with plantmixed surfacing. District VII, Route 175, Section B. Carlo Bongiovanni, Hollywood, $79,454; Martin & Schmidt, Contractors, Long Beach, $79,708; J. S. Metzger & Son, Los Angeles, $87,588; Contracting Engineers Co., Los Angeles, $89,957; Mittry Bros. Construction Co., Los Angeles, $94,504; J. E. Haddock, Ltd., Pasadena, $98,654. Contract awarded to Werner & Webb, Los Angeles, $71,812.

LOS ANGELES-ORANGE COUNTIES—At East Fork of Coyote Creek, 1.3 miles west of Buena Park, a reinforced concrete slab bridge to be constructed and about 0.3 mile of approach roadway to be graded and surfaced with plantmixed surfacing. District VII, Route 175, Section C. E. G. Perham, Los Angeles, $18,879; Martin & Schmidt, Long Beach, $18,882; Griffith Co., Los Angeles, $20,285; Roland T. Reynolds, Anaheim, $20,589; J. S. Metzger & Son, Los Angeles, $21,708; Contracting Engineers Co., Los Angeles, $22,966; J. E. Haddock, Ltd., Pasadena, $23,424; Carlo Bongiovanni, Hollywood, $25,777. Contract awarded to Werner & Webb, Los Angeles, $16,831.

LOS ANGELES COUNTY—0.5 mile of grading and paving with asphalt concrete pavement on Foothill Blvd. between Las Lomas Avenue and Irwindale Avenue. District VII, Route 9, Section G. Oswald Bros., Los Angeles, $15,775; Griffith Co., Los Angeles, $16,936. Contract awarded to J. E. Haddock, Ltd., Pasadena, $15,021.

MENDOCINO COUNTY—At Ferguson Gulch and McNamee Creek, about 0.9 mile to be graded, seal coat to be applied, and two reinforced concrete arch culverts to be constructed. District I, Route 56, Section A. J. L. Conner & Sons, Calistoga, $59,949; Lee J. Immel, Berkeley, $65,621; Louis Biasotti & Son, Stockton, $68,976; Kiss Crane Service, Berkeley, $69,600; Poulos & McEwen, Sacramento, $69,610. Contract awarded to Claude C. Wood & L. D. Tonn, Lodi, $58,223.

ORANGE COUNTY—Between Twenty-second Street and Lampson Avenue, about 1.0 mile to be graded and surfaced with plantmixed surface. District VII, Route 171, Sections A, B. Sully-Miller Contracting Co., Long Beach, $27,031; J. E. Haddock, Ltd., Pasadena, $28,293; Oswald Bros., Los Angeles, $31,226. Contract awarded to Griffith Co., Los Angeles, $25,967.

SAN DIEGO COUNTY—A 28-foot portland cement concrete bridge over Horse Ranch Creek, 6 miles west of Pala. District XI, Route 195, Section B. Contracting Engineers Co., Los Angeles, $16,923; B. G. Carroll, San Diego, $16,687. Contract awarded to Thomas Construction Co., Burbank, $11,344.

In Memoriam

Douglas Hunter Greeley

February 21, 1897—April 5, 1941

Douglas Hunter Greeley, Assistant District Maintenance Engineer in District VII, Division of Highways, died at Queen of the Angels Hospital in Los Angeles on April 5, 1941.

He was born in Belvedere, California, February 21, 1897, and began work with the Division of Highways, March 6, 1917. Eight months later he became Instrumentman and at the age of 21 became a Chief of Party, one of the youngest men ever to hold such a responsible position.

When District X was separated from District III, Mr. Greeley was appointed Equipment Superintendent for District III. He served in that capacity until 1931 and then moved to District VII, returning to the engineering field for which he was exceptionally qualified.

Possessed of unbounded energy, honesty, and loyalty, and with a personality that made friends of all whom he met, he received various promotions until at the time of his death he was Assistant District Maintenance Engineer in District VII.

He carried his energy into his hobbies, was interested in aviation, and was an enthusiastic photographer, using his skill to record his work and to entertain his friends.

He is survived by his wife, a son, Douglas, and his mother, Mrs. Rozeltha Hunter Greeley.

His passing leaves a void in District VII that will not soon be filled.

"His life was gentle, and the elements so mix'd in him that Nature might stand up and say to all the world 'This was a man!'"

Pan American Highway is Nearing Completion

One of the most important instruments in the development of international tourist travel and friendship in the Western Hemisphere—the Pan American Highway—is well on the way to completion says a report of the Public Works Administration. Three-fourths of the South American section extending from the Colombia-Panama border to Buenos Aires, Argentina, is now passable during all seasons of the year.

An accompanying map, the first ever issued, shows the condition of the 8,097 mile road as of September, 1940. The paved portion totals 2,015 miles or 25 per cent; all-weather surfaces, 4,147 or 51 per cent; dry weather surfaces, 1,646 miles of 20 per cent; and trails, 289 miles or 4 per cent.

The original route runs from the Atrato River in northwest Colombia to Valparaiso, Chile. From Valparaiso it goes east to Santiago and thence over the Andes by the Uspallata Pass, where stands the world-famous statue, the Christ of the Andes, and thence to Buenos Aires. This route is 5,757 miles long.

The alternate route, some 324 miles shorter, leaves the West Coast road at Vitor, Peru, crosses the Andes by way of Lake Titicaca to La Paz, Bolivia.

SAN JOAQUIN COUNTY—State Office Building to be reconditioned and additional office space and appurtenances to be constructed. District X. Geo. Rock, Stockton, $2,598; O. H. Chain, Stockton, $2,500. Contract awarded to S. C. Giles, Stockton, $2,264.

SAN LUIS OBISPO COUNTY — A bridge across San Juan Creek about 20 miles east of Paso Robles at Shandon to be constructed. District V, Route 33, Section B. E. G. Perham, Los Angeles, $34,851; Earl W. Heple, San Jose, $35,939; Kiss Crane Service, Berkeley, $36,455; A. Soda & Son, Oakland, $39,790. Contract awarded to Dan Caputo, San Jose, $34,170.

SOLANO COUNTY—At points between 2.5 and 3.5 miles south of Davis, 4 reinforced concrete bridges to be constructed. District X, Route 6, Section A. Louis Biassotti & Son, Stockton, $90,974; J. S. Metzger & Son, Los Angeles, $95,497; E. T. Lesure, Oakland, $95,737; Trewhitt-Shields & Fisher, Fresno, $96,302; Campbell Construction Co., Sacramento, $96,418; A. Teichert & Son, Inc., Sacramento, $100,997; Lee J. Immel, Berkeley, $104,237. Contract awarded to A. Soda & Son, Oakland, $90,932.

VENTURA COUNTY—Grade and surface with plantmixed surfacing 0.3 mile of highway about 1.6 miles west of Saticoy. District VII, Route 9, Section A. J. E. Haddock, Ltd., Pasadena, $15,174; Contract awarded to Griffith Co., Los Angeles, $15,120.

Extending Arroyo Seco Parkway Into Los Angeles

(Continued from page 8)

Earth cuts 100 feet or more in height are involved on this project. The balancing of cuts and fills was not possible because of the topographical and geological grade controls to be met.

Incidental to the highway work is the reconstruction and enlargement of the Elysian Reservoir operated by the Los Angeles City Department of Water and Power. The highway in this area will be on the downstream toe side of the dam and will be part of the earth dam structure. This work with lining and appurtenances will cost about $217,000 of WPA and city funds.

The project will provide a comprehensive plan of landscaping to be cooperatively financed by the City of Los Angeles Park Department, the WPA and the State. This will result in the complete development of the park lands adjacent to and visible from the freeway.

Approximate estimates of construction costs of various units showing the construction agency follow:

L. A. River, Substructure	$270,000	WPA, State, City
L. A. River Superstructure	400,000	Contract—Federal Aid, State
Castelar St. Separation	65,000	Contract—Federal Aid, State
Amador Street, Separation	25,000	Contract—Federal Aid, State
Bishop Road Separation	60,000	Contract—Federal Aid, State
Park Row Separation	30,000	Contract—Federal Aid, State
Solano Street Separation Substructure	25,000	WPA
Solano Street Separation Superstructure	30,000	Contract—Federal Aid, State
Grading, paving and landscaping	1,315,000	WPA
Elysian Reservoir Enlargement	217,000	WPA
	$2,437,000	

The substructure of the Los Angeles River bridge is being constructed by WPA at an estimated cost of $270,000. Work on the smaller piers is now in progress. As soon as flood danger is over work will start on the two large river piers. The removal of existing heavily reinforced concrete channel walls to permit the construction of the foundations of the river piers will be a difficult operation. Although these piers will not be ready for placing the deck until about November, 1941, other piers will be ready for the superstructure about July, 1941.

This bridge should be finished about the summer of 1942 which should coincide with the completion of the roadway grading, paving and landscaping. In other words the Extension may be opened to traffic in the summer of 1942.

If a Bridge Could Speak

Mr. W. A. Macdonald, publicity representative of the Government Travel Bureau of British Columbia, attended the dedications of the Eel River and Smith River State highway bridges. Impressed by the grandeur of the redwoods in Humboldt and Del Norte counties and the new spans of modern structural design he wrote the following for California Highways and Public Works:

I am a bridge.

I am made of steel and concrete.

Because I am a new bridge I am made of the finest materials and the utmost design that marks modern engineering achievement.

I am built for beauty that the greater beauties of nature may be more fully enjoyed.

I am built for safety in order that your enjoyment may not be marred through any fault of mine.

I permit easier access between communities and thus promote the spirit of neighborliness.

I am a bridge—a new bridge—a fine bridge.

I am a symbol.

My structure and design are symbols of American progress.

I am a symbol of man's appreciation of beautiful things, both in the things of his own creation and in God's handiwork in Nature.

I am a symbol of man's awareness of the dangers that beset his brothers—a symbol of man's efforts to lessen those dangers.

When men meet in the center of my span, far above the rushing torrent, and when they clasp hands in friendship and understanding, they may know that the great human heart of true Americans can always rise above and conquer threatening force, for I am a symbol of the greater power of a people united for the common good.

The giant redwood trees whisper in their spiring antiquity. They look down from their ages of possession upon our brief stewardship of this great land. They look down upon me—a new bridge—and upon you, the guardians of this great land. They see in me, not just a structure of steel and concrete, but a symbol of things which will endure, even as they have endured. And may it be said that they see in you those qualities of loyalty, integrity, and unity that will overcome all obstacles in assuring the great destiny of the land that bore them.

I am a bridge.
I am a symbol.

Highway Crews Win High Praise for Storm Work

"TOO much praise can not be given the members of the State Highway Division's maintenance crews—at least in this part of the State, and they probably are representative of the entire force—for their splendid fight against the elements in the recent period of flood," says the Santa Maria Times.

"No matter how hard the rain was falling, travelers found the highway crews at work, day and night. Bulldog machines were pushing huge piles of mud, sand or gravel off the pavements at dangerous points, trucks were hauling the stuff away, where it could not otherwise be disposed of temporarily; flagmen, in slickers and storm hats were directing traffic and warning of danger, signs and flares were rushed out to points where caution in driving was necessary, and work seemed to go on 24 hours out of every 24, smoothly, carefully, efficiently.

"As a result of this, under great odds, Highway 101 was kept open between Santa Maria and Santa Barbara; the same road north of the city was often freed of sand, gravel and slime, and the roadbed was guarded at the Santa Maria bridge against a mounting floodtide in the river, and difficult Cuyama highway was kept open except for a brief period when a bridge approach was washed out.

QUICK WORK RESTORED THIS BRIDGE

"Over the Bakersfield-Fresno road near Cholame, a similar battle was in progress. The highway was under water and mud in many places, but crews kept the mud back so that cars could get through and kept traffic moving through a mountain area until the swirling waters finally cut out the supports and dropped two spans of a concrete structure into the streambed.

"While it was a huge job to install a redwood flume of sufficient size to carry that flood of water and then cover it with earth and gravel, it was not a week, until the by-pass had been finished in pouring rain."

State of California

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Department of Public Works

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

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FRANK B. DURKEE, Attorney
C. R. MONTGOMERY, Attorney
ROBERT E. REED, Attorney

printed in CALIFORNIA STATE PRINTING OFFICE
SACRAMENTO, 1941 GEORGE H. MOORE, STATE PRINTER
98389 4-41 23,100

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