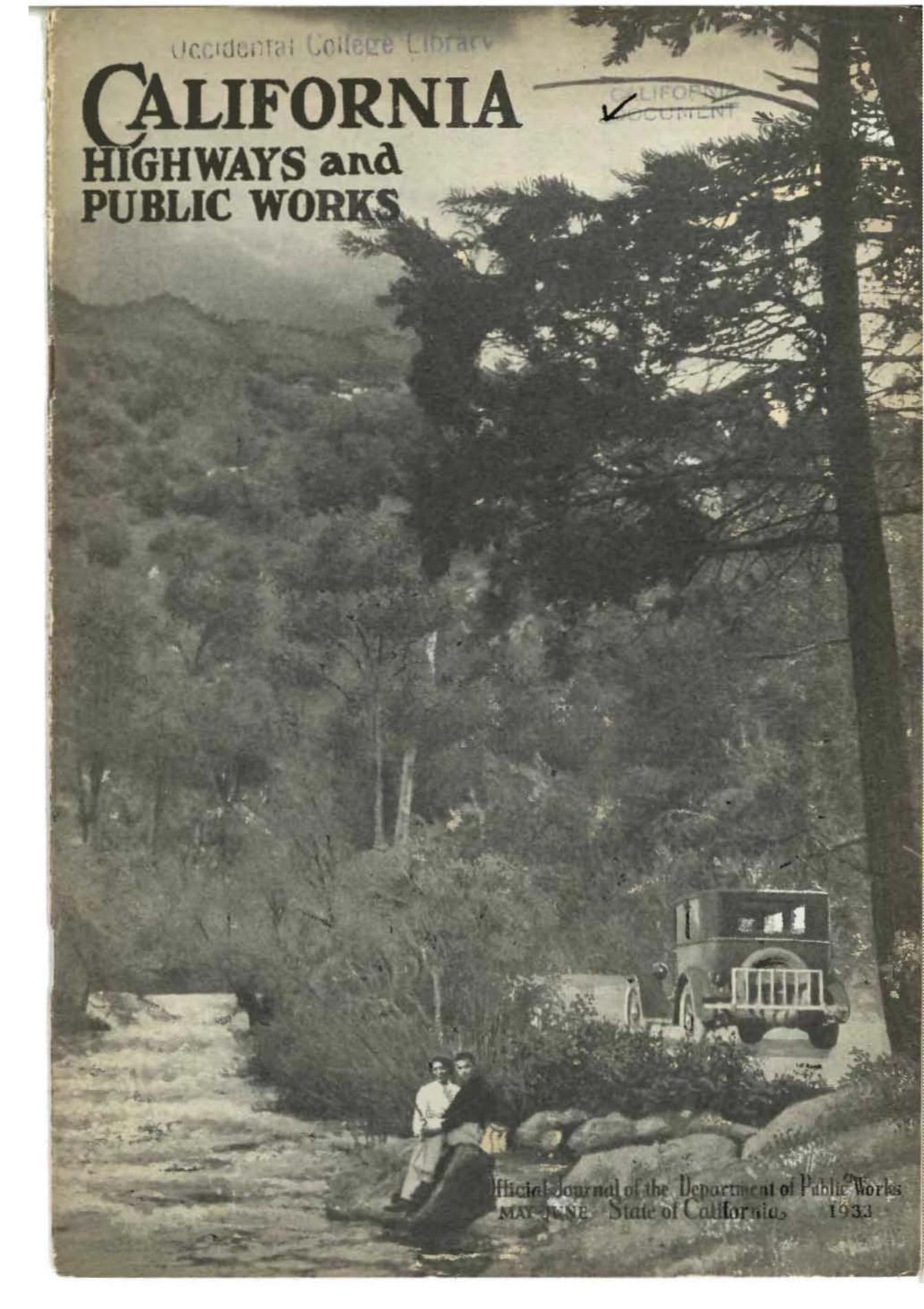


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Official Journal of the Department of Public Works
MAY-JUNE State of California 1933

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\$61,400,000 Sale of Bay Bridge Bonds State's Biggest Deal in 1933

Record Purchase by Reconstruction Finance Corporation
Makes \$2,000,000 as Cash Installment
Immediately Available for Work

By EARL LEE KELLY, Director of Public Works

THE culmination of years of thought and work on the problem of financing a bridge over San Francisco Bay came quietly and unostentatiously in Sacramento on Friday, April 27, 1933, in the office of the Director of Public Works, upon the receipt of a telegram addressed to Governor James Rolph, Jr., and signed by H. A. Mulligan, treasurer of the Reconstruction Finance Corporation, offering to purchase at par value \$61,400,000 worth of five per cent bonds against the revenues of the San Francisco-Oakland Bay Bridge.

This was easily the biggest deal put over in the United States that day. It was larger even than the day's receipts on the New York Stock Exchange. It was a real cash deal, as far as the Reconstruction Finance Corporation was concerned, because even more actual cash than we need is available and is now being transferred to California banks to provide work for men and business for merchants.

Immediately upon receiving this bid, Governor James Rolph, Jr., assembled the members of the California Toll Bridge Authority and, there being no other bidders, the bid of the Reconstruction Finance Corporation was accepted.

I then notified Chief Engineer C. H. Purell that we had sold the bonds to the Reconstruction Finance Corporation, and he proceeded to requisition the first money needed to start the big double-decked bridge—easily the greatest bridge in the world—which will connect San Francisco and Oakland.

On the following day, April 28, at a meeting of the low bidders in my office I awarded construction contracts aggregating \$36,000,000 to the five successful competitors represented by Edward J. Schneider, Columbia Steel Corporation (two contracts); C. C. Horton, Healy-Tibbitts Construction Company; Henry J. Kaiser, Bridge Builders, Inc.; Albert Huber, Clinton Construction Company and Allan McDonald, Transbay Construction Company.

Present at the meeting to witness the informal ceremony of awarding the bids were Henry J. Brunner, consulting engineer of the bridge;

Charles E. Andrew, assistant chief engineer; Harrison S. Robinson president of the Financial Advisory Committee; George McCoy, principal assistant engineer, Division of Highways and C. C. Carleton, Chief of the Division of Contracts and Rights of Way.

Those of us so close to this great picture can not realize its magnitude. Even though

THREE EPOCHAL EVENTS

April 27—Meeting of California Toll Bridge Authority called by Governor Rolph accepts bid of Reconstruction Finance Corporation for San Francisco-Oakland Bay Bridge bonds in sum of \$61,400,000.

April 28—Director Earl Lee Kelly awards six construction contracts totaling \$36,000,000.

May 9—Toll Bridge Authority requisitions cash installments aggregating \$6,000,000.

State Cooperative Highway Funds Shared by 33 Cities During Biennium

DEVELOPMENT of present-day standards on modern interlacing highway systems has been a matter of rapid growth within the last twenty years. The standards of width, alignment, grade and surface type which now obtain on great mileages of State highways in California are evidence of the rapidity of this growth.

During the early days of State highway activity the need of bringing to adequate standards long stretches of highway which connect the many metropolitan and urban communities left the responsibility of improvement of routings through incorporated cities to the communities. But with the increase of improved mileage on State highways and as longer stretches of continuous pavement were constructed, the short sections of unpaved or deteriorated pavement through communities which were financially unable to improve their streets brought the subject of State cooperation with cities and counties forcibly to public attention.

IMPORTANT TO SYSTEM

There are over two hundred cities connected by the California State highway system and in many instances city streets within their limits are important links in the State road system. The condition of such streets is a vital factor to the highway network. The aggregate length of these links within municipalities is 457 miles, or about 6 per cent of the total mileage of State highways.

As the chief function of the State system is to provide adequate and ample intrastate traffic facilities and as a considerable portion of traffic using State routes through municipalities is not of a local nature, the State recognizes its responsibility for a share in the improvement of these links within cities. The municipalities are responsible for the share of improvement chargeable to local traffic.

In 1925, legislation provided for expenditures of State highway funds within the limits of towns of less than 2500 population and by authority of chapter 807, Statutes of 1931, the authority of the California Highway Commission was broadened and the State was given a definite responsibility in the construction of

State highway routings through municipalities regardless of size.

This 1931 legislation provided certain procedure as a guide for the basis of cooperation between the State and the municipality.

FUNDS SET UP

Upon the authority of chapter 807, the State set up funds for the current biennium amounting to \$2,406,000 to be used for cooperative construction. Many proposals for such work from local authorities were considered and to date, construction has been completed, or is now under way, on projects covering improvement to the streets of twenty-three separate communities. These projects have included work on 35.3 miles of streets and the construction of nine bridges. For these improvements, the State has contributed the sum of \$1,941,352.42. Other proposed cooperative projects, whose total is in excess of the funds remaining, are now pending.

The basis of cooperation is an individual problem for each project and the equitable distribution of costs is determined by conferences of Division of Highway engineers with the local authorities of the petitioning community. However, with full realization of the dual responsibility of State and municipality and on the authority of the 1931 legislation, the Highway Commission has evolved a policy of cooperation which includes as its basis the following general rules:

GENERAL RULES ADOPTED

1. The inception of the improvement and request for participation by the State must be instituted by the municipality.
2. The routing and design of the proposed improvement must be mutually satisfactory to the municipality and the State.
3. The city must provide, unencumbered, all of the right of way; provide for the construction, removal, alteration and adaption of existing and future utilities under municipal jurisdiction, such as water and sewer lines, pole lines, etc., within the right of way; construct curbs and sidewalks and additional desired width of pavement or surfacing not improved by the State.

(Continued on page 17)



SEVENTY-SIX FEET WIDE, the new concrete pavement of the Stockton-Sacramento arterial through the city of Lodi renders traffic congestion practically impossible on this busy highway. The State paid for 40 feet of this cooperative project.



STATE CONTRIBUTED \$15,000 for construction of this 56-foot concrete pavement approximately a mile long through Oakdale on the Sonora Pass lateral in cooperation with the city.

IN GLENDORA

the Foothill Boulevard was graded 60 feet wide and surfaced with 40-foot concrete pavement for 1.5 miles, in cooperation with Los Angeles County by which the State paid approximately \$50,000.



Fulfillment of Bridge Dream at Hand

(Continued from page 1)

we will not require the entire \$61,400,000 for the bridge proper (the cost having been reduced by low bidding to approximately \$55,000,000) this money, distributed into the hands of labor and thence to the material dealers, and thence again into labor and retail trade, will make a ripple that each Californian will feel during the ensuing three years. In addition, \$10,000,000 will be invested in interurban installations on the bridge, and \$6,600,000 in the construction of the approaches.

REMOTE BEGINNINGS

I am informed that as early as 1850 a San Francisco City Council discussed the need of a bridge across San Francisco Bay, and the realization of that bridge seemed just as far away in 1925 (75 years later) as it was when the San Francisco city fathers first discussed this, then impossible, project.

It is interesting to note the steps toward this great achievement.

More than three years ago Governor Rolph, then the Mayor of San Francisco, signed an appropriation providing \$40,000 with which to make surveys and borings to find where the bay floor was best suited to support a bridge.

If we are to select the point at which the bridge reached a concrete stage it would be on Friday, May 13, 1932, when Governor James Rolph, Jr., appointed the Governor's Financial Advisory Committee to the San Francisco-Oakland Bay Bridge, and which consists of:

GOVERNOR'S ADVISORY COMMITTEE

Harrison S. Robinson of Oakland, President	
Leland W. Cutler of San Francisco, Vice President	
C. H. Purcell of Sacramento, Secretary	
Geo. T. Cameron, San Francisco	R. H. Glassley, Oakland
Joseph Carlston, Oakland	E. C. Holmes, Berkeley
C. O. Conrad, Oakland	Jos. R. Knowland, Oakland
W. W. Crocker, San Francisco	F. C. MacDonald, San Francisco
E. B. DeGolia, San Francisco	P. H. McCarthy, San Francisco
R. M. Fitzgerald, Oakland	J. H. Quinn, Oakland
Herbert Fleishhacker, San Francisco	J. P. Symes, San Francisco
A. P. Giannini, San Francisco	Geo. Tourny, San Francisco

As early as 1921 the San Francisco Motor Car Dealers, under the leadership of Billy Hughson, spent \$12,000 for preliminary borings by Ralph Modjeski and John Vipond Davies, which proved that there was rock beneath the surface of the bay at a reasonable distance.

Governor Rolph realized that despite all of the promotion and despite all of the engineering information obtained there could be no progress toward ultimate success until the most capable and experienced business men of San Francisco and Oakland were called in to work out the greatest problem in the construction of a bridge—that of financing the project.

With all the work done on the bridge prior to the appointment of this committee by the Governor, it still would have been merely a dream, though it were a dream based upon exact engineering calculations and surveys. True, the routes across the bay had been studied, costs had been estimated, but we lacked the \$71,000,000 needed, and had no more productive ideas for getting it than they had in 1850 when the Forty-niners idly discussed a bridge across San Francisco Bay.

ONE HUNDRED PER CENT AMERICAN

Now our major contracts have been awarded and executed. I gathered the contractors in my office, with President Harrison S. Robinson of the Governor's Financial Advisory Committee at my side, and told these contractors that we must have American materials, an American union standard of wages, citizens of the United States and voters and residents of California employed in the construction of this bridge.

The contracts were awarded to the lowest bidders, and no favoritism or political influences have been permitted by this department nor by the Governor to creep into this great bridge. Every person at work on this bridge and every firm receiving business therefrom has been selected for merit and by competition.

Work is soon to begin on this structure. Ground will be broken July 9th on Yerba Buena Island, according to our present calculations. The construction will require three and one-half years. An average of six thousand five hundred men will be employed for



THIRTY-SIX MILLION DOLLARS worth of construction business was given to five San Francisco contractors by State Director of Public Works, Earl Lee Kelly, when he handed to the low bidders the contract awards for building the major units of the San Francisco-Oakland Bay Bridge.

Left to right, front row, Henry J. Brunner, Consulting Engineer, C. E. Andrew, Assistant to the Chief Engineer of the San Francisco-Oakland Bay Bridge, State Director of Public Works Earl Lee Kelly, Harrison S. Robinson, President of the Financial Advisory Committee of the bridge, George T. McCoy, Principal Assistant Engineer, Division of Highways.

Left to right, rear row, Edward J. Schneider, Columbia Steel Corporation, awarded two contracts, C. C. Horton, Healy-Tibbitts Construction Company, Henry J. Kaiser, Bridge Builders, Inc., Albert Huber, Clinton Construction Company, Allan McDonald, Transbay Construction Company, and C. C. Carleton, Chief of the Division of Contracts and Rights of Way.

that period. We estimate four hundred men will be given employment directly on the bridge during the first month of construction and that twelve thousand men will be at work on the bridge eighteen months later. Material dealers will give another five thousand men work manufacturing the products which will go into the bridge.

BUSINESS STIMULATED

So far-reaching is the effect upon business resulting from the construction of the San Francisco-Oakland Bay Bridge that no one person can calculate it. I have just learned that a Sacramento iron works has received a subcontract to build the miles of steel ladders required in the construction of the bridge. Most of the barges and floating equipment on San Francisco Bay will be called into use during construction, our office is informed by R. E. Fisher of the Bay Industries Committee. Already orders are being placed with the steel mills of Pittsburg and Torrence by the Columbia Steel Company and the Moore Shipbuilding Company for tons of steel.

The steel to be utilized in this bridge will constitute 6.7 per cent of the steel output of

the United States this year. The larger shapes—some of them five feet square, for the Cantilever section of the bridge—are already being forged in the eastern steel works.

Our ground-breaking exercises will be simple as we need not rely upon any pomp or ceremony to magnify the greatness of this world's largest bridge.

Not the least glorious fact about this unparalleled project is that no part of its financing comes out of the tax payers' pockets. It is financed solely out of its own revenue and the liens against its revenue only, so that the State of California and the taxpayers thereof can never be called upon to pay one cent of the cost of this world's greatest bridge. That fact, in times of taxpayers' distress, makes the San Francisco-Oakland Bay Bridge project a boon to California of so great a value that it can not be compared to anything in the history of this State.

Probably there never was a public project launched by any State under such propitious circumstances; with such exact engineering;

(Continued on page 21)

President Expected to Assist in Bay Bridge Ceremony

Midway between San Francisco and Oakland on verdant Yerba Buena Island, ground will be broken by spade, steam shovel, and dynamite on Sunday, July 9th, under the direction of Governor James Rolph, Jr., commemorating the start of construction of the San Francisco-Oakland Bay Bridge.

Director of Public Works Earl Lee Kelly has placed details of the ceremonies in the hands of the Alameda and San Francisco County Junior Chambers of Commerce. On the recommendation of the Junior Chambers, Governor Rolph was made honorary chairman, and the following vice chairmen were named:

Leland W. Cutler
Harrison S. Robinson
Jos. R. Knowland
H. Fleishacker
J. Emmet Hayden
Earl Lee Kelly
George T. Cameron
A. B. C. Dohrmann
Robert G. Sproul
Arnold Mount
A. F. Hockenbeamer
C. H. Purcell
Clarence A. Lindner
Rear Admiral George W. Laws
Mayor Angelo J. Rossi, San Francisco
Dr. John L. Gresham, Oakland
Mayor E. N. Ament, Berkeley
Mayor Wm. F. Murray, Alameda
Senator Hiram W. Johnson
Senator Wm. G. McAdoo
Congressman Ralph Eltse
Congressman Albert E. Carter
Congressman Richard J. Welch
Congresswoman Florence Prag Kahn
William P. Carrington, Publisher Post-Enquirer.
W. N. Burkhardt, Editor San Francisco News
Robert P. Holiday, Publisher Call-Bulletin

PRESIDENT TO TALK

The program is expected to be started from Washington, D. C., when President Roosevelt or his representative touches a Postal Telegraph Company key in the White House which will set off three blasts—one in Oakland, one in San Francisco, and one on Yerba Buena Island, at the ends and in the middle of this world's largest bridge. Simple ceremonies have been planned but these significant actions and words will be broadcast by the National Broadcasting Company throughout the United States.

The only invited guests of honor are President Roosevelt and former President Herbert C. Hoover.

PLANS FOR BAY BRIDGE GROUND BREAKING

Place—Yerba Buena Island.

Date—Sunday, July 9th.

Speakers—

President Franklin D. Roosevelt.

Governor James Rolph, Jr.

President Roosevelt is expected to talk over the radio from Washington and press a button that will fire three blasts signalling beginning of construction.

Governor Rolph will turn the first spadeful of earth and act as chairman of the ceremonial exercises on Yerba Buena Island.

A salute of 21 guns will follow the President's greetings and a salute of 19 guns will follow Governor Rolph's address.

Governor Rolph, according to the preliminary plans, will make the principal speech of the program and his speech will be concluded by the new gubernatorial salute of 19 guns established by President Roosevelt at the Governor's request.

Should President Roosevelt speak over the radio to the assembled crowds on Yerba Buena Island it is planned to follow his speech with the Presidential salute of 21 guns, providing a search of official regulations indicates that rules will not be violated by firing a salute to a President present only in voice.

These and other major problems are being worked out by Director Kelly in conjunction with the Junior Chambers of the two bridge cities.

SHADE TREE PLANTING

With the idea of developing an ideal program of shade-tree planting along Coast Boulevard here, and arousing interest of neighboring communities in a similar plan, the Laguna Garden Club has adopted recommendations of the organization's shade-tree committee. Two proposed ordinances, one covering the planting and caring for shade trees, the other asking for a park and shade-tree commission, drawn up by Attorney Leslie F. Kimmell, will be presented to the city council. The program was accepted following a conference between Dr. W. L. Bigham of the Orange County Planning Commission and O. L. Halsell, also of the commission, and the Santa Ana Board of Forestry, and members of the shade-tree committee.—*Los Angeles Times*.

"Doctor, can't something be done about my husband talking in his sleep? It's all so indistinct!"—*Life*.

State of California

James Kolph, Jr. Governor

Resolution of the California Toll Bridge Authority

Whereas the Financial Advisory Committee to the San Francisco-Oakland Bay Bridge Division of the State Department of Public Works, appointed by me on the twentieth day of April - 1932 has successfully negotiated the financing of the bridge across San Francisco Bay through the Reconstruction Finance Corporation; and

Whereas an unusual and difficult portion of these successful negotiations was conducted through the persons of the Executive Committee of this Financial Advisory Committee, to-wit,

- Harrison S. Robinson... Herbert Fleishhacker.
- George C. Cameron... Amadeo P. Giannini...
- Teland W. Culler... R. M. Fitzgerald.
- Joseph R. Knowland... E. Clarence Holmes..
- and.

Whereas in so negotiating the financing of this history-making project they have rendered to the State of California

Distinguished Service

Wherefore, **Be It Resolved**, that the State of California, through its duly appointed and authorized

California Toll Bridge Authority hereby publicly commends and acknowledges its... gratitude to the members of the Financial Advisory Committee of the San Francisco-Oakland Bay... Bridge Division of the Department of Public Works, and especially to the Executive Committee thereof.

California Toll Bridge Authority

James Kolph, Jr.
Chairman.



Attest:
Earl Lee Kelly
Secretary
California Toll Bridge Authority

Attest:
Frank B. Johnson
Secretary of State



FOR DISTINGUISHED SERVICE to the State this engrossed testimonial was presented to members of the Financial Advisory Committee by the California Toll Bridge Authority.

City, County, U. S. and State Building San Gabriel Canyon Scenic Highway

By R. C. MYERS, Assistant Engineer, District VII

A SECTION of what is destined to become one of the most scenic mountain drives in Southern California is now under construction in San Gabriel Canyon from a point about three miles north of Azusa, near the mouth of the canyon to the junction of the west and north forks of the river, nine and one-fourth miles farther up the canyon. Although the construction is being done under a United States Bureau of Public Roads contract with C. S. Bruning, as resident engineer, the costs are being participated in by the State, the Los Angeles County Flood Control District and the city of Pasadena, as well as the U. S. Government.

The present project is part of a general plan for a sixty-five mile drive, known as the Angeles Crest Highway, leaving Foothill Boulevard at La Canada and extending up the Arroyo Seco to the divide between the Arroyo Seco and Big Tujunga watersheds, continuing northeasterly through the high mountains and passing through the City of Pasadena playground, Chilao and Buckhorn Flats, to connect with the proposed San Gabriel Canyon highway at the Los Angeles County Park at Crystal Lake; thence down this proposed route to again connect with Foothill Boulevard at Azusa.

THREE SECTIONS COMPLETED

The only portions of this highway which are built to requisite modern standards are the section eleven and three-fourths miles long from La Canada to Colby Canyon in the Arroyo Seco drainage, the section about twelve miles long in San Gabriel Canyon district from Azusa to the junction of the north and west forks of San Gabriel Canyon which is now being completed and a section of the highway extending up the north fork of the San Gabriel Canyon from the west fork to Coldbrook Camp, about five miles, which has been constructed by the Los Angeles County Road Department.

A narrow road with sharper curves and steeper grades has been constructed by the county and the United States Forest Service from Mount Wilson via Red Box, Barley Flat, and Chilao Flat to Buckhorn Flat a distance of about twenty-six miles.

The completion of this entire project will eventually open up and render accessible for recreational purposes the vast watersheds of the Arroyo Seco, San Gabriel and Big Tujunga, by far the largest mountain area which could be used for this purpose within easy driving distance of the metropolitan district of which Los Angeles is the center. All of this area lies within the Angeles National Forest.

BUILDING TWO DAMS

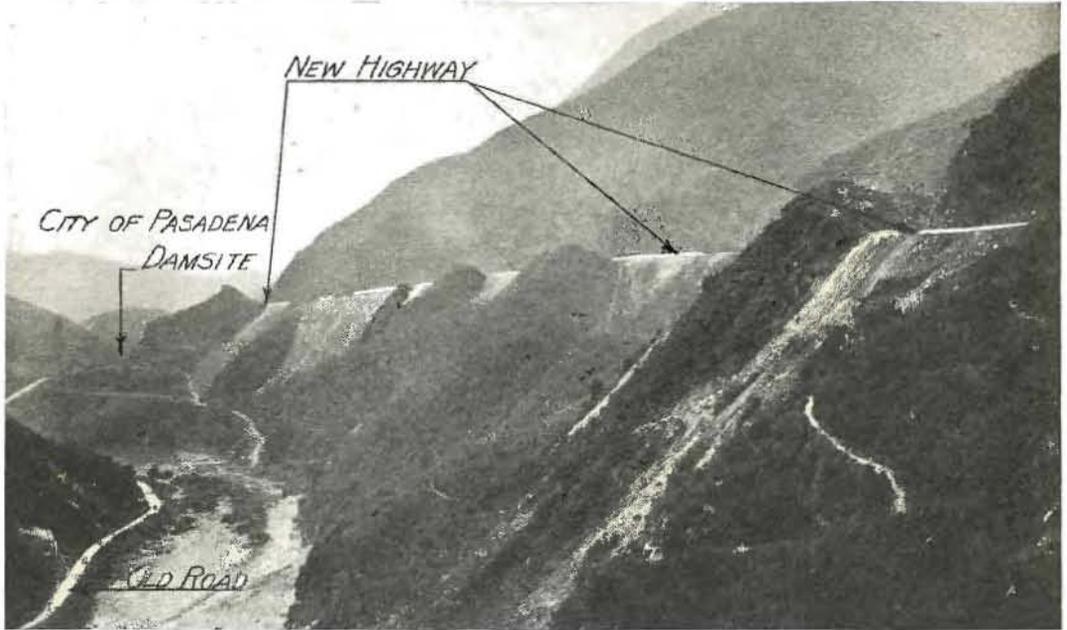
Construction of the nine and one-quarter mile section of the proposed route in San Gabriel Canyon is made necessary at this time by the construction of two dams in the canyon, one by the city of Pasadena and the other by the Los Angeles Flood Control District which will inundate the old canyon road, near the bottom of the canyon. By building these two dams with the consequent reservoirs and inundating the old road, the city of Pasadena and the Los Angeles Flood Control District were obligated to replace the old road with another road of equal standards above the high water line of their reservoirs.

As the State and the U. S. Government were both interested in constructing a highway up this canyon, the time seemed auspicious for a cooperative project among all the interested parties, viz: the U. S. Government, the State, the Los Angeles County Flood Control District and the City of Pasadena, to the end that a highway could be built on modern standards of alignment and grade above the high water of the two reservoirs as far up as the junction of the north and west forks of the river.

Under this plan of cooperation, the Los Angeles County Flood Control District and the city of Pasadena would contribute amounts equal to the cost of constructing a road of standards similar to those of the old canyon road. The U. S. Government and the State would add to this sum an amount necessary to construct the highway on modern standards of alignment and grade.

SHARING THE COSTS

Negotiations resulted in an agreement whereby the city of Pasadena and the Los Angeles County Flood Control District were



TAKING TO THE HILLS to avoid dams and lakes that will occupy the bottom of San Gabriel Canyon engineering forces are completing construction of new highline highway along steep mountain slopes of Angeles National Forest in cooperation with city, county and U. S. Government departments.



Map showing Angeles Crest Highway loop through national forest and San Gabriel Canyon.

each to contribute 40 per cent of the cost of the first seven miles. The U. S. Government and the State were each to pay ten per cent of the cost of this section. For the remaining two and one-fourth mile section to the river forks, the Los Angeles County Flood Control District was to pay 80 per

cent and the U. S. Government 20 per cent of the cost.

Preliminary surveys were started November, 1930, by field parties of the city of Pasadena and later continued by the Los Angeles County Flood Control District and the United States Bureau of Public Roads. Engineers

(Continued on page 18)

Pavement Records and Construction Progress Made During 1931 and 1932

By EARL WITHYCOMBE, Assistant Construction Engineer

THE years 1931-32 were a period marked by economy and efficiency in the construction of high-type pavements, greater speed of production, and better riding qualities of the finished product. This was due to improved methods and technique of the engineers of the Division of Highways, modern equipment used by the contractors, and effective cooperation between engineers and contractors.

In this article will be described the records made in pavement production, strength of concrete, stability and density and asphalt mixtures, surface smoothness, and improvements in the design and construction of the various types of pavements.

Two experimental portland cement concrete pavements were constructed during 1931 and 1932. In 1931, one 0.6 mile project, located between Serra Point and South San Francisco, in San Mateo County, was so planned that a study could be made of the action of high early strength, low temperature, and standard cements.

RESEARCH PROJECTS

Two sections of 40' x 11-9-11" pavement were built, one 1,016' and the other 1,184' in length, divided into 17 separate subsections, and using six different brands and 17 different kinds of cement. An earth cushion varying from 2" to 18" thick was placed over the old macadam pavement, and watered, rolled and shaped. No reinforcing steel was placed, and no transverse joints other than a 2" expansion joint in each main section. Strain meters and temperature coils were placed in each section, this work being done under the direction of the Testing and Research Laboratory.

The second project was in Placer County, Newcastle to Wise Power House, and involved the use of wire mesh reinforcing in place of the standard $\frac{1}{2}$ " marginal bars. 2.3 miles of 20' and 0.4 mile 30' width, 9-7-9" thick was constructed with wire mesh reinforcing and expansion joints 40' apart, but with no dummy joints.

On this particular project, the cost of placing wire mesh was less than for placing marginal bars, but this was offset by the added

cost of mixer delays, traffic interference, etc., due to placing mesh. A second wire mesh project is now being constructed in Santa Clara County near Sunnyvale, which will be subject to much heavier traffic conditions than the Newcastle pavement.

Portland Cement Concrete Records

During 1931, the maximum average daily yardage of concrete, using one mixer, was placed on Contract 43CN3, in Colusa County between Williams and Maxwell, where the Union Paving Company, placed 467.3 cubic yards per 8-hour day; two machine finishers were used. E. J. Peterson was resident engineer, with A. C. Briney, assistant on the street. The maximum output for two mixers was on Contract 24TC7, in San Mateo County between Burlingame and San Mateo, where Basich Bros. placed an average of 853.4 cubic yards per day. W. A. Rise was resident engineer, with E. Carlstad on the street. Three machine finishers were used.

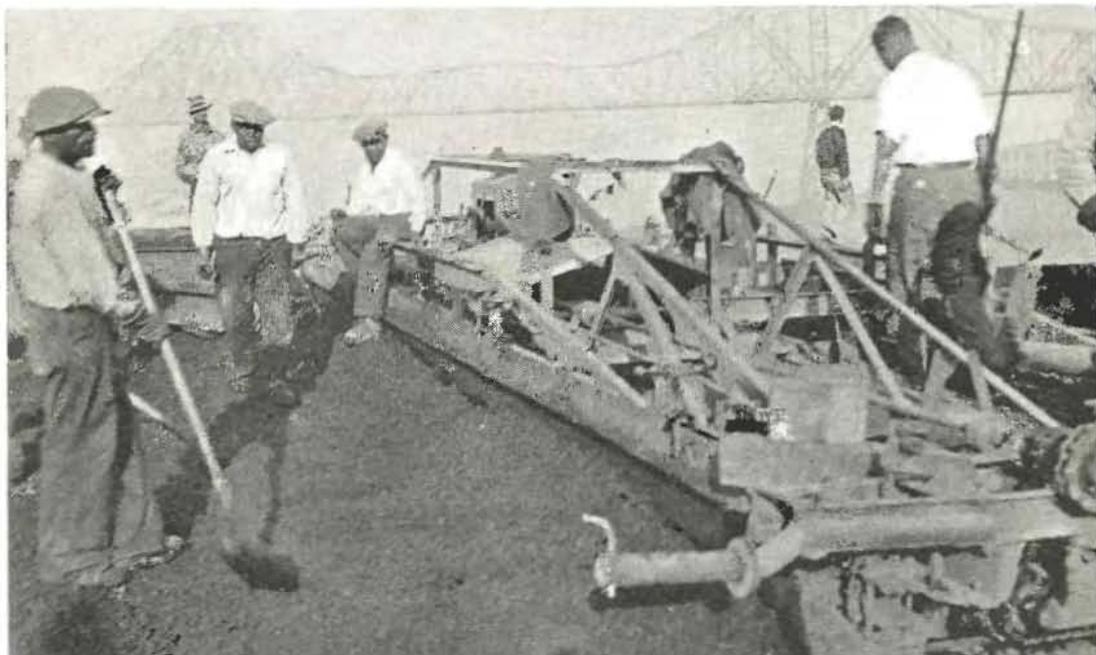
During 1932, the largest one-mixer output was on Contract 46CS1, between Tipton Crossing and Tulare, where the Union Paving Company averaged 467.9 cubic yards per day, using two finishers. W. T. Rhodes was resident engineer with P. A. Boulton on the street. For two mixers, the California record was broken on Contract 44TC2, Redwood City to Oregon Avenue in San Mateo, by Basich Bros., who placed an average of 880.7 cubic yards in eight hours, using two finishers. W. A. Rise was resident engineer, and F. W. Montell was street assistant.

STRENGTH RECORD

The strongest concrete placed during 1931 was on Contract 27FC15, at Galivan Crossing in Orange County, where an average breaking-strength of 6547 pounds was obtained. Griffith Company was the contractor, with W. J. Calvin, resident engineer. During 1932, the maximum average breaking strength of concrete was on Contract 47VC3, between Corona del Mar and Laguna Beach, also in Orange County, where 5708-pound concrete was placed by Jahn and Bressi under direction of W. D. Eaton, resident engineer.

New Methods Give Smoother Surface

(Continued from preceding page)



Thirty foot mechanical finisher on asphalt pavement in Contra Costa County.

The record for cement control during 1931 appears to be on Contract 45FC1, between Wignore and Los Alamos, in Santa Barbara County, with an average daily variation of 0.25 per cent; Basich Bros., contractor, and E. W. Taylor, resident engineer. During 1932, another District V contract, 45CS2, had the best cement control with 0.18 per cent variation, this being in Santa Barbara County between 2 miles north of Solomon Summit and 1½ miles south of Santa Maria; Fredrickson and Watson, contractors, and J. C. Adams, resident engineer.

The record for surface smoothness in 1931 was made on Contract 27VC11, La Posta Creek to Campo Road Junction, San Diego County, with a roughness of 6.6 inches per mile; contractor, E. Paul Ford; resident engineer, C. P. Montgomery. During 1932, the smoothest surface, 5.8 inches per mile, was obtained on Contract 47VC9, Rose Canyon to Sorrento Creek, also in San Diego County; B. G. Carroll, contractor; R. J. Hatfield, resident engineer.

Asphalt Concrete Records

The 1931 record for tonnage production was made on Contract 25FC6-25EC3 by the Peninsula Paving Co. in San Luis Obispo County, between Paso Robles and northerly boundary, where the average daily output was 1117.3 tons. T. W. Voss was resident engineer and J. M. Chaffee, street assistant. Contract 26FC2 in Fresno County, Goshen to Kingsburg, Union Paving Company,

was a close second, with 1025.3 tons average output. H. B. La Forge was resident engineer, L. J. Low, street assistant.

In 1932, the California record for asphalt pavement production was made on Contract 46CN1, in Fresno County, between Fancher Creek and Fresno, Union Paving Company, contractor, where 1317.7 tons were averaged per eight-hour day. H. B. La Forge was resident engineer, with L. J. Low, street assistant.

Stability of asphalt mixtures was emphasized during 1931, the record being made on Contract 48CS1, in Imperial County, East Highline Canal to Sand Hills, Griffith Company, contractor, with E. A. Wolfe, resident engineer. The average stability was 3993 pounds for surface mixture. During 1932, maximum surface stability of 3152 pounds was obtained on Contract 47VC5, at Fullerton in Orange County; Oswald Bros., contractor, and R. D. Kinsey, resident engineer.

The maximum density of asphalt mixture during 1931 was 97 per cent on Contract 28FC5, in Imperial County, Arroyo Salada to northerly boundary, R. E. Hazard Co., contractor, with H. O. Ragan, resident engineer. The 1932 density record was 97.5% on Contract 47VC4, at Glendora; Oswald Bros., contractor, L. R. McNeeley, resident engineer.

SMOOTHNESS RECORD

The record for smoothness during 1931 was made on Contract 26FC2, Goshen to Kingsburg, Fresno County, where 11.5 inches per mile was ob-

Paving Joint Construction Improved

(Continued from page 11)

tained; Union Paving Company, contractor; H. B. La Forge, resident engineer. During 1932, two projects made approximately equivalent smoothness records. Contract 46CN1, Fancher Creek to Fresno, Fresno County, registered 10.3 inches per mile, Union Paving Co., contractor, and H. B. La Forge, resident engineer; Contract 47VC5, at Fullerton, Orange County, had 10.5 inches per mile; Oswald Bros., contractor; R. D. Kinsey, resident engineer.

Summary of Pavement Design and Construction

PORTLAND CEMENT CONCRETE

During the year 1931, concrete pavement projects had an average output per day of 356.5 cubic yards, with an average compressive strength of 4961 pounds. Cement control was good, the average variation from standard 6-sack batches being but 0.65%. The average surface smoothness of concrete pavements was 10.5 inches per mile.

In general, one 27E paver was used on each project for concrete mixing; on two contracts, 43TC1 and 24TC7, Basich Bros. used two pavers each. A truck mixer was used on contract 24EC10, 0.1 mile at Colma. On 10 jobs, two machine finishers were used, on 14 jobs, one finisher was used, on one job, 3 finishers were used, and on 2 small jobs of 0.1 mile and 0.2 mile, spreading and finishing was done by hand.

On Contract 43CN3, one mixer averaged 467.3 cubic yards of concrete per eight-hour day for 45 days, operating at 97% efficiency. On Contract 24TC7, two mixers averaged 853.4 cubic yards per eight-hour day for 22 days, operating at 90% efficiency, establishing a record for two mixers. This was a 40' x 11-9-11" pavement laid in two 20' strips with a longitudinal weakened plane in each strip. Expansion joints were placed 30' apart with 1" dowels; $\frac{5}{8}$ " reinforcing bars were placed around each 10' x 30' panel. Two 20' machine finishers were used.

IMPROVEMENTS ADOPTED

Joint Construction has been improved by the introduction of various devices. End sockets of galvanized metal were used to prevent concrete from running around ends of filler; cast iron frogs were designed to clamp on to side forms to prevent finisher from pushing over the joint filler. A steel channel section was adopted to slip over the joint filler, extending $1\frac{1}{2}$ " into slab to form a true finishing line. On Contract 43TC1, an experimental dummy joint was designed to give a smoother joint finish. The joint was made with a steel plate which was removed after the heavy floating and replaced with a strip of 16-gauge sheet metal anchored on the lower edge. This results in a uniform crack after finishing surface.

Finishing practice was also improved during 1931. The heavy longitudinal float followed the machine finisher, and subsequent floating was done with one-man 8-10' ribbed floats. In dry localities, fogging was used to keep slab moist during finishing operations, resulting in a better surface,

with little hair checking. By the fogging method, the slab is kept moist while uncovered, and after finishing is completed, it is covered with burlap and kept wet until ponded or covered with an earth blanket.

1932 Construction

During 1932, the average daily concrete pavement output was 420.8 cubic yards, with an average compressive strength of 4665 pounds. Cement control averaged 0.71 per cent, about the same as in 1931. The average surface smoothness was 9.0 inches per mile, an improvement over 1931.

Two pavers were used on four contracts, two of which were 10' construction, while on 16 contracts two finishing machines were used. On Contract 44TC2, 7.5 miles of Bayshore highway south of Redwood City, the average for 44 eight-hour days was 880.7 cubic yards. This exceeded the 1931 record made by the same contractor, Basich Bros., by 27.3 cubic yards, a new high record output. Based on 486 cubic yards capacity for these pavers, an efficiency of about 92 per cent was attained. This pavement was also 40'x11-9-11".

HIGH OUTPUT RECORD

On Contract 46CS1, the Union Paving Company again made the high record for output from one paver, when an average of 469.7 cubic yards per eight-hour day was made for a period of 39 days, an operating efficiency of about 98 per cent on this paver.

Joint Construction—The 20' interval of designed joints remained standard with few variations. Several deviations were made in experimental sections within contracts, one of which was to eliminate designed joints entirely. Sufficient time has not elapsed to form any definite conclusions. Several projects were constructed with 20' interval on contraction joints and 400' interval on expansion joints.

Difficulty has been experienced in the past with localized heaving at designed joints over adverse soils due to water penetrating the subgrade through the joints. Considerable experimenting is under way to develop a satisfactory method of sealing, and more attention is being paid to selection and treatment of subgrade materials than in the past.

Finishing has been improved by lengthening the one-man floats from 10 to 16 feet.

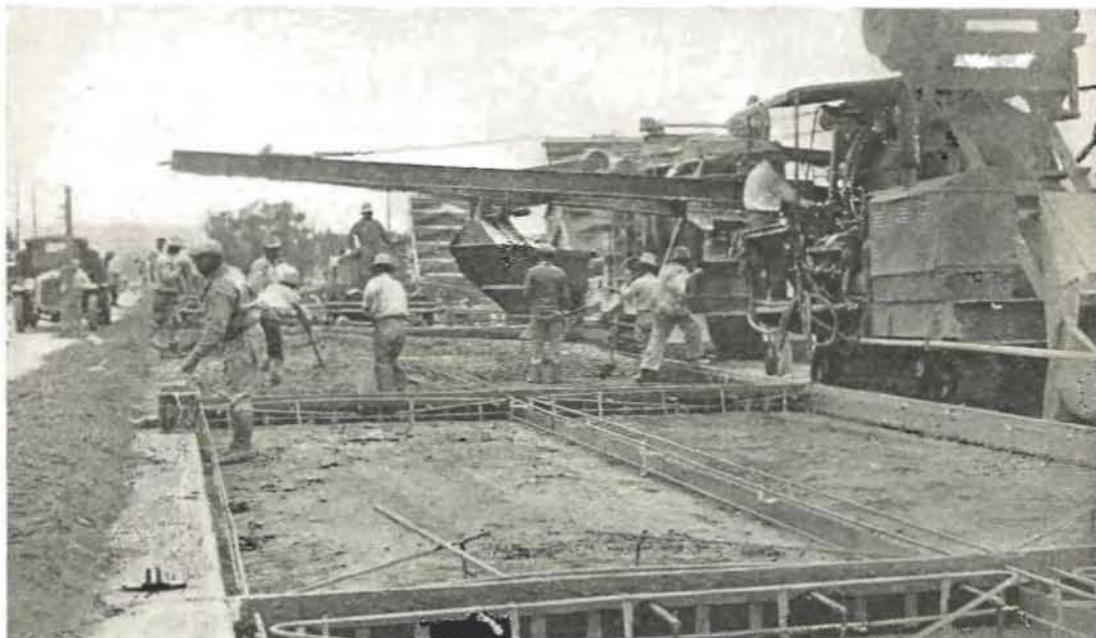
NEW METHOD DEvised

New methods of finishing are continually being tried and as improvement is made the practice becomes standardized. For example, on Contract 43CN3, Williams to Maxwell, the roughness averaged 13.7 inches per mile. The same contractor had an adjoining contract, 43EC3, Maxwell to 4 miles southerly, and paving was started immediately following the completion of 43CN3.

On the second project the resident engineer made a deviation in joint construction in an endeavor to improve the riding qualities. The joint finishing tool was mounted on a float board to prevent cutting below the general surface of the

Mixtures Controlled by Stability Tests

(Continued from preceding page)



Two mixers in operation in San Mateo County, laying cement concrete pavement.

pavement, and the final finish float was used behind the edging of joints to true up any irregularities. The second project averaged 7.3 inches per mile in surface roughness, or a decrease of 6.4 inches per mile.

Asphalt Concrete Pavement

1931 CONSTRUCTION

During 1931, the average daily output of asphalt concrete mixtures was 624.9 tons, while two projects, Contracts 26FC2 in Fresno County and 25FC6-25EC3 in San Luis Obispo County, averaged 1025.3 tons and 1117.3 tons respectively per eight-hour day. On four projects, two mechanical finishers were used, one for finishing surface and one on base. The average stability of surface mixtures was 3323 pounds, and the average relative specific gravity or density was 93.8 per cent. The average surface smoothness of asphalt pavements was 17.5 inches per mile.

In designing asphalt concrete mixtures, the Hubbard-Field stability test, applied to the mortar portion of mixtures to determine the resistance to displacement, continued to control, and surface mixes with dust contents of 22-25 per cent of the total mixture passing the 10-mesh sieve were used. It has been found that this mixture is less susceptible to pushing and rolling under present-day traffic conditions, and also retains its nonskid qualities for a longer period of time.

Automatic Proportioners — Production plants have been made more efficient by improved meth-

ods of feeding, greater storage capacity of heated aggregate, quicker discharge gates, and automatic timing devices. On one project, the proportioning device, which was operated by hydraulic jacks powered by electric motors, opens one gate and holds it open until the set weight is deposited in the weight box, then closes the first gate and opens the second gate in predetermined order. Four separate mixes may be set up at one time, and mixes can be changed by means of a selective switch. An average output of 970 tons per day for 44 days, with 2½-ton batches, was turned out with this plant, operated by Hanrahan Company in San Luis Obispo County.

Spreader boxes were in general use to distribute the truck loads of mixture, and mechanical finishers with various improvements which have been made since their inception in 1927. The rake design was improved by changing the motion to a direct fore and aft movement which gives a combing action to the mix. A traveling track arrangement was used by the Hazard Company on Contract 28FC5 in Imperial County, which eliminates the necessity of carrying track ahead.

A caterpillar tread has been used on finishers, running outside the side forms, with the screeds riding on the forms. Greater surface smoothness is being obtained by initial cross-rolling with tandem roller instead of diagonal of half-circle rolling, this method covering the entire surface better, the roller turning being done off pavement. The resulting smoothness approximates that of portland cement surfaces.

(Continued on page 22)

Frost Bitten Trees Along the Roadsides Show Signs of Life

By H. DANA BOWERS, Landscape Engineer

THE effect of the week of cold weather from December 9 to 15, 1932, is very noticeable in traveling the highways, as the roadside trees, particularly the eucalyptus, suffered severe damage. According to the Weather Bureau the temperature was the lowest of record since 1888, when 19° F. was recorded in Sacramento. A temperature of 18° was recorded in 1854. During the past winter the thermometer dropped to 17° at Sacramento, 11° at Chico, 6° below at Yreka, 13° at Ukiah and 25° at Bakersfield.

Generally speaking, very little severe frost damage is noted south of the Fresno County line in the San Joaquin Valley, and south of the Santa Clara Valley in the coastal region. While the temperature was not as low along the coast at Eureka as in valley sections, the damage was as great, as the trees were not acclimated to such low temperatures.

COAST SUFFERED LITTLE

With the exception of the Eureka region, where the frost kill was severe, the entire coastal region suffered very little, the leaves and small growth only being destroyed. The most damage was noted on the eucalyptus globulus (blue gum), which has been generally considered a very hardy variety.

In the Sacramento-San Joaquin valleys, the frost kill on eucalyptus trees might be estimated at 33 1/3 per cent at this time. A few were killed completely, but the major portion were about one-third destroyed.

The fact that many of the trees which were apparently killed are putting forth new growth is surprising. A careful inspection early in the spring showed that the bark had turned black and that the sap had coagulated like jelly near the cambium layer. Such severe damage would unquestionably have killed the other plant species. The rule does not seem to apply to the eucalyptus and it still remains to be seen just what will occur ultimately as much of the new spring growth is now dying.

BEAUTIFUL VARIETIES

The most beautiful varieties of eucalyptus, such as eucalyptus ficifolia (scarlet flowering gum), eucalyptus sideroxylon rosea (pink iron bark) and eucalyptus corynocalyx

287,859,000 MAN-HOURS OF LABOR THROUGH R. F. C. LOANS

The 103 self-liquidating loans totaling \$200,187,250 and authorized by the Reconstruction Finance Corporation up to May 1 are scattered generally throughout the United States, thereby relieving many local unemployment problems. However, Director Harvey Couch, sponsor for self-liquidating loans, reports that several States have not yet availed themselves of the opportunity offered to acquire permanent improvements and at the same time put men to work.

So far, loans have been made in 32 States and 1 Territory. Texas leads, with 12 in number, California has 5, and Utah 4. California has negotiated the largest amount of loans to date for an extensive program of bridges, aqueducts, and transmission lines, New York being second.

The 103 loans are estimated to provide 287,859,000 man-hours of direct and indirect labor. Most of the smaller loans are for water supply systems totaling \$58,038,250. Fifty-nine cities and towns have arranged to build permanent water works, thus improving sanitary conditions, safeguarding public health, and relieving unemployment through federal aid. The loans include seven bridge projects totaling \$83,100,000.—*Western Construction News.*

SHORT BRIDGES ELIMINATE 31 DANGEROUS ROAD DIPS

Completion of the improvement of State Highway Route 26 through Coachella Valley, between Whitewater and Indio, was celebrated with an extensive program of ceremonies on Sunday, April 2d.

The improvement involved the widening of some fourteen and a half miles of highway from fifteen to twenty feet, and the elimination of thirty-one dangerous dips by building short bridges, at a total cost of \$587,000.

The Highway Commission was represented by Commissioner Frank A. Tetley of Riverside, who was one of the principal speakers. The festivities included a barbecue and selections by the Sherman Indian Band of Riverside.

(sugar gum) are planted extensively in southern California, but are seen very little in the north because of their susceptibility to frost injury.

Some of the common varieties which seem adaptable to the average conditions found in the Sacramento and San Joaquin valleys are as follows:

- Eucalyptus leucoxylon (Victorian iron bark)
- Eucalyptus polyanthema (red box)
- Eucalyptus rostrata (red gum)
- Eucalyptus rudis (desert gum)
- Eucalyptus viminalis (manna gum)

The eucalyptus trees have been planted so extensively in California that many people consider them as native trees.

Work Advanced to Bids in May

The following improvements carrying an aggregate total cost of approximately \$525,000 were scheduled for advertising prior to June 1. The work includes four paving jobs, a bridge reconstruction and a subway under a railroad, with six counties sharing in the benefits of the improvements.

DETAILED LIST OF PROJECTS

County	Location	Route	Miles	Type
Tulare	Goshen to Plaza Garage	Los Angeles-Sacramento Arterial	4.2	Permanent Pavement
Los Angeles	At Brea Canyon Summit	Pomona-Fullerton Road	1.3	Permanent Pavement
San Bernardino	At Mt. Vernon Avenue Viaduct	Foothill Boulevard	0.7	Permanent Pavement
Los Angeles	Las Flores Canyon to Winter Canyon	Oxnard-Serra Highway	3.4	Permanent Pavement
San Joaquin-Stanislaus	Across Stanislaus River near Manteca	Los Angeles-Sacramento Arterial	---	Reconstructing Bridge
Kern	Four miles north of Bakersfield	Los Angeles-Sacramento Arterial	---	Minkler Spur Subway

SUMMARY

Type	Miles	Amount
Permanent Pavement	9.6	\$397,700
Bridges	(2)	127,300
Total		\$525,000

Spraying and Burning of Roadsides in 40 Counties Completed

THE annual program of spraying roadside vegetation to reduce the fire hazard to property adjacent to heavily traveled routes has been practically completed. This work was carried on in some forty counties of the State, and covered nearly 1800 roadside miles. Seven contracts were let for furnishing and spreading the oil.

Under the plan as adopted several years ago by a committee appointed by the Governor, a fire break nine feet in width is created adjacent the highway fence lines by spraying the vegetation, while still green, with diesel oil. The oil kills the vegetation, which is then

burned before adjoining areas dry up and create a hazard.

The diesel oil used is a 27° to 30° gravity. It is applied by power distributors equipped with an adjustable outrigger arm of sufficient length to reach out to the area to be sprayed and designed so that the spray bar may be readily raised or lowered to reach cut or fill slopes. About one-tenth gallon of the oil is applied in general to each square yard of surface, although where the work can be done when the vegetation is about two inches in height an application of one-twentieth gallon is effective on certain areas.

The work is confined to areas opposite grain or pasture land and forested sections. In general no work is done adjacent railroad rights of way, where orchards are alongside or similar locations where the hazard is limited by the natural conditions.

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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Editors of newspapers and others are privileged to use matter contained herein. Cuts will be gladly loaned upon request.

EARL LEE KELLY.....Director
JOHN W. HOWE.....Editor

Address communications to California Highways and Public Works, P. O. Box 1103, Sacramento, California.

Vol. 11 MAY-JUNE, 1933 Nos. 5-6

SAFE HIGHWAYS

Highway engineers, generally, now recognize that safety must be built into the highway and large sums are being expended to make new roads safe and to take the danger spots out of old ones. This is illustrated by the construction of the Ridge Route Alternate on the California State highway, to take fast-moving traffic off the old Ridge Route, where sharp curves and steep grades have taken an alarming toll in casualties. Millions of dollars are involved in this project, but it will be a good investment for the public. Large sums are also being spent to build safety into the Roosevelt State highway north of Santa Monica, where it skirts the hills at the edge of the sea. This has become in the short time since it was first constructed one of the most heavily traveled sections of the entire State highway system. Menace of slides in deep cuts and narrow roadways and dangerous curves is now being removed.

However, the building of safety into highways today in California is not so much of a problem as was the building of the original roads in the State highway system. Many of the existing hazards which are now being gradually removed were the result of inadequate financing in the earlier period. Stretching bond issues into miles, while it met the exigencies of a situation, merely shifted the burden of building adequate highways to a later period. Happily the motorist, with a growing appreciation of hard surfaced and safe roads, assumed the major part of the burden of reconstructing the original State highways at a critical time, and his generosity has been rewarded up to this time by rapid improvement of the State highway system. The gasoline tax has yielded revenues sufficient for betterments.—
Southwest Builder and Contractor.

Big Barbecue Marks Official Opening of San Julian Cut-off

BETWEEN six and seven thousand persons participated in the gala official opening ceremonies of the San Julian Cut-off near Lompoc on Sunday, May 28th. The event was attended by members of the California Highway Commission and other State, county and city officials.

The formal exercises began at 10.30 a.m. on the new cut-off near Jaro bridge when Chairman Harry A. Hopkins of the Highway Commission, armed with a huge pair of golden shears, held by a petite miss to cut a floral chain held by eight beautiful Lompoc maidens.

A monster barbecue followed in Miguelito Park, at which seventeen beeves were served to nearly five thousand people.

After the fete a program of speeches and music was conducted by Supervisor Ronald N. Adam, general chairman for the celebration. Speakers included Mayor F. T. Gunderson of Lompoc; Supervisor John R. Quinn of Los Angeles County; Supervisors C. L. Preisker, Sam J. Stanwood and Fred G. Stevens of Santa Barbara County, Senator Edgar W. Stow and Assemblyman George R. Bliss.

Among others who participated in the exercises were Highway Commissioners Philip A. Stanton, Timothy A. Reardon, and Dr. W. W. Barham; Mayor Harvey T. Neilson of Santa Barbara and Secretary W. G. Herron of the Santa Barbara Chamber of Commerce.

The new cut-off road leaves State highway route No. 2 at Las Cruces and extends northwesterly 18 miles to Lompoc. It was built by the county on modern highway standards and is included in the 6700 miles of county roads taken into the State system when Governor Rolph, on June 6th, signed Assembly Bill No. 583.

DATES BACK TO PHARAOHS

"The principle of public works for the relief of unemployment is as old as the hills," states John P. Hogan, chairman of the Public Works Committee of the American Society of Civil Engineers. "When the Pharaohs had completed their conquests and had large numbers of unemployed soldiers and slaves, they built the Pyramids, as well as roads and irrigation canals through the conquered territory.

"When the peace of Amiens brought a lull in the wars following the French Revolution, Napoleon built the magnificent road system of France.

Cooperative Projects Total \$1,941,352

(Continued from page 2)

4. The municipality must control and maintain the completed project.

5. The State will grade and pave or improve the road to a standard equal to that on the immediately adjacent State highway, of which the cooperative project is an extension or a connecting link.

IMPORTANT BUDGET ITEM

The Highway Commission welcomes proposals from local authorities and although such applications now on file are in excess of available funds, the State feels that this phase of improvement to the State highway system is a vital factor in obtaining continuity in the road network and that increasing consideration must be given to this work in preparing future budgets.

A list of cities which have availed themselves of this opportunity of securing State aid for the improvement of connecting routings shows that State cooperation is extended on the basis of the need and the ability of the local community to advance its portion of the obligation, irrespective of the size or class of the municipality. In the following cities cooperative projects for the current biennium have been completed or are now under construction:

- | | |
|--------------|--------------------|
| Napa | Huntington Beach |
| Lodi | Los Angeles County |
| Oakdale | Laguna Beach |
| Santa Clara | Glendora |
| Redwood City | Fullerton |
| Fresno | Holtville |
| Kingsburg | Ventura |
| Willows | San Diego |
| Yuba City | Brawley |
| Red Bluff | Redondo Beach |
| Placerville | Bakersfield |
| Sausalito | |

IMPROVEMENTS PLANNED

Proceedings have been instituted and plans are now in preparation for undertaking possible cooperative improvements during this biennium in the following cities:

- | | |
|------------|---------------|
| Modesto | Pasadena |
| Willits | Anaheim |
| Fresno | Santa Barbara |
| Sonora | El Cajon |
| Santa Cruz | San Diego |
| El Segundo | Long Beach |

The following summary provides a definite idea of the extent of cooperative construction completed and put under way in California during the past two years:

Type	Miles (State's share)	Amount
Permanent pavement.....	30.5	\$1,349,317 70
Bituminous treated crushed rock surfacing	0.4	41,705 45
Graded roadbed	4.4	72,687 78
Bridges	(9)	477,641 49
Totals	35.3	\$1,941,352 42

The individual projects vary greatly in size: the amounts of State participation ranging from \$1,300 to \$237,000; roadbed widths varying from 36 feet to 100 feet and pavement ranging from 20 feet to 76 feet in width. The following brief descriptions of a few representative cooperative projects will provide a conception of the methods of State cooperation.

BRIDGE FOR NAPA

In the city of Napa a reinforced concrete girder bridge was constructed across the Napa River on Third Street, where the route of State Highway No. 8 passes through the city. In sharing the cost of the construction of this bridge the State provided a flat sum of \$25,000, which was approximately one-third of the cost, the city of Napa and Napa County divided the remaining two-thirds of the cost equally. The bridge was built by contract under the supervision of the city, and the State approved the plans and kept an inspector on the construction.

The routing of the State highway through Santa Clara was changed from Franklin Street, the main business artery of the town, to an alignment along Clay and Grant Avenues and The Alameda, through residential and industrial sections. This improvement involved the construction of pavement 40 feet, 53 feet and 76 feet wide between curbs. The work was performed by a city contract with the approval of the Division of Highways. The State paid for the central 40 feet of paving and all other costs were borne by Santa Clara.

SUPERHIGHWAY BUILT

In the town of Oakdale in Stanislaus County a twenty-foot pavement was placed. In this instance the town provided the right of way

(Continued on page 31)

\$1,152,000 Project Employing 550 Men

(Continued from page 9)

of the U. S. Bureau of Public Roads made the final location from the data obtained by the various field parties. The section from Azusa to the river forks was adopted as a State highway layout June 2, 1932, in order that the State could contribute to the cost.

The project leaves the old canyon road at a point about three miles northerly of Azusa, crossing the river on a new bridge and ascends along the west side of the canyon. There was little choice of location for the first one and one-half miles, as it was necessary to climb on maximum grade to attain an elevation higher than the high water of the city of Pasadena reservoir at a point opposite the dam which is now under construction.

From a point opposite the dam site an undulating grade to fit the topography of the country, follows around the west side of the reservoir site. From the upper end of this reservoir site the grade gradually ascends to an elevation above the Los Angeles County Flood Control District reservoir high water contour. From here a rolling grade, varied to fit the topography of the country, continues to the mouth of the north fork of San Gabriel River, the end of the project.

UNDER THREE CONTRACTS

The highway was designed on standards similar to those used on the portion of this general highway project in the Arroyo Seco Drainage area, the maximum grade being 6 per cent and the minimum radius of curvature 200' in general and 300' on blind curves. The roadbed is 28' wide on fills and 30' wide in cuts. Embankments are placed in layers and watered and rolled to secure maximum compaction.

Work was let under three contracts—One being for construction of the bridge across San Gabriel River at the beginning of the project, and the other two being grading contracts for the first seven miles and the next two and one-fourth miles respectively. Bids for the first grading contract were opened June, 1932, and for the second grading contract, January, 1933. Work under the bridge contract was started November, 1932, and completed April, 1933. The cost of the first grading contract is now estimated to be \$950,000—that of the second grading contract \$150,000, and the cost of the bridge \$52,000, or a total of \$1,152,000 for the entire project.

These two grading contracts are providing employment for from five hundred to five hundred and fifty men. In accordance with the policy of the U. S. Government, preference in employment is given veterans with dependents so that several times this number of people are benefited by the employment afforded by the project.

Judging from progress made to date, the first grading contract will be completed by July 1, 1933, and the second one about one month later. A light "road-mix" oil surfacing will be applied under a State contract immediately after grading work is completed so that this entire section to the north fork of the river should be in use by the middle of the summer.

BIG EXCAVATING JOB

Probably the most unusual construction feature is the immense amount of excavation required. The two grading contracts involve the excavation of 1,800,000 cubic yards of material or about 200,000 cubic yards per mile as an average for the job. Most of this material is granite in various stages of disintegration. Fortunately, a large percentage is soft enough to be removed by tractors and scrapers without blasting. As most of the grading work is side-hill excavation involving comparatively short hauls this is a very economical method of hauling the material. On the portions where longer hauls are required, power shovels and trucks are used.

One very unusual feature is a 300,000 cubic yard embankment constructed across Brown's Gulch, one of the side canyons which comes into the San Gabriel a short distance below the Los Angeles County Flood Control District's damsite. The construction of this enormous fill rather than locating the road to cross near the head of the gulch, saves more than a mile of distance. Its inclusion in the design is economical because it provides a convenient disposal for a large amount of surplus excavated material which would otherwise be wasted.

The height of the fill on the center line is 165 feet, but the canyon which it crosses slopes on such a steep pitch that the height above the toe of slope on the lower side is considerably more than this. This canyon is an "S"

(Continued on page 23)



With all danger of floods having passed for this season and the completion of snow survey and precipitation reports the monthly report of State Engineer Edward Hyatt states it is estimated that the seasonal runoff for the combined Sacramento-San Joaquin drainage area will be 45 per cent of normal resulting in a low seasonal and summer stream flow.

As the result of these conditions, the report states, preliminary information indicates that the 1933 rice acreage will be approximately 20 per cent less than in 1932 and maximum salinity figures are anticipated at Bay and Delta stations. The water content of the season's snow pack, according to final reports, averaged only 75 per cent of last year's pack.

Details of dam construction, water distribution, flood control and irrigation district activities and the State water plan are given in the report which follows:

IRRIGATION DISTRICTS

Office work was continued in checking and assembling information furnished the State Engineer in annual reports of irrigation districts, some sixty-five of which have been received to date. Requests for information on irrigation districts and irrigation district matters in general showed increased activity during the month.

The Nevada Irrigation District contemplates an agreement with the Pacific Gas & Electric Company whereby the district will acquire the certain rights and property now used by the power company for the service of irrigation district lands in Placer County, thus placing the service of all district lands directly under the authority and responsibility of the district.

A petition was received by the State Engineer from the owners of 1711 acres in the Tulare Lake Basin Water Storage District requesting that action be taken for the exclusion of their lands from the district.

The office of the El Dorado Irrigation District was visited in connection with matters to be submitted to the Districts Securities Commission concerning the approval by the Commission of the transfer of certain funds.

FLOOD CONTROL AND RECLAMATION

Maintenance of Sacramento Flood Control Project.

Routine maintenance only by our regular crew has been performed during this period, in connection with levees, structures, pumping plants, drains and repairs to equipment. The crew has continued to work on part time and, as there have been no heavy storms and practically no water in the by-passes, no emergency work has been necessary.

The regular crew has been engaged to some extent in putting equipment and property in order and maintaining the floating river equipment and warehouses. Work has commenced on a minor repair to the east abutment of weir No. 2, in the East Sutter by-pass levee borrow pit.

Emergency Flood Protection and Rectification of Rivers.

The camp operated by this division near Lompoc, in cooperation with Santa Barbara County, has continued with a crew of approximately 30 men. This is an unemployment relief project, and the men are engaged in clearing the flood channel of the Santa Ynez River. Only unemployed, single residents of Santa Barbara County are being cared for, and the camp will probably operate at least three months longer.

Russian River Jetty.

All work on the Russian River jetty was terminated on March 24th on account of lack of funds. All tools, materials and equipment were moved to our Sutter warehouse, with the exception of the shovel, derrick, cars and locomotives, but the parts of these which might be stolen were also removed. Any or all of this equipment can be returned to the job promptly if required.

Flood Measurements and Gages.

The operation of all gages and the collection of data has continued, but there has been no occasion to make flood flow measurements on account of lack of storms. At this time it appears that all danger of floods for this season has passed. There are now available for distribution in mimeographed form flood season data reports for the following periods: 1913-14 to 1924-25; 1926-27; 1928-29 to 1930-31; and 1931-32. A reissue of the report for 1925-26 is now in preparation. The above completes the series containing all flood data of the Sacramento and San Joaquin valleys not otherwise available in printed form, from 1913 to date.

(Continued on page 24)

Stream Flows 30 to 60 Per Cent Below Normal Forecasted for Season

By HARLOWE M. STAFFORD, Supervising Hydraulic Engineer, Division of Water Resources

THE season's most important snow surveys as respecting predictions for spring and summer water supply were completed in late March and early April and the data therefrom, together with records of seasonal precipitation to April 1st were analyzed to derive the estimates of 1933 stream flow. These were published in the April 1st Snow Survey Bulletin of the Division.

This is the fourth season in which, under State supervision and through cooperation of many interested agencies, surveys have been conducted at some 160 snow courses throughout the Sierra at altitudes from 4600 to 11,400 feet and from Upper Sacramento and Pit River basins on the north to Kern River basin on the south.

LOW WATER CONTENT

In general, this season's snow pack as measured in inches of water content averaged from 60 to 90 per cent of last year's pack, with a general average of about 75 per cent. A marked exception was shown by three snow courses in the Upper Sacramento basin, Mt. Shasta, Mt. Lassen and Snow Mountain, which averaged 10 per cent greater pack than in 1932. Owens and Mono Basin courses averaged from 40 to 55 per cent of last year's pack.

For the areas where the snow surveys have been conducted for a sufficient number of years to permit the development of tentative normals, the Western Sierra slope pack varied from about normal to 35 per cent below normal with a general average of about 20 per cent below normal. Eastern slope basins averaged from 25 to 50 per cent below normal.

PRECIPITATION BELOW NORMAL

The data from the precipitation stations indicated, in general, that this season's precipitation to April 1st averaged 30 per cent below normal in Upper Sacramento Basin, 40 to 50 per cent below normal from Feather to Mokelumne basins, 25 to 35 per cent below from Stanislaus to Upper San Joaquin basins, 10 to 20 per cent below from Kings to Kern basins, and 30 to 40 per cent below

in San Gabriel, Santa Ana and Los Angeles basins. Eastern slope basins averaged 35 to 40 per cent below normal from Truckee to Walker, 50 per cent below in Mono, and 20 to 35 per cent below in Owens.

Except for South Yuba and Bowman area drainages and for Eastern Slope basins, Truckee, Tahoe, Carson and Walker, the period of record of the snow surveys has been too short to permit an entirely dependable establishment of the correlation between snow and run-off. Tentative "normals" have, however, been worked out for all snow courses by comparison with long-time stream flow records and on the basis of these, the results of this season's surveys were applied to venture forecasts of the 1933 snow run-off as represented by the stream flow during the period April to July, inclusive.

FORECASTS TABULATED

These forecasts which, because of the shortness of the basic correlation period, must be taken more as a provisional guide than a definite prediction, are shown in the accompanying tabulation. The present number and distribution of the snow courses does not permit of these provisional forecasts for all major stream basins in their entirety. The table shows also a comparison of the similar provisional forecasts which were made on April 1st a year ago and the corresponding actual April-July run-off in 1932.

Based upon all available precipitation and snow data, estimates were also made on April 1st of the 1932-33 seasonal stream flow (October, 1932, to September, 1933, inclusive) in the major stream basins. Expressed in per cent of the mean seasonal flow for the 40-year period 1889-1929 the 1932-33 estimates varied from 30 to 50 per cent of the mean for the basins of the Sacramento and San Joaquin Rivers to 55 or 60 per cent in the Kings, Kaweah, and Kern River basins.

FORTY-FIVE PER CENT STREAM FLOW

For the combined Sacramento and San Joaquin Rivers and tributaries the 1932-33

Forecast of Seasonal Stream Flow

Drainage area or stream gaging station	April-July (Inc.) stream flow acre-feet ¹			Per cent departure of forecast
	1933 forecast	1932 Forecast	Actual	
South Fork Pit River near Likely.....	32,400	42,500	44,500	-4
Pit River at Ydalmom.....	931,000	916,000	865,000	+6
North Fork Feather River near Plattville.....	268,000	300,000	233,000	+29
Bowman Area-Middle Yuba and Canyon Creek.....	100,000	124,000	127,000	-2
South Fork Yuba River at Langs Crossing.....	240,000	293,000	308,000	-5
North Fork American River at Colfax.....	293,000	350,000	311,000	+12
American River at Fair Oaks.....	1,270,000	1,700,000	1,580,000	+8
North Fork Mokelumne River near West Point.....	328,000	500,000	512,000	-2
Mokelumne River near Clements.....	390,000	588,000	564,000	+4
Middle Fork Stanislaus River near Avery.....	273,000	494,000	458,000	+8
Stanislaus River near Knights Ferry.....	640,000	1,000,000	972,000	+3
Tuolumne River near Hetch Hetchy.....	471,000	798,000	740,000	+8
Tuolumne River at Jacksonville.....	1,120,000	1,600,000	1,500,000	+6
Merced River at Pohono Bridge.....	322,000	390,000	447,000	-13
Merced River at Exchequer.....	496,000	690,000	725,000	-5
San Joaquin River above Big Creek.....	764,000	1,400,000	1,270,000	+10
San Joaquin River near Friant.....	920,000	1,600,000	1,520,000	+5
Dinkey Creek at mouth.....	90,400	150,000	155,000	-3
North Fork Kings River above mouth.....	348,000	506,000	514,000	-2
Kings River near Hume.....	696,000	1,000,000	929,000	+8
Kings River at Piedra.....	1,050,000	1,600,000	1,580,000	+1
Kaweah River near Three Rivers.....	276,000	430,000	371,000	+16
Kern River near Bakersfield.....	489,000	500,000	549,000	-9
*Truckee River at Iceland.....	220,000	310,000	290,000	+7
² Lake Tahoe (rise of lake).....	1.25 ft.	1.89 ft.	1.71 ft.	+10
² Carson River at Clifton.....	115,000	230,000	233,000	-1

¹Natural flow (measured flow corrected for regulation).

²Forecast by Nevada Cooperative Snow Surveys Committee.

seasonal flow was estimated at 45 per cent of the 40-year mean.

With the seasonal flow as estimated, minimum river flow and maximum salinity to be anticipated in the Sacramento-San Joaquin Delta in 1933, were predicted on the basis of their correlation with seasonal flow as established in past seasons.

The 1933 minimum flows expected are, in second-feet, Sacramento River at Red Bluff 2600, at Colusa 1800, at Sacramento 1600; San Joaquin River near Vernalis 600; and combined Sacramento and San Joaquin flow to the delta, 2600. Maximum salinities predicted at delta points are, in parts of chlorine per 100,000 parts of water, O and A Ferry 1000, Collinsville 800, Antioch 700, Emmaton 420, Jersey 380, Three Mile Slough Bridge 300, Rio Vista 200, and Central Landing 70.

"Oh, I wish you'd come down off your high horse," growled the exasperated husband.

"And I wish you would stop using those out-of-date expressions," retorted the ultra-modern wife. "Why don't you learn to motorize your thinking?"

FULFILLMENT OF BRIDGE DREAM AT HAND

(Continued from page 5)

with the governmental details so closely guarded against favoritism or unethical practices. Every detail of this bridge has been laid before the people, and I am proud to say in behalf of this administration that no methods of "expediency" have been permitted beyond the strictest confines of ethics.

Just as the beautiful civic center of San Francisco stands a monument to the honest efficiency of Governor Rolph's administration of that city as its Mayor, so shall the San Francisco-Oakland Bay Bridge stand as a monument to that same principle ruling the Governor's office of California.

A minister discovered two of his flock playing cards on Sunday—and for money.

"Rastus," he said, "don't you know it's wrong to play cards on the Sabbath?"

"Yes, parson," replied the sinner, ruefully, "an', believe me, Ah's paying for mah sins."—*The Humorist*.

Mixture Stability Tests Developed

(Continued from page 13)

1932 CONSTRUCTION

During 1932, the largest single project was in Imperial County, 14.7 miles between Coyote Wells and Dixieland, involving 64,950 tons of mixture, and an average output of 683.7 tons per day. The average daily tonnage of mixture laid for all projects was 614 tons. The average stability of surface mixtures was 2,683 pounds, and the average relative specific gravity was 94.3 per cent. The average surface smoothness was 11.8 inches per mile.

Mixture Design—In the design of asphalt mixtures, it has been found that with most aggregates, increasing the percentage of crushed particles in

and method consists of a multiple-section long wooden drag drawn by the finishing machine. This device was first used by Los Angeles County on similar work and their results are very favorable.

Oil Surfaced Roads

During 1931 and 1932, the present-day trend toward the bituminous treatment of rock surfaced roads has been continued.

Design of Mixtures—Materials for oil mixtures are selected prior to the letting of contracts on the basis of their soundness, respective stabilities, and resistance to disintegration of the completed mix by water.



Sixteen foot one-man finishing float on P. C. C. pavement.

the material passing No. 10 mesh increases stability. Many local materials which would otherwise have to be rejected for lack of stability are made acceptable with the addition of crushed sand, resulting in a considerable saving to the State.

The results obtained to date in mixtures controlled by stability tests indicate that this method is the most valuable development in the art of design and control of mixtures that has been brought forth in the last decade. Pavements so controlled have shown a marked uniformity and improvement in performance.

Finishing—The development of the finishing machine was likewise the greatest advance in the technique of laying smooth riding pavements. The roughness imparted to the pavement from irregularities in side forms is something that can not be removed with the machine. To eliminate this feature, experimental methods of screeding behind the finishing machine are in progress. One method is that of floating transversely behind the finishing machine with the 16' one-man float which was developed for cement concrete. A sec-

ond method consists of a multiple-section long wooden drag drawn by the finishing machine. This device was first used by Los Angeles County on similar work and their results are very favorable.

Field control is checked at regular intervals by stability tests made on the completed mix as submitted to the laboratory. No existing devices for measuring stabilities of mixtures with lighter oils were available, and the Hveem plastometer was developed in the laboratory for this purpose. In this machine the lateral resistance to deformation with load on a compacted cylinder is measured. The results of the plastometer indicate the probable performance of the mixture under traffic.

SWELL TEST USED

The effect of water on the aggregates in the completed mix is determined by the swell test. A compacted cylinder is immersed in water and the resulting change in volume of the specimen is recorded in percentage of swell, which indicates the performance of the mixture under the conditions of weathering.

The probable effect of rain water in separating the oil from the aggregates is indicated by first mixing a sample of the dry aggregates with the oil and then adding water and stirring to determine

(Continued on page 32)

3500 Miles of Traffic Stripe Placed Last Year Cost \$163,000

A REVIEW of traffic striping work during the past year shows that practically 3500 miles of stripe has been placed at an expenditure of about \$163,000. This includes restriping some of the heavier traveled sections in the Los Angeles and San Francisco territories. On the average, it cost \$40 per mile for placing a 4-inch stripe during the last year.

Fifteen gallons of traffic lacquer was used per mile of stripe which represented about three-quarters of the expense. On all the striping work, whether handled by day labor forces or under contract, particular care is taken to secure a true, even line. The specifications require that a deviation of more than one-half inch from the true line in a distance of twenty feet indicates the standard maintained.

LACQUER IS TESTED

The traffic lacquer is manufactured according to specifications prepared by the testing laboratory. Materials which go into the lacquer are tested separately and the manufacturing is done under the supervision of a testing engineer. The service to which the lacquer is subjected is severe. The prime requirements for a satisfactory material are set forth in the specifications, as follows:

1. It shall remain white under service conditions.
2. It shall dry under ordinary conditions sufficiently to allow traffic over it in from fifteen to thirty minutes after placing.
3. It shall show nonbleeding of oil or asphalt into the stripe.
4. It shall have good covering qualities.
5. It shall have good elasticity.
6. It shall have good durability under extreme weather conditions.
7. It shall satisfactorily resist the abrasive action of traffic.
8. It shall have good visibility.
9. It shall be of such consistency that the material may be used in the State paint spray machines without the use of thinners.
10. The lacquer shall not cake nor become unduly separated from the vehicle in storage.

ECONOMY EXPERIMENT

Determination of the quantity of lacquer required to provide a satisfactory line, having a reasonably usable life, was based on experience with commercial brands of material. With the development of a specification material, designed to fit California conditions, it was felt that an economy might be effected by reducing the quantity of lacquer per mile.

Steep Slopes Make Work Inaccessible in San Gabriel Canyon

(Continued on page 18)

shape where the fill crosses, and a culvert to take the drainage from the canyon would have to follow the course of the old channel for about 800 feet. It was found that a tunnel 580' long to carry the drainage water could be constructed through the ridge on which one end of the fill rests at a decided saving over the culvert method.

DIFFICULT CONSTRUCTION

A number of conditions have made construction on this job extremely difficult. A large part of the work was inaccessible to construction equipment until several miles of temporary or "pioneer" roads were built. To add to the difficulty of the work, the mountains are so steep that a number of slides have occurred. Concrete retaining walls are being built in a number of places where slopes are too steep to support embankments.

One of the most beautiful features of the project is the bridge across San Gabriel River where the new highway leaves the old canyon road. This structure is a steel deck truss bridge with reinforced concrete floor system, rails and approach spans. The south approach span is on a curve and is super-elevated in accordance with the most modern standards of bridge design.

On its completion the Angeles Crest Highway, including the San Gabriel Canyon section, will be one of the most scenic drives in southern California. The formation of two artificial lakes by the dams which are under construction in the canyon will later enhance the already superb natural beauty of the drive.

Accordingly, about 35 miles of stripe was placed in San Bernardino and Riverside counties, using varying quantities of lacquer from nine to fourteen gallons per mile. This work was completed the latter part of November. The test sections will be kept under observation to determine if an economy can be effected in the striping program without too great a reduction in the life and serviceability of the stripe.

The traffic stripe is regarded by the public in general, if letters written to the division are any criterion, as one of the most satisfactory safety measures, particularly on roads with relatively poor alignment, or in foggy areas.

Inspections Cover 245 Water Projects

(Continued from page 19)

WATER RIGHTS

Supervision of Appropriation of Water.

Nineteen applications to appropriate water were received during March; 17 were approved and 5 were denied. In the same period, 32 permits passed to license and 4 were revoked.

Of the more important applications approved during the month were two by Harry T. Wilkerson, 302 First National Bank Bldg., Stockton, California, for 50 cubic feet per second each, or a total of 100 cubic feet per second from Hurdy Gurdy Creek in Del Norte County.

Field work in connection with the inspection of permits was initiated on April 3d and will require visits to 245 projects. Work during the current month will be carried on in San Luis Obispo, Santa Barbara, Ventura, Los Angeles, Orange, San Diego, Riverside and San Bernardino counties.

ADJUDICATIONS

Whitewater River (San Bernardino and Riverside Counties). Case pending in the Superior Court of Riverside County awaiting developments in regard to the proposed All American Canal from Colorado River.

Clover Creek (Shasta County). The Clover Creek case is pending in the Superior Court of Shasta County awaiting the court's pleasure in setting a date for hearing.

Butte Creek (Siskiyou County). Case pending in the Superior Court of Siskiyou County awaiting action by the parties involved.

Eagle Creek (Modoc County). A stipulation for judgment was presented to the interested parties at a meeting at Eagleville on March 22, 1933. At this meeting the water users agreed to continue the trial distribution of the waters of Eagle Creek throughout the 1933 irrigation season.

South Fork Pit River (Modoc County). A schedule of allotments for trial distribution during the 1933 season was submitted to the water users and adopted at a meeting held at Alturas on April 11, 1933.

Hat Creek (Shasta County). The stipulation for judgment prepared by the Division is being circulated by counsel among the interested parties.

Deep Creek (Modoc County). A stipulation for judgment was presented to the interested parties at a meeting at Cedarville on March 23, 1933, and is now being circulated among nonresident parties.

Franklin Creek (Modoc County). A stipulation for judgment was presented to the interested parties at a meeting at Davis Creek on March 21, 1933, and is now being circulated among nonresident parties.

Pine Creek in Surprise Valley (Modoc County). A schedule of allotments for trial distribution during the 1933 irrigation season was adopted by the water users at a meeting held at Cedarville on March 23, 1933.

Cottonwood Creek (Modoc County). A schedule of allotments for trial distribution during the 1933 irrigation season was adopted by the water users at a meeting held at New Pine Creek on March 21, 1933.

Cedar, Davis, Deep, Emerson, Franklin, Mill, New Pine, Pine, Cottonwood, Owl and Soldier Creeks and South Fork of Pit River (Modoc County). Water master service on these streams for the 1933 season was commenced on or about April 1, excepting Cedar and Soldier Creeks where the service was begun on March 19, and the South Fork of Pit River where distribution started about April 12.

Pit River in Big Valley (Modoc and Lassen Counties). Supervision of diversions from Pit River in Big Valley for the 1933 season was commenced on April 1.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISOR

Office work has continued during the past month in preparing the 1932 report covering the stream flow, diversions, return flow, use of water, salinity, etc., throughout the Sacramento-San Joaquin territory. Field work has included routine maintenance of tide gages and permanent salinity stations in the Delta and Upper Bays; and with the beginning of irrigation on a number of projects the regular field measurements were begun the first week in April.

The flow of the Sacramento River at Sacramento is now about 20,000 second-feet and the combined river flow to the Delta about 23,000 second-feet. This is about the same flow as at the middle of March but a small storm early in April caused a greater flow reaching about 34,000 second-feet at Sacramento for a few days.

Present estimates based upon all available precipitation and snow data are for a 1932-33 seasonal run-off (October to September) of 45 per cent of normal (40-year mean 1889-1929) for the combined Sacramento-San Joaquin drainage. The estimated percentage for the Sacramento River at Red Bluff is 45 per cent, Feather River at Oroville 35 per cent, Yuba River at Smartsville 45 per cent, American River at Fair Oaks 30 per cent, Sacramento River at Sacramento 40 per cent, and San Joaquin River near Vernalis 50 per cent. Under these conditions, minimum stream flow in 1933 may be anticipated as follows: Sacramento River at Red Bluff, 2600 second-feet; at Colusa, 1800 second-feet; at Sacramento, 1600 second-feet; San Joaquin River near Vernalis, 600 second-feet and a minimum combined Sacramento-San Joaquin River flow to the Delta of 2600 second-feet.

In these estimates the assumption is made, on the basis of present preliminary information, that the 1933 rice acreage will be approximately 20 per cent less than in 1932. With low seasonal and summer flow as estimated, maximum salinity in 1933 at Bay and Delta stations is anticipated as shown in the following table. The estimates place the 1933 season as very similar to 1926 and 1929 seasons and the maximum salinity figures for these seasons are shown in the table. A comparison is shown also of the salinity on April 6th in 1926, 1929, 1932 and 1933.

Thirty Dams Now Under Construction

(Continued from preceding page)

Salinity in parts of chlorine per 100,000 parts of water

Station	Max. Seasonal Salinity		
	Actual	Est.	
Point Orient	2020	1830	---
Bullshead	1690	1370	---
Bay Point	1400	1050	---
O and A Ferry	1100	830	1000
Collinsville	1020	680	800
Emmaton	540	310	420
Antioch	920	600	700
Jersey	470	365	380

Salinity in parts of chlorine per 100,000 parts of water

Station	Salinity on April 6th			
	1926	1929	1932	1933
Point Orient	1410	1530	1020	1240
Bullshead	410	500	120	380
Bay Point	28	260	4	17
O and A Ferry	9	44	1	5
Collinsville	5	9	1	2
Emmaton		7	1	1
Antioch	6	6	2	2
Jersey			3	4

DAMS

To date there have been received 819 applications for approval of dams built prior to August 14, 1929, of which 690 are now under jurisdiction; 112 applications have been received for approval of plans for construction or enlargement; and 384 for approval of plans for repair, alteration or removal.

Thirty dams are under construction or enlargement and 109 are under repair or alteration.

Certificates of approval of 574 dams have been issued to date and six certificates of approval of removal.

Applications Received for Construction.

Dam	Owner	County
Veeh	Geo. H. Veeh	Orange

Applications Received for Alteration.

Dam	Owner	County
Lower San Leandro	East Bay Municipal Utility Dist.	Alameda

Plans Approved for Construction.

Dam	Owner	County
Eaton Wash	L. A. County Flood Control Dist.	Los Angeles

Plans Approved for Alteration.

Dam	Owner	County
Sheffield	City of Santa Barbara	Santa Barbara

Supervision over maintenance and operation is being exercised over existing dams, while more frequent inspections are made of dams under construction, enlargement or repair. Work is being actively pushed on several large dams under construction in Southern California. The city of Los Angeles has completed about half the earth fill on

their Bouquet Canyon Dam. The San Gabriel No. 2 Dam of the Los Angeles County Flood Control District is also about half completed and they have already started work on their larger rock fill structure, San Gabriel No. 1. Plans have also recently been approved for another dam to be built by this district—the Eaton Wash Debris dam—for which bids will be let shortly. This will be a rolled earth structure 38 feet high and storing 1040 acre-feet of water and debris.

The Pine Canyon Dam, being built for the city of Pasadena, is well under way. Material progress is being made on the city of San Diego's El Capitan Dam, both on the rock fill section and on sluicing operations.

COOPERATIVE TOPOGRAPHIC MAPPING

Horizontal and vertical control work in connection with cooperative topographic mapping was carried on during March in San Bernardino, Sonoma and Humboldt counties and topographic mapping proceeded in Riverside, San Bernardino, Fresno and Sonoma counties.

Field work in connection with the Gujarral Hills quadrangle in Fresno County was completed during the month.

The final sheet of Tupman quadrangle, which was issued as an advance sheet under the name of Coles Levee and which covers an area immediately north of Buena Vista Lake in Kern County, is now available, as are also the Arvin and Weedpatch quadrangle sheets. These are all published on a scale of 1:31,680 and copies may be obtained through local stationers or from the Superintendent of Documents, Washington, D. C.

WATER RESOURCES

Ventura County Investigation.

The work of detailed surveys of reservoirs on Piru Creek continued during the month and estimates of time, cost of various types and heights of dams at each of the several dam sites were also in progress. Estimates of underground capacity were completed in Santa Clara Valley, Oxnard Plain and the Moorpark-Camarillo area, leaving the Simi and Ojai areas yet to be completed. Office studies were continued on the best utilization of combined surface and underground conservation of flood flows. The crop map of the entire valley was completed.

Salinas Valley Investigation.

Office work continued on final report which will be completed during the present month or early in May.

South Coastal Basin Investigation.

The crop map of the entire area was completed. Studies were continued on rate of subdivision,

Study Report Issued on Sacramento Basin Unit of Water Plan

(Continued from page 25)

quality of water, capacity of underground basin and draft from underground basins.

Mojave River Investigation.

The field work being conducted by the Federal Bureau of Irrigation Investigations was completed during the month.

Santa Clara Investigation.

Assembly of data for publication of final report on the Santa Clara investigation is proceeding rapidly and it is expected that all material will be in the hands of the printer within the next 30 days.

Pit River Investigation (Modoc and Lassen Counties).

The final review of the report is in progress preparatory to submission to the State Printer.

STATE WATER PLAN

Bulletin No. 26 of the Division of Water Resources, entitled "Sacramento River Basin," one of a series of reports on the State Water Plan, was released during the present month.

The report presents the results of a comprehensive study of the water resources of the Sacramento River Basin. It also contains an inventory of the agricultural lands of the basin and estimates of the irrigable lands and their water requirements. Chapters are devoted to the present status of irrigation; present flood control plans and the effect of the reservoirs of the State Water Plan in increasing flood protection; the present status of navigation and the improvements that would be possible with the State Water Plan; and the present power developments in the State, the estimated rates at which additional electric energy could be absorbed and the value of the energy developed at each power plant of the State Water Plan in the Sacramento River Basin.

The major units of the plan in the Sacramento River Basin are described in some detail and estimated costs for their construction are presented. A recommendation of a first unit for construction in the development is made and an analysis of the accomplishments of this unit is given. An analysis is also presented of the accomplishments of all of the major units of the plan in the basin operated coordinately with those in the San Joaquin River Basin.

The Romans had a system of traffic regulation which might seem harsh to some truckers who often seek special permission to haul over-size loads on the State highways, but it certainly was effective, comments a Minnesota Highway Department bulletin.

The Romans controlled the size of loads over their famous highways by erecting heavy stone columns on each side of the roads at strategic points. Then if a carter tried to put on too wide a load, he simply could not get past these barriers.

Vital Statistics on Dam Applications and Improvements

APPLICATIONS FILED

Applications for approval of plans and specifications for construction or enlargement of dams filed with the State Department of Public Works, Division of Water Resources, during the month of April, 1933.

ORANGE COUNTY—Veeh Dam No. 796. Geo. H. Vee, Santa Ana, owner; earth, 20 feet above stream bed with a storage capacity of 46 acre-feet, situated on unnamed gulch tributary to Newport Bay in Sec. 25, T. 6 S., R. 8 W., S. D. B. and M. For storage and diversion purposes for irrigation and domestic use. Estimated cost \$3,000; fee paid \$30.

STANISLAUS COUNTY—Modesto Dam No. 25. City of Modesto, Modesto, owner; timber-collapsible weir, 8 feet above stream bed with a storage capacity of 670 acre-feet, situated on Tuolumne River in Sec. 32, T. 8 S., R. 9 E., M. D. B. and M. For storage purposes for recreational use. Estimated cost \$10,000; fee paid \$100.

LASSEN COUNTY—Kramer Dam No. 156-6. G. L. Kramer, Belber, owner; rock and earth fill 16 feet above stream bed with a storage capacity of 103 acre-feet, situated on Widow Valley Creek in Sec. 30, T. 35 N., R. 7 E., M. D. B. and M. For storage purposes for irrigation use. Estimated cost \$1,500; fee paid \$20.

Application for approval of plans and specifications for repair or alteration of dam filed with the State Department of Public Works, Division of Water Resources, during the month of April, 1933.

ALAMEDA COUNTY—Lower San Leandro Dam No. 31-5. East Bay Municipal Utility District, Oakland, owner; rolled fill, situated on San Leandro Creek tributary to San Leandro Bay.

PLANS APPROVED

Plans and specifications for the construction or enlargement of dams approved by the State Department of Public Works, Division of Water Resources, during the month of April, 1933.

LOS ANGELES COUNTY—Easton Wash Dam No. 32-20. Los Angeles County Flood Control District, Los Angeles, owner; rolled earth fill, 37½ feet above stream bed with a storage capacity of 54 acre-feet, situated on Eaton Wash tributary to Rio Hondo, located in Rancho Santa Anita. For debris storage, flood control and conservation purposes, for storage use.

EL DORADO COUNTY—Fallen Leaf Dam No. 461-2. Mrs. Anita M. Baldwin, Los Angeles, owner; gravity, 9 feet above stream bed with a storage capacity of 6,400 acre-feet, situated on Taylor Creek tributary to Lake Tahoe in Sec. 2, T. 12 N., R. 17 E., M. D. B. and M. For storage and diversion purposes, for power and recreation use.

Plans for the repair or alteration of dams approved by the State Department of Public Works, Division of Water Resources, during the month of April, 1933.

ALAMEDA COUNTY—Lower San Leandro Dam No. 31-5. East Bay Municipal Utility District, Oakland, owner; earth, situated on San Leandro Creek tributary to San Leandro Bay, located in Eden Township.

LOS ANGELES COUNTY—Mulholland Dam No. 6-17. City of Los Angeles, Los Angeles, owner; concrete gravity, situated on Weld Canyon in Sec. 3, T. 1 S., R. 14 W., S. B. B. and M.

An English lesson was being given in a foreign school, and the mistress asked if any pupil could make up a sentence containing the words "defense," "defeat" and "detail."

The sentence she got was as follows:

"Ven a cat jumps over defense defeat goes over in front of detail!"—*The Earth Mover.*

Water Applications and Permits

APPLICATIONS FILED

Applications for permits to appropriate water filed with the Department of Public Works, Division of Water Resources, during the Month of April, 1933.

TRINITY COUNTY—Application 7530. W. P. Anderson and R. L. Chase, c/o H. G. Schlomer, Helena, Cal., for 1.5 c.f.s. from North Fork of Trinity River, tributary to Trinity River, to be diverted in Sec. 24, T. 35 N., R. 12 W., M. D. B. and M. For power purposes (58 horsepower). Estimated cost \$40,000.

TRINITY COUNTY—Application 7531. W. P. Anderson and R. L. Chase, c/o H. G. Schlomer, Helena, Cal., for total of 15 c.f.s. from (1) North Fork of Trinity River, (2) North Fork Gulch, (3) Baxter Gulch, (4) Rapid Gulch, (5) Thurston Gulch, (6) Brown Gulch. (1) is tributary to Trinity River and (2,3,4,5 and 6) are tributary to North Fork Trinity River, to be diverted in (1) Sec. 24, T. 35 N., R. 12 W., (2) Sec. 19, T. 34 N., R. 11 W., (3) Sec. 6, T. 34 N., R. 11 W., (4) Sec. 36, T. 35 N., R. 12 W., (5) Sec. 36, T. 35 N., R. 12 W., (6) Sec. 30, T. 35 N., R. 11 W., M. D. B. and M. For mining purposes. Estimated cost \$40,000.

YUBA COUNTY—Application 7532. James G. Bennett, Route 1, Box 242, Hayward, Cal., for 3 c.f.s. from Campbell's Gulch, tributary to North Fork Yuba River, via Willow Creek, to be diverted in Sec. 1, T. 13 N., R. 8 E., M. D. B. and M. For mining and domestic purposes.

SAN DIEGO COUNTY—Application 7533. James K. Banes, Route 1, Box 399-B, Escondido, Cal., for 16,000 gallons per day and 9.7 acre-feet per annum of storage from unnamed stream, tributary to San Dieguito River, to be diverted in Sec. 18, T. 13 S., R. 1 W., S. B. B. and M. For irrigation and domestic purposes (6 acres). Estimated cost \$600.

PLUMAS COUNTY—Application 7534. Ready Bullion Mining Co., 1801 M Street, Sacramento, Cal., for 2 c.f.s. from Round Lake, tributary to Grey Eagle Creek, thence Middle Fork Feather River, to be diverted in Sec. 18, T. 21 N., R. 12 E., M. D. B. and M. For mining and domestic purposes. Estimated cost \$500.

LAKE COUNTY—Application 7535. John R. Connelly, E. P. Smith and Stephen J. York, c/o John R. Connelly, 326 Oschner Building, Sacramento, Cal., for 0.05 c.f.s. from unnamed stream, tributary to Clear Lake, to be diverted in Sec. 32, T. 15 N., R. 8 W., M. D. B. and M. For domestic purposes.

ORANGE COUNTY—Application 7537. Charles F. Morton, San Juan Capistrano, Cal., for 150 gallons per day from unnamed stream, tributary to Hot Springs Creek, thence San Juan Canyon, to be diverted in Sec. 33, T. 6 S., R. 6 W., S. B. B. and M. For domestic purposes. Estimated cost \$20.

BUTTE COUNTY—Application 7538. M. B. Turner, Elmer Johns, W. A. Dresser and Edith Bell Turner, c/o M. B. Turner, P. O. Box 87, Oroville, Cal., for 3 c.f.s. from Browns Ravine, tributary to Last Chance Creek, thence West Branch of Feather River, to be diverted in Sec. 20, T. 25 N., R. 5 E., M. D. B. and M. For mining and domestic purposes.

LOS ANGELES COUNTY—Application 7539. Imperial Rock Corporation, 3232 East 50th Street, Los Angeles, Cal., for 1.0 c.f.s. from Los Alamos Creek, tributary to Piru Creek, thence Santa Clara River, to be diverted in Sec. 34, T. 7 N., R. 13 W., S. B. B. and M. For industrial purposes.

DEL NORTE COUNTY—Application 7540. L. W. Wilson and W. D. Hill, c/o L. W. Wilson, 2401 W. 6th Street, Los Angeles, Cal., for 100 c.f.s. from Hurdy Gurdy Creek, tributary to South Fork Smith River, to be diverted in Sec. 36, T. 16 N., R. 2 E., and Secs. 1 and 12, T. 15 N., R. 2 E., H. B. and M. For mining and domestic purposes. Estimated cost \$35,000.

EL DORADO COUNTY—Application 7541. B. W. Stone, 161 Ellis Street, San Francisco, Cal., for 500 c.f.s. and 125,000 acre-feet per annum from Rubicon River, Pilot Creek, Gerie Creek, Loon Lake, Buck Island Lake, Rock Bound Lake and Little South Fork Rubicon River, tributary to American River Drainage Arca, to be diverted in Sec. 9, T. 12 N., R. 16 E.;

Sec. 11, T. 12 N., R. 12 E.; Sec. 24, T. 13 N., R. 13 E.; Secs. 1, 31, 34, T. 14 N., R. 14 E.; Sec. 4, T. 13 N., R. 15 E.; Sec. 2, T. 13 N., R. 14 E., M. D. B. and M. For municipal purposes.

PLUMAS COUNTY—Application 7542. S. O. Mitchell, 1499 Chapman Building, Los Angeles, Cal., for 20 c.f.s. from South Fork of Feather River, tributary to Feather River, thence Sacramento River, to be diverted in Sec. 17, T. 22 N., R. 10 E., M. D. B. and M. For mining purposes. Estimated cost \$2,000.

MONO COUNTY—Application 7543. Barney G. Johnson of Mammoth Lakes, Cal., for 1.5 c.f.s. from Cold Creek, tributary to Lake Mary, thence Mammoth Creek and Owens River, to be diverted in Sec. 21, T. 4 S., R. 27 E., M. D. B. and M. For power (0.25 horsepower).

HUMBOLDT COUNTY—Application 7544. Thomas Nelson McDaniel, 2904 4th Avenue, Seattle, Wash., for 200 c.f.s. from Willow Creek, tributary to Trinity River, to be diverted in Sec. 11, T. 6 N., R. 4 E., H. B. and M. For mining and domestic purposes. Estimated cost \$300,000.

HUMBOLDT COUNTY—Application 7545. Frank E. Kelly, Mrs. M. T. Holland, Mrs. J. C. Wallace, Miss Rita Regli and Miss Ella J. Kelly, c/o Frank E. Kelly, Eureka, Cal., for 2 c.f.s. from Mad River, tributary to Pacific Ocean, to be diverted in Secs. 24 and 25, T. 6 N., R. 1 E., H. B. and M. For irrigation purposes (110 acres).

PERMITS ISSUED.

Permits to appropriate water issued by the Department of Public Works, Division of Water Resources, during the month of April, 1933.

NEVADA COUNTY—Permit 4081, Application 6870. Issued to Ruth Properties, Inc., Grass Valley, Cal., March 17, 1933, for 50 second-feet from Steep Hollow Creek, in Secs. 14 and 20, T. 16 N., R. 10 E., M. D. B. and M. For mining purposes. (Omitted from March list).

SAN DIEGO COUNTY—Permit 4089, Application 6649. Issued to Southern California Water Supply Company, 1010 Bank of Italy Building, San Francisco, Cal., April 5, 1933, for 18.6 second-feet from Sweetwater River, in Sec. 17, T. 16 S., R. 2 E., S. B. B. and M. For irrigation and domestic purposes on 5000 acres. Estimated cost \$1,500,000.

ORANGE COUNTY—Permit 4090, Application 7462. Issued to Geo. H. Vech, Route 2, Box 224, Santa Ana, Cal., April 11, 1933, for 46 acre-feet of water for storage from an unnamed gulch in Sec. 29, T. 6 S., R. 8 W., S. B. B. and M. For irrigation and domestic purposes on 43 acres.

PLUMAS COUNTY—Permit 4091, Application 7410. Issued to H. E. Parker, Meadow Valley, Cal., April 13, 1933, for 0.2 second-foot from Little California Creek, in Sec. 5, T. 22 N., R. 8 E., M. D. B. and M. For mining and domestic purposes. Estimated cost \$100.

SAN JOAQUIN COUNTY—Permit 4092, Application 7332. Issued to Gibraltar Development Company, Ltd., 928 Bank of America Building, Stockton, Cal., April 13, 1933, for 50 second-feet from Deane's Ravine and South Fork Canyon Creek, in Sec. 7, T. 21 N., R. 11 E., M. D. B. and M., and Sec. 12, T. 21 N., R. 10 E., M. D. B. and M. For mining purposes. Estimated cost \$150.

BUTTE COUNTY—Permit 4093, Application 7114. Issued to Richvale Irrigation District, Richvale, Cal., April 15, 1933, for 15 second-feet from Dry Creek, in Sec. 6, T. 19 N., R. 2 E., M. D. B. and M. For irrigation purposes on 4200 acres. Estimated cost \$2,000.

VENTURA COUNTY—Permit 4094, Application 7453. Issued to W. E. Matthews, Box 323, Maricopa, Cal., April 18, 1933, for 0.05 second-foot from Blue Rock Spring, in Sec. 20, T. 9 N., R. 23 W., S. B. B. and M. For domestic and irrigation purposes on 3 acres. Estimated cost \$600.

DEL NORTE COUNTY—Permit 4095, Application 7470. Issued to G. M. Willeughby et al., Crescent City, Cal., April 26, 1933, for 3 second-feet from Cedar Springs, in Sec. 36, T. 17 N., R. 2 E., H. M. For mining purposes. Estimated cost \$25.

Value of Preliminary Investigation In Bridge Planning and Construction

By EVERETT L. WALSH, Engineer of Investigation, Bridge Department

TO the casual observer as he sees a contractor start work on a bridge project, the visual evidence symbolizes the actual beginning of all work on the project; to the bridge engineer it is really only the beginning of the end.

What goes on behind the scenes before actual construction work is started?

An important part of the work of the Bridge Department of the Division of Highways is the preliminary investigation which involves the highway bridge surveys and the gathering of pertinent data which are essential before a comprehensive and complete set of plans can be prepared. A lack of adequate information would render useless the refinements of design and structural details found in the modern highway bridge. It is impossible to design the bridge or even to select the economically suitable type of structure without gathering in advance complete and accurate information.

MANY PROBLEMS INVOLVED

Foundation—A structure, no matter how well built it may be, is only as safe as the foundation upon which it rests. Bridges must be built where needed regardless of physical conditions. Situations varying from solid rock to silt two hundred feet or more deep are likely to be encountered.

For example, a bridge now under construction in the northern part of the State presented an interesting problem which hitherto had never been encountered in the annals of bridge building in the State of California. It was necessary to found a major bridge structure upon diatomaceous earth—a silicified, chalk-like material weighing only 51 lbs. per cu. ft.

Samples of this material were obtained and tested for compaction and compressive strength under dry and saturated conditions and the exact bearing value was predetermined. This case shows strikingly that a comprehensive knowledge of the character and location of subsurface strata is of vital importance in order that a structure may be safely and economically designed.

CONDITIONS MUST BE KNOWN

Surface indications are very often deceptive. A casual inspection or superficial exploration might indicate suitable foundation at a shallow depth. However, excavation during construction operations may later disclose a softer underlying material which would require piling or wider footings. The necessary change in plans to meet the actual conditions generally involves expensive work, is bound to cause delay, and may even result in the abandonment of work already completed.

Traffic—A study must be made of the amount, speed, and character of traffic which the bridge will carry. Consideration must be given to geographic location, proximity to towns, the effect of adjoining roads and the need for sidewalks. After careful analyses of all influencing factors a prediction must be made of the maximum traffic that is to be expected during the service life of the structure.

Hydrography—If the bridge is over a stream of any magnitude it is necessary to obtain a complete waterway survey to determine the character of the watershed and stream behavior data. Considerable information is required regarding stream flow data such as rainfall charts, gradient of stream, cross-sectional area of stream at low and high water stages, high water marks, frequency and duration of floods and velocity of current.

STREAM STUDIES

California has many streams which are subject to erratic and unexpected floods. Consequently a complete study of the stream behavior—including the character, direction and velocity of currents at the different water stages, the stream alignment, tendency to scour or erode, necessity for embankment slope protection and the amount of drift the stream carries, must necessarily be obtained to plan intelligently the most economical and suitable structure for the site.

Complete and accurate information regarding the frequency, magnitude and dura-

FOUNDATION SCOUTS

for the San Francisco-Oakland Bay Bridge spent five months making borings of the bay floor from a barge outfit. They made 7,897 feet of jet borings and took 837 feet of rock cores with diamond drills.



tion of floods is essential as in some cases it is not economically justified to design a bridge for very rare floods where considerable cost can be avoided.

Materials—Complete data concerning the availability and cost of construction materials are necessary in order to determine the proper selection of type. For example there are many locations where concrete aggregates are not available in the locality of the proposed site. At such locations the cost of a concrete structure is greatly increased.

DECIDING FACTORS

A reconnaissance must be made of the vicinity and samples obtained of all promising material to determine their suitability. In many outlying districts the transportation facilities, the location of shipping points and the length of haul to the site are the deciding factors in the choice of materials of construction. In certain locations, due to the crooked mountainous roads over which the materials must be hauled, the structural members must be designed in small sections with more field splices detailed than would otherwise be necessary. The source and quantity of water to be used for construction purposes must be ascertained. When no previous knowledge is available regarding the quality of the water, a laboratory analysis is necessary and an estimate must be made of the cost of conveying it to the job.

Special Considerations—A few other factors influencing the design and construction of a bridge are listed which must be predetermined in order to work out properly the most satisfactory solution. Meteorological data involving temperatures, rainfall, snow, ice, fire hazards and drainage considerations



DIAMONDS WERE saved from loss by a drill cage devised to protect the boring equipment.

must be analyzed for various purposes. The details of removing or disposal of all obstructions and the ownership and franchise rights of all private and public utilities occupying the right of way must be ascertained.

DETOURS PLANNED

Details for providing a detour as well as maintaining and protecting traffic must be worked out in advance. It is necessary to predesignate the consideration to be given

Weather a Factor in Bridge Designing

(Continued from page 29)

to esthetic features due to natural scenic conditions and to investigate the effects and action of salt air, alkali, seawater, teredos, termites and marine borers. Special construction methods and the sequence of work are determined in advance of the award of contract so as to plan intelligently for all possible contingencies.

It will be seen that there are many factors involved and much information to be obtained before it is possible to determine the control features and evaluate the tentative type selections in order to decide the kind of construction most suitable to the particular phases implicated.

Type Selection—It has been said that correct type selection is the very keystone of economy. After the controlling features of the problem have been investigated in the field, it becomes necessary to make more detailed economic studies of the various types which are likely to fit the conditions before starting actual detailed design and preparation of plans.

The type which may be constructed with the least amount of money for the first cost of construction may not prove the most economical after computing the annual maintenance cost and the amortization of cost during the service life of the structure—especially after due consideration is given to permanence, weather conditions, fire hazard, esthetics and certain intangible factors influencing the type.

FALSE ECONOMY

There are many types of structures which may be designed to fit almost any site and the failure to investigate thoroughly every phase of the problem usually results in a waste of money far in excess of the comparatively small amount of money spent in preliminary investigation and proper engineering analysis.

All preliminary survey data are made a part of the permanent records which are kept on file for each structure in the State Highway System. During the life of the structure, inspection reports and maintenance records are added to these files. When a structure has reached the end of its service life and it becomes necessary to

replace it, such a complete authentic record is invaluable.

The ultimate object of all the preliminary investigation as described above is to furnish definite information from which a consistent and proper design may be incorporated in an economical and otherwise satisfactory bridge. If, to save money on engineering costs, incomplete preliminary information is secured, the bridge must be designed from assumptions which are quite likely to be incorrect.

FALSE ECONOMY

The designer may work up an accurate design based on a poor "guess" of physical conditions. He may plan the bridge too short, in which case it might be washed out by future floods; may design footings too small, causing settlement; may design the bridge too narrow to provide for future traffic; or to play safe, he may design the bridge with excessive length. In each case there would result an ultimate loss of capital investment.

A thousand dollars spent on preliminary investigation which saves the State a later expenditure of ten thousand dollars increases the engineering costs, but benefits the State to the extent of nine thousand dollars.

No intelligent person would think of allowing a surgeon to cut him up without his first making a complete diagnosis or "preliminary investigation" of the situation. The Bridge Department makes a complete investigation of each bridge site before any design is started, with the result—even though the layman may not know it—that the most suitable and satisfactory bridge is built with a dollar return for every dollar spent.

SPEED TREND TO AFFECT HIGHWAY DEVELOPMENT

Average cruising speed of motor vehicles has increased from about 15 miles per hour in 1902 to approximately 45 miles per hour in 1932, states a report reaching the Automobile Club of Southern California. It is indicated by these figures that the average cruising speed of cars may increase to 70 miles per hour in 1942 and 100 miles per hour in 1952, providing highways are developed to sustain the high speeds at which modern automobiles are capable of traveling, notes the club.

New Alignment to Relieve Congestion in City of Ventura

(Continued from page 17)

and approximately one-half of the \$30,000 which the improvement cost.

On the section of the Oxnard-Serra Highway, between Venice and El Segundo, Los Angeles County desired that a 40-foot pavement on an 80-foot roadbed be placed between Washington Boulevard and El Segundo, while the State's plan for construction on this section of heavily traveled highway had been a 30-foot pavement on a 60-foot roadbed. The need for this type of superhighway was apparent and so, joining forces with Los Angeles County, the Division of Highways constructed the wider pavement, the county bearing one-fourth of the cost.

Similar agreements were made with Los Angeles County for placing 40-foot pavements where this route passes through Redondo Beach and Laguna Beach.

RELIEVES CITY CONGESTION

In the city of Ventura construction on a new alignment of the Coast Route is under way and the State is constructing a new bridge on this revised alignment across the Ventura River. The new alignment of this important arterial will follow along Meta Street from Peking to West Hemlock streets and the 56-foot width of pavement between curbs will relieve the congestion of traffic which has long been felt at this point. In addition to constructing the new bridge at the northerly city limits of Ventura, the State is cooperating with the city and county by providing thirty fifty-sixths ($\frac{30}{100}$) of the construction costs, an amount of approximately \$150,000.

The largest single cooperative project involves the construction of the Coast Route along new alignment through the undeveloped areas within the city limits of San Diego. This project includes many contracts, both city and State, and construction is being spread over a period of years.

The State's share in this improvement during the current biennium has included seven contracts under which 7.3 miles of pavement have been placed, 4.4 miles of roadbed are being graded and three bridges and one grade separation are now under construction. These seven State contracts amount to approximately \$550,000. The city of San Diego has cooperated in providing the right of way and for certain portions of the work.

Bids and Awards of Contracts Made on Highway Projects

CONTRA COSTA COUNTY—Oiling roadside vegetation, approximately 19.1 miles. District IV, Mt. Diablo Park Roads. Basalt Rock Co., Inc., Napa, \$3,596; Oilfields Trucking Co., Bakersfield, \$3,850; Highway Builders, Ltd., San Anselmo, \$4,225; Lee J. Immel, Berkeley, \$3,687; A. Teichert & Son, Inc., Sacramento, \$4,300; C. F. Frederickson & Sons, Lower Lake, \$3,500; A. Mitchell, Sacramento, \$4,350; U. B. Lee, San Leandro, \$2,950. Contract awarded to Pacific Truck Service, Inc., San Jose, \$3,475.

FRESNO COUNTY—Between Church Avenue and California Avenue in Fresno, about 0.7 mile to be graded and paved with asphalt concrete. District VI, Route 4, Section B. Valley Paving and Construction Co., Fresno, \$22,789. Contract awarded to Union Paving Co., San Francisco, \$31,543.

KERN COUNTY—Between Oak Glen and one mile north of Grapevine Station, about 3.7 miles to be graded and paved with Portland cement concrete. District VI, Route 4, Section A. Basich Bros., Torrance, \$330,762; George Pollock Co., Sacramento, \$415,768; Granfield, Farrar & Carlin, San Francisco, \$372,790; Weymouth Crowell Co., and E. Penn Watson, Jr., Los Angeles, \$387,244; Von der Hellen & Pierson, Castiac, \$356,111; W. E. Kier Construction Co., San Diego, \$513,451; Hanrahan Company and J. P. Holland, Inc., San Francisco, \$360,818; Frederickson & Watson Construction Co., and Frederickson Bros., Oakland, \$382,820; Jahn & Bressi Construction Co., Inc., Los Angeles, \$361,439. Contract awarded to Griffith Company, Los Angeles, \$355,327.

MENDOCINO COUNTY—Oiling about 15.7 miles between McDonald and Boonville. District IV, Route 48, Section A. Oilfields Trucking Co., Bakersfield, \$4,550; C. F. Frederickson & Sons, Lower Lake, \$4,095; Pacific Truck Service, Inc., San Jose, \$4,077; Peninsula Paving Co., San Francisco, \$4,322; Hein Bros., Basalt Rock Co. and A. Helwig, Petaluma, \$4,445; Highway Builders, Ltd., San Anselmo, \$4,375. Contract awarded to Chas. Kuppinger, Lakeport, \$3,850.

PLACER COUNTY—Between Gold Run and Airport, 11.5 miles in length to be surfaced with bituminous crushed gravel or stone. District III, Route 37, Sections C, D and E. M. J. Bevanda, Stockton, \$173,014; Central States Contracting Co., Oakland, \$162,253; A. Teichert & Son, Inc., Sacramento, \$139,393; Hein Basalt Rock Co., Petaluma, \$167,948; N. M. Ball, D. McDonald, E. B. Bishop, Sacramento, \$175,953; Hemstreet & Bell, Marysville, \$166,335; Frederickson & Watson Construction Co., Oakland, \$135,337; Union Paving Co., San Francisco, \$158,094. Contract awarded to Peninsula Paving Co., San Francisco, \$132,831.

SANTA BARBARA COUNTY—An overhead crossing over the Southern Pacific Company's tracks at Elwood consisting of one 68-foot 8-inch deck plate girder span, four 30-foot reinforced concrete girder spans and two 20-foot reinforced concrete girder spans. District V, Route 2, Section G. Weymouth Crowell Co., Los Angeles, \$34,833; Associated Construction, Inc., Los Angeles, \$28,352; Neves & Harp, Santa Clara, \$29,341; Clark & Campbell, Los Angeles, \$28,577; J. E. Haddock, Ltd., Pasadena, \$30,861; Dimmitt & Taylor, Los Angeles, \$34,429; Oberg Bros., Los Angeles, \$28,975; Sam Sciarino, San Jose, \$33,330; Artukovich Bros., Hynes, \$31,425; R. R. Bishop, Long Beach, \$31,336; Rodenhamer Construction Co., Oakland, \$29,893. Contract awarded to M. B. McGowan, San Francisco, \$28,158.

SANTA CRUZ COUNTY—Oiling as a dust palliative, approximately 7 miles, between Slippery Rock Maintenance Station and Waterman Switch. District IV, Route 42, Section A. Pacific Truck Service, Inc., San Jose, \$1,757; Granite Construction Co., Ltd., Watsonville, \$1,767; Oilfields Trucking Co., Bakersfield, \$1,748; A. Mitchell, Sacramento, \$2,280; Peninsula Paving Co., San Francisco, \$1,672; U. B. Lee, San Leandro, \$2,850. Contract awarded to L. A. Brisco, Arroyo Grande, \$1,662.

TUOLUMNE AND MARIPOSA COUNTIES—Twenty-six miles of existing roadbed to be treated with fuel oil and asphalt road oil as dust palliatives. District X, Routes 49 and 18, Sections B, C, D, E, F and A. Oilfields Trucking Co., Bakersfield, \$8,655.

(Continued on page 32)

Contractors' License Fee Reduced 50% By Legislative Act

LEGISLATION reducing the license renewal fee of California contractors 50 per cent and providing for tightening of the State Contractors' Act was enacted into law May 26th with the approval by Governor James Rolph, Jr., of Assembly Bill No. 780.

Under provisions of the measure, the fee for renewal of licenses for the new fiscal year beginning July 1 will be cut from \$10 to \$5.

This economy measure, it is expected, will result in a saving of more than \$115,000 for California's army of 23,000 registered contractors. The measure carried an urgency clause, making it effective immediately upon approval by the Governor.

In addition to providing a reduction in the fee, the measure provides for tightening the provisions of the act and also more stringent regulation of the unscrupulous or unethical fly-by-night contractor or "jerry builder," according to Col. Carlos W. Huntington, Registrar of Contractors and Director of Professional and Vocational Standards. The measure will in no way interfere with the legitimate operations of the honest and reputable contractor, Registrar Huntington said.

The measure retains the present \$200 exemption clause, a move to reduce this to \$50 having been defeated on the floor of the Senate and Assembly.

MIXTURE TESTS DEVELOPED

(Continued from page 22)

the percentage of separation that results after the water has thoroughly soaked the mixture.

Oil contents are set from a series of curves relating oil to surface area as determined by a grading analysis; the individual curve for any material being selected by laboratory tests in advance of field design.

Finishing—Some improvement was made in the manner of finishing oil mixtures during the past season. It was found desirable to hold in reserve a small amount of uncompressed material, in order to feed it in during the blading and rolling of the finished road surface. This method has been instrumental in improving the riding qualities of this type of road.

Slurry Base—The so-called slurry type base course has become standard practice where crushed material must be provided for base for oil mixtures. Where suitable cementing material is available locally, it is applied direct without crushing, and processed in place. Comparative roughness shows that care in preparing the base is reflected in the riding qualities of the completed oil mix.

In Memoriam

WILLIAM L. KRASEVAC, an employee of District III, Division of Highways, suffered a fatal accident on Thursday, March 30, that resulted in his death about twelve hours later, bringing sorrow to his family in Grass Valley, to his coworkers, and to his many friends outside of State service.

Mr. Krasevac was assisting J. C. Womack, Location Engineer, in obtaining topographical data with respect to reconstruction of the State highway between Folsom and Placerville. Shortly after Mr. Womack had recorded an estimated clearance between the ground at the survey center line and the lowest wires of a high tension power line crossing the survey, he heard an electric explosion behind him, and turning, saw Mr. Krasevac lying unconscious on the ground with his clothes ablaze and a solid sheet of flame between the wires and Krasevac's body.

A cloth tape, with metallic reinforcement, which he is believed to have been using in an attempt to measure the clearance distance, created a contact between the power line and his body, causing burns which later resulted in his death, in spite of the flames being beaten out at once by Mr. Womack and prompt surgical and hospital aid being rendered. The exact cause of the accident, however, will never be known, for he was unconscious from the time of the tragedy until his death.

The deceased had been with the Division of Highways for the past three years, during which time, by his industry, capability, and fine disposition, he had earned the high regard of his fellow workers.

He was 23 years old, the son of Mr. and Mrs. Lawrence Krasevac, of Grass Valley, and is survived, in addition to his parents, by three brothers and three sisters, all living in Nevada County.

BIDS AND AWARDS OF CONTRACTS

(Continued from page 31)

Contract awarded to C. F. Frederickson & Sons, Lower Lake, \$7,391.

VENTURA COUNTY—Between Oxnard and Santa Clara River Bridge, 2.3 miles of earth shoulders to be treated. District VII, Routes 2 and 60, Sections C. B. Jacob P. Immel, Ventura, \$2,860; Santa Maria Construction Co., Santa Maria, \$2,686; Square Oil Co., Los Angeles, \$2,890; L. A. Briscoe, Arroyo Grande, \$3,043; Western Motor Transfer, Inc., Santa Barbara, \$3,230; Oilfields Trucking Co., Bakersfield, \$3,757. Contract awarded to Southwest Paving Co., Los Angeles, \$2,534.

ARCHITECTURAL AWARDS

LOS ANGELES STATE BUILDING—Contract for installing passenger elevator, awarded to Consolidated Steel Corporation for \$23,000.

SAN QUENTIN STATE PRISON—Contract for installing water tube boiler to California Steel Products Co., for \$10,477.

SAN JOSE ARMORY—Contract for general work to Wm. Spivock for \$33,565; contract for electrical work to Coast Electric Service, Inc., for \$1,238; contract for plumbing and heating to Wm. F. Serpa for \$2,923.

STATE OF CALIFORNIA
Department of Public Works

HEADQUARTERS: PUBLIC WORKS BUILDING, ELEVENTH AND P STS., SACRAMENTO

JAMES ROLPH, JR.-----Governor
EARL LEE KELLY-----Director
ERIC CULLENWARD-----Deputy Director

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CALIFORNIA HIGHWAY COMMISSION

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C. S. POPE, Construction Engineer
T. H. DENNIS, Maintenance Engineer
F. W. PANHORST, Acting Bridge Engineer
R. H. STALNAKER, Equipment Engineer
E. R. HIGGINS, Comptroller

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F. W. HASELWOOD, District II, Redding
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L. H. GIBSON, District V, San Luis Obispo
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S. V. CORTELYOU, District VII, Los Angeles
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Eleventh and P Streets, Sacramento, California

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A. D. EDMONSTON, Deputy in Charge Water
Resources Investigation
R. L. JONES, Deputy in Charge Flood Control and
Reclamation

GEORGE W. HAWLEY, Deputy in Charge Dams
SPENCER BURROUGHS, Attorney
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struction
W. H. ROCKINGHAM, Principal Mechanical and
Electrical Engineer

**DIVISION OF CONTRACTS AND
RIGHTS OF WAY**

C. C. CARLETON, Chief
FRANK B. DURKEE, General Right of Way Agent
C. R. MONTGOMERY, General Right of Way Agent

DIVISION OF PORTS

Port of Eureka—William Clark, Sr., Surveyor
Port of San Jose—Not appointed
Port of San Diego—Edwin P. Sample

