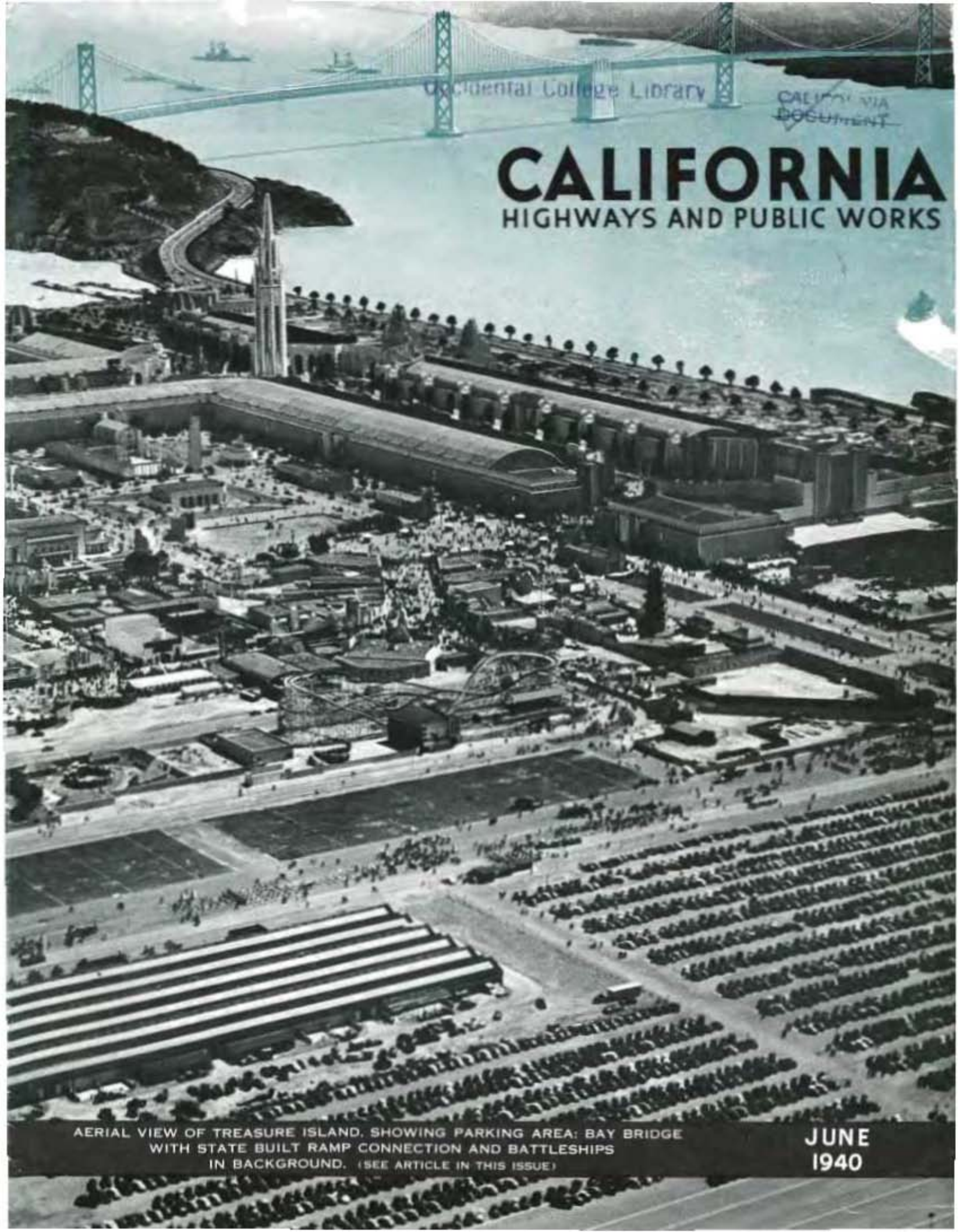


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# CALIFORNIA

## HIGHWAYS AND PUBLIC WORKS



AERIAL VIEW OF TREASURE ISLAND, SHOWING PARKING AREA; BAY BRIDGE  
WITH STATE BUILT RAMP CONNECTION AND BATTLESHIPS  
IN BACKGROUND. (SEE ARTICLE IN THIS ISSUE)

JUNE  
1940

# CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

FRANK W. CLARK, Director

C. H. PURCELL, State Highway Engineer

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Cuts will be gladly loaned upon request Address communications to California Highways and Public Works, P. O. Box 1499, Sacramento, California

Vol. 18

JUNE, 1940

No. 6

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# State Negotiating to Buy the Carquinez and Antioch Toll Spans Both on State Highways

By FRANK W. CLARK, Director of Public Works

**P**REDICATING its action upon an act passed by the Legislature in 1937, the California Toll Bridge Authority in conformity with the wishes of Governor Culbert L. Olson, its chairman, has submitted to the American Toll Bridge Company an offer to purchase the Carquinez and Antioch bridges.

The Board of Directors of the company has voted to accept the proposal and will submit it to its stockholders for approval. Negotiations for State ownership and operation of the two spans are proceeding as rapidly as is consistent with proper safeguarding of public interests involved in the deal.

While the State's offer has been approved by the directors of the Toll Bridge Company and awaits action by the stockholders, all phases of the proposed purchase will be given thorough consideration by the Department of Public Works and all problems connected therewith adjusted before any deal is consummated.

Final steps in the present negotiations will be subject to approval by the Toll Bridge Authority.

Shortly after taking office, Governor Olson took up with me the matter of the acquisition by the State of the Carquinez and Antioch bridges. The Governor was prompted by widespread dissatisfaction over the high tolls charged motorists for use of the Carquinez span and his firm conviction that toll bridges on State highways should be eliminated.

## PROPOSITION SUBMITTED

On May 9, I submitted to the California Toll Bridge Authority a proposal that the State issue, under the California Toll Bridge Authority Act, revenue bonds in the sum of \$6,850,000 for purchase of the American Toll Bridge Company's properties, including the Martinez-Benicia Ferry which



FRANK W. CLARK

operates across Suisun Bay. This amount of money would provide sufficient funds to buy the bridges, cover acquisition costs, and give the Authority a cash reserve of \$350,000.

At that time I expressed the belief that the present automobile toll on the Carquinez and Antioch bridges of 45 cents per car, 5 cents for the driver and 5 cents for each additional passenger could be reduced under State ownership to a flat rate of 25 cents per car, the same toll to apply to commercial vehicles of not more than 3000 pounds weight. I also estimated that under State operation of the structures the motoring public using the bridges would benefit between now and the expiration in 1948 of the span franchises held by the American Toll Bridge Company to the extent of ap-

proximately \$4,000,000 through lowered tolls.

## PROPOSAL APPROVED

The Toll Bridge Authority unanimously approved my proposal and a formal offer to purchase was submitted to the American Toll Bridge Company, the directors of which, on May 21, voted to accept the State's offer.

In presenting my proposal to the Authority, I cited section 1 of the California Toll Bridge Authority Act, which declares it to be the policy of the State of California to acquire and own all the toll bridges situated upon or along any part of the highways of the State with the end in view of ultimately eliminating all toll charges thereon.

I also called attention to the fact that the California Toll Bridge Authority and the State Department of Public Works were authorized by an act of the Legislature in 1937 to acquire by purchase or by eminent domain the Carquinez and Antioch bridges.

## NO PROGRESS MADE

Since enactment of the California Toll Bridge Authority Act of 1929, no definite progress has been made by responsible State agencies to make effective, in so far as the Carquinez and Antioch bridges are concerned, the policy of the State of California with respect to toll bridges or to take advantage of the enabling provisions of the Act of 1937, empowering the Authority and the Department of Public Works to acquire the Carquinez and Antioch bridges.

To enable the State to acquire the Carquinez and Antioch spans, I proposed to the Authority the issuance of one- to fifteen-year serial bonds with all maturities beyond the seventh year of maturity being subject to call and redemption at any time. I am



Privately owned Carquinez Toll Bridge across the Straits of Carquinez on State Highway Route 7, U. S. 40.

convinced that the cost of the bridges will be amortized and paid and the structures made toll-free highways within approximately the same period of time as would be the case under the existing franchises held by the American Toll Bridge Company.

#### IN THE PUBLIC INTEREST

It is my considered judgment that public interest and necessity require the immediate purchase of these bridges by the State. Following the action of the Toll Bridge Authority in directing me to enter into negotiations with the American Toll Bridge Company, two questions having to do with State ownership of the bridges and which required investigation were raised. On May 21, officials of Contra Costa, Solano and Sacramento counties, meeting with me in Sacramento, requested an opinion as to whether the State, in the event it purchased the bridges, would continue to pay to the three counties until 1948 the taxes they now receive annually from the American Toll Bridge Company un-

der their franchise rights.

The proposal to acquire the properties of the American Toll Bridge Company contemplates the setting aside of \$44,000 a year from bridge revenues for payment of taxes to the three counties involved for the remaining life of the franchises, provided the State is legally bound to pay these taxes.

#### QUESTION OF PROPERTY RIGHT

It is the view of the Legal Division of the Department of Public Works that the property right of the American Toll Bridge Company in the Carquinez Bridge is not ownership of the physical structure, i.e., the bridge, itself, but rather the right to take tolls for the remaining period of the franchise, that is, until March 7, 1948.

I have asked Attorney General Earl Warren for a ruling on the question of whether the State will, in the event it buys the Carquinez and Antioch bridges, be legally obligated to continue tax payments to Contra Costa, Solano and Sacramento counties.

On May 26, I met in Martinez with officials of that city and of Benicia and Contra Costa and Solano counties to discuss the question of the future of the Martinez-Benicia Ferry following State purchase of the American Toll Bridge Company properties.

#### WANT FERRY CONTINUED

Citizens and civic groups of Martinez, Crockett, Benicia, Vallejo, and of Contra Costa and Solano counties had requested assurances from Governor Olson, the Toll Bridge Authority and myself that the ferry service would not be abandoned if the State acquired the bridges and the ferry.

In order to determine what action the State should take with respect to the Martinez-Benicia ferry, I directed the Division of Highways to institute on May 28 a traffic count on the Martinez-Benicia Ferry to ascertain the origin, destination and amount of traffic using the ferry. This count was made over a seven-day period. Our analysis of the survey will assist us in determining whether continu-

ance of the ferry service is necessary in the public interest and whether such continuance would seriously affect anticipated revenues of the Carquinez Bridge.

The Carquinez Bridge crosses the straits of Carquinez between Crockett and Vallejo and is a link in the State Highway System, being an integral part of U. S. 40, State Route 7. It is a section of the main highway route which connects the East Bay District with highways leading to the Napa and Sacramento valleys and the Redwood Empire. It is a steel cantilever structure consisting of two 1100-foot cantilever spans, two 500-foot anchor spans, a 150-foot tower span, and 1132 lineal feet of viaduct at its southerly end, making a total bridge length of 4482 feet.

#### ON ALTERNATE ROUTE

The Antioch Bridge crosses the San Joaquin River about four miles east of Antioch on State Route 11, which runs along the Sacramento River providing an alternate route to the East Bay. It consists of one 320-foot steel lift span and one 320-foot fixed span, 2078 lineal feet of steel deck truss span on towers and 1921 lineal feet of reinforced concrete pile trestle, making a total bridge length of 4639 feet.

The Martinez-Benicia Ferry Co.,

whose stock is owned by the American Toll Bridge Company, operates ferries across Suisun Bay connecting county highways in Solano and Contra Costa counties and affording an alternate route between the Bay district and the Sacramento Valley. It competes to some extent with the Carquinez and Antioch bridges.

On February 5, 1923, the board of supervisors of Contra Costa County granted a 25-year franchise to construct and operate the Carquinez Bridge. Construction work was started in April, 1923, and the bridge was opened to traffic on May 21, 1927.

#### FRANCHISE GRANTED

On June 4, 1923, a 25-year franchise was granted by Contra Costa County to construct and operate the Antioch Bridge and this span was opened to traffic on January 1, 1926.

The franchise granted to the American Toll Bridge Company for the Carquinez Bridge will expire on March 7, 1948, at which time the structure, if not acquired by the State, shall become the property of Contra Costa and Solano counties and, because it is on a State highway route, presumably would become a free bridge and a part of the State Highway System.

Under an act passed by the 1937

Legislature, toll bridges were designated as public utilities. This act became effective on August 27, 1937, and under it the State Railroad Commission acquired jurisdiction to fix rates of toll bridges such as the Carquinez Bridge.

#### COMMISSION INVESTIGATION

Immediately after the effective date of this law, the Railroad Commission instigated, on its own motion, an investigation of the tolls being charged on the Carquinez Bridge. The taking of testimony covered a period of several months, during which the entire history of the bridge, particularly the financing thereof, the returns from tolls and probable future earnings, were gone into exhaustively by the Commission.

The Commission made its decision on February 6, 1938, by which it reduced the charge on the Carquinez span per vehicle from sixty cents to forty-five cents and reduced the charge per passenger from ten cents to five cents. The validity of the Commission's action was attacked by the American Toll Bridge Company in a proceeding before the Supreme Court of California. This tribunal upheld the ruling of the Commission.

The Supreme Court of the United States granted a review of the deci-



Privately owned Antioch Toll Bridge across the San Joaquin River on State Highway Route 11 near Antioch, Contra Costa County.

sion of the State court. But again the validity of the legislation placing the bridge under the regulation of the Commission as a public utility and of the order of the Commission reducing tolls was upheld in a decision rendered June 5, 1939.

The statement I made to the California Toll Bridge Authority is as follows:

May 8, 1940

California Toll Bridge Authority  
Sacramento  
California

Gentlemen:

Section 1 of the California Toll Bridge Authority Act reads: "It is hereby declared to be the policy of the State of California to acquire and own all toll bridges situated upon or along any part of the highways of the State, with the end in view of ultimately eliminating all toll charges thereon."

SECTION 1 OF CHAPTER 927, STATUTES OF 1937, READS: "THE CALIFORNIA TOLL BRIDGE AUTHORITY AND THE STATE DEPARTMENT OF PUBLIC WORKS ARE HEREBY AUTHORIZED AND EMPowered TO ACQUIRE BY PURCHASE OR BY EMINENT DOMAIN THAT CERTAIN PRIVATELY OWNED TOLL BRIDGE KNOWN AS CARQUINEZ BRIDGE, NEAR CROCKETT, CALIFORNIA, AND THAT CERTAIN PRIVATELY OWNED TOLL BRIDGE ACROSS THE SAN JOAQUIN RIVER CONNECTING THE COUNTIES OF SACRAMENTO AND CONTRA COSTA, COMMONLY KNOWN AS THE ANTIOCH BRIDGE, OR EITHER OF THEM."

The California Toll Bridge Authority Act was passed by the Legislature in 1929. The act authorizing acquisition by the State of the Carquinez and Antioch bridges was passed by the Legislature in 1937.

Since 1929 no definite progress has been made by responsible State agencies to make effective in so far as the Carquinez and Antioch bridges are concerned the policy of the State of California with respect to toll bridges or to take advantage of the enabling provisions of the Act of 1937 empowering this Authority and the State Department of Public Works to acquire the Carquinez and Antioch bridges.

It is, therefore, with a deep sense of personal satisfaction that, in line with the wishes of Governor Culbert L. Olson, I submit to you herewith a recommendation that in accordance with procedure provided by law the Department of Public Works be authorized to institute the necessary legal proceedings to acquire from the American Toll Bridge Company for State ownership and operation both the Carquinez Bridge and the Antioch Bridge, which are privately owned and operated as toll bridges on State highways.

The record shows that for many years there has been a continuing public demand and sporadic legislative agitation for the State of California to relieve the

motoring public of the high tolls which have been charged for the use of these two waterway spans.

The files of the State contain innumerable reports of investigations, surveys and studies with respect to these two American Toll Bridge Company properties (the Carquinez Bridge in particular) made by State employees upon order of the Legislature and executive officials in previous administrations, but I find no record of any definite or serious negotiations having been undertaken to eliminate the financial barriers to public travel on State Highway Route No. 7 as represented by the Carquinez Bridge and on State Highway Route No. 11 as represented by the Antioch Bridge. The Carquinez Bridge especially is an important link of the State Highway System, carrying a large volume of motor vehicle traffic from the Sacramento Valley to the Bay District.

Private toll bridges do not properly fit into our present State Highway System. Conceding that these toll bridges were constructed under old statutory authority, and allowing for factors existing at the time of their construction but which now are non-existent, it is clear that the demands of a modern State Highway System require their prompt elimination.

THE PRESENT ADMINISTRATION OF THE STATE OF CALIFORNIA IS VITALLY INTERESTED IN FURNISHING HIGHWAY FACILITIES FOR PUBLIC USE AT THE MINIMUM OF PERSONAL INCONVENIENCE AND EXPENSE. I NEED ONLY CITE THE EFFORTS OF GOVERNOR OLSON AND MEMBERS OF THIS CALIFORNIA TOLL BRIDGE AUTHORITY IN REDUCING TOLLS ON THE SAN FRANCISCO-OAKLAND BAY BRIDGE, FIRST FROM FIFTY CENTS TO FORTY CENTS PER PASSENGER CAR, THEN FROM FORTY CENTS TO THIRTY-FIVE CENTS, AND NOW FROM THIRTY-FIVE CENTS TO THIRTY CENTS, AS STRIKING EVIDENCE OF WHAT CAN BE ACCOMPLISHED BY PUBLIC OFFICIALS WORKING IN THE PUBLIC INTEREST. IN SHARP CONTRAST IS THE RECORD OF PRIVATELY OWNED AND OPERATED TOLL BRIDGES, THE TOLL CHARGES ON WHICH HAVE BEEN PROVOCATIVE OF WIDE DISSATISFACTION.

IT IS IN KEEPING WITH GOVERNOR OLSON'S POLICY OF FURTHERING PUBLIC OWNERSHIP THAT HIS ADMINISTRATION SHOULD, AFTER YEARS OF PROCRASTINATION IN THIS MATTER, OFFICIALLY INITIATE ACTION TO ACQUIRE THE CARQUINEZ AND ANTIOCH BRIDGES IN THE NAME OF THE CALIFORNIA TOLL BRIDGE AUTHORITY FOR THE PEOPLE OF THE STATE OF CALIFORNIA.

Preliminary and informal exchanges of ideas between the American Toll Bridge Company and the Department of Public Works have resulted in a tentative agreement as to the best method of establishing a monetary value on these bridges that will be most compatible with the greatest

public benefit and without unnecessary injury to any private investor.

The present toll charges on the Carquinez and Antioch bridges are 45 cents per car plus 5 cents for the driver and 5 cents for each passenger, or an average rate of over 55 cents for each car.

ACQUISITION OF THE CARQUINEZ AND ANTIOCH BRIDGES BY THE STATE ON THE BASIS PROPOSED IN THE ACCOMPANYING REPORT OF THE DEPARTMENT OF PUBLIC WORKS WILL IMMEDIATELY PERMIT OF THE REDUCTION OF AUTOMOBILE TOLLS TO 25 CENTS PER CAR, INCLUDING FIVE PASSENGERS. THIS RATE WILL APPLY TO COMMERCIAL VEHICLES UNDER THREE THOUSAND POUNDS WEIGHT. THEREFORE, WHAT WE PROPOSE IS A REDUCTION OF OVER 50 PER CENT IN TOLLS ON THE CARQUINEZ AND ANTIOCH BRIDGES; I.E., FROM A PRESENT AVERAGE OF OVER 55 CENTS PER CAR TO 25 CENTS PER CAR.

THE PRIVATE TOLL COLLECTING FRANCHISES HELD BY THE CARQUINEZ AND ANTIOCH BRIDGES EXPIRE ON MARCH 4 AND JULY 4, 1948, RESPECTIVELY.

IT IS ESTIMATED THAT UNDER STATE OWNERSHIP OF THESE STRUCTURES, THE MOTORING PUBLIC USING THE BRIDGES WILL BENEFIT BETWEEN NOW AND THE EXPIRATION OF THE FRANCHISES TO THE EXTENT OF APPROXIMATELY \$4,000,000 IN SAVINGS ON BRIDGE TOLLS.

It is further estimated that the cost of the bridges will be amortized and paid and the structures made toll-free highways within approximately the same period of time as would be the case under the existing franchises held by the American Toll Bridge Company.

This is a most conservative estimate as it is based upon actual 1939 traffic and reflects the difference between the present automobile toll and the proposed rate of 25 cents. It makes no allowance for any increased traffic resulting from the substantial toll cut. On the basis of the actual traffic experience of the last six months, a saving to the motoring public of some \$4,000,000 will be effected in the approximate nine-year period required to make the bridges toll-free.

The indicated savings are arrived at after including the cost of paying off the revenue bonds issued to acquire the bridges, including all interest, as well as all other costs.

A one-to-fifteen-year serial bond issue, with all maturities beyond the seventh year of maturity being subject to call and redemption at any time, is proposed as the best method to acquire these bridges. One important reason for a one-to-fifteen-year callable serial bond issue is that it will enable the Toll Bridge Authority in the future either to order a further reduction of tolls or make more rapid payment of bonds by calls ahead of maturity. However, based upon my study and knowledge of the situation, it is my recommendation that any future reductions

of tolls be confined to those made possible by reason of increased traffic over the bridges and additional revenues resulting therefrom. This, of course, would justify lower tolls and at the same time result in a toll-free bridge at no further extended date.

**IT IS MY OPINION THAT THE ISSUANCE AND SALE BY THE CALIFORNIA TOLL BRIDGE AUTHORITY OF \$6,850,000 PAR VALUE OF REVENUE BONDS WILL PROVIDE SUFFICIENT FUNDS TO PURCHASE THE BRIDGES AT A COST OF \$6,480,000, TO COVER CERTAIN INCIDENTAL ACQUISITION COSTS AND TO PROVIDE A CASH RESERVE FUND OF \$350,000.**

As is indicated by Exhibit C attached to and made a part of the Determination Order of the Department of Public Works relating to the Carquinez Bridge and the Antioch Bridge, the expected future traffic over these structures will provide ample revenues for all revenue bond service charges (interest and amortization of said bonds) within a period conservatively estimated at nine years.

Based upon actual 1939 traffic and after allowing for all operating expenses (including an allowance for 2 per cent gross earnings tax, franchise tax and personal property tax) the net earnings under public ownership by the State will permit—

(a) The financing of acquisition costs by the issuance of revenue bonds payable solely from earnings;

(b) The retirement of the revenue bonds, principal and interest in full in a period of time closely comparable to the remainder of time the present franchises exist to collect private tolls;

(c) The application of additional income resulting from the increase in traffic due to the further lowering of toll charges or to the more rapid retirement of the bond issue.

It is entirely proper for me to state that in addition to personally reviewing the work of our own experts, I have secured the advice and opinion of independent investment bankers by whom I am assured that the California Toll Bridge Authority will be able to finance the cost of the acquisition of the Carquinez Bridge and the Antioch Bridge by the issuance of revenue bonds bearing interest at not more than 3 per cent and that the cost to the State of these structures can be paid entirely from toll revenues.

I am convinced that the sum of \$6,480,000 would be a fair price to the stockholders of the American Toll Bridge Company and a fair and advantageous price to the State.

Adding to this sum approximately \$20,000 for expenses incidental to acquisition and financing, together with a reserve

fund of \$350,000, it would require, I repeat, a bond issue of \$6,850,000 to entirely consummate the proposed purchase.

The \$350,000 reserve fund is not to be regarded as an increase in the purchase price, as the California Toll Bridge Authority will retain this amount in cash.

I respectfully suggest that you authorize me, as Director of the Department of Public Works, to offer this price for the bridge properties of the American Toll Bridge Company which offer, I have reason to believe, if made at this time, will be acceptable.

I submit this report and recommendation to you with a feeling of personal satisfaction. I am proud to have been a party to the creation and development of this opportunity for public service to the people. With Governor Olson, I have every reason to believe that acquisition by the State of California of the Carquinez Bridge and the Antioch Bridge can be consummated if steps to that end are promptly taken by the California Toll Bridge Authority.

It is my considered judgment that public interest and necessity require the immediate purchase of these bridges by the State and as Director of the Department of Public Works I so recommend to you.

Respectfully yours,

**FRANK W. CLARK,**  
Director of Public Works.

## Bridge Company Accepts State Offer to Buy Spans

Director of Public Works Frank W. Clark received the following letter from the American Toll Bridge Company under date of May 21, 1940, accepting his proposal for State purchase of the Carquinez and Antioch bridges:

"The American Toll Bridge Company has received your offer dated May 9, 1940, to purchase the Carquinez and Antioch Toll Bridges and certain related assets, for a price of \$6,480,000, which you advise is subject to the ability to finance the bonds to be issued and the final approval of the offer by the California Toll Bridge Authority.

"It has always been the policy of this Company to cooperate with any program directed toward public ownership of these toll bridges which will result in lower tolls to the traveling public. The Company's opportunity to recoup its capital investment being limited by the expiration of its franchises in 1948, prevented voluntary reduction of tolls on its part. Under the circumstances as they now exist your offer of \$6,480,000 is acceptable to the Board of Directors of this Company and the Board will recommend to the stockholders of this Company that they approve that price.

"The Company, upon approval of its stockholders, stands ready to convey to you all of its title and interest to the bridges and the related assets covered by your offer. The Company believes that it can convey to the State full and complete rights and titles necessary to public ownership; however, the terms and conditions necessary to consummate the transaction must be worked out in accordance with the facts.

"This communication is to advise you that the offer is accepted by the Board of Directors of this Company subject to agreement on terms and conditions. The Company will be glad to meet with you at your convenience with a view to consummating the transaction at the earliest practical date.

"Very truly yours,

"AMERICAN TOLL-BRIDGE COMPANY

"By Wm. F. Morrish, President."



State Highway relocation on U. S. 101 between Bass Hill and O'Brien Summit involves record grading in Northern California.

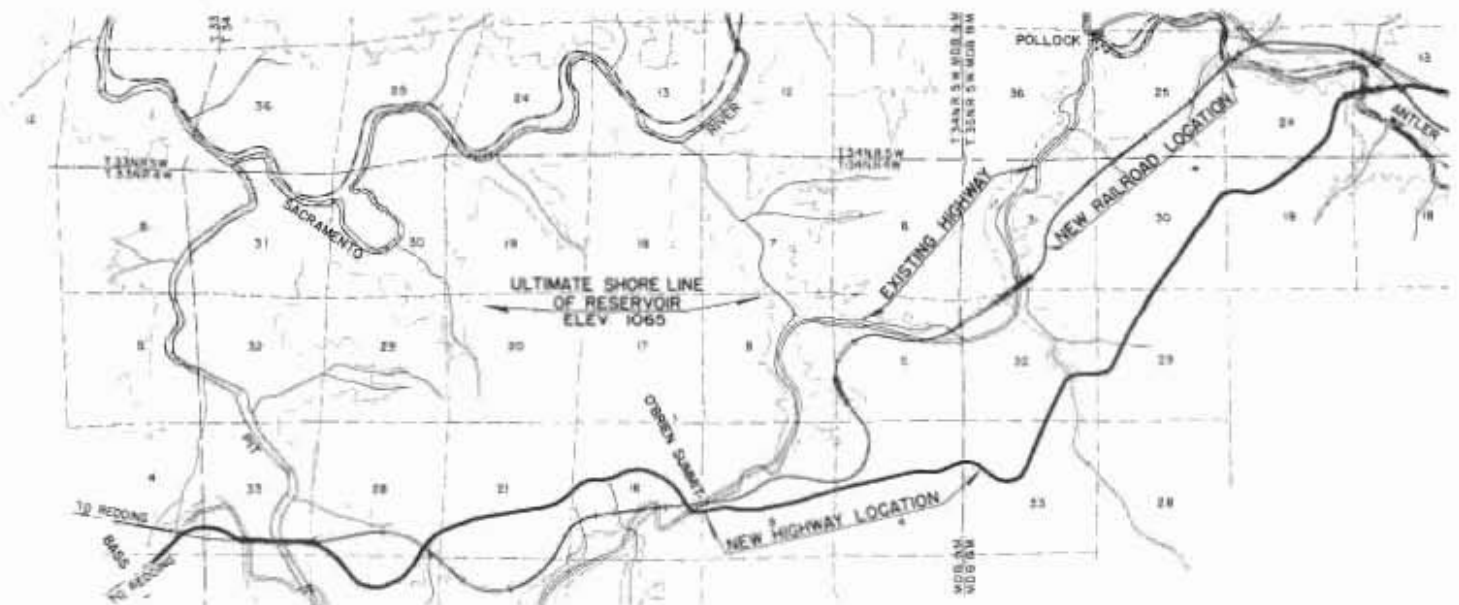
# Relocation North of Shasta Dam

By F. W. HASELWOOD, District Engineer

**T**HE CONSTRUCTION of the Shasta Dam Unit of the Central Valley Project and the consequent flooding of the canons of the Sacramento, Pit and McCloud

ivers, will eliminate from use, 18.1 miles of the Pacific Highway. To replace this, 15.5 miles of highway must be constructed on a new location.

The work will be accomplished by seven contracts, of which one has been completed, five are in progress and the seventh will be awarded in 1941.





The reconstruction of the highway is essentially a part of the Central Valley Project, which is being financed and constructed by the U. S. Government, under the supervision of the Bureau of Reclamation. In order to secure certain improvements in standards on the relocated highway, the State is contributing to the cost. The State's share of the cost, as measured by the value of the improvement in standards being secured, approximates 10 per cent of the grading and surfacing costs and 23.5 per cent of the cost of the bridge across the Sacramento River near Antler.

#### GRADE SEPARATION NECESSARY

The first unit to be constructed consisted of 2.53 miles at the north end of the relocation where the conflict was with the relocation of the Southern Pacific Railroad rather than with the reservoir. This work was included with an adjoining unit of railroad relocation and was awarded to Granfield, Farrar & Carlin by the Bureau of Reclamation, in the spring of 1939. Work was completed in the fall at a cost of \$157,507.

As a part of the railroad work included in this contract, a grade separation structure was built near Antler to allow the highway to pass under the railroad. This structure provides for two lanes each way, with an 8-foot dividing strip.

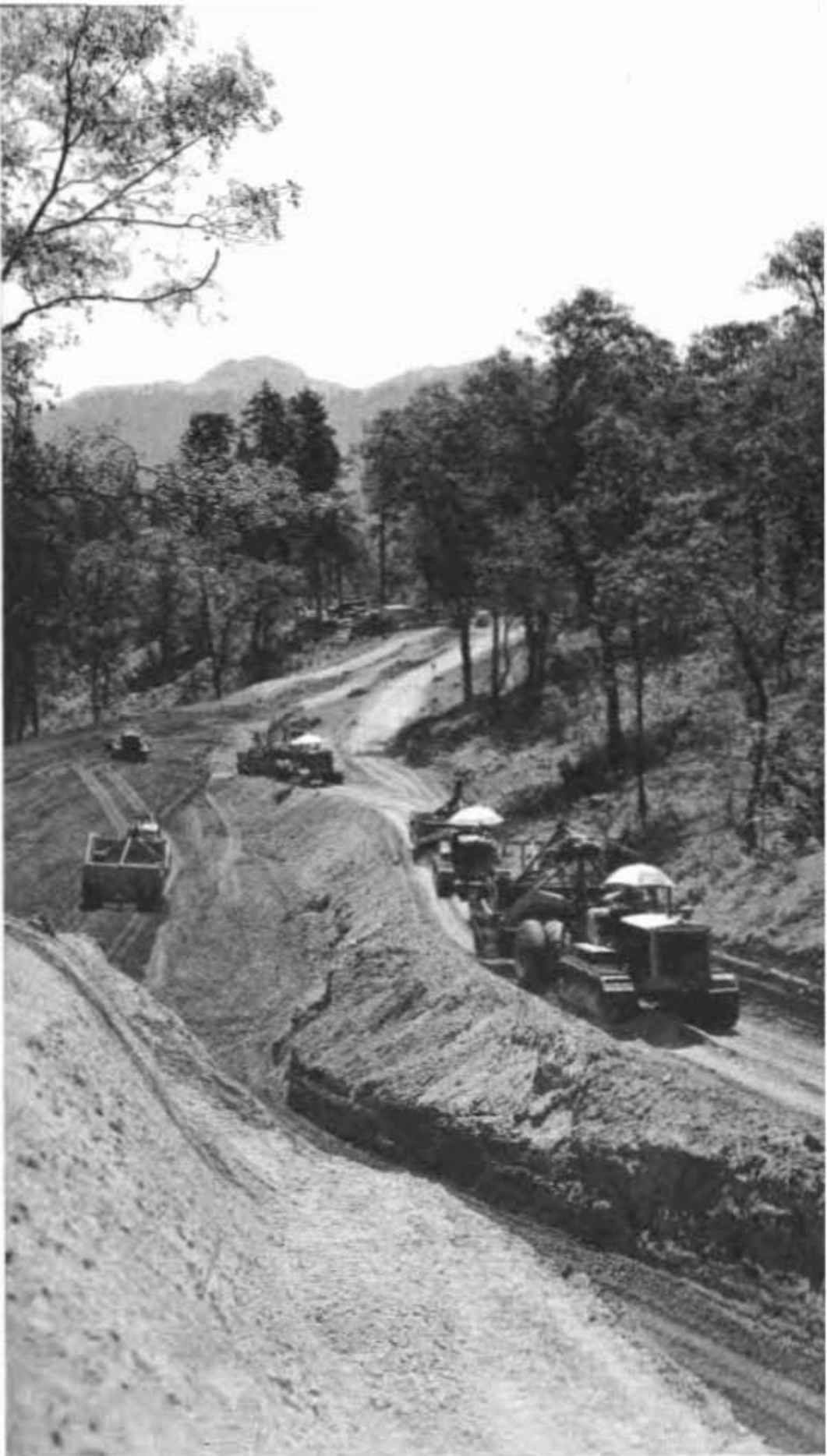
All other work involved in the highway reconstruction, except the Pit River bridge, which is a joint railroad and highway structure, is being supervised by the Division of Highways.

#### HEAVY GRADING CONTRACT

The first contract to be awarded by the State was for grading 4.08 miles between Bass Hill and O'Brien Summit. This is the southerly unit of the relocation and lies on either side of the Pit River bridge. Granfield, Farrar & Carlin were awarded this contract on November 29, 1939. The contract includes the movement of about 1,164,000 cubic yards of excavation and the construction of a concrete bridge 376 feet long on the face of a precipitous bluff over the north portal of tunnel number 3 on the relocation of the Southern Pacific Railroad.

This unit contains some of the heaviest grading ever undertaken on two-lane construction in Northern California. In one mile on this project movement of 598,000 cubic yards of excavation is required.

(Continued on page 25)



On the highway relocation north of Shasta Dam, this grading contract requires moving 598,000 cubic yards in one mile.

# Santa Barbara Coast Highway Project Reduces Steep Grades

By L. E. McDOUGAL, District Office Engineer

**O**N DECEMBER 11, 1939, Director of Public Works Frank W. Clark awarded a contract for the grading and surfacing of that portion of the Coast Highway designated as U. S. 101 and located approximately between one-half mile east of El Capitan Creek and the Southern Pacific Siding of Orella, being 2.3 miles in length. This section along the coast is separated from the shore line by the Southern Pacific Railroad for its entire distance.

In the design it was determined that this section of highway would eventually lend itself to a type of freeway construction, as will most of the highway in this general vicinity. As the centerline of the highway parallels the Southern Pacific Railroad limited access on the southerly or ocean side is controlled by the railroad. On the land or northerly side,

however, sufficient width of right of way was obtained to provide for an eventual four-lane construction with a median strip and service road.

#### LONG VERTICAL CURVES

The design selected provides for rolling the grades down into the drainage crossings, but with much lighter grades and long vertical curves to give as long a sight distance as was economically justified. The maximum gradient on the highway now under construction will be 2.23 per cent as compared with 6½ per cent on the existing highway and the minimum vertical sight distances will be 2000 feet as compared with 400 feet.

Two other methods of design were investigated before the final adoption of that being constructed. The first of these would have followed the same alignment but with only nominal im-

provement of sight distance and gradients. The second design study contemplated the construction of two new lanes separated from the present pavement by a median strip 6 feet to 26 feet wide, with only nominal correction of grade to obtain "non-passing sight distance," and correction of alignment to that of final design.

#### THE OLD AND NEW

Because of the nature of the reconstruction, which for a considerable distance follows closely the present center line of pavement, it was necessary to design detours covering a major portion of the job.

The roadbed section on the existing highway had a graded width averaging about 30 feet, on which had been placed at various times between 1919 and 1936 a 15-foot by 4-inch portland cement concrete base, later

Coast Highway reconstruction in Santa Barbara County showing the existing highway, the new grade and an ocean panorama.





View of new grade under construction east of El Capitan Creek while traffic uses the existing highway.

widened with 2½-foot by 6-inch portland cement concrete shoulders. Between these concrete shoulders a 15-foot by 2-inch asphaltic concrete surface was placed in 1923. The shoulders were subsequently road-mixed with asphaltic oil and a portion of them sealed.

The tabulation below will indicate the improvement being accomplished in this reconstruction project. Excellent alignment and grades will carry traffic at high speeds with safety and with a minimum of delay, even considering the anticipated increase in total traffic, particularly truck traffic:

	Present	Proposed
Number of curves (1000 feet radius or less).....	2	0
Minimum radius .....	700'	3800'
Total angles .....	78° 4½'	22° 17'
Maximum grades .....	6.5%	2.23%
Minimum vertical sight distance .....	400'	2000'

#### BASE THICKNESS

The section being used in the going construction provides generally for a 1-foot thickness of select material placed directly on the new grade for the entire width of the roadbed which is generally about 42 feet. On this selected material subbase a variable thickness of imported borrow or

stabilized base is to be placed. This base treatment will be 6 inches thick under the roadway surfacing and a lesser thickness on the shoulders. On this stabilized base will be placed a 22-foot width of plant-mixed surfacing of 3 inches to 4 inches minimum thickness.

On the shoulders and gutter or berm there will be 1½ inches of oil-mixed material salvaged from the detour surfacing topped by 1¾ inches of plant-mixed surfacing. This surfacing section, of course, varies throughout the job, depending upon the proximity of the existing 20-foot portland cement concrete and asphaltic concrete pavement and other factors.

On the up-hill side there will be constructed, for a considerable portion of the distance, an intercepting ditch and dike 4 feet deep and 16 feet in width. The material in the adjoining fields is very highly cultivated and is of such a friable nature that it washes readily if not in crop at the time of heavy rainfall. The result is that considerable material is carried directly onto the pavement if such an intercepting ditch is not built.

The cut slopes are generally 1½:1 as are also the fill slopes. There are a few exceptions where cut slopes have been designed on 1:1 slope and

in some of the lighter fills 4:1 slopes are used.

The stabilized 6-inch depth of base treatment referred to above is a partial misnomer in that certain sections will not be so treated; however, most of the job will have a plant-mixed base using liquid asphalt, a portion of which will use about 5 per cent ROMC 5 and the balance 3½ per cent of a stabilizing type of asphaltic emulsion. These three types of base, all with the same mineral aggregate, are being used on this section more or less as an experiment to obtain data as to the relative value of bituminous stabilized bases as compared with untreated bases.

The base material both stabilized and untreated as well as the mineral aggregate for plant-mixed surfacing will be obtained from a local deposit in the Arroyo Quemado about five miles westerly from the west end of the present project. This material has been used on other projects in this general vicinity and found to be very satisfactory for this type of construction. This material was to be used for the oil-mixed detours and later removed to form a portion of the surfacing on shoulders. However, the contractor has elected to use

(Continued on page 23)

# Flood Control and Restoration Bill Passed by Legislature

**T**AKING cognizance of the grave emergency occasioned by the storms and floods during the spring of 1940, Governor Olson included items in his call for the second extraordinary session in 1940 to provide funds for construction work on the Sacramento River Flood Control Project and for repair and restoration of property damaged or destroyed by these storms and floods. The Legislature took action upon these matters and, with the Governor's approval, Chapters 1 and 2, Statutes of 1940, second extra session, have become law—Chapter 1 providing money for repair and restoration and Chapter 2 providing money for construction work on the flood control project.

Over 635,000 acres of land were inundated by the successive high waters in Northern California, and damage or destruction to public and private property exceeding \$12,000,000 occurred as a result thereof. Applications received for State assistance in repair of flood damaged property total in excess of \$2,500,000. Within the area of the Sacramento River Flood Control Project, most of the damage was resultant from breaks in levees and works which had not been brought up to grade and cross section contemplated in the eventual plans.

Federal money is available for furthering construction on the Sacramento project dependent upon State contributions for the same purpose. Chapter 2 appropriates \$1,900,000 for the works and will go far to aid completion of the project under the present approved plans. A Federal appropriation of \$1,242,000, for construction, is under consideration at this time by the Congress and favorable action thereon is anticipated. However, due to experience acquired during the recent floods, some revision of the project may be required, and a survey by the Federal Government is in progress to determine this matter.

The Reclamation Board is the State agency dealing with construction plans on the Sacramento River Flood Control Project, while the Depart-

## British Museum Asks For Magazine

The Science Museum  
South Kensington,  
London, S. W. 7

Sir:

With reference to your kindness in presenting the publications of the Department of Public Works to the National Library of Science and Technology at the Science Museum, I would inquire whether you would be so good as to present also the publication "California Highways and Public Works."

In addition to its comprehensive sets of literature on cognate subjects, which are not available in special libraries, this Library contains an exceptionally extensive collection of works on highway engineering.

Ten thousand scientific and technical periodicals are received regularly in the Library. All publications added to the Library are recorded in its Weekly List of Accessions to the Library, which has a wide circulation among research workers and institutions.

I invite your attention to the enclosed leaflet, which gives an account of the scope, aim, and activities of the Library.

I am, Sir,

Your obedient servant,  
**E. JONES,**  
Director.

ment of Public Works carries out State maintenance work and such of the actual construction work as may be delegated by the Reclamation Board.

Outside of the works of the project, great damage occurred from storms and floods subsequent to January 1, 1940, in various parts of the State to levees, flood control works, irrigation

works, city and county roads and bridges and other property having a general public and State interest, for the cost of repair or restoration of which Chapter 1 appropriates \$500,000 to the State emergency fund for expenditure by the Department of Public Works. In order to receive aid from this appropriation, it is required that local agencies provide money at least equal to the amount of State funds allocated for each item of work.

The amount appropriated by Chapter 1 for repair or restoration of flood damaged property is less than the amount estimated required to fully care for the problem involved but should give material assistance to the damaged areas.

### NAPA RIVER BILL PASSED

The Governor also included in his call as Item 3 the consideration of legislation to provide for the acquisition, construction, maintenance and operation of works for control, storage, conservation and utilization of the waters of the Napa River and its tributaries. Senate Bill No. 10, by Senator Gordon, was introduced and passed under this item, several other bills having died in committee.

Senate Bill No. 10, now before the Governor for approval, reappropriates the unexpended balance of \$650,000 made by two former appropriations to the Department of Finance for construction of a dam and distribution system in Napa County to serve the State institutions in Napa Valley. Senate Bill No. 10 expands to a certain extent the service possibilities of the proposed system and removes some restrictions as to contracting powers of the Department of Finance with other State agencies. The Department of Public Works would be affected by the approval of this bill as actual construction on the part of the State would be carried out by the department.

Definition of a man: "Man is a worm in the dust. He comes along, wiggles around a while, and finally some hen gets him."—The Tennessee Road Builder.

## Planning to End Sewage Stench on Bridge Approach

**I**N ACCORDANCE with expressed wishes of Governor Culbert L. Olson, Director of Public Works Frank W. Clark has interested himself in the problem of eliminating the sewage stench that rises from the tideland flats along the East Bay Highway approach to the San Francisco-Oakland Bay Bridge, a problem that has vexed the officials of Oakland, Berkeley, Emeryville and Albany for years.

Director Clark, in letters to the mayors of these cities, proposed that they meet with him to fully discuss the situation with a view to determining what assistance, if any, the State can give in eradicating the obnoxious odors which assail motorists approaching the Bay Bridge over the East Bay Highway.

### MOTORING THOUSANDS SUFFER

In view of the fact that the State owns and operates the Bay Bridge, Governor Olson and Clark are anxious to abate the tideland nuisance for the benefit of the thousands of motorists, many from outside the State, who must endure the stench while approaching the span from points east and north of Berkeley, Albany and Richmond on a State highway. The Governor also considers the situation a bad one from the standpoint of public health.

The cities interested in the problem have provided a fund of \$57,000 to defray the cost of a survey to determine how best to cope with the situation. City Engineer Harry Goodridge and Mrs. H. N. Herrick, member of the Berkeley City Council, have informed Mr. Clark that Berkeley would welcome State aid in making the survey.

Because the Santa Fe Railroad Company owns 3000 acres of the tidelands involved, its property line extending 1500 feet out into the bay, Mr. Clark has voiced a desire that officials of this company attend the proposed conference, together with representatives of the Federal Government, to which the East Bay cities look for financial help in work-



ANSON BOYD

ing out their sewage disposal problems.

### SEWAGE SYSTEM INVOLVED

Construction of a new outflow sewage system is involved as well as proposals to fill in the objectionable flats by pumping and from San Francisco Bay.

Clark addressed invitations to a conference to Mayors Frank F. Gaines, Berkeley; Dr. W. J. McCracken, Oakland; Al. J. Lacoste, Emeryville; Charles F. Graeber, Albany, and John A. Bell, Richmond. He is awaiting their replies.

Dr. Bertram P. Brown, newly appointed Director of the State Department of Health, has also been requested by Mr. Clark to attend the meeting.

A little boy and his mother were walking down Fifth Avenue in New York. The little boy was looking at the skyscrapers. Turning to his mother he said, "Are there skyscrapers in heaven?"

His mother replied, "No, dear, engineers build skyscrapers."

Taxidermist's Secretary: "Congratulations, the stork has arrived!"

Absent-Minded Taxidermist: "Well, don't stand there. Show him in and I'll stuff him."

## Anson Boyd New State Architect

**A**NSON BOYD of Pasadena was appointed Chief of the Division of Architecture of the State Department of Public Works by Frank W. Clark, Director of the Department, on May 31, the appointment becoming effective June 1.

Mr. Boyd was chosen from the civil service eligible list and succeeds George B. McDougall, retired. Since the latter's retirement on November 1, 1938, the duties of the Division have been under the charge of W. K. Daniels, Assistant State Architect.

Mr. Boyd is a graduate of the School of Fine Arts and Architecture, University of Pennsylvania, where he was the holder of the Sims Memorial Scholarship. He pursued his profession in Philadelphia and New York until 1917 when he was commissioned in the U. S. Army Air Service. He was demobilized in April, 1919, and resumed architectural work in New York. In March, 1923, he took up his residence in Los Angeles, where he became architect for the Los Angeles District Board of Education.

In this capacity, he supervised the expenditure of the \$35,000,000 bond issue which involved the construction of 30 junior high schools, 18 senior high schools, more than 200 elementary schools, gymnasiums, vocational centers, development schools, etc.

In private practice, he helped in the designing of many buildings in southern California, including the California Club, Los Angeles; Beverly Hills High School and Pomona Progress-Bulletin Building.

The new State Architect will take over a large State building program which during the past year and a half under Director Clark has involved the expenditure of upward of ten million dollars and includes the State Prison at Chino, the construction of two State colleges, one at Santa Barbara and one at San Francisco and the proposed Acute Psychiatric Hospital Unit.

"In announcing the appointment," Director Clark said, "I wish to express my appreciation of the very efficient service Mr. W. K. Daniels has given to the State during the time he has performed the duties of the office to which I have named Mr. Boyd."



Break in Butte Slough Levee in Sutter County on March 1, 1940. Flood waters flowed through 1200 foot gap, inundating 35,000 acres of farm lands. Arrow marks far side of break.

# Emergency Work on Levee Breaks

By R. L. JONES, Deputy State Engineer

**D**URING the last days of February, 1940, a storm occurred which caused heavy flood discharges in the upper tributaries of the Sacramento River, resulting in numerous levee breaks. These mostly occurred on February 28 and 29 and March 1. On March 15, 1940, Governor Culbert L. Olson made available to the Division of Water Resources \$60,000 from the State Emergency Fund (Emergency Allotment No. 24, Chapter 655, Statutes 1939), "to close levee breaks in the Sacramento River and its tributaries, caused by flood conditions in February and March, 1940."

Immediately following the availability of funds, steps were taken to close the levee breaks on the Sacramento River and its tributaries in the order indicated by the necessity for immediate future protection. Owing to its urgency, the Division of Water Resources undertook the work by force account.

The breaks which occurred in the levees of the Sacramento River Flood Control Project in Sutter, Butte and Colusa counties were in levees which had not been completed to standard grade and cross-section, so that their repair was undertaken by the California Debris Commission with State and Federal funds as a part of project construction.

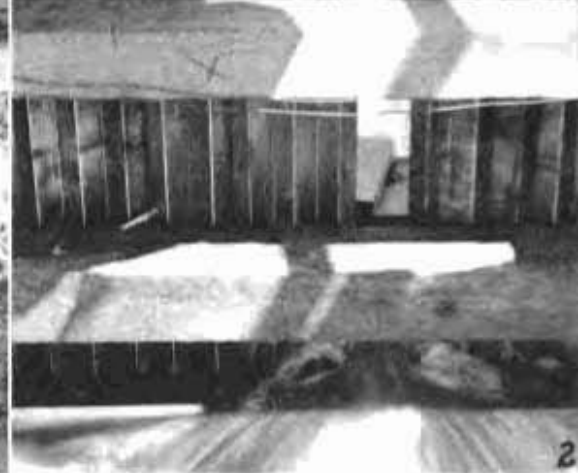
On March 18, 1940, work was commenced on closure of the large break in the Butte Slough levee of Reclamation District No. 70 in Sutter County, which had flooded 35,000 acres of developed farm lands in Reclamation Districts No. 70 and 1660. This work was continued until the late March flood forced its discontinuance on March 29th. This second flood caused a delay in the work of 14 days and an added cost of approximately \$10,000. Work was resumed on April 9th and a closure was finally effected on April 19th at a cost of \$44,560, which entirely cut off water

flowing through Districts No. 70 and 1660 and permitted the farmers to proceed with restoration of their lands to normal use.

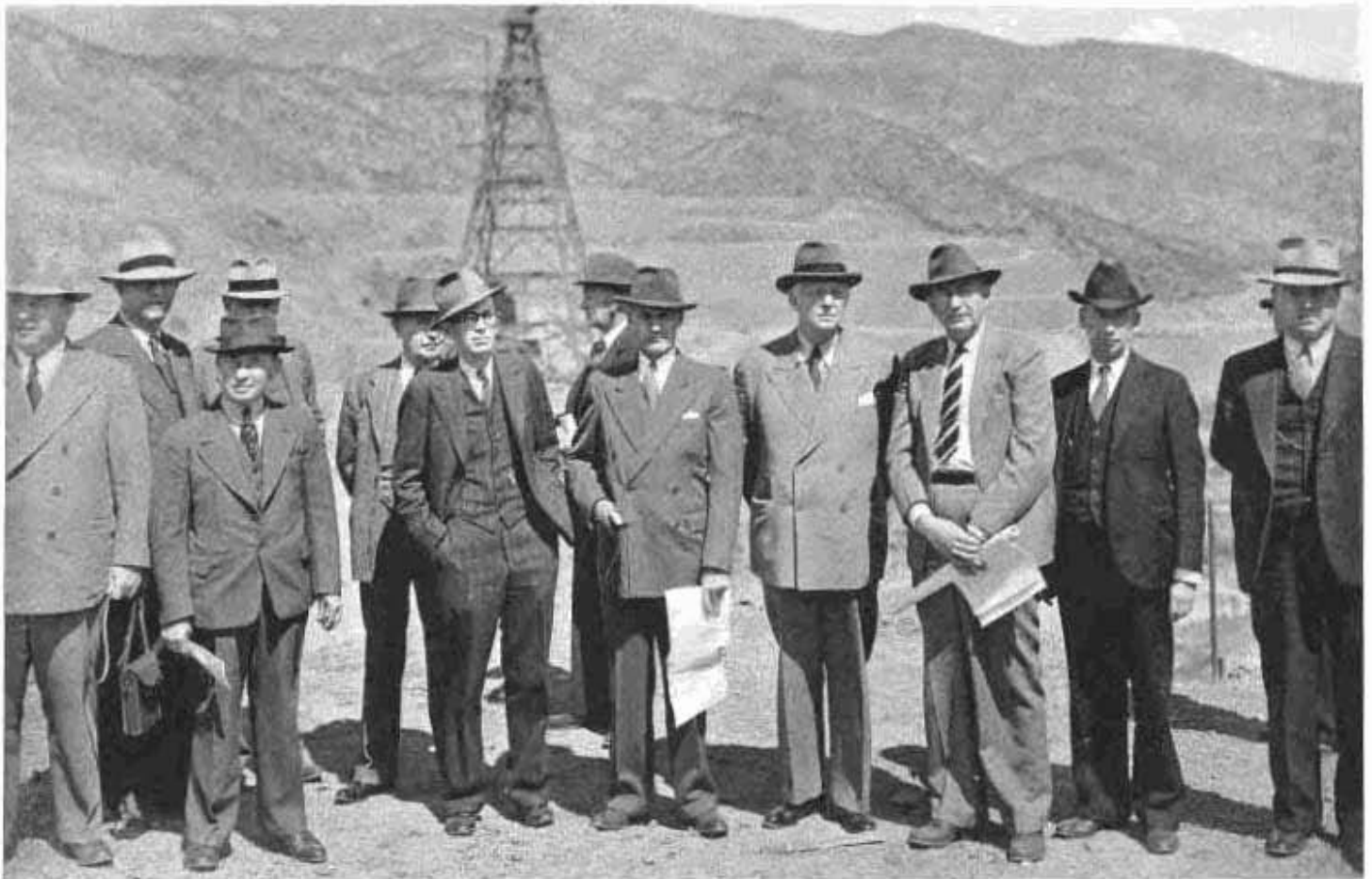
This closure also enabled the California Debris Commission to commence construction of a standard project levee at this location as a permanent repair. This work is still in progress.

The closure structure consisted of a pile and timber bulkhead 700 feet long, faced with light section steel sheet interlocking piling, 18 feet long, driven to a minimum penetration of four feet in solid ground. The structure, shown in the illustrations was equivalent to an over-fall dam capable of withstanding 10 feet of water pressure. It was designed so that, in case a freshet should occur, an over-fall of water over the crest three feet deep could be sustained without damage.

Had the structure been completed at the time of the second flood, it



Construction views of timber and steel sheet pile emergency overfall dam in Butte Slough, 700 feet long with two wing levees. Total length, 1100 feet. 1—Bulkhead showing 3 drivers at work. 2—Final closing of steel piling. 3—Laborers wheeling cobbles for bottom protection in closure section. 4—Bulkhead showing steel piling. 5—Drivers at work on structure. 6—One of wing levees.



Governor Olson and official party on an inspection tour of Shasta dam and other highway and bridge units of the Central Valley Project. Left to right—Jesse W. Carter, Supreme Court Judge; A. J. A. Johnstone, C. J. McConnell; Superior Court Judge Albert F. Ross; A. H. Gronewoldt; State Engineer Edward Hyatt, Manly Harris; Director of Public Works Frank W. Clark, Governor Culbert L. Olson, Engineer R. W. Lowrey, U. S. Bureau of Reclamation; Judge Francis Carr, S. F. Finley.

would not have been damaged, but water would have passed into Districts No. 70 and 1660, although in a greatly lessened quantity and with an earlier complete stoppage of flow. The bulkhead structure described above was provided with substantial abutments which were connected to the intact levee along Butte Slough by wing levees on the north and south of the break wash with an aggregate length of 1200 feet. On completion by the California Debris Commission of the final repair, the material in this structure may be salvaged.

On March 19th, equipment was at work closing breaks in the levees of the Sacramento River above Princeton, in Glenn County. This work was continued until taken over by the California Debris Commission on March 23, 1940. By that time the fills in six breaks had been brought to an elevation considered safe from normally expected spring freshets. At Robinson Bend on the Feather River, in Butte County, levee breaks and bank washes were repaired, commene-

ing on April 5th, to a height expected to be safe against expected spring freshets.

On April 19th levee repairs were undertaken in Butte and Tehama counties, in conformity with recommendations of the Northern California Water Control Association, representing eight counties. Work has been completed at 15 places, 32 breaks having been closed, and about three more breaks will be repaired with the unexpended balance of the emergency allotment, which on June 1st was approximately \$4,000.

#### PHOTO CREDIT LINE OMITTED

Through an oversight, credit for the picture on the front cover of the May issue of this magazine was not given to C. D. Clearwater, Publisher of the PALISADIAN newspaper of Pacific Palisades, who took the photograph and kindly donated it to California Highways and Public Works.

The photograph showed a spectacular view of the bluff sealing work with a large bulldozer on the precipitous cliffs fronting the Coast Highway along the Pacific Palisades north of Santa Monica.

## Post Roads in U. S.

Adequate highways are needed to carry on most of the functions of government. Mail is moved between post offices on 290,000 miles of main routes. Rural free delivery of mails extends over routes totaling 1,390,000 miles of public roads (exclusive of city delivery).

Such governmental use of the rural roads presupposes a Federal responsibility to contribute materially to the cost of construction and maintenance of roads. The responsibility was accepted definitely by the Act of Congress of July 11, 1916, entitled "An Act to provide that the United States shall aid the states in the construction of rural post roads, and for other purposes" and by subsequent amendments to that Act.

A son at college wrote to his father, "No mon, no fun, your son."

The father answered, "How sad, too bad, your dad."



# California Highway Program Requires More Federal Aid

By C. H. PURCELL, State Highway Engineer

In the May issue of this magazine, State Highway Engineer C. H. Purcell expressed some views on the subject of Federal Aid to States for highway construction and discussed provisions of a bill now pending in Congress to authorize the Reconstruction Finance Corporation to make loans at cost for highway work to States which are in a position to borrow such funds. Governor Olson sent Mr. Purcell to Washington last January to urge favorable consideration of the bill by the Roads and Highways Committee of the House of Representatives. In the following article Mr. Purcell deals with the highway situation in California in relation to the measure now being considered by Congress.

I WISH to discuss Title II of the bill before Congress from the standpoint of the State of California, and which, I believe, is also of interest to other States having a large population, and that is the question of traffic in urban areas. Urban areas include oftentimes more than the actual city limits of the metropolitan city and extend for some distance beyond such limits. The resulting problem is a great deal larger than is universally understood, although it is thoroughly understood by the metropolitan areas affected and the States which deal with such problems.

Our Federal-Aid System passes through and sometimes around our large cities. It is a part of the Federal-Aid System, so when we speak of this metropolitan problem, it becomes part of our Federal Aid problem as such and should not be considered as separate and distinctive.

## LOS ANGELES PROJECTS

With reference to our rural roads, Governor Olson, Director of Public Works Frank W. Clark and the Highway Commission are concerned with keeping up with the trend of the times. Therefore, we are not suggesting any reduction in the program on our Federal-Aid System. Feeder roads are also of much importance, reaching the outlying sections and, were it not for this feeder road money, we would be forced to slow down on our primary roads.

The addition of the one-cent gas tax by the Federal Government to existing State gas tax increased this tax to the point where it makes it

much more difficult for the States to increase their gas tax to help solve these problems. The problem in California, which is typical of some of our larger metropolitan areas in other States, is this:

In Los Angeles, there has been spent a large amount of money in completing a study and report on the traffic situation in this metropolitan area; likewise, a similar survey in the San Francisco Bay area, to find out exactly the origin and destination of traffic, what this traffic is doing, what time is spent traveling on city streets, the time of congestion, and other information affecting motor transport. We are faced with a traffic movement problem in the city of Los Angeles, involving some 180 to 200 miles of city streets, where congestion exists to the extent that it is city-wide.

## COSTLY RIGHTS OF WAY

Entering into the picture of metropolitan development, the State of California is developing a system of connecting streets in Los Angeles as a State function, amounting to approximately \$8,500,000 biennially, by the allocation of a percentage of the gasoline tax funds based on population, as well as an additional contribution of State funds. This has resulted in a further postponement of the development of rural roads.

The act before Congress refers to excess condemnation, which is a misunderstood term. What is excess condemnation? A case of this nature has actually developed in that we spent some \$8,000,000 in the purchase of rights of way through an organized

right-of-way department with skilled appraisers. In acquiring this right of way, it was more economical to purchase entire blocks and, after razing improvements on them, we used what land was required for highway purposes and resold the remaining portions, resulting in this property again being placed on local tax rolls.

Another matter is the question of approaches. We have had to acquire buildings, which were in the way of a proper approach, or destroyed visibility, and which would interfere with a clean-cut, finished appearance.

While we are not interested or anxious to engage in speculative ventures in real estate, we are interested in the chance to secure a loan or lease or rental from the Federal Government or direct Federal aid on a reasonable basis. I believe that motor transport, which is a business of large future possibilities, represents a safe investment, at least as safe as any other large business. This is a growing business and is not on the way out.

## QUESTION OF FORMULA

The question of formula has been raised. We naturally are always interested in a formula if any money is to be allotted to the States by Congress. I do not know whether this matter is to be followed up. If it is, there is one phase which must be considered in regard to the metropolitan or urban areas in regional highway development, and that is a complete study of traffic such as has been made in California as a cooperative Federal and State project.

(Continued on page 26)

# Redecking the Yolo Causeway

By W. E. SUTTON, Resident Engineer

**T**HE Yolo Causeway, an important link in the State Highway System five miles west of Sacramento, is now being redecked. This structure 16,538 feet long is on the main route from San Francisco to Sacramento.

The Yolo basin, which is 3.13 miles in width at the bridge site, affords a by-pass for the periodic overflow of the Sacramento River. This by-pass is flooded annually for three or more months during the winter when the heavy runoffs occur on the Sacramento River. The water is diverted into the by-pass to avoid overflowing of the levees of the main channel of the river.

The structure was first opened to traffic 24 years ago. At that time it had a roadway width of only 21 feet, which was ample for the traffic. It was a combination timber and concrete trestle type structure with a 113 foot plate girder bascule span equip-

ped with hand operated machinery. The bascule span is for the purpose of allowing passage to floating dredgers utilized in the repair and maintenance of the levees.

The timber construction comprised one hundred thirty 19-foot spans for a length of 2470 feet at the west end. The substructure consisted of four creosoted piles in each bent and untreated Douglas fir caps. The superstructure consisted of untreated Douglas fir stringers and an untreated 2 by 4 inch laminated fir subflooring with an asphaltic concrete pavement.

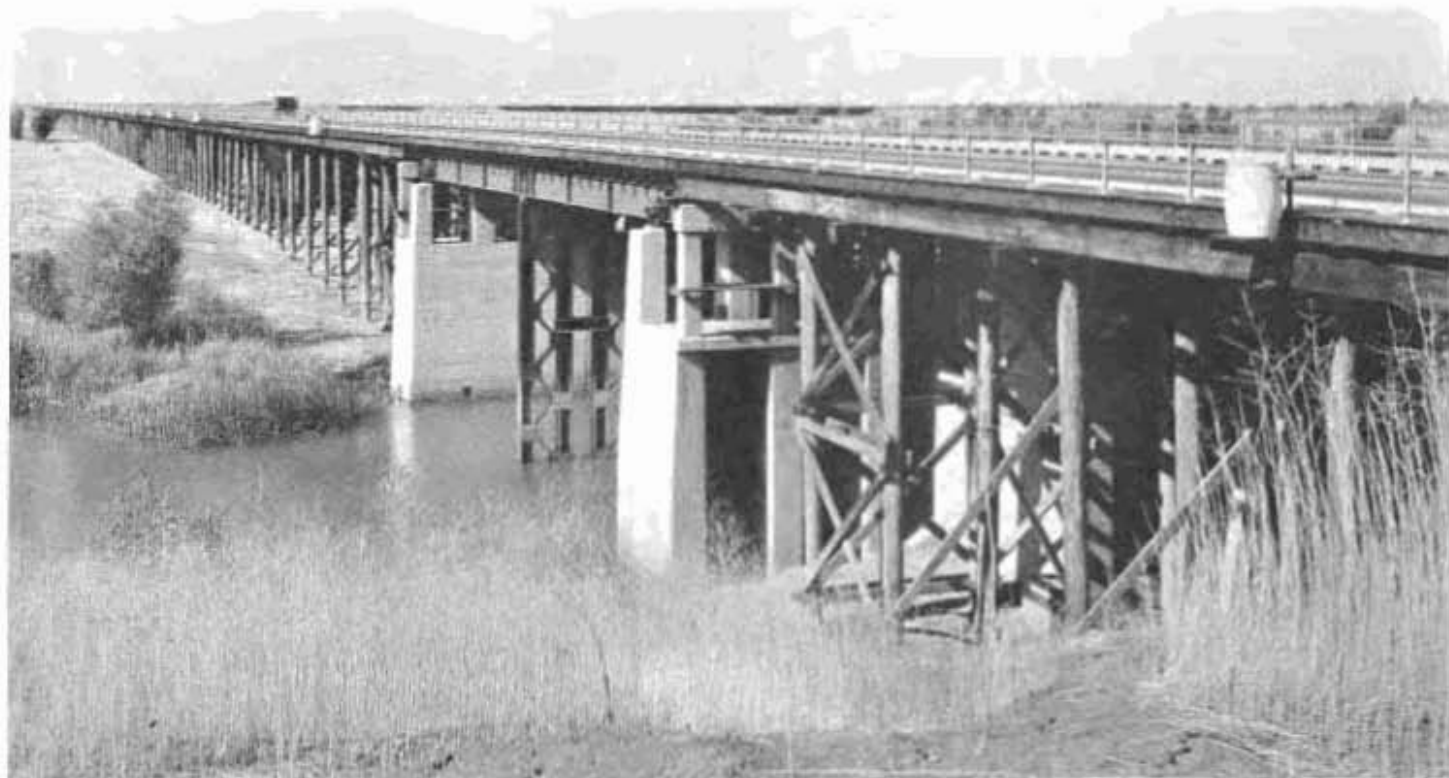
The concrete portion of the trestle at the east, or Sacramento end, consisted of 19-foot reinforced concrete spans supported on reinforced concrete piles and caps.

The timber portion of the trestle at the westerly end was constructed for economic reasons. In a permit granted to the State Highway Commission by the State Reclamation Board, it

was provided that upon construction of a new levee approximately one-half mile from the west end of the causeway, the structure could be shortened to meet this levee and replaced with an embankment. Under these conditions construction of a permanent concrete structure was not justified. However, the California Legislative Act of July, 1927, established the boundaries of the west levee at the west end of the structure, thereby making it mandatory to maintain the structure for the full distance of 16,538 feet.

In 1932 increased traffic necessitated the widening of the causeway. Its widening was chosen as an emergency relief project to provide employment for local people during the height of the depression. For this reason a redwood timber trestle was constructed along the south side, and thus was provided a clear roadway

(Continued on page 32)



Yolo Causeway, a 16,538 foot concrete and timber trestle structure across Yolo By-Pass on U. S. 40 near Sacramento being redecked and paved.



Paving Yolo Causeway with reinforced concrete. Traffic is kept moving in two of the four lanes while work is under way on the other two except for intervals while concrete is setting when one-way traffic control is in effect.

# State and U. S. Building Approach Road to General Grant Park

By C. F. WAITE, District Office Engineer

**E**AST of Fresno lie some of the most spectacular portions of the High Sierras. Embraced in this area are Sequoia National Park, General Grant National Park and far famed Kings Canyon Country. After many years of effort a great portion of the High Sierras has recently been placed in the Kings Canyon National Park, and General Grant National Park has been enlarged to include additional groves of huge Sequoias and is now a part known as the General Grant Grove Section, of the Kings Canyon National Park.

In the development of this vast wonderland the State and the Public Roads Administration acting for the National Forest Service and the National Park Service have expended large sums for highways. The State built the highway from General Grant Grove down into the Kings River Canyon, some 24.5 miles to Deer Cove Creek. Here the Forest Service, with Civilian Conservation Corps labor took up the task and continued construction about three miles to Cedar Grove.

At the same time the Federal Government was busy building a modern

highway, the General's Highway, between General Grant Grove and Sequoia National Park.

## ACCESS ROAD NEEDED

As this construction in the high mountains neared completion, attention was directed to providing for a suitable access road from the valley. There was an existing county road from Fresno, via Centerville, Minkler, Squaw Valley, Dunlap, Pinehurst to the General's Highway near General Grant Grove Section. This county road was taken into the State Highway System for maintenance in 1933. This road is the old mountain type with narrow tortuous alignment, steep grades and inadequate sight distance.

This road was adequate until the development in the back country created such a demand for an easier, faster approach to these scenic highways. To meet this demand the Federal Government as early as 1931 began the survey and relocation of the approach road from General Grant Grove, or as then known General Grant National Park, westerly toward Dunlap and Fresno.

An entirely new location was made, which with the exception of the first

two miles or so from the Park is far removed from the present road, and does not again intersect the old road until the crossing of Mill Creek is reached, some five miles or more west of Dunlap.

In carrying out this program the Federal Government has already completed grading and oiling from Grant Grove westerly about 8.5 miles. This section is now under traffic since Fresno County has reconditioned and oiled an old county road from Dunlap easterly to the west end of the completed road.

The use of this county road lessens to a very great extent the number of miles of winding mountain road traveled in going to the back country. The Federal Government expects within a month or so to complete the construction of the approach road to the Forest boundary about 6.2 miles, the limit of full Federal financing.

## STATE LINK STARTED

The State is now taking up the work and with Federal cooperation will continue construction westerly of the Forest Boundary. Bids were opened on the first section, Forest Boundary to White Deer Road on



May 1st. The contract was awarded to Heafey Moore, Frederickson Watson Co. This section involves the construction of slightly more than three miles of road. The fact that 310,000 cubic yards of roadway excavation will be moved is indicative of the magnitude of the work.

No unusual construction difficulties are anticipated on the present project and barring unforeseen or unpredictable occurrences this section should be completed this fall. The present project does not contemplate surfacing other than a road mix of the native disintegrated granite.

This State construction will not join up with the present traveled way. Fresno County has volunteered, however, to put the White Deer Road in good condition so that traffic can be carried to the new construction

(Continued on page 22)



At top, Construction of rock retaining wall on PWA link of Grant Park approach road. Bottom, Drilling for removal of cliff.

# Bay Bridge Traffic Breaks All Records With Opening of the Fair

By RALPH A. TUDOR, Principal Bridge Engineer, San Francisco-Oakland Bay Bridge

**M**AY traffic on the San Francisco-Oakland Bay Bridge exceeded all past records and totaled 1,202,577 vehicles. This traffic was materially affected by three major events during the month of May. At midnight on the 16th the Southern Pacific Golden Gate auto ferries ceased operating between the East Bay and San Francisco; tolls on passenger autos were reduced another 5 cents to 30 cents on the 25th; and the Exposition on Treasure Island opened its gates to the public on the same date. In fact the exposition was an influencing factor before the 25th because of the heavy commercial traffic preceding opening.

The discontinuance of the ferries evidently diverted about 4000 additional vehicles per day to the bridge of which a high proportion was trucks. Since the day the bridge opened the ferries have been fighting a losing battle. They have been operating for almost 90 years and reached their peak in 1930 when they carried over 4½ million vehicles between the East Bay and San Francisco. However, they were slow and expensive. The average toll charged just before the bridge opened was 83 cents. They met the initial reductions brought about by the bridge but still suffered a 90 per cent loss of their traffic. They then drastically reduced their passenger auto tolls, but not truck tolls, to about half those on the bridge. This recovered some traffic. Several ferry routes were abandoned and schedules reduced. However, continued high traffic on the bridge and a reduction in interest rate on the money borrowed permitted the bridge to successively reduce its tolls on all types of vehicles. Traffic remaining on the ferries dwindled until it amounted to only about 40 per cent of its 1930 peak. Revenues were reduced a great deal more because of reduced tolls. Under the

## Passenger Autos and Auto Trailers

May 1940	May 1939	April 1940	Total Since Opening
1,093,789	761,650	874,469	32,059,916

## Motorcycles and Tricars

May 1940	May 1939	April 1940	Total Since Opening
4,513	3,759	3,788	146,474

## Motor Buses

May 1940	May 1939	April 1940	Total Since Opening
21,866	17,350	17,970	530,627

## Trucks and Truck Trailers

May 1940	May 1939	April 1940	Total Since Opening
61,874	47,352	49,231	1,559,548

## Other Vehicles

May 1940	May 1939	April 1940	Total Since Opening
20,535	17,814	18,346	550,777

## Total Vehicles

May 1940	May 1939	April 1940	Total Since Opening
1,202,577	847,925	963,804	34,847,342

combination of convenient, fast, and cheap facilities provided by the bridge, the outmoded ferries could not compete and the doom which was foreshadowed on November 12, 1936, was sealed on May 16, 1940.

Preliminary figures indicate that this year the proportion of persons going to the exposition by private auto over the bridge will exceed even last year's high figure. This is not unexpected since the bridge toll is only 30 cents for a round trip and the island parking fee is cut in half. Furthermore, the method of handling automobiles on the island has been radically changed

and has already proved to be a great improvement over 1939. On May 25, 17,038 vehicles entered Treasure Island and at no time was there any delay or congestion on the bridge. The maximum number of vehicles thus handled last year was 19,845 at which time the congestion was severe. It is not anticipated that there will be any such difficulty this year.

Ferry service to Treasure Island from the East Bay proved to be quite unsatisfactory in 1939, and for 1940 a fast, convenient bus service across the bridge has been substituted. This again has increased the bridge load.

The third toll reduction within a year, and the fourth since the bridge was opened, went into effect during the month. Passenger autos now pay only 30 cents. A corresponding reduction in the commutation rate went into effect on June 1. It is anticipated that a corresponding reduction in truck rates can be effected within a short time.

The heaviest day's traffic occurred on May 25, when 54,737 vehicles used the bridge. Since the collectors must handle those vehicles traveling between the East Bay and Treasure Island three times, they handled almost 70,000 transactions that day. This compares with 75,218 transactions on the bridge's heaviest day of November 15, 1936.

The first part of May the daily traffic averaged 34,568 vehicles per day. After the ferries discontinued and the exposition opened, the average was 45,605. The average for the entire month was 38,793 per day.

Rain and cold weather reduced the normally heavy Memorial Day traffic.

Traversing the bridge, which ultimately will be a toll-free State highway, and without which Treasure Island probably never would have come into existence, thousands of visi-

(Continued on page 22)



At top—Treasure Island showing how the Golden Gate International Exposition is reached via the San Francisco-Oakland Bay Bridge. Below is a portion of the 6-lane State-built ramp approach. At bottom—Automobiles waiting for the gates to open early on the first day.

# Bay Bridge Tolls Cut To 30 Cents for Automobiles

**M**EETING in Sacramento on May 9, the California Toll Bridge Authority voted to lower automobile tolls on the San Francisco-Oakland Bay Bridge from 35 to 30 cents, thus effecting the third reduction in rates since Governor Culbert L. Olson assumed office as the State's Chief Executive and as such became chairman of the Authority.

The new tolls for automobiles, automobile trailers and related vehicles went into effect on May 25 and a corresponding decrease in commute rates for passenger automobiles became effective on June 1.

A reduction in truck tolls will be made as soon as traffic justifies, probably within the next few months.

On May 6, Director of Public Works Frank W. Clark approved a reduction in bus fares in line with expressed wishes of the Toll Bridge Authority.

The new schedule of tolls is as follows:

Class	Vehicle	New Rate	Old Rate
1.	Automobiles, ambulances, taxis, commercial or light delivery automobiles	.30	.35
2.	Trailers drawn by automobiles	.30	.35
3.	Trucks or truck trailers, including any load:		
a.	(To remain in effect until Rate 3b below is ordered.)		
	Gross weight up to 20,000 lbs., per ton at		.175
	Additional gross weight from 20,000 lbs. to 40,000 lbs., per ton, at		.15
	Additional gross weight over 40,000 lbs., per ton, at		.125
	Minimum charge		.50
b.	(To be made effective on order of the Director of Public Works.)		
	Gross weight up to 20,000 lbs., per ton, at	.15	
	Additional gross weight over 20,000 lbs., per ton, at	.125	
	Minimum charge	.50	
4.	Local Key System buses, per passenger carried	No change	.025
5.	Other buses—Bus with driver and passengers	1.00	.75 per bus, 5c per each passenger
6.	Motorcycles	No change	.15
7.	Tricars	No change	.25
8.	Vehicles requiring special permit, per ton gross weight*	No change	.20
	Minimum charge*	No change	1.00
9.	Vehicles not otherwise specified:		
a.	(To remain in effect until Rate 9b below is ordered.)		
	Per ton gross weight		1.75
	Minimum charge		.50
b.	(To be made effective on order of the Director of Public Works.)		
	Per ton gross weight	.15	
	Minimum charge	.50	.50
The following monthly commutation rates are prescribed:			
10.	Commutation—For passenger automobiles only. Book to contain from 50 to 54 one-way trip tickets (depending on length of calendar month) good for the calendar month.	10.75	12.25
In addition the book will contain twenty (20) provisional tickets, each good for a one-way trip upon presentation and payment of twenty-five cents (25c) provided all regular tickets have been used.			
Additional provisional tickets for the same calendar month will be issued upon surrender of the complete empty cover—front and back—of a \$10.75 book of the same month.			
11.	Commutation—For passenger automobiles only. Book to contain 40 one-way trip tickets, good for the calendar month.	9.00	10.25
In addition the book will contain ten (10) provisional tickets, each good for a one-way trip upon presentation and payment of twenty-five cents (25c) provided all regular tickets have been used. Provisional tickets, in excess of the above, will not be issued to purchasers of this book.			

\* (Vehicles exceeding limits of special permit to be assessed double this toll.)

# Bay Bridge Traffic Breaks All Records

(Continued from page 20)

tors to the 1940 Golden Gate International Exposition daily are traveling over a State-built approach which rounds Yerba Buena Island from the great bay span and leads directly into the Fair Grounds.

The Division of Highways constructed the road on Yerba Buena and the approach from the island to the Fair site for the 1939 Exposition Company, thus creating an integral temporary highway link from the Bay Bridge to Treasure Island.

In the California Building, the Division of Highways has also constructed a large diorama comparing the highways of today and tomorrow depicting the highways common throughout the country with grade crossings, left turns, narrow and poor surfacing.

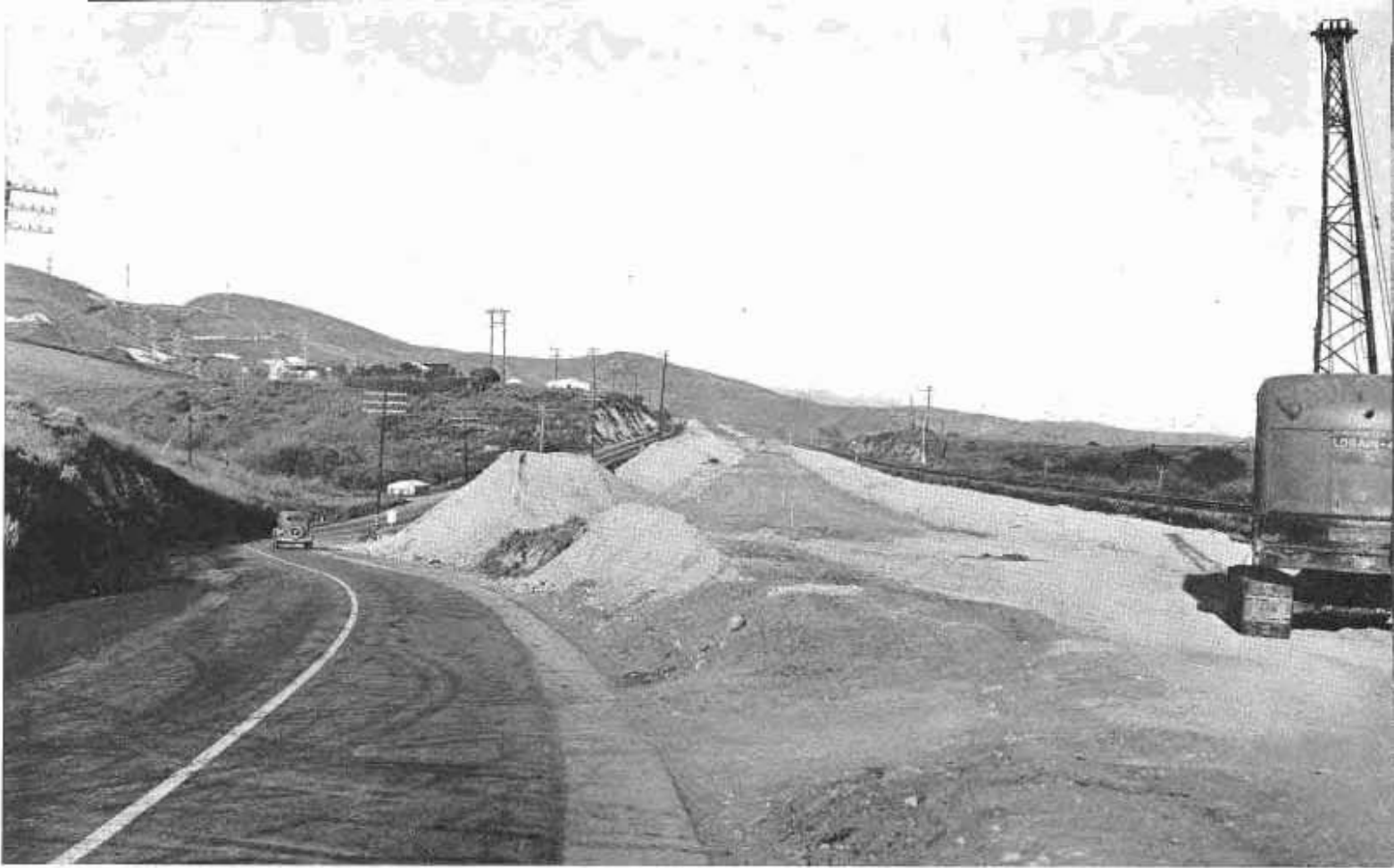
"Highways of Tomorrow," which is attracting many visitors, shows a double four-lane ribbon of roadway, with a parking strip between. There are no left turns, no railroad crossings and no sign boards. Overhead structures and underpasses remove the possibility of collisions at both highway and grade crossings and modern clover leaf designs at intersections provide safe entrance and exit.

Another diorama in the California Building shows modern type highways through mountains, redwood forests, and broad meadows and includes a most realistic scene of heavy equipment at work, grading for the highway relocation in a mountainous section made necessary by the construction of the Shasta Dam unit of the great Central Valley Project.

As a result of the combination of convenient, safe, and cheap facilities provided by the Bay Bridge, indications are that the new Exposition will roll up an attendance record greater than that of 1939 for the corresponding May period.

A report for the weekend of the 1940 season (May 31-June 2, inclusive) with the corresponding weekend for 1939, which would be June 2, 3, 4, shows the exposition had 248,993 paid admissions in 1939 while this year totaled 407,352.





New grade on Santa Barbara coast highway reconstruction runs between existing highway on left and railroad on right.

## Santa Barbara Highway Project

(Continued from page 5)

plant-mixed material on the detours in order to expedite their construction and permit grading to proceed without delay.

### TRAFFIC INCREASE

Highway traffic in this vicinity has increased at the midsummer counts on Sunday and Monday from 2800 and 2200, respectively, in 1928 to as high as 4400 and 3500 in 1937. It is estimated that the traffic in 1965 will reach an hourly peak of 740 vehicles.

The accident record on this section of highway indicates that those accidents reported totaled 11 between the years 1936 and 1938, inclusive, with five of these accidents involving two cars and six involving one car. All of these accidents involved injury and two involved fatalities. It is believed that the above figures represent less than 50 per cent of the accidents that have occurred on this section although the accidents noted above probably covered most of those involving serious injury or fatalities.

The grading work has progressed very well, considering the sporadic rainfall which has occurred on the job this spring. The contractor, R. E. Hazard & Sons and Clarence Crow, expects to complete the entire job about August 15th, although the contract date for completion is October 30th.

This work is being performed under the direction of John C. Adams, Resident Engineer for the State.

### YALE OFFERS 7 FELLOWSHIPS

The Bureau of Street Traffic Research of Yale University is offering nineteen graduate fellowships beginning September 26, 1940, of which seven are available only to employees of State highway departments.

The fellowships provide a living stipend of \$800 dispensed at the rate of \$100 per month for eight months, and a tuition fee of \$400. In addition a maximum of \$200 is available to each Fellow for scheduled field investigations. The Bureau has just published "A Library Classification and Sample Bibliography of Traffic Engineering Materials."

## Gen. Grant Park

(Continued from page 19)

about one-half mile and thus make available this additional nine miles of high type highway at an earlier date than would be possible otherwise.

### MANY CURVES ELIMINATED

Statistics of the old road are not available and it is doubtful if surveys were ever made of the old road. The curvature eliminated will amount to many full circles. There are many curves of less than 50 foot radius and the grades approach 10% if in some cases it is not exceeded.

The new road within the Forest, constructed by the Federal Government, has minimum radius curves of 300 feet except one of 225 feet and one of 275 feet. All curves under 1000 feet radius are spiralled. A maximum grade of 6% compensated is used.

On the State work the maximum grade uncompensated is 6%. Minimum radius of curvature is 700 feet with exception of one 500 foot radius curve at the Forest Boundary.

# State Supervised School Buildings Unhurt by Imperial Valley Shake

By D. C. WILLETT, Supervising Structural Engineer

CALIFORNIA'S luck still held when a destructive temblor shook the Imperial Valley from 8.36 p.m. intermittently for over an hour on May 18th, for the shock came at a time when schools were unoccupied and but few people were in the business district.

Structural engineers of the Division of Architecture from Sacramento and Los Angeles were ordered to the district to assist county, municipal and school officials in investigating the resultant damage. These engineers assisted the county superintendent by inspecting the buildings in the Moreland, Verde, Acacia, Imperial, Magnolia, Alamitos, Eastside, Sunset Springs, Palmetto, and McCabe school districts, and the trustees of the Brawley, El Centro, Calexico, Mulberry and Holtville school districts by determining the structural condition of their buildings after the shake.

Schools built prior to 1933 were without exception found lacking in the necessary stability to assure safety. Some were shattered beyond economical repair. Chimneys came through the ceilings carrying with them portions of the roof and floor framing. Entire ceilings dropped in some instances, wall plastering and blackboards were dislodged and thrown into the room, gables were shaken loose, and concrete and brick walls shattered.

The loss to the Brawley elementary school district alone has been estimated between \$250,000 and \$300,000.

**The one bright side of the picture is that not a single one of the fifteen new school buildings built in the Imperial Valley under the jurisdiction of the Division of Architecture was damaged in any way, not even to minor cracking of the plaster.**

In all parts of California, as well as many other localities, history has proven that we may anticipate the occurrence of earthquakes of varying durations and intensities, at irregular intervals. The Imperial Valley earth-



Ceiling dropped to floor in one old school.



New Brawley Union High School buildings were undamaged.

quake was the 28th destructive one to occur in California in the last hundred years, but it was not until 1933 that State legislation was enacted to provide some degree of safety in the construction of buildings.

This was accomplished in the enactment of Chapter 59, known as the Field Bill, regulating school construction, and Chapter 601, known as the Riley Act, regulating building construction in general with minor exemptions. The wisdom of this legislation was certainly impressed upon the inhabitants of the Imperial Valley and those visiting the area, for all buildings constructed in compliance

with these acts are a testimonial to the efficiency and assurance of safety secured through state supervision.

The cost of the new schools which withstood the shock has been but very little more than those that failed. In checking over the some 3300 school projects supervised by the Division of Architecture, totaling over \$140,000,000, it is the belief of the division that the additional construction expense over what the buildings would have originally cost has been less than 2 per cent. It should be remembered that the additional 2 per cent has been spent in strengthening and making

# Highways Need More Federal Aid

(Continued from page 15)

We must take into consideration the number of registered vehicles and the amount of traffic produced in these urban areas in relation to the registration and traffic lying outside of the urban areas. Such a consideration should be made a part of any formula which is developed. Probably other items will have to be taken into consideration, although I have not studied the problem to a great extent, but it would appear that traffic and registration would cover a formula for the States to follow.

We are in agreement with that part of section 2 of the congressional bill which stipulates that the States shall be the one agency for coordination with the Federal Government, because urban development overspreads county boundaries and is not confined to municipal limits. It also has a definite relation to the Federal Aid System, which is a vital one.

## TRAFFIC DELAY

An example of traffic delay which we found, citing the city of Los Angeles as a typical case, was that the average speed on a city street is around 16½ miles per hour, while on an express highway or freeway, this speed will increase from 30 to 43 miles per hour. This will give an idea of the saving in time, for which the motorist will and can pay.

Our State highway system contains 14,000 miles, including about 7000 miles in the Federal Aid Highway System. The construction of the Federal Aid System was started many years ago.

Obsolescence is not figured entirely in materials. One point of obsolescence is light surfaces placed at a time when capital was not available to produce a heavier surface. Another is location. In the early days in order to serve traffic, locations followed contour and section lines. These were limited to speeds of 25 to 30 miles per hour. Today it is 45 or better. To take care of these changed conditions, location is brought into the picture. You can not meet these present day conditions by following the old location.

Still another point of obsolescence is our bridge problem, brought about

principally by commercial vehicles, heavier loadings and faster speed. It is the overloading of these structures, combined with deterioration to an unsafe condition through the years, which has produced obsolescence in our bridges. In California, legislation has been enacted which permits structurally unsound bridges to be posted for less than the legal load and speed limits. We have many bridges which have been posted for five tons or less which are used for moving lumber, farm products to market areas and other forms of commodities.

Practically our entire farm product is moved on trucks and trailers to rail heads and harbors. The necessity of retiring these narrow, defective structures is quite apparent from the standpoint of service, as well as eliminating a dangerous and increasing hazard to traffic; but we find ourselves able to finance only a small portion of these structures, resulting in the continuation of posted bridges.

One form of obsolescence takes place when business establishments locate along relocated highways until they destroy the use of the highway to through traffic, caused by local congestion.

## REVENUE BOND FINANCING

With Governor Olson and Director Clark, I am convinced that revenue bond financing, guaranteed by the gas tax or tolls and whatever Federal aid may be available for cooperation, is necessary in the solution of our metropolitan transportation problem.

Public utilities are financed on the principal of revenue bonds, where their lines and other facilities represent the investment and the distribution produces resources to retire these bonds and furnish dividend rates on common and preferred stocks. Highway traffic is now paying for itself; and the Government, through the Reconstruction Finance Corporation, was one of the first to recognize that revenue bonds could be made respectable; and in our particular case, they were made respectable by reselling San Francisco-Oakland Bay Bridge bonds to private interests at a substantial profit.

It has been my experience on many large projects that money will be obtained at a lower rate and will be more efficiently expended on highways if there is a cooperative relationship between the Federal Government, the States and municipalities.

## LOANS IMPORTANT

We feel that a loan contribution by means of our ability to sell to the Reconstruction Finance Corporation for the purpose of acquiring rights of way, is a very important issue. In many States, new legislation would be required. While it is quite probable that not over 10 to 15 States will be able to take advantage of such loans, in most of those States local legislation must be adjusted.

A State taking advantage of these loans will find itself in the position of being able to give more benefit to the rural areas in that such loans will prevent or postpone the transfer of much needed gas tax funds from the rural areas, which otherwise would be required for solving city problems. The solving of this city and town problem will be a benefit to economical transportation, at least the equal of anything heretofore accomplished by Federal and State cooperation.

We have the means of constructing these metropolitan highways, but the right of way problem is so large that it would not begin to start the metropolitan development we have planned in Los Angeles.

At the present time, we are constructing only one express highway, known as the Arroyo Seco Freeway, connecting Pasadena and downtown Los Angeles. We have received a PWA grant and sponsor funds are being contributed by the State.

Where we can not secure sufficient direct Federal aid and want to go as far as we can with our own funds, we still do not want to take money from our rural funds and put it into the urban areas.

## NO DANGER IN LOANS

I see no danger in the principle of a law which permits the Reconstruction Finance Corporation and the Public Roads Administration,

(Continued on page 28)



**THANKS FOR SIGNS**  
**CHAMBER OF COMMERCE**  
Azusa, Los Angeles County

March 27, 1940.

Mr. Frank W. Clark,  
Director of Public Works,  
Sacramento, California.

Dear Mr. Clark:

For the Azusa Chamber of Commerce and the traveling public, I wish to thank you for your interest in having the Crystal Lake Park signs erected on U. S. 66 and California 39 in Azusa and on Holt Avenue and Azusa Avenue in West Covina. The signs were erected yesterday by the Automobile Club and certainly are a credit to the State Highway Department and I know will be appreciated by the autoists desiring to know the turning point to this most popular public recreational area.

Our thanks and best wishes,

Respectfully,  
CORNELIUS SMITH, Secretary.

**GIVES VALUABLE DATA**  
**NATIONAL AUTOMOBILE THEFT**  
**BUREAU**  
San Francisco, California

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

Dear Sirs:

Will you kindly place my name upon your list to receive copies of your excellent journal which is issued monthly. I have seen copies of the Journal and find that it contains much valuable information and important data which I can use in speaking before various law enforcement agencies and civic organizations.

Thanking you, I remain,

Very truly yours,  
C. F. CLINE,  
Special Agent in Charge.

Lodi, California.

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

Gentlemen:

I have been a reader of your publication "California Highways and Public

Works" for a number of years but have never had a copy of my own.

I think that the publication is well worth while, both in the manner it is put up and its contents. Will you please put me on your mailing list.

Sincerely yours,  
(Signed) E. REIMCHE.

**CREDIT TO STATE**  
**AMADOR COUNTY**  
**CHAMBER OF COMMERCE**

Jackson, California.

California Highways  
and Public Works,  
Sacramento, California.

Gentlemen:

It has been our pleasure for some time to receive copies of your very fine publication.

It seems that each issue is an improvement over the last. Your stories are most interesting, your cuts are of the finest and the book is, all in all, a credit to the State.

Yours very truly,  
(Signed) EDWARD M. FENNON,  
Secretary.

Editor,  
California Highways  
and Public Works  
Sacramento, California

Dear Mr. Howe:

We have forwarded our last copy of your publication "California Highways and Public Works" to Illinois.

We would appreciate your kindness in forwarding a copy to us for our files, if it is possible for you to do so.

Yours very truly,  
PACIFIC BRIDGE PAINTING CO.,  
By A. Gerake

**REQUESTED BY PWA**

Care of Public Roads Admin.,  
Crescent Mills, California.

California Highways and Public Works,  
Sacramento, California.

Dear Sirs:

I have enjoyed reading, practically from its inception, intermittent issues of your excellent publication.

No longer being content to depend on borrowed copies, I am requesting that you

place me on your mailing list to insure that I'll miss no future issues.

Very truly yours,  
(Signed) J. T. CASSELL,  
Resident Engineer.

**AIDS TRAFFIC RESEARCH**

Editor California Highways  
and Public Works,  
Sacramento, California.

Dear Sir:

Since you kindly placed me on your mailing list the first of this year, I have read your current issues with deep interest and gained much information aidful in my traffic research and studies, and consider your publication a valuable addition to my reference file.

The recent article by Mr. S. V. Cortel-you, Highway Engineer, District VII, regarding "Freeways" and the "Arroyo Seco Parkway," was an especially interesting and informative one, as I am not only interested in this local improvement but have made a country-wide study on that subject.

Sincerely yours,  
EDMUND C. EASTMAN,  
Traffic and Transport Analyst,  
Los Angeles, California.

**FOR CHAMBER OF COMMERCE**

Colusa Chamber of Commerce,  
Colusa, California, May 3, 1940.

California State  
Highway Department,  
Public Works Building,  
Sacramento, California.

Gentlemen:

Please mail us two copies of the last two issues of the Highway Magazine for the files of the Colusa Chamber of Commerce. We are particularly interested in the maps in them in reference to the Flood Control Situation.

Thanking you for this courtesy, we are

Yours truly,  
A. B. DIVISON,  
Colusa Chamber of Commerce.

Little Winnie had evidently been thinking hard as she sat on mother's knee before the fire. Presently she asked:

"Mother, why did you marry daddy?"

Mother looked at her sadly and sighed:

"So you've begun to wonder, too, have you?"

# Change in Road Procedure Opposed By Western States Highway Officials

**T**HE recent nineteenth annual convention of the Western Association of State Highway Officials attended by 112 official delegates representing all the western coast States, including Texas, adopted some resolutions having an important bearing on the disposition of federal funds received from the States from gasoline taxes and allocated to the States for highway construction.

One resolution vigorously opposes any change in the existing fundamental procedure, organization, and method of allocating funds and designating road systems and mileages. This resolution is in protest to a tendency on the part of other agencies to create a duplicating agency to carry on similar types of work.

The resolution also urged that federal funds for highway work be expended solely through the State highway departments and the Public Roads Administration.

## WANT GAS TAXES RETURNED

Another resolution urges that all taxes collected from highway users by the federal government be returned to the States for systematic and coordinated highway construction through the State highway departments and the Public Roads Administration.

A third resolution urges that congress authorize federal funds for participation in State highway programs during the 1942 and 1943 fiscal years total not less than the 1938 and 1939 authorizations, pointing out that current federal aid authorizations expire at the end of the 1941 fiscal year.

## RIGHTS OF WAY ISSUE

A resolution of supreme importance in long range highway planning foresees the pressing necessity for more adequate rights of way along highway alignments and aid in the acquisition thereof from the federal government.

Other resolutions recommend separation of forest highway funds from other forest road funds to eliminate unnecessary confusion and declared that in the future the Association

## Resolution

Whereas, for the past 25 years, through cooperation between the state highway departments and the Public Roads Administration, there has been constructed in the United States a system of highways which is outstanding in the world; and

Whereas, from the funds allocated, the people of the nation now have a capital investment of at least 75 per cent of such funds which is still paying returns to them; and

Whereas, there is an apparent tendency on the part of other agencies to create a duplicating agency to carry on similar types of work; and

Whereas, through the cooperation of the state highway departments and the Public Roads Administration, basic data has been compiled which now is available to determine comprehensive state highway programs; and

Whereas, through the present cooperative arrangement there has been developed in the state highway departments and the Public Roads Administration a trained engineering personnel and organization competent to carry on highway building activities.

Now, therefore, be it resolved, that the Western Association of State Highway Officials representing the highway construction activities of the 12 western states does hereby vigorously oppose any change in the fundamental procedure, organization and methods of allocating funds and designating road systems and mileage; and

Be it further resolved, that it is the considered opinion of this association that any federal funds in the future to be used for highway construction should be expended through the state highway departments and the Public Roads Administration and no other federal agencies.

shall include, in addition to the eleven western States, the State of Texas.

Present at the convention were delegations from all member States, comprising Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Texas, Utah, Washington and Wyoming, as well as district and regional officials of the Public Roads Administration and W. C.

Markham, Executive Secretary of the American Association of State Highway Officials.

B. G. Dwyre, State Highway Engineer of New Mexico, was elected president, succeeding Robert A. Allen of Nevada. C. F. Seifried, Wyoming Highway Department Office Engineer, was elected vice president, and R. H. Flint, Idaho Highway Director was named secretary and treasurer.

Three new executive committee members named were: Mr. Allen; Preston G. Peterson, Utah Highway Commissioner and W. R. Hutchins, Arizona State Highway Engineer. The four holdover members are R. L. Bobbitt, Texas Highway Commissioner; Dr. L. I. Hewes, Regional Public Roads Administration, San Francisco; D. A. McKinnon, Montana Highway Engineer.

## Highways Need More Federal Aid

(Continued from page 26)

based on an executed agreement between parties, to loan money on meritorious projects; and I do not see any danger in anyone abusing such authority. The only danger I can see is the possibility of not obtaining loans on reasonable terms.

The loans for the Reconstruction Finance Corporation are self-liquidating and repayments are made on a monthly, semiannual, or annual basis, or from resale of the bonds. This money is not lost forever but is repaid, which would then make it eligible for other projects.

I believe that where the Federal Government can loan money, as has been done through the Reconstruction Finance Corporation, if a State or municipality can obtain better terms through the Federal Government, they should take advantage of such loans. The Reconstruction Finance Corporation has ample facilities to pass on the liquidating features of an application.

Here in California, we do not contemplate going very far ahead of our construction program and our ability to finance construction.

## Highway Bids and Awards for the Month of May, 1940

**EL DORADO COUNTY**—At Upper Truckee River about one mile west of Meyers, a reinforced concrete girder bridge to be constructed, about 0.3 mile of roadway to be graded and road-mix surface treatment applied. District III, Route 11, Section J. Scheumann & Johnson, Eureka, \$34,594; Holdener Construction Co., Sacramento, \$37,266; Harold Smith, St. Helena, \$37,294; Campbell Construction Co., Sacramento, \$37,298. Contract awarded to E. T. Lesure, Oakland, \$33,685.00.

**FRESNO COUNTY**—Between White Deer Road and Sequoia National Forest Boundary, about 3.1 miles to be graded and penetration oil treatment applied. District VI, Route 41, Section T. A. Teichert & Son, Inc., Sacramento, \$144,330; Hemstreet & Bell, Marysville, \$159,900; Piombo Bros. & Co., San Francisco, \$187,743; Guerin Bros., San Francisco, \$188,191; Johnston Rock Co., Inc., Stockton, \$190,426; A. S. Vinnell Co., Alhambra, \$192,069; Isbell Construction Co., Reno, \$194,127; Denni Investment Corp., Wilmington, \$207,129. Contract awarded to Heafey-Moore Co. Fredrickson & Watson Construction Co., Oakland, \$137,755.

**HUMBOLDT AND DEL NORTE COUNTIES**—At various locations, about 23.8 miles road-mix surfacing and seal coat to be applied. District I, Route 1, Oranges Bros. Construction Department, Stockton, \$38,092. Contract awarded to Hayward Building Material Co., Hayward, \$37,410.25.

**SOLANO COUNTY**—Bridge across Sonoma Creek about 10 miles west of Vallejo, a portion to be redecked. District X, Route 208, Section A. Harold Smith, St. Helena, \$30,672; Campbell Construction Co., Sacramento, \$31,688; Albert H. Siemer and John Carcano, San Anselmo, \$32,742; E. E. Smith, Eureka, \$33,340; M. J. B. Construction Co., Stockton, \$36,421; Carl N. Swenson Co., San Jose, \$37,223; A. G. Raisch, San Francisco, \$43,000. Contract awarded to Lee J. Immel, Berkeley, \$29,095.

**IMPERIAL COUNTY**—Stockpile pit run gravel in windrows on shoulders between Niland and County Line. District XI, Route 187, Sections F, G. R. E. Hazard & Sons, San Diego, \$5,440; Haines Canyon Materials Co., Glendale, \$2,984; A. L. Gabrielson, Arlington, \$5,080; A. E. Fowler & Sons, Santa Ana, \$5,840; E. L. Yeager, Riverside, \$5,600; A. S. Vinnell Co., Alhambra, \$5,192; M. McClelland, El Centro, \$4,800; F. J. Heidlebaugh, Long Beach, \$3,960; H. L. Miller, Hemet, \$6,320; Cozens & Hammond, Encinitas, \$5,840; A. C. Bussey, Riverside, \$7,840; Billings Truck Co., San Diego, \$9,840; V. R. Dennis Construction Co., San Diego, \$7,480; Contract awarded to Minnis & Moody, Los Angeles, \$3,600.

**KERN COUNTY**—Between 3.3 miles south of Poso Creek and Poso Creek, about 3.3 miles to be graded and road-mix surfacing applied. District VI, Route 129, Section A. Rexroth & Rexroth, Bakersfield, \$42,631; A. S. Vinnell Co., Alhambra, \$44,194; Louis Biasotti & Son, Stockton, \$45,709; Calowell Construction Co., Bakersfield, \$46,281; L. A. & R. S. Crow, Los Angeles, \$46,917; Guerin Bros., San Francisco, \$47,642; A. Teichert & Son, Inc., Sacramento, \$48,809; Claude C. Wood, Lodi, \$52,181; Dimmitt & Taylor, Los Angeles, \$55,713; Claude Fisher Co., Ltd., Los Angeles, \$57,124; Haines Canyon Materials Co., Glendale, \$57,142; L. C. Karstedt, Watsonville, \$58,443. Contract awarded to George E. France, Visalia, \$40,233.46.

**LOS ANGELES COUNTY**—Flashing light system to be installed about 1.9 miles

south of Newhall. District VII, Route 23, Sections H & I. Chandler Electric Co., Arcadia, \$848. Contract awarded to Moore Electric Co., Los Angeles, \$816.

**LOS ANGELES COUNTY**—Road-mix surface treatment over existing highway between W. Fork San Gabriel River and La Cienega. District VII, Route 62, Section B. Dimmitt & Taylor, Los Angeles, \$9,279. Contract awarded to A. S. Vinnell Co., Alhambra, \$7,739.

**LOS ANGELES COUNTY**—Over Arroyo Seco Channel at Avenue 60 Service Road, a rigid frame reinforced concrete box girder bridge to be constructed and roadway approaches to be graded and paved with portland cement concrete. District VII, Route 205, Section L.A. Oberg Bros., Los Angeles, \$18,863; J. S. Metzger & Son, Los Angeles, \$18,868; Contracting Engineers Co., Los Angeles, \$18,999; Carlo Bongiovanni, Hollywood, \$19,732; Wm. J. Distell, Los Angeles, \$20,050; Byerts & Dunn, Los Angeles, \$20,662; Baruch Corp., Los Angeles, \$22,054; John Higgins, Huntington Park, \$22,383; C. R. Butterfield & Kennedy Co., San Pedro, \$22,656; Geo. J. Bock Co., Los Angeles, \$22,726; Oscar Oberg, Los Angeles, \$23,217. Contract awarded to J. E. Haddock, Ltd., Pasadena, \$18,270.

**MARIPOSA COUNTY**—Between Mariposa and 2 miles north, about 1.9 miles to be graded and surfaced with road-mix surface on gravel base. District X, Route 18, Section D. Louis Biasotti & Son, Stockton, \$86,790; A. S. Vinnell Co., Alhambra, \$90,387; A. Teichert & Son, Inc., Sacramento, \$92,248; Piombo Bros. & Co., San Francisco, \$97,615; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, \$91,944; M. J. B. Construction Co., Stockton, \$99,596. Contract awarded to Valley Construction Co., San Jose, \$78,231.

**MENDOCINO AND LAKE COUNTIES**—At various locations, about 32.1 miles road-mix surfacing and seal coat to be applied. District I, Routes 1, 15, 48. J. A. Casson Co., Hayward, \$75,140; Independent Construction Co., Ltd., Oakland, \$77,893; Oranges Bros. Construction Co., Stockton, \$79,457; E. A. Forde, San Anselmo, \$84,532; A. S. Vinnell Co., Alhambra, \$89,935; Marshall S. Hanrahan, Merced, \$92,494. Contract awarded to C. M. Syar, Yuba City, \$55,540.

**MENDOCINO COUNTY**—At Fox, Hearn and Schefer Gulches and at Pierson Draw, about 0.9 mile to be graded, blanketed with imported borrow and prime coat and seal coat applied thereto. District I, Route 59, Sections A, C. J. L. Conner and Sons, Point Arena, \$33,649; Guerin Bros., San Francisco, \$38,448. Contract awarded to John Burman & Sons, Eureka, \$32,563.

**MENDOCINO COUNTY**—Across Greenwood Creek about 19 miles north of Point Arena, an existing bridge to be repaired. District I, Route 59, Section C. F. Fredenburg, So. San Francisco, \$14,334; M. A. Jenkins, Sacramento, \$14,582; Fred J. Maurer & Son, Eureka, \$16,142; Harold Smith, St. Helena, \$16,513; James E. Anderson, Visalia, \$17,034; Albert H. Siemer and John Carcano, San Anselmo, \$17,084; R. G. Clifford, San Francisco, \$18,856. Contract awarded to Scheumann & Johnson, Eureka, \$13,416.

**MONO COUNTY**—Across West Walker River near Sonora Junction, a reinforced concrete box girder bridge to be constructed and approaches to be graded. District IX, Route 13, Section A. A. S. Vinnell Co., Alhambra, \$35,631; E. T. Lesure, Oakland, \$37,517; Valley Construction Co., San Jose,

\$43,284; Scheumann & Johnson, Eureka, \$44,342; Albert H. Siemer & John Carcano, San Anselmo, \$47,043. Contract awarded to Campbell Construction Co., Sacramento, \$35,341.

**PLACER COUNTY**—Between Grove Street in Tahoe City and three miles westerly, about 2.9 miles to be graded and surfaced with plant-mixed surfacing on gravel base. District III, Routes 39 and 38, Sections A & B. Piazza and Huntley, San Jose, \$72,889; Louis Biasotti & Son, Stockton, \$79,305; Marshall S. Hanrahan, Redwood City, \$128,422. Contract awarded to Independent Construction Co., Ltd., Oakland, \$68,813.

**PLACER AND NEVADA COUNTIES**—Between Hampshire Rocks and Soda Springs about 5.5 miles portions of roadway to be graded and the project to be surfaced with crusher run base and plant-mixed surfacing. District III, Route 37, Sections F, B. Independent Construction Co., Ltd., Oakland, \$83,245; Piazza & Huntley, San Jose, \$86,544; Marshall S. Hanrahan, Merced, \$106,151. Contract awarded to J. R. Reeves, Sacramento, \$66,172.

**SAN JOAQUIN COUNTY**—Walkaway constructed on Mossdale Bridge. District X, Route 5, Section B. Pomeroy Sinnock, Stockton, \$11,997; C. C. Gildersleeve, Berkeley, \$11,399. Contract awarded to F. Kaus, Stockton, \$9,744.

**SANTA BARBARA COUNTY**—Between Jonata Park and Zaca, about 2.7 miles to be graded and surfaced with plant-mixed surfacing on crusher run base. District V, Route 2, Section D. A. Teichert & Son, Inc., Sacramento, \$137,337; Denni Investment Corp., Wilmington, \$145,675; Clarence Crow, Los Angeles, \$148,413; Louis Biasotti & Son, & L. D. Tonn, Stockton, \$149,931; Daley Corp., San Diego, \$154,290; Heafey-Moore Co., Oakland, \$156,610. Contract awarded to Guerin Bros., San Francisco, \$131,932.

**SISKIYOU COUNTY**—Existing bridge across Klamath River about 26 miles northeast of Orleans to be redecked. District I, Route 46, Section A. Fred J. Maurer & Son, Eureka, \$8,153; Fred Fredenburg, So. San Francisco, \$9,985; Scheumann & Johnson, Eureka, \$8,222; C. C. Gildersleeve, Berkeley, \$9,299. Contract awarded to E. E. Smith, Eureka, \$7,621.

**SOLANO COUNTY**—Under the tracks of the Southern Pacific Co. about 0.7 mile south of Davis, an underpass consisting of a through steel girder deck on concrete piers and abutments to be constructed. District X, Route 6, Section A. Campbell Construction Co., Sacramento, \$178,196; E. E. Smith, Eureka, \$183,455; Earl W. Heple, San Jose, \$187,030; Engineers, Ltd., Sacramento, \$188,780; United Concrete Pipe Corp., Los Angeles, \$189,236; A. Soda & Son, Oakland, \$191,558. Contract awarded to Heafey-Moore Co. Fredrickson & Watson Const. Co., Oakland, \$175,903.

**RIVERSIDE COUNTY**—Existing bridge to be repaired by extending 7 bents with steel piles and reinforced concrete about five miles west of Indio. District XI, Route 64, Section Q. R. J. Daum, Inglewood, \$7,714; Valley Construction Co., San Jose, \$8,343; A. S. Vinnell Co., Alhambra, \$7,435; J. E. Anderson, Visalia, \$6,489; T. B. Penick & Sons, San Diego, \$8,863. Contract awarded to Thomas Construction Co., Burbank, \$6,025.

**RIVERSIDE COUNTY**—Between Banning and junction Route 187, about 11 miles to be graded and surfaced with plant-mixed

(Continued on page 32)

# Cement Experiments Through the Ages

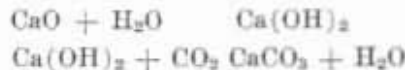
By LESTER C. MEDER, Assistant Physical Testing Engineer

The following is the third and concluding installment of a paper upon the history and manufacturing of Portland cement. The first two parts briefly summarized the history of cement, the winning and preparation of the raw materials, and the burning and cooling of the clinker.

UNTIL comparatively recently it was thought that, to be sound, cement should be made from a clinker exposed to the weather for several months. More recent research, however, has developed that one of the principal causes of unsoundness may be the presence of "free" or uncombined lime, an indication that the burning processes in the kiln had been incomplete.

Many current specifications frown upon the practice of aging clinker, one actually requiring that the clinker be ground within six weeks of its manufacture and further specifying that it shall be kept covered and dry until ground. Other specifications attempt to control this feature by limiting the allowable "free" lime in the clinker.

Volume change or unsoundness is caused by the presence of a dead-burned, uncombined lime or calcium oxide in a state that hydrates very slowly. This calcium oxide in the presence of moisture forms hydrated lime, which in turn is converted to calcium carbonate in the presence of carbon dioxide in the air, or:



If these reactions take place while the cement is still in the clinker stage, no serious harm may be done, though the cement would be of a definitely inferior quality. However, if the changes take place after the cement has been made into concrete, sufficient expansive forces may be set up to rupture the concrete.

As soon as the clinker has cooled it is ready for grinding. In some mills it is first passed rapidly through rolls or some preliminary crushers where it is reduced to the fineness of coarse sand. In other plants this preliminary reduction is eliminated and the kiln run clinker is fed directly into the tube mills.

The tube mill is a hollow, heavy steel cylinder from 5 to 10 feet in diameter and up to 60 feet long, supported by heavy, hollow steel trunions or shafts on each end. It revolves at a speed of approximately 20 revolutions per minute, the speed depending upon the radius of the mill and the specific gravity of the grinding media, being somewhat faster for smaller

mills and slower for the larger mills. The tube is nearly half full of rounded steel slugs. The clinker is crushed and the grinding accomplished by the falling slugs as the tube revolves.

At the ideal speed the slugs describe the greatest and most effective drop. At slower speeds they roll ineffectively down the side after exceeding the angle of repose, whereas at speeds above the ideal, they are carried too far and on falling strike the opposite side of the mill at an ineffective angle. At still greater speeds, centrifugal force holds the slugs against the side of the tube so that they do not fall at all.

Grinding in tube mills is effected almost entirely by percussion or shock; attrition, or rubbing being reduced as much as possible. The rotation of the mill at proper speed carries the slugs around to a point where gravity overcomes the centrifugal force and the slugs fall onto the cement clinker in the bottom of the tube. It is this continuous action, and impact of the slugs that reduces the cement clinker to an impalpable powder.

Formerly, round flint pebbles were

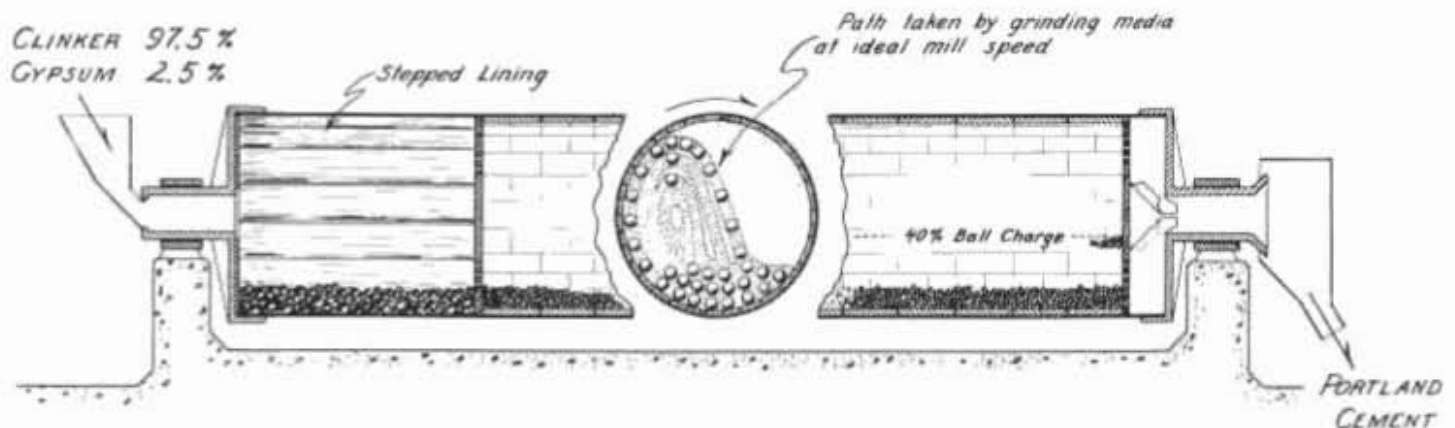


Fig. 3 - Section of Compound Mill used for grinding Cement Clinker. 20% Ball Charge Shown. Charges up to 40% often used.

used as a grinding media. These were imported in great quantities from England, France and western Europe where flint nodules occur in extensive chalk deposits. The nodules are set free by wave action along the coast and are then rounded in the surf. In this country, though there are many flint formations, none of them outcrop near a shore, and therefore only rough angular rocks unsuitable for grinding are available. One of the northern California mills at one time obtained its pebbles from the gravel deposits near the American River. In grinding, these local pebbles wore down about twice as fast as the imported pebbles, but as they cost less than half as much, the greater wear was more than compensated by the lower cost. Of recent years steel slugs have almost entirely replaced flint as a grinding media, except in cases where pollution by iron must be avoided. These steel slugs are in various shapes; spheres, tetrahedrons, short and long cylinders, springs, cones, being some of the more ordinary shapes. They vary from 3 inches to  $\frac{3}{4}$  inches in size, and from 4 pounds to .06 pounds in weight.

Since 1920 there has been a definite trend toward the use of larger grinding mills and compound mills or mills with more than one compartment. Figure 3 shows a typical two compartment mill. Some mills in use have three or more compartments. The compound mill tends to eliminate the preliminary crushing of the clinker. The first compartment (fig. 3) which carries the larger slugs is lined with chrome steel stepped plates, while the second or longer compartment carries the smaller slugs and is lined with a smooth surface of white cast iron or wear-resisting steel.

The clinker is fed into the charge end of the tube mill at a measured rate, and a definite percentage (2.5%-3.0%) of gypsum is added at this point. As this mixture flows into the path of the falling slugs, it is shattered and rapidly reduced to a coarse powder, the coarse powder then passes out of the first compartment and into the next where finish grinding is accomplished by small balls. As the material passes on toward the outlet, or discharge end, it becomes finer and finer until it is discharged as an impalpable powder.

There are three types of grinding in general use at the present time: (1) "open circuit," (2) "closed circuit," and (3) "windswept." When

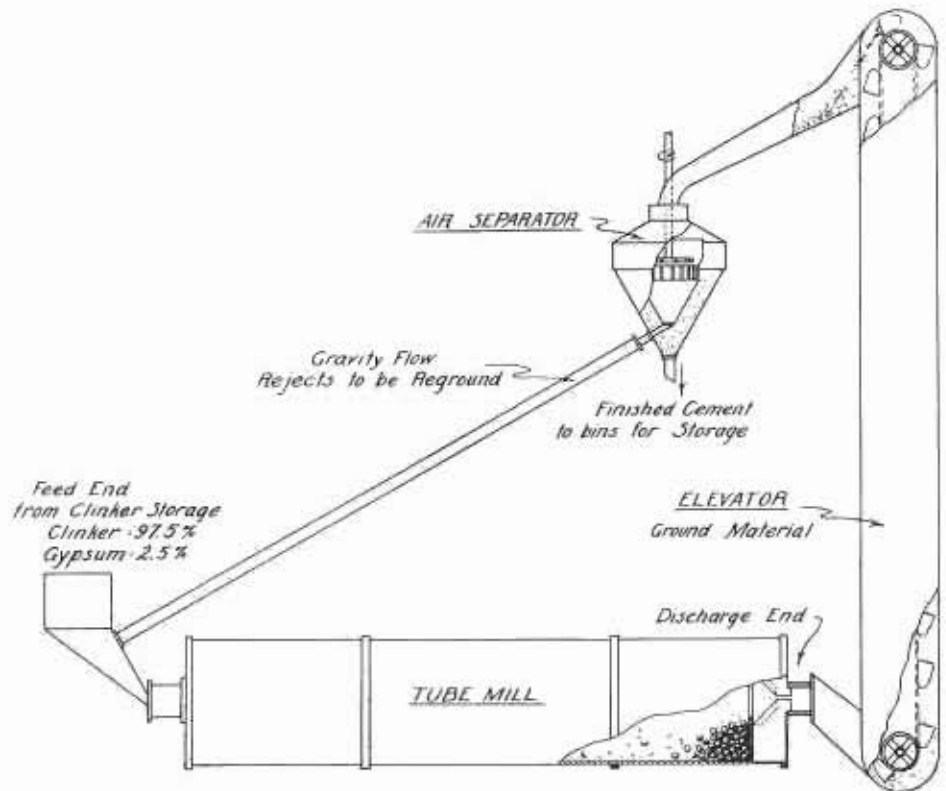


Fig. 4 - Flow Sheet for Finish Grinding Process.

grinding in "open circuit," the clinker enters the mill, passes through, and emerges as a finished cement, the complete grinding process being accomplished in one passage through the mill. When discharged, it is conveyed to the storage bins. In "closed circuit" grinding, the cement is passed through the mill at a much higher rate, made possible by the use of larger balls. When the cement leaves the tube mill, only a fraction is as fine as desired. It is then lifted in an elevator to an air separator where a strong draft of air separates out the finer material which is the finished product, and conveys it to the storage bins. The coarser material, or rejects are returned to the feed end of the tube mill to be reground. The flow sheet for this process is shown in Figure 4. In a typical set up, a mill might have a circulating load of 350%. This means that 450 pounds of material, of which 100 pounds is fresh clinker and 350 pounds of rejects from the air separator are fed in to the mill. Of this combined charge 100 pounds will be completely ground to a finished product, and 350 pounds will be returned to the system as rejects. Under such conditions, the average particles will pass through the mill three or four times

before being reduced to the desired size. In the third type, or the "windswept" mill, a draft of air is passed constantly through the tube mill. As soon as a cement particle is small enough, it is swept out of the mill as the finished product. The last two types of grinding are now in universal use because they increase the efficiency of a mill by reducing the amount of very fine flour in the mill which would only serve to cushion the blows and thereby reduce the grinding efficiency.

The rate of grinding is a function of the fineness of the finished product, and is controlled by the rate the clinker is added to the mill. To give an idea of relative speeds, a mill that produces 60 barrels of cement per hour with a surface area of 1600 square centimeters per gram would produce only about 20 barrels if the surface area were increased to 2100.

The size of the balls used in grinding is determined by the size of the material to be ground. They should be large enough to completely shatter a piece of clinker. Greater efficiency is developed using smaller balls if they qualify under the first requirement. For equal total weights, one charge with balls weighing five

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# Redecking the Yolo Causeway

(Continued from page 18)

width of 42 feet with a 3-foot sidewalk. The full width of the roadway was surfaced with an asphaltic concrete pavement.

The Sacramento River Flood Control Project contemplates the construction of the levee near the west end of the causeway at some time in the future. The proposed levee height would necessitate the raising of the grade of the causeway approximately 8 feet for a distance of 1,200 feet at the westerly end.

Because of the indeterminate date of future levee work as well as lack of sufficient funds, it was decided to reconstruct the twenty-four-year-old timber portion of the structure on the existing grade by means of a standard timber deck with a concrete slab wearing surface. The concrete slab is designed with a timber deck so that it can be jacked up to ultimate grade whenever the west levee is constructed, without any loss of the present investment.

On January 25, 1940, a contract was awarded to redeck the original timber trestle. This work consisted of removing the existing rail and asphalt concrete surfacing of 2,470 feet of trestle. The existing caps, stringers, and subflooring were removed and new caps, stringers, and 1-inch subfloor were placed on 2,337 feet of the causeway. The existing subflooring remained in place on 133 feet. All contact surfaces were treated with two coats of wood preservative before the timbers were placed.

The reinforced concrete pavement was poured in two lanes by means of transit mixed concrete. The north traffic lane, 10 feet in width was poured first followed by the pouring of the south lane, 11 feet in width. A longitudinal construction joint was formed between lanes and the steel was lapped at this joint to provide a 40 diameter lap of the reinforcing steel.

The slabs were finished with a mechanical paving machine supplemented by 8 foot airplane floats. The deck was given a broom finish to provide a non-skid surface.

To avoid cracking of the partially poured concrete over the transverse reinforcing steel caused by vibration

# Bids and Awards

(Continued from page 29)

surfacing on cement stabilized base. District VIII, Route 26, Section Ban., C. Heafy-Moore Co. Frederickson & Watson Construction Co., Oakland, \$376,444; Griffith Co., Los Angeles, \$375,861; Warren Southwest, Inc., Los Angeles, \$375,861; Basich Bros., Torrance, \$376,499; Daley Bros., San Diego, \$378,653; Oswald Bros., Los Angeles, \$379,681; Fredrickson & Westbrook, Sacramento, \$379,947; A. Teichert & Son, Inc., Sacramento, \$386,584; United Concrete Pipe Corp., Los Angeles, \$390,731; Matich Bros., Elsinore, \$393,155; J. E. Haddock, Ltd., Pasadena, \$414,314; Claude Fisher Co., Ltd., Los Angeles, \$435,434. Contract awarded to Geo. Herz & Co., San Bernardino, \$367,305.

**SAN MATEO COUNTY**—Across Pescadero Creek about 20 miles south of Half Moon Bay and across San Gregorio Creek about 13 miles south of Half Moon Bay, two reinforced concrete girder bridges to be constructed. District IV, Route 56, Section B. E. T. Lesure, Oakland, \$91,515; Scheumann & Johnson, Eureka, \$91,865; Harry J. Oser, San Francisco, \$94,935; A. Soda & Son, Oakland, \$95,539; Fred J. Maurer & Son, Eureka, \$97,592; E. E. Smith, Eureka, \$103,284; R. G. Clifford, San Francisco, \$109,105. Contract awarded to Campbell Construction Co., Sacramento, \$82,964.04.

**VENTURA COUNTY**—At the Fillmore Maintenance Station Site, a water supply well to be drilled. Contract awarded to Leonard A. Anderson, Camarillo, \$790.

set up by fast moving vehicles on the adjacent traffic lane, it was necessary to place one-way traffic control with a pilot car. Such traffic control is maintained until the concrete has been allowed to set for approximately 12 hours. Upon the completion of this contract, traffic will be confined to the two lanes on the north half of the structure.

Another contract was awarded on April 20, 1940, to repave the entire south half of the structure, a length of 3.13 miles, with a 4-inch reinforced concrete pavement. It provides for the removal and disposal of the existing asphaltic concrete surfacing on the south half, the construction of a light weight concrete deck on the bascule span, and the feathering out of asphalt concrete surfacing on the north half of the structure for a distance of 14,068 feet. The paving of the south half also will be performed with standard paving equipment.

Both contracts, which have been awarded to Lee J. Immel, are being prosecuted simultaneously. It is anticipated that the redecking will be completed and the causeway thrown open to four lanes of traffic by September 1. The total cost of the work involved in both contracts is approximately \$203,000.

# Cement Experiments Through the Ages

(Continued from page 21)

pounds each and the other with balls weighing only one pound, there would be five times as many separate blows per revolution of the mill with the lighter than with the heavier balls.

With the demand for finer ground cements, the grinding problem has become more and more complicated. Efficient grinding requires that certain conditions be met, and in order to meet them, there is a growing demand for grinding aids, and improved grinding methods. The use of dispersing agents or grinding aids, unless they are proven by use, may lead to an inferior grade of cement and for that reason, they are closely watched.

For maximum efficiency the following conditions must be met:

1. The balls must be kept clean so that the impact is at a maximum.
2. The cement particles must be kept from agglomerating, or sticking together.
3. The mill temperature must be kept below 300°-350° F. to keep the gypsum from being altered.

After the completion of the grinding process, the cement is conveyed in steel pipes with compressed air into the bins where it is stored until used.

Up to comparatively recent years cement was handled entirely in sacks, but with the tremendous quantities now being used in relatively small areas, such as for the piers of the San Francisco-Oakland Bay Bridge, the Boulder and other dams, more and more cement is being shipped in bulk, both by railroad and by truck. Packing the cement in sacks is one of the interesting sights in a plant.

The sacks, which have a flap valve in the bottom, are first tied automatically, and then slipped on a hollow tube. The cement, flowing through this tube fills the sack to 94 pounds, at which weight the flow is automatically stopped. Ninety-four pounds is the weight of one cubic foot of cement. The filled sack then drops on a belt conveyor to be loaded into cars on trucks.

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# MAP SHOWING STATE HIGHWAY SYSTEM

**LEGEND**  
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 Secondary Roads   
 Proposed Roads 



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