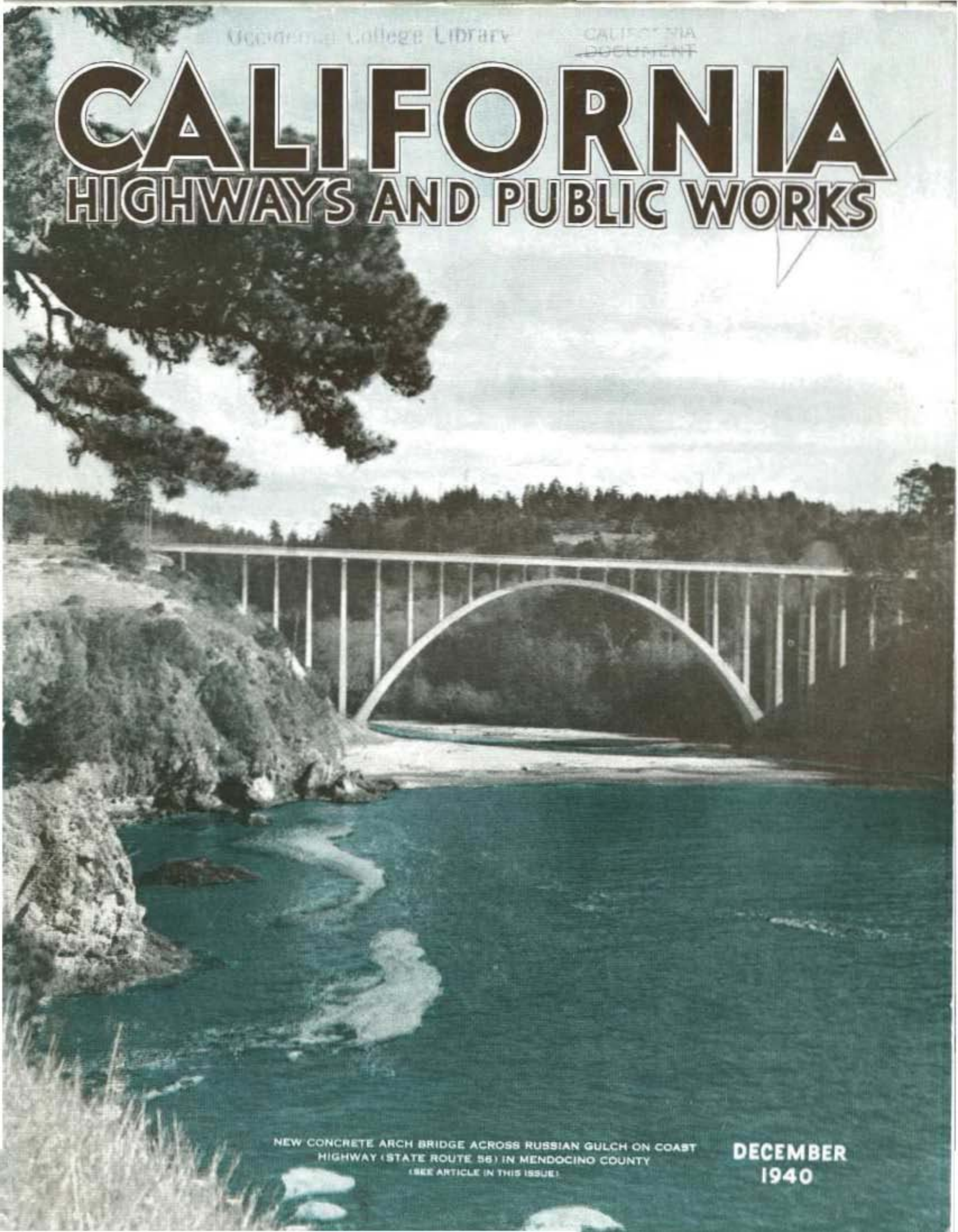
CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



NEW CONCRETE ARCH BRIDGE ACROSS RUSSIAN GULCH ON COAST HIGHWAY (STATE ROUTE 56) IN MENDOCINO COUNTY
(SEE ARTICLE IN THIS ISSUE)

DECEMBER
1940

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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700 Bridges on Federal Military Highway Network in State Inadequate for Defense Needs

By F. W. PANHORST, Bridge Engineer

A PRELIMINARY study shows that nearly half the bridges on the Military highway net work in California will have to be replaced, widened or strengthened in order to bring them up to the standards required by the War Department.

In the November issue of "California Highways and Public Works," Mr. C. H. Purcell, State Highway Engineer, discussed the importance of a proper system of highways as part of a national defense program and pointed out the woeful inadequacy of available funds for bringing the existing highway system up to needed standards. It was shown that not only must existing roads be widened and reconstructed to carry a large volume of traffic with heavy load concentrations but also new arteries of travel must be provided.

In this connection the present condition of highway bridges merits particular attention because of its relative importance in the general problem of reconstructing the highways. That it is important is shown by statements made by the United States Public Roads Administration and others to the effect that reconstruction of bridges should be given first consideration in undertaking the highway reconstruction program.

EXPENSE RESTRICTION

A bridge can be looked upon as a very expensive section of highway. Because of their cost, it is general practice to restrict the roadway somewhat at bridges, and in many cases—also because of the expense—bridges are not widened when the road is reconstructed to proper standards. The general result has been a lag in bridge construction with regard to providing proper roadway widths and standards of alignment at the bridge and its approaches. In these respects restrictions on travel are the same as in the case of the roadway except that the remedy in the case of bridges is harder to apply because of the greater relative cost.

An old timber truss bridge that collapsed under a truck and trailer loaded with a power shovel, both vehicles being considerably over the posted weight limit. The truck and fallen span lie in shallow water

However, the maintenance of old weak structures is a condition which, if not remedied, has more sinister possibilities than the maintenance of narrow roadways or inadequate roadbeds. Usually, it is possible to get traffic over a road somehow, no matter how bad its condition, perhaps at the cost of some delay and extra maintenance. The failure of a bridge, or a major part of it, means that traffic stops and may wait hours or days for either a detour to be built or repairs to be made.

ARMY HELD UP

In some cases other routes are possible at the cost of extra travel and extra road maintenance, but often—and this is particularly true of California with its large areas of rugged topography—there are no practicable detour roads. Only a few years ago highway traffic, including a unit of the United States Army, sat down and waited several days for a new bridge to be built over a deep ravine on the Redwood Highway to replace one that had failed completely and could not be repaired.

It makes no difference as far as the effect on traffic is concerned whether a bridge fails because of weakness or is blown up by a retreating enemy. Even a superficial study of the developments of the war in Europe will

No. 1—Light, narrow bridge posted and likely to collapse if struck by a vehicle out of control. No. 2—Inadequate expansion detail in concrete girder span caused serious cracking. No. 3—Poor concrete in pile coupled with abrasion by floating drift resulted in serious weakening. No. 4—Support piles weakened by marine borers.

show the importance of keeping a bridge in place, or demolishing it if you are on the retreating side.

Not only in war but also in times of peace are weak bridges a matter of serious concern. Always a hazard, the danger is increasing constantly because of the wear and tear of growing numbers of heavy commercial vehicles and the tendency toward greater load concentration.

Because of the unscientific provisions of the present motor vehicle laws, maximum loadings may be carried by each type of vehicle no matter how closely its axles are bunched together, and the use of shorter vehicles is increasing because of the need for maneuverability and the public's objection to passing long vehicle combinations.

REDUCED SAFETY FACTOR

Because of the weight concentrations, the public now finds that a large portion of the safety factor built into its modern bridges is encroached upon. The increased stresses in bridge members over those contemplated in their design may not be a matter of immediate concern but will be, and in fact is already being, reflected in increased cost of maintenance and shorter service life. The serious problem, however, is the effect on a large number of existing bridges designed to a lower standard or so deteriorated that little or no safety factor remains under the maximum loads possible under the present law.

22% NOW POSTED

In connection with the use of roads for war purposes the War Department has accepted the H-15 design standard for bridges that are to carry military loads such as are now contemplated. The so-called "H" loadings are in general used throughout the United States for the design of highway bridges.

The H-15 loading which is based on a fifteen ton truck with 24,000 pounds on its rear axle, is the particular loading used for a large majority of the nation's highways. For long spans this loading assumes the 15 ton truck to be followed and preceded by similar 12½ ton trucks spaced at 30 foot intervals. It is of particular interest to consider the situation with regard to bridges that are not up to this standard.

First, let us take the State Highway System as a whole.

At the present time there are 235 bridges on the State Highway System legally posted for less than the load limit provisions of the Vehicle Code. These reductions in the loading are based on factors of safety that are considerably less than those incorporated in the design of a new bridge, and this is permitted only because such bridges are under regular and frequent inspection by competent men. Likewise, in such cases saving in maintenance costs or prolonging the service life of the bridge is waived to a large extent.

While it is true that these posted bridges are being repaired or replaced continuously, others are steadily deteriorating or being damaged to the point where they also must be posted, and many large and strategically located structures are included in this classification. In addition to the above number there are 94 bridges posted for reduced speed either because they are not strong enough to withstand the pounding of heavy high-speed traffic, or because impact from a mishandled vehicle might bring about complete collapse of a span.

It is estimated that about 230 more bridges may have to be posted for reduced loadings within the next two or three years. Another 320 bridges or so are not up to modern standards, but it is expected—or at least hoped—they can be kept in service for several more years without posting for reduced loads.

1200 BELOW STANDARD

Although not included in the class of weak bridges, there are about 430 other bridges inadequate in either width of roadway or alignment of the bridge and approach roadway. Thus there are about 1200 State bridges, out of a total of 4200, not up to an acceptable standard, and the general condition of 8000 or more bridges on county roads is known to be a still more serious problem.

At the beginning of the current biennium it was estimated that about $9,000,000 would be required to replace the bridges unsafe for legal loads. Many bridges included in this total have been replaced, but others—as already stated—have reached the same stage. It was estimated also that it would take $35,000,000 to replace all the structurally inadequate bridges, that is, all

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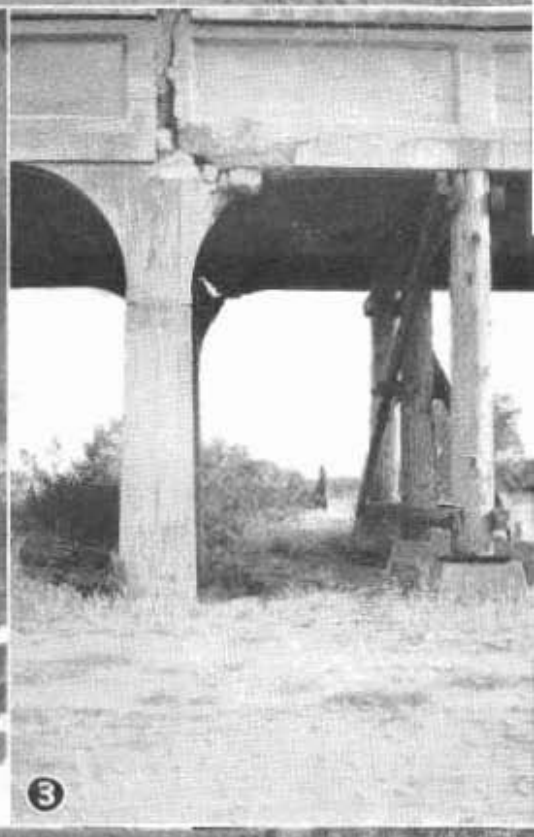

Pictures 1 and 2 show decay in bents of this timber overhead structure evidenced by settlement of the deck. No. 3—A defect in expansion detail of concrete girder structure resulted in disintegration of beam. Note temporary timber supports on shallow footings. No. 4—One-way timber suspension span posted and reinforced by adding additional hangers between originals

Governor Olson Discusses Highway Development in Next Ten Years

By CULBERT L. OLSON, Governor of California

ADEQUATE development of the California State highway system during the coming decade is dependent upon a variety of diversified and, at the same time, interwoven factors. While it is quite impossible in any short statement to cover in detail all such factors confronting State officials charged with the responsibility of highway administration, there are three or four outstanding problems whose satisfactory solution is fundamental to adequate highway development.

During the past ten years, motor vehicle registration in California has increased by nearly three-quarters of a million cars and trucks. It would be a conservative estimate that, during the coming ten years, the increase will be about the same. This means that, where this State now has approximately 2,700,000 registered motor vehicles, by 1950 the number will be around 3,300,000.

California has a State highway system of 13,865 miles. The volume of traffic using this system today is such that on certain sections in the more densely populated districts in large urban areas traffic congestion presents a serious problem. Looking ahead toward 1950, it is most apparent that, with a prospective increase in traffic volume of between 20 and 25 per cent, the problem of congestion on State highways may be far more serious than at the present.

It is, therefore, necessary that during the next ten years the State must make a most determined effort to provide highway facilities capable of moving traffic freely and safely.

Some such facilities have recently been completed, others are under construction and still others are in the preliminary stages of design.

Results of engineering studies and research have evolved that construction of comprehensive systems of freeway routes leading from urban centers to the rapidly developing suburban areas present the best solution to congestion around cities. In California, one such freeway, the Arroyo Seco Parkway, has recently been opened to traffic between Pasadena and down town Los Angeles. Another, the Cahuenga Freeway leading from Hollywood toward the San Fernando Valley is partially completed and work is rapidly progressing on Olympic Boulevard leading westerly from Los Angeles towards Santa Monica.

GOVERNOR CULBERT L. OLSON

In the San Francisco Bay area detail plans are now in preparation for converting the Bay Shore Highway between Palo Alto and San Francisco into a freeway and preliminary designs are being prepared for other such arterials along the east shore of the bay.

Other phases of highway development which must be continued in rural sections include construction of greater mileages of divided highways for high speed, interurban travel on main arterials. In both urban and suburban areas the building of separate routes restricted to the use of truck transportation is still another method which has proven of great assistance to the free movement of traffic and the number of such routes must be increased.

One of the greatest problems confronting the State in providing highway facilities which are sufficient for an increasing traffic volume is that of the obsolesence of bridges. On the California State highway system there are some 3500 bridge and grade separations. Approximately 25% of these structures are inadequate for present day traffic. Many built in past years are too narrow or restricted as to clearance for modern automotive equipment. Others are inadequate in design and structurally insufficient for loads and speeds which now obtain. In addition to those structures which should now be replaced, others will prove to be inadequate during the next ten years. Besides these bridges, there are still others which are structurally sound but which should be replaced because of their location on inferior alignment.

The magnitude of the bridge problem is such that it is estimated by the State Highway Engineer that an amount of approximately $75,000,000 will be necessary to provide the California State highway system with adequate bridge structures.

During the past few months another factor of no mean proportions has presented itself to complicate the situation. There is no doubt that one of the most important problems confronting the American people today is that of national defense. One of the prime necessities of a defense program is a complete system of strategic highways over

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White Bars on Pavement Give Danger Warning

ACCIDENT experience has shown that the raised bar on the pavement, painted white, is an effective device in traffic guidance and control at underpass approaches, the beginnings of divided highways, the protection of center placed traffic signs, such as KEEP TO RIGHT signs, at roadway intersections and wyes, and in divided highways to accentuate the neutral strip.

For some time past the Division of Highways has been experimenting with these traffic control devices. Bars of different materials constructed at various heights, slopes and angles have been installed. Careful observations of their effectiveness have been made. The reaction of the motorist has been noted. Conclusive evidence of their practicability has been obtained.

PROVIDE DOUBLE WARNING

Psychologists tell us that a major portion of our impressions come through our eyes and that a slightly lesser percentage of our actions are visually controlled. These whitened bars are so laid as to constitute a visual warning of an approaching hazard. Angled and raised in a manner to convey high visibility, their warning is transmitted a long distance to the motorist.

But if the sense of sight is lazy or inactive for the moment—and sight should be the most actively awake sense of the motor car driver—a second sense is jarred into hazard recognition by the raised bars. A car bumping over but a bar or two should arouse a dozing driver immediately, be it a mental or physical napping, and give him a sharp warning of danger.

Present experience seems to indicate that the bars should be laid on an angle of about forty-five degrees to the center line of traffic. To give good long distance visibility, they should be not less than six inches wide with the far face higher than the near face. However, some bars have been constructed with a flat top surface—and have been effective.

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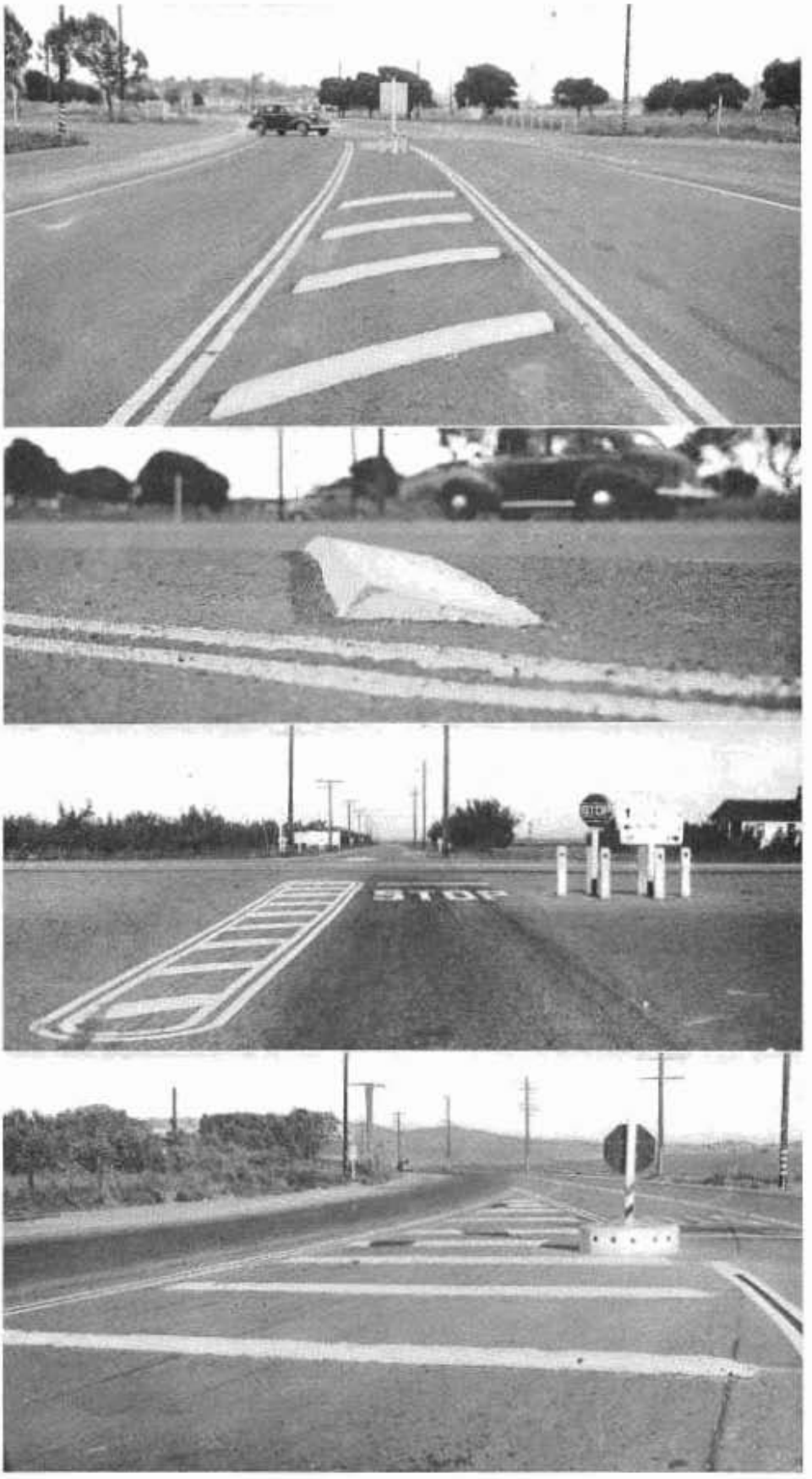

Control and guidance of traffic by raised white bars proves effective for intersections, wyes, neutral strips on divided highways and protection of central placed signs

Constructing sidehill viaduct carrying State highway across slide area along Russian River

Russian River Sidehill Viaducts

TWO sidehill viaducts are now under construction on the Russian River near Guerneville on State Sign Route 12 in Sonoma County. One of the structures has a length of one hundred and twelve feet and the other, two hundred and fifty-two feet. They will carry sections of roadway on the steep banks of the Russian River approximately fifty feet above the river.

The design of each of the structures is similar in that the decks or roadways consist of reinforced concrete continuous slab spans twenty feet in length built on open steel pile bents.

Each viaduct will provide a 26 foot clear roadway width and a single four foot pedestrian sidewalk with standard concrete handrail on the river side of the viaducts.

Due to the instability of the roadways at the sites of the viaducts, it has been necessary to construct the deck slabs the full width of the roadway in approximately half of the length of each of the structures.

Steep slopes and unstable soils often make it impractical to maintain a graded highway. Or perhaps expensive property improvements adjacent to the proposed road prevent the spreading out of cuts and fills to obtain a stable roadbed.

In such cases it may be economical to resort to structures supporting the roadway whose supports can be made to reach more stable foundation. Although such structures are also expensive, they pay for themselves through future savings in maintenance.

Although the ideal foundation for bridges is rock—solid, native rock—it is frequently necessary to make use of some less favorable material. In that case the bridge design is modified to take full advantage of conditions. A case in point are the sidehill viaducts pictured here which are being constructed to carry the new State highway across dangerous slide areas along the Russian River near Guerneville. Here steel piles were driven through several feet of soft material to a firm foundation and encased in concrete for protection. The open steel bents will permit the free flow of over-saturated muck beneath the structures while the concrete spans carry the motorists over in safety.

White Bars on Pavement Give Danger Warning

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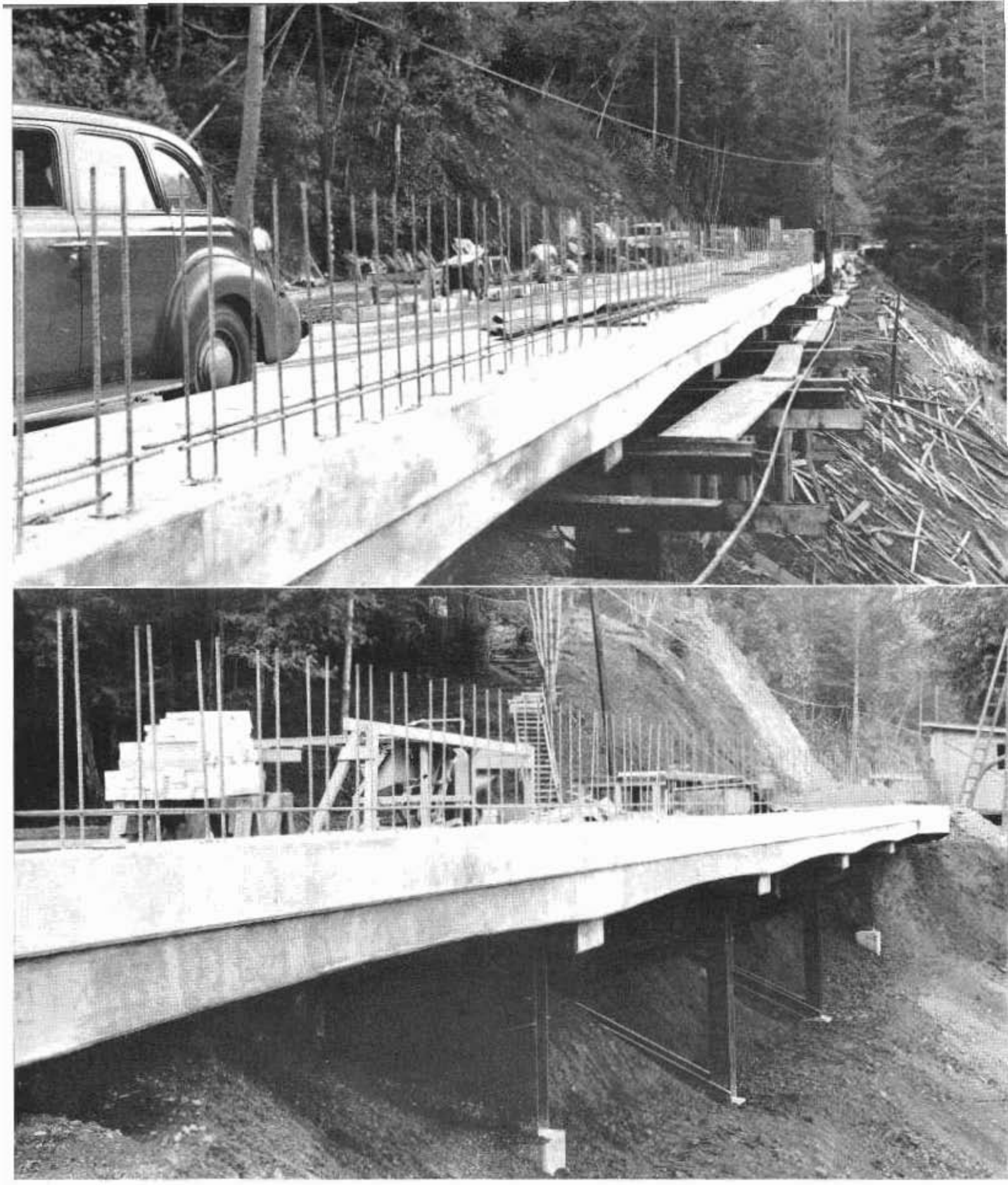
It must be borne in mind that feasibility of construction and ease of maintenance must be a prerequisite in the placement of raised bars. By their very use, it is expected that they will be damaged and must needs be repaired for they are in a way a gentle but emphatic warning of danger rather than a barrier such as a solid high concrete curb or a fixed guard rail.



Two sidehill viaducts being constructed along the Russian River near Guerneville in Sonoma County provide 26-foot roadways of reinforced concrete. Continuous slab spans 20 feet in length are built on open steel pile bents. Four-foot pedestrian sidewalks with concrete rails are provided on the river side

Four-Lane Divided Highway Being Constructed East of Redlands

By A. EVERETT SMITH, Assistant Resident Engineer

AS AN additional step in improving U. S. Highway 99, a State highway contract was recently awarded and work commenced by Dimmitt and Taylor, contractors. This project begins near the east city limit of Redlands and extends easterly through the Crystal Springs canyon and over adjacent rolling terrain toward Beaumont for a total distance of 3.11 miles.

The project consists in general of constructing a graded roadbed and placing an approved surfacing aggregate and installing drainage structures. A two-lane graded roadbed will be constructed north of the existing pavement from the east city limit of Redlands to 17th Street, as shown by the accompanying reference map.

The existing pavement will be left intact to carry eastbound traffic and the new lanes will relieve the now overtaxed road of westbound traffic. Many large eucalyptus trees bordering the north side of the existing pavement will remain in place, being situated in limits of the new dividing strip.

From near 17th Street the grade will be constructed to a four-lane divided highway section on new improved alignment south of the existing road, with a transition at Florida Street decreasing the roadbed width to a two-lane section at a point of adequate sight distance. The two-lane section will continue to and merge into the existing two-lane pavement ahead.

By utilizing the existing pavement west of 17th Street, two and one-half miles of four-lane highway with a central dividing strip will be available east of Redlands city limit.

This project makes connection to the west with an improvement completed in 1938 in which 2.4 miles of Portland cement concrete pavement was placed on new alignment eliminating numerous sharp horizontal and vertical curves which affected sight distance in that section.

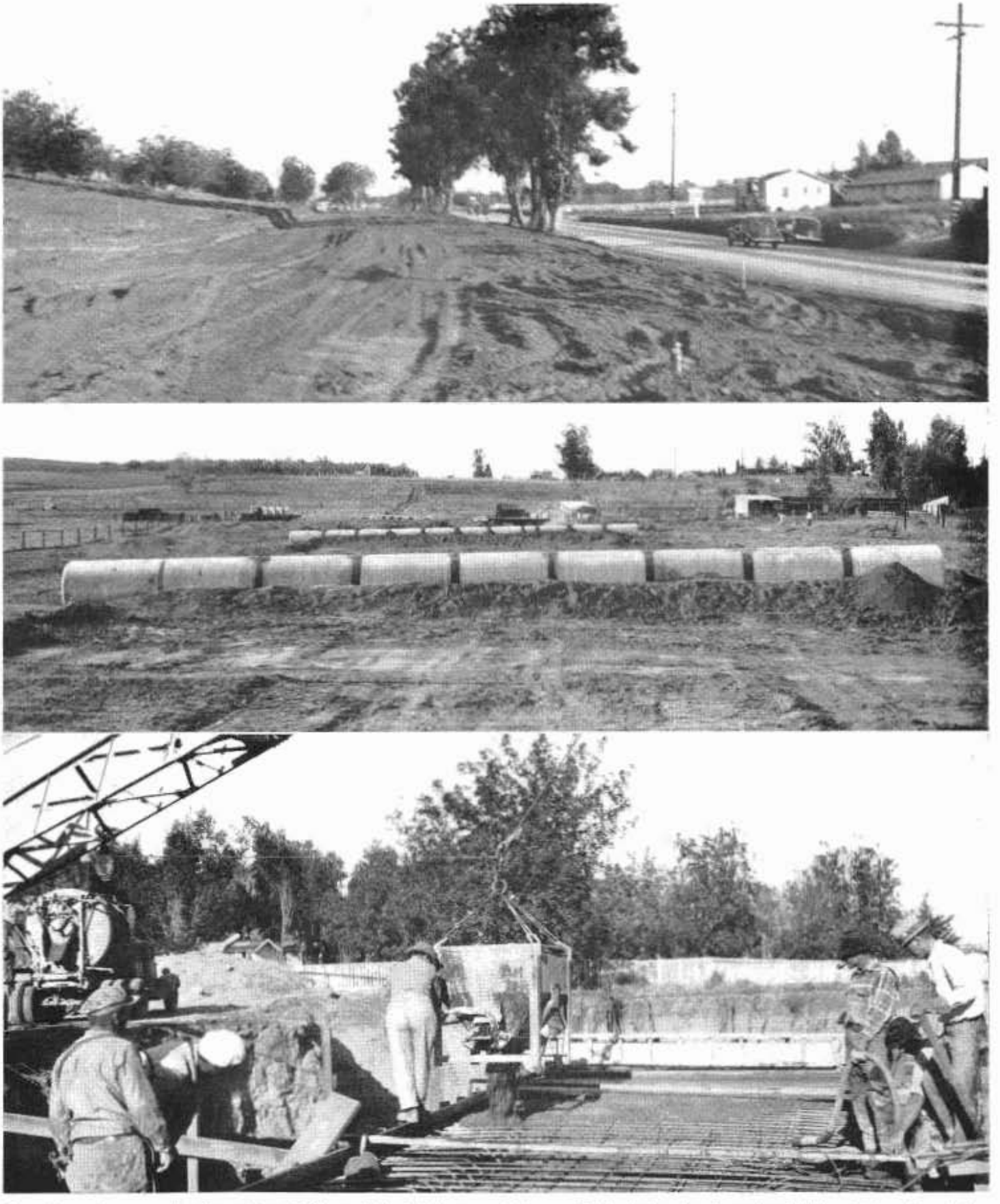
The four-lane divided section through Crystal Springs canyon will permit the faster vehicles to pass heavy laden trucks and other slow moving vehicles without danger of head-on collision.

Traffic over this route is heavy, with a marked increase during winter months due to the popularity of desert resorts. A large volume of heavy truck traffic is also carried by this route, hauling produce supplies and freight between the Imperial Valley and the Los Angeles markets and harbor area.

Preliminary to construction, much work was required in clearing the new right of way of buildings and moving public utility facilities out of the way.

Construction work which is still in the early stage includes clearing and grubbing, roadway excavation, placing reinforced concrete pipe culverts and the construction of a 12 by 12 foot reinforced concrete box culvert in Yucaipa Creek.

This work is under the supervision of O. B. Brinkerhoff, Resident Engineer.



Top picture shows grading for section of 4-lane divided highway project near Redlands leaving trees in dividing strip with existing road for other 2 lanes. Other views show placing of concrete pipe and construction of box culvert

Four-lane approach highway on new alignment to connect with north end of San Rafael Viaduct

Highway Viaduct In San Rafael

TO CARRY a large volume of traffic at high speed through cities and thickly populated areas expensive structures must often be built. By their use, delays due to cross traffic are avoided and the service to adjacent properties separated from the arterial traffic.

A four-lane divided highway viaduct is being constructed in the City of San Rafael over approximately five city blocks of residential and industrial property in order to carry the fast, heavy Redwood Highway arterial traffic through the city with a minimum of interference to the local properties and traffic.

The viaduct will be a reinforced concrete structure approximately twenty-two hundred feet in length and will provide a fifty foot divided roadway elevated about twenty-five feet above the adjoining ground. Five city street grade separations will thus be provided as well as grade separations for the ingress and egress of each direction of traffic on the arterial highway.

Considerable engineering study was necessary in the planning of the San Rafael viaduct in order to secure a structure of good aesthetic qualities that will blend with the development of the city and yet be an economical structure of sound engineering design. The spans have been designed of variable lengths to fit the numerous conditions along the structure and provide the utmost in economy.

The viaduct which occupies the creek channel of Irwin Creek, a stream which carries the run-off from practically all the streets in the eastern portion of San Rafael, will have a total of 67 spans varying in length from 17 feet to 57 feet 6 inches.

The superstructure is of two types: The northerly nine spans and the southerly 22 spans are reinforced concrete slab construction and the interior spans of the reinforced concrete girder type. Slab spans provide minimum clearance for the traffic on cross streets. Transitions from the slab spans to the girder spans are designed continuous. Expansion joints will be placed from 120 feet to 150 feet apart.

To provide a new channel for Irwin Creek along the center line of the viaduct between the two center columns the bridge was designed with four-column vents or piers. Reinforced concrete box culverts are being constructed under Fifth Avenue, Fourth Street, Third Street and Second Street to carry the channel water. The whole structure is founded on piles.

A unique feature of the viaduct structure is that the girders are curved concentrically with the center line to provide a uniform view from underneath. The use of curved girders simplifies deck form work and also provides a uniform cantilever distance from the outside girder to the deck.

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Upper picture shows 4-lane highway viaduct under construction through San Rafael at junction with existing highway to San Francisco. Lower shows deck forms and reinforcing steel details

Cities Designated to Take Over The Martinez-Benicia Ferry

By FRANK W. CLARK, Director of Public Works

BY his executive approval of enabling legislation passed by the legislature in special session, Governor Culbert L. Olson on December 5 made it possible for the Department of Public Works to request the American Toll Bridge company to transfer and convey to the cities of Benicia in Solano County and Martinez in Contra Costa County the operative properties and franchises now owned by the Martinez-Benicia Ferry and Transportation Company.

It was my privilege as the Director of the Department of Public Works to formally request Mr. Will F. Morrish, President of the Toll Bridge Company, to apply to the California Railroad Commission for permission to turn its ferry properties over to the two cities situated on opposite banks of the Carquinez Straits across which the ferry now operates.

As this issue of California Highways and Public Works goes to press, the necessary legal steps for public ownership and operation of the ferry system are being taken by the Toll Bridge Company and the interested municipalities.

MADE URGENCY MEASURE

At Governor Olson's request, the bill empowering the cities of Martinez and Benicia or either of them was made an urgency measure to take effect immediately and was passed by both houses of the legislature. The bill was authored by Senators Thomas McCormack, representing Solano County, and T. H. DeLap, of Contra Costa County. A companion measure was sponsored in the Assembly by Assemblyman Ernest Crowley of Fairfield and Assemblyman Harold F. Sawallisch of Richmond.

Under the law as it existed prior to passage of the McCormack-DeLap bill and its signing by the Governor, cities of the sixth class such as Martinez and Benicia had no legal authority to acquire or operate a ferry system. Under the measure approved by the Governor this was made possible.

EMPOWERED TO DECIDE

When the State of California through the California Toll Bridge Authority acquired the Carquinez and Antioch bridges and other properties of the American Toll Bridge Company, it was agreed between the contracting parties that the Director of Public Works should decide what disposition should be made of the Martinez-Benicia ferry, which the Toll Bridge Company desired to abandon.

The Director was empowered to designate Solano and Contra Costa counties or either of them; or the cities of Martinez and Benicia or either of them; or a cooperative organization composed of the employees of the ferry who were desirous of operating the system in the event that the counties or the cities declined to take over the utility.

It was the belief of Governor Olson, the members of the California Toll Bridge Authority and myself, as Public Works Director, that the interest of the public and those persons using the ferry would best be served if either the counties or the cities affected assumed operation of the ferry.

CITY OPERATION FAVORED

At a joint meeting of the boards of supervisors of Solano and Contra Costa counties, the officials of the cities of Martinez and Benicia and representatives of the employees, it was the concensus that the cities should apply for the right to own and operate the transportation system.

The employees of the ferry have rendered faithful service over a period of years and it is the hope of Governor Olson and myself that every consideration relative to their continued employment will be given to them by the new owners of the ferry system. The bill which made possible public ownership of the Martinez-Benicia ferry reads as follows:

PROVISIONS OF BILL

An act to add Sections 862c and 862d to an act entitled "An act to provide for the organization, incorporation, and government of municipal corporations," approved March 13, 1883, relating to the acquisition and operation of ferries by cities of the sixth class, either alone or jointly with other cities of the same class or counties, to take effect immediately.

The people of the State of California do enact as follows:

SECTION 1. Section 862c is hereby added to the act cited in the title hereof, to read as follows:

Sec. 862c. Any city of the sixth class, through its city council, may by gift, purchase or eminent domain acquire any existing ferry, together with any franchise, wharf or landing place necessary for its operation, and may operate such ferry upon navigable waters within or adjacent to the territorial limits of the city. The cost and expense of such acquisition and operation may be paid for out of the city's general fund. Any such ferry may, in the council's discretion, be operated either as a toll or free ferry.

SEC. 2. Section 862d is hereby added to said act, to read as follows:

Sec. 862d. Any city of the sixth class, through its city council, may, pursuant to contract, join with another city of the same class or with any county in acquiring any existing ferry, together with any franchise, wharf or landing place necessary for its operation, and in operating such ferry upon navigable waters lying within or adjacent to the territorial limits of both cities or of the city and the county. Each of the contracting parties may pay its proportionate share of the cost and expense of acquiring and operating the ferry out of its general fund. Any such ferry may, in the discretion of the legislative bodies of the contracting parties, be operated either as a toll or free ferry.

SEC. 3. This act is hereby declared to be an urgency measure for the immediate preservation of the public peace, health and safety within the meaning of Section 1 of Article IV of the State Constitution and shall therefore go into immediate

Martinez-Benicia Ferry authorized by Legislature to be transferred to cities as designated by Director of Public Works Clark

effect. A statement constituting such necessity is as follows:

Under the terms of the agreement leading to the purchase by the State of the Carquinez Bridge, the seller is obligated to transfer its rights in a ferry operated by it between Benicia and Martinez to any city or county between or within which the ferry operates. This act is designed to implement and facilitate such designation by authorizing the cities and counties affected to acquire and operate ferries for operation over waters within or adjacent to their territorial limits. Until the authority is granted it is possible that the present owner of the ferry may abandon its operation thereof and relinquish existing franchises therefor. Should this happen, it would be impossible for many years to operate a new ferry in the same vicinity, in view of Section 12 of the California Toll Bridge Authority Act, to the detriment of the public interest and welfare. It is therefore a matter of extreme urgency that this act take effect immediately.

There are approximately 85,700 school buses in use in the United States, reports the Automobile Club of Southern California. Twice every school day these buses cover 1,280,000 miles of highway.

She: "What do you do?"
He: "I'm a panhandler."
She: "I'd be ashamed to admit it."
He: "Don't get me wrong. I work in a beauty shop, giving facials."

Governor Olson Discusses Highway Development in Next Ten Years

(Continued from page 4)

which movements of troops, munitions and supplies may be quickly and freely moved.

The effect upon highway construction in California by the necessary readjustment in the financing of projects to meet the demands of the proposed system of defense roads will be far reaching. The results of surveys made in this State for proposed improvements which would be required for the Federal strategic military road system indicate that approximately $150,000,000 will be required for such work in California. In addition to this amount, a sum of some $11,000,000 will be necessary for construction of access roads to several cantonments, naval and military reservations planned for this State.

The construction of such cantonments and military bases further complicates highway development in their vicinity by reason of abnormal increases in population and buildings.

Most important of all factors relating to future highway construction and of vital import to all other factors is that of sufficient financing.

The program of State highway development indicated by the preceding paragraphs will require an income for highway purposes of much larger proportions than is available at the present. In the face of the apparent inadequacy of present revenues, reduction in Congressional appropriations for Federal Aid to the States presents a serious problem. The demand for development of a comprehensive system of strategic highways for national defense purposes complicates the financial problem to the extent that it would appear that there

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At Arroyo Drive Bridge fan palms and floral plantings decorate slopes with ice plant on center strip

Landscaping Arroyo Freeway

NATURAL scenic beauties of Arroyo Seco through which runs the new Freeway between Los Angeles and Pasadena are being enhanced by landscape engineers of the Division of Highways.

Approximately ten thousand young plants of various varieties have been propagated especially for this landscaping project. Some 47 kinds of plants will be used in improving the right of way on either side of the new highway. Of these 42 are native species.

Eleven species of ceanothus, or wild lilac, are included in this list. The ceanothus produces brilliant clusters of flowers in light blue, bright blue, deep blue and white, providing a succession of flowers from mid-winter until June.

NAMED AFTER FREMONT

Named after its discoverer, General John C. Fremont, the beautiful Fremontia with its golden yellow blossoms will also be used in profusion, as will the attractive Catalina cherry, with its heavy green foliage and the holly-leaved cherry, which is somewhat similar. These two shrubs are particularly adaptable where the planting area on each side of the boulevard is limited. They bear a rich green foliage throughout the year.

During the early summer months, the Freeway will be colorful with matilija poppies, together with yellow tree poppies. Clumps of California holly, or toyon, will be planted throughout the entire course of the boulevard and during the fall of the year and up until Christmas will provide a brilliant display of red berries.

NATIVE SYCAMORE GROUPS

Native to the Arroyo is the sycamore and many of these trees will be planted in clumps to tie in with the natural growth. The Nevin's barberry, with its large clusters of yellow flowers which bloom in the late winter months, will be used extensively. Wild roses will be interspersed with the other plants throughout the length of the Freeway. On steep banks the wild buckwheat will be used profusely.

Other native plants to be used in the Arroyo Seco landscaping scheme will include purple sage, blue sage, bush snapdragon, manzanita, mountain mohagany, pink and yellow flowering currants, fuchsia, fuchsia flowered gooseberry, lemonade berry, laurel sumach, elderberry, bluebeard tongue and California fuchsia.

Among five exotic plants which will be used is an evergreen perennial morning-glory which is especially usable on steep banks. While this plant grows wild in many parts of southern California, it is not in general garden use. It will serve to cover unsightly inclines on Arroyo Seco and will add materially to the general color scheme.

When the landscaping is completed, the Division of Highways expects it will be an outstanding example of modern highway beautification.

Top and bottom pictures show plantings on slopes of Arroyo Seco Freeway including blue dawn flower, catsclaw, wild grape, trailing lantana, and honeysuckle, with Boston ivy on structure abutments and piers and oleanders and toyons in groups on slope tops. On dividing strips are compact myrtle and ice plant with cocos palms placed at center piers and close to structures. Center picture shows stages of slope planting and application of top soil

Evolution of Grading and Paving Methods in Highway Construction

By EARL WITHYCOMBE, Assistant Construction Engineer

IN NO form of construction has more rapid progress been made than in the field of grading. The development from the station-man's wheelbarrow and the horse-drawn scraper of thirty years ago to the present day tractor-drawn wheel scraper of thirty-cubic-yard capacity, marks considerable progress in dirt-moving methods.

The intermediate stage of power shovel and truck is now relegated to excavation in rock formation and to hauls that are beyond economical limits with scraper equipment. The rock has to be extremely hard or the hauls exceptionally long for the present day contractor to abandon scraper equipment for power shovels.

EQUIPMENT DEVELOPMENT

This evolution of equipment has not only resulted in a marked decrease in the unit cost of grading operations, but it has also made it possible to complete within a few months a project which formerly might have required a year or more. The dollar spent in construction these days yields a much larger return to the purchaser than it did thirty years ago.

Clearing and grubbing of the native growth, formerly performed by laborious hand methods supplemented by powder, is now largely done by tractor equipment.

These developments and adaptation of the modern power equipment to construction are the result of the painstaking experimentation of men in the construction industry. Many of the highly successful implements of the present day were looked upon as harebrained dreams by able operators of earlier times.

Embankments on railroad and highway construction were formerly built by end-dump methods and subsequent settlement took place over a period of many years. Maintaining the roadbed to the predetermined grade during this period of readjustment was a costly and unsatisfactory practice.

Experimental projects were set up to construct embankments in thin layers which were wetted and rolled. These projects indicated that subsidence within the embankment itself could be avoided. Research developed methods of measuring the degree of compaction within the layers and definite limits were established. This advancement preceded the perfection of the tractor-drawn scraper. It fitted in admirably with this method of dirt moving and was a decided impetus to its development.

Engineers soon became aware of occasional subsidence due to inequalities in the original ground. It is now the practice to carry on a thorough investigation of the subsurface conditions which might affect the stability of the superimposed embankment. Particular attention is paid to the character of the soil, the presence of underground water, and any apparent weakness in the geological structure. This investigational work is done largely with drill rigs, and ranges in cost from $75 to $1,000 per mile. The necessary corrective measures are then decided upon from the results of the investigational work.

P. C. C. PAVEMENT METHODS

The methods employed in pavement construction have undergone many changes over the same period. The mixing machine was formerly the only piece of mechanical equipment employed on portland cement concrete paving construction. The batching and the laying of the mixture was performed entirely by hand. Charging the mixer with aggregates measured in wheelbarrows from stockpiles along the grade has now been supplanted by mechanical batchers. These are usually located at the point of origin of the aggregates, where the individual components are proportioned over automatic scales by dropping each batch into its proper compartment in a truck for delivery directly to the mixer.

The rough spreading of the mixture as it is dumped from the mixer is largely done by hand; but equipment is available and is coming into general use to spread the concrete faster and more efficiently by worming the mixture across the full width to be poured.

The laborious manner of hand compacting the concrete has been supplanted by mechanical compacting and screeding devices that produce a dense concrete with a surface of uniform texture. To aid in the placing of mixtures of a harsher consistency, mechanical vibration has been added in very recent years to these machines. This advancement permits the lowering of the water-cement ratio and makes possible a more economical use of cement.

MECHANICAL FINISHING FLOATS

Were it not for subsequent subsidence in the slab as the concrete is reaching its set, nothing further would have to be done following this compaction to insure a uniformly smooth surface. The subsidence, however, distorts the slab surface and occasional readjustments are necessary to correct the condition. This was accomplished by means of a series of long floats operated transversely across the pavement by hand and cutting and filling in the irregularities. The results obtained depended largely upon the skill of the individual operators.

In recent years a mechanical drag finisher has replaced the floats, and by numerous trips over the slab as it is taking its set, maintains the surface true to cross section. As a final precaution, a steel cut float is drawn over the hardened concrete to check and remove any slight irregularities that might yet remain.

Under earlier methods of pavement construction, it was considered necessary to use at least six sacks of cement to the cubic yard of concrete

to produce the desired minimum of strength under all of the variations in control existing at that time. Since the adoption of improved mechanical methods with their resulting uniformity of product, it has been practicable to reduce materially the amount of cement.

Mixtures generally consist of five sacks of cement to the cubic yard, and some have been placed with four and even three sacks per cubic yard. The early strengths of the lean mixtures are usually low; however, the three-sack mix has given average compressive strengths of 3600 pounds per square inch at a two-year age and has carried traffic for the entire period without sign of distress.

ASPHALT CONCRETE PAVEMENT

A great many changes have been made in recent years in the technique with which asphalt mixtures are designed, proportioned, and laid. The general design and scheme of operation of asphalt mixing plants is much the same today as it was thirty years ago. The changes that have been made were for the purpose of controlling uniformity and increasing production.

Mixing plants were formerly fed by teams and scrapers with the aggregate stockpiled in two sizes around the plant yard. The material went first to the dryer and then to a separation screen, where it was separated into two sizes and stored in bins above the mixer. As the uniformity in the grading of the material in the bins depended largely upon the care exercised in the blending and the feeding of the material to the dryer, the resulting mixture reflected largely the skill of the individual in charge of this feature. An attempt was made to overcome this difficulty by separating the material still further into a total of four sizes. This separation was a decided improvement; but it still left much to be desired and the manner of feeding was completely revised.

Belt feeding was required, and the aggregate, separated into the sizes roughly approximating the grading of material in each bin, is now fed onto the belt by controlled gates from bunkers or into a tunnel in the relative proportions used in the mixture. Although this innovation was criticised by the average operator when it appeared in specifications, it proved to be such an aid in increasing average output that seldom will a contractor set up a plant (even on the low type of surfacing where it is not required) without making it a part of the installation.

HIGHER PENETRATION TYPES

Low-penetration asphalts were used in earlier mixtures, and because of a certain amount of subsequent raveling and cracking of these pavements, seal coats were provided for all projects. Since the present-day technique of applying such seal coats was unknown, they soon became glazed and were a serious traffic hazard in unfavorable weather. In order to overcome the objection from a service standpoint, the mixtures were revised and seal coats eliminated, but the former objections of lack of life reappeared. Research disclosed that lack of life was accompanied by loss of penetration in the asphalt, which immediately suggested that much higher penetration was desirable in the original asphalt. The present practice is to use asphalts of penetration ranging from 70 to 120 for this type of construction, and the results are very promising.

The spreading of asphalt concrete had always been performed by hand. Fifteen years ago experiments were made with the modified mechanical spreading machines which were used at that time for portland cement concrete. After a year or two of perfecting, they became a success and are used universally wherever this type of construction is placed. The machines have since been designed and manufactured specially for this purpose.

THREE-AXLE ROLLERS ADOPTED

Steel-tired power rollers have been used throughout for compaction of this type of pavement. Minor improvements have been made from time to time in rolling equipment, the most noted of which is the comparatively recent innovation of three-axle rollers that permit a decided increase in concentration of load on isolated humps in the surface and act somewhat as a planer without removing any material or scarring the pavement.

The question of riding comfort has always been debatable since the first pavements were laid. Methods of evaluating this quality were under discussion for a great many years. In 1924 a means was developed whereby spring deflections of an automobile traversing a piece of pave-

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November Traffic on State Owned Bridges Totals 1,688,599 Vehicles

THE record of vehicular traffic on the San Francisco-Oakland Bay Bridge for the month of November shows a total of 1,384,735 of all classes of vehicles making a grand total of 1,688,599 of all vehicles using the three State-owned spans.

The recent reduction of tolls on the Carquinez and Antioch bridges was reflected in an increased traffic on those two spans. The total of all vehicles using Carquinez and Antioch in November was 303,864 compared with 300,072, a gain of 3,792 and representing a considerable saving to owners. Passenger autos and auto trailers crossing the Carquinez bridge totaled 260,976 compared with 251,192 in October, and 16,178 on the Antioch bridge compared with 15,539 the preceding month. The total November traffic on the three bridges is shown in the following tabulation:

	San Francisco-Oakland Bay Bridge	Carquinez Bridge	Antioch Bridge
Passenger autos and auto trailers	1,276,130	260,976	16,178
Motorcycles and tricars	3,278	521	27
Buses	18,113	4,562	192
Trucks and truck trailers	66,139	19,094	2,179
Others	21,075	124	11
Total vehicles	1,384,735	285,277	18,587

700 Bridges on Military Road Network Inadequate

(Continued from page 3)

bridges operating under a material reduction of the normal safety factors. While some of the most dangerous bridges have been repaired or replaced during this biennium, the economic picture is not much improved because of the steady deterioration of substandard bridges already referred to.

700 INADEQUATE FOR ARMY

Now let us look at the situation on Military Roads alone.

The War Department recently requested that the Public Roads Administration, in cooperation with the States, make an estimate of the cost of bringing up to the desired standard, highways tentatively selected by them for their military importance.

It was found that there were about 1500 bridges on this military network in California and, although it included our best and most important State highways, there were 200 bridges that should be replaced and 500 more that should be strengthened. The estimated cost of doing this, exclusive of any road approach work, was about $12,000,000, in addition to which there would be the cost of other bridges on extensions of highways not yet built.

It must be realized that even if money is provided for reconstructing these substandard bridges, they still can not be replaced over night. It would be necessary to make surveys to establish the proper highway location, to obtain foundation data and to prepare plans and specifications before construction can even be started. In the meantime, expensive repairs may have to be made and use of the highways continue to be limited by the reduced load limits at the bridges.

RESTRICTS HAULING

This limitation of the use of adjacent highways is a matter of general importance at all times. Very often the load limit on a bridge restricts hauling on many miles of highway because of the absence of alternative routes. If the capital investment in the roads is to pay its proper dividends, load restrictions on the bridges must be removed.

Although heavy loads naturally occur more frequently on major traffic arteries, no road is immune from occasional loads of maximum weight. Consequently all bridges, regardless of the importance of the road, must be designed and kept in condition to safely sustain these maximum loads.

Unfortunately, even the best technically trained expert can not say definitely when a weak bridge will fail, for the principal reason that it is governed to a large extent by the laws of probability or chance. The possibility of the right number of loads coming onto the bridge in just the right position to cause the greatest stress in every critical member must be assumed, but the probability of such an occurrence may be rather small. If it does not occur for many years, heavier single loads than that for which the bridge is posted may cross over with apparent safety and seem to discredit the engineer's computations.

RISK ALWAYS PRESENT

However, the risk is always there and it is well to remember that a bridge may be damaged by a heavy vehicle but not collapse until later on—perhaps under a vehicle that is far too light to cause any overstress in the structure. There have been many cases where State Highway bridges have been damaged to the point where their collapse could be expected momentarily. However, due to the constant inspection given to structures, whose strength is under suspicion, the condition has been observed in time to shore up the structure before it failed either under its own weight or a vehicle.

In concluding it seems advisable to stress the point that while old bridges stand a lot of abuse they have a habit of giving up at critical times, and when they do it means serious delay and an economic loss out of all proportion to the failure of any other link in highway transportation.

Also, bridge construction is expensive, so the investment should be as permanent a one as it is possible to make. It is, therefore, necessary that bridges be reconstructed in their final location, which means that a study and rebuilding of the adjacent highway must proceed simultaneously. Time is required to do this properly.

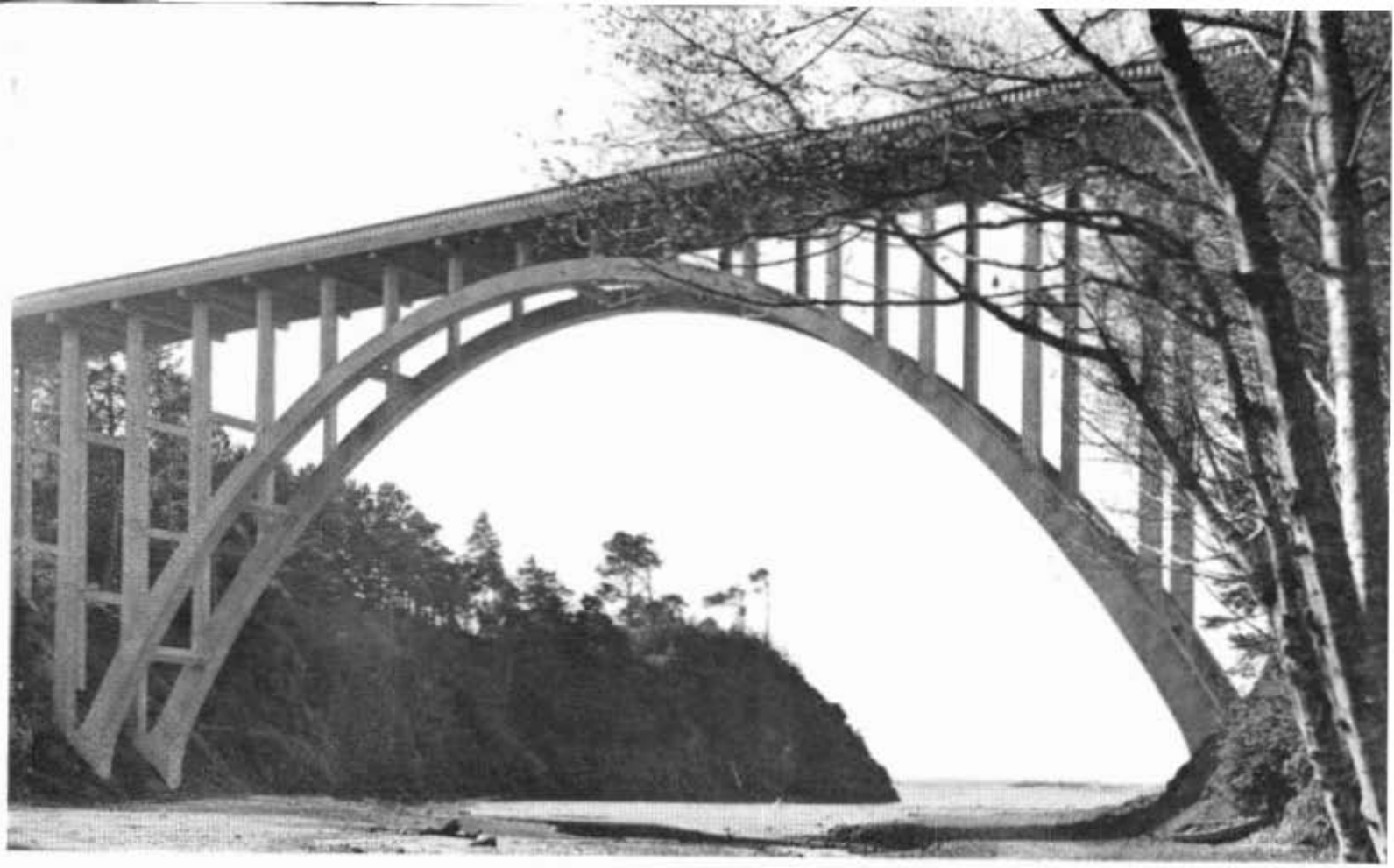
Finally, since it is necessary to build new roads, all funds available for construction can not be used for building bridges. The proportion of the funds now available that can be applied to bridge replacements and the accompanying road relocation, is so limited it will require many years to eliminate existing hazards.

Lawrence Barrett

Chairman Barrett Sends Greetings

Chairman Larry Barrett of the California Highway Commission has just returned from a state-wide tour of inspection of highway improvements proposed for inclusion in the budget.

"I want to inform the many friends I met all over the State on this trip" said Mr. Barrett "that the budget will be in the hands of Governor Olson for submission to the Legislature by the first of the year, and to them and all my other good friends I send my best wishes for a Merry Christmas and the happiest of New Years."



New bridge over Russian Gulch on Mendocino Coast has a 240-foot arch span.

Russian Gulch Bridge on the Mendocino Coast

THE coast of California is to a large extent extremely rugged, with deep gashes which must be crossed by the highway. Important structures are often required at these points in order to avoid long and winding detours around the head of the ravine or estuary.

The bridge over Russian Gulch on the Mendocino Coast Highway pictured on the cover and on this page is of a type that indicates economy in its construction but through its very simplicity of line harmonizes extremely well with the rugged scenery that frames it.

The 240-foot arch span, by no means the longest in the State, is still long enough to be worthy of note. It can be seen how it lends itself to the need for avoiding damage to footings which if placed in the stream bed always have been subjected to the force of the waves and the drift thrown up by the ocean during winter storms.

This arch bridge is a good example of how beauty can be attained without sacrifice of serviceability and economy.

Ralph A. Tudor

Bay Bridge Engineer Tudor Goes into Army

Ralph A. Tudor, Principal Bridge Engineer of Maintenance and Operation of the San Francisco-Oakland Bay Bridge, has been given military leave of absence to join the Army on January 1. Mr. Tudor entered the service of the Bridge Department of the State Division of Highways in 1929 and was transferred two years later to the San Francisco-Oakland Bay Bridge Division in direct charge of operation and maintenance of the new structure.

Mr. Tudor graduated from West Point in 1923 and was in the regular Army serving one year in the Coast Artillery and five years in the Corps of Engineers before he came to California.

His rank in the Army will be Lieutenant-Colonel and he will be stationed at San Luis Obispo as Assistant to the Chief of Staff in Charge of Military Intelligence of the General Staff of the Fortieth Division.

He is a National Guard officer, not a Reserve officer.

Tentative Budget Estimate for Highway Construction $36,341,230

TENTATIVE budget estimates for the 1941-43 biennial period were submitted to the California Highway Commission today by the Division of Highways and showed that there will be available for highway construction projects during the 93d and 94th fiscal years approximately $36,341,230.

Highway revenues for the next biennium are estimated at $90,600,000, which after allocations for administration, traffic engineering and special investigations, highway maintenance, maintenance of the Carquinez and Antioch bridges, highway planning survey, shops and equipment, and maintenance stations, major city streets, engineering, right of way, joint highway districts, one-quarter cent to cities for State highways and for the reserve and contingency funds will leave only $36,341,230 for highway construction projects.

ESTIMATED REVENUE DETAILS

Estimated revenues are as follows: Gas Tax, $73,000,000; Motor Vehicle Fees, $8,474,000; Use Fuel Tax (Diesel), $1,300,000; Federal Aid (1942-43), $7,600,000; Caravan Fees, $226,000; Total, $90,600,000.

These revenues will be allocated generally as follows: Administration, $3,900,000; Traffic Engineering and Special Investigation, $325,000; General Maintenance, $18,350,000; Maintenance of Carquinez and Antioch bridges, $50,000; Highway Planning Survey, $210,000; Capital Investment (shops and equipment) $400,000, (maintenance stations) $300,000; Major City Streets (¼-cent allocation), $9,125,000; Construction and Improvement, Engineering, Right of Way, Joint Highway Districts, City ¼-Cent State Highways, Construction Projects, Reserve and Contingency Fund, $57,940,000.

DIVISION NORTH AND SOUTH

The sum of $57,940,000 will be divided between northern and southern California counties on the following basis:

For primary North highways, 54.26% of 50%, $15,719,122; for primary South highways, 45.74% of 50%, $13,250,878; total for primary highways, $28,970,000.

For secondary North highways, 50% of 50%, $14,485,000; for secondary South highways, 50% of 50%, $14,485,000; total for secondary highways, $28,970,000.

The total for Primary and Secondary highways in the North is $30,204,122 and for Primary and Secondary highways in the South, $27,735,878.

TENTATIVE CONSTRUCTION FUNDS

Tentative allocation of highway funds for construction and improvement is as follows:

	North		*South*	
	Primary	*Secondary*	*Primary*	*Secondary*
Preliminary Engineering	$760,000	$585,000	$620,000	$675,000
Construction Engineering	990,000	860,000	900,000	850,000
Right of Way	1,950,000	600,000	1,200,000	550,000
Joint Highway District	------	200,000	------	------
City ¼¢ State Highway	1,878,071	1,733,604	1,764,264	3,749,061
Contingency and Reserve	560,596	349,611	395,804	427,759
Construction Projects	12,157,080	7,580,160	7,980,175	8,623,815
Totals	$18,295,747	$11,908,375	$12,860,243	$14,875,635

SUMMARY

PRIMARY NORTH	$18,295,747	PRIMARY SOUTH	$12,860,243
SECONDARY NORTH	11,908,375	SECONDARY SOUTH	14,875,635
	$30,204,122		$27,735,878

Viaduct in San Rafael

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The slab spans as well as the girder spans are constructed on regular parabolic curves.

An electric conduit is installed throughout the structure to provide for the placing of luminaires in the future.

While present construction will provide for four lanes of traffic the viaduct is designed to allow for future widening.

The need for this project was evidenced by traffic counts taken in July, 1939, which showed 21,562 vehicles on Sunday and 12,538 on Monday near the south city limits of San Rafael. At the north city limits the counts were 19,441 and 10,298, respectively, for Sunday and Monday, indicating an average daily traffic of approximately 13,500 vehicles.

Well Meaning Old Lady: "Do you like to go to school, little boy?"
Small Boy: "Oh, going is all right, and coming back isn't so bad either. It's staying there between times that makes me so tired."

Evolution in Highway Construction Methods

(Continued from page 17)

ment were transmitted to an instrument installed in the car and recorded. Methods were soon worked out to calibrate these records and reduce them to a common basis of comparison.

To this one innovation the traveling public is indebted more than to any other development for the riding comfort built into the present-day pavement. The use of this rating device has created competition between engineers and contractors alike to obtain smoother and better work. The very efficient implements by which perfection is being obtained are but the result of such competition.

Prof: "What is the outstanding contribution that chemistry has given the world?"
Soph: "Blondes."

Teacher: "Johnny, in the Jones family there are the father, the mother, and the baby. How many does that make?"
Johnny: "Two, and one to carry."

Maintenance Equipment Study By National Highway Research Board

A SUBCOMMITTEE of the Maintenance Department of the National Highway Research Board has been designated to undertake a research study of maintenance equipment. The purpose of the study is to obtain accurate information on all of the various types of equipment which are available for performing highway maintenance work, and to recommend the most suitable and practical equipment for accomplishing particular operations.

This committee is composed of the following men:

T. H. Dennis (Chairman), Maintenance Engineer, Division of Highways, State of California.

A. A. Anderson, Manager, Highways and Municipal Bureau, Portland Cement Association.

H. K. Bishop, Chief, Division of Construction, U. S. Public Roads Administration.

Bernard E. Gray, Chief Engineer, The Asphalt Institute.

J. E. Lawrence, Maintenance Engineer, Department of Public Works, Massachusetts.

Rex M. Whitton, Maintenance Engineer, State Highway Department, Missouri.

The work of assembling the data necessary for the study is now under way. In order to insure a thorough canvass of the subject and to provide for a presentation of the data and the committee's recommendations in a useful and practical form for reference purposes, a method of procedure has been decided upon, which provides for the classification of all equipment into groups, according to its utility for performing specific operations.

TEN OPERATION GROUPS

As a basis for this classification, an outline of the study was prepared which groups all highway maintenance operations into ten major categories, as follows:

1. **Maintenance of traveled way**
2. **Maintenance of shoulders**
3. **Maintenance of roadsides**
4. **Maintenance of bridges**
5. **Maintenance of miscellaneous structures**
6. **Snow removal, drift and ice control**
7. **Maintenance of trees, shrubbery and plantings**
8. **Maintenance of safety devices**
9. **Blasting**
10. **Miscellaneous**

Each of these major categories is further broken down into various items of detailed work so that as many subheadings may be set up under each main classification as are necessary to fully cover the field. For example, under Topic 1, "Maintenance of traveled way," twelve subheadings have been listed, each representing the maintenance of one type of highway surfacing.

It is proposed to examine the equipment requirements for performing each item of work listed in the outline, and as far as is feasible, make definite recommendations as to the most practical type of equipment to use for each piece of work, and set up brief specifications for each unit of equipment. That is to say, it is proposed to set up suitable equipment, accompanied by controlling specifications, for performing the work under each main classification and each subheading of the outline.

ALL STATES COOPERATING

In a nationwide survey of this sort, it is of course obvious that suggestions and opinions concerning the equipment needed or considered desirable should be secured from as many sources and authorities as possible, in order that soil and climatic conditions in all sections of the country may be taken into account. The committee has therefore communicated with, and has solicited the cooperation of all of the State Highway Departments, and certain other public and private agencies which are interested in or are especially qualified or experienced in certain phases of maintenance work.

The opinions of the district engineers of the Public Roads Administration have been requested, and in addition, the Portland Cement Association is cooperating with regard to the maintenance of portland cement concrete highways and structures and the Asphalt Institute is cooperating with respect to the maintenance of bituminous surface roads.

There will no doubt be considerable divergence in the suggestions offered by different authorities, and in the opinions received from different sections of the country. However, with a wide range of data at hand, the committee should be in a position to analyze each type and unit of equipment with reference to its utility for maintenance work.

TYPICAL EQUIPMENT SETUPS

In contacting the various states and other agencies, mimeographed copies of the outline of the study were forwarded, together with two exhibits, or sample setups, illustrating the type of information wanted and the manner in which it should be listed. One exhibit showed a typical setup recommended for maintaining an earth road, Topic 1-a in the outline, and the second showed a typical equipment setup recommended for the maintenance of steel bridges, Topics 4-a, b. These two exhibits, or typical equipment outfits accompanied by specifications, were in sufficient detail and in such a form as to readily illustrate the purpose and scope of the study.

All the agencies which have been contacted were requested to follow this form as closely as possible, in submitting their data, so that the information which is accumulated will be reasonably uniform and comparable, which will greatly assist the committee in analyzing the material and arriving at its recommendations.

It will probably be some time after the first of the year before the work of assembling this data is completed. Until all the information is received and studied, it is hardly possible to foresee what the scope of the committee's report will be. There will undoubtedly be a wide range of equipment recommended for performing the various maintenance operations, when the opinions from throughout the country are reviewed.

For example, the equipment setup recommended for maintaining an

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Interstate Project Completed on California-Oregon Unit of U.S. 99

By F. W. HASELWOOD, District Engineer

OFFICIALS and citizens of Oregon and California gathered on the Pacific Highway at the State line on November 26, to celebrate the opening of a new and better highway and to dedicate it as another evidence of enduring friendship between the people of the two States.

Travel over the Siskiyou Mountains began over a century ago and has encountered the usual obstacles and handicaps leading up to the present triumph of road building.

History records that the first white man to cross the summit of the Siskiyous in Southern Oregon was Peter Skene Ogden on February 14, 1827. His diary records that he observed to the south a great white mountain comparable to Mt. Hood which he called Mt. Sastie.

FIRST WAGON TRAIN 1849

Captain Applegate, a hardy pioneer and Indian fighter who but recently died, took the first wagon train over the mountain pass in 1849.

Since that time traffic has remarkably increased although it by no means requires the oldest inhabitant to relate stories of hazard and hardship when a trip by either horse-drawn or motor vehicle between Yreka and Ashland was an adventure of several days duration. It is related that unsung pioneer poets were wont to express their sentiment in rhymes which were written on the signboard which informed the traveler that he had reached the Summit of the Siskiyous, a few of which read something like this:

"My feet emerge from wornout shoes,
Trying to cross the Siskiyous."

"I've got this far but t'aint no use,
I'll never get through the Siskiyous."

"This road is impassable,
It's not even jackassable.
If you must travel
Bring your own gravel."

In the short span of a generation remarkable changes have been wrought in what has become a major artery of travel on the Pacific Coast, and a link in a great international highway which will eventually reach from Alaska to South America.

CEMENTED STATE FRIENDSHIP

The group that gathered at the State line between Yreka and Ashland on November 26 to dedicate the latest accomplishments of Oregon and California in improving the highway over and through the Siskiyous, brought from men yet young these memories of the past road conditions to compare with the excellence of the road now open for traffic. It cemented the friendship of the peoples of the two States in their mutual rejoicing over this evidence of cooperative effort. The major addresses of the occasion were made by State Highway Engineer R. H. Baldock and Governor Charles A. Sprague of Oregon.

At the beginning of the era of highway construction in California, Oregon had constructed and paved with asphaltic concrete a magnificent highway from Ashland to the State line, and California at once undertook to meet it with an equally serviceable road.

It is small wonder that roads laid out nearly thirty years ago, magnificent as they were in service to the traffic of that time, have long since become obsolete.

FINAL LOCATION IN 1938

In 1931 Oregon began to give serious consideration to the extreme urgency of improving their portion of the road over the Siskiyous, consisting of almost 21 miles from Ashland to the State line. In 1933 the first of 14 contracts was awarded for a valley section out of Ashland along the adopted route. The last of these contracts, which was for surfacing the section from a mile north of the Siskiyou Summit to the State line, was recently completed.

In 1932 the Division of Highways received inquiries from the Oregon highway engineers as to whether it would be physically and financially possible for California to construct a new connection to meet their road at the State line, a point considerably lower and some distance west of the present State line connection.

The final location in both States was worked out in 1938 and financing was arranged so that the unit in California and the final work in Oregon would be completed at approximately the same time.

MAXIMUM GRADE 5.5%

The new highway in Oregon is 16 miles long, approximately 4.7 miles shorter than the old. It has maximum grades for southbound traffic of 5.5% and of 5% for northbound traffic. The minimum curve radius is 573 feet. The improvement in alignment has reduced the curvature from 35½ to 5½ complete circles. The graded road bed is 32 feet wide. Except for the valley section south of Ashland, which is paved with concrete, the road surface consists of 9 inches of crushed rock, ranging from 4½ to 2 inches, placed in two layers the full width of the roadbed. Rock ranging from ¾ inch to dust is used as a choker on top of this base and the surface layer is constructed of bituminous macadam. Unoiled crushed rock shoulders border the surface.

The total cost of the sixteen miles of new construction in Oregon was $1,800,000, or about $112,000 per mile.

To connect with Oregon's highway at the State line, California constructed 1.8 miles all on new location at a cost of $123,000, or about $68,000 per mile.

The minimum curve radius in the California unit is 1,432 feet and the maximum grade is 6%. The graded width is 36 feet. Base course is 6 inches of crusher run base over the entire grade with selected material from roadway cuts for subgrade. The

(Continued on page 28)

(Photos courtesy Texas Journal.)

Views on newly completed section of U.S. 99 over the Siskiyou Mountains built by the States of Oregon and California. The combined cooperative project, 17.8 miles long, results in saving five miles in distance and at least thirty minutes traveling time

Sonoma Shore Line Improvements Eliminate 18 Unsafe Timber Bridges

By R. P. DUFFY, District Construction Engineer

WITH the contract awarded by Director of Public Works Frank W. Clark on June 4, 1940, to James E. Anderson of Visalia, for constructing a reinforced arch culvert on an improved alignment at McClellan Gulch on the Coast Highway about twenty-nine miles north of Jenner in Sonoma County, the last of the old timber bridges posted for restricted loading on this section of the State highway in District IV is being eliminated.

This section of roadway, from the mouth of the Russian River to the mouth of the Gualala River, extending for some forty miles along the Sonoma Coast, was transferred from the Sonoma County road system to the State Highway System by legislative action in 1933, at which time the surface was of native material, muddy and slippery in the winter, and dusty in the dry season. Shortly after becoming a part of the State Highway System, the surface was dust-oiled by the State forces, thereby providing a dustless summer and mudless winter route.

UNSAFE TIMBER BRIDGES

There were, however, some eighteen timber bridges across the numerous streams along this section that were designed for lighter than present-day standards, and were of such age that they had long passed their safe load capacity for even this light design.

State bridge engineers investigated all structures, and their findings dictated the necessity for legal posting for restricted loadings, although many minor repairs were made by State forces to allow maximum use of the structures pending available funds for their replacement.

In 1938 a contract was awarded to Parish Bros. of Oakland for the elimination of eight of the bridges, at a cost of $49,000. These were replaced by seven redwood box culverts and one 90-inch multiplate pipe culvert on improved alignment, providing a 26-foot oil-treated roadway. Where funds permitted these improvements were placed on the ultimate location of the road.

MAJOR LINE CHANGE

In 1939 a second contract, embracing 2.14 miles of grading a 26-foot oil-treated roadway, including the elimination of nine timber structures, was awarded to Guerin Bros. of San Francisco, at a cost of $111,300. A major line change at Russian Gulch was included in this contract, crossing the stream in Russian Gulch below the forks, thereby replacing three poor, narrow timber bridges with one 3-span reinforced concrete bridge.

This line change, 1.17 miles in length, with a roadway width of 26 feet and oil-treated surface, on modern alignment and grade, replaces a narrow winding road along both sides of the canyon, shortening the distance 2,023 feet, reducing the curvature 806 degrees and providing an appreciable saving in driving time and comfort.

This location is especially noted for and secures its name from the Russian explorers and settlers who played an important part in its early history. Stories told by old-time residents of the area picture these explorers landing in the protected cove of Russian Gulch and traveling northward, settling at Fort Ross about 1812. The historic buildings and stockade, some of which have been restored, have been acquired by the State Park Department, and many visitors annually view these relics.

IMPROVEMENT ENDS RESTRICTIONS

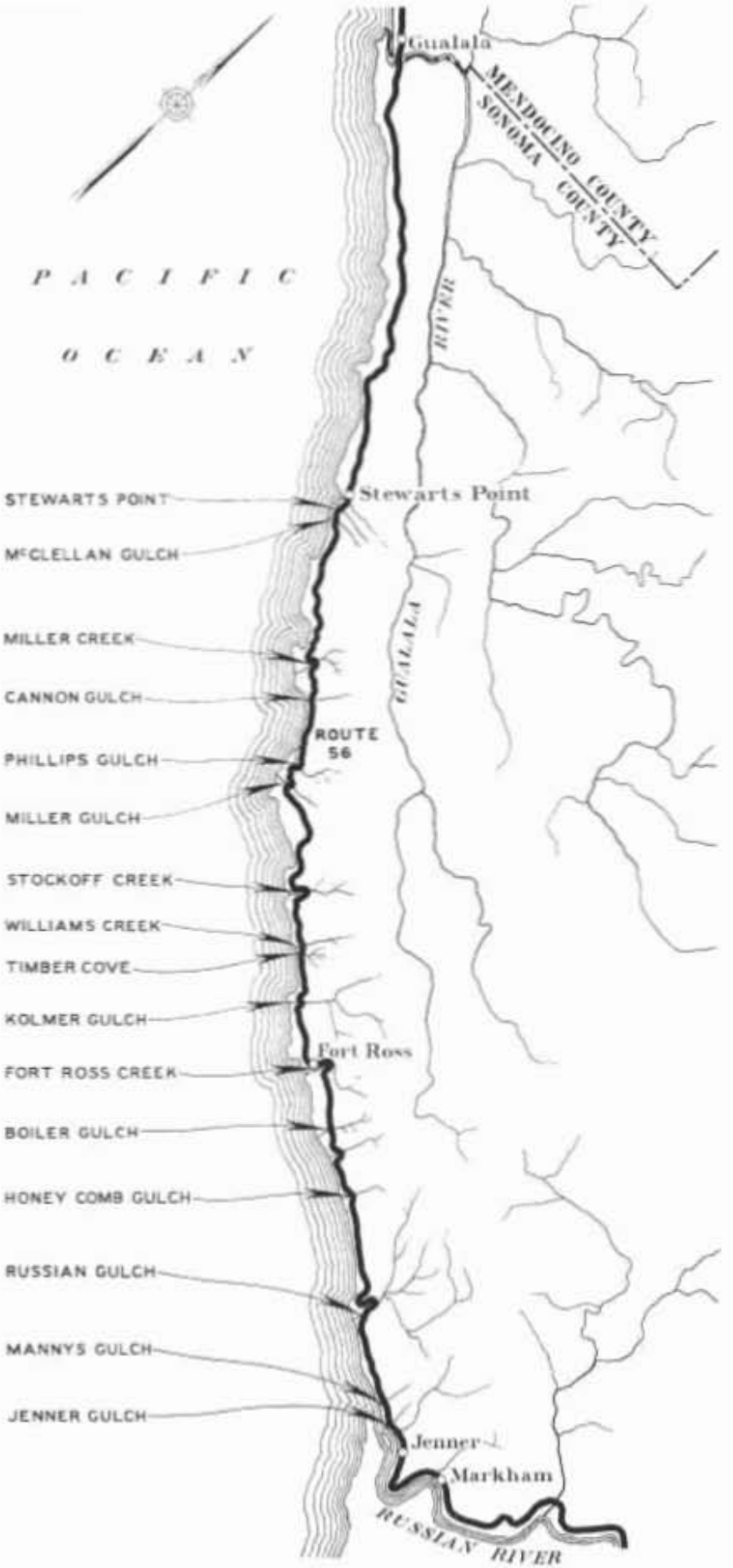
At other points along this road evidence can be seen of early day lumbering activities, including portions of old ship loading rigs where ships were anchored off shore to secure their lumber cargo by high lines between the shore and the ship. Some lumber is still produced in the hills to the east of the road, but due to restricted loadings on the old timber structures and the short radius curves at many of the bridge approaches, hauling of this product was severely restricted.

The elimination of these restrictive features by the recently completed highway construction along this route has removed this barrier from that industry.

The work on Guerin Bros. contract was completed in June, 1940. This same month, a third contract was awarded to James E. Anderson of Visalia, at a cost of $23,500, for the elimination of McClellan Gulch Bridge near Stewart's Point, as noted at the commencement of this article. This contract is now under way and upon completion thereof, the last of the old timber bridges which were posted for restricted loading will have been eliminated on this section of highway in Sonoma County.

Names of the bridges replaced under the foregoing contracts are shown on our records as:

1. **Boiler Gulch Bridge, replaced with 90-inch multiplate culvert.**
2. **Fort Ross Creek Bridge, replaced with redwood box culvert.**
3. **Kolmer Gulch Bridge, replaced with redwood box culvert.**
4. **Williams Creek Bridge, replaced with redwood box culvert.**
5. **Stockoff Creek Bridge, replaced with redwood box culvert.**
6. **Miller Gulch Bridge, replaced with redwood box culvert.**
7. **Phillips Gulch Bridge, replaced with redwood box culvert.**
8. **Miller Creek Bridge, replaced with redwood box culvert.**
9. **Three bridges over forks of Russian Gulch, replaced by a single 3-span reinforced concrete bridge.**
10. **Jenner Gulch Bridge, replaced by corrugated metal pipes.**
11. **Manny's Gulch Bridge, replaced by corrugated metal pipes.**



12. **Honey Comb Gulch Bridge**, replaced by R. C. arch culvert.
13. **Cannon Gulch Bridge**, replaced by R. C. arch culvert.
14. **Timber Cove Bridge**, replaced by tunnel through native rock bluff.
15. **Stewart's Point Bridge**, replaced by R. C. arch culvert.
16. **McClellan Gulch Bridge**, now being replaced by R. C. arch culvert.

GEORGE A. SEDGWICK GOES TO PANAMA CANAL COMMISSION

George A. Sedgwick has resigned from the Division of Architecture to accept a position as Associate Engineer with the Panama Canal Commission.

Mr. Sedgwick served 11 years with the State prior to his resignation, joining the Harbor Board in San Francisco in 1929, the Bridge Department of the Division of Highways in 1933, and the Division of Architecture in 1937. He has been connected with several major projects, including the structural design of the new Professional and Vocational Standards Building in Sacramento, and the Big Creek arch bridge on the San Simeon-Carmel coast route 56.

Mr. Sedgwick graduated from the University of California in 1927, receiving his degree in the College of Civil Engineering. He is a registered Civil and Structural Engineer in California, an associate member of American Society of Civil Engineers, and holds membership in the honorary engineering fraternities Tau Beta Pi and Chi Epsilon.

Mr. Sedgwick will be missed by his fellow engineers, especially at various annual banquets where his success as a toastmaster is unparalleled.

PLEASURE TO RECEIVE

Bank of America,
San Diego, California.

Editor,
California Highways
and Public Works,
Sacramento, California.

Dear Sir:

It is always a pleasure to receive your very educational magazine which so clearly shows the development of California's highways and natural resources.

I commend and congratulate you for this splendid publication.

Sincerely,

A. V. MAYRHOFER,
Assistant Vice President.

Bay Bridge Five Times Safer for Traffic Than Average Highway

THE chances of a person being either injured or killed in a motor vehicle accident on the San Francisco-Oakland Bay Bridge are about one-half what they would be on the average highway in California or the nation, according to a report of State Highway Engineer C. H. Purcell made to Director of Public Works Frank W. Clark.

Mr. Purcell's report comprised data submitted in advance of a proposed conference with James M. Carter, Director of Motor Vehicles, and E. Raymond Cato, Chief of the California Highway Patrol, for the purpose of discussing ways and means for increasing traffic safety on the bay bridge.

In his report, Mr. Purcell said:

"The Bay Bridge is the heaviest traveled toll structure in the world and one of the busiest of all highways. At the same time it is one of the safest, and a 4-year record shows that the chances of a person being either injured or killed on the bridge are about one-half what they would be on the average highway in the State or the nation. For the past 12 months even this record has been improved to the point where the relative chance of being killed in an accident on the bridge has been 1 to 5½ on the average highway.

"In 1938 a person could drive about 7,040,000 miles in California, or 8,020,000 miles throughout the United States, before expecting to be killed in an accident. In four years on the bridge he could have traveled 14,600,000 miles before anticipating a comparable fate. In the last year his chances on the bridge were far better and he could enjoy 39,000,000 life-safe miles.

"In 1938 the same person could drive an average of 380,000 miles on California highways before expecting to be injured in an accident. For the past four years he could drive 775,000 miles on the bridge before taking the same risk. In the last 12 months his chances on the bridge were not quite so good and he could expect injury after 625,000 miles.

"The accompanying table gives these facts in greater detail:

	United States for 1938	California for 1938	Bay Bridge Since opening Nov. 12, 1936 to Oct. 31, 1940	Bay Bridge Last 12 months October, 1939 to October, 1940
1. Vehicle miles	260,000,000,000	19,500,000,000	236,000,000	78,000,000
2. Total personal injury and fatal accidents	.....	36,643	151	72
3. Fatal accidents	.....	2,550	10	2
4. Persons killed	32,400	2,775	16	2
5. Persons injured	.....	51,150	302	125
6. Vehicle miles per personal injury or fatal accident	.....	531,000	1,550,000	1,080,000
7. Vehicle miles per fatal accident	.....	7,650,000	23,600,000	39,000,000
8. Vehicle miles per fatality	8,020,000	7,040,000	14,600,000	39,000,000
9. Vehicle miles per injury	.....	380,000	775,000	625,000

London Library Carries on With Magazine Files

German bombers over London evidently have not interfered with the orderly work of the Science Museum Library, South Kensington, in England's capital city.

The mail from overseas brought to Director of Public Works Frank W. Clark today a letter from E. Hamorten-Jones, Keeper of the Library at the Museum, requesting several back issues of CALIFORNIA HIGHWAYS AND PUBLIC WORKS, the official magazine of the Department of Public Works. Jones wrote:

"With reference to CALIFORNIA HIGHWAYS AND PUBLIC WORKS which you have kindly forwarded to the National Library of Science and Technology at this Museum, I beg to inquire whether you would be so good as to supply copies of Volume 18, Nos. 1 to 3 and 7 to 9 and onwards, which have not been received, in order that the library set may be complete to date."

The Science Museum Library is a National Central Library of pure and applied science. The Library contains works printed in Great Britain and the more important scientific books published abroad, and, in addition, an exceptionally extensive collection of current scientific and technical periodicals of all countries. It is particularly rich in the transactions of societies, bulletins, monographs, reports, etc., of government departments, experiment stations, research laboratories, and scientific institutions. The total number of periodicals in the library is about 15,000, of which some 10,000 are current. The number of volumes in the library is approximately 280,000, and is being augmented at the rate of 12,000 a year.

USED IN CLASSES

San Diego, Calif.

Dear Sirs:

I use your magazine in my social science classes. We took a lot of our units on conservation and transportation from the California Highway numbers. I assign articles to the various students and then they give oral reports on what they have read. I do enjoy your magazine.

RALPH M. YOUNG,
Social Science Teacher,
Herbert Hoover Sr. High School.

Highway Bids and Awards for the Month of November, 1940

ALAMEDA COUNTY—Silver Springs highway crossing under the tracks of the Western Pacific Railroad at Sunol to be constructed. District IV, Route 107, Section A. A. Soda & Son, Oakland, $148,764; Piazza & Huntley & Trewhitt, Shields & Fisher, San Jose, $150,265; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, $150,435; Lee J. Immel, Berkeley, $163,727; Fred J. Maurer & Son, Eureka, $164,587. Contract awarded to Earl W. Heple, San Jose, $139,067.

DEL NORTE COUNTY—Embankment stabilization, 4.5 miles south of Crescent City. District I, Route 1, Section B. Claude C. Wood, Lodi, $13,772; Fred J. Maurer & Son, Eureka, $15,476; John Burman & Sons, Eureka, $16,263. Contract awarded to Mercer Fraser Co., Eureka, $12,325.

FRESNO-MADERA COUNTY—Remove existing bridge across San Joaquin River about 10 miles north of Fresno. District VI, Route 125, Sections C, A. Louis Biasotti & Son, Stockton, $2,950; Fred Fredenburg, So. San Francisco, $3,500; J. L. Webster, Stockton, $4,700; M. A. Jenkins, Sacramento, $5,220; George E. France, Visalia, $8,000. Contract awarded to Kiss Crane Service Co., Berkeley, $2,750.

KERN COUNTY—Between San Luis Obispo County line and 0.2 mile south of Kings County line, about 4.7 miles to be graded and road-mix surface treatment applied. District VI, Route 125, Section A. Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, $123,241; Brown Materials Co., Ltd., Avenal, $126,284; Louis Biasotti & Son, Stockton, $130,169; J. E. Haddock, Ltd., Pasadena, $138,829; A. Teichert & Son, Inc., Sacramento, $146,877; Basich Brothers, Torrance, $156,312. Contract awarded to Griffith Co., Los Angeles, $119,371.

KERN COUNTY—Two bridges to be constructed, one across Kern River and the other across Beardsley Canal about one and two miles, respectively, north of Bakersfield. District VI, Route 142, Section A. R. R. Bishop, Long Beach, $192,565; Carlo Bongiovanni, Hollywood, $192,877; Griffith Co., Los Angeles, $193,275; A. Soda & Son, Oakland, $195,321; Trewhitt-Shields & Fisher, Fresno, $199,969; J. E. Haddock, Ltd., Pasadena, $210,487; Ralph A. Bell, San Marino, $201,924; Heafey-Moore Co. & Fredrickson & Watson Const. Co., Oakland, $207,620; Harry J. Oser, San Francisco, $214,030. Contract awarded to A. Teichert & Son, Inc., Sacramento, $192,339.

LOS ANGELES COUNTY—In Arcadia at Huntington Drive between Second and Third Avenues, an undergrade crossing under the tracks of the Atchison, Topeka & Santa Fe Ry. to be constructed and approaches about 0.1 mile in length to be graded and surfaced with asphalt concrete. District VII, Route 161, Section Ada. Byerts & Dunn, Los Angeles, $165,414; Griffith Co., Los Angeles, $168,740; Oscar Oberg, Los Angeles, $172,492; Carlo Bongiovanni, North Hollywood, $175,172; Baruch Corp., Los Angeles, $185,276; Oswald Bros., Los Angeles, $189,019; United Concrete Pipe Corp., Los Angeles, $193,408; Sander Pearson, Santa Monica, $194,204; Mittry Bros. Construction Co., Los Angeles, $205,145. Contract awarded to J. E. Haddock, Ltd., Pasadena, $163,059.

LOS ANGELES COUNTY—At Newhall Station California Highway Patrol, truck scale to be furnished and installed. District VII, Route 79, Section B. Fairbanks Morse & Co., Los Angeles, $4,906. Contract awarded to Toledo Scale Co., Toledo, Ohio, $4,299.

LOS ANGELES COUNTY—Chilao Maintenance Station Angelus Crest Highway, about 26 miles north of junction with Foothill Blvd. Sanitary plumbing for 3-4 room dwellings and one truck shelter to be furnished and installed. District VII, Route 61, Section C. Hickman & Ritter, Pasadena, $1,407; Earl O. Stice Co., Los Angeles, $1,619; Edw. H. Martin, Los Angeles, $1,201. Contract awarded to Adolph Gronlund, La Crescenta, $636.

LOS ANGELES COUNTY—Chilao Maintenance Station at above location. Electrical wiring. Magee Electric Co., Glendale, $538; H. O. Bauerle, Los Angeles, $949. Contract awarded to G. A. Fjelstrom, Glendale, $532.

SAN BENITO, SANTA CLARA COUNTIES—Between Prundale junction and Sargent overhead, about 2.6 miles to be graded and surfaced with plant-mixed surfacing. District IV, Route 2, Sections A, C. Macco Construction Co., Clearwater, $136,111; N. M. Ball Sons, Berkeley, $138,828; Earl W. Heple, San Jose, $145,738; Louis Biasotti & Son, Stockton, $146,915; Union Paving Co., San Francisco, $147,597; Gibbons & Reed Co., Burbank, $149,452; A. Teichert & Son, Inc., Sacramento, $142,653. Contract awarded to Heafey-Moore Co. and Fredrickson & Watson Construction Co., Oakland, $131,221.

SAN JOAQUIN COUNTY—In the city of Stockton, on North Wilson Way, about 0.17 mile to be paved with asphalt concrete. District X, Route 4, Section Stkn. M. J. B. Construction Co., Stockton, $8,915. Contract awarded to S. M. McGaw, Stockton, $8,565.00.

SANTA CLARA, SAN BENITO COUNTIES—Across Pajaro River six miles south of Gilroy, a steel girder bridge on concrete piers and abutments, having a length of 340 feet, to be constructed. District IV, Route 2, Sections C, A. Trewhitt-Shields & Fisher, Fresno, $128,780; A. Soda & Son, Oakland, $129,485; Earl W. Heple, San Jose, $136,222; Joseph Shaw, Crescent City, $140,358; Harry J. Oser, San Francisco, $146,489; United Concrete Pipe Corp., Los Angeles, $159,501. Contract awarded to C. W. Caletti & Co., San Rafael, $124,081.

SANTA CLARA COUNTY—University Avenue underpass in Palo Alto, about 0.14 mile to be landscaped. District IV, Feeder route, Section P. A. Leonard Coates Nurseries, San Jose, $4,598. Contract awarded to California Nursery Co., Inc., Niles, $2,445.

SANTA CRUZ COUNTY—Between Davenport and 1½ miles south, about 1.0 mile to be graded and road-mix surface applied. District IV, Route 56, Section B. A. Teichert & Son, Inc., Sacramento, $56,490; Louis Biasotti & Son, Stockton, $58,318; N. M. Ball Sons, Berkeley, $61,685. Contract awarded to Heafey-Moore Co. and Fredrickson & Watson Construction Co., Oakland, $52,994.

STANISLAUS COUNTY—Between Keyes and Hatch Crossing, about 5.5 miles to be graded, portions to be paved with portland cement concrete, portions to be surfaced with plant-mixed surfacing on portland cement concrete base, borders of crusher run base to be constructed adjacent to the new pavement, and a reinforced concrete bridge to be constructed. District X, Route 4, Section A, Cer, B. Fredericksen & Westbrook, Sacramento, $222,292; Basich Bros., Torrance, $224,102; N. M. Ball Sons, Berkeley, $229,152; A. Teichert & Son, Inc., Sacramento, $236,817; Union Paving Co., San Francisco, $238,208; Heafey-Moore Co. & Fredrickson & Watson Const. Co., Oakland, $244,420; United Concrete Pipe Corp., Los Angeles, $249,273. Contract awarded to M. J. B. Construction Co. and F. Kaus, Stockton, $213,980.

TULARE COUNTY—Across Cameron Creek about five miles east of Visalia, a reinforced concrete slab bridge. District VI, Route 10, Section C. J. L. Webster, Stockton, $10,318; Trewhitt-Shields & Fischer, Fresno, $10,737; James E. Anderson, Visalia, $11,173; George E. France, Visalia, $11,674; L. D. Tonn, Lodi, $12,754. Contract awarded to Louis Biasotti & Son, Stockton, $10,000.

TULARE COUNTY—Across Sand Creek about 0.5 mile south of Orosi, a reinforced concrete slab bridge. District VI, Route 132, Section C. Fred Fredenburg, So. San Francisco, $8,199; Brown & Doko, Pismo Beach, $8,301; Trewhitt-Shields & Fisher, Fresno, $8,551; Louis Biasotti & Son, Stockton $8,744; James E. Anderson, Visalia, $9,642; A. A. Tieslau, Berkeley, $10,346; A. H. Siemer & J. Carcano, San Anselmo, $10,425. Contract awarded to Thomas Construction Co., Burbank, $7,733.

TUOLUMNE COUNTY—Between Columbia Wye and Sonora, about 1.9 miles to be graded and surfaced with road-mix surfacing on crushed rock or gravel base. District X, Route 65, Section A, Sra. Poulos & McEwen, Sacramento, $95,572; Louis Biasotti & Son, Stockton, $96,145; Claude C. Wood, Lodi, $109,796; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, $112,424; A. Teichert & Son, Inc., Sacramento, $120,385. Contract awarded Johnston Rock Co., Inc., Stockton, $87,465.

VENTURA COUNTY—At Camarillo State Hospital, near Camarillo, roads within hospital grounds to be graded, surfaced with plant-mixed surface on imported subgrade material and portland cement concrete curbs, gutters, and sidewalks. J. E. Haddock, Ltd., Pasadena, $30,887; Griffith Co., Los Angeles, $30,911. Contract awarded to Sander Pearson, Santa Monica, $30,772.

YOLO COUNTY—Between Swingle and Yolo Causeway, about 1.5 mile, south lane of a divided highway to be graded. District III, Rout 6, Section A, B. A. Teichert & Son, Inc., Sacramento, $34,987; Piazza & Huntley, San Jose, $40,190; Kiss Crane Service, Berkeley, $47,758; Shea & Beebe, Hawthorne, $49,666; Lee J. Immel, Berkeley, $49,940; J. R. Reeves, Sacramento, $53,223. Contract awarded to Fredericksen & Westbrook, Sacramento, $34,031.

October Awards

SAN BERNARDINO COUNTY—Between Redlands and three miles east, about three miles to be graded and surfaced with surfacing material. District VIII, Route 26, Section Rld., B. Matich Bros., Elsinore, $69,476; Oswald Bros., Los Angeles, $71,253; E. L. Yeager, Riverside, $72,247; Griffith Co., Los Angeles, $75,418; A. S. Vinnell Co., Alhambra, $85,944. Contract awarded to Dimmitt & Taylor, Los Angeles, $63,367.

SAN MATEO COUNTY—Between Edgemar and Thornton, about 0.6 mile to be graded and surfaced with road-mixed surfacing on pit run base. District IV, Route

56, Section E. Macco Construction Co., Clearwater, $25,800; N. M. Ball Sons, Berkeley, $28,760; Louis Biasotti & Son, Stockton, $29,914; Fredericksen & Westbrook, Sacramento, $29,474; Heafey-Moore Co. & Fredericksen & Watson Construction Co., Oakland, $33,472; A. Teichert & Son, Inc., Sacramento, $34,863; Xenophon Carrithers, San Mateo, $49,029. Contract awarded to Piombo Bros. & Co., San Francisco, $23,185.

SAN MATEO COUNTY—Between Broadway and Charter Streets in Redwood City, about 1.3 miles to be graded and paved with asphalt concrete. District IV, Route 2, Section Rdw.C. Marshall S. Hanrahan, Redwood City, $210,832; Chas. L. Harney, San Francisco, $228,795. Contract awarded to Piazza and Huntley and Trewhitt-Shields and Fisher, San Jose, $209,302.

SAN MATEO COUNTY—Between Rockaway Beach and Edgemar, about 3.2 miles to be graded and surfaced with plant-mixed surfacing. District IV, Route 56, Section E. N. M. Ball Sons, Berkeley, $88,260; Piombo Bros. & Co., San Francisco, $89,711; Fredericksen & Westbrook, Sacramento, $95,923; Heafey-Moore Co. & Fredrickson & Watson Construction Co., Oakland, $98,457; Macco Construction Co., Clearwater, $99,513; Chas. L. Harney, San Francisco, $109,884; Union Paving Co., San Francisco, $112,738. Contract awarded to A. Teichert & Son, Inc., Sacramento, $76,023.

SANTA BARBARA COUNTY—Between Orella and one mile west of Canada del Refugio, about 2.0 miles to be graded and surfaced with plant-mixed surfacing and a reinforced concrete girder bridge to be constructed. District V, Route 2, Section F. J. E. Haddock, Ltd., Pasadena, $197,868; A. Teichert & Son, Inc., Sacramento, $202,434. Contract awarded to Basich Brothers, Torrance, $170,717.

SANTA CLARA COUNTY—Between Llagas Creek and Gilroy, about 5.6 miles to be graded and paved with asphalt concrete and portland cement concrete. District IV, Route 2, Section C. Macco Construction Co., Clearwater, $186,273; Fredericksen & Westbrook, Sacramento, $189,537; Heafey-Moore Co. and Fredrickson and Watson Construction Co., Oakland, $195,057; J. E. Haddock, Ltd., Pasadena, $215,151. Contract awarded to N. M. Ball Sons, Berkeley, $181,632.

Maintenance Equipment Study by Research Board

(Continued from page 21)

earth road under California soil and climatic conditions, that is, average conditions in one state, includes five alternatives for performing the work of shaping and blading. Whether a single type of equipment should be recommended for a certain piece of work, or whether alternative types of equipment should also be suggested, will have to be determined by analysis of the data and circumstances.

The plan under which this study is proceeding should permit the compilation of quite a complete and comprehensive text on maintenance equipment. The work probably will be concluded and a report submitted during 1941.

In Memoriam

Richard Barry, Assistant Resident Engineer, was laid to rest in Holy Cross Cemetery in San Francisco, after his death at Red Bluff on November 16, 1940.

Mr. Barry was born in Inagh, County Clare, Ireland, on February 26, 1884, where he received his early education in the Inagh National School. Coming to America in his youth he entered the Preparatory School of Notre Dame University, continuing in the College of Civil Engineering at Notre Dame and at the Ohio State University.

Mr. Barry first entered the service of the State in September, 1921, and was employed on two short assignments. He reentered the service in 1929 in District II and continued as an employee until his death.

During the summer of 1939, Mr. Barry and his brothers and sisters enjoyed a family reunion in Ireland; returning shortly before the war made sea travel dangerous.

He is survived by two sons, Hubert M. and Richard M.; his sisters, Mrs. Mary Cullen of Chicago, Mrs. Martin Halloran of New York, Mother Mary Gerald, Mother General, Dominican Sisters, Adrian, Michigan; and his brothers, Michael Barry of Inagh, Ireland, Reverend Joseph B. Barry of Biri, Ireland, Frank J. Barry, Los Angeles, John Barry, Redding and Mons. Wm. Barry, Vicar General, St. Augustine Diocese, Miami, Florida.

His untimely death, due to an automobile accident near Redding, California, on November 14, was a shock to his associates in the Division of Highways. Always a loyal and conscientious worker, he made friends with superiors and subordinates alike. His happy personality will be long remembered by his co-workers.

T. V. A. ENGINEER REQUESTS

Knoxville, Tenn.

California Highways
and Public Works,
Sacramento, California.

Gentlemen:

I should appreciate being added to your mailing list to receive copies of the magazine "California Highways and Public Works." I have been reading the magazine regularly through the courtesy of a friend, but now that he has left town, this opportunity is no longer available.

Your kindness will be greatly appreciated.

Very truly yours,
M. L. DICKINSON,
Hydraulic Engineer,
Tennessee Valley Authority,
Knoxville, Tennessee.

Project Completed on California-Oregon Unit

(Continued from page 22)

surface consists of deuse graded plant mix .15 by 22 feet covered with .06 by 22 feet of open graded plant mix producing a nonskid surface. Shoulders are covered with deuse graded plant mix one-tenth of a foot thick.

SAVES 5 MILES

This combined cooperative project 17.8 miles long results in a gross saving of 5 miles in distance and at least 30 minutes in traveling time and provides an infinitely safer road. Full credit for this major improvement of the Pacific Highway is due to Oregon highway officials and engineers for their vision in conception of the project and their broad viewpoint in dealing with the problems involved.

At other locations in both California and Oregon work of modernizing obsolete sections of the Pacific Highway will continue as rapidly as funds are available.

Governor Culbert L. Olson and Director of Public Works Frank W. Clark were represented at the opening ceremonies by Secretary Walter L. Ballou of the California Highway Commission and State Highway Engineer C. H. Purcell by Construction Engineer R. M. Gillis of the State Division of Highways.

Gov. Olson Discusses Highway Development

(Continued from page 13)

must be increases in Federal assistance to the States if the program is to advance with the speed which is necessary.

The next ten years in highway development place before State and Federal officials a challenge which must be squarely met if the nation is to be provided with the highway facilities to which it is entitled.

KEEPING INFORMED

Sirs:

Kindly place us on your mailing list to receive journal CALIFORNIA HIGHWAYS AND PUBLIC WORKS.

One million miles of highway travel in the last eighteen years in California makes us appreciate the work your division has done. We desire to keep up with the progress to be made. Thanks.

M. D. and S. L. CLARK,
Loomis, California.

State of California

CULBERT L. OLSON, Governor

Department of Public Works

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

FRANK W. CLARK, Director of Public Works

FRANZ R. SACHSE, Assistant Director

MORGAN KEATON, Deputy Director

CALIFORNIA HIGHWAY COMMISSION

LAWRENCE BARRETT, Chairman, San Francisco
IENER W. NIELSEN, Fresno
AMERIGO BOZZANI, Los Angeles
BERT L. VAUGHN, Jacumba
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WALTER T. BALLOU, Secretary

DIVISION OF HIGHWAYS

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

DISTRICT ENGINEERS

E. R. GREEN, District I, Eureka
F. W. HASELWOOD, District II, Redding
CHARLES H. WHITMORE, District III, Marysville
JNO. H. SKEGGS, District IV, San Francisco
L. H. GIBSON, District V, San Luis Obispo
E. T. SCOTT, District VI, Fresno
S. V. CORTELYOU, District VII, Los Angeles
E. Q. SULLIVAN, District VIII, San Bernardino
S. W. LOWDEN (Acting), District IX, Bishop
R. E. PIERCE, District X, Stockton
E. E. WALLACE, District XI, San Diego

SAN FRANCISCO-OAKLAND BAY BRIDGE

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

DIVISION OF WATER RESOURCES

EDWARD HYATT, State Engineer, Chief of Division
GEORGE T. GUNSTON, Administrative Assistant
HAROLD CONKLING, Deputy in Charge Water Rights
A. D. EDMONSTON, Deputy in Charge Water Resources Investigation
GEORGE W. HAWLEY, Deputy in Charge Dams
SPENCER BURROUGHS, Attorney
GORDON ZANDER, Adjudication, Water Distribution

DIVISION OF ARCHITECTURE

ANSON BOYD, State Architect
W. K. DANIELS, Assistant State Architect
P. T. POAGE, Assistant State Architect

HEADQUARTERS

H. W. DEHAVEN, Supervising Architectural Draftsman
C. H. KROMER, Principal Structural Engineer
CARLETON PIERSON, Supervising Specification Writer
J. W. DUTTON, Principal Engineer, General Construction
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