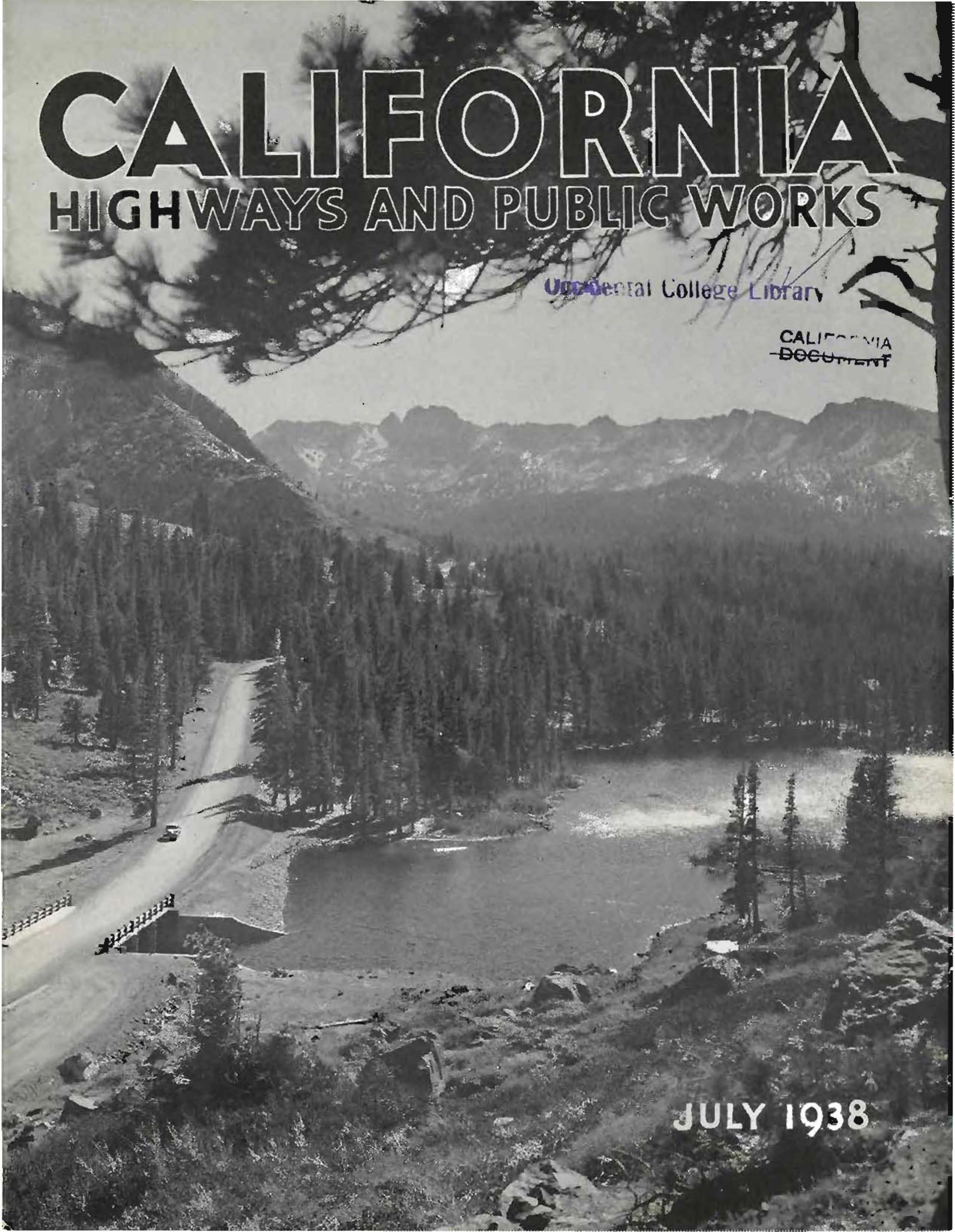
CALIFORNIA
HIGHWAYS AND PUBLIC WORKS



JULY 1938

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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

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Symposium on Requirements of California Highway System as Reported by District Engineers

Lack of Paved Roads Serious

By F. W. HASELWOOD
District Engineer, Dist. II

THERE have been many critical periods in the brief history of California highway progress. The story of the rapid increase in number and weight of motor vehicles and their radius of travel is a familiar one. The efforts that have been made to meet the requirements of this growing traffic in highway financing, design and construction may not be so well known. Necessarily, as motor vehicle traffic increased there was need for an expansion in the highway system to serve a wider area and a change in standards to meet the new requirements. The initial mileage of 3000 has now become 14,000, and standards of highway design have been greatly modified.

The latest expansion in highway mileage occurred in 1933 with the addition of some 6600 miles, with a public anticipation that all of these additional roads would immediately be improved. There were no increased finances to take care of these roads. In fact, the construction fund was immediately reduced by about $1,500,000 required for maintenance, then one-half cent of the gas tax was assigned to the cities.

Regardless of how essential these uses were, the effect was to reduce by more than half, the funds available for highway construction at a time when the highway mileage was doubled. The effect of this decrease in finances in relation to increased needs was somewhat obscured as far as the public was concerned by the Federal emergency funds that were allocated to the states during the depression. Since these supplemental funds are no longer available, the situation is becoming so acute as to constitute a new crisis in highway affairs.

From the beginning, the problem on California highways, as well as on those of every state in the Union, has been to provide quick service over the entire mileage. The inevitable result was that as traffic expanded in volume, increased in speed, and changed in weight of loads, these earlier roads became obsolete as to alignment, grade, and width, and inadequate as to durability of surface.

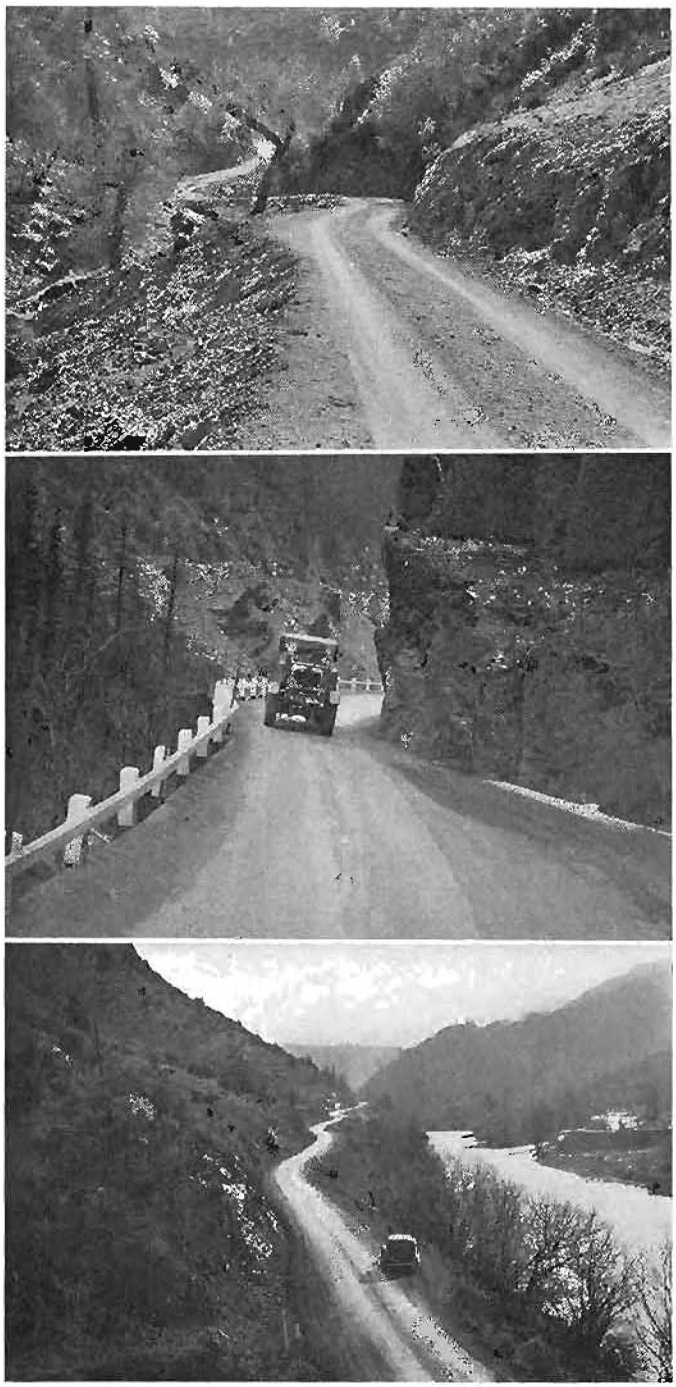
Adequacy of design and improvement was not in sight when the system was doubled in 1933. The only procedure possible in connection with the added mileage, which was of very low standard, and, in some districts, was entirely unimproved, was the lowest type of improvement that would as quickly as possible make these roads dustless and mudless.

In order to get a closer picture of the highway problem as it exists today in California, the District Engineers in each of the eleven highway districts in the State have been asked to report on the conditions and needs in their respective jurisdictions.

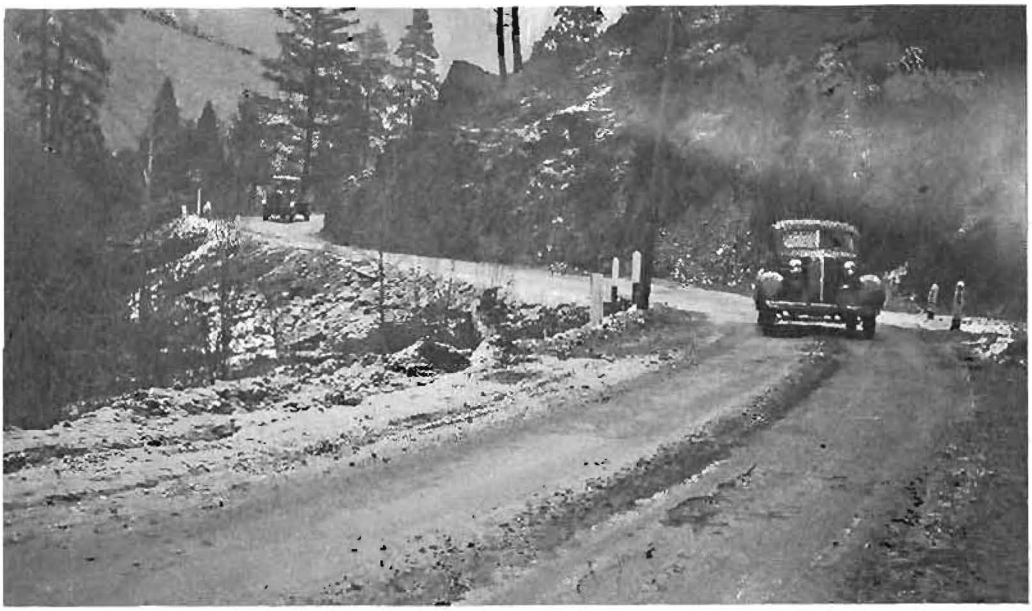
The situation in District II is presented in the following report by District Engineer F. W. Haselwood:

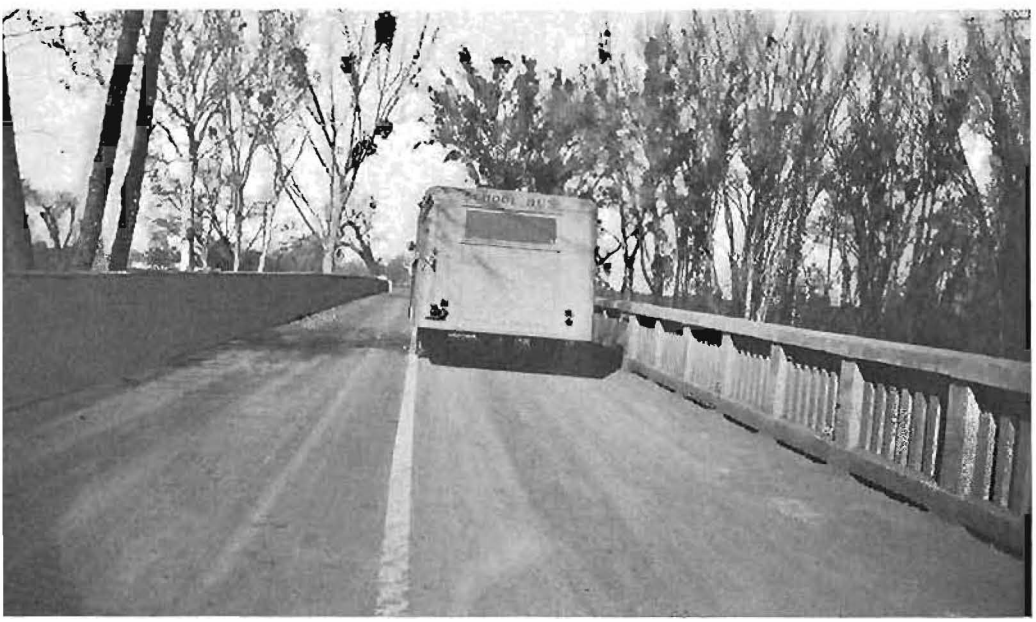
District II one of the eleven California highway districts, occupies the northeast corner of the State, including all or portions of nine counties with 1400 miles of highway. The area is largely mountainous. The climate in winter is severe and road surfaces must support heavy snow removal equipment.

Of the high type pavement, 87 miles are obsolete as to alignment and width, or inadequate as to thickness and serviceability, or both. Of the intermediate type surface, 217 miles are of stage construction and will require addi-



Types of unimproved road in Shasta (top), Plumas (center) and Siskiyou counties in District II.





Top—Sharp curve, narrow roadway and narrow bridge combine to make unsafe this Plumas County road. Center—This sharp alignment, steep bridge approach and blind vertical and narrow bridge are at city limits of Redding. Bottom—This narrow bridge in Tehama County requires careful driving.

tional increments of surface at intervals.

The status of improvement on these 1400 miles, which is just 10 per cent of the state's total mileage is:

67 miles,	or 5%	unimproved and unoiled earth roads.
483 miles,	or 34%	oiled earth roads, inferior as to grade, alignment and width.
386 miles,	or 28%	graveled roads with light oiled surface.
327 miles,	or 23%	intermediate type of surface.
137 miles,	or 10%	of high type pavement.

All of the graveled and earth roads require periodical construction and heavy annual maintenance expenditures to keep them in service until more substantial work can be financed. In other words, most of the work done to date has had to be inadequate to cover as much mileage as possible, and the problem of holding it together at all requires so much of the biennial allocation that little progress can be made toward more substantial improvement.

An examination of the status of improvement of the 1400 miles of highway in District II reveals that to bring these roads to the standards required by present day traffic, 649 miles, or 46 per cent, will require grading at a cost of $14,000,000. Of this, 272 miles will be entirely new construction and 377 miles will be widening or realigning present obsolete roads.

When it comes to surface, we find, by reason of the necessity of following the expedient of stage construction, by which light surfaces are constructed and strengthened periodically by additional increments, that some work will have to be done on 1349 miles at a cost of $16,000,000.

There are about 35,000 lineal feet of bridges that need widening or replacement by reason of being structurally weak, too narrow, or located on obsolete alignment. The cost of these bridges will be about $5,250,000.

The total cost of grade surface and bridges to satisfy present demands aggregates $35,250,000.

Of course this improvement is not going to be accomplished immediately,

Top—Obsolete alignment and inadequate 16-foot pavement in Siskiyou County. Blind vertical curve in left background. Center—Narrow oiled earth road in Tehama. Poor alignment and narrow inadequate bridge. Bottom—This 14-foot roadway in Trinity has many hairpin turns on grade.

and traffic must be served in the meantime even though at an exorbitant maintenance cost. A reasonable program that would result in the improvement of these roads in a period of 16 years, provided that during this period there are no additions to the system, and that the requirements of traffic and standards of highway design are not materially changed, would call for an annual construction expenditure of $2,300,000. This is twice the amount now available to the district.

This would provide for seven miles per year of high type pavement, 30 miles of intermediate type, 30 miles of completion of stage constructed surfaces, a variable mileage of periodical surface treatment, together with the necessary grading and about $330,000 for bridge construction.

At the end of this 16-year period 152 miles, or about 11 per cent of the roads in the district would be surfaced with high type pavement on standard alignment and the remainder with intermediate type.

On at least 900 miles the graded width would not exceed 26 feet, and there would not be more than six miles of multi-lane road outside of incorporated cities.

Even this status could not be considered as entirely adequate for it is becoming increasingly apparent that intermediate type surfaces are not sufficiently durable where heavy snow equipment must be operated. These roads must some time be provided with more durable pavement.

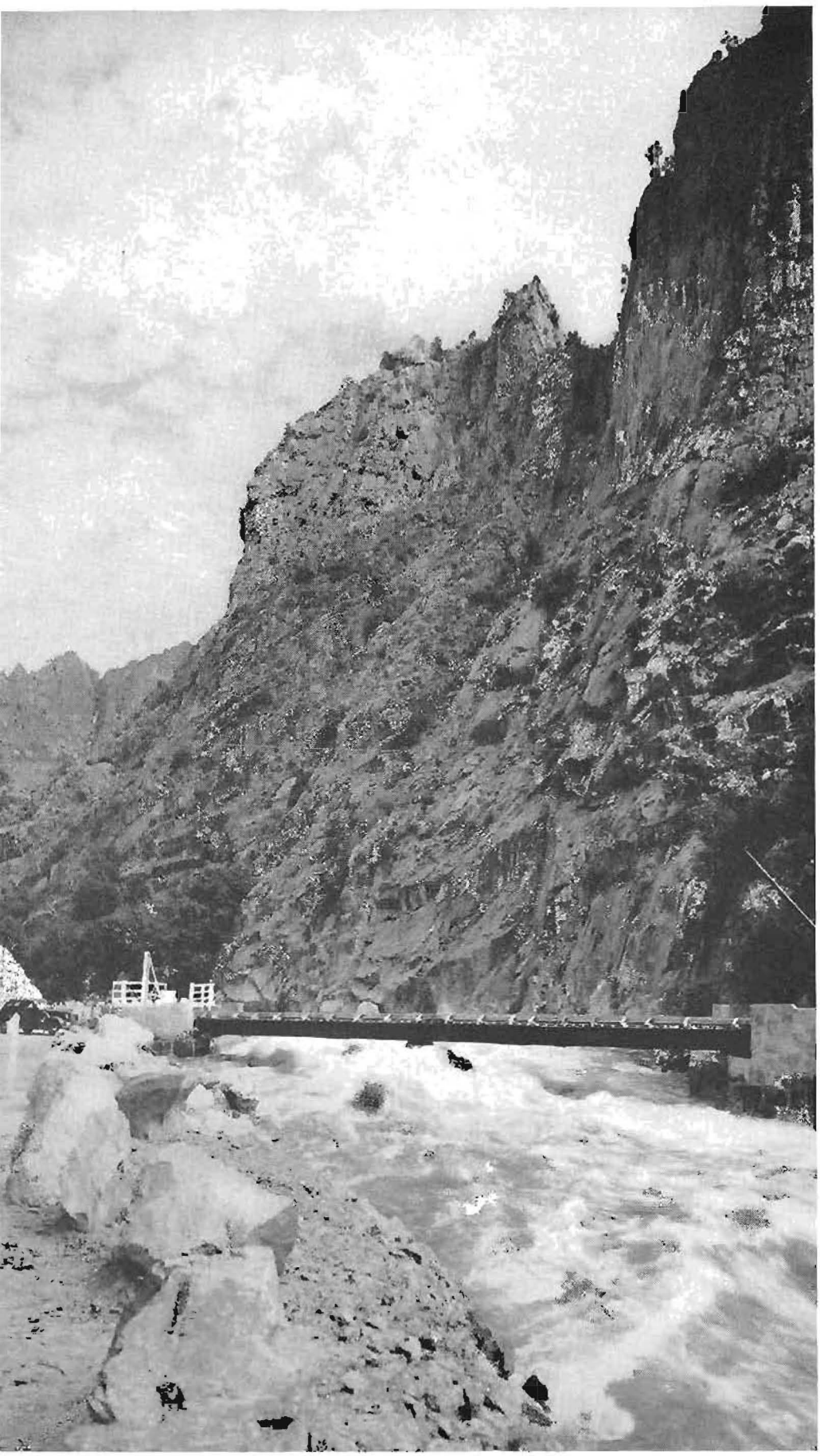
(The needs of another highway district will be described by a District Engineer in next month's issue of California Highways and Public Works).

An English reporter, frequently reprimanded for relating too many details and warned to be brief, sent in the following:

"Last night Sir Dwight Hopeless, a guest at Lady Panmore's ball, complained of feeling ill, took a drink, his hat, his coat, his departure, no notice of his friends, a taxi, a pistol from his pocket, and finally his life. Nice chap. Regrets."

New Scenic In Kings

By R. S. BADGER, Dist



Kings River Bridge. Abutments and center pier complete. Superstructure half complete. Kings River, nearing flood stage, is roaring through canyon.

THERE is an increasing and eager interest shown by the public in the progress of construction on the Kings River Canyon Highway. This project forms a portion of State Highway Route 41. It lies between the northerly boundary of General Grant National Park and Deer Cove Creek, where it joins the South Fork of Kings River. The U. S. Forestry Service will extend this road with a Forest Highway from Deer Cove Creek into Cedar Grove and on up the South Fork to Copper Creek and another beautiful recreational area will be opened to the public.

The construction work from General Grant Park to the crossing of Ten Mile Creek involved very heavy excavation quantities. However, from this point to the Kings River crossing at Windy Cliff, not only was there encountered much heavier yardage, but the character of the country rendered construction much more difficult.

Hard, fine-grained granite and metamorphosed sedimentary deposits, the latter upturned to form vertical cliffs, made the task of cutting the highway along the mountain side very difficult.

In certain spots the steep cliffs lay in such irregular alignment that thorough cuts involving large quantities of rock excavation were necessary in order to provide room for the roadway. At many other places foundations for high masonry walls were carved out of the steep rocky face of the mountain and in one location, where no footing could be obtained for a wall, an arch was built to carry the outer half of the road over a steep niche in the cliff. The remainder of the roadbed width at this place was benched into the face of the cliff.

One of the spectacular features of the construction was involved in the blasting of a coyote tunnel at Horse

Highway River Gorge

rict Construction Engineer

Shoe Bend. In this section the river gorge winds through an "S" bend, cut to startling depths through vertical rocky cliffs.

In order to give reasonable alignment to the road in this section, very heavy rocky cuts were required. A coyote tunnel from four to six feet in diameter was driven along the proposed inside gutter line of the roadway for a distance of 570 feet. At intervals stub tunnels were cut leading across the proposed roadbed. In each of these tunnels and in the main tunnel along the gutter line, charges of powder were placed and the entire remaining space in the entire tunnel system was backfilled with the material previously excavated. One battery shot was then made to explode 37 tons of powder. The view from the roadway at this location now forms one of the striking features of the varied scenery along this route.

From the crossing of the river at Windy Cliff, the character of the location changes decidedly. The roadbed follows about 15 feet above the river and involves comparatively light excavation yardage.

Throughout the whole project the tourist will be treated to a charming variety of scenery. The grandeur of the Kings River country is nearly equal to that of Yosemite.

Sequoia and General Grant Parks have always drawn tourists into this section of the Sierras. When finished, the Kings River project will add greatly to the attractiveness of their trip.

Sequoia National Park covers an area of 604 square miles. It contains twelve redwood groves, among which is the Giant Forest of 3200 acres with 500,000 stately trees. Here is the General Sherman Tree, the largest living thing on earth.

Several miles to the northwest of Sequoia is General Grant National Park covering four square miles.

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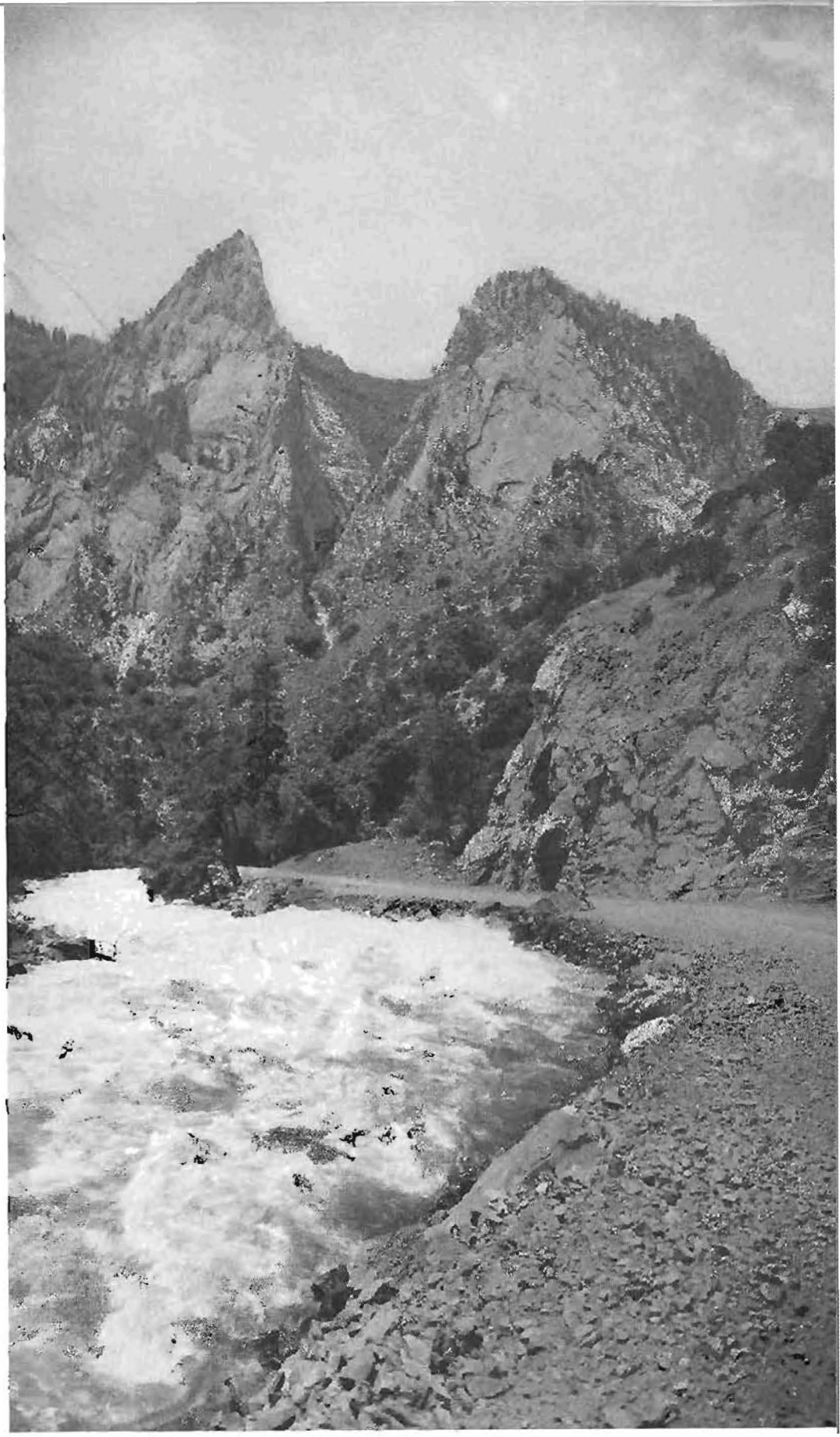


Down the Kings River toward mouth of Boulder Creek. Rugged peaks in limestone formation enhance the picturesque beauty of this canyon.

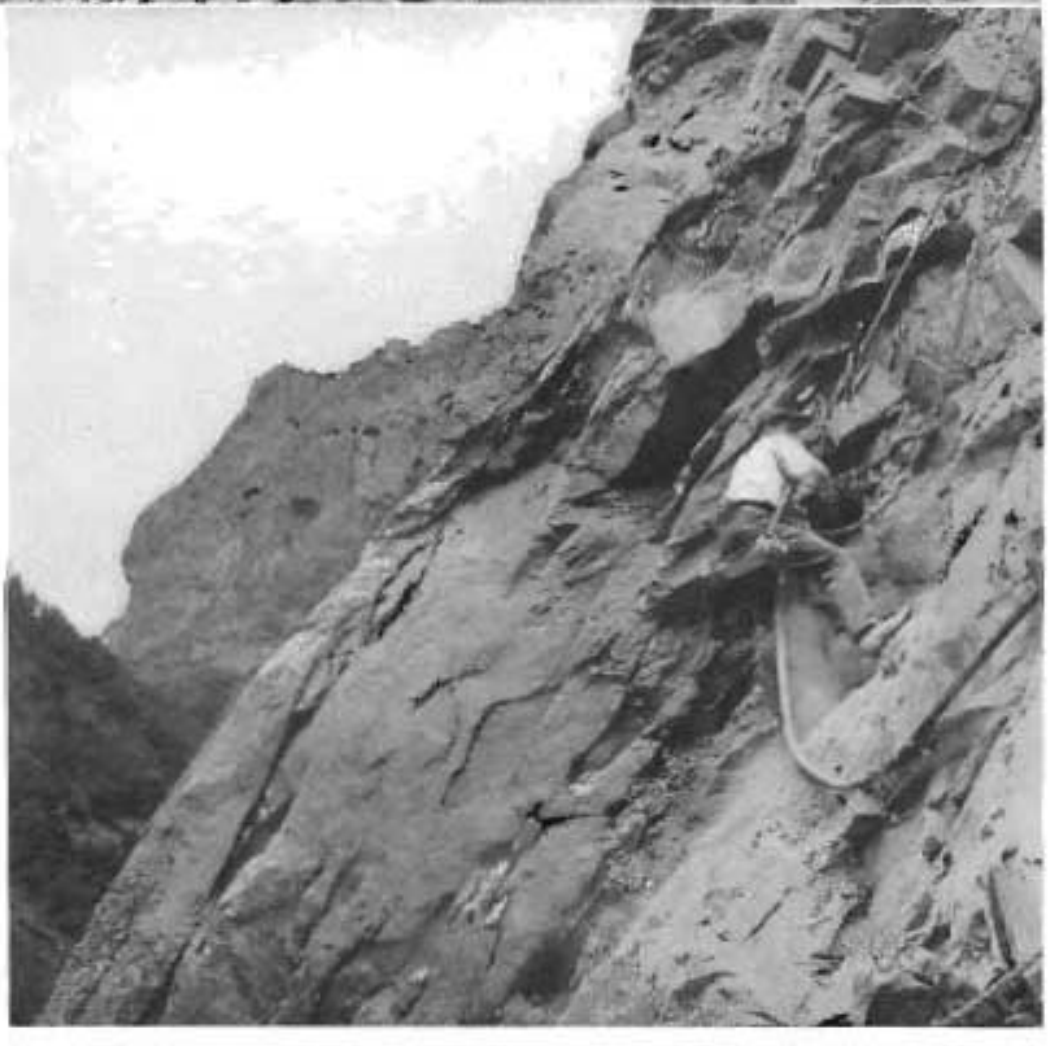
This is the home of the General Grant, the Nation's Christmas tree, towering 267.4 feet. It is the oldest living thing on earth.

Starting from General Grant Park, as one approaches Cherry Gap, he can, on a clear day, see in the distance, a 50 mile section of the San Joaquin Valley. As he passes beyond Cherry Gap he views, for the first time, the rugged beauty of the lower Middle Fork of the Kings. Later at Lookout Point he again sees this view and notes the ruggedness of the country along the South Fork and the relative location of Ten Mile Creek, the two Forks and the main Kings River Gorge.

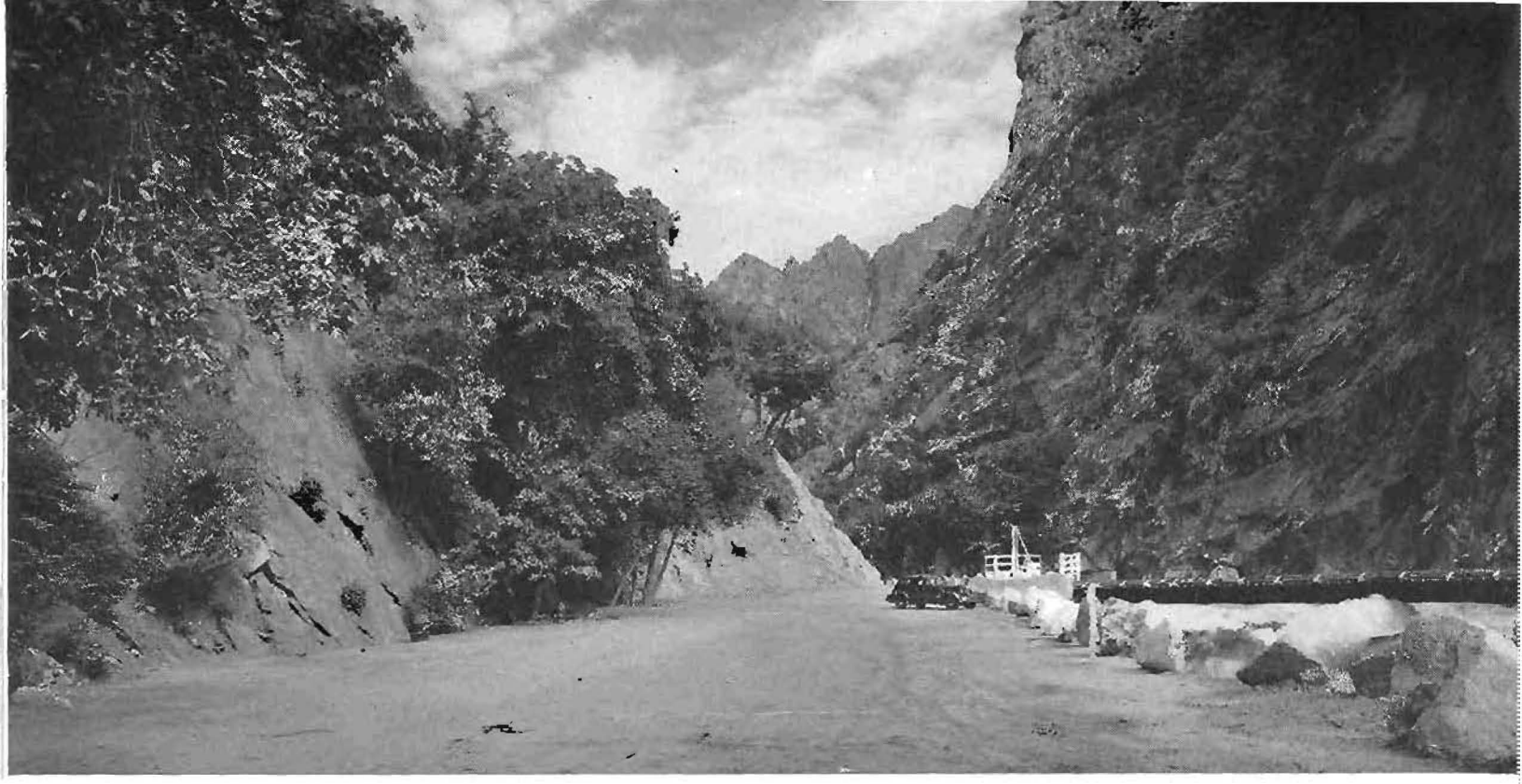
Yucca Point is immediately above the Forks of the Kings River and from that point on the tourist sees one scenic attraction after another.

A good oiled road has been completed to the Kings River crossing, where a gate prevents the public from following the highway further. At this point the Forest Service maintains a guide to direct tourists, if they wish, to Putt Boyden's Cave, located in the face of Windy Cliff some 200 yards from the crossing. The cave is in a limestone formation and its beauty fully rewards the tourist who climbs the trail to its entrance.

Although the public is not permitted to travel beyond the Kings River crossing, the roadway is roughly finished for approximately



Above—Windy cliff crossing of Kings River; the highway follows the right bank. Steam shovel biting into hard rock. Lower—This cliff face typical of many that had to be blasted.



Parking area at Windy Cliff River crossing on Kings River Highway. A drinking fountain for visitors will be erected here.

four miles above this point and pioneer work has reached Grizzly Creek, some 7000 feet from Deer Cove Creek, at which point the U. S. Forest Service road will begin.

The U. S. Forest Service plans to coordinate its roadway work with that of the State and no doubt will be able to open its road from Deer Cove Creek to Copper Creek and invite the touring public into the Cedar Grove and Copper Creek country at the same time that the State Highway to Deer Cove Creek is made available for public traffic.

The State will complete actual construction on its portion of the highway before November, 1939.

Important Condemnation Decision

By CLARENCE W. MORRIS, Assistant Chief, Division of Contracts and Rights of Way

A RECENT decision of the appellate court of this State ruled for the first time upon a question of vital importance to all governmental agencies engaged in building roads and highways over and upon lands acquired by railroad companies through grants from Congress.

The decision arose in the case of *People of the State of California, acting by and through the Department of Public Works, versus Tulare Packing Company et al., as to defendant Southern Pacific Railroad Company* (reported in Vol. 93, C. A. D., page 217). Among other things it was held that the railroad company, where it has merely a "right of way" over a portion of the lands sought to be condemned, has only an inalienable (nontransferable) title thereto, and is entitled only to compensation for the damage which the use of the property taken by the Division of Highways would cause to the right of use of the railroad company.

OWNERSHIP DISPUTED

This action in condemnation was brought against the Southern Pacific Company to condemn a right of way for a new State highway across lands owned by the Southern Pacific Company lying within the city limits of Tulare. At certain places where the new highway was located, the ownership of the land was claimed by the Southern Pacific Company.

The Southern Pacific Company acquired this land as "Congressional grant land" under Secs. 2 and 3 of an Act of Congress approved July 27, 1866 (14 U. S. Stats. 292). Substantially all of the congressional grants have two important sections therein, one of which (Sec. 2) grants to the railroad company, in consideration of its constructing and maintaining a railroad, an easement for right of way and for station grounds, etc., the same being a certain specified number of feet in width; while the other section (Sec. 3) grants to the railroad company in fee, as a bonus, a certain number of alternate odd numbered sections extending out a specified number of miles on each side of the railroad right of way.

The subject case involved an interpretation of Secs. 2 and 3 of a con-

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View of section of new link of Orange Belt Highway constituting wide northern gateway to City of Porterville.

Porterville Opens New Highway

By C. F. WAITE, District Office Engineer

AN IMPORTANT major link in the Orange Belt Highway, State Sign Route 65, that ultimately will extend from Bakersfield north to Sequoia and General Grant National parks, through the east side of Tulare county, the new mile-long highway constituting a broad northern entrance into the City of Porterville was officially dedicated on June 16th.

Officials of the State and of Tulare and Kern joined with civic leaders and citizens of these two counties in a celebration that hailed completion of another section of the Orange Belt Highway, an undertaking into which the communities of eastern Tulare have put ten years of effort.

The Porterville link will be an integral part of an agricultural and recreational route on which the roadway between Strathmore and Lindsay already has been standardized.

Following a luncheon tendered to 400 representatives of highway minded groups by the Porterville Women's Club and official opening of the new construction by Director of Public Works Earl Lee Kelly, representing Governor Frank F. Merriam, a meeting was held at which officials of the State Department of Public Works, the California Highway Commission and of Tulare and Kern counties discussed plans for the future development of the Orange Belt Highway.

At this conference it was the concensus that the building of the remaining portion of the east side highway will have to be placed on a two-biennium basis; that the section between Bakersfield and Porterville will have to be constructed in sections over a four years period and linked into one direct route from Bakersfield north to Ducor, Terra Bella and Porterville where it will join the Porterville stretch and go on to Strathmore, Lindsay, Exeter and Woodlake and points to the north. Director Kelly announced that a reconnaissance survey of the project will be undertaken as soon as possible by the Division of Highways and said that Kern County, making use of available Federal and State funds, would be prepared to build ten miles of the southern portion of the highway on whatever line is approved by the engineers of the Division of Highways. Kern County officials promised whole-hearted cooperation.

The Porterville reconstruction, which is 0.86 of a mile in length, between Morton Street and Mulberry Street, lies partly within the city of Porterville, 0.65 mile, and partly without, 0.21 mile, and provides an excellent entrance to the city from the north. Two curves of long radius are substituted for three on the old alignment, one of which is a right angle turn, and another a turn of almost a right angle.

Two thousand feet of the southerly end of the project within the city was graded full width of the right of way, while the balance of the project is graded to a 36-foot width between shoulders. Soil conditions were adverse on the greater part of the project, and imported borrow and imported surfacing material were brought in for the top layers. The pavement is plant mix surfacing on crusher run base 22 feet in width. The shoulders were given a road mix surface treatment full width.

Bids were opened on March 16, 1938, and the date of completion as set by the contract was August 1, 1938. N. M. Ball Sons, of Berkeley, were the successful bidders. The work has been very efficiently and successfully prosecuted to the end that the project was completed some 45 days ahead of schedule.

The cost of this improvement is $41,296.

Irving T. Ball was superintendent for the contractor, while C. F. Oliphant was Resident Engineer for the State.

Speaking at the luncheon and at the dedication ceremony, Director Kelly, aware of the importance to Tulare County of the Central Valley Water Project, said that this huge water conservation undertaking and the building of highways in Tulare and Kern counties are closely allied. He pointed out that when the Central Valley Project is completed, the new highways constructed in Tulare last year, this year, and to be built in the future will directly serve the increased motor vehicle traffic through this wealthy agricultural region.

> WITH state officials and civic leaders guests of honor, Porterville dedicates to public use the new, mile-long highway connection that gives the community a wide northern gateway to motor traffic, and constitutes one of the major links in the eastside short route from Bakersfield and the south to the Sierra Playgrounds of Sequoia National Forest, Sequoia National Park and General Grant National Park.
>
> Planned and worked for for years by communities of the east side of Tulare county, from Ducor on the south to Woodlake on the north, the short route some day will provide a direct passage way for the varied agricultural products of an immense area, to the great cities of the southern part of the state, and a tourist route that will draw thousands from those same cities to summer and winter vacation areas of the Sierra.—*Porterville Recorder.*

Representing the California Highway Commission, of which he is chairman, H. R. Judah of Santa Cruz spoke briefly at the luncheon and also at the dedication.

"The State Highway System," Mr. Judah said, "is one of the best, if not the best, investment the people of California ever have made. It was built largely with gasoline tax funds, as was this project of yours. The gas tax is not a tax; it is an investment."

Emmett R. Berry acted as chairman of the luncheon meeting and Assemblyman Ford A. Chatters of Lindsay was master of ceremonies. Short talks were made by Harry A. Hopkins, Assistant Director of Public Works; R. M. Gillis, Construction Engineer; E. T. Scott, District Engineer; W. R. Woollomes, Chairman Kern County Board of Supervisors; Highway Commissioner William T. Hart of Carlsbad; Carl E. McStay, Automobile Club of Southern California, and others.

Director Kelly and other speakers paid high compliments to State Senator Frank W. Mixter of Exeter and State Senator J. I. Wagy of Bakersfield, who were at the speakers' table, for the years of cooperation they have given to the Central Valley Project and the highway program.

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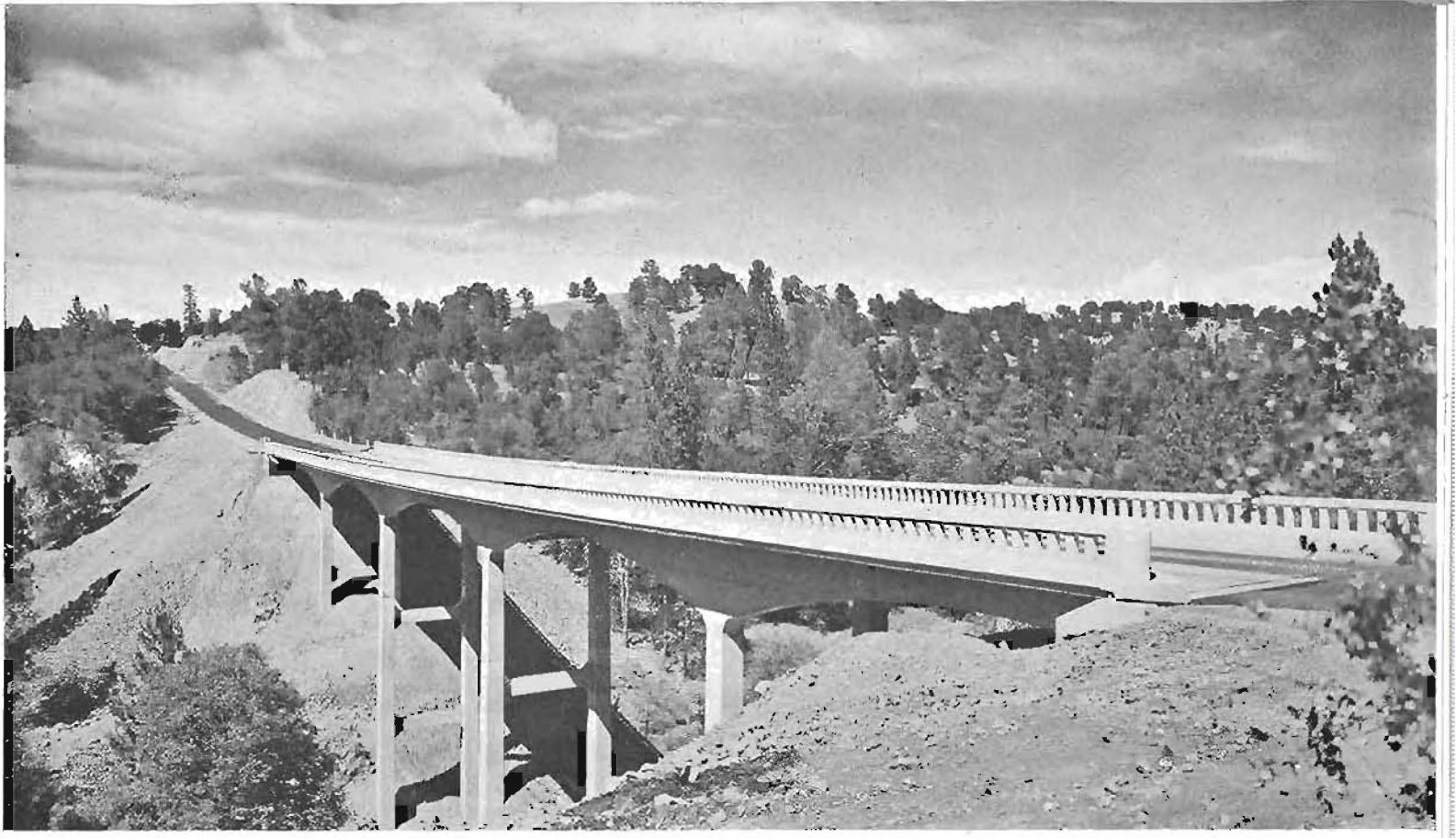
Director of Public Works, Earl Lee Kelly, officially opens new Porterville Highway. Front row, left to right—J. G. Brown, Plano; Assistant Director of Public Works Harry A. Hopkins; H. R. Judah, Chairman, California Highway Commission; Miss Joan Berry; Director Kelly; Miss Betty Jones; Highway Commissioner, Wm. T. Hart; F. M. Pfrimmer, Porterville City Manager. Rear row, left to right—W. R. Woollomes, Chairman, Kern Board of Supervisors; C. B. Allumbaugh; R. M. Gillis, Construction Engineer, Division of Highways; J. R. Fauver, Exeter; E. T. Scott, District Engineer; Senator Frank W. Mixter; Reverend J. A. Milligan; Senator J. I. Wagy, Bakersfield.



View of new Webber Creek Bridge on recently completed highway between El Dorado and Clark's Corners, near Placerville.

Pioneer Road Unit Modernized

Several hundred persons who witnessed the official ceremonies attending the dedication of the new stretch of highway on U. S. 50 south of Placerville in El Dorado County saw something novel in the way of ribbon-cutting when Henry Barton, famous pioneer stage driver, drove an ancient stage coach through a ribbon barrier stretched across the recently completed Webber Creek highway bridge on the reconstructed route and Harry A. Hopkins, Assistant State Director of Public Works, whose father freighted bullion from Virginia City to Sacramento in the 70's, riding on the antique vehicle, reached down and snipped the silken strand with a pair of scissors, thereby formally opening the new highway. Mr. Hopkins represented Governor Frank F. Merriam and Earl Lee Kelly, Director of the Department of Public Works.

By HARRY A. HOPKINS, Assistant Director of Public Works

TO AN accompaniment of cannonading in the skies and a lavish aerial electrical display staged by Nature, the newly-aligned section of U. S. Highway 50 between El Dorado and Placerville, washed spick and span and christened by a summer rain, was dedicated to public service on Sunday morning, June 19.

The thunder and lightning and the ensuing downpour failed to dampen the enthusiasm of several hundred citizens of El Dorado County and visitors who participated in the road-opening celebration. As a matter of fact, the brief and unexpected storm added a rather enjoyable interlude to the dedicatory ceremonies.

Opening of the new highway was celebrated exactly eighty years to the day after the first mail coach rumbled into Placerville, then Hangtown, from Sacramento.

Completion of this project marks another step in the improvement of the road between Sacramento and Lake Tahoe, via Placerville. The growing popularity of the Tahoe resorts and the American River recreational area is increasing the use of this road and it is anticipated that as soon as money becomes available other units will be improved until the entire route has been brought up to modern standards of alignment and grade.

In the gold rush days this route, with its stagecoaches and pony express riders, was among the most colorful and romantic on earth.

Following an inspection of the project, a group of official guests was entertained at luncheon at the Hotel Raffles in Placerville. Informal talks were made by Henry S. Lyon, district attorney of El Dorado; Fred C. Tatton of the California State Chamber of Commerce; William Breedlove, chairman of the El Dorado board of supervisors; Mayor George Faugsted, Mayor of Placerville, and others.

Representing the city of Sacramento at the dedication ceremonies were City Manager James S. Dean and Edwin R. Pickett, president of

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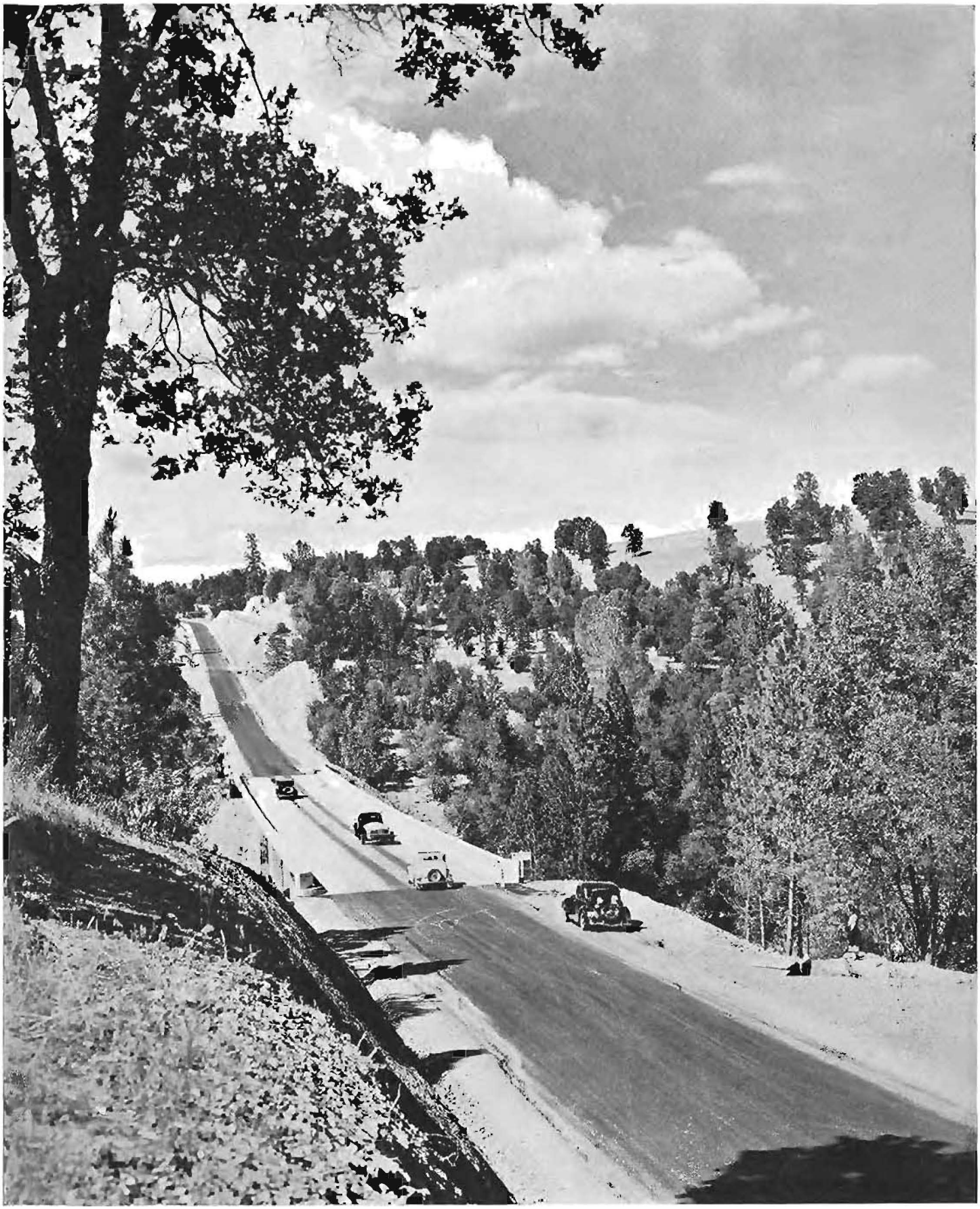


This highway crossing Webber Creek replaces old, crooked alignment on U. S. 50 southwest of Placerville.

SOIL STABILIZATION

By THOMAS E. STANTON, Jr., Materials and Research Engineer

The following article is the second part of a paper prepared and presented at a recent meeting of the County Engineers Association of California recently held in San Diego. The first part appeared in the June issue of this magazine.

A SUBJECT by no means new but of recent years all dolled out in new clothes is the subject of "soil stabilization" as now generally understood and which covers the entire field from consolidation of clay and adobe soils at optimum moisture without admixtures to the latest developments in emulsified asphalt and Portland cement soil mixtures.

Soil stabilization as defined by C. A. Hogentogler of the U. S. Bureau of Public Roads is—

> "The process of giving natural soils enough abrasive resistance and shear strength to accommodate traffic or loads under prevalent weather conditions without detrimental deformation. The essential consideration in stabilization is to provide the combination of internal friction and cohesion required to furnish the soil with high shearing strength. It is well known that the denser the soil the greater is its stability. The methods employed include the use of admixtures, compaction and densification by specific technical theory and laboratory control. Optimum water content is fundamental with gradation. Admixtures may be soil materials, deliquescent chemical, solutions of electrolytes, soluble cementitious chemical, primers and neutralizers and insoluble binders."

GENERAL METHODS

The essential features of stabilization include prevention of clay, silt and loamy soils becoming detrimentally wet, incorporation of granular materials in clay soils, furnishing granular soils with cohesive binder, or a combination of one or more of these.

General methods for accomplishing stabilization may be enumerated as follows:

1. Selection of natural soils with granular materials and binder which furnishes high stability.
2. Adding soil binder to granular materials or adding granular material to clays.
3. Treating graded soils with deliquescent materials such as calcium or sodium chloride.
4. Waterproofing soils with bituminous materials.
5. Cement-soils mixtures.
6. Densification of natural soils by special manipulation in combination with admixtures of physical or chemical materials other than soil to eliminate permanently those colloidal and clay properties productive of volume change.

IN NEW FIELD

The term stabilization as applied to items 1 to 5 is simply the application of a new term to methods and processes extending back several generations at least. It has been standard road construction procedure to bind granular materials with clay; dilute clays with granular materials; treat soils with diliquescent salts to eliminate dust; and waterproof and bind granular soils with bituminous materials and Portland cement.

As applied to the stabilization of adobe and clay soils with materials, other than soils, to permanently eliminate those properties productive of volume change we get into a new field; a field in which considerable progress has been made in recent years. It is experience in this last field which will be discussed more at length in this paper.

According to McKesson and Frickstad in a report of a cooperative investigation of intermediate road types, 1927, the use of crude asphaltic base oil and light residuum for the preservation of road surfaces was begun in the western part of the United States forty years ago. One of the earliest detailed reports of oiled road construction in California, prepared by James W. Abbot, appeared in the U. S. Department of Agriculture Year Book of 1902. Mr. Abbott described the construction of six miles of road in Los Angeles County in 1898 where oil was used to lay the dust. Only four years later 750 miles of county roads and city streets had been oiled in 25 counties in California.

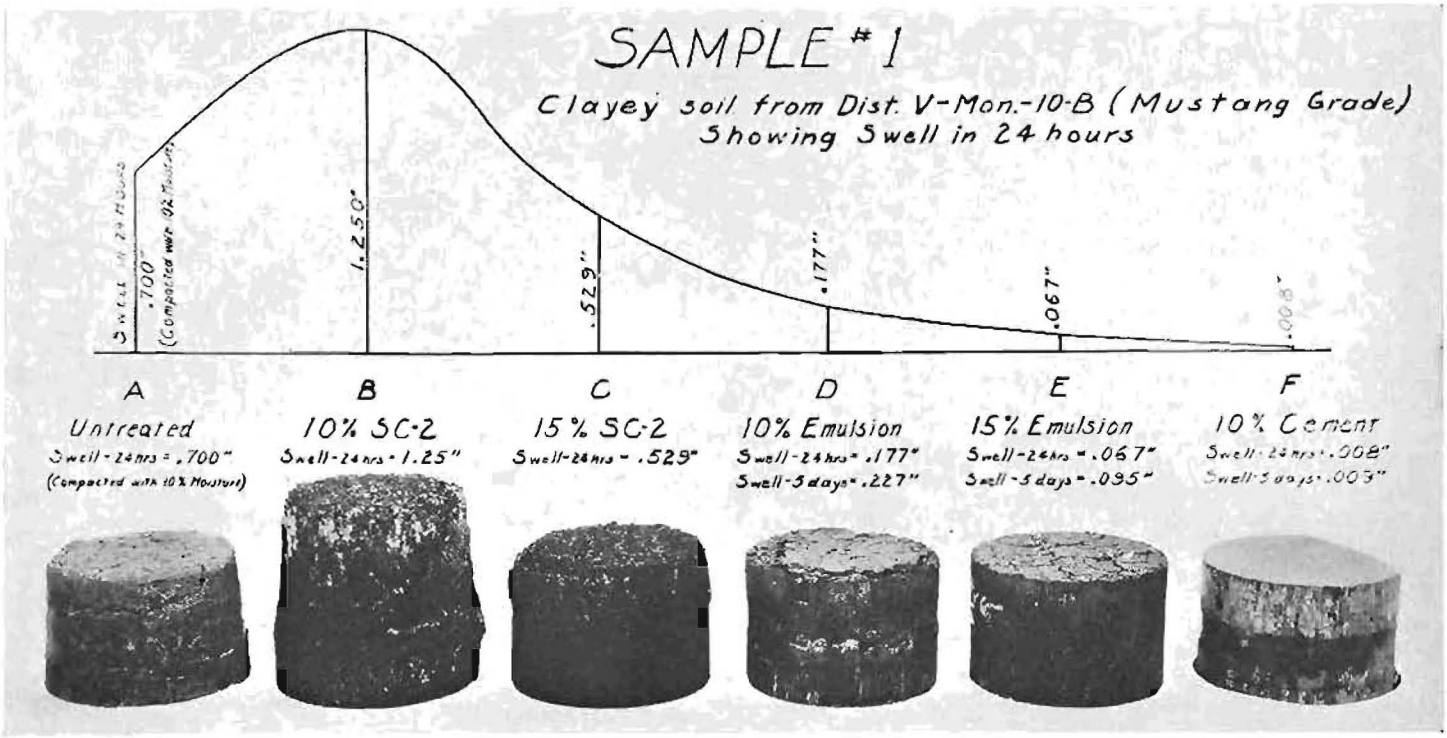
Neglect of maintenance and, in many cases, unsuitable soils were the cause of failure of much of this early oil road construction. The surfaces were presently a mass of chuck holes and corrugations and the roads were rougher riding than if no oiling at all had been done.

LIGHT OIL TREATMENTS

As a result light oil road construction received a black eye in California and it was not until twenty years later that the West began to give serious and systematic attention to this inexpensive type of road surfacing. Oregon had considerable success with surface treatments in 1923 and in 1924 and 1925 California followed suit.

The light oil treatments evolved in Oregon and California were of two types, the surface treatments method, and the surface mixing method. The early Oregon work was confined to the surface treatment method, whereas in California both methods were used, the mixing method gradually acquiring favor over the surface treatment method.

The treatment of metaled roads by the surface mixing process was

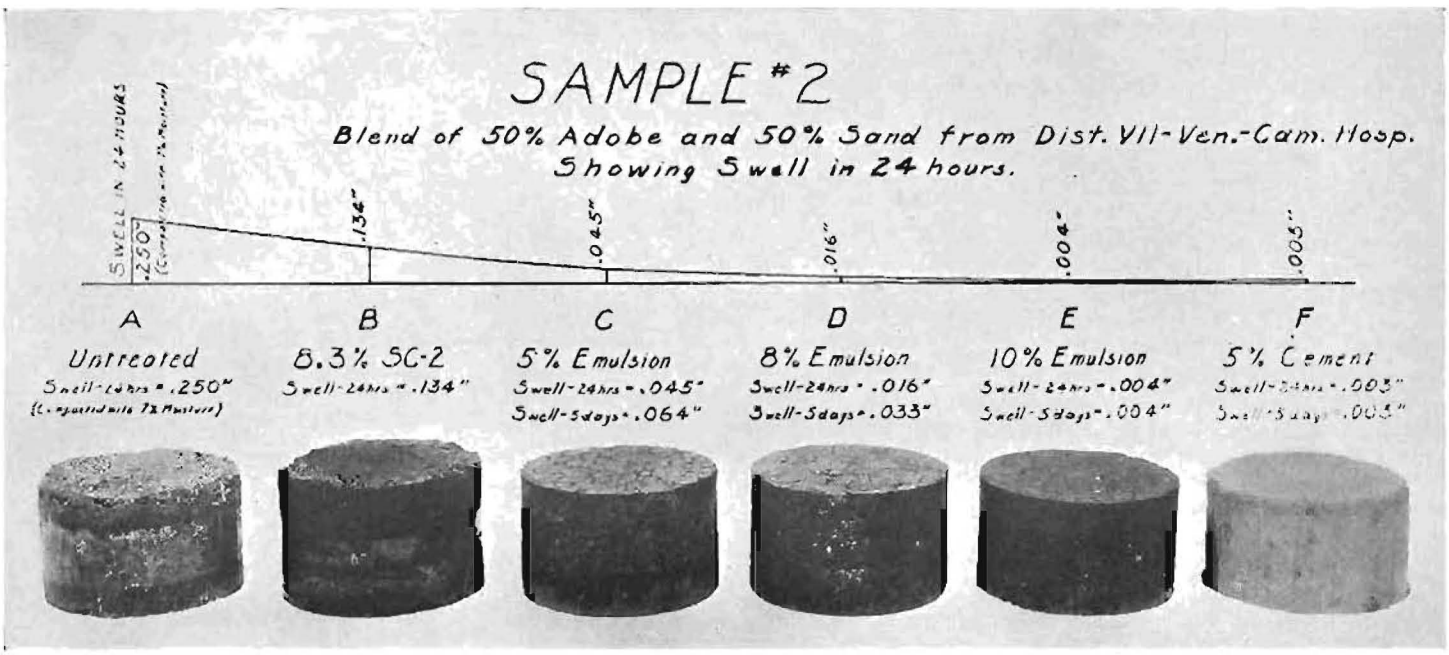


merely a modification of the methods used extensively on natural soil over an extended period in Stanislaus County, California, and other counties of the State. No new principles were introduced but there was a change in construction details. Wisconsin began using the method in 1923, Nevada and Wyoming experimentally in 1925 and California in 1926.

The first oil mix road on the State Highway System in California was constructed in San Bernardino County between Victorville and Barstow in 1926 under the direction of E. Q. Sullivan, District Engineer. The roadbed material was of excellent quality for this type of construction and considerable success attended the work, which is still in fairly good shape after twelve years of service.

The success of the Victorville-Barstow project encouraged an extensive program of this type of construction and approximately three thousand miles of similar construction have been built on the California State Highway system since that date.

In 1929, however, a section constructed that year easterly from Yermo, San Bernardino County, developed distress under traffic in a short time after construction. The Materials and Research Department undertook to determine the cause of the trouble and F. N. Hveem of the



department was assigned to the study. Hveem quickly determined that the local aggregate reacted entirely different in the presence of oil and water than did the aggregate on the Victorville project. It was subsequently learned that the Yermo material had about everything wrong with it that could be wrong with a material of this type.

LESSONS LEARNED

First it was found that even though in the desert, the coarse particles contained sufficient moisture so that in the surface area determination on which the proper oil content is based, the fine dust particles clinging to the coarser particles, were not readily screened through the 200-mesh screen with the result that not enough oil was being used. A mixture which at first appeared rich, quickly dried up and become dead as the oil slowly penetrated the film of fine particles and was absorbed by the rather porous coarser aggregate.

The aggregate had a greater affinity for water than for oil thereby resulting in early failure due to raveling or rutting under traffic. There was likewise a high swell of the mixture in the presence of water, another manifestation of the greater affinity of the aggregate for water than for oil.

From this and similar experiences was developed the clause in our specifications covering the wash test for determining percentage of fines and the water asphalt preferential test for determining the characteristics of the fine aggregate.

ARIZONA EXPERIMENTS

About the same time, Arizona was experiencing similar difficulties with caliche and other typical Arizona soils. Several test methods were devised to detect the susceptibility of oil roads to moisture conditions. The methods now in use in the laboratory of the California Division of Highways are modifications of methods originally adopted by the Arizona State Highway Department under the direction of J. W. Powers, Materials Engineer.

There are two tests for the purpose. The first, the water asphalt preferential test is made on a sample of dust passing a 200-mesh sieve and determines the water-resisting properties of the filler used in the mixture. The second, the swell test

SHOWING COMPARATIVE SWELL OF TREATED AND UNTREATED SOILS OF VARIOUS TYPES

SOIL			SWELL*					REMARKS
No.	Specimen	Treatment	24 hrs.	2 days	3 days	4 days	5 days	
	A	Untr.	.700"					Compacted with 10% Moisture
	B	10% SC2	1.250"					
1.	C	15% SC2	.529"					Clayey material from Dist. V-Mon-10-B (Mustang Grade)
	D	10% Emuls	.177"	.203"	.217	.222	.227	
	E	15% Emuls	.087"	.083"	.090	.093	.095	Equivalent to A-7 Soil in USBPR Class
	F	10% Cmt	.008"	.008	.009	.009	.009	
	A	Untr.	.250"					Compacted with 7% Moisture
	B	8.3% SC2	.134"					Material consists of a blend of 50% adobe and 50% Sand from Dist-VII-Ven. Co.
2.	C	5% Emuls	.045"	.055	.060	.062	.064	
	D	8% Emuls	.016"	.024	.029	.031	.033	
	E	10% Emuls	.004"	.004	.004	.004	.004	Camarillo Hospital. Equivalent to A-6 Soil
	F	5% Cmt	.003"	.003	.003	.003	.003	
3.	A	4.9% SC2	.003"					Sandy Material. Dist. VIII-Riv-26-A. Equiv. A-3 Soil.

* Standard swell test for Bituminous Mixtures. Materials & Research Dept., Cal. Div. of Highways.

is more conclusive as it is made on a compacted specimen of oil mixed aggregate representing typical proportions of oil or asphalt as well as the grading used in actual construction.

PROBLEM OF AGGREGATES

Experience has shown that if filler dust, which has a greater affinity for water than for oil, or aggregate, which has a high swell when mixed with oil and subjected to the swell test. is used in oil road construction trouble may be anticipated and, therefore, our specifications are so written as to eliminate unsuitable material of this type.

In view of the fact that much of the local soil in California fails to pass the water asphalt preferential and swell tests and has been found unsuited for mixing asphaltic oil as evidenced by failure in service, the use of such local materials with oil has been eliminated with resultant higher cost for importing suitable aggregate.

This situation has been the occasion of intense studies both locally and nationally to develop some methods of treating these adverse soils so as to eliminate absorption of moisture through capillarity and consequent swell and disruption.

Two methods have been developed which give considerable promise provided they are found economical of application on specific projects.

EMULSIFIED ASPHALT STABILIZATION

The first method to attain prominence in this field was that of stabilization with emulsified asphalt.

According to the theory of C. L. McKessen:

"Stabilization with emulsified asphalt has three definite objectives:

1. Waterproofing the individual soil particles and thereby rendering the base highly resist-

ant to water which would otherwise be absorbed by capillarity.

2. Forming on the soil particles an absorbed film of hard asphalt, of almost infinitesimal thickness to give high frictional resistance.
3. Obtaining supporting strength on the finished pavement slab by preserving the naturally high cementitious (dry) strength of clay when the pavement is subjected to long continued exposure to water."

That there is considerable merit in the use of emulsified asphalt for stabilization of many soils there can be no doubt judging by laboratory tests and the service of several experimental projects constructed by the Division of Highways.

Too short a time has elapsed, however, to determine the period of years over which this method of treatment will be effective and some soils have been definitely determined as being unsuitable for such treatment.

The economy of the process must be studied separately for each project and comparison should be made with the cost of importing selected material with low swell and high bearing value which can be satisfactorily mixed with the cheaper road oils or cutbacks.

CEMENT SOIL STABILIZATION

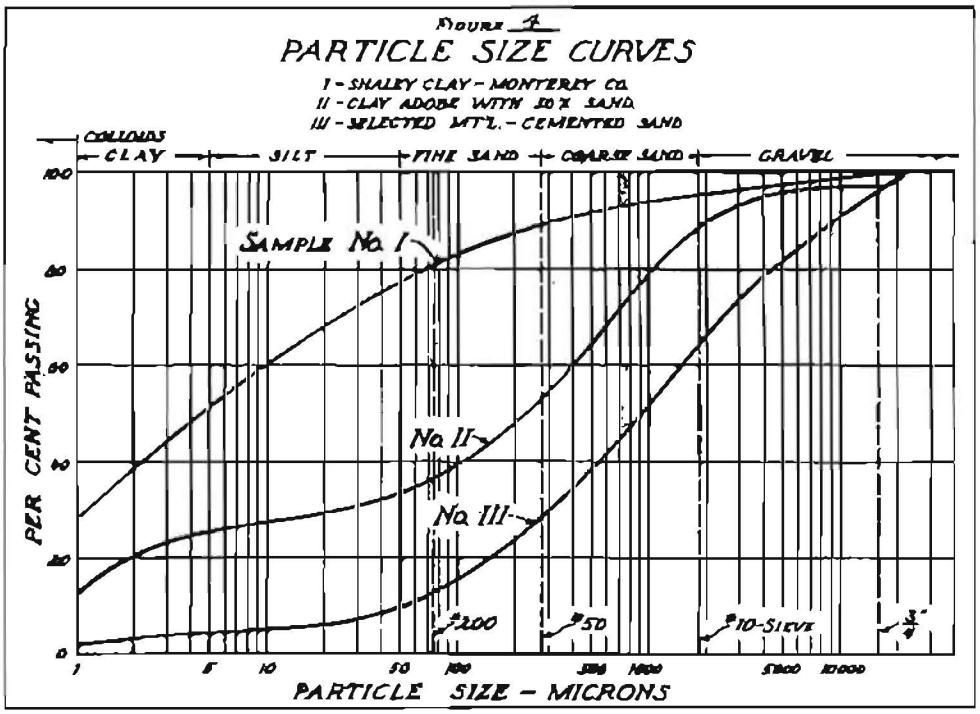
A second method of stabilization which has attained considerable attention of late is the Portland cement-soil mix type of construction.

Here as in the case of emulsified asphalt, there is no doubt but that capillarity and swell of many, if not most, adverse soils can be destroyed by admixing Portland cement and then properly consolidating the mixture with the optimum percentage of moisture for the densest compaction.

Several experimental projects of this type have recently been completed or are to be constructed on the California Highway system.

The results to date have been quite satisfactory, although here again, as in the case of emulsified asphalt, the economic factor is an important one. Neither one of these methods of construction have yet been able to compete in cost with oil mix construction where local soil or aggregate suitable for oil mixing is to be found in the finished subgrade under normal construction operations or on a short haul.

It is where the haul and purchase price of imported selected material is high that there may be a real field for the emulsified asphalt or cement-mix type of stabilization and experience may even ultimately determine that the greater serviceable life and traffic carrying ability or stabilized mixes of these types justify their use even in locations where the cost is greater than that of a first class oil or cutback mix job.



Bay Bridge Revenues Decrease

TRUCK traffic over the San Francisco-Oakland Bay Bridge is continuing to increase, according to a traffic report for June filed by State Highway Engineer C. H. Purcell with State Director of Public Works Earl Lee Kelly. However, revenues showed a drop of approximately $8,700 last month compared to May. A total of $369,596.20 was collected in June compared to $378,289.70 in the previous month.

Despite a one-day shorter month, the number of trucks showed a gain of 3064 in June over May, with totals for the two months 35,530 and 32,466 trucks respectively. Truck trailers also increased from 1452 in May to 1688 in June. Number of freight pounds carried over the bridge reached an all-time high with 92,797,000 pounds transported, bringing the total to date to 1,176,231,909 pounds. Tolls and freight rates were lowered on May first from 75¢ per truck to 60¢ and from 3¢ per one hundred to 2¢.

Average vehicles per day also showed an increase, although the total number of vehicles fell below the May figure due to a shorter month in June. Last month's average was 29,806 as compared with the previous month's figure of 28,583. Total number of vehicles was 714,173 for June and 731,079 for May. June traffic brought the total number of vehicles crossing the bridge since its opening November 12, 1936, to 14,511,504.

Comparative figures follow:

	Total May	Total June	Total Since Opening
Passenger automobiles	665,863	641,653	13,822,690
Auto trailers	1,082	1,378	22,622
Motorcycles	2,768	2,736	49,562
Tricars	1,137	1,102	15,122
Buses	11,369	11,273	167,133
Trucks	32,466	35,530	488,951
Truck trailers	1,452	1,688	29,633
Total vehicles	731,079	714,173	14,511,504
Extra passengers	206,252	204,247	3,308,017
Freight lbs.	18,014,417	92,797,000	1,176,231,909

Pioneer Road Unit Modernized

(Continued from page 10)

the Sacramento Chamber of Commerce.

As was mentioned in a previous article in the December, 1937, issue of this magazine, this new construction is approximately 4.3 miles in length, about 1.9 miles shorter than the old route. The new alignment, with a minimum radius of curvature of 1000 feet, eliminates many sharper curves, some with radii shorter than 100 feet.

The surfacing on the project consists of plant-mixed bituminous treated crushed rock, 22 feet wide by 0.25 of a foot thick, on a crusher run base 23 feet wide by 0.4 of a foot thick. The grading and surfacing cost approximately $190,000. The contractor was Hemstreet and Bell and Mr. J. D. Greene and Mr. H. F. Sherwood were the resident engineers for the State.

The Webber Creek bridge, over 100 feet high and 322 feet long, is of the reinforced concrete girder type. A graceful span, blending well with the surrounding country, it was built concurrently under a separate contract at a cost of about $41,000. The contractor was the Campbell Construction Company and the resident engineer for the State was Mr. J. H. Horn.

Contract for 75,000 Barrels of Cement

Bids were recently opened in Washington, D. C., for 75,000 barrels of finely ground standard portland cement for Central Valley Project construction.

This is the largest cement order to date on the Central Valley Project. The cement will be used for work on the Kennett and Delta Divisions, with 30,000 barrels destined to Coram and 20,000 barrels to Redding, in Shasta County, and 13,000 barrels to Antioch and 12,000 barrels to Neroly, in Contra Costa County.

Harry A. Hopkins, Assistant Public Works Director, assisted by Ed Willis, Highway Maintenance Superintendent, snips ribbon barrier on new Placerville Highway as Henry Barton, pioneer stage driver, drives ancient stage coach through it.

New Foothill Highway Link Is Dedicated

By A. EVERETT SMITH
Assistant Highway Engineer

AMID a picturesque and historical setting on June 3, Governor Frank F. Merriam, accompanied by Earl Lee Kelly, Director of Public Works, and Harry A. Hopkins, Assistant Director of Public Works, dedicated the final link of the four-lane Foothill Boulevard to the use of the traveling public.

The dedication was held beside the Madonna of the Trails statue located at the intersection of Euclid Avenue, nationally famed for its beauty, and the Foothill Boulevard which carries a large volume of business and recreational traffic and is especially noted as the longest four-lane highway in California.

Following an address given by Governor Merriam, who was introduced by C. E. Grier, chairman of the county board of supervisors, a short talk was given by Director Kelly. Other speakers for this occasion were Godfrey A. Andreas, Assemblyman; Dr. C. G. Houston, Director of California Safety Council; Franklin Lowney, Executive Vice President of the Safety Council; E. Q. Sullivan, District Highway Engineer; and J. B. Gill, President of the Foothill Boulevard Association. Rollin L. Leman, President of the Upland Chamber of Commerce, presided.

Completing his address, Governor Merriam symbolically opened the highway to a new era of traffic when he walked to the center of the boulevard and clipped a ribbon barrier. Thus, with years of planning and building, this route has advanced from a mere farm road to a modern, four-lane, divided highway.

This final link of the four-lane Foothill Boulevard extends from the Los Angeles County line at Claremont easterly over Highway Route 66 to San Bernardino, a distance of twenty-one miles. The contract covering this improvement is in the final stage of construction. The work is being done by the United Concrete Pipe Corporation, contractors, under the inspection of J. M. Hollister, resident engineer.

To obtain this width of highway, the existing asphaltic concrete pavement, completed to a thirty-foot width in 1929, was by this project widened to a width of forty-six feet by placing an additional sixteen foot width of asphaltic concrete pavement. The forty-six foot width of surface bears two eastbound and two westbound traffic lanes, the two inside lanes being separated by a central dividing strip four feet in width, in line with recent State highway practice in constructing four-lane, divided highways. Each inside lane is eleven feet in width, and each outside lane is ten feet in width bordered by an eight-foot shoulder of oiled road-mix surface treatment.

The placement of the additional sixteen-foot width of pavement and shoulder construction necessitated the extension of numerous existing corrugated metal pipes, reinforced concrete box culverts, and reinforced concrete bridges.

Greatest care was used in the design to avoid cutting down trees. Three hundred palm trees were removed and replanted where they were too close for safety. Pavement widening was designed for placement on alternate sides of the existing pavement in such manner as to preserve the magnificent palm and eucalyptus trees that adorn this highway, without seriously sacrificing standards of alignment.

At areas where curbs were constructed, the distance from center line to curb was increased approaching street intersections to give a maximum of visibility at these points.

Intersections from side roads were paved to give free access to the highway and to prevent mud from being tracked onto the highway, thus guarding against it being slippery in wet weather.

Governor Frank F. Merriam, with Director of Public Works, Earl Lee Kelly, J. B. Gill, and little Joan Andreas, dedicates new four-lane link of Foothill Boulevard, shown above. This route will provide a means of rapid transportation between the Los Angeles Metropolitan area and San Bernardino, from which point transcontinental highways pass through the Imperial Valley, the Colorado Desert, and the Mojave Desert. Also, from this point, roads lead directly to the popular mountain resorts located nearby.

Lower photo courtesy Los Angeles Examiner.

Decrease of $4,300,000 in Federal Aid to California Highway System

By R. F. REYNOLDS, Assistant Office Engineer

PRESIDENT ROOSEVELT signed the Federal Aid Highway Act of 1938 on June 8. This act authorizes the expenditure of $349,500,000 in Federal aid to the states and territories for highways during the two fiscal years between July 1, 1939, and June 30, 1941.

Funds appropriated by Congress under this act provide the following amounts for the several road classifications eligible for expenditure of Federal money:

Regular Federal Aid	$215,000,000
Sec. or Feeder Roads	30,000,000
Grade Cross. Elimination	50,000,000
Public Lands	3,000,000
Forest Highways	23,000,000
National Park Roads	23,000,000
Indian Roads	5,500,000
	$349,500,000

California will receive a total of about $13,500,000 from these Federal funds for highway construction for the two fiscal years ending June 30, 1940, and June 30, 1941. Of this sum approximately $11,350,000 will be expended under the direct supervision of the California Division of Highways for construction of highways and bridges and the elimination of hazards at railroad grade crossings.

The sums authorized for apportionment to California by this act are approximately $4,300,000 less than the total sums which previously were allocated for the two fiscal years ending June 30, 1938 and 1939.

The effect of this $4,300,000 decrease in Federal apportionments will necessitate the curtailment of an equal amount of important highway construction and grade crossing elimination.

The action of Congress in decreasing Federal authorizations for highway construction was mainly brought about by the apparent inability of the majority of states and territories in the Union to promptly expend previous Federal apportionments. In this regard, figures released by the Bureau of Public Roads on April 30, 1938, showed that all but eight states out of the total of fifty states and territories had balances of regular Federal aid available for programmed projects in an amount in excess of their latest apportionment of regular Federal aid for the fiscal year ending June 30, 1939.

CALIFORNIA AHEAD OF ALL STATES IN NUMBER OF MOTOR VEHICLES

At the close of 1937, California led all states in the Union in the number of registered motor vehicles of all types and in the number of pleasure motor vehicles registered, according to Howard Deems, Registrar of the State Motor Vehicle Department

New York dropped into second place last year on the basis of these comparable figures:

	New York	California
All types of registered motor vehicles	2,640,678	2,657,233
All types of registered pleasure cars	2,207,906	2,319,341

Deems received his New York figures from Commissioner Hartnett of the New York State Motor Vehicle Department.

CALIFORNIA'S POSITION

Of these eight states, California ranks first, in that its available unobligated regular Federal aid amounted to only 70 per cent of the total for the fiscal year ending June 30, 1939, and with approximately a similar percentage of time remaining before the 1940 apportionment of regular Federal aid will become available.

This would indicate that by January 1 of 1939, California will have obligated all of its regular Federal aid and will be awaiting the next apportionment provided by the Federal Aid Highway Act of 1938.

It is also contemplated that before the expiration of the fiscal year ending June 30, 1939, California will have obligated its entire apportionment of secondary or feeder funds, Federal aid grade crossing elimination funds and public lands funds and be in a position to immediately place under way projects to be financed from these apportionments.

A comparison of the funds allocated under the Act of June, 1938, with those previously granted to this State by the Act of 1936 is shown in the following table:

	Totals for fiscal years Ending June 30, 1938 and 1939 apportioned	Totals for fiscal years ending June 30, 1940 and 1941 estimated
Regular Federal Aid Funds	$9,593,488	$8,100,000
Secondary or Feeder Funds	1,918,698	1,140,000
Grade Crossing Elimination Funds	3,700,209	1,825,000
Public Lands Funds	474,837	287,000
Total	$15,687,232	$11,352,000

In addition to the above, the estimated apportionment for California's Forest Highways in amount $1,810,000 is a reduction of approximately $400,000 below the total sum of $2,200,000 as received for the fiscal years ending June 30, 1938 and 1939.

Vanguard of automobile caravan at dedication of Atascadero-Morro Bay Highway in San Luis Obispo County.

Open Atascadero-Morro Bay Highway

By EDWARD J. NERON, Deputy Director of Public Works

AT 11:00 O'CLOCK on June 19th, in San Luis Obispo County, there was held in beautiful Atascadero Creek Canyon, the dedication celebrating the completion of the Atascadero-Morro Bay highway on Route 125.

This road crosses through a low gap in the Santa Lucia mountains over one of the most accessible passes in that range. The ceremony was held at one of the several bridges crossing Atascadero Creek and was organized under the joint auspices of the Morro Bay and Atascadero chambers of commerce.

Dr. Victor Ward of Atascadero was master of ceremonies which were opened by introduction of State and county officials and of citizens who had played their part in the attainment of this highway. Chairman H. R. Judah of the California Highway Commission made the principal address and, following a talk by State Senator Chris Jespersen, Mr. Judah, assisted by two charming bathing maids of Morro Bay, Miss Evelyn Young and Miss Peggy Price, cut the ribbon barrier and formally opened the highway to the public.

DIRECT ROUTE FROM VALLEY

This section of highway (U. S. Route 466) lies between the main coast road between San Francisco and Los Angeles, U. S. Route 101, and the scenic coast road between San Luis Obispo and Monterey, the Roosevelt Highway. It also affords the most direct route from the populous portion of San Joaquin Valley to the ocean, particularly from that area in Fresno, Tulare, King and Kern counties. With the further improvement of the highway leading to the valley, this route is destined to become very popular with the valley residents.

The present contract has a length of 2.8 miles and was constructed at a cost of $155,000. It has a roadbed width of 26 feet with a roadmix type of surface. There are three bridges on the project. The minimum radius of curvature is 350 feet with a maximum gradient of 7%. Because of the very crooked alignment of the road which is replaced, there is a saving in distance of 1.1 miles. There has been previously expended on the highway between Atascadero and Morro Bay the sum of $230,000.

SCENERY PRESERVED

In the location of the highway, particular attention was given to the preservation of natural scenery along the route. Alignment and grades were so established as to make accessible the many picnic and recreational areas along Atascadero Creek.

Widened right of way was obtained at such points by donations from San Luis Obispo County, the Atascadero Development Association and private citizens, thus preserving to the public for all time these very attractive parks. Geo. K. Thompson & Co. were contractors and the road was built under the supervision of H. J. Doggart, Resident Engineer.

(Continued on page 25)

Important Condemnation Decision

(Continued from page 7)

gressional grant, and it was necessary to determine: Whether the railroad company was entitled to compensation equal to the current market value of adjoining properties for that portion of the railroad right of way and station grounds, etc., which was sought to be condemned, or damages based on the extent of interference with the right of use of the railroad right of way by the vehicular highway.

The appellate court decided that portions of the lands sought to be condemned were parts of the Southern Pacific right of way and station grounds extending southerly from Goshen Junction through the city of Tulare, in Tulare County. It was further found that the grant by Congress to the Southern Pacific Railroad Company covered bonus lands and right of way which lay in Secs. 3 and 11 in the city of Tulare. The grant of the railroad right of way also carried with it additional lands to be used for station grounds, machine shop, roundhouse, water tanks, and other adjuncts necessary to maintaining and operating a railroad. The areas to be occupied by these latter appurtenances were never definitely defined by the congressional grant or the maps used in conjunction therewith. As a result it was impossible to determine the extent or area of the station grounds, machine shop and roundhouse reservation in relation to the right of way.

STATE'S CONTENTION

The State maintained that the railroad company had merely an easement or limited fee made on an implied condition of reverter in the right of way, as well as in the station grounds, machine shop and roundhouse reservation, and therefore could not alienate said lands to other than highway departments. The situation was further complicated by the fact that the railroad company had been granted a land patent to the aforesaid odd-numbered bonus sections 3 and 11, and the railroad company maintained that the patent vested a "fee" rather than an "easement" in the railroad right of way, station grounds, machine shop and roundhouse reservation, which the land grant overlapped.

The appellate court held that the railroad company acquired title to its right of way and station grounds in the city of Tulare under the act of Congress, and that its title was of limited fee made on an implied condition of reverter; that the subsequent patent to the two odd-numbered sections added nothing to the estate it held in the right of way and station grounds, and that the land described in the patent not within the right of way and station grounds was owned by the railroad company in fee simple with all of the rights of private ownership.

COURT'S FINDINGS

The court further found that the railroad company was entitled to the reasonable market value of the property taken which was owned in fee by the railroad, but as to the property which the railroad company did not own in fee (railroad right of way, station grounds, etc.) it was entitled only to compensation for the damage which the use of the property taken by the highway department would cause to the right of way use by the railroad company.

The instant case is one where the right of way sought to be condemned lay parallel to and extended longitudinally with the railroad right of way, and this court held, as in the previous case of City of Los Angeles vs. Allen, 32 C. A. 553, that the right to condemn longitudinally is very different from the mere right to cross, for in the one case the rights of the railroad company may be materially impaired, while in the other, the taking is such that both uses can stand together. The railroad company, therefore, was entitled to have the court determine the amount of compensation for the diminution in value, if any, of the railroad company's right of way where the property is subjected to a concurrent use for both vehicular and railroad traffic.

This case was handled throughout by two members of our legal staff, Lincoln V. Johnson and Holloway Jones, and they are entitled to a great deal of credit for developing the point upon which the decision was based.

Gas Tax Diversion Costs Bay State Loss of $472,862

THE Department of Agriculture has announced its finding that Massachusetts has diverted State motor vehicle revenues to other than highway purposes in such manner as to make necessary the withholding of $472,862 of the Federal-aid apportionment of $3,171,423 for the fiscal year ending June 30, 1938.

This action is made mandatory by the Hayden-Cartwright Act of 1934 which requires that Federal-aid funds be withheld from any State using the proceeds of State motor-vehicle registration fees, gasoline taxes and other special taxes on motor-vehicle owners and operators for other than highway purposes in an amount greater than was being so used prior to June 18, 1934. The amount to be withheld may not exceed one-third of the apportionment for any fiscal year.

Massachusetts authorities were notified in October, 1937, that a study of the State's disposition of motor vehicle revenues disclosed an increased use for non-highway purposes subsequent to June 18, 1934. The State was called upon to show why a penalty should not be applied. A showing that could be accepted under the provisions of the law has not been made and the funds in question have not been restored for highway use.

Under similar circumstances $250,000 was deducted from the apportionment to New Jersey for the fiscal year 1937. Maryland, Pennsylvania and Georgia were found to have used motor vehicle revenues for non-highway purposes to such an extent as to require Federal action. Maryland and Pennsylvania have restored the required amounts to highway funds and no further action is to be taken. Georgia officials have given assurance that they will follow a similar course but have not yet done so.

PAN AMERICAN ROAD CONGRESS

Elaborate preparations are being made in Santiago, the Capital of Chile, for the Third Pan American Road Congress to be held in that city during the first two weeks in September of this year.

Chile is one of the most progressive of the South American republics in the development of its highway system and especially of its portion of the Pan American Highway.

City of Petaluma, California

June 15, 1938.

Col. Jno. H. Skeggs,
District Engineer,
Division of Highways,
State Building,
San Francisco, California.

Dear Sir:

May I take this opportunity of telling you how pleased the citizens of Petaluma are with the marking of Route No. 101 through this city.

The work was accomplished with courtesy and precision, and with a minimum of inconvenience to our local people and the traveling public. Mr. Nelson had his crew of painters commence their work at daylight, marking all of the business district during the hours when traffic was light. The pedestrian marking was done under the supervision of Mr. Moore of the maintenance division and that work was also carried on most efficiently.

Since the lines have been painted, giving four lanes for traffic and two for parallel parking, we notice that the through traffic has been handled much more efficiently, there being no congestion in the city, even over the last week end when traffic was heavy. This is most gratifying to us and I know it will be to your department.

There has been so much favorable comment since the painting of the traffic lines that I just wanted you to know that the public does appreciate the work of the organization under your jurisdiction.

Sincerely yours,

(Signed) J. S. WOODSON,
Mayor, City of Petaluma.

UNITED STATES POST OFFICE

Coachella, California

California Highway and
Public Works
P. O. Box 1499
Sacramento, Calif.

Gentlemen:

I would be very much pleased if you will place my name on your mailing list for your magazine "California Highways and Public Works."

I find the magazine very interesting and of an educational value as to what benefits we are getting from the department.

Thanking you, I am

Very truly yours,
W. R. McCutchen,
Postmaster, Coachella, Calif.

Bank of America

San Diego, California,

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

Dear Sir:

For the last two years, I have been fortunate in receiving the monthly magazine of "California Highways and Public Works." May I at this time express my sincere thanks and appreciation for this courtesy shown to me.

You have a splendid magazine. It is historical, educational and is far reaching in acquainting the public of the developments of California's highways and natural resources.

The magazine has been very helpful to me in presenting views of California's growths.

Thank you again, and wishing you every success, I remain,

Sincerely yours,

(Signed) A. V. MAYRHOFER,
Assistant Vice President.

Berkeley, California,

California Highways and Public Works,
Sacramento, California.

Gentlemen:

Through the courtesy of an engineer friend of mine, I have been receiving your magazine for the past several months and I wish to take this opportunity to thank you and express my appreciation for your publication.

Of the many magazines that I read, I really look forward to receiving the "California Highways and Public Works" each month.

The photography in particular is excellent and I believe your magazine to be one of the best edited.

Yours very truly,

(Signed) R. P. NEWCOMB.

A. Russell Berti

California Highways and Public Works,
Department of Public Works,
Sacramento, Calif.

Gentlemen:

Will you please put me on your mailing list for your publication, California Highways and Public Works.

I intend to use it in my work in the Department of Economics at the University of San Francisco.

Sincerely,

(Signed) A. RUSSELL BERTI.

Redlands Horticultural and Improvement Society

Redlands, California

Mr. E. Q. Sullivan,
District Highway Engineer,
San Bernardino, California.

My dear Mr. Sullivan:

On behalf of the Redlands Horticultural Society and the Beautification Committee of the Redlands Contemporary Club, we with to express our appreciation of the manner in which the widening of the Foothill Boulevard is being carried on. It is a pleasure to all of us who travel on the highway to see the noble ranks of trees, left intact to give continued shade and beauty; and to find in the road occasional graceful curves to break the monotony of the straight-away.

Too often, necessary road improvements have been made at the unnecessary sacrifice of the beauty of the landscape. You are achieving a happier result.

Very sincerely yours,

EDWARD H. BRENAN,
President

KATHERINE FIELD HOTCHKISS,
Corresponding Secretary
Redlands Horticultural Society.

BELLE B. DIBBLE,
Chairman

EDITH A. FINLAY,
Co-Chairman
Beautification Committee of the
Redlands Contemporary Club.

UNIVERSITY OF CALIFORNIA AT LOS ANGELES

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

Dear Sir:

Thank you for your generous response to our request to be placed on your mailing list for California Highway and Public Works. This periodical will indeed be a valuable addition to our collection and we shall look forward to receiving the monthly issues.

Very truly yours,

EVELYN HUSTON, LIBRARIAN,
Bureau of Governmental Research.

Father: (after son had taken enormous bite) Another bite like that and you'll leave the table.

Son: Another bite like that and I'll be through.

Flood Damage in Modoc County Prevented by State Engineers

By T. R. SIMPSON, Senior Hydraulic Engineer

THE severe floods and tremendous run-off during the winter of 1937-38 caused mounting hazards to life and property in Modoc and Lassen counties during last May. Several full reservoirs had yet to stand the load from spring thaws of melting snows from high mountain ranges. The most serious threat in this locality was the filling of the Tule Lake Reservoir and the impending failure of the Cedar Creek levee, which in turn rendered unsafe the West Valley Dam located downstream therefrom in the Pit River watershed.

The United States Forest Service established a portable radio broadcast and receiving station at the Cedar Creek levee on Tule Lake Reservoir as soon as the dangerous condition was discovered. Another broadcast and receiving station was installed at the Madeline Tunnel Portal on the reservoir and the station at the Forest Service warehouse in Alturas was kept open at all hours to receive and send messages to the reservoir. All residents in the vicinity of Alturas who had ordinary short wave receiving sets kept tuned in on the progress reports that were made hourly.

RADIO BROADCASTS

These radio broadcast stations were installed primarily to give rapid warning to the residents in the danger zone in case it was necessary to evacuate the area. The State Highway Patrol had an officer stationed at the West Valley Dam to look for any sudden rise in the water flowing through the spillway. The storage capacity in the West Valley Reservoir above the spillway crest would probably absorb the load, in the event of failure of the Cedar Creek levee, for at least two hours before overtopping the West Valley Dam.

Several residents of South Fork Valley walked and rode horseback to inspect the Cedar Creek levee prior to the arrival of dirt-moving equipment on the job. They considered the conditions so threatening that children were withdrawn from school and kept on high ground. Many thousands of livestock were moved from the lowlands and the city of Alturas was a buzzing hive for a few days with a large portion of the populace ready to stampede on slight provocation.

Tule Lake Reservoir occupies the site of an old lake in the northerly portion of Lassen County within the Pit River stream system. Prior to last winter, the east shore of the lake was separated from the channel of Cedar Creek by a low divide, or lip, about six feet high and 200 yards wide. The lake, which has a watershed of 34 square miles, naturally tributary thereto, has never filled and spilled over the lip into Cedar Creek since the time of settlement, more than 50 years ago.

50-YEAR OLD DAM

The natural inflow into Tule Lake normally evaporates each year leaving a natural meadow on the lake bed embracing nearly 2000 acres. The natural water suply, however, was inadequate to insure a good crop of meadow grass each year. Consequently about 50 years ago the water supply was augmented by diversion from Cedar Creek by means of a dam and canal leading on a slight grade over the east lip into the lake.

The Tule Lake Ranch was converted into a reservoir in 1902 by means of an earth levee 600 feet long constructed across Cedar Creek a short distance below the old diversion canal. The levee was higher than the east lip of the lake and was constructed for the purpose of diverting all surplus waters of Cedar Creek over and above the capacity of the canal into Tule Lake. This resulted in 46 square miles of additional watershed being made tributary to the lake. At the same time a tunnel was commenced through the west lip of the lake and completed two years later. The tunnel serves to release water from the lake for irrigation purposes on 1400 acres in the vicinity of Madeline, which area is within the Great Basin and outside the watershed of Pit River.

TREMENDOUS RUN-OFF

The flood in December, 1937, eroded away the east lip of Tule Lake and allowed the waters therein to back up against the Cedar Creek levee. The tremendous run-off during the winter of 1937-38 from the tributary watershed had filled the lake to a depth of 14 feet representing a storage of 35,000 acre feet early in May. The Cedar Creek levee is in a remote and inaccessible locality and no one ever goes there during the winter and spring seasons. It had never occurred to anyone that high water might be a source of danger in this area because the reservoir had never been more than half full even after an accumulated catchment of three years water supply in comparatively wet years from 1902 to 1905.

The dangerous condition of the Tule Lake Reservoir was accidentally discovered by a range rider several miles away who happened to have a view of it from a higher elevation on the Warner range of mountains. He immediately informed the South Fork Irrigation District of the advisability of an inspection of the Cedar Creek levee. The irrigation district owns the West Valley Reservoir to which Cedar Creek is tributary about 8 miles below Tule Lake Reservoir. Three of the landowners in the district made an inspection of the Tule Lake Reservoir on May 6th. A night letter was received from them the following morning by the State Engineer requesting an immediate inspection of the alarming appearance of the Cedar Creek levee. The owner of the reservoir is away on a tour of Europe.

The writer, who was in Alturas at that time on adjudication and water distribution work for the Division of Water Resources, was contacted by

View of new Tule Lake Reservoir levee which was raised six feet under emergency construction to prevent its destruction and consequent wiping out of West Valley dam and flooding of Alturas.

telephone and dispatched to make an immediate investigation to determine if an emergency existed on Tule Lake Reservoir.

It was found that the freeboard between the top of the Cedar Creek levee and the water level in the reservoir ranged from only 8 to 16 inches. The total inflow into the reservoir at that time was 10,500 miners inches and no water was running out. It was discovered that there were two cave-ins of the old timbered section of the Madeline Tunnel that had the outlet portal completely blocked Also the shaft down to the outlet gate at the intake portal of the tunnel had caved in and was filled with debris. There was thus no way of immediately releasing any water from the reservoir which was not equipped with a spillway.

DANGEROUS CONDITION

From snow surveys that had recently been made on the Warner range of mountains, an additional run-off of about 8000 acre-feet was to be expected from melting snow on the 80 square miles tributary to Tule Lake Reservoir before the close of the current run-off season. It was also probable that additional run-off would occur from storms during the remaining period of flow from melting snow. It appeared certain from the existing inflow onto the six square miles of water surface covered by the reservoir that the Cedar Creek levee would be overtopped with water within a week even with the outlet tunnel releasing at full capacity of 3000 miners inches.

The West Valley Reservoir, into which the Tule Lake Reservoir would empty in the event of failure of the Cedar Creek levee, was filled to capacity of 18,000 acre-feet and water 18 inches deep was running through the spillway. The West Valley spillway has a capacity of about 300,000 miners inches, but it was never designed to carry the load of failure of the Cedar Creek levee. The Cedar Creek levee, was constructed of loose material, had more than 100 leaks along the base of the fill, each about the size of a pencil.

It was possible for the entire levee to sluice away in a short time if it was overtopped with water, thus releasing a stream 600 feet wide and about 10 feet deep into the West Valley Reservoir. Such a load would certainly overtop the West Valley Dam several feet. The West Valley Dam, which is 60 feet high, is an earth-fill structure and of course was never designed to be overtopped with water.

EMERGENCY WORK STARTED

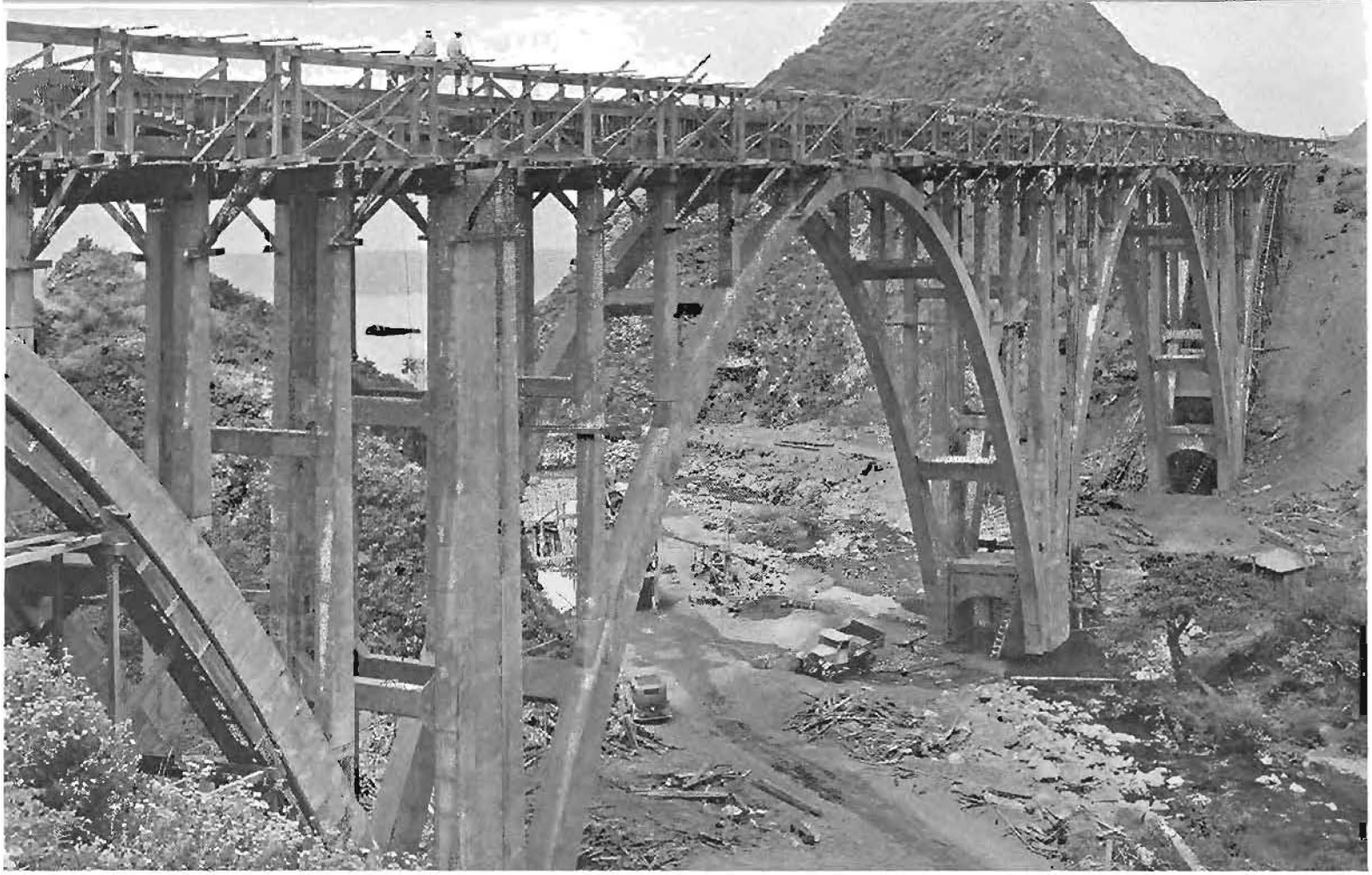
The channels of South Fork of Pit River and of Pit River between Likely in Modoc County and Muck Valley in Lassen County were already filled and overflowing with some resultant property damage during the first two weeks in May. The release of any additional stored water at that time would have caused heavy property damage. A sudden failure of the Cedar Creek levee and the simultaneous failure of the West Valley Dam would cause a disaster too terrible to contemplate in the grave hazard to the lives of the residents along the valley floor in Modoc and Lassen Counties, including the Towns of Likely, Alturas, Canby, Lookout, Bieber and Nubieber and possibly even farther downstream.

Work was commenced immediately on clearing the Madeline Tunnel which was opened in 48 hours at full capacity. However, the inflow into the reservoir was more than three times the rate of release. It was not known as to whether it was even possible to push through to the Cedar Creek levee with a caterpillar and heavy dirt-moving equipment due to the rough terrain with numerous marshy spots to cross. However, it was necessary to get such equipment on the job in order to move 15,000 cubic yards of earth onto the levee within the limited time available to relieve the emergency.

C. C. C. GIVES AID

A six-horse team with a plow and scraper was immediately sent to the levee to commence filling in the low places. The services of the Juniper Flat C. C. C. Camp near Likely were enlisted in the emergency. This camp

(Continued on page 25)



This photograph of Big Creek bridge on Carmel-San Simeon Highway shows unique type of construction.

Big Creek Bridge Is Unique

F. W. PANHORST, Bridge Engineer

AN UNUSUAL BRIDGE is now being built at Big Creek on the San Simeon Highway about fifty miles south of Carmel.

This bridge is unusual in that the end spans, or arches, are held back by the main portion of the bridge and are not supported by the ground.

At the point where Big Creek empties into the ocean the highway grade is about 90-feet above the bed of the creek. To span the canyon a bridge over 500-feet long was required.

At the ends of the bridge is a large amount of loose rock of a character which is unsuitable as foundation material for the ordinary type of bridge. To construct a supporting pier for the ends of the structure would have been uneconomical and unsafe, since preliminary investigation indicated that the material would undoubtedly slide. To overcome this difficulty the end spans are tied back to the middle portion of the bridge which rests on three large piers so constructed in the solid material as to provide permanent firm anchorage.

TWO CENTRAL SPANS

The structure consists of two central spans open spandrel arches each 177-feet, 6-inches in length. At either end of these arches there is an 81-foot, 6-inch cantilever, or tied-back arch, and a 34-foot, 6-inch concrete girder span. The bridge will provide a 24-foot roadway between curbs.

In general appearance, the structure will be somewhat similar to the other concrete arches between Carmel and Big Creek, such as the structures at Rock Creek and Garrapadis Creek. The end spans of the arch, instead of resting on abutments, are supported by steel eye-bars which extend the full length of the arch span and are located in the outside girders. The stress in the eye bars is transmitted from the cantilever arches—or the end span arches—by means of structural steel brackets around which the concrete is poured in the arch rib.

The steel ties are prestressed for full dead load by means of toggle joints and 125-ton hydraulic jacks which are placed at the center pier. When there is no live load, such as highway traffic, on the bridge, the end spans are tied through the bridge to each other and balance themselves.

(Continued on page 28)

Atascadero-Morro Bay Highway

(Continued from page 19)

Completion and opening of the project makes available another scenic and service road for San Luis Obispo and the San Joaquin Valley counties.

PROGRAM OF SPEECHES

Following the dedication ceremonies, a luncheon was served to State and county officials and interested citizens of San Luis Obispo County at the Morro Beach Inn at Morro Bay. After the luncheon, at which Dr. Ward presided, addresses were made by H. R. Judah, Chairman of the California Highway Commission, and by Edward J. Neron, Deputy Director of Public Works, representing Governor Merriam for the occasion. Brief talks were made by Claude Arnold, Chairman of the San Luis Obispo County Supervisors, A. L. Ferrini, County Supervisor, Superior Judge T. A. Norton, Phillip A. Stanton and Paul G. Jasper of the California State Highway Commission, Mayor Newell of Ventura, State Senator Chris Jespersen and by various citizens of San Luis Obispo County.

Congratulations were exchanged between the visiting State officials and county residents on the cooperative efforts culminating in the completion of a highly desirable addition to the State Highway System.

NEW BOOK ON DAMS ISSUED

Dams, control works and special engineering investigations of the Bureau of Reclamation are described in detail in a new book entitled "Dams and Control Works" published by the Department of the Interior.

Chapters are devoted to the design, and the construction of such outstanding structures as Boulder, Grand Coulee, and Imperial dams, and special articles written by experts of the Bureau of Reclamation staff are devoted to "High Pressure Reservoir Outlets," in the design and improvement of which the Bureau has had a large part, "Temperature Control of Mass Concrete in Large Dams," and other similar topics.

Of particular interest to engineers and students, the various descriptions and discussions are illustrated by photographs and engineering drawings.

"You seem very happy."

"I am. I'm secretly engaged and everybody's talking about it!"

Flood Damage in Modoc County Prevented by State Engineers

(Continued from page 23)

had the closest equipment and manpower and it was thought they could prevent the levee from being overtopped until heavy dirt moving equipment could be transported to this remote place. The men from the camp scouted a possible path for a caterpillar and moved the camp bulldozer about half way into the levee on May 10th. A second bulldozer equipped with lights, which was dispatched from Likely on its own power, passed the camp bulldozer during the night. After fifteen hours of continuous struggle over almost insurmountable difficulties (the "Cats" being mired to their ears on numerous occasions) both arrived at the dam and commenced raising the freeboard.

The closest truck transport for moving an RD8 and 12 yard carry-all was located at Susanville. Harms Brothers made this equipment available and two RD8 and 12 yard carry-alls were moved to the job in the following two days. This equipment walked in from Likely to the levee in 7 hours due to the rapidly improving bulldozer trail with favorable weather conditions prevailing.

NARROW ESCAPES

The assistance of the Division of Highways was enlisted to improve an old wagon road leading from Madeline to the tunnel portal at the west end of Tule Lake Reservoir. This made it possible for camp equipment and supplies to be delivered by truck at the tunnel portal and transported by motor boats six miles across the reservoir to the Cedar Creek levee. A strong wind, which prevailed for the duration of the work, caused the boat trip to be somewhat hazardous. One boat capsized with two operators and a load of equipment and supplies. The operators, who were equipped with life preservers, swam safely ashore. Most of the load was lost in the reservoir but the boat, which was equipped with two outboard motors, was saved.

The work of raising and widening the Cedar Creek levee was completed and the emergency was over on May 19th. The levee was raised an additional height of 6½ feet and was widened 30 feet by bulldozing a berm in the water across the front face. The length of the levee was increased from 600 to 1050 feet. The total additional earth placed in the levee was 15,000 cubic yards. Working conditions were extremely adverse for efficient operation, the average haul being about 1400 feet. Good material would be readily available during the dry-weather season if the reservoir was partially emptied.

The water level in Tule Lake Reservoir continued to raise until June 6th at which time it was higher than the top of more than 400 feet of the old levee. All seepage through the levee was cut off by the berm thrown across the front face. The dam is considered safe for the summer season, but certain additional work will be required to be done by the owner before fall to permanently eliminate any hazard from this source.

PORTERVILLE OPENS NEW HIGHWAY

(Continued from page 9)

Mayor Charles Cummings opened the dedicatory ceremonies and introduced James Fauver, chairman of the Tulare County Water Commission, as master of ceremonies. Rev. J. A. Milligan delivered an invocation. Brief addresses were delivered by Director Kelly, Mr. Hopkins, Commissioner Hart, Commissioner Judah and Supervisor Woollomes.

Two charming Porterville girls, Miss Betty Jones and Miss Joan Berry assisted Director Kelly in cutting the ribbon stretched across the new roadway.

SAFETY CONFERENCE TO MEET

The Western Safety Conference, comprising officials and groups interested in the cause of traffic, home, industrial, and public safety generally, will be held in Los Angeles at the Ambassador Hotel, September 12-16, inclusive.

It is announced that the conference will cooperate in creating a safety program that will greatly aid in reducing accidents and the death toll on highways, in the home and in industry generally.

THE Division of Water Resources representing the Department of Public Works has continued investigations of applications for allotments from money appropriated to the Emergency Fund by Chapter 11, Statutes of 1938, Extra Session, for the restoration of public property, levees, flood control works, county roads and bridges, damaged by recent floods throughout the State, pursuant to instructions from the Director of Finance. About 200 applications, applying for more than $20,000,000 have been received. Investigations of most of these applications have been made and reports on many of them have been prepared and others are now in preparation. Reports and recommendations on these applications are being made by this Division and the State Reclamation Board to the Director of Finance and eighty-three of such reports have been issued. Allocations totaling $1,901,200 have been approved by Governor Merriam and allotments totaling $1,563,100 have already been made for the flood damage repair work pursuant to the reports of the Division and the State Reclamation Board.

IRRIGATION DISTRICTS

A petition for the formation of Delano-Earlimart Irrigation District was presented to the Board of Supervisors of Tulare County and a copy filed in this office June 15, 1938. The proposed new district embraces an area of some 30,000 acres located 25 miles north of Bakersfield on the line of the Friant-Kern Canal of the Central Valley Project.

A proposal to organize a water conservation district on San Luis Rey River for the purpose of constructing storage at the Bonsall reservoir site is being sponsored by Fallbrook and Vista irrigation districts in cooperation with the cities of Oceanside and Carlsbad in San Diego County.

Projects under way in the Lindsay-Strathmore Irrigation District include extensive replacement of existing distribution pipe lines which have been in service for more than twenty years. Requests for approval of expenditures of $10,000 for this purpose and of $4,000 for purchase of additional land was reported upon to the Securities Commission during the month.

Appointment of a new director in Buena Vista Water Storage District in Kern County was made on June 7, 1938, to fill a vacancy on the Board caused by resignation of one of the members.

SUPERVISION OF DAMS

Applications for the repair of Littlerock Dam, Pacoima Dam, San Dimas Dam have been received and approved. The application for repair of the Fairmount Dam in the City of Riverside was approved and construction work has started.

The application for the construction of the Suttenfield Dam at the Sonoma State Home was received and approved and the application for the construction of the Charles Lee Tilden Park Dam has been revised and resubmitted for approval.

SACRAMENTO-SAN JOAQUIN WATER SUPERVISION

The field work of this office is now going forward on the regular summer schedule and all points of diversion are being visited and measurements of the diversions made.

Substantial progress is being made in compiling the annual mimeograph report and it should be completed during the coming month. This will show the amount of water diverted from and returned to streams in the Sacramento-San Joaquin territory. It will also show the amount of land irrigated, flow in the stream channels and the rate of advance and retreat of salinity in the delta.

The stream flow into the delta from the Sacramento Valley has shown a marked decrease but the flow from the San Joaquin continues at a high rate. The flow of the Sacramento River on June 24th was about 28,000 cubic feet per second. On the same day the flow of the San Joaquin at Lathrop was 18,000 cubic feet per second. On the corresponding date last year, the flows were 12,400 and 12,500, respectively.

TOPOGRAPHIC MAPPING

Final maps of the Gorman, Liebre, Quail, and Bear Trap quadrangles covering areas in northwestern Los Angeles County are now available. These are published on a scale of 1:24,000 with contour intervals of 5 feet and 25 feet. The work was done by the Geological Survey in cooperation with Los Angeles County.

Plan and profile drawings of Sacramento River from Red Bluff to Mile 65 and Clear Creek from the confluence to French Bluff are now available. These are published in 6 sheets with a horizontal scale of 1:31,680 and the vertical scale is one inch equals 20 feet.

Advance sheets of Sebastopol quadrangle in Sonoma and Marin counties are now available. These are published on a scale of 1:48,000 with 25 feet contours. The last named is a cooperative sheet.

WATER RIGHTS

Nineteen applications to appropriate water were filed last month. Ten were denied, thirteen were approved and the rights under three applications were confirmed by the issuance of license.

CALIFORNIA COOPERATIVE SNOW SURVEYS

With the opening up of the mountain roads during the past month, the snow surveying equipment that had been kept in the shelter houses during the winter was gathered and collected at convenient central locations. It is now being repaired and put in good shape and will be stored away for distribution to the shelter cabins again next fall.

Work in the office has continued; forecasts previously made have been given a final check and forecasts not regularly published have all been predicted from the data gathered during the winter. Snow-pack runoff curves are being revised and brought forward and supporting data gathered during the last autumn and winter are being reviewed and put into shape for permanent filing.

CENTRAL VALLEY PROJECT

Work was continued by the Division of Water Resources, representing the Water Project Authority of the State of California, on engineering studies in connection with the Central Valley Project which are being carried on under a cooperative work agreement with the U. S. Bureau of Reclamation. These studies have comprised the obtaining of data to be used in connection with negotiations for the acquisition of water rights.

Highway Bids and Awards for the Month of June, 1938

BUTTE COUNTY—Between 6 miles south and 1 mile south of Paradise, about 4.6 miles in length, a graded roadbed to be constructed. District III Feeder roads. Fredericksen & Westbrook, Lower Lake, $43,570; Claude C. Wood, Stockton, $44,610; M. J. Ruddy, Modesto, $45,771; George K. Thompson & Co., Los Angeles, $49,061; Hemstreet & Bell, Marysville, $50,865; Johnston Rock Co., Inc., Stockton, $62,635; Ralph A. Bell, Monrovia, $79,955. Contract awarded to Chas. L. Harney, San Francisco, $38,330.

CALAVERAS COUNTY—Between 2.5 miles East of Valley Springs and San Andreas, about 5.9 miles in length to be surfaced with gravel and plant-mixed surfacing. District X, Route 24, Section B. Claude C. Wood, Stockton, $57,386; Lee J. Immel, Berkeley, $63,308; Pacific States Const. Co., San Francisco, $63,189; Hanrahan Co. Redwood City, $63,688; Union Paving Co., San Francisco, $69,250; Independent Construction Co. Ltd., Oakland, $71,622; Mountain Const. Co., Sacramento, $73,906. Contract awarded to Piazza & Huntley, San Jose, $54,071.90.

CALAVERAS COUNTY—Two concrete bridges, one across Haupt Creek and the other across North Fork of Calaveras River, at point about 4.0 and 7.5 miles East of Valley Springs. District X, Route 24, Section B. Valley Constr. Co., San Jose, $43,621; Campbell Construction Co., Sacramento, $49,296; Williams Bros., & Hans Inc., San Francisco, $52,056; Chas. L. Harney, San Francisco, $52,344; Mountain Const. Co., Sacramento, $52,488; S. A. Cummings, San Diego, $52,800; B. A. Hawkins & Co., San Francisco, $58,274; A. Soda & Son, Oakland, $58,352; J. S. Metzger & Son, Los Angeles, $59,791; Palo Alto Road Materials Co., Palo Alto, $59,818. Contract awarded to F. Kaos, Stockton, $41,679.50.

LOS ANGELES COUNTY—Construction of sewers, manholes, junction chambers and flush tank in South Pasadena between Arroyo Drive and Meridian Avenue. District VII, Route 205, Section South Pasadena. E. L. Flemming & B. O. Zaich, Los Angeles, $7,662; Arruckovich Bros., Hynes, $7,069; Gogo & Radog, Los Angeles, $8,369; Sutulo & Ramljik, Los Angeles, $7,112; Peter S. Tomich, Los Angeles, $8,365; Culiak & Zelko, Los Angeles, $7,258; Radich & Brown, Los Angeles, $7,338; J. E. Haddock, Ltd., Pasadena, $7,330; M. F. Kemper, Los Angeles, $8,049; P. & J. Artukovich, Los Angeles, $8,548; R. A. Wattson, Los Angeles, $8,274; Jack T. Cantella, Los Angeles, $8,125; Griffith Co., Los Angeles, $7,329; J. L. Kruly, Los Angeles, $8,379; Bebek & Brkich, Los Angeles, $7,169. Contract awarded to V. C. K. Const. Co., Los Angeles, $6,015.05.

MERCED COUNTY—Between 5.7 miles southerly and Merced, about 5.7 miles in length to be graded, portions to be paved with P. C. C. and A. C. Portions to be surfaced with plant-mixed surfacing on untreated crushed gravel or stone and reinforced concrete bridges to be constructed. District X, Route 4, Section A. Union Paving Co., San Francisco, $372,508; Griffith Co., Los Angeles, $358,414; Macco Const. Co., Clearwater, $337,328; United Conc. Pipe Corp., Los Angeles, $334,606; Fredericksen & Westbrook, Lower Lake, $358,636; Warren Southwest, Inc., Los Angeles, $360,535; Chas. L. Harney, San Francisco, $396,888. Contract awarded to Hanrahan Co., San Francisco, $335,324.20.

MERCED COUNTY—Reinforced concrete bridge to be constructed across North Branch Mud Slough about 5.2 miles East of Gustine. District X, Route 122, Section A. J. S. Metzger & Son., Los Angeles, $13,813; Palo Alto Road Materials Co., Palo Alto, $13,208; Franzini & Fredenburg, San Rafael, $12,069; F. Kaus, Stockton, $14,488. Contract awarded to M. A. Jenkins, Sacramento, $11,082.

MONTEREY COUNTY—Salinas River Bridge approaches at Soledad, about 1.0 mile in length to be graded and paved with Portland cement concrete. District V, Route 2, Section D. N. M. Ball Sons, Berkeley, $52,755; Fredericksen & Westbrook, Lower Lake, $57,015; Louis Biasotti & Son, Stockton, $58,414. Contract awarded to Granite Constr. Co., Ltd., Watsonville $44,566.

ORANGE COUNTY—Near Galivan, about 1.2 miles in length to be graded and surfaced with plant-mixed surfacing. District VII, Route 2, Section A.B. Ralph A. Bell, Monrovia, $69,204; Daley Corp., San Diego, $56,816; A. S. Vinnell Co., Alhambra, $65,736; Sully Miller Contr. Co., Long Beach, $67,961; Martin Bros. Trucking Co., Long Beach, $62,521; Winston Bros. Co., Los Angeles, $74,142; Gibbons & Reed Co., Burbank, $72,496; Claude Fisher Co., Los Angeles, $64,271; Macco Const. Co., Clearwater, $56,101; Basich Bros., Torrance, $56,540; C. R. Butterfield-Kennedy Co., San Pedro, $57,900; S. Edmondson & Sons, Los Angeles, $67,408; George J. Bock Co., Los Angeles, $64,572; C. O. Sparks & Mundo Eng. Co., Los Angeles, $65,838; Dimmitt & Taylor, Los Angeles, $59,393; Radich & Brown, Los Angeles, $72,063; Triangle Rock & Gravel Co., San Bernardino, $71,403; Oswald Bros., Los Angeles, $56,812; Griffith Co., Los Angeles, $61,731; J. A. Haddock Ltd., Pasadena, $57,612; Clyde W. Wood, Los Angeles, $65,281; United Conc. Pipe Corp., Los Angeles, $58,882. Contract awarded to V. R. Dennis Const. Co., San Diego, $52,996.50.

PLUMAS COUNTY—Between southerly boundary and Vinton, about 7.4 miles in length to be graded and penetration oil treatment applied. District II, Feeder Roads. Fredericksen & Westbrook, Lower Lake, $43,560; Embleton-Schumacher Co., Albany, $44,199; Isbell Const. Co., Reno, Nev., $44,700; Claude C. Wood, Stockton, $45,217; M. J. Ruddy, Modesto, $47,534; Clifford A. Dunn, Klamath Falls, Ore., $47,876; Geo. Pollock Co., Sacramento, $48,130; Mountain Const. Co., Sacramento, $52,366; Chas. L. Harney, San Francisco, $53,156; Union Paving Co., San Francisco, $55,730; Geo. K. Thompson & Co., Los Angeles, $60,923. Contract awarded to Harms Bros., Susanville, $43,077.40.

PLUMAS COUNTY—Bridges at Rock Creek, Chipps Creek and Yellow Creek and a culvert at Little Indian Creek to be constructed and about 0.25 mile of roadway to be graded. District II, Route 21, Sec. A. A. Soda and Son, Oakland, $71,584. Contract awarded to Campbell Construction Co., Sacramento, $63,891.

SANTA BARBARA COUNTY—Between Los Olivos and Zaca about 3.0 miles in length to be graded and surfaced with imported borrow and road-mix surface treatment applied. District V, Route 80, Section A. J. E. Haddock, Ltd., & Crow Bros., Const. Co., Pasadena, $65,675; N. M. Ball Sons, Berkeley, $67,592; M. J. Ruddy, Modesto, $62,934; A. S. Vinnell Co., Alhambra, $65,692; Basich Bros., Torrance, $67,078; George K. Thompson & Co., Los Angeles, $68,705; Oswald Bros., Los Angeles, $69,116; Gibbons & Reed Co., Burbank, $69,980; Guerin Bros., San Francisco, $71,613; C. R. Butterfield-Kennedy Co., San Pedro, $73,856; United Concrete Pipe Corp., Los Angeles, $74,636; Dimmitt & Taylor, Los Angeles, $80,899; C. O. Sparks & Mundo Eng. Co., Los Angeles, $90,176. Contract awarded to Macco Const. Co., Clearwater, $61,261.55.

SAN LUIS OBISPO COUNTY—Between Summit and 3 miles south of Paso Robles, 2 timber bridges and a corrugated multiplate culvert, to be constructed and about 0.8 mile of roadway to be graded and road-mix surface treatment applied. District V, Route 33, Section E. Robert B. McNair, Oakland, $24,230; Franzini & Fredenberg, San Rafael, $26,020; Granite Construction Co., Ltd., Watsonville, $26,594; S. A. Cummings, San Diego, $27,706; L. A. Brisco, Arroyo Grande, $27,014; Rexroth & Rexroth, Bakersfield, $28,784; R. R. Bishop, Long Beach, $29,040; Albert H. Siemer & John Carcano, San Anselmo, $31,332. Contract awarded to E. G. Perham, Los Angeles, $21,616.20.

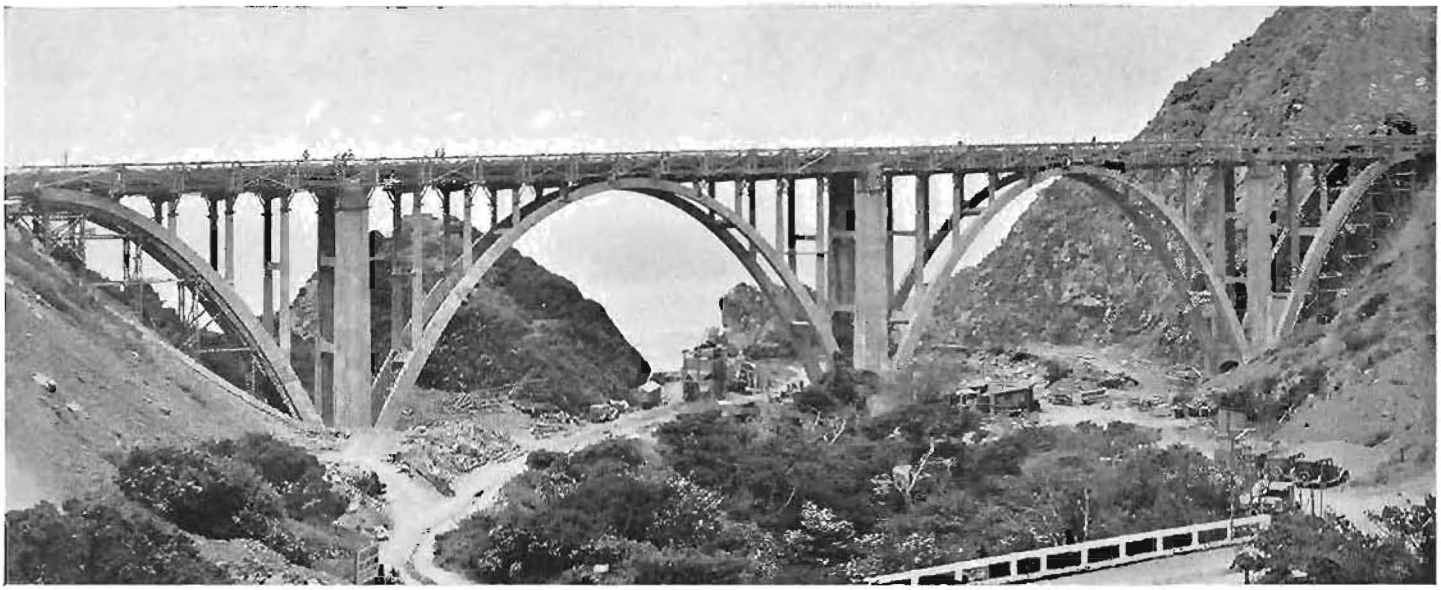
SHASTA COUNTY—At 0.8 mile east of Bella Vista and between Seamen's Gulch and 0.3 miles east of Jagot, about 7.7 miles in length, to be graded and surfaced with crusher run base and salvaged surfacing base, and R. C. Box Culvert to be constructed. District II, Route 28, Section A.B. Clifford A. Dunn, Klamath Falls, Ore., $89,700; Pacific States Construction Co., San Francisco, $94,860; N. M. Ball Sons, Berkeley, $99,442; Mountain Const. Co., Sacramento, $117,185. Contract awarded to C. W. Caletti & Co., San Rafael, $86,095.45.

TRINITY COUNTY—At various locations between Big Bar and Junction City about 4.1 miles in length to be graded and surfaced with road mix surfacing and penetration oil treatment. District II, Route 20, Sections E.F. Harold Smith, St. Helena, $89,224; N. M. Ball Sons, Berkeley, $106,280. Contract awarded to Young & Son Co., Ltd., Berkeley, $87,874.60.

TRINITY COUNTY—Between 1 mile southwest of Hayfork and ½ mile east of Duncan Creek, about 2.2 miles in length, to be graded, imported surfacing material placed and penetration oil treatment applied. District II, Route 35, Section B. Young & Son Co., Ltd., Berkeley, $19,805; Helwig Const. Co., Sebastopol, $21,773; N. M. Ball Sons, Berkeley, $22,393; Harold Smith, St. Helena, $22,763; Lee J. Immel, Berkeley, $24,648; Piazza & Huntley, San Jose, $22,807; Geo. Pollock Co., Sacramento, $24,902; A. Soda & Son, Oakland, $33,618. Contract awarded to Harms Bros., Susanville, $19,739.

YUBA COUNTY—At Dry Creek about 13 miles east of Marysville, a reinforced concrete bridge to be constructed and about 0.2 mile of roadbed to be graded and seal coat applied. District III, Route 15, Section A, B. Hemstreet & Bell, Marysville, $50,681; Campbell Construction Co., Sacramento, $53,606; C. W. Caletti Co., San Rafael, $55,081; Holdener Construction Co., Sacramento, $56,273; J. S. Metzger & Son., Los Angeles, $56,850; J. M. Walker, Berkeley, $61,959. Contract awarded to Valley Construction Company, San Jose, $49,734.

A business genius is a man who knows the difference between being let in on a deal and taken in on one.



This is another view of the Big Creek Bridge being constructed on Carmel-San Simeon Highway

Big Creek Bridge is Unique

(Continued from page 24)

When there is an unbalanced live load, such as a heavy truck on one end of the bridge, this unbalanced load is supported by transmitting the stresses through the eye bars to the main piers, which are designed to take care of such unbalanced live load.

SPAN WILL REVOLVE

From the ends of the cantilever spans are two short girder spans 34-feet, 6-inches long, which rest on the ground and are fastened to the main structure by hinges. This arrangement is provided so that if the ground should move the span will revolve about the hinge, and there will be no ill effect on the main structure.

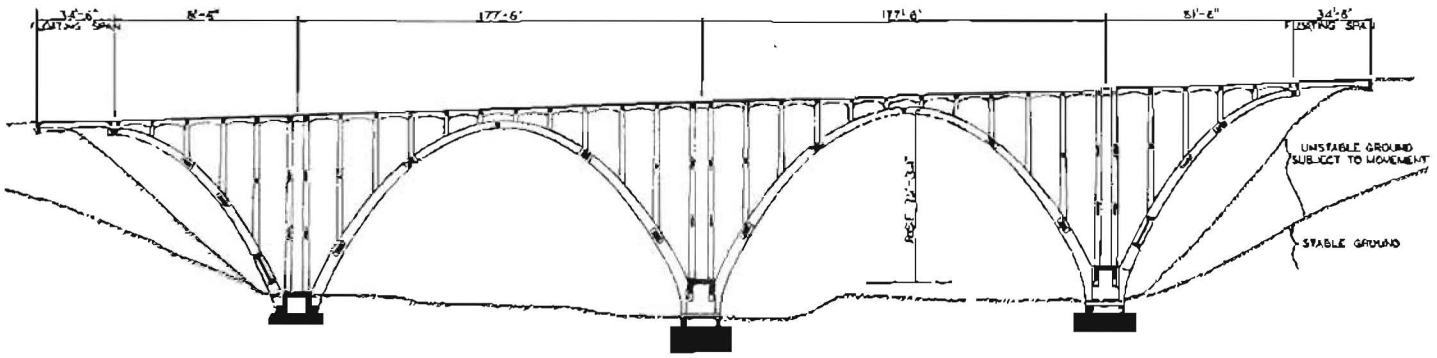
The concrete in the arch ribs was supported on timber falsework built according to accepted practice. However, instead of using a highline for erecting falsework and transporting materials, the contractor utilized the falsework to support a runway for workmen and concrete buggies at the elevation of the roadway.

During the heavy storm last winter, the wind, which reached a velocity of over 70 miles per hour, blew down the timber falsework, of which about 80 per cent was in place. This accident delayed the time of completion.

SMOOTH CONCRETE SURFACES

For the forms the contractor elected to use plywood. All the rib and column forms were laid out accurately on the ground and later erected in place. The use of plywood accompanied by this careful procedure will result in smooth concrete surfaces and lines. To keep construction joints to a minimum, the arch columns were poured the full length in one operation in order to obtain a smooth concrete surface without unsightly joints. Because of the proximity to the ocean, and the deteriorating effect of salt water and air, great care was taken in designing the concrete mix to secure as dense and strong a concrete as possible.

The Big Creek Bridge, costing approximately $146,000, will be completed about September 1st. C. O. Sparks and Mundo Engineering Company are the contractors.



This drawing shows construction plan of unusual Big Creek Bridge now being built by Division of Highways

STATE OF CALIFORNIA

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Port of Eureka—E. S. MACKINS, Surveyor

59008 7-38 17,000

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MAP OF

CALIFORNIA

SHOWING

UNITED STATES AND STATE NUMBERED HIGHWAYS

Statute Miles

LEGEND

- UNITED STATES HIGHWAYS - SIGN'D
- UNITED STATES HIGHWAYS - NOT SIGNED
- STATE HIGHWAYS - SIGNED
- STATE HIGHWAYS - NOT SIGNED
- COUNTY ROADS - SIGNED
- STATE HIGHWAYS - NOT CONSTRUCTED

SAN FRANCISCO AND VICINITY

LOS ANGELES AND VICINITY

M E X I C O