

NOTE.—This Bulletin is a “folder,” doubled lengthwise with large map inside. As folded the pages are in consecutive order.

CALIFORNIA HIGHWAY BULLETIN

SACRAMENTO, CALIFORNIA, JULY 1, 1916

FIFTH ISSUE



One of the many heavy cuts on the Castaic Ridge Route between Bakersfield and Los Angeles, depth 110 feet. Over one million cubic yards of excavation were necessary in the construction of two sections of this road.

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CALIFORNIA HIGHWAY BULLETIN

PUBLISHED BY THE
CALIFORNIA HIGHWAY COMMISSION

OF THE
Department of Engineering
State of California

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OVERHEAD

The question of "overhead" of the California Highway work is pertinent.

The Commission operates a purchasing department and supplies to contractors all the material that goes into the road. It costs tens of thousands; it saves to the job hundreds of thousands by quantity purchasing and insures to the job honest materials. It runs up the "overhead," causing an expense that in other states is borne by the contractors. It is a unique feature of this character of work—but it justifies itself.

That the magnitude of the work may be appreciated note that the purchasing department in August last purchased and distributed approximately 3,145 cars of rock and sand, 385 cars of cement, 9,500 barrels of oil, and other materials aggregating about 4,750 cars, or nearly 200 cars per working day.

The Commission does its own auditing and disbursing—and charges the "overhead" with the cost thereof. It is an unusual expense for this character of a job—but it gets results in a way that saves money to the state.

The system of inspection with resident engineers on every job is expensive, but it is certain that honest work as well as honest materials go into the roads, and the slack ordinarily allowed for faulty construction is thus taken up.

At the beginning of work in any county, the "overhead" is 100 per cent; an organization must be created, field work done, drafting and mapping completed, plans and specifications drawn, all before a single contract can be let. Gradually as actual construction progresses this preliminary cost is absorbed.

A recent statement shows a total expenditure from the highway fund of \$13,746,396.00, distributed over 1,320 miles of state highway.

The cost of administration, technically known as "overhead," including the purchasing, auditing and disbursing departments, the Commission's attorney and its secretary, the engineering assistants at headquarters, the division engineers and their assistants, and the clerical force, both at headquarters and in the divisions, including salaries, expense accounts, rentals, etc., amounts to \$604,926.00, or 4.41 per cent.

Now "overhead" may be variously limited and defined. To find a definition sufficiently broad to satisfy the most captious, suppose as "gross overhead" every dollar that did not find its way into the road itself in progress estimates or cost of materials be included.

Of the total expended, \$11,591,188.00 represents contract payments and materials furnished—contracts let under the most spirited competition in bidding at a time when construction work was scarce and bidders correspondingly eager, and materials bought at the lowest prices known in California.

In other words, 84.32 per cent of the total expenditure went directly into 1,320 miles of roads.

The 15.68 per cent not so expended represents, in addition to the technical "overhead," every other character of expenditure—field and office drafting work, the most rigid and therefore expensive system of resident engineer inspection, salaries, expense accounts; everything.

The greater part of this expenditure has been apportioned and charged directly where it originated. The technical "overhead," however, can not be so charged until the completion of the work makes possible a proportional distribution.

Included therein is equipment and stores on hand amounting to 1.19 per cent. Included also is the field and drafting work for 850 miles of highway in advance of contracts, amounting to 1.9 per cent.

Deducting these items, the "gross overhead" cost of building 1,320 miles of highway is 12.59 per cent, on an expenditure of a trifle over two-thirds of the \$18,000,000.00.

In other words, in spending two-thirds of the \$18,000,000.00, the "gross" overhead has been reduced from 100 per cent to 12.59 per cent.

Included therein are many other items not properly chargeable as "overhead," but not easily segregated. Thousands have been spent in designs and inspection of bridges being built by counties for the state highway, the cost of which does not appear in the capital expenditure. Field data have been gathered on many roads in addition to those permanently surveyed.

The Commission has faced a financial condition that made highway bonds unsalable in the open market. It has hampered the work and with a weaker organization would have ended it. But with county support, depreciated securities have been sold at par, thus financing the work.

Expert aid in office and in the field has been extended to counties that have needed help.

The good roads movement is new in California, and the work of the pioneer has fallen to the Highway Commission.

Yet with it all the Commission believes no similar work, whether private, corporate, or public, can show an administration at once so comprehensive and so economical as the state highway work in California.

STATE HIGHWAY BRIDGES

The establishment of standard requirements in the construction of highway bridges throughout the State is generally accredited to the California Highway Commission.

Following the suggestions, and under the guidance of the Commission, the counties have generally adopted the concrete type of construction. Even for bridges off the state highway, and not in any way under the Commission's jurisdiction, the county authorities often insist upon the minimum demands of the Commission's standards.

In the main, these requirements are for a width of vehicle use of not less than 21 feet, and of strength sufficient to sustain a uniform live load of 150 pounds per square foot and to safely carry a 20-ton traction engine.

The steel bridge standards of the Commission vary slightly from the above minimum demands, but for both classes of structure the margin

and the chances are generously resolved in favor of permanence and safety.

The splendid spirit of co-operation on the part of the various counties with the Highway Commission's work has been evinced, not merely by accepting the State bridge standards, but in promptly proceeding with the construction of needed bridges on the highways.

It is safe to say that within the last three years more money has been expended by California counties in concrete and steel bridge building than during any fifteen years previously.

As will be seen by the accompanying illustrations, these bridges are models of modern engineering in all that constitutes grace and strength in such structures.

Hardly less than an aggregate of \$2,000,000 is the cost to the various counties of the new bridges which they have built on the state highway in conformity to specifications approved by the Commission.

After the completion of these bridges, and their formal acceptance by the Commission, they pass to the State which thereafter is pledged to maintain them without further cost to the counties.

In this and in succeeding issues of the Bulletin, the story of the building of our state highways will be simply told so as to show what the Commission has actually accomplished in highway construction and what the work has cost.

The interests of the State at large in the success of this undertaking to build a comprehensive and permanent system of highways is so great and overshadowing that the Commission feels justified in asking careful and discriminating consideration of the facts herein presented.



"The Old Bridge that was, the New that is," over Weber Creek, Placer County.

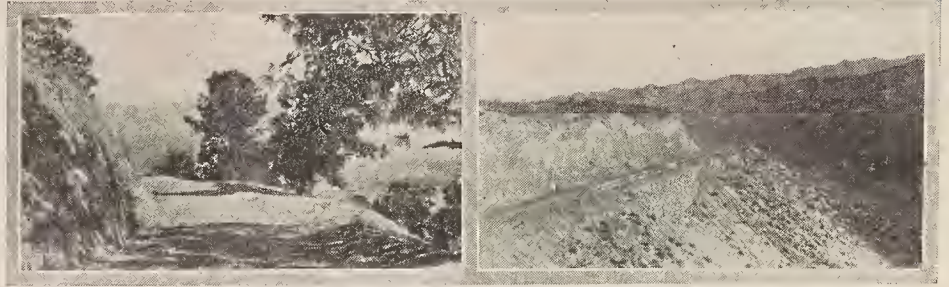
THE GREAT SHORT CUT OVER TEHACHAPI MOUNTAINS

How the Tejon-Castaic Ridge Road between Bakersfield and Los Angeles was Located and Constructed

One of the biggest engineering problems that challenged the Highway Commission at the inception of its work was the location of the trunk road between Los Angeles and Bakersfield.

The only highway between the San Joaquin Valley and the southern metropolis lay in part through the Mojave desert, and the distance between Los Angeles and Bakersfield via Tehachapi, the desert and Mint Canyon was about 170 miles. The so-called Tehachapi route traversed two mountain ranges, reaching an elevation of nearly 4,000 feet between Saugus and Palmdale, dropped 1,500 feet into Mojave desert and again climbed steep grades to an elevation of about 4,000 feet at Tehachapi. If one chose the Tejon Pass for the northerly part of his journey, he also had rough roads and steep grades to contend with.

Most people assumed that the state highway would follow the Tehachapi route, but consistent with its policy to build the state highways



Glimpses Along the Castaic Ridge Road.

taic Ridge. For a distance of about 29 miles, the state highway follows on the Ridge, winding from one side to the other through the saddles but keeping substantially the elevation attained. Near the northerly end,



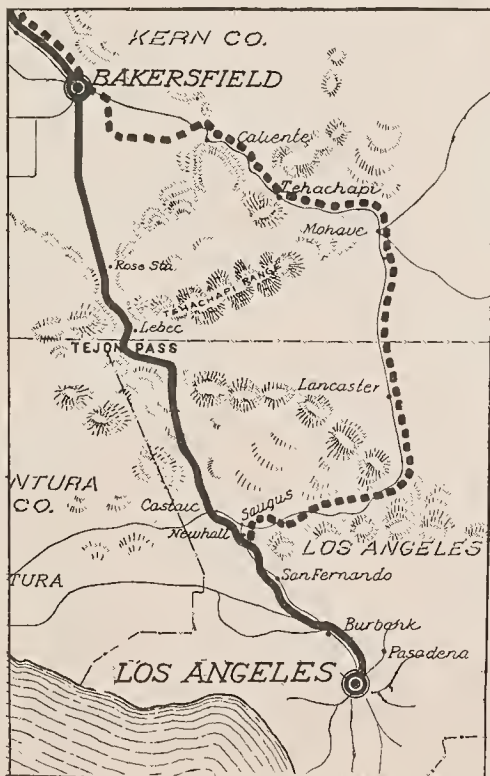
Bird's eye view of the Castaic Ridge Route between Bakersfield and Los Angeles.

by the most direct and practicable routes, the Commission determined at the outset to explore Tejon Canyon and the ranges and ridges to the south for a shorter, easier, and more scenic highway into the southland.

A preliminary study and reconnaissance made by W. Lewis Clark, then Division Engineer at Los Angeles, dissipated all doubt as to the feasibility of the enterprise, and to his able, painstaking work much credit must be accorded.

On January 25, 1912, surveys were ordered over lines closely following the present location of the Castaic Ridge route.

The so-called Ridge route begins at a point near Saugus in the northerly part of Los Angeles County, and by easy grades, in no place exceeding 6 per cent, climbs up on what is known as the Cas-



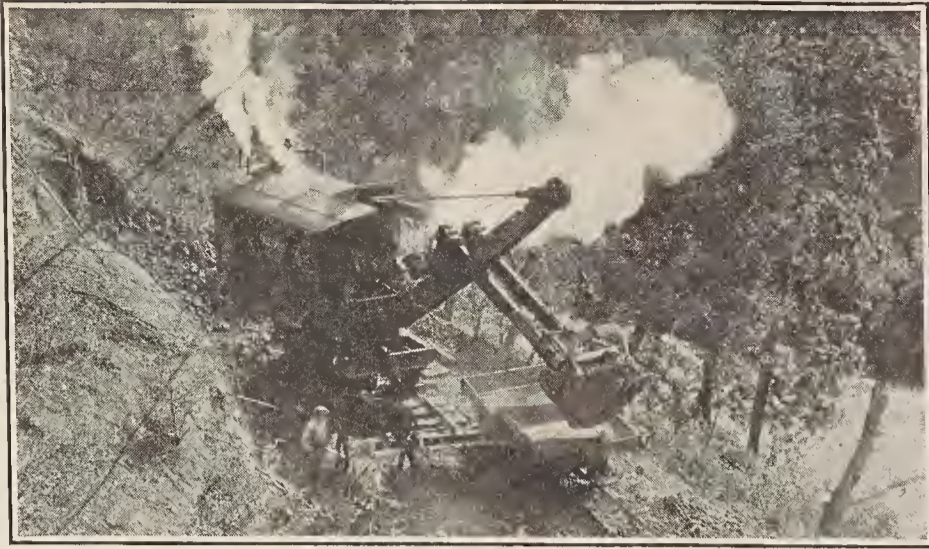
taic Ridge. From this point on, the highway follows the Tejon Pass, via Lebec, and comes out into San Joaquin Valley at a point near Rose Station.

The Tejon Pass had for many years been the competitor of the Tehachapi route between Bakersfield and Bailey's ranch and had been preferred by many to the Tehachapi, but by means of judicious relocations and grade changes in the Tejon Pass a great transformation has been worked. Whereas there were formerly grades as steep as 20 per cent, there is now no grade in excess of 6 per cent, and this is smooth and hard and safe.

Only the person who saw the country through which the road south of Bailey's passes in its native wildness can realize the magnitude of the undertaking. Chopping their way through the brush, clinging to the precipitate walls of canyons where no pack mule could keep his feet, across ravines and along the crests of the mountains, the surveyors fixed their stakes, and, link by link, laid the lines along which this mighty highway should run.

It is still another story of thrills—the story of how the construction contractors attacked these forbidding mountain ranges with but trails by which to transport their machinery to the work; how storms in winter and dearth of water in summer; how landslides, boggy adobe, and granite walls made their task a gigantic struggle between human wit and courage on the one hand and nature's untamable elements upon the other.

Enraptured by the panoramic beauty of the scenery at every dip and turn of the road, the traveler is lulled into happy forgetfulness of the



A State Highway Steam Shovel in Action.

fact that but a few brief seasons since where he now rides in cushioned and upholstered luxury, mountain goats and coyotes monopolized the solitudes of these perpendicular canyon walls and mountain ledges.

Whereas the old "roundabout" Tehachapi route climbed by steep grades to an altitude of 4,000 feet, then dropped 1,500 feet into Mojave

CALIFORNIA HIGHWAYS MOST NOTABLE IN U. S.

"I have just returned from a thousand-mile tour of California highways, more than six hundred miles of which traversed the State system of trunk lines. With due regard for the great work already completed and under way in the Eastern states, I predict that the California highway system, now in the making, will be, when completed, the most notable system of highways in America, if not in the world."—J. E. PENNYBAKER, Chief of Road Economics, United States Office of Public Roads.

The San Francisco *Chronicle* of recent date gives the following picturesque description of this Castaic Ridge road:

"One of the most remarkable engineering feats accomplished by the State Highway Commission, and one which will prove of incalculable value to the San Joaquin Valley and southern California, was accomplished recently when the new ridge route between Saugus and the Tejon Pass was thrown open for travel. Cutting off forty-five miles of the distance between Los Angeles and San Francisco, it provides the shortest route between San Francisco and the southern metropolis.

"Thirty miles of this road is in the wildest of southern California's mountain country, a section previously known to only a few ranchers and oil companies.

"But the motorist is little aware that he is rapidly climbing to the 'top of the world' in the first stretches of this wonderful route, for the gradient is so easy that



The Pit River Bridge near Baird, Shasta County. It lacks only a few feet of having the longest concrete arch west of the Rockies.

desert, and then climbed up and down the steep and tortuous Tehachapi grades to an altitude of 4,000 feet, putting about 170 miles between Bakersfield and Los Angeles, this new Castaic Ridge route by easy grades and gracefully-sweeping curves, reaches its highest elevation of 4,233 feet on the Los Angeles side, then descends by gentle grades 1,100 feet to the western rim of Antelope Valley, thence gradually climbs the Tehachapi range and crossing it at an elevation of 4,200 feet at Tejon Pass, thence via Tejon Canyon, it makes a veritable "bee line" for Bakersfield.

Between Newhall in Los Angeles County and Bakersfield in Kern, the point of greatest divergence from a straight line is in Tejon Pass, and there it is only about 7 miles southwest of an air line.

From 45 to 60 miles of a toilsome desert and rough mountain road are eliminated between Bakersfield and Los Angeles, and in no place between the two cities is it necessary to use any but the high gear.

The distance by the Tejon-Castaic Ridge route, between the points named, is almost exactly 124 miles.

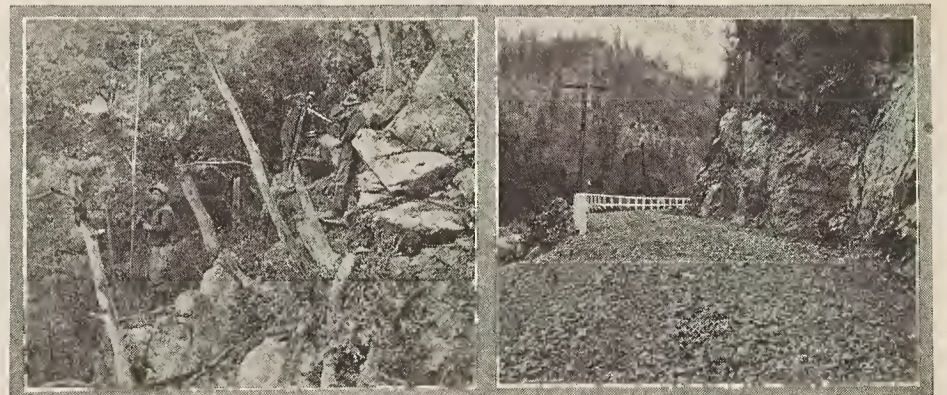
On page 1 of this bulletin appears a picture of one of the numerous heavy "cuts" that were made in the construction of this road. It has been called the state highway's "Culebra" excavation. It has a depth of 110 feet. On two sections alone of this work more than a million cubic yards of earth and rock were moved. Large cuts along steep mountain sides and through the saddles between peaks ran up the cost of construction but vastly reduced the mileage.

In thus shortening the distance and reducing the grades, the Castaic Ridge route has already become a great and powerful influence in promoting the unity and integrity of heretofore divided sections and in discouraging state division agitation.

few indeed are the cars which can not make the drive on high gear. After the road attains the ridge between Castaic and Piru canyons it follows the top of the hills in a remarkable series of curves and cuts, which entirely do away with the old 30 per cent grades which took the stamina out of a motor on the Midway route.

"It skirts 1,000-foot precipices. It disappears within cuts that are tunnel-like in their depth. It spirals to gain the upper altitudes so that the traveler catches a glimpse of the roadway at a half dozen different levels. It is southern California's *magnus opus* in mountain highway construction."

Of the whole distance between Los Angeles and Bakersfield there remains but about 34 miles unpaved. Whether or not these remaining miles shall be paved like the rest of the highway is dependent upon the action of the voters next November on the proposed new bond issue for state highways.



Before and After; Showing Locating Highway Surveyors at Work Where Later the New Road Appears—State Highway, Shasta County.

ELIMINATING THE TERRORS OF THE BELL SPRINGS GRADE

What the New State Highway via the South Fork of Eel River Means to Humboldt and Mendocino Counties

The city of Eureka, situated on Humboldt Bay, in central Humboldt County, has a population of 15,000. The Northwestern Pacific Railroad was completed to Eureka in August, 1914. Prior thereto this city had the distinction of being the largest city in the United States without railroad communication. The growth of a city to this size under such adverse conditions is unprecedented. Eureka may be justly proud of its achievement, which is not only a monument to its enterprising citizenship but indisputable evidence of the wonderful resources of Humboldt County.

more eagerness than the gap between Cummings and the Humboldt County line, a distance of 29.3 miles.

From Cummings the route lies down the Rattlesnake Creek to its junction with the South Fork of the Eel River, thence down the east bank of the river to its junction with the main Eel River at the town of Dyerville.

The elevation at Cummings is 1,414 feet, and the descent is on a gradual grade not exceeding 6 per cent, to Dyerville, elevation 163 feet, the distance from Cummings to Dyerville being 69 miles. As this change in the route of the San Francisco and Eureka overland road means the elimination of 2,686 feet of heavy grades, its importance may be readily conceived.

That portion lying between Dyerville and Miranda, distance 14 miles, and between Garberville and the Mendocino-Humboldt county line, distance 11 miles, has already been constructed, having a roadbed varying in width from 16 to 20 feet. The gap of 29.3 miles between Cummings and the Humboldt-Mendocino county line is now in the course of construction by prison labor.

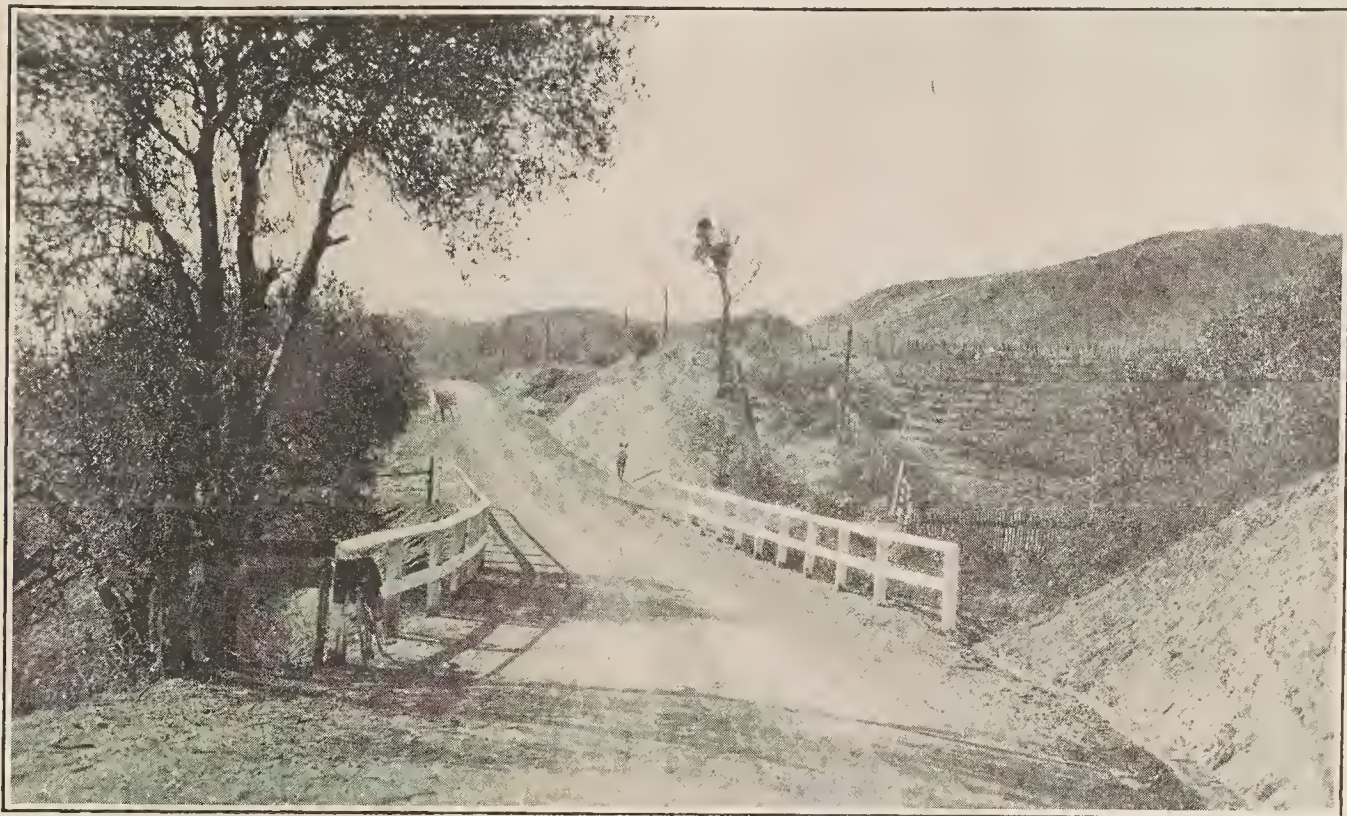
This construction entails the erection of several bridges of a formidable nature, among which are Cedar Creek bridge, 350 feet in length, 135 feet in height; Rock Creek bridge, 210 feet in length, 145 feet in height; and the two crossings of the South Fork of the Eel River, each 350 feet in length.

The presence of forests of redwood timber along the route, and the remoteness of the locality, made it inadvisable to incur the expense of transporting steel and cement, and induced the Highway commission to adopt timber bridges of modern design. Preparations for their

construction are now going forward.

The country traversed is in a virgin state, for the most part devoid of wagon roads or even passable trails except those made within recent years by the state highway surveyors. Until recently much of the land was not open for entry, so the country between Cummings and the Humboldt-Mendocino county line is settled principally by homesteaders, although there are a few spots that have been under cultivation for several years.

The scenery is unsurpassed in California and the redwood forests, river views and picturesque ruggedness will be a revelation to the tourist. It is needless to say that the opening of this stretch of road



A Stretch of Mendocino State Highway.

Still more wonderful is the fact that this stage of development has been reached without even all-year-round wagon road communication. In fact, Eureka can be reached even during the summer months only under the most strenuous conditions, by means of a public road from San Francisco over the summit of the Bell Springs mountain, the elevation of which is 4,100 feet above sea level.

After the first rains, which generally occur in October, this road is impassable for motor vehicles and even for horse-drawn vehicles. When snowstorms set in transportation is limited to saddle and pack animals.

The beginning of the ascent on the south slope is at Cummings, a post office at the foot of "Rattlesnake Grade." The elevation is 1,414 feet. A climb of 2,686 feet is made up and down grades exceeding 20 per cent, to the summit, which is distant 12 miles, to an elevation of 4,100 feet. From this point a descent of 3,937 feet is made on up and down grades, some of them as high as 30 per cent, to the town of Dyerville, distant 46 miles from the summit, elevation 163 feet.

The distance across this spur of the Coast Range mountains is 58 miles. Although the high altitudes on the route afford a splendid view of the surrounding country in all directions, the tourist and wayfarer would willingly forego the scenic advantages of the Bell Springs mountain to travel a less strenuous route.

But the terror of the Bell Springs mountain will, in the near future, it is hoped, exist only in memory. This pioneer highway of northern California is to be superseded by the northern extension of the coast line of the state highway system.

For the past twenty years the elimination of the Bell Springs mountain grades by means of a road following either the Eel River or its South Fork has been the dream of the enterprising citizens of Humboldt County. At one time the solution of this problem was thought to have been reached through the co-operation of the counties of Humboldt and Mendocino; but upon making the reconnaissance of the routes the engineers were confronted by many physical obstructions, which so discouraged the supervisors of the two interested counties that the project was abandoned.

The California Highway Commission immediately upon assuming their duties ordered a reconnaissance of the several routes, which resulted in the selection of the South Fork route. This action has elicited unanimous approval.

It is doubtful whether the completion of any stretch of road in the State is looked forward to locally and also by the general public with



Cuts, Fills, and Culverts—State Highway Construction, Santa Barbara County.

will be one of the notable events in the history of Mendocino and Humboldt counties, and will create as much interest as was manifested at the opening of the Northwestern Pacific Railroad between Willits and Eureka.

On another page the story of the progress of the prison labor camps on this work is graphically told.

STORY OF THE GREAT YOLO BASIN CONCRETE TRESTLE

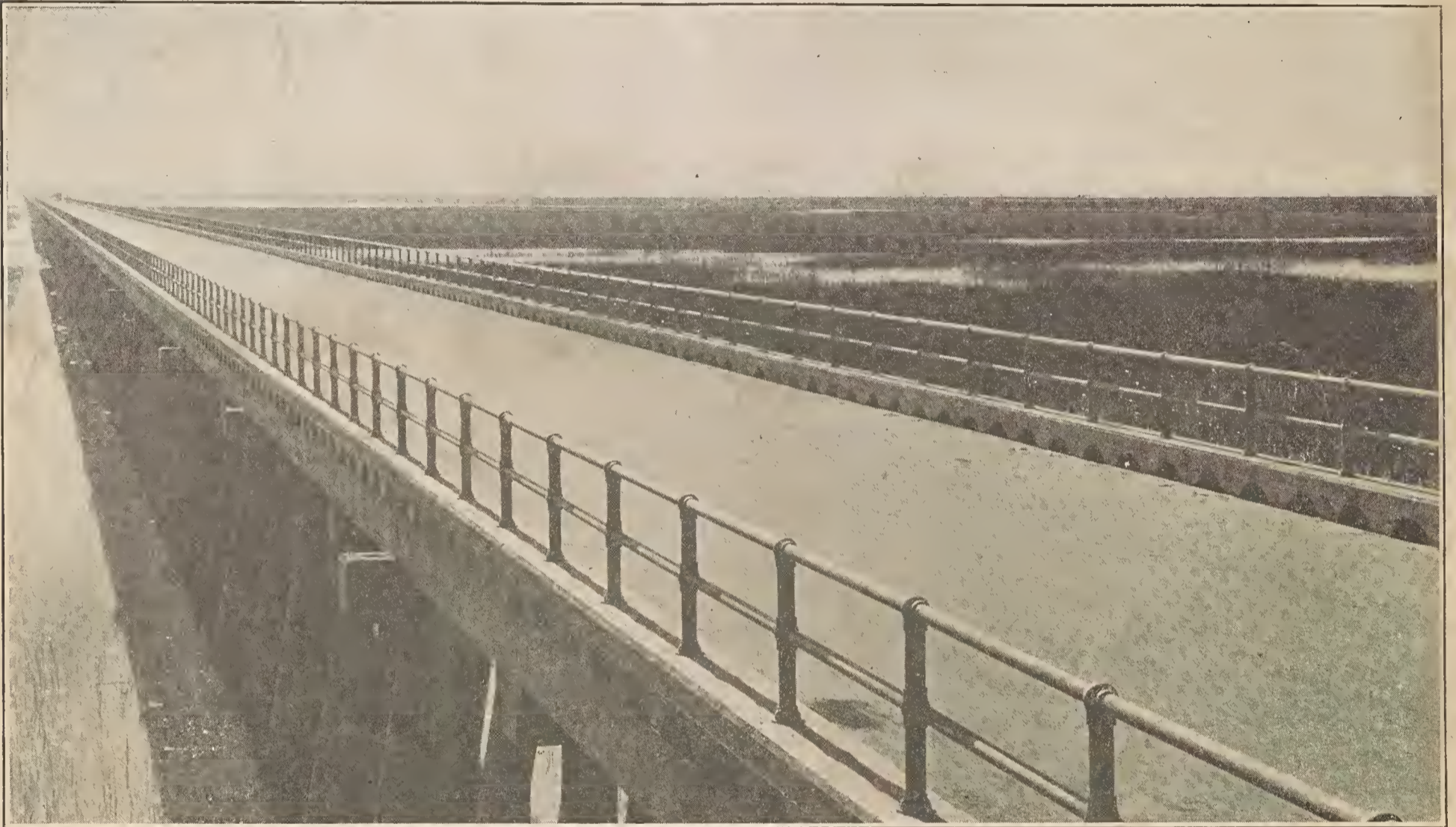
It Bridges over Three Miles of Marsh Lands and Unites the East and West Sides of Sacramento Valley

The completion of the Yolo Basin Trestle by the State Highway Commission was the occasion of a celebration May 11 to 14, 1916, in which practically the entire Sacramento Valley participated in the formal opening and dedication of this, the longest concrete trestle in the world.

For forty years the people of Sacramento Valley had been dreaming of the day when the basin would be permanently bridged, and at last the dream has come true.

occasion of an event comparable in spirit and enthusiasm with the celebration of the opening of the Panama Canal by the nation last year. For in truth, in a local way, the Yolo Basin Causeway is even of larger significance to Sacramento Valley and Central California than the Canal is to the country at large, slides or no slides.

The building of this trestle of concrete was in pursuance of the policy of the California Highway Commission to construct the state highway system in a durable manner, and choose routes that would



The Yolo Basin Concrete Trestle, over three miles long and costing about \$400,000.

The so-called Yolo Basin is flooded annually for six or eight months, and is a part of the great marshy district extending from a point some fifteen miles north of Marysville to Rio Vista, a distance of more than 120 miles. The flooded territory is as wide as three miles in places.

South of the bridge at Meridian, which lies due west of Marysville, there has been no way of crossing the overflowed area in vehicles during the flood periods; and the east and west sides of the great Sacramento Valley have had no means of intercommunication by highway at such times.

For a few months during summer and fall, when the flood waters from the Sacramento have subsided and the marsh lands have dried out somewhat, a precariously passable road, known as the "Tule Jake" road, was the only means of crossing the basin.

It is unnecessary to say that "Tule Jake's" road was usually a concatenation of ruts and chuck-holes.

Thus the reader from a distance may readily understand how the social and commercial interests of the Capital City have been hemmed in and how the farmer on the other side has been denied access to the market center of California by this great Yolo Basin; and he no longer wonders that the building of a solid concrete trestle with asphaltic pavement across this marsh was the

most directly and strategically connect the centers of population, regardless of engineering difficulties and false theories of economy in first cost.

The design of this trestle was worked out by the engineering forces in the Commission's office in Sacramento.

The westerly 2,000 feet of the trestle is of timber construction for the reason that some day a levee to define the westerly margin of the Yolo By-pass is to be built. Thereafter an earth fill may be substituted for the wooden trestle.

Including this wooden portion, the entire trestle is over three miles in length, and is reported as stated to be the longest trestle in the world. Its average height is 20 feet and it provides a clear driveway of 21 feet in width.

The contract for the work was let July 31, 1914. Driving the wooden piles on the west end began November 1st of that year, and the first concrete pile was driven on January 3, 1915, and the last on October 1, 1915.

On Saturday, March 18, 1916, the general public was given the first and long looked for opportunity to use the trestle; and on the following day over 2,000 automobiles, conveying 8,000 people, traveled over it.

Nearly 1,100 carloads of material were used in the construction of this great bridge, including 21,692



tons of crushed stone, 12,553 tons of sand, 32,000 barrels of cement and 2,200 tons of reinforcing steel. These materials, which cost \$148,000, were supplied by the Commission under its special half-rate freight schedule agreement with the railroad company.

The contractors, the Graff Construction Company of Seattle, received \$246,000 under their contract. The total cost of the trestle was therefore a little under \$400,000.

The trestle, as shown by the accompanying illustration, is a structure resting upon reinforced concrete piles from 32 to 50 feet long, driven in groups of four abreast, called "bents," to an average depth of 20 feet. These piles are 14 inches square, the lower five feet being tapered to facilitate driving. They weigh from three to five and one-half tons each, according to length.

They were conveyed from the casting grounds to position by a narrow gauge railroad, especially built by the contractors for the purpose. The piles were cast with the ends of the heavy steel reinforcing bars projecting two feet from their tops. The two inside piles of each "bent" were driven vertical, the outside piles were sent down at a slant, giving the structure a widened and a braced foundation.

Each group of four piles is capped and bound together by a concrete cap. This cap is reinforced by heavy steel rods, and is cast in place, forming a solid monolithic member, with the projecting ends of the steel reinforcing bars of the piles embedded and anchored into the cap when cast.

Spanning the 20 feet from "bent" to "bent," the reinforced concrete floor slabs were placed directly upon the caps. These slabs weigh about

six tons each. They are formed like a huge inverted box with side and end walls eighteen inches high and top six inches thick. Five of these slabs, side by side, bound by reinforcing steel and cement to the caps, form a practically solid stone structure three miles in length.

The precision of the lines and grades of the trestle have been favorably commented upon by many who have closely examined the work. As the piles and the guardrail stretch away out of sight across the watery wastes, one marvels at the skill displayed in driving the great concrete piles with such unvarying accuracy and at the assembling of all the bulky parts into a complete whole so that its lines and grades are as true as if the structure had been cast as a monolith.

This trestle, together with the connecting roadways, reduces the distance from Sacramento to San Francisco by automobile to 98 miles, a saving of 30 miles via Stockton and Altamont.

The run to Davis from Sacramento may be easily covered by auto in half an hour, and Woodland is now brought to within fifty minutes' driving time from the Capitol.

There is a double satisfaction to the public in knowing this very important and necessary structure, which would be cheap at almost any price, has been finished in the most creditable manner at a cost that under the present war market conditions would cost many thousands of dollars more than the State has paid for it.

Incidentally, this trestle stands as a very striking physical exhibit of the California Highway Commission's methods in disbursing the state highway funds.

CONVICT LABORERS ON THE MOUNTAIN LATERALS

They Are Building Roads of a Character and in Places that Otherwise Would Not Be Built

Convict labor on state highways is one of the solvents for California's tremendous mountain road problem.

Ever since the "days of old, the days of gold," which Bret Harte describes as "heaven for men and dogs, but hell for women and children," the mountain road problem of California has been beyond her resources. For years to come it must be so.

The convict building such roads takes work from no man, but does work that otherwise could not be done; makes available acres for the landless that otherwise would not be opened; stirs up counties to local road improvement that increases vastly the sum total of road work open for the free road builders of California.

The intent of the convict labor law is to build roads of a character and in locations that otherwise are beyond the resources of the State.

No better description could be given of the laterals demanded by the Highway Act to connect the trans-Sierra county seats with the trunk line in the valley. Unfortunately where people and land values are not, road costs are highest. And the needs of these mountain communities, blocked by snow from the balance of the State for half the year, are the most acute. Yet this is the part of California that should be the playground of the nation, and a tremendous financial asset to the State.

On the other hand is the prison population of the State: 4,000 men—outcasts, hopeless—a financial and social burden.

In California at least this is a problem of young men, their average age less than thirty, men who are coming out to live the greater part of their lives as increasing assets or liabilities.

The convict labor law brings the need and the man together, on a working basis that appeals to both.

The law became effective last August. In September the first camp of thirty men was established in northern Mendocino. The scope of the work was gradually enlarged, on a safety first basis. We carried two camps with 125 men through the winter, working every day but Sunday, through a rain and snow fall of seventy inches. The men have been given sanitary camps that probably surpass and food that at least equals the best free labor camps. We have given them better living and working conditions, a large measure of personal freedom and under the law the crowning incentive of one day's reduction of sentence for every two days of loyal work.

The laying out and direction of the work has been in the hands of the Highway Commission, as well as providing camps, commissary, etc. The discipline of the men has been in the hands of the Board of Prison Directors, represented by three guards without arms in each camp—one acting as captain of the camp, the others as subforemen on the work.

To the intelligent co-operation of these two departments of the state is due the conspicuous success of the scheme.

The humanitarian side of the work is self evident. The men are immeasurably bettered physically, which means mentally and morally. Constructive work instead of the jute mill, under blue skies and among the beauties of mountain California instead of behind stone walls,

co-operating with the state instead of being outcasts of the state—these things are alone worth the doing.

But there is another side without which the scheme would not solve the problem for which it is intended.

These men have come soft from prison to a new work under almost impossible weather conditions. We have supplied them with every-



Convict Workers on the Mendocino-Humboldt Highway.

thing they have or use—clothing, transportation, guards, food, beds, medical attention, as well as the ordinary expense for materials and equipment for road work—all this many miles from transportation—and the winter's work shows a profit.

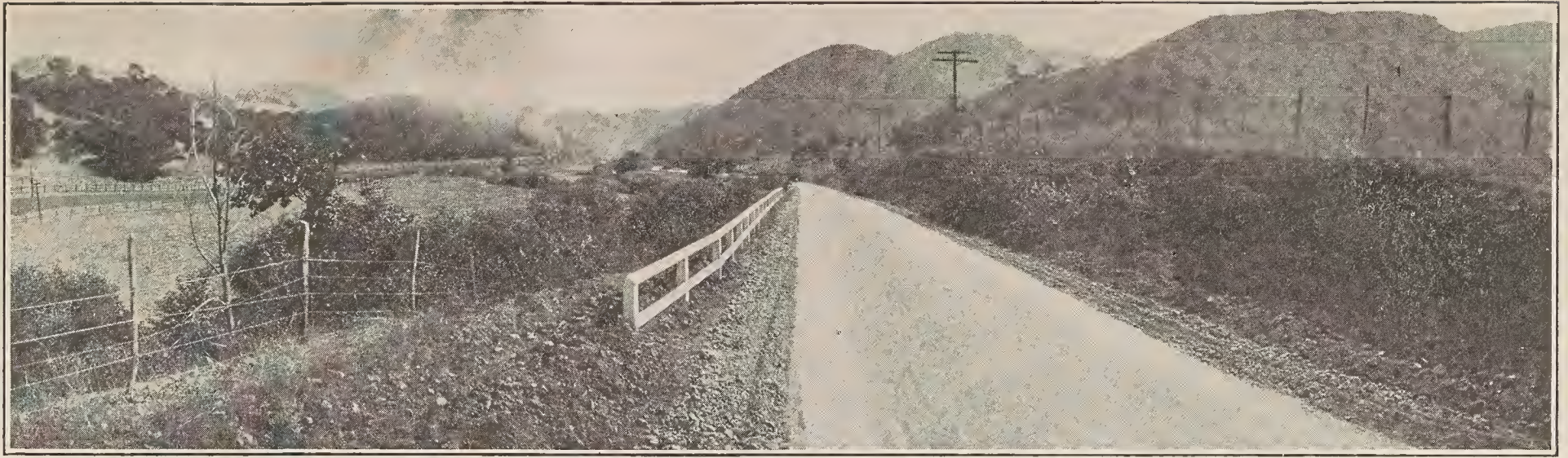
Through the winter eight miles of difficult canyon road has been built for 25 per cent less than the estimate, and little more than half what similar work has cost on contract in the same locality. As weather conditions improve costs are falling and yardage increasing.

The success of the work in Mendocino led to the placing of a crew from Folsom on a section of the Placerville road, near Shingle Springs. Only an inadequately small amount of maintenance funds were available for this section, but this expedient will give the equivalent of \$18,000.00 in work for an expenditure of \$5,000.00, and make possible an improved section of a needed road which otherwise must have waited for the next bond issue.

The Commission is now preparing to attack the Sierra lateral question by placing convict camps on each of four of these roads for active construction this summer.

The experimental stage of this scheme is passed.

There is no longer a question that convict labor is not only successful as a humanitarian measure, but that it will make possible the construction of many miles of mountain roads that otherwise could not be built.



Panorama on state highway near Santa Margarita, San Luis Obispo County.

SALES HIGHWAY BONDS TO COUNTIES

The campaign which the Commission inaugurated to induce the counties to buy highway bonds made slow headway for many months and only by the aid of a few live and active spirits in scattered sections did the movement make a start.

The first sales of bonds were negotiated by individual citizens and chambers of commerce.

The Commission backed the introduction of a special legislative enactment at the session of 1913 which specifically empowered the super-

Below is a tabulation of the amounts of bonds sold to the various counties. The statement shows:

Total amount of bonds bought by counties.....\$13,720,000
 Total amount of bonds sold independently..... 4,280,000 \$18,000,000

Sales Highway Bonds to Counties.

DIVISION I.			DIVISION IV—Cont.		
Humboldt ----	\$600,000		Santa Cruz ----	135,000	
Mendocino ---	445,000	\$1,045,000	San Mateo ----	325,000	
			Sonoma -----	220,000	\$2,293,000
DIVISION II.			DIVISION V.		
Shasta -----	\$205,000		Monterey ----	\$580,000	
Siskiyou -----	225,000		San Benito ----	125,000	
Tehama -----	350,000		Santa Barbara--	694,074	
Trinity -----	15,000	\$795,000	San L. Obispo	385,000	\$1,784,074
DIVISION III.			DIVISION VI.		
Butte -----	\$325,000		Fresno -----	\$150,000	
Colusa -----	486,000		Inyo -----	100,000	
El Dorado ----	150,000		Kern -----	640,000	
Glenn -----	268,000		Kings -----	105,000	
Placer -----	250,000		Mariposa ----	-----	
Sacramento ---	-----		Merced -----	220,000	
Solano -----	350,000		Mono -----	50,000	
Stanislaus ---	210,000		Tulare -----	265,000	\$1,530,000
Sutter -----	105,000				
Tuolumne ----	100,000		DIVISION VII.		
Yolo -----	50,000		Imperial ----	\$380,000	
Yolo-Sac'to --	627,000		Orange -----	400,000	
Yuba -----	40,000	\$2,961,000	Los Angeles---	1,195,000	
DIVISION IV.			Riverside ----	100,000	
Alameda -----	\$400,000		San Bernardino	193,000	
Contra Costa--	300,000		San Diego ----	522,000	
Marin -----	150,000		Ventura -----	521,926	\$3,311,926
Napa -----	125,000				
Santa Clara---	638,000		Total -----	\$13,720,000	
			General -----	4,280,000	\$18,000,000

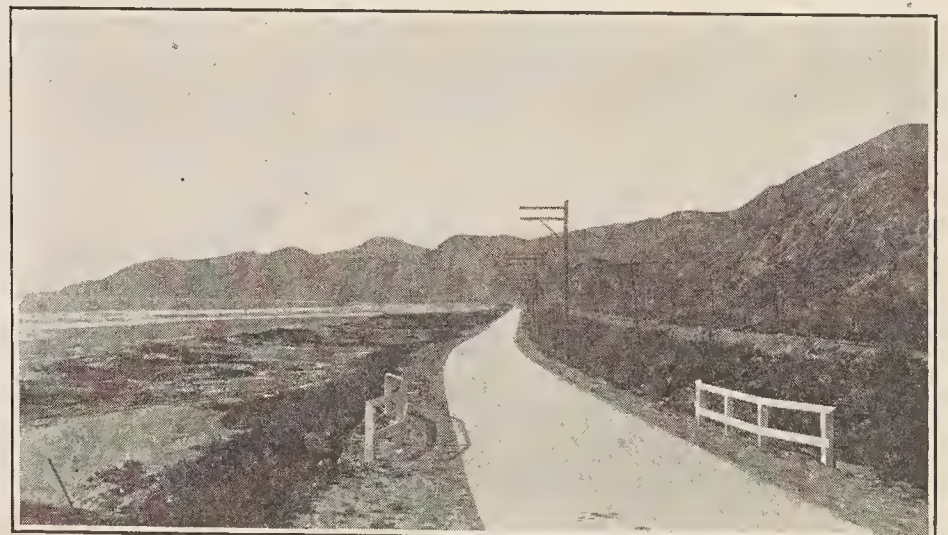
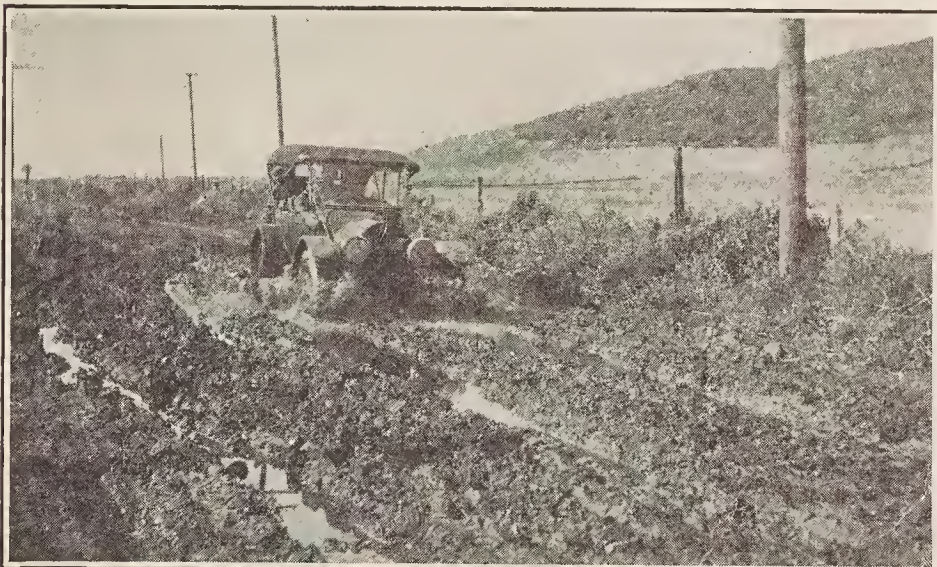


"Safety First" (Ventura County)—One of Many Underpasses on the State Highway.

visors of any county to invest their surplus county funds in state securities. Under this act, one by one, the counties began to negotiate with the Commission for bonds and highways.

When the Commission began to refuse to apportion the amounts of bonds clamorously asked for by some of the counties, when it became apparent that there was not enough to go around, a veritable scramble ensued among the counties to "get in on" what was left.

As a consequence many communities were sorely disappointed. But in Grover Cleveland's words, "it was a condition and not a theory" which the State's highway enterprise was facing. Like sympathetic friends at a funeral, the Commissioners could only say to the mourners, "We are sorry for you."



The above companion pictures, taken at practically the same location, show conditions in Ventura County along the state highway before and after Highway Commission constructed this section of the road. They graphically tell the story of the change in road conditions generally wrought by the state highway in the various counties.



STATE OF CALIFORNIA
DEPARTMENT OF ENGINEERING
CALIFORNIA HIGHWAY COMMISSION

ROAD MAP OF THE STATE OF CALIFORNIA

Compiled from Maps by the United States Government and from various County Maps,
under the Direction of
AUSTIN B. FLETCHER - HIGHWAY ENGINEER

COMMISSIONERS
CHARLES D. BLANEY (Chairman)
NEWELL D. DARLINGTON
CHARLES F. STERN

Statute Miles
1916

STATE HIGHWAYS
(BOND ISSUE \$18,000,000)

Paved ————
Graded ————
Surveyed ————
Reconnaissance ————

WHAT WILL BE DONE WITH THE \$18,000,000 BOND FUND

The Commission's balance sheet of April 15, 1916, shows the following expenditures to that date:

Highways under construction	\$14,468,082
Construction plants and equipment	181,400
Surveys, the expense of which has not yet been distributed to the contract sections	745,044
Headquarters and division offices general expense	725,087
Total	\$16,119,583

The unexpended balance of the fund, in round numbers, \$1,900,000, will all be needed to complete the roads already under contract and for the construction of some few sections, to do which the Commission is obligated.

SOME STATISTICS OF THE WORK.

Miles of Road surveyed	2280
Miles of Right of Way secured	1705
Acres of Right of Way secured	13327
Miles of Highway Constructed:	
Old Macadam	129
Concrete Pavement	933
Asphalt	33
Graded	395
Total	1490

Miles of roads paved by counties and taken over, improved and maintained by the State 108
11,700,000 cubic yards earth and rock moved at average cost of 33 cents.
8,750,000 square yards concrete pavement laid at average cost of 7 1/2 cents.
1,000,000 cubic yards concrete pavement laid at average cost of \$3.64.
143 grade crossings eliminated.
200 miles, approximately, saved on the trunk lines.
443 bridges secured from counties of aggregate value of \$3,450,000.
Eliminating advance surveys and materials on hand, out of every dollar expended, 87 1/2 cents went directly into the roads in materials bought at "rock bottom" prices and contracts let under keen competition.
The remaining 12 1/2 cents represents every other character of expenditure including costly preliminary studies of mountain laterals, and expensive aid given to many counties.

TO THE PEOPLE OF CALIFORNIA

The map of the State above shows what the California Highway Commission has and will have accomplished with the \$18,000,000 appropriated by the State Highway Act of 1909.

The map also shows eloquently what the Commission is not able to do. The red spaces are the gaps that will be left in the state highway system when the funds are exhausted.

Whether or not these red lines will be covered over later by the heavy black lines indicating completed state highways depends on the vote of the people next November upon the new State Highways Act passed by the legislature of 1915. This act appropriates \$15,000,000 to complete the system originally planned and to add to it certain other connecting and much needed cross state roads.

Of the \$15,000,000, the sum of \$3,000,000 is intended for such additional roads, and the other \$12,000,000 to fill the gaps in the original scheme, and to pave certain of the sections shown on the map in dotted black lines where the paving must now be omitted for lack of money.

The total length of the completed state highway shown in black on the map is 1,122 miles. The dotted black lines, representing the graded roads not paved except with local gravels, aggregate 358 miles. The red lines showing where surveys only have been made, and to build which the new bond issue is needed, total about 1,400 miles, including the mountain laterals.

The act of 1909 provided \$18,000,000 and called for the construction of nearly 2,900 miles of road, an average allowance of approximately \$6,200 per mile, including expenses of every nature.

The state highways of other states, where the conditions of traffic and topography are comparable to those of California, and where roads

of equal width and integrity of construction have been built, cost from \$10,000 to \$15,000 per mile. Their official reports show this.

New Jersey, with an area of 8,224 square miles, as against California's 158,297 square miles, has very recently approved a bond issue of \$7,000,000 for the specific purpose of building 350 miles of cross state highways. This is an average of \$20,000 per mile.

Former Governor James N. Gillett, who was in office when the \$18,000,000 act was passed, and under whose scrutiny the act was framed, very recently made the following public statement:

"I suggested that the first state good roads bond issue should be for only \$18,000,000, not because I supposed for a moment that that amount would build all the roads or even all the state highways needed. I believed that if the sum of \$18,000,000 was judiciously used that the result would be to convince the people of the wisdom of good roads, and that whatever money was needed in the future the people would gladly give. I said that I thought it would take over \$50,000,000 to build the main trunk lines that the State requires."

The Commissioners and their assistants have done their utmost to conserve the funds and to build as much highway as was consistent with good workmanship.

Their successful endeavors to secure the lowest possible prices for the materials of construction; their negotiations with the counties to secure donations of rights of way and bridges; their success in floating most of the state highway bonds when they were not marketable at par; these and their other activities are too well known to the people to need exploitation here.

The quality of the work done speaks for itself.

WHAT WILL BE DONE WITH THE PROPOSED \$15,000,000 ISSUE

Twelve million dollars will be used for the completion of the original system of trunk roads and county seat laterals as shown on the above map, filling all gaps and making the map all black.

Three million dollars will be applied on a county aid co-operative basis to the building of the following needed additional highways by the most direct and practical routes:

- (1) An extension connecting the interior and coast main roads through Trinity and Humboldt counties.
- (2) An extension connecting the San Joaquin Valley trunk road between Merced and Madera with the coast main road at or near Gilroy, Santa Clara County, via Pacheco Pass.
- (3) An extension of the Mariposa County State highway lateral to El Portal, Mariposa County, the gateway to Yosemite Valley.
- (4) An extension of the laterals between Visalia and Hanford, via Coalinga to connect the San Joaquin Valley main road in Tulare County with the coast trunk road in Monterey County.
- (5) An extension connecting the San Joaquin Valley trunk road at or near Bakersfield with the coast trunk road in San Luis Obispo County, via Cholame Pass.
- (6) An extension of the San Bernardino County State highway lateral to Barstow in San Bernardino County.
- (7) An extension connecting Antelope Valley, Los Angeles County, with the city of Los Angeles.
- (8) An extension of the San Bernardino County State highway lateral to the Arizona State line near Yuma, via Brawley and El Centro in Imperial County.

EVERYBODY'S ROADS

Everywhere, these are everybody's roads. A mile of good roads anywhere in California contributes not only to the local prosperity, but to the larger and all-inclusive interests of the entire State.

The State highway which opens Shasta Canyon clears away the mountain barriers between Oregon and Los Angeles. The Cascade Ridge road, marvelously quickens communication between the southland and all the northern counties, to their mutual benefit.

Not until this great State highway system is completed, and all the disconnected and isolated sections are brought into its unifying embrace will the people of the State fully realize and enjoy the advantages of the State highway system.