

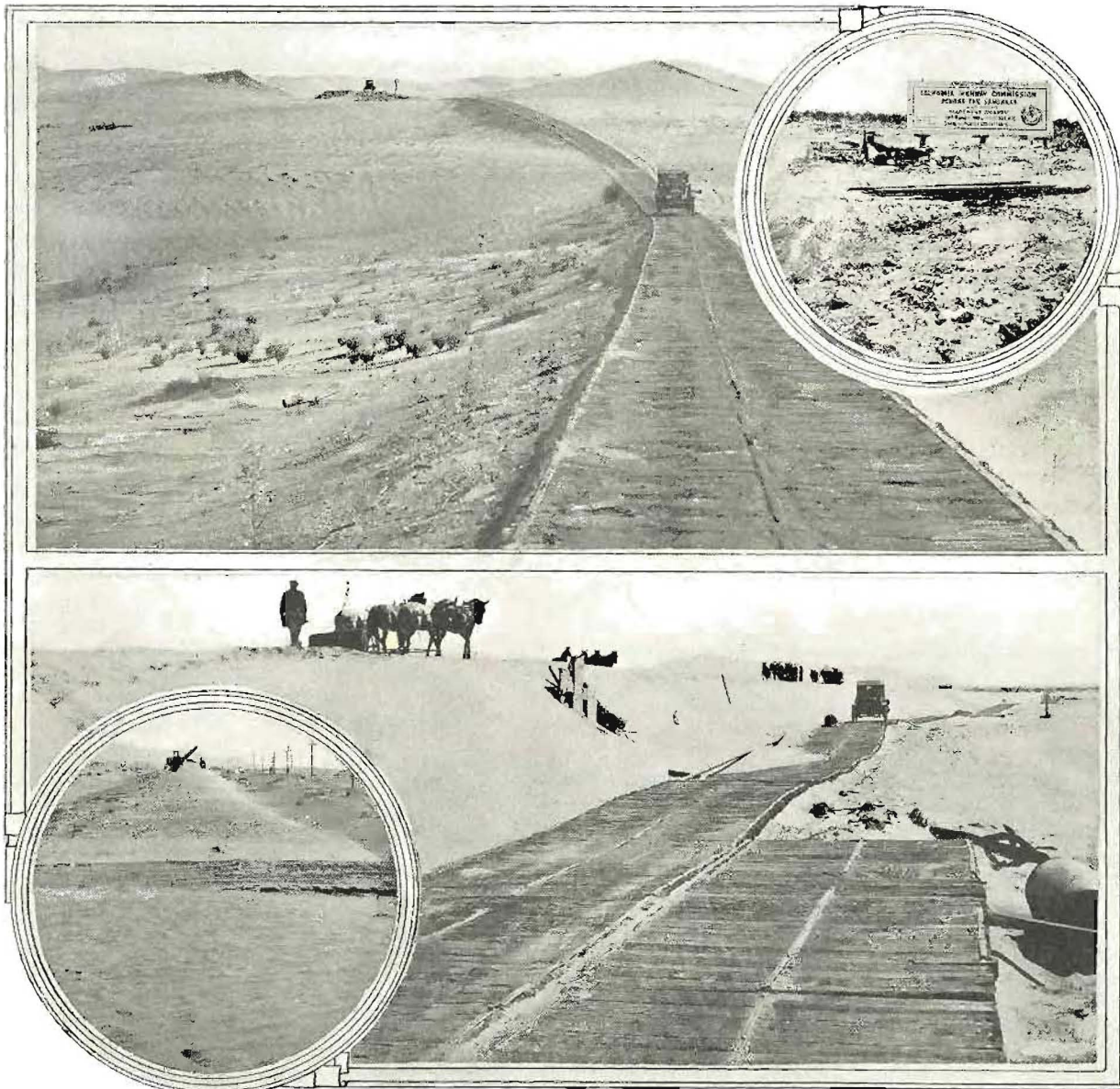
CALIFORNIA HIGHWAYS

A BULLETIN ISSUED BY THE CALIFORNIA HIGHWAY COMMISSION FOR THE
INFORMATION OF ITS EMPLOYEES AND THE PUBLIC

Vol. 3

AUGUST, 1926

No. 8



ACROSS THE SAND HILLS—Views on Sand Hills paving project in Imperial County. *Above*, narrow plank road crossing dunes now eliminated; *Below*, two views of grading operations; both teams and power shovels were used in building new grade upon which twenty-foot pavement has been placed.

In this issue: SPECTACULAR SAND HILLS PROJECT OPEN TO TRAFFIC—RESEARCH ENGINEER DISCUSSES STRENGTH OF CONCRETE.

CALIFORNIA HIGHWAYS

This Bulletin is published by the California Highway Commission for the information of its employees and the public. Editors of newspapers and others interested are welcome to use, without restriction, any of the matter herein contained. Cuts will be gladly loaned upon request.

FRANK B. DURKEE - - - - Editor
P. O. Box 1103, Sacramento, California.

Vol. 3 AUGUST, 1926. No. 8

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BETTERMENT WORK BRINGS LETTER FROM SANTA CLARA CITIZEN.

BBETTERMENT of the state highway system goes constantly forward from year to year. Maintenance foremen are always planning their work ahead to the time when funds will be available to improve their sections. Shoulders are widened, curves are eliminated; always the highway is being made better and safer.

Recently Foreman E. Martinsen of Division IV "daylighted" a curve on the San Jose-Santa Cruz route. The improvement was so apparent that a resident of the neighborhood sent the following letter to Division Engineer J. H. Skeggs:

Wright, Calif., May 21, 1926.

Mr. Jno. H. Skeggs,
Division Engineer.

Dear Sir:

On behalf of motorists in general and of our district in particular, I desire to express grateful appreciation of the wonderful improvement made under your direction in "day-lighting" the turn at road IV SCI-5-B-3, near Woodwardia.

If you could hear the many favorable comments you could not help feeling gratified.

Thank you for handling the matter so splendidly.

Yours sincerely,

W. L. CRICHTON.

GOOD ROADS AND TRAFFIC.

Ham's Station, on the Alpine state highway leading from Jackson, Amador County, over Kit Carson Pass into Alpine County, reports that but three automobiles passed over this route during the summer of 1913. On July 3d and 4th of this year over 3000 cars passed Ham's Station. Since 1913 the road has become a part of the highway system and during the last few years has been considerably improved by Division X. It is under state maintenance for its entire length.

EVERY employee of the highway commission has a direct interest in the improvement of the highway organization's methods and results, both engineering and clerical, office and field. To that end, the State Highway Engineer invites constructive criticism or suggestions from every employee.

Ideas as to the more economical and efficient handling of your job, or suggestions for elimination of waste will be welcomed. Criticism is also desired from persons outside the organization, who are in a position to give facts.

Send only signed communications addressed as follows: California Highways, P. O. Box 1103, Sacramento, Cal.

Interstate Connections and Other Major Projects

THE OPENING to traffic of the Imperial County Sand Hills paving project calls attention to what has been recently accomplished by the California Highway Commission, looking to the completion of trunk highways and interstate connections. The section of pavement across the Sand Hills, removing a particularly objectionable barrier on a southern entrance to the state, comprises but seven out of 300 miles of improved highway on interstate connections, completed during the last three and a half years.

On the same route, an almost impassable road from the Sand Hills to the Colorado River, opposite Yuma, has been succeeded by a splendid graded and surfaced highway. And west of the Sand Hills the gaps between El Centro and Holtville and Holtville and the Highline canal have been graded and surfaced on alignment that is a marked improvement over the former county road.

To the north, one contract for grading and surfacing on the Mecca-Blythe highway has been completed and others are under way, while the entire route is under state maintenance.

Likewise the National Old Trails route through San Bernardino, and the recently added Silver Lake cut off on the Arrowhead Trail, in San Bernardino County, have both been placed under state maintenance, while grading and surfacing on permanent location has been completed through Barstow as far east as Daggett and at other places along the route. Dangerous grade crossings in Barstow and at Oro Grande have been eliminated.

The trunk highway extending northward from Mojave through the Owens Valley, and beyond, has been vastly improved under state maintenance which practically amounts to construction; for miles the road has been placed on a permanent location.

In the northern part of the state, the Truckee River highway stands out as a major accomplishment. Built despite many difficulties, this great road provides California with a water grade from Donner Lake to the Nevada border, opening the eastern doorway to welcome transcontinental travel to the west. On the same route the Donner Summit has been crossed by a remarkable section of highway, blasted from solid granite, that eliminates

forever the 20 per cent grades of former years. Other projects have been completed east of Auburn.

The last unimproved gap in the great Pacific highway, the heaviest traveled of all the interstate connections, has been removed, while many thousands of dollars have gone into reconstruction projects north of Redding to bring this highway up to standards of alignment and grade that will make it the equal of any mountain highway in America. Its death curves are being done away with while great bridges span its canyons.

In far off Del Norte County, the great Redwood highway, just now beginning to have a place among the famous roads of the Nation, has been uncorked by the elimination of the dreaded grade over Gasquet mountain. In the place of this monotonous climb there has been substituted an inspiring highway along Smith River, which is yet to be discovered by large numbers of motorists. The Klamath River has been bridged; the Big Lagoon crossed, while a convict camp is finishing the road into Crescent City.

These are only a few of the larger projects. Much has been done on the minor interstate connections to provide good, travelable highways leading to the borders of California. All unconstructed state highways have been taken over for maintenance, which is contributing effectively to the improvement of many of the lateral roads. Maintenance generally has been given more consideration and is more efficient than ever before.

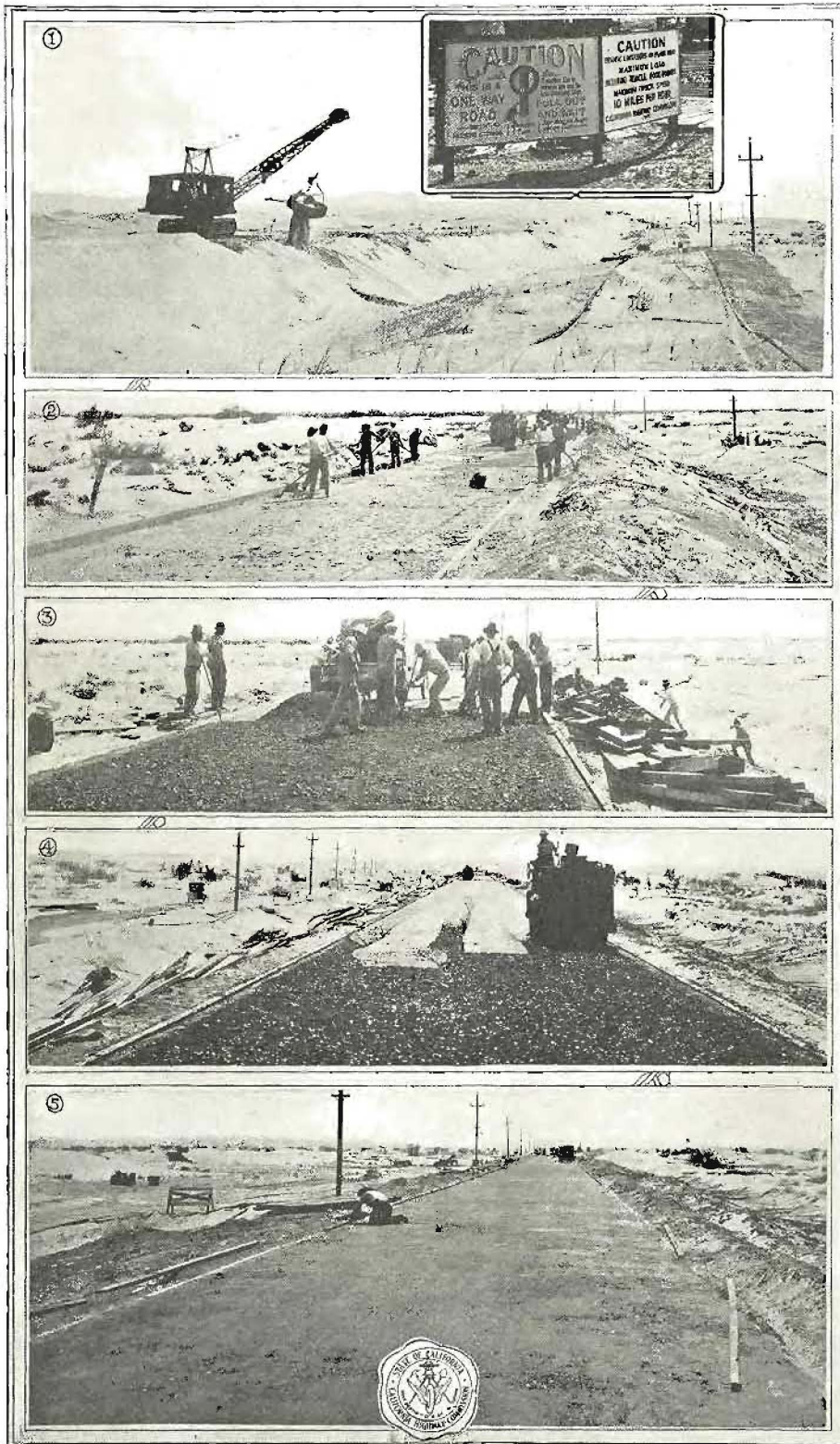
All this has been done and more; the great Yosemite Valley has been opened by the new Merced Canyon entrance to comfortable travel at all seasons of the year; the beaches of the southern coast, many heretofore inaccessible, are now paralleled by a broad highway, for the most part paved; the Rincon seawalls have been built; a high standard highway has been started around Lake Tahoe; a gigantic program of reconstruction that contemplates widening and thickening of trunk highways, elimination of grade crossings, sharp curves and other dangers, and the rebuilding of bridges, has been begun.

What has been done is the realization of what the commission proposed, when, in 1923, it announced the policy of concentration of construction funds on main trunk lines and interstate connections and reconstruction of previously built highways in accordance with the demands of traffic.



OILING REDWOOD HIGHWAY Experimental oiling of a considerable section of the Redwood highway has been under way during the Summer. *Left*, newly oiled section of rock-surfaced highway; *Right*, salvaging rock from the loose material broomed off the highway prior to oiling. Brooming permits oil to penetrate into rock surface. (Photos by Division I.) See article on page, ten.

Spectacular Sand Hills Project Open to Traffic



PAVEMENT ACROSS SAND HILLS—Scenes on spectacular project on El Centro-Yuma interstate connection, Imperial County, Division VIII. Sides of embankment will be oiled to prevent erosion of sands by wind. Asphalt concrete was placed in two courses. Bottom view shows base course completed.

DOWN near the border in a land which has provided the desert locale for hundreds of American films—the famous Imperial County Sand Hills—the California Highway Commission through an able contractor is completing one of the most spectacular paving projects in America. Despite the terrific heat of the desert grading and paving operations have gone steadily forward and the seven-mile barrier of shifting dunes is being conquered with a firm, smooth pavement, twenty feet in width.

The pavement has been completed and opened to traffic and finishing of other necessary work by September 15th is promised.

The solving of the problem of the Sand Hills has been before the highway engineers of California since 1911 when the department was first established. Agitation for a connection with Arizona at Yuma, over which motor vehicle travel would be possible, resulted in 1916 in the building of the present plank road, largely by public subscription. This road, eight feet in width with turn outs, was constructed in sections to make possible its shifting about with the changing contour of the dunes of light blow sand in constant motion under wind action.

Traffic Demanded Solution.

Rapid deterioration of the plank road, the only crossing of the Sand Hills, and increasing traffic of recent years made its replacement imperative if the Borderland transcontinental highway were to be kept open. Following the establishment in 1923 of Division VIII a study of desert road conditions was begun, including a crossing of the Sand Hills.

Preliminary surveys were run and stakes several feet in height placed to measure the extent of the movement of the sand during wind storms and at other times. Various types of roadway and pavement were proposed and given careful consideration. Early studies centered about the idea that the roadway must be of a movable character to permit raising and shifting with the advance of the encroaching dunes. After long consideration of the cost and other objections to such a road, either of timbers or concrete slabs, the initial plan was abandoned for another which called for a pavement located upon a grade line above the height of the surrounding

dunes. A permanently located road was believed the only one that would adequately serve present and future traffic into California over this route.

The bold plan of permanent paving was finally adopted and approved by State Highway Engineer R. M. Morton.

Commission Drills A Well.

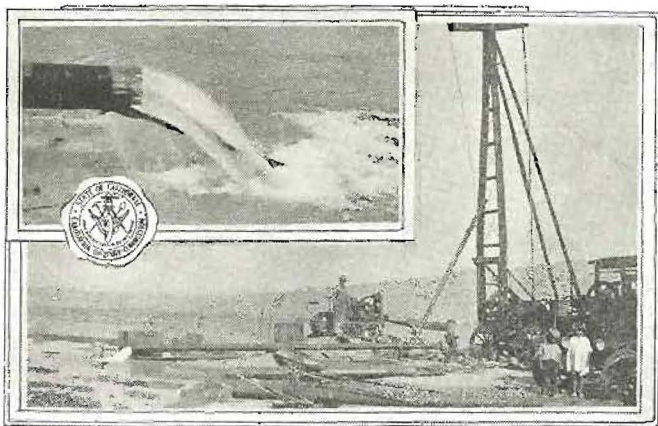
An interesting development during the course of the investigation was the boring of a well in Open Valley, a small open tract on the route of the highway almost in the center of the Sand Hills, which for some unexplainable reason has not been inundated by the advancing sands. There was no water supply for many miles. Water requirements would greatly increase the cost of the work, regardless of the type of pavement finally decided upon. Some scoffed when the commission began drilling in the middle of the desert, but to the surprise of everyone a flow of 500 gallons of water per minute was struck at a depth of 92 feet. Drilling was continued to a depth of 153 feet. This well put down by the commission at a cost of \$1,350 solved the water question and saved the state many dollars in connection with the Sand Hills project. It has been a factor of utmost importance.

Having decided upon a permanent location and grade for the highway, bids were asked on alternative types of pavement. The contract awarded calls for grading and placing of an asphalt concrete pavement in two courses. The base has a thickness of four inches and the wearing surfacing two inches. A special feature of the project is the thickened edge of nine inches, the specifications providing that this part of the base must be hand tamped when placed.

No pavement was placed until after the subgrade had been drenched with water to a penetration of three feet, which packed the soft blow sand into a comparatively firm subgrade. Sufficient water for this purpose was furnished by the commission's well in Open Valley.

Slopes to be Protected.

To prevent wind erosion of the embankment slopes, the contract includes the oiling of all shoulders and slopes to form an oil cake.



State well, Sand Hills project.

The grading was done by two dragline outfits working twenty-four hours a day to keep ahead of paving operations.

Careful determination has been made of the height of such dunes as are likely to encroach upon the new highway, and a grade line has been established to conform to this height. By thus elevating the grade it is expected that likelihood of the highway being engulfed by shifting sand has been minimized. No permanent encroachment is believed possible.

Project Attracted Attention.

The unusual features of the Sand Hills project interested a number of contractors. The successful bidders were Schmidt & Hitchcock of Phoenix, Arizona, a firm thoroughly familiar with

the desert conditions under which the work must be done. Their bid for building embankment was 14½ cents per cubic yard, the state assuming the liability for sand blown away during storms. The contract price for asphalt concrete mix was \$7.60 per ton. The bid is reasonable considering the isolation of the job. The mixing plant is located on the Southern Pacific railroad 9.5 miles from the project. To date the state has suffered little additional expense because of the liability assumed on the grading.

The Sand Hills job of 6.45 miles is a notable California Federal aid project. The total estimated cost, including a short extension, is \$340,000. Preliminary locations were made by F. R. Goodwin under the direction of E. Q. Sullivan, Division Engineer. F. R. Baker is resident engineer.

The Sand Hills of Imperial County have now been converted from a dreaded barrier to another of California's unusual and marvelous attractions, safely and comfortably accessible by automobile; another door has been opened on an important interstate connection.

PERMITS TO CROSS HIGHWAY WITH CATERPILLAR-TYPE TRACTORS NO LONGER REQUIRED.

Division engineers have received the following order regarding the movement of tractors on the State highways from T. H. Dennis, acting maintenance engineer:

Hereafter permits will not be required of tractor operators desirous merely of *crossing* the highways, providing the equipment used has its propulsive power exerted not through wheels resting upon the ground but by means of a flexible band or chain known as a movable track, when the portions of the movable tracks in contact with the surface of the highway present plane surfaces. Where the track in contact with the surface of the highway does not present plane surfaces, filler blocks must be used.

A hard surfaced highway, 265 miles long, has recently been completed between Kansas City and St. Louis. It is now possible to go from the Atlantic coast to central Kansas without hitting earth roads.

TO THE ROAD BUILDERS

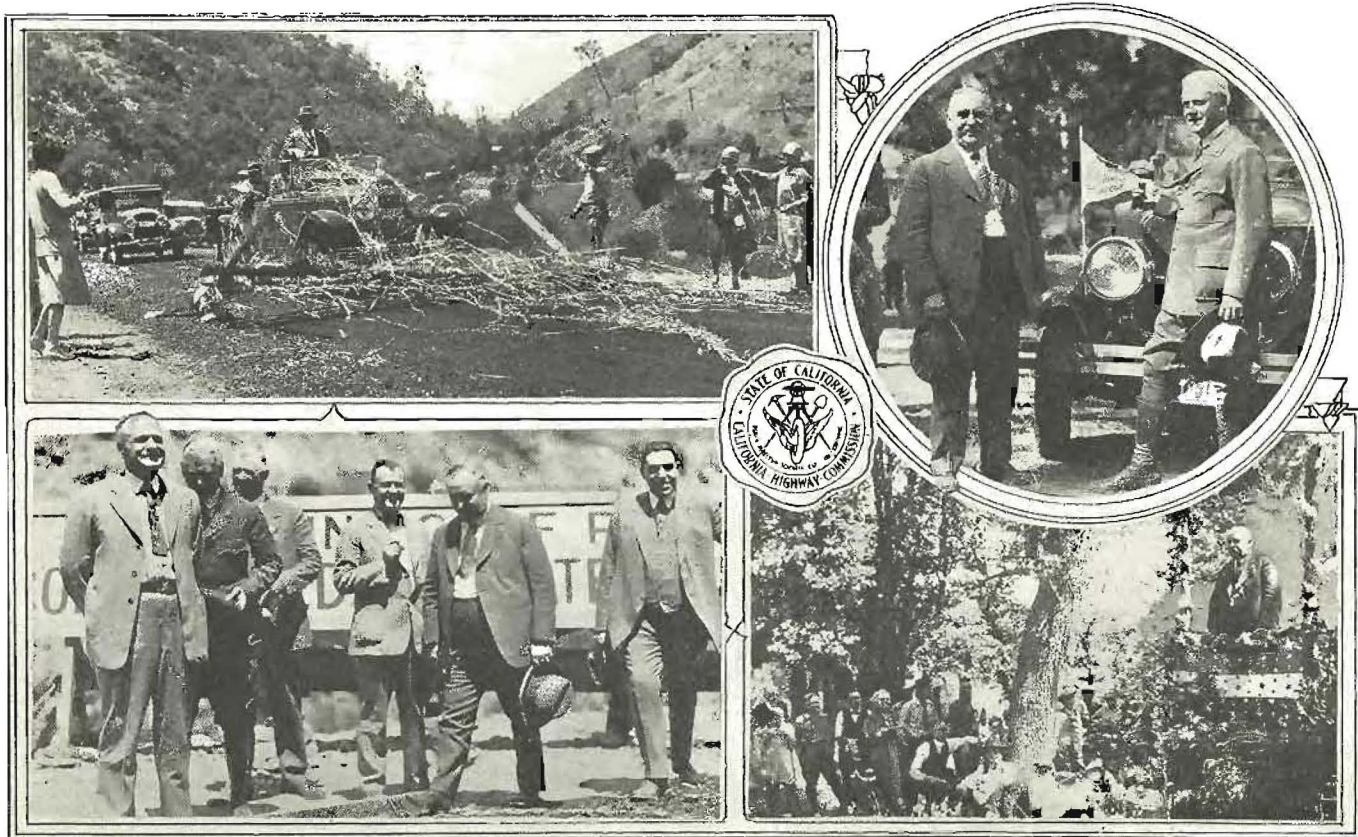
IN WESTERN Arizona where the word Pioneer can still be used in every day parlance when speaking of our present settlers, who have conquered the natural obstacles and wrested from broiling sands a wonderful Empire, it is fitting to give recognition to the engineering staff and builders of the great Sand Hills Highway project.

The last great barrier on the great transcontinental Lee Highway will soon be history. Replacing these worn and twisted planks of past days, will be a well constructed, hard surfaced road. * * *

And all this we owe to the intrepidity of the engineers and contractors who undertook to construct this highway. To these men is due the credit for bringing about an engineering achievement.

What a fitting combination in the construction of this road; engineered by the California State Highway Commission Engineering Department and contracted and built by Schmidt and Hitchcock of Phoenix. Just as these two great states have been brought closer together by the actual building of the road, it was likewise the combination of the road building skill of the two states that eradicated the last barrier in quick transportation over the desert.—*Yuma (Arizona) Examiner.*

WHEN THE YOSEMITE ALL-YEAR ROAD WAS DEDICATED



CARAVAN OPENS HIGHWAY—Upper left, Governor Richardson's official car crashes barrier on All-year road; Upper right, The Governor and Director Stephen T. Mather of the National Park Service exchange greetings; Lower left, State and National officials in happy mood—Left to right, Commissioner Nelson T. Edwards, Director Mather, Commissioner Louis Everding, R. M. Morton, State Highway Engineer, Governor Richardson, Chairman Harvey M. Toy; Lower right, Governor speaking at dedication ceremonies at Clark Ranch. (Photos by James V. Lloyd, Yosemite National Park.)

NEW YOSEMITE ROAD SAVES MOTORISTS FUEL

THE CONSTRUCTION of the new Briceburg all-year highway into the beautiful Yosemite Valley furnishes excellent material for publicity to be used in "good roads" campaigns. Recently, the Gilmore Oil Company of Los Angeles sent a "scout car" over the new highway and then over the old Wawona road into the valley in two test trips to determine just what the new road construction will do for the motorists of California. And this is one of the outstanding features of the report the members of the scout car party made following the test:

By a compilation of figures based on the saving of gasoline

alone for the 500 cars entering and leaving the park every average day, it was revealed that the saving in engine fuel alone would amount to approximately \$156,185 annually.

In addition, there is a saving of one pint of oil for each car, a tremendous decrease in the amount of depreciation on the cars and the almost incalculable value of the increased comfort provided by the new road. Such figures are active proof of the contention of highway experts that good roads soon pay for themselves and then proceed to make money for the territories which they serve.—*Western Highways Builder.*

SEEK NON-SKID ASPHALT SURFACE

ASPHALT-COATED screenings have been used for finishing 2.8 miles of the widened and thickened trunk highway near Delano, Kern County, Division VI. Thirty pounds of asphalt to a ton of screening was used, and the result seems to be the type of asphalt surface engineers have long been seeking. Screenings thus treated, it is believed, will stock and close the pavement, and at the same time leave the surface somewhat rough. The purpose of the experiment is to lessen the danger of skidding of motor vehicles.

Travel over the Big Oak Flat road into Yosemite Valley took a decided slump for a few days after the opening of the new all-year highway, but rangers at the checking station report that after the first few days, traffic started to pick up again and on August 6th and 7th was back to within a few cars of normal.

LIGHTING TRIED AS CROSSING WARNING BY DIVISION X.

Division X has been conducting an experiment with illuminated warning signs at two railroad crossings near Tracy. Ten Westinghouse lighting units were installed, six at one crossing, and four at the other. The lights were found to be effective as highway lighting units but not as a warning to traffic. It was the expectation that traffic would slow down on approaching a well-lighted area, but this did not prove true upon trial.

Distinctive illuminated warning signs are soon to be placed at these crossings, and two of the lighting units will be retained at each crossing to illuminate the crossing itself and show up clearly passing trains.

Relation of Voids in Aggregate to Strength of Concrete

By C. L. McKesson, Materials and Research Engineer.

ONE OF the outstanding and inspiring features of the period through which we are passing is the increasing evidence of a desire on the part of our large producers to assist in the development of the sciences relating to the use of their products. The Asphalt Association and the Portland Cement Association have, during recent years, maintained research agencies and have expended large sums of money in the effort to point out better and more economical ways in which their products may be used.

A few months ago the National Crushed Stone Association secured the services of A. T. Goldbeck, one of the world's best known research engineers, as director of their research department. About the same time, National Sand and Gravel Association employed Stanton Walker, a well known research engineer of the Structural Materials Research Laboratory of Chicago, in a similar capacity.

In taking the modern viewpoint, the producers are undoubtedly prompted by the desire to render better service to the public and by the knowledge that better and more economical usages of their materials are sure to result in increased demand.

In order to point out how rock and sand producers can render substantial assistance in improving concrete, it seems desirable to discuss, nontechnically, some of the fundamental considerations involved in the economical use of concrete materials. Most of you are familiar with these fundamental principles, but by presenting them, perhaps in a slightly different way, their vital importance may be more forcibly brought out.

The term "Better Concrete" should be understood to mean the desired strength for the least possible cost. Compressive strength will be used in this discussion as the measure of quality because concrete is largely used for purposes in which compressive strength is required and because it has been well demonstrated that flexural strength, surface hardness and resistance to alkalis bear well defined general relations to the compressive strength. Compressive strength is easy to determine. Large numbers of tests can be made for a moderate expenditure.

In securing high strength at low cost it is necessary to bear in mind that cement is, relatively, the most expensive ingredient in concrete. Pound for pound it costs probably about five times as much as sand and rock. This differential in cost between cement and aggregate suggests that any change in design which will maintain a given strength and reduce the quantity of cement is desirable. From another viewpoint, any improvement in the design of concrete which will increase the strength without increasing the quantity of cement is of equal value. In the design and construction of pavements, it is not possible to anticipate all of the stresses and destructive forces to which concrete will be subjected and we, therefore, strive to secure the maximum possible strength without increased cost for cement.

That this result is being accomplished wherever there is careful, scientific supervision of the work, is now a matter of general knowledge. 2000 pound to 2500 pound twenty-eight day concretes have, in the past, been considered satisfactory. In some localities, such strengths are still the rule, but in our work, and on other work similarly conducted, due to the cooperation of engineers, contractors and materialmen, there is little difficulty in securing 3500 pound to 5000 pound concretes with the same amount of cement as was formerly used.

Sometimes the requirements of our modern specifications may seem unnecessarily precise and producers are entitled, if they are to be asked to cooperate, to full knowledge of the purpose of these requirements. There is nothing new in the principles which we are applying, but the methods of application may differ from those used in other places.

Much has been said and written in recent years regarding the phenomenon that strength in concrete bears a general relation to the amount of water used to produce workable concrete. Variations in quantity of mixing water are an effect rather than a cause and in giving too much consideration to this effect, there may be a tendency to lose sight of the causes producing it. In the illustrations hereinafter used, it will be assumed throughout that the quality of the aggregate is uniform and that enough water is used to produce workable concrete with approximately a 1-inch slump (the present practice in highway paving work in this state).

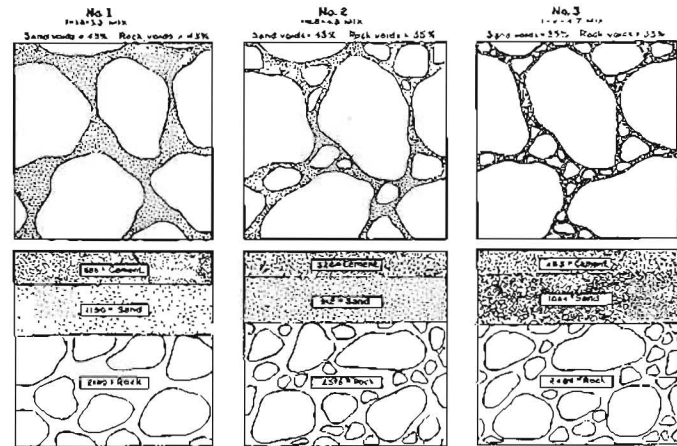
Figure Number 1 shows the effect of grading of aggregate in concrete. Typical cross-section views are included, First, of

concrete made with voids of 45 per cent in both sand and rock; Second, of concrete with 45 per cent of voids in sand and 35 per cent voids in rock, and Third, of concrete with 35 per cent voids in both sand and rock. It has been found by experimenters that the minimum voidage for spheres of one size is approximately 44 per cent regardless of the size of the spheres. It is not unusual to secure coarse aggregate containing voids as high as 45 per cent (in loose material) and very well graded coarse aggregate is sometimes secured with voids as low as 35 per cent. Sand likewise shows voids varying between 35 per cent and 45 per cent according to grading and shape of particles. The examples as shown are, therefore, well within the range of probabilities of concrete construction work.

Almost invariably in practice, high voidage in sand is found to be associated with a sand consisting mostly of fine particles. Another undesirable characteristic of fine sand is that the surface area to be coated with cement increases very rapidly as the size of the particles is decreased. It has been shown that sand consisting entirely of 1/4-inch particles would have a surface area of 518 square yards for each cubic yard of sand. Twenty-mesh sand has an area of 3325 square yards and fifty-mesh sand of over 10,000 square yards. This condition has long been taken into consideration in the design of asphaltic mixtures, but has often been lost sight of in the design or preparation of concrete mixtures.

Referring again to Figure 1 in Concrete Number 1, we find a large area between the rock particles which must be filled with mortar. The sand being poorly graded and having a high surface

Effect of Grading of Aggregates
SKETCHES SHOWING CROSS SECTIONS OF CONCRETE WITH VARIOUS VOIDS IN SAND AND ROCK FIG. 1



Relative amount of materials for 1 cu yd. of concrete as shown above
variability and strength remaining approximately constant

area, requires additional cement to fill the voids between the particles and to coat their surfaces. In this figure, an attempt has been made to show concretes of approximately the same strength, and in order to secure adequate mortar strength in this concrete, it is necessary to use a 1-1.8 mortar.

In Concrete Number 2, the sand is of the same inferior grading and the same richness of mortar is, therefore, required. In Concrete Number 2, however, it will be noted that smaller pieces of rock fill a considerable portion of the space between the larger rock particles. The rock, in this case, is well graded from fine to coarse and in thus using well graded rock, the volume of mortar required is greatly reduced.

In Concrete Number 3, a well graded sand is used. The larger particles of the sand are next in size to the smaller particles of the rock. The sketch is intended to show the manner in which these coarser sand particles decrease the area to be filled with fine sand and cement and they also greatly decrease the surface area to be coated with cement. Using a coarse sand in proportions of one part of cement to two parts of sand will give as great or probably a greater strength than can be had with the richer mortar used in Concretes Number 1 and Number 2.

The lower part of Figure Number 1 shows the component

parts of one cubic yard of concrete of each of the different mixtures, workability remaining approximately constant.

It will be seen that Concrete Number 1 contains nearly 50 per cent more cement than Concrete Number 3. In this case, proper grading of material has resulted in displacing 230 pounds of cement with approximately the same amount of sand and gravel. This displacing of expensive cement with inexpensive sand and gravel has a very appreciable effect on the cost of concrete as is shown by Table Number 1. Between Concretes Number 1 and Number 3 this saving can easily amount to \$4,000 per mile.

Figure Number 2 shows graphically the cost per cubic yard of materials in Concretes Number 1, Number 2 and Number 3.

In the preparation of specifications for concrete materials limits of grading are specified as a means to an end. It has been found by experimentation that certain gradings are associated with low percentages of voids in ordinary materials. Void determina-

TABLE 1.
COST OF MATERIALS.

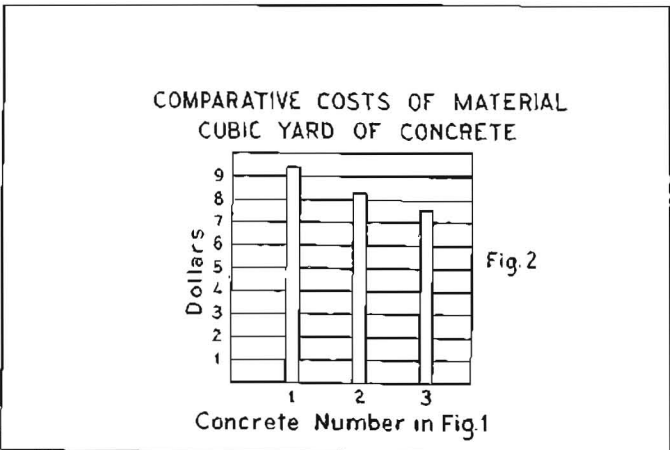
Cement \$3.00 per barrel. Sand \$2.00 per ton. Rock \$2.40 per ton.

Material	Concrete No. 1	Concrete No. 2	Concrete No. 3
Cement	\$5.47	\$4.20	\$3.48
Sand	1.19	0.91	1.07
Rock	2.62	3.09	2.99
Total per cubic yard concrete	\$9.28	\$8.20	\$7.54
Per mile of pavement—2330 cu. yd.	\$21,344.00	\$18,860.00	\$17,342.00

tions have, in the past, been considered as rather difficult to make in the field and the practice has grown up of specifying the grading which is expected to produce low voidage rather than to specify the percentage of voids desired. This usual method, while having the merit of providing a simple screen test, is open to the objection that it does not always insure low voidage.

Samples of screened gravel have been tested in our Laboratory within the last year which, when graded to theoretical maximum density grading, still contained approximately 55 per cent of voids. This was due to the shape of the particles, and grading specifications in this case failed utterly in securing desired low voidage in the material. Usually, however, a uniform grading of particles from fine to coarse results in low percentage of voids and low surface area.

It is quite likely that the wide variation in specified gradings of sand and rock found in different specifications is due to different results obtained with different materials by investigators who were attempting to secure gradings which would give

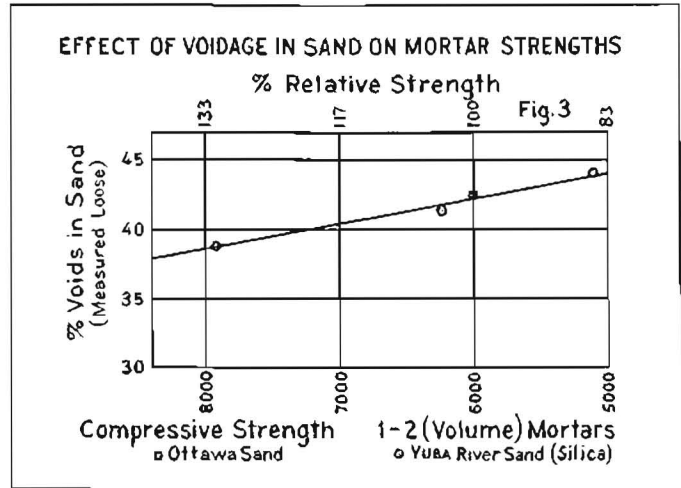


low voids. Engineers sometimes lose sight of the fact that the real object to be attained is to secure the lowest possible voidage in the quarry or pit product.

It is in this matter of securing properly graded aggregate with a low percentage of voids that the producer can render real service to the public. Sand and gravel which is properly graded to produce low voidages has a greater value to the user than poorly graded material and if there is some additional cost involved in producing such material, the user should be glad to bear this added expense with the knowledge that it is saving him much more, by giving increased strength or, for a given strength, by reducing the amount of cement required.

There is another advantage from the producer's viewpoint in that the quantity of rock and sand required is greater for a given volume of concrete when the material is properly graded than when it has high voidages to be filled with cement.

Table Number 2 shows the quantity of material per mile of pavement for Concretes Numbers 1, 2 and 3 in Figure 1. From this table it will be seen that the use of the better graded material results in substituting approximately 250 tons per mile of rock and sand for an equal amount of cement. In other words, proper grading would result in about 6 per cent more sand and rock being used.



Thus far, the matter has been considered entirely on the basis of assuming that more cement can and will be used to secure a given strength. Instead of increasing cement because of poorly graded aggregate, it is much more usual, where the use of such aggregate is permitted, to accept greatly reduced strengths.

The matter will now be discussed on the theory that the amount of cement to be used remains constant. In this case, improvement in the grading of the aggregate will be reflected by increased strength in the concrete. With a sand in which the particles, both fine and coarse, are of equal soundness and structural qualities, the mortar strength increases very rapidly with decreased voidage.

Figure 3 shows the results of tests in our Laboratory with natural sand consisting almost entirely of water-worn particles of silica. In this case, variation from 44 per cent voids to 38 per cent voids resulted in an increased mortar strength of nearly 3000 pounds per square inch. In concrete with this same material, the increased mortar strength due to 6 per cent lower voids would

TABLE 2.
QUANTITY OF MATERIAL.
TONS PER MILE OF PAVEMENT.
(2300 Cubic Yards.)

CONCRETE.

Material	No. 1	No. 2	No. 3
Cement	780	605	534
Sand	1350	1050	1223
Rock	2490	2965	2862
Rock and sand combined	3840	4015	4085

NOTE.—This table assumes that concrete of equal density can be obtained. It is difficult to secure a high degree of density with poorly graded material as used in Number 1 Concrete. With lower density the quantity of material used would be slightly less and material would be replaced by air voids in concrete.

be reflected by an increase of at least 1000 pounds in the compressive strength of the concrete.

In Table Number 3, the probable strength of concrete using six sacks of cement to the cubic yard is shown with varying voidages in rock and sand. The sand used in this case is of a quality equal to that used for the tests, results of which are shown in Figure Number 3.

Poorly graded material used in Concrete Number 1 gives an estimated strength of 2800 pounds per square inch as compared with 4800 pounds per square inch with well graded aggregate used in Concrete Number 3, the amount of cement per cubic yard remaining constant. These figures may seem startling, but from our observation and experience in the Laboratory, they are in reality conservative.

(Continued on next page.)

DIVISION X GIRL IN LONDON TELLS OF ENGLISH PAVING METHODS

AN INTERESTING first-hand description of woodblock paving methods as followed in the improvement of London streets is contained in a letter from Miss Ruth Miles, received at the headquarters of Division X. Miss Miles, chief stenographer of the Division, is on leave of absence and is visiting England with relatives after which she expects to return to Sacramento.



RUTH MILES.

Miss Miles' letter indicates a keen interest in highway matters. Coming upon a street paving project in west London, she asked many questions of the superintendent in charge after which she wrote the division the following account of her observations:

"This is a brief description of work observed on Bayswater road, a prominent street, 38 feet wide, in the western section of London. The foreman gave us the following information as to materials and methods used:

As a base, there is placed 12 inches of concrete, pounded well, then a layer of cement and sand (floating dry) one inch thick. The next operation is to place one layer of dirt blocks, which have been previously 'pitched.' These blocks measure 9" long by 5" deep, and 3" wide. They are laid by hand, the street being improved half width at a time. The alternate rows of blocks are commenced with half blocks, and the trimming is done on the job with a knapping hammer which resembles somewhat a hatchet.

How Blocks are Trued up.

After laying a few rows the next procedure is to 'true up' with a wooden plank and sledge. It is found necessary sometimes to take out certain blocks and replace them with others,

or chop small pieces off before resetting them in the pavement. We saw the foreman go over the work and do this. Then we saw a 'higher official' appear on the scene, and he saw some irregularities. As he pointed them out, one by one, the blocks were taken out, and if not discarded were either turned over or reduced in size by the hatchet and then reset. Before the next operation, the chips were swept off the wooden surface and later placed in a sack. The next operation is the placing of a thin layer of black pitch melted with crude oil to fill the holes. This is then grouted with white cement and sand 1:1, spread on by brooms (hand-power).

Then a thin layer of 'shingle' ($\frac{3}{8}$ " rock) is placed and the road is completed. A space $1\frac{1}{2}$ inches wide is left at either side of the road to take care of the expansion. This is later filled with sawdust mixed with clear oil to pack it.

It is claimed that this type of surfacing will last from 12 to 15 years. The blocks may then be taken up and turned over when reconstruction takes place.

Inquires About Cost Data.

The foreman informed us that each block costs nine pence (18 cents). He also told us that four men working four hours had laid 16,000 blocks, and that the wage paid the men was one shilling, five pence, 'hapenny' (or 35¢) per hour.

These roads apparently are very substantial and to the motorist, smooth riding. It is claimed also that they are easier on horses than some other types, and in London one still sees many horses. The completed road presents a very even appearance and the traffic seems less noisy than on concrete pavement."

STRENGTH OF CONCRETE

(Continued from page 8.)

In some sections it is found that the larger sand particles are not quite as perfect in quality as the smaller, and this was taken into consideration in assuming that Concrete Numbers 1, 2 and 3 in Figure 1 would be of equal strength. As a matter of fact, if the sand consisted of pure silica particles graded as shown in the various mixes, Concrete Number 3 would not only be much less expensive, as is shown, but it would also be appreciably stronger.

During the last year we have had the opportunity to compare concretes on two jobs constructed in the same locality at the same time and using the same cement. The sand and rock in both cases was of high quality as to soundness of particles, but in one case a high standard of grading was maintained with low voidages; on the other, excessively fine sand was used. The amount of cement used per cubic yard of concrete was the same on both jobs. The average compressive strengths with the well-graded material averaged nearly 5000 pounds and on the job with poorly graded material, about 2000 pounds. In all fairness, it is to be noted that a somewhat wetter consistency was used on the job with the fine material, but the slump was reported as less than 2 inches and the specimens did not appear to have been excessively wet.

From the foregoing discussion it is very apparent that producers of sand and rock products can render great assistance in improving the quality of concrete and that for so doing, they can reasonably request some share of the saving effected, in proportion as it increases their cost of production. The service can be best rendered by assisting in establishing specification standards which will insure the use of sand and gravel with low voidages. It is necessary, if concrete is to be produced economically, that such materials be well and uniformly graded from fine to coarse at the time they are used. A high percentage of voids is always present when particles of the same size are loosely placed in a container.

Materials, may be properly blended and mixed at the producer's plant but if segregation occurs before the material is placed in the mixer, some batches will consist of coarse particles with high

voidage and other batches of finer particles with equally high voidage. The benefits derived from careful grading at the plant can be entirely nullified by segregation in handling. For this reason it is desirable that materials be furnished to the work in several sizes, each size well graded within its limits. Even then care is necessary in loading and unloading to prevent segregation of size. The design of plants in such a manner that materials can be furnished well mixed and well graded is essential, if the best concrete is to be secured for the least money.

TABLE 3.
PROBABLE STRENGTH OF CONCRETE.

Mix	Sand	Voids %	Rock	Approx. Comp. Strength
1-2-2-4	45		45	2805
1-1.7-4	45		35	4182
1-1.63-3.77	35		35	4875

Roads and Schools Worth Their Cost.

If it were not for the schools and the roads, it wouldn't cost much to run the state. But if it were not for the schools and the highways the state wouldn't be worth running.—Willmar (Minn.) Journal.

No action of the present State Highway Commission is of greater importance than that of widening the highways. Contractors are at work widening the Pacific highway between Redding and Dunsmuir and for miles three cars can run abreast. All our interstate highways should be at least thirty feet wide. The widening can be done with gasoline tax money as it comes under the head of maintenance and reconstruction.—Placerville Mountain Democrat.

DIVISION VI DRAGS PROVE EFFECTIVE MAINTENANCE AID

AFTER considerable experimenting Division VI has evolved a new type of drag which, the Division reports, has proved effective in the maintenance of shoulders and unpaved highway surfaces. It answers the need of the San Joaquin section so well that the plans are presented herewith for the benefit of other divisions that may be interested.

Plans for the Division VI drag were worked out after watching various types of equipment in operation and analyzing their effect on the roadway. These studies led to a decision to build a long drag with blades so arranged to cut the high spots and carry the material to the depressions. After experiments with drags of various sizes and construction, the Division has standardized on two types, one 7 feet wide and 14 feet long for rock surface and earth roads, and the other 5 feet wide and 12 feet long for shoulder work.

Wright Describes Construction.

Describing in detail the construction of these drags, W. K. Wright, assistant division engineer, writes as follows:

The frame of the larger drag is built of 3" x 12" lumber to which steel runners are bolted to provide a wearing surface. Old wagon tires have proved the best material for runners. Three-inch by 6-inch spreaders are used with $\frac{1}{2}$ " tie rods. The front blade is set at an angle and cut off 8" to 10" from the runner on one side to permit the accumulated material to pass through to the rear blade which spreads it evenly over the road. Blades too worn to be of further use on a grader are well suited for use on the drags.

The mold-boards for the blades are built with levers so that either end of the blade can be quickly raised or lowered.

This makes the machine particularly adaptable for cutting down excessive crown, pulling in material from the sides or building up the superelevation on curves. When equipped with sharp blades it has been used with success in smoothing oil macadam surfaces. A scarifer has been placed in the center of one drag with the idea of just scratching the high points. It works well if set in lightly, but a better method of holding the teeth is necessary and is being worked out. The weight of the road drag without the scarifer is 1500 to 1600 pounds.

Shoulder Drags Similar.

The shoulder drags are built of the same materials as the larger type and on the same plan. The weight of this drag, which is pulled by a small tractor or by a one-man grader, is about 1275 pounds. One particular advantage of this drag is that, in addition to pulling material against the pavement and leveling the shoulder, it leaves the pavement clean and with a distinct line at the edge.

The average cost has been about \$70 per drag, but this includes considerable experimental work. The scarifer attachment adds about \$20 to the cost.

A drag of the same type, but without regulating levers, has been built of old 30-pound narrow gauge railway steel. The weight and the cost are about the same as the timber drag. This drag is not as adaptable as the other types, but the cost of repairs is somewhat less.

While these drags have not entirely eliminated the corrugations in gravel surfaced roads, they have kept them to a minimum at a very low cost.

Credit for the drags should go to Carl F. Nelson, maintenance foreman at Cathay, and to B. W. Latour, general foreman at Fresno.

(See cuts and drawing next page.)

DIVISION I SALVAGING SURFACE MATERIAL REMOVED DURING OILING

PRIOR to making applications of asphaltic oil on sections of the Redwood highway, Division I, all loose surfacing material is broomed off to permit the oil to penetrate downward into the road surface. The loose material often contains considerable valuable rock.

To salvage this successfully, Division Engineer T. A. Bedford devised a screen built on wheels so that it may readily be moved from place to place. It is six feet long and the wheels have a four-foot tread. Mr. Bedford reports that two men can recover sixteen yards of rock per day at a cost of 50 to 75 cents per yard, depending upon the nature of the material.

When using a Number 10 screen 20 to 40 per cent of dust is found in the roadside sweepings.

Where it was desirable to recover portions of the rock mulch surfacing for covering the road after the applications of oil, the division devised an efficient method of removing the rock from the dust. A wire screen of 3/16-inch mesh was substituted for a portion of the blade of a Rogers scoop shovel. After a few preliminary shakes of the shovel roadside rock, free of dust, can be handled upon the road.

TRUCK OPERATORS PRAISE WORK OF MAINTENANCE CREW

ACLOUD BURST, which occurred recently in the Salton Sea region of Imperial County, did considerable damage to the trunk highway leading from the valley to Los Angeles, over which much produce is transported to city markets. The emergency was handled by a maintenance crew of Division VIII which opened the road following the storm with practically no delay to traffic.

The following letter of commendation has been received by the division headquarters at San Bernardino from one of the regular users of the highway:

As operators of a freight and express truck line between Los Angeles and Imperial Valley points, we wish to express our appreciation of the excellent work and efficiency shown in opening the highway to traffic after the storm of last week.

Although the highway was practically impassable the day after the storm, there was no delay in the movement of light cars and only a few hours delay in the movement of the large trucks. We were able at all times to maintain a reasonably regular schedule with all of our large trucks.

In view of the excessive amount of damage done to the highway by the cloud burst, we think the speed and efficiency shown by your local foreman, Mr. F. C. Davis, in opening the highway to traffic is worthy of special mention, and again we wish to express our appreciation of the work and the cooperation of both the officials of the Highway Commission and Mr. Davis.

(Signed) IMPERIAL VALLEY-LOS ANGELES EXPRESS.

By C. B. Dearing, District Engineer.

HIGHWAY WORKER FINDS GUN OF GOLD RUSH DAYS.

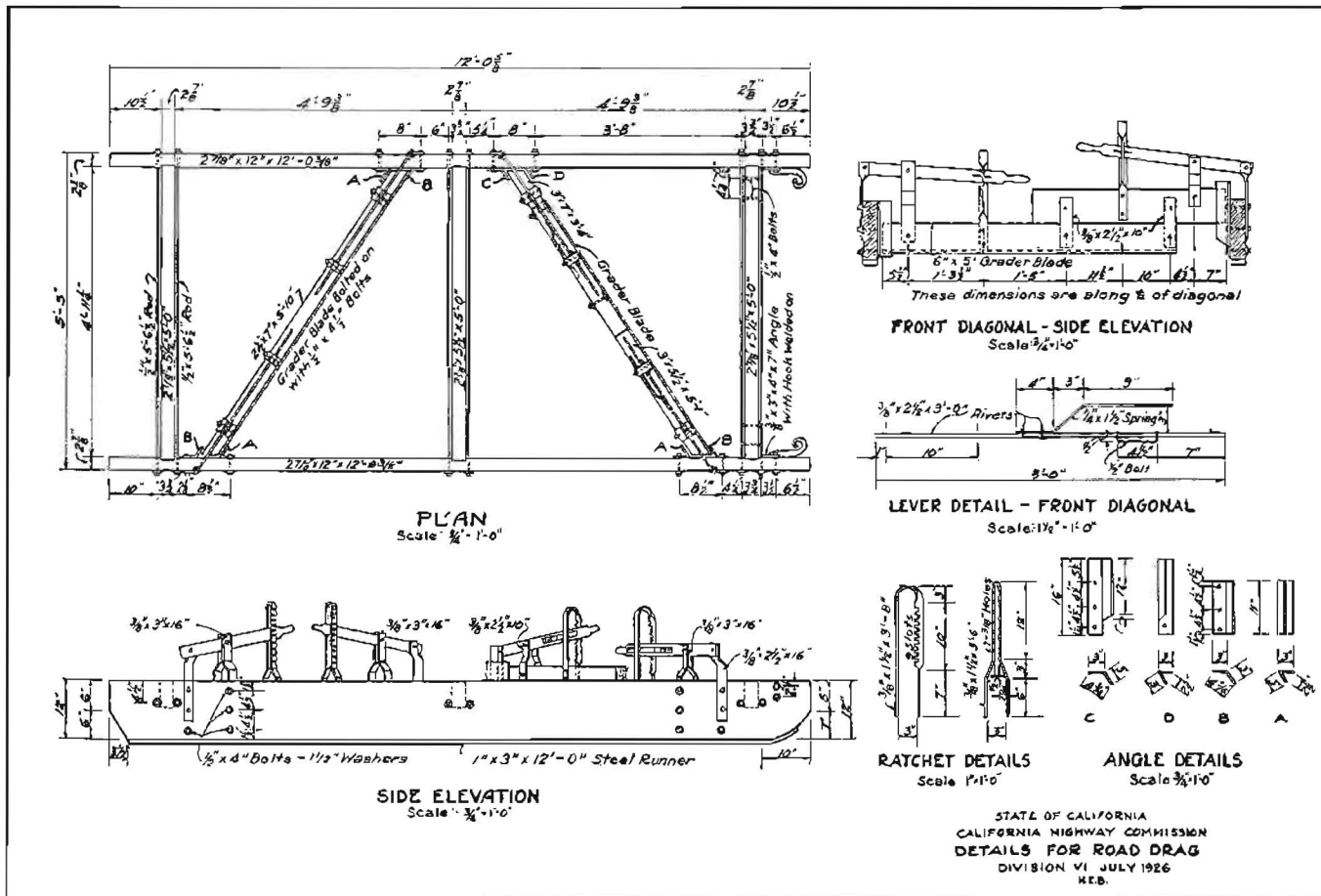
D. G. Hasse, bridge carpenter of Division X working on a bridge on the North Fork of Calaveras River, on the Mother Lode highway between San Andreas and Jackson, picked up, when excavating under the bridge, an interesting relic which is a real old time six gun of the ball and cap type.

It was fully loaded and protected by a holster, fairly well preserved. The holster was a left-hand one indicating that the owner might have been a two-gun man.

The Mother Lode country, particularly in the vicinity of this find, was the scene of much activity during the days of the gold rush.



DIVISION VI BUILDS DRAG—Views show equipment development by maintenance forces of Division VI for dragging of shoulders and earth and rock surfaced highways.



(See article on opposite page.)

WHAT THE DIVISIONS ARE DOING

DIVISION III.

HEADQUARTERS, SACRAMENTO.

F. W. HASELWOOD, DIVISION ENGINEER.

Counties of Butte, Colusa, El Dorado, Glenn, Nevada, Placer, southern Plumas, Sierra, Sutter, Yuba, and northern Sacramento and Yolo.

THE CONTRACT of Clark & Henery for the construction of 1.14 miles of asphalt concrete pavement on Del Paso boulevard, North Sacramento, is now well under way.

C. W. Rust is in charge of the work for the state's section. A full width street is being built with the cooperation of the municipality of North Sacramento. When completed this contract will provide a paved thoroughfare, 76 feet wide, through North Sacramento, a decided improvement over the present 18-foot roadway.

Preliminary studies for a line change at Newcastle hill have been made by the division.

Progress Around Tahoe.

A high standard highway which eventually will circle Lake Tahoe is beginning to take form. Work is now under way at four places around the lake on high standards and on final locations where deeded right of way has been secured.

Work is progressing on state highway relocation east of Placerville.

DIVISION VI.

HEADQUARTERS, FRESNO.

E. E. WALLACE, ACTING DIVISION ENGINEER.

Counties of Fresno, Madera, Merced, Mariposa, Kings, Tulare, and Kern, north of the Tehachapi.

ROCK spreaders attached to trucks were an interesting feature of an asphalt macadam surfacing job recently completed on the Merced-Yosemite lateral by Division VI. The macadam surfacing was placed to improve the concrete base, which was broken and uneven in places, the work being done under the so-called Riverside specifications.

A frame extension with a tail gate regulated by a long hand lever was built for each truck. One man rides the truck and regulates the flow of material. The truck backs over the material as spread, thus avoiding picking up or roughening the oiled sub-base.

The accompanying illustration shows spreading of material by this arrangement.



SPREADING ROCK—Division VI outfit on Yosemite lateral where uneven cement pavement was resurfaced with crushed rock and oil. Special spreader arrangement on truck.

The division is planning to take over for maintenance, on September 1st, the Kern River road from the end of the state construction at Democrat Springs to the county line. This will

open the road to traffic through Walker basin to a connection with the Bishop highway at Freeman. A maintenance station has been established at Isabella. Rough grading on the latter section has been done by Kern County.

Milk Trucks Kept Moving.

Fast work was required recently of a Division VI maintenance crew stationed on the Pacheco Pass highway. A car was wrecked at a wooden bridge, which caught fire and burned when the gasoline tank of the car exploded, leaving a forty-five-foot gap. A temporary crossing had to be built to get the early morning milk trucks from Los Banos out on schedule.

For the first two days the new Merced canyon entrance to Yosemite was open to traffic, July 31st and August 1st, 1195 cars passed over the road entering and leaving the park. Despite the fact that a control is on the road within the park because of paving operations, a heavy traffic is daily passing over this route.

Placing of cement concrete shoulders from Borden to Madera on the trunk highway in Madera County has been completed. The shoulders widen the highway to 20 feet.

Record Set up of Bunkers.

Record time was made by F. L. Richardson, of the headquarters equipment department, in setting up bunkers and a crushing plant for the production of rock for surfacing the Merced canyon highway. With only pick up labor available, Richardson had the plant turning out rock in two weeks time. The rock was urgently needed to complete the preliminary surfacing of the highway before the opening date. The plant is considered especially efficient.

W. B. Albertson, superintendent at the Bloss convict camp, is again on the job after an illness of several weeks. J. I. Boaz, of Division VIII, had charge of the work during the absence of Mr. Albertson.

DIVISION VII.

HEADQUARTERS, LOS ANGELES.

S. V. CORTELYOU, DIVISION ENGINEER.

Counties of Los Angeles, Ventura, Orange, San Diego, and eastern Kern, south of Mojave.

THE H. H. PETERSON contract for widening and thickening the state highway with "second story" between Ventura and Camarillo, Ventura County, a distance of 132 miles, is completed and opened to traffic. Construction of crushed stone borders is progressing rapidly. S. F. Corfield, former assistant division engineer of Division VI, is superintendent of construction for the contract.

The Fred Nighbert contract for widening of the pavement on the Ridge route, in Los Angeles County, along the inside of curves, where the alignment has been changed by state forces, has been extended to cover additional work. The contractor is now working between Big Swede cut and Reservoir hill, widening the pavement by constructing crescent-shaped areas of macadam.

Rock Borders Complete Project.

The placing of two-foot rock borders along the edges of 6.3 miles of recently completed concrete pavement through the Malibu Ranch between Las Flores and Latigo creeks has been completed. The 0.4 of a mile of bituminous macadam on fills subject to settlement is also in place. At Las Flores Creek, construction of a bridge by Los Angeles County is in progress.

Between Newport Beach and Corona Del Mar, on the Coast highway, the new concrete pavement is completed and open to traffic. Southerly from Corona Del Mar and extending to Laguna Beach, placing of bituminous macadam surface on a waterbound macadam base is nearly completed.

Grading has been completed and placing of crushed stone surfacing 24 feet wide, is practically finished on the Coast highway

between Laguna and Serra, in Orange County. The county is constructing a bridge at Aliso Creek.

San Diego Job Nears Completion.

Work is nearing completion on the Jahn and Bressi contract in San Diego County, where widening and thickening of the Coast highway is under way between Oceanside and a point near San Onofre. All concrete pavement is finished and placing of crushed stone borders is nearly completed. Traffic is using the new underpass where the highway passes under the Santa Fe tracks north of Oceanside. A new underpass under the Santa Fe tracks at Las Flores, to replace the present inadequate one, is under construction.

DIVISION VIII.
 HEADQUARTERS, SAN BERNARDINO.
 E. Q. SULLIVAN, DIVISION ENGINEER.
 Counties of San Bernardino, Riverside, and Imperial.

ACCOMPLISHING what was believed impossible, Schmidt and Hitchcock, contractors, continued paving operations across the Sand Hills in Imperial County throughout the summer and completed the seven miles of asphalt concrete pavement weeks ahead of schedule. The section is now open to traffic and oiling of shoulders and slopes is scheduled for completion on September 15th.

Several weeks prior to the completion of the Sand Hills paving job, grading and surfacing operations were finished between El Centro and Holtville, 9 miles, and between Holtville and the High-line canal, 7 miles. The state highway follows an almost direct line across the country, eliminating the right angle turns and other bad features of the old county road. A six-inch rock base was placed on both of these sections.

The three projects, all within Imperial County, complete the initial construction of the Borderland highway from Yuma, Arizona, to San Diego, California.

Other Contracts Finished.

Reconstruction of the state highway between Riverside and Ontario, Riverside County, a distance of 15 miles, has been completed. Asphalt concrete was used to widen and thicken the existing highway.

Grading and surfacing on the National Old Trails has been finished between Victorville and Hicks. This completes the improvement of this route as far east as its junction with the Arrowhead Trail.

Riverside County by court action has secured an order of possession for rights of way on the Mecca-Blythe state highway and a grading contract recently awarded by the commission will be under way shortly.

DIVISION X.
 HEADQUARTERS, SACRAMENTO.
 R. E. PIERCE, ACTING DIVISION ENGINEER.
 Counties of Amador, Calaveras, Alpine, Tuolumne, Stanislaus, San Joaquin, Solano, and southern Sacramento and Yolo counties.

CONSTRUCTION has been started on the westerly approach to the M street bridge which will improve the state highway entrance into Sacramento from the west. H. Brown of Sacramento has the contract for placing a cement concrete pavement, 30 feet in width. C. A. Potter will be resident engineer.

Placing of asphalt concrete surfacing on the Modesto-Stanislaus River project, in Stanislaus County, has been started by the Valley Paving and Construction Company. The cement concrete shoulders will widen the highway to 20 feet. J. W. Cole is state inspector on this job.

Mountain roads in Division X have had the heaviest traffic in history during the present summer. This has been coupled with a lack of water which tended to prevent the usual sprinkling in many places. Oiling has been extensively resorted to as a substitute and a considerable mileage has been thus treated during recent weeks.

The gravel road between the Sacramento County line and Central House, in Amador County, has recently been oiled much to the satisfaction of those along the route.

Experiment With Oil on Clay.

As an experiment, eight miles of clay road near Pine Grove, Amador County, was recently oiled in an attempt to keep the surface in good shape. The oiling was done when it became apparent that water holes were drying up so that the road could no longer be sprinkled. An application of approximately 1/5 gallon of 14+ fuel oil to the square yard was placed early in July. The road soon became dusty in spots, but held up well in other places. A second application of the same amount of oil was placed except where the first application was sufficient.

From present indications, this second application will keep the road in good shape for the balance of the season. It is necessary to drag the surface frequently to keep it smooth and free from pot holes and oil cake.

Heavy trucking over the Oakdale-Sonora highway has caused quite a few failures. Foreman L. P. Laird has a concrete mixer and crew at work replacing broken concrete. A new feature in connection with this patching is the edging of all patches to present a neat joint between the old and new concrete. These are easily filled with asphalt and present a far better appearance than a ragged joint not so edged.

Center Lines Painted.

Painting a center traffic stripe on all the concrete roads in San Joaquin County has recently been completed. The asphalt was sprayed on the pavement with a machine invented by Superintendent J. W. Bicksler and described in a recent issue of the Bulletin. Four widely separated roads were painted which necessitated a move between each job, but despite this fact eighteen miles of pavement were painted in two days. Gilmore 95 per cent asphalt was used throughout. On eleven miles of pavement, coarse sand was used to cover the asphalt and on seven miles a fine pea gravel was used. Both jobs present a neat appearance and will be closely studied to see which gives the best results.

HIGHWAY NEWS NOTES

CHARLES R. BLOOD, assistant maintenance engineer, has handed his resignation to State Highway Engineer R. M. Morton, effective on September 1st. Mr. Blood is resigning to accept a position as assistant to City Engineer Alan Wagner of Sacramento, former maintenance engineer in the state highway department. Mr. Blood has been with the commission since his return from service in France in 1919.

H. L. Montfort, until recently in charge of the Placerville-Lake Tahoe road, Division III, has been transferred to Division X, where he will be in charge of maintenance work on the Big Oak Flat road.

Division Engineer R. E. Pierce announces that A. M. Nash, formerly chief draftsman, has been placed in charge of all right of way work in Division X. He has been succeeded by W. W. West as acting chief draftsman.

W. E. Sutton, formerly with the testing laboratory, has been transferred to Alta, Division III, as assistant resident engineer on surfacing work.

E. J. L. Peterson, a recent graduate of Stanford, has accepted a position as draftsman and computer in the Division III office.

The many friends of Lucille Steers will be pleased to hear that she is rapidly recovering from a severe illness.

Division IV Notes.

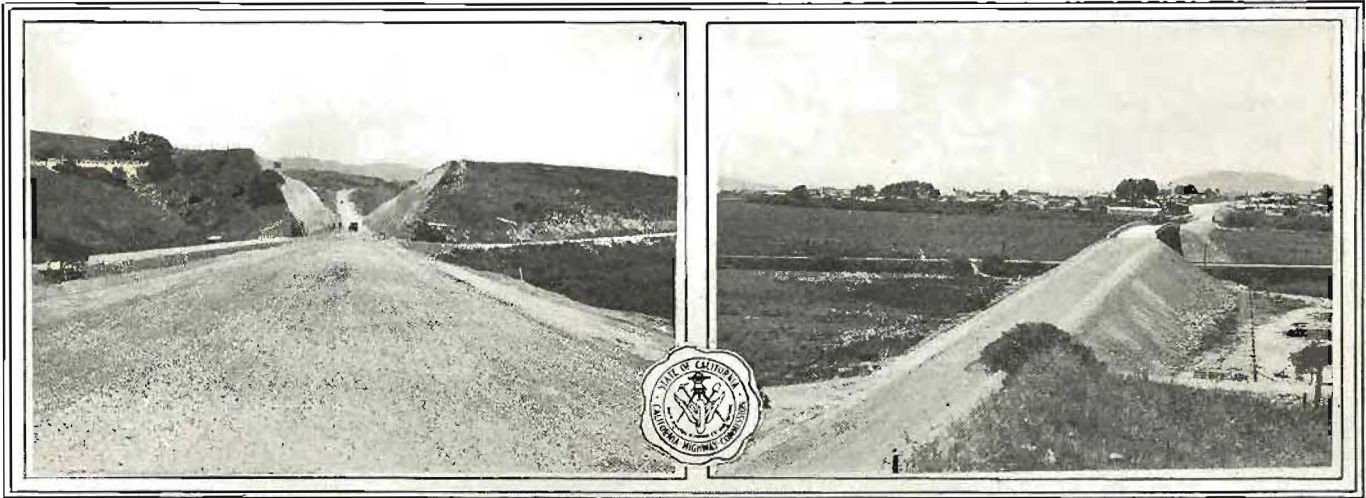
Miss Georgina Burns of Division VI visited Alaska for her vacation. Miss Marie Lennox, also of Division IV, has returned from a vacation in Honolulu and Hawaii. Miss Maria Hammerstrom spent her vacation in Yosemite. Mrs. Leona Duden Smith and Miss Florence Cameron spent vacations in the southern part of the state.

H. D. Perry of the right of way department, Division IV, and Miss Dorothy Fox were married last month. A beautiful silver percolator and serving set were presented the couple by division employees. Miss Harriett Anderson is a new employee in Division IV. Miss Jessie Shepherd of the accounting department has been transferred to the equipment department.

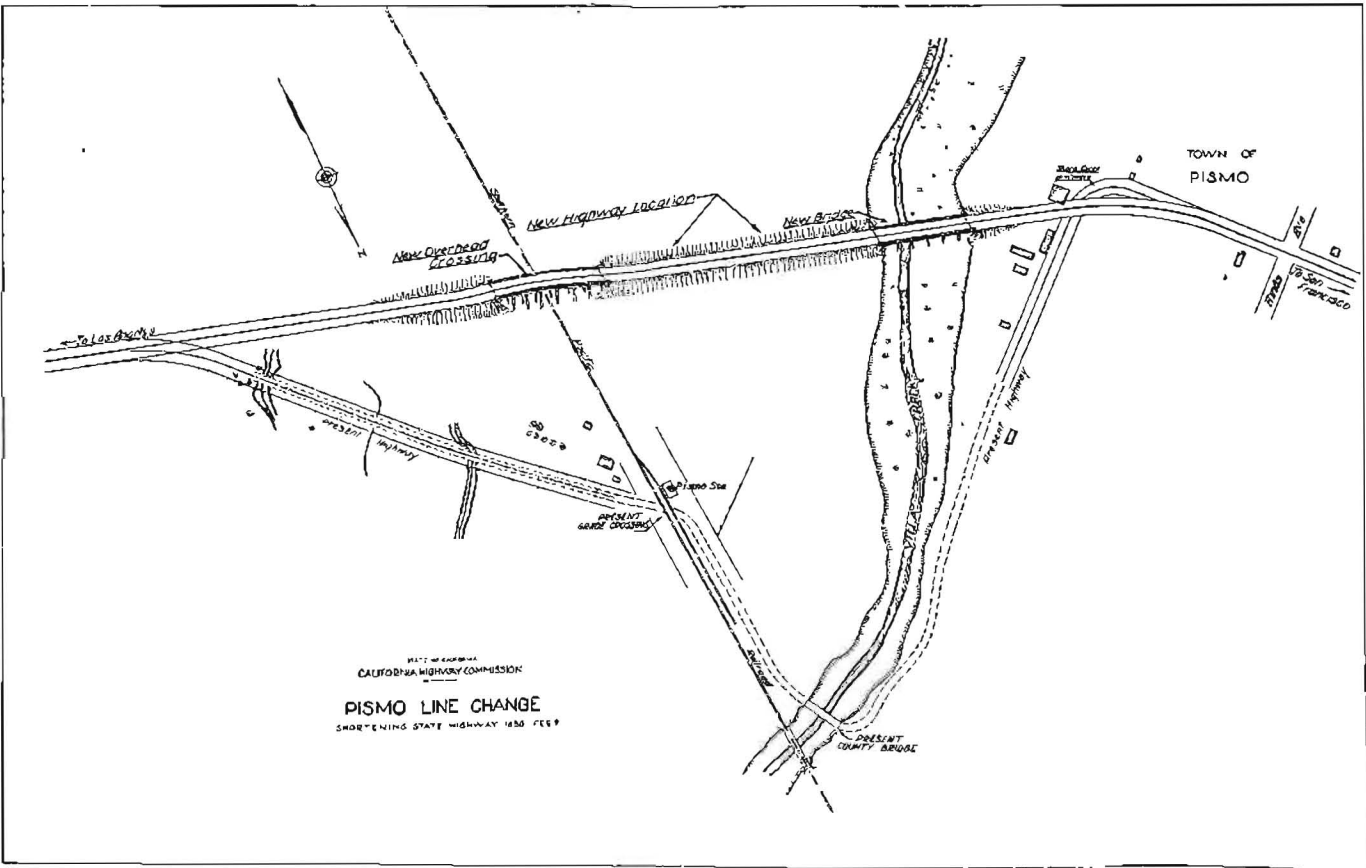
The home of H. D. Stover of the bridge department was recently visited by the stork. Mother and son are doing well.

The bridge department reports that C. O. Dingle will be resident engineer on the great South San Francisco underpass, construction of which will start on August 28. Dingle had charge at the Ventura seawalls which were recently completed.

IMPROVEMENT AT PISMO ON COAST ROUTE OPEN TO TRAFFIC



PISMO LINE CHANGE—New section in San Luis Obispo County which shortens distance, removes curves, and eliminates grade crossing. *Left*, looking south from Pismo; *Right*, looking north toward Pismo. Overhead over Southern Pacific Railroad and new Villa Creek bridge in distance. Photos by Division V.)



“SPIRIT OF COOPERATION.”

While the Willow Brook bridge in Sonoma County was under construction, it was necessary to maintain a detour around the structure and over private property. The Division IV maintenance superintendent in charge has received the following letter from the property owners regarding the removal of the detour:

Mr. R. A. Wilson, Maintenance Superintendent,
California Highway Commission,
Petaluma, California.

Dear Sir:

I am glad of the opportunity to advise you that the work of removing the detour and putting my property back in shape has been done entirely to my satisfaction. Your men showed a spirit of cooperation and courtesy that was very pleasing. Trusting this will cover your inquiry, I am

Yours truly,

(Signed) JOHN R. DENMAN,
Hillcrest Farm.

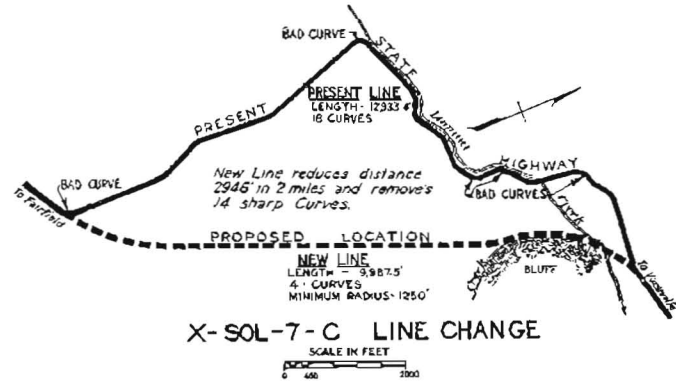
Fourteen

DIVISION X PLANS IMPORTANT LINE CHANGES

DIVISION X has completed plans for three important line changes on trunk highways in Sacramento, San Joaquin and Solano counties. The changes in alignment, which are typical of others under way and proposed in numerous places throughout the state, have been approved by State Highway Engineer R. M. Morton and the highway commission. It is proposed that the work be included in the program for 1927, if the interested counties provide rights of way.

New Entrance to Stockton.

San Joaquin County already has acted to secure the land necessary for the proposed new state highway entrance to Stockton



from the north, which will shorten the distance 3358 feet and eliminate four railroad grade crossings. The new route also will remove several bad curves and greatly facilitate traffic in and out of Stockton. One of its chief features is the elimination of the dangerous Cherokee crossing of the Central California Traction

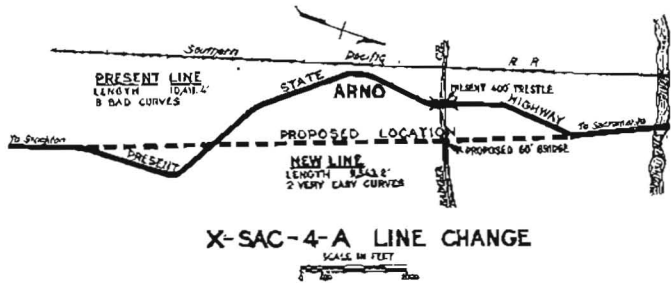
Railroad near the Calaveras River bridge. This improvement seems assured for next year.

Sacramento County Change.

The Sacramento County change would shorten the distance between Stockton and Sacramento by the elimination of a number of dangerous curves in the vicinity of Arno, just south of the Cosumnes River. It has become known as the Arno cut-off and will be graded and surfaced next year if rights of way are obtained.

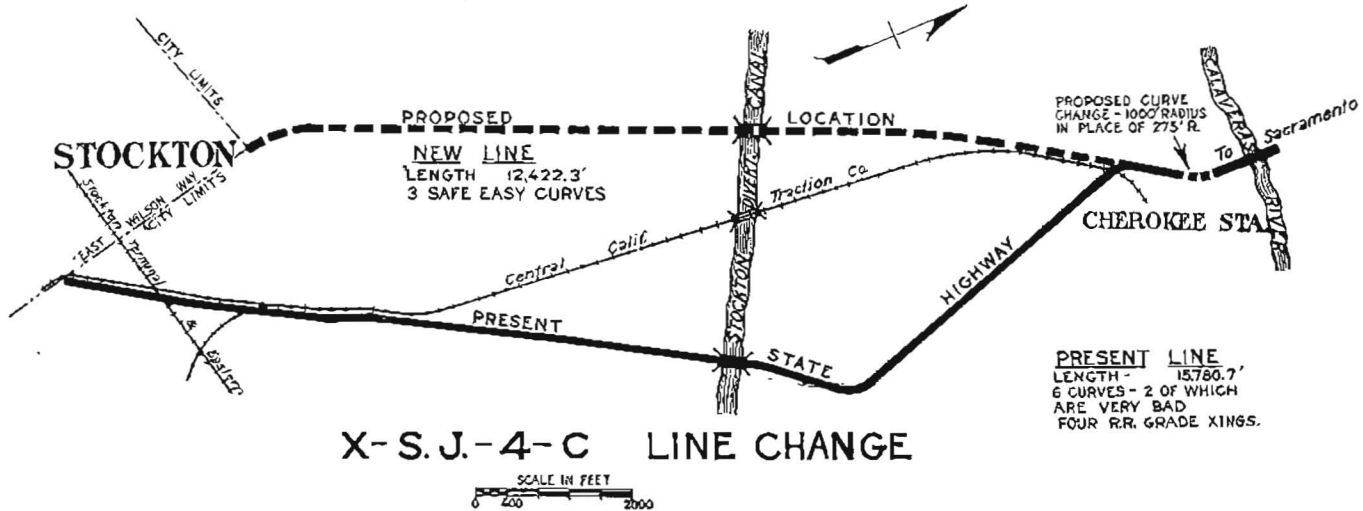
Changes Planned at Cherry Glen.

The changes in Solano County are planned for the vicinity of Cherry Glen, between Vacaville and Fairfield. Here it is possible



to substitute four easy curves for eighteen existing curves on the present line, many of which are sharp and dangerous. The new location would shorten the distance 2946 feet in two miles.

The Sacramento and Solano County boards of supervisors have the proposal of the commission under consideration. The desirability of the changes has not been questioned, and it is hoped they may be included in the reconstruction work to be undertaken during the coming season.



SONORA PASS ROAD, 9000 FEET ELEVATION, GETS REPAIRS

WORKING at an elevation often in excess of 9000 feet, Superintendent Ed Harris and a maintenance crew of Division X have been taking out some of the kinks of the Sonora-Mono Pass state highway through the canyon of Dead Man's Creek. This route has the reputation of being the roughest and steepest of existing highways over the Sierra and those who have made the trip well know the literal truth of the statement. The road, better known in the mining days than now, was added to the state highway system in 1901 by legislative act. It opens a

wonderfully scenic country which some day will take its place among the many attractions of California.

By blasting a roadway through solid granite, Superintendent Harris and his crew have succeeded in eliminating some of the worst sections between Dead Man's Creek and the summit and within a month old timers will hardly know the road of former years.

Five cars made the trip over this summit six years ago. Last year the traffic jumped to 100 and a big increase has been noted this year. The drive is still considered somewhat of a feat, but the improvements now being made by the state will open it to fairly comfortable motor travel for cars in good condition.

STATE HIGHWAY FUND CONTRACTS (Bond Funds, Including Federal Aid)

Cont. No.	Di- vision	County	Route	Sec.	Location	Miles	Type	Contractor	Estimated cost	Date contract awarded	Contract time, days
COMPLETED AND ACCEPTED SINCE JULY 14, 1926.											
490	III	Nevada	38	B	Across S. P. tracks near Hinton		Concrete Girder Bridge	T. H. and M. C. Polk	\$21,178 18	June 17, 1925	
475	VIII	Imperial	27	C	El Centro to Holtville	8.93	Grading and Standard Surfacing	S. Y. Faucett	140,225 77	July 13, 1925	
478	VIII	Imperial	27	D	Holtville to East High Line Canal	6.90	Grading and Gravel Surface	Norman B. Conway	122,759 48	Aug. 14, 1925	
485	V	San Luis Obispo	2	E	Pismo to 1 mile south	0.88	Grading and Standard Surfacing	Collins and Seppi	65,659 20	Oct. 23, 1925	
489	VIII	San Bernardino	31-58	F-E	Hicks to Daggett	18.52	Grading and Standard Surfacing	Ken Hodgman	179,092 12	Nov. 30, 1925	
AWARDED SINCE JULY 14, 1926.											
512	VIII	San Bernardino			At San Bernardino		Division Office Building	George Herz and Co.	\$31,781 25	July 30, 1926	120
513	VII	Ventura	60	A	Between Oxnard and Hueneme Road	4.92	Grading and P. C. C. Pavement	United Conc. Pipe and Const. Co.	173,319 88	July 30, 1926	200
514	X	Yolo	6	C	Between West Sacramento and the M St. Bridge	0.55	P. C. Concrete Pavement	Henry Brown	35,454 60	July 30, 1926	90
515	VII	San Diego	13	H	Between top of Mountain Springs Grade and Meyers Creek Bridge	6.80	P. C. Concrete Pavement	Jahn and Bressi Const. Co., Inc.	331,920 32	Aug. 16, 1926	75
	VIII	Imperial	12	A							
Sub-total						12.34			\$573,476 05		
PENDING AWARD—NONE.											
Total State Highway Fund Contracts Awarded and Pending Award						12.34			\$573,476 05		

NOTE.—Primary construction covered by the above contracts does not include funds obligated on cooperative forest highway projects, prison camp road activities, or day labor jobs not being done under contract.

STATE HIGHWAY MAINTENANCE FUND CONTRACTS (Including Gasoline Tax Fund)

Cont. No.	Di- vision	County	Route	Sec.	Location	Miles	Type	Contractor	Estimated cost	Date contract awarded	Contract time, days
COMPLETED AND ACCEPTED SINCE JULY 14, 1926.											
M-107	VIII	San Bernardino	10	B	Ontario to Riverside	14.62	Asphalt Concrete Pavement	Steele Finley	\$238,608 05	Nov. 30, 1925	
M-121	IV	Riverside	19	A	Between Vineburg Junction and Easterly County Boundary	1.10	Grading and Bit. Macadam Surf.	W. H. Hauser	14,409 54	April 23, 1926	
		Sonoma	8	B							
AWARDED SINCE JULY 14, 1926.											
M-134	IX	Inyo			At Bishop		Maintenance Shop Building	Grant T. Johnson	\$16,522 88	July 30, 1926	100
M-135	VII	San Diego	2	A	Across A., T. and S. F. Railway at Del Mar		Concrete Girder Bridge	John Short	34,506 56	July 30, 1926	175
M-136	IV	Marina	1	B	Across Corte Madera Creek, at Ross		Widening existing Bridge	McDonald and Maggiora	11,070 00	Aug. 16, 1926	100
M-137	IV	San Mateo	2	B	Through Hillsborough	0.23	P. C. C. Pave. and Asph. Conc. Surf.	Municipal Improvement Co.	8,092 91	Aug. 16, 1926	40
Sub-total						0.23			\$70,192 35		
PENDING AWARD.											
	V	Monterey	2	D	Across Salinas River 1 mile south of Soledad		Refloor, Clean and Paint Bridge		36,487 00		150
	VII	Los Angeles	2	D	Between Michigan Ave., Whittier, and South Boundary	3.20	Grading and P. C. C. Pavement		180,583 37		150
Total State Highway Maintenance Fund Contracts Awarded and Pending Award						3.43			\$296,263 41		

NOTE.—The above obligations charged against the State Highway Maintenance Funds do not include funds from these sources obligated for general maintenance and for specific betterments being done under day labor authorization.

CALIFORNIA HIGHWAYS.

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