

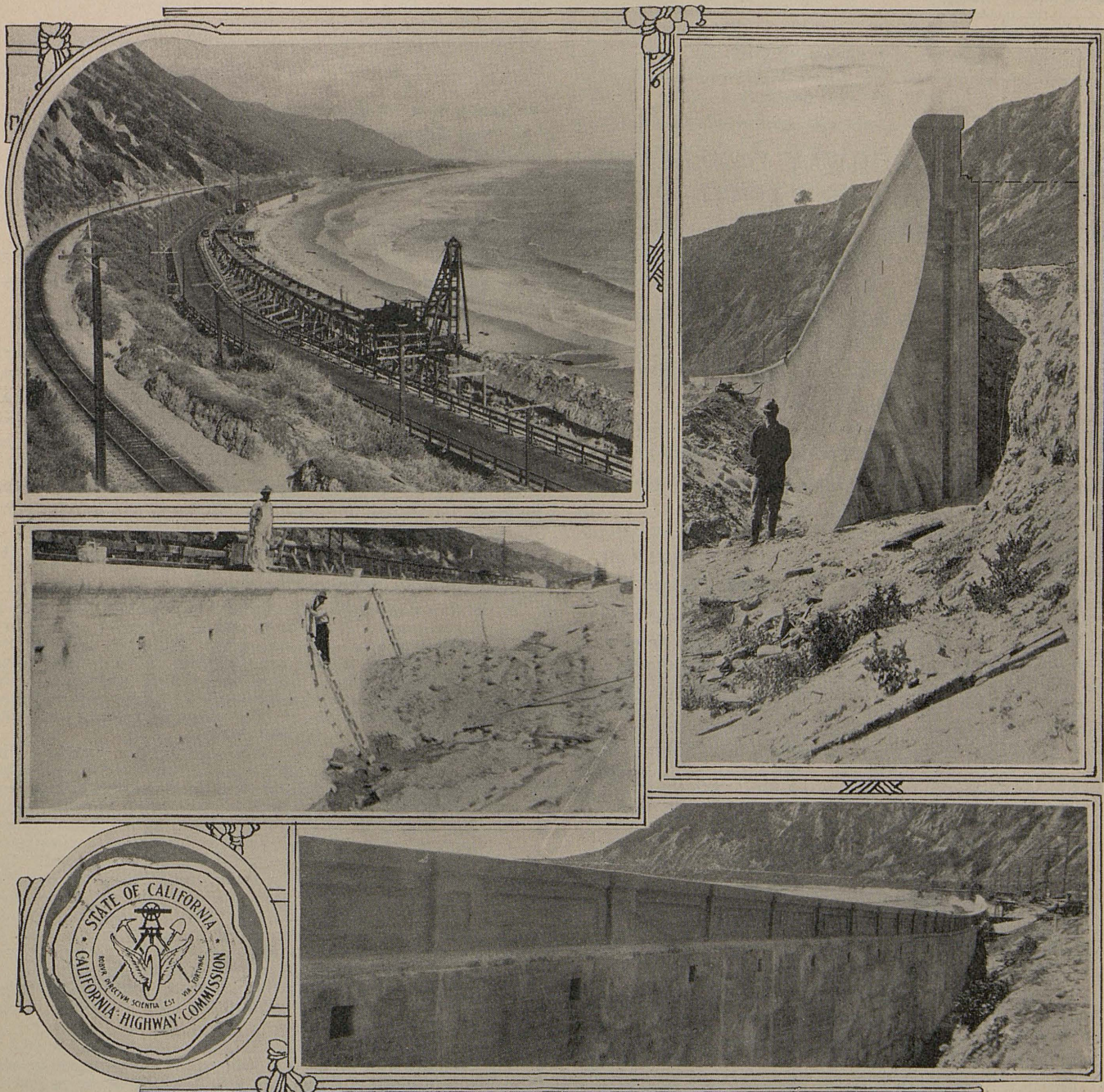
CALIFORNIA HIGHWAYS

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

Vol. 2

AUGUST, 1925

No. 8



VENTURA SEAWALL, UNDER CONSTRUCTION—Building of the great seawall, near El Rincon, Ventura County, on the Coast route, is progressing steadily under direction of the Bridge Department. *Upper left*, general view of scene of construction and the old wooden causeway, which will be eliminated when the wall and fill are finished. *Upper right*, section of the wall; dotted line shows ultimate height of fill upon which the pavement will be placed. Other views show sections of wall as it looks today. See article on page seven. (Bridge Department Photos.)

CALIFORNIA STATE FAIR, SACRAMENTO, SEPTEMBER 5th to 13th, INCLUSIVE

CALIFORNIA HIGHWAYS

IN THIS NUMBER.

HARVEY M. TOY, Chairman;
N. T. EDWARDS and LOUIS EVERDING, Commissioners.

ROBERT M. MORTON, State Highway Engineer.

W. F. MIXON, Secretary.

We are pleased to permit publication of any of the matter contained herein or to loan cuts and this privilege is extended newspapers and periodicals without restrictions.

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

Vol. 2. AUGUST, 1925. No. 8

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J. C. McLEOD, Division X, Sacramento

General Headquarters, Fifth Floor, Forum Building, Sacramento

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THE COMING BATTLE

THE West and the awakened South, sections of the country which seem most appreciative of federal aid in highway construction, must prepare for a determined effort in its behalf if the present policy of the national government is to be continued. In the East, federal aid is being attacked as paternalistic and an invasion of state's rights.

In these more or less academic questions the West has little interest. Its demand for federal aid is based on altogether different grounds.

Under the heading, "Federal Aid Misjudged," *Western Highways Builder*, Los Angeles, has this to say:

With the paternalistic aspects of federal aid, the west is little concerned. Much may be said in its defense. The theory of administration of a quasi-socialistic democracy such as these United States has always recognized the justice of demanding that the richer sections of the nation must contribute to the poorer sections for works benefiting the nation as a whole, on the basis of their ability to pay rather than on proportionate benefits derived from the improvement.

But the west is not interested in such abstract theories. The vices and virtues of paternalism may be discussed *ad infinitum*; we shall cling to the demand for a much more simple justice. So long as the federal government pursues the policy of withholding vast areas of the public domain as reserved territory, unimproved and tax free, we must insist that compensation be made to the states wherein these lands are situated. The public lands of the western states are as much the property of New York, Massachusetts, Pennsylvania and those other far eastern commonwealths as they are, say, of Nevada, Idaho, Arizona or Montana, and the periodical assaults on the federal aid plan—the only compensative scheme yet promulgated to aid the west—emanating in the far east must be sedulously resisted else the west may find itself land-throttled, paying tribute to an absent landlord who denies any obligations to his tenants.

The measure of a nation's civilization, its advancement in education and in material things, can to a large extent be judged by the condition of its highways. Here and there some genius may rise above his surroundings and become a great leader though born amid the dirt and squalor which are usually associated with impassable mud roads or bottomless sand roads. But, broadly speaking, a people can rise no higher than the condition of their highways.—*Manufacturers' Record*.

LABORATORY TAKES GUESS WORK OUT OF HIGHWAY BUILDING



RESULTS OF RECENT RESEARCH DISCUSSED AT ENGINEERS' CONFERENCE

(From a report prepared by C. S. POPE, Construction Engineer.)

THE RESEARCH laboratories of the several states, working in cooperation with the National Research Council and the United States Bureau of Public Roads, are rapidly taking the guesswork out of highway construction. Great strides in this direction have been made in the last few years, and in this work the research laboratory of the California Highway Commission, which is under the jurisdiction of the construction department, has had an important part.

Today, laboratory and field control of highway construction in California is complete. Material of every kind entering into state pavements—the rock, sand, cement, water, asphalt, steel reinforcing, metal pipes—must undergo the most searching chemical and strength tests at the laboratory, as well as the necessary controls during construction. Before the pavement is laid the subbase has been examined, and daily tests are made and samples taken as the work progresses. Nothing escapes the searching eyes of the laboratory staff and the men in the field, who see to it that all work conforms to the standards and methods fixed by the construction department. Stronger and better pavements are the result.

Construction Department Presents Program.

At the recent conference in Los Angeles of the engineering staff of the commission, to which the county engineers were invited, information obtained as a result of recent laboratory investigations was presented by the construction department and discussed by Research Engineer C. L. McKesson, aided by stereopticon projections.

Probably the most important of the subjects presented was, "Finishing and Curing of Concrete," a paper read by Mr. McKesson at the recent meeting, in Salt Lake City, of the American Society of Civil Engineers. It is based upon the cooperative tests conducted in Sacramento by the California Highway Commission and the Lewis Institute of Chicago.

The presentation at the Los Angeles conference is altogether too voluminous for publication, in full, in the bulletin. Mr. C. S. Pope, construction engineer, under whose general direction the research work is being done, has prepared the following summary of the subjects investigated and the conclusions reached:

Finishing and Curing Concrete.

The deductions to be drawn from Mr. McKesson's paper on "Finishing and Curing Concrete," related more particularly to curing. It seems probable from the experiments conducted at the laboratory that the following deductions may be drawn:

The critical time of watering concrete for proper curing is within the first three or four days. It is probable the time of watering may be cut to possibly seven days, instead of fourteen days as practiced at present; the additional protective period to be seven days, or fourteen days in all from the time the pavement is placed until it may be opened to traffic.

The advantage of such decrease of curing period will be apparent when it is considered it will reduce the time during which

Three

the road is out of service by one-third and correspondingly decrease cost of curing and maintenance of detours.

Calcium Chloride Curing.

Other points brought out were that, while calcium chloride offers substitute method of curing concrete pavements, it is not as efficient in California as the standard ponding method and should be resorted to only when shortage of water does not permit the use of usual methods.

Other matters covered in this paper, it is expected, will be released in the near future by the Lewis Institute.

Mixing Time Studies.

These studies included a determination of the effect of mixing time on the strength of concrete cast in cylinders. The results indicate mixer manufacturers have properly rated their mixers to do efficient work at one minute mixing time, and that a two minute mixing period does not give an appreciable increase in strength, although mixing times at three, four, and five minutes undoubtedly do give a slight increase in strength.

Soil Analysis.

Methods of soil determination were discussed. The conclusion reached was that two simple methods of analysis are all that are necessary for determination of the quality of soil and the probable results of its use in subgrades. The first of these is shrinkage, which is determined by making up the soil in moulded bars of a proper consistency to obtain the lineal shrinkage when dried to constant weight.

The second is the determination of moisture equivalent of soil, that is, the quantity of water which various soils will absorb under certain methods of manipulation. Heretofore, in making the moisture equivalent test, it has been necessary to employ laboratory methods, but recent investigations by the Bureau of Public Roads, which are confirmed by our laboratory, show these tests may be made in the field. A simple apparatus, consisting only of a bowl and spoon with proper weighing devices, is all that is necessary. This method of determining moisture equivalent is known as the Rose Method.

Subgrade Materials.

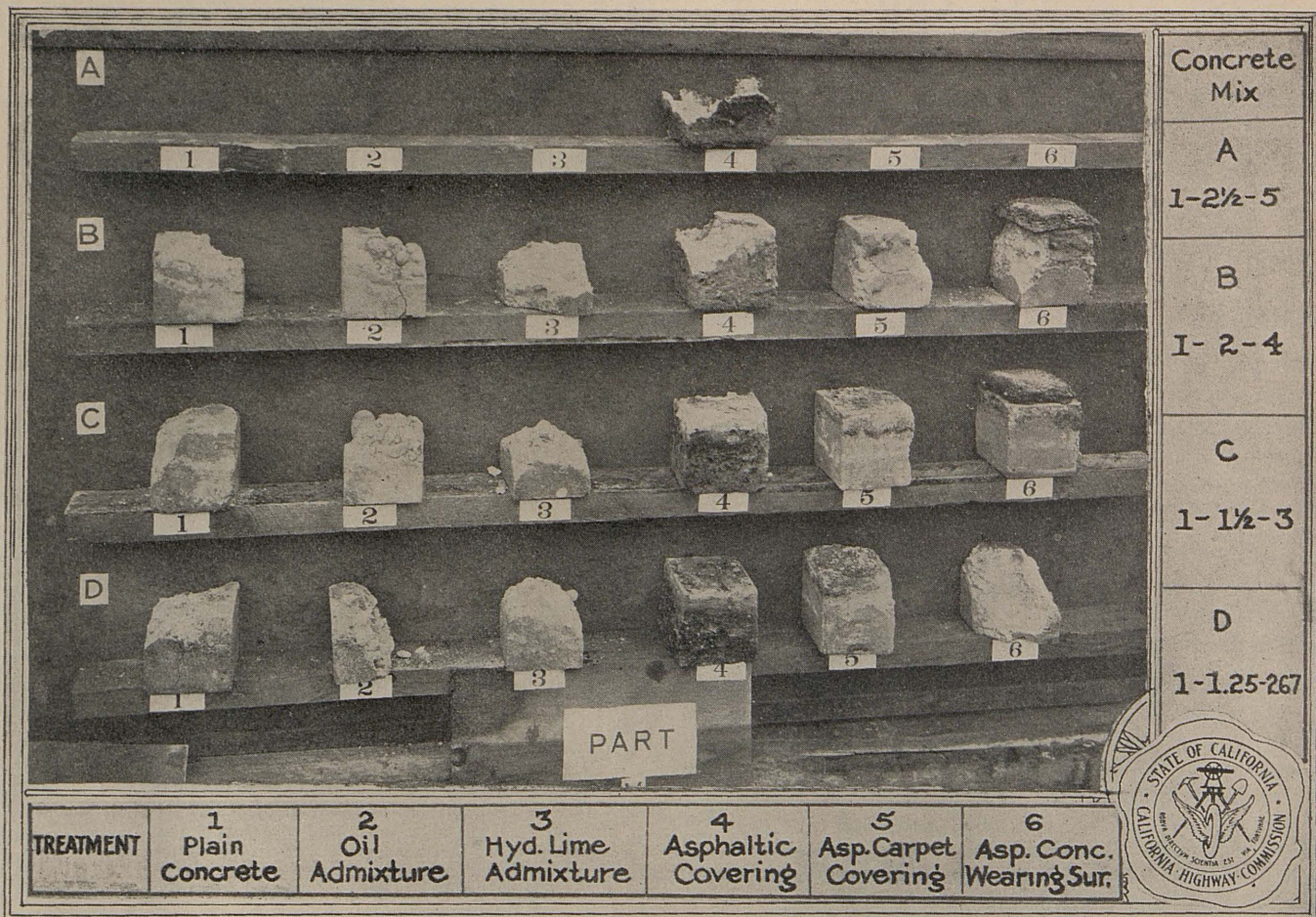
The methods used in California for sampling and making an analysis of subgrades were presented. The construction department analyzes subgrades and if any are found unsuitable, necessary measures are taken to protect pavements against adverse soil.

The importance of a proper method of sampling for alkali was emphasized. It was demonstrated a skimming only should be taken, since alkaline soils, if sampled to a depth greater than two or three inches, will not give an indication of the extreme concentration of alkali, which takes place at the surface, and which is so destructive to concrete paving.

Sand Grading Studies.

A discussion of the studies made in connection with the grading and strengths of sand, as used in concrete mortar throughout the

(Continued on next page.)



WHAT ALKALI DOES TO PAVEMENTS—Cubes of concrete buried for a period of forty-four months in a sample of alkali soil secured along the highway in one of the desert sections of the state. Similar experiments have been made with alkali soils from other sections. Results of these tests demonstrate to engineers necessity for protecting pavements against contact with subbase soils containing alkali. It is believed failure of some original California pavements undoubtedly was due to this cause. Research engineers are endeavoring to find means of overcoming alkali.

LABORATORY TESTS DISCUSSED

(Continued from page 3.)

state, was given together with slides showing the curves obtained by plating the gradings of sand on diagrams. The studies included tests on some 450 different sources of supply in the state, covering various divisions of the highway organization. The tests show that good concrete sands exist in practically every section of the state, with the exception of two coast counties. The increase in strength of concrete, obtainable by proper grading of sands of suitable structural strength, was brought out by means of trial gradings.

Factors in Concrete Strength.

Tests of concrete, using different cements, sands and quantity of mixing water, indicated the factors entering into concrete strength are in the following order:

1. The amount of mixing water;
2. Grading of sand;
3. Strength of individual cement and,
4. The coarse aggregate.

Strength of Cement.

Charts were shown giving the results of tests of different brands of cement in use in California. These tests were conducted by the California Highway Commission, the Bureau of Public Roads, and the Washington State Highway Commission, in a joint series, to determine the variation of strength in the different brands. This study is of considerable value to the cement companies, because

it gives them the rating of their product as compared with other producers. The continuation of these studies will tend to produce a uniformity in the strength of California cements.

At the present time, the standard requirements of the State Highway Department are met by all of the California plants. But there is a considerable difference in the actual strength of concrete obtained by using the different brands.

Early Strength Studies.

The purpose of these studies was the development of an early strength concrete for use in repair work and patching. Tests of a new cement containing a high aluminum content were reported upon, as were tests of standard cement using seven and eight sacks to the cubic yard, instead of six sacks, the California standard. The Lumnite cements show compressive strength exceeding 5000 pounds in twenty-four hours, but their cost is so great that only in emergency cases can they be used.

It was brought out that a suitable strength probably could be developed with the ordinary cements, if a sufficient amount were used, and that it would be possible to open patches with safety within three or four days.

Permeability Studies.

This report covered the results of experiments using various impermeable cements or admixtures to secure waterproofing. A number of cements produced in California, and used for waterproofing, were tried as well as a number of admixtures. It was found that vessels, made from standard cements in which the quantity was increased slightly over the usual amount and the con-

crete made as dense as possible, gave the best results as to impermeability. In making the test, cylindrical jars of the different mixtures were cast, and as soon as cured, were filled with water and sealed with paraffine. They were then kept at a constant temperature, and in a uniform state of humidity for a number of weeks. The jars were weighed at stated intervals during this period to determine the loss of water by evaporation through the walls.

Test of Road Gravel.

Tests recently devised by the Testing and Research Laboratory in connection with the examination of road gravels were discussed under this heading. The method employed reduces road gravels to a material, all of which will pass a one-half-inch screen and fifteen per cent of which will pass a Number ten. The latter fifteen per cent consists of more or less dust and finer material. The whole mass is then wet to a proper consistency and cast in a mould four and one-half inches square by nine inches long. After being dried to constant weight, these prisms are crushed to determine their cementing value. This test, in addition to the usual test for hardness, indicates the value of the gravel for road purposes.

Effect of Alkali on Concrete.

Some four years ago, the state began a series of tests, which recently have been completed, to determine the effect of alkali on concrete pavements. A study of the condition of test blocks of concrete after remaining in samples of alkaline soil for forty-four months, resulted in the following conclusions:

- (a) Asphaltic paint coats or surfaces provide protection to concrete subjected to action of alkali;
- (b) Concrete, rich in cement and relatively dense, resists action of alkali better than more porous concretes;
- (c) Necessity for insulating against alkali was clearly demonstrated, as many of the experimental blocks, subjected to intense action, were entirely destroyed.

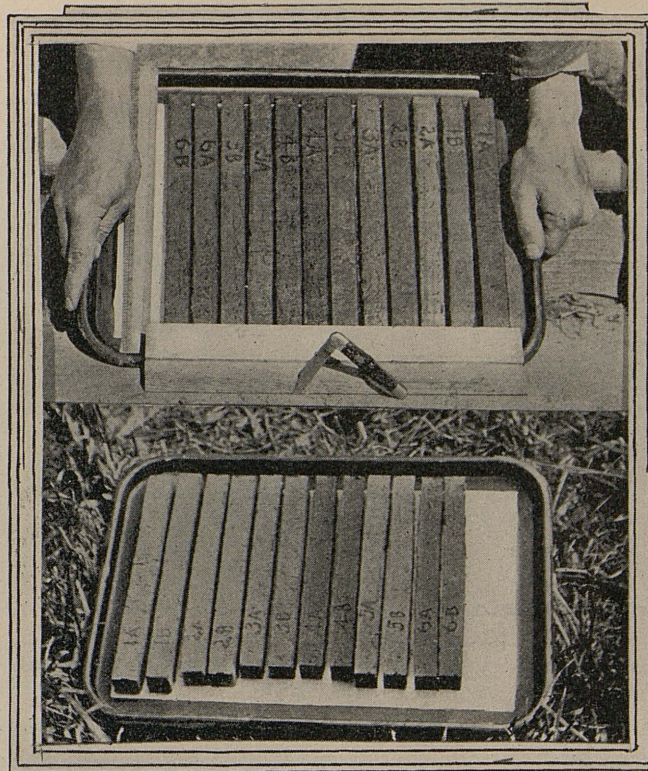
Standardizing Sieve Sizes.

The results of a conference with southern California manufacturers of stone and gravel were reported. At this conference, participated in by leading producers of stone and gravel in southern California, engineers of the city and of the county of Los Angeles, as well as engineers in private practice, an agreement was reached upon the size of stone to be specified on work in the southern part of the state. Standard screen sizes were adopted.

The rock companies also agreed to conform to the gradings for sand and stone fixed by the specifications of the California Highway Commission. The agreement is considered most satisfactory, as it will decrease the number of screen sizes which the companies might have been required to use, because of different specifications by different engineers. It will make possible a great saving in the construction of screens and also in the stockpiling of materials.

Asphaltic Surfacing.

In connection with other matters, a short, incidental discussion of



DETERMINING SHRINKAGE OF SOILS—A simple method of determining the shrinkage of soils. Above, moulded bars of earth mixed with water to their moisture equivalent content. Below, shrinkage evident after being dried to constant weight. Soils that hold a large amount of water in winter and shrink in summer do not make good subbase for pavements and must be guarded against. (United States Bureau of Public Roads tests.)

asphaltic surfacing took place. The most important factors brought out were the reduction in the amount of asphalt in asphaltic concrete work, due to improved grading of materials; the larger mixers in use, which materially cheapen the work; use of the spreader box, now a California standard. The spreader box materially reduces the cost of placing this type of pavement.

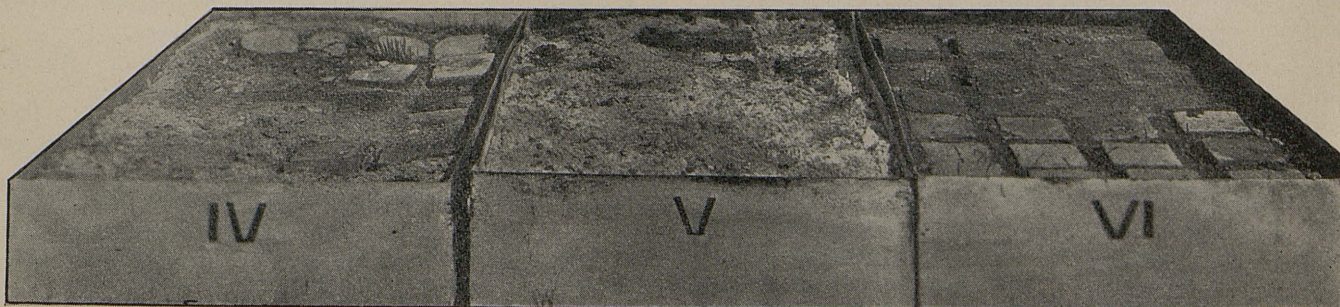
The omission of a seal coat on recent California highway work was discussed briefly, as were a number of proposed improvements in the quantity of filler used, and character of asphaltic cement.

Vialog Tests.

Use of the vialog for testing the smoothness of concrete and other pavements was described. This machine is attached to an automobile and registers automatically the number of units of roughness per mile in the pavement surface.

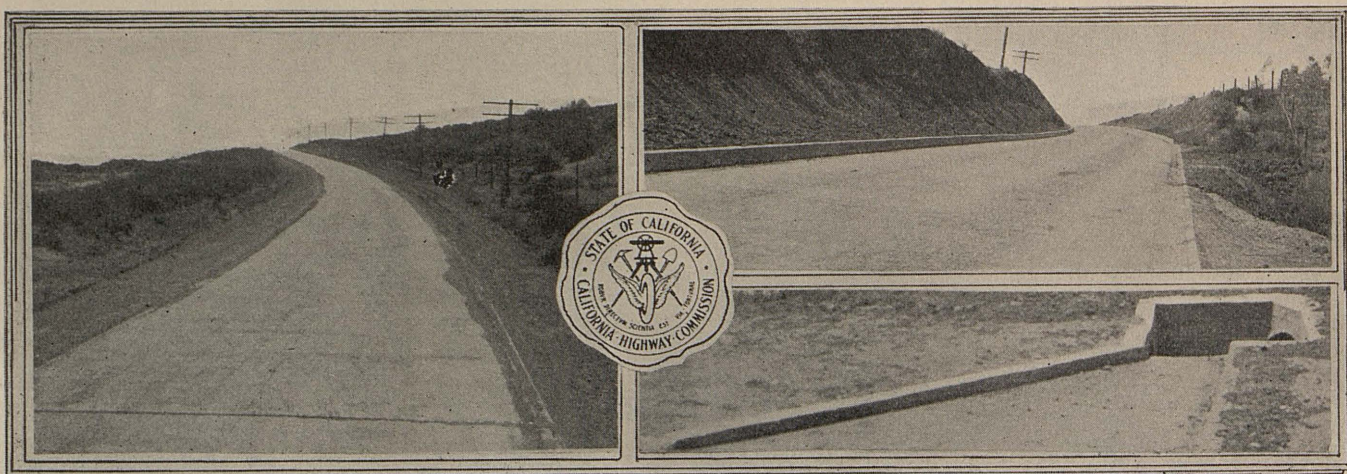
While the present machine is subject to criticism, in that different results will be obtained by different operators and at

(Continued on page 6.)



ALKALI SOIL TESTS—The above illustrates method used in studying destructive qualities of alkali soils. The concrete blocks were buried in the soil for a period of forty-four months and then removed to observe the results, as shown on page four.

REDLANDS AND BEAUMONT CELEBRATE PAVEMENT OPENING



ANOTHER GAP CLOSED—Views of new section of twenty-foot concrete pavement recently opened to traffic between Redlands and Beaumont, Riverside County. It closes an unpaved gap in the Imperial Valley trunk highway. The views show the curb and gutter design, used in cuts to prevent washing of shoulders. Lower right, a gutter leading to a slope drain, constructed to prevent erosion of the fill. (Photos by Division VIII.)

REDLANDS and Beaumont joined several weeks ago in celebrating the completion of 7.1 miles of new pavement, connecting the two cities and eliminating one of the last unpaved gaps between San Bernardino and Imperial Valley, to a point near Westmoreland.

The commission ordered the work done months ago as a part of its program to close gaps in the trunk lines wherever possible. The work was financed from the second state highway fund which had been replenished with federal aid.

Construction Features.

Except for a few slight line and grade corrections the subgrade followed closely the surface of the grade built in 1920.

The pavement is concrete, twenty feet wide and six inches thick, increasing in thickness from six to nine inches, in the outer three feet. It was struck off and tamped with a Lakewood tamping machine running on 3-inch by 10-inch timber headers and finished with a longitudinal float and belt. Careful supervision of the

finish was maintained and it is believed a vialog test of the road will show an exceedingly smooth finish.

Expansion Joints Used.

A center joint was placed the entire length of the contract. The joint consisted of 1-inch by 5-inch by 10-foot pine boards toe nailed to the subgrade with 40d spikes, and held together at the abutting ends by strips of tin nailed to the upper edges.

Careful control was maintained in proportioning of materials. The batch truck system was used, all batches being proportioned at the plant on the railroad siding at Beaumont. The coarse aggregate was measured in two sizes to obtain the proper grading.

In addition to paving, culverts were extended where necessary. Curbs were constructed along the edge through cuts, and gutters leading to slope drains were provided where necessary to avoid erosion of the fills.

Basich Brothers of Los Angeles were the contractors. R. L. Young was resident engineer.

LABORATORY TESTS DISCUSSED

(Continued from page five.)

different speeds, it, nevertheless, is the opinion of the department that, when operated under uniform conditions, it has considerable value in determining the relative smoothness of pavements. Particular stress, however, was laid on the fact that it must be operated in the same manner at all times. The results should be considered as pertaining only to the particular machine used.

Ball Indentation Test.

This test consists in forcing a steel ball one-half inch in diameter into concrete pavements to a depth of one-quarter inch. It is an application of the Brinell test. When carefully made, it appears to be of value in determining the hardness of the pavement surface. A great many tests have been made by the California Highway Commission on pavement samples, in connection with other investigations. A discussion of the subject will be found in the publication to be issued by the Lewis Institute. The indentation, generally speaking, varies with the strength of the concrete, and with the method of curing the surface. It was found, for instance, that surfaces cured with water gave a higher indentation test than those cured with calcium chloride.

EGYPTIAN ENGINEERS STUDY CALIFORNIA HIGHWAY METHODS

FROM the far off valley of the Nile have come M. Hassaan and Halim Abdel Malek, engineers of the Egyptian highway department, to study highway building as exemplified by California construction practices. After some time spent in Washington, D. C., as the guests of the United States Bureau of Public Roads, the bureau recommended that they inspect California state highways, as typical of American road building.

The visiting engineers, after spending several weeks inspecting various construction projects in the vicinity of Sacramento, are now employed without compensation in Divisions IV and VII to obtain a more practical working knowledge of the California way of building roads.

California state highways, during recent years, have attracted engineers from many parts of the world, who come here to study the engineering features of the state's road system.

C. S. Pope, construction engineer, reports the highway on Route 16, Hopland to Lakeport, in excellent condition and wishes to commend the maintenance foreman in charge.

VENTURA SEAWALL TESTS SHOW HIGH QUALITY CONCRETE

By HARLAN D. MILLER, Bridge Engineer.

THE spectacular concrete seawall, more than a mile in length, under construction by the California Highway Commission along the ocean front at the foot of the famous Rincon cliffs, on the Coast highway, in Ventura County, is now well under way. Tests of concrete already placed indicate exceptionally high quality, with a compressive strength, in some instances, as high as 5680 pounds per square inch.

The total length of the Rincon wall will be about a mile and a quarter; its average height twenty feet. It is so located with relation to the cliffs and paralleling tracks of the Southern Pacific railroad, that it will retain a sand fill forty feet in width, upon which will be placed a pavement with a width of twenty-six feet. This will provide parking space, in addition to a twenty-foot roadway. There also will be a six-foot sidewalk, inside the rail.

About one-half of the seawall proper has been completed. Placing of the sand fill, which will be done with a suction dredge working off the beach, has not yet been undertaken.

Built to Resist Wave Action.

The seaward face of the wall has been curved to better resist wave action; and, for the same reason, the parapet, which also

acts as a rail for the sidewalk, has been made solid with the outer face curved, as shown in the front cover illustrations.

Particular care has been taken in planning construction of this wall to assure an impervious concrete. Necessary rock crushing and mixing plants have been designed to produce a strong, dense product, of a quality that will withstand action of sea water.

Tests made of concrete already placed have shown a compressive strength as high as 5680 pounds per square inch. The average for ninety-day tests is 5053 pounds.

The old pile trestles, soon to be a thing of the past, were built a number of years ago by citizens of Ventura County, the work being financed largely by private subscription. Under the circumstances, they were constructed as cheaply as possible and are now altogether inadequate to handle the traffic on this important trunk highway.

A Gas Tax Job.

The passage in 1923 of the gasoline tax act provided the funds which have made construction of the seawall possible at this time.

The J. H. Tillman Company, of Portland, Oregon, is the contractor. The cost of the project, when completed, will be approximately \$500,000. C. O. Dingle is resident engineer for the state.

DINGLE'S VERSION OF TEMBLOR

On the morning of June 29, near the Rincon seawall between Santa Barbara and Ventura, as we were about to sit down to breakfast, suddenly we were surprised to find the house rocking gently. When the stove and furniture began to sway and the house creak and groan as though it would leave its foundation, we made a rapid exit. There was no doubt the earth was on a rampage. Great clouds of dust hovered over the highway and ocean near the shorter causeway, due to landslides. The slides continued during the day with each shock.

Work on the seawall was not delayed in any way because of the earthquake as there was no damage to either the contractor's equipment or the wall. In one way the earthquake was of great benefit to the contractor. It replenished his depleted water supply, which was from a small creek near the large causeway. He now has more water than is needed. Another stream near his concrete mixing plant, which before the earthquake was dry, is now flowing.

Due to the crowds of motorists going to Santa Barbara to see the results of the earthquake, the highway has been taxed to its capacity.

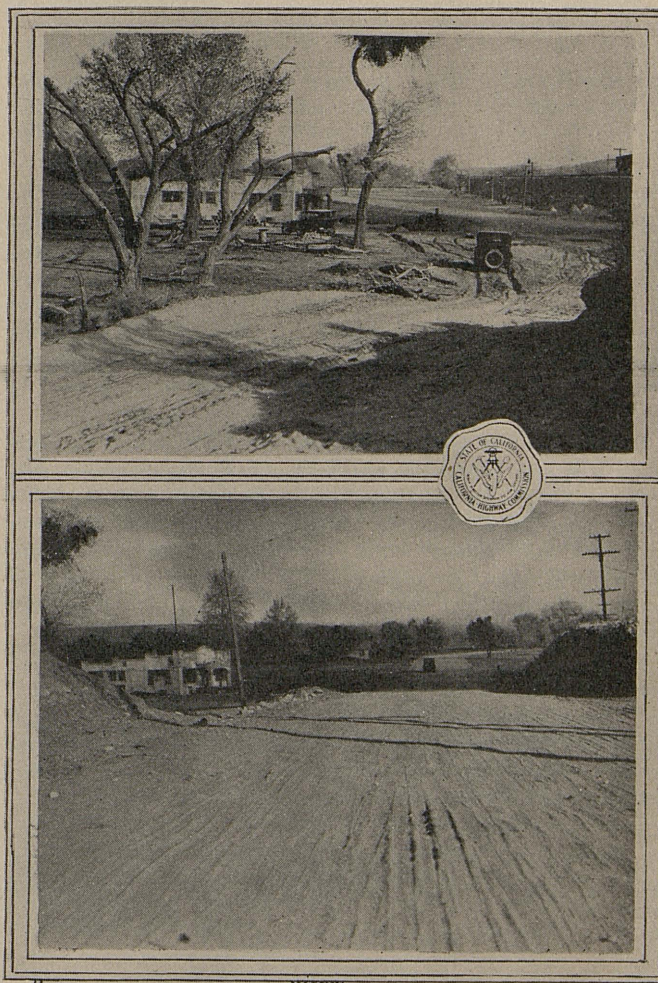
It is gratifying to know that the seawall had sufficient strength to withstand such a severe test.

RESEARCH MEETING IN DECEMBER

AT A RECENT meeting of the Executive Committee of the Highway Research Board of the National Research Council, it was decided to hold the Fifth Annual Meeting of the board at Washington, D. C., December 3 and 4, 1925. Progress reports received from the chairmen of the research committees indicate they are conducting important studies on almost every phase of highway development, including finance, design, construction and maintenance, thus assuring a successful annual meeting. The program for the meeting is now being prepared and will soon be announced.

Consider the fish; he never gets caught as long as he keeps his mouth shut.

Seven



ON THE NATIONAL OLD TRAILS—Before and after views near Oro Grande, San Bernardino County, showing improvements made by the grading of the state highway. This work was completed during recent months.

SAN JOAQUIN FARMERS PAY FINES FOR FLOODING HIGHWAY



MAINTENANCE SUPERINTENDENT TAKES ACTION TO PROTECT PUBLIC

THE DUTY of the California Highway Commission includes the protection of the highways from damage; it does not end with construction.

Where it can be avoided, representatives of the department are reluctant to take drastic measures against offenders, but the recent flooding of the state highway in San Joaquin County demanded action which resulted in two farmers each paying a fine of \$50 in the justice court at Stockton.

The occasion serves to draw attention to the fact that the negligent, malicious or wilful flooding of a state highway, or other wilful damage, is a misdemeanor, and that the law will uphold the Commission in action to protect the highways, and the rights of the traveling public.

What the Law Says.

Section 588 of the Penal Code, enacted in 1921, provides as follows:

Digging up or flooding highway. Every person who negligently, wilfully or maliciously digs up, removes, displaces, breaks down, or otherwise injures or destroys any state or other public highway or bridge, or any private way, laid out by authority of law, or bridge upon any such highway or private way, or who negligently, wilfully or maliciously drains, diverts, or in any manner permits by seepage, overflow or otherwise, any waters thereinto or thereon from lands lying adjacent to or in the vicinity of any such state or other public highway or bridge or private way, shall be guilty of a misdemeanor.

Under this section, C. Bovey, Maintenance Superintendent in the vicinity of Stockton, Division X, swore to complaints against two dairymen who had permitted irrigation water to flood the state highway in the vicinity of Turner Station. The fines were imposed by Justice of the Peace A. C. Parker after Ira B. Langdon, an attorney of Stockton, and a good roads advocate, had voluntarily appeared as special counsel upon behalf of the Highway Commission. The accused dairymen pleaded guilty when confronted by the facts in the case, which are explained by Bovey as follows:

The irrigation of the tract of land was begun during the night time. The main ditch, 100 feet from the highway right of way, broke at 5 a.m., and the water soon covered the highway for a distance of some 400 feet, and to a depth of three feet. The ditch tender of the irrigation district happened to be near at hand and the two defendants were notified to stop the breaks and to keep the water off the highway. No attempt was made to do this, and the water continued to drain onto the highway during the day.

The two ranchers were very indignant when first brought into court, but when the representative of the district testified they had been notified thirty days in advance of the time the water would be turned on, and again twenty-four hours in advance, and that they had been warned when the break first occurred, they decided to plead guilty.

Superintendent Bovey, who had made an investigation, testified the men had made no attempt to repair the ditches prior to receiving the water, and had done nothing to stop the breaks after they occurred.

State Put to Expense.

The state was put to the expense of placing warning lanterns and removing the water as fast as possible. This was done with a 1000-gallon water truck, equipped with a pump. It was necessary to haul the water a quarter of a mile and dump it into an

irrigation ditch. The road was practically closed for several hours, and there was much inconvenience to traffic.

Judge Denounces Carelessness.

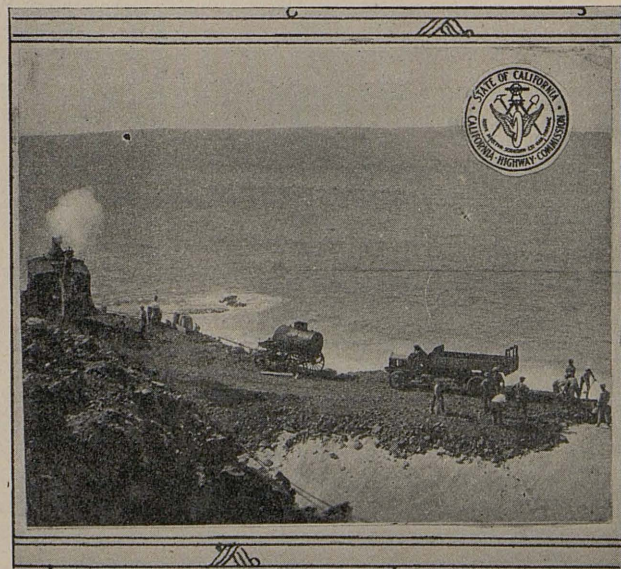
After being informed of the facts by sworn testimony, Justice Parker denounced the carelessness of the defendants and deplored the fact that negligence upon their part, and upon the part of others, costs the taxpayers considerable sums each year. The incident was given publicity in the Stockton press, and has established a precedent which will help enforce the law in that county in the future.

Discussing the case and the importance of keeping water off the highways, particularly in the summer time, Superintendent Bovey made the following statement to the *Stockton Record*:

"People have no idea of the amount of damage that can be done to a highway by water, especially in the summer time. When water escapes from ditches and enters the borrow pits along the roadside, if allowed to stand, most of it eventually finds its way into the highway subgrade. It is drawn up by capillary attraction, and, under heavy impact of vehicles pounding along the pavement, a pump-like action is started. The pavement gradually is undermined through the softening of the subgrade and the road goes to pieces.

Before running water into irrigation ditches bordering along highways, the farmer should see to it that his ditches are in good shape. Weeds should be removed and squirrel holes should be sealed by harrowing the sides and bottoms of the canals. There is no disposition on the part of the California Highway Commission to prosecute persons who exercise ordinary diligence. We are only after those individuals who seem to show no appreciation of their obligation to their neighbors and to the general public.

When irrigation water gets into the borrow pits, along the highways, those responsible for the situation can be compelled to remove it by pumping it off. If they fail to do so, we can remove the water and charge the expense to the property owner."



ON THE VENTURA COAST—Spreading a rock "blanket" over a sand fill, a step in the construction of the Coast boulevard, south of Oxnard. (Division VII.)

EXPERIMENTS ON SOLANO LATERAL DEMONSTRATE INEFFECTIVENESS OF SUBGRADE IMPROVEMENT BY SOIL ADULTERATIONS

(From a report of Research Engineer C. L. McKesson.)

ADULTERATION of subgrades with cement or lime compounds as a means of improving subbase conditions by securing stability in heavy soils is ineffective and uneconomical.

This, in brief, is the report of Research Engineer C. L. McKesson, to the State Highway Engineer, after a study of experimental sections on the Rio Vista lateral, Solano County, placed in 1921 and 1922 by the California Highway Commission.

The special subgrade treatment was undertaken in an effort to determine, if possible, an economical method of treating adobe to eliminate its swelling and plastic condition when saturated with moisture, and subsequent shrinkage and cracking when dried out. The plan tried called for the thorough mixing with the subgrade in varying quantities and depths of Portland cement, hydrated lime, limestone dust, and asphaltic oil.

Twelve Sections Tried Out.

The work was started in 1921, and the pavement was completed during the summer of 1922. Twelve sections, with one exception, each 500 feet long, were chosen; an effort being made to select those with soil conditions as nearly identical as possible. An examination shows the soil to be adobe and silty clay, with some variations in quality.

The treatment consisted of loosening and pulverizing the subgrade to a depth of six and twelve inches, after which the various adulterants were mixed with the soil and well worked into the subbase. Except on the experimental sections, a four-inch gravel subbase was placed on all heavy soil on the paving project. It is possible, therefore, to compare this more or less standard method of subgrade treatment with the various experimental admixtures. An eighteen-foot concrete slab, five inches in thickness, was placed.

Observations After Two Years.

After the work had been down for more than two years, Mr. McKesson made a condition survey. He reports the relative efficiency of the various methods of treatment, based on the present condition of the pavement, as follows:

FOUR INCH GRAVEL SUBBASE on untreated subsoil is found to be very efficient. All sections in good condition. No longitudinal cracks and transverse cracks are 40 to 100 feet apart.

SIX INCH PORTLAND CEMENT (Sec. a, b, 3 and 4).

Where subsoil is similar, there is little or no difference apparent between sections having 1-10 and 1-20 admixtures. Failures consist of transverse cracks averaging about 40 feet apart.

TWELVE INCH ASPHALTIC OIL (5 gal. per sq. yd., Sec. 8).

This section has transverse cracks averaging about 25 feet apart. There is little difference in condition between this section and the twelve inch Portland cement sections.

TWELVE INCH HYDRATED LIME (Sec. 5).

This section has transverse cracks 10 to 60 feet apart, and several short irregular longitudinal cracks. Some surface checking was also noted.

TWELVE INCH PORTLAND CEMENT SECTIONS.

Sections 1 and c, with 1-10 admixture, are in slightly better condition than sections 2 and d, having 1-20 admix-

ture. Transverse cracks on average about 30 feet apart on sections 1 and c and about 25 feet on sections 2 and d. Sections 1 and 2 have a number of longitudinal cracks. The average condition of these sections is slightly better than the plain untreated Section 7, but not enough to justify any expenditure.

PLAIN TWELVE INCH.

This section was plowed up and soil pulverized as for admixture treatments. It was then rerolled, without the addition of any adulterant. Pavement on this section is in little worse condition than on twelve inch 1-20 cement section, but the soil is apparently heavier than on any other section of the experimental work. A comparison of this section with gravel subbase sections, shows clearly the benefit to be obtained from the use of a gravel subbase.

TWELVE INCH LIMESTONE DUST (Sec. 6).

This section is in the worst condition of all. The pavement is broken up into narrow strips by the many transverse cracks, and in some places short longitudinal cracks are numerous. Had it not been for transverse reinforcement, this section would probably be a total failure.

Commenting upon the Rio Vista lateral experiments, Mr. McKesson states they appear to justify three conclusions, which he sums up as follows:

1. That soil adulteration with cement or lime compounds is not an efficient or economical method of securing stability in heavy soils.
2. That the suitability of soil for subgrade purposes, or of the merits of various methods of soil treatments, can be determined by relatively simple laboratory tests and that expensive field tests, in some cases at least, can be avoided by first resorting to a properly conducted laboratory investigation.
3. That a sand or gravel layer is an efficient and economical method of minimizing damage to pavement, resulting from swelling or shrinkage of the subsoil.

Bureau Gets Similar Results.

In making his report, the Research Engineer calls attention to the fact that the results of the California tests are similar to those obtained by A. C. Rose, who conducted like experiments for the United States Bureau of Public Roads at about the same time. The federal experiments were made with Cove clay, a soil similar to the adobe of the Rio Vista lateral, in this state.

In the report of his tests, Mr. Rose makes the following statement, which will be of interest to California engineers:

"Adulterating the subgrade with a lime compound or sand to a depth of one foot reduces shrinkage in the portion adulterated, but the subsoil for a considerable depth beneath this treated layer would continue to swell and shrink and displacement of the upper layer and of the pavement would doubtless continue, although to a less degree. The efficiency of this method of subgrade treatment is doubted.

The Better Treatment.

"It is believed that a better treatment of heavy soil subgrade is:

1. To use a sand cushion to act as an equilibrant to run into irregularities of the subgrade, which is deformed by shrinkage or swell of the soil, and thus to maintain a uniform surface in contact with the base of the pavement, or
2. To establish an unchanging moisture content in the immediate subgrade."

ROAD HOGS AND HIGHWAYS—THE COMMISSION GOES INTO THE PORK BUSINESS

THIS is the story of Ralph Brown's pigs. It is also a story of practical economy in the administration of public affairs. Brown, it should be explained, is a blue eyed young man who builds roads for California with labor supplied by the Folsom State Prison. Brown's achievements as a road builder are well known to those who are in touch with California's prison road camps, but few are aware of his success as a hog raiser:

Brown's hogs are the kind that help build roads, rather than appropriate them. His hogs go into food for prison labor.

It began up in Yuba County in 1918, when Brown was in charge of the Folsom Prison camp, engaged in building the Downieville lateral from Nevada City into Sierra County. The camp was located near Comptonville when Brown first started raising hogs.

How it Started.

It had been his practice to distribute the camp garbage to local residents gratis as the best means of securing its prompt removal. It appears, however, the local ranchers had some difficulty in agreeing among themselves upon a division of the camp spoils, and, to end their disputing, Superintendent Brown decided to utilize it himself by raising his own hogs. That's how the Commission got into the hog business.

The division engineer, Mr. T. A. Bedford, approved the plan and a purchase order was issued for five purebred Berkshire sows and a Poland-China boar, which were purchased at a cost of \$20 per head.

During the first two years Brown slaughtered \$2,400 worth of pork. Then the camp was moved to Trinity County, which caused a temporary slowing down of pork production. Over a period of

several years, however, an average of \$2,000 worth of pork was slaughtered annually. Last year the camp was moved to the Kern River Canyon, east of Bakersfield, and in the new location, \$1,500 worth of hogs have been butchered. The recent hog population of the Kern camp was 165 head, consisting of 20 mature sows, a boar, and the balance suckling pigs and feeders.

Brown values his present herd at easily \$1,500, and estimates the value of pork butchered during the last six years at \$8,000. The initial investment was \$120, and he still has two of the original Berkshire sows.

When the camp was moved from Downieville to Trinity County, a three-deck truck was constructed, in which sixty-odd hogs were moved 250 miles to the new camp, in about two days, the truck traveling night and day. But one head was lost during the trip, which was made in the month of August.

Waste is Eliminated.

Camp scraps, that otherwise would go to waste, are used for feeding. Of course, Brown has little labor trouble as there are plenty of men who would rather be swine herders out in California's glorious mountains than rock breakers within the walls of Folsom Prison.

It always has been the policy of the Commission to provide prisoners working on the highways with plenty of good wholesome food. And in the Folsom camp, Brown's hog industry furnishes a considerable part of the meat supply. It is a notable example of the economies practiced in the management of the state's prison road camps.

KERN COUNTY GRADING ROADS IN ANTICIPATION OF STATE MAINTENANCE

IN ANTICIPATION of state maintenance, after January 1, 1926, of all traversable roads within the state highway system, as authorized in Assembly Bill 589, Kern County is expending approximately \$30,000 for the improvement of sections of the Kern River-Walker Pass state highway. The first unit under construction by the county is a heretofore uncompleted three-mile extension of Niles street, directly east of Bakersfield. It is located, in part, on the present county road, the eastern end following the new state highway location. The road is being graded, and proper drainage structures installed.

Rebuilding Lateral.

At Democrat Springs, the eastern terminus of the state con-

struction authorized (now rapidly nearing completion by convict labor), the new state highway ends in a narrow county road. The county, for the past two months, has had a force of men and equipment at work rebuilding the road from Democrat Springs to Bodfish, a distance of seventeen miles. The new roadway is being made twenty feet wide, with frequent elimination of sharp curves, and improvement of alignment and grades.

In the eastern part of the county, the state highway between Mojave and the easterly boundary is being graded on the state survey.

In so far as gaps in the state highway system are concerned, Kern County soon will have her roads ready for state maintenance.

VISITS CALIFORNIA TO LEARN ROAD BUILDING

DETERMINED to learn road building by actually participating in it, A. A. Natrass, contractor of Taihapi, New Zealand, has been spending some time in California working on state highway projects as a common laborer.

Natrass has been traveling about the state observing methods in use on state highway construction. Whenever a particular job interested him, he secured employment, and studied California practices by actually participating in the building of the highway, placing the pavement, or whatever else may have been under way.

Upon visiting the Sacramento headquarters, he declared California the best place in the world to study modern highway construction. Natrass is the second New Zealander to make a study of California state highways in recent months.

INVESTMENT IN MOTOR VEHICLES

THE automobile has been perhaps the greatest single new productive force in the economic and social development of the United States in the past twenty-five years. Practically unknown when the twentieth century began, individual transportation has since added billions of dollars of wealth to the nation's resources.

In 1900 there were but a few hundred automobiles in the United States and their use was regarded as a luxury limited to the few. Today there are 17,500,000 motor cars and trucks, one to about every seven persons, performing for the most part an essential transportation function.

Naturally enormous sums have been invested in the purchase and maintenance of these machines. For ten years the average sum spent in the acquisition of cars has been close to \$2,000,000,000 annually and the amount expended for gasoline, tires, repairs and garage items will now average almost three times that amount.—*Committee on Highway Transport.*

FRACTURED CONCRETE TEST SPECIMENS HEAL AND SHOW INCREASED COMPRESSIVE STRENGTH WHEN RETESTED

By F. T. MADDOCKS, Testing Engineer.

A RECENT press report quotes Professor Duff Abrams of Lewis Institute, Chicago, as announcing that concrete cylinders, once cracked and then retested after a period of years, had been found to have developed a strength equal to two and one-fourth times the strength originally developed.

This phenomenon was noted in 1918, in the California testing laboratory.

A specimen, received from Sacramento County, which had been previously broken, was placed in the compression machine and developed considerably more strength than when first tested. This led to a short series of tests in which specimens were broken at ten days, returned to the storage water, and again broken at twenty-eight days. In nearly every case, an increase in strength was noted.

Additional tests were made during 1924 with specimens received from the field. Two of these specimens are molded each day by the resident engineers, one for ten-day strength and the other for the twenty-eight-day test. Ten-day cylinders were removed from the testing machine the instant they received their ultimate loads, and replaced in the storage tanks. They were again broken at twenty-eight days along with the regular twenty-eight-day specimens.

At the present time, seventy-four specimens have been broken. The results are shown in the attached table.

What the Tests Showed.

When rebroken at twenty-eight days, 88 per cent of the cylinders showed an increase in strength ranging from 0.2 to 74.5 per cent. The average of all specimens was 21 per cent. The average increase of the unbroken twenty-eight-day over the ten-day specimens was 38.5 per cent. Twenty-six per cent of the unbroken samples were stronger at twenty-eight days than the regular twenty-eight-day cylinders for this period. This may be due to a lack of uniformity in fabricating the two test pieces, representing the day's run.

It is not probable the ultimate strength of concrete, once broken, ever will equal the strength of the same concrete had it been cured to final test without being fractured. It is evident, however, there is a pronounced tendency for the concrete to reunite across the fractured area.

Chemist Explains Phenomena.

The phenomenon is explained by G. H. P. Lichthardt, chemical testing engineer for the California Highway Commission, as follows:

"The increase of strength in concrete, subjected to a stress that will injure it, is due to the added results of the completed chemical reactions which have taken place subsequent to the injury.

One of the compounds formed by the hydration of cement is a kind of calcium hydrate, which is water soluble to the extent of about 15/100 per cent; therefore, should concrete be placed in water, this hydrate would dissolve until a saturated solution is obtained. If the test piece be taken from the curing vat, cracked or caused to yield without disintegration, and then replaced in the water, or kept moist, crystals will be deposited upon the facets of the freshly exposed material. This secondary deposit has the effect of sealing the cracks, but naturally will not have the strength of the original material.

The same action will take place in concrete which is alternately wet and dried, as well as that which is immersed in the curing vat, but the healing will be of longer duration and the deposit weaker as there is greater opportunity for carbonation taking place."

Eleven

Value of Discovery.

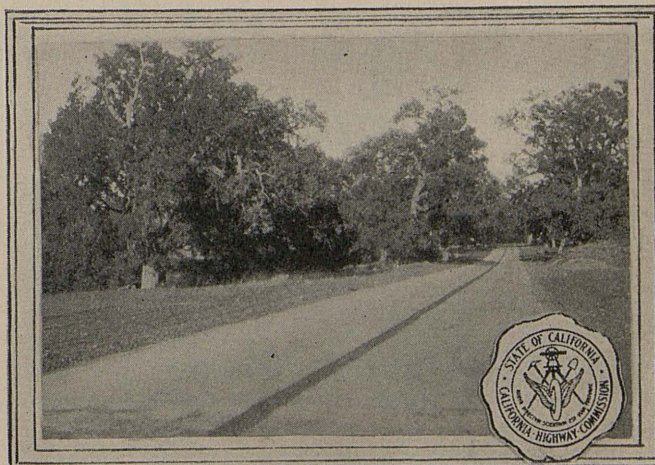
This discovery, noted in California seven years ago, is probably of more academic than practical value. It is well to know, however, minor cracks that may appear during the initial setting of concrete structures, particularly bridges, and in pavements, do not mean a failure is eminent. A sealing process probably is going on, and the ultimate strength of the concrete, in many cases, may not be seriously impaired.

TABLE SHOWING STRENGTHS OF 6 x 12 CYLINDERS BROKEN AT TEN DAYS AND REBROKEN AT TWENTY-EIGHT DAYS COMPARED WITH SPECIMENS SAME CONCRETE BROKEN AT TWENTY-EIGHT DAYS.

Test number	Strength in pounds per square inch			Per cent increase in strength	
	10th day	*28th day (10 day broken specimen)	**28th day unbroken	At 28th day (10 day broken specimen)	At 28th day unbroken
01028	2,880	2,590	3,090	-10.0	7.2
01033	3,085	2,450	4,590	-20.6	48.8
01034	4,615	4,330	5,520	-6.2	20.0
01037	2,715	3,230	3,590	19.0	32.2
01042	2,420	3,780	3,275	56.1	35.4
01044	3,795	5,390	6,060	42.0	59.7
01046	4,850	5,425	6,700	12.0	38.1
01049	2,315	3,250	3,790	40.4	63.7
01047	2,005	2,825	3,515	40.9	75.4
01050	3,455	3,385	4,355	-4.8	26.0
01052	2,605	2,800	3,415	7.5	31.1
01054	3,490	2,545	5,150	-27.0	47.5
01055	3,585	2,330	4,590	-35.0	28.0
01079	2,670	3,105	3,170	16.3	18.7
01080	2,635	3,550	3,955	34.8	50.1
01081	2,560	3,040	2,750	18.8	7.4
01082	2,680	2,970	3,270	10.8	22.0
01083	2,985	2,990	3,675	0.2	23.0
01084	3,105	3,625	3,775	16.8	21.5
01093	2,320	3,330	3,175	43.5	36.9
01094	2,600	3,910	3,480	50.4	33.9
01100	2,755	3,205	4,465	16.2	62.0
1016	2,520	2,395	4,040	-7.6	55.7
1019	2,860	3,000	4,970	4.9	73.8
1034	3,250	3,190	3,160	-1.8	-2.7
Average 25 specimens	2,990	3,310	4,060	12.7	36.6
Average 74 specimens	2,620	3,170	3,630	21.0	38.5

*These specimens were broken at ten days, then cured in water for an additional period of eighteen days, then rebroken on the twenty-eighth day.

**Corresponding specimens from same concrete cured in water twenty-eight days and then broken.



A view on the Ventura boulevard between Los Angeles and Ventura, showing new "second story" concrete pavement twenty feet wide placed over the old fifteen-foot slab. A gasoline tax job.

WHAT THE DIVISIONS ARE DOING

DIVISION III.

HEADQUARTERS, SACRAMENTO.

F. W. HASELWOOD, ACTING DIVISION ENGINEER.

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

THE Nevada Contracting Company has equipment on the job and is starting work on the grading of the last section of the Truckee River highway from Floriston to the Nevada line. The race is now on to get the road open in time for 1926 travel.

Other grading contractors in the division are making good use of the summer. C. R. Adams, contractor, between Colfax and Gold Run, is working his power shovels three shifts daily.

The time for the completion of the Williams grading and surfacing contract, on the Tahoe-Ukiah highway, Colusa County, has been extended to August 26th.

The approaches to the dangerous grade crossings at Emigrant Gap are being improved, until such time as funds are available for their elimination.

Manetas and Company have been given an informal contract for placing 600 cubic yards of masonry walls on the road about Lake Tahoe.

W. H. Miller is superintendent in charge of the state forces engaged in placing an asphalt seal coat on the Auburn-Colfax section.

DIVISION VI.

HEADQUARTERS, FRESNO.

J. B. WOODSON, DIVISION ENGINEER.

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

THE contracts of H. H. Peterson, and Stewart and Bland, who have been doing widening and "second story" paving work north of Fresno, have been extended to include placing of rock shoulders alongside the new pavement. The new twenty-foot pavement may then be considered completed in first class shape.

The Kaiser Paving Company is at work placing ten miles of rock shoulders in the vicinity of Los Banos on the Pacheco Pass lateral. The contract was awarded recently by the commission.

DIVISION VII.

HEADQUARTERS, LOS ANGELES.

S. V. CORTELYOU, DIVISION ENGINEER.

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

AFTER having been under way for more than two years, the famous Hauser contract, for grading a section of the Coast Boulevard in Ventura County, has been completed and the contractor has moved off the job. This project was one of the most difficult ever undertaken in the history of highway construction in California.

Grading has been completed and pavement is being placed on the widening of the Whittier boulevard between Montebello and Whittier, where a fifty-six-foot street is being placed to handle southern California traffic. The county is paying half the cost.

Widening and thickening of the highway north of Oceanside has been begun. Between San Juan Creek and Galivan, embankment widening has been completed and placing of pavement started. Jahn and Bressi have both contracts.

DIVISION X.

HEADQUARTERS, SACRAMENTO.

J. C. McLEOD, DIVISION ENGINEER.

Counties of Amador, Calaveras, Alpine, Tuolumne, Stanislaus, San Joaquin, Solano, and southern Sacramento and Yolo counties.

APPROACHES to the Rio Vista bridge over the Sacramento River are being paved by the Valley Paving Company under an informal contract.

J. F. Knapp has completed the second-story pavement and "flush" shoulders from Manteca south to the Stanislaus River, and is now working north from Manteca to Turner Station, where grading is under way.

The "flush" shoulder work between Woodland and Davis, being done by the Kaiser Paving Company, is about completed.

Maintenance allotments have been made for line and grade changes on the Red Lake grade, east of Carson Pass on the Alpine highway, and near the Kinner Reservoir east of Ebbett's Pass, both in Alpine County.

Funds also have been allotted for additional surfacing work between Ione and Jackson, in Amador County.

A special authorization has been approved for grade widening and improvement on the Big Oak Flat road between Bucks Meadow and South Fork. This is a popular entrance to the Yosemite.

BRIDGE DEPARTMENT NEWS

HARLAN D. MILLER, Bridge Engineer.

THE need for a new under pass under the tracks of the Sacramento Northern railroad, at West Sacramento, was demonstrated recently, when the present narrow wooden subway caught fire and held up traffic for several hours. Bids have been asked for the new subway, which will have a clear roadway width of thirty feet, in addition to sidewalks. The blind curve also will be eliminated.

Bids also have been asked for a concrete girder bridge across Willow Brook, Sonoma County, on the Redwood highway. It will have a width of thirty feet and will replace a county-built structure which collapsed last winter during high water.

Bordwell and Zimmerman, contractors, have begun work on the Charley Creek arch, on the Pacific highway in the Sacramento River Canyon. W. H. Johnson will be the resident engineer.

T. K. May and O. P. Dodds have been added to the staff of the bridge department.

Harold Peacock has been attending the Red Men's convention at Pismo Beach, as a delegate from Sacramento.

E. A. Welch and Norman B. Raab are others from the department recently on vacations.

EQUIPMENT DEPARTMENT NOTES

R. H. STALNAKER, Equipment Engineer.

THE Equipment Department has taken charge of the new shop recently completed at Crescent City, on the Redwood highway. The shop located at the Smith River convict camp has been moved to the new building and is in charge of Mechanic Frank E. Symms.

J. W. Grace is in charge of equipment in Division I. He reports the Willits shop greatly encouraged by its success in the construction of certain auxiliary equipment. Recent work turned out includes a hand operated crane, mounted on a standard cargo truck for moving heavy equipment.

Protracted rainy weather of the coast section makes necessary protection for operators of Fordson tractors. The top designed

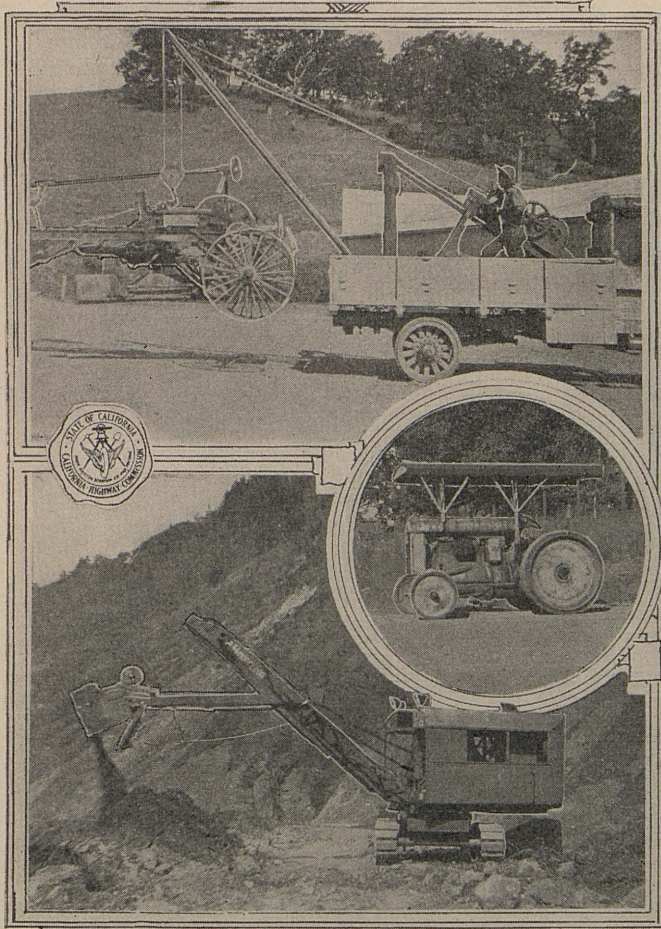
CALIFORNIA HIGHWAYS.

by the shop keeps the equipment on the road, when maintenance work otherwise would have to be discontinued.

A six-ton trailer has been built from an old Packard truck chassis.

A new cleat to protect bolt heads on Yuba tractors also has been devised, which has prolonged the life of bolt heads on this equipment from a week to several months.

Remodeling work at the headquarters shop, Sacramento, is well under way.



WORK OF THE EQUIPMENT DEPARTMENT—Above, Hand operated crane mounted on standard cargo truck, built at the Willits shop. *Inset*, Fordson tractor equipped with special top to shield operator and machine, particularly during stormy weather. Below, gasoline shovel removing slides. It is equipped with a steel cab to protect operators and machinery from falling rocks and earth, and is electrically illuminated for night work. Equipment in service on the Redwood highway.

ALL-WESTERN ROAD SHOW.

Western highway builders are expected to take considerable interest in the All-Western Road Show, which will be held in San Francisco during the week of November 9th. This date has been definitely decided upon and the management promises a comprehensive display of the latest road building machinery. A number of organizations are planning meetings in San Francisco during the week of the exhibit. The show is the first of its kind to be held in this section of the country.

Not more than "45 minutes from Broadway" a concrete crew was laying a road through a New York village recently, and in front of the home of an observant old lady the reinforcing steel mesh was being put in place. The placing of the wire mesh greatly impressed her.

Later in the day the old lady, discussing the new pavement with one of the village trustees, said:

"Now I know why concrete pavements are so easy to ride on. This morning I watched them lay the bed springs in the concrete."—*Highway Engineer and Contractor.*

Thirteen

YES, THEY DO COST MORE

The State Highway Commission received bids yesterday for grading that portion of the Old Trails highway between Victorville and Hicks. The bids ran from \$155,000 to \$173,000. And inasmuch as this contract does not carry any paving at all, some idea of the large expense of road building, these days, may be had.—*Redlands Facts.*

THE California Highway Commission is well aware of the increased cost of highway construction. The 1913 dollar is worth about 55 or 60 cents today. Pavements, originally considered adequate when they were fifteen feet wide and four inches thick, now have a minimum width of twenty feet and a minimum thickness of six inches with nine inches at the edges. In many places, pavements must be much wider and even thicker to care for 1925 traffic. Twenty-one-foot grades of 1912 must now have a minimum width of thirty feet; there must be no more sharp and blind curves.

California had 75,000 motor vehicles in 1912, when state highway construction began; the prediction for 1925 is 1,500,000. Highway construction is done by contract, awarded after open competitive bidding, and just now there is plenty of competition, too.

But highways can't be had for what they cost in 1912 no more than newspaper print, shoes, clothing or anything else necessary to supply the needs of our modern civilization.

OLD PIPE MAKES FENCE POSTS

BEFORE commencing construction of a foreman's cottage and the combination bunk house and garage at the New Santa Clara River maintenance station, Ventura County, Division VII, the site was fenced that building materials might be safely stored on the premises, while work was in progress.

The fence, a little over seven feet high, was constructed with seventy-six inches of woven fence wire with three strands of barbed wire on top. Fence posts were made at the Lankershim shop from old discarded two and two and a half inch pipe.

It required 1260 lineal feet of fence to enclose the station site. The cost was 37 cents per foot of fence for materials, and 32 per cent per foot of fence for labor. Cost of gates is included in the above.

Several other maintenance stations in Division VII have been enclosed with the same type of fence, which has proved satisfactory.



DISCARDED PIPE NOW FENCE POSTS—Division VII uses discarded pipe for fence posts when enclosing maintenance yards. The pipe is secured from the Lankershim shop. The view above shows the fence being erected at the new Santa Clara River station. This type of post has proved satisfactory.

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
458	VIII	San Bernardino-Riverside	26	B-A	COMPLETED AND ACCEPTED SINCE JULY 13, 1925. One third mile north San Bernardino County Line to Beaumont.....	7.10	P.C. Concrete Base.....	Bassich Bros. Co.....	\$212,594 96	Nov. 15, 1924	
					AWARDED SINCE JULY 13, 1925.						
476	VIII	San Bernardino.....	31	D-E-F	Victorville to Hicks.....	25.74	Grade and Gravel.....	H. G. Fenton.....	\$182,037 49	July 29, 1925	250
477	VIII	Riverside.....	26	E	Across Coachella Stormwater Drain.....		R.C. Girder Bridge.....	Badt, Falk and Bergendahl.....	42,181 88	July 29, 1925	125
478	VIII	Imperial.....	27	D	Holtville to East Highline Canal.....	6.90	Grade and Gravel.....	Norman B. Conway.....	122,264 48	Aug. 14, 1925	225
479	VII	Orange.....	60	A-B	Newport Beach to Laguna Beach.....	9.78	4.00 miles R.C. Concrete Pavement..... 5.78 miles Asphalt Macadam.....	Kavanagh and Twohy.....	219,560 06	Aug. 14, 1925	250
					Sub-total.....	42.42			\$566,043 91		
					PENDING AWARD.						
	VII	Los Angeles.....	60	A	Latigo Creek to Las Flores Canyon.....	6.68	P.C. Concrete Pavement.....		205,672 50		
					Total State Highway Fund Jobs Awarded and Pending Award.....	49.10			\$771,716 41		

NOTE—Primary construction covered by the above contracts does not include funds obligated on cooperative forest highway projects, prison road camp 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
M-61	VIII	San Bernardino.....			COMPLETED AND ACCEPTED SINCE JULY 13, 1925. San Bernardino.....		Shop Building.....	Houghton and Anderson.....	\$27,937 13	Feb. 13, 1925	
					AWARDED SINCE JULY 13, 1925.						
M-94	VI	Fresno.....			Fresno.....		Maintenance Shops.....	J. P. Williams.....	\$32,953 50	July 29, 1925	90
M-95	II	Shasta.....	3	C	Charley Creek.....		R.C. Bridge.....	Bordwell and Zimmerman.....	80,741 76	July 29, 1925	175
M-96	VIII	Riverside.....	26	E	Edom to 2 miles north of Indio.....	9.10	P.C. Concrete Shoulders.....	Bassich Bros. Co.....	90,249 75	July 29, 1925	150
M-97	VII	Los Angeles.....	2	D	Philadelphia Street to Michigan Ave.....	1.90	P.C. Concrete Pavement.....	J. Paul Benson.....	93,185 66	Aug. 14, 1925	125
					Sub-total.....	11.00			\$297,130 67		
					PENDING AWARD.						
					Total State Highway Maintenance Fund Jobs Awarded and Pending Award.....	11.00			\$297,130 67		

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 not being done under contract.

CALIFORNIA HIGHWAYS.

HIGHWAY NEWS NOTES

STATE Highway Engineer R. M. Morton made a trip to Washington, D. C., during the early part of the month, to attend a meeting of the joint board appointed by the Secretary of Agriculture to prepare plans for a uniform system of warning and direction signs for the federal aid highways. Mr. Morton is a member of the board.

J. C. McLeod, Division Engineer, Division X, was unable to attend the recent staff conference in Los Angeles because of illness. He is now back on the job.

Secretary F. W. Mixon is taking the first vacation he has had since his appointment in January, 1923.

Mrs. Julia Harlow, of the BULLETIN office, has returned from a vacation trip to Portland and Seattle.

Mrs. Alice Nathan is another vacationist who is back in the office.

Miss Gladys Miller, stenographer-clerk in the Willits shop, motored to Yosemite National Park recently in her new car.

Arthur E. Shaffer, of Shop I, returned to Willits recently with a brand new bride.

Miss Elizabeth Etzel, of headquarters, drove all the way to Canada and back while on her vacation.

H. O. Ragan and Norman Coote, respectively resident engineer and assistant on the concrete shoulder job north of Fresno, Division VI, have completed this work and moved to Bakersfield to take charge of 8.2 miles of asphalt reconstruction work now under way.

W. F. Walker has been promoted to the position of foreman on the widening work under way along the west shore of Lake Tahoe.

A. D. Griffin, after having spent several years on the Ventura coast as resident engineer on the Hauser contract, Division VII, has been assigned to a "second story" concrete job in San Diego County. Ralph D. Kinsey is assistant on the same contract.

E. B. Milnor and O. W. Monroe have been assigned to the Jahn and Bressi contract as assistant resident engineers.

W. J. Nelson is now on the San Onofre line change as assistant resident engineer.

THE LAITY'S VIEWPOINT

A REMARKABLE lay encomium for the cause of road construction recently came to my attention. In the *Typosium*, a publication for Los Angeles printers, appears the following editorial comment:

"Did you ever stop to think how much a good road has contributed to civilization?"

"Once upon a time all roads led to Rome. And why? Only because Rome saw to it that all roads were well paved. They made going easy. And when it was necessary to make a short cut to any place, she made it. Travelers tell us that the Apian Way is still a marvel of a good road."

"It was only the barbarian that made it difficult for travelers and commerce to pass freely from place to place. Shakespeare shows us in the 'Comedy of Errors' that it was death for a Syracusan to be found in Ephesus and vice versa."

"One reason why Henry Ford is the truly great man that he is, lies in the fact that he has made a car for the multitude. Under the car must be a good road. There were Henry Fords in Rome, and there were great road builders, but there were also small-visioned men who said, 'If you make a better chariot than the ox-cart, you will hurt business in our town.' So these chaps put up barriers to travelers and commerce. They stood at the bridges and collected tolls. Then civilization limped, and it still limps because of the same things."

"Good roads have aided civilization because they make it easier for men to meet on common ground—to pass from this place to that—and enable commerce to exchange its surplus here for that surplus there. Every hindrance to this achievement is a harking back to barbarism."

There can be no doubt but that the citizenry appreciates the merits of improved highways but the impression that road construction is a transient activity must be corrected and the fact that highway building, reconstruction and maintenance will be without end, must be sedulously proclaimed.—*Western Highways Builder.*

A Proper Retort.

"It's no wonder you're such a sissy," declared the bad boy. "You're pa and ma were married by a justice of the peace."

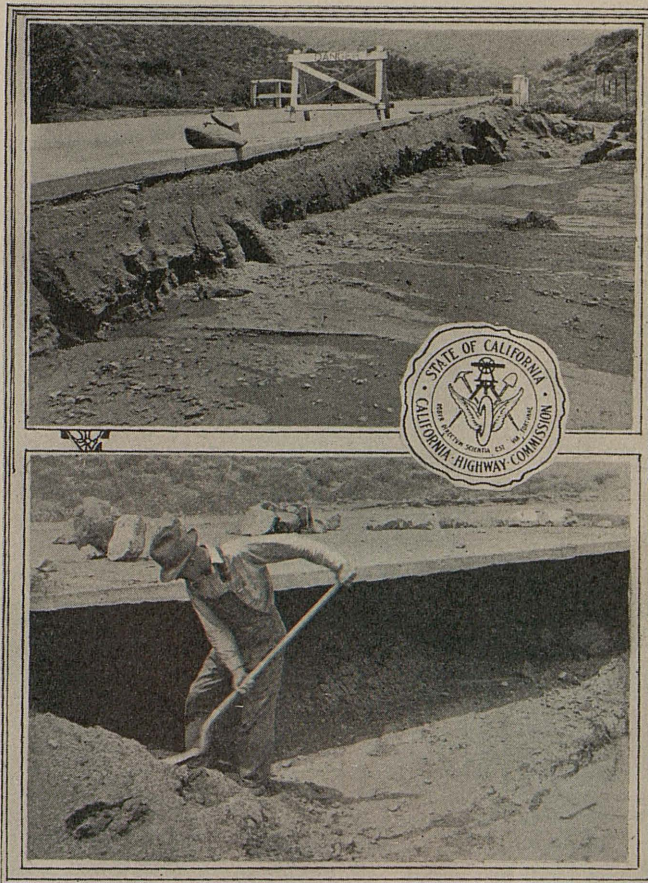
"Well," retorted independent Mary, "from the noise I hear coming from your house, your pa and ma must have been married by the secretary of war."

Fifteen

CLOUDBURST LANDS ON HIGHWAY

IN MINT CANYON, about twenty miles easterly from Saugus, Division VII, two opposing groups of clouds got together recently and had a little cloudburst. The excitement lasted about an hour and it all happened along a three-mile stretch of highway. Water running two feet deep down the roadway washed a truck loaded with hay off the pavement.

Several culverts were filled with debris, shoulders were badly washed and the pavement was undermined in several places, as shown in the illustrations.



WHERE MAINTENANCE MONEY GOES—The views show what a cloudburst did to a section of state highway in the southern part of the state. The concrete slab held despite the washing away of the subgrade. Gasoline tax funds help to finance repair work of this kind.

HIGHWAYS BENEFIT FARMERS

The development of motor transportation has revolutionized the life of the farm. It has brought the town and country into closer touch. It has in a considerable degree destroyed the historic isolation of the farm and the farmer. It has permitted a notable extension in educational facilities available for rural populations. The centrally located school reachable by motor transport from a large surrounding area has largely contributed to the solution of the problem of adequate equipment and adequate instruction for the rural children.—*Committee on Highway Transport.*

In a Broadway Street Car.

First Kindergarten Teacher—"And how many children have you?"

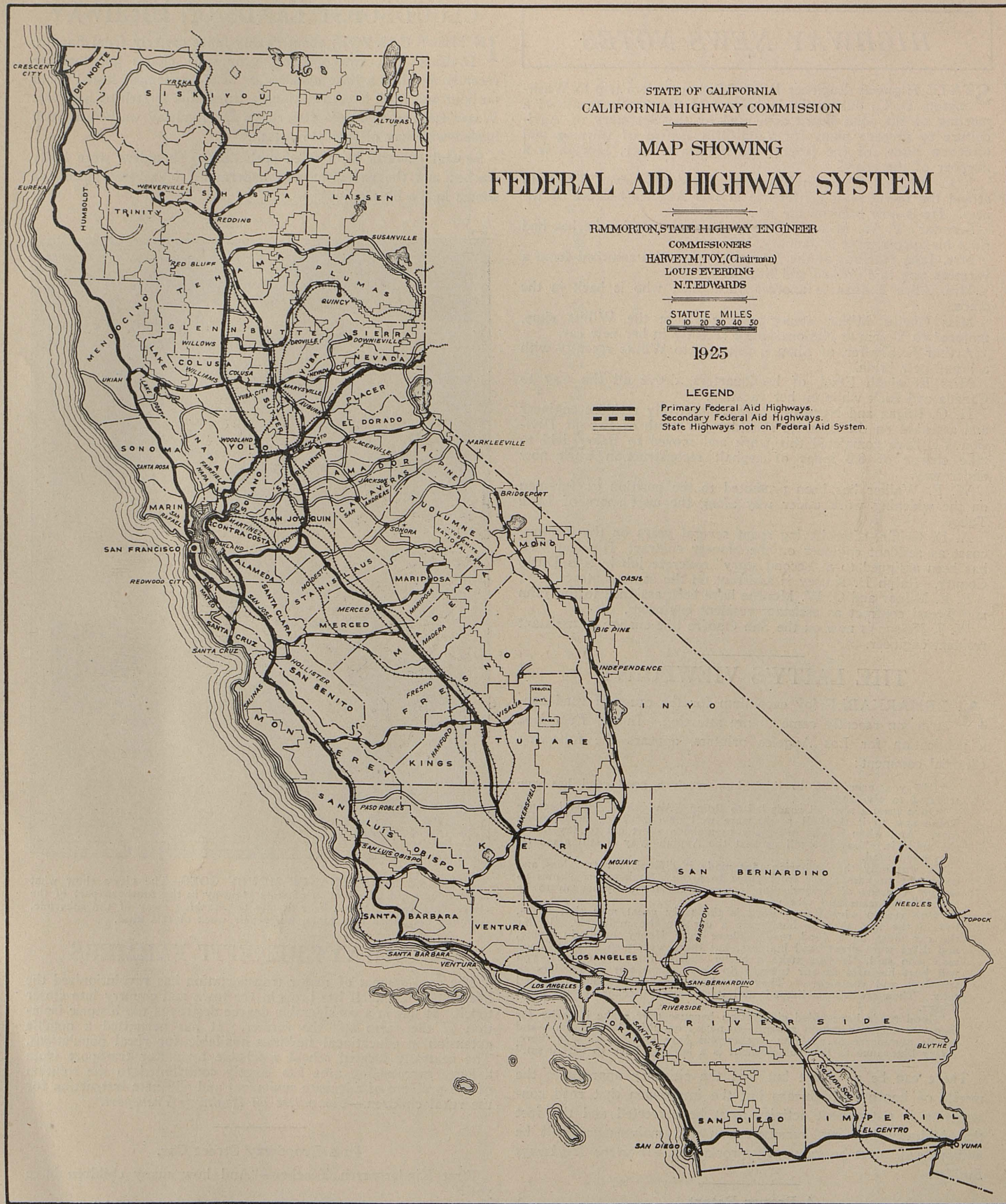
Second Kindergarten Teacher—"Twenty-nine. And how many have you?"

First Kindergarten Teacher—"Thirty-six."

Pat, in seat ahead—"Say, what part of Ireland are ye from?"

—*Carnegie Tech. Puppet.*

CALIFORNIA HIGHWAYS.



STATE OF CALIFORNIA
CALIFORNIA HIGHWAY COMMISSION

MAP SHOWING
FEDERAL AID HIGHWAY SYSTEM

R. MORTON, STATE HIGHWAY ENGINEER
COMMISSIONERS
HARVEY M. TOY, (Chairman)
LOUIS EVERDING
N. T. EDWARDS

STATUTE MILES
0 10 20 30 40 50

1925

LEGEND

- Primary Federal Aid Highways.
- Secondary Federal Aid Highways.
- State Highways not on Federal Aid System.

The above map shows the federal aid highway system of California in its relation to other state highways. The roads shown on this map constitute the present state highway system, except in one or two minor particulars where the federal aid system includes short sections not designated state highways.

CALIFORNIA STATE PRINTING OFFICE
JOHN E. KING, State Printer
SACRAMENTO, 1925

centimeters
10
9
8
7
6
5
4
3
2
1
0

inches
4
3
2
1
0

Golden Thread
D50 Illuminant, 2 degree observer
Density

1	2	3	4	5	6	7	8	9	10	11(A)	12	13	14	15
39.12	65.43	49.87	44.26	59.82	70.82	63.51	35.92	52.44	67.36	82.74	69.44	85.44	71.19	64.07
13.24	19.11	14.34	-4.34	-13.80	19.82	34.26	-11.81	48.55	-9.40	50.66	-9.75	54.06	-6.06	47.07
15.07	-18.72	-22.29	22.85	-24.49	-0.35	59.60	-46.07	18.51	1.13	0.23	0.21	0.43	0.28	0.19
0.75	0.98	1.24	1.57	2.04	2.42									

Colors by Munsell Color Services Lab