

CALIFORNIA HIGHWAYS

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

Vol. 3

MAY, 1926

No. 5



IN SMITH RIVER CANYON—The newest section of the Redwood highway in California is the cooperative forest project recently opened to traffic between Adams Station and the Oregon line, Del Norte County. Construction was under direction of the United States Bureau of Public Roads, the state advancing half the cost.

In this issue: INCREASING THE SAFETY OF STATE HIGHWAYS.

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

Inches 4 3 2 1 0

Colors by Munsell Color Services Lab

1	2	3	4	5	6	7	8	9	10	11(A)	12	13	14	15
L*	39.12	65.43	49.87	44.26	55.56	70.82	82.74	91.12	97.06	92.02	87.34	82.14	72.06	62.15
a*	13.07	18.72	-22.29	22.85	-24.49	-33.43	34.26	11.81	48.55	-0.40	-0.75	-1.06	-1.19	-1.07
b*	15.07	18.72	-22.29	22.85	-24.49	-33.43	34.26	11.81	48.55	-0.40	-0.75	-1.06	-1.19	-1.07

Density

Golden Thread

D50 Illuminant, 2 degree observer

CALIFORNIA HIGHWAYS

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. 3 MAY 1926. No. 5

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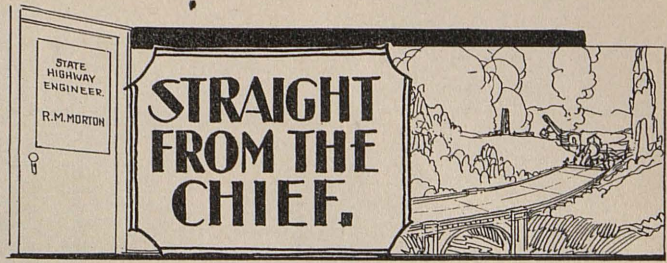
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THE FOLLOWING principles should be axiomatic with every engineer in the highway department. Experience, the great teacher, eventually hammers these truths home to all.

The proper location should be used, regardless of private property or existing highway improvements. Ten years from now, future development will show up instances of improper locations.

Alignment should be so planned as to permit of high speed. Some day there will be no speed limits on most public highways.

Real money should be put into the foundation and its suitability should not be taken for granted. The paving to be laid is not a foundation, whether it be oil macadam, asphaltic concrete, or hydraulic cement concrete. Foundations are perfected by weather, time and traffic, acting on the prepared earth roadbed, and these factors are more important than the rolling and compacting operations which can be performed during construction.

Subgrades Should be Studied.

Unstable soils should be avoided. No pavements should be placed on soils which shrink and swell without precautions to minimize these dangerous characteristics.

Widths of pavement should be ample to provide for traffic increase. A factor of safety is used in every other kind of engineering construction, including bridges and buildings. A factor of safety should be used in planning pavement width.

Quality is more popular with the public and will insure future continuation of highway construction, more surely than long mileage inadequately improved.

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INCREASING THE SAFETY OF STATE HIGHWAYS

By R. M. MORTON, State Highway Engineer.

(Editor's Note: The following abstract is from a paper read before the annual convention of the California Supervisors' Association, at San Diego, California, March 11, 1926.)

INASMUCH as one in three persons in California is responsible for the operation of a motor car, the subject of safety on the public highways is of constant public interest. There are perhaps three classes of danger which threaten the motorist.

First: Weaknesses in his vehicle itself. Records show that a prolific source of accident are those from worn tires, the breaking of wheels, the crystallizing of steering arms or axles. From this class of trouble the road builder can not be held responsible.

A second class of accidents is caused by the incompetent or irresponsible driver, who is an ever present menace to himself and to all others. Until some system is inaugurated for mental tests for operators, which will weed out the physically and mentally unfit, automobile driving will contain a large element of danger.

The third class of accidents includes those for which road conditions must share in the responsibility. This cause is inseparably related to the second, for the safe and careful driver tries to adjust his control of the machine to the highway conditions which he perceives immediately before him. However, in California, with the large mileage of smooth straight roads and the generous legal speed limit, the motorist has gradually come to believe in his right to proceed at the maximum of the legal rate of speed over the highway surface, in any location outside of cities and built-up sections. The universal use of the automobile for the transaction of every kind of business and pleasure has created public demand for safety in the highways. The efforts of the road building agencies, both county and state, to provide smooth, hard surfaces, capable of sustaining high speeds, is generally taken by the motorist as a recognition of his rights to proceed at the maximum speed which the law allows. The motorist has gradually

become more exacting in his demands regarding all details of highway improvement.

Experience Shows Dangers.

Improved highway construction in California has had crowded into its fifteen years of intensive history, a vast wealth of experience, example and precedent as to safety details. The state and county highway builders are better able now than ever before to state in exact terms what details constitute danger in highways.

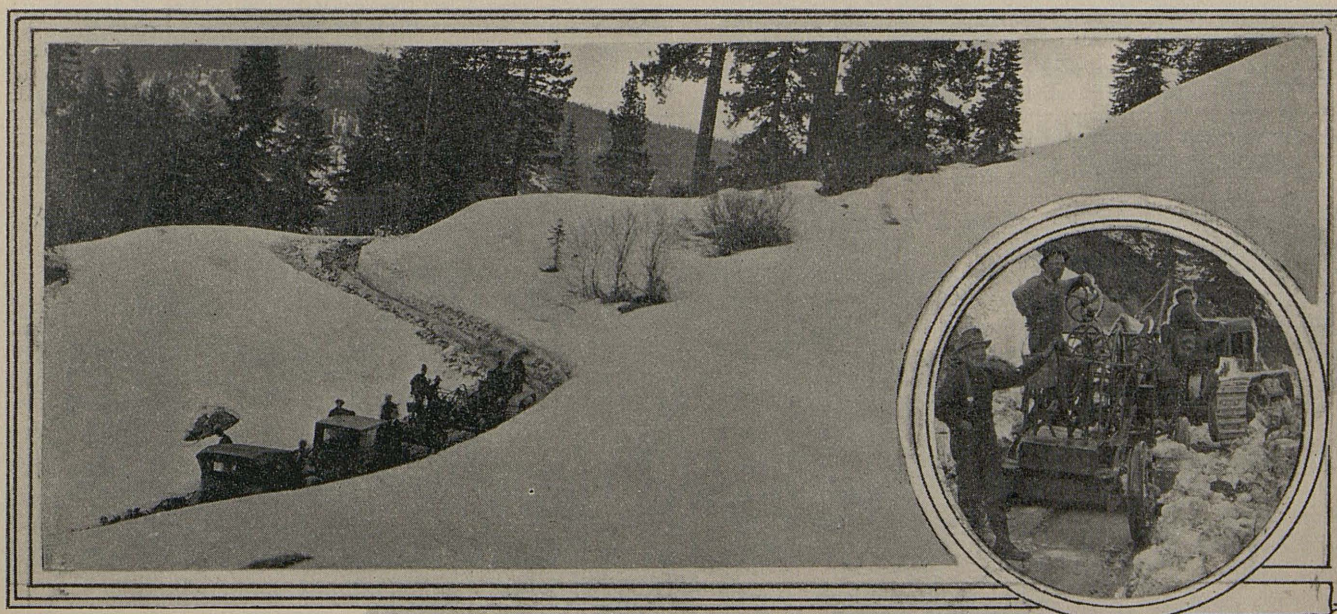
There are many details in the design of highways which have little influence on their efficiency for slow moving traffic, but which threaten the safety of the fast moving vehicle. At low speeds almost any improved highway is safe, assuming a good car and an experienced driver who has the ordinary co-relation of his senses. However, now it is for the faster traffic that we must design our highways, if we desire to reduce danger to a minimum.

The ideal highway should have sufficient width to accommodate the pavement, plus a margin of usable width to permit a car to get completely off the pavement at all points. The Motor Vehicle Act makes it a misdemeanor for a car to stop for repairs on the paved portion of the roadway, and the time is at hand when this provision should be more strictly enforced. There is no more serious menace to traffic than a car stopped on the pavement. It is an invitation to death for the persons in the car which is stopped. Many an accident has been caused by the meeting of two other vehicles at a point opposite the disabled car. At night it is doubly a menace, for it is often impossible to know quickly when approaching a red tail light, whether the car is stopped or is moving.

If a shoulder wide enough to permit of parking clear of the pavement is not provided by the road builder, the motorist is forced to stop upon the pavement.

Borrow Pits Menace.

We now know that the high grade with deep borrow pits scooped out in the right of way is often a death trap for the motorist. So
(Continued on next page.)



OPENING THE ECHO SUMMIT—Scenes taken recently in Division III when maintenance crews opened the Echo summit to travel on the road from Placerville to Lake Tahoe. At left, tractor towing grader and two cars up Meyers grade. (Photo by Division III.)

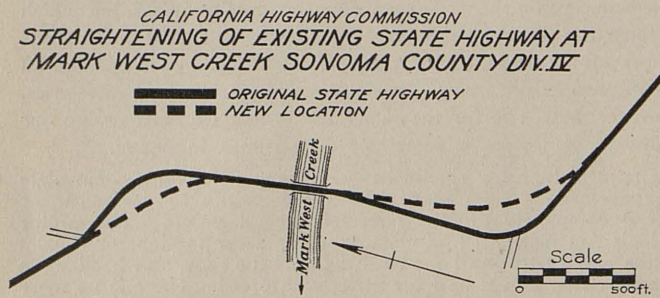
Three

INCREASING THE SAFETY OF STATE HIGHWAYS

(Continued from page 3.)

many accidents occur on account of these deep borrow pits that it is almost axiomatic in the state highway department that they are not to be constructed. Although drainage provisions are usually necessary, in country which seems to require construction by means of deep borrows on the sides, the excavation often greatly exceeds drainage necessities. When a grade is built by robbing the roadside, the drainage conditions are usually made worse instead of better, because ponds of water stand in the borrow pits, to the future detriment of the roadbed.

No road should be paved to a less width than 18 feet. Traffic on all of our public highways is now reaching a point where two lines must be provided. However, the 18-foot width of roadway does not provide any factor of safety to permit the free, easy, and safe passage of an automobile and a wide truck or stage. The pavement is built to take the traffic, and the road builder can not assume that the driver of one vehicle should get half way off the pavement to pass a wide load. Widths of 20 feet are considered to be necessary if we are to look a little to the future,



and assume the greater use of highways which is bound to come.

The junction between the firm material of a hard pavement, and the earth of the grade, is a great danger point on all paved roads, and a fruitful source of accident to the motorist. In rainy weather, if he leaves the pavement with one wheel to pass a vehicle, he sinks into the soft slippery shoulder, then endeavors to climb back by a quick turn on the steering wheel. Sometimes he goes across the pavement into the other traffic lane, thereby endangering the lives and property of those using that side of the road. Many accidents occur on low soft shoulders by the car overturning before its wheels climb back to the pavement.

This is a situation which road builders should not tolerate and can do much to prevent. It is the endeavor of the state to protect the edge of all new pavements by an additional two feet of crushed rock. The purpose of this is to widen the usable hard surface, as well as to create a transition area, the outside edge of which will not be so rigid or so abrupt as the edge of the hard pavement.

A good means of keeping traffic off the shoulders of the highway is to supplement with rock the width of the pavement and to permit vegetation to grow on the sides. It is noticed that motorists are much more careful to keep off the grass than off a smooth appearing earth shoulder. This reduces maintenance

expense and at the same time it increases safety by encouraging more careful driving.

Safe Curves Appreciated.

Curvature in road alignment has ceased to be a pet of the engineer, used by him only to cause right of way difficulties for the supervisors. The motoring public has become educated to the difference between a 100-foot radius curve and 300, 500 or a 1000 foot. He knows there are certain bad bends which require reducing his average speed to one half, and that there are others around which he can travel without slackening. He appreciates the safe curve. A highly superelevated curve of 300-foot radius is about the minimum which the average driver can safely negotiate at a speed of 35 miles per hour. The center of a 300-foot radius curve at a right angle corner will lie about 125 feet from the intersection of the two straight lines. A 500-foot radius curve will lie about 200 feet in from the intersection of the two straight lines.

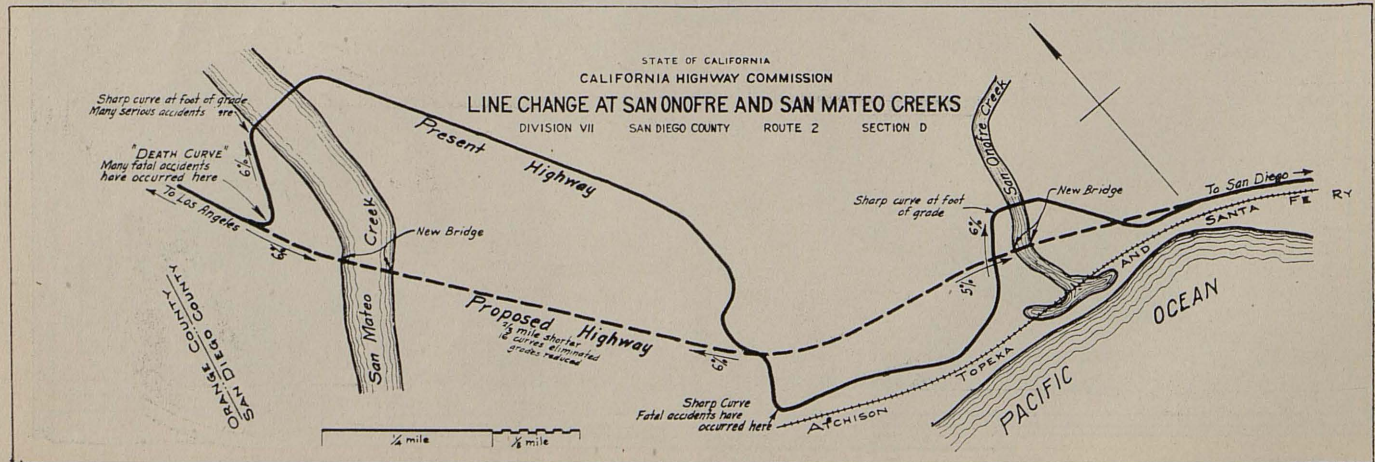
When first considered, the idea of taking valuable property just to ease up a corner for the speeding motorist may seem unreasonable, but these and even more drastic lines are necessary to build real safety into the roads. If the highway is to be paved, there will be an actual saving in length of pavement by installing a 500-foot radius curve instead of building a right angle of over 200 feet in length. At \$4 per lineal foot for the pavement, this amounts to over \$800 saving in cost of paving construction, which can be devoted to procuring the new right of way. On a curve of 1000-foot radius in such a location, the difference in length of pavement would be over 400 feet, which at the same rate would permit of \$1,600 being devoted to procuring new right of way.

Superelevation is another semitechnical term loved by the engineer and by the motorist. It means simply the banking, or raising of the roadbed on the outside, to make the car lean to the inside as it passes around the curve. Combined with the force of gravity and the centrifugal force, a properly banked curve keeps the center of gravity of the car properly spaced between the wheels in contact with the roadbed. Railroad tracks are laid out with superelevation on the curves, thereby permitting high speed trains to take them without slackening speed.

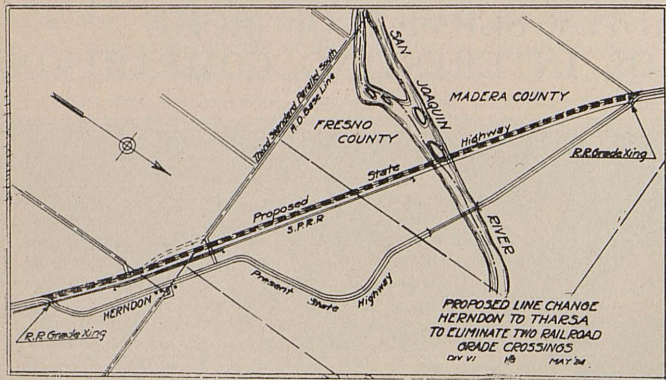
The necessity of superelevation, as a safety measure on the public highways, is now a well learned lesson.

Importance of "Sight Distance."

The term "Sight Distance" denotes the distance which the motorist traveling on the right side of the road can see past an obstruction, to sight an approaching car. Human beings differ in their time of recording sensations on the brain and getting the muscles into action. Some drivers are slow in their reflexes. A car moving at 30 miles per hour travels 44 feet in one second; at 40 miles per hour it travels 50 feet in one second. Assuming that two cars are approaching each other at 30 miles per hour around a curve, the distance between them is lessened by 44 feet in one second for each car, or at a combined rate of 88 feet per second. Therefore, with a sight distance of 88 feet on the curve, there would be one second for the senses of the drivers to act, for the muscles to act, and for the vehicles to respond and pass safely. Any such small distance is entirely too short to permit of a speed of 30 miles per hour. The average driver will require one second to adjust himself, one second should be allowed for the vehicle to respond, and there ought to be one second to spare. Therefore, a sight distance of 300 feet is the minimum which can be considered really safe. Even around curves from which obstructions have



Line change recently completed in San Diego County. See article on page 10.



been removed to make a sight distance of 300 feet, speeds greater than 30 miles per hour are hazardous. Sight distances must be increased to four or even five hundred feet in order to permit of safe travel at a speed of forty miles per hour.

Sight distance also comes into the calculations of the road builder on vertical curves, where two cars will approach the crest of a hill from opposite sides. In such cases curvature should be such that there is as long a sight distance as possible. To pass a vehicle going in the same direction when approaching the crest of a hill is always dangerous, until the driver has a clear view of the road ahead over the top of the hill. Good practice requires that the crest of the hills be lowered by means of long, flat vertical curves.

The problem of railroad grade crossings has consumed the time of many committees during the past few years. The grade crossing catches good and poor drivers alike. There is only one safe rule for the motorist in approaching a grade crossing, that is, to slow down to a speed which permits him to carefully look in each direction when still at a good distance from the crossing, and assure himself personally that a train is not approaching. Warning signs, bells, human flagmen, wigwags, and even traffic gates do not protect the motorist who does not take this common sense precaution. We sometimes say that he kills himself, but that does not repair the loss sustained by society when a carload of passengers is wiped out in an instant. The Railroad Commission of this state has adopted a policy of refusing to open grade crossings except when another is closed.

Grade Crossings Part of Improvement.

There is one good rule for the highway builder, and that is, to never improve a highway at grade across a main line railroad. If the highway is worth building, it must be because of the amount of traffic, and if the amount of traffic justifies building the highway, it usually justifies going a little farther and planning a grade separation to be constructed along with the highway project.

The practice which has become fairly standard in California is to assess one-half the cost of the project to the railroad, the other half being borne by the public. Although this phase of highway work is expensive, and adds to the number of major structures which must be built, there is nothing which is more appreciated.

The points above enumerated, which make for safety, have to do entirely with the designing and building of the road. They include the width of grade and pavement, the avoidance of death trap borrow pits, treatment of the shoulders, the alignment of the road, superelevation of the surfacing, sight distance on curves, and railroad separations. If a highway is well laid out with due attention to all of these details, the road builder has gone far in safeguarding the user of the highway. There are additional minor safety measures, the need for which should be studied by the road builder after the highway is in operation. These are improvements or betterments of a minor nature, which contribute added safety for fast traveling motorists.

One very important measure, which is highly conducive to safety, is the center guide line, which divides the pavement into traffic lanes. This is a great help to the motorist, both day and night, for it marks off a certain width for his exclusive use, and he proceeds with the assurance that the approaching motorist, desiring similar courtesy, will not encroach upon his side of the road. Workmanlike guide lines are not easily installed. White paint makes the best guide line on either cement or asphalt surface, at a cost of from \$40 to \$50 per mile. Black guide lines of asphalt paint can be installed for \$10 per mile or less, where there is much of it to do.

A white guard rail of substantial character looming up at night is a true friend of the motorist. He should have the same feeling

to it that the mariner has to the lighthouse on an unfamiliar sea. Guard rail, to be really worth while, should be sufficiently substantial that it will successfully resist an occasional sideswipe. The state of Pennsylvania standardizes on the use of heavy cables on extra heavy wooden posts. This guard is considered practically unbreakable, and I am informed that even trucks do not go through the heavy type. Even a light guard rail, however, is entirely serviceable as an indicator of danger. The motorist highly appreciates this installation made for his particular benefit. The guard rail now standardized on California state highways consists of 8 x 8 posts, 6 feet apart, and 6 x 6 rail, and costs from 80 cents to \$1 per lineal foot.

Flasher signals, many of which have been installed by the automobile clubs and associations, in some cases with financial aid from the counties, are a valuable safety device. The presence of a danger spot or a sharp turn in the road is indicated by these flashers, and many lives have been saved by the advance information thus given to the driver of a car.

The reflecting lenses, many of which have been installed both on state and county highways, are a great help in night driving, and are well worth their cost.

Safety Should be Built into Highways.

The question as to how much a county can afford to spend on the installation of safety devices can be answered from two different angles. The first answer is that safety should be built into the highways. A road alignment which is safe usually costs little more than one which is unsafe. The right of way expense, often magnified to be a serious item, in many cases is overbalanced by the savings to be made in reduction of distance. The wound caused by obtaining proper right of way is rarely deep and soon heals.

The adoption of adequate pavement width is an economy so far as future maintenance is concerned because of the distribution of traffic over a greater road surface, which prevents the concentration which tends to break up a narrower pavement.

Grades should be intelligently laid. Materials should be hauled in for making fills instead of scooping out borrow pits. Obstructions to sight should not be permitted. Grade curves over summits should be long and flat. Buildings, poles or other encroachments, including trees in the line of sight, which endanger the life of the motorist, should be kept clear of the roadway.

The other answer is in the close study of each mile of constructed road, its traffic and its accidents. Many of these can be prevented by relatively inexpensive installations of guard rails, flash warning or reflector signs, and traffic guide markers.

The counties of this state, excluding Los Angeles and San Francisco, in 1925 received an average of about \$100,000 each from the gas tax and motor vehicle license fees. Los Angeles County paid 40 per cent of the approximate \$20,000,000 total of receipts from license and gas tax, and received back for its own expenditure 20 per cent, or \$4,000,000. San Francisco County paid 8 per cent of the total amount collected and received back 4 per cent, or about \$800,000. The average return to the balance of the counties of the state was almost \$100,000. This fund contributed by the motorist could well be expended in each county in making the highways safer for motor travel.

TRUCKEE RIVER HIGHWAY TO BE DEDICATED IN JUNE

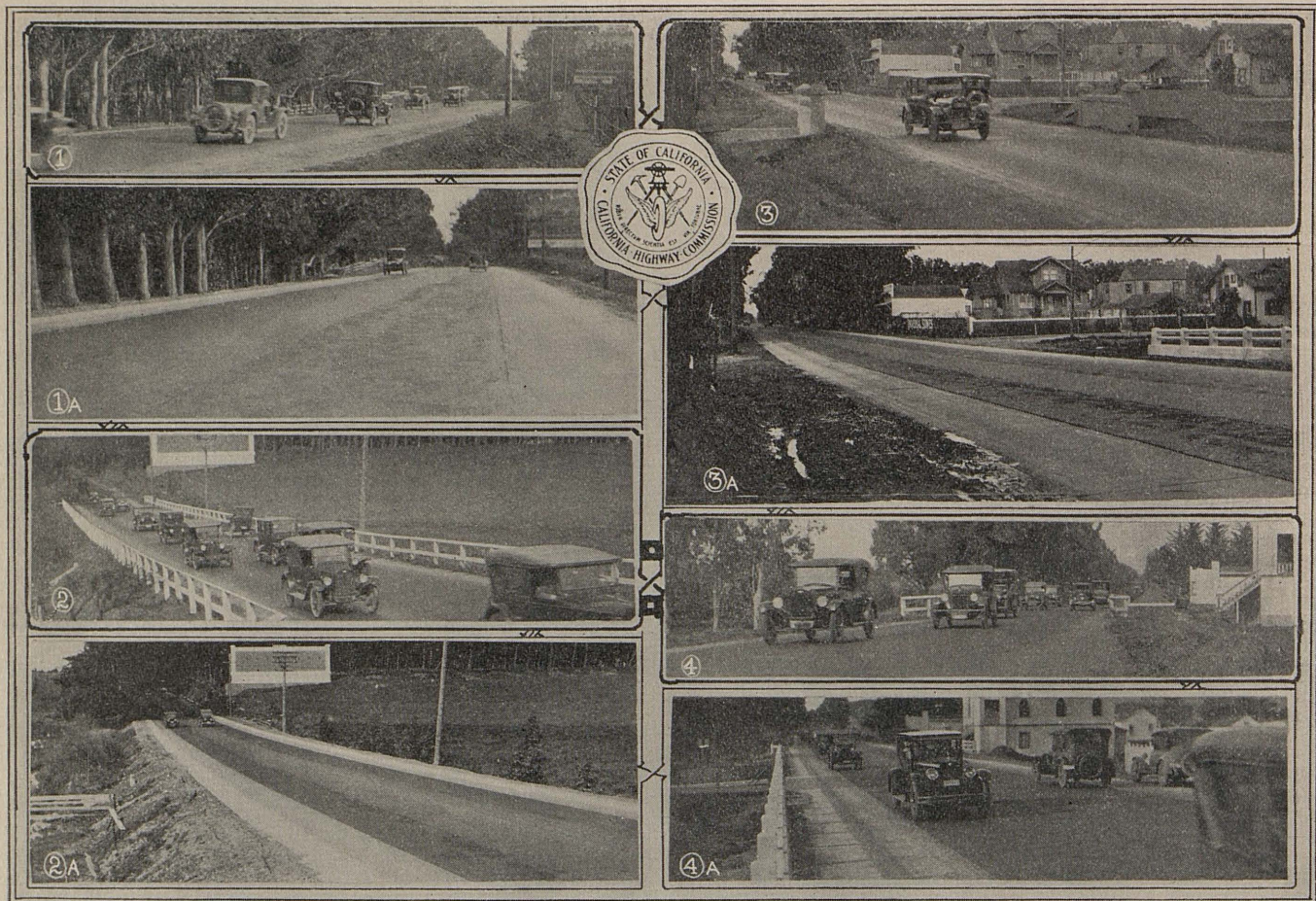
GRADING of the Truckee River highway, the new scenic route from Truckee along the river to the Nevada line and Reno, has been completed. The new highway will be dedicated to the use of the public on June 10th by officials of the commission and a great caravan of Californians, who are making a trip over the Victory highway from San Francisco to Salt Lake City, leaving San Francisco on June 9th.

The caravan will be headed by Chairman Harvey M. Toy and a delegation of San Francisco business men and officials of the California State Automobile Association and the Utah-Nevada-California Highway Association.

Commissioners Louis Everding and Nelson T. Edwards and their wives also will accompany the caravan to Salt Lake. State Highway Engineer R. M. Morton will inspect the work, returning after the ceremonies at the California-Nevada line.

The Bulletin, in the June issue, will give details of the project.

CONTRACT NUMBER I, REBUILT AFTER SERVICE OF MORE THAN TWELVE YEARS, AFFORDS INTERESTING COMPARISONS



CONTRACT No. I BEFORE AND AFTER RECONSTRUCTION—Peninsula highway between Cypress Lawn Cemetery and San Bruno, San Mateo County, including sections of Contract Number 1, recently reconstructed. (1) Before rebuilding; (1-a) widened pavement, same location, with heavy cement concrete shoulders for truck traffic; (2) old highway near Cypress Lawn; (2-a) widened highway at same point; (3) near San Bruno; (3-a) same point with dangerous drainage structure widened to promote safety; (4) through San Bruno; (4-a) widened highway at same point. (Photos by Division IV.)

THE FIRST contract ever awarded by the California Highway Commission was for the placing of a pavement twenty-four feet in width on the Peninsula highway, in the vicinity of Cypress Lawn cemetery and San Bruno, San Mateo County, Division IV. The recent rebuilding of this section affords engineers some interesting comparisons between methods followed in 1912 and 1913 and today.

A study of the final report on Contract Number I reveals that the specifications provided for a cement concrete base, twenty-four feet wide, surfaced with sheet asphalt to a thickness of one to 1½ inches. The concrete put down was known as Class C and the proportions were: 1 part cement, 3 parts sand and 6 parts gravel. Engineers were "careful to see that it was kept moist for not less than five days after placing." The mix was what was termed "wet" concrete. "Standard" Portland cement was used, with "Keystone" sand and "Niles" gravel for the greater part of the job.

The "Standard" asphaltic surfacing had an average penetration of 70 degrees and daily samples were taken and shipped to a testing laboratory in Sacramento. The pavement was placed with a decided crown of several inches.

Despite these specifications, which would be held inadequate today, Contract Number I held up remarkably well under the

extremely heavy traffic of the Peninsula highway. It was not so much the condition of the pavement as the necessity for a wider street that caused its widening to forty feet under the contract recently completed.

First Contractor Had Troubles.

Contract Number I was for 5.4 miles and was awarded to F. R. Ritchie on July 23, 1912. A subcontractor began building the grade, which was to be forty feet wide, August 5, 1912. In November of the same year the contractor assigned the contract to his bondsmen, who turned it over to the Ransome-Crummey Company of Oakland for completion. The latter firm began work on November 27, 1912 and completed the project on June 26, 1913.

The final cost to the state was \$97,002. The estimate of the then Division Engineer A. E. Loder was \$100,001.81 and the original bid of Ritchie, which was the lowest of thirteen bids, was \$89,369. L. L. Clark was resident engineer for the state.

Much has been learned concerning road building since the days of the first state highway contract. Today California concrete pavement specifications provide for 1 part of cement, to 1.8 parts of sand, to 3.6 parts of rock, proportioned by the most exact methods. The proper amount of water is most carefully determined and measured. Concrete pavements are cured for a period

of fourteen days by "ponding," as compared with the five days wetting down of thirteen years ago. Asphaltic concrete surfacing must have a penetration of 40 to 50 degrees and sheet asphalt surfaces are no longer placed on state highways. A roughened surface has been devised which lessens skidding, contributing to the safety of travel. Crown has been practically eliminated in the interests of safety.

How Pavement was Rebuilt.

The pavement placed under Contract Number I was widened to forty feet by placing eight-foot cement concrete shoulders on either side of the existing pavement, eight inches thick in the center with ten-inch edges. They were placed about 2½ inches above the surfacing of the existing pavement, which was resurfaced with asphalt concrete 2½ inches thick at the edge of the old slab and decreasing in thickness to about one inch in the center, thus removing the extreme crown of the old road.

From San Bruno to Baden, the asphaltic surfacing consists of wedges on each side of the old pavement about 1¾ inches thick at the edge and thinning out approximately six feet either side of the center line. This plan also reduces the crown where a thicker pavement was not deemed necessary.

Standard superelevation was used on all curves and here the wedges of asphalt are considerably thicker. In addition, a five-foot rock and earth shoulder was constructed on either side of the widened pavement, making a clear roadway width of fifty feet. Drainage structures also were lengthened to conform to the new width. The latter improvement alone removed several bad hazards from this section of the highway.

Modern Methods of Reconstruction.

Under the heading, "TAKING THE GUESS OUT OF MIXING CONCRETE," R. E. Messner, resident engineer on the project for Division IV, has the following to say concerning methods devised by the Federal Paving Company to conform to present day specifications of the commission:

"One of the most modern central concrete mixing plants in the west was operated in connection with construction of concrete shoulders on the Peninsula highway between Cypress Lawn Cemetery and San Bruno, San Mateo County.

Specifications for proportioning the aggregate for hydraulic concrete require that the materials be delivered to the concrete mixer, separately in three different sizes, viz: 2½- to 1¾-inch rock; 1¾- to ¾-inch rock; and sand, the rock to be measured by volume and the sand to be measured by weight or by volume in a state of inundation.

Aggregates were unloaded from the cars directly into a three-compartment bunker, each compartment having a capacity of 40 cubic yards (1 carload) by use of ¾-yard clam-shell crane.

The coarse aggregates were measured in Johnson adjustable measuring hoppers placed on the bottom of the bunkers. These hoppers were carefully measured and their cubical contents computed and a table made showing the capacity for the various adjustments, which were made by a special homemade caliper scale. Sand was weighed in a weigh box similar to that used for measuring aggregates at an asphalt plant. The aggregate was then transported to the hopper of a 21 E 5-sack capacity Koehring concrete mixer by use of a belt conveyor 24 inches wide with the outer 4 inches set at an inclination of 30 degrees and traveling at a speed of 275 feet per minute. Cement was placed in the mixer hopper between the coarse aggregate and the sand.

Automatic Water Control.

The concrete mixer was equipped with an automatic timing device which locked the outlet lever of the mixer until all aggregate had been mixed for the required time. The mixer was also equipped with an automatic water control system which measured the required amount of water to be used per batch. The water tank was carefully measured and a table of its contents made by graduating the water glass installed outside of the tank.

It was found that the adjusting device, provided by the

Seven

manufacturer for measuring the water, was not graduated to sufficient refinement; therefore a turn buckle was attached to the handle of the vernier to permit a more exact adjustment.

All aggregate was furnished by the California Rock Company from its Eliot plant in Alameda Creek. Samples were taken from each carload of aggregate and screened, which soon enabled the company to furnish aggregates which produced an ideal grading.

The adjustable measuring hoppers, the sand weigh box, the automatic water control system, the timing device controlling the time of mixing, and the constant screen analysis of the aggregates took the guess out of mixing concrete. Every batch left the mixer with approximately the same grading of aggregate and the same amount of water. The only adjustment to be made was for moisture content in the aggregates."

The approximate cost of the reconstruction was \$250,000. The gasoline tax provided the funds.

FRESNO ENGINEER COMMENTS ON LATERAL MAINTENANCE

AS AUTHORIZED by the legislature at its 1925 session, the commission, on January 1st, began the maintenance of all existing county roads on state highway routes. Considerable already has been accomplished in the interests of the traveling public.

How the work in Fresno County appeals to the county road building authorities, the following letter will testify:

CHRIS P. JENSEN
COUNTY SURVEYOR
FRESNO, CALIFORNIA

April 20, 1926.

Mr. Robert M. Morton,
State Highway Engineer,
Sacramento, California.

Dear Mr. Morton:

I went over that portion of the Coalinga-San Lucas highway lying within Fresno County, yesterday.

I wish to take the opportunity to compliment you upon the manner in which you have undertaken the maintenance of that portion of the highway which has not been affected by any reconstruction program. Your men are taking every opportunity to widen the road as much as possible with the grader, which together with the grading and crowning, produces a most noticeable improvement.

It was very gratifying to me to see the results, and I am sure that the county as a whole will be duly appreciative of your efforts.

With best regards, I beg to remain

Very truly yours,

(Signed) CHRIS P. JENSEN,
County Surveyor.

TRAFFIC INSURANCE

(From the Monterey Herald.)

MONTEREY County, under the guidance of its county engineer and board of supervisors, has adopted a far-sighted position toward highway development.

Dr. John L. D. Roberts, supervisor, who has done so much for this district, aims for eighty-foot rights of way for all main county roads—the same standard that has been the objective of the *State Highway Commission*.

That is *traffic insurance* for the Monterey peninsula five, ten and twenty years from now—a common sense provision practical today before further building and private improvements make highway widening prohibitive.

Great Klamath River Bridge, Memorial to Assemblyman Douglas, to Brea

HISTORY OF KLAMATH RIVER BRIDGE PROJECT

(From the memorial program prepared by the commission.)

FORTY-FIVE miles south of the California-Oregon state line, the waters of the great Klamath River merge with those of the Pacific Ocean. The Klamath is one of the least known rivers of California. Rising at a high altitude in the snows of the Cascade Mountains which surround the Klamath Lake region in southern Oregon, it flows for almost its entire length through deep, rugged canyons and virgin forests of giant trees.

The Klamath is bridged in but few places. Most of the existing bridges are of the suspension type, built high above the waters, which sometimes rise as much as forty feet in flood stage. This great river, with its antiquated ferries, operating only in fair weather, has been a barrier which has effectively isolated Del Norte County from the remainder of the state.

The late Dr. Douglas was persistent in his efforts to obtain recognition of the necessity for a great bridge near the mouth of the river which would link Del Norte County with the improved highway system of the balance of the state, and indications pointed to his success during the 1923 session of the legislature. However, before the culmination of his efforts, he died suddenly in Sacramento, mourned by all who knew him.

The untimely death of Dr. Douglas sharply impressed the necessity for the bridge upon the attention of his colleagues in the legislature. Governor Richardson had previously approved the project, and under a suspension of the rules, the bill which Dr. Douglas had introduced was passed and signed. It appropriated \$225,000, not only to reward his efforts in representing his community, but to construct a fitting memorial to his memory.

Bridge Considered for Many Years.

The bridging of the Klamath River, thereby connecting Route No. 1 throughout its length, has long been an ambition of the engineers of the California Highway Commission. Surveys, studies, and soundings have been made during the past ten years, preliminary to deciding upon the type of bridge and the proper location. The route was authorized by the 1909 highway bond issue; the Highway Commission was, therefore, able to supplement with bond funds the appropriation provided by the legislature. The special appropriation of \$225,000 made the bridge possible, although the contract was awarded for \$391,000.

The Douglas Bridge spans the Klamath about three miles from its mouth, at a point where the river is nearly a quarter of a mile wide. Heretofore, the river has been crossed by a small ferry which could not be operated at times of extreme high or extreme low water.

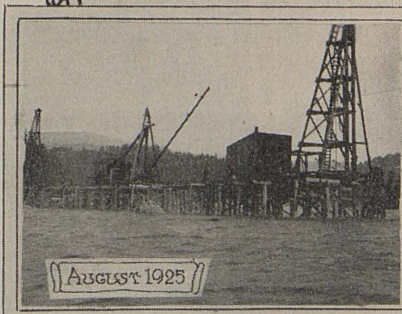
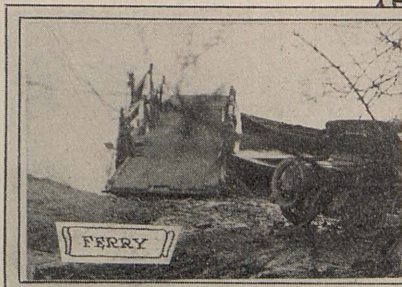
Steel was the structural material first considered for construction of the bridge, but when the memorial features were introduced, it was decided the structure should be of concrete. The bridge, now approaching completion, will be ready for final acceptance later in the summer. It consists of five main arch spans, each 210 feet in length, with short approach spans at each end. In some respects the structure is unique, and the only one of its kind in the world. It is the largest on the California highway system.

Much objection was presented by engineers to prove the impossibility of bridging the wild floods of the Klamath River with concrete arches; the current was too swift, the floods were too great, the drift too heavy (frequently full sized redwood trees, some as great as fifteen feet in diameter, are floated down the river with their roots dragging). The concrete arch spans, it was said, could not be built high enough or long enough to pass such drift; also, there was only an unstable sand and gravel bottom on which to build such mammoth arches. It was pointed out that nowhere in the world had such large concrete arches been successfully built on such foundation.

Memorial Features Determine Design.

The bridge department of the California Highway Commission was not daunted by such objections. The problem was approached by the bridge engineer and his assistants with the same conservative assumptions as

(Continued on page 14.)



KLAMATH RIVER

Thousands Attend Celebration

NEARLY 4000 people from northern California and southern Oregon gathered near Requa, Del Norte County, on May 17th, to join with the California Highway Commission in celebrating the virtual completion of the Klamath River bridge. Prominent among visiting officials were Governors Friend Wm. Richardson of California and Walter M. Pierce of Oregon.

Many former residents of the north coast counties came from distant parts of the state to view the realization of the dreams of years. Members of the California Press Association joined the automobile associations and civic organizations in participating in the event, which proved to be the greatest highway celebration in the history of the Redwood highway.

Toy Chairman of the Day.

Following a barbecue at noon and a band concert by the Arcata High School band the speaking program was held at the north approach to the bridge. Chairman Harvey M. Toy of the California commission presided as chairman of the day for the presentation of the following program:

Introduction of visiting officials and engineers.

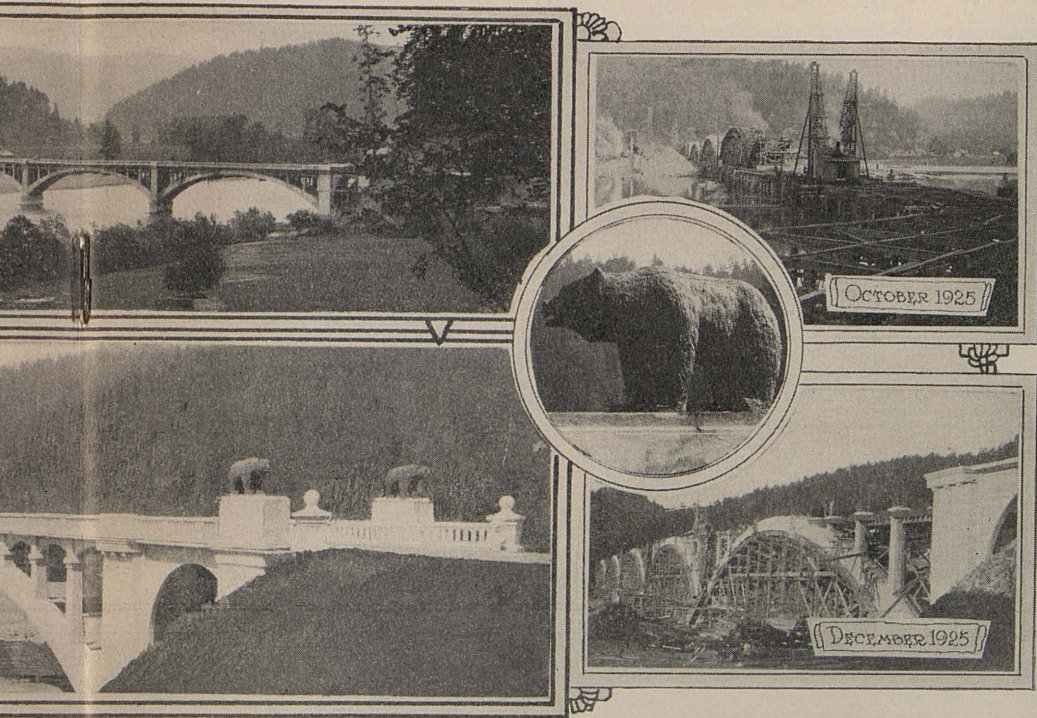
Program of addresses—A. D. Lee, Del Norte County; T. W. Hine, Humboldt County; Louis Everding, Highway Commissioner; R. M. Morton, State Highway Engineer; Frederick Meyer, President, Redwood Highway Association; Dr. L. I. Hewes, Deputy Chief Engineer, United States Bureau of Public Roads; Walter M. Pierce, Governor of Oregon.

Address of the Day—Friend Wm. Richardson, Governor of California.

Unveiling Memorial Tablet: Donald Douglas, son of the late Dr. Douglas.

Following the program, the festivities were continued during the afternoon and evening with music and dancing on the bridge. The structure was beautifully decorated for the event with wild flowers gathered by school children from among the redwoods of Del Norte County.

Break Barrier on Redwood Highway and End Isolation of Del Norte County



KLAMATH RIVER BRIDGE.

WHAT KLAMATH BRIDGE MEANS TO ENGINEER

(From the address of State Highway Engineer R. M. Morton.)

WE OF the California Highway Commission rejoice today in the interest which is evidenced in the building of this great structure. Seldom occurs such opportunity for the works of the engineer and the constructor to be so forcibly impressed upon the minds of thoughtful and influential citizens.

No mere words can adequately impress upon you the conception of this work, from earliest detail of plans to final realization of the actual massive structure, as it is visualized in the minds of its engineers and its constructors. To the state's engineers, who have had a part in this magnificent accomplishment, the celebration here today has a twofold significance.

Into the structure have been incorporated those same qualities which characterized the man whose memorial it is. The qualities manifested by both of solidity and strength, usefulness of purpose, dignity, and beauty of outline are as necessary in good bridges as in good citizens.

To the state's engineers, the other significance of this celebration is in realization of the joy which comes only to him who creates and builds. Three short years ago the Klamath River stretched unbridged for thirty miles inland, its banks unscarred by pick or shovel, a barrier effectively isolating a large section of California. This gorge was as forbidding to man's puny crawling efforts as any portion of the canyon which you now see by looking eastward.

Even then the surveys had indicated to the creative mind of the engineer how obstacles could best be overcome, and the bridge was taking skeleton outline form on the drafting boards. Their conception dominated the minds of many men by day, and filled their dreams by night. Their plans now brought to fruition stand as their lasting contribution to the memory of Dr. Douglas and to the advancement of civilization.

A Dream of Years.

This moment of congratulations is not the important moment. We are thinking of the thousands of years during which this stream existed unconquered by man; of the fifteen years past during which to the highway engineers, the bridge has been a possibility; of the solution of each separate problem of the survey, design, and erection. Without the engineer and the constructor, achievements such as this would be impossible. Human existence would still be as in the cave man's day.

The urge of creative instinct to build for the betterment of mankind is as irresistible to the engineer and constructor as is the creative instinct of the painter or sculptor. This instinct draws men irresistibly to the building professions, thereby insuring the progress of civilization.

Visualize the creative ability, the mental ingenuity, the sweat of human industry, which have made this bridge a reality. Imagine the loneliness of men banished to work in this beautiful but isolated spot. The anxiety of families for their welfare. The grief for three who lost their lives during the construction. The temptations to the men themselves. The strain of sustained physical effort in menacing flood and weather. The tests of character in the maintaining of proper relations to each other, under trying conditions. These are the lot of the engineer and the constructor, which they accept, grumbling sometimes, but, nevertheless, in their hearts, glad of the opportunity to build.

The Urge to Achieve.

The funds provided for this structure, the plans evolved in the minds of the designers, have drawn as with a magnet a group of men skilled in construction. These men have experienced the satisfaction of seeing develop from their work an object of usefulness and beauty, where two short years ago the obstacles seemed unconquerable. The assembling and arranging of equipment, the planning of the sequence of operations, the coping with unforeseen difficulties and even the humdrum monotony of ever rotating machinery, and oft repeated routine, form an enchantment and a reward in the completed whole. When the result is good, the reward has no equal in human experience.

To these men only—engineers and constructors—is possible the double appreciation of all which this gathering really celebrates. They have planned and built well. With the accomplishment of their purpose, their work here is done. The achievement of their brains and hands becomes an

(Continued on page 15.)

Department Supplies Data About Structure

FACTS of interest in connection with the building of the Klamath River bridge:

AUTHORIZATION: Special act appropriating \$225,000 approved by Governor Friend Wm. Richardson, May 25, 1923.

BIDS: Bids were asked by California Highway Commission April 28, 1924, and received May 26, 1924.

CONTRACT: Contract number 443 awarded by the commission June 19, 1924.

FEDERAL AID: California federal aid project number 116A.

CONSTRUCTION: Work commenced by contractor July, 1924.

COST: \$400,000.

LENGTH: 1147 feet, consisting of five main arch spans each 210 feet long, with short approach spans at either end.

WIDTH OF ROADWAY: 21 feet clear between curbs.

HEIGHT OF ROADWAY ABOVE WATER SURFACE: 51 feet.

MATERIAL REQUIRED IN CONSTRUCTION: 9060 cubic yards concrete; 850,000 pounds of reinforcing steel; 946 foundation piles; 2,000,000 feet of sawed lumber. A fully equipped saw mill was built at the site of the bridge to furnish the lumber.

FOUNDATIONS: Foundations are 30 feet below low water surface, supported on heavy fir piles which are pointed with cast iron shoes.

CONTRACTOR: F. Rolandi, San Francisco, California. R. J. Kennedy, construction superintendent for the contractor.

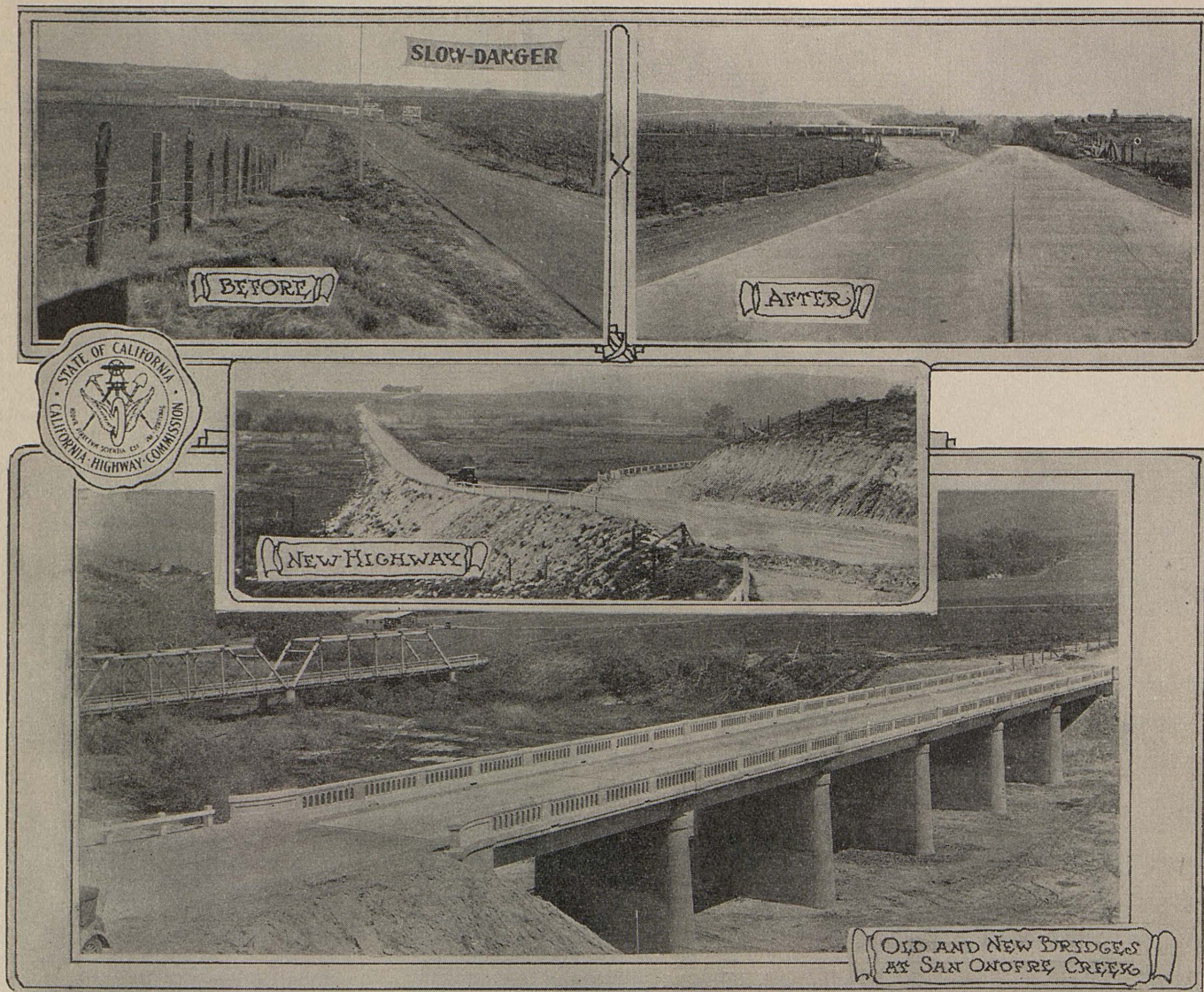
COMMISSION: Harvey M. Toy, Chairman; Louis Everding, Nelson T. Edwards.

ENGINEERS: R. M. Morton, State Highway Engineer; Harlan D. Miller, Bridge Engineer.

RESIDENT ENGINEERS FOR THE COMMISSION: Stewart Mitchell, associate bridge engineer; D. C. Willett, associate bridge engineer; J. C. Wilson, resident engineer; H. Carter, resident engineer; J. F. Orr, assistant resident engineer.

BRONZE MEMORIAL TABLETS: These are placed on pylons at the four corners of the bridge setting forth the fact that the bridge is a memorial to Dr. G. H. Douglas. On each pylon there is a large figure of a grizzly bear, the bear being symbolical of the country in which the bridge is located.

HANDSOME NEW BRIDGES FEATURE SOUTHERN LINE CHANGE



WHERE DEATH TRAPS WERE ELIMINATED—Views on the San Mateo-San Onofre line change on the Coast highway, San Diego County. The map on page four shows how dangerous curves and grades were eliminated and the distance shortened nearly a mile. The new highway runs straight across the San Mateo Creek flat. The old road can be seen winding off to the right. (Photos of highway by Division VII, bridges by Bridge Department.)

BOTH the bridge department and Division VII have much to be proud of as a result of the completion and opening to traffic of the San Mateo-San Onofre line change on the Coast highway in northern San Diego County. The handsome new reinforced concrete bridges across the two creeks and the straight alignment, eliminating sixteen curves and shortening the distance two-thirds of a mile, have evoked much deserved praise from the traveling public.

A part of the line change has been paved with concrete 20 feet wide. The remainder is a fill across the San Mateo Creek flat, which has been surfaced with crushed rock to permit settlement before paving is completed. It is being kept in excellent condition by constant maintenance under the direction of Division VII.

Replace Narrow Structures.

The two new bridges are also one of the features of the improvement much appreciated by users of the highway. They

replace narrow wooden Pratt trusses built by the county years ago on the line of the old road, which was also graded by the county. The new structures are of similar design and construction, of the three-girder type 50-foot spans, with a clear roadway width of thirty feet. With three exceptions, where the formation made it unnecessary, they have Douglas fir pile foundations under the piers, the piles being driven to a penetration of forty feet.

The San Onofre Creek bridge has six spans resting on seven piers, the length being 300 feet. The approach fills were protected at the toe with reinforced slope paving, five inches thick. The hollow type of pier construction was adopted to reduce the dead load and as the more economical.

The San Mateo Creek bridge is similar, except that it has seven piers and one abutment and a total length of 400 feet. The abutment is of the reinforced type with counterforts. The south approach fill is protected with slope pavement.

Central Mixing Plan Used.

R. A. Wattson, the contractor on the San Mateo Creek bridge, supplied his concrete from a central mixing plant on the north bank. Harry Carter was resident engineer and was later succeeded by G. W. Thompson, assisted by L. DeCew. Thompson was also resident engineer on the San Onofre bridge which was built by the Fluor Construction Company.

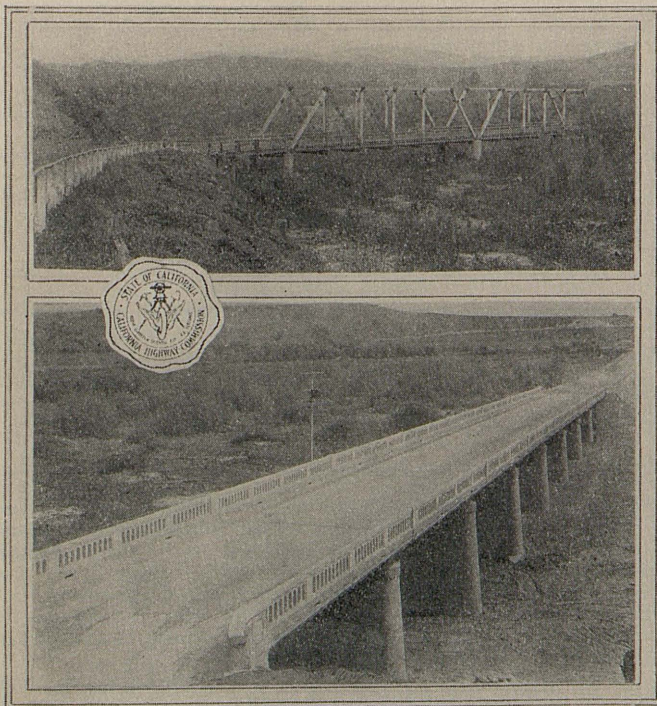
Finishing of the surface of both bridges was done with a Berg Concrete Surfacing Machine. After the bridge floors had been ground to the desired smoothness a cement grout was rubbed in with a float faced with a piece of carpet. Excellent results were obtained.

The grading and paving of this line change was financed with gasoline tax funds. San Diego County is refunding to the state the cost of the bridges, having voluntarily agreed to this cooperation in anticipation of the wonderful improvement to be brought about in the highway.

CORRECTING OUR MISTAKES

(From the Martinez Standard.)

THE MISTAKE that was made in the early days of road building in California—making the highways too narrow—is being corrected now at great expense. Highways are being widened in many places, to meet the demands of constantly increasing and badly congested traffic. In construction of new roads, ample allowance should be made for increased traffic, and the roads should be made wide—the wider the better. No danger of getting them too wide. The time is coming when every main thoroughfare in the state will have to be at least one hundred feet wide, or else there must be two fifty-foot highways paralleling each other, with one-way traffic. The phenomenal increase in the number of automotive vehicles in California foreshadows a period of traffic volume which roadways as they are today would not accommodate.



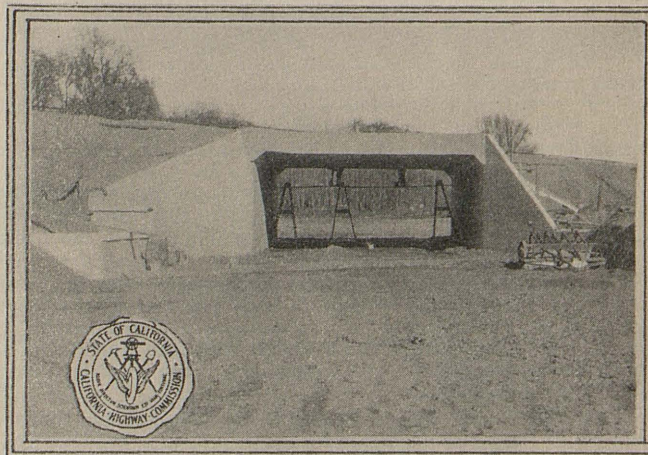
SAN MATEO CREEK BRIDGE—This beautiful reinforced concrete structure was an important part of the radical line change in northern San Diego County. The old bridge which has been replaced is shown above. (Photos by Bridge Department.)

Eleven

RAPID HARDENING CEMENT SPEEDS COMPLETION OF NEW YOLO SUBWAY

THE PROBLEM of maintaining railroad traffic across a subway under construction on the state highway in Yolo County was satisfactorily solved recently by the bridge department by the use of rapid hardening cement concrete. The structure, which will permit the highway to pass under the tracks of the Woodland branch of the Sacramento Northern, consists of reinforced concrete abutments with a deck of structural steel I beams encased in concrete and covered with a concrete slab.

As soon as the abutments had attained the necessary strength, the steel girders were put in place and the track supported on wooden stringers, which in turn were supported by wooden blocks



YOLO UNDER PASS—Improvement at the western entrance to Sacramento under construction by the Bridge Department.

placed directly on the girders. Temporary piling on which the track had been supported was then removed.

The concrete portion of the deck was poured complete, except that openings were left around all track supports. After the deck had hardened the track was supported on the finished portions and the openings filled with a rapid hardening Lumnite cement concrete. Within thirty-six hours it was possible to remove all temporary supports from under the rails and to replace the ballast in its permanent condition.

Four aggregates were used in all concrete as follows:

- Cement— 1 sack.
- Sand—1.9 cubic feet.
- Pea Gravel—1.4 cubic feet.
- ¾" Gravel—1.6 cubic feet.
- 1½" Gravel—1.0 cubic feet.
- Water—48 to 52 pounds—which produced a slump of approximately 3 inches.

The rapid hardening concrete was placed in the afternoon and ponded before leaving it for the night, and on the second morning it was possible to place the ballast on the deck. Use of rapid hardening cement reduced the curing time from four weeks to less than two days. As the job was practically completed when the track supports were removed, use of ordinary cement would have meant considerable delay to the contractor before the ballast could have been replaced.

C. M. Butts was resident engineer for the bridge department.

URGES CLEAN UP.

During August, Susanville, Lassen County, will entertain the state convention of the American Legion. In preparation for the event, Maintenance Superintendent E. J. Gribble, of Division II, is doing all he can to have the roads in the vicinity in the best possible condition.

Gribble also has issued an appeal to the people of the community to assist him in cleaning up the roadsides by refraining from dumping cans and rubbish on the highways. He will appreciate the cooperation of the people of Westwood and Susanville.

❁
WHAT THE DIVISIONS ARE DOING
❁

DIVISION II.
 HEADQUARTERS, REDDING.
 H. S. COMLY, DIVISION ENGINEER.
 Counties of Siskiyou, Modoc, Trinity, Shasta, Lassen, Tehama, and northern Plumas.

WORK is again under way in the Sacramento canyon, the George C. Pollock Company having commenced operations on its grading contract for the Dog Creek-La Moine section of 4.5 miles. Several radical line changes will be made, particularly at La Moine where considerable distance will be saved.

Bids have been asked on two other Division II projects—grading in Lassen County and a surfacing job east of Alturas.

The Halfway Creek-Dog Creek contract of the Nevada Contracting Company has been completed and accepted, making available ten miles of additional safe and fast highway in the Sacramento canyon.

Division II maintenance crews are now preparing for the period of heavy summer traffic. Particularly is this true of the county roads on state highway routes taken over for maintenance on January 1st. Considerable progress has been made and favorable comment has been received regarding the condition of the Trinity and Modoc laterals.

The Charley Creek bridge, constructed by Bordwell and Zimmerman under the direction of the bridge department, has been completed and its beauty of design is attracting much attention. It crosses a deep ravine on the Sacramento canyon section saving considerable distance and eliminating many curves.

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.

GRADING of the Truckee River highway has been completed and a splendid water grade road is now ready for traffic from Truckee to the Nevada line, eliminating for all time the notorious Dog Valley grade. In its place has been substituted a pleasant and safe highway along the beautiful Truckee River. The celebration of the opening of the new road will take place at the California-Nevada line on June 10th.

Work has started on the placing of 5400 cubic yards of surfacing on the Donner Lake-Truckee section of the Victory highway.

A division contract has been awarded to Hemstreet and Bell for the placing of 8000 cubic yards of surfacing on the Gold Run-Emigrant Gap section east of Colfax.

C. R. Merrill is moving 21,000 cubic yards of material excavated from a drainage ditch in Glenn County and is placing it among the shoulders of the highway for a distance of nearly three miles south of Willows.

Tahoe Work Starting.

Construction has been begun on road improvements around Lake Tahoe between Emerald Bay and Tahoe City in Placer and El Dorado counties. A high standard road on new alignment is being constructed by state forces.

Echo summit was opened to traffic this year on April 14th; Donner summit on April 22d; and the Yuba Pass route at about the same time.

An extensive program of widening and reshaping of the roadbed between Placerville and Camino has been completed.

Through Camino, El Dorado County, 4000 lineal feet of 2" by 12" curbing has been placed and the shoulders surfaced with crushed rock.

Considerable rock shoulder work has been done on the West-side highway in Yolo and Glenn counties.

DIVISION IV.
 HEADQUARTERS, SAN FRANCISCO.
 JOHN H. SKEGGS, DIVISION ENGINEER.
 Counties of San Francisco, Marin, Sonoma, Napa, Contra Costa, Alameda, Santa Clara, Santa Cruz, and San Mateo.

EQUIPMENT has been moved in and construction is starting on the improvement on a mile between Vineburg Junction and the Napa County line, Division IV. Improvement of this short section will provide a paved highway connecting the Napa and Sonoma valleys. W. H. Hauser of Oakland has the contract for placing a bituminous macadam surface, after grading and reshaping the existing roadway.

Two power shovels are operated in Division IV on slide removal on the Pacheco Pass highway and on the Skyline boulevard.

Rapid progress is being made by contractor J. B. Galbraith on the placing of second-story concrete pavement, 20 feet wide, from a mile north of Mark West Creek to Santa Rosa. Galbraith hopes to complete his contract early in the summer before the peak of traffic is reached.

Concrete shoulders for the widening of the highway to 20 feet have been completed from Healdsburg to the Russian River.

DIVISION V.
 HEADQUARTERS, SAN LUIS OBISPO.
 Counties of San Benito, Monterey, San Luis Obispo, and Santa Barbara.
 L. H. GIBSON, DIVISION ENGINEER.

DIVISION V, generally a section where fair weather prevails, did not escape the recent severe storms which did much damage to highways in many parts of the state. Heavy floods occurred in southern Santa Barbara County, where a rainfall of five inches in as many hours was reported. Mud was washed upon the pavement in several places, impeding traffic until it could be removed by maintenance crews.

A cloudburst in the upper Cuyama Valley did damage to construction work on Route 57, the Cuyama lateral. A pile bridge was swept away by the flood, a large trestle damaged, and roadbed under construction washed away.

A party has begun the recently ordered survey of the proposed new line between Salinas and San Juan for the elimination of the San Juan grade. The new line will run to the west of the present location and the data gathered will determine the practicability of the proposed change.

The survey was ordered by the commission at the request of the Supervisors of Monterey County.

DIVISION VI.
 HEADQUARTERS, FRESNO.
 E. E. WALLACE, ACTING DIVISION ENGINEER.
 Counties of Fresno, Madera, Merced, Mariposa, Kings, Tulare, and Kern, north of the Tehachapi.

THE Merced canyon highway providing an all-year-around entrance to Yosemite National Park will be opened to public travel on July 31st. This date has been set by the commission for the official opening and plans are under way for a great celebration of the event, which is expected to draw visitors from all parts of the state. A force of 250 prisoners, nearly 100 free men, and five power shovels and other equipment is now rushing the grading and surfacing to completion.

Work is starting on two reconstruction projects on the trunk line through the San Joaquin Valley from Madera to Borden and from Delano to the Kern County line. The highway in each instance is being widened to 20 feet and thickened.

Contractors for Fresno County are completing the grading of a section of the Coalinga lateral which will be taken over by the

CALIFORNIA HIGHWAYS.

commission as soon as the work is accepted by the county. This is a section of the Sierra to the Sea highway.

Additional widening and straightening work is being done on the Sequoia Park entrance in the vicinity of Three Rivers, Tulare County. A power shovel is being used to complete the work in advance of heavy summer traffic.

Maintenance Activities.

Recent unprecedented rains and cloud bursts have imposed extra duties upon maintenance crews of Division VI. In the vicinity of Bakersfield the pavement was flooded to a depth of several feet and the adjoining embankment of the Southern Pacific Railroad was washed out in places. The unprecedented character of the flood is demonstrated by the lack of sufficient culverts under the Southern Pacific tracks, despite the fact that the railroad has been completed through the valley for many years.

Division VI, in cooperation with Division IV, is oiling several miles of rock-surfaced highway on the Pacheco Pass route.

Puncture vine control is receiving considerable attention from the maintenance department of the division. The highway forces are endeavoring to coordinate the work of the several county horticultural commissioners of the valley. Several interesting experiments are being made with various solutions of distillate, used as a spray in an effort to stop the spread of the pest.

DIVISION VII.

HEADQUARTERS, LOS ANGELES.

S. V. CORTELYOU, DIVISION ENGINEER.

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

TWO miles of 20-foot concrete pavement have been completed and opened to traffic on the new Coast highway through the Malibu Ranch. April rain storms stopped paving operations, but this work is again under way.

On the new Coast highway in Orange County south of Laguna grading has been completed from San Juan Creek near Serra to Aliso Creek, a distance of 5½ miles.

Work is now well under way on the important line change of seven-tenths of a mile long at Chalk Hill on the Ventura boulevard in Los Angeles County. Several dangerous curves will be eliminated and the grade reduced. The new section of highway when graded will be paved with a 24-foot oil macadam.

Additional Slides.

Another slide of approximately 21,000 cubic yards has occurred on the Coast highway in Ventura County, necessitating the addition of a second power shovel and several dump trucks to the equipment of the maintenance crew at work on this section.

On the Jahn and Bressi contract along the coast in San Diego County, the "second-story" 20-foot concrete pavement has been completed and opened to traffic from Las Flores underpass to the north end of the contract near San Onofre, a distance of about 8 miles. A center traffic guide line has been painted along this entire stretch of new highway.

Grading in connection with the improving of the alignment on Mountain Springs grade on the Borderline highway in San Diego and Imperial counties has been completed.

Maintenance Crews Show Worth.

Maintenance forces worked day and night in many parts of Division VII during the recent period of heavy rains caring for traffic and those who were shut off from the highway by washouts. Teams were used to pull cars through the mud on Coast highway near the Ventura causeways. Considerable debris was washed up to the highway by the storm and had to be cleared away to restore normal traffic conditions.

Sections of the Arroyo Seco highway in the Angels National Forest were completely washed away by cloudbursts. Maintenance crews rigged up cable crossings as a means of communication with resorts in the canyon. Emergency foot-bridges were installed in some places.

DIVISION VIII.

HEADQUARTERS, SAN BERNARDINO.

E. Q. SULLIVAN, DIVISION ENGINEER.

Counties of San Bernardino, Riverside, and Imperial.

PAVING of the six-mile section across the Sand Hills, Imperial County, on the interstate connection with Arizona, is now under way. Placing of an asphalt concrete pavement, 20 feet wide, was

Thirteen

begun at the eastern end of the section and will be continued westward. More than two miles of grading have been completed,



ON THE CREST ROUTE—A typical slide on the state highway in the San Bernardino Mountains where Division VIII is being forced to make large expenditures of maintenance funds because of heavy storms during recent weeks.

involving the moving of 150,000 cubic yards of sand. Two large drag-line outfits are being used by the contractors.

Absence of usual wind storms and much rain have facilitated the movement of the sand for the making of the embankment upon which the pavement is being placed. The sand has proved easy to handle when moist.

Shoulders to be Oiled.

A production plant for the screening of gravel has been set up near Yuma, where the contractor's asphalt plant is located. Eighteen light trucks will be used on the project and as fast as the pavement is completed the shoulders and slopes of the high sand embankment will be oiled to prevent erosion by wind storms.

Heavy rains have caused the worst slides in the history of the division on the Crest route in the San Bernardino Mountains. It is estimated that 35,000 cubic yards of material must be moved to completely clear the road. J. I. Boaz is in charge of the shovel crew at work on this route.

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.

RECONSTRUCTION of the San Joaquin Valley trunk highway between Modesto and the northern boundary of Stanislaus County has been begun by the Valley Paving Company of Modesto. The highway is being widened to 20 feet by the addition of cement concrete shoulders. It will be thickened with an asphalt concrete surfacing.

The sand fill for the new approach to the M street bridge in West Sacramento, Yolo County, is practically completed and bids for the placing of a pavement will be asked in the immediate future.

All grading and paving work on the state's part of the Stockton boulevard improvement at the southern entrance to Sacramento has been completed and opened to traffic.

Line Changes Planned.

Plans for two proposed line changes, one near Arno, Sacramento County, and a second near Vacaville, Solano County, each eliminating many curves and considerable distance, have been completed and submitted to headquarters. The commission has agreed in each instance to do the grading and surfacing during 1927, provided the counties will secure necessary rights of way.

Extensive improvements have been completed on the Big Oak Flat entrance to Yosemite National Park under the direction of Foreman W. H. Martin. The grade at each side of Big Creek has been widened and straightened. Rock walls in the vicinity of South Fork carried away by winter slides have been replaced. Bad curves have been eliminated near Carl Inn.

HISTORY OF THE KLAMATH RIVER BRIDGE PROJECT

(Continued from page 8.)

have for the past fourteen years insured the stability of structures built under the direction of the commission. Comparative cost estimates of a steel structure and various combinations of concrete structures were made, the memorial features of the structure always being borne in mind. Final decision was made on a bold design of massive concrete arches founded on deep piles, surrounded and protected by cofferdams driven to refusal in the sand and gravel at the bottom of the river.

Carefully checked measurements were constantly under way during construction, and the centers were struck in the false work without apparent settlement of the arches. The bridge will stand for all time as a suitable and beautiful memorial to Dr. Douglas.

Throughout two winters, while under construction, this bridge has withstood floods, as great as ever have come upon this river, with absolutely no damage. The most delicate of engineering instruments have not detected any settlement, either of the arches or the foundation. Each pier of the bridge rests upon 150 piles, each pile hammered to refusal under repeated heavy blows. The piers are as firm as though built upon solid rock. This is an unusual record for foundations on bridges of this type. Even the designers expected some settlement when the heavy arches first carried the load for which they were designed.

The completion of the Klamath bridge will close one of the few remaining gaps in the Coast state highway between San Francisco and Portland, Oregon. It will also open to the motorists of California and the nation a vacation land of virgin woods and mighty streams, the like of which is to be found nowhere else. To some it is a region for care-free outdoor sport, to others a land of dreams, a place for solemn communion with the ever-living redwoods of a forest primeval whose mysteries of life go back beyond the time of civilizations now gone from the earth. Whatever appeal this north coast section of California may make, it is one of unequalled boldness and beauty, unsurpassed in any section of the West.

Jim: "Now that you're back from your motor trip what do you intend to do?"

Bill: "Devote the rest of my life to the promotion of good roads."—*Selected.*

SAVINGS ON RURAL DELIVERY PAY FOR FEDERAL AID

"IT IS a matter of record that increased services at lower cost in rural mail and parcels post has already made savings which go far toward paying the interest on every dollar of federal aid spent for highway construction."

This is one of the answers given the critics of federal aid by A. M. Loomis of the Washington office of the National Grange, also a member of the Advisory Board of the District of Columbia Division of the American Automobile Association.

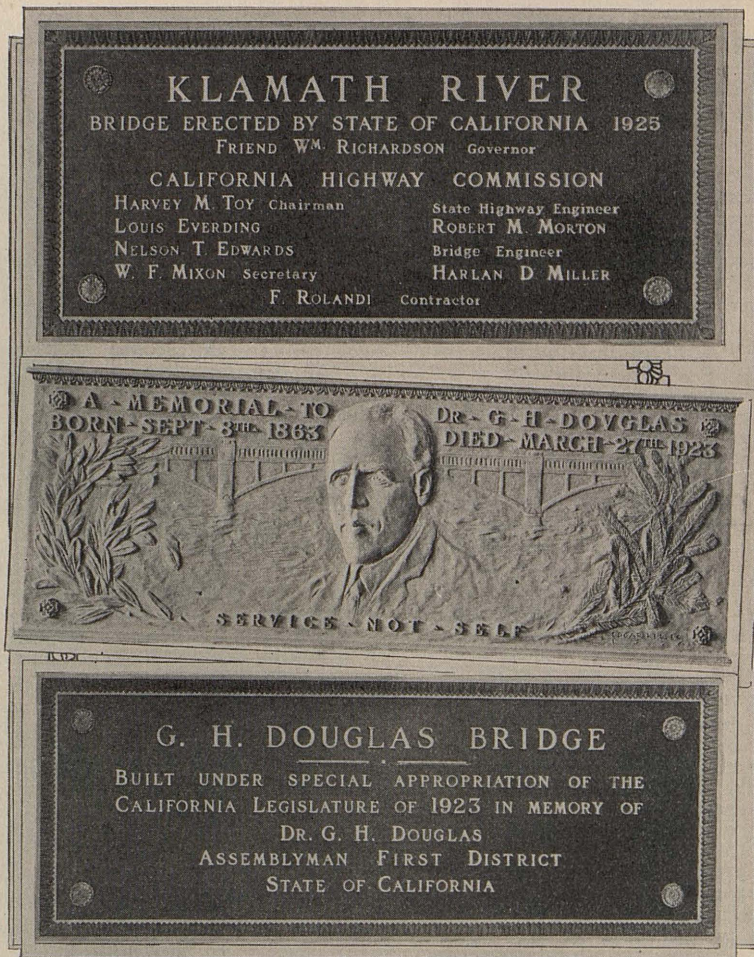
With the introduction of rural delivery mail service, the use of the highways by the government was greatly increased, Mr. Loomis points out, while every mile of surfaced road means longer delivery routes and a larger number of people served.

The federal government is now using 1,205,572 miles of highway every day for this service. While it has so far assisted the states in improving approximately 200,000 miles. In the use of this road mileage by the government, 30,060,816 individuals are being served and there are still 14,000,000 persons to be added as the service is extended.

Extract From an Accident Report.

EXTENT OF INJURY—Small gash in head, cut by falling rock.
STATEMENT OF INJURED—"Holy Smoke!"

(How things have changed since the time when highways were built almost entirely by mules and mule-skinners.)



Six plaques in all have been placed on the pylons at the approaches to the Klamath River bridge—two of each of the above. The sculptural work on the Douglas Memorial Tablet (center above) was done by Edgar Keller, California sculptor, a native of Del Norte County.

"THAT'S WHAT CAESAR DID"

When Caesar took a westward ride
And grabbed the Gauls for Rome,
What was the first thing that he did
To make them feel at home?
Did he increase the people's loads,
And liberty forbid?
No! he dug in and built good roads—
That's what old Caesar did.

He built good roads from hill to hill,
Good roads from vale to vale,
He ran a good-roads movement
Till Rome got all the kale;
He told the folks to buy at home,
Built roads their ruts to rid,
Until all roads led up to Rome—
That's what old Caesar did.

If any town would make itself
The center of the map,
Where folks will come and settle down
And live in plenty's lap;
If any town its own abodes
Of poverty would rid,
Let it go out and build good roads—
Just as old Caesar did.

—From Kansas City Journal-Post.

HIGHWAY NEWS NOTES

H. W. SCREIBER has resigned as maintenance engineer in Division IV to accept a position with the Granite Construction Company of Watsonville. He has held various positions with the department over a period of nearly seven years during which time he has had several promotions.

E. L. Stump is again in charge of maintenance in the Red Bluff district, Division II, after a leave of absence of six months. **R. E. Ward** in charge during his absence has been made chief of party in the Sacramento canyon.

E. J. Bassett will act as resident engineer on the Dog Creek-La Moine grading contract in the Sacramento canyon. **A. A. Bigelow** and **R. F. Reynolds** will be assistants.

J. A. Casson, maintenance superintendent at Hayward, Division IV, has resigned to enter the contracting firm of Hauser and Casson. He will be succeeded by **A. S. Moore**, formerly foreman on the Peninsula highway.

R. W. Brown Resigns.

OFFICIALS of the convict department and free men connected with the Folsom Prison camp recently presented Superintendent **Ralph W. Brown** with a handsome gold watch and chain upon the occasion of his resignation. Mrs. Brown was remembered with a wrist watch. Brown has accepted a position with the **George C. Pollock Company** and will be in charge of the Dog Creek-La Moine grading contract in the Sacramento canyon. Brown has been a prison camp superintendent since the establishment of some of the first camps in 1916.

N. D. Douglas, Division V draftsman, has resigned to accept a position on an irrigation survey near **McKittrick**.

O. B. Brinkerhoff, formerly assistant resident engineer on the **Hicks to Daggett** grading contract, Division VIII, is now with the **Southern Sierras Power Company**.

C. A. Potter, formerly with Division I, is now resident engineer on the paving project in northern Stanislaus County, Division X.

C. W. Springer, former resident engineer with Division X, has resigned to accept a position with **J. F. Knapp**, contractor.

J. D. Greene, formerly with the Nevada Highway Department, is assistant resident engineer on the Stanislaus project.

Caruthers With Division IX.

Announcement is made of the appointment of **W. S. Caruthers** as assistant division engineer with Division IX, headquarters **Bishop**.

**EFFORTS OF MAINTENANCE CREW
PRAISED BY SONOMA PAPER**

A HANDSOME new reinforced concrete bridge across Willow Brook on the Redwood highway in Sonoma County was recently completed under the direction of the bridge department. The efforts of the Division IV maintenance crew under superintendent **R. P. Duffy** and Foreman **Carl Lauritzen** to properly handle traffic during the period of construction and recent stormy weather is commented upon by the *Petaluma Argus* as follows:

Too much praise can not be given **Mr. Duffy** and his men for their work while the bridge was being built. Several times during the winter the temporary bridge was several feet under water, while the road was under water that was as high as the top of the fences.

On both sides of the road leading from the bridge site to **Rainsville**, there are wide and deep ditches and the highway force marked the roadway with red flags, every time the water was high, guarded the temporary bridge, kept men on hand to direct strangers to the detour over the hill road when that course was necessary, and kept powerful motor trucks on hand to tow stranded cars through the high water to safety.

On the Job.

These men were on the job day and night and were always right at hand and never missed a point. To make matters still better, it is a most courteous and accommodating bunch of men, but they could not be anything else and work with their popular head, **Mr. Duffy**.

The *Argus* has watched with interest the manner in which these workers handled things; how they patrol the highways and quickly remove obstructions and remedy breaks and repair

Fifteen

WORTH CELEBRATING

(From the Reno (Nev.) Gazette.)

THE PLAN of the California Highway Commission to open the Truckee River highway with formal exercises will meet with a favorable response in western Nevada, and there is every prospect that this state, or at least Washoe County, will join with the Californians in observing the event.

For more than seventy miles this magnificent road follows the course of the Truckee River, without including the Lake Tahoe byroad, which adds another fourteen miles. For three-fourths of the distance it is situated in the river's canyon, which it does not finally leave, after it is encountered at Truckee, until the open country is reached at **Wadsworth**. Almost fifty miles of the route is located within the state of Nevada, which, like California, is prosecuting its completion with all possible speed. The California end will be completed first, but already the Nevada section is practically finished from Reno to the California line and probably will be open when California holds her exercises. One year later the route will be in use for its entire length.

A Splendid Gateway.

The adoption of the river route for the mountain section between Truckee and the Nevada line was essentially a Nevada plan. Its preeminent scenic value was repeatedly presented to the California commission by interested persons in Reno and vicinity but without effect until **Friend Wm. Richardson** became governor and **Harvey M. Toy** became the chairman of the highway commission of that state. They were quick to see its advantages as a splendid gateway to California and for that reason and to please the citizens of a sister state it was adopted. Its cost will exceed, perhaps, the Dog Valley route approved by the old California Commission, but the difference is offset many times over by the other advantages secured.

It will be truly a magnificent road. It is worth celebrating.

damage and the *Argus* is ready to wager that in all of the great highway system of the State of California, there is not a more efficient, popular, accommodating or interested maintenance crew. And they are extremely popular citizens, looking out for the interests of the state as well as of the people who use the portion of the highway under their care and control. The *Argus* delights in saying nice things of people who actually deserve praise and these splendid men surely do deserve all the good things that can be said of them. And in the whole district, nobody is happier over the completion of the bridge and the restoration of traffic over it, than are they.

The bridge which was destroyed was built by the county while the elegant new bridge was built by the State Highway Commission.

**WHAT THE KLAMATH RIVER
BRIDGE MEANS TO ENGINEER**

(Continued from page 9.)

easily accepted and quickly forgotten part of your daily life. Urged by the instincts of creative art within them, they move restlessly to other fields, looking for more difficult tasks, where even greater ingenuity, industry and effort are required.

Hail the engineers and the constructors.

GARDENER COMMENDED.

Secretary **W. F. Mixon** and Commissioner **Louis Everding** returned recently from a trip over the Redwood highway enthusiastic over the lawns and flower beds surrounding the division office at **Willits**. **F. H. Taylor**, the gardener in charge, was given high praise by the visiting officials for the work he is doing, which is making the state property one of the attractive spots along the highway.

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 APRIL 5, 1926.											
482 488	VII, VIII VIII	San Diego-Imperial Riverside	12 64	H-A C	Top of Mountain Springs Grade to Myers Creek Bridge	1.90	Grading	A. R. McGrath	\$74,250 00	Sept. 21, 1925	
					Desert Center to 4 miles west of Hopkins well	21.00	Grading	F. C. Payton	31,207 50	Nov. 30, 1925	
AWARDED SINCE APRIL 23, 1926.											
497 498 499	I VIII III	Del Norte Imperial Placer	1 26, 27 3	C G-C, D A	Across Smith River, about 1 mile west of Adams Station		Reinf. Concrete Arch Bridge	Smith Brothers Co.	\$44,183 36	May 7, 1926	175
					Brawley Main Canal, Alamo River and Lowline Canal		Three Timber Bridges	W. M. Ledbetter & Co.	20,836 13	May 7, 1926	125
					Across Auburn Ravine at Lincoln		Reinf. Concrete Girder Bridge	Holdener Construction Co.	17,618 18	May 15, 1926	125
Sub-total									\$82,637 67		
PENDING AWARD—None.											
Total State Highway Fund Contracts Awarded and Pending Award									\$82,637 67		

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 APRIL 5, 1926.											
M-95 M-102 M-108	II IV IX	Shasta Sonoma Kern-Inyo	3 1 23	C C D, E-G	Across Charley Creek		Reinf. Concrete Arch Bridge	Bordwell and Zimmerman	\$80,741 76	July 29, 1925	
					Across Willow Brook		Reinf. Concrete Girder Bridge	Lozier and Carr	20,247 19	Oct. 9, 1925	
					Ricardo to Five Mile Canyon	36.70	Grading	Harry Wilson	21,332 81	Nov. 30, 1925	
AWARDED SINCE APRIL 23, 1926.											
M-122 M-123 M-124 M-125 M-126 M-127	V VI V VIII III	Santa Barbara Kern San Benito Monterey Riverside El Dorado	2 4 22 2 26 11	K F A H D F	Between Santa Barbara and Goleta	5.11	P.C.C. Widening and A.C. Surfacing	Cornwall Construction Co.	\$159,569 25	May 7, 1926	175
					Between 1 mile S. of Delano and the northerly boundary	2.77	A.C. Pavement Widening and Surf.	Warren Construction Co.	55,776 38	May 7, 1926	90
					Between San Juan Bautista and Hollister	6.90	P.C.C. Widening and Bit. Mac. Surf.	Granite Construction Co.	155,145 60	May 7, 1926	200
					Between San Ardo and Bradley		1 R.C. Culvert and 2 R.C. Bridges	Granite Construction Co.	95,492 81	May 7, 1926	200
					Between Whitewater River and Edom	17.30	P.C. Concrete Widening	Matich Brothers	121,944 38	May 15, 1926	150
					Between 2 miles E. of Sportsman's Hall and Riverton	8.56	Grading and Standard Surfacing	Irey and Holden	59,933 59	May 15, 1926	125
					Sub-total						40.64
PENDING AWARD—None.											
Total State Highway Maintenance Fund Contracts Awarded and Pending Award						40.64			\$647,862 01		

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.

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CALIFORNIA HIGHWAYS.

