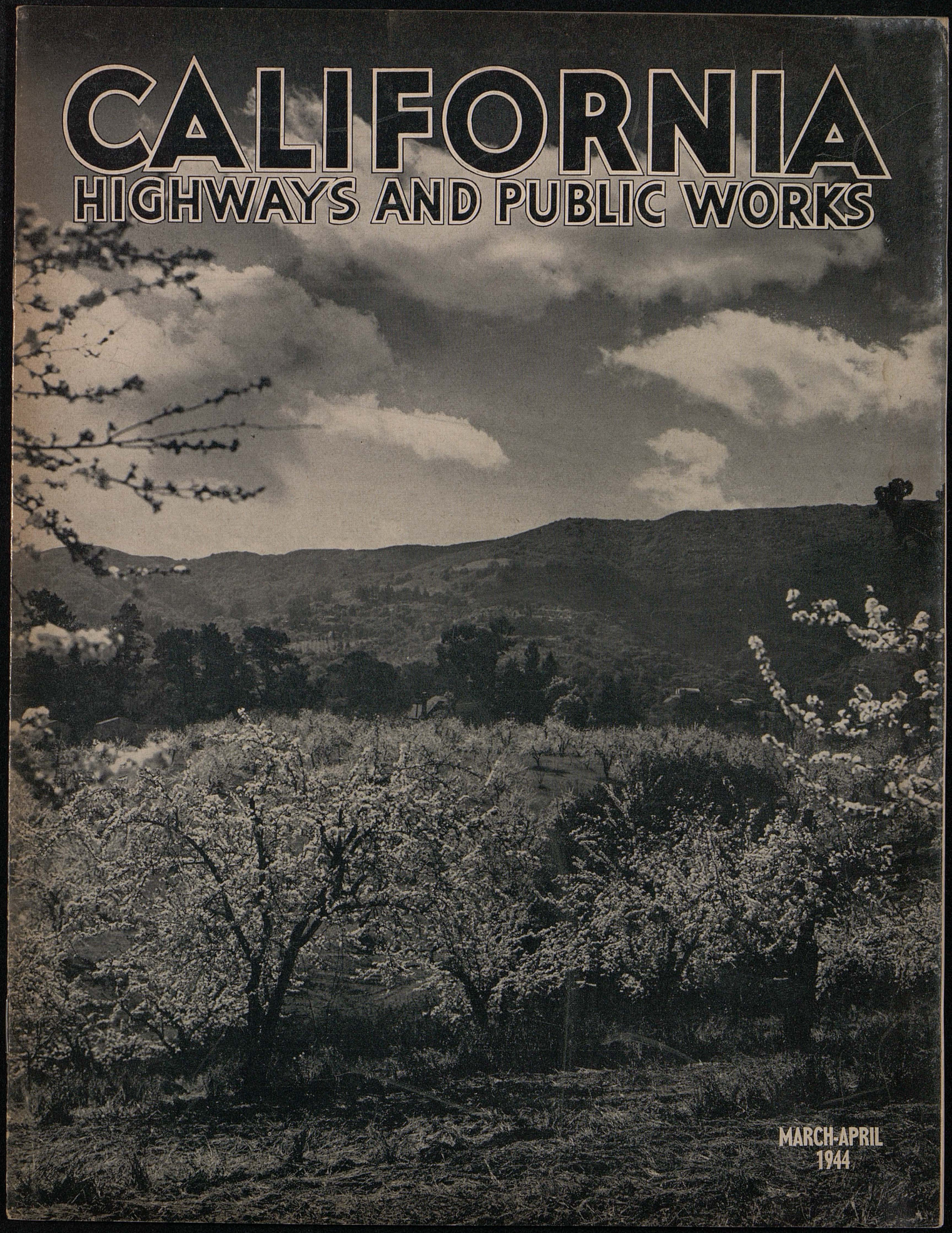
CALIFORNIA

HIGHWAYS AND PUBLIC WORKS



MARCH-APRIL
1944

CALIFORNIA HIGHWAYS AND PUBLIC WORKS

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Great Importance of the Federal Aid System and the Need for its Improvement

By C. H. PURCELL, Director of Public Works and Chairman of California Highway Commission

The following article is a paper presented before the Road Committee of the House of Representatives in Washington March 2d, by Director of Public Works C. H. Purcell representing the American Association of State Highway Officials at a hearing on the Robinson Bill providing a Federal appropriation of one billion dollars a year for three years to improve the highways of the Nation as recommended by the A. A. S. H. O. The subject of the paper was assigned to Mr. Purcell by the Executive Committee of the Association.

THE United States has spent the last 30-odd years developing roads and highways to serve the Nation's transportation.

The results of this effort are evident in the 478,000 miles making up the several State Highway Systems, in the 2,400,000 miles of county and township rural roads and in the 300,000 miles of city streets.

A considerable portion of the 2,400,000 miles of rural county roads has had little improvement. While most of the State highway mileage has had some degree of improvement, this improved mileage is in various states of repair and a notable portion now needs replacement or further improvement.

It is also most probable that the State Highway Systems are subject to expansion up to some 10 per cent to 20 per cent by inclusion of some of the more important county routes which are not distinctly land-use roads.

55% HIGH TYPE

Of the 478,000 miles of State highways, 433,000 miles are improved. These improved State highways represent almost 91 per cent of the total miles in the State systems. However, it must be understood that these "improved" State highways include 170,000 miles where the "improvement" is less than low cost bituminous mix surface and 263,000 miles are medium or high type pavement.

Thus, of the total 478,000 miles in the State Highway Systems, which are supposed to represent the best in road development in the various States, only 55 per cent have been improved to standards of intermediate and high type pavements.

To reach this minor degree of development, it is estimated that since 1910 approximately 25 billion dollars have been expended on designated State highways, city streets and county rural roads, exclusive of relief expenditures. Of this amount it is definitely known some 12 billion dollars have been expended on the several designated State Highway Systems.

It is estimated that the total annual motor travel in the United States approximates 292 billion vehicle miles. Of this amount approximately 150 billion vehicle miles is generated on rural roads and 142 billion on urban roads. Recent studies by the Public Roads Administration show that on the main rural roads of the Nation, primarily the several State Highway Systems and comprising about 12 per cent of the total rural mileage, is generated 72 per cent of the total vehicle miles of travel.

CARRIES HALF THE TRAVEL

The Federal Aid Highway System of approximately 226,000 miles comprises but 7.7 per cent of the total National road mileage. The composition of the Federal Aid System is such, however, that most of the Nation's important and heavily traveled routes are included in it, with the result that on this 7.7 per cent of road mileage is generated 56 per cent of the total vehicle miles traveling the Nation's highways. In other words, the Federal Aid System is only one-thirteenth of the Nation's road mileage and yet it carries well over one-half of the Nation's travel.

When the composition of the Federal Aid System is considered, this condition is not surprising. The Federal Aid System was primarily designed to insure improvement of the more important routes within each State and to provide for correlation of such improvement between States. The result approaches an articulated National Highway System largely connecting the important areas and principal population centers of the Country.

That the selection of routes in the system has been well done, is evidenced by the laying out of subsequent road systems on a National scale. In determination by the War Department of the 79-thousand-mile strategic highway network, it was found that practically all roads selected were located on the Federal Aid System.

INCLUDES OTHER ROUTES

The status of the Federal Aid routes resolves itself into the backbone of the Nation's highway transportation system, comprising the Country's most heavily traveled routes, both as regards to trucking and passenger traffic. It includes within itself most of the proposed interregional routes; the military strategic highway network; principal interstate connections; and main intrastate highways.

From 1917 to 1943 the total amount of Federal Aid and emergency highway appropriations was $3,745,000,000. This does not include WPA or similar relief allocations. It is estimated that State funds used to match these Federal appropriations, amount to considerably more than an equal figure, so that it may be stated that total expenditures on Federal Aid routes since the inception of the sys-

tem will total to between 8 and 9 billion dollars.

EXCISE TAXES DIVERTED

At this point your attention also is directed to the fact that during the eleven years between July 1, 1932, and June 30, 1943, more than $4,200,000,000 was collected in Federal excise taxes levied against the Nation's motorists. During this same 11-year period the total of Federal Aid and emergency funds apportioned to the several States amounted to $2,500,000,000. This shows, therefore, that more than 40 per cent of the Federal taxes collected on gasoline, tires, automobiles, trucks and parts, and the $5 use tax were diverted from road purposes.

However, improvements accomplished by expenditure of the Federal and State funds are extensive, but there has been no time during the 26 years when the Federal Aid System was completely adequate for the traffic it carried. Developments in automotive transportation have been so rapid during the past 30 years that road builders have been unable to keep their improvements abreast of the phenomenal advances in mechanical equipment.

Radical changes in motor transport may be consummated in a season. Major changes in road and bridge design will require two years or more between inception of the idea and completed construction. Under this handicap the highway engineer has worked at a great disadvantage. However, this lag between the development of motor equipment and highway design is being shortened through cooperation between manufacturers' organizations and road designers.

SURVEY SHOWED DEFICIENCIES

The extent of the discrepancies between highway construction and traffic needs on the Federal Aid System may be gauged from the survey in 1940 by the Public Roads Administration relating to the 79,000-mile Strategic Highway Network. Practically all of this network is located on the Federal Aid System and includes about one-third of the total Federal Aid mileage. Data compiled in this study showed that:

5,500 miles of road surface were less than 18 feet wide;

14,000 miles of road surface needed to be strengthened;

Survey Revealed Inadequate Roads

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Of the 16,000 bridges on the network, the load capacity of 1,800 was less than 15 tons; the horizontal clearance of 1,700 was less than 18 feet; and on 150, the vertical clearance was less than 12½ feet.

In the three years since that survey, the condition of these highway facilities has not, in general, improved. Obsolescence and deterioration have resulted in a considerable increase in these deficiencies.

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A most optimistic appraisal of these data would indicate that the road surfaces and bridges on the strategic network are only about 75 per cent adequate, and on the remaining two-thirds of Federal Aid System the percentage of adequate improvement must be less.

It is quite apparent, therefore, that Federal Aid funds heretofore appropriated, together with State matching funds and State funds expended entirely without Federal assistance on the Federal Aid System, were totally insufficient for development of the system to standards needed by the traffic it is required to carry. On the basis of past expenditures of both Federal and State funds it is estimated that it would require eight or nine years to bring the Federal Aid System to acceptable present-day standards.

APPROPRIATIONS INSUFFICIENT

During the six years prior to the war, the States and the Public Roads Administration, working cooperatively, completed comprehensive rural road studies through the several Highway Planning Survey organizations. The work of this survey in each State included compilation of complete road and traffic inventories and analyses of the data obtained have been translated into highway needs.

By 1941 the States, with this definite knowledge of their highway needs, were on the way to well-organized planning for progressive development of their several road systems, with primary emphasis on main routes, including the Federal Aid System.

With the entry of this Country into the world conflict and the turn of the Nation to an all-out war effort, it was necessary to defer active road development on all projects not directly connected with the successful prosecution of the war. While this deferment of normal highway construction is a necessity during the period of the war, the result of the enforced inactivity will have far reaching effect upon the Nation's highways.

DETERIORATION INCREASING

Through lack of new construction and renewal by reconstruction the rate of obsolescence of road surfaces and bridges is rapidly increasing. Curtailed maintenance operations, in consequence of lack of manpower, materials, equipment, and equipment parts, coupled with wartime increases in heavy truck and bus traffic are resulting in greater deterioration of both structures and roadways.

On the Federal Aid System, the only construction undertaken during the past two years has been at locations where Federal access road projects, requested by the military, have happened to be on the system. Such instances have been comparatively few. Otherwise, practically all work that has been

(Continued on page 11)

Major Highways Blocked by Heavy February and March Snowfalls

By MARTIN A. O'BRIEN, Maintenance Assistant

THE winter of 1943-1944, while resulting in a moderate snow pack on the Sierra Nevadas, caused the first serious closure of U. S. Highway 40 over the Donner Summit since 1938. This occurred during the weekend storm of March 3d and 4th at a time when the official weather bureau records showed only 15 inches of new snow.

Two weeks earlier a similar storm in Southern California blanketed the Ridge Route under five feet of snow and resulted in the closure of U. S. Highway 99. With the exception of short periods when these two routes were intentionally closed for the safety of traffic, they had not been blocked for six years.

The closing of a major highway is unpleasant for everyone concerned. That it can happen is only another example of the limitations of man when pitted against the forces of nature.

ON OTHER HIGHWAYS

The following snow falls were reported on other main highways during these same storms, but none of these routes were closed:

U. S. Highway 395 in Mono County____4 ft. of new snow
Highway 36—Red Bluff to Susanville_____8 ft. of new snow at Morgan Summit
Highway 24—Feather River Route_____3 ft. of new snow on Spring Garden Summit
Highway 89 at McCloud_____5 ft. of new snow
U. S. Highway 299—Redding to Alturas_44 in. of new snow on Hatchet Mountain
U. S. Highway 99 at Mt. Shasta City___30 in. of new snow

Immediately upon the outbreak of war, the military authorities requested our cooperation in keeping the strategic and transcontinental routes open throughout the winter months. Until the storm of March 3d and 4th, U. S. 40 had been open every day since the winter of 1938.

To a convoy of trucks bound from the east to some California port of embarkation, its closing means a delay in shipment of war materials; may cause a ship to sail without essential cargo, or postpone the sailing time, with the possibility of goods reaching our fighting front too late.

In the past the unexpected closing of such a highway often resulted in trucks and other vehicles becoming stalled in the snow, usually without heat or food.

Two big truck units stalled on Ridge Route section of U. S. 99 between Los Angeles and Bakersfield when heavy snowstorm closed the highway for three days

RADIO CONTACT MAINTAINED

The Division of Highways installed two-way short-wave radio communication equipment in maintenance stations and on snow plows several years ago, in all areas affected, to handle emergency matters such as breakdown of equipment. When ice, visibility or other storm conditions indicate traffic hazard, the control gates are closed and the Highway Patrol is notified to stop traffic.

The following traffic control measures are customary in snow areas: (a) Trucks are usually stopped first when snow or ice cause a slippery pavement as they too often get out of control and jackknife across the road, blocking it to further traffic; (b) One-way controls established and (c) closing the highway to all traffic.

For this purpose gates have been installed on U. S. 40 at Baxters and Donner Lake and at the Ridge Route Maintenance Station and Grapevine on U. S. 99. Traffic to and from Los Angeles over the Ridge Route is also stopped in advance of the snow area at Castaic and Greenfield as at these points alternate routes, via Mojave and Ventura are available.

SNOW EQUIPMENT AVAILABLE

Several years ago the Division of Highways constructed maintenance stations, one at Donner Summit, with others at convenient locations along U. S. 40, especially designed to house men and equipment and to allow for servicing and repair of the snow removal equipment. During the winter months each station is staffed with

Upper photo shows result of snow clearing work on Mineral Summit of State Route 29
Below a busy scene where motorists stopped to put on chains at Donner Summit of U. S. 40

trained and experienced men drawn from other points in the district.

Some of the trucks and snow equipment are over-aged, having been in service for more than ten years. These can be maintained in good repair only under very adverse conditions. New equipment can not be purchased due to war time restrictions and many spare parts can not be obtained and must be made in the Highway Shops.

It, therefore, soon became apparent that if essential service on major highways was to be provided, snow plows would have to be taken from roads in recreational areas, as stand-by equipment, for use in the event of a breakdown or unusual storm conditions. Breakdowns of equipment in service have occurred this year in nearly all snow removal areas, and the wisdom of this plan has been justified.

SNOW CLEARING PROCEDURE

Snow removal equipment works continuously during a storm and unless the snowfall is very heavy or visability is seriously restricted, the plows can remove sufficient snow to permit full or limited use of the road. At the beginning of a snow storm, push type plows start working as soon as an appreciable amount of snow covers the pavement. These plows push the snow into windrows at the pavement edge and are followed by the rotary plows which pick up the snow and throw it over the side.

The area of heavy snow on U. S. 40 is between Baxter and Donner Lake, a distance of approximately 32½ miles. Within this area eight push plows and seven rotaries are available. Every piece of equipment on hand was used for the storm that began at 5.30 a.m. on Friday, March 3d, and which continued almost unabated until 7.30 a.m. on Sunday, March 5th.

DEVELOPED BLIZZARD VELOCITIES

This storm developed into blizzard proportions with wind velocities up to 50 miles per hour. The snow-filled air so restricted vision that the equipment operators could not see. In fact, visibility approached zero for several hours. Notwithstanding the efforts of the maintenance crews which kept the road open for the first 23 hours of the storm, it closed at 4.30 a.m. on Saturday, March 4th.

By 11 o'clock that night a one-way road was temporarily opened and convoys of stranded cars and buses followed a snow plow out of the area. The road then remained closed until

8 a.m. Sunday, March 5th, when it was again opened to cars and buses equiped with chains. Trucks were not permitted travel until 8.30 a.m. when they were released at 15 minute intervals. These restrictions were lifted at 12 noon.

The highway was first closed near Blue Canyon. At this point the traveled way follows a ridge for approximately two miles and is in a very exposed position, unprotected by trees. During high wind velocities, the snow drifts at a high rate.

The maintenance crew working this area reported that at times the snow drifted on the pavement became 12 ft. deep. One of the rotary plows made no forward progress for one hour, but continued to remove snow from a standing location.

DRIFTS STALLED PLOWS

The following comments offered by the maintenance crews working in this area may further explain the difficulties experienced. On February 28th and 29th, 46 inches of light, dry snow fell at Donner Summit. By March 1st, the road was completely widened. The snow, however, did not crust over and when the wind velocity increased on March 3d and 4th, much of this dry snow drifted into the cleared area of the highway and added materially to the difficulties experienced during this period.

During the storm of the 3d and 4th, drifts and slides were encountered from 60 to 144 inches in depth on the roadbed. From 12.01 a.m. until 8 a.m. on March 4th, numerous snow slides occurred on the grade from Donner Summit to Donner Lake. It required the continued use of two Snogos to maintain a one-way road through this 3.3 mile section. At 3 a.m. on March 4th three push plows became stuck in snow drifts, one-half mile west of Donner Summit, with 70 to 80 inches of snow on the road. These plows were removed from the drifts by a Snogo at 8 a.m.

Further west, near the Blue Canyon Airport, several vehicles were unexpectedly trapped at approximately 2.30 a.m. on March 4th. Five large transport trucks and four passenger cars headed west, and three transports, four Greyhound buses and four passenger cars headed east became stalled, in addition to one of the push plows that had failed mechanically.

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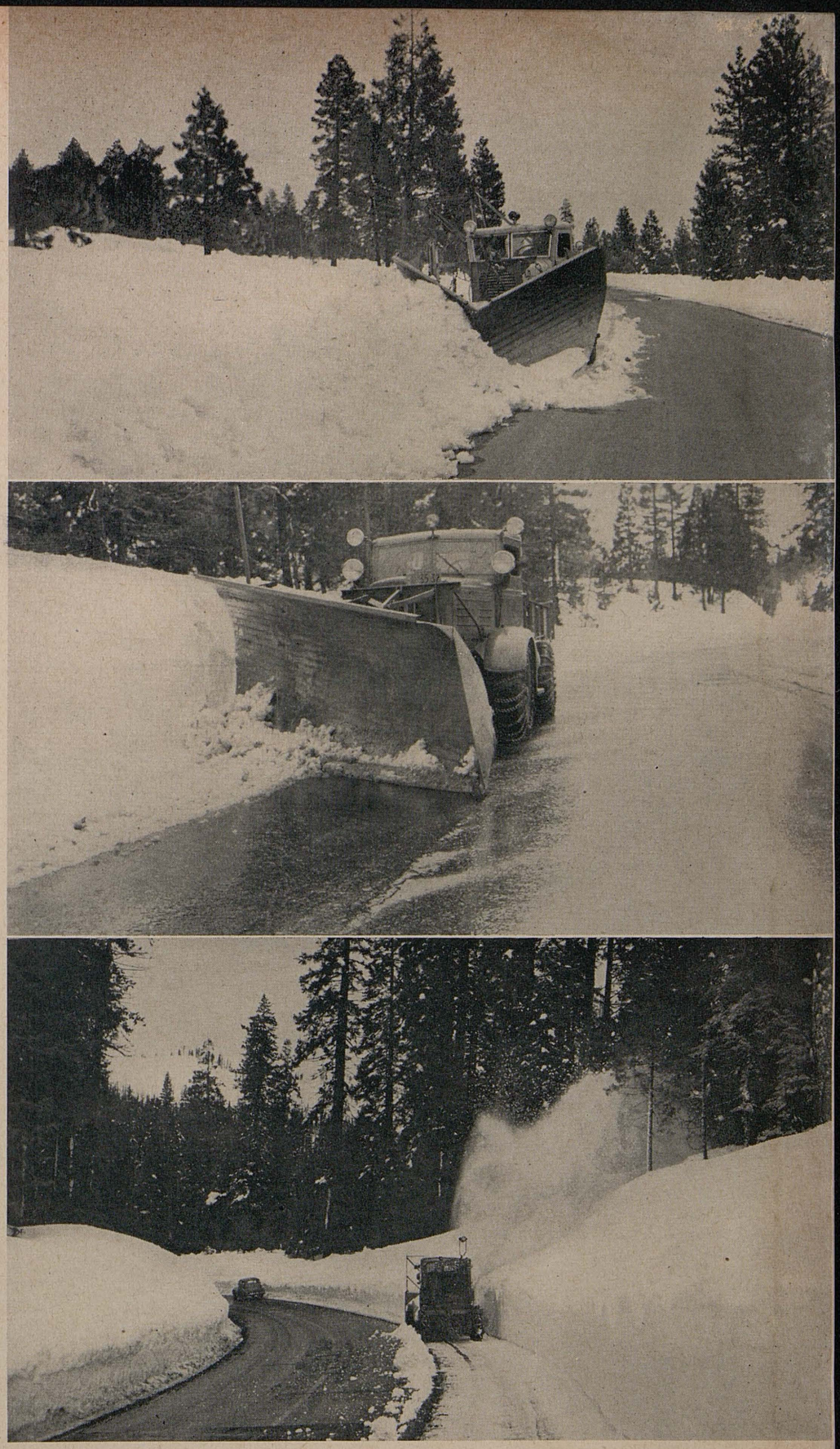


Push plows of several types shown in the two upper photos aided by a rotary plow kept State Highway 36, the Red Bluff-Susanville lateral, open during an 8-foot snowfall on March 3d to 5th

Laboratory Builds a Profilograph to Measure Pavement Roughness

By F. N. HVEEM, Senior Physical Testing Engineer*

ONE of the primary purposes in building a highway is to provide a vehicle path which is more smooth and uniform than the original ground. As a consequence highway engineers have placed considerable emphasis on the surface smoothness of the roadway and from time to time have devised equipment to measure and evaluate pavement roughness.

One of the first of these devices was an instrument known as the vialog developed by the New York State Highway Department which was mounted in a car and actuated by the vertical oscillations of the front axle as the car is driven over the road. A modification of this apparatus is still in use in California and is generally known as a roughometer or "bumpometer."

The roughometer device on a car indicates pavement roughness by summarizing on mechanical counters the vertical movements of the front axle of the car and hence the final totalized values do not differentiate between a number of movements of small amplitude as compared to fewer bumps of greater size. In other words while some idea of total roughness may be gained it is impossible to identify the **kind or variety of roughness.**

PREVIOUS DEFICIENCIES OVERCOME

In order to study highway pavements and to correctly understand the variations in pavement contours due to the effects of traffic, moisture and temperatures, it is necessary to develope a profile on paper which will enable the engineer to visualize not only the magnitude and frequency of pavement inequalities as they affect motor vehicles, but the approximate shape or contour as well. Several devices of this sort have been constructed. One, described in a report of the Road Research Board in Great Britain in 1936, pictures a device with a series of 16 wheels connected by an intricate tubular frame. The entire apparatus appears to have an overall length of some 25 feet.

It is also reported that following the first World War the State of Wisconsin constructed a somewhat similar apparatus using a large number of bicycle wheels. California Highways for December, 1939, carried an article describing a viagraph constructed in District VII and designed in the Los Angeles County Road Department by Mr. C. F. Galloway.

NOT MOUNTED ON AUTO

Most of the units thus far constructed seem to have certain disadvantages which may be analyzed as follows: An instrument mounted in an automobile actuated by movements of the car axle does not reflect pavement contour truly, but is a composite value depending on the spring suspension and riding characteristics of the individual car.

The elaborate multiple wheel units such as used in England are very cumbersome and would be difficult to transport for long distances. The type of apparatus using only three wheels does not produce a true profile record as many pavement inequalities are canceled out, others are amplified or multiplied in number.

In designing a profilograph for use by the Materials and Research Department in California an attempt was made to satisfy the following conditions or requirements:

REQUIREMENTS FULFILLED

1. The instrument should have a length or "wheel base" approximately the same as a typical automobile in order that the pavement roughness should be recorded with reference to a motor vehicle plane and not with reference to a continuous plane.

2. The instrument should be supported by a multiplicity of wheels, at least 16, mounted on compensating axles in order to provide a datum plane of about the wheel base of an average car parallel to the local pavement contour but which would be virtually independent of minor inequalities.

3. The equipment should be collapsible and capable of quick assembly and, when collapsed, should be compact enough to permit transportation in an ordinary sedan car.

4. Preferably, the instrument should not require special paper with either rulings or perforations. Such paper is expensive and if plain paper rolls similar to that used in commercial adding machines could be utilized a considerable saving would result.

CONTROLLED BY OPERATOR

5. The operator should be in a position to observe the graph at all times during the process of recording and the recorder should be available for remarks or notation on the paper strip.

6. The operator should be able to steer the profilograph in order to select and follow a predetermined path.

7. The frame should be very rigid and free from any tendency to sag or "spring" while in operation.

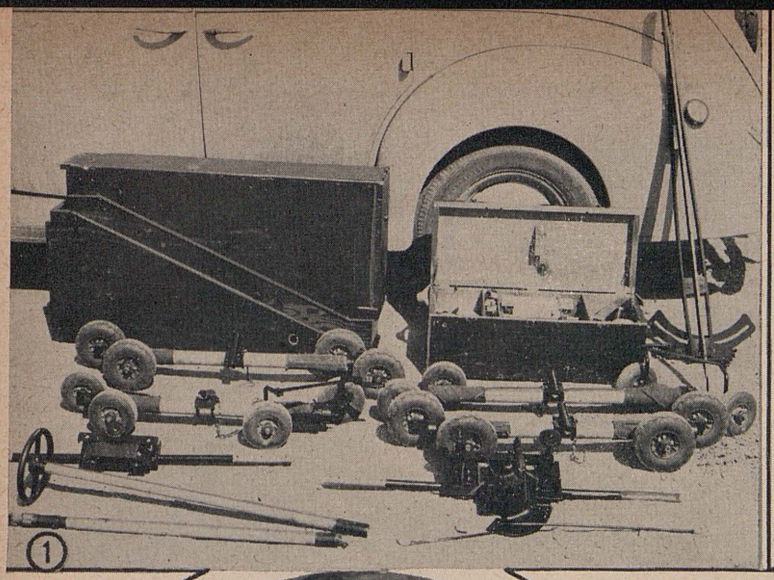
Accompanying sketches and photographs indicate the manner in which these conditions are satisfied. Sixteen small pneumatic-tired wheels were provided, each of which is free to move independently in a vertical plane. These carrier wheels are fixed in a staggered arrangement in order that no two wheels will strike a transverse ridge or inequality (such as an expansion joint), at the same time.

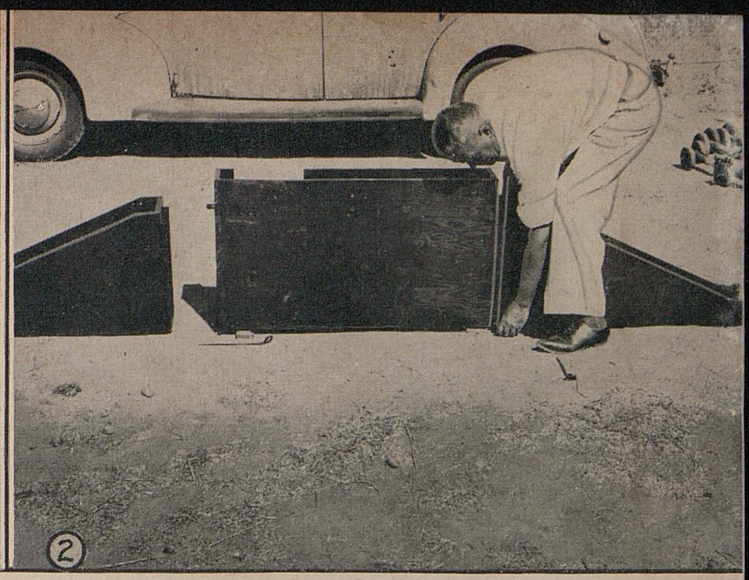
PORTABLE APPARATUS

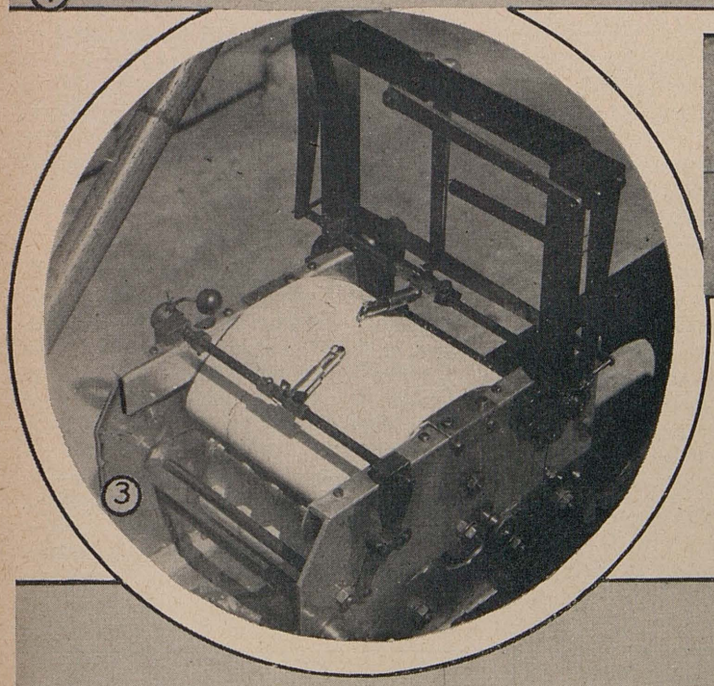
The apparatus may be dismantled into units not over 40″ in length and the entire assembly readily stowed in the trunk and tonneau of a small sedan. The instrument as constructed permits changing of the horizontal scale of the recorded graph to either of the following: 1″ = 50′, 1″ = 25′. The vertical scale may be either 1″ = ½″ or 1″ = 1″. The examples of pavement profiles illustrated herewith were recorded to the scale 1″ horizontal = 25′, 1″ vertical = ½″, and have been reduced to one-half of the original size.

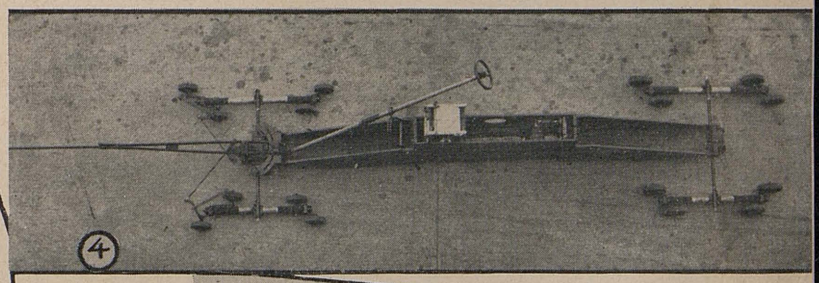
Operation of the profilograph involves the following steps after arriving on the job. First, assembling the

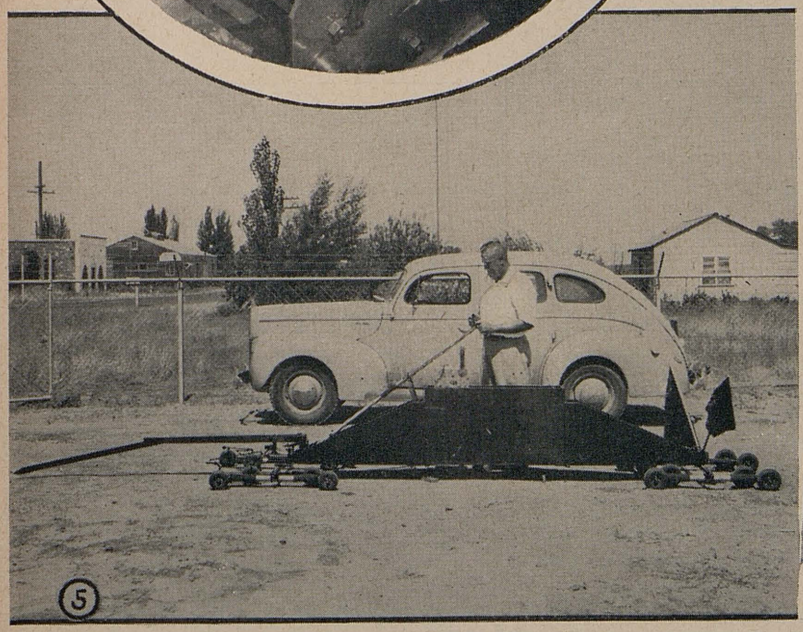
* Mr. F. N. Hveem, the writer of this article is also the designer of the new profilograph machine built by the Testing and Research Laboratory of the Division of Highways, for measuring the roughness of highway pavements.



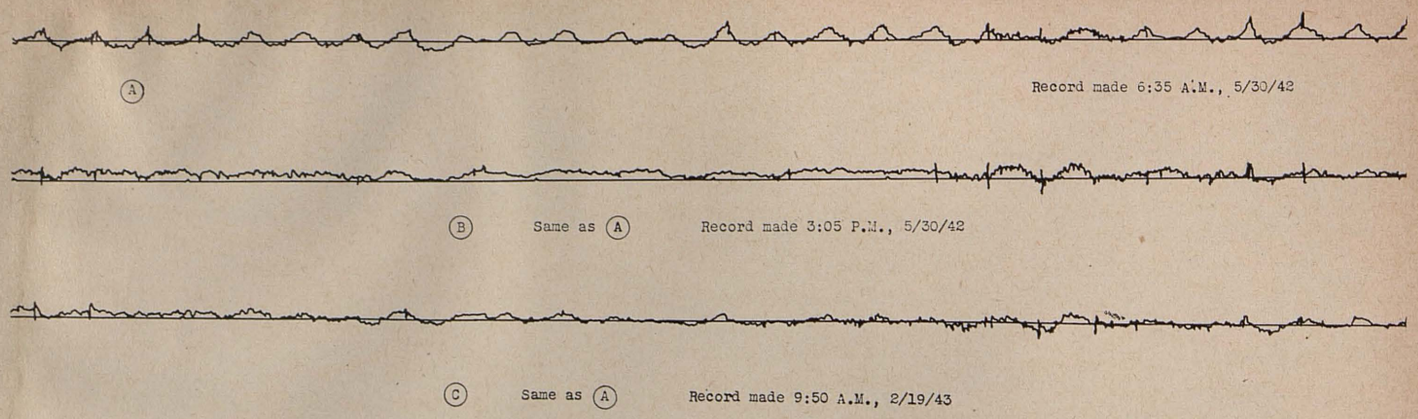








1. Units of profilograph machine for measuring pavement roughness. 2. Assembling the frame. 3. Close-up of recording mechanism. 4. Plan view of the machine. 5. Profilograph assembled, ready for use. 6. Profilograph in use



Facsimiles of profilograph records taken on a new pavement under different temperature and weather conditions

machine, second, checking air pressure in the bicycle tire, third, the recording device is installed and pens are filled with ink and adjusted. One pen records the vertical movement of the bicycle wheel with reference to the main carrier frame, the second is adjusted to provide a datum line as a basis for judging the relative deviation of the recorded profile.

TWO PENS USED

The datum pen is actuated by an interrupter which registers a small break in the line at 50 or 100-foot intervals depending on the horizontal scale gear ratio being used. This arrangement of the pens makes it unnecessary for the paper strip to be precisely true or uniform as the two pens will maintain their relative position irrespective of slight lateral movements or shifts on the part of the paper strip.

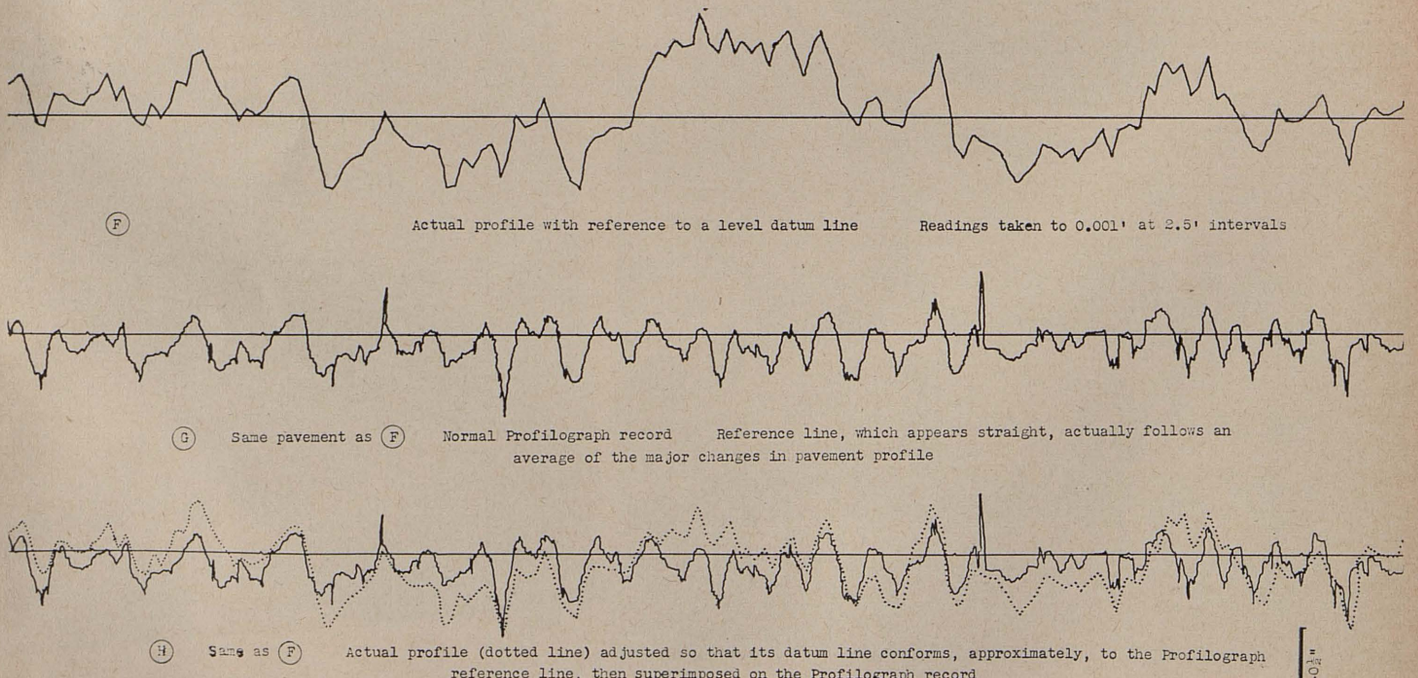
The paper is fed or controlled by two hard rubber rolls and provides a very uniform and dependable horizontal scale without the necessity for special paper having perforations for a sprocket drive. The recording pen is mounted on a small rod supported by flexible bronze reeds. This construction eliminates all sliding bearings which previously gave considerable trouble through the accumulation of dust in the bearings or sliding surfaces which impaired the sensitivity of the recording mechanism.

The instrument can be operated at some three to four miles per hour or as fast as the operator can walk. When being moved from locations separated by only a few miles, it may be readily towed behind an automobile at a speed up to 20 miles per hour.

TEMPERATURE EFFECTS SHOWN

The accompanying photographs illustrate the several steps necessary to assemble the profilograph and the appearance of the unit in operation. The assembling operation will require about 10 minutes and it may be knocked down and loaded into a car in even less time.

To illustrate the type of record produced by the profilograph there are



Facsimile records "F," "G" and "H" illustrate the relationship between a profilograph record and an actual profile platted from level notes

shown herewith facsimilies of records which were taken on actual pavements.

Graph "A" represents new pavement; record made in the early morning when the surface of the pavement was colder than the under side in contact with the subgrade.

"B." Same section recorded in the afternoon when the pavement surface temperature was higher than the subgrade temperature.

"C." Same section nine months later taken on a cloudy day in February where pavement temperature and moisture content were very uniform, showing the difference between summer and winter conditions.

INDICATES PAVEMENT CONTOUR

"F," "G," and "H" are included to illustrate the relationship between a profilograph record and an actual profile platted from level notes. The profilograph having an over-all length of some 13′ with a rigid span of only 10′ does not of course, indicate the major undulations in the pavement surface and for the same reason tends to diminish many of the larger irregularities.

A profilograph record should be regarded as evidence of the inequalities which tend to interfere with the smooth travel of the motor vehicle rather than as an exact replica of the pavement profile in space. On a whole, it appears that a profilograph record is an excellent indication of the pavement contour and does not tend to exaggerate the actual roughness other than that which is provided by the scale relationships used.

All of the examples shown were taken in the path followed by the left wheel of the car and the direction of traffic is from right to left.

It seems to be an old rule that before an engineer can be in a position to design improvements of any nature, it is first necessary to measure and evaluate the conditions. The profilograph offers means for providing a reasonably accurate recording of pavement surfaces and should be an aid in solving the difficult problem of designing and constructing pavements which are not only smooth when constructed but which will remain smooth after construction.

Two stenographers were airing their troubles. "I'd like to get a divorce. My husband lives in Ohio and I'm here, and we don't get along."

"Why don't you sue him for incompatibility?" asked the other sympathetically.

"I would if I could catch him at it."

California Snow Pack Below Normal and Water Must Be Conserved

"NO water to waste," is the judgment of Edward Hyatt, State Engineer, in appraising the 1944 water prospects for California.

The State Division of Water Resources cooperating with most of the water using organizations of California has just completed an extensive survey of the mountain snow pack in order to determine the amount of water that will come down the rivers of California when the snow pack melts.

Some 150 men traveling on skis visited over 200 locations in the mountains to measure the amount of water stored in the snow pack reaching the length of the Sierras from the Klamath to the Kern.

The snow surveyors found that the snow pack as a whole measured only about 75 per cent of normal; three quarters of its average.

The average snow depth throughout the mountains is four and one-half feet. This is solid and well packed. Measurements in the Coast Range west of Willows show four feet there at the higher elevations. Singularly the greatest depth of snow on the ground measured by the snow surveyors this year was in the mountains of southern California. In Ice House Canyon on the watershed of the Santa Ana River the snow averages 125 inches deep. Second in depth this year is the area that usually runs first; the Lake Helen area in Mt. Lassen National Park. The snow there this year averages 115 inches in depth.

In a bulletin issued April 10th the Division of Water Resources listed all snow measurements made throughout the mountains and also published its forecasts of streamflow based upon the snow survey measurements.

Appraising the irrigation situation the Division finds:

"In the Sacramento Valley, with the increased planting of crops for war demands shortages in natural runoff may develop. Economical use will be necessary."

"In the San Joaquin Valley, while there will be no water to waste, there should be sufficient to supply all reasonable demands."

"Present indications are that little or no water will this year flow into Tulare Lake."

"At Lake Tahoe the snow surveys indicate that the lake surface should rise about a foot above its April 1st elevation; to 6,227.8. This will be 1.3′ below the allowable maximum of 6,229.1 settled upon by agreement between the water users and the property owners around the lake."

The forecasts of run-off of the major rivers of the Sierra during the four months' melting period, April 1st to July 31st, in percentage of the normal run-off for the same period as made by the division were as follows:

	Per cent
Sacramento at Shasta Dam	64
Feather River at Oroville	74
Yuba River at Smartville	81
American at Fairoaks	76
Mokelumne at Mokelumne Hill	70
Stanislaus below Melones	73
Tuolumne at La Grange	78
Merced River at Exchequer	76
San Joaquin at Friant	78
Kings River at Piedra	73
Kaweah at Three Rivers	89
Kern River near Bakersfield	93
Truckee River at Farad	60
Rise of Lake Tahoe	60

Federal Excise Taxes Diverted From Roads

During the 11 years between July 1, 1932, and June 30, 1943, more than $4,200,000,000 was collected in Federal excise taxes levied against the Nation's motorists. During this same 11-year period the total of Federal Aid and emergency funds apportioned to the several States amounted to $2,500,000,000. This shows, therefore, that more than 40 per cent of the Federal taxes collected on gasoline, tires, automobiles, trucks and parts, and the $5 use tax were diverted from road purposes.

At District Right of Way Agents' meeting in Sacramento. Back row (left to right) J. M. Sorenson, Leland Rose, Herman D. Jerrett, J. B. Woodson, L. Ph. Bolander, W. G. Stuntz, Earle Bunker, E. N. Whittemore, Leo J. McCarthy. Middle row, Frank B. Durkee, Lincoln V. Johnson, Joseph F. De Martini, Jack Howard, E. P. Jones, Serge Ray, Brad Perry, George Pingry, George C. Hadley, Robert E. Reed, Holloway Jones. Front row, Ray Pianezzi, E. F. Wagner, G. T. McCoy, Fred Grumm, J. G. Standley, R. H. Wilson, S. W. Elliott, Frank C. Balfour.

Highway District Right of Way Agents Hold Annual Meeting at Sacramento

By FRANK C. BALFOUR, Chief Right of Way Agent

THE annual meeting of the District Right of Way Agents of the 11 districts of the Division of Highways, was held in Sacramento on February 10 and 11, 1944.

The agenda for this year's meeting was the most ambitious in the history of the annual gathering. The topics discussed covered all phases of right of way acquisition and the numerous problems encountered by the right of way agent in his field contacts and negotiations with the property owner.

Ways and means of completing the largest right of way acquisition program in the history of the Right of Way Department—to clear the right of way for the huge postwar construction program—were discussed at length, and it was the consensus of opinion that there will be no delay in postwar construction because of failure of right of way personnel to carry through their portion of the program to a successful conclusion.

A portion of the meeting was given over to a joint session with the staff of the legal department, at which time Attorneys Frank B. Durkee and Robert E. Reed explained the three recent Supreme Court decisions having a direct and important bearing on freeway and divided highway construction. It was their opinion that the effect of the decisions can not be accurately stated, as they fail to lay down clear general principles that can be applied to different factual situations. In any event, it may be anticipated that the general effect of the decisions will be to make right of way acquisition more difficult not only from the standpoint of increased demands by owners, but also because additional numbers of property owners may have to be contacted.

During the course of the meeting, the new procedure to be followed in right of way acquisition contact work as a result of these decisions, was explained to the gathering.

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The Federal Aid System and the Need for its Improvement

(Continued from page 2)

done on the system has been in the nature of surface patching and repair and in bolstering weakened bridges.

In July, 1943, the American Association of State Highway Officials circularized the 48 State Highway Departments on the minimum amount of needed construction on main or principal highways in each State. It should be stressed that the data submitted in response to these questionnaires included the *MINIMUM* of needs on the main routes, and while these routes are not of necessity confined to the Federal Aid System in the main, they correspond to the Federal Aid routes and may be considered to generally represent the minimum immediate needs of the Federal Aid System.

MINIMUM NEED TOTALS

Compilation of these estimates show that a total of 158,500 miles of highway and 30,000 bridges need rebuilding, widening or relocation and the total estimated cost of these immediate requirements is in excess of 7 billion dollars.

This total is broken down as follows:

	Miles	Amount
Roads should be rebuilt	74,900	$2,610,000,000
Roads should be widened	46,700	1,190,000,000
Roads should be relocated	36,900	2,420,000,000
Roads, total	158,500	$6,220,000,000
Bridges should be widened or rebuilt	(30,000)	810,000,000
Total		$7,030,000,000

In addition to these estimates of minimum necessities, the American Association of State Highway Officials also has compiled estimates of requirements for the 48 States to bring the Regular Federal Aid System, the Federal Aid Secondary or Feeder System, and the several urban highway systems to desirable standards for modern traffic. The estimates of these improvements needed for adequately handling traffic on Federal Aid and urban routes total $11,138,000,000. Broken down between the three route classifications this total estimate shows the costs of needed improvement as follows:

Regular Federal Aid System	$5,315,000,000
Secondary Federal Aid System	3,289,000,000
Urban highway system	2,534,000,000
Total	$11,138,000,000

In the study of the needs of the Nation's Federal Aid highways, certain factors of change must be given proper consideration. Federal assistance to the States and establishment of the Federal Aid System was originally designed as an aid in the development of rural road systems, on the basis of the National interest in good facilities on rural post roads. Similarly, the interest of State highway departments during the earlier years of highway development was entirely concerned with rural roads. City streets were considered the concern of local authorities and their improvement was left in the hands of these local officials.

As motorization of the Nation increased and the roads became filled with cars and trucks it became apparent that responsibility for provision of highway facilities on principal routes through cities could not be saddled entirely upon local agencies. The universality of traffic on these routes necessitated the shifting of responsibility to State Highway Departments. The entire picture changed and proper development of State routes through cities moved up to equal importance with rural road development as a responsibility of the State.

The same change applies to the responsibility of the Federal Government. Rural post roads are no longer the principal criteria. Expansion of interstate traffic on main routes, both rural and urban, has correspondingly enlarged the scope of Federal responsibility. This change already has been increasingly accepted by the Federal Government in Congressional appropriation of funds and in promulgation of rules and regulations by the Public Roads Administration.

FEDERAL AID INADEQUATE

From the foregoing discussion, it is hoped we have established definitely that previous Federal Aid appropriations have been inadequate for the proper development of Federal Aid routes to standards required by modern traffic.

In the light of the facts presented, it is evident that increased Federal appropriations are justified; particularly when consideration is given to the inadequate status of improvement of the Federal Aid System prior to the war, the present increase in the rates of obsolescence and deterioration resulting from the current cessation of construction and reconstruction, and the curtailment of much normal maintenance.

In some sectors the ability of the States to assume postwar programs of large dimensions has been questioned. In support of the contention that the States will be unable to put under way a large National postwar construction program, the critics turn back to the delays in getting highway contracts under way for unemployment relief during the depression of the early thirties. While there is some truth to this claim, such failure on the part of States to quickly let contracts designed to furnish maximum employment was due almost entirely to a lack of preparation of projects located in urban areas where unemployment existed.

In those years the transition of State highway interest from rural to urban areas was just beginning and State Highway Departments had practically no plans prepared for construction in urban areas. Today the picture is entirely different. Every State Highway Department in the Union is now working diligently on the preparation of plans and acquisition of rights of way for projects, balanced between urban and rural areas. By the close of the war each State will have a shelf, well stocked with complete plans for proposed highway construction.

STATES ABLE TO HANDLE

That the States are capable of quickly placing contracts under way is further demonstrated by the success of the current Access Road Program. In our own State of California we have put under way, in addition to the regular work of the department, 142 access road and flight strip projects totaling nearly $30,000,000. Of these projects 114 contracts costing $23,000,000 have been completed and 28 contracts estimated to cost approximately $7,000,000 are still in progress. Other States with comparable military and industrial establishments can produce similar data on access and flight strip construction projects.

Question has also been raised relative to the ability of contractors to take on such a program.

(Continued on page 16)

State Highway Bridge Maintenance Involves Care of 4,633 Structures

By HARVEY D. STOVER, Bridge Maintenance Engineer

MAINTENANCE of California State highway bridges during the war emergency when overloading of structures is often necessary for the movement of heavy equipment is of paramount importance to the Division of Highways. The utmost care is required to keep detailed information based on constant inspections available for instant reference as to the condition and safety factors of each structure.

This extraordinary maintenance control is especially imperative under prevailing conditions that limit repair materials and new construction.

Effort is being made under war conditions to maintain bridges safe for traffic with the minimum of new construction and for this reason, coupled with the difficulty of securing structural materials, bridges scheduled for replacement this season offer unusual maintenance problems.

The Bridge Department of the Division of Highways consists of four sections — Preliminary Investigations, Design, Construction, and Maintenance and Research.

BRIDGES TOTAL 4633

The Maintenance and Research Section is responsible for the maintenance of all bridges on the State Highway System with the exception of several toll bridges where maintenance is under another section of the Division of Highways. These total 4,633 structures, excluding culverts, distributed throughout the 13,891 miles of State highways—3,139 built of steel and concrete, 1,380 built of timber and 114 of steel and timber combined.

The activities of the Maintenance and Research Section include:

1. Inspection of State bridges
2. Inspection of bridges for other agencies.
3. Structural materials records.
4. Control of overloads on bridges.
5. Collecting of statistical data.
6. Railroad crossing records.
7. Research activities.

Inspection of State Bridges

An original inspection report has been prepared for each bridge on the State Highway System and supplemental reports are made annually. In special cases where the structure is failing rapidly, monthly inspections are necessary.

The bridge inspection report records the bridge name, number, location by route and section, and log mile, number and length of spans, type, width clearance diagram, a brief history by whom built, date, designer, etc., condition of stream bed and other pertinent data. Repairs, strengthening or replacement, as required is outlined under the engineer's recommendations. Computations for strength rating are made and filed with the original report and when posting for restricted loading is necessary, the posting limits are included in the engineer's recommendations. The posting procedure will be discussed later.

Inspection of Bridges for Other Agencies

When cities, counties, Division of Forestry, State Department of Natural Resources or other controlling agencies so request, their bridges are inspected and reports are prepared and posting is handled similarly to State highway bridges.

Access road bridges are inspected by agreement with the Public Roads Administration. Striking an average for the past five years, 192 inspection reports on bridges for other agencies have been made annually. The trend of this work is upward.

Control of Overload Permits

In order to allow all districts more leeway in the issuing of overload permits and at the same time to prevent some districts from issuing permits for loads which are too severe on bridges, maps were made of the various highway districts which rated the highways on a basis of bridge capacities, the different capacities being shown by means of colors. Usually highway sections were rated to the strength of the weakest bridge on the section. However, where State highway or important county road junctions occurred between section limits, such sections were subdivided for rating purposes. All highway bridges were rated by the following classifications:

Class 1. Represented the better concrete and steel structures, generally those of H-15 or equivalent design. Such structures were allowed loads 50 per cent in excess of the legal limit under permit.

Class 2. Consisted of the better timber bridges, of which the greatest number are designed for the H-12½ loading, and those concrete and steel structures which were not quite safe for Class 1 loads. These structures were permitted loads 30 per cent in excess of legal.

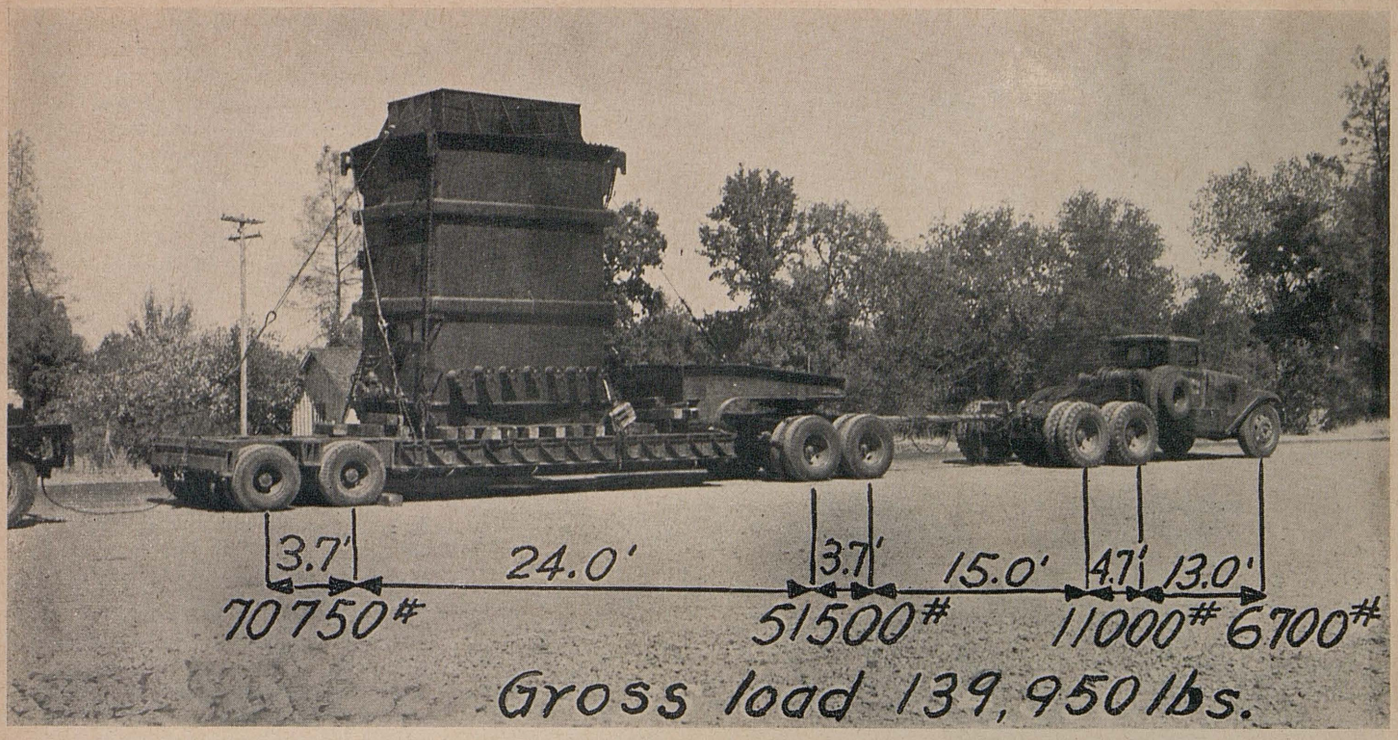
Class 3. Represented those bridges which, although not posted, were safe for legal loads only by virtue of a reduced safety factor. No loads in excess of the legal limits were permitted on these structures.

Class 4. Represented all structures posted for restricted loading. Districts are not permitted to issue load permits in excess of the posted limit of any such structures.

Maps, charts and sample computations were sent to all highway districts. In order to be able to route loads across district lines, the various highway districts have made copies of their maps and exchanged with the adjacent districts so that at present each district office has maps covering a major portion of the State.

COMPREHENSIVE MAPS

When there is a change in bridge status, such as, posting of structure, replacement of a posted structure, or general progressive deterioration sufficient to effect a change in strength of rating, changes are made on the Bridge Department map and the district in-



A typical overload, the largest ever permitted to cross a timber trestle on the State Highway System up to date was a huge transformer for an electric power station. The gross load was 139,950 pounds and the required number of axles on tractor and trailer and the distribution of the weight as figured by the highway engineers is shown in the above picture

volved notified by letter to make a similar change on their map.

The information contained in these maps and charts has been a great help to the districts in issuing overload permits, has placed overloads on a uniform basis throughout the various districts in the State and has resulted in an appreciable reduction of the overloads submitted to the Bridge Department for approval. Another factor which was not anticipated originally is a reduction in a large percentage of loads to fit those allowed by the structure classification. In other words, if an application is submitted for a load in excess of the values given on the chart, the district makes an effort to have the load reduced to chart rating, and is successful in a majority of the cases.

EXCESS LOADS

Loads in excess of those shown which can not be broken down reasonably are submitted, with axle spacings and tire data, to the Bridge Department for future check. Such loads are checked against the actual structures involved. If stresses are not excessive, permits are approved. In a number of cases, the Bridge Department will require redistribution of the load to the various axles or the placing of additional axles under the load before approval is given. As a matter of policy, all loads in excess of those shown on the charts must be weighed, preferably before crossing the structures involved. The certified scale weights of the loads on the various axles are forwarded to the Bridge Department. In some instances we have required that the load be weighed in the presence of a motor vehicle officer and not allowed to continue if the gross or axle loads were in excess of those shown on the permit.

Actually, there is no definite upper limit of gross load which may be allowed under permit provided sufficient axles at adequate spacing can be placed under the load or provided the hauler is willing to place adequate supports under the structures involved at his own expense.

UNUSUAL UNDERTAKING

In the first connection, a load which grossed 228,000 pounds was moved for a short distance over modern concrete bridges. However, the length of load was 151 feet and we required two extra width dual axle dollies each with 16 pneumatic tires between the 3-axle tractor and the 3-axle trailer. The maximum concentration under this vehicle's train was a total of 56,000 pounds on a 10-foot wide, 16-tired 2-axle dolly, which concentration was within the chart limits for the structures involved.

To illustrate the second condition, it recently became necessary to move a load weighing 330,000 pounds over two State highway bridges. The front end of the load was supported on a heavy low bed semitrailer combination consisting of a 3-axle tractor and 2-axle semitrailer having a total of 16 tires on the semitrailer duals. The rear end of the load was supported on a 2-axle 16 tired dolly. Axles were spaced 5 feet and had a width out to out of tires of 13½ feet. Although there were no available scales capable of weighing this concentration, the estimated load was about five times the legal allowable load.

In order to permit this load to cross the Waldo Undercrossing, we required nine 5-post bents, two under each of the 19-foot spans and one under the 13-foot end span as well as additional posts under the caps at midpoint of existing columns. All bents were jacked tightly into place and each post was supported by a 12x12 sill 4 feet in length. Only one bent of similar design was required under the heavier Sausalito Road Undercrossing. We required that a representative of the Bridge Department be present to inspect the supports before the load

Pictures show typical repairs to a timber trestle scheduled for replacement in fall of 1943. Arrows point to rotted stringer and 6- by 8-inch corbels or supports bolted to the sides of the piles. The corbels support 4- by 16-inch stringers used to reinforce the cap

could be moved. With these precautions, this tremendous load was moved without damage to the structures involved.

During the 12-month period July 1, 1942, to June 30, 1943, 8,729 overload permits were issued by the various State highway district offices.

Collecting and Furnishing Statistical Data for Use of State Agencies and the General Public

The maintenance and research section furnishes much statistical information to State and Federal Government agencies, including the military, as well as the general public.

A "Bridge List and Log of State Highways" in book form (8.5 x 11 inches — mimeographed) containing some 125 pages, gives an itemized list of all structures on the State Highway System including all grade crossings. This is arranged in order along any given route. One line in the list notes the most pertinent information relative to any one item. Each structure and grade crossing is identified by a "Bridge Number." This number is painted on each structure for identification purposes. With the number is shown the name; location—such as district, county, route and section—log mile; type of structure such as concrete girder, steel truss or timber stringer; number and length of spans; total length of structure and roadway width with sidewalks noted, if any. The vertical clearance is also noted if the structure has an impaired clearance.

The list also shows the city limits of all incorporated cities and towns, junction of all State highways, all section changes and other important features along the route.

It is issued to interested persons and agencies including certain military agencies and the Public Roads Administration. The persons holding these copies are furnished copies of all revisions of this publication.

POSTED BRIDGE LIST

A "Posted Bridge List" shows all structures on the State Highway System which have been posted for less than legal loads, in accordance with the provisions of the Vehicle Code. This list indicates the limits for which the structure is posted and this information is used by all districts in controlling heavy traffic movements and in issuing permits. Many trucking agencies also call for this list which is used by them in routing their loads.

In addition to the "Posted Bridge List" a special map is issued monthly which indicates not only the location of all "Posted Bridges" and the minimum allowable load for each section of State highway, but also shows any other obstructions to the natural flow of traffic. These might be slides, washouts of roads or bridges, or one-way traffic control due to oiling of road or a construction project.

This map is kept up-to-date and issued monthly for use by the State and other agencies, both private and public.

Special reports are made from time to time, to the various military agencies, upon their special request, indicating the capacities of State highways and bridges, for both load and clearance.

RAILROAD CROSSINGS

A field investigation and standard report is made for each grade crossing on the State Highway System. These reports contain all pertinent data as well as a sketch and photographs of the crossing. Supplemental investigations are made at periodic intervals and the reports corrected for changes in protection, trackage, etc. as required.

The section further keeps the accident record of all State highway crossings up-to-date and has available the latest records of highway and railroad traffic. This office is able to furnish trackage, protection, accident and traffic data for all State highway crossings and the major portion of such data for crossings off the Highway System. One function of this section is the furnishing of lists of crossings for additional protection or for separation on a basis of need, particularly when Federal funds become available for such purposes.

Research Activities

The research portion of the work of the maintenance and research section may generally be divided into three classes as listed below, although occasionally, more than one class may be combined in the solution of a particular problem.

1. The collection and compilation of published data and the records of the maintenance and research section and other highway agencies to arrive at conclusions affecting the work of the department.

2. Making physical tests of materials of construction in cooperation

with the Materials and Testing Laboratory.

3. Testing of bridge structures in the field and following up experimental use of new construction materials.

The first method may be illustrated by the following specific projects.

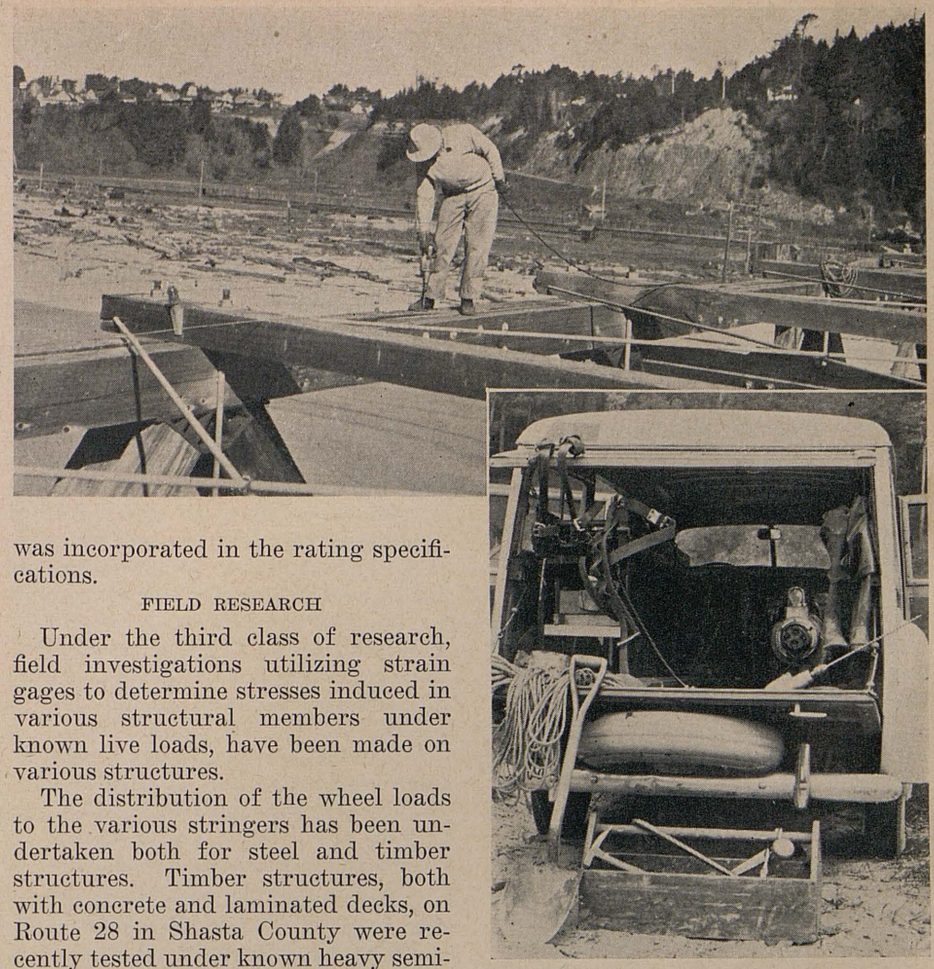
A compilation was made of axle loads and spacings of some 50,000 loaded vehicles of various types from data obtained in the field by the State Highway Planning Survey. One result was the adoption of the standard vehicle types used in the load rating of the existing structures. Another report prepared from this data showed the great discrepancy existing between stresses induced by actual vehicles traveling the highways, as compared to those induced by H-15 design loading, then in use. As a result of the pioneering work done by this department, the State of California is now using a semitrailer design load, and the American Association of State Highway Officials has included a similar loading in their specifications.

CAREFUL INVESTIGATIONS

The development of specifications for rating existing structures was an important project undertaken by this section. These specifications form a basis for computing the capacity of existing structures and, through the efforts of this department, the major provisions of these specifications have been incorporated in the specifications of the A. A. S. H. O.

Quite an exhaustive investigation was made to determine the effects of age in the strength of timber. The engineering index was combed for any published data on this subject and timbers from several old bridges were delivered to the State testing laboratory for strength determination.

An important research undertaken, with the cooperation of the testing laboratory, was the investigation of bridge pins. In these tests, a uniform material, 2-inch steel shafting, was tested in bending under both center and third point loading over a range of span lengths varying from pure shear to a span of 10 diameters. The second part of this investigation consisted in testing actual pins from old structures which had been in service for from 30 to 50 years. As a result of these investigations, the provision that "Bending in pins need not be computed where the lever arm of the couple is less than the diameter of the pin" was incorporated in the rating specifications.



Engineer is examining condition of a timber structure using 3/8-inch ship auger 18 inches long in a 1/4 H.P. electric drill and additional special equipment carried in station wagon

FIELD RESEARCH

Under the third class of research, field investigations utilizing strain gages to determine stresses induced in various structural members under known live loads, have been made on various structures.

The distribution of the wheel loads to the various stringers has been undertaken both for steel and timber structures. Timber structures, both with concrete and laminated decks, on Route 28 in Shasta County were recently tested under known heavy semitrailer loadings operating under permit.

Personnel

There are 14 engineers now employed in the Maintenance and Research Section. The greater portion of these are licensed civil engineers. These men make the field inspections and prepare the bridge reports. When the report recommends day labor work be done, the engineer prepares the plans, bill of materials and estimate of cost. When contract work is recommended, the report is sent to the Bridge Department design section where the plans, estimate and specifications are prepared. When the work is accomplished by day labor, the construction engineering required is assigned to the engineer in the Maintenance and Research Section.

Day Labor Construction Work

Work required in the nature of replacing stringers, redecking, placing supplemental bents, strengthening, pile stubbing, and scour protection, where the extent of the work is more or less indeterminate until the job is underway, is handled by day labor by the Maintenance Department of the Division of Highways. This work is done in most instances during the fall of the year when the district maintenance crews have finished the summer oiling and general highway maintenance. It serves as a ballast in the work to keep the maintenance men busy throughout the season. The availability of these crews throughout the State is of utmost importance for bridge maintenance. In cases of flood damage to bridges or structural failure due to overload, etc., repairs can be started at once. As a result there is minimum delay to traffic when failures occur.

The Maintenance and Research Section is assisted in the inspection work to the extent that each District Maintenance Engineer or a qualified assistant inspects all structures at least twice

(Continued on page 25)

The Federal Aid System and the Need for its Improvement

(Continued from page 11)

In California we have examined possible apportionments to the States under the proposed bill, and it was found that $50,000,000 a year would be the maximum which California could expect.

CONTRACTORS CAN DO WORK

During the past two years contractors of our State have entered into and largely completed Federal contracts totaling $300,000,000 for military establishments, air fields, etc. In addition they have undertaken the $30,000,000 in contracts for access roads and flight strips. It certainly would stand to reason that if Pacific Coast contractors could successfully complete these programs, they have the ability to assume an annual highway program based upon a $50,000,000 Federal Aid apportionment.

The availability of equipment and materials for the proposed postwar program has likewise been questioned.

There is no doubt that there is a shortage of equipment. At the present, things are not quite as tight as they were six months ago. However, the resourcefulness exhibited by contractors during the past two years in getting the jobs done with whatever was available, coupled with the expected release of equipment at the close of the war leaves little doubt that the situation will be met as far as equipment is concerned.

Materials shortage is not the problem which some would try to make it.

Even with the routing of steel production into war channels, reinforcing bar steel and some structural shapes are available for necessary work.

NO CEMENT SHORTAGE

There is no cement shortage and while asphaltic products were originally rationed because of feared limited supplies, restrictions on their use were lifted when it was found that, being a residue of manufacture, the supply was not depleted.

A shortage of lumber and timber—yes. However, it must be remembered that the entire output of many mills is going into crates and shipping boxes. This diversion from dimension timber will, to a large extent, stop at the close of the war and the mills will be back to normal production by the time highway jobs are under way.

Sand and gravel present no difficulty. Commercial stockpiles are now from two to five times the quantities on hand prior to the war.

During the period of transition of the Nation from the current wartime economy to that of normal peacetime the dislocation of labor and industry will be something unprecedented in our National history. Never before has as great a number or percentage of the people been transferred from civilian pursuits to the armed forces and war industry. Through various official discussions we are informed that approximately one-half the persons employed in manufacture are manufacturing war products. Similar or even higher percentages probably obtain for those employed in services, as all or a major part of most of such services are in connection with the war effort.

Never before has so great a percentage of industry been withdrawn from civilian production to war industry.

TRANSITION CHANGES STAGGERED

As the transition from peace to war has been on an unprecedented scale, so will the postwar transition from war to peace be greater than ever experienced for both industry and those whom industry employs. To meet this latter problem of transition, staggered demobilization and staggered termination of war contracts is anticipated and will be of assistance. The change in public temper at the cessation of hostilities, however, is most likely to make such staggering extremely difficult.

It is generally understood that the period needed for conversion and retooling of industry to peacetime activities will require from six months to two years in the various lines. An additional period of time will be required before industrial production will reach full capacity. In all probability the complete transition to peacetime activity and full employment will consume a period of three to four years during which unemployment will be one of the principal problems of the Nation.

This period of anticipated unemployment will coincide with the period of greatest need for reconstruction and improvement of the Nation's highways.

AUGMENTED HIGHWAY PROGRAM

As previously stated, the anticipated unemployment will be centered in urban areas. The great highway need for arterial and freeway development articulates with employment needs. An augmented highway program during the postwar years of transition will serve in considerable part to alleviate unemployment conditions and to fulfill that function of public works which is designed to keep employment at high levels during depression years.

In conclusion, may I emphasize the principal factors relative to the importance of the Federal Aid Highway System, the need for its improvement and the desirability of other highway development.

While the Federal Aid System consists of 226,000 miles, or only 7.7 per cent of the total National road mileage, it includes the principal State routes and interregional highways and carries 56 per cent of the total motor, truck, and bus travel. Deterioration and obsolescence of the Federal Aid routes and other important highways during the war period of deferred construction, reconstruction and curtailed maintenance will require correction at the earliest possible moment if these arteries of traffic are to serve the great load which they are called upon to carry. The need applies to important routes in and through cities, heavily traveled county roads, State routes and Federal Aid highways.

In this rehabilitation and improvement the responsibility of the Federal Government to interstate and interregional traffic must be given the consideration it deserves.

The proposed Federal appropriations are reasonable in the light of past participation and the present needs of the Federal Aid System, city arterials and important rural county roads.

The States are preparing the plans and acquiring the needed right of way for the task. The contractors have the ability and the desire to undertake the program. Sufficient equipment and materials will be available, and the work will mitigate anticipated unemployment.

Recommendation by the House and Senate Road Committees for the passage of the pending bills is strongly urged.

District Right of Way Agents Hold Annual Meeting at Sacramento

(Continued from page 10)

Holloway Jones, attorney in charge of condemnation trial work for the department, submitted a complete and interesting report on the progress being made in bringing condemnation suits to trial promptly, which during the last two years had proven extremely satisfactory.

The topic of simplifying legal descriptions in documents conveying title or subordinate interests in land to the State, was ably presented by Supervising Right of Way Agent E. F. Wagner.

The question of proper cooperation with county and city officials in handling payment of taxes in connection with acquisition of rights of way, was discussed at length, and a revised policy under which it is hoped to materially improve the present fine spirit of cooperation which exists between the State Highway Right of Way Department and city and county tax collectors, was outlined.

PREPARATION OF APPRAISALS

Supervising Right of Way Agent S. W. Elliott led the discussion on proper preparation of appraisals to determine the market value of land to be acquired and damage to the remaining portion not taken in connection with right of way acquisition.

The present inflationary effect on real estate values and how much consideration should be given to the inflationary trends, received considerable attention, and also the question of consideration of the benefits to accrue to the remaining portion of property not taken, in arriving at a settlement with the property owners.

A number of other important topics having a direct bearing on right of way acquisition and procedure, including further improvement in the maintenance of records of rights of way acquired, were discussed.

ROUND-TABLE DISCUSSION

The last two-hour period of the second day of the meeting was given over to a round-table discussion of the problems the negotiators confront in the field, and ways and means of solving such problems, with special emphasis being placed upon the vital importance of a negotiator fully understanding the proposed highway improvement and the possible effect it will have on abutting property, both beneficial and detrimental. The consensus of opinion was that a successful right of way negotiator must have the ability to sell the improvement to the property owner in a fair and unbiased manner. Otherwise, we can not expect to successfully acquire the necessary right of way.

The District Right of Way Agents in attendance at the meeting, in the order of the highway districts they represent, were as follows:

J. M. Sorenson_____District I, Eureka
Leland Rose_____District II, Redding
H. D. Jerrett_____District III, Marysville
J. B. Woodson__District IV, San Francisco
L. Ph. Bolander_District IV, San Francisco
W. G. Stuntz__District V, San Luis Obispo
Earle R. Bunker_____District VI, Fresno
E. N. Whittemore_District VII, Los Angeles
Leo J. McCarthy_____
_____District VII, Los Angeles
E. P. Jones__District VIII, San Bernardino
Serge Ray_____District IX, Bishop
B. J. Perry_____District X, Stockton
Geo. S. Pingry_____District XI, San Diego
S. W. Elliott__Supervising Right of Way Agent, Northern Districts—San Francisco
E. F. Wagner_Supervising Right of Way Agent, Southern Districts—Los Angeles
Raymond S. J. Pianezzi_____
_____Supervising Right of Way Agent Central Right of Way Office, Sacramento

Representatives of the legal department who attended part of the two day right of way session, were as follows:

C. R. Montgomery, Frank B. Durkee, Robert E. Reed _____Central Office Sacramento
George C. Hadley_____
_____State Building, Los Angeles
Jack Howard, Holloway Jones, Lincoln B. Johnson, J. F. De Martini _____Russ Building, San Francisco

It is to be regretted that Mr. C. C. Carleton, Chief of the Legal Department, was absent for the first time in the history of the annual Right of Way Agents' meeting at Sacramento, due to an unfortunate accident in which he fractured a bone in his foot.

The following representatives of the Division of Highways Central Office staff also attended the meeting:

G. T. McCoy_____State Highway Engineer
Fred Grumm_____Asst. Highway Engineer
J. G. Standley____Principal Asst. Engineer
Richard H. Wilson_____Office Engineer
F. W. Panhorst_____Bridge Engineer
E. R. Higgins_____Comptroller

Life Saved by Aid of Highway Crews

"Big Bear Lake, Calif.
March 21, 1944

Mr. E. Q. Sullivan
State Highway Maintenance Dept.
San Bernardino, California

Dear Mr. Sullivan:

On February 23d we were called for an emergency pneumonia case to be transported to a hospital. The roads were all blocked because of snow and impassable to cars. We phoned your local maintenance camp, but getting no answer, located the crew on the north side of Big Bear Lake and sent them a message that it was imperative for us to get down the hill. In response to our appeal, the foreman sent one plow over the grade and one around the lake, opening the road for us.

Due to the prompt response, we were able to make the trip in time to save the patient's life. We wish to commend the courteous cooperation of the Big Bear Lake crew. It is a great relief to us in the Valley to know that in times of dire need we can count on such splendid support from the State Highway Department.

Appreciatively yours

LARRY BOYLE, Driver
Mountain Ambulance Service"

Little Tommy had spent his first day at school. Mother was anxious to know how he had got on.

"What did you learn, dear?" she asked.

"Didn't learn nothin'," come the reply.

"Well, then, what did you do?"

"Didn't do nothin'. A woman wanted to know how to spell 'dog,' and I told her. That's all."

Major Highways Blocked by Snows

(Continued from page 5)

TRUCK COMPLETELY BURIED

Two of the Greyhound buses followed a rotary plow east, but one broke down due to engine trouble after traveling one mile. The other bus traveled only to the Yuba Gap Maintenance Station. By 11 a.m. a one-way road was opened from Yuba Gap to the airport and all bus passengers were removed and taken to Colfax. Private cars and transport trucks were later dug out and sent west. In this same area a state-owned light truck abandoned near the airport was entirely buried by snow in about two hours.

The official records of the United States Weather Bureau indicate wind velocities during this particular storm at Donner Summit and Blue Canyon between 25 and 46 miles per hour on March 3d, and 22 to 48 miles on March 4th. The snow pack at Donner Summit was 123 inches prior to the storm and 138 inches at 7.30 a.m. March 5th.

After five short closures of U. S. Highway 99 over the Ridge Route, a severe storm of four days' duration closed this important highway from 7.30 p.m. on February 19th to 12.30 p.m. on February 23d. The snow fell between Newhall and the north end of the Grapevine, although the heaviest snowfall was near the Summit and covered approximately 25 miles of highway. During this time, 58 inches of snow was measured at Gorman.

DISTANT EQUIPMENT SECURED

In order to open the road, all available snow removal equipment was moved from the Angeles Crest Highway which was allowed to close in order to speed up the work on U. S. 99. A total of nine push or grader plows and two rotary plows were in continuous use throughout the storm.

As soon as the snow was removed from the pavement of U. S. 99 during this four-day closure, the cold weather which accompanied the storm caused ice to form on the pavement. This ice cake, varying from 1 to 4 inches in thickness, could not be removed by snow plows and made driving hazardous. During this time, when snow plow operations permitted, a few convoys of trucks and passenger cars with chains were escorted through behind snow plows or sanding trucks.

In the Los Angeles area where snow is a rarity, only a few motorists, those who frequent snow sport areas, have skid chains. It therefore became necessary to close the highway for the safety of traffic. In other localities, cars properly equipped are allowed to travel under similar snow conditions.

The importance of carrying skid chains when driving into snow areas can not be too strongly emphasized. Without chains motorists endanger their lives as well as others when there is snow or ice on the pavement.

The Department has endeavored to give the best possible service on the major transcontinental routes. We recognize the hardship that may have been felt by people living in resort areas who had become accustomed to prompt snow removal and by others whose roadside business was of necessity affected by the road closures. However, the war has made it necessary to do without many things. As we have not been able to purchase new equipment, it was felt necessary to conserve that on hand. Our efforts were therefore concentrated on strategic highways.

Governor Sets Precedent in Naming New Toll Bridge Authority Member

FOR the first time since it was created, the California Toll Bridge Authority has as a member a citizen who is neither an elective nor appointive State official.

Appointed by Governor Earl Warren on April 4th, Ernest L. Adams, prominent Chico business man, assumed the duties of his office at a meeting of the Authority on April 6th.

Under the law establishing the Authority, it was provided that the members of that important State agency shall consist of the Governor, Chairman; the Lieutenant Governor, Director of Public Works, Director of Finance, and Chairman of the California Highway Commission. When the 1943 Legislature combined the positions of Director of Public Works and Chairman of the Highway Commission, and Charles H. Purcell as Director of the Department of Public Works became also the head of the Highway Commission, there existed in the opinion of the Attorney General a vacancy on the Authority which the Governor was empowered to fill by the appointment of a private citizen.

RICE CROP EXPERT

Mr. Adams, a native of Kansas, following his graduation from the Kansas State College, entered the service of the United States Department of Agriculture and was in charge of the Division of Wheat and Barley in Montana and the Northwest until 1912, when he was sent to California to help develop the rice industry.

He established a federal rice experimental station at Biggs in Butte

(Continued on page 21)

A powerful rotary plow hurls snow high over the Donner road to the opposite bank

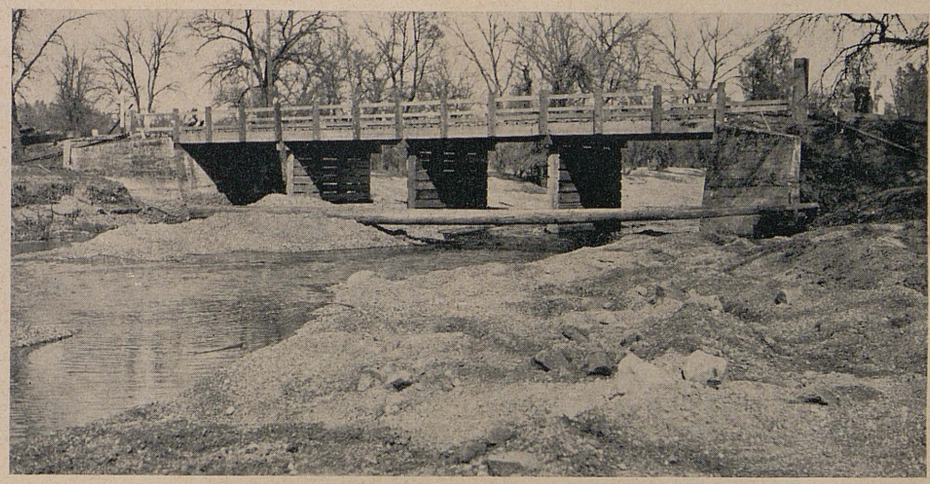
Old Railroad Span Refabricated to Provide a New Highway Bridge

By CHARLES R. POPPE, Associate Bridge Engineer

AN excellent example of the manner in which the Division of Highways was able to replace one storm damaged bridge while using a minimum amount of critical material was provided by the bridge across Oak Run Creek in Shasta County, abount 12 miles east of Redding on State sign route 44.

The original timber bridge on concrete abutments across Oak Run Creek was built by the county in 1912. It consisted of four spans of approximately 20 feet each and provided a roadway width of 18 feet, 6 inches.

During the winter of 1942-43, the central bent or support of the structure was washed away. A temporary support was installed in order to permit the use of the bridge until such time as a new one could be constructed.



Old four-span timber bridge across Oak Run Creek that had to be replaced

Single span steel railroad bridge State was able to buy for replacement

BOUGHT OLD RAILROAD SPAN

Previously, when it had become almost impossible to obtain critical materials for bridge construction on nondefense highways, the Division of Highways had been able to purchase a complete, through plate girder railroad bridge of 82 feet, 8 inches span. This bridge had originally been built by the American Bridge Company in 1919 for the Bay Point and Clayton Railroad at its crossing over the Santa Fe Railroad near Port Chicago, Contra Costa County.

The bridge was purchased by the State primarily for the girders inasmuch as the floor beams were too short for reuse as such on a highway structure. Consequently, when the bridge was dismantled, the floor beams were carefully cut off with a torch at a distance of 3 feet 11 inches out from the girders leaving the entire floor beam brackets in place on the girders.

When it became necessary to replace the bridge at Oak Run Creek, it was found possible to alter the old steel railroad bridge to such an extent that it could be used at that location. A careful study of the alteration problem indicated that by welding approximately 12 inches of plate on each floor beam bracket, it would be possible to splice the railroad stringers to the brackets, thereby making floor beams upon which a concrete deck providing an 18-foot roadway width could be placed.

Also in order to accommodate the girders, it would be necessary to provide girder seats on the existing concrete abutments at Oak Run Creek and to permit the clearance required for high water, the highway grade must be raised about 2.7 feet.

OLD RIVET HOLES USED

Plans were prepared on this basis and also provided for the railroad bridge floor beams to be cut up to furnish much of the needed splice material. Wherever it was possible to do so, existing rivet holes in the splice material were used in order to reduce the refabrication costs to a minimum.

It is interesting to note that of the 134,060 pounds of structural steel in

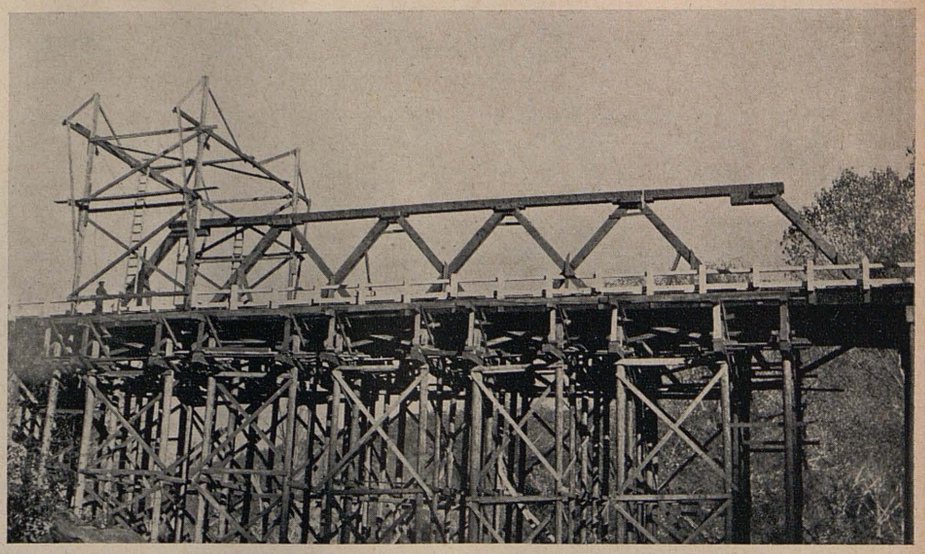
(Continued on page 28)

Cosumnes River Bridge Truss Replaced Without Interruption of Traffic

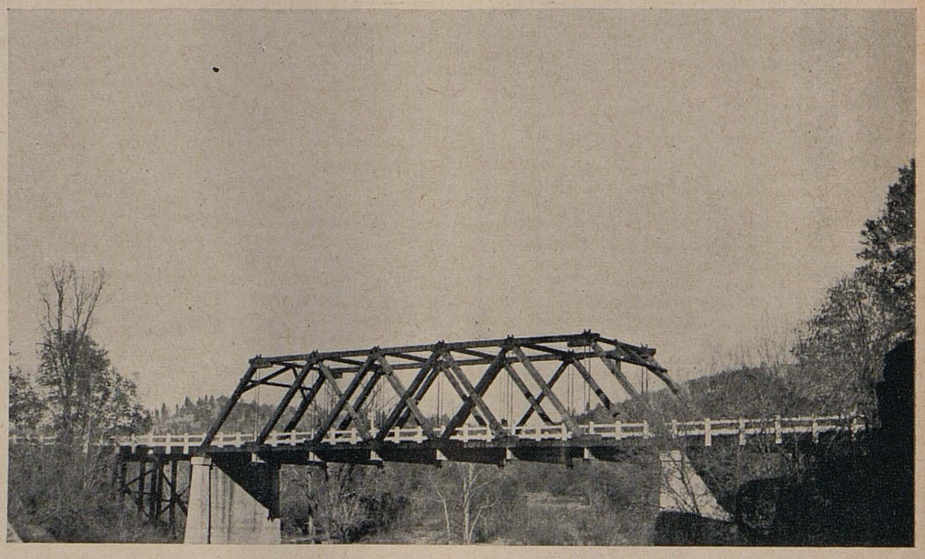
IN line with the Division of Highway policy of keeping traffic flowing with the least possible use of new and strategic materials another bridge has been reconditioned to provide safe travel for the duration.

An inspection revealed that the contion of the structure made imperative the installation of a new truss. The deck, or floor system, was accordingly supported on falsework while the old truss was removed and a new truss built around the deck while traffic continued to use the bridge.

This bridge spans the Cosumnes River on State Route No. 65 between Plymouth and El Dorado and consists of a 120-foot through timber truss span with timber trestle approaches at each end, making a total length of bridge of 271 feet. Periodic inspection had made it increasingly apparent that major repairs would have to be made immediately if traffic, important to the war effort, was to be maintained with safety.



With falsework supporting deck and a traveling gantry new truss is being installed



Completed job with new truss in place and falsework removed

SERIOUS EFFECTS OF DECAY

Although minor repairs had been made, decay in the truss joints and floor beams had progressed to a point where serious deflection had taken place. The approach trestle and the floor system of the truss were found to be in fair condition.

Since most of the truss members were decayed beyond repair it became necessary either to erect a new truss or place bents under the floor system of the old truss thus making a trestle of it. The latter solution was discarded, however, in view of the high water which prevails at the site during peak run-off.

NEW TRUSSES DESIGNED

Having determined that a new truss was necessary the problem of availability of material arose, since timber had become as difficult to obtain as many other more durable building materials. After some inquiry a local mill was found that could produce the timber necessary for truss construction but could not handle pieces of greater length than 22 feet nor could they furnish new 20 by 26-inch timber floor beams. Further search located some State-owned steel "I" beams in a maintenance yard which could be used for floor beams. With these materials and the steel rods, castings, and hardware of the old bridge, new trusses were designed and built.

The new truss members are made up of three laminated timbers 6 by 14 inch with splices staggered along the chord members. The proper distribution of stress was obtained by the use of split-ring timber connectors, thereby making use of the available short timbers.

STEEL SPLICE PLATES USED

Steel splice plates from the old truss splices were also used in the new splices. The steel floor beams were hung from the steel hanger rods salvaged from the old truss. These rods had to be turned 90 degrees to their former position to straddle the floor

beams at each end and a connecting plate formed a seat for these beams. The floor beams were cut and fabricated at a shop before shipment to the site.

TRAFFIC UNINTERRUPTED

To provide for uninterrupted traffic during the dismantling of the old truss and erection of the new, the deck of the truss span was supported on temporary bents located on both sides of each floor beam. These bents were extended each side of the trusses to support a track for the legs of a gantry traveler which the contractor used for dismantling and erecting. The new trusses were framed and assembled for fit on a large platform in a yard at Ione, adjusted as necessary, then taken apart and hauled to the site for erection.

The advertising of the contract was so timed that all work could be completed before danger of high water. The resulting structure is compact and sturdy and should give a number of years of satisfactory service.

Governor Sets Precedent In Naming Toll Bridge Authority Member

(Continued from page 18)

County and supervised its operation for a period of five years, when he resigned to enter the rice growing business for himself. On July 1, 1924, he was elected president of the Rice Growers Association of California and has served continuously in that position until the present time. He is the owner of a 8,000-acre ranch in the Chico area, which he personally operates for diversified farm purposes. He is also a member of the California Almond Growers Exchange.

REPRESENTS PRODUCE SHIPPERS

The appointment by Governor Warren of Mr. Adams gives to the great Sacramento Valley and the truck shippers of produce of California who are users of the State's three publicly-owned toll bridges—the San Francisco-Oakland Bay Bridge and the Carquinez and Antioch bridges—all of which are under the jurisdiction of the Toll Bridge Authority, their first representation on the Authority.

Mr. Adams brings to the Toll Bridge Authority many years of experience in the farming, agricultural and livestock shipping and transportation field.

Water Storage Behind Shasta Dam Exceeds Million Acre-Feet

IN view of the current dry year and the consequent necessity for conserving water this season, State Engineer Edward Hyatt is encouraged by the announcement of the United States Bureau of Reclamation that at 5 a.m. on April 15th the water storage of Shasta Dam reservoir had attained the 1,000,000 acre-feet mark. The reservoir has a capacity of 4,500,000 acre-feet.

Water has been backed up behind the dam for some 30 miles. The water depth at the face of the dam is 325 feet.

"It will be our purpose," said Assistant Regional Director Robert S. Calland of the Bureau of Reclamation, "so to regulate releases from Shasta Dam that irrigators will be able to get their full entitlements. In this connection we are asking the irrigators to cooperate not only in giving us advance notice of their needs for additional water, but also when they expect to reduce their diversions, so that we can meet the requirements without wasting water.

ELIMINATES SALINITY MENACE

"The stored water behind Shasta Dam will be a highly valuable asset during the late summer months and it will be to every irrigationist's advantage to cooperate with a difficult situation in this dry year."

In the wealth of water already in storage at Shasta Dam, State Engineer Hyatt sees a factor that may be of prime importance in salinity control in the delta area of the lower Sacramento River and the San Joaquin River this summer.

"Should conditions in the Contra Costa canal, valuable unit of the Central Valley Project, threaten to become salty this season due to lack of water," Hyatt said, "the storage volume at Shasta will make it possible to eliminate such a threat. The Contra Costa canal already is serving irrigationists and it would be serious if we were unable to control salinity problems that might arise there. Hence, the water already stored at Shasta is an encouragement to Contra Costa irrigators. Irrigationists in the delta region also, it would appear, will have no cause for alarm although it will be imperative that no water be wasted this year."

Calland pointed out that Shasta Dam already is serving the multiple purposes for which it was designed.

PREVENTED FLOOD MENACE

While this year was not marked by heavy precipitation in the Sacramento Valley the Shasta Dam on one occasion operated to prevent an overflow of water into the lowlands along the Sacramento River.

Early in February the river crested at 11.3 feet in Red Bluff, Tehama

(Continued on page 27)

Trucking Industry Calls Attention to Highway Problems

In large display advertisements appearing in many newspapers throughout the Nation during April, the American Trucking Industry calls attention to problems which confront the California Division of Highways as well as other State Highway Departments due to wartime restrictions on highway construction and maintenance and on the purchase of equipment and equipment parts.

Calling attention to the percentages of food products hauled by the trucking industry, such as 100 per cent of the milk for 34 large cities and big percentages of meat, poultry, butter and vegetables, the advertisement says:

"To keep food and war materials moving swiftly, highway transportation must be given sufficient new equipment quickly. Highway bottlenecks must be completely erased. Roads must be regularly and properly maintained. Roads that are inadequately maintained, slow and endanger irreplaceable equipment. Let's supply our Highway Commissions with the tools, engineers, materials and men they need, now."

Report on Progress and Records in Pavement Construction During 1942-43

By EARL WITHYCOMBE, Assistant Construction Engineer

THE demands of the war effort on the trained personnel of both the contractor and the State, and the scarcity of construction equipment resulted in a decreased rate of production and some sacrifice in the quality of the work completed in 1942 and 1943 as compared to that of previous years.

Despite conscientious efforts on the part of contractors to speed the work as much as possible to meet the tempo demanded in time of war, the lack of crews trained in teamwork retarded progress materially.

In the work of paving, it is nearly axiomatic that speed of production and quality of work go hand in hand. The high degree of efficiency necessary to excel in output contributes to the improvement in quality of the finished product.

However, the records of the work completed in 1942 and 1943 reflect these conditions when compared to past records, but not to an alarming degree. The results obtained by the contractors' organizations and the State forces working under such adverse circumstances reflect much credit to both.

CEMENT-TREATED BASE

About 53.3 miles of cement-treated base were constructed in 1942, and 9.1 miles in 1943, of which 6.0 miles were under asphalt concrete pavement, and 56.4 miles under plant-mixed surfacing. These cement-treated projects were all plant-mixed excepting one 2.4-mile job in San Joaquin County, which was road-mixed.

Test results indicate these base courses are of excellent quality. Some breaks are nearly as high on this very lean and dry mixture as those on concrete paving projects. No attempt has been made to compile and compare these mixtures on a strength basis due to the obvious wide range in strengths, depending upon the nature of the aggregate provided for the individual projects. With a given aggregate, a resident engineer can obtain no greater strength from his mixtures than that inherently in the aggregate itself, and it would be manifestly unfair to compare all the projects on such a basis.

PORTLAND CEMENT CONCRETE

The use of redwood plank as expansion joint material has become universal in practice. A more positive expansion joint has resulted due to the rigidity of the material which aids greatly in placing and maintaining in the designed position. The standard joint interval now is ¾-inch expansion joint at 120-foot intervals, with weakened plane intermediate joints at 15-foot intervals.

During 1942, all steel was eliminated from the standard design for concrete pavement, including the dowel steel for load transfer at transverse joints. As a substitute for the load transfer design, the slab end at expansion joints on the side of approaching traffic is thickened in the last two feet of length, from the thin center to the uniform thickness of the edge.

On the departing side, the uniform thickness of the edge is carried a distance of 5½ feet from the joint and then tapered in 2 feet to the thin center section, with a weakened plane joint in the center of this 15-foot panel. No change in design was made at weakened plane joints when dowel transfer was removed, in the belief that aggregate interlock affords sufficient transfer.

The use of larger pavers is receiving considerable attention and during the past two years the 34E paver made its appearance on some of the projects. With the permissible 20 per cent overload now provided for in our specifications, these pavers can mix 1½ cubic yards of concrete.

ASPHALT CONCRETE

Bituminous finishers of the type that operate without side forms were used to a much greater extent during 1942 and 1943 than ever before. Side forms, however, were used in much of this work, and the finishers were operated on them by means of outrigger wheels riding on these side forms. It is not possible to lay in widths greater than one lane with these machines. Asphalt concrete was used to a much greater extent for thin resurfacing in the past two years than ever before. This has been largely brought about by the perfection of the above machines.

Riding qualities in general are not as good on work performed by the machines that lay their own grade as that obtained with the conventional self-propelled spreading, raking, and finishing machines operating from side forms. The cost of doing the work is not comparable between the two methods. For these reasons the two methods are never permitted to be optional and the exact method to be used is specifically designated in the special provisions for the individual project.

BITUMINOUS TREATED SURFACES

Plant-mix was used on 87 per cent of the bituminous treated mileage laid in 1942 and 73 per cent in 1943. The greater part of this mileage was laid with spreading machines. Some of the best-riding surfaces and some of the poorest are included in the work done by machines.

The outstanding work of spreading with motor graders are the three plant-mix projects in District VIII. On the two projects, Contract 48AXC3, Dracaea Avenue to Rte. 19; and Contract 48AXC1, 3 miles south of March Field to Dracaea Avenue, the binder was 150 to 200 penetration asphalt, and on Contract 48VC2, Cherry Avenue to

San Bernardino, the binder was SC-6 liquid asphalt.

A special technique had to be worked out to successfully lay this hard asphalt with blades. The riding qualities of the finished pavement are surprisingly good for the type of mixture used.

An exceptionally good riding surface was secured on the one armor coat project constructed during 1942, Contract 44WC6, Watsonville to Rob Roy Station. Such work is ordinarily considerably rougher than other types of pavement.

Following is the tabulation of the records achieved in the various types of pavement construction during the years 1942 and 1943. With the return of more normal working conditions, it is believed that the excellent records made on State highway projects during preceding years will again be approached if not surpassed.

PORTLAND CEMENT CONCRETE PAVEMENT RECORDS FOR 1942

Location	Contractor	Resident Engineer	Street Assistant	Average cu. yds. laid per day	Average strength, 28 days, lbs. per sq. inch	Roughness index, inches per mile
Bass Hill—Crespos	A. Teichert & Son	M. Fredericksen	A. Bigelow	223.7	3049	6.4
2.5 mis. E. of Yolo Causeway—Washington Underpass	A. Teichert & Son	J. W. Corvin	W. J. Braker	285.0	2981	8.5
Ben Ali—McClelland Field	J. R. Reeves	W. G. Remington	W. J. Braker	383.3	3642	10.6
Powell St.—Panhandle Blvd.	Lee J. Immel	H. A. Simard	G. W. Levier	150.4	3910	12.5
San Luis Obispo—0.8 mi. W. of Pennington Crk.	H. W. Polk	H. J. Doggart	S. N. Isham	354.1	4010	9.2
Ft. Tejon—1.4 mis. N. of Grapevine Sta.	Griffith Co.	F. W. Howard	L. Tresidder	400.0	2510	8.3
At Beetox, over Beardsley Canal	Vido Kovacevich	E. L. Seitz	F. Noel	115.5	4205	5.2
Long Beach Traffic Circle—Carson St.	J. E. Haddock	C. N. Ainley	R. Palmer	456.0	3273	---
N. Figueroa St., Ave. 22—Adobe St.	WPA	C. P. Montgomery	W. T. Lamb	211.0	4275	11.0
Rosemead Blvd., Las Tunas Dr.—Longden Ave.	J. E. Haddock	C. P. Montgomery	H. D. Johnson	384.1	5105	12.9
Centinela Ave.—Slauson Ave.	Griffith Co.	C. N. Ainley	P. M. Hine	379.8	4392	13.3
Riverside—Route 78	J. E. Haddock	G .E. Malkson	B. Nelson	543.0	3105	8.2
Carson St.—Center St.	Sully-Miller Contr. Co.	W. D. Eaton	C. C. French	241.7	3900	12.9
Jct. Rte. 74 near Flosden—Walnut St.	Heafey-Moore Co.	G. R. Hubbard	F. L. Lucas	408.4	4450	13.3
1.3 mis. N. of Dixon—S. Fork Putah Crk.	N. M. Ball Sons	R. H. Lapp	F. L. Lucas	692.7	3790	5.1
Pacific Highway, Market St.—Couts St.	V. R. Dennis Co.	F. D. Pearce	M. C. Barron	171.6	2750	---
Pacific Highway, Enterprise St.—Mission Bay	Griffith Co.	W. T. Rhodes	S. M. Templeton	253.0	2112	---
			Averages	367.3	3690	8.0

PORTLAND CEMENT CONCRETE PAVEMENT RECORDS FOR 1943

Location	Contractor	Resident Engineer	Street Assistant	Average cu. yds. laid per day	Average strength, 28 days, lbs. per sq. inch	Roughness index, inches per mile
East end of S. F.-Oak. Bay Brg.—Toll Plaza	Lee J. Immel	W. A. Rice	L. G. Marshall	201.0	3829	12.8
¼ mi. W. of Orinda Jct.—1¾ mis. W. of LaFayette	Chas. L. Harney	G. L. Beckwith	D. M. Young	426.7	4306	10.6
Distribution structure, University Ave.	Lee J. Immel	F. W. Montell	H. Ray	132.1	3888	21.9
22nd St. Peralta St.—Wood St.	Louis Angelus Co.	H. A. Simard	C. Hendrickson	136.0	4516	22.7
Salinas—¼ mi. North of Santa Rita	Granite Construction Co.	F. R. Pracht	S. Isham	559.8	4744	11.8
0.7 mi. N. of Monterey Ave., Marina—Castroville	Granite Construction Co.	J. C. Adams	M. Dawson	506.9	4219	10.6
0.7 mi. N. of Monterey Ave., Marina—Reservation Bdy.	W. J. Wilkinson & H. B. Scott	J. C. Adams	M. Dawson	528.2	3704	15.0
Snow Road—2.5 mis. S. of Shafter Rd.	Union Paving Co.	F. W. Howard	C. C. Hinsdale	557.8	3199	12.5
On Fries Ave. LaPaloma Ave. & Falcon St., Anacapa St.—San Clemente Ave.	Griffith Company	W. D. Eaton	Z. Holzman	310.2	4121	16.3
Macy Street—Indiana Street	J. E. Haddock	G. H. Lamb	H. Noble	207.2	4140	14.4
On Harbor Drive N., Civic Center—Rosecrans St.	Ralph A. Bell	H. F. Caton	C. R. Hagberg	523.0	3007	13.3
Rosecrans St., Mission Valley Rd., Lytton St. Sixth St. Ext.	R. E. Hazzard & Sons	J. F. Jorgensen	S. M. Templeton	299.0	3185	11.0
8th St.—Harbor Dr. S, Roosevelt St., National City, G St., San Diego	V. R. Dennis Const. Co.	R. C. Payne	E. C. Daniels	295.7	3252	13.1
Torrey Pines—Del Mar	Oswald Bros.	W. T. Rhodes	C. L. Harkins	229.6	2861	24.7
			Averages	337.0	3588	14.2

ASPHALT CONCRETE PAVEMENT RECORDS FOR 1942

Location	Contractor	Resident Engineer	Street Assistant	Average tons laid per day	Average stability of surf. mix in %	Roughness index, inches per mile
Watsonville—San Andreas Road	Granite Rock Co.	A. Walsh	W. Samarzich	348.0	39.6	13.7
On 14th and 15th Sts., Richmond	Heafey-Moore Co.	L. G. Marshall	H. Deardorf	210.0	30.1	28.2
El Cerrito Hill Overhead, Albany—Richmond	Piazza & Huntley	F. W. Montell	H. L. Joynes	722.3	32.8	16.3
Powell St.—Panhandle Blvd.	Lee J. Immel	H. A. Simard	G. W. Levier	208.1	36.2	39.2
Southern Pacific R. R.—Levee Canal	Griffith Co.	D. G. Evans	L. Tresidder	503.5	45.4	34.4
Southern Pacific R. R. crossing Levee Canal	Griffith Co.	D. G. Evans	W. M. Nett	522.1	45.0	28.9
Carson St.—Center St.	Sully-Miller Contr. Co.	W. D. Eaton	R. E. Schott	365.2	41.8	19.3
At Long Beach Traffic Circle	Vido Kovacevich	C. L. Gildersleeve	E. C. Daniel	278.2	37.7	27.2
Through Hermosa Beach, on Sepulveda Blvd.	Griffith Co.	C. N. Ainley	V. K. Tarwater	452.7	41.7	11.3
Lincoln Ave.—Orangethorpe Ave.	Oswald Bros.	C. L. Gildersleeve	C. J. McCullough	628.2	39.5	19.5
Long Beach Traffic Circle—Carson St.	J. E. Haddock	C. N. Ainley, W. D. Eaton	H. Lindley	627.4	31.3	18.6
Croft Ave.—Fairfax Ave.	Frank West	C. N. Ainley	P. M. Hine	369.6	45.0	33.5
Long Beach Traffic Circle—Carson St. and Lakewood Blvd.	Vido Kovacevich	Z. Holzman	R. Palmer	450.5	44.0	23.7
Redlands—3 mis. east	Oswald Bros.	R. A. Bergman	W. Ford	401.8	41.3	17.1
Pacific Highway, Market St.—Couts St.	V. R. Dennis Co.	F. D. Pearce	M. C. Barron	400.4	37.9	15.2
Pacific Highway, Enterprise St.—Mission Bay	Griffith Co.	W. T. Rhodes	M. C. Barron	529.0	42.6	21.5
Barnett Ave. and Lytton St., Rosecrans St.—Pacific Highway	R. E. Hazard & Sons	F. D. Pearce	S. M. Templeton	377.0	47.2	15.7
			Averages	452.0	38.7	19.3

ASPHALT CONCRETE PAVEMENT RECORDS FOR 1943

Location	Contractor	Resident Engineer	Street Assistant	Average tons laid per day	Average stability of surf. mix in %	Roughness index, inches per mile
Cutting Blvd., Richmond, Garrard Blvd.—14th St.	Lee J. Immel	H. C. Farris	E. Carlstad	478.9	45.8	17.4
N. City Limits, Richmond—Carquinez Brg. (por.)	A. J. Raisch	A. Walsh	A. W. Steward	638.1	41.8	16.0
Dublin—Castro Hill	Louis Biasotti & Son	E. A. Bannister	W. Gillespie	146.8	44.8	16.3
Bay Brg. Toll Plaza—Distribution Structure	Lee J. Immel	L. G. Marshall	L. G. Marshall	453.9	---	17.1
3d St., Custer Ave.—23d St., Mariposa Ave.—4th St.	Chas. L. Harney	H. A. Simard	G. W. Levier	537.9	44.5	12.9
Atlantic Ave., Main St.—Webster St.	Heafey-Moore Co.	L. G. Marshall	L. G. Marshall	360.5	---	11.4
Charter St., Redwood City—San Francisquito Crk. Brg.	Union Paving Co.	G. A. Wildman	E. W. Herlinger	836.7	42.0	12.7
Distribution Structure—University Ave.	Lee J. Immel	F. W. Montell	J. R. Brummer	472.4	45.7	26.2
Orinda Junction—1¾ mis. W. of LaFayette	Chas. L. Harney	G. L. Beckwith	H. Ray	528.0	41.0	16.8
Snow Rd.—2.5 mis. S. of Shafter Rd. (por.)	Union Paving Co.	F. W. Howard	C. C. Hinsdale	452.7	40.7	31.4
Macy Street—Indiana Street	J. E. Haddock	G. H. Lamb	W. C. Winkler	480.0	42.0	17.8
Imperial Highway, Anza Ave.—Sepulveda Blvd.	J. E. Haddock	C. N. Ainley	W. D. de Camp	527.5	44.2	17.7
At Rindler Creek	Louis Biasotti & Son	G. R. Hubbard	R. J. Clarke	337.5	---	40.2
On Harbor Drive North, Civic Center—Rosecrans St.	Ralph A. Bell	H. F. Caton	M. C. Barron	357.2	47.7	29.0
8th St. & Harbor Drive South (por.)	V. R. Dennis Const. Co.	R. C. Payne	C. B. Mackey	327.3	46.0	25.3
Torrey Pines—Del Mar	Oswald Bros.	W. T. Rhodes	W. Ford	324.7	45.7	29.1
Rosecrans St., Mission Valley Rd., Lytton St. 6th St. Ext.	R. E. Hazard & Sons	J. F. Jorgenson	S. M. Templeton	300.7	33.0	28.8
			Averages	489.0	43.1	17.4

BITUMINOUS TREATED SURFACES—1942

PLANT MIX

Location	Contractor	Resident Engineer	Roughness Index Inches per Mile
At Rohnerville Curve and Fernbridge	Mercer-Fraser Co.	J. E. Dessinger	36.4
Loleta—Salmon Creek	Mercer-Fraser Co.	J. E. Dessinger	30.8
Bass Hill—Crespos	A. Teichert & Son	M. Fredericksen	7.4
Keddie—Quincy	Harms Bros.	R. R. Norton	48.0
Quincy—Western Pacific Subway	Harms Bros.	R. R. Norton	27.4
Roseville—0.6 mile east	Poulos & McEwen	E. L. Miller	13.9
Mills—Mather Field	A. Teichert & Son	E. Hay	18.6
Morrison Crossing—Camp Beale	Hemstreet & Bell	A. S. Hart	13.7
Linda Corners—Camp Beale	Hemstreet & Bell	J. W. Corvin	15.4
Sacramento City Limits—Auburn Blvd.	A. Teichert & Son	E. Hay	14.3
Beach Road—San Andreas School	WPA-Granite Const. Co.	C. T. Ledden	9.9
Intersection Routes 1 and 52 Alto.	J. J. Ongaro	W. A. Rice	35.6
Jct. Rte. 14—west of Christie Underpass	Lee J. Immel	L. G. Marshall	24.5
East Reservation Bdy.—Jolon	WPA-N. M. Ball Sons	V. E. Pearson	8.5
North Reservation Bdy.—Jolon	WPA-N. M. Ball Sons	V. E. Pearson	7.6
Rt. 2 near Bradley—Hames Valley School	L. Biasotti & Son	V. E. Pearson	8.9
North Reservation Bdy.—Quinado Canyon	Brown, Doko & Baun	F. R. Pracht	21.3
East Reservation Bdy.—Hames Valley School	N. M. Ball Sons	V. E. Pearson	9.0
Quinado Canyon—King City	Basich Bros.	F. R. Pracht	6.7
Castroville—Rte. 2 near Prunedale	Harms Bros.	F. C. Weigel	12.6
Santa Margarita—Northerly Boundary	A. J. Raisch	A. L. Lamb	11.9
Various locations on Rts. 2, 56, 149	L. A. Brisco	D. J. Faulkner	17.6
0.6 mi. W. of Bakersfield—Bakersfield	George von Kleinsmid	D. G. Evans	32.1
S. Chester Ave. 4.5 mi. S. of Bakersfield	George von Kleinsmid	C. C. Hinsdale	50.8
Stewart St., Dorchester Ave., Exposition Blvd.	Griffith Co.	G. E. Farnsworth	14.0
Katella Ave., Denni St., Los Alamitos Blvd., Farquhar Ave.	Griffith Co.	C. L. Gildersleeve	18.7
Chavez Ravine Rd., Coronel St. and connections	Griffith Co.	C. P. Montgomery	16.6
Dracaea Ave.—Rt. 19	George Herz & Co.	E. A. Bannister	12.8
3 mi. S. of March Field—Dracea Ave.	George Herz & Co.	E. A. Bannister	11.8
Waterman Ave.—Sterling Ave., on E. 3d St.	San Bernardino County	W. H. Crawford	11.4
Cherry Avenue—San Bernardino	George Herz & Co.	J. M. Hollister	8.5
Cottonwood Creek—Northerly	Basich Bros.	A. T. Moore	11.1
Benicia—3.2 miles north	Parish Bros.	A. K. Nulty	21.6
On 5th St. and H St., Benicia	Fredrickson & Watson	A. K. Nulty	32.8
Rt. 77—0.6 mile west	Arthur A. Johnson	C. R. Hagberg	27.0
		Average	14.6

ROAD MIX

Weott—0.5 mile north	J. L. Conner & Sons	H. M. Hansen	55.5
Wilder, Little Baldwin, Coja Creeks	Granite Construction Co.	G. L. Beckwith	34.2
Route 138—Gardner Field	Louis Biasotti & Son	C. F. Oliphant	19.6
Route 4 near Buhach—Merced Flying School	E. A. Forde	A. Hull	25.8
0.5 mi. W. of Mokelumne River—Terminous	Clyde W. Wood	A. N. Lund	26.8
		Average	25.5

ARMOR COAT

Watsonville—Rob Roy Junction	W. J. Wilkenson & H. B. Scott	A. Walsh	16.3

Highway Bridge Maintenance Involves Care of 4,633 Structures

(Continued from page 15)

each year, one prior to and once following the winter season. The maintenance superintendent inspects all structures in his territory at least once every three months. Defects noted which endanger traffic or the structure itself are reported by the district office to headquarters office and action is taken to protect traffic if an emergency exists, pending receipt of recommendations from the Bridge Department.

One 4-inch by 6-inch card for each bridge is kept in alphabetical order of counties and in increasing order of route number within a county. In any given route, the cards are filed in increasing order of BLM (Bridge Log Mile) which places them in order, along the route, in direction of the log.

These cards show, briefly, the engineering history and rating and condition of every structure as extracted from the regular bridge reports.

Bridge Posting

Bridge inspection reports recommending posting are forwarded to the district in which the bridge is located with instructions to post a written notice on the bridge stating the date and place of a public hearing; such notice is posted five days in advance of the date of hearing. The hearing is conducted by a licensed structural engineer of the Maintenance and Research Section who determines the required limits of the posting and makes a report to the Director of the Department of Public Works. The posting is enforced in accordance with Sections 516 and 715 of the Motor Vehicle Code.

BITUMINOUS TREATED SURFACES — RECORDS FOR 1943

PLANT MIX

Location	Contractor	Resident Engineer	Roughness Index Inches per Mile
Arcata—Eureka Section Base	John Carlin Construction Co.	L. A. Weymouth	20.8
Arcata—Clam Beach	Mercer-Fraser Co.	H. N. Hansen	16.4
Lamoine—Hilt Road (por.)	Clements & Co.	F. S. Saunders	21.3
Edgewood Road—4 miles north	Poulos & McEwen	P. F. Duffy	23.2
Cougar—Macdoel	Poulos & McEwen	P. F. Duffy	19.4
Redding Airdrome—Route 20	M. J. Ruddy & Son	A. A. Bigelow	19.9
0.5 mi. S. of Clear Creek—Redding Subway	A. Teichert & Co.	C. I. Brown	8.4
Redding—Bass Hill	M. J. Ruddy & Son	A. A. Bigelow	25.2
1 mi. E. of Weaverville—Fawn Lodge	Clements & Co.	W. H. Bartlett	36.8
Helena—Weaverville	Clements & Co.	W. H. Bartlett	22.4
Edes Ranch—State Line	Isbell Construction Co.	G. Sundman	16.6
Irrigation Canal—Reclamation Ditch	McGillivray Construction Co.	P. L. Dito	22.0
Truckee—State Line	Hemstreet & Bell	J. L. Foster	8.6
Baxter's Airport	Hemstreet & Bell	J. L. Foster	10.6
Lincoln—Wheatland	A. Teichert & Co.	R. I. Nicholson	22.6
Clarksville—Shingle Springs	McGillivray Construction Co.	A. C. Irish	19.7
Yuba City—Butte County Line	Hemstreet & Bell	R. I. Nicholson	13.9
Yolo County Line—4 miles South of Williams	Clements & Co.	A. C. Irish	20.6
Truckee—Nevada State Line	Hemstreet & Bell	J. L. Foster	9.3
So. Willow Ave., Pasado Ave.—Feather River Blvd.	Hemstreet & Bell	R. I. Nicholson	23.2
Route 3—Camp Kohler	A. Teichert & Co.	W. G. Remington	14.4
Danville—one mile north	Union Paving Co.	E. Carlstad	13.1
At South Verona Underpass	Dan Caputo	G. W. Levier	37.6
Butler Boad, South San Francisco	L. C. Smith	A. Walsh	33.4
Harbor Street, Pittsburg	L. Biasotti & Son	J. H. Creed	26.4
Ignacio—Sears Point	A. G. Raisch	W. A. Rice	32.6
Hendy & E. California Aves., Sunnyvale	Union Paving Co.	A. Walsh	16.1
Industrial Way, South San Francisco	Union Paving Co.	C. T. Ledden	18.8
Vallejo & Fresno Aves., near Santa Rosa	C. M. Syar	G. H. Heberling	33.9
Near Waldo	N. M. Ball Sons	W. A. Rice	27.6
5th Ave., San Mateo—Redwood City	Union Paving Co.	J. H. Creed	15.6
Napa—Solano County Line	A. G. Raisch	J. H. Creed	18.0
Mountain House—Greenville	A. G. Raisch	G. A. Wildman	10.1
1.9 miles E. of Orinda Jct.—0.1 mile W. of Walnut Creek	Union Paving Co.	E. W. Herlinger	11.9
Walnut Creek—1 mile north of Danville	Lee J. Immel	E. Carlstad	13.2
Muir Station—Christie Underpass	Piazza & Huntley	F. W. Montell	14.5
Casmalia—Santa Maria	Fredrickson & Watson Co.	F. C. Weigel	18.4
Cebada Canyon—Reservation Boundary	Calowell Construction Co.	J. C. Adams	21.7
Surf—Lynden School	Brown, Doko & Baun	D. J. Faulkner	23.5
In Paso Robles	Granite Construction Co.	H. J. Holman	22.6
Castillo—Leadbetter Road, Santa Barbara	Fredrickson & Watson Co.	M. A. Dawson	25.0
Southerly Boundary—King City	Granite Construction Co.	H. J. Doggart	14.9
Santa Inez River—San Luis Obispo	Brown, Doko & Baun	H. J. Doggart	24.4
Santa Rita—San Benito River	Granite Construction Co.	H. J. Doggart	13.5
Blackstone Ave. at intersection Shields Ave.	Brown, Doko & Baun	H. W. Porter	28.3
Lemoore Flying School—Jct. Houston Ave.	Piazza & Huntley	C. F. Oliphant	15.6
Various locations, Tulare County	Piazza & Huntley	C. F. Oliphant	10.9
13.5 miles south of Bakersfield—Famosa	Griffith Company	F. W. Howard	13.7
Houston Avenue—Hub	Warren Southwest, Inc.	C. F. Oliphant	22.5
Ocean Ave., Huntington Beach, W. City Limits—E. City Limits	Sully-Miller Contracting Co.	W. D. Eaton	17.3
¼ mi. N. of Nauman Road—Calleguas Creek	G. W. Ellis	C. P. Montgomery	15.2
Santa Clara River Bridge—Santa Clara Ave.	G. W. Ellis	V. O. Sheff	14.3
Galivan—Irvine	Sully-Miller Co.	R. Cooley	19.4
On Firestone Boulevard and Imperial Highway	Griffith Company	H. B. Lindley	20.4
Pearl Street, Sepulveda Blvd.—Centinela Ave.	Sparks & Mundo	C. N. Ainley	29.7
Harvard Street, Santa Paula—Main St.	G. W. Ellis	F. Noel	19.3
Redondo Blvd., El Segundo Blvd.—116th St., Century Blvd.—Manchester Ave.	Vido Kovacevich	C. N. Ainley	20.5
Baker St., Harbor Blvd.—Newport Blvd.	Griffith Company	H. B. Lindley	22.7
Various roads & streets near Hueneme	Basich Bros.	W. A. Norman	26.6
Rte. 4, Castaic Crk.—Los Alamos Crk., Rte. 23, Harold—Palmdale	Schroeder & Co.	C. P. Montgomery	15.0
Los Angeles—Ventura County line	Schroeder & Co.	C. P. Montgomery	15.3
El Rio-Oxnard, Ventura-Santa Barbara Co. line	G. W. Ellis	F. Noel	15.4
Ventura Blvd., Calabasas—Newbury Park	Schroeder & Co.	C. P. Montgomery	15.9
Newport Blvd.—Route 2	State forces	C. Gildersleeve	23.7
Mill Street, E St.—S. Entrance Air Depot	San Bernardino County	J. M. Hollister	12.1
Corona—Riverside	George Herz & Co.	J. M. Hollister	16.0
Pine Creek Road	State forces	J. N. Stanley	8.6
Willow St., Carlton Ave., North Drive, Occidental Ave., Buena Vista Ave.—Pollock Shipyard	Louis Biasotti & Son	E. L. Craun	21.2

BITUMINOUS TREATED SURFACES — RECORDS FOR 1943

PLANT MIX—Continued

Location	Contractor	Resident Engineer	Roughness Index Inches per Mile
Route 74 near Flosden—Rte. 7 near Blue Rock Springs Road	Heafey-Moore Co.	G. R. Hubbard	16.7
On Tenn. & Georgia Sts., Vallejo—Route 7	A. G. Raisch	G. R. Hubbard	27.1
Sacramento St., Vallejo, Route 208—Frisbie St.	E. A. Forde	G. R. Hubbard	20.4
Solano Ave., Vallejo, 4th St.—Route 7	Chas. L. Harney	G. R. Hubbard	18.2
Washington St. & Fresno Ave., S. J. River—Rte. 75	A. Teichert & Son	E. L. Craun	27.2
JX Road & Lathrop Rd. Rte. 5—Durham Ferry Rd.	Louis Biasotti & Son	E. L. Craun	8.6
East City Limits, Vallejo—Yolo County Line	McGillivray Construction Co.	A. J. Hull	10.6
0.5 mile East of Vallejo—Benicia Arsenal	Paul J. Tyler & Parish Bros.	A. K. Nulty	20.0
San Diego River—La Jolla Junction	V. R. Dennis Const. Co.	J. F. Jorgensen	18.1
Oceanside—Fallbrook	J. E. Haddock	C. R. Hagberg	24.5
El Centro—Brawley	Basich Bros.	M. C. Barron	15.7
Leucadia—Ora. Co. Line & 4.8 mis. SE of Vista—San Luis Rey River Bridge	Southwest Paving Co.	W. T. Rhodes	28.1
		Average	18.8

ROAD MIX

Flynn Creek—Navarro	John Burman & Son	D. E. McCollum	39.4
Eagle Field—Russell Ave., & S. Dos Palos-Dos Palos	Brown, Doko & Baun	R. Windele	24.7
1.2 mis. N. of 5th Standard Parallel-Stratford	Wm. C. Railing	C. F. Oliphant	39.8
Merced County Line—Firebaugh	M. W. Stanfield Co.	R. Windele	21.6
Russell Ave., Althea Ave., South Dos Palos	County forces	R. Windele	39.8
On Firestone Blvd. & Imperial Highway	Griffith Company	H. B. Lindley	28.3
Antelope School—Route 58	Griffith Company	W. I. Templeton	10.2
McGee Creek—Crestview	Basich Bros.	A. T. Moore	8.6
Laws Bridge—1 mile S. of Benton Sta.	Phoenix Construction Co.	W. I. Templeton	20.9
Chrisman Road, Kellogg Road—Ludwig Rd.	L. Biasotti & Son	E. L. Craun	42.8
San Joaquin County Line—San Andreas	George French Jr.	E. L. Craun	21.3
2.5 miles north of Merced County Line—Lingard	Phoenix Construction Co.	George Barry	59.2
San Andreas-Angeles Camp	A. Teichert & Co.	E. L. Craun	21.4
4 mis. West of Shavers Summit-2.9 mis. W. of Blythe	Arthur A. Johnson	F. B. Stewart	18.9
Lakeside Bridge—Mt. Woodson	Clyde W. Wood	L. H. Williams	24.3
San Luis Rey—Rancho Santa Margarita	Basich Bros.	C. R. Hagberg	20.4
Miramar Road, Rte. 2—Route 77	Calowell Construction Co.	W. T. Rhodes	21.9
Trifolium Canal—2 miles W. of Sandy Beach Rd.	R. E. Hazard & Sons	M. C. Barron	16.7
		Average	22.4

ARMOR COAT

Hopland—Crawford Ranch	E. A. Forde	R. A. Miller	56.1
Old Sherwood Road—Rattlesnake Creek Xing no. 3	Close Building Supply	R. A. Miller	51.8
Riverview Ranch—1.4 miles N. of Pepperwood	Close Building Supply	R. A. Miller	43.4
1.5 mis. W. of Christie Underpass—Glen Fraser Sta.	N. M. Ball Sons	C. F. Price	37.8
3.5 mis. E. of Bell's Sta.—Merced Co. Line	Granite Construction Co.	H. C. Farris	31.0
Reed Road & Tiburon Blvd., Rte. 52—4 mis. East	Heafey-Moore Co.	W. G. Remington	69.7
2 mis. So. of Tunitas—1 mi. So. of Lobitas	Harms Brothers	H. Deardorf	44.9
East Garrison—Route 117	Granite Construction Co.	H. C. Farris	30.0
		Average	48.1

Water Storage Behind Shasta Dam Exceeds Million Acre-Feet

(Continued from page 21)

County. At that time if it were not for Shasta Dam checking the runoff in the upper valley the overflow stage would have been surpassed, causing inundation of a considerable amount of land.

"Besides alleviating high water danger and providing an increased supply of water for irrigation and salinity control," Calland said, "the dam already is storing water for the production in the near future of hydro-electric power.

"There will be left vacant for flood control purposes 500,000 acre-feet of reservoir space from December through March, and 250,000 acre-feet in November and April.

"Frequently during those months the vacant space actually will be much greater than the prescribed minimum, since in many years the winter runoff by itself will be inadequate to fill the available reservoir capacity."

HIGHWAY BIDS AND AWARDS FOR FEBRUARY — MARCH 1944

LOS ANGELES COUNTY—On Ontario Street, city of Burbank, between Empire Avenue and Thornton Avenue and on Woodley Avenue North and Roscoe Blvd. in city of Los Angeles between Parthenia Street and Woodley Avenue South, about 0.8 mile to be graded and surfaced with plant-mix surfacing. District VII. R. R. Hensler, Glendale, $23,-998. Contract awarded to Schroder & Co., Inc., Roscoe, $22,708.

MENDOCINO COUNTY — At Albion River Bridge about 18.5 miles south of Fort Bragg, about 0.4 mile to be graded, surfaced with gravel base and a seal coat applied. District I, Route 56, Section D. Edward Keeble, San Jose, $24,656; Ted Watkins, Linden, $25,072; Lester L. Rice, Marysville, $25,081; Fred J. Mauer & Son, San Francisco, $26,563; A. A. Tieslau & Son, Berkeley, $29,289; J. P. Buonaccorsi, Santa Rosa, $30,149; Heafey-Moore Co., Oakland, $30,356; H. Sykes, Patterson, $30,695; E. A. Forde, San Anselmo, $32,476. Contract awarded to A. J. Clauson, Berkeley, $22,142.

SAN JOAQUIN COUNTY—The timber deck of the existing steel truss bridge across Mokelumne River north of Clements to be repaired. District X, Route 97, Section B. M. A. Jenkins, Sacramento, $8,400; F. R. Zinck, Stockton, $13,117; C. C. Gildersleeve, Willows, $12,686; George Roek, Stockton, $9,177; A. R. McEwen, Sacramento, $8,243; J. L. Webster, Lodi, $8,590; Earl W. Heple, San Jose, $6,455; Stockton Construction Co., Stockton, $9,405; Jas. H. McFarland, San Francisco, $7,319; F. Fredenburg, So. San Francisco, $7,420; A. A. Tieslau & Son, Berkeley, $11,733; L. D. Tonn, Lodi, $10,945; Lord & Bishop, Sacramento, $6,815; F. Kaus, Stockton, $8,871; Wallace Engineering Co., Escalon, $11,642; Markwart Co., Sacramento, $8,095. Contract awarded to George M. Carr, Santa Rosa, $6,107.

SAN DIEGO COUNTY—In the city of Coronado, between south city limits of Coronado and Naval Air Station, about 2.9 miles to be graded and surfaced with asphalt concrete pavement and plant-mixed surfacing. District XI, Route 199. R. E. Hazard & Sons Contracting Co., San Diego, $93,787; Griffith Co., Los Angeles, $96,934. Contract awarded to V. R. Dennis Construction Co., San Diego, $92,439.

MARIN COUNTY—Between San Rafael viaduct and California Park overhead bridge, about 0.9 mile, to be repaired by grading portions, placing plant-mixed material on graded areas and existing surfacing and applying a seal coat thereto. District IV, Route 1, Section San Rafael, C. A. A. Tieslau & Son, Berkeley, $19,203; Louis Biasotti & Son, Stockton, $19,878; Stolte, Inc., Oakland, $20,-983; Frederickson & Watson Construction Co., Oakland, $21,993; Lee J. Immel, Berkeley, $21,570; Heafey-Moore Co., Oakland, $22,033; Chas. L. Harney, San Francisco, $22,097. Contract awarded to A. G. Raisch, San Francisco, $17,945.

ORANGE COUNTY—On Avenida Dolores in the city of San Clemente, between State Highway Route 2 and San Diego County line, about 0.2 mile to be surfaced with plant-mixed surfacing. District VII. Oswald Bros., Los Angeles, $7,789. Contract awarded to Sully-Miller Contracting Co., Long Beach, $4,584.

SAN DIEGO COUNTY—At the intersection of National Avenue and Eighth Street in National City, a traffic signal system to be furnished and installed. District XI, Route 2. Econolite Corporation, Los Angeles, $6,-400; California Electric Works, Ltd., San Diego, $6,880. Contract warded to C. D. Draucker, Los Angeles, $5,980.

SAN DIEGO COUNTY—Across San Diego River in the city of San Diego, a reinforced concrete bridge to be constructed. District XI, Route 77, Section S.D. Griffith Co., Los Angeles, $161,970; M. H. Golden Construction Co., San Diego, $164,991; Kiss Crane Co., San Pablo, $176,531; R. R. Hensler-Heuser & Garnett, Glendale, $177,854; B. G. Carroll, San Diego, $183,345; Oberg Bros., Inglewood, $183,730; Ralph A. Bell, San Marino, $184,480; Bent Construction Co., Los Angeles, $192,485; Carlo Bongiovanni, Los Angeles, $199,999; Vinnell Co., Alhambra, $203,057; Byerts & Dunn, Los Angeles, $217,810; Shannahan Bros. Inc., Huntington Park, $219,491; W. J. Disteli, Los Angeles, $224,767; J. E. Haddock, Ltd., Pasadena, $229,379. Contract awarded to Ralph O. Dixson, Los Angeles, $151,914.

SAN DIEGO COUNTY—For constructing curbs, sidewalks, and driveways between Palm Street and Vine Street. District XI, Route 2. James M. Floyd, San Diego, $3,-778; B. G. Carroll, San Diego, $5,499; Griffith Co., Los Angeles, $5,605. Contract awarded to V. R. Dennis Construction Co., San Diego, $3,652.

SAN DIEGO COUNTY—In the city of San Diego between Mission Valley Road and Linda Vista Housing Project about 1.1 miles to be graded and surfaced with Portland cement concrete pavement and plant-mixed surfacing. District XI, Route 77. R. E. Hazard & Sons Contracting Co., San Diego, $78,801; V. R. Dennis Construction Co., San Diego, $82,499; Daley Corp., San Diego, $85,-756. Contract awarded to Griffith Co., Los Angeles, $75,316.

Federal Aid Highways Carry 56% of Traffic

The Federal Aid Highway System of approximately 226,-000 miles comprises but 7.7 per cent of the total National road mileage. The composition of the Federal Aid System is such, however, that most of the Nation's important and heavily traveled routes are included in it, with the result that on this 7.7 per cent of road mileage is generated 56 per cent of the total vehicle miles traveling the Nation's highways. In other words, the Federal Aid System is only 1/13 of the Nation's road mileage and yet it carries well over one-half of the Nation's travel.

Dora: "That sailor is such a dear: He's going to teach me to play cards so I'll know all about it after we're married."

Daisy: "That's nice. What game is he going to teach you?"

Dora: "I think he calls it 'solitaire.'"

Old Railroad Span Rebuilt to Make New Highway Bridge

(Continued from page 19)

Eighteen-foot solid paved roadway now carries highway across Oak Run Creek

the bridge, only 1,650 pounds were new steel, and included in this weight were the anchor bolt assemblies and field rivets.

A contract for the construction of the bridge was awarded to the low bidder, Jack Gilmore, and the bridge was constructed without incident. Work was started on September 24, 1943, and the bridge was put in service on December 22, 1943.

The refabrication of the steel was done by the Moore Dry Dock Company. Approach work was handled by the Maintenance Department. G. A. Crayton was resident engineer for the Division of Highways.

State of California

EARL WARREN, Governor

Department of Public Works

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