PUBLIC ROADS

A JOURNAL OF HIGHWAY RESEARCH

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF PUBLIC ROADS

VOL. 11, NO. 2 ▽ APRIL, 1930

DRINKING FOUNTAIN ON AN OREGON HIGHWAY

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VOL. 11, No. 2 APRIL, 1930 R. E. ROYALL, Editor

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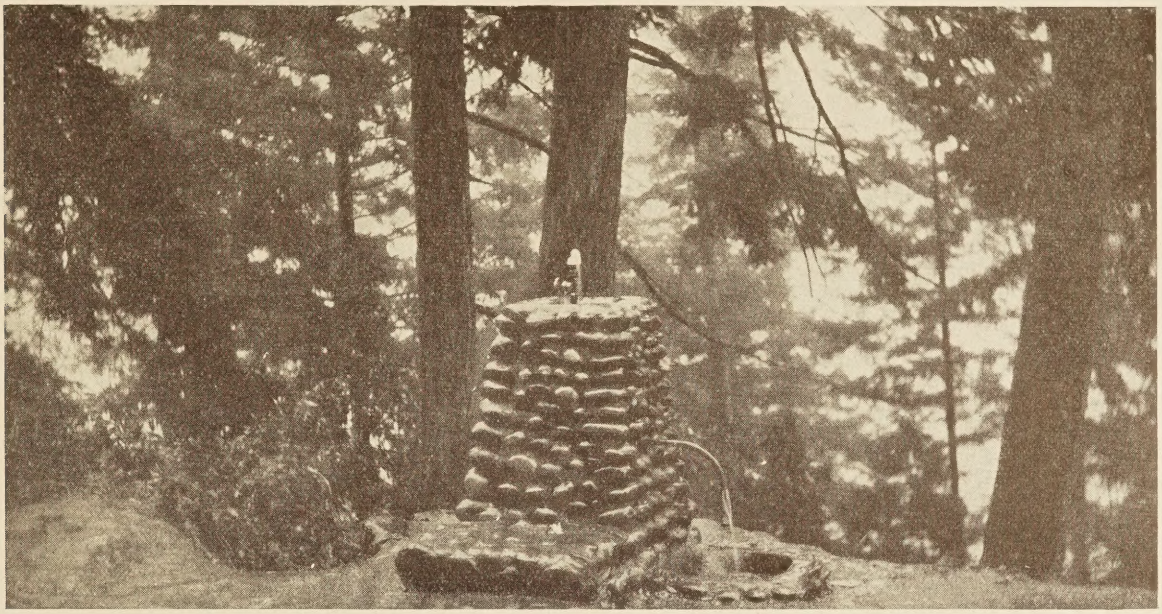
DRINKING FOUNTAINS ALONG OREGON HIGHWAYS

Reported by T. M. DAVIS, Highway Engineer, United States Bureau of Public Roads



On the Ashland-Klamath Falls Highway

MOTORISTS driving along the highways in the State of Oregon will occasionally pass a sign notifying them that there is good drinking water 300 feet ahead. At such places they will find an artistically designed drinking fountain erected by the Oregon State Highway Commission and a water supply which they may feel safe in using.

No standard plans have been prepared for the construction of these fountains, each fountain being designed by the engineers to harmonize with the surroundings and to make use of the native materials at hand. Though the same general scheme is followed, the designs differ, being influenced by available materials, site, and quantity of water.

At the springs a small reservoir of concrete or cement rubble masonry is constructed, from which a pipe leads to the fountain. Each reservoir has overflow and drain pipes. The fountains are of native rock, some of them built of hand-faced stone, while others are of rubble masonry, using bowlders or large-size gravel.

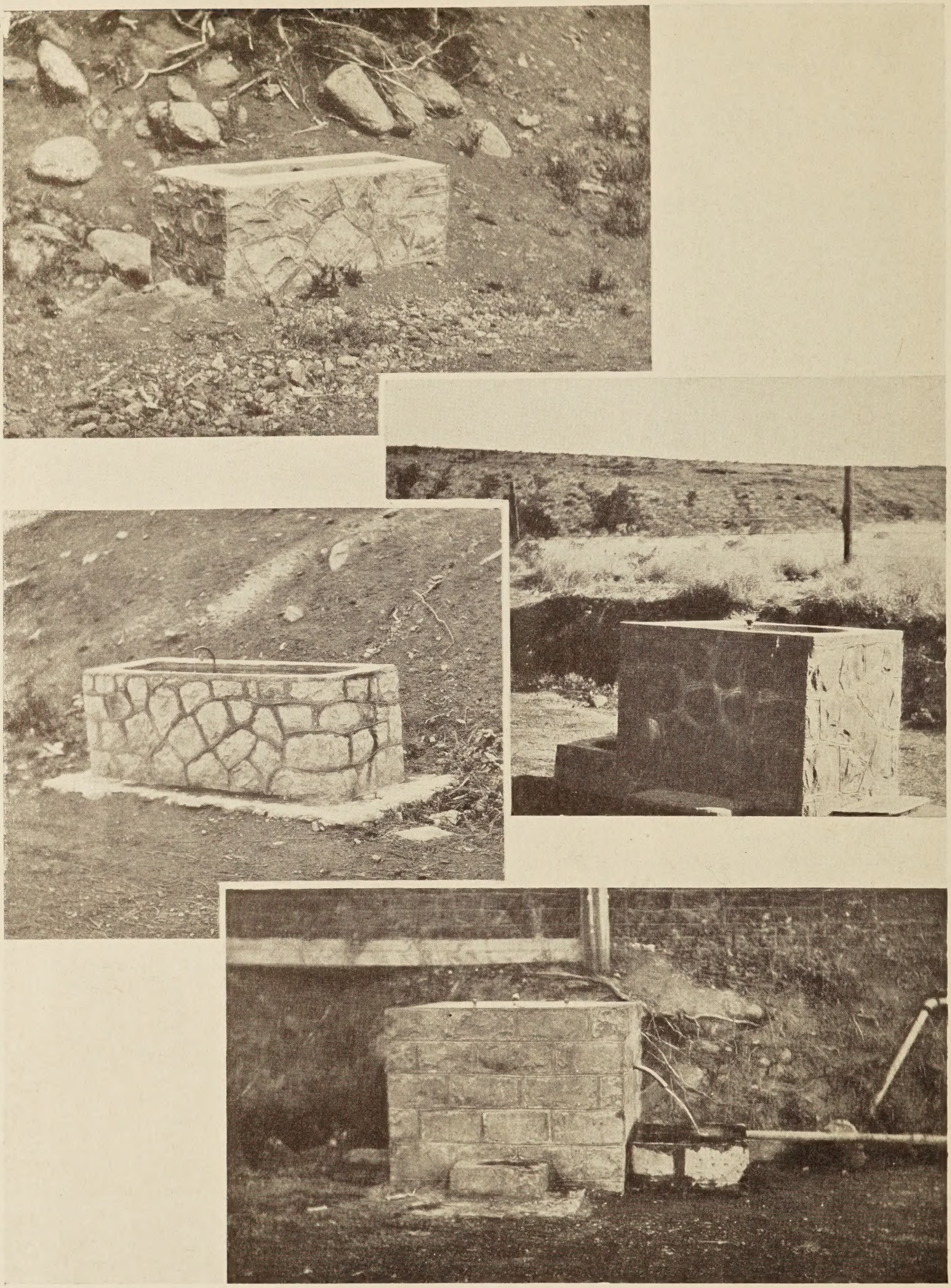
In most instances the fountains were constructed by the regular maintenance forces of the State highway department, though some were constructed by contractors' forces. In the erection of five fountains in Oregon by the United States Bureau of Roads, built according to the same general plans as the State fountains, it was found cement rubble masonry fountains cost from $200 to $300 each.

The fountains have bubblers for drinking, and a pool from which water for filling radiators may be dipped. When there is not a sufficient supply of water for bubblers a small pipe has been used for drinking purposes. Many of these fountains have been built with a step at one of the bubblers, making it more convenient for children. The pools are used mostly for obtaining water for filling radiators, and a few of the fountains have a small pool constructed near the ground for the use of dogs or other small animals. Shut-off and drain valves are used so that proper care of the fountain may be taken during severe freezing weather.

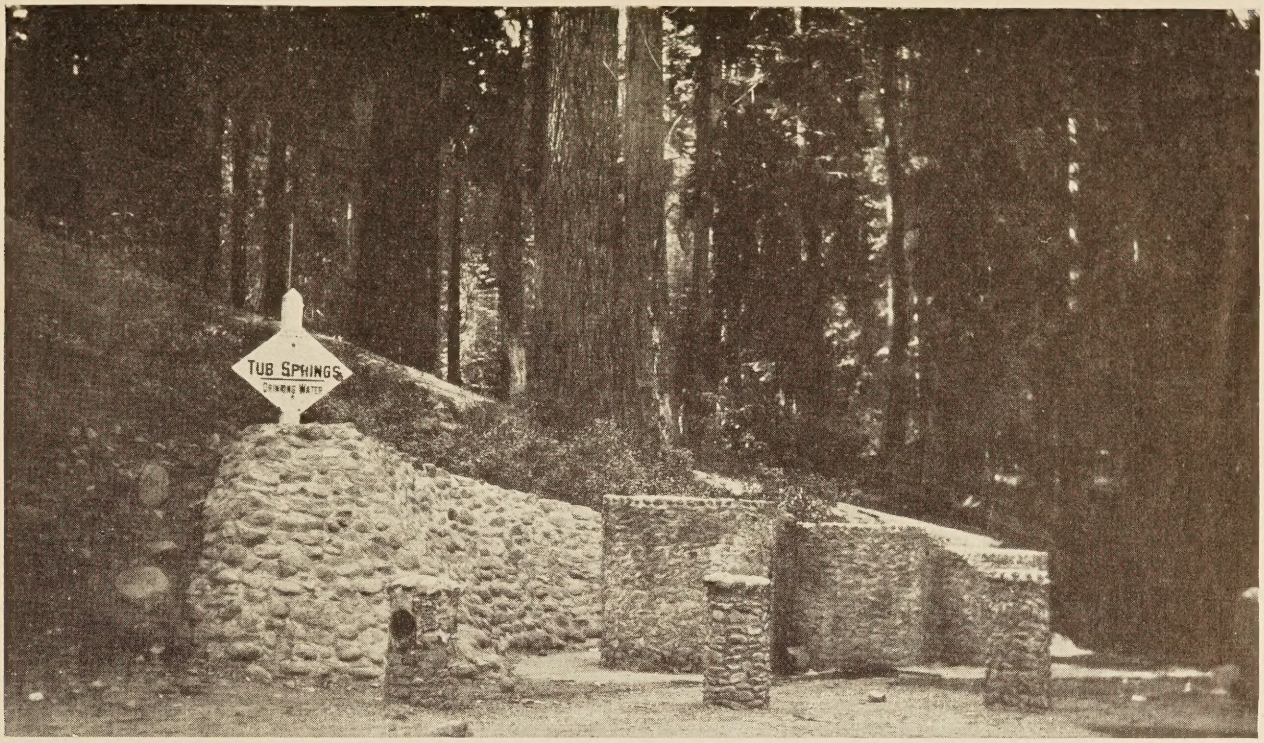
The water used is from live springs and is tested by the State to ascertain its suitability for drinking before the erection of a fountain. Signs are placed about 300 feet each side of the fountains, calling attention to drinking water ahead, and at the fountains themselves ample parking space is provided so that cars may be parked off the highway.

It is found that these fountains are a great convenience to motorists, and they are used by a great many people during the summer months, particularly on the heavier traveled highways. Many are situated at scenic locations with tall evergreen trees and beautiful shrubbery, ferns, and wild flowers; and motorists find it a joy to tarry for a few minutes' rest. During the summer days there will generally be found one or more cars at each fountain, the travelers resting a minute or two and obtaining a drink of cold spring water, or filling a hot radiator with fresh cool water.

At present there are some 30 fountains along the Oregon highways, and additional ones are placed wherever suitable conditions are found. The construction of these fountains by the Oregon State Highway Commission is in line with their policy of developing the scenic features of the highways of the State.



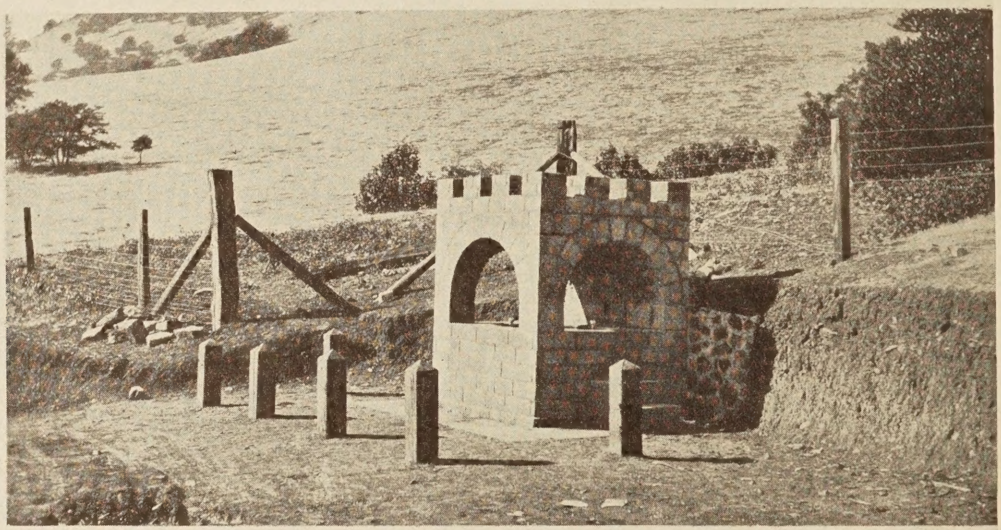
Drinking-fountain Designs are Varied According to Available Materials and the Water Supply

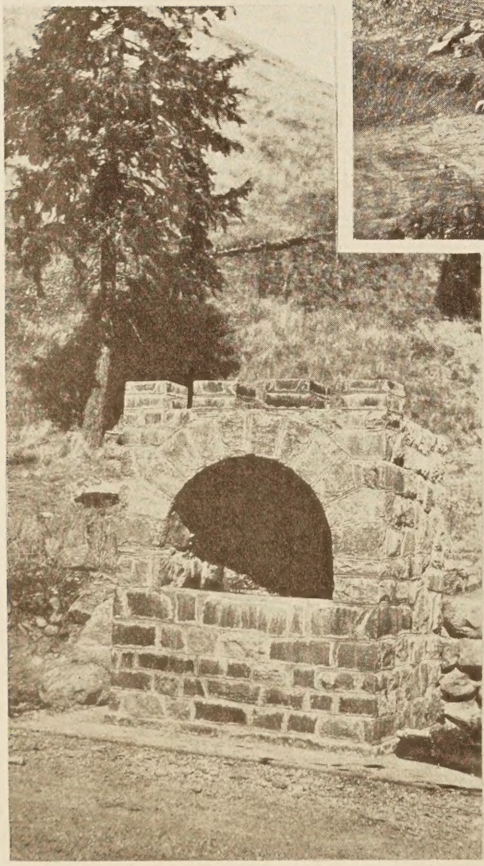


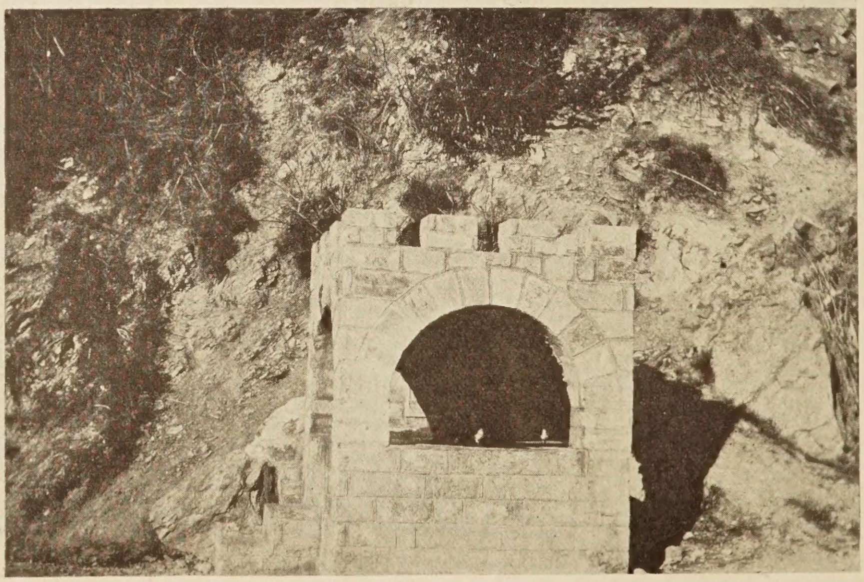
On Federal-aid Project No. 86 Between Ashland and Klamath Falls

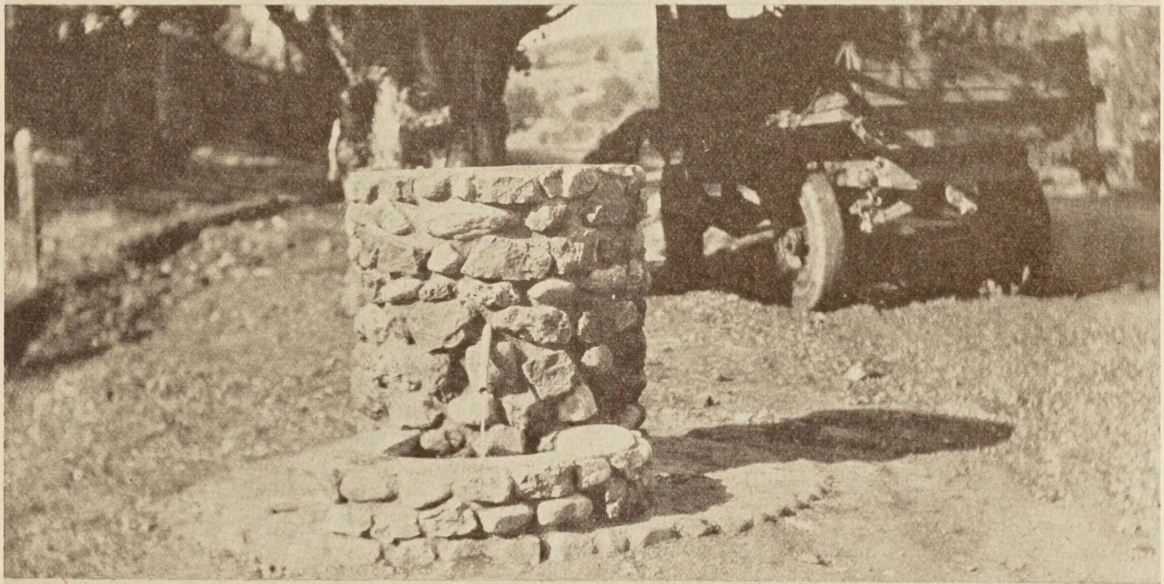
On United States Highway Route No. 199 Near the California State Line

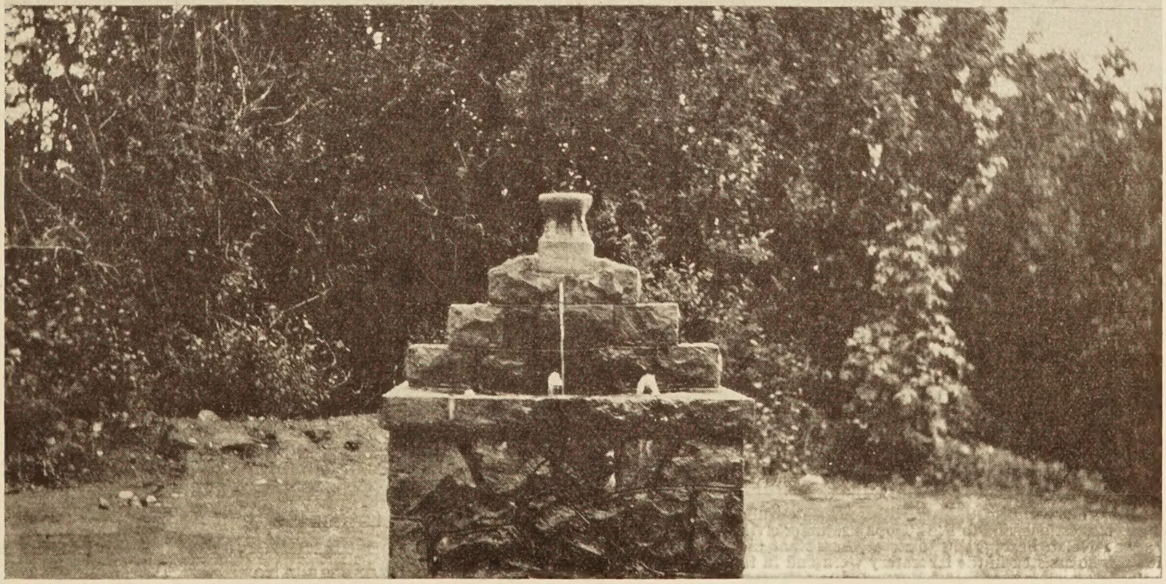
DRINKING FOUNTAINS ON OREGON HIGHWAYS











Many of the Fountains are in Attractive Locations Where Travelers Often Stop for a Short Rest

FLOW OF FLOOD WATER OVER RAILWAY AND HIGHWAY EMBANKMENTS

By DAVID L. YARNELL, Senior Drainage Engineer United States Bureau of Public Roads, and FLOYD A. NAGLER, Professor of Hydraulic Engineering, State University of Iowa

THIS report presents the results of 572 experiments on the flow of water over full-size sections of railway and highway embankments, made for the purpose of developing formulas for use in calculating the quantity of flood water flowing over such embankments. The experiments were conducted by the Bureau of Public Roads of United States Department of Agriculture and the State University of Iowa at the University hydraulic laboratory. The rails and ties used were furnished by the Cedar Rapids and Iowa City Railroad, J. D. Wardle, chief engineer.

THE PROBLEM OUTLINED

A knowledge of the quantity of water that flows down a given valley during extreme floods is often a matter of considerable importance to the engineer. It is one of the fundamental bases of design, not only of railroad and highway embankments across such valleys, but of works planned for the protection of agricultural land and of cities and towns. Engineers, therefore, should avail themselves of every opportunity to obtain reliable data on this suject.

Highway and railroad embankments across river valleys generally act as barriers to the flow of flood water and often are overtopped during the highest floods. At such an embankment the total discharge is the sum of that through bridge, trestle, and culvert openings, and that flowing over the embankment. The discharge through a bridge opening during a flood may be computed with a fair degree of accuracy if the drop-down at the bridge opening is known. A highway, railroad, or levee embankment over which water is flowing may be treated as a broad-crested weir. Therefore if the proper coefficient for a particular type of embankment is known the quantity of water flowing over an embankment of that type may be determined with reasonable accuracy. The specific purpose of this investigation was to determine these coefficients for certain types and widths of embankments so that the usual formulas for computing flow over broad-crested weirs could be employed.

THE MODEL EMBANKMENT DESCRIBED

The hydraulic laboratory of the University of Iowa is located on the west bank of the Iowa River, at the university dam. The principal testing canal is 190 feet long, 10 feet wide, and 10 feet deep. At the upstream end of the canal, where it joins with the end of the dam, is a wooden head gate 10 feet wide by 12 feet deep. A 10-foot weir of the suppressed type for measuring flow in the canal is located 60 feet downstream from the head gate. Numerous baffles were placed in the canal immediately below the head gate to obtain uniform velocity distribution as the water approached the weir, and a smooth flow over the crest. Similar baffles were placed in the canal immediately downstream from the weir to prevent commotion of the water as it approached the embankments.

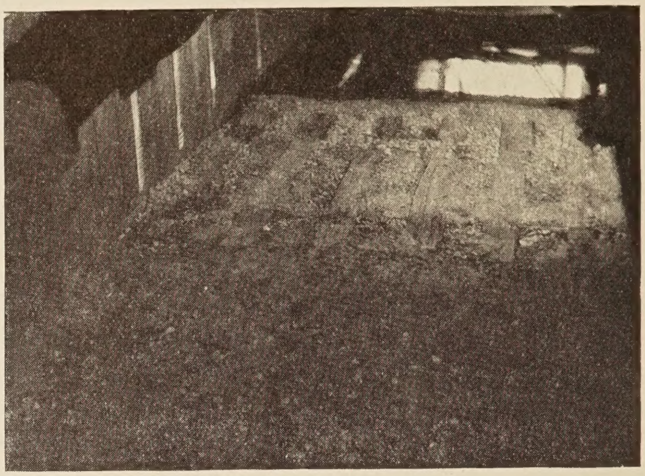


FIGURE 1.—SINGLE-TRACK EMBANKMENT WITHOUT RAILS

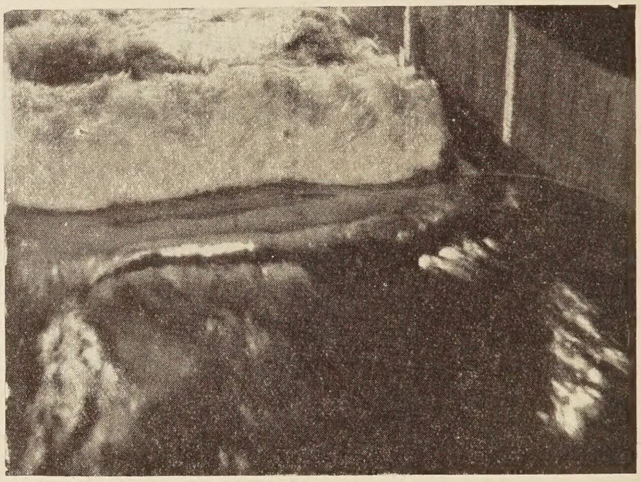


FIGURE 2.—SINGLE-TRACK EMBANKMENT WITHOUT RAILS, 50.4 CUBIC FEET PER SECOND FLOWING OVER EMBANKMENT, HEAD ON EMBANKMENT, 1.42 FEET

A full-size section of a single-track embankment, 10 feet in length, was built in the testing canal 92 feet downstream from the weir. The embankment proper consisted of a wooden structure which was covered with gravel and upon which was placed the standard depth of gravel ballast and the ties and rails. The American Railway Engineering Association specifications for standard single and double track, gravel ballast, were followed. Seventy-pound rails were used. The top of rail of the single track was 3.8 feet above the floor of the canal. A view of the single-track embankment without rails is shown in Figure 1. The same embankment under test is shown in Figure 2. The embankment without rails corresponds to a highway with approximately a 12-foot roadway.

In building the double track the extra track was added to the upstream side of the single track, the distance center to center of tracks being 13 feet. The height of the top of rail of the double track, however, was only 1.8 feet, as the floor here is 2 feet higher

[1] Acknowledgment is made to Prof. S. M. Woodward, State University of Iowa, fou valuable advice and suggestions, and to P. L. Hopkins, junior civil engineer, Bureau of Public Roads, and Nolan Page, graduate research assistant in hydraulics, State University of Iowa, who assisted in the laboratory work and in the computation of esults.

FIGURE 3.—DOUBLE-TRACK EMBANKMENT WITH RAILS IN PLACE

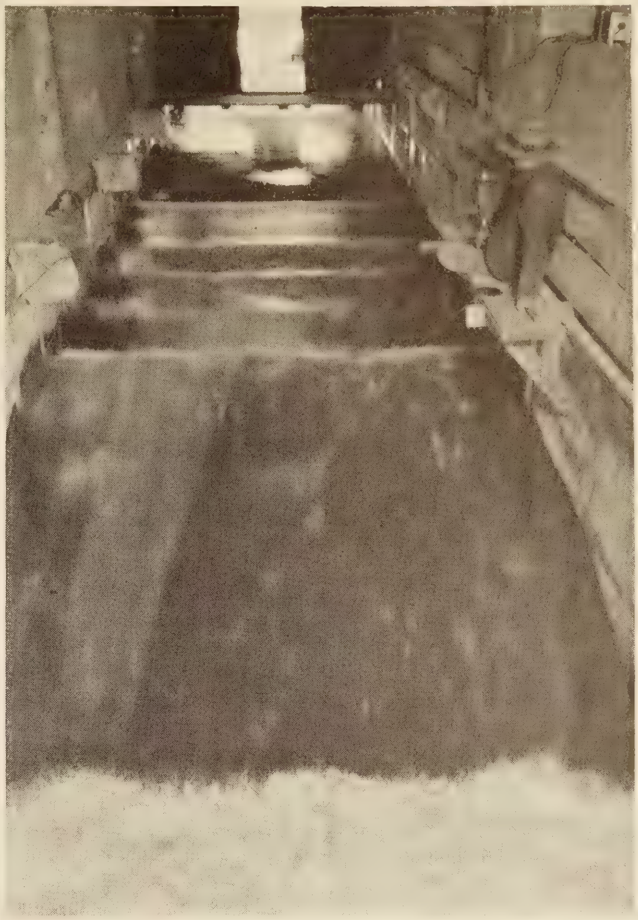


FIGURE 4.—DOUBLE-TRACK EMBANKMENT WITH RAILS IN PLACE, 46 CUBIC FEET PER SECOND FLOWING OVER TRACKS. HEAD ON UPSTREAM RAIL, 1.33 FEET. STANDING WAVES CAUSED BY THE RAILS

than the floor in the downstream end of the canal. This difference is due in part to a false wooden floor placed in the canal for use in connection with other experiments. The double-track embankment with rails in place is shown in Figure 3, and Figure 4 shows the double-track embankment while under test. Corresponding views with one track removed are shown in Figures 5 and 6. This embankment, without rails, is representative of a highway with a roadway 23 feet wide.

Twenty-seven staff gages, graduated to hundredths of a foot, were placed along the walls of the canal at frequent intervals, 14 being placed along the west wall and 13 along the east wall. The zero of these staffs was set level with the top of rail.

A bear-trap weir 6 feet high and located 22 feet downstream from the center of the single track, or 28.5 feet from the center of the double track, was used to regulate the water level downstream from the embankment, and in some experiments to submerge the embankment. This weir was hung on hinges and was regulated by means of a block and tackle attached to a windlass.

It will be noted in Figure 3 that the downstream face of the embankment is grouted. This was done to prevent the material from washing off of the wooden base.

The side slopes of most highway and railroad embankments are covered with a heavy growth of grass and weeds which resist erosion.

THE TESTS

Tests on each embankment were begun with a head of 0.5 foot of water discharging over the measuring weir, and continued with successive increases of 0.1 foot in head on the weir, until the maximum flow was obtained. For each head on the measuring weir the following conditions of outflow were imposed by means of the bear-trap weir: (1) With water surface on the downstream side of the track raised until the ratio $\frac{d}{D}$ (depth of water over rail on the downstream side of the embankment, to depth on upstream side of embankment as illustrated on drawings) was about 0.95; (2) with $\frac{d}{D}$ less than 0.95 (obtained by gradually lowering the bear-trap weir); (3) with water discharging freely over the embankment, thus simulating free flow over one type of broad-crested weir.

In each test a constant head was first obtained on the measuring weir and then the bear trap was adjusted to obtain a definite ratio of depth of flow. When this had become constant, one observer first took readings on the weir hook gage and weir staff, then successively read the staffs downstream on one side of the channel and upstream on the other side. After determining that the readings on the two opposite upstream staffs

FIGURE 5.—DOUBLE-TRACK EMBANKMENT WITH UPSTREAM TRACK IN PLACE AND DOWNSTREAM TRACK REMOVED

FIGURE 6.—DOUBLE-TRACK EMBANKMENT WITH UPSTREAM TRACK IN PLACE AND DOWNSTREAM TRACK REMOVED. 42.5 CUBIC FEET PER SECOND FLOWING OVER TRACK. DEPTH OF FLOW, 1.12 FEET OVER TRACK

checked, he again took readings on the weir hook gage and weir staff. In the meantime, another observer plotted a profile of the water surface. Horizontal lines 0.1 foot apart, as well as vertical lines 1 foot apart, had been painted on both sides of the canal. By means of these continuous gage lines (shown in fig. 3) an accurate profile of the many variations in the water surface was obtained which it was not possible to obtain with the staff gages. This method gave a record of the waves caused by the rails as illustrated in Figures 4 and 6.

In testing the single-track embankment with rails in place it was noted that a standing wave was sometimes formed over the downstream rail. To determine the effect of the downstream rail on the flow some tests were run with only the upstream rail in place. On the double-track embankment tests were also run with the upstream track in place and the downstream track removed.

The results of the tests were computed as the experiments were under way, thus making it possible to rerun any doubtful tests.

FORMULAS DERIVED FOR VARIOUS CONDITIONS OF FLOW

The following basic formula was used in all of the computations:

$$Q = CLH^{3/2} \qquad (1)$$

In this formula,

Q = volume of discharge per unit of time,
C = an empirical coefficient,
L = length of the embankment overflowed,
H = the head corrected for the effect of the velocity of approach; i. e., measured depth plus $\frac{V}{2g}$ where V is the mean velocity of approach to the weir.

The discharge over the measuring weir was computed by Bazin's weir formula. The readings on the various staffs gave the heights of the water above the top of rail. In the tests on the embankments with the rails removed the height of the rail was therefore added to the staff readings to get the depth of water on the embankment. For the tests in which the embankment was submerged the degree of submergence is expressed by the ratio $\frac{d}{D}$ before mentioned.

The results of the experiments were plotted on cross-section paper with the ratio $\frac{d}{D}$ as abscissas and the empirical coefficient C as ordinates. These curves are shown in Figures 7 to 12, inclusive. It will be noted that when $\frac{d}{D}=0$, the water flowing over the embankment has a free drop. Under such conditions the coefficient C varies more for some embankments than for others. For example, in Figure 11 the points are grouped whereas in Figure 8 they are more scattered. Since it was impossible to show all such values of the coefficient on the diagrams (many of them coincided), the points through which the curves are drawn were

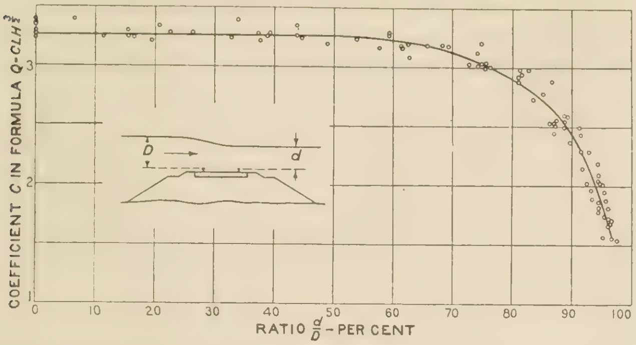


FIGURE 7.—RELATION BETWEEN COEFFICIENT AND PER CENT SUBMERGENCE, SINGLE TRACK, BOTH RAILS IN PLACE

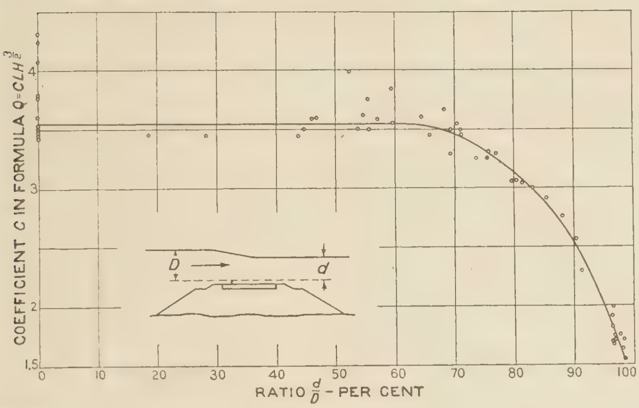


FIGURE 8.—RELATION BETWEEN COEFFICENT AND PER CENT SUBMERGENCE, SINGLE TRACK, DOWNSTREAM RAIL REMOVED

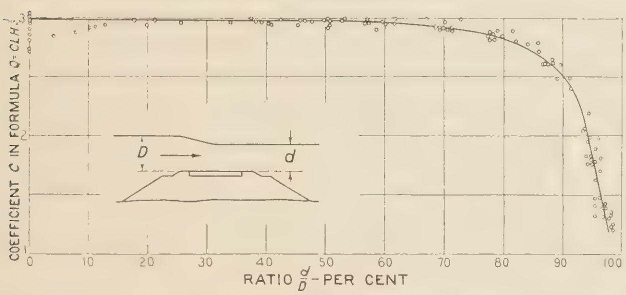


FIGURE 9.—RELATION BETWEEN COEFFICIENT AND PER CENT SUBMERGENCE, SINGLE TRACK, BOTH RAILS REMOVED. EQUIVALENT TO A HIGHWAY EMBANKMENT WITH A 12-FOOT ROADWAY

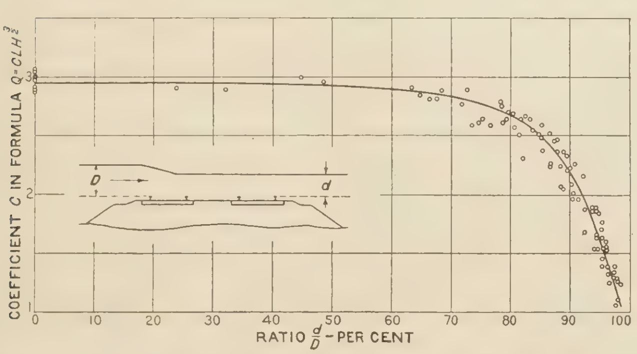


FIGURE 10.—RELATION BETWEEN COEFFICIENT AND PER CENT SUBMERGENCE, DOUBLE TRACK, FOUR RAILS IN PLACE

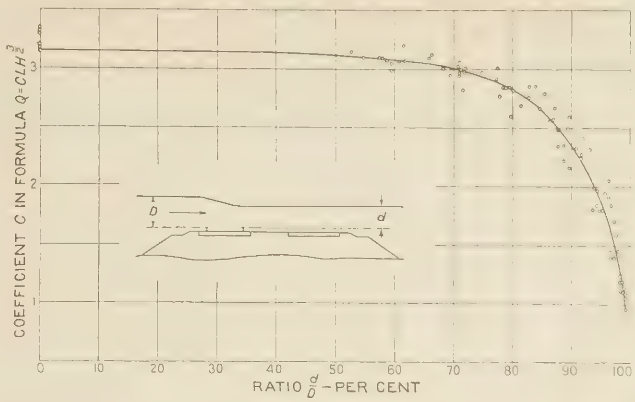


FIGURE 11.—RELATION BETWEEN COEFFICIENT AND PER CENT SUBMERGENCE, DOUBLE TRACK, TWO DOWNSTREAM RAILS REMOVED

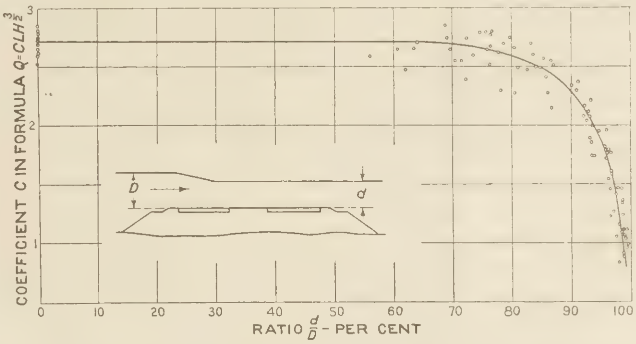


FIGURE 12.—RELATION BETWEEN COEFFICIENT AND PER CENT SUBMERGENCE, DOUBLE TRACK, ALL FOUR RAILS REMOVED. EQUIVALENT TO A HIGHWAY EMBANKMENT WITH A 23-FOOT ROADWAY

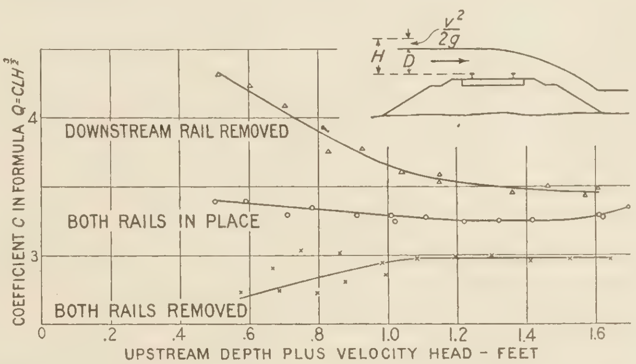


FIGURE 13—VARIATION OF COEFFICIENT WITH HEAD. SINGLE TRACK

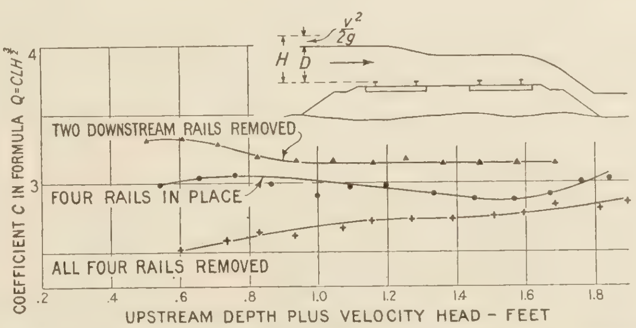


FIGURE 14.—VARIATION OF COEFFICIENT WITH HEAD. DOUBLE TRACK

determined in the following manner: Values, the discharges, Q, were plotted on logarithmic paper as ordinates and the heads, corrected for velocity of approach, as abscissas. A line having a slope of 3/2 was drawn through the majority of the points, the greater weight being placed on the higher heads. The intercept on the unity vertical axis was taken as the value of C through which the curve should pass.

During the progress of the tests it was observed that for values of $\frac{d}{D}$ less than 0.6, the coefficient was practically constant since the elevation of the tailwater had no effect on the height of the headwater. This was due to the fact that the critical velocity occurred at the downstream edge of the embankment. Therefore, to conserve time in experimenting on some of the embankments, comparatively few tests were run with values of $\frac{d}{D}$ between 0.1 and 0.5.

For those tests in which the water had a free drop over the embankment it was noted that the coefficient varied somewhat with the head when the exponent of H was taken as 3/2. This variation is shown in Figures 13 and 14 in which the coefficients have been plotted as ordinates and the heads as abscissas. These curves show that the exponent of H is not exactly 1.5. The test data were therefore plotted on logarithmic paper with the discharge Q as ordinates and the head H (corrected for velocity of approach) as abscissas. Lines were drawn through the points and the discharge equations determined for the various types of embankments.

The equations as determined for free flow over the embankments are as follows:

Single track, both rails in place—
$Q=3.27\ LH^{1.47}$ (2)

Single track, upstream rail only in place—
$Q=3.66\ LH^{1.37}$ (3)

Single track, both rails removed—
$Q=3.00\ LH^{1.49}$ (4)

Double track, all four rails in place—
$Q=2.95\ LH^{1.47}$ (5)

Double track, upstream track only in place—
$Q=3.17\ LH^{1.48}$ (6)

Double track, all four rails removed—
$Q=2.66\ LH^{1.60}$ (7)

USE OF FORMULAS ILLUSTRATED BY EXAMPLES

These experiments have made available coefficients for use in hydraulic formulas for computing the flow over embankments during floods. When free flow exists over an embankment one of formulas (2) to (7) may be used, depending upon the type of the embankment. If the embankment is submerged the appropriate coefficient may be taken from the curves shown in Figures 7 to 12, after the percentage of submergence has been determined. In all of the computations for the curves and formulas the head corresponding to the velocity of approach has been added to the depth of water over the embankment to get the true head. Thus these coefficients are applicable to all embankments regardless of the velocity of approach. In a specific case, however, the velocity of approach must be assumed in the preliminary calculations and the assumed value checked after the discharge has been computed. This procedure can best be illustrated by practical examples.

Example 1.—Assume that water has been discharging over a single-track railroad embankment. The track at elevation 75 was not washed out. After the flood a survey for high-water marks showed that the water on the upstream side of the track had been at elevation 76.6, and on the downstream side of the track at elevation 74. Assume the height of the embankment (to top of rail) above the natural ground surface to be 6.5 feet, and for convenience consider a length of 100 feet of track. The formula applicable to this problem is equation (2) which is

$$Q=3.27\ LH^{1.47}$$

in which

$$L=100 \text{ feet.}$$

The measured head is 1.6 feet. Assume the velocity of approach to be 0.80 foot per second, then

Velocity head = 0.0099
Total head, $H=1.61$

and

$$Q=3.27\times100\times1.61^{1.47}$$

or

$$Q=658 \text{ cubic feet per second.}$$

But the cross-sectional area of flow is 810 square feet and

$$\frac{Q}{A}=\frac{658}{810}=0.81 \text{ foot per second,}$$

which approximates the assumed velocity of approach.

Example 2.—A single-track railroad was overtopped by flood water. A survey showed the track to be at elevation 50, the water level upstream at 53, and downstream at 52.5. The height of the embankment or top of rail is 3.5 feet above the natural ground surface, and the length of track overflowed 100 feet. The percentage of submergence would then be

$$\frac{d}{D}=\frac{2.5}{3.0}=83.3.$$

From Figure 7 the coefficient, C, is found to be 2.80. Hence the formula would be

$$Q=2.80\ LH^{3/2}$$

in which

$$L=100.$$

The measured head is 3 feet. Assuming the velocity of approach to be 2 feet per second, the velocity head is 0.0622 and the total head, H, is 3.0622. Thus

$$Q=2.80\times100\times3.0622^{3/2}$$
$$Q=1{,}500.$$

The area of flow is 650 square feet and the velocity of approach is $\frac{1{,}500}{650}=2.31$ feet per second. The first assumption being too small, assume the velocity of approach as 2.3 feet per second. The velocity head then is 0.0822; and the total head, $H=3.0822$.

$$Q=2.80\times100\times3.0822^{3/2}$$
$$Q=1{,}515.$$

The velocity of approach is $\frac{1{,}515}{650}=2.33$ feet per second which agrees quite closely with the second assumption. Thus the discharge over a 100-foot section of the track is 1,515 cubic feet per second, or 15.15 cubic feet per second per lineal foot of track overflowed.

PLANS FOR INTERNATIONAL ROAD CONGRESS ANNOUNCED

The American Organizing Commission announces that the Sixth International Road Congress will be held in this country in October, 1930, at the invitation of the United States Government, with the object of continuing the studies begun in Paris in 1908 and continued in Brussels in 1910, in London in 1913, in Seville in 1923, and in Milan in 1926.

The congress will open in Washington on Monday, October 6, and close on Saturday, October 11.

Simultaneously with the congress it is contemplated that a private international road exhibition will be held by the American Road Builders' Association.

TENTATIVE PROGRAM OF THE CONGRESS

The official opening of the congress will occur Monday afternoon, October 6, at Constitution Hall, preceded by a meeting in the morning of the International Permanent Commission at the offices of the Chamber of Commerce of the United States.

Registration will begin Monday morning and continue through Thursday, October 9. Members are urged to register as early during the week as possible.

All sessions of the congress, except the official opening, will be at the building of the Chamber of Commerce of the United States.

Section meetings will be held the morning and afternoon of October 7, the morning sessions being followed by motion-picture exhibits of road-building operations.

The same procedure will hold for Wednesday, October 8, and for Thursday, October 9.

Friday is reserved for a visit to the experiment station of the United States Bureau of Public Roads, and over Mount Vernon Memorial Highway to Mount Vernon, home of George Washington.

Saturday morning, October 11, will see the official closing of the congress, with the afternoon of that day reserved for excursions, to be followed by sight-seeing tours on Sunday, October 12.

The detailed program will be announced at a later date.

AGENDA

(Prepared by the Permanent International Commission)

First Section

CONSTRUCTION AND MAINTENANCE

First question.—Results obtained by the use of:
- (*a*) Cement;
- (*b*) Bricks or other artificial paving.

(Methods employed for road construction and maintenance in these materials.)

Second question.—The most recent methods adopted for the use of tar, bitumen, and asphalt in road construction.

Third question.—The construction of roads in new countries, such as colonies and undeveloped regions.

Second Section

TRAFFIC AND ADMINISTRATION

Fourth question.—Ways and means of financing highways:
- (*a*) Road construction;
- (*b*) Maintenance.

Fifth question.—Highway transport: Correlation and coordination with other methods of transport; adaptation to collective (organizations) and individual uses.

Sixth question.—(1) Traffic regulation in large cities and their suburbs; traffic signals; design and layout of roads and adaptation to traffic requirements in built-up areas. (2) Parking and garaging of vehicles.

There probably will be a number of unofficial luncheons and dinners tendered the delegates and members by various organizations. The jurisdiction of the American Organizing Commission, however, is limited to the official events appearing on the program.

CONDITIONS FOR PARTICIPATION IN THE CONGRESS

In addition to the delegates of the various countries, expressly appointed by their respective Governments, the permanent and temporary members of the Permanent International Association of Road Congresses may take part in the Congress.

Permanent members.—The permanent members of the association are members who have the right to participate in all the road congresses. Individuals or representatives of groups already enrolled as permanent members are required only to notify the American Organizing Commission at Washington of their intention to participate in the sixth congress. (Blank forms for this purpose will be supplied upon request.)

Individuals or groups desiring to be enrolled as permanent members of the association should request suitable application forms from one of the addresses given below.[1]

For individual permanent members the regular annual dues are 25 French francs ($1). These dues, however, are increased to 125 French francs ($5) for new members enrolled during a congress year, as in the case for the year 1930. For life membership the subscription fee is 500 French francs ($20).

For groups, the minimum annual dues in any year are 100 French francs ($4). For each 100 French francs paid, one delegate may be sent to the congress. All fees received from the above classes of membership are paid to the Permanent International Association of Road Congresses.

Temporary members.—Individuals or groups who do not belong to the association and who desire only to participate in the sixth congress, are considered as temporary members of the association, under articles 2, 8, and 10 of the statutes. Honorary members are enrolled as temporary members.

The fee for enrollment in the congress for each temporary member is 125 French francs ($5). The payment of 250 French francs ($10) bestows the right to the title of honorary member. Three-fifths of the fees received from temporary members are allocated to the American Organizing Commission and two-fifths to the Permanent International Association of Road Congresses.

Applications for temporary membership should be made on a form which can be obtained from any of the addresses given in footnote 1.

Membership privileges.—All classes of members mentioned above have the right to attend all the meetings of the congress, and to participate in all official receptions and official excursions during the congress proper.

[1] The address of the secretary general of the Permanent International Association of Road Congresses is M. Le Gavrian, secretary general, Permanent International Association of Road Congresses, 1, Avenue d'Iéna, Paris, XVI, France. The address of the secretary general of the American Organizing Commission is Thos. H. MacDonald, secretary general, American Organizing Commission, 1723 N Street NW, Washington, D. C., U. S. A. The address of the secretary of the British Organizing Committee is E. B. Hart, secretary, British Organizing Committee, 7 Whitehall Gardens, London, S. W. 1, England

They are also entitled to the special transportation rates established for attendance at the congress.

They will receive, previous to the opening of the congress, the official papers on the subjects indicated in the program, and after the congress a copy of the proceedings. These publications can be obtained only through membership in the congress.

The executive bureau, and the American Organizing Commission, however, do not undertake to send the papers previous to the opening of the congress to those members who have not been enrolled at least one month prior to the opening. (Art. 11 of the statutes of the association.)

A circular is available for distribution giving information concerning reductions in rates of ocean steamship lines, passports, and hotel accommodations and rates. Hotel reservations may be made through the American Organizing Commission.

A railroad rate of three-fourths the regular round-trip fare has been arranged for members attending the congress.

MOTOR VEHICLE REGISTRATIONS AND REVENUE AND GASOLINE TAXES IN 1929

According to reports received from State registration authorities by the Bureau of Public Roads, a total of 26,501,443 motor vehicles were registered in 1929. From the owners of these vehicles the States and the District of Columbia collected in license fees, registration fees, permit fees, fines, etc., the sum of $347,-843,543.

The registration figure includes passenger automobiles, taxis, buses, motor trucks and road tractors, trailers, and motor cycles, and represents an increase of 2,008,319 or 8 per cent over the 1928 figure. The total fees collected represent an increase of $25,213,518 over the 1928 figure. After deducting $24,505,737 for collection and miscellaneous purposes, the balance of $323,337,806 was applied to highway purposes; $223,-292,969 to State funds, $66,861,364 to local funds, and $33,183,473 to State and county bond funds.

The States having the 10 highest registration figures are as follows: New York, 2,263,259; California 1,974,-341; Ohio, 1,766, 614; Pennsylvania, 1,733,283; Illinois, 1,615,088; Michigan 1,395,102; Texas, 1,348,107; Indiana, 866,715; New Jersey, 832,332; and Massachusetts, 817,704.

In percentage gain, the District of Columbia and New Mexico each show 19 per cent. Nevada reports a gain of 16 per cent, Arizona 15 per cent, and Utah 14 per cent. Four States, Georgia, Maryland, Massachusetts, and Tennessee, each show a gain of 12 per cent, and three States, Michigan, Montana, and Texas each report an increase of 11 per cent. California, Idaho, Kentucky, New Jersey, and Washington each show a gain of 9 per cent.

Details as to the number of registrations are shown on page 37 and registration receipts are shown on page 38.

GASOLINE TAX YIELDS LARGE REVENUE FOR HIGHWAYS

Reports received by the Bureau of Public Roads show that $431,636,454 were collected in taxes on the sale of 13,400,180,062 gallons of motor fuel in 1929. These figures include a 12-month collection in 46 States and the District of Columbia, a 5-month collection in Illinois, and the collections of eight months in New York. The entrance of the latter two States into the list of those collecting a gasoline tax marks the adoption of this method for part payment of the highway bill by all States. The pioneer States—Oregon and Colorado—led the way in 1919. All others have followed in the succeeding period of 11 years, but the tax did not become effective in New York until May 1 and in Illinois until August 1.

The average fee per gallon was 3.22 cents as against 3 cents in 1928, 20 States having increased the rate of taxation either 1 or 2 cents. The highest tax per gallon was 6 cents; the lowest 2 cents. At the close of the year, 3 States had a 6-cent tax; 8 a 5-cent tax; 19 a 4-cent tax; 1, Utah, a 3½-cent tax; 10 a 3-cent tax; and 7 States and the District of Columbia a 2-cent tax.

During the year the rate per gallon was increased 1 cent in Colorado, Florida, Indiana, Kansas, Minnesota, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Carolina, Vermont, Washington, and Wyoming; a 2-cent increase became effective in Georgia, Louisiana, Montana, Nebraska, Tennessee, and Texas.

Comparison of the total number of vehicles registered in 1929, with the total tax collected and with the taxable gallonage in all States (except New York and Illinois) and in the District of Columbia shows an average tax revenue of $17.72 per vehicle and an average purchase of 532 gallons of gasoline.

After deducting collection costs, the entire net revenue in 34 States was used for construction and maintenance of rural roads. In the other 14 States and the District of Columbia, a total of $24,405,207 was used for other purposes. In three States a portion was used for public-school purposes. In eight States, a part of the revenue went to cities for repair and improvement of streets, as did the entire collection for the District of Columbia. In six States, small sums were deposited in general funds; in Mississippi, a special extra tax was collected in two counties for seawall protection of highways; and in New Jersey a small portion of the receipts was turned over to the department of commerce and navigation.

Of the portion of the total revenue applied to rural road purposes, $297,967,756 was used for construction and maintenance of State highways; $85,113,708 for construction and maintenance of local roads; and the balance of $23,371,785 was used for payments on State and county road bonds.

The table on page 39 shows the total tax earnings and total number of gallons taxed in the various States.

MOTOR VEHICLE REGISTRATIONS, 1929 [1]

[Compiled for calendar year from reports of State authorities]

State	Registered motor vehicles individually and commercially owned [2]			Other registered vehicles		Tax-exempt official motor cars and motor cycles			Number of licenses or permits		Total registered motor cars and trucks, in 1928	Year's change in motor-vehicle registrations		State
	Grand total registered motor cars and trucks	Passenger automobiles, taxis, and buses [3]	Motor trucks and road tractors	Trailers [4]	Motor cycles	United States cars [5]	State and local cars	Motor cycles (official)	Dealers	Operators and chauffeurs		Number increase or decrease (—)	Per cent	
Alabama	285, 533	247, 701	37, 832	3, 024	704	167	869		4, 712	2, 714	269, 519	16, 014	6. 0	Alabama.
Arizona	109, 013	98, 327	10, 686	1, 249	396	176	1, 173	43	182	20, 643	94, 372	14, 641	15. 5	Arizona.
Arkansas	233, 128	193, 396	39, 732	2, 808	400	39	919	31	515	5, 023	214, 931	18, 197	8. 5	Arkansas.
California	1, 974, 341	1, 760, 308	214, 033	42, 899	9, 628	1, 217	15, 005	552	14, 000	250, 855	1, 799, 890	174, 451	9. 7	California.
Colorado	303, 489	274, 988	28, 501	159	1, 142	283			3, 684	7, 916	284, 867	18, 622	6. 5	Colorado.
Connecticut	328, 063	278, 057	50, 006	324	2, 314	71	2, 068	270	4, 073	379, 122	309, 792	18, 271	5. 9	Connecticut.
Delaware	54, 960	44, 728	10, 232	389	308	44			684	60, 887	51, 210	3, 750	7. 3	Delaware.
Florida	345, 977	288, 684	57, 293	900	1, 104	75	3, 788	204	1, 906	2, 326	352, 961	—6, 984	—2. 0	Florida.
Georgia	358, 905	310, 362	48, 543	2, 597	1, 138	934				2, 973	318, 856	40, 049	12. 6	Georgia.
Idaho	118, 074	104, 398	13, 676	485	355	103	1, 092	15	466	780	108, 154	9, 920	9. 2	Idaho.
Illinois	1, 615, 088	1, 411, 753	203, 335	5, 068	6, 055	979			4, 605	106, 551	1, 504, 359	110, 729	7. 4	Illinois.
Indiana	866, 715	741, 366	125, 349	10, 407	2, 983	3, 184	4, 965		2, 794	55, 164	823, 806	42, 909	5. 2	Indiana.
Iowa	784, 450	714, 919	69, 531	528	1, 650	44	3, 461	76	2, 483	19, 067	733, 466	50, 984	6. 9	Iowa.
Kansas	581, 223	507, 529	[6] 73, 694	360	1, 178	192	2, 470	60	2, 784		533, 799	47, 424	8. 9	Kansas.
Kentucky	332, 848	298, 716	34, 132		727	90	1, 916		1, 158	11, 859	304, 231	28, 617	9. 4	Kentucky.
Louisiana	280, 868	234, 565	46, 303	8, 000	600	209			456	22, 834	264, 293	16, 575	6. 3	Louisiana.
Maine	184, 506	147, 962	36, 544	1, 652	1, 258	64	1, 467	82	1, 151	226, 087	172, 638	11, 868	6. 9	Maine.
Maryland	319, 873	281, 034	[7] 38, 839	876	1, 986	1, 969			7, 231	82, 714	285, 311	34, 562	12. 1	Maryland.
Massachusetts	817, 704	719, 436	98, 268	556	5, 568	556	900		3, 094	944, 338	726, 295	91, 409	12. 6	Massachusetts.
Michigan	1, 395, 102	1, 219, 158	[6] 175, 944	31, 577	3, 985	371			2, 282		1, 249, 221	145, 881	11. 7	Michigan.
Minnesota	730, 399	630, 703	99, 696	4, 783	1, 900	252	1, 304		2, 160		673, 573	56, 826	8. 4	Minnesota.
Mississippi	250, 011	217, 362	32, 649	4, 321	204	74			5, 567		246, 242	3, 769	1. 5	Mississippi.
Missouri	756, 680	671, 237	[6] 85, 443	2, 686	1, 893	311	1, 604	5	2, 686	33, 265	712, 965	43, 715	6. 1	Missouri
Montana	140, 387	115, 285	25, 102		234	229			537	414	126, 035	14, 352	11. 4	Montana.
Nebraska	418, 226	375, 946	42, 280	6, 515	972	226	1, 101		3, 584		391, 355	26, 871	6. 9	Nebraska.
Nevada	31, 915	25, 302	6, 613	273	95	42	468		119		27, 376	4, 539	16. 6	Nevada.
New Hampshire	108, 880	94, 900	13, 980	635	1, 263	22			561	129, 539	102, 644	6, 236	6. 1	New Hampshire.
New Jersey	832, 332	698, 959	133, 373	2, 424	6, 531	708	7, 173	933	3, 418	971, 235	758, 430	73, 902	9. 7	New Jersey.
New Mexico	78, 374	76, 000	2, 374	509	203	156	820	4	208		65, 737	12, 637	19. 2	New Mexico.
New York	2, 263, 259	1, 922, 068	341, 191	8, 232	13, 527	1, 666	17, 499	1, 313	5, 039	2, 708, 036	2, 083, 942	179, 317	8. 6	New York.
North Carolina	483, 602	430, 651	52, 951	3, 584	1, 298	429	7, 092		7, 614		464, 376	19, 226	4. 1	North Carolina.
North Dakota	188, 046	162, 092	25, 954		230	3			869		173, 525	14, 521	8. 4	North Dakota.
Ohio	1, 766, 614	1, 560, 182	206, 432	15, 000	9, 180	2, 362	10, 843		29, 298	4, 436	1, 649, 699	116, 915	7. 1	Ohio.
Oklahoma	570, 791	510, 401	60, 390		1, 196	530	4, 725		3, 923		529, 843	40, 948	7. 7	Oklahoma.
Oregon	269, 007	247, 131	21, 876	1, 308	1, 694	141	1, 483	102	603	52, 451	248, 118	20, 889	8. 4	Oregon.
Pennsylvania	1, 733, 283	1, 515, 875	217, 408	5, 067	13, 375	1, 383	1, 057		29, 599	2, 153, 944	1, 642, 207	91, 076	5. 5	Pennsylvania.
Rhode Island	134, 009	114, 010	19, 999	87	917	56	837	107	330	157, 474	125, 698	8, 311	6. 6	Rhode Island.
South Carolina	231, 274	205, 683	25, 591	2, 048	451	91	3, 017		628		216, 805	14, 469	6. 7	South Carolina.
South Dakota	204, 199	181, 419	[6] 22, 780		207	85	999		1, 110		191, 374	12, 825	6. 7	South Dakota.
Tennessee	362, 431	329, 697	[6] 32, 734		1, 203	132	4, 377		711		322, 137	40, 294	12. 5	Tennessee.
Texas	1, 348, 107	1, 165, 150	182, 957	16, 260	4, 016	2, 505			4, 423	14, 897	1, 214, 297	133, 810	11. 0	Texas.
Utah	112, 661	95, 661	17, 000		525	173	1, 200				98, 541	14, 120	14. 3	Utah.
Vermont	93, 030	84, 471	8, 559	280	487	28			365	95, 387	86, 231	6, 799	7. 9	Vermont.
Virginia	387, 205	328, 525	58, 680	966	2, 141	1, 141	3, 514	143	4, 561	10, 376	360, 545	26, 660	7. 4	Virginia.
Washington	442, 341	379, 995	62, 346	2, 986	2, 403	637	4, 349	180	5, 109	460, 622	402, 875	39, 466	9. 8	Washington.
West Virginia	268, 888	228, 715	40, 173	725	1, 397	33	2, 388	120	11, 854	85, 514	251, 556	17, 332	6. 9	West Virginia.
Wisconsin	793, 502	689, 447	104, 055	497	2, 723	92	943	128	3, 138		742, 135	51, 367	6. 9	Wisconsin.
Wyoming	60, 680	51, 880	8, 800		92	209	356		338		56, 336	4, 344	7. 7	Wyoming.
District of Columbia	151, 450	135, 455	15, 995		1, 009	837	1, 586	183	2, 107	63, 921	126, 556	24, 894	19. 7	District of Columbia.
Total	26, 501, 443	23, 121, 589	3, 379, 854	193, 044	114, 845	[8] 33, 179	118, 828	4, 551	188, 719	9, 143, 364	24, 493, 124	2, 008, 319	8. 2	Total.

[1] This table lists only the number of registrations, licenses, and permits. For financial statement see table on next page.

[2] The first 3 columns show regularly registered motor cars and trucks, eliminating reregistrations, nonresident registrations, etc.

[3] Buses are included with passenger cars except as noted in next column.

[4] Some States do not register trailers.

[5] Bureau of the Budget data as of 1925.

[6] Buses included with trucks and not reported separately.

[7] Includes commercial cars with pneumatic tires, formerly reported with passenger cars.

[8] Total includes 7,859 "cars-at-large," not allocated to any State.

MOTOR VEHICLE REGISTRATION FEES, LICENSES, PERMITS, FINES, ETC., 1929[1]

[Compiled from reports of State authorities]

State [2]	Total gross receipts	Registration receipts [2]: Motor car receipts: Total motor cars	Registration receipts [2]: Motor car receipts: Passenger cars and buses	Registration receipts [2]: Motor car receipts: Trucks and tractors	Registration receipts [2]: Other vehicles: Trailers	Registration receipts [2]: Other vehicles: Motorcycles	Miscellaneous receipts [2]: Dealers' licenses	Miscellaneous receipts [2]: Chauffeur and operator permits	Miscellaneous receipts [2]: Other miscellaneous	Disposition of gross receipts: Collection and administration [3]	Disposition: For highway purposes: State highways	Disposition: For highway purposes: Local roads	Disposition: For highway purposes: State and county road bonds [4]	Disposition: For other purposes	State [2]
Alabama [2]	$3,736,380									$177,819	$1,324,322	$728,594	$1,505,645		Alabama.[2]
Arizona	748,565	$526,390	$300,214	$226,176	$13,311	$1,222	$775	$20,202	$186,665		748,565				Arizona.
Arkansas	4,212,161	4,125,968			42,120		6,510	23,019	14,544	84,243	914,039	543,369	[5] 2,670,510		Arkansas.
California	10,489,068	9,026,648	5,729,508	3,297,140	330,908	34,681	48,540	327,085	721,206	2,098,197	4,195,436	4,195,435			California.
Colorado	1,835,386	1,691,618	1,382,742	308,876	2,138	1,985	30,256	15,765	93,624	166,652	834,367	834,367			Colorado.
Connecticut	7,992,755	6,075,244	4,630,608	1,444,636	12,675	10,386	92,137	1,160,031	642,282	618,158	7,374,597				Connecticut.
Delaware	1,023,440	825,115	602,287	222,828	5,298	1,225	7,680	183,259	863		1,023,440				Delaware.
Florida	4,959,129	4,893,564	3,601,701	1,291,863		5,291	25,329	4,279	30,666	297,548	3,496,186	1,165,395			Florida.
Georgia	4,568,209	4,491,505	3,705,564	785,941	20,199	5,619	38,427	5,859	6,600	164,825	4,403,384				Georgia.
Idaho	1,787,467	1,743,294	1,431,716	311,578	8,422	1,773	27,735	1,560	4,683	29,344	175,813	1,582,310			Idaho.
Illinois	17,087,209	15,938,407	12,249,403	3,689,004	84,549	19,770	90,140	373,679	580,664		9,623,138		7,428,636	[6] $35,435	Illinois.
Indiana	6,253,424	5,727,856	4,404,613	1,323,243	52,387	5,202	51,230	37,130	379,619	276,100	5,977,324				Indiana.
Iowa	11,919,350	11,048,755	9,849,983	1,198,772	6,511	5,871	84,166	38,134	735,913	417,177	10,962,849	392,225		[7] 147,099	Iowa.
Kansas	5,697,306	5,678,086							19,220	292,602	3,804,704	1,600,000			Kansas.
Kentucky	5,381,302	5,204,833	4,023,896	1,180,937		5,638	33,262	47,064	90,505	235,562	4,555,272	590,468			Kentucky.
Louisiana	4,523,634	4,456,325						67,152	157	50,000	4,473,634				Louisiana.
Maine	3,030,128	2,316,935	1,762,353	554,582	5,126	6,572	45,687	478,411	177,397	267,806	1,958,220		664,102	[9] 140,000	Maine.
Maryland	3,295,314	2,538,840	2,263,128	275,712	22,306	9,755	36,162	211,658	476,593	329,531	2,372,626			[9] 593,157	Maryland.
Massachusetts	7,117,725	4,125,779	2,927,100	1,198,679	24,310	8,768	9,283	1,888,676	1,060,909	1,392,066	4,995,116		730,543		Massachusetts.
Michigan	23,212,316	21,188,145	16,296,515	4,891,630	315,204	15,600	101,863	297,657	1,293,847	891,104	15,239,152	6,000,000	1,082,060		Michigan.
Minnesota	10,846,826	10,690,671	8,871,718	1,818,953	21,570	7,081	39,384	55,647	32,473		6,990,359		[10] 3,800,527	[6] 55,940	Minnesota.
Mississippi [2]	2,963,381									151,380	253,401	2,558,600			Mississippi [2]
Missouri	9,690,727	9,663,645							27,082	454,982	6,168,245		3,067,500		Missouri.
Montana [2]	1,549,487									86,914		1,429,260		[11] 33,313	Montana.[2]
Nebraska	4,289,969	4,028,067	3,411,760	616,307	8,660	3,236	58,672		191,334	105,927	1,239,342	2,891,798		[7] 52,902	Nebraska.
Nevada	296,881	292,172				475	4,000		234	15,524	107,385		173,972		Nevada.
New Hampshire	2,248,213	1,796,597				6,615	30,833	291,207	122,961	175,797	2,057,374			[7] 15,042	New Hampshire.
New Jersey	14,803,016	10,814,412	6,850,483	3,963,929	88,322	13,062	85,240	2,901,719	900,261	948,071	8,716,581	4,782,258		[12] 356,106	New Jersey.
New Mexico	756,763	723,234	640,505	82,729	5,648	568	11,144		16,169	74,692	449,726	224,862	[13] 7,483		New Mexico.
New York	38,293,313	34,040,850	24,411,272	9,629,578	147,714	59,210	216,279	3,146,192	683,068	1,415,965	27,360,992	5,806,006		[14] 3,710,350	New York.
North Carolina [2]	7,045,116									300,000	4,239,853		2,505,263		North Carolina.[2]
North Dakota	1,989,475	1,973,344	1,564,028	409,316		1,222	14,909			262,915	[15] 928,280	798,280			North Dakota.
Ohio	12,860,453	12,324,285						11,125	525,043	390,000	6,430,226	6,040,227			Ohio.
Oklahoma [2]	6,964,360									215,310	2,770,092	3,978,958			Oklahoma.[2]
Oregon	7,644,226	7,346,205	6,327,607	1,018,598		9,597	29,213	62,932	196,279	351,325	2,142,138	1,807,381	3,343,382		Oregon.
Pennsylvania	29,264,695	21,932,837	15,406,163	6,526,674	57,423	33,426	360,371	2,608,203	4,272,435	1,750,000	23,821,267		2,761,783	[8] 931,645	Pennsylvania.
Rhode Island	2,403,809	1,985,526	1,531,955	453,571	1,848	3,322	16,030	314,948	82,135	229,644	2,117,414	45,338		[16] 11,413	Rhode Island.
South Carolina	2,674,379	2,509,158	2,109,228	399,930	31,042	1,470	30,882		101,827	29,907	2,644,472				South Carolina.
South Dakota	3,150,657	3,064,539	2,629,191	435,348		964	27,750		57,404	63,013	1,575,329	1,512,315			South Dakota.
Tennessee [2]	4,288,420									107,368	2,090,526	2,090,526			Tennessee.[2]
Texas	20,418,696	19,678,457	16,240,125	3,438,332	205,932	15,918	71,160	37,439	409,790	796,572	11,521,233	8,100,891			Texas.
Utah [2]	838,300									130,000	372,900		335,400		Utah.[2]
Vermont	2,339,782	2,007,736	1,666,898	340,838		3,343	33,945	247,292	47,466		2,339,782				Vermont.
Virginia	6,145,296	5,662,036	4,794,734	867,302	8,164	8,121	72,902	52,367	341,706	260,000	5,885,296				Virginia.
Washington	7,547,382	6,962,851	5,451,794	1,511,057	59,766	12,647	90,606	407,958	13,554	346,714	4,561,223	2,231,487		[8] 407,958	Washington.
West Virginia	4,565,836	4,131,275	3,223,064	908,211	5,105	6,095	48,640	138,679	236,042	215,621	1,210,460		3,106,667	[7] 33,088	West Virginia.
Wisconsin	11,780,703	11,382,876	9,072,253	2,310,623	20,180	17,653	107,815	71,703	180,476	650,000	6,199,689	4,931,014			Wisconsin.
Wyoming [2]	647,200										647,200				Wyoming.[2]
District of Columbia	665,914	158,672	135,675	22,997		1,009	2,107	191,763	312,363	86,423				[17] 579,491	District of Columbia.
Detailed totals [2]	319,810,899	284,792,752	([18])	([18])	1,606,838	344,392	2,081,064	15,719,794	15,266,059						Detailed totals.[2]
Grand total	347,843,543									17,402,798	223,292,969	66,861,364	33,183,473	7,102,939	Grand total.

1 Financial data only on this table. For number of registrations, etc., see preceding page.
2 Eight states thus noted do not report complete details, and receipts are not included in "detail totals."
3 States for which no figures are shown make appropriations for administration.
4 Payments on State highway bonds, except as noted.
5 Includes payments on county bonds of $1,971,291.
6 For State general funds.
7 For State motor vehicle fee refunds.
8 For State highway motor patrol.
9 For Baltimore city streets.
10 County bond payments assumed by State.
11 For auto theft fund.
12 Includes $105,106 for new State highway office building and $251,000 for free bridge commission.
13 Interest on notes outstanding.
14 For New York City general fund.
15 Includes special State bridge fund.
16 For administration of fuel tax law.
17 For traffic control signals, and streets, as appropriated by Congress.
18 Only 34 States report detail of motor car receipts as follows: Passenger car and bus receipts $189,499,784, and truck and tractor receipts $56,955,890, making a total of $246,455,674.

GASOLINE TAXES, 1929

Total tax earned on motor vehicle fuel, etc., refunds, disposition of fund, and gallons taxed

[From reports of State authorities]

State	Gross tax assessed prior to deduction of refunds	Exemption refunds: (Deducted from gross tax)	Total tax earnings on fuel for motor vehicles [1]	Other receipts under tax law (licenses)	Grand total earnings (tax and other receipts)	Disposition of grand total earnings: Collection costs [2]	Construction and maintenance on rural roads: State highways	Construction and maintenance on rural roads: Local roads	State and county road bond payments [3]	For miscellaneous purposes	Tax rates, 1929: Cents per gallon: Jan. 1	Tax rates, 1929: Cents per gallon: Dec. 31	Date of rate change	Net gallons of gasoline taxed, and used by motor vehicles
Alabama	$7, 105, 009		$7, 105, 009		$7, 105, 009	$37, 853	$2, 367, 023	$3, 522, 447	$1, 177, 686		4	4		[4] 178, 162, 903
Arizona	2, 886, 603	$326, 772	2, 559, 831	$8	2, 559, 839	([5])	1, 599, 894	959, 945			4	4		63, 995, 783
Arkansas	6, 681, 029	([6])	6, 681, 029		6, 681, 029	33, 405	4, 195, 686	420, 905	[7] 2, 031, 033		5	5		133, 620, 566
California	37, 600, 108	3, 408, 021	34, 192, 087		34, 192, 087	8, 566	23, 181, 265	10, 960, 668		[8] $41, 588	3	3		1, 139, 736, 244
Colorado	5, 745, 061	527, 582	5, 217, 479	585	5, 218, 064	[9] 46, 915	3, 619, 804	1, 435, 478		[10] 115, 867	3	4	May 1	141, 466, 891
Connecticut	4, 047, 092		4, 047, 092	50, 083	4, 097, 175		4, 097, 175				2	2		202, 354, 590
Delaware	980, 559	44, 612	935, 947		935, 947		935, 947				3	3		31, 198, 248
Florida	12, 203, 056		12, 203, 056	28, 280	12, 231, 336	16, 477	5, 666, 821	1, 544, 146		[11] 5, 003, 892	5	6	July 1	223, 373, 467
Georgia	10, 224, 108		10, 224, 108		10, 224, 108	4, 200	6, 567, 409	2, 195, 045		[12] 1, 457, 454	4	6	Sept. 1	219, 609, 473
Idaho	2, 204, 977	258, 997	1, 945, 980	379	1, 946, 359	13, 813	1, 932, 546				4	4		48, 658, 984
Illinois [13]	11, 659, 778		11, 659, 778		11, 659, 778	[14] 25, 000	[15] 7, 756, 519	[15] 3, 878, 259			0	3	Aug. 1	[13] 388, 659, 266
Indiana	16, 429, 211	818, 960	15, 610, 251	289	15, 610, 540	33, 102	11, 683, 078	2, 920, 770		[16] 973, 590	3	4	Apr. 1	410, 936, 759
Iowa	10, 068, 831	713, 046	9, 355, 785		9, 355, 785	31, 728	4, 611, 780	4, 712, 277			3	3		311, 859, 516
Kansas	9, 733, 375	1, 562, 170	8, 171, 205		8, 171, 205	([17])	6, 371, 205	1, 800, 000			2	3	Apr. 1	288, 716, 546
Kentucky	7, 742, 564		7, 742, 564		7, 742, 564	25, 777	7, 716, 787				5	5		154, 717, 831
Louisiana	6, 979, 699	1, 048	6, 978, 651		6, 978, 651	([18])	5, 255, 782		1, 722, 869		2	4	Jan. 3	176, 645, 631
Maine	3, 841, 476	132, 794	3, 708, 682		3, 708, 682	26, 052	2, 301, 644	1, 380, 986			4	4		91, 610, 422
Maryland	6, 532, 418	235, 250	6, 297, 168		6, 297, 168	2, 500	5, 035, 734			[19] 1, 258, 934	4	4		157, 429, 197
Massachusetts	9, 888, 730	129, 914	9, 758, 816		9, 758, 816	20, 000	6, 770, 807	2, 968, 009			2	2		487, 940, 778
Michigan	23, 558, 077	2, 249, 068	21, 309, 009	3, 920	21, 312, 929	40, 286	11, 058, 317	6, 810, 406	3, 000, 000	[20] 403, 920	3	3		710, 300, 302
Minnesota	9, 631, 151	739, 026	8, 892, 125		8, 892, 125		6, 283, 903	2, 608, 222			2	3	May 1	338, 631, 771
Mississippi	7, 045, 120		7, 045, 120	131, 006	7, 176, 126	5, 900	2, 736, 601	4, 223, 532		[21] 210, 093	5	5		[22] 140, 902, 401
Missouri	7, 866, 605	185, 933	7, 680, 672		7, 680, 672	54, 940	7, 625, 732				2	2		384, 033, 575
Montana	3, 767, 737	965, 720	2, 802, 017		2, 802, 017	13, 584	2, 788, 433				3	5	Apr. 1	57, 514, 249
Nebraska	7, 860, 046	60, 567	7, 799, 479		7, 799, 479	7, 500	5, 982, 429	1, 809, 550			2	4	Mar. 29	208, 869, 358
Nevada	712, 507	60, 206	652, 301		652, 301		599, 377	52, 924			4	4		16, 307, 535
New Hampshire	2, 332, 906	65, 854	2, 267, 052		2, 267, 052		1, 700, 289		566, 763		4	4		56, 676, 294
New Jersey	9, 961, 276	([23])	9, 961, 276	34, 828	9, 996, 104	20, 040	9, 886, 064			[24] 90, 000	2	2		498, 063, 808
New Mexico	2, 273, 966		2, 273, 966	15, 801	2, 289, 767	45, 795	1, 752, 722		491, 250		5	5		45, 479, 332
New York [25]	19, 488, 422	433, 248	19, 055, 174	32, 218	19, 087, 392	([26])	14, 278, 044	3, 807, 478		[27] 1, 001, 870	0	2	May 1	[25] 962, 601, 285
North Carolina	12, 506, 185	499, 801	12, 006, 384		12, 006, 384	9, 000	7, 702, 647		4, 294, 737		4	5	Apr. 1	260, 210, 528
North Dakota	2, 968, 370	1, 169, 144	1, 799, 226	1, 876	1, 801, 102	25, 000	1, 396, 102	380, 000			2	3	July 1	71, 591, 708
Ohio	35, 741, 107	1, 658, 919	34, 082, 188		34, 082, 188		21, 316, 968	6, 567, 787		[28] 6, 197, 433	3	4	Apr. 17	910, 154, 885
Oklahoma	10, 870, 642	29, 033	10, 841, 609		10, 841, 609		7, 798, 066	3, 043, 543			3	4	June 22	314, 388, 292
Oregon	4, 888, 886	346, 284	4, 542, 602		4, 542, 602	8, 851	4, 533, 751				3	[29] 3		[30] 152, 090, 900
Pennsylvania	35, 887, 503	140, 189	35, 747, 314	10, 502	35, 757, 816	145, 825	27, 061, 099	5, 217, 705	3, 333, 187		3	4	July 1	1, 047, 914, 175
Rhode Island	1, 556, 538	13, 779	1, 542, 759	3, 202	1, 545, 961		1, 160, 271		385, 690		2	2		77, 826, 879
South Carolina	6, 895, 951	29, 343	6, 866, 608	4, 468	6, 871, 076		5, 725, 897	1, 145, 179			5	6	Mar. 16	118, 038, 130
South Dakota	4, 680, 153	1, 134, 388	3, 545, 765		3, 545, 765	10, 500	2, 585, 894		845, 416	[8] 103, 955	4	4		88, 644, 138
Tennessee	9, 290, 853		9, 290, 853		9, 290, 853	46, 454	4, 936, 989	1, 719, 329	[31] 2, 588, 081		3	5	Feb. 17	194, 497, 225
Texas	23, 092, 702	775, 208	22, 317, 494		22, 317, 494		16, 738, 121			[32] 5, 579, 373	2	4	July 16	761, 421, 692
Utah	1, 979, 226		1, 979, 226	384	1, 979, 610	4, 150	1, 536, 960		438, 500		3½	3½		56, 546, 967
Vermont	1, 703, 091		1, 703, 091		1, 703, 091		1, 703, 091				3	4	Apr. 1	43, 990, 554
Virginia	10, 419, 421	524, 480	9, 894, 941		9, 894, 941	([33])	6, 596, 627	3, 298, 314			5	5		197, 898, 821
Washington	6, 461, 106	518, 067	5, 943, 039		5, 943, 039	([34])	4, 663, 362	1, 279, 677			2	3	July 1	233, 333, 570
West Virginia	5, 061, 572	195, 380	4, 866, 192	7, 106	4, 873, 298		2, 376, 725		2, 496, 573		4	4		121, 654, 788
Wisconsin	7, 867, 899	382, 860	7, 485, 039		7, 485, 039	10, 899	2, 752, 212	4, 183, 051		[16] 538, 877	2	2		374, 251, 957
Wyoming	1, 296, 299		1, 296, 299		1, 296, 299	4, 066	1, 024, 157	268, 076			3	4	Apr. 1	34, 242, 816
District of Columbia	1, 437, 754	9, 573	1, 428, 181		1, 428, 181					[35] 1, 428, 181	2	2		71, 409, 032
Total			431, 311, 519	324, 935	431, 636, 454	778, 178	297, 967, 756	85, 113, 708	23, 371, 785	24, 405, 027	Aver. rate..3. 22			, 180, 062

1 This is the net gasoline tax earned after deduction of refunds for exemptions according to law.
2 Many States pay collections costs from other State funds, and when the amounts are reported they are noted.
3 Payments for State highway bonds except as noted.
4 Includes 1,075,385 gallons at 2-cent rate under old law but not previously reported.
5 Paid from State budget, $14,433.
6 No refunds reported this year.
7 Consists of $514,439 for State bonds and $1,516,694 for county bonds.
8 Reserve for refunds.
9 Includes all expenses of State inspector of oils.
10 For town and city streets.
11 Consists of $2,758,354 for city streets, $2,233,735 for schools and permanent buildings, and $11,803 for refund reserve.
12 For public schools.
13 For last 5 months of year.
14 Estimate from 1927 data.
15 Funds held by courts pending decision.
16 For city streets.
17 From State general fund, $15,000.
18 State appropriation of $7,500.
19 For Baltimore city streets and grade crossings.
20 Consists of $400,000 for city streets and $3,920 (from dealers' licenses) to State general fund.
21 Special additional tax of 2 and 3 cents in Hancock and Harrison Counties for sea wall to protect road.
22 Gallons taxed for highway purposes and also reported separately as taxed for sea wall included only once.
23 Exemption claimed upon purchase.
24 For State department of commerce and navigation.
25 For last 8 months of year.
26 Charged to State general fund, $24,504.
27 Consists of $50,000 for reserve for refunds and $951,870 for New York City.
28 Consists of $75,000 for rotary fund for refunds and $6,122,433 for municipal streets.
29 Tax increased to 4 cents on Jan. 1, 1930.
30 Includes 4,025,392 gallons of distillate taxed at 2½ cents.
31 Consists of $652,833 for State bond payments and $1,935,249 for county bonds.
32 Free school fund.
33 State appropriation of $11,088.
34 Paid from motor-vehicle fund, $7,000.
35 For repair and improvement of Washington streets.
36 Approximate grand total of gallons of gasoline consumed by motor vehicles allowing for estimated gallons used in Illinois and New York during early months in year when no tax was assessed.

SOIL SAMPLING WITH A COMPRESSED AIR UNIT

By H. F. BLANEY, Associate Irrigation Engineer, and C. A. TAYLOR, Assistant Irrigation Engineer, Division of Agricultural Engineering, Bureau of Public Roads

FIGURE 1.—COMPRESSOR UNIT MOUNTED ON TRUCK

In making investigations regarding rainfall penetration in southern California, the authors [1] are conducting soil moisture studies in which soil samples are taken at 1-foot intervals to a depth of 18 feet, using the improved soil tube.[2] The success of this work depends, to a considerable extent, upon the speed with which a large number of samples can be obtained, and since the physical effort required may become the limiting factor in obtaining samples at considerable depths, a compressed-air unit has been adapted for use in driving the tubes in order that as many samples as desired can be taken quickly and easily. A description of the apparatus is presented as it may be of interest to investigators in several fields, such as that of highway engineering.

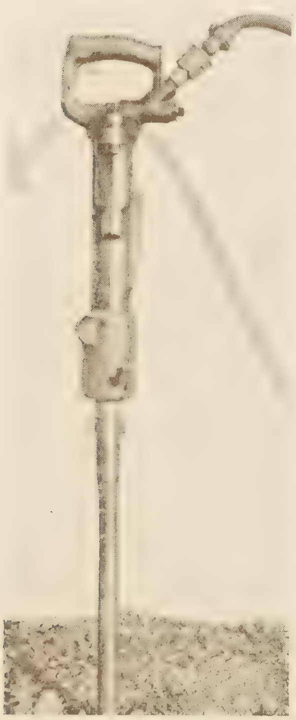


FIGURE 2.—AIR HAMMER

The apparatus consists of a compressor unit mounted on a truck, a light air hammer, and a 100-foot length of hose. Figures 1 and 2 show the mounting of the apparatus and the manner in which soil tubes are driven. The compressor unit consists of a 2-cylinder air compressor coupled directly to a 4-cylinder gasoline engine with a self-starter. The air receiver and gasoline tank are mounted in front of the compressor. The complete unit is mounted on a channel iron frame and bolted to one side of the truck floor, thus leaving one-half of the truck body space available for carrying other equipment. A reel with 100 feet of ½-inch rubber hose is mounted at the back of the truck, and special hose couplings permit connections to be quickly made to the hammer and compressor. An air pressure control automatically maintains any desired pressure up to 150 pounds per square inch and the displacement of the compressor is 59 cubic feet per minute at 800 revolutions per minute.

The hammer is of the clay-digger type, capable, when working under an air pressure of 100 pounds per square inch, of delivering 2,250 blows per minute, each blow striking with a force of 16 foot-pounds. Extending down into the soil tube is a 6-inch guide rod, the shoulder of which may be seen resting against the end of the soil tube in Figure 2. The trigger grip gives the operator ready control of the hammer, and by properly cramping the guide rod in the end of the soil tube, very little vibration is transmitted to the arms of the operator. The jack [3] used for pulling the soil tubes is shown on the ground in Figure 1.

The set-up for sampling is quickly made, as it is only necessary to reel the hose out to the desired location and snap it onto the compressor. This unit has been in use since October, 1929, and has proved very satisfactory. It is estimated that the time of sampling has been cut to one-third of that required for handwork.

[1] Under the supervision of W. W. McLaughlin, Associate Chief of the Division of Agricultural Engineering, Bureau of Public Roads, United States Department of Agriculture, in cooperation with the State of California, Department of Public Works.

[2] "An Improved Soil-sampling Tube," by F. J. Veihmeyer, Soil Science, Vol XXVII, No. 2 (February, 1929).

[3] "An Efficient Soil Tube Jack," by C. A. Taylor and H. F. Blaney, Soil Science, Vol. XXVII, No. 5 (May, 1929).

ROAD PUBLICATIONS OF BUREAU OF PUBLIC ROADS

Applicants are urgently requested to ask only for those publications in which they are particularly interested. The Department can not undertake to supply complete sets nor to send free more than one copy of any publication to any one person. The editions of some of the publications are necessarily limited, and when the Department's free supply is exhausted and no funds are available for procuring additional copies, applicants are referred to the Superintendent of Documents, Government Printing Office, this city, who has them for sale at a nominal price, under the law of January 12, 1895. Those publications in this list, the Department supply of which is exhausted, can only be secured by purchase from the Superintendent of Documents, who is not authorized to furnish publications free.

ANNUAL REPORTS

Report of the Chief of the Bureau of Public Roads, 1924.
Report of the Chief of the Bureau of Public Roads, 1925.
Report of the Chief of the Bureau of Public Roads, 1927.
Report of the Chief of the Bureau of Public Roads, 1928.
Report of the Chief of the Bureau of Public Roads, 1929.

DEPARTMENT BULLETINS

No. *136D. Highway Bonds. 20c.
257D. Progress Report of Experiments in Dust Prevention and Road Preservation, 1914.
*314D. Methods for the Examination of Bituminous Road Materials. 10c.
*347D. Methods for the Determination of the Physical Properties of Road-Building Rock. 10c.
*370D. The Results of Physical Tests of Road-Building Rock. 15c.
386D. Public Road Mileage and Revenues in the Middle Atlantic States, 1914.
387D. Public Road Mileage and Revenues in the Southern States, 1914.
388D. Public Road Mileage and Revenues in the New England States, 1914.
390D. Public Road Mileage and Revenues in the United States, 1914. A Summary.
407D. Progress Reports of Experiments in Dust Prevention and Road Preservation, 1915.
463D. Earth, Sand-Clay, and Gravel Roads.
*532D. The Expansion and Contraction of Concrete and Concrete Roads. 10c.
*583D. Reports on Experimental Convict Road Camp, Fulton County, Ga. 25c.
*660D. Highway Cost Keeping. 10c.
*670D. The Results of Physical Tests of Road-Building Rock in 1916 and 1917.
*691D. Typical Specifications for Bituminous Road Materials. 10c.
*724D. Drainage Methods and Foundations for County Roads. 20c.
1216D. Tentative Standard Methods of Sampling and Testing Highway Materials, adopted by the American Association of State Highway Officials and approved by the Secretary of Agriculture for use in connection with Federal-aid road construction.
1259D. Standard Specifications for Steel Highway Bridges, adopted by the American Association of State Highway Officials and approved by the Secretary of Agriculture for use in connection with Federal-aid road work.
1279D. Rural Highway Mileage, Income, and Expenditures 1921 and 1922.
1486D. Highway Bridge Location.

DEPARTMENT CIRCULARS

No. 94C. T. N. T. as a Blasting Explosive.
331C. Standard Specifications for Corrugated Metal Pipe Culverts.

TECHNICAL BULLETIN

No. 55. Highway Bridge Surveys.

MISCELLANEOUS CIRCULARS

No. 62M. Standards Governing Plans, Specifications, Contract Forms, and Estimates for Federal-Aid Highway Projects.
*93M. Direct Production Costs of Broken Stone. 25c.
*109M. Federal Legislation and Regulations Relating to the Improvement of Federal-Aid Roads and National-Forest Roads and Trails. 10c.

SEPARATE REPRINTS FROM THE YEARBOOK

No. 914Y. Highways and Highway Transportation.
937Y. Miscellaneous Agricultural Statistics.
1036Y. Road Work on Farm Outlets Needs Skill and Right Equipment.

TRANSPORTATION SURVEY REPORTS

Report of a Survey of Transportation on the State Highway System of Connecticut.
Report of a Survey of Transportation on the State Highway System of Ohio.
Report of a Survey of Transportation on the State Highways of Vermont.
Report of a Survey of Transportation on the State Highways of New Hampshire.
Report of a Plan of Highway Improvement in the Regional Area of Cleveland, Ohio.
Report of a Survey of Transportation on the State Highways of Pennsylvania.

REPRINTS FROM THE JOURNAL OF AGRICULTURAL RESEARCH

Vol. 5, No. 17, D- 2. Effect of Controllable Variables upon the Penetration Test for Asphalts and Asphalt Cements.
Vol. 5, No. 19, D- 3. Relation Between Properties of Hardness and Toughness of Road-Building Rock.
Vol. 5, No. 24, D- 6. A New Penetration Needle for Use in Testing Bituminous Materials.
Vol. 6, No. 6, D- 8. Tests of Three Large-Sized Reinforced-Concrete Slabs Under Concentrated Loading.
Vol. 11, No. 10, D-15. Tests of a Large-Sized Reinforced-Concrete Slab Subjected to Eccentric Concentrated Loads.

* Department supply exhausted.

UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF PUBLIC ROADS

CURRENT STATUS OF FEDERAL AID ROAD CONSTRUCTION

AS OF

MARCH 31,1930

STATE	COMPLETED MILEAGE	UNDER CONSTRUCTION					APPROVED FOR CONSTRUCTION					BALANCE OF FEDERAL-AID FUNDS AVAILABLE FOR NEW PROJECTS	STATE
		Estimated total cost	Federal aid allotted	MILEAGE			Estimated total cost	Federal aid allotted	MILEAGE				
				Initial	Stage[1]	Total			Initial	Stage[1]	Total		
Alabama	2,120.6	$ 1,947,423.11	$ 957,297.62	69.8	21.0	90.8	$ 510,075.83	$ 255,037.91	21.7	1.1	22.8	$ 3,202,594.73	Alabama
Arizona	818.3	3,532,598.06	2,651,919.56	124.2	133.8	258.0	215,374.91	187,121.20	4.6	19.2	23.8	1,849,258.88	Arizona
Arkansas	1,737.8	5,473,611.07	2,551,362.89	143.8	31.9	175.7	1,324,370.00	565,075.03	54.2	18.9	73.1	1,333,302.74	Arkansas
California	1,884.6	6,745,866.53	2,983,289.64	167.9	8.9	176.8	1,277,090.21	267,727.02	6.7	16.0	22.7	1,467,821.23	California
Colorado	1,179.6	4,529,096.13	2,358,012.11	178.1	38.7	216.8	571,883.75	318,322.63	32.3		32.3	2,146,030.42	Colorado
Connecticut	240.3	1,095,890.67	455,428.80	6.5		6.5	1,336,849.84	567,777.59	7.1		7.1	618,817.96	Connecticut
Delaware	249.3	601,316.96	222,817.99	16.6		16.6	374,914.90	172,500.96	15.9		15.9	239,106.44	Delaware
Florida	467.2	5,002,294.59	2,269,116.74	102.0	5.5	107.5	953,391.19	436,618.46	31.4		31.4	1,148,290.48	Florida
Georgia	2,721.2	1,131,814.96	536,760.13	38.3	8.5	46.8	358,129.82	178,524.78	20.4	.3	20.7	3,860,711.80	Georgia
Idaho	1,193.9	713,108.23	430,934.62	55.7	27.8	83.5	242,133.15	145,452.71	24.3		24.3	1,311,447.00	Idaho
Illinois	2,034.5	15,137,362.22	6,676,755.85	430.1		430.1	609,858.67	304,929.33	20.7		20.7	5,742,647.49	Illinois
Indiana	1,344.0	7,509,467.02	3,525,586.95	233.1		233.1	374,724.44	178,170.00	11.9		11.9	1,944,445.43	Indiana
Iowa	3,130.0	818,396.20	343,538.63	15.1	18.5	33.6	4,594,049.99	2,034,098.01	30.6	138.9	169.5	37,833.61	Iowa
Kansas	2,717.6	4,755,346.35	2,197,784.31	294.0	17.5	311.5	1,478,303.18	727,360.10	75.9	8.3	84.2	1,514,965.75	Kansas
Kentucky	1,397.8	4,238,953.63	2,013,037.35	235.5	20.2	255.7						1,856,480.70	Kentucky
Louisiana	1,355.7	4,070,418.63	1,988,556.96	126.1	12.5	138.6	626,770.55	307,613.70	10.1	1.8	11.9	1,473,105.97	Louisiana
Maine	520.0	1,905,021.13	736,937.56	47.5		47.5	87,912.01	43,956.00	5.6		5.6	1,530,800.42	Maine
Maryland	630.7	1,428,486.60	598,781.99	58.0		58.0	204,641.50	92,829.63	7.6	2.1	9.7	542,274.28	Maryland
Massachusetts	660.2	2,357,902.66	733,497.62	31.0		31.0	576,151.16	183,051.50	8.0	2.6	10.6	2,103,642.60	Massachusetts
Michigan	1,605.1	9,391,839.03	4,001,321.45	209.6	30.5	240.1	421,348.73	204,445.00	17.8		17.8	2,096,433.60	Michigan
Minnesota	4,107.5	5,684,979.57	1,554,300.00	144.9	85.3	230.2	5,328,379.60	1,190,475.61	77.0	161.4	238.4	147,703.39	Minnesota
Mississippi	1,810.5	1,846,209.28	716,929.45	65.6	7.7	73.3						2,647,800.78	Mississippi
Missouri	2,435.5	5,373,345.10	2,046,191.17	74.1	66.7	140.8	7,012,636.09	2,309,410.71	95.3	73.9	169.2	195,636.06	Missouri
Montana	1,722.2	7,543,696.71	4,393,686.42	519.4	12.8	532.2	970,567.45	527,822.26	63.2	50.8	114.0	2,953,296.35	Montana
Nebraska	3,596.3	7,290,479.06	3,471,451.51	330.5	148.1	478.6	1,271,876.37	531,698.22	29.4	39.4	68.8	1,707,151.01	Nebraska
Nevada	1,124.1	1,274,254.02	1,122,892.45	120.4	96.8	217.2	301,187.58	267,605.15		32.7	32.7	565,156.33	Nevada
New Hampshire	350.6	414,924.02	111,495.00	5.4	2.1	7.5	183,425.63	71,206.14	2.1		2.1	377,976.34	New Hampshire
New Jersey	500.2	4,136,550.77	852,015.00	56.8		56.8						1,091,319.08	New Jersey
New Mexico	1,935.0	3,222,209.17	2,043,523.55	186.5	2.1	188.6	814,414.64	571,458.47	18.4	18.2	36.6	711,851.51	New Mexico
New York	2,458.2	18,480,217.76	3,787,505.00	253.2		253.2	5,596,400.00	989,550.00	65.7		65.7	6,307,935.06	New York
North Carolina	1,765.2	1,519,021.81	748,811.25	92.0	22.3	114.3	1,508,490.24	745,040.21	76.1		76.1	2,112,719.58	North Carolina
North Dakota	4,175.7	1,196,709.89	482,732.47	205.4	101.6	307.0	1,796,183.97	916,867.41	313.1	165.8	478.9	1,124,324.24	North Dakota
Ohio	2,177.8	12,929,559.21	3,750,225.17	206.9	18.8	225.7	6,881,324.21	2,418,079.39	135.5	20.3	155.8	1,682,333.36	Ohio
Oklahoma	1,873.8	2,684,036.66	1,198,801.72	80.4	29.7	110.1	2,478,599.42	1,070,123.01	61.1	43.2	104.3	617,362.08	Oklahoma
Oregon	1,147.7	2,809,226.36	1,687,826.48	176.9	56.2	233.1	2,254,451.65	1,263,658.38	50.9	29.2	80.1	256,940.38	Oregon
Pennsylvania	2,266.2	14,653,228.83	3,494,552.43	212.9	14.1	227.0	4,275,514.21	1,124,861.25	60.0		60.0	2,061,894.90	Pennsylvania
Rhode Island	184.8	1,381,818.85	395,698.58	18.5		18.5						617,574.52	Rhode Island
South Carolina	1,896.7	2,999,920.73	1,035,176.18	86.6	22.3	108.9	1,579,062.09	571,970.84	41.0	32.9	73.9	840,066.19	South Carolina
South Dakota	3,430.7	4,067,731.42	2,162,173.18	423.7	116.8	540.5	602,425.30	308,794.28	46.7	47.8	94.5	783,348.50	South Dakota
Tennessee	1,243.3	1,871,857.29	817,145.16	74.8		74.8	685,577.23	342,788.61	19.0	12.5	31.5	2,139,265.12	Tennessee
Texas	6,745.0	10,826,830.66	4,394,669.44	311.6	89.6	401.2	2,527,554.33	1,006,611.57	110.6	23.9	134.5	3,844,092.67	Texas
Utah	988.9	589,171.08	381,932.01	25.8		25.8	404,693.19	296,379.18	21.8	8.1	29.9	745,883.38	Utah
Vermont	257.8	1,009,330.13	299,380.24	20.1		20.1	1,343,211.60	259,344.01	22.4	2.6	25.0	81,873.19	Vermont
Virginia	1,413.9	3,336,503.10	1,562,568.09	145.1	15.6	160.7	1,249,474.85	600,904.46	35.1	7.7	42.8	389,648.61	Virginia
Washington	914.4	3,238,771.51	1,215,000.00	64.9	40.2	105.1	742,854.61	324,200.00	24.3		24.3	1,036,961.29	Washington
West Virginia	712.9	3,170,534.29	1,207,156.33	75.4	12.5	87.9	735,889.87	350,767.91	14.1	6.2	20.3	455,471.78	West Virginia
Wisconsin	2,259.1	3,194,816.98	1,399,185.13	121.0	1.7	122.7	664,293.71	270,000.00	18.8		18.8	1,627,965.68	Wisconsin
Wyoming	1,757.1	1,333,730.81	862,873.64	118.6	24.3	142.9	34,843.01	22,874.43	4.7		4.7	929,005.82	Wyoming
Hawaii	39.5	964,949.48	384,686.43	23.2		23.2						1,438,289.16	Hawaii
TOTALS	83,298.0	211,430,846.31	85,813,322.25	6,823.5	1,362.6	8,186.1	67,381,304.68	25,523,103.05	1,813.1	985.8	2,798.9	75,489,846.90	TOTALS

[1] The term stage construction refers to additional work done on projects previously improved with Federal aid. In general, such additional work consists of the construction of a surface of higher type than was provided in the initial improvement.

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