

U. S. BUREAU OF PUBLIC ROADS

Report

of the

MAINTENANCE SECTION

DIVISION OF CONSTRUCTION

January 1, 1936 - December 31, 1936.

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UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PUBLIC ROADS
WASHINGTON, D. C.

IN YOUR REPLY PLEASE

REFER TO FILE NO. B-3

April 14, 1937.

Mr. H. K. Bishop,
Chief, Division of Construction,
U. S. Bureau of Public Roads,
Washington, D. C.


Dear Sir:

I transmit herewith the report of the Maintenance Section of the Construction Division showing the maintenance status of Federal aid, Public Works, Works Program, Flood Relief, Federal Lands and Forest Roads in the Continental United States, Hawaii and Alaska. The report contains a brief outline of the results obtained, also descriptions and illustrations of maintenance equipment developed by State highway organizations.

This report covers the period from January 1, 1936 to December 31, 1936 and presents the status of the latter date.

Respectfully submitted,

Maintenance Section, Division of Construction,


By R. F. Severs,
Ass't. Engineer of Maintenance.

MAINTENANCE OF FEDERAL AID, PUBLIC WORKS, WORKS PROGRAM, FLOOD
RELIEF, FEDERAL LANDS AND FOREST ROADS
Year ending December 31, 1936

Prepared by
H. A. Radzikowski,
Associate Highway Engineer.

MAINTENANCE INSPECTIONS

Maintenance inspections by Bureau of Public Roads engineers in the Continental United States, Alaska and Hawaii during the year covered 33,899 projects, comprising 158,846.3 miles of highways. They include Federal aid, Flood Relief, Federal Lands, National Recovery, Works Program and Forest projects. The Federal investment in these projects together with others placed under maintenance during the maintenance inspection period and their status reported through final construction inspection reports was \$2,390,062,223 as of December 31, 1936. The total construction cost including the States' share of funds was \$3,926,208,867..

At least one maintenance inspection was required during each half of the calendar year 1936 on all projects on which Federal funds were expended under the administration of the Bureau. The quality of maintenance was rated during these inspections and a copy of the ratings for each project submitted to the Washington Office for review, analysis and recording. Additional inspections were made on projects found receiving unsatisfactory maintenance and the State requested to improve the quality. A report of the analysis of maintenance inspections made by the Maintenance Section was sent to the Districts at the end of each inspection period. These reports indicate that the quality of maintenance in thirty-

one States is of sufficient merit to require only one maintenance inspection during the ensuing calendar year. In the seventeen remaining States the practice of making semi-annual maintenance inspections is being continued.

There has been noticeable improvement in maintenance results in most States since the assignment of full time Maintenance Engineers by the District Offices in late 1935. More detail attention is being given to unsatisfactory conditions and those projects which are satisfactory but need attention. This is reflected in the maintenance quality ratings which are generally higher than those for preceding periods. In some instances the problem of seeking improvement in the quality of maintenance is intensified by limited State maintenance funds, State maintenance engineers' limited authority over personnel, floods, the effect of unusual dry conditions during the summer and the severe winter of 1935-1936. On projects where the maintenance is below standard reports indicate that the districts received assurance from State highway officials that every effort will be made to place the projects in satisfactory condition.

The following tables list by States the number of projects and mileage inspected for maintenance:-

NUMBER OF PROJECTS AND MILEAGE INSPECTED
By Field Engineers of the Bureau
as reported by the Districts
Inspection period ending December 31, 1936.

(Forest projects are listed in a separate table)

State	Total projects	Total mileage
Montana	703	4,474.5
Oregon	497	2,312.0
Washington	542	1,926.1
Arizona	245	1,939.4
California	619	3,699.6
Nevada	217	2,259.0
Colorado	674	2,902.6
New Mexico	345	3,379.5
Wyoming	408	3,089.9
Minnesota	1,180	5,884.1
North Dakota	923	7,130.0
South Dakota	652	5,477.1
Wisconsin	1,122	3,738.0
Iowa	959	5,194.0
Kansas	1,172	5,081.0
Missouri	1,454	5,336.0
Nebraska	771	5,046.4
Arkansas	597	2,958.3
Louisiana	323	1,981.9
Oklahoma	943	3,595.5
Texas	1,479	11,804.2
Illinois	1,238	4,895.1
Indiana	608	2,949.3
Kentucky	705	3,298.3
Michigan	831	3,617.3
Alabama	399	2,759.8
Florida	235	1,030.9
Georgia	743	3,730.9
Mississippi	324	2,550.1
Tennessee	471	2,253.4
Connecticut	169	498.6
Maine	643	1,154.1
Massachusetts	405	1,036.7
New Hampshire	504	573.3
New Jersey	268	787.0
New York	1,431	4,998.4
Rhode Island	179	405.1
Vermont	406	621.0

Table I (cont)

State	Total projects	Total mileage
Dist. of Columbia	53	30.0
Delaware	164	582.3
Maryland	400	1,067.7
Ohio	1,518	3,996.1
Pennsylvania	1,474	4,606.1
Idaho	409	2,241.7
Utah	370	1,839.3
North Carolina	809	3,894.3
South Carolina	537	2,787.0
Virginia	1,229	3,544.1
West Virginia	411	1,298.0
Totals.....	32,758	152,255.0

The above mileage includes the following types of surface:-

	Mileage
Graded and drained.....	5,875.3
Sand-clay, gravel and macadam:	
Untreated.....	35,898.1
Treated.....	22,313.6
Low cost bituminous mixtures.....	21,058.7
Bituminous macadam.....	5,637.6
Bituminous concrete.....	7,808.9
Portland Cement Concrete.....	51,284.9
Block.....	1,305.0
Sub-total.....	151,182.1
Bridges.....	321.0
Roadside improvement.....	751.9
Grand total.....	152,255.0

Table II
FOREST PROJECTS
Mileage under Maintenance as of December 31, 1936.
As reported by the Districts

District	Total number of projects	Mileage	Projects Maintained by B.P.R. Number	Mileage	Projects Maintained by Forest Service Number	Mileage	Projects Maintained by Local Authority Number	Mileage
<u>District 1</u>	<u>352</u>	<u>1,910.109</u>	<u>63</u>	<u>231.303</u>	<u>14</u>	<u>127.450</u>	<u>275</u>	<u>1,551.356</u>
Montana	107	591.076	16	71.045	8	112.269	83	407.762
Oregon	170	999.268	30	114.064	4	9.275	136	875.929
Washington	75	319.765	17	46.194	2	5.906	56	267.665
<u>District 2</u>	<u>228</u>	<u>1,524.103</u>	<u>24</u>	<u>143.139</u>	<u>2</u>	<u>3.579</u>	<u>202</u>	<u>1,377.385</u>
Arizona	75	565.632	11	63.126			64	502.506
California	128	784.657	12	63.913	2	3.579	114	717.165
Nevada	25	173.814	1	16.100			24	157.714
<u>District 3</u>	<u>247</u>	<u>1,257.006</u>	<u>87</u>	<u>390.834</u>	<u>3</u>	<u>4.154</u>	<u>157</u>	<u>862.018</u>
Colorado	109	532.108	44	159.170	2	4.135	63	368.803
New Mexico	43	304.993	20	111.605			23	193.388
So. Dakota	18	61.244					18	61.244
Wyoming	77	358.661	23	120.059	1	0.019	53	238.583
<u>District 4</u>	<u>30</u>	<u>129.505</u>					<u>30</u>	<u>129.505</u>
Minnesota	28	113.857					28	113.857
Wisconsin	2	15.648					2	15.648
<u>District 5</u>	<u>3</u>	<u>16.742</u>					<u>3</u>	<u>16.742</u>
Missouri	2	8.063					2	8.063
Nebraska	1	8.679					1	8.679
<u>District 6</u>	<u>20</u>	<u>141.061</u>					<u>20</u>	<u>141.061</u>
Arkansas	17	125.007					17	125.007
Oklahoma	3	16.054					3	16.054
<u>District 7</u>	<u>14</u>	<u>48.357</u>					<u>14</u>	<u>48.357</u>
Illinois	1	1.490					1	1.490
Kentucky	1	.049					1	.049
Michigan	12	46.818					12	46.818

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Table II (cont)

District and State	: Total number : of projects :	: Mileage	: Projects		: Projects		: Projects			
			: Number :	: Mileage :	: Number :	: Mileage :	: Number :	: Mileage		
			: Maintained by B.P.R. :		: Maintained by Forest Service :		: Maintained by Local Authority			
<u>District 8</u>	<u>23</u>	<u>134.704</u>					<u>23</u>	<u>134.704</u>		
Alabama	1	5.059					1	5.059		
Florida	10	61.589					10	61.589		
Georgia	6	20.673					6	20.673		
Tennessee	6	47.383					6	47.383		
<u>District 9</u>										
N.Hampshire	10	27.658					10	27.658		
<u>District 10</u>										
Pennsylvania	5	9.111					5	9.111		
<u>District 11</u>										
Alaska	26	254.844	26	254.844						
<u>District 12</u>	<u>164</u>	<u>1,040.098</u>	<u>33</u>	<u>171.041</u>			<u>131</u>	<u>869.057</u>		
Idaho	111	687.947	23	131.558			88	556.389		
Utah	53	352.151	10	39.483			43	312.668		
<u>District 14</u>	<u>19</u>	<u>98.003</u>					<u>19</u>	<u>98.003</u>		
Nc.Carolina	7	50.888					7	50.888		
So.Carolina	2	15.629					2	15.629		
Virginia	7	22.874					7	22.874		
W.Virginia	3	8.612					3	8.612		
Totals.....:	1,141	6,591.301	233	1,191.161	:	19	135.183	:	889	5,264.957

Maintenance Studies

The results of studies of weed control and eradication on roadsides and of snow removal and ice treatment practices during the winter season of 1935-1936 were presented in reports prepared by the Maintenance Section. A report on snow removal was also prepared for a film strip and recorded lecture. A film strip and record are now in the process of development.

The study of maintenance costs on special selected sections through the facilities of the District offices is progressing favorably. We now have maintenance costs for a two-year period from a number of States reported under uniform classifications. Due, however, to the fluctuation in the amount of maintenance work performed from year to year - a curtailment of activities in one year due to limited funds and perhaps a campaign of surface patching, etc., the following year - it is believed that an average annual maintenance cost for a longer period would be more representative of average conditions.

The following is a tabulation showing types, mileage and percentage now involved in the maintenance cost studies as shown in programs submitted by the forty-seven States:-

<u>Type of surface</u>	<u>Number of sections</u>	<u>Total mileage</u>	<u>Percent of mileage</u>
Concrete.....	433	6,679.32	35.69
Brick.....	14	157.69	.84
Bituminous.....	286	3,001.68	16.04
Oil processed.....	140	2,801.85	14.97
Surf. tr. stone, gravel, sand-clay, etc.....	177	2,294.45	12.26
Untreated stone, gravel, etc...	173	3,587.48	19.17
Topsoil.....	5	90.68	.48
Graded.....	5	103.26	.55
Totals.....	1,233	18,716.41	100.00

MAINTENANCE EQUIPMENT - New Developments Reported by
District Maintenance Engineers

Equipment of the nature described below may be in use in other States. They are, however, reported by the District Maintenance Engineers as new developments in the States in which they were observed. Equipment built by the State highway departments illustrate the resourcefulness of highway maintenance workers.

Earth Loader for Cleaning Ditches and Shaping Shoulders

Submitted by Mr. J. F. Cameron,
Maintenance Engineer, District No. 1

Equipment built by the State
of Washington

The loading machine illustrated in the accompanying photographs was developed primarily to facilitate rapid and economical loading of excess material left from shaping ditches and shoulders. The present machine has a number of improvements resulting from experience under varying conditions of soil, turf and moisture. The first machine constructed in 1935 was built almost entirely of salvaged parts at the State equipment shops. It would not, however, pick up clods of turf or grass. This deficiency was remedied by installing a series of teeth on a separately powered axle to cut the sod and rake the material into the elevated buckets and thence onto the conveyor belt.

"The cost of ditching, including picking up material with the loader and distributing it by truck where shoulders are deficient in width, runs from \$40.00 to \$90.00 per mile. The cost the second year, since the ditch has been formed, is approximately \$40.00 per mile. Yardage handled varies from 80 to 200 cu. yds. per mile.

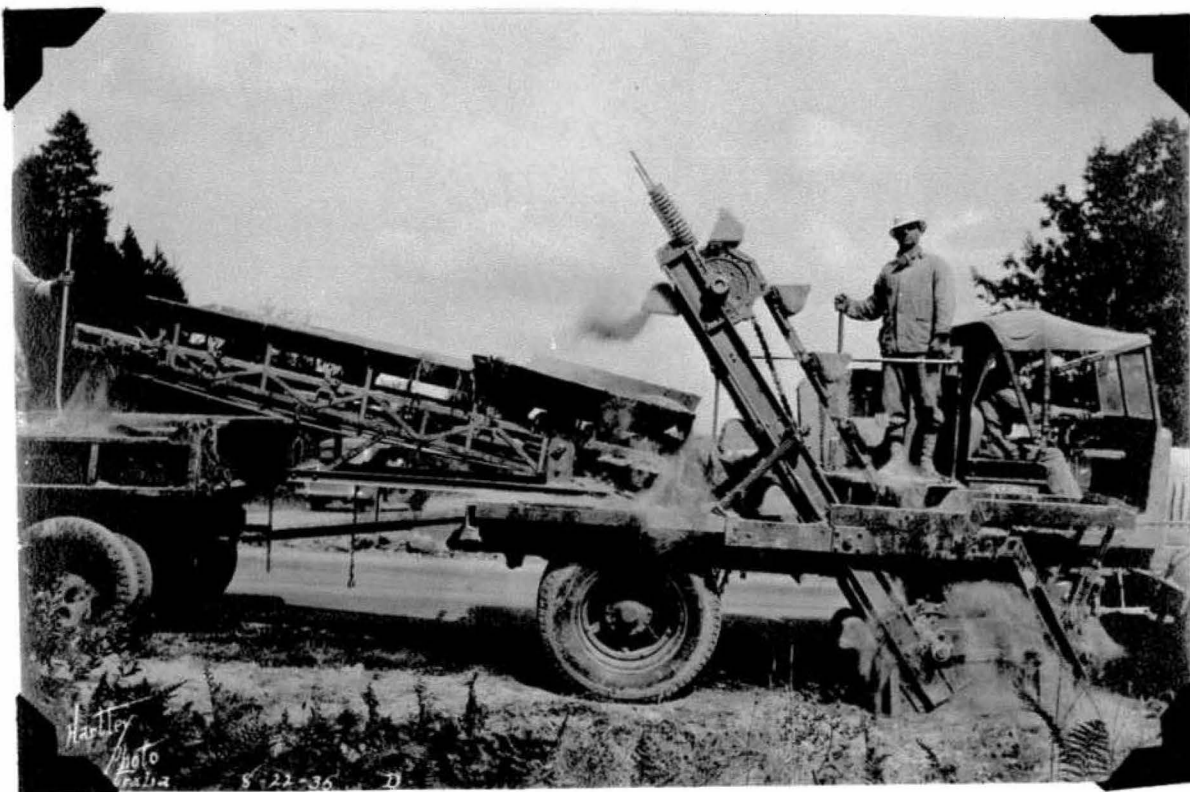
"The above costs include a power grader, 110 H. P. truck for ditching, the loader and necessary hauling trucks, as well as a small grader for dressing shoulders. The only hand work done in this operation is the cleaning of culvert inlets.

"This machine is used in ditching about 90% of the road mileage each year at a saving over hand methods, with superior results being obtained.

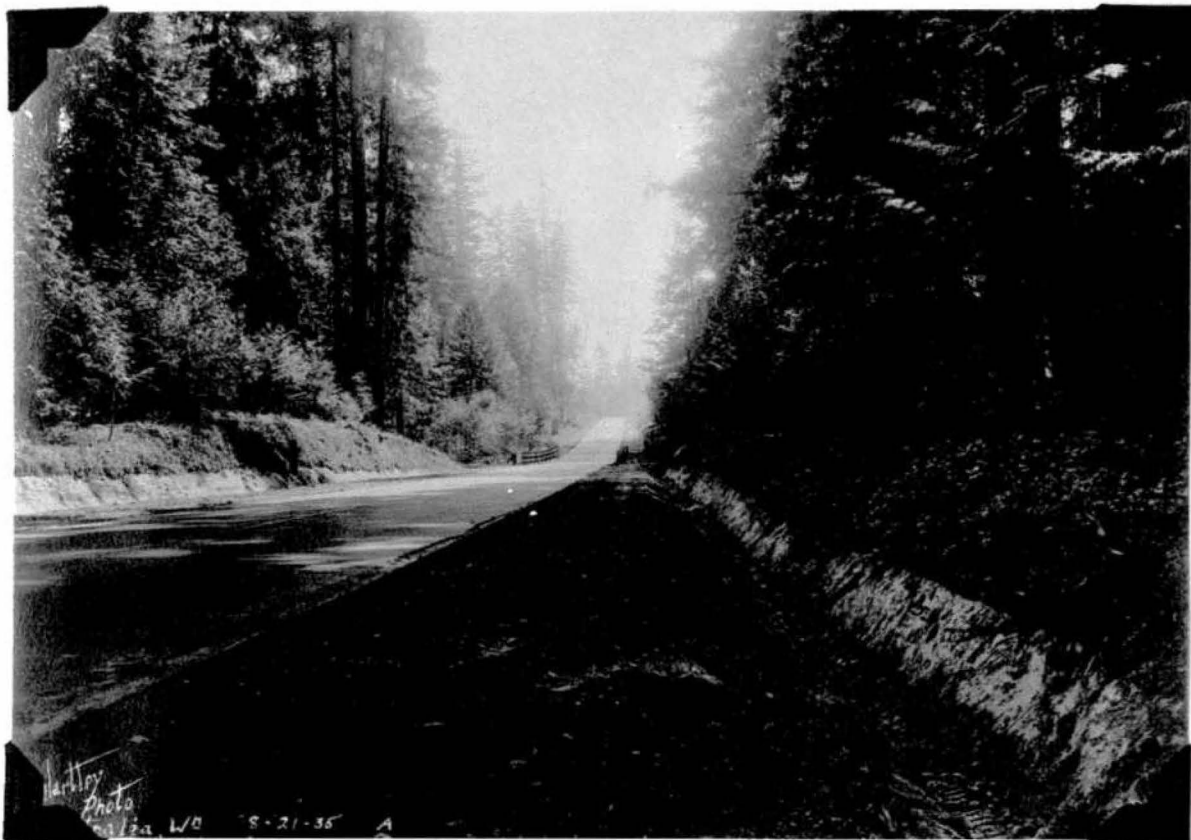
"The loader has also been successfully used on many projects for loading stockpiled materials and for picking up excess surfacing materials windrowed on shoulders."



Loader developed by Washington Department of Highways, Maintenance Division. Note teeth mounted ahead of buckets for cutting sod and raking clods into buckets. Truck is towed behind loader while in operation.



View of loader in operation. Under ordinary conditions time required to load 2-yard truck is from $1\frac{1}{2}$ to 2 minutes. Note separate power unit for operation of buckets and conveyor.



Typical ditch and shoulder appearance after blading and removal of excess material with loader and trucks. The small amount of dirt on edge of pavement is all that is left by loader. This is brushed off by a small blade with steel broom which follows loader and gives final dressing to shoulder.

Ditch Cleaner

Submitted by Mr. R. S. Corlew,
Maintenance Engineer, District No. 3

Equipment built by the State
of Colorado.

"The ditch cleaner was built in the field by a maintenance patrolman and helper operating between Craig and Meeker."

"The 'ditch cleaner' is mounted on an old obsolete blade grader and consists of an old Model A Ford engine and chassis which drives a bucket elevator. The parts were gathered up from various pieces of abandoned equipment. A tractor is used to pull the outfit. Though rather crude in appearance, the machine works successfully and the idea is a good one."



Ditch cleaner - rear view



Front view with "30" tractor for tractive power.

Joint Trimming Machine

Submitted by Mr. J. F. Cameron,
Maintenance Engineer, District No. 1

Equipment built by State of
Washington

"The machine illustrated in the accompanying photographs has been developed in District No. 6 at Spokane. In that district due to heavy frost heaving, much joint trimming is necessary. With this machine three men recently cut back expansion joint material on a six-mile stretch in about two days, which formerly required the labor of from four to six men for a period of six weeks. As will be noted, power is supplied from a truck-mounted compressor to a jackhammer attached rigidly to an axle with undersized wheels and pneumatic tires. This machine does a clean, neat job and is very fast in its action. Limited cost data indicate that, using present equipment, the cost is \$11.68 per mile. This was for a 220-ft. compressor, which capacity is not required, as a 50-ft. compressor would furnish sufficient power and the operating cost would be considerably reduced. A minimum of four miles per day has been worked over with this machine."



Asphalt joint cutter in action.



Photo supplied by Washington State Highway Maintenance Department, illustrating construction of joint cutting machine.

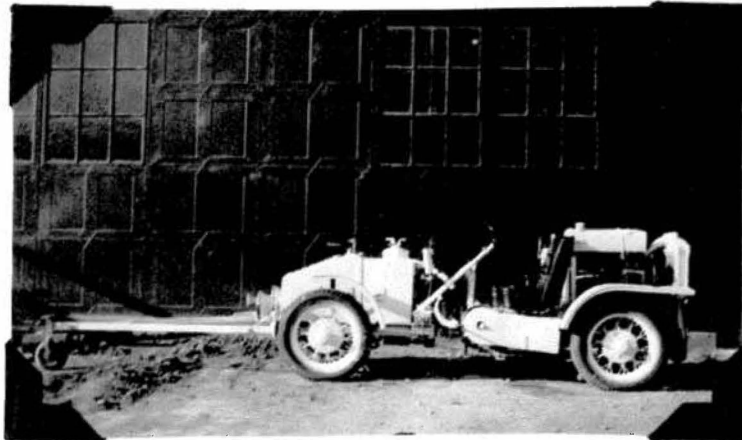
Center Line Striping Machine

Submitted by Mr. E. J. McCracken,
Maintenance Engineer, District No. 2

Equipment built by State of
Nevada

"During the past summer (1936) many new sections of major routes have been centerlined with a 4" white traffic stripe. All blind vertical and horizontal curves with less than 1,000 feet of sight distance are being marked with double stripes of 4" width separated by a 6" dull black painted center. Signs reading 'Do Not Pass Over Double Line' are being installed in advance of markings.

"One traffic striping machine was designed and produced in the equipment shop. It is a self-contained unit, capable of traveling at a speed of from 40 to 50 miles per hour, and is efficient enough to stripe from 20 to 30 miles of traffic line in a working day." The following photograph illustrates the machine.

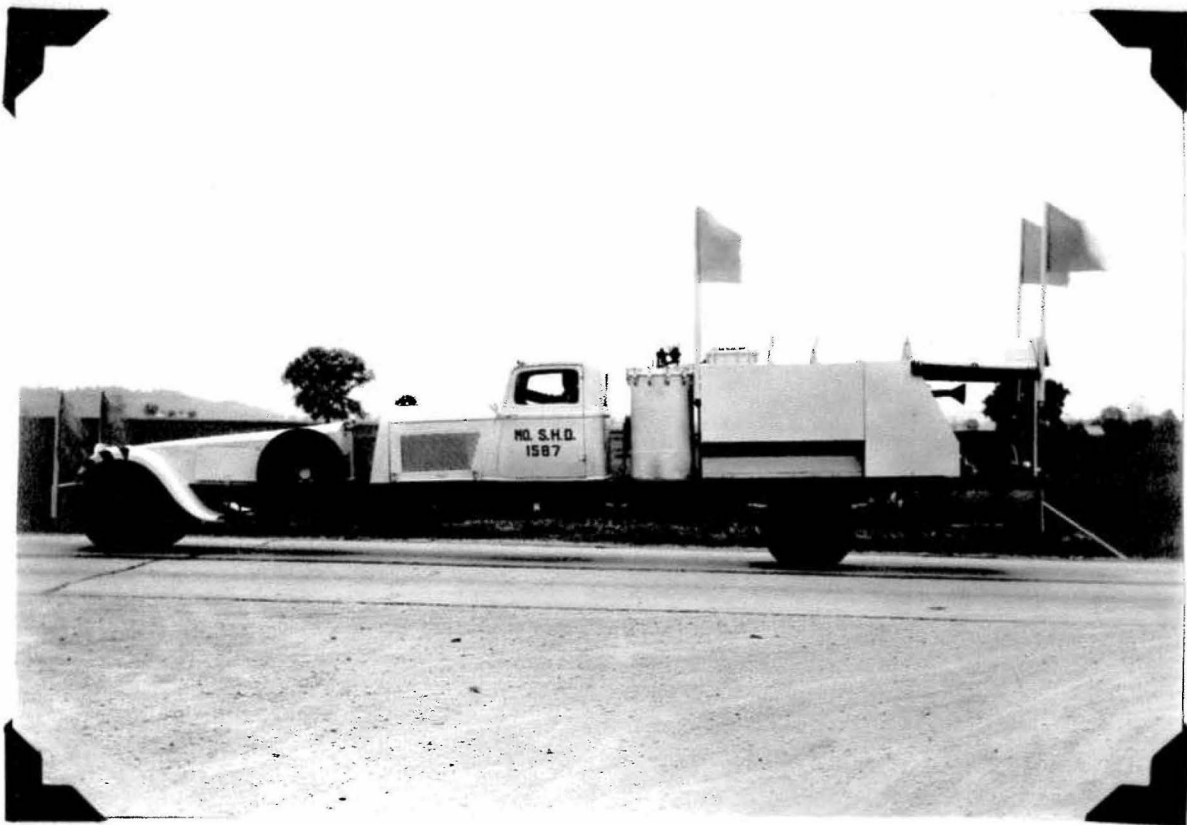


Center Line Striping Machine

Submitted by Mr. E. L. Brown,
Maintenance Engineer, District No. 5

Equipment built by State of
Missouri

"Photographs of the State built center striper are attached. This machine is extra well constructed and gives very good results. Another photograph attached shows the high type stripe obtained by the machine."



Center line striping machine designed and built in headquarters shop. State of Missouri.



Front view of center line striping machine showing narrow gauge. Note flags and signs for safety.



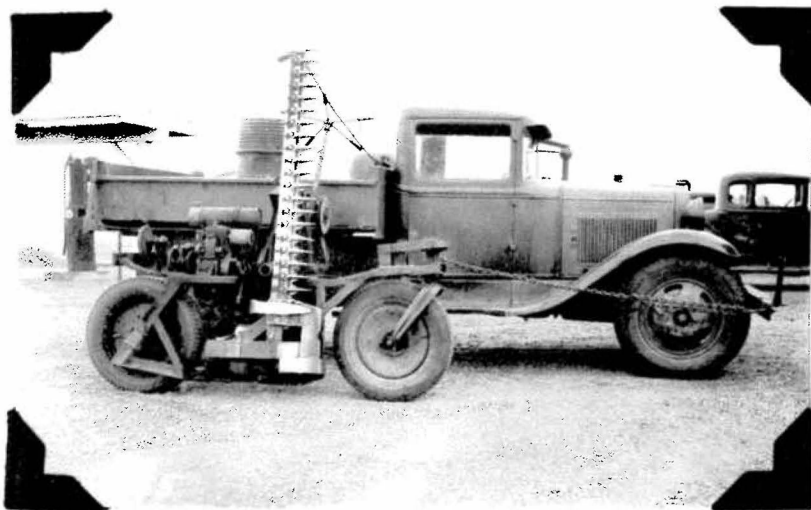
Well defined marking of four lane highway in the State of
Missouri.

Mowing Machine

Submitted by Mr. J. F. Cameron,
Maintenance Engineer, District No. 1

Equipment used by the State
of Montana

"Mowing machine. The assembly has quite a wide latitude of adjustments a variable distance from truck, an adjustment for variable upright positions of the carriage itself and the sickle bar can cut over a range from horizontal to vertical."



MAINTENANCE METHODS AND PRACTICES - New Developments re-
ported by District Maintenance Engineers

The following descriptions and illustrations of methods and practices were reported in the District Maintenance Engineers' semi-annual reports as new developments in the States in which they were observed.

Radio Communications with Field Maintenance Forces

Submitted by Mr. J. F. Cameron,
Maintenance Engineer, District No. 1

State of Washington

"An interesting and comparatively recent development in Washington is the construction of a short wave radio system establishing communication between headquarters and the several districts and with a number of their maintenance supervisors' districts.

"The system * * * has been especially valuable during the winter months in facilitating the disposition of snow removal equipment and for relaying information with respect to weather and road conditions.

"Sending stations are located in each of the six different offices and about ten more at various maintenance depots and snow removal camps in various parts of the State. In addition, about twelve Rotary snow plows are equipped with two-way communication, and there is some talk of equipping a number of trailer carts with sending sets to accompany extra gangs or for emergency use by patrolmen.

"The extra force required for operation of the system has been but one man at headquarters, as maintenance clerks and shop men have been trained to operate the sets at the various district offices and equipment shops.

"Broadcast is unlimited as to time, but the present license limits the nature of business to highway emergencies and to business of the State Police. It is hoped to secure a license permitting business of unlimited nature.

"There are about twenty-five or thirty highway officials' cars equipped with receiving sets and about fifteen receiving stations.

"The system has proven of great value especially during the winter and snow removal season. The Maintenance Department is enabled to render valuable service in the broadcast of snow and road conditions and the handling of traffic under adverse conditions."

Mail Box Standards Improved in Appearance by State Maintenance Forces

Submitted by Mr. J. F. Cameron,
Maintenance Engineer, District No. 1

State of Oregon

"The State has for a number of years realized and endeavored to correct the unsightly condition and hazardous location of rural mail box standards. The majority of these appurtenances, when left to the care of rural mail patrons, become dilapidated and unattractive, and are generally placed with but one consideration - cheapness of installation. At a time when more serious consideration is being given to roadside care and improvement, much of the effort is nullified by the weird effects achieved by numerous rural dwellers. As far as regulations of the Post Office Department are concerned, it appears that they are allowed to express themselves in any manner which appeals to them as long as the mail receptacle is placed at the proper height to permit deposit of mail without inconvenience to the mailman.

"This State annually budgets a small amount to eliminate this condition. Apparently there is no objection raised by either the Post Office Department or the householder when the State assumes the cost and provides ready access to the box. In addition to remedying an extremely unsightly condition, it is possible to eliminate in many cases bad traffic hazards by placing the boxes at a safe distance from the traveled roadway and providing a turnout for the mailman.

"The standards erected by the State are simple and pleasing in design and are maintained with the same degree of care as traffic signs or other appurtenances."

Following are photographs of such installations:

