in the hands of a competent commission or other federal body.

This body should apply itself to the formulation of a comprehensive policy of stream restoration, development and control; a policy based upon a thorough scientific study of stream resources, advantageous uses, protective measures, and necessary and feasible restrictions. The development and adoption of such a policy is of greater importance than the immediate enforcement of remedies, for this work looks far into the future. It will be found necessary to mould into form the more difficult existing situations by steady, consistent but gradual pressure, protecting to the maximum, all established interests in streams, while enforcing all reasonable and feasible corrective measures.

By the early adoption and effective prosecution of such a program, the government may not only avoid the difficulties and losses that inevitably result from neglect of remedial treatment until industrial and municipal developments are well established, but in the end will have effected an enormous conservation of the vital capital of the nation.

KEEP THE MAIN ROADS OPEN IN WINTER*

By Geo. H. Biles

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UR state was put to the crucial test last winter in answering the call of the nation to keep the roads open. I dare say that few of us recall a more severe winter and it augurs well for the future when such abnormal conditions can be successfully combated as was the case with our main arteries of traffic. The first steps taken to cope with the situation were to provide an organization to prosecute the task efficiently. This was but an enlargement of the regular force of maintenance employees. I might mention here that we have a colossal maintenance proposition in Pennsylvania in looking after the upkeep of over 10,000 miles of highways, approximately 65% of which are unimproved, and with a working force in some periods of the season of over 12,000 men, it must be granted modern business principles in organization and operation are essential.

The Division of Maintenance of the Department composed of the Assistant Engineers, Superintendents, Foremen, Caretakers, Labor, etc., took complete charge of the snow removal work under the direct supervision of the Second Deputy Commissioner. From the inception of this Division in 1913, surveys and studies have been made of snow conditions and data compiled that has and will continue to serve in good stead, for there are many points where it has been developed that the construction of snow fence is the most economic practice. Considerable of this snow fence has been constructed up to the present time and is ready to be put in place. At present prices, this costs approximately 50c. per running foot in place and the design closely approximates the railroad standards.

Snow removal work from the experience of the speaker resolves itself into snow fighting from the time the first snow makes its appearance. Work begins when heavy falls come by breaking through a track with road drags or small "V" shaped plows drawn by teams. These are followed by the road machines or motor trucks with the snow plow attachments. Turnouts are made at convenient intervals and as soon as possible thereafter the road opened to the desired width of from fourteen to eighteen feet depending upon the traffic. On improved roads every effort is made to remove the snow within a few inches of the metal of the road, in order that no opportunity is given the traffic to track. What snow remains that does not melt, is removed entirely.

Rolling Sometimes Suffices

I will qualify remarks just made by saying that these methods apply particularly to improved roads, for if traffic is permitted to track during periods of freezing and thawing on such highways, the surface becomes affected to various degrees depending on the type of the road. We have a number of miles of waterbound macadam roads with bituminous surface treatments on the main trunk lines, and in order to preserve them during such periods it is essential to distribute the traffic. On the unimproved roads the snow is not taken off entirely down to the surface, but several inches is left remaining for the travel to pack, and as it softens more snow is dragged from the sides, in order to keep the surface comparatively smooth at all times. Rolling of snow is done on the lesser important lines, but this has not been very satisfactory on the roads where there is much motor traffic, on account of the rough condition that results when the surface becomes cut up. The snow being rolled and wet from time to time with sleet and rainstorms, becomes almost as hard as ice. However, there are a number of roads where the travel is light and used mostly by horsedrawn vehicles, where this method will suffice.

In the work just described, especial attention was given to the drainage and cuts were made through the banks of snow to the ditch lines at certain intervals where possible and drains and culverts kept open and free from obstruction. This precautionary measure produced very good results, for when the snow passed away in the spring, the roads had come through the winter in better shape than they had any previous time, in spite of the fact that they had been subjected to greater traffic and increased weight of loads.

Special Treatment for Heavy Drifts

The heavy drifted condition required especial treatment. Drifts were so deep and banks so high on either side of the road in some places that snow had to be shoveled and hauled out. Snows up to twelve inches in depth can be handled advantageously with road machines, and from twelve to thirty-six inches, if not too heavy, can be moved with motor trucks with plow attachments, with excellent results. The truck is run along the one side of the highway and back on the opposite side at the rate of about four miles per hour and carries a small crew of men with shovels that are used when the snow piles up in front of the blade, which it will do especially when the snow is wet. When there is a greater depth than three feet, a large "A" shaped plow is used. This implement is 30 inches high at the nose and 6 feet at the back with 20 ft. legs and 16 feet wide at the back, held together with movable braces and drawn by a heavy tractor, and it has proven a very economical and effective device. The movable braces are provided for the purpose of permitting vehicles to pass during the operation, if necessary. The light tractors for his work do not hold the road and have been found unsatisfactory. Mechanical devices are preferable in the majority of cases but if the drifting is a continuous performance in cuts, it resolves itself into a shoveling proposition.

^{*}Abstracted from paper read before the recent Conference on "Snow Removal from Trunk Highways." held in New York City.