

EFFICIENT ROAD MAINTENANCE

By N. M. Isabella,
Maintenance Engineer, Wisconsin State Highway
Commission

The establishment of a preferred system of highways by any unit of government should carry with it the immediate maintenance of that system by the establishing unit. It cannot be over-emphasized that a state system of roads should not be laid out unless real state control of its maintenance is also provided.

Highway maintenance is quite different from construction. In the building of a highway, definite factors are considered, such as alignment, grade, drainage structures, thickness and width of surfacing and other details that vary with the locality. In maintenance, the remedy or method applicable to one road does not necessarily apply to another. The problem is to keep the road up to its original condition insofar as funds will permit. The condition of the road varies with the type and character of the traffic, drainage, topography, weather conditions, and thus one cannot definitely say what the maintenance cost of a given road will be because these items cannot always be determined in advance. Efficient road maintenance will, therefore, depend on the following factors:

1. Sufficient funds available.
2. Organization and equipment.
3. Proper planning and budgeting of funds to meet traffic demands.
4. Efficient execution of the work as planned.

To carry out the maintenance work successfully, sufficient funds must be provided. In most of the states, the funds used for maintenance work are derived from revenues collected from motor vehicle fees. The motor vehicle owner is becoming more critical each year in his highway service requirements, and takes the opportunity of informing the highway official that he is paying the bill and desires that he be given just returns for his taxes.

It is very essential that the work be handled by a competent organization supplied with up-to-date equipment.

Item No. 4 is one of the most important because it involves the thought and energy of the men who actually carry out the work as well as the official in charge.

In the maintenance of our highways in Wisconsin, we have tried to keep these items in mind and in planning our work the thing uppermost in the minds of the officials has been to render service at minimum cost and to provide for the

public a safe and comfortable highway. All seem to agree that the expenditure of large sums of money for construction is an extravagant use of funds unless followed by systematic maintenance. It follows, therefore, that in the design of a highway the maintenance factors should be considered. The cheapest in original construction cost is not always the most efficient and economical highway to maintain, and it is well for those in charge of design to keep this in mind when planning for the future. It often happens that the highway required by traffic conditions in a particular locality cannot be constructed because of the lack of funds, but there should be no excuse for planning the wrong type when conditions are favorable. In other words, *build the maintenance into the construction of the road*. Maintenance work, while it is variable from season to season, can be efficiently executed if properly planned. Special study should be made of the entire road system with the idea of planning for each individual section of the highway. Often, the expenditure of a few hundred dollars can save thousands of dollars for the future.

In order that a maintenance organization may function efficiently, it must not be tied up in too much departmental red tape. There should be a governing head or body to all successful organizations, but in work which varies as much as the maintenance of a state highway system, a certain amount of judgment and discretion must be left with the man actually doing the work and to his immediate superiors. The general policies can well be formulated by the governing body, but the matter of details which vary with every locality and with every highway must necessarily be left to the maintenance man who actually carries out the work.

In all highway organizations, there should not only be co-operation between the man who actually does the work and his superiors; there should also be thorough co-operation between the maintenance and construction departments. It is necessary for those in charge of maintenance to be informed as to the contemplated construction projects, their location and the proposed detours. The great bulk of highway construction is planned well in advance, and by knowing just where the projects will be located for the coming year, detours may be provided and improved by the maintenance forces before the road involved is actually closed. We have followed this policy quite consistently in Wisconsin and in many instances detour roads have been previously widened and surfaced to take care of the through traffic during the construction of the main road.

Maintenance Methods

Maintenance work may be divided into four general classes as follows: spring, summer, fall and winter maintenance.

Probably the most critical time in the maintenance of earth, gravel and other light surface roads is in the spring of the year when the frost is leaving the ground. It is true that spring conditions do not show their effect so much on a permanent or durable pavement, but as the hard surfaced or paved road comprises only a small percentage of the rural highway mileage, the big problem lies in the proper maintenance of the gravel, shale, stone and earth roads.

At the beginning of the maintenance season which is usually during the month of April, the ditches must be opened, the culverts cleaned out, the surface graded smooth and repaired wherever necessary. Objectionable features must be removed from the right of way and guard rails, rip rap, etc., should be repaired. At this time of the year it is possible to do the best work in shaping the cross section of the road. The high places may be cut down and the low places filled. If the patrolman gets a good start in the spring, the maintenance of his section will not be a great task during the summer season, but if the important details are neglected during the spring, he is bound to have trouble during the summer months when traffic is at its maximum. It is sometimes impossible for a single patrolman to do all the work necessary on his section in the spring, and if this is true, he should be given extra help and in most instances a tractor-grader outfit should be run over his section to open the ditches.

After the details of spring maintenance have been taken care of, the patrolman's time is then required almost constantly on the surface of the road. From time to time, he will find it necessary to replenish the surface materials from the stock piles which have been provided. Where traffic reaches 500 or more vehicles per day on the ordinary dirt or gravel road, the patrolman finds that he must keep his grader at work constantly on the surface in order to provide a smooth riding road. One of the important items during the summer is the cutting of weeds along the shoulders, ditches and right of way. In some cases, two cuttings a season are sufficient, but we have found that in many cases it is necessary to cut the weeds and grass as many as four times. The months of July and August require the most intense maintenance on the surface for during these months the traffic is at its maximum. In Wisconsin it is not expected that the patrolman can do much more than keep the surface in a smooth riding condition during this period. Usually, extra work which is required on his section is taken care of by special crews.

In the fall of the year when traffic has decreased considerably, the patrolman will find more time to take care of work other than the surface. At this time the ditches should be opened again, all culverts cleaned out, and the weeds and brush cut from the right of way to prevent snow from drifting on

the highway during the winter. Stock piles of materials should be provided at those places where the road is apt to give trouble in the spring. The road surface should be kept smooth so that, when heavy frost comes, it will freeze in a uniformly smooth condition. It is very essential that the patrolman continue his grading operations until the ground becomes frozen.

In most states of the latitude of Wisconsin, the amount of winter maintenance done is comparatively small on account of snow conditions. Quite a number of states have adopted systematic snow removal programs and are attempting to give through highway service during the winter months. We believe the time is not far distant when well formulated programs for winter maintenance and snow removal will be put into practice in all states in the snow belt. The demand for through highway service during the winter months is rapidly growing. This is very plainly shown in Wisconsin by comparing the snow removal activities of last winter with that of this winter. During the season of 1925-1926 approximately 1,500 miles of road were involved in the snow removal program. About \$100,000 was expended. Sixty miles of snow fence were placed. This fall \$250,000 was appropriated for snow removal work, 275 miles of snow fence were placed, and additional equipment was purchased. The counties are also attempting to keep all the main highways open to traffic. In the northern part of Wisconsin considerable logging is done during the winter and it is necessary to leave about five or six inches of snow for sleighing. This makes snow removal in the northern counties a little more difficult, but the roads are giving good service to both the sleigh and automobile traffic.

Highway Safety

One of the growing evils on the highways is the number of automobile accidents. These are responsible for upwards of 20,000 fatalities annually in the United States. Several factors contribute to this alarming death rate but in most cases the driver is responsible. There are a number of cases, however, where the condition of the highway has caused very serious accidents. It is the duty of every highway worker to do everything possible to eliminate the causes of these accidents. The proper signing of a highway aids greatly by warning the public of the dangerous and hazardous places. The marking of a centerline on paved roads also tends to reduce accidents. Much remains to be done in the separation of grades at railroad crossings at high speed highway intersections. The dust problem on gravel and dirt roads is very serious. Some states are beginning to cope with this, but

when one considers that 80 per cent of the total rural highway mileage is unsurfaced, it can be readily seen that considerable thought and energy must be directed toward this problem.

Supervision and Co-ordination of the Work

No activity can be carried to a successful conclusion unless it is properly supervised, and the forces involved properly co-ordinated. We find that it is impossible to get the best service from the patrolmen unless they are given attention from time to time by a superintendent or foreman. They try to do their best, but when any man is put out on the highway ten hours each day with the small amount of supervision that he ordinarily gets, it is next to impossible to get maximum results. Thus, by having one who can visit with the patrolman and exchange ideas from time to time, the results will be better maintenance at no increased cost.

To co-ordinate the work among the various agencies in the county and state, county road schools are held each year at the county seats, usually at the beginning of the season, in which all subjects pertaining to the maintenance of highways are discussed. At these meetings the patrolmen are given a chance to speak freely and outline their ideas as learned from experience and to discuss with other patrolmen the advantages of carrying on their work according to the best methods. At this time, when all the patrolmen are assembled, general instructions are issued to them by the commission's representative. Any doubtful points are discussed and agreed upon. The county road schools are primarily for the benefit of the patrolmen, but they also serve as a co-ordinating influence between all those interested in the development of highways.

In order to discuss highway problems from a state wide viewpoint, an annual state road school is held at the State Capitol. The law requires that every county committee and highway commissioner must attend these meetings. All citizens interested in highway work are invited and many do attend all sessions of the road school. The county road school and the state road school have had a very great influence in the development of the highway system in Wisconsin and have served to co-ordinate the work of all the counties so that uniform maintenance has resulted throughout the entire state.

This paper has dealt primarily with state highway systems, but we are frank to say that no state highway system can be considered a success unless the secondary or local highways experience a parallel growth commensurate with their importance as arteries of transportation. In other words, to give the best of service to all, from the most remote farmer to

the city dweller, it is essential that we have improvements made on the local and county roads as well as on the state highways.

If we assume that each of the 800,000 motor vehicles owned and operated by the citizens of the state of Indiana travel 5,000 miles per year and that through efficient maintenance on the highways each owner is saved one cent a mile in vehicle operating costs there would be a total saving of $800,000 \times 5,000 \times 1c = \$40,000,000$. This looks like a large sum but I believe it is conservative.

I do not know what amount of money is being spent for the maintenance of all rural highways in your state but I venture to say that it is under ten million dollars. Even at this figure you would be saving 3 times the actual expenditure to say nothing of the added safety, comfort and convenience. I like to think of maintenance not as an expenditure but as a saving to the motoring public. We must not lose sight of the facts because upon the highway official will rest the responsibility of rendering efficient traffic service. Each has his part to play from the patrolman up to the state highway engineer and when thorough co-operation exists between all, then can it truly be said that traffic is served.

PRACTICAL HIGHWAY ENGINEERING

By Otto S. Hess,
Engineer-Manager, Kent County Road Commission,
Grand Rapids, Mich.

In this paper I will give you a description of the plan and methods as applied to the particular types of roads which are being constructed and maintained in Kent County, Michigan. Do not understand that I am advising everyone to follow our methods. I will only attempt to describe to you the practices which we are following in our highway work leaving it to you to pick out such features of the work as may possibly apply to your own work.

We have three general classifications of roads in Kent County.

The state trunk line and federal aid roads comprise 150 miles of the total system and are quite largely paved with concrete. The county road system makes up about 350 miles, some of which is paved with concrete and the balance being gravel. The township roads total about 1,400 miles, some of