

## HIGHWAY SERVICE THAT SATISFIES

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Highway service that satisfies is the one thing that most highway departments are attempting to attain but as yet few have succeeded in accomplishing. The mere fact that most highway bodies are more or less politically organized has a tendency to compel them to do many things that are not according to best engineering practice. Special privilege, too often prevalent, has stepped in and ruined a program which has been carefully planned for the best interests of the people as a whole. One of the big wastes of public funds can be attributed to this evil. Confidence of the public should be cultivated by a successful road board and it is only by keeping faith with the public; insuring them an efficient, honest, well balanced organization that a satisfactory service can be rendered.

Much research work is being carried on by the Bureau of Public Roads, our engineering colleges and different state highway departments. As a result of this work, I believe our construction program is being executed according to the most modern methods.

In Michigan we are standardizing on right of way of 100 to 200 feet in width. We are looking ahead to the day when a 20-foot pavement will not accommodate our traffic and in some cases we have already been compelled to construct super-highways with an 80-foot width of pavement. Wide right of way also permits the construction of 8-foot shoulders for parking. This feature relieves any excuse for cars being parked on the pavement and as a safety measure is essential. Wide right of way also gives plenty of room for pole lines, trees, shrubbery and snow fences.

There is no one type of road pavement that you can call permanent, neither is there any type that should be used under all conditions of subgrade, traffic and climate. The type of road pavement should be determined by the natural resources of the district through which the road runs. The limited funds provided for road purposes will not allow any road official to overlook this point if he expects to conduct an efficient, effective program.

I will not attempt to discuss the different types of pavement or road surfaces in this paper for there are many that give satisfactory service and their use must be governed by those who are informed and have given thought and study to the local conditions.

### Importance of Maintenance

A well organized maintenance division can probably do more in satisfying the general public than any other branch of a road building department. Maintenance should begin the day traffic commences to use the road and it should never stop. It is the only insurance you have on your original investment.

In Michigan, the state is maintaining about 7,500 miles of road on its trunk line system. The cost of this work for the year 1928 will be a little over \$5,000,000. To handle this work, the state is divided into five districts, each under a division engineer. Each district contains two residencies with a maintenance supervisor in charge who has no other duty except to look after maintenance. Each maintenance supervisor has a superintendent in each county under his jurisdiction. This organization works under the general direction of the state maintenance engineer at Lansing.

At the present time we have a total of 4,065 miles of trunk line gravel roads. As this type of surface represents more than one-half of our total road mileage, you can readily see that to be able to render satisfactory service to the traveling public it is absolutely necessary that we keep this mileage in the best possible condition. A trained personnel with men



Fig. 1. Spring Blade attached to truck.

who are skilled and experienced in this line of work is probably the most important factor to be taken into consideration. The next item is equipment. Trying to maintain roads with old, worn-out antiquated equipment is not only impossible but it is expensive. A comparison of the costs of the different methods of dragging and floating gravel roads is difficult due to the fact that the results obtained differ very widely with the class of equipment used. A poorly maintained gravel

road is expensive to the traveling public regardless of the current cost. In former years, before maintenance came to be fully recognized as of vital importance to any road system, horse-drawn equipment was used almost exclusively. *With the advance of the motorized maintenance equipment and with the growing need for more intensive maintenance, horse-drawn equipment had to be abandoned and is now considered obsolete.*

It might be of interest to compare the cost of dragging gravel roads with horse-drawn equipment with the cost of dragging the same road with a 3½-ton truck equipped with a 12-foot, truck scraper attachment (Fig. 1) supplemented by heavy equipment consisting of a 10-ton tractor and heavy grader for scarifying and heavy spring cutting. In 1927 the cost of dragging with trucks and heavy equipment on 117 miles of road having a 20-foot gravel surface and carrying approximately 1,000 vehicles per day during the dragging season was \$170.95 per mile. In order to completely cover a 20-foot width would require two round trips with teams and patrol graders. Assuming a team could make two round trips a day on a 5-mile section at a cost of \$7.50 per day, the cost per year (counting 200 dragging days, which is a conservative estimate for Michigan) would be \$1,500 per section or \$300 per mile. The cost of doing this class of work with teams and antiquated equipment can therefore be estimated as costing almost twice as much as with motorized equipment. It seems ridiculous now to think of a highway organization using such expensive and inefficient horse-drawn dragging equipment. No criticism should ever be directed to officials who used this class of equipment before the coming of improved, motorized types. It was the best available at the time and served a useful purpose in the evolution of highway practice.

### Dust Nuisance

The dust nuisance on gravel roads is something on which the public has become very critical and in many instances this criticism has become so intense that a perfectly good gravel road has been replaced by a more expensive type of pavement whereas if it had been properly cared for it would have served the traffic for many years. In Michigan we are preserving our gravel roads by treating them with tar, asphalt or calcium chloride. During the coming year we will place calcium chloride on 3,430 miles of trunk line gravel roads at a total expense of \$952,000. This seems like a lot of money but when you consider the convenience this type of maintenance affords the public and when you consider that you save almost enough resurfacing gravel which is ordinarily blown away or shoved off the road to take care of the cost of this chloride in addition to the elimination of the nuisance, the expenditure is more than justified.

Before a road is treated with any surfacing material it should be brought to an even cross section, thoroughly consolidated and the proper drainage established. We find  $\frac{1}{4}$ " to the foot crown to be sufficient. If loose gravel exists, binder should be added to the extent of from 8 to 12%. Loose gravel and excessive crown cause the concentration of traffic which makes ruts. Even distribution of traffic over the entire width of the roadbed prolongs its life and decreases maintenance costs. If it is found impossible to consolidate all of the gravel, loose material should be bladed to the sides of the road and left there throughout the summer season. Calcium chloride will not consolidate a gravel that does not contain a certain percentage of binder and it is a waste of money to make this application unless the roadbed has been properly prepared. We find that five tons of chloride per mile is sufficient for the first application. This application is made about the first of June and later in the season two or three tons are added per mile as the conditions of traffic and weather may demand. We find that on the ordinary road 8 to 10 tons of calcium chloride will keep your surface in a dustless, compacted condition throughout the year.

In applying this chloride we use a  $3\frac{1}{2}$ -ton truck to which is attached a standard chloride spreader or drill (Fig. 2). We



Fig. 2. Equipment used in applying Calcium Chloride on Gravel Road.

find it desirable to have this drill equipped with pneumatic tires carrying a pressure of 20 to 30 pounds. In order to get the greatest benefit, the chloride should be evenly distributed upon the surface and this equipment allows us to accomplish this purpose. The  $3\frac{1}{2}$ -ton truck is kept supplied with calcium chloride by small trucks which bring the material

from cars at different points on the road and the same is transferred from the smaller trucks to the distributor truck.

After calcium chloride has been on the road for one day we start floating the surface with a tractor-grader or truck equipped with a spring blade attachment. The road is first floated out and the blade is set so that it cuts the surface just enough to eliminate any chatter bumps that may have come into the road. This gives us a very small ridge of calcium chloride material which can be floated back on the road within the next day or two, or whenever necessary. On heavy traffic roads we have found that it is necessary to float a road daily, but in many cases we have been able to keep this surface in good condition by floating only two or three times per week. The dead material which is floated out before the road is treated should never be floated back or brought into the road surface during the floating season. It is desirable that this material be floated on to the road during the late fall and consolidated into the surface. Calcium chloride costs us about \$30.00 a ton applied on the road. In case a 10-ton application is necessary this work will cost about \$300.00 per mile per year.



Fig. 3. "V" Shaped Snow Plow Attached to Truck.

### Snow Removal

Our snow removal program for the present season provides for the maintenance of wheel traffic on practically the entire mileage of our trunk line system. The average cost of this work for last year was about \$50 per mile. This cost varied from \$6 in several counties to as high as \$300 per mile in the Upper Peninsula. The equipment used for this work consists of 3-ton and 3½-ton trucks equipped with "V" (Fig. 3) and one-way plows, and 10-ton Holt tractors equipped with

"V" and rotary plows. This equipment, except for the snow plows, was practically the same as we used for our summer maintenance work. We have found that the truck plow when properly handled can take care of from 30 to 35 miles of road economically and keep it open under most severe conditions. On account of the cost and the slowness of the 10-ton tractor and rotary plow, we are only using this equipment to widen out and remove the snow banks which are thrown up by the truck plows.

Snow fence of the picket type has also been used quite extensively for the last two years and at the present time we have about 1,200,000 feet of this fence erected on our trunk line system. This is so placed as to take care of the worst places where drifting occurs and it is only with the aid of this fence that a truck plow can economically keep a road clear for traffic during a severe storm.

Snow removal in Michigan has been appreciated. We find that we can give the people uninterrupted use of our highways 365 days of the year. The expense of winter maintenance is only  $\frac{1}{4}$  of the expense of summer maintenance.

During the past season the trunk line marking system of Michigan was changed to conform with the Federal standards which have been adopted by practically every state. This system is undoubtedly far superior to anything that has ever been used before and we have had much favorable comment from the traveling public both from within and without the state. We are planning next year to adopt a county numbering system for our county roads in Michigan and in all cases will use the standard warning signs except having them painted white instead of yellow. Proper marking of roads is a service that is appreciated by everybody, and the U. S. system as now planned should be adopted at once by every state.

In summing up the different points of this paper it seems to me that the most satisfying service to the public must be rendered by more attention to maintenance with the necessary increased appropriation of funds. Most of the efforts of highway bodies have been directed to raising money for construction and only during the last few years has it been possible to convince most officials that maintenance of any road was more than a useless expenditure. If sufficient funds are not available to take care of the highway program in any community, I believe the maintenance budget should be provided for first and if curtailment is to be made it should be in the construction program. At the present time we have more automobile traffic than our present road system is able to handle. It is only with the most intensive and well-planned maintenance program that we can keep up with this ever-increasing traffic and render service that satisfies.