MAINTENANCE OF ROAD SURFACES, SHOULDERS, DITCHES, AND RIGHT OF WAY AREAS

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It is evident that the subject is a broad one and covers a large portion of highway maintenance.

Now, what is maintenance? The best definition that I have been able to find is this: *Constantly preserving that condition of a road or bridge which exists at the time it is turned over to the maintenance division for attention.*

Unlike construction, there is no blueprint for maintenance, and proper maintenance procedures have only been arrived at by pooling the combined experience of many engineers and highway workers who have dealt exclusively with the problem for many, many years. Engineering experience in the construction field is invaluable to the Maintenance engineer and likewise, maintenance experience is invaluable to the construction engineer.

The maintenance of highways requires constant care, as the forces of nature and the pounding of traffic are ceaselessly at work tearing down what man has constructed. Maintenance personnel must be trained to always be on the alert for the first signs of deterioration and be prepared to do the necessary work to correct the condition before it becomes more serious. Failure to patch small holes and raveled places in a bituminous surface may result in extensive patching or an entirely new surface treatment. Failure to take care of washes on steep grades when they first appear, can result in destroying the entire shoulder or serious undermining of the pavement.

To impress you with the immensity of the maintenance problem in the State of Kentucky I should like to quote a few figures. At the end of the calendar year 1952 there was a total of 15,963 miles of roads under State Maintenance, divided into five general surface classifications as follows:

1. High Type (Non-bituminous surface) .................................. 1,212 miles
2. High Type Bituminous Surface ........................................ 2,661 miles
3. Medium Type Bituminous Surface .................................... 5,592 miles
4. Low Type Bituminous Surface ........................................ 894 miles
5. T.B.M.; Gravel; Graded Earth ....................................... 5,605 miles

The maintenance of roadway surfaces occupies the first attention of the Maintenance foreman and his crew. This is the portion of the roadway that the motorist and traveling public is concerned with and surfaces must, at all times, be maintained in as safe and smooth riding condition as possible. Other phases of maintenance work, though equally as important in the long run, must be subordinated to surface maintenance.

Now for a discussion of proper maintenance procedures on the various surface types.

1. Rock Asphalt – The State system includes 731 miles of this type, which is only 5% of the total mileage. All of our Rock Asphalt surfaces have been placed on substantial bases and in general do not require much surface maintenance until considerable age is acquired. When surface patching is needed, the patching material should always be with like material. Cracked areas should never be skin-patched with oil and stone chips unless the pavement is about to be re-
surfaced. These white patches, irregularly spaced over the surface, present a very unsightly appearance against the black background of the surrounding unpatched area. This method of patching will invariably start a scaling action of the Rock Asphalt in a short period of time, which will require further patching, and thus an endless cycle of patching is set up. Rock Asphalt surfaces usually last ten to fifteen years before they need resurfacing.

2. Concrete Pavement — Our system includes 945 miles of this type, which is 6% of the total. In the maintenance of concrete pavements it should be borne in mind that smoothness is essential to its preservation, because, being a rigid type pavement, any irregularities sufficient in height or depth to cause a perceptible impact when traffic passes over them produces a very detrimental effect, resulting in a gradual disintegration of the concrete, to say nothing of discomfort to motorists and damage to vehicles and tires.

Also very troublesome is the leaking of water through the joints to the subgrade and the subsequent pumping action at the joints, which if not corrected will lead to serious damage.

In maintaining concrete pavements, cracks and joints must receive regular attention to prevent water, soil and other materials from entering the pavement. These cracks and joints should be sealed with the proper grade of bituminous material during the early spring and late fall when the pavement is contractcd and the joints are more open. Joints should be cleaned of dirt, sand or other foreign material before pouring and no pouring should be done when the pavement is damp.

Spalled areas on concrete pavements have been successfully patched by an ordinary chip seal. More serious pavement failures, such as slab settlement, may be corrected by one of the following methods:

(1) Bituminous material in the form of a grader patch using either road mix or plant mix may be placed on the settled pavement in order to obtain a uniform grade over the settled area.

(2) The settled section of pavement slab may be raised with a mud jack.

(3) The area may be removed entirely, the subgrade brought to proper elevation and a new concrete slab poured to replace the settled area.

Perhaps the most serious problem to be faced in the maintenance of concrete pavement is pumping at the joints. All of you have observed this pumping action and are familiar with the type of failure that results from continued pumping action. The corrective measure of course, which at best is only temporary in duration, is the undersealing of the joints with a soil-cement slurry; a combination of soil, cement and asphalt emulsion; or a pure asphalt cement of low penetration. Since this type of treatment at best provides only temporary relief, the only permanent solution is to cover the affected areas with a heavy bituminous mat.

3. Bituminous Surfaces — Our system includes 8,416 miles of this type, which is 53% of the total. Some of this mileage is on substantial bases; a lot of it on weak bases; the latter type of course requiring the most intensive maintenance. This is especially true during extended periods of bad weather.

The proper maintenance of bituminous surfaces is not merely the patching of holes after they have formed. It should consist to a large degree of preventative measures, such as skin-patching, or sealing of the entire surface when signs of failure begin to appear. The first sign of failure is map cracking, checking or alligatoring of the surface and usually begins in small areas. Finally, if not patched they will spread over the entire road surface, causing raveling and formation of pot holes and even damage to the subgrade. Careful watching and prompt sealing of the cracked areas should, to a large extent, prevent the development of pot holes. Skin patching and surface sealing, except in emergencies,
should be done only in the good weather months when air temperatures are warm or moderate. Wintertime sealing usually results in a patch loaded too heavily with oil which forms a bleeding area and becomes slick as soon as warm weather comes.

In patching potholes in the surface, to secure lasting results, certain important details should be observed. Among these are proper cleaning of the hole and priming it with bituminous material before the patch is placed. (Unfortunately many of our maintenance crews fail to do this, and many failures can be traced to this neglect.) The patching material should be thoroughly tamped into the hole. It is also essential that the patching material was properly prepared. That is, the aggregate in the mix should be dry before mixing with bituminous material, and the proper proportioning of aggregate and bituminous material is of utmost importance.

Settlements, low and uneven places should be corrected by laying out a blade mix patch or by the use of a plant mix material. The important details to be observed are proper cleaning and priming of the area; uniform application of the patching material and proper compaction. Small areas can be satisfactorily compacted with a loaded truck, but large areas should be compacted with a steel wheeled roller.

Slippery surfaces are not infrequent on bituminous surfaces, and in general were caused by an excess of bitumen in the mix or by improper gradation of the aggregate. These sections are very dangerous during wet weather and have caused many accidents. It is obvious that such areas should be deslacked as soon as they are discovered. Several methods have been used for deslicking, including the application of oil and coarse chips; loosening the excess bituminous material with kerosene and applying sand; but to my mind there are only two effective methods, namely the application of a spinner rock asphalt seal at the rate of five to ten pounds per square yard, or complete resurfacing of the slick area.

4. Non-Paved Surfaces — This includes all traffic bound, gravel and graded earth types. The State system includes 5,605 miles of this character, which is 36% of the total. This presents a problem of maintenance that is not easy in any sense. The one redeeming feature however, is that in general the traffic volume carried by these roads is relatively light. The two principal features of maintenance on these types are adequate blading of the surface and the addition of replacement material annually. Unfortunately the maintenance budget never provides quite enough money to purchase the quantity of replacement material that is really needed. Weather conditions and traffic volume determine to a large degree the amount of surface grading that is required and the amount of replacement material that should be added each year. In wet weather the surface should be graded once or twice each week if the traffic volume is as much as 200 vehicles per day. As the weather becomes drier, and during the summer months less frequent grading will be required. It becomes a matter of individual judgment, as to how often these surfaces must be graded, taking into account the traffic volume and the season of the year.

It is believed that during the dry season, if there is considerable floater material on the road, only a small amount should be left on the traveled way and the rest of it graded into a windrow along the shoulder line. This will not only conserve the material, but will provide a smoother riding surface for the motorist.

Each time the road is graded, this existing ridge of stone should be bladed across to the opposite shoulder, and a small amount of the fines should be allowed to drift out under the blade and left on the roadway surface.

Road shoulders are an integral part of the roadway and provide lateral support to the pavement; space for emergency passing, stopping or parking by the motorist; space for pedestrians to walk; space for the installation of guardrail or other safety devices; space for the installation of necessary traffic and route signs;
space for mail boxes and the construction of proper side road approaches. The maintenance of shoulders is a type of work which must be carried on to some extent throughout the entire year; however, the greater part of such work is done during the months of good weather in conjunction with ditching operations.

The dressing of shoulders is important, because if the surface of the shoulder is smooth and properly sloped it will drain properly. A smooth shoulder flush with the pavement edge adds to the safety of driving and general appearance of the highway and encourages pedestrians to use the shoulder instead of walking on the pavement.

Shoulders should be maintained for their full width and uniformly sloped from pavement edge on a sufficient pitch to provide proper drainage of the roadway. It is believed that generally, slopes should be approximately 3/4" to the foot for earth shoulders, approximately 1/2" to the foot for stabilized shoulders and approximately 1" to the foot for grass shoulders.

The regular blading of shoulders to keep them flush with the edge of the pavement is important because, (1) if the shoulder is too high, water is retained on the edge of the pavement to cause surface deterioration, or to soak down at the edge of the pavement and soften the subgrade. It can also result in the formation of ice in the winter time. (2) if the shoulder is too low, or if ruts and holes are permitted to remain in the shoulder at or near the edge of the pavement, a serious traffic hazard is created, and in the case of bituminous surfaces, raveling of the edges is induced. Water retained in such ruts or holes will also soak into the subgrade to remove pavement edge support.

Grass shoulders should be established and maintained wherever practicable; however, they are inadequate where the pavement is narrow and traffic is heavy, also inadequate at the outskirts of municipalities, through rural residential settlements or at congested rural business areas. Therefore, on all the heavier travelled roads it is considered advisable to work toward shoulders of stable material, such as creek gravel, bank gravel, river gravel, crushed stone or slag, cinders, red dog, chert, shale or sand.

In general these stabilizing agents are adequate without any additional binding material except the clay or soil already present; however, sections of stabilized shoulders subject to concentrated traffic, such as parking areas in rural communities, should be treated with bituminous material to insure stability.

Roadway Ditches are constructed to carry off surface water from the roadbed and portions of the right of way area and to keep the water table below the subgrade. Therefore, the proper maintenance of ditches is of the utmost importance.

It is realized that only emergency ditching such as slide removal or cleaning out short sections that have become clogged and are causing serious damage to the roadbed and shoulders can be done in the winter season. In general, ditching operations can be started early during the month of May if it is a normal season; however, this would vary according to locality. Inspections should be made of your roads in advance and ditching operations started on the roads that need it at the earliest date that ground conditions will permit. Surplus material taken from the ditch lines should be hauled to and disposed of along the nearest fill section. This material should be dumped along the shoulder line parallel with the center line of roadway and shoved over the edge of the shoulder with a grader. This method will enable you to obtain a uniform distribution of the material along the edge of the fill shoulder.

The general practice has been to end-dump this material over the edge of the fill shoulder, which places it in such a position that it cannot be smoothed down with a grader, and smoothing it down by hand methods is too slow and expensive. Consequently, where this type of dumping has been done, there exists an unsightly series of knots and bumps just below the top edge of the fill slope.
In pulling ditch lines the grader man should be careful not to undermine the toe of the cut slope as this will induce erosion and re-filling of the ditch line.

Another important detail to be attended to in the ditching operation is to do enough hand work to insure the ditch line carrying up to the inlets and outlets of all entrance pipe. The same type of work should be done at each cross drain pipe where needed. Failure to do this will prevent the new ditch from draining properly and to a large degree destroy the value of the ditching operation.

The season of 1952, due to unusually favorable weather conditions, was a banner year in the Maintenance Division for amount of ditching work accomplished. Records indicate that a total of 5,097 miles were ditched during this period, 152 miles of which were done by contract. This is the first time that any ditching by contract has been done on state roads. Results obtained were very satisfactory, the cost was reasonable and it is believed that in the future a good portion of our ditching can be done by contract, especially in the non-mountainous sections of the State.

To my mind there is no phase of maintenance work that improves the appearance of a road and actually benefits it in every respect like a thorough ditching job.

*The maintenance of Right of Way Areas* includes mowing of weeds and brush, trimming of trees, the periodic removal of trash, such as tin cans, paper, bottles, wire, etc., also dead animals that have been killed by motorists; cleaning up around picnic table areas and roadside parks; planting and seeding for erosion control.

This type of work is necessary not only to keep the roadside attractive but serves a vital purpose in safety for the motorist by maintaining proper sight distances around curves and in the control of erosion on cut and fill slopes. Thus, on many cut and fill slopes along the right of way and even on many level sections of roadside in rough or wooded areas, existing vegetation except weeds and brush can be left in mowing and clearing operations, thereby reducing maintenance costs and helping to control erosion. In such areas, by mowing only the shoulders, ditches and one pass beyond the ditch to keep drainage clear, a great deal of time can be saved and much desirable vegetation left on the roadsides. In open country, where the entire right of way is mowed, trees should be saved wherever possible to shade the highway and add interest to the route.

Special attention should be paid to increasing sight distances on the inside of curves. This does not mean that all growth should be removed. Tall trees should have their lower limbs cut in order that vision below the foliage will not be restricted. Clumps of trees on the outside of curves, particularly sharp ones, should be preserved as a safety factor, as it is a known fact that they automatically create the illusion of a hazardous condition and cause the motorist to reduce speed, thus easing him around the curve safely.

During this winter season most of you have been doing a considerable amount of right of way cleaning which includes cutting of dried weeds, briar, brush and trimming of trees. This is fine work and is certainly improving the appearance of all roads where this work has been done.

The maintenance of roadside parks, tables and overviews along the highways is another important activity during the summer months. These rest stops are very popular with tourists and receive heavy use during these months. Consequently, they should be kept in the best possible condition. This will require visiting the sites frequently for cleanup purposes. Sufficient trash cans should be provided as a means of helping to keep these sites clean. We can create a good or bad impression with the traveling public depending upon how well these facilities are serviced.

Right of way mowing, as you know, presents quite a problem in the summer months and always has for that matter. In the days when we rented teams and
mowers it was very difficult to obtain them when first needed as the farmers from whom they were rented were usually busy on the farm and we were forced to wait and get a late start on mowing. When the power mower first came into the picture I was delighted, because I felt that when we got at least one in each county the mowing problem would be solved. Now, with an average of two machines per county, we are still unable to cope with the mowing problem adequately. Last season, as you know, a few groups of roads were advertised for mowing by contract, but bid prices received were considered excessive and no contracts were awarded. Later several of the Districts rented some privately owned power mowers and it is my understanding that results obtained were very satisfactory. It is believed that instead of purchasing additional power mowers, we should continue to rent privately owned mowers so long as they can be obtained at reasonable prices.

Now in conclusion, I would like to say that highway maintenance is an invaluable public service and everyone connected with this phase of highway work should make every reasonable effort to provide the traveling public with the best possible service at all times.