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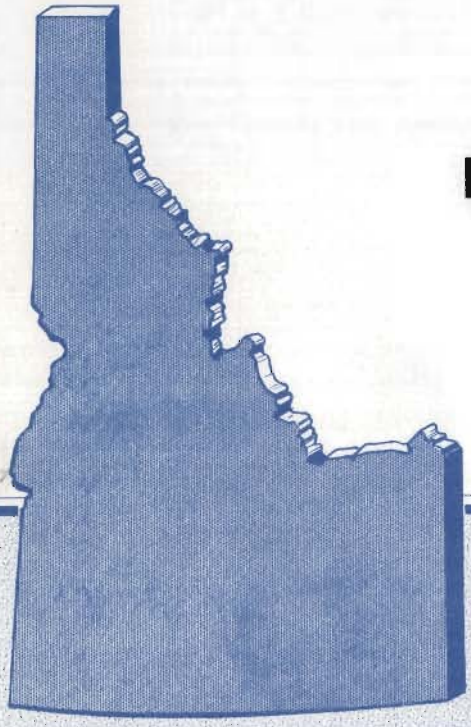
THE USE OF KEROSENE AS A DESLICKING AGENT



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RESEARCH PROJECT NO. 56

STATE OF IDAHO DEPARTMENT OF HIGHWAYS

USE OF KEROSENE

AS A

DESLICKING AGENT

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Without the interest of both Mr. Blaine Sessions, District Engineer and Mr. Dale Harding, Assistant District Engineer, and their helpful instructions the project could not have been accomplished.

Mr. L. F. Erickson, Materials and Research Engineer provided the stimulus for the project when he suggested the use of kerosene as a deslicking agent.

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INTRODUCTION

It has been no secret for many years that a flushing or bleeding pavement provides a slick surface when it is wet. This has been taken care of in past years by posting a flushing area with a "SLIPPERY WHEN WET" sign. However, they have been ineffective in preventing accidents.

With the large and continuous increase in traffic volume and higher speeds on our highways there has also been a noticeable increase in what are termed "skidding" accidents due to the slipperiness of flushing pavements during a rainstorm.

During the summer of 1968 the Department had the opportunity to measure the skid resistance or the slipperiness of our highway surfaces using the B.P.R. Skid Test Trailer and equipment. This provided means to show quantitatively what we already knew from experience, that areas of flushing pavements were truly slick when wet. In fact, some very badly flushed areas gave skid numbers (coefficients of friction) near that of ice.

Flushing is caused by several things, such as improper design or construction of a plantmix pavement; loss of chips (cover coat material) from a seal coat; by pumping during hot weather of asphalt from a recently placed pavement containing too much asphalt.

In an effort to eliminate these slick spots and slippery areas once they have appeared, the Department has resorted to such things as burning the surface, burning and serrating, grooving, Gilsabind and sand, Kerosene and sand; burning, being the most commonly used.

This report is concerned with the use of Kerosene to "deslick" flushing pavements. This method was brought to our attention when we received a copy of the method used by the Michigan Highway Department. The Materials and Research Engineer suggested that some of the Districts try the Kerosene method. District Two elected to try it. The District Engineer assigned the project to E.I.T.

Gary Hazen who laid out and conducted the study.

CONCLUSIONS AND RECOMMENDATIONS

Most of the test sections appeared to give excellent results immediately following the experiment and throughout the winter months. A large enough quantity of blotter material was embedded in the flushed asphalt, softened by Kerosene, to give them a coarse mat-like surface. The crusher rejects appear to give the best results.

A set procedure for the operation that appeared to yield the best results had been determined from the original tests. Now, after a summer of service, there seems to be very little difference in the sections of a given area even though the application procedure used varied within each area. All of the sections show only a slight, if any, improvement.

It is recommended that flushing areas of highways be treated with Kerosene and blotter material in accordance with the recommended procedures in the Appendix of this report.

Since there was no indication that any harm came to the roadway, the application could be changed to increase the Kerosene's effect on the flushed asphalt. Such a change may give results that would last longer and thus make the operation economical. A reasonable change would be to increase the application rate of Kerosene. This would allow the Kerosene to stand on the flushed areas longer before being blotted. Also, the operation could be conducted during slightly warmer weather than previously, so that the Kerosene penetration would be faster and deeper. This would increase the amount of asphalt dissolved so that more of it could be blotted up, resulting in less free asphalt on the surface to flush out later.

In areas where there is considerable excess asphalt present it is recommended that the sand and blotted asphalt be bladed or broomed off and a second application of sand made. In extreme cases a second application of Kerosene and sand treatment may be repeated either immediately or after the first treatment has been in service a few days.

EXPERIMENTAL PROCEDURE

The theory behind this process is that the Kerosene will act as a solvent on the flushing asphalt. The sand will then blot the dissolved asphalt and will either be retained as part of the surface, or will be whipped off by traffic, or swept or bladed off.

Three study locations were selected for this project: (1) on US-93 between Mileposts 78.0 and 81.0 approximately 5 to 8 miles north of Shoshone (2) on US-93 just north of Twin Falls, Mileposts 53.5 to 54.5 and (3) I-80N near Burley, Mileposts 220-229, the eastbound travel lane.

The procedure was to lay out test sections on the flushed pavement and apply the Kerosene to the different sections at one of four application rates: .04, .05, .06 and .07 gallons per square yard at ambient temperature. Following the application the kerosene was allowed to stand for a specified time varying from 20 minutes to 60 minutes. It was then covered with from 5 to 20 lbs. of blotter material per square yard, the best application rate was generally found to be from 12-15 lbs./s.y. Some sections were rolled with a maintenance truck before traffic was allowed on the section; on some, the section was rolled and the loose material either swept or bladed off before traffic was allowed on the treated pavement, on others slow traffic was allowed on the pavement following the application of the sand. In all cases the adjacent lane was swept clean of the loose sand and chips, as a safety factor. Figure 1 shows the sequence of this procedure, pictures (a) and (b) are of sections having received 0.07 and 0.05 gal./s.y. respectively.

Two types of blotter material were used: one was a sand which had 99% passing the No. 6 sieve, and less than 1% passing the No. 200 sieve. The other was a secondary crusher reject which had 65% passing the No. 6 and 7% passing the No. 200.

The blotter was applied by three different methods. The first was a sander.

(a) .07 Gal./S.Y.-Running Off Roadway

(b) .05 Gal./S.Y.-O.K.

(c) Applying Sand With Sander

(d) Rolling With Truck

(e) Finished Section 5 1/2 Hours After Application

FIGURE 1 - THE SEVERAL STEPS OF KEROSENE DESLICKING PICTURES TAKEN ON U.S. 93 NORTH OF SHOSHONE.

This was the easiest method but had disadvantages, such as variable application rate depending upon amount of blotter material in the truck; impossible to get evenly spread over full width of the lane; and blotter material was wasted by being thrown off the roadway.

The second method of application was using a dump truck with a "turkey tail". This equipment would not spread the blotter full width.

The third method, the Flaherty Spreader, had the advantage of being easy to adjust the rate of the spread and it would spread whatever width was desired. A problem of bridging was experienced when the blotter being used was moist.

RESULTS OF TESTS

Probably one of the most critical problems associated with the successful use of kerosene for deslicking flushed pavements is that of when to apply the sand blotter after the kerosene has been distributed. From the tests ran, it was found that the best standing time for the kerosene was from 30 to 40 minutes. The actual time is dependent upon the roadway surface, the pavement temperature, the air temperature and the wind conditions. All the environmental conditions, except roadway surface, affect the rate of evaporization of the kerosene. However, it was found that kerosene penetration into the pavement will be faster and deeper at higher pavement temperatures, but penetration into a highly flushed surface will be relatively slow. All these conditions tend to make it difficult to estimate the rate of application of the kerosene. This is further complicated since the air and pavement temperatures fluctuate so much in any given day.

The experience gained during this study shows that the best average application rate was .05 gal./s.y. depending on the above mentioned factors. On US-93 north of Twin Falls, having a very smooth surface full width, the .05 gal./s.y. was too much. This was notable by the amount of kerosene which ran off the flushed travelway onto the shoulder.

On the Interstate section the .05 gal/s.y. was about right because the surface was about the right texture and all other factors were right.

Where .07 gal./s.y. was used on US-93 north of Shoshone a little kerosene ran off the wheelpaths but was retained between the wheelpaths because this area was not flushed and restricted the flow.

In most cases the immediate effect of this treatment is to give the surface a coarser mat-like surface texture. However, a close inspection of some of the newer mats and porous patched areas indicated a tender surface from which some aggregate had ravelled indicating that the kerosene had softened the mat up long

enough for the traffic to cause some damage. These effects were not apparent on the sealed areas regardless of whether or not they were flushing. This indicates that some caution must be exercised in applying kerosene to new or unsealed mats. Figures 2 and 3 are of treated and untreated sections taken approximately one month after completion of the work. From the appearance of the test sections during this period the crusher rejects produced the best results. The following observations were made ten months after the kerosene and blotter were applied, and after the test sections had experienced one summer of traffic action:

On US-93 north of Shoshone signs of new flushing have appeared. Approximately 50% of the treated areas have had asphalt flush up around the embedded aggregate. This has occured on all the test sections regardless of the treating procedure used. The areas without the new flushing have a coarser surface texture than before the treatment.

The kerosene does not appear to have caused any detrimental side effects to the pavement. A small amount of ravelling occurred during the first month after application but none has appeared since. All the "new" flushing is occurring in the areas which had flushed previously, no new flushing areas have appeared.

On US-93 north of Twin Falls the kerosene-blotter treatment appears to have had no effect. No difference can be observed between the treated and untreated sections. There does not appear to be any embedded material in the flushed asphalt as there was following the treatment.

The original surface was very smooth with many cracks and only a small amount, i.e. a thin layer of flushed asphalt. These conditions caused the kerosene to run off the flushed areas, probably not allowing enough dissolving time for the kerosene and thus getting a poor result.

The I-80N test section near Burley is much like the US-93 section north of Twin Falls. It shows practically no improvement from the kerosene treatment after ten months of service.

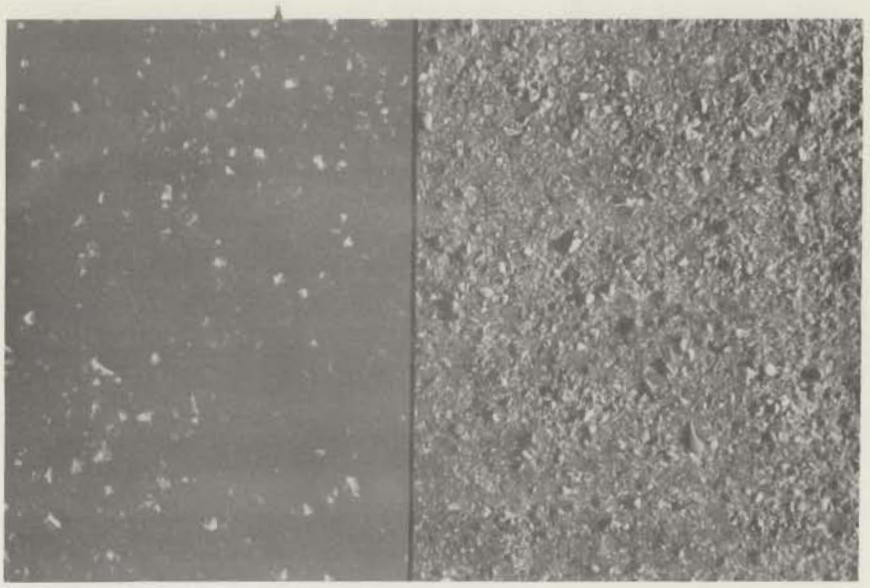

Figure 2 - Before and After Deslicking
Showing Texture (1) Before, Left (2) After, Right

Figure 3 - Views Showing Texture (1) Before,
Right and (2) After Deslicking, Left.

COST COMPARISON

The cost for burning the flushing pavement surface is reportedly from 7 to 10 cents per square yard depending largely on the severity of the flushing. District Two reports that burning costs on the average are 9.3 cents per square yard.

For this project, the cost for deslicking using kerosene and blotter averaged approximately 4.2 cents per square yard. This indicates that burning costs are approximately 2.2 times as much as the use of kerosene for deslicking flushing pavements. This will probably be reduced as experience is gained in this type work.

APPENDIX

IMPLEMENTATION OF RESEARCH FINDINGS

Recommended Procedure for Deslicking Asphalt Pavements Using Kerosene and Blotter Material

This work shall be done usually in the fall of the year when the air temperature is between 32°F. and 70°F. so that pavement temperatures will not be high. A warm pavement surface may result in excessive solvent action of the kerosene thereby causing excessive deterioration of the asphalt surface, with possible ravelling.

Kerosene will be applied using an asphalt distributor at a rate between .04 and .06 gallons per square yard, usually .05 g/sy is best, depending upon the surface texture and weather conditions. If the weather is fairly warm or windy, allowance should be made for rapid evaporation of the solvent.

After application the kerosene will be allowed to set for a minimum of 30 minutes, but never over 40 minutes, before the sand blotter material is applied. Blotter material should be applied when the solvent action has progressed to the "tacky" stage and prior to the appearance of dry spots. Blotter material should be applied at a rate of between 12 and 15 pounds per square yard depending upon the amount of kerosene on the surface. This should blot the dissolved excess asphalt. Spreading may be done with a tailgate sander, a Flaherty Spreader or any other satisfactory equipment.

Immediately following the spreading of the blotter sand the area may be opened to traffic. This should work the excess sand to the side of the roadway leaving a slightly sand paper type texture on the pavement surface.

It may be desirable to roll the area prior to opening it to traffic to assure that the sand is firmly embedded into the softened asphalt. This may be done with pneumatic tired rollers; or maintenance truck wheels may be substituted for pneumatic rollers.

For serious conditions where considerable excess asphalt is present it may be necessary to blade off the sand-asphalt and follow with a second application