Field Testing of Abrasive Delivery Systems in Winter Maintenance

Tech transfer summary

Testing shows that a variety of methods allow abrasive material to be placed on the road more effectively than standard methods. The use of pre-wetting and zero-velocity spreaders both provide significant benefits in the application process.

OBJECTIVES

The purpose of this study was to investigate various methods of applying abrasives to roads in winter weather. Abrasives increase friction on the road surface for a period of time, and the ultimate goal of the research was to enhance friction on the road for as long as possible.

Figure 1: One Type of Zero-Velocity Spreader.

PROBLEM STATEMENT

The key goals in winter maintenance operations are preserving the safety and mobility of the traveling public. To do this, it is in general necessary to increase the friction of the road surface above the levels found on a snow or ice covered roadway. In general, this improvement in friction is best achieved by a pro-active use of chemicals. However, sometimes, the use of chemicals may not be recommended or may not be possible. In such circumstances,

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RESEARCH PROJECT TITLE

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SPONSORS

Iowa Highway Research Board
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abrasives have frequently been used to improve the friction level of the snow or ice covered roadway (albeit temporarily).

A key concern when using abrasives is how to ensure the greatest increase in pavement friction when using abrasives for the longest period of time. The issue addressed in this study is which methods are the best under which circumstances.

RESEARCH DESCRIPTION

The research investigated five different ways in which abrasives can be delivered to the road by a winter truck. The first of these was the "normal" method of delivery, by way of a spinner at the back of the truck. This provided a baseline for comparison between the other methods. The other four methods were zero-velocity spreaders, chutes, pre-wetting systems, and thermal systems.

The report includes a detailed description of a series of tests conducted by Iowa DOT personnel examining three different zero-velocity spreaders. As can be seen from Figure 2, the zero-velocity spreaders place more material within a six foot width than the spinner or the "chute" method of delivery.

A series of field tests were conducted in Johnson County using spinner and chute delivery systems and measuring the friction level on the road at various times after the abrasives had been placed on the road. As expected, there was a reduction in friction over time, but unfortunately it was not possible to determine any statistically significant difference in the performance of the two delivery systems

The two final methods were examined by way of a detailed literature review. It is clear that pre-wetting abrasives at rates of about 8 gallons of liquid per ton of abrasive material provides significant benefits both in terms of material that is placed on the road on initial application, and retention of that material over time under the effects of traffic.

The thermal methods of abrasive delivery have been developed in Scandinavia for use on snow-covered roads. By heating up the abrasive material the friction enhancing effect of the abrasives could be extended to several days from a baseline value of two to three hours.

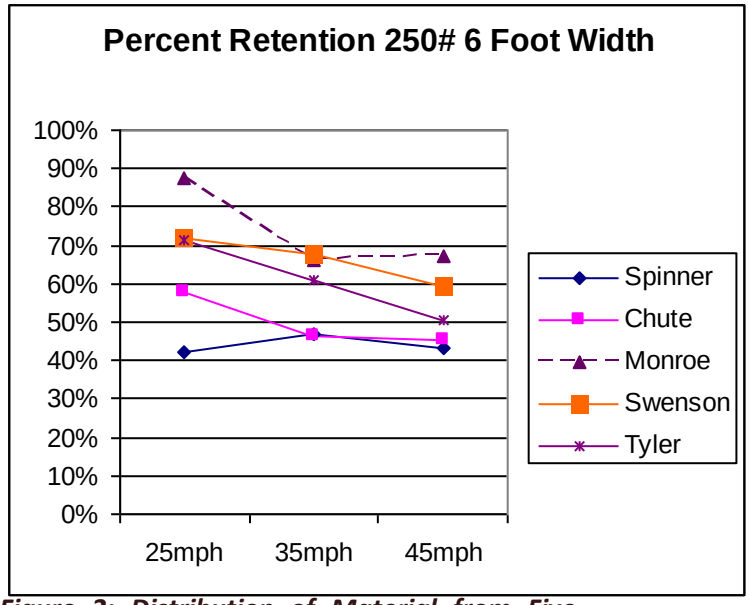

Figure 2: Distribution of Material from Five Different Delivery Systems

KEY FINDINGS

Zero-velocity spreaders provide significant improvements in material placement compared to either spinner or chute delivery of material.

No significant differences were observed in the friction benefits of abrasive placement between either a spinner or a chute delivery system. Both provided an initial friction benefit that diminished fairly rapidly over time.

Thermally enhanced application systems have been developed in Scandinavia and have been shown to wrk well, but it is not clear that such systems are feasible in Iowa.

Studies have shown clearly that pre-wetting material at rates of approximately 8 gallons of liquid per ton of material provide significant benefits both in terms of initial material placement and subsequent material retention.