JOINT TRANSPORTATION RESEARCH PROGRAM

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Investigating the Feasibility of Integrating Pavement Friction and Texture Depth Data in Modeling for INDOT PMS

Introduction

The Indiana Department of Transportation (INDOT) Research Division has had a network pavement friction testing inventory program to detect potential slippery pavements on all interstates, state routes and US highways for many years and has worked to continually refine and update the program. The Research Division annually conducts approximately 6,700 lane-miles of friction testing using the ASTM E274 towed friction trailer. When friction levels below a so-called friction flag value are measured, the district is informed and the site is visited to determine if remediation is needed; this is often called an investigatory level.

The inventory friction test results have been utilized by the districts in planning their annual pavement maintenance and resurfacing activities. However, the network inventory friction test results have not yet been integrated in the INDOT Pavement Management System (PMS). While interstates are tested annually, the inventory friction testing on the US and state roads is conducted every three years, i.e., only one-third of the US and state roads can be tested each year. Consequently there is no timely and accurate friction information on two-thirds of the US and state roads, making incorporation of this data in the PMS impractical. In addition, there are no temporal models available to forecast future friction numbers. Without predictive models, it is impossible to plan future work based on anticipation of future poor friction.

Pavement surface texture data is part of the data collected at the network level for PMS purposes. This is data that has not been utilized due to the lack of models to correlate it to pavement friction or distress types (such as raveling, stripping or disintegration). This project investigated whether it is feasible to use this network level texture data with the inventory friction data, and perhaps other readily available information, to provide realistic pavement friction information at the network level. An alternate option would be to identify a minimum texture level that could be used to signal the possibility of decreasing friction; this could potentially be used as a simple screening tool to identify locations that warrant a more detailed examination, similar to the way the friction flag value is currently used.

Findings

- Potential models to predict friction based on surface texture measurements were examined to determine if they could be implemented with the currently available equipment and data. No models that could accomplish the objectives were identified because of limitations in the equipment and lack of readily available mixture and aggregate information on a network level.
- Next, the available friction and texture data were analyzed in a variety of ways to determine if a minimum texture value could be identified that would give some assurance that adequate friction would be provided. No clear texture limit could be identified. Although there were some cases where pavements with low friction values also had low textures, there were many more pavements—of a given type, road classification, district, approximate traffic level, etc.—that had much higher friction levels. Using a given texture level as a flag value or screening level would result in a large number of “false positives,” as shown in Figure 4.6 of this report, and would create a great deal of investigatory effort to determine if a real friction issue existed on those pavements.
- In addition, selected pavements were examined to determine if changes in texture over time could signal that friction issues might be developing. There was no clear trend that would predict incipient friction issues based on changes in texture.
- Lastly, a few pavements that were suspected of having experienced a loss of friction over time were examined to explore whether there was also a loss of texture that could signal the loss of friction. No relationship was observed between loss of friction and change in texture.
- In conclusion, at the present time and with the data that is readily available, it is not feasible to incorporate friction in the pavement management system through use of the texture data collected during routine condition monitoring with the Pathway van. The available data was analyzed in a variety of ways, and no reliable, or even remotely definitive, relationships could be found to identify pavements that might demonstrate inadequate friction because of

low texture. It is theorized that this lack of a correlation, or minimum texture value to provide adequate friction, is at least in part because the current texture measurements are of the macrotexture only and the significant effects of microtexture are not being captured. Future advances in laser technology, however, may make measuring microtexture feasible. This concept could be revisited in the future.

Implementation

At the present, it is not feasible to incorporate management of pavement friction in the PMS through the use of the pavement texture data collected during routine pavement condition monitoring. INDOT should remain open to consideration of future technological advances that may make it feasible to quantify the effects of pavement microtexture at highway speeds. The Office of Research and Development is ideally suited to continue to search for feasible technologies.

For spot testing for forensic analysis or for testing in places where the towed friction trailer cannot operate safely, it would be possible to measure friction and texture using the Dynamic Friction Tester (DFT) and Circular Texture Meter (CTM) as outlined in other research, as these values have

been correlated with the towed friction trailer data. The CTM is particularly well suited to forensic analyses since its data can be analyzed to separate the effects of micro- and macrotexture, which helps to identify the causes of low friction. The North Central Superpave Center has this equipment and expertise in its use and would be available to assist with spot investigations.

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Figure 4.6 Texture vs. friction with friction flag value and potential minimum texture reading.