Enhanced Treatment Selection for Reflective Joint Cracking in Composite Pavements

Introduction

Composite pavements are currently the most prevalent type of pavement on the highway system administered by the Indiana Department of Transportation (INDOT), mainly due to the fact that about 60% of all rehabilitated pavement projects are composite pavements. The correct type of treatment for reflective cracking in composite pavements is commonly determined by a visual inspection of the crack on asphalt overlay, although it should be selected based on the condition of the concrete underneath because it is difficult to determine the condition of the concrete joints or cracks by only examining the surface distresses of the asphalt overlay. Due to this uncertainty, many good concrete pavements have been unnecessarily replaced as field engineers decided on full-depth patching, and this had been leading INDOT’s dissipation of costs, materials, and manpower.

This research, therefore, was necessary to enhance identification of the condition of the underlying concrete joints by looking at the surface distresses of the asphalt pavements and to develop a decision-making process to enhance treatment selection for joint cracking in composite pavements. The main objectives of this research are to fulfill these research needs and to develop a guideline that can assist INDOT with their decisions. (ASSUMPTION 1: low- and moderate-severity concrete cracks need partial-depth patching, and high-severity concrete cracks need full-depth patching.)

Findings

Based on the analyzed results from the four-step data collection processes, this report documents the results of Phase II, which includes a summary of the study’s major findings from the literature review, data collection and analysis, and the decision-making guidelines.

Visual inspections of reflective cracks on the pavement surface and the exposed concrete pavement are the first and the last steps of the data collection procedure. Based on the 2010 PCR Data Collection Manual, the visual inspection of reflective cracks was classified into three levels of severity (low, moderate, and high) and extent (few, several, and many).

Based on the data collected from I-69 in Fort Wayne, a trend was revealed that the severity level of an asphalt crack was closely correlated to the severity level of the exposed concrete crack underneath the asphalt layer. Correlations between asphalt and concrete crack severity levels were as follows: 85% of high-severity asphalt cracks were located over high-severity concrete cracks; 60% of moderate-severity asphalt cracks were located over moderate concrete cracks; and 75% of low-severity asphalt cracks were located over low-severity concrete cracks.

In terms of the distribution of joint cracks and mid-panel cracks at the I-69 site, 33 cracks were at the joint and the remaining 27 were at the mid-panel, and 55% of the cracks were located over joints whereas 45% of the cracks were located over mid-panel distresses in the concrete pavement. All the low-severity cracks were located over joints. Moreover, 65% of the moderate-severity cracks and 70% of the high-severity cracks were located over mid-panel distresses in the concrete pavement.

Implementation

Although this study attempted to consider various factors and criteria for the decision making, standardized results could not be provided in this report as it is realistically difficult to infer the condition of the concrete joints and cracks underneath an asphalt layer with 100% accuracy. Furthermore, only selected variables were used in this study to analyze the correlations between the severity levels of asphalt cracks and concrete cracks. Therefore, to obtain more accurate analysis, more variables need to be considered.

Furthermore, the decision-making tool proposed by this study employs the sample data that is already stored in the database to suggest crack treatments. Therefore, to obtain more reliable results with this tool, adding to the number of sample data is critical. This study therefore suggests conducting additional field evaluations (four steps) to add more sample data to the database to enhance the decision-making tool’s suggestions.

This study also provides a database, a computer application, and a pocket book for INDOT field engineers. The database and the computer application will be helpful when organizing the collected data and will increase field engineers’ access to the sample data, improving the analysis process by providing better visualization tools. Employing the pocket book will be useful when field engineers are making preliminary decisions on reflective crack treatments.

This study can be utilized to quickly estimate the condition of the concrete joint underneath the asphalt layer with a defined selection of factors and criteria required. However, the decision-making tool’s usability is practical, its reliability remains to be determined. The treatment criteria and suggestions made by this study should mainly be implemented as an academic consultation and preliminary implementation, rather than as a definitive decision. If the crack treatments suggested by the decision-making tool are not fully appropriate, the field engineers should still have the autonomy to make final decisions, it is recommended to have additional information, such as pavement history and maintenance records, before implementing the suggested treatment decision.

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