

JOINT TRANSPORTATION RESEARCH PROGRAM

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Crack Sealing and Filling: Best Practices

Introduction

The Indiana Department of Transportation (INDOT) performs in-house crack sealing/filling practices on pavements based on INDOT Performance Standard Activity 2070 for Crack Filling and Activity 2090 for Crack Route and Seal. Those activities are the primary pavement preservation techniques considered in the INDOT Pavement Preservation Initiative (PPI).

Even though crack sealing/filling has been used popularly on pavements, there are mixed research findings regarding the effectiveness of sealing/filling and routing. For instance, a study for the Ohio Department of Transportation (ODOT) concluded that the crack sealed pavements exhibited better performance in terms of pavement condition rating than the untreated section on a 5-year life cycle. Another study conducted with Long-Term Pavement Performance (LTPP) data in 2012 on short-term effectiveness of pavement treatment on International Roughness Index (IRI) reported that crack sealing application offered a significant jump in pavement performance in terms of IRI down to 28 in./mile. However, two Indiana studies (Fang et al., 2003; Ong et al., 2010) found that there were no significant IRI differences between sealed and untreated pavements. For the effectiveness of routing in crack sealing practice, Masson (1997) found that routing on an asphalt concrete pavement created micro-cracks at the bitumen aggregate interface and within aggregates. A recent Illinois study concluded that routing is not recommended for all types of cracks, just for working cracks. The controversial effectiveness in terms of sealing/filling and pavement performances should be clarified for INDOT's crack sealing/filling practice. There is also a need for a study to evaluate INDOT's crack sealing/filling and routing effectiveness.

INDOT currently uses AE-90S for the crack filling application (2070 Activity) and hot poured sealants (crumb rubber asphalts) for the crack sealing application (2090 Activity). Various materials are available in the crack sealing/filling industry. Specifically, this study found that more than 70 products were listed in the approved/qualified product lists of 17 state DOTs. Accordingly, having a proper material selection guide is important for ensuring crack sealing/filling performance. INDOT uses American Society for Testing and Materials (ASTM) D 6690 Type II sealant. Recently, "Performance Based Sealant Grading (SG)" was introduced with better correlations between sealant rheological properties and field performances at low temperature. Therefore,

there is a need to evaluate SG to assess its validity and applicability to INDOT.

INDOT Specification Section 408 specified that crack sealing/filling operations cannot be performed when either a pavement surface is not dry or the ambient temperature is below 40 °F. INDOT conducts crack sealing/filling throughout the year and those conditions often pose limits on the available season and operation time. A hot air lance (HAL) is an option to increase the construction time and help the production rates. HAL produces high velocity hot air, directed towards the pavement surface, thus removing dust and moisture from the crack.

A Strategic Highway Research Program (SHRP) manual of practice recommends a HAL for removal of dust and moisture. HAL is popular in other DOTs. For instance, a HAL application is a common practice for crack sealing in Illinois. INDOT has very limited experience with HAL: only 3 out of 29 INDOT Sub-districts have any experience with a HAL. Consequently, the performance and applicability of the HAL need to be reviewed for its possible vitalization in Indiana.

INDOT requires cracks to be routed prior to the placement of sealant. A few issues with routers have been reported, such as safety, production rates, and their maintenance. A new router, called the RapidRouter™ (RR), was recently introduced to INDOT. RR is a skid steer mounted router controlled by a skid loader controller. Thus, an operator can be in a safer environment with constant production rates and less operator fatigue. This study evaluates the performance of a prototype RR available to INDOT.

The primary objectives of the proposed research project are: (1) to review the current state of practice for crack sealing/filling; (2) to evaluate the effectiveness of crack sealing/filling; (3) to assess the effectiveness of routing cracks; (4) to evaluate the performance of crack sealing/filling materials; (5) to review the performance-based sealant grading system; and (6) to evaluate the crack sealing/filling equipment performance.

Findings

An extensive literature review and nationwide/statewide survey in 2012 were performed to understand the state of crack sealing/filling practices. The key findings are as follows: (1) most state agencies used both sealing and filling terminologies interchangeably; (2) 65% of the responses indicated that routing is

required for crack sealing/filling application; (3) ASTM D 6690 Type II was the most widely used material type with only Missouri and Indiana including emulsions in their specifications as crack sealing/filling materials; (4) over 70 products were listed in the approved/qualified product lists of 17 state DOTs; (5) most of the sealants and fillers are produced by Crafcro, Deery, McAsphalt, and Right Pointe; (6) INDOT performed crack sealing throughout the year while crack filling was primarily conducted during the winter season; (7) most INDOT Sub-districts shared crack sealing equipment within their respective Districts. Crack sealing/filling equipment availability and their maintenance were the biggest concerns.

The experimental evaluation was performed to assess the effectiveness of crack sealing/filling applications, routing, material performance, and equipment performance. Five crack sealant and four crack filling materials were tested utilizing IRI, Falling Weight Deflectometer (FWD), surface crack evaluation, adhesive/cohesive/spalling (ACS) failure, Ultrasonic Pulse Velocity (UPV), texture scanner, and flow rate. In addition, the new sealant grading system was conducted with the same nine crack sealing/filling materials and the performance of the RR and HAL were evaluated.

Implementation

Routing Practice

The mixed results regarding the effectiveness of the routing were obtained from the literature review and the field evaluation. Some literature and a recent study conducted by the Illinois DOT reported that routing is effective, and the Illinois study also concluded that routing was effective in minimizing ACS failures. However, routing was not determined to be effective in terms of ride quality, structural integrity, pavement surface crack, crack integrity, and material deformation for two years in the test sections. As a result, the Study Advisory Committee recommended that routing in the 2090 Activity be limited to a single transverse crack (reflective crack) on asphalt concrete over concrete pavements.

AE-90S Replacement

The test section results show that there are some better performing sealants and fillers than AE-90S. AE-90S costs about 65% of the average hot poured sealant and filler cost (\$0.45) used in this study. However, considering the residue of AE-90S (e.g., 65%), the hot poured sealants have competitive pricing. Therefore, replacing AE-90S with the other crack sealants or fillers for the filling application (2070 Activity) should be considered.

Material Selection

INDOT currently uses ASTM Type II crack sealants, which from the evaluation showed overall good pavement and crack performances. The correlation between sealant performance grades of each material and the pavement and crack performance test results were poor and insignificant. Thus, the current INDOT crack sealant material selection process (ASTM Type II) is concluded to be adequate.

Hot Air Lance

The hot air lance (HAL) effectively cleans and dries the wet cracks and provides better bonding between the materials and the asphalt pavement surface than conventional air compressors. The incorporation of a HAL in wet conditions is recommended to extend operable time and the seasonal availability for crack filling and sealing construction (2070 and 2090 Activities).

References

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