TECHSUMMARY May 2015

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Mitigation Strategies of Reflective Cracking of Pavement

The RAC Region II has initiated a collaborative research program consortium through the Transportation Pooled Fund (TPF) Program. The research program is called the Southeast Transportation Consortium (STC) and is intended to encourage coordination among member states, as well as provide resources and management of collaborative studies. The Consortium intends to address high priority transportation research topics of common interest to the southeastern and adjoining states. Louisiana serves as the lead agency in the STC.

INTRODUCTION

Reflective cracking in asphalt concrete (AC) when it is placed over Portland cement concrete (PCC) pavement is a serious failure mechanism, leading to premature failure of the AC overlay and allowing water infiltration through the cracks, which can cause stripping in AC layers. The base and/or subgrade may deteriorate as well. Practical experience shows that reflective cracking propagates at a rate of 1 in. per year.

Starting from the early 1960s, different crack control treatment methods have been utilized to control reflective cracking including metallic grids, different types of geosythetics, asphalt-based interlayers, and fractured-slab approaches. Fractured PCC slab approaches including crack and seat, break and seat, and rubblization are considered pavement reconstruction techniques that aim at reducing or eliminating the effective length of the original slab in order to prevent movement of the concrete layer, which in turn eliminates or reduces reflective cracking.

The U.S. Department of Transportation (USDOT), Federal Highway Administration (FHWA), and the Southeastern Transportation Consortium (STC) financially supported this research project.

OBJECTIVE

The primary objective of this study was to conduct an in-depth literature review of research projects on reflective cracking of asphalt concrete overlays and a survey of the practices of highway agencies with regard to the types of cracking mitigation strategies used, selection criteria for the different strategies, construction methods employed to implement the strategies, experiences with the strategies and constructed systems, benefit/cost analysis performed, and guidelines for selecting appropriate strategies and constructing a chosen treatment system. This review will serve as a baseline for future research projects on this topic as identified by the results of the synthesis.

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SCOPE

To achieve the aforementioned objectives, a comprehensive review of previous research studies was conducted to investigate the main types of crack control treatment methods used to delay/prevent reflective cracking. A questionnaire survey was conducted in order to identify current practices used by different states DOTs to combat reflective cracking. Collected information was used to conduct a comparative analysis that summarizes and assesses each treatment method in terms of cost, effectiveness, and long-term performance. Based on the results of this synthesis, the research team identified the most promising treatment methods that should be considered for further evaluation and for quantification of their cost-effectiveness.

RESULTS

The recommended treatment methods are as follows:

For existing HMA pavements, one of the following treatment methods may be selected:

- Crack sealing and overlay (pros: low cost and suitable for cracked asphalt pavements; cons: reflective cracking may still appear)
- Chip seal and open-graded interlayers (pros: low cost and adequate control of reflective cracking)
- Full-depth reclamation (pros: prevent reflective cracking, suitable for heavily cracked pavements, environmentally friendly; cons: cost)
- Cold-in place recycling (pros: prevent reflective cracking; cons: not suitable for heavily cracked pavements with fatigue cracking)

For existing PCC pavements, one of the following treatment methods may be selected:

- Saw and seal (pros: low cost and well-proven performance)
- Chip seal and open-graded interlayer system (pros: low cost and adequate control of reflective cracking, can be used with weak subgrade)
- Rubblization (pros: eliminates slab action, high probability of success; cons: only suitable in projects with suitable subgrade/base support, cost, thick overlay, may require shoulder work and/or guardrail adjustment)
- NovaChip: While results have been mostly positive, the literature available for this treatment method is limited. A number of states have reported a positive experience.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the literature review and the survey questionnaire, a summarized assessment is presented for each reviewed treatment method. Further, a number of treatment methods were identified for further evaluation. For existing HMA pavements, crack sealing and overlay, chip seal and open-graded interlayers, full-depth reclamation, and cold-in place recycling are the most promising treatment methods. For existing PCC pavements, saw and seal, chip seal and open-graded interlayer systems, and rubblization are the most promising treatment methods. However, one should consider that rubblization requires a thick overlay and may also necessitate guardrail adjustments and/or shoulder work.

Based on the results of this study, the research team recommends that a follow-up study be conducted in order to evaluate the cost-effectiveness of the most promising treatment methods and to develop guidelines for the control of reflective cracking. The developed crack control guidelines will present recommended treatment methods for different classes of rehabilitated pavements in order to achieve adequate control of reflective cracking in a cost effective manner. It is envisioned that a simple computer tool would be developed to allow the designer to enter information for a given project and with the computer program providing the recommended crack control treatment method along with cost saving estimates based on project conditions.