

Florida Department of Transportation Research Investigation of Reflection Crack Mitigation Techniques BDK78-977-17

When new asphalt is placed over concrete or asphalt pavement, cracks or joints in the old layer can appear in the new overlay; this is called reflective cracking (RC). In current Florida practice, an asphalt rubber membrane interlayer (ARMI) is placed between old and new pavements to reduce reflective cracking. However, ARMI has shown inconsistent performance and a recent accelerated pavement testing (APT) study found that ARMI can initiate instability rutting when subjected to slow moving truck loads and elevated summer temperatures. Therefore, the Florida Department of Transportation (FDOT) is seeking alternatives to prevent and mitigate RC.

In this project, University of Central Florida researchers focused on asphalt concrete overlays over flexible pavements. They identified suitable RC mitigation methods for Florida conditions and ranked them by cost, performance, and other design variables. The researchers examined many aspects of the problem, conducting an extensive literature review, a survey, personal interviews, numerical simulation using finite element analysis (FEA), and Life Cycle Cost (LCC) and Multi Criteria Decision Making (MCDM) analyses.

The survey and personal interviews addressed current RC mitigation practice across the country. Researchers found that the most popular RC mitigation was increasing inlay/overlay thickness. However, most state highway agencies had no overlay design method specifically addressing RC.

To investigate RC mechanisms, researchers conducted a thorough literature review, followed by FEA. Previous work largely agreed that the main RC mechanism for jointed concrete pavements (JCPs) was vertical differential movement at joints under wheel loads; for underlying HMA, it was bending deformation. Overlay fracture modes also differed. In the FEA study, the effects of different cracking conditions (e.g., full-depth, top-down, and bottom-up cracks) and also the influence of different RC



Pavement cracks are both engineering and safety concerns. They can become sites of more severe pavement damage, including spalling, pot holes, and damage to the underlying road structure.

mitigation methods (mill and inlay, fabric, and ARMI) were evaluated.

LCC analysis was conducted to evaluate the cost-performance effectiveness of eight different RC mitigation methods: fabric (geotextile); chip seal; STRATA interlayer system; interlayer stress absorbing composite; ARMI; cold in-place recycling; hot in-place recycling; and increased thickness of inlay/overlay. Performance varied greatly among methods; thus, a new procedure that accounts for the performance compared with the control section was developed and applied to the LCC analysis. The LCC results are presented with the range of minimum and maximum performance of each RC mitigation method.

MCDM analysis was used to rank the top RC mitigation methods using a broader range of input variables that decision makers might consider, such as performance (life span), recyclability, design and construction familiarity, proprietary product, etc. Multiple scenarios were analyzed, including budget, performance, and recyclabilitypriority. With project budget/life cycle cost as the priority, fabric was more effective. But with performance and recyclability as priorities, thicker inlay/overlay was more effective.

Project Manager: James Greene, FDOT Materials Office Principal Investigator: Boo Hyun Nam, University of Central Florida For more information, visit http://www.dot.state.fl.us/research-center