Project Summary

Texas Department of Transportation

0-1777: Field Synthesis of Geotextiles in Flexible and Rigid Pavement Overlay Strategies Including Cost Considerations

Background

For flexible, rigid, and composite pavements, a common technique used by many highway agencies for preventive maintenance and/or rehabilitation is simply to construct a thin hot mix asphalt (HMA) overlay. When placing an overlay over a pavement containing joints and/or cracks, one of the more serious concerns associated with the use of thin overlays is reflective cracking. This phenomenon is commonly defined as the propagation of cracks from the movement of existing cracks or joints in the underlying pavement or base course into and through the new overlay. One of the techniques to reduce reflection cracking on HMA overlays is to incorporate a geosynthetic plus an asphalt tack coat product into the overlay pavement system. Geosynthetic products are defined herein as fabrics, grids, or composites. This approach is typically accomplished by attaching the geosynthetic product to the existing pavement (flexible or rigid) with an asphalt tack coat and then overlaying with a specified thickness of HMA pavement. Based on findings during the literature review and from test pavements evaluated in this study, these materials have exhibited varying degrees of success.

The overall objectives of project 0-1777 were: 1) to investigate and develop information that will aid in the evaluation of the relative effectiveness of commercially available geosynthetic materials for reducing the severity or delaying the appearance of reflective cracking, and 2) to calibrate and validate FPS-19 Design Check using data collected from field performance evaluations and laboratory testing.

What the Researchers Did

A previous phase of this project established multiple test pavements in three locations (Amarillo, Pharr, and Waco Districts) to evaluate certain geosynthetic products. Overlays in the Amarillo and Pharr District were placed on flexible pavements; whereas, those in the Waco District were placed on plain jointed concrete pavement. The researchers continued to monitor and record performance of these 26 test pavements through 2007. They obtained beam specimens and tested them using the small and large TTI overlay testers.

Researchers attempted to use the resulting data to calibrate the FPS-19 Design Check but were unable to accomplish this because of the following: 1) Design Check for FPS-19 was developed based on the development of medium-severity reflection cracks; but hardly any medium-severity cracks developed in any of the test pavements, and 2) the analysis technique for the data from the large overlay tester proved to be very cumbersome when attempted manually and was unsuitable for automated analysis using a computer.

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As an alternative the researchers used the data with necessary extrapolations to compute relative life ratio (with respect to reflective cracking only) for the overlays containing a geosynthetic product as compared to the respective control pavements without a geosynthetic. Further, they conducted a review of current pertinent literature that had been published since the last report from this project.

What They Found

Based on the field and laboratory evaluations and a review of current literature, the research team found the following.

- The findings of this project and the literature review of other recent field evaluations of geosynthetic products shows that their effectiveness in reducing the number of reflective cracks is marginal. The literature review indicated that certain geosynthetic products can, however, reduce the severity of reflective cracks that appear but not all geosynthetics are equal. Some materials are better than others.
- The Design Check for FPS-19 was developed based on the development of medium-severity reflection cracks. Since hardly any medium-severity cracks developed in any of the test pavements, the resulting data were unsuitable for calibration or validation of the Design Check for FPS-19.
- Using the field performance data, the researchers computed the relative life ratio for the various products tested in Amarillo and Waco test sections. On average, when a geosynthetic product was used, these calculated values showed significant reduction in reflection cracking in Waco on the concrete pavement and marginal improvement in Amarillo on the flexible pavement. These computations involved extrapolations and should therefore be viewed with caution.
- The small overlay tester appears inappropriate for evaluating specimens containing a geosynthetic interlayer.
- Based on this project and several previous projects, the large overlay tester is a valuable tool for evaluating the cracking potential of composite beam specimens. However, one should expect specimens to occasionally separate at the interlayer when testing certain geosynthetic products.
- Usually, during the first couple of years, pavements using geosynthetics perform somewhat better than the respective control pavements without a geosynthetic, but as the overlay gets older, the difference diminishes.

What This Means

The findings indicate that geosynthetic products should be used judiciously with careful planning and forethought. Past experience using these materials is the best indicator of their performance. The use of geosynthetic products incorporates more risk into an HMA overlay project if not used properly. There appears to be no guarantee that a geosynthetic will provide cost-effective performance in reducing reflective cracking in an HMA asphalt overlay.

Neither calibration nor validation of FPS-19 Design Check could be accomplished due to the absence of a sufficient amount of cracks with a medium severity level. Therefore, the validity of the Design Check for accurately predicting overlay design life is questionable.

For More Information:

0-1777-1 Geosynthetics in Flexible and Rigid Pavement Overlay Systems to Reduce Reflection Cracking

0-1777-2 Field Tests Using Geosynthetics in Flexible and Rigid Pavements to Reduce Reflection Cracking

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