Texas A&M Transportation Institute

PROJECT SUMMARY

Texas Department of Transportation

0-6741: New Laboratory Design Tools and Field Performance Equipment for Permeable Friction Courses

Background

Permeable friction course (PFC) mixes have proven to be excellent mixes that exhibit a number of desirable characteristics: rut resistance, crack resistance, reduced wet weather splash spray, reduced tire noise, and increased visibility of pavement markers during heavy rain. The Texas Department of Transportation pays a premium price for these benefits, but they are sometimes short lived, and several districts have restricted their use because of premature raveling problems. Other problems have been reported with surface fusion where the PFC loses its drainage capabilities.

What the Researchers Did

This study was initiated to address these performance issues, focusing on:

- Developing new laboratory test protocols to be used at the design stage to potentially eliminate mixes with stripping susceptibility. Testing was focused on aggregate and binder combinations that had prematurely raveled.
- Monitoring the performance on sections constructed with new specifications, with changes aimed at minimizing these performance problems. Researchers monitored a section constructed with asphalt rubber PFC, a coarse aggregate gradation to minimize the risk of surface fusion, and numerous sections of fine PFC. Finally, lab tests were conducted using the criteria proposed in this study on materials from districts that have historically had raveling problems to make recommendations for the construction of test sections.
- Constructing an automated splash spray monitoring system to measure how existing PFC pavements are performing, helping to optimize future designs.

What They Found

Researchers found:

- To ensure that a mix has an adequate aggregate skeleton and does not crush or break down under the application of traffic, *a locking point maximum value of 100 gyrations* is recommended. The concept of this simple test is that the combination of mostly single-sized PFC aggregates should readily lock in place, and during compaction in the Superpave gyratory compactor very small changes in density should be observed with an additional number of cycles. If the mix continues to consolidate, then either the aggregates are crushing under the applied load, or the aggregate gradation needs to be revised.

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- Due to the inherent presence of water within a PFC mixture, a moisture susceptibility test is needed. Two tests are proposed to identify a mixture that is prone to moisture damage:
  - A maximum of 10,000 cycles in the Hamburg wheel tracking test and/or
  - A maximum of 30 percent Cantabro loss after MIST conditioning of 40 psi, 140°F, and 1,000 cycles.
- The new coarse gradation appears to be a solution for asphalt rubber PFCs, which has been reported to be closing up (surface fusion) primarily in Houston. A test section on IH 45 under heavy traffic was draining well and performing excellently after 2 years.
- The fine PFC sections monitored in this study were found be performing very well. Sections have been placed at a thickness of 0.75 inch, which makes this mix very economical. It is a very simple mix (100 percent grade 5 material) that is easy to compact.
- The Pharr District should discontinue the use of crushed gravel in its PFC mixes. These have not performed well in the past. Based on the moisture susceptibility testing proposed, the district would get much better performance by using a locally available matrimar crushed limestone mix with 7.1 percent PG 76-22. The original asphalt rubber mix with gravel lasted 526 passes in the Hamburg test. The newly proposed limestone mix lasted over 13,700 passes.
- The research team was able to develop an innovative splash spray monitoring system to determine if each design is maintaining its water-draining capabilities over time. The system captures high-definition video images and uses an advanced video-processing package to monitor the spray characteristics of any pavement surface.

What This Means

The recent changes to the PFC specification, which includes the introduction of the coarse gradation for asphalt rubber PFC mixes and the new generation of fine PFCs, are a step in the right direction. Test sections constructed using both of these new mixes are performing very well. Districts wishing to construct asphalt rubber (AR) PFCs should be encouraged to use the new coarse gradation. It is recommended that consideration be given to dropping the fine gradation. Districts should also be encouraged to field test the new fine PFCs. Successful test sections have been built in four districts. Consideration should also be given to implementing the locking point and moisture conditioning proposed in this study.

Districts in South Texas continue to have performance problems with AR PFCs where the main aggregate is crushed gravel. Several of these districts are currently not constructing PFCs, and they should be encouraged to construct and monitor sections with high-quality crushed limestone. This material passes all of the performance tests proposed in this study.

The newly developed splash spray monitoring system shows great potential; consideration should be given to further implementation of this promising pavement-monitoring tool.

For More Information

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