



Project Summary

Texas Department of Transportation

0-5598: Development of Very Thin Overlay Systems

Background

The most commonly used overlays in Texas are dense graded mixes, placed in 2-inch-thick lifts. Very thin overlays of 1 inch or less have been used in the Houston District since 2000, but primarily as a crack resistant level-up course on top of old concrete pavements where a final wearing surface would be a traditional or high performance mix. Project 0-5598 designed and constructed very thin overlays that could be used as wearing surfaces.

For thin overlays, the engineering properties that are considered in the design phase are rut resistance and reflection cracking resistance. The Texas Department of Transportation (TxDOT) already has the Hamburg Wheel Tracking Test to screen out mixes that are susceptible to rutting and moisture damage. In this research, the newly developed upgraded overlay tester was used to ensure that proposed thin overlays would have superior resistance to reflection cracking.

What the Researchers Did

Researchers, using a special specification proposed by TxDOT, designed eight different crack attenuating mixes (CAM). These used the volumetric design procedure where the optimal asphalt content was determined using a gyratory compactor, achieving 98 percent density in 50 gyrations. Samples of the mix compacted to 93 percent density then have to pass TxDOT's Hamburg requirement and also last more than 750 cycles in the overlay tester.

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Problems were encountered with this design procedure with locally available limestone aggregates, so the researchers investigated alternative designs. They recommended a procedure where the performance tests are run first at a range of binder contents, and the optimal binder content is defined as the middle of the range of binder contents where both performance criteria are satisfied. In this project very thin overlays, which met the proposed performance criteria, were placed on five major highways in Texas. Two of these were on jointed concrete pavements.

Figure 1. Placement of the CAM Mix on Pumphrey Drive, Fort Worth.

What They Found

The CAM mix performance to date has been very good. The performance of the 1-inch overlay over jointed concrete pavement on Pumphrey Drive in Fort Worth (Figure 1) has been very encouraging although more monitoring must be performed. Only minimal reflection cracking has been found after 18 months, and the skid resistance values remain high.

Successful projects were also constructed in Laredo District (Loop 20), Lufkin District (US 59), and Austin District (US 281). However, construction problems were encountered when the temperature of the CAM at time of compaction was not carefully controlled. These very thin mats will cool rapidly and will not be adequately compacted if temperature is not controlled. The use of the infrared bar or thermal camera inspection should be encouraged on future jobs.

What This Means

The combination of the Hamburg and overlay tester is highly recommended to produce a balanced mix design for these thin overlays. The design procedure proposed in this project has several advantages over the volumetric procedure:

- It provides districts with a working range of binder contents where acceptable performance can be anticipated. (This range can be used to set tolerance levels during production).
- It quickly identifies asphalt and aggregate combinations where both performance requirements cannot be met.
- It can provide a more economic mix as it is thought the current volumetric procedure often results in too high an asphalt content.

The CAM mixes designed in this study were on average 25 percent more expensive than the traditional dense graded materials. However, given that the CAM mixes are placed in lifts of 1 inch rather than 2 inches, there is a clear economic incentive to continue to use these high performance mixes. These very thin overlays have additional advantages in urban areas and in locations where clearances or geometrics are a concern. More monitoring is required, but to date performance has been very good. The CAM mix appears to be a valuable tool for district designers maintaining large networks with limited budgets.

For More Information:

0-5598-1 Thin HMA Overlays in Texas: Mix Design and Laboratory Material Property Characterization

0-5598-2 Design And Performance Evaluation Of Very Thin Overlays In Texas

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