Texas A&M Transportation Institute

PROJECT SUMMARY

Texas Department of Transportation

0-6615: Use of Fine-Graded Asphalt Mixtures

Background

Thin hot mix asphalt (HMA) overlays can be placed at a thickness of 1.0 inch or less because they use a small nominal maximum aggregate size (No. 4 or 3/8 inch), and the use of high-quality aggregates and polymer modified binders ensures adequate performance. They are more economical than traditional overlays and mitigate problems with curb/gutter height restrictions. Though still more expensive than surface treatments, these mixes should not have chip-loss problems and, because of the fine texture, are relatively quiet. When properly designed and constructed, they may provide a service life comparable to traditional mixes.

Another option for thin pavement maintenance is slurry overlay systems. These emulsion- or cement-based materials are spread or sprayed onto the pavement surface at ambient temperatures, do not require compaction, and can be opened to traffic after a short time.

This research (1) monitored existing thin overlay performance, (2) developed new thin overlay specifications that districts can easily and cost-effectively implement, (3) worked with districts to construct new thin overlay test sections, and to a lesser extent (4) evaluated various slurry overlay systems in similar applications.

What the Researchers Did

Based on a literature review and preliminary field evaluations, researchers created draft specifications for three thin HMA overlay mix types:

- Fine dense-graded mix (fine DGM).
- Fine-graded stone matrix asphalt (fine SMA).
- Fine-graded permeable friction course (fine PFC).

In the laboratory, the researchers designed each mix type with five different aggregates and tested the designs for rutting resistance, cracking resistance, raveling resistance (fine PFC), and permeability (fine PFC). The performance tests were run on samples molded to the optimum asphalt content (OAC) from the volumetric determination and at OAC + 0.5 percent. Testing also included two supplementary studies on the effects of screening type in fine SMA and the effects of recycled asphalt pavement/shingles (RAP/RAS) on fine SMA and fine PFC. Several of these designs, and a few new designs, were placed in the field.

The researchers also evaluated several existing slurry overlay projects in the field and compared existing slurry overlay designs (MicroTekk, MicroTekk Flex, Tuffseal, and experimental skid slurries) in the laboratory. The properties investigated in the laboratory study were cracking resistance, abrasion resistance, skid/polishing resistance, and bond strength.

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Project Completed:
8-31-12

What They Found

In nearly all cases, the draft specifications produced acceptable designs based on the performance tests. Minor adjustments to the density criteria and gradation bands were made. Fine SMA compaction was highly dependent on screening gradation, and lower quality screenings decreased the mix cracking resistance. The mixes in the RAP/RAS study performed very well, suggesting that quality, well-engineered mixes can have good rutting and crack-resistant properties even when recycled materials are introduced in limited amounts. In the field applications, most thin HMA overlays were constructed without problems, though some encountered issues with over-compaction (fine PFC) or under-compaction (fine SMA).

Concerning the slurry overlay laboratory testing, many of the test methods employed did not produced clear results. More work is needed to develop defensible performance-related tests for slurry overlays.

What This Means

The researchers recommend adaptation of the proposed specifications for fine DGM, fine SMA, and fine PFC, as given in Appendix A of Report 0-6615-1. Key aspects of the specifications are summarized as follows:

- High aggregate quality requirements (surface aggregate classification A encouraged, LA abrasion: 30 maximum, sulfate soundness: 20 maximum, no RAP/RAS at this time).
- High binder quality requirement (PG 76-22 for the first applications in Texas districts; future studies should focus on other binders such as PG 70-22).
- Gradations with nominal maximum aggregate size between 3/8 inch and No. 4.
- Target lab molded density of 96 percent for fine DGM in the Superpave gyratory compactor (SGC), 96.5 percent for the fine SMA in the Texas gyratory compactor, and within 74–78 percent in the SGC for the fine PFC.
- Performance tests at two asphalt contents: the OAC from the volumetric design and the OAC + 0.5 percent.
- Hamburg wheel-tracking tests (HWTT): 1/2 inch at 20,000 passes for fine DGM and fine SMA and 10,000 passes for fine PFC. Overlay tester: 300 cycles for all mixes.
- Minimum asphalt content of 5.5 for fine DGM and 6.0 for fine SMA and fine PFC.
- For all mixes, pay for the asphalt as a separate bid item.
- For the trial batch, in addition to binder content and density testing, also run the HWTT and overlay test.
- Tandem rollers recommended during fine SMA compaction.
- Water flow: < 20 sec for fine PFC (no in-field density requirement); >120 sec for fine DGM and > 60 sec for the fine SMA to ensure impermeability.

The researchers also recommend using the pavement evaluation and mix selection guidelines in Chapter 6 of Report 0-6615-1.

For More Information

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Keyword: Research