

0-6132: New Generation HMA Mix-Design Procedures and Specifications for Texas

Background

The Texas Department of Transportation (TxDOT) has introduced the Hamburg wheel tracking test into routine hot-mix asphalt (HMA) mix designs in order to minimize the risk of designing mixes with either rutting or stripping problems. This shift has prompted designers to move to stiffer asphalt-binder grades (e.g., PG 70-22S and PG 76-2). In addition, the increasing use of recycled materials has raised concerns that the typical mixes are now drier, more difficult to compact, and more susceptible to premature cracking (Figure 1). This project developed alternative mix-design approaches that will optimize HMA field performance, particularly with respect to cracking.

What the Researchers Did

Researchers developed the balanced mix-design (BMD) approach for selecting the optimal asphalt content for all of TxDOT's HMAs, including dense graded mixes, and measured the engineering properties with both the Hamburg wheel tracking test and the overlay test.

Researchers constructed test pavements at the Louisiana Transportation Research Center (LTRC) and trafficked them under accelerated loads using the ALF machine. Researchers evaluated the rutting and reflection cracking potential of a control mix compared to a modified mix to meet the balanced mix-design criteria. They also worked with TxDOT districts to design and construct test sections.



Figure 1. Premature Cracking in New Overlays.

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What They Found

In the accelerated pavement testing conducted at LTRC, the mixes performed as predicted by the balanced mix design. The control mix proved to be more rut resistant than the modified mix with the measured average wheel path ruts after 75,000 load applications of 7.7 mm and 11.8 mm, respectively. When placed over a jointed concrete pavement, the control mix had cracks in less than 75,000 load applications, whereas the modified mix had no reflection cracks in more than 200,000 load applications.

In the field testing in Texas, the BMD approach was able to optimize the design of typical dense graded mixes. By switching to PG 64-22 binder and an increase in asphalt content by 0.2 percent, the overlay tester cycles increased to more than 200. This modified mix performs well to date under very heavy traffic.

What This Means

For dense graded mixes, researchers recommend:

- Requiring the Hamburg and overlay performance tests for every mix to be performed at a minimum of two different asphalt contents.

- Computing for every project the required overlay tester requirement based on pavement type, current conditions, traffic level, and environment. To make these estimates, the researchers developed a user-friendly computer program to estimate the reflection cracking life of any proposed overlay/pavement combination. It is proposed that the required OT cycles be a project-specific estimate entered into plan notes for each project.
- Modifying the specifications for all mixes so that the aggregates and asphalt are paid for under separate bid items.
- If the balanced mix design is adopted, removing some of the restrictions on reclaimed asphalt pavement (RAP) and reclaimed asphalt shingle (RAS) usage. The results from the performance tests will dictate the maximum level of usage.
- Running both performance tests in the acceptance testing of the trial batch since the expanding use of warm mix and other technologies are not accounted for in the mix-design testing.

For More Information

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