

0-6674-01: Improving Fracture Resistance Measurements in Asphalt Binder Specifications with Verification on Asphalt Mixture Cracking Performance

Background

The current performance-grade (PG) specification for asphalt binders was developed 25 years ago during the Strategic Highway Research Program. Over the years, many changes have occurred. Although asphalt binders produced still meet the requirements of the PG specification, many state departments of transportation are increasingly experiencing premature failures of pavements. These failures can be associated with many changes the asphalt pavement industry has experienced, which include crude oil sources, improved refinery technologies to extract more saturates from crude oil before producing asphalt binders, new techniques to engineer asphalt binders (such as the use of re-refined engine oil bottoms [REOB] and polyphosphoric acid [PPA]), new additives, and increased use of reclaimed materials (such as ground tire rubber, reclaimed asphalt pavements, and recycled roof shingles in asphalt pavement construction). All these changes make the asphalt binders very complex. Consequently, asphalt binders with the same PG may perform completely differently. To verify laboratory findings, many field test sections were constructed under the previous Project 0-6674 to validate the good performance of soft but highly modified asphalt binders.

This study:

- Continued monitoring previous field test sections.

- Validated the statewide binder selection catalog through building test sections in West, South, and East Texas.
- Evaluated asphalt binders engineered with various modification techniques.
- Updated the statewide binder selection catalog.

What the Researchers Did

Researchers kept surveying the field test sections constructed with soft and polymer-modified binders with a focus of improving cracking resistance of asphalt mixes. Furthermore, six new test sections were paved and continuously monitored in three different environmental zones around Texas. Also, the plant mixes from these test sections were collected during the construction and then tested in the laboratory for their dynamic modulus, rutting resistance, and cracking resistance. Researchers evaluated the performance of asphalt binders engineered with various modification techniques including REOB, PPA, aromatic extracts, bio-rejuvenators, and fatty acids. Both rheological and chemical properties of the engineered binders were characterized

Research Performed by:

Texas A&M Transportation Institute

Research Supervisor:

Fujie Zhou, TTI

Researchers:

Pravat Karki, TTI

Project Completed:

8-31-2018

in the laboratory. Finally, researchers updated the statewide binder selection catalog, as shown in Figure 1.

What They Found

The field test sections constructed under Project 0-6674 accumulated cracking over the years. The sections constructed with the softer and polymer-modified binders have performed generally better than the ones constructed with the stiffer binders. The newly constructed field test sections have not accumulated significant cracking and rutting, mostly because these pavements were relatively new in age, slightly over two years.

Researchers also found that binders produced with the same target PG but with different modification techniques can have quite different rheological and embrittlement properties. Specifically, the parameter ΔT_c from the bending beam rheometer is a good parameter for asphalt binder quality or embrittlement. The current binder selection catalog should be expanded for different applications, specifically for asphalt overlay mixes. The newly recommended binder selection catalog is a much better fit for practical applications.

PG GRADE RECOMMENDATION BASED ON CLIMATE - 98% CONFIDENCE

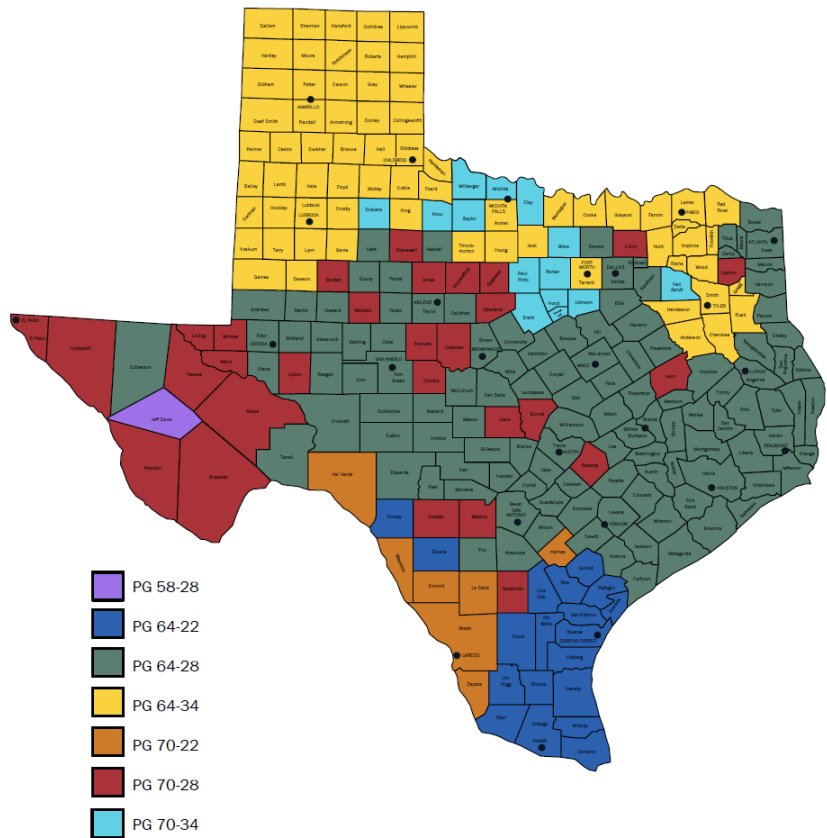


Figure 1. Binder Selection Catalog for Asphalt Overlay over Jointed Concrete Pavement.

What This Means

The Texas Department of Transportation (TxDOT) should add a new binder quality parameter ΔT_c into the binder PG specification. TxDOT also should consider implementing the recommended binder selection catalog. The implementation of these recommendations will make pavements last longer as intended.

For More Information

Project Manager:

Darrin Jensen, TxDOT, (512) 416-4728

Research Supervisor:

Fujie Zhou, TTI, (979) 458-3965

Technical reports when published are available at <http://library.ctr.utexas.edu>.

Research and Technology Implementation Office

Texas Department of Transportation

125 E. 11th Street

Austin, TX 78701-2483

www.txdot.gov

Keyword: Research