DRISI
Caltrans Division of Research,
Innovation and System Information

Research Results

Performance-Related Specifications for Rubberized Asphalt Binder

Laboratory testing was continued to develop a Superpave Performance Grading procedure for asphalt rubber binders.

Pavement

MAY 2019

Project Title:
Performance-Related Specifications for Rubberized Asphalt Binder

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WHAT IS THE NEED?

California Department of Transportation (Caltrans) uses penetration and viscosity as acceptance of quality control; however, these parameters do not necessarily provide a satisfactory link between the measured binder properties and potential performance in the field over a range of operating temperatures. Superpave Asphalt Binder Performance Grading (PG) system proposed by the Strategic Highway Research Program (SHRP) is the standard method used to characterize the performance-related properties of unmodified and polymer-modified asphalt binders.

WHAT WAS OUR GOAL?

The objective of this project is to recommend testing procedures and criteria for performance based specifications of asphalt rubber binders, since these Superpave parameters were developed for binders that do not contain additives or particulates.

WHAT DID WE DO?

- Evaluate the rheological properties of laboratory and field produced asphalt rubber binders at high and intermediate temperatures using both parallel plate and concentric cylinder geometries.
- Evaluate and refine short- and long-term aging procedures for asphalt rubber binders.
- Evaluate low temperature rheological properties of asphalt rubber binders.
- Evaluate the relationship between the rheological properties of asphalt rubber binders and mix performance in terms of

rutting, fatigue cracking, and low temperature cracking.
- Recommend performance-related specification criteria for asphalt rubber binders.

WHAT WAS THE OUTCOME?

A Superpave-type PG grading system for asphalt rubber (AR) binders produced with crumb rubber particles up 2.36 mm (i.e., passing the #8 sieve) in size has been developed.

Key differences from the standard PG grading procedure include:
- The AR binder procedure uses concentric cylinder geometry instead of parallel plate geometry in a DSR to determine the high and intermediate temperatures. The parallel plate geometry is not appropriate for testing binders that contain particulates because the particulates will dominate the result.
- The AR binder procedure continues to use a bending beam rheometer (BBR) to determine the low temperature properties, however, a new beam specimen fabrication mold configuration was developed to facilitate pouring of the more viscous AR binder. Beam specimens produced using the conventional mold configuration tend to be irregular in shape and usually contain air bubbles, both of which render the specimens unsuitable for testing.

The rolling thin film oven (RTFO) procedure was also modified to age AR binders at 193°C instead of the prescribed 163°C to better reflect AR mix production and placement temperatures. Changing this temperature also results in more uniform coating of the RTFO bottle, which is not achieved at 163°C.

WHAT IS THE BENEFIT?

This research has resulted in the development of a PG grading system for asphalt rubber binders. This will allow Caltrans to test AR binders and interpret the results in the same way that conventional and polymer modified binders are tested and graded. If adopted by Caltrans, engineers will be able to specify a PG grading for AR binders to ensure that the right binder is used on projects, and will be able to check that the binder used meets the project specification requirements. This will ensure optimal mix performance in terms of rutting and cracking performance.

LEARN MORE

To view the complete report:

http://www.ucprc.ucdavis.edu/PublicationsPage.aspx

IMAGES

Image 1: Bridge cores; cores equal to or longer than 3 inches were used for ASR visual inspection

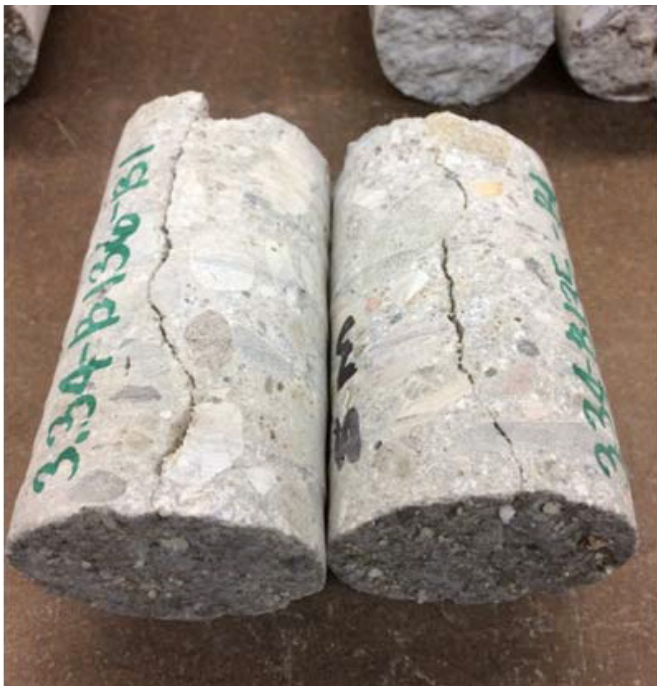

Image 2: Bridge cores; cores equal to or longer than 3 inches were used for ASR visual inspection

Image 3: Pavement and bridge cores after cutting for visual inspection

Image 4: Pavement and bridge cores after cutting for visual inspection