DRISI
Caltrans Division of Research,
Innovation and System Information

Research Notes

Performance Related Specifications for Rubberized Asphalt Binder

Development of testing procedures and criteria for performance related specifications for rubberized asphalt binder.

Pavement

SEPTEMBER 2019

Project Title:
PPRC 17 Performance Related Specifications

Task Number: 3186

Start Date: July 1, 2017

Completion Date: June 30, 2020

Task Manager:
Junxia Wu
Transportation Engineer
junxia.wu@dot.ca.gov

WHAT IS THE NEED?

Currently, California Department of Transportation (Caltrans) provides testing and acceptance criteria for terminal blended rubberized binders that mimic polymer-modified asphalt binders. However, the larger rubber particle sizes currently allowed in the Caltrans specifications prevent the use of those criteria for wet process binders.

The use of conventional parallel plate testing systems with either 1- or 2-mm gaps in a dynamic shear rheometer (DSR) results in the rubber particles potentially contacting the plates, leading to measurements dominated by the rheology of the rubber particles instead of the binder. Increasing the gap size to more than 2 mm violates the temperature equilibrium of the sample.

The current specification used for testing and acceptance of wet-process asphalt rubber binders is focused mainly on measuring the viscosity in the field using a handheld rotational viscometer. However, viscosity does not relate directly to in-service performance of the binder in a Rubberized Hot Mix Asphalt. Superpave binder tests, i.e., viscosity, DSR, and bending beam rheometer (BBR) testing, are not appropriate for testing wet-process asphalt rubber binders due to large rubber particle size.

WHAT ARE WE DOING?

As part of the first and second phases of this research project, a new DSR testing protocol using concentric cylinder geometry was investigated. Refinements to the rolling thin film oven test (RTFO) and to the specimen preparation procedure for BBR testing were also made and evaluated.

Preliminary mix testing was carried out as part of a process of interpreting the binder rheology test data to formulate realistic and representative performance grading (PG) criteria for asphalt rubber binders. To complete the development of these performance related specifications (PRS), the following tasks will be conducted:

- Literature review of recently completed research.
- Laboratory testing to understand short- and long-term aging of asphalt rubber binders and to refine the RTFO and pressure aging vessel (PAV) procedures if justified.
- Laboratory testing of field-produced mixes with associated binder testing using both concentric cylinder and 3-mm parallel plate geometries to refine PG criteria.
- Design of a round robin study for concentric cylinder geometry tests by laboratories that have invested in the equipment.
- Acceleration of pavement testing to compare rutting performance of 1/2 in. and 3/4 in. nominal maximum aggregate size mixes, the use of thicker than currently permitted lift thicknesses, and the use of coarse recycled asphalt pavement as aggregate, but not binder replacement.
- Preparation of a research report documenting the study.

WHAT IS OUR GOAL?

The main goal of this research is to address the issues related to PRS for asphalt rubber, wet process binders, and support Caltrans in its implementation.

WHAT IS THE BENEFIT?

It is expected that the research will lead to simplified PRS in terms of specification development and deployment in Asphalt Concrete long life projects. The simplified PRS will be easier for contractors and districts to understand and communicate, and will not increase risk of poor performance to Caltrans.

WHAT IS THE PROGRESS TO DATE?

The following tasks are partially accomplished:

- Literature review
- Testing aged binders and investigation to assess specimen preparation for PAV aging
- Collecting asphalt binder and plant mix samples (RIV-86); binder and mix testing on collected samples; analyzing low temperature test results
- Preparation for test track construction; installing instruments on test track and performing Heavy Vehicle Simulator testing; testing of track materials and specimens cored/sawn from track
- Updating report detailing test results and preparing test track construction report