Florida Department of Transportation Research

Structural Coefficient for High Polymer Modified Asphalt Mixes

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BE321

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Current Situation

Asphalt has been used as a driving surface since the early 1900s. Over the years, traffic volumes and axle loads have increased many times over, which has compelled research and development of new asphalt mixtures. For example, the introduction of modified asphalt binders provided transportation agencies with an effective tool to design asphalt mixtures that can resist both permanent deformation and fatigue cracking while reducing moisture damage and aging, thus increasing long-term durability. Polymer-modified asphalt (PMA) mixtures, with 2% to 3% polymer content, have shown improved long-term performance. Increasing the polymer content might offer additional advantages in flexible pavements subjected to heavy and slow-moving traffic loads.

The PaveBox allows full-scale testing of asphalt pavement constructions.

Research Objectives

University of Nevada, Reno (UNR), researchers determined the structural coefficient for asphalt concrete mixes manufactured with a high polymer (HP) modified asphalt binder that contains approximately 7.5% Styrene-Butadiene-Styrene (SBS) polymer.

Project Activities

The researchers began with the current literature on asphalt binders. In particular, they investigated related research and the extent of data available for determining the structural capacity of high polymer asphalt concrete (AC).

Extensive laboratory evaluation of high polymer asphalt binders and mixtures was conducted. AC mixtures were made from virgin Florida or Georgia aggregate and recycled asphalt pavement (RAP). Eight conventional polymer-modified asphalt (PMA) binders and eight high polymer (HP) binders were used in the design of 16 AC mixes. The designed mixes were evaluated in terms of engineering properties (e.g., stiffness) and performance characteristics (e.g., resistance to rutting, fatigue cracking, top-down cracking, and reflective cracking).

Advanced mechanistic analysis was conducted in the 3D-MOVE model to determine the developed properties and characteristics of PMA and HP AC mixtures under various loading conditions. Structural coefficients of the HP modified asphalt mixtures were determined using the fixed service life approach. The structural coefficients were verified against other distress modes (i.e., AC and total rutting, top-down cracking, and reflective cracking). Pavement testing was conducted using the PaveBox, a room-size container at UNR that allows full-scale construction of a section of asphalt roadway. Testing verified the structural coefficients developed and checked previously through lab-scale testing and computer modeling. This extensive research provided essential data, material properties, and knowledge to frame testing of HP AC pavements in Florida.

Project Benefits

Further improvements in pavement materials promise more asphalt roads for Florida that require less maintenance and have longer services lives.

For more information, please see www.fdot.gov/research/.