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GUIDELINES FOR USE OF MODIFIERS IN SUPERPAVE MIXTURES

PROBLEM STATEMENT

The Superpave mix design procedure has generally placed much stricter requirements on the shear resistance of asphalt mixtures at higher temperatures. However, no mechanical tests are required to evaluate the cracking resistance of Superpave mixtures, and the design approach typically results in lower design asphalt content for higher volume facilities. Consequently, it may be difficult to produce Superpave mixtures, with conventional asphalt cement, that have both adequate rutting and cracking resistance. Asphalt modifiers offer the possibility of producing mixtures that can resist both rutting and cracking for today's most demanding traffic and environmental conditions. There is a clear need to evaluate the effects of modifiers on the cracking performance of Superpave mixtures so that better guidelines for their use can be developed. A clearer understanding of the effects of modification will also lead to improved methods to characterize their benefit and to evaluate their potential benefit in specific mixtures and loading environments.

OBJECTIVES

The overall objective of this study was to investigate the effects of two particular asphalt modifiers, styrene butadiene styrene (SBS) polymer and ground tire rubber (GTR), on the cracking performance of asphalt mixture. A clearer understanding of their effects per asphalt modification would lead to better guidelines for their use and improved methods to characterize their benefit and to evaluate their potential benefit in specific mixtures and loading environments. Other objectives included identifying mixture properties that uniquely characterize the presence of modification and developing laboratory test methods and evaluation procedures that can realistically evaluate the effects and cost benefits of modification.

FINDINGS AND CONCLUSIONS

Researchers identified laboratory mixture tests that reveal the beneficial effect of SBS polymer modification on pavement cracking performance. It was determined that the effect of SBS modification must be evaluated on the basis of tests performed on modified asphalt mixture. The primary beneficial effects of SBS polymer were not revealed in Superpave binder test results. Two relatively simple laboratory test procedures were identified to uniquely characterize the presence of SBS polymer modification in mixtures. A method, based on the HMA fracture mechanics model developed at the University of Florida, was developed to evaluate the cost-effectiveness of using modifiers in asphalt mixture.

It was determined that the use of SBS modifiers in surface structural mixtures appears to be cost effective for most pavement structures in Florida. SBS modifiers also appear to be justified as a replacement for ground tire rubber (GTR) in open grated friction course (OG FC) mixtures. SBS modifiers appear to provide much greater benefit than GTR in terms of pavement cracking performance. Furthermore, it was determined that SBS modifiers provide greater benefit to open grated mixtures than to dense grated mixtures. SBS modification does not appear to affect either the healing or the age hardening characteristics of asphalt mixture.

In conclusion, it appears that the use of SBS modified asphalt mixture in structural surface course layers would reduce construction costs and improve the cracking performance of pavement in Florida. The use of SBS modifiers also appears to be justified as a replacement for GTR in OG FC mixtures.

BENEFITS

The research provides clear evidence that the use of SBS modifiers can result in significant cost savings and improved cracking performance of asphalt pavement in Florida. The laboratory testing and evaluation methods developed provide practical tools that can be used by materials engineers to characterize the presence and beneficial effects of modification on the cracking resistance of asphalt mixture. These tools are essential for the development of effective mix design methods, specifications, and quality assurance procedures that are suitable for modified asphalt mixture.

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