



Project Number

BDV29-977-35

Project Manager

Greg Sholar

FDOT Materials Office

Principal Investigator

Hesham Ali

Florida International University

Florida Department of Transportation Research

Evaluation of the Effect of Homogeneity of the Asphalt Binder on Performance of a Recycled Mix

June 2019

Current Situation

Repaving operations generate a significant amount of used pavement material each year. Reclaimed asphalt pavement (RAP) can be used in new asphalt mixes, with economic and environmental payoffs. However, the properties and behavior of RAP must be thoroughly understood to assure that pavements made with RAP-containing mixes perform as required, for example, in resisting rutting and cracking. Concerns with using RAP mixes focus on issues like controlling the size of aggregate in the mix, proper aging protocols for RAP binder, and effective blending of aged binder, new binder, and the rejuvenator, a chemical designed to refresh aged binders. These concerns usually limit the quantity of their use in the topmost pavement layers.

Research Objectives

Florida International University researchers evaluated the effect of rejuvenators on the performance of RAP-containing asphalt mixes and compared their performance to conventional mixtures.

Project Activities

In this project, an experiment was conducted to evaluate the effects of rejuvenator type, quantity, and mix aging protocol on RAP homogeneity and mix performance. Five mixes were used. For the control, one mix was made with virgin materials (no RAP) using a standard preparation protocol (performance grading, or PG). The remaining four mixes were made with RAP, using either rejuvenator type 1 or type 2, and using the same PG as the control or a PG with a peak temperature several degrees higher than the control. The rejuvenator type 1 was selected to represent effective rejuvenation, and the type 2 was selected to represent lower quality rejuvenation with respect to durability and homogeneity. Testing protocols to classify rejuvenators was developed in a previous project by FIU.

The experimental mixes were subjected to numerous tests, including the loaded wheel test, the semi-circular bend test, and the Florida indirect tension test. The results showed that the using the PG with the higher temperature protocol yielded mixes that performed better in resisting rutting and comparably in cracking. There was a strong correlation between binder stiffness gradient and cracking performance.

Another experiment was conducted to evaluate the ability of several simulated aging protocols to produce a binder stiffness and stiffness gradient similar to those observed in natural aging. Aging protocols simulate aging that asphalt will experience in the field, and are essential for more accurate testing of asphalt mixes. The best simulated aging protocol was to heat the mix to 110°C for 4 days. Heating to 135°C, as commonly done, leads to a different stiffness gradient than the one seen in naturally aged mixes.

Project Benefits

An improved understanding of how asphalt mix ingredients interact and how they respond to preparation protocols, along with improved testing methods, can lead to more durable roadways. This improves the driving experience and safety and reduces expenses due to maintenance and replacement.

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



Hot-mix asphalt is continuously placed into the path of a paving machine as part of a road resurfacing operation.