Florida Department of Transportation Research

Field Test Method to Determine Presence and Quantity of Modifiers in Liquid Asphalt Follow-up Data Analysis

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Current Situation

Asphalt modified with styrene butadiene styrene (SBS) polymer and/or ground tire rubber (GTR) is widely used in the U.S. to improve asphalt concrete performance. The high cost and proven performance benefits of modified binders make it important to verify that the proper binder is being used during construction. A mobile testing protocol is desirable to minimize delays due to laboratory testing.

Research Objectives

In this project, the Agilent Technologies 4300 Handheld FTIR spectrometer was compared with devices evaluated previously. The primary focus was the device's ability to determine the SBS and GTR content of a modified asphalt, its portability for field use, and its precision compared to the laboratory device.

Ground tire rubber (GTR; left) and styrene butadiene styrene (SBS; right) are frequently used as asphalt additives.

Project Activities

In a previous project (BDV25-977-06), the research team had identified Fourier transform infrared (FTIR) spectroscopy as the optimum method for determining the amount of SBS or GTR in asphalt samples. Further, they tested two portable FTIR devices, Alpha FTIR spectrometer (Bruker Corp.) and TruDefender FTX (Thermo Scientific), which gave measurements very similar to those produced by desktop FTIR devices. In this project, the researchers tested a third device, the Agilent Technologies 4300 Handheld FTIR spectrometer, which had not been available for testing during the previous project.

As in the previous project, the 4300 was tested against standard desktop spectrometers to determine its accuracy and precision in quantifying modifier contents in samples of known composition and against the other portable devices to recommend one for field use. The 4300 tested the same samples as the previous study, which contained a range of SBS and GTR contents prepared by two commercial sources. The 4300 returned results of similar accuracy and precision to the portable FTIRs tested in the previous project.

Based on samples with known modifier content, models were developed and then evaluated with program samples from Florida Department of Transportation (FDOT) projects. The modifier content of the field samples was determined by FDOT technicians but was unknown to the researchers. In most cases, SBS values for the FDOT samples were within limits, but when samples contained certain binders, the results were not within acceptable limits. Further work will be needed to resolve these issues, possibly as part of a preliminary implementation.

Project Benefits

An accurate, portable means of determining the presence and amounts of asphalt modifiers could reduce expenses of poor performance that result from using the wrong binder and construction delays that result from the current method of testing.

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