Texas Department of Transportation

CENTER FOR TRANSPORTATION RESEARCH

PROJECT SUMMARY REPORT

0-7168: Use of X-Ray Fluorescence (XRF) to Determine Tire Rubber Content in Asphalt Binders

Background

Tire rubber is required in certain TxDOT asphalt binders; e.g., AC-205TR, used for chip seal construction. These binders are specified and used in several districts across the state. Current Receiving Agency Standard Specification Item 300, Asphalts, Oils, and Emulsions, includes using test procedure Tex 553-C, "Determination of Re-Refined Engine Oil Bottoms, Polyphosphoric Acid, and Tire Rubber Content in Asphalt using X-Ray Fluorescence Spectroscopy."

This test procedure is currently only performed at the Receiving Agency Materials and Tests Division (MTD). This test can be implemented in the field with a portable XRF device and test procedure Tex-553-C can be used in conjunction with a calibration chart to evaluate and obtain a quantitative estimate of tire rubber at the district level.

What the Researchers Did

Work performed on this project included:

• CTR purchased three portable XRF analyzers and their operation was verified in the CTR lab.

• Calibration standards were acquired to develop a calibration spreadsheet for all instruments. Calibration is instrument specific.

• CTR revised test procedure Tex 553-C, "Determination of Re-Refined Engine Oil Bottoms, Polyphosphoric Acid, and Tire Rubber Content in Asphalt using X-Ray Fluorescence Spectroscopy" to improve the test method and allow for the use of portable XRF in the field.

• A training program (video) was developed for the operation of the XRF analyzer to determine TR content in asphalt according to Tex-553-C.

• Three TxDOT Districts were supplied with a portable XRF analyzer and trained in its operation.

• New calibration standards were acquired for some suppliers to modify the calibration spreadsheet, which was then supplied to the three districts to replace the original spreadsheet.

• A round robin on a blind sample from one producer showed that the accuracy of the output to be approximately +/- 0.1 % TR to +/- 0.2% TR.

What They Found

Measurement of TR content can be accomplished with a portable XRF analyzer. One must use a calibration model unique for each instrument (XRF gun), using standards at various TR contents,

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that accounts for each base asphalt (producer) and TR combination that will be supplied. Any change in the source of the ingredients will necessitate developing a new calibration for that material.

What This Means

A District that has a portable XRF instrument can evaluate tire rubber-modified binder at the district level to determine the tire rubber content in a timely manner.

For More Information

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