RESEARCH
PROJECT CAPSULE [12-3B]
November 2014
TECHNOLOGY TRANSFER PROGRAM

Chemical Characterization of Asphalts Related to their Performance

JUST THE FACTS:

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23 months

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Funding:
SPR: TT-Fed/TT-Reg

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POINTS OF INTEREST:

Problem Addressed / Objective of Research / Methodology Used / Implementation Potential

PROBLEM

A correlation between molecular structure of asphalt binders of conventional hot mix asphalt mixtures (HMA) as well as mixtures containing high recycled asphalts content and their cracking potential is needed to better understand the behavior of asphalt mixtures. The molecular structure of binders will address the distribution of species by molecular mass as determined by gel permeation chromatography technique (GPC), emphasizing in particular the amount of asphaltenes as they are first-hand related to the age hardening of asphalt materials. To this aim, the GPC data will be correlated with the carbonyl oxygen content from infrared spectroscopic measurements of binders. Cracking potential will be evaluated using the semi-circular bend (SCB) test procedure. Comparing this information in addition to other mix and binder physical properties from the point of view of their chemical composition and/or their reactivity towards their immediate environment (such as air oxygen) should help establish a relationship to their performance in paving the roads. At present, there are methods to neither verify percentages of recycled asphalt use nor to accurately predict the recycled asphalt binder blends from a design perspective without costly extractions. This work, if successful, will verify specification limits for recycled asphalt and new asphalt mixture blends and provide a method to identify recycled asphalt quantities in mixtures confirming design submittals.

OBJECTIVE

The objective of this study is to correlate the molecular structure of asphalt binders of conventional HMA mixtures and of mixtures containing high recycled asphalts content with their cracking potential.

METHODOLOGY

The researchers will:

- Conduct an extensive literature review
- Acquire samples of binders with different content of asphaltenes, widely used in Louisiana for preparation of HMA: PG 64-22 and lower grades, PG 70-22M and PG 76-22M
- Identify roads paved in Louisiana using binders provided by the same sources of Task 2 and collect samples for binder extraction
- Refine and write procedures to define the content of asphaltenes, maltenes, and polymer modifiers in polymer-modified asphalt cements (PMACs)
- Extract asphalt binders from pavements of roads greater than 7 years old
- Identify sources and collect reclaimed asphalt pavement (RAP) samples for binder extraction extract RAP binders
- Conduct GPC and Fourier transform infrared spectroscopy (FTIR) analytical tests
- Conduct rheological tests [Dynamic Shear Rheometer (DSR) and Multiple Stress Creep Recovery (MSCR)]
- Perform SCB test of mixtures
- Prepare draft final report

IMPLEMENTATION POTENTIAL

The research will potentially impact HMA producers, asphalt producers, the highway paving contractors, and DOTD. All could conceivably benefit from the utilization of this new approach of incorporating recyclable asphalt in HMA pavements. Ultimately, recycling asphalt creates a cycle that optimizes the use of natural resources and sustains the asphalt pavement industry.