Research Project

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C a p s u l e

LTRC

Technology Transfer Program

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The Use of DMA to Characterize the Aging of Asphalt Binders

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Problem

Over a decade ago, polymer-modified asphalt cements (PMACs) were shown to improve asphalt pavement performance. After years of service on the roadways, PMAC pavements are now being recycled. Recycled asphalt pavement (RAP) is combined with new aggregate and asphalt binder, and reheated to form a new asphaltic concrete mixture.

Materials engineers are concerned about the effect of aging on the properties of asphalt materials, especially PMACs, and how this aging may affect pavement designs. Extensive oxidative aging of polymers and PMAC pavements eventually brings about the loss of elastic properties. A technique for evaluating the viscoelastic properties of aged PMAC binders and mixtures is needed.

Equipment for Dynamic Mechanical Analysis of Asphalt Materials

Objective

The objective of this study is to develop correlations between the aging of PMAC materials and their dynamic mechanical response when loads are applied. The scope of this study is the investigation of different types of asphalt cements containing various kinds of polymeric materials.

Description

Plant control and handling of PMAC materials and RAP have been based on traditional viscosity limits and practices developed for neat (unmodified) asphalts. These traditional limits are simply adjusted for PMACs based on historical test data.

A recently completed study by the researchers for this project suggests that new limits should be developed for PMACs using either dynamic-shear rheometry (DSR) at high temperatures or dynamic-mechanical analysis (DMA) at low temperatures.

Viscoelastic properties of aged PMACs may be correlated with basic physical parameters using DMA. A statistically designed test factorial will be developed, tested, and analyzed to determine the influence of aging on various asphalt characteristics.

Implementation Potential

It is anticipated that this study will provide a tool for verification of viscoelastic characteristics of PMAC binders and will allow a better understanding of aging effects on the properties of these binders and associated mixtures.

As determined by DMA, the quality and quantity of RAP allowable in asphalt mixtures may be redefined, and a "limiting aging index" may be specified to prevent the over-oxidation, or "burning," of polymer-modified asphalt through plant operations.