RESEARCH
PROJECT CAPSULE [19-2B]
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TECHNOLOGY TRANSFER PROGRAM

Development of a Moisture Sensitivity Test for Asphalt Mixtures

JUST THE FACTS:

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POINTS OF INTEREST:

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

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PROBLEM

Moisture-induced damage of asphalt mixtures is a significant distress affecting not only the long-term performance of asphalt pavements, but also the safety of the traveling public. The Louisiana Department of Transportation and Development (DOTD) has been using a standard test method based on the modified Lottman test (AASHTO T-283) to evaluate the moisture susceptibility of asphalt mixtures. The modified Lottman test is a widely used method, based on the Tensile Strength Ratio (TSR) for evaluation of moisture sensitivity.

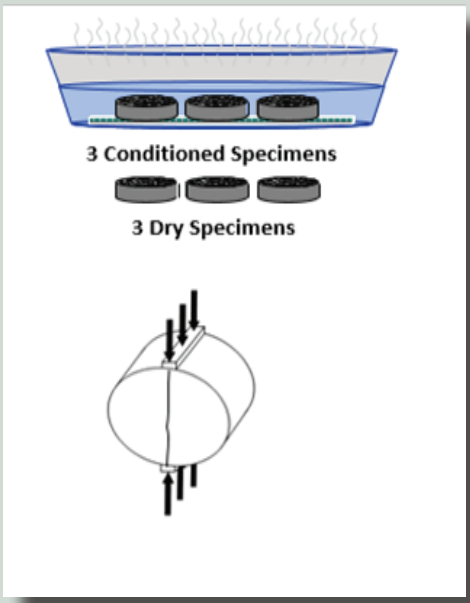

Figure 1
Modified Lottman test - AASHTO T 283

Many researchers have argued that the TSR is not a consistent and reliable indicator of moisture sensitivity for asphalt mixtures. The moisture conditioning procedure of the modified Lottman test has been criticized for its impracticality and incapability of simulating actual moisture damage in the field. To address the shortcomings of AASHTO T-283, DOTD recently included AASHTO T-324 (Hamburg Wheel-Track Testing) in its Standard Specifications for Roads and Bridges.

However, the accuracy of moisture susceptibility "pass/fail" criteria for the wheel-track testing on typical Louisiana asphalt mixtures is limited. This study proposes to perform a comprehensive evaluation of current moisture damage test procedures and to establish a reliable protocol with state-of-the-art moisture conditioning and mechanical tests.

OBJECTIVE

The objective of this study is to establish a reliable moisture-susceptibility test procedure for consistent evaluation of asphalt mixture resistance to moisture-induced damage. Specific objectives include: identification of candidate moisture conditioning procedures and laboratory tests for evaluation of asphalt mixture moisture susceptibility, evaluation of the current and the candidate moisture-susceptibility test methods with typical Louisiana asphalt mixtures, and establishment of a laboratory test protocol that combines state-of-the-art moisture conditioning and mechanical tests.

METHODOLOGY

After collecting and reviewing information from a variety of sources regarding completed and ongoing studies about moisture-induced damage and its effect on asphalt mixture performance, component materials will be selected for design of this study's asphalt mixtures. Four binders (unmodified PG 67-22, polymer-modified PG 70-22 and PG 76-22, crumb rubber-modified PG 76-22) and two aggregates (high moisture susceptible and low moisture susceptible) are being considered for a test factorial of eight 12.5 nominal maximum aggregate size (NMAS) asphalt mixtures.

Figure 2
Loaded wheel tracking test device - AASHTO T 324

Laboratory mixture specimens will be prepared according to the specific requirements of each test. The Superpave gyratory compactor will be used to compact the cylindrical specimens, each with air voids of 7.0 ± 0.5%. A minimum of three specimens will be compacted for each test (semi-circular bend, loaded wheel tracking, and modified Lottman).

A comprehensive evaluation of the asphalt binders and mixtures subjected to different moisture conditioning protocols will be performed using the selected mechanical tests: binder - frequency sweep, binder bond strength, atomic force microscopy, mixture-boil and calorimeter measurement, loaded wheel tracking, semi-circular bend, modified Lottman.

Comparative analyses of test results will help determine the reliability and repeatability of the candidate test procedures and to determine statistical significance for the effect of various moisture conditioning schemes. Existing and candidate moisture susceptibility test procedures will be critically evaluated to assess their advantages and limitations.

Figure 3
MiST conditioning device

Figure 4
Semi-circular bend test setup

A scorecard will be developed for evaluation based on reliability and repeatability of the tests. The practicality of tests will also be incorporated into the scorecard with criteria such as difficulty of specimen preparation, required skill level for tests, testing time, equipment cost, etc. The best conditioning and test combination will be recommended for implementation.

IMPLEMENTATION POTENTIAL

An improved testing protocol for evaluation of moisture damage to asphalt mixtures is anticipated. The use of the recommended protocol will improve the durability and long-term performance of Louisiana's asphalt pavements.