Statement No. 6

Arkansas State Highway and Transportation Department
Transportation Research Committee

RESEARCH PROBLEM STATEMENT

DATE: 09/10/2016 | **PROJECT AREA:** Pavements

TITLE: Predicting Compatible Aggregate-Binder Systems and Finding an Effective Moisture Resistance Test Method for Asphalts in Arkansas

PROBLEM STATEMENT:

Moisture susceptibility has been recognized as a major pavement distress since early 1990s. Great effort has been given in this field to come up with effective test methods to quantify the moisture susceptibility of asphalt concrete to take remedial action for longevity of the structures. The most popular forms of moisture resistance tests of asphalt mixtures are the Boiling, Indirect Tensile Strength and Hamburg Wheel test methods, which are followed by over 80% of the agencies while only the AHTD uses the Marshal-based Retained Stability (AASHTO T 245) test. AASHTO T 245 is obsolete and has been abandoned by other states due to its poor correlation with the field performance. Conventional mechanistic-Empirical tests such as Texas Boiling Test (ASTM D3625), Tensile Strength Ratio (AASHTO T 283), Hamburg Wheel Test (AASHTO T 324) have been reported superior to the Retained Stability method to predict the in-service behavior of pavement. Even though the mechanistic-empirical approaches are being followed by many agencies, they inherit some limitations as they are not based on materials surface chemistries, which are predictors of moisture resistance. For an accurate prediction of moisture susceptibility, the mineral aggregates and asphalt binder interaction along with the physical test results will have to be considered. This study proposes establish an effective test protocol to quantify moisture susceptibility of asphalt mixture considering the surface chemistries and molecular level properties as well as aggregate-binder compatibility. Aggregates around the state of Arkansas and asphalt binders from different crude sources will be collected and tested to understand aggregate-binder compatibility on moisture susceptibility. Conventional tests (e. g., Retained Stability, Tensile Strength, Hamburg Wheel Test, and Texas Boiling Test) along with surface chemistry based methods (Sessile Drop and Atomic Force Microscopy techniques) will be conducted to gather multiscale (micro, meso and nano) level performance data to choose the most effective approach for AHTD. The outcome of this project is expected to minimize premature stripping related pavement failures and save taxpayers' money by adopting the most effective test method and compatible materials.

OBJECTIVES:

1. Estimate stripping resistance of aggregate-binder systems using surface chemistries and molecular level material properties.
2. Evaluate moisture susceptibility of asphalt mixture samples using conventional mechanistic-empirical test procedures (Texas Boiling test, Tensile Strength Ratio, Retained Stability and Hamburg Wheel Tester)
3. Find the most effective test method based on materials' surface chemistries, mechanistic and field performance data
4. Provide recommendations to AHTD for possible revision of asphalt mixture test specification (Article 404.04) by new test protocol.

FORM OF RESEARCH IMPLEMENTATION:

1. A report containing recommendation for possible modification of AHTD's Asphalt mixture test specification (Article 404.04: Quality Control of Asphalt Mixtures) with the most effective moisture susceptibility test applicable for Arkansas.
2. A database of compatible aggregate-binder systems for Arkansas considering their mineral-binder compatibility on moisture damage.
3. A technology transfer workshop for AHTD contractors and Materials Division Engineers in the case a test method other than the Retained Stability test is recommended.

REVIEWER: Bryan Signorelli

Estimated Project Duration: 24 mo.

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Standing Subcommittee Ranking	Advisory Council Ranking	Statement Combined with Statement Number(s)
4/7	25	