Research Need Statement

Experimental Design for Field Validation of Tests to Predict Cracking in Asphalt Mixtures

I. Research Problem Statement

Cracking of asphalt pavements is the primary cause of deterioration that leads to the need for rehabilitation. Several recent research studies have evaluated and or recommended a variety of laboratory tests and models to assess the cracking potential of asphalt mixtures. As asphalt mix designs become more complex with many different binder modifiers, recycled materials, and warm mix asphalt technologies, many pavement engineers have recognized the critical need to establish and implement reliable performance tests that can be used as part of routine practice to improve mixes and ultimately extend rehabilitation periods.

However, there are several modes of asphalt pavement cracking, including low-temperature cracking, reflection cracking, fatigue cracking, and top-down cracking, all of which are affected by numerous factors and their interactions. One of the major challenges in validating tests and models to predict these different modes of cracking is isolating and quantifying the factors in the field. Accelerated pavement testing (APT) facilities and test roads provide the necessary link to calibrate and validate lab results to field performance and establish criteria for properties and/or test results for use in future asphalt mixture specifications. However, the current practices of operating APT facilities is not coordinated in such a way to adequately address major issues such as development of laboratory performance tests.

This research will develop the plans necessary to choose appropriate laboratory cracking tests for routine use and develop field experiments using Accelerated Pavement Testing facilities to establish lab to field relationships and criteria for assessing the cracking potential of asphalt mixtures.

II. Research Objectives

1. Conduct a literature review to identify the most promising laboratory test methods and models to predict different modes of cracking. Summarize the advantages and disadvantages of each method for use in routine practice, including equipment costs, technician training, results interpretation, and time to prepare, test, and analyze data. Recommend tests for further examination in field-validation efforts.
2. Design APT experiments having test pavements/sections with quantifiable loads, base support, climatic conditions, and a range of asphalt mixtures representing properties that are expected to yield good to poor cracking performance. The experiment should involve four or more APT facilities to represent different climates, loading conditions, and pavement structures. The test sections should be instrumented to monitor critical strains and temperature with the asphalt layers.

3. Develop plans for sampling, storage, transportation, and testing of the asphalt mixtures in the APT experiments. The plan should consider utilizing laboratories which have been involved in the development of the recommended test methods and models as well as laboratories that represent new users of the procedures to aid in refining the methods and establishing precision information.
4. Develop an estimated budget for objectives 2 and 3 detailing the construction and operational cost of experimental test sections and total cost for conducting the tests for each mode of cracking.

III. Estimate of Funding and Research Period

$200,000 over 12 months

IV. Urgency, Payoff Potential, and Implementation

Reliable laboratory cracking tests are needed to fully realize the benefits and limitations of current asphalt paving technologies such as high RAP contents, shingles, warm mix asphalt, and modified asphalt binders. A coordinated research validation effort is critical to establishing which tests are reliable and the criteria for use in future specifications. This research will develop the plans for the validation and procedure ruggedness information.

Sponsoring Committee: Chair:
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