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Project Title

Use of the IDEAL-CT Test for Pavement Cracking to Achieve a Balanced Asphalt Mix Design

University

University of Utah

Principal Investigators

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Research Needs

In an effort to obtain a 'balanced' asphalt mix design and control detrimental material in asphalt mixtures, a significant amount of work has been done to develop a test that can evaluate potential material behavior at low and intermediate temperature. Two tests configurations have been evaluated, the Bending Beam Rheometer (BBR) for mixtures (AASHTO TP-125) as proposed by the University of Utah and the University of Minnesota and the Semi-Circular Bend (SCB) as proposed by the University of Illinois, known as the Flexibility Index Test (IFIT) (AASHTO TP-124). Consideration has been given about the ability of these tests to differentiate asphalt mixtures that might have poor performance, the variability of the results, and the eased of performing the test including sample preparation. It is well known that, the easier the test is to run, the more likely it will be implemented by a highway agency. A wealth of knowledge has been obtained from performing these two tests on both field and laboratory data. However, the specimen fabrication for the IFIT still requires significant attention to detail, specialized saws, and dedicated time. An alternative test called Indirect Tensile Asphalt Cracking Test (IDEAL-CT) has been proposed by researchers at Texas A&M. Even though this test is not as theoretical rigorous as the SCB, it shows some promise in relating to field performance, reasonable repeatability, and -just as important- simplicity by requiring no cutting, drilling, gluing, or notching of the specimen. If the IDEAL-CT test can be used as a surrogate for the current SCB, adoption of it at the regional labs would be simpler. However, before such test can be adopted, it must be evaluated and compared against know results.

Research Objectives

The objective of this research is to determine the feasibility of using the IDEAL-CT test as a surrogate for the SCB in obtaining the Flexibility Index (or equivalent parameter) for asphalt mixtures. At the conclusion of the project, an assessment will be made as to which test provides BOTH accuracy and simplicity, thus facilitating adoption by highway agencies.

Research Methods

Determining the ability of the IDEAL-CT test to identify asphalt mixtures that might have poor cracking performance involves comparing the results obtained from previous lab and field testing of SCB samples to new results from the IDEAL-CT test. The specific steps to be followed include:

1. Select the same materials that have been already tested using the SCB IFIT test (AASHTO TP-124) and compact gyratory samples for IDEAL-CT testing. Then test the samples using the IDEAL test.
2. Compare the relative ranking of the mixtures as obtained from testing them in the SCB IFIT and the IDEAL-CT test.
3. Evaluate the variability and reproducibility of the IDEAL-CT test and compare it to the SCB IFIT (AASHTO TP-124)
4. Report and recommend if the simplified IDEAL-CT test is a good test for adoption during mixture design or quality control

Expected Outcomes

The expected outcome of this work will be an understanding of the most practical methods to evaluate low and intermediate temperature properties of mixtures and how these tests relate to the current mix design practices. Potentially, this will allow highway agencies to transition to performance-based materials specifications that would ensure optimal performance throughout the complete temperature range expected in the road. Such approach will allow for innovation and introduction of new materials by practitioners while minimizing the risk to the highway agencies. The impact of such specification would be significant economic savings; for example, extending the life of a road surface by just one year could results in at least a 10% savings in maintenance budgets which directly translates into millions of dollars.

Specific deliverables will include:

1. Report comparing the currently used SCB IFIT to the IDEAL-CT test in terms of their ability to rank mixtures and detect mixtures parameters that might affect mixtures performance (e.g., binder content, RAP content, air voids, etc.)
2. Evaluate the practicality and variability of the IDEAL-CT test in comparison to the SCB iFIT
3. Develop a threshold specification, if appropriate.

Relevance to Strategic Goals

State of Good Repair is one of the strategic goals of the USDOT. The results from this project will help develop new resources to help improve and sustain the conditions of the pavement infrastructure. The concepts developed from this project will allow highway agencies and industry partners to optimize the design of asphalt mixtures to improve its longevity and thus minimize the life cycle cost of the system.

Educational Benefits

At least one graduate student and one undergraduate student will be funding through this project. Students will be involved in all aspects of the project including sample preparation, sample

testing, and data analyses. Beyond the obvious acquisition of knowledge, by being involved in the research they will have to present results and write journal articles on their discoveries, thus greatly improving their communication skills.

At the end of their studies, these students will join the workforce as knowledgeable practitioners.

Technology Transfer

The main objective of this work is to allow for a balanced, longer lasting, asphalt mix design by means of performance testing. Technology transfer will be an integral component of this project since this work is part of a large project with partners both from state highway agencies (i.e., UDOT), and contractors (i.e., PEPG Material testing). There is already a UDOT advisory committee who would guide the process and ensure the technology will be applicable to the state department of transportation. Furthermore, the work will include publication in the leading journals and presentation in conferences such as the Transportation Research Board Meeting that occurs every January. The PI will work with MCP staff to advertise the results so that other interested parties can benefit from the technology being developed.

A report will be provided so that agency leaders, materials engineers, and interested staff can evaluate for themselves the ability of both tests to capture mixture performance then decide which test better suits the agency needs.

Work Plan

Task 1 –Equipment Setup and Selection of Mixtures: The existing testing equipment currently used for SCB testing will be modified (i.e., a new loading head will be obtained) and the mixtures that were previously tested will be reproduced.

Task 2 – Testing of Mixtures: The mixtures identified in Task 1 will be tested using the modification to the equipment done in Task 1.

Task 3 – Analysis of Results: Results will be evaluated; the ability of the IDEAL-CT to rank the mixture performance, its variability, and practicality will be compared to the known results from the SCB IFIT.

Task 4 –Reporting: A report will be made outlining the benefits of each test in test of ability to rank asphalt mixtures based on performance, variability or results, and practicality

Project Cost

Total Project Costs:	$174,000
MPC Funds Requested:	$40,000
Matching Funds:	$134,000
Source of Matching Funds:	Utah Department of Transportation