

2016 UDOT RESEARCH PROBLEM STATEMENT

*** Problem statement deadline is March 14, 2016. Submit statements to Tom Hales at tahales@utah.gov. ***

Title: SemiCircular Bending Ruggedness Study

No. (office use): 16.01.04

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Select One Subject Area

Materials/Pavements

Maintenance

Traffic Mgmt/Safety

Preconstruction

Planning

Public Transportation

1. Describe the problem to be addressed.

UDOT is working toward a balanced mix design based on performance in the four areas of pavement distress. Rutting and stripping were addressed some years ago with the implementation of the Hamburg Wheel Tracking Device. This effort has skewed the mix toward stiff, cracking prone designs. An effort is underway by UDOT and nationally to pull mixes back toward the center where cracking issues are balanced with rutting. Previous phases of this effort have involved the investigation of both intermediate and low temperature cracking. The mix sliver BBR test has shown great success in being repeatable and has been made an AASHTO provisional standard. Work to set materials standards is underway.

Louisiana State University proposed a test using the Semi-Circular Bending (SCB) configuration to address the intermediate temperature cracking issue. The test allows for an understanding of the energy required to propagate a crack through an asphalt pavement. Equipment, software and technician training have been accomplished in the initial phase (I) of this effort. Balanced mix design is being investigated under the current phase (II).

The procedure used for phase I and anticipated for use in phase II is based on the procedure described by Louisiana State University. During evaluation of several mixes in phase I, variations of an unexpected magnitude were encountered. It is unclear as to whether this is due to unknown variables in sample preparation, unknown variables in test procedures or unknown variances in equipment condition. The Louisiana procedure was expected to have been validated through a ruggedness study, however no evidence of a ruggedness study could be easily found, either through simple literature searches or through communication with Louisiana State University. The repeatability (ruggedness) of the proposed SCB protocols must be validated before any information from the testing can be trusted.

2. Explain why this research is important.

Early cracking distress in pavements is being observed in many pavements in the UDOT system. This distress has widely been attributed to low virgin binder content driven by SuperPave designs and high levels of binder replacement due to the use of Recycled Asphalt Pavement. This early distress behavior causes the road surface to open and water to penetrate. Softening of the base pushes the pavement into early failure. The superior ride that asphalt pavements are known for, suffers as does customer satisfaction.

The use of the SCB procedure is expected to help balance the mix designs from a cracking standpoint, significantly reduced the expected maintenance costs of crack sealing or other reactive maintenance related to aged mixes. Validation of the SCB procedure is necessary to be able to utilize the results.

3. List the research objective(s):

1. Perform an in-depth literature search and investigation of the Louisiana State University efforts to determine if a ruggedness study was performed.
2. If Objective 1 determines that a ruggedness study was not performed or is insufficient to validate the full SCB procedure, perform a ruggedness study of the procedure.
3. If Objective 1 determines that a proper ruggedness study exists, use remaining funds to perform an evaluation of fiber mixes in using the SCB to further the knowledge of SCB test evaluation.

4. List the major tasks:

1. Perform internet, TRIS, and library research of published documents related to LSU SCB procedure.
2. Communicate with LSU regarding procedures and evaluations performed by LSU
3. Prepare a paper reporting the literature review results.

Alternative 1:

4. Using baseline mix design, collect and fractionate aggregates and additives.
5. Prepare SCB samples in accordance with current protocol.
6. Test the SCB samples in the test apparatus using varying practices for:
 - a. Double End Cuts
 - b. Variable Test Temperatures
 - c. Variable Cord Lengths
 - d. Other
7. Prepare a summary paper.

Alternative 2:

4. Perform Literature Search of fiber reinforced HMA mixes
5. Using baseline mix design, collect and fractionate aggregates and additives.
6. Prepare SCB samples in accordance with current protocol with varying fibers and fiber contents. Possibilities include:
 - a. Mineral Fiber (Fiberand, USG)
 - b. Cellulose Fiber (Central Fiber, Interfibe)
 - c. Industry Standard HMA Reinforcement Fibers
 - i. Polypropylene (Forta)
 - ii. Nylon (Nycon)
 - iii. Kevlar Aramid (Service Tech)
7. Prepare SCB samples and test the SCB samples in the test apparatus.
8. Prepare a summary paper.

5. List the expected results:

1. It is expected that LSU based UDOT procedures will need to be modified to reduce variabilities.
2. It is expected that by identifying these characteristics, UDOT will be able to improve the consistency of the SCB testing.
3. If tested, it is expected that UDOT will gain an understanding of how fibers can be used to mitigate cracking in HMA mixes based on SCB testing.

6. Describe how this research will be implemented.

Information from this study will be used to help set minimum mix design standards. Reduction of variability will establish validity of test to industry. If fibers are tested, positive results will give additional options to cracking mitigation. The test has the potential to supplement volumetric standards and to tie field performance to lab results.

7. Requested from UDOT: \$60,000
(or UTA for Public Transportation)

Other/Matching Funds: \$

Total Cost: \$60,000

8. Outline the proposed schedule, including start and major event dates.

Project to begin when funding is available. Historically this is July of following fiscal year (2016).
Literature review can begin immediately upon funding and contract, estimated at October of 2016.
Materials collection can begin Fall/Winter of 2016.
Testing of samples to begin December 1, 2016 and end March 30, 2017
Paper to begin April 1, 2017 and end June 30, 2017