



Transportation Consortium of South Central States

Key Points

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18BASU02

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Funds Requested to UTC:

\$50,000

Funding Source(s):

Tran-SET

Arkansas State University
Paragon Technical Services, Inc.

Total Project Cost:

\$100,331

Elimination of Empirical, Ineffective and Expensive PG Plus Tests to Characterize Modified Binders

Brief Project Description

The goal of the proposed study is to develop new test method(s) to evaluate modified binders as a replacement for elastic recovery (ER) test. This objective will be accomplished by testing asphalt binder samples modified with different additives such as polymers, ground tire rubber, and acid. Rutting and fatigue resistance of these binders will be evaluated so that empirical tests can be eliminated.

Problem Statement

Most departments of transportation, such as the Arkansas Department of Transportation (ARDOT), evaluates the high-temperature resistance of asphalt binders using a dynamic shear rheometer (DSR) in accordance with AASHTO T 315, which is unable to adequately capture the effects of elastomeric modification. Thus, ARDOT requires conducting the Elastic Recovery (ER) method (AASHTO T 301), and a PG Performance Grade (PG) Plus test that is empirical in nature, expensive and time-consuming. However, findings of a recent ARDOT sponsored project reveals that neither ER nor Multiple Stress Creep Recovery (MSCR) tests are effective to characterize high PG grade binders (i.e., PG 70-22 or PG 76-22) modified with non-polymeric additives such as acid. Therefore, other mechanistic or chemical-based test methods such as SARA (saturate, aromatic, resin and asphaltene) analysis will have to be explored to find a simple and effective test protocol for characterizing high PG grade binders irrespective of the modification process.

Objectives

The main objective of the proposed study is to develop new test method(s) to evaluate modified binders as replacements of PG Plus tests. Specific objectives are given as: (i) test ARDOT certified binders with respect to local service conditions (temperature and traffic levels) by following MSCR and Elastic Recovery test methods, (ii) develop guidelines toward adopting AASHTO T 350 so that neither suppliers nor users are penalized, (iii) perform chemical analyses (e.g. FTIR and SARA) and other mechanistic tests to characterize non-polymeric high PG binders, (iv) explore other test



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methods that is capable of characterizing polymer modified binders, and (v) propose simple and effective test methods for characterizing non-polymeric high PG grade binders.

Intended Implementation of Research

Workforce Development

The proposed study will help the PI to recruit and train graduate and undergraduate students. In addition, a webinar will be organized to broadcast the findings of this study with a broad audience that will include Department of Transportation (DOT) engineers, asphalt professionals and researchers around region. Two presentations will also be given at the annual meetings organized by the ARDOT Technical Research Committee (TRC) and Tran-SET.

Education

The PI will also blend this research into undergraduate and graduate curricula. This initiative is aligned with the recent nation-wide policy to disseminate research in classrooms. Students enrolled in Civil Engineering Materials and Advanced Civil Engineering Materials will be introduced with the challenges in asphalt binder characterization processes and innovative resolution techniques and tools such as SARA (saturate, aromatic, resin and asphaltene) analysis and Fourier transform Infrared (FTIR) technology.

Outreach

The PI will train a local high school student as part of an existing internship program with Jonesboro High School. Also, a high school senior preview session will be made throughout the project period. These sessions will be helpful educating school going future citizens about the recent innovations in infrastructure technologies.

Anticipated Impacts/Benefits of Implementation

The results of this study will be used to help ARDOT and other DOTs in the region to use simple and effective test method for characterizing modified binders, which can reduce testing time and the cost of conducting PG Plus tests. The project's outcomes are also expected to result in substantial cost savings for asphalt industries and state agencies as new equipment will not be needed.

Weblinks:

- [Tran-SET's website \(http://transet.lsu.edu/research-in-progress/\)](http://transet.lsu.edu/research-in-progress/)
- [TRB's Research in Progress \(RIP\) database \(https://rip.trb.org/View/1505429\)](https://rip.trb.org/View/1505429)