

JUST THE FACTS

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INTEREST:

- Problem Addressed
- Objectives of Research
- Methodology Used
- Implementation Potential

Validity of Multiple Stress Creep Recovery Test for LADOTD Asphalt Binder Specification

PROBLEM

Higher traffic coupled with heavier loads have led the asphalt industry to introduce polymer modified binders to enhance the durability and strength of hot mix asphalt (HMA) pavements. Numerous research showed that $G/Sin\delta$, the high temperature specification parameter for the current Performance Graded (PG) asphalt binder, is not adequate to reflect rutting characteristics of modified binders. Even though $G^*/Sin\delta$ can capture the viscous and elastic effects of neat binders, it is unable to denote the benefits of elastomeric modification of asphalt binders. Consequently, many state Departments of Transportation (DOTs) have added supplemental specifications, also known as "PG-Plus" tests, to identify the presence of polymer modified binders. Louisiana is among the states that are currently using a PG-Plus specification. Louisiana also employed a grade "bump" to PG 76 from the suggested PG 64. Separation of polymer, force ductility, and elastic recovery tests are the required tests for the Louisiana Department of Transportation and Development's (LADOTD's) PG-Plus requirement. However, most of these PG-Plus tests are unable to evaluate the performance of the polymer enhanced binders. The need of a test to quantify the polymer performance in asphalt led to the research and development of a new test: the multiple stress creep recovery (MSCR) test, which can be a potential candidate to resolve the problem.

OBJECTIVES

The objectives of this research are to characterize the elastic response of various binders used by LADOTD to determine the feasibility of the MSCR test to be included in the LADOTD asphalt binder specification and to evaluate if there is any correlation between the MSCR test and other binder tests currently used to specify polymer modified asphalt in Louisiana.

METHODOLOGY

The MSCR test [AASHTO TP 70] is a creep and recovery test conducted using a Dynamic Shear Rheometer (DSR) with a parallel plate geometry set-up. This test is performed at two stress levels: 100 Pa and 3200 Pa with the application of a controlled shear stress using a haversine load for 1 second followed by a 9-second rest period. At each individual stress level, 10 consecutive creep-recovery cycles are conducted. The test begins with the application of the lower stress, 100 Pa, for 10 creep-recovery cycles. Immediately after the 10 cycles are completed, the testing continues with an additional 10 creep-recovery cycles using the 3200 Pa shear stress. A non-recoverable creep compliance J_{nr} and percent elastic recovery computed from this test will be exercised to characterize the stress dependency of polymer modified asphalt binders. Modified asphalt binders listed in the Qualified Product List (QPL) of LADOTD and supplied from various commercial crude oil producers will be

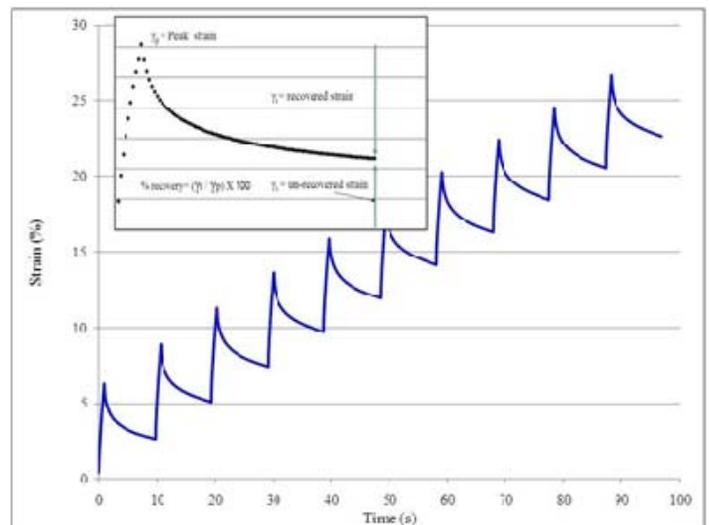
experimented in this study. The list will cover a wide spectrum of binders and will include all PG 64-22, PG 70-22M, and PG 76-22M asphalt binders commonly used in the state. In addition, a crumb rubber-modified binder, PG 82-22CRM, will be investigated. Both original and rolling thin film oven (RTFO) aged asphalt samples will be tested at 58, 64, 70, 76, and 82 °C using a Kinexus DSR manufactured by Malvern Instruments. Force ductility, elastic recovery, and other sample verification test results for each asphalt binder will be collected from the LADOTD Materials Lab and compared with MSCR test results for binder characterization.

IMPLEMENTATION POTENTIAL

Louisiana has been using polymer and crumb rubber modified binders for a long time. With the inclusion of the MSCR test in the latest AASHTO binder specification for PG graded asphalt, there is a need for Louisiana to determine whether the parameters such as J_{nr} and percent elastic recovery computed from the MSCR test are sensitive to polymer and crumb rubber modified binders. This study will be the first step to identify the feasibility for LADOTD to make a transition to the latest AASHTO asphalt binder specification. It can also provide a necessary tool to evaluate the effectiveness of any new asphalt binder modifiers.



Kinexus DSR



Typical binder response to repeated loading

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