

Research at a Glance

Technical Brief

Principal Investigator

Thomas Bennert, Ph.D.

Director, Rutgers Asphalt Pavement Laboratory and Associate Research Professor, Center for Advanced Infrastructure and Transportation (CAIT), Rutgers, The State University of New Jersey

609-213-3312

bennert@soe.rutgers.edu



Evaluation of Semi-Circular Bend Test for HMA Specialty Mixes

The SCB Flexibility Index (FI) test is a new and promising test procedure proposed for evaluating the fatigue cracking resistance of asphalt mixtures. The test method shows improved testing speed over the Overlay Tester, which is currently used by the NJDOT for the performance testing of HPTO, BRIC, and HRAP asphalt mixtures. Unfortunately, the NJDOT has little experience with the test method, and therefore required additional information regarding its sensitivity to test parameters, influence by asphalt mixture characteristics, and general repeatability.

Research Problem Statement

The NJDOT is one of the few state agencies that incorporates performance testing during asphalt mixture design, quality control and acceptance. For fatigue cracking evaluation, the NJDOT utilizes the Overlay Tester (NJDOT B-10) for their HPTO, BRIC, and HRAP asphalt mixtures. Unfortunately, although the NJDOT has had great success with the Overlay Tester during mixture design and QC/QA testing, the test procedure can be time consuming due to sample preparation and general testing time. Therefore, to help expedite performance testing, the NJDOT was interested in evaluating the SCB Flexibility Index test in the hope that it ranks fatigue cracking performance in the same manner as the Overlay Tester, yet reduces the time to complete the performance testing.



New Jersey Department of Transportation

Research Objectives

The purpose of this project was to research and evaluate the different variations (temperature, notch dimensions, load rates, etc.) of the Semi-Circular Bend (SCB) Flexibility Index (FI) test. This project was also aimed to develop a method of comparison of the fatigue performance results between the SCB FI and the Overlay Tester to help provide the industry with an alternate means of fatigue cracking evaluation that correlates to the NJDOT's Overlay Tester procedure.

Methodology

To fulfill the objectives, the methodology utilized in the research study first consisted of a modified ruggedness study to evaluate the different test parameters of the SCB FI test and how they affected the final test results. Companion testing between the Overlay Tester and the SCB FI was then conducted to develop a robust relationship between the two test methods in an effort to propose a fatigue cracking criteria for the SCB FI test for NJDOT asphalt mixtures. In addition, statistical analyses enabled for the determination of asphalt material properties that were highly influential to the SCB FI final results. A round robin study was then utilized to assess the expected single operator and multiple operator repeatability of the SCB FI test procedure.

Results

Based on the testing conducted in this study, the following conclusions can be drawn:

- The SCB Flexibility Index (FI) was found to be sensitive to the test temperature, loading rate, notch width and compacted air voids as test parameters;
- The SCB FI was found to be sensitive to the Intermediate and Low Temperature PG grades, total and effective asphalt contents, and the elastic response of the asphalt binder as determined in the Multiple Stress Creep Recovery Test;
- A strong relationship exists between the results of the Overlay Tester and the SCB FI test results, allowing for a proposed SCB FI fatigue cracking criteria for NJDOT Specialty Mixes; and
- The single operator repeatability of the test procedure was determined as 21.5% coefficient of variation, with the multiple operator being 26.1%.

Mixture Type		Min. Cycles in Overlay Tester	Min. SCB Flexibility Index (Rounded)	
HRAP	Surface	76-22	275	10.0
		64-22	200	9.0
	Intermediate/ Base	76-22	150	8.0
		64-22	100	6.0
BRIC	Mixture Design	700	17.0	
	Production	650	16.0	
HPTO	Mixture Design	600	15.0	
	Production			

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Research Project Manager

Kimbrali Davis

609-963-2100

Kimbrali.Davis@dot.nj.gov