

Balanced Mix Design (BMD) for Asphalt Mixtures

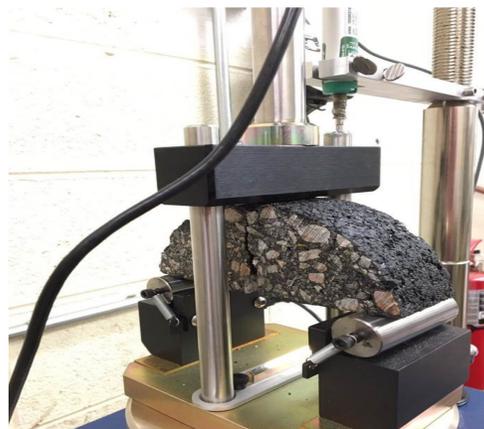
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Background

Balanced mix design (BMD) is an innovative methodology in evaluating asphalt mix designs by utilizing performance – related tests correlated to various engineering properties to analyze the rutting, cracking, and moisture susceptibilities of the mixtures. VTrans is currently using two (2) test methods for this endeavor.



The Hamburg Wheel Tracker Test (HWTT) equipment at left; Illinois Flexibility Index Test (I-FIT) equipment at right

Methodology

The HWTT has been used for investigative purposes beginning in 2015 to analyze the rutting and moisture susceptibilities of asphalt mixtures. It is a “torture” test in which a compacted asphalt mixture is subjected to a moving, concentrated load as part of analyzing the rate of permanent deformation.

The I-FIT has also been used for investigative purposes after equipment was purchased in 2017 using FHWA SHRP2 R07 funds. It is a cracking resistance test utilizing semi-circular bend (SCB) geometry, in which a compacted mixture cut into a half-disc has a notch parallel to the direction of load application.



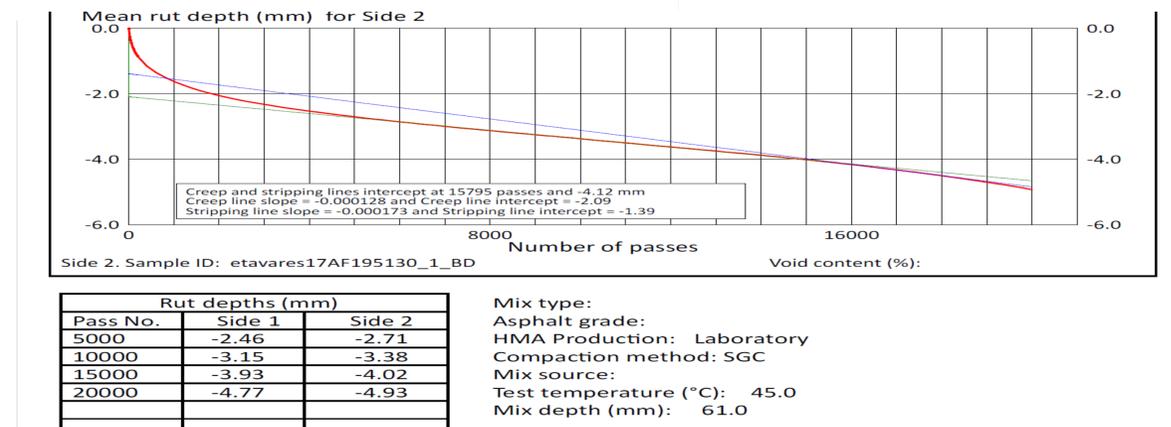
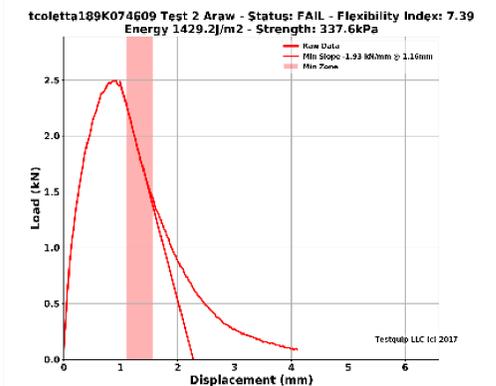
At left: Specimens before and after HWTT testing. At right: Specimens after I-FIT testing.

Analysis

Outputs from the HWTT are the measured rut depth and the stripping inflection point (SIP), which is when the aggregate – binder bond in the mixture breaks, leading to stripping and/or raveling.

The primary output from the I-FIT is the Flexibility Index (FI), a parameter derived from the measured fracture energy and the post-peak slope of the load-displacement curve that is meant to characterize the brittleness and cracking resistance of the asphalt mixture.

Based on data collected from 2015 through 2018, it has been determined that recycled asphalt materials (RAM), PG binder grade, asphalt content, and use of certain additives (WMA, anti-stripping agents, etc.) are critical in developing a “balanced” asphalt mixture overall.



Moving Forward

VTrans will begin requiring that HWTT and I-FIT results be submitted with all mix designs beginning in the 2020 construction season. This will enable further analysis of test data to determine further refinements to existing specifications, such as pass/fail criteria, sample preparation procedures, and the possibility of introducing these test methods into existing VTrans Quality Assurance (QA) specifications for asphalt materials with associated incentive/disincentive pay factors.