
Standard Method of Test for

Determining the Indirect Tensile N_{flex} Factor to Assess the Cracking Resistance of Asphalt Mixtures

AASHTO Designation: TP 141-22 (2024)¹

Technically Revised: 2022

Reviewed but Not Updated: 2024

Technical Subcommittee: 2d, Proportioning
of Asphalt–Aggregate Mixtures



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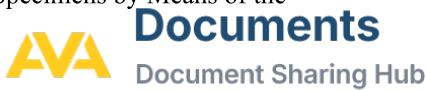
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1. SCOPE

- 1.1. This test method covers the determination of cracking resistance of asphalt mixtures using the indirect tensile (IDT) geometry at 25°C. The Toughness (area beneath the stress-estimated strain data) and Brittleness Slope (post peak stress-estimated strain rate) are used to calculate a parameter referred to as the N_{flex} factor, which may be a useful indicator of load-related cracking of asphalt pavement layers.
- 1.2. This procedure applies to test specimens having a nominal maximum aggregate size (NMAS) of 19 mm or less. Lab compacted specimens or field core specimens can be used.
- 1.3. *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish and follow appropriate health and safety practices and determine the applicability of regulatory limitations prior to use.*
- 1.4. *The quality of the results produced by this standard is dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*

2. REFERENCED STANDARDS

- 2.1. *AASHTO Standards:*
 - M 339M/M 339, Thermometers Used in the Testing of Construction Materials
 - R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
 - R 30, Mixture Conditioning of Asphalt Mixtures
 - T 166, Bulk Specific Gravity (G_{mb}) of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens
 - T 269, Percent Air Voids in Compacted Dense and Open Asphalt Mixtures
 - T 312, Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor



- 2.2. *ASTM Standards:*
- D3549/D3549M, Standard Test Method for Thickness or Height of Compacted Asphalt Mixture Specimens
 - D6931, Standard Test Method for Indirect Tensile (IDT) Strength of Asphalt Mixtures
 - E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
 - E879, Standard Specification for Thermistor Sensors for General Purpose and Laboratory Temperature Measurements
 - E1137/E1137M, Standard Specification for Industrial Platinum Resistance Thermometers
- 2.3. *International Electrotechnical Commission Standard:*
- IEC 60751: 2008 Industrial Platinum Resistance Thermometers and Platinum Temperature Sensors
- 2.4. *Referenced Document:*
- West, R. C., C. V. Winkle, S. Maghsoodloo, and S. Dixon. Relationships between simple asphalt mixture cracking tests using N_{design} specimens and fatigue cracking at FHWA's accelerated loading facility. *Road Materials and Pavement Design*, Vol. 18, No. sup4, 2017, pp. 428–446.

3. TERMINOLOGY

- 3.1. *Definitions:*
- 3.1.1. *linear variable displacement transducer, LVDT*—sensor device for measuring linear displacement.
- 3.1.2. *vertical displacement, Y* —total displacement of the specimen during testing measured in the direction of the load application.
- 3.1.3. *brittleness slope, m* —slope of the equation fitted to the stress-estimated strain data at the first inflection point following the peak stress.
- 3.1.4. *toughness, T* —area under a stress-estimated strain plot to a particular point of interest. In this method, Toughness is determined from the initiation of load through the first inflection point following the peak stress.
- 3.1.5. *N_{flex} factor*—index property of an asphalt mixture, which has been correlated to cracking resistance (West et al., 2017). N_{flex} factor is calculated by dividing toughness by the brittleness slope.

4. SUMMARY OF METHOD

- 4.1. An asphalt mixture compacted in the Superpave Gyratory Compactor (SGC) to the number of gyrations specified for mix design (N_{design}) is cut to obtain specimens 50 mm in thickness. After conditioning to the test temperature (i.e., 25°C), the specimen is positioned in the indirect tension fixture and a load is applied along the vertical diameter of the specimen. The load is applied such that a constant vertical deformation rate of 50 mm/minute is maintained for the duration of the test. The load and vertical displacement are measured during the entire duration of the test. A minimum of three specimens are tested to determine the average results for a mixture. The test fixture and specimen geometry are shown in Figure 1.