Standard Method of Test for

Determining the Fracture Potential of Asphalt Mixtures Using the Illinois Flexibility Index Test (I-FIT)

AASHTO Designation: T 393-21[1]

Adopted with Revisions: 2021 **Editorially Revised: 2021**

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

AASHTO

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1. SCOPE

1.1. This test method covers the determination of Mode I (tensile opening mode during crack propagation) cracking resistance properties of asphalt mixtures at intermediate test temperatures. Specimens are tested in the semicircular bend geometry, which is a half disc with a notch parallel to the direction of load application. The data analysis procedure associated with this test determines the fracture energy (G_f) and post peak slope (m) of the load–load line displacement (LLD) curve. These parameters are used to develop a flexibility index (FI) to predict the fracture resistance of an asphalt mixture at intermediate temperatures. The FI can be used as part of the asphalt mixture approval process.

1.2. These procedures apply to test specimens having a nominal maximum aggregate size (NMAS) of 19 mm or less. Lab compacted and pavement core specimens can be tested according to this test procedure. A thickness correction factor will need to be developed and applied for pavement cores tested at a thickness less than 45 mm.

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 are 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 DOCUMENTS

2.1. *AASHTO Standards*:

- R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
- R 67, Sampling Asphalt Mixtures after Compaction (Obtaining Cores)
- T 166, Bulk Specific Gravity (G_{mb}) of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens

- T 209, Theoretical Maximum Specific Gravity (G_{mm}) and Density of Asphalt Mixtures
- T 269, Percent Air Voids in Compacted Dense and Open Asphalt Mixtures
- T 283, Resistance of Compacted Asphalt Mixtures to Moisture-Induced Damage
- T 312, Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor
- TP 105, Determining the Fracture Energy of Asphalt Mixtures using Semicircular Bend Geometry (SCB)

2.2. *ASTM Standards*:

- D8, Standard Terminology Relating to Materials for Roads and Pavements
- D3549/D3549M, Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens

2.3. *Other Publications:*

- Al-Qadi, I. L., H. Ozer, J. Lambros, A. El Khatib, P. Singhvi, T. Khan, and B. Doll. 2015. *Testing Protocols to Ensure Performance of High Asphalt Binder Replacement Mixes Using RAP and RAS*, FHWA ICT-15-07. Illinois Center for Transportation, Rantoul, IL.
- Doll. B., H. Ozer, J. Rivera-Perez, J. Lambros, and I. L. Al-Qadi. 2016. Investigation of Viscoelastic Fracture Fields in Asphalt Mixtures using Digital Image Correlation. *International Journal of Fracture*, Vol. 205, No. 1, pp. 37–56.
- Ozer, H., I. L. Al-Qadi, J. Lambros, A. El-Khatib, P. Singhvi, and B. Doll. 2016a. Development of the Fracture-Based Flexibility Index for Asphalt Concrete Cracking Potential Using Modified Semi-Circle Bending Test Parameters. *Construction and Building Materials*, Vol. 115, pp. 390–401.
- Ozer, H., and P. Singhvi, T. Khan, J. Rivera, I. L. Al-Qadi. 2016b. Fracture Characterization of Asphalt Mixtures with RAP and RAS Using the Illinois Semi-Circular Bending Test Method and Flexibility Index. *Transportation Research Record*, Transportation Research Board, National Research Council, Washington, DC, Vol. 2575, pp. 130–137.
- Ozer, H., I. L. Al-Qadi, P. Singhvi, J. Bausano, R. Carvalho, X. Li, and N. Gibson. 2017. Assessment of Asphalt Mixture Performance Tests to Predict Fatigue Cracking in an Accelerated Pavement Testing Trial. *International Journal of Pavement Engineering*, Special Issue for Cracking in Flexible Pavements and Asphalt Mixtures: Theories to Modeling, and Testing to Mitigation.
- RILEM Technical Committee 50-FMC. 1985. "Determination of the Fracture Energy of Mortar and Concrete by Means of Three-Point Bend Tests on Notched Beams." Materials and Structures, Springer Netherlands for International Union of Laboratories and Experts in Construction Materials, Systems and Structures (RILEM), Dordrecht, The Netherlands, No. 106, July–August 1985, pp. 285–290.

3. TERMINOLOGY

3.1. *Definitions*:

3.1.1. *critical displacement, u_1*—displacement at the intersection of the post-peak slope with the displacement-axis.

3.1.2. *displacement at peak load, u_0*—recorded displacement at peak load.

3.1.3. *final displacement*, u_{final}—recorded displacement at the 0.1 kN cut-off load.