Standard Method of Test for

Determining the Fracture Energy Density of Asphalt Binder Using the Binder Fracture Energy (BFE) Test

AASHTO Designation: TP 127-17 (2019)[1]

Technical Subcommittee: 2b, Liquid Asphalt

Release: Group 3 (July)

AASHTO

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1. SCOPE

1.1. This test method covers the determination of fracture energy density of asphalt binder by means of a direct tension test. For evaluation of relative cracking performance, it is recommended that this test procedure be used with asphalt binder aged using T 240 (RTFO) plus R 28 (PAV). However, this test can be used for determination of binder facture energy for any binder including any aged (RTFO plus PAV or PAV only) neat or modified binder and asphalt binder extracted and recovered from pavement. The test apparatus is designed for testing within the intermediate temperature range, from 0°C to 25°C.

1.2. *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and to determine the applicability of regularity limitations prior to use.*

2. REFERENCED STANDARDS

2.1. *AASHTO Standards*:

- M 320, Performance-Graded Asphalt Binder
- R 28, Accelerated Aging of Asphalt Binder Using a Pressurized Aging Vessel (PAV)
- R 49, Determination of Low-Temperature Performance Grade (PG) of Asphalt Binders
- R 66, Sampling Asphalt Materials
- T 240, Effect of Heat and Air on a Moving Film of Asphalt Binder (Rolling Thin-Film Oven Test)

2.2. *ASTM Standards*:

- C670, Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
- E4, Standard Practices for Force Verification of Testing Machines
- E77, Standard Test Method for Inspection and Verification of Thermometers
- E83, Standard Practice for Verification and Classification of Extensometer Systems

2.3. *ISO Standard*:

- ISO 10012, Measurement Management Systems—Requirements for Measurement Processes and Measuring Equipment

3. TERMINOLOGY

3.1. *Definition*:

3.1.1. *asphalt binder*—an asphalt-based cement that is produced from petroleum residue either with or without the addition of particulate organic modifiers of size less than 250 μm.

3.2. *Description of Terms Specific to This Standard*:

3.2.1. *brittle*—type of failure in a direct tension test where the stress–strain curve is essentially linear up to the point of failure and the failure is sudden by rupture of the test specimen without appreciable reduction in cross-sectional area of the specimen.

3.2.2. *brittle–ductile*—type of failure in a direct tension test where the stress–strain curve is curvilinear and the failure is by the rupture of the test specimen. Limited reduction in the cross-section of the specimen occurs before rupture.

3.2.3. *ductile*—type of failure in a direct tension test where the specimen does not rupture but fails by flow at large strain.

3.2.4. *failure*—for specimens exhibiting a stress–strain curve with a single peak stress followed by a continuously increasing reduction in stress, failure is the point at which the tensile stress reaches a maximum value.

3.2.5. *failure strain*—the tensile strain corresponding to the failure stress.

3.2.6. *failure stress*—the tensile stress at the point associated with failure as defined in Section 3.2.4.

3.2.7. *fracture energy density*—maximum energy that can be stored in a unit volume of material without the occurrence of fracture.

3.2.8. *large strain formulation*—analysis, which includes changes in geometry due to excessively large strain.

3.2.9. *necking*—disproportionately large strain localized in a small region of the asphalt binder specimen which results in a prominent decrease in local cross-sectional area.

3.2.10. *tensile strain*—axial strain resulting from the application of a tensile load and calculated as the change in length of the effective gauge length caused by the application of the tensile load divided by the original unloaded effective gauge length.

3.2.11. *tensile stress*—axial stress resulting from the application of a tensile load and calculated as the tensile load divided by the original area of cross-section of the specimen.

3.2.12. *true strain*—strain determined by accounting for reduction in cross-sectional area.

3.2.13. *true stress*—ratio of the applied load to the instantaneous cross-sectional area.

3.2.14. *true stress–true strain curve*—graphical representation of the relationship between true stress and true strain.