Standard Method of Test for

Determining the Flexural Creep Stiffness of Asphalt Mixtures Using the Bending Beam Rheometer (BBR)

AASHTO Designation: TP 125-16 (2020)[1]

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

Release: Group 3 (July)

AASHTO

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1. SCOPE

1.1. This test method covers the determination of the flexural creep stiffness or compliance of asphalt mixtures by means of a bending beam rheometer. It is applicable to material having a flexural stiffness value from 2 GPa to 20 GPa (creep compliance values in the range of 0.5 nPa^{-1} to 0.05 nPa^{-1}). The test apparatus is designed for testing within the temperature range from –36 to 0°C.

1.2. Test results are valid for beams of asphalt mixtures that deflect at least 15 µm and less than 150 µm (550 microstrains) during the entire duration of the test, when tested in accordance with this method.

1.3. This method has been verified with asphalt mixtures having a nominal maximum aggregate size of 12.5 mm.

1.4. *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 regulatory limitations prior to use.*

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- *Mechanistic-Empirical Pavement Design Guide*
- T 313, Determining the Flexural Creep Stiffness of Asphalt Binder Using the Bending Beam Rheometer (BBR)

2.2. *ASTM Standard*:

- E77, Standard Test Method for Inspection and Verification of Liquid-in-Glass Thermometers

2.3. *Deutche Industrie Norm (DIN) Standard*:

- 43760, Platinum Resistance Thermometer

3. TERMINOLOGY

3.1. *Definition*:

3.1.1. *asphalt mixture*—an asphalt-based composite material that consists of asphalt binder, coarse and fine aggregates, filler, and air voids.

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

3.2.1. *contact load*—load required to maintain positive contact between the beam and the loading shaft, and equal to 35 ± 10 mN.

3.2.2. *estimated flexural creep stiffness, S(t)*—the creep stiffness obtained by fitting a second-order polynomial to the logarithm of the measured stiffness, from 8.0 to 1000 s, as a function of the logarithm of time.

3.2.3. *flexural creep*—a test in which a simply supported asphalt mixture prismatic beam is loaded with a constant load at its midpoint and the deflection of the beam is measured with respect to loading time.

3.2.4. *flexural creep compliance, D(t)*—ratio obtained by dividing the time-dependent maximum bending strain in the beam by the time-independent maximum bending stress.

3.2.5. *measured flexural creep stiffness, Sm(t)*—ratio obtained by dividing the maximum bending stress in the beam by the maximum bending strain. $S(t)$ is the inverse of $D(t)$. $S(t)$ has been used historically in asphalt technology while $D(t)$ is commonly used in studies of viscoelasticity.

3.2.6. *m-value*—absolute value of the slope of the logarithm of the estimated stiffness curves versus the logarithm of the time. Note that *m*-value estimation for any time during the test is based on the creep test results for the entire duration of the test.

3.2.7. *seating load*—load of 1-s duration required to seat the beam, and equal to 4000 ± 100 mN.

3.2.8. *test load*—load of 1000-s duration required to determine the stiffness of the material being tested, and equal to 4000 ± 100 mN.

3.2.9. *testing zero time, s*—time at which the signal is sent to the solenoid valve to switch from zero load regulator (contact load) to the testing load regulator (test load).

4. SUMMARY OF TEST METHOD

4.1. The bending beam rheometer measures the midpoint deflection of a simply supported beam of asphalt mixtures subjected to a constant load applied to the midpoint of the beam. The device operates only in the loading mode; recovery measurements are not obtained.

4.2. A test beam is placed in the controlled temperature fluid bath and loaded with a constant load for 1000-s. The test load (4000 ± 100 mN) and the midpoint of deflection of the beam are monitored versus time using a computerized data acquisition system.

4.3. The maximum bending stress at the midpoint of the beam is calculated from the dimensions of the beam, the span length, and the load applied to the beam. The maximum bending strain in the beam is calculated for the same loading times from the dimensions of the beam and the deflection of the beam. The stiffness of the beam is calculated by dividing the maximum stress by the maximum strain.