Standard Method of Test for

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

AASHTO Designation: T 313-19[1]

Technical Subcommittee: 2b, Liquid Asphalt

Release: Group 3 (July)

AASHTO

American Association of State Highway and Transportation Officials
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1. SCOPE

1.1. This test method covers the determination of the flexural creep stiffness or compliance of asphalt binders by means of a bending beam rheometer. It is applicable to material having a flexural stiffness value from 20 MPa to 1 GPa (creep compliance values in the range of 50 nPa–1 to 1 nPa–1) and can be used with unaged material or with material aged using T 240 (RTFOT) or R 28 (PAV), or both. The test apparatus is designed for testing within the temperature range from –36 to 0°C.

1.2. Test results are not valid for beams of asphalt binder that deflect more than 4 mm, or less than 0.08 mm, when tested in accordance with this method.

1.3. *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*:

- M 320, Performance-Graded Asphalt Binder
- R 28, Accelerated Aging of Asphalt Binder Using a Pressurized Aging Vessel (PAV)
- R 66, Sampling Asphalt Materials
- T 240, Effect of Heat and Air on a Moving Film of Asphalt Binder (Rolling Thin-Film Oven Test)
- T 314, Determining the Fracture Properties of Asphalt Binder in Direct Tension (DT)

2.2. *ASTM Standards*:

- C802, Standard Practice for Conducting an Interlaboratory Test Program to Determine the Precision of Test Methods for Construction Materials
- E77, Standard Test Method for Inspection and Verification of Thermometers

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

- 43760, Industrial Platinum Resistance Thermometers and Platinum Temperature Sensors

2.4. *NCHRP Document*:

- NCHRP Web-Only Document 71 (Project 09-26), Precision Estimates for AASHTO Test Method T 308 and the Test Methods for Performance-Graded Asphalt Binder in AASHTO Specification M 320

3. TERMINOLOGY

3.1. *Definitions*:

3.1.1. *asphalt binder*—an asphalt-based cement that is produced from petroleum residue either with or without the addition of nonparticulate organic modifiers.

3.1.2. *physical hardening*—a time-dependent stiffening of asphalt binder that results from the time-delayed increase in stiffness when the asphalt binder is stored at low temperatures. The increase in stiffness due to physical hardening is reversible when the temperature is raised.

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

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

3.2.2. *measured flexural creep stiffness, $S_m(t)$*—ratio obtained by dividing the maximum bending stress in the beam by the maximum bending strain.

3.2.3. *estimated creep stiffness, $S(t)$*—the creep stiffness obtained by fitting a second-order polynomial to the logarithm of the measured stiffness at 8.0, 15.0, 30.0, 60.0, 120.0, and 240.0 s and the logarithm of time.

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

3.2.5. *m-value*—absolute value of the slope of the logarithm of the stiffness curves versus the logarithm of the time.

3.2.6. *contact load*—load required to maintain positive contact between the beam and the loading shaft; 35 ± 10 mN.

3.2.7. *seating load*—load of 1-s duration required to seat the beam; 980 ± 50 mN.

3.2.8. *test load*—load of 240-s duration required to determine the stiffness of material being tested; 980 ± 50 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 binder 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.