Standard Method of Test for

Determining the Dynamic Modulus and Flow Number for Asphalt Mixtures Using the Asphalt Mixture Performance Tester (AMPT)

AASHTO Designation: T 378-17[1]

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

Release: Group 3 (August 2017)

AASHTO
American Association of State Highway and Transportation Officials
444 North Capitol Street N.W., Suite 249
Washington, D.C. 20001

Standard Method of Test for

Determining the Dynamic Modulus and Flow Number for Asphalt Mixtures Using the Asphalt Mixture Performance Tester (AMPT)

AASHTO Designation: T 378-17[1]

AASHTO

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

Release: Group 3 (August 2017)

1. SCOPE

1.1. This standard describes test methods for measuring the dynamic modulus and flow number for asphalt mixtures using the Asphalt Mixture Performance Tester (AMPT). This practice is intended for dense- and gap-graded mixtures with nominal-maximum aggregate sizes up to 37.5 mm.

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 standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use*.

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standard*:

- R 83, Preparation of Cylindrical Performance Test Specimens Using the Superpave Gyratory Compactor (SGC)

2.2. *Other Publication*:

- Equipment Specification for the Simple Performance Test System, Version 3.0, Prepared for National Cooperative Highway Research Program (NCHRP), October 16, 2007

3. TERMINOLOGY

3.1. *Definitions*:

3.1.1. *confining pressure*—the stress applied to all surfaces in a confined test.

3.1.2. *deviatoric stress*—the difference between the total axial stress and the confining pressure in a confined test.

3.1.3. *dynamic modulus*, |E*|—the absolute value of the complex modulus calculated by dividing the peak-to-peak stress by the peak-to-peak strain for a material subjected to a sinusoidal loading.

3.1.4. *flow number*—the number of load cycles corresponding to the minimum rate of change of permanent axial strain during a repeated-load test.

3.1.5. *phase angle*, δ—the angle in degrees between a sinusoidally applied stress and the resulting strain in a controlled stress test.

3.1.6. *permanent deformation*—the nonrecovered deformation in a repeated-load test.

4. SUMMARY OF METHOD

4.1. This test method describes procedures for measuring the dynamic modulus and flow number for asphalt mixtures.

4.2. In the dynamic modulus procedure, a specimen at a specific test temperature is subjected to a controlled sinusoidal (haversine) compressive stress of various frequencies. The test may be conducted with or without confining pressure. The applied stresses and resulting axial strains are measured as a function of time and used to calculate the dynamic modulus and phase angle.

4.3. In the flow number procedure, a specimen at a specific test temperature is subjected to a repeated haversine axial compressive load pulse of 0.1 s every 1.0 s. The test may be conducted with or without confining pressure. The resulting permanent axial strains are measured as a function of the load cycles and numerically differentiated to calculate the flow number. The flow number is defined as the number of load cycles corresponding to the minimum rate of change of permanent axial strain.

5. SIGNIFICANCE AND USE

5.1. The dynamic modulus is a performance-related property that can be used for mixture evaluation and for characterizing the stiffness of asphalt mixtures for mechanistic-empirical pavement design.

5.2. The flow number is a property related to the resistance of asphalt mixtures to permanent deformation. It can be used to evaluate and design asphalt mixtures with specific resistance to permanent deformation.

6. APPARATUS

6.1. *Specimen Fabrication Equipment*—For fabricating dynamic modulus test specimens as described in R 83.

6.2. *Dynamic Modulus Test System*—Meeting the requirements of the equipment specification for the Simple Performance Test (SPT) System, Version 3.0, except for the following provisions: In the referenced equipment specification, Sections 10.7 and 11.3 shall require a temperature sensor range of 0 to 75°C (32 to 167°F) and Section 11.1 shall require a temperature control range from 4 to 70°C (39 to 158°F).

6.3. *Conditioning Chamber*—An environmental chamber for conditioning the test specimens to the desired testing temperature. The environmental chamber shall be capable of controlling the temperature of the specimen over a temperature range from 4 to 70°C to an accuracy of ±0.5°C. The chamber shall be large enough to accommodate the number of specimens to be tested plus a "dummy" specimen with a temperature sensor mounted in the center for temperature verification.