Standard Method of Test for

Determining the Dynamic Modulus for Asphalt Mixtures Using Small Specimens in the Asphalt Mixture Performance Tester (AMPT)

AASHTO Designation: TP 132-19 (2021)[1]

First Published: 2019 **Reviewed but Not Updated: 2021** **Editorially Revised: 2021**

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

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1. SCOPE

1.1. This standard describes test methods for measuring the dynamic modulus for asphalt mixtures using the asphalt mixture performance tester (AMPT). This practice is intended for dense-graded mixtures with nominal-maximum aggregate sizes up to 19.0 mm (0.75 in.).

1.2. *This standard may involve hazardous material, operations, and equipment. This standard does not purport to address all safety problems 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.*

1.3. *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 STANDARDS

2.1. *AASHTO Standards*:

- PP 99, Preparation of Small Cylindrical Performance Test Specimens Using the Superpave Gyratory Compactor (SGC) or Field Cores
- R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
- R 62, Developing Dynamic Modulus Master Curves for Asphalt Mixtures
- R 84, Developing Dynamic Modulus Master Curves for Asphalt Mixtures Using the Asphalt Mixture Performance Tester (AMPT)
- T 378, Determining the Dynamic Modulus and Flow Number for Asphalt Mixtures Using the Asphalt Mixture Performance Tester (AMPT)

2.2. *Other Documents*:

- NCHRP Report 629, Equipment Specifications for the Simple Performance Test System, Appendix E, October 16, 2007

- VTRC Report 15-R26, Asphalt Mixture Performance Characterization Using Small-Scale Cylindrical Specimens, June 2015

3. TERMINOLOGY

3.1. *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.

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

3.3. *test specimen*—a 38-mm (1.50-in.) diameter by 110-mm (4.33-in.) tall cylindrical specimen cored and sawed from either an SGC specimen or field core.

4. SUMMARY OF METHOD

4.1. This test method describes the procedure for measuring the dynamic modulus of asphalt mixtures. A test specimen at a specific test temperature is subjected to a controlled sinusoidal (haversine) compressive stress of various frequencies. The applied stresses and resulting axial strains are measured as a function of time and used to calculate the dynamic modulus and phase angle.

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 HMA for mechanistic–empirical pavement design.

6. APPARATUS

6.1. *Specimen Fabrication Equipment*—For fabricating dynamic modulus test specimens as described in PP 99.

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:

6.2.1. 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).

6.2.2. Section 11.1 shall require a temperature control range from 4 to 70°C (39 to 158°F).

6.3. *38-mm Specimen Dynamic Modulus Platens*—Platens meeting the requirements of the equipment specification for the Simple Performance Test (SPT) system, Version 3.0, except the following provisions:

6.3.1. The lower platen loading surface diameter shall be not less than 42 mm and not more than 45 mm.

6.3.2. The upper platen diameter shall be not less than 42 mm and not more than 45 mm.

6.4. *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 (39 to 158°F) to an accuracy of ±0.5°C (0.9°F). The chamber shall be large enough to accommodate the number of specimens