Proposed Standard Test Method for

Determining the Dynamic Modulus of Asphalt Mixtures Using the Indirect Tension Test

AASHTO Designation: TP 131-18 (2020)[1]

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

Release: Group 3 (July)

American Association of State Highway and Transportation Officials
555 12th Street NW, Suite 1000
Washington, DC 20004

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1. SCOPE

1.1. This standard describes the test method for measuring the dynamic modulus of asphalt mixtures using the indirect tension test. This test is intended for dense- and gap- graded mixtures with nominal maximum aggregate sizes up to 25 mm.

1.2. *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the 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 its use.*

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standard*:

- PP 95, Preparation of Indirect Tension Performance Test Specimens

2.2. *Other Publications*:

- Equipment Specification for the Simple Performance Test System, Version 3.0, Prepared for National Cooperative Highway Research Program (NCHRP), October 16, 2007.
- Barksdale, R.D., J. Alba, N.P. Khosla, Y.R. Kim, P.C. Lambe, and M.S. Rahman. Laboratory Determination of Resilient Modulus for Flexible Pavement Design, Final Report, National Cooperative Highway Research Program 1-28 Project, June 1997.
- Chapra, S.C. and R.P. Canale, *Numerical Methods for Engineers*, McGraw-Hill, 2009.
- Kim, Y. R., Y. Seo, M. King, and M. Momen. Dynamic Modulus Testing of Asphalt Concrete in Indirect Tension Mode. In *Transportation Research Record: Journal of the Transportation Research Board, No. 1891*, TRB, National Research Council, Washington, D.C., 2004.
- Lacroix, A., A. A. Mosavi Khandan, Y. R. Kim. Predicting the Resilient Modulus of Asphalt Concrete from the Dynamic Modulus. In *Transportation Research Record: Journal of the Transportation Research Board*, TRB, National Research Council, Washington, D.C., 2007.

3. TERMINOLOGY

3.1. *Dynamic Modulus*—a linear viscoelastic material property that describes the stiffness of asphalt mixture at different frequencies and temperatures.

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3.2. *Phase Angle—δ*, the angle in degrees between a sinusoidal applied stress and the resulting strain in the same direction (vertical or horizontal).

3.3. *Poisson's Ratio*—the ratio of the strain transverse to the loading direction (horizontal strain), divided by the axial strain (vertical strain).

3.4. *Permanent Deformation*—non-recovered deformation in a repeated load test.

3.5. *Indirect Tension* (*IDT*)—a method of loading a material by applying a compressive force on a cylindrical specimen in one direction, which results in a tensile stress and strain in the perpendicular direction due to the Poisson's effect.

3.6. *LVDT Components*

3.6.1. *Rod*—thin, stainless steel bar that holds the LVDT core.

3.6.2. *Core*—magnetic component of LVDT that attaches to rod.

3.6.3. *Head*—-component that surrounds the core to measure the displacement.

3.6.4. *Target*—component glued to the specimen to hold the LVDT rod and head away from the surface of the specimen.

4. SUMMARY OF THE TEST METHODS

4.1. This test method describes procedures for measuring the dynamic modulus from the indirect tension test for asphalt mixtures.

4.2. In the dynamic modulus procedure, an asphalt mixtures specimen, at a specific test temperature, is subjected to controlled sinusoidal (haversine) compressive stress in the vertical axis at various frequencies. The applied stresses and resulting axial and transverse strains are measured as a function of time and used to calculate the dynamic modulus, phase angle, and Poisson's ratio.

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.

6. APPARATUS

6.1. *Specimen Fabrication Equipment*—Equipment for fabricating dynamic modulus test specimens as described in AASHTO PP 95, *Preparation of Indirect Tension Performance Test Specimens*.

6.2. *Dynamic Modulus Test System*—A dynamic test system meeting the requirements of Equipment Specification for the Simple Performance Test System, Version 3.0. A servo-hydraulic testing machine capable of producing a controlled haversine compressive loading shall be used. The testing machine should have a capability of applying a sinusoidal load over a range of frequencies from 0.1 to 25 Hz and load level up to 25.0 kN. For sinusoidal loads, the standard error of the applied load shall be less than 5 percent.

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

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