Standard Method of Test for

Determining Dynamic Modulus of Hot Mix Asphalt (HMA)

AASHTO Designation: T 342-11 (2019)[1]

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

Release: Group 3 (July)

AASHTO

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

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1. SCOPE

1.1. This test method covers procedures for preparing and testing hot mix asphalt (HMA) to determine the dynamic modulus and phase angle over a range of temperatures and loading frequencies.

1.2. This standard is applicable to laboratory-prepared specimens of mixtures with nominal maximum size aggregate less than or equal to 37.5 mm (1.48 in.).

1.3. *This standard may involve hazardous material, 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 determine the applicability of regulatory limitations prior to use.*

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- R 30, Mixture Conditioning of Hot Mix Asphalt (HMA)
- T 166, Bulk Specific Gravity (G_{mb}) of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens
- T 209, Theoretical Maximum Specific Gravity (G_{mm}) and Density of Asphalt Mixtures
- T 269, Percent Air Voids in Compacted Dense and Open Asphalt Mixtures
- T 312, Preparing and Determining the Density of Asphalt Mixture Specimens by Means of the Superpave Gyratory Compactor

2.2. *ASTM Standard*:

- E4, Standard Practices for Force Verification of Testing Machines

2.3. *Other Document*:

- Chapra, S. C. and R. P. Canale, *Numerical Methods for Engineers,* The McGraw-Hill Companies, Inc., New York, NY, 1985, pp. 404–407.

3. TERMINOLOGY

3.1. *Definitions*:

3.1.1. *complex modulus* (E^*)—a complex number that defines the relationship between stress and strain for a linear viscoelastic material.

3.1.2. *dynamic modulus* ($|E^*|$)—the normal value of the complex modulus calculated by dividing the maximum (peak-to-peak) stress by the recoverable (peak-to-peak) axial strain for a material subjected to a sinusoidal loading.

3.1.3. *phase angle* (ϕ)—the angle in degrees between a sinusoidal applied peak stress and the resulting peak strain in a controlled stress test.

4. SUMMARY OF METHOD

4.1. A sinusoidal (haversine) axial compressive stress is applied to a specimen of asphalt concrete at a given temperature and loading frequency. The applied stress and the resulting recoverable axial strain response of the specimen is measured and used to calculate the dynamic modulus and phase angle.

4.2. Figure 1 presents one schematic of the dynamic modulus test.

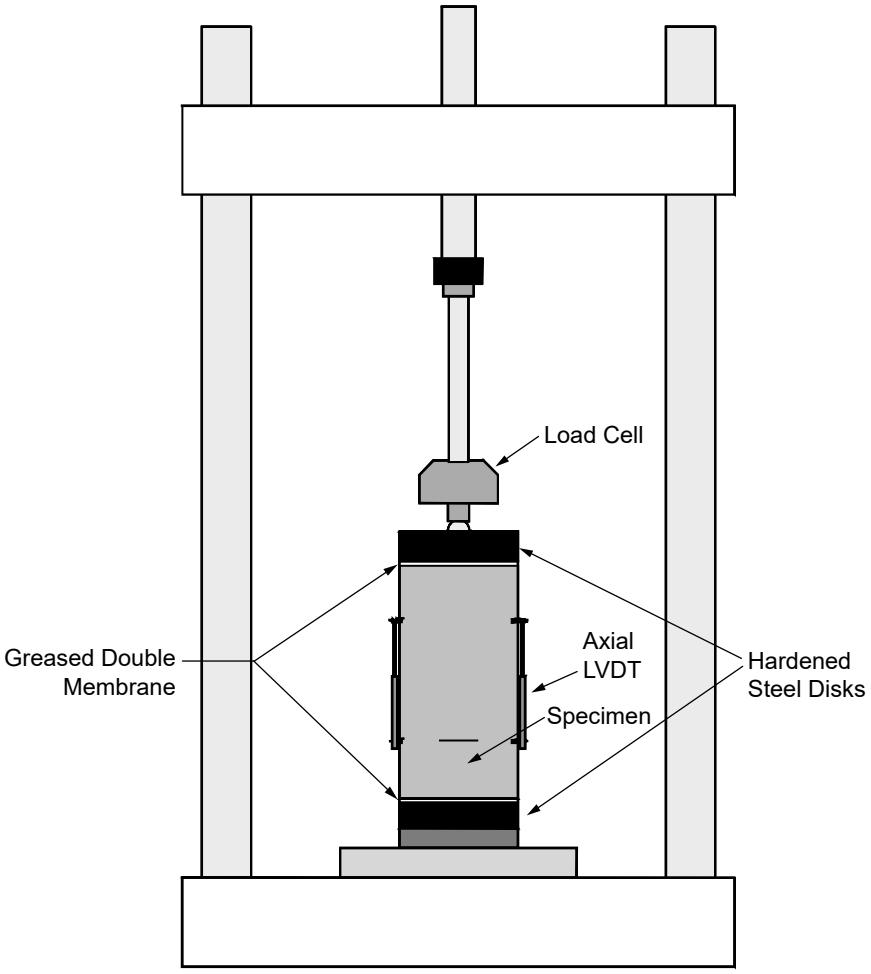

Figure 1—General Schematic of Dynamic Modulus Test