Standard Practice for

Developing Dynamic Modulus Master Curves for Hot Mix Asphalt (HMA)

AASHTO Designation: PP 62-10[1]

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

Standard Practice for

Developing Dynamic Modulus Master Curves for Hot Mix Asphalt (HMA)

AASHTO Designation: PP 62-10[1]

1. SCOPE

1.1. This practice describes testing and analysis for developing a dynamic modulus master curve for hot mix asphalt (HMA). This practice is intended for dense- and gap-graded mixtures with nominal-maximum aggregate sizes up to 37.5 mm. This practice is intended for use with TP 62 and addresses the wide range of test temperatures and frequencies specified therein.

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 Standards*:

- PP 60, Preparation of Cylindrical Performance Test Specimens Using the Superpave Gyratory Compactor (SGC)
- R 35, Superpave Volumetric Design for Hot Mix Asphalt (HMA)
- T 342, Determining Dynamic Modulus of Hot Mix Asphalt (HMA)
- *Mechanistic-Empirical Pavement Design Guide* (MEPDG)

3. TERMINOLOGY

3.1. *dynamic modulus master curve*—a composite curve constructed at a reference temperature by shifting dynamic modulus data from various temperatures along the “log frequency” axis.

3.2. *reduced frequency*—the computed frequency at the reference temperature, equivalent to the actual loading frequency at the test temperature.

3.3. *reference temperature*—the temperature at which the master curve is constructed.

3.4. *shift factor*—the shift in frequency associated with a shift from a test temperature to the reference temperature.

4. SUMMARY OF PRACTICE

4.1. This practice describes the testing and analysis needed to develop a dynamic modulus master curve for HMA. It involves collecting dynamic modulus test data at specified temperatures and loading rates, then manipulating the test data to obtain a continuous function describing the dynamic modulus as a function of frequency and temperature.

5. SIGNIFICANCE AND USE

5.1. Dynamic modulus master curves can be used for mixture evaluation and for characterizing the modulus of HMA for mechanistic-empirical pavement design.

6. APPARATUS

6.1. *Specimen Fabrication Equipment*—For fabricating dynamic modulus test specimens as described in PP 60.

6.2. *Dynamic Modulus Test System*—Meeting the requirements of TP 62.

6.3. *Analysis Software*—Capable of performing numerical optimization of non-linear equations.

Note 1—The "Solver" tool included in Microsoft Excel® is capable of performing the numerical optimization required by this practice.

7. HAZARDS

7.1. This practice and associated standards involve handling of hot asphalt binder, aggregates, and HMA. It also includes the use of sawing and coring machinery and servo-hydraulic testing equipment. Use standard safety precautions, equipment, and clothing when handling hot materials and operating machinery.

8. STANDARDIZATION

8.1. Items associated with this practice that require calibration or verification are included in the documents referenced in Section 2. Refer to the pertinent section of the referenced documents for information concerning calibration or verification.

9. DYNAMIC MODULUS TEST DATA

9.1. *Test Specimen Fabrication*:

9.1.1. Prepare at least two test specimens at the target air void content ±0.5 percent and with the aging condition in accordance with PP 60. Use Table 1 to select an appropriate number of specimens based on the uncertainty that can be tolerated in the analysis.

Note 2—The coefficient of variation for properly conducted dynamic modulus tests is approximately 13 percent. The coefficient of variation of the mean dynamic modulus for tests on multiple specimens is given in Table 1.