
Standard Practice for Developing Dynamic Modulus Master Curves for Asphalt Mixtures Using the Asphalt Mixture Performance Tester (AMPT)

AASHTO Designation: R 84-17 (2021)¹

Adopted: 2017

Reviewed but Not Updated: 2021

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



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

Standard Practice for

Developing Dynamic Modulus Master Curves for Asphalt Mixtures Using the Asphalt Mixture Performance Tester (AMPT)

AASHTO Designation: R 84-17 (2021)¹

AASHTO

Adopted: 2017

Reviewed but Not Updated: 2021

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

1. SCOPE

- 1.1. This practice describes testing and analysis for developing a dynamic modulus master curve 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. This practice accounts for the temperature limitations of the AMPT and provides guidance to the user for the selection of appropriate test temperatures.
- 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 Publications:*
- < [R 83](#), Preparation of Cylindrical Performance Test Specimens Using the Superpave Gyratory Compactor (SGC)
 - < [T 378](#), Determining the Dynamic Modulus and Flow Number for Asphalt Mixtures Using the Asphalt Mixture Performance Tester (AMPT)
 - < *Mechanistic-Empirical Pavement Design Guide* (MEPDG)
- 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.
 - < Christensen, D. W., T. K. Pellinen, and R. F. Bonaquist. Hirsch Model for Estimating the Modulus of Asphalt Concrete, *Journal of the Association of Asphalt Paving Technologists*, Vol. 72, 2003.
-

3. TERMINOLOGY

- 3.1. *Definitions:*
- 3.1.1. *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

- 3.1.2. *reduced frequency*—the computed frequency at the reference temperature, equivalent to the actual loading frequency at the test temperature.
- 3.1.3. *reference temperature*—the temperature at which the master curve is constructed.
- 3.1.4. *shift factor*—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 required using the AMPT and the analysis needed to develop a dynamic modulus master curve for asphalt mixtures. 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 asphalt mixtures for mechanistic-empirical pavement design.

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.
- 6.3. *Analysis Software*—Capable of performing numerical optimization of nonlinear 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 the handling of hot asphalt binder, aggregates, and asphalt mixtures. It also includes the use of sawing and coring machinery and servohydraulic 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:*