Standard Method of Test for

Determining the Fatigue Life of Compacted Asphalt Mixtures Subjected to Repeated Flexural Bending

AASHTO Designation: T 321-17

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

Release: Group 3 (August 2017)

AASHTO

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1. SCOPE

1.1. This standard provides procedures for determining the fatigue life and fatigue energy of 380 mm long by 50 mm thick by 63 mm wide asphalt mixture beam specimens sawed from laboratory- or field-compacted asphalt mixtures and subjected to repeated flexural bending until failure.

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 procedure to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.*

2. REFERENCED DOCUMENTS

2.1. *AASHTO Standards*:

- PP 3, Preparing Hot Mix Asphalt (HMA) Specimens by Means of the Rolling Wheel Compactor[1]
- R 66, Sampling Asphalt Materials
- T 2, Sampling of Aggregates
- T 168, Sampling Bituminous Paving Mixtures
- T 247, Preparation of Test Specimens of Hot Mix Asphalt (HMA) by Means of California Kneading Compactor
- T 269, Percent Air Voids in Compacted Dense and Open Asphalt Mixtures

2.2. *ASTM Standards*:

- D3549/D3549M, Standard Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens
- D5361/D5361M, Standard Practice for Sampling Compacted Bituminous Mixtures for Laboratory Testing
- E29, Standard Practice for Using Significant Digits in Test Data to Determine Conformance with Specifications

3. TERMINOLOGY

3.1. *Definition*:

3.1.1. *failure point*—the load cycle at which a peak occurs in the plot of stiffness multiplied by load cycles versus load cycles, which is indicative of the formation of a crack in the specimen.

4. SIGNIFICANCE AND USE

4.1. The fatigue life and failure energy determined by this standard can be used to estimate the fatigue life of asphalt mixture pavement layers under repeated traffic loading. The performance of asphalt mixtures can be more accurately predicted when these properties are known.

5. APPARATUS

5.1. *Test System*—The test system shall consist of a loading device, an environmental chamber (optional), and a control and data acquisition system. The test system shall meet the minimum requirements specified in Table 1.

Table 1—Test System Minimum Requirements

Load measurement and control	Range:	0 to 5 kN
	Resolution:	2 N
	Accuracy:	5 N
Displacement measurement and control	Range:	0 to 5 mm
	Resolution:	2 µm
	Accuracy:	5 µm
Frequency measurement and control	Range:	5 to 10 Hz
	Resolution:	0.005 Hz
	Accuracy:	0.01 Hz
Temperature measurement and control	Range:	–10 to 25˚C
	Resolution:	0.25˚C
	Accuracy:	±0.5˚C

5.1.1. *Loading Device*—The test system shall include a closed-loop, computer-controlled loading component that, during each load cycle in response to commands from the data processing and control component, adjusts and applies a load such that the specimen experiences a constant level of strain during each load cycle. The loading device shall be capable of (1) providing repeated sinusoidal loading at a frequency range of 5 to 10 Hz; (2) subjecting specimens to four-point bending with free rotation and horizontal translation at all load and reaction points; and (3) forcing the specimen back to its original position (i.e., zero deflection) at the end of each load pulse. (Figure 1 illustrates the loading conditions.)

5.1.2. *Environmental Chamber (Optional)*—The environmental chamber shall enclose the entire specimen and maintain the specimen at the test temperature ± 0.5°C during testing. An environmental chamber is not required if the temperature of the surrounding environment can be maintained within the specified limits.

5.1.3. *Control and Data Acquisition System*—During each load cycle, the control and data acquisition system shall be capable of measuring the deflection of the beam specimen, computing the strain in the specimen, and adjusting the load applied by the loading device such that the specimen experiences a constant level of strain on each load cycle. In addition, it shall be capable of recording load cycles, applied loads, and beam deflections and computing and recording the