
Standard Method of Test for Multiple Stress Creep Recovery (MSCR) Test of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)

AASHTO Designation: T 350-19 (2023)¹

Technically Revised: 2019

Reviewed but Not Updated: 2023

Editorially Revised: 2021

Technical Subcommittee: 2b, Liquid Asphalt



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1. SCOPE

- 1.1. This test method covers the determination of percent recovery and nonrecoverable creep compliance of asphalt binders by means of the Multiple Stress Creep Recovery (MSCR) test. The MSCR test is conducted using the Dynamic Shear Rheometer (DSR) at a specified temperature. It is intended for use with residue from T 240 (Rolling Thin-Film Oven Test (RTFOT)).
- 1.2. The percent recovery value is intended to provide a means for determining the elastic response and stress dependence of polymer modified and unmodified asphalt binders.
- 1.3. The values stated in SI units are to be regarded as the standard.
- 1.4. *This standard does not purport to address all of the safety concerns, if any, 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.*
- 1.5. *The quality of the results produced by this standard are dependent on the competence of the personnel performing the procedure and the capability, calibration, and maintenance of the equipment used. Agencies that meet the criteria of R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*

2. REFERENCED DOCUMENTS

- 2.1. AASHTO Standards:
 - < M 320, Performance-Graded Asphalt Binder
 - < M 332, Performance-Graded Asphalt Binder Using Multiple Stress Creep Recovery (MSCR) Test
 - < R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
 - < T 240, Effect of Heat and Air on a Moving Film of Asphalt Binder (Rolling Thin-Film Oven Test)

- < T 315, Determining the Rheological Properties of Asphalt Binder Using a Dynamic Shear Rheometer (DSR)

2.2. *ASTM Standards:*

- < C670, Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials
- < D8, Standard Terminology Relating to Materials for Roads and Pavements

3. TERMINOLOGY

3.1. *Definitions:*

- 3.1.1. Definitions of terms used in this practice may be found in ASTM D8, determined from common English usage, or combinations of both.

3.2. *Definitions of Terms Specific to This Standard:*

- 3.2.1. *creep and recovery*—a standard rheological test protocol whereby a specimen is subjected to a constant load for a fixed time period and then allowed to recover at a constant zero load for a fixed time period.
- 3.2.2. *nonrecoverable creep compliance (J_{nr})*—the residual strain in a specimen after a creep and recovery cycle divided by the stress applied, kPa^{-1} .

4. SUMMARY OF TEST METHOD

- 4.1. This test method is used to determine the presence of elastic response in an asphalt binder under shear creep and recovery at two stress levels at a specified temperature. For performance-graded (PG) asphalt binders, the specified temperature will typically be the PG high temperature as determined in accordance with M 332, Section 4. Refer to Note 4 in M 332 for additional guidance.
- 4.2. Asphalt binder is first conditioned using T 240 (RTFOT). A sample of the RTFO-conditioned asphalt is tested using T 315 (DSR). The 25-mm parallel plate geometry is used with a 1-mm gap setting. The sample is tested in creep at two stress levels followed by recovery at each stress level. The stress levels used are 0.1 kPa and 3.2 kPa. The creep portion of the test lasts for 1 s, which is followed by a 9-s recovery. Ten creep and recovery cycles are tested at each stress level.

5. SIGNIFICANCE AND USE

- 5.1. This method is designed to identify the presence of elastic response in a binder and the change in elastic response at two different stress levels while being subjected to ten cycles of creep stress and recovery. Nonrecoverable creep compliance has been shown to be an indicator of the resistance of an asphalt binder to permanent deformation under repeated load.

6. APPARATUS

- 6.1. Use the apparatus as specified in T 315.