
Standard Practice for

**Characterizing the Relaxation
Behavior of Asphalt Binders Using
the Delta T_c (ΔT_c) Parameter**

AASHTO Designation: PP 113-21

First Published: 2021

Technical Subcommittee: 2b, Liquid Asphalt



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

Standard Practice for

Characterizing the Relaxation Behavior of Asphalt Binders Using the Delta T_c (ΔT_c) Parameter

AASHTO Designation: PP 113-21



First Published: 2021

Technical Subcommittee: 2b, Liquid Asphalt

1. SCOPE

- 1.1. This practice provides a means of evaluating the behavior of an asphalt binder at low temperature using the results (Stiffness and m-value) from the Bending Beam Rheometer (BBR) test to calculate a value (identified as Delta T_c or ΔT_c) that is indicative of the relaxation properties of the asphalt binder. This practice is primarily intended for use with residue generated after long-term conditioning with T 240 (Rolling Thin-Film Oven (RTFO)) and R 28 (Pressurized Aging Vessel (PAV)), but may also be used on recovered asphalt binder from asphalt mixture, reclaimed asphalt pavement (RAP), and reclaimed asphalt shingles (RAS).
- 1.2. The behavior of an asphalt binder at low temperature can provide insight to the technologist indicating to what extent the asphalt binder exhibits adequate relaxation properties to minimize its contribution to non-load related cracking in an asphalt pavement.
- 1.3. This practice may be used in conjunction with M 320, *Specification for Performance-Graded Asphalt Binder*, or M 332, *Performance-Graded Asphalt Binder Using the Multiple Stress Creep Recovery (MSCR) Test*.
- 1.4. The values stated in SI units are to be regarded as the standard.
- 1.5. *This standard does not purport to address all 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.*

2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
 - T 313, Determining the Flexural Creep Stiffness of Asphalt Binder Using the Bending Beam Rheometer (BBR)
 - T 240, Effect of Heat and Air on a Moving Film of Asphalt (Rolling Thin-Film Oven Test)
 - R 28, Accelerated Aging of Asphalt Binder Using Pressurized Aging Vessel (PAV)
 - R 29, Grading or Verifying the Performance Grade (PG) of an Asphalt Binder
 - M 320, Performance-Graded Asphalt Binder
 - M 332, Performance-Graded Asphalt Binder Using the Multiple Stress Creep Recovery (MSCR) Test

- PP 78, Design Considerations When Using Reclaimed Asphalt Shingles (RAS) in Asphalt Mixtures

2.2. *ASTM Standards:*

- D8, Standard Terminology Relating to Materials for Roads and Pavements
- D7643, Determining the Continuous Grading Temperatures and Continuous Grades for PG Graded Asphalt Binders

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. $T_{c,s}$ —the critical temperature at which the specification criterion (300 MPa) is exactly met for BBR Stiffness, S , at 60 seconds of loading.
- 3.2.2. $T_{c,m}$ —the critical temperature at which the specification criterion (0.300) is exactly met for BBR m -value, m , at 60 seconds of loading.
- 3.2.3. ΔT_c (ΔT_c)—the calculated difference between $T_{c,s}$ and $T_{c,m}$. It is related to the relaxation properties of the asphalt binder.

4. SUMMARY OF PRACTICE

- 4.1. This practice is used to evaluate the relaxation behavior of an asphalt binder using parameters obtained from the Bending Beam Rheometer (BBR) test at two or more temperatures to calculate a value for a parameter, ΔT_c .
- 4.2. The ΔT_c value may be determined on asphalt binders being evaluated for compliance with M 320 or M 332. The ΔT_c value may be determined on asphalt binders recovered from asphalt mixture, pavement cores or slabs, reclaimed asphalt pavement (RAP), or reclaimed asphalt shingles (RAS).

5. SIGNIFICANCE AND USE

- 5.1. This practice is used to evaluate the behavior of an asphalt binder at low temperatures as an indication of the relaxation properties of the asphalt binder. Although the evaluation is conducted at low temperature, it is expected that the properties measured will be highly correlated with the relaxation properties of the asphalt binder at intermediate temperature. In either case, asphalt binders which exhibit poor relaxation properties are expected to be susceptible to non-load related cracking in service.

6. APPARATUS

- 6.1. Use apparatus as specified in T 313, T 240, and R 28.