Standard Method of Test for

Determining the Cracking Temperature of Asphalt Binder Using the Asphalt Binder Cracking Device (ABCD)

AASHTO Designation: T 387-19[1]

Technical Subcommittee: 2b, Liquid Asphalt

Release: Group 3 (July)

AASHTO

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1. SCOPE

1.1. This test method covers the determination of cracking temperatures of asphalt binders by the means of an Asphalt Binder Cracking Device (ABCD). This device can be used with unaged material or with material aged using T 240 or R 28, or both. The test apparatus is designed for testing a cracking temperature in the range of –60 to +20°C.

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*:

- R 28, Accelerated Aging of Asphalt Binder Using a Pressurized Aging Vessel (PAV)
- T 240, Effect of Heat and Air on a Moving Film of Asphalt Binder (Rolling Thin-Film Oven Test)

2.2. *ASTM Standard*:

- C670, Standard Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

3. TERMINOLOGY

3.1. *Definitions*:

3.1.1. *asphalt binder*—an asphalt-based cement produced from petroleum residue with or without the addition of particulate organic modifiers of a size less than 250 m.

3.1.2. *Invar*—a nickel steel alloy with a low coefficient of thermal expansion (CTE). The typical CTE of Invar is about 1.2×10^{-6}/°C.

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

3.2.1. *ABCD cracking temperature*—the temperature at which a sudden reduction of compressive strain on the ABCD ring occurs due to the fracture of a test specimen during the test specified in this standard.

3.2.2. *fracture stress*—the maximum tensile stress in the specimen calculated from the strain jump at the time of fracture.

3.2.3. *strain jump*—the amount of strain that the asphalt binder specimen releases when it cracks during the test specified in this standard.

4. SUMMARY OF TEST METHOD

4.1. The asphalt binder cracking device measures the temperature and strain of a restrained asphalt binder ring subjected to a constant rate of cooling.

4.2. Asphalt binder samples are heated and poured outside of an Invar ring placed in the center of a silicone mold. The Invar ring includes a strain gauge to record the strain applied to it by contraction of the asphalt binder during cooling and a surface-mounted resistance temperature detector (RTD) to record the temperature of the sample.

4.3. Samples are cooled at a constant rate and the cracking of the asphalt binder sample is represented as a jump in strain on a real-time plot.

4.4. The ABCD cracking temperature is determined by reading the temperature at the strain jump on a strain versus temperature plot.

4.5. The strain jump is recorded and, through calculations, the fracture stress of the asphalt binder specimen at the cracking temperature is determined.

5. SIGNIFICANCE AND USE

5.1.1. The thermal cracking temperature can be estimated directly without elaborate assumptions and calculations by creating a condition similar to that encountered in the field.

5.1.2. The thermal stress and fracture strength can be determined from strain readings.

5.1.3. The low-temperature thermal cracking performance of asphalt pavements is related to the ABCD cracking temperature of the asphalt binder contained in the pavement.

6. APPARATUS

6.1. *Asphalt Binder Cracking Device (ABCD) System*—System consisting of the following components: (1) an air-cooled environmental chamber capable of being programmed to cool specimens at a constant rate from a temperature of +25°C to a temperature of –60°C; (2) a computer-controlled data acquisition system capable of real-time display and of recording strain, temperature, and time readings; (3) ABCD rings; and (4) specimen molds.