Designation: D6931 – 17

Standard Test Method for Indirect Tensile (IDT) Strength of Asphalt Mixtures[1]

This standard is issued under the fixed designation D6931; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This test method covers procedures for preparing and testing laboratory-fabricated or field-recovered cores of asphalt mixtures to determine the indirect tensile (IDT) strength.

1.2 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.3 *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.*

1.4 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

D1074 Test Method for Compressive Strength of Asphalt Mixtures

D1561/D1561M Practice for Preparation of Bituminous Mixture Test Specimens by Means of California Kneading Compactor

D3387 Test Method for Compaction and Shear Properties of Bituminous Mixtures by Means of the U.S. Corps of Engineers Gyratory Testing Machine (GTM)

D3496 Practice for Preparation of Bituminous Mixture Specimens for Dynamic Modulus Testing (Withdrawn 2010)[3]

D3549/D3549M Test Method for Thickness or Height of Compacted Bituminous Paving Mixture Specimens

D3666 Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials

D4013 Practice for Preparation of Test Specimens of Bituminous Mixtures by Means of Gyratory Shear Compactor (Withdrawn 2013)[3]

D4867/D4867M Test Method for Effect of Moisture on Asphalt Concrete Paving Mixtures

D5581 Test Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus (6 inch-Diameter Specimen)

D6925 Test Method for Preparation and Determination of the Relative Density of Asphalt Mix Specimens by Means of the Superpave Gyratory Compactor

D6926 Practice for Preparation of Asphalt Mixture Specimens Using Marshall Apparatus

D6927 Test Method for Marshall Stability and Flow of Asphalt Mixtures

E1 Specification for ASTM Liquid-in-Glass Thermometers

2.2 *AASHTO Standards:*[4]

AASHTO T 245 Standard Method for Resistance to Plastic Flow of Bituminous Mixtures Using Marshall Apparatus

AASHTO T 312 Standard Method for Preparing and Determining the Density of Hot Mix Asphalt (HMA) Specimens by Means of the Superpave Gyratory Compactor

3. Summary of Test Method

3.1 The IDT strength of asphalt mixtures is determined by loading a cylindrical specimen across its vertical diametral plane at a specified rate of deformation and test temperature. The peak load at failure is recorded and used to calculate the IDT strength of the specimen.

4. Significance and Use

4.1 The values of IDT strength may be used to evaluate the relative quality of asphalt mixtures in conjunction with laboratory mix design testing and for estimating the potential for rutting or cracking. The results can also be used to determine

[1] This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.26 on Fundamental/Mechanistic Tests.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] The last approved version of this historical standard is referenced on www.astm.org.

[4] Available from American Association of State Highway and Transportation Officials (AASHTO), 444 N. Capitol St., NW, Suite 249, Washington, DC 20001, http://www.transportation.org.

the potential for field pavement moisture damage when results are obtained on both moisture-conditioned and unconditioned specimens.

NOTE 1—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 Specification D3666 are generally considered capable of competent and objective testing, sampling, inspection, etc. Users of this standard are cautioned that compliance with Specification D3666 alone does not completely ensure reliable results. Reliable results depend on many factors; following the suggestions of Specification D3666 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.

5. Apparatus

5.1 *Loading Device*—Loading jack and ring dynamometer or a mechanical or servo-hydraulic testing machine with an electronic load cell, in accordance with Test Method D6927, capable of applying a compressive load at a controlled deformation rate while measuring the load and deformation.

5.2 *Loading Strips*—Steel loading strips with a concave surface having a radius of curvature equal to the nominal radius of the test specimen. For specimens with nominal diameter of 100 mm, the loading strips shall be 12.70 ± 0.3 mm wide. For specimens with nominal diameter of 150 mm, the loading strips shall be 19.05 ± 0.3 mm wide. The length of the loading strips shall exceed the thickness of the specimen. The outer edges of the loading strips shall be beveled slightly to remove sharp edges.

5.2.1 The loading strips shall be part of a test fixture, similar to that shown in Fig. 1, in which the lower loading strip is mounted on a base having two perpendicular guide rods or posts extending upward. The upper loading strip shall be clean and freely sliding on the posts. Guide sleeves in the upper segment of the test fixture shall be in such a position as to direct the two loading strips together without appreciable binding or loose motion in the guide rods.

5.3 *Temperature Control System*—An air or water bath capable of maintaining the specimens at the specified test temperature within ±1.0 °C.

5.4 *Thermometer*—A calibrated liquid-in-glass thermometer of suitable range with subdivisions readable to 0.1 °C or any other thermostatic device of equal accuracy, precision, and sensitivity shall be used. Thermometers shall conform to the requirements of Specification E1.

5.5 *Miscellaneous*—A tape, ruler, or set of calipers for specimen height measurement.

NOTE 2—If testing to determine the potential for moisture damage, the apparatus from Test Method D4867/D4867M or similar will also be necessary.

6. Specimens

6.1 *Laboratory-Molded Specimens*—Prepare the laboratory-molded specimens in accordance with one of the following standards: Test Methods D1074, D3387, D6925; Practices D1561/D1561M, D3496, D4013, D6926; and AASHTO T 245 or AASHTO T 312. A minimum specimen height of 50 mm is required for specimens with a nominal diameter of 100 mm. A minimum specimen height of 75 mm is required for specimens with a nominal diameter of 150 mm. A minimum of three replicates shall be prepared for each mixture.

6.2 *Core Specimens*—Cores should have smooth surfaces and parallel faces, conforming to the height and diameter requirements specified for laboratory-molded specimens, except that a minimum height of 38 mm is permitted for specimens with a nominal diameter of 100 mm. A minimum of three replicates from an in-service pavement shall be prepared for testing.

NOTE 3—Specimens with a nominal diameter of 100 mm are suitable for mixtures with a nominal maximum particle size of 19 mm or less. Specimens with a nominal diameter of 150 mm are suitable for mixtures with a nominal maximum particle size of 37.5 mm or less.

7. Procedure

7.1 Determine the specimen height in accordance with Test Method D3549/D3549M, to the nearest 1 mm.

7.2 For core specimens, measure the diameter at the mid height along axes that are 90° apart, and record the average to the nearest 1 mm.

7.3 Bring the specimen to test temperature ±1 °C by any of the following three alternative procedures. The recommended test temperature is 25 °C.

NOTE 4—Based on previous experience, a standard temperature that has been used for most IDT strength testing is 25 °C. Other test temperatures may be used at the discretion of the user.

7.3.1 *Procedure A*—Place the specimen in an air bath for a minimum of 4 h.

7.3.2 *Procedure B*—Place the specimen in a heavy duty leak-proof plastic bag and then place the specimen in a water bath for a minimum of 2 h.

7.3.3 *Procedure C*—Place the specimen in a water bath for a minimum of 30 min but not longer than 120 min.

7.4 Remove the specimen from the air or water bath, remove the specimen from the plastic bag (if necessary), and place onto the lower loading strip. Slowly lower the top loading strip to bring it into light contact with the specimen. Ensure that the loading strips are parallel and centered on the vertical diametral plane. The elapsed time between removal of test specimens from the bath and the final load determination shall not exceed 2 min.

7.5 Apply a vertical compressive ramp load until the maximum load is reached. The recommended deformation rate is 50 ± 5 mm/min. Record the maximum load.

NOTE 5—This rate of loading has been commonly used for IDT strength specimens with a nominal diameter of 100 mm and is also recommended in Test Method D5581 when testing larger specimens for Marshall Stability with a nominal diameter of 150 mm. Research has not yet indicated if this deformation rate should be adjusted for IDT strength specimens with a nominal diameter of 150 mm. Some researchers[5] have also used a rate of 3.75 mm/min at higher temperatures (30 to 40 °C) on specimens with a nominal diameter of 150 mm to evaluate rutting potential.[5]

[5] Christensen, D. W., Bonaquist, R., and Jack, D. P., "Evaluation of Triaxial Strength as a Simple Test for Asphalt Concrete Rut Resistance," Pennsylvania Department of Transportation, Pennsylvania Transportation Institute, Final Report, August 2000.