Designation: ~~D7063/D7063M – 11~~ D7063/D7063M – 17

Standard Test Method for Effective Porosity and Effective Air Voids of Compacted ~~Bituminous Paving~~ Asphalt Mixture Samples[1]

This standard is issued under the fixed designation D7063/D7063M; 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 the determination of effective porosity or effective air voids of compacted mixtures by the use of a vacuum sealing method.

1.2 This method can be used for compacted field and laboratory ~~bituminous paving~~asphalt mixture samples, as well as other compacted samples with ~~well defined~~ well-defined geometrical shapes, such as concrete cylinders, cored rocks, and metal samples.

1.3 The results of this test method can be used to determine the degree of interconnectivity of air voids within a sample and can be correlated to permeability of compacted ~~bituminous paving~~ asphalt mixture samples.

1.4 A multi-laboratory precision and bias statement for this standard has not been developed at this time. Therefore, this standard should not be used for acceptance or rejection of a material for purchasing purposes.

1.5 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalent; therefore, each system shall be used independently of the other. Combining values from the two systems may result in ~~non-conformance~~nonconformance with the standard.

1.6 The text of this standard references notes and footnotes which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of the standard.

1.7 *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 requirements prior to use.*

1.8 *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]

D8 Terminology Relating to Materials for Roads and Pavements
~~D979~~D979/D979M Practice for Sampling Bituminous Paving Mixtures
D3666 Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials
D4753 Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing
D5361/D5361M Practice for Sampling Compacted Asphalt Mixtures for Laboratory Testing
D7227/D7227M Practice for Rapid Drying of Compacted Asphalt Mixture Specimens Using Vacuum Drying Apparatus
E691 Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method
~~D5361 Practice for Sampling Compacted Bituminous Mixtures for Laboratory Testing~~

3. Terminology

3.1 For definitions of terms used in this standard, refer to Terminology D8.

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[1] This test method is under the jurisdiction of ASTM Committee D04 on Road and Paving Materials and is the direct responsibility of Subcommittee D04.21 on Specific Gravity and Density of Asphalt Mixtures.

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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.

4. Significance and Use

4.1 In this test method, a compacted sample is vacuum sealed inside a plastic bag. The density of the sample, SG1, is calculated using a water displacement method, with the sample sealed. With the sample still in water, the bag is cut open. Since the sample is under vacuum and the air voids are evacuated, water will rush in to fill all the ~~water accessible~~ water-accessible air voids in the compacted sample. With the saturated weight of sample known, an apparent maximum density, SG2, can be calculated. The difference between SG2 and SG1 is the measure of the amount of water that has penetrated the compacted sample. This difference can be used to determine the fraction of total number of voids that are accessible to water, ~~Effective Percent Porosity or Percent Effective Air Voids.~~effective percent porosity or percent effective air voids.

4.2 The results obtained from this method can be used to determine the percentage of total air voids in a compacted sample that can be filled with water through surface or interconnected paths within the sample. In general, ~~Effective Percent Porosity~~effective percent porosity should be less than total percent air voids.

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.

4.3 This method can be used for ~~100 mm and 150 mm~~100-mm [4-in.] and 150-mm [6-in.] diameter cylindrical samples and cubical samples.

5. Apparatus

5.1 *Balance,* with ample capacity, and with sufficient sensitivity to enable bulk specific gravity of specimens to be calculated to at least four significant figures, that is, to at least three decimal places. It shall be equipped with a suitable apparatus[3] to permit weighing the specimen while it is suspended in water. The balance shall conform to Guide D4753 as a class GP2 balance.

NOTE 2—Since there are no more significant figures in the quotient (bulk specific gravity) than appear in either the dividend (the mass of the specimen in air) or in the divisor (the volume of the specimen, obtained from the difference in mass of the specimen in air and in water), this means that the balance must have a sensitivity capable of providing both mass and volume values to at least four figures. For example, a sensitivity of 0.1 g [0.00022 lb] would provide four significant figures for the determination of a mass in the range from 130.0 to 999.9 g [0.29 to ~~2.20 lb]~~ 2.20 lb] when the specific gravity is 2.300.

5.2 *Water Bath,* with minimum dimensions ~~(Length~~(length × ~~Width~~width × ~~Depth)~~depth) of 610 ×by 460 ×by 460 mm [24 ×by 18 ×by 18 in.] or a large cylindrical container with a minimum diameter of ~~460 mm~~ 460 mm and depth of 460 mm [18 ×by 18 in.], for completely submerging the specimen in water while suspended, equipped with an overflow outlet for maintaining a constant water level and temperature controls to maintain the water temperature at 25 ± ~~1° C~~ 1 °C [77 ± 2 °F].

NOTE 3—It is preferable to keep the water temperature constant by using a ~~temperature controlled~~ temperature-controlled heater. Also, to reduce the chance for the bag to touch the sides of the water tank, it is preferable to elevate the water tank to a level at which the sample can be placed on the weighing mechanism while the operator is standing up (waist height), and the placement of the sample and the bag in the water tank can easily be inspected.

5.3 *Cushioned ~~holder;~~Holder,* for water displacement of the sample, having no sharp edges.

NOTE 4—To avoid accidental puncture of the plastic bags in the water bath, ~~plastic coated~~ plastic-coated cushioned holders have been found to work well for this test method.

5.4 *Vacuum Chamber,* with a pump capable of evacuating a sealed and enclosed chamber to a pressure of 6 mm Hg ~~[6 Torr],~~ [6 Torr], when at sea level. The chamber shall be large enough to test samples 150 mm [6 in.] wide by 350 mm [14 in.] long by 150 mm [6 in.] thick. The device shall automatically seal the plastic bag and exhaust air back into the chamber in a controlled manner to ensure proper conformance of the plastic to the specimen. The air exhaust and vacuum operation time shall be set at the factory so that the chamber is brought to atmospheric pressure in 80 to 125 ~~seconds;~~s, after the completion of the vacuum ~~operation .~~ operation. The vacuum system shall be provided with a latch to control the chamber door opening.

5.5 ~~A~~ *Vacuum Measurement Gage,* independent of the vacuum sealing device that could be placed directly inside the chamber to verify vacuum performance and the chamber door sealing condition of the unit. The gage shall be capable of reading down to 3 mm Hg [3 Torr] and readable to 1 mm Hg [1 Torr].

5.6 *Plastic Bags,* used with the vacuum device shall be one of the two following sizes. The smaller bags shall have a minimum opening of 235 mm [9.25 in.] and maximum opening of 260 mm [10.25 ~~in.~~]in.], and the larger bags shall have a minimum opening of 375 mm [14.75 in.] and a maximum opening of 394 mm [15.5 in.]. The bags shall be of plastic material that will not adhere to asphalt film, is puncture resistant, is capable of withstanding sample temperatures of up to ~~70°C [158°],~~70 °C [158 °F], is

[3] The sole source of supply of the apparatus and the method known to the committee at this time is InstroTek, Inc., Raleigh, NC. If you are aware of alternative suppliers, please provide this information to ASTM Headquarters. Your comments will receive careful consideration at a meeting of the responsible technical committee,[1] which you may attend.