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Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Mixtures Using Automatic Vacuum Sealing Method[1]

This standard is issued under the fixed designation D6752; 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.

~~ε[1] NOTE—Paragraph 8.2 was corrected editorially in December 2004.~~

1. Scope

1.1 This test method covers the determination of bulk specific gravity of compacted bituminous mixtures by the vacuum sealing method.

1.2 This method can be used for compacted cylindrical and cubical bituminous laboratory and field specimens.

1.3 The bulk specific gravity of the compacted bituminous mixtures may be used in calculating the unit weight of the mixture.

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1.4 The values stated in SI units are to be regarded as the standard. The values given in parenthesis are for information only.

1.5 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[2]

C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials ~~D979 Practice for Sampling Bituminous Paving Mixtures~~

~~D1461 Test Method for Moisture or Volatile Distillates in Bituminous Paving Mixtures~~

D2726 Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Bituminous Mixtures

D3203 Test Method for Percent Air Voids in Compacted Dense and Open 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~~ Guide for Evaluating, Selecting, and Specifying Balances and Standard Masses for Use in Soil, Rock, and Construction Materials Testing

D5361 Practice for Sampling Compacted Bituminous Mixtures for Laboratory Testing

D7227 Practice for Rapid Drying of Compacted Asphalt Specimens Using Vacuum Drying Apparatus

2.2 *AASHTO Standards:*[3]

MP323 Standard Specification for Superpave Mix Design

3. Significance and Use

3.1 The results obtained from this method can be used to determine the unit weight of compacted bituminous mixtures and in conjunction with Test Method D3203, to obtain percent air voids. These values in turn may be used in determining the relative degree of compaction.

3.2 Since specific gravity has no units, it must be converted to density in order to do calculations that require units. This conversion is made by multiplying the specific gravity at a given temperature by the density of water at the same temperature.

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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 Bituminous 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.

[3] Available from the American Association of State Highway Transportation Officials (AASHTO), 441 N. Capitol Street, NW, Washington, DC 20001.

~~3.3This method can be used for 100 mm and 150 mm diameter cylindrical as well as cubical asphalt specimens to correct for absorptive and open graded mixes. Mixes such as Stone Matrix Asphalt (SMA), porous friction coarse, and Superpave coarse graded mixes with significant surface texture and interconnected voids should be sealed for accurate bulk specific density results. Follow manufacturer recommendation for appropriate bag sizes to be utilized with cubical and abnormally shaped samples.~~

3.3 This method can be used for 100 mm (4 in.) and 150 mm (6 in.) diameter cylindrical as well as cubical asphalt specimens to correct for inconsistencies in sample weight determinations resulting from drainage of water from samples and inaccuracy in saturated surface dry weight of absorptive coarse and open graded mixes. Mixes such as Stone Matrix Asphalt (SMA), porous friction course, and coarse graded mixes with significant surface texture and interconnected voids can be tested with this method. Follow manufacturer recommendation for appropriate bag sizes to be utilized with cubical and abnormally shaped samples.[4]

NOTE 1—The personnel and equipment used in performing this test can be evaluated in accordance with Practice D3666.

4. Apparatus

4.1 *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 to permit weighing the specimen while it is suspended in water. The balance shall conform to Guide D4753 as a class GP2 balance.

NOTE~~1—Since~~ 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 would provide four significant figures for the determination of a mass in the range from 130.0 to 999.9 g when the specific gravity is 2.300.

4.2 *Water Bath*, with minimum dimensions (Length × Width × Depth) of 610 × 460 × 460 mm (24 × 18 × 18 in.) or a large cylindrical container, for completely submerging the specimen in water while suspended, equipped with an overflow outlet for maintaining a constant water level.

NOTE~~2—It~~ 3—It is preferable to keep the water temperature constant by using a 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 standing up, and the placement of the sample and the bag in the water tank can easily be inspected.

4.3 *Cushioned holder*, for water displacement of the sample, having no sharp edges.

NOTE~~3—To~~ 4—To avoid accidental puncture of the plastic bags in the water bath, plastic coated cushioned holders have been found to work well for this test method.

4.4 *Vacuum Chamber*, with a 0.93 kW (1.25 hp) pump capable of evacuating a sealed and enclosed chamber to a minimum pressure of 10 mm Hg (10 Torr) in less than 60 s, when at sea level. The chamber shall be large enough to seal samples of 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 asphalt specimen. The air exhaust and vacuum operation time should be calibrated at the factory prior to initial use. The air exhaust system should be calibrated to bring the chamber to atmospheric pressure in 80 to 120 s, after the completion of the vacuum operation. The vacuum system should be provided with a latch to control the chamber door opening.

4.5 *A Vacuum Measurement Gauge*, 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 gauge shall be capable of reading 3 mm Hg (3 ~~TORR)~~Torr) pressure.

4.6 *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~~241 mm ~~(9.25~~(9.50 in.) and maximum opening of 260 mm (10.25 in.) and the larger bags shall have a minimum 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, is impermeable to water, ~~containing~~ and contains no air channels for evacuation of air from the bag. The bags shall have a minimum thickness of 0.100 mm (0.004 in.) and maximum thickness of 0.152 mm (0.006 in.). The apparent specific gravity for the bags shall be provided by the ~~manufacturer for each bag shipment.~~manufacturer. The apparent specific gravity provided for each size bag shall account for the different sample weights and bag weight used during testing.

4.7 *Specimen Sliding Plate*, used within the chamber for reduction of friction on the plastic bags.

4.8 *Bag Cutting Knife*, or scissors.

~~4.9Sufficient aggregate and asphalt binder to prepare a laboratory compacted sample of 4.75 mm design misture with minimum dimensions of 100 mm diameter by 60 mm thick. The compacted sample should be molded to create air voids in the range of 4 % to 8 % at 6 % asphalt content. Refer to AASHTO MP2 provisional standard for instructions on how to design 4.75 mm mixes. Refer to AASHTO provisional standard MP2, printed in 2003, for more information on 4.75 mm mix design.~~

[4] Bulk specific gravity determined by this method may be lower than the results obtained by Test Method D2726. As a result, air voids determined from these bulk specific gravity values may be higher than the air voids values determined using Test Method D2726. These differences may be more pronounced for coarse aggregate mixtures. Users of this method are cautioned to evaluate any alteration in percent asphalt content or aggregate gradations for mix designs with a known positive performance history.