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## Standard Test Method for Bulk Specific Gravity and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method<sup>1</sup>

This standard is issued under the fixed designation D6752/D6752M; 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 ( $\epsilon$ ) indicates an editorial change since the last revision or reapproval.

### 1. Scope

- 1.1 This test method covers the determination of bulk specific gravity of compacted asphalt mixtures by the vacuum sealing method.
- 1.2 This method can be used for compacted cylindrical and cubical laboratory and field asphalt mixture specimens.
- 1.3 The bulk specific gravity of the compacted asphalt mixtures may be used in calculating the unit weight of the mixture.
- 1.4 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 equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in nonconformance with the standard.
- 1.5 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.
- 1.6 *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, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*
- 1.7 *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:<sup>2</sup>

- [C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials](#)
- [D8 Terminology Relating to Materials for Roads and Pavements](#)
- [D2726/D2726M Test Method for Bulk Specific Gravity and Density of Non-Absorptive Compacted Asphalt Mixtures](#)
- [D3203/D3203M Test Method for Percent Air Voids in Compacted Asphalt Mixtures](#)
- [D3666 Specification for Minimum Requirements for Agencies Testing and Inspecting Road and Paving Materials](#)

<sup>1</sup> 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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<sup>2</sup> For referenced ASTM standards, visit the ASTM website, [www.astm.org](http://www.astm.org), or contact ASTM Customer Service at [service@astm.org](mailto:service@astm.org). For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.



[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

2.2 AASHTO Standard.<sup>3</sup>

[M323M 323](#) Standard Specification for Superpave Mix Design

### 3. Terminology

3.1 For definitions of terms used in this standard, refer to Terminology [D8](#).

### 4. Significance and Use

4.1 The results obtained from this method can be used to determine the unit weight of compacted asphalt mixtures, and in conjunction with Test Method [D3203/D3203M](#), to obtain percent air voids. These values in turn may be used in determining the relative degree of compaction.

4.2 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.

4.3 This method can be used for 100 mm [4 in.] and 150 mm [6 in.] diameter cylindrical as well as cubical asphalt mixture 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. Asphalt 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.<sup>4</sup>

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 *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 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, ~~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] when the specific gravity is 2.300.

5.2 *Water Bath*, with minimum dimensions (length × width × depth) of 610 by 460 by 460 mm [24 by 18 by 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 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.

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

<sup>4</sup> Bulk specific gravity determined by this method may be lower than the results obtained by Test Method [D2726/D2726M](#). 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/D2726M](#). 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.

5.3 *Cushioned 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 cushioned holders have been found to work well for this test method.

5.4 *Vacuum Chamber*, with a ~~0.93-kW [1.25-hp] pump~~ 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~~, 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.

5.5 *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] pressure.

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 ~~241 mm [9.50 in.]~~ 235 mm [9.25 in.] and maximum opening of 267 mm [10.50 in.], and the larger bags shall have a minimum of 368 mm [14.50 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 °F], is impermeable to water, and contains no air channels for evacuation of air from the bag. The bags shall have a minimum thickness of ~~0.127 mm [0.005 in.]~~ 0.102 mm [0.004 in.] and maximum thickness of 0.178 mm [0.007 in.]. The apparent specific gravity for the bags shall be provided by the manufacturer. The apparent specific gravity provided for each size bag shall account for the different sample weights and bag weight used during testing.

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

5.8 *Bag-Cutting Knife*, or scissors.

## 6. Sampling

6.1 Test specimens may be molded from laboratory-prepared samples or taken from asphalt pavement in the field. Field samples should be obtained in accordance with Practice [D5361/D5361M](#).

## 7. Test Specimens

7.1 It is ~~recommended~~, recommended (1) that the diameter of cylindrically molded or cored specimens, or the length of the sides of sawed specimens be at least equal to four times the maximum size of the aggregate; and (2) that the thickness of specimens be at least ~~one and one-half~~ one and one half times the maximum size of the aggregate. Pavement specimens are to be taken by such means as coring, sawing of blocks, and so forth.

7.2 Take care to avoid distortion, bending, or cracking of specimens during and after removal from pavement or mold. Store specimens in a safe, cool place.

7.3 Specimens shall be free of foreign materials such as sealcoat, tack coat, foundation material, soil, paper, or foil. When any of these materials is visually evident, it shall be removed. Sealcoat, ~~tack coat~~, tack coat, or irregular surfaces that may result in the plastic bag not complying with the sample shall be removed by sawing the bottom or the top faces, or both, of the sample.

7.4 If desired, specimens may be separated from other pavement layers by sawing or other suitable means.

7.5 Use a brush or a soft sanding block to break sharp edges around the top and bottom corners of the sample.