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Standard Test Method for Bulk Specific Gravity and Density of Compacted Bituminous Asphalt Mixtures Using Automatic Vacuum Sealing Method¹

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 (ϵ) 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 ~~bituminous~~ asphalt mixtures by the vacuum sealing method.

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

1.3 The bulk specific gravity of the compacted ~~bituminous~~ 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 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.

1.5 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 and health practices and determine the applicability of regulatory requirements 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:*²
- [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 Bituminous Mixtures](#)
 - [D3203/D3203M Test Method for Percent Air Voids in Compacted ~~Dense and Open Bituminous Paving Asphalt~~ 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](#)
 - [D536/D536M Practice for Sampling Compacted ~~Bituminous Asphalt~~ Mixtures for Laboratory Testing](#)
 - [D7227/D7227M Practice for Rapid Drying of Compacted Asphalt Specimens Using Vacuum Drying Apparatus](#)
- 2.2 *AASHTO Standards:*³
- [M323 Standard Specification for Superpave Mix Design](#)

3. Terminology

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

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.

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

4. Significance and Use

4.1 The results obtained from this method can be used to determine the unit weight of compacted ~~bituminous mixtures~~ asphalt mixtures, and in conjunction with Test Method ~~D3203~~ 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. ~~Mixes~~ Asphalt mixes such as ~~Stone Matrix Asphalt~~ 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~~ 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 ~~this test can be evaluated in accordance with Practice~~ 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, 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, 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~~ 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.

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 0.93 kW (~~1.25 hp~~) [1.25 hp] pump capable of evacuating a sealed and enclosed chamber to a minimum pressure of 10 mm Hg (~~10 Torr~~) [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.

5.5 *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~~) [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.] 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 [~~158°F~~], 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 0.100 mm

⁴ Bulk specific gravity determined by this method may be lower than the results obtained by Test Method ~~D2726~~ 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~~ 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.