



Designation: D1188/D1188M – 22

Standard Test Method for Bulk Specific Gravity and Density of Compacted Asphalt Mixtures Using Coated Samples¹

This standard is issued under the fixed designation D1188/D1188M; 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.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope

1.1 This test method covers the determination of bulk specific gravity of specimens of Parafilm-coated, compacted asphalt mixtures.

1.2 This method should be used with samples that contain open or interconnecting voids or absorb more than 2.0 % of water by volume, or both.

NOTE 1—A method for calculating the percent water absorbed by the specimen on a volume basis is described in Test Method [D2726/D2726M](#).

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.*

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. Referenced Documents

2.1 ASTM Standards:²

[D979/D979M](#) Practice for Sampling Bituminous Paving Mixtures

[D1461](#) Test Method for Moisture or Volatile Distillates in Asphalt Mixtures

[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

[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

[E1](#) Specification for ASTM Liquid-in-Glass Thermometers

[E1137/E1137M](#) Specification for Industrial Platinum Resistance Thermometers

3. Significance and Use

3.1 This test method is useful in calculating percent air voids as given in Test Method [D3203/D3203M](#). Since specific gravity has no units, it must be converted to density when this type of measurement is required. This conversion is made by multiplying the specific gravity at a given temperature by the density of water at the same temperature.

NOTE 2—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,

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.



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. Apparatus

4.1 *Balance*, with ample capacity and with sufficient sensitivity to enable bulk specific gravities to the 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. To avoid erroneous readings by undue displacement of water, use wire or fishing line of the smallest practical size to suspend the specimen and holder. Do not use chains, strings, or sash cords. The balance shall conform to Guide **D4753** as a Class GP2 balance.

NOTE 3—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*, capable of maintaining a temperature of $25 \pm 1^\circ\text{C}$ [$77 \pm 1.8^\circ\text{F}$] for immersing the specimen in water while suspended, and equipped with an overflow outlet for maintaining a constant water level. The water in the bath shall always be kept at the same level as the overflow outlet. The use of an overflow outlet is mandatory.

NOTE 4—The water bath does not need to be a sophisticated device. Any method that maintains $25 \pm 1^\circ\text{C}$ [$77 \pm 1.8^\circ\text{F}$] can be used including tempering, aquarium heaters, stirrers, or other devices.

4.3 *Thermometer*, for measuring the temperature of the water bath, with a temperature range from at least 20 to 30°C [68 to 86°F] with a tolerance range of $\pm 0.25^\circ\text{C}$ [$\pm 0.45^\circ\text{F}$].

4.3.1 Thermometers that can meet these requirements include a 17C [17F] Specification **E1**, a Class A Pt-100 RTD (Specification **E1137/E1137M**) with a three or four-wire configuration at the connection terminal, and an NTC thermistor. The electronic sensors need to be in a stainless steel metal sheath and paired with an appropriate meter capable of displaying the temperature to at least two decimal places.

NOTE 5—The ASTM 17C has a maximum scale error of 0.1°C and Class A Pt-100 RTD thermometers have a tolerance range of $\pm 0.1^\circ\text{C}$. This tolerance range is also typically available for thermistor thermometers.

5. Materials

5.1 *Parafilm*—100 mm [4 in.] wide roll of elastomeric film obtainable from most scientific suppliers.

NOTE 6—Parafilm rolls come in various lengths. Typical lengths range from 38 to 76 m [125 to 250 ft].

5.2 *Polyurethane Foam Mat (Two Pieces)*—To be used for pressing the Parafilm onto the surface of the specimen. One piece of the foam mat shall be larger than the specimen diameter (working surface). The second piece shall be approxi-

mately the same diameter of the specimen (interface between specimen and load used to press film onto surface).

NOTE 7—The soft, compressible interface between the counter and specimen, and between the top of the specimen helps minimize the potential for sharp aggregate edges to puncture the film.

5.3 *Calibration Specimen*—A smooth-sided aluminum cylinder approximately the same size as the asphalt mixture specimens being tested.

NOTE 8—Aluminum is used for the calibration specimen because it is readily available from local machine shops and has a specific gravity that is close to that of traditional compacted dense-graded asphalt mixture specimens (from around 2.64 to 2.81).

6. Test Specimens

6.1 Test specimens may be molded from laboratory-mixed field samples or be cut from asphalt pavement in the field. Field samples should be obtained in accordance with Practice **D979/D979M**. Pavement specimens shall be taken from pavements with a core drill, diamond or carborundum saw, or other suitable means, in accordance with Practice **D5361/D5361M**.

6.2 *Size of Specimens*—It is 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 times the maximum size of the aggregate.

6.3 Take pavement specimens from pavements with a core drill, diamond or carborundum saw, or by other suitable means.

6.3.1 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.

6.3.2 Specimens shall be free of foreign materials such as seal coat, tack coat, foundation material, soil, paper, or foil. When any of these materials is visually evident, it shall be removed in accordance with **6.3.3**.

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

7. Procedure

7.1 Mass of Uncoated Specimens:

7.1.1 For cores and for other specimens that may contain moisture or solvents, thoroughly dry specimens under a fan until a constant mass has been achieved and determine the mass of the specimen. A constant mass is defined as less than a 0.05 % change in mass between consecutive 15 min drying intervals. Other methods such as Practice **D7227/D7227M** may be used to dry the specimen as long as a constant mass is achieved (mass repeats within 0.1 %). Designate this mass as A.

7.1.2 Laboratory-prepared specimens, including plant-mixed, laboratory compacted specimens, are considered to be dry and can be tested without additional drying.

7.2 Mass of Coated Specimen:

7.2.1 Cut Parafilm for wrapping the specimen ends.

7.2.1.1 For 100 mm [4 in.] diameter specimen, cut two approximately 100 mm [4 in.] and one 200 mm [8 in.] lengths of Parafilm.