

METHODS OF SAMPLING AND TESTING
MT 315-04
METHOD OF TEST FOR BULK SPECIFIC GRAVITY OF
COMPACTED BITUMINOUS MIXTURES USING PARAFFIN-COATED SPECIMENS
(MODIFIED AASHTO T 275)

1 Scope:

1.1 This method of test covers the determination of bulk specific gravity of specimens of compacted bituminous mixtures.

1.2 *Definition: Bulk Specific Gravity (of Solids) – The ratio of the weight in air of a unit volume of a permeable material (including both permeable and impermeable voids normal to the material) at a stated temperature to the weight in air of equal density of an equal volume of gas free distilled water at a stated temperature. The form of the expression shall be:*

Bulk Specific Gravity x/y °C

where:

x = temperature of the material

y = temperature of the water.

1.3 This method should be used with samples that contain open or interconnecting voids and/or absorb more than 2 percent of water by volume, as determined by MT-314.

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

2 Referenced Documents:**2.1 AASHTO:**

M 231 Weighing Devices Used in the Testing of materials

T 166 Bulk Specific Gravity of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens

T 275 Bulk Specific Gravity of Compacted Asphalt Mixtures Using Paraffin-Coated Specimens

MT Manual:

MT-314 Bulk Specific Gravity of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens

3 Test Specimens:

3.1 Test specimens may be either laboratory-molded bituminous mixtures or from bituminous pavements. The mixtures may be surface or wearing course, binder or leveling course, or hot mix-base.

3.2 *Size of Specimens* – It is recommended that: (1) 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) the thickness of specimens be at least one and one-half times the maximum size of the aggregate.

3.3 Pavement specimens shall be taken from pavements with a core drill, diamond or carborundum saw, or by other suitable means.

3.4 Care shall be taken to avoid distortion, bending, or cracking of specimens during and after the removal from the pavement or mold. Specimens shall be stored in a safe, cool place.

3 Test Specimens: (continued)

- 3.5** Specimens shall be free from foreign materials such as seal coat, tack coat, foundation material, soil, paper, or foil.
- 3.6** If desired, specimens may be separated from other pavement layers by sawing or other suitable means. Care should be exercised to ensure sawing does not damage the specimens.

METHOD A:**4 Apparatus:**

- 4.1** *Balance* – The balance shall have sufficient capacity, be readable to 0.01 percent of the sample mass, or better, and conform to the requirements of AASHTO M 231. The weighing device shall be equipped with suitable suspension apparatus and holder to permit weighing the specimen while suspended from center of scale pan of balance.
- 4.2** *Suspension Apparatus* - The wire suspending the container shall be of the smallest practical size to minimize any possible effects of a variable immersed length. The suspension apparatus shall be constructed to enable the container to be immersed to a depth sufficient to cover it and the test sample during weighing.
- 4.3** *Water Bath* - for immersing the specimen in water while suspended under the balance, equipped with an overflow outlet for maintaining a constant water level.

5 Procedure:

- 5.1** *Mass of Uncoated Specimens* - Weigh the specimen after it has been dried to a constant mass. Designate this mass as *A*.

Note 1 - Constant mass shall be defined as the mass at which further drying $52 \pm 3^{\circ}\text{C}$ ($125 \pm 5^{\circ}\text{F}$) at does not alter the mass by more than 0.05 percent. Samples shall initially be dried overnight at $52 \pm 3^{\circ}\text{C}$ ($125 \pm 5^{\circ}\text{F}$) and then weighed at two hour drying intervals.

- 5.2** *Mass of Coated Specimen in Air* – Coat the test specimen on all surfaces with melted paraffin sufficiently thick to seal all voids. Allow the coating to cool in air at room temperature at $25 \pm 5^{\circ}\text{C}$ ($77 \pm 9^{\circ}\text{F}$) for 30 minutes and then weigh the specimen. Designate this mass as *D*.

Note 2 - If it is desired to utilize the specimen for further tests that require the removal of the paraffin coating, the specimen may be dusted with powdered talc prior to coating.

Note 3 – Application of the paraffin may be accomplished by chilling the specimen in a refrigerating unit to a temperature of approximately 4.5°C (40°F) for 30 minutes and then dipping the specimen in warm paraffin (5.5°C or 10°F above melting point).

- 5.3** *Mass of Coated Specimen in Water* – Weigh the coated specimen in water bath at $25 \pm 1^{\circ}\text{C}$ ($77 \pm 2^{\circ}\text{F}$). Designate this mass as *E*.
- 5.4** *Specific Gravity of Paraffin* – Determine the specific gravity of the paraffin at $25 \pm 1^{\circ}\text{C}$ ($77 \pm 2^{\circ}\text{F}$), if known, and designate this as *F*.

6 Calculation:

- 6.1** Calculate the bulk specific gravity of the specimen as follows (round and report the value to the nearest three decimal places):

6 Calculation: (continued)

$$\text{Bulk Specific Gravity} = \frac{A}{D - E - \left(\frac{D - A}{F}\right)}$$

where:

A = mass in grams of the dry specimen in air

B = mass in grams of the dry specimen plus paraffin coating in air

E = mass in grams of the dry specimen plus paraffin in water.

F = specific gravity of the paraffin at $25 \pm 1^\circ\text{C}$ ($77 \pm 2^\circ\text{F}$).

METHOD B:**7 Apparatus:**

7.1 Balance – shall have sufficient capacity, readable to 0.1 percent of the sample mass or better, and conforming to the requirements of AASHTO M 231.

7.2 Water Bath - thermostatically controlled so as to maintain the bath at $25 \pm 0.5^\circ\text{C}$ ($77 \pm 0.9^\circ\text{F}$).

7.3 Thermometer - ASTM 17°C (17°F), having a range of 19 to 27°C (66 to 80°F), graduated in 0.1°C subdivisions.

7.4 Volumeter - calibrated to 1200 mL, or an appropriate capacity depending upon the size of the test sample. The volumeter shall have a tapered lid with a capillary bore.

8 Procedure:

8.1 Dry the specimen to a constant mass (See Note 1). Cool the specimen to room temperature at $25 \pm 5^\circ\text{C}$ ($77 \pm 9^\circ\text{F}$) and record the dry mass.

8.2 Coat the specimen with melted paraffin until sufficiently thick to seal all surface voids. Allow the coating to cool in air at room temperature for 30 minutes and then weigh the specimen (Notes 2 & 3).

8.3 Fill a calibrated volumeter with distilled water at $25 \pm 5^\circ\text{C}$ ($77 \pm 9^\circ\text{F}$). Place the coated specimen into a volumeter and cover the volumeter, making certain that some water escapes through the capillary bore in the tapered lid. Wipe the volumeter dry with a dry absorbent cloth and weigh the volumeter and its contents.

8.4 Determine the specific gravity of the paraffin at $25 \pm 5^\circ\text{C}$ ($77 \pm 9^\circ\text{F}$), if unknown.

9 Calculations:

9.1 Calculate the bulk specific gravity of the specimen as follows (round and report the value to the nearest three decimal places).

$$\text{Bulk Specific Gravity} = \frac{A}{D - \left[E - C + \left(\frac{C - A}{F} \right) \right]}$$

where:

A = mass in grams of the dry specimen,

C = mass in grams of the paraffin-coated specimen,

9 Calculations: (continued)

D = Mass in grams of the volumeter filled with water at 25°C (77°F)

E = mass in grams of the volumeter filled with the paraffin-coated specimen and water at 25°C (77°F)

F = specific gravity of the paraffin at $25 \pm 1^\circ\text{C}$ ($77 \pm 2^\circ\text{F}$).

10 Precision:

- 10.1** Duplicate specific gravity results by the same operator should not be considered suspect unless they differ more than 0.02.

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