MT 314-14
BULK SPECIFIC GRAVITY OF COMPACTED BITUMINOUS MIXTURES
(MODIFIED AASHTO T 166)

1 Scope:

1.1 This test method covers the determination of bulk specific gravity (G_{mb}) of specimens of compacted plant mix surfacing (PMS).

1.2 Do not use this method with samples that contain open or interconnecting voids or absorb more than 2 percent of water by volume, as calculated in section 7.2. If sample absorbs more than 2 percent of water by volume, refer to AASHTO T 275.

1.3 The bulk specific gravity (G_{mb}) of the compacted bituminous mixtures may be used in calculating the unit mass of the mixture.

1.4 The values stated in SI units are to be regarded as the standard.

2 Referenced Documents:

AASHTO:

M 231 Weighing Devices Used in the Testing of Materials
T 166 Bulk Specific Gravity (G_{mb}) of Compacted Hot Mix Asphalt (HMA) Using Saturated Surface-Dry Specimens
T 275 Bulk Specific Gravity (G_{mb}) of Compacted Hot Mix Asphalt (HMA) Using Paraffin-Coated Specimens

ASTM:

D7227 Rapid Drying of Compacted Asphalt Specimens Using Vacuum Drying Apparatus

3 Terminology:

3.1 *Bulk Specific Gravity (of Solids) (G_{mb})* – The ratio of the mass 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 mass in air of equal density of an equal volume of water at a stated temperature. Express G_{mb} as follows:

$$Bulk\ specific\ gravity\ (Gmb)\ at\ \frac{x}{y}°C$$

where:

x = temperature of the material; and

y = temperature of the water.

3.2 *Constant mass* – the state at which a mass does not change more than 0.05 percent.

3.2.1 Determine the mass after each cycle (Core Dry Method) or after an initial dry time of 90 ± 5 minutes (Suspension Method). Continue drying the sample at 30 ± 5 minute intervals, at a temperature not to exceed mix design compaction temperature range. Determine the mass at each cycle or interval until the sample has achieved constant mass.

Note 1 - Recently molded laboratory samples, which have not been exposed to moisture, do not require drying. Core samples may be air dried in lieu of oven drying if results are proven not to differ from the oven drying method. The oven drying method is the standard and shall be used in case of dispute.

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4 Test Specimens:

4.1 Test specimens may be either laboratory-compacted Plant Mix Surfacing (PMS) or sampled from PMS pavements.

4.2 *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 1.5 times the maximum size of the aggregate.

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

4.4 Avoid distortion, bending, or cracking of specimens during and after the removal from the pavement or mold. Store specimens in a safe, cool place.

4.5 Ensure specimens are free from foreign materials such as seal coat, tack coat, foundation material, soil, paper, or foil.

4.6 Separate specimens from other pavement layers, if necessary, by sawing or other suitable means. Ensure sawing does not damage the specimens.

4.7 Once a testing method has been selected, all core samples for the project must be evaluated using the selected method.

5 CoreDry (InstroTek® Inc.) Drying Method:

5.1 Follow the manufacturer's recommendations for warm up and self-test procedures.

5.2 *Daily Test:* Every day before starting the testing operation, dry the cold trap and the specimen chamber. Run the unit without any specimens. Ensure the pressure reading on the display is 6 mm Hg or less. If the indicated pressure is higher than 6 mm Hg, refer to the manufacturer's trouble shooting instructions for obtaining a proper pressure reading in the chamber.

5.3 *Drying Specimens:* Use a handheld infrared thermometer to ensure that the surface temperature of the specimen is between 15°C and 30°C (59 ºF and 86 ºF). If the specimen is below 15°C or above 30°C (59 ºF and 86 ºF), place the specimen in a room temperature environment until the surface temperature approaches the required testing temperature of 15°C to 30°C (59 ºF and 86 ºF).

5.4 Place a specimen (on its side) on top of the specimen support plate inside the chamber.

5.5 Place the lid on the vacuum chamber and press the lid down to ensure contact between the lid and the chamber, and start the drying process. The unit will automatically stop when it determines the specimen is dry.

5.6 Remove the specimen, determine and record the mass.

5.7 Repeat sections 5.4, 5.5 and 5.6, as needed, until the specimen is dried to a constant mass per section 3.2.

5.8 Cool the specimen to room temperature at 25 ± 5ºC (77 ± 9ºF), and record the dry mass as *A*.

5.9 Immerse each specimen in water at 25 ± 1ºC (77 ± 1.8ºF) for 4 minutes ± 1 minute and record the immersed mass as *C*.

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5 CoreDry (InstroTek® Inc.) Drying Method: (continued)

5.10 Remove the specimen from the water. Damp-dry the specimen *(Note 1)* by blotting with a damp terry cloth towel and determine the Saturated Surface Dry (SSD) mass as *B* as quickly as possible *(the entire operation is not to exceed 15 s)*. Any water that seeps from the specimen during the weighing operation is considered part of the saturated specimen. Immerse and weight each specimen individually.

Note 1 - Damp is considered to be when no water can be wrung from the towel that has been completely submerged in water.

5.11 Calculate the bulk specific gravity as given in section 7.1.

6 Suspension Method:

6.1 Apparatus:

Ensure equipment used meets the following requirements;

6.1.1 *Forced Air, Ventilated, or Convection Oven* – capable of maintaining mix design compaction temperature range.

6.1.2 *Weighing Device* –weighing device of sufficient capacity, readable to 0.1 percent of the sample mass, or better, and conforms to the requirements of AASHTO M 231. Use a device equipped with suitable suspension apparatus and holder to permit weighing the specimen while suspended from center of the scale pan of the weighing device.

6.1.3 *Suspension Apparatus* – the wire suspending the container must be the smallest practical size to minimize any possible effects of a variable immersed length. The suspension apparatus must enable the container to be immersed to a depth sufficient to cover it and the test sample during weighing. Ensure no trapped air bubbles exist under the specimen.

6.1.4 *Water Bath* - for immersing the specimen in water while suspended under the balance, equipped with an overflow outlet for maintaining a constant water level.

6.2 Procedure:

6.2.1 Dry the specimen to a constant mass at a temperature of 125 ± 5°F (52 ± 3°C).

6.2.2 Cool the specimen to room temperature at 25 ± 5ºC (77 ± 9ºF), and record the dry mass as *A*.

6.2.3 Immerse each specimen in water at 25 ± 1ºC (77 ± 1.8ºF) for 4 minutes ± 1 minute and record the immersed mass as *C*.

6.2.4 Remove the specimen from the water. Damp-dry the specimen *(see Note 1 in section 5.10)* by blotting with a damp terry cloth towel, and determine the Saturated Surface Dry (SSD) mass as *B* as quickly as possible, *(the entire operation is not to exceed 15 s)*. Any water that seeps from the specimen during the weighing operation is considered part of the saturated specimen. Immerse and weight each specimen individually.

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7 Calculation:

7.1 Calculate the bulk specific gravity of the specimen as follows:

$$G_{mb} = \frac{A}{(B-C)}$$

where:

G_{mb} = Bulk Specific Gravity

A = mass in grams of the specimen in air

B = mass in grams of the surface-dry specimen in air

C = mass in grams of the specimen in water

7.2 Calculate the percent of water absorbed by the specimen (on a volume basis) as follows:

$$Percent\ of\ Water\ Absorbed\ by\ Volume = \frac{(B-A)}{(B-C)} \times 100$$

8 Report:

8.1 Include the following:

8.1.1 The method used (CoreDry or Suspension).

8.1.2 Bulk Specific Gravity reported to the nearest thousandth, 0.001.

8.1.3 Absorption reported to the nearest hundredth 0.01%.

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