FLORIDA DEPARTMENT OF TRANSPORTATION
State Materials Office
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Florida Method of Test for Bulk Specific Gravity of Compacted Asphalt Specimens

Designation: FM 1-T 166

1. SCOPE

This method covers the determination of the bulk specific gravity of laboratory compacted asphalt mixtures and cores from asphalt pavements.

2. REFERENCED DOCUMENT

AASHTO M 231, Weighing Devices Used in the Testing of Materials

ASTM D7227/D7227M, Rapid Drying of Compacted Asphalt Specimens Using Vacuum Drying Apparatus

3. APPARATUS

3.1 Balance - A balance, with a capability of 8 kg or greater, accurate to 0.2 g or 0.1% conforming to the requirements of AASHTO M 231, Class G2. All masses measured for this test method shall be recorded to the nearest 0.1 g. The weighing device shall be equipped with a suitable suspension apparatus and holder to permit weighing the specimen while suspended from the center of the scale pan of the weighing device.

3.2 Suspension Apparatus – The wire suspending the container shall be 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. Care should be exercised to ensure no trapped air bubbles exist under or around the specimen.

3.3 Water Bath – For immersing the specimen in water while suspended under the weighing device, equipped with an overflow outlet for maintaining a constant water level. The temperature of the water bath shall be maintained at (77 ± 2.0°F). Water shall be clean and clear.

3.4 Towel – Large cotton or terry cloth type bath towel used for drying the specimen to a saturated surface-dry condition. During testing, the towel shall be in a damp condition. Damp is considered to be the point where no water can be wrung from the towel.

3.5 Vacuum Drying Machine – A device meeting the requirements of Section 5.2 of ASTM D7227/D7227M.

4. TEST SPECIMENS

4.1 Test specimens may be either laboratory compacted asphalt mixtures or cores from compacted asphalt pavements.

4.2 Size of Specimens – The diameter of a specimen should be at least equal to four times the maximum aggregate size. The thickness of the specimen shall be at least one and one-half times the maximum aggregate size.

4.3 Cores shall be taken from pavements using a diamond tipped core drill. Ice may be placed on the surface of the pavement to expedite cooling.

4.4 Care shall be taken to avoid distortion, bending or cracking of specimens during and after removal of the specimen from the mold or pavement. Do not submerge the specimen in an ice or water bath during transport or storage, unless the specimen is enclosed in a plastic bag or other means to prevent the specimen from being exposed to direct contact with water or ice. This will prevent absorption of water into the specimen prior to testing, which would adversely affect the density determination of the specimen.

4.5 Specimens shall be free from foreign materials such as tack coat, foundation material, soil, etc.

4.6 Pavement specimens shall be separated from other layers by sawing. Do not damage the specimen during the sawing operation.

5. PROCEDURE

5.1 Laboratory Compacted Asphalt Specimens

5.1.1 Laboratory compacted specimens shall be cooled to room temperature (77 ± 9°F) after removal from the compaction mold prior to testing.

5.1.2 Record the dry mass of the specimen as *A*.

5.1.3 Immerse the specimen in the water bath for 4 ± 1 minutes and record the immersed mass as *C*.

5.1.4 Remove the specimen from the water, damp-dry the specimen by rolling the specimen on its side one complete roll and blotting each face once with a damp towel as quickly as possible (not to exceed 15 seconds) and determine the saturated surface-dry mass as *B*. Any water that seeps from the specimen onto the scale during the weighing operation is considered part of the saturated surface-dry mass.

5.2 Asphalt Pavement Cores

5.2.1 Place the core (specimen) on top of the specimen support plate inside the vacuum chamber.

5.2.2 Place the lid on the vacuum chamber and ensure secure contact between the lid and the chamber.

5.2.3 Begin the drying process by pressing the Start button. When the process is done, the unit will automatically stop.

5.2.4 Remove the specimen from the chamber and record the dry mass.

5.2.5 Repeat steps 5.2.1 through 5.2.4 until achieving a constant mass of the dried specimen, and record the mass as *A*. Constant mass shall be defined as the mass where an additional vacuum drying cycle does not alter the mass by more than 0.1 g.

5.2.6 Immerse the specimen in the water bath for 4 ± 1 minutes and record the immersed mass as *C*.

5.2.7 Remove the specimen from the water, damp-dry the specimen by rolling the specimen on its side one complete roll and blotting each face once with a damp towel as quickly as possible (not to exceed 15 seconds) and determine the saturated surface-dry mass as *B*. Any water that seeps from the specimen onto the scale during the weighing operation is considered part of the saturated surface-dry mass.

6. CALCULATIONS

6.1 Calculate the bulk specific gravity (G_{mb}) of the specimen to the nearest 0.001, as follows:

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

Where: A = dry mass of specimen, g.
B = saturated surface-dry mass of specimen, g.
C = mass of specimen immersed in water, g.

7. REPORTING

7.1 Report the following items:

a) Date tested and tester's name.
b) Sample identification, including appropriate information such as sample number, mix design number, project number, and date sampled.
c) Individual masses and calculated G_{mb} value, as shown in Section 6.1.

8. PRECISION

8.1 Laboratory Compacted Asphalt Mixtures

8.1.1 The single-operator (within-laboratory) and multi-laboratory precision values are stated in **Table 1**. For single-operator precision, a test result is defined as the bulk specific gravity for one specimen (a laboratory compacted sample). For multi-laboratory precision, a test result is defined as the average G_{mb} of two specimens (two laboratory compacted samples). For either situation, the precision value, stated in Table 1, is the maximum allowable difference between two test results. These precision values were determined through a round-robin interlaboratory study conducted using plant-produced asphalt and includes the variability associated with sampling, splitting, compacting, and testing the asphalt. The round-robin study included 14 laboratories, six asphalt mixtures and three replicate specimens per mixture.

Table 1 – Precision Values for G_{mb} of Laboratory Compacted Bituminous Mixtures

Precision Type	Acceptable Range of Two Test Results
Single Operator	0.011
Multi-Laboratory	0.022

8.2 Asphalt Pavement Cores

8.2.1 The multi-laboratory precision values are stated in **Table 2**. For multi-laboratory precision, a test result is defined as the G_{mb} of a single roadway core. The precision value stated in **Table 2** is the maximum allowable difference between two test results, where each test result is the G_{mb} of the same roadway core.

Table 2 – Precision Values for G_{mb} of HMA Pavement Cores

Multi-Laboratory Precision	Acceptable Range of Two Test Results
Fine graded mixtures	0.014