
Standard Method of Test for

**In-Place Density of Asphalt
Mixtures by Nuclear Methods**

AASHTO Designation: T 355-18¹

Technical Subcommittee: 2c, Asphalt–Aggregate Mixtures

Release: Group 3 (July)



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1. SCOPE

- 1.1. This test method describes the procedure for determining the in-place density of asphalt mixtures by use of nuclear gauge. The density of the material is determined by the backscatter/air-gap ratio method.
- 1.2. *Density*—The total density of asphalt mixtures is determined by the attenuation of gamma radiation where the source and detector(s) remain on the surface (backscatter method).
- 1.2.1. The density in mass per unit volume of the material under test is determined by comparing the detected rate of gamma radiation with previously established calibration data.
- 1.3. *SI Units*—the values stated in SI units are to be regarded as the standard. The inch-pound equivalents may be approximate. It is common practice in the engineering profession to concurrently use pounds to represent both a unit of mass (lbm) and of force (lbf). This implicitly combines two systems of units, that is, the absolute system and the gravitational system.
- 1.3.1. In the U.S. Customary units system, the pound (lbf) represents a unit of force (weight). However, the use of balances or scales recording pounds of mass (lbm) or recording density (lbm/ft³) should not be regarded as nonconformance with this standard.
- 1.4. *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 limitations prior to use.* See Section 6, Hazards.
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2. REFERENCED DOCUMENTS

- 2.1. *AASHTO Standards:*
- T 166, Bulk Specific Gravity (G_{mb}) of Compacted Asphalt Mixtures Using Saturated Surface-Dry Specimens
 - T 191, Density of Soil In-Place by the Sand-Cone Method
 - T 209, Theoretical Maximum Specific Gravity (G_{mm}) and Density of Asphalt Mixtures
 - T 331, Bulk Specific Gravity (G_{mb}) and Density of Compacted Asphalt Mixtures Using Automatic Vacuum Sealing Method

- 2.2. *ASTM Standards:*
- D2216, Standard Test Methods for Laboratory Determination of Water (Moisture) Content of Soil and Rock by Mass
 - D2937, Standard Test Method for Density of Soil in Place by the Drive-Cylinder Method
 - D7013/D7013M, Standard Guide for Calibration Facility Setup for Nuclear Surface Gauges

3. SIGNIFICANCE

- 3.1. This test method is useful as a rapid, nondestructive technique for the determination of the in-place density of asphalt mixtures.
- 3.2. This test method is used for quality control and acceptance testing of compacted asphalt mixtures for construction and for research and development.
- 3.3. *Density*—The fundamental assumptions inherent in the methods are that Compton scattering is the dominant interaction and that the material under test is homogeneous.
- 3.3.1. Test results may be affected by chemical composition, sample heterogeneity, and to a lesser degree, material density and the surface texture of the material being tested.
- 3.4. The test results can be used to establish the optimum rolling effort and evaluate the job mix formula for in-place properties. The nondestructive nature allows for repetitive measurements at a single test location and statistical analysis of the results.

Note 1—For in-place density results, correlation with cores is recommended (see Appendix X1).

4. INTERFERENCES

- 4.1. *In-Place Density Interferences:*
- 4.1.1. The chemical composition of the sample may affect the measurement, and adjustments may be necessary.
- 4.1.2. The gauge is more sensitive to the density of the material in close proximity to the surface.
Note 2—The nuclear gauge density measurements are somewhat biased to the surface layers of the material being tested. This method is more sensitive to the material within the first several inches from the surface.
- 4.1.3. Other radioactive sources must not be within 10 m (30 ft) of the gauge in operation.
- 4.1.4. Large objects must be at least 3 m (10 ft) away.
- 4.1.5. Use the gauge manufacturer's correction procedure when the gauge will be closer than 600 mm (24 in.) to any vertical mass, or less than 300 mm (12 in.) from a vertical pavement edge.

5. APPARATUS

- 5.1. *Nuclear Density Gauge (Either Density/Moisture or Density Gauge)*—While exact details of construction of the gauge may vary, the system shall consist of:
- 5.1.1. *Instruction Manual*—For the specific make and model of gauge.