
Standard Method of Test for

**Determining the Relative Density
(Specific Gravity) and Absorption
of Lightweight Aggregate for
Internally Cured Concrete Mixtures**

AASHTO Designation: TP 139-22 (2024)¹

Technically Revised: 2022

Reviewed but Not Updated: 2024

Technical Subcommittee: 1c, Aggregates



**American Association of State Highway and Transportation Officials
555 12th Street NW, Suite 1000
Washington, D.C. 20004**

Determining the Relative Density (Specific Gravity) and Absorption of Lightweight Aggregate for Internally Cured Concrete Mixtures

AASHTO Designation: TP 139-22 (2024)¹



Technically Revised: 2022

Reviewed but Not Updated: 2024

Technical Subcommittee: Aggregates

1. SCOPE

- 1.1. This test method covers the determination of the relative density (specific gravity) in the field or laboratory of lightweight aggregate for internally cured concrete mixtures.
- 1.2. *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all safety concerns associated with its use. It is the responsibility of the user of this procedure to establish appropriate safety and health practices and to determine the applicability of regulatory limitations prior to use.*
- 1.3. *The quality of the results produced by this standard is 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 R 18 are generally considered capable of competent and objective testing/sampling/inspection/etc. Users of this standard are cautioned that compliance with R 18 alone does not completely assure reliable results. Reliable results depend on many factors; following the suggestions of R 18 or some similar acceptable guideline provides a means of evaluating and controlling some of those factors.*

2. REFERENCED STANDARDS

- 2.1. *AASHTO Standards:*
 - M 231, Standard Specification for Weighing Devices Used in the Testing of Materials
 - M 339M/M 339, Thermometers Used in the Testing of Construction Materials
 - R 18, Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories
 - R 76, Reducing Samples of Aggregate to Testing Size
 - R 90, Sampling Aggregate Products
 - T 84, Specific Gravity and Absorption of Fine Aggregate
 - T 164, Quantitative Extraction of Asphalt Binder from Hot Mix Asphalt (HMA)
 - PP 97, Determination of Constant Mass
- 2.2. *ASTM Standards:*

- E1, Standard Specification for ASTM Liquid-in-Glass Thermometers
- E230/E230M, Standard Specification for Temperature-Electromotive Force (emf) Tables for Standardized Thermocouples
- E2877, Standard Guide for Digital Contact Thermometers

2.3. *International Electrotechnical Commission Standard:*

- IEC 60584-1:2013, Thermocouples - Part 1: EMF Specifications and Tolerances

3. TERMINOLOGY

- 3.1. *absorption*—Increase in the mass of aggregate due to water in the pores of the aggregate material, but not including water adhering to the outside surface of the particles, expressed as a percentage of the dry mass.
- 3.2. *internal curing*—Supplying water within a cementitious mixture using pre-wetted aggregate, or other materials that readily release water from within the particles, thereby mitigating self-desiccation and sustaining hydration.
- 3.3. *specific gravity*—The ratio of mass of a volume of a material at a stated temperature to the mass of the same volume of distilled water at the same temperature.

4. SUMMARY OF METHOD

- 4.1. A sample of aggregate is immersed in water for 72 ± 4 h to allow filling of the permeable pores. Excess water is then decanted and a centrifuge is used to remove water from the surface of the particles. The mass of the sample is measured and recorded. Next, the sample of aggregate is placed in a graduated container and the volume of the sample is determined by utilizing a pycnometer. Finally, the sample is oven-dried and the mass is determined again. Using the mass values thus obtained, specific gravity and absorption of the aggregate are calculated. The surface moisture of the lightweight aggregate is determined by omitting the drying and soaking steps.

5. SIGNIFICANCE AND USE

- 5.1. Lightweight aggregate is used as an additional source of water in internally cured concrete mixtures resulting in reduced early-age cracking potential.
- 5.2. The specific gravity and absorption values calculated in this test method are used in the design of internally cured concrete mixtures.

6. APPARATUS

- 6.1. *Centrifuge*—Extraction apparatus conforming to T 164, Method A.
- 6.2. *Filter Ring*—Felt or paper, to fit the rim of the bowl, conforming to T 164.
- 6.3. *Pycnometer*—1000-mL flask as specified in T 84. The pycnometer should have a capacity at least 50 percent more than the volume needed to accommodate the test sample.
- 6.4. *Oven*—Drying apparatus capable of drying the test specimen at $110 \pm 5^\circ\text{C}$ ($230 \pm 9^\circ\text{F}$). Oven(s) for heating and drying shall be capable of operation at the temperatures required, between 100 to 120°C (212 to 248°F), within $\pm 5^\circ\text{C}$ ($\pm 9^\circ\text{F}$), as corrected, if necessary, by standardization. More