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American Association State
Highway and Transportation Officials Standard
AASHTO No.: T121

Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete¹

This standard is issued under the fixed designation C138/C138M; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

This standard has been approved for use by agencies of the U.S. Department of Defense.

1. Scope*

1.1 This test method covers determination of the density (see [Note 1](#)) of freshly mixed concrete and gives formulas for calculating the yield, cement content, and air content of the concrete. Yield is defined as the volume of concrete produced from a mixture of known quantities of the component materials.

1.2 The values stated in either SI units or inch-pound units are to be regarded separately as standard. The values stated in each system may not be exact equivalents; therefore, each system shall be used independently of the other. Combining values from the two systems may result in non-conformance with the standard.

NOTE 1—Unit weight was the previous terminology used to describe the property determined by this test method, which is mass per unit volume.

1.3 The text of this test method references notes and footnotes that provide explanatory information. These notes and footnotes (excluding those in tables) shall not be considered as requirements of this test method.

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. (Warning—Fresh hydraulic cementitious mixtures are caustic and may cause chemical burns to skin and tissue upon prolonged exposure.)*²

1.5 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recom-*

mendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.

2. Referenced Documents

2.1 ASTM Standards:³

- C29/C29M Test Method for Bulk Density (“Unit Weight”) and Voids in Aggregate
- C31/C31M Practice for Making and Curing Concrete Test Specimens in the Field
- C143/C143M Test Method for Slump of Hydraulic-Cement Concrete
- C150/C150M Specification for Portland Cement
- C172/C172M Practice for Sampling Freshly Mixed Concrete
- C173/C173M Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method
- C188 Test Method for Density of Hydraulic Cement
- C231/C231M Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method
- C1758/C1758M Practice for Fabricating Test Specimens with Self-Consolidating Concrete

3. Terminology

3.1 Symbols:

- A = air content (percentage of voids) in the concrete
- C = actual cement content, kg/m^3 [lb/yd^3]
- C_b = mass of cement in the batch, kg [lb]
- D = density (unit weight) of concrete, kg/m^3 [lb/ft^3]
- M = total mass of all materials batched, kg [lb] (see [Note 3](#))
- M_c = mass of the measure filled with concrete, kg [lb] or
- M_m = mass of the measure, kg [lb]
- R_y = relative yield
- T = theoretical density of the concrete computed on an airfree basis, kg/m^3 [lb/ft^3] (see [Note 2](#))

¹ This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.60 on Testing Fresh Concrete.

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² See section on Safety Precautions, Manual of Aggregate and Concrete Testing, *Annual Book of ASTM Standards*, Vol 04.02.

³ For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard’s Document Summary page on the ASTM website.

*A Summary of Changes section appears at the end of this standard