Designation: C1849/C1849M – 17

Standard Test Method for Density and Air Content (Pressure Method) of Freshly Mixed Roller-Compacted Concrete[1]

This standard is issued under the fixed designation C1849/C1849M; 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.

1. Scope

1.1 This test method covers the determination of density and air content of freshly mixed roller-compacted concrete (RCC) using the apparatus described in Test Method C231/C231M and the vibrating hammer described in Test Method C1435/C1435M.

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—Sieve size is identified by its standard designation in Specification E11. The alternative designation given in parentheses is for information only and does not represent a different standard sieve size.

1.3 The text of this test method references notes and footnotes that provide explanatory information. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of 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. (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 Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

C31/C31M Practice for Making and Curing Concrete Test Specimens in the Field

C125 Terminology Relating to Concrete and Concrete Aggregates

C138/C138M Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete

C172/C172M Practice for Sampling Freshly Mixed Concrete

C192/C192M Practice for Making and Curing Concrete Test Specimens in the Laboratory

C231/C231M Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method

C670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

C1067 Practice for Conducting a Ruggedness Evaluation or Screening Program for Test Methods for Construction Materials

C1170/C1170M Test Method for Determining Consistency and Density of Roller-Compacted Concrete Using a Vibrating Table

C1435/C1435M Practice for Molding Roller-Compacted Concrete in Cylinder Molds Using a Vibrating Hammer

E11 Specification for Woven Wire Test Sieve Cloth and Test Sieves

3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this test method, refer to Terminology C125.

4. Significance and Use

4.1 The test determines the air content of freshly mixed RCC exclusive of any air that may exist inside voids within aggregate particles. For this reason, it is applicable to concrete made with normal-density or high-density aggregate particles

[1] This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.45 on Roller-Compacted Concrete.

Current edition approved June 15, 2017. Published July 2017. DOI: 10.1520/C1849_C1849M-17.

[2] 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.

and requires determination of the aggregate correction factor described in Test Method C231/C231M.

4.2 If the concrete being tested contains aggregate that would be retained on a 50-mm (2-in.) sieve, the air content of the total mixture is only approximated by the test.

4.3 The test determines the density of freshly mixed RCC containing aggregate with a maximum size not greater than 50-mm (2-in.).

4.4 The air content of hardened RCC may be either higher or lower than that determined by this test method. This depends upon the methods and amount of consolidation effort applied to the RCC from which the hardened concrete specimen is taken; uniformity and stability of the air bubbles in the fresh RCC; accuracy of the microscopic examination, if used; stage in the delivery at which the air content of the unhardened RCC is determined; and other factors.

5. Apparatus

5.1 *Air Meter*—Type B air meter and auxiliary equipment conforming to Test Method C231/C231M.

5.2 *Vibrating Hammer*—A vibrating compaction hammer conforming to Practice C1435/C1435M.

5.3 *Tamping Plate*—A circular steel plate attached to a steel shaft, which is inserted into the vibrating hammer chuck. The plate diameter shall be 6 to 13 mm [¼ to ½ in.] less than the inside diameter of the measuring bowl. The mass of the plate and shaft assembly shall be 8 to 12 kg [18 to 26 lb] (see Fig. 1).

5.4 *Mallet*—A mallet conforming to Test Method C231/C231M.

5.5 *Strike-Off Plate*—A strike-off plate conforming to Test Method C231/C231M.

5.6 *Sieve*—37.5-mm (1½-in.) with at least 0.2 m^2 [2 ft^2] of sieving area.

5.7 *Scoop*—A size large enough so each amount of concrete obtained from the sampling receptacle is representative and small enough so it is not spilled during placement in the measuring bowl.

5.8 *Stopwatch*—A stopwatch capable of measuring elapsed time to the nearest second.

5.9 *Balance*—A balance or scale accurate to 50 g [0.1 lb] or to within 0.3 % of the test load, whichever is greater, at any point within the range of use. The range of use shall be considered to extend from the mass of the measure empty to the mass of the measure plus its contents at 2600 kg/m^3 [160 lb/ft^3].

5.10 *Syringe*—A syringe capable of injecting water into one petcock on the cover assembly.

6. Standardization of Apparatus

6.1 Standardize the apparatus and maintain standardization records in accordance with the procedure prescribed in Annex A1 of Test Method C231/C231M for a Type B meter.

7. Determination of Aggregate Correction Factor

7.1 Determine the aggregate correction factor on a combined sample of fine and coarse aggregate as directed in Test Method C231/C231M.

NOTE 2—The aggregate correction factor will vary with different aggregates. It can be determined only by test. The test can be made easily. Ordinarily the factor will remain reasonably constant for given aggregates, but an occasional check test is recommended.

8. Preparation of Concrete Test Sample

8.1 Obtain the sample of freshly mixed concrete in accordance with applicable procedures of Practice C172/C172M.

8.2 Use concrete that does not appear to have undergone segregation.

NOTE 3—Concrete with stiff to very dry consistency is highly susceptible to segregation during handling, transporting, and preparing samples for testing.

8.3 If the concrete contains coarse aggregate particles that would be retained on a 50-mm (2-in.) sieve, wet-sieve a sufficient amount of the representative sample over a 37.5-mm (1½-in.) sieve, as described in Practice C172/C172M, to yield sufficient material to completely fill the measuring bowl. Weigh and record the mass of the sample before and after wet-sieving. Make no attempt to wipe adhering mortar from coarse aggregate particles retained on the sieve.

8.4 Remix the concrete passing through the sieve with a shovel until it appears uniform and proceed with testing.

9. Procedure

9.1 *Placement*—Dampen the interior of the measuring bowl. Weigh the dampened bowl. Record the mass of the bowl and place it on a supporting surface that will not deform during the test procedure. The entire surface of the bottom of the bowl shall remain in contact with the supporting surface during the test procedure with the sides of the bowl plumb to within 5 degrees of vertical. Using the scoop described in 5.7, place the concrete in the measuring bowl in two layers of approximately equal volume. While placing the concrete in the bowl, move the scoop around the perimeter of the bowl opening to ensure an even distribution of the concrete with minimal segregation.

9.2 *Consolidation*—Place the vibrating hammer with tamping plate onto the first layer of concrete. Start the vibrating hammer and allow the concrete to consolidate under the tamping plate. Observe the concrete in the annular space between the outer edge of the tamping plate and the inside wall of the measuring bowl. As the concrete consolidates, mortar should move into the annular space between the outer edge of the tamping plate and the inside wall of the measuring bowl. Observe the mortar until it forms a ring around the total perimeter of the tamping plate. Stop the vibrating hammer when the mortar ring forms completely around the tamping plate. Return mortar that remains on the tamping plate to the measuring bowl before placing the second layer. Place the second layer and repeat the process to consolidate the second layer. Return mortar that remains on the tamping plate to the measuring bowl. If the top of the concrete is below the top of the measuring bowl after returning the mortar that remains on the tamping plate, add concrete and repeat the process to