Designation: C1435/C1435M – 14

Standard Practice for Molding Roller-Compacted Concrete in Cylinder Molds Using a Vibrating Hammer[1]

This standard is issued under the fixed designation C1435/C1435M; 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 practice[2] covers molding cylindrical test specimens from concrete when the standard procedures of rodding and internal vibration, as described in Practice C31/C31M and Practice C1176/C1176M, are not practicable. This practice is applicable to freshly-mixed concrete, prepared in the laboratory and the field.

1.2 Freshly-mixed concrete is molded in cylindrical molds using an electric vibrating hammer equipped with a shaft and circular plate.

1.3 The values stated in either SI units or inch-pound units are to be regarded separately as standard. Within the text, the inch-pound units are shown in brackets. 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.

1.4 The text of this practice references notes and footnotes, which provide explanatory material. These notes and footnotes (excluding those in tables and figures) shall not be considered as requirements of this practice.

1.5 *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.*

2. Referenced Documents

2.1 *ASTM Standards:*[3]

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

C39/C39M Test Method for Compressive Strength of Cylindrical Concrete Specimens

C172/C172M Practice for Sampling Freshly Mixed Concrete

C470/C470M Specification for Molds for Forming Concrete Test Cylinders Vertically

C496/C496M Test Method for Splitting Tensile Strength of Cylindrical Concrete Specimens

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

C1176/C1176M Practice for Making Roller-Compacted Concrete in Cylinder Molds Using a Vibrating Table

2.2 *ACI Documents:*

ACI 207.5R Report on Roller-Compacted Concrete[4]

ACI 211.3 Practice for Selecting Proportions for No-Slump Concrete[4]

3. Summary of Practice

3.1 This practice describes molding cylindrical concrete test specimens using a vibrating hammer. Test specimens are molded vertically in cylindrical molds by compacting the stiff to very dry concrete mixture in four lifts using a vibrating hammer.

4. Significance and Use

4.1 This practice, intended for use in testing roller-compacted concrete, may be applicable to testing other types of cementitious material such as coarse-grained, soil-cement. This practice provides standardized requirements for molding stiff to very dry consistency concrete mixtures commonly used in roller compacted concrete construction. This practice is used instead of rodding or internal vibration, which cannot properly consolidate concrete of this consistency.

NOTE 1—Further description of roller compacted concrete consistency is given in ACI 207.5R and ACI 211.3. The consistency of concrete using

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

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[2] Supporting data have been filed at ASTM International Headquarters and may be obtained by requesting Research Report RR:C09-1045. Contact ASTM Customer Service at service@astm.org.

[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.

[4] *ACI Manual of Concrete Practice, Part 1, Materials and General Properties of Concrete*, American Concrete Institute, Farmington Hills, MI.

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

a vibrating table may be determined in accordance with Test Methods C1170/C1170M.

4.2 This practice is used to mold cylindrical test specimens commonly used for testing compressive or tensile strength of concrete. Specimens tested for compressive strength and splitting tensile strength shall be in accordance with Test Methods C39/C39M and C496/C496M, respectively. Test specimens also may be used to determine density of fresh concrete.

NOTE 2—For some extremely dry mixtures; (those with a consistency greater than 45 s when tested in accordance with Test Methods C1170/C1170M)[5] the density of specimens made in accordance with this practice may be greater than the in-place density of roller-compacted concrete due to the greater potential for voids at the bottom of the lifts in the field.

NOTE 3—The mass of the apparatus and amount of force applied by the operator may significantly affect the density of specimens made from these mixtures; thus, discretion is advised when interpreting test results on specimens made according to this practice.

5. Apparatus

5.1 *Molds:*

5.1.1 *Type A Reusable Mold*—A cylindrical mold conforming to the requirements of Specification C470/C470M for 150-mm [6-in.] diameter by 300-mm [12-in.] high reusable molds.

5.1.2 *Type B Single-Use Mold*—A single-use plastic, cylindrical mold 150-mm [6-in.] diameter and 300-mm [12-in.] in height. The mold specifications shall conform to Specification C470/C470M for single-use, plastic molds.

5.1.2.1 *Mold Sleeve*—A Type B cylindrical mold shall be inserted into a rigid cylindrical sleeve. The cylindrical sleeve shall be made of steel or other hard metal resistant to cement paste corrosion. The sleeve shall be capable of firmly holding the plastic mold upright without deformation of the mold. The sleeve shall be split and hinged on one side so that it can be opened to remove the plastic mold; adjustable clamps shall be provided on the other side for tightening the sleeve around the mold. A metal base plate with brackets shall be provided in which to insert the bottom portion of the sleeve to hold the sleeve during compaction. The sleeve shall have a minimum wall thickness of 3 mm [⅛ in.], and a minimum base plate thickness of 6 mm [¼ in.]. The inside diameter of the mold sleeve shall be 3 ± 1 mm [⅛ ± 1⁄16 in.] larger than the outside diameter of the Type B mold and have a height 13 ± 6 mm [½ ± ¼ in.] less than the height of the Type B mold.

5.2 *Vibrating Hammer*—A vibrating compaction hammer having a mass (without tamping plate and shaft) of 8.5 to 13.5 kg [19 to 30 lb]. It also shall have a minimum power input of 900 W and be capable of providing 2000 ± 200 impacts/min.

NOTE 4—The vibrating hammer used to compact the specimens, such as shown in Fig. 1, is of the type used typically for breaking up concrete and masonry. It provides oscillatory motion in the axial direction that makes the hammer an effective vibratory compactor.

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 146 ± 3 mm [5 ¾ ± ⅛ in.] and the mass of the plate and shaft assembly shall be 3 ± 1 kg [6.6 ± 2.2 lb] (See Fig. 2).

5.4 *Small Tools*—A square-ended shovel, a hand scoop, a tamping rod, and a stopwatch.

6. Sampling

6.1 Samples of freshly-mixed concrete shall be obtained in accordance with Practice C172/C172M.

6.2 Concrete samples shall have a maximum size aggregate of 50 mm [2 in.] or less. If the concrete has aggregate larger than 50 mm [2 in.] samples shall be obtained by wet sieving over a 50-mm [2-in.] sieve in accordance with Practice C172/C172M.

6.3 Concrete test specimens shall be molded within 45 min after the completion of mixing unless otherwise specified.

6.4 *Technical Precautions:*

6.4.1 When obtaining samples, ensure that the samples are representative of the bulk production.

6.4.2 Concrete with stiff to very dry consistency is highly susceptible to segregation during handling. To minimize segregation, use care in obtaining samples and during transporting, remixing, and preparation of the specimens.

7. Calibration

7.1 Calibrate the vibrating hammer after any event, including repairs, that might affect its operation, after 300 h of service, or at least one time per year.

8. Molding Specimens

8.1 *Type A Molds:*

8.1.1 Coat Type A molds with a suitable lubricant or bond breaker prior to casting the test specimens to facilitate removal from the mold.

8.2 *Type B Molds:*

8.2.1 Insert Type B mold into the mold sleeve and adjust the clamps to tighten the sleeve around the mold so that the mold is held firmly in the sleeve.

8.3 *Type A and B Molds:*

8.3.1 Hold the mold stationary either by clamping to a rigid, flat base or standing on the foot brackets and center the vibrating hammer so that the edges of the tamping plate do not touch the walls of the mold. Lower the vibrating hammer into the mold to check for proper clearance.

8.3.2 Place enough concrete in the mold so that the mold will be filled to one-fourth of its volume after consolidation, approximately 3.4 kg [7.5 lb]. Use a tamping rod to distribute the loose concrete as it is added. During filling, use square-ended shovels and scoops to obtain representative samples and handle the concrete in such a manner that larger sized coarse aggregates do not separate from the mortar.

8.3.3 Place the vibrating hammer with tamping plate onto the concrete (Fig. 1).

8.3.4 Start the vibrating hammer and allow the concrete to consolidate under the tamping plate. Observe the concrete in the annular space between the edge of the tamping plate and

[5] Hansen, K. and Kahler, C., "RCC Tests, Testing, and Test Sections – Lessons Learned," *The Journal of Dam Safety*, Volume 2, Issue 1 (Winter 2004), p.14

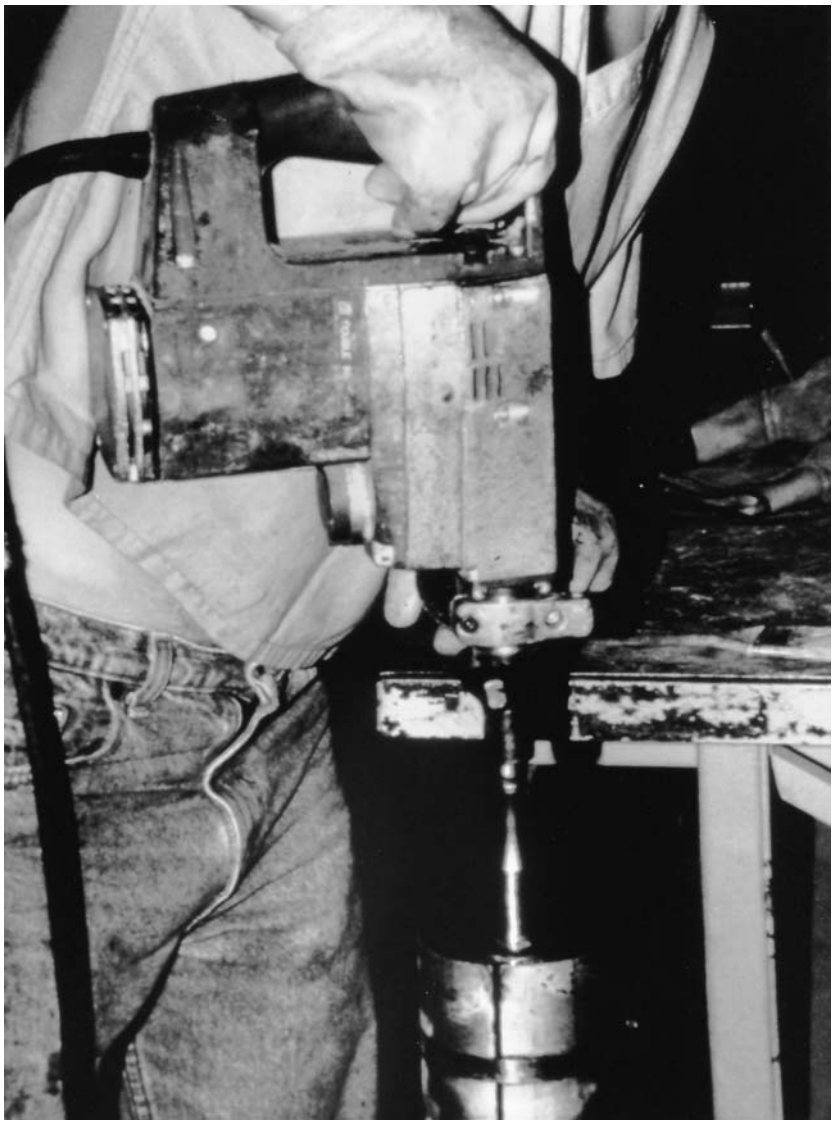


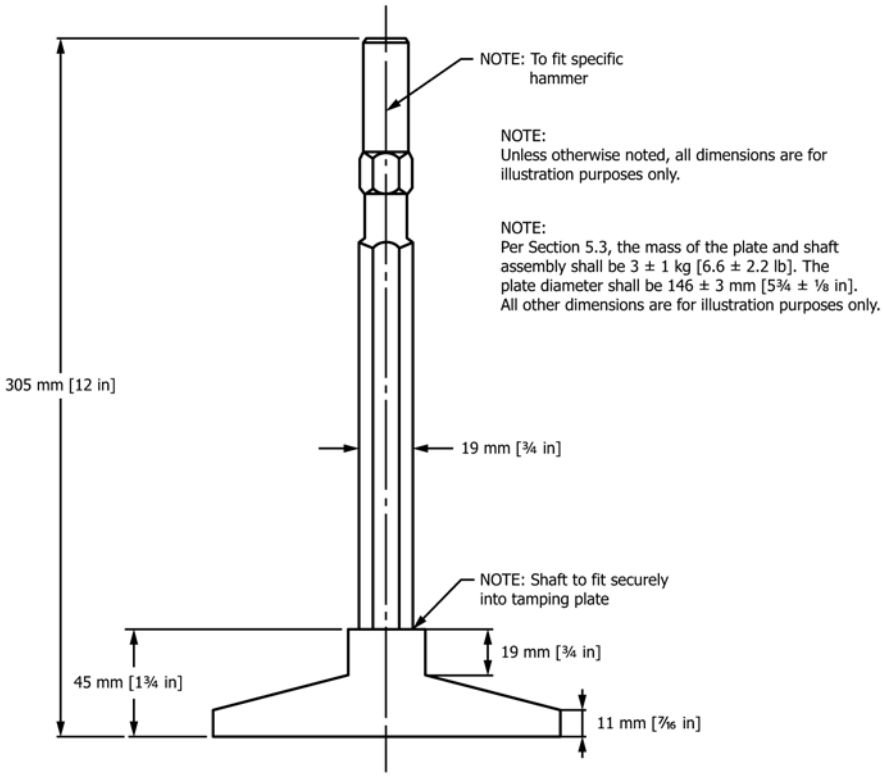
FIG. 1 Vibrating Hammer for Molding RCC Specimens

the inside wall of the mold. As the concrete consolidates, mortar should fill in the annular space between the outer edge of the tamping plate and the inside mold wall. Observe the mortar until it forms a ring around the total perimeter of the tamping plate. When the mortar ring forms completely around the tamping plate, stop the vibrating hammer.

8.3.5 If a rock or rock pocket prevents the mortar ring from forming at one small location, even though it has formed in all other locations, the vibrating hammer can be stopped and the next layer of concrete added.

8.3.6 If a significant portion of the mortar ring does not form after 20 s, the vibrating hammer shall be stopped and the next layer of concrete added. This situation may be a result of insufficient mortar due to either improper sampling, segregation, or improper mixture proportioning. In these instances, the concrete should be inspected visually after stripping from the mold to determine if there is adequate mortar distribution and a decision made whether to accept or reject the specimen.

8.3.7 Repeat the procedure in 8.3.2 – 8.3.6 for the second and third lifts of concrete, filling the mold to approximately one-half and three-fourths of its volume, respectively. For the fourth lift, overfill the mold by mounding the concrete above the top of the mold. Again, place the tamping plate on the loose concrete and consolidate. If the tamping plate consolidates concrete below the top level of the mold, turn off the vibrating hammer. Place additional concrete in the mold so that, when consolidated, the concrete can be finished smooth and level with the top of the mold.



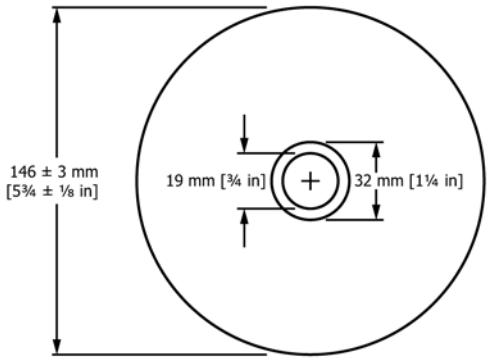


FIG. 2 Circular Steel Tamping Plate and Metal Shaft

8.3.8 Finally, strike off the top of the concrete with the vibrating hammer and tamping plate. With the hammer in operation and the plate in contact with the rim of the cylinder mold, move the plate back and forth across the top of the cylinder to force excess material beyond the rim. Continue working the surface until it is smooth and level with the top of the cylinder mold. Avoid tearing the surface of the concrete.

9. Keywords

9.1 compressive; consolidate; cylinder; molds; roller compacted concrete; soil cement; specimen; strength; tensile; vibrating hammer

SUMMARY OF CHANGES

Committee C09 has identified the location of selected changes to this practice since the last issue, C1435/C1435M – 08, that may impact the use of this practice. (Approved October 1, 2014)

(1) In Section 4, a note was added addressing the significance of apparatus mass.
(2) In 5.2, the allowable range of hammer mass was broadened.
(3) In 5.3, the diameter of the tamping plate was increased.
(4) Revised Fig. 2.