Designation: C 495 – 07

Standard Test Method for Compressive Strength of Lightweight Insulating Concrete[1]

This standard is issued under the fixed designation C 495; 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 Department of Defense.

1. Scope*

1.1 This test method covers the preparation of specimens and the determination of the compressive strength of lightweight insulating concrete having an oven-dry density not exceeding 50 lb/ft^3 (800 kg/m^3) as determined by the procedures described herein. This test method covers the preparation and testing of molded 3 by 6-in. (75 by 150-mm) cylinders.

1.2 The values stated in inch-pound units are to be regarded as the standard.

1.3 *This standard does not purport to address all of the safety problems, 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:* [2]

C 39/C 39M Test Method for Compressive Strength of Cylindrical Concrete Specimens

C 88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate

C 109/C 109M Test Method for Compressive Strength of Hydraulic Cement Mortars(Using 2-in. or [50-mm] Cube Specimens)

C 172 Practice for Sampling Freshly Mixed Concrete

C 617 Practice for Capping Cylindrical Concrete Specimens

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials

3. Significance and Use

3.1 This test method provides standardized requirements for sampling, molding, curing, and testing lightweight insulating concretes for the purpose of determining compliance with compressive strength and density specifications.

4. Apparatus

4.1 *Testing Machine*—Use a testing machine as prescribed in Test Method C 39/C 39M.

4.2 *Scales and Weights*—Use scales and weights in weighing specimens that conform to those specified in the Apparatus Section of Test Method C 109/C 109M.

4.3 *Drying Oven*—Use an oven as specified in Test Method C 88.

4.4 *Molds*—Use molds made of nonabsorbent materials or of materials treated to reduce absorption, that are watertight, and not subject to distortion of more than 1/16 in. (1.6 mm) in any dimension during molding and early curing of specimens. Coat all mold surfaces that will be in contact with concrete except single use plastic molds with wax or mineral oil, prior to use. Use molds having a diameter of 3 ± 1/16 in. (75 ± 1.6 mm) and a length of 6 ± 1/8 in. (150± 3 mm).

5. Sampling

5.1 Sample fresh lightweight insulating concrete in accordance with applicable provisions of Practice C 172, with the following exceptions:

5.1.1 *Sampling from Pump Equipment*—Fill a bucket of approximately 10-qt (9-dm^3) capacity by passing through the discharge stream of the concrete pump hose being used to place the concrete, at the point of placement of the concrete. Exercise care to ensure that the sample is representative of the pour, avoiding the beginning or ending of the discharge from the equipment. Prepare the test specimens as described in Section

[1] This test method is under the jurisdiction of ASTM Committee C09 on Concrete and Concrete Aggregates and is the direct responsibility of Subcommittee C09.21 on Lightweight Aggregates and Concrete.

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[2] 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.**

6, by filling them with a scoop of lightweight insulating concrete dipped from the bucket.

5.1.2 *Remixing Sample*—Do not remix the sample.

6. Test Specimens

6.1 *Size and Shape*—Use cylindrical test specimens 3 ± 1/16 in. (75 ± 1.6 mm) in diameter and 6 ± 1/8 in. (150 ± 3 mm) in length, with the base of each specimen perpendicular to the longitudinal axis within the limits prescribed in 6.8.

6.2 *Number*—Obtain at least four test specimens for compressive strength tests from each sample of lightweight insulating concrete.

6.3 *Molding*—In molding the specimens, place the concrete in two approximately equal layers. Tap the sides of the mold lightly with a rubber mallet after placing each layer until the surface of the layer has subsided approximately to a plane. Over fill the mold when placing the second layer. Do not rod the concrete.

6.4 *Finishing Surface*—Strike off the specimens immediately after filling the molds. Cover them in such a manner as to prevent evaporation without marring the surface (Note 1). If desired, cover the filled mold with a glass or metal plate to obtain a surface that will be suitable for testing without capping and with a minimum of grinding.

NOTE 1—It is desirable to place the filled mold in a moist room if one is available. If this is done, protect the surface from dripping water.

6.5 *Removal from Molds*—Do not remove specimens from molds until danger of damage to the specimens is past. In any event, remove specimens from the molds within 7 days after molding.

6.6 *Curing*—For the first 24 h after molding, maintain the specimens at a temperature of 70 ± 10 °F (21.1 ± 5.5 °C). After 24± 2 h, store the specimens in a moist condition (Note 2) at a temperature of 73.4 ± 3 °F (23.0 ± 1.7 °C) (Note 3). Do not expose specimens to a stream of running water nor store in water, unless a saturated lime (calcium hydroxide) solution is used. After 7 days, store the specimens at a temperature of 70 ± 10 °F and a relative humidity of 50 ± 30 % for 18 days. Twenty-five days after molding, dry the specimens in an oven at 140 ± 5 °F (60 ± 2.8 °C) for 3 days (Note 4). Cool specimens to room temperature and test for compressive strength at an age of 28 days.

NOTE 2—A moist condition is that in which free water is maintained on the surfaces of the specimens at all times.

NOTE 3—The temperature within damp sand and under wet burlap or similar materials will always be lower than the temperature in the surrounding atmosphere if evaporation takes place.

NOTE 4—Caution must be observed in loading the oven so that the moisture content of the specimen at time of test does not exceed 5 % of the oven-dry density determined in accordance with 9.1.

6.7 *Preparation for Testing*—Check the surfaces of the specimen that will be in contact with the bearing surfaces of the testing machine within 0.02 in. (0.5 mm). If the bearing surfaces depart from a plane more than 0.02 in. (0.5 mm), grind them to conform to this tolerance or cap in accordance with Practice C 617. Cap surfaces to be plane within 0.002 in. (0.05 mm). Check the planeness of the bearing surface of the specimen by means of a straightedge and feeler gage, making a minimum of three measurements on different diameters of the specimen. Make sure the surface of the specimen in contact with the lower bearing block of the testing machine does not depart from perpendicularity with the longitudinal axis of the cylinder by more than 1° (approximately equivalent to 0.1 in. in 6 in. (2.5 mm in 150 mm)) or the combined departure of the two bearing surfaces from perpendicularity by more than 3°.

6.8 *Measurement of Specimen*—Determine the diameter of the specimens to the nearest 0.01 in. (0.3 mm) by averaging two diameters measured at right angles to each other at about midheight of the specimen. Use these dimensions in computing the cross-sectional areas. Determine the height of the specimen to the nearest 0.01 in.

7. Procedure

7.1 *Placing of Specimen*—Wipe clean the bearing faces of the upper and lower bearing blocks of the compression test machine and of the test specimen and place the test specimen on the lower bearing block. Carefully align the axis of the specimen with the center of thrust of the spherically seated block. As the spherically seated block is brought to bear on the specimen, gently rotate its movable portion by hand so that uniform seating is obtained.

7.2 *Rate of Loading*—Continuously apply the load without shock at a constant rate such that the maximum load will be reached in 65 ± 15 s. Record the maximum load sustained by the specimen. Note the type of failure and the appearance of the concrete.

8. Calculation

8.1 Calculate the unit compressive strength of the concrete by dividing the maximum load by the average cross-sectional area and record to the nearest 10 psi (69 kPa).

9. Oven-Dry Density

9.1 When the oven-dry unit density is desired, mold two companion specimens for this purpose at the same time as the compressive strength specimens. Cure the companion specimens the same as the compressive strength specimens, except dry the companion specimens at the age of 28 days in an oven at 230 ± 18 °F (110 ± 10 °C) and weigh at 24-h intervals until the loss in weight does not exceed 1 % in a 24-h period. Determine the mass and dimensions of the oven-dry specimens and calculate the density from the average data obtained.

10. Report

10.1 For each specimen tested report the following information where applicable:

10.1.1 Identification number,

10.1.2 Dimensions of test specimen, in inches (millimetres),

10.1.3 The cross-sectional area in square inches (square centimetres),

10.1.4 Type of cap,

10.1.5 Maximum load, in pounds-force (or kilonewtons),

10.1.6 Unit compressive strength in pounds-force per square inch (or kilopascals),

10.1.7 Type of fracture and appearance of the concrete following determination of compressive strength,

10.1.8 Defects in either specimen or caps,

10.1.9 Age of specimen, in days,

10.1.10 Calculated oven-dry density, if determined,

10.1.11 Average ambient temperature and average relative humidity at which specimens were stored during the 18-day curing period, and

10.1.12 Summation of tests of specimens from same sample with average of test results. This summation shall be shown on the report of the last specimen tested and should be referenced in reports of other specimens.

11. Precision and Bias

11.1 *Precision*:

11.1.1 The single operator standard deviation for a test result (where a test result is, as defined in this test method, the average of four separate compressive strength measurements) has been found to be 21 psi (Note 5). Therefore, results of two properly conducted tests (each consisting of the average of four individual measurements) by the same operator on concrete samples from the same batch should not differ by more than 59 psi (Note 5). The range (difference between highest and lowest) of the four individual measurements used in calculating the average should not exceed 155 psi (Note 6).

11.1.2 The multilaboratory standard deviation for a test result has been found to be 29 psi (Note 5). Therefore, results of two properly conducted tests (each consisting of the average of four individual measurements) by two different laboratories on concrete samples from the same batch should not differ by more than 83 psi (Note 5).

NOTE 5—These numbers represent, respectively, the (1s) and (d2s) limits as described in Practice C 670.

NOTE 6—Calculated as described in 3.4.3 of Practice C 670.

11.2 *Bias*—The bias of this test method cannot be determined because compressive strength can only be defined in terms of this test method.

12. Keywords

12.1 compressive strength; density; lightweight insulating concrete; oven-dry density

SUMMARY OF CHANGES

Committee C09 has identified the location of selected changes to this test method since the last issue, C 495 – 99a, that may impact the use of this test method. (Approved July 15, 2007)

(*1*) Replaced “weight” with “density” in 1.1, Note 4, the title of Section 9, 9.1, and Section 12.

(*2*) Replaced “weight” with “mass” in 9.1, and corrected the citation in Note 4 from 8.1 to 9.1.