Designation: C 513 – 89 (Reapproved 1995)

Standard Test Method for Obtaining and Testing Specimens of Hardened Lightweight Insulating Concrete for Compressive Strength[1]

This standard is issued under the fixed designation C 513; 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 obtaining, preparing, and testing specimens of hardened, lightweight, insulating concrete having an oven-dry weight not exceeding 50 lb/ft^3 (800 kg/m^3).

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

1.3 *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:*

C 39 Test Method for Compressive Strength of Cylindrical Concrete Specimens[2]

C 88 Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate[2]

C 109/C109M Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or 50-mm Cube Specimens)[3]

C 670 Practice for Preparing Precision and Bias Statements for Test Methods for Construction Materials[2]

3. Significance and Use

3.1 This test method is used to determine the compressive strength of hardened lightweight insulating concrete in place in the field. The test results can be used to determine specification compliance when results of tests on specimens molded at the time of construction are not available or are defective, and to establish the strength properties of existing construction.

4. Apparatus

4.1 *Masonry or Carpenter's Saw*, for removing a sample from hardened concrete and cutting cubes from the sample. For concrete thicker than 6 in. (150 mm), a core drill may be used.

4.2 *Testing Machine*, conforming to the requirements in Test Method C 39.

4.3 *Scales and Weights*, used in weighing specimens shall conform to those specified in Test Method C 109/C 109M.

4.4 *Drying Oven*, conforming to the requirements specified in Test Method C 88.

5. Sampling

5.1 Remove a sufficiently large sample so that at least four test specimens for compressive strength, and one for unit weight, may be prepared without the inclusion of any concrete that has been cracked, spalled, undercut, or otherwise damaged. The sample shall be of such length and width as to permit the cubes and prisms to be cut therefrom without approaching any edge of the sample closer than 1 in. (25 mm). Unless otherwise specified, the sample shall not be obtained until the concrete is 14 days old.

6. Test Specimens

6.1 Compressive strength specimens shall be cubes not less than 2 in. (50 mm), nor more than 4 in. (100 mm) on a side. The dimensions of the cubes shall be equal to the thickness of the concrete slab unless that thickness exceeds 4 in., in which case the depth of the specimen shall be reduced to 4 in. by sawing off the lower portion as placed.

6.2 Specimens for unit weight determination shall be oven-dry prism-shaped specimens which have a volume of 40 in.^{3} (640 cm^3) or more.

7. Preparation of Test Specimens

7.1 The surfaces of compressive strength specimens that will be in contact with the bearing surfaces of the testing machine shall be plane within 0.02 in. (0.5 mm). The planeness of the bearing surfaces of the specimens shall be checked by means of a straightedge and feeler gage, making measurements across both diagonals of the bearing faces of the cube. If the bearing surfaces depart from a plane more than 0.02 in., they shall be ground to within this tolerance or capped with a conventional sulfur mixture. The capped surface shall be plane within 0.002 in. (0.05 mm) (Note 1). The surface of the specimen in contact with the lower bearing block of the testing machine shall not depart from perpendicularity to the axis by more than 1° (approximately equivalent to 0.03 in. (0.8 mm) in

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[1] This method is under the jurisdiction of ASTM Committee C-9 on Concrete and Concrete Aggregatesand is the direct responsibility of Subcommittee C09.21on Lightweight Aggregates.

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[2] *Annual Book of ASTM Standards*, Vol 04.02.

[3] *Annual Book of ASTM Standards*, Vol 04.01.

2 in. (50 mm), and 0.07 in. (1.77 mm) in 4 in. (100 mm)) and the combined departure of the two bearing surfaces from perpendicularity to the axis shall not exceed 3°. Cube edges shall differ by not more than ⅛ in. (3.2 mm).

NOTE 1—These relatively low-strength materials can tolerate greater deviation from planeness of bearing surfaces without affecting strength than can more rigid materials. However, if the specimen is capped, the capped surface shall conform to the more restrictive specification.

7.2 Store specimens in laboratory air until drying is initiated.

7.3 The specimens to be tested for compressive strength shall be dried in an oven at 140 ± 5°F (60 ± 2.8°C) for 3 days prior to testing.

7.4 Measure the sides of each specimen at about midheight to the nearest 0.01 in. (0.3 mm) and calculate the cross-sectional area to the nearest 0.01 in.^{2}(6.5 mm^2). Measure the height of the specimen to the nearest 0.01 in.

7.5 The specimens to be tested for unit weight shall be dried in an oven at 230 ± 18°F (110 ± 10°C) and weighed at 24-h intervals until the loss in weight does not exceed 1 % in a 24-h period. The weight and dimensions of the oven-dry specimens shall be determined and the weight per cubic foot calculated from the average obtained.

8. Procedure

8.1 Test four specimens for compressive strength in accordance with the following:

8.1.1 *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. Test specimens in the direction in which they were cast. Align the axis of the specimen carefully 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.

8.1.2 *Rate of Loading*—Apply the load continuously and without shock at a constant rate such that the maximum load will be reached in 50 ± 30 s. Record the maximum load sustained by the specimen. Note the type of failure and the appearance of the concrete.

9. Report

9.1 Report the following for each specimen tested, where applicable:

9.1.1 Source of sample,

9.1.2 Identification number,

9.1.3 Dimensions to nearest 0.01 in. (0.3 mm),

9.1.4 Cross-sectional area to nearest 0.01 in.^{2}(6.5 mm^2),

9.1.5 Type of cap,

9.1.6 Maximum load, pounds-force (or kilonewtons),

9.1.7 Unit compressive strength, to the nearest 10 psi (69 kPa),

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

9.1.9 Defects in either specimen or caps,

9.1.10 Age, in days, and

9.1.11 Calculated oven-dry density.

10. Precision and Bias [4]

10.1 *Precision*:

10.1.1 *Within-Laboratory Single-Operator Precision for Compressive Strength Specimens for Hardened Lightweight Insulating Foam Concrete*—The within-laboratory single-operator standard deviation for compressive strength as determined by a single test result (where a test result is defined as the evaluation of four separate measurements) has been found to be 40 psi (0.276 MPa).[5] Therefore, the results of two properly conducted tests by the same operator on the same concrete in the same laboratory should not differ by more than 110 psi (0.758 mPa). The range (difference between highest and lowest) of the four individual measurements used in calculating the test results should not exceed 300 psi (2.068 MPa)[6].

10.1.2 *Multi-laboratory Precision for Compressive Strength for Hardened Lightweight Insulating Foam Concrete*—The multi-laboratory standard deviation of a test result for compressive strength as determined by this test method has been found to be 40 psi (0.276 MPa)[5]. Therefore, results of two properly conducted tests in different laboratories on the same concrete should not differ by more than 110 psi (0.758 MPa).

10.1.3 *Within-Laboratory Single-Operator Precision for Compressive Strength Specimens for Hardened Lightweight Insulating concrete*—The within-laboratory single-operator standard deviation for compressive strength as determined by a single test result (where a test result is defined as the evaluation of four separate measurements) has been found to be 20 psi (0.138 MPa). Therefore, the results of two properly conducted tests by the same operator on the same concrete in the same laboratory should not differ by more than 60 psi (0.414 MPa)[5]. The range (difference between highest and lowest) of the four individual measurements used in calculating the test results should not exceed 150 psi (1.034 MPa)[6].

10.1.4 *Multi-laboratory Precision for Compressive Strength Specimens for Hardened Lightweight Insulating Concrete*—The multi-laboratory standard deviation of a test result for compressive strength as determined by this test method has been found to be 20 psi (0.138 MPa)[5]. Therefore, results of two properly conducted tests in different laboratories on the same concrete should not differ by more than 60 psi (0.414 MPa)[6].

10.2 *Bias*—No standard exists that would permit determination of bias.

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[4] Calculated as described in Section 3.3.3 of ASTM Practice C 670. Tests to determine precision statements included 3 laboratories; 3 different materials; 2 operators at each laboratory; and 6 replicas.

[5] These numbers represent the (1s) and (d2s) limits as described in Practice C 670.