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TECHNICAL BULLETIN

Method for Sampling and Testing Low Density Cellular Concrete Cylinders

This bulletin is to provide guidance for conducting compressive strength and density testing of lightweight insulating concrete cylinders.

Cellular concrete follows various ASTM test methods that apply to lightweight insulating concrete. These are ASTM C 495 "Standard Test Method for Compressive Strength of Lightweight Insulating Concrete," ASTM C 796 "Standard Test Methods for Foaming Agents for Use in Producing Cellular Concrete Using Preformed Foam," and ASTM C 869 "Standard Specification for Foaming Agents Used in Making Preformed Foam for Cellular Concrete."

Cellular Concrete is used in variable applications with densities ranging from 20-pcf to 110-pcf. Usually if the unit weight is lower than 70-pcf, cellular concrete does not use conventional aggregates. Because of this fact, cellular concrete does not fall under the test procedures for normal weight concrete. As a result, the testing guidelines are those recommended by the Manufacturer based on ASTM Test Methods.

Sampling Method

1. A representative sample of the material shall be taken in 3" x 6" cylinder at the project.
    a. For geotechnical projects that would be every four hours or for each 300 cubic yards of material placed or as directed by the project engineer
    b. For roof decks and floor fills projects it is suggested that a sample be taken every four hours or for each 100 cubic yards of material placed

2. The samples should be filled at the point of placement, with the time and location noted on the field report. A testing lab is not required for this procedure.

3. The cylinders shall be overfilled by pouring the material down the sides of the cylinders, which allows air to escape during filling. Lightly tap the cylinder on the sides and bottom to close any accidental entrained air voids. Strike off the samples with a plate and immediately cover the cylinders with a plastic cap or plastic bag over the cylinder. DO NOT ROD THE MATERIAL IN THE CYLINDERS.

4. Mark the cylinders and place it in a location where it will not be disturbed or subjected to temperature extremes. Excessive or early handling may damage these test cylinders. Normally, after 2-3 days, the cylinders may be shipped. When shipping the cylinders with the material in them, ensure that they are properly packed to prevent damage to the material during transit to the testing laboratory.

    Note: The importance of proper handling of these samples cannot be overlooked. They are representative of the material placed. After 24 hours of initial set in a location free of vibration and temperature extremes,

it is recommended that the cylinders be placed in a warm, high humidity environment until shipped to the testing facility

Preparation for Testing

1. The sample should be stripped, trimmed, and prepared per ASTM C 495 Test Method and follow the guidelines of ASTM C 617 Test Methods.

2. The cylinders should be capped prior to compressive testing.

3. Apply oil or appropriate release agent to the horizontal capping surface. The surface should be flat and level.

4. Mix an appropriate amount of US Gypsum Hydrostone for the number of cylinders being capped. Add water based on US Gypsum recommendation of a ratio of 32 parts water to 100 parts Hydrostone and mix thoroughly.

5. Place a pond approximately 3-1/2 inches in diameter for each 3x6 inch cylinder being capped on the pre-oiled capping surface.

6. Stand the cylinder in the center of each pond in a vertical position and allow the capping material to set initially.

7. The material can either be pushed into and slightly up the side of the cylinder or pulled away from the cylinder leaving a radius of about 1/4 inch around the cylinder. Once the capping material has initially set, trimmed around each test cylinder.

8. Allow the capping material to fully set. The setting time will vary depending on factors such as the dryness and composition of the cylinder and the ambient temperature and humidity

9. Before the test sample is moved, tap the capping surface to break the seal between the sample and the casting surface. Carefully remove the sample.

10. Clean off the capping surface, re-oil, and repeat the procedure for the other end of the cylinder.

Information regarding Hydrostone such as the physical properties, instructions and the MSDS may be found on US Gypsum's website (www.plaster.com).

Neoprene Pads for Capping Concrete Cylinders can be used instead of the Hydrostone capping compound

Testing Method

1. The cylinders should be placed into the curing environment once it is received at the testing laboratory.

2. After 48 hours of casting the cylinders, place the cylinders in a non-moisture loss environment (i.e. cure box or ice chest).

3. Keep the cylinders in this environment up to three days prior to compressive testing and make sure not to test the cylinders in moist condition. Leave the samples capped in the cylinders during the 25 days curing period and follow the temperature specification for curing stated in ASTM C 495.

4. De-mold and air-dry the specimen for three days prior to compressive strength testing. Be extra careful not to damage the specimen during the removal process. DO NOT OVEN DRY CELLULAR CONCRETE CYLINDER WHICH ARE TO BE TESTED FOR COMPRESSIVE STRENGTH (ASTM C 796 - Sections 8.9 and 8.10)

5. For cylinder to be tested less than 28 days, de-mold cylinder and air dry for 24 hrs prior to compressive strength testing.

Note: Cylinders cast at low densities (less than 38 pounds per cubic foot) and those made with partial cement replacement may be quite fragile - even at 7 days. We recommend waiting to strip the cylinder until a few days before the test date. If damage occurs or soft bottoms are encountered, trim one inch of the cylinder bottom prior to testing and apply appropriate correction factors (ASTM C 42 Section 6.7).

Note: The diameter of the 3-inch by 6-inch cylinder must be measured. It is not unusual for the actual diameter to be 2.9 inches. When this is translated into the bearing area for calculation of the compressive strength, the result reflects a 6.5% error. Assuming the diameter to be 3 inches when it is actually 2.9 inches will result in a compressive strength 6.5% lower than it should be.

Testing Equipment

The accuracy of the testing machine is critically important in determining the correctness of the test results. The maximum load required to break the sample should not be less than 10% of the maximum load range being used. Frequently, testing laboratories use equipment that has the loading capability to break structural concrete. The load to break a lightweight insulating concrete cylinder can be well below 10% of the most sensitive range available on these large machines. A testing machine with a load range of 5,000 pounds is appropriate to use when testing lightweight insulating concrete.

For example, the load to break a 3-inch by 6-inch, 125 psi cylinder will be approximately 880 pounds. A testing machine with a maximum load range of 10,000 pounds is not appropriate for testing this material because 10% of the range equals 1,000 pounds. This is greater than the expected result.

1. Cylinders should be centered in the compression-testing machine and loaded to complete failure. If cylinders compress rather than fracture, slightly increase the rate of loading until a complete fracture occurs.

The common break pattern is a conical or shear fracture and it has to penetrate a minimum of 67% of the cylinder mass (fig. 1) for an accurate reading.

Figure 1: Correct cylinder breaks

Figure 2: Incorrect cylinder breaks