



**INDIANA DEPARTMENT OF TRANSPORTATION
DIVISION OF MATERIALS AND TESTS**

**DETERMINING THE CELLULAR CONCRETE CAST DENSITY,
FOAM DENSITY, IN SITU STRENGTH, AND COMPRESSIVE
STRENGTH OF CELLULAR CONCRETE FILL**

ITM No. 522-26

1.0 SCOPE.

- 1.1** This test method describes the various tests performed during the installation of cellular concrete fill (CCF). The CCF shall be in accordance with Section 216 of the INDOT Standard Specification.
- 1.2** This ITM may involve hazardous materials, operations, and equipment and may not address all of the safety problems associated with the use of the test method. The user of the ITM is responsible for establishing appropriate safety and health practices and determining the applicability of regulatory limitations prior to use.

2.0 REFERENCES.

2.1 ASTM Standards.

ASTM C495 Standard Test Method for Compressive Strength of Lightweight Insulating Concrete

2.2 ITM Standards.

ITM 509 Field determination of Strength Using Dynamic Cone Penetrometer

3.0 TERMINOLOGY. Definitions for terms and abbreviations shall be in accordance with the Department's Standard Specification, Section 101 and as follows:

Cast Density. The mass per unit volume of CCF (pcf).

Foam Density. The mass per unit volume of a foam (pcf).

Dynamic Cone Penetrometer (DCP). A test that is used to measure penetration resistance and determination of in situ strength of the CCF.

4.0 SIGNIFICANCE AND USE. This ITM shall be used to determine the cast density, foam density, in situ strength using the DCP, and compressive strength of CCF.

5.0 APPARATUS.

- 5.1** Balance

- 5.2 Mold, as provided by the contractor performing the CCF work
- 5.3 DCP, in accordance with ITM 509
- 5.4 Straight edge, at least 12 in. in length
- 5.5 Scoop
- 5.6 Tamping rod: 5/8 in. diameter and 16 in. to 24 in. long, having a hemispherical tip the same diameter as the rod on at least one end of the rod.

6.0 PROCEDURE – CAST DENSITY

- 6.1 The cast density for the CCF will be checked at the point of placement. The Contractor, manufacturer's representative, or the Engineer may perform the procedure. The Engineer will witness the procedure.
- 6.2 Weigh the empty mold and record the weight in pounds (W_1).
- 6.3 Record the volume of the mold in cubic feet, ft^3 (V_1).
- 6.4 Stand on both foot pieces to hold the mold firmly in place.
- 6.5 Use the scoop to fill the mold 1/3 full by volume.
- 6.6 Consolidate the layer with 25 strokes of the tamping rod, using the rounded end. Rod the bottom layer throughout its depth. Distribute the strokes evenly over the entire cross section of the CCF.
- 6.7 Use the scoop to fill the mold another 1/3 full by volume.
- 6.8 Repeat 6.6.
- 6.9 Use the scoop to fill the mold the final 1/3 to overflowing.
- 6.10 Repeat 6.6 once again. If the level of the CCF falls below the top of the mold, stop, add more CCF and continue rodding from where you left off.
- 6.11 Strike off the top surface of the CCF with the straight edge.
- 6.12 Clean overflow CCF away from the base of the mold.
- 6.13 Weigh the filled mold and record the weight in pounds (W_2)
- 6.14 Calculate the Cast Density, in pcf, using the following equation:

$$\text{Cast Density} = \frac{W_2 - W_1}{V_1}$$

7.0 PROCEDURE – FOAM DENSITY

- 7.1 The foam density for the CCF will be checked at the project site staging area where the foam is being mixed with the neat cement. The Contractor, manufacturer's representative, or the Engineer may perform the procedure. The Engineer will witness the procedure.
- 7.2 Weigh the empty mold and record the weight in pounds (W_3).
- 7.3 Record the volume of the mold in cubic feet (V_2).
- 7.4 Stand on both foot pieces to hold the mold firmly in place.
- 7.5 Use the scoop to fill the mold with CCF.
- 7.6 Fill the mold to overflowing.
- 7.7 If the foam falls below the top of the mold, stop, add more foam.
- 7.8 Strike off the top surface of the foam with the straight edge.
- 7.9 Clean overflow foam away from the base of the mold.
- 7.10 Weigh the now filled mold and record the weight in pounds (W_4).
- 7.11 Calculate the Foam Density, in pcf, using the following equation:

$$\text{Foam Density} = \frac{W_4 - W_3}{V_2}$$

8.0 PROCEDURE – IN SITU STRENGTH USING DCP

- 8.1 The first set of DCP tests for in situ strength will be performed once 500 ft² of CCF has been placed to a depth of 2 ft. The Engineer will perform the procedure.
- 8.2 Perform three DCP tests in accordance with ITM 509. Each test will be spaced uniformly throughout the 500 ft² area. These tests will be performed after 24 hours.
- 8.3 The average DCP blow count for each 500 ft² section shall be at least 10 blows per 12 in. depth.
- 8.4 After meeting the requirements of 8.3, the next 2 ft lift of the CCF may be placed.

8.5 Repeat 8.2 thru 8.4 as necessary until the plan fill height has been reached. Note the top lift of CCF may be less than 2 ft as necessary.

8.6 The average blow count for each lift of CCF will be reported to the Engineer.

9.0 PROCEDURE – COMPRESSIVE STRENGTH

(Note: Compressive strength testing will be performed by the Division of Geotechnical Engineering or their designated lab.)

9.1 A lot of CCF will be defined as 500 cys.

9.2 The Contractor shall cast four specimens per lot. Each specimen shall be immediately covered after casting.

9.3 The specimens shall be moist cured for 26 days and then given to the Engineer. The specimens will be air cured for 2 days prior to the compressive strength testing.

9.4 The specimens shall not be oven dried.

9.5 Testing of the specimens will be in accordance with ASTM C495.

9.6 The compressive strength will be reported in psi.

10.0 REPORT.

10.1 The cast density will be reported at hourly intervals during placement as pounds per cubic foot, pcf.

10.2 The foam density will be reported twice per day as pounds per cubic foot.

10.3 DCP blow count averages will be reported for every lift.

10.4 Compressive strength will be reported for each lot as psi.

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