

LIGHTWEIGHT CELLULAR CONCRETE FILL

Effective: November 11, 2001

Revised: April 1, 2016

General: This work consists of providing lightweight cellular concrete fill (LCCF) at the locations(s) and according to the dimensions shown in the contract plans.

Submittals: Within 45 calendar days prior to proposed installation, the Contractor shall submit the following:

- (a) The name of the subcontractor providing and installing the light weight cellular fill. The Contractor shall present an organization chart including names, telephone numbers, current certifications and/ or titles, and roles and responsibilities of all those involved in the manufacturing and installation of the lightweight cellular fill.
- (b) Manufacturer's specifications, catalog cuts, and other product data needed to demonstrate compliance with specified requirements. These shall include reports and test results from laboratories.
- (c) The subcontractor installing the lightweight fill shall be certified in writing by the Manufacturer of the lightweight fill. The certified applicator shall be regularly engaged in the placement of lightweight fill of a similar nature including the completion of mass fills having a minimum of 13,000 cu yd (9,950 cu m) in the past five years.
- (d) A description of the proposed installation procedure. The procedure shall address the following.
 - (1) Proposed construction sequence and schedule.
 - (2) Location of the equipment and batching areas.
 - (3) Type of equipment and tools to be used.

Materials. Materials shall be according to the following.

Item	Article/Section
(a) Portland Cement.....	1001
(b) Fly Ash	1010
(c) Water.....	1002
(d) Fine Aggregate	1003
(e) Concrete Admixtures	1021
(f) Foaming Agent (Note 1)	

Note 1. The foaming agent shall be according to ASTM C 869, and shall be listed on the Department's Qualified Product List of Foaming Agents for Cellular Concrete. The manufacturer shall provide an infrared spectrophotometer trace no more than five years old. When the infrared spectrophotometer trace is more than seven years old, a new one shall be provided.

Equipment. Equipment shall be according to the following.

Item	Article/Section
(a) Concrete Mixers and Trucks	1103.01
(b) Batching and Weighing Equipment	1103.02
(c) Automatic and Semi-Automatic Batching Equipment	1103.03
(d) Water Supply Equipment	1103.11
(e) Mobile Portland Cement Concrete Plants	1103.04
(f) Foam Generator (Notes 1 & 3)	
(g) Mobile Site Batch Plant (Notes 2 & 3)	

Note 1. Foam generating equipment shall be calibrated daily to produce an accurate volume of foam.

Note 2. Mobile site batch plants shall be capable of mixing and pumping cellular concrete, and shall have a minimum 1 cu yd (0.76 cu m) capacity. Mobile site plants shall be calibrated before the start of the project, and then during the project as determined by the Engineer.

Note 3. Foam generators and mobile site batch plants shall be certified in writing by the manufacturer of the lightweight cellular concrete and approved by the Engineer.

Lightweight Cellular Concrete Classes. The four general classes of lightweight cellular concrete delineated by maximum as-cast density and minimum compressive strength are given in Table 1. If the class of lightweight cellular concrete is not specified in the contract, the class to use shall be as directed by the Engineer.

Table 1. CLASSES OF LIGHTWEIGHT CELLULAR CONCRETE				
Class	Maximum Lift Height ft (m)	Maximum As-Cast Density lb/cu ft (kg/cu m)	Minimum Compressive Strength	
			Psi (kPa)	
			Days (Note 1)	
			7	28
I	4 (1.2)	30 ± 2 (481 ± 32)	30 (205)	40 (275)
II	4 (1.2)	36 ± 2 (577 ± 32)	60 (415)	80 (550)
III	2.5 (0.76)	42 ± 2 (673 ± 32)	90 (620)	120 (825)
IV	2.5 (0.76)	50 ± 2 (801 ± 32)	115 (795)	150 (1035)

Notes:

(1) When fly ash is used, the required 7-day and 28-day strengths may be reached at 14 and 56 days, respectively.

Other Lightweight Cellular Concrete Criteria. The lightweight cellular concrete shall be according to the following.

- (a) **Proportioning and Mix Design.** For all Classes of lightweight cellular concrete, it shall be the Contractor's responsibility to determine the mix design material proportions and to proportion each batch. The Contractor shall provide the mix designs a minimum of 45 calendar days prior to production. The Engineer will verify the mix design submitted by the Contractor.

For a new mix design to be verified, the Engineer will require the Contractor to provide a trial batch at no cost to the Department. The trial batch shall be scheduled a minimum of 30 calendar days prior to anticipated use and shall be performed in the presence of the Engineer. A minimum of 1 cu yd (0.75 cu m) trial batch shall be produced and placed offsite. The trial batch shall be produced with the equipment, materials, and methods intended for construction. The trial batch will be evaluated and tested by the Contractor and Engineer via split samples for as-cast density and compressive strength according to the sampling and testing requirements specified herein. The lightweight cellular concrete will also be evaluated and tested by the Engineer according to Illinois Test Procedure 501, as applicable.

Verification of the mix design will include trial batch test results and other criteria as determined by the Engineer. The Contractor will be notified in writing of verification. Verification of a mix design shall in no manner be construed as acceptance of any mixture produced. Tests performed at the jobsite will determine if a mix design can meet specifications.

- (b) **Admixtures.** Admixture use shall be according to Article 1020.05(b).
- (c) **Temperature.** The air temperature at the time of placement and for 24 hours thereafter shall be a minimum of 35 °F (2 °C). The temperature of the lightweight cellular concrete at point of discharge shall be a minimum of 45 °F (7 °C) and a maximum of 95 °F (35 °C).

Curing. Curing may be required for applications with significant surface area exposed (least width dimension of minimum 80 ft (24 m)) to the elements if rapid drying conditions are expected during placement, as determined by the Engineer. When curing is required, each lift shall be cured with a method recommended by the manufacturer of the lightweight cellular concrete. If curing compound is used, it shall be compatible with other construction materials it may interact with, and shall not inhibit bond of subsequent lifts.

Quality Control Sampling and Testing by the Contractor. The Contractor shall sample and test the lightweight cellular concrete as follows:

- (a) **As-Cast Density.** The first batch placed each day and every 2 hours thereafter shall be sampled and tested as described for "experimental density of the concrete after pumping" according to ASTM C 796, except the hose length shall be that used for jobsite placement. The as-cast density shall be the average of at least two tests.

If the average as-cast density is outside the specified tolerance from Table 1, the Contractor shall reject the batch or make an adjustment to the mix before placement. Adjustments to the mix shall be accomplished by either increasing or decreasing the foam only.

- (b) Compressive Strength. First batch placed each day and every 200 cu yd (155 cu m) thereafter shall be sampled according to ASTM C 495, except that samples shall not be oven dried at any time before testing. The minimum number of batches sampled per day shall be two. Eight 3 in. x 6 in. (75 mm x 150 mm) cylindrical test specimens shall be molded from each sample.

A compressive strength test is defined as the average of four cylinder breaks. For each sample, tests shall be conducted at 7 and 28 days, except when the mix includes fly ash, in which case, the tests may be conducted at 14 and 56 days, respectively.

Quality Assurance Sampling and Testing by the Engineer. The Engineer will sample and test the lightweight cellular concrete for quality assurance on independent and split samples. An independent sample is a field sample obtained and tested by only one party. A split sample is one of two equal portions of a field sample, where two parties each receive one portion for testing. The Engineer may request the Contractor to obtain a split sample. Any failing strength test specimen shall be retained until permission is given by the Engineer for disposal. The results of all quality assurance tests by the Engineer will be made available to the Contractor. However, Contractor split sample test results shall be provided to the Engineer before Department test results are revealed. The Engineer's quality assurance independent sample and split sample testing for placement or acceptance will be as follows:

- (a) As-Cast Density. One independent or split sample test for the first batch placed each day and as determined by the Engineer thereafter.
- (b) Compressive Strength. One independent or split sample for the first batch placed each day and as determined by the Engineer thereafter.

Comparing Test Results. Differences between the Engineer's and the Contractor's split sample test results will be considered reasonable if within the following limits.

Test Parameter	Acceptable Limits of Precision
Compressive Strength	5 psi (34.5 kPa)
Density	1 lb/cu ft (16 kg/cu m)

Action shall be taken when either the Engineer's or the Contractor's test results are not within specification limits for strength or density. Action may include, but is not limited to, the Contractor being required to replace or repair test equipment as determined by the Engineer.

Placed material that fails in compressive strength will be considered unacceptable.

Acceptance by the Engineer. Final acceptance will be based on the Standard Specifications and the following:

- (a) Validation of Contractor quality control test results using split samples. Any quality control or quality assurance test determined to be flawed may be declared invalid only when reviewed and approved by the Engineer. The Engineer will declare a test result invalid only if it is proven that improper sampling or testing occurred. The test result is to be recorded and the reason for declaring the test invalid will be provided by the Engineer.
- (b) Comparison of the Engineer's quality assurance test results with specification limits using samples independently obtained by the Engineer.

The Engineer may suspend mixture production, reject materials, or take other appropriate action if the Contractor does not control the quality of lightweight cellular concrete. The decision will be determined according to (a) or (b).

Installation. Prior to installation, the ground surface shall be cleared of organic top soils, debris, sharp objects, and trees. Tree stumps shall be either removed or cut to the level of the ground surface. All wheel tracks or ruts in excess of 3 in. (75 mm) in depth shall be graded smooth or otherwise filled with soil to provide a reasonable smooth surface.

If a geotechnical fabric for ground stabilization or geomembrane is specified in conjunction with the LCCF, it shall be furnished and installed as specified elsewhere in the Contract and shall be in place prior to placing the LCCF.

The lightweight cellular concrete fill shall be placed according to the approved installation procedures provided by the manufacturer.

There shall be no standing water in the area to be filled. If necessary, dewatering shall be continuous during the time the lightweight cellular concrete fill is constructed. Lightweight cellular concrete fill shall not be placed during or when periods of precipitation are expected unless placed in an enclosed, covered area and the ground water is diverted away from the LCCF.

If any items are to be encased in the fill, the items shall be set to the final location both horizontally and vertically prior to installation of the LCCF.

Mixing and placement of the LCCF shall be done as follows:

- (a) After mixing, the materials shall be promptly placed in the final location.
- (b) No mechanical vibration of the LCCF shall be permitted.
- (c) The material shall be placed to prevent segregation. Intermediate lifts shall be placed horizontal while only the top lift shall be sloped to grade. The final surface elevation of the lightweight cellular concrete fill shall be within ± 1.5 inches (± 38 mm) of the plan elevation.
- (d) Limit the area of placement to the volume that can be placed within 1 hour, up to the maximum lift height. Stagger placements such that the vertical joints are at least 10 ft (3 m) apart.

- (e) The cellular concrete shall be placed with a hose. The discharge hose length shall not exceed 800 ft (244 m) in length. Discharge from the hose shall not be allowed to flow more than 30 ft (9 m) from where it is deposited to its final position.
- (f) Heavy construction equipment or other unusual loading of the lightweight cellular concrete fill shall not be permitted.
- (g) Construction activities on any recently placed lift will not be permitted until at least 12 hours has elapsed and a minimum compressive strength of 8 psi (55 kPa) has been achieved. However, if any work on the recently placed LCCF resulting in cracking or indentations of more than an 0.125 inch (3 mm), the contractor shall discontinue construction, revise their wait time, mix strength or equipment used and submit to the Engineer for approval.
- (h) Sawing or ripping of the lightweight cellular concrete fill for utilities, drains or other conflicts will be by methods approved by the Engineer and lightweight cellular concrete fill Manufacturer.

| **Method of Measurement.** Lightweight cellular fill shall be measure for payment in cubic yards (cubic meters) according to Article 202.07.

| **Basis of Payment.** This work will be paid for at the contract unit price per cubic yard (cubic meter) for LIGHTWEIGHT CELLULAR CONCRETE FILL.