SP-150899
(New)

SPECIAL PROVISIONS
FOR
LIGHTWEIGHT FOAMED CONCRETE FILL

Johnson County
IM-080-6(488)242--13-52

Effective Date
September 20, 2022

THE STANDARD SPECIFICATIONS, SERIES 2015, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

150899.01 DESCRIPTION.

A. This work shall consist of providing and placing lightweight foamed concrete fill (LFCF) as backfill for a mechanically stabilized earth (MSE) wall and roadway embankment at the locations designated on the plans, and as specified in these special provisions.

B. The LFCF Installer shall coordinate its work with the MSE wall designer/supplier and the MSE wall installer.

150899.02 MATERIALS.

A. Submittals.

1. Submit a LFCF quality control (QC) and placement plan. Placement of the LFCF shall be in accordance with the information provided in the QC and placement plan. Submit the plan to the Engineer for review and comment no later than 2 weeks prior to LFCF placement. LFCF production shall not begin before the plan has been reviewed and accepted by the Engineer. The submitted QC and placement plan shall provide, as a minimum, the following elements:

- **a.** An organizational chart including names, telephone numbers, current certifications / titles, roles, and responsibilities of those involved with the quality control program.
- **b.** The process of communication by which the quality control information will be disseminated to the appropriate persons, including materials suppliers. This shall include a list of recipients, the communication means that will be used, action time frames, and report formats.
- **c.** Materials list of items proposed to be provided under this section.
- **d.** Manufacturer's specifications, catalog cuts, and other product data needed to demonstrate compliance with the specified requirements.
- **e.** Mix design for the LFCF, prepared by the foaming agent manufacturer, showing compliance with the specified LFCF properties.
- **f.** Certification of batch, mixing, and placing equipment by the foaming agent manufacturer, meeting the requirements specified herein.

g. Written evidence that producer/supplier is certified and approved by the foaming agent manufacturer.
h. Written evidence that LFCF installer is certified and approved by the foaming agent manufacturer.
i. LFCF curing procedures.

2. At least 6 weeks prior to placement, and in the presence of the Engineer, a Trial Batch will be prepared, and the Trial Batch testing results submitted 30 calendar days later showing the proposed LFCF material properties comply with the requirements of this specification and design requirements of the MSE wall. This shall include certified test results of the LFCF reinforcing pullout resistance and pullout friction factor, f*, meeting the minimum requirements of the MSE wall design and written certification the reinforcing material is not susceptible to corrosion when in contact with the proposed LFCF material. The equipment, materials, and techniques used to produce the Trial Batch shall be that which will be used to produce the LFCF. The accepted Trial Batch mix design and tested properties will become the standard of the material furnished under this contract.

3. At least 6 weeks prior to placing, the Contractor shall submit ten 3 inch diameter by 6 inch tall cylinder samples of the designed and tested LFCF material to the Engineer. Specimens shall be covered after casting to prevent loss of moisture and shall not be oven dried. At the Engineer's option, the samples may be tested for strength and density in accordance with the requirements of ASTM C495, to verify the submitted test results and validate the LFCF Installer's testing procedures and quality of the furnished product.

4. The LFCF Installer shall supply daily records of production and quantities of materials used each day to the Engineer. The LFCF Installer shall provide cast density reports within 24 hours of sampling. Provide the Engineer with a final report detailing unconfined compression testing and cast density results. Submit final report within 30 calendar days after the last LFCF placement.

B. Materials.
Materials used for the LFCF shall meet the following requirements:

1. Portland cement and Portland pozzolan cement type 1 meeting the requirements of Section 4101 of the Standard Specifications.

2. Air Entraining, water reducing, set retarding admixtures meeting the requirement of Section 4103 of the Standard Specifications.

3. Engineering fabrics meeting the requirements of Materials I.M. 496.01.

4. Pozzolans and admixtures (for accelerating, water reducing, retaining, improving the bond, etc.) may only be used if specifically designated and approved by the Foaming Agent Manufacturer.

5. During placement of the initial batches, the cast density shall be checked and the mix adjusted as required to obtain the specified cast density at the point of placement. Take one set (four test specimens) for each 300 cubic yards of LFCF placed or every 4 hours of placing, whichever results in the greater number of sets. Minimum of two sets per day.

6. Testing shall be performed by the Contractor in accordance with ASTM C495 (except that samples shall not be oven dried at any time before testing). The specimens shall be 3 inch diameter by 6 inch tall cylinders covered after casting to prevent damage and loss of moisture. Specimens may be tested at any age to monitor the unconfined compressive strength. The Contractor shall report test results to Engineer for distribution.

7. The foaming agent from the selected Foaming Agent Manufacturer shall conform to ASTM C869 and ASTM C796, and shall produce a LFCF material that complies with the specifications in table below.

Table SP-150899.02-1: Lightweight Foamed Concrete Fill (LFCF)

PROPERTY	REQUIREMENTS	TEST METHOD
Cast Density	31 to 36 pcf	ASTM C495, except that samples shall not be oven dried at any time before testing
Minimum Unconfined Compressive Strength @ 28 days	80 psi	ASTM C495
Minimum Effective Friction Angle	34 degrees	ASTM D4767
Coefficient of Permeability @ 2 psi	On the order of 10^{-5} cm/sec	ASTM D2434
Freeze-Thaw Resistance, minimum cycles at relative Young's Modulus, E = 70%	120 cycles	ASTM C666 Procedure B (rapid freezing in air and thawing in water), modified per E. L. Bidwell, University of Illinois, letter dated April 2, 1975.

150899.03 CONSTRUCTION.

A. Personnel Requirements.

1. The LFCF installer shall be certified by the foaming agent manufacturer and regularly engaged in the production and placement of the LFCF. This shall include the completion of lightweight foamed concrete fills having a minimum of 1000 total cubic yards in the past 4 years. Furthermore, the material shall have been successfully applied on at least three LFCF projects, which have performed satisfactorily for at least 3 years.

2. The LFCF installer's foreman shall have a minimum of 2 years of experience in this type of work and shall have worked on at least one of the three successful LFCF projects presented.

3. The LFCF installer shall employ adequate numbers of skilled workers who are thoroughly trained and experienced in the necessary crafts and who are familiar with the specified requirements and the methods needed to assure proper performance of this work.

B. Placement of LFCF.

1. Subgrade for LFCF shall be prepared in accordance with Section 2109 of the Standard Specifications.

2. Prior to LFCF placement, the surface of the site shall be clean and free of foreign material, ponded water, and frost. The LFCF Installer shall ensure the LFCF remains above the water table at all times during construction.

3. Precast panels, MSE wall steel reinforcing strips, and any other items to be fully or partially encased in LFCF shall be properly set and stable in their final location prior to the installation of the LFCF.

4. Prior to placing LFCF, vertical and horizontal joints between MSE wall panels and, if used, any wire mesh facing, shall be covered with geotextile fabric on the back face of the panels or wire face.

5. Placement of LFCF shall be coordinated with the placement of the MSE wall reinforcement as specified in the plans. Place only that amount of reinforcement required for immediately pending work to prevent undue damage. Suitable arrangement shall be made to hold the reinforcement in place before placing the LFCF. The MSE wall steel reinforcing strips shall be fully encased in the LFCF.

6. Placement of LFCF shall be coordinated with the construction of pavement longitudinal subdrains, storm intakes, underground utilities, and/or structural elements that will be placed within the LFCF.

7. The LFCF will be placed at locations designated on the plans and in accordance with the foaming agent manufacturer's recommendations.

8. LFCF shall only be proportioned, mixed, and placed using equipment approved by the foaming agent manufacturer as indicated in the accepted LFCF QC and placement plan. Once mixed, the LFCF shall be conveyed promptly to the location of placement without excessive handling.

9. LFCF shall be a homogeneous mixture and all materials shall be approved prior to use. LFCF shall not be mechanically vibrated or otherwise disturbed.

10. The discharge hose length shall not exceed lengths recommended by the Foaming Agent Manufacturer.

11. Move the discharge hose(s) sufficiently to ensure leveled filling through the specified fill area. Uneven filling is not permitted.

12. During construction, the surface of intermediate LFCF lifts should be kept relatively horizontal, while only the top lift shall be sloped to grade.

13. LFCF shall be placed in lifts not exceeding 48 inches in depth. Cold joints are not allowed within 6 inches vertically of MSE wall panel reinforcement elements. The first lift shall be at least 2 inches below the top of the lowest MSE wall precast panel or wire face.

14. Limit the area of LFCF placement to the volume that can be placed within 1 hour, up to the maximum lift height of 48 inches. Stagger placements such that vertical joints, if any, are at least 10 feet apart.

15. Allow a minimum of 24 hours between subsequent lifts. Prior to verification of the minimum specified unconfined compressive strength by testing, additional LFCF lifts may be placed after the 24 hour minimum at the Contractor's risk. Any material that does not meet the minimum specified strength within 28 days shall be removed and replaced by the Contractor at no additional cost to the Engineer.

16. Material shall be protected before, during, and after installation, and the LFCF Installer shall protect the work and materials of other trades. In the event of damage, immediately make replacements and repairs to the acceptance of the Engineer, at no additional cost to the Engineer.

17. LFCF shall not be placed on any surface containing frost or frozen material, or when the air temperature is below 32°F or is expected to fall below 32°F in less than 24 hours, unless precautions are taken to maintain temperatures above freezing. Any LFCF that is damaged by freezing shall be removed and replaced at no additional cost to the Engineer.

18. During periods of hot weather (above 100°F) or windy conditions, special precautions shall be taken by the LFCF Installer to minimize moisture loss through excessive surface evaporation due to a combination of air temperature, relative humidity, LFCF temperature, and wind conditions.

19. LFCF shall not be placed while it is raining.

20. Cure LFCF in accordance with the accepted QC and placement plan.

21. The final surface elevation of the LFCF shall be within ±0.1 foot of the elevations shown on the plans and shall be sloped to promote drainage as indicated on the plans.

22. Paving machines, heavy construction equipment, or other unusual loading of the LFCF shall not be permitted until the LFCF has attained the specified 28 day unconfined compressive strength.

23. Any excavation or sawing of the LFCF for utilities, drains, or other conflicts shall be by methods approved by the Engineer.

24. Any LFCF material that does not comply with the minimum specified criteria shall be removed and replaced at no additional cost to the Engineer.

150899.04 METHOD OF MEASUREMENT.

Measurement for LFCF, in cubic yards, will be the quantity shown in the plans.

150899.05 BASIS OF PAYMENT.

A. Payment for LFCF will be at the contract unit price per cubic yard. Such payment shall constitute full reimbursement for all work necessary to complete the lightweight foamed concrete fill, including proportioning, mixing, placing, and all other incidental operations (e.g., preparation of submittals, material testing, coordination and scheduling of LFCF placement with MSE wall erection, furnishing and placing geotextile fabric, groundwater and surface water control, temporary shoring, forming, etc.).

B. Payment for a Trial Batch will be paid for on a lump sum basis. Such basis shall constitute full reimbursement for all materials, labor, equipment, mobilization, demobilization, and all other incidentals necessary to produce the Trial Batch.