SP-150503
(New)

SPECIAL PROVISION
FOR
LIGHTWEIGHT FOAMED CONCRETE FILL

Pottawattamie County
IM-NHS-029-3(171)48--03-78

Effective Date
June 18, 2019

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.

150503.01 DESCRIPTION.

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

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

150503.02 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 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 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 engineering data needed to demonstrate compliance with the specified requirements.
- **e.** Mix designs for the LFCF, prepared by the manufacturer, showing compliance with the specified properties.

f. Certification of batch, mixing and placing equipment by the LFCF manufacturer meeting the requirements specified herein.
g. Written evidence of acceptance of the certified producer/supplier by the foam agent manufacturer.
h. Written evidence that LFCF Installer is certified by and approved by the foam agent manufacturer.
i. LFCF curing procedures.

2. At least 2 weeks prior to placement, a trial batch will be prepared and trial batch testing results submitted showing that 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 that the reinforcing material is not susceptible to corrosion when in contact with the proposed LFCF material. The accepted trial batch mix design and tested properties will become the standard of the material furnished under this contract.

3. At least two weeks prior to placing, the contractor shall submit ten 3 inch diameter by 6 inch high cylinder samples of the designed and tested LFCF to the Engineer. Specimens shall be covered after casting to prevent loss of moisture and shall not be oven dried. At the department's option, the samples may be tested for strength and density in accordance with the requirements of ASTM C495 and ASTM C796, respectively, to verify the submitted test results and validate the contractor's testing procedures and quality of the furnished product.

B. Materials.
The materials used for the LFCF Backfill 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 LFCF Manufacturer.

5. During placement of the initial batches, the density shall be checked and the mix adjusted as required to obtain the specified cast density at the point of placement. Take four test specimens for each 300 cubic yards of LFCF placed or every 4 hours of placing.

6. Testing shall be performed by the LFCF manufacturer in accordance with ASTM C796 (except do not oven dry load test specimens). The specimens shall be 3 inch diameter by 6 inch high cylinders covered after casting to prevent damage and loss of moisture. Moist cure the specimens at for at least 7 days prior to a 28 day compressive strength test. Specimens may be tested at any age to monitor the compressive strength. The manufacturer shall report test results to its certified applicator for distribution.

7. The foaming agent from the selected manufacturer should produce a lightweight foamed concrete fill material that complies with the specifications in table below.

Table 150503.02-1: Lightweight Foamed Concrete Fill Requirements

PROPERTY	REQUIREMENTS	TEST METHOD
Class B: Maximum/ Minimum Dry Density Minimum Unconfined Compressive Strength @ 28 days curing	48.0 pcf / 40.0 pcf 120 psi	ASTM C 796 (No oven drying)
Internal Friction Angle	45 degrees (min.)	AASHTO T236 (ASTM D3080-72)
Frost Heave Sample @ 250 hr exposure, 4.5 inches high x 4 inch dia.	< 0.5 in	British Road Research Laboratory, Lab Report LR 90, 1967, by Croney, Jacobs.
Freeze-Thaw Resistance - minimum cycles @ relative E = N/N ≥ 70% per ASTM C666 modified per Bidwell Report dated April, 1975	Relative Young's Modulus, E ≥ 80% at 300 cycles.	ASTM C 666 Procedure B (Rapid freezing in air and Thawing in water) As modified
Coefficient of permeability @ 2.0 psi	1 x 10-5 cm/sec	

150503.03 CONSTRUCTION.

A. Construction Supervision.

LFCF suppliers shall provide a qualified and experienced representative on site at the beginning of the wall construction for up to 3 days at no additional cost to the Contracting Authority.

B. Personnel Requirements.

1. The LFCF installer shall be certified by the manufacturer of the foaming agent 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 shall be certified and approved in writing by the foam agent manufacturer of the LFCF material. The 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 Installer shall use 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 the work noted in this Section.

4. The manufacturer's representative shall be experienced in the placement of LFCF and shall be on site full time during placement.

C. Placement of LFCF.

1. The placement of the LFCF shall be coordinated with the placement of the MSE 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.

2. The placement of the LFCF shall be coordinated with the construction of the sign structure foundations that will be placed within the LFCF.

3. The placement of the LFCF shall be coordinated with the construction of the pavement

longitudinal subdrains, storm intakes and any underground utility or structural element that will be placed within the LFCF.

4. LFCF shall be a homogeneous mixture and all materials shall be approved prior to use.

5. During construction, the surface of the fill should be kept relatively horizontal.

6. The areas to be filled shall not have any standing water prior to placement of the LFCF. The contractor shall ensure the LFCF remains above the water table at all times during construction.

7. Subgrade for LFCF fill will be prepared in accordance with Section 2109 of the Standard Specifications.

8. Any items to be fully or partially encased in the LFCF shall be properly set and stable prior to the installation of the LFCF

9. 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 Department.

10. Precast panels and MSE steel reinforcing strips should be fully or partially encased in the LCFC and properly set and stable prior to the installation of the LFCF. Drainage pipes, or any other items that will be encased in the LFCF shall be set and stable prior to installation of the LFCF.

11. LFCF shall not be placed at a temperature below 32°F, nor when freezing conditions are expected in less than 24 hours unless precautions are taken to maintain temperatures above freezing. Do not place LFCF on frozen ground.

12. Cure LFCF in accordance with the accepted placement plan.

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

14. LFCF shall be placed in lifts not exceeding 30 inches in depth. The first lift shall be at least 2 inches below the top of the lowest MSE wall precast panel or wire face.

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

16. Scarify each lift before placing the next lift. Each lift shall be scarified to a minimum depth of 1/2 inch using a hand rake or other suitable means. Scarifying shall be done in a manner to not disturb the alignment of the reinforcing strips/mesh. Scarifying shall be done after sufficient curing time such that foot traffic will not excessively damage the lift surface (no greater than 1/4 inch indentation).

17. The final surface of the completed LFCF embankment—surface where top soil and seeding shall be placed over as shown in the plans, shall also be scarified.

18. Allow a minimum of 24 hours between subsequent lifts. Prior to verification of the minimum specified compressive strength by testing, additional lifts may be placed after the one day

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.

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

20. Limit the area of placement to the volume that can be placed within 1 hour, up to the maximum lift height of 2.5 feet. Stagger placements such that the vertical joints are at least 10 feet apart.

21. The discharge hose length shall not exceed 500 feet in length.

22. The final surface finish of 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.

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

24. Sawing or ripping of the LFCF for utilities, drains, or other conflicts will be by methods approved by the Engineer.

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

26. The LFCF will be applied at locations designated on the plans and in accordance with the manufacturer's recommendation.

150503.04 METHOD OF MEASUREMENT.

Measurement for Lightweight Foamed Concrete Fill, in cubic yards, will be the quantity shown in the plans.

150503.05 BASIS OF PAYMENT.

A. Payment for Lightweight Foamed Concrete Fill will be at the contract unit price per cubic yard.

B. Payment is full compensation for:

- Furnishing and placing LFCF for the reinforced earth zone, for any core-outs and other remedial/ground improvement locations, and in the zone behind the reinforced earth zone as shown in the plans.
- Preparation of submittals.
- Material testing.
- Coordination and scheduling of LFCF placement with MSE retaining wall erection on site manufacturer representative.
- Specialized equipment to mix, transport and placing LFCF.
- Furnishing and placing geotextile fabric.
- Groundwater and surface water control.
- Temporary shoring.
- Forming.