SPECIAL PROVISION
FOR
MSE WALL WITH LIGHTWEIGHT FOAMED CONCRETE FILL

Pottawattamie County
IM-NHS-080-1(374)4--03-78

Effective Date
October 27, 2015

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.

150008a.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 at locations designated on the plans, and, as specified in these special provisions.

B. The LFCF manufacturer shall be recommended in writing by the MSE wall vendor. The LFCF manufacturer and installer shall coordinate its work with the MSE wall designer/supplier and the MSE wall installer.

C. Section 2432 of the Standard Specifications shall be used with the exception of what is specified herein.

150008a.02 DESIGN AND MATERIALS.

A. Design.

1. Design Requirements.
- **a.** The design by the wall system supplier shall consider the internal stability of the wall mass. Wall design shall be according to the LRFD Bridge Design Specifications AASHTO (2014), with a minimum service life of 75 years.
- **b.** All appurtenances behind, in front of, under, mounted upon, or passing through the wall such as drainage structures, utilities, or other appurtenances shown on the plans shall be accounted for in the stability design of the wall.

2. Submittals.
- **a.** Submit a LFCF quality control (QC) and placement plan. Placement of the MSE backfill 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:

1) An organizational chart including names, telephone numbers, current certifications / titles, roles, and responsibilities of those involved with the quality control program.

2) 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.

3) Materials list of items proposed to be provided under this section.

4) Manufacturer's specifications, catalog cuts, and other engineering data needed to demonstrate compliance with the specified requirements.

5) Mix designs for the LFCF, prepared by the manufacturer, showing compliance with the specified properties.

6) Certification of batch, mixing and placing equipment by the LFCF manufacturer meeting the requirements specified herein.

7) Written evidence of acceptance of the certified producer/supplier by the foam agent manufacturer.

8) Written evidence that LFCF Installer is certified by and approved by the foam agent manufacturer.

9) LFCF curing procedures.

b. 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.

c. 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.

1. The materials used for the LFCF Backfill shall meet the following requirements:

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

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

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

d. 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.

e. 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.

f. 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.

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

PROPERTY	REQUIREMENTS	TEST METHOD
Class B: Maximum/ Minimum Dry Density Minimum Unconfined Compressive Strength 28 days curing Class B	48.0 pcf / 40.0 pcf ~~50 psi /~~120 psi	Unit Weight (ASTM C 796) (No oven drying) 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 below
Coefficient of permeability @ 2.0 psi	1 x 10-5 cm/sec	

150008a.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. Reinforcement Placement within the LFCF.

1. The reinforcement shall be installed in accordance with the manufacturer's recommendations, unless otherwise modified by this special provision. The reinforcement shall be placed within the layers of the LFCF as shown on the plans.

2. The reinforcement shall be placed in continuous longitudinal strips in the direction of the main reinforcement.

3. 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. Care should be taken that the reinforcement is not damaged or displaced during the placement of the LFCF.

4. After the specified LFCF layer has been placed, the next reinforcement layer shall be installed. The process shall be repeated for each subsequent layer of reinforcement and LFCF.

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

6. Reinforcements are to be placed within 3 inches of the design elevations and extend the length as shown on the elevation view unless otherwise directed by the Engineer. Correct orientation of the reinforcement shall be verified by the Contractor.

D. Placement of LFCF.

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

2. 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.

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

4. 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.

5. 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.

6. 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.

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

8. 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.

9. LFCF shall be placed in lifts not exceeding 24 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.

10. 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.

11. 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).

12. 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.

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

14. Limit the area of placement to the volume that can be placed within 1 hour, up to the maximum lift height of 2 feet. Stagger placements such that the vertical joints are at least 10 feet apart.

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

16. 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.

17. 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.

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

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

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

150008a.04 METHOD OF MEASUREMENT.

The quantity of Class B Lightweight Foamed Concrete Fill, in cubic yards, required in the reinforced earth zone and the zone behind the MSE wall reinforcement identified in the contract documents will be the quantity shown in the contract documents. LFCF material placed outside the limits shown on the plans will not be measured for payment unless authorized in advance of placement by the Engineer.

150008a.05 BASIS OF PAYMENT.

A. For Contractor furnished Class B Lightweight Foamed Concrete Fill for the reinforced earth zone; any core-outs or other remedial/ground improvement locations; and placed in the zone behind the reinforced earth zone as shown in the contract documents, the Contractor will be paid for the quantity of material furnished, hauled, and placed at the contract unit price per cubic yard.

B. Payment is full compensation for preparation of written submittals, material testing, coordination of and scheduling of LFCF placement with MSE retaining wall erection, on site manufacturer representative, specialized equipment to mix, transport, and place LFCF, geotextile fabric, groundwater control and temporary shoring, and include all associated costs such as materials, labor, equipment and incidentals necessary to complete the work in accordance with the contract.