



Iowa Department of Transportation

SPECIAL PROVISIONS FOR EXPANDED POLYSTYRENE FILL

Woodbury County
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Effective Date
August 18, 2015

THE STANDARD SPECIFICATIONS, SERIES 2012, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE SPECIAL PROVISIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

120350.01 DESCRIPTION.

A. General.

The work shall consist of designing the size and layout of the expanded polystyrene (EPS) blocks and related aspects of the EPS fill, and furnishing all labor, material, and equipment for placement of EPS block fill, complete, as specified in the contract documents.

B. Design Requirements.

1. Design of the EPS fill block composition and layout shall include the proposed location, layout, and details of all EPS blocks, penetrations, and all necessary items to be used as part of the fills or to construct them. The submitted drawings shall include, but not limited to, plans, elevations, cross-sections showing profiles and cross-slopes, location of penetrations, accessory items as necessary, and construction means and methods as appropriate.
2. The block layout shall be designed in accordance with the following general design requirements:
 - a. The plane on which a given layer of blocks is placed is to be flat and level.
 - b. The longitudinal axes of all blocks within a given layer are to be parallel to each other.
 - c. Within a given layer of blocks, blocks placed in a row are to be offset a minimum of 2 feet relative to blocks placed in adjacent rows of the same layer.
 - d. Each subsequent layer of blocks is to be overlapped and rotated 90 degrees in the horizontal plane from the direction of placement of the layer below to avoid continuous joints.
 - e. The longitudinal axes of the uppermost layer of blocks are to be perpendicular to the longitudinal axis of the road alignment.
 - f. Blocks shall be placed with their smallest dimension oriented vertically.
 - g. The layout of all EPS blocks and attachments shall be within 4 inches of the lines and grades shown on the plans. Inner corners of the blocks shall reach the EPS envelope

shown on the plans.

3. The block layout and details will be reviewed and approved for conformance with the specifications only by the Engineer prior to construction. The EPS fill designer shall remain engineer of record for the EPS block layout and construction.

120350.02 MATERIALS.

- A. All EPS block fill shall consist entirely of expanded polystyrene. EPS shall be fabricated using virgin feedstock manufactured into blocks having no more than five percent regrind content. Previously used EPS blocks are not allowed in part or in full on this project. Blocks shall have a height of at least 32 inches or 16 inches for a half block, a width of at least 48 inches, and a length of at least 96 inches.
- B. EPS blocks used in the surface course of EPS fill for this project shall be grade EPS39 as defined in ASTM D6817. EPS blocks with the top surface of the block 3 feet or more below the surface of the EPS fill shall be grade EPS22 as defined in ASTM D6817. Only EPS39 and EPS22 block material type designations shall be used on all correspondence and communication relate to this project.
- C. Inter-Block Connectors: If required, inter-block mechanical connector ('gripper") plates shall be made of 20 gage (minimum) galvanized steel with two-sided multi-barbed design, or approved equal, capable of piercing the EPS up to 3/4 inch.
- D. Sand: Sand fill and sand blanket shall be natural sand meeting the requirements of Section 4110 or 4134 of the Standard Specifications.
- E. Geomembrane: Geomembrane shall meet the requirements of the Special Provisions for Geomembrane over Expanded Polystyrene Fill.
- F. Subdrains: Drain lines for the toes of the EPS fill shall be 4 inch nominal diameter perforated plastic pipe meeting the requirements of Section 4143 of the Standard Specifications.
- G. Each EPS block shall not deviate from the theoretical dimensions shown on the approved EPS Fill Designer's drawings by more than 0.5% but not to exceed 0.25 inches. The corner or edge formed by any two faces of an EPS block shall be perpendicular, i.e. form an angle of 90 degrees unless indicated to be otherwise on the EPS fill designer's approved drawings. The deviation of any face of the block from a theoretical perpendicular plane or the indicated angle, if different, shall not exceed 0.5%. Any one face of a block shall not deviate from theoretical planarity by more than 0.5%.
- H. The EPS shall contain a flame retardant additive and shall have UL Certification of Classification as to External fire Exposure and Surface burning characteristics so as to comply with the Oxygen Index requirements of ASTM D2863.
- I. All EPS blocks shall be treated by the manufacturer with a tested and proven termite treatment for below-grade applications, 3 year minimum exposure. The termite treatment agent shall be an EPA registered material. The resulting EPS blocks shall be safe for handling and non-corrosive.
- J. The EPS manufacturer will sign a certification that the products furnished comply with or exceed these Special Provisions and ASTM D6817 for EPS. This documentation must state the source (nation of origin) and specifications (including, but not limited to, bead size, flame retardancy, relative content of pentane blowing agent, optional chemical additive such as insect control, and use of oil or any other type of additive intended to assist the molding process) of all EPS. Should

any changes in the source and/or specifications of EPS occur during the course of the project, updated information must be supplied for approval prior to the implementations of any change.

- K. The molder or supplier shall provide written documentation that will indemnify and hold harmless the Iowa DOT against all environmental risks associated with any additive(s) that may exist at present or might develop in the future.
- L. All EPS blocks shall be manufactured using a vacuum-assisted mold. Written documentation and technical information concerning the mold to be used shall be submitted and approved. All EPS blocks shall be adequately seasoned (aged) for a minimum of 72 hours prior to shipment to the project site within a building or other structure that protects the EPS blocks from moisture as well as UV radiation.

120350.03 CONSTRUCTION.

A. Submittals.

1. **EPS Fill Designer and Contractor Experience Requirements:** The EPS fill layout shall be designed by a person with 5 years of experience performing the design of EPS fills. The superintendent employed by Contractor (and subcontractors if used) shall have 3 years of experience in the construction and installation of EPS fills, including a minimum of three projects of similar size as this project. For the qualifications of each of the individuals or the contractor mentioned in this section, a list of EPS fill projects performed shall be provided, along with names and contact information or client and/or owner representatives who can verify the experience referenced.
2. At least 30 calendar days before the planned start of installation, the Contractor shall submit the experience qualifications for the proposed EPS fill designer and contractor/installer. Upon receipt of the experience qualifications submittal, the Engineer shall have 15 calendar days to approve or reject the proposed EPS fill designer and contractor/installer.
3. At least 30 calendar days before the planned start of installation, the Contractor shall submit a copy of the manufacturer's Quality Control program, along with all related documents or documents referenced in this document.
 - a. The Contractor shall supply summaries of test results performed by an independent testing agency compliant with the Material Properties stated in Article SP-120350.02. Product certificates shall be signed by the Supplier to certify material compliance with the specified performance characteristics, criteria, and physical requirements outlined in this Special Provision.
 - b. The Contractor shall submit for approval, supplier's standard warranty document or certificate executed by an authorized company official. Supplier's warranty is in addition to, and not a limitation of, other rights the Iowa DOT may have under contract documents. Upon receipt of the submittals, the Engineer shall have 15 calendar days to approve or reject the submittals.
4. **EPS Fill Design Submittal:** At least 30 calendar days before the planned start of construction or installation of any EPS fill, the Contractor shall submit four sets of complete design drawings, descriptions and related materials for review and approval. The drawings shall include all plan and elevation views, and all details, descriptions, dimensions, quantities, ground profiles, and cross-sections necessary to construct and inspect the EPS fill, and as described in these Special Provisions. The Contractor shall verify the limits of the EPS fill and ground survey data before preparing drawings. If the Contractor's design drawings as originally submitted are not approved and are revised and resubmitted, a minimum of 15 additional working days will be required to review and approve the drawings per each revision

cycle. Construction of the EPS fill shall not begin until the design drawings have been approved.

- a. The Design Submittal shall include:
 - 1) Applicable code requirements and design references.
 - 2) Descriptions of means and methods to avoid displacement or damage of the geomembrane and the EPS Blocks.
 - 3) Design notes including an explanation of symbols and computer programs used in the design.
 - 4) Drawings (plan, elevation, and cross-section views) to show the specific layout, position, orientation and interaction of the EPS blocks. The drawings will be based on the plans and show:
 - a) Project centerline and elevation datum .
 - b) Offset from centerline.
 - c) Stations for beginning and end of EPS fill.
 - d) Centerline of any drainage structure or drainage pipe behind, passing through, or passing under the EPS fill.
 - e) The elevation at the top of the EPS fill at all horizontal and vertical break points, and at least every 25 feet along the EPS fill.
 - f) Elevations at the EPS fill base.
 - g) Existing and finish grade profiles
 - h) Details showing how the EPS fill will be stepped to transition from the EPS fill to the earth embankment.
 - b. Cross Sections showing:
 - 1) Interlocking or keying of the EPS fill into previous EPS fill installations or the existing embankments.
 - 2) Interface and interaction of the EPS fill with proposed abutments of the adjacent bridge.
 - 3) These cross sections shall be provided at a maximum spacing of 50 feet for the length of the EPS fills from beginning to end.
 - 4) A listing of the summary of quantities on each cross section showing estimated square feet and the cubic yards of EPS fill between adjacent cross sections.
5. EPS fill material properties, block dimensions, applicable codes, and any other parameters used in the block composition and layout design.

B. Sampling and Testing.

1. Contractor Quality Control Testing (CQCT) of the EPS block product will be conducted to verify the material submittals. The Contractor shall have primary responsibility for all CQCT, and shall provide reports of all activities including but not limited to results of measurements, test results, data recorded, certifications, measurements, listings of any blocks rejected within two working days of activity and other documents for review and approval. On-site CQCT activities shall be performed in the presence of the Engineer.
2. No EPS block shall be placed until such time as all activities of the construction site CQCT has been completed as specified and in the order as follows:
 - a. Each block of every grade of EPS fill delivered on every truck to the construction site shall be inspected on-site visually to check for damage as well as for verification of the labeled information on each block. Any blocks with damage not meeting the requirements of these Special Provisions will be rejected on the spot, marked "unacceptable", be placed in an area separate from those blocks that are accepted and eventually returned to the molder or supplier at no cost to the State.
 - b. One block from the first truck and at least one block from every 325 cubic yards of EPS fill delivered to the construction site shall be tested for compliance with the materials properties of ASTM D6817. Each 325 cubic yards of EPS fill is considered one sample

- size. Properties to be tested for are dry density and compressive resistance at 1% and 10% strain. Additional blocks of each sample size may be selected for testing when in the opinion of the Engineer, additional sampling and testing is needed
- c. If any of the tests from the 325 cubic yard sample size fails then three additional samples shall be taken from the block number and three additional samples shall be taken from the 325 cubic yard sample size. Each additional sample shall be tested for dry density and compressive resistance at 1% and 10% strain.
 - d. If any of the three additional samples from the block number fails any of the tests then that entire block number will be rejected. If any of the three samples from the 325 cubic yard sample size fails, the re-sampling process will be repeated.
3. Independent assurance consisting of laboratory testing for compliance with the material properties of ASTM D6817 will be conducted by the Engineer at a rate of 1 set per 3000 cubic yards. The Contractor under the direction of the Engineer shall sample the cubes to be supplied to the Engineer for independent assurance. The Engineer will determine the block(s) to be sampled.
- a. If unsatisfactory results are obtained, the Contractor shall remove potentially defective EPS blocks and replace them with blocks of acceptable quality at no additional expense to the State.
 - b. Portions of sampled blocks that are damaged by sampling or used for testing are not acceptable for construction. Portions of sampled blocks that are not damaged or otherwise compromised by the sampling and are otherwise acceptable can be used as desired by the Contractor provide that they comply with all other requirements of this Special Provision and the Contractor's requirements.
 - c. The Contractor shall allow for early delivery of the EPS blocks to the construction site to allow for conducting laboratory testing of the blocks. For those truckloads where EPS blocks will be selected for sampling and testing, as described above, a minimum of 5 business days, or longer time if required to complete laboratory testing, are required prior to their scheduled installation to allow for samples to be taken and laboratory testing conducted. Any shipment of EPS blocks, for which the representative samples fail to meet the parameters outlined in this Special Provisions are considered defective and shall be replaced by the Contractor with non-defective EPS block at no additional cost or time to the State.
 - d. The construction site quality assurance shall include preparation of as-built drawings as well as additional record keeping to document the location of all EPS blocks placed for the project.

C. Delivery, Storage, Handling.

1. The Contractor shall prevent any damage to the EPS blocks during delivery, handling, storage, and construction, and shall visually inspect each block for damage. EPS blocks with cracks of any size are not acceptable and shall be rejected. Holes shall not be created in the blocks at any stage of manufacturing, storage or construction to facilitate shipping or handling of the blocks. Damaged blocks shall be rejected and must be replaced by the Contractor with undamaged equal EPS blocks at no additional cost.
2. Each EPS block shall be labeled to indicate the name of the Molder (if there is more than one for a given EPS fill structure), the date the block was molded, the mass of the entire block in pounds as measured after a satisfactory period of seasoning as specified in the materials section of this Special Provisions, the dimensions of the block in inches and the actual dry unit weight in pounds per cubic foot.
3. Additional identification markings using alphanumeric characters and/or symbols, applied as necessary by the Supplier, to indicate the location of placement of each block relative to the Contractor's approved design drawings shall also be provided. Stripes of different color paint

shall be utilized to identify blocks of their grade of EPS. The use of no marking shall be considered an acceptable marking for the lower (lowest) grade EPS blocks supplied. Any paint, etc., used to mark EPS blocks shall be chemically compatible with EPS and not cause any dissolution of the EPS during, or subsequent to, application of the paint.

4. If the EPS blocks are to be stockpiled at the construction site until placement, a secure storage area shall be identified and designated by the Contractor for this purpose, subject to approval. The storage area shall be away from any heat source, hydrocarbon fuels, or smoking. EPS blocks in temporary on-site storage shall be protected from damage by wind, heat, sunlight, or equipment.
5. Correct damage to EPS as follows:
 - a. Slight damage (<0.12 cubic feet with no linear dimension >1 foot) may be left in place as is.
 - b. Replace EPS blocks with damage (i.e., exceeding the "slight" category) with EPS blocks which meet the specifications. EPS blocks exceeding the slight damage criteria may be cut to eliminate the damage and the remaining undamaged portion of the block may be used within the fill, provided the undamaged portion of the block meets all other requirements.

D. Site Preparation.

The site for the EPS fill shall be prepared as follows:

1. The surface to receive EPS fill shall be excavated to the grades indicated on the contract drawings and a minimum 8 inch thick sand blanket placed at the base of the excavation. Standing water will not be allowed to collect in the excavation. The sand blanket shall be compacted by tamping by hand or with light equipment such as plate vibrators.
2. The subgrade surface upon which the EPS blocks will be placed shall be flat, level, and smooth prior to the placement of the first block layer. The required smoothness is defined as a vertical deviation of no more than 0.4 inches over a 10 foot horizontal distance.
3. There shall be no standing water or accumulated snow or ice on the sand bedding within the area where EPS blocks are placed at the time of block placement. EPS blocks shall not be placed on a frozen subgrade.

E. Execution.

Set, maintain, and reset all alignment stakes, slope stakes, and grade stakes necessary for the construction of the EPS fill. This includes, but is not limited to subgrade preparation, and all appurtenances within the limits of the EPS fill and load distribution layer.

1. EPS Block Placement.

- a. The Contractor shall be responsible for safety during EPS fill placement. Special attention shall be given to handling and placement of blocks in windy, wet or sub-freezing weather.
- b. EPS blocks shall be placed at the locations and in configurations shown on the Contractor's approved design drawings.
- c. There shall be no debris, standing water or accumulated snow, ice or frost between adjacent surfaces of EPS blocks at the time adjacent EPS blocks are placed.
- d. EPS blocks shall be placed so that all vertical and horizontal joints between blocks are tight. Where EPS block is placed against a cut in soil for benching or keying into the existing ground or new embankment, if there are gaps between EPS blocks and adjacent soil cut, the space shall be filled with sand and hand tamped.
- e. Blocks placed next to exterior vertical surfaces shall be placed such that the resulting exterior surfaces on the sides of the EPS fill structures are vertical and planar within a tolerance of +/- 1/8 inch between blocks. Block faces not satisfying this criterion shall be

field trimmed using a hot wire cutting apparatus to achieve the desired evenness within the above tolerance.

- f. Care shall be exercised during placement of cover material so as not to cause any damage to the EPS blocks or displacement or damage to the geomembrane. The surfaces of the EPS blocks and the overlying geomembrane shall not be directly traversed by any vehicle or construction equipment during or after placement of blocks. If construction traffic is required before the load distribution slab is complete, a minimum thickness of 1 foot of temporary sand protection shall be required before traffic or construction equipment will be allowed over the blocks.
 - g. The Contractor shall provide temporary soft weighting or guying of the blocks as necessary until cover materials are in place. The Contractor shall be responsible for disposal of EPS block material or portions of unused blocks resulting from testing or construction by returning it to the supplier/molder for recycling. Such process shall be conducted on a regular basis or as directed.
- 2. Geomembrane Placement.**
- Geomembrane shall be placed continuously as shown in the plans and in accordance with the Special Provisions for Geomembrane over Expanded Polystyrene Fill. The geomembrane shall be placed directly on the top layer of EPS fill, and shall be pulled taut and free of wrinkles before placement of fill over it. Joints between adjacent sheets or ends of sheets of geomembrane shall be spliced or otherwise connected in accordance with the Special Provisions for Geomembrane over Expanded Polystyrene Fill. The result of the splices or methods of connecting adjacent sheets of geomembrane shall be that a continuous sheet of the material having the specified minimum strength at all locations and in all directions within the plane of the geomembrane shall be provided over the entire area of the EPS fill.

3. Load Distribution Slab Construction.

The cover materials, load distribution slab, and special backfill shall be installed over the EPS fill and/or geomembrane using appropriate labor and equipment that will not damage the EPS fill or the geomembrane. No vehicles or construction equipment shall traverse directly on the EPS blocks or on the geomembrane. Materials for the load distribution layer shall not be pushed onto the geomembrane and EPS fill. Materials shall be placed using a method that does not displace or drag the geomembrane or the EPS blocks.

120350.04 METHOD OF MEASUREMENT.

The item for EPS fill will be the cubic yards in place within the limits indicated in the plans. The Engineer will measure the quantity of EPS fill in cubic yards.

120350.05 BASIS OF PAYMENT.

The Contractor shall be paid the contract unit price per cubic yard for EPS Fill. This payment shall be full compensation for furnishing, trimming, and placing the EPS fill, providing construction survey for EPS fill, pre-construction certification and construction site testing of the EPS material, and all labor, equipment and incidentals needed to complete the work. Incidentals include inter-block connectors, if required; items used for storage and protection of the EPS fill; sand fill and sand blanket; sand for filling gaps between EPS blocks or between the EPS fill and sides of overexcavation or overlying Class 10 fill; subdrains and outlet pipes; and removal of all leftover materials, blocks, cuttings from blocks, equipment and supplies at the completion of the project.