

MECHANICALLY STABILIZED EARTH (MSE) ABUTMENT BACKFILL SYSTEM

****From Waitsfield BRF 013-4(39)**

- xx. DESCRIPTION. This work shall consist of fabricating, transporting, and constructing a mechanically stabilized earth (MSE) abutment backfill system, in accordance with the specifications, and in reasonably close conformity with geometry and dimensions shown on the Plans or as established by the Engineer.

The mechanically stabilized earth abutment backfill system shall consist of connecting high adherence reinforcing strips (with ribs perpendicular to their long axis) to Precast Concrete Structure (Abutment No. 2), and placing/compacting select granular backfill in multiple lifts to specified elevations. The high adherence reinforcing strips allowed for this project shall correspond with the approved (and fully evaluated) systems associated with Mechanically Stabilized Earth (MSE) Walls noted in the Agency's "VAOT Earth Retaining System Selection Chart", located at the following link.

https://outside.vermont.gov/agency/vtrans/external/docs/construction/03_GeotechEng/Engineering/MandRSoilAPPROVED_Retaining_Walls_8-2012_Final%20Engineering.pdf

- xx. MATERIALS. The Contractor shall make arrangements to purchase from the supplier the materials covered herein, including ribbed steel reinforcement strips, attachment devices, fasteners, and all necessary incidentals. The Contractor, or the supplier as the Contractor's agent, shall furnish the Engineer a certificate of compliance certifying that the applicable materials comply with these provisions. Materials not conforming to these provisions shall not be used without written consent of the Engineer.

- (a) Soil Reinforcing and Attachment Devices. All reinforcing and attachment devices shall be carefully inspected to ensure these are true size and free from defects that may impair their strength and durability.

- (1) Ribbed Steel Reinforcing Strips. Reinforcing strips shall be hot rolled from bars to the required shape and dimensions. Their physical and mechanical properties shall conform to ASTM A-572 Grade 65. Galvanizing shall conform to the minimum requirements of ASTM A-123 or AASHTO M111. The galvanizing thickness shall be 2 oz/ft².

- (2) Tie Strips. Tie strips shall be shop fabricated from hot rolled steel conforming to the minimum requirements of ASTM A1011 (formerly A-570), Grade 50. Galvanizing shall conform to ASTM A-123 or A-153. The minimum coating thickness shall be 2 oz/ft².

- (3) Fasteners. Fasteners shall consist of galvanized hexagonal cap screw bolts and nuts conforming to the requirements of ASTM A449 and galvanized per ASTM A-153.

- (b) Select Granular Backfill. Select granular backfill material shall be reasonably free from organic and otherwise deleterious

materials, and shall conform to the following gradation limits as determined in accordance with AASHTO T 27:

Sieve Size	Percent Passing
101.6 mm (4 inch)	100
75 mm (3 inch)	75 - 100
.425 mm (No. 40)	0 - 60
75 mm (No. 200)	0 - 12

In addition the backfill shall conform to the following requirements.

- (1) Plasticity Index. The Plasticity Index (P.I.), as determined by AASHTO T 90, shall not exceed six.
- (2) Soundness. The material shall be substantially free of shale or other soft particles with poor durability characteristics. The material shall have a sodium sulfacte soundness loss of less than 8 percent after five (5) cycles, as determined by AASHTO T 104.
- (3) Electrochemical Requirements. The backfill material shall conform to the following requirements.

PROPERTY	REQUIREMENT	TEST METHOD
Resistivity at 100% saturation	Minimum 3000 ohm-cm	AASHTO T288
pH	Acceptable Range 5 - 10	AASHTO T289
Sulfates	Maximum 200 ppm	AASHTO T290
Chlorides	Maximum 100 ppm	AASHTO T291
Organic Content	<1%	AASHTO T267

Backfill not conforming to these provisions shall not be used without the written consent of both the Engineer and supplier.

- (4) Uniformity Coefficient. Backfill material shall have a minimum uniformity coefficient, C_u , of 2.

xx. SUBMITTALS. The Contractor shall submit five (5) sets of fabrication and construction drawings for approval prior to beginning of construction.

- (a) Working drawings shall be submitted to the Engineer for review an approval a minimum of four (4) weeks before work is to begin and shall include but not limited to the following:
 - (1) An elevation view(s) of Abutment No. 2, which shall include elevations at all horizontal and vertical break points, the length of reinforcing strips, the distance along the face of the wall to where changes in length of the reinforcing strips occur, and an indication of the final ground line.
 - (2) Typical cross section(s) showing the elevation relationship between ground conditions and proposed grades, including existing ground elevations that have been verified by the Contractor for entire abutment and wingwall elements.

- (3) General notes pertaining to the wall construction.
 - (4) A listing of the summary of quantities on the elevation sheet for each element.
 - (5) The details for diverting reinforcing strips around Wingwall 3.
 - (6) The details for the connection between the abutment and reinforcing strips.
 - (7) Other information required in the Contract Documents or requested by the Engineer.
- (b) Approval of the Contractor's Working Drawings shall not relieve the Contractor of any responsibility under the Contract for the successful completion of the work.

xx. CONSTRUCTION.

- (a) Manufacturer's Representative. The Contractor shall make the necessary arrangements with the wall supplier to have a technical representative on the project to supervise the initial placement of the mechanically stabilized earth abutment backfill system. The technical representative shall also be required to be on-site any time during wall installation as requested by the Engineer. The representative shall be available for a minimum of 5 work days.
- (b) Placement of Reinforcements. Prior to the first layer of reinforcements, backfill shall be placed and compacted in accordance with part (c) of this Subsection. Soil reinforcements shall be placed normal to the face of the wall, unless otherwise shown on the Plans or directed by the Engineer. If skewing of the soil reinforcements is required due to obstructions in the reinforced fill, the maximum skew angle shall not exceed 15 degrees from the normal position.
- (c) Backfill Placement. Backfill placement shall closely follow erection of each course of panels. Backfill shall be placed in such a manner as to avoid any damage or disturbance to the abutment. Any precast materials which become damaged or disturbed during backfill placement shall be corrected or removed and replaced at the Contractor's expense, as directed by the Engineer.

No backfill shall be placed until test results from a qualified independent testing laboratory have been submitted for the proposed material. Test results shall demonstrate conformance with the backfill requirements included in these provisions.

Backfill shall be compacted to 95 percent of the maximum density as determined in accordance with AASHTO T 99, Method C or D (with oversize correction). The moisture content of the backfill material prior to and during compaction shall be uniform throughout each layer. Backfill material shall have a placement

moisture content less than or equal to the optimum moisture content. Backfill material with a placement moisture content in excess of the optimum moisture content shall be removed and reworked until the moisture content is uniform and acceptable throughout the entire lift. The optimum moisture content shall be determined in accordance with AASHTO T 99, Method C or D (with oversize correction).

The frequency of sampling of Select Granular Backfill material, necessary to assure gradation control throughout construction, shall be as directed by the Engineer. If 30 percent or more of the Select Granular Backfill material is greater than 19 mm (3/4 inch) in size, AASHTO T 99 is not applicable. For such material, the acceptance criterion for control of compaction shall be either a minimum of 70 percent of the relative density of the material, as determined by ASTM D 4253 and D 4254 or a method specification (based on a test compaction section) which defines the type of equipment, lift thickness, number of passes of the specified equipment, and placement moisture content.

The maximum lift thickness after compaction shall not exceed 250 mm (10 inch), regardless of the vertical spacing between the reinforced soil layers. The Contractor shall decrease this lift thickness, if necessary, to obtain the specified density. Prior to placement of the reinforcements, the backfill elevation, after compaction, shall be 50 mm (2 inches) above the attachment device elevation from a point approximately 300 mm (12 inches) behind the back face of the panels to the free end of the soil reinforcements, unless otherwise shown on the Plans.

Compaction within 900 mm (3 feet) of the back face of the panels shall be achieved by a minimum of three (3) passes of a lightweight mechanical tamper, roller or vibratory system. The specified lift thickness shall be adjusted as warranted by the type of compaction equipment actually used, but no soil density tests need be taken within this area. Care shall be exercised in the compaction process to avoid misalignment of the panels or damage to the attachment devices. Heavy compaction equipment shall not be used to compact backfill within 900 mm (3 feet) of the wall face.

At the end of each day's operation, the Contractor shall slope the last level of backfill away from the wall facing to direct runoff of rainwater away from the wall face. In addition, the Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

- xx. METHOD OF MEASUREMENT. The quantity of Special Provision (Mechanically Stabilized Earth Abutment Backfill System) (FPQ) to be measured for payment will be the number of cubic yards complete in place in the accepted work, measured within the limits specified on the Plans or as directed by the Engineer.

- xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (Mechanically Stabilized Earth Abutment Backfill System) (FPQ) will be paid for at the Contract unit price per cubic yard. Payment shall include full compensation for detailing, fabricating, furnishing,

transporting, and erecting the mechanically stabilized earth abutment backfill system, including preparing all required submittals; for materials required but not limited to select granular backfill, PVC pipe, drainage aggregate, soil reinforcements, attachment devices, fasteners, and geotextiles; for preparing the wall foundation, proof rolling foundation soils ,and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.608 Special Provision (Mechanically Stabilized Earth Abutment Backfill System) (FPQ)	Cubic Yard