

RETAINING WALL

****From Stowe BHF 0235(15)**

****From Cavendish RREW12K**

- xx. DESCRIPTION. This work shall consist of designing, detailing, fabricating, furnishing, and erecting a retaining wall at the location(s) specified and in conformance with the lines and grades shown on the Plans or as directed by the Engineer.
- xx. DESIGN REQUIREMENTS. The design shall be performed in accordance with the AASHTO LRFD Bridge Design Specifications and the design criteria specified in the Plans.

Acceptable earth retaining systems are those included in the "VAOT Earth Retaining System Selection Chart", available on the Agency's website at the following address:

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

Prefabricated earth retaining systems shall employ concrete facing.

All wall components shall have a minimum design life of 75 years.

- xx. MATERIALS. Materials shall meet the following requirements:
 - (a) Precast Concrete. Precast Concrete shall meet the requirements of Section 540.
 - (b) Cast-in-Place Concrete. Cast-in-place concrete shall meet the requirements of Section 501 for Concrete, High Performance Class B, unless otherwise specified in the Contract Documents.
 - (c) Reinforcing Steel. Reinforcing Steel shall meet the requirements of Section 507.
 - (d) Backfill. Backfill shall meet the following requirements:
 - (1) Gradation Limits. Select granular backfill material used in walls 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:

<u>SIEVE SIZE</u>	<u>PERCENT PASSING</u>
101.6 mm (4 inch)	100
75 mm (3 inch)	75 - 100
0.425 mm (40)	0-60
75 µm (200)	0 - 12

- (2) Plasticity Index. The Plasticity Index (P.I.), as determined in accordance with AASHTO T 90, shall not exceed six.

- (3) Soundness. The material shall be substantially free of shale or other soft particles with poor durability characteristics. The material shall have a sodium sulfate soundness loss of less than 8 percent after five (5) cycles, as determined in accordance with AASHTO T104.

Select granular backfill shall have a minimum uniformity coefficient, Cu, of 2.

In addition to these requirements, backfill for walls using metallic soil reinforcing shall meet the following:

<u>PROPERTY</u>	<u>REQUIREMENT</u>	<u>TEST METHOD</u>
Resistivity at 100% saturation	Minimum 3000 ohm-cm	AASHTO T 288
pH	Acceptable Range 5 - 10	AASHTO T 289
Sulfates	Maximum 200 ppm	AASHTO T 290
Chlorides	Maximum 100 ppm	AASHTO T 291
Organic Content	< 1%	AASHTO T 267

Backfill not conforming to this specification shall not be used unless approved in writing by the Engineer and wall supplier.

Backfill material shall be compacted in accordance with the manufacturer's recommendations and Contract specifications.

- (e) Geotextile. Geotextile shall be a non-woven fabric meeting the requirements of Section 649 for Geotextile for Roadbed Separator, unless otherwise specified by the wall supplier.
- (f) Soil Reinforcing and Attachment Devices for MSE wall systems. All reinforcing and attachment devices shall be carefully inspected to ensure they are true size and free from defects that may impair their strength and durability.
- (1) Reinforcing Mesh Elements. Reinforcing mesh elements shall be shop fabricated from cold drawn steel rod conforming to the minimum requirements of AASHTO M 32M/M 32 and shall be welded at the junctions between longitudinal and transverse wires in accordance with AASHTO M 55M/M 55. Galvanization shall be applied after mesh fabrication and shall conform to the minimum requirements of AASHTO M 111M/M 111. The galvanizing thickness shall be determined and specified based on the design life requirements of the structure.
- (2) Loop Embeds. Loop embeds shall be fabricated from cold drawn steel rod conforming to AASHTO M 32M/M 32. Loop embeds shall be welded in accordance with AASHTO M 55M/M 55. Loop embeds shall be galvanized in accordance with AASHTO M 232M/M 232.

- (3) Reinforcing Strips. Reinforcing strips shall be hot rolled from bars to the required shape and dimensions. Their physical and mechanical properties shall conform to AASHTO M 223 or equal. Galvanization shall conform to the minimum requirements of AASHTO M 111M/M 111. The galvanizing thickness shall be determined and specified based on the design life requirements of the structure.
- (4) Tie Strips. The tie strips shall be shop fabricated of hot rolled steel conforming to the minimum requirements of ASTM A 570, Grade 50 or equivalent. Galvanization shall conform to AASHTO M 111M/M 111 or AASHTO M 232M/M 232. The minimum coating thickness shall be 0.610 kg/m².
- (5) Fasteners. Fasteners shall consist of galvanized hexagonal cap screw bolts and nuts conforming to the requirements of AASHTO M 164 or equivalent. Fasteners shall be galvanized in accordance with AASHTO M 232M/M 232.
- (6) Joint Material. Joint material shall meet the requirements of Subsection(s) 707.06, 707.07, 707.08, or 707.09, unless otherwise specified in the Contract Documents or as part of an approved retaining wall system.
- (7) Bearing Pads. Bearing pads shall be preformed EDPM rubber pads conforming to ASTM D 2000 M2AA 807, having durometer hardness equal to 80±5.
- (8) Joint Cover. Horizontal and vertical joints between panels shall be covered by a geotextile. The geotextile may be either a non-woven needle punched polyester geotextile or a woven monofilament polypropylene geotextile meeting the requirements of Section 720 for Geotextile Under Stone Fill. The wall supplier shall approve adhesive used to hold the geotextile filter fiber material to the rear of the facing panels prior to backfill placement.

xx. SUBMITTALS. Working Drawings shall be submitted to the Structures Engineer in accordance with Section 105. The submittal shall include all detailed design computations and details, dimensions, quantities and cross sections necessary to construct the wall. In addition, the submittal shall include, but not be limited to, all of the following that apply to the particular wall system being constructed:

- (a) Complete design calculations substantiating that the proposed design satisfies the design parameters in the Contract Documents. The wall design calculations shall be signed, stamped, and dated by a Professional Engineer. The Contractor shall not start work on any earth retaining system for which Working Drawings are required until the Engineer has approved such drawings.
- (b) A plan view of the wall showing the limit of the widest module, tiebacks, nails, mesh, or strip and the centerline of any drainage pipe which is behind or passes under or through the wall.

- (c) An elevation view of the wall which shall include the elevation at the top of the wall at all horizontal and vertical break points and at least every 15 m (50 ft) along the face of the wall, all steps in the leveling pads, the designation as to the type of panel, the length of soil reinforcing elements, the distance along the face of the wall to where changes in length of the soil reinforcing elements occur, and an indication of the final ground line and maximum calculated bearing pressures.
- (d) A typical cross section or cross sections showing the elevation relationship between ground conditions and proposed grades.
- (e) All details for foundations and leveling pads, including details for steps in the footings or leveling pads, as well as design maximum and minimum bearing pressures.
- (f) Details of the drainage systems or other facilities required to accommodate the system.
- (g) The details for connection between the wall and the soil reinforcements.
- (h) The details for diverting soil reinforcements around obstructions such as piles, catch basins, and other utilities.
- (i) All reinforcing details, including reinforcing bar bending details.
- (j) Any general notes required for the construction of the wall.
- (k) A listing of the summary of quantities on the elevation sheet for each wall.

Any construction drawings required for elements meeting the requirements of Section 540 shall be submitted and shall meet the requirements of Subsection 540.04.

All design and construction details will be checked by the Agency's Structures and Materials and Research Sections. Approval of the detailed design and plans, and notification to begin the work, will be made by the Structures Section. The Contractor shall allow the Agency 30 calendar days to review and approve the Working Drawings.

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. PRECAST CONCRETE INSPECTION. Precast concrete inspection will be in accordance with Subsection 540.06.

The Fabricator shall provide a tentative casting schedule to the Engineer and Structural Concrete Engineer for the following casting week a minimum of 3 calendar days prior (a casting week will be Sunday to Saturday). The Fabricator shall maintain a Quality Control file that shall contain at a minimum the piece identification, date and time cast, concrete test results, quantity of concrete used per element, batch quantity printout, cylinder results, and aggregate gradation and moisture.

- xx. METHOD OF MEASUREMENT. The quantity of Special Provision (Retaining Wall) to be measured for payment will be the number of exposed square meters (square feet) of wall surface area complete and in place in the accepted work. The height of exposed face shall be the difference between the top of the wall and the top of the finish ground along the front face of the retaining wall.

- xx. BASIS OF PAYMENT. The accepted quantity of Special Provision (Retaining Wall) will be paid for at the Contract unit price per square meter (square foot). Payment will be full compensation for designing, detailing, fabricating, and installing the materials specified, including but not limited to the geotextile fabric, backfill material, concrete, bar reinforcement and welded steel wire fabric, drainage pipe, drainage aggregate, precast concrete facing panels, soil reinforcements, attachment devices, fasteners, bearing blocks, shims, geomembrane, geotextile, and expansion material; any excavation, sheeting, bracing, dewatering, and siltation control; preparing and submitting Working Drawings; and for furnishing all labor, tools, equipment, and incidentals necessary to complete the work.

Any grouting work, such as fairing out unevenness between adjacent concrete pieces and filling leveling screw holes, shear keys, transverse anchor recesses, and dowel holes, is considered incidental to the work for Special Provision (Retaining Wall).

Payment will be made under:

<u>Pay Item</u>	<u>Pay Unit</u>
900.645 Special Provision (Retaining Wall)	Lump Sum
900.670 Special Provision (Retaining Wall)	Square Foot
900.675 Special Provision (Retaining Wall)	Square Meter