

SECTION 32 32 23

CONCRETE SEGMENTAL RETAINING WALL SYSTEM

PART 1 GENERAL

1.01 SUMMARY

- A. The work under this section of these specifications includes, or is incidental to, the design, furnishing, and constructing a modular block retaining wall as indicated on the drawings or as specified herein. The work shall include the footings, drainage, the modular block, anchoring devices, railings, specified accessories and related items of construction.
- B. Related Sections:
 - 1. Section 01 57 13 - Temporary Erosion and Sediment Control.
 - 2. Section 31 23 00 - Excavation and Fill.

1.02 PRICE AND PAYMENT PROCEDURES

- A. Measurement and Payment
 - 1. The measurement for the pre-cast concrete wall shall be the area in square feet of the entire wall face above the footing furnished and installed as specified.
 - 2. Payment shall be at the Contract price per square foot under Concrete Block Retaining Wall and shall be compensation in full for all costs to construct the wall complete in-place.
 - 3. The footing block, a minimum of 1 row, shall be incidental to the cost of the wall.
- B. The furnishing and installing of specific items and/or the performance of work under certain circumstances shall not be individually paid. The costs shall be included in the unit price bid for the associated retaining wall items. Such items of work include but are not limited to:
 - 1. Furnishing and installing appropriate sub-drainage, including piping and granular backfill, include in the price bid for retaining wall.
 - 2. Excavation, furnishing and installing granular footing material, and backfilling, include in the price bid for retaining wall.
 - 3. Furnishing and installing any anchoring support necessary, include in the price bid for retaining wall.
 - 4. Furnishing and installing a geosynthetic wall reinforcement system, include in the price bid for retaining wall.
 - 5. Disposal of any excess or unsuitable excavated material, include in the price bid for retaining wall.
 - 6. Protecting existing improvements from damage included in the price bid for retaining wall.
 - 7. Gradation and compaction testing to meet requirements of source and field quality control include in the price bid for retaining wall.
 - 8. Preparation, furnishing, and applying surface sealer as specified herein, include in the price bid for retaining wall.

1.03 REFERENCES

- A. The design shall be per AASHTO and the MnDOT Road Design Manual.
- B. The materials, design, fabrication and erection of the retaining wall, foundation, geosynthetic wall reinforcement and associated items shall conform to the current MnDOT Specification Section 2411

- Minor Concrete Structures and MnDOT Technical Memorandum No. 03-07-MRR-03 or updates thereto, except as modified herein

- C. The material, excavation and backfill for the retaining wall and associated items shall conform to the current MnDOT Specification Section 2451 - Structure Excavations and Backfill, except as modified herein.
- D. Unless otherwise noted, the provisions in this Section are in addition to the referenced specifications.
- E. In addition, all work and equipment shall conform to the most current applicable OSHA standards.

1.04 SUBMITTALS

- A. The successful bidder shall submit detailed design drawings and computations for the construction of the modular block retaining wall.
 - 1. The drawings and computations shall include, but not be limited to, footing / foundation drawings, wall details, anchoring requirements, compaction requirements, subdrainage details, railing details, re-bar schedules and other drawings and details that are appropriate for the successful completion of the project.
 - 2. Each manufacturing facility shall provide the State Materials Engineer with a copy of its quality control plan and procedures, including testing rates and material sources.
 - 3. Each manufacturing facility shall also supply test reports and documentation to verify compliance with this Specification.
 - 4. Included shall be a typical section detailing excavation limits, geotextile locations, block embedments, leveling pad dimensions, backfill, etc.
 - 5. Include as many sections and other views necessary for the construction and inspection of the wall. The information on embedment, geotextile locations, and geotextile lengths as they relate to wall heights may be shown in tabular form.
 - 6. Also included shall be pertinent information on the individual blocks, the geotextile material and compaction requirements.
 - 7. All drawings submitted by the Contractor shall be certified and signed by a Professional Engineer registered in the State of Minnesota.
 - 8. Each plan sheet shall clearly identify the name of the responsible engineering firm and the name of the person certifying the plan.

PART 2 PRODUCTS

2.01 MATERIALS

- A. The pre-cast walls shall be segmented block walls similar to those manufactured by the following or an approved equal:
 - 1. Keystone Retaining Wall Systems
 - 2. Rockwood Wall Systems
 - 3. Anchor Wall System
 - 4. Versa-lok
 - 5. Allan Block
- B. Product information shall be submitted to the Engineer to approve the color and texture.
- C. The blocks shall have a minimum compressive strength of 3000 psi and a maximum absorption of 6 percent for all local projects. All Mn/DOT funded projects shall have block with a minimum compressive strength of 5800 psi and a maximum absorption of 5 percent.

- D. If a fence is required along the top of the wall, the wall shall be designed to include the additional loading. The geogrid shall be designed and reinforced around the openings for fence footings.
- E. When the longitudinal slope of the footing is greater than 10:1, the footing may be stepped.
- F. Utilities shall be located outside the construction limits of the retaining wall. Any utilities needing to be located within this area shall be installed as the wall is being constructed. Once the geotextile layers are installed, neither the geotextile nor the utility shall be disturbed at any time. Any future maintenance on the utility will require dismantling the wall.
- G. When the exposed height of the wall is less than 4.0 feet the following shall apply:
- H. The pre-cast wall system shall be constructed in accordance with the manufacturer's recommendations upon approval of the design methodology by the Engineer.
- I. When the exposed height of the wall is greater than or equal to 4.0 feet, or will support a roadway or structure within a distance from the top of the wall equal to the design height of the wall, the following shall apply:
 - 1. The wall shall be designed and the detailed drawings prepared by a Professional Engineer experienced in retaining wall design that is registered in the State of Minnesota. The design computations and the plans shall be certified by the Engineer and submitted to the wall Owner for their permanent record. The design shall be per AASHTO and the Mn/DOT Road Design Manual.
 - 2. The detailed drawings shall contain all the necessary information for the construction of the wall. Included shall be a typical section detailing excavation limits, geotextile locations, block embedments, leveling pad dimensions, backfill, etc. Include as many sections and other views necessary for the construction and inspection of the wall. The information on embedment, geotextile locations, and geotextile lengths as they relate to wall heights may be shown in tabular form. Also included shall be the pertinent information on the individual blocks, the geotextile material and compaction requirements.
 - 3. All plan sheets shall clearly identify the name of the responsible engineering firm and the name of the person certifying the plan. Each sheet shall be certified.
 - 4. The typical section shall conform to figure 9-4.03A (Mn/DOT Mechanically Stabilized Retaining Wall) and keynotes in the Mn/DOT Road Design Manual.
 - 5. When the exposed height of the wall is greater than or equal to 10.0 feet, or will support a roadway or structure, the final certified retaining wall plan must be approved by State Aid Bridge Office prior to the construction of the modular block retaining wall.
- J. SURFACE SEALER
 - 1. Surface sealers shall meet the requirements on file in the Mn/DOT Concrete Engineering Unit (651/779-5572). The list may also be viewed on the Mn/DOT website at www.mrr.dot.state.mn.us/pavement/concrete/products.asp
- K. GEOSYNTHETIC WALL REINFORCEMENT
 - 1. No exception to the referenced specification is made.
- L. SUB-SURFACE DRAINS
 - 1. Perforated PVC drain pipe, SDR35 (ASTM D3034)
 - 2. Perforated PVC drain pipe, A-2000 (ASTM D2412)
 - 3. Perforated corrugated polyethylene drainage tubing, PE (ASTM D3350)
 - 4. Cleanout caps on inspection tees shall be cast iron screw in type.
- M. GEOTEXTILE SOCK

1. The geotextile sock shall conform to the requirements of MnDOT 3733, Type I.

N. GRANULAR MATERIALS

1. The filter aggregate shall conform to the requirements of MnDOT 3149-H for coarse filter aggregate.

PART 3 EXECUTION

3.01 GENERAL

- A. Shown in the Plans are Plan and Elevation views including all horizontal and vertical controls. Soil information, if not provided, including boring locations, soil types, and bearing information needed to design the wall(s) may be available from the Engineer. If not available it shall be the responsibility of the wall designer to obtain the information. See MnDOT Spec. 1205 regarding use of the soils information.
- B. The pre-cast walls shall be constructed in the location and configuration as shown on the cross sections. The Engineer reserves the right to alter this alignment to improve constructability and aesthetics.
- C. All work shall be done in accordance with the approved drawings.

D. SEALER

1. Segmental masonry retaining wall surface sealing shall consist of preparation, furnishing and applying the surface sealer to the top, exposed front face, and backside of the upper three courses of all walls.
2. Due to the potentially hazardous ingredients contained in sealer formulations extreme care must be exercised in their handling and use, and the manufacturer's recommendations shall be closely followed.
3. The Contractor shall comply with the manufacturers written instructions for preparing, handling and applying the surface sealer.
4. The surface to be treated shall receive a light water-blast to the extent that the surface is clean and free of oils.
5. Before the surface sealer is applied the surface to be sealed shall be dry and free of all dust, debris, and frost.
6. Surface sealers shall be applied at the heaviest application rate specified by the manufacturer.

3.02 SOURCE QUALITY CONTROL

- A. The minimum required sampling rate for laboratory testing is one sample set per 10,000 units or fraction thereof, with a minimum of one sample per product type per contract. Sample size = 5 whole units per block type. Wall units and cap units are considered separate block types.
- B. The units shall conform to ASTM C1372, except that:
 1. The minimum compressive strength requirements shall be 38 Mpa (5500 psi) for any individual unit and 40 Mpa (5800 psi) for the average of 3 units.
 2. The freeze/thaw durability of wall units tested in accordance with ASTM C 1262 in a 3% saline solution shall be the minimum of the following:
 - a. The weight loss of each of five test specimens at the conclusion of 90 cycles shall not exceed 1% of its initial weight; or
 - b. The weight loss of 4 out of 5 test specimens at the conclusion of 100 cycles shall not exceed 1.5% of its initial weight, with the maximum allowable weight loss for the 5th specimen to not exceed 10%.

- C. The freeze/thaw durability of cap units test tested in accordance with ASTM C 1262 in a 3% saline solution shall be the minimum of the following:
 - 1. The weight loss of each of five test specimens at the conclusion of 40 cycles shall not exceed 1% of its initial weight; or
 - 2. The weight loss of 4 out of 5 test specimens at the conclusion of 50 cycles shall not exceed 1.5% of its initial weight, with the maximum allowable weight loss for the 5th specimen not to exceed 10%.
- D. Cap units must meet the requirements of (a) and (c) and have a top surface sloped at minimum of 1 mm fall per 10 mm run (1 inch fall per 10 inches run) front to back or be crowned at the center.
- E. ASTM C 1262 test results shall be recorded and reported in 10 cycle intervals
- F. Note: It is the intention of this testing that 100% of the wall units and cap units meet the weight loss requirements for (b1) and (c1) respectively, or that a minimum of 80% of the wall units and cap units tested meet the weight loss requirements for (b2) and (c2) respectively.
 - 1. If a manufacturer chooses to increase the sample size tested beyond the 5 units required for each block type, these percentages will still apply to the sample size chosen (i.e. if a sample size of 7 blocks is tested a minimum of 6 must meet the weight loss requirement of (b2) or (c2), if a sample size of 10 blocks is tested a minimum of 8 must meet the weight loss requirement).

3.03 SAMPLING AND TESTING

- A. Cap units and wall units shall be sampled and tested as separate block types.
- B. Shall conform to ASTM C 140, except that: Section 6.2.4 shall be deleted and replaced with:
 - 1. "The specimens shall be coupons cut from a finished side or back shell of each unit and sawn to remove any face shell projections. The coupon size shall have a height to thickness ratio of 2 to 1 before capping and a length to thickness ratio of 4 to 1. The coupon shall be cut from the unit such that the coupon height dimension is in the same direction as the unit height dimension. Compressive testing of full size units will not be permitted. The compressive strength of the coupon shall be assumed to represent the net area compressive strength of the whole unit."

END OF SECTION