

SECTION 13100

MECHANICALLY STABILIZED EARTH RETAINING WALLS

PART 1 -- GENERAL

1.01 THE REQUIREMENT

- A. Includes all labor, material, equipment, testing and submittals required to design and complete construction of Mechanically Stabilized Earth (MSE) retaining walls, including foundation preparation, drainage, reinforcement, facing, backfill and all necessary and incidental items required to complete MSE retaining walls in accordance with the Drawings and these Specifications
- B. This Specification section applies to walls whose entire height does not exceed 25-feet. This section may not include all engineering requirements for walls exceeding 25-feet in height.
- C. Design of MSE Wall shall include internal and external static, hydrostatic and dynamic loading conditions to establish minimum factors of safety against internal or global failure. Design of the MSE Wall shall be conducted using soil properties for the soil backfill to be used in wall construction. It is the intent of this Specification for all components of the MSE Wall, with the exception of the foundation leveling pad and the backfill, to be provided by an approved MSE Wall supplier. The MSE Wall Supplier shall be responsible for preparation of the wall design based upon the profiles and grading provided on the Drawings.
 - 1. MSE Wall design shall be prepared and sealed by a Professional Engineer licensed and registered to practice in South Carolina. The MSE Wall designer shall be available to provide technical assistance during review of design information and construction of the MSE Wall, including foundation preparation. The Contractor shall be responsible for submitting design and MSE Wall information to the Engineer for review.
- D. For purposes of these Specifications, MSE wall height shall be measured from the base of the lowest facing element to the top of the reinforced soil zone as shown on the Drawings.

1.02 RELATED WORK SPECIFIED ELSEWHERE

- A. Section 02200 - Earthwork
- B. Section 13800 - Geogrid
- C. Section 02274 - Geotextiles

1.03 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

- A. Without limiting the generality of the other requirements of the Specifications, all work herein shall conform to the applicable requirements of the following documents. All referenced Specifications, codes, and standards refer to the most current issue available at the time of Bid.
1. South Carolina Department of Transportation Standard Road and Bridge Specifications, latest edition.
 2. American Society for Testing and Materials (ASTM):
 - ASTM C-90 Load Bearing Concrete Masonry Units.
 - ASTM C-140 Sampling and Testing Concrete Masonry Units.
 - ASTM D-448 Sizes of Aggregate for Road and Bridge Construction.
 - ASTM D-698 Laboratory Compaction Characteristics using Standard Effort.

1.04 SUBMITTALS

- A. In accordance with the procedures and requirements set forth in Section 01340 - Submittals, the Contractor shall submit the following:
1. Name and location of all material suppliers.
 2. Certificate of compliance with the standards specified above for each source of each material.
 3. Plans, profiles and cross sections of each MSE wall showing side slopes and limits of the excavation at grade, reinforcement locations, drainage details, connection details and other construction details. Where design details and profiles are provided in the Drawings, the Contractor's submittals shall conform to the Drawings. Design of MSE Walls shall include complete static and dynamic earth loading, hydrostatic loading and any uniform, strip or point loads applied to the backfill or reinforced zone. Where no external loading is indicated within or adjacent to the top of the reinforced zone, the designer shall assume that a uniform load of at least 200-psf is applied to the surface of the reinforced zone.
 4. Design calculations and details for the MSE Wall, including vertical and horizontal loads used, test data for select backfill soil, reinforcing elements and wall panel material,
 5. Samples of geosynthetics for reinforcement, filtration and drainage with manufacturer's certificates or catalog cuts stating the mechanical and physical properties. Samples shall be at least three (3) foot wide and four (4) feet long taken across the roll with the warp/roll direction appropriately marked.
 6. Source information for imported soil backfill material.
 7. Complete installation details for the concrete modular facing units, connections, railings, piping and appurtenances.

PART 2 – MATERIALS

2.01 MATERIALS

- A. Concrete Modular Facing Units - a durable modular concrete facing unit, machine made from portland cement, water and mineral aggregates manufactured in accordance with ASTM C-90 and ASTM C-140.

Concrete wall units shall have a minimum 28-day compressive strength of 3,000 psi. Standard weight concrete shall have a maximum moisture absorption of 8%. Dimensional tolerances shall be in accordance with ASTM C-90 except those measured to the split face, which varies.

The color and finish of the Concrete Modular Facing Unit shall be selected by the Owner. Contractor shall provide a minimum of ten blocks of candidate units for on-site inspection by the Owner and Engineer prior to approval of the unit for Construction.

The nominal dimensions of the facing unit shall be 8-inches high, 18-inches wide and 12-inches deep.

- B. Geogrid - a geosynthetic formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth and function primarily as reinforcement.
- C. Facing Unit Connection – A mechanical connection between the concrete modular facing unit and the geogrid to assure the required load transfer at minimum displacement. The Contractor shall submit the facing unit manufacturer's connection details and performance demonstration to Engineer for approval. The Owner shall select from available manufacturer's styles meeting the requirements of these Specifications shall select the unit color and finish.
- D. MSE Wall Backfill – Soil backfill in the reinforced zone shall be approved imported select clean natural free draining granular soil free from organics and deleterious material. MSE Wall backfill shall have no particles greater than 4-inches in size and shall have no greater than 15-percent by weight passing the No. 200 US Standard Sieve and shall not exhibit a Plasticity Index (ASTM D4318) greater than 5. This material is not available on the project site. All backfill shall be placed in accordance with these Specifications under strict Quality Control and Assurance programs.
- E. Drainage Aggregate – Aggregate backfill against the facing unit and used to fill the core of the facing units, where applicable, shall consist of AASHTO No. 57 stone.

PART 3 – EXECUTION

3.01 SHIPPING, HANDLING AND STORAGE

- A. During periods of shipment and storage, all geosynthetic materials shall be protected from direct sunlight, temperature greater than 140°F, water, dust, chemicals and debris. Geosynthetic materials that are damaged during shipping, handling or storage will be rejected and shall be replaced at Contractor expense.
- B. Concrete Modular Facing Units shall be stored so as to be kept free of mud, chemicals and debris. Units shall be handled and stored in accordance with manufacturer recommendations. Damaged units shall be rejected and shall be replaced at Contractor expense.

3.02 FOUNDATION PREPARATION

- A. Contractor shall excavate to the lines and grades shown on the Drawings and outlined in Section 02200 – Earthwork, of these Specifications. Contractor shall not disturb areas outside established excavation limits. Over-excavation may require placement of additional lengths of reinforcement or additional facing units.
- B. The Contractor shall protect the exposed foundation against the effects of water from any source, desiccation, or disturbance from vehicles or equipment.
- C. The foundation subgrade shall be proofrolled using a loaded dump truck or similar approved equipment under observation of the Engineer or his representative in order to identify any soft, loose or otherwise unsuitable areas. Foundation soils shall be approved by the Engineer or his representative prior to placement of the aggregate foundation layer.

3.03 FOUNDATION LAYER

- A. A foundation layer, consisting of crushed stone aggregate or Class B concrete, shall be placed on the approved foundation immediately prior to MSE wall construction in accordance with the Drawings.
- B. Aggregate material shall be compacted to provide a dense, level surface on which to place the first course of facing units. Compaction shall be to 95% of Standard Proctor Density as determined in accordance with ASTM D698.

3.04 CONCRETE MODULAR FACING UNIT INSTALLATION

- A. The initial course of concrete modular facing units shall be carefully placed on the foundation layer in accordance with the approved Shop Submittals and shall be checked for proper seating, level and alignment.
- B. Install adjacent and overlying facing units in accordance with the approved installation procedures and place aggregate fill within the units and drainage aggregate as shown on the Drawings.

- C. Rows of facing units installed with improper or inconsistent setback, rows that are not level or units of improper finish, color or exhibiting damage shall be removed and replaced by the Contractor at no cost to the Owner.
- D. Where the base of the wall changes elevation, units can be stepped with the grade or turned into the embankment where indicated on the Drawings. For the reinforced MSW wall sections, base units shall be embedded the minimum distance shown on the Drawings. In non-reinforced sections of the MSE wall, the minimum embedment shall be approved by the Engineer.
- E. Facing units that correspond to the elevation where reinforcement is to be installed shall be verified for line and grade and clearly marked using surveyors' paint (on the backfill side of the unit) or other means.

3.05 INSTALLATION OF REINFORCEMENT

- A. Geosynthetic reinforcement shall be a Geogrid meeting the requirements of Section 13800 – Geogrid of these Specifications and approved by the Engineer. Geogrid shall be installed only after underlying soils have been compacted, leveled and approved by the Engineer or his representative. Geogrid shall not be installed over frozen subgrade or standing water.
- B. Geogrid shall be placed at the elevations and over the aerial extent shown on the Drawings or approved by the Engineer. All Geogrid shall be installed such that the roll direction is perpendicular to the axis of the wall. Overlap of adjacent Geogrid panels shall be in accordance with approved shop submittals. No overlap shall be permitted in the roll direction of the Geogrid.
- C. Geogrid shall be mechanically connected to the facing units as shown in the approved shop submittals. Pretension each Geogrid panel to minimize slack as outlined in Section 13800 of these Specifications.
- D. Any Geogrid panel that has been damaged shall be removed from the construction area and replaced with new Geogrid meeting the requirements of these Specifications. Patching of the Geogrid shall be prohibited.
- E. The exposed Geogrid shall be off limits to heavy construction equipment. Turning of light duty vehicles on the exposed Geogrid is prohibited. Any Geogrid and facing units damaged during installation shall be removed and replaced at Contractor expense.

3.06 BACKFILL

- A. Soil backfill for MSE retaining walls shall be approved imported select granular soils meeting the requirements of Paragraph 2.01D of these Specifications.
 - 1. Soils not meeting the requirements of Paragraph A above shall not be incorporated into the MSE retaining wall construction. Imported soil shall be approved by the Engineer in advance.
- B. All soil backfill associated with MSE retaining wall construction shall be placed in horizontal lifts not exceeding 8-inches in thickness (loose measure) in accordance with

Paragraph 3.09A Section 02200 – Earthwork of these Specifications. Backfill soil shall be compacted to a minimum in-place density equal to 95% of the maximum Standard dry density (ASTM D698) at moisture contents approximately equal to Optimum Moisture Content (ASTM D698).

- C. Compaction equipment shall not cause damage or excess deformation of the geosynthetic reinforcement. Heavy compaction equipment shall not be operated within 3-feet of the wall facing units. The backfill within 3-feet of the wall facing units, including the drainage aggregate layer, shall be compacted using light weight hand operated equipment approved by the Engineer.
- D. Aggregate placed within and behind facing units shall be protected from mixing or fouling by backfill soils. Contractor shall use Filter Geotextile or other means approved by the Engineer to strictly segregate drainage media and backfill soils.
- E. Each lift of backfill soil shall be at the proper moisture, density, line and grade prior to placement of overlying soil or geosynthetic reinforcement.
- F. The exposed subgrade shall be protected from excessive damage due to weather, precipitation or vehicles during construction. At the end of each workday, exposed soils should be “seal rolled” using a smooth drum roller to minimize infiltration and softening. The ground surface shall be sloped away from the wall face to the degree practical and run-on to the MSE retaining wall section from adjacent areas shall be diverted by the Contractor during construction.
- G. The base and upper surface of the reinforced zone as well as the horizontal extent of the face of the wall shall be surveyed by the Contractor’s surveyor to verify as-built lines and grades.

- END OF SECTION -