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Standard Specifications

CONCRETE SEGMENTAL RETAINING WALL

Section 02830

PART 1 GENERAL

1.01 SUMMARY

- A. This work shall consist of furnishing and constructing a Mechanically Stabilized Earth (MSE) segmental retaining wall system having high molecular weight, high tenacity polyester geogrids positively connected to Segmental Concrete Facing Units. Work shall be done in accordance with these specifications and in reasonably close conformity with the lines, grades, design and dimensions shown on the plans.

- B. Related Sections
 - Section 02200 - Site Preparation
 - Section 02300 - Earthwork

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - C1372 - Standard Specification for Segmental Retaining Wall Units
 - C140-91 - Method of Sampling and Testing Concrete Masonry Units
 - C150-94 - Specification for Portland Cement
 - C33-93 - Specification for Concrete Aggregates
 - C595/C595M - Specification for Blended Hydraulic Cement
 - C90-93 - Specification for Load-bearing Concrete Masonry Units
 - D422 - Gradation of Soils
 - D424 - Atterburg Limit of Soils
 - D698 - Test method for Laboratory Compaction Characteristics of Soil Using Standard Effort

 - D5262 - Test Method for Evaluating the Unconfined Tension Creep Behavior of Geosynthetics
 - D4355 - Test Method for Deterioration of Geotextiles from Exposures to Ultraviolet Light and Moisture
 - D4595 - Test Method for Tensile Properties of Geotextiles by the Wide Strip Method

- B. Geosynthetic Research Institute (GRI)
 - GG1 – Standard Test Method for Geogrid Rib Tensile Strength
 - GG4 - Standard Practice for Determination of Long Term Design Strength of Geosynthetic Reinforcements
 - GG5 – Standard Test Method for Determination of Geogrid Pullout

- C. National Concrete Masonry Association (NCMA)
 - NCMA Design Manual for Segmental Retaining Walls, Second Edition
 - NCMASRWU-1 - Determination of Connection Strength between Geosynthetics and Segmental Concrete Units
 - NCMASRWU-2 - Determination of Connection Strength between Segmental Concrete Units

1.03 DEFINITIONS

- A. GeoStone Segmental Concrete Facing Unit - A Segmental Concrete Facing Unit, machine made from Portland cement, water, and mineral aggregates.
- B. GeoStone Geogrid - a structural element formed by a regular network of integrally connected tensile elements that allows interlocking with surrounding soil, rock, or earth and functions primarily as reinforcement.
- C. GeoStone Connector - a polyester resin connection method used to positively connect the Geosynthetic Reinforcement to the Segmental Concrete Units. Connector is not necessary but used as an additional connection method when required.
- D. Unit Fill - free-draining, coarse granular soil which is placed within, between and behind the Segmental Concrete Units
- E. Reinforced Backfill – compacted structural fill which is placed within the reinforced zone soil volume as outlined on the plans

1.04 SUBMITTALS

- A. Product Data – Manufacturer’s materials specifications, installation instructions, and general recommendations
- B. Design Data – Engineering plans prepared by a professional engineer registered in the State of the project location. The engineering designs, techniques and material evaluations shall be in accordance with parts 2 and 3 of this specification

1.05 QUALITY ASSURANCE

- A. Construction – Contractor performing work in this section shall have a minimum of 2 years experience and have constructed at least 50,000 square feet of segmental concrete retaining walls on projects of like scope. When requested, evidence of experience, noting project, owner, and design professional shall be furnished to the owner or owner’s agent.
- B. Testing – An independent testing lab shall be required to test the select fill material to determine suitability of material for the project and shall conduct compaction tests

for each layer of fill material at the rate of at least 1 test per 1000 square feet per lift.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. GeoStone Segmental Concrete Units – Contractor shall inspect materials upon delivery to ensure that the specified type, grade, color and texture has been received and shall prevent excessive mud, wet concrete, epoxy, or other deleterious materials from coming into contact with and affixing to retaining wall materials.
- B. GeoStone Polymeric Materials – Contractor shall inspect materials upon delivery to ensure that the specified type and grade has been received and shall store materials in such a manner as to prevent degradation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. The GeoStone Segmental Concrete Facing Unit shall be manufactured by an approved GeoStone Licensee and/or an approved manufacturer of the GeoStone Retaining Wall Units.
- B. The GeoStone Geogrid shall be manufactured by an approved manufacturer of the GeoStone Retaining Wall Systems' Geosynthetic Reinforcement.

2.02 MATERIALS

- A. GeoStone Segmental Concrete Facing Units – Hollow load-bearing units conforming to ASTM C-90, normal weight, Type II with a minimum compressive strength of 4000 psi, a maximum absorption rate of 8% by weight and a minimum face shell thickness of 2 inches. The GeoStone Segmental Concrete Facing Units shall conform to NCMA TEK 2-4A, Section 3.1.
 - 1. Color of the retaining wall units shall be _____
 - 2. Finish of the retaining wall units shall be straight geometry split face.
- C. GeoStone Structural Geogrids – Geosynthetic reinforcements consisting of high tenacity, high molecular weight, low carboxyl end group polyester yarns, woven into a stable interlocking grid and then coated with polyvinyl chloride to provide protection from harmful UV rays. The type, strength and placement location of the GeoStone Geogrids shall be shown on the engineering plans. The design properties of the GeoStone Geogrids shall be determined according to the procedures outlined in this specification.
- D. GeoStone Connector – Polyester resin with silica inclusions

2.03 ACCESSORIES

- A. Geotextile – 6oz. per square yard polypropylene non-woven geotextile, AASHTO M288, Class 2, produced by Evergreen Technologies, Inc. or equal as approved by GeoStone Retaining Wall Systems, Inc.
- B. Adhesive – As recommended by GeoStone Retaining Wall Systems, Inc.

2.04 BASE LEVELING PAD MATERIAL

- A. Materials shall consist of compacted sand, gravel or crushed rock or leveling concrete (non-reinforced) as shown on the construction drawings. The leveling pad shall be a minimum of 6 inches thick. The leveling concrete shall be a minimum of 4 inches thick with 2 inches of compacted soil for a total thickness of 6 inches.

2.05 BACKFILL MATERIALS

- A. Unit Fill (Core Fill) – Free draining, coarse-grained soil that is placed within the empty cores of the Segmental Concrete Facing Units.
 - a. 100 to 75 percent passing a 1-in. sieve
 - b. 50 to 75 percent passing a $\frac{3}{4}$ -in. sieve
 - c. 0 to 60 percent passing a No. 4 sieve
 - d. 0 to 50 percent passing a No. 40 sieve
 - e. 0 to 5 percent passing a No. 200 sieve
- B. Drainage Fill – Free draining, coarse-grained soil which is placed behind the Segmental Concrete Facing Unit.
 - a. 100 to 75 percent passing a 1-in. sieve
 - b. 50 to 75 percent passing a $\frac{3}{4}$ -in. sieve
 - c. 0 to 60 percent passing a No. 4 sieve
 - d. 0 to 50 percent passing a No. 40 sieve
 - e. 0 to 5 percent passing a No. 200 sieve
- C. Reinforced Backfill – Granular fill with a Ph range of 2 to 12 and graded as follows:
 - a. 100 to 75 percent passing a 2-in. sieve
 - b. 100 to 75 percent passing a $\frac{3}{4}$ -in. sieve
 - c. 100 to 20 percent passing a No. 4 sieve
 - d. 0 to 60 percent passing a No. 40 sieve
 - e. 0 to 35 percent passing a No. 200 sieve

PART 3 CONSTRUCTION

3.01 QUALIFICATION

- A. Contractor and site supervisor shall have proven qualified experience to complete the installation of the segmental retaining wall system.

3.02 EXCAVATION

- A. Contractor shall excavate to the lines and grades shown on the construction drawings. Architect/Engineer will inspect the excavation and approve prior to placement of leveling pad or fill soils.
- B. Contractor shall take precautions to minimize over excavation. Over-excavated areas shall be filled with compacted infill material as directed by the Architect/Engineer.
- C. Excavation of unsuitable soils and replacement with approved compacted material shall be performed as directed by the geotechnical engineer.
- D. General Contractor shall verify location of existing structures and utilities prior to excavation.

3.03 FOUNDATION PREPARATION

- A. Foundation trench shall be excavated to the dimensions indicated on the construction Drawings.
- B. The reinforced zone and the leveling pad foundation soil shall be examined by an engineer to ensure proper bearing strength.
- C. Soils not meeting required strength shall be removed and replaced with proper materials as approved by the Engineer.
- D. Foundation materials shall be compacted to a minimum of 95 percent Standard Proctor Dry Density in accordance with ASTM D698 before placing the leveling pad.

3.04 LEVELING PAD

- A. Leveling pad materials shall be placed as shown on the construction drawings with a Minimum thickness of 6 inches.
- B. Leveling pad material shall be compacted to provide a dense, level surface on which to place the first course of units.
- C. The leveling pad shall be level both horizontally and front to back to ensure the first course of units and subsequent courses, are level as well as to ensure complete contact of the retaining wall units with the base.

3.05 UNIT INSTALLATION

- A. The first course of segmental units shall be placed on the base leveling pad and leveled side to side and front to back and unit-to-unit.
- B. All units shall be laid snugly together and parallel to the straight or curved line of the wall face.

- C. A string line can be used to align a straight wall, or flex pipes can be used to establish a smooth convex or concave curved wall.
- D. The GeoStone Segmental Concrete Units shall be swept clean of all debris before installing the next course of units and/or placing the geogrid materials

3.06 STRUCTURAL GEOSYNTHETIC REINFORCEMENT INSTALLATION

- A. GeoStone geogrids shall be oriented with the highest strength axis perpendicular to the wall alignment.
- B. GeoStone geogrids shall be placed at the elevation and to the extent shown on the engineering plans or as directed by the Architect/Engineer.
- C. GeoStone geogrids shall be laid horizontally on compacted backfill. Place the next course of segmental concrete units over the geosynthetic reinforcement. The geosynthetic reinforcement shall be pulled taut, and anchored prior to backfill placement on the geosynthetic reinforcement.
- D. Tracked construction equipment shall not be operated directly on the geosynthetic reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geosynthetic reinforcement.

3.07 DRAINAGE FILL AND UNIT FILL

- A. Unit Fill and Drainage Fill, placed 12 inches behind the wall, shall consist of a free draining, coarse-grained soil meeting the requirements of Section 2.05
- B. Unit Fill and Drainage Fill shall be placed in all of the unit voids and behind the wall every one or two courses or before placing the geogrid materials.

3.08 BACKFILL

- A. The reinforced backfill material shall be placed in maximum lifts of 8 inches and shall be compacted to a minimum of 95 percent Standard Proctor Dry Density in accordance with ASTM D698.
- B. Only hand-operated compaction equipment shall be used within 3 feet of the tail of the GeoStone Segmental Concrete Facing Unit.
- C. The backfill shall be smooth and level so that the geogrid lays flat.

3.09 CAP INSTALLATION

- A. Cap units shall be glued to underlying units with an approved adhesive.
- B. A string line or flex pipes shall be used to align caps

3.10 TOLERANCES

- A. Variation from batter indicated: Plus or minus 1/8 in. per ft. maximum.

END OF SECTION