

GEOWALL Max MSE Specifications

The following specification is for the construction of GEOWALL MSE segmental retaining wall (SRWs). Specifications for segmental retaining wall units are as follows:

GEOWALL MAX RETAINING STRUCTURE

PART 1: GENERAL

1.01 Description

- A. Work shall consist of furnishing all materials, labor, equipment, and supervision to install system in accordance with these specifications and in reasonably close conformity with dimensions shown on the plans or as established by the Owner or Owner's Engineer.
- B. Work shall consist of furnishing and installing applicable materials required for construction of the retaining wall as shown on the construction drawings.

1.02 Reference Standards

- A. Engineering Design
 - 1. NCMA SRW Design Manual for Segmental Retaining Walls 3rd Edition, 5th Printing
 - 2. ASTM D 6638 – Current Edition: Standard Test Method for Determining the Connection Strength Between Geosynthetics Reinforcement and Segmental Concrete Units
 - 3. ASTM D 6916 - Current Edition: Standard Test Method for Determining the Shear Strength Between Segmental Concrete Units
- B. Segmental Retaining Wall Units
 - 1. ASTM C140 - Current Edition: Sampling and Testing Concrete Masonry Units
 - 2. ASTM 1262 - Current Edition: Standard Test Method for Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units
 - 3. ASTM C1372 - Current Edition: Standard Specification for Dry-Cast Segmental Retaining Wall Units
- C. Geosynthetic Reinforcement
 - 1. ASTM D 4595 - Current Edition: Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method
 - 2. ASTM D 5262 - Current Edition: Standard Test Methods for Evaluating the Unconfined Tension Creep and Creep Rupture Behavior of Geosynthetics
 - 3. ASTM D 5321 - Current Edition: Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method

4. ASTM D 5818 – Current Edition: Standard Practice for Exposure and Retrieval of Samples to Evaluate Installation Damage of Geosynthetics
5. ASTM D 6637- Current Edition: Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method
6. ASTM D 6706 – Current Edition: Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil
7. ASTM D 6992 – Current Edition: Standard Test Method for Accelerated Tensile Creep and Creep-Rupture of Geosynthetic Materials Based on Time-Temperature Superposition Using Stepped Isothermal
8. ASTM D 6706 - Current Edition: Geosynthetic Pullout Resistance in Soil ASTM D6916 Shear Strength Between Segmental Concrete Units

D. Soils

1. ASTM D 698 - Current Edition: Standard Test Method for Laboratory Compaction Characteristics of Soil Using Standard Effort (12 400 ft-lb/ft³(600 kN-m/m³))
2. ASTM D 1556 - Current Edition: Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method
3. ASTM D1557 – Current Edition: Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lb/ft³ (2,700 kN-m/m³))
4. ASTM D 2487 - Current Edition: Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System)
5. ASTM D 6938 - Current Edition: Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth)
6. ASTM D 4318 - Current Edition: Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils
7. ASTM D 6913 - Current Edition: Standard Test Methods for Particle-Size Distribution (Gradation) of Soils Using Sieve Analysis
8. ASTM G 51-18 - Current Edition: Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing

E. Drainage Pipe

1. ASTM F 667- Current Edition: Standard Specification for 3-inch through 24-inch Corrugated Polyethylene (PE) Pipe and Fittings
2. ASTM F 758 - Current Edition: Standard Specification for Smooth-Wall Poly (Vinyl Chloride) (PVC) Plastic Underdrain Systems for Highway, Airport, and Similar Drainage

Where specifications and reference documents conflict, the Architect/Engineer shall make the final determination of applicable document.

1.03 Definitions

- A. GeoWall Max Unit – a dry-stacked concrete retaining wall unit manufactured by Basalite Concrete Products, LLC. and made from Portland cement, water and aggregates.
- B. Unit Drainage Fill – drainage aggregate that is placed within and immediately behind the GeoWall Max concrete units.

- C. Reinforced Backfill – compacted soil that is placed within the reinforced soil zone.
- D. Retained Soil – the soil mass behind the reinforced soil zone
- E. Foundation Soil – the soil mass below the leveling pad and reinforced backfill.
- F. Leveling Pad – crushed rock or unreinforced concrete material placed to provide a level surface for placement of the GeoWall Max concrete units.
- G. Geosynthetic Reinforcement – polymeric material designed specifically for soil reinforcement.

1.04 Approved Segmental Retaining Wall Systems

- A. Suppliers of SRW system material components shall have demonstrated experience in the supply of similar size and types of segmental retaining walls on previous projects, and shall be approved by the Owner's Engineer. Each supplier must be approved two weeks prior to bid opening. Systems approved for this work are:

1.05 Segmental Wall Units

- A. Basalite Concrete Products – GeoWall Max

1.06 Geosynthetic Reinforcements

- A. T.C. Mirafi
Strata Systems
Tensar Earth Technologies

1.07 Submittals

- A. Material Submittals – The Contractor shall submit manufacturer's certifications, 30 days prior to the start of work, stating that the SRW units, geosynthetic reinforcement, reinforced backfill, and gravel fill meet the requirements of Part 2.0 of this specification.
- B. Minimum requirements for the contractor shall include training and certification of NCMA SRW Installer Certification Level 1 course and a minimum of 3 years of continuous experience and 5,000 square feet of SRW wall installation with the system required.
- C. Contractor shall submit construction drawings and design calculations for the retaining wall system prepared and stamped by a Professional Engineer registered in the state of the project and in accordance with all applicable local regulations.

1.08 Delivery, Storage and Handling

- A. The Contractor shall inspect the materials upon delivery to assure that proper type and grade of material has been received.
- B. The Contractor shall store and handle materials in accordance with manufacturer's recommendations and in a manner to prevent deterioration or damage due to moisture, temperature changes, contaminants, corrosion, breaking, chipping or other causes.
- C. The Contractor shall protect the materials from damage. Damaged material shall not be incorporated into the segmental retaining wall.

PART 2: MATERIALS

2.01 GEOWALL Max Retaining Wall Units

- A. GeoWall Max retaining wall units shall conform to the following architectural requirements:
 - 1. Face color - concrete gray, unless otherwise specified. The Owner may specify standard manufacturers' color.
 - 2. Face finish - hard split in angular tri-plane, straight face, straight face bevel or ashlar configuration. Other face finishes will not be allowed without written approval of Owner.
 - 3. Bond configuration - running with bonds nominally located at midpoint in vertically adjacent units.
 - 4. Exposed surfaces of units shall be free of chips, cracks or other imperfections when viewed from a distance of 20 feet (6 m) under diffused lighting.
- B. GeoWall Max concrete units shall conform to the requirements of ASTM C1372 - Standard Specifications for Segmental Retaining Wall Units.
- C. GeoWall Max concrete units shall conform to the following structural and geometric requirements measured in accordance with ASTM C140 Sampling and Testing Concrete Masonry Units:
 - 1. Compressive strength: ≥ 3000 psi (21 MPa).
 - 2. Absorption: ≤ 8 % for standard weight aggregates.
 - 3. Dimensional tolerances: $\pm 1/8$ " (3 mm) from nominal unit dimensions not including rough split face.
 - 4. Unit Size: 8" (203 mm) (H) x 18" (457 mm) (W) x 21.5" (546 mm)(D) minimum.
- D. GeoWall Max concrete units shall conform to the following constructability requirements:
 - 1. Vertical setback: $1/8$ inch (3 mm) \pm per course (near vertical) or $1\ 1/8$ inch (28 mm) + per course (battered), per the design.
 - 2. Alignment and grid attachment mechanism - fiberglass pins, two per unit.

Maximum horizontal gap between erected units shall be $\leq 1/2$ inch (13 mm).

2.02 Fiberglass Reinforcement Pins

- A. Pins shall be capable of holding the geogrid in the proper design position.
- B. Reinforcement pins shall be 1/2-inch (12 mm) diameter thermoset isophthalic polyester resin pultruded fiberglass reinforcement pins with the following requirements:

- (1) Flexural Strength in accordance with ASTM D4476: 128,000 psi (882 MPa) minimum.
- (2) Short Beam Shear in accordance with ASTM D4475: 6,400 psi (44 MPa) minimum.

2.03 Drainage Pipe

- A. The drainage collection pipe shall be a perforated or slotted PVC or corrugated HDPE pipe. The pipe may be wrapped with a geotextile to function as a filter.
- B. Drainage pipe shall be manufactured in accordance with ASTM F 405 or ASTM F 758.

2.04 Geogrid Reinforcement

- A. Geosynthetic reinforcement shall consist of geogrids manufactured for soil reinforcement applications and shall be manufactured from high tenacity polyester yarn or high density polyethylene.

2.05 Leveling Pad

- A. Material for Leveling shall consist of a compacted crushed stone base, sand and gravel or unreinforced concrete, as shown on the construction drawings.

2.06 Unit Fill/ Drainage Aggregate

- A. Unit Fill/ Drainage Aggregate shall consist of free draining crushed stone.
- B. The material shall be a clean crushed stone or granular fill meeting the following gradation:

Sieve Size	Percent Passing
1 in.	100
3/4 in.	75 - 100
No. 4	0 - 60
No. 40	0 - 50
No. 200	0 - 5

- C. The vertical drainage layer placed within and behind the GeoWall Max unit shall be no less than 24 -inches wide as measured from the front face of the Max units.

2.07 Infill Soil/ Reinforced Backfill

- A. The reinforced backfill shall be free of debris and consist of one of the following inorganic USCS soil types: GP, GW, SW, SP, SM, meeting the following gradation:

Sieve Size	Percent Passing
1 in.	100
No. 4	100 - 20
No. 40	0 - 60
No. 200	0 - 35 ¹

¹ Cohesionless, coarse-grained soils, are preferred; finer soils with low-plasticity (i.e., PI of the finer fraction is less than 20) may be used provided the following four additional design criteria are implemented:

1. Proper internal drainage is installed.
2. Only soils with low to moderate frost heave potential are utilized.
3. The internal cohesive shear strength parameter is conservatively ignored for stability analysis.

4. *The final design for critical walls is checked by a qualified Professional Engineer to ensure that the use of cohesive soils does not result in unacceptable time-dependent movement of the SRW system.*
 - B. The maximum size should be limited to 1.0 in. for geosynthetic reinforced soil SRWs unless tests have been performed to evaluate potential strength reduction in the geosynthetic due to installation damage.

2.08 Geotextile Filter

- A. When required, geotextile filter fabric shall be a needle-punched, nonwoven fabric that meets the requirements of AASHTO M288.

PART 3: CONSTRUCTION

3.01 Construction Observation

- A. The Owner or Owner's Engineer should verify the materials supplied by the contractor meet all the requirements of the specification. This includes all submittals and proper installation of the system.
- B. The Contractor's field construction supervisor shall have demonstrated experience and be qualified to direct all work at the site.

3.02 Leveling Pad Construction

- A. A minimum 6 in. thick layer of compacted granular material shall be placed for use as a leveling pad up to the grades and locations as shown on the construction drawings. The granular base shall be compacted to provide a firm, level bearing pad on which to place the first course of concrete segmental retaining wall units. A leveling pad consisting of 2-4 in. (minimum) thick lean, unreinforced concrete may be used at the wall contractor's option, or if so detailed on the plans.
- B. The leveling pad shall extend laterally a minimum of 6 inches in front of and behind the GeoWall Max block.
- C. Leveling pad shall be prepared to insure full contact with the base surface of the concrete units.

3.03 SRW Placement

- A. All materials shall be installed at the proper elevation and orientation as shown in the wall details on the construction plans. The GeoWall Max concrete segmental wall units shall be installed in general accordance with the manufacturer's recommendations. The drawings shall govern in any conflict between the two requirements.
- B. Units with chipped or stained faces should not be placed in the retaining wall.

3.04 Geogrid Installation

- A. Geogrid shall be installed with the highest strength direction perpendicular to the wall alignment.
- B. Geogrid reinforcement shall be placed at the strengths, lengths and elevations shown on the construction drawings.
- C. The geogrid shall be placed over the pins, pulled taut and anchored prior to backfill placement on top of the geogrid.
- D. Geogrid reinforcements shall be continuous throughout their embedment lengths and placed side-by-side to provide 100% coverage at each level. Spliced connections shall be reviewed and by Owner's Engineer.

3.05 Gravel Fill and Drainage Placement

- A. Gravel fill shall be placed to the minimum finished thickness and widths shown on the construction plans.
- B. The main collection drain pipe, just behind the block facing, shall be a minimum of 4 inches in diameter. The secondary collection drain pipes should be sloped a minimum of two percent to provide gravity flow into the main collection drain pipe. Drainage laterals shall be spaced at maximum 50 ft spacing along the wall face.

3.06 Cap Block Placement

- A. The cap block and/or top SRW unit shall be bonded to the SRW units below using an approved masonry cap adhesive . The block shall be dry and swept clean prior to adhesive placement.

PART 1: END OF SECTION

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