SPECIFICATION FOR GRAND LEDGE® WALL SYSTEM

PART 1: GENERAL

1.1 Scope

Work includes furnishing and installing concrete retaining wall units to the lines and grades designated on the construction drawings and as specified herein.

1.2 Reference Standards

AASHTO M288 Geotextile Specifications for Highway Applications
ACI 301 Structural Concrete
ACI 318 Building Code Requirements for Reinforced Concrete
ASTM A615 Reinforcing Steel
ASTM C33 Concrete Aggregates
ASTM C39 Compressive Strength of Concrete
ASTM C94 Ready-Mixed Concrete
ASTM C143 Slump of Concrete
ASTM C231 Air Content of Concrete
ASTM C557 Adhesives for Fastening Gypsum Wallboard to Wood Framing
ASTM C1776 Wet-Cast Precast Modular Retaining Wall Units
ASTM D412 Vulcanized Elastomers – Tension
ASTM D448 Sizes of Aggregate for Road and Bridge Construction
ASTM D698 Laboratory Compaction Characteristics of Soil Using Standard Effort
ASTM D1557 Laboratory Compaction Characteristics using Modified Effort
ASTM D6637 Tensile Properties of Geogrid
HUD/FHA Use of Materials Bulletin #60

1.3 Delivery, Storage, and Handling

A. Contractor shall check the materials upon delivery to assure proper material has been received.
B. Contractor shall prevent excessive mud, wet concrete and like materials from coming in contact with the precast modular blocks.
C. Contractor shall protect the materials from damage. Damaged material shall not be incorporated in the project.

PART 2: MATERIALS

2.1 Wall Units

A. Wall units shall be Grand Ledge® precast modular block units as produced by a manufacturer licensed and authorized by the precast modular block licensor to produce the units.
B. Wall units shall meet Grand Ledge® block specifications and be made from wet-cast concrete in accordance with ASTM C1776, per the following chart, and as modified herein.

Freeze-Thaw Exposure Class*	Air Content %	28-Day Compressive Strength *psi (MPa)*	Maximum Water Cement Ratio	Min. Concrete Temp. at Placement *°F (°C)*
Negligible	1½ to 4½	4000 (27.6)	0.45	50 (10)
Moderate	3½ to 6½	4000 (27.6)	0.45	50 (10)
Severe	4½ to 7½	4000 (27.6)	0.45	50 (10)
Very Severe	4½ to 7½	4500 (30.0)	0.40**	50 (10)

All Grand Ledge products shall use frost-free aggregate.

*Exposure class is as described in ACI 318. “MODERATE” describes concrete that is exposed to freezing and thawing cycles and occasional exposure to moisture. “SEVERE” describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture. “VERY SEVERE” describes concrete that is exposed to freezing and thawing cycles and in continuous contact with moisture and exposed to deicing chemicals. Exposure class should be specified by owner/purchaser prior to order placement.

**For Very Severe exposure, fly ash, other pozzolan, and/or slag shall be limited as described in ACI 318 4.2.3.

Notwithstanding anything stated above, all material used in the wall units must meet applicable ASTM and ACI requirements for exterior concrete.

C. Exterior block dimensions, as measured in accordance with ASTM C1776, shall be uniform and consistent. Maximum dimensional deviations shall be 1/8 inch (3 mm) or 2%, whichever is less, excluding the architectural surface. Maximum width (face to back) deviation including the architectural surface shall be 1/2 inch (13 mm).
D. Exposed faces shall have a textured finish. Other surfaces to be smooth form or troweled surface type.
E. Shear heels shall be intact and free from cracks or other defects. Chips, holes, and cracks in the unit smaller than the dimensions described in ASTM C1776 may be permitted.

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2.2 Aggregate and Fill Material

A. Leveling pad shall be crushed stone, meeting the requirements of ASTM No. 57 aggregate, or similar material as approved by the Engineer.

B. Free draining backfill material shall be washed stone, shall be placed to a minimum of 12 inches (305 mm) width behind the back of the wall blocks, and shall extend vertically from the Leveling Pad to an elevation 4 inches (102 mm) below the top of wall. Free draining backfill shall meet the requirements of ASTM No. 57 or approved similar material.

C. Backfill material and reinforced soil material (if needed) shall be suitable soils meeting the strength properties as required by the design and be approved by the geotechnical engineer. Site excavated soils may be used if suitable and approved by the geotechnical engineer. Suitable soils generally include predominately granular soils with non-plastic fines. Unsuitable soils, those with a PI > 6, organic soils, saturated soils, and frost susceptible soils, shall not be placed within a 1 to 1 influence area from the base of the wall.

E. Where additional fill is needed, the Contractor shall submit sample and specifications to the Engineer for approval.

2.3 Drainage

A. Internal and external drainage shall be evaluated by the Professional Engineer who is responsible for the final wall design.

B. Perforated drain pipe should be a minimum of 4 inches (102 mm) in diameter, meeting the requirements of AASHTO M278 (corrugated or smooth-walled PVC) or AASHTO M252 (corrugated polyethylene).

2.4 Geotextile & Geogrid

A. Non-woven geotextile fabric shall meet the requirements for Class 2 construction survivability in accordance with AASHTO M288.

B. Geogrid reinforcement shall be a woven or knitted PVC-coated geogrid manufactured from high-tenacity PET polyester fiber with an average weight greater than 25,000 (M_n > 25,000) and a carboxyl end group less than 30 (CEG < 30). The geogrid shall be furnished in prefabricated roll widths of certified tensile strength by the manufacturer. The ultimate tensile strength of reinforcement shall be as shown of the plans and measured in accordance with ASTM D6637.

2.5 Cast-in-Place Concrete Backfill

A. Cast-in-place concrete backfill shall be ready-mixed concrete meeting the requirements of ASTM C94 with a minimum 28-day compressive strength of 2,500 psi (17.2 MPa).

B. Rebar ties shall consist of 18-inch (457 mm) No. 4 reinforcing steel, meeting the requirements of ASTM A615, Grade 60, bent into a U shape, 9 inches (229 mm) per leg, or as specified by design engineer.

PART 3: CONSTRUCTION OF WALL SYSTEM

3.1 Excavation

A. Contractor shall excavate to the lines and grades shown on the construction drawings.

3.2 Foundation Soil Preparation

A. Native foundation soil shall be compacted to 95% of standard proctor maximum dry density (ASTM D698) or 90% of modified proctor maximum dry density (ASTM D1557) prior to placement of the leveling pad material.

B. In-situ foundation soil shall be examined by the geotechnical engineer to ensure that the actual foundation soil strength meets or exceeds assumed design strength. Foundation soil found to be unsatisfactory shall be removed and replaced with acceptable, compacted material, or otherwise improved, to the satisfaction of the geotechnical engineer.

3.3 Leveling Pad Placement

A. Leveling Pad shall be placed as shown on the construction drawings to ensure a level, hard surface on which to place the first course blocks.

B. Leveling Pad shall be placed on undisturbed native soils or suitable replacements fills as directed by the geotechnical engineer.

C. Leveling Pad shall be placed in uniform maximum lifts of 6 inches (152 mm) and compacted by a minimum of three passes of a vibratory compactor capable of exerting 2,000 lbs (8.9 kN) of centrifugal force to the satisfaction of the geotechnical engineer. Pad shall be constructed to the proper elevation to ensure the final elevation shown on the plans.

D. Leveling Pad shall have a 6-inch (152 mm) minimum depth or deeper as designed by the Professional Engineer responsible for the wall. Pad dimensions shall extend beyond the blocks in all directions to a distance at least equal to the depth of the pad or as designed by the Engineer.

E. Place perforated drain pipe in leveling pad and connect to suitable gravity outlet, as shown on the design.

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3.4 Unit Installation

A. The first course of wall units shall be placed on the prepared Leveling Pad with the aesthetic surface facing out and the back edges tight together. All units shall be checked for level and alignment as they are placed. Grand Ledge blocks shall be placed with the back of the blocks offset from the back of wall reference line based on their unit height. A 6-inch (152 mm) high Grand Ledge block shall be offset 4.5 inches (114 mm) from the reference line, a 12-inch (305 mm) high Grand Ledge block shall be offset 3 inches (76 mm) from the reference line, an 18-inch (457 mm) high Grand Ledge block shall be offset 1.5 inches (38 mm) from the reference line, and a 24-inch (610 mm) high Grand Ledge block shall be set with the back of the block flush with the reference line.

B. Ensure that units are in full contact with Leveling Pad. Proper care shall be taken to develop straight lines and smooth curves on base course as per wall layout.

C. The backfill in front and back of entire base row shall be placed and compacted to firmly lock them in place. Check all units again for level and alignment. All excess material shall be swept from top of units.

D. Install next course of wall units on top of base row. Position blocks to be offset from seams of blocks below. Blocks shall be placed fully forward so shear heels and back of lower block are engaged. Check each block for proper alignment and level. Backfill to a 12-inch (305 mm) width behind the block with Free Draining Backfill. Spread backfill in uniform lifts not exceeding 8 inches (203 mm). Employ methods using lightweight compaction equipment that will not disrupt the stability or batter of the wall. Hand-operated plate compaction equipment shall be used around the block and within 3 feet (0.91 m) of the wall to achieve consolidation. Compact backfill to 95% of standard proctor maximum dry density (ASTM D698) or 90% of modified proctor maximum dry density (ASTM D1557) within 2% of its optimum moisture content.

E. Non-woven geotextile fabric shall be placed between the back of the Rosetta blocks and the free draining backfill. Additional non-woven geotextile fabric shall be placed between the Free Draining Backfill and retained soil if required in the detailed wall design.

F. Install each subsequent course in like manner. Repeat procedure to the extent of wall height.

G. Allowable construction tolerance at the wall face is 2 degrees vertically, 3-inch (76 mm) maximum, and 1 inch in 10 feet (25 mm in 3.0 m) horizontally.

H. All walls shall be installed in accordance with local building codes and requirements.

3.5 Geogrid Installation

A. Construct wall and place and compact reinforced soil to the elevation of the first layer of geogrid.

B. Place geogrid layers as shown in the project details extending into the reinforced soil zone to the design length.

C. Install geogrid with the strong direction (roll or machine direction) into the reinforced soil zone and not parallel to the wall. Place geogrid as a continuous length from its connection at the blocks to the back of the reinforced zone. Do not splice or overlap the geogrid.

D. Pull the geogrid taut to eliminate any folds and pretension the geogrid. Backfill from face to back of reinforced soil zone to maintain a taut condition.

E. Do not operate rubber tire nor track vehicles on the geogrid without a minimum 9 inches (229 mm) of reinforced soil over the geogrid. Avoid sudden braking or turning over the reinforced soil zone.

3.6 Cast-in-Place Concrete Backfill Installation

A. Install Grand Ledge units (without backfill) to height of concrete backfill, in accordance with section 3.4.

B. Place rebar ties around each lift hook cast into the Grand Ledge units.

C. Place formwork to the required width and height of cast-in-place concrete backfill section. Alternatively, concrete backfill can be cast neat against the edge of excavation, provided a suitable drainage composite is utilized between edge of excavation and concrete.

D. Place concrete in accordance with ACI 301 to required height, aligning rebar ties to extend into the concrete. Place concrete in lifts, as required to prevent displacement of Grand Ledge units.

E. Once concrete has cured, backfill in accordance with section 3.4.

PART 4: AVAILABILITY

Rosetta products are available from a licensed manufacturer, authorized to produce the units, or an authorized dealer. For a list of approved manufacturers contact:

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