

**SECTION 02832
CONCRETE SEGMENTAL RETAINING WALL SYSTEM**

PART 1: GENERAL

1.01 WORK INCLUDED

- A. This section includes the following: The Specifications on furnishing the design, materials and labor required to construct the modular concrete retaining walls within the project. This will include and is not limited to preparing foundation soil, furnishing and installing leveling pad, unit drainage fill and backfill to the grades shown on the construction drawings, the modular retaining wall units, installing geogrid soil reinforcement of the type, location, and lengths designated on the construction drawings, wall components and a stamped engineered design.

1.02 RELATED WORK

- A. Furnishing Rockwood units and caps as shown on the construction wall profiles and typical drawings and details.
- B. Furnishing geosynthetic reinforcement as shown on the construction wall profiles and typical drawings and details.
- C. Furnishing leveling pad, unit core fill, drainage fill and reinforced backfill material as specified herein and as shown on the construction wall profiles and typical drawings and details.
- D. Installation of wall drainage system as shown on the typical drawings and details.
- E. Excavation, processing, placement and compaction of foundation undercut, leveling pad, unit core fill, drainage fill, and reinforced backfill material as shown on the construction wall profiles and typical drawings and details.
- F. Erection of segmental concrete units and placement of structural reinforcement as shown on the construction wall profiles, typical drawings and details, and geosynthetic material manufacturers specifications.

1.03 REFERENCES

- A. Concrete Units - American Society for Testing and Materials (ASTM)
 - 1. ASTM C-1372 Specification for Segmental Retaining Wall Units
 - 2. ASTM C 1262 Freeze-Thaw Durability of Concrete Masonry Units
 - 3. ASTM D-422 Particle Size Analysis
 - 4. ASTM D-698 Laboratory Compaction Characteristics of Soil –Standard Effort
 - 5. ASTM D-4318 Liquid Limit, Plastic Limit and Plasticity Index of Soils

- B. Drainage Pipe
 - 1. ASTM D-3034 Specifications for Polyvinyl Chloride Pipe (PVC)
 - 2. ASTM D-1248 Specifications for Corrugated Plastic Pipe
 - 3. ASTM 448-86 Standard Classification for Sizes of Aggregate for Road and Bridge Construction

- C. Geogrid Reinforcements - Geosynthetic Research Institute (GRI)
 - 1. GG1-87 Test Method for Geogrid Rib Tensile Strength
 - 2. GG2-87 Test Method for Geogrid Junction Strength
 - 3. GG3-91 Test Method for Tension Creep of Geogrids
 - 4. GG4-91 Determination of Long Term Design Strength of Geogrids
 - 5. GG5-91 Determination of Geogrid (soil) Pullout
 - 6. ASTM D-4595 Tensile Properties of Geotextiles - Wide Width Strip
 - 7. ASTM D-5262 Unconfined Tension Creep Behavior of Geosynthetics

- D. Engineering Design - National Concrete Masonry Association (NCMA)
 - 1. NCMA - Design Manual for Segmental Retaining Walls - Second Edition
 - 2. NCMA SRWU-1 Test Method for Determining Connection Strength of SRW
 - 3. NCMA SRWU-2 Test Method for Determining Shear Strength of SRW

- E. Soils
 - 1. ASTM D-698 Laboratory Compaction Characteristics of Soil –Standard Effort
 - 2. ASTM D-4318 Liquid Limit, Plastic Limit and Plasticity Index of Soils
 - 3. ASTM D-422 Gradation of Soils
 - 4. ASTM D-424 Atterberg Limits of Soils
 - 5. ASTM D-G51 Soil pH

1.04 SUBMITTALS/CERTIFICATION

- A. Prior to the start of work, the Contractor needs to submit a Manufacturer's certification, indicating that the retaining wall materials meet the requirements of this specification.

- B. Before beginning construction the Contractor needs to submit the construction drawings and design calculations for the retaining wall system prepared by a Professional Engineer registered in the state of the project. The engineering design will be per NCMA Design Guidelines For Segmental Retaining Walls, or the AASHTO Standard Specification.

- C. The Contractor, Manufacturer or Installer needs to furnish one (1) segmental unit in the color and face pattern specified for the project to the project manager when requested. The Contractor, Manufacturer or Installer will also furnish the manufacturers testing report completed by an independent laboratory indicating compliance with the concrete materials specifications within this section.

1.05 DELIVERY, STORAGE AND HANDLING

- A. The Contractor shall check all materials upon delivery to assure that they are the proper type, color, and that all certifications have been received.
- B. The Contractor needs to protect all stored materials from damage. Damaged materials will not be incorporated into the work and will be disposed of or removed from the job site as soon as possible.
- C. The faces of the concrete wall units will be free of excessive chips and cracks and will not have stains that discolor the faces. The Contractor and /or Installer need to prevent excessive mud, adhesives, moisture, and etc. that could come in contact with the retaining wall materials and cause discoloration or damage.

PART 2.: PRODUCTS

2.01 DEFINITIONS

- A. Modular Unit - a concrete retaining wall unit, as manufactured by a licensed Rockwood Retaining Wall producer, machined from portland cement, water, and aggregates. Same as segmental concrete unit.
- B. Geogrid - Polyester fiber, polyethylene expanded , or a polypropylene woven material used as a soil reinforcement component and is used in conjunction with the Modular Units. The Geogrid is a structural component formed by a network of connected elements capable of producing tested tensile strengths and must also contain apertures of sufficient size to allow interaction with the geology. Same as soil reinforcement and geosynthetic reinforcement.
- C. Unit Drainage / Unit Fill – aggregate which is placed within and immediately behind the modular concrete units. The aggregate will be crushed, free draining stone. Same as unit core fill.
- D. Backfill - the compacted soil that is placed within the reinforced soil zone of the retaining wall. The soil will be non-organic in composition and contain the moisture necessary for proper compaction to the densities required in the plans.

2.02 MODULAR CONCRETE RETAINING WALL UNITS

- A. The Modular concrete units will conform to the following aesthetic requirements:
 - 1. Utilize a 50/50 ratio of Classic Colonial 18 and Classic Colonial 6-12.
 - 2. color - color should be specified by the Owner or Designer.
 - 3. face surface - fractured rock face with a non conforming flush split.

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- 4. bond - running with bond is a term used to describe the alignment of the set courses of block. A wall conforming to true bond has successive vertical units staggered midpoint to endpoint evenly up the face of the wall.
- B. Modular concrete retaining wall units shall conform to the requirements of ASTM C1372 - Standard Specifications for Segmental Retaining Wall Units.
- C. Modular concrete retaining wall units shall conform to the structural and unit measurement tolerances in accordance with the Rockwood specifications.
- D. Cap units will be attached using an adhesive meeting the manufacturers specifications.

2.03 LEVELING PAD MATERIAL

- A. The leveling pad will consist of either a minimum of 6 inches of compacted crushed stone, or a minimum of 4 inches of lean Portland cement concrete as determined by the site-specific conditions.

2.04 UNIT DRAINAGE / UNIT FILL

- A. Unit drainage and unit core fill shall consist of clean, well draining, 1” minus crushed stone or gravel. The sieve analysis will be in accordance with ASTM D-422. The tested gradation should be as follows:

<u>Sieve Size</u>	<u>Percent Passing</u>
1 inch	100
3/4 inch	75-100
No. 4	0 - 10
No. 200	0 - 1

- B. The unit fill must be placed behind and completely fill the core areas within and around the retaining wall units. The unit drainage fill must be placed at a minimum of 12”, total depth, directly behind the modular wall units during construction.

2.05 BACKFILL

- A. The backfill, which will be compacted on top of and around the geogrid reinforcement shall be free of debris, non-organic in nature and meet the following gradation tested in accordance with ASTM D-422:

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<u>Sieve Size</u>	<u>Percent Passing</u>
2 inch	100 - 75
3/4 inch	100 - 75
No. 40	0-60
No. 200	0-35

The plasticity of the fine fraction of the reinforced soil shall be <20, liquid limit < 40, as per ASTM D-4318.

- B. The maximum aggregate size in the backfill soils should be limited to 2 inches unless tests have been performed to evaluate potential strength reductions to the geogrid design due to construction damage.

2.06 GEOGRID SOIL REINFORCEMENT

- A. Geosynthetic reinforcement will be manufactured specifically for soil reinforcement applications and will be manufactured from high tenacity geogrid or geotextile.
- B. The geosynthetic reinforcement used in the Modular Retaining Wall will have been tested in accordance with Part 1.03C and also have test data available for the design with Rockwood Retaining Walls.

2.07 DRAINAGE PIPE

- A. If required, the drainage collection pipe shall be perforated or slotted PVC or corrugated HDPE pipe. The pipe and surrounding drainage aggregate may be wrapped with a geotextile fabric to aid in filtration.

PART 3.: EXECUTION

3.01 EXAMINATION

- A. The area and conditions where the retaining wall is to be constructed needs to be examined and documented. The documentation needs to be forwarded to the designing engineer for their review and records. If conditions exist that seem detrimental or hazardous to the construction, design or lifetime performance of the retaining wall before or after the initial documentation, the design engineer should be notified.

3.02 EXCAVATION

- A. A. The Installer shall excavate to the lines and grades shown on the approved construction drawings submitted by the design engineer. Any over excavation that is not approved by the wall engineer, owner or the owner's representative will not be paid for. Soils are not to be disturbed beyond the designed grade lines and the

stability of adjacent properties and structures is the responsibility of the wall installer.

3.03 LEVELING PAD

- A. The Leveling pad material shall be placed to the lines and grades shown on the construction drawings. The leveling pad can be constructed of either 6 inches of crushed limestone or an approved DOT road leveling material capable of high compaction or a unreinforced, lean 4 inch concrete pad, whichever the design engineer has approved. In both cases, the leveling pad needs to extend laterally a minimum of 6 inches in front and behind the modular wall unit.
- B. The Leveling Pad needs to be constructed on undisturbed or properly prepared, per ASTM D-698, foundation soils. The leveling pad needs to be constructed in a manner that allows full contact of wall units with foundation, do not rock back and forth, and also must allow the wall units to remain in contact horizontally without gapping.
- C. Aggregate Leveling Pad shall be compacted to a minimum of 95 % standard proctor density per ASTM D-698.
- D. Leveling pad shall be prepared to insure full contact to the leveling surface of the concrete units.

3.04 MODULAR UNIT INSTALLATION

- A. Wall units are placed directly on the leveling pad. Sand can be used for final leveling at a maximum depth of 1/16 of an inch. Block alignment and levels, parallel and perpendicular to the wall face, should be checked to ensure that all units are in full contact with the leveling pad and completely level. Wall units must also be inline horizontally, or side to side, with adjacent units.
- B. As the wall is being constructed the drainage fill is placed within and behind wall units during each coarse placement. Place backfill soils behind drainage fill carefully and in a maximum of 8” lifts for proper compaction.
- C. For curves and corner applications, please consult the manufactures specifications.

3.05 GEOGRID SOIL REINFORCEMENT AND BACKFILL

- A. The geogrid reinforcement will be placed at elevations and depths shown on the construction drawing given by the design engineer. Care should be taken that the geogrid reinforcement is placed correctly; with the strength direction of the reinforcement is perpendicular to the retaining wall.

- B. The geogrid reinforcement is installed horizontally on the compacted backfill and placed fully to the front of the retaining wall units. The next course of retaining wall blocks are put in place next, binding the geogrid reinforcement between the lower and just installed wall units. The geogrid reinforcement will then be pulled taut, and staked at the end furthest away from the wall face prior to further backfill placement. Care needs to be taken that the stakes or the tension applied does not adversely affect the installed condition of the geogrid reinforcement.
- C. The geogrid reinforcement sheets will be continuous horizontally, side-by-side, to provide total coverage on each installed course. Each sheet of installed geogrid reinforcement will be continuous. Splicing shorter pieces to make longer ones during construction is not permitted.
- D. The backfill soils will be placed, spread, and compacted in a manner that minimizes the development of slack and damage in the installed geogrid.
- E. The backfill soils will be placed and compacted in 4" lifts when hand compaction is being used or 8" when mechanized compaction equipment is used. Only plate compactors or light wheeled compactors are allowed within the reinforcement zone of the retaining wall so to minimize the possibility of geogrid reinforcement damage. Care should also be taken that the compaction equipment should not come too close to the wall units themselves. Please consult the engineering installation package included with the construction drawings for limitations.
- F. The backfill will be compacted to 95% proctor density per ASTM D698 if not already specified by the design engineer.

3.06 CAP INSTALLATION

- A. Cap units shall be adhered to underlying units with the Rockwood SSA adhesive or an all-weather adhesive recommended by the manufacturer. Caps may need to be cut for proper side-by-side alignment.
- B. For a proper finish, the finished grade should come to the top of the cap units.
- C. Cap adhesives shall be used with caution and in accordance with the manufacture's instructions.

3.07 FIELD QUALITY CONTROL

- A. The Owner or General Contractor should inspect or enlist the assistance of a qualified third party to provide quality assurance, testing services during construction and/or a final inspection for the retaining wall project. The presents of this third party does not alleviate the installer from fault.

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- B. As a minimum, compaction testing should be done on the leveling pad and spot testing on the reinforcement soils with construction quality verification to ensure the wall is being constructed within the design parameters given within the engineered drawings and Rockwood's specifications.