

SECTION 02832 - SEGMENTAL RETAINING WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specifications, apply to this Section. Design of segmental retaining walls shall also be in accordance with the National Concrete Masonry Association, St. Louis County and the City of Sunset Hills Building Codes.

1.2 SUMMARY

A. This Section includes single and multiple depth segmental retaining walls with soil reinforcement.

B. Related Sections:

1. Section 02300 - Earthwork

1.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Contractor shall design segmental retaining walls, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Global Stability: Contractor shall provide comprehensive engineering analysis of global stability and settlement by a qualified professional engineer using performance requirements and design criteria indicated.

C. Structural Performance: Engineering design shall be based on the following loads and be according to NCMA's "Design Manual for Segmental Retaining Walls."

1. Gravity loads due to all applied pressures resulting from grades and sloped backfill indicated.
2. Superimposed loads (surcharge) indicated on Drawings.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. Samples for Initial Selection: Concrete unit and cap.

C. Samples for Verification: For each color and texture of concrete unit required. Submit full-size units.

1. Include one full-size unit for each type of concrete unit required.

D. Delegated-Design Submittal: For segmental retaining walls indicated to comply with performance requirements and design criteria, including analysis data and drawings (typical sections, and elevation views, etc.) signed and sealed by the qualified professional engineer responsible for their preparation. Obtain any necessary permits and submittal approvals for the wall design.

1. Compliance Review: Qualified professional engineer responsible for segmental retaining wall design shall review and approve submittals and source and field quality-control reports for

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compliance of materials and construction with design prior to design submittal. Submit certification of compliance with design submittal.

1.6 INFORMATIONAL SUBMITTALS

A. Qualification Data: For qualified professional engineer and testing agency.

B. Product Certificates: For segmental retaining wall units and soil reinforcement, from manufacturer.

1. Include test data for shear strength between segmental retaining wall units according to ASTM D 6916.

2. Include test data for connection strength between segmental retaining wall units and soil reinforcement according to ASTM D 6638.

C. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, for segmental retaining wall units and soil reinforcement.

1. Include test data for freeze-thaw durability of segmental retaining wall units.

2. Include test data for shear strength between segmental retaining wall units according to ASTM D 6916.

3. Include test data for connection strength between segmental retaining wall units and soil reinforcement according to ASTM D 6638.

1.7 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 or approved equivalent for testing indicated.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store and handle concrete units and accessories to prevent deterioration or damage due to contaminants, breaking, chipping, or other causes. Follow manufacturer's instructions.

B. Store geosynthetics in manufacturer's original packaging with labels intact. Store and handle geosynthetics to prevent deterioration or damage due to sunlight, chemicals, flames, temperatures above 160 deg F or below 32 deg F, and other conditions that might damage them. Verify identification of geosynthetics before using and examine them for defects as material is placed.

PART 2 - PRODUCTS

2.1 SEGMENTAL RETAINING WALL UNITS

A. Concrete Units: ASTM C 1372, Normal Weight, except that maximum water absorption shall not exceed 7 percent by weight and units shall not differ in height more than plus or minus 1/16 inch from specified dimension.

1. Manufacturers: Subject to compliance with requirements, provide products by available manufacturers offering products similar or functional equivalent to VERSA-LOK Standard Block, manufactured by Kirchner Block and Brick, Inc., 12901 St. Charles Rock Road, Bridgeton, MO 63044.

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2. Provide units that comply with requirements for freeze-thaw durability.
3. Provide units that interlock with courses above and below by means of pins or similar aligning/locking features.

B. Color: As selected by Owner from manufacturer's full range.

C. Shape and Texture: Provide units matching basic shape, dimensions, and face texture similar to the Standard block.

D. Batter: Provide units that offset from course below to provide at least 1:8 batter.

E. Cap Units: Provide cap units as noted on plans with smooth, as-cast top surfaces without holes or lugs.

F. Special Units: Provide corner units, end units, and other shapes as needed to produce segmental retaining walls of dimensions and profiles indicated and to provide texture on exposed surfaces similar to Standard block units.

2.2 INSTALLATION MATERIALS

A. Pins: Product supplied by segmental retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.

B. Clips: Product supplied by segmental retaining wall unit manufacturer for use with units provided, made from nondegrading polymer reinforced with glass fibers.

C. Cap Adhesive: Product supplied or recommended by segmental retaining wall unit manufacturer for adhering cap units to units below.

D. Leveling Base: Comply with requirements for base material as designated by wall designer:

1. Leveling Course: As designated by wall designer.

E. Drainage Fill: Comply with requirements as designated by wall designer.

F. Reinforced-Soil Fill: Comply with requirements as designated by wall designer.

G. Reinforced-Soil Fill: Crushed limestone, 1 inch clean or 1 inch minus, quarry produced, and as specified by wall design engineer, free of debris, waste, frozen materials, vegetation, and other deleterious matter;

H. Nonreinforced-Soil Fill: Comply with requirements in Section 02300 Earthwork for satisfactory soils and as designated by wall designer.

I. Drainage Geotextile: Nonwoven needle-punched geotextile, manufactured for subsurface drainage applications, made from polyolefins or polyesters; with elongation greater than 50 percent.

1. Apparent Opening Size: No. 70 to 100 sieve, maximum; ASTM D 4751.
2. Minimum Grab Tensile Strength: 110 lb; ASTM D 4632.
3. Minimum Weight: 4 oz./sq. yd.

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J. Subdrainage Pipe: Comply with requirements as designated by wall designer.

K. Soil Reinforcement: Product specifically manufactured for use as soil reinforcement and as designed by wall designer.

2.3 SOURCE QUALITY CONTROL

A. Direct manufacturer to certify each roll of soil reinforcement at the factory meet minimum average roll values for geosynthetic index property tests, including the following:

1. Weight.
2. Roll size.
3. Grab or single-rib strength.
4. Aperture opening.
5. Rib or yarn size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions, with Installer present, for compliance with requirements for excavation tolerances, condition of subgrades and subsoils, and other conditions affecting performance of segmental retaining walls.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 RETAINING WALL INSTALLATION

A. General: Place units according to NCMA's "Segmental Retaining Wall Installation Guide" and segmental retaining wall unit manufacturers and wall design engineer's written instructions.

1. Lay units in standard pattern arrangement.
2. Form corners and ends by using special units or cutting units with motor-driven saw.

B. Leveling Base: Place and compact base material to thickness indicated and with not less than 95 percent maximum dry unit weight according to ASTM D 698.

1. Leveling Course: At Contractor's option, unreinforced lean concrete may be substituted for upper 1 to 2 inches of base. Compact and screed concrete to a smooth, level surface, and "wetset" blocks to assure full bearing of base block.

C. First Course: Place first course of segmental retaining wall units for full length of wall. Place units in firm contact with each other, properly aligned and level.

1. Tamp units into leveling base as necessary to bring tops of units into a level plane.

D. Subsequent Courses: Remove all excess fill and debris from tops of units in course below. Place units in firm contact, properly aligned, and directly on course below.

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1. For units with lugs designed to fit into holes in adjacent units, lay units so lugs are accurately aligned with holes, and bedding surfaces are firmly seated on beds of units below.
2. For units with lips at front of units, slide units as far forward as possible for firm contact with lips of units below.
3. For units with lips at bottom rear of units, slide units as far forward as possible for firm contact of lips with units below.
4. For units with pins, install all pins and align units.
5. For units with clips, install all clips and align units.

E. Cap Units: Place cap units and secure with cap adhesive per manufacturer's guidelines.

3.3 FILL PLACEMENT

A. General: Comply with requirements in Section 02300 Earthwork and NCMA's "Segmental Retaining Wall Installation Guide," and segmental retaining wall unit manufacturer's written instructions.

B. Fill voids between and within units with drainage fill. Place fill as each course of units is laid.

C. Place, spread, and compact drainage fill and soil fill in uniform lifts for full width and length of embankment as wall is laid. Place and compact fills without disturbing alignment of units. Where both sides of wall are indicated to be filled, place fills on both sides at same time. Begin at wall and place and spread fills toward embankment.

1. Compact nonreinforced-soil fill to comply with Section 02300 Earthwork and as per wall design specifications.

D. Place drainage geotextile and drainage fill as per wall design.

E. Place a layer of drainage fill at least 12 inches wide behind wall as shown on wall design. Place a layer of drainage geotextile between drainage fill and soil fill.

F. Place sub-drainage pipe in drainage fill as indicated, sloped not less than 0.5 percent to drain.

G. Place and compact to project specifications impervious fill over top edge of drainage fill layer.

H. Slope grade at top of wall away from wall as per plans. Slope grade at base of wall away from wall. Provide uniform slopes that will prevent ponding.

I. Place soil reinforcement in horizontal joints of retaining wall where indicated on wall design plans and according to soil-reinforcement manufacturer's written instructions. Embed reinforcement a minimum of 8 inches into retaining wall and stretch tight over compacted backfill. Anchor soil reinforcement before placing fill.

1. Place additional soil reinforcement at corners and curved walls to provide continuous reinforcement.
2. Place geosynthetics with seams, if any, oriented perpendicular to segmental retaining walls.
3. Do not dump fill material directly from trucks onto geosynthetics.

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4. Place at least 6 inches of fill over reinforcement before compacting with tracked vehicles or 4 inches before compacting with rubber-tired vehicles.

5. Do not turn vehicles on fill until first layer of fill is compacted, and second layer is placed over each soil-reinforcement layer.

3.4 CONSTRUCTION TOLERANCES

A. As-built variation from Level: For bed-joint lines along walls, do not exceed 3/4 inches in 10 feet, 1 1/2 inches maximum.

B. Variation from Indicated Batter: For slope of wall face, do not vary from indicated slope by more than 2 degrees.

C. Variation from Indicated Wall Line: For walls indicated as straight, do not vary from straight line by more than 2 inches.

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency, acceptable to Owner, to perform tests and inspections.

B. Comply with requirements in Section 02300 Earthwork for field quality control and all testing specified in the wall design plans.

1. In each compacted backfill layer, perform at least 1 field in-place compaction test for each 50 feet or less of segmental retaining wall length.

2. In each compacted backfill layer, perform at least 1 field in-place compaction test for each 12 inches of fill depth and each 50 feet or less of segmental retaining wall length.

C. Contractor shall coordinate and obtain approved inspections by municipal inspection agency.

3.6 ADJUSTING

A. Remove and replace segmental retaining wall construction of the following descriptions:

1. Broken, chipped, stained, or otherwise damaged units. Units may be repaired if Owner approves methods and results.

2. Segmental retaining walls that do not match approved Samples and mockups.

3. Segmental retaining walls that do not comply with other requirements indicated.

B. Replace units so segmental retaining wall matches approved Samples and mockups, complies with other requirements, and shows no evidence of replacement.

3.7 WALL PERFORMANCE

A. Wall settlement, rotation, leaning, cracking or gapping shall not exceed the following criteria within a 1-year warranty period;

B. Post-Construction Deflection Criteria

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| 1. Maximum Vertical Total Settlement: | 1 inch |
| 2. Maximum Horizontal Ship: | ½ inch |
| 3. Maximum Differential Settlement within a 10 ft. length: | ½ inch |
| 4. Maximum Wall Batter: | 1/6 inch |
| 5. Maximum Cap between units: | ½ inch |
| 6. Maximum Crack in Precast Block: | ¼" inch |

END OF SECTION 02832

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