

## **SECTION 323223 - 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 Specification Sections, apply to this Section.

#### **1.2 SUMMARY**

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

#### **1.3 ACTION SUBMITTALS**

- A. Product Data: For each type of product.
- B. Samples for Initial Selection: For texture and color of concrete units specified.
- C. Samples: For each color and texture of concrete unit selected. Submit full-size units.
- D. Delegated-Design Submittal: For segmental retaining walls.

#### **1.4 INFORMATIONAL SUBMITTALS**

- A. Product Certificates: For each type of segmental retaining wall unit 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.
- B. Product Test Reports: For each type of segmental retaining wall unit and soil reinforcement, for tests performed by a qualified testing agency.
  - 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.

- C. Research/Evaluation Reports: For segmental retaining wall units and soil reinforcement, from ICC-ES.

## **1.5 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.
- 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 use, and examine them for defects as material is placed.

## **PART 2 - PRODUCTS**

### **2.1 PERFORMANCE REQUIREMENTS**

- A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design segmental retaining walls.
- B. Compliance Review: Qualified professional engineer responsible for segmental retaining wall design shall review and approve submittals and source and field quality-control reports for compliance of materials and construction with design.
- 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 soil pressures resulting from grades and sloped backfill indicated.
  - 2. Superimposed loads (surcharge) of 100 pounds per square foot at top of wall.

### **2.2 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, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
    - a. Allan Block Corporation.
    - b. Anchor Wall Systems, Inc.
    - c. Keystone Retaining Wall Systems, Inc.

- d. Versa-Lok Retaining Wall Systems.
  - 2. Provide units that comply with requirements in ASTM C 1372 for freeze-thaw durability.
  - 3. Provide units that interlock with courses above and below by means of integral lugs, lips, or tongues and grooves, pins clips, or splines.
- B. Color and Texture: As selected by Architect from manufacturer's full range.
- C. Shape and Texture: Provide manufacturer's standard units with options for machine-split textured, smooth, or flat exposed faces.
  - 1. Face Dimensions: 6 to 8 inches high by 12 to 16 inches long.
- D. Batter: Provide units that offset from course below to provide at least 1:24 batter.
- E. Cap Units: Provide cap units of same shape as other units with smooth, as-cast top surfaces without holes or lugs.
- F. Special Units: Provide end units and other shapes as needed to produce segmental retaining walls of dimensions and profiles indicated and to provide texture on exposed surfaces matching face.

### **2.3 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 in Section 312000 "Earth Moving" for base course.
  - 1. Contractor's Option: Lean concrete with a compressive strength of not more than 500 psi.
- E. 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.

- F. Soil Reinforcement: Product specifically manufactured for use as soil reinforcement and as follows:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
    - a. Bonar Inc.; a Low & Bonar company.
    - b. Hanes Geo Components; Leggett & Platt Incorporated.
    - c. Huesker Inc.
    - d. Koninklijke Ten Cate nv.
    - e. Luckenhaus Technical Textiles, Inc.
    - f. Mirafi Construction Products.
    - g. Propex Fabrics Inc.
    - h. Strata Systems, Inc.
    - i. Synteen Technical Fabrics, Inc.
    - j. Tenax Corporation - USA.
    - k. Tensar Earth Technologies, Inc.
    - l. Versa-Lok Retaining Wall Systems.
    - m. Webtec, Inc.
  2. Product Type: Knitted or woven geogrid made from polyester yarns with a protective coating; molded geogrid made from high-density polyethylene; or woven geotextile made from polyamides, polyesters, or polyolefins.

### **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 other conditions affecting performance of the Work.
- 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 manufacturer's written instructions.
  1. Lay units in running bond.
  2. Form ends by using special units.
- B. Do not use units with chips, cracks, or other defects that are visible at a distance of 20 feet where such defects are exposed in the completed Work.

- C. 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 or may be placed over leveling base 1 to 2 inches thick. Compact and screed concrete to a smooth, level surface.
- D. 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.
- E. Subsequent Courses: Remove excess fill and debris from tops of units in course below. Place units in firm contact, properly aligned, and directly on course below.
  - 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 pins and align units.
  - 5. For units with clips, install clips and align units.
- F. Cap Units: Place cap units and secure with cap adhesive.

### **3.3 FILL PLACEMENT**

- A. General: Comply with requirements in NCMA's "Segmental Retaining Wall Installation Guide," and with 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. Use only hand-operated compaction equipment within 48 inches of wall, or one-half of height above bottom of wall, whichever is greater.
  - 2. Compact reinforced-soil fill to not less than 95 percent maximum dry unit weight according to ASTM D 698.

- a. In areas where only hand-operated compaction equipment is allowed, compact fills to not less than 90 percent maximum dry unit weight according to ASTM D 698.
3. Compact nonreinforced-soil fill to comply with Section 312000 "Earth Moving."
- D. Place drainage geotextile against back of wall, and place layer of drainage fill at least 12 inches wide behind drainage geotextile to within 12 inches of finished grade. Place another layer of drainage geotextile between drainage fill and soil fill.
  - E. Wrap subdrainage pipe with filter fabric and place in drainage fill as indicated.
  - F. Place impervious fill over top edge of drainage fill layer.
  - G. Slope grade at top of wall away from wall unless otherwise indicated. Slope grade at wall base away from wall. Provide uniform slopes that prevent ponding.
  - H. Place soil reinforcement in horizontal joints of retaining wall where indicated 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 geosynthetics with seams, if any, oriented perpendicular to segmental retaining walls.
    2. Do not dump fill material directly from trucks onto geosynthetics.

### **3.4 CONSTRUCTION TOLERANCES**

- A. Variation from Level: For bed-joint lines along walls, do not exceed 1-1/4 inches in 10 feet, 3 inches maximum.
- B. Variation from Indicated Batter: For slope of wall face, do not vary from indicated slope by more than 1-1/4 inches in 10 feet.
- C. Variation from Indicated Wall Line: For walls indicated as straight, do not vary from straight line by more than 1-1/4 inches in 10 feet.
- D. Maximum Gap between Units: 1/8 inch.

### **3.5 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 Architect approves methods and results.
  2. Segmental retaining walls that do not match approved Samples.

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.

**END OF SECTION 323223**