

GENEST CONCRETE WORKS, INC. - GUIDE SPECIFICATIONS FOR ANCHOR WALL
SYSTEMS RETAINING WALL

SECTION 32 32 00
RETAINING WALLS
(Section 02830)

PART 1 GENERAL

1.1 SECTION INCLUDES

**** NOTE TO SPECIFIER ** Delete items below not required for project.**

- A. Concrete segmental retaining wall units.
- B. Geosynthetic reinforcement.
- C. Leveling pad base.
- D. Drainage aggregate.
- E. Reinforced Backfill.
- F. Drainage pipe.
- G. Pre-fabricated Drainage Composite.
- H. Geotextile Filter.
- I. Impervious Materials.
- J. Construction Adhesive.

1.2 RELATED SECTIONS

**** NOTE TO SPECIFIER ** Delete section below if not relevant to this project; add others as required.**

- A. Section 310000 - Earthwork.

1.3 REFERENCES

**** NOTE TO SPECIFIER ** Delete references from the list below that are not actually required by the text of the edited section.**

- A. American Association of State Highway Transportation Officials (AASHTO):
 - 1. AASHTO M288 Geotextile Specification for Highway Applications.
 - 2. AASHTO Standard Specifications for Highway Bridges.
- B. ASTM International (ASTM):
 - 1. ASTM C 140 - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units.
 - 2. ASTM C 1262 - Standard Test Method for Evaluating the Freeze-Thaw Durability of Manufactured Concrete Masonry Units and Related Concrete Units.
 - 3. ASTM C 1372 - Standard Specification for Segmental Retaining Wall Units.
 - 4. ASTM D 448 - Standard Classification for Sizes of Aggregate for Road and Bridge Construction.
 - 5. ASTM D 698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/cu ft) (600 kN-m/cu.m.).
 - 6. ASTM D 1556 - Standard Test Method for Density and Unit Weight of Soil In

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- Place by the Sand Cone Method
7. ASTM D 1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/cu ft) (2700 kN-m/cu.m.).
 8. ASTM D 2487 - Standard Classification of Soils for Engineering Purposes (Unified Soil Classification System).
 9. ASTM D 2922 - Standard Test Methods for Density of Soil and Soil-Aggregate In Place by Nuclear Methods (Shallow Depth).
 10. ASTM D 3034 - Standard Specification for Type PSM Poly (Vinyl Chloride) (PVC) Sewer pipe and Fittings.
 11. ASTM D 4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
 12. ASTM D 4491 - Standard Test Method for Water Permeability of Geotextiles by the Permittivity Method.
 13. ASTM D 4595 - Standard Test Method for Tensile Properties of Geotextiles by the Wide-Width Strip Method.
 14. ASTM D 4873 - Standard Guide for Identification, Storage and Handling of Geosynthetics.
 15. ASTM D 5084 - Standard Test Method for Measurement of Hydraulic Conductivity of Saturated Porous Materials Using a Flexible Wall Permeameter.
 16. ASTM D 5262 - Standard Test Method for Evaluating the Unconfined Tension Creep Behavior of Geosynthetics.
 17. ASTM D 5321 - Standard Test Method for Determining the Coefficient of Soil and Geosynthetic or Geosynthetic and Geosynthetic Friction by the Direct Shear Method.
 18. ASTM D 5818 - Standard Practice for Obtaining Samples of Geosynthetics from a Test Section for Assessment of Installation Damage.
 19. ASTM D 6637 - Standard Test Method for Determining Tensile Properties of Geogrids by the Single or Multi-Rib Tensile Method.
 20. ASTM D 6638 - Standard Test Method for Determining Connection Strength Between Geosynthetic Reinforcement and Segmental Concrete Units.
 21. ASTM D 6916 - Standard Test Method for Determining the Shear Strength Between Segmental Concrete Units.
 22. ASTM D 6706 - Standard Test Method for Measuring Geosynthetic Pullout Resistance in Soil.
 23. ASTM F 405 - Standard Specification for Corrugated Polyethylene (PE) Tubings and Fittings.
 24. ASTM G 51 - Standard Test Method for Measuring pH of Soil for Use in Corrosion Testing.
- C. Federal Highway Administration
1. Elias, V., Christopher, B., and Berg, R., "Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Guidelines", Federal Highway Administration Report No. FHWA-NHI-00-043, March 2001.
 2. Elias, V., Christopher, B., and Berg, R., "Corrosion/Degradation of Soil Reinforcements for Mechanically Stabilized Earth Walls and Reinforced Soil Slopes", Federal Highway Administration Report No. FHWA-NHI-00-044, March 2001.
- D. National Concrete Masonry Association (NCMA)
1. NCMA Design Manual For Segmental Retaining Walls, Second Edition, Second Printing (1997).

1.4 DEFINITIONS

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- A. Concrete Segmental Retaining Wall (SRW) Units: Dry-stacked masonry units used as the retaining wall fascia.
- B. Reinforced Backfill: Soil which is used as fill behind the SRW unit, and within the reinforced soil mass (if applicable).
- C. Drainage Aggregate: Material used (if applicable) within, between, and directly behind the concrete retaining wall units.
- D. Stabilized Aggregate: A formulated mix design of clean stone, cement, and water that creates a permeable homogeneous zone (mass). It is obtained by the elimination of fine aggregates (sand) from the normal concrete mix.
- E. Geotextile Filter: Material used for separation and filtration of dissimilar soil types.
- F. Foundation Soil: Soil mass supporting the leveling pad and reinforced soil zone of the retaining wall system.
- G. Geosynthetic Reinforcement: Polymeric material designed specifically to reinforce the soil mass.
- H. Pre-fabricated Drainage Composite: three-dimensional geosynthetic drainage medium encapsulated in a geotextile filter, used to transport water.
- I. Impervious Materials: Clay soil or low permeability geosynthetic used to prevent water percolation into the drainage zone and reinforced backfill behind the wall.
- J. Global Stability: The general mass movement of a soil reinforced segmental retaining wall structure and adjacent soil mass.
- K. Project Geotechnical Engineer: A registered engineer who provides site observations, recommendations for foundation support, and verifies soil shear strength parameters.

1.5 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Material description and installation instructions for each manufactured product specified.
- C. Shop Drawings: Retaining wall system design, including wall elevation views, geosynthetic reinforcement layout, pertinent details, and drainage provisions. The shop drawings shall be signed by a registered professional engineer licensed in the state of wall installation.
- D. Design Calculations: Engineering design calculations prepared in accordance with the NCMA Design Manual For Segmental Retaining Walls, or the AASHTO Standard Specifications for Highway Bridges, Section 5.8 (whichever is applicable). Analysis of global stability must be addressed and incorporated into the shop drawings.
- E. Samples:
 - 1. Furnish one unit in the color and face pattern specified, if requested.
 - 2. Furnish 12 inch square or larger piece of the geosynthetic reinforcement specified.
- F. Test Reports: Independent laboratory reports stating moisture absorption and

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compressive strength properties of the concrete retaining wall units meet the Project Specifications when tested in accordance with ASTM C140, Sections 6, 8 and 9.

- G. LEED Submittals:
1. Manufacturer shall provide product certificate for credit MR 4.1 materials and resources recycled content 5%. Use concrete segmental retaining wall units with supplementary cementing materials such as fly ash or slag.
 2. Manufacturer shall provide product certificate for credit MR 4.2 materials and resources recycled content 10%. Use concrete segmental retaining wall units with supplementary cementing materials such as fly ash or slag.
 3. Manufacturer shall provide certificates for credit MR 5.1 materials and resources regional materials. Use locally manufactured concrete segmental retaining wall units and aggregate materials.
 4. Manufacturer shall provide product certificates for credit MR 5.2 materials and resources regional materials. Use locally extracted materials for concrete segmental retaining wall units.

1.6 QUALITY ASSURANCE

- A. Manufacturer's Qualifications
1. Member in good standing with the National Concrete Masonry Association.
 2. Manufacturer shall provide systematic testing of retaining wall units during production by a National Concrete Masonry Association Certified Masonry Testing Technician.
 3. Manufacturer shall provide independent quality assurance test results for retaining wall units manufactured and tested within a calendar year.
- B. Installer Qualifications: All products listed in this section are to be installed by a single installer with a minimum of five (5) years demonstrated experience in installing products of the same type and scope as specified.

**** NOTE TO SPECIFIER ** Include a mock-up if the project size and/or quality warrant taking such a precaution. The following is one example of how a mock-up on a large project might be specified. When deciding on the extent of the mock-up, consider all the major different types of work on the project.**

1.7 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Concrete Retaining Wall Units and Accessories: Deliver, store, and handle materials in accordance with manufacturer's recommendations, in such a manner as to prevent damage. Check the materials upon delivery to assure that proper material has been received. Store above ground on wood pallets or blocking. Remove damaged or otherwise unsuitable material, when so determined, from the site.
1. Exposed faces of concrete wall units shall be free of chips, cracks, stains, and other imperfections detracting from their appearance, when viewed from a distance of 10 feet.
 2. Prevent mud, wet cement, adhesives and similar materials that may harm appearance of units, from coming in contact with system components.
- C. Geosynthetics (including geosynthetic reinforcement, geotextile filter, pre-fabricated drainage composite) shall be delivered, stored, and handled in accordance with ASTM D4873.

1.8 WARRANTY

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- A. At project closeout, provide to Owner or Owners Representative a copy of the Anchor Wall Systems Inc. standard limited warranty against manufacturing defect, outlining its terms, conditions, and exclusions from coverage.

1.9 EXTRA MATERIALS

- A. Furnish Owner with 3 replacement units identical to those installed on the Project.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Manufacturer: Genest Concrete Works, Inc.
 - 1. Contact: Genest Concrete Works, Inc. 36 Wilson Street, Sanford, Maine 04073, phone: 1-800-332-4773, fax: 1-207-490-5076, www.GenestConcrete.com. Email: sales@genest-concrete.com
- B. Physical Requirements: Meet ASTM C 1372, except the unit height dimension shall not vary more than plus or minus 1/16 inch.
- C. Substitutions: Not permitted.
- D. Product: Subject to compliance with requirements: [provide the following:] [provide one of the following:] [available products that maybe incorporated into the work include, the following:]

2.2 HIGHLAND STONE RETAINING WALLS

**** NOTE TO SPECIFIER ** Retain only products required on this project and delete all others.**

- A. Highland Stone - 3 inch (76mm):
 - 1. Face: Random.
 - 2. Color: As selected from manufacturer's full range of available colors.
 - 3. Texture: Split Rock Face.
 - 4. Dimensions:
 - a. Front Height: 3 inches (76mm).
 - b. Front Length / Weight - Small: 6 inches (152mm) / 14 lbs. (6.4 kg).
 - c. Front Length / Weight - Medium: 12 inches (305mm) / 28 lbs (12.7 kg).
 - d. Front Length / Weight - Large: 18 inches (457mm) / 41 lbs. (18.6 kg).
 - e. Front Depth: 11 1/2 inches (292mm).
 - f. Setback: 9/16 inch (14mm).
- B. Highland Stone - 6 inch (152mm):
 - 1. Face: Random.
 - 2. Color: As selected from manufacturer's full range of available colors.
 - 3. Texture: Split Rock Face.
 - 4. Dimensions:
 - a. Front Height: 6 inches (152mm).
 - b. Front Length / Weight - Small: 6 inches (152mm) / 30 lbs. (13.6 kg).
 - c. Front Length / Weight - Medium: 12 inches (305mm) / 59 lbs (26.8 kg).
 - d. Front Length / Weight - Large: 18 inches (457mm) / 73 lbs. (33.1 kg).
 - e. Front Depth: 12 inches (305mm).
 - f. Setback: 1 1/8 inches (29mm).
- C. Highland Stone Cap:
 - 1. Front Height: 3 inches (76mm).
 - 2. Front Length: 17 inches (431mm).

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3. Front Depth: 12 inches (305mm).
4. Back Length: 15-1/2 inches (374 mm).
5. Weight: 44 lbs. (20 kg) per unit.
6. Coverage: 1.25 lin. ft (381mm).

- D. Highland Stone Step:
1. Front Height: 6 inches (152mm).
 2. Front Length: 16 inches (406mm).
 3. Front Depth: 12 inches (305mm).
 4. Weight: 85 lbs. (38.6 kg) per unit.

2.3 DIAMOND RETAINING WALLS

**** NOTE TO SPECIFIER ** Retain only products required on this project and delete all others.**

- A. Diamond - 6 inch (152mm) Straight Face:
1. Color: As selected from manufacturer's full range of available colors.
 2. Texture: Split Rock Face.
 3. Dimensions:
 - a. Front Height: 6 inches (152mm).
 - b. Front Length: 17 1/8 inches (435mm).
 - c. Front Depth: 12 inches (305mm).
 - d. Weight: 72 lbs. (32.7 kg) per unit.
 - e. Setback: 1 1/8 inches (29mm).
- B. Diamond - 6 inch (152mm) Beveled Face:
1. Color: As selected from manufacturer's full range of available colors.
 2. Texture: Split Rock Face.
 3. Dimensions:
 - a. Front Height: 6 inches (152mm).
 - b. Front Length: 15 7/8 inches (403mm).
 - c. Front Depth: 12 inches (305mm).
 - d. Weight: 68 lbs. (30.8 kg) per unit.
 - e. Setback: 1 1/8 inches (29mm).
- C. Diamond Cap:
1. Front Height: 3 inches (76mm).
 2. Front Length: 17 inches (431mm).
 3. Front Depth: 12 inches (305mm).
 4. Back Length: 15-1/2 inches (374 mm).
 5. Weight: 32 lbs. (14.5 kg) per unit.
 6. Coverage: 1.13 lin. ft (344mm).
- D. Diamond Step:
1. Front Height: 6 inches (152mm).
 2. Front Length: 16 inches (406mm).
 3. Front Depth: 12 inches (305mm).
 4. Weight: 89 lbs (40.4 kg) per unit.

2.4 DIAMOND STONE CUT RETAINING WALLS

**** NOTE TO SPECIFIER ** Retain only products required on this project and delete all others.**

- A. Diamond Stone Cut - 6 inch (152mm) Casual Face:
1. Color: As selected from manufacturer's full range of available colors.
 2. Texture: Split Rock Face

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3. Dimensions:
 - a. Front Height: 6 inches (152mm).
 - b. Front Length: 15 7/8 inches (403mm).
 - c. Front Depth: 12 inches (305mm).
 - d. Weight: 68 lbs. (30.8 kg) per unit.
 - e. Setback: 1 1/8 inches (29mm).

- B. Diamond Cap:
 1. Front Height: 3 inches (76mm).
 2. Front Length: 17 inches (431mm).
 3. Front Depth: 12 inches (305mm).
 4. Back Length: 15-1/2 inches (374 mm).
 5. Weight: 32 lbs. (14.5 kg) per unit.
 6. Coverage: 1.13 lin. ft (344mm).

- C. Diamond Step:
 1. Front Height: 6 inches (152mm).
 2. Front Length: 16 inches (406mm).
 3. Front Depth: 12 inches (305mm).
 4. Weight: 89 lbs (40.4 kg) per unit.

2.5 DIAMOND PRO RETAINING WALLS

- A. Diamond Pro - 8 inch (203mm) Straight Face:
 1. Color: As selected from manufacturer's full range of available colors.
 2. Texture: Split Rock Face.
 3. Dimensions:
 - a. Front Height: 8 inches (203mm).
 - b. Front Length: 18 inches (457mm).
 - c. Front Depth: 12 inches (305mm).
 - d. Weight: 74 lbs. (32.7 kg) per unit.
 - e. Setback: 1 inch (25mm).

2.6 DIAMOND PRO STONE CUT RETAINING WALLS

**** NOTE TO SPECIFIER ** Retain only products required on this project and delete all others.**

- A. Diamond Pro Stone Cut - 8 inch (203mm):
 1. Face: Random.
 2. Color: As selected from manufacturer's full range of available colors.
 3. Texture: Split Rock Face.
 4. Dimensions:
 - a. Front Height: 8 inches (203mm).

**** NOTE TO SPECIFIER ** Retain only size(s) required on this project from the next three options and delete all others.**

- b. Front Length / Weight - Small: 7 inches (457mm) / 34 lbs. (15 kg).
- c. Front Length / Weight - Medium: 11 inches (279mm) / 45 lbs (20 kg).
- d. Front Length / Weight - Large: 18 inches (457mm) / 77 lbs. (35 kg).
- e. Front Depth: 12 inches (305 mm).
- f. Setback: 1 inch (25mm).

- B. Diamond Pro Stone Cut Cap:
 1. Front Height: 3 inches (76mm).
 2. Front Length: 17 inches (431mm).
 3. Front Depth: 12 inches (305mm).
 4. Back Length: 15-1/2 inches (374 mm).

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5. Weight: 40 lbs. (18.1 kg) per unit.
 6. Coverage: 1.13 lin. ft (344mm).
- C. Diamond Pro Stone Cut Corner:
1. Front Height: 8 inches (203mm).
 2. Front Length: 18 inches (457mm).
 3. Front Depth: 9 inches (229mm).
 4. Weight: 101 lbs. (46 kg) per unit.

2.7 VERTICAL RETAINING WALLS

**** NOTE TO SPECIFIER ** Retain only products required on this project and delete all others.**

A. Vertica:

**** NOTE TO SPECIFIER ** Select required face type. Delete one of the next two paragraphs.**

1. Face: Straight.
2. Face: Beveled.
3. Color: As selected from manufacturer's full range of available colors.
4. Texture: Split Rock Face.
5. Dimensions:
 - a. Front Height: 7-1/2 inches (191mm).
 - b. Front Length: 18 inches (457mm).
 - c. Front Depth: 12 inches (304mm).
 - d. Weight: 86 lbs. (39 kg) per unit.
 - e. Setback: 1/2 inch (13mm).

B. Vertica Stone Cut:

1. Face: Stone Cut.
2. Color: As selected from manufacturer's full range of available colors.
3. Texture: Split Rock Face.
4. Dimensions:
 - a. Front Height: 7-1/2 inches (191mm).
 - b. Front Length: 18 inches (457mm).
 - c. Front Depth: 12 inches (305mm).
 - d. Weight: 95 lbs. (43.1 kg) per unit.
 - e. Setback: 1/2 inch (13mm).

C. Vertica Pro:

**** NOTE TO SPECIFIER ** Select required face type. Delete one of the next two paragraphs.**

1. Face: Straight.
2. Face: Beveled.
3. Color: As selected from manufacturer's full range of available colors.
4. Texture: Split Rock Face.
5. Dimensions:
 - a. Front Height: 7-1/2 inches (191mm).
 - b. Front Length: 18 inches (457mm).
 - c. Front Depth: 20 inches (508mm).
 - d. Weight: 115 lbs. (52.2 kg) per unit.
 - e. Setback: 1/2 inch (13mm).

D. Vertica Cap:

1. Front Height: 3 inches (76mm).
2. Front Length: 17 inches (431mm).
3. Front Depth: 12 inches (305mm).

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4. Back Length: 15-1/2 inches (374 mm).
5. Weight: 40 lbs. (18.1 kg) per unit.
6. Coverage: 1.13 lin. ft (344mm).

E. Vertica Corner:

1. Front Height: 7-1/2 inches (191mm).
2. Front Length: 18 inches (457mm).
3. Front Depth: 9 inches (229mm).
4. Weight: 101 lbs. (45.8 kg) per unit.

2.8 LANDMARK RETAINING WALLS

**** NOTE TO SPECIFIER ** Retain only products required on this project and delete all others.**

A. Landmark Full Component:

1. Face: Straight.
2. Front Height: 15 inches (381mm).
3. Front Length: 8 inches (203mm).
4. Front Depth: 12 5/8 inches (321mm).
5. Weight: 85 lbs. (38.6 kg) per unit.

B. Landmark Tapered Full Component:

1. Face: Straight.
2. Front Height: 15 inches (381mm).
3. Front Length: 8 inches (203mm).
4. Front Depth: 11 7/8 inches (302mm).
5. Weight: 80 lbs. (36.3 kg) per unit.

C. Landmark Half High Component:

1. Face: Straight.
2. Front Length: 8 inches (203mm).
3. Front Depth: 12 3/16 inches (310mm).
4. Weight: 50 lbs. (22.7 kg) per unit.

D. Landmark Foundation Component:

1. Face: Straight.
2. Front Height: 7 1/2 inches (191mm).
3. Front Length: 8 inches (203mm).
4. Front Depth: 11 3/4 inches (298mm).
5. Weight: 48 lbs. (21.8 kg) per unit.

E. Landmark Cap:

1. Front Height: 7 1/2 inches (191mm).
2. Front Length: 17 1/4 inches (438mm).
3. Front Depth: 10 3/8 inches (264mm).
4. Weight: 43 lbs. (19.5 kg) per unit.
5. Coverage: 1.15 lin. ft (351mm).

F. Landmark Corner:

1. Front Height: 8 inches (203mm).
2. Front Length: 18 inches (457mm).
3. Front Depth: 9 inches (229mm).
4. Weight: 101 lbs. (45.8 kg) per unit.

2.9 RELATED PRODUCTS

- A. Geosynthetic Reinforcement: Polyester fiber geogrid or geotextile, HDPE or

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polypropylene woven geotextile, as shown on the Drawings.

1. Geotextile fabric: Manufactured by Ten Cate Nicolon, Mirafi Construction Products, Pendergrass, GA 706-693-2226. www.mirafi.com
 - a. Material Type and Description: [Specify material type and description].
 - b. Material Standard: [Specify material standard].
 - c. Manufacturer: Acceptable to concrete retaining wall unit manufacturer.
 2. Or approved equal.
- B. Leveling Pad Base:
1. Aggregate Base: Crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448:
 - a. Sieve: 1 inch - 100 percent passage.
 - b. Sieve: No. 4 - 35 to 70 percent passage.
 - c. Sieve: No. 40 - 10 to 35 percent passage.
 - d. Sieve: No. 200 - 3 to 10 percent passage.
 - e. Base Thickness: 6 inch (152mm) minimum compacted thickness.
 2. Concrete Base: Nonreinforced lean concrete base.
 - a. Compressive Strength: 3000 psi (minimum).
 - b. Base Thickness: At least 2 inches (52mm).
- C. Drainage Aggregate: Clean crushed stone or granular fill meeting the following gradation as determined in accordance with ASTM D448:
1. Sieve: 1 inch - 100 percent passage.
 2. Sieve: 3/4 inch - 75 to 100 percent passage.
 3. Sieve: No. 4 - 0 to 60 percent passage.
 4. Sieve: No. 40 - 0 to 50 percent passage.
 5. Sieve: No. 200 - 0 to 5 percent passage.
- D. Backfill: Soil free of organics and debris and consisting of either GP, GW, SP, SW, or SM type, classified in accordance with ASTM D2487 and the USCS classification system.
1. Soils classified as SC, ML and CL are considered suitable soils for segmental retaining walls with a total height of less than 10 feet unless the Plasticity Index (PI) is 20 or more.
 2. Maximum particle size for backfill is 4 inches.
 3. Unsuitable soils are organic soils and those soils classified as CH, OH, MH, OL, or PT.
- E. Impervious Material: Clayey soil or other similar material which will prevent percolation into the drainage zone behind the wall.
- F. Drainage Pipe: Perforated or slotted PVC or corrugated HDPE pipe manufactured in accordance with D3034 and/or ASTM F405. The pipe may be covered with a geotextile filter fabric to function as a filter.
- G. Construction Adhesive: Exterior grade adhesive as recommended by the retaining wall unit manufacturer.
1. Construction Adhesive Manufacturer: SRW Products, Princeton, MN, 763-389-2722. www.srwproducts.com
 - a. Material Type and Description: [specify material type and description]
 - b. Material Standard: [specify material standard]
 - c. Manufacturer: Acceptable to concrete retaining wall unit manufacturer.
 2. Or approved equal.

PART 3 EXECUTION

- A. Examine the areas and conditions under which the retaining wall system is to be

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erected, and notify the Architect/Engineer/Owner/Contractor in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

- B. Promptly notify the wall design engineer of site conditions which may affect wall performance, soil conditions observed other than those assumed, or other conditions that may require a reevaluation of the wall design.
- C. Verify the location of existing structures and utilities prior to excavation.

3.2 PREPARATION

- A. Ensure surrounding structures are protected from the effects of wall excavation.
- B. Excavation support, if required, is the responsibility of the Contractor, including the stability of the excavation and its influence on adjacent properties and structures.

3.3 EXCAVATION

- A. Excavate to the lines and grades shown on the Drawings. Over-excavation not approved by the Architect will not be paid for by the Architect/Engineer/Owner/Contractor. Replacement of these soils with compacted fill and/or wall system components will be required at the Contractor's expense. Use care in excavating to prevent disturbance of the base beyond the lines shown.

3.4 FOUNDATION PREPARATION

- A. Excavate foundation soil as required for footing or base dimension shown on the Contract Drawings, or as directed by the Project geotechnical engineer.
- B. The Project geotechnical engineer will examine foundation soil to ensure that the actual foundation soil strength meets or exceeds that indicated on the Drawings. Remove soil not meeting the required strength. Oversize resulting space sufficiently from the front of the block to the back of the reinforcement, and backfill with suitable compacted backfill soils.
- C. The Project geotechnical engineer will determine if the foundation soils will require special treatment or correction to control total and differential settlement.
- D. Fill over-excavated areas with suitable compacted backfill, as recommended by the Project geotechnical engineer.

3.5 BASE COURSE PREPARATION

- A. Place base materials to the depths and widths shown on the Contract Drawings, upon undisturbed soils, or foundation soils prepared as specified in this section.
 - 1. Extend the leveling pad laterally at least 6 inches in front and behind the lowermost concrete retaining wall unit.
 - 2. Provide aggregate base compacted to 6 inches thick (minimum).
 - 3. The Contractor may at their option, provide a concrete leveling pad as specified in Subparagraph 2.01.C.2, in lieu of the aggregate base.
 - 4. Where a reinforced footing is required by local code official, place footing below frost depth.
- B. Compact aggregate base material to provide a level, hard surface on which to place the first course of units.
- C. Prepare base materials to ensure complete contact with retaining wall units. Gaps

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are not allowed.

3.6 ERECTION

- A. General: Erect units in accordance with manufacturer's instructions and recommendations, and as specified herein.
- B. Place first course of concrete wall units on the prepared base material. Check units for level and alignment. Maintain the same elevation at the top of each unit within each section of the base course.
- C. Ensure that foundation units are in full contact with natural or compacted soil base.
- D. Place concrete wall units side-by-side for full length of wall alignment. Alignment may be done by using a string line measured from the back of the block. Gaps are not allowed between the foundation concrete wall units.
- E. Place at least 12 inches (305mm) of drainage aggregate between, and directly behind the concrete wall units. Fill voids in retaining wall units with drainage aggregate. Provide a drainage zone behind the wall units to within 9 inches of the final grade. Cap the backfill and drainage aggregate zone with 12 inches (305mm) of impervious material.
- F. Install drainage pipe at the lowest elevation possible, to maintain gravity flow of water to outside of the reinforced zone. Slope the main collection drainage pipe, located just behind the concrete retaining wall units, 2 percent grade minimum to provide gravity flow to the daylighted areas. Daylight the main collection drainage pipe through the face of the wall, and/or to an appropriate location away from the wall system at each low point and at 50 foot (15.25 m) maximum intervals along the wall. Alternately, the drainage pipe can be connected to a storm sewer system at 50 foot (15.25 m) maximum intervals.
- G. Remove excess fill from top of units and install next course. Ensure drainage aggregate and backfill are compacted before installation of next course.
- H. Check each course for level and alignment. Adjust units as necessary to maintain level and alignment prior to proceeding with each additional course.
- I. Install each succeeding course placing units in a random pattern. Backfill as each course is completed. Pull the units forward until the locating surface of the unit contacts the locating surface of the units in the preceding course. Interlock wall segments that meet at corners by overlapping successive courses. Attach concrete retaining wall units at exterior corners with adhesive specified.
- J. Install geosynthetic reinforcement in accordance with geosynthetic manufacturer's recommendations and the Contract Drawings.
 - 1. Orient geosynthetic reinforcement with the highest strength axis perpendicular to the wall face.
 - 2. Prior to geosynthetic reinforcement placement, place the backfill and compact to the elevation of the top of the wall units at the elevation of the geosynthetic reinforcement.
 - 3. Place geosynthetic reinforcement at the elevations and to the lengths shown on the Contract Drawings.
 - 4. Lay geosynthetic reinforcement horizontally on top of the concrete retaining wall units and the compacted backfill soils. Place the geosynthetic reinforcement within one inch of the face of the concrete retaining wall units. Place the next course of concrete retaining wall units on top of the

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- geosynthetic reinforcement.
5. The geosynthetic reinforcement shall be in tension and free from wrinkles prior to placement of the backfill soils. Pull geosynthetic reinforcement hand-taut and secure in place with staples, stakes, or by hand-tensioning until the geosynthetic reinforcement is covered by 6 inches (152mm) of loose fill.
 6. The geosynthetic reinforcements shall be continuous throughout their embedment lengths. Splices in the geosynthetic reinforcement strength direction are not allowed.
 7. Do not operate tracked construction equipment directly on the geosynthetic reinforcement.
 8. At least 6 inches of compacted backfill soil is required prior to operation of tracked vehicles over the geosynthetic reinforcement. Keep turning of tracked construction equipment to a minimum.
 9. Rubber-tired equipment may pass over the geosynthetic reinforcement at speeds of less than 5 miles per hour. Turning of rubber-tired equipment is not allowed on the geosynthetic reinforcement.

3.7 BACKFILL PLACEMENT

- A. Place reinforced backfill, spread and compact in a manner that will minimize slack in the reinforcement.
- B. Place fill within the reinforced zone and compact in lifts not exceeding 6 to 8 inches (loose thickness) where hand-operated compaction equipment is used, and not exceeding 12 inches (loose thickness) where heavy, self-propelled compaction equipment is used.
 1. Only lightweight hand-operated compaction equipment is allowed within 4 feet of the back of the retaining wall units. If the specified compaction cannot be achieved within 4 feet of the back of the retaining wall units, replace the reinforced soil in this zone with drainage aggregate material.
- C. Compaction testing shall be done in accordance with ASTM D1556 or ASTM D2922.

**** NOTE TO SPECIFIER ** In the paragraph below, select revised modified Proctor densities if necessary, in lieu of standard Proctor densities specified**

- D. Minimum Compaction Requirements for Fill Placed in the Reinforced Zone
 1. The minimum compaction requirement shall be determined by the project geotechnical engineer testing the compaction. At no time shall the soil compaction requirements be less than 95 percent of the soil's standard Proctor maximum dry density (ASTM D698) [modified Proctor maximum dry density (ASTM D1557)] for the entire wall height
 2. Utility Trench Backfill: Compact utility trench backfill in or below the reinforced soil zone to 98 percent of the soil's standard Proctor maximum dry density (ASTM D698) [modified Proctor maximum dry density (ASTM D1557)], or as recommended by the Project geotechnical engineer. If the height from the utility to finish grade is higher than 30 feet, increase compaction to 100 percent of the standard Proctor density [modified Proctor density].
 - a. Utilities must be properly designed (by others) to withstand all forces from the retaining wall units, reinforced soil mass, and surcharge loads, if any.
 3. Moisture Content: Within 2 percentage points of the optimum moisture content for all wall heights.
 4. These specifications may be changed based on recommendations by the Project geotechnical engineer.
 - a. If changes are required, the Contract Sum will be adjusted by written

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Change Order.

- E. At the end of each day's operation, slope the last level of compacted backfill away from the interior (concealed) face of the wall to direct surface water runoff away from the wall face.
 - 1. The General Contractor is responsible for ensuring that the finished site drainage is directed away from the retaining wall system.
 - 2. In addition, the General Contractor is responsible for ensuring that surface water runoff from adjacent construction areas is not allowed to enter the retaining wall area of the construction site.
- F. Refer to Article 3.10 for compaction testing.

3.8 CAP UNIT INSTALLATION

- A. Apply adhesive to the top surface of the unit below and place the cap unit into desired position.
- B. Cut cap units as necessary to obtain the proper fit.
- C. Backfill and compact to top of cap unit.

3.9 SITE CONSTRUCTION TOLERANCES

- A. Site Construction Tolerances:
 - 1. Vertical Alignment: Plus or minus 1 1/2 inches (38mm) over any 10 foot (3048mm) distance, with a maximum differential of 3 inches (76mm) over the length of the wall.
 - 2. Horizontal Location Control From Grading Plan
 - a. Straight Lines: Plus or minus 1 1/2 inches (38mm) over any 10 foot (3048mm) distance.
 - b. Corner and Radius Locations: Plus or minus 12 inches (305mm).
 - c. Curves and Serpentine Radii: Plus or minus 2 feet (610mm).
 - 3. Immediate Post Construction Wall Batter: Within 2 degrees of the design batter of the concrete retaining wall units.
 - 4. Bulging: Plus or minus 1 1/4 inches (32mm) over any 10 foot (3048mm) distance.

3.10 FIELD QUALITY CONTROL

- A. Installer is responsible for quality control of installation of system components.
- B. The Owner or General Contractor, at their expense, will retain a qualified professional to perform quality assurance checks of the installer's work.
- C. Correct work which does not meet these specifications or the requirements shown on the Drawings at the installer's expense.
- D. Perform compaction testing of the reinforced backfill placed and compacted in the reinforced backfill zone.
 - 1. Testing Frequency:
 - a. One test for every 2 vertical feet (610mm) of fill placed and compacted, for every 50 lineal feet (15.25 lm) of retaining wall.
 - b. Vary compaction test locations to cover the entire area of the reinforced soil zone, including the area compacted by the hand-operated compaction equipment.

3.11 ADJUSTING AND CLEANING

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- A. Replace damaged units with new units as the work progresses.
- B. Remove debris caused by wall construction and leave adjacent paved areas broom clean.

END OF SECTION