

3.8 DRAINAGE SYSTEM

- A. Drainage Collection Pipe:
  1. Install the drainage collection pipe according to line, grades and sections shown on the Drawings.
  2. Install drainage collection pipe to maintain gravity flow of water from reinforced soil zone. Daylight drainage collection pipe at storm sewer manhole or along slope at an elevation lower than lowest point of reinforced soil mass, every 40 feet minimum.
  3. Main collection pipe for segmented units shall be minimum 4 inches in diameter. Secondary collection drain pipe shall gravity flow independently or tie into main collection drain pipe with laterals at maximum 40 foot spacing along wall face.
- B. Drainage Aggregate:
  1. Install drainage aggregate to line, grades, and sections shown on the Drawings.
  2. When blanket drain is installed, non-woven geotextile shall be installed prior to aggregate placement in accordance with the Drawings.
- C. Drainage Composite:
  1. Install drainage composite as shown on the Drawings.
  2. Wrap upper ends of drainage composite with approved geotextile fabric.
  3. Drainage composite shall extend upwards minimum of 2/3 of height of backfill and be spaced on horizontal centers to give a minimum of 50% to 100% horizontal coverage as required.
  4. Drainage composite shall terminate in a french drain effectively connecting to a collector pipe wrapped in drainage aggregate and an approved geotextile fabric.

3.9 SRW CAP INSTALLATION

- A. Place SRW Cap units per manufacturer's recommendations. Backfill and compact to finished grade.
- B. Incorporate surface water drainage control (swale) into finished grading at top of wall, as shown on the Drawings.
- C. Attach cap units to wall units with construction epoxy. Apply epoxy to bottom surface of cap unit and install on clean units below. Follow epoxy manufacturer's directions to ensure permanent bond.

3.10 CONSTRUCTION

- A. SRW Tolerances: Installation of SRW face location shall be within all the following tolerances:
  1. Vertical control from plan:  $\pm 1.25$  inches over a 10 ft. distance.
  2. Horizontal location control from plan:
    - a. Straight & constant radius:  $\pm 1.25$  inches over a 10 ft. distance.
    - b. Straight & variable radius:  $\pm 1.0$  ft.
    - c. Curves and serpentine radius:  $\pm 2.0$  ft.
  3. Rotation of the wall face during construction:
    - a. Maximum 2.0 degrees from established wall plan batter.
    - b. Maximum  $\pm 10.0\%$  from total established horizontal setback.
  4. Bulging:  $\pm 1.25$  inches over a 10.0 ft. distance.
- B. Mechanical vibrating plate compactors shall not be used on top of the units. Compact fill between units and the backfill zone behind the units by running hand-operated compaction equipment just behind units. Perform compaction to manufacturer's recommendations.

3.11 FIELD QUALITY CONTROL

- A. The Contractor shall engage inspection and testing service agencies, including independent laboratories, to provide quality control and testing services during construction. The Owner may engage a testing and inspection agency for quality assurance, but this does not relieve the General Contractor from providing the specified construction quality control and testing.
- B. Testing and inspection services shall be performed by trained and experienced technicians currently qualified for the work to be performed.
- C. The testing agency shall submit written reports of inspections to the Contractor on weekly basis. Such reports shall include description of work performed, deficiencies noted in construction, and corrective action taken to resolve such deficiencies. Owner shall be notified directly by the Contractor's testing agency of deficiencies noted by testing agency and provided with a summary and schedule for corrective action. Written reports will also include location, type, and results of all tests taken on the Project.
- D. The Contractor shall provide a certification to the Owner that the completed SRW has been installed in accordance with the contract documents.
- E. Segmental Retaining Wall Units:
  1. Compressive strength test specimens shall conform to the saw-cut coupon provisions of Section 5.2.4 of ASTM C140 with the following exceptions:
    - a. Coupon shall have a minimum thickness of 1-1/2 inches.
    - b. Coupon shall not be oven dried before testing.
  2. The compressive strength shall be considered the average of three or more test coupons.
  3. Run compressive strength testing for every 7,500 square feet of installed wall facing material or fraction thereof. The testing shall be performed immediately upon receipt from laboratory.
- F. Soil and Backfill Testing: Unless otherwise directed by the Owner or required by this technical scope of work, type and minimum frequency of testing for soils-related portions of construction shall be as follows.
  1. Field density tests in accordance with ASTM D 2922:
    - a. Subgrade Soils: One test for every 2,500 square feet per lift of material
    - b. Base Leveling Pad: One test for every 100 linear feet
    - c. Reinforced Backfill: One test for every 2,500 square feet per lift. Every other lift shall be tested.
  2. Laboratory moisture-density relationships, ASTM D 1557: One test for every compacted material type.
  3. Gradation Analysis, ASTM D 422:
    - a. Unit Fill: One test for every 500 cubic yards of material
    - b. Reinforced Backfill: One test for every 500 cubic yards of material or when material type changes.

1.1 SEGMENTAL RETAINING WALL ALTERNATE PROPOSAL REQUIREMENTS

- I. SUBMITTAL REQUIREMENTS
  - A. Submittal packages shall include the following:
    1. Notarized certificate from General Contractor shall be provided to the Owner prior to start of work stating that the SRW system complies with the criteria referenced in this section.
    2. The General Contractor shall provide the SRW system design and supporting signed and sealed structural calculations to the Owner prior to the start of work. The design submitted shall be based on soil parameters, foundation conditions, and loading stated in documentation as outlined in the Construction Documents. General Contractor's Engineer shall provide wall design and analyses utilizing SRW wall computer software.
    3. Proprietary product literature indicating specifically which segmental retaining wall units are proposed for use on project, including color, face style and texture.
    4. Proprietary product specifications indicating compressive strength, unit weight, mix and percent absorption for the units proposed.
    5. Retaining wall shop drawings showing complete wall profiles, reinforcement elevations, reinforcement lengths, reinforcement types, top of wall, bottom of wall, proposed grades at top of wall, proposed grades at bottom of wall, and stations showing beginning and end of wall as well as beginning and end of turns and radii. Shop drawings shall include detail drawings for facing connections, wall penetrations, guard rails, hand rails, leveling pad, drainage swales and typical sections and construction details.
    6. Retaining wall shop drawings shall show design parameters for retaining wall, required bearing capacity of foundation soils along with provided factor safety against bearing capacity failures wall subgrade and construction details.
    7. Retaining wall shop drawings shall be accompanied by a complete set of construction specifications which conform to the requirements of this section.
    8. Retaining wall shop drawings and specifications shall be stamped "FOR BID ONLY-NOT FOR CONSTRUCTION" in red ink
    9. Retaining wall shop drawings and specifications shall be accompanied by engineer's design calculations and/or computer output addressing required design parameters according to NCMA recommendations.
    10. Four copies of the submittal package shall be provided to the project civil engineer of record for distribution for review as follows:
      - a. 2 copies to the owner.
      - b. 1 copy to the project geotechnical engineer.
      - c. 1 copy to be retained by the civil engineer of record.
- B. After submittals are approved, shop drawings shall be provided stamped "FOR CONSTRUCTION"

II. DESIGN

- A. Design for SRWs using extensible (geosynthetic) reinforcement shall be prepared according to design methodology presented in NCMA "Design Manual for Segmental Retaining Walls" and conform to the minimum safety factors as specified in this section. Design submittals not meeting this design criteria or technical/administrative criteria as specified will be rejected in their entirety until complete compliance is achieved. Owner reserves all rights in determining compliance for plan approval and may reject any submittals.
- B. Only SRW systems with positive mechanical fascia connections will be considered. Connections shall provide uniform horizontal setback per course, which equates to uniform initial wall batter of between 3 and 17 degrees for installed units.

C. Designs submitted using inextensible reinforcements, including Panel Wall Systems, shall be performed per AASHTO Standard Specifications for Highway Bridges. Allowable tensile stress at the end of design service life shall not exceed 25 percent of the ultimate tensile strength of the reinforcement. Design submittals not meeting this design criteria or technical criteria as specified will be rejected in their entirety until complete compliance is achieved. Owner reserves all rights in determining compliance for plan approval and may reject any submittals.

D. Soil design parameters shall be as provided in the Construction Documents. Wall Design Engineer of Record shall be responsible for selecting and specifying reinforced fill material. Reinforced fill material shall have minimum angle of internal friction of 30 degrees. General Contractor is responsible for ensuring and documenting the reinforced fill meets the specified parameters for both strength and compaction. Compacted retained soil shall meet the minimum requirements specified in 4.02.D

E. Design Parameters: Design of the SRW system shall be based on the following soil parameters as determined during the geotechnical investigation.

Wall Segment Friction Angle Cohesion Unit Weight  
 Reinforced Backfill 30 degrees min \_\_\_\_\_pcf  
 Retained Backfill \_\_\_\_\_degrees \_\_\_\_\_pcf  
 Foundation \_\_\_\_\_degrees \_\_\_\_\_pcf

F. Design Requirements:

- 1. Unless otherwise indicated below, SRW design shall be performed in strict accordance with the procedures presented in the NCMA Design Manual for Segmental Retaining Walls.
  2. Internal Stability of Walls:
    - a. Minimum Factor of Safety on Tensile Overstress 1.2
    - b. Minimum Factor of Safety on Geogrid Pullout (peak load criterion) 1.5
    - c. Minimum Factor of Safety on Geogrid Pullout (serviceability criterion) 0.75 inches 1.0
    - d. Minimum Factor of Safety on Facing Shear (peak load criterion) 1.5
    - e. Minimum Factor of Safety on Facing Shear (serviceability criterion) 2% of height of SRW units 1.0
    - f. Minimum Factor of Safety Connections (peak load criterion) 1.5
    - g. Minimum Factor of Safety Connections (serviceability criterion) 0.75 inches 1.0
  3. External Stability:
    - a. Minimum Factor of Safety Against Base Sliding (static condition) 1.5
    - b. Minimum Factor of Safety Against Overturning 2.0
    - c. Minimum Factor of Safety for Global Stability 1.5
    - d. Minimum Factor of Safety for Bearing Capacity 2.0
- 4. Design shall address hydrostatic loading, seismic loading, rapid drawdowns, surcharge, and backlopes where appropriate. Minimum Design Live Load of 125 psf shall be used for all walls. Minimum Design Live Load of 250 psf shall be used for walls supporting entrance drives, service drives and other areas subject to traffic.
- 5. Minimum geogrid length shall be 70 percent of the wall height. Geogrid reinforcement coverage at each layer shall be 100 percent (no gaps)
- 6. The maximum vertical distance between layers of soil reinforcement shall be as recommended by the manufacturer, but shall not exceed 31 inches.

**BETHLEHEM TOWN CENTER II**  
 BETHLEHEM, NY

**NIGRO COMPANIES**  
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NO.	DATE	DESCRIPTION	REV.	CRD.
1	4/1/05	NEW DRAWING	000	PAC
2	09/01/05	REDATE ONLY	000	PAC
3	09/29/05	REDATE ONLY	000	PAC
4	10/11/05	REDATE ONLY	000	PAC

NOTE:  
 Unauthorised alteration or addition to this drawing is a violation of the New York State Education Law Article 143, Section 720b.

PLANNING BOARD  
 TOWN OF BETHLEHEM  
 ALBANY COUNTY, NEW YORK  
 This Site Plan Approval:  
 Title: \_\_\_\_\_  
 Date: 5/11/06

**RETAINING WALL NOTES**

RECEIVED  
 MAY 6 2006  
 PLANNING BOARD  
 TOWN OF BETHLEHEM

Project Manager  
 P. Giovanni, PE

Designer  
 D. Clougher

Checked By  
 P. Giovanni, PE

DATE  
 MAY 13, 2006

Scale  
 No Scale

Project Number  
 0605.00

File Name  
 110902.rvt\wallsect.dwg

Drawing Number  
**C507**

