

SEGMENTAL RETAINING WALL UNITS

PART 1: GENERAL

- 1.01 Description
 A. Work includes furnishing and installing segmental retaining wall (SRW) units to the lines and grades designated on the construction drawings or as directed by the Architect/Engineer.
 Also included is furnishing and installing appurtenant materials required for construction of the retaining wall as shown on the construction drawings.
- 1.03 Reference Standards
 A. ASTM C 90 - Load Bearing Concrete Masonry Units
 B. ASTM C 140 - Sampling and Testing Concrete Units
 C. ASTM D 698 - Moisture Density Relationship for Soils, Standard Method
 D. NCMA TEK 50 A - Specifications for Segmental Retaining Wall Units
 E. NCMA SRWU-1 - Determination of Connection Strength between Geosynthetics and Segmental Concrete Units
 F. NCMA SRWU-2 - Determination of Shear Strength between Segmental Concrete Units
 G. NCMA - Design Manual for Segmental Retaining Walls
 H. Where specifications and reference documents conflict, the Architect/Engineer shall make the final determination of applicable document.
- 1.04 Certification
 A. Contractor shall submit a notarized manufacturer's certification prior to start of work stating that the SRW units meet the requirements of this specification.
- 1.05 Delivery, Storage and Handling
 A. Contractor shall check the materials upon delivery to assure that specified type, grade, color and texture of SRW units has been received.
 B. Contractor shall prevent excessive mud, wet concrete, epoxies, and like materials which may affix themselves, from coming in contact with the materials.
 C. Contractor shall protect the materials from damage. Damaged material shall not be incorporated into the reinforced soil wall.

PART 2: MATERIALS

- 2.01 Segmental Retaining Wall Units
 A. SRW units shall be VERSA-LOK Retaining Wall Units.
 B. SRW units shall meet the following architectural requirements:
 1. Color of SRW units shall be concrete.
 2. Finish of SRW units shall be split face.
 3. SRW unit faces shall be of straight geometry.
 4. SRW unit shall have a maximum height of 6 inches.
 5. SRW units shall be capable of being erected with a variable bond configuration. Bond should vary between 1/4 to 3/4 bond.
 6. All SRW units shall be sound and free of cracks or other defects that would interfere with the proper placing of the unit or significantly impair the strength or permanence of the construction. Cracking or excessive chipping may be grounds for rejection. Units showing cracks larger than 1/2" when measured along their length shall not be used within the wall. Units showing chips visible at a distance of 30 feet from the wall shall not be used within the wall.
 C. SRW units shall meet the following structural requirements:
 1. The SRW units shall be solid through the full depth of the unit.
 2. For constructability considerations, the SRW units shall provide a minimum weight of 125 pcf of wall face area.
 3. Concrete used to manufacture SRW units shall have a minimum 28 days compressive strength of 3000 psi in accordance with ASTM C 90 and C 140. The concrete shall have adequate freeze/thaw protection with a maximum moisture absorption rate, by weight of 8%. Compressive strength test specimens shall conform to the saw-cut coupon provisions of Section 5.2.4 of ASTM C140 with the following exception: Coupon shall be taken from the least dimension of the unit of a size and shape representing the geometry of the unit as a whole.
 4. SRW units molded dimensions shall not differ more than + or - 1/8 inch from that specified, except height which shall be + or - 1/16 inch.
 D. SRW units shall meet the following constructability and geometric requirements:
 1. Units shall be capable of attaining concave and convex curves and 90 to 140 degree inside corners and 25 to 90 degree outside corners.
 2. Units shall be positively engaged to the unit below with connection pins so as to provide a 3/4-inch horizontal setback per 6-inch-high course (a cant of 7 degrees from vertical). The installed wall cant shall not differ more than + or - 2 degrees from that specified.

- 2.02 Segmental Retaining Wall Unit Connection Pins
 Sec SRW connection pins which interlock the units shall meet manufacturer's specifications.

- 2.03 Leveling Pad
 A. Material for leveling pad shall consist of compacted sand or gravel and shall be a minimum of 6 inches in depth. The leveling pad should extend laterally at least a distance of 6 inches beyond the toe and heel of the lower most SRW unit.
 B. Do not run mechanical vibrating plate compactors on top of the units. Compact fill between units by running hand-operated compaction equipment just behind unit. Compact to minimum 95% Standard Proctor Density (ASTM D 698) or 90% of Modified Proctor Density (ASTM D 1557).
- 2.04 Drainage Aggregate
 A. Drainage fill materials shall be the 1" clean free draining crushed stone.
 B. Vertical drainage layer behind the wall face shall be placed no less than 1 ft3 per 1 ft2 of wall face.
- 2.05 Reinforced Backfill (Infill Soil)
 A. The reinforced backfill material shall be free of debris and consist of 1" minus crushed stone.
 B. The reinforced backfill shall be compacted in maximum 8-inch-thick compacted lifts to a minimum density of 95% of the maximum Standard Proctor Density (ASTM D 698).
- 2.06 Retained Backfill or Common Backfill
 A. Soil placed behind the reinforced backfill can be any inorganic soil with a liquid limit less than 50 and plasticity index less than 30, or as directed by the Engineer.
 B. Retained backfill shall be compacted to a minimum 90% maximum Standard Proctor Density (ASTM 698).

PART 3: EXECUTION

- 3.01 Excavation
 A. Contractor shall excavate to the lines and grades shown on the project grading plans. Contractor shall take precautions to minimize over-excavation. Over-excavation shall be filled with compacted infill material, or as directed by the Engineer/Architect, at the Contractor's expense.
 B. Architect/Engineer will inspect the excavation and approve prior to placement of leveling pad material.
 C. Excavation of deleterious soils and replacement with compacted infill material, as directed by the Architect/Engineer, will be paid for at the contract unit prices.
 D. Contractor shall verify location of existing structures and utilities prior to excavation. Contractor shall ensure all surrounding structures are protected from the effects of wall excavation. There is an existing 157 diameter reinforced concrete pipe approximately 20 feet away and parallel to the wall.
- 3.02 Leveling Pad Construction
 A. Leveling pad shall be placed as shown on the construction drawings with a minimum thickness of 6 inches. The leveling pad should extend laterally at least a distance of 6 inches from the toe and heel of the lower most SRW Unit.
 B. Foundation soil shall be proofrolled and compacted to 95% Standard Proctor Density and inspected by the Architect/Engineer prior to placement of leveling pad materials.
 C. Soil leveling pad material shall be compacted to provide a level hard surface on which to place the first course of units. Well-graded sand can be used to smooth the top 1/2 to 1/4 inch of the leveling pad. Compaction will be with mechanical plate compactors to 95% of maximum Proctor density (ASTM D 698).
 D. Leveling pad shall be prepared to ensure intimate contact of SRW units with pad.
- 3.03 SRW Unit Installation
 A. First course of SRW units shall be placed on the leveling pad. The units shall be leveled side-to-side, front-to-rear and with adjacent units and aligned. The first course is the most important to ensure accurate and acceptable results.
 B. Insure that units are in full contact with base.
 C. Place the front of the units side-by-side. Do not leave gaps between the front of adjacent units. Alignment may be done by means of a string line or offset from base line to the back of the units or along the pinning grooves. Lay out of curves and corners in accordance with SRW manufacturer's installation guidelines.
 D. Place and compact drainage fill between and behind units. Place and compact infill soil behind drainage fill.
 E. Clean all excess debris from top of units and install next course.
 F. Insert two connection pins for each unit through pin holes of the upper course units into receiving slots in lower course unit. Pins shall be fully seated in the pin slot below. Push units forward to remove any looseness in the unit-to-unit connection and then check alignment. Check level of the units.
 G. Repeat procedures to the extent of the wall height, ensuring that pins are engaged in each successive course.
 H. SRW caps shall be glued to underlying units with manufacturer's recommended concrete adhesive. Caps shall be setback from the top course of units.

END OF SECTION

GEOSYNTHETIC WALL REINFORCEMENT

PART 1: GENERAL

- 1.01 Description
 Work includes furnishing and installing geosynthetic reinforcement to the lines and grades designated on the plans.
- 1.03 Reference Standards
 A. ASTM D 4595 - Tensile Properties of Geotextiles by the Wide-Width Strip Method.
 B. ASTM D 4632 - Tensile Properties of Geotextiles
 C. ASTM D 52 - Tensile Creep Testing of Geosynthetics
 D. GRI:GG1 - Single Rib Geogrid Tensile Strength
 E. NCMA SRWU-1 - Determination of Connection Strength between Geosynthetics and Segmental Concrete Units
 F. NCMA - Design Manual for Segmental Retaining Walls
 G. Where specifications and reference documents conflict, the Architect/Engineer shall make the final determination of applicable document.
- 1.04 Certification
 A. Contractor shall submit a notarized manufacturer's certification, prior to start of work, stating that the geosynthetic reinforcement meets the requirements of this specification.
- 1.05 Delivery, Storage and Handling
 A. Contractor shall check the geosynthetic reinforcement upon delivery to assure that the proper grade and type of material has been received. A product certification should be provided with each shipment.
 B. The geosynthetic reinforcement shall be stored above -20F.
 C. Rolled geosynthetic material shall be stored in accordance with manufacturer's recommendations.
- 1.06 Measurement and Payment
 A. Measurement of the geosynthetic reinforcement is on a square yard basis.
 B. Payment shall cover geosynthetic reinforcement supply and installation.

PART 2: MATERIALS

- 2.01 Definitions
 A. Geosynthetic reinforcement shall be a polymer product specifically manufactured as a soil reinforcement element that meets the requirements of this specification.
 B. Concrete segmental retaining wall (SRW) units are as detailed on the drawings and specified under Section 2.01 - Segmental Retaining Wall Units.
 C. SRW Unit pins are as detailed on the drawings and specified under Section 2.02 - SRW Units.
 D. Leveling pad material is sand or gravel as specified under Section 2.03 - SRW Units or low strength unreinforced concrete.
 E. Reinforced backfill (infill soil) is the soil used within reinforced soil mass.
 F. Retained backfill or Common backfill is the soil behind the reinforced soil mass and leveling pad.
- 2.02 Geosynthetic Reinforcement Properties
 A. The geosynthetic reinforcement shall possess the following minimum design properties, determined by product specific testing as defined in the NCMA Design Manual for Segmental Retaining Walls (Section 3.5).
- | Geogrid Type "A" | LTDS
(2000 lb/ft) | Ci
(0.85) | Cds
(0.85) |
|---------------------------------------|----------------------|--------------|---------------|
| Miragrid 8T as manufactured by Mirafi | | | |
- Miragrid 8T as manufactured by Mirafi meets these design properties.

PART 3: EXECUTION

- 3.01 Foundation Soil Preparation
 A. Foundation soil preparation shall be as specified in Section 2.03.
- 3.02 Wall Erection
 A. Wall erection shall be as specified in Section 3.03 - SRW Units.
- 3.03 Geosynthetic Reinforcement Installation
 A. The geosynthetic reinforcement shall be installed at the wall height, horizontal location, and to the extent as shown the project construction plans, or as direct by the Architect/Engineer.
 B. The geosynthetic reinforcement shall be laid horizontally on compacted reinforced backfill and connected to the concrete SRW units. Embedment detail shall be consistent with the SRW manufacturer's recommendations.
 C. Correct orientation (Roll direction) of the geosynthetic reinforcement shall be verified by the Contractor.
 D. Place segmental unit and fill in accordance with Section 3.03 - SRW Units.
 E. The geosynthetic reinforcement shall be pulled taut and free of wrinkles prior to placement of soil fill. The geosynthetic may be secured in place with staples, pins, sandbags, or fill as required by fill properties, fill placement procedures, or weather conditions, or as directed by the Architect/Engineer.
 F. For constructability considerations, maximum spacing between geogrid layers shall be 3.0 vertical feet.

DRAINAGE AGGREGATE

PART 1: GENERAL

- 1.01 Description
 Work includes providing and installing all drainage aggregate materials to the lines and grades designated on the project construction plans.
- 1.03 Reference Standards
 A. ASTM D 3034 - Specification for Polyvinyl Chloride (PVC) Plastic Pipe
 B. AASHTO T-27 - Test Method for Gradation Limits Fine Filter Material
 C. ASTM D 1248 - Specification for Corrugated Plastic Pipe
 D. Where specifications and reference documents conflict, the Architect/Engineer shall make the final determination of applicable document.
- 1.04 Certification
 A. Contractor shall submit a notarized manufacturer's certification, prior to start of work, stating that the drainage aggregate meets the requirements of this specification.
- 1.05 Delivery, Storage and Handling
 A. Plastic Pipe shall be stored in accordance with the manufacturer's recommendations to prevent damage and deleterious materials from becoming affixed.
 B. Drainage aggregate shall be stored to prevent contamination with other site and/or fill soils.

PART 2: MATERIALS

- 2.01 Definitions
 A. Drainage collection pipe shall be a perforated/slotted PVC or corrugated HDPE pipe. The pipe may be covered with a knitted or non-woven geotextile sock specifically designed to function as a filter.
 B. Drainage aggregate shall be a free draining material, relative to the surrounding soil, so as to prevent build up of hydrostatic pressure.
 C. Drainage geotextile shall have to the following minimum properties or as recommended by the Design Engineer.
- | | | |
|-----------------|-------------|-----------|
| AOS | ASTM D 4751 | 70-100 |
| Grab Tensile | ASTM D 4632 | 110 lb |
| Trap Tear | ASTM D 4533 | 40 lb |
| Water Flow Rate | ASTM D 4491 | 75 gpm/ft |
| Puncture | ASTM D 4833 | 40 lb |
- D. Drainage pipe shall be manufactured in accordance with ASTM D 3034 and/or ASTM D 1248. Geotextile placed around the drainage or as shown on drawings.

PART 3: EXECUTION

- 3.01 Drainage Collection Pipe
 A. Install the drainage collection pipe according to the line, grades and sections shown in the project construction plans.
 B. Install the drainage collection pipe to maintain gravity flow of water to outside the reinforced soil zone. Daylight the drainage collection pipe at a storm sewer manhole or along a slope at an elevation lower than the lowest point of the pipe within the reinforced soil mass.
 C. The main collection drain pipe just behind the segmental units shall be a minimum of 3 inches in diameter. Any secondary collection drain pipe can gravity flow independently or tie into the main collection drain pipe with laterals at a maximum 50 foot spacing along the wall face.
- 3.02 Drainage Aggregate
 A. Install the drainage aggregate to the line, grades and sections shown on the project construction plans.
 B. Place the drainage aggregate to a minimum finished thickness and widths shown on the details herein, or as directed by the Engineer.
 C. When a blanket drain is installed, a non-woven geotextile should be installed prior to aggregate placement in accordance with the details provided on the drawings.

END OF SECTION



REVISIONS

NO	DATE	DESCRIPTIONS

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TITLE:
 RETAINING WALL
 SPECIFICATIONS

DATE: 5-12-95
 PROJECT NO.: 94189

SHEET:
 C-7