Specification Guidelines

KEYSTONE Concrete Modular Retaining Wall

Section 02276

Part 1: General

1.01 Description

A. Work includes furnishing and installing concrete modular block retaining wall units to the lines and grades shown on the construction drawings and as specified herein.

B. Work includes preparing foundation soil, furnishing and installing leveling pad, unit fill and backfill to the lines and grades shown on the construction drawings.

C. Work includes furnishing and installing all related materials required for construction of the retaining wall as shown on the construction drawings.

1.02 Related work

A. Section 02200 - Earthwork

B. Section 02246 - Geogrid soil reinforcement.

1.03 Reference standards

A. ASTM C-90 Load Bearing Concrete Masonry Units.

B. ASTMC-140 Sampling and Testing Concrete Masonry Units.

C. ASTM D-448 Sizes of Aggregate for Road and Bridge Construction.

D. ASTM D-698 Laboratory Compaction Characteristics using Standard Effort.

1.04 Delivery, storage and handling

A. Contractor shall check the materials upon delivery to assure that proper materials have been received.

B. Contractor shall prevent excessive mud, wet cement, epoxy, and similar materials (which may affix themselves) from coming in contact with the materials.

C. Contractor shall protect the materials from damage. Damaged materials shall not be incorporated into the retaining wall structure.

1.05 Submittals

A. Samples of all product used in the work of this section.

B. Manufacturer's specifications (latest edition) for proposed materials, method of installation and list of materials proposed for use.

C. Design information establishing the stability of the proposed structure(s).

1.06 Quality assurance

A. Owner will be responsible for soil testing and inspection quality control during earthwork operations.

Part 2: Products

2.01 Definitions

A. Modular Concrete Units - a KEYSTONE modular concrete facing unit, machine made from portland cement, water and mineral aggregates.

B. Structural Geogrid - a structural geogrid formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth and function primarily as reinforcement.

C. Unit Fill - drainage aggregate which is placed within and immediately behind the modular concrete units.

D. Reinforced Backfill - Compacted soil which is within the reinforced soil volume as shown on the plans.

2.02 Concrete units

A. Modular wall units shall be KEYSTONE Retaining Wall Units as manufactured by **Anchor Concrete Products, Inc., 100 Foul Rift Rd., Phillipsburg, NJ 08865, Contact Louis Mangiaracina at 908-475-1225 Fax 908-475-1787** in accordance with ASTM C-90 and ASTM C-

140.

B. Concrete wall units shall have a minimum 28-day compressive strength of 3,000 psi. Standard weight concrete shall have a maximum moisture absorption of 8%.

C. Dimensional tolerances shall be in accordance with ASTM C-90 except those measured to the split face which varies. Standard and Compac units shall have a minimum of 1 sq. ft. face area each. Mini units shall have a minimum 1/2 sq.ft. face area each.

D. KEYSTONE modular units shall provide an in-place weight of 130 pcf. including the unit fill which is contained within the nominal dimension of the unit.

E. Units shall have angled sides capable of concave and convex alignment curves with a minimum radius of 3.5 feet (Where applicable, for straight walls, use non-angled straight side cap units.)

2.03 Fiberglass connecting pins

A. Connecting pins shall be 1/2" diameter thermoset isopthalic polyester resin-pultruded fiberglass reinforcement rods supplied by the unit manufacturer.

B. Pins shall have a minimum flexural strength of 128,000 psi and short beam shear of 6,400 psi

2.04 KEYSTONE KapSeal™ construction adhesive

A. Material shall conform to ASTM 2339 and shall be supplied by the KEYSTONE unit supplier.

2.05 Base leveling and pad material

A. Material shall consist of compacted crushed stone or unreinforced concrete as shown on the construction drawing. "Pea gravel" or any other poorly graded stone shall not be permitted

2.06 Unit fill

A. Fill for units shall be free draining crushed stone or gravel, 1/2" to 3/4", with no more than 5% passing the No. 50 sieve and conforming to ASTM D448. Gradation of the fill shall be approved by the engineer. "Pea gravel" shall not be used.

2.07 Backfill

A. Material may be site excavated soils when approved by the Engineer or otherwise specified in the design drawings. Unsuitable soils for backfill (high plastic clays or organic soils) shall not be used in the backfill or in the reinforced soil mass.

B. Where borrow or imported fill is required, contractor shall submit samples and material specifications to the Engineer for approval.

Part 3: Execution

3.01 Excavation

A. Contractor shall excavate to the lines and grades shown on the construction drawings. Contractor shall be careful not to disturb embankment and foundation materials beyond lines shown.

3.02 Foundation soil preparation

A. Foundation soil shall be excavated as required for leveling pad dimensions shown on the construction drawings, or as directed by the Engineer.

B. Foundation soil shall be approved by the Engineer to confirm that the actual foundation soil conditions meet or exceed assumed design conditions.

C. Unsuitable soils shall be removed and replaced with acceptable material.

D. Over-excavated areas shall be backfilled with approved compacted backfill material

3.03 Base leveling pad

A. Leveling pad materials shall be placed upon an approved foundation as shown on the construction drawings to a minimum thickness of 6".

B. Aggregate material shall be compacted to provide a dense, level surface on which to place the first course of modular units. Compaction shall be to 95% of Standard Proctor Density as determined in accordance with ASTM D698. For crushed rock, material shall be densely compacted as determined by visual observation.

C. Leveling pad shall be prepared and leveled to ensure complete contact of retaining wall unit with base.

D. Contractor may use a reduced depth of gravel or crushed rock in conjunction with a concrete topping. Concrete shall be unreinforced and a minimum of 3" thick.

3.04 Unit installation

A. The first course of concrete modular wall units shall be carefully placed on the base leveling pad. Each unit shall be checked for level and alignment.

B. Ensure that all units are in full contact with base and properly seated.

C. Units are placed side by side for full length of wall alignment. Alignment may be done by means of a string line or offset from a base line.

D. Install fiberglass connecting pins and fill all voids in and around the modular units with unit fill material. Tamp or rod unit fill to insure that all voids are completely filled.

E. Sweep excess material from top of units and install the next course. Ensure that each course is completely unit filled, backfilled and compacted prior to proceeding to next course.
F. Place each subsequent course ensuring that pins protrude into adjoining courses a minimum of 1". Two pins are required per unit. Pull each unit forward, away from the fill zone, locking against the pins in the previous course and backfill as the course is completed. Repeat procedure to the extent of wall height.
G. Follow wall erection and unit fill placement closely with any other backfilling required. Compaction of all soils shall be to 95% of Standard Proctor Density as determined in accordance with ASTM D698. The top 8" of the structure fill shall be a low permeability soil to minimize surface water runoff from directly entering the unit fill or reinforced soil zones.
H. As appropriate where the wall changes elevation, units can be stepped with the grade or turned into the embankment with a convex return end. Provide appropriate buried units on compacted leveling pad in area of convex return end.

3.05 Cap installation

A. Place KEYSTONE Cap units over projecting pins from units below. Pull forward to setback position. Backfill and compact to finished grade with low permeability soil.
B. As required, provide permanent mechanical connection to wall units with KEYSTONE KapSeal™ construction adhesive. Apply adhesive to top surface of unit below and place cap unit into position.

3.06 Geogrid installation

A. Follow the requirements of Section 02246, Geogrid Soil Reinforcement.

Geogrid Soil Reinforcement
Section 02246

Part1: General

1.01 Description

A. Work includes furnishing and installing geogrid reinforcement and backfill to the lines and grades designated on the construction drawings.
B. Work includes furnishing and installing all related materials required for construction of the geogrid reinforced soil retaining wall as shown on the construction drawings.

1.02 Related work

A. Section 02276: KEYSTONE Concrete Modular Retaining Wall.

1.03 Reference standards

A. See specific geogrid manufacturer's reference standards.

1.04 Delivery, storage and handling

A. Contractor shall check the geogrid upon delivery to assure the proper material has been received.
B. Geogrids shall be stored above -20F.
C. Contractor shall prevent excessive mud, wet cement, epoxy and similar materials (which may affix themselves to the gridwork) from coming in contact with the geogrid material.
D. Rolled geogrid material may be laid flat or stood on end for storage.

1.05 Submittals

A. Samples of all products used in the work of this section.
B. Manufacturer's specifications (latest edition) for proposed materials, method of installation and list of materials proposed for use.

1.06 Quality assurance

A. Owner will be responsible for soil testing and inspection quality control during earthwork operations.

Part 2: Products

2.01 Definitions

A. Geogrid products shall be high-density polyethylene or polypropylene expanded sheet or polyester woven fiber materials, specifically fabricated for use as soil reinforcement.
B. Structural Geogrid - a structural geogrid formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth and function primarily as reinforcement.
C. Modular Concrete Units - a KEYSTONE segmental concrete facing unit, machine made from portland cement, water and mineral aggregates.
D. Unit Fill - drainage aggregate which is placed within and immediately behind the modular concrete units.
E. Reinforced Backfill - Compacted soil which is within the reinforced soil volume as shown on the plans

2.02 Geogrid

A. Geogrid shall be the type as shown on the drawings having the property requirements described within the manufacturer's specifications and required by the design.

2.03 Acceptable manufacturers

A. A manufacturer's product shall be approved by the Engineer.

Part 3: Execution

3.01 Excavation

A. Contractor shall excavate to the lines and grades shown on the construction drawings. Contractor shall be careful not to disturb embankment and foundation materials beyond lines shown.

3.02 Foundation soil preparation

A. Foundation soil shall be excavated as required for leveling pad dimensions shown on the construction drawings, or as directed by the Engineer.
B. Foundation soil shall be approved by the Engineer to confirm that the actual foundation soil conditions meet or exceed assumed design conditions. Unsuitable soils shall be removed and replaced with acceptable material.
C. Over-excavated areas shall be backfilled with approved compacted backfill material.
D. Foundation soil shall be proof rolled prior to fill and geogrid placement.

3.02 Wall erection

A. Wall erection shall be as specified under Section 02276: KEYSTONE Concrete Modular Retaining Wall.

3.03 Geogrid installation

A. Geogrid shall be laid at the proper elevations and orientation as shown on the construction drawings or as directed by the Engineer.
B. Correct orientation (roll direction) of the geogrid shall be verified by the contractor.
C. The geogrid soil reinforcement shall be connected to the modular wall units by placing the geogrid over fiberglass pins and laying the grid back to the fill side.
D. The geogrid shall be pulled taut (50lbs/ft±) to eliminate loose folds and pretension the reinforcement. Stake or secure back edge of geogrid prior to and during backfill and compaction.
E. Follow manufacturer's guidelines relative to overlap requirements of uniaxial and biaxial geogrids

3.04 Fill placement

A. Backfill material shall be placed in 8" lifts and compacted to 95% of Standard Proctor density as determined in accordance with ASTM D698. The in-place moisture content shall not exceed the optimum moisture content as determined in accordance with ASTM D698 and be no lower than 2% below optimum moisture content
B. Backfill shall be placed, spread and compacted in such a manner that minimizes the development of slack or loss of pretension of the geogrid.
C. Only hand-operated compaction equipment shall be allowed within 3' of the back surface of the KEYSTONE units.
D. Backfill shall be placed from the wall back towards the embankment to ensure that the geogrid remains taut.
E. Tracked construction equipment shall not be operated directly on the geogrid. A minimum backfill thickness of 6" is required prior to operation of tracked vehicles over the geogrid. Turning of tracked vehicles should be kept to a minimum to prevent tracks from displacing the fill

and damaging the geogrid.

F. Rubber-tired equipment may pass over the geogrid reinforcement at slow speeds, [less than 10 mph.] Avoid sudden braking and sharp turning.