

MODULAR CONCRETE RETAINING WALLS

PART 1 GENERAL

1.1 SECTION INCLUDES

- A. MESA Mechanically stabilized earth (MSE) retaining wall system with high-density polyethylene or polypropylene geogrids positively connected to modular concrete facing units.
- B. Drainage Fill and Reinforced Backfill.
- C. Geotextile and Adhesive.

1.2 REFERENCES

- A. AASHTO M288 - Standard Specification for Geotextiles.
- B. ASTM C 33 - Standard Specification for Concrete Aggregates.
- C. ASTM C 90 - Standard Specification for Load-Bearing Concrete Masonry Units.
- D. ASTM C 1372 - Standard Specification for Segmental Retaining Wall Units.
- E. Tensar Earth Technologies, Inc. – MESA Retaining Wall Systems – Construction and Quality Control Manual.

1.3 SUBMITTALS

- A. Submit under provisions of Section 01300.
- B. Product Data: Manufacturer's data sheets on each product to be used, including:
 - 1. Preparation instructions and recommendations.
 - 2. Storage and handling requirements and recommendations.
 - 3. Installation methods.
- C. Shop Drawings: Engineering drawings.
 - 1. Include design calculations sealed by a Registered Professional Engineer licensed in the State where the project is located.
 - 2. Manufacturer's certifications that the ultimate tensile strength and junction strength of the geogrid are equal to or greater than those specified.
 - 3. Samples: Two samples of each standard color.
- D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE



- A. Design Requirements: Design retaining wall system in accordance with the local codes and regulations and the design guidelines of AASHTO, NCMA or Tensar Earth Technologies Design shall be by a professional engineer registered in the state where the project is located and who is employed by a firm that has designed at least five mechanically stabilized earth wall projects of similar construction and scope.
- B. Manufacturer Qualifications: MSE wall system components manufactured by Tensar Earth Technologies, Inc. and its Licensees and by companies approved and authorized by Tensar Earth Technologies, Inc.
- C. Installer Qualifications: Firm with documented experience of at least five projects of similar construction and scope. Include brief description of each project and name and phone number of owner's representative knowledgeable in each listed project.
- D. Pre-Construction Meeting: Prior to erection of retaining walls, conduct a meeting at the site with the retaining wall materials supplier, the retaining wall installer, and the Contractor to review the retaining wall requirements. Notify the Owner and the Architect at least 3 days in advance of the time of the meeting.

1.5 DELIVERY, STORAGE, AND HANDLING

- A. Store products in manufacturer's unopened packaging until ready for installation.
- B. Prevent excessive mud, fluid concrete, epoxy, or other deleterious materials from coming in contact with retaining wall materials.

1.6 PROJECT CONDITIONS

- A. Do not install leveling pad when subgrade is wet or frozen.
- B. Do not place or compact backfill during wet or freezing weather that prevents achievement of specified compaction requirements.

PART 2 PRODUCTS

2.1 MANUFACTURERS

- A. Acceptable Manufacturer: Tensar Structural Geogrids: Tensar Earth Technologies.
- B. Acceptable Manufacturer: Modular Concrete Facing Units: Palumbo Block Co., Inc. Dover Plains, New York. 1-800-724-8460 E-mail info@palumbo.biz manufacturer of the MESA retaining wall system.
- C. Substitutions: Not permitted.

2.2 MATERIALS

- A. System Description: Modular Concrete Retaining Walls consist of a mechanically stabilized wall system of engineered backfill reinforced with high-density



polyethylene or polypropylene geogrids that are positively connected to modular concrete facing units.

- B. Modular Concrete Facing Units: Units certified by an independent laboratory to meet ASTM C 1372 and specified absorption, compressive strength and dimensional tolerances.
1. Load-bearing masonry units, ASTM C90, normal weight, Type II, minimum compressive strength of 4,000 psi (27,580 kPa), and produced by Palumbo Block Co., Inc.
 2. Maximum water absorption rate of 6 percent by weight.
 3. Standard Unit: Mesa.
Size: 8 inch by 18 inch by 11 inch
 4. Cap Unit: Mesa.
 - a. Size: 4 inch by 18 inch by 11 inch
 5. Corner Unit: Mesa.
 - a. Size: 8 inch by 18 inch by 9
- C. Structural Geogrid: Tensar UX1100MSE. Polymeric grid formed by 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.
1. Ultimate Tensile Strength: 3970 pounds per linear foot (58 kN/m), minimum average roll value, when tested in accordance with ASTM D 6637.
 2. Junction Strength: 3690 pounds per linear foot (54 kN/m), minimum average roll value, when tested in accordance with GRI-GG2.
- D. Structural Geogrid: Tensar UX1400MSE. Polymeric grid formed by 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.
1. Ultimate Tensile Strength: 4800 pounds per linear foot (70kN/m), minimum average roll value, when tested in accordance with ASTM D 6637.
 2. Junction Strength: 4520 pounds per linear foot (66kN/m), minimum average roll value, when tested in accordance with GRI-GG2.
- E. Structural Geogrid: Tensar UX1500MSE. Polymeric grid formed by 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.
1. Ultimate Tensile Strength: 7810 pounds per linear foot (114kN/m), minimum average roll value, when tested in accordance with ASTM D 6637.
 2. Junction Strength: 7200 pounds per linear foot (105 kN/m), minimum average roll value, when tested in accordance with GRI-GG2.
- F. Structural Geogrid: Tensar UX1600MSE. Polymeric grid formed by 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.
1. Ultimate Tensile Strength: 9870 pounds per linear foot (135kN/m), minimum average roll value, when tested in accordance with ASTM D 6637.
 2. Junction Strength: 9250 pounds per linear foot (135 kN/m), minimum average roll value, when tested in accordance with GRI-GG2.

PALUMBO
BLOCK CO., INC.
CONCRETE BLOCK AND MASON SUPPLIES

- G. Connectors: High-density polyethylene or polypropylene with fiberglass inclusions.
1. Use MESA Standard Connectors (4 teeth and 2 flags) to connect the geogrid to Standard facing units and to serve as alignment and shear connectors between facing courses that do not require geogrid reinforcement. Use two Standard connectors per facing unit with the four teeth driven into the two connector slots.
- H. Unit Core Fill: Free-draining, coarse-grained soil.
1. 100 to 75 percent passing a 1-inch (25 mm) sieve.
 2. 50 to 75 percent passing a 3/4-inch (19 mm) sieve.
 3. 0 to 60 percent passing a No. 4 sieve (4.75 mm).
 4. 0 to 50 percent passing a No. 40 sieve (0.425 mm).
 5. 0 to 5 percent passing a No. 200 sieve (0.075 mm).
- I. Drainage Fill: Free-draining, coarse-grained soil.
1. 100 to 75 percent passing a 1-inch (25 mm) sieve.
 2. 50 to 75 percent passing a 3/4-inch (19 mm) sieve.
 3. 0 to 60 percent passing a No. 4 sieve (4.75 mm).
 4. 0 to 50 percent passing a No. 40 sieve (0.425 mm).
 5. 0 to 5 percent passing a No. 200 sieve (0.075 mm).
- J. Reinforced Backfill: Granular fill with a pH range of 2 to 12, when tested in accordance with AASHTO T 289 and graded as follows:
1. 100 to 75 percent passing a 2-inch (50 mm) sieve.
 2. 100 to 75 percent passing a 3/4-inch (19 mm) sieve.
 3. 100 to 20 percent passing a No. 4 sieve (4.75 mm).
 4. 0 to 60 percent passing a No. 40 sieve (0.425 mm).
 5. 0 to 35 percent passing a No. 200 sieve (0.075 mm).
 6. $PI \leq 20$.
- K. Geotextile: Non-woven geotextile, AASHTO M288, Class 3.
- L. Drainage composite: Non-woven geotextile, AASHTO M288, Class 3, bonded to both sides of a polyethylene net structure.
1. Minimum Allowable Transmissivity: Not less than 1.5 gallon per minute per foot of width (3×10^{-4} square meters per second) when tested in accordance with ASTM D 4716 at a confirming pressure of 14.5 pounds per square inch (100 kPa).
 2. Minimum Allowable Peel Strength of Geotextile from Polyethylene Net: Not less than 1 pound per inch of width (175 N/m) when tested in accordance with ASTM F 904.
- M. Adhesive: Exterior, waterproof concrete bonding adhesive.

PART 3 EXECUTION

3.1 PREPARATION

- A. Do not begin installation until excavation, foundation preparation and leveling pad have been completed and properly prepared.



- B. If subgrade preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation. Do not begin work until unsatisfactory conditions have been rectified.
- C. Excavation:
 - 1. Excavate the subgrade vertically to the plan elevation and horizontally to the extent of the geogrid lengths.
 - 2. Excavate trench for leveling pad to the dimensions indicated on the approved shop drawings.
 - 3. Remove soils not meeting required strength and replace with approved materials by the Owner's Geotechnical Engineer.
 - 4. Protect excavated materials to be used for backfilling the reinforcement zone from the weather.
- D. Foundation Preparation:
 - 1. Over-excavated areas of the subgrade and leveling pad trench shall be filled in maximum loose lifts of 10 inches (250 mm) and shall be compacted to a minimum of 95 percent Standard Proctor Dry Density in accordance with ASTM D 698.
 - 2. Owner's Geotechnical Engineer will inspect the subgrade soil for the reinforced zone and leveling pad to ensure proper bearing strength in accordance with the Field Quality Control provisions specified.
- E. Leveling Pad:
 - 1. Material: Use one of the following:
 - a. Unreinforced concrete.
 - b. Well or poorly graded aggregate or sand, 3/4 inch (19 mm) maximum size, compacted to 95 percent Standard Proctor Dry Density in accordance with ASTM D 698.
 - 2. Dimensions: 6 inch (150mm) minimum thickness, 24 inch (600mm) minimum width.
 - 3. Surface of Leveling pad shall be smooth and horizontal both side-to-side and front-to-back to ensure the first course of units and subsequent courses are level.
 - 4. Vertical steps in the leveling pad shall be equal to the height of the MESA units or multiples of that height to provide uniform support to overlying units.

3.2 CONSTRUCTION

- A. Construct modular concrete retaining walls in accordance with the approved shop drawings and Tensar Earth Technologies Construction and Quality Control Manual.
- B. Facing Unit Installation:
 - 1. Place first course of modular concrete facing units on the leveling pad.
 - 2. Verify the first row of units are level from side-to-side and from front-to-back.
 - 3. Use a string line to align a straight wall; use flexible pipes to establish a smooth convex or concave curved wall.
 - 4. Use rear edges of the facing units for alignment and measurement.
 - 5. Sweep tops of modular concrete facing units clean of all debris before installing the next course of units or placing geogrid materials.
 - 6. Pull a string line after each course has been set to ensure maintenance of the wall's geometry. Reference the string line from the connector slot, the edges of the interior void, or the rear edges of the facing unit.



- C. Geogrid Connection and Connector Installation:
1. Unroll geogrid and cut to length indicated, minus distance between front face of the unit and the front of the connector. Cut geogrid ribs immediately in front of the transverse bar.
 2. Place the geogrid on the facing unit. Insert the connector teeth through the apertures of the geogrid into the slot in the underlying unit. Pull the grid snug against the teeth. Hammer the connector into the slot.
 3. For the Mesa Standard System, two Standard connectors are used for each facing unit:
 - a. Position the geogrid laterally on the unit such that all four teeth of each connector are driven into the two connector slots in each facing unit.
 - b. Position the flags of the connectors forward for vertical walls and rearward for battered walls.
 - c. In the next course, center each facing unit over the two underlying units such that the flags of the connectors extend up into the void of the overlying units.
 - d. Insert Standard connectors into facing units where no geogrid reinforcement is required to provide alignment and resistance to inter-unit sliding. Orient Standard connector flags in same direction as above.
- D. Unit Core fill:
1. Place unit core fill into the unit cores, between the units and to a distance of 12 inches (300 mm) behind the rear edges of the units.
 2. Place unit core fill behind the wall before placing the geogrid materials.
 3. Cover the unit core fill with geotextile to separate it from the reinforced fill, as indicated on the Drawings.
 4. Provide core fill to within 8 inches (200 mm) of the final grade. Seal the top of the unit core fill column with 8 inches (200 mm) of impervious soil or other material as indicated on the Drawings.
- E. Drainage fill:
1. Place drainage fill between the units and to a distance of 12 inches (300 mm) behind the rear edges of the units.
 2. Place drainage fill behind the wall before placing the geogrid materials.
 3. Cover the drainage fill with geotextile to separate it from the reinforced fill as indicated on the Drawings.
 4. Provide drainage fill to within 8 inches (200 mm) of the final grade. Seal the top of the drainage fill column with 8 inches (200 mm) of impervious soil or other material as indicated on the Drawings.
- F. Reinforced backfill:
1. Place the reinforced backfill material in maximum loose lifts of 10 inches (250 mm) and compact to a minimum of 95 percent Standard Proctor Dry Density, per ASTM D 698.
 2. Use only hand-operated compaction equipment within 3 feet (1 meter) of the rear edges of the facing units. Use a minimum of 3 passes to compact this zone.
 3. Soil density testing is not required within 3 feet (1 meter) of the rear edges of the facing units.
 4. Smooth and level or slope the backfill as indicated so that the geogrid lays flat.



- G. Geogrid placement:
1. Unroll the geogrid on the compacted backfill and cut to the length indicated.
 2. Pull the geogrid taut to remove slack in the geogrid and at the connectors.
 3. Stake or pin the geogrid near the end to maintain alignment and tension during filling.
 4. Place a minimum of 3 inches (75 mm) of fill between overlapping layers of geogrid where overlapping occurs behind curves and corners of a wall.
 5. Rubber tired vehicles may travel on the geogrid at low speeds, less than 5 miles per hour. Turning of vehicles should be avoided to prevent dislocation or damage to the geogrid and the connected wall facing units.
 6. Tracked vehicles shall not be operated directly on the geogrid. A minimum of 8 inches (200 mm) of fill cover over the geogrid is required for operation of tracked construction vehicles in the reinforced zone.
 7. Place geogrid shims on the front flange of all facing units connected to geogrid as indicated or as shown in the Tensar Earth Technologies Construction and Quality Control Manual.
- H. Toe Fill:
1. Area in front of leveling footing and lower facing courses shall be filled and compacted before the wall is constructed above 5 feet (1.5 m) high.
 2. Toe fill shall be placed in loose lifts of 10 inches (250 mm) and shall be compacted to a minimum of 95 percent Standard Proctor Dry Density in accordance with ASTM D 698.
- I. Cap Installation:
1. Install the cap units by bonding them to the units below using an approved exterior concrete adhesive.
 2. Place cap units to achieve a nominal 1-inch (25 mm) overhang.
 3. Clear cap units and modular concrete facing units of all debris and standing water before applying the approved adhesive.
 4. Use string line or flexible pipes to align cap units.
- J. Tolerances:
1. Variation from overall wall batter measured between top and bottom of the wall: Plus or minus 1/8 inch per foot (10 mm per meter), maximum.
 2. Horizontal and vertical alignment: 3/4 inch per 10 feet (6 mm per meter) excluding variations due to facing unit shape or split face irregularities.

3.3 FIELD QUALITY CONTROL

- A. Testing and Inspection shall be provided by an independent laboratory provided by the Contractor and acceptable to the Architect.
- B. Perform in place compaction tests in accordance with the following:
1. Density Tests: ASTM D 1556, ASTM D 2167, or ASTM D 2922 as appropriate for material tested.
 2. Moisture Tests: ASTM D 3017.
- C. Frequency of Tests:
1. Leveling Pad Trench: A minimum of one test per 100 feet (30 m) of trench.
 2. Subgrade Soil: A minimum of one test per 50 feet (15 m) length of wall.

PALUMBO
BLOCK CO., INC.
CONCRETE BLOCK AND MASON SUPPLIES

3. Reinforced Backfill: Provide one test for every 50 cubic yards (40 cubic meters) of fill placed.

3.4 PROTECTION

- A. Protect installed products until completion of project.
- B. Repair or replace damaged products before Substantial Completion.

END OF SECTION

PALUMBO
BLOCK CO., INC.
CONCRETE BLOCK AND MASON SUPPLIES

800-724-8460

info@palumbo.biz

www.palumbo.biz