

## 854 – LANDSCAPE RETAINING WALL SYSTEM

### SECTION 854

#### LANDSCAPE RETAINING WALL SYSTEM

##### 854.1 DESCRIPTION

Landscape retaining walls as defined by KDOT consist of systems meeting all of the following requirements:

- a total height less than 6 feet measured from top of footing to top of wall cap at the highest point;
- the maximum live load surcharge of 100 pound per square foot;
- the backslope is level;
- is not a multiple tiered wall; and
- is not a critical structure whose failure would cause loss of life, serious loss of function or access to adjacent necessary services/structures, or result in significant property damage.

For systems meeting these criteria, National Concrete Masonry Association Design Standards for Segmental Retaining Walls may be utilized. The scope of work for wall erection includes; excavation, grading and compaction of the wall foundation, general and local dewatering as required for proper execution of the work, construction of leveling pads, erection of modular block wall (MBW) elements, placement of soil reinforcing and placement and compaction of select backfill material as required. The scope of work also includes providing and placing cast-in-place concrete coping, if specified.

Include in the wall foundation all area underlying the leveling pad and the reinforced soil volume.

##### **BID ITEM**

Landscape Retaining Wall

##### **UNITS**

Square Foot

##### 854.2 MATERIALS

**a. General.** Provide the complete landscape retaining wall system (engineering design, geosynthetic reinforcing, MBW and all necessary accessories) from an approved manufacturer according to the acceptable alternates for each particular structure as listed in the Contract Documents.

The Bureau of Materials and Research will maintain a list of approved systems. Products will remain on the prequalified list as long as Field Performance is satisfactory. Prequalification is attained upon submittal of a HITEC review and successfully addressing all issues and concerns raised by the HITEC review and KDOT. Alternately, the Mechanically Stabilized Earth supplier provides documentation in accordance with Section 8.2 of the Federal Highway Administration Publication titled “Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Design and Construction Guidelines”, publication number FHWA-NHI-00-043, and then subsequently addresses all issues and concerns raised by KDOT.

##### **b. Retaining Wall System.**

(1) Concrete. Use cement complying with **DIVISION 2000**. Use air entrained concrete with a minimum compressive strength at 28 days of 4000 psi. Retarding admixtures may be used with prior approval of the Engineer. Accelerating agents or any admixture containing chlorides are prohibited.

Provide the MBW elements with a maximum absorption rate of 5% by weight and a minimum face shell thickness of 2 inch and complies with ASTM C 1372.

(2) Testing and Inspection. The compression testing and sampling for MBW will comply with ASTM C 140, Sampling and Testing Concrete Masonry Units, except as noted elsewhere in this specification. The MBW will be considered acceptable, regardless of curing age, if compression test results comply with the 28-day strength specifications, and if the visual inspection is satisfactorily completed. Provide facilities and perform all necessary sampling and testing. The Engineer may observe sampling and testing. Give notice a minimum of 1 week in advance of sampling and testing.

(3) Casting. Cast the MBWs in a standard manner acceptable to the National Concrete Masonry Association.

(4) Curing. Cure the MBW units in a manner acceptable to the National Concrete Masonry Association. Any production lot which does not comply with **subsection 854.2b.(2)**, Compressive Strength, will be rejected.

(5) Removal of Forms. Do not remove the forms until they can be removed without damage to the unit.

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(6) Finish. Finish the MBW as specified in the Contract Documents. Screed the non-exposed faces of the MBW to eliminate open pockets of aggregate and surface distortions in excess of ¼ inch.

(7) Tolerances.

- MBW: Manufacture all units within 1/8 inch of the plan dimension and connection slots within 3/16 inch of plan dimension. Provide MBW units with a minimum of:
  - 0.83 square feet of face area each for full units.
  - 0.5 square feet of face area for each cap unit.

Provide a MBW system with angled sides capable of concave or convex alignment curves with minimum radius of 4 ½ to 6 feet.

(8) Compressive Strength. Acceptance of the MBW with respect to compressive strength will be determined on a production lot basis as specified in ASTM C 140.

(9) Rejection. Units will be rejected because of failure to comply as specified above, or any of the following defects:

- Defects that indicate imperfect molding
- Honeycombed or open texture concrete surfaces
- Any damage that would prevent making a satisfactory joint
- Chipped facing panel/unit edges
- Discolored panels or blocks beyond reasonable variances in the opinion of the Engineer.

(10) Marking. Prominently display the date of manufacture and lot number on each production lot of MBW stored at the casting plant in a manner acceptable to the Engineer.

(11) Handling, Storage, and Shipping. Handle, store and ship all units in a manner that eliminates the danger of staining, chipping, cracks, fractures and excessive bending stresses. Support blocks in storage on firm foundations in a manner that will protect the exposed exterior finish.

(12) Basis of Acceptance. The Retaining Wall System will be accepted on the basis of satisfactory results of materials test, compliance with dimensional requirements and visual inspection at the point of usage

**c. Backfill.** Provide aggregates for backfill complying with **DIVISION 1100** if required.

**d. Aggregate Leveling Pads.** Provide aggregates for leveling pads that meet the requirements for crushed stone listed in **TABLE 1107-6**, or SB-1 or SB-2 in **TABLE 1107-1**, if required.

**e. Concrete for Leveling Pads and Coping.** Provide the following:

- Leveling pads. Commercial Grade (AE) concrete complying with **SECTIONS 401, 402 and 1102**.
- Cast-in-Place copings. Grade 4.0 (AE) concrete complying with **SECTIONS 401, 402 and 1102**.

**f. Soil Reinforcing.** Use soil reinforcing shown in the Contract Documents

(1) Soil Reinforcing Mesh. Provide shop fabricated reinforcing mesh of cold drawn steel wire complying with the minimum requirements of ASTM A82 and weld into the finished mesh fabric in accordance with ASTM A185. Form loops or weld connection plates so the variation in length between the longest and the shortest longitudinal wire in a reinforcing mesh panel is no more than ⅛ inch when measured from the cross-wire nearest the end of the reinforcing mesh panel. Loop fabrication must permit a 5/8 inch diameter rod to pass through all loops on each piece of mesh. Galvanize reinforcing mesh in accordance with ASTM A123M. The mesh will be accepted on the basis of a Type A Certification and visual inspection.

(2) Soil Reinforcing Geogrid. Use soil reinforcing geogrid of oriented, drawn, long chain high density polyethylene or polypropylene containing stabilizers and inhibitors added to the base plastic for resistance to ultraviolet and heat degradation. The geogrid material will be listed on the approved list for Geogrid Mechanically Stabilized Embankment/Earth Slopes on Firm Foundations, and according to the Contract Documents.

(3) Soil Reinforcing Geosynthetic. Use soil reinforcing of woven, high tenacity polyester yarns coated with polyvinyl chloride to maintain the integrity of the geosynthetic during handling and placement and to protect it during construction. The geosynthetic material will be listed on the approved list for Geogrid Mechanically Stabilized Embankment/Earth Slopes on Firm Foundations, and according to the Contract Documents.

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### **g. Attachment Devices.**

(1) Connection Pins. Use Connection Pins fabricated of cold drawn steel wire complying with ASTM A 82 and galvanized in accordance with ASTM A 153.

(2) Devices will be accepted on the basis of receipt and approval of a Type A Certification and visual inspection.

**h. Joint Materials.** Use joint material as shown in the Contract Documents.

### **854.3 CONSTRUCTION REQUIREMENTS**

**a. Wall Excavation.** Remove all materials encountered without regard to classification. Coordinate excavation for the wall with the underdrain construction so that drainage pipes will be constructed as specified.

Maintain stable sides at all excavations by providing reasonable cut back slopes or shoring where necessary.

**b. Foundation Preparation.** Grade the foundation for the retaining system volume level with the top of the leveling pad for a width equal to or exceeding the length of the soil reinforcing (if used) plus 6 inches or to the limits shown in the Contract Documents. Compact the foundation prior to wall construction, with a smooth wheel vibratory roller with a minimum static weight of 8 tons to recompact any loose material the excavation process created to Type AA, MR 3-3 requirements. Remove and replace any foundation soils found to be unstable or unsatisfactory.

Construct an unreinforced concrete or aggregate leveling pad at foundation level as shown in the Contract Documents. Cure the concrete pad for a minimum of 12 hours before placement of blocks.

**c. Wall Erection.** Check the plumbness and tolerances of each modular block row at the face prior to erection of the next row. Should any modular blocks be out of tolerance, remove the fill and reset to their proper tolerances.

(1) MBW. Place modular blocks at locations shown in the Contract Documents with the use of small lifting devices or by hand. Place blocks in successive horizontal lifts in the sequence shown in the Contract Documents as backfill placement proceeds. Leave modular block unit cores void unless drainage fill material is specifically called for in the Contract Documents. Take care when placing material behind the blocks to prevent the blocks from moving outward. Vertical tolerances and horizontal alignment tolerance shall not exceed 1 ½ inch when measured with a 10-foot straightedge. Offset each block from the block below it as shown in the Contract Documents, with a maximum allowable offset of 1 inch. The maximum vertical overall tolerance of the wall is 1 inch per 10 feet of the wall height.

Construct uniform horizontal and vertical joint openings between modular blocks a maximum of ⅛ inch thickness.

Extend the Mesa Connector into adjoining courses with 2 Mesa standard connectors per unit.

Place Anchor Lock Bar continuously only at elevations where geosynthetic reinforcement is required.

Place KeySystem I steel connection pins at soil reinforcing connection locations only and fiberglass alignment pins at all other pin locations.

**d. Backfill Placement.** Closely follow the erection of each lift of facing with backfill. At each reinforcing level, roughly level backfill before placing and or attaching the reinforcement. Place reinforcing as shown in the Contract Documents, normal to the face of the wall. For geosynthetic reinforcing, the end of the geogrid sheet shall terminate with a transverse element at the retained soil limit to prevent curling of the sheet and aid in construction. Tightly draw the reinforcing against the connections at the connectors and stake the end of the geogrid sheet at the retained soil limit before backfilling is allowed, and maintain tautness during backfilling operations. Place backfill in maximum loose lift thickness of 10 inches or less as may be necessary to obtain the specified density.

Compact the entire retained earth volume to 95% of maximum laboratory dry density at a moisture requirement of MR 3-3, **SECTION 205**. For backfills containing more than 30% retained on the ¾ inch sieve, use a method compaction consisting of at least 4 passes of a heavy roller. Accomplish compaction without disturbance or displacement of reinforcing and facing. Begin compaction from the area nearest the wall face to the back of the reinforcing, except for a strip 3 feet wide adjacent to the backside of the facing. Compact this 3-foot strip with light mechanical tampers after compaction of the remainder of the layer. Soil density tests will not be required within this 3-foot area.

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At the end of each day's operations, shape the last level of backfill to permit runoff of rainwater away from the wall face.

Remove and replace any wall materials that become damaged during backfill placement at the Contractor's expense.

Trim excess geogrid protruding from the face of the wall for MBWs to match the modular block's face. Seal any geogrid permanently exposed from exposure to the elements with the use of epoxy grout, grout or other methods as approved by the Engineer.

### **854.4 MEASUREMENT AND PAYMENT**

The Engineer will measure Landscape Retaining Wall by the square foot. The Engineer will use the neat lines shown in the Contract Documents to compute the quantities.

Payment for "Landscape Retaining Wall" at the contract unit price is full compensation for the specified work.