### 2515 Revetment systems

###  2515.1 DESCRIPTION

This work consists of providing and placing a protective covering for earth slopes, river channels, vehicle accesses, spillways, and susceptible soil erosion areas.

###  2515.2 MATERIALS

A Precast Articulated Concrete 3604

B Geotextile Filter 3733

C Bedding Material 3149

D Concrete Armor Units 3608

E Concrete 2461

###  2515.3 CONSTRUCTION REQUIREMENTS

A General

Excavate the foundation for the revetment systems, with geotextile filter, using toe, terminal, and upper bank trenches. Shape the foundation excavation to the cross‑sections as shown on the plans unless otherwise directed by the Engineer. Grade and compact termination trenches, embankment crests, and toes to prevent water from migrating under the block and geotextile material. Grade final subgrade smooth before placing the base course material to allow uniform contact with the geotextile and articulated concrete.

B Subgrade Preparation

Prepare the subgrade per 2112, “Subgrade Preparation.” Provide subgrade material free of stones, sticks, and other debris or irregularities that might puncture the geotextile fabric or create other system failures. If the system is subject to vehicle loading, install a geogrid for extra support, as shown on the plans.

C Bedding Material

Provide bedding material consisting of at least 6 in spread evenly over the compacted subgrade, made of one the following materials:

(1) Select Grading Material per 2105.1.A.6,

(2) Granular Material per 3149.2.B.1, or

(3) Granular Bedding per 3149.2.F.

Compact the Bedding Material per 2105.3.F.2, “Quality Compaction”.

D Geotextile Filter

Place Type 3 geotextile per 3733, “Geotextiles,” as a filter under the revetment systems unless otherwise required by the contract. Place the geotextile filter material on the entire area supporting the revetment system. Secure the geotextile filter material with 6 in. steel pins or staples, unless otherwise shown on the plans. If installing anchors, cut the geotextile to allow the anchors to penetrate the geotextile.

Place and compact prepared subgrade and bedding material, and place geotextile filter material without tearing, puncturing, or shifting the fabric. Place a 1 in. sand layer on the geotextile fabric before placing the block.

Place the required multiple fabric widths or lengths with the longest dimension parallel to the direction of water flow. Place un-seamed fabric with splices and joints overlapped at least 18 in., except overlap splices and joints underwater at least 36 in. Shingle the joint laps in the flow direction and from top of slope to bottom to direct water flow over the joint without undermining. As an alternative to joint over‑lapping, the Contractor may sew multiple fabric pieces together to meet the seam breaking strength requirements of 3733, “Geotextiles.” Bury upgrade edges of the fabric area to direct water flow over the fabric without undermining. For un-seamed geotextile, place steel pins with washers or staples at locations and in quantities as approved by the Engineer to prevent movement of the geotextile filter during placement of the articulated concrete revetment system.

Do not operate construction equipment directly on top of the geotextile.

E Precast Articulated Concrete

E.1 Articulated Block Mat

Place the mats in accordance with the appropriate manufacturer recommendations. Place the mats no greater than 2 in apart. After cable clamping and anchoring, use Type 3A grout per 2461, “Structural Concrete,” to close gaps greater than 2 in [51 mm]. Entrench and bury the outside edges of the mat system at least one block into the ground filled with compacted fill. Do not allow mats to overlap and blocks to project vertically greater than 1 in. beyond the adjacent block. Fasten the protruding longitudinal and transverse cable connections together along the adjacent sides of the mats.

E.2 Articulated Interlocking Block

Install articulated interlocking blocks by hand. Do not overlap blocks and allow blocks to project vertically by greater than 1 in beyond the adjacent blocks. Place anchors through cuts in the geotextile and position the anchors on the concrete block to maximize the pull out resistance.

E.3 Clamps

Use wire rope clamps to join cable loops of horizontal and vertical adjoining concrete revetment mats as specified by the manufacturer, unless otherwise directed by the Engineer.

E.4 Anchors

Install anchors at 8 ft. intervals at lead edge and around perimeter of the revetment system, and as shown on the plans, as specified by the manufacturer, or as directed by the Engineer. Embed anchors at least 3½ ft deep. Fasten the exposed cables of the concrete mats to the anchors driven into the anchor trench.

F Concrete Armor Units

Place concrete armor units so not to tear the geotextile filter. Embed and entrench at least one block into the ground at the toe with compacted fill material. Begin placement of the system at the toe termination trench and proceed up the slope and as per manufacturer recommendations.

G Filling and Vegetation

If vegetating is shown on the plans, fill the voids of the revetment system with screened common topsoil borrow per 3877, “Topsoil Borrow,” 35-241 seed mix per 3876, “Seed”, and category 4 Erosion control blanket per 3885, ”Rolled Erosion Control Products”, unless otherwise shown on the plans. Perform filling and vegetation after the Engineer completes inspection of any required clamping and anchoring systems.

###  2515.4 METHOD OF MEASUREMENT

The Engineer will measure precast articulated concrete of each type by area on the basis of actual surface dimensions as staked.

The Engineer will measure geotextile filter material by area on the basis of actual surface dimensions as staked. The Engineer will not include allowance for overlaps or seams in the measurement for geotextile filter.

The Engineer will measure concrete armor units by surface area covered by each size provided, installed, and accepted by the Engineer, including the buried portions, using the outermost extremity of the units as required by the contract. On small projects, the Engineer will accept concrete armor units by the number of complete units assembled and installed as required by the contract.

###  2515.5 BASIS OF PAYMENT

The contract unit prices for revetment systems include the cost of excavating and preparing the foundations, providing system materials, geotextile filter, base, and bedding materials, grouting, clamping, and anchoring.

The Department will pay for revetment systems on the basis of the following schedule:

| **Item No.:** | **Item:** | **Unit:** |
| --- | --- | --- |
| 2515.502 | Concrete Armor Units \_\_\_\_ (size) | Each |
| 2515.504 | Articulated Block Mat Open Cell, Type \_\_\_ | square yard  |
| 2515.504 | Articulated Block Mat Closed Cell, Type \_\_\_ | square yard  |
| 2515.504 | Articulated Interlocking Block Open Cell, Type \_\_\_ | square yard  |
| 2515.504 | Articulated Interlocking Block Closed Cell, Type \_\_\_ | square yard  |
|  |  |  |
|  |  |  |
| 2515.504 | Concrete Armor units \_\_\_\_ (size) | Square yard |

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