



UNILOCK®

INSTALLATION SPECIFICATIONS FOR DURA-MAT™

Non-Cable Articulating Concrete Block Revetment

1-800-UNILOCK

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FOREWORD

This outline specification has been prepared for the general guidance of specifiers, engineers, contractors and superintendents associated with the construction of Dura-Mat™ Non-Cable Articulating Concrete Block Revetment. A qualified engineer must determine the suitability of the design, confirm site conditions and monitor the installation in critical applications.

DURA-MAT™ NON-CABLE ARTICULATING CONCRETE BLOCK REVTMENT INSTALLATION SPECIFICATION

PART 1 GENERAL

1.1. Description

- A. The work covered by this section includes the furnishing of all labor, materials, equipment and incidentals for the design, inspection and construction of cellular concrete interlocking erosion control system including subgrade treatment, filter fabric placement and articulating concrete block placement as shown on the Construction Drawings and as described by the Contract Specifications. The work included in this section consists of, but is not limited, to the following:
1. Design, inspection and certification by a registered professional engineer.
 2. Subgrade preparation.
 3. Furnishing and placement of the filter fabric.
 4. Furnishing and placement of articulating concrete block.

1.2. Related Work

- A. Section 02100 - Site Preparation
B. Section 02200 - Earthwork

1.3. Reference Standards

- A. Engineering Design
1. NCMA TEK 11-12 - Articulating Concrete Block (ACB) Revetment Design.
 2. NCMA TEK 11- 9A - Specifications for Articulating Concrete Block.
- B. Articulating Concrete Block
1. ASTM C 1319 - Standard Specification for Concrete Grid Paving Units
 2. ASTM C140 - Standard Method of Sampling and Testing Concrete Masonry Units
- C. Geotextile Filter
1. ASTM D 3786 - Mullen Burst
 2. ASTM D 4491 - Flow Rate
 3. ASTM D 4491 - Permittivity
 4. ASTM D 4533 -Trapezoidal Tear
 5. ASTM D 4751 - Standard Test Method for Apparent Opening Size

D. Soils

1. ASTM D 698 - Moisture Density Relationship for Soils, Standard Method
2. ASTM D 422 - Gradation of Soils
3. ASTM D 424 - Atterberg Limits of Soils
4. ASTM D G51 - Soil pH

E. Where specifications and reference documents conflict, the Owner or Owner's Representative shall make the final determination of applicable document.

1.4. Approved Products

- A. Dura-Mat Articulated Concrete Block System as supplied by Unilock
Unilock® Location (Address, Phone, Fax) _____
- B. Color to be [_____].

1.5. The Contractor

- A. The term Contractor shall refer to the individual or firm who will be installing the erosion control system.
- B. The Contractor must have the necessary experience for the project and have successfully completed projects of similar scope and size.

1.6. Delivery, Material Handling and Storage

- A. The installing contractor shall check all materials delivered to the site to ensure that the correct materials have been received and are in good condition.
- B. The Contractor shall store and handle all materials in accordance with Unilock's recommendations and in a manner to prevent deterioration or damage due to moisture, temperature changes, contaminants, breaking, chipping or other causes.

1.7. Engineering Design and Certification

- A. The term Engineer shall refer to the individuals or firms who have been retained by the Contractor to provide design and inspection services for the erosion control system. The Design Engineer may be a different individual or firm from the Inspecting Engineer as Unilock® may provide this service. The Engineer(s) must be qualified in the area of erosion control design and construction and must be licensed to practice engineering in the State or Province that the wall is to be constructed.
- B. The Engineer(s) will perform the following tasks:
1. Produce sealed construction drawings and detailed design calculations, completed in accordance with the design requirements outlined in Part 3 of these specifications.
 2. Review the site soil and geometric conditions to ensure the design is compatible with the site prior to construction.

3. Inspect the site conditions, materials incorporated into the erosion control project, and the construction practices used during the construction.
4. Provide the Contractor with a letter after completion, certifying the design meets the requirements of this specification, the design was compatible with the site and the revetment was constructed according to design.

1.8. Submittals

- A. The Contractor shall submit the following information for approval thirty (30) days prior to the construction of the erosion control revetment.
 1. Design Submittal – Provide three (3) sets of stamped construction drawings and detailed design calculations, completed and sealed by the Engineer in accordance with the design requirements outlined in Part 3 of this specification. A detailed explanation of the design properties for the filter fabric shall be submitted with the design.
 2. Materials Submittal – Manufacturer’s certifications, stating that the articulating concrete blocks, the filter fabric, and imported soils meet the requirements of this specification and the Engineer’s design.
 3. Installer Qualifications - The Contractor must be able to demonstrate that their field construction supervisor has the necessary experience for the project by providing documentation showing that they have successfully completed projects of similar scope and size.

1.9 Measurement for Payment

- A. Payment for earthworks to prepare the site for erosion control revetment construction will be based on the contract unit price per cubic meter (or cubic yard) for site cut and fill earthwork as detailed in the Site Plan. Additional earthwork as directed and approved in writing by the Owner, or Owner’s representative, shall be paid for under a separate pay item.
- B. Payment for the articulating concrete block system will be based on the contract price per square meter (or square foot) of the area on which filter fabric and articulating concrete blocks are to be placed as shown on the construction drawings.

The contract unit price shall include the cost of all engineering, labor, materials, and equipment used to subgrade construction, filter fabric placement, articulating concrete block placement, cell backfill and site clean up.

PART 2 MATERIALS

2.1. Definitions

- A. Articulating concrete blocks are dry-cast concrete units that interlock together to form an erosion-resistant matrix.
- B. Subgrade is the base area on which the filter fabric and articulating concrete block are to be placed.

- C. Filter fabric is permeable synthetic fabric as specified in design and placed on top of subgrade. It allows the passage of water while preventing the migration of subgrade soil.
- D. All values stated in metric units shall be considered as accurate. Values in parenthesis stated in imperial units are the nominal equivalents.

2.2. Products

A. Articulating concrete blocks

1. The Articulating concrete blocks shall be 580 x 580 x 100 mm (23 x 23 x 4 inches) with a maximum tolerance of plus or minus 6.4 mm (1/4 inch) for each dimension.
2. The Articulating concrete blocks shall have a minimum weight of 38kg (84 lbs.) per block.
3. The Articulating concrete block shall have 34.2% - 44.9% open area, a total transmissive percentage defined as system's total open area at the base and top of block.
4. The Articulating concrete blocks shall have a minimum 28-day compressive strength of 35 MPa (5000 psi) as tested in accordance with ASTM C 140. The concrete shall have a maximum moisture absorption rate of 5 percent to ensure adequate freeze-thaw protection.

B. Subgrade Soil

1. Undisturbed native soil or imported engineered fill as specified in the Construction Drawings.
2. The Engineer shall review and determine the suitability of the soil at the time of construction.

C. Filter Fabric

1. The filter fabric can be either woven mono-filaments or nonwoven material as specified on the construction drawings. The selection of the appropriate filter fabric should satisfy criteria of retention, permeability, anti-clogging, and survivability/durability based on a specific site condition. Generally, a commonly used geotextile for filtration will have an Apparent Opening Size ranging between 0.149 and 0.210 mm (U.S. Sieve Sizes 100 to 70) and a minimum unit weight of 135 grams per square meter (5.0 oz /square yard).

The coefficient of permeability will typically range between 0.1 and 0.3 cm/second.

D. Crushed Stone

1. Articulating concrete blocks that are below the normal waterline and exhibit an average open area greater than 5%, shall be backfilled with crushed stone as approved by Project Engineer.

PART 3 ARTICULATING CONCRETE BLOCK REVETMENT DESIGN

3.1. Design Standard

- A. The Design Engineer is responsible for providing a design that shall consider all the relevant hydraulic analysis factors of an open-channel flow such as discharge quantity, flow velocity, Manning's roughness coefficient, channel geometry, channel bottom slope and side slope, etc.
- B. The articulating concrete block revetment shall be designed in accordance with recommendations of the NCMA Design for articulating concrete block revetment – Factor of Safety Method.

3.2. Recommended Product Design Parameters

Length: 580mm (22.8 inch)

Width: 580mm (22.8 inch)

Height: 100mm (3.9 inch)

Weight per block: 38kg (84lbs)

Weight per unit area: 2.33 kN/m² (48.6 lbs/sqft)

Moments arms: I₁=50mm (2 inch), I₂=I₄=410mm (16 inch) I₃=80mm (3.2 inch)

Open area: 34.2% - 44.9% (from fully contracted to fully expanded)

Foot print area: 0.16 m² (1.74 sqft)

Critical shear value (t_0): this value is based on full scale testing currently not available for Dura-Mat™ system. Testing on similar products has yielded typical values of between

1.1 - 1.32 kPa (22.8-27.5 lbs/sqft)

PART 4 CONSTRUCTION

4.1. Inspection

- A. The Engineer is responsible for verifying that the contractor meets all the requirements of the specification. This includes the use of approved materials and their proper installation.
- B. The Contractor's field construction supervisor shall have demonstrated experience and be qualified to direct all work related to the articulating concrete block revetment construction.

4.2. Construction Tolerances

- A. The following tolerances are the maximum allowable deviation from the planned construction

Subgrade: 0 to +/- 12.7mm (0 to +/-1/2 inches) over a 3.05m (10 ft) straight edge

4.3. Subgrade Construction

- A. The subgrade shall be constructed to the lines and grades specified and shown on the Construction Drawings or as directed by the Owner or Owner's Representative. Where such areas below the allowable grade they shall be brought to grade by placing layers not to exceed 250mm (10") of select backfill. The depth of layers and amount of compaction shall be as required to obtain a density equal to the adjoining undisturbed soil, or as specified by the Engineer.
- B. The subgrade for the concrete blocks shall be free of voids, pits and depressions. Depressions shall be brought to grade by backfilling with select backfill in accordance with the guidelines in (A).
- C. Obstructions, such as roots and projecting stones larger than 25mm (1 inch) remaining on the surface shall be removed and soft or low density pockets of material removed shall be filled with select backfill and compacted to obtain a density equal to the adjoining undisturbed soil, or as specified by the Engineer.
- D. Immediately prior to placing the filter fabric and cellular blocks, the prepared area shall be inspected by the Contractor and approved before the fabric or blocks are placed thereon.

4.4. Filter Fabric Placement

- A. Filter fabric shall be placed within the limits as shown in the Construction Drawings.
- B. Filter fabric shall be placed directly on the prepared area. Longitudinal and transverse joints shall be overlapped at least 460mm (18 inches) or as shown in the drawings.
- C. The filter fabric panels shall be placed so that the upstream strip of fabric will overlap the downstream strip.
- D. As needed, securing staples shall be inserted through both strips of overlapped fabric along one line through the midpoint of the overlap to temporarily hold the filter fabric panels in place until the articulating concrete blocks can be placed.
- E. Each securing staple shall be pushed through the fabric until it bears against the fabric and secures it firmly to the ground. Job site sewing of fabric panels shall be allowed in lieu of overlapping methods as approved by Project Engineer.

4.5. Articulating Concrete Block Placement

- A. Articulating concrete block shall be placed within the limits shown on the Construction Drawings or as directed by the Engineer.
- B. Articulating concrete blocks shall be placed individually on the filter fabric in a manner that produces a level surface.
- C. Articulating concrete blocks shall be placed to produce a continually interlocking surface free from field seams and non-interlocked connections (except as approved by Project Engineer and/or as shown in Contract drawings).

4.6. Articulating Concrete Block Furnishing

- A. Articulating concrete blocks that are below the normal water level and exhibit an average open area greater than 5%, shall be backfilled with crushed stone as approved by the Engineer.
- B. The open cells of articulating concrete blocks that are above the normal water level shall be backfilled with plantable soil or bedding for riprap as shown on the Construction drawings or as approved by Project Engineer.

END OF SECTION