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Drop-In Specification  
Standard Flexamat Erosion Control System (English Units)

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The following specification is a sample guideline to be customized by the engineer as needed for preparing a site-specific specification. This information is provided for reference purposes only and is not intended as a warranty or guarantee. Motz Enterprises assumes no liability in connection with the use of this information. Please contact Motz Enterprises for additional information, questions and guidance.

## TIED-CONCRETE BLOCK EROSION CONTROL MAT SPECIFICATION

### **1 GENERAL**

#### **A. SCOPE**

1. This specification covers the technical requirements for the Manufacturing, Installation and Quality Assurance of the Tied-Concrete Block Erosion Control System. All materials shall meet or exceed the requirements of this specification, and all work will be performed in accordance with the procedures provided in these project specifications
2. Furnish and install Tied-Concrete Block Erosion Control Mat at specified locations according to associated plans, drawings, standard specifications and manufacturer's guidelines as detailed herein.
3. The contractor shall furnish all labor, materials, equipment and incidentals required and perform all operations in connection with the installation of Tied- Concrete Block Erosion Control Mat in accordance with the lines, grades, design and dimensions shown on the contract drawings and as specified herein.

#### **B. MATERIALS & MANUFACTURE**

The Tied-Concrete Block Erosion Control Mat shall be Flexamat Channel Liner ®™ as manufactured by Motz Enterprises, Inc. (Cincinnati, OH).

Contact Info for material supply:

Motz Enterprises, Inc.  
Matt Motz  
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Cincinnati, OH 45241  
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Each block shall be tapered, beveled and interlocked. Each block shall incorporate interlocking surfaces or connections that prevent lateral displacement of the blocks within the mats when they are lifted for placement.

Tied Concrete Blocks shall be wet-cast or dry-cast and conform to the following applicable ASTM specifications:

Portland Cements - Specification C 150, for Portland Cement.

Blended Cements - Specification C 595, for Blended Hydraulic Cements.

Hydrated Lime Types - Specification C 207, for Hydrated Lime Types.

Pozzolans - Specification C 618, for Fly Ash and Raw or Calcined Natural Pozzolans for use in Portland Cement Concrete.

Aggregates shall conform to the following ASTM specification, except that grading requirements shall not necessarily apply:

Normal Weight – Specification C33, for Concrete Aggregates.

#### Physical Properties of Tied Concrete Blocks

The Tied-Concrete Block Mat shall have the following nominal characteristics:

Table 1. Physical Requirements					
Compressive Strength		Water Absorption		POA	
Net Area		Max. , lb/ft <sup>3</sup>		(percentage open area)	
Min. PSI (mPa)		(kg/m <sup>3</sup> )			
Avg. of	Individual	Avg. of	Individual	Avg. of	Individual
3 units	unit	3 units	unit	3 units	unit
4,500 (31)	4,000 (27.6)	10 (160)	12 (192)	30%	30%

**Durability:** Tied Concrete Blocks shall exhibit resistance to mild concentrations of acids, alkalis and solvents. The manufacturer of dry-cast products shall satisfy the purchaser by proven field performance that the concrete blocks have adequate durability when subjected to a freeze-thaw environment.

Backing material shall be adhered to Tied Concrete Block Mat, and shall be double-net excelsior blanket (Curlex® II), or equal, to promote growth of vegetation, unless otherwise specified on the plans.

Tied-Concrete Block Erosion Control Mat shall be manufactured or field fabricated from integrally formed individual concrete blocks tied together with high strength geogrid or pre-approved cable system.

### Polypropylene Geogrid:

The Tied-Concrete Block Mat shall be constructed of a high strength, rough service, low elongating, continuous filament polypropylene geogrid with an acrylic coating certified by the manufacturer to achieve 25-year minimum service life in direct sunlight. Interlocking geogrid shall have the following physical properties:

**Mass/Unit Area** ASTM D-5261 7.0 oz./yd<sup>2</sup> 240 g/m<sup>2</sup>

**Aperture Size** Measured 1.6 x 1.6 inch 40 x 40 mm

Wide Width Tensile Strength

Machine Direction (MD) ASTM D-6637 2,055 lb./ft. 30 kN/m

Cross Machine Direction (CMD) ASTM D-6637 2,055 lb./ft. 30 kN/m

**Elongation at Break** ASTM D-6637 6 % 6 %

**Tensile Strength @ 2%**

Machine Direction (MD) ASTM D-6637 822 lb./ft. 12 kN/m

Cross Machine Direction (CMD) ASTM D-6637 822 lb./ft. 12 kN/m

**Tensile Strength @ 5%**

Machine Direction (MD) ASTM D-6637 1,640 lb./ft. 24 kN/m

Cross Machine Direction (CMD) ASTM D-6637 1,640 lb./ft. 24 kN/m

**Tensile Modulus @ 2%**

Machine Direction (MD) ASTM D-6637 41,100 lb./ft. 600 kN/m

Cross Machine Direction (CMD) ASTM D-6637 41,100 lb./ft. 600 kN/m

**Tensile Modulus @ 5%**

Machine Direction (MD) ASTM D-6637 32,900 lb./ft. 480 kN/m

Cross Machine Direction (CMD) ASTM D-6637 32,900 lb./ft. 480 kN/m

NOTE: Polypropylene geogrid shall be determined by the manufacturer.

### Revetment Cable and Fittings:

Galvanized or other metal cables are not allowed.

Polyester Revetment Cable and Fittings. Revetment cable shall be constructed of high tenacity, low elongating, and continuous filament polyester fibers. Cable shall consist of a core construction comprised of parallel fibers contained within an outer jacket or cover. The weight of the parallel core shall be between 65% to 70% of the total weight of the cable. The revetment cable shall have the following physical properties:

Table 2. Polyester Cable				
Nominal Cable Dia.	Approx. Ave. Strength		Weight per Length	
	(in.)	(Lbs)	(kN)	(Lbs)/100ft (kg/m)
1/4	3,000	13.3	2.2	0.03
5/16	7,000	31.1	4.4	0.07
3/8	10,000	44.5	5.5	0.08
1/2	15,000	66.7	9.7	0.14

Elongation requirements specified below are based upon stabilized new, dry cable. Stabilization refers to a process in which the cable is cycled fifty (50) times between a load corresponding to  $200D^2$  and a load equal to 10%, 20% or 30% of the cable's approximate average breaking strength. Relevant elongation values are as shown in the table below. The tolerance on these values is  $\pm 5\%$ .

Table 3. ELASTIC ELONGATION		
at Percentage of Break Strength		
10%	20%	30%
0.6	1.4	2.2

The revetment cable shall exhibit resistance to most concentrated acids, alkalis and solvents. Cable shall be impervious to rot, mildew and degradation associated with marine organisms. The materials used in the construction of the cable shall not be affected by continuous immersion in fresh or salt water.

Selection of cable and fittings shall be made in a manner that insures a safe design factor for mats being lifted from both ends, thereby forming a catenary. Consideration shall be taken for the bending of the cables around hooks or pins during lifting. Revetment cable splicing fittings shall be selected so that the resultant splice shall provide a minimum of 60% of the minimum rated cable strength. Fittings such as sleeves and stops shall be aluminum and washers shall be galvanized steel unless otherwise shown on the Contract Drawings.

#### Filter Fabric:

The geotextile filter fabric, when required, shall meet the type and style shown on the plans.

### **Size of Tied-Concrete Block Erosion Control Mat**

**General:** The concrete blocks, cables, geogrid, fittings and other applicable elements shall be manufactured or fabricated at an approved location into mats with a width of up to 16' and a length of up to 80' as determined by the engineer and manufacturer to best suit the project needs.

#### **C. ALTERNATIVE MATERIALS**

Alternative materials may be considered. Such materials must be pre-approved in writing by the Engineer prior to bid date. Alternative material packages must be submitted to the Engineer a minimum of fifteen (15) days prior to bid date. Submittal packages for alternate materials must include, as a minimum, the following:

1. Full-Scale laboratory testing performed by an independent 3<sup>rd</sup> party testing facility with associated engineered calculations certifying the hydraulic capacity of the proposed Tied-Concrete Block Erosion Control Mat meets the requirements in Item F – Hydraulic Performance.
2. A list of 15 comparable projects in terms of project size, application and material dimensions in the United States, where the results of the specific alternative material's use can be verified and reviewed for system integrity and sustained, consistent vegetation growth after a minimum of 5 years of service life.

#### **D. SHIPPING, TRANSPORT, STORAGE & HANDLING**

Tied-Concrete Block Mats shall be rolled for shipment. These rolls shall be packaged with high-strength lifting straps for mobilization on-site. Any other shipment method or the elimination of handling straps must be pre-approved by the engineer.

Upon delivery, rolls may be left exposed for up to 30 days. If exposure will exceed 30 days, the rolls must be tarped or otherwise covered to minimize UV exposure.

Rolls shall be inspected upon delivery to insure no damage occurred during transportation. Damage will most likely be observed at roll edges where they may have been bumped with loading/unloading equipment. Any damage to delivered rolls not noted at time of delivery is the responsibility of the contractor.

**E. VISUAL INSPECTION**

All units shall be free of defects that would interfere with the proper placing of the unit or impair the strength and permanence of the overall system. Surface cracks incidental to the normal manufacture of concrete shall not be deemed grounds for rejection. Surface chipping resulting from customary methods of manufacture, shipping, handling and installation shall not be grounds for rejection.

Cracks exceeding 0.25 inches in width and/or 1.0 inch in depth shall be deemed grounds for rejection and unit replacement.

Chipping resulting in a weight loss exceeding 15% of the average weight of a concrete unit shall be deemed grounds for rejection and unit replacement.

If a unit is deemed rejected, replacement of said unit shall be in accordance with manufacturers specified Unit Replacement Procedures. (see manufacturer)

Rolls/Units rejected prior to delivery acceptance shall be replaced at the manufacturers expense. Blocks rejected at the job site which are discovered at time of unrolling shall be replaced at manufacturers expense. Blocks damaged following CQA acceptance of covered area shall be replaced at contractor/owners expense.

**F. Hydraulic Performance**

Tied-Concrete Block Erosion Control Mat shall conform to the following Hydraulic Performance table minimum values.

Table 4. Hydraulic Performance (min)	
Velocity (ft./sec)	19*
Shear Stress (lb./ft <sup>2</sup> )	24*

\*when subject to Large-Scale Channel Erosion Testing over non-vegetated USCS Soil Classification – Silty Sand (SM) in accordance with ASTM D6460 (modified) @ 30% slope.

**G. CONSTRUCTION**

Bidding installer shall be pre-approved and qualified by the manufacturer and shall provide a letter of approval from the manufacturer with other required submittals.

The prepared subgrade shall provide a firm, unyielding foundation for the mats with no sharp or abrupt changes or breaks in the grade.

The subgrade shall be prepared as detailed on the plans. Subgrade surface shall be free of any debris, protrusions, rocks, sticks, roots or other hindrances which would result in an individual block being raised more than  $\frac{3}{4}$ " above the adjoining blocks. Undulations, rolls, knolls and rises in the subgrade to which the Tied-Concrete Mat is able to contour over and maintain intimate contact with the subgrade will be allowed.

Apply seed directly to the prepared soil prior to installation of mats. Use seed and/or topsoil per project specifications.

Install mats to the line and grade shown on the plans and according to the manufacturer's installation guidelines.

The manufacturer or authorized representative will provide technical assistance during installation as needed.

1. ANCHORING:

Flexamat is to have a toe-in at the leading edge of 12-18" in areas parallel to the direction of hydraulic flow. Alternately, if flows are low, limited or infrequent a soil transition cover may be placed over the leading 18-24" of the mat in lieu of placement in an anchor trench.

Alternate systems; where permanent anchoring is required, e.g. hanging mats on steep slopes without toe construction, the cables (polyester) shall be attached to the anchoring system as indicated on the Contract Drawings. The design and layout of the anchored system shall be designed by the engineer or designated party by the engineer.

The manufacturer shall allow for manipulation of the mat during installation to achieve proper positioning and placement through the use of standard construction equipment including, but not limited to; excavator, forklift, skid-steer, or other under supervision of approved manufacturer representative.

Panel Seaming:

Panel seams perpendicular to the hydraulic flow will be seamed utilizing a 4' x roll width section of geogrid. The geogrid is to be placed under the joining sections and connected to the grid of the Flexamat utilizing either hog rings or zip ties (see performance requirements below)

1. Zip Ties used shall exhibit the following minimum



- performance levels in accordance with ASTM D-4066 PA 0111
- 18 lb. min. tensile
- Carbon Black content of 2.5% min
- UV Resistance criteria for a minimum of 2 years exposure

2. Hog Rings used shall be minimum 1" Galvanized Steel.

Fasteners selected shall be placed at 12" maximum spacing along and within one foot from the seam.

**H. CONTRACT ITEM (Pay Item) PAY UNIT**

Tied-Concrete Block Erosion Control Mat.....Square Foot

Payment for Tied-Concrete Block Erosion Control Mat shall include all labor, equipment and materials to complete work as described.