

**Section 02380**  
**[Enkamat 7018]**  
**Permanent Geosynthetic Turf Reinforcement Mat**

**1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Permanent Geosynthetic Turf Reinforcement Mat (TRM) to prevent soil and vegetation loss resulting from excessive water flow (velocity and shear stress) in which unreinforced vegetation could not resist.

**1.2 RELATED SECTIONS**

- A. Section [02200] – [*Site Preparation*]
- B. Section [02300] – [*Earthwork*]
- C. Section [02900] – [*Planting*]

**1.3 UNIT PRICES**

- A. Method of Measurement: By the square meter (or square yard - as indicated in contract documents) including seams, overlaps, and wastage.
- B. Basis of Payment: By the square meter (or square yard - as indicated in contract Documents) installed.

**1.4 REFERENCES**

- A. American Society for Testing and Materials (ASTM):
  - 1. D 4759 - Practice for Determining the Specification Conformance of Geosynthetics
  - 2. D 4873 - Guide for Identification, Storage, and Handling of Geotextiles
  - 3. D 5035 – Standard Test Method for Braking Force and Elongation of Textile Fabrics (Strip Force)
  - 4. D 6524 – Standard Test Method for Measuring the Resiliency of Turf Reinforcement Mats (TRMs)
  - 5. D 6525 - Standard Test Method for Measuring Nominal Thickness of Permanent Rolled Erosion Control Products
  - 6. D 6454 - Standard Test Method for Deterring the short-term Compression Behavior of Turf Reinforcement Mat
  - 7. D 6566 - Standard Test Method for Measuring Mass Per Unit Area of Turf Reinforcement Mats
  - 8. D 6567 - Standard Test Method for Measuring the Light Penetration of a Turf Reinforcement Mats

9. D 6575 - Standard Test Method for Determining Stiffness of Geosynthetic Used as Turf Reinforcement Mats
- B. Geosynthetic Accreditation Institute (GAI) - Laboratory Accreditation Program (LAP).
- C. American Association of State Highway and Transportation Officials (AASHTO)
- C. National Transportation Product Evaluation Program (NTPEP).

## **1.5 DEFINITIONS**

- A. Minimum Average Roll Value (MARV): Property value calculated as typical minus two standard deviations. Statistically, it yields a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed value reported.
- B. Typical Value: Physical property value referred to as average, mean or “target” value. Also referred to as the statistical average value.

## **1.6 SUBMITTALS**

- A. Submit under provisions of Section [1300] [Submittals]:
  1. Certification: The contractor shall provide to the Engineer a certificate stating the name of the manufacturer, product name, style number, chemical composition of the filaments or other pertinent information to fully describe the Turf Reinforcement Mat (TRM). The Certification shall state that the furnished TRM meets or exceeds the MARV requirements of the specification as evaluated under the Manufacturer's quality control program. A person having legal authority to bind the Manufacturer shall attest to the Certification.
  2. The contractor shall submit five (5) copies of the manufacturer’s data, specifications and samples and a list of previous project installations of a TRM.
  3. The contractor shall submit a manufacturer’s certification that the proposed material complies with the requirements specified herein and are suitable for the intended purpose.
  4. No material shall be shipped to the Project Site until the manufacturer certification is submitted to and approved by the Engineer.
  5. The contractor and/or the engineer shall meet with a manufacture’s representative on site prior to beginning installation. A letter shall be submitted prior to installation that this meeting has occurred and any concerns about the installation procedures have been addressed.
  6. Alternative products to be submitted as an equal to the specified product within this specification will require the following minimum documentation: Performance data (Permissible Velocity or Permissible Shear Stress and Soil Loss) for a minimum 30 minute and maximum 50 hr duration (under uniform flow conditions) in a vegetated state. Said data must be developed by independent third party testing from a recognized testing facility. As well, a written statement describing any noncompliance items of the alternative product.

## 1.7 QUALITY ASSURANCE

### A. Manufacturer Qualifications:

Manufacturer's shall maintain a written Quality Assurance policy / manual and make said policy / manual available to the Engineer at his request. ISO 9000 certification may be acceptable.

## 1.8 DELIVERY, STORAGE, AND HANDLING

A. Product labels shall clearly indicate the manufacturer or supplier name, style name, and roll number as per ASTM D-4873.

B. Each TRM roll shall be wrapped with a material covering that will protect the TRM from damage due to shipment, sunlight, and storage.

C. During storage, TRM rolls shall be adequately covered to protect them from the following: site construction damage, extended ultraviolet radiation, chemicals that are strong acids or strong bases, flames including welding sparks, excessive temperatures, and any other environmental conditions that may damage the physical property values of the TRM.

## 2. PRODUCTS

### 2.1 MANUFACTURERS

A. Colbond Geosynthetic, Inc  
Sand Hill Road  
P.O. Box 1057  
Enka, North Carolina, USA 28728  
1-800-365-7391  
1-828-665-5000  
1-828-665-5009, fax  
[www.colbond-usa.com](http://www.colbond-usa.com)

B. Substitutions: Manufacturers others than those noted above should be a member of the Geosynthetic Institute (GSI) and/or the North American Geosynthetics Society and/or the International Geosynthetics Society (IGS) and as per provisions in Section [01630].

### 2.2 MATERIALS

#### A. Turf Reinforcement Mat:

1. The TRM shall be Enkamat 7018 manufactured for the purpose of permanent channel lining and turf reinforcement. The TRM shall be made from 100% synthetic material and contain no biodegradable or photodegradable components or materials.

2. The TRM shall be a three-dimensional matrix and maintain the three dimensional stability without laminated or stitched layers. The TRM shall have a sufficient Area Holding Capacity and a minimum 90% open space available for soil and root

interaction. The TRM shall not loose its structural integrity and shall not unravel or separate when TRM is cut in the field.

3. The TRM shall exhibit no buoyancy factor (i.e., the specific gravity of the fibers used should be greater than 1.0) so as to allow the TRM to maintain intimate contact with the soil (particularly between fasteners) under low flow conditions.
4. The TRM shall meet the requirements of Table 1.

**TABLE 1 - PERMANENT TURF REINFORCEMENT MAT**

<b>Property</b>	<b>Test Method</b>	<b>Units</b>	<b>Value</b>
Mass/Unit Area	ASTM D 5261	oz/yd <sup>2</sup>	8.6
Thickness	ASTM D 5199	inches	0.7
Tensile Strength (MD)	ASTM D 5035 mod	lb/ft	150.0
Area Holding Capacity	Calculated	in <sup>3</sup> /yd <sup>2</sup>	825
Porosity	Calculated	%	>95
UV Stability	ASTM D 1682 mod	%	80
Velocity 30 min. Vegetated 50 hr. Vegetated	Flume Testing <sup>1</sup>	ft/sec	19.0 14.0
Shear 30 min. Vegetated 50 hr. Vegetated	Flume Testing <sup>1</sup>	lb/ft <sup>2</sup>	9.0 7.0

<sup>1</sup> Acceptable facilities include Utah State University, Colorado State University

### 2.3 ACCESSORIES

#### A. Anchoring Devices

1. The TRM shall be secured in place using heavy-duty metal staples. The metal staples shall be U- shaped, a minimum of 6 inch long (each leg), one and one half (1-1/2) inches wide, and shall be fabricated from 9 gauge diameter metal wire. If difficulties arise installing the staples, then 10 inch pins fabricated from 9 gauge with one and one half (1-1/2) inch diameter washer or 7 inch gutter spike with one and one half (1-1/2) inch diameter washer shall be used. In some cases where loose soil conditions exists and anchors of stated length do not properly secure the TRM to the ground, then longer staple should be used such as a 8-12 inch long staples or pins.

### 2.3 QUALITY CONTROL

- A. Manufacturing Quality Control: Testing shall be in compliance with the manufacturers Quality Policy. Quality Control testing shall be at a frequency that complies with recommendations of ASTM D 4354, "Practice for Sampling of Geosynthetics for Testing."

### **3. EXECUTION**

#### **3.1 PREPARATION**

- A. The installation site shall be prepared by clearing, grubbing, and excavation or filling the area to the design grade.
- B. The surface to receive the TRM shall be prepared to relatively smooth conditions free of obstructions, depressions, debris and soft or low density pockets of material. The material shall be capable of supporting a vegetative cover.
- C. Erosion features such as rills, gullies, etc. must be graded out of the surface before TRM deployment. Smooth roll drum compaction may be required before deploying TRM to make sure the TRM makes immediate contact with the soil.
- D. Cut trenches for initial anchor trenches, termination trench and longitudinal anchor trenches (6 inches wide and 9 inches in depth) as shown on the drawings.
- E. Where appropriate, cut intermediate check slots at 25-35 ft. apart, perpendicular to channel flow direction (6 inches wide and 9 inches in depth) depending on channel alignment. An acceptable alternative to trenched check slot is a “stapled” check slot constructed by placement of two rows of staples/pins staggered 3 inches apart and separated by 3 inches at a 20 ft interval.

#### **3.2 INSTALLATION**

- A. TRM is shown on the drawings to depict the locations and portions of the work where the TRM may be installed. The owner reserves the right to direct the contractor to limit the location and/or areas of the site where the TRM will be installed.
- B. For channels, begin at the downstream end in the center of the channel and place initial TRM into the termination anchor trench and fasten into the trench with staples.
- C. Position second TRM with a minimum 4-inch overlap of the previous TRM and secure it into the anchor trench. After entire width area is installed with the TRM, then backfill the anchor trench.
- D. Continue deploying TRM upstream to the next check slot. Overlay a minimum of 18 inches the ends of rolls with the next roll(s) being deployed. Continue the processes until you reach the upgrade starting point of the TRM.
- E. When overlapping successive TRM rolls, the rolls shall be overlapped upstream over downstream, and/or upslope over downslope.
- F. Install anchoring devices at a frequency of 2 ½ staples per square yard. Increase anchoring devices may be required depending on site conditions or alignment of the slope or channel. Always staple the seams between individual TRM rolls.
- G. Care shall be taken during installation so as to avoid damage occurring to the TRM as a result of the installation process. Should the TRM be damaged during installation, a TRM patch shall be placed over the damaged area extending 1 m (3.28 ft) beyond the perimeter of the damage.
- H. Alternative installation methods must be approved by Engineer prior to execution.

- I. Broadcast seed and fertilizer over TRM or by hydro-seed directly into the open TRM.
- J. Hydro-mulch with a tacifer over the seeded TRM.
- K. Apply supplement water over the area as direct by site personnel during germination and initial three months of vegetation growth.

**END OF SECTION**