

SECTION 02926

EROSION CONTROL MATTING

PART 1. GENERAL

1.01 DESCRIPTION

- A. An erosion control mat is a degradable erosion control blanket (ECB) designed to hold seed and soil in place until vegetation is established in disturbed areas or is a synthetic turf reinforcement mat (TRM or HPTRM) combining vegetative growth and synthetic materials to form a high-strength mat that helps prevent soil erosion in channels and on steep slopes.

1.02 MEASUREMENT AND PAYMENT

- A. Unit Prices.
1. Payment for erosion control matting will be made by the square yard of surface area covered, complete in place and ready for use as an erosion control surface treatment.(Erosion Control Matting necessary for anchorage trenches, overlaps and waste is subsidiary to the design surface area.)
 2. Refer to Section 01270 - Measurement and Payment for unit price procedures.
- B. Stipulated Price (Lump Sum). If Contract is Stipulated Price Contract, payment for work in this Section is included in total Stipulated Price.

1.03 SUBMITTALS

- A. The submittal requirements for this specification item shall include the erosion control matting type and sample.
- B. One (1) full set of Manufacturer's literature and installation recommendations, and any special details necessary for the proposed application.
- C. Certifications: Manufacturer shall submit a letter of certification that the products meets or exceeds all physical property, endurance, performance and packaging requirements as laid out by this specification.
- D. Conform to requirements of Section 01330 - Submittal Procedures.

PART 2. MATERIALS

2.01 EROSION CONTROL BLANKETS (ECBs) - TEMPORARY

- A. Straw Blanket ECB - shall consist of 100% wheat straw or excelsior mechanically bound and covered with degradable double netting. The straw or excelsior shall be homogeneously blended and evenly distributed throughout the blanket. The netting shall be rapid degrading polypropylene (< 90 days) or photodegradable polypropylene (> 90 days < 1 year) with mesh openings of approximately 3/8 in. by 3/8 in. (11 mm by 11 mm). The blanket shall be sewn on approximately 2 in. (51mm) centers with degradable polypropylene thread. For applications see Tables 2and 4.
- B. Mix Media ECB shall consist of 70% wheat straw and 30% coconut fiber or 100% excelsior mechanically bound and covered on both sides by netting. The straw and coconut fiber or excelsior shall be homogeneously blended and evenly distributed throughout the blanket. The bottom netting shall be photodegradable polypropylene with mesh openings of approximately 3/8 in. by 3/8 in. (11 mm by 11 mm). The top netting shall be photodegradable polypropylene with mesh openings of approximately 5/8 in. x 5/8 in. (16 mm by 16 mm). The blanket shall be sewn on approximately 2 in. (51 mm) centers with degradable polypropylene thread. For applications see Tables 2and 4.
- C. Coconut Fiber ECB -shall consist of 100% coconut fiber or excelsior mechanically bound and covered on both sides by netting. The coconut/ excelsior fiber shall be homogeneously blended and evenly distributed throughout the blanket. Both the top and bottom nettings shall be photodegradable polypropylene with mesh openings of approximately 5/8 in. by 5/8 in. (16 mm by 16 mm). The blanket shall be sewn on approximately 2 in. (51 mm) centers with degradable polypropylene thread. For applications see Tables 2and 4.
- D. Products in each category shall have the following Minimum Average Roll Values (MARV) for physical properties, as derived from quality control testing performed by a Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP) accredited laboratory. Letters of certification signed by a responsible representative of the manufacturer shall be sent within 24 hours of each truckload shipment of material to the construction site.

Table 1 Erosion Control Blanket Properties

	Property	Test Method	Straw Blanket ECB	Mix Media ECB	Coconut Fiber ECB
Physical	Mass/Unit Area	ASTM D5261	8.0 oz/yd ² (271 g/m ²)	8.8 oz/yd ² (298 g/m ²)	8.8 oz/yd ² (298 g/m ²)
	Thickness	ASTM D1777	0.25 in (6 mm)	0.40 in (10.16 mm)	0.30 in (7.62 mm)
	Fiber Composition	Observed	Wheat straw/ excelsior	70% wheat straw / 30% coconut or 100% excelsior	Coconut or 100% excelsior
Mechanical	Grab Tensile Strength	ASTM D5035	75 x 75 lb/ft (1 x 1 kN/m)	100 x 100 lb/ft (1.46 x 1.46 kN/m)	150 x 150 lb/ft (2.19 x 2.19 kN/m)
	Grab Elongation	ASTM D5035	25%	30%	25%
	Vegetated Velocity ²	---	≤ 5 ft/sec (1.5 m/sec)	≤ 5 ft/sec (1.5 m/sec)	≤ 5 ft/sec (1.5 m/sec)
Performance	Unvegetated Shear Stress ³	---	1.5 lb/ft ² (72 N/m ²)	1.75 lb/ft ² (84 N/m ²)	2.0 lb/ft ² (96 N/m ²)
Endurance	Functional Longevity	Observed	≤ 12 months	≤ 24 months	≤ 36 months

Note:

1. Above table represents typical values. A typical value is the average value obtained when testing the product
2. Maximum permissible design values based on short-term peak flow duration (0.5 hr), vegetated data obtained at Department-approved independent hydraulics testing facility on an erodible soil bed.
3. Maximum permissible design values based on short-term peak flow duration (0.5 hr), unvegetated data obtained at Department-approved independent hydraulics testing facility on an erodible soil bed.

Shear (kN/m³) = unit weight of water (9.81 kN/m³) x depth (m) x slope (m/m) in a "hydraulically wide" channel.

Shear (lb/ft²) = unit weight of water (62.4 lbs/ft³) x depth (ft) x slope (ft/ft) in a "hydraulically wide" channel.

Table 2 ECB and TRM Selection Guide for Slope Applications

	Slope Batter			
Functional Longevity (months)	5.0H:1V	4.0H:1V	3.0H:1V	2.0H:1V
3 – 12	Staw Blanket ECB			
12 – 24	Mix Media ECB			
24 – 36	Coconut Fiber ECB			
> 36	Turf Reinforcement Mats (TRM or HPTRM)			

Note:

1. For critical structures and/or 2:1(H:V) slopes a HPTRM should be considered.
2. For design purposes only. For slopes steeper than 2:1, please consult with Public Works for approval.

2.02 TURF REINFORCEMENT MATS (TRMs) – PERMANENT

- A. The contractor shall submit, as a requirement of an acceptable bid, the name and manufacturer of the TRM and/or HPTRM on the bid form of this project.
- B. Turf Reinforcement Mat (TRM) – shall be constructed of a web of mechanically or melt bonded polymer netting, monofilaments or fibers that are entangled to form a strong and dimensionally stable mat. Bonding methods include polymer welding, thermal or polymer fusion or the placement of fibers between two high-strength, biaxially oriented nets mechanically bound by parallel stitching with polyolefin thread. TRM shall be defined as Long-Term Non-Degradable material designed to reduce soil erosion and assist in the growth, establishment and protection of vegetation for a period of time exceeding 5 years. All components of TRM shall be 100% synthetic and resistant to biological, chemical, ultraviolet degradation, and be tan or green in color. For applications see Tables 2 and 4.
- C. High Performance Turf Reinforcement Mat (HPTRM)– shall be a three-dimensional, lofty geosynthetic specially designed for erosion control applications on steepened slopes and vegetated waterways. The matrix shall be composed of tan or green, monofilament yarns woven into a uniform configuration of resilient pyramid-like projections or entangled with a high tenacity geogrid or steel wire mesh. The matrix shall exhibit very high interlock and reinforcement capacity with both soil and root systems and demonstrate high tensile modulus. TRM's manufactured from

discontinuous or loosely held together by stitched or glued, netting, or composite of any type, shall not be allowed in this category. HPTRM shall be defined as a High Survivability Long-Term Non-Degradable material designed to reduce soil erosion and assist in the growth, establishment and protection of vegetation for a period of time exceeding 5 years. All components of HPTRM shall be 100% synthetic and resistant to biological, chemical, ultraviolet degradation. This category should be used especially when field conditions exist with high loading and/or high survivability requirements. These requirements consist of maintenance, structural backfills protecting critical structures, utility cuts, potential traffic areas, abrasion, and higher factors of safety and/or general durability concerns. For applications see Tables 2 and 4.

- D. These materials shall conform to the Minimum Average Roll Values (MARV), listed in Table 3, for physical properties, as derived from quality control testing performed by a Geosynthetic Accreditation Institute – Laboratory Accreditation Program (GAI-LAP) accredited laboratory:

Table 3. Permanent Turf Reinforcement Mat Physical Properties

	Property	Test Method	TRM	HPTRM
General	Mass per Unit Area	ASTM D6475	10 oz/yd ² (340 g/m ²)	14 oz/yd ² (475 g/m ²)
	Thickness	ASTM D6525	0.50 in (12.7 mm)	0.50 in (12.7 mm)
Performance Index	Tensile Strength ²	ASTM D5035	170 x 130 lb/ft (2.4 x 1.8 kN/m)	3,000 x 2,100 lb/ft ³ (43.8 x 26.3 kN/m)
	Elongation	ASTM D5035	50 % (max)	55 % (max)
	Porosity ⁴	Calculated	95 %	95 %
	Resiliency	ASTM D6524	80 %	80 %
	UV Resistance ⁵	ASTM D4355	80 % @ 1000 hrs	90 % @ 3000 hrs
Endurance	Functional Longevity	Observed	> 5 years	> 5 years
Performance	Maximum Velocity ⁶	---	15 ft/sec (5.5m/sec)	25 ft/sec (7.69m/sec)
	Maximum Shear Stress ⁷	--	8 lb/ft ² (383 N/m ²)	12 lb/ft ² (575 N/m ²)

Notes:

- 1 All physical property values shall be derived from quality control testing performed by a GAI-LAP accredited lab.
- 2 Values of both machine and cross machine directions, respectively, under dry or saturated conditions.
- 3 As referenced by the proposed ECTC guidance specification to FHWA for High Survivability Turf Reinforcement Mat.

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- 4 Porosity calculated based on unit weight, thickness and specific gravity.
- 5 Tensile strength retained of all components after exposure.
- 6 Maximum permissible design values based on short-term peak flow duration (0.5 hr), vegetated data obtained at Department-approved independent hydraulics testing facility on an erodible soil bed.
- 7 Shear (kN/m^3) = unit weight of water (9.81 kN/m^3) x depth (m) x slope (m/m) in a "hydraulically wide" channel. Shear (lb/ft^2) = unit weight of water (62.4 lbs/ft^3) x depth (ft) x slope (ft/ft) in a "hydraulically wide" channel.

Table 4. Selection Chart for Channel Lining System

Shear Stress, lb/ft^2						
Functional Longevity	Permanent	0	2	4	6	8
		10				
	Temporary	HPTRM				
		TRM				
		Coconut				
		Mix Media				
		Straw Mat				

2.03 QUALITY ASSURANCE SAMPLING, TESTING AND ACCEPTANCE

- A. Rolled erosion control products (RECPs) shall be subject to sampling and testing to verify conformance with this specification. Sampling for testing shall be in accordance with ASTM D 4354.
- B. Acceptance shall be in accordance with ASTM D 4759 based on testing of either conformance samples obtained using Procedure A of ASTM D 4354, or based on manufacturer's certification and testing of quality control samples obtained using Procedure B of ASTM D 4354.
- C. Quality Assurance Sampling and Testing will be waived for products manufactured at an ISO 9002 Certified Manufacturing Facility. Documentation of ISO 9002 Certification shall be provided upon request.
- D. Alternate RECPs not strictly conforming to this specification must be approved by the Public Works 10 days prior to bid.

2.04 MANUFACTURING QUALITY CONTROL

- A. Manufacturing Quality Control (MQC) testing shall be performed at a laboratory accredited by GAI-LAP for tests required for the turf reinforcement mat, at a frequency exceeding ASTM D 4354, with following minimum acceptable testing frequency:

Table 5. Minimum Acceptable Testing Frequency for Index Properties

Property	Test Method	Temporary Test Frequency	Permanent Test Frequency Test/yd ² of production
Mass per Unit Area	ASTM D-5261	1/production run	1/24,000
Tensile Strength	ASTM D-5261	1/production run	1/24,000
Tensile Elongation	ASTM D-5261	1/production run	1/24,000
Ground Cover Factor	Light Projection Analysis	1/production run	1/24,000

- B. Letters of certification signed by a responsible representative of the manufacturer shall be sent within 24 hrs of each truckload shipment of material to the jobsite.

PART 3. EXECUTION

3.01 SITE PREPARATION – ECBS and TRMs

- A. Grade and compact areas to be treated with RECP and compact as indicated or as directed by the Public Works.
- B. Remove large rocks, soil clods, vegetation, and other sharp objects (larger than 2" in diameter) that could keep the RECP from intimate contact with subgrade.
- C. Prepare seedbed by loosening 50 to 75 mm (2 to 3 in) of soil below final grade. Select and apply soil amendments, fertilizer, and seed as required by the Public Works to scarified surface prior to installation of the RECP (Types 1A-3A and Types 2A-2B). For Type 3B, the contractor will additionally seed and uniformly soil fill (.5 inches) with live soil on top of the mat. Successful preparation of the seedbed will result in 50 to 75 mm (2 to 3 in) of live soil. . The Public Works has final determination of whether or not the soil is "live." If insitu soil is not "live", "live" soil will be imported as approved by the Public Works.
- D. Construct 150 x 300 mm (6 in x 12 in) anchor trench at upgrade end of installation to inhibit undermining from stray surface water. Excavate 150 x 150 mm (6 in x 6 in) check slots at 7.6 to 9.1 meter (25 to 30 feet) intervals along length of channel. At the Public Works' discretion, excavated check slots may be replaced by a double row of staples offset by 6 inches and placed on 1 ft centers. Cut longitudinal anchor slots 150 x 150 mm (6 in x 6 in) at top of each side slope. The aforementioned dimensions are minimums and the dimensions detailed on the drawings will control.

3.02 INSTALLATION – ECBS and TRMs

- A. The following installation details are the minimums required. The installation details noted in the drawings will control the RECP installation.
1. Install the RECP at elevation and alignment indicated.
 2. Beginning at downstream end in center of channel, place initial end of first roll of RECP in anchor trench and secure with ground anchor devices at 300 mm (12 in) intervals.
 3. Position adjacent rolls in anchor trench in same manner, overlapping proceeding roll minimum 75 mm (3 in).
 4. Secure the RECP at 300 mm (12 in) intervals along the trench, backfill and compact with specified soil or as directed by Public Works.
 5. Unroll center strip of RECP upstream over compacted trench. Stop at next check slot or terminal anchor trench. Unroll adjacent rolls of RECPs upstream in similar fashion, maintaining 75 mm (3 in) overlap.
 6. Fold and secure the RECP snugly into transverse check slots. Lay material in bottom of slot, and then fold it back against itself as indicated. Anchor through both layers of RECP at 300 mm (12 in) intervals. Backfill with soil and compact. Continue unrolling the RECP widths upstream over compacted slot to next check slot or terminal anchor trench.
 7. Secure RECP to channel bottom with ground anchoring devices at a frequency of 3 anchors per square meter (2 ½ anchors per square yard). Anchors should be a minimum of 8 gauge and 200 mm (8 in) in length or so that they have sufficient ground penetration to resist pullout. Increased anchoring frequency may be required if site conditions are such that the Public Works determines it necessary.
 8. At the discretion of the Public Works, certain TRM's can be soil filled to improve vegetative establishment and performance. If specified in the project plans or specifications, after seeding, spread and lightly rake ½" of fine topsoil into the TRM. Smooth soil fill in order to just expose top of TRM. Do not place excessive soil above mat.
 9. At the Public Works' discretion a manufacturer's designated representative shall be on site for installation assistance.

10. Any installation of angular placement, overlapping around curves, or modified placement methods must be detailed on the construction drawings.
11. Public Works must approve alternate installation methods prior to execution.

3.03 Irrigation, Mowing and Project Acceptance

- A. Prior to project acceptance by the Public Works, it shall be the responsibility of the contractor to establish a minimum of 70% of the area seeded shall be covered with the specified vegetation with no bare or dead spots greater than 10 square feet. The contractor shall be responsible to set up and maintain temporary irrigation, as required, to assist in establishment of vegetation.
- B. All areas that erode prior to project acceptance shall be repaired at the expense of the contractor including necessary reseeding, watering, and repair of the RECP.
- C. Seeded areas shall not be mowed prior to establishment of 70% vegetative density and a minimum grass growth of 3 inches. Mower height shall not be set lower than 3 inches. Throughout the duration of the project, the contractor shall be responsible for mowing to facilitate growth and shall not let the vegetation in the seeded areas exceed 18". In addition, the
- D. Contractor shall water all grassed areas as often as necessary to establish satisfactory growth and to maintain its growth throughout the duration of the project.

END OF SECTION