

SECTION 02375

EROSION CONTROL MATTINGS AND COMPONENTS

PART 1 GENERAL

1.01 SUMMARY

- A. This section addresses erosion control blankets, erosion control revegetation matting, turf reinforcement matting, and open weave textile.
- B. Related Work Specified Elsewhere: Section 02377, Vegetative Erosion Control.
- C. Measurement and Payment Procedures.
 - 1. For public funded capital improvement projects, See Section 01025.
 - 2. For privately funded development projects, Owner will determine measurement and payment requirements.

1.02 REFERENCES

- A. American Society for Testing and Materials (ASTM)
 - 1. ASTM D 1117 – Test Methods for Nonwoven Fabrics
 - 2. ASTM D 4355 – Test Method for Deterioration of Geotextiles from Exposure Ultraviolet Light and Water
 - 3. ASTM D 4491 – Test Methods for Water Permeability of Geotextiles by Permittivity
 - 4. ASTM D 4632 – Test Method for Grab Breaking Load and Elongation of Geotextiles
 - 5. ASTM D 4751 – Test Method for Determining Apparent Opening Size of a Geotextile
 - 6. ASTM D 4873 – Guide for Identification, Storage, and Handling of Geosynthetic Rolls
 - 7. ASTM D 5035 – Test Method for Breaking Force and Elongation of Textile Fabrics
 - 8. ASTM D 5199 – Test Method for Measuring Nominal Thickness of Geotextiles and Geomembranes
 - 9. ASTM D 5261 – Test Method for Measuring Mass per Unit Area of Geotextiles
 - 10. ASTM D 5338 - Test Method for Determining Aerobic Biodegradation of Plastic Materials Under Controlled Composting Conditions
 - 11. ASTM D 6459 – Test Method for Determination of Erosion Control Blanket Performance in Protecting Hillslopes from Rainfall-Induced Erosion
 - 12. ASTM D 6460 – Test Method for Determination of Erosion Control Blanket Performance in Protecting Earthen Channels from Stormwater Induced Erosion
 - 13. ASTM D 6525 – Test Method for Measuring Nominal Thickness of Permanent Rolled Erosion Control Products
 - 14. ASTM D 6818 – Test Method for Ultimate Tensile Properties of Turf Reinforcement Mats
- B. Erosion Control Technology Council (ECTC) Guidelines
 - 1. Light Penetration

1.03 SUBMITTALS

- A. Certificate of Compliance for each proposed product indicating that it meets the requirements of this specification. This certificate shall be accompanied by a document stating the manufacturer's minimum average roll values (MARVs) for the product.
- B. Manufacturer quality control plan and product performance and physical property testing results as specified in Paragraph: Quality Assurance.

1.04 QUALITY ASSURANCE

- A. See Section 01010, paragraph 1.08.
- B. Manufacturer Qualifications
 - 1. Manufacturers required to furnish materials under this specification shall maintain recurrent material testing to ensure minimum quality standards are being met.
- C. Manufacturing Quality Control
 - 1. Physical property testing shall be performed at an indoor laboratory accredited to perform such tests required for the products of this Section, at a frequency not to exceed annually. The manufacturer upon request shall provide a certification of the recurrent testing requirement. The certification shall at a minimum identify the test facility, manufacturer, product ID, test ID, and test date to verify conformance with manufacturers published specifications.
 - 2. Manufacturers providing materials under this specification shall, upon request, submit a written description of the manufacturer's quality control program to verify conformance with this specification. The manufacturer's quality control program shall include a guaranteed remedy for nonconforming material supplied to project.
 - 3. Product performance testing shall be performed at an indoor laboratory accredited to perform such tests required for the products of this Section. Performance testing is required for all products provided under this specification. Products must be guaranteed to perform to the minimum performance standards under the specific conditions as stated in this specification. Manufacturer's performance certifications and testing quality assurance shall be provided upon request to verify conformance with this specification.

1.05 DELIVERY, STORAGE, AND HANDLING

- A. Labeling, shipment, and storage of products shall follow ASTM D 4873 or the manufacturer's written storage and handling procedures. Product labels shall clearly show the manufacturer or supplier name and product type name.
- B. Products shall be wrapped with a material that will protect the product from damage due to shipment, water, sunlight, and contaminants.
- C. During storage, the products shall be elevated off the ground and adequately covered to protect them from the following: site construction damage, precipitation, extended ultraviolet radiation including sunlight, chemicals that are strong acids or strong bases, flames including welding sparks, excess temperatures, and any other environmental conditions that may damage the physical property values of the products.

1.06 DEFINITIONS

- A. Minimum Average Roll Value (MARV): Property value calculated as two standard deviations below the mean value of all rolls tested. Statistically, it yields a 97.7 percent degree of confidence that any sample taken during quality assurance testing will exceed value reported.
- B. Erosion Control Blanket (ECB)
 - 1. A temporary degradable rolled erosion control product composed of processed natural or polymer fibers mechanically, structurally, or chemically bound together to form a continuous matrix to provide erosion control and facilitate vegetation establishment.
- C. Erosion Control Revegetation Mat (ECRM)
 - 1. A permanent non-degradable rolled erosion control product composed of UV stabilized, non-degradable, synthetic fibers, filaments, nettings, and/or wire mesh processed into low-profile three dimensional reinforcement matrices designed for permanent and critical hydraulic applications. ECRMs are installed after seeding.
- D. Turf Reinforcement Mat (TRM)
 - 1. A permanent non-degradable rolled erosion control product composed of UV stabilized, non-degradable, synthetic fibers, filaments, nettings, and/or wire mesh processed into three dimensional reinforcement matrices designed for permanent and critical hydraulic applications where design discharges exert velocities and shear stresses that exceed the limits of mature, natural vegetation. TRMs provide sufficient thickness, strength, and void space to permit soil filling and/or retention and the development of vegetation within the matrix. Unlike ECRMs, TRMs are installed first then filled with soil and seeded.
- E. Open Weave Textile (OWT)
 - 1. A temporary degradable rolled erosion control product composed of processed natural or polymer yarns woven into a matrix, used to provide erosion control and facilitate vegetation establishment.

PART 2 PRODUCTS

2.01 EROSION CONTROL BLANKET (ECB)

- A. The ECB shall be machine produced using 100% certified weed free agricultural straw and/or coconut (coir) fibers evenly distributed over the entire area of the blanket. The straw and/or coconut (coir) fibers shall be sewn into a medium weight natural fiber, degradable top net on 1.5-inch centers with cotton polyester or polypropylene thread. Natural fiber threads will not be allowed. The ECBs shall be at a minimum 60 square yards per roll.
- B. Light weight open weave jute netting or other OWT shall not be allowed under this specification.
- C. The ECB shall meet the minimum performance requirements of Table 1 below.

**Table 1
Erosion Control Blanket (ECB) Requirements**

Property	Test Method	Unit	Minimum Value	Material	Unit	Minimum Value
Tensile Strength MD	ASTM D 5035	(lbs/in)	25.3	Top Net	(lbs/1000 ft ²)	9.3
Tensile Strength TD	ASTM D 5035	(lbs/in)	28.3			
Thickness	ASTM D 5199	(Inches)	.35	Bottom Net	(lbs/1000 ft ²)	N/A
Mass Per Unit Area	ASTM D 5261	(lbs/square yard)	0.5			
Soil Loss ²	Rainfall Sim. ²	(lbs/hr.) ²	.55 (max)	Thread (B.L.) ³	(lbs/ft)	17.0
Germination Ratio ²	Rainfall Sim. ²	% of total pos.	67.5			
Biodegradability (FTC)	Measured	% of total wt.	97.4	Straw Fiber	Avg. Length (in)	3.0
Light Penetration	ECTC	% penetration	30 (max)			

1 As measured in accordance with applicable ASTM standard.

2 Minimum 5 in./hr.-Minimum duration .75 hrs. or 10 year storm event on 2:1 slope with Sandy Loam type soil.

3 Minimum Allowable Break Load.

2.02 EROSION CONTROL REVEGETATION MAT (ECRM)

- A. Shall meet the requirements for ECRM in Paragraph: Description.
- B. ECRM shall be used in channels and on slopes not exceeding 0.5:1 (H:V) where vegetation alone will not sustain expected flow conditions and/or provide sufficient long term erosion protection and where shear stress is less than or equal to 2.5 lbs./square foot.
- C. Shall meet the minimum requirements below in Table 2. For products containing degradable components, all property values shall be obtained on the non-degradable portion of the matting alone.

Table 2	
Erosion Control Revegetation Mats (ECRM) Requirements	
Short Term – Light Duty	
Duration	Less than 1 year
Max Permissible Shear Stress	ASTM D 6460. Varies by product – Typically 1.0 lbs/ft ² to 1.5 lbs ft ²
Slope Erosion Protection	ASTM D 6459. Soil loss not to exceed a Cover Management © Factor of 0.20 according to the Revised Universal Soil Loss Equation (RUSLE)
Minimum Acceptable Vegetation Density	Clay Soils – 80% Sandy Soils – 70%
Netting	Netting products should be bonded sufficiently to prevent separation of the net from the parent material for the life of the product.
Anchoring Device	Shall be completely biodegradable as determined by ASTM D 5338
Extended Term – Medium Duty	
Duration	Typically 2 to 3 years
Max Permissible Shear Stress	ASTM D 6460. Varies by product – Typically 2.0 lbs/ft ² to 2.5 lbs ft ²
Slope Erosion Protection	ASTM D 6459. Soil loss not to exceed a Cover Management © Factor of 0.20 according to the Revised Universal Soil Loss Equation (RUSLE)
Minimum Acceptable Vegetation Density	Clay Soils – 80% Sandy Soils – 70%
Netting	Netting products should be bonded sufficiently to prevent separation of the net from the parent material for the life of the product.
Fiber Longevity	ASTM D 1117 – Maximum water absorption rate of 300% by weight, maximum swell of 30%
Anchoring Device	Shall be completely biodegradable as determined by ASTM D 5338

2.03 TURF REINFORCEMENT MAT (TRM)

- A. Shall meet the requirements for TRM in Paragraph: Description.
- B. TRM shall be used in channels and on slopes not exceeding 0.5:1 (H:V) where vegetation alone will not sustain expected flow conditions and/or provide sufficient long term erosion protection and where shear stress is greater than 2.5 lbs./square foot, but less than 10 lbs./square foot..
- C. Shall meet the minimum requirements below in Table 3. For products containing degradable components, all property values shall be obtained on the non-degradable portion of the matting alone.

Table 3 Turf Reinforcement Mat (TRM) Requirements			
Shear Stress ^{3,4}	Minimum Tensile Strength ^{1,2}	Minimum Thickness (ASTM D 6525)	UV Stability (ASTM D 4355 @ 500 Hours)
≤ 6 lbs/ft ²	125 lbs/ft (1.82 kN/m)	0.25 inches (6.35 mm)	80%
6 lbs/ft ² < Stress ≤ 8 lbs/ft ²	150 lbs/ft (2.19 kN/m)	0.25 inches (6.35 mm)	80%
8 lbs/ft ² < Stress ≤ 10 lbs/ft ²	175 lbs/ft (2.55 kN/m)	0.25 inches (6.35 mm)	80%
<p>1 Minimum Average Roll Values, machine direction only for tensile strength determination using ASTM D 6818 (Supercedes Mod. ASTM D 5035 for RECPs).</p> <p>2 Field conditions with high loading and/or high survivability requirements may warrant the use of a TRM with a tensile strength of 44 kN/m (3,000 lb/ft) or greater..</p> <p>3 Shear stress that fully vegetated TRM can sustain without physical damage or excess erosion [>12.7 mm (0.5 in.) soil loss]. During a 30-minute flow event in large scale testing.</p> <p>4 Acceptable large-scale testing protocol may include ASTM D 6460 or other independent testing deemed acceptable by the Engineer.</p>			

2.04 OPEN WEAVE TEXTILE (OWT)

A. General.

- OWT shall be a woven or nonwoven fabric of polymeric filaments or yarns such as polypropylene, polyethylene, polyester, or polyamide formed into a stable network such that the filaments and yards retain their relative position to each other. The OWT shall be inert to commonly encountered chemicals and shall be free of any chemical treatment or coating that might significantly reduce porosity or permeability.
- OWT shall be uniform in texture, thickness, and appearance, and be free of defects, flaws or tears that would significantly alter its strength or filtering properties. All authorized repairs shall be completed to the satisfaction of the Engineer.
- OWT shall not be left exposed to the sun for a period in excess of 7 days without being covered by the appropriate protective soil or rock layer. The Engineer may require replacement of any OWT exposed to the sun for periods longer than 7 days or if the OWT is contaminated with foreign matter.

B. Physical Properties

- OWT shall conform to the requirements of Table 4 below.

Table 4 Open Weave Textile (OWT) Requirements		
Property	Test Method (ASTM)	Units
Grab Tensile Strength minimum, each principal direction	D4632 Pounds	200
Elongation minimum, each principal direction	D4632 Percent	15
Seam Breaking Strength minimum	D4632 Pounds	180
Apparent Opening Size (AOS) maximum opening size or range)	D4751 U.S. Std. sieve size	50
Permitivity minimum	D4491 falling head per sec.	0.3

PART 3 EXECUTION

3.01 OPEN WEAVE TEXTILE (OWT)

- A. OWT shall be placed under riprap or other stone protection, gabions, interlocking concrete blocks, and cable-tied concrete revetment mattresses.
- B. Place multiple OWT widths with the longest dimension parallel to the direction of water flow.
- C. Splice multiple OWT widths by mechanical seaming or by overlapping. Overlap shall be a minimum of 18 inches except that minimum overlap if filter is placed under water shall be 36 inches. Overlap joints in a shingle arrangement.
- D. Bury upgrade edges of OWT to prevent undermining.
- E. Anchor OWT to prevent movement during riprap or other revetment material placement.
- F. Do not operate equipment on OWT fabric.

3.02 ROLLED EROSION CONTROL PRODUCTS (RECPs)

- A. General
 1. Make the soil surface stable, firm, and free of rocks and other obstructions. Install RECPs according to the manufacturer's published installation recommendations or the following minimum guidelines. In areas to be mowed soon after installation, use ultra-short temporary RECPs that utilize or consist of rapidly degrading nettings having a maximum service life of 3 months or less.
 2. Install RECPs not requiring soil in-filling after application of seed, fertilizer, and other necessary soil amendments. For TRMs and other RECPs requiring soil in-filling, install the RECP, apply seed, and lightly brush or rake topsoil in the voids to fill the product thickness.
 3. Staples or stakes for securing RECPs to the soil must be at least 6-inches long. Longer anchors may be necessary in sandy, loose, and/or wet soils.
 4. Unroll the RECP parallel to the primary direction of flow and place it in direct contact with soil surface (avoid "tenting"). Do not stretch or allow material to bridge over surface inconsistencies. Overlap edges of adjacent RECPs by a minimum of 4-inches. Use a sufficient number of stakes or staples to prevent seam separation. Overlap roll ends of joining RECPs by a minimum of 6-inches in the direction of flow.
 5. Repair any damaged areas immediately by restoring soil to finished grade, re-applying soil amendments and seed, and replacing the RECP.
- B. Slope Installations. At the top of the slope, anchor the RECP by one of the following methods.
 1. Staples. Install the RECP a minimum of 3 feet over the shoulder of the slope onto flat final grade. Secure with a single row of staples or stakes on 1-foot centers.
 2. Anchor Slot. Construct a 6-inch x 6-inch anchor slot. Extend the upslope terminal end of the RECP 3 feet past the anchor slot. Use stakes or staples to fasten the product into the anchor slot on 1-foot centers. Backfill the slot and compact the soil. Apply seed and any necessary soil amendments to the compacted soil and cover with remaining 1-foot terminal end of the RECP. Secure terminal end with a single row of stakes or staples on 1-foot centers.
 3. Check Slot. Construct a stake or staple check slot along the top edge of the RECP by installing two rows of stakes or staples 4-inches apart on 4-inch centers. Driver all stake and staple heads flush with soil surface.

4. On the slope, securely fasten all RECPs to the soil by installing stakes or staples at a minimum rate of 1.3 per square yard.

C. Channel Installations

1. Construct an anchor slot at the beginning of the channel across its entire width according to Paragraph: Slope Installations. Follow the manufacturer installation guidelines in constructing additional anchor slots or check slots at intervals along the channel reach and at the terminal end of the channel, according Paragraph: Slope Installations.
2. Securely fasten all RECPs to the soil by installing stakes or staples at a minimum rate of 1.7 per square yard. Significantly higher anchor rates may be necessary in sandy, loose, and/or wet soils, and in severe applications.
3. Intermediate check slot. Construct a 6-inch trench check slot within channels at intervals no greater than 40 feet apart. Stake or staple the RECP along the bottom of the check slot at 1-foot centers.

END OF SECTION