January 30, 2014

REVISION OF SECTION 216

SOIL RETENTION COVERING

**NOTICE**

This is a standard special provision that revises or modifies CDOT’s *Standard Specifications for Road and Bridge Construction.*  It has gone through a formal review and approval process and has been issued by CDOT’s Project Development Branch with formal instructions for its use on CDOT construction projects. It is to be used as written without change. Do not use modified versions of this special provision on CDOT construction projects, and do not use this special provision on CDOT projects in a manner other than that specified in the instructions unless such use is first approved by CDOT’s Standards and Specifications Unit. The instructions for use on CDOT construction projects appear below.

Other agencies which use the *Standard Specifications for Road and Bridge Construction* to administer construction projects may use this special provision as appropriate and at their own risk.

**Instructions for use on CDOT construction projects:**

Use in projects having soil retention blanket or turf reinforcement mat.

Section 216 of the Standard Specifications is hereby deleted for this project and replaced with the following:

**DESCRIPTION**

**216.01** This work consists of furnishing, preparing, applying, placing, and securing soil retention blankets and turf reinforcement mats for erosion control on roadway slopes or channels as designated in the Contract.

# MATERIALS

**216.02** Soil retention covering shall be either a soil retention blanket or a turf reinforcement mat as specified in the Contract. It shall be one of the products listed on CDOT's Approved Products List and shall conform to the following:

1. *Soil Retention Blanket.*  Soil retention blanket shall be composed of degradable natural fibers mechanically bound together between two slowly degrading synthetic or natural fiber nettings to form a continuous matrix and shall conform to the requirements of Table 216-1 and 216-2. The blanket shall be of consistent thickness with the fiber evenly distributed over the entire area of the mat.

When biodegradable blanket is specified, the thread shall be 100 percent biodegradable; polypropylene thread is not allowed.

When photodegradable netting is specified the thread shall be polyester, biodegradable or photodegradable.

Blankets and nettings shall be non-toxic to vegetation and shall not inhibit germination of seed. The materials shall not be toxic or injurious to humans. Class 1 blanket shall be an extended term blanket with a typical 24 month functional longevity. Class 2 blanket shall be a long term blanket with a typical 36 month functional longevity. The class of blanket is defined by the physical and performance characteristics.

1. *Soil Retention Blanket (Straw-Coconut).* Soil Retention Blanket (Straw-Coconut) shall be a machine produced mat consisting of 70 percent agricultural straw and 30 percent coconut fiber. It shall be either biodegradable or photodegradable. When specified lightweight polypropylene netting shall be 1.5 pounds per 1000 square feet; heavyweight netting shall be 2.9 pounds per 1000 square feet. Blankets shall be sewn together on 1.50 inch to 2 inch centers.

Netting shall be as follows:

When biodegradable netting is specified, the top and bottom netting shall be 100 percent biodegradable organic jute fiber. Netting shall be constructed using a weave unattached at intersections which allows the strands of the net to move independently of each other.

When photodegradable netting is specified, the bottom side shall be lightweight polypropylene. The top side shall be heavyweight or lightweight polypropylene.

1. *Soil Retention Blanket* (*Excelsior).* Soil Retention Blanket (Excelsior) blanket shall consist of a machine produced mat of 100 percent curled wood excelsior , 80 percent of which shall be 6 inches or longer in fiber length. It shall be either biodegradable or photodegradable. When specified, lightweight polypropylene netting shall be fastened on both sides of the blanket and shall be 1.5 pounds per 1000 square feet. Blankets shall be sewn together at a maximum of 4 inch centers.

Netting shall be as follows:

When biodegradable netting is specified, the top and bottom netting shall be 100 percent biodegradable organic jute fiber. Netting shall be constructed using a weave unattached at intersections which allows the strands of the net to move independently of each other.

When photodegradable netting is specified, the bottom side shall be lightweight polypropylene. The top side shall be heavyweight or lightweight polypropylene.

1. *Soil Retention Blanket (Coconut).* Soil Retention Blanket (Coconut)shall be a machine produced mat consisting of 100 percent coconut fiber. It shall be either biodegradable or photodegradable.

Netting shall be as follows:

When biodegradable netting is specified, the top and bottom netting shall be 100 percent biodegradable organic jute fiber. Netting shall be constructed using a weave which is unattached at the intersections, and which allows the strands of the net to move independently of each other.

When photodegradable netting is specified, the bottom and top side shall be heavyweight polypropylene.

**Table 216-1**

**PHYSICAL REQUIREMENTS FOR SOIL RETENTION BLANKET –**

**PHOTODEGRADABLE OR BIODEGRADABLE BLANKETS**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Product**  **Class** | **Minimum Roll Width** | **Minimum**  **Thickness**  **ASTM D 6525** | **Acceptable**  **Matrix Fill**  **Material** | **Min. Mass per Unit Area**  **ASTM D 6475** | **Size of Net Opening** | |
| Photo-degradable | Bio-degradable |
| 1 | 6.5' | 0.25" | Straw/Coconut | 8 oz/sy | Minimum: 0.50"x0.50"  Maximum:  0.75"x0.75" | Minimum:  0.50"x0.50"  Maximum:  0.5"x1.0" |
| 1 | 6.5' | 0.25" | Excelsior | 8 oz/sy | Minimum:  0.50"x0.50"  Maximum:  1.0"x2.0" | NONE |
| 2 | 6.5' | 0.20" | Coconut Fibers | 8oz/sy | Minimum:  0.50" x0.5"  Maximum:  0.75"x0.75" | Minimum:  0.50"x0.50"  Maximum:  0.5"x1.0" |

**Table 216-2**

**PERFORMANCE REQUIREMENTS FOR SOIL RETENTION BLANKET –**

**PHOTODEGRADABLE OR BIODEGRADABLE BLANKETS**

|  |  |  |  |
| --- | --- | --- | --- |
| **Product Class** | **Slope Application**  **“C” Factor1**  **ASTM D 6459** | **Channel Application**  **Permissible Shear Stress2**  **(Un-vegetated) ASTM D 6460** | **Minimum Tensile Strength**  **ASTM D 6818** |
| 1 | < 0.10@3:1 | 2.00 lbs/sf | 100 lbs/ft |
| 2 | < 0.10@3:1 | 2.25 lbs/sf | 125 lbs/ft |
| Notes:   1. "C" Factor calculated as ratio of soil loss from soil retention blanket protected slope (tested at specified or greater gradient, h:v) to ratio of soil loss from unprotected (control) plot in large-scale testing. 2. Permissible shear stress is the minimum shear stress that a product must be able to sustain without physical damage or excess soil loss when it is installed on a bare soil channel. Failure is defined as ½ inch of soil loss during a 30 minute flow event in large scale testing. | | | |

Blankets shall be tested for physical properties and have published data from a pre-approved independent testing facility.

Large scale testing of Permissible Shear Stress and Slope Erosion Protection (“C” factor) shall be performed by a pre-approved independent testing facility.

A sample of the staples and a copy of the manufacturer's product data showing that the product meets the Contract requirements shall be submitted for approval at the environmental preconstruction conference. Installation of the blanket will not begin until approval has been received from the Engineer in writing.

1. *Turf Reinforcement Mat.* Turf reinforcement mat (TRM) shall be a rolled mat consisting of UV stabilized, corrosion resistant, non-degradable synthetic fibers, filaments, or nets processed into a permanent three-dimensional matrix of the thickness specified in Table 216-3 and 216-4. TRMs shall provide sufficient thickness, strength and void space to permit soil filling and retention, and the development of vegetation within the matrix. The class of TRM is defined by the physical and performance characteristics as specified in the following tables.

**Table 216-3**

**PHYSICAL REQUIREMENTS1 FOR TURF REINFORCEMENT MAT**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Product Class** | **Minimum**  **Roll Width** | **Minimum**  **Thickness**  **ASTM D 6525** | **Acceptable**  **Matrix Fill**  **Material2** | **Size of Net Opening2** |
| 1 | 6.5' | 0.25" | Excelsior, Straw/Coconut, Coconut, or Polymer fibers | Minimum:  0.50"x0.50"  Maximum:  0.75"x0.75" |
| 2 | 6.5' | 0.25" | 100% UV Stabilized Synthetic or Coconut Fibers | 0.50"x 0.50" |
| 3 | 6.5' | 0.25" | 100% UV Stabilized Synthetic Fibers | 0.50"x 0.50" |
| **Notes:**   1. For TRMs containing degradable components, all property values shall be obtained on the non-degradable portion of the matting alone. 2. For TRMs with nets and fill material. Netted TRMs shall be sewn together on 1.5 inch to 2 inch centers. | | | | |

**Table 216-4**

**PERFORMANCE REQUIREMENTS FOR TURF REINFORCEMENT MAT**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Product Class** | **Tensile Strength**  **MD**  **ASTM D 6818** | **UV Stability @ 500 Hours ASTM D 4355** | **Maximum Permissible Shear Stress1 (Vegetated)**  **ASTM D 6460** | **Maximun Permissible Shear**  **Stress1**  **(Unvegetated)**  **ASTM D 6460** |
|  |  |  |  |  |
| 1 | 125 lbs/ft | 80% | 6.0 lbs/sf | 4.0 lbs/sf |
| 2 | 150 lbs/ft | 80% | 8.0 lbs/sf | 6.0 lbs/sf |
| 3 | 175 lbs/ft | 80% | 10.0 lbs/sf | 8.0 lbs/sf |
| **Notes:**   1. Permissible shear stress is the minimum shear stress that a product must be able to sustain when placed on a fully vegetated channel or unvegetated without physical damage or excess soil loss. Failure is defined as ½ inch of soil loss during a 30 minute flow event in large scale testing. | | | |  |

TRMs shall be tested for physical properties and have published data from a pre-approved independent testing facility.

Large scale testing of Permissible Shear Stress will be performed by a pre-approved independent testing facility.

A sample of the staples and a copy of the manufacturer's product data showing that the product meets the Contract requirements shall be submitted for approval at the environmental preconstruction conference.

1. *Staples.* Staples shall be made of ductile steel wire, 0.165 inches in diameter, 8 inches long and have a 1 inch crown. “T” shaped staples will not be permitted.

**CONSTRUCTION REQUIREMENTS**

**216.03** The Contractor shall install soil retention coverings in accordance with Standard Plan M-208-1 and the following procedure:

1. Prepare soil in accordance with subsection 212.06 (a). .
2. Apply topsoil or soil conditioning as directed in the Contract to prepare seed bed.
3. Place seed in accordance with the Contract.
4. Unroll the covering parallel to the primary direction of flow.
5. Ensure that the covering maintains direct contact with the soil surface over the entirety of the installation area.
6. Do not stretch the material or allow it to bridge over surface inconsistencies.
7. Staple the covering to the soil such that each staple is flush with the underlying soil.
8. Ensure that staples are installed full depth to resist pull out. No bent over staples will be allowed. Install anchor trenches, seams, and terminal ends as shown on the plans.

The Contractor shall install TRMs using the following procedure:

1. Place 3 inches of topsoil or soil amended with soil conditioning.
2. Apply half of the specified seed at the broadcast rate and rake into soil.
3. Install TRM
4. Place 1 inch of topsoil or soil amended with soil conditioning into the matrix to fill the product thickness.
5. Apply the remaining half of the specified seed at the broadcast rate and rake into soil.
6. Install soil retention blanket (Class 1) over the seeded area and TRM.

When applicable, the covering shall be unrolled with the heavyweight polypropylene netting on top and the lightweight polypropylene netting shall be in contact with the soil.

**216.04 Slope Application**. Soil retention coverings shall be installed on slopes as follows:

The upslope end shall be buried in a trench 3 feet beyond the crest of the slope. When specified by the manufacturer, trench depth shall be increased up to 12 inches in depth. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil, compacted by foot tamping, and seeded. Fabric shall be brought back over trench and stapled at 1 foot on center.

There shall be an overlap wherever one roll of fabric ends and another begins with the uphill covering placed on top of the downhill covering. Staples shall be installed in the overlap.

There shall be an overlap wherever two widths of covering are applied side by side. Staples shall be installed in the overlap.

Staple checks shall be applied on the slope every 35 feet. Each staple check shall consist of two rows of staggered staples.

The down slope end shall be buried in a trench 3 feet beyond the toe of slope. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil, compacted by foot tamping, and seeded. Fabric shall be brought back over trench and stapled. If a slope runs into State waters or cannot be extended 3 feet beyond the toe of slope, the end of covering shall be secured using a staple check as described above.

Coverings shall be securely fastened to the soil by installing staples at the minimum rate shown on the plans. Staple spacing shall be reduced where required due to soil type or steepness of slope.

**216.05 Channel Application**. Soil retention coverings shall be installed as follows on a channel application:

Coverings shall be anchored at the beginning and end of the channel across its entire width by burying the end in a trench. When specified by the manufacturer, trench depth shall be increased up to 12 inches in depth. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil and compacted by foot tamping, and seeded. Fabric shall be brought back over the trench and stapled.

Covering shall be unrolled in the direction of flow and placed in the bottom of the channel first. Seams shall not be placed down the center of the channel bottom or in areas of concentrated flows when placing rolls side by side.

There shall be an overlap wherever one roll of covering ends and another begins with the upstream covering placed on top of the downstream covering. Two rows of staggered staples shall be placed.

There shall be an overlap wherever two widths of covering are applied side by side. Staples shall be placed in the overlap.

The covering shall be anchored every 30 feet with a check slot. Check slots shall extend the entire width of the channel. The covering shall be buried in a trench. Before backfilling begins, staples shall be placed across the width of the trench. The trench shall then be backfilled to grade with soil amended with soil conditioning or topsoil, compacted by foot tamping, and seeded. Fabric shall be brought back over trench and continued down the channel.

Coverings shall be securely fastened to the soil by installing staples at the minimum rate shown on the plans. Staple spacing shall be reduced where needed due to soil type or high flows.

**216.06 Maintenance***.* The Contractor shall maintain the soil retention coverings until all work on the Contract has been completed and accepted. Maintenance shall consist of the repair of areas where damage is due to the Contractor’s operations. Maintenance shall be performed at the Contractor’s expense. Repair of those areas damaged by causes not attributable to the Contractor’s operations shall be repaired by the Contractor and will be paid for at the contract unit price. Areas shall be repaired to reestablish the condition and grade of the soil and seeding prior to application of the covering.

# METHOD OF MEASUREMENT

**216.07** Soil retention coverings, including staples, complete in place and accepted, will be measured by the square yard of finished surface. Allowance will not be made for overlap.

# BASIS OF PAYMENT

**216.08** The accepted quantities of soil retention coverings will be paid for at the contract unit price per square yard.

Payment will be made under:

## Pay Item Pay Unit

Soil Retention Blanket (\_\_\_\_) (Photodegradable Class \_) Square Yard

Soil Retention Blanket (\_\_\_\_) (Biodegradable Class \_) Square Yard

Turf Reinforcement Mat (Class \_) Square Yard

Preparation of seedbed, fertilizing, and seeding will be measured and paid for in accordance with Section 212.

TRM and its associated blanket will be measured and paid for separately. Placing and preparation of seedbed, fertilizing, and seeding of soil under the TRM layer will be measured and paid for in accordance with Section 212. Topsoil or amended soil and seed placed on the TRM will be measured and paid for in accordance with Section 207 and 212.