

BONDED FIBER MATRIX (BFM)

SCDOT Designation: SC-M-815-5 (11/08)

1.0 Bonded Fiber Matrix (BFM)

This supplemental specification replaces sections 815.1.1.5, 815.2.10, 815.4.15, 815.5, and 815.6 for Bonded Fiber Matrix (BFM) in the *South Carolina Department of Transportation Standard Specifications for Highway Construction*, 2007 Edition.

1.1 Description

Use Bonded Fiber Matrix (BFM) as an allowable mulch for erosion control and vegetation establishment as outlined in *Supplemental Specification for Seeding SCDOT Designation SC-M-810*. Do not use BFM as a channel liner or for areas receiving concentrated flow. Install BFM in the following situations:

- For enhancement of temporary cover operations to reduce erosion and expedite seed germination.
- When high performance mulch is required for permanent cover.
- When seeding application will take place on highly erodible soil or slopes.
- On slopes up to 2H:1V, for permanent cover applications on slopes less than 50 feet.
- On slopes up to 1H:1V for temporary cover by mulch and temporary cover by seeding applications on slopes less than 35 feet.
- When the minimum required functional longevity of soil protection is 6 months.
- When the soil is dry and rain is not expected within 48 hours after application.
- When there is a high degree of certainty that heavy rains will not follow application.

Do not use a BFM as Type A Temporary Erosion Control Blankets, channel liners or in areas receiving concentrated flow. Do not use BFM as a Fiber Reinforced Matrix (FRM).

1.2 Materials

Provide a Bonded Fiber Matrix (BFM) composed of a hydraulically applied matrix composed of organic defibrated fibers and cross-linked insoluble hydro-colloidal tackifiers that upon drying becomes insoluble and non-dispersible to eliminate direct raindrop impact on soil. Do not use materials composed of paper, cellulose fiber, or a mixture of paper, cellulose, and other materials. Provide a BFM composed of:

- Long strand, non-toxic fibers.
- Thermally processed fibers heated to an appropriate temperature for sterilization purposes.
- Water insoluble cross-linked hydro-colloidal tackifier.

Use a BFM that does not form a water-insensitive crust that can inhibit plant growth. Provide a BFM that completely photo-degrades or biodegrades. Do not use materials listed for use as a Hydraulic Mulch (HM) or Stabilized Mulch Matrix (SMM). Seed, lime, and fertilizer may be added to the BFM mixture according to the current requirements of **Section 810, Seeding Specifications**.

Provide a BFM meeting the following requirements:

- Passes a free liquid quality control test when mixed as a liquid slurry, (liquids separate from fibrous solids no greater than 1 inch per minute as measured on a standard test board).
- Does not dissolve or disperse upon re-wetting.
- Has no holes greater than 1 mm in size.
- Has no gaps between the BFM and the soil.
- Has no germination or growth inhibiting factors and will not form a water-resistant crust.

Furnish BFM components pre-packaged by the manufacturer to assure material performance and compliance with the minimum physical requirements of Table 1 when applied at a rate of 3,500 pounds per acre. Under no circumstances will field mixing of additives or components be accepted.

Table 1: Minimum BFM Performance and Physical Requirements

BFM Property		Required Value
Thermally Processed Fiber by Weight		80% ± 10%
Cross-linked Hydro-Colloidal Tackifiers		10% ± 2%
Moisture Content		10% ± 3%
Organic Matter		90% minimum
Color		Colored to contrast application area, shall not stain concrete or painted surfaces.
BFM Property	Test Method	Required Value
Physical		
Mass Per Unit Area	ASTM D6566*	10.0 oz/yd ² minimum
Thickness	ASTM D6525*	0.10 inch minimum
Ground Cover	ASTM D6567*	97% minimum
Water Holding Capacity	ASTM D7367	1000% minimum
Endurance		
Functional Longevity	Observed	Minimum of 6 months
Performance		
Cover Factor	SCDOT Approved Large Scale Testing	0.05 maximum
% Effectiveness	SCDOT Approved Large Scale Testing	95% minimum
Cure time	Observed	24 - 48 hours
Vegetation Establishment	ASTM D7322*	400% minimum

* ASTM test methods developed for Rolled Erosion Control Products (RECPs) that have been modified to accommodate Hydraulic Erosion Control Products (HECPs).

Provide BFM from a manufacturer listed on the most recent edition of the *SCDOT Qualified Product List 65* and provide documentation of testing at an approved independent laboratory demonstrating performance based on reduced water runoff, reduced soil loss, and enhanced plant germination.

1.2.1 Quality Assurance

Before installation of BFM, provide the following information from the manufacturer:

- Written quality control program conforming to the requirements of subsection 1.2.2 *Quality Control*.
- Documentation of field and/or laboratory testing that quantifies the performance of the product conforming to the requirements of subsection 1.2.2 *Quality Control*.

Ensure that each package of BFM bears complete identification including, but not limited to, the following:

- Manufacturer's name and location,
- Manufacturer's telephone number and fax number,
- Manufacturer's e-mail address and web address,
- BFM name, model, and/or serial number, and
- BFM physical composition.

Ensure the BFM is listed on the most recent edition of *SCDOT Qualified Product List 65* prior to being accepted for use. Prior to inclusion on *SCDOT Qualified Products List 65*, the BFM must meet the physical and performance criteria outlined in this specification.

1.2.2 Quality Control

Before installation of BFM, provide the following information from the manufacturer:

- Written description of the manufacturer’s quality control program of field and/or laboratory testing that quantifies the performance of the product. Performance testing must take place at a laboratory accredited to perform tests required for the product tested.
- Instructions on the proper installation and maintenance of the BFM.
- Certification of the testing requirements upon request.

Provide verification of conformance with manufacturer’s published specifications (i.e. the certification) which at a minimum identify the following:

- Independent qualified test facility name and location,
- Manufacturer,
- Product ID,
- Test ID, and
- Test date.

1.3 Construction Requirements

1.3.1 Installation

Use BFM with components pre-packaged by the manufacturer to assure material performance. Do not field mix materials, additives, or components.

Examine substrates and conditions before applying materials. Do not proceed with installation until unsatisfactory conditions are corrected. Apply BFM to geotechnically stable slopes that are constructed to divert runoff water away from the face of the slope, eliminating damage to the slope face caused by the surface flow from above the slope.

Use personnel or subcontractors certified and trained by the manufacturer in the proper procedures for mixing and application of BFM. Strictly comply with the manufacturer’s mixing recommendations and installation instructions. Use approved hydraulic seeding/mulching machines with appropriate nozzles for BFM applications. Apply BFM from opposing directions to the soil surface in successive layers, reducing the “shadow effect” to achieve maximum coverage of all exposed soil. Do not apply the BFM immediately before, during, or after rainfall. Allow BFM a minimum of 24 hours to dry after installation. Install BFM materials at the general application rates of Table 2.

Table 2: BFM Installation Requirements

Condition	Max Continuous Slope Length (ft)	Temporary Cover by Mulch (no seed) Application Rate (lbs/acre)	Temporary Cover by Seeding Application Rate (lbs/acre)	Permanent Cover Application Rate (lbs/acre)
4:1 Slope	70	2,500	1,500	2,500
3:1 Slope	60	3,000	1,800	3,000
2:1 Slope	50	3,500	2,000	3,500
1:1 Slope	35	4,000	2,500	Not Applicable

1.3.2 Delivery Storage and Handling

Use BFM with components pre-packaged by the manufacturer to assure material performance. Have materials and products delivered in UV and weather resistant factory labeled packages. Store and handle BFM in strict compliance with the manufacturer's instructions and recommendations. Protect BFM from damage from weather, excessive temperatures, and construction operations. Clean all spills promptly.

1.3.3 Inspection and Maintenance

Prepare a BFM maintenance plan that includes the following:

- Reapplication of BFM as directed by RCE to disturbed areas that require continued erosion control.
- Maintenance of equipment to provide uniform application rates.
- Rinsing all BFM mixing and application equipment thoroughly with water to avoid formation of residues and appropriate discharge of rinse water.

Degradation of BFM can be expected to occur as a result of mechanical degradation, chemical degradation, biological hydrolysis, sunlight, salt, and temperature. Where necessary, reapply BFM in accordance with the manufacturer's instructions. Reapplication is not required unless BFM treated soils are disturbed or turbidity or water quality shows the need for an additional application. If BFM treated soils are left undisturbed, the necessity of reapplication will be determined by the RCE. The Department will not pay for the reapplication of BFM within 6 months of the initial application unless the reapplication is approved by the RCE.

1.3.4 Acceptance

Obtain RCE acceptance and approval of BFM installations. When requested by the RCE, ensure that a manufacturer's representative is on-site to oversee and approve the initial BFM installation. Obtain a letter from the manufacturer approving the installation when requested by the RCE.

1.4 Measurement

The quantity for the pay item Bonded Fiber Matrix (BFM) is the surface area covered by the BFM applied at the recommended rate and is measured by the one one-acre (acre) unit of BFM in-place, complete and accepted. The installation of BFM may require written acceptance by the manufacturer's representative before acceptance for payment.

1.5 Payment

Payment for Bonded Fiber Matrix (BFM) is full compensation for installing BFM as specified or directed by the RCE and includes furnishing, applying, and maintaining the BFM including testing and documentation of Quality Control and Quality Assurance programs and all other materials, labor, equipment, tools, supplies, transportation, and incidentals necessary to fulfill the requirements of the pay item in accordance with the Plans, the Specifications, and other terms of the Contract.

Table 3: Bid Item Number

Bid Item Number	Description	Units
8151010	Bonded Fiber Matrix (BFM)	acre