

SECTION 03395

Geosynthetic Concrete Composite Mat CC5 Slope and Channel Usage

GENERAL

1.01 SUMMARY

- A. This section specifies a Geosynthetic Concrete Composite Mat (GCCM) that consists of a flexible, three-dimensional fiber matrix impregnated with cement that hardens when hydrated to form a durable concrete layer. The base fabric shall be evenly distributed throughout the concrete layer to reinforce the concrete, preventing crack propagation and providing a safe plastic failure mode. The GCCM shall have a PVC backing on one surface of the geocomposite to ensure the material from edge to edge is water resistant allowing for water resistant performance when needed with the proper joint details. The GCCM shall not be simply made of cells of concrete between two containment layers void of any internal fiber reinforcement and the concrete shall be continuous so that it acts monolithically. In addition, the base fabric shall resist swelling in the thickness direction sufficiently to prevent over-hydration of the cement during wetting or immersion.
- B. When installed and hydrated in the field, the GCCM provides a strong, durable protection layer. The GCCM has a low alkaline reserve and a low wash rate for a low ecological impact. The cement is specially formulated to provide greater resistance to chemical attack and to provide greater abrasion resistance than commonly used cements. It has good resistance to attack by UV light. The product has an initial set as low as 80 minutes and final set at high as 270 minutes at room temperature. The GCCM will achieve about 70% to 80% of its strength within 24 hours of hydration. GCCM can be hydrated using either fresh or seawater.

1.02 SUBMITTALS

- A. Product Data: Submit manufacturer's product data and installation instructions. Include required substrate preparation and a list of fastening devices to be used.
- B. Certifications: Manufacturer shall submit a letter of certification that the product meets or exceeds all technical and packaging requirements.

1.03 DELIVERY, STORAGE AND HANDLING

- A. Deliver materials and products in a sealed factory labeled package to prevent moisture from the air or other sources from reaching the GCCM. Store and handle in strict compliance with manufacturer's instructions and recommendations. Protect from damage, weather, excessive temperatures and construction operations.

PRODUCTS

2.01 ACCEPTABLE MANUFACTURER and PRODUCT

- A. Milliken Infrastructure Solutions, LLC
920 Milliken Road, M-153
Spartanburg, SC, 29303
855-655-6750 (Fax 864-503-2756)
www.infrastructure.milliken.com

2.02 MATERIALS

A. The GCCM shall be **Concrete Cloth™ – CC5** and conform to the following properties under laboratory conditions.

Property	Test Method	Indicative Properties (English)
Physical Thickness (uncured) Thickness (cured) Mass/unit area (uncured) Mass/unit area (cured)	ASTM D5199 ASTM D5199 ASTM D5261 and D5993 ASTM D5261 and D5993	0.20 inches 0.21 inches 1.4 psf 1.9 psf
Performance Compressive Strength Ultimate Strip Tensile Strength (MD) (cured) Ultimate Strip Tensile Strength (MD) (uncured) 3 Point Bending Strength	ASTM C109 (3-Day) ASTM D5035 ASTM D5035 ASTM C1185	4000 psi 40 lb/in 60 lb/in 475 psi

2.03 COMPOSITION

All components shall be pre-packaged by the Manufacturer to assure material performance properties. The GCCM shall be a polyester fiber matrix, which is cement impregnated and PVC backed, manufactured in rolls that conforms to the shape of its substrate and hardens when watered.

A. Components:

1. Fabric – polyester
2. Cement – specially formulated
3. PVC Backing

2.04 PACKAGING

A. Roll size: Batch Roll: 3.625 ft. by 30 feet (108.9 sq.ft./roll) or Bulk Roll: 3.625 ft. by 600 feet (2,175 sq.ft./roll)
 Weight: Batch Roll: 156 lbs. per roll or Bulk Roll: 3,100 lbs

2.05 ACCESSORIES (when required)

A. Anchoring Devices: The GCCM shall be secured in place using heavy-duty metal staples or spikes. 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 GCCM to the ground, then longer staple devices should be used such as 8-12 inch long staples or pins.

- B. Stakes shall be 12inches minimum, with 2 inch washers
- C. Fastening Screws: Stainless Steel #10 or #12 Hex head self-tapping coarse thread, ½ to 1 inch in length (depending on subsurface conditions) used for securing all overlaps together. See drawings for placement and frequency.
- D. Adhesive Caulk (if required, see drawings): Loctite PL Premium Polyurethane, Sikaflex 1A or other adhesive that has been demonstrated in laboratory tests to adhere to both sides of the Concrete Cloth. Strictly comply with manufacturer's installation instructions and recommendations. See drawing for placement.
- E. Earth Percussion Anchors (if required, see drawings): Gripple Inc., Platipus or equal. Strictly comply with manufacturer's installation instruction and recommendations to determine load capacity. See Drawing for placement

EXECUTION

3.01 SUBSTRATE PREPARATION

- A. Examine substrates and conditions where materials will be applied. Ensure surface is relatively flat to achieve optimum contact of the GCCM with soil surface unless it is the desire of the designer to create an energy dissipation structure with considerable roughness. Erosion features such as rills, gullies, etc. must be graded out of the surface before GCCM deployment. Apply the GCCM to geotechnically stable slope(s) or channel(s), otherwise, compact the surface (as required by the Engineering plans/specifications) before deploying GCCM. Make sure the GCCM makes direct contact with the surface to minimize soil bridging or potential soil migration under the GCCM. Do not proceed with installation until satisfactory conditions are established. Rocks or foreign objectives larger than 1 inch in diameter and any other material which could damage the GCCM or not allow the GCCM to be directly in contact with the surface shall be removed from the surface. Each day during placement of GCCM, the Subcontractor and Construction Manager shall inspect the surface on which GCCM is to be placed and certify in writing that the surface is acceptable. Repairs to the subgrade shall be performed at no additional cost to the Owner. During placing when adhesive seaming of the overlaps are required, the subgrade shall be kept free of all standing water to allow the adhesive to cure per manufacturer's requirements unless the adhesive manufacturer lists application of the adhesive underwater as a recommended use.
- B. Depending upon project sequencing and intended application, prepare subgrade in compliance with other specifications
- C. Cut trenches for initial anchor trenches, termination trenches and longitudinal anchor trenches (min 6 inches deep) as shown on the drawings.
- D. Where appropriate or required, cut intermediate check slots at 30-40 ft. apart, perpendicular to channel flow direction (min. 3 inches wide and min. 6 inches in depth) depending on channel alignment. This is an acceptable alternative if approved by Engineer prior to installation

3.02 INSTALLATION

- A. Strictly comply with manufacturer's installation instructions/recommendations and drawings.
- B. Each panel of the GCCM shall be rolled out and installed in accordance with the approved shop drawings prepared by the Subcontractor or as depicted on the drawings. The layout shall be designed to keep field seams of the concrete cloth to a minimum and consistent with proper methods of manufacturer's installation requirements. The GCCM shall be free of tensile stresses, folds, and wrinkles.
- C. GCCM rolls shall be placed using proper spreader and rolling bars so that the GCCM would not be stretched during deployment.
- D. The Subcontractor shall inspect each panel, after placement and prior to seaming, for damage and/or defects. Defective or damaged panels shall be replaced or repaired.

- E. The Subcontractor shall avoid dragging the GCCM sheets on rough soil subbase.
- F. Personnel working on the GCCM shall not wear damaging shoes or involve themselves in any activity that may damage the GCCM.
- G. Vehicular traffic across the GCCM shall not be allowed, except as specified herein. When the subgrade has been prepared and is stiff enough to carry vehicle traffic or a designed base is constructed to carry the vehicle traffic, vehicle traffic will be allowed. Otherwise vehicle traffic over the GCCM may very well deform into ruts that form in the subgrade.
- H. All damaged areas and destructive sample locations shall be recorded and located on the as-built drawings.
- I. The GCCM shall be kept free of debris, unnecessary tools and materials. In general, the GCCM area shall remain neat in appearance.
- J. Should it be necessary to place equipment required to perform the installation on top of the GCCM, a scrap piece of the GCCM shall be placed under the equipment and between the equipment and the GCCM being installed in order to protect from possible damage.
- K. No equipment shall be allowed to remain on top of the installed GCCM overnight. All equipment must be removed and stored away from the installed GCCM.
- L. Care shall be taken during installation to avoid damage occurring to the GCCM as a result of the installation process. Should the GCCM be damaged during installation, a GCCM patch shall be placed over the damaged area extending a minimum of 6 inches in all directions beyond the damaged area and attach the GCCM in place according to the manufacturer's instructions.
- M. Remove the protective plastic cover of each GCCM roll only when ready to deploy and install to prevent undue exposure to humidity, precipitation or other construction activities that would cause the GCCM to start to hydrate prior to completing the installation of the roll.
- N. Install the approved anchoring devices if required (will depend on application, soils and terrain) at a minimum frequency of 0.25 pins/staples per square yard. Additional anchoring devices may be required depending on site conditions or alignment of the slope or channel. See drawings for required anchor systems and spacing.
- O. When overlapping successive GCCM rolls or edge rolls, the rolls shall be overlapped upstream over downstream and/or upslope over downslope to allow for shingling and to prevent water from striking exposed edges in the direction of water flow.
- P. **For channel applications**, begin at the downstream end of the channel. Inspect trenches for position accuracy and depth and re-dig to required dimensions. If trenches have not yet been constructed, dig termination anchor trench, check slot trenches and longitudinal anchor trenches as illustrated in installation guidelines or as directed on the plans. Unroll and cut the GCCM to the desired length. Position and deploy the GCCM over the termination trench, see drawings for overlap directions – PVC side should always be facing down). Secure the GCCM within the termination trench and longitudinal trench with the appropriate anchor device when required. See drawing for placement and frequency.
- Q. Position the next panel with a 4 inch overlap from the previous panel installation. Continue deploying the GCCM upstream to the next check slot. Overlap a minimum of 4 inches the ends of rolls with the next roll(s) being deployed, or position in bottom of check slot and anchor. If significant water has accumulated within the anchor trench, remove excess water as directed by engineer or owner. Install anchoring devices and fasten screws as shown on drawings. Apply Mechanical Channel, Adhesive Caulk, fasten screws or Adhesive Tape (if required) concurrently during the overlap process of deploying the next GCCM over the previous GCCM installation panel. Always backfill intermediate check slots prior to deploying the next GCCM panel over the backfill check slot. Only install what can be fully installed and hydrated (including anchor devices) before the end of construction day to minimize any adverse effect on the installation and/or performance capabilities of the product.

R. **For slope applications**, construct top anchor trench 1-3 ft beyond crest of slope, or as illustrated in drawings or shown in manufacturers recommended installation guidelines. Position GCCM roll at crest of slope with sufficient material to line the anchor trench as illustrated in the drawings. Position adjacent rolls to facilitate 4 inch overlaps. Anchor GCCM in trench with appropriate pins/staples at the required intervals as shown on the drawings. The preferred method of deployment is to roll the GCCM down slope and stand on the uphill side of the roll and install the anchoring devices as it rolls out down the slope, minimizing foot traffic until GCCM is secured with anchor devices and fastening screws at the overlaps. Always allow the mat to drape over the soil, never pulling it taut, to ensure contact with the surface. Place additional pins into any apparent depressions to maintain contact with the soil. During the anchor trench backfill compact the soil alongside the GCCM and spray the GCCM within the anchor trenches with water to start the hydration process. Do not backfill soils into trench if significant water has accumulated within the anchor trench. Remove excess water as directed by engineer or owner. Apply Mechanical Channel/Adhesive Caulk or Adhesive Tape (if required) concurrently during the overlap process of deploying the next GCCM over the previous GCCM installation panel. Only install what can be fully installed and hydrated (including anchor devices) before the end of construction day.

3.03 DEFECTS AND REPAIRS

Repair or replace torn or damaged GCCM. Perform repairs in accordance with manufacturer's requirements. Remove and replace GCCM rolls which cannot be repaired. Repairs shall be performed at no additional cost to the Owner.

3.04 VISUAL INSPECTION AND EVALUATION

The GCCM, seams, and non-seam areas shall be visually inspected by the Subcontractor and Construction Manager for defects, holes, or damage due to weather conditions or construction activities. A daily inspection report will note the area of inspection, time, date and who inspected the area, when the GCCM was installed and when it was fully hydrated (weather: temperature and precipitation events). At the Construction Manager's discretion, the surface of the GCCM shall be brushed, blown, or cleared by other methods by the Contractor if the amount of dust, mud, or foreign material inhibits inspection or functioning of the GCCM. Refer to the MSDS for personal protective equipment recommendations when blowing dust off the surface of the GCCM. Inspection shall be completed prior to and after hydration.

3.05 Hydrate the installed GCCM either by mist or spray.

Hydration shall be completed in accordance with the manufacturer's requirements. Spray the fiber surface multiple times until the GCCM is fully saturated. The wet concrete cloth will first darken and then become lighter as it absorbs the water. Depending on the size and duration of the installation, you might want to hydrate in sections and not wait until the entire area is completed. Do not spray high pressure water directly onto the GCCM as this may wash a channel in the material. The GCCM can be hydrated using fresh water or salt water and will hydrate and set underwater. There is a working time of 1-2 hours after starting the hydration activity. Working time will be reduced in hot climates. If the GCCM is not fully saturated, setting may be delayed and strength reduced. If found to be under hydrated, re-wet immediately. Minimum ratio of water to CC is 1:2 by weight

To determine whether the GCCM has been sufficiently hydrated simply press your thumb into the GCCM and release. If water is present in the depression in the GCCM, it has been sufficiently hydrated. If no water is observed then more water must be applied. The GCCM cannot be over hydrated and excess water is always recommended. Minimum water volume for the GCCM is 0.2 gals/sq.ft. Repeat hydration of the concrete cloth after 1 hour from the initial hydration if needed. In hot/dry conditions, hydrate each hour for the first five hours. For CC5, respray once more after 1 hour.

If the temperature is expected to fall below 32 degrees Fahrenheit within 8 hours following hydration, hydration shall not be allowed unless directed by Engineer. The Engineer must design a system to prevent water from freezing before it reacts with the cement and hardens. A combination of accelerators, plastic covers, heat blankets, warm water, and or heaters may be considered. Contact the manufacturer for advice in designing the proper cold weather protection scheme. It is also not recommended to install on frozen ground as the ground may move significantly when it thaws, creating voids underneath the set GCCM.

In some extremely sensitive ecological areas and/or if regulation governing the project require, it may be necessary to collect the excess hydration water and dispose of this water by some alternative method, rather than releasing the water at the project site.

At the owner's request, the contractor will provide an installation date two weeks prior to installation so that a manufacturer's representative can be on the site during the initial installation of the GCCM to provide guidance and technical assistance.

3.06 PROTECTION

- A. Properly dispose of all packaging material and core tube per project requirements.

4.0 MEASUREMENT AND PAYMENT

- A. The GCCM shall be measured and paid for by the square foot following all installation instructions within the specifications, drawings and manufacturer recommendations. No allowances shall be made for overlapping, splices, anchor trenches or material cut off or wasted. Payment for GCCM shall include furnishing the material, labor and equipment required to furnish, place and anchor the GCCM, and any hand work necessary to establish final grades prior to installing the GCCM, cut materials, make connections at overlaps and bury material in any anchor trench called for in the plans.

Pay Item	Pay Unit
Geosynthetic Concrete Composite Mat (GCCM)	Square Foot