



Concrete Cloth™

Geosynthetic Cementitious
Composite Mat (GCCM)

INSTALLATION GUIDE

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Milliken™

Milliken Infrastructure
Solutions, LLC

Overview

This document provides guidance for the installation of Milliken's Concrete Cloth material under field conditions. Final details for any installation of Concrete Cloth products is the responsibility of the end user.

The proper installation of Concrete Cloth GCCM is essential to achieving optimal performance and durability. The guidelines detailed in this document are intended to aid in understanding the preferred methods for preparing the project for installation, and for the installation of Concrete Cloth material in different applications. Individual projects will vary, therefore it is important to use this guide in conjunction with project specific details and procedures.

It is the responsibility of the project contractors to ensure safe work practices are followed in the use of Concrete Cloth materials and all installation equipment. The installation contractor is expected to comply with all regulatory codes for the work site including, but not limited to, OSHA (Occupational Health and Safety Administration) and use all required PPE (Personal Protective Equipment).

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Inspection and Offloading

Concrete Cloth products will be delivered to the job site on pallets. Smaller rolls, referred to as batch rolls, may be delivered stacked as multiple rolls on a pallet. Larger rolls, referred to as bulk rolls, will be delivered one (1) roll to a pallet.

Concrete Cloth rolls come individually wrapped in plastic. It is important to check the wrapping when Concrete Cloth rolls arrive to the jobsite. Unopened Concrete Cloth rolls can be stored in a dry location, off the ground, and away from moisture for up to one year. Any damage to the packaging should be repaired prior to storage using plastic wrap and tape to protect the Concrete Cloth material from premature hydration.



Batch Roll Offloading

Batch rolls come individually wrapped in plastic and are of a weight such that the rolls can be unloaded and moved by two individuals.

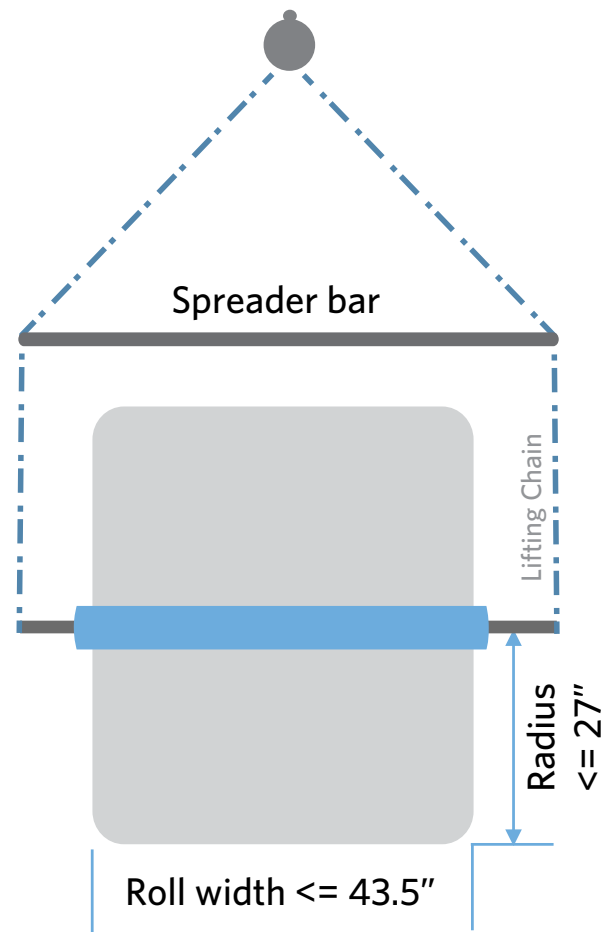
Bulk Roll Offloading

Bulk rolls are of a weight that lifting equipment will be required for offloading. Fork lifts can be used to move palletized rolls to the desired location. A spreader bar can be used to remove the Concrete Cloth roll from the pallet and to aid in the placement of the Concrete Cloth material. When handling bulk Concrete Cloth rolls, all personnel should remain well clear of the lifted roll to avoid potential injury.

Spreader Bar

When using a spreader bar to transport bulk Concrete Cloth rolls, it is important to ensure that the bar:

- 1) is capable of carrying the load
- 2) is placed unimpeded through the core of the Concrete Cloth
- 3) is well fastened on either side of the roll
- 4) can be adjusted to be level
- 5) does not restrict unwinding of the roll.



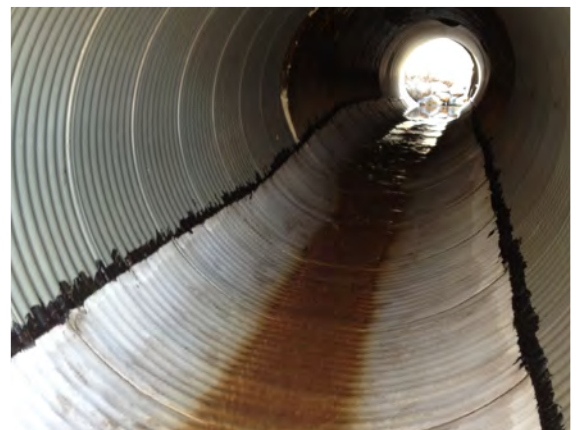
Subgrade Preparation

Compacted and smooth subgrade should be prepared to engineering specifications prior to placement of Concrete Cloth GCCM. Subgrade should be prepared to the lines and tolerances of the engineered drawing for the installation. Soil should be clear of surface vegetation, debris, rocks, and branches. Uneven subgrade may create voids beneath the Concrete Cloth material, which may reduce it's support. To the extent possible, Concrete Cloth material should be in intimate contact with the sub-surface to which it is being applied. If the grade upon which the Concrete Cloth product is placed contains ridges, bumps, or valleys, these features will be visible once the product is installed.

The product should be installed at a temperature above freezing. If the temperature is expected to drop well below freezing after the install, ensure that it is insulated and the heat of hydration will continue the curing process.



When installing Concrete Cloth GCCM in underwater applications, it is the contractor's responsibility to conduct appropriate testing to ensure proper subgrade preparation. Once placed in an underwater application, Concrete Cloth material will begin hydrating immediately and subsequent modifications to the subgrade may be time limited (*working time once hydrated is approximately 2hrs*).



Installation

Concrete Cloth Material Placement

Because of the nature of the overlap design used in many Concrete Cloth GCCM installations, typical installation will begin at the lowest point of the project and proceed up the grade. A 'shingled' installation overlapping Concrete Cloth rolls is used to reduce any water seepage between the overlapped rolls.

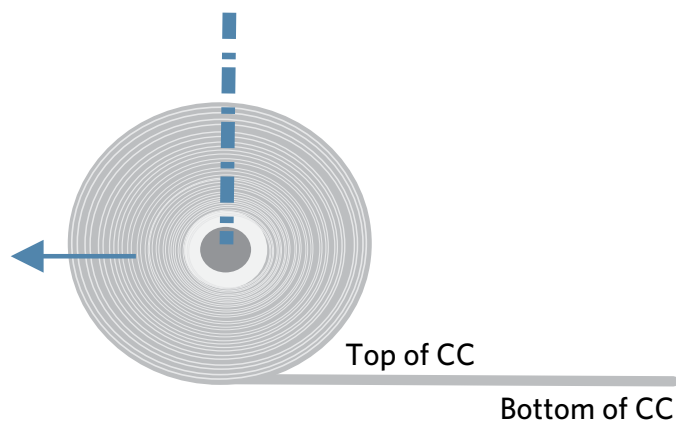
Concrete Cloth materials are designed such that the plastic backing of the material will be against the subgrade in almost all applications. This side is water resistant and will not allow subsequent hydration if the material is installed upside down. The back side is easily identifiable because it is a continuous plastic film on the Concrete Cloth material. Additionally Concrete Cloth GCCM is batched into rolls such that the backside will always be on the outside of the roll. For this reason when installing Concrete Cloth material from rolls, it is important to let the fabric off from the bottom side of the roll.



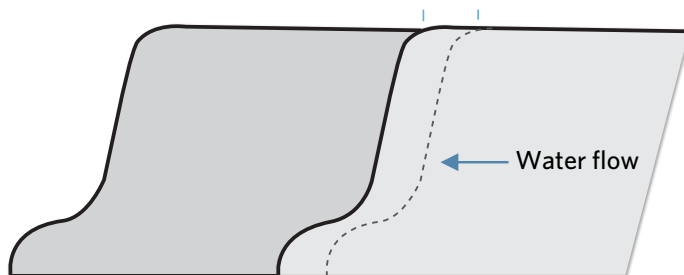
Top of CC



Bottom of CC



When using bulk rolls, it is important to ensure that the roll is well centered on the spreader bar so that the material will smoothly unroll. Temporary anchoring may be used on the leading edge to aid in the unrolling of the roll from the spreader bar.



After installation of the first roll, the leading edge of the second roll will typically be 'shingled' over the first for the reasons mentioned above. In certain applications special joints and seams may be used rather than the 'Shingle' method (*these are discussed in subsequent sections of this guide*).

Cutting Concrete Cloth Products

Often times the Concrete Cloth material will need to be cut to a specified length, or to conform to the installation area. Concrete Cloth GCCM is designed to be cut with commonly available cutting tools. A 'box cutter' or 'razor knife' will work well in making cuts in Concrete Cloth products. Always use appropriate hand PPE when working with cutting tools.

To make the cut, simply place the Concrete Cloth material onto a desirable cutting surface. For example, a piece of plywood acts as a suitable cutting surface. The use of the cutting surface is to protect the tool and will result in a clean Concrete Cloth edge. It is completely possible to make cuts after installation, assuming it can be done safely. Place the backside of Concrete Cloth material (*this is the side with the plastic backing*) down in contact with the cutting surface. Always cut Concrete Cloth material from the top side of the material (*non coated side*) when possible. This will minimize any tearing of the backing.

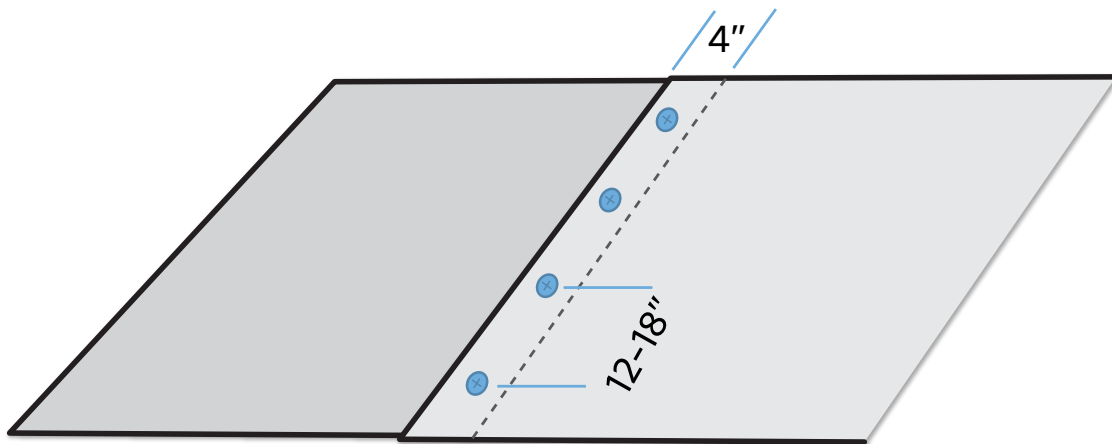


Seams and Overlaps

As previously discussed, in many applications a simple 'shingle' technique is quite sufficient for overlapping as you work up a slope. When using multiple widths side by side 'on grade', other techniques of seaming and overlap may be required.

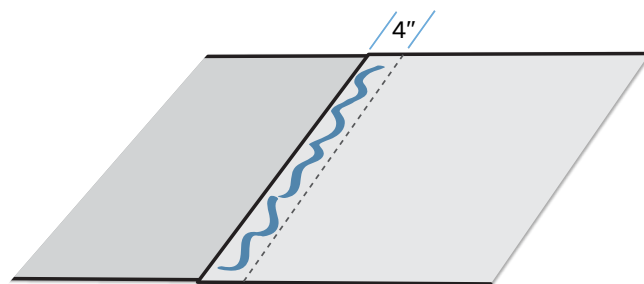
Overlap Seaming with screws

In this technique one of the Concrete Cloth rolls is overlapped approximately four inches (4") atop the other roll. A stainless steel #12 screw is used to fasten the two rolls together. One screw is placed every linear foot along the cloth. The screw is located more than one inch (1") from the overlapped edge of the upper roll.



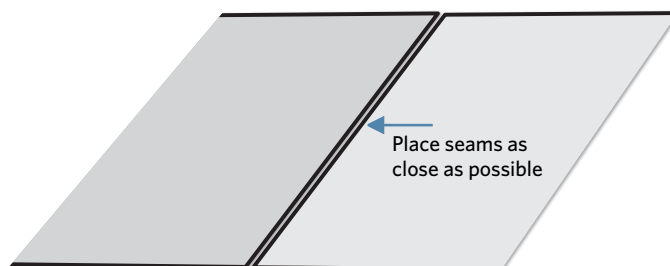
Overlap Seaming with adhesives

In this technique one of the Concrete Cloth rolls is overlapped approximately four inches (4") atop the other roll. The edge of the top layer is then pulled back and a bead of adhesive is laid, centered in the overlap. The adhesive chosen will depend on the performance requirements and environment the seam is expected to experience. This seam may be desirable when a lower joint permeability is desired.



Butt Joint Seams

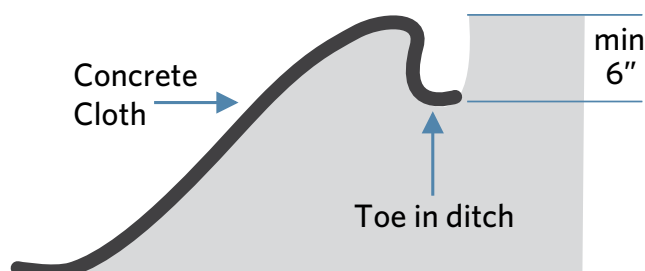
Butt joint seams are typically not recommended but may be required in certain applications. When producing a butt joint seam it is important to ensure that the two rolls to be joined are as parallel to one another as possible. After initial installation of the rolls to be seamed, fine tune adjustment along the length of the seam may be required to eliminate gaps and overlaps. It must be noted that in most installations a butt joint seam will be prone to higher levels of leakage at the seam joint.



Anchoring

Soil Anchors and Soil Nails

Some applications may require anchors or nails to stabilize the underlying soil mass against internal instability. There are several producers of soil anchors, soil nails, and other stabilization devices. Concrete Cloth material may be used as the non-structural facing treatment when internal anchorage conditions are required. Anchors may be installed first, then covered, or Concrete Cloth materials may be installed first and the anchors inserted through the cloth. Hydrate the material before backfilling.



Toe-In Trenching

Along all exterior edges (top, bottom, and sides) of the Concrete Cloth material installation, it is recommended to install a toe-in trench (minimum 6 inches in depth) to resist migration of surface water between the Concrete Cloth material and the subgrade. This toe-in trench may vary in location and depth depending upon site conditions including soils, sub-grade, and recommendation of the design engineer.

Depending upon the job site and equipment accessibility before and after Concrete Cloth material installation, it may be preferable to dig the toe-in trench prior to laying Concrete Cloth GCCM. Should the edge of the Concrete Cloth material installation not line up exactly with the toe-in trench, adjustments can usually be made with a simple hand shovel.

Consult your rep to determine the best anchoring system for your application and where to purchase materials.



Self-tapping Course Stainless Steel Screws

Mechanical fasten overlaps together (washers might be required) 3/4 inch to 1 1/4 in length



Landscape Screws with Washers

Used to hold in place from sliding and resisting low shear values on Concrete Cloth GCCM (washers are required) 7 inch to 18 inches long depending on slope angle, soil type and water shear



Anchor Bolts

Used to secure Concrete Cloth material with a batten strip to a concrete wall



Rock Anchor

When high anchoring strength is required and rock is present in the subsurface



Percussion Anchors

When high tensile resistance is required (such as water shears) about 10 lb/ft², or steep slopes greater than 1:1

Hydration

Complete hydration of Concrete Cloth material is critical to optimal performance. Concrete Cloth products cannot be overhydrated and incomplete hydration may result in reduced strength of the product. Hydration can be done with virtually any water source and can be installed in the rain. Salt water and or dirty water will not have a negative effect on the performance of the product in most circumstances.



To hydrate Concrete Cloth

- 1) Saturate the top-side of the Concrete Cloth material. This will take multiple passes of a moderate spray of water from a garden hose or other source.

Note: More water will be required to saturate the product as the slope of the installation increases.

- 2) Ensure that the Concrete Cloth material has been saturated by means of the “thumb test”, where a thumb is pressed into the Concrete Cloth material and water is observed to pool in the indentation.
- 3) Wait 30-60 minutes then put a final dose of water onto the Concrete Cloth material to ensure complete hydration.

In special applications where it is important not to allow excess water runoff, or water is scarce, water troughs of appropriate size may be used. Submerge the Concrete Cloth material in the water filled trough for a period of 5-10 minutes, remove and install.



Vertical and Overhead Installation

Placing Concrete Cloth material in vertical and / or overhead applications provides significant challenges. Gravity and the flow of water make hydration of installations in vertical and overhead applications more difficult after installation. For this reason it is recommended, when possible, to hydrate the Concrete Cloth material in small sections prior to installation. This will significantly increase the weight of the material to be installed so it is very important to plan the install in sections which can be easily managed into position.

In situations where hydration prior to installation cannot be done it is possible to hydrate the Concrete Cloth material in a vertical installation; however, this hydration requires an extended period of time and a lower spray velocity. Additionally 80% of the hydration should take place in the top 1/3 of the installed material as gravity will allow the water to flow to the lower part of the install. Hydration of an installed overhead Concrete Cloth product is not possible.

Meeting Infrastructure Challenges with Science

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