



 **CONCRETE CANVAS®**

Concrete on a Roll

 **CCHYDRO™**

Containment on a Roll

**INSTALLATION GUIDE:**  
**BUND LINING**



The Queen's Awards  
for Enterprise:  
International Trade  
2019



Board of Trade  
Winner  
2018



Winner  
Technical Innovation Award



award  
winner  
ICE Wales Cymru Project Awards  
Innovation Award  
ICE Wales Cymru Awards 2017



British Board of Agrément  
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Service  
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RAIL



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MINING



PETROCHEM



AGRO



PUBLIC WORKS



UTILITIES



DEFENCE



DESIGN



SHELTER

## 1.0 Introduction

### 1.1 Background

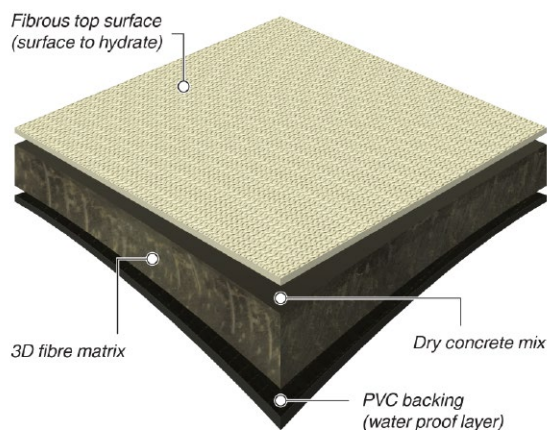
Concrete Canvas® (CC) is part of a revolutionary new class of construction materials called Geosynthetic Cementitious Composite Mats (GCCMs).

It is a flexible, concrete impregnated fabric that hardens on hydration to form a thin, durable, water proof and fire resistant concrete layer. Essentially, it can be described as ‘concrete on a roll’ and is used for a wide variety of applications including the rapid lining of bunds, water channels, providing slope protection, weed suppression, culvert repair and general concrete remediation.

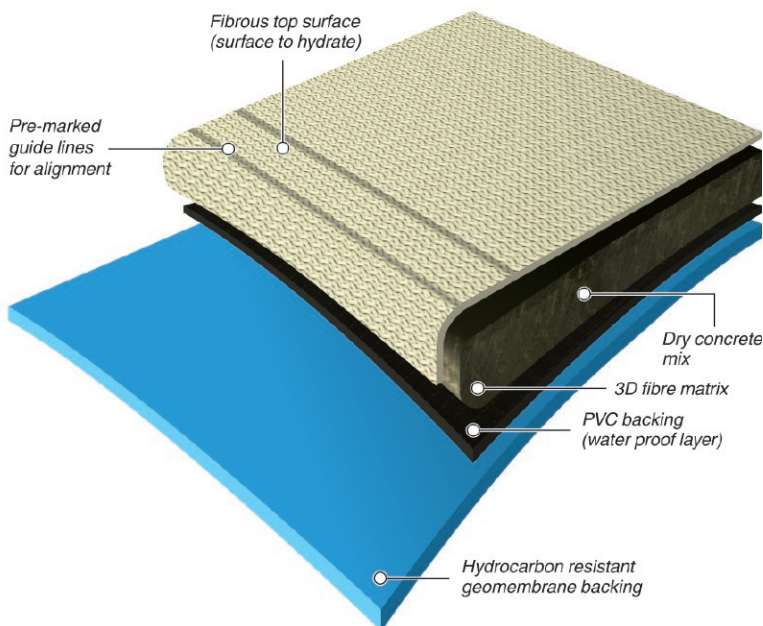
CC Hydro™ (CCH) Geosynthetic Cementitious Composite Barrier (GCCB), combines the company’s concrete impregnated fabric technology with a high impermeability, chemically resistant geomembrane backing. The geomembrane provides a high performance liner with a testable joint for quality assured containment applications. The liner incorporates a hi-visibility welding strip allowing joints to be thermally bonded with a double or triple-track air channel for on-site testing.

CCH provides long term protection to the geomembrane from puncture, abrasion, weathering and UV degradation. This hard armour concrete surface effectively removes the need for concrete, soil or aggregate top cover, normally required with conventional liner systems.

### Concrete Canvas® GCCM section



### CC Hydro™ GCCB section



### 1.2 Scope

- This document provides guidance procedures for the installation of CC & CCH as **bund lining** in a manner that maximises safety, efficiency, and the physical integrity of the material and channel.
- This document provides useful information for installers, customers and specifiers of CC & CCH and provides an overview of installation techniques for the lining of bunds.
- The versatile nature of CC & CCH means that this document is not exhaustive and is intended for guidance purposes only. Exceptions to this guideline may be required to address site-specific and/or product-specific conditions.
- The performance of CC & CCH is highly dependent on the quality of the installation. It is the installer’s responsibility to adhere to these guidelines where applicable and to the project specification and drawings.

## 2.0 Specification and Installation Essentials

### 2.1 Specifying the correct Product

Concrete Canvas® (CC) is designed to be used for **Erosion Control** applications, for example as a capping layer for clay berms to provide protection against weathering, animal damage and prevent vegetation growth. CC should not be used as a replacement for clay or an impermeable liner.

CC Hydro™ (CCH) is designed to be used for **Containment** applications, for example as a replacement for clay or a geomembrane liner covered with a protective overburden. CC Hydro™ combines the durability of concrete with the impermeability of a geomembrane, significantly reducing earthworks through reduced excavations and importation of top cover fill.

### 2.2 Specifying the correct CC Thickness

CC is available in 3 thicknesses, CC5™ (5mm), CC8™ (8mm) and CC13™ (13mm). CC Hydro™ is available in 2 thicknesses, CCH5™ (5mm) and CCH8™ (8mm).

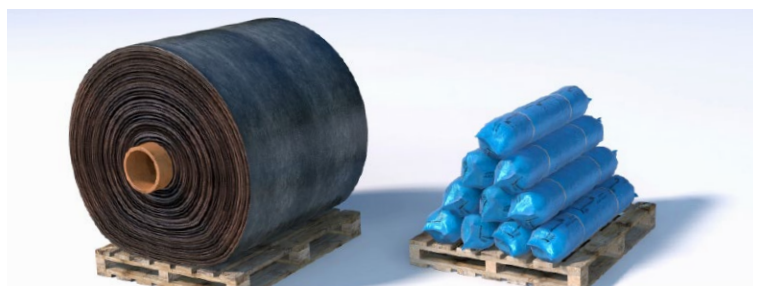
- CC5™ and CCH5™ are most commonly used to line secondary containment bunds where there is no requirement for trafficking, for example from maintenance contractors.
- CC8™, CC13™ and CCH8™ are recommended for use on areas exposed to high a degree of water flow such as flood protection bunds and water channels; or areas required to be lightly trafficked.

	GCCM Type	Thickness (mm)	Roll Width (m)	Dry Weight (kg/m <sup>2</sup> )	Batched Roll Coverage (m <sup>2</sup> )	Batched Roll Length (m)	Bulk Roll Coverage (m <sup>2</sup> )	Bulk Roll Length (m)
Concrete Canvas®	CC5™	5	1.0	7	10	10	200	200
	CC8™	8	1.1	12	5	4.55	125	114
	CC13™	13	1.1	19	N/A	N/A	80	73
CC Hydro™	CCH5™	5	1.0	8	N/A	N/A	150	150
	CCH8™	8	1.0	13	N/A	N/A	100	100

### 2.3 Specifying the correct CC Roll Format

CC and CCH are available in **Bulk Rolls**, CC is also available in smaller **Batched Rolls**.

- **Bulk Rolls** offer the quickest installation but must be deployed using heavy lifting equipment and a spreader beam. Bulk Rolls are generally more efficient to use than Batched Rolls, in terms of material use and transportation.
- For sites where this isn't suitable, man portable **Batched Rolls** can be installed without the need for plant and are well suited to smaller scale works in restricted access areas.
- CC is now also available in **Wide Rolls** of up to 4 times the standard roll width. Contact Concrete Canvas for further details.



CC Bulk Rolls and Batch Rolls



Wide Rolls of up to 4 times the standard roll width are now available

### 2.4 Specifying the correct Fixing

**Perimeter Fixings:** The GCCM/GCCB must be firmly secured around the entire perimeter of the installation prior to hydration, in order to prevent movement during curing and wrinkling during subsequent thermal expansion. Perimeter fixing is also needed to eliminate wind ingress and wind actions which can result in sheet uplift. This can be achieved by capturing the GCCM/GCCB in a concrete anchor trench or by using ground pegs combined with an anchor trench backfilled with aggregate or soil. The fixing design should be sufficient to resist wind uplift. Alternatively, it can be secured to existing concrete infrastructure using mechanical fixings such as concrete anchor bolts (see images). Where only one face of the bund is to be covered, the GCCM/GCCB will also need to be secured to the crest to prevent wind from getting beneath the GCCM/GCCB and to resist wind actions.



Anchor trenched CC



CC captured within a poured curb



CC fixed to concrete headwall



CC fixed to concrete drainage channel

**Intermediate Fixings:** On large berms where wind uplift forces may be significant, intermediate fixings may be required to prevent uplift (calculation of wind loads can be obtained using the methodology described in BS EN 1991-1-4:2005) and the appropriate national annex. Intermediate fixings such as ground pegs, soil nails or earth percussion anchors can be used. Depending on the design wind loads in the location, bunds covered with CC5™ with a slope face length above 7m may require an intermediate fixing at the mid-point of the bund through the overlapped joints.<sup>1</sup> Suitable fixings will need to resist at least 50% of the net wind load perpendicular to the bund face.

When installing CC Hydro™ intermediate fixings will normally only be required for bund faces with a slope face length above 20m or in exceptionally exposed locations<sup>1</sup> (this is due to the high tensile strength of the CCH and welded joints). Contact Concrete Canvas Ltd for further advice and guidance including non-penetrative fixings.



CC being fixed with a ground peg



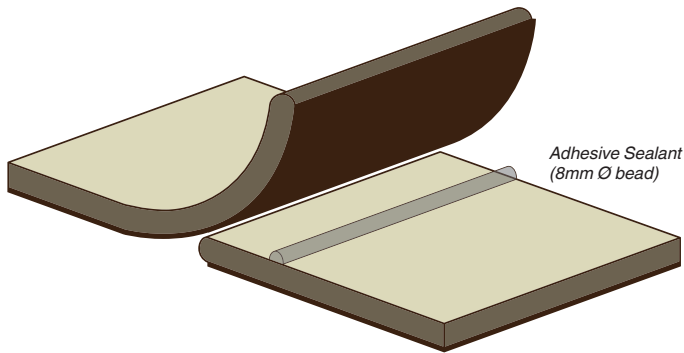
A Percussion Anchor fixed into place

1. Example given for guidance purposes only, based on BS EN 1991 wind speed data from the UK National Annex based on an installation in the Shetland Islands with typical bund geometry and infrastructure topology. Wind loading analysis should be conducted by the Project Engineer according to customer requirements and site-specific conditions.

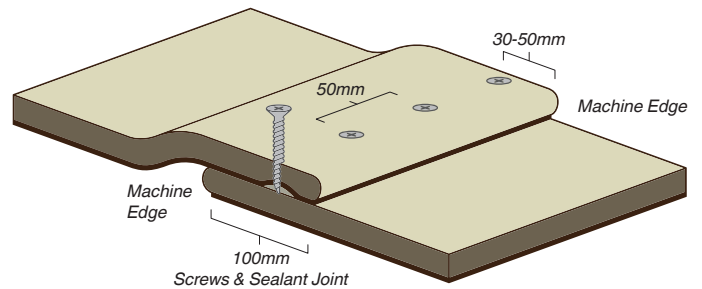
## 2.5 Specifying the correct Joints

- Concrete Canvas should be overlapped by 100mm and jointed using either:

**Stainless steel screws** at 50mm centres, positioned between 30-50mm from the edge of the joint, in addition to an 8mm diameter bead of a Concrete Canvas approved adhesive sealant, applied to the surface of the CC whilst wet and still flexible (see diagram). It is important that a compatible adhesive sealant is used, please contact Concrete Canvas to confirm compatibility. The joint should be clean and the adhesive sealant must be compressed to maximize the adhesive contact area. Once cured the concrete within CC will set around the thread of the screws.

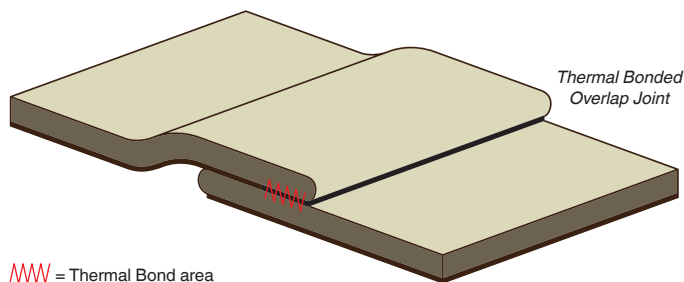


Adhesive sealant applied prior to screw jointing



Screws inserted at 50mm centers, 30-50mm in from machined edge

**Thermal bonding** - using a hand-held heat gun such as a Leister Triac AT with 60mm perforated slot nozzle, or an automatic welder such as a Leister Twinny 50mm combi-wedge (without test channel). Screws can also be used in conjunction with the thermal bonded joint for some applications. Please refer to [CC User Guide: Thermal Bonding](#).



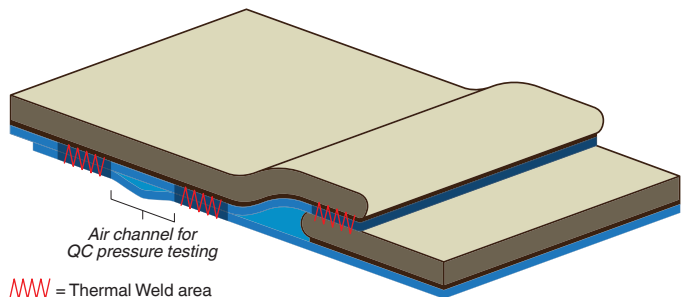
≡ = Thermal Bond area

Thermally Bonded Overlap Joint



- CC Hydro™ should be jointed using:

An automatic thermal welder such as a Leister Twinny with a double or triple track combi-wedge (with test channel). Welding of CC Hydro™ should be carried out by a qualified thermal welding contractor in accordance with the design specification and [CC Hydro™: Thermal Welding Guide](#).

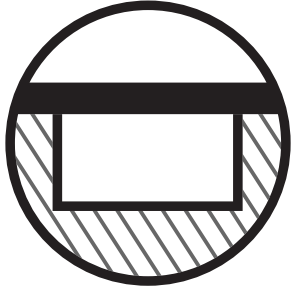


CC Hydro™ double/triple-track weld



### 3.0 Four Key Installation Principles of CC

The unique material properties of Concrete Canvas (CC) mean that it can be used for a variety of applications. Following the Four Installation Principles below will help ensure a successful installation.



**Avoid Voids**

#### 1. Avoid Voids

Prepare the substrate so it is well compacted, geotechnically stable and has a smooth and uniform surface.

- For soil substrates, remove any vegetation, sharp or protruding rocks and fill any large void spaces. Ensure the CC makes direct contact with the substrate to minimise soil bridging or potential soil migration under the layer.
- For concrete substrates, remove any loose or friable material, cut away any protruding exposed re-bar and fill any large cracks or voids.

#### 2. Secure Canvas

It is important to ensure that the CC is **Jointed** at every overlap between layers and that those layers are **Fixed** to the substrate.



**Secure Canvas**

- **Jointing:** Overlapped CC layers should be securely jointed together, typically this is achieved using stainless steel screws applied with an auto-fed screw gun at regular intervals. Correct screw placement will help ensure intimate contact between CC layers, prevent washout of the substrate, and limit potential weed growth. An adhesive sealant can be applied between the layers to improve the joint impermeability.

A non-penetrative method of jointing is to 'thermally bond' the CC layers together. This also improves joint impermeability. For more jointing options see the [CC User Guide: Jointing and Fixing](#).

- **Fixing:** When fixing to a soil substrate, ground pegs (eg J-pegs) are typically used. On rock or concrete substrates, CC layers can be jointed together and fixed to the substrate using masonry bolts, percussion anchors or shot fired masonry nails. Stainless steel fixings with washers are recommended.

#### 3. Prevent Ingress

It is important to prevent water or wind ingress between the CC and the substrate, both around the perimeter of the installation and along the joints.

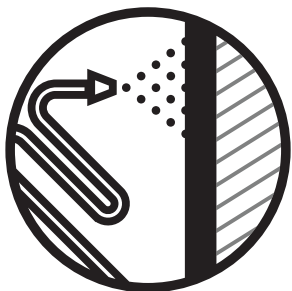


**Prevent Ingress**

- For soil substrates, this is typically achieved by capturing the entire perimeter edge of the CC within an anchor trench.
- On rocky or concrete substrates, the perimeter edge should be sealed with a concrete fillet or an adhesive sealant.
- All overlapped CC layers should be lapped in the direction of water flow.

#### 4. Hydrate Fully

It is critical to properly hydrate CC, taking into account the quantity of material used and ambient temperature conditions.



**Fully Hydrate**

- Always ensure hydration through the fibrous top surface.
- Ensure to hydrate any overlapped areas and anchor trenched material prior to backfilling.
- Spray the fibre surface with water until it feels wet to touch for several minutes after hydration (the 'Thumb Test').
- Follow the [CC User Guide: Hydration](#).

## 4.0 Installation Methodology

### 4.1 Bund Preparation

CC & CCH will conform closely to the underlying surface contours of a bund profile. The degree of ground preparation needed will depend on the bund construction and surface finish required. For best results it is recommended that loose soil, vegetation, soft ground and protruding rocks are removed and any voids filled. A suitable non-woven geotextile layer can be used to provide puncture protection to the geomembrane liner when laying CC Hydro™.

### 4.2 Laying

Unwrap the material, ensuring that the fibrous surface of the product is facing upwards and the membrane backing is in contact with the bund. Align the roll perpendicularly and simply unroll over the bund profile.

### 4.3 Positioning

Cut to length ensuring there is sufficient excess for the specified anchor trench.

When positioning subsequent CC rolls, ensure that there is at least a 100mm overlap between layers.

When positioning subsequent CC Hydro™ rolls ensure the layers are aligned within the pre-marked black guidelines.

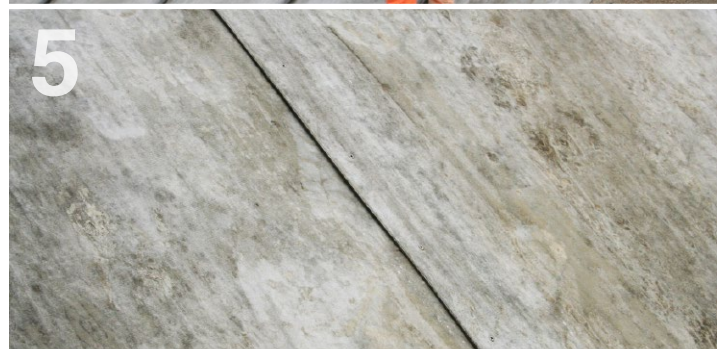
### 4.4 Hydrating overlaps

If laying CC, the overlapped areas should be hydrated by spraying with water (sea water may be used). Fold back one edge to expose the overlapped section. Spray the fibre surface with water until it feels wet to touch for several minutes after spraying. **This applies to CC only and not CCH.**

### 4.5 Jointing

CC: The fastest and easiest method of jointing with CC is using stainless steel screws at 50mm spacing in addition to an 8mm bead of adhesive sealant. These can be applied using an auto-feed collated screw driver and the adhesive sealant applied with a caulking gun. Alternatively, a thermal bonded joint can be used with CC.

CCH: Joints are thermally welded – please refer to the [CC Hydro™ User Guide: Thermal Welding](#).



### 4.6 Hydration

Once in position and the joints secured, **the material should be hydrated as per the CC Hydration Guide.** Hydrate from crest to toe to ensure a uniform finish. An excess of water should be used as the material cannot be over hydrated (minimum ratio of water:CC is 1:2 by weight). Avoid trafficking wetted GCCM to prevent staining. Please note that you should not rely on precipitation to hydrate the material.

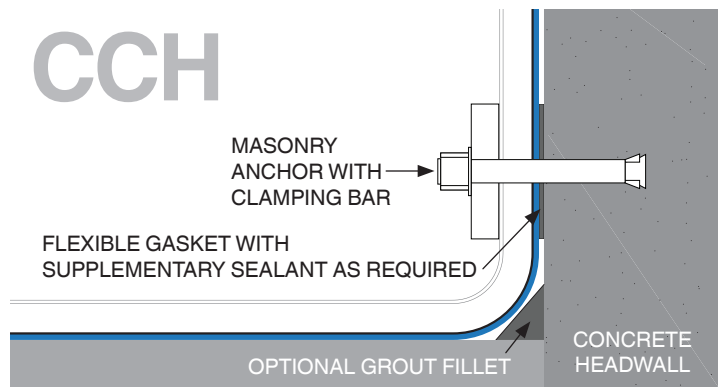
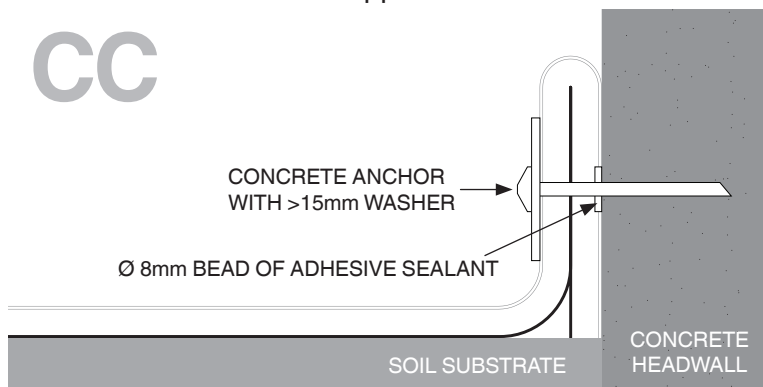
### 4.7 Junctions and Corners

CC & CCH are very easy to shape before setting and layers can be laid in multiple directions to form junctions and corners or cut to create pie-welds when using CC Hydro™. **The perimeter edges of the material must be buried or securely fixed to existing concrete infrastructure to prevent wind and water ingress.**

### 4.8 Terminations

#### CC:

Terminations into concrete headwalls or upstands can be achieved by folding the edge of the CC over by 50mm and fixing to the concrete substrate using concrete anchors. Where there are water ingress concerns at the termination, a bead of sealant should be applied.



#### CCH:

Interfaces with concrete headwalls or upstands can be fixed using a steel batten and masonry anchors, sealed using neoprene gaskets (TWI suggests a 5x40mm batten with 12mm holes at 200mm centres). Please contact Concrete Canvas to request access to our library of CAD design details.

### 4.9 Setting

Once hydrated, the material remains workable for approximately 2 hours. In warm climates, working time may be reduced. CC & CCH will harden to 80% of their 28-day strength in 24 hours and are ready for use.

See [CC Equipment List](#) for full details. Dust hazard. Wear appropriate PPE. Consult [CC SDS](#) document.

