



# **CONCRETE CANVAS®** Concrete on a Roll

## BANK EROSION PROTECTION CASE STUDIES



The Queen's Awards  
for Enterprise  
International Trade  
2019



Board of Trade  
Winner  
2018



Winner  
Technical Innovation Award



Innovation Award  
ICE Wales Cymru Awards 2017



British Board of Agreement  
Certified



ACS Registrars Ltd  
ISO 9001 Accreditation



Certified CPD  
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RAIL



ROAD



MINING



PETROCHEM



AGRO



PUBLIC WORKS



UTILITIES



DEFENCE



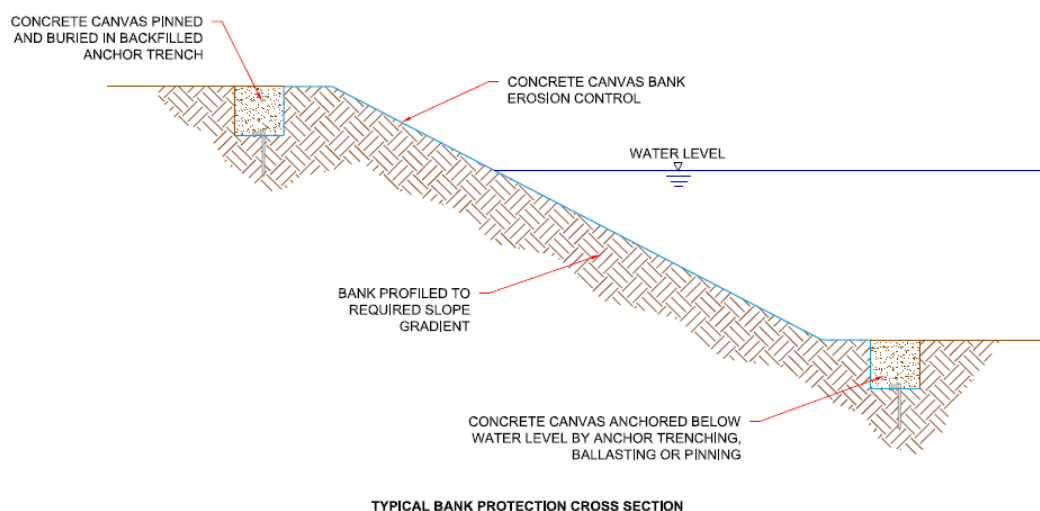
DESIGN



SHELTER

Concrete Canvas® (CC) is part of a revolutionary new class of construction materials called GCCMs\*. It is a flexible, concrete filled geosynthetic that hardens on hydration to form a thin, durable and water proof concrete layer. The material is predominantly used for erosion control applications, offering a faster, lower carbon alternative to conventional concrete.

River, pond and lagoon banks may require a concrete lining where higher levels of protection are required than vegetated slopes can offer, or when vegetation needs to be prevented from establishing in order to simplify maintenance. CC can be used to replace poured, precast, sprayed concrete and stone mattress/rip rap solutions as a durable, long term alternative.



## Concrete Canvas® User Benefits

### Rapid Install

CC can be laid at rates up to 10 times faster than conventional concrete solutions. CC has a working time of 2 hours after hydration and can be installed in wet weather conditions, reducing disruption. CC cures in 24 hours, a fraction of conventional concrete's curing time, returning structures to service quicker.

### Easy to Use

The concrete is pre-mixed, eliminating the need for mixing, measuring or compacting. CC cannot be over hydrated and will set underwater.

### Low Project Cost

The speed and ease of installation mean CC is more cost-effective than conventional concrete, with less logistical complexity.

### Eco-Friendly

CC is a low mass, low carbon technology which uses up to 95% less material than conventional concrete for many applications. The material has a low alkaline reserve and washout rate; CC has been specified by environmental agencies worldwide and successfully installed in natural watercourses without adversely affecting the water quality.

## Concrete Canvas® Key Properties

### Abrasion Resistant

CC prevents surface erosion from weathering and is 5 times as abrasion resistant as standard OPC concrete.

### Conforms to Profile

CC has excellent drape characteristics, allowing the material to conform to the profile of the substrate making it more homogeneous with the surrounding environment.

### Low Mass

CC can be supplied in 1.5 tonne bulk rolls with a lifting beam for deployment, the fastest method of installing the material, or in man-portable batched rolls eliminating the need for plant on site and allowing for installation in restricted access areas. Prior to hydration, CC can be cut to length using basic hand tools, eliminating wastage.

### Weed Suppressant

CC acts as an effective weed inhibitor, preventing costly maintenance required for unlined or vegetated banks.

### Ageing

Moss can grow on the fibrous top surface of CC resulting in it 'greening over' and blending in with its surroundings.

**The following pages contain a collection of case studies highlighting the advantages of using Concrete Canvas® GCCM for bank erosion protection applications.**

\* Geosynthetic Cementitious Composite Mat



## Project Info



01 / 08 / 18



CC5™ Batched Rolls



1,200m<sup>2</sup>



Vertical layers



Moneyreagh, Co. Down,  
Northern Ireland



Cameron Landscapes  
& Garden Centre



CC5™ used to provide  
erosion protection to  
slopes of a large pond  
used as a golf reservoir



*Pond slopes following CC installation in Moneyreagh, Northern Ireland*

In August 2018, Concrete Canvas® GCCM (CC) was used to provide erosion protection for a pond embankment in Moneyreagh, a small village south of Belfast. The pond was originally lined with clay for a golf reservoir, but erosion of the pond embankment meant an erosion protection solution for the slopes was required. The bottom of the pond would remain unlined to reduce the build-up of hydrostatic pressure. Poured concrete was considered but CC was chosen due to its speed and ease of installation and its flexibility in terms of site access, as the use of heavy plant was not possible.

Prior to installation, the water was diverted using pumps. The side slopes were then excavated to remove sharp or protruding rocks before laying and compacting crushed stone to ensure a smooth substrate. 300mm anchor trenches were dug at the crest and toe of the slope with a mini excavator.

Batched rolls of CC5™ were delivered to site and cut with a disc cutter into 5 linear metre lengths to match the average height of the slope. The CC was fixed within the crest anchor trench using steel ground pegs. Subsequent layers were overlapped by 100mm and jointed using 30mm stainless steel screws. Following installation, the material was hydrated and the anchor trenches later backfilled, compacted and seeded.

The installation team were impressed by the speed and ease of installation of CC on a site with heavily restricted access. In total 1,200m<sup>2</sup> of CC5™ were installed in 3 days with a crew of 4 people without specialist training or plant equipment and will provide long-term erosion control for the pond embankment.







*Pond prior to works*



*Water pumped from pond*



*Excavation of embankment*



*Crushed gravel compacted on slope for optimum substrate*



*CC overlaps jointed using screws, placed at 200mm intervals*



*CC secured into crest and toe anchor trenches*





*CC hydrated at the end of each day*



*Anchor trenches backfilled and compacted*



*CC easily accomodated corners of pond*



*Concrete fillet applied at CC and rock termination*



*CC lined pond inlet channel*



*Inlet channel and completed CC installation*



## Project Info



11 / 07 / 17



CC5™ Bulk Rolls



2800m<sup>2</sup>



Longitudinal/ Vertical  
layers



Pasir Gudang,  
Johor Bahru, Johor,  
Malaysia



Edup Design Sdn Bhd



CC5™ used to  
remediate slope, guard  
rails and footpaths  
around a recreational  
lake



*Completed installation in Pasir Gudang Bahru, Malaysia*

In September 2017, Concrete Canvas® GCCM (CC) was used to remediate a number of slopes, guard rails and footpaths surrounding a recreational lake in Pasir Gudang, Johor Bahru in Johor, Malaysia.

The lake is used for recreation and sees vast numbers of visitors each week. The slopes around the lake were deteriorating, leading to water from the lake seeping into the surrounding soil, destabilising guard rail foundations, causing concrete walls to collapse and creating dangerous voids. The local council planned to use sheet pile to remediate the slopes but it was CC's overall cost savings compared to alternatives that led to its specification. CC can also be installed without heavy plant and machinery, minimising disruption on site. The works were carried out by Edup Design Sdn Bhd for Pasir Gudang Municipal Council.

Prior to installation, the slopes were levelled and the cracking and damage to existing retaining concrete walls were remediated using gabions which were submerged in the lake. The voids between the gabions and slope were filled with rocks. CC was then installed directly into the lake, as the material has a two-hour window of workability for it begins to set. The material was laid vertically from crest to toe on the slopes, and longitudinally around the edge of the lake where remediation of the paths was required. Poured concrete and grout were used to seal the exposed edges, while screws, wall plugs and ground pegs were used to fix and joint the CC edges and overlaps.

2,800m<sup>2</sup> of CC5™ were installed in 30 days. The Pasir Gudang Municipal Council were impressed by CC's performance and the speed of install and are looking to specify CC for a slope protection project in the near future.







*Sections where erosion has caused the soil slope to collapse into the lake*



*Guard rails collapsing into lake due to erosion*



*Ground pegs, wall plugs, screws & poured concrete used to joint & fix CC*



*CC was able to accomodate curved sections of slope*



*CC buried in anchor trenches to preserve grassy areas above slope*



*Completed slope protection installation*



## Project Info



14 / 01 / 14



CC8™ Bulk Rolls



875m<sup>2</sup>



Vertical layers



Middle East



Undisclosed



CC8™ used to rapidly line a blow down pit to provide weathering protection and impermeability



*Completed, lined blow down pit*

In January 2014, Concrete Canvas® (CC) was used in a trial to line the walls of a blow down pit in order to demonstrate the speed and ease of CC compared to traditional concreting methods. The primary aim was to improve impermeability and protect against weathering erosion.

The pit is located at an oil field in the Middle East, operated by a large petroleum company, and is required for containment of contaminated materials produced by crude oil recovery. Conventional concrete lining of blow down pits uses in-situ poured concrete and shuttering with re-bar reinforcement. This can typically take anywhere from 9 to 12 weeks, from breaking the ground to completion, depending on site size and accessibility.

The pit measures 37m long x 25m wide x 2.5m deep. CC had to accommodate concrete steps with handrails, concrete plinths, a sump pit and a concrete pillar. The substrate, which was made up of sands, unconsolidated rock and underlaying rock, provided a high degree of impermeability, as a result the pit base did not require lining.

Anchor trenches were excavated around the outside and inside perimeters and the berm profiles levelled by removing protruding rocks to ensure a smooth substrate. Bulk rolls were delivered to site, batched to man-portable lengths and moved into position manually. Overlaps were thermally bonded and localised areas also sealed using grout. 250mm steel ground pegs were used to fix the CC to the substrate through the joints at the crest and toe. All joints were compressed and hydration started at dusk to avoid evaporation. Certain areas were rehydrated an hour later. The inner perimeter anchor trench was backfilled with concrete for an impermeable transition between the pit floor and CC-lined berm.







*Project site*



*Excavated pit prior to lining*



*CC was batched and moved to site by hand*



*Thermally bonding CC joints*



*Accommodating existing infrastructure*



*Applying concrete backfill to anchor trenches post-hydration*

Despite the site's remote location, the pit was successfully lined, sealed and hydrated in less than 5 days, compared to 9-12 weeks for alternatives. The client felt that if they were to carry out a similar sized project, the experience they have gained for installing the material would allow them to complete the installation within 2-3 days.



## Project Info



02 / 11 / 16



CC13™ Bulk Rolls



1,040m<sup>2</sup>



Vertical layers



Pontypridd, South Wales,  
UK



Natural Resources  
Wales



CC used to provide  
slope protection to  
sections of the River  
Taff.



[CLICK TO  
WATCH VIDEO](#)

*Completed CC lined section of River Taff*

In November 2016, Concrete Canvas® (CC) GCCM was used to remediate sections of embankments of the River Taff in South Wales which were formed from grouted rip rap embankments believed to have been installed in the early 1950's. A particular section, within Treforest Industrial Estate, was heavily cracked, showing signs of severe spalling and established vegetation growth. Remediation was required to prevent further scour and undermining of a walkway along the crest of the bank.

Following similar successful works in Newport, Concrete Canvas Ltd were approached by Natural Resources Wales. The slope section was approximately 220 linear metres long and 4 metres high. The rip rap butted into a concrete kerb at the toe, which capped sheet piling beneath. It was considered to simply re-point sections of the rip rap, but this would be a costly, temporary solution and wouldn't address underlying drainage issues. Replacing the rip rap in its entirety would involve the costly excavation and import of fill in a difficult access area. Other solutions considered included sprayed and in-situ concrete and vegetation mats. These solutions required specialist contractors and equipment, could contaminate the river, would be time consuming and not adequately durable.

CC13™ was specified in order to maximise the durability and effectiveness of CC as an erosion protection solution and to withstand the potential fast flow velocities of the River Taff, shear force loads and the likelihood of impact from debris. CC was delivered via temporary access road and deployed from a plant-mounted spreader beam. The rip rap was removed using plant and the substrate graded to a uniform, smooth finish. A layer of separation geotextile was laid prior to deploying CC, mitigating washout of substrate fines through tidal action between CC joints.







*Embankment prior to works, during low river levels*



*Dispensing of bulk roll CC13 via spreader beam*



*Fixing of the overlapped CC layers using SS screws at 150mm centres*



*Hydration of the CC lined sections using water from the River Taff*



*CC-lined slope painted green using masonry paint following discussion with Natural Resources Wales to help it blend in with surroundings more successfully*

CC was deployed vertically, allowing for installation in stages. CC layers were overlapped by 100mm in the direction of water flow and screwed together, creating a natural weep path and allowing the release of hydrostatic pressure. The top edges were captured within an anchor trench and each layer pinned to the substrate using 250mm galvanised steel pegs before being hydrated. At the toe, CC was draped across the full height of the kerb and captured to the vertical face using concrete masonry anchors with washers. The side edges were anchor trenched at the interface with the rip rap within concrete poured backfill to prevent water ingress. Drainage chambers were installed along the embankment.



## Project Info



06 / 03 / 17



CC8™ Bulk Rolls



225m²



Vertical layers



Buraydah, Al-Qassim,  
Saudi Arabia



FOQSCO



CC8™ was used to protect the slopes of ponds to prevent the flow of rainwater from causing erosion.



Completed installation

In March 2017, CC was used to protect a pond slope in Buraydah, Al-Qassim in Saudi Arabia, in order to prevent weathering erosion. Replacing the existing rip rap was disregarded due to the associated time and costs. The existing rip rap had come apart in some places during the storm season. As a result, CC was chosen due to its ease of use and speed of installation, even in difficult areas. The works were carried out by FOQSCO for Qassim Municipality, with input from consultants Khatib & Alami.

Sharp rocks were removed and initial levelling done by hand. Following compacting, backfilling and levelling were repeated using sand. Bulk rolls of CC8™ were delivered to site, deployed from a spreader beam, and cut to length using hand tools. The material was then transported and unrolled by hand from crest to toe, with layers overlapping by 100mm. CC was fixed to the existing concrete at the crest using stainless steel bolts and the edges laid in an anchor trench. CC was fixed to the adjoining rip rap using bolts and pegged inside pre-dug trenches along the sides and toe.

Overlaps were thermally bonded using heat guns and rollers, and fixed using stainless steel screws. All anchor trenches were then filled with concrete to prevent water ingress. The CC was hydrated using a hose and water tank and repeated multiple times due to the prevalent dry and hot conditions.

225m² of CC8™ were installed in 4 days by 10 people despite very dry, hot weather conditions. The project was a success due to the drastic reduction in installation time and logistics compared to rip rap. All involved were very pleased and are considering using CC over rip rap for all similar future projects.







*Levelling and backfilling the substrate following compacting*



*Batched lengths of CC ready for transportation to site*



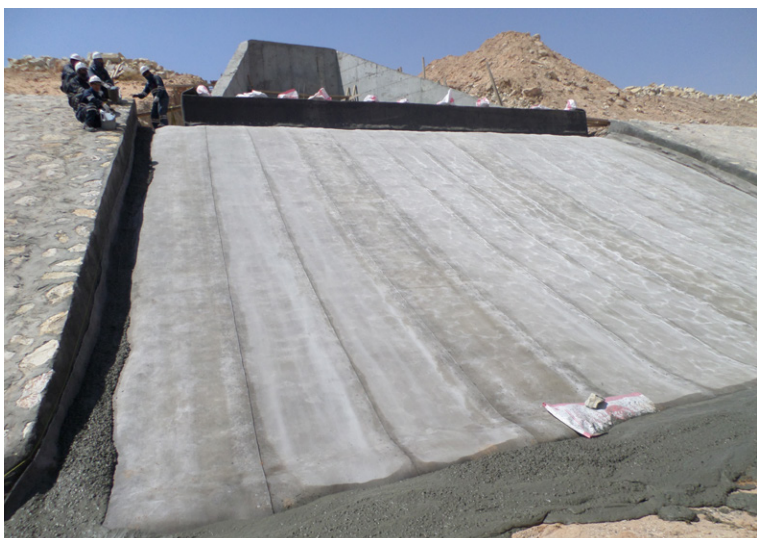
*Deployment of CC*



*CC fixed to existing concrete at crest using steel bolts*



*CC secured with ground pegs and jointed using screws*



*Anchor trenches backfilled with poured concrete following hydration*



## Project Info



19 / 04 / 18



CC8™ and CC13™ Bulk Rolls



375m²



Vertical layers



Wilster, Germany



Jens Maag Lohnbetriebe



CC8™ used to protect sections of pond embankment and prevent erosion



Completed CC installation in Wilster, Germany

In April 2018, Concrete Canvas® (CC) was trialled to provide erosion protection to sections of pond embankment in Wilster, Germany. The pond, owned by the local commune of Wilster (Amt Wilstermarsch), was losing water due to badly eroded sections of embankment. The works were carried out by Jens Maag Lohnbetriebe, with material provided by Beco Bermuller.

In preparation for the installation, approximately 150mm of clay topsoil was removed from the sections requiring lining. The substrate was then graded to provide a flat, level surface and an anchor trench created at the crest. Batched rolls of CC8™ were delivered to site and laid vertically from crest to toe. Subsequent layers of CC overlapped the previous by 100mm, and were then jointed using 20mm stainless steel screws. 300mm ground pegs were used to fix the CC to the substrate through overlaps at the crest, while Platipus ground anchors were used to fix the material at the toe.

Following installation, a hosepipe attached to a water pump was used for hydration and a layer of clay was used to cover the CC entirely in order to stabilise the slope from below, preventing further erosion and undermining.

A total of 375m² of CC8™ were installed in 7 hours by a team of 4 people with no previous experience of installing CC, and on a site with access limitations. The trial was deemed a success, and the client was very impressed with the speed and ease of installation. The client is now looking into lining the remaining embankments of the pond using CC in the near future.







*Site prior to works*



*Section of embankment affected by erosion*



*Clay topsoil removed using a digger & an anchor trench was created manually*





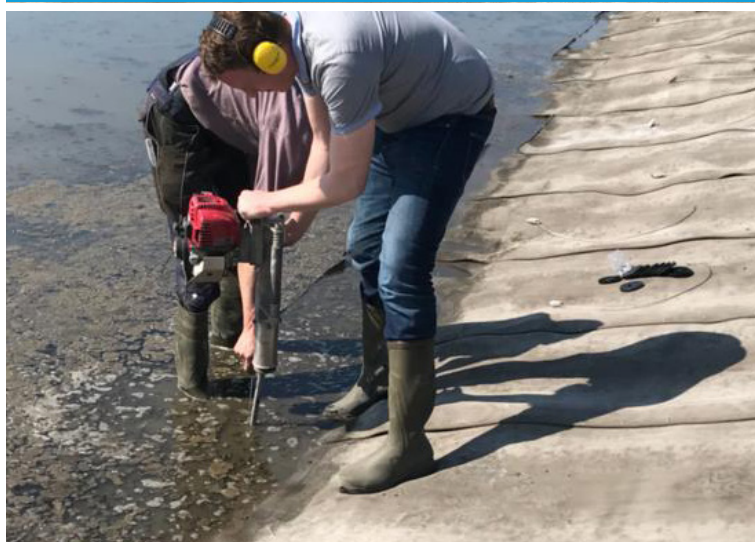
*A disc cutter was used to cut the CC to length*



*Ground pegs were used to secure CC at the crest*



*Overlapped layers were jointed using stainless steel screws*



*Platipus ground anchors fixed the CC to the substrate at the toe*



*Platipus ground anchors fixed the CC to the substrate at the toe*



*Completed installation prior to placement of clay top cover*