



CONCRETE CANVAS® Concrete on a Roll

MINING CASE STUDIES



RAIL



ROAD



MINING



PETROCHEM



AGRO



PUBLIC WORKS



UTILITIES



DEFENCE



DESIGN



SHELTER

Concrete Canvas® is a Geosynthetic Cementitious Composite Mat (GCCM), part of a revolutionary new class of construction materials. It is a flexible, concrete filled geosynthetic that hardens on hydration to form a thin, durable, water proof and fire resistant concrete layer. Essentially, it's concrete on a roll. The material is predominantly used for erosion control applications such as ditch lining and slope protection, offering a faster, more cost effective alternative to conventional concrete.

Concrete Canvas® User Benefits

Rapid Install

CC can be laid at a rate of 200sqm/hour, 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 programme disruption.

Easy To Use

CC is available in man portable rolls for applications with limited access. The concrete is pre-mixed so there is no need for mixing, measuring or compacting. Just add water.

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. Up to 200sqm can be delivered on a single pallet; enough to replace two full mixer trucks.

Concrete Canvas® Key Properties

Erosion Protection

CC prevents surface erosion from weathering and has twice the abrasion resistance of OPC.

Conforms To Profile

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

Plant Not Required

CC can be supplied in man portable rolls eliminating the need for plant on site and allowing for installation in areas with restricted access. Prior to hydration, CC layers can be cut to length using basic hand tools, eliminating wastage.

Reduced Maintenance

CC acts as an effective weed inhibitor, preventing costly maintenance required for unlined ditches.

Ageing

Moss can grow on the fibrous top surface of CC resulting in it 'greening over', helping the CC to blend in with its surroundings. CC has a minimum design life of 50 years when installed correctly.

The following pages contain a collection of case studies highlighting the advantages of using Concrete Canvas® GCCM over conventional methods in the mining industry.



Project Info



01 / 06 / 17



CC13™ Bulk Rolls



1,520m²



Transverse layers



Avoca Mines, Tigroney
West, Co. Wicklow,
Ireland



Priority Construction Ltd.



CC13™ was used to
provide scour protection
to drainage channels
at the Avoca Mines in
Wicklow



Completed installation



The channel was excavated prior to installation



CC was cut to profile length and laid transversely



Steps were installed in places to dissipate water flow

In June 2017, Concrete Canvas® GCCM* (CC) was used to line a channel at the Avoca Mines in Wicklow, Ireland. Water discharges from the old mines are acidic and metal laden, which impacts water quality of the Avoca River.

A combination of precast concrete channels and a HDPE liner/rip rap channel was originally considered, however, the steep, varying slopes around the site made this difficult. CC was specified as it allows concrete construction without the need for plant or mixing equipment on site. The work was carried out by contractor Priority Construction Ltd.

Prior to installation, bulk rolls of CC13™ were delivered to site, the channel was excavated and compacted, and a trench was created on either side to allow the CC's edges to be buried to prevent undermining. The CC was mounted onto a spreader beam and hung from an excavator, unrolled and cut to profile length to minimise wastage.

The CC was laid transversely, overlapping layers by 100mm in the direction of water flow. Overlaps were sealed with Everbuild Clearfix adhesive sealant and screwed at 200mm intervals. Steel ground pegs were then inserted through each overlap in the anchor trenches, which were backfilled. In some areas, concrete steps were installed and covered with CC to dissipate water energy. The CC was hydrated using a hose and a 6000L water carrier.

In total, 1,520m² of CC13™ was installed within 2 weeks. CC is now being considered for multiple projects in the same region in both the public and private sectors.

*Geosynthetic Cementitious Composite Mat



Project Info



01 / 12 / 13



CC5™ Bulk Rolls



810m²



Vertical layers



Brockman 4 mine site,
Western Australia



ROCK Australia



CC5™ used to line a
slope at a Run of Mine
(ROM)



The CC was laid vertically down the slope and the side filled with poured concrete



Site before preparation



All vegetation was removed before installation



Completed installation

In December 2013, Concrete Canvas® GCCM* (CC) was used to line a slope at a Run off Mine (ROM) situated in the Brockman 4 mine site, Western Australia.

The main objective for the project was to prevent surface water from penetrating the slope which causes instability. There was also a need for erosion control and weed suppression on the site. Alternatives such as shotcrete were considered, but CC was selected due to the speed and ease of installation as well as being the most cost-effective solution.

Large rocks, other debris and vegetation were removed from the slope before it was levelled in preparation for installation. CC5™ was delivered to site in bulk rolls and unrolled down the slope using a crane and spreader beam. The overlaps were then hydrated before being sealed and screwed. Ground pegs were then used to fix the CC to the substrate along one edge, and a grouted joint along the other, creating a water impermeable seal between the CC and retaining wall. At the crest of the slope, a transverse layer was used to overlap the vertical layers, before being anchor trenched and fixed with ground pegs. A water cart was used for hydration.

In total 810m² of CC5™ was installed in three days by a team of three people. The bulk rolls enabled a fast, easy and cost-effective install under very high temperatures of up to 43°C.

*Geosynthetic Cementitious Composite Mat



Project Info



05 / 12 / 2013



CC8™ Bulk Rolls



7,250m²



Transverse and Longitudinal layers



Albania, La Guajira, Colombia



MERT S.A.S



CC8™ used to line channels at a mine, to provide drainage and prevent erosion



Completed installation - Botadero Comuneros

In December 2013, Concrete Canvas® GCCM* (CC) was used to line 12 drainage channels at a mine in Albania, Colombia. The channels dealt with rain water and man-made drainage caused by mining activity.

The original channels were carved from the substrate with no lining, and therefore suffered extreme erosion, causing damage to the local environment. As a result, The National Authority for Environmental Permits ordered urgent installation of lining to prevent further environmental damage. A geo-membrane and gabion combination was considered, but CC was specified due to speed of installation, which was key due to the possibility of penalties if drainage measures were not put in place by March 2014. CC can be installed ten times faster than conventional concrete, meaning the penalties could be avoided entirely. The work was carried out by MERT S.A.S.

Prior to installation, vegetation and debris were cleared to ensure intimate contact with the substrate. Bulk rolls of CC8™ were delivered to site and cut to length to reduce wastage, positioned and fixed using ground pegs. Layers were overlapped by 100mm in the direction of water flow and secured using screws at intervals of 200mm. For longitudinal layups, a spreader beam and plant were used to unroll bulk rolls of CC8™ along the length of the channels. These were then fixed using ground pegs every 1.5 metres and joined with screws at 200mm intervals. Both layups were sealed with an adhesive sealant along overlaps.

*Geosynthetic Cementitious Composite Mat





Botadero Comuneros site before ground preparation



CC8™ was delivered to site in bulk rolls



CC8™ was laid transversely across most channels



Completed installation - Caida Porterito

Baffling was needed in a steep channel known as 'Caida Poteito' to dissipate the water's energy and prevent fast flowing water undercutting the substrate at the bottom. The channel was graded to 45 degrees before pairs of sandbags were placed at 2m intervals on either side of the channel. CC8™ was then laid over them and fixed in place. The CC was then hydrated using a water truck.

The channel lining was installed consecutively by a team of six over a seven-week period in high temperatures of up to 34°C and under a tight deadline. The CC was able to accommodate the sharp bends, corners and existing pipework, among other complicated aspects of the installation. The client was very pleased with the results and the ANLA officials visited the site and gave their approval of the lining, which allowed mining works to continue without financial penalty.

Project Info



29 / 08 / 16



CC8™ and CC13™ Bulk & Batched Rolls



837m² of CC8™
128m² of CC13™



Transverse layers



Glenridding, Ullswater,
Cumbria



75 Engineer Regiment



Re-lining of existing
channel on top of a
tailings dam to prevent
further damage caused
by storm Desmond in
2015.

Lake District
National Park



Batch & Bulk Rolls of CC being delivered by the UK International Search and Rescue Team

In August 2016, Concrete Canvas® GCCM* (CC) was used to line a drainage channel at Glenridding, Ullswater, Cumbria. The objective was to re-line an existing channel on top of a tailings dam to prevent further damage caused by storm Desmond in 2015. The site was an operational lead ore mine between 1825 and 1961, and is now a designated SSSI site.

Various other methods were considered, including dry stone walling and poured concrete. However, due to the limited site access, sensitivity of the site and several other factors, CC was chosen as the best solution. The works were carried out by multiple agencies, the 75 Engineer Regiment under 42 Brigade and the UK International Search and Rescue Team, with an additional aim to ensure materials and contaminants from the old mines did not affect the village below. The site is 2 miles up a remote track and there were a number of logistical issues for delivery so HIAB wagons and a UK International Search and Rescue Team helicopter had to assist.

Some of the dry stone walls and overburden on one side of the channel were removed prior to installation. The rolls of CC8™ were batched to specific lengths to accommodate the varying width of the channel. The CC was trimmed using knives and anchored to the ground using steel pegs and heavy rocks. The overlaps were jointed using screws at 200mm intervals. An army-issue, portable temporary 1000L reservoir was used for hydration.

A total of 965m² CC was installed over a ten-day period, in mostly clear weather, on a site with limited access.

*Geosynthetic Cementitious Composite Mat





The original channel



CC was delivered to site by truck and helicopter in bulk and batched rolls



Site was cleared of rocks which were reused after installation



Site access was limited, so the CC had to be transported manually



Hydration of the installed channel



Completed installation

Project Info



02 / 01 / 2016



CC8™ Bulk Rolls



1640m²



Transverse layers



Glyncorrwg, Wales, UK



Jim Davies Engineering /
The Coal Authority



CC used to provide
scour protection to a
series of mine water
drainage channels in
South Wales.



Completed installation at Glyncorrwg

In January 2016, Concrete Canvas® GCCM* (CC) was used to line a series of channels on the site of Glyncorrwg Colliery, a disused mine which closed in the 1970s, in the Afan Valley, South Wales. The channels carried water down through the mine site, running parallel to the river Corrwg, and had become heavily contaminated with bright orange ochre deposition. The channels had previously been lined with an LLDPE liner protected by a nonwoven geotextile, however, this had severely degraded and would lead to further water contamination. Vegetation had also established and overgrown, risking overspill. As a result, CC was chosen as a channel lining and weed suppression solution due to its low maintenance properties and ease of install.

Sections of the drainage channels were dammed off with water flow directed further downstream, and anchor trenches were cut into the shoulders of the channels in preparation for installation. The channels were then cleared of debris and deteriorated sections of geotextile. The CC was unrolled and cut to profile length, and positioned with overlaps of 100mm. The CC was then fixed using steel ground pegs inserted in the anchor trenches which were backfilled, and the overlaps were jointed using stainless steel screws at 200mm intervals. Hydration was achieved using a bowser and hose.

A total of 1,640m² of CC8™ were installed over 4 weeks, in often severe weather and over poor ground conditions. Following the success of the installation similar schemes within the region are being considered by the Coal Authority for remediation using CC.

*Geosynthetic Cementitious Composite Mat





The original channel was contaminated with ochre discharge from the mine



The team cleared the channel of debris and drained it prior to installation



The CC was delivered in bulk rolls



Screws were used to join the CC layers



The completed installation



A return visit to the installation

Project Info



01 / 08 / 16



CC8™ Bulk Rolls



11,125m²



Transverse layers



Central Vancouver Island,
Canada



Nuna Innovations Inc.



CC lining of a large
diversion channel at an
underground zinc and
copper mine in Canada.



Nuna Innovations Inc.



Completed installation

In August 2016, Concrete Canvas® (CC) GCCM* was used to line a channel at a zinc and copper mine on Central Vancouver Island, Canada. The channel, which transports clean water from the hillside to a lower creek, was originally lined with shotcrete which had begun to degrade. It was also in need of enlargement in order to manage fast water flow. Alternatives such as shotcrete were considered, but the demands of the project, and a need for the water to be diverted while works were underway, meant CC was chosen instead due to its quick installation times. The works were carried out by Nuna Innovations Inc. for an undisclosed client.

Prior to excavation of the new channel, all trees, brush and other vegetation in the area were removed, and standing water was drained away. A new, significantly wider channel was then created, measuring 735m in length, between 5–8.5m wide, with an average depth of 1.5m. CC8™ was delivered to site in bulk rolls which were positioned along the channel to save time during the installation. A transverse layup was used, allowing the CC8™ to be cut to size and minimising wastage. Layers of the CC were overlapped by 100mm in the direction of water flow and secured using 1.5m earth percussion anchors with 3mm stainless steel cables every metre and eight one-inch screws at 150mm intervals. The CC was then pinned into anchor trenches, which were backfilled prior to hydration.

A total of 11,125m² of CC8™ was installed in 6 weeks by a team of six in temperatures of up to 34°C. The client was impressed with the product, ease of install and lack of need for specialist training or equipment.

*Geosynthetic Cementitious Composite Mat





The original concrete lined channel



The CC was unrolled from a spreader beam mounted to an excavator



Hydration



The CC channel was wider than the original to accommodate fast water flow



Birdseye view of completed installation



Drone captured image of installation site (channel far right)

Project Info



01 / 10 / 14



CC13™ Bulk Rolls



1680m²



Transverse layers



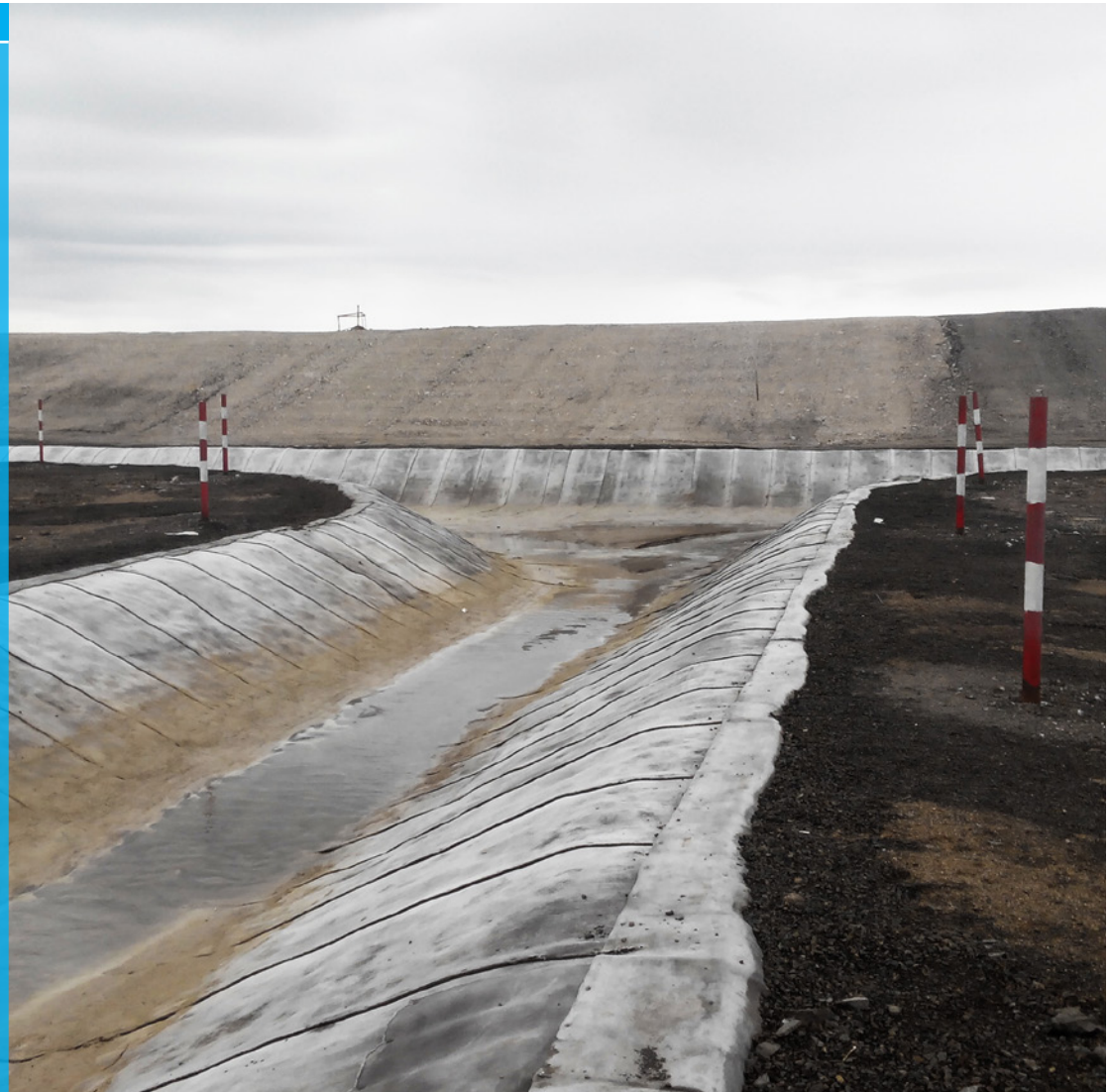
Mirny Airport, Yakutia,
Russia



Undisclosed



CC13™ was used to
improve an existing
water management
system.



Completed installation

In October 2014, Concrete Canvas® GCCM* (CC) was used to line a newly excavated drainage channel at Mirny Airport, Yakutia, Russia. The airport is the main means of transport for Mirna Diamond Mine. Due to the small window of dry weather conditions in the area, speed of install was vital. The area is also very cold during that time of year, which would have brought work to a halt with traditional concreting methods, however, CC has been successfully tested against freeze-thaw weathering cycles, making it the only option.

24 bulk rolls of CC13™ were delivered to site and transported using a forklift. The channel was excavated using a 20T excavator, and an anchor trench were created at the crest of the channel to allow the CC to be buried to prevent undermining. The CC was mounted onto a spreader beam, hung from a crane and unrolled across the channel before being cut to profile length with hand tools to minimise wastage. The CC was laid transversely, with layers overlapped by 100mm in the direction of water flow and screwed at 200mm intervals with 30mm screws. The CC was further fixed with 400mm ground pegs at the crest before an additional longitudinal layer was laid along the edge of the anchor trench before being secured and backfilled as an extra undermining precaution.

1,680m² of CC13™ was installed in 3 days, making it 10-times faster to install than traditional methods. Installation was carried out in temperatures of 5°C with night temperatures reaching -4°C. The client was satisfied with the product and is considering placing another order the next construction period.

*Geosynthetic Cementitious Composite Mat





Channel before installation



The CC was delivered to site in bulk rolls



A spreader beam was used to deploy the CC



Screws and ground pegs were used to secure the CC



Hydration



Overview of finished installation

Project Info



06 / 10 / 15



CC13™ Bulk Rolls



7,000m²



Transverse layers



Vazante, Minas Gerais,
Brazil



Cabral Engenharia



CC was used to line
drainage ditches and
a drainage lagoon
constructed to decant
alkaline mine water.



Completed installation at Minas Gerais, Brazil

In October 2015, Concrete Canvas® GCCM* (CC) was used to line a newly constructed drainage lagoon at Votorantim Metais Zinco mine in Vazante, Minas Gerais, Brazil. Alkaline mine water would be transported to the lagoon via a series of drainage ditches, also lined with CC, to be decanted and treated. Installation was carried out during the rainy season, which would have led to disruption had shotcrete been used. However, CC can be installed during inclement weather allowing for fast and easy installation. The material was supplied by SPI Engenharia e Representações.

Vegetation was removed from the area and the lagoon slopes graded and compacted in preparation for the installation. Bulk rolls of CC13™ were delivered to site and mounted onto a spreader beam, unrolled down the lagoon faces and cut to profile length. Layers were overlapped by 100mm and pegs inserted through overlaps at the crest. Everbuild Clearfix adhesive sealant was then used to join the overlaps and joints were compressed. Hydration was then achieved using a water truck and hose. 7000m² of CC13™ were installed in two months in inclement weather and temperatures of up to 42°C. The client was impressed with the CC and its ease of install.

"We were very happy with the lagoon lining, this installation will become a reference within the Votorantim Group."

Sebastiao Alves da Silva
Site Operations Manager, Votorantim Metais

*Geosynthetic Cementitious Composite Mat





Lagoon before preparation



CC13™ was used to line the lagoon



The project took a total of two months to complete



The adjoining channels were also lined with CC13™



Protruding pipes were easily negotiated by cutting the CC with hand tools



Completed installation