CONCRETE CANVAS®
Concrete on a Roll

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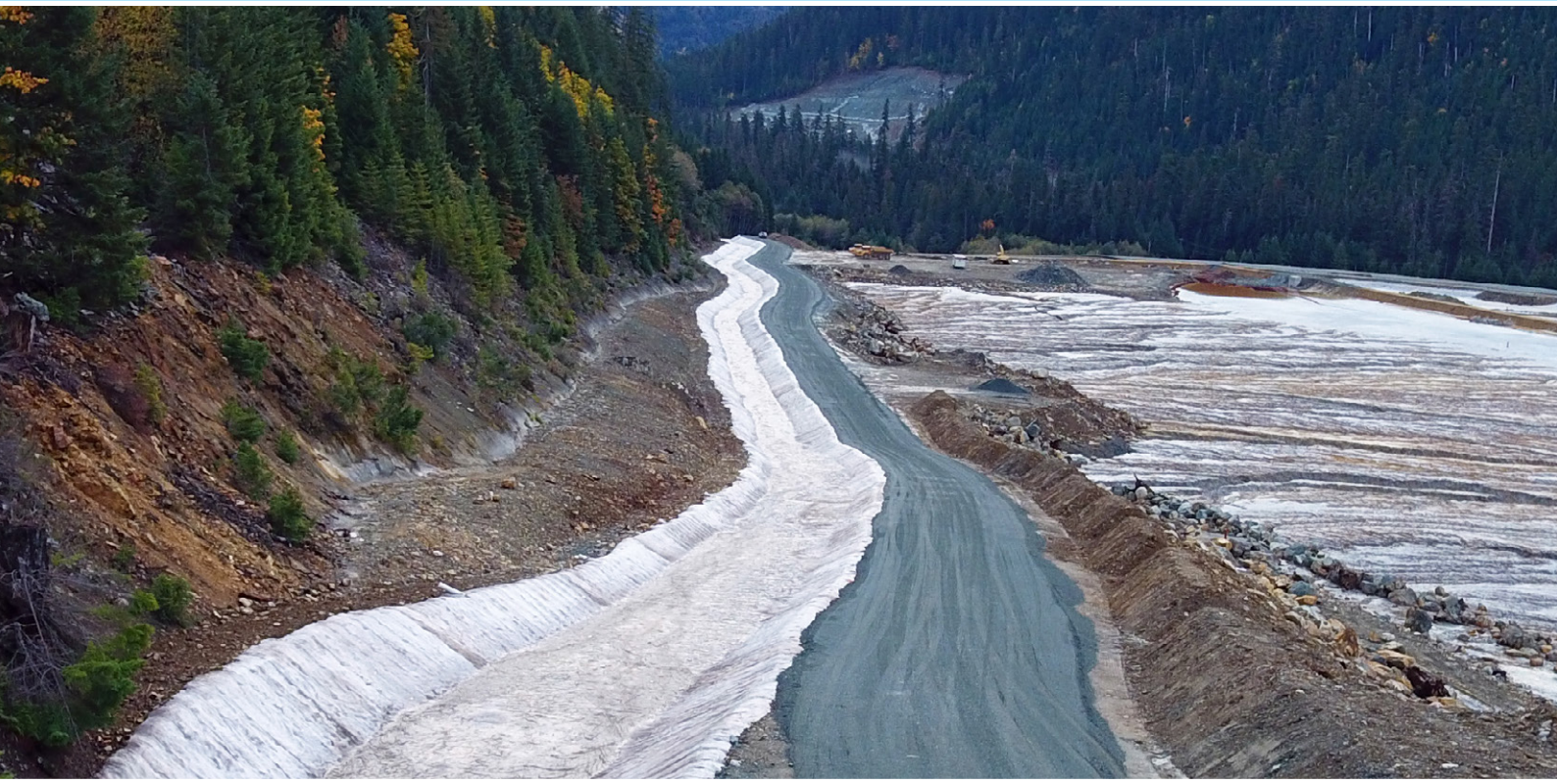
MADE IN UK



CONCRETE CANVAS®

Concrete on a Roll

CHANNEL LINING

CASE STUDIES

RAIL · ROAD · MINING · PETROCHEM · AGRO · UTILITIES · PUBLIC WORKS · DEFENCE · DESIGN · SHELTER

GROUND ENGINEERING AWARDS 2017
Winner
Technical Innovation Award

ice award winner 2017
Institution of Civil Engineers
ICE Wales Cymru Project Awards
Innovation Award
ICE Wales Cymru Awards 2017

THE SUNDAY TIMES FAST TRACK 100 2014
2014 Fast Track 100
16th fastest growing company in the UK.

2014 Queen's Award for Enterprise in Innovation

2013
Macrobert Award
Finalist

2013 Innovation Award Winner
Railtex Exhibition

2012 R&D 100
50th ANNIVERSARY
2012 R&D 100
Award winner
R&D Magazine

Material ConneXion®
MEDIUM AWARD
MATERIAL of the YEAR
2009 Winner
Material Connexion Medium Award
Material of the Year

07
D&AD Yellow Pencil Award
Winner
Product Design

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CHANNEL LINING

Project Info

- 01 / 08 / 16
- CC8™ Bulk Rolls
- 11,125m²
- Transverse layers
- Central Vancouver Island, Canada
- Undisclosed
- CC lining of a large diversion channel at an underground zinc and copper mine in Canada

Completed CC lined channel with high flow 5 weeks after installation

In August 2016, Concrete Canvas® (CC) GCCM* was installed as a protective liner for a large diversion channel at an underground zinc and copper mine on Central Vancouver Island, Canada.

The diversion channel, which conveys clean water from the hillside above to a lower creek, was originally lined with shotcrete but the material had begun to degrade over time. It was recommended that the diversion channel should be enlarged and realigned to effectively handle the high-water volume and velocities.

Alternative options such as replacement shotcrete were considered, however CC was specified due to its ability to cope with high water velocities, its ability to accommodate variance in profile and the ease of repair if future damage occurred due to falling trees or large boulders from the above hillside. Since the water was diverted away from the channel during installation, the speed of installation was key as the diversion pipes wouldn't be able to handle the high-water volume expected to begin in early October. The use of CC meant measures could be in place much faster than using conventional concrete or shotcrete. The fibre reinforcement inherent in CC gives a durability and design life well above competitor geomembrane products, whilst the integral PVC backing ensures minimal water loss in the diversion channel.

The channel was designed to handle water velocities of up to 20m/s with slopes as steep as 16% and 20% in some sections.

*Geosynthetic Cementitious Composite Mat

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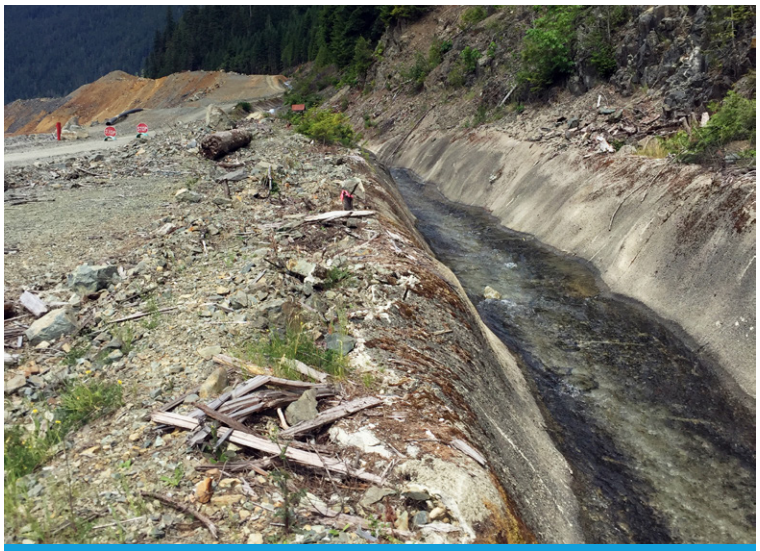
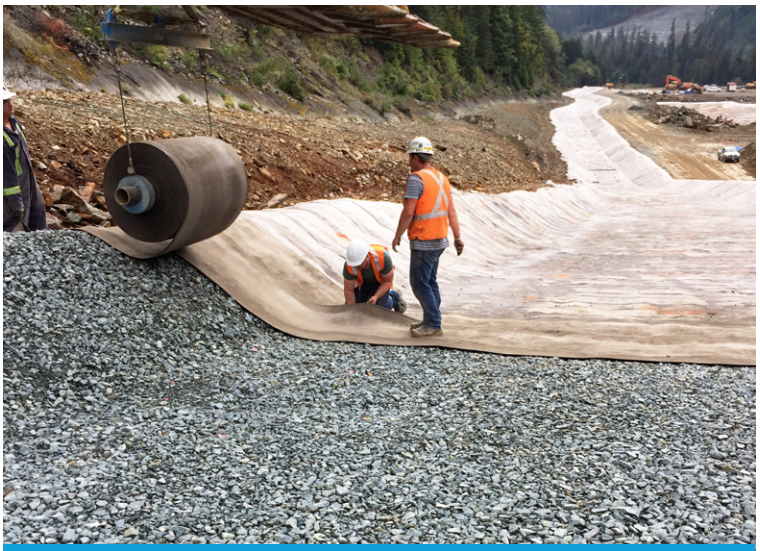
CHANNEL LINING



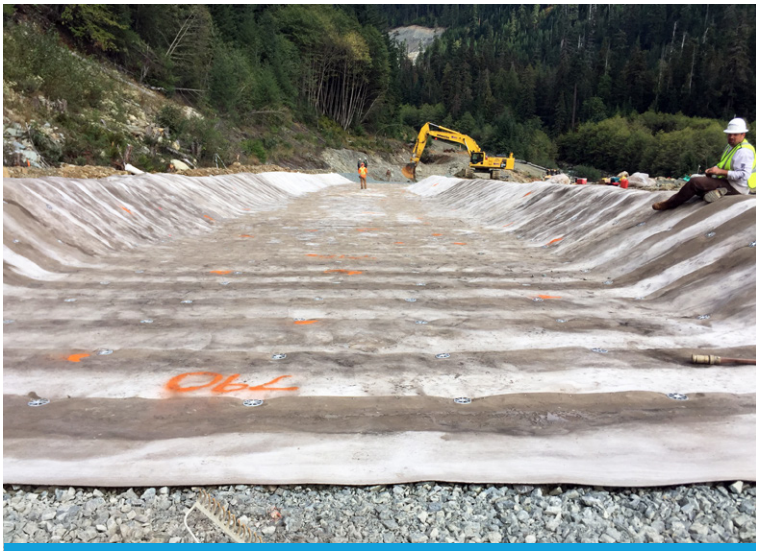
Previous shotcrete lined channel showing signs of degradation



Dispensing of bulk roll CC8™ via spreader beam mounted onto excavator

Anchor trench prior to backfilling

Screwing overlapped joints at 150mm centres



Spacing of percussion anchors through overlapped CC8™ layers

Hydration of the CC layers

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Aerial view of installation

Aerial view of the mouth of the channel showing transition anchor trench

Prior to excavating the new diversion channel, the main contractor completely removed and disposed of all trees, brush and other vegetation growth in the area. Any standing water was drained away from the exposed excavated areas to prevent pooling and infiltration.

Prior to installation, a new channel was created which was significantly wider than the original shotcrete lined channel. The final channel measured 735m in length, 5-8.5m wide with an average depth of 1.5m with a 2:1 side slope. Due to the anticipated flow velocities, 8mm thick Concrete Canvas (CC8™) was specified. The 125m^2 CC8™ bulk rolls were delivered to site and positioned strategically along the channel to save time and minimise handling and vehicle movement during installation.

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Aerial footage showing completed CC lined channel in relation to the mine

To account for the variation in profile width, a transverse layup was specified and bulk rolls of CC8™ were deployed from a spreader beam mounted from an excavator to unroll the material across the width of the channel. Adjacent layers of CC8™ were overlapped by 100mm in the direction of water flow and secured using 1.5m earth percussion anchors with 3mm stainless steel cables every meter along the overlaps in conjunction with 8 stainless steel 1" screws at 150mm intervals. The CC was pinned into 300mm deep anchor trenches on either side of the channel using the 1.5m earth percussion anchors. The trenches were then backfilled with material to provide a neat termination and to prevent water ingress underneath. When fixing the CC to rock in some sections of the channel, Hilti rock anchors and 600mm rock bolts were used.

The material was hydrated using a water truck and due to CC having a very low wash out rate and low alkaline reserve, treatment of the run off from installation was not required. CC has a working time of approximately two hours from hydration, meaning that work can continue even in very wet conditions. This can reduce programme disruption typically caused by bad weather when using traditional solutions.

The installation took 6 weeks to complete with an average crew size of 6 men and daily temperatures up to 34°C. The client was satisfied with the product and the minimal amount of specialist training or equipment required. In addition to this, the speed of installation meant the project was completed before the heavier precipitation arrived at the mine in early October which may have caused significant project delays.

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CHANNEL LINING

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

PRIORITY CONSTRUCTION

Overview of completed drainage channel

In June 2017, Concrete Canvas® GCCM* (CC) was used to line a series of drainage channels to divert surface water around a remediated contaminated spoil site at the Avoca Mines in Wicklow, Ireland.

Copper mining is reported to have begun in the Avoca River valley in around 1720 and continued, with interruptions, until 1982. Copper has been primarily mined along with silver and gold. The Avoca river, which flows southwards through the site, is overlooked by upland areas known as the East and West Avoca mine areas. The site in question is located to the west of a railway line at the base of the East Avoca mining area. Water discharges from the abandoned copper and sulphur mines are acidic and metal laden which impacts water quality in the Avoca River.

Civil and Environmental Engineering Contractor, Priority Construction Ltd. was appointed to carry out health and safety and remediation works at a part of the site known as Tigroney West in 2016.

As part of the remedial works, the spoil areas were regraded and capped with clay soil, and drainage channels were installed at the site boundaries to redirect upstream drainage around the capped area instead of through it. The original design used precast concrete channels and a HDPE liner/rip rap channel. In order to reduce long lead times, Priority Construction Ltd. proposed CC as an alternative. The main advantages of CC over conventional concrete are speed and ease of install, cost savings, durability and environmental friendliness, due to its low alkaline reserve and washout rate which will not bave an adverse affect on the local water course.

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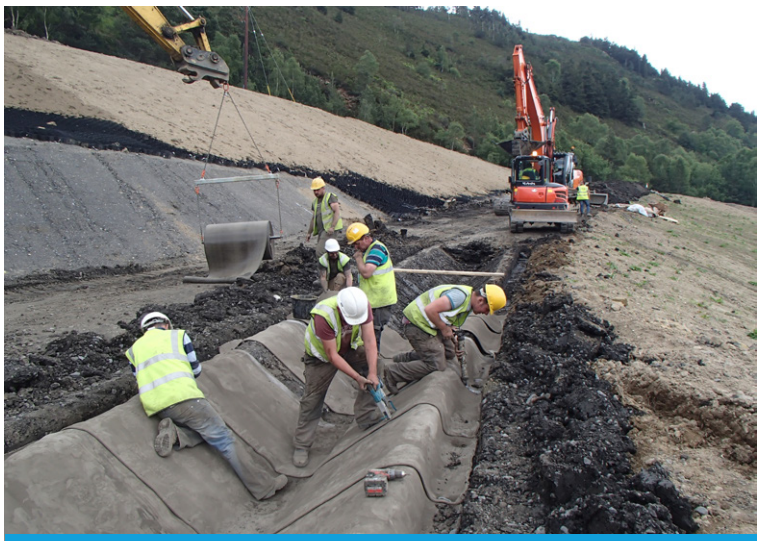
CHANNEL LINING

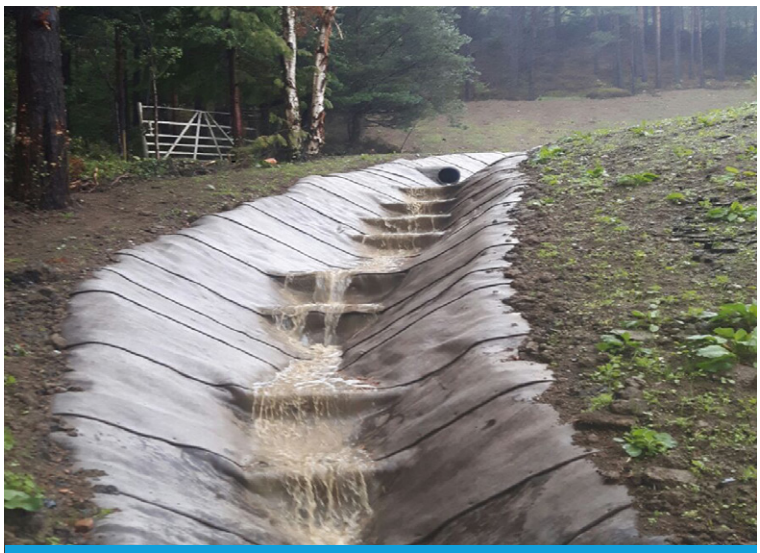
Site before installation of CC13™

Channels prior to installation



Sealing overlaps with Clearfix & securing with screws at 200mm intervals

Hydrating the CC13™



Completed installation in use

Headwall detail on upstream side

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CHANNEL LINING

Completed installation

Bulk rolls of CC13™ were delivered to site. Prior to installation, the channel was excavated and compacted to profile, and anchor trenches were created on either side of the channel to allow the edges of the CC to be buried later on. The CC was mounted onto a spreader beam and hung from an excavator, then unrolled and cut to profile length.

The CC was laid transversely to accommodate profile variations, overlapping layers by 100mm in the direction of water flow. The overlaps were sealed using Everbuild Clearfix adhesive sealant, and screwed together at 200mm intervals. The edges were secured in the anchor trenches using ground pegs before the trenches were backfilled as an extra precaution against undermining. In some areas, concrete steps were installed and CC was laid over them to dissipate the water energy. The CC was pinned into the vertical interface of the steps using Hilti anchors. The CC material was hydrated after each day's work.

In total, 1,520m² of CC13™ was installed within 2 weeks and will provide long-term scour protection and erosion control for the channels. Despite the steep and varying slopes and difficult to access areas on site, the contractor achieved installation rates of over 200m² per day. Following the success of this installation, CC is now being considered for multiple projects in the same region in both the public and private sectors.

"As the project progressed it became clear that this solution provided a number of benefits when compared with traditional methods. These benefits included speed of installation and flexibility in terms of levels e.g. where there were changes in design levels. I intend to use this product on future projects where possible."

Ken Madden
Senior Contracts Manager, Priority Construction Ltd.

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CONCRETE CANVAS®

CHANNEL LINING

Project Info

- 01 / 02 / 16
- CC8™ Bulk Rolls
- 1,250m²
- Transverse layers
- M32, Bristol, UK
- National Grid / PPV Ltd
- CC used to provide erosion protection to near road side drainage channel on M32

nationalgrid

GRAHAM CONSTRUCTION

Completed installation

In February 2016, Concrete Canvas® GCCM* (CC) was used to line a drainage channel at the side of the M32 motorway in Bristol. The installation was part of construction works for a new bridge designed for bus-only traffic and the MetroBus scheme, a series of major improvements to the transport network by Bristol, South Gloucestershire and North Somerset Councils which aimed to ease conjestion and improve public transportation services.

An existing channel was designed to accomodate surface run-off from the adjacent field and Purdown Hill. However, this had to be realigned to accomodate the new slip road. CC was chosen for this project due to its quick installation times, ability to be installed in wet conditions, and the reduction of disruption to traffic. The works were carried out by Graham Construction, and commissioned by The National Grid and PPV Ltd.

The existing poured concrete channel was removed and the new section was excavated using plant and v-bucket. The base was then scattered with aggregate before the CC was laid across the width of the channel and cut to size using a petrol disc cutter. The CC was overlapped in the direction of water flow by 100mm, and screwed together at 200mm intervals. The outside edges of the CC were then pinned in anchor trenches using 200mm steel ground pegs and backfilled. Hydration was then given via a roadside bowser and pump.

In total, over 1,250m² of CC8™ was installed in under 8 days by eight people in incliment weather. The project saved time, money and avoided signficant traffic disruption and unnecessary lane possession.

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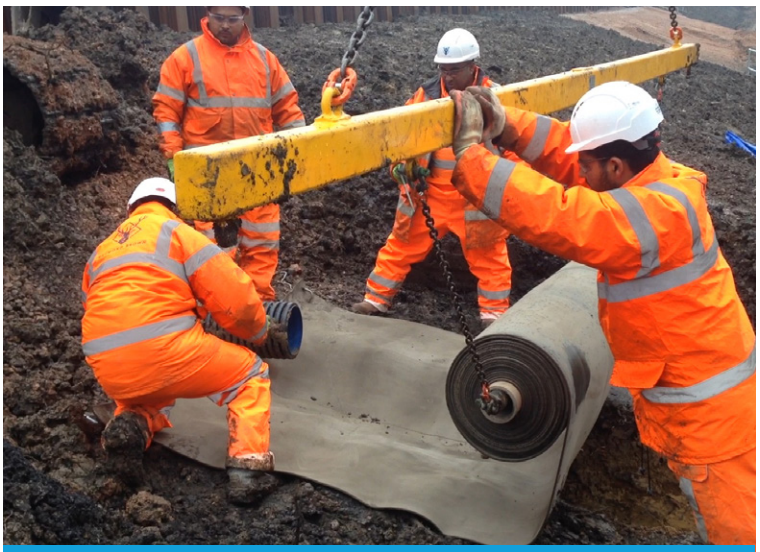
CHANNEL LINING

Channel before preparation

All vegetation and debris was removed before installation

Hand power tools were used to cut the CC



Steel pegs and screws were used to secure the CC

Hydration was given via hosepipe

Completed installation and the surrounding area

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CHANNEL LINING

Project Info

- June 2017
- CC8™ Bulk Rolls
- 1,950m²
- Transverse layers
- Fosse Way, Sherston, Phase 2, Wiltshire
- BAM Nuttall
- CC8™ used to line a drainage channel along rail cutting to prevent erosion and prevent washout failures.

Completed installation

In June 2017, Concrete Canvas® GCCM* (CC) was used to line a drainage channel at Fosse Way, near Sherston, as part of the Great Western Electrification Project. This installation followed on from the successful installation of CC on a separate section in 2014, where CC was used to line an open drainage channel to prevent erosion and reduce cutting saturation, which could otherwise have caused land slippage.

Since then, downstream of the original installation, an unlined section of the channel had eroded away, resulting in a 3m deep scour pocket occuring as water discharged from a headwall. The scour resulted in flooding of neighbouring fields and there was concern that future storm events could flood the nearby track. The works were carried out by BAM Nuttall for Network Rail, with consultation from Tony Gee and Partners LLP.

The 750mm diameter culvert was extended for 80m before a new headwall was formed. The open channel was regraded and lined with CC8™ material. Tony Gee and Partners specified CC based on the success of the existing installation from 2014. The CC channel continued for 350m before terminating into an existing sprayed concrete channel. The trapezoidal channel was formed using a ditching bucket, with a width of 700mm and 1:1 side slope and a typical depth of 1.5m.

Due to restricted access next to the rail track and a need for end-on working, the team carried out the works in 30m sections, preparing the channel and then carrying out the installation works. The channel was excavated, cleared of debris, and the CC then mounted onto a spreader beam and excavator, and laid transversely across the channel.

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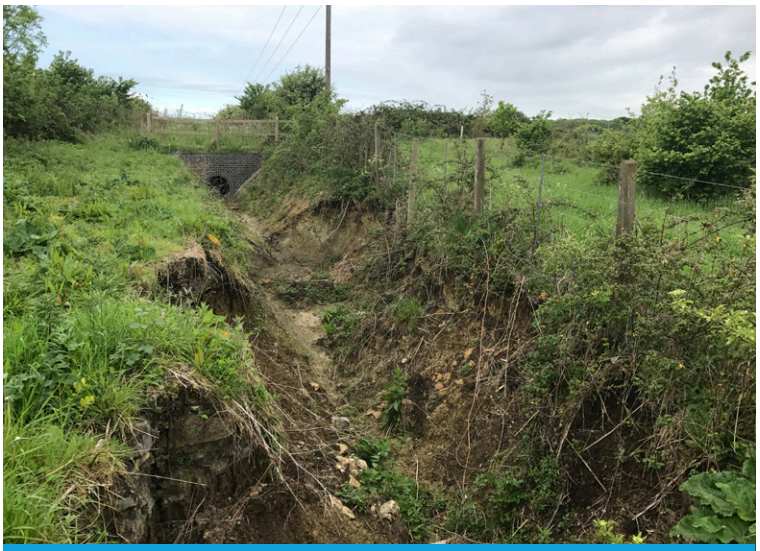
Original channel installed in 2014, 3 years after installation



Unlined channel showing 3m deep scour and erosion

First layer of CC placed on existing concrete channel

During installation, working upstream

Installed CC prior to hydration and backfilling of anchor trench

Headwall detail

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Completed installation

The team began downstream at the existing concrete channel and worked upstream towards the headwall, overlapping adjacent layers of CC in the direction of water flow. Overlapped joints were screwed together to ensure intimate contact and prevent erosion between layers. To prevent water ingress beneath the material, the edges of the CC were terminated in an anchor trench, secured using ground pegs, and the anchor trench backfilled.

At the headwall, the CC was laid underneath before being placed on top. The wingwalls to the headwall were backfilled to ensure the CC was tightly captured. All joints between the headwall and CC were finished with an adhesive sealant to prevent water ingress and potential scour.

Once installation was completed, the material was hydrated. At times the installation was carried out in 30°C heat; to ensure adequate hydration was achieved, contractor BAM Nuttall used 6L+ of water for every m^2 of CC installed. Even with restricted access and by end on working, 1950m^2 of CC8™ was installed in 3 weeks.

"The Concrete Canvas installation was completed on budget, on time and to the satisfaction of Network Rail and third parties. We will look to use Concrete Canvas on future schemes wherever possible."

Ken Buchanan
Site Manager, BAM Nuttall

"The installations at Fosse Way set the benchmark for all future Concrete Canvas channel lining works."

Mark Howells
Senior Drainage Engineer Western Route, Network Rail

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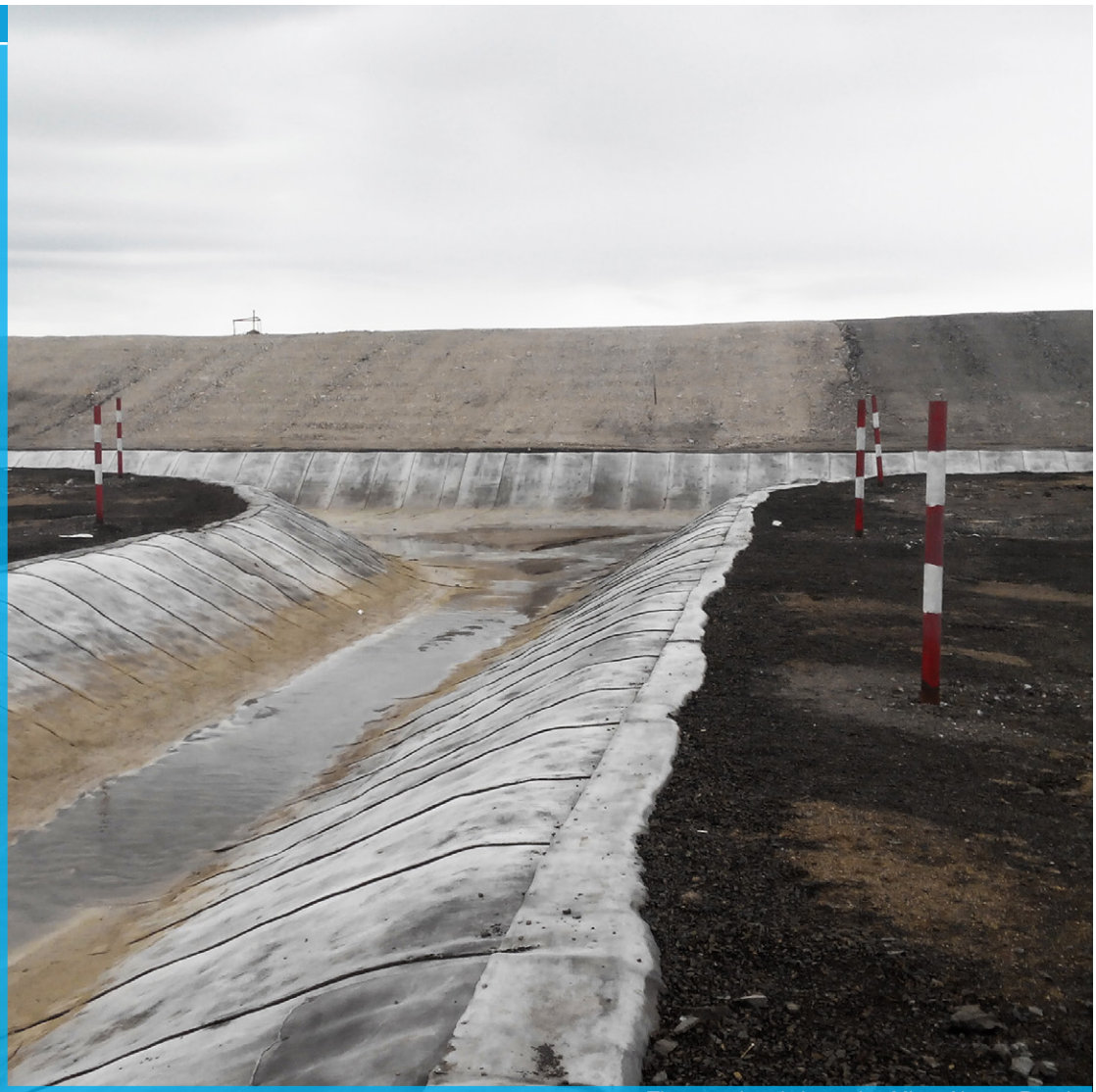
CHANNEL LINING

Project Info

- 01 / 10 / 14
- CC13™ Bulk Rolls
- 1,680m²
- Transverse layers
- Mirny Airport, Yakutia, Russia
- Undisclosed
- CC13™ was used to create a better water management system at the Mirny Airport site



The completed channel at Mirny Airport, Russia

In October 2014, Concrete Canvas® GCCM* (CC) was used to line a newly excavated drainage channel at Mirny Airport, Yakutia, Russia.

The airport serves Mirna Diamond Mine and is the main means of transport in and out of the mine due to the remote location. Yukutia's severe weather conditions mean that there are only 3 months of the year during which construction is possible, making speed of installation vital. Additionally, even during this 3 month window, the temperatures remain very low. This, along with the expense of transporting raw materials to such a remote location, rules out almost all other channel lining options.

Traditional concreting methods were considered, however these would require much longer installation times and would be halted by any precipitation or low temperatures. These methods had been tried before and proved to be unsuitable. The loose ground conditions resulted in undermining, and freeze thaw weathering was also a major issue. CC was chosen because it could be installed rapidly, in low temperatures and in adverse weather conditions, freeing up more time for other necessary construction works on site. CC is also more resistant to freeze thaw weathering due to the 3D fibre matrix within the material preventing crack propagation.

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CHANNEL LINING

The excavated channel

Bulk roll of CC13™ being lowered into position

Overlapping the CC layers by 100mm

Joining the CC overlaps using screws

Hydration of the CC

Protecting the CC with plastic sheeting

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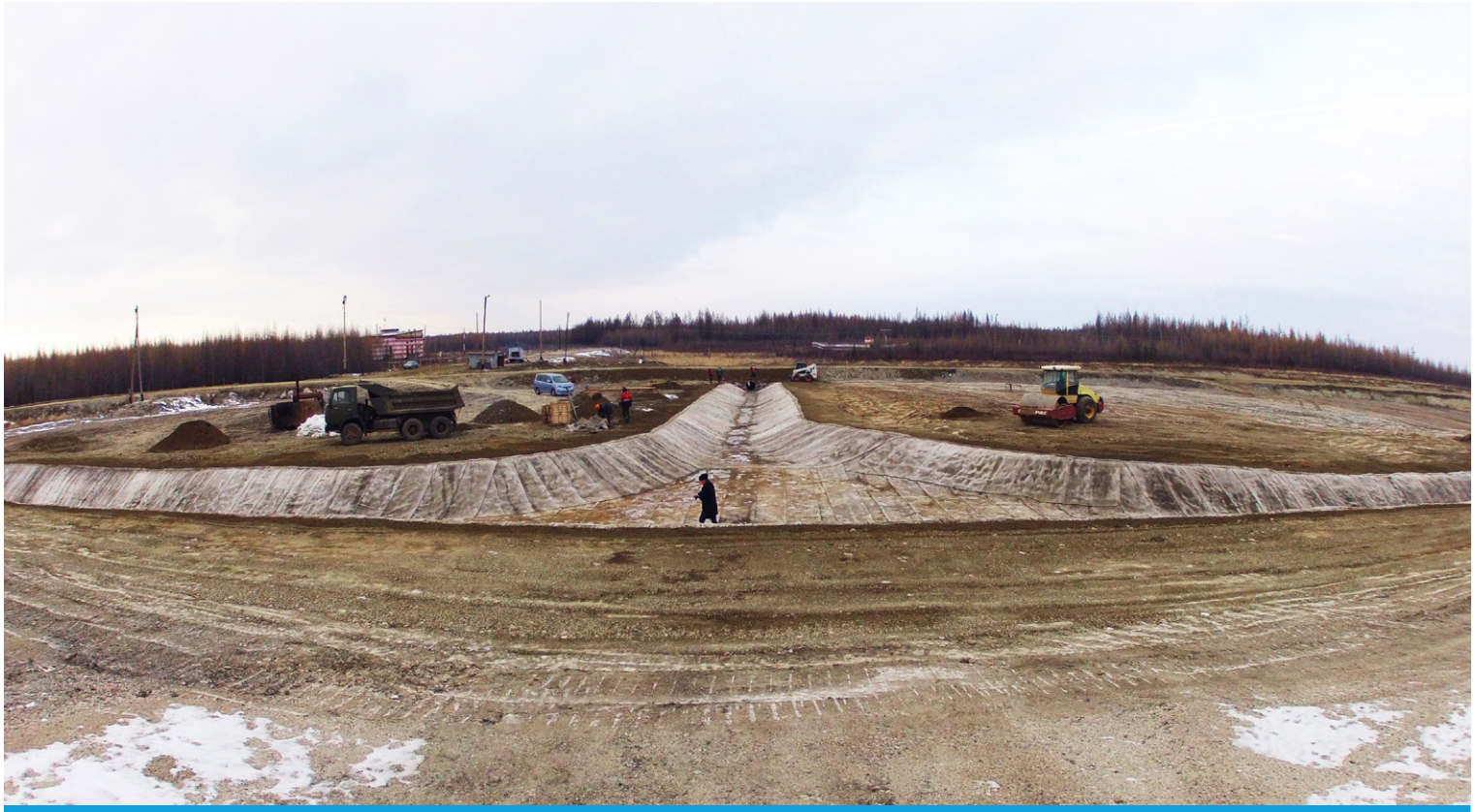

The finished project

24 Bulk rolls of CC13™ were delivered to Mirny airport and transported to site using a forklift. The channel was excavated to profile using a 20T excavator. An anchor trench was created at the crest of the channel to allow the leading edge of the CC to be buried so as to prevent undermining.

The CC was mounted onto a spreader beam and hung from a crane, unrolled across the channel before being cut to specific profile length with a utility knife, minimising wastage. The contractor laid the CC transversely, overlapping layers by 100mm in the direction of water flow. The overlaps were screwed at 200mm centres with 30mm screws. 400mm groundpegs were inserted through every overlap at the crest of the channel. One longitudinal layer of CC was used to cover the leading edge of the transverse layers and then buried into the anchor trench as an extra precaution against undermining. The CC was hydrated using a hose with spray nozzle attached and a 6000ltr water carrier. After hydration, the CC was protected with plastic sheeting due to the expected low overnight temperatures.

1,680m^2 of CC13™ were installed in 3 days, compared to the estimated 1 month it would have taken to install a traditional solution, meaning CC was 10 times faster to install. Installation was carried out during day temperatures of 5 degrees Celsius down to night temperatures of -4°C.

A material saving of around 90% was achieved, meaning a much lower logistical cost and minimal plant requirements, allowing other works to run consecutively. The client was satisfied with the product and is considering placing another order for the next construction period.

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