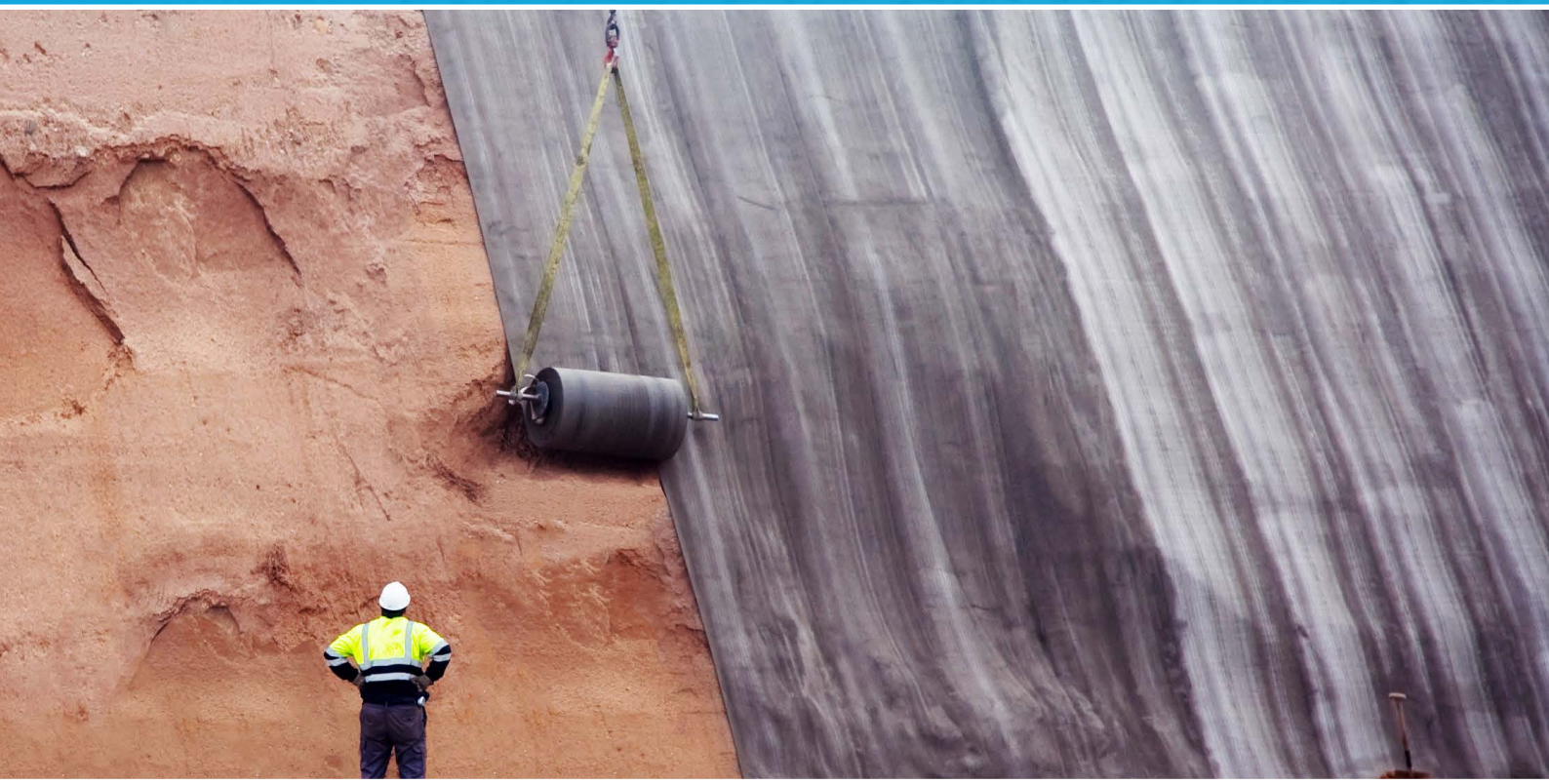
1504.EN.CP

MADE IN UK



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SLOPE PROTECTION CASE STUDIES

ROAD RAIL AGRO UTILITIES PETROCHEM MINING DESIGN OTHER

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 Award winner R&D Magazine

2011 Expert's Choice Winner Most Innovative Product

2011 Brit Insurance Designs of the Year Nominee

2009 Winner Material Connexion Medium Award Material of the Year

2007 Winner D&AD Yellow Pencil Award Product Design

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SLOPE PROTECTION

Project Info

- 05 / 2013
- CC8™ Bulk Rolls
- 335sqm
- Vertical layers
- Cloudhill Quarry, Derby, UK
- DHRA
- CC trialled as an alternative to shotcrete in providing surface erosion protection to sandstone.

Completed section of slope lined with CC5™

In May 2013, Concrete Canvas® GCCM* (CC) was trialled as an alternative to shotcrete to provide surface erosion protection to sections of sandstone overburden at a limestone quarry site in Derby, UK. Reinforcing the sandstone overburden would allow the quarry site to conduct additional excavation and blasting, maximising the potential yield of the site and helping to ensure its continued operation for an additional 10 years.

8mm thick CC (CC8™) bulk rolls were delivered to site and suspended from spreader beam equipment using a 3.5T telescopic forklift. The CC was batched to specific lengths to reduce wastage. Using a rough terrain cherry picker, each length was then initially hung from the top onto the rock face using 250mm steel ground pegs, folding the top edge by 50mm to ensure a neat termination and to reduce the risk of water ingress. Subsequent layers of CC were then positioned with an overlap of 100mm. These overlapped sections were then screwed together with 30mm stainless screws at 200mm intervals using an auto-fed screwdriver. The CC was then secured to the rock face at 2m intervals along the overlaps and at void points using 100mm long rock bolts with 20mm washers to ensure intimate contact between the CC and reduce void spaces. The CC was then hydrated using water from a 4000 gallon dust suppression tank. Post set, the CC layer was draped in Geobrugg Deltax wire mesh and the rock face stabilised using a GEWI thread bar system with load bearing plates and nuts.

Successful blasting of the rock face took place two weeks later with no signs of slope deterioration from either blast or the period of weathering since installation. **CC also proved to be 60% less expensive than the traditionally used shotcrete option and saved Breedon Aggregates over £14,000**. The 335sqm trial installation was completed in two days using a crew of three.

"The installation of CC was a new one for DHRA but proved to be quick and cost effective. There is no mess, no clean down of machinery and is I believe environmentally friendly and could prove to be a useful alternative to shotcrete in difficult access situations."

Simon Jackson
DHRA Geotechnical Ltd., Industrial Rope Access Contractors

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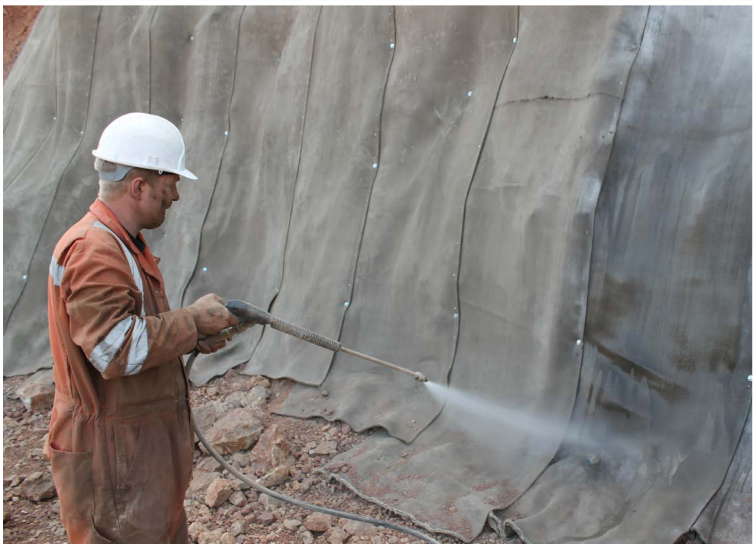
SLOPE PROTECTION

The installation site was suffering from severe surface erosion

Unset CC8™ cut to length using a disk cutter

CC8™ hung from top of rock face using 250mm steel ground pegs

Adjacent lengths of CC fixed using autofeed screwdriver



CC hydrated water from a 4000 gallon dust suppression tank

CC surviving the blast unscathed

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SLOPE PROTECTION

Project Info

- 01 / 10 / 2013
- CC5™ and CC8™ Bulk Rolls
- 15,730sqm
- Vertical layers
- Curtis Island, Queensland, Australia
- Bechtel
- Concrete Canvas® GCCM trialled as a slope protection method at an LNG site.

Completed installation

In October 2013, Concrete Canvas® GCCM* (CC) was specified as the surfacing material for 60m high cuttings surrounding Queensland Curtis LNG (QCLNG), Australia, which will be the world's first project to turn gas from coal seams into liquefied natural gas, or LNG. The project, which has been under construction since 2010, will provide cleaner hydrocarbon energy for export markets from 2014. The three (LNG) projects sit side-by-side, with the first plant scheduled for completion in 2014.

CC was specified over conventional lining solutions such as shotcrete or reinforced concrete due to the cost and time savings offered as well as additional site specific benefits, such as the difficulty of getting concrete trucks or pump trucks to site.

CC was needed to protect newly cut batters from the effects of wind and long term environmental damage, which could cause a slip. Bulk rolls of CC5™ and CC8™ were delivered to site and mounted on a spreader beam, before being cut to length. These pieces were then lifted into place on the slope using an excavator, before being fixed to the substrate using 200mm or 400mm deck spikes depending on the soil conditions. CC was then hydrated via spraying from a water truck.

A total of 15,730sqm of CC5™ and CC8™ was installed on red soil in order to protect the slope against the effects of wind and long term environmental damage.

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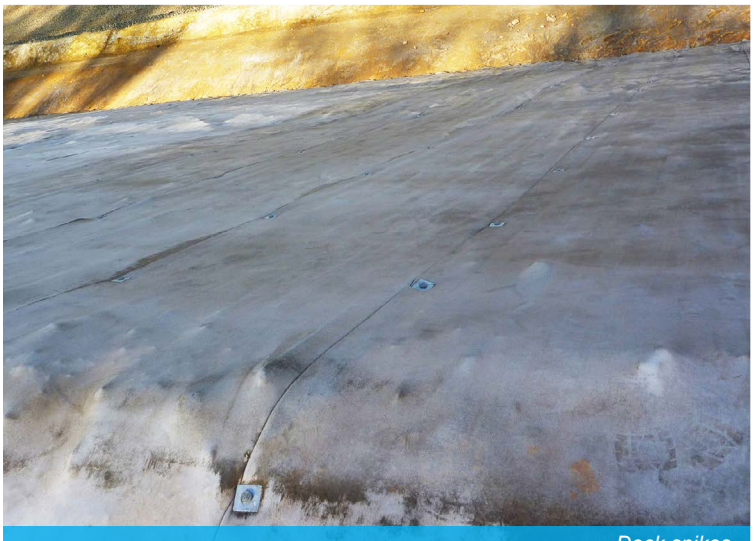
SLOPE PROTECTION

Ground conditions before installation

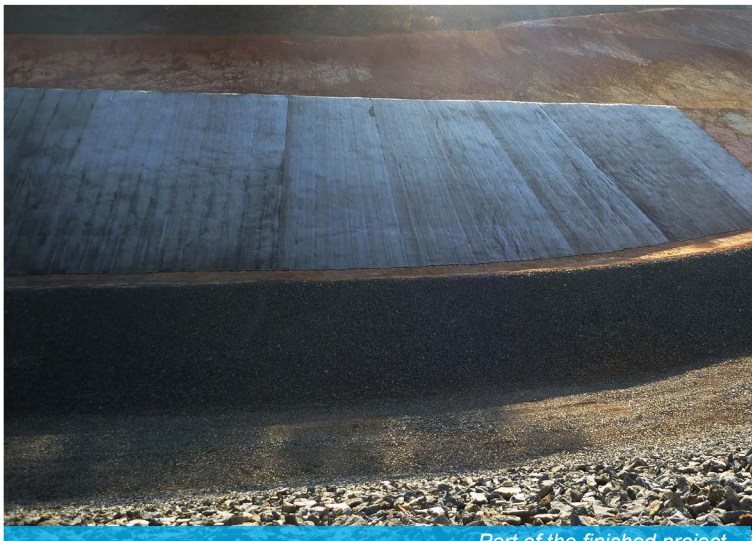
The batter

CC bulk rolls

Unrolling the CC with plant



Deck spikes



Part of the finished project

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SLOPE PROTECTION

Project Info

- 21 / 12 / 2010
- CC8™ bulk rolls
- 2500sqm
- Transverse layers
- Alcobendas Station, Madrid, Spain
- ADIF

- Slope stabilisation of railway embankments on a high speed rail line.
- Installation of CC allowed train traffic to continue without disruption of service.
- 2500sqm CC8™ used
- Installed at a rate of 450m/day

TDH

Dispensing CC8™ bulk rolls from spreader beam equipment

In December 2010, ADIF, the Spanish authority responsible for railway infrastructure management, specified Concrete Canvas® GCCM* (CC) to be used as slope protection for a railway station in Madrid. CC was chosen to address years of erosion and instability issues affecting the entrance of Alcobendas tunnel station. Erosion of the steep railway slope embankments had caused silting at the drainage pumps in the tunnel entrance. Shotcrete had been used twice previously but presented several problems with installation and durability.

2500sqm of CC8™ were specified and delivered on site in bulk rolls, which were dispensed from spreader beam equipment and plant. The CC was fixed at the top of the 12m slope using galvanised steel pegs whilst adjacent CC layers were screwed together. A shallow surface runoff ditch was formed at the toe of the slope. Train traffic was not affected during the works: the station was able to remain open during the installation as there was no risk of discharge from material onto the tracks, often a problem with sprayed concrete techniques.

Installing at a rate of over 450sqm/day, the project was completed in under a week and was 70% quicker to install than if shotcrete or gunite had been used.

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SLOPE PROTECTION

Project Info

- 12 / 10 / 2012
- CC5™ bulk rolls
- 255sqm
- Vertical layers
- Bogotá D.C. , Cundinamarca, Colombia
- MERT S.A.S
- Slope stabilization project. CC was used to prevent surface erosion and degradation which was causing material to fall into a nearby road.

Completed CC lined slope

In October 2012, Concrete Canvas® GCCM* (CC) was specified as a hard armour surface coating to prevent further weathering erosion of a roadside embankment in Cundinamarca, Colombia. The slope had degraded to the point that traffic on the nearby road was at risk from falling rock and debris. Shotcrete or mortar slab had originally been considered for the project, but CC was chosen due to its speed and ease of installation, homogeneity and consistency compared to shotcrete. It also allowed greater flexibility in terms of site access, as the installation team were unable to use heavy plant at the crest of the slope.

255sqm of CC5™ were delivered on site in bulk rolls which were then cut into 12 linear metre lengths to match the average height of the slope. The rolled lengths were mounted onto a spreader beam which was towed to the crest of the slope with ropes. The CC was then fixed securely to the crest with 250x12mm steel ground pegs into the soil substrate before unrolling down the embankment. Sikaflex 1A and CT1 adhesive were used to fix the CC to several PVC drainage tubes protruding from the slope, whilst 30mm screws were used to join adjacent overlapping layers of CC. Hilti expansion anchors were used to fix the CC to the slope in overhanging sections to avoid voids between the material and the uneven profile. Hydration was via a pump and bowser as there wasn't an available nearby water supply.

The installation team were impressed by the speed and ease of installation of CC on a site with heavily restricted access. The client was pleased with the aesthetic quality of the finished project and how the drape characteristics of CC5™ resulted in an organic, rock-like appearance. A 5-man installation team were able to complete the entire 255sqm installation, including site preparation, in 8 days without specialist training or plant equipment.

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SLOPE PROTECTION

Project site before CC installation

Site preparation including removal of vegetation and loose substrate

Pre-cut 12 linear metre lengths of CC on rope mounted spreader beam

CC secured at top of slope with anchor trench and ground pegs

CC overlaps double screwed at 120mm intervals

The finished, painted slope

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