CONCRETE CANVAS®
*Concrete on a Roll*

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# CONCRETE CANVAS®

*Concrete on a Roll*

# AGED CASE STUDIES

RAIL ROAD MINING PETROCHEM AGRO UTILITIES PUBLIC WORKS DEFENCE DESIGN SHELTER

Winner
Technical Innovation Award

Innovation Award
ICE Wales Cymru Awards 2017

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

2009 Winner
Material Connexion Medium Award
Material of the Year

D&AD Yellow Pencil Award
Winner
Product Design

**www.concretecanvas.com**

# AGED INSTALLATIONS

Accelerated age testing has been conducted by Concrete Canvas Ltd on Concrete Canvas® GCCM* (CC) products: CC5™, CC8™ and CC13™. Testing is based on British Standard BS EN 12467:2004 and is designed to assess the effects of environmental degradation on fibre cement sheets.

CC has passed the Category A Weather Resistance requirements - the highest level of weather resistance for fibre cement sheets "which are intended for applications where they may be subjected to heat, high moisture and severe frost".

Based on these test results CC can be expected to resist normal weathering for a minimum of a 50-year life for outdoor installations in a UK climate. (See 'CC Aged Certification' document.)

When used for channel lining, untreated CC will naturally 'green' over time as the textured top surface allows moss growth when installed in the right conditions. The fibre-reinforced concrete layer will prevent root-growing vegetation, which would otherwise restrict water flow and increase maintenance costs. CC also provides an effective erosion control measure when used in slope protection, preventing scour whilst remaining aesthetically sympathetic to the local environment.

**The following pages show examples of Concrete Canvas® products at various stages of the 'aging' process.**


*Lunan Bay - Channel Lining*

A combination of surface water and silt run-off from adjacent fields had resulted in a landslip onto a section of the East Coast Rail line in Angus, Scotland. In addition to the resulting disruption to passengers and services, the slip also threatened the biodiversity of the award-winning 'Blue Flag' beach front, just a quarter of a mile South of the site.

Concrete Canvas® (CC) was used to line a 100 linear metre drainage channel near the track to transport surface run-off from the adjacent potato field.

Various options were considered by the design and build contractor, QTS, including pre-cast and poured concrete, but both would have required the construction of haulage routes to site and the use of heavy plant. QTS liaised with Network Rail and specified CC as a lining solution for the newly excavated channel.

Eight years after installation, the CC was found to be performing well, and showed considerable moss and algae growth established on the fibrous top surface of the material, creating a mottled brown appearance and making it more homogeneous with the surrounding environment.

*Geosynthetic Cementitious Composite Mat

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# AGED INSTALLATIONS


*Church Village, UK - Channel Lining*

The Church Village Bypass scheme involved the construction of a new bypass road to ease congestion through Church Village, near Pontypridd in South Wales. Alongside these works, various new pieces of infrastructure were constructed, including bridges, footpaths, roundabouts and a subway.

Concrete Canvas® (CC8™) was chosen by the contractor, Costain, for lining a purpose-built drainage and water management channel along the crest of a slope which runs adjacent to an existing road below the bypass. CC met requirements for alternative materials which would minimise the environmental impact due to its eco-friendly properties.

Nine years on, the CC is showing significant algae and moss growth, and is successfully continuing to suppress vegetation growth within the channel, despite established and overgrown vegetation and weed growth around the channel.


*Marine Terminal Facility, UK - Bund Lining*

In November 2012, CC was used to line refurbished secondary containment bunds at a Marine Terminal Facility in the UK. The bunds surrounded a series of tank farms storing hydrocarbons as part of the larger onshore facility. CC provided hard armour weathering protection, effective weed suppression, protection against animal damage and additional levels of containment and fire protection.

A return visit five years on showed the CC was still performing well and had darkened as a result of the settlement of dust and the growth of dark mosses on the material's fibrous top surface.

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*Alcobendas, Spain - Slope Protection*


In December 2010, ADIF, the Spanish authority for railway infrastructure management, specified CC for slope protection at a railway station in Madrid. CC was installed along the length of slopes on either side of the track to provide erosion protection and address associated issues affecting the entrance of a tunnel station.

Six years after the completion of this installation, the site was re-visited to assess CC's performance. The material was found to be performing exactly as designed, and was providing effective erosion protection to the slope and in turn protecting the rail line and its users. Some changes in colour were evident, with minor 'greening' due to algae growth in places.

*Senghennydd, UK - Channel Lining*


In 2014, CC was installed on a former ash tip site near new housing as a channel lining solution. The installation was carried out by representatives from Concrete Canvas Ltd and was observed by representatives from French Rail authority SNCF who were considering specifying the material for a project in France.

The site was re-visited five years after the installation to assess its performance. Despite the growth of new trees and other vegetation, and the addition of a small foot bridge, the material is intact and performing as designed. The CC has bedded in well, blending in with its surroundings with moss and algae growth covering the material's surface.

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*Glyncorrwg, UK - Channel Lining*

In January 2016. CC was used to line a series of drainage channels at Glyncorrwg Colliery, South Wales and provide scour protection to the system. The site required an effective and impermeable solution which could contain and effectively transport ochre-contaminated water on the site. The client also required a solution which could provide UV, puncture and wear resistance as well as vegetation suppression as their previous solution, an LLDPE liner, had failed as a result of exposure to these conditions and became overgrown and blocked with vegetation growth.

Three years on, the material has greyed due to the environmental conditions of the site and is still providing effective water management, preventing the contaminated water from adversely affecting local watercourses and wildlife.


*Abu Dhabi, UAE - Bund Lining*

In January 2016, CC was specified to line a pipe protection berm in Abu Dhabi, UAE to provide erosion prevention. The bund was at risk of weathering erosion, due to the fine sand-based substrate, which could have led to exposure of the gas transport pipe beneath. This risk to the infrastructure and the environmental damage that would occur as a result of damage to the pipe. A total of 3000m$^2$ of CC5™ was installed in this project.

Three years on, the material is performing well in the arid climate of Abu Dhabi and the surface of the material is showing no signs of UV degradation or evidence of weathering erosion.

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*Corbridge, UK - Channel Lining*


In January 2016, a steep slope overlooking part of the Newcastle to Carlisle line, between Corbridge and Riding Mill, suffered significant failure and caused a landslide, covering the tracks and closing the line. Following initial works to stabilise the slope and reopen the track, CC was specified to line a drainage channel at the crest. The channel was excavated at a greater depth than the original drainage system in order to ensure effective management of the water volumes flowing through it and reduce the risk of future ingress and slip.

Two years on, CC was found to be performing as designed and is beginning to 'green', with algae and moss growth establishing itself on the fibrous top surface of the material.

*Kyoto, Japan - Weed Suppression*


In July 2016, a trial was carried out on two sites in Kyoto Tamba-cho in Japan, to verify the strength of CC joints and establish CC's effectiveness as a vegetation control method for invasive plant species, including Japanese Knotweed.

The material joints were placed over sites where Japanese Knotweed shoots had been identified, and the sites monitored for knotweed shoot protrusions through the joints over the course of two years. CC was found to be an effective suppressant against knotweed, with no evidence of growth through the joints. The site was re-visited around six months after the end of the trial; CC was found to still be performing well, with no evidence of weed growth through the material despite a significant amount of growth around the installation and on the rest of the site.

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*Jubilee Lakes, UK - Channel Lining*

In January 2018, CC was installed as an erosion protection solution for a channel carrying water from an outfall pipe to a silt trap lagoon before entering the Jubilee Lake in Royal Wootton Bassett, Wiltshire, UK.

CC replaced a concrete block system which had eroded, leading to the formation of scour pockets. The full 75m long channel was lined and works completed within 3 weeks.

A year on, the CC had evidently bedded in quickly, with evidence of algae and moss growth on the material's fibrous top surface. This was particularly evident on the base of the channel due to typical low flows.


*Cooks Bridge, Midhurst, UK - Culvert Lining*

The Cooks Bridge culvert is situated below a highway, providing the only passage under the road for a stream. The existing corrugated steel culvert had corroded over time due to sediment and gravel transported thorugh the structure in high flow conditions. The flow of water started to erode the soil beneath the structure, affecting the long-term performance of the culvert. CC13™ was specified to provide scour protection to the culvert and increase the structure's working life.

One year on, the material is successfully protecting the corrugated steel culvert. There is evidence of some build up of silt on the culvert floor, however the protection provided by CC means this will not cause any further damage to the structure.

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## Evaluation of retained strength of aged CC8, installed as a channel lining after 7 years of use

Samples of CC8™ material were removed from a section of channel which had been in place for 7 years in a UK climate. The section of channel identified was jet washed and labelled prior to cutting with a disc cutter. The channel sections removed were designated as being from the bottom (invert), sides or shoulders of the channel.

The section was cut into test bars and mechanically tested using a flexural bend test to ASTM D8058 and the 1st crack strength and ultimate bending strength recorded.

*Fig. 1: Section of channel identified for testing*

*Fig. 2: Section of channel prior to cutting*

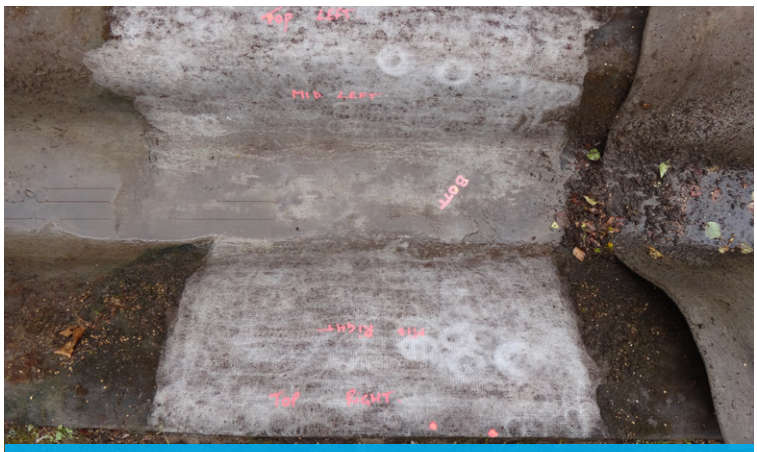

*Fig. 3: Labelling of section prior to cutting*


*Fig. 4: Channel section after cutting*

## Results

| | Channel Invert (MPa) | Channel Sides (MPa) | Channel Shoulders (MPa) | Channel Average (MPa) | 28 day Control (MPa) | Residual Strength (%) |
|---|---|---|---|---|---|---|
| **1st Crack Strength** | 6.76 | 6.35 | 4.97 | 6.03 | 4.41 | **137%** |
| **Ultimate Failure Strength** | 11.06 | 10.67 | 10.86 | 10.86 | 9.00 | **121%** |



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