SLOPE PROTECTION

Project Info

- 09 / 12 / 2020
- CC5™ Batched Rolls
- 230m²
- Vertical layers
- Old Whittington STW, Chesterfield, UK
- Ken Rodney Construction
- CC5™ was used to provide hard armour protection to a slope situated alongside a sludge cake storage facility
- Replacing 100mm of poured concrete to provide a 40% carbon saving

YorkshireWater

KEN RODNEY CONSTRUCTION

Completed slope protection installation at the Old Whittington Sewge Treatment Works

Project Introduction

In August 2020, Concrete Canvas Ltd was approached by Ken Rodney Contractors regarding a scheme where a section of slope at the Old Whittington Sewage Treatment Works in Chesterfield required a hard armoured protective layer to prevent cake from coming into contact with the soil on the slope.

Old Whittington STW processes sewage from 100,000 customers within the areas surrounding Chesterfield. As part of the process the site creates dry sludge mix known as cake; a semi dry mix that, after the treatment process has taken place, can be stored on site and transported away from the STW via bulk haulage to act as fertiliser in local agriculture.

The storage area at Old Whittington STW is connected to the treatment plant via a number of screw conveyors which terminate in a storage shed at the top of the site. Under the screw conveyors the slope was unlined and there was a risk of cake spillage onto the slope surface during maintenance activities. Yorkshire Water wanted to ensure the area underneath the conveyors was a controlled area in line with permit conditions.

One of the original designs for the slope involved mass pouring of concrete over the area; however, the time required for installing the poured concrete, curing time and potential mess and emobied carbon impact involved meant that ultimately Concrete Canvas® (CC) GCCM* was chosen as an alternative.

*Geosynthetic Cementitious Composite Mat

CONCRETE CANVAS®
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Installing Concrete Canvas®

The works were carried out by Ken Rodney Construction for the client, Yorkshire Water Services. CC5™ batched rolls were chosen for this project in order to accommodate sensitive infrastructure on site, and to eliminate the requirement for plant on site during the installation.

Prior to installation, the slope was completely regraded using type 2 hardcore. This was then compacted using a whacker plate to ensure a smoother, more uniform surface on which to install the CC.

The batched rolls of CC5™ were deployed from the top of the slope where the material was secured to a concrete upstand using a termination bar and stainless-steel fixings. The material was rolled vertically down the slope face and terminated into an anchor trench at the toe. Subsequent layers of material were laid so as to overlap the last by 100mm and fixed along the overlaps using sealant and screws positioned in a zigzag formation.

Once deployment and fixing of the material was completed, the toe anchor trench was filled with poured concrete to provide a neat termination between the CC edges and a concrete plinth. One of the slope sides was terminating into soil, so the CC was captured within a pre-dug anchor trench, which was then backfilled with soil. The other side of the slope was terminating against newly installed concrete steps; here the CC was secured in place with termination bars and mechanical fixings. Termination bar was also used to secure the CC against the plinth upstands to prevent water and cake ingress.

Slope prior to installation

Type 2 hardcore was used to regrade the slope

The hardcore was compacted to provide a uniform installation surface

CC edges terminated against concrete upstand at the crest

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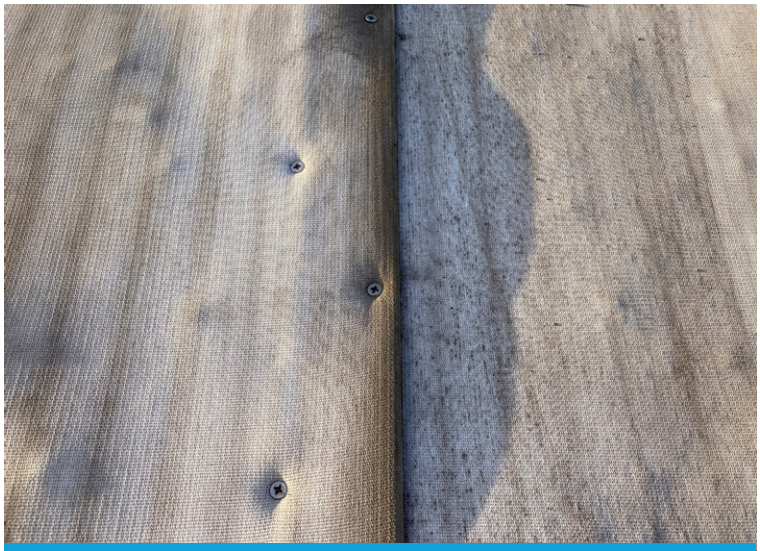
SLOPE PROTECTION

Stainless steel fixings and a termination bar were used at the crest

Termination at the crest

Adhesive sealant was applied to overlapping layers



Screws were inserted in a zigzag formation to secure overlaps

Termination at concrete stairway at one end of the slope

CC terminating into concrete stairs

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Installing Concrete Canvas® continued...

While conditions throughout the installation period were dry and bright, the temperature dropped below 5°C during the first few nights, meaning hydration methods had to be adjusted to account for the potential for frost and delayed setting. As a result, once hydration was given via bowser, plastic sheeting was used to cover the fibrous top surface of the material to prevent freezing, as per the hydration guidance given by Concrete Canvas Ltd.

Outcome

The installation of 230m^2 of CC5™ was completed by a team of two over a total of four days in cold weather conditions, using only hand tools due to access restrictions on the site.

Hydrating CC

Plastic sheeting used to cover CC overnight to prevent freezing after hydration

Poured concrete used to backfill anchor trench at toe

Completed installation

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Completed slope protection installation at the Old Whittington STW

"We're extremely happy with Concrete Canvas for the project at Old Whittington. The material is perfectly suited for this type of application and it's benefits are obvious for the site and our commitments to carbon reduction, cost and timely project delivery. The range of uses with the offering by Concrete Canvas has been realised, and we look forward to working with them again on future installations."

Stu Elliot-Thatcher
Project Engineer
Specialist Projects at Yorkshire Water

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Carbon Savings

One of the key benefits in using CC to replace conventional concrete is the significant carbon savings that can be achieved:

The concrete industry is a leading producer of carbon dioxide (CO_2), generating up to 8% of worldwide man-made CO_2 emissions.[1] In 2013, the UK Government published 'Construction 2025', detailing their vision for the construction industry. They have set a target of lowering greenhouse gas emissions in the built environment by 50%.

As a result, both the concrete industry and its clients must find ways to reduce carbon production in both the manufacturing process and end-use.

To quantify its potential environmental benefits, Concrete Canvas Ltd appointed Ricardo Environment and Energy Ltd to undertake a product Life Cycle Assessment of Concrete Canvas® products and subsequently create a model to enable the comparison in using CC to replace traditional ST4 (20MPa) poured concrete for real world erosion control applications.

Using the model, the Old Whittington STW site-specific data was used to determine the Global Warming Potential (GWP) in using CC5™ which was then compared to the GWP in using the 100mm of ST4 poured concrete alternative, assuming the ST4 could be sourced 10km away from the site.

The model assessed each system's GWP - measured in kg of carbon dioxide equivalent per square meter (kg CO_2e/m^2) - considering a cradle-to-grave system boundary. This means it included all the upstream processes associated with raw material extraction; core (production) processes such as energy use during manufacture; and downstream processes such as transport to site, installation, use, removal and disposal.

The results (see graph below) show that **CC5™ is hugely preferable to the poured concrete alternative, providing a GWP saving of over 40%.**

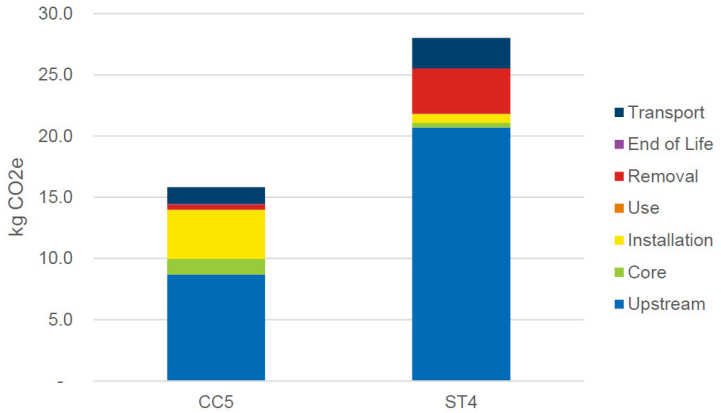
CC5™ has just over 15.81kg of embodied carbon per square meter of slope, compared to 28.02kg of embodied carbon per square meter of slope for the ST4 concrete.

See the CC Carbon Comparison Report, found on our website's Downloads page, for more information on the carbon savings in using CC.

Project Results per m^2 of project

Description	Value	Unit
Total Project m^2	163	m2
CC5 needed per m2 of project	1.16	m2
ST4 needed per m2 of project	0.10	m3

kg CO2e	CC5	ST4
Upstream	8.7	20.7
Core	1.27	0.39
Installation	4.02	0.73
Use	-	-
Removal	0.43	3.71
End of Life	0.05	-
Transport	1.36	2.50
Total	**15.81**	**28.02**



[1]Chatham House Report "Making Concrete Change: Innovation in Low-carbon Cement and Concrete": https://reader.chathamhouse.org/ making-concrete-change-innovation-low-carbon-cement-and-concrete

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