SLOPE PROTECTION

Project Info

- 04 / 04 / 22
- CC8™ Bulk Rolls
- 700m²
- Vertical layers
- M6 Nr. Spaghetti Junction, Birmingham
- Jackson Civil Engineering
- Installed to provide slope protection to a reprofiled embankment under the M6 motorway and next to a Network Rail cross city line.
- Replacing 250mm of poured concrete to provide a 66% carbon saving

Completed installation

In April 2022, Concrete Canvas® GCCM* was used to provide slope protection to a newly reprofiled embankment under the M6 Motorway - an area commonly known as Spaghetti Junction - and next to a Network Rail cross city line. The project was part of the wider Flood Alleviation Scheme (Culvert 2A Scheme) for The Environment Agency with involvement from Highways England and Network Rail. The Culvert 2A scheme was designed to upgrade a culvert that runs under the cross city line to allow the surrounding area to flood in the event of storm events. The passive flooding of the area around the culvert would help prevent flooding of nearby businesses and warehousing that are located near the site.

As the area is to actively flood during storm events, the embankment surrounding the culvert, which is Network Rail land, would need to be protected from erosion. The original design called for a mass poured concrete slab to be installed on the embankment to protect the area from erosion. However, due to the location of the site being under the M6 nr.Spaghetti Junction, access was limited and concerns arose about the delivery of the concrete, the pumps and formwork that would be needed.

Ultimately CC8™ was chosen for its need for minimal plant machinery, ease and speed in which it can be installed and its low maintenance.

*Geosynthetic Cementitious Composite Mat

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Slope prior to works commencing

Slope reprofiled with vegetation removed

CC8™ Bulk Rolls laid vertically down the slope

Adhesive sealant applied to reduce permeability of joints

CC8™ layers secured using autofed screwdriver and stainless steel screws

CC8™ secured in anchor trenches using stainless steel J-pegs

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CC8™ material hydrated using a hose

CC8™ terminated using stainless steel terminating bar

"JCE were faced with a tough design to build in challenging conditions whereby the provided solution was not practicable. Through liaison with CC we scoped and developed a new solution that was not only suitable for the client but also acceptable by Network Rail and provided a solution to a logistical nightmare for a wet concrete design. As a team, we had never used CC previously, however the standard installation guides were easy to follow and the ground preparation work carried out in advance of the product being delivered to site. As Concrete Canvas is supplied in individual rolls, it aids with minimising waste and the carbon savings are impressive. CC has introduced an extremely useful product that I believe will have potential future applications in our sector of work."

Scott Johansen, Site Agent, JCE

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Prior to installing the CC8™ material, the slope was reprofiled where all old vegetation was removed and a knotweed barrier was installed, followed by a layer of compacted sand and a geotextile. This created a uniform and smooth substrate with no voids underneath the material. Anchor trenches at the crest and toe of the slope were dug using an excavator.

As CC8™ Bulk Rolls are delivered on pallets, the logistics team worked with the site agents to ensure the material was delivered on a suitable wagon which could navigate its way off road and to site while being able to carry the material. Bulk Rolls of CC8™ were unloaded from the wagon and lifted into position using an excavator and spreader beam. Once in place the CC8™ material was laid vertically down the slope with each layer cut to the desired length using hand tools.

Each layer of the CC8™ material was then overlapped by 100mm and then jointed using sealant and stainless steel screws. To prevent any ingress of water or undermining, the leading edges of CC8™ was pegged into anchor trenches at the crest and toe of the slope using stainless steel J-pegs and backfilled with excavated substrate. Located on the slope was a concrete stairway that allows access to the Network Rail land. The CC8™ material was cut to lap up this stairway and secured against the structure using a stainless steel termination bar.

After installation, sections of the CC8™ material were then hydrated using a hydrant, with other sections hydrated with the use of an IBC. Installation was carried out over several weeks as the installation of the material took place at the same time as other works on site.

Concrete Canvas Ltd worked closely with the contractor, Jackson Civil Engineering and the designer, Jacobs, to answer their questions and provide details for the installation of the material from the jointing, termination and hydration to ensure the scheme was a success.

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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 M6 nr.Spaghetti Junction site-specific data was used to determine the Global Warming Potential (GWP) in using CC8™ which was then compared to the GWP in using the 250mm 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 **CC8™ is hugely preferable to the poured concrete alternative, providing a GWP saving of over 66%.**

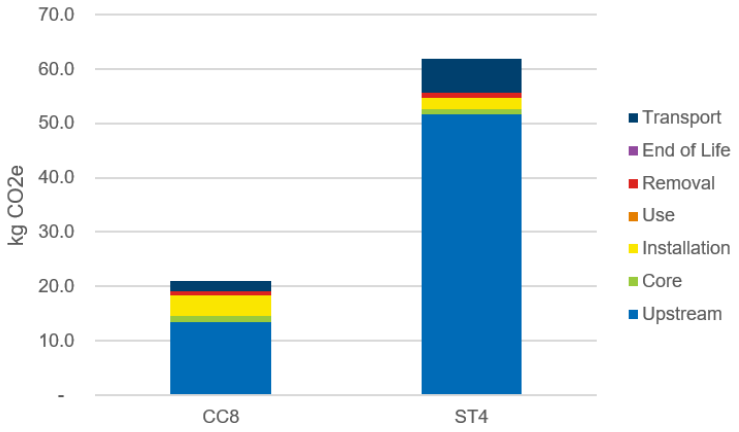
CC8™ has just over 20.94 kg of embodied carbon per square meter of slope, compared to 61.95kg of embodied carbon per square meter of slope for the ST4 concrete.

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	700	m2
CC8 needed per m2 of project	1.10	m2
ST4 needed per m2 of project	0.25	m3

kg CO2e	CC8	ST4
Upstream	13.4	51.7
Core	1.13	0.99
Installation	3.74	2.00
Use	-	-
Removal	0.82	1.01
End of Life	0.07	-
Transport	1.76	6.24
Total	**20.94**	**61.95**



[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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