

Project Info



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CC13™ Bulk Rolls



36m²



Transverse layers



Nottingham, UK



National Grid / PPV Ltd.



CC used to provide protection to shallow cover high-pressure gas pipeline crossings for National Grid.

nationalgrid



Completed CC lined drainage channel above pipe crossing

In April 2016, Concrete Canvas® GCCM* (CC) was trialled as a means of providing fibre reinforced concrete protection to shallow covered gas pipelines for National Grid.

National Grid have a series of pipelines (assets), many of which are crossed by drainage channels in privately operated farms and fields. The regular maintenance of these drainage channels can erode the protective top cover for buried high-pressure and intermediate-pressure pipelines which then run the risk of impact or puncture by landowners and third parties.

National Grid IGE/TD/1 and T/PM/Maint/5 Part 2 technical documents state that a minimum level of top cover must be maintained over pipelines. Assets are inspected at regular intervals through line walking where each crossing point is assessed according to its depth and further examination if necessary using the Direct Current Voltage Gradient Survey to determine any damage to coatings.

A trial site in Mansfield was selected where a section of drainage channel and the surrounding easement area was lined with 13mm thick CC (CC13™) material to provide a durable, erosion preventative and impact protective concrete layer immediately above the shallow covered gas pipeline.

*Geosynthetic Cementitious Composite Mat



Traditionally, there are four methods for maintaining and protecting the shallow cover above pipelines.

Firstly, there is the standard regular maintenance of the channel by the site owner, which typically involves mechanical dredging or manual clearance of the channel. Both of which run the risk of reducing the level of protective top cover, are time consuming, costly and pose Health and Safety risks of working within the vicinity of a high pressure gas line.

Alternatively, if the site requires it, crossing points may require installation of a flume; damming the channel with sandbags before applying a gravel layer and installation of a pipe (see example below). This is a costly process and can take 2-3 days to install.

Larger sites may warrant installation of a full culvert which is also costly and time consuming to install. Neither flume nor culvert allows for open visual inspection of the channel and are prone to blockage. Lining the channel with CC does not affect the hydraulic capacity nor flow rate of the existing channel, unlike with flumes or culverts.

The final option available to contractors is the installation of costly precast concrete slabs. Generally shallow cover sites are remote and difficult to access. The concrete slabs used can be up to 400mm thick, are difficult to handle and install due to their weight and require mobilisation of much larger plant than CC.



National Grid were looking for a solution that would not only provide impact protection, but remove the need for any plant and maintenance work in the vicinity of the pipeline. In terms of direct impact protection, CC13™ is a 40mPa concrete and has been successfully tested to ASTM G13 Impact Resistance of Pipeline Coatings.

The product also has excellent abrasion and scour resistance, typically twice that of a standard OPC cement. Lining the drainage channel with CC would prevent any further erosion of the invert and surrounding substrate which would otherwise compromise the level of protective cover.

CC also has excellent weed suppression qualities, having been tested to and passing Root Penetration (DD CEN/TS 14416:2005). By controlling the level of vegetation growth, the channel will be less prone to blockage, greatly reducing the need for maintenance and the need for de-vegetation measures and dredging.

In addition, CC also offers high visibility of the lined channel, ideal for aerial inspection and, in conjunction with the current Marker Posts, provides a warning to 3rd party maintenance teams. A number of colouring options of CC are available which may be trialled at later sites.

The speed of CC installation means contractors spend less time on site, improving Health and Safety, limiting site access and returning the asset to full operation more quickly. CC has a minimum design life of 50 years, offering a long-term and robust solution.

CC also has a very low logistical footprint and can be easily installed without the need for specialist contractors, allowing National Grid to make use of their existing framework contractors. However, Concrete Canvas Ltd does offer full on-site training and technical support. Although an inherently simple product to install, there are a number of small but key time saving measures which can be employed to increase the rate of installation.

Finally, many of the shallow cover pipeline crossings are in greenfield sites or areas of special scientific interest. CC has a very low washout rate and low alkaline reserve, eliminating the risk of adversely affecting pH levels and the surrounding environment or flora and fauna.



Channel section prior to ground preparation



Grading of the profile



Damming of the channel section and laying of the Type 1 aggregate layer



Deploying CC13 material via a plant mounted spreader beam



Screwing of the overlapped layers of CC



Hydration of the upper sections of CC

Prior to the installation of the CC material, the channel section and surrounding easement area were dammed with sandbags and the water re-routed with a sump pump. Vegetation was removed and the channel then graded to the desired profile. Due to the low CBR of the substrate, a type 1 MOT layer of aggregate was spread over the bottom of the invert to provide a more solid base 500mm from the crown of the pipeline on which to lay the CC. Shallow 300mm anchor trenches were excavated along each shoulder and across the leading end of the channel.

The CC was deployed via a machine-mounted spreader beam and laid transversely across the width of the channel, removing the need for manual handling. On sites where access is restricted or plant equipment is unavailable, CC can be specified in man portable batched rolls for manual transportation and deployment.

The CC layers were cut in-situ, eliminating wastage. Subsequent layers overlapped the previous by 100mm in the direction of water flow, and created natural weep paths which allow for the release of any hydrostatic pressure, as well as accommodating rising water tables.

Following deployment, the overlapped areas of CC were hydrated before being screwed together at 200mm centres using stainless steel screws from a magazine fed auto-screw driver. Typically CC is fixed to the substrate with galvanised steel pegs, but due to the current cathodic protection system used by National Grid, this trial utilised 150mm reinforced plastic ground pegs to capture the edges of CC within the anchor trenches.

Hydration of the lined channel was completed via a bowser. The sandbag dam was also released to allow for additional hydration, as CC is capable of setting underwater and cannot be over-hydrated.

The final stage of installation was the backfilling of the anchor trenches, not only securing the CC in place, but preventing water ingress beneath the material as well as resulting in a more natural looking channel profile, sympathetic to the surrounding environment.

Installed in a matter of hours, CC provided a rapid and easy to install concrete lining solution, providing robust, long term protection to the shallow covered pipeline. National Grid have selected a number of similar sites in the East Midlands for further trials with the potential of adopting the material nationally as a cost effective alternative to the more time consuming conventional flume and culvert methods.



Completed channel section

“Concrete Canvas has been a real eye opener for us in terms of technology. Our main priority is to ensure the safe and consistent transport of gas through our assets and adequately protect them from third party interference. Concrete Canvas provides three layers of protective measures: It prevents the need for maintenance over the Pipelines, it provides good visual detail for the Aerial surveillance teams and third parties and it physically protects the pipeline. We are extremely pleased with the results and speed of installation and following further trials will look to utilise this material still further for other functions and applications across the Gas Distribution Networks.”

Chris Thomas,
Network Supervisor (Reduced Depth of Cover)
East Midlands Operate & Maintain, National Grid

Concrete Canvas Ltd. revisited the installation site in April 2018 to inspect the performance of the material and its appearance.

Whilst continuing to provide a maintenance-free solution over the key gas infrastructure required by Cadent Gas, the material is also continuing to prevent further erosion around the key infrastructure which would compromise the level of cover over the pipeline.

Pictures show the material 12 and 24 months after installation and the material is performing well and as expected.



Channel section 1 year after installation



Aged CC 2 years on