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Geosynthetic Cementitious Composite Mat in Mining Channel Lining Applications

ABSTRACT

GCCM used in Channel Lining

Construction of channel drainage system on projects has become a major challenge both in terms of time and cost. Not only do asset companies need to manage their facilities in accordance with budget, they also need to ensure that the interference of construction, maintenance and upgrades has a minimal effect on the operating capacity of these facilities. The use of traditional concrete solutions in channel lining applications on projects has become a major challenge both in terms of time and cost and alternative solutions are often required. Geosynthetic Cementitious Composite Mats (GCCMs) are deployed in roll format (like conventional geosynthetics), but on hydration they harden to form a thin, fibre reinforced concrete layer. GCCMs allow for overall project cost savings, replacing traditional concrete techniques through ease of maintenance and rapid installation.

This paper reviews how a GCCM has been used to replace a poured concrete solution on a newly constructed channel at a mine site in the state of Minas Gerais, Brazil. The aim of the project was to create a channel which would direct tailing from mine and rain water through a tailing pond which was under reconstruction. The case study provides insight into the physical properties and practical benefits of GCCM utilisation within the core Civil and Mining sectors.

Project requirements:

- The size of the designed channel should remain the same.
- The flow rates should not be altered.
- The material resistance to abrasion, rupture and puncture - essential characteristics to compare performance.
- The speed of installation should be optimised to anticipate the use of the channel before rainy season.

Convention concrete had been considered for the scheme but due to the works being undertaken during the rainy season, this solution was not a viable option as the inclement weather would regularly result in stoppage of works. The client also had time constraints to consider, with a deadline of December 2018.

As a result, the 1.5km channel had to be completed within just 2.5 months, ruling out a number of traditional concreting methods due to long lead times and the time required for setting or curing of the concrete. CC was chosen as it was the only viable option given the circumstances, and would allow for rapid installation in all weathers.

Prior to installation

The 3m deep channel was excavated from tailings material which had been compacted over 10 years. The 3m slopes on either side where then profiled and compacted for a smooth finish, allowing the CC to be installed without risk of voids forming below the material. Anchor trenches were then dug on either shoulder of the channel, measuring 20 x 20 cm.

Picture 1 *Excavation of 3m deep channel*

Picture 2 *Channel following ground works*

Installation works

The specified CC8™ material was delivered to the site in bulk rolls, transported by truck from a warehouse 15 minutes from the site. The CC was then cut to required lengths of 9.5m on average and manually transported to and deployed transversely across the channel.

Picture 3 *CC8 deployed transversely*

The edges of the CC material were captured within the anchor trench and fixed using steel ground pegs at approximately 1.5m intervals. Subsequent layers of CC were overlapped by 100mm and double-jointed using 35mm screws set at 200mm intervals following hydration of the lower layer below the overlap.

This method was repeated along the full length of the channel before hydration was carried out via a 5000m³ bowser.

Initial hydration was carried out for 15 minutes and repeated an hour later. The anchor trenches were then backfilled using poured concrete.

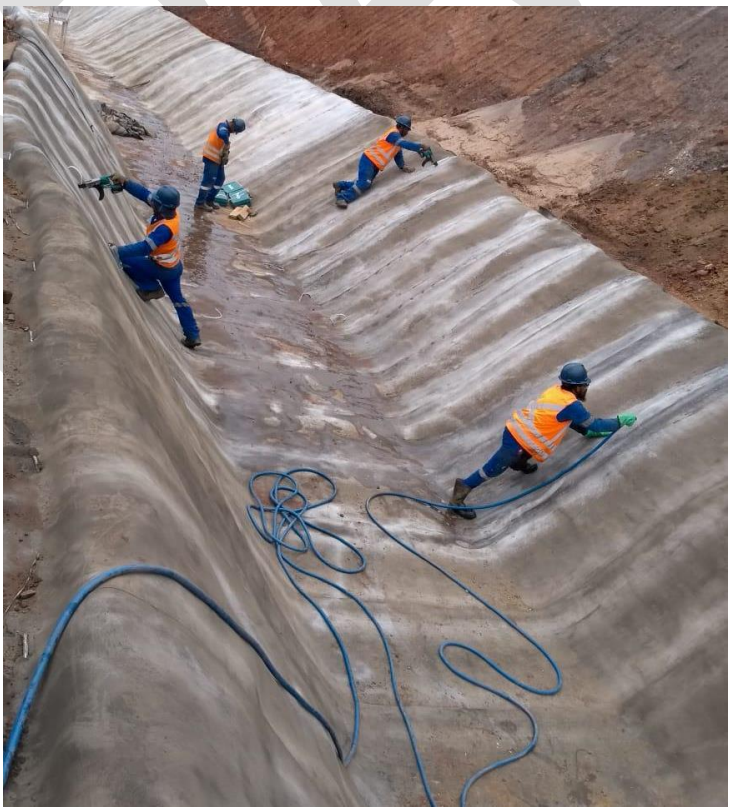
Picture 4 *Completed channel and backfilling of anchor trenches using mortar*

In four sections of the channel, where flow rates were above 10m/s, a concrete column measuring 20 x 20 x 400cm was installed on the base of the channel to dissipate water energy.

Work performance

A total of 11,750m² were installed over 60 days, with the crew working 8-hour days, 6 days per week. On three days, no work was carried out and four other days were worked as half days due to torrential rain which made it impossible for the crew to continue.

Despite disruptions, the CC was installed at rates of up to 532m². On the team's most productive day, the crew installed 56 x 9.5m sections, using 3,546 screws to joint the overlaps and 399 pegs to secure the CC.



Picture 5 *Jointing of the overlaps*

Project Specific Technical Advantages

Commissioning/Return to Service

Reduced Channel Preparation

Erosion Protection

Durability

Weed Suppression

Flow Rates

Transport Efficiency

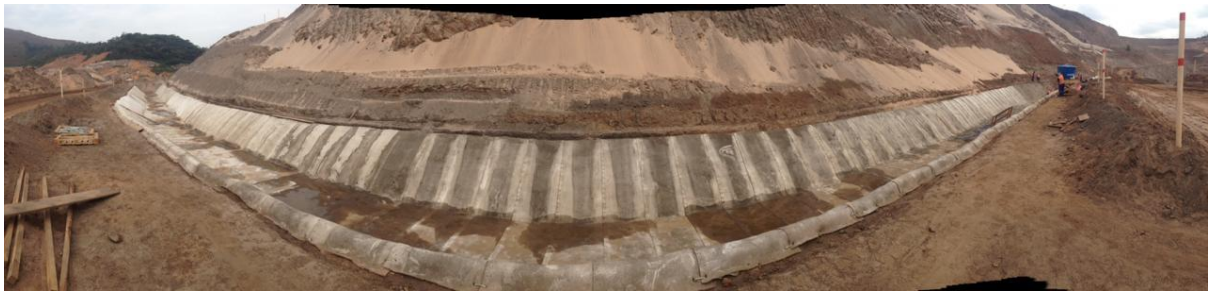
Ecology

Reduced Future Maintenance

Picture 6 *Channel section in use*

Conclusion

GCCM'S, although relatively new technology in the civil and mining industry, are fast becoming the solution of choice for clients considering channel lining construction. The key benefits of GCCM's being time, cost and ease of installation, make feasibility extremely attractive.
As a certified solution it is anticipated that more and more clients, contractors and engineers around the world will be requesting, suggesting or specifying GCCM's respectively.



Picture 7 *Completed channel section at a mine site in Brazil*