FLUME TESTING

Project Info

19 / 01 / 12

CC8™

Transverse and Longitudinal layers

TRI/Environmental – Erosion Testing Lab; Clemson, SC USA

TRI Environmental, Inc. ran hydraulic testing for Milliken & Company to quantify the hydraulic flow capacity of the Concrete Canvas® GCCM, and answer the question "How much water can flow over CC8™ before it is dislodged, lifted up and/or washed away?"

Flume test in progress

When the testing was complete, TRI had subjected the Concrete Canvas® GCCM* (CC) to the highest water velocities and shear forces possible at their test facility. The CC did not fail during the test, enduring water velocities in excess of 8.62 m/s.

Test Design Rationale

The goal of the test was to understand the characteristics of CC when subjected to water flow under installation conditions that approximated a real-world installation of the product. To achieve this goal, it was decided to set up two channels, one with lap joints shingled transverse or perpendicular to the direction of flow and one with lap joints longitudinal to the direction of flow.

In addition, to test the potential to use CC for repair applications, two patches that projected up into the water flow were installed at the end of the second channel. Both patches were connected to the underlying material with screws, and one also included an adhesive bead to provide additional sealing capacity.

*Geosynthetic Cementitious Composite Mat

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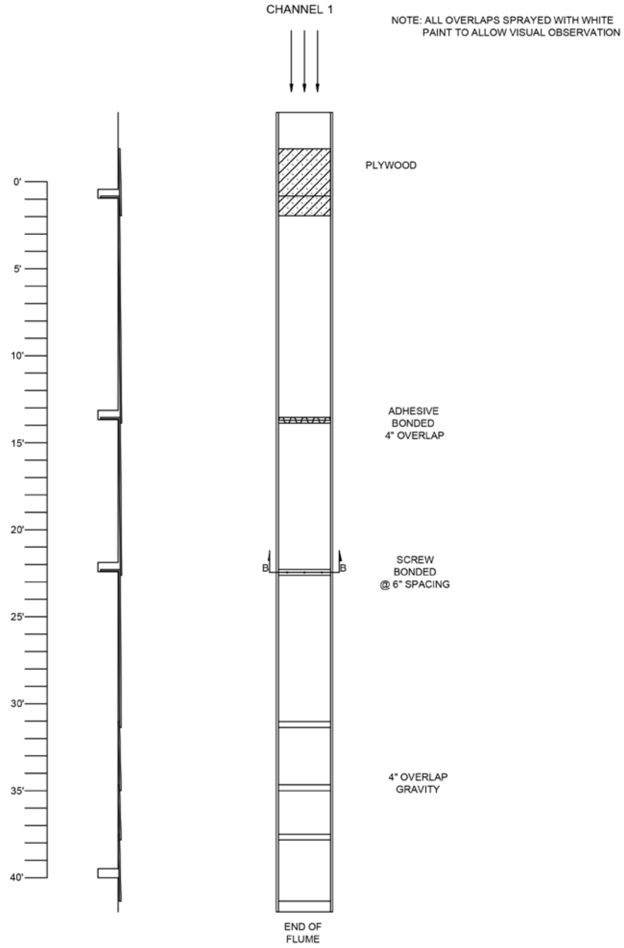
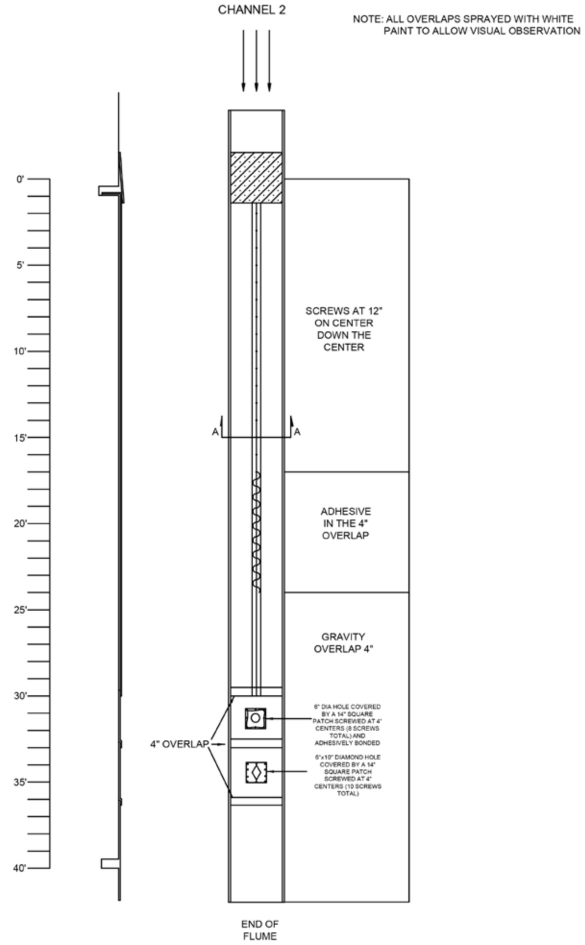


CC-TRI FLUME TESTING PLAN VIEW & SECTION
CHANNEL 1



CC-TRI FLUME TESTING PLAN VIEW & SECTION
CHANNEL 2

In addition, both channels used three (3) different kinds of joint connections as described below:

1. One connection section used adhesive to connect the upper layer of CC to the lower layer
2. One used screws, and
3. One utilized only gravity.

This variety of lap joints was constructed in order to assess capability of different overlapping techniques. An anchor trench was used to restrain the first two layers in the first channel with the lap joints shingled transverse or perpendicular to the direction of flow.

A consideration in developing the test protocol was deciding how to eliminate or minimize edge effects from the narrow flume width. Lining the walls of the channel with CC would have resulted in a stiffer cross section than would be encountered in a normal field installation. It was decided to install a flat piece of CC with a thin membrane attached to each side to prevent water flow around the edges of the 610mm width piece. This light weight membrane was attached to the underside of the CC and run up the sides of the channel. This approach was selected to better simulate the weight of CC in a project covering a large area in order to focus the test on whether CC could withstand the drag forces created by great amounts of rushing water over the top of the product.

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Setting

The product was hydrated according to recommended procedures, and sandbags were placed on top of the joint overlaps to hold the CC layers together during setting. The sandbags were removed once the product was set and before testing commenced. The CC was allowed to cure to full strength (~10 days) prior to performing the flow test.

CC during installation

Weighting edges during initial 24-hour cure

Joints painted to assist with detecting movement

Initial flow

Test Observations

The test consisted of running water at various flow rates over the material. Throughout the testing process, measurements of water height were made down the length of the channel.

No failure of any seam, and no movement was detected for any of the CC panels during the course of the test. In addition, no subgrade erosion was observed as a result of the test.

Both the transverse lap joints shingled in the direction of flow and the longitudinal lap joints parallel to the direction of flow were sufficiently robust to resist the flows encountered during the test.

All joint connection approaches (adhesive, screws, and gravity) resisted the flow velocities, with similar results for each approach being observed. The installed 'repair' patches also resisted the test flow conditions.

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Maximum water flow over Channel 1

Maximum water flow over Channel 2

No separation at joints detected

Only subgrade changes seemed related to wall seepage

Conclusions

From the TRI report, “All joint types and patches appeared to provide a dependable seal throughout the test.” Neither the longitudinal nor the transverse overlaps showed any distress during even the highest flow conditions.

No soil loss was observed in either channel regardless of the velocities and flow depths experienced.

In short, the maximum amount of water possible at TRI’s test facility was run over the CC with no effect on the installed material.

For more information contact info@concretecanvas.com

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