

Project Info



04 / 01 / 2021



CC8™ Bulk Rolls



250m²



Transverse layers



Hendy, Wales



Kaymac Marine &
Civil Engineering Ltd



CC used to line a
damaged culvert to
extend its working life



Completed culvert lining project below the M4 near Hendy, Wales

In January 2021, work began to repair a large culvert that runs under the M4 near junction 48, West of Swansea in Wales.

The original culvert had been installed in the mid part of the 20th century and was in need of upgrade. The invert had corroded, which would eventually lead to undermining of the structure.

Custom mould GRP culvert lining was considered for the works. However, the restricted site access would have posed significant logistical and practical issues. As a result, a remedial lining solution was required to instead repair the existing culvert. CC was chosen as it would provide a robust lining for the culvert floor and extend the structure's operational life.

The works were carried out by Kaymac Marine & Civil Engineering Ltd on behalf of main contractor Knights Brown, for the South Wales Trunk Route Agency (SWTRA), with design consultation provided by AECOM.

*Geosynthetic Cementitious Composite Mat



In order to access site, significant de-vegetation works were undertaken. Once access was gained to the culvert, a sandbag dam with a waterproof membrane was constructed. The installation was carried out during the winter when there was an increased flow of water down the small river. As a result, the water was over-pumped to give the construction team a dry workspace.

Several tonnes of alluvial silt were removed from the invert of the culvert before remediation work could begin. The removal of the silt exposed numerous holes in the floor of the steel culvert that had formed over time. The corroded holes, some as large as 100mm by 50mm, were filled with a marine grout. The removal of the silt also exposed rows of bolts that connected the pieces of the culvert together, which protruded above the culvert floor by approximately 50mm. In order to provide a level and smooth surface on which to install the CC, the inverts of the culvert floor were filled and the floor raised by 50mm to also cover the bolts.

The restricted space on site meant that cutting of the CC8™ bulk rolls would have been complicated. As a result, Kaymac Marine & Civil Engineering Ltd's works manager made the decision to pre-batch the material to the required 3.5 linear metre lengths at their headquarters, where the material was delivered. The batched rolls were then easily transported to site via van and trailer, and carried to the culvert for installation.



Damaged culvert floor and sediment build up



Corroded culvert floor and protruding bolts



Corrugation inverts filled and floor levelled with grout to cover protruding bolts



Culvert following preparation works and installation of wooden battens



CC batched to required lengths off site



Custom length rolls transported to site on a trailer



Trolley used for easy transportation of batched CC lengths on site



CC laid transversely across culvert floor and secured to walls

The lengths of CC8™ were deployed transversely across the culvert floor and quickly and easily fixed to the grouted inverts and steel culvert using M8 stainless steel 50mm self-tapping masonry screws. CC's 3D fibre matrix prevents dislocation of the cementitious fines contained within the material. This meant that the contractors could hang the material vertically part-way up the culvert walls during installation which significantly increased the speed and ease of the operation. For a neater termination, easier installation and to avoid voids behind the material, the edges of the CC lengths were terminated against a timber batten fixed to the culvert using additional M8 screws.

The screws were placed at 150mm centres along the edge of the material on the vertical sides of the culvert and at 200mm centres across the culvert. The screws were driven through the 100mm lap joints and topped with a 25mm diameter stainless steel washer to prevent pull-through on the material.

Once the material had been fixed and jointed it was hydrated using water pumped from the upstream dam via a lay flat hose. 24 hours later, the inverts behind the set material edges were backfilled with a grout slurry mix to fill the voids and prevent ingress behind the material. The edges and sides of the CC had an additional layer of grout applied as further ingress prevention and to ensure the waterflow of the stream could not undermine and lift the CC.



Grout used to fill voids behind material edges to prevent ingress



Termination of CC edges outside culvert

A total of 250m² of CC8™ was installed by a team of five from Kaymac Marine & Civil Engineering Ltd during winter when there was an increased flow of water in the small river, which would otherwise have caused complications for alternative solutions. CC has a 2-hour window before it begins to set after hydration. This meant the material was ideal to install in the confined space of the culvert in challenging and sometimes wet conditions.

The preparation of the culvert (removal of silt and filling the invert) took approximately 2 weeks including site set-up. Installation of the CC8 material was installed over five days. The material installation itself was completed in the first three days, with the final two days used for grouting. The installation team had no prior experience of using CC but found the installation process quick and simple.

In specifying CC8™ to upgrade the culvert, SWTRA has effectively reduced the amount of time spent on site and negated the need for a costly rebuilt or full internal lining while extending the culvert's operational life. The works manager was impressed with the speed of installation of CC and will consider the material for other similar projects as a result.