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A LITTLE CO-OPERATION AND LATERAL THINKING GO A LONG WAY

Established supply chain partnerships and experienced personnel with specialist product knowledge are pivotal to meeting the challenges presented by marine concrete repair projects, as discussed by **Fosroc's Hazel Lowe** in two recent project case studies.

Fosroc became involved in the Highland Council's Uig Harbour redevelopment project in early 2022, after being contacted by the appointed specialist repair contractor, Concrete Repairs Ltd (CRL). Highland Council has a good working relationship with the main contractor RJ McLeod, which in turns work closely with CRL. The relationship between CRL and Fosroc has gone from strength to strength in recent years due to collaborations on other structural repair, water industry and windfarm

projects. This allowed for an open and honest discussion in relation to challenges on-site and proposed solutions, as well as logistical problems to be overcome.

Being located at the north-westerly point of the beautiful, yet remote Isle of Skye, working at Uig Harbour presented significant logistical challenges in terms of maintaining a steady supply of product for application. With preparation and the correct approach, however, potential supply issues were identified in advance and consistent communication from the outset

helped to mitigate product shortages. The material supplier, the contractor and the distributor Kestral Construction Products worked in co-operation together and Kestral was able to commit to holding increased stock levels, while CRL arranged for a third-party haulier to safely collect, store and deliver material between Airdrie and site – a journey of over 230 miles.

Following the hydro-demolition of the soffit repair, the team were left with repairs up to 170mm deep and 5–6m² in some locations. This proved challenging to apply the specified

MAIN IMAGE AND INSET:
Porthcawl Breakwater.



LEFT:

Uig Harbour.

BELOW LEFT:

Repairs to the soffits at
Uig Harbour.

extends into the sea by several hundred metres, consists of a masonry wall protected by a revetment, formed partly of the natural bedrock and rock armour placed over the years. The exposed structure faces the brunt of storms and tides, and is placed within the Bristol Channel, known to have the second highest tidal range in the world.

The original breakwater was constructed in 1820, beginning at the landward end at rock outcrops. This was extended in 1886, both in the length of the breakwater and increasing the heights of the parapets on the seaward face. The method of construction of the 1860s extension was to build a timber-framework 'trestle' acting as formwork and then laying mass masonry blocks within this shape on top of consolidated beach sand deposits. In subsequent years, the extension of the breakwater required overlaying of mass concrete blocks and then in 1971 further overlaying was completed on the seaward face and roundhead of in-situ concrete protection panels.

VOIDING

At various times, and in particular in 1974, overtopping damage and unseen voiding both on the revetment and on the deck resulted in a significant inner wall failure on the slipway face. Following a sonic survey, the Porthcawl Breakwater masonry walls and revetment were found to have worn, leaving large voids. There was also severe corrosion to the steel reinforcement in the concrete section, causing spalling.

Fosroc was originally engaged with architect Arup a year prior to the repair works taking place, where Cebex grout was specified as a typical underwater grout for this type of project. However, on further investigation, the volume of product required to fill the voids was found to be twice initial estimates. Some lateral thinking was needed with regard to a suitable product solution to provide the volume yet stay within budgetary constraints. Trials were undertaken using Conbextra GP as a pumped void-filling grout,

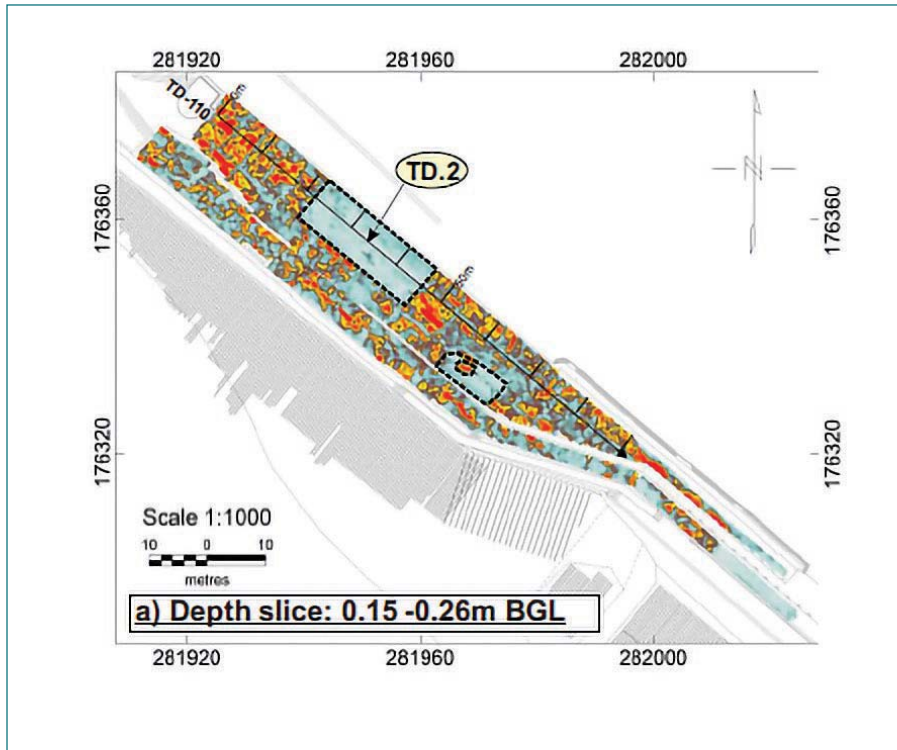
dry-spray mortar Renderoc DS in a single pass due to the weight of the material in the repair. It was found that the repairs could be applied in two coats, provided the newly hardened material was water-jetted to remove any laitance and loose material before a second layer was applied. In areas at the top of the columns where access for a spray application was impossible, watertight formwork was erected so alkaline micro-concrete Renderoc LA60 could be poured from above. At each stage, the repairs had to be carried out with the tide in mind, as high tide cut off access to the repair areas.

By using hydro-demolition and dry-spray repairs, CRL was able to reinstate up to 5 tonnes of Renderoc DS in a single shift,

between tides. By having the option of using the dry-spray mortar and alkaline micro-concrete together, the obstacle of confinement was overcome, allowing the repair areas to be reinstated. Additional reinforcement was anchored in using a high-performance chemical anchor, ensuring longevity of the solution. During a joint site visit in summer of 2022, RJ McLeod was clearly impressed by the smooth finish achieved and the added value brought by the effective working relationship between Fosroc, CRL and Kestral.

PORTHCAWL BREAKWATER

Porthcawl Breakwater in Wales protects the small former fishing harbour that now houses a gated marina. The breakwater, which



LEFT:
Sonic survey.

without the addition of extra water. It provided a degree of retardation to the grout mix, allowing more time from batching to placement and better control of the placing process to fill the voids and avoid washout by incoming tides. For the concrete repair element of the project, Renderoc DS was used alongside Renderoc DSR, where tides would again affect the set of a standard material.

The volumes of void-filling required made the use of a proprietary underwater grout prohibitive from a cost perspective, so use of a grout with an admixture proved to be the ideal solution, with approximately 600 tonnes of the grout used to fill the voids. The partnership between contractor and material supplier paved the way for a successful, uninterrupted application and a high-quality finish, avoiding product wastage to keep project costs minimised. **C**

with the occasional addition of an anti-washout agent when required. Fosroc and contractor Beton Bauen were able to establish a cost-effective workable solution with Fosroc's Conplast UW admixture. When added to the grout, the admixture produces a gel in the water phase, which surrounds the cement particles and other fine

components of the concrete. This protects them from washout during placement and when the concrete is finally in position. Unlike other anti-washout materials, Conplast UW contains plasticising agents, which counteract the effects of the increased cohesion necessary to minimise washout and allow normal consistence levels to be maintained



Porthcawl marina.