SCIRT Rebuilding Infrastructure

LEARNING LEGACY

Lessons learned from one of New Zealand's most challenging civil engineering projects: rebuilding the earthquake damaged pipes, roads, bridges and retaining walls in the city of Christchurch 2011 - 2016.

SCIRT work holds back the tides

Story: Beachville Seawall

Theme: Construction

A document which describes how the new Beachville Road seawall was built.

This document has been provided as an example of a tool that might be useful for other organisations undertaking complex disaster recovery or infrastructure rebuild programmes.

For more information about this document, visit www.scirtlearninglegacy.org.nz

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SCIRT work holds back the tides

The construction of a new seawall on Beachville Road in Redcliffs was a demanding SCIRT project which won praise from residents and the construction industry alike.

Putting it to seabed: SCIRT workers prepare to lay the Reno mattress on the sea floor.

Riprap rock revetment. That's the engineering design SCIRT chose for the new Beachville Road seawall, built to replace its more than 100 year-old predecessor, damaged beyond repair by the February 22, 2011 earthquake.

The 500-metre long seawall, completed in November 2016 after a technically demanding year-long construction, provides Redcliffs residents living by the sea with greater security against flooding and storm surges during bad weather.

The original, 2.5 metre, vertical wall, built in the early 1900s, succumbed to lateral spread and liquefaction, settling up to half a metre and slumping forward up to a metre in places during the earthquake.

Now what graces the coast line along Beachville Road is a superior structure, an elegant and gently curving three-metre wide sloping wall of rocks. Its outward simplicity belies the challenge of constructing the riprap revetment design while working around a daily tidal range of 2.4 metres.

The new seawall provides protection from erosion and scouring, is less susceptible to lateral spread and the riprap (loose rock), can easily be topped up if damaged in any future earthquakes.

Key design features were its gradient and the size of the rocks which are of sufficient weight to resist the force of the waves and of incoming and outgoing tides from the estuary of the Avon and Heathcote rivers, which flow through Christchurch to the sea.

Given the intensity of the project and the year-long timeframe for construction, keeping the local community informed was crucial to building rapport with them and maintaining good will and patience with the ongoing disruption.

That was done through clear and timely work notices telling local people about what was involved and planned, providing regular progress reports, and holding community information sessions for those wanting to talk in more detail to SCIRT staff.

So successful was the project that scores of local people turned out for a SCIRT and community group celebration on Sunday 6 November 2016 to mark the completion of the seawall and another section of the new "Coastal Pathway", also part of the work.

Beachville Road resident Jan Bargrove said local interest in the progress of the seawall had been "huge". The new seawall was a "huge improvement" from what was there prior to the earthquakes. "I think it gives us a great sense of security."

Another resident wrote the following to SCIRT's Downer delivery team which managed the job.

"Congratulations to all the SCIRT and Downer team who have been working on the project. It is brilliant and such an improvement to the area. Thanks to all the workmen whom I found, at all times, to be professional, friendly and considerate. I walked past the site regularly during construction and at all times felt safe and

respected. Many thanks to all concerned including the managers who have developed this exemplary culture of behaviour."

Working in seawater where the daily tidal range was

2.4 metres was the greatest challenge.

SCIRT's Downer delivery team contracted local company Seipp Construction to build the seawall. The company's expertise was rewarded with the 2016 Canterbury Contractor of the Year Award, in the $1.5 million to $5 million category, for the challenging nature of the seawall project.

The construction was carried out in sections. The crew had to create dry spaces to work in and did this through sheet piling, where long steel sheets were vibrated into the ground and locked together to form a "cell" and then the water was pumped out.

Each section of the wall was constructed inside the dry cell and tied to the previous section. Three to four of the cells operated at one time. In all 20, 25-metre sections were required to build this protection and defence against coastal erosion.

Downer project manager Mark Gleave said when working in a tidal environment or where there was a flow of water along a natural system it was important to maintain regular progress with the temporary works otherwise it might be necessary to protect the works or adjacent ground from scour by the flow or water or the build-up of deposited solids.

The core of the seawall under the road was constructed of an impermeable geotextile which surrounded more than 6500 cubic metres of engineered fill.

On the seaward side of the core a 40cm thick layer of smaller rocks was placed and on top of that a 60cm revetment layer of larger rocks. More than 7000 cubic metres of rock was used. Under the first rock layer was geotextile to prevent the underlying soil from moving up through the rip rap.

"Reno mattresses", steel mesh mattress- shaped baskets filled with rocks, were placed in the water at the toe of the seawall to provide extra strength and protection. The mattresses were constructed on shore and lifted by a giant 85-tonne crane into place using GPS and divers.

Gleave said the Reno mattresses and associated geotextile liner were installed in short windows just before and after low tide so that the crew would be working in in shallower water. This sometimes required early and late shifts to be worked and that had been planned for.

Working at low tide and even at high tide when the water level was fairly stable for two to three hours was easier than when the tides were moving in and out because at those times the currents were very strong, Gleave said.

The last part to be built was a low concrete wall sitting along the top of the seawall and on the edge of Beachville Road. It consisted of more than 200 precast concrete blocks grouted into place.

Included in the highly successful $8 million SCIRT project were also repairs to a water main and storm water pipes on Beachville Road and construction of another 1.2 kilometre section of the Coastal Pathway, alongside the seawall to join up with the pathway on Main Road, Redcliffs.

Lessons learnt:

Regular, timely and open communications is essential for strong community relationships: The SCIRT Downer delivery team worked proactively to keep local residents informed of progress through all the phases of the seawall construction. The team built a rapport with residents whose feedback was complimentary of the crew and their efforts to mitigate the disruption in the area.

Be flexible when working with the tides: Working with the flow and range of the tides requires detailed forward planning so that a project can capitalise on the various benefits of working in low tides. That might require early or late shifts. Other unexpected benefits might come from working at different times within the tide cycle as those working on the seawall found.