

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.

Best in show: Retain and gain for Sumner Road

Story: Sumner Road Retaining Wall – Stage 4

Theme: Construction

A document which describes the process that SCIRT took to repair the Sumner Road retaining wall – stage 4.

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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Best in show: Retain and gain for Sumner Road

Fulton Hogan delivered the “Best Public Works Project” worth under \$5 million in New Zealand in 2015.



Stress fracture: cracks in the wall of retaining structures.

The SCIRT Fulton Hogan delivery team was recognised at the 2016 IPWEA (Institute of Public Works Engineering Australasia) NZ Excellence Awards for the Sumner Road retaining wall, stage four, project in Lyttelton. The project navigated an unstable site and the discovery of rock-loving lizards to swing into action from a movable platform.

An important arterial route, Sumner Road links harbourside Lyttelton with beachside Sumner. Prior to the earthquakes, heavy trucks used Sumner Road to transport goods to and from the port. The road has been closed since the magnitude-6.3 earthquake battered Christchurch on February 22, 2011, amid fears of further rockfalls and landslides. The road also provides access to many homes. The wall retains sections of fill which support the Sumner Road carriageway and services.

Work on the Sumner Road retaining walls was undertaken as five separate projects. Each project had different design needs and repair methodologies.

By December 2016, SCIRT delivery teams had repaired and rebuilt 10 retaining walls in Sumner Road. Work on the five projects took four-and-a-half years to complete and cost about \$15 million in total.

SCIRT’s new retaining walls were specially engineered resilient structures.

It was one of SCIRT’s longest-running construction commitments.

In many cases, the old walls simply provided erosion protection. Some walls in the area dated back to the late 19th century and were built by prison labour. Red ash (volcanic) rock was used for walls up to eight metres tall. Loose rubble, clay or rock was combined for placement behind the wall. Work on the heritage walls required consultation with archaeologists before SCIRT started on each section.

A positive relationship with the Lyttelton community eased the workload for SCIRT as supportive residents and a committed business group coped with the daily disruption in a fractured environment.

In the stage four project, the damage to the retaining wall included the failure of sections of the gravity stone facing and horizontal and vertical displacement of the footpath and roadway behind the wall.

The eight-month stage four project – costing \$1.45 million – focused on strengthening and repairing the Sumner Road retaining walls above the Holcim Cement site. Cement supply was vital for the post-quake Christchurch rebuild and Holcim remained open during the arduous project work.

Geotechnical engineers had warned that the bank was at further risk of subsidence after floods in March 2014. Concerns were raised over loose rocks and vegetation above the Holcim tanks and the road was also at risk of collapse, underlining the importance of the retaining wall repairs.

The design work proved difficult because of the limited site access and unstable slope. The SCIRT designers and delivery team needed to ensure that each construction step did not put pressure on the wall and cause catastrophic failure.



Concrete solution: An engineer checks the repairs.

If the old wall could not be stabilised, it would have been difficult to manage the storm water flow over the site and potential erosion above the Holcim site. Designers had to keep the existing structure but strengthen the wall. Most importantly, the work had to be completed without loading the road or causing the wall to fail.

SCIRT opted for the soil nail strengthening approach and an innovative access method. The SCIRT delivery team developed a method to install the nails and construct the concrete footing beam and shotcrete facing that was safe, cost effective and allowed Holcim to remain open. Drilling from a crane-lifted work access platform was deemed to be the safest and most cost-effective way of installing the nails. No additional load would be placed on the wall or downhill slope.

The platform was specially designed for suspension. It also needed to be big enough to carry the drilling equipment and meet all the health and safety requirements.

The retaining walls consisted of 100-year-old stone walls up to six metres high. Under SCIRT's design, 180 new soil nails were drilled through the existing blocks and grouted into place up to eight metres long and 180 millimetres in diameter. Once the soil nails were in place, drainage was installed, a footing was dug and poured and a reinforced shotcrete facing was applied in two 150mm layers. A handrail and repairs to the damaged kerb and channel and footpath completed the project. Work was under way by January 2015 and wrapped up by September 2015.

Much to their surprise, the work crew found 10 Canterbury geckos living in the wall. Construction workers quickly turned lizard catchers, prompting the development of an accidental discovery protocol for lizards and skins across the SCIRT program. The geckos were soon basking in a new home on a nearby outcrop.

Despite difficult manoeuvres, a tricky site and lively lizards, the stage four project was completed ahead of schedule and under budget. The SCIRT delivery team was involved in every phase, from design to delivery to gecko round-up.

For the delivery team, it was a very challenging job, but an extremely satisfying one.



Protect and preserve: The rebuilt retaining wall in Lyttelton, Christchurch