



## CASE STUDY:

# SITE 7 ROCKFALL BUND

KAIKOURA, NEW ZEALAND  
MAY 2019

## MACCAFERRI GREEN TERRAMESH®

Maccaferri Terramesh is a versatile, modular system for reinforced slope systems and mechanically stabilised earth walls that can be a more cost effective solution than the mass gravity Gabion wall because of the speed of installation and reduced rock fill requirements.

The Maccaferri Terramesh retaining wall system is designed for use in a wide range of applications in road, mining and rail infrastructure works. The system comprises of a gabion type facing with integral woven mesh soil reinforcement panels that can be used to construct structures with either a stepped front face or vertical facing.

Maccaferri Terramesh are pre-assembled units of double twisted wire mesh. The facing section of the unit is formed by connecting a back panel and diaphragms to the main fascia unit, thus creating the rectangular shaped cells used for stone confinement. The geogrid reinforcement, fascia and lid are all one continuous panel of mesh.

Kaikoura is a coastal town in the North Canterbury region of the South Island of New Zealand. It is a popular tourist destination known for its abundant wildlife and its sperm whale population. The region was badly affected by the November 2016 earthquake. The 7.8 magnitude earthquake caused landslides and rockfalls along the coastal State Highway, SH1. The SH1 connects Kaikoura, North to Blenheim and South to Christchurch, as well as being a major tourist route with its scenic view along the coast. The rail corridor also sits along the SH1, responsible for carrying resources in from Picton.

Not long after the earthquake, the NZ Transport Agency and KiwiRail set up the North Canterbury Transport Infrastructure Recovery (NCTIR) alliance with four major contractors. NCTIR is tasked with restoration of the transport infrastructure networks within a given time frame to leave it safer and more resilient than it was before the earthquake. Various solutions and rockfall protection structures of different energy capacities were considered along the coastal road, depending on the site's condition. These include Green Terramesh bunds, high energy rockfall barriers and hybrid barriers.

At site 7, about 22 km north of the Kaikoura township, there was a significant rockfall event during the earthquake. The NCTIR designers decided a rockfall embankment (bund) was the preferred solution. This structure has the capability to absorb multiple rock fall events up to a high energy level. The use of Green Terramesh allows the embankment slopes to be steepened and the footprint reduced to form a stable and robust bund with high energy



## > Site 7 Rockfall Bund



Tensar RE560 uniaxial geogrid in lower part of bund.



Hand placed rock in front face.



The longest Maccaferri Green Terramesh rockfall bund in the world.

absorption characteristics.

The structure is typically filled with compacted granular material or engineered soil fill with a horizontal soil reinforcement. The front face can either be vegetated or finished with a rock veneer.

Actual rock impacts in excess of 4,000 kJ into Green Terramesh rockfall embankments have been tested, back analysed and the design methodology verified using numerical modelling (FEM) techniques. This research completed in Northern Italy has resulted in the development of the simplified design charts to provide designers with a simplified design method based on rock penetration depth.

Geofabrics assisted the designers with this information and also looked at other aspects of rockfall embankment design like:

- The projection of fragments over the embankment after impact;
- The over topping of the upper proportion of the embankment by blocks;
- Penetration depth estimation and determination of serviceability and ultimate limit state;
- The internal stability of the embankment;
- Development of instability within the soil foundation as a result of the dynamic forces such as an earthquake.

The final bund design was 488 m long in two parts including a 10 m gap to allow access for clearing debris. The southern section is 185 m with an exposed height of 5.4 m above the existing ground level, while the northern section is 293 m long and stands 3.6 m high, both bunds have a minimum crest width of 1.5 m.

**The client was very happy and stated, “The Green Terramesh bunds constructed at Slip 7 have provided an aesthetically pleasing barrier that provides protection from slips and rock fall to Kiwirail’s Main North Line and NZTA’s State Highway 1. Simple to construct in 600 mm lifts, the bunds have already shown their resilience with the containment of some recent rockfalls. Both Kiwirail and NZTA are very pleased with the completion of these terramesh bunds. They add a certain ‘wow’ factor to the area around Ohau Point”.**

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