

CASE STUDY:

SLOPES & WALLS

Wakefield Ave Rockfall Protection

**SUMNER RD, CHRISTCHURCH
NOVEMBER 2016
CLIENT: CHRISTCHURCH CITY
COUNCIL**

GREEN TERRAMESH BUND

FEATURES & BENEFITS

One of the key benefits of Green Terramesh unit is the ability to locally patch, after rock impacts without affecting the reinforced soil bund structural integrity. This is subject to a penetration depth of <20% of bund thickness or usually < 500-700mm of up slope deformation. This is the serviceability limit state of the bund. A similar double twist mesh layer can be laced over the impacted area once hit and will be ready for subsequent impacts.

The primary objective of the Wakefield Avenue project was to mitigate rockfall risks with rock source areas scattered some hundreds of meters away on the hill side above the road level. Trajectories analysis and evidence post-earthquakes indicated that the falling rocks had impacted on the road level with some potential risk reaching the residential zone opposite the road.

During the recent Canterbury earthquake sequence, the Sumner area experienced rockfall, cliff collapses and landslides. Wakefield Avenue in Sumner is located in an important link from Lyttelton to Sumner and Christchurch. Christchurch City Council identified 4 major sections along the live route with an aim to mitigate the geohazard risks to an acceptable level of service for road users. This area is known as the Sumner-Lyttelton Corridor project where Wakefield Avenue form one of them.

Rock sizes of up to 2.0m nominal diameter had been identified by the engineers from both geological mapping as well as site records. Initial attempts of trying to mitigate the issue by scaling and removing the loose rocks on the slope proved to be a mammoth task as it was not possible to scale rocks on the entire hillside.

> Wakefield Ave Case Study – Continued.

Another consideration was that the scaling process may aggravate the fracture rocks and make the source areas even more unstable than before. Mesh draping over the entire hill side to interfere and control the rocks was deemed to be cost prohibitive due to the large surface area for meshing. The final decision to construct a rockfall protection structure at a convenient location to intercept the falling rocks. The options then came down to either an ETAG 27 certified catch fence or a reinforced soil bund. In this instance, the reinforced soil bund option was the favoured fence due to the following reasons:

- A cheaper whole of life cost
- Easier maintenance and repair after each rockfall event without the need of replacement
- Multiple impacts ability
- No requirement of horizontal displacement distance
- Blend well with the environment
- > 50 years' design life



CROSS SECTION VIEW OF GTM BUND

Wakefield Ave Before Filling

Below: GTM bund 2 in Wakefield Ave (rockfill face)



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The adopted 'facing unit' for the reinforced soil bund is a Green Terramesh (GTM) unit. Fig 1. shows the isometric view of the unit. Unlike normal face unit, the 2m long double twist PVC Galfan (Zn + 5% Al) coated mesh 'tail length' serves as soil reinforcement without geogrid for lower height structure. For a taller structure, additional geogrid reinforcements are included in between unit heights. The mesh is continuous from the base to the upper lid and the units will be connected with stainless steel rings during construction.

Rockfall analysis was performed by the engineer on various sections along the bund. This was collated into 3 major categories based on the boulder sizes, bounce height and kinetic energy based on 95th percentile boulder size of 3m³.

The final results were GTM bunds with 3 different heights and geometry ranging from 3.6m to 6.0m and face inclination of 70° or 80°. Along the different sections of the bund, choices of surface finish will consist of rock fill face and vegetated or planted face.

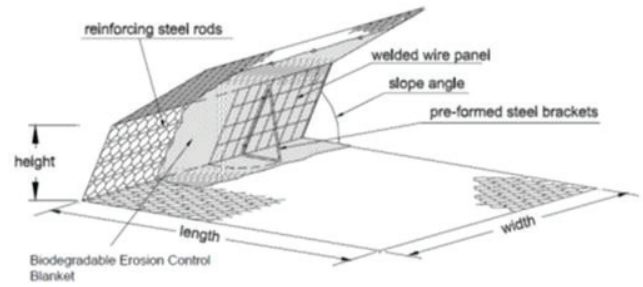


FIG 1. GREEN TERRAMESH

Caption of photograph to go in this space.



GTM BUND 1 IN WAKEFIELD AVENUE

Before vegetation



GREENING OF GTM

Ready for vegetation

CONTRACTOR: HEBS CONSTRUCTION
CONSULTANT: JACOBS