# CASE STUDY

Geogrid

Project: Waioeka Gorge
Date: November – December 2012
Client: NZTA
Location: Location

GEOFABRICS®

# Tensar RE Geogrid

State Highway 2 is the main route for freight and tourist traffic between the Eastern Bay of Plenty and Gisborne. The alternative route is a six hour diversion around the East Cape.

Over the weekend of 2nd March 2012 the Waioeka Gorge experienced a significant slip resulting in the closure of State Highway 2. The gorge is well known for being subject to occasional slips, however this was the largest slip experienced through the gorge in 14 years which resulted in closure of the highway. After closure for a period of over 3 weeks it was partially opened between the hours of 8am - 5.30pm and then fully opened a week later.

The slip dislodged an estimated 100,000 cubic metres of material, the majority needing to be relocated to enable the highway to be fully reopened as a two lane route.

Stabilisation works on the uphill slopes were carried out on site over a 6 month period following the slip. It was not until the 18th September 2012 that these were completed to allow for the road reinstatement works to commence. During the stabilisation phase a temporary road had to be constructed located effectively 25m away from the original highway alignment adjacent to the Opatu Stream. This temporary road was constructed using the material made available from the slip.

Whilst the stabilisation work continued the site investigation could be carried out for the design of the reinstatement of State Highway 2.The final design considered keeping the new road alignment away from the slip and widening the temporary diversion route. This meant that an embankment adjacent to the Opatu Stream would have near vertical sides to provide the necessary road width. This resulted in the need for soil reinforcement using geogrids to achieve a structurally stable road embankment.

Tensar TriAx® laid over Green Terramesh wall

Tensar TriAx® is installed in preparation of the pavement

Green Terramesh wall

The design called for large concrete blocks along the toe of the embankment. These alone are not capable of providing the necessary stability and as a result the designers incorporated **Tensar RE500** uniaxial geogrids for reinforcement of the retained fill material. **Tensar RE500** uniaxial geogrids are manufactured from HDPE that allow them to be cast into the concrete blocks to achieve a positive connection between the concrete block face and the geogrid reinforced soil. The 6.5m lengths of geogrid contained within the reinforced fill were connected using bodkins to the cast in geogrid lengths. This connection technique using **Tensar uniaxial geogrids** and **bodkins** has independent approval for use in highway works. The concrete block retaining wall formed the lower section of the structure. A layer of large boulders was placed in front of the concrete wall section as an additional barrier to protect the soil embankment from scour during flood events.

**Green Terramesh** system was installed using the onsite fill material above the concrete wall section. **Green Terramesh** was chosen by the designer for several reasons. Firstly, the fill height could be constructed in a cost effective manner due to speed of construction that the **Green Terramesh** system allows. The **Green Terramesh** system will allow the regeneration of vegetation and therefore provide a more natural finish to the structure than continuing fully with concrete. The **Green Terramesh** system also allows for the flexibility of incorporating the large amount of readily available spoil to be used for embankment fill, therefore eliminating the need to important fill at high expense thus keeping costs down and maintaining site efficiencies.

Water is a key element to be considered in soil slope stability. The design incorporated **Enkadrain**, a geocomposite sheet drain developed to provide a similar performance level to that of a 300mm gravel chimney drain but at a lower installed cost.

**Enkadrain** laid at the rear of the reinforced fill ensures that no excess water can enter the reinforced soil zone that, if not managed, could result in an increase in pore pressures and potential embankment instability.

After completion of the reinforced fill embankment a layer **Tensar TriAx®** was laid over the fill for the start of the pavement. **Tensar TriAx®** geogrid is designed to improve the performance of the subbase aggregate thereby increasing the design life of the pavement to help reduce the level of maintenance required along a key route where any disruption to traffic can have an economic impact of the region.