CASE STUDY:

EROSION CONTROL

Redbank Station

REDBANK, QLD
DECEMBER 2017
CLIENT: **QUEENSLAND RAIL**

GEOWEB

The Geoweb geocell cellular confinement system is the most advanced soil stabilisation technology available. It was initially developed by Presto Geosystems together with the US Army Corp of Engineers to allow heavy vehicles to travel over soft ground. It is widely used in Australia for load support, erosion control, slope stability, retaining structures and high velocity channels.
The Geoweb system consists of a robust three-dimensional structure housing a network of interconnected cells that confine and compact soil. The confinement action prevents erosion and improves the structural performance of the soil or aggregate infill providing an alternative to reinforced concrete or armour.
The Geoweb cellular confinement system comes in collapsed, lightweight panels which can be handled easily and safely onsite.

QR and Civil Engineers throughout the country face difficult engineering problems daily, but when they can partner with trusted experts in geosynthetics, solutions which were not possible 20 years ago can now be realised.

Rail network operators, Queensland Rail (QR), not only need concern themselves with maintaining the rail track formation and infrastructure directly relating to their rolling stock, but often encounter complex engineering challenges within the Rail corridor.

One specific challenge developed along a boundary embankment near Redbank Station, southwest of Brisbane, Queensland. The presence of highly erodible soils, regular heavy sub-tropical rainfall, and a moderately steep slope, combined to promote aggressive erosion over a 100 m long section. Compounding the erosion problem, was the location of 600 mm deep service pits at the foot of the slope to which access was being compromised by the eroded soil. Other concerns raised by QR in their request to Geofabrics for support were: their inability to schedule track closures to complete repair works and the desire to establish a catch drain at the top of the slope with workable space restricted by a boundary fence.

GEOFABRICS®
Smarter Infrastructure

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Eroded Slope
The embankment prior to placement of the geosynthetic solutions

Having access to an impressive suite of systems and products from world-leading manufacturers and extensive experience as Australia's leading geosynthetic supplier for nearly 40 years, Geofabrics developed several solutions for QR's consideration.

The design, which QR selected, incorporated the following geosynthetic materials and systems:

1. Maccaferri Double-Twist Steel Wire Gabion Baskets
2. bidim Non-woven Geotextiles
3. Presto Geosystems Geoweb Cellular Confinement System
4. Grassroots Permanent Rolled Erosion Control Matting
5. Concrete Canvas, Concrete Impregnated Fabric

After clearing the bank of vegetation, a single course of Gabions, 1 m in height and width, were installed along the length of the embankment to form a permanent toe from which the slope could be re-graded. All the while insuring the underground services were protected and access to them maintained. The placement of bidim geotextile at the interface of the permeable gabions and the slope soils, prevents the fine particles from washing out through the gabions, while allowing any seeping or pore water to freely drain. A bidim layer covered the entire area of re-established slope for this same purpose, prior to installing the Geoweb system. By anchoring the Geoweb and tendons into an established trench at the top of the slope and with ATRA Anchors spaced throughout the slope face, once expanded, QR created a reinforced, three-dimensional, honeycomb, embankment surface, 150 mm deep, into which they could place any choice fill materials, including "foulled ballast".

With the Geoweb secured and filled, QR elected to then cover the ballast filled geoweb with Grassroots erosion control matting. Along with its natural coloured aesthetic, high resistance to UV degradation, and capacity to dramatically lower the hydraulically induced sheer forces acting on underlying soils, Grassroots has a strong track record of proven performance with the QR engineers involved on the Redbank works.

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GRASSROOTS

Grassroots is an erosion control matting designed to protect underlying soil in steep slopes and channels from moderate to high velocity water flows, rain splash and other erosive conditions, while allowing seeds to germinate successfully and grow through the matting providing permanent vegetative reinforcement. Grassroots is made in Australia by Geofabrics from heavy synthetic UV stabilised fibres which are needle punched together into an open weave synthetic scrim creating a three-dimensional structure which holds vegetation in place in extreme environmental conditions.

MACCAFERRI GABIONS

Maccaferri Gabions are a trusted, technically sound way to retain earth and combat soil erosion.

Maccaferri Gabions are rectangular woven wire mesh baskets filled with rock to create flexible, permeable structures such as retaining walls for architectural, mining, industrial and road projects. They are also used for erosion protection, weirs and bank stabilisation and to create architectural and design features. Their strength comes from a double twisted hexagonal mesh of steel wire, reinforced by heavier gauge wire along the edges and internal diaphragms. Maccaferri Gabions have been widely used across Australasia for over 50 years.

CONCRETE CANVAS

Concrete Canvas is a flexible, concrete impregnated fabric that hardens when hydrated to form a thin, durable, water proof and fire resistant concrete layer. It is the original concrete on a roll.
Concrete Canvas allows concrete construction without the need for plant or mixing equipment. Simply unroll and position Concrete Canvas, and then just add water (any type of water, including sea water).
Concrete Canvas has no impact on the pH of runoff water. Concrete Canvas is widely used as a cheaper alternative to non-structural shotcrete.
Concrete Canvas is used in a variety of civil infrastructure applications, such as ditch lining, slope protection and capping secondary containment bunds.

BIDIM

Australian made bidim non woven geotextiles provide engineers with an economical solution for separation and filtrations across a range of infrastrcuture projects.
bidim nonwoven geotextiles have a three-dimensional structure designed to improve drainage performance. Ideal for use in subsoil drainage systems, bidim will assist in the removal of water from road and railway works and behind retaining walls.
Using a layer of bidim geotextile to separate the soft ground from the fill material reduces the amount of fill required, increase the life span of the structure and cut long-term maintenance costs.

1. Laying the Geotextile
Laying the geotextile prior to installing the gabions at the toe of the slope

2. Installing the Gabions
a single course of Gabions, 1 m in height and width, were installed along the length of the embankment to form a permanent toe from which the slope could be re-graded

Having now stabilised the slope, creation of a “V” drain at the top of the embankment commenced. Directly over the anchor trench, the drain was formed with more fouled ballast and topsoil, to capture runoff and channel it around the rebuilt slope. Once shaped the drain was lined with an innovative fabric impregnated with concrete aptly named Concrete Canvas. Included in a new class of construction materials known as Geosynthetic Cementitious Concrete Mats (GCCM), Concrete Canvas hardens once hydrated to form a durable, fibre-reinforced, concrete layer. Because the site had limited access, and the cost of poured or sprayed concrete can be inhibitive, the quick to install Concrete Canvas helped QR meet their timelines and complete the works prior to the approaching Christmas holidays.

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3. Installing Geoweb
Anchoring the Geoweb and tendons into an established trench at the top of the slope.

Foulled ballast is material which has become "foulled" due to the infiltration of subgrade fines, like clay, or through the break-down of the ballast particles themselves into fines. Unfortunately, this spent ballast, due to its' contaminated classification, cannot simply be replaced and disposed of in local landfill, so it typically remains stockpiled throughout the rail corridor. And when operating 6,500 km of rail, you can be assured fouled ballast is not in short supply. The versatility of genuine Geoweb, enabled the use of this material in stabilising the embankment, a win-win from QR's perspective.

5. Installing Grassroots
With the Geoweb secured and filled, QR elected to then cover the ballast filled geoweb with Grassroots erosion control matting.

4. Geoweb Installation Progress
Once expanded the Geoweb system created a reinforced, three-dimensional, honeycomb, embankment surface, 150 mm deep, into which QR could place any choice fill materials, including "foulled ballast"

6. Installed Concrete Canvas
A "V" drain was constructed at the top of the embankment directly over the anchor trench. The drain was formed with more fouled ballast and topsoil, to capture runoff and channel it around the rebuilt slope. Once shaped the drain was lined with Concrete Canvas.

7. The Completed Reconstructed Slope