CASE STUDY

Cairnmuir Landslide

Central Otago NEW ZEALAND

Reinforced Earth® Walls with TerraTrel® Wire Mesh facing panels

Owner: Contact Energy Limited

Consultants: Opus International Consultants Limited

Contractor: Fulton Hogan Limited

Construction: November '93 to May '94

Background:

The Clutha River is New Zealand's highest volume and second longest river. It flows from Lake Wanaka, in Central Otago southwards to discharge into the South Pacific Ocean about 75 km south of the City of Dunedin.

Between the townships of Cromwell and Clyde the River flows through the Cromwell Gorge.

A 100 metre high concrete gravity dam was constructed across the Clutha River, at the southern outlet of the Cromwell Gorge, between 1977 and 1992. The Lake formed by the Dam has a surface area of 26 sq km.

Several large scale landslides in the Cromwell Gorge, which would be affected by the filling of the Dam, were stabilized over the period of the Dam Construction.

The Cairnmuir Landslide was not affected by the filling of the Lake as its failure surface is some 50 metres above the maximum lake level. Long term monitoring of the landslide indicated there was an unacceptable risk of failure of the landslide into the lake with potentially catastrophic effects on the townships of Clyde and Alexandra downstream of the dam.

The main contribution to the ongoing Landslide movement was found to be the infiltration of rainwater into the landslide base. Remedial measures had been effective in the upper areas of the landslide but ineffective in the lower areas (called the Landslide Frontal Lobes).

The Lower Frontal Lobe area had a general slope of about 45 deg. This area was to be waterproofed with a Geomembrane, weighted down with continuous stone filled wire baskets.

The Upper Frontal Lobe area was to be waterproofed by constructing vertical Reinforced Earth® retaining walls along the contour and sealing the resulting flat surfaces with a sprayed bitumen/stone surface. Rainwater was then to be concentrated in lined gullys, either side, and directed safely to the Lake.

In October 1993, the then owner, Electricorp NZ Limited (a State Owned Enterprise), let a Contract to Fulton Hogan Limited to undertake these works. The Contract required completion by 30 June 1994.

Geoquest, formerly Reinforced Earth Limited, was the nominated subcontractor for the design and supply of materials for 14,000 sqm of TerraTrel®, wire mesh faced, Reinforced Earth® retaining walls.

Transport infrastructure

Main picture and above: Reinforced Earth® retaining walls, with TerraTrel® wire mesh facing panels, at the Cairnmuir Slide. Cromwell Gorge - Central Otago,

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Reinforced Earth® retaining walls with TerraTrel® wire mesh facing panels at the Cairnmuir Slide in the Cromwell Gorge

The Challenge

The Reinforced Earth® walls were to be constructed on a moving landslide with a surface slope in excess of 30 degrees.

Changing the mass balance on the surface of the frontal lobe could trigger a landslide with potential catastrophic effects on Clyde and Alexandra downstream from the Clyde Dam.

As a consequence the Walls had to be constructed along the existing contour. The bench for the lowest wall was excavated first with the material excavated removed to the top of the site. Thereafter, material excavated to form each bench, was crushed and screened, using mobile plant, and used as Select Fill for the retaining wall below.

The Contractor also had to deal with a narrow, steep, access track and operating plant on steep unstable ground. Attention to site safety was absolutely critical.

Program

The supply of the Reinforced Earth® design and materials controlled the Critical Path.

The first enquiry to Geoquest New Zealand was made at the beginning of October 1993. Preliminary design and logistics investigations were undertaken during early October enabling a formal Quotation to be issued on the 28th October. The Order was received on the 2nd November.

Detailed Design was undertaken quickly with the Design Certificate issued on the 11th November. First materials deliveries were made on schedule on the 23rd November. Construction of the Walls was completed in April 1994 and all Site Works by the end of May 1994.

Movement of the Landslide has been reduced to a few mm per year post completion of the Works.

Project Specifications

System	TerraTrel® wire mesh facing panels
Finish	Black Welded Wire Mesh with rock fill
Structure	Reinforced Earth® retaining walls stabilizing a deep seated earth slide
Area	14,000 sq m
Max. Height	7.4 metre
Length	about 2,900 metre
Design load	20kPa live load
Design life	50 years

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