**CASE STUDY**

## SH 20 to 1

## MANUKAU EXTENSION

**Redoubt Road Flyover**
**Manukau, AUCKLAND, NZ**

Reinforced Earth™ Walls
TerraPlus® Precast Concrete facing

**OWNER**: NZ Transport Agency
NZTA Consultant: AECOM

**CONTRACTOR**: Leighton Works JV
Contractors Design: SKM & Golder

**CONSTRUCTION**: 2006 to 2010

**Background:**
The Auckland Western Ring Route is being implemented, in stages, to provide a second major traffic route from the South to the North of the Auckland isthmus. This Route is designated SH20.

SH20 connects to the existing motorway passing through Auckland (SH1) at Manukau in the South and proceeds west and north to the Auckland Airport; crosses the upper reaches of the Manukau Harbour between Mangere and Onehunga and passes through the western side of the Auckland isthmus to connect with the Auckland Northwest Motorway (SH18) at Waterview.

The Auckland Western Ring Route will, when completed, significantly reduce the traffic which now passes through and congests the Auckland CBD Interchanges. It will provide much enhanced access to the Auckland Airport as well as allow traffic to pass seamlessly though Auckland without having to cross the Auckland Harbour Bridge.

The SH20to1 – Manukau Extension Project was tendered as a Design and Construct Project.

The Project was awarded to the LeightonWorks JV in June 2006.

The SH20 to 1 Interchange forms a three level connection between the two State Highways. The uppermost level is a ten span, curved, 240m long bridge. The bridge allows traffic from the SH1 Southbound lanes, and from Redoubt Road, in the East, direct access to the SH20 west bound lanes.

**Reinforced Earth Ltd's Involvement**
Both abutments of the Redoubt Road Flyover were piled. Reinforced Earth Ltd was engaged by the Contractor to design and Supply a "Headstock Restraint" system, incorporating proprietary ***REhas*** galvanised steel earth reinforcing strips and concrete connections, for each Abutment.

This Headstock Restraint system controlled longitudinal displacement of the Headstocks which allowed the bridge designers to reduce the cross-section of the piles and hence reduce cost.

The Redoubt Road Flyover's western end lands on a piled abutment surrounded by Reinforced Earth™ Retaining Walls. The Contractor also engaged Reinforced Earth Ltd to design and supply the Reinforced Earth™ walls (TerraPlus® facing panel walls) supporting both sides and abutment wall of the western embankment.


**Main picture and above:** TerraPlus® at the SH20 to 1 Redoubt Road Flyover exit embankment.
The pattern comprises three panel finishes arranged in a chequer pattern

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**Above:** The Redoubt Road Flyover western approach embankment – north facing retaining wall

The Reinforced Earth™ retaining walls totalled **742 sqm** over a total length of **150 metres**. The maximum wall height was 10.980m on the northern side of the Abutment wall.

Design of the Reinforced Earth ™ retaining walls and Headstock Restraint systems was carried out in the Reinforced Earth Pty Ltd Design Office in Sydney, in accordance with the requirements of the Transit New Zealand Bridge Manual 2nd Edition. Independent Verification was undertaken by Michael Adler and Associates, also of Sydney. Seismicity in this region is low resulting in the use of a seismic design coefficient of just 0.175g

Construction commenced in July 2009 and was completed to Abutment Beam level in October 2009. The construction was finally completed in June 2010 after all adjacent bridge works were complete

**Features of this project:**
One unusual feature was in the piling. The use of ***REHas*** to control longitudinal displacement of the headstock resulted in the use of multiple slender precast concrete piles. These were driven through voids left in the constructed Reinforced Earth™ Block rather than the more usual method of first driving the piles and then constructing the Reinforced Earth™ Block around the piles.

Another, was the architectural finish. The Reinforced Earth™ Structure was very visible, not only from both Motorways but also from the nearby arterial road.

The Contractor achieved a stunning visual impact by using three differently coloured facing panels arranged in a chequer pattern. One panel type had an exposed basalt aggregate with black oxide, one similar but ground smooth to give a “terrazzo” finish and the other painted glossy white

**Project specifications**

| | |
|---|---|
| **System** | TerraPlus® |
| **Finish** | Special |
| **Structure** | Reinforced Earth™ wall |
| **Area** | 742 sqm |
| **Max. Height** | 10.98 m |
| **Length** | Total length of the three walls is 150 m |
| **Design load** | Transit New Zealand Bridge Manual 2nd edition |
| **Design life** | 100 years for RE walls |

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