



## CASE STUDY

# Blenheim Road Deviation

Christchurch NEW ZEALAND

Reinforced Earth® Walls with TerraClass®  
Precast concrete facing panels

Owner: The Christchurch City Council

Consultants: MWH Limited

Contractor: Downer NZ Limited

Construction: March 06 to April 07

### Background:

Blenheim road is a major arterial road, feeding traffic, from the south and western sides of Christchurch, into the CBD. The road has an average traffic flow of 35,000 vehicles per day

### The *Blenheim Road Deviation*

Project involved the realignment of the westernmost kilometre of road and the design and construction of a new 4 lane bridge over the SIMT railway, to improve traffic flow and safety.

The Christchurch City Council awarded the Contract to Downer NZ Ltd (Then Works Infrastructure Ltd) in late 2005.

Post award, the Contractor offered the Council an alternative design incorporating Reinforced Earth® walls which gave a significant cost saving over the conforming design. The alternative design was accepted and work commenced on site in December 2005.

### Challenges

The Contractor and their Designer faced a number of significant challenges.

The location of the site, close to the CBD, required the Project footprint to be minimised by using vertical retaining walls on each side of both approach embankments.

The foundation comprised deep alluvial deposits with lenses of silt. The site had been assessed as subject to liquefaction in a seismic event.

The abutment design featured Reinforced Earth® structures supporting the bridge deck directly on Sill Beams. This avoided potential lateral spreading of piles in a seismic event.

The foundations, in the immediate vicinity of the bridge abutments, were strengthened with stone columns and the whole "footprint" surcharged to minimise post construction settlement.

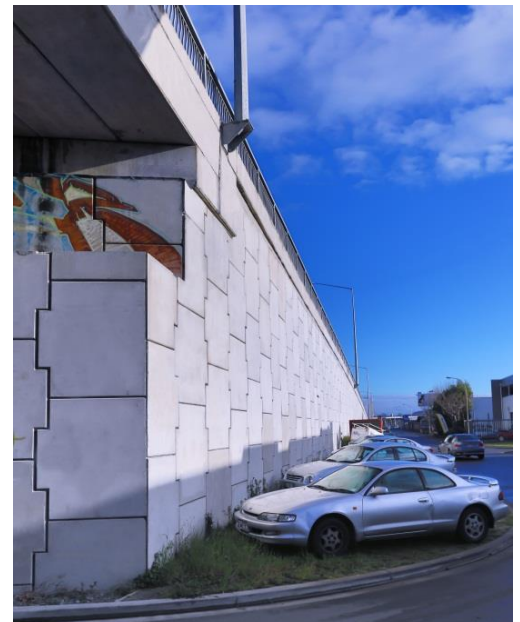
Large diameter stormwater pipes passed underneath the Reinforced Earth® structures on each side of the rail line.

The Contractor was required to provide temporary access through the work site (and approach embankments) to adjacent businesses either side of the rail line. It was not permitted for either plant or workers to cross the rail line which bisected the site.

The above issues resulted in a need to carefully stage the construction of the Reinforced Earth® Structures.

### Reinforced Earth® Structures.

Reinforced Earth Ltd provided detail design of the Structures, including the Provision of PS1 and PS2 Certificates, Construction Drawings, Specification and Construction Observation.



**Main picture and top above:** TerraClass® true abutment walls at the Blenheim Road Deviation Project in Christchurch

**Above:** Construction was staged to provide temporary access to adjacent businesses

Transport infrastructure



TerraClass® faced, Reinforced Earth® true abutment and retaining walls at Blenheim Rd Deviation

Design was in accordance with the TNZ Bridge Manual – 2<sup>nd</sup> edition

Detailed design was carried out in the Reinforced Earth Pty Ltd Design Office in Sydney, with independent verification by Dr John Wood of John Wood Consulting, Wellington

Seismicity in this area is high. The walls were designed to not exhibit any permanent displacement when subjected to a 2500 year return period seismic event. The Seismic design coefficient was 0.30g.

The Select Fill used in the construction of the Walls was river gravel sourced locally. The Design assumed an effective internal angle of friction of 36 degrees and a compacted bulk density of between 21 and 24 kN per cum. Cohesion was taken as 0 kPa.

The TerraClass® precast concrete facing panels used in these Walls have an acceptable differential settlement capacity of 1.5%.

Design Documentation was completed in January 2007. Manufacture of the TerraClass® precast concrete facing panels commenced in January, and construction of the first Wall commenced in early March 2007.

Reinforced Earth Limited provided observation of the Wall construction and supplied a PS4 Certificate on completion of the Construction Works.

#### Performance in Christchurch Earthquakes

Between September 2010 and December 2011 the Reinforced Earth® Walls were subjected to 4 significant, and many lesser earthquakes.

The Christchurch Earthquake of 22 February 2011 subjected the Walls to severe shaking of an estimated 0.45g, much higher than the design acceleration of 0.30g. No significant damage was experienced

#### Project Specifications

<b>System</b>	TerraClass® precast concrete facing panels
<b>Finish</b>	Plain Grey Concrete
<b>Structure</b>	Reinforced Earth™ true abutments and approach walls four sides
<b>Area</b>	3,372 sq m
<b>Max. Height</b>	8.423 metre
<b>Length</b>	840 metre in all walls
<b>Design load</b>	TNZ Bridge Manual 2 <sup>nd</sup> Edition
<b>Design life</b>	100 years