



## CASE STUDY

# North Kiama Bypass

South Coast, NSW, Australia

TechSpan® Arches  
Reinforced Earth Walls  
TerraClass®

Owner: RTA, NSW  
Consultants: Hughes Trueman & Brian Bourne  
Contractor: John Holland Pty Ltd  
Construction: Stage 1 – April 2004

### Background

Kiama is a beautiful township two hours drive south of Sydney with beautiful beaches, lush green mountainous surroundings, little craft shops, café's and of course the widely renowned spectacular "Blow hole". Places like these, within easy access of a world city, often become a must for tourists and the road infrastructure accessing the region suffers the consequences.

In 1986 the main road traversing North Kiama, Princes Highway, was already showing signs of having reached its design life and upgrade options had to be considered.

Construction of a 7.6km North Kiama bypass, valued at \$179 million, was selected to improve safety and travel conditions in the region.

This comprised two main stages:

- A 942m-long concrete bridge across the Terragong Swamp completed in February 2003.
- The four lane North Kiama Bypass.

### Challenge

RECO's involvement on the project was at a full-diamond interchange: Bombo Interchange, where RECO designed and supplied a 65-metre long railway tunnel, 2400m<sup>2</sup> of TerraClass® Reinforced Earth

walls and 1270m<sup>2</sup> of temporary Reinforced Earth "wire walls" for use during construction.

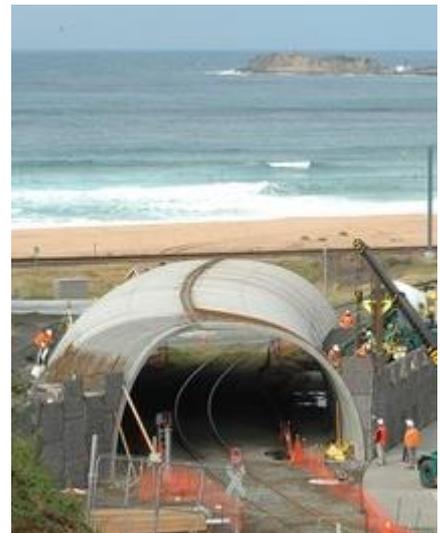
The two major technical challenges of this project were the low clearance height of the North Kiama bypass route above the rail line and the tight radius of the rail line to the nearby Bombo Quarry.

From a construction point of view the major challenge lay in the need to stage the construction in order to enable the Princes Highway to remain open to traffic at all times.

### Solution

Brian Bourne Bridge Engineers Pty Ltd - as the structural consultant to Hughes Trueman Consulting Engineers, developed the rail overpass tunnel concept. Head contractor John Holland Pty Ltd awarded RECO the contract for the detailed design and supply of the precast concrete arch tunnel and the associated reinforced soil walls. RECO engaged Interactive Design Services for specialised design assistance for the arch and Cardno MBK for independent design verification.

The design of the 64m TechSpan® Arch rail tunnel for the North Kiama Bypass required the construction of a unique skewed and splayed end detail to allow the structure to fit a geometrically complicated site.



Main Picture: RECO's design team developed an elegant solution to the technical challenges presented by the low clearance height of the North Kiama Bypass route and the tight radius of the rail line to the nearby Bombo Quarry.  
Top: Modular construction of TechSpan® tunnel.  
Above: Construction of a tight radius TechSpan® tunnel is made possible through the use of individually designed and precast TechSpan® units.

Transport infrastructure



**REINFORCED EARTH**  
SUSTAINABLE TECHNOLOGY



Left: Contractor John Holland engaged RECO to supply temporary TerraTrel® walls so that the construction of the TechSpan® tunnel and the permanent TerraClass® retaining walls could be staged to keep the Princes Highway open to traffic at all times. Above: RECO often develops a site-specific architectural finish, as was the case for the North Kiama Bypass.

The design of the stepped irregular buried structure, which is curved in three dimensions, was a further complication. Compliant with SM1600 traffic loading, the crown of the arch would have minimal cover and the load conditions would be highly asymmetrical. The severe skew of the tunnel could not encroach on the road boundaries either. Therefore 3D finite element analysis and modelling with the fill load applied in stages, to mimic the construction sequence, was used.

Construction of the tunnel using the specially manufactured wedge units was logistically complicated through working on a restricted site.

To overcome the challenge associated with permanent traffic flow, contractor John Holland engaged RECO to supply temporary TerraTrel® walls so that the construction of the TechSpan® tunnel and the permanent TerraClass® retaining walls could be staged to keep the Princes Highway open to traffic at all times.

#### Special features/benefits

- The facing of the TerraClass® panels was customised in accordance with RTA specifications to ensure a pleasing aesthetic appearance of the wall, that would blend in well with the surrounding environment.
- Precast segments for the TechSpan® arch were specifically manufactured in accordance with the design to accommodate the geometrically complicated site.
- Staged construction was made possible through the use of TechSpan® precast arches and temporary “wire walls”. This enabled the road to remain open to traffic whilst upgrading took place.
- North Kiama project demonstrated every possible reason why owners and contractors can rely on The Reinforced Earth Company for the success of their projects: Challenging, Multi Disciplinary, Technically Complicated and Tight Timelines.

#### Project specifications

<b>System</b>	<b>TechSpan®</b>
<b>Arch Type</b>	TSN
<b>Span</b>	12.947m
<b>Height</b>	5.925m
<b>Length</b>	65.84m
<b>Thickness</b>	250mm
<b>No. Units</b>	86
<b>System</b>	<b>TerraClass®</b>
<b>Finish</b>	Vertical Slate
<b>Structure</b>	Head / Wing Walls
<b>Area</b>	2430m <sup>2</sup>
<b>Max. Height</b>	6.805m
<b>Length</b>	560.5
<b>Design load</b>	220kPa (DL) 290kPa(DL+LL)
<b>Design life</b>	100 years