CASE STUDY

Orphan School Creek

Prairiewood, NSW, Australia

Reinforced Earth Walls
TerraClass®
TechSpan® Arches

Owner:	RTA, NSW
Consultants:	RTA, NSW
Contractor:	Barclay Mowlem Construction Ltd
Construction:	April 2002

Background

As part of an incentive to encourage public transport use within Sydney, the Roads and Traffic Authority (RTA) completed an exclusive bus transit way from Liverpool to Paramatta. Said to reduce travel time by up to 30 minutes on a typical journey between the two suburbs, the link was designed to pass over Orphan School Creek in the suburb of Prairiewood.

Orphan School Creek is an intermittently flowing creek meandering it's way through some of the fastest growing residential areas in Sydney. It is subject to the consequences of urban sprawl, such as increased runoff.

Challenge

The construction of the Orphan School Creek over pass needed to be conducted with minimal impact to the local residents and wildlife.

Additionally, the design had to allow for temporary flood levels during periods of high rainfall.

Solution

The Reinforced Earth Company's (RECO's) involvement on the Orphan School Creek section of the works consisted of the design and supply of 33 metres of TechSpan® arch and 118m² of TerraClass®, vertically ribbed retaining walls. The TechSpan® arch system was used in lieu of twin box culverts.

TechSpan® is a three-pin, two-piece, funicular curve shaped arch. It is the leading precast concrete arch system available in Australia and New Zealand.

Unlike other systems, every TechSpan® design is carefully tailored, structurally and geometrically, to meet the individual requirements of the particular project. In this case the arch geometry was designed to maximise the area beneath the arch to accommodate any increase in the quantity of water flowing through the structure.

RECO uses finite element analysis and funicular curve theory to define the optimum curvature for the arch in consideration of span, clearance envelope, ground parameters and construction sequence. The resulting design will:

- Optimise the properties of concrete and reinforcement
- Minimise the tensile stresses and cracking in the concrete
- Optimise the shape of the arch
- Optimise arch thickness and amount of material used

This results in:

- Minimum materials required for the arch
- Maximum durability of the arch
- A cost effective total solution for the client.

Main Picture: Construction of TerraClass® wing walls. Note, backfilling on the TechSpan® arch has begun and the waterproofing used between adjoining arch units is clearly visible.

Top: The first two TechSpan® units are wired together.

Above: The third TechSpan® unit is being placed. Note two cranes are required for the placement of the first few units; thereafter only one crane is necessary.

Transport infrastructure

REINFORCED EARTH
SUSTAINABLE TECHNOLOGY

Left: The 33 metre arch structure is completed awaiting installation of headwalls. Stones located at the base of the arch within the waterway to minimise scouring of concrete.
Above: Construction of TerraClass® wing walls. Note vertical rib architectural finish.

The adaptability of the arch shape allowed optimisation of the section while respecting the anticipated water flow. TechSpan® was the solution of choice for this application as the prefabricated durable concrete units used were cost-effective and could be constructed without diverting the stream.

Waterproofing the structure saw each vertical arch joint between adjacent arch elements sealed using a sheet of self-adhesive impermeable membrane covered by 500mm wide geotextile.

Additional 500mm geotextile was laid horizontally along the base of the structure to the level of permanent inundation as additional protection.

The wingwalls were architecturally finished with a 20mm deep vertical rib to create an aesthetically pleasing structure within the project's residential surroundings.

Construction initially began in March 2002, however the uncovering of a number of Aboriginal artefacts during the initial excavations temporarily delayed erection. Once the artefacts had been identified and referred to the appropriate authorities, construction continued one month later.

Special features/benefits

- The arch structure was designed to replace the twin box culverts specified, saving the contractor valuable construction time.
- The erection process was supervised on a regular basis to ensure efficient construction and minimal disruption to the local residents.
- Reinforced Earth retaining walls were more economic than the specified spandrel wing wall units.
- Providing a total precast solution meant all items could be delivered and assembled on site with very little disruption to the surrounding residents.

Project specifications

System	**TechSpan®**
Arch Type	TSD
Span	10.20m
Height	2.90m
Length	33.10m
Thickness	200mm
No. Units	45
System	**TerraClass®**
Finish	Vertical Rib
Structure	Wing Walls
Area	118m²
Max. Height	4.105m
Design load	110kPa (DL) 130kPa (DL+LL)
Design life	100 years

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