



CASE STUDY

Mt Arthur North Reclaim Tunnels

Hunter Valley, NSW, Australia

TechSpan® Arches
Reinforced Earth Walls
TerraPlus®

Owner: BHP Billiton
Consultants: Sinclair Knight Merz
Contractor: Sinclair Knight Merz
– Robert Schaefer
Joint Venture
Construction: August 2002

Background

Located in the heart of the New South Wales wine-producing region, Mt Arthur North Coal Mine is surrounded by both vast reserves of coal and a breathtaking view of the surrounding valley. The mine, initially a 'green field' site, was designed to operate with three major stockpile facilities aptly named export, domestic and circular.

Challenge

To maximise space on the site, stockpiling of coal above the conveyors was suggested. Cast *in situ* chambers containing electronically operated valves regulating the release of coal onto the conveyor below would be needed. The project also required a design to house the conveyors, which would also act as a support from which the conveyors could be hung. Concrete headwalls were also required.

Solution

The Reinforced Earth Company (RECO) was contracted to supply over 1000 lineal metres of precast TechSpan® arch units to sustain the loads applied by stockpiles up to 25m in height.

Designing an arch unit specifically to meet the requirements of the project, 38 separate arch reinforcement

designs were required to accommodate a number of differing load cases. Each tunnel needed to withstand the various loading cases arising in relation to the height and position of the coal stockpile above.

Another specific requirement of the design was to conceive a support strong enough to sustain the loads imposed by hanging the conveyors directly from the arch. Ferrules were cast directly into each unit with additional reinforcement provided to ensure sufficient strength to avoid the ferrules pulling out during the conveyor's operation.

The coal chambers located at regular intervals along the length of the domestic and export tunnels were constructed in-situ prior to the arch erection. Each chamber required the adjacent arch units to be chamfered allowing for a flush finish with the square ended chambers. Sealing the gap between the arch unit and the chamber was achieved with a mastic strip held in place with self-adhesive bituminous tape and covered with a layer of geotextile.

A maximum 13% grade towards the end of the circular stockpile was the steepest grade upon which a TechSpan® structure has been constructed. Design issues such as each unit's center of gravity coupled with transport and weight



Main Picture: Mt Arthur North TechSpan® reclaim tunnel and stockpile.

Top: Construction of TechSpan® reclaim tunnel.

Centre: Inside completed TechSpan® reclaim tunnel.

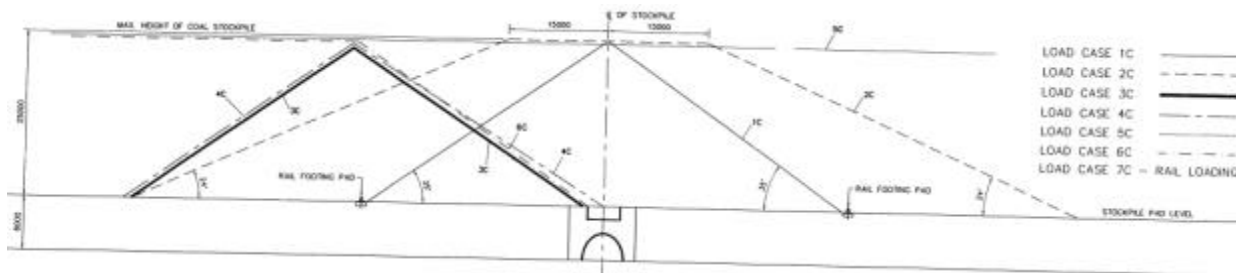
Above: Circular stockpile.

Mining infrastructure



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Above: Drawing showing varying load cases designed for over the circular conveyor tunnel.
 Below: Drawing showing circular conveyor tunnel, headwalls and stockpile.

restrictions required careful planning to guarantee a conforming design.

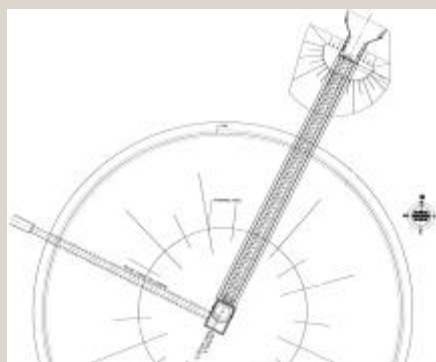
Although designed externally, the arches raft footings were required to accommodate the very high loads associated with the very heavy stockpile. They fulfilled a secondary purpose as a solid access base for vehicles maintaining the tunnels through out the tenure of their operation.

Special Features / Benefits

- Units designed to sustain loads applied from up to 25m of material stockpiled above.
- By designing for the maximum grade, the same arch profile was used throughout the entire

project.

- Arch designed to carry loads of conveyor hung from roof of the tunnel.
- Impervious membrane installed atop each wall to seal the structure and direct all moisture away from the Reinforced Earth block.
- Space optimisation by housing coal stockpile above conveyor as illustrated.
- Design load equivalent to 33m head of material.
- Numerous load cases were analysed to accommodate all conceivable load possibilities.
- Top loading coal chambers incorporated into the arch design.



Project specifications

System	TechSpan®
Arch Type	TSQ
Span	6.2m
Height	3.9m
Length	1024
Thickness	170mm
No. Units	904
System	TerraPlus®
Finish	Plain
Structure	Head / Wing Walls
Area	645m ²
Max. Height	5.72m
Design load	120kPa (DL) 130kPa (DL + LL)
Design life	100 years



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