Innovative Engineering to Replace Small Bridge Structures
Who we are

A company specialising in pipeline construction & rehabilitation solutions

Accredited & chosen by many councils, road, rail, mining & water service providers throughout Australia

A team of qualified engineers, project managers, customer support personnel & specialist field operators

Established in 2005

Certified to ISO 14001, ISO 9001, AS4801

Provide a full range of maintenance & refurbishment solutions to Australian utility authorities & asset managers
Definition of an Engineer

- “Someone who can do for 20c…
- …what any ‘fool’ can do for $1”
- Not just in economic terms
  - Triple bottom line – includes People and the Planet
- Aim – to demonstrate how the right innovation can also positively impact the triple bottom line
Asset Maintenance

- **Aging assets** – Many Tunnels, pipelines and small bridges in need of urgent renewal exist throughout the country
- **The unknown** – Cracks, Cavities & voids can form without knowledge
- **Failure** – The results of failed structures can be disruptive, dangerous & expensive
Result of failed infrastructure

- Flooding
- Surcharges
- Subsidence
- Sinkholes
- Loss of road & structures
- Environmental damage
Small Bridge Rehabilitation
Rehabilitation of small multi-span Bridge structure

Existing 3 arch bridge section 8.0m spans with 4.0m vertical clearance
Case Study

• Triple Cell 8.0m * 4.0m CSP arch
  • Built 1973, 40 year life

• Project Parameters
  • Each Cell 17m deep / long
  • Depth of Cover 1.5m
  • Live loading to 35 Tonne Axles
  • Reinforced high strength Concrete
  • Designed to AS3725 & AS5100
  • 100 year design life
  • Compliant with Australian Standards
Dilapidation Issues

Water seepage causing spalling on concrete surfaces

Corrosion of existing CSP from outside reducing plate thickness
Dilapidation Issues

Loss of concrete capping to faces of headwall above arch spans

Water damage and cracking of intermediate pier supports
CSP Lining - Issues

Internal Corrosion
Sectional delamination
Signs of potential
Buckling

Several Previous patch repairs
Loss of CSP thickness in places
Movement during transient loading
Design Scope

• Provide a stand alone structural rehabilitation solution
• 100 year design life
• RC and Concrete Design
• Compliance to Quality Regime
• Total Load 353kN (350LA)
• No Disruption to Rail Traffic
Design Scope

- Designed as a Buried pipe to AS/NZS 3725
- Loading to AS/NZS 5100 Road & rail
- Deflection and point load tests to AS/NZS 4058
- Concrete design in accordance with AS/NZS 3600
- Formwork design to AS/NZS 3610
Design Considerations

- Condition Assessment
- Existing Structure Design
- Structural Design with FEA
- Hydraulic Design – Manning’s & Colebrook White
- Temporary Works Design
- Formwork
- Headwall Structures
Harnessing the existing Structure

- Excavate to Rock Head
- Test existing footing
- Concrete infill
- New Ground Beam
- Tie to existing Foundation
Staged Construction

- Centre Cell first in 3 sections
- Centre, then either side
- Headwalls last
- Reduce loading impact
- Reduce transient Stress across the structure
- Reduce Flooding impact to Construction program
Formwork and Support

- Super strong light weight modular panel system
- Each Panel weighing 60 Kg
- Smooth external surface
- Intermediate Supports
- Design checked using FE modelling
- Design sign off to Australian Standards AS/NZS 3610
Reinforcement

- Twin cage N16 Bar
- Continuous through depth of arch
- Tied into Ground beam
- Profile symmetrical to true arch
- No expansion joints
- Verified by FEA
Concrete Mix Design

- Consistent Quality fundamental
- Designs to AS/NZS 3600
- Test and trial mixings
- Computer controlled batching for mix traceability
- Mix blending is critical
- QA testing and site checks fundamental
Concrete Mix Design...cont’d

- 40, 50 & 60 MPa special design mix - 10mm aggregate with super plasticizer and retarder
- Fly Ash (or GGBS replacement if possible)
- High flow- high durability
- 240mm Slump ± 40mm
Construction Highlights

- Stand alone structural design
- Harness off existing foundations
- Works undertaken without speed restrictions or line closures
- 100 year design life
- Tried and tested materials
- Supporting Australian Design Standards
Construction Advantages

- Minimal time on site vs full replacement
  - 40% to 60% faster
- Reduced Cost – 50% vs full replacement
- Minimal environmental impact vs full replacement
  - Plant movements
  - CO₂ footprint
  - Noise / Pollution / Waste / Landfill
Take home messages

Renewal of pipelines, Bridges culverts and Tunnels no longer requires the use of open cut replacement methods.

Stand alone, Cost effective Structural rehabilitation solutions meeting AS5100, AS3725.

100 year design life

Repair methods allow for continued use of assets negating a need for lengthy shut down periods, reducing environmental & community impact

Triple Bottom Line Accountability… Less cost, waste, stakeholder and environmental impact