

# Project Profile

## Roe Highway Bridge Strengthening Project

### Decrease in traffic congestion and improved amenity for bridge users

#### PROJECT BACKGROUND

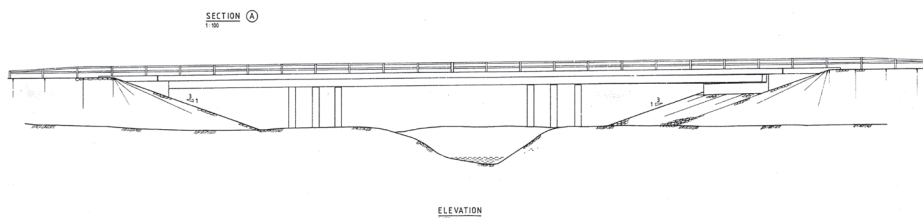
An average of 60,000 vehicles per day use Bridge 1148, which carries the Roe Highway over the Helena River in Helena Valley, approximately 10km from Midland.

Over recent years, increasing volumes of traffic on the Roe Highway, particularly an increase in heavy vehicles as a result of the WA mining boom, was affecting the bridge's structure. To limit damage, Main Roads Heavy Vehicle Services division had also placed a 10 km/hr restriction on heavy vehicles travelling over the bridge, which was causing significant traffic congestion.

Main Roads WA had identified that the existing post-tensioned concrete bridge girders (bridge beams) were substandard in deflection (hogging) with the tell-tale signs of cracking beginning to appear in the concrete. The existing pre-stressed, pre-cast concrete piles were also insufficient in capacity for the required vehicle loadings. As a result the bridge was designated for urgent strengthening works.

#### BRIDGE SPECIFICATIONS

Roe Highway Bridge no.1148 is a three span (16.5/21/16.5 metre) post-tensioned continuous concrete structure. It has an overall width of 17.64 metres, comprising two 7.7 metre carriageways between kerbs, a median traffic barrier with a superstructure consisting of three integral trapezoidal shaped beams spaced at 6 metre centres, and total depth of 900mm.



#### PROJECT CHALLENGES

The design phase, undertaken by structural designer, AECOM in collaboration with Main Roads WA, identified the optimum bridge strengthening solution to involve the installation of additional bridge beams (steel girders) and columns (steel columns). These would be supported by a micro-piled foundation solution, which had become the preferred foundation solution due to its eco-friendly cost-saving properties.

#### CONTRACT

55/14, Construct Only, AS2124

#### CLIENT

Main Roads WA

#### PRE-QUALIFICATION

B3

#### TIMEFRAME

Dec 2015 - June 2016

#### PROJECT VALUE

\$2.7million



However, the use of steel girders with micro-piled foundations was the first time this methodology had been used in bridge strengthening works for an existing structure in WA. As such, it would present a number of challenges for the constructor, as no construction precedents existed.

Other key challenges included:

- Working around the significant space restrictions and work area limitations, and avoiding any potential for damage to an existing structure;
- Maintaining the current flow of traffic on Roe Highway without imposing further load restrictions;
- Ensuring the stability of work platforms for equipment and worker safety due to the uneven/ excavated ground material;
- Ensuring the integrity of the temporary support structure used to take the vehicle load during steel girder installation;
- Connectivity of the steel girder to the soffit including developing a suitable high strength flowable epoxy grout system to provide a structural bond between the steel girder top flange and soffit; and
- Meeting a very tight construction program which required the installation of 4-5 micropiles per day.

## ABOUT THE CONTRACTOR

The contract to perform bridge strengthening works was awarded to the Highway Construction/Albem Operations Joint Venture (HAJV).

The HAJV is an established joint venture partnership between Highway Construction and Albem Operations, who since forming in 2009 has delivered the \$110 million design and construct Dampier Highway Duplication Project (also in partnership with Downer); a new \$18.5 million bridge over Big McPhee Creek south of Kununurra on the Great Northern Highway; and most recently, the \$9 million Onslow Ring Road construction.

These highly complementary strengths combined, ensured this small but complex project would benefit from Albem's structural capabilities and Highway Construction's depth of expertise delivering major road contracts for Main Roads WA.

## PROJECT SCOPE

The HAJV was responsible for project construction and delivery using designs commissioned by Main Roads WA. This included:

- Civil works;
- Structural works;
- Aboriginal Heritage management;
- Environmental, quality, occupational health and safety; and
- Traffic management disciplines.



HIGHWAY  
CONSTRUCTION

ALBEM

### Key activities included:

1. Excavation around existing structure and pile caps;
2. Temporary shoring works;
3. Installation of micro piles;
4. Marking of overhead holes for chem-set anchors;
5. Drilling of holes (horizontal & overhead) for chem-set anchors;
6. Construction of pile caps;
7. Installation of columns & temporary support system;
8. Installation of steel beams;
9. Grouting between beam & soffit;
10. Backfilling and reinstatement.

### EXAMPLES OF PROJECT SOLUTIONS AND INNOVATIONS

#### *Overcoming height restrictions and ground instability:*

- low set piling rigs were used to excavate the 16-18 metre bore holes, and single reinforcement bars (T76S drilled hollow bars) were installed in one metre sections and joined with couplers designed to provide full capacity to the bars;
- beam installation had to be achieved from below using forklifts and telehandlers;
- bridge beams were fabricated into customised 10 x 7 tonne steel girders; and
- geo-technical engineers were engaged to work out the stability of excavation around existing pile caps and to geo-technically engineer working platforms for pile rigs and lifting equipment to overcome ground instability issues.

#### *Maintaining traffic flow:*

- an independent structural engineering firm was engaged to design an enhanced temporary support system and construction methodology to ensure the integrity of the temporary support system to be used during steel girder installation;
- construction activities were planned and sequenced in such a way that there was no requirement to reduce the bridge's load limit which kept traffic flowing at all times; and
- a customised epoxy solution was developed to enable the gap between the bridge soffit and steel girders to achieve a minimum of 40MPa within 4 hours – minimising lane closures and keeping traffic moving.

#### *Meeting a tight delivery program*

- an intensive scheduling and planning of multi-disciplined work was implemented to ensure the installation of 76 micro-piles to meet a very tight delivery program.

#### *Environmental, cost and time saving innovations*

- a polymer based solution was used to flush excavated materials during micro pile installation and to stabilise surrounding material. This eliminated the need to use temporary liners to avoid soil collapse. The polymer was also recycled using a temporary sediment pit; and
- Modifications were made to the over head drill press used as part of the reo bar installation to reduce fatigue (1400 holes had to be pre-drilled).



## KEY OUTCOMES

The HAJV, working in partnership with Main Roads WA, was able to safely overcome this complex program of activity within a tight work area, without disrupting traffic flow and whilst respecting the environmental integrity of the area.

The safety system adopted was also commended during the 3rd party auditing from the Office of the Federal Safety Commissioner and later by our Client's and our internal safety, quality and environmental audits.

This was achieved using a combination of:

- a highly flexible and experienced approach to project management;
- advanced programming and traffic management ability; open two-way communication with the Client;
- innovative thinking in the development and application of specialised materials; and
- advanced construction techniques.

The end result was a project that met all agreed timelines, underspent on the Client's budget, and which has set new benchmarks in the delivery of similar works into the future.

Equally as important, the successful completion of these works also meant no further restrictions on the bridge for oversize vehicles resulting in an immediate decrease in traffic congestion and improvement in amenity for the travelling public and freight users.



## PROJECT REFEREES

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