ACCELERATED TIMBER BRIDGE REPLACEMENT

Abstract
The Southern Queensland Accelerated Road Rehabilitation Project (SQARRP) is replacing 31 timber bridges on strategic road networks in southern Queensland. The majority of the project is being delivered under a new project alliance delivery model. The key points of difference with this model to other alliances are that alliance participant organisations were selected individually, and the supply chain (namely concrete precasters and pile driving contractors) have been incorporated into the alliance as full alliance participants.

Introduction
Following the Queensland Parliamentary Public Works Committee’s report, Inquiry into the Maintenance of the State-Controlled Road Network, delivered in 2000, Queensland Treasury provided special funding to Main Roads to test a proposal for the bulking up and bringing forward of a road rehabilitation program.

Two projects were approved:
- Central Queensland Accelerated Road Rehabilitation Project (ARRP) for the rehabilitation of 71km of the Dawson Highway (Gladstone to Banana) including five timber bridge replacements
- Southern Queensland ARRP Bridge Project for the replacement of 31 timber bridges and approaches throughout the Main Roads Border, Southern and Wide Bay Districts.

The ARRP model aims to achieve economies of scale, cost and time. By bulking up a program of individual projects into one larger program, and by fostering an environment of innovation and efficiency, the ARRP projects aims to deliver an improved road network more quickly and cost effectively than the traditional project delivery models.
The SQARRP bridge project also will deliver improved environmental outcomes by RoadTek salvaging recyclable timber from the timber bridges for use in maintenance and repair of remaining timber bridges on the state-controlled road network. This reduces the pressure on already scarce hardwood timber resources.

Many of the timber bridges on the Main Roads state-controlled road network were built over 50 years ago. Today, they carry traffic volumes and heavy vehicle loads well in excess of what was originally intended and require more maintenance than is cost effective.

Thirty-one of these bridges, were identified as being the highest priority for replacement, because of their location on strategic routes and their subsequent relative importance to the Queensland economy.

Main Roads could have chosen to follow the established method of individually contracting the replacements, at the usual one or two bridge replacements per year, per district. However, it was anticipated that this approach would have resulted in:

- higher overall project cost
- extended replacement time frames
- reduced organisational learning outcomes
- reduced interaction and knowledge transfer with suppliers and sub-contractors.

Two bridges, Fat Hen Creek at Kilkivan and Wallaby Creek No. 3 at Moore, were delivered early as designs were complete. Sandy Creek at Childers was severely damaged in a bushfire which meant bringing it forward for replacement. All three of these bridge replacements were administered by the districts and constructed by RoadTek under individual contracts. The remaining 28 bridges are being delivered under an alliance contract.

**Project Delivery**

The Main Roads project team carried out a market sounding exercise with industry through a value management workshop early in the project concept stage. Attending the workshop were designers, construction contractors, piling contractors and concrete precasters. The workshop confirmed that the best way to deliver the project in the current infrastructure boom and to achieve the project objectives (in particular fast tracked delivery, and promoting innovation) was via an alliance.

The alliance type of project delivery is not new to Main Roads. In the traditional alliance contract the proponents, usually contractors and designers, come together as a single entity and present themselves to the client through an expression of interest (EOI) process. The winning alliance team is selected using non-price selection criteria (for example, capability, expertise, experience, and ability to work in an alliance framework).

Given that a large proportion of the project involved precast concrete products and piling work, the involvement of these suppliers in the alliance was crucial. To minimise supply risk, promote innovation and enhance efficiencies, it was decided to incorporate the piling and precast concrete suppliers as full alliance participants. It is believed that this is the first time that Main Roads has included supply chain participants in an alliance.
Figure 1. Plan of replacement bridge locations
As full alliance participants, pile drivers and concrete precasters are given the opportunity to deliver and be rewarded for project productivity improvements and innovations. For example, in being able to provide input into bridge design, the potential for improvements in constructability are realised as their specific knowledge is harnessed and used for the benefit of the project.

Several rounds of industry briefing were concluded in January 2006, Main Roads sought expressions of interest from individual organisations to enter into an alliance to design and construct the bridges.

Twenty-one firms comprising 5 designers, 4 pilers, 5 precasters, and 7 constructors, submitted proposals for initial consideration in the alliance. With a large applicant pool, Main Roads was able to achieve its goal of selecting the best team for the project, and was confident the individual companies would work successfully together. Alliance partners have been chosen on the basis of their individual attributes as well as the synergies that they can bring through interaction with all other alliance partners.

After a series of selection workshops, the final selection was concluded in June 2006. The following firms were successful in being appointed to the alliance:

- construction: Civil Mining and Construction Pty Ltd and Queensland Bridge and Civil
- pile driving: Wagstaff Piling Pty Ltd
- design: Connell Wagner Pty Ltd
- precast concrete: Rinker Australia Pty Ltd (Humes).

Main Roads is a full alliance partner, committing staff to critical roles in the project. Engineering, communications, financial, administrative and information technology roles are performed by Main Roads staff alongside the private sector.

Additionally, senior Main Roads staff and consultants participate in the alliance management team and alliance leadership team, providing project leadership and direction and making critical best-for-project decisions in conjunction with the other alliance participants.

The set-up phase was concluded in May 2007, with the signing of the project alliance agreement (PAA). Construction commenced immediately thereafter.

The alliance payment structure has been altered in direct response to feedback obtained from the alliance commercial partners. Alliances allocate financial risk and benefit through pain/gain arrangements. The feedback received by Main Roads was that potential alliance participants would be more comfortable in entering into the alliance if a lower limit was placed on any potential losses.

Figure 2. Signing of the PAA. (top l-r) David Wheeley (Humes), David Ahern (Civil Mining and Construction Pty Ltd), Darren Kesby (Queensland Bridge and Civil), Greg Anderson (Wagstaff Piling). (bottom l-r) Charlie Miller (Connell Wagner), Graham Hobbs (DMR – Contracts & Standards Branch)
In providing a concession to limit financial risk for alliance participants, Main Roads established a cap on potential profits (Figure 3). Figure 3 also shows the ‘flat line’ concept that has been incorporated into the model to equally encourage adherence to the project budget, and significance in project savings. As with other alliances, the costs for overheads, and normal business profits are incorporated into the target outturn cost (TOC) for the project, but the Limb 2 payments are capped at levels which were agreed to in the IPAA phase.

Good performance across a broader range of outcomes in addition to cost performance is important. Main Roads established a small bonus fund as an incentive for the participants to achieve a rating of “outstanding” in the project’s key result areas (KRA’s) of:

- safety - for road users, site workers, and staff travelling to and from work
- quality - to deliver the project to the highest of quality
- community - to establish effective and positive relationships with our external community
- environmental and cultural heritage - to comply with legislative intent and to improve the environmental value of the project bridge sites
- knowledge transfer - to share knowledge successes and lessons learnt with project participants, industry and Main Roads
- alliance culture - to align the alliance team to a positive organisational culture and personal development of individuals working on the project.
Figure 4. The replacement of Wilkie Creek bridge on the Moonie Highway at Dalby was completed in December 2007, before schedule and under budget.

Figure 5. Barambah Creek bridge before and after reconstruction
The PAA defines the required benchmarks that need to be achieved for the fund to be awarded to the commercial partners. A result of “outstanding” can only be achieved with the implementation of innovation and dedicated effort. In the non-cost KRA’s a result of “business as usual”, a level of performance that occurs currently in industry, will result in the alliance partners receiving no dividend from the non-cost fund.

The setup phase has been benchmarked as being slightly longer than optimum for an alliance or a regular design and construct model. The detailed planning that was undertaken during the IPAA phase is showing benefits as the project is still well ahead of the program to complete the works by the end of 2009. Stretch program and financial targets have been agreed by all participants.

The decision to include the supply chain into the alliance is now delivering benefits. Many key supply chain firms now have a forward commitment for up to eighteen months due to the large construction boom in the south-east corner of Queensland. The SQARRP bridge project now has greater flexibility in scheduling and revising the timing of individual bridge projects.

**Key project complexities**

The replacement of a number of ‘simple’ rural bridges belies the complexities of this project, such as:

- covers an area with a geographical spread of over 500km from north to south
- operates across three separate Main Roads districts
- operates at multiple bridge sites at any one time
- has government supplied obligations such as relocation of utility services, land acquisition and environmental clearances, being delivered just in time so as not to impede construction progress
- reporting project performance to several parent organisations and stakeholders, is a significant challenge.

The success of the alliance in delivering a program of multiple bridges will be judged by:

- delivery of productivity savings due to improving repetitive tasks
- the sequencing of tasks
- innovation at all levels of the project
- value management through all participants involved in design and construction
- procurement savings
- knowledge transfer.

The project offers improved training opportunities for Main Roads staff, educates smaller contractors, and suppliers who would normally be sub-contractors in a conventional alliance project. This important skilling of the private and public sectors will benefit future road projects.

Cultural heritage, stakeholder management, environmental considerations, design issues, and service relocations are typical issues for most road construction projects.
However, in the SQARRP bridge project, these issues presented themselves 31 times over. This placed great emphasis on the need to develop an ongoing register of learnings, to create efficiencies, by duplicating successes and avoiding the repetition of negative impacts. Key learnings have therefore become a priority for the alliance, and the dissemination of these key learnings (an area which Main Roads is placing increasing emphasis upon) is a KRA for the alliance.

The alliance maintains a register of innovations. The financial value of savings ranges significantly. An example is reducing the environmental impacts of works, which actually cost the alliance financially while contributing towards the non-cost environmental KRA.

The alliance has also provided opportunities for other industry sectors to be involved. Local government have subcontracted to construct sidetracks and undertake approach works and to provide emergency repair services. RoadTek are demolishing the existing structures and salvaging the useable timbers for reuse in maintenance and rehabilitation programs.

Team building, relationships and developing a new organisational culture within the alliance is important and ensures that best for project decisions are made and that a convivial and productive work environment is fostered.

This is a challenge on such a geographically dispersed project where staff have limited opportunities to interact with each other. In the absence of regular face-to-face contact, tools such as an internal staff newsletter have become important in developing alliance cohesiveness.

**Current status**

As at the end of March 2008, the alliance is on track to have fully completed seven of the 28 bridges and approaches.

The stretch target that the SQARRP Bridge Project has set for itself currently aims to have:

- Area 1 (southern) bridges completed by December 2008
- Area 2 (northern) bridges by July 2009
- The project complete 6 months ahead of schedule.
This anticipated time saving along with productivity efficiencies and purchasing gains will also deliver a project which is currently projected to be finalised at approximately 7% under the TOC.

The value management register currently lists 49 innovation/value managements for the project. An example of how value has been provided to the project includes standardisation of design to enable bulked up purchases of bridge rail and rail ends to create purchasing efficiencies. Another example is the refinement of bridge and approach design through negotiation with service providers to mitigate service relocations.

The alliance is currently on the way to achieving the stretch KRA goals. For example, the project has had only one minor safety incident recorded, no environmental non-conformances, and the initial alliance health check has indicated a strong alliance culture within the SQARRP organisation. All individuals and project groups are being encouraged to exhibit behaviours that are consistent with the aims and intent of the KRA’s and to encourage similar behaviours in others.

The future and possible extensions
External to the SQARRP Bridge Project the alliance has undertaken to complete two cross-border bridges for the Roads and Traffic Authority, NSW. These have been scheduled to commence after the current programme of works is completed.

With the set-up phase of the project providing a strong basis for the alliance and with all participants now working together very strongly, it has been a relatively easy task to extend the program to incorporate additional works. The alliance intends to pursue further opportunities with Main Roads.

Conclusion
The current organisational culture within the alliance is one of rising to the challenge to meet the stretch targets that it has set for itself. This has been brought about by heavy emphasis on relationship development within the alliance, to encourage a work ethic that enables the project to meet the goals that have been set for it. Main Roads remains integrally involved in the project at an operational and managerial level, committing staff to varied key roles within the alliance, providing professional development opportunities for these staff.

In line with the identified goals of the ARRP proof of concept plan, the SQARRP Bridge Project is on track to be delivered ahead of schedule, within cost targets, whilst having a spirit of innovation and efficiency. The project will provide key input into future bulk-up and bring forward programs. The new and innovative alliance model that the majority of the project is being delivered under will be rigorously scrutinised to determine the role that selecting each alliance participant individually, and incorporating the supply chain, has had in achieving the goals of an accelerated and bulked-up program of works. To date, the alliance believes that it has proved that the model has enabled Main Roads to put together the best team for the project and that supply risk is mitigated through the incorporation of the major supply chain suppliers into the alliance.