MOTORWAY ALLIANCE DRIVES PERFORMANCE IMPROVEMENT

Alliances are proving to be an effective way of controlling costs and obtaining superior outcomes in major construction projects.

The project alliance, formed to design and construct the majority of works for the Port of Brisbane Motorway (POBM) in Queensland, achieved impressive project benefits, including:

- 10% reduction in project cost;
- 30% reduction in time required for project completion;
- 10% reduction in traffic management costs;
- 40% reduction in the lost time injury frequency rate.

These gains arose in large part from a preparedness to trial and implement new technology and procedures within the alliance framework.

The POBM Alliance was formed to deliver five kilometres of four-lane motorway and 12 major new bridges, to carry an expected 8,000 trucks per day by 2011, for a Total Cost Estimate (TCE) of $112m.

The project was completed early and under the TCE, after a one-year construction program. The participants included the Queensland Motorways Limited (QML) for Queensland Department of Main Roads and Port Motorway Ltd, Leighton Contractors, Parsons Brinckerhoff and Coffey Geosciences.

Alliances are an innovative form of project delivery, and the POBM Design and Build road project alliance in Queensland appears to be the first alliance of this type employed internationally.

It follows from the success of smaller road construction alliances undertaken in Queensland, the first building project alliance internationally (on the successful Australian National Museum project in Canberra), and the longer-running successes of project alliances in the gas and oil industry.

The success of the POBM Alliance arose out of a 'value-for-money' approach, which was supported by sound relationships focused around collective responsibility for project delivery, which fostered a 'best-for-project' philosophy between participants. The 'partnership' culture established was reinforced by contractual arrangements to share 'the pain or gain' depending on actual outcomes compared to target outcomes.

DMR has championed the use of road project alliances in Australia and has reaped the benefits of adapting the traditional alliance formula found on gas and oil projects to the unique demands of complex road projects.

The POBM Alliance team was made up of senior representatives from the client, contractors and consultants. The Project Proposal describes the client's intentions with regard to the alliance, as follows:

"Unlike traditional forms of contract where risk is allocated to different parties, under a true project alliance, the alliance participants take collective ownership of all risk associated with delivery of the project, with equitable sharing (in fixed pre-agreed ratios) of the 'pain' or 'gain' depending on how the outcomes compare with pre-agreed targets. The risk/reward arrangements are designed so that exceptional performance will deliver excellent outcomes for all parties while poor performance will result in poor outcomes for all parties. This underlying commercial alignment is consistent with a 'no blame/best for project' alliance philosophy that focuses all parties on achieving common objectives, so as to attain a 'win-win' result."

These features led to harmonious project relationships and the pursuit of opportunities for improved project performance which would not otherwise have been explored. Innovation on the POBM project centred around the alliance itself, but also involved a number of associated developments which were facilitated by the alliance structure. These innovations included:

- three-dimensional global positioning system (GPS) to control machinery - adopted for the first time on a construction project in the southern hemisphere;
- third party certification for safety, quality and environment - using integrated management systems to achieve triple-certification for the first time on an Australian road project;
- slip-formed, reinforced bridge barriers - adopted for the first time in Queensland;
- water quality design - winning an Australian award; and
- elevated tri-level motorway interchange - the first designed and constructed in Queensland.

The benefits

The benefits of the innovations adopted under the POBM Alliance included:

- **Project cost**: 10% saving on the TCE - this amounted to a saving for the client of $13.4m, $5.5m of which was delivered as additional project scope;
- **Time delivered**: six months ahead of expectations, representing a 30% reduction in time required for completion;
- **Traffic management costs**: 10% reduction in traffic management costs compared to recent south-east Queensland projects - traffic management costs on the POBM constituted 2.3% of construction costs, compared to an average of 2.6% across similar projects;
- **Lost time injury frequency rate (LTIFR)**: 40% improvement in the LTIFR, which for the alliance package on POBM was 3.5, compared to an average rate for Leighton's civil projects of 5.9 over the past three years - this result has been assisted by innovations such as 3-dimensional GPS, which reduces the rate of injury to 'stringers' interacting with earthmoving machinery;
- **Direct bridge costs**: saved up to 30% in direct bridge costs compared to industry averages;
- **Earthworks/drainage/pavements:** all delivered at the lower to mid-region of the range of costs associated with a sample of major urban road projects in south-east Queensland.

These measurable benefits sit alongside a number of other significant project achievements flowing from the innovative alliance structure, many of which are difficult to quantify. For example, the project was completed with no residual contractual issues or risk of litigation and no requirement to allow further contingencies for these issues.

This meant less dependence on programming resources for activities other than those focussed on 'getting the project built'.

This outcome was despite the emergence of several construction-related issues which, under a traditional delivery method, would most likely have led to extra cost and/or delays.

Another key benefit of the alliance was the integration of the alliance works on the POBM with other POBM works

packages being conducted around the same time. The incentive structures within the alliance were linked to the successful completion of all four POBM works packages.

One of these (Package 1, the early works) was delayed, potentially impacting the overall project. Under normal circumstances, with a hard dollar contract for the main works (Package 3 - the Alliance), problems with the early works would have resulted in contract variations.

However, the alliance structure encouraged a flexible 'best for project' response. The alliance agreed (without variation) to manage the pre-load settlement process, giving it freedom to optimise the placement of surcharge fill and use excess fill as required elsewhere on the project, thereby freeing up the flow of works with no need for the pre-load team on-site. The early works package and the alliance (in association with extra scope works at a new interchange) utilised polystyrene fill to minimise settlement in difficult areas. This was the first use of polystyrene fill in Queensland.

Other alliance benefits included:

- negotiation of several 'win/win' community/project trade-offs, including innovative noise amelioration treatment at a local school;
- negotiation of financial win/win outcomes between alliance participants;
- excellent stakeholder relations, which will assist in expediting related works planned for the future;
- supporting Queensland Government priorities;
- safety auditing of traffic control plans;
- savings achieved through negotiation of performance incentives with major suppliers; and
- private and public sectors working together and dispelling some myths regarding the calibre, capability, attitude and commitment of government employees.

Implementation

Generally speaking, alliances are driven initially by clients. DMR and QML chose an alliance contract to deliver the POBM in view of the need for improved delivery performance on road projects, especially complex ones, to address concerns about poor cost/time outcomes, unsatisfactory quality, high rates of rework, poor stakeholder/community relations, and dissatisfied clients, designers and contractors.

Their choice was driven by their knowledge of potential benefits, given their first-hand experiences on smaller alliance projects and their research into alliances in other industries. The initiative was in keeping with senior management commitment to innovative project delivery.

Further, there was recent advice from government auditors in the UK and Australia suggesting that public sector accountability concerns are not compromised by alliances as a form of project delivery.

Indeed, it is likely that alliances will be employed with increasing frequency, as best practice public sector clients turn their attention away from hard dollar project delivery models toward more effective 'value-for-money' approaches. Implementation of alliances is also being facilitated in Australia by the lead taken by major contractors in championing the approach.

These factors help explain the choice of an alliance contract for the POBM. Within that structure, the team was keen to maximise outcomes, so DMR provided the opportunity to 'challenge' their Standard Specifications and established construction procedures and practice, through a detailed peer review process, value management workshops and joint problem-solving exercises.

This resulted in key initiatives which underpinned project benefits, such as co-location of designers and geotechnical staff on site with construction personnel. Consultants were then easily accessible, enabling timely responses to constructability issues. Indeed, in order to deliver under the TCE, the alliance '...recognised the need for a high level of design input, and more importantly, a significant integration of design, planning and construction activities.'

The alliance also appointed an in-house culture manager to champion the alliance approach and assist in maintaining harmonious relationships and encouraging project integration, in part by providing coaching and support services.

The emphasis on strong integration of project functions and building trust through effective relationships is reflected in the significant investment made in the design process and site management/facilities. The alliance considers that this investment in integrated design, planning and construction was a major factor in achieving the project benefits outlined above.

Overcoming difficulties

The alliance encountered a number of significant difficulties during the project. Many of these involved relationships with the community, including community irritation with the 'start/stop' nature of the project in its planning and development stages; serious noise concerns from a local school; road closures resulting in loss of access; and construction across floodplains and wetlands, with associated environmental problems.

The project's full-time community liaison officer was a key resource in addressing these problems. The officer promoted community ownership of the project, coordinating initiatives such as painted noise barriers, community events, site tours and a community hotline. These activities assisted in securing community support.

Nevertheless, the floodplain/wetland problem around the Bulimba Creek Oxbow was particularly difficult for the alliance. Rehabilitation of the area was an objective of the alliance from the outset of the project (following ministerial commitments and advice contained in an earlier Impact Assessment Statement).

The TCE included an allowance for a feasibility study. However, environmental groups were keen to see a fuller commitment to rehabilitation of the Oxbow area as part of the POBM project. Indeed, the area was already significantly degraded and the motorway works could easily have exacerbated the problem.

The alliance took the lead in developing a MoU between key stakeholders and secured a commitment of funds to carry out the rehabilitation. The alliance framework accommodated the increase in scope that a full rehabilitation involved and facilitated the excellent results that have been recognised by several environment awards.

The 'virtual organisation' represented by the alliance structure was able to draw on the collective skills of its team to find a best practice solution to the Oxbow problem. Initially, it appeared that bridges and culverts costing $11 million would be required to meet the 'hydro-ecology' objectives of environmental groups.

However, through the adoption of advanced flood modelling software, the alliance was able to demonstrate that

$250,000 in strategically placed earthworks and drainage structure would achieve similar environmental outcomes.

The modelling software helped convince all stakeholders, through quantitative analysis, that the outcome being proposed was optimal. This solution was adopted thanks to a well structured team approach, which effectively integrated the often separate skills of design and construction.

There were other difficulties, which were internal rather than external. First, there were challenges in adopting the alliance 'best for project' culture. Although participants directly related with the project were well supported in making the required mind-shift from hard-dollar contracts, those at more junior levels and those further removed from the project adapted less well to the new delivery system.

This caused some relationship problems between the alliance and some DMR groups not directly involved with the project. However, during the course of the project, these problems became less frequent as the level of exposure of DMR officers to the alliance culture improved.

Secondly, the preliminary design (horizontal and vertical geometry) of the Port Motorway presented some challenges and needed to be optimised in the detailed design stage. This included adjustments to the geometry to achieve the required design speeds in a very constrained site at the Gateway Motorway interchange.

Leighton and Parsons Brinckerhoff came up with an innovative structural arrangement involving a portal beam assembled in two parts which spanned the Gateway Motorway. Adjustments to the design were also required to minimise the embankment heights on the soft foundation soils, while still maintaining flood protection. The optimum design was achieved with the designers (Parsons Brinckerhoff, Coffey Geosciences and DMR staff) working closely with the builder Leighton.

Thirdly, the design brief specified a 6.6 metre clearance height to bridge structures.

However, Parsons Brinckerhoff challenged this and, in consultation with DMR, it was agreed to reduce clearances to 6.1 metres consistent with the adjoining motorway network, given that an alternative route for excess height vehicles was available. This adjustment delivered significant cost savings.

Fourthly, exclusive use of DMR's standard (generally prescriptive) specifications for traditional delivery could have hampered the flexibility of the alliance to pursue innovative solutions. Therefore, the alliance and DMR adopted a 'fit-for-purpose' approach to the design and construction activities, enabling a more effective and efficient outcome.

Finally, the alliance structure and the large scope of the project encouraged the team to put aside their risk aversion and trial a range of new technologies, including slip-formed, reinforced bridge barriers.

Initially, DMR had some reservations about the bridge barrier technology being proposed by Leighton, concerned that it would not produce a fit-for-purpose result. Often, that would be the end of an innovation; however, in a collaborative alliance context and with many bridges to construct, Leighton and DMR had sufficient incentive to undertake some tests. The results justified the use of a concrete paving machine, instead of formworkers, providing project benefits in safety, labour costs and time.

Lessons learned

The alliance reviewed project performance and noted key learnings, including:

- building sound relationships with project stakeholders provides a solid platform for the resolution of issues which, under a traditional contract, could be insurmountable barriers to project completion;
- preparedness to trial and implement new technology results in excellent project outcomes in terms of cost, innovation and quality;
- involvement of designers in all phases of the project alliance is critical to producing infrastructure that is fit-for-purpose and meets quality and safety requirements;
- peer review of the design process is very effective in ensuring 'value-for-money' outcomes; and
- external review of quality assurance and key performance indicators is particularly necessary under alliances to ensure good project governance.

Steps to follow

At a more detailed level, Main Roads and the Queensland Motorway Limited advise that, in relation to project alliances, clients should:

- develop a sound budget before entering into a project alliance, because budgets set expectations about TCEs;
- be informed buyers so they can make informed decisions - having designers and other technical experts as alliance members helps in this regard;
- show leadership to ensure that design changes intended to result in value improvements do not lead to reduced standards;
- conduct a financial audit of the alliance proponent, rather than seeking financial information from all alliance project offerers in the initial stages of the selection process, in order to minimise the cost of tendering and improve value-for-money;
- conduct thorough workshops with offerers to help establish the effectiveness of relationships between various teams and the client;
- encourage the use of value management workshops and joint problem-solving exercises by the alliance team to help develop an appropriate scope of work to achieve needed functionality at acceptable cost;
- be involved in development of the TCE to avoid the perception that the TCE is a quasi-tender bid; and
- exercise care in the adoption of fit-for-purpose standards, and involve peer reviewers in the development of the TCE, to ensure that the drive to reduce cost is appropriately balanced against operational suitability, durability and whole-of-life costs.

For more information, contact Dr Karen Manley, CRC for Construction Innovation, ph (07) 3864 1762, email: k.manley@qut.edu.au