Abstract
In the current market of a high demand for infrastructure and relatively limited resources, the Early Contractor Involvement (ECI) form of project delivery makes very efficient use of resources, allows innovation in the project and provides for a value outcome. ECI has the advantage that it does not involve excessive costs or resources during the bidding stage of a project. Its objective is to get the contractor involved in the design process as early as possible. It offers advantages over the traditional road construction contract delivery method and the more relationship-based alliance method. Through a two-stage bidding process, ECI combines the best of both of these contract types to ensure efficient, effective delivery and value for money for the department. It has been successfully trialled on Main Roads road and bridge construction projects.

Introduction
An innovative contract delivery method pioneered by Main Roads on the Maroochy River bridge duplication pilot project is achieving results and gaining attention from around Australia. The Early Contractor Involvement (ECI) methodology was developed by Main Roads Project Delivery Improvement Branch to maximise the benefits gained through a Design and Construct (D&C) delivery method, while minimising the intensive resources required during a normal tender process for this type of delivery.

ECI is a new, two-staged approach similar to a project alliance during the first stage and a D&C contract during the second. It essentially involves putting additional resources into the crucial early planning phase in order to maximise the benefits and cost savings that can be achieved during construction. Its innovation comes from the selection process, the interaction between the client, contractor and designer during stage one, and the strong relationship-based interaction between the parties.

Background
The fundamental principle of Early Contractor Involvement (ECI) is not new. However, as a contract type, ECI is new. It utilises the age-old idea of getting the builder involved in the design process as early as possible. Those who have been involved in large day labour organisations will acknowledge that it is beneficial to have contractor personnel providing design input. The Design and Construct contract (D&C) delivery method also aims to get the benefit of better constructability by involving the contractor earlier in the design process.

In a market where there is a high demand for new infrastructure and a shrinking resource base to carry out the work, the D&C process can tie up excessive resources in the bidding stage. In comparison to the traditional D&C contract, the ECI contract significantly reduces the tendering costs and resources of both the contractors and the contractor’s designers. A traditional D&C will have three teams of contractors/designers producing three costed designs (∼ 80% complete) to tender for the works. With a D&C, the extent of the client's input into the designs is through an initial brief and very little interaction with the client occurs during the tender period.

In contrast, the ECI contract engages a contractor/
designer through a simple non-price process and has a high involvement of the client in building up and negotiating price, design and risks. The client’s input during this phase is greater than in a traditional D&C contract.

The ECI contract has been designed to meet market conditions of high demand for infrastructure and a relatively low supply base. An ECI contract was introduced in the United Kingdom by the Highways Agency in a pathfinder project in the 1990s to overcome difficulties in delivering a major infrastructure program. The ECI contract is now the Highways Agency’s preferred contract type.

The ECI model is an innovative alternate model. It offers advantages over the traditional road construction contract delivery method and the more relationship-based alliance method. ECI combines the best of both of these alternatives to ensure efficient, effective delivery and value for money for the department. Overall in the current market of a high demand for infrastructure and relatively limited resources, the ECI makes very efficient use of the resources, allows innovation in the project and provides for a value outcome.

The Two Stages of ECI

At the commencement of an ECI project, Main Roads will have prepared a business case but will have done little work in preparing the detailed planning and preliminary design report prior to commencement of Stage 1. Figure 1 shows the various activities, which make up the two stages of an ECI contract.

During the expression of interest phase and the contractor selection process, prospective tenderers are not required to invest large amounts of capital and critical resources in preparing submissions. The contractor is selected based on criteria similar to the non-price criteria used in the selection of a qualification based consultancy. Interviews with proposed project’s onsite staff, designers and management are part of the selection process of the preferred contractor. These interviews are conducted in the contractor’s or contractor designer’s workplace. A contract is let that covers the project through to completion. This differs from a project alliance method that has contracts for both the interim stage and alliance stage. Price, risks and design are negotiated and fixed in Stage 1.

To ensure that public funds are spent efficiently and transparently, ECI uses open book accounting and competitive pricing for subcontract and materials during:

Stage 1. Probity officers are present during the selection process and later in the development of the risk adjusted price. The contractor needs to team with and engage a designer prequalified with Main Roads. During Stage 1, the client, the contractor and the contractor’s designers jointly plan, design, document and price the project with the contractor operating under a service agreement. The price for the contract cannot be determined until the detailed planning and preliminary design report is finalised.

A structured methodology allows the project team to identify and assess risks associated with delivering the project. These risks are then allocated to the party best able to manage the risks and costed accordingly. The risks of the project can be appropriately allocated before construction commences and may result in some risks being retained by the client to optimise value to the project.

Main Roads is heavily involved with the contractor and the contractor’s designer to:

- plan the performance of the work under the contract
- prepare the detailed planning and preliminary design report
- identify, negotiate and apportion the delivery risk in Stage 2
- price the works for Stage 2
- submit a Stage 2 offer
During Stage 1, plans are developed by the team to ensure critical timeframes could be met. The contractor then submits a Stage 2 offer with a "risk adjusted price". If the principal accepts the offer, the contractor completes the detailed design, prepares the construction documentation and constructs the project. The contract is adjusted at this stage by a deed of variation. The advantages over traditional contract delivery methods include:

- synergies arising from a high performance design and construction team
- better integration of specific construction methods into the design
- greater flexibility in timing and planning
- earlier dedication of construction resources
- earlier procurement of critical construction materials such as steel pile liners and precast concrete products
- good understanding of risk by all parties
- negotiated apportionment of risk

The end result is a substantial resource and time saving for contractors and the department. Effective relationship management between the client, constructor, designer and contract administrator is a foundation component of the ECI methodology. Relationship management ensures effective, efficient decision-making and a more enjoyable working environment. The contract has partnering principles built into it and a partnering issue resolution matrix is included. There is a requirement for co-location of the contractor’s and principal’s teams.

The ECI concept and contract is a new way of contracting for government. It was developed to get a good client/designer/constructor interface early in the planning and design of a project so that constructability, construction safety and innovation could be incorporated into the project. It enables a contractor to be engaged before, for example, land acquisition, environmental and cultural heritage clearances have been obtained, which can speed up the delivery of the project considerably. It also allows for construction to commence as detailed design is progressed, further speeding up delivery.

The concept of ECI is shown in Figure 2 and is based on the following:

- In the early phases of a project, the cost of making design changes are low but increase sharply as the project progresses
- Change is relatively easy in the early stages of a project but quite difficult in the construction phase
- The benefit of the change is more often high in the earlier phases of a project
- Significant portion of claims in construction contracts are related to the client’s design
- Use high calibre people and fully plan the project as early as practicable

![Figure 2. Cost of changes vs. project time.](image)

Involving the contractor early in the process and allowing the contractor greater responsibility for the design capitalises on the above concept and also allows a very good understanding of the project risks to the client, designer and constructor. The process also makes effective and efficient use of the contractor’s resources, both intellectual and physical. It allows the contractor to apply its specially developed design skills and construction equipment to shape the design.

Obtaining the right price for a project is achieved through:

- Open book in Stage 1
- Independent estimators
- Productivity rates on benchmark projects provided by the contractor
- Competitive materials and subcontract rates
- A full understanding of project risk
- The ability of the client or contractor to terminate the contract if agreement is not reached
The ECI also allows a high degree of flexibility. The Maroochy River bridge duplication pilot project has adopted very early engagement of a contractor's designer just after the development of the business case. A later project, Townsville Ring Road, had a significant amount of planning and preliminary design already completed. In this case the current Main Roads' designer was novated to the successful contractor. In yet another project, the North Ward Road in Townsville, a program ECI has been established to enable the use of second tier contractors to complete larger works. The price and design for subsequent projects is negotiated during the construction of the first project. Performance during the previous project is also a factor in agreement for subsequent projects. The ECI contract has attracted strong interest from Queensland local authorities and state road agencies.

At the end of Stage 1, the detailed planning and preliminary design report is complete. The contractor is reimbursed on an open book basis for the time of its personnel including designers at the rates contained in the contractor's tender. This includes allowance for overheads and margin. At the end of Stage 1 the principal should have obtained all necessary approvals and acquisition of all necessary land. After being directed to do so by the principal, the contractor submits the risk-adjusted price to complete the work in Stage 2. The risk-adjusted price takes into account the risk apportionment negotiated in Stage 1. The development of the risk-adjusted price is expected to be built up progressively with the design and conducted on an open book basis. The risk-adjusted price is a lump sum payment, which includes allowance for everything to complete detail design, document the project works and construct the project works.

Main Roads has the ability to terminate the contract if the risk-adjusted price does not meet the project works budget or does not represent value for money. If termination occurs, the agreements between the contractor and its designers may be novated to Main Roads if the Stage 2 offer is not accepted. Main Roads owns the intellectual property rights to the design. These factors enable Main Roads to complete the detailed design and documentation and to take the project works to the market as a construction contract. This would be expected to occur only in rare circumstances.

In Stage 2, the internal Main Roads resources are significantly less than that required in a project alliance agreement and also less than an equivalent Road Construction Contract (RCC). During Stage 2 of the ECI the contractor:

- Completes detailed design in accordance with the project brief and the detailed planning and preliminary design report
- Prepares construction documentation in accordance with the approved detailed design
- Constructs the project works in accordance with approved construction documents to the agreed risks in the contractor's Stage 2 offer

**Pilot project for the ECI**

The Minister for Transport and Main Roads, The Honourable Paul Lucas, announced on 15 June 2004, funding of $110 million for the duplication of the Sunshine Motorway between Maroochydore Road and the David Low Way at Pacific Paradise by 2008-2009. This project is to include the construction of a new three-lane bridge across the Maroochy River downstream of the existing structure and the widening of the existing bridge to three lanes.

SMEC (Australia) Pty Ltd undertook the concept planning for the duplication of the bridge and road approaches. It is proposed that traffic will be transferred to the new bridge on completion to allow for the widening of the existing bridge. The full project scope includes:

- Construction of a new 13 x 31m span bridge across the Maroochy River immediately downstream of the existing structure. This bridge is proposed to have a deck width of 17.1m to provide for three lanes of southbound traffic and an off-road pedestrian and cycle path on the downstream side of the structure
- Widening of the existing bridge from 10.9m to 12.3m to accommodate three northbound lanes including the removal of the existing pedestrian footpath
- Inclusion of noise and anti-throwing devices into the design as appropriate
• Incorporate urban design treatments as appropriate
• Preservation of a future transport corridor, investigated under the Caboolture to Maroochydore Corridor Study (CAMCOS), immediately downstream of the proposed bridge
• Managing cultural heritage and environmental issues at the site
• Managing safety and traffic issues at the site
• Assisting Main Roads with the management of community consultation for the project.

This project was the first time the ECI contract type was used by Main Roads. To trial the concept the Maroochy River bridge project was excised from the adjacent roadworks with the roadworks being delivered by traditional means. During the expression of interest phase, the ECI method of delivery generated positive interest with both contractors and designers.

The ECI was developed based on overseas experience and adapted to Queensland conditions in conjunction with the private sector. Gadens and Connell Wagner worked under the direction of Project Delivery Improvement Branch of Engineering & Technology Group and the Major Projects Office of Main Roads in developing the documentation to be used for the first ECI contract on the Maroochy River bridge duplication.

Main Roads held an industry briefing with the prequalified contracting firms. Over twenty companies were represented and were briefed on the new ECI conception. Where appropriate the feedback obtained at this briefing was incorporated into the contract documents. Construction commenced months earlier than would have happened if this project had been delivered by traditional means and the project is on track to meet a ministerial commitment to have the bridge available to the public at an early date.

In the river section of the bridge, the initial design involved driven piles terminating at a pile cap at water level (Figure 3). Three piers supported the superstructure. The final accepted bridge design is different than was first envisaged. The new design reduced costs, simplified construction by the use of two bored piles in lieu of driven piles and eliminated the need for a pile cap (Figure 4). This simplified design also overcomes the possibility of pile joint breakages, which occurred during construction of the previous Maroochy River bridge. A new cross section girder is being used in the superstructure primarily due to the contractor’s knowledge of the precast concrete supplier’s capabilities. This resulted in better load carrying ability and reduction of costs. Another project outcome has been changes to Main Roads’ internal financial approval system resulting in just-in-time approvals, which further speed up the process.

**Conclusion**

It is generally recognised that there is a serious shortage of experienced staff in the road sector. The use of ECI contract is not touted as a ‘fix-all’ panacea however it does address the skills shortage issue by utilising the combined skills of both the principal and contractor’s staff. It involves the use of teamwork and through its relationship management focus builds more friendly and productive project relationships. The ECI contract has demonstrated that a project can be delivered on price and on time and offer value for money.

There has been significant interest shown by external organisations. Transport South Australia has undertaken an ECI project using an earlier version of Main Roads documentation. Department of Main Roads, Western Australia has requested ECI documentation and has included it on the agenda of a national alliance conference. Transit New Zealand has also contacted Main Roads about its use on a major bridge project.
**EXISTING BRIDGE (BEFORE WIDENING)**

**INITIAL CONCEPT DESIGN**

17.1 m

Figure 3. Original planned structure.

Figure 4. Stage 2 offer.