Procurement Decision Tool: A Case Study of the Toowoomba Second Range Crossing
31 July 2020
Today’s moderator

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Austroads acknowledges the Australian Aboriginal and Torres Strait Islander peoples as the first inhabitants of the nation and the traditional custodians of the lands where we live, learn and work. We pay our respects to Elders past, present and emerging for they hold the memories, traditions, culture and hopes of Aboriginal and Torres Strait Islander peoples of Australia.

Austroads acknowledges and respects the Treaty of Waitangi and Maori as the original people of New Zealand.
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• Department of Infrastructure, Transport, Regional Development and Communications
• Australian Local Government Association
• New Zealand Transport Agency
Housekeeping

Presentation = 40 mins
Question time = 15 mins

Type questions here
Let us know the slide number your question relates to
## Today’s presenter and agenda

<table>
<thead>
<tr>
<th><strong>Procurement Decision Tool (“the Tool”)</strong></th>
<th><strong>The Toowoomba Second Range Crossing (TSRC) Case Study</strong></th>
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<tr>
<td>Introduction to the team</td>
<td>Expression of Interest document for TSRC</td>
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<td>Summary of the project</td>
<td>Steps in the Tool applied to TSRC</td>
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<td>Conclusion and recommendations</td>
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<td>Key differences between the Tool and current practice</td>
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<td>High level view of the Tool</td>
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<td><strong>Q+A</strong></td>
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Introduction to the team
Introduction to the team

Project Team

Austroads
- Project Manager
  Ross Guppy

QUT
- Project Manager
  Adrian Bridge

QUT Research Team
- Adrian Bridge
- Gerald (Mango) Murphy PSM
- Dr. Farshad Rezvani
- Nora Kinnunen
- Linda Carroli

Review Team

Austroads Project Delivery Task Force

Austroads Board
Summary of the project
Summary of the project

• Value-for-Money

• Bundling (or **contract packaging**) and nature of contracting (i.e. from **collaborative to competitive contracting**)  

• **Guide future procurement decisions**; and/or **review** an actual procurement decision

• Case study successful application and validation of the Tool (**in review mode**) on Toowoomba Second Range Crossing (TSRC)

• **Credentials:** The Tool is developed, empirically tested and successfully trialled (in an Australian Research Council/**ARC grant**); cited by **Australia’s Productivity Commission**; cited by **ITF/OECD** as key part of “way forward”; and highlighted in forthcoming book by **NBER**, USA
Why we urgently need the Tool
Why we urgently need the Tool

Evidence of market failure

- Sample of 87 Australian public sector major roads and health projects worth $32bn (in the ARC grant in which the Tool developed)

Refer to Section 1
Why we urgently need the Tool

Evidence of market failure

- Sample of 87 Australian major projects
- Larger projects dominated by **single contracts** and Design and Construct; Early Contractor Involvement (ECI); Managing Contractor (MC); and Alliance-based models of procurement
- Stereotypical contracts and mistaken “collaboration”.
  - One-size-fits-all
  - Red herrings
  - Asymmetry
  - Government constraints

Refer to Section 1
Why we urgently need the Tool

The Tool guides the user to:

- Avoid bundles (and contracts) that are either **too large** or **too small**; and develop most efficient size & number of bundles (and contracts).

- Avoid **mistaken collaboration** or **mistaken competition**; and develop the most efficient nature of contracting associated with each bundle (and contract).
Why we urgently need the Tool

• Delivering stimulus in COVID-times in Australia → danger pendulum might swing too far and for too long towards unbundling.
• The Tool employs a structured and tried/empirically tested microeconomic principles.
• At very least the Tool provides efficient baseline/benchmark.
• If near term inefficient unbundling and contracting, then assume that we will need the pendulum to swing again.
• Not back at too much bundling, rather to a more sustainable position of efficient bundling and efficient contracting.
Key differences between the Tool and current practice
Key differences between the Tool and current practice

Current practice is typically reliant on some variant of the Multi-Attribute Utility Approach, often termed “Procurement Options Analysis” (POA).

In POA, typically revolves around one or few short-term targets (as opposed to the longer-term goal comprising the Value-for-Money priorities in the Tool).
Key differences between the Tool and current practice

- The Tool sees **no one approach** to contract packaging is universally advantageous.
- Guides users to configure contracts to align the project characteristics and context with **Value-for-Money priorities** (key performance attributes).
- Contract packaging will vary dependent on project characteristics and its context.
- **Different** kinds of **risks** across the project’s activities are **treated differently**.

### Table: Time/Quality/Compliance

<table>
<thead>
<tr>
<th>Time Start/Finish (Minimum)</th>
<th>Time Compliance (Certainty)</th>
<th>Capital Cost (Minimum)</th>
<th>Lifecycle Cost (Minimum)</th>
<th>Whole-Life Cost (Minimum)</th>
<th>Cost Compliance (Certainty)</th>
<th>Quality Innovations (Maximum)</th>
<th>Quality Compliance (Certainty)</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
</tr>
</tbody>
</table>

*Note: 1 = Highest Priority; 2 = Moderate Priority; 3 = Least Priority*
High level view of the Tool
High level view of the Tool

The Tool combines various schools of economic thought → procurement strategy → the efficient management of microeconomic risk in the externalisation of key project-specific DCOM activities arising from the project schematic, or reference design.

Refer to sections 1 & 2
Expression of Interest document for TSRC
Expression of Interest document for TSRC

Extracts concerning reference design in TSRC’s EOI document (Projects Queensland, 2014; & pre-Covid)

Overview of the Project and Opportunity

“The Toowoomba Second Range Crossing (TSRC) is a proposed bypass route to the north of Toowoomba, approximately 41 km in length.

Reference Design

“The reference design forming the basis of the statutory planning and environmental approval process features: five intersections/interchanges…; two lane carriageway for a posted speed of 100kph; three lane divided carriageway; four lane divided carriageway including dual two lane tunnels (approximately 700 metres in length) for a posted speed of 100kph; maximum gradient of 6.5%; and service roads and auxiliary lanes.”

Key Considerations

“It is expected that the TSRC will be tolled. However, at this stage, the Project scope will not include the provision of toll collection systems or associated toll collection services as this is intended to be procured separately.”

Pilot Tunnel

“A pilot tunnel was constructed between August and December 2007 using drill and blast methods. The pilot tunnel project enabled the collection of geological data, sampling of rock mechanics and cuttability tests, estimation of ground water inflows, in situ stress and convergence measurements, monitoring and measurement of drill and blast induced vibration levels.”
Steps in the Tool applied to TSRC
Steps in the Tool applied to TSRC

State-of-the-art microeconomics underpin the steps of the Tool’s procurement strategy.
Step 1. Activity analysis

- Key DCOM activities
- Distinct knowledge and skills
- Each key activity initially grouped across project.

Refer to sections 2 & 3
Step 1. Activity analysis

Design activities in TSRC

<table>
<thead>
<tr>
<th>Design of Road (Interchanges, Overpasses, Underpasses, Carriage ways, Bridges)</th>
<th>Design of Driven Tunnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design of construction of road</td>
<td>Design of construction of tunnel</td>
</tr>
<tr>
<td>1. Geometric design</td>
<td>10. Space proofing</td>
</tr>
<tr>
<td>2. Road design</td>
<td>11. Geometric design</td>
</tr>
<tr>
<td>3. Pavement design</td>
<td>12. Structural design</td>
</tr>
<tr>
<td>4. Landscaping design</td>
<td>13. Ventilation design</td>
</tr>
<tr>
<td>5. Road lighting design</td>
<td>14. Electrical design</td>
</tr>
<tr>
<td>6. Bridge and retaining wall design</td>
<td>15. Drainage design</td>
</tr>
<tr>
<td>7. Noise mitigation design</td>
<td>16. Rock mechanics/structural design</td>
</tr>
<tr>
<td>8. Drainage design.</td>
<td>Design of performance specification of maintenance to tunnel</td>
</tr>
<tr>
<td>Design of performance specification of maintenance to road</td>
<td>17. Plan for routine and programmed maintenance to specialist linings, mechanical and electrical and fire elements in driven tunnel</td>
</tr>
<tr>
<td>9. Plan for routine maintenance, programmed maintenance and rehabilitation of road pavement, road furniture, drainage maintenance &amp; ITS</td>
<td></td>
</tr>
</tbody>
</table>
Step 1. Activity analysis

Construction activities in TSRC

<table>
<thead>
<tr>
<th>Construction of Road (Interchanges, Overpasses, Underpasses, Carriage Ways, Bridges)</th>
<th>Construction of Driven Tunnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>18. Site preparation</td>
<td>33. Excavation</td>
</tr>
<tr>
<td>19. Drainage</td>
<td>34. Roof support</td>
</tr>
<tr>
<td>20. Earthworks</td>
<td>35. In-situ concrete works</td>
</tr>
<tr>
<td>21. Paving (base and sub-base)</td>
<td>36. Formwork</td>
</tr>
<tr>
<td>22. Asphalt surface</td>
<td>37. Reinforcement</td>
</tr>
<tr>
<td>23. Lining and marking</td>
<td>38. Drainage</td>
</tr>
<tr>
<td>25. Traffic signs and furniture</td>
<td>40. Electrical fit-out</td>
</tr>
<tr>
<td>26. Guardrail</td>
<td>41. Pavement</td>
</tr>
<tr>
<td>27. Landscaping</td>
<td></td>
</tr>
<tr>
<td>28. Concrete barrier</td>
<td></td>
</tr>
<tr>
<td>29. Kerbs and traffic islands</td>
<td></td>
</tr>
<tr>
<td>30. Traffic management</td>
<td></td>
</tr>
<tr>
<td>31. Bridge works including piling</td>
<td></td>
</tr>
<tr>
<td>32. Retaining walls.</td>
<td></td>
</tr>
</tbody>
</table>
### Operations and maintenance activities in TSRC

<table>
<thead>
<tr>
<th>Operations</th>
<th>Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>42. Intelligent Transport Systems</td>
<td>45. Inspections and data collection, implementation of routine, programmed</td>
</tr>
<tr>
<td>43. Traffic operations</td>
<td>and reactive (emergency) maintenance to:</td>
</tr>
<tr>
<td>44. Incident response services</td>
<td>a. Drainage;</td>
</tr>
<tr>
<td></td>
<td>b. Paving (base and sub-base);</td>
</tr>
<tr>
<td></td>
<td>c. Asphalt surface;</td>
</tr>
<tr>
<td></td>
<td>d. Lining and marking;</td>
</tr>
<tr>
<td></td>
<td>e. Lighting;</td>
</tr>
<tr>
<td></td>
<td>f. Traffic signs and furniture;</td>
</tr>
<tr>
<td></td>
<td>g. Guardrail;</td>
</tr>
<tr>
<td></td>
<td>h. Landscaping;</td>
</tr>
<tr>
<td></td>
<td>i. Concrete barrier;</td>
</tr>
<tr>
<td></td>
<td>j. Kerbs and traffic islands;</td>
</tr>
<tr>
<td></td>
<td>k. Traffic management;</td>
</tr>
<tr>
<td></td>
<td>l. Bridge works including piling;</td>
</tr>
<tr>
<td></td>
<td>m. Retaining walls; and</td>
</tr>
<tr>
<td></td>
<td>n. Tunnel M&amp;E systems.</td>
</tr>
</tbody>
</table>
Step 2: Project specific-or-network analysis

Refer to sections 2 & 3

<table>
<thead>
<tr>
<th>Project specific activities (≠ recurrent activities in existing network)</th>
<th>Network activities (= recurrent activities in existing network)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design activities in road</td>
<td>Operations activities</td>
</tr>
<tr>
<td>Design activities in tunnel</td>
<td>Maintenance activities</td>
</tr>
<tr>
<td>Construction activities in road</td>
<td></td>
</tr>
<tr>
<td>Construction activities in road</td>
<td></td>
</tr>
</tbody>
</table>
Step 3: Risk \((\text{make-or-buy})\) analysis

- Project Specific D & C Activities
- 4 kinds of risk \(\rightarrow\) 8 theoretical patterns (5 to 8 = outsource)
- TSRC Actual patterns 6 or 7 except 8s in tunnel (detailed design and installation of M&E) \(\rightarrow\) all outsource.
Step 3: Risk (make-or-buy) analysis

Project Specific D & C Activities

Questions (concerning hold-up):
- Direct sunk/switching costs (i.e. disestablishment and re-establishment costs of supply)
- Indirect sunk/switching costs (costs of delay to buyer’s business)
- Third party interference during D&C
- Environmental changes during O&M
- Buyer’s demand for activity versus typical scale of activity in leading suppliers
- Pipeline of activity.

Questions (concerning capability and competence/capacity):
- Buyer’s capability (knowledge and skills) and capacity (sufficient resources) with and without temporary staff
- Supply of market firms capable of delivering the activity and likely to EOI
- Difficulty and cost to buyer to develop same or better capability as market firms in delivering activity.
Step 3: Risk *(make-or-buy)* analysis

Example of pattern 6 (Pavement Design)

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Logic</th>
<th>Asset Specificity</th>
<th>Uncertainty</th>
<th>Frequency</th>
<th>Value</th>
<th>Rarity</th>
<th>Costly to Imitate</th>
<th>Make-or-Buy</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Capability (RBT)</td>
<td>+</td>
<td>0 or +</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>Internal</td>
</tr>
<tr>
<td>2</td>
<td>Production Competence (RBT)</td>
<td>0 or +</td>
<td>0 or +</td>
<td>+</td>
<td>+</td>
<td>+</td>
<td>0</td>
<td>Internal</td>
</tr>
<tr>
<td>3</td>
<td>Organisation Competence (Coase)</td>
<td>0 or +</td>
<td>0 or +</td>
<td>+</td>
<td>+</td>
<td>0</td>
<td>0</td>
<td>Internal</td>
</tr>
<tr>
<td>4</td>
<td>Hold-up (TCE)</td>
<td>+</td>
<td>+</td>
<td>0/+</td>
<td>-/+</td>
<td>0</td>
<td>0</td>
<td>Internal</td>
</tr>
<tr>
<td>5</td>
<td>Hold-up (TCE)</td>
<td>+</td>
<td>+</td>
<td>0</td>
<td>-/+</td>
<td>0</td>
<td>0</td>
<td>External</td>
</tr>
<tr>
<td>6</td>
<td>Organisation Competence</td>
<td>0 or +</td>
<td>0 or +</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>External</td>
</tr>
<tr>
<td>7</td>
<td>Production Competence (RBT)</td>
<td>0 or +</td>
<td>0 or +</td>
<td>0</td>
<td>-</td>
<td>+</td>
<td>0</td>
<td>External</td>
</tr>
<tr>
<td>8</td>
<td>Capability (RBT)</td>
<td>0 or +</td>
<td>0 or +</td>
<td>0</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>External</td>
</tr>
</tbody>
</table>
Step 4: Contract packaging (bundling) analysis

Opportunity costs/trade-off
- More bundling/less contracts (when low unpredictability)
  - Less compliance costs & more innovations (positive externalities)
  - More bundling/less contracts (regardless of unpredictability)
    - Less competition

Resolves less versus more contracts tension
- First, focus on the troublesome activities (hold-up – none in TSRC) and pattern 8 (thin supply – M&E in tunnel in TSRC); then leverage efficiencies of more bundling/less contracts
- **Bundle and Contract #2.** Detailed design and installation of the M&E activities in the tunnel.
- Allowing pattern 6 & 7s to be bundled (while not creating a pattern 8) with less contracts; because of the ranking of key performance attributes (slide 19).
- **Bundle and Contract #1.** D&C of all activities (except M&E activities in tunnel in Bundle/Contract #2).
Step 5: Competitive-or-collaborative analysis contracting (exchange relationship) analysis

<table>
<thead>
<tr>
<th>Pattern</th>
<th>Logic</th>
<th>Asset Specificity</th>
<th>Uncertainty</th>
<th>Frequency</th>
<th>Value</th>
<th>Rarity</th>
<th>Costly to Imitate</th>
<th>Exchange Relationship</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>Hold-up (TCE)</td>
<td>+</td>
<td>+</td>
<td>0</td>
<td>-/+</td>
<td>0</td>
<td>0</td>
<td>Collaborative Contracting</td>
</tr>
<tr>
<td>6</td>
<td>Organisation Competence</td>
<td>0 or +</td>
<td>0 or +</td>
<td>0</td>
<td>-</td>
<td>0</td>
<td>0</td>
<td>Standard Competitive Contracting</td>
</tr>
<tr>
<td>7</td>
<td>Production Competence (RBT)</td>
<td>0 or +</td>
<td>0 or +</td>
<td>0</td>
<td>-</td>
<td>+</td>
<td>0</td>
<td>Standard Competitive Contracting</td>
</tr>
<tr>
<td>8</td>
<td>Capability (RBT)</td>
<td>0 or +</td>
<td>0 or +</td>
<td>0</td>
<td>-</td>
<td>+</td>
<td>+</td>
<td>Bespoke Competitive Contracting</td>
</tr>
</tbody>
</table>
Step 5: Competitive-or-collaborative analysis contracting (exchange relationship) analysis

Outcome-based contract terms (Pattern 8 and Pattern 6/7 Bundles)
- Fixed price
- High power incentive
- Agent’s risk to completion
- Agency costs
  - specification of outcomes
  - verification of outcomes
  - risk premium
  - suitability for information asymmetry
  - outcome certainty
  - better goal alignment

Hybrid contract terms (Pattern 5 Bundles)
- Target out-turn costs or guaranteed construction sum linked with gain-share or pain-share regime
- Risks balanced between agent and principal
- Suitable for outcome uncertainty

Behaviour-based contract terms (Pattern 5 Bundles)
- Cost-plus
- Low power incentive
- Principal’s risk to completion
- Agency cost
  - specification of behaviour
  - monitoring of behaviour
  - outcome uncertainty
  - high project complexity
  - less goal alignment

Refer to sections 2 & 3
Validation and discussion

- Direct assessment of Value for Money problematic
- Indirect assessment using EOI
  - Established at early stage and close to the point in time just after the procurement decision
  - Captures both the potential for high bid prices, or pre-contract market failure, and the potential for hold-up, or post-contract market failure
- Hypothesis
  - Actual competition is expected to be within the optimum range of competition, i.e. 5 to around 8 EOI inclusive, in cases where actual procurement substantially matches the procurement strategy recommended by the Tool; and
  - Actual competition is expected to be outside the optimum range of competition i.e. 4 or less EOI, or 9 or more EOI, in cases where actual procurement substantially mismatches the procurement strategy recommended by the Tool.

Refer to sections 2 & 3
Validation and discussion

<table>
<thead>
<tr>
<th>TSRC Actual Procurement</th>
<th>Tool’s Recommended Procurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Single contract</td>
<td>2 contracts (though cost substantially in Contract #1)</td>
</tr>
<tr>
<td>D&amp;C&amp;M bundled</td>
<td>D&amp;C bundled in Contract #1 &amp; M separated as network activity</td>
</tr>
<tr>
<td>Substantial government capital contributions for D&amp;C, with</td>
<td>All government finance</td>
</tr>
<tr>
<td>Private finance mainly for M</td>
<td></td>
</tr>
</tbody>
</table>

- Given the small cost of maintenance, relative to the much larger cost of design and constructing TSRC, the procurement strategy for this project recommended by the Tool mostly matches the actual approach.
- Anecdotally, there were 5 to 6 EOI.
- Also anecdotally, the absence of private finance may well have increased the number of firms expressing an interest, and closer to the optimum 8 EOI.
Conclusions and recommendations
Conclusions

• Value-for-Money → efficient bundling (or contract packaging) and efficient contracting (i.e. from collaborative to competitive contracting).

• The single Alliance road project in the ARC grant (slide #14) and TSRC illustrates significant improvements in Value-for-Money that would have likely been delivered by the Tool.

• All four cases in the ARC grant supported the hypothesis developed to test the Tool.

• The Tool is expected to appreciably improve the chances (up to double the chance) that the procurement approach is successful in setting the project on a path to deliver superior VfM (in contrast to current practice).

• The Tool has now also been supported by the results in its trialling in TSRC (funded by Austroads) and a major health project (funded by Infrastructure Australia).
Conclusions

• Beyond significantly advancing Value-for-Money, the Tool will deliver other microeconomic benefits, including promoting:
  • Objectivity
  • Accountability and transparency
  • Reliability and consistency
  • More time for planning and design development

• Beyond microeconomic benefits industry and macroeconomic benefits.

• As COVID-times render the Tool compelling to ensure that the best Value-for-Money is delivered and demonstrated on each and every new infrastructure project.

• The trialling of the Tool on both TSRC and the major health project and forms the basis of the Tool’s forthcoming User Guide to be published by Infrastructure Australia.
Two key recommendations:

• An agency **does not wait** for the publication of the User Guide by Infrastructure Australia.

• Austroads consider a proposal to develop the economics in the Tool into a further tool to be applied to the **procurement of network activity** including the operations and maintenance of roads.
Questions?

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## Upcoming Austroads webinars

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</thead>
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<td>Vehicles and Technology Future State 2030</td>
<td>6 August</td>
</tr>
<tr>
<td>Standards Australia – Bitumen and Related Materials for Roads</td>
<td>11 August</td>
</tr>
<tr>
<td>Classifying, Measuring and Valuing the Benefits of Place on the Transport System</td>
<td>13 August</td>
</tr>
<tr>
<td>Framework and Tools for Road Freight Access Decisions</td>
<td>20 August</td>
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