Transport and Main Roads

Strategy for Management Of Construction Quality

Quality & Improvement Unit
Contracts & Standards Branch
Engineering & Technology Division
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Queensland Government

Contents

Background

Recent changes in the social and economic environment have had significant impacts on the time and cost drivers in our industry, as evidenced through unprecedented demand, with an increasing shortage of supply of skilled resources. It had become apparent that behaviours and decision making were also being affected in relation to the balance of time, cost and quality.

Evidence of these pressures was being seen through:

- Various adverse reports on constructed outcomes including Captain Cook Energex Audit (refer memo 25 Nov 2008)
- Various bridge and miscellaneous structural issues (NCR's, rework) as described in Superintendent forums - 2007, 2008
- Increasing reports questioning as-constructed quality of delivery from various asset managers / element managers.

In addition, various recent major projects and benchmark studies have highlighted significant shortcomings in construction quality. These have led to undesirable and avoidable outcomes including:

- Under-performing deliverables including pavements and precast structural elements.
- Completion of projects outside time, budget, scope and quality requirements.
- Delays in resolution of deficiencies.
- Projects under Superintendent Surveillance not meeting Main Roads requirements.
- Lack of confidence in test results.
- Disenchantment with processes for certification of compliance of work lots.

It was considered that these are symptoms of shortcomings including:

- Confusion in respect of role of quality.
- Lack of consistency in management systems being applied on surveillance of projects. This includes Principal's Representatives and Superintendents.
- Inadequate controls for selection, engagement and supervision of subcontractors, including testing authorities.
- Extent and distribution of appropriately trained and experienced personnel across the State.
- Very low use of expertise across Departmental boundaries.
- Poor planning of project surveillance.
- (Lack of) appropriate involvement of specialist technical personnel early in the project.
- Inadequate processes for dealing with difficulties that arise during delivery of projects.
- A focus on systems details and associated data to the detriment of astute field surveillance.
- Project design details that lack practical constructability requirements.
- The inability, or at times lack of preparedness, to make judgements / decisions at appropriate times.

Underpinning many of these issues are (in) adequate remuneration for contract delivery, poor understanding / application of effective management loops for improvement and learning, and an ineffective means of incorporating specification, selection and surveillance learnings from across the supply chain.

In 2003 a QiC Strategy was developed and deployed addressing these issues relevant to the risks identified and the resources available. This included MR use of Communities of Practice to facilitate improved disposition of the changes. This document is a continuance of the original 2003 QiC Strategy.

Various initiatives are currently in progress addressing, in part, various aspects of the issues noted above. While acknowledging these, the need for a focus on some key elements has been highlighted. Improved alignment of these initiatives has also been as needed for effective deployment of this and other strategies.

In 2007/08 it became apparent that mounting issues were arising in relation to increased demand and quality of delivery. It was proposed that decision makers were being impacted by time and cost drivers, at the expense of quality. While incidents and issues were reported to the Technical Governance Committee, it was felt that the issue of balance, and the apparent declining trend, was significant enough to warrant validating. As a result, an investigation was initiated through the Quality in Construction (QiC) project to determine the reality, and possible extent, of this proposition.

Given limited resources, a semi-structured interview approach was adopted. This was designed to provide direction in questions asked, while allowing flexibility of response and capture of associate issues and comments from the persons being interviewed. This exercise has confirmed that, with this imbalance of focus on time and / or cost at the expense of quality, DTMR has increased risks of:

- Reduced whole of life performance of projects,
- Increased cost of design and construction due to rework, and
- Increased cost of maintenance over time.

It is noteworthy that all interviewees agreed with the proposition that the quality of delivery has declined in recent years (Refer Time, Cost & Quality - discussion paper for more information).

What is meant by "construction quality"?

The National Committee on Quality in Engineering of the Institution of Engineers, Australia has defined Quality in Engineering in the following terms:

Quality in Engineering is –
- *Using those concepts, tools and techniques*
- *Which enable achievement of planned objectives*
- *Through management of processes which are controlled*
- *To an extent commensurate with the risks involved.*

Quality in Engineering is founded on the application of the following principles:
- *Strategic focus on business objectives*
- *Customer focus*
- *Leadership*
- *Involvement of people*
- *Technical competence*
- *Systematic approach to the management of processes*
- *Continual improvement*
- *Decision making based on facts*
- *Mutually beneficial relationships and partnerships.*

Construction quality in the Department of Transport and Main Roads, Queensland is defined as:

"Application of 'Quality in Engineering'
in the delivery of TMR construction projects."

In the Main Roads context of a construction project this translates to:

- Completion of projects in accordance with project specifications.
- Best practice[1] techniques utilised by all parties through all stages of projects including planning and management of delivery, work processes and verification of compliance with specified requirements.
- There is an understanding of what is being achieved of a quality product.
- Documentation for Main Roads projects of a high standard that adequately reflects practical constructability requirements.
- All parties involved in Main Roads projects are adequately and fairly rewarded.
- Main Roads infrastructure projects deliver value for money, with service life of at least that intended in project design.

[1] Best Practice is seen as the most appropriate practice for the current situation and future needs.

Scope of this Strategy

This Strategy provides the framework for actions and a managed process for the achievement of significant and sustained improvement in quality on Main Roads construction projects.

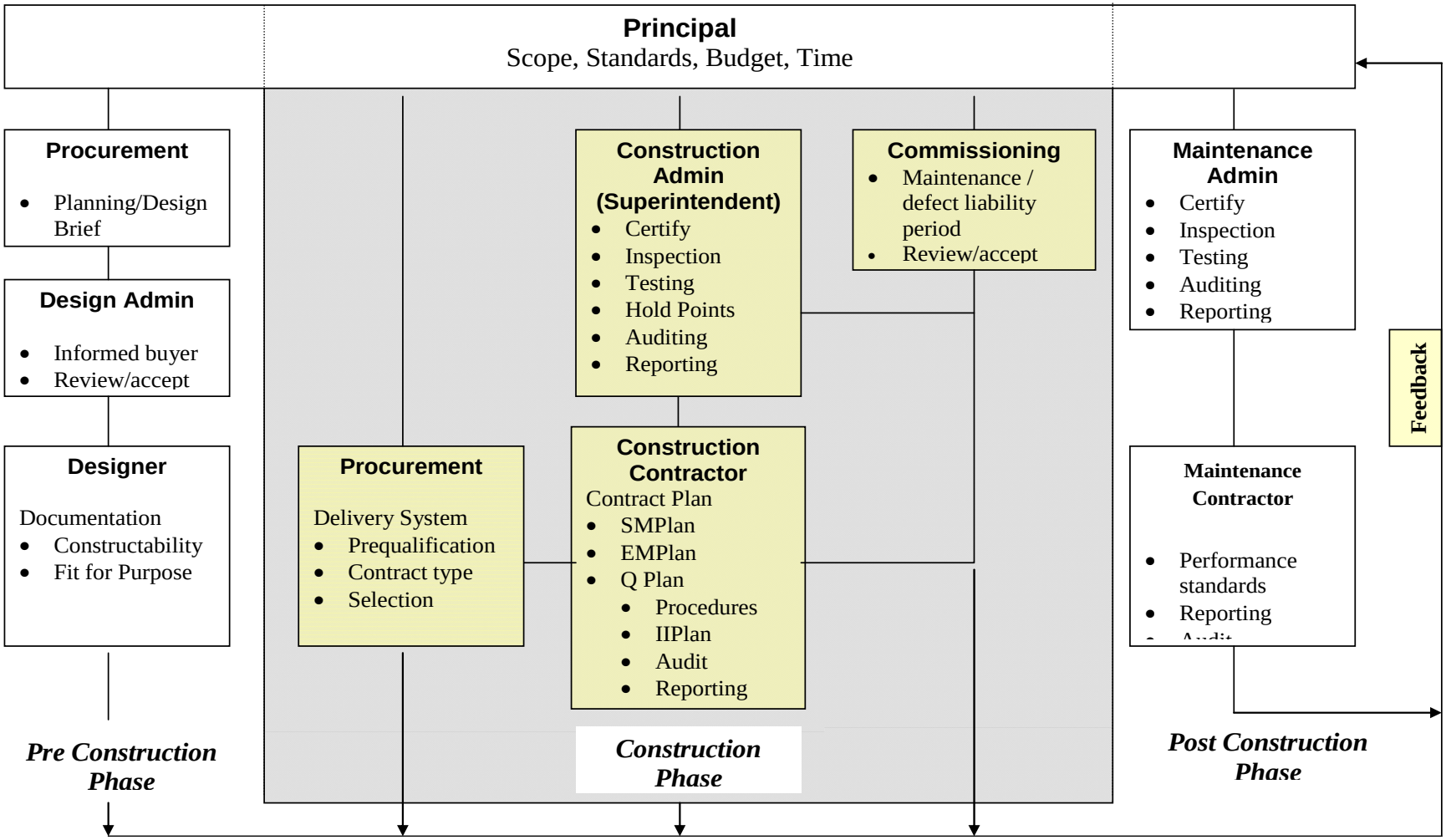
The focus of this strategy is within the "Construction Phase" of the project as shown in Figure 1 below. This includes:

- Simple and effective surveillance and administration systems for the delivery of projects.
- Capability of people delivering and supporting the delivery of projects.
- Effective, and well understood, procurement practices for contracts, including high risk (or specialist) suppliers.
- Performance monitoring, assessment and review practices for improvement of project delivery.

Interactions supporting effective specification, selection of suppliers and surveillance of contracts that are also considered in scope include:

- The role of designers during the Construction Phase including validation of design assumptions and learning.
- The responsibilities of contractor and superintendent in relation to verification of conformance being clear and understood.
- Effective performance review processes (Construction and Post Construction Phases) for capture, distillation and sharing of information and learnings.
- Effective feedback processes to assist future decision-making by Main Roads and other parties. This may influence issues such as contract design, purchasing arrangements and skilling requirements.
- Leadership that supports the delivery of appropriate quality standards in MR products and services.
- Access to Knowledge and Information (Standards)

Figure 1 Quality in Construction Model (*Items shaded are primarily in scope)*



Vision

Main Roads will be a recognised leader to achieve quality of its construction and have confidence in its ability to sustain this position.

Objectives

Objectives to attain this Vision, with a short description, are:

1. ***Applied Leadership within Main Roads, at all levels, supporting quality in construction.***
   This includes client, programme, technical and project leadership. Main Roads leaders understand and promote the application of quality principles through both the planning and delivery of projects and the application of supporting business processes.

2. ***Effective systems that support efficient management and delivery of construction quality.***
   Development and use of consistent management systems within Main Roads that support construction. These include contract surveillance, pre-qualification and management of specialist suppliers (precast, asphalt, testing), and improvement (see obj 4).

3. ***Staff / Personnel adequately trained in, thoroughly understand and capable of applying all relevant techniques.***
   To have trained and experienced people who can, as a group, set, interpret and apply standards for construction. The skill set includes technical and interpersonal skills that facilitate overall delivery of construction standards.

4. ***The construction industry and other stakeholder interests are aligned with Main Roads objectives in relation to quality in construction.***
   To attain this alignment and gain from industry / stakeholder experience, effective relationships are maintained and encouraged with all project delivery partners. This includes Districts, Senior Management in Main Roads and Industry.

5. ***Effective Assessment and Performance Review systems are deployed that foster cooperative continuous improvement.***
   Development and deployment of processes for project review and communication of relevant learnings. These include agreed and consistent performance measures, project review, process for analysis of information captured and identification of important issues, and communication of these issues for future use.

   The approximate time frame for these objectives to be realised is three years – July 2009. Actions about these objectives are described more fully in Appendix 1. More detailed actions, with time frames, are detailed in the Project Plan raised for this strategy.

   These objectives will be pursued and achieved under the guidance of a steering committee of

senior officers (refer Appendix 2) with commitment, support and leadership from the Senior Management Group.

Alignment of Strategy (with other related strategies)

This strategy strongly supports the *Main Roads Strategic Plan (2007 – 2012)* in the following areas:

Infrastructure Program Delivery:

- Improve the reliability, quality and consistency of project delivery

Capable Organisation

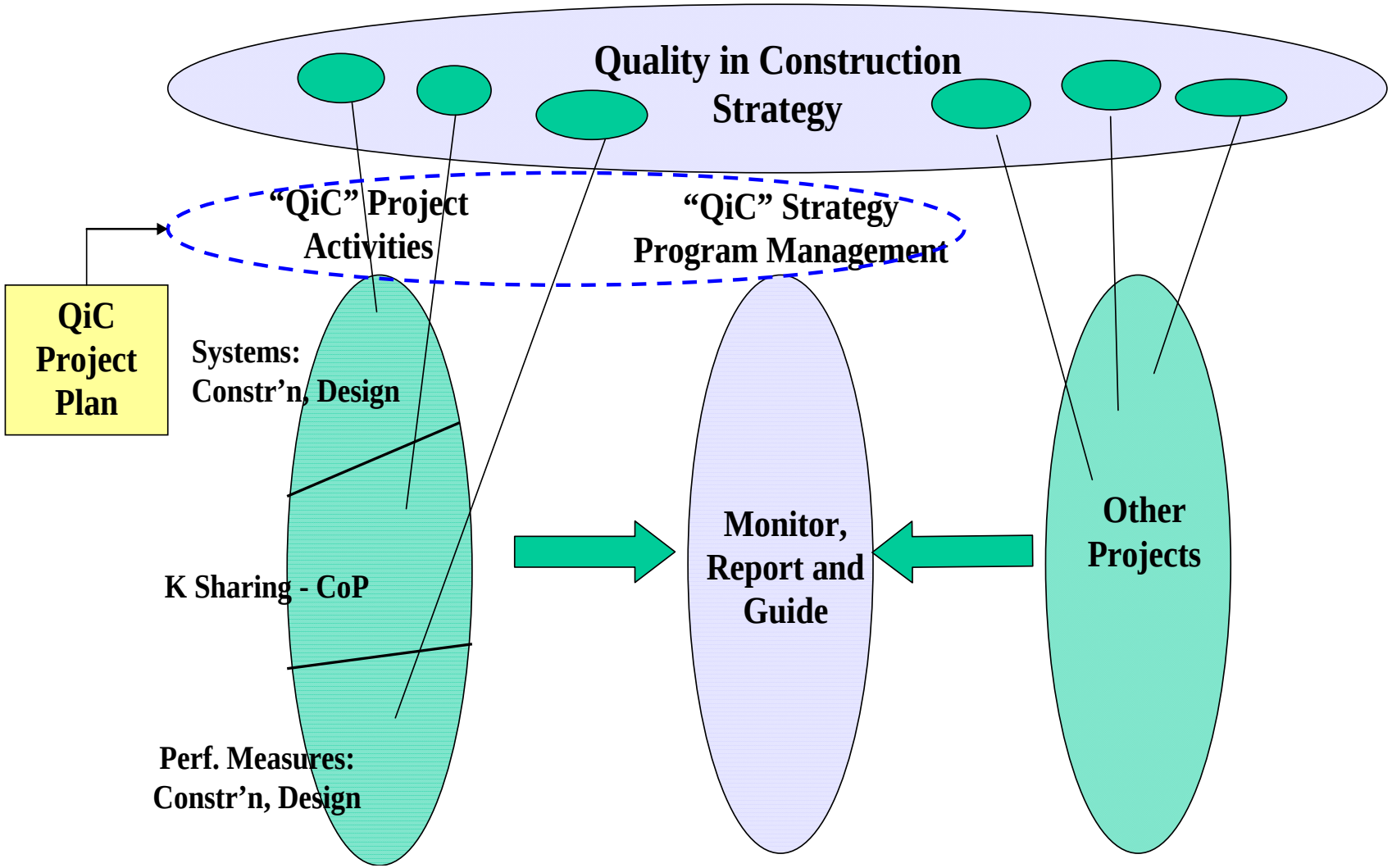
- Mandate standardised systems, processes and practices.
- Manage our people and knowledge as assets and foster a performance driven culture
- Ensure ongoing governance improvements (including compliance, systems, and processes and performance).

Technical Knowledge Management (TKM) Strategy

- Develop an environment supporting sustained technical knowledge management within TMR
- Have practices and supporting systems for effective management of, access to and dissemination of technical knowledge

- The objectives of this strategy are supported by various other strategies and initiatives including *Technical Capability, Knowledge Management, Research and Development* and Contracts. A linking model for these strategies is shown in Appendix 3.

- This strategy supports technical governance through:
  - Improving consistency of practices and risk management in defined operational areas. This is by supporting systems incorporating standard processes and risk based planning.
  - Providing and embedding processes that support improved organisational learning
  - Supporting / developing performance methods aligned to quality of construction.


Quality in Construction Strategy
"QiC" Project Activities
"QiC" Strategy Program Management
QiC Project Plan
Systems: Constr'n, Design
K Sharing - CoP
Perf. Measures: Constr'n, Design
Monitor, Report and Guide
Other Projects

References

1. *Benchmarking Project Management: Site Management of Contractors*. Main Roads. Sept. 1998.
2. *Pacific Motorway Learnings Project. 2001-02.*
3. *Guidelines for audit and surveillance of activities on construction projects.* Capability and Delivery Division. Main Roads. Dec 2002.
4. *Guideline to quality systems in infrastructure delivery.* Capability and Delivery Division. Main Roads. Dec 2002.
5. Review of Quality in Construction project plan 2003 – 2006.
6. QiC Strategy (2003)
7. Time, Cost and Quality - Discussion Paper

Appendix 1: Action List

Objective #1: **Applied Leadership within Main Roads, at all levels, supporting people in construction.** This includes client, programme, technical and project leadership. Main Roads leaders understand and promote the application of quality principles through both the planning and delivery of projects and the application of supporting business processes.	
Outcome	**Actions**
• Leadership has a thorough understanding of quality in construction and its significance. • People demonstrate appropriate quality and relational values through their attitude and behaviour.	Promote clear understanding of QA principles & what is meant by quality, across TMR • Development of Quality Policy for TMR • Undertake regular Regional Visit to promote QA awareness, CAS, Q-product measure, etc • Have presentation/introduction at various industry forums to promote QA • Measures link to Executive Management • Bring Awareness of T, $, Q balance & impact on decision making • Ensure effective communication between Regions, E&T, and industries on various issues affecting QA

Notes:
1. To a significant extent the outcomes of this objective will be through the delivery of the other Objectives, however, Senior Leadership sets the attitude and organisational environment.

Objective #2: Effective systems that support efficient management and delivery of construction quality. Development and use of consistent management systems within Main Roads that support construction. These include contract surveillance, pre-qualification and management of specialist suppliers (precast, asphalt, testing), and improvement (see obj 4).	
Outcome	**Actions**
• Effective Prequalification system. • Good Performance of contract surveillance systems. • All parties associated with Main Roads construction projects have a thorough understanding of and ability to apply the systems for construction projects.	1. Development and embedment of consistent Contract Administration System (CAS) for construction projects for Regional use. (Note 1) 2. Monitor the health in the use of CAS manual (may be through the Regional Visit to provide clarity, assistance & support in the use of CAS) 3. Provide input in the future development of Q-design (risk based verification, improved consistency, quality of design document) 4. Investigate and develop CASS (IT version supporting CAS) 5. Effective management practices and process supporting Specialist Supplier Register • Internal Audit • Trend Reporting 6. Develop Pink Sheet (who?) 7. Develop and embed Technical Alert Notice (TAN) 8. Ease access to technical documents and experts 9. TKM Systems (Tech Connect, TPSG) to transfer information (health check, access, accuracy of data, knowledge exists) 10. Expand knowledge sharing protocols supporting increased knowledge

Notes:

1. This development is to be done on a participative approach with Regions and other key stakeholders.
2. This development is to be done on a participative approach with Regions and other key stakeholders (see Obj 4).

Objective #3: Staff / Personnel adequately trained in, thoroughly understand and capable of applying all relevant techniques. To have trained and experienced people who can, as a group, set, interpret and apply standards for construction. The skill set includes technical and interpersonal skills that facilitate overall delivery of construction standards.	
Outcome	**Actions**
• All TMR personnel engaged in relation to construction projects are adequately skilled for their respective functions. • Management and personnel are happy with the level of expert advice and support.	1. Organise and conduct QA awareness session to all Regions 2. Regional Learning Forum and other events to assist in learnings and systems development. (Notes 1, 2) 3. Develop understanding and core skills in quality management and surveillance 4. People Management Planning and Development including: • Technical training, • Systems training, • QA awareness training • Increased coaching & mentoring • Deployment of Career Groups (includes definition of Discipline Heads/Technical Experts) • Development and co-ordination of CoP (to monitor health) 5. Provide training in "Pink Sheet" to improve understanding of intent of specifications & standards 6. Deploy TKM strategy to provide ready access to experts and relevant information. 7. Develop Registration System for superintendent & surveillance personnel 8. Succession Planning for experienced verification personnel

Notes:

1. Training Capability Strategy outlines mandated courses and references sources for training.
2. Refer Appendix 4 for links to Technical Capability Strategy and importance of Rotation, Mentoring and Coaching. While the latter items are not specifically actions for this strategy, overall success for sustained improvement will be dependent upon success in these areas across Main Roads.

Objective #4: The construction industry and other stakeholder interests are aligned with Main Roads objectives (in relation to quality in construction). Effective relationships are maintained and encouraged with all partners in project delivery. This includes Districts and Industry.	
Outcome	**Actions**
• Relationships with all our partners in project delivery are strong and mutually valued. • Main Roads Strategies in Construction support, and are supported by, the Construction industry.	1. Capability and Delivery dialogue with industry in respect of continuing mutual development. 2. Promote cooperative skilling and system development with relevant stakeholders. 3. Develop performance criteria for construction projects with Regions and other relevant key stakeholders. 4. Specialist suppliers/prequalification • Monitor and review effectiveness of management of specialist supplier register (using internal audit) • Trend reporting to CE (action for specialist suppliers & communication with industry) 5. Inform and ensure understanding by, high-risk suppliers to TMR of our requirements and expectations, including TMR's specifications & standards (intents) 6. Effective liaison between Regions, Head Office and Industries 7. Establish and maintain Improved working relationships with industries/ key stakeholders

Objective #5: Effective Assessment and Performance Review systems are deployed that foster cooperative continuous improvement. Development and deployment of processes for project review and communication of relevant learnings. These include agreed and consistent performance measures, project review, process for analysis of information captured and identification of important issues, and communication of these issues for future use.	
Outcome	**Actions**
• The quality of design and construction are assessed through recognised performance measures. • Effective performance assessments are available for use. • Performance information is well understood and clearly supports decision making by management. • Systems for project-based learnings are well understood and used.	1. Develop & embed a simple Q-product performance measures, and processes, for construction projects. (Note 1) 2. Monitor and review on health/effectiveness of the systems & measures 3. Provide input into the development of Q-Design 4. Review/assessment of performance of construction projects at relevant stages and on completion is consistently undertaken. This includes assessment of supplier performance and that of associated Main Roads personnel(Note 2), and performance feedback • Contractor Performance Report • Q-Design • Trend Report (specialist suppliers) • Project Learning - capture of distilled issues for future reference 5. Review the reporting, and communication protocols for executive management. This includes measure, learning and quality of delivery (Note 2). 6. Review and adjust the “Best for Project” philosophy, perhaps “Best for Programme” may be employed

Notes:
1. Participative development with Regional personnel.
2. This will require validation through internal assessment and review processes.

Appendix 2: Structure and Process

Review

Review of the progress and outcomes of the associate project plan is to be undertaken yearly with at least the project's Sponsor. Results of this review are to be incorporated in any proposed amendments to the plan and potentially this Strategy, and communicated for endorsement to the Steering Group.

Steering Group

The Steering Group consists of:

Chair (and Sponsor):

- DCE (PMG&S), R Guppy

Technical Rep's:

- A/CE (E&T), Julie Mitchell (Customer)
- DCE (Structures), R Pritchard,
- D (C&S), M Swainston

Regions and Districts:

- GM (PD&M), K Beattie
- ED (PDS), MIP, T Los
- RD (Central West), E Denham
- RD (Fitzroy), T Hill

The CoP for Superintendents that has been established assists in communication and information exchange supporting decision

Appendix 3: Model of management of knowledge for sustainable (technical) capability of TMR.