Manual

Preconstruction Processes Manual

Queensland Government

Preconstruction Processes Manual

Foreword

This manual is one of the Department's critical technical publications, providing the project management and authorisation process for every pre-construction project the Department undertakes.

It was initiated in 2003 and the first edition was released in June 2005.

The manual is currently being reviewed and details are given here explaining how the revisions and amendments are being managed.

Since the first edition release of the manual, there have been several advancements in terms of strategic controls mandated for the preconstruction phases of road infrastructure projects.

The key strategic controls include strategic policy directions, Road System Manager Framework, Program and Project Management Framework, and other delivery frameworks such as the State-wide Planning Process and the Element Management Program. Each of these strategic controls has undergone development and change since June 2005 and, as a result, the manual has been reviewed and updated to maintain currency and relevance.

In the review of the manual, it is important to keep in mind that it has been developed to set the framework for the planning and design of new and upgrading of existing roads in Queensland. The purpose of the manual is to ensure that all of these projects are built in accordance with an agreed set of corporate standards that include considerations of local circumstances. Sufficient flexibility has been incorporated to allow competent planners and designers to use this manual to tailor each design to the particular circumstances of the project.

Document Information

Manual Name	Preconstruction Processes Manual (PPM)
Manual Customer	Executive Director (Road & Delivery Performance)
Manual Sponsor	Director (Project Delivery Improvement)
Manual Owner	Director (Project Delivery Improvement)
Manual Review Team Members	Principal Manager (Industry Direction) – PDI Branch Principal Advisor (Roadwork Performance) – PDI Branch Senior Advisor (Delivery Systems Improvement) – PDI Branch Senior Project Officer - PDI Branch

Amendment & Review Strategy

The manual has been written in a modular format to allow individual chapters to be reviewed.

The first stage of the review process was to update Chapter 1 (Planning and Design Framework) and Chapter 2 (Pre-project Planning). Chapters 1 and 2 are now released for use in Junction under the Publication Series.

The updated Chapters 1 and 2 set the context and align the preconstruction processes with the recently developed state-wide planning process, program and project management framework.

In the updated Chapters, references to other Main Roads' documents and standards are only included if necessary. In order to reduce repetition and duplication, some external references have been removed as the topics are now being addressed in other departmental documents or are not relevant. Some of these related documents and standards are –

- *RIP Development Guidelines* (This document can be found in Junction under Program Development and Delivery Group, RIP Business Processes);

- *Road Planning and Design Manual*;
- *Project Cost Estimating Manual* (This document can be found in MR Publication Series);
- *Guide to the Road System Manager Framework* (Contact Principal Manager (RSM) for more information);
- *Guidelines for Strategic Road Network Planning* (This document can be found in MR Publication Series);
- *Program Management Framework*; and
- *OnQ Project Management*.

The remaining Chapters 3-6 of the manual are currently under review. It is expected that -

- Chapter 3 (Business Requirements) will be removed from the manual and the content incorporated as part of the Program and Project Management Framework;
- Chapter 4 (Planning and Design Process) and Chapter 5 (Project Scoping) will remain in the manual; and
- Most parts of Chapter 6 (Design Management) will remain in the manual, with the exception of the checklist in the appendix which will be removed and be added to the Road Planning and Design Manual.

The review of Chapters 3-6 will depend on a number of factors including the finalisation of the Program and Project Management Framework and the RSM Framework. Once completed, a new edition of the manual will be available for purchase from the Technical Reference Centre and/or download from the Main Roads intranet site. This is not expected to happen before early to mid 2010.

Please be aware that in the meantime there could be some inconsistency between the revised Chapters 1 & 2 and the existing Chapters 3-6.

All feedback and improvement requests should be directed to Principal Advisor (Roadwork Performance), Project Delivery Improvement Branch. The phone number is (07) 3834 5467.

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Chapter 1

Planning and Design Framework

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Chapter 1 Amendments

Revision Register

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Issue/Rev No.	Reference Section	Description of Revision	Authorised by	Date
1		First Release	D.Hicks	Mar 2003
2	New Section 1.6	The Business Model Framework has been included to provide linkages to the Road System Manager.	D.Hicks	Jan 2004
3	New Sections: 1.11, 1.12 and 1.13	The chapter has been expanded to include sections on legislative Accountability, Hierarchy of Queensland Roads, and Strategic Vision	D.Hicks	Feb 2005
4		First Edition Release	D.Hicks	June 2005
5	New Chapter 1	The chapter has been revised to set the context and align the preconstruction processes with the recently developed state-wide planning process, program and project management framework.	J Worrall	July 2009

Chapter 1
Planning and Design Framework

1.1 General

The Department is a key stakeholder in the development of Queensland's public road network and its integration with the overall transport system. Other key stakeholders are the Commonwealth Government for the declared 'National' roads, local governments for roads under their jurisdiction, the community, other government departments and the private sector.

The Department is responsible for the stewardship of the state-controlled road system, which involves the system's operation and the delivery of projects for enhancement and MPO (maintenance, preservation and operation). These activities encompass the following State Government priorities as defined in the Department's visioning document "Roads Connecting Queenslanders" –

- Safer roads to support safer communities;
- Efficient and effective transport to support industry competitiveness and growth;
- Fair access and amenity to support liveable communities; and
- Environmental management to support environmental conservation.

The Preconstruction Processes Manual has been developed to guide the project management of new and the improvement of existing state-controlled road infrastructure. This project management is based on a road network management system (operating, planning, design and delivery) which provides for consistent decisions, policy development and supporting systems, and state-wide processes.

The purpose of the manual is –

To ensure that the planning, design and provision of roads infrastructure contributes to State government outcomes, meets stakeholders' needs and is consistent with sound project management principles.

The Preconstruction Processes Manual provides the corporate methodology to identify and manage appropriate projects in planning and design to achieve strategic outcomes and value for money. Sufficient flexibility is incorporated within the planning and design framework to enable planners and designers to tailor each project to the outcomes desired.

To this end, project planning and design is undertaken within a broader planning context encompassing –

- The local community, through community accessibility analysis and consultation;
- The natural and built environment;
- Cultural heritage;
- Regional land use and infrastructure planning, as well as Local Government and industry land use decisions;
- Road route and link planning; and
- The Department's strategic objectives and planned investment strategies.

1.2 Manual Structure

The Preconstruction Processes Manual is structured so as to guide the user in the development of appropriate projects through the planning and design and to achieve required approval.

Chapter 1 (Planning and Design Framework) describes the context in which project planning and design takes place.

Chapter 2 (Pre-Project Planning) describes the strategic and route/link planning framework which identifies road infrastructure needs to guide the subsequent identification of the majority of potential projects.

Chapter 3 (Business Requirements) describes the project management process as well as the procedures and approvals required.

Chapter 4 (Design Development Process) describes the process of concept design, options analysis and business case development of the preferred option.

Chapter 5 (Project Scoping) describes scope development, management and risk analysis.

Chapter 6 (Design Management) describes the initiation and management of the design process, contract preparation and supplier selection, design review, auditing, and document control, contract documentation, tendering process and project closeout.

1.3 Relationship with Other Manuals/Documents

In the Preconstruction Processes Manual, references to other Departmental documents and standards are minimised. In order to reduce repetition and duplication, some detailed external references have been removed as the topics are now being addressed elsewhere or are irrelevant. Some of these related documents and standards are –

- *RIP Development Guidelines* (This document can be found in Junction under Program Development and Delivery Group, RIP Business Processes);
- Road Planning and Design (RPD) Manual;
- Project Cost Estimating Manual (This document can be found in MR Publication Series);
- Guide to the Road System Manager (RSM) Framework (Contact the Principal Manager (RSM) for more information);
- Guidelines for Strategic Road Network (SRNP) Planning (This document can be found in MR Publication Series);
- Program Management Framework; and
- OnQ Project Management.

The RSM Framework is an over-arching document describing the way the Department operates. The framework provides –

- A consistent state-wide approach for the Department as a modern state road agency;
- A high level view of the Department's end-to-end processes in meeting government priorities and community outcomes;
- An environment for decision-making, policy development and support; and
- A description of what each group does in the Department so all groups have a unified view of the part they each play in this networked organisation.

The RSM will not be discussed in detail in this manual. For more information, refer to "Guide to Road System Manager Framework" and the RSM Portal.

Table 1 is a guide which provides an indication of where each manual/document applies to the various stages of preconstruction work.

1.4 Planning and Design Framework

A terminology convention aligned with the OnQ project management framework has been adopted to provide a uniform understanding and application of the project planning and design process throughout the Department.

Integral to the planning, design and delivery activities is a set of standard project reporting templates, roles and responsibilities, as well as milestone approval points.

1.4.1 Templates

Part of the project management rigour is derived from the consistent documentation of the project planning, progress and history. The Department has tailored the OnQ methodology to road projects and includes a series of generic project management templates addressing discretionary and mandatory activities within project planning.

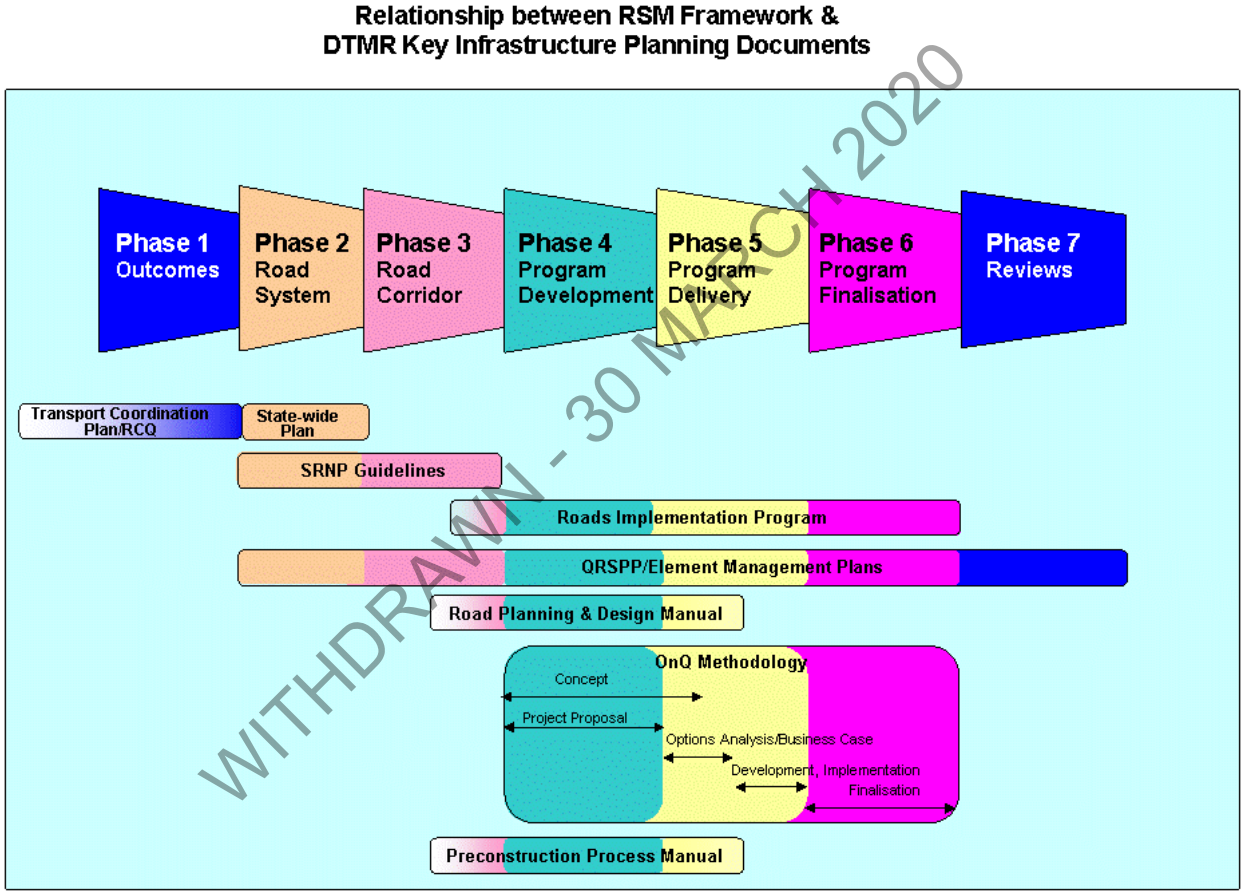
It should be noted that although there are common activities to project development, there are alternative templates within some phases. The different templates relate to the scope of works. Generally, the more complex and extensive the project, the more planning, issues resolution and risk involved, and consequently the greater degree of project documentation that is required.

1.4.2 Approval Process

The planning and design framework incorporates a number of mandatory hold points where a project cannot proceed until the necessary approvals have been obtained.

For more information, refer to the OnQ intranet site and the “RIP Development Guidelines”.

Table 1 – Department of Transport and Main Roads' Key Infrastructure Planning Documents



Transport Coordination Plan (TCP), Road Connecting Queenslander (RCQ), State-Wide Plan (SWP), Queensland Road System Performance Plan (QRSPP), Strategic Road Network Planning (SRNP), Preconstruction Processes Manual (PPM), Road Planning and Design Manual (RPD), Roads Implementation Plan (RIP)

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Chapter 2
Pre-Project Planning

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Chapter 2 Amendments

Revision Register

2

Issue/Rev No.	Reference Section	Description of Revision	Authorised by	Date
1		First Release	D.Hicks	Mar 2003
2	New Section 2.1.1	The chapter has been expanded to include the overall process	D.Hicks	Feb 2005
3		First Edition Release	D.Hicks	June 2005
4	New Chapter 2	The chapter has been revised to set the context and align the preconstruction processes with the recently developed state-wide planning process, program and project management framework.	J Worrall	July 2009

Chapter 2
Pre-Project Planning

2.1 Delivering Whole-of-Government Outcomes

Government outcomes are delivered in an integrated manner providing a consistent planning basis for State government departments, local government and other stakeholders.

The Commonwealth, State and Local Governments share responsibility for roads in Queensland. These responsibilities are reflected in Commonwealth and State legislation and administrative arrangements.

2.2 National Transport Planning

The National Land Transport (AusLink) Network is an integrated network of national and inter-regional transport corridors of strategic national importance.

These corridors include connections through urban areas, links to ports and airports, rail, road and intermodal connections that together are of critical importance to national and regional economic growth, development and connectivity. The network is funded by Federal, State and Territory Governments.

The Commonwealth also contributes funding towards –

- Local roads of regional significance through the Roads Alliance and Transport Infrastructure Development Scheme (TIDS) program;
- The Strategic Regional Program for land transport projects that support growth of regional industry, respond to structural change or strengthen local social and economic opportunities; and
- The Black Spot program which aims to improve the physical condition or management of hazardous locations with a history of crashes involving fatalities or serious injury.

The Queensland and Commonwealth Governments have jointly developed AusLink Corridor Strategies to define the current state and future needs of National Highways in Queensland.

2.3 Queensland Government Planning

Whole-of-Government planning processes, including state infrastructure planning, provide the strategic context for guiding integrated regional plans.

Queensland regional planning for growth management and regional transport planning have strong links with road planning. Regional growth management plans (e.g. South East Queensland Regional Plan, 2026) provide the whole-of-government objectives for regional development and form the basis for integrating land-use and transport planning.

Integrated Regional Transport Plans and regional transport infrastructure plans are for the integrated, future development of all transport modes in a region, and are linked to land use planning. Some examples are the South East Queensland Infrastructure Plan and Program 2026 and the Border Integrated Transport Plan 2005.

The Queensland Government also undertakes transport planning in response to specific community and industry needs not reflected in the regional growth management planning. Programs and works planning may be initiated as a result of safety, asset management, or changing traffic conditions.

2.4 Local Government Planning

Local government land use planning and local transport plans also influence the wider road and transport system. Local government planning instruments identify the desirable use of land and hence transport demand in the local context. Local planning can also promote transport and land use integration through

planning scheme provisions and Integrated Local Transport Plans.

2.5 Transport Coordination Plan

The Transport Coordination Plan (TCP) is a departmental document which sets the overarching strategic direction for Queensland's transport system over ten years and is a requirement of the Transport Planning and Coordination Act, 1994. The Transport Coordination Plan is a multi-modal (road, rail, ports, etc) strategy, providing policy coordination and consistency in direction across the various modes to achieve the Queensland Government priorities for the long term development of the transport system. The transport system objectives of the Transport Coordination Plan are translated into specific outcome areas in the strategic document Roads Connecting Queenslanders.

2.6 Roads Connecting Queenslanders

Roads Connecting Queenslanders (RCQ) is the strategy for roads within the whole-of-government state-wide planning and the broader transport planning framework.

The Roads Connecting Queenslanders sets the long term policy direction on how the Department will deliver stewardship over the total road system for the next decade and beyond. It addresses the long-term needs and strategic choices about funding road projects and road operations, and describes how the Department will respond to the community, industry and government: social, cultural, economic and environmental expectations.

2.7 Other Documents

Some other documents that are relevant in pre-project planning are –

- State-Wide Plan (SWP);
- Queensland's Road System Performance Plan (QRSPP);
- Road System Elements Plans;
- Road Route Strategies; and
- Road Link Plans.

These documents will not be described in detail in this manual. For more information, refer to "Guidelines for Strategic Road Network Planning", "RIP Development Guidelines" and the RSM Portal.

2.8 Design, Tendering and Delivery

The Department has two manuals which guide the design process and the tendering and delivery process. These are Road Planning and Design Manual and Main Roads Project Delivery System (MRPDS) Manual.

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Chapter 3
Business Requirements
(Processes, Procedures & Approvals)

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Chapter 3 Amendments - June 2005

Revision Register

Issue/ Rev No.	Reference Section	Description of Revision	Authorised by	Date
1		First Release	D. Hicks	Apr 2003
2	Chapter 3	Overall reshaping following feedback and a review. Content basically just updated.	D. Hicks	Jan 2004
3	New Chapter 3 - Business Requirements	Previous Chapter 3 - Project Delivery Processes, totally rewritten to incorporate original Chapter 4 - The Concept Phase, and Chapter 5 - The Development Phase and renamed to reflect the new content.	D. Hicks	Feb 2005
4		First Edition Release	D. Hicks	June 2005

Chapter 3
Business Requirements

3.1 Business Processes, Procedures and Approvals (Project Pre-Construction Delivery)

3.1.1 General

It is important for the project manager and the planner / designer to have a clear understanding of the business processes adopted by Main Roads for the delivery of Road Infrastructure Projects.

Main Roads delivers its projects using a business model framework comprising:

- The Road System Manager - See Chapter 1 for more details,
- The project team appropriately qualified and experienced,
- The OnQ Project Management Methodology,
- The Preconstruction Processes - see Chapter 4,
- The delivery approvals (ministerial, technical, progress and financial),
- The appropriate application of independent Peer Reviews,
- The RIP Rules, and
- The concept of "Client Leadership" in the delivery of projects.

This section provides the linkages between these business requirements. In addition, the project team is expected to behave in a manner that supports:

- The establishment and maintenance of good working relationships between team members, and
- The "best for project" approach in the delivery of the project.

3.1.2 Objectives

The key objective of this chapter is to explain Main Roads business processes and procedures that specify the requirements for identifying and developing the 'right' project that satisfies the particular network functionality need. There is a close relationship between the pre-project network planning activities in assessing the justification for the project, its priority and place in the RIP.

Project cost management

Accurate project Scoping and Cost Estimating are fundamental requirements for project justification, budgeting and cost control. The department maintains a system of total project cost control that will ensure, with a high level of confidence, that actual costs will not exceed the approved project budget. This will ensure the integrity of earlier decisions of project justification, government priorities and program allocations.

Risk management

Risk management is an essential element the control of project scope and cost. Risks that cannot be adequately mitigated during the design development process are either accounted for in the scheduled work (as provisional items) or included in the contingency amount in the estimate (non-contract item) for use by the Project Manager when any of these risks actually occur.

The application of value management (value engineering) processes at the appropriate stages of the process is an essential requirement to ensure:

- The right solution is selected in the options analysis step, and

- The individual design components are the most appropriate solutions in terms of functionality and economics.

The application of quality management principles will ensure the requirements of the quality standard are carried out and recorded. The project team at regular progress meetings must not only inspect the relevant quality records but also ensure that they are actually based on the actions being appropriately carried out. The most important records in this respect are:

- The work was performed using appropriately qualified and experienced personnel,
- The project team is fully representative of the project lifecycle,
- The designs have been fully verified, and any unusual features of the design have been appropriately addressed and validated,
- The design interfaces have been checked for compatibility especially where different disciplines are involved.

Main Roads defines clear lines of responsibility and accountability for preparing, checking and approving infrastructure preconstruction activities and project budgets.

3.1.3 Delivery Management

The preconstruction delivery processes are tailored to meet the specific requirements of Main Roads. They employ practices and procedures that enhance quality design, documentation and efficiency of the delivery processes. The mandated requirements imbedded in the Main Roads delivery processes for all road infrastructure projects are:

- A project management approach to ensure an efficient and effective delivery of project deliverables in the achievement of the specified operational performance outcomes,
- A collaborative approach using client leadership to model the way forward with regular project meetings and progressively approving solutions as they evolve,
- A project team comprising:
  - An appropriate blend of technical skills and experience over the whole supply chain,
  - Members committed to establishing and maintaining good relationships to achieve successful project outcomes,
  - Members who have a 'best for project' focus to achieve the best possible project outcomes.
- A risk management approach in seeking reliable project cost estimates,
- A quality management approach in seeking quality design, documentation and outcomes,
- A value management approach in seeking the most appropriate solutions (outcomes and design), and
- A peer review is performed to confirm that all of the critical issues have been identified and appropriately addressed.

A range of project management templates have been developed to specifically support the development, delivery and approval of Main Roads road infrastructure projects in compliance with the project management methodology and the RIP Business Rules.

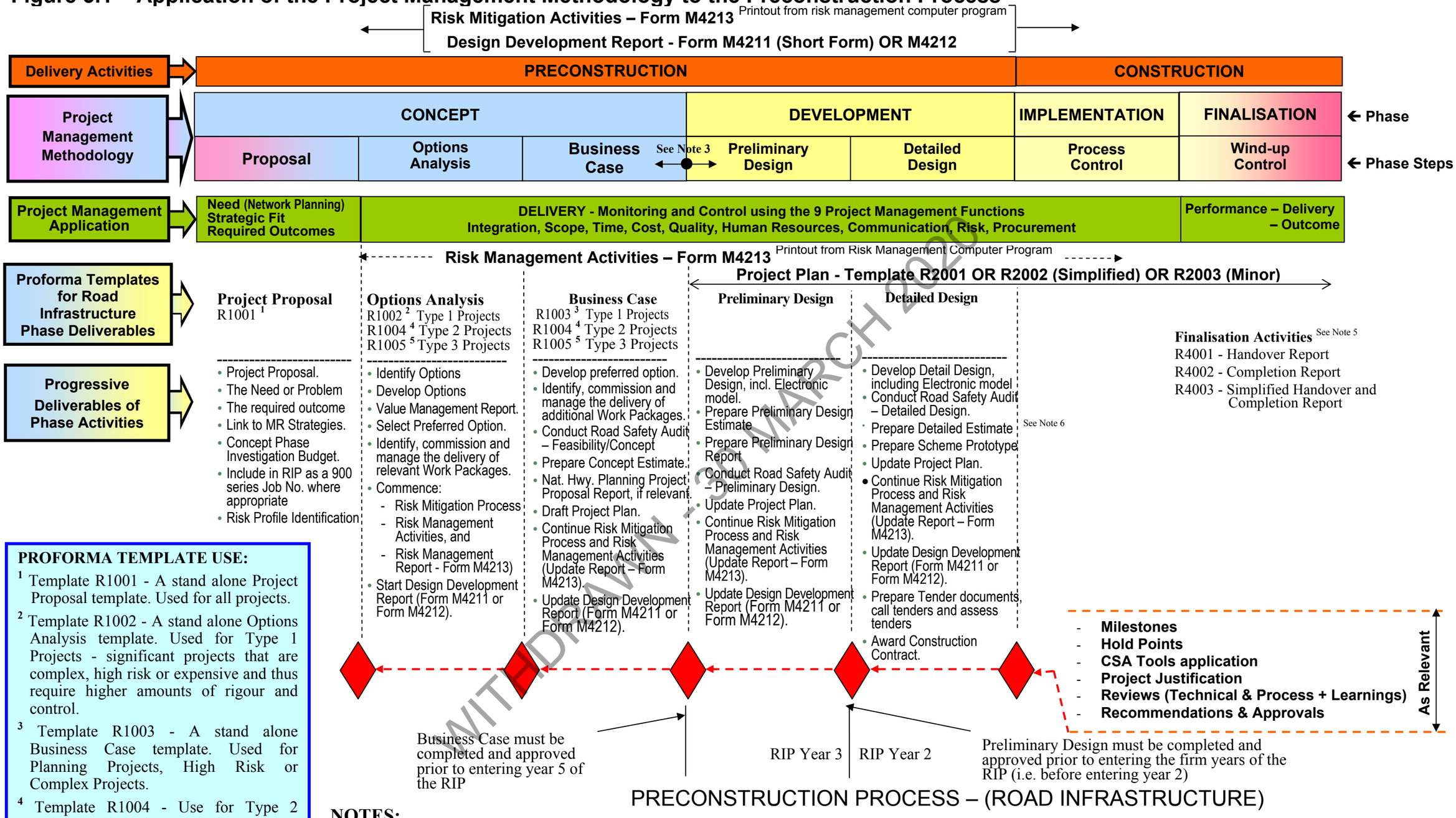
The overall relationship between the project management methodology, the preconstruction process and the Road Implementation Program (RIP) is shown in Figure 3.1 - Application of the Project Management Methodology to the Preconstruction Process.

3.2 Process Management Requirements

3.2.1 Selection of Project Team

The composition of the project team must be carefully selected to ensure the appropriate mix of technical (i.e. team members that collectively represent the whole process from conception through to construction) and management skills

Figure 3.1 – Application of the Project Management Methodology to the Preconstruction Process



PRECONSTRUCTION PROCESS – (ROAD INFRASTRUCTURE)

PROFORMA TEMPLATE USE:

[1] Template R1001 - A stand alone Project Proposal template. Used for all projects.

[2] Template R1002 - A stand alone Options Analysis template. Used for Type 1 Projects - significant projects that are complex, high risk or expensive and thus require higher amounts of rigour and control.

[3] Template R1003 - A stand alone Business Case template. Used for Planning Projects, High Risk or Complex Projects.

[4] Template R1004 - Use for Type 2 projects - relatively straight forward, low risk, projects for which a lesser amount of rigour and control is appropriate.

[5] Template R1005 - Use for Type 3 Projects - small, simple projects of low cost that progress quickly through the concept phase.

Note: Project Types are described in Section 3.2.4.

NOTES:

1. Planning Projects should have adequate lead time to deliver an approved business case for inclusion in year 5 of the RIP.
2. Construction Projects will normally enter the RIP in year 5 however urgent or political projects could enter in years 4 and 3 also.
3. Sufficient work needs to be done in the Business Case to give the Customer confidence that the Concept Estimate is of the required degree of accuracy, i.e. within ± 20%. This means that the Business Case and Preliminary Design interface is not a rigid demarcation.
4. The District Director is responsible for initiation of the project timings as they relate to the RIP formulation requirements/timings.
5. Use the intent of the Finalisation Phase to progressively close-out activities if/when they are completed, e.g. Performance Reports for Consultant Services.
6. Sufficient work needs to be done in the Detailed Design to give the Customer confidence that the Detailed Estimate is of the required degree of accuracy, i.e. within ± 10%.

for the project concerned. The concept phase would include team members from the upstream processes, the designers and representatives from other specialist areas whilst the Development Phase would have fewer team members from the upstream process but strengthened with members from the construction area. In addition, the team members must be prepared to act in the best interest of the project (i.e, to put the project above self interest advantages) together with a willingness to operate in a relational way in the delivery of the project. The adoption of a client leadership approach is essential to achieving required project outcomes (refer Section 3.2.3).

3.2.2 Delivery Process Approvals

There are many approval requirements built into the delivery process. These business procedures ensure the project progresses smoothly through all steps of the delivery process. These approval requirements are:

- project prioritisation,
- preferred solution,
- ministerial, (state and federal),
- technical,
- progress, and
- financial

Figure 3.2 - Project Delivery Approvals puts the approvals into the context of the delivery process.

Estimate Approvals

For significant projects the estimates are to be approved as specified in Table 3.1 - Estimate Stages.

AusLink National Land Transport Network Requirements

Federal DoTaRS approvals are:

Stage 1: Funding for strategic planning studies for road corridors and certain major work proposals.

Stage 2: Funding for pre-construction activities necessary to develop the project to the stage of calling tenders for construction.

Stage 3a: Funding for the construction of the project. All projects must have Stage 3a approval before tenders are called.

Stage 3b: (Also referred to as a Stage 3a variation) Covers requests for funding of variations that occur between obtaining Stage 3a approval and finalising the total cost of the project. Stage 3b is normally submitted after the total project costs are finalised. However, in some cases project costs may not be finalised (for example, resumption compensation can take several years if contested through the courts).

These requirements may change as the AusLink processes mature.

3.2.3 Application of Client Leadership Principles

Client Leadership

Client leadership is the process of the client being involved in the decision making process on a regular basis. Accordingly, the frequency of project meetings should be such that the client is able to have the necessary regular input into the decision making process and also to approve solutions as they evolve. This process should contribute to:

- Reduced rework;
- Improved quality of decisions;
- Improved efficiencies; and
- Better working relationships.

Fundamentally, client leadership is more than just being involved - it is about modelling the way forward to achieve the desired state through strong leadership and progressively addressing risk throughout the whole process.

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Process Step	Approval Type	Approval By
Pre-project	Stage 1 (AusLink National Land Transport Network Planning Projects) – Strategic Planning Report to Federal Government for approval to conduct project concept planning.	• DD (District Prioritisation) • ED (Regional Prioritisation)
Project Proposal	Project Proposal Template (Proposal Prioritisation, allocation of resources and funding for delivery of the concept phase).	• DD (District Prioritisation) • ED (Regional Prioritisation)
	Inclusion of 900 series (concept planning) projects in the RIP.	• ED (Type 1 Projects) • State Minister(PPP consideration)
Options Analysis	Options Analysis Template (Preferred option and progression to the business case).	• DD (Types 2 & 3 Projects) • ED (Type 1 or politically sensitive or realignment Projects) • (PPP submission confirmation)
	Award Consultant Contract* Progress Claims: - Progress Claim Accuracy - Financial*	• PM (Progress Claim accuracy) • * (Person with required level of financial delegation).
Business Case	Business Case Template (Project viability to progress the project to the Development Phase).	• DD (Types 2 & 3 Projects) • ED (Type 1 or politically sensitive or realignment Projects)
	Award Consultant Contract* Progress Claims: - Progress Claim Accuracy (Itemised) - Financial*	• PM (Progress Claim accuracy) • * (Person with required level of financial delegation).
	Stage 2a (AusLink National Land Transport Network Planning Projects) – Project Proposal Report to Federal Government for progression to preliminary design.	• Federal Minister (Recommended by ED)
Preliminary Design	Project Planning Report, including confirmation of project viability	• DD (Types 2 & 3 Projects) • ED (Type 1 or politically sensitive or realignment Projects) • State Minister for AIS Conditions
	Award Consultant Contract*	• * (Person with required level of financial delegation).
	Progress Claims for consultant contract: - Progress Claim Accuracy (Itemised) - Financial*	• PM (Progress Claim accuracy) • * (Person with required level of financial delegation).
	Stage 2b (AusLink National Land Transport Network Project) Project Planning Report to Federal Government for progression to contract formation	• Federal Minister (Recommended by ED)
Detailed Design	Detailed Design Report, including confirmation of project viability	• DD (Types 2 & 3 Projects) • ED (Type 1 or politically sensitive or realignment Projects) • State Minister for AIS Conditions
	Award Consultant Contract*	• * (Person with required level of financial delegation).
	Progress Claims for consultant contract: - Progress Claim Accuracy (Itemised) - Financial*	• PM (Progress Claim accuracy) • * (Person with required level of financial delegation).
	Stage 3a (National Highway Projects) - Funding request to Federal Government for progression to contract formation.	• Federal Minister (Recommended by ED)
Establish Construction Contract	Call Tenders for Construction Contract.	• * (Person with required level of financial delegation),
	Acceptance of Preferred Tenderer (Tender analysis report)	• * (Person with required level of financial delegation),
	Recommended preferred tenderer for awarding.	• * (Person with required level of financial delegation),
Implementation	Progress Claims for Construction Contract: - Progress Claim Accuracy (Itemised) - Financial*	• Project Manager • * (Person with required level of financial delegation).
- Design Changes	Award Consultant Contract*	• * (Person with required level of financial delegation).
	Approve design changes	• DD (Design appropriateness) • * (Person with required level of financial delegation).
	Progress Claims for Consultant Contract: - Progress Claim Accuracy (Itemised) - Financial*	• PM (Progress Claim accuracy) • * (Person with required level of financial delegation).
- Progress Payments	Progress Claims for Construction Contract: - Progress Claim Accuracy (Itemised) - Financial*	• Superintendent (Progress Claim accuracy) • * (Person with required level of financial delegation).
- Practical Completion	Acceptance of Work	• Superintendent
AusLink National Land Transport Network Requirements	Stage 3b (also known as Stage 3a variation) (AusLink National Land Transport Network Projects) Report to Federal Government for funding approval	• Federal Minister (Recommended by ED)
Finalisation		

Figure 3.2 Project Delivery Approvals

Relations Management

Relations management requires establishing and maintaining good relationships. This approach requires both parties to develop and maintain good relationships to ensure optimum outcomes for Main Roads, the consultant, the community and Government by aligning the efforts of the parties and making best use of the expertise and resources available. A start up meeting must always be used to agree to Key Performance Indicators (KPI) for monitoring the health of the relationship. Regular project meetings are necessary to ensure relationships are consistently addressed againts the KPI's.

Client Leadership and Relations Management Interaction with the Supply Chain

The supply chain for any project requires strong client leadership of all parties working towards common goals and acceptable outcomes. It does this through increased integration of the supply chain in which there is increased participation by downstream end users in the upstream processes. The use of group solving processes will provide Main Roads with better 'whole-of-life' outcomes. Figure 3.3 - 'Integrated Supply Chain' shows the full integration of processes for a whole project.

3.2.4 Project Management Templates

The mandated project management methodology must be used to deliver all Main Roads Road Infrastructure projects - See Section 3.7. A series of project management templates have been developed to support the use of this methodology for the delivery of road infrastructure projects. They are also the key process requirements to approve the inclusion of a project in the RIP.

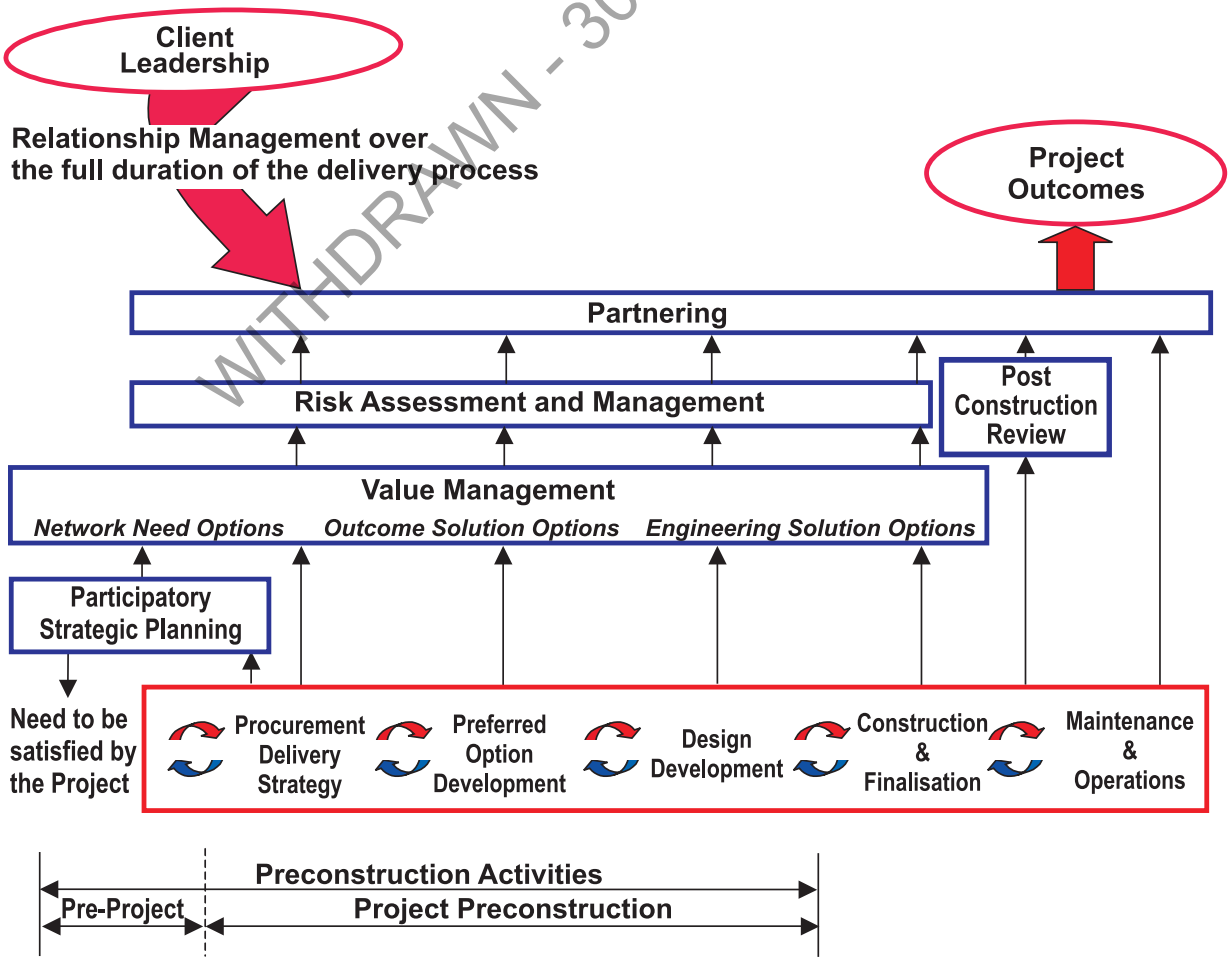


Figure 3.3 Integrated Supply Chain

The Purpose of Templates for Road Infrastructure Projects

Templates support the project management methodology by:

- Incorporating the project management methodology for each step in the concept phase,
- Acting as a project management methodology checklist,
- Providing an explanation of the intent of each project management methodology requirement;
- Providing a place to document the results of the considerations for each methodology requirement with document control provisions, and
- Delivering the Project Management consistency required by the department.

NOTE: For the use of templates, their relationship to project type and how they integrate into the design development process is shown in Figure 3.1 - Application of the Project Management Methodology to the Preconstruction Process.

The Role of Templates in the Preconstruction Process

Templates support the preconstruction process because of their alignment to the RIP development process as follows:

(a) The completed Project Proposal template requires approval to allow the project to:

- Proceed to the Options Analysis and Business Case,
- Be included in the RIP as a Planning Project, as appropriate.

(b) The Options Analysis template requires approval of the Preferred Option before further work is committed.

(c) The Business Case template requires approval to allow the project to be included in RIP as a Construction Project (Year 5).

(d) The Preliminary Design is a stage submission of the Project Plan for approval to allow the project to progress into Year 2 of the RIP.

(e) The Detailed Design is a stage submission of the Project Plan for approval to allow the project to progress to forming a construction contract.

Templates and Project Type

Template selection requires the user to first assess the project Type using the following descriptions:

1 Type 1 Projects: - significant projects that are complex, high risk or expensive and thus require higher amounts of rigor and control

2 Type 2 Projects: - relatively straight forward, low risk, projects for which a lesser amount of rigour and control is appropriate

3 Type 3 Projects: - small, simple projects of low cost that progress quickly through the concept phase

The Template Selection Process is outlined in Figure 3.4 - Project Management Template Selection.

Project Management Methodology and Project Type

The project management methodology requires a business case to justify and seek approval for the project. Main Roads projects range from very simple projects of a very short time duration to projects that require significant investigations and sometimes years to develop a business case where the estimated cost of the project is to within ± 20% of the final project cost.

The impact on the preconstruction processes is that the business case for Type 3 projects may take less than a week to prepare whereas Type 1 projects may take several years. For a Type 1 project the development of the business case may approach a completed preliminary design in order to prepare a project estimate to the required accuracy. For Type 2 projects the development of the preferred solution to meet business case

Phases & Steps / Project Characteristics	Concept Phase			Development Phase		Finalisation Phase	
	Project Proposal	*Options Analysis*	*Business Case*	*Preliminary Design*	*Detailed Design*		
Type 1 Projects	R1001	R1002	R1003	R2001 (Project Plan)		R4001 (Handover Report)	R4002 (Completion Report)
Type 2 Projects		R1004		R2002 (Simplified Project Plan)		R4003 (Simplified Handover and Completion Report)	
Type 3 Projects		R1005		R2003 (Minor Project Plan)			

Figure 3.4 Project Management Template Selection

specifications will range between the requirements for Type 1 and Type 2 projects.

3.2.5 Roads Implementation Program (RIP)

Overview

The RIP business rules specify the requirements for including road infrastructure projects in the RIP (Project Codes 1-99, 300 and 800, and 700 where the estimated cost is greater than $200,000) Check these rules in the RIP Help database for currency before use.

An overview of the RIP Framework is illustrated in Figure 3.5.

Roads Implementation Program (RIP)

Each year, MR prepares the RIP in consultation with local government, industry and other stakeholders. It is a public statement of the planning, construction and maintenance activities which the state government intends to progress over the next five years. It contains firm (committed) funding for the first two years and planned (indicative) funding for potential projects in the subsequent three years. The program may be amended during its annual review to reflect changed priorities or circumstances.

To provide confidence for the program management process, projects must meet certain criteria before they become eligible for inclusion on the RIP. These are:

(a) Planning Projects (900 Series RIP Projects)

The project concept phase (planning) budget must be based on an approved project proposal and include the cost of completing the Concept Phase (that is conducting the options analysis and preparing the business case). Planning projects will be created for more complex, expensive or high risk projects where significant funds need to be committed to develop the business case.

The larger of these projects could be up to 15 years before they enter the RIP in Year 5 as a construction project. Where significant time lapses occur between the preparation of the business case and its proposed inclusion in the RIP then a project review, including the cost estimate must be undertaken to ensure project specified outcomes, considerations, inputs, and cost are still valid.

(b) Construction Projects (RIP Projects)

A construction project is only authorised to be included in the RIP after a business case has been approved. This would usually be an output of districts and region prioritization process. In most cases the project would be included in Year 5 of the RIP.

The project budget must be based on an approved business case and include the total cost of the project (that is planning, design, construction, alteration to public utilities and ROW acquisition). The budget is presented in out-turn

PROJECT PHASES	PRE-PROJECT	CONCEPT			DEVELOPMENT		IMPLEMENTATION	FINALISATION
Process	**Strategic Planning**	**Proposal**	**Options Analysis**	**Business Case**	**Preliminary Design**	**Detailed Design (includes Contract 1Formation)**	**Construction**	**Project Handover**
Preferred Timing (Relative to RIP)	Prior to Year 5	Prior to Entry on the RIP#			Prior to Year 2	Years 1 to 2	Year 1	Post-construction
Input	Road Network Strategy; Road Network Investment Strategy	Statement of network Needs and functional Outcomes to be achieved by the completed project	Approved Proposal	Approved Preferred Option	Approved Business Case	Approved Preliminary Design	Contract Letter of Acceptance	Practical Completion
Activities	Link Strategy	Project Initiation; Proposal Development	Options Analysis	Preliminary Project Plan; Final Scope Definition; Project Justification	Project Plan; Development of Design	Documentation of scheme prototype; Call Tenders; Award Contract	Construction of works; Commissioning	General Acceptance; Project Close-out; Review and Evaluation
Output	Statement of network Needs and functional Outcomes to be achieved by the completed project	Approved Proposal	Approved Preferred Option	Approved Business Case	Approved Preliminary Design; Stage 1 Release	Approved Scheme Prototype Document; Stage 2 Release; Contract Letter of Acceptance	Practical Completion	Completed Product Consultant Report Contractors Performance Report Post-construction Report
Federal DoTaRS	Stage 1	Stage 2		Stage 2a		Stage 3a		Stage 3b*
Estimate Stage	Strategic	Planning Estimate (concept phase work only)	Comparative cost of Options	Concept Estimate*	Preliminary Design Estimate*	Detailed Design Estimate*	Accepted Tender Price	Cost at Completion

Project entry onto the RIP is via the project proposal for significant planning projects or via the business case for construction projects.
* Stage 3b covers request for variations that occur between obtaining 3a approval and finalising the total cost.
AusLink National Land Transport Network Requirements Federal - Refer Section 3.2.2 .

Figure 3.5 Overview of RIP Framework

dollars based on the expected period for construction.

Budget estimates must be based on the rigorous process of cost planning outlined in Section 4.4.2 of the Project Cost Estimating Manual.

The project stages and preferred timing at which estimates are required are detailed in Table 3.1.

This framework provides for estimates to be prepared at intervals during the concept and Development Phases of the project to assist planning and maintain control over the cost of the project.

3.2.6 Estimating Process

3.2.6.1 Overall Framework

Good estimating is fundamental to the process of project cost management, providing the basis of project justification, budgeting and cost control.

The Main Roads estimating requirements and practices are detailed in the "Project Cost Estimating Manual". It covers the preparation of estimates over the total life cycle of a project to provide reliable cost information for:

(a) Initial justification of a project in the business case, (e.g. cost/benefit analysis);

(b) Ongoing cost control during the project's development, implementation and finalisation phases;

(c) Program management

It also provides information on a range of processes and techniques to suit the varying circumstance under which estimates are to be developed. Planners and designers must consult the Project Cost Estimating Manual for guidance when preparing their estimates.

Project budgets and publicly announced estimates are in out-turn dollars (see Section 1.7 - Terminology Convention).

Project estimates are initially developed using current day costs as if all works were to be completed in the immediate future. This is a Current Dollar Estimate.

3.6.2.2 Estimate Stages

The pre-construction framework provides for estimates to be prepared at intervals during the concept and Development Phases of a project to monitor and control project cost. The project stages at which estimates are required are detailed in Table 3.1.

It is acknowledged that projects can vary substantially in terms of their size and complexity, and therefore may have varying requirements as to the number and staging of estimates.

The full range of estimates as listed in Table 1 would be typical of a major project of high complexity where significant development activities take place between stages. There might even be a need to review estimates within these stages to provide the necessary control particularly if the development of the project extends over a long period of time. The mandatory estimates correspond to:

- Business Case
- Preliminary Design, and
- Detailed Design

It is recommended that completely revised and updated estimates are prepared at each of the mandatory stages to ensure the scope of the project, which has been refined over time, is accurately reflected in the estimate under preparation.

3.2.7 Scope and Cost Management

3.2.7.1 The Process

The main objective of cost management is to manage and control project cost from the Concept Phase to the Implementation Phase within the program limit imposed by the Business Case, i.e. Concept Estimate. The principle is to design to a fully validated budget.

Table 3.1 Estimate Stages

Project Stage	Stage of Cost Estimate	When Prepared	Approved By
Concept Phase	Proposal (Investigation estimate Mandated)	The investigation estimate is the budget required for approval to produce the options analysis and business case, and where relevant for inclusion of a planning project in year 5 of the RIP.	Regional Executive Director.
	Options	Comparative Costs of each option for comparison purposes only. These estimates are not refined since the total scope and all of the risks are not necessarily known at this stage.	
	Concept Estimate (Mandatory)	The concept estimate (within ± 20%) is an output from the Business Case (based on developing the preferred option to the extent necessary to establish a reliable project cost estimate). It is the first project estimate produced and includes the outcomes from community consultation, environmental studies, geotechnical studies, etc. based on the preferred option. Approval at this stage allows the project to proceed for inclusion in the RIP.	Regional Executive Director(All Projects)
Development Phase	Preliminary Estimate (Mandatory)	The preliminary estimate (within ± 12-15%) is an output of the Preliminary Design Stage of the Development Phase and confirms the scope and cost justification for the project. All risks should have been identified and accounted for in the estimate. Approval required before inclusion in the RIP at Year 2.	Regional Executive Director.(All projects)
	Detailed Estimate (Mandatory)	The Detailed Estimate (within ± 10%) is an output of the Development Phase (at the end of the detailed design stage). It includes the construction estimate and all other costs associated with development activities. All risks should be addressed and accounted for at this stage.	Regional Executive Director(All projects)

The approach is to provide a procedure to establish project scope control that is the basis for project cost estimation and management over the project life cycle which also interfaces with the Main Roads project management system and all departmental procedures.

The project scope and cost control procedure commences as soon as the Project Proposal has been approved at the start of the Concept Phase. Project Scope and Cost Management applies over all of the project lifecycle Phases.

The full Concept Phase development cost for routine projects is considered to be part of the network planning activities. For major projects, the options analysis and the business case development costs are sourced through the RIP as planning projects.

Under the project management methodology the first project estimate produced is the concept estimate. It is produced as part of the business case and has an ongoing influence on all subsequent phases. All estimates include the whole spectrum of cost activities which make-up the total project cost i.e. cost of design, surveys, consultant fees, materials testing, supervision, construction, project management, closeout, etc.

Using this approach, there is a requirement to:

- Provide resources for the delivery of the Development Phase and manage them efficiently in order to meet the project's objectives;
- Identify costs associated with the delivery of:
  - Concept Phase (Options Analysis and Business Case);

- Development Phase (Preliminary Design and Detailed Design); and
- Implementation Phase (Construction); and

• Forecast the final project costs in order to develop the project budget, and manage these costs to make sure the objectives developed in the business case are met.

The above approach necessitates revision of the total project cost at each phase/ phase stage after the concept phase, to determine the variance between the revised estimate to completion and the concept estimate (project budget).

The intention of the above exercise is to provide for an early detection of possible cost overruns, so the Project Manager can take necessary corrective action in order to bring the project cost within the programmed budget.

If at any stage of the project's lifecycle the estimated project cost forecasted at project completion exceeds the project budget, re-justification is required. Alternatively, a revised solution meeting the budget could be developed and considered.

3.2.7.2 Scope Management

See Chapter 5 - Project Scoping.

3.2.7.3 Cost Management

Preamble

The Project Cost Estimating Manual (Main Roads 2004) provides detailed guidelines on cost management (Section 4.5 of that Manual). The procedures described therein should be followed in controlling a preconstruction project. The processes include:

• Resource planning;

• Cost estimating;

• Cost budgeting; and

• Cost control.

Resources

Defining the scope and preparing cost estimates must be undertaken by experienced competent personnel familiar with delivering infrastructure projects.

From the outset of involvement in the project, it is critical that the Project Manager engages staff and/or agents who have an appropriate extent of experience and proven capability for the various functions and specialties that the project will comprise. An example of this arises in the project appreciation where engagement of very experienced assistants, probably with a range of backgrounds and perspectives, can provide the means for timely recognition of all relevant information needs, areas of vagueness or uncertainty, and the extent of risk which exists and which has to be accommodated in project management time tables and estimates.

Cost Estimating

Production of an accurate cost estimate requires clear definition of the project scope. Scope definitions and project estimates are undertaken or reviewed at each phase in the project life cycle. Refer to Section 3.7 of this manual and to the Project Cost Estimating Manual for more details.

When the preferred outcome option has been developed, a concept estimate of its total cost is required so that the project can be evaluated on the basis of benefits and costs. This estimate must be itemised (Construction, Planning and Design, Project Management, and Administration) to show the relevant cost components of delivery.

The concept estimate needs to forecast the final project cost with sufficient accuracy for the business case evaluation decisions to be valid and the total budget allocation to be realistic. For this reason, a substantial itemized contingency amount might need to be included in the concept estimate to cover the high inherent risks and uncertainties in estimating costs at this stage of the project.

Thorough appreciation of the project, its complexities and the extent of uncertainty that prevails at any stage is essential when preparing

the implementation cost estimates and estimates for investigation and design activities.

Project managers are accountable for the accuracy of project estimates and for ensuring that projects are delivered in accordance with the approved scope.

Cost Budgeting

3

The project budget is a summation of the Concept (Options Analysis and Business Cases Stages, as relevant) Development, Implementation and Finalisation budgets.

The first step towards reduction of the risks and uncertainties arise in the process for handover by the client to the chosen Project Manager. Ideally at this point the client requirements are fully defined and available for reference in the handover process.

Irrespective of the completeness of the formal brief at this point, it is critical that the Project Manager formally enters into a period of appreciation of the project dimensions, objectives and background. The more thorough this appreciation, the more will risks and uncertainties be reduced.

Project Cost Control

Project performance must be measured regularly to identify variances from the project plan. These variances are fed into change control processes for the project. Variances that threaten the objectives of the project will trigger an adjustment to the plan by repeating the appropriate planning process. This could result in an adjustment to the plan in areas other than the area where the major variance occurred.

Cost control is concerned with influencing the factors which create changes to the cost baseline, identifying when changes have occurred, taking corrective action to correct cost overruns or prevent their reoccurrence and informing appropriate stakeholders of authorised changes. For example cost overruns could be occurring through scope creep. This may prompt action to review the process of scope control as well as reviewing the design strategy for achieving the project objectives. If the variances are large enough they might prompt a review of the business case and re-justification of the project.

Project cost control commences with the concept estimate, which establishes the project budget.

The purpose of the Concept Estimate is twofold. Firstly, it is used to establish the project budget. Secondly, it forms an integral part of the project justification process, when benefit cost ratios are calculated.

The estimate of project costs includes an item to cover the cost of risk in the event of risk actually occuring as follows:

- Risk Contingency Amount

Risk Reserve and Variation Reserve are included in the project estimates as itemized contingencies.

Although the project's budget is formed from the combined value of both the Base Estimate and the Contingency Allowance, these two components should be monitored and project managed separately.

Consequently, when producing the Earned Value Chart, there should be two graphs presented, one representing Basic Estimate, and the second referring exclusively to the Contingency Amounts.

Bear in mind also that the project budget always refers to the forecasted costs at project completion. Furthermore, at any time, when assessing the project progress, the costs associated with the remaining activities should be projected to the project completion date and if any discrepancies (overruns/ under runs) between the original project budget and the forecasted cost at completion are detected, the appropriate management action should be undertaken.

As the project progresses through the Development Phase, revised and updated estimates are required to be prepared to reaffirm project justification and affordability, which is easy to do if the estimated cost does not increase beyond the budget. The project scope and risk assessments need to be accurately documented in

order to justify a change in scope and hence the project cost.

Project cost control concentrates on the Concept and Development Phases, each of which contains a number of tasks and deliverables. The mandated estimates provide review opportunities to assist in project cost management. The estimating stages are shown in Table 3.1 - Estimate Stages.

Project Cost Peer Review

The objective of peer reviews is to confirm that all of the critical issues have been identified and appropriately addressed at each stage of the preconstruction process in order to give confidence that the project cost is to the required accuracy. Reviews should be undertaken at the start of each phase of the process at the least. In the Development Phase, reviews should be done at the start of the Detailed Design as well as at the start of the Preliminary Design to ensure that the project is in scope.

These reviews target the key issues of the project e.g.:

- The identification and treatment of project risks ensuring mitigation on a progressive basis;
- The identification of all relevant stakeholders and addressing of their requirements;
- The appropriateness of the solution in relation to the need and operational performance outcome; and
- The rigour of scope and estimating with respect to project costing.

Project estimates are to include the costs of all resources and activities required to deliver the project.

Estimates are a prediction of the final cost of the project and as such should be rounded up to the nearest $1000 in recognition of the level of uncertainty in the final outcome.

Review of estimates is mandatory and should be undertaken by an experienced estimator independent of the project team. Projects to be referred to Project Development Office (PDO) include:

- State funded projects with an estimated cost greater than $20 Million,
- Federally funded projects with an estimated cost greater than $10 Million,
- All high risk or complex projects.

Estimate reviews are to be performed by peer review groups as detailed in Table 3.2.

Table 3.2 Peer Review Group Composition

Project Value $M (OT)	Leader	Team			
		DD	M(TP)	M(ID)	Functional Leaders
< $5M	M(TP)/ M(ID)				As appropriate from RS&E, PDO and region/district
$5M to $20M	DD		✓	✓	✓
> $20M	D-DG/ RED	✓	✓	✓	Functional Leaders/ EDs/GMs from: - RS&E - SP&D - F&BS

3.2.7.4 Project Evaluation

In order to be included in the Road Implementation Program, candidate projects for evaluation must be generated from the directions included in the approved Transport Infrastructure Strategy (Federal, State or Regional).

According to the current "Evaluation Guidelines for Road Projects" prepared by Infrastructure Development Division, the initial project justification is a two stage process.

The first stage of the evaluation process involves a Cost Benefit Analysis (CBA) carried out in accordance with the Cost Benefit Analysis Manual for Road Infrastructure Investment (Main Roads 1999).

It was recognized that CBA alone could not provide the full basis for evaluation because of its inability to take account of a number of relevant factors. Therefore, a set of guidelines for the second stage of the project evaluation process was developed.

The relevant parameters of Stage 2 evaluation are as follows:

3

- General Considerations
  - * Policy / strategy match
  - * Risk / feasibility
    - Socio / political
    - Technical / delivery
  - * Network effects
- Development Outcomes
  - * Economic
  - * Trade
  - * Regional
  - * Sensitivity test of travel time
- Social Justice Outcomes
  - * Equitable access
  - * Community viability e.g. Rural Employment
- Environment Sustainability Outcomes
  - * Impacts on Natural environment
  - * Impacts on built environment
  - * Impacts on cultural environment
- Safety Outcomes
  - * Hazardous goods
  - * Vulnerable groups

These requirements are fully incorporated in the project management templates for the Concept Phase Stages of Project Proposals (authorises planning project to be included on the RIP), and the Business Case (authorises a construction project to be included on the RIP).

3.2.7.5 Financial Management

The numbers used for projects and jobs are to be determined using the Road Program Management System (RIPA). A project can have one or many subsequent job numbers.

These project and/or job numbers are to be opened in the Queensland Government Financial Management System (QGFMS) after notification of the pre-construction phases of the project has been given. The job number for each phase will include a character that identifies that project phase in the QGFMS. The owner's costs for activities in each phase will therefore be available for monitoring or review purposes.

A business unit costing system shall be used by business units to record their actual costs for each item of work in each of the phases for pre-construction and/or construction work. This system shall be capable of providing data and analysis results, and be linked to the QGFMS for sharing specific information to aid in monitoring or review of performance and cost control.

3.3 Value Management

Main Roads have been designing and constructing roads for decades. Over this time roads have progressed from old narrow dirt tracks, to paved roads, and on to the modern motorways of today. Continuing funding pressures has made it increasingly important to develop processes that help us to achieve greater value for the available funds. One way we can do this is to apply the Value Management (VM) to our process for developing road infrastructure projects.

3.3.1 Value Management Objectives

The goal of a VM study is to achieve design excellence in the delivery of road infrastructure. Its objectives are to improve quality, minimize total ownership costs, reduce construction time, make the project easier to construct, insure safe operations, and assure environmental and ecological goals. The VM team is looking for the

optimum blend of scheduling, performance, constructability, maintainability, environmental awareness, safety, and cost consciousness.

Main Roads defines Value Management (also referred to as Value Engineering) as the systematic application of recognised techniques by a multi-disciplined team to:

- Identify the function of a product or service,
- Establish a worth for that function,
- Generate alternatives through the use of creative thinking, and
- Provide the needed engineering functions to accomplish the specified purpose (required operational outcomes) of the project.

This process should deliver these objectives reliably, and at the lowest life-cycle cost without sacrificing safety, specified quality, and environmental attributes of the project. This section on value management has been tailored to the delivery of road infrastructure and consequently it has a strong value engineering emphasis.

3.3.2 Value Management Application to Road Infrastructure Projects

Volume 1 of MRPDS requires VM application to all large or complex projects and for the physical packaging for projects estimated to cost more than $20M.

VM can be applied at any point in the design development process, but to obtain maximum effectiveness, VM studies should be undertaken as early as possible when the impact of decisions (on life-cycle costs) is the greatest.

For road infrastructure projects VM can provide benefits in the development and delivery phases with respect to:

- Identification of the best solution 'preferred option' to the need/problem and achieving the required required outcomes (For identifying and developing options and conducting options analysis),
- Achieving the best value in the development of the preferred option. (There is a strong focus on engineering functions in this part of the process),
- Identifying the best physical packaging method to maximise value in the construction process.

To maximise benefits VM must be an integral and essential part of the delivery process scheduled routinely into the design development process in areas offering the greatest potential for improvement and/or value. Also, see Figure 3.3 - Integrated Supply Chain.

3.3.3 The Value Management Process

Main Roads is responsible for getting the best overall project value for the taxpayer. Applying the VM process to suitable projects will help achieve this purpose. Simply stated, VM is an organized application of common sense and technical knowledge directed at finding and eliminating unnecessary costs in a project.

A team of 5 to 8 persons with diverse backgrounds seems to work best. The length of time required for a study varies and is dependent upon the complexity of the project. The VM team effort should be done at one time rather than spreading it over several weeks or months. By doing this the team members do not have to become reacquainted with the project and momentum is maintained.

The most frequently heard first response to a presentation on VM is "we do it all the time, but we don't use that name!" However, it is highly unlikely that they do, do it all of the time. Value Management has many elements, such as, team work, functional analysis, creativity, cost-worth, and the systematic application of a recognized technique. Unless all of these elements are used, it isn't VM and it will not yield the results that a VM study will yield.

The "systematic application of recognized techniques," referred to in Section 3.3.1 is embodied in the VM Job Plan. The Job Plan is an organised plan of action for accomplishing VM

studies and assuring the implementation of the recommended changes. The Job Plan contains the following 9 stages:

1. Selection
2. Investigation
3. Analyse
4. Speculation
5. Evaluation
6. Development
7. Presentation
8. Implementation
9. Audits

Stages 3 to 7 inclusive are performed by the VM team. The other three Stages should be carried out in accordance with Section 3.3.2 and the criteria shown in Stage 1.

The intent of each Stage is described as follows:

Stage 1 - Selection:

Project selection is outside the control of the value study team. In general, the criteria used to select projects includes:

- high cost projects,
- projects where the Business Case just does not stand up,
- projects with large risks exposure,
- important, but low priority projects that fail to meet budget affordability, and
- problem projects.

Stage 2 - Investigation:

The investigation stage is where the value study team first becomes involved. In this stage, the team determines what they know about the project from readily available information and what they must know in order to really define and / or solve the problem. It is in this stage of the VM study that we identify the elements that have the greatest potential for value improvement.

The Investigation stage immediately brings the three fundamental concepts of VM (function, cost, and worth) to bear on the problem. It is these concepts that make the VM process different from all other management and cost control techniques. This stage requires the team to ask and answer the following basic questions:

- What is it?
- What does it do? (what is the function?)
- What must it do? (is its function basic?)
- What is it worth?
- What does it cost?

Most of the information required in this stage is readily available. The length of the project, traffic projections, design speeds, and the major elements designed into the project can be easily identified from a review of the plans and other documentation. The projects cost estimate would only be known if the VM study is performed after the Business Case has been completed. Sometimes the VM team must dig harder for other information to adequately complete the investigation stage.

Applying Pareto's Law of Distribution will give you an idea of where to start looking for potential savings. It states that 80% of a project's cost will be in 20% of the work. Preparing a project cost model will begin to identify your targets of opportunity.

Stage 3 - Analyse:

Identifying the engineering functions your project and its elements perform is the next step in the VM process. Function denotes the specific accomplishment to be achieved by an element or combination of elements in the overall design. The value methodology requires that we describe a function by the use of two words - an action verb and a measurable noun (that is acted upon).

For example, the function of a bridge is to "cross obstacle." The bridge doesn't care (nor do we)

whether that obstacle is a drain, river, creek, railroad, another highway or a building. Its basic function is to provide a means to cross that obstacle. If it does not accomplish that function, we wouldn't buy it, therefore the cross obstacle function is basic. We want to be as non-specific as possible to leave us many options to perform the generalised problem or function that we have before us.

By the end of the Analysis Stage we have identified our high-cost elements, functionally analysed them, and assessed their cost / worth relationships. This phase of the VM job plan identifies the areas of a project that are ripe for further value study.

Stage 4 - Speculation:

The speculation or creativity stage is next. This is where the power of the VM technique manifests itself. The team applies brainstorming techniques to develop good alternatives to the way the project is currently designed. Brainstorming forces people to be creative. The mechanism that produces this phenomena is called synergism - which means that one idea triggers other ideas or thoughts through: similarities or like ideas; contiguous or adjoining ideas; contrasting or opposite ideas; and sound alikes.

The value study team applies creativity to its functional statements which it has selected from the cost/worth estimates. It uses the generic format of the function to speculate on all possible solutions to the problem presented in that functional statement.

The team uses brainstorming to generate a large list of potential solutions to the problem described by the two-word function and then in the next phase are able to rapidly pare the universe down to a manageable few ideas through the feasibility analysis.

Stage 5 - Evaluation:

Evaluation of the best alternatives is next. The advantages and disadvantages of each remaining alternative are listed. Of course, if the disadvantages far outweigh the advantages of any alternative, it is dropped at this point.

Each advantage and disadvantage is described in general terms. The team can perform a weighted matrix analysis to determine which alternative is best based upon the relative importance of each of the desirable criteria which must be addressed. This analysis satisfies the VM objective to achieve the best blend of performance, cost, and schedule. The objective is not to gain perfection.

Stage 6 - Development:

Once the team selects the best alternative, it is fully developed through sketches, cost estimates, validation of test data, and other technical work to determine if any assumptions made during the study are in fact valid. The final step before presenting the teams recommendations to management is to formulate an implementation plan which describes the process that the agency must follow to implement any recommendations.

The final product of a value study is the formal VM report and the presentation of the team's recommendations.

Stage 7 - Presentation:

Once the team has completed its VM Report it is necessary for the team to present its findings to management/ Project Manager. Where project improvements and/or cost savings are identified these need to be supported by relevant evidence and supportive dialogue where necessary.

It is important to realise that it is the responsibility of management/ project manager to either accept or reject the findings of the team. It would be most unusual for recommendations not to be accepted but political considerations may dictate the final position.

Stage 8 - Implementation:

No recommendation for a savings is a savings until it has been implemented. In this respect it is the responsibility of management/ project manager to take the appropriate action to ensure that the accepted suggestions are incorporated into the project at the earliest opportunity.

Stage 9 - Audits:

This stage determines the amount of savings generated by the VM study based on the amount of recommendations implemented in the construction project. A cost benefit analysis on the value of the VM Study could also be worthwhile.

3

3.3.4 Job Plan

Each stage of the Job Plan includes several tasks. It is the melding of the various tasks and techniques, coupled with finesse in their application that makes the VM process work. An example of a Job Plan is shown in Table 3.3 - Value Management Job Plan.

3.4 Risk Management

3.4.1 What is Risk?

A risk is any exposure to potential loss or damage that can impact on a project. The risk of a proposal may include both potential benefits and potential costs. In most cases, risks are taken so as to achieve some advantage and managing risks is associated with making decisions.

Risks can generally be grouped under four headings:

- Physical - injury or damage to persons or property.
- Legal - breaching legal obligations.
- Moral/Ethical - harm to the organisation's reputation.
- Financial - loss of assets of the organisation.
- Risks are made up of two elements:
  - the likelihood of something happening, and
  - the magnitude of the consequences if it did.

It is a requirement for all Main Roads projects to be delivered using a risk management approach. This requires all external and internal project risks to be identified and continually managed using a risk mitigation strategy to eliminate or minimise the risks during the development process of the project.

It is not always possible to eliminate all risks but they can be managed appropriately and this should occur at that part of the overall process that is best situated to manage then. Risk should not be managed by off loading to another party when it can be best managed some where else. Because risk is an inevitable consequence of change, the best time to manage risk is as part of planning change. Where risks cannot be eliminated it is a requirement to provide a risk contingency amount to cover the likelihood of a risk occurring in the project cost estimate.

3.4.2 What is Risk Management?

Risk Management (RM) has been described as "all the things you need to do to make the future sufficiently certain". RM is regarded as the rational processes that will allow risk to be managed well and can be defined as "the culture, processes and structures which are directed towards the effective management of potential opportunities and adverse effects." RM is systematically identifying threats (risks) to the organisation and developing ways to minimise those that do occur.

RM is not designed to stifle innovation or change but to ensure that the associated risks are understood and treated in a way that will make the desired outcome more likely and at the lowest net cost. The RM process provides for the systematic application of management policies, procedures and practices to the tasks of establishing the risk context, identifying, analysing, evaluating, treating, monitoring and communicating risk.

Typically, good RM will be proactive. Equally, good RM will be a routine activity and will therefore be integrated into general management activity. RM should be a part of the organisation's culture rather than being seen as something separate. Even if the process used is informal, it should be documented and based on a known system.

Table 3.3 Value Management Job Plan

Stage	Objective	Key Questions	Techniques	Tasks
Selection	Select Project	• What is to be sudied? • Who is best able to study problem? • What must be kown to start study?	• Solicit project ideas • Identify high cost / low value areas • Plan the project • Obtain authorisation to proceed • Allocate resources	• Speculate on project sources • Develop plan to identify projects • Evaluate projects for potential • Present projects to management • Select projects for VM studies • Implement study plan
Investigation	Investigate Project	• What is the project? • What is the problem? • What is the cost? • What is accomplished now? • What must be accomplished?	• Get information from best sources • Get all facts & available costs • Work with specifics • Identify the functions • Challenge everything	• Speculate on data sources • Develop plans to gather data • Implement data search plan • Investigate project - audit data • Speculate on functions performed
Analyse	Function & Cost	• What is the basic function worth? • What are secondary functions worth? • What are the high cost areas? • Can any functions be eliminated?	• Evaluate by comparison • Put $ on specifications & requirements • Put $ on key tolerances & finishes • Put $ on key standards	• Analyse costs • Analyse functions • Evaluate function cost / worth • Evaluate project potential • Select specific study areas
Speculation	Speculate on Alternatives	• What else will perform the function? • Where else may function be done? • How else may function be done?	• List everything - be imaginative • Use creative techniques • Defer judgement - do not criticise • Be courageous	• Select techniques to be used • Speculate on alternatives • Speculate on parameters
Evaluation	Evaluate Alternatives	• How might each idea work? • What might be the cost? • Will each idea perform basic function?	• Weigh alternatives • Choose evaluation criteria • Refine ideas • Put $ on each main Idea • Evaluate by comparison	• Speculate on evaluation criteria • Evaluate alternatives • Select the best alternative
Development	Develop Alternatives	• How will the new idea work? • How can disadvantages be overcome? • What will Be the total cost? • Why is the new way better? • Will it meet all the requirements? • What are the life-cycle costs?	• Get information from best sources, specialists & suppliers • Consider specialty material, products & processes • Consider standards • Use new Information • Compile costs - work with specifics	• Speculate on information needed • Speculate on information Sources • Develop a plan of investigation • Develop selected alternatives • Select preferred alternatives • Develop implementation plan • Audit data
Presentation	Present Alternatives	• Who must be sold? • How should idea be presented? • What was the problem? • What is the new way? • What are the benefits? / savings? • What is needed to Implement Idea?	• Make recommendations • Use selling techniques • Be factual • Be brief • Give credit • Provide an implementation plan	• Develop a written proposal • Speculate on roadblocks to acceptance • Present VM study alternatives
Implementation	Implement Alternatives	• Who is to implement change? • How will plans / contract be amended? • Have all resources been allocated?	• Translate plan into action • Overcome problems • Expedite action • Monitor project	• Develop change document • Implement approved alternatives • Evaluate process
Audits	VM Effectiveness	• What were the outcome benefits? • What were the solution benefits • What were the cost savings?	• Evaluate against expectations • Evaluate functionality performance • Evaluate by cost savings	• Confirm operational functional • Confirm engineering functionality • Analyse cost benefits

The long term maintenance of structures (e.g. bridges) and civil works (e.g. drainage) are serious issues for the department. The design must incorporate good design practices that minimise the future maintenance requirements of the completed works together with detailing that prevents water running down the exposed faces of abutments and piers of bridges and the like.

There are three main stages in RM namely identification, assessment and treatment. In summary, the ten steps to develop a risk management plan are:

1. Make a commitment as an organisation, particularly at the executive level, to RM.
2. Identify all possible threats and risks.
3. Assess the likelihood and consequences of each risk.
4. Decide to accept or treat each risk.
5. Determine treatment options for all unacceptable risks.
6. Formalise the RM action plan.
7. Implement the treatment options.
8. Communicate information to everyone affected.
9. Review the RM action plan at appropriate points.
10. Identify any new risks and update your plan.

The RM process is outlined in the diagram below.

The prime test of good RM is whether the measures taken will protect achievement of goals within the accepted tolerance of risk. A secondary, but still important test is whether this is achieved in the most efficient (lowest cost) way. The risk management process is recorded in Form M4213 - Risk Management Record.

3.5 Quality Management

All designs are required to be delivered using a fully certified Quality System that complies with AS/NZS ISO 9001-2000. In most instances these requirements will be incorporated into normal business procedures. Quality design and design documentation is a requirement for all planning/design projects prepared for Main Roads. The specific requirements where records are required to be produced and made available all through the delivery process are:

- The name of the person responsible for supervision of drawing production, including the layout and suitability for its intended purpose,
- The name of the person responsible for checking the readibility, accuracy and suitability for construction purposes,
- The name of the primary designer,
- The name of the design verifyer (verification as per AS/NZS ISO 9001-2000), including records of this verification,
- The name of the design certifying person who supervised the design as required by the Professional Engineers Act 2002,
- Records of design interfaces being checked where different design disciplines are involved, especially where the design(s) are prepared by independent sub- consultants,
- Records of how any unusual features of design have been addressed.

Planning and design is a very complex process that requires skill, care and diligence to be exercised in the preparation of engineering drawings and specifications in accordance with the ethics of the Engineering Profession. It is very important for the consultant undertaking design services to:

- Conform with the provisions of the Contract Documents,
- Check relevant safety aspects of the design;
- Consider the relevant environmental issues in the design, including the long term impact of the constructed works on the environment;

- Consider the relevant economy of the design using a value management approach; and
- Review the design and design detailing for constructability appropriateness relevant to the construction site concerned.

Designs must fulfil the stated requirements of the brief and comply with the requirements of relevant Codes of Practice and Australian Standards. In addition, the design must comply with the requirements of the relevant Main Roads manuals and the Brief/ Operational performance Specification.

Aspects of design that do not comply with the requirements specified in the departments manuals of design must be submitted for specialist approval before being incorporated into the design.

The design control process requirements are specified in Chapter 6 - Design Management.

3.6 Project Management Methodology

General

All expenditure or organizational resources need to be formally controlled and documented. The first step in that process requires individuals and organizations to understand the customer's need, think about how it can be satisfied and justify why it should be satisfied by their organization. Developing a clear and common understanding of the problem is fundamental to achieving customer satisfaction.

Projects are undertaken in an environment of risk, because all factors that might impacts on the project are not generally known, resulting in a degree of uncertainty. Projects are divided into several project phases to provide better management control of project scope and cost. Collectively, the project phases are known as the project delivery life cycle.

Each phase is marked by the completion of one or more milestones and usually incorporates a review of project performance to date. The deliverables, and hence the phases, are part of a generally sequential logic designed to ensure proper definition, scope and cost control of the project.

The project phases adopted by Main Roads (including RoadTek) and Queensland Transport are:

- Concept
- Development
- Implementation
- Finalisation

Preconstruction activities are performed in the Concept and Development Phases only. However, the intent of the Finalisation phase is also applicable to the closeout of each of these two phases.

The methodology also requires project management activities and work management activities to be separated to ensure the project management actives are fully understood and implemented. History shows us that technical people have a very strong focus on work management as one would expect but this usually comes at the expense of project management. Figure 3.6 shows the project management activities and work management activities separated by phase steps.

The delivery processes for project management and work management activities are referenced by a 'P' and 'W' prefix respectively as shown in Figure 3.6.

Use of Project Proposal Templates

It is important to understand that road infrastructure projects range in complexity, size and cost with project risk ranging from low to high commensurate to the project complexity and/or available information. Because of this a series of project management templates have been developed to assist in the appropriate application of project management to road infrastructure projects, i.e. the intensity of application will be

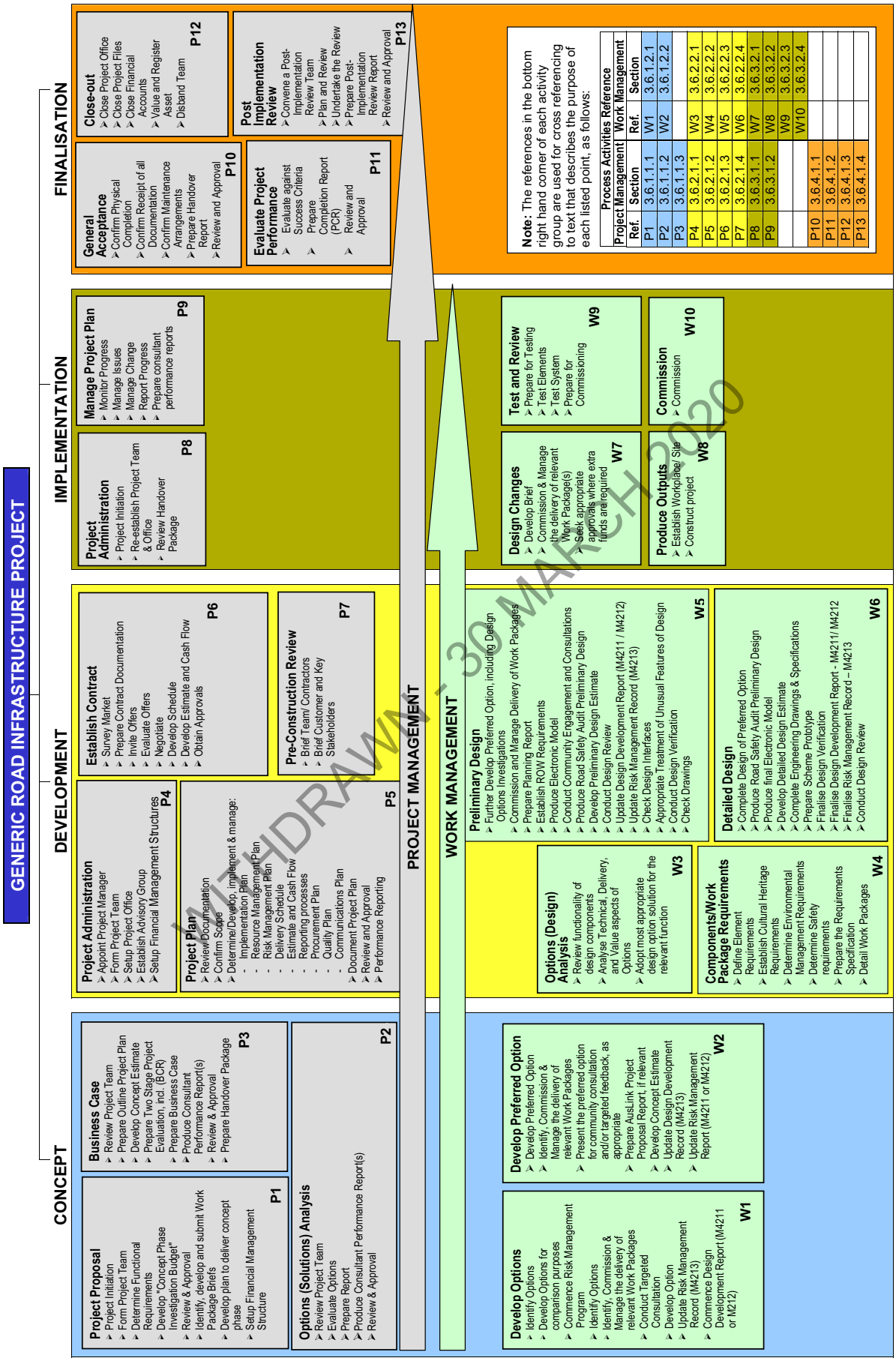


Figure 3.6 Generic Road Infrastructure Project - Activity Breakdown Structure

less for small low risk projects than large high risk projects.

The project management templates and their application sequencing for Type 1, 2 and 3 projects is shown in Figure 3.7 - Project Management Templates.

The project management Project Proposal template (Template R1001) has been developed as a mandatory requirement to initiate a project. Refer to Section 3.2.4 - Project Management Templates.

3.6.1 Concept Phase (Concept Planning and Project Scoping)

The concept phase is a three-step delivery process, which requires a sequential project build-up from network planning/ pre-project planning to a project budget and inclusion in the RIP. It is during this phase that the major decisions on the scope of the project are made and the greatest ability to influence the project outcomes exists.

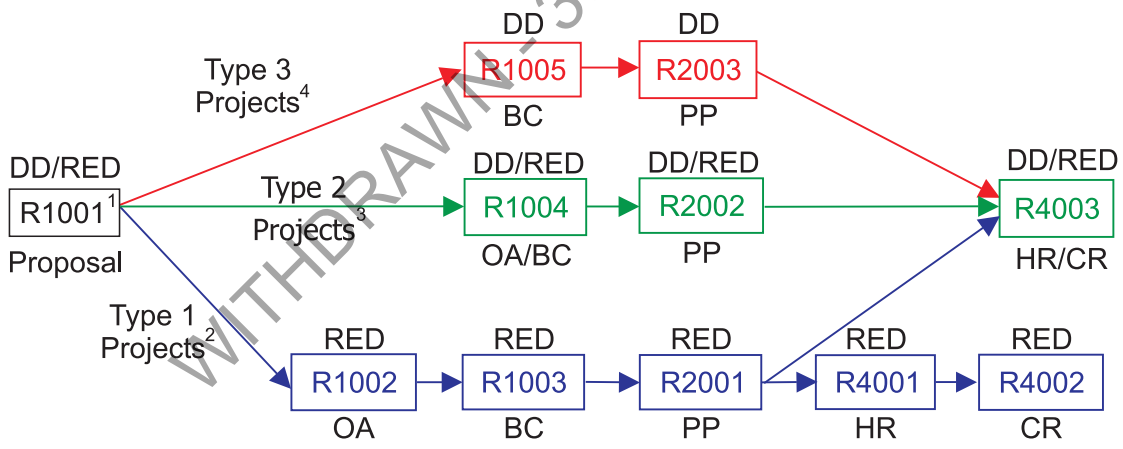
The three steps are:

- Project Proposal
- Options Analysis
- Business Case

3.6.1.1 Project Management

3.6.1.1.1 P1 - Project Proposal

The need for the project will be determined by its origin or initiating factors normally identified during the district road network management and road link strategy process. The network and link strategies in turn support the state network objectives and Integrated Regional Transport Plans (if available).



KEY Approved By
Template No.
Template Name
OA = Option Analysis
BC = Business Case
PP = Project Plan
RED = Regional Executive Director
DD = District Director
HR = Handover Report
CR = Completion Report

NOTES:

1. A common Project Proposal for all projects that will:
   - Articulate the specific problem to be addressed and establish project outcome requirements
   - Establish links to Main Roads strategic objectives
   - Develop a plan and budget for completion of the concept phase
   - Determine the type of project, based upon risk, complexity, significance, size, etc.
2. Type 1 Projects: - significant projects that are complex, high risk or expensive and thus require higher amounts of rigour and control.
3. Type 2 Projects: - relatively straight forward, low risk, projects for which a lesser amount of rigour and control is appropriate.
4. Type 3 Projects: - small, simple projects of low cost that progress quickly through the concept phase.

Figure 3.7 Project Management Templates

The project should be based on the higher order strategy documents, their identified future actions and desired outcomes. These actions may include regional development and employment objectives.

The need for a road construction project will also be balanced against other network priorities and fiscal allocations.

3

General

All expenditure of organisational resources needs to be formally controlled and documented. This activity, the first step in that process, requires individuals and organisations to understand the customer's need, think about how it can be satisfied and justify why it should be satisfied by their organisation. Understanding the problem is the key to the solution.

Scope

This activity covers the tasks required to initiate the project, understand and articulate the need, assess this against the organisation's business objectives and priorities, then develop a plan for conducting the options analysis and producing the business case.

Purpose

The project proposal step includes:

- Accept and initiate the project;
- Defining and understand the problem, including the current situation (Check that the road Functionality has not changed since original design);
- Identifying the operational performance outcome required to be achieved when solving the problem (See the Operational performance Specification);
- Defining the scope of the project deliverables and outcomes;
- Linking the project to the strategic business plans (e.g. confirming strategic fit)

  Project evaluation is carried out in the context of road network needs, government and local government priorities, political imperatives, industry requirements, local and other stakeholder requirements all within the framework of Main Roads strategic objectives;
- Preparing a budget (planning) to deliver the business case (based on information from pre-project activities, e.g., link studies, analysis of environmental constraints/opportunities based on Road Corridor Environmental Assessment data);
- Validating application of the Public Private Partnership (PPP) policy to the project.
- Provide a plan for the development the concept phase,
- Preparing a proposal report (all projects) by completing Template R1001 to:
  - Justify why the organisation should proceed with the project;
  - Secure funding for delivering the next stages (e.g. for the Options Analysis and the Business Case);
  - Seek approval to proceed to the next stage (i.e. the Options Analysis) with assignment of appropriate resources; and
  - Seek approval to proceed as a planning project on the RIP, if applicable.

Responsibility

The customer & sponsor have prime responsibility for initiating this activity. A project manager will be appointed and assume responsibility for management of the tasks.

Communication and consultation

It is important to adequately communicate and consult in the preparation of the proposal. Many customer needs are often not entirely unique and it may be possible to satisfy a number of customers under the one proposal. Alternatively a similar problem may already have been addressed which could eliminate or reduce the need for a new project. If the project is approved then the proposal sets the baseline from which scope can

be controlled and project performance measured. It is fundamentally important to actively communicate and consult widely with all key stakeholders in the preparation of the proposal. Both the sponsor and project manager must take an active role in this regard.

Tasks

1. Project Initiation

2. Prepare Proposal

3. Prepare Briefs for Work Packages

4. Review and Approval

A. Private Public Partnership (PPP) Consideration

For projects to which the PPP process is to be applied the Concept phase mirrors Stages 1, 2 and 3, the "feasibility" phase of the PPP Policy and VFM Framework (see www.sdi.qld.gov.au). There are a number of common activities in both with the PPP process relying heavily on the many investigations done in the Concept phase.

To aid in the validation that the PPP process should or should not be applied to a particular project the PPP Unit (SP&D) should notified prior to commencing this phase, even as early as network planning activities.

B. Project Initiation

Prior to commencing work on the project it is necessary to identify and appoint:

- The Project Manager (Concept)

This will clarify roles and responsibility of various parties and avoid disputes and misunderstandings.

The Concept Phase Project Manager is the person responsible for the management of all activity necessary to deliver the project proposal, options analysis and business case.

Objectives

The objectives of the project proposal are to:

- Accept and initiate the project;
- Understand and articulate the need;
- Conduct an initial stakeholder analysis and impact assessment;
- Outline the risks;
- Provide a plan for the conduct of the next (options analysis) stage of the project;
- Justify why the project should proceed; and
- Seek the release of the required resources.

Scope

The completed Template R1001 together with its attachments, e.g. operational performance specification, budget, risks, etc. assist in the decision of whether the proposed project is to be developed to a business case stage. This is because all project proposals need to be prioritised and approved as not all project proposals will get approval particularly if their priority is low.

Apart from the details provided from network planning details will not be known for all features of the project. The purpose of the options analysis is to identify the preferred solution and therefore the project proposal must avoid identifying the solution. To reasonably satisfy the question of whether the project should precede it will be necessary to provide detail commensurate with the level of risk.

Cost Estimates

A project proposal is about defining and understanding the problem and then identifying the operational performance outcomes and therefore it should be clearly understood that a project estimate is not possible at this stage. However, a budget does need to be established to undertake the planning activities as required by the options analysis and the business case. Pre-project activities will assist in the identification of required work packages to assist in the preparation of a planning budget.

C. Project Proposal Template

Below is a step-by-step description of the requirements and issues for each section in the Concept Project Proposal template.

Details of the project:

(i) ***District Name***

The name of the Main Roads District

(ii) ***Local Government name***

The name/s of the local government/s in which the project is located e.g. Banana Shire.

(iii) ***Road name***

The name of the road and if the name changes within the project area refer to both names and the road number e.g. Leichhardt Highway, 26A.

(iv) ***Road Section***

The section of the road between two known townships, urban areas or place names e.g. Westwood - Taroom.

(v) ***Project Number***

The number allocated to the project, normally associated with a shire / road / project, series of numbers e.g. Banana Shire / Leichhardt Highway / (specific link) … 8 / 26A / 305.

The shire number is constant within the shire and the road is a constant for the length of the road, however the project number will normally be associated with a link or intersection along the road.

(vi) ***Project location***

The place name or location descriptor e.g. Banana Floodway; or West of Ranch Road; or 94.7-101.4km from Block Creek

(vii) ***Project Name***

Some projects are large enough to warrant an individual name usually based on local names.

(viii) ***Executive Summary***

Summarises the key points of the proposal with a clear focus on describing the problem or opportunity, the scope boundaries, outlining the risks and provide a summary of the approach and resources required to the next stage.

Purpose of the Project Proposal Document

The purpose of the project proposal is to identify the need for the project, establish the expected operational performance outcome including potential benefits based upon the current state of knowledge and understanding.

Outline the processes to be used to develop the concept phase.

Ensure funding and senior management support for the concept phase development.

Establish link to the strategic/business plans. Project evaluation is carried out in the context of road network needs, government and local government priorities, political imperatives, industry requirements, local and other stakeholder requirements all within the framework of Main Roads strategic objectives.

The need for the project will be determined by its origin or initiating factors normally identified during the district road network management and road link strategy process. The network and link strategies in turn support the state network objectives and Integrated Regional Transport Plans (if available).

The project should be based on the higher order strategy documents, their identified future actions and desired outcomes. These actions may include regional development and employment objectives.

The need for a road construction project will also be balanced against other network priorities and fiscal allocations.

References

In the development of the Project Proposal there are many potential references most will usually relate to pre-project activities such as, Link

Studies, Regional Investment Strategies, Traffic Studies, etc.

Stakeholders

Understanding the current situation may provide an insight into the problems, needs and/or opportunities along with their associated impacts on internal and external stakeholders.

Identify stakeholders (internal and external) who may now or in the future have an interest in the proposed project, illustrating the consultation undertaken in the development of the proposal. Consultation with these stakeholders may impact on the project acceptance or influence the type of solution.

Notwithstanding a project technical justification or acceptable cost, if the community is not likely to support the proposal then delivery will be difficult. If community acceptance is not evident then consultation and project outcomes and outputs may need to be revisited.

Consultation should be carried out pursuant to the Departments 'Community Consultation Policy and Guideline'.

Project background

The project may be initiated for any number of reasons, however most will originate through the road network management process. Examples of initiators will be:

- State, Regional and National road network management needs.
- Integrated Regional Transport Planning (IRTP) outcomes and deliverables.
- Local government planning schemes and infrastructure agreements.
- Large private development, such as a shopping centre; new export opportunity, or mine.
- Public reaction to road traffic conditions.
- Safety.
- Road condition.
- Road traffic noise amelioration.

The proposal background may influence the type of solution and it is therefore important to understand the associated safety/ functionality/ road network/ previous maintenance history/ etc. Also update with any relevant information from the options analysis development.

Current situation

Understanding the current situation may provide an insight into the problems, needs and/or opportunities along with their associated impacts on internal and external stakeholders.

Purpose/Objectives of the Project

This is a brief description of what the project is aimed to achieve in terms of:

- What initiated the project?
- What are the desirable outcomes?

For example, the traffic volumes and number of accidents on a road warrant some action to improve levels of service; the solution however may or may not involve works within that corridor.

If a development project is initiated but not already addressed within the district strategies then the strategies will need to be revisited. For example, if a new primary industry required route upgrading and the project was initiated within the network planning context then the Link Strategy, Investment Strategy and Statements of Intent (if available) should be amended. The amendment must reflect if not the new intended use of the link and network, but the reprioritisation of funds and the potential delay to projects on the original program.

Outcome Scope of the Project (Operational performance Specification as an appendix to the project proposal)

To get the 'right' project and to reduce rework it is critical that the project scope be made as clear and unambiguous as possible. At the proposal stage the solution may not be defined and so the scope should be expressed in terms of:

- The need or problem to be solved
- The expected operational performance outcomes.

(i) ***In Scope Specification***

The purpose of a scope statement is to define the project boundaries to facilitate effective management of deliverables on time and to agreed/approved cost. Typically these could be:

- Improve flood immunity.
- Reduce traffic congestion on a nominated part of the road network.
- Improve the rideability of a nominated section of road.
- Improve trafficability during the wet season.

The scope outlined in any previous document should be confirmed here or updated as necessary.

(ii) ***Out of Scope Specification***

To clearly define the project scope it can be helpful to list works that will not be delivered as part of the project. This is important, as it will minimise the potential for rework or additional work and is a critical aspect in managing/avoiding project scope 'creep'.

Some out of scope items may well be deemed necessary but the work needs to be procured via other means and this interface needs to be well managed.

(iii) ***Related Projects***

Any related projects impacting on this project need to be identified, e.g. joining to a bridge under construction.

Impacts such as timing, availability of materials or workforce, may also pose significant risks to the project unless they are identified and managed in possibly a broader context.

(iv) **Constraints**

Restrictions that will limit the way the objective is to be achieved and includes anything that might impact on the successful development and/or implementation of the project e.g. restricted working hours or limited vegetation clearances, need to be identified.

(v) ***Urgency***

If there are any aspects of the project or the project itself that are urgent they should be identified stating reasons for such urgency and what action is required.

(vi) ***Assumptions***

It is very important for all assumptions made in producing this proposal be itemised and documented.

Assumptions can encompass resourcing, authorities' permits, weather and constructability.

Impacts

(i) ***Internal***

Describe when, where and how the project will impact on areas within Main Roads and include an outline of both positive and negative influences, e.g. better vehicle movements in and out of weigh in-motion sites, weigh in-motion site not considered during project development.

(ii) ***External***

Describe the impact that the project will have outside Main Roads and includes both positive and negative impacts on external stakeholders, e.g. rearranged traffic movements, improved traffic flow.

Method to Date

The steps taken so far in the development of this proposal consist of data and information gathering, targeted consultation, including the procurement of supporting work packages, as appropriate. 'Template R2002 - Project Plan' gives a listing of generic considerations that should be used as a check list to ensure all potential risks are addressed.

Risks/Issues

Risk is the chance of something happening that will have a detrimental impact upon the agency, project or other objectives. Risk events can be related to the project management process (e.g. fiscal, time or resources) or project planning activities (e.g. community pressure, cultural heritage or geological). It is extremely important that the identification process is thorough and includes both external issues and technical risks.

Findings

Outline the key findings, both financial and non-financial, that support the recommendation. At this stage a cost / benefit will not be have been accurately quantified. However, some indication of possible cost / benefit should be given to justify continuance of the project to the options analysis.

Recommendations

At this stage information should be sufficient to make a recommendation to proceed to options analysis and to include the project in the RIP as a planning project only. Where the project is a planning project it will require the establishment of a planning budget for RIP purposes. In the event where the proposal is not approved revisit the expected operational performance outcome and rework with a view to achieve approval of the proposal.

Plan to next Stage

A documented plan is required to guide both options analysis and business case development. It should facilitate communication among stakeholders, and to document approved scope, and identify the dates and milestones in the next two stages. Resources required to complete this work together with their cost must also be documented.

3.6.1.1.2 P2 - Options (Solutions) Analysis

General

The solution options analysis is to be conducted in accordance with the plan detailed in the approved proposal. The overall purpose of this options analysis activity is to select a preferred solution from the partially developed options that flow from the previous activity and document the entire options analysis process. Once the preferred option is agreed a business case is developed to justify the inclusion of the project in the corporate program of work. It is important that the 'do nothing' option is evaluated as part of this analysis to provide a baseline against which the costs and benefits can be assessed.

Scope

This activity covers the comparative evaluation of the option solutions identified in work management activity Develop options and the selection of the preferred option for further development under work management activity Develop preferred option. The scope includes the preparation, review and approval of the options analysis report.

Purpose

The Options Analysis step includes:

- Reviewing the project proposal and developing a clear understanding of the problem and the outcomes required by the customer (outcome specification);
- Identifying all plausible problem solution options (technical and non-technical) using a value management approach that will satisfy the specified requirement(s) (options could include alternative alignments, different layouts, coordination of traffic signals, or public transport schemes);
- Developing and assess solution options using a value management approach that assesses impacts, benefits and cost to a level of detail that enables a comparative evaluation to clearly determine the preferred option, including conducting Road Safety Audit (Feasibility) for each option, where relevant. (It is important that the 'do nothing' option is considered as part of this analysis to provide a baseline against which the costs and benefits can be measured);

- Ensuring project environmental sustainability through appropriate environmental assessment and management (refer to the Road Project Environmental Manual for guidance);
- Selecting the 'preferred solution' to satisfy the required operational performance outcome described in the project proposal, ensuring that it is within the defined outcome scope of the project;
- Defining the solution scope of the preferred option (refer Chapter 5); and
- Preparing the Options Analysis Report and completing Template R1002 for Type 1 Projects, Template R1004 for Type 2 Projects and Template R1005 for Type 3 Projects to:
  - Seek approval of the preferred option;
  - Seek approval to proceed to the next stage, i.e. the Business Case;
  - Confirm planning budget requirements;

The approved options analysis report authorises the project to move to the business case stage together with an approved preferred option.

The options analysis is to be conducted in accordance with the plan detailed in the approved proposal. The overall purpose of the options analysis activity is to select a preferred option from the partially developed options that flow from the previous activity and document the entire options analysis process. Once the preferred option is agreed a business case is developed to justify the inclusion of the project in RIP. It is important that the 'do nothing' option is evaluated as part of this analysis to provide a baseline against which the costs and benefits can be assessed.

The deliverable from this activity is the options analysis report.

Responsibility

The project manager is responsible for this activity. and will need to consult widely with stakeholders and with all appropriate technical and professional support either internal or external to the organisation.

Communication and consultation

Considerable communication and consultation between the customer, project team and the appropriate technical and professional staff in identifying and developing the options is required. The customer and other stakeholders must be actively involved in the option analysis process to generate a sense of participation in and ownership of the final solution. Independently selecting an option and imposing it upon the stakeholders will create resistance and lead to project failure.

Tasks

1. Comparative evaluation of options
2. Prepare options analysis
3. Review & approval

A. Private Public Partnership (PPP) Consideration

The work done here mirrors of the PPP process at Stage 2 "Preliminary Assessment' except that only a range of viable technical solutions are developed. The recommended option referenced below is one of the viable technical solutions that go into Stage 3 of the PPP process "Business Case Development'.

B. Options Analysis Process

The options analysis is to be conducted in accordance with the plan detailed in the approved proposal. The overall purpose of the options analysis activity is to select a preferred option from the partially developed options that flow from the previous activity and document the entire options analysis process. Once the preferred option is agreed a business case is developed to justify the inclusion of the project in RIP. It is important that the 'do nothing' option is evaluated as part of this analysis to provide a baseline against which the costs and benefits can be assessed.

The deliverable from this activity is the options analysis report.

Options Analysis Compilation Process Requirements/ Considerations

The requirements and considerations that the planners/ designer must take into account, assess and include as relevant in the compilation of the options analysis are:

Objectives

The objectives of this activity are to:

- Select the best solution for satisfying the need;
- Obtain agreement of the selected option; and
- Obtain approval to proceed with the development of the business case.

Scope of The Solution (Preferred Option)

The scope of this activity covers the comparative evaluation of the options, prepare options analysis and review and approve the deliverables identified in work management activities:

- Develop operational performance requirements;
- Identify Options; and
- Develop options

The use of Templates R1002 or R1004 or R1005 together with its attachments will assist in the decision on whether the project is to proceed to the business case.

Cost Estimates

Only comparative cost estimates are prepared as part of the options analysis development.

C. Options Analysis Template

Below is a step-by-step description of the requirements and issues for each section of the Concept Options Analysis template.

Review of Project Proposal

A review is required of the project proposal for all items up to and including Risks/Issues, i.e.

1. Introduction
2. Project Customer, Sponsor and Project Manager
3. Stakeholders
4. Background
5. Current Situation
6. Purpose/Objectives
7. Scope of Project
8. Impacts
9. Method to Date

'Template R2002 - Project Plan' gives a listing of generic considerations that should be used as a check list to ensure all potential risks are addressed.

Risks/Issues

The review should focus on what has changed since the preparation of the project proposal, including any issues that may have been overlooked at that time. Where a change has occurred up-date the relevant details and include in the options analysis template. Include any risks identified in 'Out of Scope' and 'Related Projects'. All risks should be recorded in Form M4213 - Risk Management Record.

D. Options Analysis Report

This section should explain in full all options identified in response to the proposal, including those not recommended.

Risks at this stage may not be fully understood however with the development of the preferred option they will progressively get sharper.

Each option should be analysed separately. The following subheadings should be used for evaluation of each option. The information should be presented in order of ranking. The same information should also be presented in serial format or in a table comparing each option. The basis for ranking options should be detailed in this section.

- Strategic Fit

- Feasibility
- Costs
- Benefits
- Option Specific Risks/Issues
- Impacts
- Timing
- Deliverables
- Others
- Assumptions
- Dependencies/Constraints

Recommended Option

This section should give the reasons why that option is recommended. Where an option involves a number of steps or actions, each should be detailed in the recommendation.

This section should also outline the costs incurred to date on previous stages of the project (i.e. for an Options Analysis, expenditure incurred for the preparation of the Project Proposal and for the Options Analysis and the resources required, cost, and time frame for the next deliverable (Business Case).

A recommendation could also include changing or redefining project scope.

Business Processes/Operational performance Requirements

Provide a summary of the Business Process changes and the Business Operational performance Requirements Specifications completed to this point. Also refer to the Business Process Analysis (BPA) and the Business Requirements Specification (BRS).

The operational performance requirements need to be clearly identified in terms of existing and desired conditions, e.g. existing capacity vs proposed capacity, existing safety record vs targeted safety proposal.

Plan to Next Stage

Describe the next step recommended in this Options analysis. Identify the key dates/ milestones in the next process (e.g. Business Case).

Also, describe the resources (specific item and names where available) and the associated costs to complete the next step (e.g. Business Case) and where/how funded. This does not include total project costs or benefits at this stage.

E. Use of Project Options Analysis Templates

It is important to understand that projects range in complexity, size and cost with project risk ranging from low to high commensurate to the project complexity. In the context of the requirements and considerations that need to be addressed project management project Options Analysis template (Template R1002 or R1004 or R1005) have been developed as a mandatory requirement to initiate a project. Refer to Section 3.2.4 Project Management Templates.

3.6.1.1.3 P3 - Business Case

General

This is the final activity in the concept phase. The sole purpose of the business case document is to present a case for including the project in the RIP. Main Roads have an array of potential projects competing for limited resources and will be endeavouring to put together a RIP that offers the greatest benefits in terms of value for money and advancing the organisation's strategic objectives and priorities. To support the organisation, it is critical that the business case presents a complete and unbiased justification of the project. Embellished, inflated or under resourced justifications could lead to significant departmental embarrassment and lost opportunities.

To facilitate the transition from the concept phase to the Development Phase, a handover package is required. This package is particularly important when a time delay or change in project manager may occur between phases.

Included with the business case is the preliminary project plan, this document is included to provide direction and control of project activities post project approval. The plan should also include provision for the orderly termination of the project if approval is not given.

Scope

This activity covers the tasks necessary to develop and present a justification for the project's continuation and the tasks necessary to prepare a plan to progress the project once the business case has been considered.

Purpose

The purpose of the Business Case is to:

- Review:
  - the proposal to develop a clear understanding of the customer's requirement (outcome specification);
  - the solution options analysis report to understand the reasons for selecting the preferred option (solution); and
  - the scope of the preferred option.
- Develop the preferred option as a documented single problem solution ensuring that it is within the scope of the project, including conducting Road Safety Audit (Feasibility). The business case will include appropriate investigations, consultations and development to establish the project cost to within ± 20% of final project cost);
- Ensure development of the preferred option achieves:
  - Environmental sustainability through appropriate environmental assessment and management (refer to the Road Project Environmental Manual for guidance).
  - Economic solution through good design practice.
  - Constructability practically and efficiency.
- Preparing the Business Case report and completing Template R1003 for Type 1 Projects , Template R1004 for Type 2 Projects and Template R1005 for Type 3 Projects to seek approval for:
  - Delivering the preferred solution option;
  - Delivering the construction budget;
  - Including the project on the RIP as a construction project; and
  - Proceeding to the next phase, i.e. the Development Phase.
- Develop the justification for including the project in the RIP.
- Put together a handover package to facilitate the transition to the next phase.
- Develop a draft project plan for directing and controlling project activities after the business case has been accepted.
- Develop a plan for the orderly termination of the project if the business case is not accepted.

Responsibility

The project manager is responsible for drafting and submitting the business case. The customer is responsible for timely approval.

Communication and consultation

It is important that the project manager maintains close communications with stakeholders. It is particularly important that all stakeholders are aware of the importance of an honest justification and provide the project manager with unbiased advice. The business case, if accepted, provides an important baseline in determining project scope. Effective communication at this stage will ensure that all stakeholders make a contribution to developing this important document and that, if accepted, the business case will produce outputs and outcomes that will satisfy the customer need.

Tasks

1. Prepare preliminary project plan
2. Prepare business case
3. Review and approval

4. Prepare handover package

A. Business Case Template

Below is a step-by-step description of the requirements and issues for each section of the Business Case template.

The paragraph number corresponds to the Templates R1003 and R1004.

3

Details of Business Case

A review of the options analysis is required of the project options analysis for all items up to and including - Risks/Issues, i.e.:

1. ***Introduction***
2. ***Project Customer, Sponsor and Project Manager***
3. ***Stakeholders***
4. ***Background***
5. ***Current Situation***
6. ***Purpose/Objectives***
7. ***Scope of Project***
8. ***Impacts***
9. ***Method to date***
10. ***Overall project risks/issues***

'Form M4211 or M4212 - Design Development Report' gives a listing of generic considerations that should be used as a check list to ensure all potential risks are addressed.

11. Options

Provide a summary of the options considered and why the recommended option was chosen. Where available, an executive summary of the options analysis paper should provide this information.

12. Options Analysis

Identify the risks associated with the project *development and implementation*. Document in the Risk Management Record (Form M4213). Include any risks identified in 'Out of Scope' and 'Related Projects'.

The process requires a sound understanding of the risks, including how they are mitigated during preparation of the Business Case.

13. Issues

Also, review what has changed since the preparation of the options analysis, including any issues that may have been overlooked at that time. Where a change has occurred up-date the relevant details and include in the business case template.

List all known issues to be resolved.

14. Business Processes/Operational performance Requirements

Confirm summary of the Business Process changes and the Business Operational performance Requirements Specifications completed to this point. Also refer to the Business Process Analysis (BPA) and the Business Requirements Specification (BRS).

The operational performance requirements need to be clearly identified in terms of existing and desired conditions, e.g. existing capacity vs proposed capacity, existing safety record vs targeted safety level.

15. Delivery Approach

Outline of steps to complete project (Development and Implementation Phases), i.e. the steps to be taken to implement the business case, including the procurement of supporting work packages, as appropriate:

- Detail the resources required to deliver the project;
- Detail any standards which are applicable;
- Describe how the project schedule (timeline) will be managed;
- Outline the consultation process to be used;
- Describe how project change will be managed;
- Describe how project issues will be managed;

- Described how project risks will be managed;
- Provide a high level schedule containing key activities and milestones (Refer Chart 1 in Chapter 2 for guidance); and
- Identify major items that need to be procured and any significant supply time delays that may be expected.

Also, review the proposed implementation method, e.g. Design and then construct, Design and construct.

16. Financial Issues

(i) Financial Costing Requirements

All projects must have a fully itemised cost of the project by phase step, as follows:

- Concept Phase for the preparation of:
  - the options analysis; and
  - the business case;
- Business Case for the preparation of:
  - the design development; and
  - the detailed design;

The acquisition cost of all work packages is to be included in the relevant phase step.

The expected year for programming of funds is included in the RIP.

(ii) Funding

Identify source, timing and cost distribution by financial year, as appropriate.

17. Project Performance Measurement

Detail how the performance of the project will be measured during the project's life. An example table format is shown below.

Success Criteria	Responsibility

18. Product Benefits Realisation

Include the actions that will ensure that the benefits are realised. Nominate the stages or decision points at which assessments should be made or corrective actions taken within the project.

Detail how the benefits of the project will be measured. This may or may not be during the life of the project. An example table format is shown below.

Success Criteria	Responsibility	Measurement method	KPI	Target

19. Recommendation

Provide a summary of reason why the project should proceed to the next stage and identify the impacts of not proceeding.

Justification for the project could be based on a combination of the following factors:

- Benefits to the business operations
- Strategic direction
- Cost/Benefit analysis
- Technology
- Legal Costs to the Project should be given.

Also include the costs incurred to date on previous phases of the project (i.e. for a Business Case, the expenditure incurred for the preparation of the Project Proposal, the Options Analysis and the Business Case) and the resources required, cost and time frame for the next deliverable (the project outcomes through to completion).

Note: A recommendation could also include changing or redefining project scope.

3.6.1.2 Work Management

General

To ensure stakeholder's needs and expectations from a project are delivered it is essential that proper management of project deliverables is performed.

The work management activities in the concept phase are:

- Develop options
- Develop preferred option

3.6.1.2.1 W1 - Develop Options

General

Having developed a plan, and gained approval for the conduct of an options analysis, the next step is to develop a clear and thorough understanding of the problem to be solved. Understanding the problem is the key to the solution. It is critically important to identify the stakeholders and obtain their assistance and involvement with identifying and developing the options.

A cost estimate is required for each option. Cost estimates at this stage are not estimates of the project cost and must not be released outside the project. The estimate is only developed to a level that enables a comparative evaluation of options to occur and an informed selection to be made.

Scope

The scope of this activity covers the work necessary to:

- Develop a clear understanding of the customer requirement.
- Identify all plausible options that could satisfy the requirement.
- Develop and cost those options to a level that enables a comparative evaluation to clearly determine the preferred option.

The level of detail required in this activity is governed by the requirement to clearly determine a preferred option.

Purpose

The purpose of this activity is to:

- Determine the operational performance requirements.
- Identify the options.
- Develop and cost the options.
- Present the options for comparative evaluation.

Responsibility

The project manager is responsible for the coordination of this task. External personnel may conduct the work elements.

Communication and consultation

Communication and consultation between the project manager and the work teams is critical in determining that all plausible options are identified and developed to a level of detail just sufficient to support their comparative evaluation. Effective communication and consultation with the customer and users is important to ensure that the solutions identified and developed will satisfy the customer's need.

Tasks

1. Develop operational performance requirements
2. Identify solution options
3. Develop options

A. Develop Operational Performance Requirements

Guidance

The operational performance specification/Brief details the requirements and specifications for all elements of the intended delivery process. Requirements should be reviewed for purpose, necessity, feasibility and tolerances.

Responsibility

The project manager, component managers and team leaders have responsibilities in accordance with the project plan.

References

Product development methodologies
Organisational procedures

B. Identify Solution Options

Identifying solution options is the first step in the design development process. It is a creative process of synthesising and implementing the knowledge and experience of humanity to enhance the welfare, health, and safety of all members of the community, with due regard to the environment in which they live and the sustainability of the resources employed. The planner/designer must display detailed technical and professional understanding and the wise application of that understanding in the identification of options that appropriately satisfy the problem or need being addressed. The identification of options must be within the context of the processes and technical requirements identified in Chapter 4 - Planning and Design Processes.

C. Develop Options

The development of solution options is a continuation of the identification process complying with the requirements of Chapter 4 that specifies the requirements and considerations for the design development process applicable to all of the technical options.

3.6.1.2.2 W2 - Develop Preferred Option

General

The development and definition of the preferred option that flows from the options analysis will not be sufficiently rigorous or reliable to support the definition of the business case. The scope, cost, quality and schedule information presented in the business case is used to select the organisation's program of work; it sets the initial baseline against which the project's performance will be assessed. This activity develops the preferred option information to a level that supports development of the business case.

Scope

The scope of this activity covers the work necessary to develop the preferred option to a level sufficient to support the submission of the business case. Cost estimates produced during this activity are likely to be made available to personnel external to the project and must therefore possess a commensurate confidence level, i.e. to within ± 20% of the total projecr cost.

Estimate accuracy is dependent upon:

- Correctly identifying all of the work items necessary to deliver the project
- Accurately calculating the work item quantities
- Appropriately assessing and applying Market Forces to the unit rate cost.

Purpose

The purpose of this activity is to conduct:

- Conduct an appropriately detailed scope definition.
- Provide a detailed list of assumption and constraints.
- Conduct an appropriately detailed risk analysis.
- Conduct an appropriately detailed stakeholder and impact analysis.
- Conduct a detailed business process analysis.

Responsibility

The project manager is responsible for the coordination of this task. External personnel may conduct the work elements.

Communication and consultation

Communication and consultation between the project manager and the work teams is critical in determining that the option is developed to a level

of detail just sufficient to support the submission of the business case. Effective communication and consultation with the customer and users is important to ensure that the solution described and justified in the business case is what is needed to satisfy the need.

Tasks

1. Develop Preferred Option

3

A. Develop Preferred Option

Developing the preferred option is a continuation of the design development process based on more information and data becoming available from various work packages. The extent of development is set by the requirement to achieve an estimated project cost within ± 20% of the total project cost.

3.6.2 Development Phase

The Development Phase is a two-stage process to suit RIP timing / alignment and Right-of-Way (ROW) acquisitions. These stages are:

- Preliminary Design; and
- Detailed Design.

This section provides a detailed description of the tasking to be undertaken during the Development Phase of the project lifecycle.

The Development Phase commences following the approval of the business case and the allocation of organisational resources. For some projects the approval of the business case and the allocation of resources occur simultaneously. For many projects however, the allocation of resources occurs as an independent process some time after the approval of the business case. It is not uncommon for there to be a time delay of many months or even years between the concept phase and the Development Phase.

Scope

The scope of the Development Phase includes the establishment of the project management organisational structure, project planning, solution design and contract formation. The major products in terms of project management are the project plan and arrangements for contracts.

Objective

The overall objective of the Development Phase is to set up the mechanisms for effective implementation and management of the project.

Key Activities

The Development Phase consists of the following key activities:

Project Management:

- Project Administration
- Manage Project Plan
- Establish Contract
- Pre-Construction Review

Work Management:

- Design Options Analysis
- Requirements Definition
- Preliminary Design
- Detailed Design

3.6.2.1 Project Management

3.6.2.1.1 P4 - Project Administration

Each project, regardless of size, requires the project team and its management structure to be formally established.

The scope of this activity covers all tasks associated with raising and establishing the project team and project office. The output from this activity is a formal project control structure.

The major objectives of this activity are to set in place the mechanisms and the people to facilitate project management, including:

- Appointing a project manager

- Setting up the project team structure
- Establishing the project office and control structure
- Establishing a Project Advisory Group
- Establish Financial Management Structure

This activity follows the approval of the business case. However, preliminary work, such as identification of skills and personnel, and the need for an advisory group, should be commenced in parallel with development of the business case and included in the draft project plan that accompanies the business case.

(a) Appoint Project Manager

Select the best person based on appropriate technical and management skills matching the complexity and size of the project.

(b) Establish Project Team

Select a project team that has technical and management skills matching the complexity and size of the project. It is essential for the project team to include representatives of the key technical disciplines. It is important for the Project Team to be established early in the process to ensure resources are available when required.

(c) Establish Project Office

If the project is to be managed from its own dedicated office rather than the normal workplace it's important for a suitable project office be established to conduct the project management affairs of the project. This could include provision for meetings, model and other graphic displays, and be suitably located for meeting attendees, site access and suitably equipped with appropriate office equipment.

(d) Project Advisory Committee

These roles and their relationship to the organisational management structure need to be determined for each project or type of project, taking into account its scale and nature. The interests of the various roles differ. If any one person is allocated more than one of these roles, then they will, at times, be placed in a position of attempting to satisfy competing interests.

These arrangements propose advisory committees rather than steering committees. This recognises that the State Purchasing Policy (SPP), and normal administrative arrangements require there to be one accountable officer. This officer may well seek advice from a group that is currently called a steering committee. However, such officer cannot justify arrangements outside the SPP simply because a committee voted for it. If the committee cannot authorise spending, it isn't steering, it is really advisory in nature. These roles relate to the project organisation model (see Figure 3.8 - Project Organisation Model Diagram).

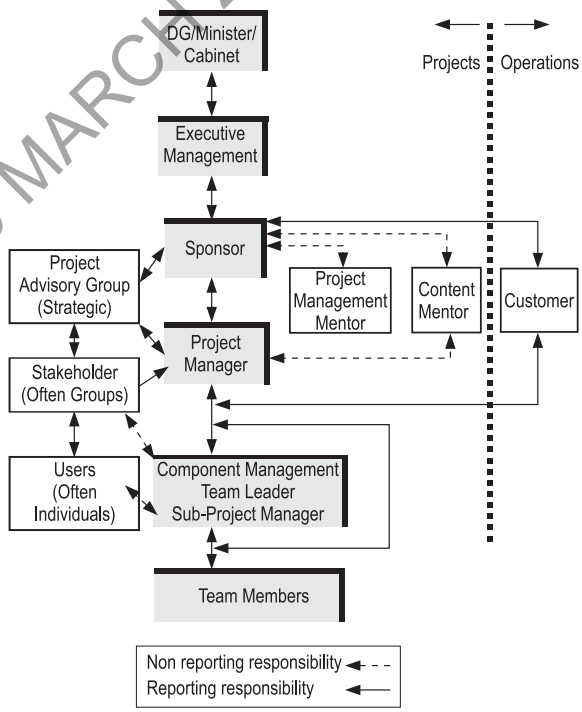


Figure 3.8 Project Organisation Model Diagram

Business support staff for major or significant projects may also be required.

The Role of this group may vary from project to project and this needs to be established at the first meeting. Typical responsibilities of the group are:

- Are good working relations being maintained?
- Are defined outcomes being achieved?

- Reviewing function
- Could perform the function of a peer review group
- Could be used as a 'sounding board'
- Internal Project Management review for PM/QA/supervisor/cost clerk/etc.
- External interfaces

3

(e) Establish Financial Management Structure

It is important for project cost to be tracked to permit proper monitoring of project expenditure for the various stages of the project, e.g. options analysis, business case, design development and detail design. The adoption of corporate cost codes must occur to provide uniformity across the department.

3.6.2.1.2 P5 - Project Plan

The project plan is the vehicle to guide the delivery of the Development Phase in two steps:

- Preliminary Design, and
- Detailed Design

The requirements of a project plan are:

(a) Review Current Documentation

The outputs from the concept phase (Business Case) and the supporting data/information and assumptions (e.g. traffic counts and analysis, link studies, surveys, etc.) are critical inputs to the Development Phase, Stage 1. It is very important to understand how the preferred option was arrived at as its acceptance is necessary before commencing the Development Phase (Stage 1).

Also, information from similar projects such as problems and adopted solutions could assist in minimising the risk to project outcomes.

(b) Confirm Scope Definition

The project definition delivered from the concept phase needs to be understood and confirmed as part of the project acceptance process.

The project scope may need to be further defined to ascertain if changes are required as a result of further information being obtained.

This is a critical requirement in the control of project 'creep' and 'over' design.

(c) Determine Implementation Strategy

Produce a Work Breakdown Structure (WBS) that identifies a logical sequence of activities to achieve the outcome, i.e. geotechnical investigation, survey, community consultation, environmental investigations, cultural heritage, traffic reports/data, hydraulic studies, risk identification and assessment, etc.

(d) Allocate Resources

Only human resources that are appropriately educated, experienced and relations oriented shall be appropriately assigned to perform the work. This is a critical aspect in the assignment of tasks.

Human resources need to be supported by appropriate site conditions and 'tools of trade', e.g. computers with the relevant software.

(e) Perform Detailed Risk Analysis

At this stage it is very important to identify all of the potential risks which might either stop the project progressing to construction or cause an expansion of scope during the delivery of the project. A risk analysis with appropriate allowance made in the project cost estimates is an important requirement in calculating a realistic project 'scope' estimate.

The risk identification checklist is a guide to assist in the process of identification and assessment, and the development of contingencies.

(f) Produce Draft Schedule

Extend the WBS to include task duration, cost and resource requirements together with task dependencies and hold points, e.g. a Gantt Chart or network diagram. The schedule provides the basis against which a projects performance is measured. Float should be built into the schedule to allow for contingencies and downtime.

Resource levelling may be required for major projects.

(g) Produce Budget Estimate

This is the approved budget in outturn dollars for the project. The project costs must not exceed the Project Budget. The Client approves the Project Budget at key stages throughout the Project Life cycle and this budget is normally based on the Project Estimate or Anticipated Final Cost submitted for consideration. The Project Budget may also include:

- The stage at which it was approved;
- A submission, review or approval date;
- A comment where applicable;
- Assumptions made; and
- A brief description of the scope of work.

A. Project Plan Template

Below is a step-by-step description of the requirements and issues for each section of the Project Plan template (R2001).

The front cover provides the Details of Proposed Project:

District: The District name

Local Government: The name/s of the local government/s in which the project is located e.g. Banana Shire.

Road Name: The name of the road and if the name changes within the project area refer to both names and the road number e.g. Leichhardt Highway, 26A.

Section: The section of the road between two known townships, urban areas or place names e.g. Westwood - Taroom.

Project Number: The number allocated to the project, normally associated with a shire/road/ project, series of numbers e.g. Banana Shine/ Leichardt Highway/(specific link) …..8/26A/305. The shire number is constant within the shire and the road is a constant for the length of the road, however the project number will normally be associated with a link or intersection along the road.

Project Location: The place name or location descriptor e.g. Banana Floodway; or West of Ranch Road; or 94.7-101.4km from Block Creek

Project Name: Some projects are large enough to warrant an individual name.

Executive Summary: Summarises the key points of the proposal with a clear focus on describing the problem or opportunity, the scope boundaries, outlining the risks and provide a summary of the approach and resources required to the next stage.

(a) Introduction

(i) Purpose of this Document

The purpose of the project plan is to detail how the project will be managed and to provide a baseline for the measurement of progress.

(ii) References

List any documents to which this document refers and could include reports on any previous investigations carried out. Include all previous documents prepared as part of this project.

(b) Project Customer, Sponsor and Project Manager

Enter the name of the project customer together with the name of the project sponsor and the project manager on the front cover of the project plan.

(c) Stakeholders

Understanding the current situation may provide an insight into the problems, needs and/or opportunities along with their associated impacts on internal and external stakeholders.

Review previously identified stakeholders and update as appropriate (internal and external) who may now or in the future have an interest in the proposed project, illustrating the consultation undertaken in the development of the proposal.

Consultation with these stakeholders may impact on the project getting up or influence the type of solution.

Illustrate the consultation undertaken with stakeholders in developing this document and the key findings of that consultation. List all stakeholders with an interest in this document including internal and external stakeholders.

3

Consultation should be carried out pursuant to the Department's 'Community Consultation Policy and Guideline'.

The stakeholders are:

Stakeholder Area	Stakeholder Representative	Responsibility	Interest/ Context

(d) Background

Provide a brief history to bring the reader up to date on the subject matter and associated business issues.

This section should describe the history of the project. It should include details of:

- Who initiated the project and how it was initiated.
- Describe the products and/or services.
- Describe any other initiatives carried out previously to address related issues.

(e) Current Situation

Describe the current situation and the problems, needs and/or opportunities along with their associated impacts on internal and external stakeholders.

(f) Purpose/Objectives

(i) The Purpose

Provide a statement of what the project is expected to achieve including potential benefits based upon the current state of knowledge and understanding.

For example, the traffic volumes and number of accidents on a road warrant some action to improve levels of service; the solution however may or may not involve works within that corridor.

(ii) Links with the Department's Strategic Objectives

The proposal background may influence the type of solution and it is therefore important to understand the associated safety/ functionality/ road network/ previous maintenance history/ etc. Also update with any relevant information from the options analysis development.

The need for the project will be determined by its origin or initiating factors normally identified during the district road network management and road link strategy process. The network and link strategies in turn support the state network objectives and Integrated Regional Transport Plans (if available).

The project should be based on the higher order strategy documents, their identified future actions and desired outcomes. These actions may include regional development and employment objectives. Establish and document link to the strategic/business plans.

The need for a road construction project will also be balanced against other network priorities and fiscal allocations.

If any project is initiated but not already addressed within the district strategies then the strategies will need to be revisited. For example, if a new primary industry required route upgrading and the project was initiated within the network planning context then the Link Strategy, Investment Strategy and Statements of Intent (if available) should be amended to reflect if not the new intended use of the link and network, but the

reprioritisation of funds and the potential delay to projects on the original program.

Project evaluation is carried out in the context of road network needs, government and local government priorities, political imperatives, industry requirements, local and other stakeholder requirements all within the framework of Main Roads strategic objectives.

(g) Scope of Project

To get the 'right' solution and to reduce rework it is critical that the project scope be made as clear and unambiguous as possible.

(i) In Scope

The purpose of a scope statement is to define the project boundaries to facilitate effective management of deliverables on time and to agreed/approved cost. The operational performance outcome is arrived at by the analysis of operational performance outcome options. Typically these could be:

- Improve flood immunity.
- Reduce traffic congestion on a nominated part of the road network.
- Improve the rideability of a nominated section of road.
- Improve trafficability during the wet season.

The scope outlined in any previous document should be confirmed here or updated as necessary. All items included in the scope of this project should be itemized and documented.

(ii) Out of Scope

To clearly define the project scope it can be helpful to list works that will not be delivered as part of the project. This is important, as it will minimise the potential for rework and misunderstanding and it is a critical aspect in managing/avoiding project scope 'creep'.

Some out of scope items may well be deemed necessary but the work needs to be procured via other means and this interface needs to be well managed and documented.

(iii) Related Projects

Any related projects or proposals impacting on this project needs to be identified together wit its relationship to this project, e.g. joining to a bridge under construction.

Impacts such as timing, availability of materials or workforce, may also pose significant risks to the project unless they are identified and managed in possibly a broader context.

(iv) Constraints

Restrictions that will limit the way the objective is to be achieved and includes anything that might impact on the successful development and/or implementation of the project e.g. restricted working hours or limited vegetation clearances etc., should be identified early in the process.

(v) Urgency

If there are any aspects of the project or the project itself that are urgent they should be identified stating reasons for such urgency and what action is required.

(vi) Assumptions

It is very important for all assumptions made in producing this proposal be itemised and documented.

Assumptions can encompass resourcing, authorities permits, weather and constructability.

(h) Impacts

Identify areas of potential impact, the nature of impact and who will be impacted (internal and external). Include both the impacts envisaged during the life of the project (i.e. costs, disruptions to traffic, temporary local traffic arrangements, etc.) and ongoing impacts resulting from the project's implementation, e.g. traffic noise, heavy loads, etc.

(i) Internal

Describe when, where and how the project will impact on areas within Main Roads and include an outline of both positive and negative influences, e.g. better vehicle movements in and

out of weigh in-motion sites, weigh in-motion site not considered during project development.

(ii) External

Describe the impact that the project will have outside Main Roads and includes both positive and negative impacts on external stakeholders, e.g. rearranged traffic movements, improved traffic flow.

(i) Method to Date

The steps taken so far in the development of this proposal consist of data and information gathering, targeted consultation, including the procurement of supporting work packages, as appropriate. 'Template R2002 - Project Development Details' gives a listing of generic considerations that should be used as a check list to ensure all potential risks are addressed.

(j) Business Processes / Operational performance Requirements

Provide a summary of the business process changes and the Business Requirements Specifications.

(a) Business processes needing addressing:

- does the recommended option require the district to modify any of its existing business procedures?
- Are the existing district processes and procedures for managing projects adequate for this project?
- Are any special requirements required for the management or implementation of this option?

(b) Operational performance requirements documentation:

- Existing and desired conditions.

(k) Broad Strategy

During development of the business case and preliminary plan, a broad strategy for producing project outputs and outcomes should have been documented. This step now requires refinement of the strategy to produce a Work Breakdown Structure that identifies a logical sequence of activities required to achieve the project objectives.

Activities to cover include:

1. Investigation.
2. Design.
3. Preparation.
4. Procurement
5. Building.
6. Testing.
7. Implementation.
8. Review.

Break the project down into phases, activities and tasks. As more information becomes available and uncertainties are reduced, further work breakdown can occur.

(i) Project Control

Project control is the coordination of planning, organising, monitoring and controlling of all aspects of a project in a continuous process to achieve its objectives, both internal and external. It is a discipline requiring the application of skills, tools and techniques and the balancing of competing demands of product or service specification, time and cost, within prescribed constraints.

(ii) Integration

Describe how the various elements and their impacts on each other will be controlled to achieve successful project outcomes. In particular review impacts on scope, time, cost and quality.

(iii) Scope Management

Describe how changes to scope will be managed (including software tools to be used, paper system, etc, as relevant).

(iv) Time Management

Describe how changes to time and resources will be managed (including software tools to be used,

paper system, etc, as relevant). Refer to attached project schedule breaking the project into activities (Work Breakdown Structures) displaying start, finish, internal resources, external resources and major milestones.

(v) Cost Management

Describe how changes to cost will be managed (including software tools to be used, paper system, etc, as relevant). Refer to attached budget estimate breaking the project into activities (Work Breakdown Structures) displaying the estimated cost for internal resources and external resources.

(vi) Quality Management

Describe what quality systems are being used to manage the project. If the standard corporate systems are being used, document any changes or modifications specific to the project. This could include quality plans, project specific work instructions, safety or environmental management.

Quality requirements are expressed in the expected project outcomes, the brief from the concept phase, relevant standards, manuals and references, quality assurance systems (ISO 9000) and human resource selection.

Project review requirements are specified in the project plan. The types of reviews that should be performed are:

- Reviews by the project team
- Peer reviews by experts external to the project team
- Value management reviews

A final review must be performed for all projects and in addition any learnings for use in future projects should be documented and circulated.

All design activities are to undertaken in accordance with the requirements of a fully certified Quality Assurance System.

Also, allowing appropriate time to deliver the project together with appropriate remuneration are critical success factors. Quality can also be confirmed by the verification of design, customer approvals, etc.

(vii) Human Resources Management

Describe the approach to be taken with the deployment of internal and external resources. Provide a project team organization structure and describe roles and responsibilities.

Provide details of any project specific training required.

Refer to a responsibility matrix, if required.

(viii) Communication Management

Describe the approach to be taken with the deployment of internal and external resources. Provide a project team organization structure and describe roles and responsibilities.

Provide details of any project specific training required.

Refer to a responsibility matrix, if required.

All projects will require regular meetings to address:

- Relations issues
- Progress issues
- Expected project outcomes
- Technical issues

All meetings shall have approved documented minutes circulated to an approved distribution list.

All requests, submissions and approvals shall be in writing.

For major projects a communications management plan is essential.

(a) Internal Communication

Detail the project reports to be produced. Identify who will produce them, who will receive them and what action is required from the receiver.

(b) External Communication

Describe the communication processes for all internal parties including Executive Management, Advisory Group Members, Stakeholders, Sponsor, Director, team members, and users. Refer to a detailed communication plan, if required.

3

(ix) Risk and Issues

(a) Risk

Describe how the project will manage risks (including software tools to be used). Refer to the Risk Management Record (Form M4213) showing identified risks, severity, likelihood and mitigation actions. A listing of typical risks encountered on civil engineering projects is included in the Risk Record for user guidance purposes only.

Risk is the chance of something happening that will have a detrimental impact upon the agency, project or other objectives. Risk events can be related to the project management process (e.g. fiscal, time or resources) or project planning activities (e.g. community pressure, cultural heritage or geological).

(b) Issues

Describe how the project will manage issues (including software tools to be used). Refer to an attached listing of issues.

A risk or opportunity will become an issue if the event occurs.

Issues can be resolved either within the scope of the project as currently defined or via a change to the project.

(x) Procurement Management

Identify how external goods and services will be procured, e.g. by sole invitation, RCC, D&C, Alliance, etc. This includes contract/subcontract management, ROW acquisitions, material procurement, contract administration.

The timing of going to tender needs to be reviewed against the schedule.

In all cases procurements must use standard Main Roads procurement methods, including procurement management practices.

(xi) Environmental Management

Describe the approach to be taken with the deployment of internal and external resources. Provide a project team organization structure and describe roles and responsibilities.

Provide details of any project specific training required.

Refer to a responsibility matrix, if required.

(xii) Cultural Heritage Management

Describe the approach to be taken with the deployment of internal and external resources. Provide a project team organisation structure and describe roles and responsibilities.

Provide details of any project specific training required. Refer to a responsibility matrix, if required.

(xiii) Safety

Describe the approach to be taken with the deployment of internal and external resources. Provide a project team organisation structure and describe roles and responsibilities.

Provide details of any project specific training required. Refer to a responsibility matrix, if required.

(xiv) Operational Issues

Identify any known operational issues. This could include asset transfer/ownership, commissioning, handover support, maintenance, warranty.

Relations management is an integral part of establishing and maintaining good operations

All projects will require regular meetings to address:

- Relations issues
- Progress issues
- Expected project outcomes

- Technical issues

All meetings shall have approved documented minutes circulated to an approved distribution list.

All requests, submissions and approvals shall be in writing.

For major projects a communications management plan is essential.

(xv) Project Performance Measurement

Detail how the performance of the project will be measured during the project's life. An example table format shown below is acceptable.

Success Criteria	Responsibility	Measurement method	KPI	Target

(xvi) Project Benefits Realisation

Detail how the benefits of the project will be measured. This may or may not be during the life of the project. An example table format is shown below.

Success Criteria	Responsibility	Measurement method	KPI	Target

3.6.2.1.3 P6 - Establish Contract

(a) Review Project Acquisition Strategy

The acquisition strategy (in-house, outsourced, partially outsourced, prequalified suppliers etc) should have been identified in the Business Case. The strategy adopted should be reviewed against the criteria of providing efficiency and value for money. Confirmation from higher management may also be appropriate.

Consultation with industry associations is DMR policy. All districts should discuss proposed methods of delivery with industry associations during the decision making process.

(b) Undertake Market Survey

Main Roads uses a prequalification system to obtain the best value for money but with minimal overall cost to government and industry.

- Preconstruction

Generally, Main Roads uses a Prequalification System for the engagement of consultants on engineering projects. These engagements are private selections on rotation from the prequalification system. An agreed and documented brief is a mandated outcome of this process. This system is administered by the RS&E group.

For other acquisitions, e.g. geotechnical, environment, community consultation, land surveys (terrain, features), etc. the Main Roads uses standard procurement system is used "Manual for the engagement and use of consultants". E.g. how tenders are to be called for the type of contract selected, eligible tenderers, tender analysis & selection.

- Construction

Generally, eligibility of organisations to tender for open Main Roads Major Works Projects is determined by the Major Works Prequalification System. This system is administered by the RS&E group.

The Main Roads Project Delivery System manual documents the various delivery options available for construction works. E.g. how tenders are to be called for the type of contract selected, eligible tenderers, tender analysis & selection.

(c) Formalise Agreements

Where project development is to be undertaken internally, formal agreement to proceed is given by management in the form of signatures on the relevant internal documents. This task also includes formal commitment of resources within

your organisation, as indicated in the Project Plan and relevant supporting plans.

If the project is to be covered by a formal contract, that is, when implementation is to be undertaken by external contractors, Local Governments or internal commercial units, ensure that all proposed contractual arrangements have been agreed and all required signatures obtained.

(d) Initiate Supplier Selection Process

Suppliers need a clear understanding of the requirements and contractual conditions set by the organisation. This task is necessary to ensure that appropriate documentation is developed to enable suppliers to provide detailed proposals for meeting the requirements.

A detailed brief should be developed where required and should include such requirements as:

- The Solution Specification (The brief)
- Standards to be adopted.
- A list of deliverables

(e) Conduct Evaluation

All responses need to be evaluated to determine which supplier best meets the requirements of the brief/tender. This task is essential to maintaining public accountability.

(f) Conduct Contract Negotiations

All proposed amendments, concessions, waivers, and standards need to be negotiated and agreed by both parties to remove ambiguities and uncertainties from contractual document. Just as the organisation has gone through the process of reviewing contractual issues and preparing for negotiations, so too has the potential contractor. Now is the time for all issues and differences to be resolved in order to minimise risks associated with the contract.

3.6.2.1.4 P7 - Pre-Construction Review

(a) Submit Project Plan for Approval

Management needs to be satisfied that an appropriate plan has been established for efficient conduct of the project through the lifecycle. Approval of the Project Plan will provide the basis for approval to proceed to project implementation. Approval of the plan will also signify agreement by key stakeholders with respect to their commitments to the project in terms of provision of resources and support.

The Project Plan should be submitted to the Advisory Group or the delegated approving authority for consideration. The approving authority will view the plan to confirm consistency with management policies and procedures, and to ensure that all probable issues have been identified.

(b) Setup Financial Management

Prior to committing RIP funds, it is essential that appropriate measures are established to enable management of project funds. The Organisation's financial management procedures will need to be followed.

(c) Brief Project Team

This is probably the first opportunity that the Project Manager has to address the team as a team. It is therefore an important basis for building a team identity. It is essential that each member of the team understands the scope and objectives of the project in outline, and is aware of project constraints. Only on this basis will there be informed review by the team of their individual roles, Terms of Reference and assignment briefs. This will enable any remaining errors to be identified. It is also important that team members understand where they fit in the project and how they can contribute to the success of the project and benefits to the organisation.

Ensure that all team members are fully conversant with all standards and procedures relating to technical deliverables, project requirements and quality management, and to the administration of the project.

(d) Brief Customer and Key Stakeholders

The Project Manager should conduct a meeting with the customer. The members of the project advisory and management teams, and contractors, should also be invited to attend this meeting. Items for the agenda will include:

- Relations management.
- Project Plan.
- Contracts.
- Project Budgets.
- Administrative Procedures.

This meeting should identify any remaining anomalies which can be corrected prior to moving to the Implementation Phase. Meeting Minutes are to be recorded and distributed to all stakeholders.

A project plan detailing the project execution and project control shall be produced and include documented planning assumptions and decisions. It must also facilitate communication among stakeholders and document approved scope, cost, and scheduled baselines. The extent of the detail included in the project plan must be relevant to the project size and complexity.

3.6.2.2 Work Management

3.6.2.2.1 W3 - Options (Design) Analysis

Review Business Case

The Business Case and supporting documentation will provide a wealth of information relating to the current system and the user requirement. It is essential that this documentation be reviewed as it has a client focus and should emphasise the functionality (what the solution is to do). The Project Manager must develop and maintain a comprehensive understanding of the actual requirements in respect of a product, service or combination of both. The Business Case provides the baseline definition for the development of a solution. Clearly defined and agreed requirements are also necessary for development of an unambiguous Scope Definition.

In some instances the customer, internal or external, may be uncertain as to the actual requirement. This might also be evident from the options analysis undertaken to raise the Business Case. The documentation of the technical understanding of the requirement and the validation of this understanding with the customer through negotiation can provide an effective means of focusing attention on areas of misunderstanding or uncertainty.

In reviewing the Business Case, the Project Manager should address the following:

- The customer's problems (real or perceived) as these must be solved in any solution that is offered.
- The operational performance requirements.
- The size and location of the project.
- Timing of the requirement.
- Constraints that may apply to the project, such as cost or related activities.
- Justification for proceeding.

Conduct Design Options Analysis

In conducting options analysis, the following guidelines need to be observed:

a) Technical Viability

Need to:

- Confirm the functionality of the option.
- Ensure all technical standards have been met.
- Determine the best design option for meeting the outcome requirements.

b) Resource Viability

Ensure the right mix of management and technical skills for analysis of each option.

Implementation agencies have been consulted to determine:

- Any specific lead-times for studies, investigations, consultation, inputs from other government departments, industry and local government, etc.
- Any constraints that may apply to the timing of specific support to deliver the above.
- Specific needs of other parties in respect of the format and type of data provided.

c) Cost Benefit

Initially, only broad estimates for cost might be available; notwithstanding, all cost elements need to be considered (e.g.: capital, training, documentation, management, maintenance and whole of life costs, etc).

Similarly all benefits, including those that cannot be given a dollar value, are determined, based on available information.

The cost or benefit to the organisation is determined in accordance with current financial management policies (Net Present Value, Internal Rate of Return, Payback Period, etc).

d) Safety

Check that the option complies with documented safety standards. An options safety audit is a required output from this process. The option should also be tested to determine its compatibility to adjacent sections.

e) Risk

Risk is to be determined with respect to such issues as cultural and organisational aspects, technology, finance, schedule and scope.

For projects that are large or complex, by nature of the customer's requirement or the combination of services and products being proposed, it may be necessary to conduct a formal briefing of the implementation agencies/divisions. This will ensure a common understanding of the requirement and hence technical, resource and financial implications.

It is important that any constraints that may apply to the delivery of the project to the customer be fully documented at this time and as necessary detailed in the tender or documentation.

Define High Level Statement of Works

The preferred solution needs to be defined in terms of the work required to implement the solution. This may include a summary of the work supported by drawings, aerial photographs, etc.

3.6.2.2.2 W4 - Components/Work Package Requirements

Define Sub-Solution Requirements

Estimating requirements on the total solution is a difficult task. The solution must be broken down to components against which specific requirements can be allocated, e.g Pavement design, drainage systems, traffic signals, etc. This process will also assist in determining process flows and interface requirements. Breakdown (the big lumps already identified) into work packages using functionality as a guide. Each functional (discipline/major task) area satisfies an allocated portion of the basic solution functions.

For each sub-solution defined, requirements are allocated in terms of:

- Outputs and technical requirements.
- Design constraints.
- Interface requirements.
- Availability.
- Maintainability.

Establish Cultural Heritage Requirements

For certain projects cultural heritage can have a significant impact in developing the solution requirements and producing the solution design. It is important that any cultural heritage issues are identified in the planning processes and the appropriate requirements developed and incorporated.

Determine Environmental Management Requirements

For certain projects environmental issues can have a significant impact in developing the solution requirements and producing the solution design. It is important that any environmental management issues are identified in the planning processes and the appropriate requirements developed and incorporated. Prepare an environmental management plan in accordance with departmental policy documents.

Safety Requirements

For certain projects safety issues can have a significant impact in developing the solution requirements and producing the solution design. It is important that any safety management issues are identified in the planning processes and the appropriate requirements developed and incorporated.

Prepare Solution Requirements Specification

A detailed design brief is prepared in accordance with the standard format defined in our policies and procedures. The document is an aggregation of the sub-solution requirements developed during the previous task. When completed the following checklist needs to be applied to confirm conformance with expected outcome of preferred option:

- Confirmation of the requirement (is the requirement necessary?).
- Confirmation that the requirement is not over-specified (limiting solutions, leading to potentially higher costs).
- Confirmation that compliance with the requirement can be tested and verified.
- Assurance that adequate margins and tolerances have been identified.
- Ambiguity checks.
- Confirmation that standards have been tailored sufficiently.

For projects involving business process changes a Business Requirements Specification is used to record and obtain agreement on the new or changed business requirements resulting from the project. The Business Requirements Specification addresses not only the "what" but the "how" of the project's implementation. Although specifically tailored to business process projects the Business Requirements Specification has broader application and should be considered by all projects.

A ***Business Requirements Specification*** template is provided for this purpose.

Define Detailed Statement of Works

The detailed design brief is reviewed to determine the tasks required to complete the design. The individual tasks are then sorted into the detailed work packages required to complete the final solution.

Solution Design

This is the last of a series of three activities in the Development Phase that takes the preferred option and develops and refines it to a state suitable to commence the implementation phase. Having defined the operational performance requirements for the solution in the previous two activities this activity now finalises the solution design. This is the final opportunity for the customer to influence the design before contracts are formed for its supply.

The scope of this activity covers the tasks associated with and preparing the final solution design.

The deliverable from this activity is an agreed solution design.

The objectives of this activity are to:

- confirm the understanding of the customer's requirement
- identify current or previous projects that can assist the design process
- conduct a market review to establish what the market can provide

- design the solution in sufficient detail to support the procurement plan
- obtain customer agreement to the design

Communication between the design agency, project manager and customer is critically important during this activity. This is the final opportunity for the customer to ensure that the project staff understands their need and how the solution is to be employed. Understanding the requirement is the key to the solution.

Joint Scope Definition

In formal consultation with the client, review the project documentation developed to date, including:

- Needs Analysis.
- Options Analysis.
- Requirements Definition.
- Business Case.
- Recommended Solution Requirements Specification (completed form including attachments approved by the relevant position).
- The Project Plan.

The purpose is to confirm the understanding of the customer's requirement and how the solution will be operated and supported. The customer is briefed on the implementation strategy, method of procurement, and solution design and their agreement obtained.

Review Technical Precedents

Existing design solutions can provide a useful starting point for defining a new or improved system. This task will minimise the possibility of duplication of effort and outcomes.

Review the corporate repository for information on recent projects, including variations which might be similar to the current requirement. Determine if any of the elements or components of the system being reviewed could be used as part of the solution or as the basis for developing the new solution requirements.

Identify Departmental Standard Solutions

Development effort is both time consuming and expensive. Existing departmental standards such as Standard drawings, standard specifications, contract provisions, and standard systems should be adopted, where relevant. Use of non standard solutions requires approval from the client.

Prepare Design

Drawings, electronic design models, specifications, contract provisions, design estimate, and electronic schedules are completed in accordance with the solution specification. Design is undertaken in accordance with Departmental Policies, Processes and Technical Manuals.

Submit to Customer for Review

The client must be satisfied that the Solution Requirements Specification and the Solution Design, are appropriate, comprehensive, complete, and reflects the stated and agreed need, and that the specification/design is in accordance with the agreed project scope.

The Solution Requirements Specification/Design is reviewed with the client, or client representatives, usually as a formal Solution Design Review, to confirm that all needs have been met. It is also appropriate to indicate to the client where opportunities exist for alternative solutions and cost savings. This process should happen throughout the development of the design and the client should take a lead role by progressively approving the design as it evolves. This process is best undertaken in a face-to-face meeting to minimise the probability of omission or misunderstanding of the requirement. Once the specification/design is complete, the client should sign-off to this effect.

External Communications

a) Scope:

The scope of this task is the actions necessary for generating support for the project from external stakeholders and other interested parties.

b) Objective:

The objective of this task is to increase awareness, encourage acceptance and to develop support for the project.

c) Deliverable:

The deliverable from this task is an external communications plan that specifies all the communication activities covering stakeholder consultation and community relations on the project in sufficient detail to enable successful completion and implementation of the project.

External Stakeholder Consultation

It is important to consult with affected stakeholders external to the project team to ensure that the project reasonably accommodates the needs of affected stakeholders and that project development is not adversely affected by external issues. Successful project outcomes often rely on the cooperation of external parties. This is achieved by the use of a Communications Plan.

Key elements of the Plan are:

- Identifying the stakeholders, including LG, other Government Departments, Business Groups and relevant community groups.
- Developing the methods for dealing with the community and industry groups
- Preparing display materials
- Selecting appropriate personnel in order to explain effectively the project details, including technical details such as assumptions, reasons for aspects of the design solution, etc.
- Seeking support from other agencies / individuals

Community Relations

Develop the requirements for an implementation community relations plan.

Key Steps:

1. Identify external parties requiring information
2. Develop community relations strategies/actions
3. What & How

These requirements will assist the contractor in preparation of an acceptable Community Liaison Plan as per Clause 13 of the Supplementary Conditions of Contract (Form C6838) of Road Construction Contract (RCC).

- Design Development Requirements/ Considerations

Design Inputs

Generally speaking design considerations are contained in Form M4211 or M4212 - Design Development Report. These considerations are identified through Legislation, Investigations, Studies and Consultations. They also identify risks and issues that need to be addressed during the development of the project.

Also refer to Chapter 4.

NB For some projects these considerations may need to be known for the development of options and for the development of the preferred option.

3.6.2.2.3 W5 - Preliminary Design

Design development is an iterative process that often involves changes when output from a particular step indicates the need to revisit an earlier decision (e.g. in the investigation and design activities, any of the listed items can provide outputs which indicate that a review of options or a previous decision is warranted).

The Development Phase Manager is the person responsible for the management of all activity necessary to deliver the preliminary design, and the detailed design. The first task of the project manager is to preview the preliminary Project Plan and update as appropriate. The project plan is used as the control mechanism for the delivery of the Development Phase. Selecting an appropriate team to deliver the Development Phase is a critical success factor in the achievement of a successful project.

The Preliminary Design stage develops the preferred problem solution (approved in the

business case), keeping within the scope of the project. For a road infrastructure solution activities include:

- Finalising the geometric design solution produced in the business case, e.g. horizontal and vertical alignments, cross sections, and major intersection layouts, including conducting Road Safety Audit (Preliminary Design);
- Conducting design options analysis for major design solutions, e.g. a bridge vs. a large culvert;
- Designing major components (e.g. pavement details, bridges, retaining walls, storm water drainage systems);
- Preparing electronic models;
- Preparing the Preliminary Estimate; and
- Determining ROW requirements (e.g. resumption drawings, lease requirements, native title arrangements).
- Ensure project environmental sustainability through appropriate environmental assessment (refer to the Road Project Environmental Manual for guidance).
- Ensure the design is an economic solution.
- Ensure that functionality of design components are appropriate for their intended purpose
- Ensure the constructability of the project is practical and efficient.
- Confirm the project cost is within the limits of the business case cost estimate. This is very important as ROW acquisitions may be held up due to project re-justification requirements if the project cost has increased during the preliminary design step.

3.6.2.2.4 W6 - Detailed Design

The Detailed Design step finalises the design by:

- Completing details of all components (geometry, bridges, road furniture, etc), including conducting Road Safety Audit (Detailed Design);
- Designing routine cross drainage together with associated environmental treatments;
- Designing other miscellaneous items (e.g. gully pits);
- Project environmental certification (refer to Road Project Environmental Manual for guidance).
- Documenting the design (Scheme Prototype), and
- Establishment of the construction contract.

The detailed design step produces engineering drawings and an electronic model for construction purposes. It also delivers final project schedules and estimates and all other construction contract documentation relevant to the type of contract proposed.

ROW acquisitions occur during the preparation of the detailed design. This is necessary to ensure the project may be constructed during the RIP timeframe.

3.6.3 Implementation Phase

The Implementation phase is used for constructing the works. This section describes the activities & tasks required in the implementation phase.

This phase covers the activities necessary to produce, test and commission project deliverables in accordance with the project plan. The scope may also include the decommissioning of any existing or legacy systems and the migration to the new system if included in as part of the project.

The purpose of this phase is to ensure that:

- project implementation occurs in accordance with the project plan
- project progress is monitored and tracked against the planned schedule

- unacceptable variance is identified early and action taken to bring the project back on track
- the products and deliverables are produced to the required standard and specification
- the product or service is commissioned and brought into operation

Major activities are:

Project Management: -

- Project Administration
- Manage project plan

Work Management :-

- Design Changes
- Produce outputs
- Test and Review
- Commission

Responsibility

The customer, sponsor & project manager have responsibilities in this phase.

3.6.3.1 Project Management

General

The discipline of planning, organizing, monitoring, and controlling all aspects of a project in a continuous process to achieve its objective, both internal and external.

3.6.3.1.1 P8 - Project Administration

Each project, regardless of size, requires the project team and its management structure to be formally established. Where all phases are delivered by the same project manager and project team the requirements of this activity are usually a continuation from the previous phase. Where this is not the case the project administration activity will need to be reestablished.

The scope of this activity covers all tasks associated with raising and establishing the project team and project office. The output from this activity is a formal project control structure. The major objectives of this activity are to set in place or confirm the mechanisms and the people to facilitate project management.

Tasks

1. Project initiation

2. Establish project team and office

3. Review handover package

A. Project Initiation

Prior to commencing work on this phase of the project it is necessary to identify and appoint/ confirm the Project Manager and project team.

This will clarify roles and responsibility of various parties and avoid disputes and misunderstandings.

The Implementation Phase Project Manager is the person responsible for the management of all activity necessary to monitor and control the construction process.

Objectives

The objective of the implementation phase is to:

- Accept and initiate the project;
- Understand the need and how the contract documents require this need to be satisfied;
- Understand requirements and conduct impact assessment in relation to:
  - The stakeholders
  - The environment, and
  - Any other project specific issues
- Outline the risks;
- Seek the release of the required resources.

Scope

To ensure the administration requirements are established and set-up to facilitate contraction

administration and to support the project superintendent, e.g. project office, project files, payment process, etc.

B. Establish Project Team and Office

Establish Project Team

Select a project team that has appropriate management skills matching the complexity and size of the project. It is essential for the project team to include representatives of the key technical disciplines to ensure the intent of the design is not compromised. It is important for the Project Team to be established early in the process to ensure resources are available when required.

Establish Project Office

If the project is to be managed from its own dedicated office rather than the normal workplace it's important for a suitable project office be established to conduct the project management affairs of the project. This could include provision for meetings, model and other graphic displays, and be suitably located for meeting attendees, site access and suitably equipped with appropriate office equipment.

C. Review handover package

The project manager and superintendent must review the contract documents and the project proposal to develop a clear and common understanding of the need for the project together with the required outcomes. It is most important that the intent of the design is not compromised in any way. This is the fundamental basis for the accepted price.

This review is an essential requirement if the project manager is to guide the project through to a successful conclusion.

3.6.3.1.2 P9 - Manage Project Plan

General

Activities and tasks are conducted in accordance with the project plan. The project manager monitors the project's progress against the schedule and plans to ensure activities remain on track. In an ideal world the activities will occur as planned and the project manager will have little to do. In reality risks eventuate and issues arise that threaten the project's success. The project manager must address those issues and guide the project through to a successful conclusion. This management work may involve supervision of internal & outsourced or contracted resources and may involve developing and administering various forms of contract.

Scope

This activity covers all tasks associated with implementing the plan, tracking progress, managing issues and controlling change. This activity produces several outputs:

- Regular project update reports
- Updated issues, risk and learnings registers
- Approved change requests
- Records of meetings

Purpose

The purpose of this activity is to:

- Control the project so it is completed on time and within budget:
- Control changes
- Manage risk and issues
- Keep stakeholders informed
- Capture learnings

Responsibility

The project manager is responsible for this activity.

Communication and consultation

It is important that the project manager maintains effective communication to enable the early identification of problems. Early identification will enable remedial action to be taken before the problems develop into issues.

Tasks

1. Monitor progress

2. Manage issues

3. Manage change

4. Report progress

3.6.3.2 Work management

General

The management of project deliverables, eg options, in order to meet stakeholders needs and expectations from a project.

3.6.3.2.1 W7 - Design Changes

General

This is an activity of the implementation phase that is only used when there is an approved change to the design. This could be a result of any number of issues such as unexpected:

- ground conditions,
- location of public utility services,
- error in original design,
- etc.

Scope

This activity covers the work required to provide a new or modified design to suit the current circumstances.

Purpose

The purpose of this activity is to ensure that the design meets the new requirements of the site and the actual design function to allow the construction to continue without comprising the required outcomes.

Responsibility

The project manager and customer are jointly responsible for this activity.

Communication and consultation

The project manager should consult with the sponsor and customer to determine how the activity will be conducted and exploited.

Tasks

1. Redesign required aspects of the works

3.6.3.2.2 W8 - Produce Outputs

General

This activity is the "do it" activity. Whatever output the project was raised to produce is produced here. The work may be carried out in-house or produced externally under contract.

Scope

This activity covers all tasks necessary to produce the project deliverables.

Purpose

The purpose of this activity is to produce the required project outputs.

Responsibility

The project manager, component managers and team leaders are responsible for this task as per the responsibility assignment matrix in the project plan.

Communication and consultation

Close communication and consultation between the various production agencies and project team during production will assist in keeping progress on track and help identify problems early.

Tasks

1. Establish workplace/ site

2. Deliver project outputs

3.6.3.2.3 W9 - Test and Review

General

Testing is an essential element of quality control. It ensures that you get what you asked and paid for. The solution design specification should contain acceptance criteria for all the works, whether delivered internally by component project managers or by external contractors.

A testing regime should be developed covering all items in the design specification.

Scope

This activity covers the tasks associated with testing components, products and services to ensure they meet the required specifications.

Purpose

The purpose of this activity is to:

- Confirm the acceptance testing criteria.
- Ensure that all deliverables are tested prior to acceptance and commissioning.
- Ensure products comply with defined requirements and specifications.

Responsibility

Individual testing tasks will be assigned in the project plan Responsibility assignment matrix.

Communication and consultation

Communication between the production teams, test agencies and project office will speed up the test and evaluation process.

Tasks

1. Prepare for testing

2. Test elements

3. Test system

4. Prepare for commissioning

3.6.3.2.4 W10 - Commission

General

This is the final activity of the implementation phase and transitions the product/solution from development and production to operational service.

Scope

This activity covers the work required to confirm that the product/service functions as intended and can be accepted onto the organisation's asset register.

Purpose

The purpose of this activity is to ensure that the final product/service is ready to be placed into operation, producing the intended benefit.

Responsibility

The project manager and customer are jointly responsible for this activity.

Communication and consultation

The transition of the product/service to operational use is a key milestone and offers good community relations and marketing opportunities. The project manager should consult with the sponsor and customer to determine how the activity will be conducted and exploited.

Tasks

1. Commission

3.6.4 Finalisation

3.6.4.1 Project Management

General

The discipline of planning, organizing, monitoring, and controlling all aspects of a project in a continuous process to achieve its objective, both internal and external.

The project management activities in the finalisation phase are:

- General Acceptance
- Evaluate Project Performance
- Close-out
- Post Implementation Review

3.6.4.1.1 P10 - General Acceptance

This activity signifies the formal completion of the project manager's obligations to the customer. Once the product or system has been delivered to, and accepted by, the customer, the project manager responsibility to the customer ceases.

Scope

This activity covers the tasks required to hand the project over to the customer, and to ensure ongoing maintenance/support arrangements are in place.

A handover report is signed that transitions control of the product from the project office to the customer.

Purpose

The purpose of this activity is to ensure customer satisfaction with and acceptance of the project deliverables and handover package, including the handover report.

Responsibility

The project manager and customer are responsible for this activity.

Communication and consultation

Communication and consultation between the stakeholders is important to ensure that all of the customer's requirements and concerns are identified and addressed. This is the last practical opportunity for the customer to voice their views.

Tasks

1. Confirm physical completion

2. Confirm receipt of all documentation

3. Confirm maintenance arrangements

4. Prepare handover report

5. Review & approval

A. Confirm physical completion

Guidance

The purpose of this activity is to prove to the customer's satisfaction that all deliverables agreed to as part of the project have been delivered in accordance with the approved plan. This activity is usually conducted as a formal meeting between the project manager, the customer and major stakeholders.

The project manager needs to demonstrate that the delivered product(s)/services(s) are completed to the required standard, documented, ready for immediate use, operating properly and to the customer's satisfaction.

Responsibility

The project manager and customer are responsible for this activity.

References

- Project plan

- Contract documentation

- Proposal and business case

B. Confirm receipt of all documentation

Guidance

The following documentation, as appropriate, needs to be assembled, ready for handover to operations and asset management:

- As constructed plans
- Operations manuals
- Guarantees and warranties
- Training packages

- List of outstanding defects

Responsibility

The project manager and customer are responsible for this task.

References

- Project plan

- Contract documentation

C. Confirm maintenance arrangements

Guidance

The project manager should confirm that responsibilities and procedures for ongoing maintenance are established and that the terms and conditions of maintenance agreements and contracts are documented, understood and agreed.

Plans should be in place to handle any remaining defects, or defects that may arise during the initial operating period.

Responsibility

The project manager and customer are responsible for this task.

References

- Project plan

- Contract documentation

D. Prepare handover report

Guidance

Prepare a handover report that identifies all variations to the original contract and seeks acknowledgment from the customer that:

- All deliverables have been delivered.
- All training has been completed.
- The product/service has been fully tested and operates to specification.
- All appropriate documentation has been provided.
- The service support arrangements are in place.

Responsibility

The project manager is responsible for this task.

References

- Project plan

- Contract documentation

E. Review and approval

Guidance

The handover report needs to be reviewed by the sponsor prior to presentation to the customer for signature. Presentation to the customer usually occurs at a formal meeting. In preparing for the meeting the project manager should:

- Provide early warning to the customer of the intention to commence preparation of the handover report.
- Schedule a meeting with the client to review and agree the handover report;
- Provide a copy of the handover report to the client a reasonable time ahead of the meeting.
- At the meeting, be prepared to discuss any issues that may have influenced the client's satisfaction with the way the project was delivered, and which may impact on acceptance of the products and services.

Responsibility

The project manager, sponsor and customer have responsibility for this task.

References

- Handover report

- Project plan

- Contract documentation

- Proposal

- Business case

3.6.4.1.2 P11 - Evaluate Project Performance

General

The project manager's direct responsibility to the customer ended with the sign off of the handover report however the project manager still bears considerable responsibility to the sponsor and the delivery organisation. Of particular importance is this review and evaluation activity which seeks to evaluate the project performance in terms of the success criteria and key performance indicators established in the concept phase. In addition the review seeks to identify changes to organisational processes and procedures that should be fed back into the strategic, business and project planning processes to improve organisational performance.

Scope

This activity covers the actions necessary to review and evaluate the project's performance and produce a project completion report.

Purpose

The purpose of this activity is to:

- Identify and document how the project performed in terms of the success criteria and key performance indicators established in the concept phase.
- Evaluate the organisational processes and procedures used throughout the project, identify where problems occurred, and recommend improvements.
- Identify and explain any variance between the initial baseline plan, contract and schedule and their final versions.
- Assess how well the individual management plans performed (risk, safety environment, etc) and identify procedural modifications that would improve their performance.
- Document the evaluation in a project completion report.

Responsibility

The project manager is responsible for this activity.

Communication and consultation

Communication and consultation with all stakeholders is important to obtain a fair and honest appraisal of the project's performance. It may be appropriate to use a method of communication that protects the identity of people to help elicit useful criticism.

Tasks

1. Evaluate against success criteria

2. Prepare Completion Report (CR)

3. Review & approval

A. Evaluate against success criteria

Guidance

Project success criteria specified in the business case should be reviewed. This task reviews the project's actual performance against those measures to determine project success. Performance should be reviewed against both initial and final baselines. Any variance between the initial versions and final versions of the schedule, plan and contract need to be identified and justified. The review seeks to identify changes to organisational processes and procedures that should be fed back into the strategic, business and project planning processes to improve organisational performance.

This task also includes, in effect, an audit to ensure that all project finalisation activities have been completed. Final costs are determined and compared with the various estimates produced throughout the project lifecycle to determine how well the estimation process performed.

Responsibility

The project manager has responsibility for this task.

References

- Handover report
- Project plan
- Contract documentation
- Proposal
- Business case

3

B. Prepare Completion Report (CR)

Guidance

The project completion report documents the complete project's performance and provides a succinct history of changes to the originally justified proposal. The report further documents lessons learnt for use by subsequent projects. These lessons should be fed back into the organisations strategic, business and project planning processes to ensure mistakes are not repeated and provide the opportunity for things that worked well to be repeated in subsequent projects.

This report includes the results of the previous steps evaluation of project performance against the pre-determined success criteria. It also evaluates project governance arrangements.

The project completion report template appears under the templates tab.

Responsibility

The project manager is responsible for this task.

References

- Handover report
- Project plan
- Contract documentation
- Proposal
- Business case

C. Review and approval

Guidance

The completed project completion report should be circulated to all relevant stakeholders for review prior to submission to the sponsor for approval.

On completion, the signed project completion report is stored in a way that makes it accessible to other project managers as required.

Responsibility

The project manager is responsible for coordinating the review. The sponsor is responsible for a timely consideration and approval of the report.

References

- Project completion report
- Handover report
- Project plan
- Contract documentation
- Business case

3.6.4.1.3 P12 - Close-out

General

This activity closes down the project office and disbands the project team. It is critically important that this activity is thought through and conducted thoroughly. The project team must maintain their vigilance to ensure that all the work is completed in a timely and efficient manner. There is a significant risk that motivation and the level of effort put into the project can drop off considerably after the product or service has been handed over to the customer and some team members start looking toward the next project. This activity involves the handling and disposal of assets and finances and must be conducted in accordance with the appropriate organisational instructions, regulations and legislation. The data and information generated under the project is a very valuable corporate asset and must be sorted,

indexed and stored appropriately. It is particularly important to provide appropriate reward and recognition for the efforts of project staff. The project manager must provide adequate references for staff members and assist with their placement in new positions.

Scope

This activity covers the tasks associated with closing down the project office including administrative and financial closure and the disbandment of the project team.

Purpose

The purpose of this activity is to ensure that:

- All stakeholders are informed of the imminent project closure.
- All project office assets are appropriately disposed of
- Project ledger accounts are closed off.
- Project information is stored and archived appropriately.
- All applicable financial and administrative legislation, regulations and instructions are complied with.
- All project staff are debriefed and assistance provided for subsequent placement.

Responsibility

The project manager is responsible for coordinating this activity.

Communication and consultation

Communication and consultation with organisational administrative, financial and human resource staff is essential to ensure that the necessary requirements and regulations are met. It is important that all stakeholders are informed of the intention to close the project office to allow them to raise any issues that still remain.

Tasks

1. Close project office

2. Close project files

3. Close financial accounts

4. Value and register asset

5. Disband team

A. Close project office

Guidance

If the project team has been working from a project office, this office needs to be closed or the space reallocated. This may involve ending leases, removing furniture and equipment, disconnecting power or removing site offices.

Responsibility

The project manager is responsible for this task.

B. Close project files

Guidance

In addition to all of the key project documents produced during the course of the project, substantial amounts of paper and electronic correspondence will have been received and generated which constitute a valuable corporate asset and form an important historical and auditable trail for the project.

It is of vital importance that this information is sorted, indexed and stored in an appropriate manner in accordance with applicable legislation, regulations and instructions. Much of this wealth of information will be of great use for future projects and needs to be readily available to staff within the organisation. It may be necessary to place appropriate controls over sensitive, commercial or personal information to prevent inappropriate access.

Arrangements need to be made for storing/ archiving both paper and computer files.

Responsibility

The project manager is responsible for this task.

References

- Applicable administrative regulations and

- Procedures

- Project plan

3

C. Close financial accounts

Guidance

Project cost centres/internal orders need to be closed and paper financial records appropriately stored/archived. Assets, both office assets and project deliverables need to be returned to their owner. Records of all disposals need to be kept and any proceeds credited to the project ledger. Any remaining lease, rent or hire agreements must be terminated.

Responsibility

The project manager is responsible for this task.

References

- Applicable financial management procedures

- Project plan

D. Value and register asset

Guidance

Any new assets need to be recorded and valued in such a way that makes subsequent revaluation/depreciation possible.

Responsibility

The project manager and customer are responsible for this activity.

References

- Organisational asset valuation guidelines

E. Disband team

Guidance

Endings can be difficult. Appropriate community recognition and reward should be given for the efforts of the team. It is also important for the team to maintain their vigilance to ensure that all work is conducted and standards of work don't fall away while looking for other work. It is generally beneficial to have a wrap up function/wake.

Project team members will posses vital information on the project that needs to be captured and recorded as part of the project record. Feedback should be sought from them. Final performance reviews should be carried out, and any certification of experience for professional bodies/qualifications should be completed.The project manager should assist project staff with placements after project closure.

Responsibility

The project manager is responsible for this task.

References

- Organisational human resource management procedures

- Project plan

3.6.4.1.4 P13 - Post Implementation Review

General

The Post Implementation Review (PIR) is an activity conducted after the project has been closed down and the project's product or service has been in operation for some time. The activity is not strictly a project activity as the project no longer exists. It is more an organisational activity designed to evaluate the outcomes generated by the project in relation to the original need and identify lessons for improving organisational processes and procedures.

Not all projects require a formal post implementation review; the sponsor must exercise judgement in selecting which projects to review. The conduct of the review should be considered as

a project in its own right and planned and managed accordingly. In many cases the personnel conducting the review will not be from the original project team staff who will have since moved on.

Scope

The scope of this activity covers all tasks associated with the post implementation review from the raising of the implementation team through to the approval of the review report

The deliverable from this activity is a post implementation review report.

Purpose

The purpose of this activity is to:

- Raise a review team and conduct the review.
- Identify the outcomes and benefits generated by the project.
- Determine the final cost of the project.
- Evaluate the outcomes in terms of the original need.
- Identify lessons learnt in terms of organisational processes and procedures.
- Document the review.

Responsibility

The project manager, sponsor and customer are responsible for this activity.

Communication and consultation

The post implementation review is a project in its own right and requires the level of communication and consultation necessary to raise any project. Stakeholders must be identified and their views and concerns canvassed. Considerable communication between the implementation team and the sponsor is necessary to understand the requirement and plan the review. Where possible the review team should consult with the original project team to gain a greater understanding of the original project.

Tasks

1. Convene post implementation review team

2. Plan the review

3. Undertake the review

4. Prepare post implementation review report

5. Review & approval

A. Review and approval

Guidance

The post implementation review report needs to be circulated to stakeholders for review prior to submission to the sponsor for approval.

Responsibility

The project manager is responsible for coordinating the review and submission of the report. The sponsor is responsible for a timely consideration and approval.

References

- Post implementation review report.

References

Road Planning and Design Manual
Queensland Department of Main Roads

Road Policy Manual
Queensland Department of Main Roads

Project Cost Estimating Manual
Queensland Department of Main Roads

Project Estimating
Road Transport Authority of New South Wales

A Guide to the Project Management Body of Knowledge
Australian Institute of Project Management

Project Management Manual
Queensland Department of Main Roads

Value Engineering
United States Department of Transportation (Federal Highway Administration - Infrastructure)

4

Chapter 4

Design Development Process

Manual Contents

Table of Contents

Chapter 4 Amendments - June 2005

Revision Register

Issue/ Rev No.	Reference Section	Description of Revision	Authorised by	Date
1		First Release	D. Hicks/ R.Guppy	Mar 2003
2		General updates following feedback	D. Hicks	Jan 2004
3	Chapter 4 - Planning and Design Processes	Totally new Chapter 4 - Planning & Design Processes, following the incorporation of the original chapter 4 - The Concept Phase into the new Chapter 3.	D. Hicks	Feb 2005
4		First Edition Release	D. Hicks	June 2005

Chapter 4
Design Development Process

4.1 Concept Planning and Design Environment

4.1.1 General

The framework for planning and design in Main Roads is described in Chapter 1. This framework provides the basis of the environment within which planning and design is undertaken.

In the first instance, planning and design has to be in harmony with the strategic directions of the Department and the obligations of the Chief Executive described in the relevant Acts. These are described in Chapter1 and are manifested in the Road Network Strategy, the Investment Strategies and the Roads Implementation Program. This manual is intended to provide the detailed knowledge required to implement the requirements of these over-arching documents.

4.1.2 Overall Process

The overall planning and delivery process is illustrated in Figure 4.1, which shows the relationship between the various steps in that process. This Chapter discusses the pre-project process from early planning of the project to its inclusion on the RIP. This Chapter deals with the Road Planning Process. Each succeeding phase relies on the results of its predecessor and must apply those results to retain the integrity of the process.

Figure 4.1 shows the desirable flow of activities throughout the process but at any given time, all activities may be in some stage of review. Further, the boundaries between the phases of the project are not precise and activities may fall on one side or other of these boundaries depending on the particular elements of the project.

Manuals covering Environmental Management, Noise Management, Landscape Design, Pavement Design, Drainage Design and Structural Design are separate publications and these have been referred to as necessary throughout.

Where approvals will be required from other government departments or agencies (e.g. Department of Natural Resources and Mines, Wet Tropics), they should be approached early in the process to avoid rework and disharmony as the project developed.

Figure 4.1 shows the desirable flow of activities throughout the process but at any given time, all activities may be in some stage of review. Further, the boundaries between the phases of the project are not precise and activities may fall on one side or other of these boundaries depending on the particular elements of the project.

Scoping (including the road planning process) represents the first step in the project planning process and occurs within the context of the overarching strategies described in Chapter 1. Figure 4.2 illustrates a typical approach to the road planning process and shows how the various elements interact to produce the planning report on which the future decisions will be made. The elements of this process are discussed in detail in following sections.

It is essential that the cost of projects be kept under strict control throughout the process. The Project Cost Estimating Manual provides guidance on the management and control of projects and should be consulted to help plan a project. These project management procedures should be introduced at the earliest phases of the project because:

- the decisions made in the early stages of a project have the biggest impact on the success or failure of the project; and

4

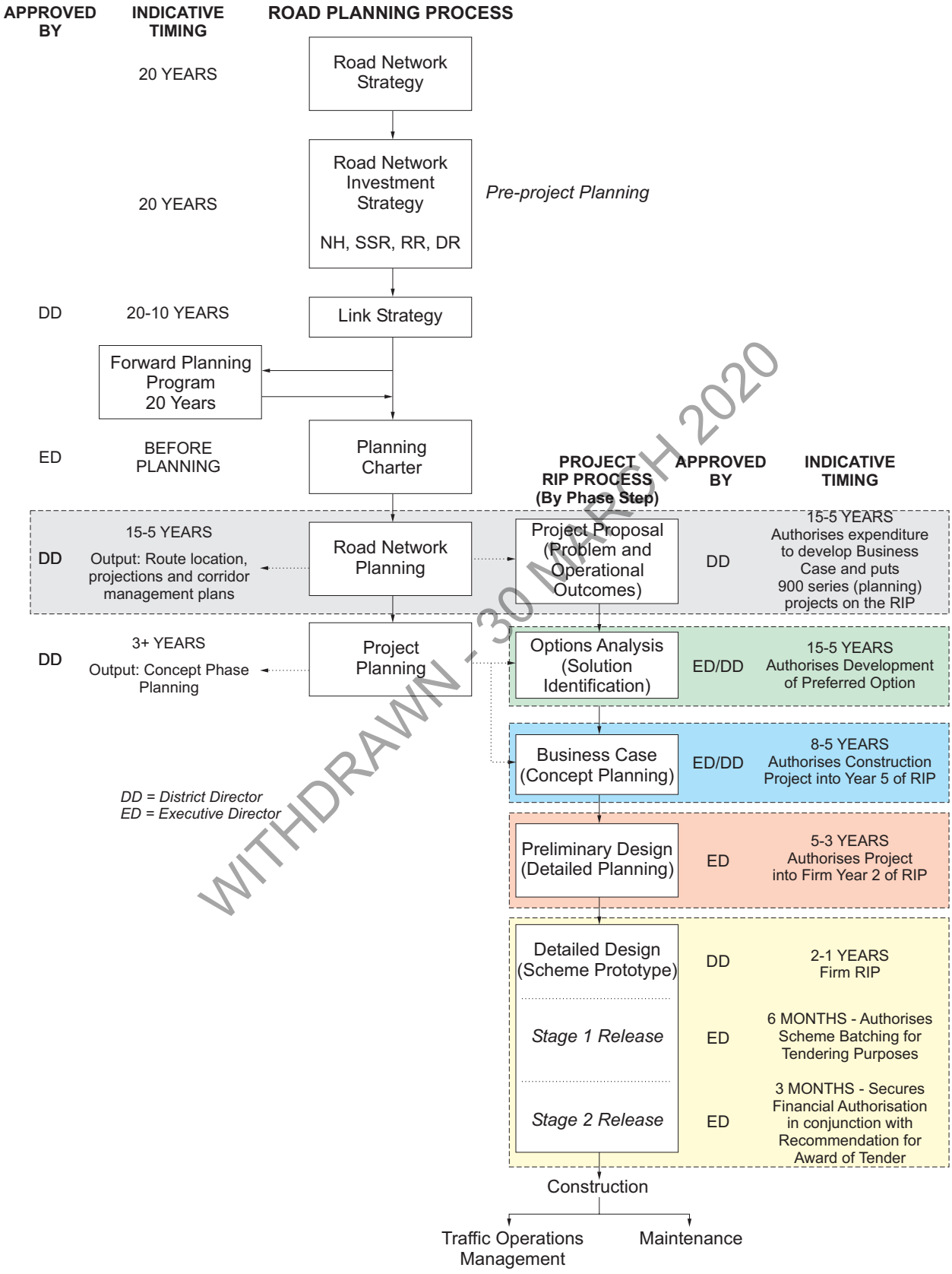


Figure 4.1 Overall Preconstruction Processes

Figure 4.2 Typical Road Planning Process

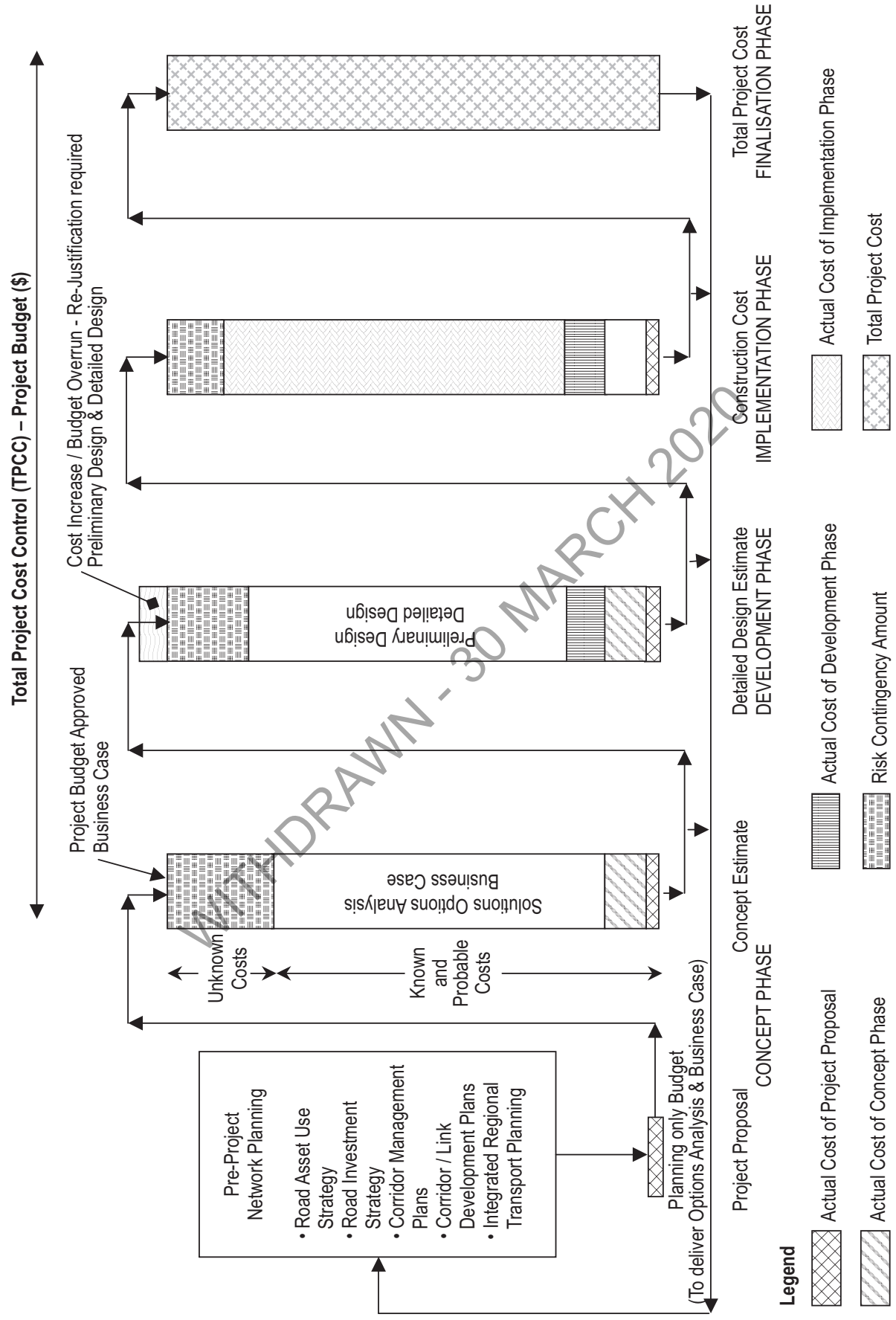


Figure 4.3 Estimated Costs Allocation over the Various Phases of Project Life Cycle

- the potential for cost reduction decreases as the project matures.

Appropriate risk management studies are essential to identify all risks associated with the execution of the project at the various stages of the life cycle of the project. This will allow appropriate estimates of the costs of the project at the various stages with proper allowances for the unknowns identified in the risk assessment. Figure 4.3 illustrates the approach to be taken.

4.1.3 Process Elements

Following from the Road Network Strategy and the various Investment Strategies, specific implementation plans must be developed. The complexity of these plans will depend on the location and scale of the projects envisaged and will range from simple rural road developments to complex urban motorway projects. The level of complexity will determine the detail of the processes required.

The essential elements of the process are:

- Land use/transport planning (including environmental impact assessment);
- Community engagement;
- Project proposal (problem, required outcomes, budget to deliver it);
- Business case (e.g. business case and the brief);
- Planning and preliminary design; and
- Detailed design.

Each of these elements is discussed in the sections below.

4.2 Community Engagement and Consultation

The planning process is a community driven one and an important element at every stage of the process is consultation with stakeholders. Stakeholders include affected and adjoining landowners, relevant statutory authorities (local government, other government departments, public utility authorities), industry bodies and users of the facility. The involvement of stakeholders throughout the planning process will help to ensure that all issues and needs are identified and considered and will lead to outcomes with a high degree of support and ownership.

Community consultation is therefore an essential part of all planning and design activities. To get the best results, it is necessary to start with a "clean sheet" and develop the project as the input from the consultation process unfolds. If this is not done, the consultation process will suffer from a perception that the Department has made up its mind and is in the process of selling the proposal. Figure 4.4 outlines the consultation project cycle.

The "clean sheet" approach is particularly applicable to route location proposals and "green field" sites. Some modification to the process may be justified when the proposal is an upgrading of an existing facility. The initial consultation will require information on the need for upgrading and the general concept considered to apply. This will allow the stakeholders to understand the intent of the project and to make more informed comments.

However, it is desirable that alternative proposals for the project be developed after the initial input so that they can be developed in the knowledge of the range of community concerns. The second phase of consultation will then have more specific proposals to consider and may result in additional issues arising. This approach retains the essential elements of the "clean sheet" approach and avoids settling on preferred alternatives too early in the process.

The Department has accepted the definition of Community Consultation as "the two way information exchange/s between the Departments of Main Roads and Transport and their publics before decisions are made. It is an open and accountable process whereby individuals and groups can participate in decision making processes and influence the outcomes of a policy or decision".

4

THE CONSULTATION PROJECT CYCLE

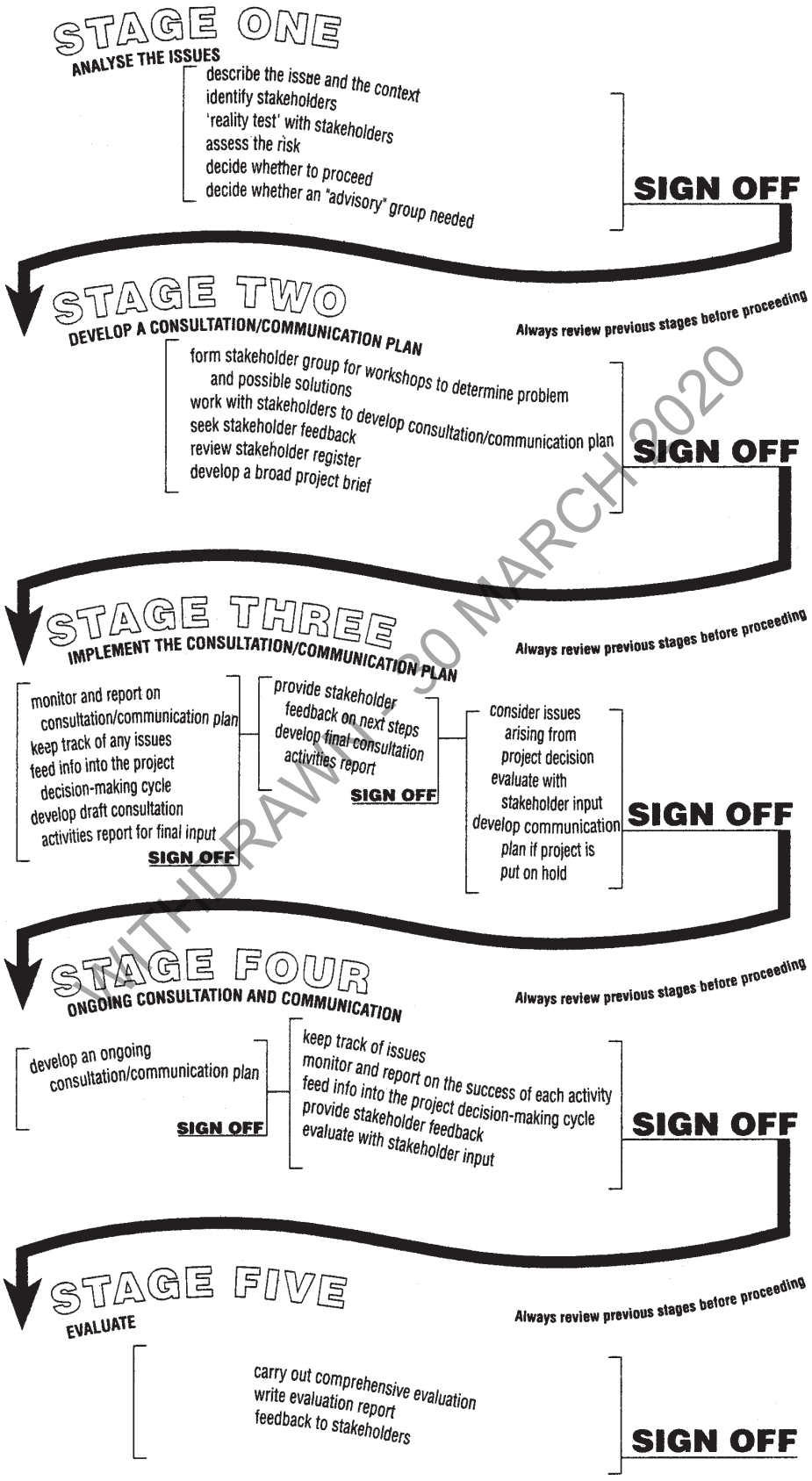


Figure 4.4 The Consultation Project Cycle

The consultation program should be designed in accordance with the following publications:

- Community Consultation Policy, Standards and Guidelines;
- How to Gain Broader Participation in Consultation; and
- Consultation Planner.

Main Roads and Queensland Transport produce all of these.

Further guidance for specific communities is provided by the following publications produced by the Department of Families, Youth and Community Care:

- Protocols for Consultation and Negotiation with Aboriginal People; and
- Proper Communication with Torres Strait Islander People.

4.3 The Design Development Process

4.3.1 What is Design Development?

Design development is the process of:

- Developing a clear and common understanding of the need/problem with the project sponsor,
- Understanding the required outcomes specified in the functional specification,
- Identifying the solution options to satisfy the needs/ problem articulated in the project proposal/functional specification,
- Selecting the preferred solution option that satisfies the needs and specified outcomes,
- Developing the preferred option through to the completion of detailed design, and
- Establishing a construction contract.

The design development process is a continuum that relies on proper planning to ensure that all of the necessary data, information and considerations are available when required to maximise the efficiency of the process, and to avoid or at least minimise the potential for rework. Most projects will require community (or at least targeted) engagement and consultation, data and information collection, special purpose studies, and investigations to be carried out in order to deliver a quality outcome with stakeholder approval. Some investigations and studies may identify further investigation and studies for specific purposes, e.g. for rare and endangered species. This is mainly associated with major projects but when required it could result in unavoidable rework.

Standard inputs to the design development process are:

- The Project Proposal (R1001),
- Relevant pre-project information, including known risks,
- Technical design details - Design Development Report (Form M4211 or M4212),
- Functional Specification or Brief,
- Engineering survey, and
- Reports from consultation, investigations and studies.

Standard Design Development Process Deliverables are:

- Options Analysis Report, including Templates R1002 or R1004 or R1005, as appropriate
- Business Case Report, including Template R1003 or R1004 or R1005, as appropriate, including Project Proposal Report for National Highways
- A Project Planning Report
- Detailed Design Report
- Scheme Prototype
- Completed Design Development Report (Form M4211 or M4212)

- Completed Risk Management Record (Form M4213)

4.3.2 Project Scope

The project scope can only be defined to the level of available information, e.g. at the project proposal stage (refer 4.5.1) of a project the scope is defined at a very high level in the form of a comprehensive understanding of the need or problem to be solved together available background information from pre-project activities and the location of the need. The functional specification will specify the functional outcomes required to be achieved by the completed and in-service road infrastructure.

As the project moves through the design development process the scope becomes more and more defined. The process has built in progressive deliverables, i.e. Options Analysis (refer Section 4.4.2), Business Case (refer Section 4.4.3), Preliminary Design (refer Section 4.4.4) and Detailed Design (refer Section 4.4.5) that are designed to require the scope to be progressed to the extent necessary to allow these deliverables to be achieved. The extent necessary is governed by the ability to achieve a project cost estimate accuracy specified in the Main Roads Project Cost Estimating Manual using a risk management approach. The concept of a management reserve is not acceptable as all risk are to be managed using a probability approach to calculate a contingency amount to cover the cost of a risk should it eventuate during construction.

For further details on project scoping refer to Chapter 5.

4.3.3 Pre-Design

The Road Network Strategy, the Investment Strategies and Link Strategies in combination with consultation with Federal, State and local government and the community establish the projects necessary to meet the requirements of the Department's stewardship of the road network. Having identified the problems and needs, individual project proposals are developed and prioritised. The approval of a project proposal will authorise:

- A major planning project to be included on the RIP for the development of the options analysis report and the development of a business case, or
- The preparation of an options analysis and the development of a business case.

The approval of planning projects (900 series jobs) and business cases collectively form a significant input to the RIP development process.

4.3.4 Design Development

A generic framework for delivering a RIP project (Design Development Process) is shown in Figure 4.5.

The design development process commences with an approved project proposal. The information from pre-project activities (Network Planning) may assist in the identification of all plausible solution options. *The development of options will require the consideration of the same issues that are necessary for the full development of the preferred option through to detailed design.* The intensity of the available information will grow with time as the results from studies, investigations, and consultations become available. The activities described in this section should be seen as a listing of the issues that need to be addressed over the whole design development process, including the development of options.

At the outset, the criteria on which the project is to be judged must be developed. Some of these will flow from the various overarching strategies, which will define the overall objectives. More detailed criteria will be required to satisfy the needs of the stakeholders in the consultation process. These criteria should ideally be developed in conjunction with the stakeholders so that they can accept ownership of them.

Planning should start with the development of solution options for the project consistent with the Road Network and relevant Investment Strategies

Figure 4.5 – Generic Framework for the Delivery of RIP Projects

(NOTE: The work activities specified under work management columns varies from a consideration check for Type 3 projects to delivering comprehensive work packages for Type 3 projects)

*** AM = Asset Management and PM = Project Management** **** Steps within the Concept Phase** **++ Steps within the Development Phase – Note:** The Step 'Detailed Design' includes contract formation

AM Phases*	**1, 2, 3 & 4**	**4**					**5**						**6**	**7➔**
PM Phases*	**N/A**	**CONCEPT**					**DEVELOPMENT**					**IMPLEMENTATION**	**FINALISATION**	
Phase Deliverables	**PRE-PROJECT** *Network Planning*	**PROPOSAL ****	**OPTIONS ANALYSIS ****		**BUSINESS CASE ****		**PRELIMINARY DESIGN ++**		**DETAILED DESIGN ++**			**CONSTRUCTION**	**HANDOVER**	
		Project Management	*Project Management*	*Work Management*	*Project Management*	*Work Management*	*Project Management*	*Work Management*	*Project Management*	*Work Management*		*General*	*Close-Out*	
Process Activities	INPUTS: ● Whole of Government Outcomes ● Legislation ● Portfolio Prioritisation ● Funding ● Land Use & Integrated Transport Planning ● Road Asset Use Strategy ● Road Investment Strategy ● Corridor Management Plans. ● Corridor / Link Development PI ● Integrated Regional Transport planning. (IRTP). **DELIVERABLES:** - Prioritised list of network needs - $OT Link Estimates	INPUTS: ● The Need or Problem articulated ● The required outcome ● Link to MR Strategies ● Link Studies, including $OT Link Estimate & BCR ● Road History details. ● Road Safety Review/ Existing Road Audit ● Appoint Project Manager and initiate project. ● Review and clarify problem to be solved. ● Determine functional requirements/outcomes and prepare brief for options analysis together with briefs for any relevant sub components. ● Consider project procurement strategy for Concept Phase and prepare concept phase plan and budget ● Conduct preliminary project risk identification (refer to stewardship activities). ● Compile Template R1001, review and submit for approval ● Consultant Contract Formation (Options Analysis) **DELIVERABLES:** - Required Outcome Specification - Project brief - Preliminary risk record - Plan and budget to deliver options analysis and business case. - Completed Template R1001, including Concept Phase Development Budget. - Federal Stage 1 Approval	INPUTS: ● Deliverables from Project Proposal ● Manage Concept Phase Plan - Review Proposal (required outcomes) - Monitor the delivery of work packages, e.g. community consultations, etc - Monitor project management and work management risks - Monitor communications with all stakeholders - Monitor work management activities, e.g. development of options ● Identify project management risks and commence risk management process, e.g. record risks in form M4213 ● Collect all relevant data and information. ● Develop required brief(s) and commission work packages - Geotechnical - Environmental ● Conduct external communication with full engagement of all relevant stakeholders - Community - Industry ● Evaluate options and prepare an options analysis assessment ● Conduct Options Analysis, including documentation, e.g. Template R1002 ● Determine how the Business Case will be delivered, e.g. In-house, consultant ● Review and submit for approval - Completed Template R1002 - Options analysis report, including comparative cost. ● Prepare handover package ● Consultant Contract Formation (Business Case)	● Review functional requirements (the need) ● Identify options - Collect all relevant data, information and conduct planning to identify possible options - Conduct value management workshops to assist in the development and assessment of options (include the public and all other relevant stakeholders). ● Commence design development report Form M4211 or 4212, as relevant ● Commence risk management by mitigating or removing risks on a continuing basis with all actions recorded in risk report M4213 ● Validate application of PPP policy to project ● Conduct Value Management workshop for all projects with an estimated project cost >$30M ● Develop options Develop options for comparative costing purposes and estimate comparative costs for each option. **DELIVERABLES:** - Options analysis report, including outcomes from value management workshop, as appropriate - Drawings, photographs, maps, and so on detailing options - Comparative estimates - Completed Template: ▫ R1002 (Complex Projects) ▫ R1004 (Simple Projects) ▫ R1005 (Minor Projects) - Risk Management Record (M4213), includes all identified Risks/Issues - Design Development Report - Component Brief(s) - Reports/Documentation from relevant studies, investigations and consultations	INPUTS: ● Deliverables from Options Analysis ● Manage Concept Phase Plan: - Review Options Analysis assessment and preferred option report - Monitor the delivery of Work Packages, e.g. environmental studies - Monitor project management and work management risks - Monitor communications with all stakeholders - Monitor work management activities associated with the development of preferred option, e.g. project design ● Continue monitoring project management risks and the risk management process, e.g. computer program 'risky' – produces completed form (M4213): ● Develop briefs and commission the delivery of work packages, as required, e.g. Geotechnical, Environmental, Cyclist, Cultural Heritage, Native Title, Hydrology, etc. ● Conduct external communications with full engagement of all stakeholders: - community - Industry ● Identify opportunities, e.g. possibility of pullovers on narrow formations in flat terrain at cut/fill locations ● Review BCR and project feasibility ● Conduct design verification, including design interfaces ● Conduct Project Review ● Advise Senior Advisor (Road Plan & Inventory) of possible changes to network ● Determine project procurement strategy, e.g. PPP/Traditional, RCC, Alliance, D&C, etc. (use MRPDS as a reference). If greater than $30M refer for PPP consideration ● Prepare Brief for Preliminary Design ● Complete Business Case Report (R1003, R1004 and R1005, as relevant) ● Develop outline Project Plan to deliver Development, Implementation and Finalisation Phases, including delivery method ● Review and submit Business Case for approval - Business Case Report (R1003, R1004 & R1005 - Preferred option development details, e.g. drawings, maps, concept estimate and BCR ● Prepare handover package. - Outline project plan (R2001 or R2002 or R2003) - Approved Business Case - Brief for Preliminary Design ● Consultant Contract for Preliminary Design	● Review preferred option with respect to functional requirements ● Develop preferred option to the extent needed to produce a concept estimate ±20% (This may include targeted public consultation appropriate to the project concerned). ● Conduct Stage 2 Road Safety Audit ● Review scope definition. ● Prepare Concept Estimate. ● Compile Template R1003, R1004 or R1005 ● Continue design development report Form M4211 or M4212, as relevant ● Continue risk management by mitigating or removing risks on a continuing basis with all actions recorded in risk report M4213 ● Review design considerations ● Display preferred option, as appropriate ● Produce Concept Estimate ● Produce BCR & 2nd Stage Evaluation ● Conduct Road Safety Audit – Feasibility ● Conduct Value Management workshop for all projects with an estimated project cost >$30M **DELIVERABLES:** - BCR & 2nd Stage Evaluation - Preferred option report, including details of major design elements - Road Safety Audit – Feasibility - Concept Estimate $OT - Approved Business Case, including completed Template R1003, R1004 or R1005, as, appropriate - Brief for Preliminary Design - Updated Design Development Report - Update Risk Management Record - Preliminary Project Plan - NH Project Proposal Report, if relevant - Reports/Documentation from relevant studies, investigations and consultations - Federal 2a Approval - ROW proposals (900 series planning projects only)	INPUTS: ● Deliverables from Business Case ● Project Administration: - Appoint Project Manager - Establish Project Team - Establish Project Office - Establish Advisory Group - Establish Financial Management Structure. ● Develop Project Plan: - Review Business Case and other current documentation - Confirm link to investment strategy. - Final review of stakeholders. - Review delivery method, e.g. traditional, alliance, D&C, etc. - Review Project Scope, including design considerations, design interfaces, assumptions, constructability, design criteria and standards, and outputs meet next stage requirements - Allocate resources - Perform risk analysis - Produce schedule - Produce Budget Estimate - Determine Reporting requirements - Procurements using MR procurement process. - Determine quality requirements - Finalise Project Plan - Review/update Project Plan and seek approval ● Implement Project Plan, monitor and control activities ● Confirm proposed changes to network to Sen. Advisor (Road Plan & Inventory) ● Prepare handover package. - Project plan - Preliminary Design - Brief for Preliminary Design ● Consultant Contract for Detailed Design	● Review Business Case (preferred option) with respect to functional requirements ● Develop Preliminary Design including estimate ±15% and drawings with due regard for the design considerations and assumptions (design development report) ● Continue design development report Form M4211 or M4212 ● Continue risk management by mitigating or removing risks on a continuing basis with all actions recorded in risk report M4213 ● Determine environmental management requirements ● Conduct Value Management workshop for all projects with an estimated project cost >$30M ● Options Analysis of design solutions - Conduct options analysis, e.g. culvert vs bridge; asphalt vs concrete pavement; etc. ● Design Solution Requirements: - Waterway discharge - Bridge loadings - Erosion and sediment control - Safety requirements. - Materials availability ● Detail ROW requirements. ● Conduct design verification, including design interfaces ● Conduct design review ● Prepare Road Safety Audit – Preliminary Design ● Prepare Planning Report **DELIVERABLES:** - Confirm BCR & 2nd Stage Evaluation - Planning Report, including details of major design elements - Road Safety Audit–Preliminary Design - Preliminary Design Estimate $OT - Updated Design Development Report - Update Risk Management Record - Conduct Peer Review, as appropriate - Updated Project Plan R2001 or R2002 or R2003 - Federal 2b Approval - ROW Clearances (Resumption Plans, Native Title suppression, acquisition of road leases, etc) - Reports/Documentation from relevant studies, investigations and consultations	INPUTS: ● Deliverables from Preliminary Design ● Confirm project scope ● Review/update Project Plan and seek approval ● Confirm Design will satisfy Functional Requirements ● Confirm Design has appropriately: ○ Review technical precedents ○ Review technical interfaces ○ Adequately and appropriately addressed: - Assumptions - Considerations (environmental, consultations, geotechnical, etc.) - Public Utility Plant ○ Constructability ○ Outputs meet next phase requirements ○ Adopted appropriate Design Criteria & standards ● Acquire ROW ● Conduct peer reviews ● Account for all risks ● Construction Contract Formation: - Confirm delivery method (using MRPDS as a reference), e.g. traditional (RCC), Alliance, D&C, etc. - Use MR procurement system (prequalification & assessment) - Prepare Contract Documents - Appoint selection team - Agree selection criteria - Approve preferred tender ● Pre-Implementation Review: - Appoint contract administrator ● Advise Senior Advisor (Road Plan & Inventory) of proposed changes to the road network, e.g. change of section name/ number, L.G. taking over responsibility for a road part, including any details/ conditions, etc.	● Review Preliminary Design (preferred option) with respect to functional requirements ● Complete Detailed Design ● Prepare Detailed Design estimate ±10% ● Prepare Road Safety Audit – Detailed Design ● Finalise Risk Report M4213 ● Finalise Design Development Report M4211 or M4212 ● Conduct Design Review ● Certify Design by RPEQ ● Compile Scheme Prototype ● Prepare Press Release **POST DETAILED DESIGN** ● Obtain approval to call Tenders ● Prepare Tender Documents ● Tender Analysis ● Clarify and agree tender before award ● Award Contract **DELIVERABLES:** - BCR & 2nd Stage Evaluation - Detailed Design - Road Safety Audit Detailed Design - Detailed Design Estimate $OT - Peer Review Record - Updated Design Development Report M4211 or M4212 - Update Risk Management Record M4213 - Completed Design Development Report - Electronic Model, as appropriate - ROW Clearances details (Resumption Plans, Native Title suppression, acquisition of road leases - Scheme Prototype - Updated Project Plan - Quality records - Federal 3a and 3b Approvals - ED approvals: - Stage 1 - Stage 2	INPUTS: ● Contract Documents ● Track Progress ● Manage Project Issues ● Manage Project Change Control ● Engage consultant for approved design changes ● Undertake Project Reporting ● Undertake Physical Commissioning ● Undertake Financial Commissioning ● Keep All Stakeholders informed on Project Progress ● Keep Road Users informed on proposed Changes to Road Conditions ● Undertake Acceptance Testing, including Road Safety Audits: - Construction/ Roadwork - Pre-Opening/Post Construction **DELIVERABLES:** ● Amended Design ● Consultant Performance Report ● Implementation: - Quality Records - Financial Records - Progress Reports - Progress Payments ● Commissioning of project ● Public notification plan on the progress of works and their impact on road users and local businesses ● Federal 3b Approval for Contract Variations ● Complete Risk Report M4213	INPUTS: ● Contract Performance ● Undertake Test Readiness Review ● Undertake Solution Readiness Review ● Undertake Project Performance Reporting ● Undertake Physical Commissioning ● Undertake Financial Close-Out ● Undertake Administrative Close-Out ● Update ARMIS system ● Confirm with Senior Advisor (Road Plan & Inventory) of actual changes to the road network, e.g. change of section name/ number, L.G. taking over responsibility for a road part, including any details/ conditions, etc. ● Submit for updating of Road Corridor Development Plans ● Debrief Project Team **DELIVERABLES:** ● Actual Cost. ● Performance Reports: - Construction Contractor - Sub-Contractors - Engineering Consultants ● Prequalification Review ● Handover Report. ● Project Completion Report. ● Post Implementation Review Report - (was specified outcome functionality achieved?)	
Funding	Stewardship Budget*	900 Series RIP Projects (*Individual Complex and high risk projects with significant stakeholder/locally sensitive issues)					**RIP Project**							
	Stewardship and Capability Budget for all projects that are not 900 Series RIP Projects													
Support Systems	● ARMIS; ● GIS; ● Benchmark Estimating System; ● TRARR; ● TRIPS; ● SATURN; ● PAMINET; ● MAPINFO; ●RISK Management Software; ● CSA Tools						● Project Management System; ● Quality Systems (QA); ● CAD Software; ● Road Design Software; ● Estimating Software; ● Structural Software; ● CSA Tools ● Etc.					● Project Management System ● Quality Systems (QA, QC) ● Construction Software	● Contract Administration System ● ProjMan/WMS	
Project Reports, Justification & Review Stages	NOTE: 1. A Road Safety Audit Report (with an emphasis on Geometric Design) is required to be produced at the following milestones: Business Case, Design Development and Detailed Design 2. Full project reviews should be conducted at the same time as the road safety audits.	Proposal - Approval to include in RIP as a Planning Project or to proceed to Options Analysis stage. Federal Stage 1, if applicable					**Business Case** - Approval to include in RIP as a Construction Project and to proceed to Design Development Federal Stage 2a Approval		Detailed Estimate – Project Re-justification Review Preliminary Design Estimate (Re-justification) Federal Stage 2b Approval			Federal Stage 3a Approval – Affordability (Tender Advertisement) Federal Stage 3b Approval – (Affordability to award Contract)		
Supporting Work Packages	Targeted Consultation, e.g. Key Stakeholders/LG/Industry/ Community Reference Groups/Government Departments, etc.		Options Display	Preferred Option Display	Community Consultation		Review Community Consultation		Ongoing Communications: Newsletters, Radio, Job Signs, etc.					
	Environmental Constraints/Opportunities Analysis (using RCEA data)	Environmental Assessment, Environmental Management and Environmental Certification Documentation : Environmental Approval Report [REF/IAS+ EMP (Planning) + EDR]										Environmental Management Plan (Construction)		
	Geotechnical Investigations, Environmental Investigations, Cultural Heritage, Native Title Investigations, Land Surveys, Public Utility Plant, Hydraulic Studies, etc.								Right-of-Way (ROW) Acquisitions					
Standards	Roads Connecting Queenslander's, Main Roads Strategic Plan, State Investment Strategies (National Highways, State Strategic Roads and Regional Roads), Technical Standards, Management Systems, Computer Systems, Processes, Procedures and Work Instructions, and Methods													
Mandatory	Relevant Legislation (Main Roads Act), Statutory Requirements, Main Roads Policies (e.g. Corridor – advertising, telecommunications, roadside vending, environmental management, etc.)													
Approvals District Director							- Right-of-Way (ROW) Requirements - Environment Clearance Certificate		- Approval to advertise the calling of tenders					
Executive Director	Strategic Project Budget	Planning for Major Projects			Approval of recommended option (major project or realignment)		- Project Business Case - Project Budget		- Confirm procurement option - Approval to award contract			**Stage 1** Approval (Authorises Scheme Batching for Tendering Purposes) **Stage 2** Approval (Secures Financial Authorisation in conjunction with Recommendation for Award of Tender)		
Federal		Stage 1 (Planning)			Stage 2 (Progression to Preliminary Design)		Stage 3a (Progression to Detailed Design)					< **Stage 3b** - Approval to award a construction contract		
Ministerial					Preferred Option (RIP)		AIS Conditions							

together with the need specified in the project proposal, the functional outcome specified in the functional specification and the required technical specifications (Form M4211 or M4212). Developing options is an acquired creative skill producing a range of alternative solutions that will satisfy the goals of the project. The initial development of options should be done with as few constraints as possible so that creative ideas are not ignored. All viable options can then be compared with the criteria outlined at the outset to determine the one best meeting (or exceeding) those criteria.

Developing appropriate solution options requires the designer to be sensitive to the environment of the area through which the road passes. To do this, the designer must be aware of the physical context and location of the proposed facility. This may need a comprehensive data gathering exercise involving site visits and discussions with local people. This is important as it allows the designer to identify any physical constraints early in the process.

US Dept of Transportation (1997) suggests the following questions to be asked:

- Physical characteristics of the corridor - urban, suburban or rural?
- How is the corridor being used (other than for vehicular traffic)? Are there destination points requiring safe access for pedestrians to cross? Do bicycles or other non-motorised vehicles travel along the road? (An additional question is: "Would they be likely to use the road if appropriate facilities were provided?")
- What is the vegetation along the corridor, e.g. sparse or dense; special plants or trees, etc.
- Are there important views from the road?
- What is the size of the existing road and how does it fit into the surroundings?
- Are there historic or especially sensitive environmental features (such as wetlands or endangered species) along the roadway?
- How does the road compare to other roads in the area?
- Are there particular features or characteristics of the area that the community wants to preserve (e.g. rural character, neighbourhood atmosphere, or main street) or change (e.g. overhead electrical wires, congested main street)?
- Is there more than one community group in the area? Are different groups interested in different features/characteristics? Are different groups affected differently by possible solutions?
- Are there concentrations of children, the elderly, or disabled individuals with special design and access needs (e.g. pedestrian cross walks, kerb ramps, audible traffic signals, median refuge areas)?

Understanding these issues will place the designer in a good position to develop solution options appropriate to the area.

Careful consideration of the following activities is required to produce a comprehensive and rigorous design development process. The full extent of these activities may not always be required for preparing the deliverables from the design development process (e.g. a business case) but they will have to be completed at some stage in the process. For less complex projects, these activities will more readily fit in with the preliminary design step

Economic Evaluation

Where options have differing economic impact, the Cost Benefit Analysis Manual for Road Infrastructure Investment (Main Roads, 1999a) should be used to evaluate the merits of each option. The evaluation should include an assessment of:

- Industry demands (such as freight movements);
- Economic trade (including tourism, agriculture, mining, manufacturing, wholesale/retail);
- Regional development;
- Export industries;
- Improved efficiency within the network.

For significant projects the solution options analysis process should include an economic evaluation using a whole of life approach. The project economic evaluation (BCR) is always conducted in the preparation of the business case.

Environmental Analysis

Decisions on the form of project taken at the options analysis and business case of the process will have the most significant effect on the environmental impacts. It is therefore important that all of the potential impacts are identified at this early stage to minimise the impacts and any required amelioration works thereby minimising the cost of the project.

The detailed requirements for the assessment of environmental effects are described in the Road Project Environmental Management Processes Manual (Main Roads, 1998b). The first step is the Review of Environmental Factors (REF), the outcome of which will be one of the following:

- The project has minimal adverse impacts on the environment and concept planning may proceed without the need for an Environmental Impact Study (EIS); or
- The REF requires additional work to determine more appropriately the effect on a particular environmental factor; or
- A more detailed environmental analysis is required (i.e. an EIS) to determine more accurately the effect on the environment; or
- The project has an unacceptable impact on the environment and will not be considered as an option.

If the result of the REF is that an EIS is required, then that process must be undertaken.

Cultural Heritage

Cultural Heritage (both Indigenous and European) issues must be identified and appropriate consideration and arrangements made to accommodate them in the overall delivery process, i.e. during planning, design and construction.

Refer to the Cultural Heritage Manual for guidance on the processes required.

Native Title

All Native Title issues must be identified and appropriate actions taken during the concept planning process. Where Native Title is affected by the project in any way engagement and consultation with the original owners should be undertaken to ensure a smooth overall delivery process. The required notifications should be prepared and submitted at the same time as Land Resumption Requests are made to minimise delays in acquiring the right-of-way.

Topography

For new alignments, the location of a route will be affected by the topography of the area through which it passes. As part of the environmental analysis, or in conjunction with it, the topographical controls and influences should be determined and taken into account during the process. Detailed information on the topography can be obtained through a variety of means, depending on the accuracy required at that stage of the planning process (topographic maps, aerial photography, orthophoto maps, ground survey).

Community Consultation

See Section 4.2 Community Engagement and Consultation.

Land Acquisition

A range of issues concerned with land acquisition can affect the planning and design of a road project:

- Native Title - this is a significant consideration and should be dealt with early in the process. Consultation with the appropriate aboriginal communities is an essential component of the approach to be taken (Dept of Families, Youth and Community Care 1997a, 1997b);
- Heritage Listings - advice from the Environmental Protection Agency must be sought where there is any possibility of an impact on a heritage listed site;

- Vegetation Protection Orders (By-Laws) and Green Areas - Local Governments may have tree preservation orders and /or rare tree listings and these may have a significant effect on the planning and design of the project;
- Acquisition Costs - Property Services Branch of the Department can provide the appropriate advice (injurious affection may be a significant cost);
- Type of property - communities have concerns for the residents of low cost housing being able to relocate, and for local producers being able to re-establish;
- Number of People affected - this may be more important than the number of properties;
- Property Values - there are often concerns that the value of property will be adversely affected by the project -
  - increase in traffic volumes and noise;
  - property access limited;
  - adverse effect on personal privacy due to loss of entertainment and recreation area;
  - future dwelling extensions prevented;
  - loss of neighbourhood parks.
- Severance of Farming Properties - this may require accommodation works to provide for:
  - animal and machinery access e.g. cattle creeps;
  - relocation of farm infrastructure;
  - maintenance of access to irrigation, dams, bores, streams etc;
  - restoration of fencing (including dingo and rabbit fences where applicable); and
  - construction or relocation of grids.
- Mining Leases - consultation with the Department of Mines and Energy is required;
- Quarry Leases - consultation with the Local Government is required;
- Town Plan - respect for the town plan and its objectives is essential. Consultation with the Local Government can assist in locating a new road to reinforce the objectives of the plan rather than be in conflict with it (refer to Section 4.2 Land Use/Transport Planning).

Effect of Options on Adjacent Land Users

- Property Values - properties not required for acquisition may be affected by the options in different ways and may be an issue in deciding between alternatives. Costs of amelioration works may also be a consideration.
- Community severance - may require special consideration of pedestrian and cyclist facilities, together with provisions for local traffic movement.
- Local Government and State Owned Land - the future use of adjacent land owned by government authorities may have a significant effect on the development of the road proposal. Considerations may include -
  - Access requirements (may need incorporation of additional lanes, channelisation and traffic signals);
  - Service roads;
  - Contributions by others to the infrastructure;
  - Special needs for education, police, hospitals, day care centres, libraries, etc.
- Emergency Services - the project may adversely affect the level of service provided by the various services (ambulance, fire brigade, and police) and access requirements should be considered. For example, traffic signals may be required to allow rapid access to the road for a fire brigade.
- Educational Institutions - the requirements for pedestrians, cyclists, drop off zones, parking and bus stops must be considered.
- Airport Clearances - projects in the vicinity of airports have to consider the effect of structures and poles on the air space around the airport. Further, road lighting in the vicinity of the airport may be confusing or distracting for

pilots at night (Refer to Civil Aviation Authority publication "Lighting in the Vicinity of Airports - Advice to Designers").

- Other Institutions - the following should be considered:
  - Institutions/war memorials;
  - Hospitals;
  - Retirement Villages;
  - Vibration sensitive industries
  - Ports (clearance heights and shipping manoeuvre clearances)

Public Utility Plant

Alterations and/or relocations of Public Utility Plant (PUP) can be one of the most expensive components of a road construction project. The location and size of all such services must be determined early in the process to allow appropriate adjustments in the proposals to minimise the costs involved. The relevant authorities must be consulted to obtain accurate information in addition to what can be ascertained from ground survey. Future proposals for upgrading the installations should also be determined. Services include:

- Telecommunications
  - Telephone exchanges
  - High band width communication conduits - fibre optic cables, co-axial cables
  - Low band width communications - local connections
  - Cables
  - Satellite communication facilities
  - High band width communication towers
- Water
  - Large reticulation systems
  - Pressure mains
  - Water towers, storage tanks
  - Pump stations
  - Waste Water and Sewerage
  - Pump stations
  - Large mains
  - Pressure mains
- Electricity
  - Towers
  - High voltage overhead lines
  - Substations
  - Power pole mounted transformers
  - High voltage underground cables
- Gas
  - major gas mains
- Oil Pipelines

Drainage

Major Drainage Structures

Design calculations should be undertaken on major drainage structures to obtain approximate structure sizes for inclusion in the business case costings. A major drainage structure is one where the cost of the structure has a significant effect on the total estimate and includes structures over rivers or creeks.

In some rural schemes without major drainage crossings, the drainage costs may only be a very small part of the overall cost. In this case, very few calculations will be required to determine the drainage requirements and cost. However, in some cases in urban situations, drainage costs are a substantial part of the overall cost and planning of the drainage system will need to be more exact.

Design for major drainage structures includes obtaining topographic maps or contour plans of the catchment areas surrounding the alignment to determine major drainage paths. Approximate flows may be determined from the rational method based on assumed values of run-off co-efficient, intensity, and area. Future upstream development should be considered in the calculation of the drainage flows. Any possible drainage reserves or easements that are required should also be considered.

Cross Drainage

For cross drainage, an approximate waterway area may be calculated by assuming a velocity and using the formula Q = V x A, or calculated by assuming inlet control only. Once an approximate waterway area is determined, an approximate type and size of culvert may be determined from the preliminary vertical alignment and natural surface. Any possible adverse effects of the resultant upstream headwater level should be considered. If it is suspected that tailwater levels may have a dominant effect (i.e. in low-lying flat areas), then the design calculations assuming outlet control and a tailwater level should be considered.

If a floodway is to be considered on a National Highway, flood immunity requirements can be obtained from the reference "Standards and Guidelines for the Construction of National Highways". For other roads, the flood immunity requirements are defined in the Road Network Strategy and the Link Strategies for that road.

Methods of floodway design are contained in the Road Drainage Design Manual.

Longitudinal Drainage

The location of the outlets of longitudinal drains may affect the quantity of water to be carried in some of the culverts and therefore can have a major bearing on culvert sizes and lengths. In some cases, the boundaries of the catchments may be affected by the distribution of the water from the longitudinal drainage system - this should be avoided. The water level at the outlet is also a major consideration. Refer to the Road Drainage Design Manual for design methods.

Complex Hydraulic Analysis

Where the major drainage structure is on a waterway that requires more precise analysis than the rational method can provide, specialist advice should be sought on the flood immunity and the type and size of structure required. Complex hydraulic analysis is generally required on the following waterway types:

a) waterways on large catchments;

b) waterways on complex catchments, e.g. multi stream systems peaking at different times during the design flood;

c) streams with unsteady flows;

d) flood plains;

e) waterways downstream from dams, weirs and reservoirs;

f) waterways with tidal flow;

g) waterways with significant local storage;

Minor Drainage Structures

There is generally no requirement to undertake any design calculations for minor drainage systems. A nominal cost is usually sufficient to allow for minor drainage systems. Cross drainage culverts can be located by visual inspection of topographic maps or contour plans.

For urban minor longitudinal drainage, pits may be placed at a nominal spacing along the roadway and a nominal number of pits may be allowed for at each intersection.

Geotechnical (Ground) Conditions

Geotechnical conditions for any particular option may have a significant influence on its feasibility and cost. In extreme cases, natural hazards may preclude some options altogether while the presence of land slips, swamps, rock outcrop and the nature and depth of structure foundations will invariably influence the adoption of some options.

As these conditions occur below the ground surface, some level of geotechnical investigation will normally be required at the development and comparison of options stage to allow the development of preliminary geotechnical models to assist in the assessment of the possible options.

The level of investigation will vary from a simple collation of existing data confirmed by visual assessment, to some level of sampling, testing and analysis. A competent engineering geologist or geotechnical engineer should undertake such investigations. The geotechnical models can be

progressively developed through the design development process.

Ground conditions which have a significant influence on the feasibility of any particular option include:

- Conditions of natural slopes including evidence of potential land instability, erosion, nature of materials and groundwater seepage.
- Occurrence of hard rock in cuts and the impact on excavation techniques and slope stability (and hence resumptions), stabilisation measures and drainage requirements.
- Presence of soft and swampy ground under embankments and implications for settlement, stability, need for ground improvements, construction programming and investigation requirements and timing.
- Subgrade soil conditions that will influence pavement design and drainage.
- Presence of acid sulphate soils.
- Presence of sodic soils.
- Usability of excavated materials and implication on earthworks balance, disposal of unsuitable material and selective winning and usage of suitable materials.
- Presence of underground openings (caves, old mine workings, etc.) causing potential short and long term subsidence problems for both road and structures.
- Presence of services, adjacent structures (embankments, retaining walls, and bridges) and/or need to construct under traffic restricting the range of alternatives.
- Presence of problem materials such as spoiled fill, refuse, contaminated land and other unsuitable material requiring specific improvement techniques or remove and replace.

Major Structures

Chapter 22 of the Road Planning and Design Manual discusses the requirements of major structures and their impact on road and project development.

Road Design Considerations

All of the factors to be considered are detailed in the Road Planning and Design manual:

- Traffic Parameters and Human Factors (Chapter 5);
- Speed Parameters (Chapter 6);
- Cross Section (Chapters 7 and 8);
- Sight Distance (Chapter 9);
- Alignment Design (Chapters 10, 11 and 12);
- Intersections (Chapters 13 and 14);
- Auxiliary Lanes (Chapter 15);
- Interchanges (Chapter 16);
- Transit Lanes (Chapters 2 and 7).

Pedestrians and Cyclists

Transportation corridors provide a medium for all modes of transport. In urban environments, cyclists and pedestrians form a significant proportion of transport corridor users. Cycling facilities (paths and terminus facilities) and pedestrian provisions must be considered for inclusion in all new projects. Many Local Governments are actively encouraging increased walking and cycling. Therefore, high quality, convenient, connected, safe and attractive routes for cycling and walking need to be incorporated into road designs at the planning stage to encourage use of these modes and to ensure the safety of these 'unprotected road users'.

Providing for pedestrians and cyclists is a major function of Local Government. It is therefore necessary to ensure that Main Roads proposals are compatible with the Local Government's responsibilities, and vice versa. This may involve sharing costs between the Local Government and Main Roads, both for construction and for maintenance. The responsibilities and cost sharing arrangements are set out in Main Roads et al (2000).

The planning and design of new road infrastructure must consider the inclusion of bicycle and/or pedestrian facilities. Where bicycle and/or pedestrian facilities are incorporated into a project the planning must take into consideration how bicycle and/or pedestrian operations can be safety accommodated in the traffic management plan for construction.

The following questions should be answered in the planning stage:

- Cyclists

1. Bicycle facilities or wider road shoulders must be considered on main roads (urban motorways will require separated provision for cycling to be built into the project due to the higher traffic volumes and speeds). Provision for cycling increases the safety of all road users and avoids the slowing effect created by having cycling in the general traffic lanes. Planners and designers need to consult with the Local Government to ensure that installation of the bicycle facility conforms with the local authority bike plan. Regional cycling strategies, including the Queensland Cycle Strategy, Integrated Regional Cycle Network Plan for South-East Queensland (IRCNP) on internet site http://www.transport.qld.gov.au/qt/tpSite.nsf/index/ircnp and Cycle Southeast are additional references when considering provisions for cyclist. If no bike plan is in place, consultation with local authority staff and local bicycle users will be necessary. Refer to Chapter 5 of the Road Planning and Design Manual and as a secondary reference Part 14 (Austroads, 1999) for guidance on provision of bicycle facilities.

2. When providing a bicycle facility, consider whether an on- or off-carriageway facility is required. Off-carriageway facilities may increase land resumption and increase the estimate of the cost, and must be taken into account. In rural areas, it may be less costly to provide for the bicycles on an off road facility as the cost of the construction will be less than the cost of widening the road pavement (extra land would rarely be required in these cases.) The most appropriate type of facility will depend on speed and volume of traffic, surrounding land uses and the types of user expected on the facility. Refer to Chapter 5 and Austroads, 1999.

3. How many potential bicycle/motor-vehicle conflict points require special treatment? Special intersection treatments such as advanced stop lines, storage bays, bike lanes or bike crossing signals, may be required and the cost included in the estimates. The planning process should pay particular attention to bicycle trip generators (e.g. schools and shopping centres). Any need for the use of grade separated structures should be identified at this early stage.

- Pedestrians

1. Provision for pedestrians will be required on all main roads in built up areas except those such as motorways where separate provision will need to be built into the project. The planning stage should involve consultation with the Local Government and community groups to confirm the requirements for pedestrians. Refer also to Chapter 5 of the Road Planning and Design Manual.

2. If a footpath is required, what width is needed? The width necessary for the installation of Public Utility Plant must be taken into account. Footpath width will affect the land acquisition requirements (See Chapters 5 and 7 of the Road Planning and Design Manual).

3. How many potential pedestrian/motor-vehicle conflict points are there? Special intersection treatments may be needed and the costs to the project of providing the necessary facilities must be taken into account. (See Chapter 13 of the Road Planning and Design Manual and Austroads, 1995).

4. Note that all pedestrian facilities provided must be in accordance with design standards for people with disabilities.

- Combined Pedestrian and Cycling Facilities

  - It is important to note that Austroads Part 14 (Austroads, 1999) outlines design requirements for joint pedestrian/cycling

facilities which are also designed to a standard suitable for people with disabilities.

Local Government Involvement

All proposals will impact on the responsibilities of Local Government in some way. Consultation with the relevant Local Government/s at all stages of the process is therefore essential. Agreement must be reached on the details of the project and in particular, any requirements for changes to Local Government infrastructure or for Local Government input into the project.

It is also necessary to reach agreement on the cost sharing arrangements if applicable. Main Roads et al (2000) sets out the agreement between the Local Government Association and Queensland Main Roads on responsibilities and cost sharing and must be applied in discussions with the relevant Local Government on these matters.

Passenger Transport Modes

The information on bus routes given in this section is taken from Main Roads et al (2000). Refer to this reference for any additional information required above what is given in this section.

In any community there is a demand for "public" transport to and between work, shopping, education, leisure activities and residential areas.

The level and nature of demand for these transport services are determined by such factors as density of development, spatial distribution of activities and the age structure and socio-economic characteristics of an area. The extent to which public transport can meet the potential demand is influenced not only by these factors, but also by the road layout, hierarchy and geometry in the service area.

In major urban areas, trains often provide a major public transport service. It is important that good quality access to railway stations for all modes (walking, cycling, buses, private car) be provided where required. Facilities could include:

- Pedestrian and cyclist under- or overpasses;
- On- and/or off-road pedestrian and cycle lanes;
- Bus priority measures;
- "Kiss and Ride" facilities;
- Bike storage facilities;
- Bus stops.

In rural areas well removed from urban communities, the major public transport requirement is for school buses. Providing access to the road system for this service is usually the dominant public transport issue. However, some long distance services require some level of access and these must also be considered.

Land Use Planning and Bus Routing

The general philosophy of land use planning for efficient public transport servicing is that which best combines:

- provision of direct routes between major activity centres such as retail centres, industrial estates, commercial centres, large schools, and significant leisure centres and the patronage source (the residential areas);
- provision of appropriate density of residential developments along such routes, within "convenient" walking distance to bus stops;
- provision of appropriate and convenient pedestrian facilities, accessible for people with disabilities, giving access to all bus stop locations;
- location of lesser activity centres such as smaller schools, local shops or commercial centres, post offices or public buildings on, or very close to, the routes between the major activity centres;
- placement of residential centres such that residents have a choice of major activity centres, in either direction on the bus route;
- progressive coordinated development of land parcels which enable new or extension bus service to be implemented efficiently or which "fill-in" gaps in existing route catchments;

- opportunities for intermodal trips by providing safe and convenient bicycle access to public transport interchanges.

Bus Routing and Road Planning Options

The role that public transport should perform on various classes of road are as outlined below:

- Arterial Roads

  Bus usage of arterial roads should be restricted to trunk express or limited stop services. Wherever bus stops occur, passengers should be isolated as far as practicable from the arterial road traffic by providing stopping areas clear of the main carriageway (preferably on service roads) and walk/access facilities segregated from the arterial road vehicles (grade separation desirably, pedestrian signals as a minimum).

- Sub-arterial and Collector Roads

  Principal pedestrian access to, facilities for, and routes of major bus services are best suited to sub-arterial and collector roads.

- Local Roads

  Local roads should be restricted to residential traffic only and are not suitable for use as bus routes.

Ease of bus movements between the various road types must be considered in the design of the road layout and intersection control.

In particular, buses should not be expected to cross or make uncontrolled right turns onto arterial roads through "Stop" or "Give Way" control. Channelisation, roundabout or traffic signal control should be introduced to assist bus access to the arterial system or alternative bus priority measures implemented. Wherever possible, T-junctions rather than 4 way intersections should be used as these significantly improve safety and accessibility.

At any location where significant bus delays are expected, introducing some form of bus priority should be considered. (See also Section 4.2.5.)

Regional Commercial and other Major Developments and Bus Access

Where a large commercial development, such as a shopping centre, office park, college or hospital is planned for an area away from the central city area, the needs of, and demands on public transport should be carefully assessed.

Particular factors to be considered include:

- Bus access/egress and stop facilities should not be intermixed with normal car parking or affected by private vehicle queues;
- Route diversions off the sub-arterial or collector roads through the centre should be as short as possible, in both distance and time;
- Bus stop facilities should be as close as possible to the pedestrian access of the centre;
- Colleges and hospitals should be located adjacent to major transport routes and have good pedestrian access between bus stop and facility, desirably including bus shelter and even covered walkways for very high volume routes;
- Intermodal transport: people travel by car, bicycle and walking to public transport. Appropriate facilities are required for all user types to allow intermodal trips.

Consultation with Local Government and other stakeholders is essential.

Other Route Planning

Bus routes should not be allocated to streets which have:

- speed bumps;
- deep drainage invert channels;
- short sharp vertical changes in grade;
- tight horizontal alignment.

Queensland State Transport Regulations provides for single deck buses to a height of 4.3 metres and double deck buses to a height of 4.4 metres. Structures on bus routes (overpasses, tunnels etc.)

and within bus interchange areas should provide adequate clearance for these vehicles - a minimum of 4.5 metres is desirable.

Additional care must be taken for roads under a structure on a sag curve, as this effectively increases the height clearance requirements of a bus.

To maintain an acceptable speed differential between buses and other vehicles, gradients on bus routes should not exceed 10%.

Options Analysis of Identified Solutions

The evaluation process must include an assessment of each option's ability to fulfil the purpose or need outlined in the project proposal and functional specification.

Considerations that should be assessed are listed below but not all of these considerations would necessarily be assessed for any one project. Some aspects may not be able to be quantified and therefore a qualitative comparison must be made. Documentation of the evaluation considerations should be included in the planning report.

To assist in determining the preferred solution an option analysis procedure for evaluations project planning (solution) options is included in Appendix 4A.

Consideration of Quantifiable Construction Costs

Concept estimates for large projects have a demonstrated likelihood to be below cost because unforeseen factors are revealed during the design and construction phases. To ensure this occurance is minimised sufficient upstream work must be undertaken to ensure the concept estimate is consistently within ± 20% of the final total project cost. In this respect, the extent of upstream work must be appropriate for the identification of all significant project risks and to allow the calculation of a contingency amount (dollar value) to cover the cost of any risk should it eventuate. The preparation of an estimate for planning projects should concentrate on the major cost items. Time and effort will be wasted in trying to determine the cost of every minor item at the business case stage. When estimating project costs it is important to understand *market forces* and to provide due allowance in project cost estimate unit rates.

However, it is more often than not that the concept estimates are below final costs because unforeseen factors are revealed during the design and construction phase. For this reason, a contingency amount is to be included in the project cost estimates to cover the cost of any risk should it eventuate. This contingency amount is calculated using a risk management approach based on the probability of each individual risk occurring. (refer to The Project Cost Estimating Manual, Main Roads, 2004).

Consideration of Quantifiable Operating Costs

Operating costs are the ongoing costs occurring after completion of the project. These costs include:

- Pavement and road maintenance (See Pavement Design Manual for whole of life analysis for pavements. For heavy duty pavements, Main Roads (1998d) should be considered).
- Road user costs e.g. vehicle operating costs, delays (particularly commercial vehicles).
- Accident costs

The department's "Cost Benefit Analysis Manual" (Main Roads, 1999a) provides the details for estimating these costs.

Consideration of Non-Quantifiable Issues

Non-quantifiable issues are those that can not be measured or are difficult to measure and include varying degrees of subjectivity (referred to as externalities). These include:

- Some environmental impacts;
- Impact on the community (health impacts, convenience of access, quality of life);
- Level of service.

Additional Benefits

For each option any additional benefits over and above those assumed at the concept stage should be identified and included in the planning report.

Anticipated Risks

During the design development process, additional risks may be identified for various options. Such risks may include:

- Susceptibility to cost over runs due to wet weather;
- Additional costs that may be identified from geotechnical investigations or construction techniques; and
- Using a unique construction method or new materials;
- Design failing to consider all road user needs;
- Radical changes in road use requirements after construction;
- Increased safety risks to vulnerable road users from increased traffic speeds and volumes, and reduced crossing opportunities.

These risks should be assessed as to their influence on the project viability.

4.3.5 Developing the Design

The following discussion is intended to cover all of the considerations and inputs, regardless of the project type . The design input considerations will serve as a mind jogger with the designer taking full responsibility for determining the relevance and degree of impact of any consideration to the project. Some considerations may be applicable more than once during the process and the designer must be vigilant so as not to over look these occurrences.

It is very important for the designer not to lose sight of the project objectives as the design develops because scope and cost, and outcomes may change if these requirement are overlooked or not clearly understood. Project objectives as specified in the Project Proposal and must be reviewed at the start of each phase step, i.e. options analysis, business case, preliminary design and detailed design. The process requires succeeding steps to build on previous steps not to rework them as so often happens, i.e “I can do it better thinking”.

The design process has mandatory hold points for review, justification and approval purposes. The designer will have to determine the level of detail required to suit the accuracy required of the various mandated project cost estimates, i.e. concept, preliminary design and detailed design.

To commence the design development process the following are required:

- An approved project proposal,
- A Functional Specification,
- A clear and common understanding of the requirements with the sponsor, and
- An understanding of pre-project data and/or information that could assist in the development of the preferred solution., and
- A budget to deliver an options analysis and the business case.

It is a requirement that these details be kept under review during the whole design development process. Sometimes studies and investigations will require further but usually more specific studies and investigations. As the results of these studies and investigations become available they may dictate a revisit to earlier conclusions. As issues change and develop and some of the conclusions reached at the earlier phase may move out of alignment with the new requirements. In these circumstances rework maybe necessary to account for this newer information.

All of the following elements have to be determined and addressed during this phase.

Environmental Assessment

The environmental assessment activities must be continued in this phase at a higher level of detail.

If the Concept REF identified the need for an EIS, it will be necessary to undertake it at this stage.

Otherwise, a Planning REF will be required. An Environmental Management Plan (Planning) (EMP Planning) must be prepared in either case.

The Road Project Environmental Processes Manual (Main Roads, 1998b) defines the requirements for the preparation of the Planning REF and the EMP (Planning).

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Cultural Heritage

Cultural Heritage (both Indigenous and European) issues must be identified and suitable arrangements made to accommodate them in this phase of the process.

Refer to the Cultural Heritage Manual for guidance on the processes required.

Native Title

All Native Title issues must be identified and appropriate actions taken in this phase of the process. The required notifications should be prepared and submitted at the same time as Land Resumption Requests are made to minimise delays in obtaining right-of-way.

Design Traffic Volume

Predicted traffic volume on the road in question is the basis for many aspects of the design. The traffic parameters to be used are discussed in Chapter 5 of this manual.

Road Geometry

The road geometry has to be designed in accordance with the requirements set out in this manual, namely:

- Horizontal Alignment;
- Vertical Alignment;
- Coordination of the horizontal and vertical alignments;
- Cross Section (including Transit lanes if required).

Structures

- Flood immunity required for bridges is defined in the Department's Road Drainage Design Manual.
- Types of bridges are discussed in Chapter 22 of the Road Planning and Design Manual.
- Cross section requirements for bridges are discussed in Chapter 7 of the Road Planning and Design Manual.
- Bridges for Interchanges are discussed in Chapter 16 of the Road Planning and Design Manual.
- Public Utility Plant on Bridges:
  - Requirements should be determined early in the planning process
  - Utilities inside closed cells of bridges can pose a serious hazard - water and sewer lines can leak and proper drainage is required; gas mains should not be placed inside closed cells because of the risk of explosion;
  - High pressure gas mains present a serious explosion hazard if ruptured and should not be placed on bridges without special precautions;
  - High voltage electrical cables may have a significant heat output and may require ventilation;
  - PUP Authorities may have restrictions on the location of their service with respect to other services;
  - Electrical cable ducting for street lighting is to be provided on bridges where required for present or future lighting;
  - PUP may be provided for in the footway/bikeway, or suspended from the side of prestressed units, or under the deck in girder bridges as permitted by the PUP Authority.

Intersections

Details of intersection requirements are included in Chapter 13 (Intersections at Grade) and

Chapter 14 (Roundabouts) in the Road Planning and Design Manual.

Drainage

The relevant Local Government should be contacted to obtain details of any Strategic or Master drainage schemes it may have. The drainage design of the road should fit in with these schemes where possible.

Existing drainage networks can also be obtained from the relevant Local Government and from previous departmental documents.

Major drainage structures may require the approval of the Department of Natural Resources.

During this phase of the design, it will be necessary to undertake a more detailed examination of the requirements of major drainage structures if the following circumstances occur:

- cultural heritage issues arise;
- native title issues arise;
- the size and shape of the structure affects the land acquisition required;
- environmental impacts may be significant;
- the vertical distance from the base of the drainage path to the bottom of the pavement is critical;
- the height of the upstream head may cause flooding problems; and
- the proposed drainage structure may conflict with services or other structures thereby affecting size, shape and location.

These structures will need to be adequately designed to determine their type, shape and size so as to ensure that major changes are not required at the detailed design stage. This may require a detailed hydraulic analysis to be undertaken in the project proposal phase. If complex hydraulic analysis is required, specialists should undertake it.

If additional property is required for drainage reasons, it should be determined at this stage.

There is no need to undertake calculations for minor drainage requirements at this stage since the details are not likely to affect the land required or the size and placement of other features. Enough detail can be determined from the cross sections and layouts to give sufficient confidence in the estimates required at this stage.

Geotechnical Investigations

Additional geotechnical investigations should focus on the critical geotechnical aspects of the selected option. This progressive development of the geotechnical model will also facilitate the development of a program of geotechnical investigation to be completed and utilised in the project proposal phase to ensure appropriate design parameters are adopted as well as identifying any constraints on the construction process.

Pedestrians and Cyclists

The needs of pedestrians and cyclists must be incorporated into the process and included in the relevant parts of the elements described in preceding sections. The basic parameters for assessing these requirements are described in Chapter 5 of the Road Planning and Design Manual. Special features will often be required to accommodate their needs.

In some cases, an overall strategy is in place to provide a network of cycle ways and pathways and these strategies form the basis of the decisions required for the facilities to be included. Planners and designers should ascertain the strategies in place for the area in question and incorporate the necessary features into the project.

Public Utility Plant

A more detailed assessment of utility services relocation requirements must be undertaken at the preliminary design stage. It is necessary to determine the extent of the work and to assess whether early relocation may be advantageous to facilitate the construction process. The various Authorities should be advised early in the

preliminary design stage of the proposals so that any affected services can be identified.

Where possible, relocation of services should be minimised by judicious adjustment to the design. Minor changes to the layout can often be made without compromising the standard of the design and major savings can be achieved.

If stage construction is involved, services should be placed in their final locations if possible.

Chapter 7 of the Road Planning and Design Manual provides guidance on the clearances required for services (overhead and underground) as well as desired locations for services in the road reserve.

Stage Construction

The potential for developing the project in stages has to be determined at the preliminary design phase. Appropriate staging will require a detailed analysis of the traffic impacts of the staging and the likely life of the stages proposed.

Proper attention must be given to the design to ensure that future construction of the next stages can be achieved without undue disruption to the road users and the adjacent property owners. This can affect various aspects of the design and can have a significant effect on the detail of the design adopted. Some features affected include:

- width of medians;
- location of carriageway in the road reserve;
- length of overpass bridges;
- grading of the carriageway to facilitate future grade separation;
- location of intersections;
- location of property accesses;
- provision for pedestrians and cyclists;
- transit lanes;
- depth of pavement;
- clearance to overpass structures;
- extent of works to facilitate temporary connections and their removal.

Traffic Diversion During Construction and Construction Sequencing

Preliminary design must ensure that the project can be constructed in an economical manner and that business, traffic and pedestrians are not unduly disrupted in the process. This may require changes to the design and some additional works to ensure that a satisfactory outcome is achieved. Issues to be addressed include:

- maintenance of access to property and business - this does not only include direct access to adjacent property but must consider the wider effect on customer access to established businesses;
- pedestrian and cyclist movements - special pathways and protective devices may be required to ensure adequate pedestrian and cyclist movement through the site. All pedestrian treatments must consider the needs of people with disabilities;
- traffic movements - considerable attention must be given to the safety of traffic movement and the management of traffic through the project. This may include -
  - lane closure
  - traffic diversion via another route
  - construction of side tracks, paved and sealed, or other temporary roadways;
- bus routes - maintenance of bus stops and service to the community is essential.

Important data for this stage includes traffic volume, percentage of heavy vehicles, traffic speeds, and intersection capacity and delay.

The preliminary design must examine the sequencing of the works to determine the feasibility of the project and to determine the temporary works required to manage the construction process. This has to be documented even though the contractor may adopt a different approach during the project.

Sequencing of the construction process is different from the staging of the project and requires a different approach. The sequencing is the set of activities required to ensure that the project is constructed economically while minimising disruption. Staging defines the works to be carried out over an extended time to achieve some "ultimate" goal for the standard of the road.

Pavements

Pavements can be the most expensive part of a project and considerable attention to the design of the pavement is required at the preliminary design stage to obtain a reasonable estimate of the cost of the works. The type of pavement affects the cross section and both need to be designed in conjunction with each other.

Details of the approach to pavement design can be found in the Pavement Design Manual. For special pavements (e.g. heavy-duty motorway pavements), specialist assistance should be obtained.

Roadside Furniture

The elements of roadside furniture to be considered and dealt with elsewhere in this manual are:

- Signs - refer to the Manual of Uniform Traffic Control Devices (MUTCD) for warrants and design requirements;
- Pavement markings - refer to the MUTCD and the Guide to Pavement Markings manual;
- Lighting - includes route and intersection lighting - refer to Chapter 17 of the Road Planning and Design Manual;
- Roadside barriers - refer to Chapter 8 of the Road Planning and Design Manual;
- Fencing - refer to Chapter 8 of the Road Planning and Design Manual.

Additional Safety Considerations

- School zones - speed limits will apply in school zones (refer to MUTCD)
- High rainfall areas - special attention to pavement surfacing is required, particularly where alignments are winding, steep or heavily trafficked;
- Aquaplaning;
- Areas of fog - good delineation is required;
- Roadside hazards - particular attention to the presence of potential hazards is required. Such hazards should be removed or protected with barrier - refer to Chapter 8 the Road Planning and Design Manual;
- Runaway vehicle facilities - refer to Chapter 15 the Road Planning and Design Manual;
- Crossfall - there are limitations on the amount of crossfall on curves because of the adverse effect on vehicles with a high centre of gravity - refer to Chapter 7 of the Road Planning and Design Manual.

Special Works

- Cattle Creeps may be required where a new road severs a rural property - usually placed where the vertical alignment affords the opportunity but it may be necessary to adjust the design to accommodate the crossing to make it convenient to use;
- Fauna crossings - refer to Chapter 3 of the Road Planning and Design Manual;
- Grids are installed for the convenience of the landholder to avoid the need for fencing. If the traffic volume exceeds 700vpd, grids are not suitable and the road should be fenced to ensure adequate safety for the traffic. Grids are only installed where a written request is received from the landholder and an agreement has been signed absolving the Department from the responsibility for fencing the road boundaries;
- Open Level Rail Crossings are dealt with in Chapter 21 of the Road Planning and Design Manual.

Rest Areas

Rest areas are established in accordance with the departmental policy on location of these facilities. They are off road stopping places providing safe parking, toilet facilities, shelter shed, picnic table/s, rubbish bins, fireplace and drinking water where possible. Access to the rest area must be properly designed with attention to the required acceleration and deceleration lanes and turning facilities (refer to Chapters 13 and 20 of the Road Planning and Design Manual).

Service Centres

Service Centres are major facilities provided by private enterprise on major roads with full access control. Acquisition of land for Service Centres is the responsibility of the developer. The requirements for Service Centres are described in Chapter 20 of the Road Planning and Design Manual.

Land Acquisition

Land required for the project should be determined at the Preliminary Design stage and Resumption plans prepared in accordance with the Drafting and Design Presentation Manual.

Land required should be determined from the clearance requirements defined in Chapter 7 of the Road Planning and Design Manual. In addition, any land for environmental amelioration must be identified at this stage and allowed for in the resumption plans. This land may be required for such things as noise mounds, sedimentation ponds, gross filter traps and buffer zones.

Where future development of the road will require property in addition to that required for the current project, it is desirable that it be acquired at the same time. This will avoid undue disruption to property owners in the future and provide a secure basis for future planning by the Department.

Stock Routes

Stock Routes are managed by the Department of Natural Resources from a central office in Brisbane (General Manager (Stock Routes)). Where Limited Access declarations may impact on a Stock Route, the General Manager (Stock Routes) must be consulted before finalising the plans.

Proposals are to be forwarded to the General Manager in the first instance and he/she will coordinate with the local officers of the Department of Natural Resources.

4.4 Project Delivery

The relationship between the deliverables from the Concept Phase (Project Proposal, Options Analysis and Business Case) and the Development Phase (Preliminary Design and Detailed Design) in the context of the design development process is shown in Figure 4.6. The design development process is shown in Figure 4.7 - Design Development Flowchart for Road Infrastructure Projects.

4.4.1 Project Proposal

Preparing the project proposal is a pre-project activity and it is only when it is approved that a project is created and the cost of preparation transferred to the cost of the project. This phase step is an output from the pre-project activities of network planning.

The first step in the preparation of a project proposal is to:

- Understand and define the problem arising from network planning, including the current situation together with the current road Functionality as it may have changed since original design,
- Identify the functional outcome required to be achieved by the completed and operational infrastructure. This is a key requirement when developing solutions to the problem, i.e. the required functionality to be achieved by this project may be different to the current functionality,
- Define the scope of the project deliverables and outcomes (Functional Specification),

- Link the project to the strategic business plans, e.g. confirming strategic fit,
- Prepare a budget (planning) to deliver the options analysis and the business case based on:
  - Information from pre-project activities, e.g., link studies, analysis of environmental constraints/opportunities based on Road Corridor Environmental Assessment data, and
  - An assessment of likely work packages, e.g. environmental study, together with the cost of consultancies to deliver them,
- Validate application of the PPP policy to the project,
- Identify risks to the project (external and internal),
- Prepare a proposal report (all projects) by completing Template R1001 to:
  - Secure funding for delivering the next stages (e.g. for the Options Analysis and the Business Case);
  - Seek approval to proceed to the next stage (i.e. the Options Analysis) with assignment of appropriate resources; and
  - Seek approval to proceed as a planning project on the RIP, if applicable.

Outputs Summary

- A Project Proposal (need), Template R1001 (Mandated),
- Functional Specification (required outcomes),
- Briefs for work packages (consultancy requirements),
- Identified Risks to the Project,
- A plan to deliver the Options Analysis and the Business Case,
- A budget to deliver the Options Analysis and the Business Case.

4.4.2 Options Analysis

When preparing a solution options analysis the first step is to review the project proposal to understand the need and required functional outcomes. Developing this clear understanding of the requirements with the sponsor will assist in the management of the project scope by not allowing it to drift to include non imperative design 'niceties'. Refer Chapter 6 for information on scoping a project.

After developing a clear and common understanding of the requirements the first step in the development of the options analysis is to:

- Examine any relevant pre-project acquired data and/or information that could assist in the development of the preferred solution,
- Identify all plausible problem solution options (technical and non-technical) using a risk management approach that will satisfy the specified requirement(s) (options could include alternative alignments, different layouts, coordination of traffic signals, or public transport schemes),
- Identify required work packages, e.g. for consultations, studies or investigations, prepare relevant briefs and engage consultants to deliver them,

The identification and development of options includes the development of all the plausible solution options to the extent necessary for realistically conducting an options analysis to select the preferred option. *This process includes addressing all of the issues identified in the Design Development Process- Refer Section 4.3.* The extent of consideration will range from a thought process for straight forward low risk projects (Type 3 Project) to fully explored and well documented options for complex and/or high risk and/or major projects (Type 1 Project). The selected option for major and/or more complex and/or high risk projects will require Regional Executive Director approval whilst straight forward projects would normally be approved by the District Director (refer Figure 4.7). However, regional procedures will specify the local

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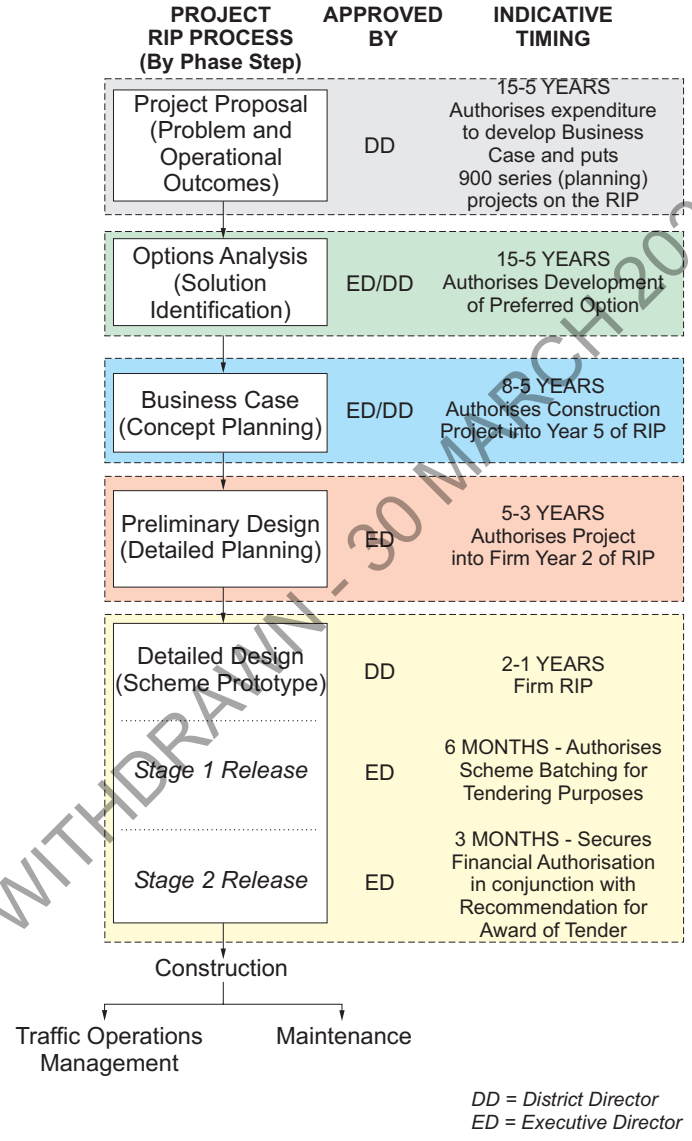

Figure 4.6 Planning and Design Process - Design Development Deliverables

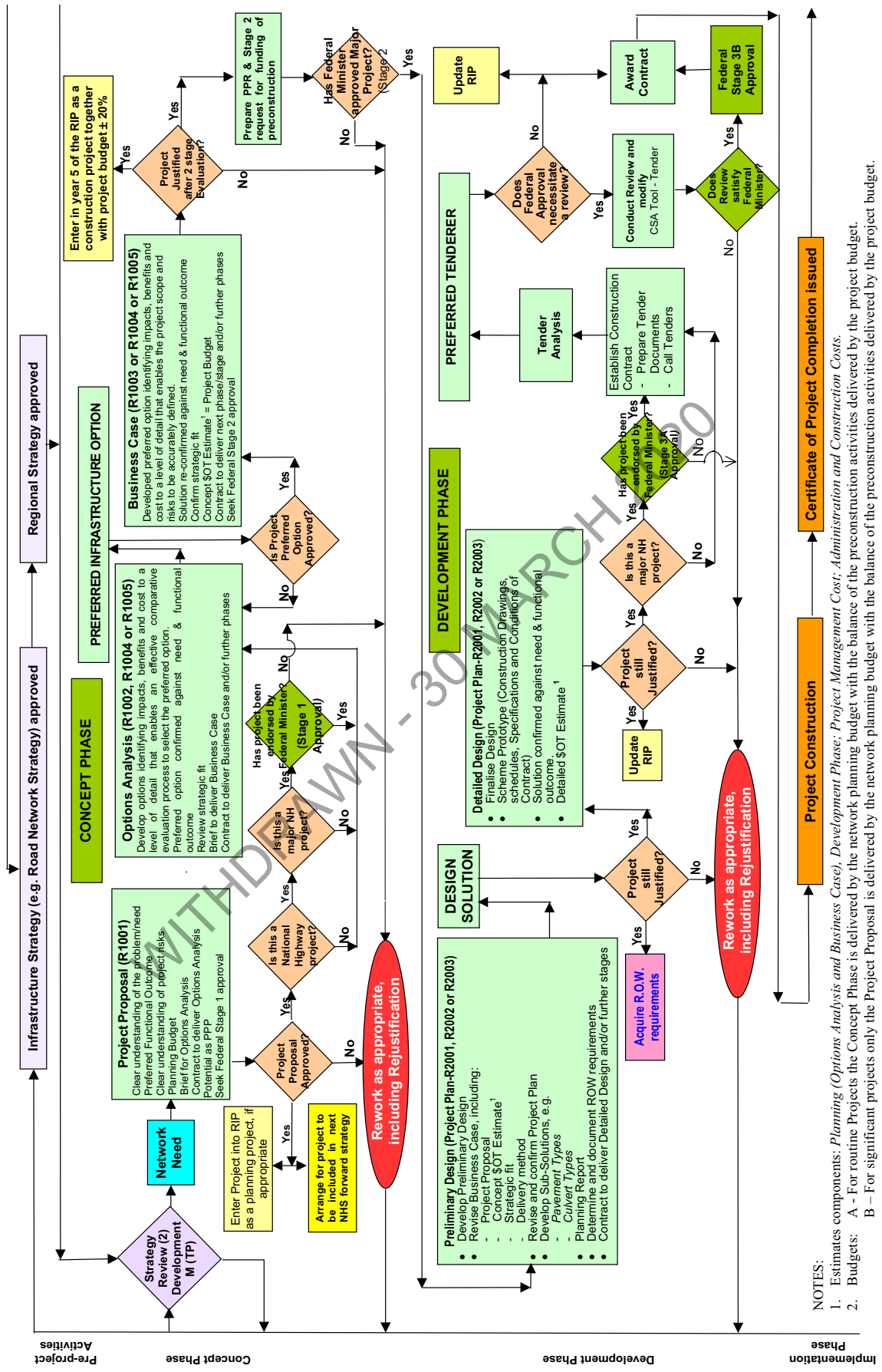

Figure 4.7 Design Development Flowchart

requirements in this respect. The preferred option (adopted solution) during its development for business case purposes starts to establish the tangible scope of the project.

The development and assessment of solution options must utilise a Value Management approach (refer Section 3.3 in Chapter 3) that assesses impacts, benefits and cost to a level of detail that enables a comparative evaluation to clearly determine the preferred option, including conducting Road Safety Audit (Feasibility) for each option, where relevant. (It is important that the 'do nothing' option is considered as part of this analysis to provide a baseline against which the costs and benefits can be measured). The process must ensure the options are within the defined scope of the project.

The process must also ensure project environmental sustainability through appropriate environmental assessment and management (refer to the Road Project Environmental Manual for guidance).

Preparing the Options Analysis report and completing Template R1002 for Type 1 Projects, Template R1004 for Type 2 Projects and Template R1005 for Type 3 Projects to:

- Seek approval of the preferred option,
- Seek approval to proceed to the next stage, i.e. the Business Case,
- Confirm planning budget requirements.

The following discussion is intended to cover all of the considerations, regardless of the project type, and the proponent will have to determine the level of detail required to suit the accuracy required of the various mandated project cost estimates.

It is required that the details of the Project Charter be kept under review during this phase of the process. Issues change and develop and some of the conclusions reached at the earlier phase may move out of alignment with the new requirements.

Outputs Summary

- An Options Analysis Report
- A completed Options Analysis Template (R1002, R1004 or R1005) (Mandated)
- Planning REF,
- Briefs for work packages (consultancy requirements)
- A plan and budget to deliver the Business Case,
- Design Development Report (Form M4211 or M4212)
- A Risk Management Record (Form M4213).

4.4.3 Business Case

When preparing a business case the first step is to review the project proposal and options analysis report to understand the need and required functional outcomes. Developing this clear understanding of the requirements will assist in the ongoing management of the project scope. Refer Chapter 6 for information on project scoping.

After developing a clear and common understanding of the requirements with the sponsor the first step in the development of the business case is to develop the preferred option to the extent necessary to reliably produce a project cost estimate (concept estimate) to within ± 20 of the total project cost (refer to the Project Cost Estimating Manual for guidance). *This process includes addressing all of the issues identified in the design development process together with other issues that may come to light from time to time as the project develops, e.g. the discovery of rare and endangered species*. For very large projects (Type 1) this requirement may take several years to develop and result in the development of the preferred option that approaches a preliminary design. Small routine projects may take less than a week to perform this activity. The development of the preferred option establishes a reasonably well defined scope of the project.

Once the concept estimate has been produced it is then necessary to justify the project through a two stage evaluation process (BCR and 2nd stage

evaluation). Should project evaluation fail to justify the project the planner/ designer must seek an acceptable solution. This may require the scope of the preferred option to be modified or in extreme circumstances a revisit to the options analysis step or even the specified need may be necessary.

The development of the business case must be in accordance with the requirements of Section 4.4.3 together with any other requirements identified during the development process. The approval of the business case template authorises the project to be included in the RIP as a construction project and authorises expenditure to produce the development phase.

For Federally funded projects, it is necessary to prepare an additional report (Project Proposal Report (PPR) using the table of contents guide shown in Figure 4.8). This report must meet the Federal Government requirements specified in the "Australian Land Transport Development Program Administrative Procedures" (1992).

Preparing the Business Case Report and completing Template R1003 for Type 1 Projects, Template R1004 for Type 2 Projects and Template R1005 for Type 3 Projects to:

- Seek approval to include the project in RIP, and to proceed to the next stage, i.e. the Preliminary Design,
- Confirm Development Phase budget requirements.

Outputs Summary

- A Business Case Report, including a Concept Estimate,
- A completed Business Case Template (R1003, R1004 or R1005) (Mandated),
- A Project Proposal Report (National Highway Projects only)
- EIS if required,
- Briefs for work packages (consultancy requirements),
- A plan and budget to deliver the Preliminary Design and the Detailed Design,
- Design Development Report (Form M4211 or M4212)
- A Risk Management Record (Form M4213).

Preferred Option Review

The basic assumptions and criteria established at the beginning of the process should be reviewed to ensure that they are still valid. Issues that have arisen during the process should be resolved before proceeding. Any design changes required have to be identified and the impact of the changes assessed. Will the changes affect the viability of the project? Is the project still justified as planned or should a revised approach to the project be taken?

If a major change to the project is required, the process has to return to the earlier phases to resolve the issues.

If the review confirms the project, then the preliminary design can proceed.

The following discussion is intended to cover all of the considerations, regardless of the project size or complexity, and the proponent will have to determine the level of detail required to suit the accuracy required of the various mandated project cost estimates.

This phase may require further Work Packages identified from the Business Case process. These may be an extension to existing studies or new studies identified from the work done so far. The extent of these needs should have been identified when developing the solution options but the process of further detailing may reveal the need for additional information.

All items required for the project to function have to be explored in this stage. This will require detailed final calculations leading to the refining of the design of all elements and final decisions on the options available -

- Road Geometry - alignment and cross section;
- Structures;

Typical Project Proposal Report Contents Page (Federal Stage 2 requirement for AusLink Projects)

1. Introduction

1.1 Purpose

(To provide the justification, cost, scope, nature and design features of the project and timeframe).

1.2 Design Statement

(Outline the standards proposed for design and construction giving the maximum or minimum values wgere appropriate, in sufficient detail to enable the Commonwealth to be assured that adequate and appropriate standards are to be used)

2. Economic and Social Justification

2.1 AusLink Justification

(the justification and objectives of the project in relation to the AusLink strategy).

2.2 Economic and Social Evaluation.

(Findings and conclusions of economic and social evaluations).

2.3 Traffic Projections

(Traffic Estimates for 5, 10 and 20 years into the future disaggregated into truck and other traffic).

2.4 Crash Information.

(Traffic accident report on the crash history of vehicles on the section of road concerned).

2.5 Design Consistency.

(Assurance that standards are consistence with adjacent sections).

2.6 Environmental Compliance.

(Certification of compliance with Federal and State environmental legislation).

2.7 Regional and Community Impacts

(Relevant regional and/or community implications of the project).

2.8 Project Completion

(Estimated time for completion of the project).

3. Physical Details

3.1 Project Location and Context

(Maps showing location of the project in the road network, zoning and use of abutting land).

3.2 Significant Project Components

(Maps showing the position of bridges, intersections and interchanges, as relevant).

3.3 Design Profiles

(Drawings showing typical longitudinal and cross section with number and width of lanes, shoulder width, lateral clearance and right of way width).

3.4 Pavement Design

(Pavement construction details including design life).

3.5 Design Standards

(Design Information including confirmation that Standards and Guidelines for the Construction of National Highway will be met, or details and reasons of proposed departures from them).

3.6 Staged Openings to Traffic

(Staging proposals, for bringing segments of the route into use before construction of the full length is completed).

3.7 Landscaping, Rest Areas and/or Service Areas

(Brief notes on landscaping, rest areas and/or service areas proposed).

4. Cost and Timeframe

4.1 Project Cost Estimate

(Cost of the project with a break-up into appropriate sub-items (expressed in outturn dollars).

4.2 Project Cost Estimate Accuracy

(Basis and level of confidence of the cost estimate).

4.3 Delivery Program

(Estimated completion date and expected annual expenditure).

5. Appendices

Attach relevant and supporting maps, drawings reports, etc.

Figure 4.8 Project Proposal Report

- Interchanges;
- Channelised intersections;
- Drainage - cross drainage, longitudinal drainage and pavement drainage;
- PUP relocations;
- Pavement design (notional);
- Safety barriers;
- Signing and marking;
- Lighting;
- Fencing;
- Accesses;
- Constructability;
- Construction sequencing; and
- Environmental management.

4.4.4 Preliminary Design

When preparing the Preliminary Design the first step is to review the project proposal, options analysis report, the business case report and to understand the need and required functional outcomes together with the approved design elements to date. Developing this clear understanding of the requirements will assist in the ongoing management of the project scope and allow further development of the preferred option to preliminary design stage without rework and within budget.

The further development of the preferred option is required to the extent necessary to reliably produce a project cost estimate (preliminary design estimate) to within ± 12 - 15% of the total project cost (refer to the Project Cost Estimating Manual for guidance). *This process includes addressing all of the issues identified in the design development process together with other issues that may come to light from time to time, e.g. the discovery of cultural heritage artifacts*. The development of the preferred option establishes a very well defined scope of the project.

Once the preliminary design estimate has been produced it is then necessary to confirm that the project is within budget and justification. Should the project fall outside the budget an acceptable solution must be sought. A review of the business case must be undertaken to confirm scope creep has not occurred during the preliminary design process. In extreme circumstances a review of the preferred option may be necessary in order to deliver a project within the budget approved in the business case.

If the review confirms the project, then the preliminary design can proceed.

The development of the Preliminary Design must be in accordance with the requirements of Section 4.4.4 together with any other requirements identified during the design development process. The approval of the preliminary design authorises the project to be included in firm year two of the RIP.

A Planning Report is required to be produced using the table of contents guide shown in Figure 4.9.

The proposed procurement strategy for delivering the project must be reviewed and confirmed.

Outputs Summary

- A Planning Report, including a Preliminary Design Estimate,
- Briefs for work packages (consultancy requirements),
- Approved alignments and layouts,
- Approved ROW requirements
- A plan and budget to deliver the Detailed Design,
- Updated Design Development Report (Form M4211 or M4212)
- Updated Risk Management Record (Form M4213).

Preliminary Design Review

The following discussion is intended to cover all of the considerations, regardless of the project size or complexity, and the proponent will have to

determine the level of detail required to suit the accuracy required of the various mandated project cost estimates.

This phase may require further minor work packages. The extent of these needs should have been identified at the business case stage but the process of further detailing may reveal the need for additional information.

4

All items required for the project to function have to be detailed in this phase. This will require detailed final calculations leading to the refining of the design of all elements and final decisions on the options available -

- Road Geometry - alignment and cross section;
- Structures;
- Intersections;
- Interchanges;
- Drainage - cross drainage, longitudinal drainage and pavement drainage;
- PUP relocations;
- Pavement design;
- Barriers;
- Signing and marking;
- Lighting;
- Fencing;
- Accesses;
- Constructability;
- Construction sequencing; and
- Environmental management.

4.4.5 Detailed Design

When preparing the Detailed Design the first step is to review the project proposal, options analysis report, the business case report, the preliminary design report and to understand the need and required functional outcomes together with the approved design elements to date. Developing this clear understanding of the requirements will assist in the ongoing management of the project scope and allow further development of the preferred option to the detailed design stage without rework and within budget. Figure 4.6 illustrates position of detailed design in the overall process.

The further development of the preferred option is required to the extent necessary to:

- reliably produce a project cost estimate (detailed design estimate) to within ± 10% of the total project cost (refer to the Project Cost Estimating Manual for guidance).
- provide appropriate construction information to allow construction to progress with minimum interpretation of the drawings and/or the electronic model.

This process includes addressing all of the issues identified in the design development process together with other issues that may come to light from time to time. The development of the preferred option to the completion of detailed design establishes a full and detailed scope of the project.

The development of the detailed design must be in accordance with the requirements of Section 3.4.5 together with any other requirements identified during the development process.

This part of the process finalises all of the details of the design within the limits of the project as defined in the project proposal and functional specification.

This is a process of refinement and confirmation of the details identified during the preliminary design stage. All of the issues identified in Sections 4.4.4 and 4.4.5 have to be revisited with additional detail to complete the design. Essential elements of the process are discussed below.

Detailed Design

This phase may require further minor:

- detailed survey of specific PUP installations;
- geotechnical investigation;

Typical Planning Report Contents Page

Figure 4.9 Typical Planning Report Contents Page

- hydraulic analysis; and
- traffic assessment.

The extent of these needs should have been identified at the preliminary design stage but the process of further detailing may reveal the need for additional information.

All items required for the project to function have to be detailed in this phase. This will require detailed final calculations leading to the refining of the design of all elements and final decisions on the options available -

- Road Geometry - alignment and cross section;
- Structures;
- Interchanges;
- Channelised intersections;
- Drainage - cross drainage, longitudinal drainage and pavement drainage;
- PUP relocations;
- Pavement design;
- Safety barriers;
- Signing and marking;
- Lighting;
- Fencing;
- Accesses;
- Constructability;
- Construction sequencing; and
- Environmental management.

This is a process of refinement and confirmation of the details identified during the preliminary design stage. All of the issues identified in Sections 4.4.4 and 4.4.5 have to be revisited with additional detail to complete the design. Essential elements of the process are discussed below.

Final Review

The detailed design estimate of cost of the project will now be available and the final cost of the job will be known. It is necessary to review the cost of the job and assess its affordability before proceeding to finalise the documentation and call tenders. A decision will be required on the ability to proceed with the project as designed if the cost is excessive. The possible outcomes of the review are:

- Proceed with the project as designed with appropriate adjustments to the RIP;
- Proceed with the project but with a reduced length of job to more closely match the budget (the remaining parts of the job to be reprogrammed in the RIP);
- Proceed with the job but with reduced scope of works; or
- Defer the project.

Outputs Summary

- Detailed Design Report,
- Environmental Design Report,
- Verified and Certified Design,
- Scheme Prototype,
- Detailed Design Estimate,
- Completed Design Development Report (Form M4211 or M4212),
- Completed Risk Management Record (Form M4213),
- Contract Documents.

Documentation

Contract Documents

Contract documents are to be prepared in accordance with Main Roads standards. Supplementary Conditions of Contract and Supplementary Specifications may be required. These documents will include the certified design plans and specifications, which must be prepared

to high standards of accuracy and completeness (see Chapter 6 - Design Management).

Detailed Design Report

A Detailed Design report is required in order to:

- Demonstrate that the design has met all of the requirements of environmental and other impact management plans;
- Document any special features of the design that must not be varied in construction;
- Document particular features of the design that require specific maintenance procedures to be adopted;
- Document the assumptions made during the design; and
- Record the various reports and other inputs used in completing the design.

The Detailed Design Report should address at least the following issues:

- Designer's certification;
- Notes on design interface checks (essential that the interfaces between different design disciplines are thoroughly checked);
- Notes on sensitive environmental issues;
- Notes on sensitive community consultation issues;
- Notes on negotiations with adjacent property owners plus cross reference to any agreements;
- Notes on sensitive drainage issues;
- Justification for construction sequence plans (if required);
- Justification for provision for traffic requirements;
- Notes on sensitive landscaping issues;
- Methodology used to calculate the scheduled quantities (or the actual calculations) including assumptions made to assist the Superintendent certify quantities for payment - refer Section 2.2 of MRS11.01;
- Calculations for topsoil quantities including basis of assumptions;
- Notes on unusual design aspects or unique design aspects not to be amended in the field;
- Notes on any features of the design requiring particular maintenance procedures to be adopted;
- Notes on unusual specifications and the reasons for them;
- Cross reference geotechnical reports and highlight potential problem areas;
- Notes on all statutory approvals;
- Notes on any other issues which should be brought to the attention of the Administrator of the Construction Contract;
- Other issues (see below);
- Notes on Scheduled Items including (if ordered) items and unusual items;
- Annotated Cross Sections (if not included in the contract documents);
- Data on Principal's Materials or Works including Public Utility Plant works, Traffic Signals and Red Light Cameras, etc;
- Copy of estimate for the Local Government's Contribution and correspondence with the Local Government; and
- Notes on issues to be discussed at the pre-start meeting (refer Construction Administration System (CAS) Manual - Procedure P-003: Prestart Meeting and to the Standard Form SF-004: Prestart Meeting Agenda). Note: It is very important that the superintendant and the construction contractor clearly understand the intent of the overall design, the functions of the various design components and any unusual/ special features of the design.

The following documents should be appended to the Report:

- Planning Report;
- All addenda prepared since the planning report was completed (Addenda to REF, EMP, Community Consultation Report, Geotechnical Reports, etc as applicable)
- Environmental Design Report (if not separately submitted);
- Agreements with property owners to construct Accesses;
- Agreements with property owners on types of fences along resumption boundaries;
- Any other agreements with property owners;
- Constructability Report;
- Construction Sequence Plans (if any and not included in the contract documents);
- Copy of all Statutory Approvals;
- Report on status of Public Utility Plant relocations including Drawings, Specifications, etc;
- Offers for relocation of Public Utility Plant;
- Agreement for Point of Supply for Lighting, Signals, etc;
- Written Offer for installation of Traffic Signals;
- Construction Traffic Management Report;
- Risk Analysis Report;
- Construction Programme;
- Resumption and Access Limited Plans.

As a guide to the content of the report, the following should be considered:

1. *Environmental Issues*

Highlight the most environmentally significant issues and their importance; detail any negotiated outcomes to be achieved; and cross-reference the relevant Sections of the Review of Environmental Factors, Environmental Management Plan (Planning), etc.

Any other documents that clarify these issues should be appended.

2. *Unusual Design Aspects or Unique Design Aspects*

These could include:

- timing of installations (fencing, noise barriers, drainage, high tide effects on the works, etc);
- retaining walls;
- new types of materials;
- alternative construction method/s.

3. *Statutory Approvals*

The Designer is usually required to obtain all statutory approvals that the Principal requires to effect the delivery of the project.

The Approval Conditions (on both the Designer and the Principal) must be included in the report to the Construction Contract Administrator.

4. *Other Issues*

The Designer should provide advice on all other issues that may affect the satisfactory delivery of the project.

These could include but are not limited to:

- Items of Cultural Heritage;
- Local events;
- Other local issues;
- Discussions with landowners affected by resumption;
- Advice of possible unexploded ordinance;
- Local Government Involvement.

5. *Principal's Obligations (Materials or Works or Contingencies)*

For all Principal's Materials, the Designer should include the following as applicable:

- For Public Utility Plant relocation works, provide the following:
  - Specifications and Plans including backfill treatments to all trenches;
  - details of limitations on access to the site;
  - provision for traffic requirements;
  - details of any special treatments, etc;
  - quotes for Relocation of Services (including itemised schedules for complex works);
  - any specific timing requirements;
  - name and other details of contact personnel within the Utility Service Providers;
- All other Principal's Materials (Correspondence, Plans, Specifications and Estimate required for all items listed as Principal's Materials or Works);
- Quotes for traffic signal and red light camera works (if applicable).

6. *Issues to be Discussed at the Pre-start Meeting*

These could include but are not limited to:

- Design Intent, including any unusual features of the design and design functionality issues for each design component;
- Environmental Issues;
- Reasons for working hour restrictions;
- Reasons for other working limitations (noise, vibration, road closure restrictions, etc); and
- Reasons for other specification requirements.

Environmental Design Report

The requirements for, and the rationale of, the Environmental Design Report are set out in the Road Project Environmental Management Processes Manual. This report is to be prepared after the completion of detailed design and must show the ways in which the environmental requirements of the EMP (Planning) have been incorporated into the design and contract documentation.

Post Construction Review

A review of the design must be undertaken in a post construction review. This should include:

- review of standards used and their appropriateness;
- construction difficulties encountered;
- elements that could have been constructed more economically with a different design;
- feedback from the construction team;
- feedback from users;
- feedback from adjacent residences, businesses and other institutions; and
- feedback from other stakeholders.

The learnings from this review should be documented in the "Consultant Performance Report" (Part B). The learning results should be considered for incorporation in this Manual as appropriate.

4.5 Whole of Life Considerations

4.5.1 General

When developing options and deciding between them, both the initial capital cost of the facility and the ongoing cost of operations and maintenance must be considered. Decisions on the form of the design, the materials used and the staging of the works can have an impact on the whole of life costs of a project. Adopting a cheap solution for the initial construction will not necessarily produce the minimum whole of life cost.

4.5.2 Staging

Whole of Life considerations would indicate that current works should provide for the future stages to be implemented with minimal effect on the current works. In addition, they should make for ease of construction of the future works. Hence, a pavement may be extended to provide a clean joining point for a future extension to the carriageway clear of the traffic using the first stage.

Other examples include:

- Providing space for piers for a future overpass;
- Designing for a future overpass rather than an underpass;
- Allowing space for future widening into the median;
- Allowing for duplication of a single carriageway in the same right of way;
- Providing for spoil to be placed on a future carriageway;
- Providing space for PUP clear of the carriageways;
- Locating PUP so that it does not have to be relocated for future stages of the road development;
- Minimising the temporary works required for future stages;
- Allocating corridor space to future on- or off-road bicycle facilities.

4.5.3 Materials

Selection of the materials to use for pavements, bridges, safety barriers and noise barriers can have a marked effect on both the initial cost and the long-term costs of a project.

Pavements

The choice of pavement material and style of pavement is one between low initial cost and high recurring costs of maintenance and rehabilitation, and high initial cost and low ongoing costs. The whole of life costs can be readily estimated and the decision can be made on economic grounds. In some cases, the volume of traffic will be the determining factor but availability of material is often the crucial issue.

Bridges

Concrete is the material of choice for long term low maintenance costs (assuming that the concrete is manufactured correctly with durable materials). Steel structures require ongoing maintenance (painting) that may negate any initial cost advantage they may have. In arid western areas, maintenance needs are significantly less and galvanized steel girders may represent an economical solution because the savings in transportation costs of girders to site, may more than adequately offset any maintenance costs. A further consideration is the availability of suitable maintenance personnel and the accessibility of the structure.

Safety Barriers

Choice of type of barrier involves considerations other than the material type since the circumstances prevailing may not allow all types to be used (see Chapter 8 of the Road Planning and Design Manual). However, if different types are suitable, the cost of replacement and ongoing maintenance is a consideration. Concrete barriers have the lowest ongoing costs since they are not usually damaged in a collision and there is little other maintenance required.

Noise Barriers

The lowest cost noise barriers are usually made of treated timber. However, timber is not as long lasting as concrete and other materials and it may require attention to prevent deterioration over its life. In addition, timber noise barriers are susceptible to damage by fire – a risk that should be assessed. The whole of life costs can readily be assessed and an appropriate decision reached.

4.5.4 Maintenance Needs

The ongoing maintenance costs of the various features of a design must be considered in the decision making process. Consider the maintenance requirements of the following:

- Pavements (see Section 4.5.3);
- Pavement edges – seal shoulders to reduce this;
- Outer wheel path pavement deformation – sealing shoulders reduces this if the depth is adequate;
- Batter slopes;
- Line marking – materials used have different durability;
- Flush seal pavements – require reseal every seven years on average;
- Debris removal from drainage inlets and outlets (affects size and type of opening, use of grates);
- Surface drainage features (natural materials, concrete lining, channel shapes, use of bicycle safe grates);
- Materials requiring painting;
- Safety barriers (see Section 4.5.3);
- Landscaping elements (see Section 4.5.5);
- Access for maintenance personnel and vehicles.

4.5.5 Landscaping

The whole of life costs of landscaping is heavily dependent on the type of treatments adopted and the standard of appearance desired - see Figure 4.7 and the Road Landscape Manual.

Issues to be considered include:

- Growth habit of trees and shrubs (know the expected size of trees and shrubs at maturity);
- Long term effects on sight distance;
- Impact of root growth – intrusion into drainage lines, heaving of pavements and footpaths;
- Watering costs;
- Mowing, pruning and weed control.

4.5.6 Public Utility Plant

The objective should be to reduce the need for future road openings to zero. This is an unlikely possibility but the fewer road openings, the lower the long term costs for the road. To minimise the number of road openings, careful attention to the location of the PUP in the first instance is essential. In addition, providing sufficient space in the area allocated to the individual services, and installing enough ducts to provide for future expansion will reduce the need for future openings. (See also Section 4.5.2 above.)

4.5.7 Rehabilitation

Various components of the road require periodic rehabilitation to maximise the service life of the component. In particular, road pavements other than concrete require rehabilitation at intervals depending on the type of pavement. The design should recognise this and make provision for this process to be carried out with as little disruption as possible.

Clearances to overhead structures should be provided to allow overlays to be done without breaching the requirements for that structure.

Where allowance is made for future overlays, the width of formation must also be adjusted so that this can be accommodated.

4.5.8 Road User Costs

Road user costs represent a significant part of the whole of life costs of a road. Benefit cost analyses account for these costs that are affected by the following:

- Road roughness;
- Grades;
- Length of travel;

- Accident rates;
- Delay, including delays caused by flooding.

In addition to the immediate impact of particular features of the design, planners and designers have to take account of the rate of change in that feature with time and usage. In particular, road roughness increases with time and usage, the rate of increase depending on the type of pavement and its durability.

Delay also may change with time as traffic volumes and congestion increase. Potential flooding delay remains constant for the road as long as the road levels remain constant.

4.5.9 Crime Prevention Through Environmental Design

Crime Prevention through Environmental Design (CPTED) is an important consideration in reducing the incidence of crime near or adjacent to roads. Detailed discussion with Police and Community groups is required to ensure that appropriate measures are taken.

References

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Relationship to Other Chapters

- Logically follows and complements Chapters 1 and 2;
- Traffic forecasting and travel demand overview related to parts of Chapter 5 of the Road Planning and Design Manual; and
- Further details of pedestrians and cyclists follow in Chapter 5 of the Road Planning and Design Manual.

Appendix 4A: Procedure for Evaluating Project Planning (Solution) Options

Purpose and Scope

The purpose of this procedure is to provide a model for evaluating and selecting the most appropriate solution when more than one planning option exists. The model is based on a process using a Ranking Matrix.

Definitions

Feature: a feature is a distinctive or characteristic aspect of a project.

Attribute: an attribute is a characteristic quality appropriate to a feature used in the evaluation process.

Process

Features and Attributes

The first step in the process is to decide from the Concept Phase which features of the project will significantly impact planning decisions within the corridor. Examples of features are as follows:

- Earthworks Balance;
- Flood Immunity of Road/Bridge;
- Local Access;
- Environmental Issues such as noise and pollution;
- Staging of Construction;
- Resumptions;
- Effect on National Parks etc;
- Alignments.

When choosing features for the evaluation process keep it to a manageable number, say six or seven, and do not choose features that will have a common treatment for each option, eg 'Design Speed' would have the same value in each option, say 100 km/h. The number of features required in the matrix will depend on the complexity of the project. The ranking matrix should be completed early in the planning process preferably before being involved with any of the planning options. It is important to note that the cost estimate does not form part of the matrix at this stage of the process.

To complete the matrix it is advisable to establish a committee of say four (maybe more for complex projects) which is representative of all aspects of the project. This may well involve using a person from the community consultation process if warranted. The committee will then rank one feature against the other until all boxes are completed. This is a pair wise ranking such that two boxes are completed for each decision.

The process is effective if not too much time is spent on this. If the majority think one feature has greater impact it is scored as 2, and the other 0, whereas if there is a balance of opinion or any indecision do not spend time discussing the pros and cons but score them 1 each.

The scores for each feature are then tallied and ranked in order. This then allows you to assign % weights to each feature.

Example:

To assess whether 'Environmental Effects' were more important than the 'Effect of Flooding on Adjacent Properties', the committee was unanimous in its decision that the latter was more important, therefore a 2 is placed in the column under 'Effect of Flooding' and a 0 in the column under 'Environmental Effects'. Similarly when comparing 'Local Access' with 'Staging of Construction' there was a balance of opinion so a 1 was placed in each column.

The next step in the process is to evaluate each option under the relevant features. Only personnel experienced in the particular feature should complete the option evaluation. Each feature may be scored directly or by breaking it into a number of attributes that may be weighted and scored individually as shown in the following example for 'Horizontal and Vertical Alignment'.

Attribute	Weight
1. Horizontal Speed and Visibility	25%
2. Vertical Speed and Visibility	20%
3. Economy of Earthworks	25%
4. Coordination of Alignment	15%
5. Overtaking Opportunities	15%

The weightings in this section may be handled directly or by the matrix method.

Therefore in this example Option 3 (highest score) best accommodates the significant features of the project.

Estimates

We now have to address the estimate of cost for each option. In most cases there will be a need to balance the benefits flowing from the particular treatment of a feature against the cost of the treatment. The aim is to determine which option is best value for money.

The example below illustrates how the cost of different treatments may be compared for various options.

Example:

Option 1 has a comparative estimated cost of $3.6m and Option 3 a comparative estimate of $3.8m. We can now examine which attribute will change if we choose the cheaper option. From the tables above the difference occurs in the feature 'Horizontal and Vertical Alignment' under the attribute 'Earthworks'. It may be that cost is reduced by an option which has less favourable cut and fill batters slopes. A decision is now required on whether the $200,000 cost saving balances the reduced quality of the final product. The final decision will be made by the District Director / Regional Director.

For an actual evaluation the process may need to be iterative and the cost difference may be apportioned in part to several attributes. The evaluation team has the task of apportioning the cost difference and recommending a course of action to achieve best value for money.

Final Evaluation

To complete the procedure it is important to check that the following points were adequately addressed:

- Appropriate features chosen for the Ranking Matrix;
- A representative committee to establish the rankings;
- Experienced personnel to rate each option under a particular feature;
- The selected option gives the best value for money.

This procedure needs only be an complex as the project being undertaken ie it may be reduced or expanded but it must provide an accountable process of selection based on the principle of value for money.

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Chapter 5

Project Scoping

Manual Contents

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Chapter 5 Amendments - June 2005

Revision Register

Issue/ Rev No.	Reference Section	Description of Revision	Authorised by	Date
1		First Release	D. Hicks/ R.Guppy	Mar 2003
2		General updates following feedback	D. Hicks	Jan 2004
3	New Chapter 5 - Project Scoping	Original Chapter 6 now chapter 5, following the incorporation of the original Chapter 5 - The Development Phase into the new Chapter 3.	D. Hicks	Feb 2005
4		First Edition Release	D. Hicks	June 2005

Chapter 5
Project Scoping

5.1 Introduction

5.1.1 Understanding Scope

It is important to have a common understanding of what is meant by project scope. For road infrastructure proposals it is essential for project costs to be tightly managed and controlled. In this context there are two aspects of scope that need to be managed effectively during the delivery of the preconstruction processes, i.e.:

- The What or Product Scope (functional outcome); and
- The How or Project Scope (work necessary to deliver the functional outcome).

The OnQ project management methodology identifies the activities for these two aspects of scope as:

1 **Work Management** - describes the project work activities necessary to deliver the product in accordance with the specified requirements (functional specification).

2 **Project Management** - describes the project management activities necessary to manage the delivery of the product.

Road infrastructure project scope is defined within the context of the required outcomes and in accordance with the specified corporate objectives for the link concerned, i.e. "Fitness for Purpose".

Defining "Fitness for Purpose" is a critical prerequisite. The process requires articulating the problem (specific problem to be addressed), the need (functional requirements) and the determination of constraints on the options and the final solution. In this context "Fitness for Purpose" means:

1. The solution meets the Corporate Objective for the development/ maintenance of a specific part of the road network, e.g.:
   - The outcome satisfies the Investment Strategies,
   - The solution is economical,
   - The solution has the appropriate level of safety.
2. Compliance with the appropriate corporate standards in the development of the solution (Road Planning and Design Manual, *including the extended design domain for existing roads only*, Road Drainage Manual, Drafting and Design Presentation Manual, Pavement Design Manual, etc.);
3. The application of the standards to achieve a solution that is in harmony with the site/location conditions: - e.g.
   - Ground conditions;
   - Environmental circumstances;
   - Local community considerations/ restrictions (noise, vibration, local accesses, night work, visually acceptable, etc.);
   - Traffic management through the work site.

In the first instance, project operational objectives are described in a functional specification (see Section 5.1.5). The brief must clearly specify the requirement. This is important as it puts a boundary around the project deliverables to prevent scope creep during the development of the project. In this respect 'in scope' and 'out of scope' statements help to tightly define the requirement. Scope definition includes functionality requirements, maps, dimensions, plans, lists of works to be undertaken, descriptions of major components (e.g. intersections), specifications and assumptions on

what is to be encountered during project delivery (see Section 5.1.2).

In the second instance, it is necessary to identify all of the considerations, including the issues and risks that impact on the actual work comprising the deliverables. These requirements are established by investigations (*e.g. native title, geotechnical, environmental, cultural heritage, public utility plant*), consultations (*e.g. community, local member, local government, native title*), studies (traffic, hydraulic), and reports (*e.g. road safety audits, developmental proposals*).

Although the level of detailed information improves as the project life cycle unfolds, project managers should ensure adequate information is available to define project scope consistent with the level of accuracy possible at that stage in the project lifecycle.

Project scope must be carefully monitored throughout the whole project life cycle to ensure the project benefits and the infrastructure provided are consistent with that approved by the client.

5.1.2 What Defines Scope

Effective project scope definition leads to:

- Effective cost control;
- Effective time management; and
- Effective quality in outcomes.

Project scope is defined in a number of dimensions, each of which has an influence on the final outcomes, including cost, timing and quality of the product, and on the business or functional reasons for undertaking the project

Scope incorporates:

- **Location** - site remoteness, transportation, terrain type, adjoining industry (e.g. airports), presence of other infrastructure or developments (proposed, planned, perceived), population density (rural, urban), local features, etc;
- **Geotechnical** (e.g. availability of materials, construction conditions)
- **Physical dimensions** - length (start and finish point), width, number of lanes, number of carriageways;
- **Service standards** - traffic capacity, traffic delay, intersection treatments, access control, accident reduction, closure due to flooding in flood prone areas, amenity for local residents and businesses, disruption during construction;
- **Quality standards** - design speed, design standards, design life, traffic loading on structures, technical specifications, tolerances, architectural features, urban design;
- **Environment** - Noise levels, rainfall intensities, erosion and sediment control, flora and fauna preservation, heritage protection;
- **Timing** - time for completion or putting the infrastructure into service, or achieving designated milestones;
- **Estimate of cost** - while determined by other aspects of scope, the cost estimate puts a boundary on the project cost; and
- **Programming and Budget** - total funds provided, distribution of funds over the life of the project.

Some of the generic influences on the project scope include:

- Design standards;
- Traffic loading on structures;
- Technical specifications;
- Tolerances;
- Environmental standards; and
- Regulatory requirements.

It is important that the organisation has a clear understanding of these issues as changes to these can still affect the time, cost, function and other project outcomes.

The definition of the project scope must state the assumptions, constraints and exclusions that have been used. This can mean that issues not included in the list above can emerge (e.g. needs of a culturally diverse community). These should be included in the description of the scope if appropriate.

The elements listed above should be incorporated in the project scope with the appropriate level of detail. In addition, considering the required outputs of the applicable phase provides further detail for the scoping development. Some details are refined as the project develops and the project manager should ensure that these are documented and progressively approved by the Client.

Charts 4, 5 and 6 (Chapter 3) provide generic details as to the approvals, inputs and outputs of each phase.

5.1.3 Importance of Accurate Scope Description

Since the project scope defines what is to be built, it is a key factor in delivering the Client's desired business, or road network outcomes. The risks of poorly defined scope include:

- Inaccurate estimates creating problems in funding;
- Project not being viable economically and in other ways;
- Delivered project not being fit for its intended purpose;
- Functional, social, strategic, environmental outcomes not being realized;
- Influence of stakeholders/ interested parties not able to be controlled, e.g. community pressure to make changes during construction;
- Less control occurring on the project, particularly in design (e.g. 'gold plating' vs. fit for purpose), community expectations, project and project management performance;
- No clearly defined scope of works being signed off by Client / Sponsor;
- No baseline for controlling future changes to the project hence less control on 'scope creep';
- Delayed approval process occurring as a result of the approving authority not being clear on the impacts of what is being approved. This can include funding, environmental approvals, and Government endorsement;
- No criteria for gauging Client satisfaction with the completed project;
- Uncertainty and inefficiency in budgeting, programming across projects and cash flow occurring;
- Unclear understanding of the project and project outcomes at all levels, including community and Government;
- Uncertainty affecting the project team, leading to inefficiencies, confusion and rework; and
- Uncertainty in scoping briefs, contract documentation etc needed to deliver the project occurring;

In addition, flow-on effects outside of the project can be quite damaging, e.g.

- An unaffordable project being built at the expense of affordable projects; and
- Inefficiencies occurring in delivering the Roads Program due to funding uncertainties;

The above risks highlight the importance of well-defined project scope and reinforce the need for putting sufficient time and resources into the scope definition.

5.1.4 Scope as Project Control

The project scope defines what the client wants in terms of the physical product, including its life (how long it will last), visual aspect (architectural and roadscape), how it fits in to the environment, as well as the traffic operation and other functions of the project.

It also defines what is expected of the project manager and contractors in delivering the project.

The scope is also an essential project control for:

- Benefits / economic analysis;
- Project planning;
- Cost estimating;
- Time estimating and scheduling;
- Budgeting;
- Time and cost reporting;
- Developing work packages, e.g. design briefs, construction contracts;
- Reporting on progress against requirements; and
- Finalisation and project evaluation.

Changes to the scope of a project are not to be made without concurrence or approval of the Client.

5.1.5 The Functional Specification

The functional specification is the key document in a planning and design project as it describes the scope of work, the activities to be undertaken and how the management of the scope of works will be undertaken.

Different functional specifications provide various levels of control depending on the nature of the project. There is no one correct way of creating or managing the functional specification. However, management tools and techniques that aid in the process are available to ensure that the functional specification is applied to the circumstances at hand most effectively.

The development of the functional specification requires a structured framework to ensure:

- The scope is adequately defined;
- The management of the project is undertaken such that that original scope is adequately and regularly monitored against needs and functionality; and
- Any identified changes to scope are appropriately investigated, approved and authorised before being undertaken.

When used for briefing a consultant to undertake the work, the content of the functional specification should include at least those details depicted in standard proforma specifications for Options Analysis, Business Case, Preliminary Design and Detailed Design (Refer Section 4.3.2 of the Manual - Consultants for Engineering Projects). These can also be useful for internal functional specifications.

This manual is specifically developed for the traditional process (a design then construct delivery strategy), and not the "design and construct" type project delivery strategy, even though much of the material would be useful in both cases.

5.2 Scoping

5.2.1 Scope Development

The scope will be defined in the brief / functional specification from the Client and be based on the business outcomes required, the functions the project is to perform, the funds available and the expected return on investment. Future management, operation and maintenance factors should also be considered. The process includes a number of hold points or stages where the Client can review details of the project progress and give approval to proceed to the next stage.

The Client remains responsible for the scope throughout the life of the project.

The Project Manager may assist in defining the project scope on behalf of the Client, but the Client is the one who must approve the scope. Part of the process of defining the scope should include identifying and analysing the project risk to ensure that assumptions and exclusions in the scope are well founded.

The scope is progressively defined and refined at various stages:

- Strategic level (*Studies that establish corporate objectives*);
- Pre-project activity (*project requirements described in terms of required outcomes*);
- Concept Phase (*defining the solution*); and
- Development Phase (*detailing the solution*).

Inputs include the functional specification and previous information, reports and studies. If an extended period of time has elapsed since the previous phase, the project particulars will need to be revisited and their completeness, accuracy and applicability confirmed. This especially applies to the estimate and the desired functionality.

If considerable time has elapsed, substantial rework of the previous phase might have to be undertaken. There is no benefit to be derived from proceeding with a previously dormant project without verifying its current status.

Any changes need the agreement of the Client.

5.2.1.1 Network Planning Phase

The process of defining a project follows the completion of a strategic needs analysis / link study, undertaken to identify such things as road / transport network deficiencies, traffic flow, road safety, rehabilitation requirements, structural deficiencies, new developments and relationships with existing infrastructure.

A broad project scope is defined as part of the strategic analysis. It will include location and approximate length, and have some broadly defined requirements such as level of service and traffic capacity.

5.2.1.2 Concept Phase

The major decisions on project scope are made during the Concept phase of the project. This is also the period in which the greatest ability to influence the project outcomes occurs. The process includes a number of hold points or stages where the client can review the project proposals and give approval to proceed to the next stage.

The first stage of this phase is the **Project Proposal** (Section 4.4.1), which defines the requirements a particular project is expected to deliver. In many cases the requirement may be restricted to addressing only part of the overall need to match available funding. In this circumstance a clear understanding of the requirement must be articulated to avoid scope creep during the design development process.

The project concept phase is about defining the scope to the extent where a project cost estimate (concept estimate) can be produced to within ± 20% of total project (final) cost. It includes, in addition to the Project Proposal, an Options Analysis, and Business Case development.

The **Options Analysis** (Section 4.4.2) is largely about identifying a preferred option and its scope.

See Section 4.4.2 for the purpose and objectives of options analysis.

The development of project solution options requires the benefits and costs of the project to be established, based on each option having a clearly defined scope, comparative cost and functional requirements. Determining the relevant investigations, consultations and studies to be conducted is the approach to a large extent for establishing the scope of each option, having involved community, other government agencies and planning authorities in a formal process of review and approval.

Once the preferred option has been selected it is submitted together with a recommendation to the client for approval. Approval authorises the options analysis to progress to the next stage of the project - **Business Case** (Section 4.4.3).

The development of the business case reviews the required outcomes from the project and the preferred option, including benefits to the road users and community. The project scope is further refined in the development phase by detailing how those outcomes are to be delivered.

Once the preferred option has been developed to the stage where a *reliable cost estimate* (i.e. fully validated concept estimate) has been established, it is submitted together with a recommendation to the client for approval. Approval authorises the business case to proceed to the next stage of the project - Development.

A key output of developing the business case is to identify and instigate the necessary detailed studies to consolidate the scope and to identify associated risks.

The environmental assessment requires the benefits and costs of the project to be spelled out, based on a clearly defined project scope and functional requirements. Determination of the environmental assessment (EIS or REF) fixes the project scope to a large extent, having involved the community, other Government agencies and planning authorities in a formal process of review and approval. After determination, changes to the project may require a further EIA.

Project scope determined at the Concept stage is critical to project outcomes. Unidentified issues requiring changes during design or construction can be very costly.

The Client must approve the project scope prior to the REF / EIS being publicly displayed and again prior to determination of the REF / EIS if there are any changes. Following determination of the REF / EIS for Development projects, a Project Business Case is submitted to the Client to confirm the scope and cost components and the required cash flow. This gives approval to proceed to the next phase.

This is an important stage in the process of ensuring that the scope is right and that the project is able to deliver the desired outcomes.

Client approval of the Business Case, at the end of the Concept phase, is an important milestone, allowing the project to enter the Development Phase.

5.2.1.3 Development Phase

The project development phase is about refining the scope defined in the concept phase to the extent where a project cost estimate (detailed estimate) can be produced to within ± 10% of total project (final) cost. The development phase occurs in two parts - **Preliminary Design** and **Detailed Design** (see Chapter 5 for details).

It is absolutely crucial to the project that at this stage an appropriate risk management study be conducted in order to identify all possible risks that may be associated with project delivery at various stages of its lifecycle. Each item of risk/ uncertainty must be scheduled as a separate contingency.

The **Preliminary Design** activities progress and further refine the scope by adding more detail to the preferred option by virtue of greater depth of project design, e.g. pavement structures in lieu of notional pavement design. Also, structure design (e.g. bridge design) is undertaken and the details of key aspects (e.g. foundations, substructures, superstructures) are completed.

Once preliminary design has been completed (all major design components concluded, including major structures), together with a preliminary estimate, a recommendation is submitted to the client for approval. Approval authorises Preliminary Design to progress to the next stage of the project - Detailed Design.

See Chapter 5 for the purpose and objectives of the preliminary design.

Detailed Design completes all design activities and hence finalises the scope by providing a full schedule of work for estimating and construction purposes. This provides the final scope review before the development phase is completed.

The accurate calculation of project work items cannot be made until all project risks and issues have been identified and dealt with progressively throughout the delivery process. Some of these risks and issues will result in additional work items in the project schedule whilst others that cannot be fully quantified will appear as contingencies in the schedule.

Whilst most risks are identified during the concept phase it cannot be taken for granted that all risks have been identified. For example, it is not an uncommon occurrence for further risks to be identified in relation to the design of underground structures in the development phase. In this respect it is very important to ensure risks that relate to the need to move public utility plant to accommodate proposed new work items are identified and managed. It is also important to ensure that design interfaces (including underground installations) are checked for compatibility.

During the development phase all risks should have been identified and accounted for by either removal as a risk or provision made in the schedule for each such risk as a contingency with a dollar amount to cover its treatment during construction.

This phase includes establishing the construction contract.

See Chapter 6 for the purpose and objectives of detailed design.

If, as a result of the development phase, changes are proposed to the approved scope, they must be submitted to the Client for approval.

5.2.2 Scope Planning

Scope planning includes the process of scope development together with a written scoping statement including the criteria used to measure the success of the scope development process.

It is critically important that the project passes through interfaces between phase activities without losing any information (e.g. assumptions made) or understanding of the requirements. This baton change / handover process needs to be rigorous and as seamless as possible. The client leadership approach (Chapter 3) will assist in a smooth project transition across activity interfaces as this should make the client conversant with the project details because the client agreed to development issues on a progressive basis through the phases. Also, including key personnel from adjoining upstream and downstream phase activities facilitates effective baton changing.

Ultimately the Project Plan is developed from negotiations and should document the scope of works. This becomes an output of the scope planning activities. Outputs are defined by project deliverables and these should be documented in the Project Plan. If the deliverables are already detailed in the proposal and remain unchanged, appropriate cross-referencing to the Proposal in the Project Plan could be sufficient.

5.2.2.1 Scope Definition

The scope of a project is dependent upon accurately identifying all work activities that comprise the project. For infrastructure projects the extent of work required to establish the work activities will vary depending on the project environment. However, identifying key stakeholders is essential to ensure that the less obvious project issues are identified. In addition, the studies, investigations and consultations undertaken in the options analysis stage will identify further activities that need to be considered in the development of the project.

Scope definition requires the subdivision of the project deliverables into smaller components (i.e. tasks) and aims to:

- Improve the capability to estimate costs;
- Define a base line against future performance measurement; and
- Facilitate allocation of responsibility to work packages.

Assumptions can be documented via the risk analysis process.

Identifying the major elements of the project enables structuring the Work Breakdown Structure (WBS) over the applicable phase or phases of the project life cycle. Thus the first level should include concept phase (proposal, options analysis and business case) and development phase (preliminary design and detailed design).

The next level should include work packages such as survey, geotechnical, environmental, hydraulics, impact assessment statement (IAS), road safety audits, native title and public utility plant (PUP) as applicable.

Functional units will further disaggregate activities for their management purposes, usually in the form of a project program.

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A draft program should be supplied with the proposal to represent the WBS and it is useful to indicate to the client that the Project Manager appreciates the scope of works. Major deliverables such as review and approval requirements should also be detailed in the program at the first level of break down. This draft is reviewed and amended following award of the project and forms an element of the Project Plan.

At about this stage the various programmed activities are assigned a unique identifier that reflects the costing code of accounts.

Proper scope definition is important to ensure that future inevitable changes that occur will not cause disruptions that will have significant time and cost implications.

5.2.2.2 Scope Verification

Scope verification is about formal acceptance by the client that agreed work has been done satisfactorily, e.g. the approval and sign off of the preliminary design activity is the ultimate scope verification for a planning project.

Successful scope verification requires the progress of the project to be documented, and opportunities to be provided for joint reviews (client, project manager and key team members) of the project and activities so that formal acceptance is progressive. These processes are built into the Project Quality Plan and are facilitated by various project quality forms that document the various communications, reviews and sign-off of progress evaluations (see Attachment G of the Manual for the Engagement and Use of Consultants).

5.2.2.3 Scope Control

Scope control is about:

- dentifying the factors that create scope changes to ensure changes are beneficial;
- Determining that scope change has occurred;
- Managing the changes if and when they occur, including client approval of change.

The system requires not just changing the scope because it is required but also identifying and documenting the need for, and impact of the change and the review and approval of changes.

Not all scope changes are readily obvious. A more insidious form of scope change is scope 'creep'; it often goes unnoticed until a re-estimate occurs at the end of the phase. This should be avoided by determining effective monitoring of progress against the functionality required in the brief.

The identified changes must be reflected in a revised project program and estimate.

5.2.2.4 Common Pitfalls in Developing Scope

(a) Insufficient Information

- Unable to gather sufficient facts before starting.
- Misunderstanding or insufficient knowledge of the full requirements of the original project plan.
- Decisions based on "educated guesses".

(b) Misleading Assumptions

- Erroneous interpretations or conclusions of the facts.
- Unfortunate experiences with past applications of materials, etc.
- Bias against using new and sometimes very complex technology even though it has a proven benefit.

(c) Habitual Thinking

- Doing things the same way we've always done them.
- Tendency to re-use what worked the last time.
- Copying standards of other agencies.
- Insufficient attention given to the current state-of-the-art.

(d) Risk of Personal Loss

- The use of experienced personnel minimizes risk through trial and error.
- Risk associated with trying something that you have not tried before.
- Decisions based on comparable data, rather than the actual case.

(e) Reluctance to Seek Advice

- Designers should seek advice from others in their field for projects outside their normal experience range.
- Test their design/solutions with others.

(f) Time pressures

- Need to provide a project design as quickly as humanly possible.
- Pressure becomes so great that anything with a reasonable chance of working is designed into the project.
- Acceptance of the first workable solution in order to complete the design on time.
- No time to sit and contemplate.
- No time to sit and think up alternative approaches.
- Lack of appropriate tools/software.

(g) Negative Attitudes

- Reluctance to consider a change of any type regardless of its merit.
- Check again the initial design to test there is not a better solution.
- No time to identify and call on experienced personnel.

(h) Rapidly changing technology

- Rapid strides taking place in the development of processes, products, and materials.
- Technology is constantly changing.
- No one person can be expected to be completely current in any field.
- Specialist advice not accessible.

(i) Strict Adherence to "Requirements"

- Requirements are often unrelated to required performance, materials, safety or procedures.
- Assumed requirement when not actually specified.
- Concentration on the development of a reliable system that exceeds all known and assumed requirements.
- Each unnecessary requirement that is met in a design costs money, but worse still, may increase the chance of failure of the overall system.

(j) Unsatisfactory Human Relations

- Insufficient communications.
- Misunderstandings.
- Jealousy.
- Ego/afraid to 'lose face'.
- Normal friction between team personnel.

5.3 Techniques for Scope Development

There are a number of useful processes that can be used to assist in establishing project scope, e.g. value management, risk management, value engineering and group problem solving processes. Where the community is involved in these processes, care must be taken to ensure that they clearly understand that the outputs from these processes serve as inputs into the final decision making process. Final decisions are not made at public forums/workshops. However, it is important to reach a consensus on some of the key issues. In this respect the use of specific issue selection criteria with weightings could help bring about resolution of opposing views.

Using the concepts exposed in Section 4.3.2 - Project Scope, and Sections 5.3.1 to 5.3.4 describe useful methods for identifying scope together with relevant risks/issues are.

5.3.1 Value Management

Value management is a particularly useful and necessary method when assessing options for a major project e.g. town by-pass.

Value management is usually an 'open' and facilitated process that draws together in a workshop environment as many stakeholders as possible to identify the pros and cons of alternative options e.g. alternative routes for a town by-pass, by establishing:

- Community preferences;
- Industry and other road user preferences;
- Risks for each option;
- Advantages and disadvantages of each option;
- Issues relative to each option.

This type of workshop must include the community and other major stakeholders, e.g. representatives of local businesses and the transportation industry.

5.3.2 Risk Management

Risk management is a useful way of identifying specific risks/issues. The process often involves a facilitated workshop of appropriate stakeholders to review the project. These workshops can be held at any time during the preconstruction process to provide confidence that nothing has been overlooked in the scoping process.

Traditionally, risk management exercises are undertaken at the following process stages:

- In the project proposal where the risks relate more to the project itself; whereas
- In the options analysis where the focus moves towards item work risks; andIn the business case and the development phase where the focus is almost totally on work item risks.

5.3.3 Value Engineering Reviews

The goal of a Value Engineering (VE) study is to achieve design excellence. Its objectives are to improve quality, minimize total ownership costs, reduce construction time, make the project easier to construct, ensure safe operations, and assure environmental and ecological goals are met. The VE team is looking for the optimum blend of scheduling, performance, constructability, maintainability, environmental awareness, safety, and cost consciousness.

The VE review process seeks to overcome the pitfalls listed in Section 5.2.2.4 because it uses a team of individuals representing different disciplines who do not have a vested interest in the project. Value Engineering reviews are successful because they use multi-disciplined teams to break down a project into its basic functions and then use creativity to find different ways to perform these functions.

The following steps are used in every VE review:

- Identify the major elements of a project;
- Analyze the functions these project elements perform;

- Use brainstorming to develop several design alternatives to perform those functions;
- Evaluate the alternatives to ensure they do not degrade the project;
- Assign costs (including life-cycle cost) to each of the most promising alternatives; and
- Develop the promising alternatives into acceptable recommendations.

Value Engineering teams should provide management with as many recommendations as practicable. Staff officers whose specialty areas are impacted by the proposed recommendation should then evaluate the recommendations. Management must then decide, based on all available information, whether or not to approve the recommendation.

5.3.4 Group Problem Solving Process

5.3.4.1 Context

Group problem solving processes form part of providing strong client leadership to all parties towards gaining common and accepted project outcomes. It does this through increased integration of the supply chain in which there is increased participation by:

- downstream suppliers in upstream processes;
- upstream suppliers in downstream processes; and
- end users in upstream processes.

Correctly used, group problem solving processes will provide Main Roads with better whole of life outcomes across the project life from concept through to operation and maintenance.

5.3.4.2 Definition

Group problem solving processes are structured, systematic and analytical processes in which a group of interested parties (decision makers, stakeholders, technical specialists and others) combine to optimise value in systems, processes, products and services.

Value relates not only to price or value for the resources used but also to achieving what is of benefit or importance to the stakeholders in a particular circumstance.

The primary concept is that the collaborative output and thinking power of the group is greater than the sum of the output and thinking power of the individuals.

Typical group solving processes include Participatory Strategic Planning, Value Management, Value Engineering, Risk Identification & Management, Partnering (including Relationship Contracting) and Post Construction Reviews.

5.3.4.3 Purpose

The purpose of group problem solving processes is to produce a range of alternative ideas which may be used by the client and those participating in the planning, design and construction process to assist in taking decisions about the project. The process may be used to arrive at a decision on a project or to develop alternatives for further analysis.

5.3.4.4 Benefits

A number of benefits arise from Group problem solving processes:

- Shared understanding among a wide range of stakeholders;
- Savings in life cycle costs;
- A holistic solution to meet particular needs;
- Clarity, focus and improved communication;
- Savings in design and construction time;
- Reduced or well managed risks;
- Reflections and learnings transferred to future projects; and
- Injection of alternative ideas.

5.3.4.5 Appropriate Use

The use of group problem solving processes will vary with the project scale and complexity.

Group problem solving processes can be used in various phases of a project and for various reasons:

- In the early concept phase to identify the base needs and the functional requirements to be incorporated into the project brief along with other physical characteristics;
- In the preliminary design stage to ensure that the design options generated meet the functionality requirements, to eliminate factors that do not contribute to the functionality and to optimise the balance between function cost and worth;
- In the detailed design phase to optimise the technical components of the project;
- During the project to identify and manage the risks associated with the project;
- During the project to identify the optimum delivery process and packaging for the project;
- During any contract process (e.g. consultancy, construction and maintenance) to quickly identify and resolve issues that arise during the contract; and
- At project completion to identify specific learnings arising from the project.

The most appropriate uses of the varying group solving processes are:

- Participatory Strategic Planning workshops - the concept phase of a project;
- Value Management workshops - the concept, planning and packaging decision phases;
- Risk Assessment and Management workshops - from planning through to design;
- Value Engineering workshops - in the design phase;
- A Post Construction Review workshop - would be held shortly after project completion; and
- Partnering workshops including team building and team problem solving techniques - could be used at any stage of a project that involves a form of contractual relationship from the concept phase through to maintenance and operation.

In general the participants at group problem solving workshops will come from a more diverse background in the earlier phase of a project than the latter phases.

5.3.4.6 The Process

Although the process differs slightly for the different techniques, the underlying principles are very similar. One of the major differences in the varying workshops is the type of group or individual that is requested to participate in the workshops.

The process starts by identifying the base need or project outcome required.

The process is based on analysing the function performed by products or services. This involves clearly identifying what they do and what they must do at a high level to meet the project objectives.

Once these high level functional objectives have been set, they are listed in priority order and ideas are generated as to how the functional objectives can be met.

- Collection of information:
  - present any project information such as current design proposal and cost estimates;
  - define any givens;
  - identify the known assumptions;
  - define what's important about the subject of the study; and
  - identify any restrictions;

- Analysis of functions:
  - define the primary intended purpose; and
  - identify functions to be performed;
- Generation of alternatives;
- Evaluation of alternatives;
- Development of selected alternatives; and
- Conclusions, recommendations and action plans.

5.3.4.7 Critical Success Factors

There are certain factors that assist in the success of the process:

- Disseminating the information, implementation plans and final decision to the participants of the workshop at the earliest opportunity;
- Holding the workshop prior to strong opinions being generated regarding decisions;
- Stating any non-negotiables at the beginning of the process; and
- Limiting the issues to be addressed at a workshop to one key issue i.e. does not attempt to address, say, functionality and project packaging in the one workshop.

Facilitators trained in the group problem solving techniques achieve the best results from the process.

5.4 Scope Management

5.4.1 General

When developing the scope, the characteristics of the requirement should be identified and documented as completely as possible and in measurable terms.

At the commencement of the project lifecycle (at concept) there is naturally some uncertainty about the project's deliverables and the methods used to achieve them. The level of uncertainty can be reduced significantly during the initial stages through careful appreciation and briefing processes. The more information that can be learned about the project, its objectives and background to the decision to proceed, the less will be the uncertainty about how the project is to be developed. In this respect proper briefing by the client together with progressive client leadership during the process offers significant advantages in meeting client requirements.

The prime focus of the scope risk management study is then to identify all aspects where vagueness, lack of clarity and/or needs for further investigation exist. A carefully planned and logical approach to the scope risk management study is essential.

The ultimate solution exists in the range of possible solutions available at that time - the question is how to get to the right solution efficiently and effectively. To do so we follow the "Framework for Delivery of RIP Projects" undertaking the various studies, investigations, consultations and reviews required gradually narrowing the field of possible solutions until one option emerges as the preferred option.

Within this process, while many other activities are being undertaken to narrow down the field, scope review is regularly being undertaken keeping in mind the goal of defining functional outcomes that satisfy the needs.

Scope management for design is about ensuring that enough work is done to enable the project to be sufficiently documented to enable the client to enter into a contract for construction. This includes monitoring for scope creep and influences that could lead to scope creep. Anything extra that does not achieve stated needs and functionality, despite being desirable, should be resisted. These add-ons only consume time and cost more.

5.4.2 Success Measures

Identifying measures or mechanisms by which the success of the project can be determined provides additional focus.

A guide to suitable relationship measures is provided in the Manual - Consultants for Engineering Projects, Section 8.2.4. It details the establishment of Key Performance Indicators (KPI's) to monitor the health of the relationship and communications between the parties.

Similarly there must be a mechanism that enables the project activities to be monitored and assessed. One such mechanism is to build into the functional specification a management review process together with client leadership actions.

Generally, project deliverables are reviewed at the milestone points occurring at the end of the following activities:

- Proposal;
- Options Analysis;
- Business Case;
- Preliminary Design; and
- Detailed design.

These milestones are shown in Figure 3.1.

All reviews must be undertaken by appropriately qualified and experienced staff to enable them to be undertaken effectively. To ensure the quality of the outcomes, required reports are provided for review prior to meetings to enable comments to be gathered and issues adequately addressed beforehand.

5.4.3 What Work Needs to be done

Determining the scope of work is not an easy matter and depends heavily on the state of knowledge available. There are, however, some generic studies that must be done (e.g. Review of Environmental Factors (REF), cultural heritage, native title) as they have statutory implications. Other studies or work required are a result of project features (e.g. no hydraulic studies if no rivers, no noise studies if in a remote location).

Irrespective of delivery by a consultant or not, the project must have a Project Management Plan developed at each phase to provide a structured framework for project definition. The Project Quality Plan, aided by a scope risk analysis, improves the state of knowledge, provides certainty as to influences that might affect measures of success, and gives confidence to proceed down a planned path of activities.

5.4.4 Amount of Work

This is more difficult to define for planning projects as the level of enquiry can only be subjectively assessed. How much is enough?

- Some say that there is never enough, but that approach only leads to endless enquiry;
- Some say a useful measure is when the cost of enquiry costs more than the potential impact it is time to call it quits, but that approach might not enable the question asked to be answered; but
- A better view is that the level of enquiry should be sufficient to enable the question to be answered within an acceptable degree of confidence.

This will vary from project to project and initial scoping studies may be required. This is why, for example, the REF is undertaken before the IAS. The REF provides the ability either to differentiate between options or to justify further enquiry.

5.4.5 Source of Scope Change

Changes of scope may be initiated by the Client or suggested by the project manager. Either way the Client must approve them.

The scope can change as a result of changing community expectations, Government priorities, changed funding, changed standards or legislation, or other external influences. In addition, the project manager may identify issues such as improved benefits, reduced costs, or other worthwhile opportunities that could arise from a change to a project.

5.4.6 Management of Scope Changes

Client and project manager must closely manage changes to scope. This includes:

- Notification by the **Client** to the project manager of possible changes to scope. This is to ensure that the cost of changes is minimised by reducing rework. Full details of the change are not needed at this stage;
- Notification by the **project manager** to the Client of suggested scope changes. Full details of the change are not needed at this stage but the notification should include reasons and possible benefits;
- Preparation of detailed change of scope:
  - For Client initiated changes, the variation to the scope must be documented and agreed to by the Client at least to the same level of detail as in the original scope definition. This will allow the project manager to assess the impacts on the time, cost etc and the project management fees;
  - Changes proposed by the project manager must be detailed in a submission to the Client Representative for approval by the Client. The submission should outline alternatives and indicate impacts on time, cost, budget, commitments and other project benefits and outcomes. The submission should also detail any implications of the approval not being granted. The Client Representative might need to add information to the submission on the impact of changes to the Program, project outcomes and benefits;
- Keeping a record of scope changes, dates of approval and impacts on project time and cost; and
- Adjusting other project controls such as Project Plan, and estimates of time and cost in accordance with the new approved project scope.

Where a project appears to be going outside scope and cannot be covered by contingencies, it is important to inform the Client as soon as possible. This will allow early assessment of possible impacts on the Program. Reporting to the Client on contingency usage is also important in assisting with managing these possible over runs.

Changes outside the project scope can include over-expenditure due to unforeseen circumstances or unforeseen risk occurrence, rectification or mistakes, or delays within the control of the project manager.

Change approvals must be dealt with in a timely manner at all levels. Undue delays can create problems with achieving agreed deadlines and contract duration, and cause other inefficiencies.

5.4.7 Impact on Project

Proposed changes to the project that impact on the approved scope can often arise during project concept, development and implementation phases. Some of these changes may have little or no effect on the total project cost, time, quality, budgeting or benefits or require no additional funds to be required. However if they affect the project scope, they still require approval by the Client.

The cost of scope changes during the concept and development phases is managed by the use of contingencies that are included in the respective budgets for the concept and development phases. Future activities can be allowed for in the project budget, the project schedule or both, for responding to risks of scope changes if and when they occur. Being essentially a reactive response, contingencies aim to reduce the impact of such risks.

If the Customer approves these changes they can then be incorporated in the project base lines. Performance of the project at completion is measured against this approved amended baseline.

5.5 Scope Risk Management

5.5.1 Introduction

Risk pervades all functions of project management because all things cannot be known in advance. Risk therefore is a natural ingredient of all environments in which projects are undertaken. For example, risk will impact upon the requirements of the functional specification, since in the case of a consultancy, the consultancy contract is a risk transfer device.

The scope of a project will contain a mix of work activities that are:

- Readily identified;
- Identified but not quantified; and
- Unknown.

It is important to establish a standard, systematic approach to risk management planning and to the development of a project risk management plan, as the basis for ensuring that issues that could adversely impact the project scope are understood and controlled.

Uncertainties should be managed by a structured approach, the aim being to take full advantage of opportunities for improvement by minimising the impact of potential negative events. The potential for improvement is sometimes overlooked, caused by the traditional view that risk means suffering harm or loss.

The risk management methodology applies to all projects. It covers the following:

- Risk identification;
- Risk analysis;
- Risk response planning; and
- Risk monitoring and control.

Risk management applies to all project phases. The process of risk management interacts with other project management processes to different degrees as risk is greatly influenced by the characteristics of the project. For example, projects that are innovative are inherently riskier. Risk management is not a discrete element and should be repeated at least once in every phase.

Risk management is covered in more detail in the Main Roads Project Management Methodology, which can be found on the Queensland Transport and Main Roads intranet site "OnQ" - not available to external sources.

5.5.2 Identifying Scope Risk

The purpose of this step is to identify project risks that should be taken into account during project appraisal and to provide a basis for development of the project plan.

Identifying risks that are likely to affect the project is not a one off event and should occur on a regular basis throughout the project. Functional specifications should include requirements for a risk analysis to be undertaken to review past evaluations and to make a reassessment within each phase a necessary activity.

Inputs into risk identification consist of all previous reports of the preceding phase; cover internal and external project and organisational matters impacting upon the project; and require external involvement to be effective. Project team knowledge, files and previous reports used for scope definition are applicable as inputs into risk identification.

Using checklists is efficient and their value cannot be overestimated.

Cause and effect (fishbone) diagrams are also useful. The cause can be derived from the purpose of the risk analysis being undertaken. The extent of detail required is decided by answering:

- Is the level of detail sufficient for the purpose of the analysis?
- Can the risk be assigned to one identifiable owner?
- Are specific responses indicated?

Negative answers to any one of these questions indicate a requirement for greater detail.

As tolerances to risk vary across stakeholders (internal and external) it is imperative that a wide range of stakeholders participates in the risk management process. Participants invariably consist of local government representatives, local chamber of commerce representatives, community groups, industry representatives, civil contractors, suppliers and DMR staff (especially previous phase staff who can provide valuable historical perspectives on matters that arise).

Identifying potential risks can be achieved by consultation with as many stakeholders as possible. Brainstorming a group of stakeholders is an appropriate technique to use. The risk management workshops held can be quite dynamic as there are many competing interest groups and associated agendas. This is not to be suppressed but valued but a capable and experienced facilitator is required to guide the participants through the process.

During these workshops, the project should be reviewed in a global manner first (from the top down) and then at task level (bottom up). Risks may include, but not be limited to:

- Lack of definition of the requirement;
- Restrictive time frame;
- Product maturity;
- Availability of resources;
- Reliability of test and acceptance procedures;
- Wide span of activity;
- Developing infrastructure; and
- Lack of capacity.

5.5.3 Scope Risk Analysis

Once the risks have been identified:

- Document the risk factors, organised in accordance with the categories of risk; and
- Assess the probability of occurrence of the risk factors and the relative significance of their impact on the project if they do occur.

Generally, impact will be determined in terms of either time or cost.

From consideration of risk factor, probability and relative impact it is possible to prioritise the risks. This provides focus on the risks that must be managed closely as distinct from those that need only be monitored.

Risk quantification can be presented in terms of a monetary value, statistical simulations (Monte Carlo simulations), what-if simulations using Project Evaluation Review Technique (PERT) or Critical Path Method (CPM) network analysis, decision trees and experienced judgment.

Quantified risks can be compared to developing criteria enabling a decision to accept the risk or to treat it in some manner.

Treatment options should be developed and evaluated as part of the Risk Management Plan subsequently produced. The Risk Management Plan includes the results of the risk identification and quantification process, documented procedures of how risk will be managed throughout the project, who is responsible for managing areas of risk, contingency plans and how reserves are allocated.

Treatment of risk can consist of:

- Elimination of the cause (design out the problem such as deleting an intersection by grade separation), and/or mitigation of the effect (reduce risk of accidents by signalizing an intersection or providing carriageway separation; provide financial reserves); and/or
- Acceptance, but actively managing (fire incident in tunnel managed by fire, life and safety treatments such as CCTV monitoring, jet fans, heat sensors, cross doors, hydrants, etc; contingency plans); and/or
- Control risks (monitor and review).

5.5.4 Scope Risk Response Planning

Notwithstanding that identified risks might or might not eventually occur contingency plans must be developed for the eventuality that they do.

These plans may operate at a number of levels such as the initial response (contain event), medium term (implement response), and long term (evaluate response for effectiveness and amend if not achieving required outcome).

These different approaches reflect the requirement that the required risk management plan must reflect the nature of the underlying cause of the risk for adequate treatment.

Following the risk analysis, determine a strategy for the containment of each factor. In broad terms, one of three decisions needs to be made:

- Avoid or reduce the risk through application of alternative approaches to achieving the objective, or through changes to the project plan, schedule, quality, budget or resource requirements;
- Transfer the risk through the use of contracts and internal agreements; or
- Adopt the risk with contingency plans to minimise the impact if the risk eventuates.

For some risks it is appropriate to plan around the occurrence of the risk such that the risk no longer has any bearing on the project. This strategy might involve identifying an alternative course of action such as revised timing, different technical solutions or a different resource mix.

For other risks it is sufficient to put in place a monitoring process to capture the occurrence of the risk, supported as necessary by contingency plans which can be applied should the risk situation occur.

Risk can also be transferred to another party that has greater control over the risk situation, or is less susceptible to the impact of the risk factors. Commonly, this is achieved through a contractual arrangement.

Options to plan around the occurrence of a risk must take into account the impact such a change in planning will have on the time, cost and quality of the project, in comparison to the assessed impact of that risk on the project. A judgment then needs to be made as to whether the implications of changing the project plans to accommodate the identified option are worthwhile in comparison to the probable impact the risk situation will exercise on the project.

The Project Risk Management Report is essentially a document for use by the project manager. Elements of the document will form part of the Project Plan.

Some of the most common risks encountered for road infrastructure projects are shown in the Risk Managemet Report (Form M4213).

5.5.5 Scope Risk Monitoring and Control

Risks should be reviewed on a continuous basis as the process moves through the concept and development phases and identify other risk factors that may have arisen as a consequence of:

- Refining the project planning;
- Making changes to the scope of the project;
- Undertaking discussions/ negotiations with the client; and
- Deleting previously identified risk factors that are no longer relevant.

From a review of the risk assessment table it is possible to make judgments concerning the relative importance of risks to the project. For those of high importance (high probability and significant impact), immediate action to manage the risk is required. For other risk factors, a contingency approach can be used. These strategies will provide the basis for a proactive approach to risk management.

For those risks that can be managed by monitoring occurrence and implementing a contingency plan, or through transfer via a

contract, the questions that need to be addressed at this time are:

- When is the risk situation likely to occur?
- What can be done if it does occur?
- What are the possible courses of action available if it does occur?
- What pre-planning can be undertaken ahead of the risk occurring?
- Is it worthwhile developing contingency plans to address this risk?

For each risk factor, a schedule for monitoring and control needs to be developed. Review points can be milestone based, periodic (e.g. daily, weekly, monthly), deliverable based, or in accordance with standard operating procedures. As guidance, risk factors should be listed for discussion at periodic progress meetings.

A single appointment should be given a role responsibility for monitoring and controlling the risk. This appointment should be the person or organisation who/that has most control over the risk factors.

5.5.6 Secondary Benefits of Risk Management

Experience has found that the risk management process has other valuable secondary benefits such as:

- Providing an aid in the baton change between parts of the organisation (e.g. from Transport Planning to Infrastructure Delivery in a District). Why? If for no other reason than the previous phase team has intimate knowledge of the project history that lies behind the various documented reports;
- Avoiding the review process becoming either a digging exercise to find the project "secrets" or an ad hoc overview that does not enable real issues to be analyzed. Both of these processes are unsatisfactory and ineffective. This would be overcome if the receiving team were actively involved with the previous team to present a seamless baton change across the various parts of the project life cycle particularly across the Concept and Development interface;
- Jogging the corporate memory after projects are reactivated after long periods of inactivity, to raise matters long suppressed by more recent and pressing events;
- Helping redefine the scope after reactivation of a project; and
- Documenting the risks to enable the functional specification to be scoped so the elements of risks (both threats and opportunities) can be actively addressed. This includes not only drawings and specifications but also such things as communication plans, environmental management plans and safety plans. None of these plans in themselves result in a physical asset such as a pavement, bridge, culvert or traffic signals but are absolute necessities for successful project implementation.

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Chapter 6
Design Management

Manual Contents

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Chapter 6 Amendments - June 2005

Revision Register

Issue/ Rev No.	Reference Section	Description of Revision	Authorised by	Date
1		First Release	D. Hicks	Mar 2003
2	Appendix A - Detailed Checklist	1. Previously Chapter 7 now Chapter 6 2. The Checklist Verified column for initials and date has been removed.	D. Hicks	Feb 2005
3		First Edition Release	D. Hicks	June 2005

Chapter 6
Design Management

6.1 Introduction

Efficient management of the planning and design process and the project itself is an essential element in achieving the best value for money projects and in ensuring that the whole of life costs are optimised. It is also essential in ensuring that the output is of high quality with accurate and appropriate documentation.

The greatest opportunity for influencing the final cost and quality of a project is in the planning and design phases of the project. Even though the planning and design phase of the project will rarely exceed 10% of the project cost, the decisions taken in that process will be critical in determining the final cost of the project and the ongoing operational costs. The American Society of Civil Engineers has estimated that 80% of the opportunity to influence life cycle costs is exhausted during the design phase, with well over 50% of it during the first third of the design phase.

Management of the process therefore assumes critical importance.

This chapter of the Manual sets out the processes to be followed in managing the project and includes details of quality control as well as project control techniques. Methods for the performance evaluation of consultants are also provided.

6.2 Communication and Documentation

6.2.1 Principles

The success of any project will depend largely on the effectiveness of the relationships and the communications between the people undertaking the project. Whether the people involved are internal to Main Roads or are external consultants, the design team as a whole is responsible for the outcome. It is therefore essential to ensure that the design team performs in a harmonious way, with a common goal of success on the project.

It is important that all team members share the information available and that they are kept fully informed of all aspects of the project as it proceeds. This allows them to take ownership of the whole project, not just a piece of the whole with little or no understanding of the overall project.

Communications take on many forms – verbal, written and electronic. It does not include "implied", "extra-sensory" or "expected". It is important that no team member from any party assumes that someone else "should have known". It is best to provide the information through the lines of communication established and to keep those lines open at all times. Open and honest communication is essential in achieving the goals of the project.

6.2.2 Means of Communication

Communication takes place in many forms – face-to-face, by letters and facsimile, through telephone conversations and via e-mail. Web sites are sometimes used and are becoming more common. Modern methods of communication have increased the potential speed of exchanging information, but they do not necessarily document it in an accessible way. Good documentation becomes even more important.

This becomes critical in the event of personnel changes throughout the life of the project. Good documentation ensures that decisions, critical

milestones and review outcomes do not become issues for debate when new people join the project.

Some of the more common means of communication are:

Meeting Minutes

All meetings must be recorded and where appropriate, standard agenda proformas should be used. Minutes should be distributed to all participants to ensure all are satisfied with the record. A set time limit (of short duration) should be set for distribution and review of the minutes to ensure minimal delay in implementation of decisions. If critical decisions have been taken, participants should be asked to sign the minutes as accepted.

Telephone Logs

It is good practice to keep a log of all telephone calls to do with the project, and to keep these with the documentation of the project. This can avoid arguments about the content and timing of discussions and directions at a later stage.

Correspondence

A rigorous system of recording and filing all correspondence must be established at the start of the project. It is essential that time of despatch/receipt is recorded and that copies of all correspondence is on the file and available to all team members. The system must ensure that all correspondence is readily retrievable.

E-Mail

While this method of communication is convenient and effective, messages can be lost when personnel move on or if someone deletes them. Copies of e-mail messages should be printed out and filed to be accessible to team members.

6.2.3 Procedures

It is important to implement procedures to ensure that specific issues of importance to the project are addressed. These procedures should encourage team interaction and ensure that project milestones are met. Specific requirements for communications during the project should be identified in the Project Quality Plan (see Section 6.5) with specific responsibilities allocated.

Tools to assist in achieving these objectives include:

- Standard forms for meetings setting out the required issues to be addressed;
- Action lists with specific responsibilities defined (including dates); and
- Regular communication sessions scheduled on a regular basis (not necessarily face-to-face).

6.2.4 Partnering

Partnering can be a most effective means for ensuring both excellent communication and good relationships throughout the project. Partnering establishes communications between all participants in the design process, deals with issues as they arise and ensures all parties work towards the project goals.

All key participants in the design project (Main Roads personnel, key members of the consultant team and sub-consultants) should attend the partnering sessions. Having all of the decision-makers involved in the process will achieve the best results and allow all to express their concerns. The outcome of these sessions should be a set of procedures that defines the appropriate action for a range of circumstances, with specific times for decision making at the relevant levels of the organisations.

These sessions will be most effective when facilitated by an independent person. It is not essential that the facilitator is from an outside organisation and a senior person with appropriate skills from either Main Roads or the Consultant's organisation could be acceptable.

6.3 Project Initiation

6.3.1 The Brief

The brief sets out the client's expectations for the project as far as the knowledge available to the client allows. The more specific the brief, the easier for a consultant (internal or external) to assess the requirements of the project and provide an appropriate submission in the bid for the work.

The precision with which the brief can be written, and the work defined, will determine the approach to the selection of the appropriate consultant. Where the project can be closely defined, a Value Based Selection (VBS) process can be used (See Section 6.3.3). If there are indefinable elements in the project, a Qualification Based Selection (QBS) process will be needed (see Section 6.3.4).

Where the information is available, the brief should be as clear as possible on the requirements to be met by the consultant. It is important, however, that the brief is not so restrictive that a consultant cannot exercise the appropriate skills to ensure the best solution for the project. The brief should provide all of the known relevant information to the consultant and be clear where more information is required.

A comprehensive brief will allow a consultant to determine the scope of the work more easily. However, there will always be items where different people will interpret the requirements differently and these issues will have to be resolved. Subsequent sections discuss the means by which both parties can come to a common understanding of the scope of the work.

6.3.2 Establishing the Scope of a Project

Before a designer is appointed to a project, there must be an agreement between the parties on the scope of the work required and the estimated cost of the work. This is so for all projects but becomes even more critical where Qualification Based Selection is used and the fee for the work is negotiated after selection of the designer.

Developing the scope of the work and the project schedule for the work are the essential ingredients for a sound project management plan. The client and the designer must develop a shared understanding of the scope of the work and the expectations for its delivery.

The best results will be achieved when the client has undertaken a comprehensive process prior to selection of the designer. Chapters 1 and 2 set out the process for developing projects and the various elements of the process are detailed there. However, external consultants may be engaged at various points in the process, with varying degrees of certainty in the information available.

There will, therefore, be different levels of information available to the consultant depending on the point in the process at which the consultant is engaged. The extent of the information available will determine the type of selection process to be used and the level of negotiation required (see following sections).

6.3.3 Value Based Selection

Value Based Selection uses price and non-price criteria to choose the consultant. The price for the work is submitted in a separate envelope (the "second envelope"). This method is to be used where the scope can be tightly specified (straightforward projects without unknowns). This would normally be for the design process on the basis that the planning process was performed in accordance with departmental standards and signed off by the relevant authority.

Assessment is done against non-price criteria in the first instance (the second envelopes would not be opened before the non-price criteria are assessed). The second envelopes are then opened and the prices averaged. The price component for each consultant is then assessed on the basis that the average price scores the maximum points. The further from the average price (in either direction), the fewer points scored. The selection of a consultant is then based on the highest ranked consultant when price and non-price points are summed.

6.3.4 Qualification Based Selection

This method is used where the requirement cannot be tightly specified (high risk). The selection process is geared to selecting the consultant most qualified to deliver the requirements of the brief. It requires an itemised fee to be submitted by the consultant (second envelope) as part of the tendering process. Scope and price should be the negotiated outcome of this process. The price in the second envelope is only to be used as the starting point for price negotiations with the preferred consultant and is not considered as part of the initial selection.

6.3.5 Sole Invitation Process

Sole invitation is used only where the estimated fee amount is less than the allowable value (see the Manual for the Engagement of Consultants).

This approach is used for the following reasons:

- expediency for urgent work;
- administrative simplicity;
- significant background knowledge of the consultant; and
- only source of expertise available.

In this selection process, a negotiated scope and fee has to be agreed between the parties before the work starts.

6.3.6 Negotiating a Contract

The purpose of the negotiation is to agree on a scope, schedule and fee that is fair to all parties and to establish a suitable contract agreeable to the parties for the performance of the work. The fee for the work is an inevitable outcome of the way the variables are combined. These variables are:

- The scope of work;
- The types and level of personnel assigned to the work;
- The estimated hours required for these personnel to perform the work;
- The labour rates (including overheads) applicable; and
- The profit associated with the work.

Addressing each of these in an objective, dispassionate and deliberate way will lead to successful negotiations i.e. a suitable outcome for both parties. Each of these is discussed below.

Scope

The negotiation involves the two parties agreeing on the scope of work required to achieve the outcomes defined in the brief. Both parties must set out their assumptions regarding the scope, and detail what they expect to be done as part of the project before any meeting takes place.

The Project Officer must set out, in addition to the brief, what is expected of the consultant in terms of the tasks required to complete the work. This should include the estimated times for each of the items of work.

The Consultant should prepare a spreadsheet setting out the tasks required to undertake the work in accordance with the consultant's understanding of the requirements. This should also set out the times required.

The negotiating process is required to resolve any differences in these two positions. Differences can occur because of misunderstandings on both sides. The implications of the requirements of the brief may not be fully understood at the time of writing and a change in position may be needed to preserve the budget intentions. The negotiation should seek to bring both parties to a common understanding of the project requirements.

Personnel

The Project Officer needs to be satisfied that the personnel proposed for the work have the appropriate skills at the appropriate level of experience for the tasks involved. The combination of charge-out rate and time must reflect the skills and experience of the personnel

nominated. Where the appropriate level of experience is not available, then close monitoring/supervision will be required for either over-qualified or under-qualified personnel.

The Consultant should be prepared to offer appropriate personnel and to guarantee their availability for the project. There should be an agreement that proper replacements of equivalent skill and experience will be supplied in the event of any departures from the project.

Estimated Hours

The time required for each task will be dependent on both the complexity of the task and the level of skill of the personnel allocated. These times may be estimated in a range of ways, usually based on the previous experience of the parties. In many cases, this experience is related to the parameter "man/hours per drawing" for the work involved.

It is therefore important to reach agreement on the drawings required for the work and the standard required in their preparation. This will establish the number of plan sheets expected and will allow both parties to undertake their estimates more easily.

To ensure mutual understanding of the project requirements impacting on the estimate of times for tasks, the following details should be discussed:

- Basic project information (as discussed above);
- Specific standards for such things as gullies, inlets, kerbs, safety barriers and roadside delineation;
- Public Utility Plant coordination and presentation requirements;
- Requirements for drainage design, traffic control, construction sequencing, work zone speed limits, anti-gawking requirements (if applicable), etc;
- Hold points for review and other approvals;
- Time allowed for these reviews and approvals;
- Required standards for CADD;
- Scales required for plans;
- Sequence of plan sheets;
- Quantities and estimates presentation requirements;
- Contracts letting schedule;
- Variation request and approval procedures.

Labour Rates

The consultant must provide a set of labour rates to be charged for the work for each person or type of service applicable to the work. These rates should include all overheads and profit for most projects. Where the design is to be undertaken in an alliance type of contract, the profit component should be omitted since it will be a separate element of the contract.

Main Roads project officers should be satisfied that the rates are appropriate for the skills and experience of the personnel nominated. Negotiations may need to consider the level of overheads and the profit margin being applied so that their reasonableness can be assessed. Consultants should be prepared to disclose these figures, or the method used in calculating them (note that care is required in dealing with "commercial in confidence" issues and these matters must not be disclosed to any other parties).

Profit

A reasonable profit margin should be allowed. Since this is often a matter of some controversy, it may be appropriate to resolve the profit margin as a percent of cost before detailed negotiations begin. The amount of profit will depend on the complexity of the project, the degree of risk assumed by the consultant, and the size and duration of the project.

Summary

Scoping and negotiating the contract is an integral part of the project delivery process. Done well, it enhances the efficiency of project management and delivery and leads to better relationships between the parties.

6.4 Project Management

6.4.1 General

Overall project management involves the processes required to ensure that the planning/ design project is delivered on time and to the required standards. Essential elements of this include:

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- the project team;
- the resources available to the project team(e.g.software);
- the programme;
- monitoring quality; and
- monitoring progress.

These elements are applicable to both internal design projects and to those undertaken by consultants. The difference will be in the resources required to carry out the tasks required and the relationships between the people involved.

Part of the overall management process is to monitor the design process and the requirements for this are detailed in Section 6.5 – Design Control. That section is presented in terms of the control required by the project team itself. The project management team should be aware of these requirements since it will provide them with a better understanding of the issues facing the project team.

6.4.2 Project Team and Responsibilities

The major roles of the team are:

- Project Manager;
- Planner/Designer;
- Checker; and
- Reviewer.

Their responsibilities are described in the following paragraphs.

Project Manager

The role and responsibilities of the project manager are to:

- Manage the project to ensure that the project is completed on time to the requirements of the client;
- Set up and monitor the design programme to ensure completion of the project on time;
- Allocate resources to ensure that the required tasks are completed on time to the required quality;
- Supervise the design team;
- Establish the quality control regime and the degree of checking and review required (depends on the type and complexity of the project and the skills and experience of the resources available);
- Liaise with the client and resolve any conflicts between the client's requirements and good standards of design;
- Liaise with external bodies to ensure the timely flow of information required for the design; and
- Take corrective action to keep the project on time.

Figure 6.4.2 illustrates a generalised flowchart of activities for overall management of a project.

Planner/Designer

In terms of the control of the design, the planner/designer's responsibilities include:

- Checking progressively his/her own work as the design proceeds, recording the design data used, calculations, analysis and assumptions made;
- Ensuring that the output is in accordance with the project requirements and presentation standards;
- Compiling all data, outputs and other relevant details for review at hold points or the completion of tasks;

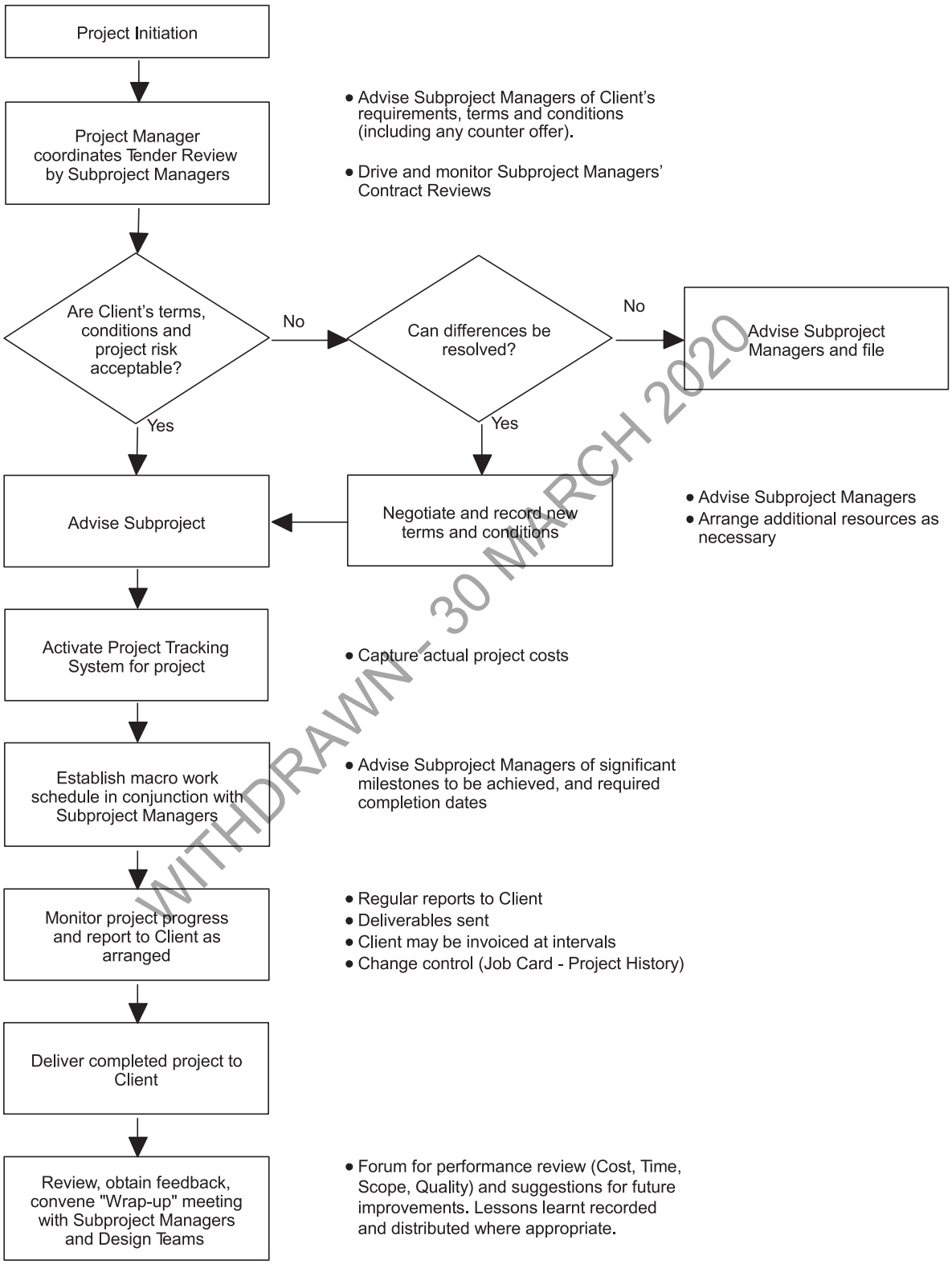

Figure 6.4.2 Generalised Flowchart of Activities for Overall Management of a Project

- Carrying out amendments and assessing the implications of amendments on other components when discrepancies are detected.

Checker

The responsibilities of the checker include verifying that:

- The work has been completed in accordance with the project requirements and objectives;
- There are no omissions;
- Calculations and analysis are complete, correct and logical and are based on the correct assumptions and criteria;
- The outputs can be traced to the inputs and any client approved variations;
- Variations have been subject to the same checking processes as the original work;
- Details shown on the drawings are technically adequate, meet the established standards, codes and manuals and meets the design intent;
- The project is practical, safe, environmentally sustainable, economical and constructable;
- Critical controls have been adequately addressed; and
- All drawings have been properly signed and dated by people with the relevant authority.

The checker must record all discrepancies, refer them to the designer and ensure that they are closed out satisfactorily before the design is completed.

Reviewer

Design review may be undertaken by an individual or by a team depending on the size and complexity of the project. Road safety audit may be part of the review or may be a separate activity. Including the road safety audit function, the responsibilities of the reviewer include:

- Identifying potential safety problems for road users and others affected by the project;
- Suggesting improvements to reduce or eliminate safety problems;
- Suggesting improvements to the design to more readily meet the project objectives and achieve economies;
- Identifying innovative approaches to the design;
- Assuring that the total design adequately addresses the project requirements and objectives;
- Assuring that the design is practical, economical and can be constructed and maintained.

6.4.3 Programming

Proper programming is an essential element of the control of any project, design included. This provides the basis of assessing the time required, the resources needed and the cost of the design. Done properly, the programme then provides the means by which the progress of the project can be monitored and controlled.

The schedule can vary from a simple manual Gantt chart to a very complex one with a large numbers of tasks with linked relationships requiring computer analysis. The size and complexity of the project will determine the level of scheduling required. The more critical the timing of the project delivery is, the more detailed will the schedule need to be.

For these more complex projects, the programme should be developed on user friendly software (e.g. MS Project) from which the necessary reports can be generated. Cost and use of resources are two important reports required to satisfactorily monitor the progress of the project.

The key parameters to be established include:

- Completion dates;
- Critical milestones;
- Required review periods; and
- Breakdown of tasks.

Particular attention to the requirements of external parties is required. These include property acquisition, Public Utility authorities and negotiations with external agencies. While these may be outside the control of the project team, the project schedule must account for their influence. The progress of these items can then be monitored and changes made to the programme as required when the actual performance is known.

All hold points, review periods and approval times required must be included in the schedule. Designers must know the times required for reviews and approvals so that they can make the necessary allowances for these periods. Project managers must be alert to the need to keep these under review and approval processes on time to avoid slippage in the completion date with consequent delays in the letting of the project.

If the project is likely to be a stop-start one with significant periods required to allow community input and the like, the periods of inaction must be clearly identified to allow the team to be engaged on other tasks.

All members of the project team should be given the detailed schedule to ensure they are aware of the output and timing required by them. If they are aware of the interactions between the work items, and the activities of other teams, then each team member will have an understanding of the impact of their work and the implications for completion. Interface schedules can assist in defining the details of hand-over times and the extent of work required at hand-over.

6.4.4 Monitoring Progress

Proper monitoring will only be feasible if the programming is done properly and kept up to date. With a reasonable software package, the task becomes much simpler but still needs attention during the project. The progress of the project is a dynamic process with numerous changes in direction and unexpected challenges. It is the job of the project manager to recognise, and predict as far as possible, these changes and take the necessary action to address them to ensure that the project remains on schedule.

Specific action to adjust the programme as these changes occur must be taken. Analysis of the new programme will show where action can be taken to keep the project on time. This updating process must be regular and rigorous if the process is to retain its credibility with the project team and the client. Reviewing the schedule on a weekly basis with the team members is recommended with updating of the schedule carried out monthly.

If the programming software and the accounting function are connected, then monitoring of costs can also be done at the same time. The accuracy of this monitoring depends on the accuracy of the reporting and the honesty of the project team. While progress on the job can be made to look good throughout the project by dishonest reporting, at the end of the job the details cannot be hidden (except by transfer to another job). The inevitable consequence of this type of behaviour will be both cost and time over-runs.

Unless there is a rigorous system of monitoring, reporting and implementing appropriate corrective action, jobs will not be controlled and both time and cost over-runs can be expected.

6.4.5 Managing a Consultancy

The consultancy is to be managed in a relational way. The Consultant selection and management system requires both parties to develop and maintain good relationships and communication. This will ensure maximum outcomes for Main Roads, the consultant, the community and Government by aligning the efforts of the parties and making best use of the expertise and resources available.

The representatives of Main Roads and the consultant are required to work in a cooperative and supportive manner. Main Roads will participate in the decision making process through input at project meetings on a progressive basis.

It is expected that a partnering approach will be adopted in managing the commission (see Section 6.2.4).

The responsibility for the quality of technical engineering issues is clearly with the consultant. Some shared responsibility will exist for the appropriateness of technical solutions.

The process to be adopted to assist in achieving these goals comprises:

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Initial Meeting

The following activities are to be undertaken at the initial meeting:

- The initial meeting shall establish a standing agenda for future meetings;
- This agenda shall address technical progress and relevant issues;
- The initial meeting shall establish Key Performance Indicators (KPIs) which relate to the ongoing health of relationships and communication between the parties and may include such issues as:
  - Openness and constructive communication;
  - Trustfulness and cooperation;
  - Working relations;
  - Teamwork and willingness to achieve project objectives.

Management Meetings

Regular management meetings should be held and must address the following issues:

Relations Management

- In a typical meeting, relational issues will be addressed prior to discussions on technical aspects regarding the project. This will include assessment and discussion of the KPIs established at the initial meeting;
- This meeting should also include an item on:
  - What's working well;
  - What's not going well; and
  - What actions to take to resolve them;
- This meeting is aimed at identifying and resolving any blockages and sticking points at the earliest opportunity;
- It may also be beneficial to discuss what opportunities exist for incorporation of improvements to process and/or product, and strategies to address these.

Project and Technical Management:

The following items/issues should be addressed:

- Review the minutes of previous meeting(s);
- Review the frequency of meetings;
- Consider and approve (if appropriate) any proposed changes to the consultant's project team members;
- Ensure that the Principal's needs and expected outcomes are being satisfied;
- Ensure that the requirements of statutory authorities are being satisfied;
- Ensure that interfaces between design disciplines have been identified and coordinated;
- Monitor/review the following and take appropriate action where necessary to ensure:
  - Technical solution is within scope and appropriate for its intended use;
  - Unusual features of the design have been appropriately addressed;
  - Project delivery is on time and to budget - Earned Value (time, cost; scope);
  - Project meets community expectations;
  - Project is in harmony with the environment;
  - Team performance of both parties to the agreement meets expectations;
- Review and approve progress payment;
- Identify and approve variations;
- Ensure extent and accuracy of documentation is acceptable;
- Review the project to ensure that it can be constructed and maintained satisfactorily;
- Ensure that the quality and acceptance criteria have been adequately defined; and

- Prepare performance reports and ensure that all resulting issues have been resolved.

6.5 Design Control

6.5.1 Overall Process

The overall design control process is illustrated in Figure 6.5.1. The essential elements of the process are:

- Quality Plan
- Contract Review – establish a mutual understanding between the client and the design team on the scope and intent of the project;
- Input correlation and review – collection of the input data and review of its adequacy and accuracy;
- Design phase – progressive self-checking and design verification;
- Design Verification - independent checking of the design, including calculations and the design detailing on drawings at planned intervals by people external to the team, but including team members as appropriate;
- Design interfaces have been checked
- Design Review – independent activity that confirms the design is an appropriate solution to the need or problem being solved;
- Drawing check - independent activity that confirms the drawing is clear, concise and free from errors;
- Unusual design - confirmation that any unusual aspects of design have been appropriately addressed;
- Design validation - an activity that confirms the constructed design will deliver the specified operational performance outcomes;
- Engineering Certification - confirmation that the requirements of the *Professional Engineers Act (Queensland)* have been satisfied during the design production process;;
- Process review – including post project review and assessment by the team (internal) and feedback from the client (external).

The elements above are the usual elements of a quality management process, but are essential for proper management of a design project. Details of these processes should be incorporated in the formal Quality Plan and the appropriate approval requirements identified in the plan.

6.5.2 Quality Control

6.5.2.1 Quality Plan

The first requirement is the Quality Plan – a must for each project. This plan should define the following:

- Roles and responsibilities of each member of the design team;
- Project programme and activity schedule including hold points and milestones;
- Specific personnel for the various jobs and appropriate work instructions;
- Sub-consultants required (includes any work required by people external to the design team);
- Interface schedules – define the interfaces between design phases and design teams together with the required timing and documentation;
- Special requirements of the design (e.g. specific software to be used);
- Liaison requirements – name the organisations and the people involved;
- Documentation requirements;
- Checklists required.

The Quality Plan should also record the following:

- Contract acceptance including deadlines;
- Contract review and any changes brought about by this;
- Design verification activities;
- Design review activities;
- Design interfaces have been checked;
- Drawings and other documentation checked;
- Any unusual features of design have been appropriately addressed;
- Design validation activities;
- Design production complies with the requirements of the *Professional Engineers Act (Queensland)*;
- Quality audit times and results.

The design team must keep appropriate quality records in accordance with the relevant Quality System and the specific needs of the project as defined in the Quality Plan.

6.5.2.2 Checklists

Checklists form an important part of the aids for the design team to undertake self-checking and for the review team to ensure that all aspects of the project have been properly dealt with. They must be an integral part of the design process and should be prepared on a project specific basis from the master lists. The following standard checklists (the "master lists") are included in Appendix 6A:

- Data correlation and Review (Design Input);
- Design Output checks –
  - Design speed;
  - Horizontal alignment;
  - Vertical alignment;
  - Coordination of alignment;
  - Cross sections (including type cross section);
  - Property accesses;
  - Drainage design;
  - Earth works and unsuitable material;
  - Pavement design;
  - Signs and pavement markings;
  - Roadside furniture (including safety barrier);
  - Public Utility Plant;
  - Traffic noise;
  - Landscaping;
  - Traffic signals;
  - Road lighting;
  - Design and quantity calculations;
  - Quantities and estimates;
  - Resumptions.

Not all of these will be required for every design in every locality. The design team should decide which are relevant before the design starts and which parts of any standard checklist are applicable to that design. This will ensure that the adopted checklists are appropriate to the specific design.

6.5.2.3 Quality Audit

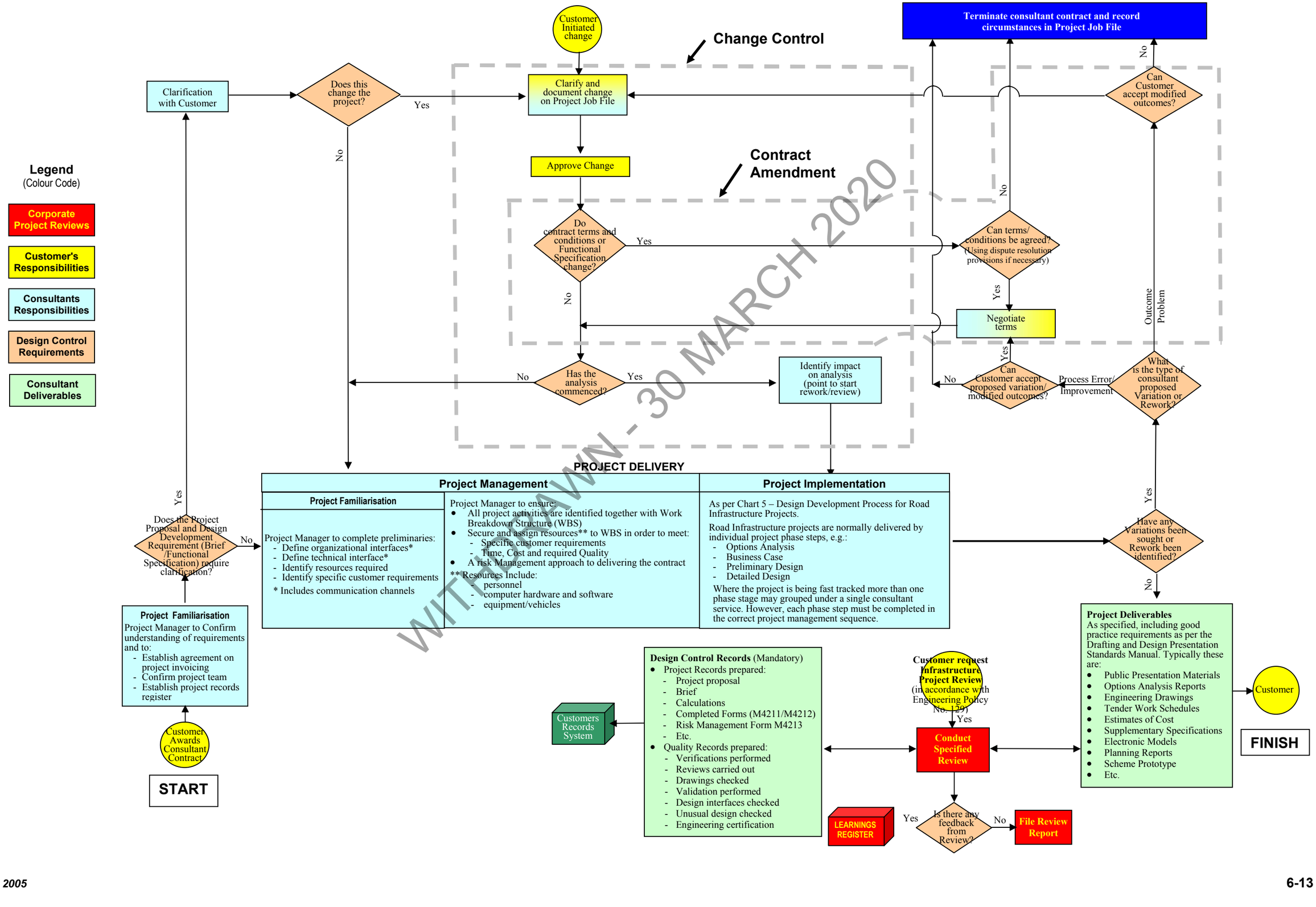
The Quality Plan should define the requirements for internal Audits and when they are to be undertaken. At the least, they should be undertaken at the end of preliminary design and at the practical completion stage. Desirably, they should be undertaken at the specified design review points and may be inputs into the design review process.

6.6 Contract Review

The purpose of the contract review is to ensure that there is a mutual understanding of the client's project requirements, the scope of the work, the available input information and the procedures to be adopted during the administration of the contract.

The objective of the contract review is to ensure that both parties understand and accept:

Figure 6.5.1 – Design Control Procedure for Design Development of Road Infrastructure



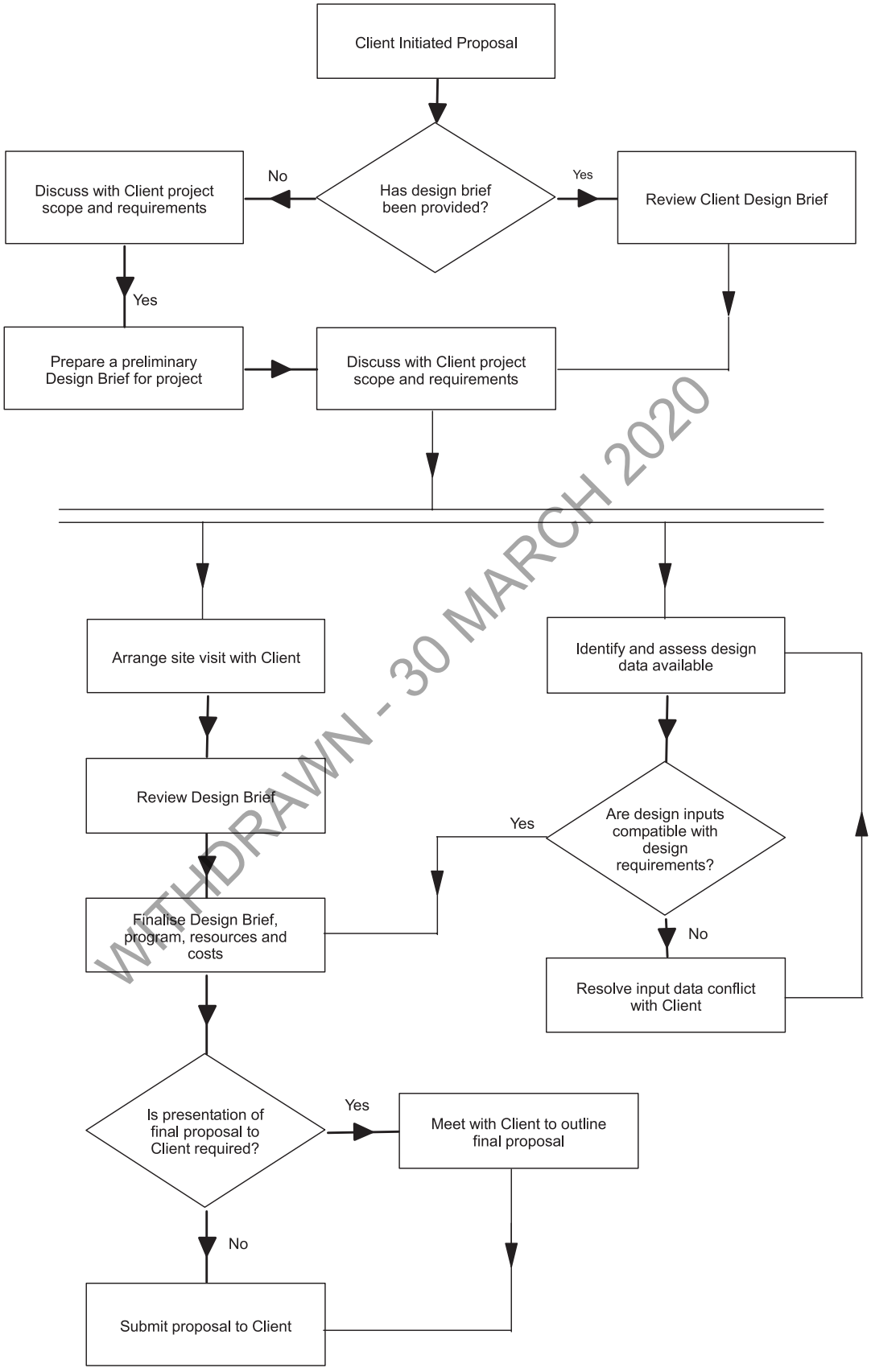


Figure 6.6.1 Process for Carrying out a Contract Review

- the project requirements including the scope of work, design standards, principles, statutory and regulatory requirements, and performance criteria;
- the relationship between the parties addressing contractual arrangements, decision making, risk sharing, time frame, budgetary controls, and design variation controls;
- the adequacy of the design information/data against the project performance requirements including constructability, operational maintenance; and
- the type and level of resources required including skill, knowledge, and technology requirements.

Figure 6.6.1 illustrates the process for the carrying out of a contract review. An outcome of the review may be a modified brief and/or clarification of the requirements.

The important aspects of this process that need to be addressed are:

- Communication between the parties to determine project requirements and resolve differences in order to reach an agreed understanding.
- Review of available design data for compatibility with project requirements;
- Identification, and determining the accessibility of additional data needs;
- Agreement by both parties on the design program; and
- Appropriateness of design control activities by both parties.

6.7 Data Correlation and Review

The purpose of the data correlation and review phase is to identify the design data to be used as the basis of the design or to be incorporated into part of the design, and to assess the adequacy of the data against the project objectives and performance requirements.

The objectives of the data correlation and review are to:

- identify the design data requirements,
- resolve any discrepancies or ambiguity in the information supplied by the client or obtained by the project team,
- assure that the design as it evolves is based on complete and accurate data to minimise the occurrence of errors.

Design data is the input data used in the development of the various stages of design and may include:

- project specification;
- performance and functional requirements;
- survey information including site inspection reports;
- design standards and codes;
- design principles;
- Road Network Strategy goals;
- Investment Strategy requirements;
- Link Strategy requirements;
- traffic loading;
- hydraulic performance;
- concept drawings;
- statutory and regulatory requirements;
- services authorities specifications;
- environmental conditions;
- minutes of meetings; and
- Road Safety Audit reports (for earlier phases of the planning and design process).

Figure 6.7.1 illustrates the process for data correlation and review.

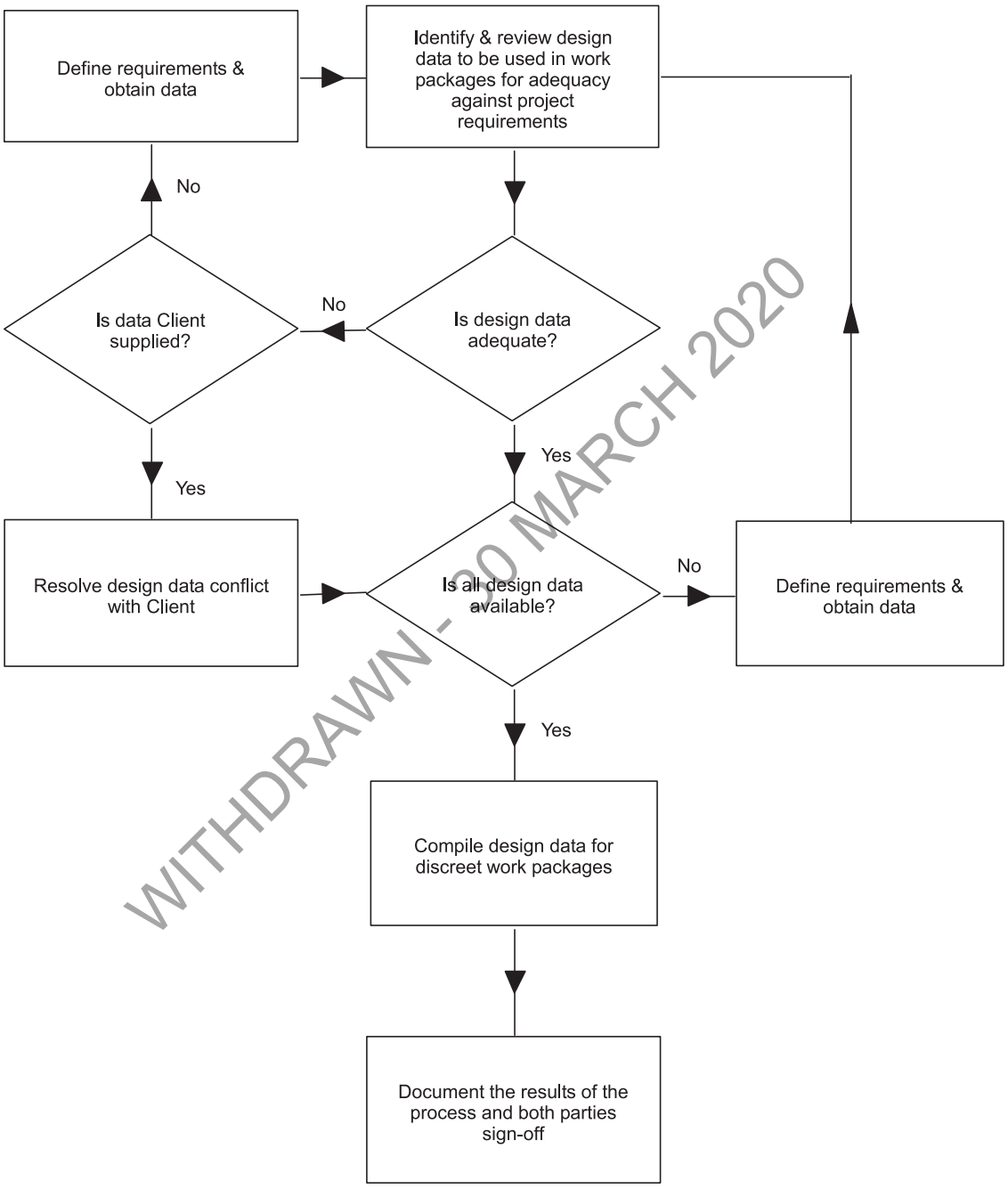


Figure 6.7.1 Process for Data Correlation and Review

The important aspects of this process that shall be addressed are:

- Review of the design data for adequacy and completeness to meet the project requirements;
- Identification of design data needs for each distinct package of work, to ensure that all necessary information is available to allow the design to proceed on a sound basis;

6.8 Design Checking and Verification Process

The purpose of design output checks is to implement an appropriate number and level of progressive checks during the design stages to provide assurance that the design complies with the project requirements and objectives, design standards and principles, road safety criteria, statutory and regulatory requirements.

This process requires two levels of checking:

- Self checking as the design proceeds; and
- Design Verification by independent and experienced personnel.

Progressive self checking is required to ensure that the design has been completed in accordance with the project requirements, has used the correct input information, is documented in accordance with the Department's requirements, is accurately calculated and documented so that another person can understand and check what has been done.

Design verification is a formally documented checking process carried out at appropriate stages of the design by suitably qualified and competent persons to ensure that the design stage output meets the design stage input requirements. It shall cover:

- Design assumptions;
- Design criteria;
- Calculations;
- Checks of dimensions and materials specification;
- Checks that all of the requirements of the brief have been met; and
- Site verification of the design.

Design verification shall ensure that:

- the correct inputs have been used;
- there have been no omissions;
- the design outputs can be traced to the design inputs including any variations agreed by the client;
- any variations have been subject to the same checking processes as the original design.

Verification may include:

- performing alternative calculations;
- checking a sample of the design calculations;
- comparing the new design with a similar proven design;
- undertaking tests and demonstrations of new appurtenances; and
- reviewing the design stage documents before release.

The appropriate levels of checking must be specified in the Quality Plan, e.g.:

- Level A – cursory check by the team leader;
- Level B – full check with the design team;
- Level C – full check by a person external to the design team.

Verifications are to be recorded by signature and dating on appropriate drawings, estimates, design calculation summaries, or other adopted forms. Signatures must be identifiable.

Non-conformances

All design requirements that have not been met are to be recorded together with the reasons for

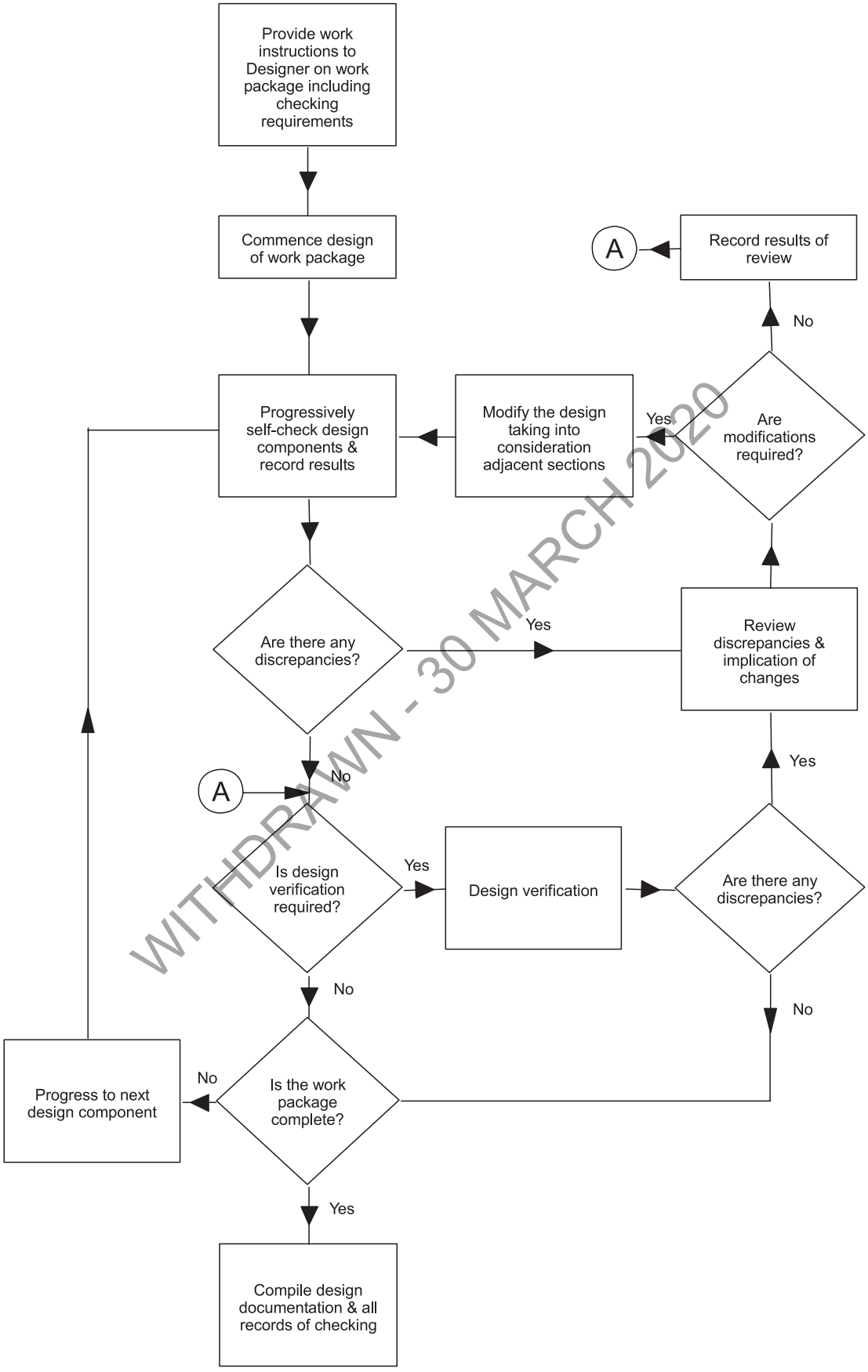


Figure 6.8.1 Design Checking and Verification Process

the non-conformance and appropriate Corrective Action Requests issued.

Design Checking and Verification Process

Figure 6.8.1 illustrates the design checking and verification process.

The important aspects of this process that shall be addressed are:

- planned checking hold points should occur prior to commencement of new design components, or stages;
- design discrepancies shall be reviewed adequately and resolved, taking into consideration the effect of design changes on already completed work and adjacent sections of design;
- all design checks shall be recorded to establish the traceability and to demonstrate the depth of checking that has occurred. All design checking documentation must be signed off and dated.

When spot checks are carried out, or resolution of design issues required before work proceeds is obtained, these shall be recorded on the checklist sheets to indicate that agreement to proceed has been given. Where this agreement is conditional, the conditions should be recorded or cross-referenced on the checking sheet, for follow up and traceability.

Checking Aids

The most appropriate aids are the checklists prepared before the project starts and included in the Quality Plan. Checklists should be tailored to the requirements of the specific project but these may be based on standard comprehensive lists that identify all of the likely items to be checked.

Appendix 6A includes a set of comprehensive checklists that may be used as the basis of checklists prepared for a specific project.

6.9 Design Review

6.9.1 Purpose

The purpose of the design review is to ensure that the design:

- Meets the client's requirements;
- Complies with statutory and regulatory requirements;
- Is applying appropriate methodologies and standards;
- Is using correct criteria and assumptions;
- Provides the most practical and economical result for the client;
- Can be constructed in a practical and economical way;
- Minimises traffic disruption and provides a practical traffic management approach to the project;
- Meets road safety requirements; and
- Documents the design in an accurate and functional way.

6.9.2 Timing

Design reviews should be planned at appropriate points in the project –

- Concept design phase;
- Functional design phase – when the layouts have been sufficiently developed to adequately define the project essentials (traffic layouts, cross sections, horizontal and vertical alignments);
- End of preliminary design (may be adequate for some designs to use this review to cover the functional design phase);
- End of detailed design before the drawings are signed.

It is important to time the reviews to ensure that corrective action can be taken before the design has proceeded too far.

6.9.3 Design Review Team

The size of the team will depend on the size and complexity of the project. For simple straightforward designs, the review team may be a single person, independent of the design team and separate from the road safety auditor. For major projects, the review team should include appropriate specialists with significant experience in the type of project being designed and be able to address the design standards and principles, environmental issues, construction issues, post construction maintenance and road safety.

The road safety audit should form part of this review but be independently undertaken, the report becoming an input to the review. Similarly, the internal quality audit should form part of the review but be independently prepared, the report becoming an input to the review.

The team may be varied for review at different times within the project if particular matters requiring specialist input are to be addressed at that time. In most cases, however, the team should be constant throughout the project to maintain continuity and minimise the learning curve at each review.

6.9.4 Design Review Process

The design review process for each project should be defined and as far as possible, standardised, to ensure that all aspects are covered. Figure 6.9.4 sets out the design review process This should be supplemented with a checklist for the team to use and should encourage some degree of flexibility to pursue particular issues on a project.

Standardising the process should make it more efficient but care is needed to ensure that the review team is not hamstrung by it.

6.10 Auditing

6.10.1 General

Three types of auditing may be applicable to a project:

- Quality Audit;
- Road safety Audit;
- Constructability Audit.

The extent of auditing undertaken should be carefully designed to be appropriate to the size and complexity of project. Otherwise, an unduly bureaucratic system will be imposed on the design project with consequent increases in costs and time for completion of projects.

6.10.2 Quality Audit

The Quality Audit should be undertaken in accordance with standard internal audit procedures. The usual reports, including non-conformance reports and corrective action requests should be prepared. Proper records of the actions taken and the close out actions are required. These should be part of the documentation provided for the Design Review.

6.10.3 Road Safety Audit

The road safety audit should be undertaken by a road safety auditor independent of the design team and be in accordance with the procedures specified by the Department. The assigned auditor shall be appropriately experienced in geometric standards and their application.

This audit should be considered as part of the design process and the output of the audit should be helpful to the design team. The auditor's report should also be provided as input to the Design Review.

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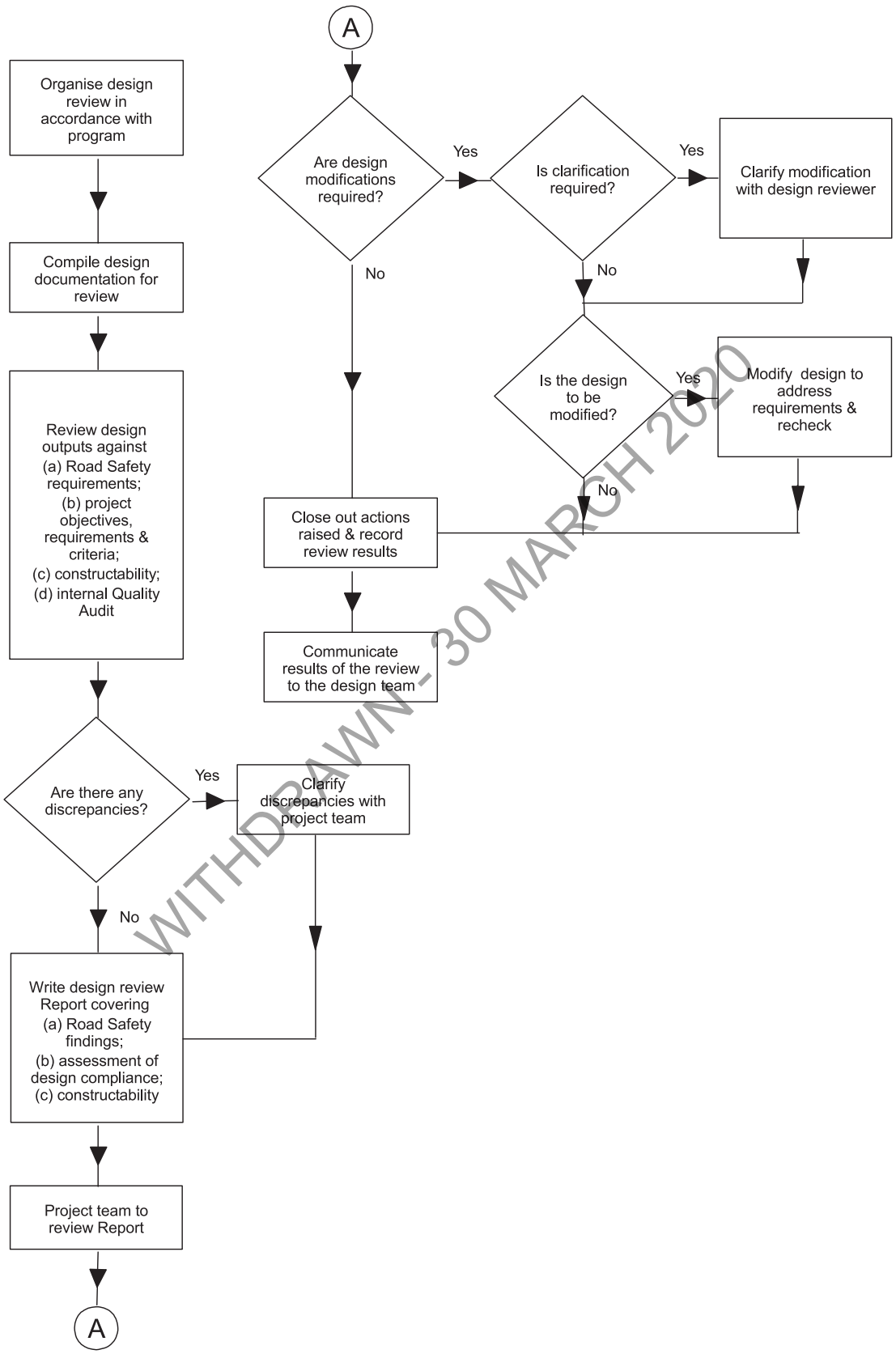

Figure 6.9.4 The Design Review Process

6.10.4 Constructability Audit

6.10.4.1 General

This type of audit is becoming more widely used but has not been standardised to the extent that the other audits have. A formal audit will not be necessary if the Design Review process is undertaken properly. However, the Design Review team should include one member with appropriate construction skills to ensure that this subject is covered adequately.

A separate Constructability Audit may be required for designs by external consultants or as input to the Design Review in some cases.

6.10.4.2 Issues for Consideration

- Traffic operations during construction:
  - Appropriate geometry (alignment, transitions, tie-ins, cross section elements)
  - Capacity
  - Signing
  - Temporary works an integral part of the design;
- Temporary drainage must work;
- Drainage channels must be appropriate to the soil types (e.g. sodic soils);
- Drainage of sags, particularly in ramps;
- Drainage at the ends of bridges must be properly directed to outlets;
- Surface drainage from high fills should be controlled with dykes and batter chutes or other positive control;
- Rate of rotation of crossfall must suit the capability of the paver – must document the start and end of all transitions;
- Widths of elements must be practical for the equipment available e.g.:
  - Widening appropriate to machine widths
  - Full paving under narrow medians and small islands
  - Full width paving (day-lighting pavements to the batter)
  - Width of paving suitable for the paver if appropriate;
- Pavement depths on adjacent sections should be rationalised for small differences in depth (e.g. there is no point in a 5mm difference when the construction tolerance is 10mm);
- Consistency of pavement layers on adjacent sections;
- Pavement layers should be continued under relieving slabs;
- Use appropriate materials for use under traffic (e.g. unbound pavements do not perform well under traffic when unsealed);
- Include suitable temporary works to ensure safety and integrity of the works during construction (e.g. intermediate sealing of surfaces to be used by traffic even if they are to be covered later);
- On concrete pavements –
  - Clear detailing of joint types, dimensioning and block-outs for drainage structures
  - Clearly describe the type of joints to be used and define their extent
  - Ensure traffic detector loops are not located under reinforcement;
- Complexity of construction at individual locations (e.g. at bridge abutments – drainage details, safety barrier, poles etc);
- Conflict between different items of road furniture (e.g. location of light poles behind safety barrier);
- Conflict between road furniture and drainage pits.

6.11 Contract Documentation

6.11.1 General

The end product of the planning and design process for a project is the contract documentation. The success of the project depends on this documentation being accurate and complete. The intent of the controls and quality management techniques discussed in other sections of this Chapter is to provide this accuracy and completeness.

Without these qualities, difficulties will arise both during the tendering process and during construction. The end result is an increase in the cost of the works and significant disruption to the management of the project and its completion.

Most of the variations to the contract and the additional costs incurred can be traced back to the inadequacies in the documentation. It is therefore essential that the production of the documents be closely controlled as described in this chapter.

The appropriate type of contract documentation will depend on the type of delivery system adopted. The various options are described in the Department's publication "Main Roads Project Delivery System, Volume 1 – Selection of Appropriate Project Delivery Options". Regardless of the type of delivery system adopted (except Design/Construct), the design documentation must be complete and suitable for use in any of the methods.

6.11.2 Scheme Prototype

The prototype is to be assembled in accordance with the Department's standards as set out in Standard Contract Provisions Roads:

- Volume 1 - Road Construction Contract;
- Volume 2 - Roadworks Performance Contract; and/or
- Volume 3 - Minor Works Contract.

All of the necessary forms, Conditions of Tendering, Conditions of Contract, Supplementary Conditions of Contract, standard specifications, supplementary specifications, drawings, standard drawings and schedules must be included. Appropriate approvals must be obtained and these must be checked before release of the prototype.

6.11.3 Quality Records

A complete set of the signed Quality records should be sighted and checked for completeness before the prototype document is accepted as completed. This check will provide assurance that the documents have been verified by competent personnel and will, as far as possible, be accurate and complete. Incomplete records should be returned to the designer for verification and completion.

6.12 Tendering Process

The tendering process is to be as described in the "Main Roads Project Delivery System, Volume 2 – Tendering for Major Works".

After the tender has been called, the design team has on-going responsibilities for providing clarification and making corrections if required. In all of these cases, time is of the essence if the process is not to be delayed.

The number and extent of requests for clarification and corrections/additions is a measure of the performance of the design team in producing satisfactory documentation of the project. Excessive numbers of such requests indicates a lack of accuracy, clarity and/or completeness in the design documentation.

6.13 Construction Period

The design team's responsibilities extend throughout the construction period in terms of:

- providing clarification of the documentation and the design intent;

- interpreting the documents;
- correcting errors in the design or the documentation (foreseeable);
- designing additional features arising from unanticipated changes in the scope of the work (unforeseeable);
- designing features omitted from the work (foreseeable);
- re-designing features where errors have been made (foreseeable);
- re-designing features to incorporate improvements identified in the construction process (unforeseeable); and
- providing advice on quantities for new work.

Foreseeable items should have been dealt with in the design and can be considered a "failure" of the design process. These matters should have been covered in the design. A well-controlled design process will minimise these variations.

Unforeseeable matters will always arise because of site conditions and external events outside the control of the design team at the time of design.

In either case, the design team will be responsible for producing the "as-constructed" drawings.

6.14 Project Close-out

6.14.1 Process Review

The purpose of the Design Process Review is to ensure that the control process has been completed in accordance with the quality plan and the programme. Further, it is to ensure that all of the client requirements have been met and that all corrective actions have been closed out.

By establishing that:

- all client requirements have been addressed;
- all issues raised by the team and reviewers have been addressed and closed out;
- all programmed checks and reviews have been properly completed; and
- all identified errors have been addressed and properly closed out,

the design can be accepted as Quality Assured.

Figure 6.14.1 illustrates the design process review procedure.

The important aspects of this procedure to be addressed are:

- traceability and completeness of all checking and review documentation, including supervisor's checks;
- adequacy of the review and resolution of design discrepancies, considering the effect of the changes/amendments on the total project;
- traceability of design documentation such as variation orders, approval and agreement to design modifications and extensions of time;
- traceability of design requirements in the design outputs;
- closing out of all Corrective Action Requests (CARs) raised against the project.

Where any part of the control process or requirements have been found to be incomplete or difficult to establish, a non-conformance shall be issued. The design process review will not be completed until all non-conformances have been addressed and the short-term corrective actions have been closed.

The design process review is to be conducted as a quality compliance audit. To achieve an adequate rating for any item objective evidence must be provided.

6.14.2 Team Review

All jobs should have a close out review to assess the performance of the team, identify both positive and negative aspects of the project and receive feedback from the client on the level of satisfaction with the result. A standard agenda

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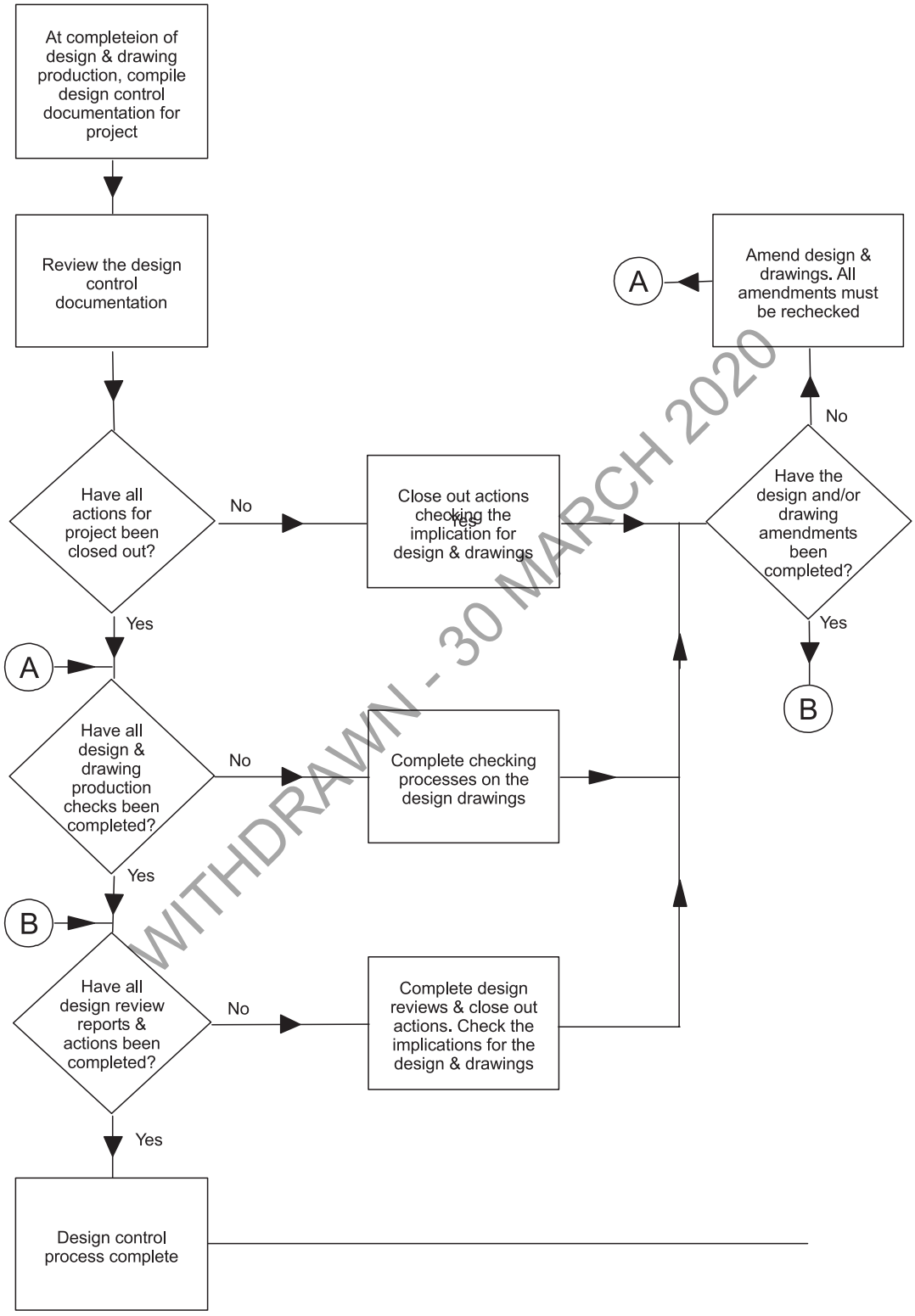

Figure 6.14.1 The Design Process Review Procedure

could be drawn up to ensure that all relevant issues are addressed.

The purpose is to:

- allow all team members to learn from the project;
- identify areas for improvement;
- identify areas where performance was excellent;
- enable all team members to correlate their perceptions of the quality of the job with the outcome from the client's perspective.

A further post construction review should be held to determine whether the expectations of the design were realised in practice and to gain further learnings from it.

It is important that the team feels comfortable in these reviews so a balance between a structured approach and retaining sufficient informality to encourage participation has to be found.

6.15 Performance Review

The system for the engagement and use of consultants on engineering projects requires consultant performance reports to be prepared:

- after supply of contract documents; and
- after construction.

This is necessary to ensure consultants get enough constructive feedback on their performance.

The consultancy management process should be such that there are no surprises to the consultant on performance during the preparation of the report and consultant feedback phase.

The performance reporting system has been designed to assess performance against selection criteria and against achieved versus expected outcomes. The system is robust enough to allow removal of consultants who consistently perform poorly.

While this process has been designed specifically for assessment of external consultants, the same approach should be taken to the assessment of the performance of internal design teams. This will provide a good opportunity for constructive feedback to design teams on their performance and the level of satisfaction of their customers.

References

1. Texas Department of Transportation: "Project Delivery and Project Management for TxDOT Projects".
2. Vicroads: "Road Design Guidelines – Design Control" (1997).

Appendix 6A: Design Output Checklist

1 Design Speed

		Relevant Consideration (Yes/No)
1.1	The design speed is compatible with the speed environment, traffic volumes, terrain and adjoining sections of road.	_____
1.2	The need for part of the job to have a lesser or greater design speed has been checked.	_____
1.3	There is an appropriate transition from one design speed to another.	_____
1.4	Temporary connections to adjoining sections of road are appropriate.	_____

2 Horizontal Alignment

2A General

2A.1	Alignment is compatible with the following where applicable: (a) Existing terrain (b) Speed environment (c) Design speed	_____
2A.2	Not less than minimum radius curves have been used (except in very tight alignment conditions).	_____
2A.3	The need for transitions has been investigated and the distance between curve tangent points is adequate for the change in superelevation.	_____
2A.4	Adequate clearance has been provided to obstacles and hazards (e.g. bridge piers, retaining walls, above-ground Public Utility Plant, buildings).	_____
2A.5	Sufficient distance has been provided between broken-back curves. (These should be avoided; use only where necessary.)	_____
2A.6	Lateral visibility is adequate:- • Through earthwork cuttings • To private accesses • To intersections and islands • To open level crossings (Should not be obstructed by buildings, large trees and shrubs, overgrown grass, large signs, bridges.)	_____
2A.7	Alignment has been located to minimise PUP conflicts.	_____
2A.8	Alignment has been located to minimise resumptions.	_____
2A.9	Maximum use has been made of existing pavement as well as kerb and channel.	_____
2A.10	The number of lanes provided is compatible with the design traffic volume and intersection traffic analysis.	_____
2A.11	Through pavement, parking lane, turn slot, bridge and shoulder widths meet the Department's standards.	_____
2A.12	The need for special widening: curve widening and benching has been considered.	_____
2A.13	Horizontal curves are long enough to avoid the appearance of a kinked alignment.	_____
2A.14	The need for an overtaking section of roadway has been considered.	_____
2A.15	Tapers for adding or dropping lanes meet the required standards.	_____

	Relevant Consideration (Yes/No)
2A.16 Every effort has been made to see that the horizontal alignment of bridges is either a straight alignment or a curved alignment, not a combination of both.	_____
2A.17 The angle of skew of bridge abutments has been minimised.	_____
2A.18 Provision of temporary connections has been considered.	_____
2A.19 Compound curve ratio is satisfactory.	_____
2A.20 Pedestrian and bicycle requirements have been investigated.	_____
2A.21 The need for public transport stops has been assessed and recommendations approved by the District	_____
2A.22 The need for parking lanes has been investigated.	_____
2A.23 Where applicable, median widths are designed to make allowance for :-	_____
(a) Future lane requirements including turn slots	
(b) Median drainage	
(c) Median lighting	
(d) safety barriers	
2A.24 The need for median openings for U-turns and emergency traffic operations has been considered.	_____
2A.25 Stage construction has been planned in detail and checked for practicability. Staging (including temporary signs and pavement marking) are shown on the drawings.	_____

2B - Intersections

2B.1 The intersection layout has been checked by superimposing the turning path template for the required design vehicle on all anticipated vehicle turns, including clearances beyond the swept path limits.	_____
2B.2 Adequate control lines and setting out lines have been provided to enable accurate setting out to be achieved.	_____
2B.3 Pavement tapers (incl. merges and diverges) are adequate.	_____
2B.4 Deceleration requirements have been considered.	_____
2B.5 Acceleration requirements have been considered.	_____
2B.6 Length of turn slots for vehicle storage is adequate.	_____
2B.7 Widths, lengths and areas of islands and medians meet minimum requirements.	_____
2B.8 Consideration has been given to pedestrian traffic (pram ramps).	_____
2B.9 Nose radii are adequate to accommodate signal pedestals, offset and set-back of islands conforms to the Department's standards.	_____
2B.10 Horizontal sight distance meets the minimum requirements for :-	_____
• Stopping	
• Sight triangle	
• Crossing sight distance	
• Property access	
2B.11 Approach angle of intersection is less than 30°.	_____

	Relevant Consideration (Yes/No)
2B.12 Barrier kerbing at noses of islands and medians has been provided for the minimum distance.	_____
2B.13 Type of island and median kerbing, kerb and channel including channel width, conform to the Department's and Local Authority requirements.	_____

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2C - Interchanges

2C.1 Design speed of all legs of the interchange are appropriate.	_____
2C.2 Lane balance parameters have been complied with.	_____
2C.3 Freeway-to-freeway merge and diverge standards have been met.	_____
2C.4 Ramp exit and access tapers (diverge and merge areas) conform to standards.	_____
2C.5 Ramp lengths (single lane, two lane) meet minimum requirements.	_____
2C.6 Design acceleration and deceleration speeds on ramps can be achieved.	_____
2C.7 Design weaving lengths and widths have been achieved.	_____
2C.8 Horizontal visibility to the following is adequate for the design speed:-	_____
• Ramp noses	
• Ramp terminals	
• Freeway exits and accesses	
• Under structures	
2C.9 Successive exit and access ramps have been spaced at the minimum distance or greater, and checked for satisfactory weaving operations.	_____
2C.10 Right exits and accesses have been avoided where possible.	_____
2C.11 The need for single or double lane exits and accesses have been investigated.	_____
2C.12 Interchange structures have been positioned with respect to the following:-	_____
• Geometry (angle of skew of abutment)	
• Limitation on span length	
• Stage construction	
• Supplementary structures (retaining walls)	
• Foundation condition	
• Environmental and aesthetic requirements	
• Public utility requirements	
• Maintenance requirements	
• Drainage	
2C.13 Horizontal and vertical clearances to obstructions meet the Department' s requirements.	_____

Relevant Consideratio
(Yes/No)

3 Vertical Alignment

3A - General

3A.1 Grades meet maximum and minimum requirements. _____

3A.2 Need for climbing lanes has been investigated with respect to grade and length. _____

3A.3 Grades through intersections and at merge and diverge areas meet the relevant standards. _____

3A.4 Vertical clearance to obstruction (e.g. bridges, public utility plant, signs) meet the relevant standards. _____

3A.5 Vertical sight distance requirements are satisfactory. _____

3A.6 Vertical curve for riding comfort has been achieved. _____

3A.7 "Sag" vertical curves are adequate for headlight visibility. _____

3A.8 Cover to drainage structures and clearances to underpasses meet minimum requirements. _____

3A.9 Headwater for drainage structures can be achieved. _____

3A.10 Full pavement depth, where possible, can be achieved over drainage structures where there is a requirement to use paving machines. _____

3A.11 Large radius "crest" vertical curves in cuts are adequately drained. _____

3A.12 "Sag" vertical curves in cuts are adequately drained. _____

3A.13 Depth of cuts and height of fills have been minimised to be consistent with earthworks economy. _____

3A.14 Need for benching in cuts has been considered. _____

3A.15 Grades have been set to cater for:- _____

- Flood height
- Existing surveyed pavement heights
- Future overlays under structures
- Acceptable property access.

3A.16 Grades have been set to enable acceptable property access. _____

3A.17 Grades will allow adequate drainage of kerb, and channel and table drains. _____

3A.18 Earthworks balance has been considered in setting of the final grade line. _____

3A.19 Consideration has been given to the type of material in cuts when setting the grade line. _____

3A.20 Hidden dips (restriction of sight distance) do not occur. _____

3A.21 Vertical sight distance (e.g. stopping, overtaking, to merge and diverge areas, to island and medians, under structures, to property accesses) meets minimum requirements. _____

3A.22 Overtaking opportunities have been investigated. _____

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Relevant Consideration (Yes/No)

3B - Intersections

3B.1 The gradient of the intersecting road is not significantly greater than the cross slope of the through pavement. _____

3B.2 The combination of horizontal and vertical alignment at or near the intersection is such that all traffic lanes, islands and medians are clearly visible, definitely understandable for any desired direction of travel, free from the sudden appearance of potential hazards and consistent with the portions of the road just travelled. _____

3B.3 Cross over crown line requirement has been met. _____

3B.4 In the case of roundabouts, the roundabout is clearly visible from all approaches. _____

3C - Interchanges

3C.1 FOR ON RAMPS: _____

- Vehicle speed in merge area meets design requirements.
- Possibility of providing a down grade has been investigated.
- The resultant cross slope between the ramps and through carriageway before the nose is such that vehicles can see each other for as great a distance as possible.
- Cross over crown line requirements have been met.

3C.2 FOR OFF RAMPS: _____

- Vehicle speed at the terminal with the surface streets meets design requirements.
- Possibility of providing an upgrade has been investigated.
- The resultant cross slope between the ramps and through carriageway meets design requirements.
- Cross over crown line requirements have been met.

3C.3 FOR BRIDGES: _____

- A situation where there is a large difference in abutment elevation should be avoided, particularly at multi-level interchanges, so that the differences in bridge span lengths can be minimised.

3C.4 Pavement design of the merge and diverge areas is adequate. _____

4 Co-ordination of Alignment

4.1 Vertical and horizontal curves coincide, with the horizontal curves slightly overlapping the vertical curves. _____

4.2 Horizontal curves are long enough to avoid the appearance of a kink. _____

4.3 Alignment co-ordination and design form is as outlined in NAASRA Guide for Design of Rural Roads. _____

4.4 If good co-ordination of alignment cannot be attained, reasons are stated. _____

4.5 Has the alignment design considered retention / maximisation of views of points of interest in the vicinity of the road (e.g. areas of high scenic value)? _____

Relevant Consideration (Yes/No)

5 Cross Sections

5A - Type Cross Section

Where applicable the following have been shown on each type cross section.

5A.1 Existing surface at time of construction. _____

5A.2 Road template fully dimensioned. _____

5A.3 Shoulder overlap details. _____

5A.4 Pavement and shoulder superelevation. _____

5A.5 All drainage requirements including subsoil drains, levees and catch banks.

5A.6 Cut and fill batter (slope stability and scouring). _____

5A.7 Related service roads, surface street, buildings, guard-rail, retaining walls, kerbing, kerb and channel etc). _____

5A.8 Fences and property boundaries. _____

5A.9 Benching. _____

5A.10 Cut and embankment slope treatment. _____

5A.11 Pavement description and extent of surface treatment (e.g. asphalt and/or bitumen surfacing). _____

5A.12 Control line fully described. _____

5A.13 Extent of existing pavement. _____

5A.14 Specific references to detailed drawings and supplementary specifications. _____

5B - Cross Sections

Where applicable the following have been considered in relation to cross section:-

5B.1 Changed widths of pavement, shoulders, footpaths, table drains. _____

5B.2 Changes in superelevation meet requirements. _____

5B.3 Benching requirements (benches drain adequately) _____

5B. 4 Pavement configurations. _____

5B. 5 Property boundaries and fences. _____

5B. 6 Public Utility Plant locations. _____

5B. 7 Kerb and kerb and channel requirements. _____

5B. 8 Details of batter points if no construction tables. _____

5B. 9 Extent of existing pavement. _____

5B.10 Details of table drain, median drain and batter points (if no construction tables available). _____

5B.11 Adequate clearance has been allowed at the top of cuts and at the toe of embankments for maintenance vehicles. _____

5B.12 Geotechnical features have been considered in determining the batter slope and benching details. _____

5B.13 Allowance has been made for access to benches by maintenance vehicles. _____

Relevant Consideration (Yes/No)

5B.14 Subsoil drains and kerbing have been considered as an alternative to table drains in cuttings. _____

5B.15 The shoulder detail is compatible with pavement drainage and discourages infiltration of water into the pavement. _____

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6 Property Accesses

Existing and proposed accesses to property have been considered in relation to the following:-

6.1 All existing accesses are shown on the drawings. _____

6.2 Location and standard of existing accesses have been checked on site and recorded. _____

6.3 All proposed accesses to property have been agreed to by the District. _____

6.4 Each access design has been checked for profile and overall dimensional suitability for the type and frequency of vehicles using the driveway. _____

6.5 The construction standard of each driveway is indicated in the documents. _____

6.6 Sight distance meets requirements. _____

7 Drainage Design

7A - General

7A.1 Existing drainage: Drawing shows location and size of existing drainage (site inspection has been done). _____

7A.2 Watershed areas: Watershed areas have been calculated from the most recent watershed plan or contour plan showing current development.

Allowance has been made for future development and future drainage requirements of the Local Authority. _____

7A.3 Design Calculation: Design calculations are in accordance with the Road Drainage Design Manual. _____

(Calculations are to be presented in a manually compiled stormwater drainage tabulation or computer printout, in a form that can be readily checked).

7A.4 Inlets, manholes and kerb and channel types are in accordance with current Departmental standards or Local Authority standards where applicable. _____

7A.5 Wherever possible, pipes, gullies and manhole locations do not conflict either horizontally and vertically with the following:- _____

- Public Utility Plant
- Pavement
- Retaining walls
- Bridge piers
- Buildings, large trees

- Road lighting, underground installations
- Large sign footings
- Traffic signal underground installations
- Gully inlets which should be located clear of pedestrian movements
- Manholes which should be located clear of the wheel paths of vehicles and be easily accessible.

		Relevant Consideration (Yes/No)
7A.6	The length of pipe for cross drainage takes into account curve widening, any special widening and extra width for safety barrier installation.	_____
7A.7	Where extensions to existing culverts are envisaged, the existing culvert is compatible with the culvert extension (i.e. size, shape and type).	_____
7A.8	Recessed inlets have been provided in the kerb at all gullies. "Bicycle Proof" grates have been used where required.	_____
7A.9	Benching and step irons in manholes.	_____
7A.10	The length of pipe as defined in specification has been specified on the drawings. (Ordering lengths may be different, multiple or standard length).	_____
7A.11	Class of pipe and method of laying has been defined.	_____
7A.12	Allowable height of fill over RCCs, CSPs and RCBCs has been checked.	_____
7A.13	Manholes are large enough to accommodate all pipes. (Details have been shown on the drawings where considered necessary).	_____
7A.14	Condition and use or re-use of existing culverts has been investigated.	_____
7A.15	Allowance has been made for drainage of traffic signal and road lighting pits.	_____
7A.16	Low points and drainage paths have been checked on pavement by contouring.	_____
7A.17	Aquaplaning (depth of water on pavement) (use contours to check).	_____
7A.18	Drainage of depressed medians has been investigated.	_____
7A.19	The effect of head and backup water on private property has been assessed.	_____
7A.20	The need for subsoil drainage has been investigated, and if required, outlets have been allowed for.	_____
7A.21	Soil suitability and water resistivity for corrugated steel installations has been checked.	_____
7A.22	A minimum height of 450mm has been maintained from the top of pipes to the top of manholes and gully grates.	_____
7A.23	The need for batter drains, energy dissipaters, and dykes has been investigated.	_____
7A.24	Outlets from property roofwater have been catered for.	_____
7A.25	Is there any requirement for pollutant traps and, if provided, are they appropriate.	_____

7B - Design Calculations

The following points have been considered in design calculations for drainage works:-

		Relevant Consideration (Yes/No)
7B.1	The maximum intensity used for calculating pavement drainage as shown in Form M2290 or design brief.	_____
7B.2	Time of concentration includes overland flow, gutter flow and pipe flow where applicable.	_____
7B.3	Intensities are in accordance with Australian Rainfall and Run-off.	_____
7B.4	Recurrence interval for cross drainage and pavement drainage as shown in Form M2290 or the design brief.	_____
7B.5	All run-offs take into account future development in the catchment area.	_____
7B.6	Hydraulic grade line is such that there will be no popping of manhole covers at full flow.	_____
7B.7	Velocity through the pipes.	_____
7B.8	Tailwater height.	_____
7B.9	Headwater height.	_____
7B.10	No pipe smaller than the minimum size specified in the Brief have been used in the design.	_____
7B.11	Pipes and kerb and channel have been placed at or greater than minimum slope.	_____
7B.12	Cost comparisons for alternative large culverts have been prepared, evaluated and approved by the District.	_____
7B.13	For right-angled turns at manholes, an invert drop of 150mm has been allowed.	_____
7B.14	Pipes are graded so that excavation is kept to a minimum.	_____
7B.15	Flood heights are such that flooding of private property has not been increased.	_____
7B.16	Velocity at outlet has been checked and additional protection provided where required.	_____
7B.17	Velocity and depth of flow in table drains and diversion channels has been investigated. (Scour, need for protection).	_____
7B.18	The allowable width and depth of flow against the kerb and channel has not been exceeded nor diverted by property accesses.	_____
7B.19	Levees and blocks have been provided in the table drain to maintain proper flows.	_____
7B.20	The need for pipe skew has been considered.	_____
7B.21	The number of culvert openings have been chosen to suit the natural channel.	_____
7B.22	Inlet heights are low enough to pick up the main water flow. Isolated water holes have been ignored.	_____
7B.23	Outlet heights are high enough to drain water away from pipes and culverts where applicable.	_____

Relevant Consideration
(Yes/No)

7C - Floodways

7C.1 The floodway has been designed to cater for a time of closure or submergence that is in accordance with the requirements in the brief or Form M2290. _____

7C.2 Where practical, culverts have been provided to cater for lower than normal flows. _____

7C.3 The floodway embankment does not increase upstream inundation to an intolerable height. _____

7C.4 In extremely flat country the embankment, even though it may be low, does not divert flood flows away from their natural channels. If so, levees have been provided to remedy the situation. _____

7C.5 Uniform flow over the length of the floodway has been achieved as far as possible. _____

7C.6 Every attempt has been made to avoid siting the floodway on a curve. _____

7C.7 Crossfall and superelevation changes in particular have been taken into consideration when designing for hydraulic flows over the floodway. _____

7C.8 The vertical alignment provides hydraulic adequacy as well as meeting design standards. _____

7C.9 Adequate scour protection and embankment stability has been allowed for. _____

8 Earthworks And Unsuitable Material

Earthworks

8.1 Adequate geotechnical data has been obtained to give the contractor a reasonable assessment of risk in relation to rock, spoil and borrow requirements. _____

8.2 The need to specify Spoil Area/Borrow Area has been assessed. _____

8.3 The need for any special supplementary specifications or payment items which give the contractor a fair basis for tendering in a competitive environment has been assessed. _____

Unsuitable material

8.4 The Quantity of Unsuitable Material shown in the tender documents has been calculated after assessment of the following:- _____

(a) Adequate geotechnical investigation

(b) A thorough site inspection.

9 Pavement Design

9.1 The pavement design has been based on the current Department of Main Roads Pavement Design Manual. _____

9.2 The following parameters have been considered in the Pavement Design:- _____

- Design period

Relevant Consideration (Yes/No)

- Traffic (volume, growth and type)
- Subgrade material properties
- Pavement material properties
- Environmental influences
- Construction and maintenance influences
- Drainage

9.3 Design alternatives and costs have been considered. _____

9.4 Appendix L of the Pavement Design Manual "Pavement Design Summary Report" has been completed and signed by the Design Engineer. (The basis for shoulder treatment is also to be indicated in this report). _____

9.5 The completed Pavement Design Summary Report has been forwarded to the District with the completed scheme. _____

9.6 Consideration has been given as to how layers will be constructed where kerb and channel is involved, especially where asphalt and CTB is used. _____

9.7 The shoulder layers are compatible with the construction of pavement layers. _____

9.8 Where bitumen surfacing has been specified, spray rates and aggregate spreading rates have been approved by the District. _____

10 Signs and Pavement Markings

10A - Signs

10A.1 Signing is in accordance with the Manual of Uniform Traffic Control Devices (Qld). _____

The following points have been addressed for regulatory and warning signs:

- Size of signs
- Location (lateral and longitudinal)
- Height of sign

10A.2 Regulatory signs: _____

10A.3 Warning signs: _____

The following points have been addressed for guide signs and freeway guide signs:

- Focal point names/legends

  (To be verified by District)
- Lettering size and type and spacing
- Layout of legends
- Colour of sign
- Reflectorisation of sign/illumination
- Shape and size
- Location of sign (lateral and longitudinal)
- Breakaway/non-breakaway supports
- Size of supports/support type
- Conflicts with pedestrians/underground-overhead Public Utility Plant /driveways

	Relevant Consideration (Yes/No)
10A.4 Guide signs:	
(a) Advance direction sign	_____
(b) Intersection direction sign	_____
(c) Reassurance direction sign	_____
10A.5 Freeway guide signs:	
(a) Freeway approach signs	_____
(b) Advance exit signs	_____
(c) Exit signs	_____
(d) Through destination signs	_____
(e) Reassurance direction signs	_____
10A.6 Route markers	
• Location	_____
• Correctness of route number	_____
• Conflicts	_____
• Support type/size	_____
10A.7 Sign table	
• Correctness of information	_____
• Sign symbol numbers	_____
10A.8 Existing signs - where existing signs are to be re-used, their condition has been field assessed	_____
10A.9 Are views from the roadway not significantly affected by the positioning of multiple support and gantry signs.	_____

10B - Pavement Markings

10B.1	Lane lines/raised marks (RRPMs)	_____
10B.2	Edge lines (shoulder edges, against kerb, around islands) (RRPMs)	_____
10B.3	Continuity lines	_____
10B.4	Give Way markings	_____
10B.5	Stop-bar markings	_____
10B.6	Chevroning / outline markings	_____
10B.7	Ramp diverges/merges (RRPMs)	_____
10B.8	Warrants for pedestrian crossings (zebra or signal controlled)	_____
10B.9	Pavement arrow warrants	_____
10B.10	Auxiliary wording on pavement	_____
10B.11	Turn lines	_____
10B.12	Barrier lines	_____
10B.13	Removal of existing markings	_____
10B.14	Painted islands/medians	_____

Relevant Consideration
(Yes/No)

11 Roadside Furniture

11.1 Road edge guide posts: _____

- The need to provide road edge guide posts.
- The type of post to be used (steel, wood etc.)
- The size and type of delineator to be used.
- The location and spacing of REGP.
- The need to show location of REGP on the drawings (Not covered adequately by Standard Drawing).

11.2 Grids: _____

- The need to provide a grid.
- Size of grid required conforms with Standard Drawing.
- Grid span and width, abutment type and details are shown on the drawings.
- The responsibility of the grid has been determined.

11.3 Steel beam guard-rail: _____

- The need to provide guard-rail.
- The type and spacing of posts to be used.
- Where applicable shoulder widening has been allowed for in the design to accommodate the guard-rail and approach taper. An allowance has been made on the bridge parapet on the bridge approach for guard-rail connection.
- Terminal details.
- The minimum length has been provided.

11.4 Fencing and gates: _____

- -245The need to provide fencing and gates.
- The type of fence and gate to be used.
- The requirements contained in accommodation work associated with resumptions.

11.5 Flood gauge posts: _____

- The need to provide flood gauge posts.

11.6 Concrete median barrier: _____

- The need to provide barriers.
- The barrier has been detailed on the drawings.
- Are lighting standards to be incorporated in the barrier? If so, provide electrical conduits.

11.7 Concrete shoulder parapet: _____

- The need to provide parapets.
- The parapet has been detailed on the drawings.
- The need to provide electrical conduits in parapet.

12 Public Utility Plant (PUP)

A typical utility service checklist includes:-

Telecommunications
Electricity
Water Reticulation
- Local Authority
- private (e.g. water meter to house or direct mains connection across the road to house).

Water Irrigation
- Local Authority
- Private (typically found crossing roads through storm water culverts to farms).

Sewerage
- Local Authority
- Private (typically related to developments e.g. caravan parks, church, community centres, etc.)

Gas
Petroleum Products
Mines
- mining structures and conveyors/pipelines

Department of Main Roads
- traffic signal and lighting ducts
- telecommunication connections to signals

12A - Conflicts

Conflict management is vital to ensure a smooth construction delivery process. Designers must ensure that design element conflicts between other design elements and also between existing infrastructure is avoided.

12A.1 Does the new road pavement, kerb and channel or fill batters cover any valves, manholes, inspection boxes, etc?

.....

.....

12A.2 Do changes to footpath heights require any valves, manholes etc. to be raised?

.....

.....

12A.3 Does a new cut batter or subgrade height expose any PUP?

.....

.....

12A.4 Does a new cut batter or subgrade height reduce the cover over any existing PUP to an unacceptable height? If so, what protection is necessary?

.....

.....

12A.5 Check the clearance from the invert of all table drains to any existing underground PUP. Is protection required?

.....

.....

12A.6 Do the new subgrade heights allow sufficient cover over existing PUP during construction?

.....

.....

12A.7 Does the installation of new stormwater pipes/culverts conflict with existing underground PUP (including any outlet structures or channels)?

.....

.....

12A.8 If pipes/culverts pass below existing PUP, can the PUP be suspended over the works during construction?

.....

.....

12A.9 Do subsoil drains or strip drains affect any underground PUP?

.....

.....

12A.10 Is existing PUP affected by the installation of underground power to road lighting or signals including clearance to underside of pits?

.....

.....

12A.11 Are the footings for signs, streetlight or signal columns clear of existing PUP?

.....

.....

12A.12 Are there any footings for bridge abutments (including piles) which are likely to affect PUP?

.....

.....

12A.13 Are the embankment loads (dead load on completion or live loads during construction) acceptable over existing conduits?

.....

.....

12A.14 Is there adequate clearance to aerial PUP both vertically and laterally?

.....

.....

12A.15 Is there sufficient clearance to overhead PUP for use of cranes etc. during construction?

.....

.....

12A.16 Does the new road design layout cause any problems with maintenance of existing PUP? (safety)

.....

.....

12A.17 Does proposed underground ducting conflict with other proposed underground ducting, i.e. between route lighting, traffic signals, communications, etc?

.....

.....

12A.18 Does proposed underground ducting conflict with other proposed underground installations, i.e. guardrail posts, footings for signs, communications, etc?

.....

.....

12A.19 Are there any other conflicts between design interfaces?

.....

.....

Note:- It is considered good design practice to prepare long sections to check on all PUP installations to ensure no conflicts occur.

12B - Relocation

12B.1 Are two or more PUP to be relocated into the same area? Will a conflict between these PUP result´

.....

.....

12B.2 Has the area into which PUP is to be relocated been set aside for:-

(a) Future roadworks?

(b) A future PUP corridor? (e.g. duplication of existing high voltage power lines).

.....

.....

12B.3 When PUP is relocated, will its new location conflict with any of the items previously mentioned in 12A - Conflict?

.....

.....

12B.4 Does the relocation of PUP into a final position affect the ability to stage the works?

.....

.....

12B.5 Does a temporary location of PUP during construction affect the programming of other sections of the Permanent Works (e.g. stormwater)?

.....

.....

12B.6 Are power poles to be relocated, clear of property access, existing PUP, existing and/or future roadways and footpaths, bus stops, underground drainage etc.?

.....

.....

12B.7 Has future development of the road network been catered for when relocating PUP because of a current conflict (e.g. allow extended extra depth on a road crossing to cater for future widening)?

.....

.....

12B.8 Should PUP be relocated prior to construction or is it necessary to do the work during construction? (Due consideration is to be given to cost and practicality.)

.....

.....

12B.9 Can some overhead PUP be placed underground at the same time as duct provision for lighting, signals, etc.?

.....

.....

12B.10 Has the likelihood of failure of PUP and the resulting disruption to traffic been weighed against the cost of relocation when major PUP is left under new roadways? The frequency of maintenance and the cost to raise manholes, valves etc., when future overlays are placed, should also be taken into account (e.g. sewers, gas, water).

.....

.....

12B.11 If parallel relocations of PUP are to be in close proximity, careful monitoring of backfill compaction will be necessary to ensure the trench for the other installation does not collapse. Can both relocations be performed simultaneously?

.....

.....

Note:- It is considered good design practice to prepare long sections to check on all PUP installations to ensure no conflicts occur.

12C - Steps to be Followed when Determining PUP Conflicts, Relocations and Costs

Relevant Consideration (Yes/No)

12C.1 A drawing showing existing features and all existing PUP in relation to existing property boundaries has been plotted from a recent survey and verified by site inspection. (All drawings must show existing and proposed boundaries). _____

Note:- There may be underground PUP not visible.

12C.2 Two copies of the above drawing have been sent to all service authorities requesting from them details of their existing drawings (including type of construction, location, depth, size). One copy to be retained by the service authority, the other returned marked up. _____

Service Authority	Date Sent
_____	__/__/__
_____	__/__/__
_____	__/__/__

12C.3 Information requested in 12C.2 above has been received as follows:- _____

Service Authority	Date Received
_____	__/__/__
_____	__/__/__
_____	__/__/__

Relevant Consideration (Yes/No)

12C.4 (After design sufficiently advanced)
All potential conflict points have been identified and marked on the drawing along with the PUP involved. All points listed under "12A - Conflicts" have been addressed. _____

12C.5 Where surveyed information was inadequate for accurately locating all conflict points, potholing has been carried out, recording location both horizontally and vertically by survey connected to existing traverse. _____

(Arrangements to have "Potholing" work carried out are to be first verified with the District Office)

12C.6 Adjustments have been made to the design, where practical, to minimise conflicts. Desirable PUP relocations have been detailed on a drawing and long section. (Consideration has been given to other relocated PUP). _____

12C.7 A copy of the plan and long section has been sent to each service authority asking for acceptance of the desirable relocations or to propose alternative relocations along with estimates of cost. _____

12C.8 A meeting has been held with each service authority addressing all the points listed under "12B - Relocation", and determining the most desirable location. Locations are to be marked on the plan and long section. _____

Relevant Consideration (Yes/No)

12C.9 In the case of major PUP relocations, a joint meeting of all service authorities to determine final relocations of PUP has been arranged.

Copies of each service authorities' drawings and long sections are to be forwarded with the agenda two weeks prior to the meeting date. (The Department's Consultant and all service authorities to attend). _____

12C.10 A set of drawings and long sections showing final relocations acceptable to all service authorities has been drawn, indicating the PUP that can be relocated prior to construction. _____

12C.11 Estimates of cost for final relocation and a program for relocation has been formally requested from each service authority. (separate estimates required for parts of PUP relocation relocated prior to construction.) _____

Service Authority	Date Sent
_____	__/__/__
_____	__/__/__
_____	__/__/__

12C.12 Information requested in 12C.11 has been received as follows:- _____

Service Authority	Date Sent
_____	__/__/__
_____	__/__/__
_____	__/__/__

12C.13 Information received in 12C.12 has been forwarded to the District (This is to be done as early as possible during design, so that the relevant PUP can be relocated prior to construction.) _____

13 Traffic Noise

Where there are noise sensitive areas, the following considerations for traffic noise attenuation measures have been assessed during the design.

13.1 (a) Location of carriageways with respect to buildings

(b) Steepness of grade

(c) Position of cuttings and embankments in relation to buildings

(d) Pavement surface type

(e) Speed limit _____

13.2 The need for earth mounds or noise barrier fences or a combination of both. _____

14 Landscaping

14.1 The sides of the road and medians have been kept clear of accessible obstructions for a minimum of 9m from the pavement edge. No trees or shrubs whose trunks grow to a diameter greater than 75mm are in this zone. _____

Relevant Consideration (Yes/No)

14.2 No plantings obscure a driver's visibility of the road ahead, or of the intersection of side roads or merging areas. Design sight distance is maintained at all points of the road. The sight distance requirement of the relevant manuals are adhered to in all cases. _____

14.3 No elements of the landscaping design require guard-rails to be installed. _____

14.4 Special attention has been given to ensuring that underground drainage systems and utilities will not be adversely affected by root systems. _____

14.5 Physical safety of the workmen has been considered in design of the landscaping elements. Hedges and shrubs that require trimming are planted so that trimming can be carried out clear of the pavement edge. A minimum distance of 1m from the kerb face or shoulder edge to the face of a trimmed hedge has been provided. _____

14.6 Road signs will not be obscured by any plantings. _____

14.7 Consideration has been given to the effects of the landscaping on light distribution on the pavements where road lighting is included in the road design. _____

14.8 No tall-growing trees will affect overhead public utility plant. _____

14.9 The use of shrubs in medians to prevent headlight glare has been considered. _____

15 Traffic Signals

15.1 Design volumes for significant peaks have been determined. (Traffic counts, pedestrian volumes and projected growth have been obtained.) Significant local traffic generators have been identified. _____

15.2 Safety issues have been identified including:- _____

- Accident figures for three years.
- Requirements of the Blind Association have been ascertained.
- Operating speeds of approach roads have been fixed.

15.3 Traffic planning and area management needs have been identified including:- _____

- Adjacent developments.
- Adjacent median closures and/or access restraints.
- ATC proposals and distance to adjacent signals.
- Provision for buses, parking, local access.

15.4 Public Utility Plant both current and proposed have been located. Routes and clearances to overhead Public Utility Plant and trees etc. have been determined. _____

15.5 An intersection base drawing with a scale not less than 1:250 has been prepared showing:- _____

(a) Pavements, medians, shoulders, kerbs, drainage and significant cross-section details and adjacent land use.

(b) Significant vertical alignment variations, approach grades and/or sight distance restrictions to be noted.

(c) Proposed relocations of Public Utility Plant and other features.

(d) Existing and proposed boundaries.

Relevant Consideration (Yes/No)

15.6 Lighting requirements of the intersection have been determined. _____

15.7 A traffic analysis of the intersection has been prepared, incorporating all traffic movements including pedestrians. _____

15.8 The signal displays to be provided have been determined by:- _____

(a) Evaluation of alternative phasing arrangements to provide adequate capacity for the design volume.

(b) Evaluation of alternative phasing arrangements to minimise delays, stops and the performance index.

(c) To satisfy any safety requirement identified in 2.

15.9 Stop Bar locations have been determined and all pavement markings and signs marked on the drawings and dimensioned. _____

15.10 Location of signal hardware to support the signals required has been determined and recorded on the drawings. (Include the location of the signal controller and power and telecommunication Public Utility Plant for the controller.) Joint use lighting hardware has been located with consideration of possible hazard to errant vehicles, and the minimum number of posts has been used. (Consider need for steel lids in traffic susceptible areas.) _____

15.11 Loop locations have been determined. _____

15.12 Underground electrical ducting routes and cable jointing pits have been located to link signal hardware, controller and detectors. Possible conflicts with other Public Utility Plant have been identified and resolved. Pits are located to finish height and clear of ramps or pathways. _____

15.13 Documentation is complete including:- _____

(a) A traffic signal layout drawing marking the above details onto the base drawing. Symbols comply with the Department's standards.

(b) Copies of design volumes, and traffic analysis are available for check if required.

(c) Schedules of materials and quantities are provided.

16 Road lighting

16.1 "Category" of lighting required has been determined. _____

16.2 "Extent" of intersection lighting has been determined. _____

16.3 "Extent" of the route lighting has been determined especially when partial lighting is required. _____

16.4 Base drawing for lighting is prepared showing:- _____

- Scale 1:500 or larger.
- Existing Public Utility Plant including underground Public Utility Plant and overhead cabling, awnings, trees.
- Future Public Utility Plant if Public Utility Plant relocations are associated with the job.
- Channelisation details, including kerb types, pavement widths, pedestrian crossings, taper and merges, guard-rail, footpaths and fences.
- Major cross-section changes such as banks, drains, batters, cuttings.
- Existing and proposed boundaries.

Relevant Consideration (Yes/No)

16.5 Locations controls are established either:- _____

(a) A control line for large jobs or

(b) A co-ordinate grid or

(c) Fixed existing features for dimensioning locations on small jobs.

16.6 Lighting design

Lighting is designed for cost-effective installation and operation, taking into account the following factors:-

INTERSECTION LIGHTING _____

Intersection lighting design to AS1158.

The number of new lighting columns required are to be kept to a minimum.

The most cost-efficient light sources are used with adequate colour rendition.

Pole locations and column types.

Power authority equipment standards, maintenance requirements and supply particulars.

ROUTE LIGHTING _____

(i) An appropriate configuration taking into account shoulder, pavement, footpath and median widths:-

- Existing pole routes or poles suitable for mounting luminaires.
- Pole location requirements
- Service and access costs for ducting and construction.
- Adjoining intersection lighting.

(ii) Using MRD STAN or equivalent STAN Program, and luminaire data for currently available luminaires.

Select luminaire type, mounting, height and spacing to optimise the Light Technical Parameters. (LTPS optimisation of design to reduce number of columns and luminaires providing LTPS not less than the AS1158 requirements should be done.)

(iii) Adjust configuration and design locations to make provision for non-uniformity of the site:-

- Spacing of luminaires on curves.
- Spacing adjustment (reductions) to accommodate physical features such as bridges, intersections or overhead power lines, or to reduce construction costs and/or to increase safety (e.g. placing columns in protected locations).
- To provide maximum lighting at locations such as median breaks, diverges, merges, abutments, bridges.

Relevant Consideration
(Yes/No)

- Utilisation of existing lighting equipment requires a non-uniform installation (i.e. varying luminaire type, mounting height and column offsets) not amenable to analysis by STAN, an isolumen plot is produced to ensure illuminance values are equivalent to those provided by the uniform STAN configuration.

16.7 Design details are provided including:- _____

(a) STAN input and output listings

(b) Isolumen plot (when done)

(c) Construction cost estimate

(d) Operating cost estimates

16.8 Construction design has been done including:- _____

(a) Ducting routes have been determined detailing duct size, duct type, conduit type.

(b) Pit sizes and locations are detailed together with lid types and other protection (e.g. concrete capping).

(c) Footing types have been detailed.

(d) Lighting circuits have been designed and optimised providing cable sizes, voltage drop, earth resistance, current rating and circuit protection details.

(e) Sharing of facilities with other systems has been investigated e.g. joint use columns, sharing with signal ducting, shared road opening/crossings.

(f) Column types have been determined.

16.9 Design is documented including:- _____

(a) Schedule of luminaries is available, showing luminaire type, wattage, mounting height, column type, orientation, location, identification number.

(b) Schedule of associated works is available including supply of power, lighting controls, existing lighting to be modified or removed.

(c) Luminaire locations, column types, ducts, pits, points of supply and cable routes are marked on the base drawing to produce a Road Lighting Drawing.

(d) A schedule of materials and quantities to implement the design is provided.

(e) Ownership/responsibility of columns is detailed.

Relevant Consideration
(Yes/No)

17 Design and Quantity Calculations

17.1 All design and quantity calculations have been presented legibly in an indexed calculation folder and can be made available if requested. _____

17.2 All quantities have been calculated from copies of the final design drawings. _____

17.3 Quantity plans and calculation sheets are suitably compiled enabling copies of them to be submitted with the final design documentation. _____

17.4 All design and quantity calculations have been checked. _____

18 Quantities and Estimates

18.1 Estimates are presented on current standard Estimating Forms. _____

18.2 Work item description and numbering is identical to the description on the drawing and in the Standard Specification or in the Supplementary Specification. _____

18.3 Work items not covered entirely by the requirements of Standard Specifications appear with the suffix "S". These items are covered by Standard Specifications and Supplementary Specifications. _____

18.4 Work items having a provisional quantity appear with a suffix "P". _____

18.5 All work items covered by a Supplementary Specification are cross referenced to the relevant Supplementary Specification. _____

18.6 Unit of payment for a work item is the same as shown in the Standard Specification or the Supplementary Specification. _____

18.7 All unit rates have been checked by the relevant District staff. _____

18.8 All quantities have been calculated and checked. _____

18.9 All extensions have been checked. _____

18.10 The materials that are to be supplied by the Principal have been determined. (These materials appear below the line.) District to determine below line items. _____

18.11 Where there is a need to apportion the cost of some of the work, a separate estimate has been prepared for that portion. _____

18.12 The title at the top of the estimate is completed correctly. _____

18.13 The summary of estimate of cost is signed. _____

18.14 All work shown on the drawing as part of the job has been allowed for in the estimate and schedule. _____

18.15 Where possible, provide an estimate on disk using "ESTIMATE". _____

18.16 Determine if bridge relieving slabs are in main estimate or bridge estimate. _____

Guide to the Break Up of Estimate

1. Main Estimate
2. Seal Coats
3. Asphalt
4. Lighting
5. Traffic Signals
6. Bridges
7. Retaining Walls

Relevant Consideration (Yes/No)

19 Resumptions

19A - Status of Resumptions

19A.1 Resumption requirements have been investigated. _____

19A.2 Resumption drawings have been drawn and completed.
(attach a list of drawing numbers and give the status of the resumptions)

(If all have not been completed List Drawing Nos of those drawn, and give reason why others are not complete). _____

19B - Drawing Preparation

19B.1 Title searches are not more than one month old. (If older than one month new searches required.) _____

19B.2 Base resumption drawing drawn from current DNRM plans, Titles Office plans, cadastral maps and titles searches referred to in (12B.1). _____

19B.3 Property description and tenure shown on the resumption drawing are current, based on (12B.1) and (12B.2) above. _____

19B.4 All holding names and lease on reserve numbers are shown. _____

19B.5 Drawing sizes, lettering sizes, ink colour and line thickness are in accordance with the relevant Chapter of this Manual. _____

19B.6 Vincula are shown where they apply. _____

19B.7 All land survey marks located by the surveyor are shown. _____

19B.8 All easements have been shown and their intended use verified. _____

19B.9 Rivers and large creeks, including the direction of flow, have been shown and named. _____

19B.10 Sufficient existing feature information has been shown to enable the property owner to readily identify with certainty the land to be resumed, e.g. fences and gates, round fence posts, power and telegraph lines and poles, existing culverts, existing buildings, descriptions of vegetation, soil and cultivation, dams, wells and mills, street names etc. _____

19B.11 All pegged base lines or control line details are shown, together with a tabulation of offset pegs. _____

19B.12 All previous resumptions that have not been surveyed are shown together with a cross reference to the resumption drawing. _____

19B.13 Local Authority boundary and parish names and boundaries are shown. _____

19B.14 Portion lines are drawn long enough to divide adjacent portions clearly. _____

		Relevant Consideration (Yes/No)
19B.15	The titles block is complete and the property description matches that shown on the current titles search.	_____
19B.16	All references to adjoining resumption drawings have been shown (e.g. joins R14-126LA).	_____
19B.17	Catch points are plotted accurately and the required clearance to the resumption boundary has been allowed.	_____
19B.18	The areas required are highlighted by the application of the approved hatch.	_____
19B.19	Provision has been made for future development where appropriate.	_____
19B.20	All sight distance requirements have been met.	_____
19B.21	Allowance has been made for service roads, parking strips, footpaths, public utility plant etc.	_____
19B.22	Property accesses have been investigated.	_____
19B.23	Setting out details have been shown correctly and can be set out by a surveyor from the information shown on the resumption drawing.	_____
19B.24	All areas required and areas remaining have been calculated accurately and that information has been presented in accordance with the relevant Chapter of this Manual.	_____
19B.25	The need to show imperial equivalent areas.	_____
19B.26	The need to show severance areas.	_____
19B.27	The need to show road closures.	_____
19B.28	The need to include "Rights and Obligations Annexure" (Positive or negative easement).	_____
19B.29	The need for new or amended Limited Access drawings.	_____
19B.30	The need for new or amended Native Title drawings (required where Native Title rights and interests are affected).	_____

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