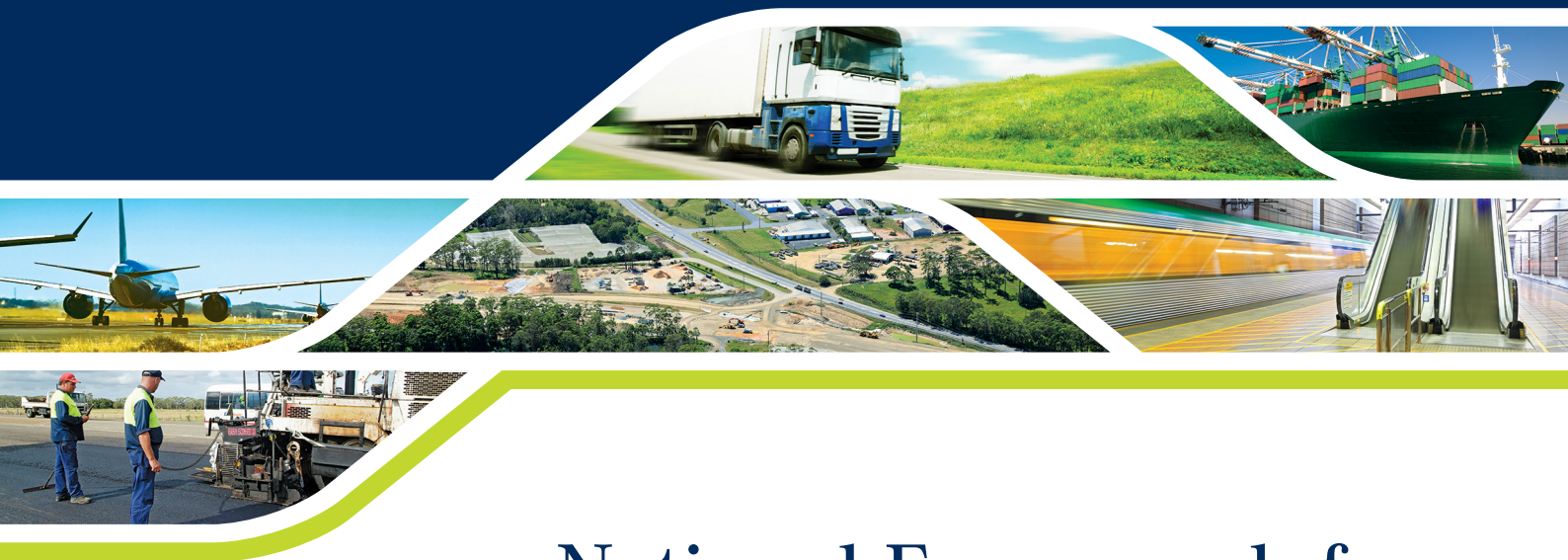




Australian Government

Department of Infrastructure and Regional Development



National Framework for Traditional Contracting

Topic Specific Guide 1 Project Definition and Tendering

September 2015



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Document Updates

This guide will be updated from time to time to reflect evolving best practices and lessons learned.

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Note

Governments in each jurisdiction will have their own individual approval processes for capital investment projects, as well as policies (e.g. probity) and legislation that will impact on all capital works delivery. These overarching jurisdictional requirements are precedent to the practices covered in this document.

Acknowledgement

This document has been prepared under the sponsorship of the Inter-jurisdictional Steering Committee for Alliancing & Traditional Contracting with membership from:

- Department of Treasury and Finance, Victoria (Chair)
- Treasury, New South Wales
- Treasury, Queensland
- Department of Treasury and Finance, Western Australia
- Department of Infrastructure and Regional Development, Commonwealth of Australia

The preparation of this document was led by the Victorian Department of Treasury and Finance with Evans & Peck Pty Ltd Level 2, 555 Coronation Drive Toowong, Queensland 4066. The past contribution of Ernst & Young Melbourne to section 3.5 on project risk is also acknowledged.

Table of Contents

1	Introduction to the Guide	6
1.1	Purpose	6
1.2	Who should use the Guide	8
1.3	Structure of the document	9
1.4	How and when to use the document	9
1.5	Relationship with existing policies and guidelines	10
1.6	Updates to the document	10
2	Developing the Project Definition	11
2.1	Introduction to the Project Definition	11
2.2	Purpose of the Project Definition	15
2.3	Ownership of the Project Definition	15
2.4	Relationship between Project Definition, Project Solution and Project Budget	16
2.5	Establishing and managing a design team	26
3	Consideration of risk and uncertainty	27
3.1	Risk in the context of Project Definition	27
3.2	Risk in infrastructure projects	27
3.3	‘Poor Project Planning’ Risks are not Project Risks	28
3.4	Skills and capability for leading risk analysis	29
3.5	Undertaking a risk analysis	30
3.6	Real Options	38

List of Appendices

Appendix A	Glossary
Appendix B	Template (Project Definition)
Appendix C	Description of Design Brief

1 Introduction to the Guide

This Chapter outlines the purpose and structure of this Topic Specific Guide and describes the relationship of this document to other relevant government policy documents and guidelines.

1.1 Purpose

The purpose of the National Framework for Traditional Contracting of Infrastructure (the 'Framework') is to assist Clients using Traditional Contracting to procure infrastructure to deliver on government's expectations and to engage the market in the most effective and efficient way.

This Topic Specific Guide ('the Guide') forms part of the *National Framework for Traditional Contracting* suite of documents. It identifies the principles and practices that support a consistent national approach to developing the Project Definition.

The Project Definition underpins the Project Budget that is approved for the Business Case and forms the basis of the subsequent tender documentation issued to Suppliers.

Research has shown that there is significant opportunity to improve project outcomes using Traditional Contracting through improving the standard of Project Definition for both the planning (business case) and tender phases.

It is widely accepted that a poor quality Project Definition is a common cause of project failure. This was captured in the research undertaken in *Towards Agreed Expectations*¹.

The Importance of Project Definition

"Inadequate Project Definition is a major cause of subsequent Project failure. This issue is more than a matter of inadequate design but a failure by Clients at the front end planning stages to effectively ensure minimal surprises in the later stages of the Project: when this failure happens everyone loses, Clients and Contractors.

... thorough front end planning by Clients and clear Project Definition have a tremendous positive effect on both time and project cost."

Senior Executive
Australian Major Contractor 2013

Given this widespread recognition of the need to improve Project Definition, the question arises as to why the problem remains and continues to be repeated. There are many reasons identified, however a primary cause is a lack of common understanding of:

¹ The concept of the 'expectation gap' at Contract Award and causes of this are discussed in *'Towards Agreed Expectations'* (www.dtf.vic.gov.au).

1. Why the Project Definition is critical to the differing requirements of the Investor (Business Case), the Client (Tender Phase documentation), and the Supplier (Contract commitments).
2. How the Project Definition relates to the Statement of Service Need, Project Solution and Project Budget at different stages in the Project lifecycle.
3. What constitutes a Project Definition.
4. Key definitions and terms (a common language).
5. Who 'owns' the Project Definition.

This Guide will assist the Investor and Client to improve Project Definition by addressing these fundamental issues.

Improved Project Definition will result in the following outcomes for the Investor and Client:

1. In the **Planning Phase** developing a quality Project Definition requires an appropriate description of how the physical asset will address the strategic goals and objectives of the Investor, the operational requirements of the Client and a recognition of the service delivery impact the community will experience from the new asset. The quality of the Project Definition directly impacts on:
 - the Investor's decision making process and the success or otherwise of the government delivering the best possible outcomes for the community; and
 - the quality of the Project Budget developed and the capital allocation by the Investor. The Investor does not assess each Business Case in isolation, but as part of a capital allocation process whereby each Business Case is 'ranked' against others based on a *Value for Money* and *Opportunity Cost of Capital* assessment.
2. In the **Tender Phase** developing high quality Tender documentation has a direct impact on the quality of the Tender outcome and ultimately the Project outcome. A well-developed Project Definition contributes to a high degree of understanding between the Client and Tenderer regarding what the Client wants. This results in:
 - Improved likelihood of the most suitable Tenderer being selected to deliver the Project;
 - The Client/Supplier relationship being established on a sound foundation with minimal expectation gap at contract award;
 - The Tenderer being able to better assess the Project risks and their allocation, thereby providing opportunity to offer a best in market price;
 - More efficient tender processes with reduced reliance on tender clarification and support resources, leading to reduced bid costs for both Tenderer and Client;
 - Reduced bid costs leading to increased numbers of potential Tenderers, improving competitive pressures to reduce project costs;
 - An appropriate balance between the need for clearly specifying the requirements against the potential to inadvertently stifle innovation from Tenderers by over specifying requirements; and
 - A high probability that the Investor's Business Case expectations will be met.

If a Project Definition is poorly developed, Clients will pay a premium to satisfy the original service need in the Business Case because:

- The contracted Project may not meet the original service need and require further investment;
- The Supplier will require a premium to deliver any changes to the contracted scope of works as a result of poor definition; and/or
- The Client/Supplier relationship is likely to come under stress due to differing perceptions of the Project Definition, potentially resulting in disputes and requiring (sometimes substantial) management resources.

In both the Planning and Tender Phase, the Guide will assist Clients by establishing a common understanding of what is a quality Project Definition and how it is developed and used. A good Project Definition sets up the success for much of the foundation work in the Planning Phase (notably the Project Budget) and is essential for good outcomes in the Tender and Construction Phases. The quality of each phase compounds and contributes to the next phase and to the overall project outcomes for enabling the Government's service objectives.

The Guide has been developed by identifying and examining proven practices from Clients routinely involved in the provision of traditionally contracted infrastructure assets. These practices, when implemented, by Clients and individuals with appropriate project delivery skills, will improve the quality of Project Definition of infrastructure projects and result in improved project outcomes.

This Guide is not a 'standard' – each Client will have its own processes, however it should allow each user to better define and communicate the Project Definition.

The Guide does not address issues related to the jurisdictional processes that apply to approval of a project, or the process for the Client's assessment of alternative procurement strategy options as part of the Business Case. There are other (overarching and general) government policies and guidelines that cover these matters.

The principles and practices described in this Guide are written from the perspective of a standalone major infrastructure project (say \$50M or more) procured through traditional contracting models.

Nevertheless, many principles and practices also apply to infrastructure programs, and some will apply to other procurement models (ie non-traditional contracting and indeed to non-residential building projects).

Similarly, principles in the Guide will apply for less complex, lower value projects, however, the practices described may be sensibly scaled down to a level appropriate to the project.

1.2 Who should use the Guide

This Guide is intended to be used primarily by government practitioners, either in delivery agencies (Clients); or central government departments (Investors) when developing intra-jurisdictional guidelines and policies. Additionally, it is expected that industry (Suppliers) will also benefit from more consistent practices by Clients across jurisdictions.

1.3 Structure of the document

The Guide addresses those aspects related to project design definition that have the greatest impact on project outcomes.

- Chapter 1: Introduction to the Guide
- Chapter 2: Developing the Project Definition
- Chapter 3: Consideration of project risks

Key points are highlighted by three types of text boxes:

	Overview of chapter
	Practice and commercial insights
	Example

1.4 How and when to use the document

This Guide has been written on the basis that Investors and Clients refer to other government policies and guidelines applying to procurement, planning, infrastructure delivery and government decision making.

The Guide describes concepts and best practice principles rather than providing detailed guidance for all aspects of Project Definition. This will improve practice in many ways, not least by having a common language as a foundation.

In some circumstances it may be appropriate to depart from the processes set out in this Guide. Each Investor or Client always has the flexibility to determine and recommend processes which are efficient, 'fit for purpose' and best suited to achieving VfM for their specific project.

The Guide has been prepared on the basis that readers already have:

- a reasonable knowledge of Project Definition processes for infrastructure projects;
- experience of developing and constructing infrastructure assets using traditional contracting methods;
- a good understanding of the terminology and general principles set out in the following chapters;
- familiarity with the relevant Acts and other jurisdictional policies and guidelines;
- an understanding of the practical challenges of prevailing market conditions that impact public sector infrastructure projects; and
- access as required to specialist professional service providers (sourced internally or externally) to assist them deliver projects in accordance with this Guide.

1.5 Relationship with existing policies and guidelines

This document forms part of the National Framework for Traditional Contracting of Infrastructure suite of documents. The National Framework is made up of the following documents:

- The Guide: Good Practice and Commercial Principles for Traditional Contracting.
- Topic Specific Guide 1: Project Definition and Tendering.
- Topic Specific Guide 2: Development of Project Budgets in Business Cases.
- Topic Specific Guide 3: Governance and Contract Management.
- Topic Specific Guide 4: Performance Assessment and Continuous Improvement.

The National Framework provides best practices (not policy) as a resource that individual Australian jurisdictions can use to inform their policy and guideline development for Traditional Contracting of infrastructure; or for project client agencies to reference as a benchmark for their practices where corresponding jurisdictional guidelines do not exist. Where there is a conflict in the material of this National Framework and jurisdictional policies and guidelines, the jurisdiction's position will take precedence.

1.6 Updates to the document

Updates to the Guide will be published from time to time on <http://www.infrastructure.gov.au/utilities/contact.aspx>

2 Developing the Project Definition

This Chapter provides an overview of the key elements that make up the Project Definition and how it is developed over the Project life.

2.1 Introduction to the Project Definition

The Project Definition describes how an improved, or new, service need will be delivered through the provision of a physical asset. This service need is a key input to the Project Definition. It describes the service gap identified by Government policy and/or announcement and the specific need to be enabled by the recommended physical asset. In line with best practice governance, governments should identify service needs using clear and transparent processes for identifying the public interest. A service need can exist for a number of reasons including:

- requirement for the provision of an entirely new service; or
- reacting to a change in law, policy, best practice or demand.

The ‘service need’, as the primary investment rationale, is ‘owned’ by the Investor and does not change over the life of the Project (unless the change is approved by the Investor) and is articulated in a ‘Statement of Service Need’ (which is expanded upon in Topic Specific Guide 3).

To ensure success in an investment, it is critical to have a clear linkage from the Investor’s approved service need to the project definition, project budget, tender documentation, contract awarded and to project completion.

The Project Definition is owned by the Client (and endorsed in the Business Case by the Investor) and also does not change over the life of the Project (unless the change is approved by the Client and endorsed the Investor). The Project Definition will however progressively increase in granularity from Planning to Tender Phase.

The Project Definition describes the physical asset that best enables fulfilment of the gap identified in the Statement of Service Need and describes the Project’s:

- Functional and Performance requirements;
- Scope;
- Risks, constraints and opportunities²; and
- Standards requirements.

The quality of each of these components sets up the success or otherwise of the subsequent components.

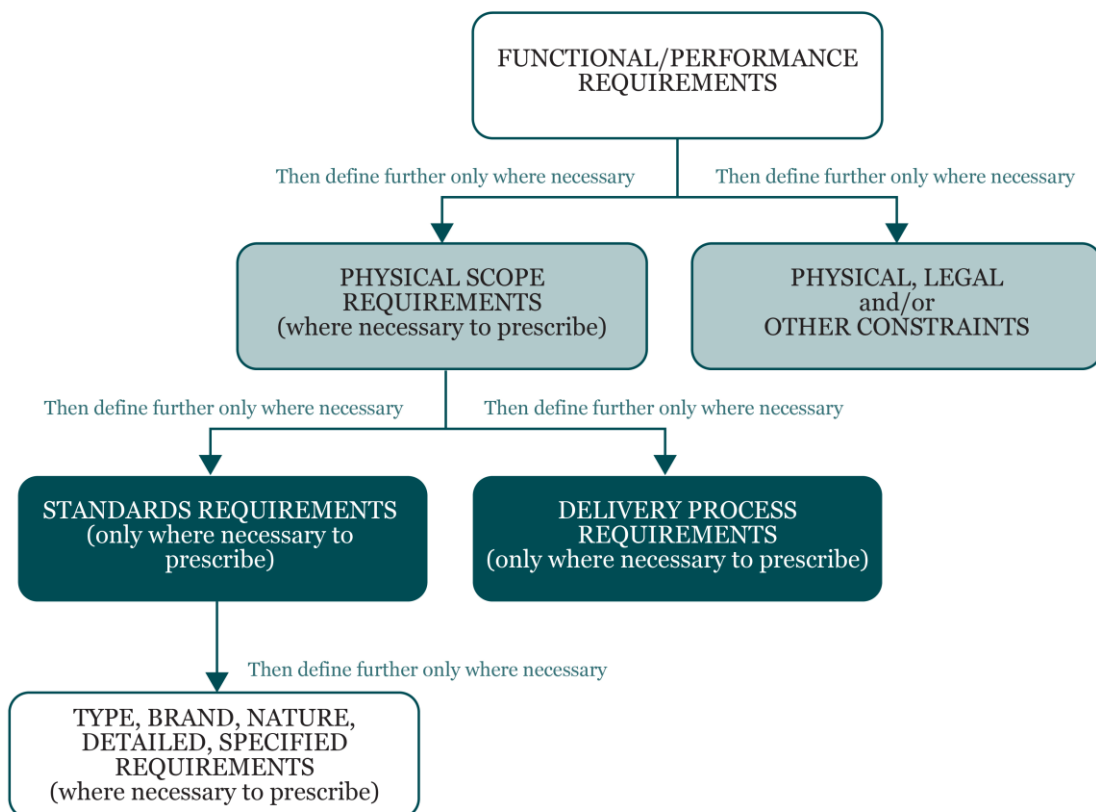
² An important component of the project definition is setting out the context of the project to be delivered (for example, the physical environment, regulatory requirements, stakeholder interests etc). This context is normally articulated in terms of (project) risks (eg ground conditions), constraints (eg timelines, regulatory imposts) and opportunities (eg ‘value capture’ revenues arising from the infrastructure investment).

2.1.1 Functional and Performance requirements

The functional and performance requirements describes the required type and functionality of the asset and the service delivery metrics to be achieved by the operational asset (i.e. its performance requirements). For example, at the Planning Phase; a new road bridge is proposed with a design capacity to deal with a given ‘annual average daily traffic’; or a new wastewater treatment plant is proposed to treat defined daily volumes and quality parameters of effluent etc. (Many performance standards are not project specific but are well documented and agreed sector or industry wide requirements.)

The stated functional and performance requirements must align with the approved service need articulated in Business Case. There may be merit in providing Tenderers with the opportunity to contest elements of the functional requirements where there is scope for innovation in addressing the service need.

Figure 1: Different levels of definition for Performance Function (extract from *Towards Agreed Expectations*)



2.1.2 Scope

The project scope describes the physical extent of the asset to be constructed. For infrastructure projects this ensures that the inherent network effects are taken into account and that the scope of the project is carefully described in that context (as well as any specific exclusions which may be required but provided for elsewhere).

The scope can include (or expressly exclude):

- Physical scope: e.g. level crossing structure and signals;
- Non-physical scope: e.g. signaling technology, ticketing software; and/or
- Plant: e.g. boom-gates, rolling stock.

The scope is rarely open ended as, to achieve good infrastructure performance, the complex network effects of this physical asset must be very clearly understood. The scope provides the basis for the work to be performed by the Supplier, as defined by the Contract between the Client and the Supplier. The Supplier is not obliged to perform any tasks that fall outside of that scope. The scope forms the basis for any changed or extra work requested by the Client through a variation.

The Project Definition, and particularly the scope component, needs to be sufficiently developed³ during the preparation of the Business Case to enable the preparation of an acceptable Project Budget. This will normally result in the Client preparing a 'reference design' for the project. If the Business Case is approved for a Construct Only (CO) delivery, the Client will then significantly develop this reference design to 'Final Design' to enable tenderers to price the construction. On the other hand, if the Business Case is approved for a Design and Construct (D&C) delivery, the Client may release in the tender documentation the Project Definition and a 'Design Brief' that do not necessarily include the reference design. In a D&C the Supplier is expected to develop and propose its own 'design and delivery solution' (i.e. design, construction methodology, program scheduling etc), which should present better value to the Client than is offered through its own reference design.

The reference design should clearly identify those elements that are mandatory, for example design elements that integrate with an existing network and are part of the agency's established standards and requirements. Beyond that, Clients should ensure that where the reference design is released, Tenderers perceive the reference design as one to be improved upon through their innovative efforts rather than perceiving it as a mandatory requirement.

Where it has been identified that scope for innovation exists, Clients may consider providing opportunities for Tenderers to contest key standards of the design. They may also consider supporting innovation by contributing to the design costs of Tenderers, on the condition that the Client owns the design. These mechanisms can supply improved value for money through creating opportunities for better project designs.

2.1.3 Risks, constraints and opportunities

In any project, there will be risks, constraints and opportunities on the development and implementation of a physical asset. These may:

- arise from the external conditions impacting on service and project delivery (i.e. the 'project risks');
- be set by Government or by the Client (e.g. timelines, regulations, policy, network or operational factors); or

³ See Topic Specific Guide 2: The development of Project Budgets in Business Cases for guidelines on what constitutes a "sufficient" level of Project Definition development for the preparation of a Project Budget.

- be opportunities (e.g. ideal ground conditions, 'value capture' revenues arising from the infrastructure investment).

The Client should understand the impact of these risks, constraints and opportunities in the early stages of any Project Definition so it can better develop its reference design and more generally the 'Project Solution' (refer 2.4) in the Business Case. Where possible, Clients should share information about site risks with Tenderers, including upgrading that information during the tender phase. This approach reinforces section 2.2.5 of the Guide that promotes the Client and Suppliers collaborating during the tender phase to minimise the "expectation gap", including allowing Suppliers to seek further information and project investigations that would be of benefit to all parties (Client and Tenderers) in achieving the required outcome for the State at the lowest cost.

Risks, constraints and opportunities can generally be grouped into four primary categories.

1. Financial (generally constraints from the Investor)

Constraints may be related to the size of the investment, the manner in which funds are made available to the Client or conditions associated with how funds are managed and spent. However, there may also be value capture opportunities arising from the public investment in infrastructure investment.

2. Time related (generally constraints from the Investor and/or the Client)

Time constraints are normally placed on the commencement and completion of a project or for specific milestones in the project delivery program. The principle driver should be the required service commencement date with the project being managed to achieve this.

3. The Environment related (generally legislative and regulatory constraints as well as project risks)

Infrastructure projects have generally extensive interfaces with the natural environment, and this will impose substantial constraints on how the project is planned, designed and delivered. Many of these constraints arise from legislation, regulations, government policies and Client practices. The natural environment, and particularly ground conditions, can also be identified as material project risks (or indeed as non-material project risks in special circumstances where there are ideal ground conditions for the project).

4. The project context (generally project risks as well as opportunities)

The context in which the project takes place, including stakeholder interests, inter-dependencies with other projects or activities, market conditions etc can create project risks, constraints and opportunities that can impact during project delivery or long term in service delivery. Whilst many of these factors are often identified with a focus on adverse project risks, the focus on opportunities (or good news) should not be forgotten as this will also impact (positively) on the contract price.

These risks, constraints and opportunities should be refined as the Project Definition evolves and develops. (The potential benefit of developing 'real options' (see section 3.6) can also be considered.)

2.1.4 Standards requirements

The Client may have technical requirements for the products to be used to construct the physical asset, e.g. material specifications and standards which must be met. This may be to satisfy national or jurisdictional requirements regarding standards relating to performance, network

integration, environment, quality and safety etc. It may also be to ensure compatibility with the broader infrastructure network. Where there is a 'fit for purpose' requirement, the purpose should be clearly defined.

Where appropriate, Tenderers should be given the opportunity to contest some standards of the design if they have identified scope for innovation while still meeting the defined purpose.

2.2 Purpose of the Project Definition

The Project Definition forms the foundation of all other project development work including the Project Solution and Project Budget, leading to the Business Case and subsequent tender documentation and contracts.

The documentation of a high quality Project Definition will reduce any expectation gap at contract award by enabling:

- clear linkages and alignment to the Statement of service need in the Business Case to satisfy Investor expectations;
- a clear understanding by all parties of the Project risks, the appropriate allocations and the mitigation plans;
- an effective evaluation (including comparison) of tender responses; and
- an effective Client-Supplier contract structure and governance.

Effective assessment of the Supplier's performance and capture of lessons learned should be undertaken to ensure continuous improvement leading to long term reduction of the cost of infrastructure. In the context of this Guide, the Supplier's performance can be impacted by poor quality project definition and documentation of the Client's requirements.

2.3 Ownership of the Project Definition

The Client is responsible for developing the Project Definition, however may seek external expertise as required.

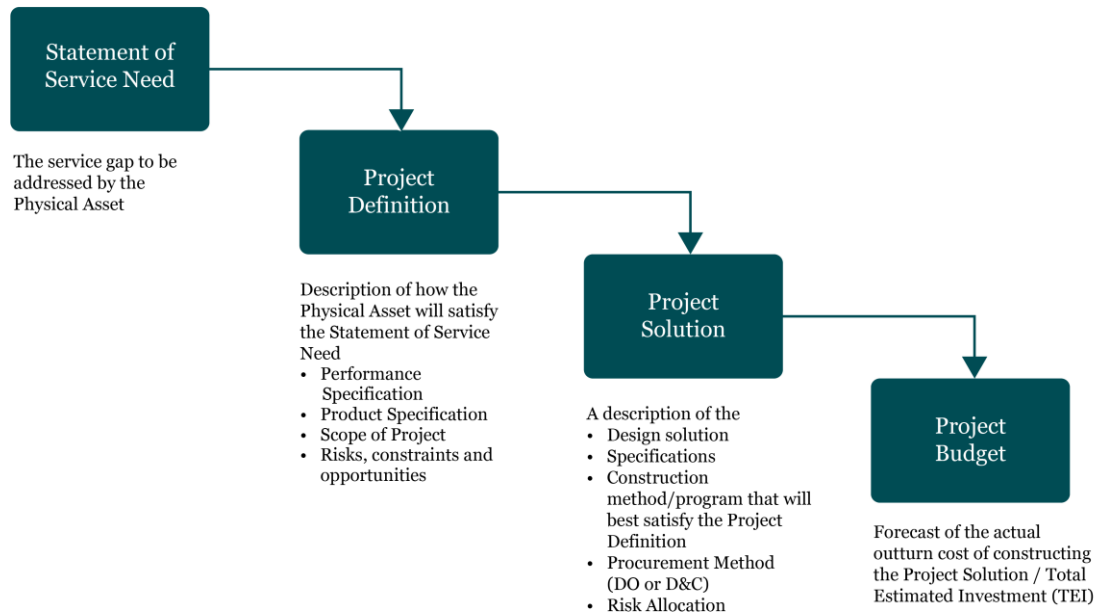
The Project Definition:

- Is owned by the Client (and endorsed by the Investor) at all stages of the project since they are responsible and accountable for delivering the service outcome. It is not the role of the Supplier to establish and develop the Project Definition, that is the Client's role;
- Does not change through the stages of the project but its level of granularity will increase as it progresses from Planning to Tender Phases (unless the change is approved by the Client and endorsed by the Investor); and
- In a D&C tender, the Project Definition will enable innovation and flexibility in design, construction methodology, program scheduling etc as it provides clear boundaries around what are the Client's 'must haves' and what is open for the Supplier's 'smarts' when developing its proposed project solution.

2.4 Relationship between Project Definition, Project Solution and Project Budget

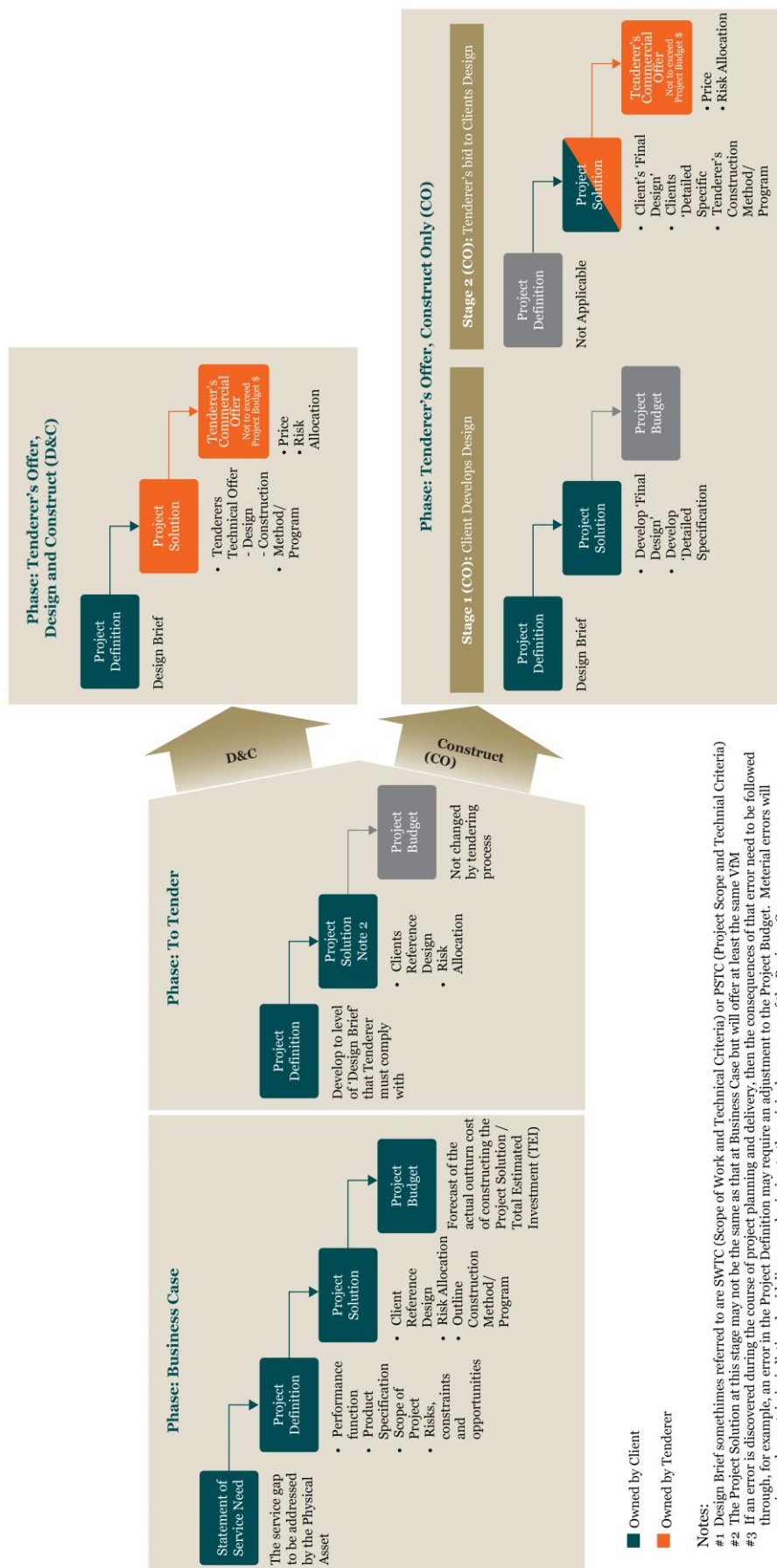
The Statement of service need, Project Definition, Project Solution and the Project Budget have a clear relationship as shown in Figure 2 below.

Figure 2: The relationship between service need, project definition, project solution and project budget



The various elements and their 'ownership' evolve over the Project Phases as illustrated in Figure 3. The only element that will change is the 'Project Solution'. The other elements will remain the same (unless the change is approved by the Client and endorsed by the Investor) but may become more detailed at each Phase.

Figure 3: Project Definition, Project Solution and Project Budget dynamics



2.4.1 Inception Phase

In the inception phase⁴, the Client can be expected to make an initial examination of the problems and opportunities that warrant attention and which allows decision makers to identify the project objectives and service needs to be addressed. This process should be conducted in accordance with good governance principles for project selection, and include consideration of:

- alternative options for meeting the service need, including the enhanced use of existing infrastructure, pricing solutions and cheaper build options;
- appropriate procurement options for any necessary assets or services, including the appropriate contract structure (i.e., design and construct, alliance, PPP); and
- possible savings from packaging projects into smaller components.

Through this process the Client identifies the appropriate strategic intervention and conducts options analysis to identify the best solution to address the service need. This includes consideration of key characteristics of any necessary physical assets resulting in a preferred option for which a design can be prepared (and in turn provide the basis for the Project Budget).

At this Phase, the Project Definition is developed to enough detail to enable the Client to consider the merits of the proposal early in its development and determine whether it justifies further investigation by progressing to Planning Phase, where a Reference Design will be required in order to develop a Project Budget to 'investment grade' level.

Table 1: Elements developed during inception phase

Element	Description
Project Definition	▪ Performance Function (high level) ▪ Product Specification (high level) ▪ Scope of Project (high level) ▪ Risks, constraints and opportunities (high level)
Project Solution	▪ Client Concept Design ▪ Construction Method / Program (high level) ▪ Critical project risks and allocation
Estimation of project costs	▪ Indicative estimate of outturn cost but not at an 'investment grade' level (i.e. it is not the Project Budget)

2.4.1.1 Early engagement of external contractors/advisors

On some projects, usually in the beginning stages of that project, a Client may wish to engage an industry adviser (ie contractor, sub-contractor, design engineer etc) to assist it with a range of preliminary tasks. Depending on the nature of the project, these tasks can include:

- advice on some significant underlying technical component of the market;

⁴ Refer to The Guide, The National Framework on Traditional Contracting of Infrastructure, Australian Department of Infrastructure and Regional Development, for generic Project Lifecycle (Figure 2).

- advice with respect to the specifications, including drafting the specifications;
- advice with respect to the 'ground conditions';
- advice with respect to 'constructability' of projects; and
- engagement as an 'early works' contractor, to undertake early works which must be commenced, due to programming and other constraints before the main tenderer/contractor can be engaged.

Probity issues can arise as a result of these types of engagements. The most common probity issues which can arise relate to perceptions of unfair advantage accruing to the industry adviser should they be allowed to participate in the later tender process for the construction project. More specifically these issues may include:

- perceptions of conflict of interest/unfairness; and
- privileged/early access to confidential information.

Both of these probity issues need to be managed in a strategic, comprehensive, consistent manner to ensure that the tender process is robust, defensible and fair.

From a probity perspective the approach that avoids probity risks is for the Client to engage only industry advisers prepared to forego participation in the subsequent tender. This should be the default position of the Client. However, in a few cases the Client may believe there is a compelling case for the engagement of an industry adviser that should be able to participate in the subsequent tender. The basis of the compelling case will likely include:

- the advice is not available internally and the advice is not available on an exclusive basis;
- a specific adviser(s) is required and it is known that this adviser (and other similar advisers) will be seeking to participate in the later tender; and
- any advice about a particular matter (ie constructability) will not be available without allowing the advisor (ie contractor) to later tender.

Where the Client has determined that there is a compelling case, to manage the probity issues of perceptions of unfairness and conflicts of interests arising, it should put in place strategies which the industry advisor agrees to at the commencement of the engagement. These strategies include:

- separation barriers;
- separation of personnel providing advisory services to those later in the bid team;
- separation of information between the two adviser's teams (with appropriate confidentiality deeds executed); and
- a statutory declaration, at a senior level, that no breaches of the separation barriers has occurred and that the barriers will remain in place during the tender process;
- Equalisation of information where tender participants must be given all relevant information in a timely manner to ensure a 'level playing field';
- All tenderers be given sufficient time, in the subsequent tender process, to comprehend that earlier information and to ask questions about it to ensure as full an understanding of the relevant issues as is possible.

Additionally, when external advice is required, it should be shared around capable industry advisors rather than one being repeatedly engaged. In this way, any advantage obtained from, for example, a contractor in providing the constructability advice (i.e. getting to know the client better etc.) will be shared throughout the market.

2.4.2 Planning Phase

In the Planning Phase the Project Solution must be developed to a point that there is enough detail to enable an 'investment grade' Project Budget to be developed. The Business Case is the document upon which the investment decision is made by Government, accordingly an 'investment grade' decision allows the Investor to be confident that the Client will meet the obligations stated in the Business Case, exposing the Investor to minimal 'default' risk. This includes the likelihood that the Client will be able to deliver the 'commitment' as contained in the Business Case. The key part of the Project Solution is the reference design.

The important role of a high quality reference design to ensure low costs and successful project outcomes cannot be over-emphasised. The Client should invest sufficient resources in the reference design such that duplication of effort by tenderers in the bid process is minimised, while allowing tenderers to contest specifications of the reference design where innovation is possible. This can help reduce bid costs and hence attract more tenderers into the bid process, improving competitive pressures. The development of a mature reference design, as discussed later, is consistent with seeking innovation from tenderers, playing a key role in allowing tenderers to focus on ways they can differentiate themselves from competitors rather than all tendering parties undertaking "baseline" design work that provides low opportunities for differentiation.

The quality and extent of the reference design must be such that the Project Budget prepared for the approval process can be independently validated to a high degree of accuracy. For example, the Base Cost Estimate should be targeted for a level of confidence of $\pm 5\%$; evidenced when the same Project Definition and 'assumption' book is used by separate cost estimators⁵ (refer Topic Specific Guide 3: *Development of Project Budgets in Business Cases*).

Achieving a Design that has sufficient detail to allow a Project Budget to be developed to 'investment grade' is an iterative process. The Client must fully control this iterative process to ensure that the final Project Solution addresses the Project Definition – no more and no less.

The Project Solution will be enhanced to reflect the more detailed Design information and include any relevant construction method/program information. The Project Risks within the Project Solution will evolve in line with the level of detail contained in the Project Definition.

Table 2: Elements developed during Planning Phase

Element	Description
Project Definition	▪ Performance Function ▪ Product Specification ▪ Scope of Project ▪ Risks, constraints and opportunities
Project Solution	▪ Client's Reference Design ▪ Risk allocation

⁵ This does not mean that the total outturn costs (Base Cost Estimate plus risk and contingency) can be forecast to $\pm 5\%$.

Element	Description
	Outline Construction Method/Program
Project Budget	Is at investment grade and comprises Base Cost Estimate (BCE); Risk; Contingency

2.4.3 Tender Phase

In the Tender Phase, the Client expands the Project Definition to produce a Design Brief which has a degree of granularity sufficient to adequately describe the Clients' requirements to service providers and Tenderers (Designers in the first instance for CO); and to Contractors and its sub-contractors in D&C). The Design Brief, sometimes referred to as the SWTC (Scope of Work & Technical Criteria) or the PSTC (Project Scope & Technical Criteria), is generally a substantial technical document which includes some or all of the following:

- Functional and Performance Requirements;
- Standards requirements;
- Schematic drawings of the Project;
- General specifications of the Project and performance criteria for the works when complete;
- Site information; and
- Any other technical details which impinge on the Physical Asset are to be constructed.

The depth or maturity of the Design Brief will depend upon whether the procurement approach is 'CO' or 'D&C'. The former requiring a lesser level of development than the latter. It is at this Tender Phase that the Client undertakes different activities depending on whether a CO model or a D&C model is used. This is shown in Figure 3.

Transparency of Tender Evaluation Criteria

Clients must be transparent on the selection of the winning tender by communicating:

- a clearly understood tender evaluation criteria; and
- how they will assess the tenders against these criteria.

Equally, Clients should give confidence that they are fully capable of applying the Tender Selection Criteria as they were intended.

Design & Construct (D&C)

In a D&C model the Client follows a single stage tender process to appoint a Supplier who is responsible for both designing and constructing the physical asset to the requirements of the Design Brief.

Seeking Innovation from Tenderers in the D&C Model

If a Client is seeking innovation from Tenderers, then they must structure and communicate a tender process that:

(a) Encourages innovation from Tenderers:

- Including an express comment that innovative responses are encouraged in the Tender documents;
- By reinforcement (from the senior client officer) in the public briefing to Tenderers;
- By allowing sufficient time for Tenderers to develop innovative proposals;
- By being proactive in industry forums in seeking innovation and clearly articulate same to Suppliers.

(b) Removes impediments to innovative responses by ensuring that there is not:

- A client track record of not respecting the Tenderer's IP;
- A failure to clearly articulate the non-negotiable functional requirements of the project;
- Inadvertent treatment of the Client's reference design as mandatory for a conforming bid.

Additionally, where a thorough assessment has demonstrated that design innovation is both worth seeking and likely to be received, Clients may also consider encouraging innovation by contributing to the design costs of tenderers, on the condition that the Client own the design. Innovative elements of non-successful Tenderer's bids can then be incorporated into the successful Tenderer's final design, with the guidance of the Client's Design Manager.

Table 3: Elements developed during D&C Tender Phase

Element	Description
Project Definition	▪ Design Brief
Project Solution	▪ Tenderer's Technical Offer: Design, Construction Method/Program
Tenderer's Commercial Offer	▪ Price ▪ Risk allocation (the default being acceptance of the Client's proposed risk allocation in the tender documents)
Project Budget	▪ Not applicable (Note that there is no change from Planning Phase). The tenderer's contract price is one component (usually the major) of the Project Budget

Construct Only (CO)

In the CO model the Client follows a 2-stage process: firstly engaging a Designer to develop the Final Design and secondly inviting Tenderers (Contractors) to provide their offers to construct the asset to the Client's Final Design.

In this CO process, the Design Brief provided to the Designer is much less developed than that provided to Tenderers in the D&C model. The primary reason being that the Designer's role is that of a Supplier to the Client rather than a bidder, and is engaged by the Client to develop the

detailed drawings and Product Specifications upon which the Tenderers base their commercial offers.

The Project Solution under CO is a combination of the Client's Final Design and Specifications together with the Tenderer's Construction Methodology and Program.

The potential for interface conflicts between the Client's design/specifications and the Supplier's Construction methodology is commonly referred to in the CO model. However, there are many examples where Clients and Suppliers have thoroughly prepared for such potential conflicts and have successfully avoided them.

The two distinct development stages of a CO tender are described further in the tables below.

Table 4: Stage 1 of a CO tender: Developing the Final Design

Element	Description
Project Definition	Design Brief
Project Solution	- Final Design - Detailed Specification
Project Budget	Not applicable (no change from Planning Phase)

Table 5: Stage 2 of a CO tender: Tenderer's Offer to Construct the Final Design

Element	Description
Project Definition	Not applicable (no change from Tender Phase)
Project Solution	- Client's Final Design - Client's Detailed Specification - Tenderer's Construction Method/Program
Tenderer's Commercial Offer	- Price - Risk allocation
Project Budget	Not applicable (no change from Business Case)

Amending the service need

Any changes to the service need, which provides the investment rationale for the physical asset, normally requires the Business Case to be amended and approved by the original approver of that Business Case. This will confirm continued government support for the project.

2.5 Establishing and managing a design team

To maintain consistency and ensure that the asset is designed to meet the functional requirements and is within project constraints, the Client must commit dedicated resources to developing the Design. This may be 'in-house' capability or these skills may be provided by external advisors. Where external advisors are employed, the Client will still require in-house capability as the ultimate responsibility for management of the Design Team remains with the Client.

The effective management of a design team is a critical ingredient to overall project success and involves more than being a 'content-free' post-box receiving and dispatching drawings that seeks to minimise design fees.

The best Design Managers have a clear and strategic goal of generating a design that meets (but not necessarily exceeds) the requirements of the Project Definition for the lowest outturn cost.

To do this they will understand the importance of:

- the integration of design with construction for infrastructure projects;
- the need for innovation early in project design development – not later when the costs of implementing innovation can often exceed the innovative benefit; and
- the importance of speed of construction to reducing overall project costs.

As a guide, such a person would have the experience and status commensurate with the Supplier's Project Manager. It is not a junior position.

High quality designs that are innovative, effective and efficient to construct and operate are produced by design teams that are:

- led by an experienced Client who understands the challenges associated with infrastructure design and delivery;
- established in the sector and have proven capability;
- appointed for a definite scope of work with clearly defined objectives and risks, constraints and opportunities;
- cohesive and made up of multiple specialist disciplines;
- considerate of the commercial environment and can evaluate the value for money proposition of each aspect of the project.

Industry has a view that the Client should have a Design Manager during the Construction Phase. They believe that this role is necessary to ensure prior recognition of the impact any Client requested design change may have on the contractor's time and price (and hence the net value of any proposed change).

3 Consideration of risk and uncertainty

This Chapter addresses how the development of the Project Definition is informed as the Client's understanding of project risks and uncertainties evolves. It also highlights the emerging use of 'real options' to address uncertainty in projects.

3.1 Risk in the context of Project Definition

The Project Solution is the primary source of information which allows the Client to make an assessment of the projects risks and informs the risk estimate in the Project Budget. The process of ongoing project risk analysis throughout the Project Solution activities informs decisions as the design develops and is finalised. It may be that in some cases the preferred solution cannot be delivered within the constraints when the project risks are considered. In this case the Client would revisit the analysis with a better understanding of the associated risks and potentially select a different preferred solution or in some instances abandon the project.

It is good practice to separate the activity of identifying risks from the quantification and pricing of risks. The unique characteristics and risks of the Project must be considered hand in hand with the Project Definition as the preferred Project Solution and Reference Design are developed. This understanding of project risk then informs the quantification and pricing of the risks which is an input in the development of the Project Budget, which is addressed in *Topic Specific Guide 2: Development of Project Budgets in Business Cases*.

3.2 Risk in infrastructure projects

The identification and analysis of project risks in infrastructure projects requires significant experience and judgement as these projects are largely heterogeneous, generally with critical elements that are structurally different and frequently involve the 'not been done many times before' factor. The extensive use of naturally occurring materials, the extensive interface with (the often unpredictable) natural environment, high exposure to volatile costs of labour, hydrocarbons etc. tends to lead to a relatively high risk profile.

Empirical evidence suggests that cost overruns and delays are often a feature of these projects. Cost overruns and benefits shortfalls of 50 per cent are relatively common; cost overruns over 100 per cent are not uncommon. In one study of major projects in 20 countries, nine out of ten projects had cost overruns⁶.

A common misconception is that the idiosyncratic nature of infrastructure means that project risks often crystallise and that this is just an unfortunate downside. Often infrastructure projects are perceived to be in the cause of 'nation building' and this in some way justifies this downside; the long term benefits dwarf the cost and time overruns.

⁶ B. Flyvberg, M. S. Holm, and S. Buhl, "Underestimating Costs in Public Works Projects: Error or Lie?" *Journal of the American Planning Association*, 68/3 (Summer 2002): 279-295.

This view is not supported by the empirical evidence. While efficient infrastructure provides services that improve both productivity and quality of life, poorly chosen infrastructure projects can reduce productivity and financially burden the community for decades with infrastructure that is unnecessary and expensive to maintain. Further, modern methods of cost-benefit analysis are capable of taking into account long-term benefits, and hence infrastructure projects present no greater obstacle to cost-benefit analysis than any other kind of government expenditure. Good project selection on the basis of rigorous analysis is no less important in infrastructure procurement than in any other field.

Unfortunately, the “nation-building argument” is sometimes erroneously seen as a license for poor planning. The reality is that all projects involve risk and large infrastructure projects have a poor reputation for coping with risk, sometimes resulting in timelines and budget targets being missed. However, this is not an inevitable result of investing in civil and process infrastructure (or buildings for that matter). It is important to draw a clear distinction between project risks and poor project planning risks.

Project risks are the risks associated with implementing the project, for example, a contaminated site, regulatory planning failure to grant a right of way, materials defect etc. Generally, these are the residual risks that projects are exposed to and which cannot be mitigated fully at any given stage but need to be managed, either:

- by transferring them to another party better able to manage and therefore price the risk; or
- by retaining the risk, which implies active management by the agency to reduce or preferably remove the risk by taking mitigating actions.

A well-managed project, and one which has been through an appropriately robust and rigorous Business Case and procurement process, could be expected to have project risks identified, usually through workshops based on the input of capable and experienced practitioners, and then each is quantified in terms of likelihood and potential consequence and then costed in the range of, normally, 5 – 20% of the Project Budget.

Any risk being assessed must be capable of being quantified. Risks which can be identified but not quantified should not be included in the risk estimates.

3.3 ‘Poor Project Planning’ Risks are not Project Risks

The term ‘risk’ is commonly used in the context of ‘project risks’, referring to possible events in project delivery/construction, associated regulatory planning approvals etc. with outcomes that can be substantially dimensioned at the time the Project Definition and design is developed to the appropriate standard. However, there are other (often very substantial) risks arising from poor or absent project planning that are not developed in accordance with required policy and feature poor and/or incomplete analysis of the investment rationale and the proposed capital works.

Inclusion of financial impacts arising from the risk of ‘poor project planning and analysis’ are unacceptable in the risk analysis and should not be considered in the Business Case for the project.

Poor project planning causes the Project Definition process to be rushed and capital works poorly defined, analysed, planned and otherwise scoped. This can lead to:

- surprises (as planning proceeds post-announcement);
- poor quality market engagement processes and outcomes;
- poor planning outcomes described as project risks; and
- actual outturn of project costs multiples of 100% of the Business Case's Project Budget .

Poor project planning, and the subsequent substandard cost estimating, cannot be remedied by a risk assessment and a provision in the cost estimate. Nor can a capital project, irrespective of the quality, or detail of its technical scoping, be satisfactorily delivered if that scoping is not directly linked to the Business Case service objectives in an efficient, effective and economical manner.

Poor project planning risks most often crystallise on projects when jurisdictional project planning policies have not been applied properly. These risks are most often associated with flawed and truncated project planning, and typically see significant scope changes and other surprises during the tender process and/or post-contract award. Scope changes are generally the result of poor Project Definition. Poor project planning risks can be catastrophic, resulting in extensive delays and cost overruns in the thousands of per cent (well documented examples include the Sydney Opera House that was delivered 10 years later than originally planned at a cost overrun of 1,400%.)

Good project planning and timelines

Good project planning and appropriate investigation of risks will be compromised when timelines are truncated. Shortened timelines will normally lead to immature project definition and typically see significant scope changes and other surprises during the tender process and/or post-contract award. Whilst it is recognised that from time to time procurement processes may be required to 'start as early as possible' to meet an urgent community service need, the client needs to fully dimension the risks and cost premiums associated with such special strategies. Moreover, the client should inform the decision makers about the cost premiums and potentially negative VfM impact arising from planning processes being truncated.

3.4 Skills and capability for leading risk analysis

Consideration of project risk is heavily reliant on good judgment and experience. Analytical 'tools' are a means of concisely capturing that judgment and making appropriate decisions. However the most critical factor in good risk analysis is the quality of thinking and deliberation that goes into considering risk. The tools assist in the process; however they will always only reflect the quality of thinking that is applied where appropriate application of expertise will result in robust risk estimates. Clients should ensure that they engage sufficiently well qualified and experienced practitioners who are capable of providing the skills and depth of input required to prepare robust, well considered risk estimates. These skills can be learnt but principally derive from personal experience and as such the risk estimator should have significant experience of similar projects.

Skills and capability for leading risk analysis

Risk analysis is complex and to be done properly it requires a high level of professional skill and judgement. Essentially two types of skills are required:

- **Process skills** that include workshop facilitation, interpretation and co-ordination of assumptions, financial modelling and interpretation of analytical results.
- **Technical skills** that generally focus on a high level of training and experience in the technical disciplines required to deliver that type of project, e.g. design and construction capability such as architects, engineers and cost estimators.

Some of the skills necessary to deliver a risk analysis are acquired by formal learning however there is also a considerable amount of professional judgement that is required, which can only be acquired by experience.

It is important to acknowledge that risk estimation is by its very nature uncertain. A level of confidence in the risk estimates is required for budget approvals that are applied as a professional standard. Analogous to the legal test applied to claims of negligence, the standard expected is that of a skilled person exercising and professing to have that specialist skill.

Inexperience is sometimes in evidence in project estimations when project risks in a Project Budget are costed well in excess of 20% of the total in well-known and repeated projects.

3.5 Undertaking a risk analysis

Good risk analysis will ensure that each project has its own set of guiding principles that focus attention on aspects which the Client can directly influence. This helps to define a risk profile that the Investor is comfortable with and which will influence responses from the market during tendering. These principles should consider as a minimum:

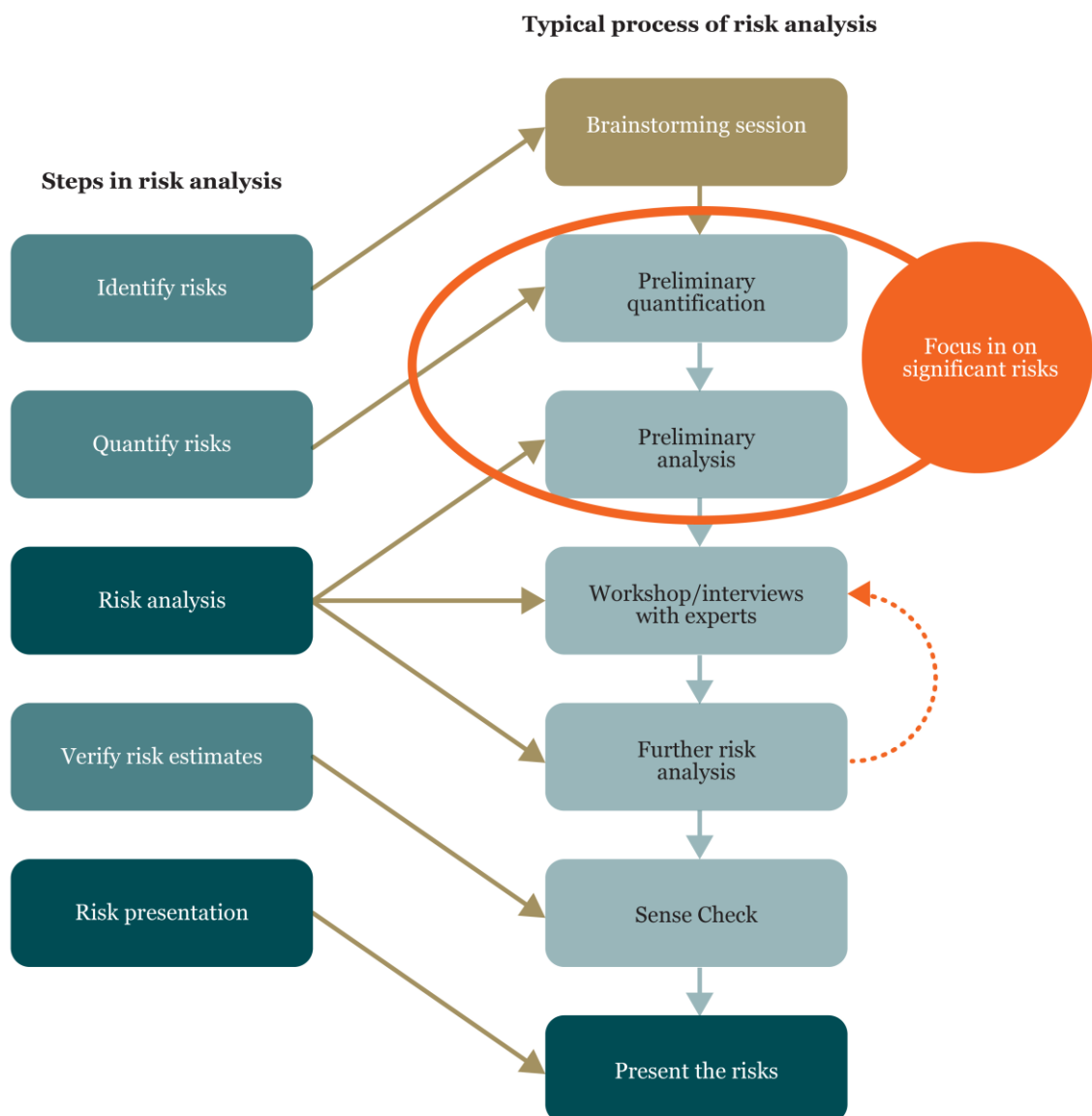
- The clearly defined service need objectives and the risks to the service provider in not meeting them;
- The appetite of the Investor or Client for deviating from the service objectives;
- The time and resources that will be required to instruct and manage changes during procurement and construction resulting from change to the project risks;
- The experience and capability of the Investor and Client in delivering this type of work and any associated risks; and
- The prevailing market conditions and the industry's appetite for risk.

Risk analysis generally proceeds through the following steps⁷:

- Step 1:** Identify project risks;
- Step 2:** Quantify of project risks;
- Step 3:** Allocate project risks and develop risk management strategies;
- Step 4:** Verify the risk estimates; and
- Step 5:** Present the risk analysis work

Figure 4 demonstrates how these steps fit into a typical risk analysis process for a project.

Figure 4: Typical risk analysis process



⁷ Whilst the principles underlining these five steps would apply for less complex, lower value projects (say, under \$50M), the practices described may be sensibly scaled down to a level appropriate for such projects.

Figure 4 is included as an example of a best practice standard for estimating risks generally suitable for medium sized projects. For simpler projects it may not be necessary to use formal workshops and interviews. For more complex projects it may be necessary to undertake multiple workshops and establish independent analysis of components of the project or high risk events.

3.5.1 Step 1 – Identify risks

The International Standard for Risk Management (ISO 31000) considers risk to include negative impacts and positive impacts, what might be termed threats and opportunities. Risks are usually thought of as the negative aspect only, such as the risk of unexpected weather events or unexpected ground conditions. A positive risk or opportunity is the ability to introduce design innovation or better construction techniques to save money on what was initially planned and designed.

However, a trap for the inexperienced is to identify and assess too many risks in quantitative terms. The practice of identifying 100+ risks is not likely to improve accuracy or better predict the market price that the Client should attract from Suppliers. This leads to a lack of perspective on what are the really important risks and could also potentially lead to double counting of risks.

It is better to accumulate risks under perhaps 10 to 15 headings at the Inception / Planning Phase and perhaps (at most) double that number at pre-tender. Only those headline risks should be considered when undertaking any analysis. Wherever possible identified risks should be mitigated by management or design actions such that remaining risks are only residual risks, being those risks that cannot be fully mitigated at any given phase.

Risks can be categorised as *inherent* or *contingent*, although sometimes the boundaries are blurred.

Inherent risk occurs where there is potential for variance in the description/scope of a particular project item, the quantity measured from the design documents and the rate/price estimated. This variance is called *inherent* risk.

Contingent risk occurs where there is potential for whole of project impacts. Such risks included the potential for unexpected weather impacts, industrial disputation, latent conditions, and changes to standards during the project life, etc. *Contingent* risks must be limited to those that can be quantified in terms of probability and consequence: the *known knowns*.

Risk and Uncertainty

A further consideration in risk identification is to separate it from the concept of uncertainty. Uncertainty relates to the level of confidence (or more precisely the lack of confidence) that can be put on the likelihood of a potential event and the cost estimation of its impact. The following is a useful guide to distinguish between the concepts of risk and uncertainty:

- potential events that can be quantified (i.e. in terms of the reasonably *known* likelihood and the reasonably *known* potential impact) are addressed in the Base Risk Allocation and in the additional risk allocation (beyond the P50). These “known knowns” are normally referred to as the project risks. The greater/lesser the confidence of estimating the likelihood and potential impact, then the more/less likely that these estimates of the project risks will be themselves accurate.

- potential events that cannot be quantified (ie identified events with a wide range of significantly different possible impacts and/or likelihood): In capital projects, the potential occurrence of such events can be anticipated from general experience (such as adverse ground conditions), but there is little available specific information (e.g. from project site investigations) on which to quantify either their likelihood and/or the potential impact on project costs. These events are uncertain and cannot be quantified with a degree of confidence that would classify them as project risks⁸.

It can be the case that further investigation provides the information that is required to increase the confidence on the estimates of likelihood and impact for such uncertainties so that they can then be classified as project risks. Often these investigations are not only desirable but necessary to satisfy the foundation points for good project budget development. Unless investigatory work is undertaken that results quantifying an uncertainty to the appropriate standard of risk analysis, there should not be an allowance or provision for these in the project budget. Moreover, tender documentation requiring tenderers to take accountability for uncertainties is more akin to requiring them to take a gamble on the contract price, and would attract price premiums and/or have unattractive consequences during project delivery.

Whilst the inclusion of estimated or guessed financial impacts arising from such uncertainties (including those arising from poor project planning and analysis) are not acceptable as project risks and should not be included as an allowance or a provision in the project Budget, it may be appropriate to deal with some uncertainties through Real Options. Real Options provides a way of dealing with some uncertainties associated with project planning and delivery. They incorporate flexibility in the investment planning process to allow investments to adapt to uncertainty. It is a useful technique for evaluating project options and planning solutions that are characterised by uncertainty. Real options enable investments to be structured to encompass flexibility at milestone stages. Real options are discussed further in section 3.6.

⁸ To ensure clarity, *project risks* are events (generally considered adverse in nature) that can be quantified. Events that can't be quantified, the *uncertainties*, should not have a funding provision in Project Budgets. However, uncertainties may be otherwise addressed, in a manner consistent with jurisdictional guidelines, when seeking project funding approval. For example, a provision for these may be made in a management reserve; or an approval note made that supplementary funding may be required; or they are dealt through Real Options.

Example of a *known unknown*

- An agency has conducted extensive research of land and historical records and has identified that the site of a future construction project was used for the manufacture of lead batteries in the early part of the 1900s. The agency followed up on this documentary discovery by engaging the specialist services of an environmental engineering firm (the 'technical risk expert') to undertake bore samples and generally investigate how underground conditions may have impacted on the movement of any soil contamination to the present day.
- Upon completion of the investigation and following receipt of the report, the agency's project risk analysis team concluded that identified soil contamination would cost \$2.5 million to remediate, however, once site excavations were well advanced, there are two likely scenarios. One scenario is that no additional contamination, the second scenario is additional contamination if suspected water table flows eventuated. The expected and additional cost of remediation arising from the second scenario is an additional \$1.2 million.
- In this case, it would be appropriate for the agency to include \$2.5 million for remediation in the Base Cost Estimate, and identify a project risk of \$1.2 million. In the total context of the project proposal, the funding authority may place the \$1.2 million in the Base Risk Allocation, or alternatively in the additional risk allocation (beyond P50). (On the other hand, if the risk analysis is that there is a 50/50 chance of the water table issue occurring, then this would suggest \$0.6 million in the Base Risk Allocation and perhaps an additional \$0.6 million in the additional risk allocation (beyond P50).)
- Further there may be a possibility that cannot be quantified with any reasonable confidence that a geological fault exists down which the contamination has been able to infiltrate to a deeper level. Remediation would cost more if this were the case. If fault lines were known to exist in the local area then this uncertainty may be a real issue for the project and it would be appropriate to undertake further site investigation, e.g. seismic surveying, in order to gather the information that would eliminate this uncertainty and either render the event as a cost or a risk estimate.
- If no known fault lines exist in the locality and further the geological structure made it extremely unlikely for such geological structures to exist then it may not be worthwhile going to the expense of the survey and the event would remain as an uncertainty, or a known unknown if identified and an unknown unknown if not identified. Either way it is not expected that such events should be costed provided that the appropriate level of investigation has been carried out in accordance with these guidelines.

3.5.2 Step 2 – Quantify risks

It is only through understanding of the likelihood of a risk occurring and of the resulting impact that mitigation measures can be planned; and in turn the impact of the residual risks on the Project Budget can be assessed.

There is a wide variety of risk assessment and management tools available to aid identification and quantification of risk in a consistent manner. Individual Clients and jurisdictions will have requirements for certain standards and processes to follow or methods to use.

It is critical to the Investor that a structured approach to risk quantification is followed and is used consistently across a program of projects. Provided this principle is rigorously adopted a solid foundation of project understanding and risk assessment can be established on which to avoid either optimism or pessimism bias. This principle must also be applied irrespective of the procurement strategy adopted for the project.

3.5.3 Step 3 – Risk allocation

There is a generally held belief that using traditional forms of contract to deliver capital investments allows the Client to ‘transfer’ risks to the private sector for the delivery of the asset. However, the Client is ultimately responsible for the service delivery and cannot transfer accountability for successful delivery to private sector Suppliers. The Client must therefore take a pragmatic approach to risk which considers that:

- the party best placed to manage a risk is made responsible for it;
- mutual support in managing and mitigating risk will be beneficial to both Suppliers and Clients/Investors;
- ‘transferring’ risks to Suppliers through procurement will have an impact on tender offers and ultimately the contract price; and
- the Client cannot take on design and construction risks it cannot manage.

The Principles of Risk Allocation

The principles of risk allocation enunciated by Max Abramson, in the 1980s, are still a sound starting point.

“A party (Supplier or Client) should bear a risk where:

- the risk is within the party’s control;
- the party can transfer the risk, e.g. through insurance, and it is most economically beneficial to deal with the risk in this fashion;
- the preponderant economic benefit of controlling the risk lies with the party in question;
- to place the risk upon the party in question is in the interests of efficiency, including planning, incentive and innovation efficiency;
- if the risk eventuates, the loss falls on that party in the first instance and it is not practicable, or there is not reason under the above principles, to cause expense and uncertainty by attempting to transfer the loss to another.”

In blunter terms, the allocation of risk to a party who is unable to do anything about it:

- turns that party into a gambler with all its negative connotations; and
- means that the particular risk cannot be managed.

There are a number of challenges with the application of the above principles given that some risks may be complex and not wholly within the control of one particular party. This requires clear understanding of the impact/consequences of risk transfer to enable an informed assessment on pricing and allocation of those risks. Some considerations are:

- There are likely to be commercial negotiations on what constitutes the “allocation of risks to the party that is able to manage and control the risks at the least cost”, with parties attempting to protect their own interests by seeking to change the “appropriateness” of risk allocation;
- Tenderers attempting to have the Client retain specific design and construction risks without a commensurate reduction in the contract price;
- Clients attempting to transfer project risks to tenderers that are not well dimensioned and have not been investigated by the Client; and
- Being uninformed and under-prepared will lead to increased construction costs arising from reducing delivery efficiency and increasing disputes and claims.

To deliver best value for money outcomes to the taxpayers, it is necessary for the selection of the optimal procurement methodology; and the development of an effective market engagement and negotiation strategy to ensure appropriate risks are allocated to the contractors and priced within a competitive environment.

Example: Risk Allocation

The Roads Agency responsible for the road network has determined that the Supplier should be responsible for latent site conditions along an upgrade route.

To manage this, in the Tender Phase the Supplier and the Client have agreed how those latent conditions will be investigated, managed and costed and this is documented in the contractual arrangements. One option is that the contract provides for payments to be based on actual costs incurred plus overheads and profit, rather than a lump sum.

It is crucial therefore that the Client identifies project risks as early as possible and begins to form an assessment of the risks that the Client is best placed to manage and those which will be allocated to the Supplier to manage. It is early in the Project Definition period where the greatest influence can be achieved in minimising risk in the project. The Client must implement a process to identify and consider risks associated with the delivery of the asset. This will be an iterative process until the nature and impact of project risks is sufficiently understood for the Business Case to be developed.

It is during pre-tender stage that the Client seeks to identify and quantify project risks, and where applicable, reduce the risks to meet the market’s skill, capacity and general appetite to tender competitively.

Cautionary Note

Australian design and construction companies are among the most successful in the world and promote a reputation of excellence. They typically have a long history of delivering complex and high risk projects and have a history of enjoying good financial outcomes. Therefore, Clients should ensure that they do not overstate the uniqueness and/or the challenges of delivering a project. An informed and experienced view needs to be taken of the industry’s capability and expertise to manage project risks.

3.5.4 Step 4 – Verification of risks

In identifying and analysing project risks it is important to remember they must be considered in the context of a commercial environment. Further, the risks identified need to be reflective of the actual situation and not be overly optimistic or pessimistic which can have the undesired effect of incorrectly influencing the Investor's approval decision.

It is important to introduce a formal verification and checking process which considers the whole spectrum of risks identified and reviews the estimated probability of occurrence and impact of the primary risks. Verification should consider:

- Justification behind the top [5-10] risks in terms of impact;
- Duplication;
- Consideration of knock-on effects or linked consequences;
- Overestimation of likelihood or impact

Where possible, every effort should be made to review available data for risk assessment and actual occurrence on similar Projects.

Benchmarking is an important tool for Clients and Investors to use to assess the levels of risk that are attributed to projects and learn from similar Projects and actual outcomes.

3.5.5 Step 5 – Risk presentation

Successful risk management requires recording and presenting risks in a clear and practical format that is easy to understand. Establishing a project risk register early in the project life-cycle which then evolves as the Project Definition matures achieves this purpose.

A risk register informs decision making by the Client and Investor. It is important to note that a risk register does not identify risk outcomes (e.g. the cost overrun associated with the discovery of poor ground conditions), rather it is a list of risk events (e.g. 'poor ground conditions') and usually records likelihood/impact and an indication of mitigation measures to prevent the risk materialising.

A common error is for the risk register to contain a long list of low likelihood and low impact risks which rather than highlighting/reflecting the current risk profile, can dilute the importance and status of significant issues.

The risks should be ranked relative to each other, using qualitative risk analysis tools, and risk management controls considered (including their likely impact on the qualitative ranking of the risks). While understanding the environment that has led to a long list of risks being identified can be useful it is important to consider the practicality of considering any more than the [10-15] greatest risks.

The project risk register provides the essential foundation on which the quantitative estimates can then be established in the Project Budget.

The extent to which the Client summarises or reports risk information to the Investor will vary by jurisdiction. However as a minimum, risks that have a severe impact on the ability of the Client to deliver the asset within the anticipated budget should they materialise must be reported.

“Ultimately the risks and trade-offs made by clients during negotiations have to be considered in the context of its business. The senior representative must judge the sometimes conflicting views of its technical advisers and those of the contractor’s and make the best decision for the business. Participating in negotiations on technical matters allows this decision to be made expeditiously. This is particularly the case when advisers may be risk averse to a different approach from the contractor that promises at least the same technical performance and functionality. Weighing these perceived risks with other trade offs and the strength of the commercial terms to hold the contractor to account will lead to the best decision for the business.”

**Ian Payne, GM, Asset Solutions, Sydney Water
September 2011**

3.6 Real Options

There is also another emerging area of infrastructure planning that changes the traditional view of project delivery and project contracts. ‘Real options’ provides a way of dealing with some uncertainties associated with project planning and delivery.

Government normally enters into contracts for ‘full’ project delivery. However, in the use of real options the investor retains flexibility to respond to systemic impacts outside the Client’s/Supplier’s control. Real options are exercised by the Government (as the Investor) as these options will generally deliver a different outcome to that anticipated in the business case, but which in the circumstances provide for a greater value-for-money outcome.⁹

Potential systemic events that can impact on the project include:

- global/systemic shifts;
- quantum technology changes;
- unpredictable climate change;
- extraordinary industrial relations developments;
- unknown unknowns; or
- known unknowns.

The use of real options (with well-defined trigger points) is planned in the business case and, if approved, are documented as the “investor’s options” and/or “break points” in the project contract. Real options are of particular interest for projects that:

- have benefits, costs and/or risks that are volatile or uncertain; and
- value can be created by designing and introducing investor flexibility, that is options to potentially exercise during the contract period of detailed planning and delivery stages.

⁹ Whilst the principles underlining the development of real options would apply for less complex, lower value projects (say, under \$50M), the application of real options as described may be sensibly scaled down to a level appropriate for such projects.

The exercise of a real option by the investor should be seen as responsible and informed resource management. It is a response to external (systemic) factors and not necessarily to the performance or non-performance of the project delivery stage.

The following examples of real options provide investors with the flexibility and ability to respond in real time to unfolding events. Such options, grouped here to indicate whether they are available to the investor pre- or post- contract award, are not mutually exclusive and can operate in sequence:

Pre-contract award

1. *defer* or wait before committing to the investment
2. *stage* the implementation of the investment/project (acquire incrementally)
3. invest in flexibility to *upgrade* in the future at a much lower cost

Post-contract award

4. *abandon* the investment proposal or *exit* the project during delivery
5. change the *scale* of the investment (expand or contract)
6. change the *scope* of the investment (different mix of deliverables)
7. *switch* inputs or processes during delivery

Real options are exercised in real time, either before or during project delivery, as events unfold and further information becomes available. In response to the additional information, decisions can be made that create additional value for the Government.

It should be noted that real options are a different concept to that of project risks:

- *Project risk* – a known event occurring with a known range of likelihood and consequence, and which the project team can manage, within its budget, in a manner that delivers the original approved project scope/outcomes.
- *Real option* – exercisable when circumstances arise that give the investor a choice to change the approved project scope/outcomes to be delivered. Exercising a real option delivers the optimal, but different, outcome for the investor (under these new circumstances).

Project risks are what the project team manages, ensuring at all times they do not exceed their authority and still deliver the original approved project scope/outcomes.

Using real options to avoid 'investment regret'

With no real options thinking applied, a D&C contract has been entered into for a large desalination plant. The desalination plant is considered to be a significant project for the state. With dam levels falling and uncertainty as to if and when the drought will break, pressure has been applied to provide attractive pay and work conditions for the workers on site, leading to an increase in costs.

Soon after work commences on the desalination plant, the drought breaks. The wet weather further increases the costs to build the desalination plant.

Over the next year or so, it becomes evident that no water will be required from the desalination plant for years to come. The 'mega' investment in the project is being regretted, as people believe that in hindsight better value of public resources would've been to at least partially direct some of that investment in upgrades to public transport.

The question of "right-sizing" a desalination plant is an investment decision, and is an investment risk that can be addressed by real options. It is not a project risk.

Appendix A

Glossary

Term	Definition	Comment
Statement of Service Need	The investment rationale in the Business Case that defines the service need and outlines the service delivery improvements and the expected outcomes to be achieved from the proposed investment of resources.	This statement articulates the service need and benefits that the capital Project will enable. It can be articulated in a strategic assessment, an investment logic map, an investment concept brief, or other such similar document.
Project Definition	The foundation document for the Project Budget. It is directly aligned to, and enables, achievement of the service benefit as set out in the Statement of Service Need. It defines the Performance function; Product specification; Scope; and Contingency relating to the capital project.	The Project Definition needs to be of sufficient quality and detail (see Specific Topic Guide 1) to enable determination of the Project Budget, and should be provided as an appendix of the Business Case.
Base Cost Estimate	The current best-in-market estimate of the expected financial costs of delivering the Project. This does not include any estimates for Escalation, Risk or Contingency.	A Base Cost Estimate for a capital Project would comprise costs for design, margins, Project management, consultants, site preparation, building materials, labour, and use of plant and equipment. It is prepared by a suitably qualified professional, and should be provided in an appendix of the Business Case.

Term	Definition	Comment
Project Risk ¹⁰	Variability in future Project delivery outcomes for which a likelihood and impact of occurrence can be estimated. Variability arises from events which are known hazards or are readily observable in practice or from experience. A reasonable estimate of the range of variation in actual outcomes can be quantified or derived from calculation. The total allocation for Project Risk provided in a Business Case Project Budget is the Base Risk Allocation plus the additional risk allocation (beyond P50).	The estimations for all Project risks (inherent and contingent) are usually determined through risk workshops with the participation of experienced and capable officials and, as appropriate, external consultants. Estimates need to be prepared by a qualified professional, and should be provided as an appendix of the Business Case. (Risks can result in either a positive or negative impact.) Caution must be exercised to ensure that Project risks are neither over- nor under- estimated; and are benchmarked to actual events and contemporary risk management responses.
Project Budget	Comprises of the Base Cost Estimate, Base Risk Allocation and the additional risk allocation (beyond P50). It addresses all delivery aspects of the approved Project.	This amount is approved as part of the Business Case decision.

¹⁰ Note: There are other (often very substantial) risks arising from poor or incomplete analysis of the investment rationale and project planning. In such cases business Cases not completed in accordance with jurisdictional guidelines and are of insufficient quality for decision making. The potential adverse financial impacts arising from the risks of 'poor project planning and analysis' are outside the scope of this paper.

Appendix B

Template (Project Definition)

Project Definition: <Project title>

This Project Definition describes the physical asset to be constructed to meet the Service Need. It forms part of the approved Business Case upon final approval and any material changes must be documented, approved appropriately and communicated.

1 Functional and Performance Requirements

The type of asset to be constructed and performance function required to fulfil the Service Need.

1.1 Asset type

A description of the type of asset.

1.2 Functional performance

A description of the function of the asset.

1.3 Performance requirements

A description of the metrics (eg on utility, capacity, performance, quality etc) that the asset must satisfy

2 Scope

The physical extent of the asset to be constructed.

2.1 Physical scope

A description of the physical scope of the asset.

2.2 Supporting plant & equipment

A description of the plant included in the asset.

3 Risks, constraints and opportunities

Requirements and risks, constraints and opportunities related to the asset or construction of the asset.

3.1 Financial risks, constraints and opportunities

Financial requirements or risks, constraints and opportunities (generally proscribed by the Investor)

3.2 Time constraints

Time related requirements or limitations.

3.3 Environmental constraints

Legislative, regulatory or policy constraints and general conditions related to the natural environment.

3.4 Project context risks, constraints and opportunities

Risks, constraints and opportunities related to the context in which the project delivery takes place, including stakeholder interests, inter-dependencies with other projects or activities, market conditions, project risks and any opportunities arising from the public investment in the infrastructure investment.

The potential benefit of developing 'real options' (see section 3.6) can also be considered.

4 Standards requirement

Technical requirements such as material specifications and standards required to construct the asset to the appropriate quality and ensure integration with existing infrastructure network and/or current network standards.

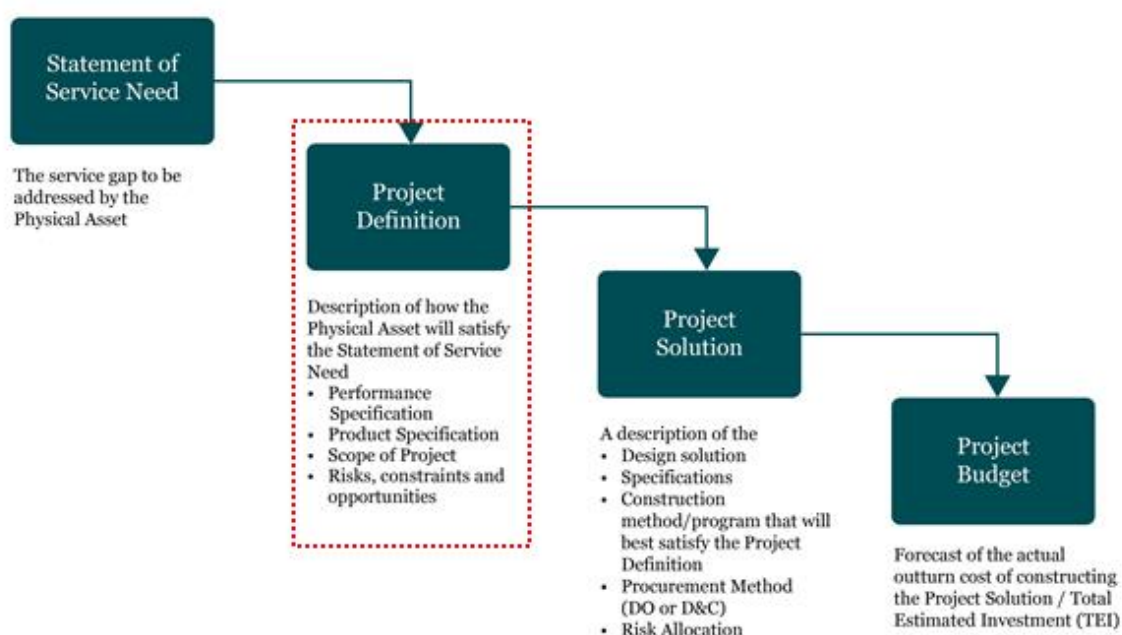
Appendix C

Description of Design Brief

Project Definition – Illustration of a CBD tunnel

This is a simple (and incomplete) illustrative example of a Project Definition which is applicable to both Design & Construct and Construct Only developments. The example is an amalgam of a number of real examples taken from Australian capital cities. It describes a physical asset to be constructed to meet an identified Service Need. The Figure 4below shows how the project definition fits into the Planning Phase, which will result in a business case.

Figure 1: Planning phase – project definition



The purpose of this example is to provide guidance about the elements expected as part of the Project Definition at the Business Case stage. The purpose is to deliver an ‘investment grade’ Project Budget, for inclusion in the Business Case. The nature of the service need being met will define the requirement for the level of detail in the Project Definition. In developing the Project Definition it is important to strike the balance between providing an appropriate level of detail to allow a project solution to be developed and for it to be understandable by reviewers of the business case that do not have a technical background.

The theoretical circumstances within this example relate to development of a road asset. In this example there are numerous jurisdictional standards, guidelines and codes of practice that form part of the detailed Project Definition as Standards Requirements (see section 4 below) and would be included as annexures. For brevity they are not included in this example.

1 Functional and Performance Requirements

The type of asset to be constructed and performance function required to fulfil the Service Need.

1.1 Asset type

A description of the type of asset.

The Project is a motorway providing a bypass of the CBD for transport travelling cross-city, proposed to be constructed mostly in deep tunnels beneath the city's northern suburbs.

The requirement is for a roadway approximately 4.4 km long of which approximately half is proposed to be in tunnels. Local connection is to be provided at major urban roads at two locations (at North Road and South Road). The Project would include:

- two separate parallel road tunnels, one for northbound traffic and one for southbound traffic, with two traffic lanes in each tunnel;
- tunnel portals and associated transitions connecting with the surface road network in two locations (at North Road and South Road);
- safety systems including safety exits, fire protection and monitoring systems;
- a ventilation system to manage air quality in each tunnel and near portals, including ventilation stations to house the extraction fans and elevated outlets;
- surface road changes to connect the Project with the existing road network;
- traffic management systems including signage, lighting, CCTV and radio/mobile re-broadcast capability;
- plant monitoring and control systems; and
- a suite of urban design and landscape measures for the above-ground infrastructure, the ventilation station and ventilation outlet, and residual land adjacent to each of the portals.

1.2 Functional performance

A description of the function of the asset.

Consistent with existing transport plans of the jurisdiction, the Project is to be designed and constructed to provide the following function:

- provide an effective and convenient bypass of the City CBD for north-south cross-city movement of people and freight;
- reduce average travel times and improve trip reliability when compared to corresponding existing surface routes;
- provide opportunities for additional public transport network capacity; and
- provide higher standards of road user safety, air quality, noise mitigation and local amenity when compared with existing conditions of areas within and

surrounding the Project Area (refer current baseline assessment within Annexures).

1.3 Performance requirements

A description of the metrics (e.g. on utility, capacity, performance, quality etc.) that the asset must satisfy

Have sufficient capacity to meet projected traffic volumes on the east-west axes out to 2030. Indicative traffic volumes as per the Reference Design are:

- 120,000 vehicles per day in total by year 2030; and
- 10,000 vehicles per peak hour by year 2030.

Indicative travel times on all identified 'Key Routes' to be consistent with or an improvement upon the Reference Design at peak time periods.

Design life of Project components to be consistent with the minimum standards specified in the Reference Design.

There is the opportunity for the Contractor to improve upon the functional and performance requirements including maximum traffic volumes, minimum travel times and asset design life. However the asset must not extend beyond the defined project footprint outlined in the asset type.

2 Scope

The physical extent of the asset to be constructed.

The following section provides an outline of the project scope. This scope outline should be read in conjunction with the detailed project data, which includes all current versions of technical reports, designs and management plans contained in the Project Data Compendium.

2.1 Physical scope

A description of the physical scope of the asset.

The scope includes all permanent new infrastructure and modifications to existing infrastructure that must be constructed to enable the Contractor to satisfy the requirements of the Contract, including the new infrastructure and modifications to existing infrastructure listed below:

- Ramps and twin unidirectional Mainline Tunnels, including the following items (as per locations in the Reference Design):
 - an entry ramp from North Road to the northbound Mainline Tunnel (the 'northbound entry ramp');
 - an northbound Mainline Tunnel from the northbound entry ramp to the northbound exit ramp;

- an exit ramp from the northbound Mainline Tunnel (the ‘northbound exit ramp’);
 - an entry ramp from South Road to the westbound Mainline Tunnel (the ‘southbound entry ramp’);
 - a southbound Mainline Tunnel from the southbound entry ramp to the southbound exit ramp;
 - an exit ramp from the southbound Mainline Tunnel to the Centenary Motorway (the ‘southbound exit ramp’);
 - a ventilation tunnel from the northbound Mainline Tunnel to the southern fan station and ventilation outlet.
- Tunnel Control Centre.
 - Facilities for operations management, traffic management and control including traffic monitoring, advice and control devices including signposting, variable message signs, variable speed limit signs, CCTV, traffic counter loops and over height detectors.
 - All infrastructure necessary for the provision of access to all parts of the motorway for operation and maintenance.
 - Environmental management facilities, including environmental monitoring stations, noise amelioration, vibration control, drainage and water treatment facilities.

2.2 Supporting plant and equipment

A description of the plant included in the asset.

The plant included in the asset is:

- a ventilation system for the tunnels;
- tunnel safety features and incident management systems including fire and life safety facilities, smoke control systems and emergency egress provisions;
- plant and equipment necessary to provide safe operation of the motorway and for incident response; and
- mechanical and electrical systems including power supplies, communication and security systems.

3 Risks, constraints and opportunities

Requirements and risks, constraints and opportunities related to the asset or construction of the asset.

The following section provides an outline of the project risks, constraints and opportunities. This outline should be read in conjunction with the detailed project data including all current versions of technical reports, designs and management plans contained in the Project Data Compendium.

3.1 Financial constraints

Financial requirements or limitations (generally proscribed by the Investor)

Planned annual operation and maintenance costs to achieve asset design life must not exceed 15% of project construction over the first 15 years of operation of the project.

3.2 Time constraints

Time related requirements or limitations.

The project is to be commissioned for operations by the XX-XX-20XX

3.3 Environmental constraints

Legislative, regulatory or policy constraints and general conditions related to the natural environment.

The Project design and construction methodology must be consistent with the existing Project approval conditions, identified in the Environment Management Plan (refer Annexure EMP).

3.4 Project context risks, constraints and opportunities

Risks, constraints and opportunities related to the context in which the project delivery takes place, including stakeholder interests, inter-dependencies with other projects or activities, market conditions; and project risks.

Future Road Interface requirements (FRIR):

The Client has identified FRIR that:

- (a) The Contractor must ensure, and demonstrate to the satisfaction of the Client and the Independent Verifier throughout the performance of the D&C Activities, which the design and construction accommodates the future implementation of the Client's planning requirements which follow:
 - (i) Smith Street (White Road to Brown Road): One traffic lane in each direction, indented bus bays, shoulders, turning lanes and some on-street parking provision;
 - (ii) Jones Street (Green Road to Black Road): Two 'through traffic' lanes in each direction plus auxiliary lanes.

A number of value capture opportunities have been identified by the Client. These will be addressed by the Client separately to this construction contract, and will not impact on the contractor's performance of its obligations.

(This simple example does not illustrate the potential use of 'real options'.)

4 Standards requirement

Technical requirements such as material specifications and standards required to construct the asset to the appropriate quality and ensure integration with existing infrastructure network and/or current network standards.

The project will be built to relevant Australian standards with a design life of x years. It will be built in accordance with delivery agencies standards. There are no expected departures from existing standards as there are no new technologies or constructions methods expected to be applied.

