

Department of Planning, Transport and Infrastructure

# ESTIMATING MANUAL

# DRAFT



Estimating Manual  
Transport Infrastructure Projects  
EST 600



Government of South Australia  
Department of Planning,  
Transport and Infrastructure

# Foreword

Accurate and reliable project cost estimates are fundamental to achieving successful project outcomes.

The release of the revised Estimating Manual – ‘Estimating Manual for Road and Rail Projects’ builds on earlier versions and incorporates the latest DIRD Guidance Notes to support estimate development, review and approval. It addresses issues relating to project scoping, contingencies and escalation – all of which have a major impact on project cost.

The manual provides the business context and instructions for estimating, covering the various stages from strategic estimates through to actual project costs. It links to and provides practical tools and information, including electronic spreadsheets.

The manual captures improvements from recent reviews, best practice studies and suggestions from practitioners. It demonstrates the department’s commitment to the adoption of the Federal Department of Infrastructure, Regional Development and Cities ‘Guidance Notes’.

Through the adoption of this manual it is expected that:

- Estimates will be realistic with reduced tendency for optimism bias
- The likelihood of cost overruns will be mitigated through the application of appropriate levels of contingency and risk allowance
- Estimate announcements will cover total project costs which are inclusive of appropriate contingency and escalation
- Projects seeking funding will have a formal estimate that is up-to-date and that accurately reflects an estimated total project cost relevant to the stage and scope of their development

All estimates prepared by and for the Department of Planning, Transport and Infrastructure (DPTI) are required to conform to the requirements and practices set out in this manual. The use of this manual together with the professional expertise provided by estimating and other consultants is essential for effective project cost estimating.

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The Estimating Manual is structured into 3 sections:

**Section 1 Estimating Approach**

This section provides an overview of the estimating processes, general principles and the Cost Estimating Framework. It provides information for internal staff and external estimators.

**Section 2 Estimate Development & Presentation**

This section provides more detailed information for estimators and estimate reviewers/approvers.

**Section 3 Appendices**

The appendices provide detailed guidance and tools to support the estimating process, including details relating to work breakdown structure, contingencies and review checklists.

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- EST 600-1 Standard Estimate Spreadsheet, Estimate Level 1 – [KNet #5751720](#)
- EST 600-2 Standard Estimate Spreadsheet, Estimate Levels 2, 3, 4, 5 & 5B (*where prepared by estimating consultants*) – [KNet #5751722](#)
- EST 600-3 Standard Estimate Spreadsheet, Estimate Levels 2, 3, 4, 5 & 5B (*where prepared by DPTI Staff*) – [KNet #5751723](#)
- EST 600-3 FS Standard Estimate Spreadsheet, Estimate Levels 2, 3, 4, 5 & 5B (*where prepared by DPTI Field Services Staff*) – [KNet #5849068](#)
- EST 600-4 Estimating Work Order – [KNet #4479522](#)
- EST 600-5 First Principles Client Costs Estimate – [KNet #5729453](#)
- EST 600-6 Environmental Cost Estimating Tool – [KNet #9362850](#)
- EST 600-7 Cash Flow Template – [#12245240](#)
- EST 600-8 Actual Project Costs, Level 6 – [KNet #9683206](#)

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Department of Infrastructure and Transport (May 2011). Best Practice Cost Estimation for Publicly Funded Road and Rail Construction, Canberra (now withdrawn from use)

Department of Infrastructure, Transport, Regional Development and Local Government (June 2008). Best Practice Cost Estimation for Publicly Funded Road and Rail, Canberra.

Department of Infrastructure, Transport, Regional Development (November 2018). Cost Estimation Guidance Notes:

- Guidance Note 1 – Project Scope
- Guidance Note 2 – Base Cost Estimation
- Guidance Note 3A – Probabilistic Cost Estimation
- Guidance Note 3B – Deterministic Contingency Estimation

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## INTRODUCTION

This manual sets out the approach, processes and standards for the preparation, review and acceptance of cost estimates. The manual provides standard processes, forms and a work breakdown structure to guide estimators and project managers/planners in the consistent production and review of estimates.

The overall cost estimating model for capital road and rail projects is supported by:

- DPTI Estimating Manual (EST 600) – this manual ([KNet #12905558](#))
- Project Management Office Project Management intranet site  
[http://cms.dpti.sa.gov.au/portfolio\\_management\\_office/project\\_management\\_framework](http://cms.dpti.sa.gov.au/portfolio_management_office/project_management_framework)
- Cost Estimation Guidance Notes (Department of Infrastructure, Regional Development and Cities)  
[http://investment.infrastructure.gov.au/about/funding\\_and\\_finance/cost\\_estimation\\_guidance.aspx](http://investment.infrastructure.gov.au/about/funding_and_finance/cost_estimation_guidance.aspx)

These documents may also be used to guide the development of estimates for projects other than road and/or rail (with appropriate changes to detail as necessary).

Cost estimates are generally prepared by external estimating specialists to provide an industry perspective of factors such as the likely construction methodology, project duration and the associated project costs. The department has an established panel contract in place to facilitate the engagement of specialist estimators, who are familiar with the guidelines established in this manual and have the appropriate skills and experience to provide infrastructure estimates.

Alternatively, cost estimating may be undertaken internally by experienced staff, however for all estimates the processes and principles contained in this manual are to be applied.

All projects are required to have a current estimate which has been prepared in accordance with the procedures and practices detailed within this document. While projects with an estimated total value (including risk) of less than \$150,000 do not require a registered estimate they are required to follow the templates and practices set out in this manual.

## GLOSSARY OF TERMS

**Base Date** – the date at which the selected options estimate has been prepared, prior to indexation to current dollars or escalation to future dollars being applied.

**Base Estimate** – represents the estimator's best prediction in terms of the quantities and current rates which are likely to be associated with the delivery of a given scope of work prior to the addition of inherent and contingent risk values or escalation allowances.

**Benchmarking** – the analysis of historical project cost data used during the very early identification of potential future project costs where the scope is of a similar nature or alternatively for more detailed estimates, comparing estimated values with actual cost data from recent projects of a similar nature.

**Budget** – the approved cost estimate for the project or the approved funding allocated to a particular activity or project.

**Business Case** – a key document that is developed early in the lifecycle that describes the reasons and the justification for the development of a project or program, based on its estimated costs, the risks involved and the expected future business benefits and value. It provides the basis for selection and authorisation of future effort on a projects definition, planning and estimating of budget requirements and implementation considerations.

**Cash Flow** – represents the project base estimate plus contingency amount expenditure profile across the financial years the funds are expected to be spent.

**Contingency** – a financial reserve included in the project estimate to offset unforeseen factors relating to the delivery of project objectives. This value represents both inherent and contingent risk.

**Contingency Management Framework** – the Contingency Management Framework provides guidelines on how cost and schedule contingency management is to be performed at project, program, and portfolio levels across the project lifecycle. The framework provides reference for the consistent approach to sizing, allocating and managing the most appropriate and reasonable contingency reserve (time and cost) at different stages of the project lifecycle.

**Contingent Risk** – contingent (or unplanned) risks are those which have a less than 100% chance of occurring. They are evaluated separately from other project items due to their unknown nature.

**Correlation** – a parameter used to describe the degree to which one variable's probability distribution is related to another.

**Cost Estimating Model** – the overarching model which illustrates how project estimates progress from early strategic estimates to final tender estimates.

**Cost to Complete (CTC)** – forecast costs to complete the project in addition to actual cost already spent or accrued.

**Deterministic Risk Analysis** – a deterministic risk model, as opposed to a probabilistic risk model, contains no random elements and as such treats all risk input factors as being

constant. This form of model also pertains to exactly predictable events, the outcome of which is assumed to be known with certainty if the inputs are known with certainty.

**Direct Costs** – are those which are directly attributed to work items. They include those items within section 4 of the Work Breakdown Structure such as environmental management, traffic management, services (by contractor), earthworks, drainage etc.

**Duplicate Estimate** – process where two separate estimates are prepared (and reconciled) to give increased confidence as to the total project costs involved. At the Senior Responsible Owners discretion, projects with an estimated P90 Project Estimate cost of greater than \$25m or which are considered to be either high risk or sensitive may be subject to the duplicate estimate process prior to seeking funding.

**Escalation** – the anticipated increase in project costs over time as a result of various factors such as inflation, market conditions, supply constraints and project complexity.

**Estimate Review Process** – the process which estimators and those requesting estimates are required to follow in reviewing and accepting estimates

**First Principles Estimate** – the method of preparing a cost estimate which considers factors such as the anticipated items of plant, labour and materials that will be used along with their associated hourly rates, rates of productivity, purchase costs etc. as applicable to the completion of individual project tasks.

**Formal Estimate** – generated using the project estimate, the formal estimate takes into account the effects of the project cash flow and subsequent escalation. It is recognised as the current total project cost until a subsequent formal estimate value is prepared for a more detailed project estimate. It is expressed in out-turn (nominal) dollars and rounded to the nearest 1000 dollars. The formal estimate is used for internal budgetary purposes, seeking project funding and is the only estimate value which is to be announced (by those authorised do so).

**Gateway Approval** – an approval at the completion of critical activities in a phase or phases, which must be in place before the project, program or component activities can progress.

**Gateway Review** – a governance activity which is a review performed at the end of a phase to arrive at a decision to either continue to the next phase, to continue with modification, or to end a project or program.

**Indirect Costs** – costs not directly attributable to work items such as on-site overheads (mobilisation/demobilisation, site supervision, site vehicles, establishment of site facilities etc.) and off-site overheads (contractors head office costs and associated administration). They do not include the contractor's corporate overhead, margin or risk.

**Inherent Risk** – applies to measured items, i.e. those specifically identified within the various components of the Base Estimate and which will definitely contribute to project cost but where there remains uncertainty as to the accuracy or reliability of the amount in the Base Estimate.

**Margin** – an allowance which is inclusive of the contractor's corporate overheads and profit.

**Non-Recurring On-Site Overheads** – indirect costs which generally are only incurred on a single occasion, these typically include items such as mobilisation of plant, equipment and personnel, establishment of site facilities and provision of insurances.

**Objective** – the planned goal, purpose or outcome of a project.

**Optimism Bias** – the tendency for those associated with the scoping and preparation of estimates to be overly optimistic and/or accurate in their assessment of project durations, quantities and costs.

**Options Estimate** – represents the total estimated cost for a given project option including the estimators best prediction of all known project scope items and their associated costs to which risks values are added.

**Outline Business Case** – an Outline Business Case (OBC) sets out the preliminary thoughts regarding a proposed project. It should contain the information needed to help the institution make decisions regarding the adoption of the project and state envisaged outcomes, benefits and potential risks associated with the proposal.

**Out-turn Dollars** – (or nominal dollars) the estimated dollar value for which the project will be completed assuming a given delivery period. Out-turn dollars are calculated by escalating the estimated project cash flow for each year of the project to represent the actual project cost in future year dollars.

**P50 Value / P90 Value** – P50 and P90 values are established to provide a level of confidence (50% confident / 90% confident) that the estimated cost at these respective levels will not be exceeded at project completion.

**Peer Review** – a review of the project estimate by one or more experienced people to ensure the quality of the estimate. Typically this will involve more senior/experienced project managers/planners (including external specialists where deemed necessary) who have delivered similar types of projects, reviewing the estimate to provide an increased level of confidence in the estimated project cost.

**Planned Risk** – see Inherent Risk.

**Present-day Dollars** – (or real dollars) are those at the point in time which the estimate is prepared. Estimates are prepared as if the project were being undertaken today and escalated to represent Out-turn dollars (or nominal dollars) based on the assumed delivery time-frame.

**Principal Arranged Insurance** – insurance provided by the Principal (DPTI) to cover the agency, contractors, subcontractors and other service providers in respect to contracts let by the principal.

**Probabilistic Risk Analysis** – the process by which cost components are identified along with the likely range of each component and the distribution of values within that range determined, prior to the use of a simulation process (e.g. Monte Carlo or similar analysis using a computer program) to generate a probability distribution of project costs.

**Project Estimate** – the project estimate represents the highest valued realistic options estimate which is used as the basis of the formal estimate. Where the highest valued option is considered unrealistic due to factors such as its high cost, social impacts etc. the next

highest valued option is carried forward as the project estimate. *Note: when seeking project delivery funding the project estimate must represent a defined option/scope of work, e.g. it is not acceptable to still be determining the best project solution such as roundabout versus signalised intersection.*

**Real Dollars** – estimates are prepared in Real Dollars reflecting current day pricing, then cash flowed and converted to Out-turn (budget) dollars via approved escalation rates to reflect their anticipated cost in future years.

**Reality Check** – the process where a more senior and/or experienced member of the team preparing the estimate reviews the estimate to ensure its reasonableness given the available project information.

**Recurring Costs** – indirect costs which occur on an ongoing basis, these include items such as project management, site supervision, site vehicles, site accommodation running costs.

**Registered Estimate** – an estimate which has been prepared in accordance with this manual and subsequently recorded within the department's estimating database.

**Risk Register** – a formal document that outlines identified project risks.

**Senior Responsible Owner (SRO)** – an Executive/Senior Manager who has the ultimate single point of accountability and responsibility for the project outcomes.

**Tender Estimate** – the tender estimate (Level 5A) is completed to provide a price for use in the comparison with actual tender prices received from contractors tendering to undertake the works. It is intended to represent a fair price to undertake all associated contract works and does not include any client costs or works undertaken by the client outside of the relevant tender. A formal estimate is not completed for level 5A estimates.

**Unplanned Risk** – see Contingent Risk.

**Work Breakdown Structure (WBS)** – provides a hierarchical structure that outlines the activities or work that needs to be done in order to complete the project scope. DPTI uses a standard WBS for the development of options estimates.

# **SECTION 1**

## **Estimating Approach**

# 1 ESTIMATING APPROACH

## 1.1 Purpose and Intent

Cost estimates for transport projects are produced for numerous purposes throughout the project lifecycle. Within the department, cost estimates are used for:

- Initial assessment of transport initiatives
- Assessing and comparing project options
- Supporting project justification
- Funding and investment decisions
- Establishing project budgets
- Comparison within tendered prices
- Validating costs associated with contractor variation claims

The overall purpose of this manual is to direct and support the development of sound cost estimates relevant to the stages of a project's lifecycle, with appropriate levels of detail for the purpose for which they are intended. By implementing a standardised approach and structure to the development, presentation, review and approval of cost estimates it is expected that estimate accuracy and reliability will be improved and that decision-makers will have as high a level of confidence as possible in the estimates produced.

Accuracy is critical and it is expected that estimates contain costs for all scope items and are not qualified with “no allowance has been made for ...” statements where these items will, or are likely to form part of the project scope.

*If works are expected to be in scope a reasonable assessment of the extent and value must be included in the estimate.*

Considerations in the development of this manual include:

- Reducing the tendency for ‘optimism bias’ (the tendency for people to be overly optimistic regarding project costs and planned durations)
- Mitigating cost overruns through the appropriate application of contingencies
- Improving scope definition and documentation
- Detailing the DPTI standard work breakdown structure with relevant levels of detail applicable to the project phase
- Promoting an understanding of inherent and contingent risk within cost estimates
- Improving estimate review and approval processes
- Ensuring estimates are cash-flowed and reported in out-turn dollars
- Implementing variance reporting to control and manage estimate changes
- Providing guidance and support in the calculation of price escalation

## 1.2 Estimate Levels and Purpose

In a project's life cycle estimates are produced based upon varying amounts of planning and design information. These estimates will generally be required to provide information for a specific purpose relating to the stage of the project's life.

Estimates produced should reflect the purpose and intent of their final use and are defined by the levels and names in Table 1. While projects with an estimated total

value (including risk) of less than \$150,000 do not require a registered estimate they are required to follow the templates and practices set out in this manual.

**Table 1 – Estimate Levels and Purpose**

ESTIMATE LEVEL	ESTIMATE DESCRIPTION AND PURPOSE
<b>Level 1 Strategic Options Estimate</b>	<ul style="list-style-type: none"> <li>• Undertaken during the Initialisation Phase</li> <li>• Provides initial strategic level cost advice for specific options of an initiative being considered</li> <li>• Based on very broad and minimal assumed project scope and design solution details relative to each option</li> <li>• Prepared using benchmark project costs of recent similar projects (adjusted to suit the current project)</li> <li>• Include relatively large risk values due to limited design information and estimating effort</li> <li>• Expressed as a mid to high range costs, inclusive of escalation based on assumed delivery dates</li> <li>• Used to inform the Outline Business Case</li> <li>• Not to be used to seek project funding</li> </ul>
<b>Level 2 Preliminary Options Estimate</b>	<ul style="list-style-type: none"> <li>• Undertaken during the Proving Phase</li> <li>• Provides initial cost analysis of specific options of an initiative being considered</li> <li>• Based on minimal assumed project scope and assumed design solutions relative to each option</li> <li>• Prepared using a combination of benchmark (nominally 80%) and first principles (nominally 20%) methods</li> <li>• Typically include large risk values due to limited design information and estimating effort</li> <li>• Expressed as P50 and P90 values, inclusive of escalation based on assumed delivery dates</li> <li>• Typically used to assess costs for a long list of project options</li> <li>• Not typically used to seek project funding</li> </ul>
<b>Level 3 Preliminary Concept Estimate</b>	<ul style="list-style-type: none"> <li>• Undertaken during the Proving Phase</li> <li>• Provides cost analysis of specific options of an initiative being considered</li> <li>• Based on minimal assumed project scope and initial design details relative to each option</li> <li>• Prepared using a combination of benchmark (nominally 40%) and first principles (nominally 60%) methods</li> <li>• Includes risk values which are commensurate to the nature, scale, requirements etc. of the project and the level of design upon which it is based</li> <li>• Expressed as P50 and P90 values, inclusive of escalation based on assumed delivery dates</li> <li>• Used to provide a more detailed cost assessment of options short listed from the previous estimate level</li> <li>• May be used to seek project funding</li> </ul>
<b>Level 4 Concept Estimate</b>	<ul style="list-style-type: none"> <li>• Undertaken during the Proving Phase</li> <li>• Provides refined cost analysis for a single specific project option of an initiative being considered</li> <li>• Based on the anticipated project scope and early design details relative to a single specific option</li> <li>• Prepared using a combination of benchmark (nominally 20%) and first principles (nominally 80%) methods</li> <li>• Includes risk values which are commensurate to the nature, scale, requirements etc. of the project and the level of design upon which it is based</li> <li>• Expressed as P50 and P90 values, inclusive of escalation based on assumed delivery dates</li> <li>• Used to provide a more detailed cost assessment of the project option selected at the previous estimate level</li> <li>• Used to seek project funding</li> </ul>
<b>Level 5 Detailed Estimate</b>	<ul style="list-style-type: none"> <li>• Undertaken during either the Pre-Delivery Phase (Construct Only contracts) OR the Procurement Phase (D&amp;C type contracts)</li> <li>• Provides an estimated total project cost of the specific option to be implemented</li> <li>• Based on the detailed project scope and design details specific to option to be implemented</li> <li>• Prepared using primarily first principles</li> <li>• Includes risk values which are commensurate to the nature, scale, requirements etc. of the project and the level of design upon which it is based</li> <li>• Expressed as P50 and P90 values, inclusive of escalation based on anticipated delivery dates</li> <li>• Used to confirm that the project budget is adequate prior to calling construction/implementation tenderer (Construct Only contracts) OR to provide DPTI's view of the anticipated project cost during the tendering phase (D&amp;C type contracts)</li> </ul>



**Table 1 – Estimate Levels and Purpose (continued)**

<p><i>Level 5A Tender Estimate</i></p>	<ul style="list-style-type: none"> <li>• Undertaken during the Procurement Phase</li> <li>• Provides an estimated total contract cost of the works requested within the tender</li> <li>• Based on the detailed project scope and design details issued with the tender</li> <li>• Prepared using primarily first principles</li> <li>• Includes risk values which are commensurate to the nature, scale, requirements etc. of the tender and the design upon which it is based</li> <li>• Expressed as real \$ values, inclusive of escalation as applicable to the tender</li> <li>• Used to provide a check price with those submitted by tenderers and aid in the analysis of tenders</li> </ul>
<p><i>Level 5B Implementation Estimate</i></p>	<ul style="list-style-type: none"> <li>• Undertaken during the Procurement Phase</li> <li>• Provides an estimated total project cost of the specific option to be implemented inclusive of the tender price to be accepted</li> <li>• Based on the detailed project scope and design details issued with the tender, other components (e.g. client costs, land acquisition, service relocation costs not included in the tender etc.) based on estimated costs and any previously incurred costs only</li> <li>• Prepared using a combination of tendered rates and the additional estimated project costs (e.g. client costs, land acquisition, service relocation costs not included in the tender etc.)</li> <li>• Include risk values using the percentages applied in either the Level 5 or 5A estimate, a combination of both OR a further risk assessment</li> <li>• Expressed as P50 and P90 values, inclusive of escalation based on planned delivery dates</li> <li>• Used to confirm that the project budget is adequate prior to contract award</li> </ul>
<p><i>Level 6 Actual Costs</i></p>	<ul style="list-style-type: none"> <li>• Undertaken during the Benefits Realisation Phase</li> <li>• Provides actual project cost and scope details of the final project</li> <li>• Compares cost estimates and associated scope at each estimate level relative to the completed project</li> <li>• Compares the accepted tender price to the final contract values, noting reasons for any variances</li> <li>• Used to inform future project cost estimates</li> <li>• All values are expressed as real dollars</li> </ul>

Level 5 estimates occur at different project phases depending on the procurement method used. A comparison between the timing of Level 5 estimates by contract type can be found at [KNet #12826998](#).

Depending on various factors including project complexity, timing and commitments, it may not be practical nor warranted for estimates to be produced for each level as described above. It is essential however that each project has a Formal Estimate (excluding those at levels 1, 5A and 6) that accurately reflects the estimated total project cost (in out-turn dollars) relevant to the intended year(s) of implementation.

### 1.3 Types of Estimates and Principles

In the context of this manual and the Cost Estimating Model (illustrated in Figure 2), estimates are defined in three ways; Options Estimates, Project Estimates and Formal Estimates.

**Options Estimates** are produced for each alternative project option being considered. There may be numerous possible options for any given project. Estimates are prepared for each project option in order to provide the information necessary to assess project costs against the perceived benefits.

Options Estimates are produced at various stages throughout the project life-cycle as a project proceeds toward delivery and additional information becomes available to better define total project costs.

Following completion of the Options Estimate(s) for a given level in the Cost Estimating Model, the highest costed realistic Options Estimate is selected as the Project Estimate and is in turn used to generate the Formal Estimate – see Figure 1.

*Note: when seeking project delivery funding the project estimate must represent a defined option/scope of work, e.g. it is not acceptable to still be determining the best project solution such as roundabout versus signalised intersection.*

Key attributes of Options Estimates are that they:

- are prepared for each 'realistic' option under consideration
- relate to the cost of a single option that has a fixed scope at a particular point in time
- are expressed in present-day (real) dollars
- have no Formal Estimate status and as such are for internal use only
- are expressed as follows:

Estimate Level	Level 1	Level 2	Level 3	Level 4	Level 5	Level 5A	Level 5B	Level 6
<b>Expressed As:</b>	Cost Range (Mid to High)	P50/P90 (or equivalent P50/P90)				Out-turn \$ (tendered values typically include escalation to completion)	P50/P90 (or equivalent P50/P90)	Actual \$

- are inclusive of the following risks which are assessed together:
  - Inherent risks – those which have a 100% chance of occurring
  - Contingent risks – those which have less than a 100% chance of occurring

Estimate Level	Level 1	Level 2	Level 3	Level 4	Level 5	Level 5A	Level 5B	Level 6
<b>Where Prepared by Estimating Consultant</b>	Not applicable	Probabilistic Risk Analysis						Not applicable
<b>Where Prepared by DPTI Staff</b>	Factor Based Deterministic Analysis	Range Based Deterministic Analysis						

- are subject to peer review and project manager/planner acceptance of quality assurance sign-offs

**Project Estimates** generally have the same characteristics as Options Estimates except that they represent the highest most realistic Options Estimate prior to the addition of cost escalation and Senior Responsible Owner approval (the Formal Estimate).

**Formal Estimates** are required at defined times in the project life-cycle and are based on the highest most realistic Options Estimate (the Project Estimate) at that point in time. *Note: when seeking delivery funding the project estimate must represent the defined option/scope of work which is to be implemented.*

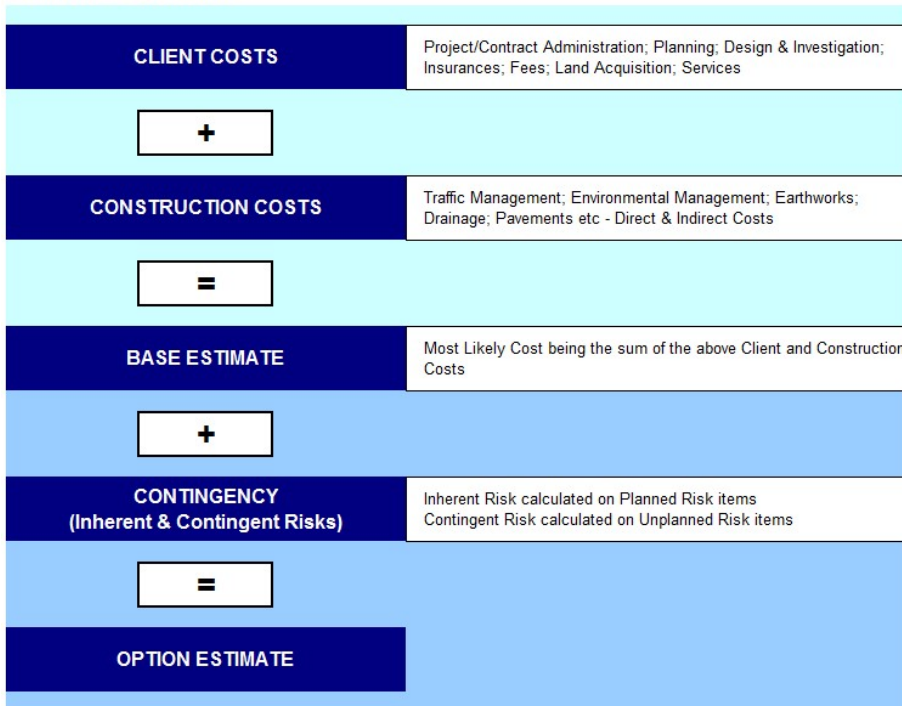
Key attributes of Formal Estimates are that they:

- are completed only for estimates at Levels 2, 3, 4, 5 and 5B. (*Note: Level 1 estimates are not 'formalised' as they are not used to seek project funding, with values quoted only as a cost range. Level 5A estimates are used for*

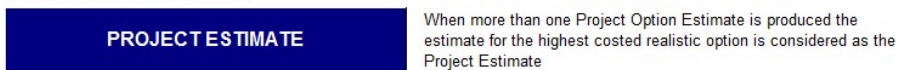
*comparison with tendered rates only and as such represented as most likely project costs for work to be performed by the contractor, they do not represent a total project cost, Level 6 estimates represent actual costs only)*

- are based on the P50 and P90 cost of the highest realistic Options Estimate (known as the Project Estimate) developed in present-day (real) dollars
- are based on an assumed completion date with provision made for relevant escalation, hence they are expressed in out-turn (nominal) dollars. *(Note: where project delivery dates are unable to be anticipated the Formal Estimate may be expressed in current day dollars. For these instances the formal estimate is required to be clearly labelled as excluding escalation)*
- are rounded to the nearest 1000 dollars
- remain the current approved estimate for a given scope of work unless replaced by another updated and approved 'Formal Estimate'
- are used for internal budgetary purposes, seeking project funding (at appropriate times) and public release (only where approved)
- are only required to be signed off at the point in time in which they are to be used to seek project funding, prior to this they are used primarily as a means of recording project details and calculating cost escalation relative to the anticipated year(s) of implementation

### OPTION ESTIMATES



### PROJECT ESTIMATE



### FORMAL ESTIMATE

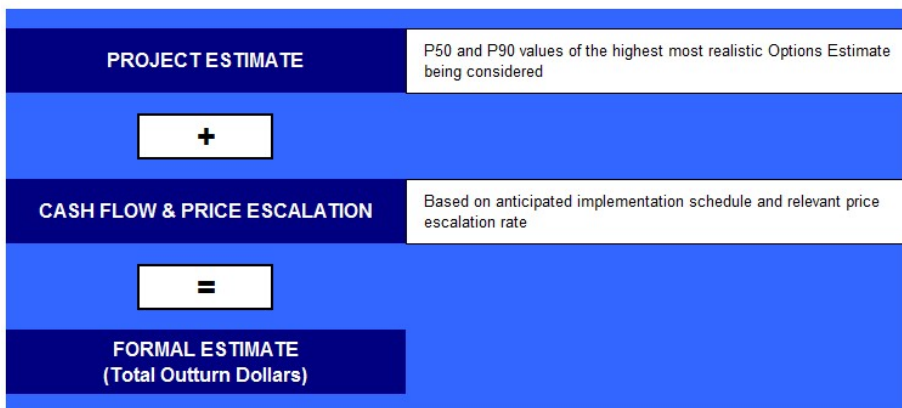


Figure 1 – Components of Options and Formal Estimates

## 1.4 Cost Estimating Model

Estimating is an integral part of a system of interdependent core inputs of scope, time, cost and quality. The Cost Estimating Model illustrated in Figure 2 sets out the various estimates as they relate to different stages of a project. The degree of detail of the project description and associated effort and accuracy of cost estimation increasing gradually from Level 1 through to Level 6. At one end of the spectrum, Level 1 involves a very preliminary idea about the nature of the project, with minimum detail and highest uncertainty about scope and costs. At the other end of the spectrum, Level 6 details the actual costs which were incurred in the delivery of the project.

As explained further in this manual, as a project advances through the various project phases the intention is to ensure that sufficient recognition of all possible costs are incorporated so that any project cost overruns are avoided.

The model summarises the development of Options Estimates, Project Estimates and Formal Estimates over the life of a project.

EST 600-8 Actual Project Costs, Level 6 ([KNet #9683206](#)) provides a template to aid in recording projects costs across all estimate levels.

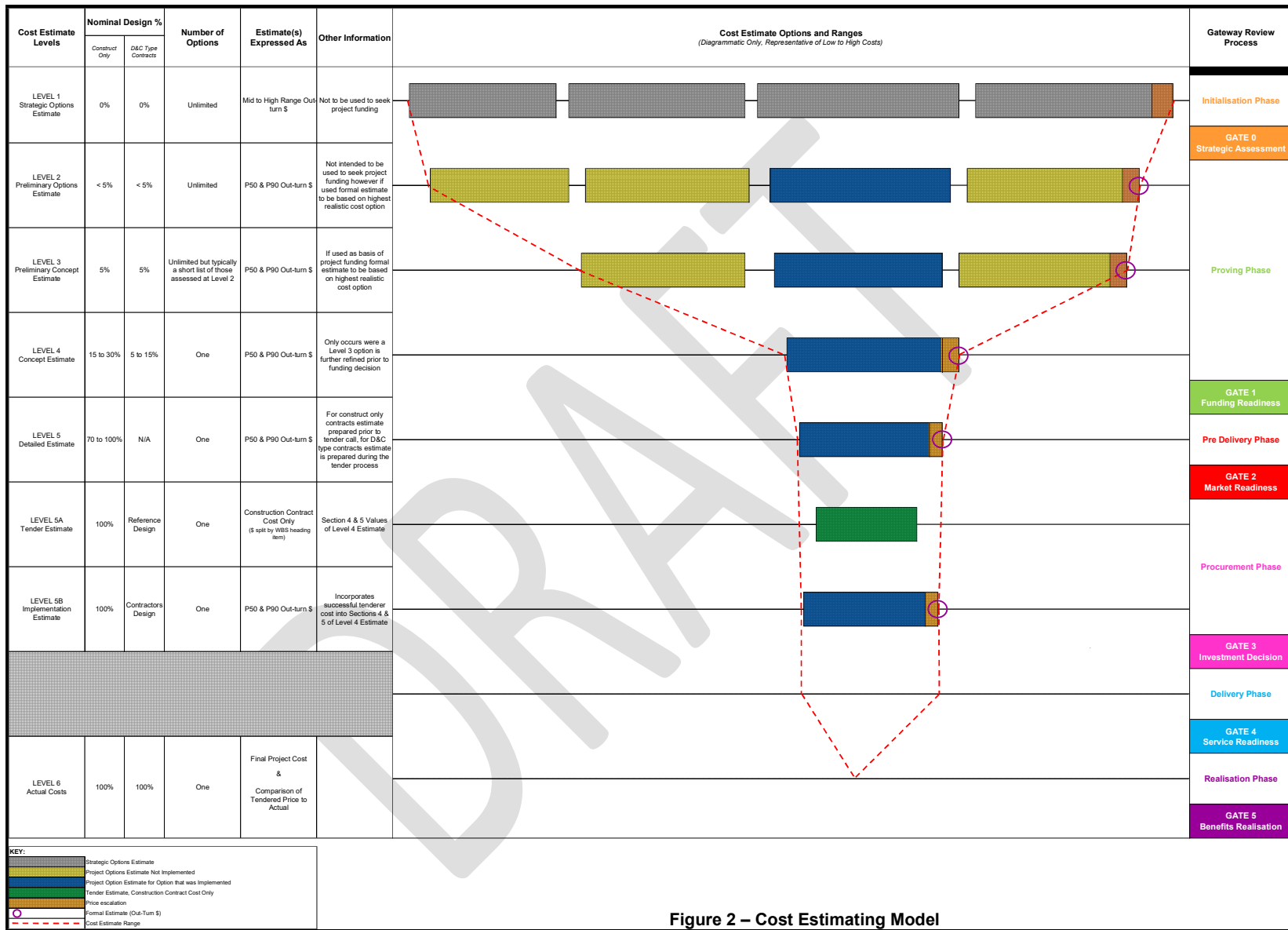


Figure 2 – Cost Estimating Model

## 1.5 Generic Estimating Process

The following flowchart outlines the typical steps involved for initiating, completing, reviewing and formalising project estimates from Level 2 onwards (Level 1 estimates are completed by DPTI staff based on very limited information using EST600-1, hence the following process is not applicable). For estimators, more detailed information relating to estimate preparation, structure and presentation is provided in Section 2.

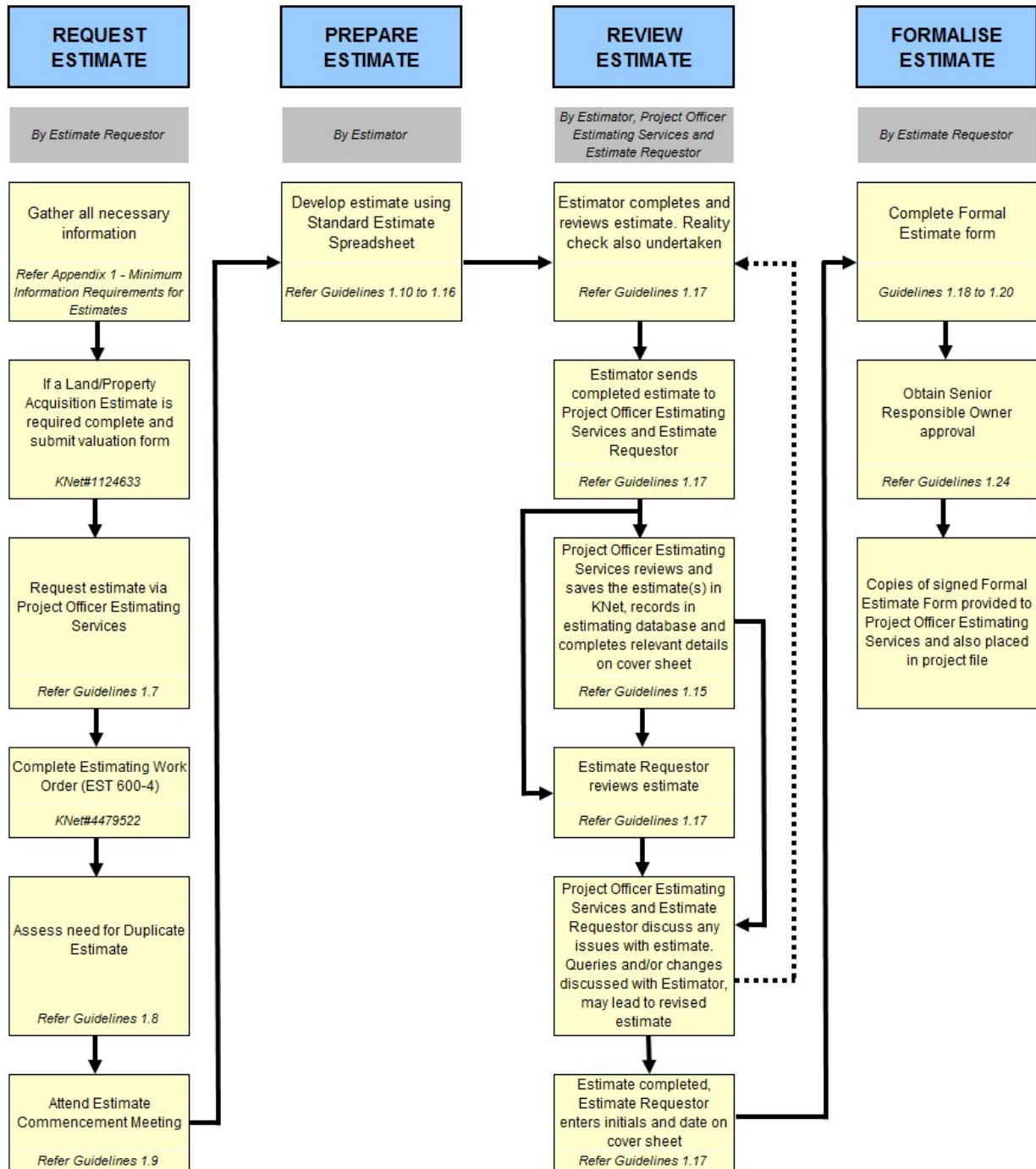


Figure 3 – Generic Estimating Process

## 1.6 Scope Definition

One of the main issues affecting the reliability of any cost estimate is the ability to accurately define what is and what is not included within the scope of the project.

The starting point for any estimate is a well defined scope. Vague scope definition is likely to result in decreased accuracy of the estimate due to the large number of assumptions that need to be made and the increased potential for variance between what has been estimated in comparison to what is ultimately required to be delivered.

*The definition of project objectives, performance criteria and scope is critical to the preparation of reliable estimates.*

Project managers/planners should be aware that the cost estimate will only represent the defined scope of work. Where changes are made to the scope of work associated with the project this will require the project to be re-estimated/updated based on the revised scope of work.

Those requesting estimates (or internal staff preparing their own estimates) need to ensure that a clear physical and functional description of the project and its scope is prepared and recorded to allow future changes and their subsequent impacts to be monitored and controlled.

The project manager/planner is responsible for determining the physical scope and requirements of the project and clearly describing and articulating this to the estimator. The completion of an Estimating Work Order (EST 600-4 [KNet #4479522](#)) will assist with this requirement. This form provides a means for the project manager/planner to provide a detailed description of the objectives, performance criteria and option specific details to the estimator, with these details transferred directly to the estimate file to provide a future record of the basis of the estimate. Additional information regarding the importance of scope definition and the factors to be considered is detailed within the Department of Infrastructure, Regional Development and Cities (DIRD) Guidance Note 1 – Project Scope.

While the level of scope information will increase as the project develops, in order for estimates to be prepared with a consistent level of information and their anticipated costs and benefits compared equally, project managers/planners need to ensure minimum levels of information are available prior to requesting estimates.

A guide to the minimum information that should be made available to estimators for each level of estimate is included in Appendix 1. To support the accuracy of estimates, in addition to the development of project scope, site constraints and the like, project managers/planners should assist estimators to accurately determine relevant items and costs associated with each of the following items:

- **Client Costs:** To account for client costs in early estimates, estimators will typically apply rates and durations for project management staff and/or contractors, consultants and the like based on their perception of the likely costs associated with this aspect of the project. As projects are further developed it is anticipated that both estimators and project managers/planners



will work towards more accurately determining applicable values including those which have been incurred to date along with those which are likely to be required to complete the project, resulting in an increasingly accurate first principles breakdown of these items within the estimated total project cost.

Project managers/planners should therefore seek to identify and provide estimators with anticipated staff and consultant cost details including their applicable hourly rates and duration of employment for each phase of the project. A template to assist project managers/planners with the preparation of an estimate of client costs via first principles is provided in EST 600-5 First Principles Client Costs Estimate ([KNet #5729453](#)).

The DPTI Overhead Charge (work breakdown structure item 1.10) will account for many of the client costs tasks. Details of the costs covered by this charge are included within Appendix 6.

- **Environmental:** Project managers/planners should seek input from DPTI Technical Services for the engagement of an Environment Officer to undertake an assessment of all environmental aspects relevant to the scope of a given project along with the process to be followed to procure these assessments and environmental advice. In particular this will relate to cost and time implications which may be applicable for specific approvals and the like along with the implementation of any mitigation measures which may be required.

DPTI projects are assessed in accordance with Environmental Approval Procedures, Environmental Instruction 21.1 ([KNet #1645388](#)). While the level of detail associated with this assessment will vary depending on location, scale and activities associated with the project, it will typically include the consideration of factors such as contamination, water quality, noise, air, cultural heritage, sustainability, flora and fauna assessment and offsets. In addition to this, risks associated with these items can be minimised through considering alternatives or implementing management strategies to minimise and/or offset the impacts associated with the project. Considerations regarding the ongoing maintenance costs associated with proposed environmental measures can also be assessed.

In assessing the cost associated with environmental items the Environment Officer will use EST 600-6 Environmental Cost Estimating Tool ([KNet #9362850](#)).

- **Land/Property Cost Information:** Project managers/planners are to source estimates for land/property acquisition from the Office of the Valuer General via DPTI's Portfolio and Acquisition Services group by completing and submitting a Valuation Request Form ([KNet #1124633](#)).

It should be noted that these costs may be subject to significant variation, in particular where commercial property is to be acquired and compensation is to be paid and/or tenants relocated. It is expected that by the time a detailed estimate is requested that discussions with property owners have commenced, more detailed acquisition estimates have been prepared and as such more accurate property estimates can be provided for inclusion in the estimate.

Project managers/planners should ensure that any available breakdown of land acquisition costs (inclusive of estimated values for land/property acquisition, disturbance, stamp duty and other statutory charges, injurious affection/severance, professional fees, DPTI costs, compensation, business losses, accommodation works, contingencies and the like) is provided to the estimator for consideration in their work. The provision of such information is important to ensure that any items included within the valuation are not duplicated by the estimator in other sections of the estimate and to assist in the ranging of risk values that may be associated with these items.

*Land/property acquisition is a high risk area which can impact greatly on the provision of reliable cost estimates*

Unless noted otherwise land acquisition values provided are to be considered as 'most likely' values.

For estimates at earlier levels it may be possible for members of the estimating panel to provide indicative costs by benchmarking against those which have been provided for similar previous projects. An exception to this may be where commercial properties are to be acquired and compensation payments may apply.

Importantly estimators should note that for acquired properties ongoing operating costs associated with items such as Council rates, Government levies and utility services fees will continue to apply. As such estimates are required to make reasonable allowances to account for these costs.

- **Services:** Where considered appropriate and/or if time permits, project managers/planners should endeavour to commence discussions with service authorities that may be impacted as a result of the proposed project. The benefit of this approach is that it allows such authorities to better define their services and potentially provide additional information regarding how the service could be relocated, programming issues, specific requirements that may need to be met if a service is to be relocated and an indication of the costs that may be associated with the works.

It is anticipated that by the time projects progress to the detailed estimate stage (Level 5) that all relevant services will have been identified and that where impacted quotes for relocation works will also be available.

For early level estimates it may not always be possible or realistic to involve the relevant service authority given that some estimates are produced purely to assess the costs associated with potential alignments or options. Therefore, benchmarking of such costs for previous projects of a similar nature may be a reasonable means of determining the potential cost of such works. It is however critical that major services are identified either by way of a site inspection, 'Dial Before You Dig' survey or some other means that can

effectively identify the extent and complexity of service relocations that may be associated with the project.

Project managers/planners should note that service relocations are typically subject to a wide range of cost variability given the often limited detail available. Hence this is seen as a key area where the ability to identify impacted services early and obtain applicable costing information can be critical in accurately determining the estimated project cost.

*The modification of existing services infrastructure is a major risk area in the preparation of reliable project cost estimates*

- **Earthworks/Pavements:** To assist estimators with the accurate and cost effective measurement of earthworks volumes and pavement areas, project managers/planners should ensure that designs incorporate the requirements detailed in the following document: [KNet #5976121](#). This document provides details regarding the provision of proposed and existing contours; and pavement area boundaries, enabling the use of specialist software to more rapidly and accurately quantify these items.
- **Urban Design/Landscape Scope:** In order to adequately account for costs associated with urban design treatments applied to projects consideration is to be given to the likely types of treatments which may apply and the costs associated with these. General considerations include public safety, access and movement, wayfinding, water sensitive urban design, public art, landscaping and public realm elements. Advice on the potential treatments and requirements which may be applicable for a given project type and location can be sought from the Office for Design and Architecture South Australia (ODASA).

In addition to the development of clear scope for the above items, when identifying project solutions project managers/planners should give due consideration to the ongoing operational and maintenance costs that will result. For example, while the provision of passenger lifts at a railway station may provide operational benefits, significantly higher ongoing costs will be realised than will be the case for a ramp used to provide the same access. Similarly the use of a tunnel on a road project would attract significantly higher ongoing operational costs in comparison as to a bridge that may serve the same purpose. Assistance with the modelling of financial operational expenditure (OPEX) impacts associated with capital infrastructure projects can be obtained from the DPTI Finance Section business partnering team leader.

## 1.7 Request for Estimating Services - Work Order

The majority of estimates are produced by estimators who are members of the department's estimating services panel contract. Members of this panel who are nominated for the provision of civil estimating services comprise of contractors assessed as having relevant experience and ability in developing cost estimates for DPTI transport infrastructure projects.

All requests for the provision of civil estimating services to be procured using the estimating panel contract must be directed to the Project Officer Estimating Services. The Project Officer Estimating Services will assign a member of the panel to complete the work based on factors such as: the type of skills that are required; the specific requests of the project manager/planner, the availability of estimators; the required completion date; and the likely costs to be incurred.

*Requests for estimates to be procured through the Estimating Panel Contract must be directed to the Project Officer Estimating Services*

On receipt of request to engage an estimator using the panel agreement, the project title will be registered in the department's estimating database and the project manager/planner will be asked to complete a Work Order (EST 600-4 Estimating Work Order [KNet #4479522](#)). This document aims to provide the estimator with a clear definition of the scope and extent of work associated with the estimate. The details provided will be transposed to the Standard Estimate Spreadsheet maintaining a history of the original request including the associated project objectives, scope, extent of work and project specific details.

### **1.8 Duplicate Estimates**

Where the project is anticipated to have a P90 Project Estimate value exceeding \$25 million (real \$) it is recommended that a duplicate estimate is sought prior to seeking funds for the delivery of the project.

In determining the need for a duplicate estimate, project managers/planners should discuss with the Senior Responsible Officer factors such as the perceived risks relevant to the project, their required level of confidence with the estimate, the end use of the estimate and the like. The process for arranging and preparing a duplicate estimate is described in Appendix 3.

*It is recommend that projects with a P90 Project Value which is estimated to exceed \$25 million (real \$) be subject to the duplicate estimate process prior to seeking project funding*

### **1.9 Estimate Commencement Meeting**

Where an estimator is sought using the panel contract agreement, following completion of the Work Order (EST 600-4 Estimating Work Order [KNet #4479522](#)) an estimate commencement meeting is typically scheduled where the project manager/planner (along with other staff and/or specialists where applicable) can talk through the details of the project with the Estimator. This meeting aims to facilitate discussion regarding the clients requirements, the scope of the project and any other specific requirements associated with the preparation of the estimate, whilst also enabling the estimators to raise and discuss any initial queries and clarifications. Relevant drawings and documentation are usually provided to the estimator at this time.

## 1.10 Standard Estimate Spreadsheet

The estimator will develop the estimate using the drawings, documentation and other information available for the project. Where necessary, further discussions may occur and/or additional information be sought to better define any details associated with the project.

The estimator will prepare and present the estimate using one of the Standard Estimate Spreadsheets. These are Microsoft Excel spreadsheets available electronically from the Project Officer Estimating Services:

- EST 600-1 [KNet #5751720](#). For estimates at level 1
- EST 600-2 [KNet #5751722](#). For estimates at levels 2, 3, 4, 5 & 5B where prepared by estimating consultants (*Note: typically these estimates will be prepared using proprietary estimating software and transferred to the template – a complete copy of the first principles estimate including all labour, plant, materials, rates of production etc. can be provided at the request of the project manager/planner*)
- EST 600-3 [KNet #5751723](#). For estimates at levels 2, 3, 4, 5 & 5B where prepared by DPTI staff
- EST 600-3 FS [KNet #5849068](#). For estimates at levels 2, 3, 4, 5 & 5B where prepared by DPTI Field Services (FS) staff for projects which involve predominately road works (*Note: this format allows project managers/planners to utilise estimates prepared by FS and apply additional costs associated with aspects of the project which are not covered by FS. Typically this relates to costs associated with project/contract management, works undertaken by service authorities and any items excluded in the Field Services estimate. In addition to this a range based deterministic assessment of risk is also applied to provide equivalent P50 and P90 estimates*)
- EST 600-8 [KNet #9683206](#). Used for recording actual project costs (Level 6) and comparing these with estimates, further details regarding the use of this template can be found in section 2.2.4

Level 5A estimates are used for comparison with tendered rates and to assist with the evaluation of tenders. These estimates are required to be presented in accordance with the tender schedule provided within the tender documents. Estimators will be required to download relevant documents as directed by the project manager/planner and submit their estimated tender price (or Principals Tender) by the same time and in the manner applicable to tenderers. Example tender forms and schedules can be found at: [https://dpti.sa.gov.au/contractor\\_documents/tender\\_forms\\_and\\_schedules](https://dpti.sa.gov.au/contractor_documents/tender_forms_and_schedules). For the majority of projects relevant to this manual the 'Major Works: Tender Form and Schedules (Excel Spreadsheet)' will apply. Values within level 5A estimates are essentially section 4 and 5 costs from the final revision of the Level 5 estimate.

Completed examples of each of the Standard Estimate Spreadsheets can be found using the following links:

- Example – EST600-1: [KNet #5939749](#)
- Example – EST600-2: [KNet #5939751](#)
- Example – EST600-3: [KNet #5939752](#)
- Example – EST600-8: [KNet #12845474](#)

Departure from the use of these spreadsheets is only permitted with the prior approval of the Project Officer Estimating Services.

### **1.11 Preparation of Base Estimates**

Base estimates are initially prepared based on the estimator's assessment of the quantities and rates that will apply to a given scope of work based on the available documentation, resulting in a most likely estimate total (the Base Estimate). Inherent and contingent risks (discussed in the following sections) are then assessed to result in the Options Estimate total.

All estimates are to be prepared exclusive of GST.

Section 2 of this manual, Estimate Development and Presentation, provides further details regarding the preparation of base estimates. Additional information is also available from DIRD Guidance Note 2 – Base Cost Estimation.

### **1.12 Risk and Contingency**

Contingencies for risk are an aggregate value made up of threats (which may add cost) and opportunities (which may reduce cost). In preparing Options Estimates there are also many situations where the inputs may be less than or greater than that anticipated due to factors such as:

- Missing or as yet unidentified project scope/elements, requiring the estimator to identify and make appropriate inclusions for such items
- Limited design information being available reducing the estimators ability to accurately measure the applicable quantities
- The time and effort available to prepare the estimate
- Market and procurement factors which can influence the estimated rates

A contingency allowance is the measure of the residual risk that exists within the project relative to achieving the project objectives and is expressed as a level of uncertainty or confidence.

Within DPTI estimates risks are considered to be either inherent or contingent. Additional information regarding these types of risk is provided in sections 1.13 and 1.14.

Contingency allowances are estimated using either probabilistic or deterministic risk cost assessment methods, versions of these methods as applicable to DPTI estimates are described in the sections 1.15 and 1.16.

### **1.13 Inherent Risk**

The assessment of inherent (or planned) risk is relates to the ranging of quantities and rates for each of the items within the estimate. Project cost estimates cannot be confidently prepared using whole number quantity and rates values as in reality there are likely to be a range of quantities and rates which are possible for each line item due to the exact nature of the task along with variability in construction methodology and pricing between contractors. This is modelled as a +/- risk range on both quantities and rates of all estimate items with these ranges used to spread risk appropriately across each item to allow for statistical modelling (i.e. P50 and P90 calculations).

## 1.14 Contingent Risk

The assessment of contingent (or unplanned) risk involves the evaluation of risk associated with unmeasured items, e.g. those not included within the Base Estimate due to their unknown nature or them being only loosely identified resulting in them having a less than 100% chance of occurring.

Items with no information, but which are known to form part of the project scope (e.g. they have a 100% chance of occurring) are to be included as line items within the Base Estimate and not rely on contingent risk items to make provision for them.

## 1.15 Probabilistic Risk Cost Assessment Methods

Probabilistic risk methods are a form of quantitative risk analysis which use computer software programs to apply Monte Carlo simulation techniques to estimate contingency values.

Within cost estimation Monte Carlo simulation is applied as a statistical sampling technique which generates a sample of a large number of possible project outcomes based on the input data (e.g. the estimate items and subsequent potential high/pessimistic and low/optimistic ranging of quantities and rates from most likely predictions). This input data and the likelihood of occurrence for outcomes reflecting the potential variances within a given range (determined by the probability density function of the input data) is taken to reflect the likelihood of an outcome arising in reality. By producing the potential outcome on numerous occasions (or iterations) Monte Carlo simulation provides a table of the estimated percentile costs, with those at the 50<sup>th</sup> and 90<sup>th</sup> percentile adopted as the respective P50 and P90 values.

When assessing inherent and contingent risks probabilistically, P50 and P90 values are calculated using risk analysis software such as @Risk, or some other form of proprietary software recognised by industry as being suitable for the calculation of such values. DPTI's preference for contractors preparing estimates is to use @Risk.

Probabilistic risk assessment methods are utilised within DPTI estimates as follows:

- Level 2 to 5B Estimates (where prepared by Estimating Consultants) Further information on this approach is contained in section 2.9.2.

More detailed information regarding probabilistic contingency estimation and methods can be found within DIRD Guidance Note 3A.

## 1.16 Deterministic Risk Cost Assessment Methods

Considered to be less accurate than probabilistic methods, deterministic risk methods treat all input values as being constant due to the fixed quantity and cost outcomes which result from the application of ranging to relevant estimate items.

Deterministic risk assessment methods are utilised within DPTI estimates as follows:

- Level 1 Estimates: Factor based – applied at the earliest stages of projects, this most basic method acknowledges that there may be insufficient information, resources or time available to allow more detailed assessments to be undertaken and aims to apply an appropriate level of contingency via a strategic review of the factors that will influence the cost outcome of the project. This approach calculates a single overall contingency range which is inclusive of inherent and contingent risk by identifying items which will have a

critical effect on the project outcome and applying ranging to them. Further information on this approach is contained in section 2.9.1.

- Level 2 to 5B Estimates (where prepared by DPTI staff): Range based – this approach requires the estimator to determine a range comprising low (L), most likely (ML) and high (H) values for each cost element and contingent risk item which are in turn used to derive equivalent P50 and P90 values. Further information on this approach is contained in section 2.9.3

More detailed information regarding deterministic contingency estimation and methods can be found within DIRD Guidance Note 3B.

### 1.17 Estimate Review Process

All estimates are to be reviewed in accordance with the Estimate Review Process described in Appendix 7.

Prior to the submission of an estimate, estimators are required to review their/the work undertaken by their company. Any errors and/or omissions identified through the review are to be corrected prior to forwarding an electronic copy of the completed estimate to the Project Officer Estimating Services and the project manager/planner.

The Project Officer Estimating Services will save the estimate document to KNet, complete the relevant section of the cover sheet, record the estimate within the estimating database and review the estimate prior to forwarding a KNet link to the estimate file to the project manager/planner for their review.

Project managers/planners are also required to review the estimate. Any required changes or issues requiring further clarification will be discussed with the Project Officer Estimating Services and/or estimator who will be asked to review/revise the estimate where deemed necessary.

As individual reviews are completed, each relevant person involved in the preparation and/or review of the estimate is to enter their details and the date which they reviewed the estimate in the 'Review Information' cells included at the base of the estimate Cover Sheet.

### 1.18 Formal Estimate

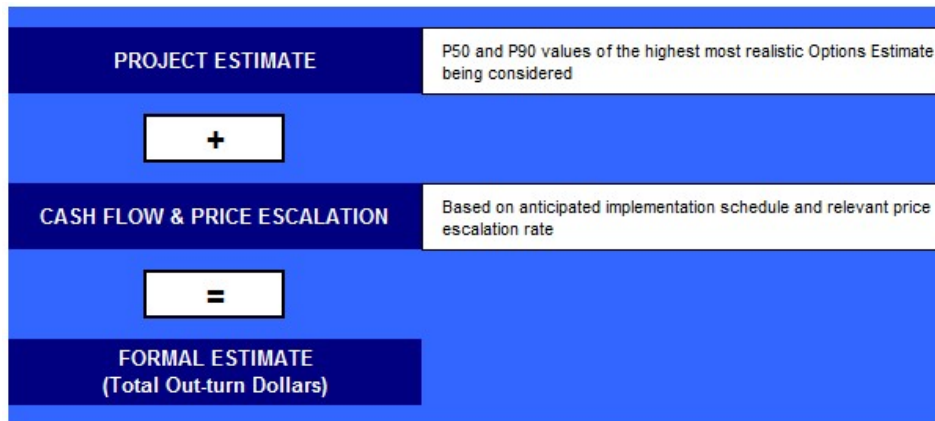


Figure 4 - Formal Estimate Process



Following completion of the Options Estimate (including reviews as detailed in Section 1.17) estimates are required to be formalised. A Formal Estimate represents the total project cost as approved by the Senior Responsible Officer at any given point in time during the projects development.

The Formal Estimate is generated by taking the estimated P50 and P90 values of the highest realistic Options Estimate, (the Project Estimate) and cash-flowing these amounts (as described in section 1.19) in order to allow for the escalation of the estimate (as described in section 1.20), thus producing the Formal Estimate cost in total out-turn dollars.

The Standard Estimate Spreadsheet (estimate Levels 2, 3, 4, 5 & 5B) contains a worksheet titled 'Formal Estimate' which is used to calculate and record Formal Estimate values. Project managers/planners are required to complete these forms and obtain Senior Responsible Officer approval/sign-off of the Formal Estimate prior to using the estimate in the process of seeking project funding.

Instructions for completing the Formal Estimate form are provided in Appendix 8.

Project managers/planners should note that when seeking project delivery funding that the project estimate must represent a defined option/scope of work.

### **1.19 Construction Program and Cash flow**

In order to accurately determine the overall duration of the project and in turn costs associated with time dependent activities (e.g. project/contract management, traffic management etc) a construction program should be developed by the estimator. Programs are required to consider each of the tasks applicable to the project and their dependences on each other, in-turn informing the development of a project cash flow which recognises expenditure associated with the anticipated completion of individual tasks.

The adopted project cash flow is to be based on the Project Estimate (the highest valued realistic Project Option Estimate, inclusive of inherent and contingent risk). Optimism bias should be avoided by being conservative as to when the project will commence construction and the likely expenditure draw-down rate through the construction period.

Projects often experience cash flows (particularly construction expenditure profiles) much slower than expected due to delays in obtaining project approvals or funding, rescheduling of works, labour or material shortages, delays in the negotiation and completion of service relocations or land acquisition processes. As such most of the contingency amount should be skewed towards the later years of the project – during the construction period – with some in the year following practical completion.

Indicative annual cash flows are included within all estimates. For estimates at levels 2 to 5B more detailed cash flows can be prepared either by the project manager/planner or as an additional service by estimating consultants, EST 600-7 Cash Flow Template ([KNet #12245240](#)) can be used to assist with the development of these values.

## 1.20 Price Escalation

Formal Estimates are expressed in out-turn (nominal) dollars (\$OT) and include price escalation to reflect the anticipated actual project cost at completion. Occasionally project delivery dates cannot be anticipated and as such the Formal Estimate may be expressed in current day dollars. In these instances the Formal Estimate is to be clearly labelled as excluding escalation. Given the risk associated with the use of estimate figures that are not escalated, it is recommended that in most instances an attempt is made to best guess the possible timing of project delivery with appropriate disclaimers made around unknowns associated with that timing.

A cash flow (or expenditure profile) is to be determined to suit project delivery timeframe. Out-turn costs are calculated by adding price escalation to the Project Estimate which is developed in present day (real) dollars and is inclusive of both inherent and contingent risk considerations.

The price escalation percentage rate is based on established price escalation forecasting endorsed by senior DPTI staff or as applicable through Federal Government requirements (for road projects which are proposed to incorporate any degree of Federal funding). It must not be randomly developed by members of the project team.

The Price Escalation Calculation Spreadsheet ([KNet #4624055](#)) is to be used to calculate out-turn dollars across multiple years. This spreadsheet includes the annual rates of escalation rates to be used for projects, with varying rates provided for State and/or Federally funded projects.

**Table 2 – Example of Price Escalation Calculation**

Description	Pre-2017/18 \$m	Current year 2018/19 \$m	2019/20 \$m	2020/21 \$m	2021/22 \$m	Total Project Cost \$OT \$m
Expenditure (present day - real \$'s)	0.5	1.5	25.0	40.0	15.0	82.0
Price Escalation @ 5% rate	1.00	1.05	1.05 <sup>2</sup>	1.05 <sup>3</sup>	1.05 <sup>4</sup>	
Project Cash flow (Nominal - \$OT)	<b>0.5</b>	<b>1.58</b>	<b>27.56</b>	<b>46.31</b>	<b>18.23</b>	<b>94.18</b>

The above example is a simple approach to reviewing how price escalation is calculated. Reference to the approved rates contained in the above referenced spreadsheet should be made (which may differ from the above rates) noting 'current year' rates often reflect a part year rate where the estimate has been prepared part way through the financial year. Varying rates per project are generally not recommended due to a preference to adopt a consistent approach through the Department of Treasury and Finance. Special circumstances can be warranted however, such as where tenderers are directly pricing some elements of price escalation into their bids.

Due to varying levels of property price escalation and the 'uniqueness' of this component per project, the linked calculation spreadsheet above recommends consultation with DPTI's Acquisition Services group for the application of escalation

rates for land/property acquisition costs. Where time is of the essence acquisition values may be escalated using the rates as applicable to the construction costs.

The deemed rate of price escalation (including the approach to 'current year escalation' which changes throughout the year) is reviewed bi-annually by the Team Leader, Financial Analysis (Finance) and updated in the Price Escalation Calculation Spreadsheet as necessary.

The cumulative amount of price escalation can be a significant percentage of the total project cost, particularly for projects that are planned to commence several years in the future and which have a considerable construction period. Due to the significance of the price escalation component in the overall out-turn cost, the price escalation figure has to be carefully assessed. Assistance and advice from the Team Leader, Financial Analysis (Finance), is highly recommended. Some drivers for price escalation growth are construction industry specific, however broader "macro" influences also play a significant role (e.g. the impact of mining industry growth on labour, material and other resource prices, national demands for materials and skilled labour in specific sectors, global influences on oil pricing / foreign currency price movements flowing onto local fuel and bitumen prices).

It should be noted that price escalation is included to provide adequate capital funding to compensate the project for forecast cost increases due to inflationary imposts in the construction sector. It is not a secondary contingency figure.

### **1.21 Project Funding and Risk Exposure**

Funding is to be sought based on the Formal Estimate P90 value, the estimated project cost of which there is a 90% chance will not be exceeded. Although not typically presented the probabilistic value in excess of the P90 (e.g. the 'maximum' project cost) is usually not funded and therefore considered as the level of risk exposure to the department.

In accordance with DPTI's Contingency Management Framework project managers/planners should aim to deliver the project for the Formal Estimate P50 cost return unspent contingency funds once the identified contingent risks have passed. Conversely, where it is identified that the final project cost is likely to exceed the estimated project cost (including contingencies), project managers/planners are required to determine the value of this increase and pursue a course of action such as reducing the project scope or seeking additional funding to account for the increased project cost. Project managers should be aware of the risks identified by the estimator which form the basis of the contingency values and where appropriate attempt to mitigate/reduce the potential likelihood and/or impact of them eventuating.

Estimates at level 1 are used to undertake the initial cost assessment of initiatives, they are not used to seek project funding. As such these estimates present only mid to high range estimated project cost values.

### **1.22 Variance Reporting**

The Formal Estimate Sign-off and Approval Form (included within estimate templates EST600-2, EST600-3 and EST600-3 FS) provides an avenue for tracking variances against key headings through subsequent estimate levels. In addition to this EST600-8 Actual Project Costs provides a template for recording estimates at each level along with final project costs, thereby providing a means of tracking estimated and

actual costs at individual heading levels throughout the life of the project. This analysis aims to better inform future early project estimates by identifying common areas of over or under-estimating project costs and to assist with the benefits realisation process.

### 1.23 Updating Old Estimates to Present Day Dollars

There are many circumstances in DPTI where estimates are prepared in earlier years and 'shelved' for a period of time prior to being re-considered for a funding bid in the present day. In these circumstances there is a requirement to adjust the historical price estimated in a previous year (real dollar figure) to the current year before escalating the project cost again to a future dollar figure (OT \$) that reflects the year/period in time for which the project is to be delivered. Care should be taken to check that the historical estimate value used excludes price escalation. This process can simply be described as follows:

**Property Cost Component** – escalated from an historical cost to present day \$ per advice from DPTI's Portfolio and Acquisition Services Section.

**Non-Property Costs** – escalated from an historical cost to present day \$ by referencing the movement in the Australian Bureau of Statistics' (ABS) Road and Bridge Construction Cost Index between the two periods.

Where time is of the essence and consultation around the price movement in the property component is not possible, all historical costs are able to be adjusted to a present day figure by reference to the above ABS Index.

Further detail regarding the process for the updating of old estimates to present day dollars is included in Appendix 9.

Project managers/planners should also assess the potential for cost increases beyond those associated with cost escalation, recognising that some project scope changes are likely to occur due to factors such as changes to design standards, existing site conditions and the like from when the estimate was originally prepared.

The process of escalating an old estimate to current day dollars using the Road and Bridge Construction Cost Index is recommended to only occur where the original estimate has been prepared within the last two years. This is due to engineering construction market pricing dynamics changing over time, leading to market pricing of elements like profit margins and the treatment of risk changing over time. In instances where estimates are more than two years old, it is recommended that the original estimator is requested to review all quantities and rates within the original estimate to produce a revised/current estimate OR that a new estimate is prepared.

### 1.24 Senior Responsible Officer Approval and Responsibilities

Senior Responsible Officers are responsible for:

- Ensuring project managers/planners seek the timely preparation of estimates for projects including the provision of new or updated estimates to reflect changes to project scope
- Where considered necessary that a duplicate estimate has been undertaken
- Ensuring estimate review processes have been undertaken

- Approving each Formal Estimate prior to its use in seeking project funds, including an assessment of the accuracy of the scope of works upon which the estimate has been based and conveying values in out-turn (nominal) dollars
- Ensuring any estimate cost data that is released relates to the latest approved Formal Estimate only
- Ensuring that any announcement of estimate details is appropriately endorsed or approved
- Ensuring the project is 'managed' to the Formal Estimate P50 value, with funding sought at the Formal Estimate P90 value
- Ensure that project managers apply reasonable measures to mitigate identified project risks
- Ensuring that excess project funds associated with project contingencies are returned as risks associated with these values pass

## **SECTION 2**

# **Estimate Development & Presentation**

## 2 ESTIMATE DEVELOPMENT AND PRESENTATION

### 2.1 General

The format and structure of transport estimates is standardised to ensure consistency in estimate presentation at all levels of the estimating framework. End-users (project managers/planners, project directors, senior responsible officers and teams) are better able to analyse, review and approve estimates, when referring to standardised work breakdown structures, understanding risk and contingency inclusions and having supporting information presented in a single estimate package.

DPTI cost estimates are generally prepared by external estimating specialists. The department has an established panel contract in place to facilitate the engagement of specialist estimators, who are familiar with the guidelines established in this manual and have the appropriate skills and experience to provide infrastructure estimates. Alternatively, cost estimating may be undertaken internally by experienced staff. For all estimates the processes and principles contained in this manual are also to be applied.

### 2.2 Estimate Presentation

The Standard Estimate Spreadsheets are used to record in a single package, details of costs, quantities, risks, assumptions and sources of information used in the build-up of the estimate.

Instructions for using and completing the Standard Estimate Spreadsheet are included in Appendix 5.

All estimates are to be prepared exclusive of GST.

There are a number of separate versions of the Standard Estimate Spreadsheet, the purpose of each is as follows:

#### 2.2.1 Estimates Level 1

EST 600-1 – [KNet #5751720](#)

This template is to be used for estimates of road and rail projects at level 1 (Strategic Options Estimate). Estimates at this early level are typically the result of benchmarking a proposed project against recent similar ones with adjustments made to account for variations in scope; local/site conditions, cost escalation and the like.

The following tabs are included in the spreadsheet (road tabs are to be substituted with copies of the rail or marine tab where the project option is predominately rail or marine based):

- Cover Sheet
- Scope, Risk and Calculation Sheet – All Options
- Inherent - Contingent Risk (Road) Option(s)
- Inherent - Contingent Risk (Road) Option 2
- Inherent - Contingent Risk (Road) Option 3
- Inherent - Contingent Risk (Rail) Option(s)
- Inherent - Contingent Risk (Marine) Option(s)

Risk values for these estimates may be determined using the tab provided within this spreadsheet – copies of these tables are also provided within Tables 5, 6 and 7 of this manual.

## **2.2.2 Estimates Levels 2, 3, 4, 5 & 5B**

For estimates prepared at levels 2 (Preliminary Options), 3 (Preliminary Concept), 4 (Concept), 5 (Detailed) and 5B (Implementation) the following templates are to be used.

It is recommended that estimates for high risk and/or high valued projects at these levels are prepared by specialist consultant estimators.

### **2.2.2.1 By Estimating Consultants**

EST 600-2 – [KNet #5751722](#)

This template is to be used for estimates prepared by estimating consultants.

This format includes sections on the calculation sheet(s) for the probabilistic calculation of combined inherent and contingent risk (P50 and P90) values.

The following tabs are included in the spreadsheet:

- Formal Estimate *(to be completed by the project manager/planner)*
- Cover Sheet
- Scope, Risk and Methodology
- Summary Option(s)
- Calculation Option(s)
- Inherent & Contingent Risk Option(s)

*Note: typically these estimates will be prepared using proprietary estimating software and transferred to the template – a complete copy of the first principles estimate including all labour, plant, materials, rates of production etc., along with the files used as the basis of risk calculations, can be provided at the request of the project manager/planner. Estimating consultants are required to retain these files in order to be able to provide them to clients upon the request to do so.*

### **2.2.2.2 By DPTI Staff**

EST 600-3 – [KNet #5751723](#)

This template is to be used for estimates prepared by DPTI staff.

This format includes a section on the calculation sheet(s) which uses the range based deterministic method to calculate the combined value of inherent and contingent risk.

The following tabs are included in the spreadsheet:

- Formal Estimate *(to be completed by the project manager/planner)*
- Cover Sheet
- Scope, Risk and Methodology
- Summary Option(s)
- Calculation Option(s)



### 2.2.2.3 By DPTI Field Services Staff

EST 600-3 FS – [KNet #5849068](#)

This template is to be used for estimates prepared by DPTI Field Services staff.

This format includes a section on the calculation sheet which uses the range based deterministic method to calculate the combined value of inherent and contingent risk.

The following tabs are included in the spreadsheet:

- Tabs Completed by Field Services:
  - Summary Sheet
  - Site Preparation
  - Earthworks
  - Drainage
  - Pavement & Bituminous Surfacing
  - Contractor
  - Street Lights
  - Traffic Signals
  - Finishing
  - Plant & Contractor Rates
  - ABMIS Sheet
- Tabs Completed by Project Manager/Planner:
  - Formal Estimate
  - Cover Sheet
  - Scope, Risk and Methodology
  - Summary Option 1
  - Calculation Sheet 1

### 2.2.3 Tender Estimates

Level 5A estimates are used for comparison with tendered rates and to assist with the evaluation of tenders. These estimates are required to be presented in accordance with the tender schedule provided within the tender documents. Estimators are required to download relevant documents as directed by the project manager/planner and submit their estimated tender price (or Principals Tender) by the same time and in the manner applicable to tenderers.

Example tender forms and schedules can be found at: [https://dpti.sa.gov.au/contractor\\_documents/tender\\_forms\\_and\\_schedules](https://dpti.sa.gov.au/contractor_documents/tender_forms_and_schedules). For the majority of projects relevant to this manual the 'Major Works: Tender Form and Schedules (Excel Spreadsheet)' will apply. Values within level 5A estimates are essentially section 4 and 5 costs from the final revision of the Level 5 estimate.

### 2.2.4 Actual Project Costs

EST 600-8 – [KNet #9683206](#)

This template is to be completed by DPTI staff.

This format includes a 'Data' tab where the majority of information is entered, this information carried forward to other tabs of the spreadsheet. This spreadsheet contains a number of tabs which aim to provide a comparison of the estimated total

project cost at various estimate levels and tendered sums to the final values which were realised.

Values to be entered for each estimate level and option are generally able to be copied directly from the summary sheet of the corresponding estimate file.

The following tabs are included in the spreadsheet, these are to be completed by the project manager/planner:

- Project Cost by Level, Data
- Project Cost by Level, Summary
- Project Cost by Level, Detailed
- Estimate, Tender, Actuals Comparison

### **2.3 Estimate Numbering Convention**

All DPTI registered estimates are allocated an estimate number to assist with their recording and future referencing. This numbering convention is explained in Appendix 4.

### **2.4 Work Breakdown Structure**

Estimates are to be completed following the **Work Breakdown Structure (WBS)** as defined in Appendix 6 and as set out in the Calculation Sheet of the Standard Estimate Spreadsheets. All DPTI estimates are to be developed using this structure to assist in the consistent preparation, review and comparison of estimates.

While DPTI standard estimate templates present items and costs to WBS Level C, the preparation of unit rate build-ups (effectively WBS Level D) are to be completed within specialist estimating software systems (or the like) and are not required to be detailed within the estimate files presented. Estimators are however required to retain these Level D work ups to allow for any necessary detailed reviews, future estimate updates and the like. At the request of DPTI estimating consultants are required to provide a complete copy of the first principles estimate including all labour, plant, materials, rates of production etc.

**Table 3 – Work Breakdown Structure by Estimate Level**

WBS Level A (Key Sections)	WBS Level B (Estimate Elements)	WBS Level C (Indicative Items/Sub-Items)
(1) Client Costs	(1.1) Scoping Phase – Project Management (1.2) Scoping Phase – Design and Investigation (1.3) Development Phase – Project Management (1.4) Development Phase – Design and Investigation (1.5) Delivery Phase – Project Management (1.6) Delivery Phase – Design and Investigation (1.7) Principal Arranged Insurance (1.8) Environmental Assessment (1.9) Other Client Costs (1.10) DPTI Overhead Charge	(1.1.1) Project Administration (1.1.2) Contract Administration/Planning (1.1.3) Community Liaison (1.1.4) Cost Estimation and Constructability (1.1.5) etc.
(2) Property Acquisition	(2.1) Property Purchase Costs (2.2) Transaction, Legal and Other Costs (2.3) Business Compensation (2.4) Property Modification	(2.1.1) Property Purchase Costs Item 1 (2.1.2) Property Purchase Costs Item 2 (2.2.1) Transaction, Legal and Other Costs Item 1 (2.2.2) etc.
(3) Services (By DPTI)	(3.1) Electricity (3.2) Communications (3.3) Gas (3.4) Water and Sewer (3.5) Other Services	(3.1.1) Electricity Item 1 (3.1.2) Electricity Item 2 (3.2.1) Communications Item 1 (3.2.2) etc.
(4) Construction Costs (Direct Costs)	(4.1) Environmental Works (4.2) Traffic Management (4.3) Services (if by Contractor) (4.4) Earthworks and Demolition (4.5) Retaining Walls (4.6) Drainage (4.7) Bridges (4.8) Tunnels (4.9) Pavement (4.10) Bituminous Surfacing / Asphalt (4.11) Secondary Pavements (4.12) Pavement Marking (4.13) Road Furniture (4.14) Lighting (4.15) Landscaping and Urban Design (4.16) Traffic Signage, Signals and Controls (4.17) Rail (4.18) Other	(4.1.1) Environmental Works Item 1 (4.1.2) Environmental Works Item 2 (4.2.1) Traffic Management Item 1 (4.2.2) etc.
(5) Contractor's Preliminaries (Indirect Costs)	(5.1) Design (by Contractor) (5.2) Onsite Overheads (5.3) Offsite Overheads (5.4) Contractor's Margin	(5.1.1) Design (by Contractor) (5.2.1) Onsite Overheads (5.3.1) Offsite Overheads (5.4.1) Contractor's Margin
(6) Contingent Risks	(6.1) Contingent Risks	
(7) P50 & P90 Risk and Contingency	(7.1) P50 Inherent & Contingent Risk (7.2) P90 Inherent & Contingent Risk	

Appendix 6 provides further details of the items and sub-items that are included within each element of the estimate.

The amount of detail that is able to be presented within an estimate will depend largely on the amount of design and documentation that is available as a basis for

the estimate. Project managers/planners should endeavour to provide project information as described in Appendix 1.

## **2.5 Estimating Methods**

DPTI utilises a number of estimating methods with these varying depending on the end use and who is preparing the estimate. The basic difference between these methods is the degree to which a project is divided into elements and the way in which applicable quantities and rates are determined. The more rigorous the process used, the greater will be the certainty of the outcomes (the accuracy) of the estimate.

Estimators should ensure that regardless of the estimating method used, most of the effort should be directed to ensuring the accuracy of the 20% of items that often make up 80% of the costs.

The following list details the methods utilised within DPTI estimates in a generally increasing confidence level:

### **2.5.1 Global Estimate (benchmark rates)**

Global estimating (or “Order of Magnitude” estimating) describes an approximate or low order method of estimating involving the use of ‘all in’ or ‘global’ composite rates. The project could be considered as consisting of one or two estimating elements only and the estimate prepared on this basis. Examples are road cost per km and bridge costs per square metre of deck area.

*Note: Global estimating has been found to be unreliable in achieving the required level of estimating accuracy, even for strategic estimates. Consequently, global estimating is not used for budgeting purposes or for media releases.*

### **2.5.2 Composite Estimate**

Composite estimating is a more refined version of global estimating, utilising rates which are inclusive of a combination of a number of work items to construct a single element of the project. The estimate is generally considered as having a small number of estimating elements only such as: drainage, environmental works, or traffic management costs per kilometre or bridge costs per square metre of deck area.

### **2.5.3 Unit Rate Estimate (based on historic rates)**

Unit rate estimating calculates the cost of each element of the project by multiplying the quantity of work by historical unit rates. The project cost is then determined by the sum of the elemental costs. The unit rate is normally determined from a careful analysis of unit costs of a number of recently completed projects of the same type, allowances being made for project differences. It is important that the project analysis recognises that the rates may include indirect costs such as contractor’s management, risk, overheads and margins, which must be adjusted when converting a unit rate to the direct cost rate.

Adjustments to be considered include:

- Inflation
- site conditions (mountainous or flat terrain)
- market conditions
- on-site and off-site overheads and profit

- scale of works (large or small quantities)
- site location (urban or remote)
- design complexity (unique or routine)
- risk profile of the ground type
- construction methods (specialised or conventional) and
- specification of materials and finishes (architectural or plain finish)

Unit rate estimating is a relatively quick method of estimating but lacks precision, especially in the interpretation of what exactly is provided for in the unit rate. Accuracy of an estimate requires emphasis on scope, reflected in a comprehensive schedule of work items that is unique to the project. Unit rates can vary from project to project, but the use of the historical unit rate, adjusted by an experienced estimator and applied to a detailed schedule, produces a more accurate estimate than a global estimate.

With a sufficient level of information in terms of the scope of the project, the work breakdown, quantities and careful selection of appropriate historical rates, the unit rate method of estimating is capable of producing estimates suitable for all project stages through to detailed design.

#### **2.5.4 Hybrid Estimate - Unit Rate/First Principles**

The hybrid method uses some features of the unit rate method and some of first principles method, thereby increasing estimating accuracy above that of the unit rate method.

The estimate is completed in a similar manner to the first principles estimate, by the application of typical percentages for on-site and off-site overheads and profit to a direct job cost estimate compiled using a direct cost unit rate method.

A weakness of the method is that it relies on the availability of direct cost unit rates (that is rates which are equivalent to the direct job costs component of the first principles method before the distribution of indirect costs). These are not normally available from industry unless the organisation itself carries out first principles estimating. Given the correct information, experienced estimators can make an adequate analysis of a contractor's tender schedule and bring the costs back to a direct cost level. For example, a business case with limited project development detail uses first principles for high value, high risk items and unit rates for low risk items.

#### **2.5.5 First Principles Estimate**

The foundation of "first principles" estimating is the calculation of project-specific costs based on a detailed study of the resources required to accomplish each activity of work determined necessary in completion of the project and subsequently recorded within the project's work breakdown structure.

Consideration needs to be taken of such things as the site conditions likely to be encountered, the program of work, site and project constraints, work methods to be employed (including alternatives), resource availability, productivity of labour and plant, wastage factors, procurement of materials and subcontractors as well as risks likely to be encountered during the course of the project.

## 2.6 Required Estimating Methods

Table 4 provides details of the estimating methods and expected level of detail as per the work breakdown structure to be used for each estimate level (for definition of WBS levels see Table 3):

**Table 4 – Estimating Method by Estimate Level**

Estimate Level	Estimating Method	Work Breakdown Structure Level Presented in DPTI Estimate Format
Level 1 Strategic Options Estimate	Global Estimate (benchmarks rates) / Composite Estimate / Unit Rates	WBS - A
Level 2 Preliminary Options Estimate	Unit Rates (Approx. 80% value) AND First Principles (Approx. 20% value)	WBS – B & C
Level 3 Preliminary Concept Estimate	Unit Rates (Approx. 40% value) AND First Principles (Approx. 60% value)	WBS – C
Level 4 Concept Estimate	Unit Rates (Approx. 20% value) AND First Principles (Approx. 80% value)	WBS – C
Level 5 Detailed Estimate	First Principles	WBS – C
Level 5A Tender Estimate	First Principles	WBS – C
Level 5B Implementation Estimate	First Principles	WBS – C
Level 6 Actual Costs	N/A - Record / Comparison of Actual Costs only	WBS – C

*Note: Where WBS Level C applies it is expected that the nominal percentage of first principles methods are used to prepare costs at WBS Level D. While a breakdown of items and costs at WBS Level D are not typically provided to DPTI estimators are required to provide these when requested by the Project Officer Estimating Services or project manager/planner.*

## 2.7 Estimate Build-up

The estimate is built-up by identifying rates and quantities for items associated with each of the following sections of the estimate. A comprehensive listing and further details of items to be considered in each section of the estimate is included in Appendix 6.

### 2.7.1 Client Costs (1.1 to 1.10)

Client costs are those costs incurred by the department to conceptualise, develop, deliver and finalise a project. Costs include: staff costs (project management, planning, design, estimating, environmental planning etc.), engaged consultancy costs, community consultation costs, principal arranged insurances, DPTI environmental assessment costs, other client costs, general staff overheads and the like.

### **2.7.2 Land Acquisition (2.1 to 2.4)**

Land acquisition costs associated with the procurement or modification of land and property that are to be paid by the department.

### **2.7.3 Services (By DPTI) (3.1 to 3.5)**

Services (by DPTI) costs include the identification and relocation or alteration of infrastructure owned by public utilities which are to be paid by the department outside of the head construction contract. Any costs relevant to services which are to be completed by or on behalf of the head contractor are included within section 4.3 of the construction costs in order for applicable overheads and margins to be applied.

### **2.7.4 Construction Costs (4.1 to 4.18)**

Construction costs include the direct cost of labour, plant and materials required to complete each activity, sub-activity or task associated with the construction component of the project.

### **2.7.5 Contractor's Design Cost, Overheads and Margin (5.1 to 5.4)**

Contractor's design costs, on site overheads (inclusive of recurring and non-recurring costs), off site overheads and margin associated with the contractors management of the implementation of the project.

### **2.7.6 Contingent Risks (6.1)**

Contingent risk items are identified and priced by the estimator with ranging applied to derive low and high pricing in the same way as applicable for all line items within the base estimate.

For Level 1 estimates specific contingent risk items are not identified, these are instead assessed in conjunction with inherent risks using the relevant table as provided within section 2.8.

### **2.7.7 P50 & P90 Risk & Contingency (7.1 to 7.2)**

This section includes calculated values for both inherent and contingent risk. Details regarding the assessment and calculation of these values are included in the following sections of this manual.

## **2.8 Inherent and Contingent Risk**

For all estimates inherent and contingent risk are assessed together when determining P50 and P90 values (or equivalent P50 and P90 values where deterministic methods are used).

### **2.8.1 Inherent Risk**

Inherent (or planned) risk is associated with the potential for variations in the assigned quantities and rates of each of the line items within the estimate. Project cost estimates cannot be confidently prepared using whole number quantity and rates values as in reality there are likely to be a range of quantities and rates which are possible for each line item due to the exact nature of the associated task along with variability in construction methodology and pricing between contractors. This is modelled as a +/- risk range on both quantities and rates of all items, with these ranges used to spread risk appropriately across each item to allow for statistical modelling (i.e. P50 and P90 calculations) to occur.

## **2.8.2 Contingent Risk**

Contingent (or unplanned) risk relates to the risk associated with unmeasured items, e.g. those not included within the Base Estimate due to them being unknown in nature and having a less than 100% chance of occurring.

Items with no information, but which are known to form part of the project scope (e.g. they have a 100% chance of occurring) are to be included as line items within the Base Estimate and not rely on contingent risk items to make provision for them.

## **2.9 Calculation of Inherent and Contingent Risk Values**

### **2.9.1 Estimate Level 1 (DPTI Staff)**

Estimates at this very early stage are considered highly variable due to the large degree of uncertainty associated with the scope and timing of the works. As such they are intended to be used for the assessment and comparison of possible initiatives, they are not to be used to seek project funding.

For these estimates inherent risk and contingent risk are assessed by adjusting percentage values based on broad questions relating to the project as detailed within the following tables. Table 5 and Table 6 are applicable to road and rail projects respectively. An electronic copy of this tool is included within EST 600-1 ([KNet #5751720](#)).



**Table 5 – Total Risk Considerations, Level 1 Estimates (Road Projects)**

Element	Factors		Highly Confident & Reliable	Reasonably Confident & Reliable	Not confident & Not Reliable	Selected Percentage (example only)
Project Scope	Are project objectives and performance criteria defined?	Yes V No Λ	2%	4%	6%	5%
	Are project scope assumptions and exclusions defined?	Yes V No Λ	2%	4%	6%	5%
	Are concept drawings available?	Yes V No Λ	3%	4%	6%	5%
Risks	Are significant risks (political, community, technical, financial) anticipated?	No V Yes Λ	2%	3%	4%	4%
	Has a detailed risk analysis been undertaken?	Yes V No Λ	3%	4%	6%	5%
	Has the project delivery / procurement method been determined?	Yes V No Λ	3%	4%	6%	5%
Constructability	Has a constructability review been undertaken?	Yes V No Λ	1%	2%	3%	3%
	Does the project involve complex staging of works?	No V Yes Λ	1%	2%	3%	3%
Key Dates	Have key dates been determined to enable the assessment of escalation / out-turn costs?	Yes V No Λ	1%	2%	3%	3%
	Is the project planned to occur in the short term?	Yes V No Λ	1%	2%	3%	3%
Site Specific Information	Have geotechnical, heritage, environmental, technical etc. specialists provided estimate input?	Yes V No Λ	1%	2%	3%	3%
	Have enabling works been identified and adequately allowed for in the estimate?	Yes V No Λ	2%	3%	4%	4%
Project Interfaces	Have external interfaces been defined and adequate costs allowed for within the estimate?	Yes V No Λ	1%	2%	3%	3%
	Is the project short? (<2km Short >5km Long)	Yes V No Λ	2%	3%	4%	4%
<b>Total contingency percentage to be adopted for an estimate with a 90% confidence of not being exceeded</b>			<b>25%</b>	<b>41%</b>	<b>60%</b>	<b>55%</b>
<b>Total contingency percentage to be adopted for an estimate with a 50% confidence of not being exceeded</b> <i>(assessed to be 40% of the Contingency percentage for a 90% confidence level of not being exceeded)</i>						<b>22%</b>
Notes:						
<ul style="list-style-type: none"> <li>• No V denotes that if answer is No, decrease the contingency.</li> <li>• No Λ denotes that if answer is No, increase the contingency.</li> <li>• Yes Λ denotes that if answer is Yes, increase the contingency.</li> <li>• Yes V denotes that if answer is Yes, decrease the contingency.</li> </ul>						

**Table 6 – Total Risk Considerations, Level 1 Estimates (Rail Projects)**

Element	Factors		Highly Confident & Reliable	Reasonably Confident & Reliable	Not confident & Not Reliable	Selected Percentage <i>(example only)</i>	
Project Scope	Are project objectives and performance criteria well defined?	Yes V	No Λ	4%	5%	7%	6%
	Are project scope assumptions and exclusions defined?	Yes V	No Λ	4%	5%	7%	6%
	Are concept drawings available?	Yes V	No Λ	4%	5%	8%	7%
Risks	Are significant risks (political, community, technical, financial) anticipated?	No V	Yes Λ	2%	3%	4%	4%
	Has a detailed risk analysis been undertaken?	Yes V	No Λ	4%	5%	7%	6%
	Has the project delivery / procurement method been determined?	Yes V	No Λ	4%	5%	7%	6%
Constructability	Has a constructability review been undertaken?	Yes V	No Λ	1%	2%	3%	3%
	Does the project involve complex staging of works?	No V	Yes Λ	1%	2%	3%	3%
Key Dates	Have key dates been determined to enable the assessment of escalation / out-turn costs?	Yes V	No Λ	1%	2%	3%	3%
	Is the project planned to occur in the short term?	Yes V	No Λ	1%	2%	3%	3%
Site Specific Information	Have geotechnical, heritage, environmental, technical etc. specialists provided estimate input?	Yes V	No Λ	1%	2%	3%	3%
	Have enabling works been identified and adequately allowed for in the estimate?	Yes V	No Λ	4%	5%	8%	7%
Project Interfaces	Have external interfaces been defined and adequate costs allowed for within the estimate?	Yes V	No Λ	1%	2%	3%	3%
	Is the project short? (<2km Short >5km Long)	Yes V	No Λ	2%	3%	4%	4%
<b>Total contingency percentage to be adopted for an estimate with a 90% confidence of not being exceeded</b>				<b>34%</b>	<b>48%</b>	<b>70%</b>	<b>64%</b>
<b>Total contingency percentage to be adopted for an estimate with a 50% confidence of not being exceeded</b> <i>(assessed to be 40% of the Contingency percentage for a 90% confidence level of not being exceeded)</i>							<b>38%</b>
Notes:							
<ul style="list-style-type: none"> <li>• No V denotes that if answer is No, decrease the contingency.</li> <li>• No Λ denotes that if answer is No, increase the contingency.</li> <li>• Yes Λ denotes that if answer is Yes, increase the contingency.</li> <li>• Yes V denotes that if answer is Yes, decrease the contingency.</li> </ul>							

**Table 7 – Total Risk Considerations, Level 1 Estimates (Marine Projects)**

Element	Factors		Highly Confident & Reliable	Reasonably Confident & Reliable	Not confident & Not Reliable	Selected Percentage (example only)	
Project Scope	Are project objectives and performance criteria well defined?	Yes V	No Λ	4%	5%	7%	6%
	Are project scope assumptions and exclusions defined?	Yes V	No Λ	4%	5%	7%	6%
	Are concept drawings available?	Yes V	No Λ	4%	5%	8%	7%
Risks	Are significant risks (political, community, technical, financial) anticipated?	No V	Yes Λ	2%	3%	4%	4%
	Has a detailed risk analysis been undertaken?	Yes V	No Λ	4%	5%	7%	6%
	Has the project delivery / procurement method been determined?	Yes V	No Λ	4%	5%	7%	6%
Constructability	Has a constructability review been undertaken?	Yes V	No Λ	1%	2%	3%	3%
	Does the project involve complex staging of works?	No V	Yes Λ	1%	2%	3%	3%
Key Dates	Have key dates been determined to enable the assessment of escalation / out-turn costs?	Yes V	No Λ	1%	2%	3%	3%
	Is the project planned to occur in the short term?	Yes V	No Λ	1%	2%	3%	3%
Site Specific Information	Have geotechnical, heritage, environmental, technical etc. specialists provided estimate input?	Yes V	No Λ	1%	2%	3%	3%
	Have enabling works been identified and adequately allowed for in the estimate?	Yes V	No Λ	4%	5%	8%	7%
Project Interfaces	Have external interfaces been defined and adequate costs allowed for within the estimate?	Yes V	No Λ	1%	2%	3%	3%
	Have impacts to commercial and/or recreational usage been adequately assessed/allowed for?	Yes V	No Λ	2%	3%	4%	4%
<b>Total contingency percentage to be adopted for an estimate with a 90% confidence of not being exceeded</b>				<b>34%</b>	<b>48%</b>	<b>70%</b>	<b>64%</b>
<b>Total contingency percentage to be adopted for an estimate with a 50% confidence of not being exceeded</b> (assessed to be 40% of the Contingency percentage for a 90% confidence level of not being exceeded)							<b>38%</b>
Notes:							
<ul style="list-style-type: none"> <li>• No V denotes that if answer is No, decrease the contingency.</li> <li>• No Λ denotes that if answer is No, increase the contingency.</li> <li>• Yes Λ denotes that if answer is Yes, increase the contingency.</li> <li>• Yes V denotes that if answer is Yes, decrease the contingency.</li> </ul>							

Contingency allowances for these early estimates of road and rail projects are summarised as follows:

**Table 8 – Summary of Contingency Allowances for Level 1 Estimates**

Probability %	Range of Contingency Allowance
ROAD PROJECTS	
50%	10% to 24%
90%	25% to 60%
RAIL PROJECTS	
50%	20% to 42%
90%	34% to 70%
MARINE PROJECTS	
50%	20% to 42%
90%	34% to 70%

*Note: The determination of a project to be either a road, rail or marine is to be made by the estimator based on their perception of the predominant project type.*

### 2.9.2 Estimate Levels 2 to 5B (Estimating Consultants)

For these estimates risk is assessed probabilistically using a computer program such as @Risk to sample the project cost with varying levels of confidence. This process requires the estimator to assign cost and quantity ranges to each line item of the estimate (sections 1 to 5) along with a probability of their occurrence which when modelled (with the risk software) the resulting output provides P50 and P90 project values. In order to present the combined inherent and contingent risk values at P50 and P90, the Base Estimate value is deducted from the calculated P50 and P90 values.

In determining the ranges to apply in arriving at low and high values, estimators should consider the output values as representing their opinion of a one in twenty occurrence (i.e. P5 and P95 respectively) with the resulting range for each cost element representing the possible variation and subsequent impact to the final cost if these variations were to occur, considering the impact of variances to both rates and quantities.

A probability of 100% is applied to each line item as by definition their inclusion in the base estimate means they are considered 100% likely to occur in completion of the project.

Contingent risk items (section 6) are then derived, with likely rates and ranging values applied in the same manner as for items in sections 1 to 5. Probability percentages are also applied to each of the risk items based on the estimators perceived likelihood of the identified risk eventuating.

*Note: It is important that the factors or influences that make up the recommended contingency amount are recorded in the Standard Estimate Template (either within*

*Section 6.1 – Contingent Risk or on a separate tab within the estimate). By providing a clear breakdown of the items which have been considered, their estimated costs and details regarding the risk/assumption, those reviewing the estimate are provided with a view of what is forming the basis of the contingent risk value.*

Having completed the derivation of contingent risk items and the assignment of inherent risk ranging and specific probabilities to these items, the probabilistic calculation of P50 and P90 project values is then undertaken using the chosen risk analysis software.

General rules for the probabilistic assessment of inherent and contingent risk values are as follows:

- Calculations are to be performed by experienced operators who have been trained in their chosen form of risk analysis software
- It is recommended that for all projects calculations sample the project using no less than 5000 iterations
- It is generally not acceptable to assign a 100% probability to any contingent risk items as this percentage suggests that an event is certain to occur and it should therefore be included as a line item within the base estimate
- It is expected that estimators will establish ranges based on their professional judgement and not simply apply a set variation percentage (e.g. +/-10%) for all estimate items
- To avoid optimism bias and over confidence, ranges should be both wide and biased toward the upside

More detailed information regarding probabilistic contingency estimation and methods can be found within DIRD Guidance Note 3A.

### **2.9.3 Estimate Levels 2 to 5B (DPTI Staff)**

For these estimates the range based deterministic method is used to assess both inherent and contingent risk. This process requires the application of low and high ranging to the assigned quantities and rates of each line item within the base estimate (sections 1 to 5).

In determining the ranges to apply in arriving at low and high values, estimators should consider the output values as representing their opinion of a one in twenty occurrence (i.e. P5 and P95 respectively) with the resulting range for each cost element representing the possible variation and subsequent impact to the final cost if these variations were to occur, considering the impact of variances to both rates and quantities.

A probability of 100% is applied to each line item as by definition their inclusion in the base estimate means they are considered 100% likely to occur in completion of the project.

Contingent risk items (section 6) are then derived, with likely rates and ranging values applied in the same manner as for items in sections 1 to 5. Probability percentages are also applied to each of the risk items based on the estimators perceived likelihood of the identified risk eventuating. The following categories are to be considered when determining contingent risk values:

- **Performance and Functionality:** may include increased requirements such as traffic capacity, axle loads, design speed, etc., compared to what was originally described in project definition
- **Third Party Influences:** may include requirements of service authorities i.e. delayed relocation works, unknown services identified during construction which require protection or alteration resulting in additional project costs etc.
- **Policy and Standards:** may include changes to the design and management requirements mandated by the department through ongoing improvements in safety, and whole-of-life considerations
- **Design Development:** may include increased costs resulting from greater work scope identified during the design process required to meet previously stated performance requirements. These increases are often incurred through lack of investigation, geotechnical and survey work. This category is not scope creep, i.e. it is not an increase in work requirement to meet previously given outcomes
- **Other:** may include any other potential project costs in excess of those identified in the above categories

These key headings are to remain the same regardless of project size. However, it is anticipated that the level of detail and time spent in the identification, assessment and costing of unplanned risk items will increase in proportion with the value and/or risk of projects.

Having completed the derivation of contingent risk items and the assignment of inherent risk ranging and specific probabilities to these items, the range based deterministic calculation of equivalent P50 and P90 project values is then undertaken using the Johnson modification of the Pearson-Tukey formula to each of the section totals (e.g. 4.4 Earthworks & Demolition). This formula is detailed as follows:

$$\frac{(3 \times L) + (10 \times ML) + (3 \times H)}{16 \times P}$$

Where: *L* = Lowest (or optimistic) estimated cost  
*ML* = Most likely estimated cost  
*H* = High (or pessimistic) estimated cost  
*P* = Probability %

The sum of the resulting section totals is deemed to be the equivalent P50 value.

The equivalent P90 value is then determined through the following calculations which are shown in their respective order of occurrence. Of the following steps the first three calculations are undertaken for each section total (e.g. 4.4 Earthworks & Demolition), while the remainder are reliant on the outputs of these.

1. Approximation to Variance (AV):

$$(H - L) / 3.25$$

2. Skewness Adjustment (SA):

$$0.2 \times (((L + H) - (2 \times ML)) / AV) ^ 2$$

3. Variance (V):

$$((H - L) / (3.35 - SA))^2$$

4. Sum of Variance (SV):

*Variance items (V) are summed for each of the section totals*

5. Half of a Standard Deviation of the Sum of Variance (HSDSV):

$$SV^{0.5}$$

6. Calculation of Equivalent P90 value:

$$P50 \text{ Value} + (HSDSV \times 1.2815515)$$

The application of these formulas is automated within the relevant estimate templates (EST600-3 & EST600-3 FS).

More detailed information regarding deterministic contingency estimation and methods can be found within DIRD Guidance Note 3B.

#### **2.9.4 Estimate Levels 2 to 5B (DPTI Field Services Staff)**

For these estimates risk is assessed deterministically using the process described in section 2.8.3.

### **2.10 Program and Cash Flow**

To assist in development of the Formal Estimate and to ensure an accurate representation of likely project timing and escalation costs, estimators are typically required to prepare a project program and cash flow in addition to the estimate.

The summary tab of the estimate templates for Levels 2 to 5B estimates contains an indicative cash flow which is to be completed for each estimate. Where a more detailed cash flow is required this may be sought as part of the estimating service via the Estimating Work Order or alternatively EST 600-7 Cash Flow Template ([KNet #12245240](#)) provides a template that can be pasted within the summary tab of the estimate where this cash flow is developed by the project manager/planner.

Estimated cash flows should consider expenditure as having occurred at the time work is carried out rather than when a contractor's claim is submitted or payment made.

### **2.11 Estimate Review Process**

On completion of the estimate, estimators are responsible for ensuring the review of estimates prior to their submission. Appendix 7 provides the steps that are required to be followed during the review of estimates. All errors identified by estimating consultants during this review are to be corrected prior to the estimate being submitted to the Project Officer Estimating Services and the project manager/planner.

### **2.12 General Considerations in the Development of Estimates**

#### **2.12.1.1 Road Projects**

Key components of road project costs and hence those where the greatest level of effort should be made by those developing scope and in-turn estimates typically include bulk earthworks, structures, pavements, bituminous surfacing and service

relocations/modifications. Factors such as the projects physical location, site working time constraints, minimum lane requirements and specific geotechnical features vary the rates of production and the subsequent unit rates which are ultimately derived for contributing items.

With the exception of items such as retaining wall components, drainage culverts, bridge beams and road furniture items there are typically few manufactured or proprietary items in comparison to rail projects. Most materials such as quarried fill and pavement materials are sourced as locally to the project as possible with the cost applied for the purchase of these items a key consideration in accurately determining the estimated project cost.

Another important factor in the determination of costs associated with road projects is that of the scope associated with public realm and landscape treatments that will ultimately be required. Examples of this include street trees, verge planting, street furniture and water sensitive design.

### **2.12.1.2 Rail Projects**

The majority of rail projects tend to be associated with upgrade or duplication of existing rail infrastructure. Unlike roads, typically these projects incorporate a high proportion of manufactured items of a proprietary nature such as sleepers, track, turnouts, signalling and communications components, power equipment and rolling stock. Within operating rail networks works have to be planned around track possessions and as such estimates need to incorporate the often limited time available and/or specific considerations associated with an intense program of work. When preparing estimates for rail projects estimators should give specific consideration to factors such as:

- the constraints imposed by the operating rail and safety requirements
- working at night and/or during weekends
- specialist knowledge associated with the implementation of rail systems such as signalling and communications including requirements for interim staging and commissioning of the works
- often narrow sites which provide limited physical access causing specific safety requirements that typically result in extended construction and overall program durations and a significantly higher proportion of indirect costs than would typically apply for road projects

In addition to the above, the scope and therefore cost associated with connectivity adjacent stations (e.g. lifts, stairs, active pedestrian crossings etc.) to facilitate patronage along with public realm and landscaping type requirements are also important considerations when preparing estimates for rail projects.

## **2.13 Retention of Estimate Input Information**

Estimators are required to retain all information used as the basis of their estimates along with any resulting outputs to allow for future revision of estimates, any required audits etc. The following key records to be retained include, but are not limited to:

- First principles estimate calculations, in particular those created within proprietary estimating software
- Copies of marked up drawings (hard or soft copies) detailing assumed temporary works, tie-ins, pavement rehabilitation areas etc.
- Input data associated with risk calculations in order to enable probabilistic risk models to be re-run if necessary



# **SECTION 3**

## **Appendices**

## Appendix 1 – Information Requirements for Estimate Levels

In order to provide estimates that are a reasonable representation of the likely project costs it is essential that the project manager/planner clearly determines the applicable scope of works for each option that is to be costed.

The level of detail that is available for each option will increase as the project proceeds through the cost estimating framework. The following is a guide to the minimum level of documentation that should be made available for each estimate.

For Level 6 Actual Costs, values are to be recorded relative to each of applicable work breakdown structure items.

Estimate Level & Description	Level 1	Level 2	Level 3	Level 4	Level 5	Level 5A	Level 5B
	Strategic Options Estimate	Preliminary Options Estimate	Preliminary Concept Estimate	Concept Estimate	Detailed Estimate	Tender Estimate (priced schedules only)	Implementation Estimate
<b>1.0 CLIENT COSTS</b>							
1.1 Scoping Phase, Project Management		First principles by estimator based on anticipated project duration and staffing levels			First principles client cost to be provided by estimate requestor using EST600-5 First Principle Client Costs Estimate <a href="#">(KNet #5729453)</a>	Not included	First principles client cost to be provided by estimate requestor using EST600-5 First Principle Client Costs Estimate <a href="#">(KNet #5729453)</a>
1.2 Scoping Phase, Design and Investigation							
1.3 Development Phase, Project Management							
1.4 Development Phase, Design and Investigation							
1.5 Delivery Phase, Project Management							
1.6 Delivery Phase, Design and Investigation							
1.7 Principal Arranged Insurances and Levies	Very limited project detail, estimate typically based on benchmark costs from similar previous projects (e.g. per site, per km, per m2)	Rate as provided by Project Officer Estimating Services via DPTI Procurement & Contracting					Rate as provided by Project Officer Estimating Services via DPTI Procurement & Contracting
1.8 Environmental Assessment		Estimator to price based on previous projects			Estimate requestor to provide Environmental Assessment Estimate sourced from DPTI Environmental Planning as per EST600-6 Environmental Cost Estimating Tool <a href="#">(KNet #9362850)</a>		Estimate requestor to provide Environmental Assessment Estimate sourced from DPTI Environmental Planning as per EST600-6 Environmental Cost Estimating Tool <a href="#">(KNet #9362850)</a>

1.9 Other Client Costs		Estimator to price based on previous projects		Estimate requestor to provide details of associated scope and likely costs	Not included	Estimate requestor to provide details of associated scope and likely costs	
1.10 DPTI Overhead Charge		Percentage as provided by Project Officer Estimating Services via DPTI Finance				Percentage as provided by Project Officer Estimating Services via DPTI Finance	
<b>2.0 PROPERTY ACQUISITION</b>	Very limited project detail, estimate typically based on benchmark costs from similar previous projects (e.g. per site, per km, per m2)	Indication of any areas likely to be acquired, estimator to assess if values not yet available	Indication of areas likely to be acquired and preliminary cost advice from DPTI's Acquisition Services group	Clearly defined acquisition areas and full costing advice from DPTI Property Section	Not included	Clearly defined acquisition areas and full costing advice from DPTI Property Section	
2.1 Property Purchase Costs							
2.2 Transaction, Legal and Other Costs							
2.3 Business Compensation							
2.4 Property Modification							
<b>3.0 SERVICES (BY DPTI)</b>		Basic information such as the presence of known major and minor services	Basic information such as the presence of known services along with Dial Before You Dig information	Location and sizing along with preliminary cost advice from authorities	Location and sizing along with quotes from relevant service authorities	Not included, some services at 4.3	Location and sizing along with quotes from relevant service authorities
3.1 Electricity							
3.2 Communications							
3.3 Gas							
3.4 Water and Sewer							
3.5 Other Services							
<b>4.0 CONSTRUCTION COSTS</b>		See 4.4 to 4.18					Prices as tendered, substituted for estimated values in previous Level 5 estimate
4.1 Environmental Works		Anticipated traffic constraints such as the minimum through and turning lane requirements along with the times these restrictions will apply		Known traffic constraints including minimum through and turning lane requirements along with the times these restrictions will apply		As applicable to tender	
4.2 Traffic Management		See 3.0, Estimator to assess which portions of work by contractor					
4.3 Services (if by Contractor)		Assumed design relevant to category (less than nominal 5% design)	Assumed design relevant to category (nominal 5% design)	Preliminary design relevant to category (nominal 15 to 30% Design)	Final Design Relevant to Category (to nominal 100% design)		
4.4 Earthworks and Demolition							
4.5 Retaining Walls							
4.6 Drainage							
4.7 Bridges							
4.8 Tunnels							
4.9 Pavement							
4.10 Bituminous Surfacing / Asphalt							
4.11 Secondary Pavements							
4.12 Pavement Marking							
4.13 Road Furniture							
4.14 Lighting							
4.15 Landscaping and Urban Design							
4.16 Traffic Signage, Signals and Controls							
4.17 Rail							
4.18 Other							

<b>5.0 CONTRACTORS PRELIMINARIES &amp; SUPERVISION</b>	Very limited project detail, estimate typically based on benchmark costs from similar previous projects (e.g. per site, per km, per m2)			
5.1 Design (if by Contractor)		Estimator to determine. Advice to be given regarding the likely procurement method	Estimator to determine based on tender documents	Prices as tendered, substituted for estimated values in previous estimate
5.2 Overheads (Onsite)				
5.3 Overheads (Offsite)				
5.4 Contractors Margin				
<b>6.0 CONTINGENT RISK</b>	Assessed by Estimator	Estimator to include as per tender schedules	Assessed by Estimator	
6.1 Contingent Risks				
<b>7.0 P50 &amp; P90 RISK &amp; CONTINGENCY</b>				
7.1 P50 Inherent & Contingent Risk				
7.2 P90 Inherent & Contingent Risk				

## Appendix 2 – Estimating Work Order

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While primarily intended as a means of formally requesting the services of estimating consultants from the DPTI Estimating Panel, the estimating work order also aims to identify and record key project information and considerations which form the basis of the estimate.

Regardless of how estimates are procured or prepared by, the following information is to be recorded within the estimate file using the format provided within the estimating work order:

- Drawings and Documentation – type, description, KNet number, KNet version
- General Overview – broad statement regarding the project and its scope
- Project Objectives – what the project is aiming to provide, e.g. additional through lanes, reduce particular accident types
- Performance Criteria – includes functional requirements such as increased intersection/road capacity, increased design speed limits, pavement life etc.
- Option Number and Title – specific to each option details regarding:
  - Extent and limit of work
  - Scope of work
  - Environmental
  - Property acquisition
  - Services work
  - Exclusions
- Known Risks & Constraints
- Milestone Dates
- Procurement/Delivery Method
- Other Project Information
- Required Estimating Deliverables

EST 600-4 the Estimating Work Order template can be found at [KNet #4479522](#).

## Appendix 3 – Procedure for Duplicate Estimates

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Duplicate estimates are not required for each level of estimate but can be requested by the project manager/planner at any time. However, for projects with a total P90 Project Estimate (real \$) which is anticipated to be in excess of \$25 million, duplicate estimates are recommended prior to seeking project funding.

The recommended process for the preparation of duplicate estimates is as follows:

- 1) Having identified that the estimated P90 Project Estimate is likely to exceed \$25 million (or for any projects where additional confidence in the estimate is required) the project manager/planner completes the relevant section of the Estimating Work Order requesting the provision of a duplicate estimate. Two estimators will then be assigned to the task and invited to attend a single Estimate Commencement Meeting, with the prefixes OE and DE assigned in order to differentiate between the deliverables of the two estimators
- 2) The selected estimators attend a single combined meeting to discuss the project, its objectives, scope, constraints, etc., and the deliverables that are to be provided. To ensure that the final estimates provide useful comparisons, clear option boundaries and any project considerations which may impact the approach used and subsequent estimating deliverables are to be discussed and a common approach agreed at this meeting. Project managers/planners are to ensure that both parties receive identical information at this meeting and where it becomes available following the meeting
- 3) Estimators prepare individual estimates based on the project details and constraints that have been provided. Where either estimator seeks clarification from the Project Officer Estimating Services and/or project manager/planner during the process of preparing the estimate, responses are communicated to both estimators to ensure consistency in the basis of their estimates
- 4) Estimates are reviewed in accordance with the Estimate Review Process (see Appendix 7)
- 5) Where DPTI consider necessary, estimators may be invited to attend a joint meeting to discuss variations between their individual estimated costs. This will typically include discussion on factors such as variances on assumed construction methodologies, constraints, assumptions and inclusions/exclusions that have been considered differently between estimators. As a guide, variations in sub-section totals of greater than 5 percent should be analysed further
- 6) Following the meeting noted in the previous step, one or both of the estimators may be given the opportunity to revise their estimates. Alternatively one of the estimators may subsequently be asked to prepare a reconciled estimate incorporating agreed methodologies, rates and scope items. Where this approach is used, once completed this estimator shall seek endorsement from the other estimator prior to the submission of the reconciled estimate

- 7) The completed estimate shall again be subject to the Estimate Review Process (see Appendix 7) with any further changes requested from the estimator(s) as deemed necessary
- 8) At the completion of the review process all relevant estimate values are to be provided to the Senior Responsible Officer to aid in the decision as to which values to adopt as the current project estimate and for the addition of applicable escalation

## Appendix 4 – Numbering Convention of DPTI Estimates

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In order to accurately track projects as they move through the levels of the Cost Estimating Framework the following number convention has been devised:

EXAMPLE: **2503 OE L4 R3**

In the above example:

**2503** The number allocated to the project option estimate for proposed works at a given site, which for this example notes the project as being 2503 in the database of project estimates. Typically this number will remain with the site/project unless an entirely different scope of work/objective is being considered

**OE** Indicates that the estimate is an Options Estimate. An unlimited number of options may be included within a single estimate file. The inclusion of numerous options within a single file ensures that the cost and scope of various options for a single project can be readily compared along with being more easily stored, retrieved and communicated within DPTI

While not preferred, for large or complex projects estimate options it may be appropriate to split estimate options into different excel files. In this case an identifier which clearly relates to the project option title is to be added after the OE prefix, e.g. OE3C within the estimate file name and estimate tabs

Where a duplicate estimate is requested, OE is to be substituted with DE by one of the estimators as directed by the Project Officer Estimating Services. Formal estimate forms will be labelled with FE in place of OE or DE

**L4** Is the Level of the estimate as per the Cost Estimating Framework, subsequently entries are limited to ranging from L1 to L6 as a project progresses through the framework from a strategic estimate to actual costs. Level 0 (L0) will be assigned to other estimating tasks which do not specifically belong to one of the other estimating levels (e.g. cost advice, variation cost assessment, program reviews etc.)

**R3** This number represents the revision of the estimate, in this example the file would be the third revision of the estimate. As an endless number of revisions may be made for a particular estimate this number is unlimited but must always start with the prefix R.

Importantly estimators must:

- ensure that as an estimate progresses to a subsequent estimate level that the revision number reverts to R1
- label the first estimate issued at each estimate level is labelled as R1
- sequentially apply new revision numbers to each revised estimate that is completed (in the case of Estimating Panel contractors all revisions created must be issued to DPTI)

All estimates are to be recorded and labelled using this numbering convention



## Appendix 5 – Completing the Standard Estimate Spreadsheet

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All estimates are to be presented using one of the following Standard Estimate spreadsheets.

- EST 600-1 [KNet #5751720](#). For estimates at Level 1
- EST 600-2 [KNet #5751722](#). For estimates at Levels 2, 3, 4, 5 & 5B where prepared by estimating consultants (*Note: typically these estimates will be prepared using proprietary estimating software and transferred to the template. Estimating consultants are required to provide a complete copy of the first principles estimate including all labour, plant, materials, rates of production, etc., along with the files used as the basis of risk calculations if requested by the Project Officer Estimating Services*)
- EST 600-3 [KNet #5751723](#). For estimates at Levels 2, 3, 4, 5 & 5B where prepared by DPTI staff
- EST 600-3 FS [KNet #5849068](#). For estimates prepared by DPTI Field Services (FS) staff at Levels 2, 3, 4, 5 & 5B of projects which involve predominately road works. (*Note: this format allows project managers/planners to utilise estimates prepared by FS and apply additional costs associated with aspects of the project which are not covered by FS. Typically this relates to costs associated with project management, land acquisition and works undertaken by service authorities. In addition to this a range based deterministic assessment of risk is also applied to provide equivalent P50 and P90 estimates. This format contains additional tabs to those otherwise detailed within this appendix*)
- EST 600-8 [KNet #9683206](#). Used for recording actual project costs (Level 6) and comparing these with estimates, further details regarding the use of this template can be found in section 2.2.4

Each of the Standard Estimate Spreadsheets consists of several ‘tabs’ (worksheets). The following tabs are included in the spreadsheets and require input by the estimator (*Note: the inclusion of tabs varies between spreadsheets, not all tabs exist in each spreadsheet*):

- Formal Estimate
- Cover Sheet
- Scope, Risk, Calculations – All Options
- Scope, Risk and Methodology
- Summary Sheet
- Calculation Sheet
- Inherent & Contingent Risk – Option X (Road)
- Inherent & Contingent Risk – Option X (Rail)
- Inherent & Contingent Risk – Option X (Marine)
- Contingent Risk Table

*Note: The tab titled ‘Formal Estimate’ is completed by the project manager/planner and no entries are required from the estimator*

The requirements for completing each tab are detailed as follows:

### **Formal Estimate**

Project managers/planners are required to complete this form in accordance with Appendix 8. DPTI staff preparing estimates should complete this form as part of preparing the estimate. Estimating consultants are not required to enter any details on this form

### **Cover Sheet**

Common to all estimates regardless of estimate level or estimator, the Cover Sheet requires estimators to enter the following details:

- **Estimate Number** – enter the estimate number as provided on the Work Order (or as otherwise provided by the Project Officer Estimating Services) adjusting the options number and revision number as necessary. The revision number is to be updated for each subsequent revision and all revisions must be issued to DPTI. A detailed description of the numbering convention to be applied is included in Appendix 4 (entry is automatically transferred to other worksheets)
- **Project Name** – enter the project name using words identical to those which have been provided on the Estimating Work Order to allow the project to be consistently recorded and tracked (entry is automatically transferred to other worksheets)
- **Date Prepared** – enter and update this cell to reflect the date of the current estimate revision. Where estimate revisions occur over a period of time it is the responsibility of the estimator to ensure that all rates used within the estimate are current (entry is automatically transferred to other worksheets)
- **Project / Task** – enter the Project / Task number that has been provided on the Estimating Work Order (entry is automatically transferred to other worksheets)
- **KNET No.** – once the estimate is received and saved to the DPTI's document management system (KNet), the Project Officer Estimating Services will enter the relevant KNet file and version number in this cell to facilitate future internal identification and retrieval of the estimate. The entry in this cell (#XXXXXXXXX (*Version #X*)) is to be retained by estimating consultants
- **Estimate Level** – indicate by placing an 'x' under the appropriate level description. This entry varies the estimate type as detailed in the top row of the tab (the resulting entry is automatically transferred to other worksheets)
- **Basis** – unless otherwise requested this should remain as the 'Cost to Complete (CTC)'. Occasionally project managers/planners will require previous expenditure to be realised (requiring them to provide details of the relevant items and values), for these estimates this entry is to be updated to 'Total Project Cost'. In the case that only an estimate of construction costs (i.e. sections 4 and 5) are required this entry is to be updated to 'Remaining

Construction Cost Only'. For Strategic Options Estimates 'Total Project Cost' shall be used.

- **Year \$ Values** – shows the current year to indicate the base estimate date for future escalation considerations. This cell is automated based on the 'date prepared' previously entered above
- **Option & Brief Description** – enter the option number and brief description as detailed on the work order, option numbers should align with those shown on the relevant drawings. These entries are automatically transferred to each of the relevant summary and calculation tabs in order to provide clear detail as to which option they represent. Where new tabs are added relevant formulas will need to be adjusted within individual tabs to detail the relative option number and title
- **Review Information** – all estimates are to be reviewed in accordance with the process described in the Estimate Review Process as detailed in Appendix 7. Following completion of their roles within this process estimators and reality checkers are required to complete each of the relevant cells prior to the estimate being submitted. Likewise the Project Officer Estimating Services and the project manager/planner will also enter their details following their review of the estimate. Reviews are to be completed for each estimate revision and the review dates amended to reflect this on each occasion
- **Revision Status** – for each revision of the estimate a revision number, the date of the revision and a clear description of what the revision involved is to be recorded

### **Scope, Risk, Calculations – All Options**

Applicable to Level 1 estimates only, the Scope, Risk, Calculations – All Options tab requires Estimators to complete the following details:

- **Project Objectives** – detail the key objectives of the project
- **Project Scope** – the estimator is required to clearly detail the anticipated project scope including details such as the anticipated project length, number of lanes, anticipated land and services impacts, extent of any structures (e.g. bridges, tunnels etc.) and the like
- **Project Assumptions** – record details of all assumptions made in the development of the estimated cost
- **Project Exclusions** – record details of all project exclusions, estimators should note that all items identified as being necessary in the completion of the project are to be included in the estimated cost. It is not appropriate to exclude components of the work such as services or land acquisition.
- **Basis of Cost Advice** – estimators are to enter details of the costs used as the basis of the high level rates applied to the estimate. Typically these will be

values benchmarked from previous project estimates or actual costs with these adjusted to account for site specific variances, cost escalation and the like

- **Strategic Cost Advice for Project** – this is the main area in which costs are developed, typically this will include \$/m2 or \$/km rates applied to components relative to the current project
- **Addition of Inherent & Contingent Risk** – using either the ‘Inherent – Contingent Risk (Road) Option X’, ‘Inherent – Contingent Risk (Rail) Option X’ OR ‘Inherent – Contingent Risk (Marine) Option X’ tab, the estimator is to apply percentages within Column I for each of the risk items based on their level of confidence and reliability in the information used as the basis of the estimated cost
- **Anticipated Construction Cash Flow** – the estimator is required to enter annual estimated annual cash percentages, with these percentages forming the basis of values used on the calculation of escalation values in the following section
- **Addition of Escalation** – no entries are required by the estimator, these values are determined by the escalation rates applied in the following section
- **Escalation Rates** – escalation rates are to be entered using those found within [KNet #4624055](#). Estimators should note that where projects are anticipated to include Federal Government funding that alternative rates will apply, these alternative values can be found within the same document

### **Scope, Risks & Methodology**

Applicable to Level 2, 3, 4, 5 & 5B estimates only, estimators are required to complete the following details within the Scope, Risks & Methodology tab:

- **Reference Documentation** – copy and paste the details of reference documentation from the Work Order. Where additional documentation is provided during the course of completing the estimate, including subsequent revisions, details of such information must also be recorded
- **Client Description of Scope as Provided on the Work Order** – cut and paste details of the scope as provided on the Estimating Work Order. Where a work order is not provided estimators are required to enter ‘Not Provided – estimators understanding of project details is as follows’ prior to them entering details regarding the overview, objectives, performance criteria etc. as would otherwise typically be provided via the estimating work order. Where this occurs those preparing the estimate are responsible for sourcing the relevant details for inclusion in the estimate file
- **Estimator’s Record of Additional scope information resulting from the Estimate Commencement Meeting** – record details of specific scope information obtained at the Estimate Commencement Meeting. Typically this will result from the estimator requesting items of information which had not been previously identified or provided

- **Estimator’s Methodology, Assumptions, Risks, Opportunities and Exclusions** – for each of the options included in the estimate file, enter information specific to each of the headings provided. This section should be considered as providing the project manager/planner (and any others who may view the estimate) with a snapshot of key scope details, construction methodologies, durations, assumptions, risks and opportunities considered in the build-up of the estimate, along with specific exclusions and areas where additional detail would allow the estimate to be further refined.

Entries in this section should typically be taken directly from where they have been recorded in the calculation tab(s), with these entries tailored to them being read as part of this page

### **Summary Sheet**

Applicable to Level 2, 3, 4, 5 & 5B estimates only, the summary sheet is automated to record summary data from the calculation tab. Estimators **must not change** the format or names of standard items within this sheet. The format provided is intended to allow for internal benchmarking comparisons of project component costs and percentages with projects of similar type and magnitude.

With the exception of the indicative cash-flow which commences at row 106, this tab requires no input from estimators. For this section (row 106 onwards) all project values are to be assumed as occurring within Year 1 with the only exception being where the estimator determines that the project duration will exceed one year, in this case they are required to provide an indicative split of costs by year.

While estimating consultants will typically utilise their own formats when preparing cash flows, a cash flow template (EST 600-7 [KNet #12245240](#)) is available to paste within this tab with this format typically only used by project managers/planners who choose to prepare their own cash flows.

### **Calculation Sheet**

Applicable to Level 2, 3, 4, 5 & 5B estimates only, the calculation sheet is where items, quantities and costs are to be recorded by the estimator.

The estimate is built-up by identifying each of the items relevant to the project and including them within the appropriate section based on the DPTI standard work breakdown structure prior to the calculation of associated quantities and rates. In addition to this, low (or optimistic) and high (or pessimistic) ranging is applied to the identified quantity and rate for each line item of the estimate. A probability percentage is also assigned for contingent risk items (*Note: probability percentages are deemed to be 100% for all items in section 1 to 5*).

Appendix 6 details DPTI’s Standard Work Breakdown Structure which includes a comprehensive listing of items to be considered for each of the following sections contained in the Calculation Sheet.

- **Client Costs** – Client costs are those costs incurred by the department to conceptualise, develop, deliver and finalise a project. Costs include: staff

costs, engaged consultancy costs, some design costs, some insurances, some environmental costs, other client costs and the DPTI overhead charge

- **Land Acquisition** – Costs associated with the procurement and modification of land and property that are to be paid by the department
- **Services** – Services costs include costs associated with identification and relocation or alteration of infrastructure owned by public utilities which are procured directly by the department. Where service relocations are managed and/or undertaken by DPTI these are included at section 3.0, where they are undertaken as part of the head contract or as a separate early works contract these are included within section 4.3 of the construction costs to ensure that appropriate contractor overheads are also applied
- **Construction Costs (Direct costs)** – Construction costs include the direct cost of labour, plant and materials required to complete each activity, sub-activity or task associated with the construction component of the project
- **Contractor's Preliminaries & Supervision (Direct and Indirect costs)** – Contractor preliminaries & supervision include allowances for the indirect job costs that contractor's require to manage and supervise the project. Where the project requires contractors to undertake design (e.g. design and construct, alliance type contract) these cost are also recorded within this section
- **Risk and Contingency** – Includes items for both inherent and contingent risks applicable to the scope of work considered within the project estimate.

Estimators should note that all estimates are to be prepared exclusive of GST.

### **Inherent and Contingent Risk Table**

The inherent and contingent risk tables (Road, Rail, Marine) are provided for use in Level 1 estimates only. Details regarding the use of this table are included within the above Scope, Risk, Calculations – All Options section. Additional details can also be found within Section 2.8.1 of this manual.

### **Inherent and Contingent Risk Output**

The inherent and contingent risk output tab is provided for estimates completed by estimating consultants for level 2, 3, 4, 5 and 5B estimates only. Estimators are required to paste a screen shot of the output which results from their probabilistic risk assessment software.

Estimators should note that all inputs used to generate the resulting risk values are to be retained for future estimate revision and review requirements.

## Appendix 6 – Standard Work Breakdown Structure Items and Content

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The following work breakdown structure is to be used by estimators when determining the allocation of all estimate items for DPTI estimates.

### Section 1 – Client Costs

Client costs are to be developed using a first principles approach which considers the number, duration and subsequent cost of DPTI staff and any consultants that are likely to be associated with the completion of tasks relevant to each of the client cost activities listed against items 1.1 to 1.6 below.

To assist in the preparation of these costs using first principles the following template has been developed: EST 600-5 First Principles Client Costs Estimate ([KNet #5729453](#)).

Client cost phases are defined as follows:

#### Scoping Phase

Scoping phase costs are those incurred during the investigation of specific project options which lead to the identification of the preferred project option(s) and P50/P90 estimate(s) in out-turn dollars against a proposed time-frame for their delivery. The work completed during this phase concludes with the preparation of a successful Business Case which typically represents the preferred option.

Estimators are to consider these costs as those incurred in developing projects and their estimates through levels 2, 3 and 4.

*Note: Estimates at level 1 are typically completed by internal staff considering strategic initiatives during the initialisation phase, with these estimates based on very limited project detail.*

*Note: For all estimates, costs associated with the scoping phase are typically not included unless they are project specific, can be readily applied to the total project cost and will be incurred or are necessary to be recovered in completion of the project.*

#### Development Phase

Development phase costs are those costs associated with detailed planning (environmental approvals, land acquisition, community consultation etc.) and design (field studies, preliminary detailed design, estimates etc.) to develop and finalise the preferred/approved project option resulting from the successful Business Case to the point where tenders can be called for its delivery.

The final estimate is to be based on the fully completed design (Construct Only contracts) or to a reasonable preliminary stage (Design and Construct, Early Contractor Involvement, Alliance type contracts).

Estimators should typically consider these costs as those incurred in developing projects and their estimates through levels 5, 5A and 5B.

## Delivery Phase

Delivery phase costs represent those associated with selection and appointment of a construction contractor along with the construction and handover of the completed project. This phase may include preliminary works (e.g. relocation of services, road network upgrades etc.) that may proceed the main contract.

Client cost activities include, but are not limited to the following:

### 1.1 Scoping Phase - Project Management

- Mobilisation / Demobilisation of People
- Project Administration
  - Project Manager
  - Project Engineer
  - Services Engineer
- Community Liaison
  - General Communications
  - Forum Facilitation
  - Presentation Materials
- Management Support Activities
  - Document Control System – Fixed Costs
  - Document Control System – Monthly Hosting Fees
  - Document Controllers
  - Risk Workshop Facilitation and Venue Costs
  - Construction Methodology Workshop Facilitation and Venue Costs
  - Request for Price / Tender Workshop Facilitation and Venue Costs
  - Value for Money Workshop Facilitation and Venue Costs
  - Project Audits
  - OH&S Activities (advice, audits, inspections etc.)
- Consultant Fees. Applicable to any services provided by consultants (if by DPTI staff included at 1.10), including but not limited to:
  - Contract Management
  - Contract Administration
  - Environmental Assessment and Approval
  - Estimating Consultants
  - Constructability Consultants
  - Programming/Scheduling Consultants
  - Construction Verification
  - Community Consultation
- Fees and Approvals
  - Project Fees
  - Legal Fees
  - Commissioning and Handover Costs



## **1.2 Scoping Phase – Design & Investigation**

- Consultant Fees. Applicable to any services provided by consultants (if by DPTI staff included at 1.10), including but not limited to:
  - Planners
  - Specialists
  - Investigations
    - Traffic Counts and Data
    - Traffic Modelling
    - Boundary Survey
    - Engineering Survey
    - Identification of Services
    - Vegetation Survey
    - Environmental Assessment
    - Structural
    - Geotechnical
    - Pavement Testing and Design
    - Hydraulic
    - Property Section Costs
  - Design Verification
  - Road Safety Audits

## **1.3 Development Phase – Project Management**

See items under 1.1 Scoping Phase – Project Management

## **1.4 Development Phase – Design and Investigation**

See items under 1.2 Scoping Phase – Design and Investigation

## **1.5 Delivery Phase – Project Management**

See items under 1.1 Scoping Phase – Project Management

## **1.6 Delivery Phase – Design and Investigation**

See items under 1.2 Scoping Phase – Design and Investigation

## **1.7 Principal Arranged Insurance and Levies**

1.7.1 Principal Arranged Insurance: This figure represents a levy which is charged to the majority of the department's construction projects to recover the costs associated those insurances which are provided by the Principal.

Estimators will be required to calculate a value for Principal Arranged Insurance based on a cent per dollar amount (as provided by the Project Officer Estimating Services) which is applied to the Section 2.4 (Property Modification), Section 3 (Services), Section 4 (Construction Costs) and Section 5 (Contractors Preliminaries & Supervision) costs. This figure is revised annually by the Procurement and Contracting Section.

As described within the policy documents, Principal Arranged Insurances are deemed to indemnify DPTI against the legal liability to pay damages or compensation in respect to:

### Construction Costs - Public Liability

- Death
- Personal Injury
- Property Damage
- Advertising Injury

Sustained as a result of an occurrence within the Territorial Limits in connection of the Business:

- During the construction period or defects liability period in respect of the insured operations;
- During the period of insurance in respect of the insured services; and/or
- During the period of insurance in respect of the insured products and/or completed operations

In addition, insurers will pay defence and other costs

Additional insurance costs apply for projects where:

- the estimated contract value exceeds \$200,000,000;
- for tunnelling Contracts, the estimated contract value exceeds \$5,000,000; or
- the original estimated construction period for the contract exceeds 36 months

### Construction Risks – Material Damage

Provides insurance for:

- Contract Works – property of every description used or to be used in part of or incidental to the insured operations. Includes, but is not limited to:
  - the whole of works whether permanent or temporary, structures, materials and supplies
  - temporary buildings, all other project buildings and their contents
  - formwork, falsework, scaffolding, access platforms, hoardings, mouldings and the like whether consumable or reusable
  - consumables, drawings and other documents

But excluding:

- construction plant and equipment and existing property not specified above AND all construction plant, tools and equipment of every description including spare parts, employees tools, equipment and personal property at a worksite
- existing structures – existing buildings, structures, plant, contents and real property of every description situated at a worksite

Additional insurance costs apply for projects where:

- the estimated contract value exceeds \$200,000,000;
- for bridge contracts, the estimated contract value exceeds \$30,000,000;
- for tunnelling contracts, the estimated contract value exceeds \$5,000,000;
- for wet civil contracts, the estimated contract value exceeds \$15,000,000; or
- the original estimated construction period for the contract exceeds 36 months

1.7.2 Project Fees and Levies: Costs associated with the payment of fees or levies to other State or Local Government bodies (or similar) are to be included within this section.

## 1.8 Environmental Assessment

DPTI projects are required to be assessed for potential environmental impacts in accordance with Environmental Approval Procedures, Environmental Instruction 21.1 ([KNet #1645388](#)). Those responsible for implementation of a project are required to ensure that an Environmental Impact Assessment has been undertaken and that all necessary approvals have been obtained.

Environmental Impact Assessment (EIA) is a process for the orderly and systematic evaluation of a project, including its alternatives and objectives and their effect on the environment, including the mitigation and management of those effects. Environmental issues should be considered from the early concept development stage through to detailed planning and design, delivery, handover and where appropriate, decommissioning phases of the project.

Estimated costs for environmental assessment and approvals are typically prepared by the department's Environmental Planning Section at the request of the project manager/planner. This assessment will consider the costs associated with undertaking the tasks as listed under the following headings:

1.8.1 Environmental advice and coordination: Costs associated with seeking external environmental technical advice, coordinating the procurement of technical services and collating information which contributes to the Preliminary Environment Impact Report, Environment Impact Assessment or similar public documents. Development of Contract specific requirements and provide surveillance of environmental risks on site during construction

1.8.2 Vegetation: Identification and assessment of vegetation that will be impacted by the works in order to recognise and where necessary obtain approvals under State and Commonwealth legislation to remove and offset this vegetation

1.8.3 Contamination: The assessment of excess spoil for re-use onsite and/or offsite disposal against the requirements of the Environment Protection Authority

1.8.4 Landscape: Considers consultation with relevant stakeholders to arrive at an agreed design for landscape works to be delivered on site. *Note: Physical works (e.g. the supply of plants, planting, earthworks preparation, irrigation, water connection and maintenance) are to be included within section 4.15 Landscaping and Urban Design*

1.8.5 Noise/Vibration: Includes noise and vibration modelling to ascertain impact of the works along with preparation of mitigation plans. *Note: Physical measures undertaken as an outcome of these assessments and plans (e.g. house treatments, and monitoring of noise/vibration during construction) are to be included within section 4.1 Environmental Works. Another outcome of this assessment may be the selection of alternative asphalt pavement types, the cost of which will be allowed under relevant heading of 4.10 Bituminous Surfacing / Asphalt*

1.8.6 Air Quality: Typically only applicable to large scale projects. The assessment is only applicable if there are significant changes to traffic volumes, traffic composition, proximity to sensitive receivers and if the proposal includes the construction of a tunnel. The air quality assessment assess predicted air quality parameters and potential build-up of fumes against the National Environment Protection measures. Mitigation and control measures are to be considered within section 4.1 Environmental Works

1.8.7 Aboriginal Heritage: Includes obtaining legal advice in relation to Native Title and Aboriginal heritage matters, engaging a heritage consultant to assist with identification of high risk areas, the preparation of a heritage management plan, facilitating consultation with traditional owners and obtaining approvals under the Aboriginal Heritage Act. Any on site requirements are to be included within section 4.1 Environmental Works

1.8.8 European Heritage: Includes the assessment of impacts, dilapidation surveys and obtaining statutory approvals prior to works commencing. Where necessary Environment, Protection, Biodiversity and Conservation (EPBC) referrals are also allowed for under this item

1.8.9 Water Quality: Considers the assessment of project impacts on water quality, identifies opportunities for incorporating stormwater sensitive design principles including treatment systems and the like. Costs associated with the preparation of an erosion management plan and water quality monitoring are also considered under this item

1.8.10 Fauna: Includes the assessment of impacts on fauna, obtaining approvals for impacts on nationally protected species and mitigation through redesign and/or monitoring through delivery of landscape or payment of SEB offsets

1.8.11 Sustainability: Projects with a construction cost in excess of \$4 million (excluding GST) are required to be submitted to Public Works Committee and Cabinet for approval. A Sustainability Management Plan is required to be submitted as supporting documentation. Projects with an estimated construction cost over \$11 million (excluding GST) are required to be assessed using the Infrastructures Sustainability (IS) Tool which will include a once off registration fee

1.8.12 Climate Change: Includes assessing the climate change impacts on infrastructure in accordance with the Climate Change Adaptation Guidelines for Asset Management Guideline. Climate Change risk could result in change to types of materials used and design consideration from early planning stages (e.g. height of bridges, jetties and coastal projects)

Costs relevant to this section of the estimate are typically prepared using EST 600-6 Environmental Cost Estimating Tool ([KNet #9362850](#)).

## 1.9 Other Client Costs

The following additional costs may be experienced by some projects:

- Testing and Commissioning – generally applicable only to rail projects this includes costs incurred in commissioning and acceptance of the works which are in excess of those within sections 4 and 5
- Possession and Bussing – typically these are costs associated with the suspension of rail operations and supply of alternative travel arrangements (usually bussing) while construction works are undertaken

## 1.10 DPTI Overhead Charge

The DPTI overhead charging model provides a consistent approach to distributing overhead costs to all projects in line with the applicable policy mandating full cost recovery. Costs are allocated to works considered in scope based on a profile which is determined by the value of the project/program, type of works and its delivery methodology (Internal vs. External).

This charge covers the following staff and overheads which are inclusive of all associated project specific costs:

- Corporate Charges – accommodation, administration, finance, HR, payroll, procurement, executive, risk, media & communications, legal
- Plant – light vehicles and heavy plant
- Contract Management – including advice and all contract management services
- Technical advice from DPTI specialists, including:
  - Technical Services – Structures, Geotechnical, Drainage & Environmental
  - Rail Risk & Assurance
  - Road and Marine Assets
  - Programs & Concept Planning
  - Rail Infrastructure Maintenance & Management
  - Architecture & Built Environment
  - Traffic Operations

The DPTI Overhead Charge does not include any costs associated with services provided by external consultants, these costs are to be accounted for within relevant scoping, development and delivery phase items (1.1 to 1.6).

The DPTI Overhead Charge is the final cost calculated within the base estimate and uses a percentage which is applied in addition to all other base estimate items.

The applicable percentage is varied depending on the estimated P90 project cost and relevant financial year(s). These percentage rates are available from the Project Officer Estimating Services.

When applying inherent risk associated with this charge estimators are required to consider the potential fluctuations of this percentage in the same way as for other estimate items along with correlating its value to ensure that values assigned during risk simulations fluctuate relevant to the occurrence of quantities and costs for other estimate items.

## **Section 2 – Property Acquisition**

Estimated costs for the procurement of land/property are typically provided by DPTI's Acquisition Services group who engage the Office of the Valuer General (OVG) who either undertake or engage external consultants to undertake these valuations. On occasions valuations may be completed by the Acquisition Services group and endorsement sought from the OVG.

All acquisition estimates are to be sought by the relevant project manager/planner who will be required to adequately detail their requirements including the extent of project impacts and the desired acquisition type (partial or full). In requesting these estimates project managers/planners are to seek a detailed breakdown of the resulting estimates to aid their assessment of:

- Scope, including any particular inclusions and/or exclusions
- Property modification items
- Contingency values, to ensure that these values are not duplicated in the overall assessment of risk values within other sections of the estimate
- The overall reasonableness of the values provided

Items to be assessed for inclusion within the estimate are as follows:

### **2.1 Property Purchase Costs**

- Purchase costs associated with the purchase of property (typically detailed as the market or land value within DPTI property estimates).

Importantly project managers/planners and estimators should note that income gained through the sale of land is not typically credited to the project; rather these funds are returned to general government revenue and therefore are not to be considered as credits to the estimated project cost unless otherwise directed.

### **2.2 Transaction, Legal and Other Costs**

- Disturbance costs
- Severance
- Injurious affection
- DPTI legal and valuation costs
- Owner legal and valuation costs
- Tenant legal and valuation costs
- Out of pocket expenses
- Stamp duty
- DPTI coordination costs (management, administration)
- Ongoing operating costs (e.g. Council rates, Government levies, utility services fees)

### **2.3 Business Compensation Costs**

- Owner compensation costs
- Business/tenant compensation costs
- Business relocation costs

## **2.4 Property Modification**

- Accommodation works
- Building works associated with partial acquisition properties
- Property boundary modifications (including the upgrade of boundary fencing, associated retaining walls and the like to adjoining properties) where completed by DPTI/outside of the construction contract (otherwise include within 4.13)

Estimators should be aware of the need for the potential for modifications to existing properties that may be in excess of those considered within the acquisition cost estimate items and make appropriate additional allowances.

Where land acquisition estimates incorporate items such as those shown above, estimators should review these values to ensure their concurrence with the figures prior to applying them to the estimate.

Costs associated with works which are likely to be completed by the head contractor (or their sub-contractors) are to be included in relevant sections of the estimate. Examples of this include:

- Demolition of residential or commercial property, section 4.4 Earthworks and Demolition
- Construction of noise walls, section 4.1 Environmental Works

## **Section 3 – Services (By DPTI)**

The presence and costs associated with any required service relocations or alterations will typically involve, but is not limited to one or more of the following services:

### **3.1 Electricity (SAPN etc.)**

- Identification of applicable services (potholing etc.)
- Design of applicable service relocations
- Relocation of applicable services
- Supply, installation and/or modification of SAPN lighting

### **3.2 Communications (Telstra, Optus, NBN etc.)**

- Identification of applicable services (potholing etc.)
- Design of applicable service relocations
- Relocation of applicable services

### **3.3 Gas (Origin, APA etc.)**

- Identification of applicable services (potholing etc.)
- Design of applicable service relocations
- Relocation of applicable services

### **3.4 Water and Sewer (SA Water etc.)**

- Identification of applicable services (potholing etc.)
- Design of applicable service relocations
- Relocation of applicable services

- Raising of top stones

### **3.5 Other Services**

- Identification of applicable services (potholing etc.)
- Design of applicable service relocations
- Relocation of applicable services

The service authorities detailed above should not be considered as an extensive list of those which may be impacted or affected. Estimators are required to identify and record costs associated with relocations or alterations to the infrastructure of any other service providers relevant to the project and record them within the relevant sections above. The disconnection of existing services to acquired and/or modified properties are to be included under each relevant section.

Service works are at times completed or managed by the department separately to the main construction contract and hence are considered outside of the main construction cost (sections 4 and 5). Any service works which are anticipated to be completed as either part of the head construction contract or through a separate early works contract are to be included within section 4.3 Services (by Contractor) so that appropriate contractor overheads and margin costs are realised.

*Note: As an exception to the above, where service works are to be completed as a separate early works contract it may be appropriate to include relevant items at 4.3 and make them inclusive of overheads so as to retain an anticipated head contract value within sections 4 and 5. Where this applies items are to be clearly detailed as being anticipated to be procured in this manner.*

Where temporary service relocations are required these costs are to be clearly detailed under relevant service headings, this is most likely to occur within section 4.3.

*Note: Costs associated with road lighting and traffic signals are considered elsewhere (see sections 4.14 Lighting and 4.16 Traffic Signage, Signals and Controls respectively), while costs associated with rail electrification, signalling and communications are included with relevant sections of section 4.17 Rail.*

## **Section 4 – Construction Costs**

The following section defines items that may be considered within each of the standard direct cost items. Items include, but are not limited to:

### **4.1 Environmental Works**

- Preparation and implementation of Environmental Management Plan
- Temporary and permanent environmental controls (e.g. silt fencing, retention, detention and sediment basins, containment structures etc. and their maintenance)
- Provision of fauna habitats, underpasses, overpasses, culverts/tunnels, rope crossings, poles and the like
- Noise, vibration, water quality monitoring etc.
- Dilapidation surveys



- Construction of noise walls and/or mounds
- Noise attenuation to properties e.g. double glazing, additional insulation etc.

## 4.2 Traffic Management

- Preparation of Traffic Management Plan
- Provision and maintenance of temporary traffic controls (road, rail, pedestrian) for the duration of project
- Temporary variable message signs
- Temporary barriers
- Temporary covered pedestrian walkways
- Maintenance of property accesses

*Note: Costs associated with temporary items relevant to other sections are to be included within these accordingly, e.g. temporary asphalt pavements within 4.10, temporary pavement marking within 4.12, temporary lighting 4.14*

## 4.3 Services (by Contractor)

Where service relocations are to be undertaken by the head contractor relevant costs are to be included at item 4.3 to ensure the addition of contractor overheads and margin applicable to these works. While the exact nature of the works to be undertaken prior to the main contract (to be included within section 3.0) or as part of the main contract (to be included here) will become clearer as the project develops, along with the need for any temporary service relocations, estimators are to make reasonable judgement as to how service relocations will be procured when assigning service items within their estimates.

Services items are to be included using the same format as for section 3.0 Services (by DPTI), being:

- 4.3.1 Electricity
- 4.3.2 Communications
- 4.3.3 Gas
- 4.3.4 Water/Sewer
- 4.3.5 Other

## 4.4 Earthworks and Demolition

- Demolition and disposal costs (including those associated with temporary works)
- Demolition of acquired properties, residential and/or commercial (including temporary fencing, block slashing, security etc.)
- Clear and Grub
- Tree Removal
- Saw cutting
- Topsoil Strip
- Bulk Earthworks, such as excavate / fill (cut to fill, import to fill, cut to spoil, cut to stockpile, material disposal and/or purchase costs, borrow pit establishment and subsequent rehabilitation etc.)
- Detailed Earthworks, such as pavement box out
- Ground improvements including stabilisation, impact rolling and pre-loading activities

- Trimming of sub-grade
- Proof rolling and repairs to unsuitable sub-grade
- Removal of rock
- Dewatering
- Contamination testing and treatment
- Compaction testing
- Material testing
- Formation of batters and trimming
- Provision and/or respreading of topsoil
- EPA Licences

#### **4.5 Retaining Walls**

- Demolition or adjustment of existing retaining walls
- Temporary retaining structures
- Reinforced earth and soil nailed walls, including detailed excavation and backfill
- Cantilever walls, including detailed excavation and backfill
- Crib or interlocking walls, including detailed excavation and backfill
- Post and panel walls, including detailed excavation and backfill
- Diaphragm walls, including detailed excavation and backfill
- Shotcrete including all preparation, reinforcement, placement etc.

#### **4.6 Drainage**

- Removal/demolition of redundant and temporary drainage items
- Temporary drainage items
- Box and pipe culverts, including excavation
- Headwalls
- Drainage Structures
- Gabion matting/outfall structures
- Gross pollutant traps
- Specific filter layers (excluding where part of a pavement design)
- Kerbing (all types)
- Driveway Crossovers
- Spoon Drains
- Pedestrian ramps
- CCTV inspections of drainage network

#### **4.7 Bridges**

All (road, rail, pedestrian etc.) bridge construction activities for all methods, not limited to:

- Temporary Works: Edge protection barriers, scaffolding, substructure works: foundation systems/piling, pile caps, piers
- Mobilisation / demobilisation of specialist bridge construction equipment
- Earthworks: Detailed excavation, backfilling, disposal of excess spoil
- Reinforced Earth Walls: Strip footing, facing units, capping beam, backfill, monitoring instrumentation
- Piling: Piles by type, diameter and length

- Cast In Situ Concrete: For each of the abutments, pile caps, piers, deck, approach slabs, wing walls, headstock and other items, where applicable specify details of blinding, concrete, reinforcing, formwork, jointing, block outs and the like
- Structural Steel: Girders, throw screens, handrails, barriers, walkways
- Bridge Deck Surfacing: By type and thickness
- Bridge Lighting: Road, pedestrian and feature lighting components
- Other Bridge Items

*Note: For projects with more than one bridge pricing of each bridge is to be provided separately*

#### **4.8 Tunnels**

All tunnel construction activities for all methods, not limited to:

- Demolition or adjustment of existing tunnels
- Mobilisation / demobilisation of tunnelling equipment
- Excavation and support
- Tunnel linings
- Tunnel drainage
- All finishing works including pavements, architectural linings, barriers, signage, markings etc.
- Cross passages
- All tunnel services including fire and life safety, lighting, ventilation, maintenance systems etc.
- Ventilation structures and equipment
- Control buildings and tunnel control systems

*Note: For projects with more than one tunnel pricing of each tunnel is to be provided separately*

#### **4.9 Pavement**

- Temporary Pavements
- Working Platform
- Unbound Sub-base Layers
- Unbound Base Layers
- Cement stabilisation
- Compaction testing

#### **4.10 Bituminous Surfacing / Asphalt**

- Temporary Spray Seal / Asphalt
- Prime
- Spray Seal
- Bound Asphalt Sub-base Layers
- Bound Asphalt Base Layers
- Asphalt Levelling Courses
- Asphalt Wearing Courses
- Plane and Reinstatement
- Profiling

- Crack Sealing
- Testing

#### **4.11 Secondary Pavements**

- Temporary secondary pavement items
- Footpaths and cycle ways (concrete, asphalt, paved including temporary provisions and base course layers)
- Tactiles
- Provision of new/alteration of existing property accesses and driveways
- Median islands (including concrete or rubble infill)
- Concrete roundabout annulus (including base course layers)
- Concrete bus bays (including base course layers)

#### **4.12 Pavement Marking**

- Removal of existing markings and associated devices
- Temporary markings including removal as necessary
- Longitudinal markings: lane lines, edge lines, barrier lines, clearway lines etc.
- Transverse markings: chevrons, arrows, symbols, messages, rail box hatchings etc.
- Coloured lane markings (e.g. green bikeways, red bus lanes)
- Kerb painting
- Raised Pavement Markers
- Pavement Bars
- Audio tactile line marking

#### **4.13 Road Furniture**

- Removal/demolition of road furniture items
- Guardrail and associated terminals, box beams, structural transitions and the like
- Bus stops/shelters (new, relocation, modification)
- Bins and shelters
- Pedestrian fencing
- Fencing (where completed by the construction contractor, otherwise include within 2.4)
- Rest area and/or street furniture and amenities
- Bike storage areas (unless associated with rail station)
- Car park wheel stops
- Temporary road furniture

#### **4.14 Lighting**

- Demolition of existing lighting infrastructure, removal or filling of existing conduits
- Temporary lighting
- Light pole footings
- Single, double and quad outreach poles
- Luminaires

- Lighting connected to SAPN poles (brackets, luminaires), *Note: where SAPN tariff these are to be included at 3.1 or 4.3.1*
- Pedestrian lighting
- Feature lighting
- Ducting/conduit
- Pits
- Switchboards
- Testing and commissioning of lighting

#### **4.15 Landscaping and Urban Design**

- Landscaping/revegetation (trees, grasses, shrubs, turf etc.)
- Minor earthworks/formation works associated with landscaping
- Landscaping soils
- Watering systems
- Mulching
- Staking of trees
- Erosion control of landscaping works
- Landscape drainage, including associated subsurface drainage
- Seed collection
- Propagation and nursery storage
- Public art
- Maintenance of plantings (e.g. weed control, watering etc.) and hard elements (e.g. graffiti removal) for a given period of time after construction, including traffic control, access equipment, safety requirements etc. as necessary

*Note: Where landscaping and urban design costs occur beyond the duration of the main contract estimators are required to consider and make adequate allowances for the requirements and subsequent costs associated with the provision of additional traffic control and/or service locations which may be required*

#### **4.16 Traffic Signage, Signals and Controls**

- Removal of existing signage, signals and controls
- Temporary signage, signals and controls
- Road signage
- Wayfinding signage
- Guide posts
- Bollards
- Pedestrian/cyclist holding rails
- Traffic signals (all types, components etc.), signal poles, and associated infrastructure
- Ducting
- Loops
- Gantries
- Intelligent Transport Systems
- Permanent Variable Message and/or speed limit signage
- Permanent lane status signage
- CCTV (unless specific to rail, see 4.17.5)
- Red light cameras

- Testing and commissioning of traffic signals and controls

## **4.17 Rail**

Items included under this heading are to be included using the following standard structure. In determining scope and developing costs particular consideration is to be given to limitations associated with site access and timing constraints, the impact of works of existing timetables/scheduling, specialist knowledge (e.g. signalling and communications)

### **4.17.1 Trackwork**

- Removal and disposal of existing rail track
- Temporary track
- Slewing or adjustment of existing rail track
- Rail track complete, including ballast, sleepers, rail, rail fittings, track laying, tamping and grinding
- Acoustic rail track, including associated track slab, acoustic or vibration track fittings, track laying, grinding
- Track turnouts, crossovers, actuators, check points, associated with the rail installation
- Buffer stops including sliding friction, hydraulic and fixed stops

### **4.17.2 Overhead Wiring and Poles**

- Removal of existing wiring and poles
- Temporary overhead wiring and poles
- Overhead traction power wiring, including all associated support structures, catenary wiring and power supply
- Trackside posts, gantries and fittings associated with the support of overhead wiring
- Catenary and power wiring and associated tensioning systems within or outside of tunnels
- Transformers, switchgear, insulators, earthing, bonding, registration equipment
- Undertrack crossings for overhead wiring installation

### **4.17.3 Power Supply and Distribution**

- Removal of existing power supply and distribution items
- Temporary power supply and distribution items
- Incoming raw power supply to sub-stations
- Substations
- High and low voltage power distribution along corridor
- Transformers for supply to overhead wiring
- Trackside installations associated with Power Distribution

### **4.17.4 Signalling**

All signalling and cabling and associated activities, including but not limited to:

- Removal of existing signalling items
- Temporary signalling items

- Signal Plans, Control Tables and design directly associated with signalling
- Mechanical and civil works where associated with signalling installation, including the services route where solely for signalling
- Control systems, automatic trail protection and control
- Interlocking
- Trackside installations associated with Signalling, including location cases, track circuits, axle counters, signal posts and signals, compressed air systems, ground frames, under track crossings, and other line side items
- Signalling power supply from substation or transformer
- Signal boxes and buildings

#### **4.17.5 Rail Communications**

- Removal of existing communications items
- Temporary communications items
- Public address systems
- Closed circuit television (CCTV)
- Passenger information systems
- Precise clocks
- Train radio
- Telecommunications systems (e.g. mobile phones, data and radio broadcast)
- SCADA
- Trackside installations associated with Rail Communications

#### **4.17.6 Combined Services Route**

- Removal of existing combined services route items
- Temporary combined services route items
- Excavation, backfilling, conduits, pits and markers to provide a trunk route for a range of rail services

*Note: If the route is solely for one service, e.g. signalling, the cost of this route is included in 4.14 Signalling.*

#### **4.17.7 Stations, Interchanges, Buildings, Stabling and Maintenance Facilities**

- Removal of existing stations, interchanges, buildings, stabling and maintenance facilities
- Temporary stations, interchanges, buildings, stabling and maintenance facilities
- Above ground stations including all associated components (platforms, vertical transport etc.)
- Below ground stations including all associated components (in particular excavation and support)
- Transport Interchanges, including structures, road pavements, lighting, vertical transport, signage etc.
- Car parks (at grade and multi-level), complete including associated access roads, controls, entry/exit boom gates etc.

- Rail Administration Buildings
- Stabling Buildings
- Maintenance facilities
- Cleaning facilities
- Driver amenities
- Public amenities
- Ticketing systems
- Bike storage lockers / buildings
- Other related buildings

*Note: for each building type, a further elemental breakdown is required (e.g. foundations, structure, façade, roof, building services etc.).*

#### **4.17.8 Commissioning and Handover**

- Testing and commissioning of component and integrated systems
- Overall commissioning of the integrated systems
- Handover of completed facilities
- Training of operators and management
- Accreditation costs associated with regulatory approval

#### **4.17.9 Rolling Stock**

- Design, procurement, commissioning and delivery of rolling stock

#### **4.17.10 Other Rail Specific Works**

- Alternative commuter costs (e.g. bus substitute costs where not provided by the Principal/included at 1.9, network upgrades to facilitate temporary passenger movements)
- Other rail specific items which cannot reasonably be included within one of the previous rail sections

#### **4.18 Other**

Works associated with buildings and marine type items are to be included within this section. With the exception of these, items should only be included in this section if they cannot reasonably be included as part of one of the previous WBS sections.

### **Section 5 – Contractor’s Preliminaries & Supervision**

#### **5.1 Design (by Contractor)**

This section of the estimate will typically only be required to be used where works are to be undertaken using an alternative contract method which includes the provision of the design. Where applicable, estimators are to allow for all relevant design activities that are likely to form part of the contractors work. Inclusion within this section ensures the addition of contractors’ overheads and margin are applied to this component of the work.



## **5.2 Contractor's Overheads (On-site)**

Items such as (but not limited to) those listed below should be considered when calculating the value of Contractor's On-site Overheads:

### **5.2.1 Non-Recurring On-Site Overheads**

- Mobilisation of plant, equipment and personnel
- Establishment of Site Facilities
- Provision of insurances, bank guarantee fees and other contract approvals
- Information management system
- CITB levy
- Industry levies
- Council permits and fees

### **5.2.2 Recurring On-Site Overheads**

- Project management, supervision and general site labour
- Consultant costs
- Community and stakeholder requirements and management
- General site vehicles, plant, equipment, scaffolding, small tools
- Site accommodation running, services and general expenses
- Communications – computer and IT costs, plan printing and copying, telephones, couriers, stationery
- Site security
- Site safety – protective clothing, safety signage, site inductions, drug and alcohol testing
- Survey costs

### **5.2.3 Demobilisation**

- Demobilisation of plant, equipment and personnel
- Dis-establishment of site facilities
- Site clean up
- Contract works maintenance

### **5.2.4 Industry and Workplace Participation and Skills Development**

- Industry participation planning and reporting
- Upskilling and training, including planning and reporting

## **5.3 Contractor's Overheads (Off-site)**

Items such as (but not limited to) those listed below should be considered when calculating the value of Contractor's Off-site Overheads:

- Head office costs
- Head office staff/administration

## **5.4 Contractor's Margin**

Accounts for the percentage of profit that contractors could reasonably be expected to assign to the costs associated with the project. In developing this percentage Estimators should take into consideration factors such as:

- Current market conditions
- The location of the project
- The size of the project
- Specific requirements of the project
- The number and type/size of contractors able to complete/likely to bid for the work etc.

*Note: Contractors off-site overheads and margin are typically applied as a percentage to all section 4 and 5.1 costs.*

## **Section 6 – Contingent Risks**

Estimators should be aware of the need to avoid optimism bias, as such ranging applied during the assessment of inherent and contingent risk should be both wide and biased towards the upside, i.e. a range of -10% and +20%.

### **6.1 Contingent Risk**

The value of contingent risk is determined by assessing items which have a less than 100% chance of occurring. Whilst not compulsory, the following five categories provide a guide to the types of contingent risks that may be considered.

#### **6.1.1 Design Development**

- Includes increased costs resulting from a greater scope of work being required than that which was identified during the previous project phases in order to meet previously stated performance requirements, often due to a lack of investigation, geotechnical and survey work
- Design changes resulting from actual site conditions
- This category includes 'scope creep'

#### **6.1.2 Third Party Influences**

- Includes requirements of service authorities such as them imposing unexpected changes during the course of the project, delayed relocation works, unknown services identified during construction which require protection or alteration
- Failure in relationships between joint venture partners, contractors/subcontractors
- Market issues such as skilled labour shortages, supply/demand issues
- Community issues such as expectations not being met, impacts on/severance of local road networks, failure to identify special interest groups, impacts on local businesses, complaints lead to reduced working hours. Project requirements may also vary based on community consultation outcomes.

#### **6.1.3 Policy and Standards**

- Includes changes to the design and management requirements mandated by the department through ongoing improvements in safety, and whole-of-life considerations
- Changes arising from safety audits

#### **6.1.4 Performance and Functionality**

- Increased requirements such as traffic capacity, axle loads, design speed, etc., compared to what was originally described in project definition
- Additional works to meet desired project outcomes as a result of these objectives not being clearly defined
- Changes under this category should not be considered as 'scope creep'

#### **6.1.5 Other**

- Contingent risks which cannot be attributed one of the above headings are to be included and described in this section.

### **Section 7 – P50 & P90 Risk and Contingency**

Values determined during the risk assessment are presented in the following sections

#### **7.1 P50 Inherent & Contingent Risk**

- Include P50 value as calculated

#### **7.2 P90 Inherent & Contingent Risk**

- Include P90 value as calculated

### **Further Estimate Considerations**

In developing estimates estimators should also consider the following:

#### **Cost to Completion (CTC), Total Project Cost (TPC), Construction Cost Only (CCO)**

The majority of DPTI estimates will represent a 'Cost to Completion (CTC)', recognising only those costs which are yet to be incurred to complete the project, with previous expenditure often not being included. Where a 'Total Project Cost' is to be developed project managers/planners are required to provide details of all relevant previous expenditure for inclusion within the relevant section of the estimate, with estimators to detail these items as having already been incurred. On occasion an estimate of construction costs only (i.e. sections 4 and 5) will be required, this should only occur where specifically requested by the project manager/planner.

#### **Principal Supplied Items**

Although uncommon and typically only applicable to Level 5 and 5B estimates, estimators are to ensure principal supplied items are recorded within the applicable section of the estimate and are labelled in a way that identifies them as being procured in this way.

Estimators are to ensure that other costs (e.g. transport, storage and the like) associated with principal supplied items are identified and included in the relevant section of the estimate and that these items are appropriately considered when assessing risk, client and contractor overheads and the like.

## Appendix 7 – Estimate Review Process

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All estimates, including any subsequent revisions are required to be reviewed prior to being submitted to the Project Officer Estimating Services and project manager/planner.

On each occasion as reviews are completed by those performing the roles below, the entry in the 'Check/Date' column of the Estimate Cover Sheet is to be recorded/updated to state that the following reviews have occurred.

### **Estimator**

Upon completion of the estimate the Estimator is responsible for checking all aspects of their work and entering their initials and the date in the check/date box on the Estimate Cover Sheet. Following this the estimate is to be forwarded to their Estimate Reality Checker for review.

### **Estimate Reality Checker**

The Estimate Reality Checker is to be a more senior and experienced staff member, typically from within the same organisation as the estimator. Their role involves providing an overall assessment of the estimate and a peer review of the estimated cost for the given scope of work/project.

It is expected that at a minimum the Reality Checker will review and check the following items prior to submission of each revision of the estimate:

- Estimate is presented in the correct format and is consistent with this manual
- All required sections of the Scope, Risk & Methodology tab (or equivalent in Level 1 estimates) have been completed including the transfer of reference documentation and scope as provided on the estimating work order, and that the entries provided by the estimator are complete and adequately document and convey details of the anticipated methodology, project assumptions, risks, opportunities and exclusions
- All project components described on the estimating work order, in subsequent meetings or correspondence have been recorded and allowed for within the estimate, with due considerations made for related constructability, staging and methodology issues
- All estimate items in the Calculation tab are included within the correct work breakdown structure headings
- Quantities (including units used) and rates appear reasonable for the given project type and scale, with no obvious errors and omissions
- Section subtotals are of suitable magnitude for the given scope of works and generally correlate with previous projects of a similar nature (or that variances are reasonable given project specific considerations)

- No items have been excluded or zero values applied for items which are known or are likely to be in scope. It is expected that for any items that can reasonably be anticipated to be in scope an assessment will be made of their magnitude and reasonable quantities and rates will be applied within the estimate
- Percentage variances that have been used in ranging of costs and quantities are reasonable
- Contractor overheads and margins are reasonable for the nature of the project, current market conditions and the anticipated procurement approach
- Contingencies values have been correctly calculated and the resulting values applied for risk are of a suitable magnitude given the information available, project type, project nature, constraints etc.
- Concurrence with items included in the estimate and their costing
- Where possible, review with recent projects of a similar nature in terms of benchmarking against current actual and/or estimated project costs

Once all checks are completed the reality checker is required to enter their initials and the date in the check/date box on the Estimate Cover Sheet prior to the estimate being forwarded to the Project Officer Estimating Services and the project manager/planner.

### **The Project Officer Estimating Services**

The Project Officer Estimating Services is responsible for providing an initial review of each revision of the estimate. This review includes items such as the scope, identified risks, assumptions made and a broad review of rates and the overall estimated project cost compared to those for recent similar projects.

Items may also be identified or brought to the attention of the project manager/planner for further assessment or consideration. Typically this will be the result of things such as rates or overall project costs that show significant variation from recent benchmarks without reason and apparent omissions or scope errors based on the information provided to and/or discussed with the estimator during the development of the estimate.

The Project Officer Estimating Services shall undertake the following checks of items within the estimate:

- Estimate is presented in the correct format including the completion of all required sections of the Scope, Risk and Methodology tab
- Review of the scope that has been included and its correlation with what has been requested
- Review project details recorded by the estimator including the assumed construction methodology, project/construction duration, assumptions, risks and opportunities, exclusions

- All estimate items in the Calculation tab are included within the correct work breakdown structure headings
- Broad review of the quantities (including units used) and rates ensuring that they appear reasonable for the given project type and scale, with no obvious errors and omissions and that specialist advice (e.g. land acquisition costs) have been correctly included
- Broad review of the reasonableness of ranges that have been applied to quantities and rates within the estimate
- Review section dollar value and percentage subtotals ensuring they are of suitable magnitude for the given scope of works and generally correlate with benchmarks for previous projects of a similar nature (or that variances are reasonable given project specific considerations)
- Review the reasonableness of calculated risk and contingency values

Once all reviews have been completed the check/date box of the Estimate Cover Sheet is completed and the estimate is forwarded to the project manager/planner together with any questions and/or comments raised from this review. On occasion the Project Officer Estimating Services may elect to seek clarifications and/or updates to the estimate prior to submitting the estimate the project manager/planner for review.

### **Project Manager/Planner**

The project manager/planner is ultimately responsible for the acceptance of the estimate. As such they must have sufficient confidence that the estimate accurately reflects the scope and subsequent estimated costs which have been developed for the project.

Where errors, or apparent omissions are identified necessitating the estimate to be revised, these are to be referred to the Project Officer Estimating Services (or where considered more suitable directly to the estimator) for initial discussion and where ultimately deemed necessary, adjustment by the estimator.

At a minimum the project manager/planner check the following items within the estimate:

- Review all project risks and assumptions
- Broad review of the scope that has been included and its correlation with what has been requested
- Where provided, review any scheduling or methodology information to ensure its practicality and appropriateness given any known project constraints
- Broad review of specialist advice or costs provided have been correctly incorporated into the estimate
- Review the reasonableness of ranges that have been applied to quantities and rates within the estimate

- Review quantities and rates to ensure they are suitable to a degree that a reasonable level of confidence is obtained with the overall estimated project cost
- Review the reasonableness of calculated risk and contingency values
- Ensure that issues or concerns raised by either the estimator and/or Project Officer Estimating Services are reviewed and addressed as necessary

At the discretion of the project manager/planner, a peer review of the estimate by more experienced staff members or other consultants may be undertaken, providing a further level of confidence and assurance.

Once the project manager/planner is satisfied with the completed estimate and all reviews have been completed they are required to complete the check/date box of the Estimate Cover Sheet prior to proceeding with the completion of the Formal Estimate form as discussed in Appendix 8.

## Appendix 8 – Completion of Formal Estimate

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Information on the following page(s) provides instructions for completing each section of the Formal Estimate. Formal estimate values are those which are to be used when seeking project funding and hence they are only developed for estimates from levels 2 to 5 and 5B (as such the formal estimate form is only found within estimate templates relative to these levels).

Project managers/planners should note the requirement to initially complete the Formal Estimate Summary Form (which commences at Line 69 of the Microsoft Excel spreadsheet) and to verify that the estimate has been reviewed in accordance with the DPTI Estimating Manual (in particular Appendix 7) prior to completing this form. The Formal Estimate Signoff and Acceptance Form (which commences at Line 5 of the Microsoft Excel spreadsheet) is intended to be used as an overlying cover sheet where only summary details and signatures are recorded.

### **Section 1: Summary of All Considered Realistic Options**

Following completion of estimates for each of the proposed options at a given level in the Cost Estimating Model, project managers/planners are required to enter relevant Project Option Estimate number(s), description(s), P50 and P90 values (or equivalent P50 and P90 values where prepared by DPTI staff) for each of the options which have considered.

Project managers/planners are also to consider the ongoing most likely operating costs associated with each option and enter this information in the column provided.

Project managers/planners are to review each of the proposed options and their costs and determine those which are considered as realistic and therefore still have potential to be delivered. The highest valued realistic option (the Project Estimate) is to be identified in the column provided and values from this option carried forward through the formal estimate form. *Note: when seeking project delivery funding the project estimate must represent a defined option/scope of work.*

### **Section 2: Key Assumptions, Risks and Opportunities Relating to the Project Estimate (Highest Valued Options Estimate)**

A summarised version of the key assumptions, risks and opportunities are recorded in this section. Typically, these details are sourced directly from those provided in the Scope, Risk and Methodology tab of the estimate.

The project manager/planner may become aware of some additional items to those identified by the estimator and these may also be recorded at this point.

### **Section 3: Items Specifically Excluded from the Project Estimate (Highest Valued Options Estimate)**

Details of any items which have been excluded from the estimate are recorded in this section. Typically, these details are sourced directly from those provided in the Scope, Risk and Methodology tab of the estimate.



Where items are excluded clear statements need to be made in any subsequent documentation regarding the exclusion of these items from the estimated cost. Alternatively (and preferably) a further revision of the estimate prepared which incorporates any items which have previously been excluded.

#### **Section 4: Project Estimate Values (Highest Valued Options Estimate)**

At this point project managers/planners are required to enter the relevant section costs from the highest realistic Options Estimate for both the previous (where available) and current Project Estimates.

This comparison provides a quick overview of areas where project costs may have changed from the previous Formal Estimate and may provide the project manager/planner with an indication of areas where scope creep, over/under estimating and the like have occurred. It may also assist in the identification of areas where estimates are either consistently high or low at early levels and therefore aid future early estimate considerations.

Comments describing the reason for cost changes against particular categories should be recorded in the relevant cells provided.

#### **Section 5: Project Estimate Inherent and Contingent Risk Values and Total (Highest Valued Options Estimate)**

This section details the combined inherent and contingent risk values which have been included in the Project Estimate. The calculated P50 and P90 values (or equivalent) for combined inherent and contingent risk are included in the relevant cells to show the current Project Estimate totals to be used for cash flowing in Section 6 of the form.

#### **Section 6: Estimated cash flow of the Project Estimate (Highest Valued Options Estimate)**

Cash flows to be applied to the formal estimate form can be found or derived in one of the following ways:

- Indicative cash flow:
  - included at the base of the summary tab of the estimate
- Detailed cash flow:
  - as prepared by the estimator, only occurs where specifically requested via the estimating work order
  - as prepared by the project manager/planner using EST 600-7 'Cash Flow Template' ([KNet #12245240](#)) which is pasted into the summary tab of the estimate, with percentages applied for applicable quarterly periods

Project managers/planners should ensure that estimated construction cash flows are relatively conservative to counteract the effect of delays associated with the approval of funding, land acquisition/site access, design delays, procurement issues and the like. As such the majority of contingency values should (where appropriate) be considered in later years of the project including some during the year after project completion. These cash flows should also consider expenditure as having occurred at the time work is carried out rather than when a contractor's claim is submitted or payment made.

Relevant costs are to be entered against each of the financial years with Non Property and Property costs entered against the relevant cells of the form.

Project managers/planners should note that expenditure associated with the P50 (or equivalent) value may occur more rapidly than that of the P90 (or equivalent) value as completing the project for the lower P50 value is likely to represent that project risks have not occurred and as such less of the contingency funds have been required.

### **Section 7: Price Escalation**

At this point project managers/planners are required to use the link provided to access the 'Price Escalation Calculation Spreadsheet' ([KNet #4624055](#)) to calculate the value of escalation to be included within the formal estimate form. To allow ease of calculating the value and future traceability, project managers/planners should import this tab into the relevant estimate file.

Estimated P50 and P90 (or equivalent) cash flows are to be entered into the relevant cells of the escalation spreadsheet with the resultant data transferred back to relevant price escalation cells within Sections 7 and 8 of the formal estimate form. Price escalation values from the previous formal estimate (where available) should also be recorded along with any relevant comments.

For assistance, queries and endorsement of the calculated values project managers/planners are required to contact the Team Leader, Financial Analysis (Finance).

It should be noted that Options Estimate values are provided in present day (real) dollar values only and therefore make no allowance for price escalation.

### **Section 8: Estimated Cash Flow of Formal Estimate**

In order to provide a more detailed breakdown of the anticipated expenditure project managers/planners are to record the estimated P50 and P90 (or equivalent) project costs for each of the listed section headings against each of the relevant years of the project. In addition to this price escalation values as calculated in Section 7 are also to be recorded against each of the relevant years.

### **Completing the Formal Estimate Signoff and Acceptance Form**

Once sections 1 to 8 of the formal estimate form have been completed project managers/planners are to commence completion of the Signoff and Acceptance Form (Line 5).

Responses to each of the sections which require entries are either automated or should be apparent from the work completed prior to this point. Cells where the final P50 and P90 values are reported within this section are automated to round these figures to the nearest 1000 dollars. Project managers/planners are required to ensure that the necessary reality checks have been completed prior to printing and signing the form to gain the approval of the relevant Senior Responsible Officer. The completed formal estimate form is to be placed in the relevant project file and a scanned colour copy (all pages) forwarded to the Project Officer Estimating Services.

## Appendix 9 – Process for Updating Old Estimates to Present-day (Real) Dollars

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The updating of estimates developed in a previous year to present-day (real) dollars, is required to reference the following index:

ABS Producer Price Index, catalogue # 6427.0  
“Road and Bridge Construction Index for South Australia” component  
Table 17 Output of the Construction Industries, subdivision and class index numbers  
Road and Bridge Construction (3101) South Australia  
Series ID A2333748X  
<http://www.abs.gov.au/ausstats/abs@.nsf/mf/6427.0>

*Note: Click on the ‘Downloads’ tab when this site opens and follow the path above*

For any updating following Sept 2010 obtain the latest index number directly using the ABS web link above. If you have any queries, contact the Team Leader, Financial Analysis (Aaron Bell on (08) 8402 1713).

### Methodology Example:

The old estimate is to be multiplied by the ratio:

$$\frac{\text{the current index value}}{\text{the index value at the time of the old estimate}}$$

### Example:

A cost estimate was previously generated in July 2016 dollars to be \$10.1m, i.e. in present-day value (real) dollars at the time.

This needs to be updated to present-day (real) dollars – May 2018

The ABS index values for these two points in time were:

September 2016	111.3
March 2018	119.0

The updated cost, in Sept 2010 present-day (real) dollars  
= \$10.1m \* 119.0 / 111.3 = \$10.81m

This figure would then be cash flowed and escalated using the approach detailed in Section 1.20 and 1.21 of this manual.

Project managers/planners should also assess the potential for cost increases beyond those associated with cost escalation, recognising that some project scope changes are likely to occur due to factors such as changes to design standards, existing site conditions and the like from when the estimate was originally prepared.

The process of escalating an old estimate to current day dollars using the Road and Bridge Construction Cost Index is recommended to only occur where the original estimate has been prepared within the last two years. This is due to engineering construction market pricing dynamics changing over time leading to market pricing of elements like profit margins and the treatment of risk changing over time. In instances where estimates are more than two years old, it is recommended that an updated estimate is prepared.



**Government of South Australia**

Department of Planning,  
Transport and Infrastructure