Foreword

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

This new release of the Estimating Manual – ‘Estimating Manual for Road and Rail Projects’ builds on the best practices of earlier versions and introduces new practices to support estimate development, review and approval. It addresses issues relating to contingencies, risks 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 final cost. 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 and Transport’s ‘Best Practice Cost Estimation for Publicly Funded Road and Rail Construction (the Standard)’.

Through the adoption of this manual it is expected that:

- Estimates will be realistic with reduced tendency for optimism bias,
- Likelihood of cost overruns will be mitigated through the application of appropriate levels of contingency and risk allowance,
- Estimate announcements will cover total project cost, including contingency and escalation,
- Projects seeking funding will at all times 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 project development.

Professional estimating companies have and will continue to be engaged through a panel contract arrangement to provide estimating services in accordance with this manual.

Use of this manual together with the professional expertise provided by the estimating panel is essential for effective project cost estimating.
## DOCUMENT CONTROL

### DOCUMENT STATUS

<table>
<thead>
<tr>
<th>Action</th>
<th>Name and Position</th>
<th>Reference</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prepared By</td>
<td>Ashley Jaensch</td>
<td>N/A</td>
<td>18/5/2012</td>
</tr>
<tr>
<td></td>
<td>Coordinator Estimating Services</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reviewed By</td>
<td>Chris Carr</td>
<td>KNET #6432414</td>
<td>18/5/2012</td>
</tr>
<tr>
<td></td>
<td>Manager, Project Office</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reviewed By</td>
<td>Scott Cooper</td>
<td>KNET #6455976</td>
<td>28/5/2012</td>
</tr>
<tr>
<td></td>
<td>Project Investment Manager</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approved By</td>
<td>Lou George</td>
<td>KNET #6680207</td>
<td>1/6/2012</td>
</tr>
<tr>
<td></td>
<td>Director, Projects</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Document Review Schedule**: As required

### DOCUMENT AMENDMENT RECORD

<table>
<thead>
<tr>
<th>Rev</th>
<th>Change Description</th>
<th>Date</th>
<th>Prepared</th>
<th>Reviewed</th>
<th>Authorised</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>Initial Issue</td>
<td>October 2012</td>
<td>May 2012</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Table of Contents

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.

INTRODUCTION ........................................................................................................................................................... 7

GLOSSARY OF TERMS ............................................................................................................................................... 8

1 ESTIMATING APPROACH ...................................................................................................................................... 12

1.1 Purpose and Intent ........................................................................................................................................... 12
1.2 Estimate Levels and Purpose ...................................................................................................................... 12
1.3 Types of Estimates and Principles .............................................................................................................. 14
1.4 Cost Estimating Model ............................................................................................................................. 17
1.5 Generic Estimating Process ....................................................................................................................... 19
1.6 Scope Definition .......................................................................................................................................... 20
1.7 Request for Estimating Services - Work Order ....................................................................................... 23
1.8 Duplicate Estimates .................................................................................................................................. 24
1.9 Estimate Commencement Meeting .......................................................................................................... 24
1.10 Standard Estimate Spreadsheet ........................................................................................................... 24
1.11 Preparation of Base Estimates ................................................................................................................. 25
1.12 Inherent Risk ........................................................................................................................................ 25
1.13 Contingent Risk ....................................................................................................................................... 26
1.14 Calculation of P50 and P90 values ........................................................................................................... 26
1.15 Estimate Review Process ........................................................................................................................ 27
1.16 Formal Estimate ....................................................................................................................................... 28
Appendix 1 - Minimum Information Requirements for Estimate Levels ......................................................... 48
Appendix 2 - Procedure for Duplicate Estimates ............................................................................................. 50
Appendix 3 – Estimate Review Process ............................................................................................................. 51
Appendix 4 - Completion of Formal Estimate ................................................................................................... 55
Appendix 5 - Numbering Convention of DPTI Estimates .................................................................................. 58
Appendix 6 – Standard Work Breakdown Structure Items and Content .......................................................... 59
Appendix 7 - Completing the Standard Estimate Spreadsheet ......................................................................... 77
Appendix 8 – Process for Updating Old Estimates to Present-day (Real) Dollars ........................................... 81

LIST OF FIGURES
Figure 1 – Components of Option and Formal Estimates ................................................................................. 16
Figure 2 – Cost Estimating Model ..................................................................................................................... 18
Figure 3 - Generic Estimating Process ................................................................................................................ 19
Figure 4 - Formal Estimate Process .................................................................................................................... 28
Figure 5 - Establishing the Risk Profile ................................................................................................................ 30

LIST OF TABLES
Table 1 – Estimate Levels and Purpose ............................................................................................................. 13
Table 2 – Example of Price Escalation Calculation ........................................................................................... 29
Table 3 – Work Breakdown Structure by Estimate Level .................................................................................. 36
Table 4 – Recommended Estimating Method by Estimate Level ..................................................................... 39
Table 5 – Contingent Risk Considerations, Estimates Level 1 and 2 ................................................................. 43
Table 6 – Contingent Risk Considerations, Estimates Level 3, 4, 5 and 6 when prepared by DPTI staff ........................................................................................................................................... 45

LIST OF SPREADSHEETS AND FORMS
EST 600-1 Standard Estimate Spreadsheet, Estimate Levels 1 & 2 – KNet #5751720
EST 600-2 Standard Estimate Spreadsheet, Estimate Levels 3, 4, 5 & 6 (when prepared by external estimating consultants) – KNet #5751722
EST 600-3 Standard Estimate Spreadsheet, Estimate Levels 3, 4, 5 & 6 (when prepared by DPTI Staff) – KNet #5751723
EST 600-4 Estimating Work Order – KNet #4479522
EST 600-5 First Principle Client Costs Estimate – KNet #5729453
EST 600-6 Environmental Estimating Tool – KNet #9362850
EST 600-7 Record of Project Estimates by Level – KNet #9683206
INTRODUCTION

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

This document is applicable to all road and rail projects over $150,000, and applies to estimates owned by and prepared for:

- Planning Division (PD)
- Transport Services Division (TSD)
- Public Transport Service Division (PTSD)

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

- DPTI Estimating Manual (EST 600) – this manual
- DPTI Transport System Management Framework (TSMF) [link]
- Project Management Website [link]
- Best Practice Cost Estimation for Publicly Funded Road and Rail Construction (Department of Infrastructure and Transport) [link]

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. 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.

Alternatively, cost estimating may be undertaken internally by experienced staff, or be requested as part of contract requirements for planning studies.

The use of the department’s estimating panel is highly encouraged. Where an estimate is prepared internally, or by others not from the panel, the processes and principles contained in this manual are also to be applied.

Projects with an estimated value of less than $150,000 do not require a registered estimate.
GLOSSARY OF TERMS

**Base Date** – the date at which the selected options estimate has been prepared, prior to escalation 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 similar projects.

**Budget** – the approved value to which project expenditure can be incurred.

**Business Case** – the mechanism for documenting and presenting the merits and impacts of a given project. It provides those allocating funding with the information they require to make a decision about whether or not the project should proceed.

**Cash Flow** – considers the estimated project expenditure across the financial years in which funds are expected to be spent. This information is necessary when considering the effects of escalation in the Formal Estimate.

**Contingency** – a financial reserve included in the project estimate to offset unforeseen factors relating to the delivery of project objectives. It is represented with DPTI estimates through the inclusion on inherent and contingent risk.

**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.

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

**Deterministic Analysis** – a process where risk is quantified through a calculation which results in a single ‘deterministic’ outcome rather than as a range or distribution of outcomes (probabilistic analysis). Within DPTI estimates this is completed for each line item by considering and applying ranges to provide estimated low, most likely and high values for both rates and quantities, these values are then multiplied together to result in a sampled mean estimated value for that item.

**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 traffic management, environmental management, 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 Sponsor’s discretion, projects with an estimated P90 Project Estimate cost of greater than
$25m or which are considered to be either high risk or sensitive should be subject to the duplicate estimate process prior to seeking funding.

**Escalation** – the anticipated increase in the total project cost over time resulting from factors such as inflation, market conditions and the like.

**First Principles Estimate** – the method of preparing a cost estimate which considers factors such as the anticipated items of plant and labour and their associated dollar rates and rates of productivity to complete individual tasks within the Work Breakdown Structure. Rates for the supply of materials components are also included within the above.

**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 should be announced (by those authorised do so).

**Indirect Costs** – costs not directly attributable to work items such as on-site overheads. They do not include the contractor’s off-site overheads and margin.

**Inherent Risk** – inherent (or planned) risks are considered for those items which have a 100% chance of occurring. The value of inherent risk is calculated by ranging the costs and quantities applicable to each line item within the base estimate.

**Margin** – an allowance within the estimate to account for the contractor’s corporate overheads and margin.

**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 duration and costs.

**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/P90 Value** – determined by probabilistic analysis, P50/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 (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).

Pre-Tender Estimate – the pre-tender (Level 7) estimate is completed to provide a likely market price for a given scope of work associated with a contract. In addition to this it may be used as a means of comparing tendered rates. A formal estimate is not completed for level 7 estimates.

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 Analysis – the process by which risk is quantified through an assessment of potential variable outcomes in inputs (both probability of occurrence and consequence) resulting in an outcome that is expressed as a potential range or distribution of values. Typically a computer program (such as @Risk) is used to sample the project cost with varying levels of confidence based on assigned cost and quantity ranges, resulting in estimated probability (P) cost values (P50 and P90) being presented.

Project Estimate – the project estimate represents the highest valued realistic project 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 implementation 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.

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

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

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

Transport System Management Framework (TSMF) – an integrated decision support system to achieve high-level transport system objectives. It provides best practice steps for project initiation, planning, and delivery.

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

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.

Best practice recommendations considered 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
- Implementing a 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 outturn 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.

If works are expected to be in scope a reasonable assessment of the extent and value must be included in the estimate.
Estimates produced should reflect the purpose and intent of their final use and are defined by the levels and names in Table 1. Projects with an estimated value of less than $150,000 do not require a registered estimate.

Table 1 – Estimate Levels and Purpose

<table>
<thead>
<tr>
<th>Level 1</th>
<th>Strategic Cost Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For providing initial strategic level advice of an initiative being considered – this level of cost estimate involves minimal detail and certainty and as such is quoted as a cost range. Typically the estimate requires relatively large risk values to account for the limited amount of detail. Estimates at this level are typically based on benchmarked values from recent similar projects (adjusted to suit the current project), they are not intended to be used to seek project funding.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 2</th>
<th>Preliminary Options Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Used in considering the range of options that deliver the objectives of the initiative - it is more option specific and involves minimal detail and certainty for each option. Project risk, cost basis and estimated values are as per level 1 estimates. These estimates are not intended to be used to seek project funding.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 3</th>
<th>Preliminary Concept Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Used in identifying options to progress to a more refined level of planning (i.e. preferred options) – this level of cost estimate is option specific and involves preliminary consideration of the issues and risks associated with the delivery of an option. Unplanned risks are to be assessed to determine appropriate levels of contingent risk. While not recommended, funding is sometimes sought based on this level of estimate.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 4</th>
<th>Concept Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For use in the Outline Business Case – assists with comparison of options; justification of project and investment decisions. Unplanned risks are to be assessed to determine appropriate levels of contingent risk. Funding may be sought using this level of estimate.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 5</th>
<th>Preliminary Design Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>For use in the Full Business Case – focuses estimating effort on the preferred project option and qualifies project justification; funding and investment decisions; incorporates community needs/desires; major scope refinement. Unplanned risks are to be assessed to determine appropriate levels of contingent risk. Ideally funding is sought using this level of estimate.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 6</th>
<th>Detailed Estimate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Used for technical refinement. Based on the detailed design allowing a high level of detail and certainty within the estimate. Unplanned risks are to be assessed to determine appropriate levels of contingent risk. Typically funding will have been granted before proceeding to this level of estimate.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Level 7</th>
<th>Pre-tender</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Final construction estimate (market price estimate) – considers only those costs associated with the package of work being tendered and subsequently is used for comparison with tendered rates.</td>
</tr>
</tbody>
</table>

Note: 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, 2 and 7) that is up-to-date and accurately reflects the estimated total project cost relevant to the current stage and scope of project development.

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 two ways; Project Options Estimates and Formal Estimates.

**Project 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.

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

Following completion of the Project Options Estimate(s) for a given level in the Cost Estimating Model, the highest costed realistic Project 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 implementation 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 Project 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 are for internal use only
- are expressed as follows:

<table>
<thead>
<tr>
<th>Estimate Level</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Level 6</th>
<th>Level 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expressed as:</td>
<td>Cost Range</td>
<td>P50/P90 (or equivalent P50/P90)</td>
<td>Most Likely Cost</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- include inherent and contingent risk, added to the Base Estimate value, to arrive at the risk adjusted Project Options Estimate totals
  - **Inherent risks** (those which have a 100% chance of occurring) are assessed as follows:
<table>
<thead>
<tr>
<th>Estimate Level</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Level 6</th>
<th>Level 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessed by DPTI Staff</td>
<td>Considered within Total Risk Table (see Table 5)</td>
<td>Deterministic Analysis</td>
<td>Base Estimate value deducted from equivalent P90 to provide Inherent Risk value</td>
<td>Not applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessed by Estimating Consultants</td>
<td>Considered within Total Risk Table (see Table 5)</td>
<td>Probabilistic Analysis</td>
<td>Base Estimate value deducted from calculated P50 and P90 to provide Inherent Risk values</td>
<td>Not applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Further detail regarding the assessment of inherent risk is provided in Section 2.6.

- Contingent risks (those which have less than a 100% chance of occurring) are assessed as follows:

<table>
<thead>
<tr>
<th>Estimate Level</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Level 6</th>
<th>Level 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assessed by DPTI Staff</td>
<td>Considered within Contingent Risk Table (see Table 6)</td>
<td>Considered within Contingent Risk Table (see Table 6)</td>
<td>Percentages determined are applied to the Base Estimate value to provide equivalent P50 and P90 contingent risk values</td>
<td>Not applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assessed by Estimating Consultants</td>
<td>Considered within Contingent Risk Table (see Table 5)</td>
<td>Probabilistic Analysis</td>
<td>Identification and pricing of contingent risks which are then assessed probabilistically to provide P50 and P90 contingent risk values.</td>
<td>Not applicable</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

**Formal Estimates** are required at defined times in the project life-cycle and are based on the highest most realistic Project Options Estimate at that point in time. *Note: when seeking implementation 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 3, 4, 5 and 6. (*Note: Level 1 and 2 estimates are not ‘formalised’ they should instead be quoted as a range. Level 7 estimates are used for comparison with tendered rates only and as such represented as likely project costs for work to be performed by the contractor, they do not represent a total project cost)*
- are based on the P50 and P90 cost of the highest realistic Project Options Estimate (known as the Project Estimate) developed in present-day (real) dollars
- are inclusive of inherent and contingent risk allowances developed during preparation of the relevant Project Estimate
- are based on an assumed completion date with provision made for relevant escalation, hence they are expressed in outturn (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
- at the Sponsor’s discretion, projects with an estimated P90 total project cost estimate cost of greater than $25m or which are considered to be either high risk and/or sensitive should be subject to the duplicate estimate process (as per Appendix 2) prior to seeking funding
- are subject to the full range of quality assurance sign-offs (as detailed in Appendix 3)
- are used for internal budgetary purposes, seeking project funding (at appropriate times) and public release (only where approved)
- remain the current approved estimate unless replaced by another updated and approved ‘Formal Estimate’

**Figure 1 – Components of Options and Formal Estimates**
1.4 Cost Estimating Model

The South Australian Transport System Management Framework (TSMF) and the department's Project Management Framework set out required and best practice steps for project initiation, planning, and delivery.

Cost estimating is exercised in the broader context of the project and program management frameworks to provide assurance that estimate values are continually dependable. Estimating is an integral part of a system of interdependent core inputs of scope, time, cost and quality.

The Cost Estimation Model illustrated in Figure 2 sets out the various estimates as they relate to different stages of a project. There are seven levels, with the degree of detail of the project description and associated effort and accuracy of cost estimation increasing gradually from Level 1 through to Level 7. 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 7 involves very tightly defined project scope and cost estimation, with a low degree of uncertainty.

As explained further in this manual, as a project advances through the scoping, development and implementation phases, the intention is to ensure that sufficient recognition of all possible costs is incorporated so that project cost overrun is avoided.

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

EST 600-7 Record of Project Estimates by Level (KNet #9683206) provides a template to aid in recording projects costs across all estimate levels.
Figure 2 – Cost Estimating Model

[Diagram showing the steps of cost estimating model with related planning/activity levels and cost estimate levels.]

- **Step 1**: System Planning
- **Step 2**: Initiative Identification
- **Step 3**: Outline Business Case Development
- **Step 4**: Full Business Case Development
- **Step 5**: Funding decision *
- **Step 6**: Delivery of Initiative (including Public Works Committee submission)

**Related Planning/Activity Levels**
- Land Use Planning
- Network, Area/Corridor Planning
- Route & Link Planning
- Preliminary Concept Planning
- Concept Planning
- Pre-Construction
- Construction

**Cost Estimate Levels**
- Estimate Level 1: Strategic Options Cost Estimate
- Estimate Level 2: Preliminary Options Estimate
- Estimate Level 3: Concept Estimate (for use in OUTLINE Business Case)
- Estimate Level 4: Project Planning Estimate (for use in FULL Business Case)
- Estimate Level 5: Detailed Estimate
- Estimate Level 6: Pre-Tender Estimate
- Estimate Level 7: Final Cost

Legend:
- Strategic Option Cost Estimates
- Options not implemented
- Project option that was finally implemented
- Price Escalation
- Formal estimate
1.5 **Generic Estimating Process**

The following flowchart outlines the typical steps involved for: initiating an estimate, completing project estimates, reviewing and formalising estimates. 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.

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 clearly describing the project and its physical scope and articulating this to the estimator. The completion of EST 600-4 – Estimating Panel Contract, Estimating Work Order (KNet #4479522) will assist with this requirement. It requires a project manager/planner to provide a detailed description of physical scope components and project objectives.

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.

To support the accuracy of estimates, project managers/planners should assist estimators to accurately determine relevant items and values associated with client costs along with the development of appropriate levels of detail for that allow a realistic cost estimate to be developed.

A guide to the minimum information that should be made available to estimators for each level of estimate is included in Appendix 1.

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.

Additional information that would greatly assist estimators and improve estimate accuracy and completeness includes:

- **Client Costs**: To account for client costs in early level strategic estimates, estimators will typically apply a percentage based on the actual cost of undertaking project management, planning and design tasks for previous projects of a similar nature.

  As projects are further developed it is anticipated that both estimators and project managers/planners will work towards more accurately determining
the various project management, planning, design etc costs 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, employment level (e.g. PO2, ASO6) and their duration of employment for each phase of the project to allow first principles calculation of these costs to be prepared and included within the estimate.

A template to assist Project Managers with the preparation of an estimate of client costs via first principles is provided in EST 600-5 – First Principle Client Costs Estimate (KNet #5729453).

- **Environmental**: Project Managers/Planners should seek the input of an Environment Officer to undertake an assessment of all environmental aspects relevant to the given scope of a project. 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 Operation Instruction 21.1 – Environmental Approval Procedure. 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 Estimating Tool (KNet #9362850).

- **Land/Property Cost Information**: Project managers/planners are to source estimates for land/property acquisition from DPTI's Real Estate Services, Architecture and Built Environment Section 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. 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 estimates can be provided for inclusion in the estimate.
Project managers/planners should ensure that any available breakdown of land acquisition costs (inclusive of allowances for land acquisition, 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 inherent risk values that may be associated with these items.

Unless noted otherwise land acquisition values provided should 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.

- **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 6) 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.

- **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 quantify these items.

### 1.7 Request for Estimating Services - Work Order

The majority of estimates are produced by estimators engaged using the department's estimating panel contract. The panel comprises contractors assessed as having relevant experience and ability in developing cost estimates.

All requests for the provision of an estimate or estimating related work using members of the estimating panel must be directed to the Coordinator Estimating Services, Project Office. The Coordinator Estimating Services will assign a member of the panel to complete the work based on the type of skills that are required, the specific requests of the project manager/planner and the likely costs to be incurred.

On receipt of request, 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 Panel Contract, 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 scope and extent of work.
1.8 Duplicate Estimates

Where the project estimate is anticipated to have a P90 Project Estimate value exceeding $25 million a duplicate estimate should be sought prior to seeking funds for the project.

In determining the need for a duplicate estimate, project managers/planners should discuss with the Project Sponsor 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 2.

1.9 Estimate Commencement Meeting

Following completion of the Work Order an Estimate Commencement Meeting is typically scheduled where the project manager/planner (along with other staff and/or specialists where applicable) can talk with the Estimator regarding their requirements, the scope of the project and any other specific requirements associated with the preparation of the estimate. 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 areas of 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 Coordinator Estimating Services:

- EST 600-1, KNet #5751720. For estimates at levels 1 & 2 Estimates, typically prepared by Planning Division but also used by estimating consultants where engaged to provide these early estimates
- EST 600-2 KNet #5751722. For estimates at levels 3, 4, 5 & 6 of projects which involve road and rail works – when 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 managers/planner)
- EST 600-3 KNet #5751723 For estimates prepared by DPTI staff at levels 3, 4, 5 & 6 of projects which involve road and rail works
- EST 600-3 FS KNet #5849068 For estimates prepared by DPTI Field Services (FS) staff at levels 3, 4, 5 & 6 of projects which involve predominately road works. This format allows project managers 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 items excluded in the FS estimate, in addition to this risk is also applied to provide equivalent P50 and P90 estimates.

Level 7 estimates are used for comparison with tendered rates only and hence are typically presented in accordance with the standard templates provided by DPTI's Contracting and Procurement Section. These templates can be found at: [http://www.dtei.sa.gov.au/documents/contractsandtenders/tender_form_and_schedules](http://www.dtei.sa.gov.au/documents/contractsandtenders/tender_form_and_schedules)

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

Departure from the use of these spreadsheets is only permitted with the prior approval of the project manager/planner and the Coordinator 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 and 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 separately to result in the Project Options Estimate total.

All estimates are to be prepared exclusive of GST.

Further details regarding the preparation of estimates are included in Section 2.

1.12 Inherent Risk

Inherent (or planned) risk is related to the ranging of quantities and rates for each of the measured items within the Base Estimate. Project cost estimates cannot be confidently prepared using whole number quantity and rates values. 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 scheduled items. The ranges are used to spread risk appropriately across the scheduled items to allow for statistical modelling (i.e. P50 and P90 calculations).

Inherent risk is applied not only to measured items within direct costs but also to measured items within indirect costs such as on-site and off-site overheads; margin; and client costs.

Additional information regarding the identification and assessment of inherent risk can be found in the ‘Best Practice Cost Estimation’ document referred to on page 5 of this document.
1.13 **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 their unknown nature or them being only loosely identified resulting in them having a less than 100% chance of occurring.

Generally 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.

Contingent risk within DPTI estimates is assessed in varying ways depending on the end use of the estimate and who it is prepared by. These approaches are explained in Section 2.7 Contingent Risk.

Additional information regarding the identification and assessment of contingent risk can be found in the ‘Best Practice Cost Estimation’ document referred to on page 5 of this document.

1.14 **Calculation of 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.

P50 and P90 values are to be calculated for the following estimates when prepared by members of the estimating panel:

- Level 3 – Preliminary Concept Estimate
- Level 4 – Concept Estimate
- Level 5 – Preliminary Design Estimate
- Level 6 – Detailed Estimate

Where estimates at these levels are prepared by DPTI staff inherent and contingent risks are assessed deterministically and therefore will produce only equivalent P50 and P90 values (as described in sections 2.6.3 and 2.7.3).
Strategic Options (Level 1) and Preliminary Options (Level 2) estimates prepared before the business case are not intended to be used in seeking project funding, rather they are to be used for the assessment and comparison of initiatives.

As estimates at these early levels are often based on highly conceptual information with very limited information regarding the actual project scope, extents, risks, timing, constraints and the like, it is considered that all project variables are possible and as such they are expressed as a cost range.

Pre-Tender (Level 7) estimates are prepared only for comparison with tendered rates and therefore presented as most likely costs.

1.15 Estimate Review Process

Prior to the submission of an estimate, estimators are required to ensure their work is reviewed in accordance with the Estimate Review Process (Appendix 3), which includes a checklist to assist with this process. 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 Coordinator Estimating Services and the project manager/planner.

The Coordinator 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 review.

Project managers/planners are required to review the estimate in accordance with the Estimate Review Process. Identified changes or issues requiring further clarification will be discussed with the estimator who will be asked to review/revise the estimate if 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.
1.16 Formal Estimate

Figure 4 - Formal Estimate Process

Following completion of the Project Options Estimate (including reviews as per Section 1.15) estimates are required to be formalised. A Formal Estimate represents the total project cost as approved by the project sponsor at any given point in time during the projects development.

It is generated by taking the estimated P50 and P90 values (estimate Levels 3 – 6) of the highest realistic Project Option Estimate, (the Project Estimate) and cash-flowing these amounts in order to allow for the escalation of the estimate thus producing the Formal Estimate cost in out-turn (nominal) dollars.

The Standard Estimate Spreadsheet (estimate Levels 3 – 6) 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 sponsor approval of the estimate.

Instructions for completing the Formal Estimate form are provided in Appendix 4.

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

1.17 Cash flow

The project cash flow considers the Project Estimate (the highest valued realistic Project Option Estimate, inclusive of inherent and contingent risk) across the financial years the funds are expected to be spent. Cash flows are heavily influenced by the implementation program and the expenditure profile during construction.

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.

Cash flows can be prepared either by the project manager/planner or as an additional service by the estimator.

1.18 Price Escalation

Formal Estimates are typically expressed in outturn (nominal) dollars ($OT) and include price escalation to reflect 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 should be clearly labelled as excluding escalation.

A cash flow (expenditure profile) is to be determined to suit project delivery timeframe. Outturn 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. It must not be randomly developed by members of the project team.

A price escalation spreadsheet tool (KNet #4624055) is to be used to calculate outturn dollars across multiple years. This spreadsheet includes the annual rates of escalation rates to be used.

<table>
<thead>
<tr>
<th>Table 2 – Example of Price Escalation Calculation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Description</td>
</tr>
<tr>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>Expenditure (present day - real $’s)</td>
</tr>
<tr>
<td>Price Escalation @ 5% rate</td>
</tr>
<tr>
<td>Project Cash flow (Nominal - $OT)</td>
</tr>
</tbody>
</table>

The above example is a simple approach to reviewing how price escalation is calculated. 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 historically high levels of property price escalation and the ‘uniqueness’ of this component per project, the linked calculation spreadsheet above recommends consultation with DPTI’s Property Planning & Management Services Section for the application of escalation rates for land/property acquisition 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 Senior Project Finance Analyst, Project Office and updated in the 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 outturn cost, the price escalation figure has to be carefully assessed. Assistance and advice from the Senior Project Finance Analyst, Project Office, 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, 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 impost in the construction sector. It is not a secondary contingency figure.

1.19 Project Risk Profile

To establish the risk profile of a project option for estimates from levels 3 to 6 the P50 value is deducted from the P90 value. The resulting value indicates the total amount of project contingency which has been included within the estimate.
Funding is to be sought based on the Formal Estimate P90 value, the estimated project value 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.

Importantly project managers/planners should aim to deliver the project for the Formal Estimate P50 cost and aim to return contingency funds if not spent 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.

Estimates at levels 1 to 2 are not intended to be used to seek funding rather they are to be used for the assessment of initiatives. For these projects the level of contingency within the estimate is presented in the ‘total contingent risk table’ included within the relevant template.

1.20 Variance Reporting

Reporting on the cost change against each of the level 2 WBS categories (identified in table 3 – see Section 2 Estimate Development & Presentation) serves as a management tool to help in the identification of trends and assist in the ongoing improvement to estimate accuracy.

The formal Estimate Sign-off and Approval Form (included within EST600-2 and EST600-3) provides an avenue for tracking variances against key headings through subsequent estimate levels. Ultimately this analysis aims to better inform future early project estimates by identifying common areas of over or under-estimating project costs.

1.21 Updating old estimates to present day dollars

Appendix 8 describes the process for escalating an estimate prepared today to reflect the expected project cost at a future point in time.

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 Property Planning & Management 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 8.

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.

### 1.22 Project Sponsor Approval and Responsibilities

Project sponsors 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
- Ensuring that where considered necessary that a duplicate estimate has been undertaken
- Approving each Formal Estimate, including an assessment of the accuracy of the scope of works upon which the estimate has been based
- Ensuring Formal Estimates are conveyed in outturn (nominal) dollars
- Ensuring estimate review processes have been undertaken
- 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 of the preferred option, with funding sought at the Formal Estimate P90 value
- 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, project directors, sponsors 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.

2.2 Estimate Presentation

The Standard Estimate Spreadsheets are used for the estimate preparation. The spreadsheet records 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 7.

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 Levels 1 & 2 (typically prepared by DPTI’s Planning Division)

EST 600-1 – KNet #5751720

This template is to be used for estimates of road and rail projects at levels 1 (Strategic Cost Estimate) and 2 (Preliminary Options Estimate) prepared by DPTI's Planning Division, but is also used by consultants when engaged to provide these early estimates. Estimates at these early levels 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 use of this format aids in the identification of the project objectives and scope allowing for future tracking of actual costs against the original basis on which the estimate was prepared individual project.

The following tabs are included in the spreadsheet:

- Cover Sheet
- Scope, Risk and Calculation Sheet
- Inherent / Contingent Risk(s)

Contingent risk values for these estimates may be determined using the tab provided within this spreadsheet – a copy of this table is also provided in item 2.7.1.
2.2.2  Estimates Levels 3, 4, 5 & 6 (prepared by Estimating Consultants)

EST 600-2 – KNet #5751722

These templates are to be used for estimates at levels 3 (Preliminary Concept), 4 (Concept), 5 (Preliminary Design) and 6 (Detailed) when prepared by estimating consultants.

This format includes sections on the calculation sheet(s) for the probabilistic calculation of 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 Risk Option(s)
- Contingent Risk Option(s)

*Note: it is expected that consultants will use proprietary estimating software to prepare their estimates and transfer outcomes to the template – a complete copy of the first principles estimate including all labour, plant, materials, rates of production etc is to be made available if requested by DPTI*

2.2.3  Estimates Levels 3, 4, 5 & 6 (prepared by DPTI Staff)

EST 600-3 – KNet #5751723
EST 600-3 FS – KNet #5849068 (only used for estimates by Field Services)

For estimates of road projects at levels 3 (Preliminary Concept), 4 (Concept), 5 (Preliminary Design) and 6 (Detailed) when prepared by DPTI staff.

This format includes a section on the calculation sheet(s) to deterministically calculate the value of inherent risk. Contingent risk values are calculated using the tab provided within this spreadsheet – a copy of this table is also provided in item 2.7.3.

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 Sheet(s)
- Calculation Sheet(s)
- Contingent Risk(s) – Note: this tool is not suitable for estimates where Federal Government funding is being requested

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

Level 7 estimates are used for comparison with tendered rates only and hence are typically presented in accordance with the standard template(s) provided by the relevant project manager/planner or DPTI’s Contracting and Procurement Section. These templates can be found at: [http://www.dtei.sa.gov.au/documents/contractsandtenders/tender_form_and_schedules](http://www.dtei.sa.gov.au/documents/contractsandtenders/tender_form_and_schedules)

### 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 5.

### 2.4 Work Breakdown Structure

Estimates are to be developed in line with the relevant road 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.

<table>
<thead>
<tr>
<th>Table 3 – Work Breakdown Structure by Estimate Level</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>WBS Level 1 (key elements)</strong></td>
</tr>
<tr>
<td>(1) Client Costs</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>(2) Property Acquisition</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>(3) Services Costs</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>(4) Construction Costs (Direct Costs)</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>
Appendix 6 provides a further guide to the types of items and sub-items that are considered within each key element or section 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 - Minimum Information Requirements for Estimate Levels.

### 2.5 Selecting the Estimating Method

The estimator should confirm with the project manager/planner the **estimating method** required to be used for the estimate build up. The method chosen will depend on both the purpose for which the estimate will be used (and therefore the required level of confidence of the estimate) and the level of detail of the available information.

The basic difference between the methods of estimating is the degree to which a project is divided into elements and the method used to apply rates and additional costs. The more rigorous the process used, the greater will be the certainty of the outcomes (the accuracy) of the estimate.

In practice, it is common for combinations of estimating methods to be used on the business case estimate. 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 methods are listed in a generally increasing confidence level.

**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.

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.

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 contained in 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, work methods to be employed (including alternatives), resource availability, productivity of labour and plant, procurement of
materials and subcontractors as well as risks likely to be encountered during the course of the project.

**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.

**Recommended Methods**

The techniques recommended for various types of estimates are shown below:

Table 4 provides a guide to the type of estimating methods and expected level of detail as per the work breakdown structure to be used for various estimate levels:

<table>
<thead>
<tr>
<th>Estimate Level</th>
<th>Estimate Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1 Strategic Cost Estimate</td>
<td>Initial strategic advice for assessment of initiatives</td>
</tr>
<tr>
<td>Level 2 Preliminary Options Estimate</td>
<td>Rapid analysis of feasible preliminary options</td>
</tr>
<tr>
<td>Level 3 Preliminary Concept Estimate</td>
<td>Assessment of options to progress to more refined level of planning</td>
</tr>
<tr>
<td>Level 4 Concept Estimate</td>
<td>Used in Outline Business Case – assists with comparison of options, justification of project and investment decision</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Estimating Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Global Benchmarks</td>
</tr>
<tr>
<td>Unit Rate / Global Benchmarks</td>
</tr>
<tr>
<td>Unit Rate (Approx 60% value) / First Principles (Approx 40% value)</td>
</tr>
<tr>
<td>First Principles at WBS3 preferred or mix of First Principles (Approx 80% value), and Unit Rates (Approx 20% value)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Work Breakdown Structure Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Typically based on benchmarks from previous similar projects using per km or per site values and adjusting accordingly</td>
</tr>
<tr>
<td>WBS 2-3</td>
</tr>
<tr>
<td>WBS 2-3</td>
</tr>
</tbody>
</table>
2.6 **Estimate Build-up**

The estimate is built-up by identifying rates and quantities for items associated with each section of the estimate, and then applying a range to each item to allocate inherent risk. A comprehensive listing and further details of items to be considered in each section of the estimate is included in Appendix 6.

2.6.1 **Client Costs**

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 and the like.

2.6.2 **Services**

Services costs include costs associated with identification and relocation or alteration of infrastructure owned by public utilities which are to be paid by the department.

2.6.3 **Land Acquisition**

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

2.6.4 **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.

2.6.5 **Contractor’s Preliminaries and Supervision (indirect costs)**

Contractor’s preliminaries include allowances for the indirect job costs that contractors require to manage the project.
2.6.6 Risk and Contingency

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 2.6 and 2.7 respectively.

2.7 Inherent risk

For estimates at levels 3 through to level 6 inherent risk is calculated through the application of ranges to the rates and quantities to each of the line items included within sections 1 to 5 of the options estimate (those which have a 100% chance of occurring).

For example, in calculating the length and cost of a culvert the most likely value (or estimator's best prediction) will be the total of the rate multiplied by the applicable quantity. The estimator’s assessment of this quantity based on the information that is available may realise a lowest likely quantity of -10% and the highest likely +25%. Likewise, the estimator may also suggest that due to variability in plant, labour and material rates along with variations in construction methodology between contractors that this rate may vary from -5% to +10%. By entering these ranges in the appropriate columns of the estimating spreadsheet risk is spread across each of the scheduled items, allowing for statistical modelling (i.e. P50 and P90 calculations). Recording details regarding the adopted rate and quantity ranges in the comments column of the estimate may be used to better inform those reviewing the estimate of the reason for the selected ranging values.

Optimism bias is common in estimating, so it is always wise to ensure that ranges should be both wide and biased towards the upside. It is more likely the range will be no less than twice on the upside what it is on the down side, i.e. a range of +20% and -10%.

Additional information regarding the identification and assessment of inherent risk can be found in the ‘Best Practice Cost Estimation’ document referred to on page 5 of this document.

Once rate and quantity ranges have been established inherent risk is assessed in one of the following ways depending on the level of the estimate:

2.7.1 Estimates Levels 1 & 2

Estimates at these very early stages 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 rather than being used to seek project funding.

For these estimates inherent risk and contingent risk are assessed at the same time by adjusting percentage values based on broad questions relating to the project as detailed in section 2.8.1.
2.7.2 Estimate Levels 3, 4, 5 and 6 when prepared by Estimating Consultants

Assessed probabilistically – using a computer program such as @Risk to sample the project cost with varying levels of confidence based on assigned cost and quantity ranges (preferred method). The Base Estimate value is deducted from the calculated P50 and P90 values to provide inherent risk values.

Following this assessment P50 and P90 values for inherent risk are to be entered in the relevant cells of the calculation tab.

2.7.3 Estimate Levels 3, 4, 5 and 6 when prepared by DPTI Staff

Assessed deterministically – average quantities and rates (across the low, most likely and high values) are calculated for each line item with the resulting totals added to arrive at a sampled mean estimated P90 project value. The Base Estimate value is then deducted from this number to provide the value of inherent risk. This process is automated within the relevant estimate template (EST600-3).

2.8 Contingent Risk

Contingent risk considers project cost items which have less than a 100% chance of occurring. It is assessed in varying ways depending on who is responsible for the preparation on the estimate and its end use.

Additional information regarding the identification and assessment of risk can be found in the ‘Best Practice Cost Estimation’ document referred to on page 5 of this document.

The different methods for this assessment are explained in the following sections.

2.8.1 Estimate Levels 1 & 2

For estimates at levels 1 and 2 the following table can be used to assist with the establishment of an appropriate percentage of risk (inherent and contingent). An electronic copy of this tool is included within EST 600-1 (KNet #5751720)
Table 5 – Total Risk Considerations, Estimates Level 1 and 2

<table>
<thead>
<tr>
<th>Element</th>
<th>Factors</th>
<th>Highly Confident &amp; Reliable</th>
<th>Reasonably Confident &amp; Reliable</th>
<th>Not confident &amp; Not Reliable</th>
<th>Selected Percentage (example)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Scope</td>
<td>Is the project scope well defined? Yes V No ^</td>
<td>3%</td>
<td>4%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Could the works be varied? Yes ^ No V</td>
<td>3%</td>
<td>4%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Are many project options possible? Yes ^ No V</td>
<td>3%</td>
<td>4%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Risks</td>
<td>Are there significant risks? Yes ^ No V</td>
<td>5%</td>
<td>6%</td>
<td>7%</td>
<td>6%</td>
</tr>
<tr>
<td></td>
<td>Has a detailed risk analysis been done? Yes V No ^</td>
<td>5%</td>
<td>6%</td>
<td>7%</td>
<td>6%</td>
</tr>
<tr>
<td>Constructability</td>
<td>Has a constructability review undertaken? Yes V No ^</td>
<td>3%</td>
<td>4%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Are there constructability issues with the proposed project type? Yes ^ No V</td>
<td>3%</td>
<td>4%</td>
<td>5%</td>
<td>4%</td>
</tr>
<tr>
<td>Key Dates</td>
<td>Are project commencement and completion dates known? Yes V No ^</td>
<td>1%</td>
<td>2%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td></td>
<td>Is the project planned to occur in the distant future? Yes ^ No V</td>
<td>1%</td>
<td>2%</td>
<td>3%</td>
<td>2%</td>
</tr>
<tr>
<td>Information</td>
<td>Have geotechnical, heritage, environmental, technical etc investigations been undertaken? Yes V No ^</td>
<td>9%</td>
<td>12%</td>
<td>15%</td>
<td>12%</td>
</tr>
<tr>
<td>Length of Project</td>
<td>What Is the extent of the project? &lt;2km short &lt;5km long Yes ^ No V</td>
<td>4%</td>
<td>7%</td>
<td>10%</td>
<td>7%</td>
</tr>
</tbody>
</table>

Total contingency percentage to be adopted for an estimate with a 90% confidence of not being exceeded

- 40%
- 55%
- 70%
- 55%

Total contingency percentage to be adopted for an estimate with a 50% confidence of not being exceeded

(assessed to be 40% of the Contingency percentage for a 90% confidence level of not being exceeded)

- 22%

Notes:
- No V denotes that if answer is No, decrease the contingency.
- No ^ denotes that if answer is No, increase the contingency.
- Yes ^ denotes that if answer is Yes, increase the contingency.
- Yes V denotes that if answer is Yes, decrease the contingency.

2.8.2 Estimate Levels 3, 4, 5 and 6 (when prepared by Estimating Consultants)

In establishing an appropriate level of contingent risk for estimates from levels 3 to 6, where estimates are prepared by estimating consultants the following categories are to be considered:

- **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 includes 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, that is 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

Estimators are required to identify potential items and costs associated with items for each of these categories. Quantity and rate ranges must then be applied to each of these items to allow the probabilistic calculation of P50 and P90 values for contingent risk.

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.

It is important that the factors or influences that make up the recommended contingency amount are recorded as line items in the Standard Estimate Template (Section 6.2 – Contingent Risk). 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 transparent view of what has been included within the contingent risk value.

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

• Calculations should only 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% likelihood 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 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%)

• To avoid optimism bias and over confidence, ranges should be both wide and biased toward the upside
### 2.8.3 Estimate Levels 3, 4, 5 and 6 (when prepared by DPTI Staff)

In establishing an appropriate level of contingent risk for estimates from levels 3 to 6 where estimates are prepared by DPTI staff the following table can be used to assist with the establishment of an appropriate percentage of contingent risk. An electronic copy of this tool is included within EST 600-3 – [KNet #5751723](#).

#### Table 6 – Contingent Risk Considerations, Estimates Level 3, 4, 5 and 6 (estimates by DPTI staff)

<table>
<thead>
<tr>
<th>Element</th>
<th>Factors</th>
<th>Highly Confident &amp; Reliable</th>
<th>Reasonably Confident &amp; Reliable</th>
<th>Not confident &amp; Not Reliable</th>
<th>Selected Percentage (example)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Performance and Functionality</strong></td>
<td>Are project scope variations likely either prior or during construction?</td>
<td>Yes ∨ No V</td>
<td>0%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Are local factors likely to increase the proposed project performance and/or functionality?</td>
<td>Yes ∨ No V</td>
<td>0%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Third Party Influences</strong></td>
<td>Have environmental assessments been undertaken (vegetation, contamination, heritage etc)</td>
<td>Yes ∨ No V</td>
<td>0%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Is property/land acquisition required for the project?</td>
<td>Yes ∨ No V</td>
<td>0%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Is there potential for unknown services to be identified during the construction of the project?</td>
<td>Yes ∨ No V</td>
<td>0%</td>
<td>3%</td>
<td>5%</td>
</tr>
<tr>
<td></td>
<td>Are there significant political or community risks and/or expectations?</td>
<td>Yes ∨ No V</td>
<td>0%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Policy and Standards</strong></td>
<td>Are design standards changes anticipated prior to construction commencing?</td>
<td>Yes ∨ No V</td>
<td>0%</td>
<td>1%</td>
<td>2%</td>
</tr>
<tr>
<td><strong>Design Development</strong></td>
<td>Is the project well defined?</td>
<td>Yes ∨ No V</td>
<td>0%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td></td>
<td>Have the project design/drawings been completed?</td>
<td>Yes ∨ No V</td>
<td>0%</td>
<td>2%</td>
<td>4%</td>
</tr>
<tr>
<td><strong>Other</strong></td>
<td>Are other unidentified/unmeasured items still likely to impact the final project cost?</td>
<td>Yes ∨ No V</td>
<td>0%</td>
<td>3%</td>
<td>5%</td>
</tr>
</tbody>
</table>

#### Total contingency percentage to be adopted for an estimate with a 90% confidence of not being exceeded

| 0% | 20% | 40% | 40% |

#### Total contingency percentage to be adopted for an estimate with a 50% confidence of not being exceeded

(assessed to be 40% of the Contingency percentage for a 90% confidence level of not being exceeded)

| 16% |

#### Notes:
- No V denotes that if answer is No, decrease the contingency.
- No ∨ denotes that if answer is No, increase the contingency.
- Yes ∨ denotes that if answer is Yes, increase the contingency.
- Yes V denotes that if answer is Yes, decrease the contingency.
Estimators should note that the use of the above tool is not suitable when requesting federal government funding.

2.9 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 may be requested to prepare a project program and cash flow in addition to the estimate.

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.

2.10 Estimate Review Process

On completion of the estimate, estimators are responsible for ensuring the review of estimates prior to their submission. Appendix 3 provides the steps that are required to be followed during the review of estimates. All errors identified during this review are to be corrected prior to the estimate being submitted to the Coordinator Estimating Services and the project manager/planner.
SECTION 3

Appendices
Appendix 1 - Minimum 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:

<table>
<thead>
<tr>
<th>Estimate Level &amp; Description</th>
<th>Level 1</th>
<th>Level 2</th>
<th>Level 3</th>
<th>Level 4</th>
<th>Level 5</th>
<th>Level 6</th>
<th>Level 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.0 CLIENT COSTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.1 Scoping Phase, Project Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.2 Scoping Phase, Design and Investigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.3 Development Phase, Project Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.4 Development Phase, Design and Investigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.5 Implementation Phase, Project Management</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.6 Implementation Phase, Design and Investigation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.7 Principal Arranged Insurances and Levies</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1.8 Environmental Assessment</td>
<td></td>
<td></td>
<td>Percentage based on previous projects</td>
<td></td>
<td>First Principles Client Cost as per EST600-5, KNet #5729453</td>
<td></td>
<td>Not included</td>
</tr>
<tr>
<td>2.0 PROPERTY ACQUISITION</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.1 Property Purchase Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.2 Transaction, Legal and Other Costs</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.3 Business Compensation</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2.4 Property Modification</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.0 SERVICES COSTS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.1 Electricity</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.2 Communications</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.3 Gas</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.4 Water and Sewer</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3.5 Other Services</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
### 4.0 CONSTRUCTION COSTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.1</td>
<td>Traffic Management &amp; Temporary Works</td>
</tr>
<tr>
<td>4.2</td>
<td>Environmental Works</td>
</tr>
<tr>
<td>4.3</td>
<td>Services (if by Contractor)</td>
</tr>
<tr>
<td>4.4</td>
<td>Earthworks and Demolition</td>
</tr>
<tr>
<td>4.5</td>
<td>Drainage</td>
</tr>
<tr>
<td>4.6</td>
<td>Retaining Walls</td>
</tr>
<tr>
<td>4.7</td>
<td>Bridges</td>
</tr>
<tr>
<td>4.8</td>
<td>Tunnels</td>
</tr>
<tr>
<td>4.9</td>
<td>Pavement</td>
</tr>
<tr>
<td>4.10</td>
<td>Spray Seal / Asphalt</td>
</tr>
<tr>
<td>4.11</td>
<td>Secondary Pavements</td>
</tr>
<tr>
<td>4.12</td>
<td>Pavement Marking</td>
</tr>
<tr>
<td>4.13</td>
<td>Road Furniture</td>
</tr>
<tr>
<td>4.14</td>
<td>Lighting</td>
</tr>
<tr>
<td>4.15</td>
<td>Landscaping and Urban Design</td>
</tr>
<tr>
<td>4.16</td>
<td>Traffic Signage, Signals and Controls</td>
</tr>
<tr>
<td>4.17</td>
<td>Rail</td>
</tr>
<tr>
<td>4.18</td>
<td>Other</td>
</tr>
</tbody>
</table>

#### Traffic Management & Temporary Works
- **Anticipated traffic constraints** such as the minimum through and turning lane requirements
- **Known traffic constraints** including minimum through and turning lane requirements along with the times these restrictions will apply

#### Environmental Works
Less than 5% of project detail, estimate based on benchmark costs from similar previous projects either per site or per km

#### Services (if by Contractor)
As per section 3.0, only work known to be part of contractors work to be included in this section

#### Earthworks and Demolition
Assumed design relevant to category (5 to 30%)

#### Drainage

#### Retaining Walls

#### Bridges

#### Tunnels

#### Pavement

#### Spray Seal / Asphalt

#### Secondary Pavements

#### Pavement Marking

#### Road Furniture

#### Lighting

#### Landscaping and Urban Design

#### Traffic Signage, Signals and Controls

#### Rail

#### Other

### 5.0 CONTRACTORS PRELIMINARIES & SUPERVISION

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.1</td>
<td>Design (if by Contractor)</td>
</tr>
<tr>
<td>5.2</td>
<td>Overheads (Onsite)</td>
</tr>
<tr>
<td>5.3</td>
<td>Overheads (Offsite)</td>
</tr>
<tr>
<td>5.4</td>
<td>Contractors Margin</td>
</tr>
</tbody>
</table>

#### Design (if by Contractor)
Estimator will determine. Advice to be given regarding the likely procurement method

### 6.0 P50 RISK & CONTINGENCY

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.1</td>
<td>P50 Inherent Risk</td>
</tr>
<tr>
<td>6.2</td>
<td>P50 Contingent Risk</td>
</tr>
</tbody>
</table>

#### P50 Inherent Risk
Assessed by Estimator

#### P50 Contingent Risk
No separate allowance, estimator will determine spread across schedule items

### 7.0 P90 RISK & CONTINGENCY

<table>
<thead>
<tr>
<th>Section</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>7.1</td>
<td>P90 Inherent Risk</td>
</tr>
<tr>
<td>7.2</td>
<td>P90 Contingent Risk</td>
</tr>
</tbody>
</table>

#### P90 Inherent Risk

#### P90 Contingent Risk
No separate allowance, estimator will determine spread across schedule items
Appendix 2 - Procedure for Duplicate Estimates

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 estimated P90 cost which is anticipated to be in excess of $25 million, duplicate estimates are recommended prior to seeking project funding. Further information regarding the assessment of the need for a duplicate estimate is provided in Section 1.8.

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

1) Having identified that the estimated P90 total project cost 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 work order requesting the provision of a duplicate estimate. Two estimators (typically selected from the estimating panel) will then be assigned to the task and invited to attend a single Estimate Commencement Meeting, with the prefixes OE and DE used to differentiate between the two estimators.

2) The selected estimators attend a single combined meeting to discuss the project, its objectives, scope, constraints etc and the outcomes that are to be provided. To ensure a consistent basis, both parties are to receive identical information at this time and as 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 manager/planner during the process of preparing the estimate responses should be communicated to both estimators to ensure consistency in the basis of their estimates.

4) Completed estimates are submitted for review as per the Estimate Review Process (see Appendix 3).

5) Where considered 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 assumed construction methodologies, constraints, assumptions, project scope details or 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) As a result of this meeting one or both of the estimators may be given the opportunity to further revise their estimates. Alternatively one of the estimators may subsequently be asked to prepare a reconciled estimate incorporating agreed methodologies, rates and scope items. 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 with any further changes requested from the estimators as deemed necessary.
Appendix 3 – Estimate Review Process

The responsibilities of those associated with the process of reviewing estimates are detailed below.

Additional revisions of the estimate made at the request of the Coordinator Estimating Services or the project manager/planner are also required to be reviewed and prior to their submission with the review dates on the Estimate Cover Sheet updated to reflect this on each occasion.

**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 the Estimate Reality Checker for review.

**Estimate Reality Checker**

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

The Estimate Reality Checker is responsible for ensuring that estimates meet the criteria specified in the following checklist.

Once reviews are completed the estimate is forwarded to the Coordinator Estimating Services and the project manager/planner.

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
- Scope definition is complete and reasonable given the level of estimate, and that all components described on the work order, in subsequent meetings or via correspondence have been included in the estimate.
- Potential scope in addition to that provided by the client has been adequately checked, researched and reviewed to ensure that all likely project items, constructability issues, methodology and staging assumptions have been considered and are allowed for within the estimate
- Assumptions and risks are realistic and adequately documented
- Rates and quantities (including units used) appear reasonable 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.

Zero values have not been provided within the estimate for items which are known or are likely to be in scope. It is expected that if items will be in scope that a reasonable assessment will be made of their extent and therefore the value of associated work will be estimated.

Percentage variances that have been used in ranging of costs and quantities are suitable.

Percentages for overheads and margins are reasonable and the value of contingencies which have been calculated are appropriate given the information available.

General concurrence with included items and their costing.

Where possible, review with recent projects of a similar nature in terms of benchmarking against current estimated project costs.

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

**The Coordinator Estimating Services**

The Coordinator Estimating Services is located within the DPTI Project Office and is responsible for providing an initial review of each revision of the estimate. This review includes items such as the scope, identified risks and assumptions made along with 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 but not definitive omissions or scope errors that may have resulted from the information provided to the estimator.

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

- Estimate is presented in the correct format
- Broad review of the scope that has been included and its correlation with what has been requested
- Broad review of the reasonableness of excluded items, items with zero dollar values and risks
Broad review of the reasonableness of ranges that have been applied to quantities and costs within the estimate

Review appropriateness of risks and assumptions

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

Review the reasonableness of calculated 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 or comments raised from the 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 estimated cost accurately reflects the scope and therefore costs associated with the project.

Where errors, or apparent omissions are identified that are deemed as being the responsibility of the estimator, these are to be referred to the Coordinator Estimating Services (or where considered more suitable directly to the estimator) for correction by the estimator.

It is suggested that at a minimum the project manager/planner check the following items within the estimate:

- Review all project risks and assumptions
- Where provided, review any scheduling or methodology information to ensure its practicality and appropriateness given any known project constraints
- Ensure that specialist advice or costs provided have been incorporated into the estimate
- Review the reasonableness of ranges that have been applied to quantities and rates within the estimate
- Review rates and quantities 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 contingency values
- Ensure that issues or concerns raised by either the estimator or Coordinator 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 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 4.
Appendix 4 - Completion of Formal Estimate

Information on the following page(s) provides instructions for completing each section of the Formal Estimate - a worksheet contained in the Standard Estimate Spreadsheet. Formal estimate values are those which are to be used when seeking or confirming project funding and hence they are only developed for estimates from levels 3 to 6.

Project managers/planners should note the requirement to initially complete the Formal Estimate Summary Form (commences Line 76 of the Microsoft Excel spreadsheet) and to verify that the estimate has been reviewed in accordance with the DPTI Estimating Manual prior to completing this form. The Formal Estimate Signoff and Acceptance Form (commences Line 5) is intended to be used as an overlying cover sheet where only key details and signatures are recorded.

Completing Section 1: Summary of All Considered Realistic Options

Following completion of estimates for each of the proposed options for 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 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 Project Option Estimate considered as 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 implementation 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.

Completing Section 2: Key Assumptions, Risks and Opportunities Relating to the Highest Valued Realistic Option

A summarised version of the key assumptions, risks and opportunities are recorded in this section. Typically, these details are sourced 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 worth recording at this point.

Completing Section 3: Project Estimate Values

At this point project managers/planners are required to enter the relevant section costs from the highest realistic Project 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(s) 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.

**Completing Section 4: Project Estimate Inherent and Contingent Risk Values and Total**

This section details the inherent and contingent risk values which have been included in the Project Estimate. The calculated P50 and P90 values (or equivalent) for both 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 5.

**Completing Section 5: Estimated cash flow of the Project Estimate**

Project managers/planners need to develop a likely program of work and cash flow (if this has not been requested from the estimator during the estimating process) which provides sufficient detail to allow the estimated P50 and P90 values (or equivalent) as determined in Section 4, to be distributed across relevant years of the project.

Project managers/planners should ensure their estimated construction programs 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. In addition to this, the majority of contingency values should (where applicable) be considered in later years of the project including some during the year after project completion.

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

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.

**Completing Section 6: Price Escalation**

At this point project managers/planners are required to use the link provided (KNet #4624055 - Price Escalation Calculation Spreadsheet) to calculate the value of escalation to be included within the formal estimate form. To allow future traceability project managers/planners may wish to import this tab into the calculation spreadsheet.

Estimated P50/90 (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 Section 6 and Section 7 of the formal estimate form. Price escalation values

---

DOCS_AND_FILES-#5559369-v26-EST_600_-_Estimating_Manual_for_Road_and_Rail_Projects.DOC Page 56 of 81
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 Senior Finance Analyst, Project Office.

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

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

Completing Section 7: 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 6 are also to be recorded against each of the relevant years.

Completing the Formal Estimate Signoff and Acceptance Form

Once sections 1 to 7 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 should then ensure that the necessary reality checks have been completed prior to printing and signing the form to gain the approval of the relevant project sponsor.

The completed formal estimate form is to be placed in the relevant project file and a scanned colour copy (all pages) forwarded to the Coordinator Estimating Services.
Appendix 5 - Numbering Convention of DPTI Estimates

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:

1503 OE L4 R3

In the above example:

1503  The estimate number allocated to the project options proposed for a given site, which for this example notes the project as being 1503 in the database of estimated projects. Typically this number should remain with the site unless an entirely different scope of work/objective is being considered.

OE  Indicates that the estimate is a Project 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.

For large or complex projects estimate options may be split into different excel files. In this case an identifier which clearly relates to the project option title should be added after the OE prefix, e.g. OE3C

Where a duplicate estimate is requested, OE is to be substituted with DE by one of the estimators as directed by the Coordinator 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 L7 as a project progresses through the framework from a strategic to a pre-tender estimate.

R3  This number represents the revision of the estimate; in this case 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. Estimators are to sequentially apply revision numbers to each revised estimate.

Importantly estimators should ensure that as an estimate progresses to a subsequent estimate level that the revision number reverts to R1.

All estimates are to be recorded and labelled using this numbering convention.
Appendix 6 – Standard Work Breakdown Structure Items and Content

The following is a reference guide to assist in the determination of costs associated with different sections of an estimate. It broadly defines the type of activities/tasks and materials that need to be considered in the estimate build-up.

Section 1 – Client Costs

Client costs are to be developed for each of the project phases, these 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 should typically consider these costs as those incurred in developing projects and their estimates through levels 3 and 4.

Note: Estimates at levels 1 and 2 are typically completed by internal staff considering strategic initiatives (the Identification Phase) based on very limited project detail. Costs at these levels are therefore not included unless they are project specific and can be readily applied to the total project cost.

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

Estimators should typically consider these costs as those incurred in developing projects and their estimates at levels 5 and 6.

Implementation Phase

Implementation phase costs represent those associated with procurement 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.

Ideally all client costs are to be developed for each phase using a first principles approach which considers the number, duration and subsequent cost of DPTI staff (Project Director,
Project Manager, Site Engineer, Site Technical Officer, Environmental Officer, Designers etc) and any consultants that are likely to be associated with the completion of tasks relevant to each of the items listed below.

To assist in the preparation of these costs using first principles the following template has been developed: EST 600-5 First Principle Client Costs Estimate – KNet #5729453

Alternatively, for early level estimates percentage rates based on the outcomes from previous similar projects may be used. Information regarding suitable percentages can be sought from the Coordinator Estimating Services. Where used, percentages are to be applied to the sum of estimated values for items 3.0 Services Costs, 4.0 Construction Costs and 5.0 Contractor’s Preliminaries and Supervision.

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

1.1 Scoping Phase - Project Management

- Mobilisation / Demobilisation of People
- Establishment / Demobilisation of Site Facilities
- Equipment Purchase
- Project Administration
  - Project Director
  - Project Manager
  - Project Engineer
  - Project Officer
  - Services Engineer
  - Environmental Officer
  - Administration Officer

- Contract Administration
  - Contract Manager (Design)
  - Contract Manager (Construction)
  - Site Engineer
  - Technical Officer
  - Graduate Engineer
  - Construction Verifier
  - Contract Administration

- Community Liaison
  - Community Manager
  - Comity Officer
  - Consultants
  - General Communications
  - Forum Facilitation
  - Presentation Materials

- Cost Estimating & Constructability (staff, consultants)
  - DPTI Staff
  - Commercial Advisor
  - Consultant – Estimating
  - Consultant – Constructability
• Consultant – Programmer
  • Independent Estimator
  • Economist

• 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)

• Facilities
  • Site Facilities – Ongoing Costs
  • Communications / Phone Costs
  • Vehicle Costs

• Fees and Approvals
  • Project Fees
  • Legal Fees / Advice
  • Agency Overhead (either funded by recurrent or project budgets)
  • Commissioning and Handover Costs

1.2 Scoping Phase – Design & Investigation

• Planning
  • Planning Manager
  • Senior Planner
  • Planners
  • DPTI Staff Specialists
  • Environmental Assessment (Vegetation, Contamination, Noise, Vibration, Heritage etc)
  • GIS Staff
  • Consultants – Planning study
  • Consultant Specialists

• Investigations
  • Traffic Counts and Data
  • Traffic Modelling
  • Boundary Survey
  • Engineering Survey
  • Identification of Services
  • Structural
  • Geotechnical
  • Hydraulic
  • Property Section Costs

• Design and Documentation (design staff costs)
• Design Verification
• Road Safety Audit
• Construction Verification

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 Implementation Phase – Project Management
See items under 1.1 Scoping Phase – Project Management

1.6 Implementation Phase – Design and Investigation
See items under 1.1 Scoping Phase – Project Management

1.7 Principal Supplied Insurances, Fees and Levies
1.7.1 Principal Supplied Insurances: This figure represents a levy which is charged to the majority of the department’s construction projects to recover the costs associated with the provision of Principal Supplied Insurances where the works are to be delivered by a contractor under the conditions of an Australian standard contract (AS 2124/AS 4300)

Estimators will be required to calculate a value for Principal Supplied Insurances based on a cent per dollar amount (currently 0.0033 cents in 2015) which is applied to the Section 2.4 (Property Modification), Section 3 (Services), Section 4 (Construction) and Section 5 (Contractors Preliminaries & Supervision) costs. This figure is revised annually by the Procurement Services Section.

Importantly estimators should note the conditions of this insurance which can be found at: http://www.dpti.sa.gov.au/__data/assets/pdf_file/0011/126389/2014-2015_Summary_of_Cover_-_Material_Damage_and_Liability.pdf

For major project estimates at later estimate levels project managers/planners may choose to obtain a quote from the Procurement Services Section to more accurately determine this figure.

1.7.2 Project Fees and Levies: Costs associated with the payment of fees or levies to other State or Local Government bodies 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 Operational Instruction 21.1 – Environmental Approval Procedures. 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. The
process is integrated into the DPTI Project Management process, and environmental issues should be considered from the early concept development stage through to detailed planning and design, implementation, 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 Environment Planning – Scoping Phase**: Considers the costs associated with the engagement of an Environment Officer to provide advice on legislative compliance and approval processes along with the identification of key environmental risks and subsequent proposed management options.

- **1.8.2 Environment Planning – Development Phase**: Includes costs associated with an Environment Officer coordinating the procurement of technical services and collating information which contributes to the Preliminary Environment Impact Report, Environment Impact Assessment or similar public documents.

- **1.8.3 Environment Officer – Implementation Phase**: Comprises costs for an environmental section representative to develop Environmental Management Plans and manage environmental risks on site during construction. Note: Costs relating to this section will typically be allowed for as a recurring cost within the DPTI project delivery team (Section 1.5 Implementation Phase – Project Management)

- **1.8.4 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.

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

- **1.8.6 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. DPTI’s Landscape Unit can provide detailed cost estimates once the scope of works is defined.

- **1.8.7 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 typically allowed for under section 4.2 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 Spray Seal / Asphalt
• 1.8.8 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.

• 1.8.9 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.

• 1.8.10 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.

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

• 1.8.12 Fauna: Includes the assessment of impacts on fauna, obtain approvals for impacts on nationally protected species and mitigate through redesign or monitoring or through delivery of landscape of SEB offsets.

• 1.8.13 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 for the project and a 10% loading on the Environment Officer under 1.8.3 Environment Officer to collate data and report.

• 1.8.14 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 by DPTI Environmental Planers using the Environmental Estimating Tool, EST 600-6 (KNet #9362850)
Section 2 – Property Acquisition

Estimated costs for the procurement of land/property are typically prepared by the department’s Property Planning and Management Section (PPMS) at the request of the Project Manager. Project Managers should seek a detailed breakdown of these costs to aid their assessment of:

- Scope, including any particular inclusions and/or exclusions
- Property modification items, to be carried forward to section 2.2 Property Modification
- Risk values, to ensure that these values are not duplicated in other sections of the estimate

Values are to be included within the estimate as follows:

2.1 Property Purchase Costs

- Site Value (SV)
- Capital Value (CV)
- Market value of required property
- Building and Other Improvements
- Minor Accommodation works

Importantly project managers 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 should not be considered as credits to the estimated project cost unless otherwise directed.

2.2 Transaction, Legal and Other Costs

- Heads of compensation (severance, injurious affection, general disturbance, out of pocket expenses)
- Legal fees
- Stamp duty
- Valuation costs (owner & DPTI)
- DPTI coordination costs (legal costs, administration)

2.3 Business Compensation Costs

- Business relocation/fit out costs
- Business impact costs

2.4 Property Modification

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 previous acquisition cost estimate items. Examples of this may include, but are not limited to the following:

- Building works associated with partial acquisition properties
- Property boundary modifications/fencing (including the upgrade of boundary fencing to properties adjoining those which are fully acquired)
Importantly if land acquisition estimates incorporate items such as those shown above, estimators should review these values to ensure their concurrence with the figures that they are transferring to their estimate.

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

- Demolition of residential or commercial property, Section 4.3 Earthworks
- Construction of noise walls, section 4.2 Environmental Works

Section 3 – Services

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

3.2 Communications (Telstra, Optus 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
- Raising of topstones

3.4 Sewer and Water (SA Water etc)
- Identification of applicable services (potholing etc)
- Design of applicable service relocations
- Relocation of applicable services
- Raising of topstones

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 section above. The disconnection of existing services to acquired and/or modified properties are to be included under each relevant section.
Service works are often completed or managed by the Department separately to the main construction contract and hence are initially considered as a client cost rather than a direct cost. As projects move to more detailed levels of estimate it may become clear that some service relocation works will be associated with the contractor's scope of work. Where this is to occur relevant costs are to be recorded within relevant categories under section 4.3 Services (if by Contractor).

Estimators should also note that at times temporary service relocations may be required. These costs should be clearly included under relevant service headings.

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 Traffic Management and Temporary Works
- 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
- Covered pedestrian walkways
- Maintenance of property accesses during construction

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

4.2 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)
- Noise, vibration, water quality monitoring etc
- Construction of noise walls and/or mounds
- Noise attenuation to properties e.g. double glazing, additional insulation etc

4.3 Services (if 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 to these works. 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 temporary service relocations.

Services items are to be included using the same format as for section 3.0 Services, 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
- Excavate / Fill (cut to fill, import to fill, cut to spoil, disposal/purchase costs etc)
- Pavement box out
- Disposal of excavated materials
- Proofing and repairs to unsuitable sub-grade
- Removal of rock
- Dewatering
- Contamination items
- Compaction testing
- Material testing
- Formation of batters and trimming
- Provision and/or respreading of topsoil
- EPA Licences

### 4.5 Drainage

- Removal/demolition of redundant and temporary drainage items
- Box and pipe culverts
- Headwalls
- Drainage Structures
- Kerbing
- Driveway Crossovers
- Spoon Drains
- Gross pollutant traps

### 4.6 Retaining Walls

- Reinforced earth and soil nailed walls, including excavation and backfill
- Cantilever walls, including detailed excavation
- Crib or interlocking walls, including detailed excavation and backfill
• Post and panel walls, including all excavation, structural elements and finishing treatments
• Diaphragm walls, including excavation activities and structural elements
• Demolition or adjustment of existing retaining walls

4.7 Bridges
All (road, rail, pedestrian etc) bridge construction activities for all methods, not limited to:
• Detailed excavation
• Foundation systems
• Abutment structures
• New or refurbished deck and suspension structures
• Barriers, handrails and walkways
• Bridge drainage
• Maintenance access and facilities
• Surface finishing

4.8 Tunnels
All tunnel construction activities for all methods, not limited to:
• 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
• Demolition or adjustment of existing tunnels

4.9 Pavement
• Working Platform
• Unbound Sub-base Layers
• Unbound Base Layers
• Compaction testing
• Temporary Pavements

4.10 Spray Seal / Asphalt
• Prime
• Spray Seal
• Bound Asphalt Sub-base Layers
• Bound Asphalt Base Layers
• Asphalt Levelling Courses
• Asphalt Wearing Courses
• Plane and Reinstate
• Profiling
• Crack Sealing
• Testing
• Temporary Spray Seal / Asphalt

4.11 Secondary Pavements
• Footpaths and cycleways (concrete, asphalt, paved) including temporary provisions
• Pedestrian ramps
• Tactiles
• Provision of new/alteration of existing property accesses and driveways
• Median infill (concrete/rubble)
• Concrete roundabout annulus

4.12 Pavement Marking
• Line marking (various types)
• Chevrons
• Raised Pavement Markers
• Pavement Bars
• Temporary markings including removal as necessary
• Audio tactile line marking

4.13 Road Furniture
• Guardrail and associated terminals
• Bus stops/relocation of bus stops
• Pedestrian fencing
• Fencing (unless associated with a property boundary, see 2.4)
• Rest area furniture and amenities
• Removal/demolition of any of the above items

4.14 Lighting
• Single and double outreach poles
• Lighting connected to SAPN poles
• Ducting
• Temporary lighting
• Removal of existing lighting

4.15 Landscaping and Urban Design
• Landscaping/revegetation (trees, grasses, shrubs, turf etc)
• Maintenance of plantings (weed control, watering etc including traffic control if necessary) for a given period of time after construction
• Watering systems
• Placement of landscaping soils
• Mulching
• Staking of trees
• Erosion control of landscaping works
• Seed collection
• Traffic control and service locations – where considered to be likely as the result of landscaping works occurring beyond the extent of the main project
• Bins and shelters

4.16 Traffic Signage, Signals and Controls

• Road signage
• Guide posts
• Bollards
• Pedestrian/cyclist holding rails
• Traffic signals, signal poles, and associated infrastructure
• Ducting
• Loops
• Gantries
• Intelligent Transport Systems
• Permanent Variable Message and/or speed limit signage
• Permanent lane status signage
• Red light cameras
• Temporary signage, signals and controls
• Removal of existing signage, signals and controls

4.17 Rail

Items included under this heading are to be included using the following standard structure

4.17.1 Trackwork

• 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
• Slewling or adjustment of existing rail track
• Removal and disposal of existing rail track

4.17.2 Overhead Wiring including 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 overtrack 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
• 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:
- 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 the point of substation or transformer
- Signal boxes and buildings

4.17.5 Rail Communications

- 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

- 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 Transport Stations, Interchanges, Buildings, Stations, 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 and controls
• Rail Administration Buildings
• Stabling Buildings
• Maintenance facilities
• Cleaning facilities
• 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 substitutes, network upgrades to facilitate temporary passenger movements)
• Other rail specific items which cannot be included within one of the previous rail sections

4.18 Other
Items should only be included in this section if they cannot be included as part of one of the previous sections.

Section 5 – Contractor’s Preliminaries & Supervision
5.1 Design (if 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 Overheads:
• Site supervision
• Authority fees and charges – council permits and fees, industry levies (where paid by contractor, separate to those in section 1.7)
• Project insurance (as additional cover to that in section 1.7)
• Bank guarantee charges
• Survey costs
• Temporary fences & hoardings associated with site offices
• Site signage and noticeboards
• Temporary site access
• Communications – computer and IT costs, plan printing and copying, telephones, couriers, stationery
• Temporary services – connection and usage fees
• Site security
• Site safety – protective clothing, safety signage, site inductions, drug and alcohol testing
• Site allowances
• Site vehicles (for Engineers, Project Managers etc)
• Site accommodation (including phones, faxes, water, sewer etc)
• Demobilisation and site clean up

5.3 Contractor’s Overheads (off-site)

• Head office costs
• Head office staff/administration

5.3 Contractor’s Margin

Estimators are required to provide an estimated percentage for the profit that contractors could reasonably be expected to assign to the direct 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 of contractors able to complete/likely to bid for the work etc

Note: Contractors Overheads and Margin are typically applied as a percentage to all section 4 and 5.1 costs.

Section 6 – P50 Risk and Contingency

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 +20% and -10%.

6.1 P50 Inherent Risk

The value of inherent risk is determined based on the ranging of rates and quantities of items in previous sections (sections 1 to 5) of the estimate. The calculation of inherent risk is discussed in section 2.6.

6.2 P50 Contingent Risk
The value of contingent risk is determined by assessing items which have a less than 100% chance of occurring. It is recommended that the following five standard categories of contingent risks be considered. These categories along with a guide to the types of items that may be applicable to each is provided below, a more comprehensive but by no means exhaustive list can be found in Appendix 5 of the ‘Best Practice Cost Estimation for Publicly Funded Road and Rail Construction’ document which can be found at: http://www.nationbuildingprogram.gov.au/publications/administration/pdf/Best_Practice_Cost_Estimation.pdf

6.2.1 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’

6.2.2 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

6.2.3 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

6.2.4 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’

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

Section 7 – P90 Risk and Contingency
Risk at the P90 level is calculated on the same basis as for the P50, see Section 6

### 7.1 P90 Inherent Risk
See Section 6.1

### 7.2 P90 Contingent Risk
See section 6.2

**Further Estimate Considerations**
In developing estimates estimators should also consider the following project costs:

**Expenditure to Date**
To ensure that a total estimated project cost is developed, where required/provided by the project manager, estimators are to ensure that incurred costs are represented within the applicable section of the estimate and are labelled in a way that identifies them as having already been incurred.

Estimators should ensure costs associated expenditure to-date items are not duplicated in other sections of the estimate such as client overheads, insurances, contractor overheads and margin, risk/contingency etc.

**Principal Supplied Items**
Although uncommon and typically mainly applicable to Level 5 (Detailed Design) and/or Level 6 (Pre-Tender) estimates, estimators should 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 should 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 - Completing the Standard Estimate Spreadsheet

Estimators will prepare and present estimates using one of the following Standard Estimate spreadsheets.

- **EST 600-1 KNet #5751720.** Typically used for estimates at levels 1 & 2 Estimates when prepared by Planning Division but also used by estimating consultants if requested to undertake these early estimates.
- **EST 600-2 KNet #5751722.** Typically used for estimates at levels 3, 4, 5 & 6 Estimates when prepared by estimating consultants.
- **EST 600-3 KNet #5751723** Typically used for estimates at levels 3, 4, 5 & 6 when prepared by DPTI staff.

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 and Methodology
- Summary Sheet
- Calculation Sheet
- Inherent Risk
- Contingent Risk
- 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 below.

**Formal Estimate**

Project managers/planners are required to complete this form in accordance with Appendix 4. Panel estimators are not required to enter any details on this form.

**Cover Sheet**

Estimators are required to complete the following details within the Cover Sheet:

- **Estimate Level** – indicate by placing an ‘X’ under the appropriate level description.
- **Project Name** – enter the project name using words identical to those which have been provided on the Work Order to allow the project to be accurately recorded and tracked. (Entry automatically transferred to other worksheets)
- **Estimate Number** – enter the estimate number identical to that provided on the Work Order adjusting the options number and providing a revision number as necessary. This revision number is to be updated for each subsequent
revision. A detailed description of the numbering convention to be applied is included in Appendix 5. (Entry automatically transferred to other worksheets)

- **Date Prepared** – enter and update this cell to reflect the current date of the latest 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 automatically transferred to other worksheets)

- **Project/Task** – enter the Project/Task number that has been provided on the Work Order. (Entry automatically transferred to other worksheets)

- **KNET No.** – this cell is to be left blank. Once the estimate is received and saved to the DPTI’s document management system, the Coordinator Estimating Services will enter the relevant KNet file and version number in this cell to facilitate future internal identification and retrieval of the estimate.

- **Basis** – unless otherwise requested this should remain as the ‘total project cost’, occasionally estimate requestors will ask for only ‘construction costs’ or ‘remaining project costs’ to be considered in which case this cell should be updated accordingly.

- **Year $ values** – enter 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 an option number and a brief description of what the option involves. Where the project manager/planner or drawings provide particular option numbers (e.g. 7A, 9C) these option numbers should be used to allow future referencing against drawings etc.

- **Review Information** – all estimates are to be reviewed in accordance with the process described in the Estimate Review Process, Appendix 3. 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 Coordinator 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 provide a revision number, the date of the revision and a clear description of what the revision involved.

**Scope, Risks & Methodology**

Estimators are required to complete the following details within the Scope, Risks & Methodology tab:

- **Reference Documentation** – cut and paste the details of reference documentation from the Work Order. Where additional documentation is provided 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 Work Order.

• **Estimator’s Record of Additional scope information resulting from the Estimate Commencement Meeting** – detail specific scope information obtained at the Estimate Commencement Meeting. Typically this will result from the estimator requesting items of information which has not been previously identified or provided.

• **Estimator’s Methodology, Assumptions, Risks, Opportunities and Exclusions** – enter information specific to each of the headings provided. This section should be considered as providing the project manager/planner (along with others who may view the estimate) with a snap shot of key assumptions, risks and opportunities considered in the build up of the estimate. Entries in this section should typically be taken directly from where they have been recorded in the calculation tab(s).

**Summary Sheet**
The summary sheet is automated to record summary data from the calculation tab. It requires no input from estimators.

Estimators **must not change** the format or names of standard items within this sheet. The format provided is intended to allow for internal benchmarking and the comparison of costs and percentages with projects of similar type and magnitude.

**Calculation Sheet**
The calculation sheet is where items, quantities and costs are to be recorded by the estimator. Estimators should note that all estimates are to be prepared exclusive of GST.

The estimate is built-up by identifying rates and quantities for items associated with each section of the estimate, and then applying a range to each item to determine inherent risk.

Appendix 6 provides 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, community consultation costs.

• **Services** - Services costs include costs associated with identification and relocation or alteration of infrastructure owned by public utilities which are to be paid by the department.

• **Land Acquisition** - Costs associated with the procurement or modification of land and property that are to be paid by the department.

• **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 (Indirect costs)** - Contractor’s preliminaries & supervision include allowances for the indirect job costs that contractor’s require to manage and supervise the project.

• **Risk and Contingency** – Includes items for both inherent and contingent risks applicable to the scope of work considered within the project estimate.

**Contingent Risk Table**

The contingent risk table is provided for estimates completed by DPTI staff.

Details regarding the use of this table are included in Section 2.7 with the resulting the percentages from this table transferred to the calculation tab.
Appendix 8 – Process for Updating Old Estimates to Present-day (Real) Dollars

The updating of estimates developed in a previous year to present-day (real) dollars, should 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
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: Aaron Bell on (08) 8402 1713

Methodology Example:

The old estimate should 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 March 2003 dollars to be $10.1m, i.e. in present value (real) dollars at the time.

This needs to be updated to present-day (real) dollars – Sept 2010

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

<table>
<thead>
<tr>
<th>Month</th>
<th>Index Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mar 2003</td>
<td>117.6</td>
</tr>
<tr>
<td>Sept 2010</td>
<td>168.4</td>
</tr>
</tbody>
</table>

The updated cost, in Sept 2010 presents day (real) dollars

\[
= \frac{10.1m \times 168.4}{117.6} = 14.5m
\]

This figure would then be cash flowed and escalated using the approach in Section 1.18 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.