



Extract from Notes on Administration (NoA) for Land Transport Infrastructure Projects (2014-15 to 2018-19)

Introduction

If a Project has already received Australian Government funding, and the Australian Government has committed to fund subsequent Phases, then the Funding Recipient must submit a PPR updated according to the guidance for the Phase for which funding is sought.

Proponents will provide cost estimates for the whole Project, and not just for the Phase/Phases that the PPR relates to, with the exception of Identification Phase PPRs. As such, whole-of-Project cost estimates will include actual costs for Phases already completed.

Unless otherwise approved by the Commonwealth, Funding Recipients must develop estimates using appropriate probabilistic cost estimation techniques to generate P50 and P90 Outturn Costs for the funded Project. Access to the data underpinning the estimates must also be provided.

Table F1: The Phases of a Project for Australian Government funding purposes

Phase	Description	NoA section
Identification	<p>The Project Identification phase requires an appraisal and/or study of broad alternatives such as road and rail technology, travel demand management and land use to solve a particular transport problem. The appraisal considers how well the broad alternatives meet programme outcomes and identifies a preferred alternative solution for progressing to the Project Scoping phase.</p> <p>This phase produces the preferred alternative with an indicative total Project cost presented as out turned and non-out turned costs with cash flows identified and reflecting contingencies at P50 and P90.</p> <p>Note: A PPR seeking Identification Phase funding only requires an estimate of the Identification Phase cost.</p>	Appendix C1
Scoping	<p>Project Scoping entails investigating specific options (such as route selections for a bypass) that achieve the preferred alternative to address the transport problem studied in the identification phase. For each option a business case analysis is required which should address the BCR, scope, budgets and timing (including contingency at P50, P90 and escalation) for each option, recognising that cost estimates will likely be based on limited information and so contingencies are likely to be high. This phase may involve land acquisition, if the land acquired is common to all options being considered.</p> <p>This phase produces a preferred option and a detailed total Project cost estimate, presented as Out-turned and non-Out-turned costs identifying cash flows and reflecting contingencies at P50 and P90.</p> <p>Note: A PPR seeking Scoping Phase funding should include the cost for the Identification Phase (if undertaken) as well as estimates for Scoping, Development and Delivery phases.</p>	Appendix C2
Development	<p>Project development entails detailed planning (such as environmental approvals, land acquisition, community consultation) and design (such as field studies, preliminary detailed design, quantity estimates) of the preferred option and the development of an updated BCR, detailed and refined Project budgets, timings (including a pre-tender estimate) and a procurement method. This phase might also involve pre-construction or preliminary construction work and land acquisition.</p> <p>This phase produces a detailed tender specification (including design requirements as appropriate) and a detailed pre-tender cost estimate for the total Project, presented as Out-turned and non-Out-turned costs identifying cash flow and reflecting contingencies at P50 and P90.</p> <p>Note: A PPR seeking Development Phase funding should include the actual costs for the Identification (if undertaken) and Scoping phases, and estimates for Development and Delivery phases as part of the overall Project cost estimate.</p>	Appendix C3

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<p>Delivery</p>	<p>Project Delivery entails at least construction and completion of the preferred option following a procurement process and the selection of a construction contractor. It may also involve detailed design where this is allocated to the construction contractor as an element of an overall contract. Preliminary works (such as relocation of services and earthworks) could precede the main construction contract.</p> <p>The point at which a project has achieved its primary purpose. For example, a new road is opened to traffic; a rail passing loop becomes operational.</p> <p>Note: A PPR seeking Delivery Phase funding should include the actual costs for the Identification (if undertaken), Scoping and Development phases, and an estimate for the Delivery phase as part of the overall Project cost estimate.</p>	<p>Appendix C4</p>
<p>Post-Completion</p>	<p>The Post-Completion Phase comprises all activities after a Project is Complete until the Project is Closed. This phase is not expected to exceed 12 months.</p> <p>Note: The cost estimate for the whole Project at the conclusion of the Post Completion phase includes the actual costs from the Scoping, Development and Delivery phases, noting that some residual property-related costs may have to be handled separately.</p>	<p>Section 2.2.8</p>

Post-procurement cost and schedule updates

The department requires up-to-date information on estimated costs and proposed Project delivery schedules. When a subcomponent of the work is awarded to a contractor, Funding Recipients must inform the department of the agreed contract price, including contingency and escalation factors, and provide an updated overall Project cost estimate (including Base Estimate, P50 and P90 Project Estimates and P50 and P90 Outturn Costs). Milestones may be varied to reflect the contractor’s delivery schedule, in accordance with Section 2.2.5.1 on Federal Notes on Administration document.

Where the updated overall P50 or P90 Outturn Project cost estimate exceeds the previous overall P50 or P90 Outturn Project cost estimate, the department may review the cost estimate.

Cost estimation guidance

Cost estimates accompanying a PPR must be prepared in accordance with the principles outlined in the department’s current Cost Estimation Guidance and the guidance in the associated Road and Rail Project Cost Breakdown templates. In instances of inconsistency in guidance, unless otherwise advised by the department, the guidance in the Project Cost Breakdown templates will, to the extent of the inconsistency, prevail. Current versions of the department’s Cost Estimation Guidance and Project Cost Breakdown templates can be obtained by contacting the department. A brief outline of cost estimation methods and Project Cost Breakdown templates follows.

Cost Estimation Methods

A probabilistic cost estimation process must be used for Projects with a total anticipated Out-turn cost (including contingency) exceeding \$25 million. Projects with a total anticipated Outturn cost (including contingency) under \$25 million may use a deterministic method, however the department recommends using a probabilistic cost estimation method where possible.

The department will review and assess the cost estimate (including the cash flows by financial year and Project phase) provided in the PPR before making a recommendation to the Minister. Proponents must cooperate with any review undertaken.

The NPA (The National Partnership Agreement on Land Transport Infrastructure Projects 2014-2019 between the Commonwealth and the States for the delivery of land transport infrastructure Projects) requires Proponents to provide access to underpinning data. As such, Funding Recipients must maintain an electronic library of all documentation consulted in determining the Project estimate.

Probabilistic Cost Estimation

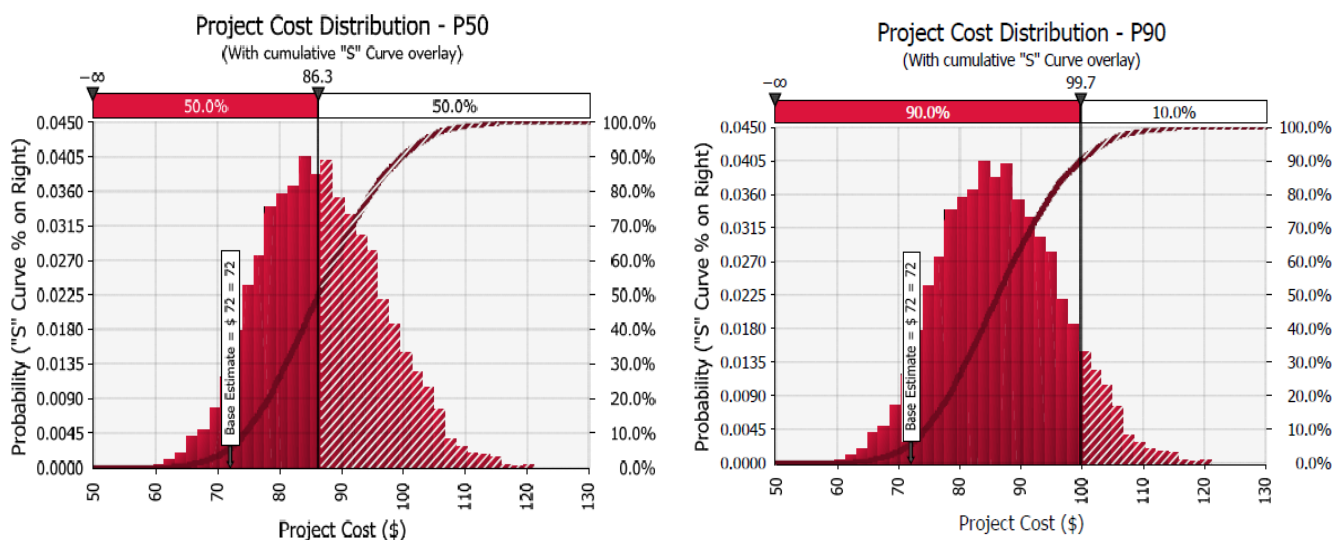
Probabilistic methods, such as Monte Carlo simulations, are now widely used to evaluate the effects of potential, multiple risks and to produce a "range of probable results," e.g., cost, schedule, or other Project values.

Galloway, PD, Nielsen, KR and Dignum, JL, 2013, *Managing Gigaprojects: Advice from those who've been there, done that*, American Society of Civil Engineers, page 58.

Probabilistic or risk-based cost estimation methods are a form of quantitative risk analysis which generally use Monte Carlo simulation to estimate contingency i.e. the component of a Project's cost in excess of the Project Base Estimate that accounts for, or reflects, risk. This simulation process is a computerised technique that allows practitioners to account for risks in quantitative risk analysis and decision making.

Monte Carlo simulation, when undertaken properly, including by providing appropriate input values, essentially generates all possible outcomes and the likelihood of occurrence of each. For instance, when provided with appropriate input variable cost items (in the form of probability distributions) associated with a Project, Monte Carlo simulation produces a distribution of all possible outcome values of the total Project cost. These possible outcome values are derived by essentially accounting for every possible value that each input variable cost item could take and then considering the probability of its occurrence. Consequently, the results of a Monte Carlo simulation include (among other figures and analysis) the confidence levels that can be assigned to all the generated possible outcome values of the total Project cost.

Each possible outcome value of the total Project cost can be given a *P* value which indicates the likelihood of the occurrence of that total Project cost. For instance, a *P50* cost is the Project cost with sufficient contingency to provide 50 per cent likelihood that this cost would not be exceeded. A *P90* cost is the Project cost with sufficient contingency to provide 90 per cent likelihood that this cost would not be exceeded. The examples in the tables below are of an output from a Monte Carlo simulation. The *P50* value is depicted in the chart to the left and the *P90* value in the chart to the right. The overlay S shaped curve on each chart is a cumulative representation of the cost distribution that permits any *P* value, including the *P50* and *P90* costs, to be directly read off the chart.



For all Projects with a total anticipated Outturn *P90* cost equal to or exceeding \$25 million, the department requires a cost estimate to be prepared by the Proponent using a probabilistic cost estimate method with the PPR to include, along with other information, the following:

- Base Estimate
- *P50* Project Estimate
- *P90* Project Estimate



- *P50* Outturn (escalated) Cost
- *P90* Outturn (escalated) Cost

Deterministic Cost Estimation

Projects with a total anticipated Outturn cost (including contingency) under \$25 million may use a deterministic method to estimate contingency, however the department recommends using a probabilistic cost estimation method where possible.

With probabilistic cost estimates, all input cost items are assigned a probability distribution. In contrast, a deterministic or single-point cost estimate treats all input cost items as a single point 'Most Likely' cost with the associated Project contingency generally estimated on a percentage basis. In developing a deterministic cost estimate, the following methods have been used:

- Factor based
- Reference class forecast method
- Item based

If a deterministic cost estimate is used, the department recommends the factor-based approach or, where sound data exists, a reference class forecast method. The department discourages using an item based deterministic cost estimate method, where contingency is added to each individual item.

The factor based method involves estimating an appropriate contingency by strategically reviewing the factors that influence the (cost) outcome of the Project. This approach also intends to provide consistency in assessing risk across Projects by providing a common template for assessment of risk.

The reference class forecast method involves estimating the contingency by reference to a similar Project, however this normally requires extensive access to benchmarking data, and frequently normalisation to ensure costs are comparable. Please refer to the departments' Cost Estimation Guidance for detailed guidance on both probabilistic and deterministic methodologies.

The specific format of the cost estimation component of the PPR and the cost estimation documents that must be provided with the PPR are discussed in Appendix C of Notes on Administration for Land Transport Infrastructure Projects.

Project Cost Breakdown Template

The department, in consultation with State jurisdictions, has developed Road and Rail Project Cost Breakdown templates as an excel spreadsheet. The purpose of these templates is to achieve improved consistency and rigour in the cost estimates included in funding submissions. The templates should be read in conjunction with the departments' Cost Estimation Guidance.

Instructions on how to populate the Project Cost Breakdown template are provided in the first worksheet and must be adhered to when populating the template. The templates include nine separate worksheets. Four worksheets contain instructions and information and five worksheets relate to Project details and data required for each of the scoping, development and delivery phases. For each funding submission, Proponents must complete the Project details' worksheet and the worksheet relevant to the phase for which funding is being sought.

The Project Details' worksheet requires the following data to be entered:

- Project Name
- Project Description
- Project Phase
- State
- Key Project Dates

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- Key Project Quantities such as road length, number of lane kilometres, tunnel length, number of tunnels, number of bridges
- Procurement method
- Reference class

With the exception of the Identification phase, the worksheet lists cost items in three tiers or levels (Project Cost Breakdown Levels 1 to 3) for each phase, as shown in the table below for the Road Project Cost Breakdown:

PCB Level 1	PCB Level 2	PCB Level 3
Client Management & Oversight Cost		
	SCOPING	Project Management-Scoping Design & Investigation-Scoping
	DEVELOPMENT	Project Management-Development Design & Investigation-Development
	DELIVERY	Project Management-Delivery Design & Investigation-Delivery Client supplied Insurances, Fees, Levies - Delivery
	PROPERTY ACQUISITION	Purchase Price Transactional Cost & Other costs Business Compensation Environmental Offsets
Construction Cost		
	CONTRACTOR	Environmental Works Traffic Management and Temporary Works Public Utilities Adjustments Bulk Earthworks Retaining Walls Drainage Bridges Tunnels Pavements Finishing Works Traffic Signage, Signals and Controls Design (if by contractor) Supplementary items
	CLIENT	Client supplied Materials and Construction Services - Delivery
TOTALS		

The data required to populate the Road Project Cost Breakdown table immediately above would draw on the same data the Proponent would use to develop the Project's Base Estimate. Some of the cost items will also require a breakdown according to *unit cost* and *elemental quantity*. The Rail Project Cost Breakdown table includes different items at PCB level 3.

The other data required to be included in the Project phase sheet (with the exception of the Identification phase which only requires the costs to be provided for that phase) is:

- The overall Project Summary including Base Estimate, Contingency at P50 and P90 levels, Project Estimates at P50 and P90 levels and Outturn Costs at P50 and P90 levels (as estimated by the proponent).
- Cash Flows of the Base Estimate, Project Estimates at P50 and P90 levels and Outturn Costs at P50 and P90 levels, including providing the escalation rates used for each relevant financial year.

The Proponent is required to submit a completed Road or Rail Project Cost Breakdown spreadsheet with a PPR.