Submission No 21

INQUIRY INTO RAIL INFRASTRUCTURE PROJECT COSTING IN NSW

Organisation: Transport NSW

Date received: 9/11/2011

Attachment 1: Typical Road Work Breakdown Structure
Attachment 2: Typical Rail Work Breakdown Structure
Attachment 3: TCA Procurement Policy CM-PO-042
Attachment 4: TCA Procurement Plan CM-ST-038
Attachment 5: TCA Delivery Strategy Guideline CM-PR-046
Attachment 6: Best Practice Standard

NSW GOVERNMENT | Premier & Cabinet

The Hon Natasha Maclaren-Jones MLC
Committee Chair
General Purpose Standing Committee No. 3
Parliament House
Macquarie Street
Sydney NSW 2000

Dear Ms Maclaren-Jones

I refer to your letter dated 23 August 2011 regarding an inquiry into rail infrastructure project costing in NSW being conducted by the NSW Legislative Council's General Purpose Standing Committee No. 3.

Please find attached the NSW Treasury submission, endorsed by the Department of Premier and Cabinet. The Department of Premier and Cabinet also endorses the Department of Transport's recent submission to the inquiry.

Should you require further information please contact Mr Tim Hurst, Acting Assistant Director General, Policy and Strategy on

Yours sincerely

Chris Eccles
Director General

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NSW GOVERNMENT | Transport

Legislative Council General Purpose Standing Committee No. 3

Inquiry into Rail Infrastructure Project Costing in NSW

Department of Transport Submission

Contents

Executive Summary

This submission has been prepared by the Department of Transport. It represents the positions of all the NSW government agencies with roles in the delivery of major rail and road transport infrastructure projects.

Legislation received assent on 13 September 2011 to establish Transport for NSW (TfNSW).

As part of the integrated approach to project delivery, TfNSW is moving towards a standardised approach to project cost estimating which is consistent with the approach suggested by the Federal Department of Infrastructure and Transport. Transport Construction Authority (TCA) and the Roads and Traffic Authority (RTA) have had well-developed estimating practices for many years, which already substantially follow the principles of the Federal Government's standardised approach, albeit with some differences in terminology.

Whilst TCA is abolished and RTA becomes part of the Roads and Maritime Services, the Projects Division of Transport for NSW will continue with well established estimating principles and the Federal approach.

This submission outlines the principles and methodologies of cost estimating for major infrastructure projects.

Estimating project costs is about predicting the future – therefore it is inherently uncertain. At the start of a project, an estimate will need to be prepared without a design, without detailed site or technical investigations, without a detailed program and without the prior knowledge of conditions which will apply during the project's delivery phase, including the state of the contracting market, inflation, labour supply, specific cost increases in raw materials and manufactured components, land prices, foreign exchange rates, weather conditions, design standards, community expectations and without knowledge of legislative or regulatory changes.

Estimates prepared at different phases of a project lifecycle will have different levels of knowledge and certainty of the scope and, therefore, different levels of uncertainty and risk. Because the scope becomes better defined and the confidence in the components and timing of the delivery process increases as the project progresses through the phases of its lifecycle, there will generally be a corresponding reduction over time in the levels of uncertainty and risk.

A project estimate must include an allowance for uncertainty and risk, referred to as a contingency allowance, or simply "contingency".

A project estimate must also include a provision for escalation, that is for increases in the cost of labour, materials and services between the base date of the base estimate and the completion of the project. The estimation of escalation requires a prediction of future cost increases, which are subject to many factors, both general and industry-specific. Experience shows that the Consumer Price Index is not a reliable basis for forecasting escalation for infrastructure projects.

A good project estimate is one which is not exceeded by the final cost of the project, even though the final cost will not be known for some years after the original estimate was prepared. An estimate which is too low will, once the project is committed, result in a later requirement for additional allocation of funds to complete the project. An estimate which is too high will cause scarce funding to be reserved when it could have been allocated to other projects or needs.

This submission addresses some special features of rail projects which must be taken into account in the delivery of rail projects and the processes employed by TCA to develop reliable cost estimates.

There are no fundamental differences in the methodologies used to estimate costs of road and rail projects. There are, however, some differences, primarily in the detailed cost Work Breakdown Structure, reflecting the different content of the two types of projects, and in the use of historical projects as a reliable source of estimating data, reflecting the much larger portfolio of completed road projects over rail projects.

The cost of construction in rail corridors is influenced by a number of factors, including restricted access, more demanding worksite protection and safety assurance regimes, track possession costs and factors unique to rail corridors, such as impact loadings to withstand train derailments and measures to minimise corrosion from stray traction currents.

There is an internationally recognised tendency to "optimism bias", that is over-optimistic estimation of costs and delivery times, for major transport projects, which are dealt with by both TCA and RTA through rigorous internal and external review processes.

The processes used by TCA for competitive tendering are described, including shortlisting of capable contractors and price competitive tendering. Similar processes are used by RTA. TCA has taken a number of steps to maximise competition in tendering, despite the high concentration of ownership of major construction contractors in Australia. These include limiting the number of related party tenderers as well as promoting its projects and tendering opportunities to non-aligned local and overseas contractors.

1. Introduction

1.1 Department of Transport

This submission has been prepared by the Department of Transport. It represents the positions of all the NSW government agencies with roles in the delivery of major rail and road transport infrastructure projects.

1.2 Transport for NSW

Legislation received assent on 13 September 2011 to establish Transport for NSW (TfNSW) as an authority which will ensure planning and policy across all modes of transport are fully integrated. The *Transport Legislation Amendment Act 2011*, at the date of this submission, awaits proclamation.

The focus for Transport for NSW is the customer, be it a public transport user, a motorist, pedestrian, farmer or importer. The customer will be at the centre of every action.

Transport for NSW is responsible for improving the customer experience, planning, program administration, policy, regulation, procuring transport services, infrastructure and freight. The new organisation will plan for both public and private transport, including road, rail, buses, taxis, ferries, light rail, cycling, walking, community transport services, regional air services and freight movement.

The operating agencies have been freed up to focus on service delivery – providing safe, reliable, clean and efficient transport services.

The six divisions in the organisation are:

- Customer Experience Division and
- Freight and Regional Development Division
- Planning and Programs: providing consolidated planning and overall investment advice for all modes
- Policy and Regulation
- Transport Projects
- Transport Services.

As part of the changes, the following organisations are being abolished with their functions to be delivered by Transport for NSW:

- Transport Construction Authority
- Country Rail Infrastructure Authority.

Another significant change is that the RTA and NSW Maritime will cease to exist and a new agency will take their place – NSW Roads and Maritime Services.

1.3 TfNSW approach to project cost estimating

As part of the integrated approach to project delivery, TfNSW is moving towards the standardised approach to project cost estimating described in the following sections, which is consistent with the approach suggested by the Federal Government. Indeed, the major transport project delivery agencies to be abolished, the Transport Construction Authority (TCA) and the Roads and Traffic Authority (RTA), have, for many years, had well developed estimating practices which substantially already follow the principles of the Federal Government standardised approach, albeit with some differences in terminology.

2. Estimating Project Costs

Estimating project costs is about predicting the future – therefore it is inherently uncertain. At the start of a project, an estimate will need to be prepared without a design, without investigation of geotechnical and other site conditions, without a detailed program or timing of delivery and without the prior knowledge of conditions which will apply during the project, including the state of the contracting market, inflation, labour supply, specific cost increases in raw materials and manufactured components, land prices, foreign exchange rates, weather conditions, design standards, community expectations and without knowledge of legislative or regulatory changes, for example in taxation and carbon pricing, environmental and planning requirements and occupational health and safety requirements.

A construction project has a lifecycle, starting from an original identified need and progressing through the identification and assessment of potential means of satisfying the need, selection of a conceptual project, selection of the best way of delivering the project, the design and planning approval processes, through to its construction and commencement of operation. In fact, the lifecycle continues through the operating life and its eventual decommissioning, demolition and recycling but, for the purpose of this submission, only those parts of the lifecycle up to and including commencement of operation will be considered.

Estimates prepared at different phases of a project lifecycle will have different levels of knowledge and certainty of the scope and, therefore, different levels of uncertainty and risk. Because the scope becomes better defined and the confidence in the components and timing of the delivery process increases as the project progresses through the phases of its lifecycle, there will generally be a corresponding reduction over time in the levels of uncertainty and risk.

Often, as projects progress, unforeseen complexities can also emerge which drive up the cost. This is often referred to in the media and elsewhere as a 'cost blowout'. However, the perceived increase in the cost of a project can sometimes be attributed to other external factors, such as:

- an early public announcement of the cost of a rail project prior to a detailed level of cost planning, engineering and design work being undertaken or
- the inclusion into the overall project package of additional or ancillary works not directly related to the core project. An example of this is the Auburn Stabling project, which is included in the overall funding envelope for the South West Rail Link or
- major changes to the scope of a project made at a very late stage. An example is the decision to tunnel the Epping to Chatswood Rail Link under the Lane Cove River, rather than an initially planned bridge over the river.

A project estimate must include an allowance for uncertainty and risk, referred to as a contingency allowance, or simply "contingency".

A good project estimate is one which is not exceeded by the final cost of the project, even though the final cost will not be known for some years after the original estimate was prepared. Any actual cost increases over the project lifecycle are funded from contingency, but the final cost never exceeds the initial estimate, including contingency.

An estimate which is too low or too high will distort the economic evaluation and business case for the project. An estimate which is too low will, once the project is committed, result in a later requirement for additional allocation of funds to complete the project. An estimate which is too high will cause scarce funding to be reserved when it could have been allocated to other projects or needs.

2.1 Terminology used in project cost estimates

The terminology used in this submission generally follows that of the report *Best Practice Cost Estimation for Publicly Funded Road and Rail Construction*, *19 June 2008*, prepared by Evans and Peck for the then Federal Department of Infrastructure, Transport, Regional Development and Local Government. This document is publicly available at http://www.nationbuildingprogram.gov.au/publications/administration/pdf/Best_Practice_Cost_Estimation.pdf and is also available as Attachment 6 in this document. It is referred to in this submission as the *Best Practice Standard*.

An updated version of the *Best Practice Standard* dated May 2011 has been released in proof version for training purposes. Unless specifically stated otherwise, references in this submission are to the publicly released 19 June 2008 version.

Some key terms, generally following the *Best Practice Standard*, are listed below.

Project Phases – The names of the different stages or phases of a project lifecycle have historically been given different names by different agencies within and between different government jurisdictions. The terms used in this submission are:

- Project Identification Phase
- Project Scoping Phase
- Project Development Phase and
- Project Delivery Phase.

These phases, together with the main activities in each phase, are shown in the table on the following page.

Table 1: Project lifecycle phases

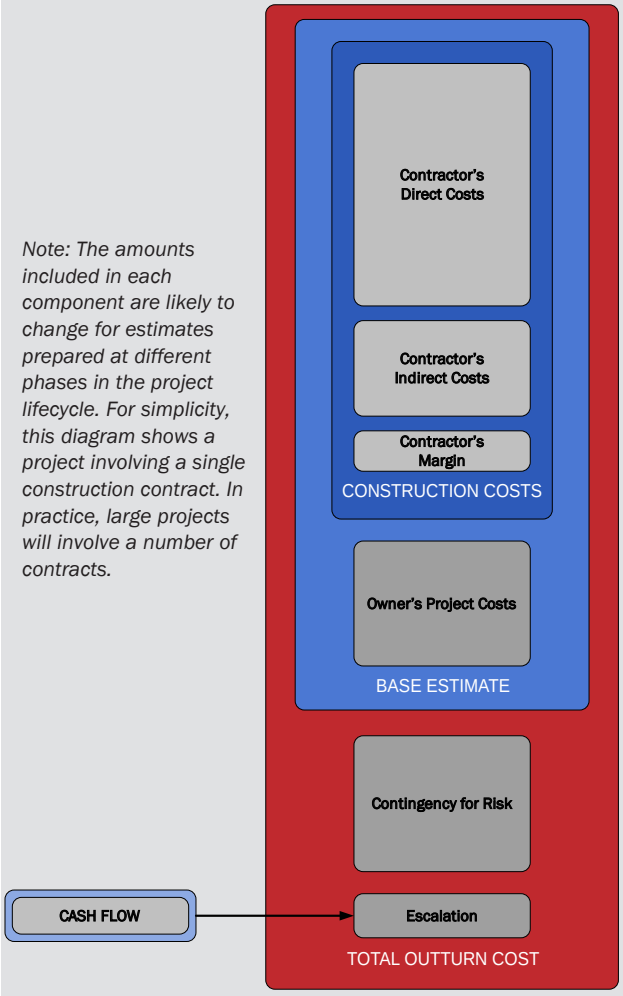
Project Phase	
Project Identification Phase	**Needs / Objectives**
	Strategic assessment. Document the broad project objectives. Appraise broad alternative solutions to satisfy the identified need. Rapid benefit-cost analysis (BCA). Identify preferred solution. Seek approval and funding to proceed to Project Scoping Phase.
Project Scoping Phase	**Getting the Right Project**
	Investigate options, test against the objectives and select the conceptual project. Identify and document the concept scope and performance requirements. Prepare concept estimate / budget and program. Preliminary business case and BCA. Seek approval and funding to proceed to Project Development Phase.
Project Development Phase	**Getting the Project Right**
	Refine and develop the concept. Delivery strategy (packaging and contracting). Detailed scope and performance requirements. Document safety assurance requirements. Design (extent dependent on delivery strategy). Constructability review and refinement. Program review and refinement. Environmental assessment and request for planning approval. Detailed estimate. Update BCA. Seek approval and funding to proceed to procurement (tendering.)
Project Delivery Phase	**Delivering the Project Right**
	Procurement – tendering, evaluation of tenders and selection of preferred tenderer(s). Approval of funds for delivery. Award of contract(s). Administration of contract(s). Management and technical oversight of design and construction. Prepare for operational readiness. Commissioning and testing. Trial running. Complete asset management documentation. Commence operation. Monitor for and rectify any defects. Close out contract(s).

Project cost estimate components

The components of a project cost estimate are shown diagrammatically in the following figure and are described in more detail in the section which follows.

Figure 1: Components in the structure of a project cost estimate[1]

Note: The amounts included in each component are likely to change for estimates prepared at different phases in the project lifecycle. For simplicity, this diagram shows a project involving a single construction contract. In practice, large projects will involve a number of contracts.



Direct Costs – The costs to the contractor of materials, manufactured components, labour and sub-contracts which together go to construct the project works and the temporary works and the site facilities required to construct the project works.

Indirect Costs – The costs to the contractor of supervision, design and certain "preliminaries", such as the costs of running site facilities, security services, insurances, authority fees and charges. A more complete "checklist" is provided in Appendix 6 of the May 2011 edition of the *Best Practice Standard*.

Contractor's Margin – The contractor's contribution to its head office operating costs and the contractor's profit margin for the project.

Construction Costs – The sum of direct costs, indirect costs and margin. This will typically be the contract sum at the time a lump sum contract is awarded.

Owner's Project Costs – The project costs payable by the owner, separate from any amounts included in a construction contract. These typically include:

- project and program management
- costs of obtaining planning and other approvals
- planning and environmental compliance costs
- design costs prior to tendering
- specialist design and technical studies and support
- legal costs
- costs of managing the tendering and procurement processes
- land acquisition costs, both for permanently required land and for temporary use as worksites
- principal or owner arranged project insurances
- principal or owner supplied materials
- track possession costs and alternative transport (bussing) costs
- contract administration
- owner's head office costs
- owner's costs in testing, commissioning and trial running
- post-completion studies and reviews.

Base Estimate – The sum of the construction costs and the owner's project costs. The base estimate will refer to a base date at which all the included costs have been estimated.

Contingency – An amount allowed for risk and uncertainty in the base estimate. There are two broad categories of risks which must be covered by a contingency allowance:

- inherent risks – events or circumstances relating to items in the base estimate which are certain to occur, but where the range of costs and quantities is uncertain. For example, it may be certain that retaining walls will be required, but the estimate may not accurately predict the quantities or the unit prices for those walls
- contingent risks – events or circumstances which may or may not occur. Contingent risks have uncertainty in both their probability of occurrence (likelihood) and in their cost and time impacts (consequences) on a project. Some contingent risks include inclement weather, unexpected geotechnical conditions, industrial disputes, technical issues becoming evident during design development, unanticipated conditions of planning approval, legal challenge, need to divert or protect previously unidentified utility services, delays in supply of materials or components, fire, contamination or hazardous materials found on the site. A more detailed list is provided in the *Best Practice Standard*[2].

Cash Flow – The rate at which the project costs are expended over time. The cash flow will depend on the project program, which should be optimised during the project development. The program may also need to take into account any constraints on the drawdown of funding.

Escalation – The allowance for increases in cost of labour, materials and services between the base date of the base estimate and the completion of the Project Delivery Phase. In a fixed price contract, the Contractor will allow for cost increases and take the risk of these cost increases in relation to the work under the contract and will include an appropriate allowance in the Contract Sum. However, escalation must be applied to the estimated project cost for this contract component and for all other components until each is progressively expended.

The estimation of escalation requires a prediction of future cost increases, which will be influenced by general inflation, legislative changes which affect the industry, the availability of labour and materials, the state of the manufacturing, design and construction markets, including the volume of projects being undertaken at any one time, as well as unusual rapid price increases in specific materials, for example, steel, concrete and oil. For example, in the financial year 2007-2008, reinforcement steel increased in price by approximately 40%, bridge deck units by 35%, concrete by 10% and plant hire rates by 10%, compared with an increase in CPI for the 2008 calendar year of 4.19%. CPI, on its own, is not an appropriate basis for forecasting escalation of infrastructure projects.

Total Outturn Cost – The total of the base estimate, the contingency and the escalation, expressed in "as spent" dollars (sometimes referred to as "nominal dollars"), in other words, the sum of all payments and other expenditure under the project.

Determining the appropriate contingency

The determination of the appropriate contingency depends on the phase of the project lifecycle.

There are two methods of selecting the level of contingency, both widely used in Australia and internationally:

- deterministic and
- probabilistic.

A deterministic selection of the level of contingency is made by applying either a single selected percentage to the total base estimate or by applying different selected percentages to individual elements or groups of elements within the base estimate. These percentages are selected from experience, previous projects and international practice, and take into account the level of scope definition, constraints, delivery methods and design at the date of the estimate.

Probabilistic estimation of contingency is regarded as a more reliable method and is generally used on all large projects in the Project Development Phase.

The method involves separate consideration of each project component and predicting worst case, most likely and best case cost outcomes for that component, together with the expected shape of the probability distribution for that component. After these attributes are assigned to each component, often in a workshop environment, a proprietary software application is used to run a Monte Carlo simulation, whose output is a probability distribution curve for the outturn cost of the project. An example curve is shown in the figure below (from Appendix 10 of the *Best Practice Standard*).

The predicted cost identified from the probability distribution curve is dependent on the level of confidence which is required. At the Project Development Phase, TCA and RTA require, as do most government capital works agencies, a 90% confidence level, usually referred to as P90. This means that, statistically, there is a 90% probability that the actual cost of the project will not exceed the estimated cost. The contingency will be the difference between the predicted cost at the selected P90 level and the base estimate. In the example above, the contingency will be about $2.3 million ($12.2 million minus $9.9 million).

Multiple contracts

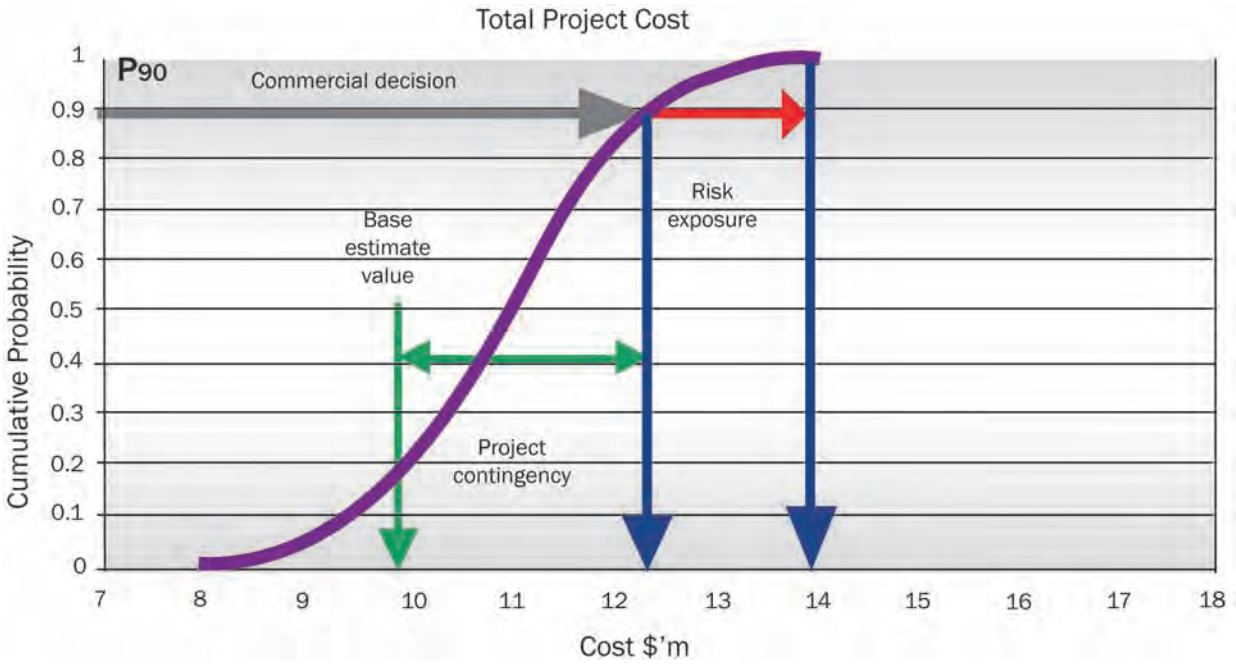
It should be noted that, for large projects, there may be a number of construction contracts rather than one as shown in the figure on the previous page, in which case there will be a number of Construction Cost components. The base estimate will then be the sum of the construction cost components for the multiple contracts and the total of the owner's project costs, which will include project management and administration costs for each contract.

The project contingency will be set having regard to:

- the risk allocation for each contract
- the interface risk between the contracts
- the residual risks retained by the owner under each contract and
- all other project risks not otherwise assigned or insured.

The escalation will be determined by taking into account the planned timing and rate of expenditure against each component of the overall project.

Figure 2: Probabilistic project cost curve



3. Submission in Response to the Terms of Reference

3.1 Transport Construction Authority (TCA)

The Transport Construction Authority (TCA) was constituted on 1 July 2010 under s18A of the *Transport Administration Act 1988*.

TCA was formerly Transport Infrastructure Development Corporation (TIDC) which, on its establishment in January 2004, took over the responsibilities of the government-owned Parramatta Rail Link Company Pty Ltd (PRLC).

Under new legislation (the *Transport Legislation Amendment Act 2011*), TCA will be abolished and TCA's functions and projects transferred to the Transport Projects Division (TPD) within Transport for NSW (TfNSW).

The principal objectives of TCA are set out in s18B of the Transport Administration Act 1988 as:

> *"(a) to develop major railway systems, and*
>
> *(b) to develop other major transport projects, in an efficient, effective and financially responsible manner."*

3.2 TCA projects

TCA and its predecessor organisations have delivered a number of major transport projects, including:

- the Epping to Chatswood Rail Line
- projects under the Rail Clearways Program, including Berowra Platform 3, Bondi Junction Turnback, Homebush Turnback, Hornsby Platform 5 and Stabling, Lidcombe Turnback, Macdonaldtown Stabling and Revesby Turnback
- North Sydney Station Upgrade and
- projects under the Commuter Car Parks Program.

TCA is presently delivering:

- the South West Rail Link
- the Auburn Stabling (Stage 1) Project
- projects under the Rail Clearways Program, including Cronulla Line Duplication, Kingsgrove to Revesby Quadruplication, Liverpool Turnback, Macarthur Turnback and Richmond Line Duplication (Stage 1) and
- Wynyard Walk.

TCA is managing the planning/concept stages for the Northern Sydney Freight Corridor and is assisting in the delivery of the Inner West Light Rail Extension.

3.3 Methodologies used by TCA to cost rail projects

TCA applies the methodologies set out in the *Best Practice Standard*.

TCA, like its predecessors, engages expert cost planners from external private sector companies to prepare cost estimates for its projects. These cost estimates are reviewed in detail by TCA's senior management at key stages in their preparation before being used as the basis of cost estimates for project funding approvals.

Before the *Best Practice Standard* was published, the principles and methodology contained within it were widely accepted and applied to all projects delivered by PRLC and TIDC, including the Epping to Chatswood Rail Line and the Rail Clearways projects.

Types of estimate

Consistent with the *Best Practice Standard*, there are two broad types of estimate used by TCA:

- **unit rates** – based on rates obtained from actual costs on earlier projects, known benchmarks or other sources and
- **first principles** – estimate built up from a specific detailed assessment of the labour costs, materials costs, the costs of services and all of the other components, preliminaries and overheads required to deliver the project.

The basis of an estimate is dependent on the phase of the project. In the early phases of a project, it is not possible to prepare a "first principles" estimate because the levels of scope definition and design have not been advanced sufficiently to allow detailed measurements. Where detailed information is not available, some components of estimates may need to be based on assumptions, which are documented as part of the estimate process. For example, in the Project Development Phase, an estimate, generally on a "first principles" basis, will be prepared, usually based on a "reference design" prepared by the project team. Estimates may also be hybrids, mainly prepared from first principles but including some components, such as proprietary equipment, which are priced on a historic basis or from other sources.

Benchmarking

As part of the estimate review process, estimates are compared, to the extent reasonably possible, against applicable benchmark rates for comparable projects. In these

benchmarking comparisons, care is taken to compare like with like, considering factors which will significantly affect costs, such as:

1. the base date of the estimate – inflation may significantly skew the comparison unless the estimates are adjusted to a common base date
2. the location of the works – inner urban, suburban or semi-rural
3. whether the works are carried out in a new corridor ("greenfield") or an existing operational rail corridor ("brownfield"). Works carried out in an operational rail corridor will have to be carried out in a way which manages the continuity of existing rail services and provides safe working conditions for construction workers, rail workers and the public. This may require: temporary relocations of track and rail services and construction of protection barriers, sometimes in multiple relocation stages, to create a safe zone in the corridor to perform some works; carrying out of all works during a limited number of short track possession windows; or a combination of those measures, all of which can impact significantly on the cost of the project
4. The cost of providing alternative public transport services during track possessions ("bussing")
5. the nature of the construction – for example, ballasted track laid on the surface versus direct fixed track in tunnel; the ground and environmental conditions; extent of bridge works, earthworks, retaining walls, noise barriers, tunnels, viaducts etc
6. the numbers, types and locations of stations or stops
7. the type of electric traction system (if any)
8. requirements for interworking compatibility with existing rail systems or technologies, particularly proprietary or "in-house" systems such as signalling control and passenger information systems
9. the impact of major utility services
10. land acquisition costs
11. costs of obtaining planning approval
12. environmental and planning compliance costs and
13. "one off" or unusual inclusions in the costs of a project. For example, the approved budget for the South West Rail Link includes two grade-separated rail junctions at Glenfield, an upgrade of the existing Glenfield Station, the upgrade of the electric traction supply for the Airport Line, new stabling yards at Leppington and Auburn, commuter car parks, as well as the construction of the new Glenfield to Leppington line itself. The costs of these clearly must be excluded from any comparison of costs per kilometre of the South West Rail Link with any other project.

Owner's costs

In addition to preparing the estimate of construction costs, as described in Section 2, TCA also estimates the owner's project costs, using in-house and external professionals. Again, the estimate of owner's costs is able to be prepared with more confidence as the project becomes better defined as it moves through the lifecycle.

Contingency

The selection of the appropriate contingency depends on the phase of the project lifecycle.

In the early phases of a project, the selection of contingency is mainly deterministic, based on experience, previous projects and advice from internal and external reviewers.

Probabilistic estimation of contingency is used by TCA on all large projects in the Project Development and later phases. At the Project Development Phase, TCA requires, as do most government capital works agencies, a 90% confidence level, usually referred to as P90.

Escalation

The two main influences on the escalation estimate are:

- the delivery program, which predicts the staging and duration of the delivery, including particularly the construction of the project and
- the rates of cost increases over time for the various components of the project.

During the Project Development Phase, TCA typically conducts constructability and program reviews to develop realistic and achievable delivery programs for a project. The delivery timeframe may also need to be tailored to suit the timing of funding. These programs are refined over time and are used as inputs to the estimation of the escalation component.

As noted earlier, the estimation of escalation requires a prediction of future cost increases, which will be influenced by general inflation, availability of labour and materials, the state of the manufacturing, design and construction markets, including the volume of projects being undertaken at any one time, as well as unusual rapid price increases in specific materials. TCA and its contracted private-sector cost planners use a variety of sources for cost indices, both historical and predictive, including NSW Treasury, the Australian Bureau of Statistics, a number of industry generated indices such as those by Rider Levett Bucknall, Cordell and Rawlinsons, as well as experience on recent projects.

Peer review

On major projects, as well as carrying out its internal review processes, TCA engages external experts to provide a peer review of estimates.

Pre-tender estimates

Before tenders are invited for each contract package, TCA prepares a "pre-tender" estimate based on the tender documents for that particular package, which it uses as a yardstick for reviewing the tender prices which will be received. Usually, tenderers are required to break up their tender prices into a schedule format prepared by TCA to assist in

comparison and identification of any unusually high or low priced components, which may need to be clarified as part of the tender evaluation process. These clarifications are to ensure that scope has not been omitted or misunderstood, that tender comparisons are based on equivalent scope and that appropriate risk adjustments are made for any commercial or technical qualifications included in tenders.

3.4 'Concept estimates' for rail project costs

TCA prepares "strategic estimates" for rail project costs at the Project Identification Phase and "concept estimates" at the Project Scoping Phase.

As noted previously, in the early phases of a project, it is not possible to prepare a "first principles" estimate because the levels of scope definition and design have not been advanced sufficiently to allow detailed measurements. Where detailed information is not available, some components of estimates may need to be based on assumptions, which are documented as part of the estimate process.

The estimates in these early phases are based necessarily on broad rates from previous projects and other available sources. As described in the previous section, deterministic estimation of contingency is used in these phases.

Optimism bias

A common issue which arises in Australia and internationally is the tendency for project managers and other project personnel to be overly optimistic in estimating project costs and durations, typically resulting in contingency levels being set too low.

This "optimism bias" is referred to in the *Best Practice Standard* (p42):

> *"A good procedure will describe the contingency range expected at each phase of the project. This is particularly important for the project identification phase. This range is linked to the level of uncertainty that exists in a project as seen objectively by experienced personnel. These views are often in conflict with the range used by optimistic project managers or estimators who believe they have fully scoped the work and covered the risks."*[3]

The *Best Practice Standard* includes, in Appendix 7, an extract from a paper prepared for the British Department for Transport in 2004[4]. This paper suggests that, for rail projects, the "uplift" to be applied to "estimated capital expenditure budgets" should be 68% for a P90 confidence estimate.

TCA manages optimism bias through a rigorous process of development and review of its project estimates, including by external reviewers. It does not simply apply a single "uplift" percentage as suggested in the British paper referred to above.

3.5 Differences between rail and road project costs methodologies

There are no fundamental differences in the methodologies used to estimate costs of road and rail projects.

There are, however, some differences which are described below. The methodologies described for road projects are those used by RTA (shortly to become part of Roads and Maritime Services, but referred to in this section as "RTA").

The work breakdown structure

In the work breakdown structure (WBS), line items in the estimates for rail and road projects are different, reflecting the different components of the two types of project.

Typical WBS formats for road and rail projects are included in the May 2011 proof version of the *Best Practice Standard*[5] and copies are included as Attachments 1 and 2 respectively to this submission.

Types of estimate

In addition to the two types of estimates (unit rates and first principles) mentioned in section 3.1 above, road projects also utilise:

- **global rates** – this an 'order of magnitude' estimate and is used to describe a coarse or low-order method of estimating involving the use of 'all in' or global rates. This method is only used for strategic estimates at an early stage, when a proposal is being scoped and developed
- **composite rates** - the term 'composite estimating' is used to describe a coarse method of estimating involving the use of rates that include the combination of a number of items of work to construct a single aspect of the project. For example, the provision of drainage for a project could be calculated as $/lane-km and must include drainage pipes, pits, gutter and kerb, subsoil drain, trench drains, excavation, bedding, backfilling, etc. It can be used at the strategic and concept stages of a project
- **unit rates and first principles** estimates can be used at any stage of a project. Most of the major Infrastructure projects (at concept and detailed stages) are prepared by external (to the road authority) cost estimators using the first principles methodology and the estimates are reviewed and checked by the road authority using unit rates.

Contingency

There are two methods of determining contingency:

- deterministic and
- probabilistic.

The deterministic (or empirical as termed by RTA) method is based on historical performances of past projects.

All major infrastructure projects by RTA (greater than $75 million or federally funded) must determine contingency using both methods. Unless the outcome is compatible, both estimates are further reviewed for inconsistencies.

Utilities

For brownfield sites on road projects, all utilities that need to be relocated or protected are third-party utilities. The RTA and its contractors have limited power or control over the extent of work or the timing. This situation also applies to rail projects, both for utilities outside but near to the rail corridor which will be impacted by construction, for example by bridgeworks, and for utilities crossing the rail corridor.

Peer review

Peer review of the estimates in road projects is undertaken by an independent and experienced person who could be internal to the RTA or external.

In addition, major projects must be reviewed and concurred by the RTA Project Management Office.

Price and estimate data

In respect of the cost rates used in estimating project costs, there is a much larger sample of previous road projects for which actual cost information is available than is the case for rail projects. The *Best Practice Standard*[6] notes that:

> *"The costing approach taken with road projects has been reliant on historic costs which are updated for inflation. The key components of many road projects are bulk earthworks, structures, pavement and drainage depending upon the topography. Productivity rates are generally well understood and there is generally a competitive tender market for the work. There is not a significant level of proprietary or manufactured items in above ground road projects (except for some road furniture). ...*
>
> *Rail projects, unless they are large greenfield projects (of which there are some but not many), tend to be major upgrades, duplications, or enlargements to existing rail infrastructure. A common Work Breakdown Structure, specific to rail projects, should be established. The components used tend to have a higher level of manufacture and are of a proprietary nature (turnouts, signaling, communications, power equipment, rolling stock, etc).*
>
> *Rail construction work has to be planned (and therefore scheduled and costed) around "possessions", being that window of time when normal train operations shut down and access is provided to enable construction work to take place. The influence of planning around possessions and the use of a higher level of manufactured items of a proprietary nature makes rail construction cost estimating different to cost estimating of roads and arguably more difficult. Rail projects also have a greater tendency to optimism bias than road projects based on the COWI report (refer Appendix 7).*
>
> *In Evans & Peck's experience the three factors that require special attention when costing rail projects are:*
>
> - *costing must be based around possessions not necessarily by work type;*
> - *costing of systems items must reflect the manufacturing and installation market competition for that equipment; and*
> - *work done in "brownfield" narrow sites (rail reserves) with limited physical access and specific rail safety requirements has significant additional indirect costs compared with a road project."*

RTA's practice in collecting and using historical data reflects the comments above and its large portfolio of completed projects. Tendered rates from past contracts are centrally captured and stored confidentially. This data is made available to all the RTA's staff.

Performance of costs and estimates are analysed and reported periodically to ensure continuous improvement in estimating costs.

Escalation

Escalation factors are determined by the RTA based on indices provided by Australian Bureau of Statistics and its own review of road costs and trends.

Long-term escalation factors are higher than short-term escalation factors to allow for the higher uncertainty in determining future cost movements.

Safety management

Safety management of both road and rail projects is the highest priority, considering all project phases including construction, operation and maintenance. Safety is a major consideration during the design of a project, to ensure that the project can safely be built, operated and maintained.

Both road and rail projects require secure and effective protection of construction workers from operating road and rail traffic, by physical segregation of worksites, by closure of corridors or parts thereof to normal traffic, by use of protection officers or other traffic management measures. However, over and above the occupational health and safety obligations applicable to all projects, all phases of rail projects including both their delivery and operation must be carried out by parties accredited under the *Rail Safety Act (NSW) 2008*.

The regimes for safety management of activities on and near operating rail corridors are more demanding and labour intensive, with correspondingly increased costs.

In addition, RailCorp, as the eventual owner and operator of the passenger rail network, and TCA, as the delivery authority for the infrastructure, have implemented structured safety assurance systems as fundamental parts of their rail safety accreditations. These safety assurance systems demand a high level of structured and well documented consideration of safety processes at every stage of the project to support the proposition (the "safety case") that the completed project is safe to operate and maintain. Accredited parties and their rail projects are subject to regulatory oversight by the Independent Transport Safety and Reliability Regulator (ITSRR). All of these processes add to the costs of delivering rail projects.

Infrastructure components, such as road bridges, will generally cost more to build over a rail corridor than for similar size bridges elsewhere. These additional costs may result from a number of factors, including:

- additional worksite protection measures
- track possession costs
- costs of providing alternative transport services ("bussing")
- restricted working hours
- impact loadings for piers, to withstand train derailment loads
- protection measures to minimise corrosion of structures from stray traction currents and
- safety assurance costs, including design reviews and documentation of the safety case.

3.6 Cost estimate methodologies applied in other Australian states, by the Australian Rail Track Corporation and internationally

The Introduction[7] to the May 2011 version of the *Best Practice Standard* states that:

> *"It [the Best Practice Standard] outlines the principles for best practice cost estimation which all states and territories agreed to adopt when signing the National Partnership Agreement on Implementation of Major Infrastructure Projects 2009-2014."*

3.7 Tendering processes

The following sections describe the tendering processes used by TCA for major rail projects. Comparable processes are used by RTA and are expected to be used in the Projects Division of Transport for NSW. RTA, with its much larger portfolio of projects, has a system of pre-qualification of contractors for different types of work (e.g. road works and bridge works) and with graded cost limits for different scales of projects, which assists in forming shortlists of tenderers for its projects. TCA has also used the RTA pre-qualification lists on occasions as a minimum criterion in evaluating Registrations of Interest for tendering shortlists.

TCA Corporate Management System

TCA's procurement processes for both professional services contracts and delivery contracts for its projects are set out in its Corporate Management System (CMS), the main relevant component documents being:

- TCA Procurement Policy CM-PO-042
- TCA Procurement Plan CM-ST-038
- TCA Delivery Strategy Guideline CM-PR-046.

Copies of these documents are provided as attachments to this submission (Attachments 3, 4 and 5 respectively).

The **TCA Procurement Policy** is the umbrella document which sets out the high-level principles guiding TCA's procurement, including those set out in the *NSW Code of Practice for Procurement*[8], summarised below.

Honesty and fairness:	Parties will conduct all procurement and business relationships with honesty and fairness.
Accountability and transparency:	The process for awarding contracts on TCA projects will be open, clear, secure and defensible.
No conflict of interest:	A party with potential conflict of interest will declare and address that interest as soon as the conflict is known to that party
Rules of law:	Parties shall comply with all legal obligations.
No anti-competitive practices:	Parties shall not engage in practices that aim to give a party an improper advantage over another.
Intention to proceed:	Parties shall not seek or submit tenders without a firm intention and capacity to proceed with a contract.
Cooperation:	Parties will maintain business relationships based on open and effective communication, respect and trust, and adopt a non-adversarial approach to dispute resolution.

The **TCA Delivery Strategy Guideline** provides guidance to the TCA project teams on selecting the appropriate means for delivery of a project. It states (section 6) that:

> *"The primary objective of the delivery strategy selection process is to select a strategy that has the highest potential to deliver the project objectives and maximise value for money within the constraints of the delivery environment..."*

In section 4 of the Guideline:

> *"The delivery strategy is defined by TCA as the means by which the objectives of a project are to be achieved and consists of the following two distinct but interrelated elements:*
>
> 1. *the packaging strategy; and*
> 2. *the contracting strategy."*

Packaging strategy

The packaging strategy defines how the project will be broken up into separate contract or works "packages" for delivery, having regard to such factors as:

- the availability of design resources (in-house, external service providers, RailCorp engineering resources)
- the criticality of certain design elements (e.g. signalling)
- the program for the project, which may require an early start to construction
- the state of the contracting market, influencing the maximum size of contract packages which can be tendered with the expectation of obtaining competitive prices at a particular time. This may for example require large projects to be broken into a number of smaller packages to provide a greater level of competition
- the extent of risk in the interfaces between packages and the cost and resources required for TCA to manage those risks
- the need to maximise the utilisation of a limited number of track possessions and
- benefits in cost and time by grouping works by location and type of work.

Contracting strategy

The contracting strategy defines how each package determined by the packaging strategy will be contracted for delivery. Selection of the type of contract for a package will typically be made from the following options:

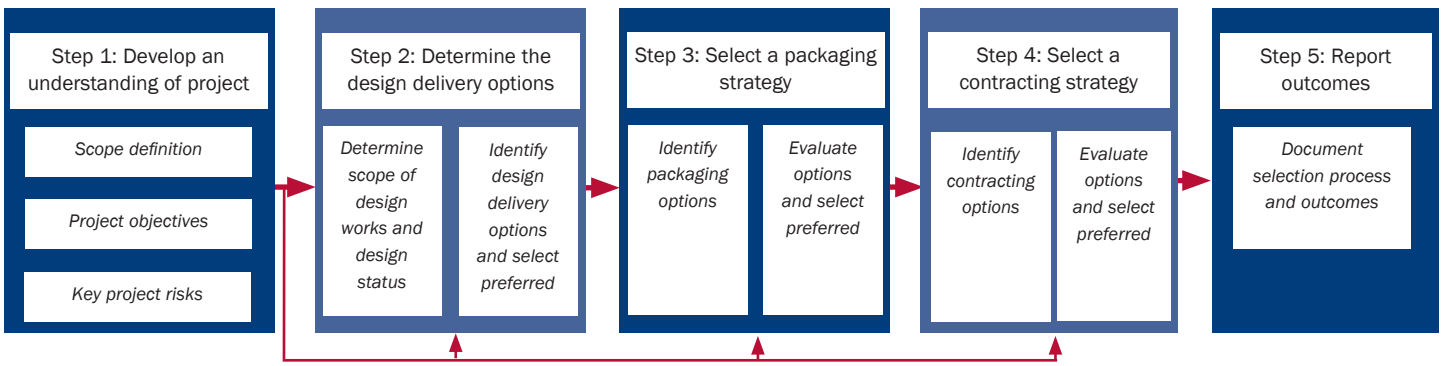
- alliance
- construct only
- design and construct (D&C)
- design, construct and maintain (DCM)
- design, develop and construct (DD&C)
- design, novate and construct (DNC)
- early contractor involvement (ECI)
- managing contractor (MC)
- public-private partnership (PPP) and
- target cost contract (TCC).

Key factors in selecting the optimum contracting strategy for each package include:

- the ability to clearly and confidently define the scope of work to be carried out under the contract – Can the scope and/or the performance requirements be sufficiently well defined to enable a tenderer to price the works? In many rail projects, there is restricted access to the rail corridor which hinders detailed investigation, such as geotechnical investigation, detailed survey of location of all services, etc. Is there benefit in early involvement of a contractor to assist in determining the optimum construction methodology and program and assist in more concisely defining the scope of work?
- certainty of access to the site of the works – Can the available track possessions be defined with certainty and are they sufficient to enable a tenderer to price the works? Are the track possessions likely to change during the contract? Can a tenderer realistically plan the delivery of the works with the available information on access? Note that if a track possession is missed, or if the planned work is not completed within a track possession, there may be a delay of six to 12 months before a further track possession can be made available. Will TCA be able to obtain competitive tender prices on a lump sum basis? To what extent is TCA exposed to extension of time claims and additional costs if the access regime is changed during the contract?
- extent of interfacing works and services by others – Are there time critical interface works which may delay the contract works? Are there system interface activities by RailCorp, for example signalling and electrical works, required to be carried out by a limited number of key RailCorp personnel?
- uncertainty as to the availability of the key RailCorp personnel referred to above, at the times they are required to carry out critical activities.

The Guideline (section 7) sets out a process for selecting the appropriate delivery strategy, which is shown diagrammatically in the figure below.

Figure 3: TCA delivery strategy selection process



In a large project, it is likely that TCA will use not only a number of contract packages, but also a number of different types of contract. For example, in delivering the Epping to Chatswood Rail Link, the following major packages and contract types were employed, in addition to a large number of minor packages.

Table 2: Main contract packages in delivering the Epping to Chatswood Rail Link

Contract Package	Contract Type
Epping to Chatswood: Civil Works/ Systems Contract	D&C
Epping and Intermediate Stations to Chatswood	Construct Only
Chatswood Rail Corridor Civil Works (South)	D&C
Chatswood Rail Corridor Civil Works (North)	D&C
Chatswood Transport Interchange	PPP
Rail corridor enabling works at Chatswood	Target Cost Contract
Rail corridor enabling works at Epping	Target Cost Contract
Epping Footbridge, Beecroft Rd	D&C
Beecroft Sub-Station	Construct Only
ECRL Commissioning Management	Alliance
Parramatta Transport Interchange	Construct Only
Parramatta Station Works	Managing Contractor

Competition in tendering

TCA's procurement practices seek to provide a price competitive tendering process amongst contractors capable of undertaking the work under the proposed contract.

Shortlisting of tenderers

For most contracts, TCA advertises for Registration of Interest (ROI) by companies wishing to tender for the contract. The registrations of interest received are evaluated against pre-defined criteria to select a shortlist of contractors to be invited to tender. The evaluation criteria for ROI are focused heavily on capability and experience. There are usually "hurdle" criteria, for example on the South West Rail Link Glenfield to Leppington D&C Contract, applicants were required to have:

1. current pre-qualification with the RTA to Open Class for road works (RX) and to class B40 for bridge works, or equivalent
2. recent or current experience in at least one multidiscipline rail project with a rail systems component of at least $50 million
3. successful procurement and management of building works of individual project value of at least $30 million in recent years
4. a safety management system that:
   - meets the requirements of and the accreditation criteria defined by the NSW Government Occupational Health and Safety System Guidelines (2004) and
   - enables the Principal to fulfil its obligations as an accredited Rail Transport Operator under the *Rail Safety Act 2008* (NSW)
5. an environmental management system that:
   - has been certified by an appropriately recognised third party as complying with ISO 14001:2004 Environmental Management Systems and
   - meets the requirements of and the accreditation criteria defined by the NSW Government Environmental Management System Guidelines (2009)
6. a quality management system that:
   - has been certified by an appropriately recognised third party as complying with ISO 9001:2008 Quality Management Systems and
   - meets the requirements of and the accreditation criteria defined by the NSW Government Quality Management System Guidelines (2006).

Applicants which pass the "hurdle" criteria are then assessed, scored and ranked against further evaluation criteria, typically including the applicant's:

1. organisation including its capability
2. experience and current workload
3. environmental, community and safety performance
4. demonstrated understanding of the critical issues and factors relevant to successful design, delivery, commissioning and operational readiness of the works and
5. proposed project team, team structure and experience, core competencies and capabilities of the applicant's key personnel.

The TCA Procurement Policy sets out that:

> *"on major design and construct contracts, to ensure appropriate competiveness and to minimise the cost to industry of tendering, TCA will shortlist a maximum of three tenderers".*

Concentration of ownership of major construction contractors

The ownership of major construction contractors in Australia is highly concentrated, with two companies between them owning five major ("Tier 1") contractors: Leighton Contractors, John Holland and Thiess are wholly owned subsidiaries of Leighton Holdings; Abigroup Contractors and Baulderstone are wholly owned by Lend Lease. TCA has taken a number of steps over recent years to broaden the field of potential contractors, including by conducting periodic industry briefings on current and forthcoming projects and by publicly advertising for registrations of interest before establishing shortlists of tenderers for each major project. In addition to contracts with

the above contractors, TCA's present and recent projects include contracts with Bouygues, Macmahon Contractors, MVM Rail, Laing O'Rourke, and AW Edwards.

The TCA Procurement Policy sets out:

> *"When short listing three or less tenderers for a price competitive construction contract, TCA will not include more than two related party tenderers."*

TCA requires related party tenderers to execute deeds undertaking to provide separation of tender teams, including at the holding company board level, with separation processes subject to audit by internal and external probity auditors.

Tendering

When inviting tenders, TCA clearly sets out in the Invitation to Tender document the criteria which will be used to evaluate the tenders received. As noted above, for major contracts, TCA invites tenders from a limited number of tenderers which have been shortlisted through a Registration of Interest (ROI) process.

Through the ROI shortlisting, TCA will have already assessed each tenderer entity as capable of carrying out the work under the proposed contract. The tender evaluation will therefore assign a high weighting to the tender price (typically 75 to 80% of a total score), but will still need to assess each tenderer's response to the specific requirements of the project. For example, for the South West Rail Link Glenfield to Leppington D&C Contract, the evaluation criteria for the tenders, in addition to the tender price, were:

- a demonstrated understanding of the Works and compliance with the Works Brief
- a demonstrated understanding of the project requirements, issues and risks, and effective methodologies to deliver the Works and
- demonstrated effective organisation structure and appropriately experienced and skilled personnel to deliver the Works.

Contractor performance reporting

TCA regularly reviews and reports on the performance of its contractors on its projects and shares and obtains similar reporting by other NSW government agencies. The TCA Guideline for Contractor Performance Reporting – CM-PR-047 sets out the requirements for the reporting regime, which includes processes for notifying the contractors and inviting their feedback. The reports are used during the assessment of ROI applicants for shortlisting and have proved effective in improving the performance of contractors on rail projects.

Notes to Submission

1. Based on Figure 11 in the *Best Practice Standard*.
2. *Best Practice Standard*, Appendix 5.
3. *Best Practice Standard*, s5.6.4.1, p42
4. The UK Department for Transport: Procedures for Dealing with Optimism Bias in Transport Planning. Guidance Document. June 2004.
5. *Best Practice Standard*, Appendix 5: Standard Road and Rail Work Breakdown Structures, sections A5.5 and A5.6.
6. *Best Practice Standard*, Sections 5.5.2, 5.5.3..
7. *Best Practice Standard*, Section 1, page 1.
8. NSW Government: Code of Practice for Procurement, 18 January 2005, available at http://www.nswprocurement.com.au/Government-Procurement-Frameworks/Files/code_of_prac-curr.aspx
9. *Best Practice Standard*, Proof Version, May 2011: Appendix 5: Standard Road and Rail Work Breakdown Structures, section A5.5.
10. *Best Practice Standard*, Proof Version, May 2011: Appendix 5: Standard Road and Rail Work Breakdown Structures, section A5.6.