Tabled by Mr Chris Lock
21 November 2011

Infrastructure - Project Cost Benchmarking Study

NSW Department of Transport

15 June 2011

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15 June 2011

Mr Warwick Proctor
Director Capital Projects
Infrastructure Division
NSW Department of Transport
18 Lee Street
Chippendale NSW 2008

Private and confidential

Dear Warwick

Infrastructure - Project Benchmarking Study Costs

Ernst & Young (EY) is pleased to present NSW Department of Transport with our final report for the Infrastructure - Project Cost Benchmarking Study project (the "Project"). We refer to the agreement between NSW Department of Transport ("DOTNSW") and Ernst & Young ("EY") dated 23 December 2010, incorporating the scope of work as set out in the Ernst & Young Proposal dated 8 December 2010, through which Ernst & Young has been engaged to provide financial and commercial advisory services to DOTNSW with respect to the Project.

Restrictions on the Report Use

The Report may be relied upon by DOTNSW, however EY disclaims all liability to any party other than DOTNSW for all costs, loss, damage and liability that the third party may suffer or incur arising from or relating to or in any way connected with the provision of the deliverables to a third party without our prior written consent.

You have agreed that you will not amend the Report or distribute the Report to outside parties without prior written approval from EY. If others choose to rely on the Report in any way they do so entirely at their own risk.

Basis of Our Work

We have not independently verified, and do not accept any responsibility or liability for independently verifying, any information provided to us by any public transport infrastructure agencies involved in the benchmarking study, nor do we make any representation as to the accuracy or completeness of the information provided.

We accept no liability for any loss or damage which may result from your reliance on any research, analyses or information so supplied. The attached Report provides the outcomes of our project analysis.

Yours sincerely

Adrian Renouf
Partner
Ernst & Young

Contents

Glossary

The following is a list of some commonly used terms in infrastructure projects and their definitions.

Term	Definition
Alliance Contracts (Single TOC, Competitive TOC)	Under and alliance contract, the government collaborates with one or more non-owner parties (e.g. a design and construction) to share the risks and responsibilities in delivering the design and construction phase of a project. There are two major types as listed below: Single Target Outturn Cost (TOC) Alliance - The Alliance model is an agreement focussed on process as much as on outcomes and involves the engagement of designers, construction contractors and other service providers to work together with the principal to deliver the project on a cost reimbursable basis with some performance incentives Competitive Alliance - A desire to place greater emphasis on price competition in alliance tender selections has created a class of alliance dubbed a competitive alliance or multiple TOC. Whereas the single TOC alliance requires selection of alliance partners based primarily on non-price selection criteria and high level value for money criteria, the multiple TOC alliance introduces direct price competition into the selection process.
Audit cost	All employee and professional services contractors costs associated with the auditing of financial statements associated with the project.
Client cost	All of costs incurred by the sponsor organisation in the delivery of a project including : - Planning & environment - Client project design costs - Community & communication - Safety, operational readiness & reliability - Audit - Legal - Commercial & procurement - Technical - Construction support - Client insurance - Project management costs - Program management costs - Corporate overheads (Delivery agency costs) - Possession & bussing - Commercial compensation
Client insurance costs	Any insurance costs associated with public liability, professional indemnity, contract works and difference in conditions.
Client project design costs	Client costs (either employee or contractor) associated with detailed project design required to reach approval for project construction.
Commercial & procurement costs	Client costs (either employee or contractor) associated with the commercial and procurement process.

Term	Definition
Commercial compensation costs	Any compensation costs, payable by the client, required to be provided to nearby commercial operators & retailers due to interruptions to their business-as-usual operations & turnover as a result of the project construction & implementation
Community & communication costs	All costs associated with internal & external communications that include government & media relation, community relations, stakeholder management, advertising & marketing activities and corporate positioning & reporting.
Contingency	An amount added to an estimate to allow for items, conditions, or events for which the state, occurrence, or effect is uncertain and that experience shows will likely result, in aggregate, in additional costs. Typically estimated using statistical analysis or judgment based on past asset or project experience.
Corporate overhead costs	Any non project-specific costs required for the project associated with maintaining an agency's head office & organisational wide costs.
Cost per Lane kilometre	Total cost per one lane kilometre. Lane kilometre is a distance measurement that is equal to the total land distance in kilometre multiplied by number of lanes. For example, a one kilometre two lane highway equates to two lane kilometres.
Cost per Track kilometre	Total cost per one rail track kilometre. Rail track kilometre is a distance measurement that is equal to the total rail distance in kilometre multiplied by number of rail tracks. For example, a one kilometre two track railway equates to two track kilometres.
Escalation	Changes in the cost or price of specific goods or services in a given economy over a period of time. This is a similar to the concepts of inflation and deflation except that escalation is specific to an item or class of items (not as general in nature), it is often not primarily driven by changes in the money supply, and it tends to be less sustained.
Fixed price contracts (D&C, Construct Only)	Under fixed price contracts, the contract value is known before construction commences. There are two main types as listed below: Design and Construct - In this type of contract, the contractor is responsible for taking a concept developed by the owner, completing the detailed design, and then pending the owner's approval on the design, they can proceed with construction; and Construct only - This describes the model of construction management in which the general contractor is engaged through a tender process after the designs have been completed by the architect or engineer.
Legal cost	All client costs (either employee or contractor) associated with the preparation and execution of legal contracts for the project.
Outturn cost	The estimated cost of the completed project in dollars of the years in which funds are expended.
Planning & environment costs	All client costs (either employee or contractor) associated with the personnel assigned to the project for planning and environmental managers, professional services contractors e.g. planning approvals, environmental management representatives (EMR), noise & vibration specialists.

Term	Definition
Possession & bussing costs	All client costs associated with track possession and bus replacements for trackwork for project construction (Rail projects only).
Program management costs	All client salaries and fees associated with high-level agency management for delivery of the project. High-level agency management salaries should be pro-rated with their time spent on the project. For example airfares and accommodation.
Project management costs	All client salaries and fees associated with agency personnel and professional services contractors assigned to manage the delivery of the project, such as senior project managers, project managers, site engineers etc (for example airfares and accommodation).
Safety, operational readiness & reliability costs	All client costs (either employee or contractor) associated with safety initiatives for the project.
Technical - construction support costs	All client costs (either employee or contractor) associated with the technical process of the project during the construction phase, for example ongoing engineering support.
Total construction cost	Sum of all direct construction costs associated with project including labour, material equipment and services.

1. Executive Summary

In December 2010, the NSW Department of Transport engaged Ernst & Young to undertake a cost benchmarking study to determine how current NSW Department of Transport client costs compare to those incurred in other jurisdictions and assess best practice in determining certain costs at the estimate stage such as contingency and escalation allowances.

Agencies submitting information that has formed the basis of this study include:

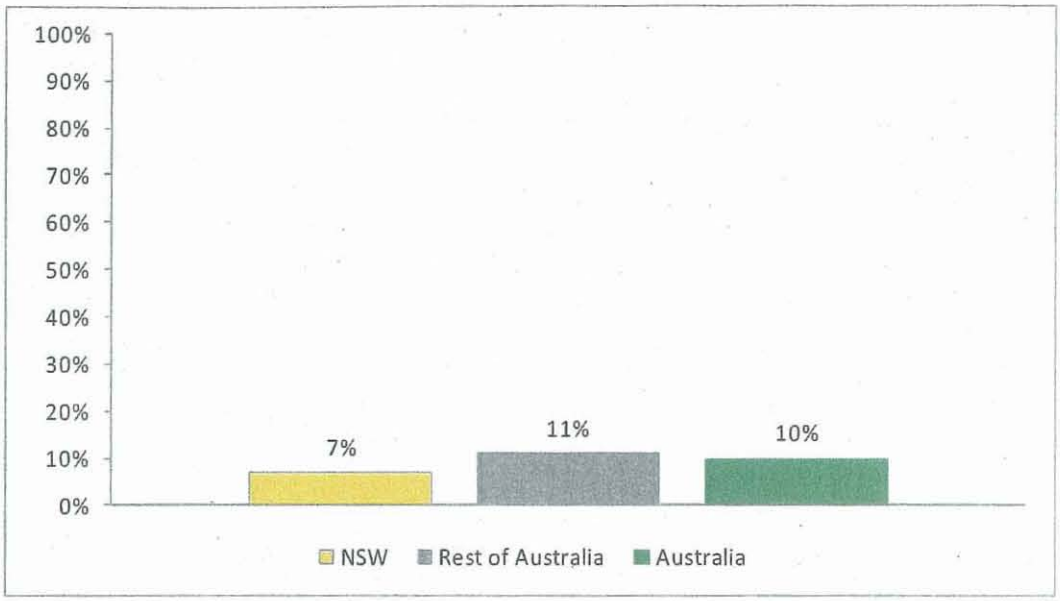
- Roads and Traffic Authority, New South Wales
- Transport Construction Authority, New South Wales
- Public Transport Authority, Western Australia
- Main Roads, Western Australia
- Department of Transport, Victoria
- Linking Melbourne Authority, Victoria
- VicRoads, Victoria
- Department of Transport and Main Roads, Queensland

The NSW Department of Transport's objective is to provide itself and other study participants with access to reliable, factual information based on the benchmarking of significant client cost elements of major public transport infrastructure projects. It will also promote the sharing of information between agencies.

In undertaking this study, Ernst & Young has made the following key findings and recommendations:

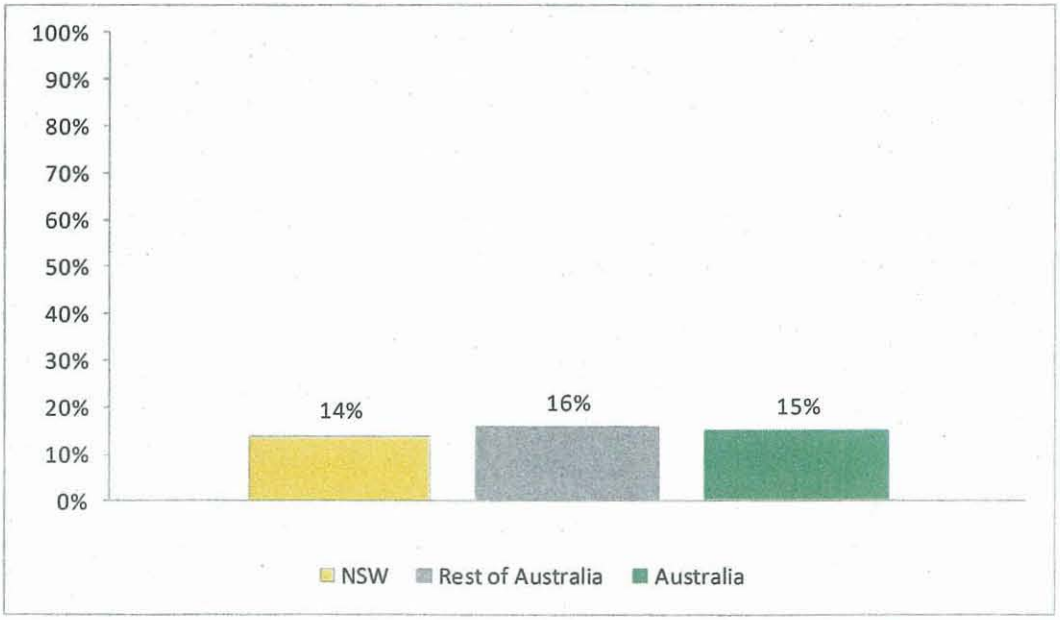
Finding	Recommendation
Client costs in relation to the delivery of road projects in NSW appeared to be lower than most agency peers. This appeared to be largely due to less overhead costs being allocated to specific projects – instead being met out of the agency's operational budget.	DOTNSW to promote greater consistency of treatment between agencies in the capture and allocation of corporate overhead costs to projects.

Road - Average client cost (excluding design costs) as percentage of total construction cost



NSW rail project client costs appeared to be in line with transport agency peers. NSW was slightly lower on design and construct projects and slightly higher on alliance projects than the rest of Australia averages.	None

Average rail client costs, excluding design costs, as a percentage of total construction costs



There are significant differences in the work breakdown structures (WBS) used by agencies. Further, there appeared to be differences in the level of detail in the WBSs used by different agencies.	DOTNSW to promote the use of a Work Breakdown Structure (WBS) that provides a consistent hierarchy of detail in cost estimates for purposes of comparison, review and benchmarking. This will increase the ability to do

	meaningful benchmarking between agencies.
The methods of determining contingency allowances varied significantly between agencies. Some agencies used a deterministic approach, some agencies used a probabilistic approach, and some used a mixture of both.	DOTNSW to undertake further analysis on the performance of actual versus budgeted outcomes under both probabilistic and deterministic contingency estimation approaches. This could form the basis of selecting the most appropriate approach (either probabilistic, deterministic or a hybrid approach) based on actual project performance against the estimated contingency allowance, leading to a standardisation of the approach to determining contingency allowances
Development and application of allowances for escalation varied significantly between agencies in terms of both source indexation indices used and whether one index is applied to a single construction phase cashflow or multiple indices are applied to different components of the construction phase cashflow	DOTNSW to undertake further analysis on the performance of actual versus budgeted outcomes under both single escalation factor approaches and elemental approaches using a mixture of general CPI and construction CPI measures applied to components of the overall construction phase cashflow. This could form the basis of selecting the most appropriate approach (either single cashflow/single escalation factor or multiple cashflows/multiple escalation factors) based on actual project performance against the estimated escalation allowance, leading to a standardisation of the approach to determining escalation allowances

In addition to these key findings and recommendations, the following general observations have been made in relation to the data (qualitative and quantitative) received:

1. For road projects project and program management costs are the single highest client cost category, on average accounting for 32% of total client costs (4% of total construction costs) followed by project design costs which on average accounted for 27% of the total client cost (3% of total construction costs).

1. NSW road projects reported significant planning costs (28% of total client cost) compared to road projects from the rest of Australia (5% of total client cost). This may reflect the planning/regulatory regime in NSW.

2. Conversely, NSW road projects reported significantly less corporate overhead costs compared to the rest of Australia (1% compared to 17%). This may indicate that for NSW road projects, less overhead costs are allocated to specific projects and are instead being met out of the agency's operational budget.

3. Corporate overhead costs for rail projects from the rest of Australia (16% of total client cost) are reported to be significantly lower than NSW projects (24% of total client cost). This may reflect the fact that TCA has a capital budget only and that corporate overheads are allocated to the programme and project level. However, as a percentage of the total construction cost the difference in corporate overheads is not as significant with the rest of Australia at 3% of total construction cost comparing to NSW projects at 4% of total client cost.

4. Based on a sample of comparable road projects, the NSW construction cost per kilometre was $6 million. The rest of Australia average cost per kilometre, (based on 5 projects), was $5 million. Within the levels of accuracy of the study and given the sample size this difference is considered immaterial.

5. Based on a sample of comparable rail projects, the NSW construction cost per track kilometre was $48 million. The rest of Australia average cost per track kilometre, (based on 4 projects), was $27 million. However, it should be noted that the sample set contained both greenfield and brownfield and passenger and freight rail projects and projects also differed markedly in size.

6. On average, road fixed price contracts had higher client design costs than road alliance costs (5% versus 1%). After adjusting for design costs, road fixed price contracts had higher client costs than alliance contracts (11% versus 8%).

7. On average, rail fixed price contracts had significantly higher client design costs than rail alliance costs (5% versus 3%). After adjusting for design costs, rail fixed price had higher client costs than alliance contracts (16% versus 14%).

8. The client cost data received shows significant variance with respect to the corporate costs allocated to projects, ranging between 0% and 80% of total client costs and 0% to 12% of the total construction cost. The agencies included in the study used a range of approaches to allocating corporate overhead to projects:

   - Agencies with a capital budget only indicated that corporate overhead costs are allocated to and recovered from the program level, with the amount allocated to each program being dependent on the relative size and future life of each program.
   - A number of agencies (with both capital and operating budgets) indicated that they apply a margin on top of the agency labour costs allocated to the project to cover corporate overheads.
   - Some agencies appear to allocate a very small amount of corporate overheads to projects, with corporate overhead costs presumable met out of the agencies operational budget.

In undertaking this study, Ernst & Young has received the following recommendations from participants:

- Promote greater consistency of treatment between agencies in the capture and allocation of corporate overhead costs to projects.

- Promote use of a Work Breakdown Structure (WBS) that provides a consistent high level hierarchy of detail in cost estimates for purposes of comparison, review and benchmarking.

- Undertake further analysis on the performance of actual versus budgeted outcomes under both probabilistic and deterministic contingency estimation approaches.

- Undertake further analysis on the performance of actual versus budged outcomes under both single escalation factor approaches and elemental approaches using a mixture of general CPI and construction CPI measures applied to components of the overall construction phase cashflow.

2. Introduction

2.1 Background

The NSW Department of Transport (DOTNSW) has been concerned with the limited publicly available information and data relating to program and project management costs and other client costs for major public transport infrastructure projects in Australian jurisdictions. This lack of information results in difficulties in:

- comparing current DOTNSW client costs to those incurred in other jurisdictions;
- assessing best practice in project management costs; and
- determining what scope, if any, exists for agencies to drive greater efficiencies in this area.

In order to overcome this information gap, the DOTNSW commissioned Ernst & Young (EY) to undertake an initial Infrastructure Project Cost Benchmarking Study (the Study) of comparable client costs from comparable public sector transport agencies. It is envisaged that this project will establish a benchmarking working group with a selection of Australian public transport infrastructure agencies, which will continue as an ongoing benchmarking program to share information, specialist knowledge and better practices to assist the participant organisations drive continuous improvement in their respective agencies.

2.2 Project scope

The project scope for the Study was to:

- identify and compare DOTNSW infrastructure client project delivery costs with inter-jurisdictional agency costs, as opposed to comparing DOTNSW costs with private sector delivery costs;
- focus on major transport infrastructure projects, as opposed to smaller 'business-as-usual' projects. This has been defined as projects with capital costs over $50 million;
- consider both Commonwealth and State Government funded projects;
- collect information on how participant organisations cost and allocate corporate and management costs to projects included in the Study sample and for major projects generally within their organisations;
- produce a report which can be used by DOTNSW and Study participants to identify how they compare to the average of all other participating Australian jurisdictions;
- present projects on a de-identified basis in the interests of maximising the likelihood of agencies outside of NSW participating in the Study; and
- produce a tailored confidential analysis for other Study participants showing how their State compares against the average of all other Australian jurisdictions in the delivery of specific major public transport infrastructure project types.

2.3 Objectives of the study

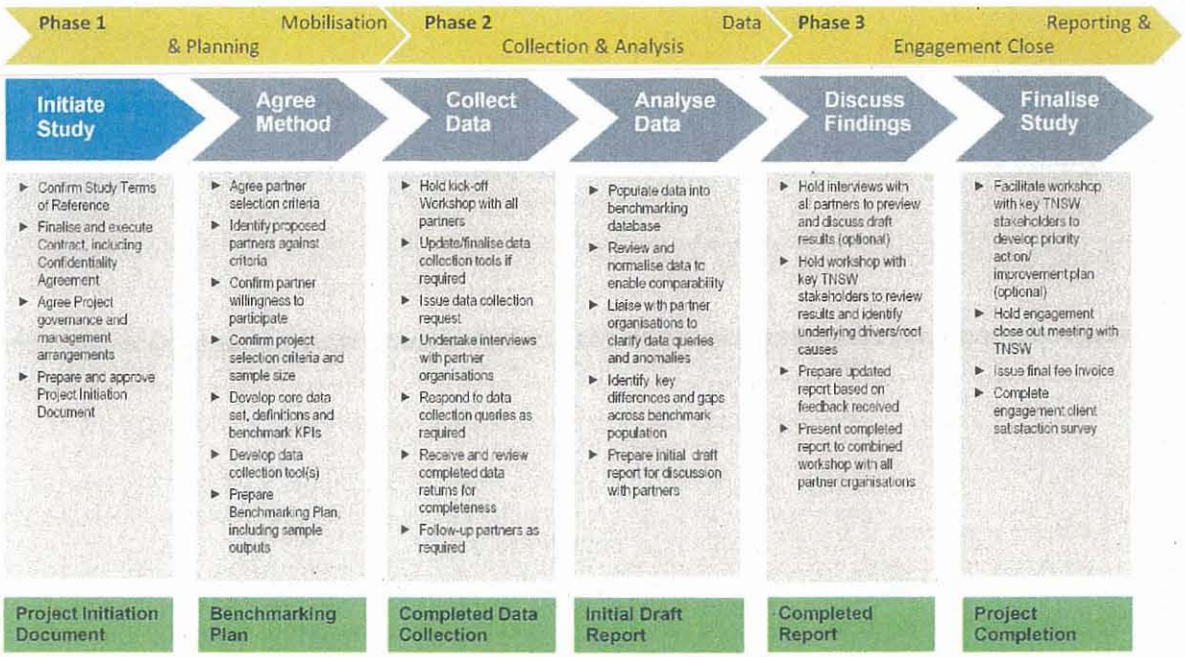
The objectives of the Study were to:

- establish a confidential database of relevant benchmarking data;
- provide DOTNSW and other Study participants with reliable, factual information based on the benchmarking of significant management cost elements of major public transport infrastructure projects;
- identify how DOTNSW and other Study participants currently cost and allocate client costs to projects;
- identify how DOTNSW and other Study participant's major infrastructure delivery management costs compare; and
- develop an ongoing dialogue with participating organisations in relation to key infrastructure procurement issues.

2.4 Broad approach to the study

A summary of the broad approach to the Study is presented in Figure 1 below.

Figure 1: Summary of study methodology



Key steps in this methodology are discussed in further detail in the remainder of this Report.

2.5 Limitations

It should be noted that Ernst & Young have relied upon the information provided by participating public transport agencies.

We have not independently verified, and do not accept any responsibility or liability for independently verifying, any information provided to us by any public transport agencies

involved in the benchmarking study, nor do we make any representation as to the accuracy or completeness of the information provided.

While we have attempted to obtain a meaningful sample size for benchmarking purposes it should be noted that the sample size is dependent upon the number of projects which met the agreed project selection criteria and in some cases the sample we have obtained may not be statistically valid.

The preparation of this report did not include an audit of any of the financial information provided to us and Ernst & Young has not undertaken any procedures that should be construed as forming part of any such audit. It is usually the case that some events and circumstances do not occur as expected or are not anticipated. Therefore, actual results will almost always differ from the forecasts and such differences may be material. To the extent that our conclusions or comments are based on forecasts, we express no opinion on the achievability of those forecasts.

3. Agencies and projects identified for benchmarking

3.1 Agencies identified for inclusion in the study

The agencies identified for inclusion in the Infrastructure Project Cost Benchmarking Study (the Study) were determined in a two-staged process.

The first stage involved Ernst & Young (EY), in conjunction with DOTNSW, identifying comparable agencies which it deemed relevant for inclusion, contacting these agencies to provide the project scope objectives and obtain buy-in. All agencies identified in this initial list agreed to participate in the project.

The second stage involved a discussion with all the agencies identified for inclusion at the initial Benchmarking Study Group tele-conference, where these agencies were asked to provide any additional agencies which were considered appropriate for inclusion.

The final list of agencies which were identified for inclusion in the Study, by jurisdiction, are shown in Table 1 below.

Table 1: Agencies identified for inclusion

Jurisdiction	Agencies
NSW	Transport Construction Authority (TCA)
	Roads & Traffic Authority (RTA)
	Rail Corporation NSW (RailCorp)
Victoria	Linking Melbourne Authority (LMA)
	Victorian Department of Transport (DoT)
	VicRoads
Queensland	Queensland Department of Transport & Main Roads (DTMR)
	Brisbane City Council (BCC)
	Queensland Motorways Limited (QML)
	Queensland Rail (QR)
Western Australia	Main Roads
	Public Transport Authority (PTA)

3.2 Criteria for project selection

The next stage of the project was to determine which projects undertaken by the identified agencies were to be benchmarked. In order to determine this, criteria for project selection were co-developed by EY and DOTNSW. Any projects which the agencies had undertaken that met these criteria would then be included in the Study, subject to data availability.

The criteria used were projects:

- completed in the past 6 years, or are very near to completion - this will allow actual costs to be compared, rather than budgeted costs;
- managed by DOTNSW entities including the Transport Construction Authority, the Roads and Traffic Authority and RailCorp and by similar organisations in comparable jurisdictions including Victoria, Queensland and Western Australia;
- comprising a variety of transport infrastructure types (rail, road, tunnel, bridge);
- of comparable scale;
- of at least $50 million outturn cost;
- delivered by a variety of procurement methods including Construct Only, Design & Construct (D&C), Alliance and Public Private Partnership (PPP); and
- submitted for Commonwealth funding in line with Federal Government Guidelines; however it is recognised that this may not be possible in all cases.

Based on these criteria, EY and DOTNSW developed an initial list of projects by agency to include in the Study. Each agency received a list of the identified projects, and provided input as to whether:

- the projects were all relevant; and
- whether any projects which met the selection criteria were omitted.

3.3 Projects identified

Based on the processes identified in Sections 3.1 and 3.2 above, the projects which were identified for benchmarking in NSW and other jurisdictions are presented in Table 2 below.

Table 2: Projects identified for benchmarking

Jurisdiction	Project	Project type	Agency
NSW	Epping - Chatswood Rail Line	Rail Link	TCA
	Richmond Line Duplication Stage 1	Rail	TCA
	Cronulla Line Duplication	Rail	TCA
	K2RQ - Kingsgrove to Revesby Quadruplication	Rail	TCA
	M7	Road and Bridge	RTA
	Lane Cove Tunnel	Road and Tunnel	RTA
	Pacific Highway - Karuah to Buladelah	Road and Bridge	RTA

Jurisdiction	Project	Project type	Agency
	North West T-Way	Road and Bridge	RTA
	Northern Distributor Extension	Road and Bridge	RTA
	Windsor Flood Evacuation Route	Road and Bridge	RTA
	Pacific Highway - Coopernook to Herons Creek	Road and Bridge	RTA
	Hume Highway - Woomargama to Table Top	Road and Bridge	RTA
	Pacific Highway	Road and Bridge	RTA
Victoria	EastLink	Road	LMA
	Geelong Ring Road	Road	VicRoads
	Deer Park Bypass	Road	VicRoads
	Pakenham Bypass	Road	VicRoads
	Tullamarine Calder Freeway	Road	VicRoads
	Calder Freeway Upgrade (Kyneton to Faraday Section	Road	VicRoads
	Laverton Rail Upgrade	Rail	DoT
	Clifton Hill Westgarth Track Duplication	Rail	DoT
	Dynon Port Rail Link	Rail	DoT
	Craigieburn Electrification Project	Station Upgrade and Electrification Works	DoT
	Wodonga Rail Bypass	Rail	DoT
	Cranbourne Stabling	Station Upgrade	DoT
	Wendouree Station	Station Upgrade	DoT
	Coolaroo Station	Station Upgrade	DoT
	Footscray Footbridge	Footbridge	DoT
Queensland	Gateway Upgrade Project	Road and Bridge	QML
	Ipswich Motorway Upgrade:	Road	DTMR

Jurisdiction	Project	Project type	Agency
	Wacol to Darra		
	Tugun Bypass	Road	DTMR
	Sunshine Motorway Upgrade - Boundary Road to Uhlman	Road	DTMR
	Sunshine Motorway Upgrade - Uhlman to Caboolture	Road	DTMR
	Sunshine Motorway Upgrade - Maroochydore Bridge Duplication	Bridge	DTMR
	Sunshine Motorway Upgrade - Pacific Paradise Bypass	Road	DTMR
	Houghton Highway Bridge Duplication	Bridge	DTMR
	Ipswich Logan Interchange	Road	DTMR
	Logan Motorway Interchange	Road	DTMR
	Western Corridor - Springfield to Yamanto	Road	DTMR
	Inner Northern Busway, Brisbane.	Busway	DTMR
	Boggo Road Busway Tunnel	Busway/Tunnel	DTMR
	M7 Clem Jones Tunnel (CLEM7)	Tunnel/road	BCC
	Go Between Bridge	Bridge	BCC
	Durra to Springfield	Rail/Road	QR
	Corinda to Darra Third Track	Rail	QR
	Robina-Varsity Lakes Rail Extension	Rail	QR
	Helensvale Robina duplication	Rail	QR
	Caboolture-Beerburrum duplication	Rail	QR
Western Australia	New Perth Bunbury Highway	Road	Main Roads
	New MetroRail Project	Rail	PTA

4. Data collection tool

4.1 Development of data collection tool

At the same stage as determining the partner agencies, Ernst & Young (EY) developed a draft qualitative and quantitative data collection tool for determining the client and program management costs associated with the provision of major public transport infrastructure projects in Australian jurisdictions.

The projects for which data was requested are presented in Table 2 in Section 3.3 above.

4.1.1 Quantitative data collection tool

The quantitative data collection tool was developed to provide quantitative information to allow the benchmarking of client costs typically incurred in the procurement of major transport infrastructure projects. It was developed by combining EY knowledge with previous studies and guidelines used to determine client costs. The quantitative data collection tool was provided to agencies involved in the Benchmarking Study Group for comments and review.

Previous studies and guidelines referenced include:

- DOTNSW cost breakdown structure (including Transport Construction Authority (TCA) and RailCorp Guidelines);
- Evans & Peck's rail project cost benchmarking - comparison of NSW and interstate rail project costs (prepared for TCA);
- Evans & Peck's 'Best Cost Estimation for Publicly Funded Road and Rail Construction' (prepared for Department of Infrastructure, Transport, Regional Development and Local Government);
- The University of Melbourne's 'National PPP Forum - Benchmarking Study, Phase II - Report on the performance of PPP projects in Australia when compared with a representative sample of traditionally procured infrastructure projects'; and
- Victorian Department of Treasury and Finance's 'In Pursuit of Additional Value: a benchmarking study into alliancing in the Australian Public Sector'.

Table 3 presents the costs included in the finalised data request.

Table 3: Client costs

Level of costs	Cost categories
Project level costs	Planning & environment
	Client project design costs
	Community & communication
	Safety, operational readiness & reliability
	Audit

Level of costs	Cost categories
	Legal
	Commercial & procurement
	Technical - construction support
	Client insurance
	Project management costs
	Possession & bussing *(if applicable)*
	Commercial compensation *(if applicable)*
Program & agency level costs	Program management costs
	Corporate overheads (delivery agency costs)

Included in the client costs are project management, program management and overhead costs attributable to the project. In addition, for all projects, agencies were asked to allocate the percentage of each cost category that was undertaken by the client to:

- Ensure total costs for each cost category are not under-estimated;
- Determine jurisdictional approach to in-sourcing and out-sourcing of management costs; and
- Enable estimation of total costs for each cost category.

Whilst the focus for the project is client costs, in addition to these costs, total construction costs, as well as land acquisition costs, contingency and escalation costs were also requested to understand the scale of the projects.

Costs were requested in the format of actual costs incurred, with the exception of contingency and escalation which were requested at the budgeting phase, given that these costs are captured within the actual costs incurred on completion of the project.

A copy of the quantitative data request, with the inclusions in each of the cost categories, is provided in Appendix A.

4.1.2 Qualitative information collection tool

In addition to the quantitative data request, a qualitative information collection tool was developed to provide contextual information and an understanding of key differences between projects in terms of scope, delivery model / risk allocation, cost allocation principles and any other pertinent project features.

The qualitative information collection tool was developed to ensure only 'like-for-like' projects were compared across jurisdictions, and also as a means for determining any factors which may increase the client and / or management costs of delivery. For example:

- location - metro versus regional;
- geotechnical conditions;

- labour availability;
- regulatory / legislative requirements; or
- working within a live transport corridor.

A copy of the qualitative data request is presented in Appendix B.

5. Data collection

5.1 Guidelines used by agencies for costing projects

Most agencies follow codified guidelines in building up cost estimates. In general, most agencies build up costs using unit rates (cross checked against current tender prices and actual costs on completed projects) and using a P90 confidence interval. Some agencies use internal estimators while other agencies outsourced the estimation task to external estimators/quantity surveyors.

5.2 Approach to data collection

All agencies participating in the Study were required to fill in a number of templates covering both client costs and total outturn costs.

These templates were constructed to be largely consistent with the work breakdown structures set out in the "Best Practice Cost Estimation for Publicly Funded Road and Rail Construction" (Department of Infrastructure, Transport, Regional Development and Local Government June 2008).

It should be noted that while some agencies were already using work breakdown structures following the Federal guidelines, other agencies use a work breakdown structure based on stage of development (e.g. planning, detailed design, building, and finalisation). These agencies have extracted data and made adjustments to present data in accordance with the templates.

5.3 Responses

Responses were received from the following agencies:

- Roads and Traffic Authority, New South Wales
- Transport Construction Authority, New South Wales
- Public Transport Authority, Western Australia
- Main Roads, Western Australia
- Department of Transport, Victoria
- Linking Melbourne Authority, Victoria
- VicRoads, Victoria
- Department of Transport and Main Roads, Queensland

It should be noted that responses were received for most but not all projects identified for inclusion in the Study as per Table 2 of Section 3.3.

Although indicating their interest in participating, the following agencies did not participate due to time constraints:

- Brisbane City Council, Brisbane
- Queensland Motorways Limited, Queensland

- Queensland Rail, Queensland

It should also be noted that, although data was received for 3 road PPP projects those projects have not been included in this study as these projects were spread across only two States. Data from a third State has not yet been received. Due to the small sample size for PPP projects it was determined in conjunction with DOTNSW that analysis should be undertaken after the remaining projects are received at which point PPPs can be included as an addendum to this report.

5.4 Normalisation of data

Normalisation data may involve the following steps:

- Breakdown of projects by procurement type;
- Issue of clarification questions to agencies where project client cost percentages depart significantly from the mean;
- Adjustment to data where allocation differences between agencies can be determined;
- Exclusion of outlier projects.

6. Results

This section focuses on an analysis of the client cost as a percentage of the total construction cost by major transport mode (road and rail). The results by transport mode are first considered on a total transport mode basis before dropping down to consider the results by procurement method under that transport mode (e.g. design and construct and construct only projects, alliance projects etc).

The intention of undertaking the analysis in this way is to:

- Ensure that broadly comparable projects are benchmarked (transport mode)
- Ensure that within a transport mode broadly comparable procurement methods are benchmarked (delivery method mode).

The client cost as a percentage of total construction cost is considered to be the best measure to compare the performance of participating agencies in terms of the client costs (planning and environment, community consultation, design, project and program management, overhead allocation etc) that they allocate to the delivery of major infrastructure projects.

An additional quantitative data analysis for client cost categories is provided in Appendix C.

6.1 Road

The road projects included in the study include projects delivered by a range of traditional procurement models including:

- Single Target Outturn Cost (TOC) Alliance - The Alliance model is an agreement focussed on process as much as on outcomes and involves the engagement of designers, construction contractors and other service providers to work together with the principal to deliver the project on a cost reimbursable basis with some performance incentives
- Competitive Alliance - A desire to place greater emphasis on price competition in alliance tender selections has created a class of alliance dubbed a competitive alliance or multiple TOC. Whereas the single TOC alliance requires selection of alliance partners based primarily on non-price selection criteria and high level value for money criteria, the two TOC alliance introduces direct price competition into the selection process.
- Design and Construct - In this type of contract, the contractor is responsible for taking a concept developed by the owner, completing the detailed design, and then pending the owner's approval on the design, they can proceed with construction; and
- Construct only - This describes the model of construction management in which the general contractor is engaged through a tender process after the designs have been completed by the architect or engineer.

The analysis below starts from a consideration of all road projects delivered by participating agencies before breaking down the data into two broad categories:

- Fixed price contracts (D&C, Construct Only)
- Alliance Contracts (Single TOC, Competitive TOC)

For each section two types of graph are shown:

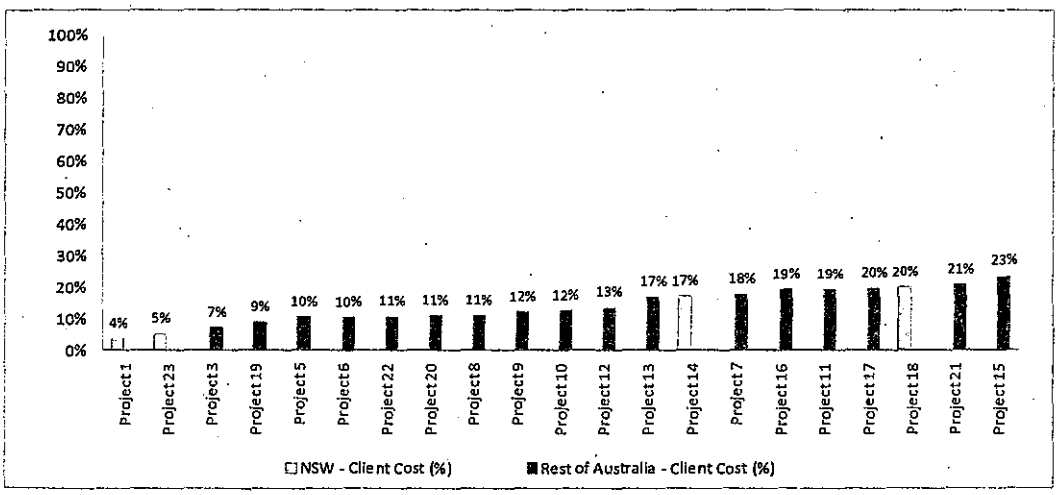
1. A graph showing all projects meeting the criteria (e.g., all road projects, all road fixed price contracts, all road alliance contracts) showing the total client cost as a percentage of the total construction cost. This shows the range of results across all of the projects falling within the specified category - providing an indication of the variance of results;

2. A graph comparing the NSW average for the projects meeting the criteria (e.g., all road projects, all road fixed price contracts, all road alliance contracts) with the rest of Australia average for other participating agencies for the total client cost as a percentage of the total construction cost. This provides an indication of the relative NSW performance versus the average performance of all other participants.

6.1.1 Road - Client cost as percentage of total construction cost

The average road client costs as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

Figure 2: Road - Client cost as percentage of total construction cost



The road projects delivered show a significant range in the client costs incurred as a percentage of the total construction cost. As seen below, this range varies from 4% to 23%. However, it should be noted that of the two lowest and two highest outlier projects in terms of client costs:

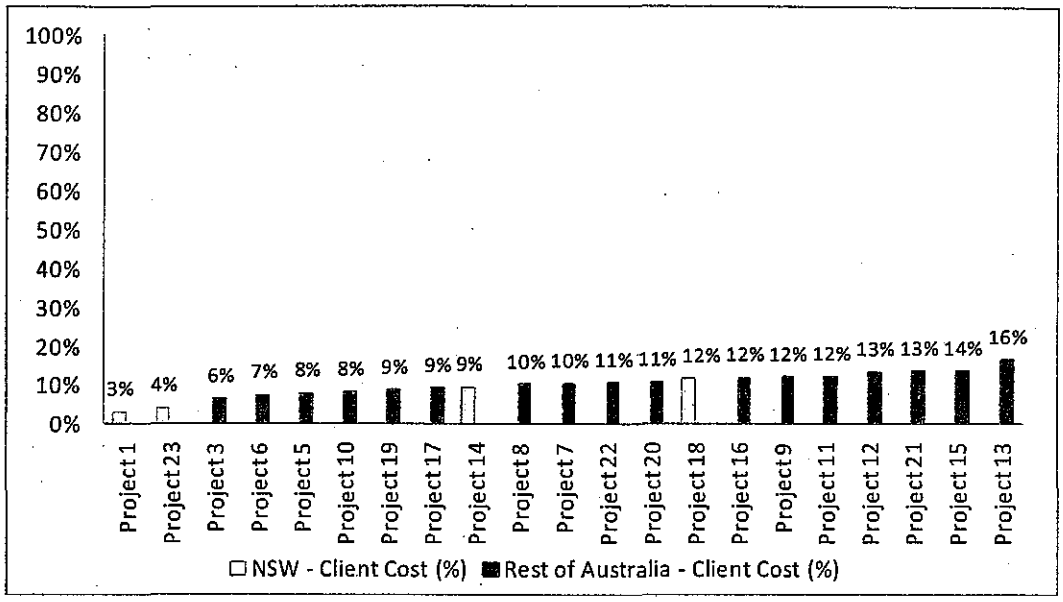
- One faced significant multi-agency jurisdictional and interface issues due to straddling two States as well as Commonwealth land that led to significant client costs;
- Another faced significant design and project management costs due to being a construct only package delivered across 4 separate contractual packages;
- The third and fourth project had client costs that appear to be low through a very low allocation of corporate overhead costs to these projects.

If these four projects are removed the range is from 7% to 20% with an average of 14%. However, it should be noted that the results below all include these four projects.

6.1.2 Road - Client cost (excluding design costs) as percentage of total construction cost

The average road client costs, excluding design costs, as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

Figure 3: Road - Client cost, excluding design costs, as percentage of total construction cost

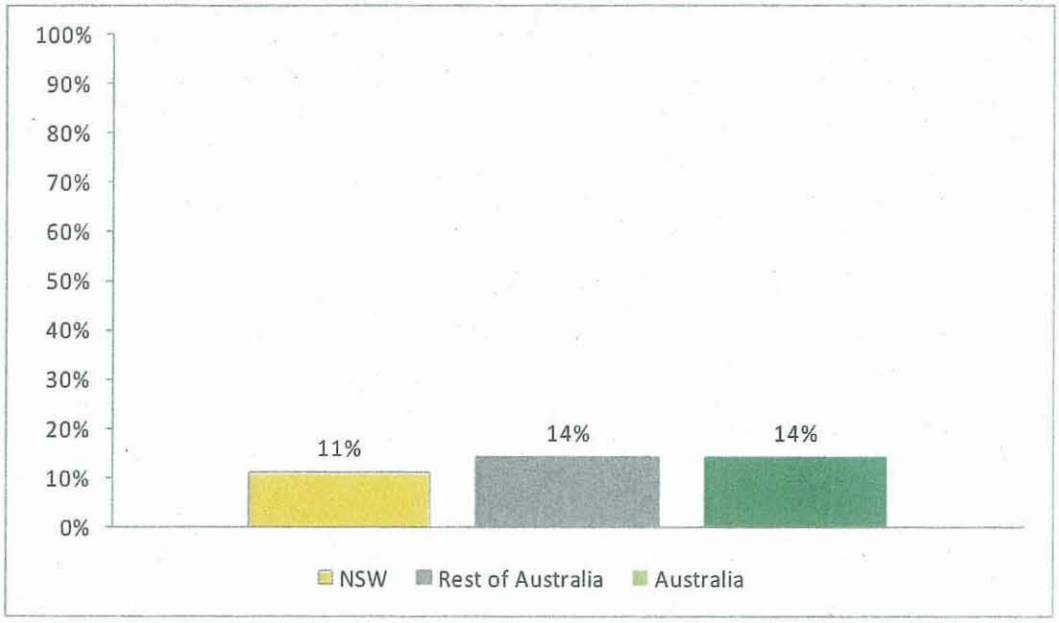


A large degree of the variance between client costs incurred on projects is due to design costs. This is due to the significant differences in design costs allocated to projects due to delivery model (construct only, D&C, alliance). To allow a like for like comparison the design costs have been excluded in the table above. It can be seen that the range is much narrower with the majority of projects clustering in a range between 8% and 13%.

6.1.3 Road - Average client cost as percentage of total construction cost

The average road client costs as a percentage of total construction costs for NSW and the rest of Australia are shown in the figure below.

Figure 4: Road - Average client cost as percentage of total construction cost

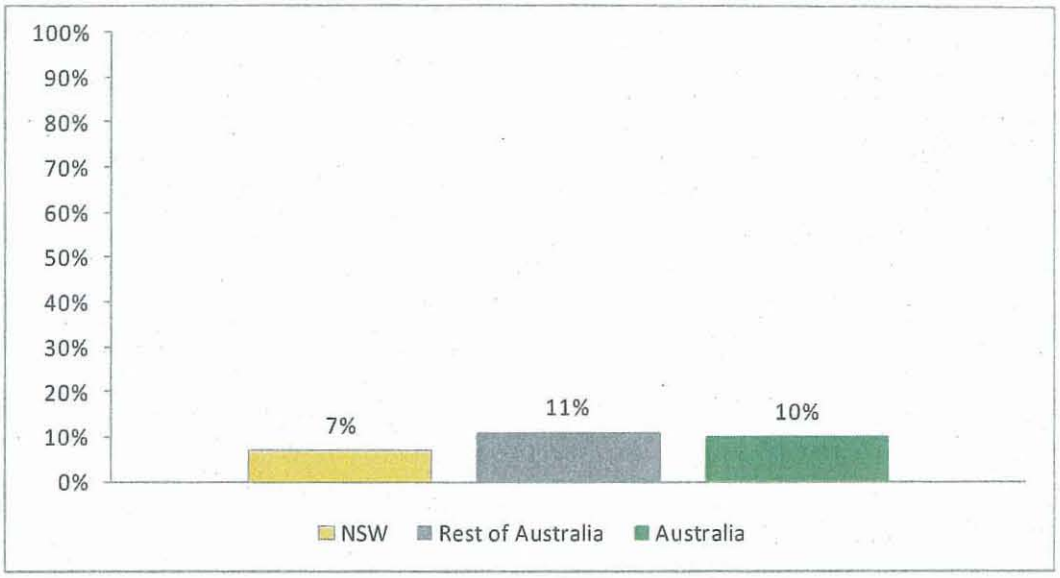


It can be seen above that across all of the projects (D&C, construct only and alliance) NSW appears to be performing well in terms of client costs incurred when compared to the rest of Australia average. However, it should be noted that two NSW project appears to have a very low allocation of project management and corporate costs to these project. If these project are omitted the NSW average becomes 14%, which is in line with the rest of Australia average of 14%.

6.1.4 Road - Average client cost (excluding design costs) as percentage of total construction cost

The average road client costs, excluding design costs, as a percentage of total construction costs for NSW and the rest of Australia are shown in the figure below.

Figure 5: Road - Average client cost (excluding design costs) as percentage of total construction cost

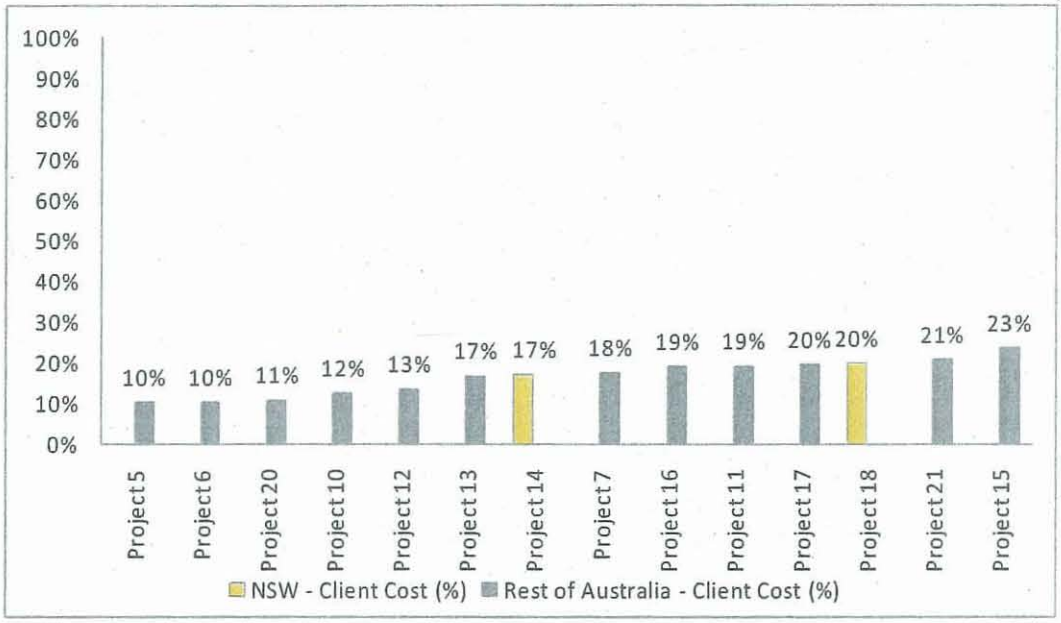


If design costs are excluded to allow a more like for like comparison it can be seen that NSW compares well against the rest of Australia average. NSW client costs seem broadly in line with the rest of Australia apart from corporate overheads, with a significantly lower allocation of corporate overheads to NSW road projects.

6.1.5 Road (Fixed Price) - Client cost as percentage of total construction cost

The average road (fixed price) client costs as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

Figure 6: Road (fixed price) - Client cost as percentage of total construction cost

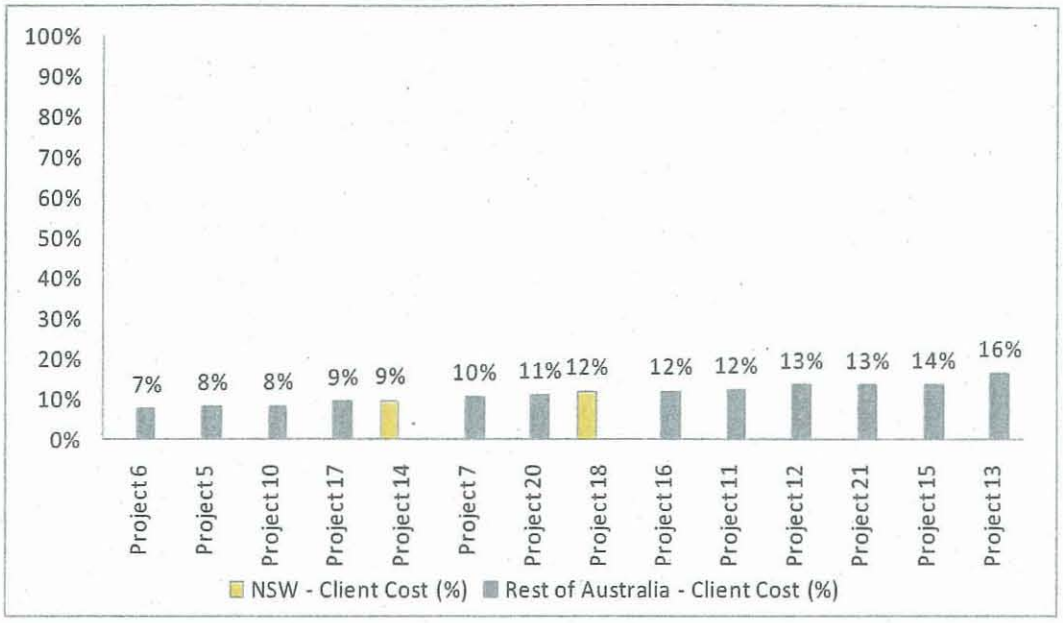


The D&C and construct only road projects delivered show a significant range in the client costs incurred as a percentage of the total construction cost, although slightly narrower than the range when alliance projects are included. As seen above, this range varies from 10% to 23%.

6.1.6 Road (Fixed Price) - Client cost (excluding design costs) as percentage of total construction cost

The average road (fixed price) client costs, excluding design costs, as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

Figure 7: Road (Fixed Price) - Client cost (excluding design costs) as percentage of total construction cost

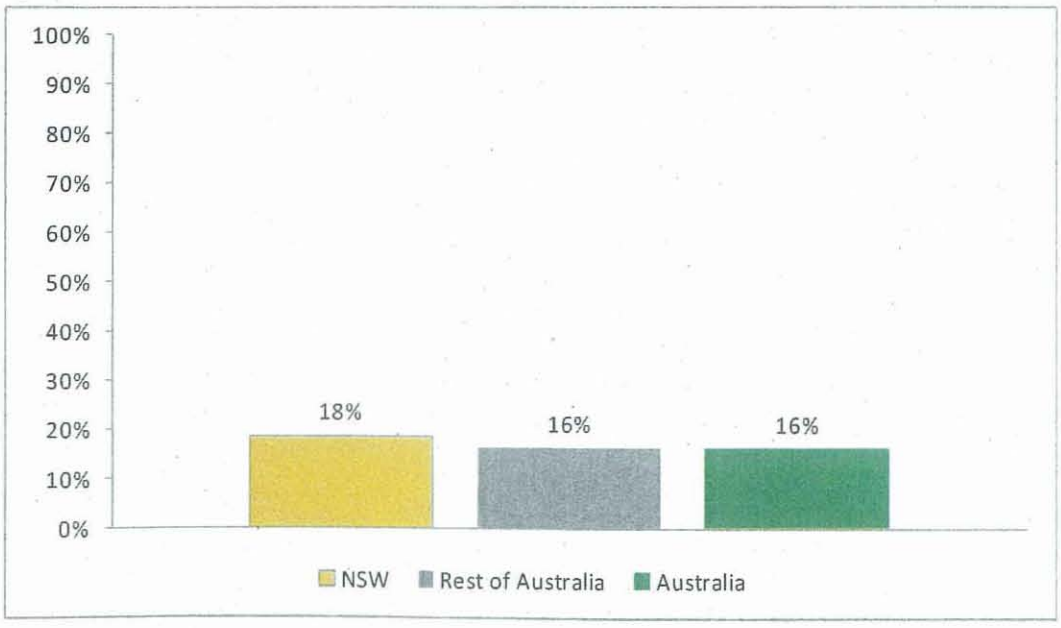


With the exclusion of design costs the range is much narrower and the average client cost (excluding design costs) for the two NSW projects is in line with the rest of Australia average of 10%.

6.1.7 Road (Fixed Price) - Average client cost as percentage of total construction cost

The average road (fixed price) client costs as a percentage of total construction costs for NSW and the rest of Australia are shown in the figure below.

Figure 8: Road (D&C) - Average client cost as percentage of total construction cost



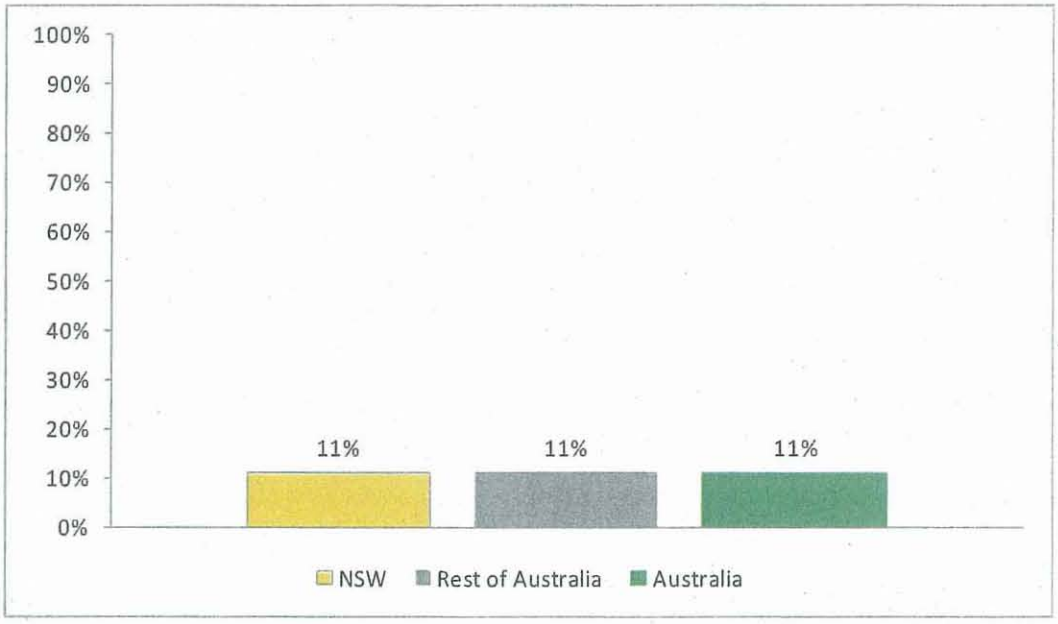
It can be seen above that across the construct only and D&C projects in NSW the client costs as a percentage of the total construction cost appear to be performing in line with the rest

of Australia average. The NSW average is 18%, which is slightly higher than the rest of Australia average of 16%.

6.1.8 Road (Fixed Price) - Average client cost (excluding design costs) as percentage of total construction cost

The average road (fixed price) client costs, excluding design costs, as a percentage of total construction costs for NSW and the rest of Australia are shown in the figure below.

Figure 9: Road (Fixed Price) - Average client cost (excluding design costs) as percentage of total construction cost

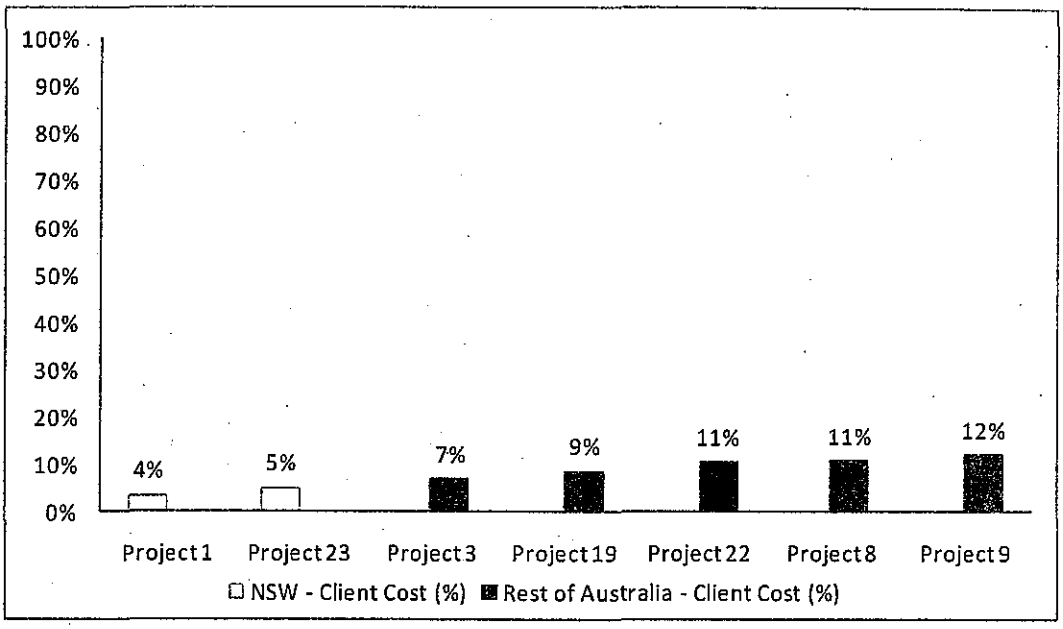


If design costs are excluded the NSW average is 11% which is in line with the rest of Australia average of 11%.

6.1.9 Road (Alliance) - Client cost as percentage of total construction cost

The average road (Alliance) client costs as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

Figure 10: Road (Alliance) - Client cost as percentage of total construction cost

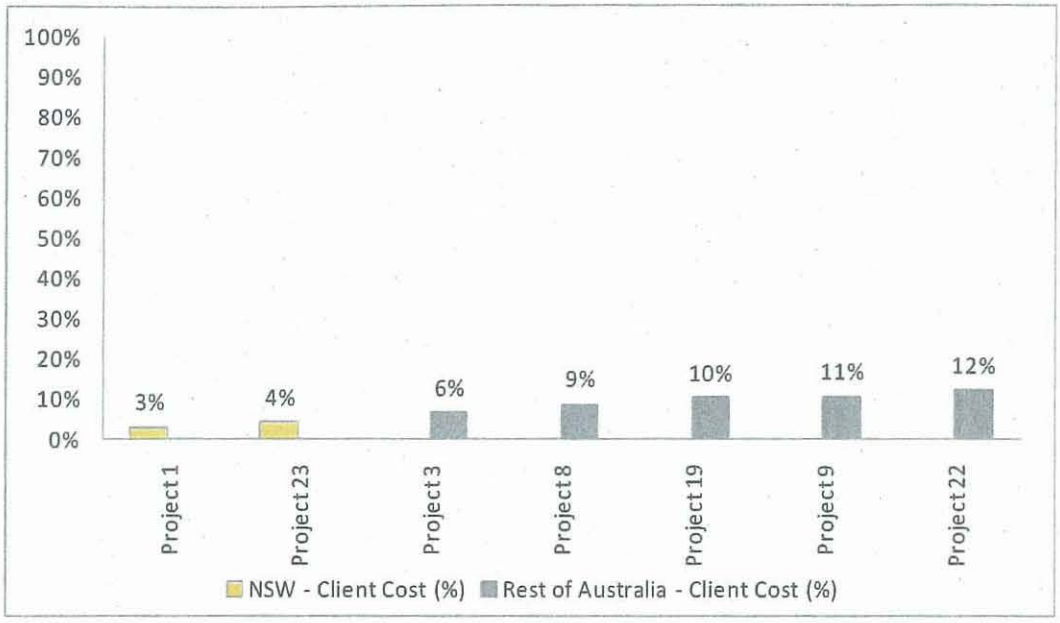


The alliance road projects delivered show a narrow range in the client costs incurred as a percentage of the total construction cost from 4% to 12%.

6.1.10 Road (Alliance) - Client cost (excluding design costs) as percentage of total construction cost

The average road (Alliance) client costs, excluding design costs, as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

Figure 11: Road (Alliance) - Client cost (excluding design costs) as percentage of total construction cost

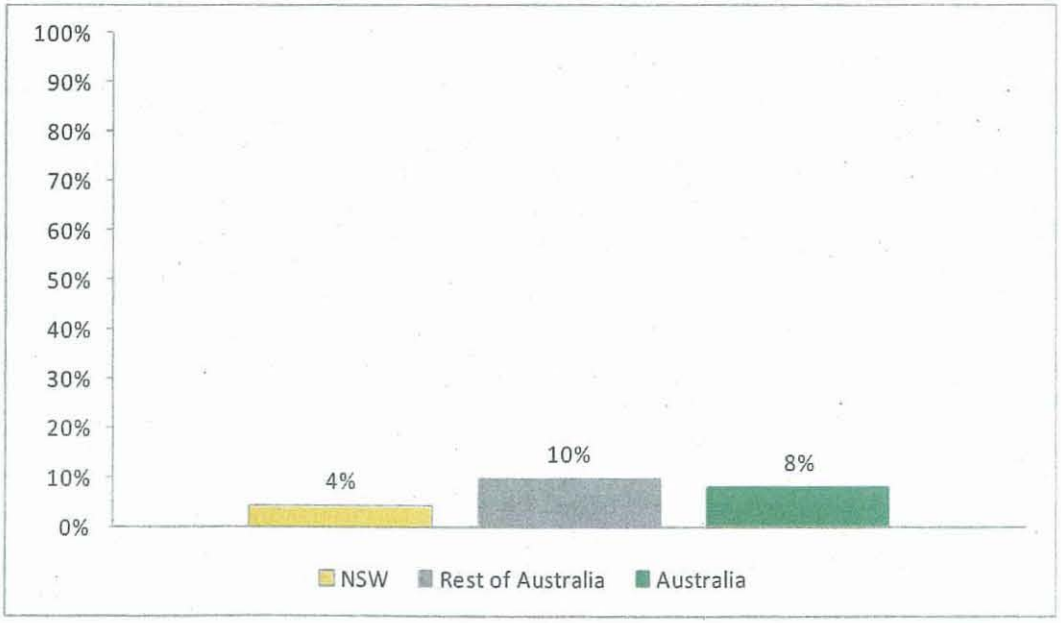


It can be seen that excluding design costs has little impact on the results due to most design costs being wrapped up within the alliance costs.

6.1.11 Road (Alliance) - Average client cost as percentage of total construction cost

The average road (Alliance) client costs as a percentage of total construction costs for NSW and the rest of Australia are shown in the figure below.

Figure 12: Road (Alliance) - Average client cost as percentage of total construction cost



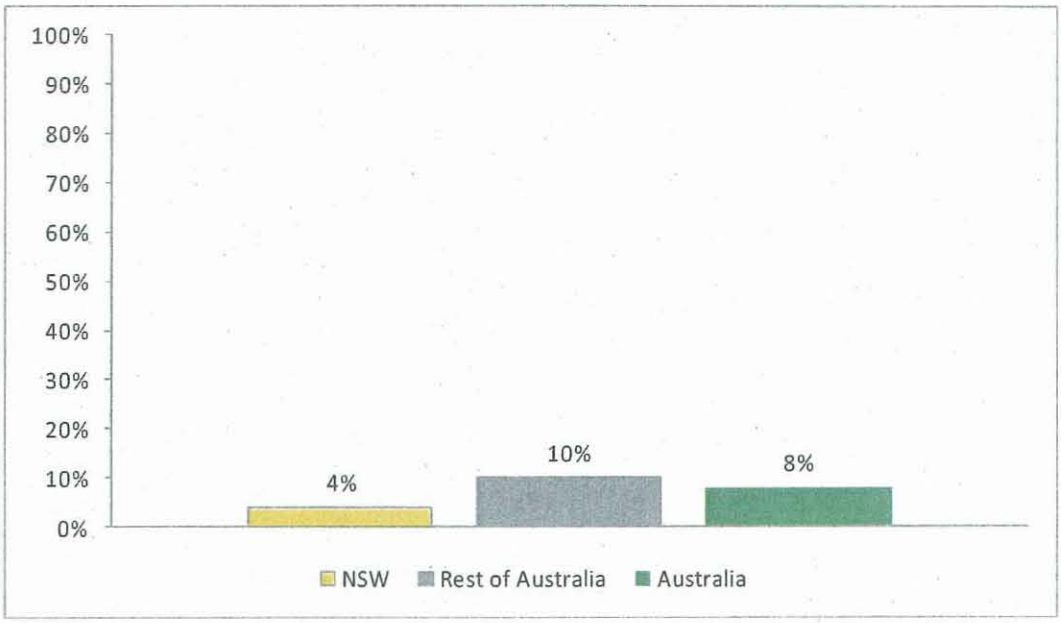
It can be seen above that across the alliance projects NSW appears to be showing much lower client costs as a percentage of total construction costs than the rest of Australia average. The NSW average is 4%, which is much lower than the rest of Australia average of 10%. However, this analysis must be considered in light of the fact that NSW had only two

road alliance project included in the study and on both of these projects there were no corporate overheads allocated to the project.

6.1.12 Road (Alliance) - Average client cost (excluding design costs) as percentage of total construction cost

The average road (Alliance) client costs, excluding design costs, as a percentage of total construction costs for NSW and the rest of Australia are shown in the figure below.

Figure 13: Road (Alliance) - Average client cost (excluding Design costs) as percentage of total construction cost



If design costs are excluded it can be seen that there is no impact on the results.

6.2 Rail

As for the road projects, the rail projects assessed in this study include projects delivered by a range of traditional procurement models including:

- Single Target Outturn Cost Alliance
- Competitive Alliance
- Design and Construct
- Construct only

The analysis below starts from a consideration of all rail projects delivered by participating agencies before breaking down the data into two broad categories:

- Fixed price contracts (D&C, Construct Only)
- Alliance Contracts (Single TOC, Competitive TOC)

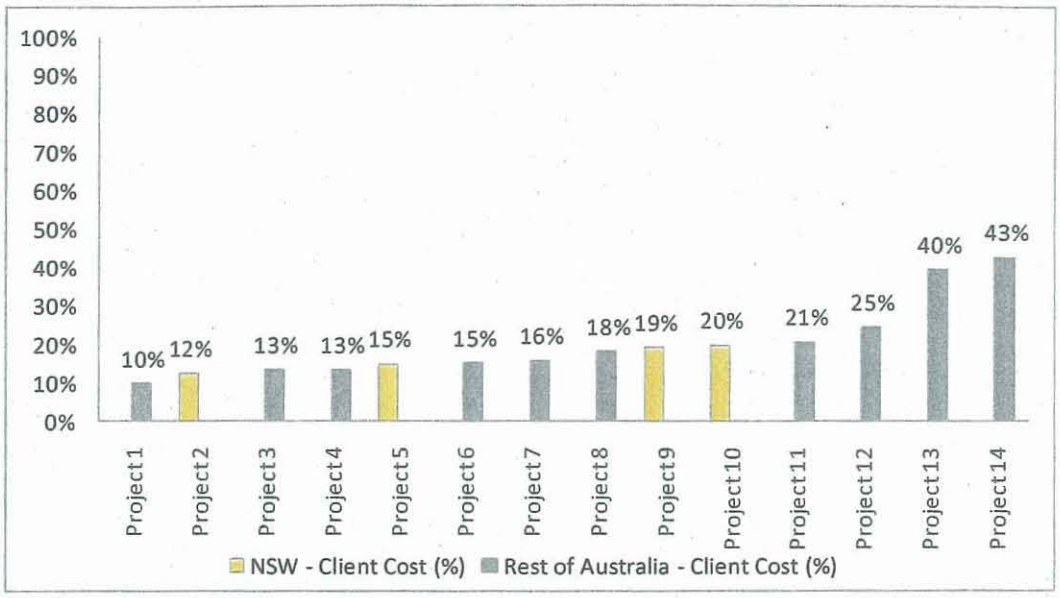
For each section two types of graph are shown:

- A graph showing all projects meeting the criteria (e.g., all rail projects, all rail fixed price contracts, all rail alliance contracts) showing the total client cost as a percentage of the total construction cost. This shows the range of results across all of the projects falling within the specified category – providing an indication of the variance of results;
- A graph comparing the NSW average for the projects meeting the criteria (e.g., all rail projects, all rail fixed price contracts, all rail alliance contracts) with the rest of Australia average for other participating agencies for the total client cost as a percentage of the total construction cost. This provides an indication of the relative NSW performance versus the average performance of all other participants.

6.2.1 Rail - Client cost as percentage of total construction cost

The rail client costs as a percentage of total construction costs are presented in the table below.

Figure 14: Rail client costs as a percentage of total construction costs



The rail projects delivered show a significant range in the client costs incurred as a percentage of the total construction cost. As seen above, this range varies from 10% to 43%. As indicated in the figure above, the NSW projects fit evenly within this range of rail client costs, ranging between 12% and 20%.

The figure above shows that of the 14 identified rail projects, there are two projects which have higher proportional client costs (projects 13 and 14 as shown in the figure). These projects have client costs as a percentage of construction costs of 40% and 43%, respectively.

For Project 13 the factor influencing the outcome of the client cost percentage is the comparative size of the design costs. As the figure below shows, the client cost percentage reduces to 20% when design costs are removed. This is more consistent with the range of all projects.

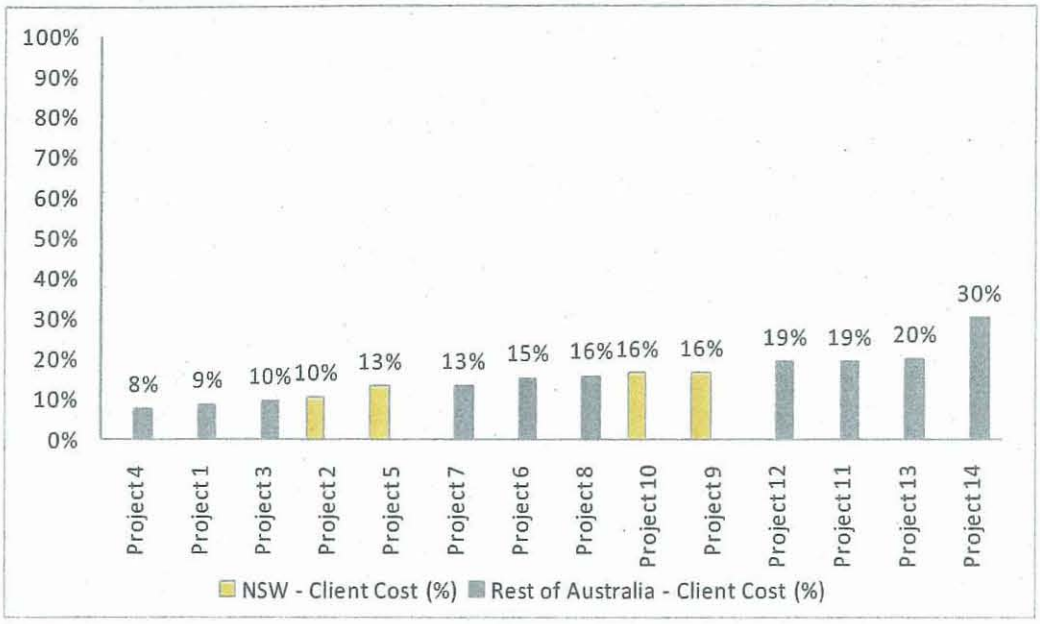
For Project 14, the result is influenced by the small size of the capital cost for the project and the relatively large project and program management costs.

6.2.2 Rail - Client cost (excluding design costs) as percentage of total construction cost

Variance in design costs across projects has a significant impact on the range of outcomes being presented in this benchmarking study. This variance is largely due to the wide variance in the amount of in-house design done before projects are tendered. For example, a construct only project has significantly more design done in house than a design & construct project. As such, an analysis has been undertaken on the outcomes excluding design costs.

The rail client costs, excluding design costs, as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

Figure 15: Rail client costs, excluding design costs, as a percentage of total construction costs

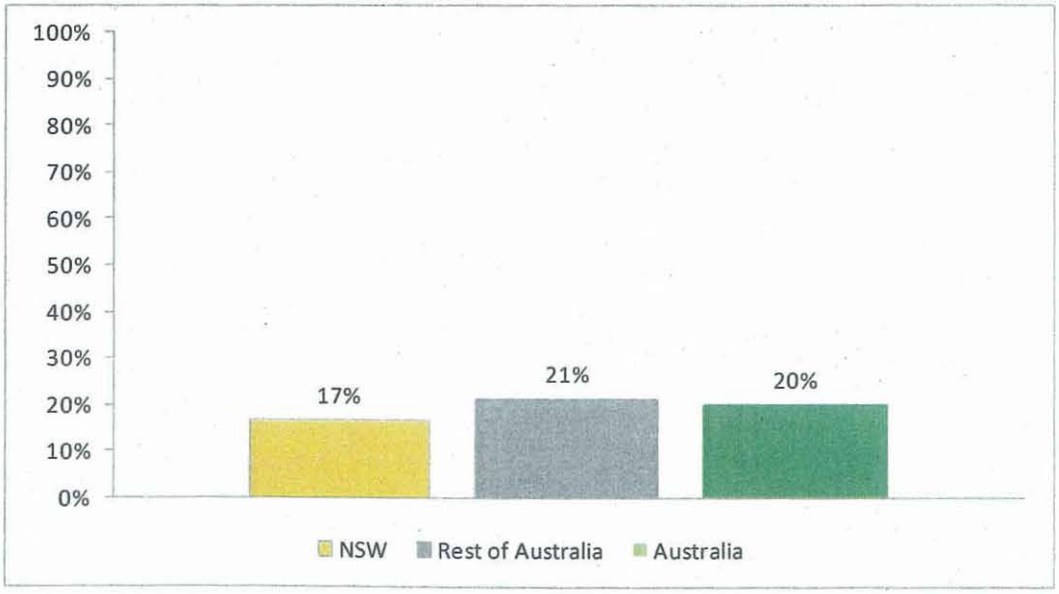


The rail projects, excluding design costs, show a range in the client costs incurred as a percentage of the total construction cost varying from 8% to 30%. As indicated in the figure above, the NSW projects fit evenly within this range of rail client costs, ranging between 10% and 16%. On a project specific basis, NSW projects sit at the lower to middle end of the spectrum of client cost percentages.

6.2.3 Rail - Average client cost as percentage of total construction cost

The average rail client costs as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

Figure 16: Rail client costs as a percentage of total construction costs



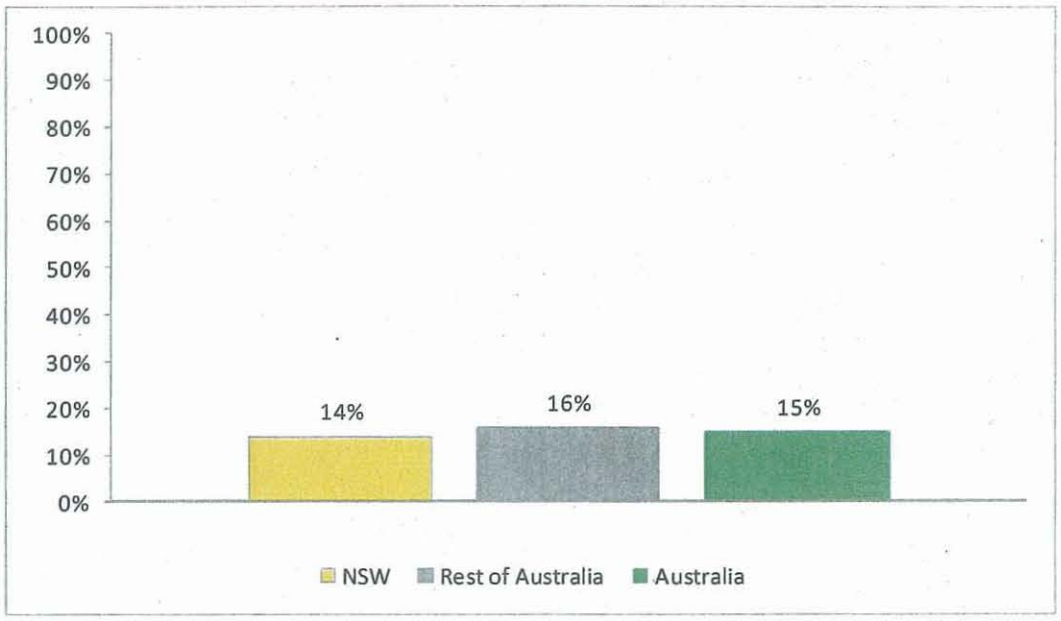
It can be seen above that across all of the rail projects, NSW appears to be consistent with the rest of Australia on the basis of the average client cost as a percentage of total

construction costs. The NSW average is 17%, which is slightly lower than the rest of Australia average of 21%.

6.2.4 Rail - Average client cost (excluding design costs) as percentage of total construction cost

The average rail client costs, excluding design costs, as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

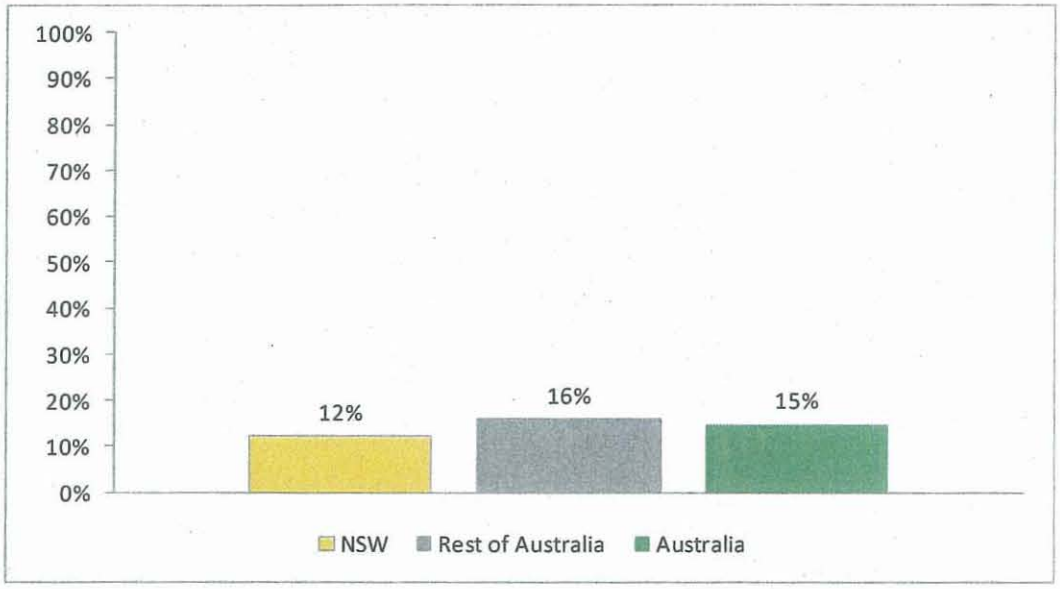
Figure 17: Average rail client costs, excluding design costs, as a percentage of total construction costs



With removal of design costs from the analysis, NSW remains consistent with the rest of Australia average on the basis of client costs as a percentage of total construction costs. The NSW average is 14%, which is slightly lower than the rest of Australia average of 16%.

6.2.5 Rail - Average client cost (excluding design, possession and bussing costs) as percentage of total construction cost

Figure 18: Average rail client costs (excluding design, possession and bussing cost), as a percentage of total construction costs

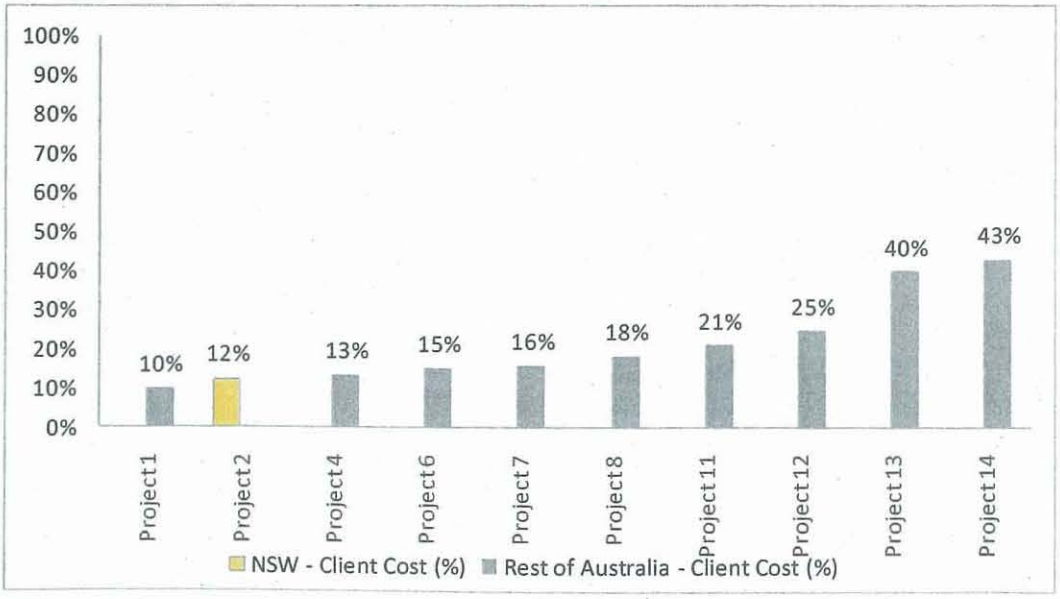


If design costs and possession and bussing costs are excluded it can be seen that the NSW average is lowered to 12% compared to rest of Australia average of 16%. This is due to the fact that possession and bussing costs have been a feature of a number of the NSW projects where work has been undertaken in a live rail corridor but have been large absent from the interstate projects.

6.2.6 Rail (Fixed Price) - Client cost as percentage of total construction cost

The rail (fixed price) client costs as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

Figure 19: Fixed Price rail client costs as a percentage of total construction costs

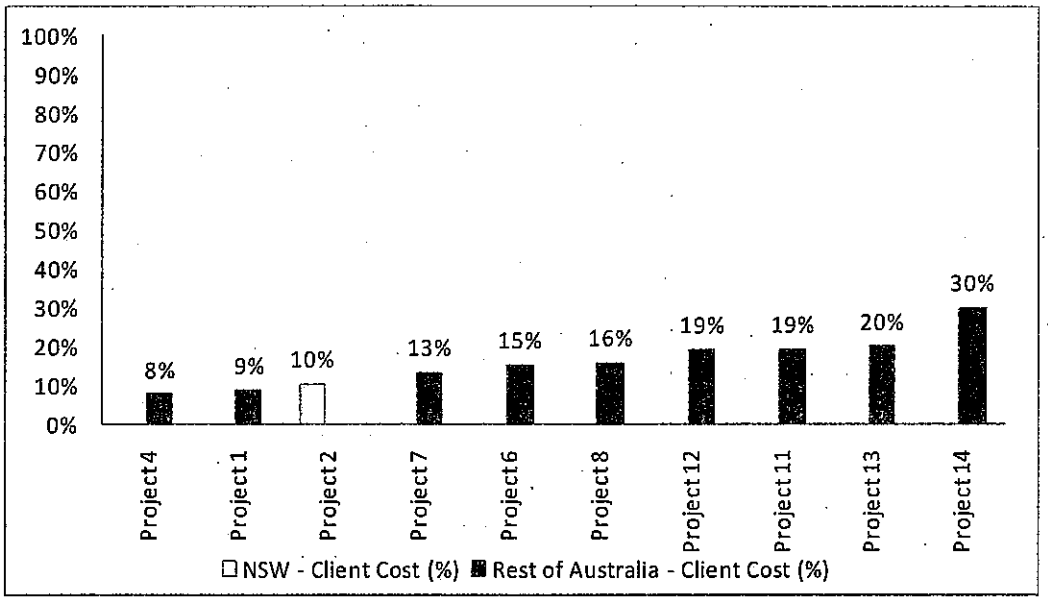


The D&C and construct only rail projects delivered show a range that varies from 10% to 43%. NSW has only one representative rail D&C project included in the benchmarking analysis, which sits at the low end of the range when compared to projects from the rest of Australia, at 12% client costs to total construction costs.

6.2.7 Rail (Fixed Price) - Client cost (excluding design costs) as percentage of total construction cost

The rail D&C and construct only client costs, excluding design costs, as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

Figure 20: Fixed Price rail client costs, excluding design costs, as a percentage of total construction costs

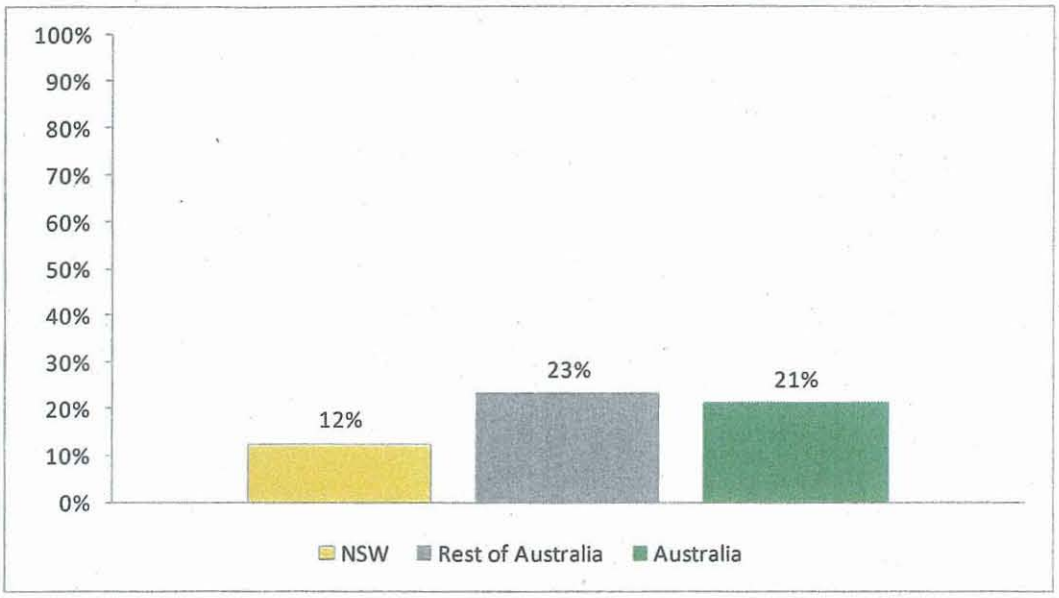


When design costs are excluded, the D&C and construct only rail projects delivered show a range of outcomes from 8% to 30%, again consistent with the overall analysis outcomes. The NSW representative rail D&C project reduces from 12% to 10% making it one of the lower client cost outcomes.

6.2.8 Rail (Fixed Price) - Average client cost as percentage of total construction cost

The average rail D&C and construct only client costs as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

Figure 21: Fixed Price average rail client costs as a percentage of total construction costs

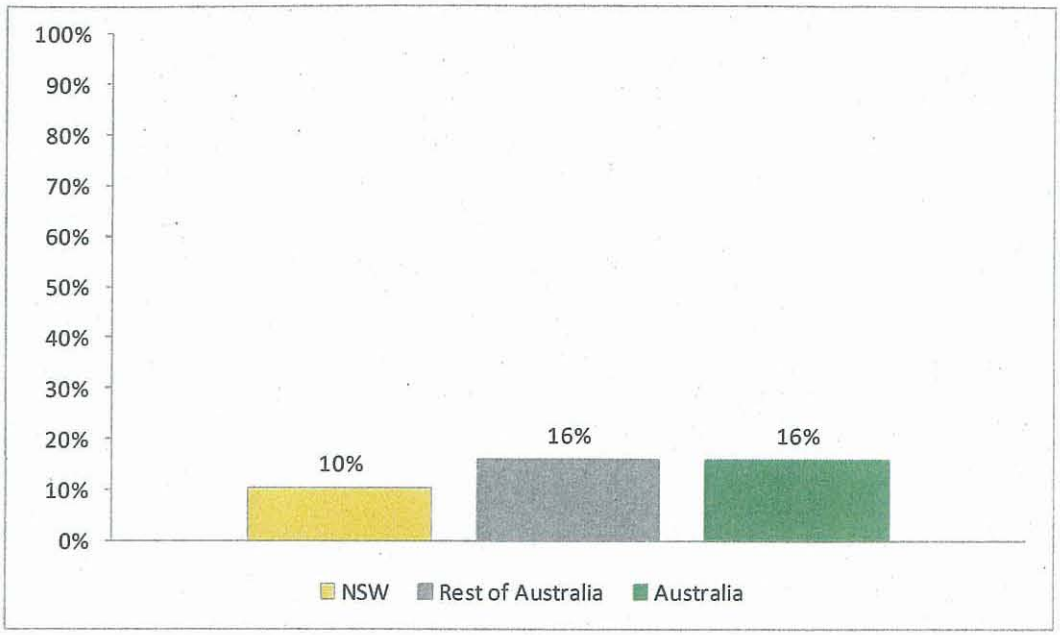


It can be seen above, that across the construct only and D&C projects, NSW appears to be much lower than the Australia average of client costs as a percentage of total construction costs. The NSW average is 12%, which is lower than the rest of Australia average of 23%. However, as mentioned above, this is based on a single rail D&C project in NSW and is influenced by the two outlier projects with client cost ratios of 40% and 43%. %. It should be noted that in NSW most recent rail projects have been delivered by alliance delivery methods as a way of dealing with the complexities of delivering projects within a live rail corridor.

6.2.9 Rail (Fixed Price) - Average client cost (excluding design costs) as percentage of total construction cost

The average rail D&C and construct only client costs, excluding design costs, as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

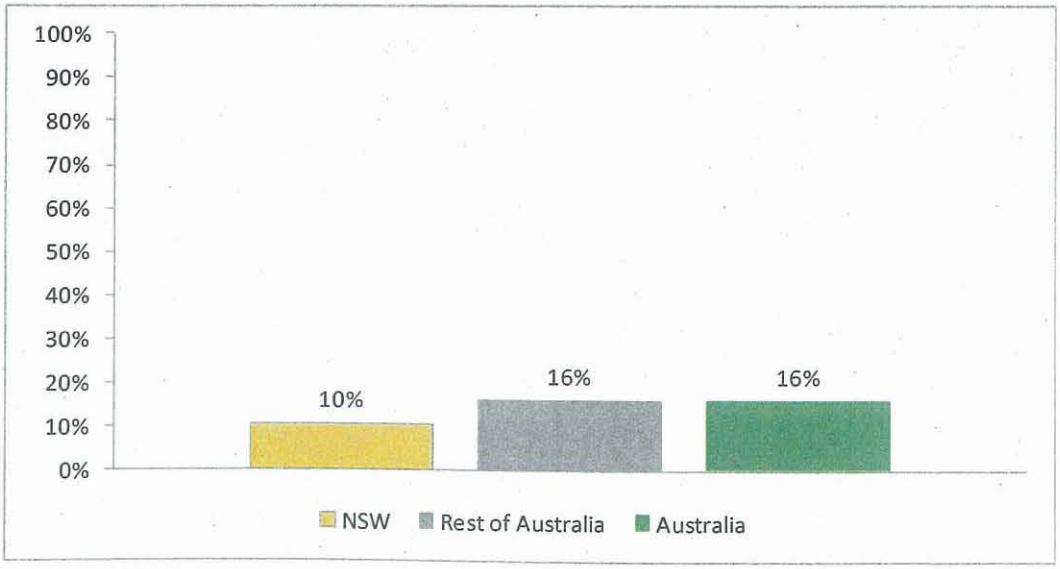
Figure 22: Fixed Price average rail client costs, excluding design costs, as a percentage of total construction costs



When design costs are removed from the client cost ratios, the NSW average moves to 10%, while the rest of Australia average is 16%. The removal of design costs has a significant influence on the outcomes on the rest of Australia average which reduces from 23% to 16%. However, even with the removal of design costs, the NSW D&C project is still much lower than the rest of Australia average for client costs.

6.2.10 Rail (Fixed Price) - Average client cost (excluding design, possession and bussing costs) as percentage of total construction cost

Figure 23: Fixed Price average rail client costs, excluding design, possession and bussing costs, as a percentage of total construction costs

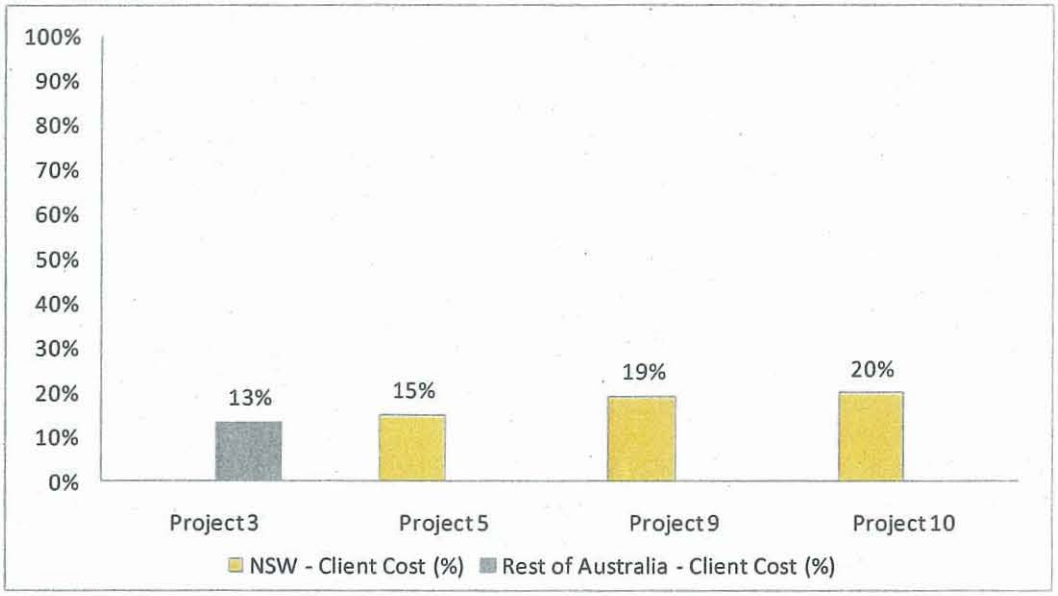


When design costs and possession and bussing costs are excluded it can be seen that the NSW average remains at 10% as well as rest of Australia average of 16%.

6.2.11 Rail (Alliance) - Client cost as percentage of total construction cost

The rail alliance client costs as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

Figure 24: Rail alliance client costs as a percentage of total construction costs



There are four identified alliance projects included in this benchmarking analysis. Three of the projects identified are from NSW.

The alliance rail projects show a fairly even spread in the client costs incurred as a percentage of the total construction cost. As seen in the figure above, this range varies from 13% to 20%. The three NSW projects had client cost percentages at the higher end of the scale with client costs of 15%, 19% and 20%.

6.2.12 Rail (Alliance) - Client cost (excluding design costs) as percentage of total construction cost

The rail alliance client costs, excluding design costs, as a percentage of total construction costs for each project considered in the benchmarking analysis are shown in the figure below.

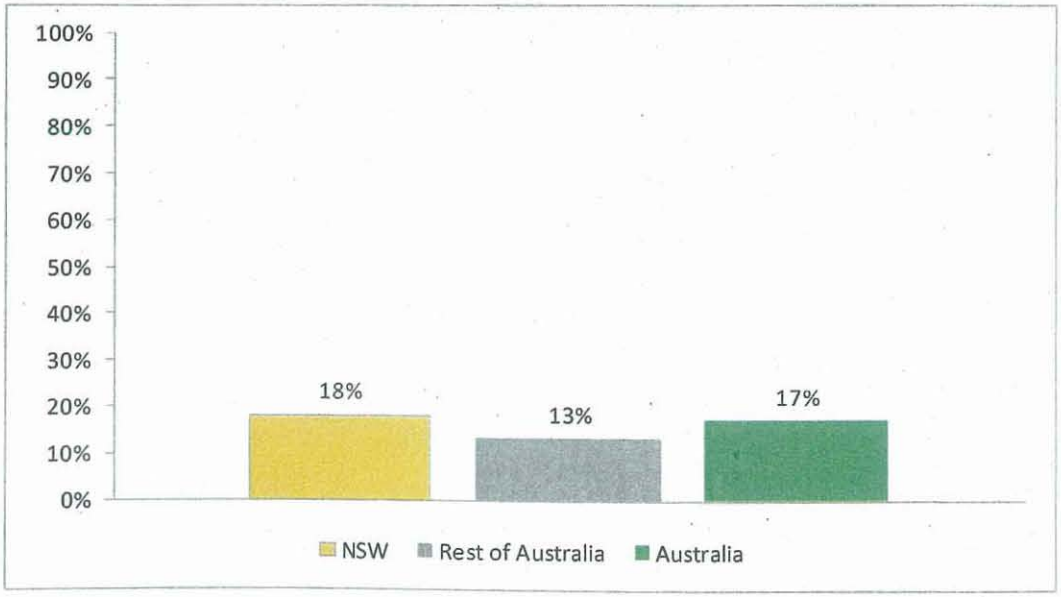
Figure 25: Rail alliance client costs, excluding design costs, as a percentage of total construction costs

When the design costs are removed from the analysis, the range of the client cost ratios for the alliance projects moves to between 10% and 16%. The three identified NSW rail alliance projects have client cost percentages of 13%, 16% and 16%, which are slightly at the higher end of the range.

6.2.13 Rail (Alliance) - Average client cost as percentage of total construction cost

The average rail alliance client costs as a percentage of total construction costs are shown in the figure below.

Figure 26: Average rail alliance client costs as a percentage of total construction costs



It can be seen in the figure above that across an average of the alliance projects NSW appears to be showing higher client costs as a percentage of total construction costs than

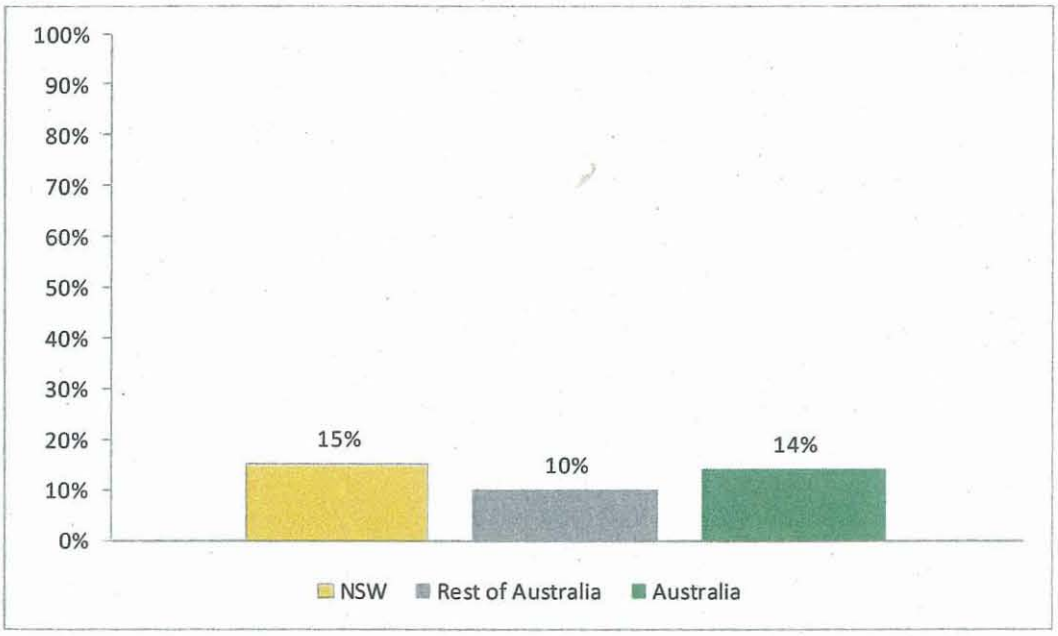
the rest of Australia. The NSW average is 18%, which is higher than the rest of Australia average of 13%.

The NSW average consists of three alliance projects while the Australian average is constructed from two representative projects.

6.2.14 Rail (Alliance) - Average client cost (excluding design costs) as percentage of total construction cost

The average rail alliance client costs, exclusive of design costs, as a percentage of total construction costs are shown in the figure below.

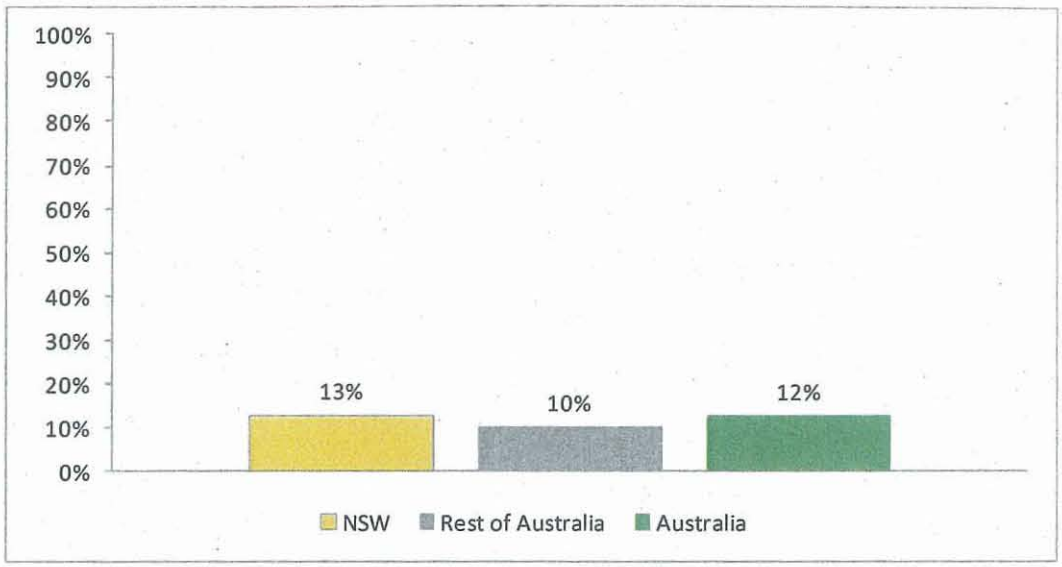
Figure 27: Average rail alliance client costs, excluding design costs, as a percentage of total construction costs



The average client cost percentages have been calculated with design costs removed. The NSW average client cost ratio moves from 18% to 15% when design costs are removed, while the Australian average moves from 13% to 10%. The removal of the design costs does not narrow the gap between NSW and the rest of Australia in terms of client cost average ratios.

6.2.15 Rail (Alliance) - Average client cost (excluding design, possession and bussing costs) as percentage of total construction cost

Figure 28: Average rail alliance client costs, excluding design costs and possession and bussing cost, as a percentage of total construction costs



With removal of design, possession and bussing costs from the analysis, NSW average moved to 13%, which compares with the rest of Australia average of 10%.

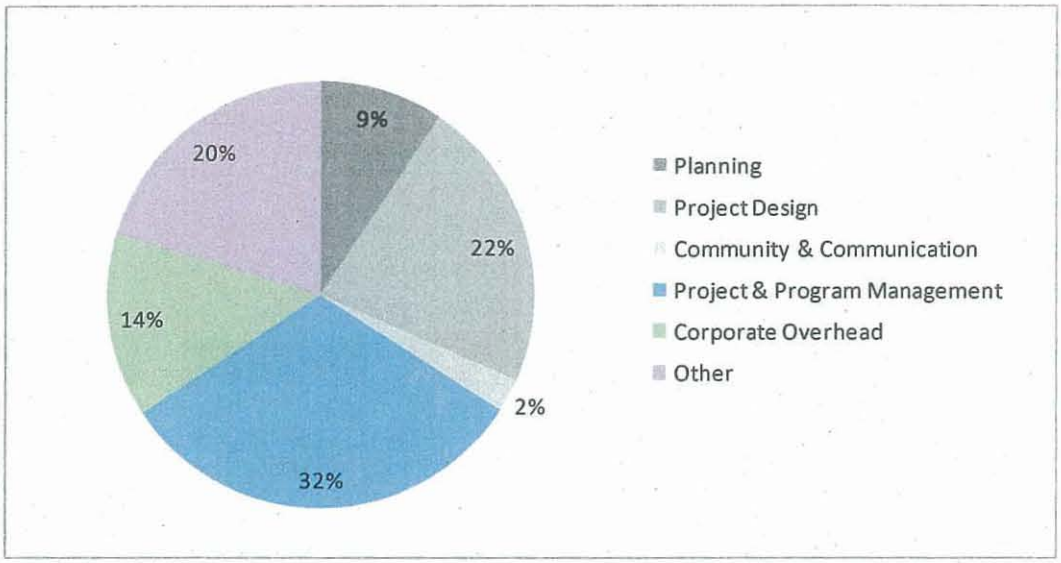
Thus, it should be noted that most of the difference between NSW and the rest of Australia appears to be due to possession and bussing, which averaged 2.6% of total construction costs across the three NSW projects. Possession and bussing was not a significant cost category across the rest of Australia projects.

6.3 Client costs by category

6.3.1 Road - Client costs by category as percentage of total client cost

The client costs by category as a percentage of total client costs for road projects are shown in the figure below.

Figure 29: Road - Client cost category as percentage of total client cost



As shown in the figure above, project and program management cost is the largest single cost category, on average accounting 32% of total client cost. The majority of projects had costs within the 1% - 45% range. Four projects appear to be outliers with respect to this cost category, with project and program management costs consisting 65% - 77% of total client costs. Removing these projects has a minor impact on the average, reducing it to 23% of total client cost.

Project design averaged 22% of total client cost. Of the 23 road projects, this cost category comprised approximately 10% - 50% of client costs for 15 of the projects. Planning costs averaged 9% of the total client cost. However, one project reported 43% of total client costs arose from planning activities. Excluding this project from the subset, planning costs averaged 8% of total client costs.

Corporate overheads averaged 14% of the total client cost. Corporate overhead was not separately identified for a significant number of road projects. Where it was separately identified, it ranged from less than 10% for 4 projects and between 50% and 80% for 4 projects. Of the four projects where corporate overhead were a significant proportion of total client cost, it also comprised a large proportion of the total construction cost, ranging from approximately 5% to 12% of total construction cost.

The Other category consists of:

- Safety, operational readiness & reliability
- Audit
- Legal
- Commercial & procurement
- Technical - Construction support
- Client insurance
- Commercial compensation

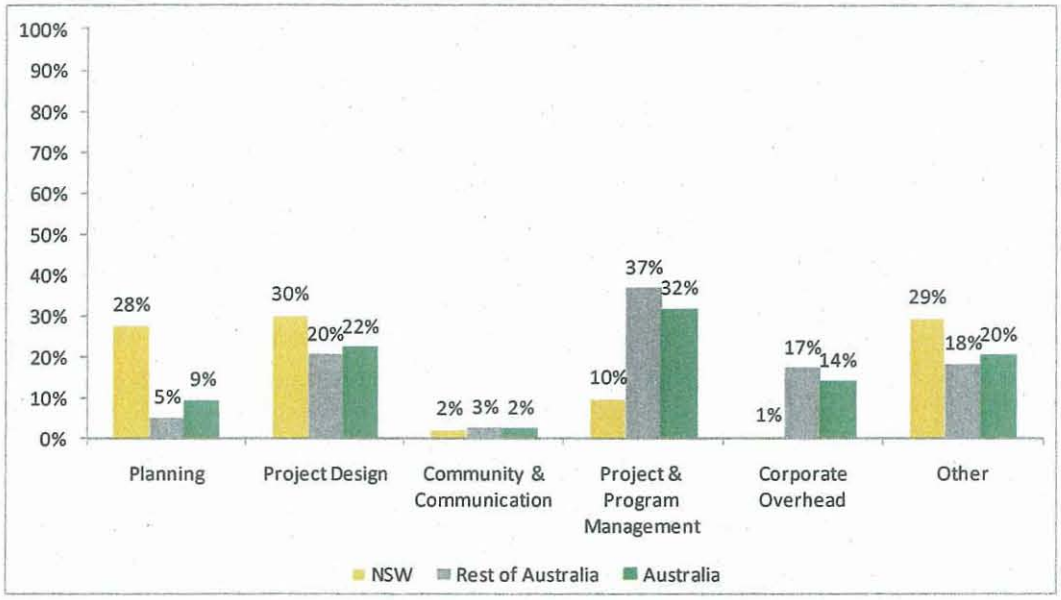
Commercial & procurement and technical - construction support appear to be the most significant costs falling within the Other category for road projects.

Please refer to appendix B which shows (by project) the client cost categories as a percentage of both the total client cost and the total construction cost.

6.3.2 Road - Comparison of client costs by category as percentage of total client cost between NSW and rest of Australia

The figure below details the comparison of client cost category as a percentage of total client cost between NSW and the rest of Australia.

Figure 30: Road - Comparison of client cost category as percentage of total client cost between NSW and rest of Australia



As shown in the figure above, NSW road projects incurred significant planning costs (28% of total client cost) compared to road projects from the rest of Australia (5% of total client cost). This may reflect the planning/regulatory regime in NSW.

Conversely, NSW road projects incurred significantly less corporate overhead costs compared to the rest of Australia (1% compared to 17%). As a percentage of the total construction cost corporate overheads averaged 0% in NSW as against an average for the rest of Australia of 2%.

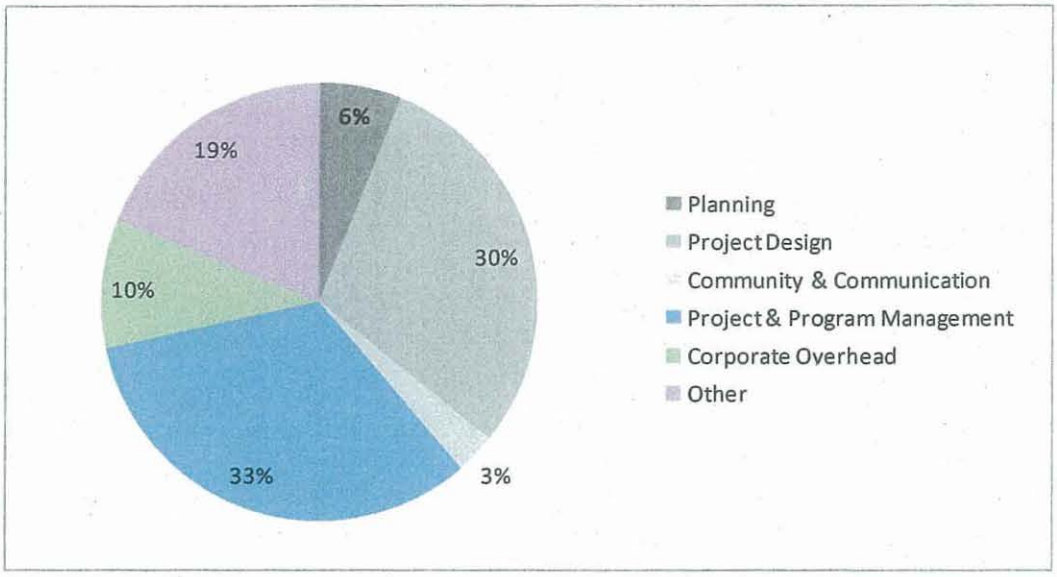
It should be noted that this may indicate that for NSW road projects, less overhead costs are allocated to specific projects - being met out of the agency operational budget.

The Other cost category for NSW also exceeds the rest of Australia (29% compared to 18%). Detailed analysis by client cost category can be found in Appendix C and Appendix D.

6.3.4 Road (Fixed Price) - Client costs by category as percentage of total client cost

The figure below details the clients costs by category as a percentage of total client costs for road (D&C) projects.

Figure 31: Road (Fixed Price) - Client cost category as percentage of total client cost



As shown in the figure above, project and program management is a significant cost category for road (Fixed Price) projects, on average accounting for 33% of total client cost. Project design accounted for, on average, 30% of total client cost. Corporate overhead accounted for, on average, 10% of total client cost.

Other costs are significant in road (fixed price) projects, accounting for approximately 19% of total client cost. Commercial & procurement and technical - construction support appear to be the largest costs within this Other cost category.

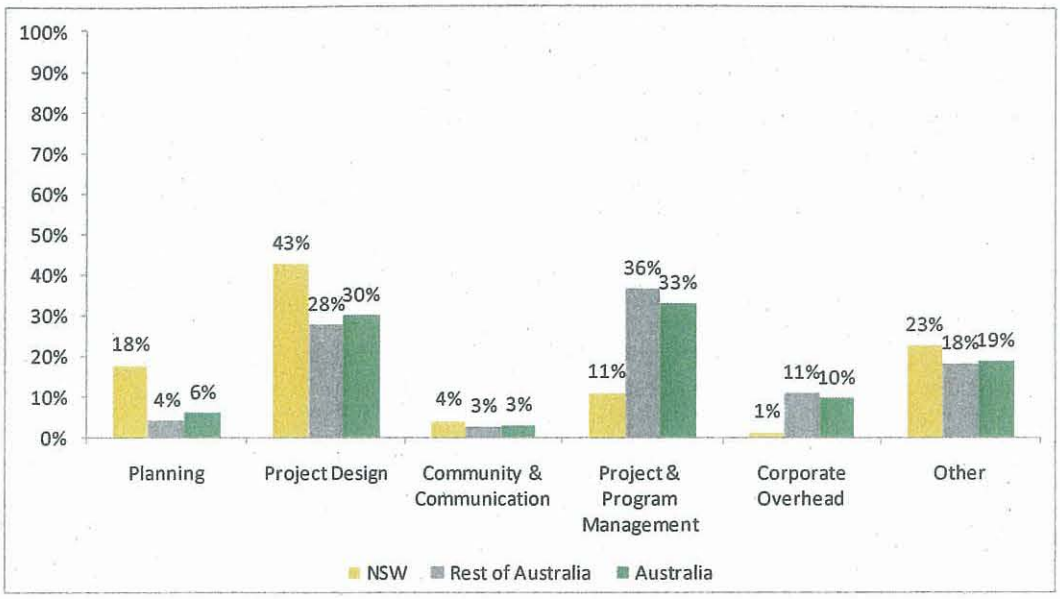
Other costs such as:

- Safety, operational readiness & reliability
- Audit
- Legal
- Commercial & procurement
- Technical - Construction support
- Client insurance
- Commercial compensation

6.3.5 Road (Fixed Price) - Comparison of client costs by category as percentage of total client cost between NSW and rest of Australia

The figure below shows the client cost category breakdowns for NSW and the rest of Australia.

Figure 32: Road (Fixed Price) - Comparison of client cost category as percentage of total client cost between NSW and rest of Australia



As shown in the figure above, NSW road (fixed price) projects incur higher planning costs than projects from the rest of Australia. One NSW project appears to have significantly higher planning costs, driving up the NSW average. Excluding this project leaves only one other NSW project (10% of total client cost) to compare with the average for the rest of Australia (4% of total client cost). This still shows a material difference in planning costs between NSW and the rest of Australia. This may reflect the planning/regulatory regime in NSW.

Design costs ranged between 20% and 50% of total client costs across the projects. Three projects reported very low design costs, imposing a downward bias on the average for the rest of Australia. Excluding these, the average for the rest of Australia increases to 37% of total client cost. On this basis, NSW projects appear to be largely in line with the rest of Australia in relation to design costs.

Project & program management costs for NSW projects are lower compared to the rest of Australia (11% compared to 36% of total client cost). It was noted in the data returned to Ernst & Young that these costs may be inaccurately recorded. For the projects from the rest of Australia, it was noted that external market factors played a role in the level of project management costs. These included labour availability, working in a live transport corridor and environmental issues which were also identified as contributing to higher project costs for projects from the rest of Australia.

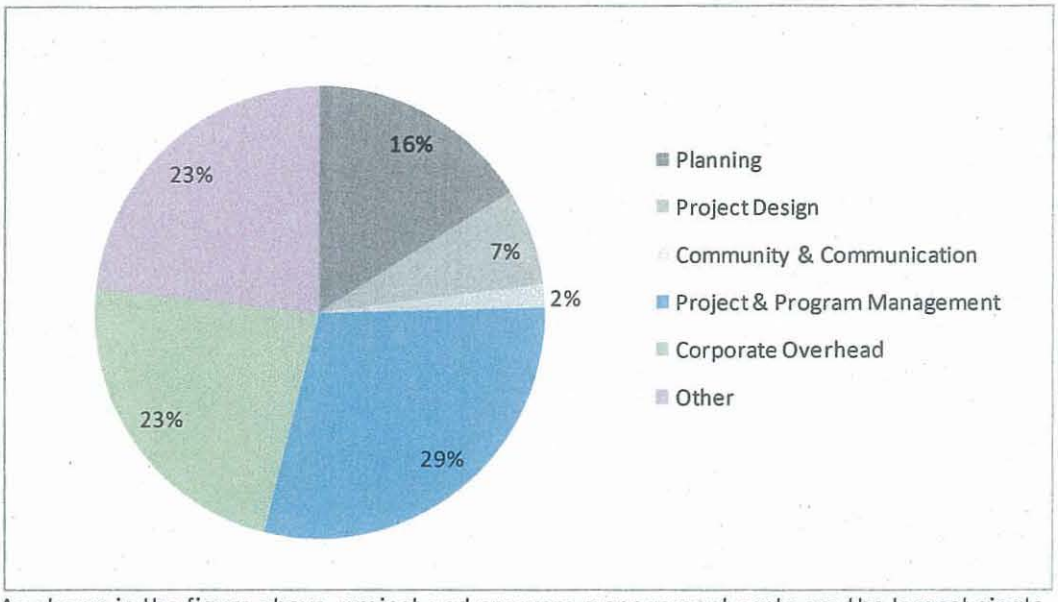
Corporate overhead costs for projects from the rest of Australia (11% of total client cost) are significantly higher than NSW projects (1% of total client cost). It should be noted that this may indicate that for NSW road projects less overhead costs are allocated to specific projects - being met out of the agency operational budget.

A detailed breakdown by project of client costs by category can be found in Appendix C.

6.3.6 Road (Alliance) - Client costs by category as percentage of total client cost

The figure below details the client costs by category as a percentage of total client costs for road alliance projects.

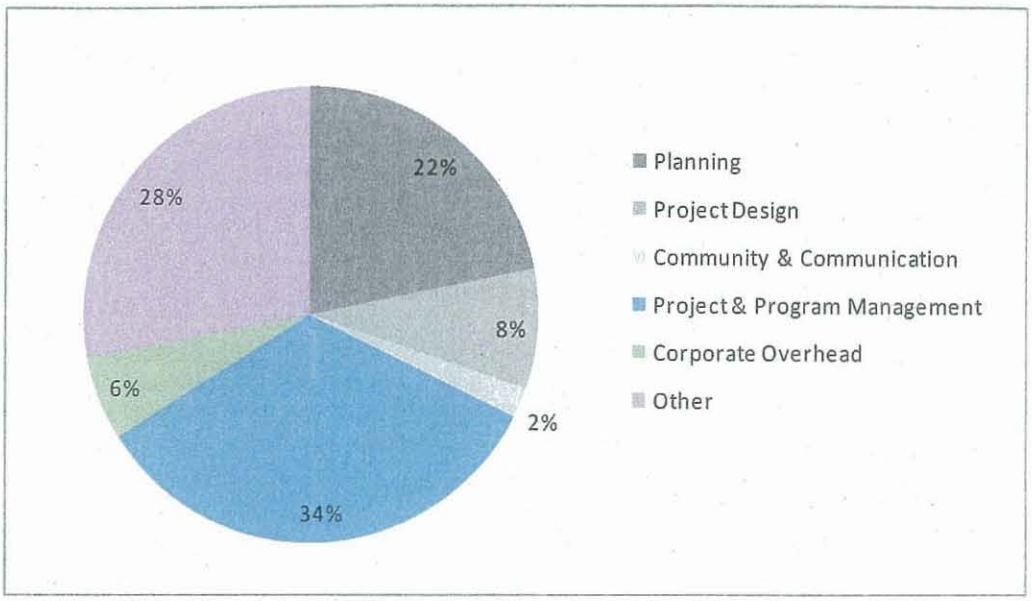
Figure 33: Road (Alliance) - Client cost category as percentage of total client cost



As shown in the figure above, project and program management costs are the largest single cost category, on average accounting 29% of total client costs. One project appears to be outliers with project and program management costs consisting 77% of total client costs. Removing this project from the analysis, the average comes down to 21%.

As shown in the figure above, planning and project design averaged approximately 16% and 7% of the total client cost respectively. Other costs also represent a significant cost, averaging 23% of total client costs. Technical -construction support, especially in projects with complex tunnelling, and insurance were the largest cost components of the Other cost category.

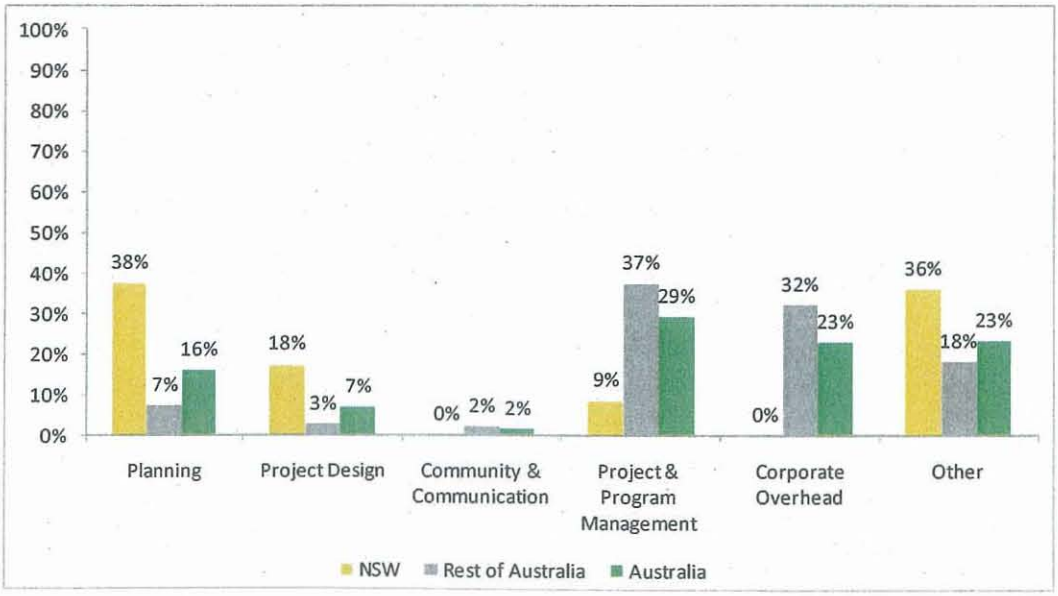
Corporate overhead is the second largest cost category in road (Alliance) projects, on average accounting for approximately 23% of total client cost. However, it should be noted that 2 projects had corporate overhead cost of 80% and 50% of total and excluding those projects, the average decreases to 6% of the total client cost as shown in figure below.
Figure 34: Road (Alliance) - Client cost category as percentage of total client cost (excluding 2 projects)



6.3.7 Road (Alliance) - Comparison of client cost category as percentage of total client cost between NSW and rest of Australia

The figure below shows the client cost category breakdowns for NSW and the rest of Australia.

Figure 35: Road (Alliance) - Comparison of client cost category as percentage of total client cost between NSW and rest of Australia



Data issues pose a challenge when conducting a comparative analysis between NSW road (Alliance) projects to those of the rest of Australia.

As shown in the figure above, NSW road (Alliance) projects incurred significant planning costs (38% of total client cost) and other costs (36% of total client cost) compared to road (Alliance) projects from the rest of Australia (7% and 18% respectively). However, it should be noted that there are only two NSW alliance project included in this study; these projects had very low design, project management and overhead costs, inflating the contribution of planning and other costs (audit, legal and insurance). Also, some of the projects from the

rest of Australia reported no or very limited planning costs, driving down the average. When looked at as a percentage of the total construction costs, planning costs in NSW at 2% where actually higher than the average for the rest of Australia at 1%.

Similarly, limitations of the data are reflected in the average project & program management costs for NSW and the rest of Australia. NSW road (Alliance) project (9% of total client) is reported significantly lower, compared to road (Alliance) projects in the rest of Australia (15% of total client cost). For the projects from the rest of Australia, possible reasons for higher costs, identified in anecdotal evidence, include external market factors, such as labour availability and skill shortages,

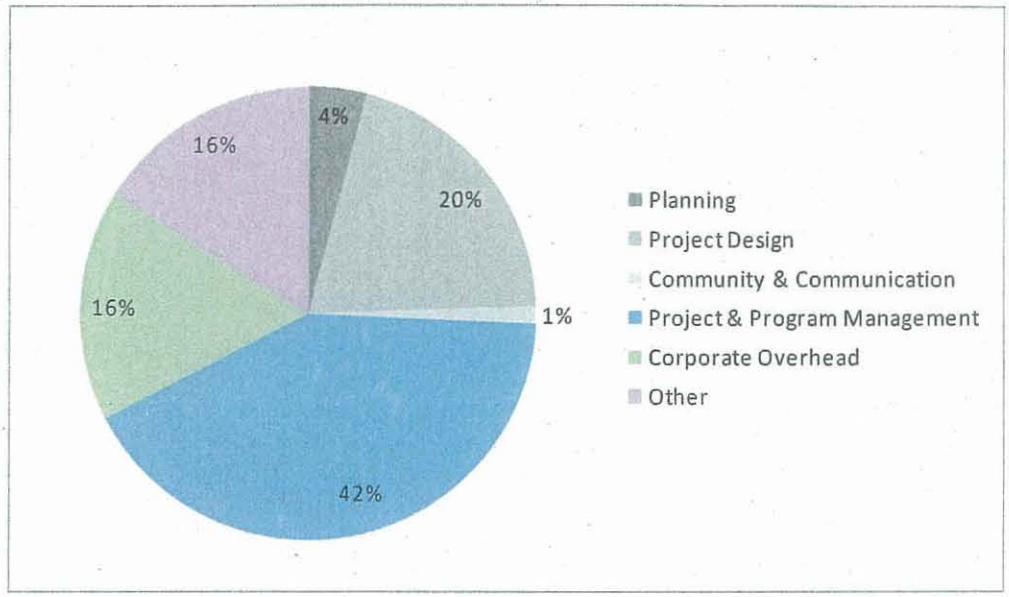
Conversely, NSW road projects had significantly less corporate overhead costs when compared to the rest of Australia (0% compared to 32% of total client cost). This is mainly due to no corporate overhead costs being allocated to the NSW road (Alliance) projects. When looked at as a percentage of the total construction cost, the NSW average of 0% compares to the rest of Australia average of 4% which remains a significant difference.

Detailed analysis by client cost category can be found in Appendix C and Appendix D.

6.3.8 Rail - Client costs by category as percentage of total client cost

The client costs by category as a percentage of total client costs for rail projects are shown in the figure below.

Figure 36: Rail client cost category as a percentage of total client costs



As shown in the figure above, project and program management is the largest single cost category for rail projects, on average accounting for 42% of total client cost. Of the 14 rail projects considered in the benchmarking study, this cost category comprised approximately 16% - 68% of client costs.

Project design is also a significant cost, on average accounting for approximately 20% of total client cost. The majority of projects had costs within the 15% - 30% range.

Planning costs averaged 4% of total client costs.

The Other cost category averaged 16% of the total client cost outcomes, which is a significant contribution to the overall client costs. The ranges of outcomes on a project basis were from 6% to 34%.

The Other category consists of:

- Safety, operational readiness & reliability
- Audit
- Legal
- Commercial & procurement
- Technical - Construction support
- Client insurance
- Commercial compensation

Legal, commercial procurement and technical - construction support appear to be the most significant costs falling within the Other category for rail projects.

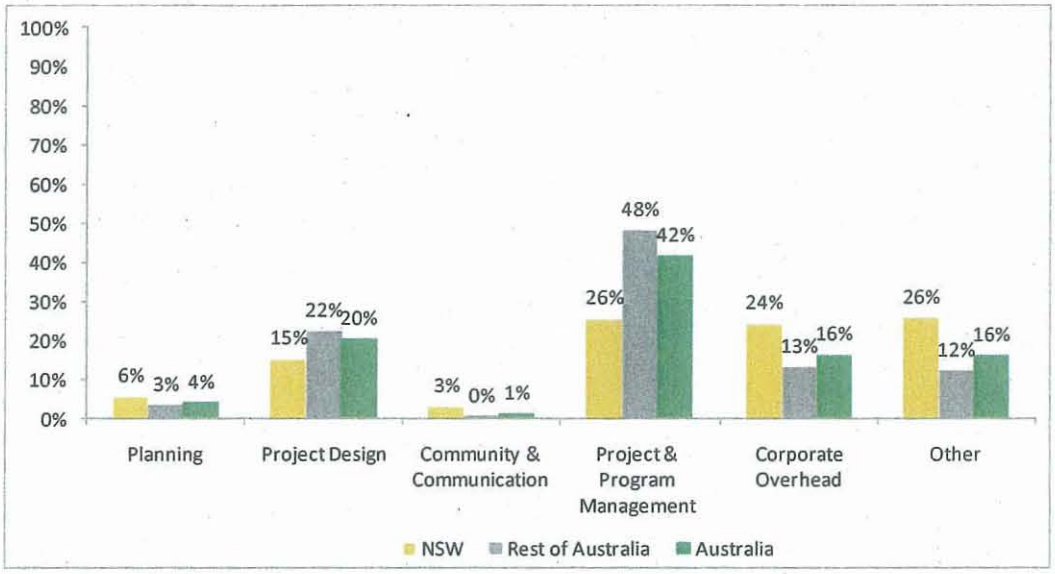
Corporate overhead also contributed to 16% of total client costs. On a project specific basis the range of outcomes were from 1% to 51% of the total client costs.

When looked at as a percentage of the total construction costs the results by cost category were largely consistent with the above with program and project management contributing 8%, design 5%, corporate overheads 3%, planning 1% and other 2%.

6.3.9 Rail - Comparison of client cost category as percentage of total client cost between NSW and rest of Australia

The figure below details the comparison of client cost category as a percentage of total client cost between NSW and the rest of Australia.

Figure 37: Rail - Comparison of client cost category as percentage of total client cost between NSW and rest of Australia



As shown in the figure above, planning costs for NSW projects (6% of total client cost) are slightly higher compared to the rest of Australia (3% of total client cost). However, it should be noted that 4 projects out of 10 non-NSW projects had not provided planning costs and excluding those projects, the average increases to 6% of the total client cost, which is in line with the NSW projects.

Project design costs for NSW projects (15% of total client cost) are slightly lower when compared to the rest of Australia (22% of total client cost). This is likely due to more projects being delivered by alliance than D&C in NSW.

NSW Rail projects incur lower project & program management than projects from the rest of Australia. This may be due to allocation differences with NSW projects allocating more costs among some of the less significant categories categorised as other costs while interstate projects include more of these costs within the project management costs.

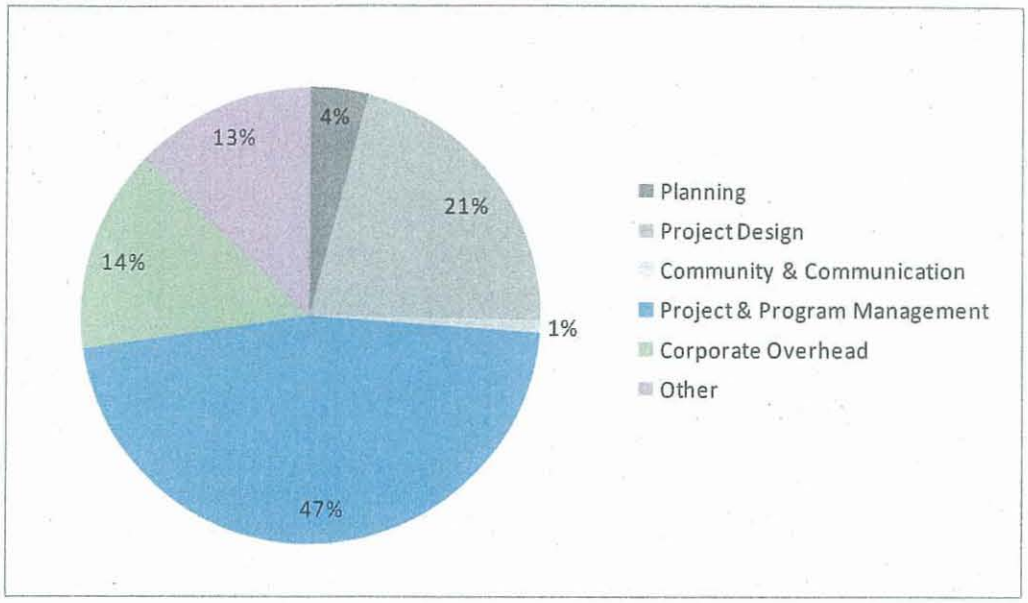
Corporate overhead costs for rail projects from the rest of Australia (13% of total client cost) are significantly lower than NSW projects (24% of total client cost). However, as a percentage of the total construction cost the difference is not as significant with the rest of Australia at 3% of total construction cost comparing to NSW projects at 4% of total construction cost.

Detailed analysis by client cost category can be found in Appendix C and Appendix D.

6.3.10 Rail (Fixed Price) - Client cost category as percentage of total client cost

The figure below details the client cost category as a percentage of total client costs for rail (fixed price) projects.

Figure 38: Rail (Fixed Price) - Client cost category as percentage of total client cost



As shown in the figure above, project and program management and project design are significant cost category for rail (fixed price), comprising on average 47% and 21% of total client costs.

Other costs account for approximately 13% of total client costs.

Other costs include:

- Safety, operational readiness & reliability
- Audit
- Legal
- Commercial & procurement
- Technical - Construction support
- Client insurance

are significant in rail (fixed price) projects, accounting approximately 13% of total client cost.

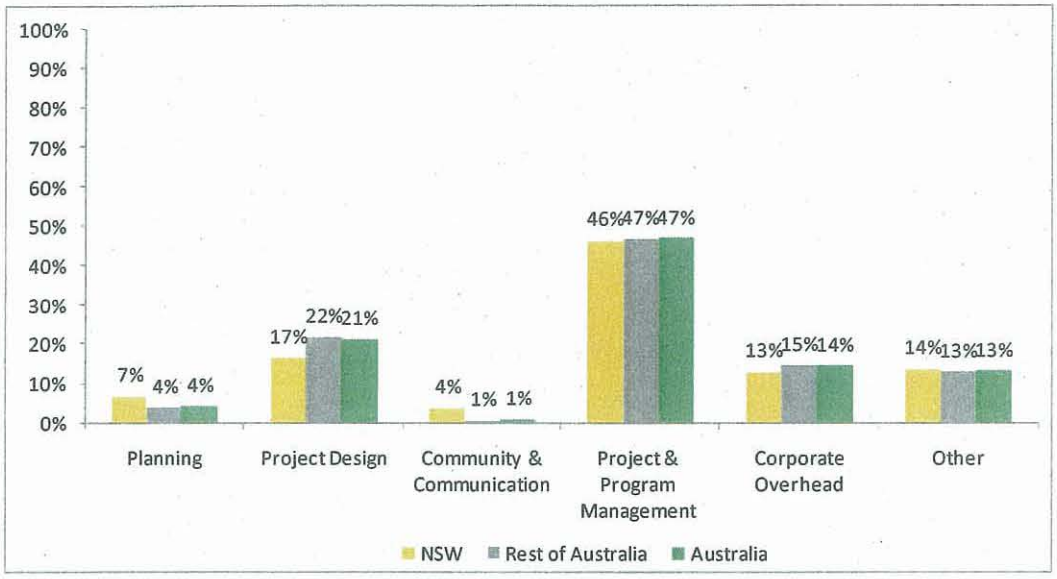
Legal and Client insurance appear to be the largest costs within the Other category for these road projects.

Corporate overhead accounts for approximately 14% of the total client cost.

6.3.11 Rail (Fixed Price) - Comparison of client cost category as percentage of total client cost between NSW and rest of Australia

The figure below shows the client cost category breakdowns for NSW and the rest of Australia.

Figure 39: Rail (Fixed Price) - Comparison of client cost category as percentage of total client cost between NSW and rest of Australia



As shown in the figure above, NSW rail (fixed price) projects incur similar costs in all cost categories except for lower project design cost compared to the rest of Australia. Project design cost for projects from the rest of Australia was higher mainly because of two projects with very high project design costs (44% and 50% of total client cost) driving up the average. Excluding these projects, the average declines to 14% of total client cost, slightly lower than NSW average. However, it should be noted that there is only 1 NSW rail (fixed price) included in the study compared to 9 projects from rest of the Australia.

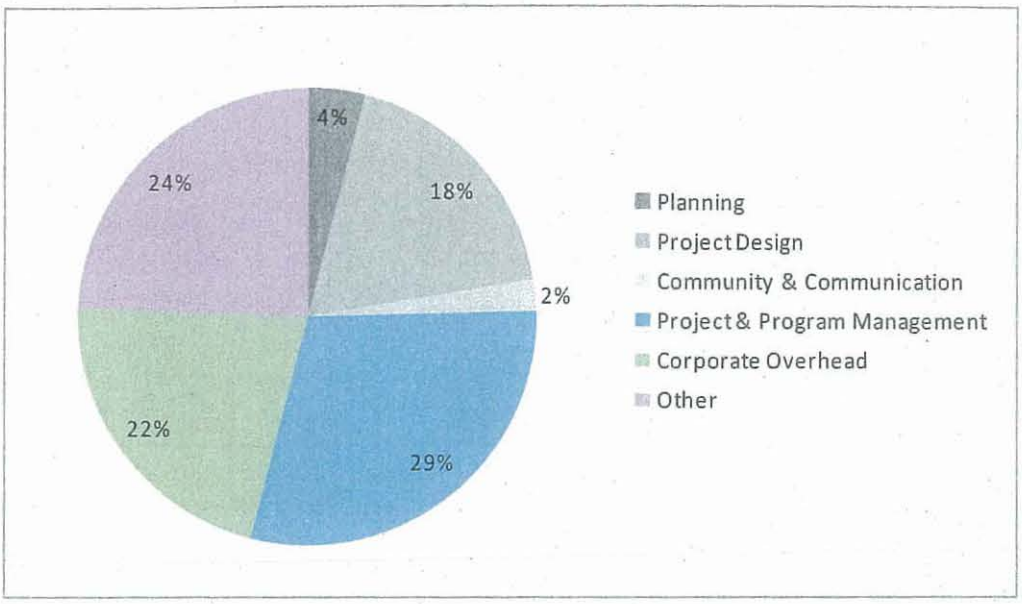
Projects from both NSW and rest of Australia had high project and program management cost compared to other cost categories. Our analysis indicated that the majority of rail (fixed price) projects have long construction durations and a changing regulatory environment over a number of years which has resulted in higher costs, particularly in systems assurance and other transport and construction regulation compliance expenses. On fixed price projects these costs are typically realised as client costs.

Detailed analysis by client cost category can be found in Appendix C and Appendix D.

6.3.12 Rail (Alliance) - Client cost category as percentage of total client cost

The figure below details the client cost category as a percentage of total client costs for rail alliance projects.

Figure 40: Rail (Alliance) - Client cost category as percentage of total client cost



As shown in the figure above, project and program management and corporate overhead are the significant cost categories for rail (Alliance), comprising on average 29% and 22% of total client costs, which is consistent with the total analysis for rail projects.

Other cost accounts for approximately 24% of total client cost, which is a significant contribution. Other costs include:

- Safety, operational readiness & reliability
- Audit
- Legal
- Commercial & procurement
- Technical - Construction support
- Client insurance
- Commercial compensation

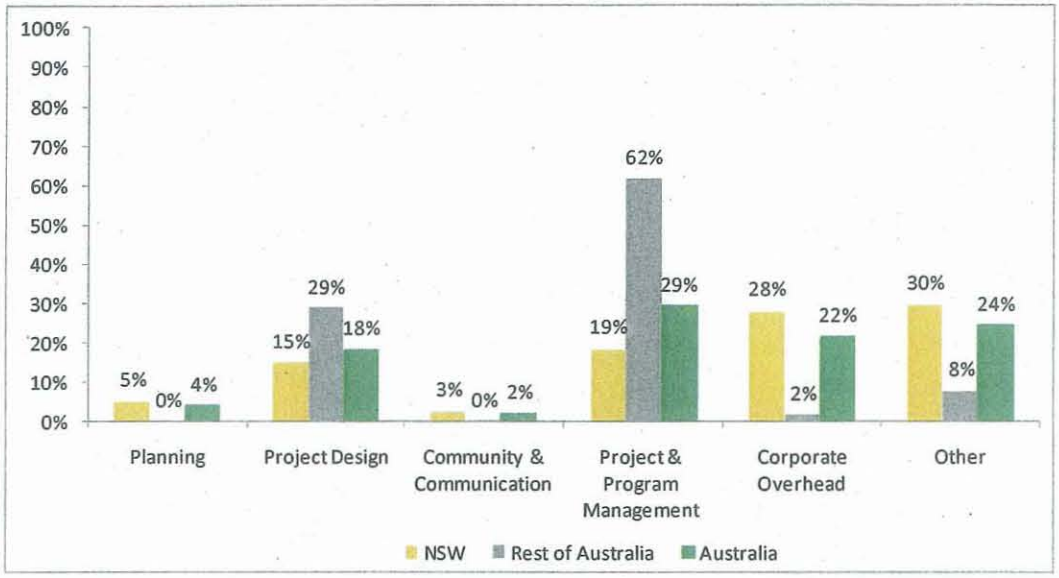
Project design is the other significant cost element contained within the rail alliance client costs, contributing 18% of the overall client cost outcomes.

When looked at as a percentage of the total construction costs the results by cost category were largely consistent with the above with program and project management contributing 5%, corporate overheads 4%, design 3% and other 4%.

6.3.13 Rail (Alliance) - Comparison of client cost category as percentage of total client cost between NSW and rest of Australia

The figure below shows the client cost category breakdowns for NSW and the rest of Australia.

Figure 41: Rail (Alliance) - Comparison of client cost category as percentage of total client cost between NSW and rest of Australia



As shown in the figure above, NSW rail (Alliance) projects incurred lower project design (15% of total client cost) compared to rail (Alliance) projects from the rest of Australia (29% of total client cost). However it should be noted that there are only one non-NSW alliance project included in the study.

Also, Project & program costs for projects from the rest of Australia (62% of total client cost) are significantly higher than NSW projects (19% of total client cost). This is also borne out by analysis based on total construction costs where the project and program costs for the rest of Australia are 4% compared to 3% for NSW.

Conversely, NSW rail (Alliance) projects incurred significantly higher other category costs compared to the rest of Australia (30% compared to 8% of total client cost and 5% compared to 1% of total construction costs). This is likely due to allocation on NSW projects of costs to line items captured within the other category that have been allocated to program and project management costs in other jurisdictions.

Planning and community & communication costs are not significant in the overall client cost development and do not vary significantly across jurisdictions.

Detailed analysis by client cost category can be found in Appendix C and Appendix D.

6.5 Total construction cost benchmarking

In this section of the assessment a benchmarking process is undertaken investigating the cost per kilometre of a number of road and rail projects. The analysis is produced using the total construction cost information provided by the agencies involved.

A selection of projects, from the total list of projects provided by agencies, has been included in the cost per kilometre analysis in attempt to ensure that projects of a similar nature are being compared. This has led to:

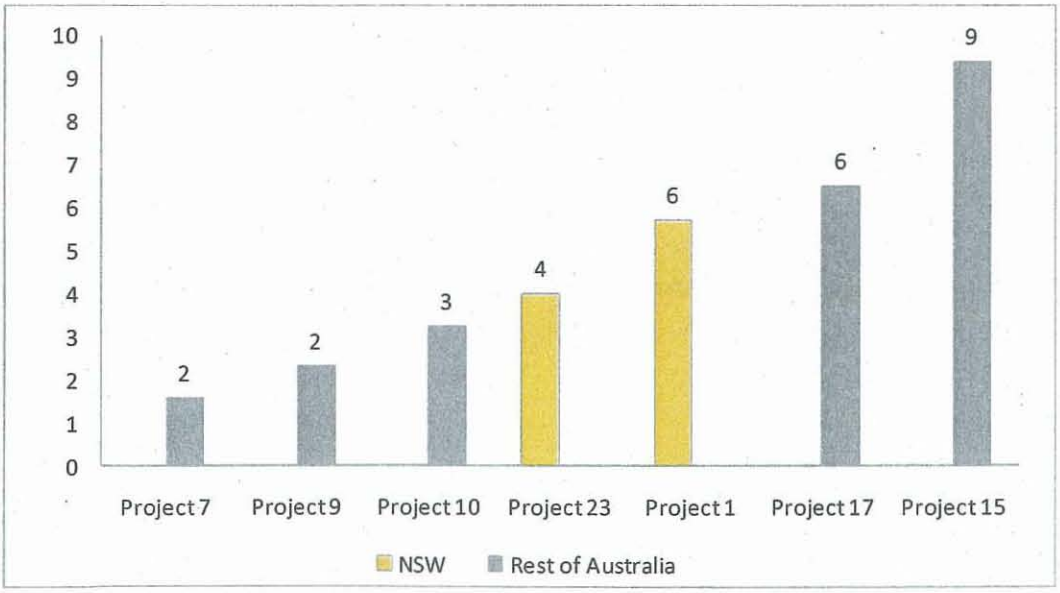
- Exclusion of road projects were the tunnel, busway or bridge component was material so as to allow a focus on the lane kilometre construction cost.
- Exclusion of track electrification, stabling and station projects to focus on projects involving the delivery of rail track.

It should be noted that the analysis should be considered indicative only due to the small sample size and the fact that adjustments have not been undertaken to normalise the cost components of the projects.

6.5.1 Road - Total construction cost per lane kilometre ($m)

In the figure below, the total construction cost per kilometre for road projects is shown. There are 6 road projects included in the cost per kilometre analysis.

Figure 42: Road - total construction cost per lane kilometre



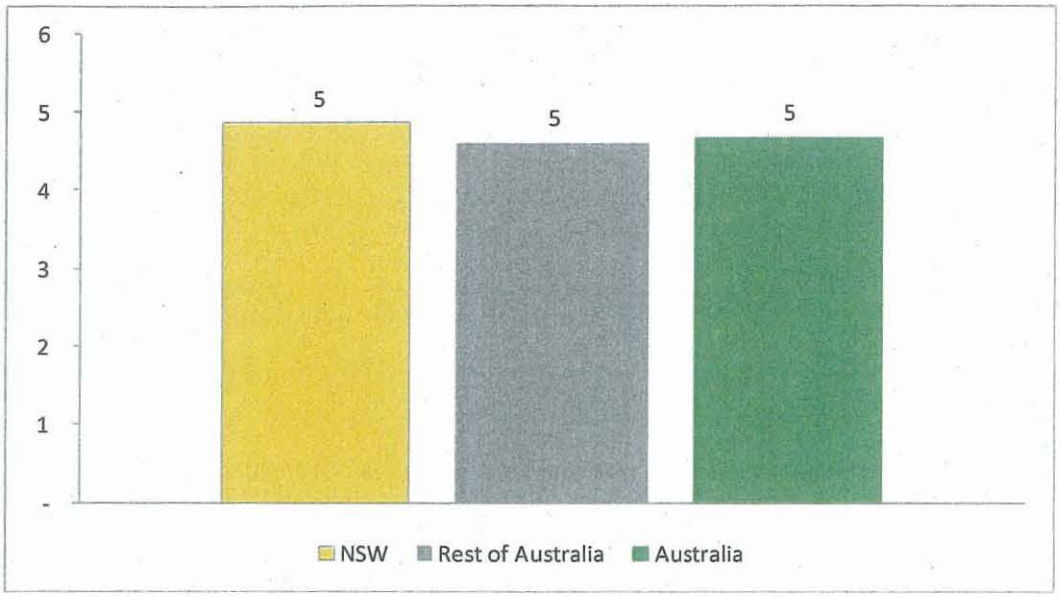
For the road projects, the cost per lane kilometre ranges from $2 million to $9 million. There are two NSW project included in this analysis with a cost per kilometre of $4million and $6 million which sit within the middle of the range of outcomes.

6.5.2 Road - Average total construction cost per lane kilometre ($m)

In the figure below, the average construction cost per kilometre for road projects is shown.

The information is provided for NSW, the rest of Australia and Australia.

Figure 43: Road - average construction cost per lane kilometre



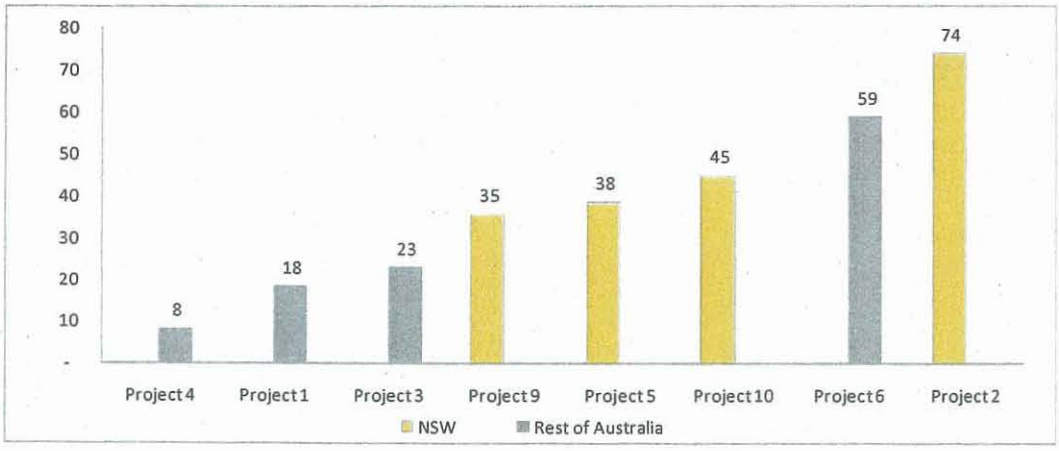
The NSW average is based on a single project and has a cost per lane kilometre of $5 million. The rest of Australia average cost per kilometre, which is based on 5 projects, is $5 million. The total Australian average cost per kilometre is $5 million.

The analysis shows that, based on the projects selected, the average road cost per kilometre is very consistent across the jurisdictions. As will be seen in the following section of analysis, the road cost per kilometre is significantly lower than the cost per track kilometre for rail projects.

6.5.3 Rail - Total construction cost per track kilometre ($m)

In the figure below, the total construction cost per track kilometre for rail projects is shown. There are 8 projects included in the per kilometre analysis. The total construction costs are inclusive of the client costs.

Figure 44: Rail - total construction cost per track kilometre



The range of cost per track kilometre outcomes is from $8 million to $74 million. The NSW projects included in this analysis fit within this range with cost per track kilometre outcomes of between $35 million and $74 million.

The rail projects included in this analysis are based on variety of construction conditions including passenger and freight rail, duplication and new build, and metropolitan and regional. As such, the purpose of this analysis is to examine the range of per kilometre rail construction costs rather than to provide specific detail.

For instance, Project 4 has a much lower cost per track kilometre cost than the other projects included in the rail analysis. This may be as a result of it being a combination of greenfield and brownfield construction and the significantly longer length (Kilometres) of the project compared to the other rail projects. And Project 2 which has a much higher per track kilometre involved the delivery of a complex brownfields project within a live rail corridor and which also included a significant tunnelling component.

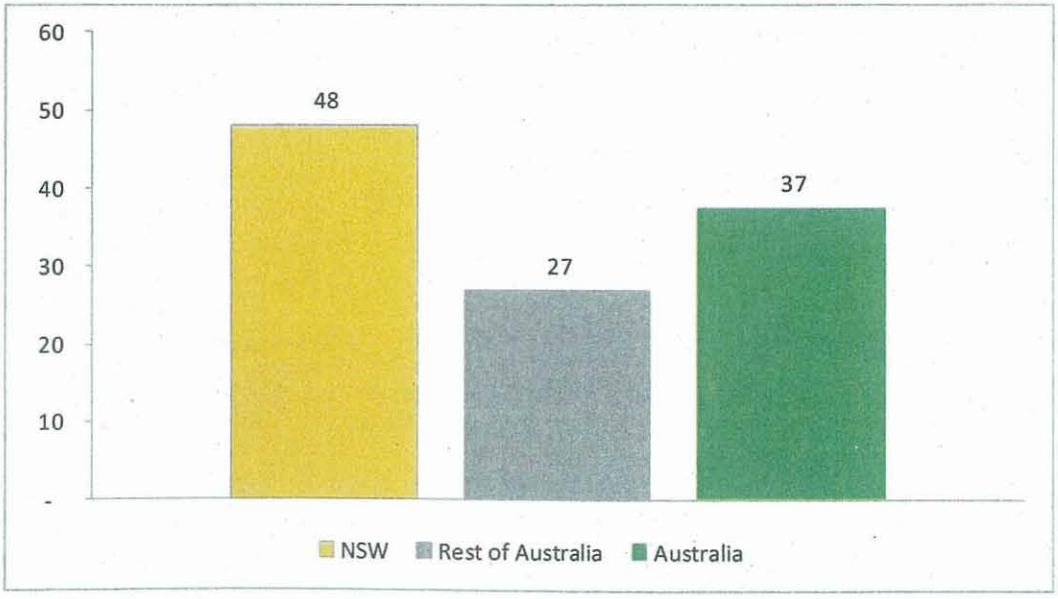
To provide a full analysis of the key project differences to explain the variance in cost outcomes would likely require providing information that would identify the projects selected. However, in general:

- greenfield projects where cheaper than brownfield projects were working within a live rail corridor led to significant additional costs;
- freight rail was cheaper than passenger rail track;
- larger projects were cheaper than smaller projects

6.5.4 Rail - Average total construction cost per track kilometre ($m)

In the figure below, the average total construction cost per track kilometre for rail projects is shown. The information is provided for NSW, the rest of Australia and all Australian projects included in the analysis.

Figure 45: Rail - average construction cost per track kilometre ($'m)



The average cost per track kilometre for NSW projects was $48 million for NSW projects based on the four projects included in the benchmarking analysis. For the rest of Australia, the average construction cost per track kilometre was $27 million, based on four projects

included in the analysis. When all projects are averaged, the construction cost per kilometre is $37 million.

It should be noted that the NSW average is pushed up by one project that involved the delivery of a complex brownfields project within a live rail corridor and which also included a significant tunnelling component. If this project is removed the NSW average becomes $39 million per track kilometre.

The analysis of rail projects across jurisdictions is not directly comparable due to the variance in project types included in the sample.

6.6 Delivery model comparisons

The following section assesses the variance in cost outcomes based on delivery model.

As has been described earlier in this document, the information and projects requested from participating agencies was categorised into two broad delivery model types:

- Fixed price contracts (D&C, Construct Only)
- Alliance Contracts (Single TOC, Competitive TOC)

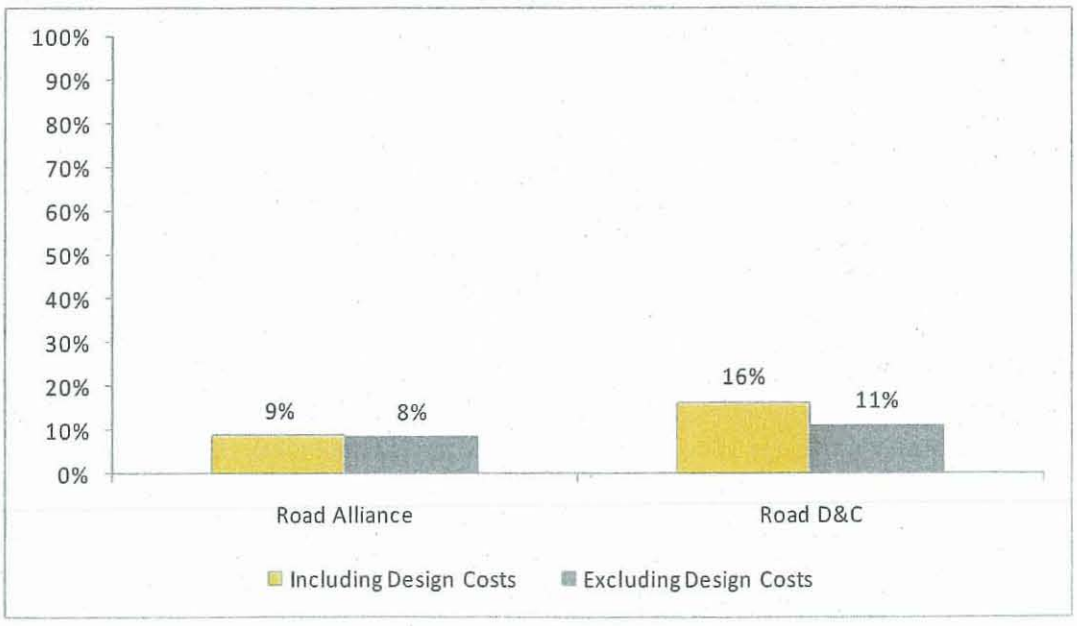
An analysis of the outcomes of client costs for road and rail projects by delivery model is presented in the following section.

6.6.1 Road - Comparison of client costs between D&C and Alliance Projects

Firstly, a comparison is made between D&C and alliance road projects.

The client costs as a percentage of total construction costs for road alliance and road D&C projects are presented in the figure below.

Figure 46: Road - comparison of client costs by delivery model



The alliance road projects have client costs, on average across all relevant projects, of 9% when including design costs and 8% when the design costs are removed. For road D&C projects, the average client costs, as a percentage of total costs, are 16% inclusive of design costs and 11% when design costs are removed.

The results suggest that when design costs are included in the analysis, there is a significant variance between alliance and D&C models (9% compared to 16%) but when design costs are removed from the assessment of client costs the variance is much smaller (8% compared to 11%).

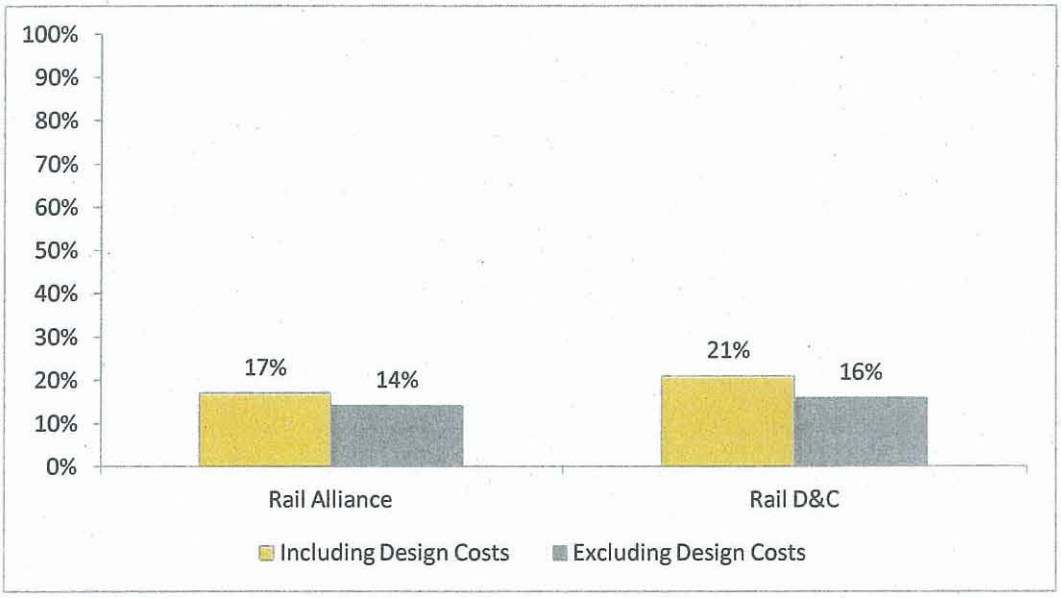
This would suggest that the agencies undertake more of the design work in the D&C process when compared to the alliance process for road projects.

The results also show that client costs are less for alliance road projects than for D&C road projects. With an alliance the non-owner participants participate earlier in the procurement process and thus costs that are allocated to the client under D&C delivery are undertaken by the alliance under alliance delivery.

6.6.2 Rail - Comparison of client costs between D&C and Alliance Projects

The client costs as a percentage of total construction costs for rail alliance and rail D&C projects are presented in the figure below.

Figure 47: Rail - comparison of client costs by delivery model



The alliance rail projects have client costs, on average across all relevant projects, of 17% when including design costs and 14% when the design costs are removed. For rail D&C projects, the average client costs, as a percentage of total costs, are 21% inclusive of design costs and 16% when design costs are removed.

The results suggest that when design costs are included in the analysis, there is a significant variance between alliance and D&C models (17% compared to 21%) but when design costs are removed from the assessment of client costs the variance is much smaller (14% compared to 16%).

This would suggest that the agencies undertake more of the design work in the D&C process when compared to the alliance process for rail projects.

The results also show that client costs are less for alliance rail projects than for D&C rail projects. With an alliance the non-owner participants participate earlier in the procurement process and thus costs that are allocated to the client under D&C delivery are undertaken by the alliance under alliance delivery.

6.7 Cost Capture

Most agencies provided very similar responses in terms of cost capture:

- An integrated financial management system (e.g., SAP, Oracle) with a standardised work breakdown structure is used to capture, allocate, record and monitor projects and program costs;
- Some agencies use a separate monthly project cost reporting system (e.g., Projman) for monthly cost reporting and monitoring against budget while others use such variance reporting functionality in their core integrated financial management system

The main area of difference is in the capture and allocation of corporate overheads:

- Agencies with a capital budget only indicated that for corporate overheads, being those costs that cannot be directly related to a project or a program, are captured under a separate project number. These corporate overhead costs are then recovered from each of the programs, the amount allocated being dependent on the relative size and future life of each program.
- A number of agencies (with both capital and operating budgets) indicated that they apply a margin on top of the agency labour costs allocated to the project to cover corporate overheads.
- Some agencies appear to allocate a very small amount of corporate overheads to projects, with corporate overhead costs presumable met out of the agencies operational budget.

The client cost data received shows significant variance with respect to the corporate costs allocated to projects, ranging between 0% and 80% of total client costs and 0% to 12% as a percentage of the total construction cost. This appears to indicate some agencies do not appropriately allocate corporate overhead costs to project.

6.8 Contingency**

A contingency allowance is used to cover risk in a project. The contingency allowance is normally established by either:

- the deterministic method (e.g. Contingency is simply determined as a percentage of the best estimate of cost, as +/- x%. The value of "x" is generally correlated to the stage of design on which the estimate is based, rather than on any detailed assessment of actual risks and opportunities associated with the project.
- probabilistic methods that apply computational techniques such as Monte Carlo simulation on the assessed variability of component costs to provide a robust means for assessing the likely range of outturn costs of a project. The quantitative risk based approach can consider both inherent risks and contingent risks within a project. Inherent risks represent the uncertainty in the pricing of a defined scope of work, and are due to uncertainties in either the quantities or unit costs rates adopted when preparing the estimate of cost. Contingent risks are events that may occur during the life of a project, and so increase or decrease the cost of the project from the best estimate (e.g. unforseen weather conditions, industrial relations issues, a major safety incident, unforseen latent ground conditions etc.)

In this section we look at the State by State feedback on the application of quantitative methods to determining the contingency allowance to see if there are any significant differences in practice between jurisdictions.

State	NSW	QLD	VIC	WA
Methodology Road	**Deterministic and probabilistic** RTA Estimating Manual and Project management Office data base uses both deterministic and probabilistic (P90&50 levels). Independent Estimator with familiarization with current RTA projects including Alliances delivery as a check.	**Probabilistic** P90 probabilistic estimating methods, using @Risk for analysis and in accordance with TMR cost estimating manual	**Probabilistic** VicRoads Scope, Cost & Time Control guidelines provide instructions for the calculation of contingency and escalation estimate VicRoads now refers to contingency as additional scope risks. These factors are identified and costed through a series of risk workshops and risk management practices. The P90 modelling approach is used to develop the final estimate for the additional scope risks and is included as a separate item in the total project cost.	**Deterministic** Contingency risk estimates done using a P90 value. Contingency set using LOAF (Main Roads Corporately set Contingency)
Methodology Rail	**Deterministic and Probabilistic** The method is often determined by which is most appropriate at the time, dependent on extent of design and risk identification. The method might start at simple deterministic at early strategic estimate stage, then change to probabilistic or a mixture of both, as	**Not provided**	**Deterministic** Each line item in the estimate had a % allowance applied for Contingency to cover uncertainty around the Quantity and unit rate. The % allowance was determined by the estimator and was based on the level of uncertainty in available information on	**Mixture of Deterministic and Probabilistic** Project contingency was a risk assessed allocation and was based on having a defined structure for the project elements. The approach taken was to separate the project into a set of elements being the work packages. The work package

State	NSW	QLD	VIC	WA
	more detail emerges. Each line item in the estimate had a % allowance applied for Contingency to cover uncertainty around the Quantity and unit rate. The % allowance was determined by the estimator and was based on the level of uncertainty in available information on the item.TCA adopt a methodology to calculate contingency levels using @risk or similar and adopt a P90 confidence level when setting budgets.		the item.	elements provided a framework for the identification and analysis of risks. Risk was analysed by combining estimates of Consequences and Likelihood in the context of existing control measures. Deterministic and probabilistic techniques were used to assess risk

Understanding of risk assessment and the methods of determining contingency allowances varied significantly between agencies.

Some agencies apply a probabilistic approach, some a deterministic approach and some a mixture of both approaches.

6.9 Escalation**

Escalation is typically applied to the Base estimate + Contingency to arrive at the Total Outturn Cost. The Total Outturn Cost is typically used in forward capital planning and determining project funding allocations. For projects that are planned to start several years after the estimate date and which have reasonable construction periods, the cumulative amount of escalation may be a significant percentage in addition to the Base Estimate + Contingency. Due to the significance of the escalation component in the overall outturn cost the escalation figure has to be carefully assessed.

Good industry practice recognises that escalation is calculated on cash flow using forecast (yearly) percentage increases, compounded year on year.

Escalation can be assessed in an overall way by multiplying the cash flow for a specific year by the expected percentage figure to cover escalation for the entire cash flow in that year. An alternative methodology can also be used that breaks down the annual expenditure into key components such as materials, labour, fuel etc and applying an appropriate price escalation percentage to each key element.

State	NSW	QLD	VIC	WA
Methodology - Road	Most projects forecast future escalation by reference to Treasury and ABS Data. Project estimates are provided in both current and outturn dollars.	Escalation estimated from first principles, using proposed cashflow, ABS indices, and taking into account periods of fixed prices from suppliers. TMR's 5-year programme development guidelines specify what rate to apply for project escalation over the forward 5 years. This is then applied to the project estimate from the estimate base date. The forecast % is developed by TMR's programme development and management division	The escalation rate used (at the time of estimating) is determined by the Department of Treasury and Finance and normally based on the current inflation rate using the Consumer Price Index (CPI). While most projects apply the escalation rate to determine the escalation cost to add to the base estimate, there are some projects where there was no provision for escalation in the project total estimated cost.	Forecasting of future escalation by reference to ABS Data and Rawlinson's Construction Cost Guide.
Methodology - Rail	TCA include escalation based on available data including CPI and construction BPI indices.	Unknown	The escalation costs were calculated using escalation rates mandated by the Department.	The escalation costs were calculated by applying the selected index that was recommended by the Department of Treasury and Finance (DTF) which was adjusted CPI for period up to 2004. In 2004, the escalation budget examined number of indices including Department of Housing and Works Building Cost index, various ABS indices for civil construction and

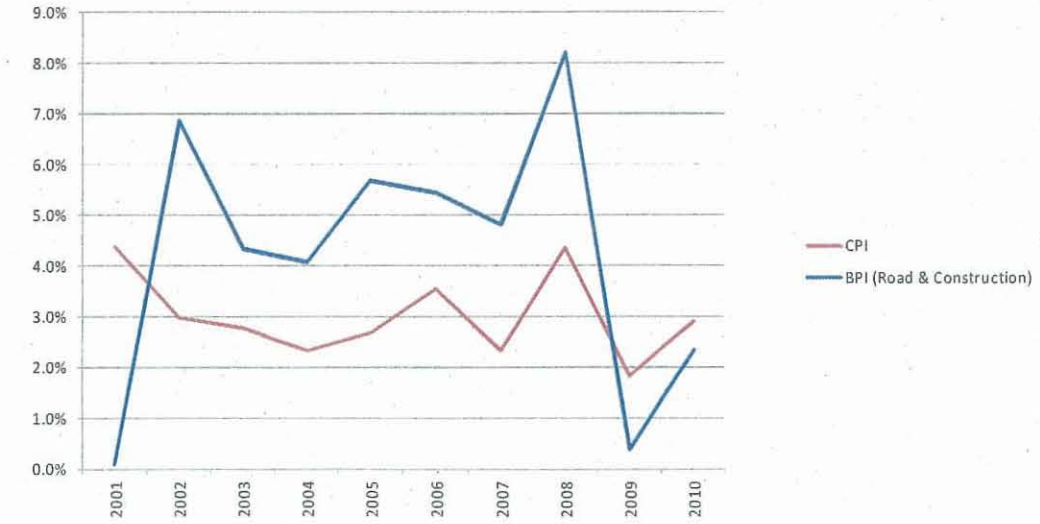
				Rawlinsons Building Price Index (BPI).

**Please note if methodology differs between project types methodologies will be presented separately.

The development and application of allowances for escalation seems to vary significantly between agencies. Data sources (Treasury, ABS, Rawlinson's) for escalation factors appear to differ significantly between agencies. There also appears to be a difference in approach with some agencies using a single escalation factor (normally CPI) to the cashflow and some taking an elemental approach and using a mixture of general CPI and construction CPI measures applied to components of the overall construction phase cashflow. It is also apparent that for some agencies on some smaller and /or older projects a separate escalation allowance has not been applied.

As can be seen in the figure below, a comparison between the CPI and the BPI (road and construction), shows that there can be a wide difference in outcomes on a year by year basis. For larger projects with longer construction periods the fluctuation in escalation factor selected will have much more significant impacts on the forecast outcomes and would therefore require more targeted and detailed escalation analysis.

Figure 48: CPI and BPI comparison (2001-2010)



This shows the importance of choosing the correct escalation approach based on the scale of the project to ensure an accurate escalation allowance based on the most appropriate indices.

7. Conclusions

7.1 Findings

As part of undertaking the study, major agencies were interviewed to understand the common issues that were faced by the agencies in preparing the templates. The general findings from the completed templates received, the analysis undertaken and the interviews with the agencies were as follows:

1. Client costs in relation to the delivery of road projects in NSW appeared to be significantly lower than most agency peers (After removing design costs to provide a like for like comparison NSW client costs were 7% against 11% for the rest of Australia). This appeared to be largely due to less overhead costs being allocated to specific projects and instead being met out of the agency's operational budget. Road projects in NSW had a significantly lower percentage of the overall client costs being contributed by corporate overheads.

9. NSW rail project client costs appeared to be in line with transport agency peers. After removing design costs to provide a like for like comparison, NSW client costs were slightly lower than interstate projects (14% NSW against 16% rest of Australia). NSW was slightly lower on design and construct projects and slightly higher on alliance projects than the rest of Australia averages.

10. There are significant differences in the work breakdown structures (WBS) used by agencies. While some agencies were already using WBSs following the Federal guidelines, other agencies use a WBS based on stage of development (e.g. planning, detailed design, building, and finalisation). Further, there appeared to be differences in the level of detail in the WBSs used by different agencies.

11. The methods of determining contingency allowances varied significantly between agencies. Some agencies used a deterministic approach, some agencies used a probabilistic approach, some used a mixture of both and some agencies used a deterministic approach on smaller projects and a probabilistic approach on larger projects.

12. Development and application of allowances for escalation varied significantly between agencies. Data sources (Treasury, ABS, Rawlinson's) for escalation factors appear to differ significantly between agencies. There also appears to be a difference in approach with some agencies using a single escalation factor to the cashflow and some taking an elemental approach and using a mixture of general CPI and construction CPI measures applied to components of the overall construction phase cashflow.

7.2 Recommendations

1. DOTNSW to promote greater consistency of treatment between agencies in the capture and allocation of corporate overhead costs to projects.

2. DOTNSW to promote use of a Work Breakdown Structure (WBS) that provides a consistent hierarchy of detail in cost estimates for purposes of comparison, review and benchmarking. This will increase the ability to do meaningful benchmarking between agencies.

3. DOTNSW to undertake further analysis on the performance of actual versus budgeted outcomes under both probabilistic and deterministic contingency estimation approaches.

   This could form the basis of selecting the most appropriate approach (either probabilistic, deterministic or a hybrid approach) based on actual project performance against the estimated contingency allowance. However, we note that the information available at the time the estimate is done can be a major driver of approach taken to escalation.

   This could also lead to a standardisation of the approach to determining contingency allowances, leading to greater consistency of treatment and more accurate contingency estimation.

4. DOTNSW to consider undertaking further analysis on the performance of actual versus budgeted outcomes under both single escalation factor approaches and elemental approaches using a mixture of general CPI and construction CPI measures applied to components of the overall construction phase cashflow. However, it may be difficult to source data to support such analysis.

   This could form the basis of selecting the most appropriate approach (either single cashflow/single escalation factor or multiple cashflows/multiple escalation factors) based on actual project performance against the estimated escalation allowance.

   This could also lead to a standardisation of the approach to determining escalation allowances, leading to greater consistency of treatment and more accurate escalation estimation.

7.3 Other Observations

In addition to the key findings and recommendations, the following general observations have been made in relation to the data (qualitative and quantitative) received:

1. For road projects project and program management costs are the single highest client cost category, on average accounting for 32% of total client costs (4% of total construction costs) followed by project design costs which on average accounted for 27% of the total client cost (3% of total construction costs).

2. NSW road projects reported significant planning costs (28% of total client cost) compared to road projects from the rest of Australia (5% of total client cost). This may reflect the planning/regulatory regime in NSW.

3. Conversely, NSW road projects reported significantly less corporate overhead costs compared to the rest of Australia (1% compared to 17%). This may indicate that for NSW road projects, less overhead costs are allocated to specific projects and are instead being met out of the agency operational budget.

4. Corporate overhead costs for rail projects from the rest of Australia (16% of total client cost) are reported to be significantly lower than NSW projects (24% of total client cost). This may reflect the fact that TCA has a capital budget only and that corporate overheads are allocated to the programme and project level. However, as a percentage of the total construction cost the difference in corporate overheads is not as significant with the rest of Australia at 3% of total construction cost comparing to NSW projects at 4% of total construction cost.

5. Based on a sample of comparable road projects, the NSW construction cost per kilometre was $6 million. The rest of Australia average cost per kilometre, (based

on 5 projects), was $5 million. Within the levels of accuracy of the study and given the sample size this difference is considered immaterial.

6. Based on a sample of comparable rail projects, the NSW construction cost per track kilometre was $48 million. The rest of Australia average cost per track kilometre, (based on 4 projects), was $27 million. However, it should be noted that the sample set contained both greenfield and brownfield and passenger and freight rail projects and projects also differed markedly in size.

7. On average, road fixed price contracts had higher client design costs than road alliance costs (5% versus 1%). After adjusting for design costs road fixed price contracts had higher client costs than alliance contracts (11% versus 8%).

8. On average, rail fixed price contracts had significantly higher client design costs than rail alliance costs (5% versus 3%). After adjusting for design costs rail fixed price had higher client costs than alliance contracts (16% versus 14%).

9. The client cost data received shows significant variance with respect to the corporate costs allocated to projects, ranging between 0% and 80% of total client costs and 0% to 12% of the total construction cost. The agencies included in the study used a range of approaches to allocating corporate overhead to projects:

   - Agencies with a capital budget only indicated that corporate overhead costs are allocated to and recovered from the program level, with the amount allocated to each program being dependent on the relative size and future life of each program.
   - A number of agencies (with both capital and operating budgets) indicated that they apply a margin on top of the agency labour costs allocated to the project to cover corporate overheads.
   - Some agencies appear to allocate a very small amount of corporate overheads to projects, with corporate overhead costs presumable met out of the agencies operational budget.

Appendix A Quantitative data request with instructions

CLIENT COST DATA

Cost Item	Methodology	% of task completed by client	Agency cost ($m)	External / contract cost ($m)	Total cost ($m)	% of total construction cost	Agency notes or comments
ACTUAL COSTS							
Actual Client Costs							
Planning & environment	Costs associated with the personnel assigned to the project for planning and environmental managers, professional services contractors e.g. planning approvals, environmental management representatives (EMR), noise & vibration specialists, and any other costs associated with: ►project planning approvals in accordance with the environmental planning legislation; ►environmental compliance & management; ►liaison with any other planning or environmental departments &/or authorities with respect to environmental compliance; and ►environmental management system audits.						
Client project design costs	Employee or contractor and other costs associated with detailed project design required to reach approval for project construction. These are the costs associated with developing (where applicable): ►drawings; ►independent design verification; ►asset management, operations & maintenance manuals; ►geo-tech; ►project commissioning plan; ►cost estimates; and ►risk register.						

CLIENT COST DATA

Cost Item	Methodology	% of task completed by client	Agency cost ($m)	External / contract cost ($m)	Total cost ($m)	% of total construction cost	Agency notes or comments
Community & communication	All costs associated with: ►internal & external communications that include government & media relations; ►community relations; ►stakeholder management; ►advertising & marketing activities; and ►corporate positioning & reporting.						
Safety, operational readiness & reliability	All employee and professional services contractors costs associated with safety initiatives for the project, including: ►development of the project safety plan; ►all inspection and test plans; ►safety audit fees; ►any associated staff training; and ►commissioning and acceptance.						
Audit	All employee and professional services contractors costs associated with the auditing of financial statements associated with the project						
Legal	All employee and professional services contractors' costs associated with the preparation and execution of legal contracts for the project.						
Commercial & procurement	All employee and professional services contractors' costs associated with the commercial and procurement process.						
Technical - Construction support	All employee and professional services contractor's costs associated with the technical process of the project during the construction phase, for example ongoing engineering support. This may include: ►management of design modifications; ►defect rectification; and ►construction surveillance and overview.						

CLIENT COST DATA

Cost Item	Methodology	% of task completed by client	Agency cost ($m)	External / contract cost ($m)	Total cost ($m)	% of total construction cost	Agency notes or comments
Client insurance	Any costs associated with (if applicable): ► public liability; ► professional indemnity; ► contract works; and ► difference in conditions.						
Project management costs	All salaries and fees associated with agency personnel and professional services contractors assigned to manage the delivery of the project, such as senior project managers, project managers, site engineers etc (for example airfares and accommodation)						
Program management costs	All salaries and fees associated with high-level agency management for delivery of the project. High-level agency management salaries should be pro-rated with their time spent on the project. (for example airfares and accommodation)						
Corporate overheads (Delivery agency costs)	Any non project-specific costs required for the project associated with maintaining an agency's head office & organisational wide costs. This includes, but is not limited to: ► office rental; ► computers; and ► utilities etc. These costs should be pro-rated with the time these overheads are used for specific project usage as a percentage of total usage.						
Possession & bussing (*if applicable*)	Costs associated with track possession and bus replacements for trackwork for project construction (Rail projects only)						
Commercial compensation (*if applicable*)	Any compensation costs, payable by the client, required to be provided to nearby commercial operators & retailers due to interruptions to their business-as-usual operations & turnover as a result of the project construction & implementation						

PROJECT COST DATA	Actual Cost	
Project:		
Dollars data presented in (e.g. 2008/09 $s, nominal)		
[Benchmarking Partner to Insert]		
[Benchmarking Partner to Insert]		
[Benchmarking Partner to Insert]		
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[Benchmarking Partner to Insert]		
Contractor's Direct Costs		Note: Where avai
[Benchmarking Partner to Insert]		
[Benchmarking Partner to Insert]		
[Benchmarking Partner to Insert]		
Contractor's Indirect Costs		Note: Where avai
Total Construction Cost		
Client Costs		
Land and Property Acquisition Costs		
Total Outturn Cost		

	Planning parameters at the Pre-tender Cost Estimate Stage (D&C, Construct Only, ECI, PPP delivery)/Target Cost Estimate Stage (alliance delivery) (Based on internal guidelines as discussed in the qualitative data request)
Contingency	
Escalation	

Appendix B Qualitative data request with instructions

NSW Department of Transport
Transport Infrastructure Project Cost Benchmarking Study

Instructions to Benchmarking Partners

This document provides basic instructions to assist the Benchmarking Partners in completing the Quantitative and Qualitative Template. Instructions for completing each Template are presented in the following format:

- Objective; and
- Completion instructions.

Quantitative Template

Objective

To provide quantitative information to allow the benchmarking of client costs typically incurred in the procurement of major transport infrastructure projects.

Instructions

- The Template contains two worksheets - a Project Cost Data Worksheet that is to be populated with high level project cost information and a Client Cost Data Worksheet to be populated with detailed Client Cost Data;
- All financial amounts are to be entered as positive numbers unless otherwise stated;

Project Cost Data Worksheet

- The Project Cost Data Worksheet seeks cost information at the Project Delivery Phase when the actual cost outcomes are known
- All financial inputs (Columns B and C) are to be expressed as $ amounts and exclusive of GST
- Benchmarking Partners are to nominate a base date for the data provided
- Benchmarking Partners are provided with the opportunity to provide further information on the build up of Contractor's Direct and Indirect Costs. However, if such information is not available the Total Construction Cost should be provided
- For contingency and escalation, the planning parameters at the Pre-tender Cost Estimate Stage (D&C, Construct Only, ECI, PPP delivery) or Target Cost Estimate Stage (alliance delivery) are to be provided

Client Cost Data Worksheet

- Where possible, the Client Cost Data Worksheet seeks data at the Project Delivery Phase when the actual cost outcomes are known
- All financial inputs (columns C, D and E) are to be expressed as $ amounts and exclusive of GST
- Outputs in Column F are to be provided as a percentage to one decimal place
- Unless otherwise stated please use current accounting policies when completing the Client Cost Data Worksheet. Please document your accounting policies in respect to specific line items in the Notes fields provided.

Qualitative Template

Objective

To provide qualitative information to provide contextual information and an understanding of key differences between projects in terms of scope, delivery model/risk allocation, cost allocation principles and any other pertinent project features.

Information Request Instructions

- Question 1: A short description of the project type (road, rail, bridge, tunnel etc.). This will allow the data collected to be analysed by transport mode.
- Question 2: A general description of the project scope. For example: the construction of a 39km fully-electronic tollway, including 6km of bypass roads. The project involved the construction of twin, three-lane, 1.6km tunnels, along with 103 other structures, including 88 bridges.
- Question 3: A general description of the project objectives. This should provide an indication of the extent to which the outcomes of the project are measured on the basis of factors other than cost minimisation (e.g. meeting a tight delivery timeframe or maximising third party revenue objectives)
- Question 4: A short description of the delivery/procurement model. For example, availability payment public private partnership, market exposure public private partnership, competitive alliance, alliance, design & construct, detailed design & construct, construct only etc. The description should provide enough information to provide a general understanding of the public sector's risk exposure to cost and time overruns in relation to the project.
- Question 5: This question asks for the percentage of the project design that was completed by the client prior to the project being put out to tender. For example, this would be close to 100% on a construct only project. This percentage would typically be higher for a detailed design and construct contract than a design and construct contract and would typically be higher for a design and construct contract than an early contractor involvement (ECI) contract.
- Questions 6: The dates of planning commencement, project construction commencement and project completion. This will aid in understanding any implications the project timeframe may have for the budgeted escalation and contingency costs and any divergence between budgeted costs and actual costs.
- Question 7: A description of the project management and delivery structure used, preferably in the form of an organisational chart showing reporting lines.

- Question 8: An outline of the roles and responsibilities of agency staff, external consultants and contractors and private sector participants in project delivery with reference to the procurement/delivery method used and the agency's management structure for project delivery.

- Question 9: A description of the agency's overall management structure above the program/project management level, including any other areas of the agency that have a role in the governance, management and delivery of projects, but which sit outside of the project delivery team. Please outline the nature and extent of their involvement in project delivery.

- Question 10: A description of the approach used by the agency to capture, allocate and monitor project costs, including all relevant corporate overhead (agency level) costs, program level overhead costs and project costs.

- Question 11: Details of the approach used to determine the project development (pre-tender) cost estimates for the project and the key assumptions used.

- Question 12: Details of the approach used to determine the contingency and escalation estimates at the project development (pre-tender) cost estimates for the project. This should include for the contingency estimate, the contingency range, level of probability (e.g. P50 or P90) and for the escalation estimate the percentage adjustment used and the base index that drove the estimation (e.g. CPI, BPI, WPI etc.)

- Question 13: Details of any benchmarking undertaken and the results of such benchmarking to indicate how the *project development (pre-tender) cost estimate* compares to internal historical benchmarks collected by the agency.

- Question 14: Details of any benchmarking undertaken and the results of such benchmarking to indicate how the *actual* project costs compare to internal historical benchmarks collected by the agency.

- Question 15: Details of any unique features of the project which resulted in the project costs being more / less expensive than standard / business-as-usual projects (e.g. location, geotechnical conditions, labour availability, working within a live transport corridor, regulatory/legislative requirements etc.). This may be cross-referenced to questions 13 and 14 where the unique features explain any divergence from internal agency benchmarks.

- Question 16: Details of any features of the of the market in which the Project was procured which resulted in the project costs being more / less expensive than standard / business-as-usual projects (e.g. large competing projects, competition for resources, stage in the economic cycle etc.). This may be cross-referenced to questions 13 and 14 where the market environment/macroeconomic factors explain any divergence from internal agency benchmarks.

- Question 17: Any further pertinent information at the Benchmarking Partners discretion.

NSW Department of Transport
Transport Infrastructure Project Cost Benchmarking Study

Note: Please refer to the preceding instructions for an explanation of each question and the level / type of response being sought before completion this questionnaire.

Project name:

1. What was the project type?

_____

2. What was the project scope?

_____

_____

_____

3. What were the project objectives?

_____

_____

_____

4. What was the project delivery / procurement model?

_____

_____

_____

5. What % of the project design was completed by the client prior to the project being put out to tender?

_____%

6. What was the date of:

a) project planning commencement?

_____

b) project construction commencement?

_____

c) project completion?

7. What was the program / project management structure used to deliver the project? Please include a project organisation charts if possible.

8. What were the roles / responsibilities of the parties involved in managing and delivering the project?

9. What is the agency's management structure above the program/project delivery layer? Please include agency organisation charts if possible.

10. What was the program / project cost centre structure used, and what procedures were used to allocate, record and monitor project costs?

11. What guidelines were used for preparing the project development (pre-tender) cost estimates for the project?

12. How were project contingency and escalation costs estimated at the project development (pre-tender) stage? That is, what are the policies / guidelines for estimating these costs within your agency?

13. Was the project development (pre-tender) cost estimate benchmarked against other projects the agency has undertaken? If so, what was the approach used to benchmark them?

14. Were the actual costs benchmarked against other projects' actual costs that the agency has undertaken? If so, what was the approach used to benchmark them?

15. Were there any unique features of the project which resulted in the project costs being more / less expensive than other, equivalent standard / business-as-usual projects (e.g. location, geotechnical conditions, labour availability, working within a live transport corridor, regulatory/legislative requirements etc.)?

16. Were there any features of the market in which the Project was procured which resulted in the project costs being more / less expensive than other, equivalent standard / business-as-usual projects (e.g. large competing projects, competition for resources, stage in the economic cycle etc.)

17. Do you have any other comments in relation to the project?

Appendix C Client cost categories as percentage of total client cost and total construction cost (by transport mode)

Figure 49: Sub client costs as percentage of total client cost

			Percentage as Client Cost														
Project	Categorisation	Project type	Planning & environment	Client project design costs	Community & communication	Safety, operational readiness & reliability	Audit	Legal	Commercial & procurement	Technical - Construction support	Client insurance	Project management costs	Program management costs	Corporate overheads (Delivery agency costs)	Possession & bussing (*if applicable*)	Commercial compensation (*if applicable*)	Unspecified Client cost
Rail																	
Project 1	Rail	D&C	4%	12%	0%	0%	0%	12%	0%	11%	6%	24%	31%	1%	0%	0%	0%
Project 2	Rail	D&C	7%	17%	4%	0%	0%	0%	0%	0%	14%	46%	0%	13%	0%	0%	0%
Project 3	Rail	Alliance	0%	29%	0%	0%	0%	8%	0%	0%	0%	22%	40%	2%	0%	0%	0%
Project 4	Rail	D&C	6%	44%	4%	0%	0%	1%	0%	11%	18%	16%	0%	0%	1%	0%	0%
Project 5	Rail	Alliance	4%	12%	3%	7%	1%	0%	3%	0%	7%	13%	5%	33%	12%	0%	0%
Project 6	Rail	D&C	0%	0%	0%	0%	0%	1%	0%	0%	5%	18%	25%	51%	0%	0%	0%
Project 7	Rail	D&C	7%	16%	1%	0%	0%	3%	0%	0%	3%	29%	39%	2%	0%	0%	0%
Project 8	Rail	D&C	0%	13%	0%	0%	0%	3%	0%	0%	5%	32%	21%	26%	0%	0%	0%
Project 9	Rail	Alliance	6%	15%	2%	5%	1%	0%	4%	0%	4%	12%	5%	25%	20%	0%	0%
Project 10	Rail	Alliance	6%	18%	3%	6%	1%	0%	5%	0%	2%	15%	6%	27%	12%	0%	0%
Project 11	Rail	D&C	17%	8%	0%	0%	0%	8%	0%	0%	3%	17%	21%	27%	0%	0%	0%
Project 12	Rail	D&C	0%	22%	0%	0%	0%	7%	0%	0%	3%	26%	39%	2%	0%	0%	0%
Project 13	Rail	D&C	0%	50%	0%	0%	0%	4%	0%	0%	4%	11%	13%	19%	0%	0%	0%
Project 14	Rail	D&C	0%	30%	0%	0%	0%	6%	0%	0%	2%	17%	43%	3%	0%	0%	0%
Australia Average			4%	20%	1%	1%	0%	4%	1%	2%	5%	21%	20%	16%	3%	0%	0%
Roads																	
Project 1	Road	Alliance	43%	14%	0%	0%	2%	1%	0%	0%	16%	0%	0%	0%	0%	0%	23%
Project 3	Road	Alliance	7%	0%	0%	0%	0%	0%	0%	0%	0%	22%	55%	0%	0%	0%	16%
Project 4	PPP	PPP	15%	11%	0%	0%	0%	4%	12%	4%	0%	24%	0%	1%	0%	0%	29%
Project 5	Road	D&C	22%	0%	0%	0%	0%	0%	0%	0%	0%	37%	40%	0%	0%	0%	1%
Project 6	Road	D&C	28%	0%	0%	0%	0%	0%	0%	0%	0%	32%	40%	0%	0%	0%	0%
Project 7	Road	D&C	41%	0%	0%	0%	0%	0%	0%	0%	0%	24%	15%	0%	0%	0%	19%
Project 8	Road	Alliance	2%	7%	0%	0%	0%	1%	1%	7%	8%	8%	16%	50%	0%	0%	0%
Project 9	Road	Alliance	1%	0%	0%	0%	0%	0%	0%	2%	4%	2%	10%	80%	0%	0%	0%
Project 10	Road	D&C	35%	0%	0%	0%	0%	0%	0%	0%	0%	35%	31%	0%	0%	0%	0%
Project 11	Road	D&C	6%	36%	5%	0%	0%	0%	0%	25%	6%	21%	0%	0%	0%	0%	0%
Project 12	Road	D&C	0%	0%	4%	1%	0%	0%	0%	0%	1%	15%	20%	59%	0%	0%	0%
Project 13	Road	D&C	1%	2%	0%	0%	0%	0%	0%	0%	0%	7%	19%	72%	0%	0%	0%
Project 14	Road	D&C	25%	45%	3%	0%	0%	0%	0%	27%	5%	0%	0%	0%	0%	0%	-5%
Project 15	Road	D&C	7%	42%	3%	0%	0%	0%	0%	25%	5%	17%	0%	0%	0%	0%	0%
Project 16	Road	D&C	12%	37%	10%	0%	0%	0%	0%	21%	5%	15%	0%	0%	0%	0%	0%
Project 17	Road	D&C	13%	53%	0%	0%	0%	0%	0%	28%	5%	1%	0%	0%	0%	0%	0%
Project 18	Road	D&C	10%	41%	5%	1%	1%	1%	4%	5%	5%	21%	1%	3%	2%	0%	0%
Project 19	Road	Alliance	25%	0%	3%	2%	0%	0%	0%	0%	26%	34%	5%	4%	0%	0%	0%
Project 2	PPP	PPP	19%	17%	1%	0%	0%	5%	9%	4%	0%	45%	0%	0%	0%	0%	0%
Project 20	Road	D&C	5%	0%	7%	3%	1%	3%	0%	27%	13%	41%	0%	1%	0%	0%	0%
Project 21	Road	D&C	4%	35%	4%	0%	0%	0%	0%	23%	5%	28%	0%	0%	0%	0%	0%
Project 22	Road	Alliance	9%	0%	8%	0%	10%	0%	0%	0%	13%	35%	0%	25%	0%	0%	0%
Project 23	Road	Alliance	32%	21%	0%	0%	2%	0%	0%	15%	13%	17%	0%	0%	0%	0%	0%
Australia Average			16%	16%	2%	0%	1%	1%	1%	9%	6%	21%	11%	13%	0%	0%	4%

Figure 50: Sub client costs as percentage of total construction cost

			Percentage as Total Construction Cost														
Project	Categorisation	Project type	Planning & environment	Client project design costs	Community & communication	Safety, operational readiness & reliability	Audit	Legal	Commercial & procurement	Technical - Construction support	Client insurance	Project management costs	Program management costs	Corporate overheads (Delivery agency costs)	Possession & bussing (*if applicable*)	Commercial compensation (*if applicable*)	Unspecified Client cost
Rail																	
Project 1	Rail	D&C	0%	1%	0%	0%	0%	1%	0%	1%	1%	2%	3%	0%	0%	0%	0%
Project 2	Rail	D&C	1%	2%	0%	0%	0%	0%	0%	0%	2%	6%	0%	2%	0%	0%	0%
Project 3	Rail	Alliance	0%	4%	0%	0%	0%	1%	0%	0%	0%	3%	5%	0%	0%	0%	0%
Project 4	Rail	D&C	1%	6%	1%	0%	0%	0%	0%	2%	2%	2%	0%	0%	0%	0%	0%
Project 5	Rail	Alliance	1%	2%	0%	1%	0%	0%	0%	0%	1%	2%	1%	5%	2%	0%	0%
Project 6	Rail	D&C	0%	0%	0%	0%	0%	0%	0%	0%	1%	3%	4%	8%	0%	0%	0%
Project 7	Rail	D&C	1%	2%	0%	0%	0%	1%	0%	0%	1%	5%	6%	0%	0%	0%	0%
Project 8	Rail	D&C	0%	2%	0%	0%	0%	1%	0%	0%	1%	6%	4%	5%	0%	0%	0%
Project 9	Rail	Alliance	1%	3%	0%	1%	0%	0%	1%	0%	1%	2%	1%	5%	4%	0%	0%
Project 10	Rail	Alliance	1%	4%	1%	1%	0%	0%	1%	0%	0%	3%	1%	5%	2%	0%	0%
Project 11	Rail	D&C	4%	2%	0%	0%	0%	2%	0%	0%	1%	4%	4%	6%	0%	0%	0%
Project 12	Rail	D&C	0%	6%	0%	0%	0%	2%	0%	0%	1%	6%	10%	1%	0%	0%	0%
Project 13	Rail	D&C	0%	20%	0%	0%	0%	2%	0%	0%	1%	4%	5%	8%	0%	0%	0%
Project 14	Rail	D&C	0%	13%	0%	0%	0%	2%	0%	0%	1%	7%	19%	1%	0%	0%	0%
Australia Average			1%	5%	0%	0%	0%	1%	0%	0%	1%	4%	4%	3%	1%	0%	0%
Roads																	
Project 1	Road	Alliance	2%	1%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Project 3	Road	Alliance	1%	0%	0%	0%	0%	0%	0%	0%	0%	2%	4%	0%	0%	0%	1%
Project 4	PPP	PPP	1%	1%	0%	0%	0%	0%	1%	0%	0%	2%	0%	0%	0%	0%	2%
Project 5	Road	D&C	2%	0%	0%	0%	0%	0%	0%	0%	0%	4%	4%	0%	0%	0%	0%
Project 6	Road	D&C	3%	0%	0%	0%	0%	0%	0%	0%	0%	3%	4%	0%	0%	0%	0%
Project 7	Road	D&C	7%	0%	0%	0%	0%	0%	0%	0%	0%	4%	3%	0%	0%	0%	3%
Project 8	Road	Alliance	0%	1%	0%	0%	0%	0%	0%	1%	1%	1%	2%	5%	0%	0%	0%
Project 9	Road	Alliance	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	10%	0%	0%	0%
Project 10	Road	D&C	4%	0%	0%	0%	0%	0%	0%	0%	0%	4%	4%	0%	0%	0%	0%
Project 11	Road	D&C	1%	7%	1%	0%	0%	0%	0%	5%	1%	4%	0%	0%	0%	0%	0%
Project 12	Road	D&C	0%	0%	1%	0%	0%	0%	0%	0%	0%	2%	3%	8%	0%	0%	0%
Project 13	Road	D&C	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	3%	12%	0%	0%	0%
Project 14	Road	D&C	4%	8%	1%	0%	0%	0%	0%	5%	1%	0%	0%	0%	0%	0%	-1%
Project 15	Road	D&C	2%	10%	1%	0%	0%	0%	0%	6%	1%	4%	0%	0%	0%	0%	0%
Project 16	Road	D&C	2%	7%	2%	0%	0%	0%	0%	4%	1%	3%	0%	0%	0%	0%	0%
Project 17	Road	D&C	3%	10%	0%	0%	0%	0%	0%	5%	1%	0%	0%	0%	0%	0%	0%
Project 18	Road	D&C	2%	8%	1%	0%	0%	0%	1%	1%	1%	4%	0%	1%	0%	0%	0%
Project 19	Road	Alliance	2%	0%	0%	0%	0%	0%	0%	0%	2%	3%	0%	0%	0%	0%	0%
Project 2	PPP	PPP	1%	1%	0%	0%	0%	0%	1%	0%	0%	3%	0%	0%	0%	0%	0%
Project 20	Road	D&C	1%	0%	1%	0%	0%	0%	0%	3%	1%	4%	0%	0%	0%	0%	0%
Project 21	Road	D&C	1%	7%	1%	0%	0%	0%	0%	5%	1%	6%	0%	0%	0%	0%	0%
Project 22	Road	Alliance	1%	0%	1%	0%	1%	0%	0%	0%	1%	4%	0%	3%	0%	0%	0%
Project 23	Road	Alliance	2%	1%	0%	0%	0%	0%	0%	1%	1%	1%	0%	0%	0%	0%	0%
Australia Average			2%	3%	0%	0%	0%	0%	0%	2%	1%	3%	1%	2%	0%	0%	0%

Appendix D Client cost categories as percentage of total client cost and total construction cost (by total construction cost)

Figure 51: Sub client costs as percentage of total client cost

			Percentage as Client Cost														
Project	Categorisation	Project type	Planning & environment	Client project design costs	Community & communication	Safety, operational readiness & reliability	Audit	Legal	Commercial & procurement	Technical - Construction support	Client insurance	Project management costs	Program management costs	Corporate overheads (Delivery agency costs)	Possession & bussing (*if applicable*)	Commercial compensation (*if applicable*)	Unspecified Client cost
Rail	**Total Construction Cost (<$100m)**																
Project 6	Rail	D&C	0%	0%	0%	0%	0%	1%	0%	0%	5%	18%	25%	51%	0%	0%	0%
Project 7	Rail	D&C	7%	16%	1%	0%	0%	3%	0%	0%	3%	29%	39%	2%	0%	0%	0%
Project 8	Rail	D&C	0%	13%	0%	0%	0%	3%	0%	0%	5%	32%	21%	26%	0%	0%	0%
Project 11	Rail	D&C	17%	8%	0%	0%	0%	8%	0%	0%	3%	17%	21%	27%	0%	0%	0%
Project 12	Rail	D&C	0%	22%	0%	0%	0%	7%	0%	0%	3%	26%	39%	2%	0%	0%	0%
Project 13	Rail	D&C	0%	50%	0%	0%	0%	4%	0%	0%	4%	11%	13%	19%	0%	0%	0%
Project 14	Rail	D&C	0%	30%	0%	0%	0%	6%	0%	0%	2%	17%	43%	3%	0%	0%	0%
	Total Construction Cost ($100m-$1000m)																
Project 1	Rail	D&C	4%	12%	0%	0%	0%	12%	0%	11%	6%	24%	31%	1%	0%	0%	0%
Project 3	Rail	Alliance	0%	29%	0%	0%	0%	8%	0%	0%	0%	22%	40%	2%	0%	0%	0%
Project 5	Rail	Alliance	4%	12%	3%	7%	1%	0%	3%	0%	7%	13%	5%	33%	12%	0%	0%
Project 9	Rail	Alliance	6%	15%	2%	5%	1%	0%	4%	0%	4%	12%	5%	25%	20%	0%	0%
Project 10	Rail	Alliance	6%	18%	3%	6%	1%	0%	5%	0%	2%	15%	6%	27%	12%	0%	0%
	Total Construction Cost(>$1,000m)																
Project 2	Rail	D&C	7%	17%	4%	0%	0%	0%	0%	0%	14%	46%	0%	13%	0%	0%	0%
Project 4	Rail	D&C	6%	44%	4%	0%	0%	1%	0%	11%	18%	16%	0%	0%	1%	0%	0%
	Australia Average		4%	20%	1%	1%	0%	4%	1%	2%	5%	21%	20%	16%	3%	0%	0%
Roads	**Total Construction Cost (<$100m)**																
Project 11	Road	D&C	6%	36%	5%	0%	0%	0%	0%	25%	6%	21%	0%	0%	0%	0%	0%
Project 12	Road	D&C	0%	0%	4%	1%	0%	0%	0%	0%	1%	15%	20%	59%	0%	0%	0%
Project 15	Road	D&C	7%	42%	3%	0%	0%	0%	0%	25%	5%	17%	0%	0%	0%	0%	0%
Project 18	Road	D&C	10%	41%	5%	1%	1%	1%	4%	5%	5%	21%	1%	3%	2%	0%	0%
Project 21	Road	D&C	4%	35%	4%	0%	0%	0%	0%	23%	5%	28%	0%	0%	0%	0%	0%
	Total Construction Cost ($100m-$1000m)																
Project 1	Road	Alliance	43%	14%	0%	0%	2%	1%	0%	0%	16%	0%	0%	0%	0%	0%	23%
Project 2	PPP	PPP	19%	17%	1%	0%	0%	5%	9%	4%	0%	45%	0%	0%	0%	0%	0%
Project 3	Road	Alliance	7%	0%	0%	0%	0%	0%	0%	0%	0%	22%	55%	0%	0%	0%	16%
Project 4	PPP	PPP	15%	11%	0%	0%	0%	4%	12%	4%	0%	24%	0%	1%	0%	0%	29%
Project 5	Road	D&C	22%	0%	0%	0%	0%	0%	0%	0%	0%	37%	40%	0%	0%	0%	1%
Project 6	Road	D&C	28%	0%	0%	0%	0%	0%	0%	0%	0%	32%	40%	0%	0%	0%	0%
Project 7	Road	D&C	41%	0%	0%	0%	0%	0%	0%	0%	0%	24%	15%	0%	0%	0%	19%
Project 8	Road	Alliance	2%	7%	0%	0%	0%	1%	1%	7%	8%	8%	16%	50%	0%	0%	0%
Project 9	Road	Alliance	1%	0%	0%	0%	0%	0%	0%	2%	4%	2%	10%	80%	0%	0%	0%
Project 10	Road	D&C	35%	0%	0%	0%	0%	0%	0%	0%	0%	35%	31%	0%	0%	0%	0%
Project 13	Road	D&C	1%	2%	0%	0%	0%	0%	0%	0%	0%	7%	19%	72%	0%	0%	0%
Project 14	Road	D&C	25%	45%	3%	0%	0%	0%	0%	27%	5%	0%	0%	0%	0%	0%	-5%
Project 16	Road	D&C	12%	37%	10%	0%	0%	0%	0%	21%	5%	15%	0%	0%	0%	0%	0%
Project 17	Road	D&C	13%	53%	0%	0%	0%	0%	0%	28%	5%	1%	0%	0%	0%	0%	0%
Project 19	Road	Alliance	25%	0%	3%	2%	0%	0%	0%	0%	26%	34%	5%	4%	0%	0%	0%
Project 20	Road	D&C	5%	0%	7%	3%	1%	3%	0%	27%	13%	41%	0%	1%	0%	0%	0%
Project 22	Road	Alliance	9%	0%	8%	0%	10%	0%	0%	0%	13%	35%	0%	25%	0%	0%	0%
Project 23	Road	Alliance	32%	21%	0%	0%	2%	0%	0%	15%	13%	17%	0%	0%	0%	0%	0%
	Australia Average		16%	16%	2%	0%	1%	1%	1%	9%	6%	21%	11%	13%	0%	0%	4%

Figure 52: Sub client costs as percentage of total construction cost

			Percentage as Total Construction Cost														
Project	Categorisation	Project type	Planning & environment	Client project design costs	Community & communication	Safety, operational readiness & reliability	Audit	Legal	Commercial & procurement	Technical - Construction support	Client insurance	Project management costs	Program management costs	Corporate overheads (Delivery agency costs)	Possession & bussing (*if applicable*)	Commercial compensation (*if applicable*)	Unspecified Client cost
Rail	**Total Construction Cost (<$100m)**																
Project 6	Rail	D&C	0%	0%	0%	0%	0%	0%	0%	0%	1%	3%	4%	8%	0%	0%	0%
Project 7	Rail	D&C	1%	2%	0%	0%	0%	1%	0%	0%	1%	5%	6%	0%	0%	0%	0%
Project 8	Rail	D&C	0%	2%	0%	0%	0%	1%	0%	0%	1%	6%	4%	5%	0%	0%	0%
Project 11	Rail	D&C	4%	2%	0%	0%	0%	2%	0%	0%	1%	4%	4%	6%	0%	0%	0%
Project 12	Rail	D&C	0%	6%	0%	0%	0%	2%	0%	0%	1%	6%	10%	1%	0%	0%	0%
Project 13	Rail	D&C	0%	20%	0%	0%	0%	2%	0%	0%	1%	4%	5%	8%	0%	0%	0%
Project 14	Rail	D&C	0%	13%	0%	0%	0%	2%	0%	0%	1%	7%	19%	1%	0%	0%	0%
	Total Construction Cost ($100m-$1000m)																
Project 1	Rail	D&C	0%	1%	0%	0%	0%	1%	0%	1%	1%	2%	3%	0%	0%	0%	0%
Project 3	Rail	Alliance	0%	4%	0%	0%	0%	1%	0%	0%	0%	3%	5%	0%	0%	0%	0%
Project 5	Rail	Alliance	1%	2%	0%	1%	0%	0%	0%	0%	1%	2%	1%	5%	2%	0%	0%
Project 9	Rail	Alliance	1%	3%	0%	1%	0%	0%	1%	0%	1%	2%	1%	5%	4%	0%	0%
Project 10	Rail	Alliance	1%	4%	1%	1%	0%	0%	1%	0%	0%	3%	1%	5%	2%	0%	0%
	Total Construction Cost(>$1,000m)																
Project 2	Rail	D&C	1%	2%	0%	0%	0%	0%	0%	0%	2%	6%	0%	2%	0%	0%	0%
Project 4	Rail	D&C	1%	6%	1%	0%	0%	0%	0%	2%	2%	2%	0%	0%	0%	0%	0%
	Australia Average		1%	5%	0%	0%	0%	1%	0%	0%	1%	4%	4%	3%	1%	0%	0%
Roads	**Total Construction (<$1,000m)**																
Project 11	Road	D&C	1%	7%	1%	0%	0%	0%	0%	5%	1%	4%	0%	0%	0%	0%	0%
Project 12	Road	D&C	0%	0%	1%	0%	0%	0%	0%	0%	0%	2%	3%	8%	0%	0%	0%
Project 15	Road	D&C	2%	10%	1%	0%	0%	0%	0%	6%	1%	4%	0%	0%	0%	0%	0%
Project 18	Road	D&C	2%	8%	1%	0%	0%	0%	1%	1%	1%	4%	0%	1%	0%	0%	0%
Project 21	Road	D&C	1%	7%	1%	0%	0%	0%	0%	5%	1%	6%	0%	0%	0%	0%	0%
	Total Construction (<$1,000m)																
Project 1	Road	Alliance	2%	1%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Project 2	PPP	PPP	1%	1%	0%	0%	0%	0%	1%	0%	0%	3%	0%	0%	0%	0%	0%
Project 3	Road	Alliance	1%	0%	0%	0%	0%	0%	0%	0%	0%	2%	4%	0%	0%	0%	1%
Project 4	PPP	PPP	1%	1%	0%	0%	0%	0%	1%	0%	0%	2%	0%	0%	0%	0%	2%
Project 5	Road	D&C	2%	0%	0%	0%	0%	0%	0%	0%	0%	4%	4%	0%	0%	0%	0%
Project 6	Road	D&C	3%	0%	0%	0%	0%	0%	0%	0%	0%	3%	4%	0%	0%	0%	0%
Project 7	Road	D&C	7%	0%	0%	0%	0%	0%	0%	0%	0%	4%	3%	0%	0%	0%	3%
Project 8	Road	Alliance	0%	1%	0%	0%	0%	0%	0%	1%	1%	1%	2%	5%	0%	0%	0%
Project 9	Road	Alliance	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	10%	0%	0%	0%
Project 10	Road	D&C	4%	0%	0%	0%	0%	0%	0%	0%	0%	4%	4%	0%	0%	0%	0%
Project 13	Road	D&C	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	3%	12%	0%	0%	0%
Project 14	Road	D&C	4%	8%	1%	0%	0%	0%	0%	5%	1%	0%	0%	0%	0%	0%	-1%
Project 16	Road	D&C	2%	7%	2%	0%	0%	0%	0%	4%	1%	3%	0%	0%	0%	0%	0%
Project 17	Road	D&C	3%	10%	0%	0%	0%	0%	0%	5%	1%	0%	0%	0%	0%	0%	0%
Project 19	Road	Alliance	2%	0%	0%	0%	0%	0%	0%	0%	2%	3%	0%	0%	0%	0%	0%
Project 20	Road	D&C	1%	0%	1%	0%	0%	0%	0%	3%	1%	4%	0%	0%	0%	0%	0%
Project 22	Road	Alliance	1%	0%	1%	0%	1%	0%	0%	0%	1%	4%	0%	3%	0%	0%	0%
Project 23	Road	Alliance	2%	1%	0%	0%	0%	0%	0%	1%	1%	1%	0%	0%	0%	0%	0%
	Australia Average		2%	3%	0%	0%	0%	0%	0%	2%	1%	3%	1%	2%	0%	0%	0%

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