



ARTC

Melbourne-Brisbane
Inland Rail Alignment Study

Final Report July 2010

Appendix L
Financial and Economic
Appraisal Methodology

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1. Introduction

The Melbourne-Brisbane Inland Rail Alignment Study (the study) was announced by Minister for Infrastructure, Transport, Regional Development and Local Government, the Hon Anthony Albanese MP on 28 March 2008. The aim of the study is to determine the optimum alignment as well as the economic benefits and likely commercial success of a new standard gauge inland railway between Melbourne and Brisbane. The study aims to provide the government and private sector with information that will help guide future investment decisions, including likely demand and the estimated construction cost of the line.

This appendix presents the methodology and key assumptions used to undertake financial and economic appraisal of Inland Rail:

- The financial analysis examines the inland railway to determine whether it is expected to be financially viable on a standalone commercial basis. A basis for evaluating private sector involvement in the project has also been presented in the final report, considering four financing scenarios.
- The economic appraisal of Inland Rail aims to assess whether it is economically viable in contrast to the situation without an inland railway. This will aid future government and private sector evaluations and help guide efficient resource allocation.

Financial compared to economic appraisal

Investment evaluations conducted from the wider economy or community's perspective are termed economic evaluations whereas those evaluations conducted from the producer's perspective only (e.g. the track operator) are known as financial evaluations. This is an important distinction as the outputs have varying purposes:

- *Financial appraisal* - Financial appraisals assess the financial viability of a project from the perspective of owners/operators (e.g. in this case, the potential track owner and operator of the inland railway). Financial appraisals are concerned only with the financial returns delivered to operator stakeholders and do not take into account the costs or benefits derived by other parties and the wider community. Financial costs and revenues include capital, operating and maintenance costs; and operation. In the case of Inland Rail, these are expected to include track access charges for the track operator (assuming separate track and train operations).

The aim of the financial appraisal of Inland Rail is to enable assessment of whether Inland Rail is viable on a standalone, commercial basis based on financial revenues and costs.

- *Economic appraisal* - Economic (cost benefit analysis) appraisals assess the total costs and benefits of a project to the community. As such, economic appraisals encompass the costs and benefits accrued and incurred by many different stakeholders, including the project proponents, users, government and the community in general. An economic appraisal takes into account costs and benefits that are not necessarily derived directly from market based transactions including, in this study of Inland Rail: value of freight travel time, reliability, accidents, and externalities and congestion. Economic evaluations also take into account the opportunity costs of resources used in the project. Consequently, taxes and subsidy payments are deducted as they simply represent transfer payments by government

and do not represent the resource cost of producing a good or service.

The aim of the Inland Rail economic appraisal is to assess the project's merits in terms of the economic efficiency of resource allocation and the quantification of total costs and benefits to the community.

2. Financial appraisal methodology

The financial analysis was undertaken on a forecast cash flow basis, using annual periods and nominal dollar forecasts. The terms of reference for this study focus on a project-specific assessment of Inland Rail. As a result, the analysis is based on Inland Rail's financial feasibility, and does not consider losses to ARTC resulting from a reduction of coastal railway freight, nor a detailed financial appraisal of both lines concurrently. Further, the analytical framework adopted focuses on project cash flows from the perspective of an Inland Rail track operator, and excludes financing cash flows as they will vary dependent on the financing structure.

The table below summarises the generic assumptions that apply to the proposed Inland Rail project. These are applied across all commencement dates examined in the financial appraisal.

Table 2-1 General financial appraisal assumptions

Assumption	Details	Notes
Analysis period	Through to 2070	Thirty years after the last scenario begins full operations, with base year in 2010
Concession period	2020: 50 years 2030: 40 years 2040: 30 years	Length of the concession is relatively long to maximise time to earn a return
Construction period	5 years	Period assumed for the construction of the inland railway track assets, with capital costs allocated on an S-curve basis
Cost and revenue base date	2010	Has the same basis as the economic analysis and uses assumptions provided by technical consultants
Net present value (NPV) date	January 2010	Base date for the calculation of the NPV of cash flows of the project, discounted at the beginning of the period
Capital cost	2010 dollars escalated by Producer Price Index	Capital cost assumptions were estimated in February 2010 dollars. For the purpose of the financial appraisal, these assumptions were escalated in the financial model by the average historical producer price index (for road and bridge construction) of 4.23% pa ¹
Operating cost and revenue estimates	2010 dollars escalated by CPI	Key revenue and cost assumptions were estimated in 2010 dollars. For the purpose of the financial appraisal, these assumptions were escalated in the financial model using CPI where applicable
Consumer Price Index (CPI)	3.0%	Upper end of Reserve Bank of Australia (RBA) target range
Basis of cash flows for financial analysis	Nominal	For the purposes of the financial appraisal, the cash flows in the financial model are in nominal terms

¹ Australian Bureau of Statistics (ABS) 2009, *Cat. No. 6427.0: Producer Price Indexes, Australia: Table 15. Selected output of division E construction, group and class index numbers, 'Road and bridge construction Australia'* (Sept 1999-Sept 2009)

Asumption	Details	Notes
Project discount rate (Nominal, Pre tax)	16.59%	The recent Weighted Average Cost of Capital (WACC) regulatory determination of the Australian Competition and Consumer Commission (ACCC) determination for the ARTC's interstate network was 11.61% post tax, nominal. ² For the purpose of the project NPV analysis, our approach was to convert this to a pre tax discount rate applying an average tax rate of 30%. This results in a nominal, pre tax discount rate of 16.6%
Capital Costs (\$ million, undiscounted, unescalated)	\$4,701.3 (P90)	Capital costs expressed in February 2010 dollars (unescalated for real and nominal increases, and undiscounted) including an 18% contingency
PV Capital Costs (\$ million, discounted, escalated)	2020: \$2,113 2030: \$705 2040: \$235	The PV of capital costs calculated using a discount rate of 16.6%, and a base date of 1 January 2010
Demand inputs	Refer Chapter 3 & Appendix B	Demand projections for the inland railway prepared by ACIL Tasman for use in the financial appraisal
Track access pricing	Refer Chapter 8	Access charges were assumed to be in line with current coastal rail prices
Construction and operating costs	Refer Chapters 7, 8 and 9	Costs were estimated for the inland route by the LTC
Depreciation rates – Track components	3.33%	Assumed average useful life of track components 30 years ³

² ACCC 2008, *Final Decision: Australian Rail Track Corporation Access Undertaking – Interstate Rail Network*, July 2008, p 164

³ ACCC 2008, *Final Decision: Australian Rail Track Corporation Access Undertaking – Interstate Rail Network*, July 2008

3. Economic appraisal methodology

3.1 Cost benefit analysis methodology

3.1.1 CBA approach

This appraisal has been undertaken in broad consistency with the relevant guidelines for cost benefit analysis (CBA) as provided by the Australian Transport Council (ATC) 2006 *National Guidelines for Transport System Management in Australia*, Infrastructure Australia, jurisdiction-based guidelines,⁴ and other mode-specific guidelines as required, e.g. Austroads.

The appraisal objective is to analyse the economic merit of the proposed Inland Rail in line with state and national guidelines for economic appraisal. According to Austroads, CBA:

*...is a technique for assessing the economic efficiency of resource allocation. It allows us to compare alternative approaches to individual projects and to set priorities amongst competing projects. It uses as its framework the values of all costs and benefits to the community which can be quantified in money terms.*⁵

The economic appraisal of Inland Rail has been undertaken to assess the project's merits. This will aid future government and private sector evaluations and would help guide efficient resource allocation. This is done by determining whether Inland Rail is economically viable (i.e. the total discounted incremental benefits of the project exceed the total discounted incremental costs over a specified period).

The appraisal uses a rail freight CBA framework. This framework assesses the potential change in economic welfare with the inland Rail by considering the following parameters:

- Project and Base Case capital costs
- Project and Base Case recurrent costs
- Rail operating costs
- Freight value of travel time
- Road and rail crash costs
- External costs (such as air pollution, noise, and greenhouse gases).

The appraisal builds on previous appraisals, including:

- *Economic appraisal undertaken in the North-South Rail Corridor Study in June 2006* – this analysed four broad route alignments or 'sub-corridors' (far western, central inland, coastal and hybrid inland/coastal), combined with two alternative routes via Shepparton or via Albury. The study found that, based on the alignments and likely timeframes and costs, none of the scenarios resulted in positive net economic benefit, with a BCR of 0.4 for the unconstrained case of \$3.1 billion capital expenditure;⁶ and

⁴ Jurisdiction-based guidelines include the Queensland Treasury 2006 *Cost-Benefit Analysis Guidelines*, Victorian Department of Transport (DoT) 2007, *Guidelines for Cost-Benefit Analysis*, the NSW Treasury 2007, *NSW Government Guidelines for Economic Appraisal*

⁵ Austroads 1996, *Benefit Cost Analysis Manual*, Sydney, 1996

⁶ The NSRCS included access revenue and externalities in the project's economic benefits whilst the appraisal in the Inland Rail Alignment Study Final Report excludes access revenue from the economic analysis as this is a financial transfer.

- *Economic analysis undertaken by the Bureau of Transport Economics (BTE now BITRE), in October 2000* – the Australian Government commissioned the BTE to undertake an economic benefit-cost analysis of the Australian Transport and Energy Corridor (ATEC) proposal (as at October 2000) for a new rail corridor linking Melbourne and Brisbane, and all associated ATEC assumptions. The BITRE analysis found that, based on the ATEC demand forecast and ATEC estimated capital costs, the rail corridor resulted in a benefit-cost ratio (BCR) between 3.6 and 5.1 (noting that the demand forecasts used assumed a significant shift in road freight, and the capital costs assumed were significantly lower than assumed in this study, ranging from \$1.2 -1.68 billion (2000 dollars). Adjusting the BCRs with the higher capital cost of \$4.70 billion developed in this study would see these BCRs fall significantly. The BTE suggested caution in interpreting the results because of the assumptions it had been asked to use. It is also noted that an earlier BTE report analysing the inland railway found the project to be economically unviable.

This study builds on these previous studies with a focus on analysing and refining a route for further analysis within the far western sub-corridor.

Key inputs to the economic appraisal

The CBA draws upon the following key inputs:

- Base Case and Inland Rail scenario definitions presented later in this chapter
- Capital and operating cost assumptions as well as railway and train performance specifications based on LTC estimates as described in Chapters 4, 5, 7, 8 and 9 and Appendices C, G, J and K
- ACIL Tasman freight forecasts as discussed in Chapter 3
 - demand outputs were provided for the years 2008-2080 and there was no requirement to further interpolate demand over the appraisal period
 - freight demand was estimated in annual terms, so a separate annualisation factor was not required to apply demand to the economic appraisal
 - ACIL Tasman incorporated assumptions into the demand forecasts concerning the ramp-up of freight volumes, and hence a ramp-up period is inherently incorporated into demand projections.

Measures of economic performance

This CBA reports on the following measures of economic performance:

- *Net Present Value (NPV)* – the difference between the present value (PV) of total incremental benefits and the present value of the total incremental costs. Scenarios that yield a positive NPV indicate that the incremental benefits of the project exceed the incremental costs over the evaluation period.
- *Benefit Cost Ratio (BCR)* – ratio of the PV of total incremental benefits over the PV of total incremental cost. A BCR greater than 1.0 indicates whether a project is also economically viable, as it presents a ratio of benefits relative to costs in present value (PV) terms. A BCR greater than 1.0 indicates PV benefits outweigh PV costs.
- *Net Present Value: Investment Ratio (NPVI)* – the NPV is divided by the PV of the investment costs (PVI). The NPVI measures the overall economic return in relation to the required capital expenditure.
- *Economic Internal Rate of Return (EIRR)* – the discount rate at which the PV of benefits equals the PV of costs. An IRR greater than the specified discount rate

(default 7%) also indicates a project is economically worthwhile. However the IRR can yield ambiguous results if the stream of costs and benefits are not continuous over time. It is therefore commonly recommended that the IRR be used along with other measures.

3.1.2 Options considered

The demand projections, and both the economic and financial appraisals conducted for this project consider the following scenarios:

- *Base Case scenario* – assumes there is no Inland Rail and freight travels by road or existing rail lines, and also assumes currently planned upgrades to the existing coastal railway proceed. It also assumes the Newell Highway will be upgraded to maintain capacity and performance levels.
- *Inland Rail scenario* – this scenario assumes development of Inland Rail with a route length of 1,731 km and a terminal-to-terminal transit time of 20.5 hours. The scenario also assumes that upgrades to the coastal railway and Newell Highway will take place in line with the Base Case.

The table below summarises the route distances, capital costs and other assumptions of the Inland Rail scenario compared with the Base Case.

Table 3-1 Summary of assumptions for specific scenarios

Assumption	Mode/route	Base Case (no Inland Rail)	Inland Rail
Capital costs (2010 dollars, undiscounted) ⁽¹⁾	Inland railway	n/a	\$ 4,701.3 (P90, exc. profit margin, inc. contingency)
	Coastal railway	\$3,011.0	\$3,011.0
	Road in corridor	Assumed as equal under the two scenarios	
Distance (M-B terminal-terminal), km	Inland railway	n/a	1,731
	Coastal railway	1,904	1,904
	Road	1,650 (door-to-door)	1,650 (door-to-door)
Transit time (M-B terminal-terminal), hours	Inland railway	n/a	20.5 hrs
	Coastal railway	27.5 hrs ⁷	27.5 hrs
	Road	n/a	n/a
Transit time (M-B door-door), hours ⁽²⁾	Inland railway	n/a	25.5 hrs
	Coastal railway	32.5 hrs	32.5 hrs
	Road	23.5 hrs	23.5 hrs
Reliability (M-B)	Inland railway	n/a	87.5%
	Coastal railway	77% in 2015	77% in 2015
	Road	98%	98%
Availability (M-B)	Inland railway	n/a	95%
	Coastal railway	93%	93%
	Road	98% (declining to 95%)	98% (declining to 95%)
Door to door price (M-B, relative to road)	Inland railway	n/a	52.2% (declining to 48.8%)
	Coastal railway	57.6% (declining to 53.6%)	57.6% (declining to 53.6%)
	Road	100%	100%

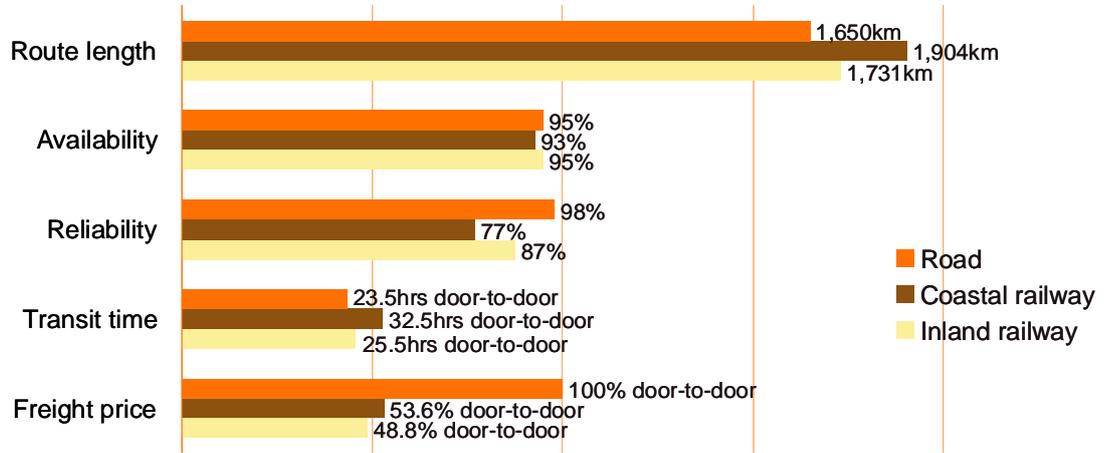
Source: LTC cost and time estimates, and ARTC estimates for other rail capital costs

Note: ⁽¹⁾ capital costs include profit margin, which is excluded from costs in the economic appraisal; ⁽²⁾ the economic appraisal is undertaken on a 'door-to-door' basis; ⁽³⁾ 23.5 hours door-to-door transit time for road is based on assumption that 70% of trips have a transit time of 22 hours, and 30% will consolidate freight via an intermodal terminal (i.e. 22 hours plus 5 hour consolidation time). This results in a weighted average road transit time of 23.5 hours door-to-door. This was confirmed by industry estimates provided to ACIL Tasman. Slower road services might attract a price discount, which are not incorporated in the demand model.

⁷ ACIL suggests that the 27.5 hour transit time may be difficult to achieve as this would require three locomotives, which operators may not otherwise choose for haulage of a 1500m train. As such, this may be a conservative estimate for Inland Rail viability.

The key characteristics distinguishing road and rail in the Melbourne-Brisbane corridor are presented graphically below.

Figure 3-1 Characteristics of the Melbourne-Brisbane road and rail freight market



Source: this chart is illustrative only and is not to scale

The alternative road and rail options available to freight travelling along the Melbourne-Brisbane corridor are presented in the map below. These form the basis of the Base Case and the Inland Rail scenario.

Figure 3-2 Alternative road and rail routes between Melbourne and Brisbane



Note: the figure above presents the National Highway from Melbourne to Brisbane via Toowoomba, using the Gore Highway to Toowoomba then the Warrego Highway to Brisbane. It is noted that freight may travel on other routes in the area, for example they may travel via Warwick using the Cunningham Highway to Warwick and the Cunningham Highway to Brisbane.

3.1.3 Base Case

In the Base Case, it is assumed that there is no inland railway and Melbourne-Brisbane freight continues to use existing road and coastal railway infrastructure. It assumed business as usual upgrading of the coastal route, the Newell Highway, port and intermodal terminal infrastructure, as described below.

(i) Coastal railway upgrades

Under the Base Case, it is assumed that ARTC's planned upgrades on the coastal railway will take place, including the committed Stage 1 of the proposed Northern Sydney Freight Corridor Program (\$840 million). This is presented in Table 3-2 alongside the costs estimated to be delayed as a result of some traffic being diverted from the coastal railway to the inland railway, assuming Inland Rail commences operating in 2020.

- *ARTC planned upgrades on the coastal railway (excluding the Northern Sydney Freight Corridor Program)* – ARTC has planned a range of expenditure on the coastal railway from 2010 including:
 - Loop extensions and new loops between Brisbane and Sydney
 - Passing lanes between Brisbane and Sydney
 - Southern Sydney Freight Line enhancement
 - Duplication of Albury to Junee (see Table 33 for details).

ARTC considers it may be possible to delay some coastal railway expenditure if there is an inland railway as some passing lanes north of Maitland can be deferred if freight travelling between Melbourne and Brisbane is diverted to Inland Rail. The extent of delayed expenditure on the coastal railway is restricted as Melbourne/Adelaide/Perth-Brisbane freight is estimated to comprise around 28% of current train movements.⁸

- *North-south corridor projects announced in the Australian Government's 2010-11 Budget* – ARTC was allocated \$1 billion in the 2010-11 Budget to further improve the productivity and performance of the rail sector. As around \$300 million of this allocation is relevant to the coastal railway, it has been incorporated in both the Base Case and Inland Rail economic scenario:
 - *NSW North Coast Curve Easing*: the program will ease tight curves at 58 specific locations on the NSW north coast, thereby shortening transit times between Sydney and Brisbane. Most of the improvements will occur within the existing rail corridor
 - *Goulburn, Moss Vale and Glenlee Double Track Passing Loops*: the improvements include construction of passing loops on the double track between Yass and southern Sydney
 - *Rerailing Albury-Melbourne (as well as Melbourne-Geelong)*: the project involves rerailing 239 track km of rail and upgrading deficient bridges and turnouts.

ARTC expects the north-south corridor projects, particularly the easing of curves on the NSW north coast, will reduce northbound transit times by 44 minutes and southbound transit times by 35 minutes on the coastal railway between Melbourne and Brisbane. As the funding was announced during Stage 3 of the study, its expected benefits were incorporated into the Final Report by assuming an average transit time saving of 30 minutes on the coastal railway. The difference in transit time savings arises because the economic modelling does not distinguish between north and southbound freight movements; nor does it assess transit time changes in less than 30 minute increments.⁹

- *Stage 1 of the Northern Sydney Freight Corridor Program* - the Australian Government's Northern Sydney Freight Corridor Program aims to remove impediments to rail freight traffic between North Strathfield and Broadmeadow

⁸ Provided by the Northern Sydney Freight Corridor project team.

⁹ ARTC 2010, *Project Snapshot 2010*, online accessed May 2010, available at: http://www.artc.com.au/library/news_2010-05-11.pdf?110501; and ARTC 2010, *Budget 2010 Project Snapshot*, 11 May 2010, online accessed May 2010, available at: <http://www.artc.com.au/Article/Detail.aspx?p=6&np=4&id=274>

near Newcastle.¹⁰ A committed funding agreement exists between the Australian and NSW governments for Stage 1 of the Program (\$840 million).

Although a further Stage 2 option is being considered by the Australian Government, these works have not yet been committed. Accordingly completion of these works has not been assumed in the Base Case for the inland railway study.

Table 3-2 ARTC proposed capital spend on the north-south corridor assumed in demand and appraisals (\$ millions, undiscounted, 2010 dollars)

Coastal capital expenditure item	Potential year of capital spend	Base Case (ARTC demand)	Base Case (ACIL demand)	Inland Rail commencement date:		
				2020	2030	2040
Brisbane-Sydney, Northern Sydney Freight Corridor Program (Stage 1) *	2010-2015	840.0	840.0	840.0	840.0	840.0
North south corridor Federal Government investment (2010 Budget)	2010-2013	300.0	300.0	300.0	300.0	300.0
Brisbane-Sydney 22 loop extensions & 4 new loops	2011	260.0	-	-	-	-
	2030	-	130.0	-	-	130.0
	2040	-	130.0	-	-	-
	Beyond 2070	-	-	260.0	260.0	130.0
Junee-Melbourne duplication, section Seymour- Tottenham	2013	300.0	-	-	-	-
	2030	-	300.0	300.0	300.0	300.0
Junee-Melbourne duplication, section Albury to Junee	2015	300.0	-	-	-	-
	2040	-	300.0	300.0	300.0	300.0
Brisbane-Sydney 17 passing lanes of 14 km each	2025	481.0	-	-	-	-
	2060	-	481.0	-	-	-
	Beyond 2070	-	-	481.0	481.0	481.0
Brisbane-Sydney 16 passing lanes of 14 km each	2028	480.0	-	-	-	-
	2070	-	480.0	-	-	-
	Beyond 2070	-	-	480.0	480.0	480.0
SSFL enhancement	2029	50.0	50.0	-	50.0	50.0
	2039	-	-	50.0	-	-
Total (undiscounted)		3,011.0	3,011.0	3,011.0	3,011.0	3,011.0
Total (PV, discounted)		1,746.0	1,200.4	1,139.4	1,146.2	1,177.6
Saving relative to the ACIL Base Case (PV, discounted)		-	-	61.0	54.2	22.9

Source: ARTC 2009 advice to PwC; Study team consultation with the Northern Sydney Freight Corridor project team; ARTC 2008, *2008-2024 Interstate and Hunter Valley Rail Infrastructure Strategy*; NSW Government 2009, *Budget 2009/10 – Transport*, 16 June 2009; and ARTC 2010, communications with PwC relating to the Federal Budget north south corridor investments, May 2010

Note: The ARTC base case is presented for comparative purposes only and is indicative of the difference between demand projections (see Box 10 in the final report). This indicates that savings in coastal rail capital costs due to Inland Rail will be higher if there is a growth in traffic

¹⁰ TIDC 2009, *Project Profile - The Northern Sydney Freight Corridor Program*, available at: <http://www.tidc.nsw.gov.au/SectionIndex.aspx?PageID=2066>

(ii) Rail infrastructure investment on approach to Brisbane

The proposed inland railway would add a standard gauge line within the current rail corridor on the approach to Brisbane from Toowoomba. As a result, any plans or commitments to upgrade or invest in this corridor are relevant to this study. An inland railway, including the Rosewood-Kagaru line, would allow all rail freight to be diverted from the congested Ipswich-Brisbane corridor.

- *Rail investment plans in the corridor* – in the *South East Queensland Infrastructure Plan and Program 2009-2026*,¹¹ the Queensland Government identified investment in the following rail infrastructure:
 - Between Rosewood and Kagaru, Queensland DTMR has conducted the Southern Freight Rail Corridor (SFRC) Study. The SFRC is a dedicated freight-only corridor connecting the western rail line near Rosewood to the interstate railway north of Beaudesert. The project is not yet committed: the route identified by the SFRC Study has been adopted for the proposed inland railway.¹²
 - Between Gowrie and Grandchester, the route initially developed by (the then) Queensland Transport and finalised in 2003, was designed to provide for future higher speed passenger services as well as freight west from Brisbane. As discussed further in section 5.4.3, the study has identified an alternative route for the inland railway between Gowrie and Grandchester, with specifications more appropriate to the operation of intercapital freight trains
 - Ipswich rail line: extending the third track between Corinda and Darra to Redbank
 - Ipswich to Springfield rail line: because this is intended mainly for passenger trains, it is unlikely to affect planning for the inland railway.
- *Capacity for freight services between Rosewood and Corinda* – in addition, the 2006 *Metropolitan Rail Network Capacity Study*, prepared for Queensland Transport, suggests that ‘given the significant growth in demand for freight services to carry coal from the Surat basin, it is ... highly likely that capacity for freight services between Rosewood and Corinda will be exhausted by 2016, [which may] ... drive the need for a third track from Corinda to Darra. This upgrade would provide extra capacity for freight services during the off peak and Citytrain services during the peak, as well as delivering improved reliability for all services’.¹³
- *Benefits of diverting freight away from passenger services (Rosewood-Corinda)* – the Queensland Department of Transport and Main Roads indicates there are likely to be benefits if freight is diverted away from passenger services (between Rosewood and Corinda), as would be possible with the inland railway. While some rail freight would continue to use the line between Rosewood and Corinda (e.g. coal for Swanbank power station near Ipswich, until it is expected to close in 2017), it is estimated that some QR maintenance costs could be avoided by closing the existing Toowoomba Range crossing. The current estimate provided by the department is \$50 million over 7 years (averaging \$7.2 million pa) which covers routine maintenance including sleepers, ballast, track and attention to structures. In addition, one-off projects that

¹¹ Queensland Government 2009, *South East Queensland Infrastructure Plan and Program 2009-2026*, p 30

¹² Queensland Transport 2008, *Southern Freight Rail Corridor Study - Draft Assessment Report*, ‘Chapter 18: Economic analysis’, prepared by Maunsell, October 2008, p 133

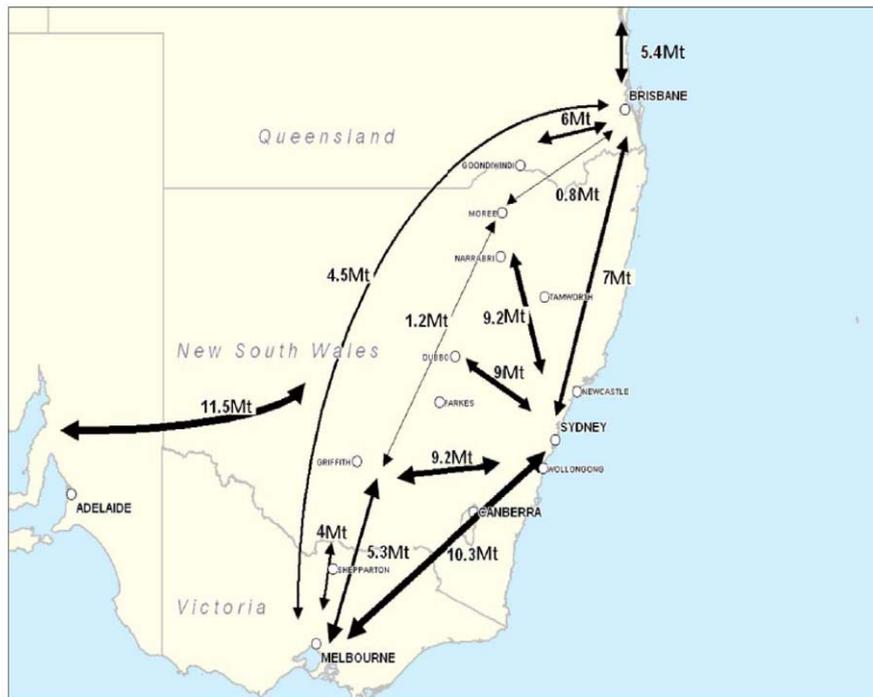
¹³ Queensland Transport 2006, *Metropolitan Rail Network Capacity Study – Final Report*, prepared by Systemwide Pty Ltd, June 2006, p 37

arise from time to time could be avoided (e.g. for stabilisation works or responses to unforeseen events such as derailments and weather events).¹⁴

(iii) Road (Newell Highway) upgrades

About 70% of intercapital freight currently travelling from Melbourne-Brisbane or Brisbane-Melbourne is freighted on road, principally on the Newell Highway between Victoria and Queensland.

Figure 3-3 Road freight in NSW



NSW RTA 2009, *RTA Transport Strategies*, presentation prepared by John Brewer, General Manager Strategic Network Planning, p 12 of 27

While this is expected to reduce to around 33% by 2040 if Inland Rail commences operations in 2020, it is estimated to reduce to 39% even if there is no inland railway because fuel and labour costs are forecast to increase in over time, impacting more on road as it is more fuel and labour intensive. In addition, the market share analysis as part of this study suggests that the inland railway will only reduce the volume of road freight volumes between Melbourne and Brisbane by an average of 7% per annum between 2020 and 2030, increasing to 12% from 2030 to 2080.

The NSW Roads and Traffic Authority (RTA) expects that the Newell Highway will be maintained and potentially increased for some capacity growth (e.g. with passing lanes/localised climbing lanes). However, it is not expected to be upgraded to a four-lane highway or similar in the near future.¹⁵ This is because compared to roads such as the Pacific Highway, the circumstances and resulting plans for development are quite different. For example, current daily traffic volumes on the Newell Highway are low away from towns

¹⁴ Queensland Department of Transport and Main Roads 2009, meetings and communications with the Inland Rail Study team during 2009

¹⁵ Communications with John Brewer, General Manager of Strategic Network Planning, NSW RTA, November 2009

(averaging 2,000 movements per day and around 6,000 movements in towns).¹⁶ There are also few significant generators of traffic along the highway.

There are likely to be some savings in capital expenditure on the Newell Highway as a result of the inland railway. However, this has not been captured in the economic appraisal as planned expenditure on the highway is not significant, and a minor proportion of intercapital freight expected to divert from road to rail as a result of the inland railway. Nevertheless savings in road maintenance have been captured as a benefit, and this is discussed further below.

(iv) Intermodal terminal and port capacity

- **Intermodal terminal capacity** – capital and operating costs of intermodal terminals are assumed to be met by train operators. As work is currently under way at Parkes and Acacia Ridge to increase intermodal terminal efficiency and capacity, and there are plans for new terminals in Bromelton, Moorebank and Donnybrook/Beveridge, the approach taken in this appraisal was not to include future terminal capacity investment costs with Inland Rail capital costs. Even without an inland railway, freight volumes in the Melbourne-Brisbane corridor will increase, and upgrades to current terminal capacity will be important to service growth in demand regardless of whether there is an inland railway. As a result, terminal costs are not expected to vary significantly between the Base Case and Inland Rail scenarios.
- **Port capacity** – an inland railway would have little impact on port throughput except for additional coal at the port of Brisbane. It has been assumed that increases in port capacity would be provided and funded by port operators so this is not included in Inland Rail costs. While the financial appraisal does not capture costs of increase port capacity for induced (coal) freight, the economic appraisal captures this in the estimate of producer surplus from induced demand.

3.1.4 Scenario with Inland Rail

The Inland Rail scenario analysed in both the financial and economic appraisals assumes development of an inland railway with a route distance of 1,731 km and a terminal-to-terminal transit time of 20.5 hours. This is faster than what is considered achievable with the coastal railway where the route distance is 1,904 km. To achieve the lower transit time, shorter route, and other improved aspects of performance including increased reliability and availability, capital expenditure of \$4.7 billion over a five-year construction period is estimated for the Inland Rail.

As discussed in Chapter 7 in the Final Report, deferring the upgrading of the Class 2 track and the Illabo to Stockinbingal deviation is not expected to compromise performance until traffic volumes increase. Deferred spending of these works has therefore been factored into the economic appraisal for scenarios when Inland Rail is assumed to commence operations in 2020 (deferring upgrades and the Illabo to Stockinbingal deviation until 2035) and 2030 (deferring the Illabo to Stockinbingal deviation until 2040). For the scenario assuming Inland Rail commences operation in 2040, it was assumed that traffic volumes demanding the route at that time would be to a scale to warrant the full capital program being completed upfront in the initial 5-year construction period (i.e. no deferral of capital costs).

The Inland Rail scenario assumed upgrades to the coastal railway and Newell Highway in line with the Base Case. Some Base Case capital costs are likely to be avoided on the

¹⁶ NSW RTA 2009, *Newell Highway Safety Review*, August 2009, p 7

coastal railway if the inland railway is built. Three possible timeframes for commencement of operations have been analysed for the inland railway to compare economic viability if services commence in 2020, 2030 or 2040.

3.1.5 General CBA assumptions

The general assumptions used in this economic appraisal are presented in the table below.

Table 3-3 Key economic appraisal assumptions

Item	Assumption	Notes
Economic analysis perspective	National interest perspective	
Base year	2010	All values have been expressed in constant dollars and all present value costs and benefits have been expressed in 2010 dollars unless otherwise stated
Evaluation period	2010 to 2070	The evaluation period starts in 2010 and ends in 2070 (30 years after the last scenario begins full operations) ⁽¹⁾
Economic analysis discount rate	7%	Sensitivity tests @ 4% and 10%. Future net benefits have been discounted to the base year using a real 7% discount rate

Note⁽¹⁾: operations are modelled to commence in either 2020, 2030 or 2040

3.1.6 Economic benefits

This economic appraisal is concerned with assessing the effects on the national community of freight transport operators' decisions to switch to Inland Rail. The national perspective requires that all transfers are netted out. Previous economic appraisals conducted for the Inland Rail project have included access charges as an economic benefit. However, access charges are considered to be a transfer between parties that does not have a net economic benefit. This is because an access charge is a payment for the rail infrastructure that represents (i) a cost to the above rail operator; and (ii) a revenue to the below rail operator. As these two revenue streams cancel out, it is only the costs of infrastructure (i.e. the capital and operating costs) that remain valid for inclusion in the evaluation.

In line with a rail freight CBA framework, this economic appraisal aims to take into account all effects on society by considering benefits to rail users and the broader community through externalities. The most significant benefits of Inland Rail relate to savings in rail user costs arising from a reduction in transit time and freight kilometres compared with the Base Case. Benefits will also accrue to third parties through the reduction of external costs, such as environmental externalities. The residual value of assets remaining at the end of the analysis period is also captured in the appraisal.

The approach used to estimate each of the benefits included in the CBA is presented below.

Savings in freight travel time costs (Consumer surplus)

The approach used in this appraisal to measure Inland Rail benefits incrementally to the Base Case, is based on defining the service being provided as 'freight transport' for either rail or road mode of travel. This approach, along with the method to apply freight travel time

to net tonne kilometres (ntk),¹⁷ draws upon the economic approach used by BITRE in October 2000.

The demand forecasts generate freight volumes (in ntk) for rail freight on the new and existing lines and for road freight. In order to estimate the value of freight transit time savings for rail users, these volumes were converted to tonne hours by estimating trip numbers and hours per average trip based on average loads and transit times. The resulting tonne hours per trip derived for each mode, and for the Base Case and each scenario, were then combined with a time value for freight in transit to determine:

- The benefits of existing rail traffic (currently travelling on the coastal railway or other existing railways) travelling faster on the new line
- The negative benefit of existing road traffic travelling slower when it changes to the new rail network
- The benefits of induced rail traffic travelling on the new line.

The time value for freight transit used in this appraisal was determined by applying the average load carried per trip for a 6-axle semitrailer and B-Double road articulated freight vehicles (assumed as 25 and 40 tonnes respectively) with Austroads 2008 values for urban and non urban freight travel time (per vehicle hour and by road vehicle type for 6-axle articulated and B-Double vehicles).¹⁸ This information was used to estimate freight travel time per tonne hour for each vehicle type. This was based on assuming a 90% non urban and 10% urban split of tonne hours travelled along the Melbourne-Brisbane corridor.

The separate vehicle travel times were then weighted against vehicle compositions (assumed as 60% articulated and 40% B-Double for this freight demand) to determine an average regional freight travel time value of \$0.79 per tonne hour (inflated to 2010 dollars based on applying the road transport section of the Producer Price Index in line with Austroads methodology)¹⁹. This travel time value was applied to tonne hour demand to estimate the change in freight travel time cost. While derived from road appraisal CBA guidelines, this value of freight travel time is considered to be conservative relative to other estimates. For example in 2000, in its *Brisbane-Melbourne Rail Link: Economic Analysis*, BTE (now BITRE) used a value of \$1.60 per tonne hour for general freight based on ATEC transit time analysis (equivalent to \$2.14 per tonne hour in 2010 dollars).²⁰

(i) Existing rail traffic (coastal traffic and coastal-inland rail diverters)

These benefits are derived through reduced journey times, as a result of faster trips on the proposed inland railway.

*The benefit to existing rail freight = the number of existing rail trips * (travel time by rail trip with the Base Case – travel time by inland rail trip with the project case) * value of travel time.*

¹⁷ Tonne kilometres are calculated by the weight of a train and the distance it runs. This can be expressed as the total weight of a train (gross tonne kilometres or gtk) or the weight of the cargo (net tonne kilometres or ntk).

¹⁸ Austroads 2008, *Guide to Project Evaluation, Part 4: Project Evaluation Data*, p 18, Table 3.2

¹⁹ Austroads 2008, *Guide to Project Evaluation, Part 4: Project Evaluation Data*, p 17 & ABS 2009, 6427.0 *Producer Price Indexes*, Australia, Table 19, 461 Road freight transport, September 2009

²⁰ In 2000, the BTE (now BITRE) *Brisbane-Melbourne Rail Link: Economic Analysis* used ATEC transit time analysis to derive value of time for freight in transit ranging from \$0.00 to \$2.99/tonne hour in the appraisal (dependent on freight type), equivalent to \$1.60 for general freight (2000 dollars). This analysis also cited a value of \$0.60 per tonne hour (2000 dollars) sourced from Austroads and derived on the same basis applied in this appraisal.

An alternative approach to estimate travel time benefits for rail freight could be to consider total tonne hours (as opposed to considering tonne hours 'per trip' and the number of trips). However, as the tonnes per train, utilisation rate and trailer load have been assumed as the same for both inland rail and the coastal rail, and as travel time is only currently known on a per-trip basis, the approach described above has been used to capture the increase in rail trip numbers compared to the Base Case.

(ii) Road-rail diverters

The inland rail project will result in freight diverting from road to rail compared with the base case. The benefit gained by diverted road-rail trips is calculated using the rule of the half whereby the benefit of each diverted trip is equal to half of the unit benefit accruing to existing rail freight remaining on the same mode. So for a particular trip on road with the Base Case that diverts to rail under the project case:

*The benefit = ½ * (the number of diverted trips to rail with the project case) * (travel time by road trip with the Base Case – travel time by inland rail trip with the project case) * value of travel time.*

Box 1 Economic basis of capturing freight travel time savings

Introduction

The measurement of freight travel time is a contentious issue, particularly if the traffic is not just-in-time deliveries. In principle, it is preferable to have freight delivered sooner rather than later because, other things being equal, it is then available for earlier sale or use. The longer the distance, the less critical small time savings become, e.g. a 30 minute delay in a 24-hour trip has less significance than a 30-minute delay in a 1-hour trip.

The approach taken in this appraisal, in line with previous analysis undertaken by BITRE (formerly BTE), is that freight customers prefer quicker rather than slower freight deliveries.

Economic basis

The economic basis behind capturing freight travel time savings is that there is a willingness to pay for freight service quality improvements that are linked to train operating costs, freight travel time and the opportunity cost of freight. In other words, there is assumed to be a benefit to shippers and receivers of getting goods to their destination more quickly, represented by some value being placed on this benefit for commodity type movements.²¹ It is captured as 'freight travel time savings' in this economic appraisal.

The infrastructure users that will gain benefits from transit time savings include:

- **Freight shippers/customers** – for a freight shipper paying a sum of money to have their goods moved, they will place a value on goods arriving more quickly at a destination. While in theory they would have no interest in vehicle or driver costs, in practice, many shippers are aware of freight haulier costs and how charges they have to pay to their haulier is related to vehicle and driver costs and so may include some element of those costs in their response. As an example, freight shippers do not place a higher value on one mode of transport exclusively, rather they place a higher value on lower travel time regardless of the mode involved
- **Freight hauliers/train operators** – are only directly concerned with train operating cost savings that may decrease as a result of lower transit time (captured separately in the economic appraisal). However these hauliers may appreciate that the shipper would be willing to pay a higher rate if the journey were quicker and more reliable.

In the economic appraisal of Inland Rail, the time value for freight transit is based on Austroads values, updated to 2008, for non-urban freight travel time, which has been used to apply an average regional freight travel time value of \$0.79 per tonne hour. This value is an average for all commodity types. BTE and a recent UK paper on freight travel time savings have indicated that this value varies by commodity. It is higher, for example, for motor vehicles and shipping containers but lower for bulk agricultural products and coal.²²

²¹ Fowkes, Tony and Whiteing, Tony 2006, *The value of Freight Travel Time Savings and Reliability Improvements – Recent Evidence from Great Britain*, Institute for Transport Studies, University of Leeds, UK

²² BTE 2000, *Working Paper 45: Brisbane-Melbourne Rail Link: Economic Analysis* & Fowkes, Tony and Whiteing, Tony 2006

Box 1 Economic basis of capturing freight travel time savings

Other applications of this benefit in transport appraisal

Australian Transport Council (ATC) support inclusion – in its *National Guidelines for Transport System Management in Australia*, the ATC supports the inclusion of freight travel time savings, as evidenced by the statement:

For most transport initiatives, the bulk of the benefits accrue (at least in the first instance) to users of the infrastructure. Trains, trucks and cars save operating costs; passengers and freight save time.²³

BITRE has captured in its own economic appraisal of rail freight – in an appraisal undertaken in October 2000 of the Brisbane-Melbourne rail link, the BTE (now the BITRE) developed an estimate for the value of freight travel time savings and applied this to net tonne kilometres.²⁴ A similar approach has been followed in the economic appraisal of Inland Rail.

Austrroads and the NSW RTA provide a dollar value for inclusion of this benefit in road infrastructure appraisal – the estimate of freight travel time savings is commonly applied to road transport appraisals. Austrroads and the NSW RTA provide values per hour for road freight transport which are used in such appraisals.²⁵ (This Austrroads value forms the basis for the value used in the economic appraisal of Inland Rail.)

Example

Some of the practical reasons behind freight shippers placing a higher value on a rail line with lower travel time include:

- *Perishability and shelf life* – fresh food and other goods with a shelf life of only a few days lose value or can become worthless if they do not reach their destination on time
- *Additional benefits in having the goods reach their destination earlier* – for example part-load and parcels operators using a hub and spoke system, speeding up travel on the spokes allows later final collection times or earlier delivery times. Speeding up the trunk section offers both of these, but also permits a wider area to be covered by the collection and delivery spokes within standard collection and delivery schedules. Manufacturers may also be able to schedule production more efficiently with their raw materials available earlier; or else the level of stocks might be reduced.²⁶

As a further practical example considering an average container, the value of freight travel time is modest in relation to both freight value and total transport costs:

- *Travel time as a proportion of freight value* – if each container comprises products with a market value of \$36,000/TEU, the value of freight time savings as a proportion of this is only 0.018% (noting that these values are not directly comparable and are provided for high level information only)²⁷
- *Travel time as a proportion of transport costs* – if the transport costs incurred by a freight shipper are approximately \$200/tonne (or \$2,000 in total) for a container sent from Melbourne to Brisbane, the transport costs would average \$65 per tonne hour based on a 30 hour door-to-door transit time. The value of freight time of \$0.79 per tonne hour as a proportion of this is only 1.2%.²⁸

Comparison of the \$0.79 per tonne hour value

Assuming that the principle behind the measurement of freight travel time has economic basis, then a more difficult issue is how to appropriately value this.

The only substantive work undertaken to date appears to be by Austrroads in its 2008 *Guide to Project Evaluation*, and BITRE's *Brisbane-Melbourne Rail Link: Economic Analysis, Working Paper 45* that applies transit time analysis undertaken by ATEC.

This appraisal has incorporated the Austrroads' value of freight for articulated trucks and B-doubles, despite this being based on Melbourne-Sydney and Melbourne-Adelaide road freight that has a just-in-time component not readily captured by rail. It is thought that this value is more conservative relative to the ATEC estimates used by BITRE (formerly BTE). In the BITRE 2000 appraisal, a value of \$1.60 per tonne hour for general freight was incorporated in the Brisbane-Melbourne rail link economic appraisal based on ATEC transit time analysis (equivalent to \$2.14 per tonne hour in 2010 dollars).

²³ ATC 2006, *National Guidelines for Transport System Management in Australia*, Part 3: Appraisal of Initiatives, p 64

²⁴ BTE 2000

²⁵ Austrroads 2008, *Guide to Project Evaluation*, Part 4: Project Evaluation Data, p 18, Table 3.2

²⁶ Fowkes, Tony and Whiteing, 2006, *The Value of Freight Travel Time Savings and Reliability Improvements – Recent Evidence from Great Britain*, Institute for Transport Studies, University of Leeds, UK

²⁷ Value of freight travel time in this appraisal is: \$0.78 per tonne hour, or \$6.25/TEU per hour – considering each container freights approximately 8 tonnes per TEU (excluding container weights)

²⁸ Assuming 10 tonnes per TEU including container weights

Savings in train and road operating costs (producer surplus)

The project case will result in reduced tonne kilometres on the road network as well as fewer tonne kilometres of rail travel due to the new rail links providing shorter distances compared to the existing coastal rail link. As a result, this will produce lower operating costs.

For rail users, total resource operating costs include fuel, crew and rollingstock maintenance costs as well as rollingstock depreciation and return on economic capital. These costs are estimated to total at 1.6 cents per ntk for users of Inland Rail. In comparison, resource operating costs for existing rail users of either the coastal railway or other existing rail lines, are estimated at 2.2 cents per ntk. The assumptions to derive these are detailed in the table below, considering other operating cost assumptions in Chapter 9.

Table 3-4 Inland versus coastal railway train operating costs (2010 dollars)

Cost item	Inland railway	Coastal railway	Assumptions
Fuel consumption	3.89 litres per thousand gtk (average north & southbound) (Per train: \$14.05/km \$0.0058/ntk)	4.45 litres per thousand gtk (average north & southbound) (Per train: \$11.82/km \$0.0068/ntk)	<i>Inland</i> – for the 1,731km between Melbourne and Brisbane, each train is estimated to use approximately 3.89 litres of fuel per gtk based on modelling of each track section. This is based on an average north and southbound train carrying 4,370 gt (train load including locomotives). <i>Coastal</i> – the route via Sydney is approximately 1,904km in length. Due to the additional grades and terrain traversed between Cootamundra, Sydney and Maitland, each north and southbound train is likely to average approximately 4.45 L/gtk. This is based on an average of 3,216 gt per train (including locomotives). Assumes each train is fuelled mid way en route and subjected to the same amount of stops even though the route via Sydney is longer with the potential for more delays. Also assumes a resource price for diesel (excluding GST and excise) that was applied to convert to \$/ntk.
Train crew costs *	\$5,945 per Melbourne-Brisbane trip (Per train: \$3.43/km \$0.0014/ntk)	\$8,121 per Melbourne-Brisbane trip (Per train: \$4.27/km \$0.0024/ntk)	<i>Inland</i> –assumes two people per crew, and includes all crew-related costs. <i>Coastal</i> –assumes two people per crew, with costs higher relative to inland railway based on transit time differential.
Rollingstock maintenance - locomotive costs	\$1.36 per km per loco (Per train: \$4.50/km \$0.0019/ntk)	\$1.36 per km per loco (Per train: \$4.50/km \$0.0026/ntk)	<i>Inland</i> – based on the life of a 3,400 kW AC locomotive in service on Interstate Intermodal traffic, covering 250,000 km per year. There are three such locomotives on each reference train. <i>Coastal</i> –assumes there are also three locomotives on each coastal train (assuming more than the current average of around 2.5 as Inland Rail is assumed to commence operations in 10-30 years time).
Rollingstock maintenance - container wagon costs	\$0.05 per km per wagon (Per train: \$3.65/km \$0.0015/ntk)	\$0.05 per km per wagon (Per train: \$3.15/km \$0.0018/ntk)	<i>Inland</i> – for the life of a typical container carrying bogie wagon in service on Interstate Intermodal traffic, covering 125,000 km per year. There are 73 such wagons on each reference train. <i>Coastal</i> – based on information provided by ARTC. Assumes a coastal train comprises 18 generic '5-pack' articulated wagons that carry 10 single-stack TEU. These wagons have 6 bogies whereas each Inland Rail wagon has 2 bogies. To apply the maintenance costs to a comparable wagon type, the number of coastal wagons was adjusted by a factor of (6/2) to reflect this (i.e. suggests 63 coastal wagons on a comparable basis with Inland Rail wagons).
Annual rollingstock depreciation and return on economic capital (economic cost of capital)	\$18,191 per trip (Per train: \$10.51/km \$0.0043/ntk)	\$22,138 per trip (Per train: \$11.63/km \$0.0066/ntk)	<i>Inland</i> – based on indicative capital costs for a new locomotive of \$5.5 million and a new wagon of \$150,000, assuming there are 3 locomotives and 73 wagons per train. Also assumes rollingstock asset life of 20 years and interest rate of 7%. The number of trips travelled per annum was linked to transit time, and assumes faster turnaround time of locos than wagons. <i>Coastal</i> – same cost, interest and depreciation rates, etc. applied, but assumes 3 locomotives and 63 wagons per trip (after adjusting wagon numbers for the number of bogies). The number of trips travelled per annum is lower relative to inland railway due to longer transit time.
Administration and management	Per train: \$3.61/km \$0.0015/ntk	Per train: \$3.54/km \$0.0020/ntk	Assumed to comprise 10% of total costs per ntk for both railways.
Total (exc. profit margin)	\$40/km \$0.0163/ntk \$28/tonne	\$39/km \$0.0222/ntk \$42/tonne	Per ntk cost is applied to ntk demand projections to estimate operating cost savings in the economic appraisal. Per tonne cost is considered in the demand projections as part of freight costs.

* Note: Some costs do not align with those in previous chapters as profit margin has been excluded for the economic appraisal

Note: average load (60% fronthaul and 40% backhaul) assumed in these costs is 2,432 nt/train (payload inc. container weight), 3,968 trailing tonnes/train (trailing tonnes inc. container and wagon but not loco weight) and 4,370 gt/train (train load inc. locos) for the inland railway. For the coastal route, a theoretical train was estimated by ARTC (after coastal route upgrades so with greater tonnage than the current actual average) that averages 1,749 nt, 2,820 trailing tonnes and 3,216 gt. The lower coastal railway load is linked to its single stacked rollingstock and shorter trains compared to double stacked, longer trains assumed on the inland railway.

For diverters from road to Inland Rail, road operating costs were estimated at 4.8 cents per ntk based on RTA literature and certain vehicle mix and tonnage assumptions. For induced rail users, operating costs were captured in the benefit estimating net economic value from induced freight. As such, they were not included in the operating cost estimates in order to avoid double counting.

The resulting costs per ntk were combined with net tonne kilometres to determine how lower operating costs on the new inland railway would benefit:

- existing rail traffic
- diverters from road.

The approach to estimate operating cost savings is based on an assumption that modal shift would be influenced by the travel time (already allowed for in travel time savings) and more particularly by the price. In commercial markets, prices charged reflect full costs, which include taxes. Thus, for commercial freight, it has been assumed that the principal distinction is between financial costs (which drive prices) and resource costs. Unlike public transport evaluations where perceived costs are generally lower than resource costs because of constrained fare settings, commercial freight customers could expect prices to be fully reflected in financial costs. An exception would be the existence of commercial discounts which are often offset by higher prices elsewhere. Overall, these practices are driven by market elasticities and the principle that total revenue should cover total costs. Thus, resource costs essentially are financial costs less taxes.

The operating costs quoted above were for a median train/truck – i.e. a container intermodal train. Operating costs for bulk freight carried by rail are likely to be lower than the equivalent rail container rate whereas bulk road unit operating cost rates are likely to be higher than the equivalent road container rate. Consequently, given the inclusion of bulk products such as coal and grain products in the calculations, the actual net operating cost difference between road and rail could be greater than calculated in the appraisal and may be conservative. This suggests that the operating cost savings for freight customers who switch from road to the inland railway may be higher than currently estimated.

(i) Existing rail traffic (coastal traffic and coastal-Inland Rail diverters)

First, reduced rail operating costs resulting from the project were determined by applying a total resource cost per net tonne kilometre for rail operators. Given that in a commercial freight market, the prices charged are likely to reflect full resource costs including taxes, the operating costs reflect long run financial costs. Our data does not include taxes, but comprise the following resource costs:

- Rollingstock depreciation and return on economic capital
- Basic running costs of the rollingstock, such as fuel, crew wages, repairs and maintenance
- Additional running costs due to significant speed fluctuations
- Additional fuel costs due to stopping and returning to line speed.

Train operating costs of 1.6 cents per ntk for Inland Rail and 2.2 cents per ntk for coastal railway were based on Inland Rail train operations modelling combined with cost modelling by ARTC for trains on the coastal railway. Chapter 9 in the final report provides further detail on how these costs were estimated.

The operating costs per ntk were applied to the rail traffic under the Base Case and project cases to estimate incremental operating cost savings as a result of the project.

*The benefit = (base case train operating cost * the number of rail net tonne kilometres in the base case) - (project case train operating cost * the number of rail net tonne kilometres in the project case).*

(ii) Diverters from road to Inland Rail

As discussed above, Inland Rail will result in freight diverting from road to rail compared with the Base Case. As a result of diverting to Inland Rail, previous road users will benefit from a reduction in vehicle operating costs due to lower train costs per ntk.

Road user vehicle operating costs (VOC) are a function of the length of a journey, traffic volume, vehicle speed, road condition (surface roughness) and characteristics (i.e. gradient and curvature). Total VOC are comprised of:

- Basic running costs (fixed and operational) of the vehicle, such as depreciation, fuel, repairs and maintenance
- Additional running costs due to road surface
- Additional running costs due to any significant speed fluctuations from free-flow speed
- Additional fuel costs due to stopping, such as queuing at traffic signals.

For road-rail diverters, road operating costs were estimated at 4.8 cents per ntk based on RTA literature, combined with vehicle mix and tonnage assumptions. More specifically, the resource cost correction is based on RTA literature for 6-axle articulated and B-Double VOCs including fuel per kilometre. Then the costs were converted to net tonne kilometres based on an average load per trip for articulated and B-Double vehicles. The 6-axle truck and B-Double figures were then weighted based on a vehicle composition assumption of 60% and 40% respectively, to derive a weighted resource VOC of 4.8 cents per net tonne km. These costs reflect the total resource cost for road freight.

*The benefit = (the number of road-rail diverted net tonne kilometres induced to rail with the project case) * (road operating cost – inland rail operating cost).*

For induced rail users, operating costs were captured in the benefit estimating net economic value from induced freight, so were not included in the operating cost estimates in order to avoid double counting.

A possible consideration in estimating train operating costs is that different train loads for backhaul are likely to result in lower operating costs per kilometre for southern compared to northern flows of freight. For example, approximately 60% of current Melbourne-Brisbane freight is estimated to flow north from Melbourne to Brisbane. However, as the demand forecasts reflect the different directional flows, and as it has not been possible to establish definitively the proportion of operating costs that would vary with different utilisation, this appraisal reflects average loads and costs per ntk.

Net economic value from induced freight (Producer surplus)

The ACIL Tasman demand projections have identified a segment of demand that will be induced if the inland railway is constructed, i.e. that is not diverted but is totally new traffic that emerges exclusively because of the project. This freight comprises a relatively minor proportion of total rail demand (averaging 7% per annum of total net tonne kilometres estimated to travel on rail under the Inland Rail scenario).

As Inland Rail is estimated to induce new freight volumes, it is expected that there will be an economic benefit for the producers of this freight, otherwise such traffic would not materialise. This implies that:

- **In the Base Case** – the gross value of the products, less production and transport, results in a negative outcome, hence these producers do not transport their products; and
- **In the scenario with Inland Rail** – transport costs can be assumed to have fallen as this is the only component likely to have changed as a result of Inland Rail. This can be assumed to result in the gross value of the product, less production and transport costs, becoming a positive number due to Inland Rail.

In order to incorporate the producer surplus from the net economic value of induced products into the appraisal, it has been assumed that 20% of the inland railway train operating costs of 1.6 cents per represent the value of these products.

Table 3-5 below presents a sample of outcomes possible for the net economic value when comparing against a base case characterised by unviable production as a result of Base Case transport costs. The 20% assumption was selected as a conservative estimate considering these and further examples.

Table 3-5 Examples of net outcome as a proportion of transport costs

Cost item	Example 1		Example 2		Example 3	
	Base case	Project case	Base case	Project case	Base case	Project case
Gross value of production	100	100	100	100	100	100
Production cost	70	70	90	90	85	85
Transport cost	40	17.5	20	8.8	25	11.0
Net outcome	- 10	12.5	- 10	1.2	- 10	4.0
Net outcome as a % transport cost		71%		14%		37%

Based on the approach discussed above, the formula below was applied to demand to estimate the net economic value of induced freight:

$$\text{The benefit} = 20\% * (\text{inland railway operating cost per net tonne kilometre}) * (\text{the number of net tonne kilometres attributable to freight induced as a result of Inland Rail}).$$

Reliability improvement for freight customers (consumer surplus)

Reliability is defined as the percentage of trains that arrive and exit within 15 minutes of the scheduled arrival/departure time. The inland railway is expected to provide a service that is more reliable than the more congested coastal railway, but less reliable than on road. The proportion of services arriving within 15 minutes of schedule is assumed to be 87.5% on the inland railway, 77% on the coastal railway and 98% on road.

To value the reliability effect, intercapital demand for the three freight options was modelled with all other characteristics held constant, and the resulting changes in market shares, compared with the Base Case, were calculated. Then reliability was set at the same level for all three alternatives, and the price changes needed to achieve the market shares were estimated. The resulting values (\$4.80/tonne for a 77-87.5% increase, and \$-4.80/tonne for a 98-87.5% decrease) were then applied to tonnage projections for Inland Rail users that have diverted from road and the coastal route. For diverted freight traffic, the rule of half convention for determining consumer surplus changes for diverted or generated traffic is applied and as such the rule of half was applied to this benefit.

Savings in crash costs (externality benefit)

As the project case is estimated to result in reduced freight vehicle kilometres on the road network, and data indicate that there are reduced fatalities on rail compared to road, it is expected that the project case will result in road crash cost savings. These road crash cost savings are offset by any induced trips to rail in the project case, which result in positive crash costs.

Booz Allen Hamilton estimated crash costs for road and rail per net tonne kilometre, which indicates that there are cost savings on rail freight compared to road freight. These values (inflated from 2001 to 2010 dollars) are 0.41 cents per ntk for road and 0.04 cents per ntk for rail.²⁹

Existing and induced rail net tonne kilometres are multiplied by rail crash costs, and road freight net tonne kilometres were combined with the road crash costs to estimated net project case crash costs incremental to the Base Case.

Reduced externalities

As with accident costs, reduced road freight vehicle kilometres resulting from Inland Rail will result a net reduction in externalities (road externalities being higher than rail externalities).

In order to measure these impacts, unit parameter values for a range of impacts were applied to the change in road and rail ntk. These values are based on the ATC National Guidelines, inflated from 2005 to 2010 dollars as summarised in the table below.

Table 3-6 Unit externality parameter values (2010 dollars)

Externality	Road freight (cents per net tonne kilometre)			Rail freight (cents per net tonne kilometre)		
	Urban	Rural	Weighted average	Urban	Rural	Weighted average
Air pollution	1.09	0.01	0.12	0.37	0.00	0.04
Greenhouse gas	0.08	0.08	0.08	0.03	0.03	0.03
Noise	0.29	0.03	0.06	0.16	0.02	0.03
Water	0.11	0.07	0.07	0.01	0.01	0.01
Nature & landscape	0.29	0.12	0.14	0.09	0.03	0.04
Urban separation	0.25	-	0.02	0.09	-	0.01
Total			0.49			0.16

Source: Provided by the Northern Sydney Freight Corridor project team (based on ATC 2005 Guidelines, with rural rail values derived from the urban rail estimates based on the same proportionate difference between road rural and urban)

Note: average values assume 10% urban and 90% rural travel

²⁹ Booz Allen Hamilton (BAH) 2001, cited in Freight Australia 2003, The Future of Rail Freight Services in Victoria: a proposal to the Government of Victoria from Freight Australia, 21 March 2003.

Reduced rail maintenance costs

As the CBA incorporates ongoing rail maintenance, it is relevant to also consider any change in road maintenance costs in the appraisal. This benefit measures both the reduction in maintenance from freight diverting from road to rail, but also captures the increase in maintenance from the pick up and delivery component relating to induced freight.

(i) Saving in coastal and other country railway line maintenance expenditure

As the existing railway lines between Stockinbingal to Narromine, and Narrabri to North Star will become part of the inland railway, ARTC and Rail Infrastructure Corporation (RIC) are expected to save fixed and reactive maintenance costs on these lines. In addition, from Newcastle to the Queensland border and Macarthur to Illabo, ARTC is expected to save a proportion of maintenance, linked to the diversion of Melbourne-Brisbane freight from the coastal to the inland railway. It has been assumed this results in a 20% saving in maintenance costs, given Melbourne-Brisbane freight comprises approximately 28% of total coastal railway freight. These savings are likely to be conservative as the analysis did not take account of maintenance savings on the RailCorp network due to the diverted Melbourne-Brisbane freight.

(ii) Saving in Toowoomba Range crossing maintenance expenditure

Benefits of diverting freight away from passenger services (Rosewood-Corinda)

The Queensland Department of Transport and Main Roads indicates there are likely to be benefits if freight is diverted away from passenger services (between Rosewood and Corinda), as would be possible with Inland Rail. While some rail freight would continue to use the line between Rosewood and Corinda (e.g. coal for Swanbank power station near Ipswich, until it is expected to close in 2017), it is estimated that some QR maintenance costs could be avoided by closing the existing Toowoomba Range crossing. Current estimates provided by the department are \$50 million over 7 years (averaging \$7.2 million pa) covering routine maintenance (sleepers, ballast, track, structures etc). In addition, one-off projects that arise from time to time could be avoided (e.g. for stabilisation works or responses to unforeseen events such as derailments and weather events).³⁰

Reduced road decongestion costs

The increase in truck movements in intrastate corridors can increase travel time and other costs imposed on road users. As this is likely to be considered more significant in urban areas, the appraisal only captures road decongestion for urban roads.

Reduced road maintenance costs

The shift of some road freight onto rail as a result of Inland Rail is expected to be reflected in reduced road maintenance. As the CBA incorporated ongoing rail maintenance, it is also relevant to consider any change in road maintenance costs in the appraisal.

BAH estimate road maintenance costs of 0.8 cents per ntk for road freight (inflated from 2001 to 2010 dollars).

³⁰ Queensland Department of Transport and Main Roads 2009, meetings and communications with the Inland Rail Study team during 2009

Residual value

For the Inland Rail scenario as well as the Base Case, a residual value is assigned to the key components of fixed infrastructure, rollingstock and land with economic lives which extend beyond the final year of the evaluation period.

For this reason the economic appraisal includes the residual values of rail assets. The residual value reflects the fact that some assets may have economic lives that extend beyond the evaluation period.³¹ Each asset item is depreciated on a straight line basis to determine the incremental residual value based on construction year, and residual values are entered in the last year of the evaluation period (2070) to represent the unused portion of assets that have lives greater than the evaluation period.

3.1.7 Economic costs

The economic costs incorporated in the appraisal include:

- Capital costs for the inland and coastal railways (as per LTC estimates presented in Chapter 7)
- Below rail operating costs (as per LTC estimates presented in Chapter 8)
- Track maintenance costs (as per LTC estimates presented in Chapter 9).

In the economic appraisal the profit margin was removed from financial costs to reflect resource costs. Road maintenance cost savings, and train and road vehicle operating cost savings were incorporated as benefits.

3.2 Economic assumptions

The general assumptions used in this economic appraisal are presented in the table below.

Table 3-7 Economic appraisal parameters (2010 dollars)

Item	Assumption	Notes
Freight value of travel time	\$0.79 per tonne hour	Source: ABS, Austroads and NSW RTA parameters and compositions Weighted for urban and non-urban assuming 10% of the trip is in urban areas
Train operating costs	Inland railway 1.6 cents/ntk (resource cost) Coastal railway 2.2 cents/ntk (resource cost)	Source for inland railway basis: LTC estimates Source for coastal railway basis: comparison of route and train differences to adjust LTC estimates, combined with ARTC train operating assumptions See Chapter 9 and Table 5
Road operating costs	Road (resource cost) 4.8 cents/ntk	Source: RTA parameters This parameter was applied to freight travelling on road from Melbourne to Brisbane, as well as ntk associated with road pick up and delivery of freight transported terminal-to-terminal by rail
Net economic value from induced freight	0.3 cents/ntk	It has been assumed that the gross value of induced products less production and transport costs is equivalent to 20% of the inland railway operating costs

³¹ Assets assumed to have a useful life are: land, earthworks, bridges, culverts, viaducts and tunnels.

Item	Assumption	Notes
Reliability improvement	\$4.80/tonne for 77-87.5% increase \$4.80/tonne for 98-87.5% decrease	Source: ACIL Tasman logit model estimate, testing change in freight cost to provide same change in reliability which was applied to tonnage projections. This modelling suggested the value of reliability is higher for Melbourne-Brisbane freight (\$5.60/tonne) than Brisbane-Melbourne (\$2.80/tonne)
Crash costs	Road crash costs 0.41 cents/ntk Rail crash costs 0.04 cents/ntk	Source: Booz Allen Hamilton (BAH) 2001 rate inflated to 2010 dollars
Externalities (air pollution, greenhouse gas, noise, water, nature and landscape and urban separation)	Road externality costs 0.5 cents/ntk Rail externality costs 0.2 cents /ntk	Source: SAHA 2009, based on ATC guidelines inflated to 2010 dollars Weighted for urban and non-urban assuming 10% of the trip is in urban areas
Reduced road congestion costs	Road congestion costs 0.1 cents/ntk	Source: BAH 2001 rate inflated to 2010dollars
Reduced road maintenance costs	Road maintenance costs 0.8 cents/ntk	Source: BAH 2001 rate inflated to 2010 dollars

4. Sensitivity tests

4.1 Sensitivity analysis

A range of sensitivity tests have been performed on the financial and economic results to test key assumptions. Sensitivity tests 1-7 are based on the Infrastructure Australia guidelines contained in *Reform and Investment Framework: Templates for use by proponents - Templates for Stage 7* (released October 2009). Others have been presented to reflect adjustments to key assumptions. These tests include:

1. *Core appraisal* - 16.6% financial pre-tax, nominal discount rate / 7% economic real discount rate
2. *Discount rate reduced* - 14.6% (financial) and 4% (economic)
3. *Discount rate increased* - 18.6% (financial) and 10% (economic)
4. *Demand reduced by 30%*
5. *Demand increased by 30%*
6. *Capital costs decreased by 30%*
7. *Capital costs increased by 30%*
8. *Coastal route considered to be unconstrained in the Base Case* – the core analysis assumes that there will be capacity constraints on the coastal route in the Base Case (reaching a practical capacity at 18 intermodal train paths per direction per day around 2052)³² This sensitivity test assumes that capacity will not be reached on the coastal railway, and that any required capital expenditure will occur to ensure this continues to be the case.
9. *Demand with more sensitive elasticity assumptions* – this sensitivity applies ARTC elasticity assumptions more sensitive than those obtained from ACIL Tasman freight customer surveys. In the core appraisal, the demand model uses elasticities obtained from ACIL Tasman surveys of freight customers, potential customers and freight forwarders (as described in Chapter 3 in the Final Report). Following ARTC and industry feedback, this sensitivity assesses the impact on Inland Rail viability when more sensitive ARTC elasticity assumptions are applied to the demand model (which result in demand being more sensitive to service and price characteristics (see Box 8 in the Final Report)).³³ As an indication of the impact on demand in the Melbourne-Brisbane corridor, more sensitive elasticity assumptions result in a practical capacity limit being reached on the coastal railway in 2042 as opposed to 2052 in the core demand.
10. *Alternative access prices for intercapital freight* – to compare against assuming similar charges as the coastal railway, this test applies a higher Inland Rail intercapital price (128% higher) estimated to deliver the greatest revenue allowing for an offset in demand. In the core demand appraisal, it has been assumed that Inland Rail access prices for non-bulk freight are similar to those charged on the coastal railway. However there may be some scope to increase Inland Rail prices as, up to a point, higher prices can be charged because Inland Rail offers reliability and transit times that are superior to

³² Provided by the Northern Sydney Freight Corridor project team.

³³ This more optimistic demand scenario is more consistent with the analysis provided by the Northern Sydney Freight Corridor project team (See Box 10 in the Final Report for further detail on the Northern Sydney Freight Corridor Program economic appraisal.)

the coastal railway. Above that point, the revenue gains from the higher price are more than offset by loss of tonnage demand to the cheaper coastal railway, or to road. ACIL Tasman has estimated the intercapital access price that delivers the greatest revenue (allowing for demand responses) is a 128% increase in the non-bulk access price (see Box 8 in the Final Report). The resulting demand and revenue impacts from the higher access price are assessed in this sensitivity test.

11. *Alternative rail access price based on road/rail access price analysis* – the issue of road and rail freight access pricing to achieve cost recovery and competitive neutrality has been a topic of debate and several public enquiries. This body of previous analysis has been reviewed in order to assess potential for reform of road and rail access process and how this may impact on the financial and economic viability of Inland Rail. Three sensitivity tests have been performed with varying pricing assumptions for road and rail:
 - a. Road pricing based on DORC values/ Rail pricing as status quo - a fundamental shift of road pricing involves pricing road on the basis of DORC values, assuming the current allocation of costs to heavy vehicles. Assumes rail under the current regime
 - b. Road pricing based on PAYGO with higher heavy vehicle cost allocation / Rail pricing based on current ARTC access charges - assumes adaptations to current road PAYGO, increasing heavy vehicle cost allocation (34.5% compared to current 23.3% for the Melbourne-Brisbane road network)
 - c. Road pricing based on DORC/ Rail pricing on DORC including a return on contributed assets - a more equal pricing regime. Assumes road user charges based on DORC and current NTC allocation of costs to heavy vehicles, and rail access charges based on DORC including a return on contributed assets
12. *High oil price* - an oil price of US\$200/barrel is assumed in comparison to US\$120 in the core appraisal. An increase in fuel prices affects road freight more than rail freight
13. *Change in GDP growth*
 - a. High GDP - core appraisal assumes low GDP growth in 2010 and 2011, moving up to 3.1% pa from 2013. This scenario tested GDP growth of 3.6% pa from 2013 onwards.
 - b. Low GDP - this scenario tests lower GDP growth forecasts of 2.6% pa from 2013 onwards.

