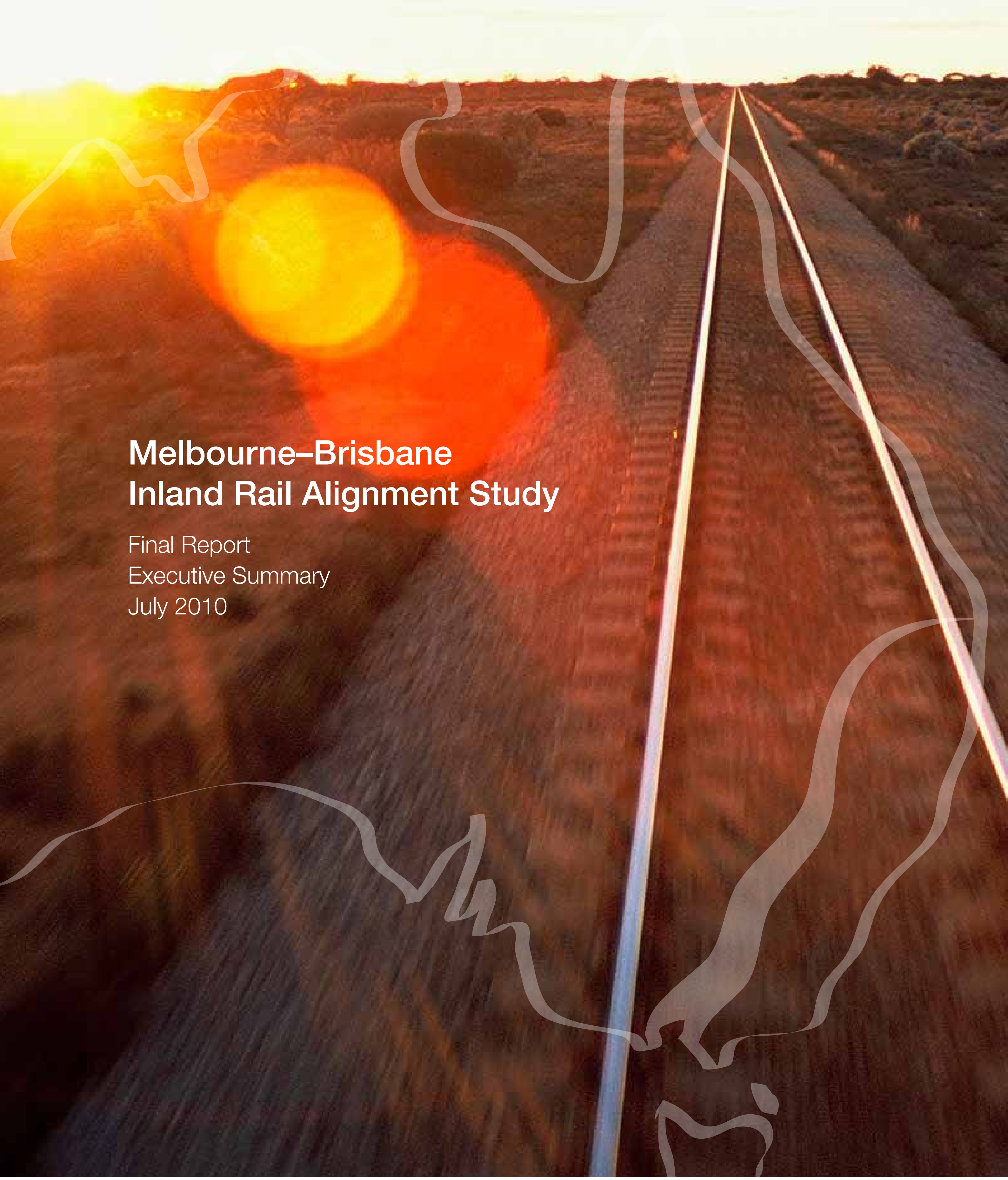

Melbourne–Brisbane Inland Rail Alignment Study

Final Report
Executive Summary
July 2010

ARTC

ACIL Tasman

aurecon

Halcrow

PARSONS BRINCKERHOFF

PRICEWATERHOUSECOOPERS

Melbourne–Brisbane Inland Rail Alignment Study

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Photos in this report are included only as illustrations.
They do not imply that operating companies whose trains are depicted would use the inland railway.

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Key points

At present, the only north-south rail corridor in eastern Australia runs from Melbourne to Albury and then to Sydney, then generally along the coastline to Brisbane.

An inland route from Victoria through central and north west of New South Wales then into Queensland (through the towns of Albury, Parkes, Narromine, Narrabri, Moree and Toowoomba) has the potential to reduce the time it takes to move freight from Melbourne to Brisbane by rail, and to increase the capacity of freight rail paths between the two cities.

To determine the optimum alignment as well as the economic benefits and likely commercial success of an inland route, this study (the Inland Rail Alignment Study) was announced by Minister for Infrastructure, Transport, Regional Development and Local Government, the Hon Anthony Albanese MP on 28 March 2008.

This report presents an analysis of Inland Rail, considering:

- Expected demand for an inland railway
- Route alignment and cost/operational options
- Financial and economic viability.

The analysis indicates:

- **There is demand for the railway** that would result in a freeing of capacity through Sydney (removing 5 northbound Melbourne–Brisbane services per day from the existing coastal railway by 2030 and around 10 by 2050), with a portion of freight continuing to need and use the coastal railway
- After analysing a number of different alignments, representing over 50,000 alternatives between Melbourne and Brisbane, **a route has been identified that can achieve an average Melbourne–Brisbane transit time (terminal-to-terminal) of 20 hours and 30 minutes over a distance of 1,731 kilometres**; approximately 65% using existing corridors
- This alignment is estimated to **provide freight in the Melbourne–Brisbane corridor with a rail option that is 7 hours faster and around 170 kilometres shorter than the existing coastal railway.** It is also expected to be more competitive on transit time, reliability, availability and, in particular, door-to-door freight prices, relative to road transport using the Newell Highway
- The outturn capital cost for this route and alignment is estimated to be **$4.7 billion** (P90 estimate), and it is estimated to require 3 years of pre-construction activities (including preliminary design, approvals, tender and award period, and land acquisition) followed by a 5 year construction period
- Most new long distance highways and general freight railways require a significant **capital contribution or service payment** in order for the infrastructure to be developed and commissioned. This study suggests the inland railway has the same requirement: financial assessment prepared from the point of view of a track operator suggests Inland Rail is not viable on a purely commercial, standalone basis without some form of government or external financial support
- From the broader point of view of rail users and the wider community, economic analysis suggests Inland Rail will achieve a **positive economic net present value at a 7% real discount rate when operations commence between 2030 and 2035**, – or when total tonnage demanding the railway is 25–26 million tonnes per annum (inclusive of container, coal and other freight). If demand volumes are stronger than the ACIL Tasman forecasts, economic viability could be reached sooner.

Consequently, it would be appropriate **to re-examine the project between about 2015 and 2020, or when tonnage approaches the level identified** (and after results of initial coastal railway upgrades can be assessed in terms of actual levels of capacity, reliability and demand growth achieved).

With the prospect that Inland Rail will in time be economically viable, consideration should be given in the meantime to **whether steps need to be taken by governments to reserve and protect the alignment** so that it is available if the railway is eventually built.

Executive summary

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.

At present, the only north-south rail corridor in eastern Australia runs from Melbourne to Albury and then to Sydney, then generally along the coastline to Brisbane. An inland route through central and north west of New South Wales has the potential to:

- Reduce the time it takes to move freight from Melbourne to Brisbane by rail
- Improve other rail performance aspects including reliability, availability and route distance for freight in the far western sub-corridor
- Increase the capacity of freight rail paths between the two cities (removing five northbound Melbourne–Brisbane services from the coastal railway by 2030 and around 28 by 2040), which could subsequently increase service performance on the coastal route for freight and passengers.

The Australian Government asked the Australian Rail Track Corporation (ARTC) to conduct the study. ARTC specified and co-ordinated the study's activities which were headed by two lead consultants: Parsons Brinckerhoff (PB) and PricewaterhouseCoopers (PwC). PB engaged Halcrow to support it in alignment development, operations and maintenance costing, Aurecon to support it in engineering and alignment development, Currie and Brown to assist in capital costing and Davidson Transport Consulting for peer review. PwC engaged ACIL Tasman to undertake volume and demand analysis and support it in economic review, and SAHA for peer review. ARTC staff assisted the study through the provision and review of information.

Study objectives

The terms of reference required the study team to determine:

- The optimum alignment of the inland railway, considering user requirements and economic, engineering, statutory planning and environmental constraints
- The likely order of construction costs
- The likely order of below rail (infrastructure) operating and maintenance costs
- Above rail operational benefits
- The level and degree of certainty of market take up of the alignment
- A project development and delivery timetable
- A basis for evaluating the level of private sector support for the project.

In developing a detailed route alignment between Melbourne and Brisbane, the terms of reference for the study specified that it should follow the far western sub-corridor identified by the September 2006 North-South Rail Corridor Study. That initial study in 2006 undertook a high level analysis of the various corridors and routes that had been proposed for an inland railway between Melbourne and Brisbane.

BOX 1 Inland Rail and inland railway

Throughout this report, engineering and other references to the physical railway line are termed the 'inland railway'. The potential business (i.e. the business concept) of financing and operating the railway is referred to in this report as 'Inland Rail'.

Approach to the study

The study has involved preparation of a series of working papers covering route options, costs, standards, environmental impacts, land requirements, finance and economics. These working papers culminated in this report, which is based on a combination of market, technical and economic modules (as presented in Figure 1). Although the figure below suggests a staged process, significant interaction and refinement occurred between the modules during the course of the study.

Market take up

ACIL Tasman conducted an analysis of market take up for an inland railway from Melbourne to Brisbane, along the far western sub-corridor. The demand assessment involved surveys, based on a questionnaire and interviews, of key freight companies and customers to understand how modal choices are made. Then, incorporating assumptions for expected future journey time reliability and capacity of the current rail route and potential inland railway route, a logit model was developed. The model was linked to forecasts of price, reliability, availability and transit time that reflect the capital costs assumed on the coastal and inland railways. It was used to estimate future mode shares and future rail tonnages with and without Inland Rail. Additional analysis was undertaken of coal, grain and other regional freight.

The analysis assessed demand for the inland railway comparing three different years for commencement of operations: 2020, 2030 and 2040. It also assessed the movement of freight along the Melbourne–Brisbane corridor with and without Inland Rail.

Key findings of the demand analysis include the following:

- By 2050, an inland railway and the existing coastal railway are estimated to carry 74% of intercapital road and rail freight in the Melbourne–Brisbane corridor (by tonnes). This is an increase from the current 30% rail share in the corridor. Without Inland Rail, the rail mode share is forecast to be 67% in 2050
- Nearly all of the 74% rail share of freight in the corridor is estimated to be carried by Inland Rail by 2050. This amounts to around 73% of total road and rail freight that is carried on Inland Rail
- The inland railway was found to induce or divert some freight. This comprised substantial quantities of coal freight over short distances; grain from other rail routes and from road; regional freight and freight from outside the inland railway corridor.

Estimates of the market take up of the inland railway are shown below.

FIGURE 1 Study approach

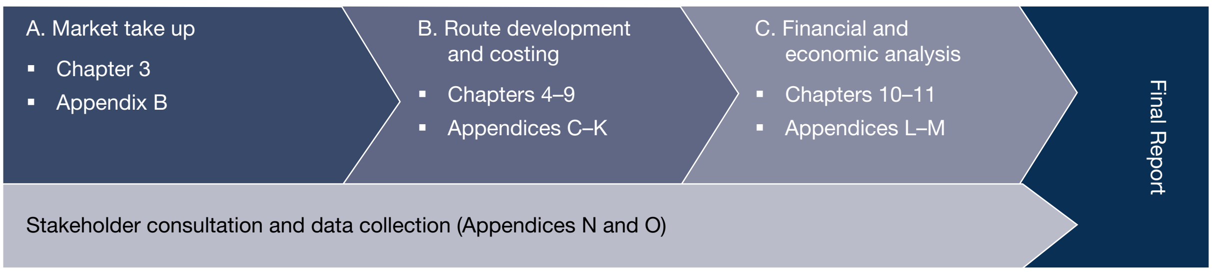


TABLE 1 Forecast north and southbound tonnes on the inland railway (assuming commencement in 2020) – thousand tonnes

'000 tonnes	2020	2030	2040	2050	2060	2070	2080
Intercapital container freight (Melbourne–Brisbane)	1,386	6,051	8,684	12,399	17,543	24,497	33,613
Extra-corridor container freight (Northern Queensland–Melbourne, Adelaide–Brisbane and Perth–Brisbane)	1,054	1,709	2,332	3,192	4,375	5,998	8,236
Induced coal and minerals	10,000	10,250	9,500	9,500	9,500	9,500	9,500
Agricultural and other products diverted from road	720	1,369	1,701	2,115	2,629	3,268	4,063
Agricultural products, coal and minerals diverted from other rail (e.g. branch line, not coastal)	5,542	6,026	6,154	6,313	6,511	6,757	7,063
Regional agricultural products	156	194	241	299	372	463	575
Total	**18,858**	**25,598**	**28,613**	**33,818**	**40,930**	**50,483**	**63,049**

Note: Inland Rail is estimated to achieve economic viability between 2030 and 2035, when total tonnage reaches between 25 and 26 mtpa–depending when it is constructed and the year it then commences operations (see further write-up below in 'Economic analysis'). Ramp up of demand has been assumed in the first three years of Inland Rail operation.

As intercapital freight is more readily comparable, the table below presents intercapital freight demand if there is no Inland Rail (the Base Case) and under a scenario with Inland Rail.

TABLE 2 Forecast intercapital tonnes (Melbourne to Brisbane north and southbound) – thousand tonnes

Scenario	Mode	2010	2020	2030	2040	2050	2060	2070	2080
Base case (no Inland Rail)	**Grand total**	3,519	4,717	6,330	8,421	11,139	14,663	19,201	24,978
	Inland	-	-	-	-	-	-	-	-
	Coastal	1,314	2,629	3,818	5,489	7,878	8,525	7,089	5,083
	Road	2,205	2,088	2,513	2,931	3,261	6,137	12,112	19,895
Inland Rail (assuming operations commence 2020)	**Grand total**	5,335	7,158	9,807	13,076	17,315	22,776	29,751	38,540
	Inland	-	1,386	6,051	8,684	12,399	17,543	24,497	33,613
	Coastal	1,805	2,474	107	136	169	204	239	269
	Road	3,530	3,298	3,649	4,256	4,747	5,030	5,016	4,658

The optimum route

The proposed inland railway comprises a 1,731 kilometre (km) long alignment between South Dynon in Melbourne and Acacia Ridge in Brisbane. Between Melbourne and Parkes, 670 km of existing Class 1 track will be used. On this section, a 37 km greenfield section from Illabo to Stockinbingal is proposed to bypass the Bethungra spiral and Cootamundra. Between Parkes and North Star, 307 km of upgraded track and 291 km of greenfield alignment is proposed. Between North Star and Acacia Ridge the inland railway comprises 271 km of greenfield construction, 119 km of existing track upgraded from narrow gauge to dual gauge and 36 km of the existing coastal route. The most significant natural features along the alignment are between Toowoomba and Kagaru.

TABLE 3 The optimum inland railway route

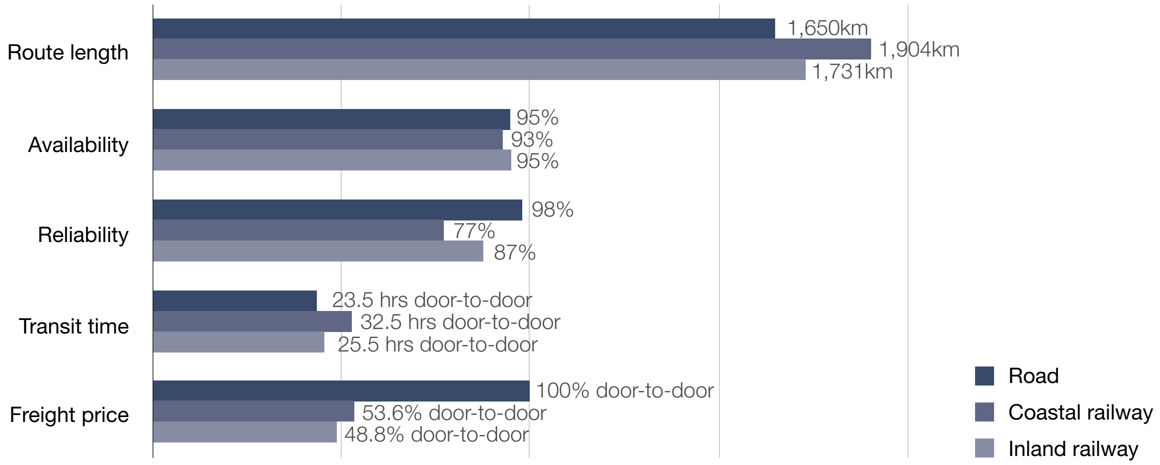
Corridor	Route distance (km)	Transit time (hours)	Capital cost ($ billion, inc. contingency, undiscounted, real)
Existing corridor from Melbourne to Narromine (with new route from Illabo to Stockinbingal), new route to Narrabri, upgraded track to North Star, new track and upgrading existing narrow gauge track to Kagaru and the existing corridor to Acacia Ridge	1,731	20.5 (terminal-terminal) (25.5 hours door-to-door)	$4.42 (P50) $4.70 (P90)

Note: P50 is a probabilistic estimate that indicates the project will have a 50% chance of costing this value or less, and P90 indicates that the project will have a 90% chance or costing this value or less. Greater explanation of Probabilistic Risk Estimating is provided in Chapter 7.

The inland railway is estimated to require 3 years of pre-construction activities (including preliminary design, approvals, tender and award period, land acquisition, etc.) followed by a 5 year construction period.

The optimum inland railway route and its key performance characteristics are compared below with the existing coastal railway and with road between Melbourne and Brisbane.

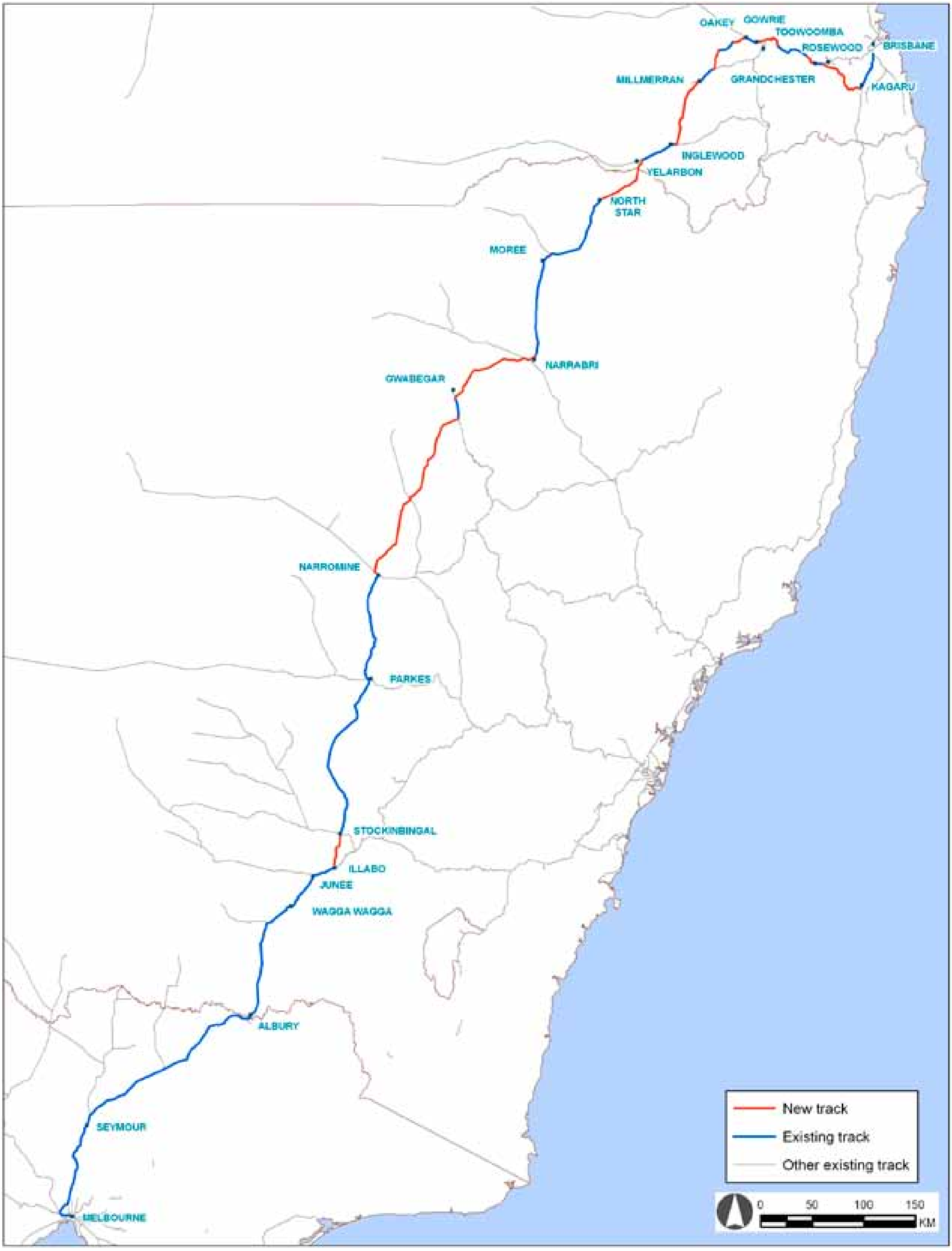
FIGURE 2 Characteristics of the Melbourne–Brisbane road and rail intermodal freight market



Note: This chart is illustrative only and is not to scale.
Availability refers to services available with departure and arrival times that are convenient for customers, dependent on cut-off and transit times. Reliability refers to the percentage of trains that arrive within 15 minutes of the scheduled arrival/departure time. These characteristics are explained in further detail in Chapter 3.

The proposed route of the inland railway is presented in Figure 3.

FIGURE 3 Proposed route of the inland railway



Financial and economic analysis

The demand projections and the economic and financial appraisals presented in this report have addressed the following scenarios:

- **Base Case scenario** – this assumed there is no inland railway and freight is transported by road or existing rail lines. Also assumed that upgrades currently planned for the existing coastal railway proceed, and the Newell Highway would be upgraded to maintain capacity and performance levels
- **Inland Rail project scenario** – this assumed the inland railway is built with a route length of 1,731 km and a terminal-to-terminal transit time of 20.5 hours. The Inland Rail project scenario also assumed that upgrades to the coastal railway and the Newell Highway would proceed in line with the Base Case.

Financial analysis

The inland railway was assessed financially to examine viability from the perspective of the railway owner/operator. The analysis did not specify whether the track operator/owner is private or public, but sought to evaluate the project on a standalone basis (i.e. assuming it is a separate entity not receiving government or other financial support).

A further assumption of the analysis is that while the inland railway is 1,731 km between South Dynon and Acacia Ridge, the Inland Rail business is assumed to comprise 1,220 km between Illabo and Kagaru (as South Dynon–Illabo and Kagaru–Acacia Ridge form part of the existing coastal railway operated by ARTC).

Financial analysis of the Inland Rail business was undertaken on a forecast cash flow basis, using annual periods and nominal dollar forecasts. The terms of reference for this project, included in Chapter 1, focus on a project-specific study of Inland Rail. As a result, the analysis was based on Inland Rail's financial feasibility, and did not consider losses to ARTC resulting from a reduction of coastal railway freight, nor a detailed financial appraisal of both lines concurrently. Furthermore, the analytical framework adopted focused on project cash flows from the perspective of an Inland Rail track operator, and excluded financing cash flows as they will vary depending on the financing structure.

Key findings of the financial appraisal are:

- Without identifying substantial new demand over and above ACIL Tasman forecasts, Inland Rail does not appear financially viable on a purely commercial, standalone commercial basis – i.e. without some for of government or external financial support
- The financial unviability of Inland Rail can be attributed to a deficiency in below-rail revenue relative to the significant capital outlay required for construction of the railway. The project has positive operational cash flows if capital costs are excluded
- Inland Rail has better financial performance by delaying its operation for 10 or 20 years as demand for the railway increases over time. In addition to higher demand in later years, improved results arising from a delay in the commencement of operations are also affected by the discounting of costs over a longer period.

The results are presented below in Table 4.

TABLE 4 Financial – summary of appraisal results ($ million, 2010 dollars, discounted, pre tax nominal cash flows excluding financing costs)

Government D&C (present value)	Year in which Inland Rail operations commence:		
	2020	2030	2040
Capital cost	-2,112	-705	-235
Below rail operating revenue	260	96	34
Below rail operating cost	-75	-26	-8
Project NPV – operating cashflows only (excluding capital costs)	185	71	26
Project NPV – total project cashflows	**-1,927**	**-634**	**-209**

Note: Excludes financing cost (debt and equity) as it is conducted from a 'project' perspective. Analysis has not specified whether the track operator/owner is private or public. Figures in this table may not total due to rounding.

The negative project net present value (NPV) in Table 4 should not be interpreted as a proxy for an inland railway subsidy requirement. Possible subsidy requirements will be greater due to interest payments, required return on equity and other financing costs.

Private sector involvement in the inland railway project could include:

- Construction
- Design
- Maintenance
- Financing
- Below rail operation
- Train operation/maintenance.

Because the project will not be economically or financially viable for some time it is inappropriate to propose an optimal strategy for delivery and operation of the railway until closer to that time. Approaches for private and public sector partnership change over time, and are likely to be different in 2020 or 2030 compared with today. While there is likely to be private sector interest in a design and construct (D&C) arrangement, the market appetite for privately financed project (PFP) options involving private sector demand risk in 10–30 years could be gauged more readily through market testing closer to that time. As the project is never financially viable on a standalone basis with no external financial support, the financial appraisal is not specific to either private or public sector delivery/financing/operation. In particular, financing costs have been excluded as these are affected to a large extent by the level of private sector involvement.

Chapter 10 of this report presents a basis for evaluating options for private sector involvement in the project.

Economic analysis

In contrast to the financial appraisal that assessed the project from the perspective of the railway owner/operator, the economic appraisal assessed the total costs and benefits of the project from the perspective of the broader community. As such, the economic appraisal has been completed from a national perspective, including costs and benefits accruing to likely users and non-users of Inland Rail. It was undertaken using a cost benefit analysis (CBA) framework that captured benefits such as freight time savings to end customers, train operator and road freight cost savings, improved reliability, producer surplus from induced freight, road maintenance savings and environmental externality cost savings resulting from development of the inland railway.

The economic analysis compared a scenario where there is an inland railway with a 'without Inland Rail' Base Case. This established the net economic benefits to the community that could be expected from the proposed railway. The Base Case scenario assumed that road and rail freight would continue using existing infrastructure, that is, existing roads and the coastal railway. Under both the Base Case and the scenario with an inland railway, it is assumed that ARTC's planned upgrades on the coastal railway between 2010 and 2070 will take place (described further in Chapter 11), which includes:

- Stage 1 of the proposed Northern Sydney Freight Corridor works ($840 million) as a committed funding agreement exists between the NSW and Australian governments for this stage
- 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
- Other north-south projects announced for Federal Government investment in the May 2010 Budget: easing tight curves at sites on the North Coast, passing loops on the double-track between Yass and Southern Sydney, and rerailing Albury–Melbourne–Geelong.

Key findings of the appraisal:

- Inland Rail does not achieve a positive economic NPV for operations commencing in 2020 (at a 7% real discount rate)
- If demand volumes are stronger, then viability would be reached sooner. This is estimated to be when total freight carried by Inland Rail is 25–26 million tonnes per annum (mtpa),[1] indicating viability could be achieved when operations commence between 2030 and 2035 based on the demand estimates developed as part of this study. This is achieved when intercapital container freight (including Perth and Adelaide–Brisbane tonnage) using both the coastal route and Inland Rail rises to more than 10 mtpa.

Because the study focused on Melbourne–Brisbane rather than Melbourne–Sydney and Sydney–Brisbane freight demand, it may understate the benefits arising from an inland railway, outside the far western sub-corridor. These benefits could include increased reliability and transit time for passenger and freight services through Sydney due to the transfer of nearly all Melbourne–Brisbane train movements to Inland Rail.

[1] This tonnage estimate comprises container, coal, and other freight carried from Melbourne to Brisbane as well as other origins and destinations along the corridor (see Table 1 split of each source of freight).

TABLE 5 Economic – summary of appraisal results ($ million, discounted, 2010 dollars)

Economic indicator	Year in which Inland Rail operations commence: 2020	2030	2040
Tonnage in first year of operation (mtpa)	18.9	25.6	28.6
Tonnage required in year 1 to achieve viability		25–26	
Economic NPV	-533	-45	138
Economic Benefit Cost Ratio (BCR)	0.80	0.97	1.19
Net Present Value: Investment Ratio (NPVI)	-0.22	-0.03	0.20
Economic internal rate of return (discount rate that results in positive economic NPV)	5.9%	6.8%	8.1%

Note: Results are presented on an incremental basis to the Base Case. Results are based on a 7% real discount rate.
The annual freight volumes estimated to achieve economic viability are dependent on when Inland Rail is constructed and commences operations. For example, lower volumes are required for later construction dates due to discounting.

Summary of findings

The analysis of Inland Rail presented in this study considered:

- expected market take up of freight services provided by Inland Rail
- route alignment and cost/operational options
- financial and economic viability.

The analysis has identified there is demand for a railway that can achieve average Melbourne–Brisbane transit time (terminal-to-terminal) of 20 hours and 30 minutes, and on a route of 1,731 km. This is more than 170 km shorter and 7 hours faster than the current coastal route. Demand for the inland railway would result in a freeing of capacity through Sydney.

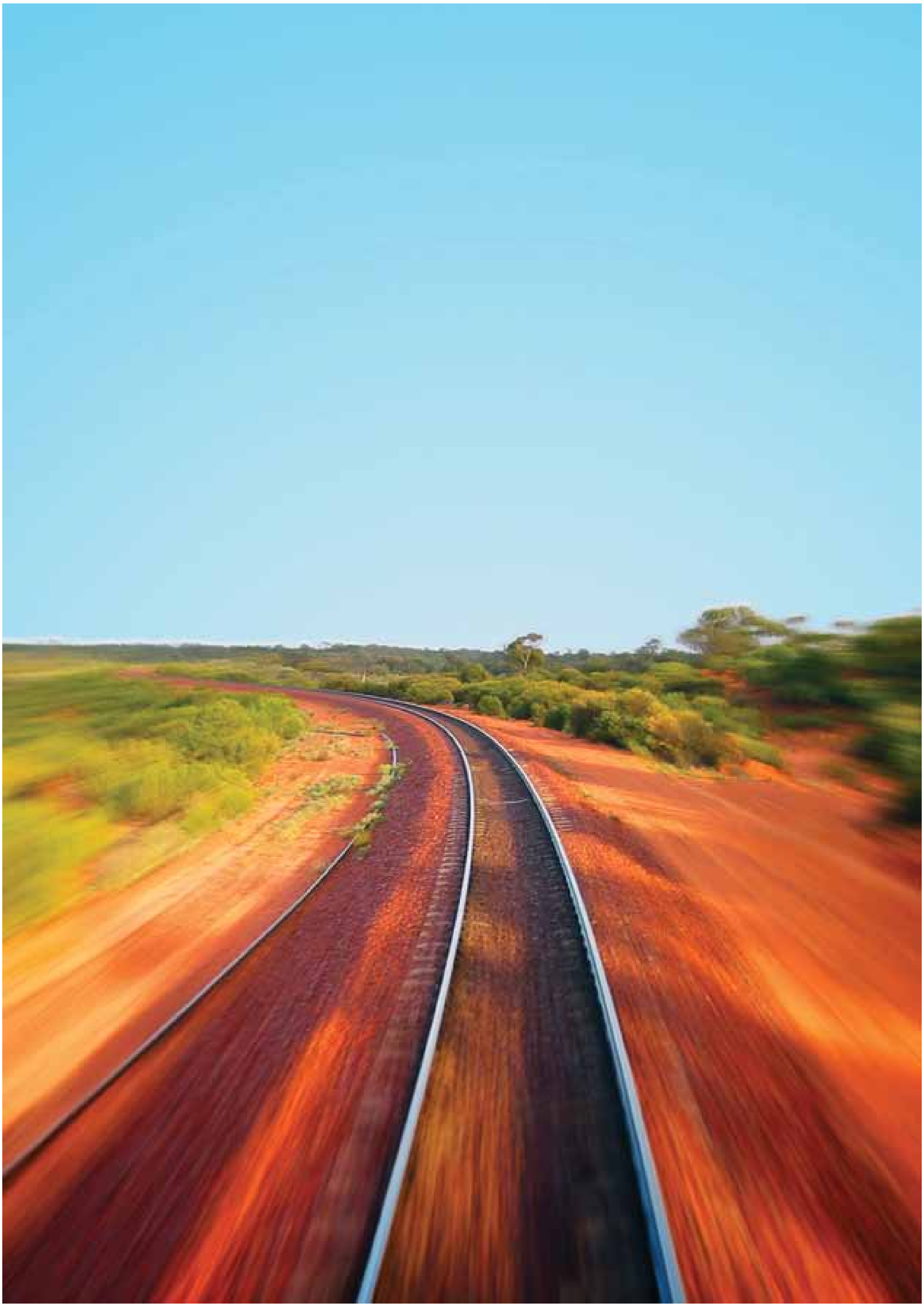
Like most new long distance highways and general freight railways, the inland railway would require a significant capital contribution or service payment for the infrastructure to be developed and commissioned. The financial assessment suggests Inland Rail is not commercially viable on a purely commercial, standalone basis without some form of external financial support for the opening dates considered. Better financial performance is achieved by delaying Inland Rail's operation for 10 or 20 years. This is due to the impacts of discounting, but also because tonnages increase in later years.

From the broader point of view of rail users and the wider community, economic analysis of Inland Rail suggests it will achieve a positive economic NPV when operations commence between 2030 and 2035. Inland Rail does not achieve a positive economic NPV for operations commencing in 2020. Furthermore, if demand volumes are stronger, viability could be reached sooner–when total tonnage carried on Inland Rail totals 25–26 mtpa.

As the inland railway would compete with the coastal railway for Melbourne–Brisbane freight volumes, capacity constraints of the Melbourne–Brisbane coastal railway through Sydney and the capital cost to increase capacity for this railway are key factors for consideration. Investments to improve capacity for freight trains on the coastal railway are underway south of Sydney and an initial package of works has been identified for trains north of Sydney. As an inland railway would reduce general freight volumes on the coastal railway by about one third, this is expected to enable the deferral of some capital expenditure on the coastal railway. Consequently, given that Inland Rail will be approaching economic viability in the medium term, it would be appropriate to consider the project again as new information becomes available and the initial coastal railway upgrades can be assessed in terms of capacity, reliability and demand growth achieved. For instance, if Stage 1 of the Northern Sydney Freight Corridor program does not achieve its targeted capacity of four freight train paths per hour per direction for 20 hours per day, the differential in transit time and reliability outcomes would increase, providing a significant boost in Inland Rail's economic viability.

Given these considerations, it would be appropriate to re-examine the project between about 2015 and 2020, or when tonnage approaches the level identified. At that time the inland railway should be considered in parallel with plans for enhancement of the coastal route and proposals to increase rail freight capacity north of Sydney, on the basis that the north-south rail system is a network. Policies related to maximum coal tonnages from Toowoomba to Brisbane are also relevant and these should be taken into account when Inland Rail is reassessed.

With the prospect that Inland Rail will in time be economically viable, consideration should be given in the meantime to whether steps need to be taken by governments to reserve and protect the alignment so that it is available if the railway is eventually built.



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