Contents

1 Executive summary

This chapter assesses likely future demand for rail transport services in the North-South Rail Corridor over 25 years, starting from the base 2004 year.

The study examined future freight demand in the Corridor (irrespective of mode) by origin, destination and commodity. The split between different freight modes was then calculated to gain an estimate of rail freight demand. Adjustments were made for freight induced or diverted by new rail options. Rail passenger demand was estimated separately.

A wide range of results was produced because of the different options and assumptions about factors influencing demand. Two sets of results, Case A and Case B (see below), were used in the financial and economic analysis reported in Chapter 8. A third case, Case C, was used to demonstrate forecasts based on lower growth assumptions.

1.1 Total freight market

The study assessed freight between the main cities in the Corridor (Brisbane, Sydney and Melbourne) and intermediate points, freight to or from points along possible inland rail routes, and freight between points in the Corridor and elsewhere in Australia.

1.1.1 Drivers of growth

Much of the Corridor is used to transport commodities used for manufacturing (for example, steel or crude paper products) or final consumption goods (for example, cars and retail products). The demand for these commodities and goods depends on the level of consumer demand. This consumer demand is influenced by the state of the Australian economy, as measured by Gross Domestic Product (GDP).

The Study Team developed three scenarios based on Commonwealth Treasury GDP forecasts (to 2008/2009) and its own GDP model forecasts. GDP growth rates varied between 2.5% to 3.8% per annum over the forecasting period. In Case A, (GDP) growth and the freight-to-GDP growth ratio declined modestly over the 25-year period. In Case B, GDP growth and the freight-to-GDP growth ratio did not decline. In Case C, GDP growth averaged 2.75% over the forecasting period and the freight-to-GDP growth ratio was uniform throughout the forecasting period. These assumptions are outlined in Table 1.

The forecasting model used was similar to the *FreightSim* application developed by FDF Management, which incorporates production, imports, freight flows and consumption between more than 500 origin-destination pairs in the Corridor.

The study found that the freight task has been growing at 1.3 times the rate of GDP growth. This was assumed to continue in Case B and to taper down in Case A, reflecting the increased concentration of industries and distribution centres and the growing number of manufactured goods being imported, with ships going direct to the main markets in Brisbane, Sydney and Melbourne.

Grain, coal and other mineral traffic are not determined by GDP but by production capability, freight capacity and international demand. ABARE and CSIRO forecasts were used to forecast demand in this case.

1.1.2 Regional freight

Freight to or from regional areas was a focus of attention, especially in the cases where an inland rail route was an option. The forecasts drew on current flows reported in chapter 3: ***Market Assessment***, interviews with freight firms and customers, earlier studies, and submissions from regional stakeholders. The existing freight consists largely of agricultural and mineral products and is expected to grow steadily. An inland rail route would also:

- Divert grain freight from other rail lines in the northern part of New South Wales and (depending on the new route) in southern Victoria;
- Divert cotton freight from northern New South Wales to the port of Brisbane;
- Allow an expansion of coal and grain freight from southern Queensland; and
- Potentially provide transport for coal, for which exploration is now proceeding in northern New South Wales.

These elements were added to the forecasts. There was no firm information put forward on other regional economic developments that would result from construction of an inland line. The induced-freight assessment is less dramatic than some have suggested because freight services are already provided throughout the region by trucks. It is only freight that is particularly suited to rail – mainly minerals – that would show a marked increase if the rail service improved.

1.1.3 Results

Freight in most markets within the Corridor is expected to double over the next 25 years. The Melbourne-Sydney route will remain the largest market while the Melbourne-Brisbane route is expected to grow faster than other lines. The overall commodity mix will remain broadly the same. Freight to or from regional areas in the Corridor (not counting the Hunter Valley and Central New South Wales) remain relatively modest.

The Study Team's three demand forecasting scenarios – Cases A, B and C – and the five demand assumptions embodied in each case are outlined in Table 1.

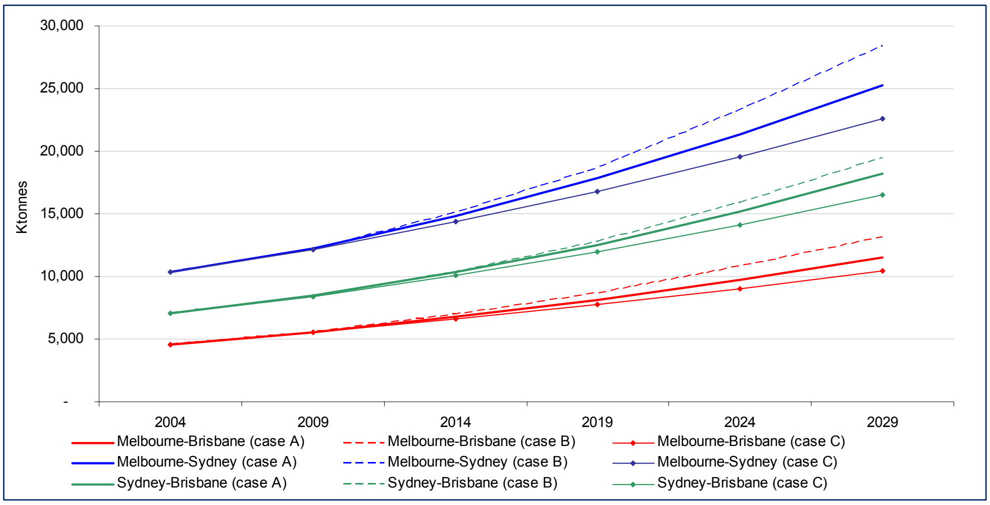
Table 1 - Cases A, B & C for sensitivity testing of forecast total freight and mode share outcomes over the forecasting period, 2004-29

	Case A	Case B	Case C
GDP growth (average over forecasting period)	3.25%	3.6%	2.75%
Transport/GDP growth ratio	1.3 to 1.05	1.3	1 (held constant)
Fuel prices	US$70 to US$50 (real)	US$70 (real) (held constant)	US$70 to US$40 (nominal)
Road labour costs	1.06 to 2009, then 1.04 to 2029	1.08 to 2009, 1.06 to 2029	1.04 to 2029
Rail labour costs	1.04 to 2009, then 1.03 to 2029	1.04 to 2009, then 1.03 to 2029	1.04 to 2029
Availability sensitive market	25-35% to 37.5-47.5%	25-35% to 50-60%	25-35% (held constant)

Chart 1 shows the sensitivity of total freight market outcomes on the three inter-capital city routes to the freight transport to GDP growth and GDP growth assumptions incorporated in Cases A, B and C.

Cases B and C on the Melbourne-Sydney route shift total freight volumes by 3 million tonnes above and below the 25 million tonnes forecast in Case A by 2029. Variances away from Case A on the Melbourne-Sydney and Sydney-Brisbane routes amount to roughly 2 million tonnes by 2029.

Chart 1 - Total freight tonnage on the Corridor by origin-destination, cases A, B and C, 2004-2029 (ktonnes)



1.2 Mode shares

1.2.1 Reversal of rail freight's declining market share

The choice of freight mode (sea, rail, road or air) depends on price and service and on the economic characteristics of each type of freight. Bulk commodities such as petroleum and cement with low value relative to volume move along the Corridor by sea. Other bulk commodities such as coal and grain use the rail network. At the other extreme, express freight moves by air or road. In between is a large portion of the market, mainly manufactured goods, which moves by road or rail.

As roads and truck design improved over the past few decades, road freight came to dominate the transport market at the expense of rail freight. Road freight offers quick and reliable door-to-door delivery while rail freight suffers from infrastructure constraints and from the need for local pickup and delivery (which adds time and cost). Most customers prefer road freight even if it is more expensive, especially on shorter sectors such as Melbourne-Sydney. However, the rail infrastructure options in this Study would greatly improve the relative performance of rail freight and allow it to improve its market share, especially on the Melbourne-Brisbane route.

1.2.2 Determinants of mode choice

The Study Team used several techniques to estimate and cross-check future modal shares:

- More than 30 freight firms and key customers were surveyed to determine their preferred freight mode, why they chose that particular mode and how they would respond to improved rail service;
- An economic (logit) model used the survey data to simulate the choices made under the different rail options; and
- Independent economic (regression) modelling was undertaken using past data.

The results were consistent with international and Australian literature on rail freight demand elasticities, and with economic analysis using past data.

The main factor driving mode choice was **door-to-door price.** Rail freight has low linehaul (terminal-to-terminal) prices but, unlike road freight, local pickup and delivery costs have to be added, which have a relatively large impact on the short-haul routes. Future prices will reflect continuing efficiency improvements in road freight, competition within and between the modes, the impact of fuel prices and labour costs (in particular increasing difficulties in recruiting truck drivers), road user charges and rail access charges. Two access charge levels were tested for inland routes in this Study, one which covered long-term operating and maintenance costs and another which maximised revenue.

The other determinant of mode choice is service quality, consisting mainly of **transit time**, **availability of service** on demand, and **reliability** (arrival within 15 minutes of schedule). Rail performance on these scores is relatively poor in the Corridor, but would improve with the infrastructure upgrade options. The surveys confirmed that the distances in this Corridor are such that travel time is of secondary importance compared with reliability, although it was concluded that faster travel times would build leeway into schedules (improving reliability), and better align their departure times with market preferences, usually at the end of the business day.

1.2.3 Results

Estimated improvements in transit time and hence reliability and availability were derived from the study of rail infrastructure options and rail operations reported in chapter 5: ***Infrastructure Assessment*** and chapter 6: ***Route Options***, and applied in the mode choice model. The key results are:

- The current AusLink/ARTC upgrade of the existing coastal route is expected to improve rail reliability from 40%-50% to 70%-75%, compared with 98% for road into capital city routes. Potential inland routes are expected this to improve this reliability even further from 80% to around 90%;
- The coastal upgrade or inland routes will improve rail availability from 44% to 87%-95% on the Melbourne-Brisbane route;
- The rail share of the Melbourne-Brisbane freight market is estimated to increase from around 30% to 63% (on the upgraded coastal route) by 2029, noting this is the smallest of the three Sub-Corridors by volume;
- On shorter routes, the effect of improved infrastructure and services is less dramatic: an increase in rail market share from 9% to 18% on the Melbourne-Sydney route and from 11% to 22% on the Sydney-Brisbane route; and
- The rail market share is higher in the optimistic case where fuel prices and labour costs are expected increase road freight costs to rail freight costs. Fuel prices have a greater impact on road transport than on rail, and higher wages reflect the problems in recruiting truck drivers.

Table 2 shows the forecast mode shares on the Melbourne-Brisbane route with a potential inland route from 2009 to 2029. The Coastal Route's mode share is forecast to decrease significantly to between 5 and 7% as soon as a potential inland route becomes operational (assumed for modelling purposes to be 2009).

Table 2 - Estimated mode shares with proposed inland rail option: Melbourne-Brisbane (both ways), all commodities, 2009-2029

	Rail coastal	Proposed inland rail option	Road	Sea	Air
2009	7%	57%	27%	8%	1%
2014	7%	61%	23%	8%	1%
2019	5%	66%	21%	7%	1%
2029	6%	67%	19%	7%	1%

Source: The Study Team, BTRE, FDF Management

The Study Team's forecasts show an inland route is likely to capture 67% of the Melbourne-Brisbane freight market by 2029. Road's mode share is forecast to decline significantly to 19% by 2029. The Study Team's results show that an inland route is expected to attract 57% of the freight market away from the Coastal Route and 10% away from road (largely by capturing more of the growing freight market rather than capturing road's traditional freight customers). These results are consistent with industry's views of likely market outcomes if an inland route was operational.

The future levels of rail freight on the existing Coastal Route and a potential inland route are estimated by the logit model, which reflects the results of the industry surveys.[1] Relative prices and service standards determine whether land freight will travel between Melbourne and Brisbane by a potential inland route, the existing Coastal Route or road.

Significant volumes of freight diversion were also forecast to result from a Far Western inland route. Freight flows of grain (28%) and cotton (50%) were forecast to be diverted away from NSW ports from the northern NSW region to the Port of Brisbane. Significant amounts of coal freight from the Surat Basin to Brisbane was also forecast to utilise a Far Western route, generating large access revenue for a potential track operator, although in future this freight may go to other Queensland ports, such as Gladstone. A vast majority of freight entering and exiting the Corridor from South and Western Australia was also expected to use an inland route, as were freight volumes from southern NSW and northern Victoria.

[1] To determine the proportion of freight carried by road, an inland route and the existing Coastal Route between Melbourne and Brisbane, the logit model was developed to allow three transport options. The road option was left as an independent choice and the two rail modes were 'nested' within the rail option. A further parameter (lambda) was added to correlate the shifts between the two rail modes and road that are not explained by price, reliability or availability (more inherent tendencies towards one mode or another). The lambda parameter correlated the logit model so that freight customers were more likely to substitute the existing Coastal Route for a new proposed inland route rather than a substituting between road and rail routes.

Table 3, below, shows the breakdown of end-to-end rail freight on the existing coastal route and a potential inland route with an inland route operational. The table also shows forecast levels of freight on a potential inland route to/from:

- Southeast Queensland to Brisbane;
- Northern New South Wales to Brisbane;
- Southern New South Wales to Melbourne;
- Northern Victoria to Melbourne; and
- Brisbane to Western Australia/South Australia.

Table 3 - Total rail tonnage with a potential inland route: Case A, 2009-2029, '000 tonnes

Route/year	2009	2014	2019	2029
Melbourne-Brisbane (inland)	2,113	2,603	3,375	4,693
Brisbane-Melbourne (inland)	1,129	1,626	2,188	3,262
Melbourne-Brisbane (coastal)	145	265	204	442
Brisbane-Melbourne (coastal)	244	210	177	265
Southeast QLD-Brisbane*	10,708	10,924	11,173	11,547
Northern NSW-Brisbane (inland)	1,031	1,100	1,181	1,278
Southern NSW-Melbourne (inland)	1,678	1,831	2,002	2,278
Southern NSW-Melbourne (existing)	420	458	500	569
Northern Victoria-Melbourne (inland)	457	490	527	598
WA/SA to Brisbane (inland)	711	832	980	1,342
WA/SA to Brisbane (coastal)	126	147	173	237

Note: * Rail Tonnage includes a combination of some coal from the Surat Basin, cotton and grain from Southern Queensland.

Source: The Study Team, BTRE, FDF Management

1.3 Future rail freight

Estimates of rail freight are derived (using *FreightSim* and supplementary analysis) from:

- The estimates for total freight in the Corridor;
- The estimates of rail modal share;
- Additions due to the diversion of some regional freight onto a potential inland rail line;
- Additional coal and grain freight in southern Queensland; and
- Growth in the total freight market resulting from a superior mix of transport services (in particular rail services that are cheaper than road and more reliable than current rail services).

Two sets of rail freight demand estimates – Case A and Case B – are presented (and carried through to the economic and financial analysis in chapter 8: ***Financial and Economic Assessment***). Case A and Case B each present different assumptions about the GDP growth, freight growth compared with GDP growth, fuel prices and road freight labour costs. Many reasonable cases can be constructed with other mixes of assumptions, and it is not prudent to concentrate on a single point estimate over the
25-year period.

1.4 Passenger demand

Rail passenger services compete with freight trains for infrastructure capacity, especially as they are usually given priority. In the Sydney area, freight trains may not operate during the suburban peak periods of 6 am to 8.30 am and from 2.30 pm to 6 pm. The restrictions have a severe impact on freight services. Most of the reliability issues around Melbourne-Brisbane services are due to problems in the Sydney area. Growth in rail passenger demand and upgrades to relevant parts of the rail infrastructure will determine whether the freight-passenger conflict will increase or decrease, which in turn has implications for rail freight reliability and future rail freight demand.

Rail services are sparse in most of the Corridor. For example, there is only one train a day each way between Sydney and Melbourne. In addition, rail services are experiencing minimal, if any growth. Improved roads and low-fare airlines have strengthened bus, car and air competition for short journeys. Airlines are also competing for longer journeys, including those between Melbourne, Sydney and Brisbane. Once the current ARTC/AusLink infrastructure upgrade is completed, the number of slots occupied by passenger trains in the Corridor, apart from the Sydney area, will only make up a small portion of the total slots. Passenger services are unlikely to be created on potential inland routes, except possibly in South Queensland.

Commuting trains such as those from Sydney to Wollongong, Goulburn and Newcastle/Woy Woy are also experiencing minimal or negative growth. However, after discussions with RailCorp and the NSW Government, it is prudent to assume that demand on the Sydney-Newcastle line will grow in line with expected population growth in the Central Coast area. Analysis of current services, their loadings and the expected growth indicates that there will not need to be any additional slots for passenger trains, except possibly in the peak periods when freight trains may not operate anyway.

Growth in demand for Sydney urban rail services will eventually lead to increased train frequency. However, this will not affect freight trains on the southern side of Sydney because a freight-only line is being constructed. Whether there is an impact on the central and northern side of Sydney (Chullora-Strathfield-Epping-Hornsby-Newcastle) will depend on whether infrastructure in these areas is upgraded. Under some upgrade scenarios, it would be possible to relax the curfew and allow freight trains to operate in the counter-peak direction. Problems would be further eased by a proposed new rail terminal on the southern side of Sydney, which would avoid conflicts with passenger trains now experienced when using Chullora (PN) and especially Yennora (QR).

The Study Team’s conclusion is that passenger growth is unlikely to create new problems for rail freight services. However, this is cold comfort as the problems experienced by freight trains in Sydney area are already so severe. Improvements in rail infrastructure are therefore important for enhancing rail freight reliability and demand.

There are minimal freight-passenger conflicts in the Melbourne and Brisbane areas because the suburban passenger network is largely separate and of a different gauge. However, care would be needed in planning for freight services on a potential inland line as its route through southern Queensland to Brisbane is on a congested double track, narrow gauge suburban line and is in a designated growth corridor.

2 Introduction

This section assesses likely future demand for rail transport services in the Corridor over 25 years (starting from the 2004 base year). It builds on chapter 3: ***Market Assessment*** on the current (2004) level of rail transport services in the Corridor. The results, along with cost estimates for various rail investment options in the Corridor, will feed a dynamic model to complete financial and economic cost benefit analyses.

2.1 Approach

The following approach was adopted:

- Establish 2004 freight demand (tonnes) using actual rail, sea and air data and estimates for road freight between multiple pairs of origins and destinations in the Corridor, and by commodity (see chapter 3: ***Market Assessment***);
- Estimate future freight demand in the Corridor by origin, designation and commodity, irrespective of mode;
- Estimate how total demand will be split between road, rail, sea and air, and use the results to estimate rail freight tonnages, again by origin, destination and commodity; and
- Establish the current level of passenger demand on relevant routes and estimate future growth.

A wide range of results is possible given different assumptions that may reasonably be made about factors such as GDP growth, fuel prices, road user charges, access prices and the responsiveness of freight customers to improvements in rail infrastructure and the quality of rail freight service. However, a narrower range of results is judged most likely and is outlined in this chapter. Of this likely range, two sets of results – reference Case A and alternative Case B – were carried forward to the Route Options analyses in chapter 7. A financial and economic analysis has been undertaken for Case A in Chapter 8. Case B was not subject to financial analysis because it presents a more optimistic outcome, which in the opinion of the Study Team, did not reflect the most likely commercial and economic outcome. A third set of results – Case C – was used for analytical purposes in this chapter. Case C represents a more pessimistic view. It was not modelled further because it was considered to resent outcomes that were unrealistically low.

2.2 Chapter structure

Section 3 of this chapter discusses the total freight market, including the factors that drive it, freight to or from regional centres, the forecasting model used, and the results.

Section 4 examines freight modal shares, analysing factors such as price, availability and reliability; relevant Australian and overseas literature; responses from an extensive survey of operators and customers; mode share modelling; and results.

The analysis undertaken in these two sections informs the rail freight volume forecasts for the Corridor in section 5.

Section 6 assesses future passenger demand on relevant routes.

3 Total freight market

This section examines growth in total freight, irrespective of mode, in the submarkets within the Corridor.

3.1 Market definition

The markets covered consist of freight moving to or from origins and/or destinations in the Corridor, including between intermediate points on possible inland routes between Brisbane and Melbourne. Freight moving to or from points outside the Corridor (for example, Tasmania, North Queensland, South Australia and Western Australia) and from or to points within the Corridor is also considered. Freight that is not primarily moved on routes relevant to the Corridor options, such as Hunter Valley coal, is considered to the extent that it has indirect implications for the options.

3.2 Factors affecting freight transport demand

The Australian experience, reflected in the literature and in the Study Team's survey of rail operators and customers, is that there are several factors that determine growth in freight tonnages ("the freight task"). These are discussed below.

3.2.1 Australian GDP growth rates

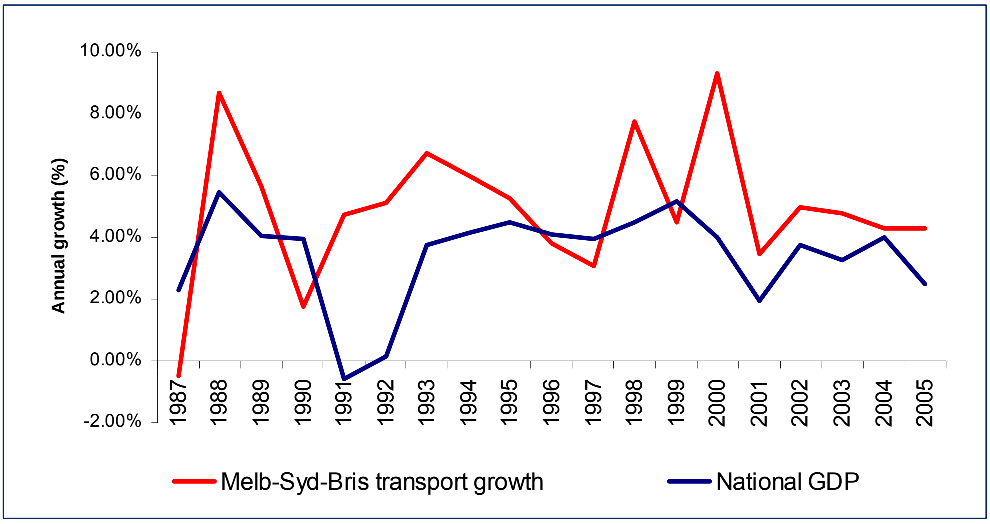
Transport is an essential part of the production supply-chain of almost all goods and services. The demand for freight transport is 'derived', that is, it depends on production and/or demand for the products carried. As shown in chapter 2: ***Methodology and Key Assumptions***, many of the commodities transported in the Corridor are used for Australian manufacturing (for example, steel, crude paper products) or are final consumption goods (for example, cars and container traffic for retail chains). The demand for freight services therefore depends on the demand for Australian manufactured products and Australian retail goods. These demands are affected by the state of the Australian economy, reflected in Gross Domestic Product (GDP).

GDP is normally used to forecast Australian consumption and imports (but not exports) of bulk products (for example, grain). In non-bulk freight (for example, manufactured goods) forecasting methodology, four elements are derived using GDP growth forecasts. These are:

- Production;
- Imports;
- Freight flows; and
- Consumption.

Economic growth is the principal driver of increasing demand for freight. The Bureau of Transport and Regional Economics (BTRE) has observed that the total non-bulk freight transport task generally grows 1.3 times faster than the economy. Chart 2 shows the relationship between Australia's average GDP growth with linehaul transport freight growth between Melbourne, Sydney and Brisbane from 1987 to 2005. It is clear that transport growth (measured in tonnes) has typically been above GDP growth rates, though the margin has begun to decline.

Chart 2 - Gross Domestic Product (GDP) and freight transport between Melbourne, Sydney and Brisbane (1987-2005)

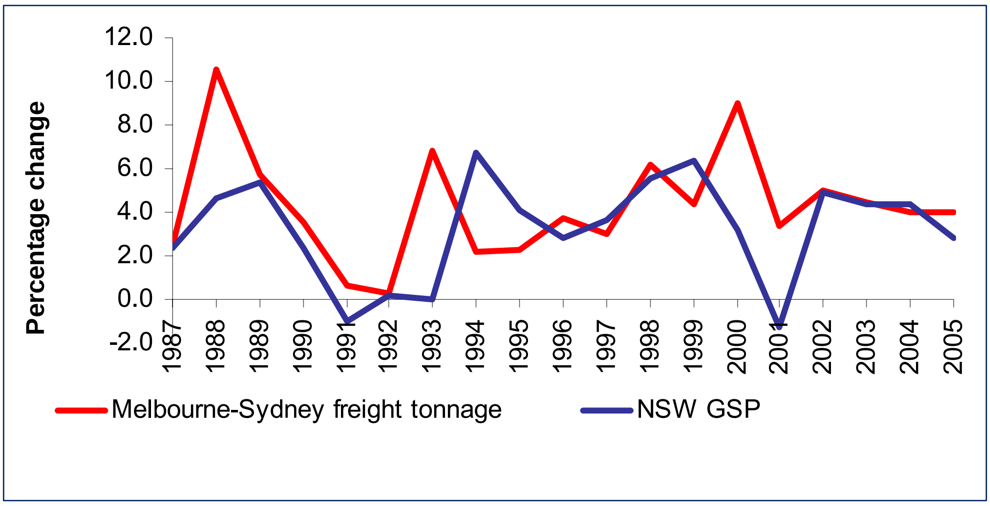


Source: *BTRE*, Information Sheet 22 – Freight between Australian cities,*2002.*

Similarly, the overall passenger task increases with real income growth. Commuter and business travel is necessary for work and leisure travel is made possible by growing incomes. Thus, growth in the entire transport task is strongly linked to economic growth (AusLink White Paper 2005).

An even closer relationship is found between Corridor freight growth and Gross State Product (GSP) growth. Chart 3 shows annual freight growth on the Melbourne-Sydney corridor against New South Wales GSP growth (New South Wales is a net receiver of freight).

Chart 3 - Freight growth on the Melbourne-Sydney corridor and New South Wales GSP growth



Source: BTRE and the Australian Bureau of Statistics (ABS).

Freight transport links participants in the economic process: suppliers, producers, distributors and consumers. For example, freight transport is required to deliver raw materials and intermediate inputs and services to producers so that they can manufacture their goods and meet customer demand. After production, freight transport services are nearly always required to distribute the outputs to wholesalers, regional distribution centres and retailers before they reach the final consumers.

The Study Team has adopted the Commonwealth Treasury's 2005-06 mid-term estimates for GDP growth to 2008-09 (see Table 4) and has extended these to 2029-30 based on the historical performance of the economy. The Study Team's GDP forecasts have taken account of these historical rates of growth and the changes in productivity, population and labour force growth expected in the future. The Study Team's assumed GDP growth path maintains 3.25% growth rate from 2008-09 to 2009-20 and tapers slightly to 3% from 2020 to 2029.

Table 4 - Real GDP projections – percentage growth per annum

Real GDP growth %	2005-06	2006-07	2007-08	2008-09	2009-20	2020-29
Case A (reference)	3	3	3.5	3.25	3.25	3
Case B (high case)	3.1	3.6	3.8	3.6	3.6	3.6
Case C (low case)	3	3	2.75	2.75	2.75	2.5

Note: Year-average percentage change.

Source: 2005-2009 Treasury, 2005. 2009-2029: ACIL Tasman (see text).

These rates of growth (average of 3.2%) are slightly lower than the rates in the 1980s and 1990s, which averaged 3.4% per annum. Over the period 1999-00 to 2004-05, GDP growth averaged 3.2% per annum.

Multiple total freight forecasts could be produced using variations of the macroeconomic analysis in this section and those immediately below. This is because of the inherent lack of precision in such assumptions over a 25-year period, and to show whether the sensitivities are significant.

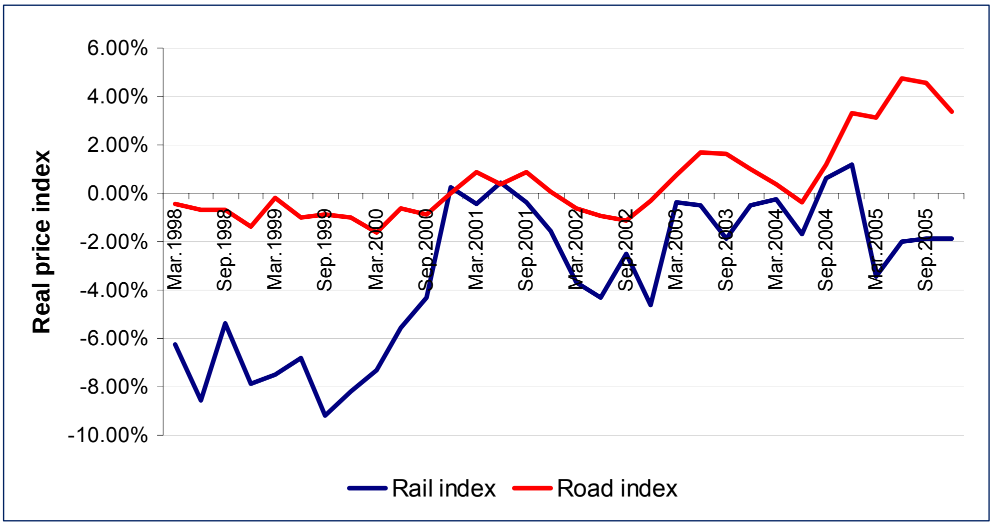
There is no absolute certainty regarding the trends of future economic growth, especially over an extended forecasting timeframe of 25 years. Therefore, alternative GDP growth assumptions higher and lower than Treasury's forecasts will be used to assess different growth assumptions on future freight transport demand.

3.2.1.1 Freight costs

In addition to the influence of the GDP, the growth of interstate non-bulk freight (which, as shown in section 2.7, is the most important type for this study) has been encouraged by a decline in real freight rates. Over the last 35 years, real road freight rates declined 50%, real rail rates declined 70% and real coastal shipping rates fell 40%. These results show the effect of improvements in technology and competition, with road prices tending to constrain rail prices. This historical trend has reversed in recent years, with road transport prices increasing over the past eight years in real terms but rail prices have continued their downward trend in real terms.

Chart 4 shows annual road prices increasing by 0.5% per annum in real terms and annual nominal rail prices declining by 3.3% from March 1996 to December 2005. Nominal rail prices have, however, increased slightly since 2001. The growth rates of freight compared with GDP partly reflects long-term price trends, that is, some of the freight growth is due to economic growth and some is stimulated or induced by declining price trends (and improved service standards).

Chart 4 - Trends of real Australian road and rail freight prices from March 1996 to December 2005 (1998-99 prices)



Source: ABS industrial price index.

3.2.2 Domestic production and international trade in manufactured products

3.2.2.1 Industrial concentration

It is not prudent to assume that past trends will necessarily continue over the next 25 years because the relationship between freight demand and GDP growth may change.

Industrial concentration in Australia over the past 20 years has been rapid. Through mergers and acquisition (M&A) activity and consolidation of firms' production and distribution facilities, fewer supply-chain facilities are handling far larger volumes of freight. The examples below demonstrate the generic consolidation of facilities in Australia:

- Australia's large retailers have recently reduced the number of distribution centres by up to 75%;
- Fosters closed its Sydney brewing facility, preferring to transport its product from Brisbane; and
- Graincorp has announced plans to close up to 100 of its smaller grain terminals to reduce costs and improve volumes at larger facilities.

These examples show that cost savings from economies of scale through larger operations have outweighed the increased costs of moving freight further to consumer markets.

Over the 25-year forecast period, the Study Team expects the pace of industrial consolidation to slow. Rapid consolidation in the consumer goods sector over the past decade appears to have limited the opportunities for future M&A activity, especially as competition concerns become more probable as industry concentration grows. Slower consolidation through M&A activity means the major driver of future industrial consolidation will be through generic or individual firms' internal restructuring (for example, factory closures or fewer distribution centres). If generic or internal consolidation develops at similar levels to recent history, the likely effect will be slower overall industrial consolidation.

Consequently, growth in freight transport is likely to rely less on industrial consolidation and more on downstream consumer consumption growth. Thus the Study Team considers future transport growth is likely to decline towards GDP growth over the forecasting period.

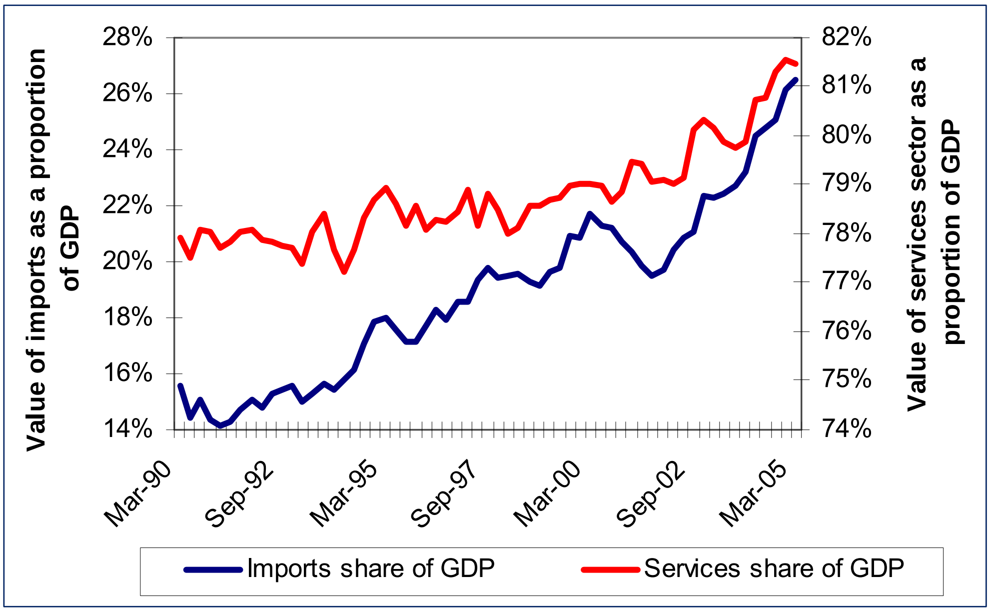
3.2.2.2 Substitution of domestic production by manufactured imports

The services sector in Australia contributes over 80% of GDP. It is assumed that this percentage will continue to grow moderately as a proportion of GDP. Cheaper manufactured imports are also assumed to continue to grow as a proportion of GDP.

Manufactured imports will be delivered by international liner cargo operations into Melbourne, Sydney and Brisbane and require local distribution over the forecasting period. Land bridging (shipping freight to one city when it is destined for another, with the final leg by road or rail) will remain at low levels in the Corridor, because direct shipping is cheaper and there is enough demand to support it. As local manufactured goods – which require linehaul domestic transport – are gradually replaced by imports delivered to Australia's three largest container ports, land transport's task for these goods would move more to regional deliveries from port terminals and away from domestic linehaul transport. Increasing industrial concentration within Australia partly offsets this effect.

Chart 5 shows the growth in the service sector's proportion of GDP and the value of imports relative to GDP from 1990 to 2005.

Chart 5 - Service sector and imports' share of GDP from March 1990 to March 2005



Source: ABS National Accounts, March 2005.

Imports – as a percentage of GDP – increased from 15.5% to 26.5% from March 1990 to March 2005. It was assumed that imports as a percentage of GDP would continue to rise throughout the forecasting period.

A higher proportion of imports relative to GDP implies future linehaul transport growth is likely to move closer to GDP growth than over the past 20 years.

Therefore, the Study Team's central assumption is that the relationship between linehaul transport growth and GDP growth will moderate from 1.30% in 2004 to 1.05% by 2029. This assumption is based on:

- The expected rise in imports as a proportion of GDP; and
- A slower pace of future industrial concentration.

The effects of Australia's increased openness to international trade, and of the changing concentration of economic activity within Australia, have been incorporated in Cases A, B and C (outlined in section 2.2.3). If either of these factors predominates, then future freight growth would vary from the scenario described by Case A, the Study Team's reference case.

3.2.3 Study team's forecast of total freight growth on inter-capital city routes

Future GDP growth and the freight transport growth-to-GDP ratio growth ratio combine to produce the Study Team's forecast of total freight growth. The Study Team formed the following cases to assess the likely range of overall growth in the total freight market on inter-capital city routes:

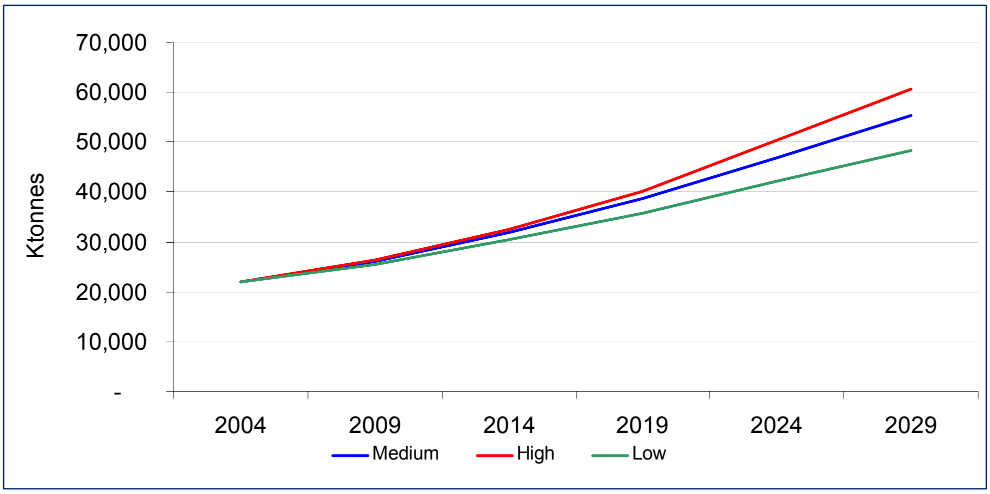
- Case A – medium – 1.3 declining to 1.05 over the forecasting period;
- Case B – high – remaining at 1.3 throughout the forecasting period; and

- Case C – low – uniform freight transport and GDP growth (i.e. 1:1) over the forecasting period.

The future GDP growth rate assumptions for the three cases are outlined above in Table 4.

Chart 6 uses the growth paths assumed in Cases B (higher) and C (lower) to illustrate the combined effect of variations away from the central freight transport to GDP growth ratio and GDP growth assumptions outlined in Case A. The chart shows freight transport growth on inter-capital city routes (Melbourne, Sydney and Brisbane) from a base of 22 million tonnes in 2004.

Chart 6 - Freight transport growth on inter-capital city routes (Melbourne, Sydney and Brisbane) from 2004-2029 ('000 tonnes) – Case A (medium), Case B (high) and Case C (low)



Source: The Study Team, BTRE, FDF Management

The Study Team's modelling of cases A, B and C shows freight volumes are forecast to grow to approximately 50, 55 and 60 million tonnes respectively by 2029.

3.2.4 Particular industries with different growth drivers

Some of the freight movements in the Corridor are not driven by Australian GDP but by a combination of overseas demand and domestic production.

3.2.4.1 Grain

Freight volumes of export grain are in practice largely aligned with domestic production, minus the quantities used by domestic customers. The international price varies according to world supply and demand, but the market always clears at some price and eventually the grain is moved. This means grain freight volumes are not much affected by changes in international demand, except when bad grain years lead to some supplies being kept in storage until the next season.

Volumes of export grain carried in the Corridor reflect production trends, including short-term fluctuations due to droughts and longer term effects due to improved grain varieties and farming techniques.

On the other hand, demand for grain among some domestic customers such as bakeries is influenced by Australian GDP and population. Other domestic customers such as feedlots face a mix of export and local demand.

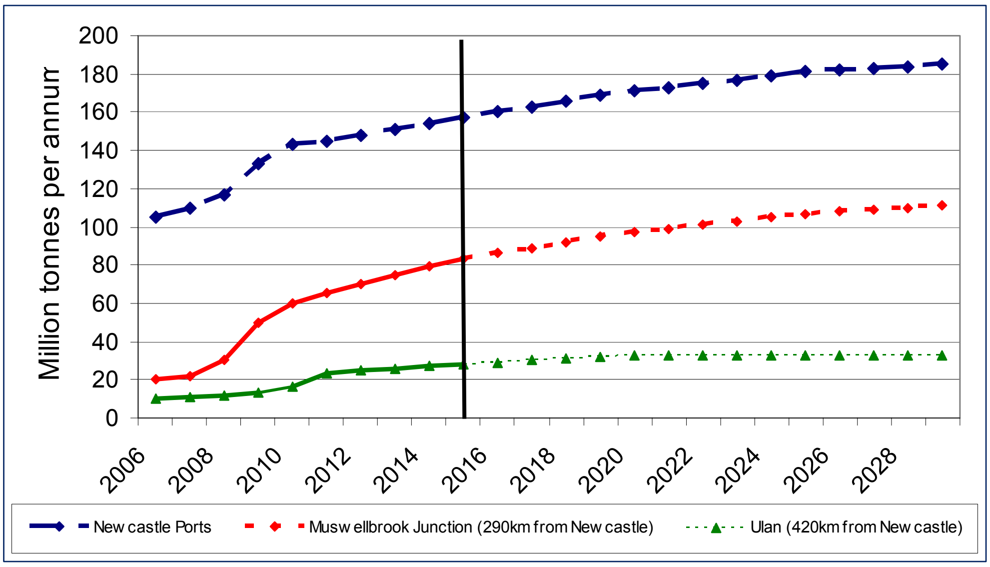
3.2.4.2 Coal

Coal freight depends on international demand for coal, Australian capacity to produce it, and port capacity. (Coal used in power stations is of little relevance in this context as the freight distance is usually very short, often by conveyor).

Although there are huge coal movements in the Hunter Valley, coal is of only secondary importance to options for the Corridor. The Hunter Valley is not one of the main route options being considered, although there is a possible hybrid option that uses it. Some of the coal movement at the top of the Hunter Valley is on track that could form part of a possible inland route. Coal moves for short distances near Newcastle along the current North-South (Coastal) Route. Significant volumes of coal are transported from the Central Highlands (immediately west of the Blue Mountains) to Port Kembla (12 million tonnes in 2004) but it is not a Corridor route.

ARTC's coal forecasts for the Hunter and Upper Hunter Valley rail networks to 2015 are shown in Chart 7. It shows total coal throughput at the Port of Newcastle reaching 160 million tonnes by 2015 and extending through moderate growth to over 180 million tonnes by 2029. Coal freight at Muswellbrook Junction (Hunter) is expected to increase to over 110 million tonnes by 2029. At Ulan (Upper Hunter), coal freight will reach nearly 40 million by 2029.

Chart 7 - ARTC and the Study Team's forecasts of coal freight in the Hunter and Upper Hunter Valley rail networks from 2004 to 2029



Note: ARTC estimates from coal industry consultation extend until 2015. ACIL Tasman extrapolated moderate growth from 2015 to 2029.

Source: ARTC Hunter Valley Coal Network Capacity Improvement Strategy, April 2006.

Coal volumes from the Surat Basin (north of Toowoomba) are forecast to reach between 5.5 and 6 million tonnes in 2006/07. Industry sources in Queensland suggest that those volumes could be constrained by capacity due to:

- Legislation giving priority to passenger trains, which like Sydney, also gives rise to freight train curfews;
- Environmental legislation that limits the number of coal trains running to Fisherman Islands because of concerns over coal dust emissions from the wagons;
- Track that only allows for 15.75-tonne axle loads and short train lengths; and
- Limited train paths through the Toowoomba Ranges as the line is single track and steep.

If these constraints are resolved, coal could grow from 5.5-6 million tonnes in 2006/07 to 8 million tonnes per annum thereafter. A potential inland route that includes a tunnel under the Toowoomba Ranges could be used to transport this traffic and is one way of overcoming the capacity constraint (provided that constraints on freight capacity through the Brisbane metropolitan network are also eased). Coal traffic is normally charged the full economic or 'ceiling' cost of the sections of track that the coal trains traverse. The alternative is that coal would go north, most likely to Gladstone.

3.2.5 Places with likely production or consumption growth

3.2.5.1 Demographic trends

Demographic trends influence the nature and location of transport demand. Australia's population is projected to grow from 19 million in 2000 to 23 million in 2020 (and at those rates to 24.5 million by 2029). Forecast population growth of 0.86% per annum over the next two decades is modest; however, most of the growth will occur in already heavily populated areas where the cost of providing additional transport infrastructure is high.

Among the three main urban areas in the Corridor, the highest population growth is expected in southeast Queensland – namely Brisbane and the Gold and Sunshine Coasts. This will attract higher numbers of distribution, wholesale and retail businesses to the region. The probability of manufacturing facilities relocating to the Brisbane area appears less likely.

Demographic trends within the greater Sydney area are also relevant to this study because some of the passenger services operate on the same tracks as North-South freight services. The main area of population growth affecting Corridor options is on the central coast of New South Wales.

3.2.5.2 Parkes

Parkes, a major road junction and where the line from South Australia meets possible inland rail routes, has received media and industry attention as a potential hub for Australia's future land freight transport operations. Related service activities could expand there. There are no implications for total freight in the Corridor, but an inland route would shorten the rail distance between Brisbane and Western Australia and hence affect mode share. Interviewees for this study suggested that Parkes might also become a hub for Melbourne-Sydney and Brisbane freight, with the Parkes-Sydney sector handled by shuttle train. However, this has not been included in the modelling because of the extra distance and handling compared with the coastal route. The Study Team tested the impact of an increase in future freight flows through Parkes in its freight database and forecasting analysis.

3.2.6 Other factors

Other factors affecting freight transport demand are more pertinent to the discussion below of mode shares, rather than for the total freight market. They include fuel and driver costs, both of which usually have more impact on road freight than on rail freight (and even less impact on sea freight). Although these factors mainly affect mode shares, there would be a slight impact on total demand if there was a very large increase in these elements – total transport costs would go up, prices would also rise and there may be a negative impact on demand.

Capacity constraints can affect demand by 'choking' it – causing queuing and congestion and/or price increases – although this is not anticipated to occur in the period of the Study. In the context of the Study, congestion outside of urban delivery areas is not a major issue as most freight moves by truck on roads that have spare capacity. There is a rail congestion problem in the Sydney area that causes service deficiencies affecting rail demand, but the problem has limited effect on total freight demand because of the road alternative.

Rail terminals are particularly important to operators' ability deliver a high proportion of on-time arrivals. Train operator data shows that on-time departures are 10% to 25% more likely to arrive on time than trains that leave after their scheduled departure time. This is not surprising given late departing trains may lose their slot in the urban network and have to wait until another slot is available.

Arrival times will improve if rail terminals can deliver a higher level of departure reliability. The increased number of slots due to infrastructure improvements will also boost on-time arrivals. This issue is addressed in chapter 5: ***Infrastructure Assessment*** and in section 3.8 of this chapter.

3.3 Regional freight

3.3.1.1 Regional freight in the Corridor

Freight to or from regional areas in the Corridor, in particular areas that would be served by potential inland route options, have been included as part of the demand forecasting work. Increased regional freight would be a useful addition to total flows and help with the economics of any project.

Analysis of current demand showed that freight to or from these regions, setting aside central New South Wales and Hunter Valley coal, consists largely of agricultural exports: grain, meat, fruit, wine, minerals, rice and cotton. As also indicated in Section 3.6, there is a limited amount of other manufactured traffic through regional areas.

If there was no inland rail route, the current pattern would be expected to continue in the absence of major new mineral discoveries or changes in agricultural techniques.

3.3.1.2 Commodity production forecasts

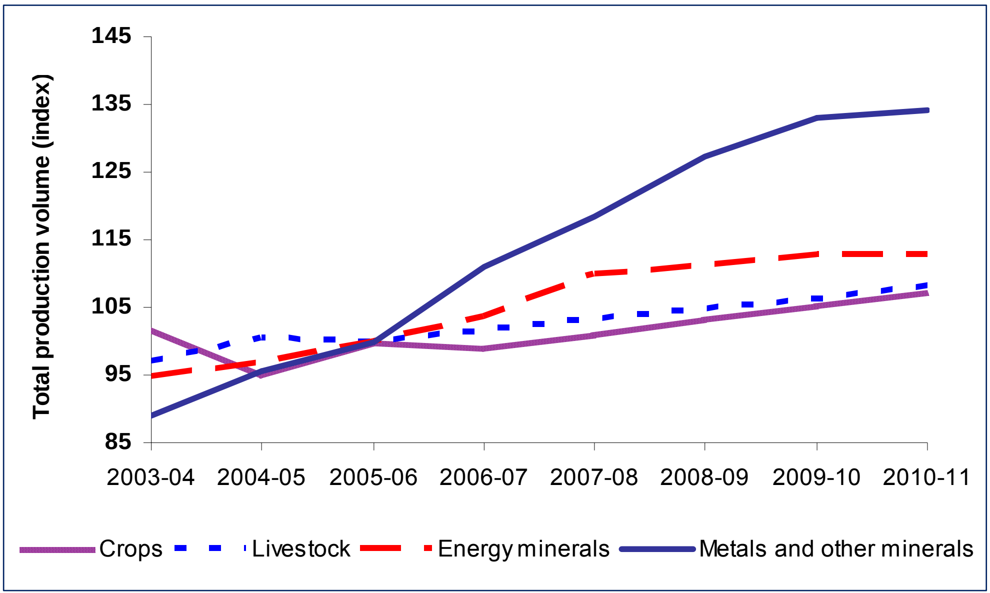
Forecasts of freight flows to or from regional areas were based on existing flows (described in chapter 3: ***Market Assessment***), aggregate commodity forecasts by ABARE (medium term) and CSIRO (longer term), and supplementary information from transport companies and producers, discussions with government officials, and submissions from interested parties in regional New South Wales and Victoria. The main findings on the impact of an inland route – diversion of some existing freight in NSW and possible new freight in Southern Queensland – are summarised in Box 1.

The forecast increase in metals and other mineral production volumes is greater than the forecast production volume growth of crops, livestock and energy minerals. In the medium term (2005/06 to 2010/11) the percentage increase in commodity volumes is forecast by ABARE to be:

- Crops - 7.4%;
- Livestock - 8.2%;
- Energy minerals - 12.7%; and
- Metals and other minerals - 34.1%.

The Study Team's future demand modelling extrapolates the forecast growth rates of commodity production from CSIRO forecasts to 2008-9 to 2029. Based on CSIRO's breakdown of commodity growth for different commodities and regions, increases in the production of commodities within the regions (SSDs) were estimated over the forecasting period. ABARE's national production forecasts (shown in Chart 8) show consistency with CSIRO's and are used here to validate CSIRO's production forecasts.

Chart 8 - Domestic farm and mineral resource production volume index: 2003-04 to 2010-11



Note: Base year (index=100) at 2005-06. Values for the financial year 2005-06 are ABARE estimates and 2006-07 through 2010-11 are ABARE forecasts.

Source: ABARE (2006).

For forecasts of grain which are essentially production-driven (as Australia is a large net exporter of grains and is not reliant on domestic demand), the central assumption is that the long-term upward trend due to improved technology and management will continue. Alternative assumptions can be considered; for example, that the long-term trend of gradually increasing output will taper off as the effects of drought and salinity are felt.

3.3.1.3 Expected Regional Freight Diversion with Proposed Route Options

The impact of an inland line for regional freight is modest as freight services already exist throughout the region in the form of road freight and existing rail routes. Significant new freight growth due to an inland rail route is only plausible for certain types of freight particularly suited to and not already adequately served by rail. In the present context, this would be minerals in areas where rail service would improve if there was an inland line.

Box 1 - Regional freight diversion opportunities

Northern New South Wales

After industry consultations the Study Team assumed that an inland route will divert 27% of grain freight from northern New South Wales away from the congested Hunter Valley line serving the Port of Newcastle to the Port of Brisbane. The halfway point is just north of Moree, and actual movements will also depend on shipping patterns and relative access charges on the two rail routes.

An inland route option could divert containerised cotton from northern New South Wales away from Port Botany to the Port of Brisbane. The approximate halfway point between Port Botany and the Port of Brisbane is just north of Narrabri, so there is a greater likelihood of a higher proportion of cotton being diverted north to Brisbane than grain. After industry consultation, an assumption that 50% of cotton will be diverted away from Port Botany to the Port of Brisbane was made. Again, actual movements will also depend on shipping patterns and relative access charges on the two rail routes.

Exploration in the Ashford area near Inverell, if successful, would result in a new flow of coal on the northern part of an inland line to Brisbane, if the port could handle it. Otherwise it would go to Newcastle, which is further away. One submission suggested that the volume could be up to 1.5 million tonnes a year.

Southern New South Wales

An inland route through Shepparton would likely result in only a small diversion of grain freight from the current East-West service in southern New South Wales to Port Kembla and on to the new line to Melbourne. Significant volumes of grain in southern New South Wales have already diverted to Melbourne since the sector was deregulated, allowing Victorian-based grain trains to haul freight from southern New South Wales to the Port of Melbourne. Industry sources indicate that of the grain currently on rail, grain from the Hillston line (northwest of Griffith) is most likely to divert to Melbourne. Freight on the Ardlethan to Temora and Narrandera to Junee lines could also possibly divert away from Port Kembla to Melbourne if shipping call patterns suited. As the Appleton Dock is constrained and the Port Kembla facility uses around 30% of its capacity, it is unlikely that significant grain volumes would be diverted south to Melbourne. It has been assumed that 5% of grain volumes will be diverted away from Port Kembla to Melbourne. Another 5% of total freight volumes from the Lower Murrumbidgee were assumed to be diverted from Sydney (on road) to Melbourne on an inland route.

There are approximately 750,000 tonnes of grain in southern New South Wales and not well serviced by rail infrastructure. A rail line linked from Narrandera down to Tocumwal, could win up to 300,000-400,000 tonnes of freight from road.

As demonstrated in chapter 2, there are significant freight volumes originating in the Griffith area bound for export terminals. As train services to Port Botany ceased in 2003/04, virtually all freight from Griffith is moved by rail to Melbourne. Up to 400,000 tonnes of rice is also moved from the Murrumbidgee Irrigation Area (near Narrandera and Coleambally) to Melbourne by rail. Chilled meat products are generally transported by road to Sydney or Melbourne. It was assumed that approximately 70% this rail traffic would be diverted if there were a rail connection through Tocumwal (approximately 450 kilometres), if the total cost of access for the shorter trip to Melbourne were proportional to the existing route via Junee (590 kilometres).

Southern Queensland

Coal and grain exports from the area around and west of Toowoomba at present moves on a capacity-constrained narrow gauge line, with many tight curves and tunnels, or by road to Brisbane. All this freight would divert on to a possible inland line including a tunnel (the track would be dual gauge), and there is the potential for a diversion of road freight and for freight growth. Future coal demand with an unconstrained network is expected to reach approximately eight million tonnes from the Surat Basin area over the forecasting period.

Western Australia and South Australia

The Study Team has assumed that 80% of freight between Western Australia and Brisbane and 90% of freight between Brisbane and South Australia would use an inland route. The freight from the west would enter and exit the Corridor via Parkes (Western Australia) and Melbourne (South Australia).

3.4 Freight forecasting model

A model was used to forecast freight flows based on the drivers discussed above, such as GDP and agricultural production. The model favoured by the Study Team is similar to a model already used by the BTRE – *FreightSim*, developed by an independent research firm FDF Management in consultation with the Bureau (see Box 2). After discussions with DOTARS and the BTRE, the Study Team also decided to use that model, which is soundly constructed and has the advantages of consistency with other BTRE applications and existing databases.

As discussed in chapter 2, the database used in the base forecasting year (2004) was a combination of:

- Air and sea freight data from official sources[2];
- Rail freight data from rail operators Pacific National (PN) and Queensland Rail (QR), and regional data from Patrick Portlink, PN Rural & Bulk, QR and Lachlan Valley Rail Freight. Data from the Australian Rail Track Corporation (ARTC) was used to cross-check the train operator data; and
- Road freight data from the BTRE (2001 estimates drawing on earlier FDF work with extensive BTRE revision based on the Australian Bureau of Statistics freight movement survey), updated to 2004 using *FreightSim*.

The processes and assumptions embedded in *FreightSim* are outlined in Box 2.

Box 2 - *FreightSim*

FreightSim

FreightSim is a forecasting model which is based on consumption, production and import functions in each of the 132 sub-statistical divisions in Australia. The residual (production + imports – consumption) is the unconsumed product which is assumed to be exported to another sub-statistical division or overseas destination (whose destination in *FreightSim* is the export port). The export function is correlated to transport costs – an explicit pricing function in-built in the model. Production, consumption and imports are correlated to forecast GDP. The relationship between GDP and the three variables is derived through a series of elasticities.

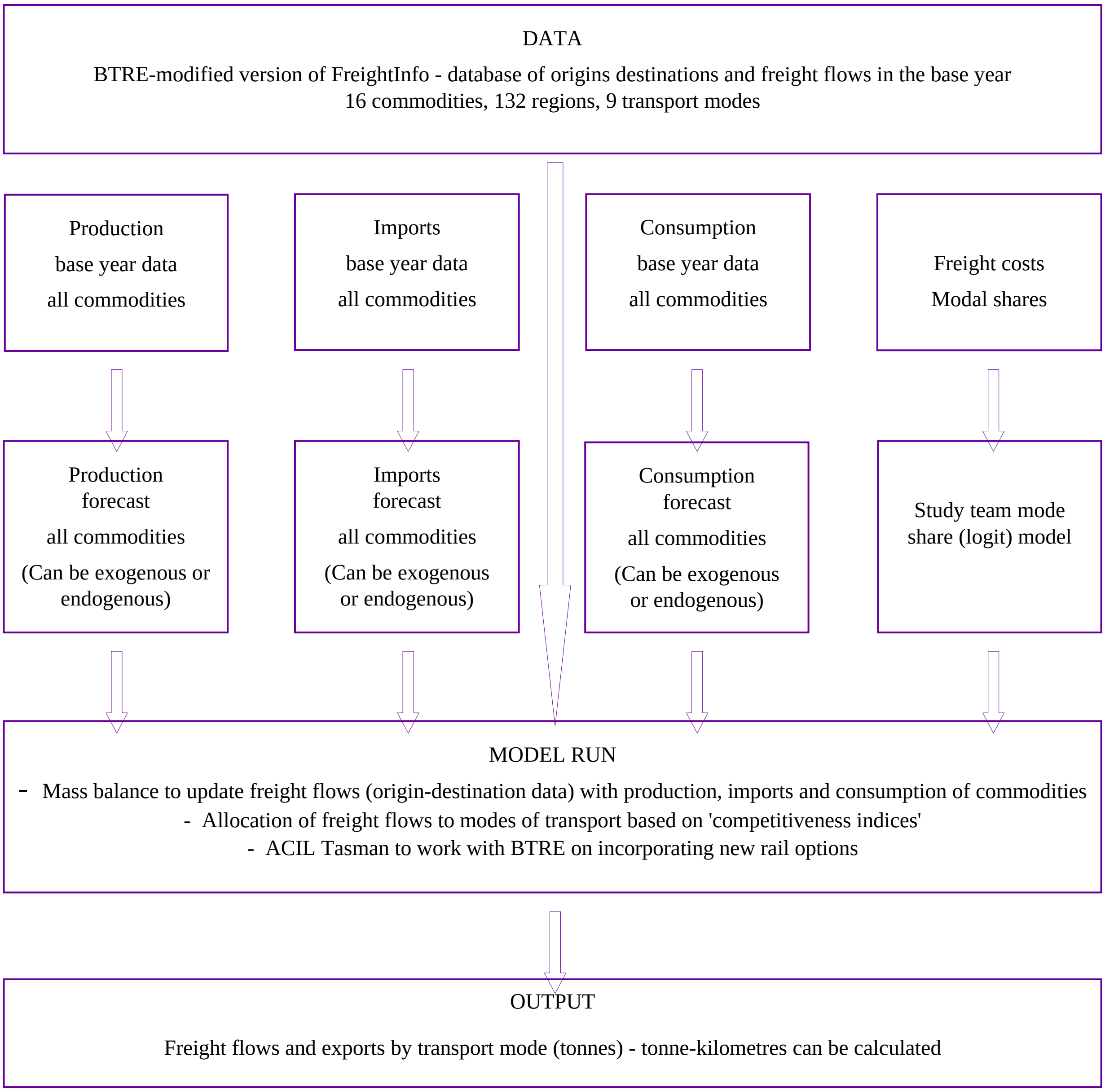
The modelling approach using *FreightSim* is shown in Figure 1. *FreightSim* models growth in freight flows through time as mainly a function of growth in production, imports and consumption of commodities. The latter are driven mainly by economic growth and population growth and can be specified as exogenous or endogenous to the model. With the exception of production of bulk commodities, growth in production of these commodities is always specified as exogenous. Production of non-bulk commodities can be endogenously or exogenously determined, as can the imports and consumption of all commodities.

Where the growth in these variables is specified as exogenous, an externally-derived set of projections is fed into the model. Sources of these projections would include CSIRO, BRS and ABARE. Where the variables are described as endogenous, the model applies growth rates to the initial starting data. These growth rates are derived by regionally-weighted GDP growth adjusted by an elasticity of response of the variable to GDP growth.

FreightSim undertakes a mass balance process to reconcile the new commodity production, consumption and imports numbers (based on the projection of growth rates for these variables) with the origin-destination (O-D) data in the *FreightInfo* database. The balance of consumption and imports from production is assigned to exports – an endogenous variable – that are available for freight transport.

[2] Department of Transport and Regional Services, *Australian Sea Freight 2003-04*, and Bureau of Transport and Regional Economics, *Airline Industry monthly summaries, by industry sector*, March 2006.

Figure 1 - Overview of the BTRE/FDF *FreightSim* model



Source: BTRE, FDF, ACIL Tasman

3.5 Induced demand

Lower transport prices in real terms and higher average service standards from transport operators combine to produce higher value for every dollar spent on transport services; this in turn will induce higher levels of freight. For example, on the Melbourne-Brisbane route freight customers will be able to select a relatively cheap transport mode with reasonable service standards. Until now, the choice was between a relatively expensive transport mode with excellent service standards (road) or a relatively cheap transport mode with poor service standards (rail).

The effect of lower transport costs as a result of a potential inland route between Melbourne and Brisbane would filter downstream into slightly lower retail prices. Lower-priced goods typically increase the quantity of goods demanded by consumers and there is a subsequent increase in the demand for transport services. The demand response here is measured by income elasticity, not substitution elasticities between transport modes (which are measured below by the logit model).

The level of induced freight is estimated by taking the combined effect of:

- Higher combined reliability;
- Higher combined availability; and
- Lower combined price,

and multiplying the forecast changes in the above demand parameters by the income elasticities with respect to price, reliability and availability.

The estimated level of end-to-end induced freight on the Melbourne-Brisbane route with a potential inland route is in the order of 2% or 123,180 tonnes in 2014 and 2.3% or 250,000 tonnes in 2029. As prices on an inland route are forecast to be approximately 2% lower than the existing coastal route and approximately 20-25% lower than road prices, the level of induced freight depends on where a potential inland route attracts its freight. As the Coastal Route is forecast to capture 63% by 2029 without an inland route, a large shift to an inland route from the Coastal Route (when an inland route is introduced) and a relatively small shift from road means the overall reduction in transport costs will be small. Thus the level of induced freight is small.

The levels of induced freight stimulated by a potential inland route from regional areas in southern New South Wales, northern New South Wales and southern Queensland were lower, given many of the product volumes are production-driven, not demand-induced[3] Estimates of induced freight from regional areas serviced by potential inland routes are approximately 0.3% or 82,260 tonnes in 2014 and 0.3% or 114,240 tonnes in 2029.

[3] Customers shipping agricultural export products have a higher export focus and place less weight on availability at certain times of day and reliability to within 15 minutes.

3.6 Results

This section presents the forecast annual freight volumes on the inter-capital city pairs from 2004 to 2029.

Table 5 outlines the two assumptions in Cases A, B and C affecting total freight volumes over the forecasting period.

Table 5 - Cases A, B & C for sensitivity testing of forecast total freight volumes over the forecasting period, 2004-29

	Case A	Case B	Case C
GDP growth	3.25	3.6	2.75
Transport/GDP growth ratio	1.3 to 1.05	1.3	1 (held constant)

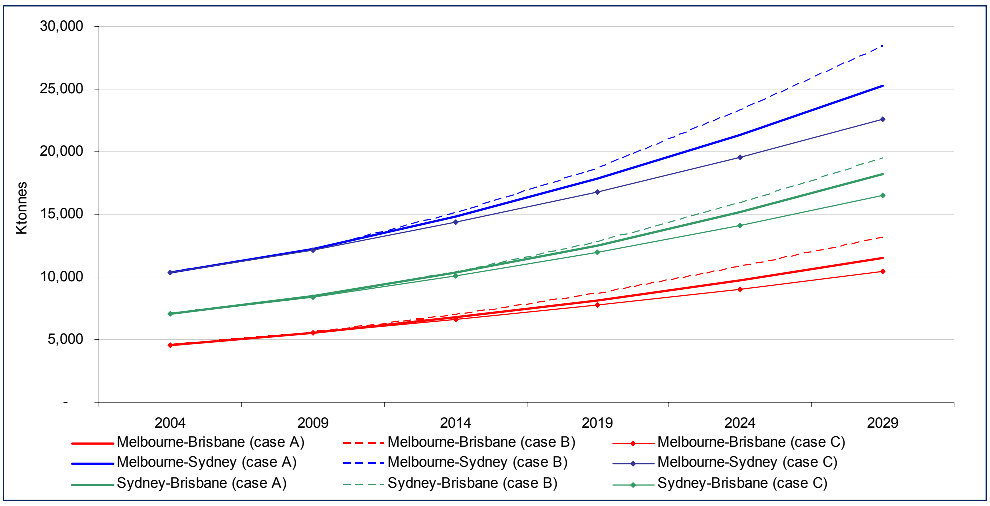
Source: The Study Team, BTRE, FDF Management

3.6.1 Total inter-capital city routes

Chart 9 shows the sensitivity of total freight market outcomes on the three inter-capital city routes to the freight transport to GDP growth and GDP growth assumptions incorporated in Cases A, B and C.

The variance on all routes are pronounced, with Cases B and C on the Melbourne-Sydney route shifting total freight volumes by 3 million tonnes above and below the 25 million tonnes forecast in Case A by 2029. Variances away from Case A on the Melbourne-Sydney and Sydney-Brisbane routes amount to roughly 2 million tonnes by 2029.

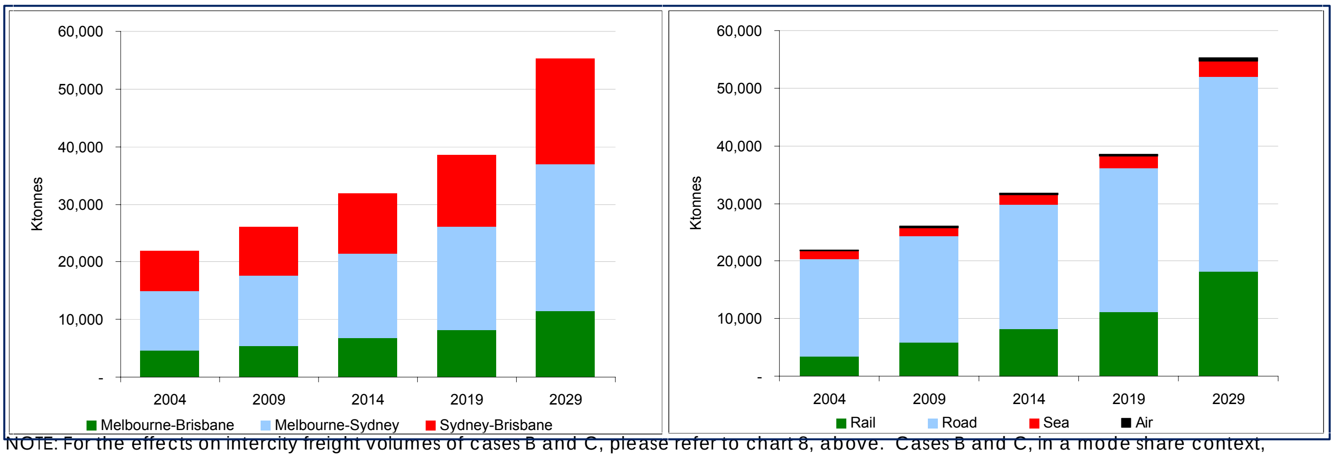
Chart 9 - Total freight tonnage on the Corridor by origin-destination, cases A, B and C, 2004-2029 (ktonnes)



Source: The Study Team, BTRE, FDF Management

Chart 10 shows the growth in the total freight market on the three inter-capital city routes and growth in volumes for each transport mode over the forecasting period. Freight on the three routes is forecast to grow proportionally with the starting volumes in 2004, with the Melbourne-Sydney route growing the most by 2029 in aggregate terms, followed by the Sydney-Brisbane and the Melbourne-Brisbane route.

Chart 10 - Total inter-capital freight on the Corridor by origin-destination (left) and mode (right), Case A, 2004-2029 ('000 tonnes)

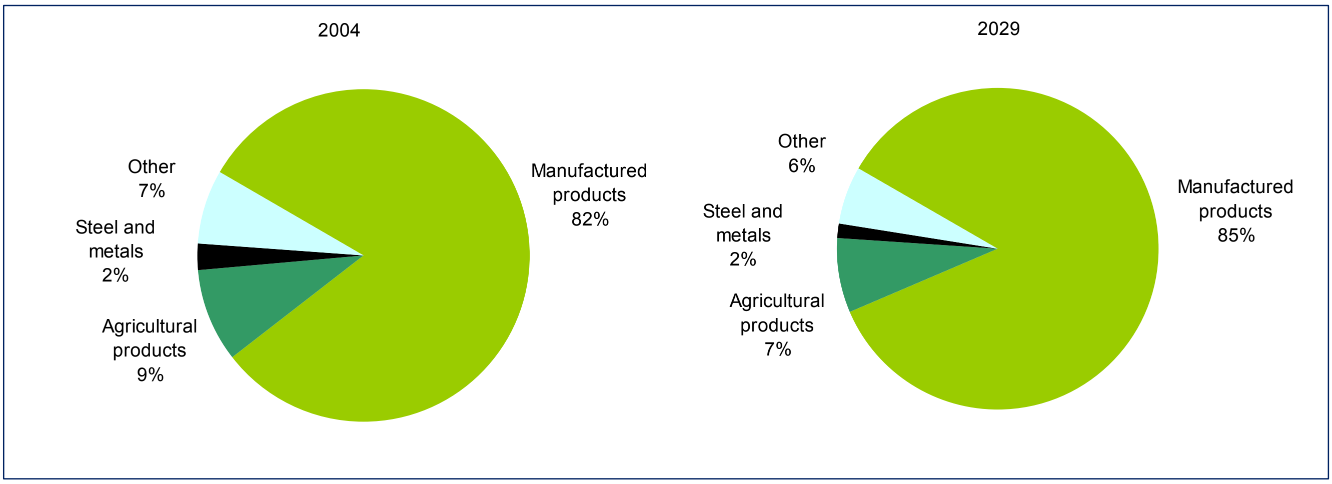


NOTE: For the effects on intercity freight volumes of cases B and C, please refer to chart 8, above. Cases B and C, in a mode share context, are discussed and presented in section 4 of this chapter.

Source: The Study Team, BTRE, FDF Management

Chart 11 shows manufactured products start and end the forecasting period with the vast majority of freight on the inter-capital routes. Manufactured goods comprised 82% of the total freight market in 2004 and are expected to increase slightly to 85% of the total freight market in 2029. Agricultural products comprised 9% of total freight in 2004 and are forecast to decline to 7% by 2029. Steel products are expected to maintain 2% of total freight and other freight is forecast to remain at 6-7% throughout the forecasting period.

Chart 11 - Commodity breakdown of inter-capital freight on the Corridor in 2004 (left) and 2029 (right), Case A



Source: The Study Team, BTRE, FDF Management

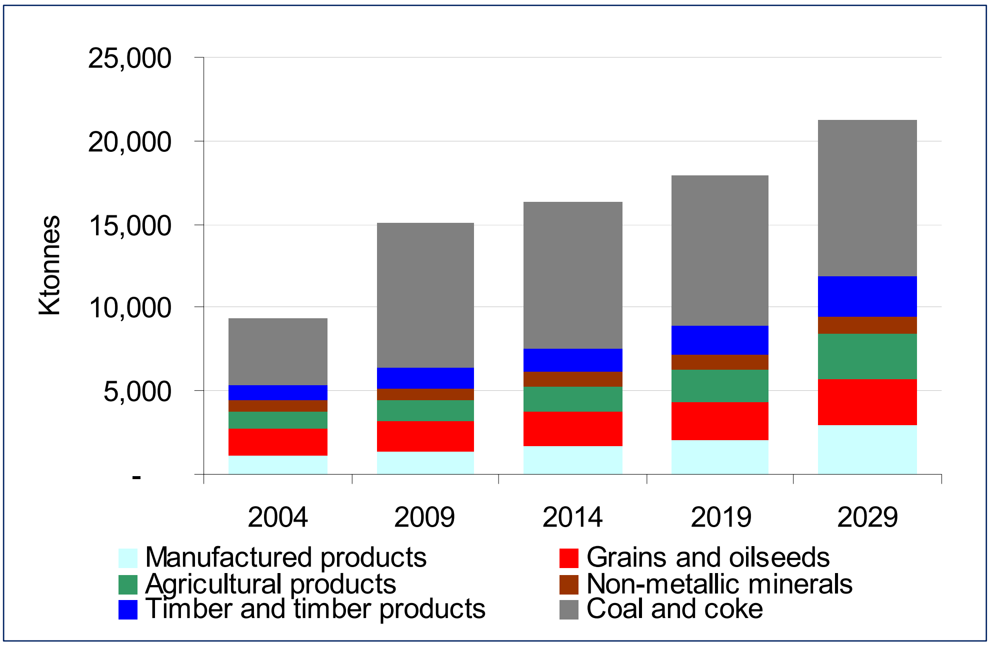
3.6.2 Regional freight

Case A is the only forecasting scenario tested for regional freight areas. Most of the freight from these areas (with the exception of to and from South Australia and Western Australia) is exported-oriented (dependent on world consumption) and production-driven, and therefore only moderately responsive to Australian GDP growth. Thus results for Cases B and C are not shown here.

3.6.2.1 Southeast Queensland

Chart 12 shows forecasts of strong coal volumes from the Surat Basin to Brisbane between 2004 and 2009 (assuming an inland route eases the current capacity constraints). Over the forecasting period, growth is also expected from manufactured products, agricultural products and grain.

Chart 12 - Freight by main commodity: Southeast Queensland, 2004-2029, Case A, ('000 tonnes)



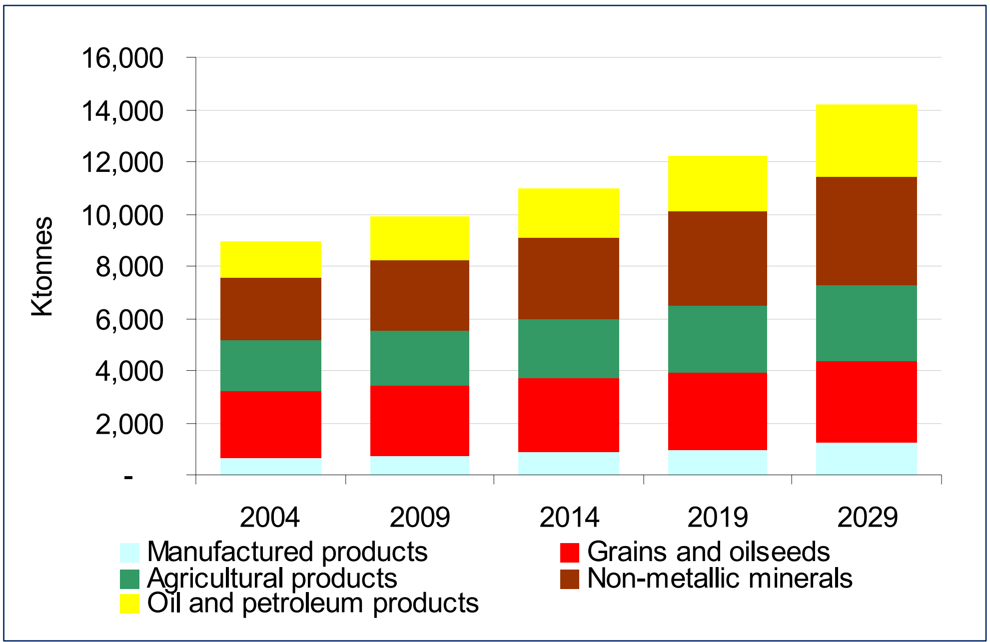
Source: The Study Team, BTRE, FDF Management.

The Queensland Government's current policy position on rail infrastructure is not inconsistent with the magnitude of these freight forecasts. The Study Team understands that the Queensland Government will review its rail infrastructure policies once the outcomes of this Study are known. One possible policy option could see freight from the Surat Basin and Darling Downs regions diverted to Gladstone and away from Brisbane.

3.6.2.2 Northern New South Wales

Chart 13 shows that non-metallic minerals, cotton (agricultural products) and petroleum products are forecast to grow significantly, while grain volumes and manufactured products are expected to grow at a slightly more modest pace.

Chart 13 - Freight by main commodity: Northern New South Wales, 2004-2029, Case A, ('000 tonnes)



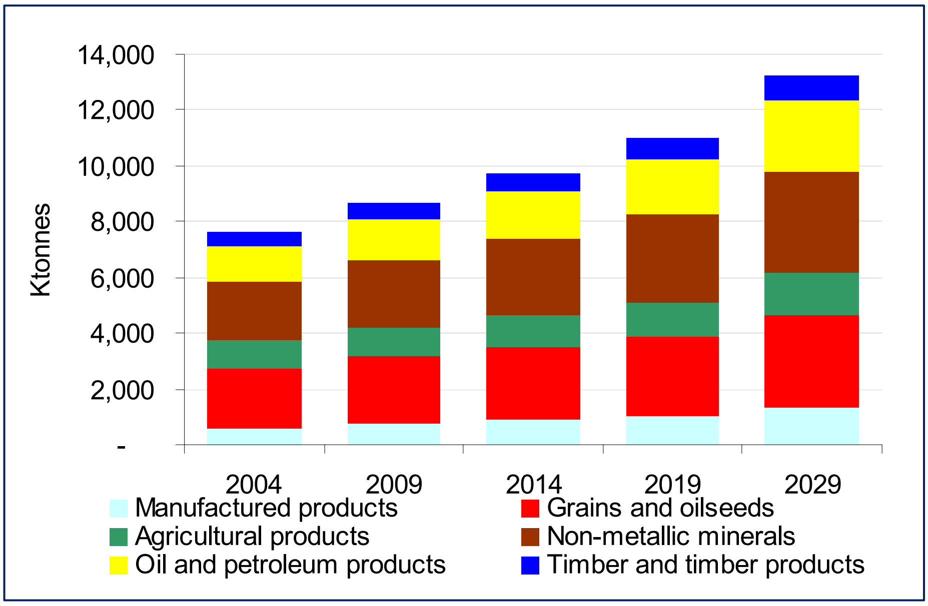
Note: This analysis excludes coal freight volumes.

Source: The Study Team, BTRE, FDF Management.

3.6.2.3 *Central New South Wales*

The five main commodities moving to and from central NSW are forecast to grow from just under 8 to 13 million tonnes over the forecasting period. As shown in Chart 14, non-metallic minerals, grain volumes and petroleum products are forecast to grow significantly, while manufactured and agricultural products will grow at a more modest pace over the forecasting period to 2029.

Chart 14 - Freight by main commodity: Central New South Wales, 2004-2029, Case A, ('000 tonnes)



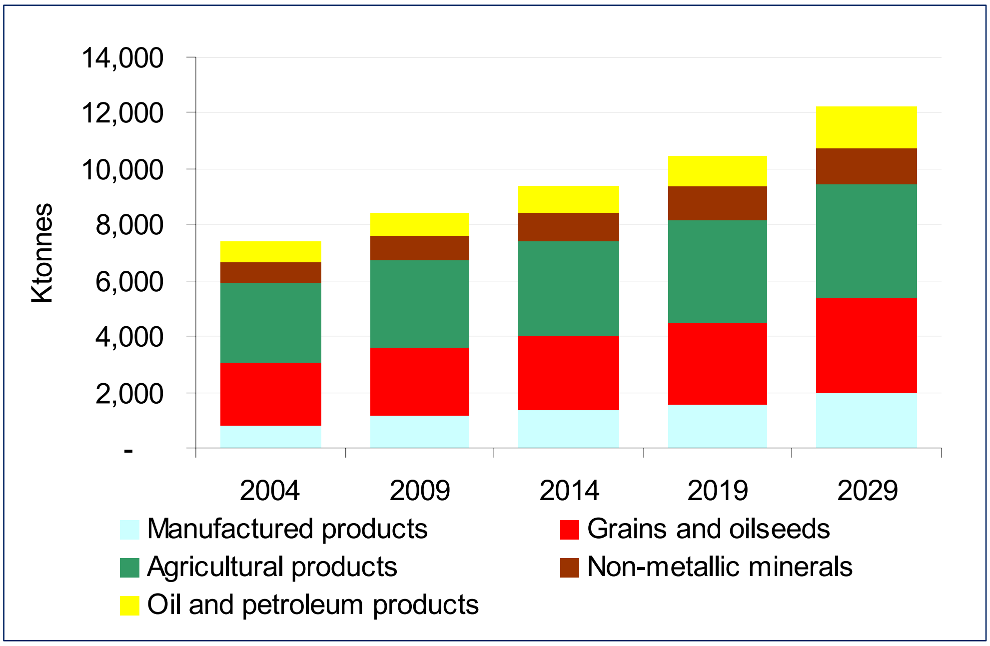
Note: This analysis excludes coal freight volumes.

Source*:* The Study Team, BTRE, FDF Management.

3.6.2.4 Southern New South Wales

The main five freight commodities moving to and from southern New South Wales are forecast to grow from seven to 12 million tonnes over the forecasting period. As shown in Chart 15, manufactured products and grain volumes are forecast to grow relatively strongly while petroleum products and non-metallic minerals will grow at a more modest pace towards 2029.

Chart 15 - Freight by main commodity: Southern New South Wales, 2004-2029, Case A, ('000 tonnes)

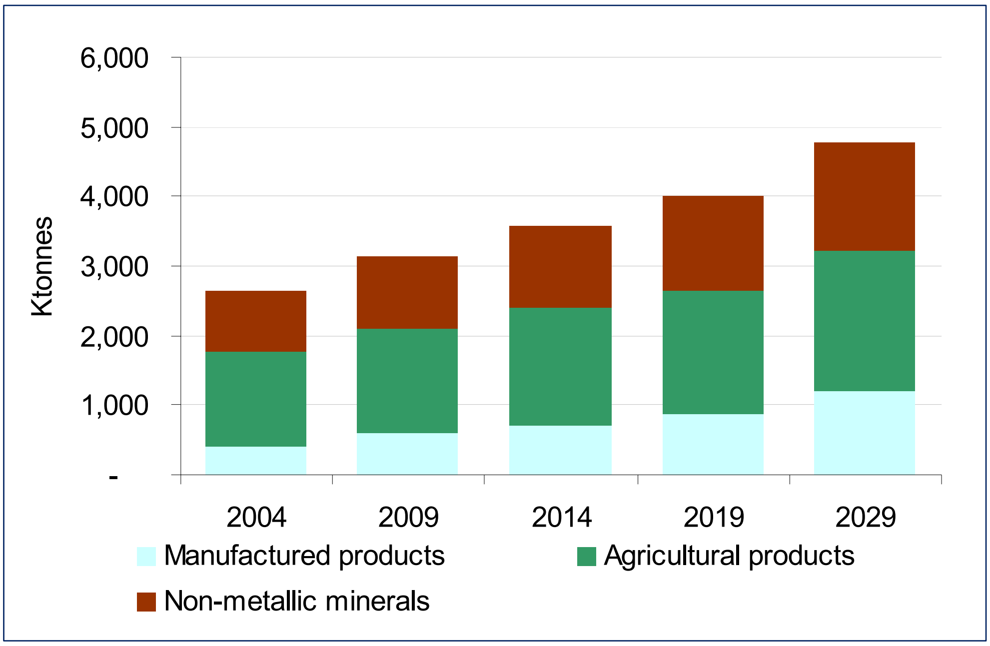


Source: The Study Team, BTRE, FDF Management

3.6.2.5 Northern Victoria

The three main freight commodities moving to and from northern Victoria are forecast to grow from 2.7 to 4.8 million tonnes over the forecasting period. As shown in Chart 16, manufactured products, non-metallic minerals and agricultural products (the largest group) exhibit uniform growth over the forecasting period to 2029.

Chart 16 - Freight by main commodity: Northern Victoria, 2004-2029, Case A, (‘000 tonnes)

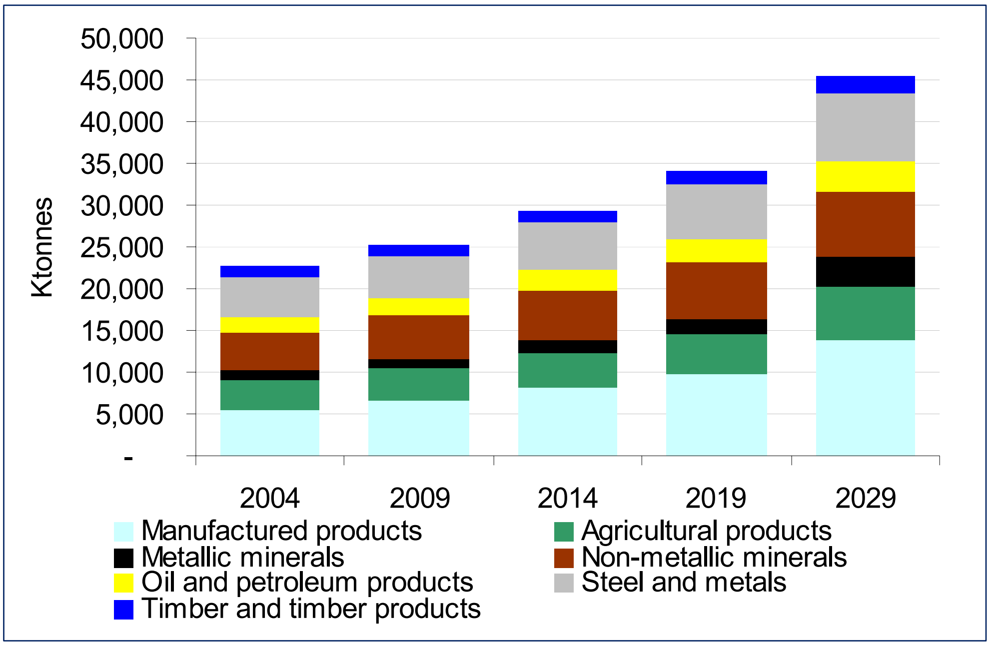


Source*:* The Study Team, BTRE, FDF Management.

3.6.2.6 Non-capital city routes on coastal corridor

The seven main freight commodities moving along the existing Melbourne-Sydney-Brisbane corridor to and from intermediate points are forecast to grow from 23 to 45 million tonnes over the forecasting period. As shown in Chart 17, by far the largest growth is forecast to occur in manufactured products, with steel and non-metallic minerals also projected to grow strongly. The remaining four products are forecast to experience more modest growth over the forecasting period to 2029.

Chart 17 - Freight by main commodity: non-capital city routes on coastal corridor, 2004-2029, Case A, ('000 tonnes)

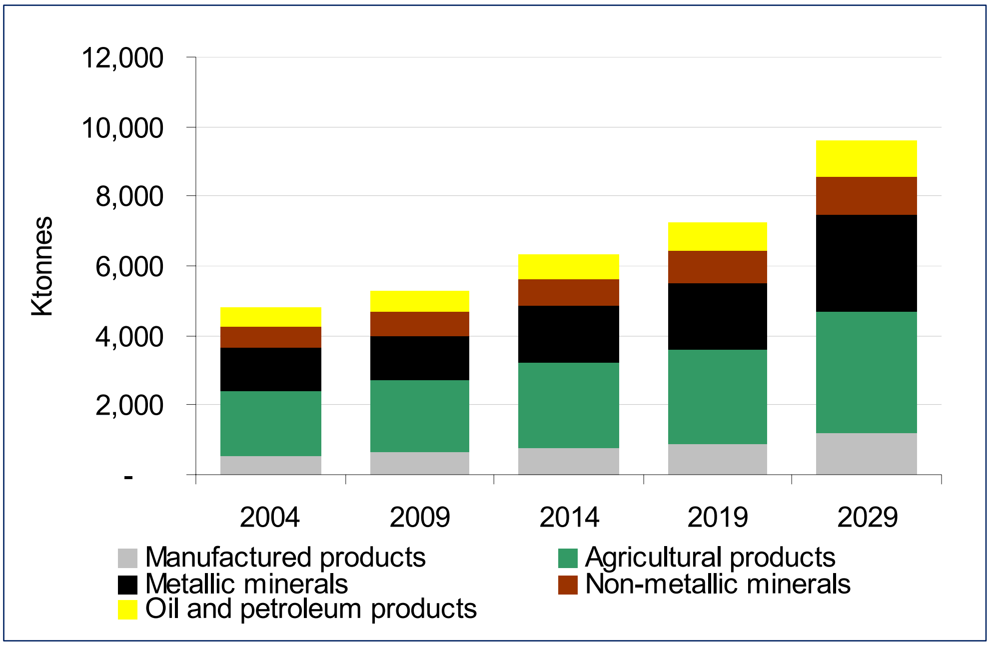


Source: The Study Team, BTRE, FDF Management.

3.6.2.7 To and from northern Queensland

The five main freight commodities moving to and from northern Queensland and points in the Corridor are forecast to grow from just under 5 to just under 10 million tonnes over the forecasting period. As shown in Chart 18, by far the largest growth is forecast to occur in agricultural products and metallic minerals, with manufactured goods, non-metallic minerals and petroleum products forecast to experience more modest growth over the forecasting period to 2029.

Chart 18 - Freight by main commodity: Northern Queensland, 2004-2029, Case A, ('000 tonnes)

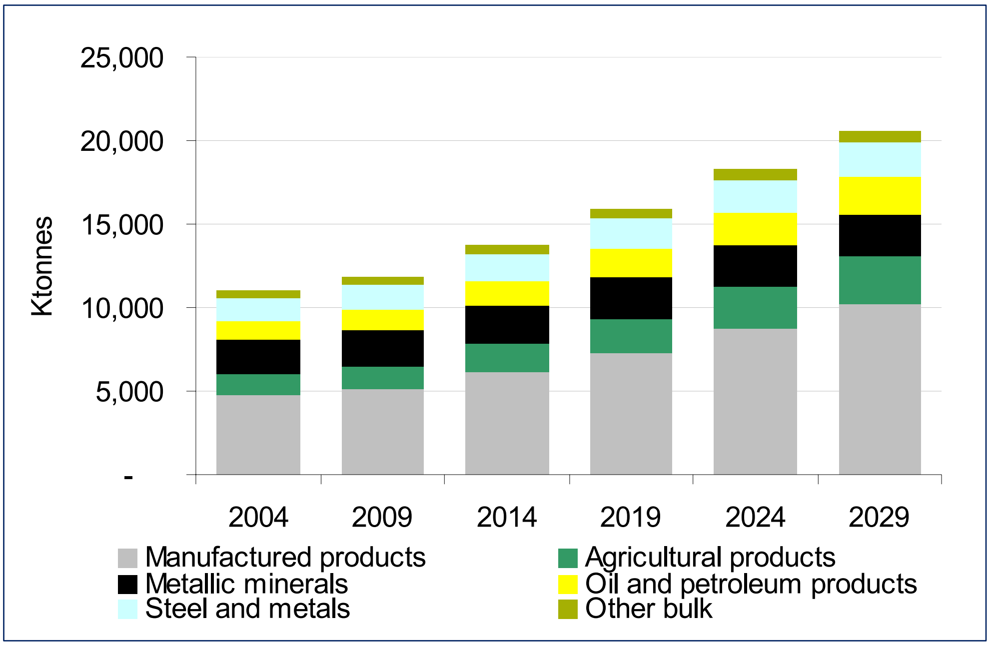


Source: The Study Team, BTRE, FDF Management.

3.6.2.8 Traffic to and from South Australia and Western Australia

The six main freight commodities moving to and from South Australia and Western Australia are forecast to grow from 11 to just over 20 million tonnes over the forecasting period. As shown in Chart 19, by far the largest growth is forecast to occur in manufactured products, with the remaining five products projected to experience more modest growth over the forecasting period to 2029.

Chart 19 - Freight by main commodity: WA/SA, 2004-2029, Case A, ('000 tonnes)



Note: This analysis excludes coal freight volumes.

Source: The Study Team, BTRE, FDF Management.

4 Freight modal shares

4.1 Context

The previous section assessed total freight in the Corridor; this section estimates the share of total freight that will be carried by rail to provide a basis for estimates (in the subsequent section) of rail freight tonnages.

In Australia's early history, domestic freight (as opposed to international freight) was dominated by coastal shipping, with limited land transport serving the hinterland behind the ports. As railways developed from the late 19th century, coastal shipping declined except for bulk commodities. Railway domination began to decline in the middle of the 19th century as truck design and roads improved. Deregulation of interstate trucking in 1955 and the subsequent removal of state regulation that protected rail freight had an added effect. From the 1970s, road became the dominant mode for freight within the Corridor except for commodities such as grain and coal for which rail freight has inherent advantages (and for relatively minor volumes of express freight that move by air). Until recently, the rail freight market share continued to decline.[4]

Recent and current changes in the industry will help rail's competitiveness in the Corridor. Hence the declining trend of rail's mode share is unlikely to be a good guide to the future. The main train operator in the Corridor was privatised in 2002, the corporatised Australian Rail Track Corporation (ARTC) took over management of Victorian interstate track in the late 1990s and much of the New South Wales track in September 2004, and the current AusLink/ARTC investment program will deliver much improved rail infrastructure by 2009. Meanwhile, road freight rates are increasing due in part to fuel prices and labour costs (reflecting a driver shortage).

The Study Team therefore did not use the modal share component of the *FreightInfo* forecasting model, which predicted continuing gradual change in rail's mode shares. Instead, the Study Team extensively surveyed freight firms and customers to learn their likely response to the step change in rail service quality resulting from the current upgrade program and potential further improvements, including a possible inland route. The survey results were used in economic modelling (with cross-checks from the literature and international experience) to produce forecasts which differ from the past and according to the route.

4.2 Factors affecting modal share

4.2.1 Relevant factors

Past experience and related literature, confirmed consistently in the Study Team's industry interviews, shows that a small number of factors explain the changes in modal share observed in the past and the likely changes expected in the future.

Usually the major determinant is **door-to-door price,** that is, the total cost of transporting from the originating point, for example, a wharf or factory, to the ultimate destination such as another factory or a supermarket. For road freight, the linehaul and door-to-door costs are often the same, whereas for rail freight (especially the container traffic that dominates in this Corridor) the cost includes linehaul costs, terminal costs and local pickup and delivery (PUD) costs. To compete, the rail freight linehaul cost must be sufficiently below the road freight equivalent to compensate for the extra terminal and PUD costs, and for differences in service quality.

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[4] See *Competitive Neutrality Between Road and Rail*, BTRE Working Paper 40, 1999

The other major determinant is **service quality**, which has several dimensions. Those that matter most are related to each other: transit time, availability and reliability. A reduction in transit time due to improved infrastructure, for example, can, depending on train operator behaviour, be used to:

- Reduce the average door-to-door transit **time** (at present much lower for road than for rail freight);
- Improve the **availability** of service when customers want it (in particular to allow rail freight departures later in the day to better match the offering from road freight); and/or
- Improve **reliability** (that is, the likelihood of arrival approximately on schedule) by allowing more margin for error to be built into the schedule, thus allowing more opportunity to catch up after delays. At present road freight services in the Corridor are much more reliable than rail freight services.

The survey provided many insights on the best mix of these, which are reported below and incorporated in the Study Team modelling.

Other aspects of service quality such as loss or damage were mentioned by only a few respondents and no longer appear to be significant in differentiating between road and rail freight services.

4.2.2 Relative price

To the extent that prices are a factor in modal choice, it is the relative prices between modes that matter. In the past, there has been a long-term downward trend in real price per net tonne kilometre (NTK) by road and rail as a result of improving technology, better roads and competition, although real road prices have been increasing since 1997 and real rail prices since 2003.

A summary of freight customers and forwarders' opinions on the importance of prices is found in section 4.6. Further discussion of future rail and road prices is set out in section 4.8.

4.2.2.1 Road freight rates

This section begins with a discussion of likely road freight developments, as rates for road freight (the dominant mode) have generally put a cap on rail freight rates. The main expected developments in road freight over the 25-year horizon for the study are:

- Continued improvements in engine and transmission technology, but with broadly similar improvements available in rail locomotives;
- Continued improvements in brakes, suspension and other aspects of truck design which, through the National Transport Commission (NTC) performance-based design program, will lead to continuing increases in maximum truck weight and truck efficiency;
- Continued improvements to main roads in the Corridor, in particular the upgrade of the Pacific Highway, which are expected to reduce the average transit time between Sydney and Brisbane by up to four hours. Transit times on the Hume and Newell highways are not expect to have a major change in transit time, although there will be continuing improvements and bridge strengthening will underpin the expected increases in truck weights;
- A possible move to some form of mass distance charging using vehicle positioning technology (satellites, transponders etc). This would allow the current system of registration charges and fuel excise to be replaced by tailor-made charges based on weight, axle loads, distance travelled, roads used, etc. A consequence is that it would become legal to operate much heavier trucks, as there would be a basis for making them pay a considerable premium for extra damage to the roads. An advance case of this approach now applies to logging trucks in parts of Tasmania. The advantage of the increased weight outweighs the extra charges, that is, the cost per NTK would further decline;

- Potentially increased truck user charges if there is a move towards charging for external costs (noise, pollution etc); earlier ACIL Tasman work for the SCOT Rail Group confirmed that the impact of externality charging would be generally be lower on rail freight and lower still on sea freight[5];
- Possible changes from decisions made following the current Productivity Commission enquiry into transport infrastructure charges (there could also be implications for rail infrastructure charging); and
- Increased operating costs due to driver shortages and fuel price increases, again with more impact on road freight than on rail or sea freight.

*4.2.2.2 **Rail freight rates***

The starting point is current rail freight rates, which are generally lower than road freight rates per NTK for the reasons discussed above.

The Study Team has also modelled alternatives where the price trends diverge, in particular where the current AusLink/ARTC investment program lowers the train operating costs which are fed into prices, and where a potential inland route also lowers operating costs and prices. The analysis is based on:

- Above rail operating and capital costs on coastal routes;
- Above rail operating and capital costs on inland routes; and
- Metropolitan pickup and delivery (PUD).

In both the rail and road sectors it is assumed that competitive forces mean that costs are reflected in prices. The road freight sector is intensely price and service-standard competitive and is expected to remain so as barriers to entry are low. The rail freight sector in the Corridor has a major train operator (Pacific National), a relative newcomer that is, however, a major train operator (Queensland Rail), and two smaller specialised train operators (Silverton Rail and Lachlan Valley Rail Freight). Specialised Container Transport (SCT), a successful train operator on the Melbourne and Perth route, has signalled its intention to operate in the Corridor.

The current AusLink/ARTC investment program will create a large number of additional train paths, thus reducing barriers to entry. There are still moderate entry barriers in the form of terminal constraints, which should be addressed, especially in Sydney and Brisbane. The conclusion is that considerable competitive pressure can be expected in this Corridor over the 25-year horizon between road freight operators, between rail freight operators, and between road and rail. Thus average rail prices will not drift too far from the combined track and train long-run marginal costs (LRMC).[6] This is consistent with the dynamic programming model's assumptions for finding equilibrium prices from modelled future market outcomes.

*4.2.2.3 **Sea freight rates***

Sea freight rates per net tonne kilometre are well below road and rail freight rates, but the lower frequency and speed of sea services has meant that sea freight in the Corridor has been largely confined to bulk commodities such as petroleum

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[5] The exceptions are very lightly loaded passenger or freight train services, where buses or trucks would have lower external impacts due to their better laden to unladen weight ratio; such services have little relevance to this project.

[6] As demand for transport services with respect to most commodities is seasonal due to agricultural products being grown at certain stages of the year and strong demand for general merchandise goods for the three-four months prior to Christmas (September to December), prices are expected to fluctuate each year. On average over the 12 months, however, the Study Team expects annual prices to be commensurate with LRMCs.

and cement. The economics (low value relative to volume) are such that these bulk commodities do not move by rail except in relatively small quantities and do not move by road except for local and regional delivery. Recent work by the Study Team in the cement sector indicated that long-distance land transport was only used for small, irregular top-up quantities.

However, the possibility of coastal shipping competing with land transport is indicated by services on East-West routes to Fremantle (especially of shipping containers) recently introduced by Pan Shipping. [7]Some increased coastal services are also permitted by foreign ships through the issuing of single and multiple voyage permits. The Study Team's shipping industry contacts were of the general view that shipping was unlikely to become a major competitor for the types of freight carried in the Corridor by road and rail services, although the contrary is not out of the question (for example, if the permit system is further liberalised) and could be considered as an outlier case.

4.2.2.4 Air freight rates

Air freight typically accounts for less than 1% of the freight volumes in the Corridor (between 0.6 and 1.1% depending on the inter-capital city pair), and comprises postal and other urgent shipments that can carry the extra transport cost. Fuel is a major component of airline costs and the situation is not expected to change significantly over the forecast period.

4.2.3 Service quality

In the Study Team's industry surveys, discussed in more detail in section 4.6, respondents were asked:

- About the current levels and types of freight (commodities, origin to destinations), current modal choice and reasons for the choice;
- How they would respond to relative rail service quality improvements expected to be achieved as a result of the current ARTC Corridor rail upgrade; and
- How they would respond to additional service quality improvements that might be achieved by further coastal upgrades or an inland route.

The responses were the basis for simulation modelling and cross-checked against earlier studies, literature and overseas experience. As predicted by earlier studies and the literature, stakeholder consultations and the survey responses indicated that, to varying degrees, freight customers and forwarders are sensitive to service standards when making mode choice decisions.

A summary of freight customers' and forwarders' opinions on the importance of service standards and their preferred levels is found in section 4.6. Further discussion of future rail and road service standards is set out in section 4.8.

4.2.4 Increased driver costs

The modelling of future road and rail price movements reflected the market's general (though not universal) contention that truck drivers will become scarcer than train drivers. It also reflected the recent introduction of COR regulations in the road sector. Thus, in Case A the Study Team assumed labour costs of linehaul road transport to increase by 6% per annum until 2010 and then 4% thereafter, that is, a higher increase than for labour in general. It also assumed rail labour costs would increase by 4% per annum until 2010 and 3% thereafter. Rail's labour cost increases are assumed to be lower than the rising salaries and labour-related costs of the past five years in the trucking industry.

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[7] www.panlogistics.com.au, accessed 28 May 2006

To demonstrate the significance of high, low and medium labour costs for road and rail on mode share outcomes, the Study Team incorporated some higher (Case B) and lower (Case C) labour cost assumptions. Case B assumed road labour costs would grow by 8% per annum from 2004 to 2009 and 6% thereafter over the forecasting period (rail labour costs remained constant). Road and rail's labour costs were assumed to remain at 4% throughout the forecasting period in Case C.

4.2.5 Increased fuel costs

In recent times, rapidly rising fuel prices have escalated transport costs sharply. The freight transport industry, much like the aviation sector, has introduced fuel surcharges to pass the higher fuel costs to customers. In Australia, for instance, the rail sector's fuel surcharge is currently between 10% and 15% and adjusts monthly to take account of movements in costs.

The Study Team built operating cost structures to forecast future price movements based on the earlier assumption that material price competition within and between the road and rail sectors would force operators to pass on cost savings to customers. The team's operating cost models show over 38%[8] of linehaul truck operating costs are fuel-related (including fuel excise) and between 12% and 16% for door-to-door rail costs in the Corridor (the variation is related to the length of the route).

Increases in future diesel prices will favour the less fuel-intensive rail sector at the expense of road. Conversely, if future diesel prices in Australia fall as a result of a higher exchange rate and/or lower crude oil prices, then road prices will fall faster relative to rail prices.

The Study Team's crude oil forecasts are based on the Energy Information Administration's (EIA) crude oil forecasts.[9] The EIA's forecasts are slightly higher than Australian-based forecasts of future crude oil prices but show declining real prices during the forecasting period from US$65 per barrel in 2006 to US$50 per barrel in 2029.[10] The Study Team has taken EIA's forecasts and via a conversion mechanism forecasted Australian fuel prices for Case A. Fuel prices for Case B are assumed to start and stay at US$70 per barrel (in real terms) throughout the forecasting period. Case C broadly follows the forecasts of Deutsche Bank and ABARE, which track down from US$70 per barrel to US$40 per barrel in nominal terms. The Study Team's modelling shows that a US$20 difference in crude oil prices will cause Australian diesel prices to differ by approximately 20 cents per litre.

4.2.6 Future access charges on coastal rail, inland rail and road

The Study Team assumed that the access arrangements for existing rail and road routes in the Corridor would continue with annual access charges declining slightly in real terms. Access prices for the possible inland route were also increased by the same annual growth factors as the coastal route. Table 6 shows the assumed levels of growth of rail access charges and road user charges.

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[8] This figure was calculated on a diesel price of $1.40 per litre, a truck consumption rate of 1.7 kilometres per litre and a truck travelling 300,000 kilometres per annum.

[9] The EIA is an analytical and forecasting arm of the US Government's Department of Energy.

[10] Australian estimates include ABARE energy forecasts (March 2006) and Deutsche Bank commodity forecasts.

Table 6 - Assumed future annual growth rates for road user charges and rail access charges

	Road user charges	Coastal rail route	Inland route
2004-2009	2% (nominal) or -0.5% (real)	0.5% (real) or -2% (nominal)	-
2010-2019	2% (nominal) or -0.5% (real)	1.5% (nominal) or -1% (real)	1.5% (nominal) or -1% (real)
2020-2029	2% (nominal) or -0.5% (real)	2% (nominal) or -0.5% (real)	2% (nominal) or -0.5% (real)

The relative charges for use of rail and road infrastructure affect the end freight costs charged to customers and the competitiveness of rail versus road freight. The extent of the impact is incorporated in the Study Team's demand analysis. The relative impact of track access charges and road user charges on end-customers' modal decisions is shown in Figure 2.

Figure 2 - The relative impact of track access charges and road user charges on end customers' modal decisions

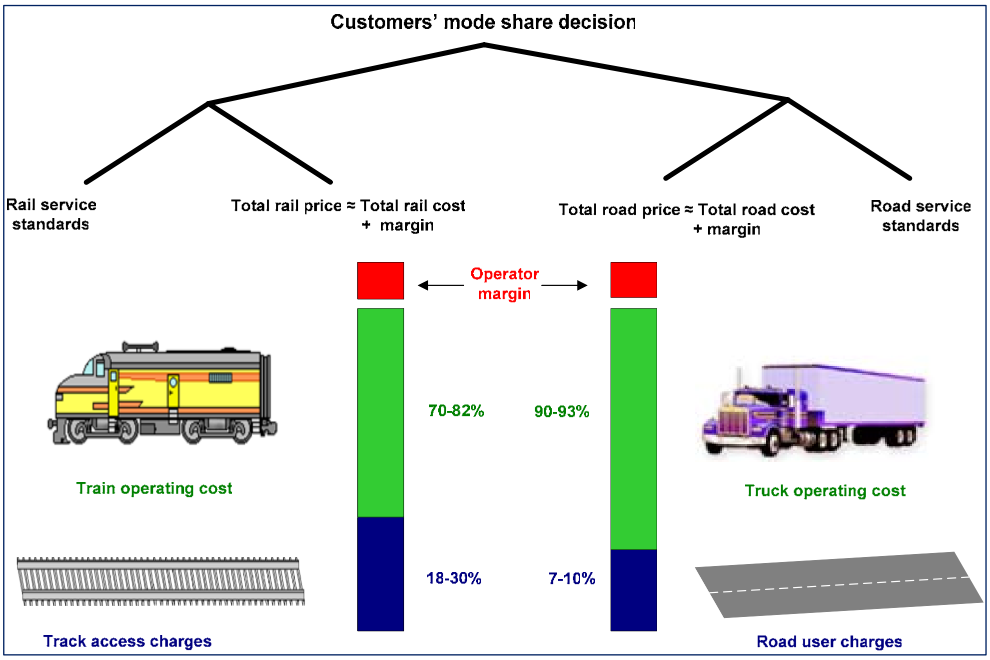


Figure 2 shows that the impact on land mode shares from changes in rail access or road user charges is unlikely to be proportional. Road user charges comprise a smaller proportion of road's operating costs than access charges do on rail operating costs, as trucks usually have higher operating costs per NTK than trains.[11] Road user charges amount to approximately 7-10% of road freight's total operating costs (for six axle articulated semis and B-doubles) and access charges are roughly between 18-30% of rail's total operating costs. An increase in rail access charges has a larger

[11] This is despite road having higher road user charges (1.0 cents per NTK) than rail access charges (0.6-0.8 cents per NTK).

impact on rail's total operating costs and hence prices than the same percentage increase in road user charges does on road's operating costs.

An increase in rail access charges will increase the infrastructure provider's revenue on a per gross tonne kilometre (GTK) basis. The likely response, however, from users of rail services would be to reduce the volume of freight they send by rail, or at least by that rail route if there was another route choice. The effect would be a reduced number of GTKs carried on an inland route. The opposite applies to a price reduction.[12] The interaction between an inland route and the existing (coastal) rail route, and between North-South road routes, expressed as cross elasticities, will determine the volume decrease in response to an increase in the cost of freight services.[13]

4.2.6.1 Possible access charges on an inland route

For the purposes of forecasting future demand and revenue in the Corridor, the Study Team applied four simple access charges to possible inland routes. The options are set out in Table 7 and assume train operators pass through the additional access costs to customers in terms of higher per tonne prices.

Table 7 - Access charges on existing and possible inland route on the Melbourne-Brisbane corridor

	Roundtrip market price ($/tonne)	Roundtrip access cost ($/tonne)	Access charges ($/000 GTK)	Increase above existing route ($/000 GTK)
Existing road price	$180	$14.50	-	-52%
Existing coastal rail price	$150	$30	$2.80-$3.20	-
Scenario 1	$150	$30	$4.01	38%
Scenario 2	$157.50	$37.50	$5.02	72%
Scenario 3	$165	$45	$6.02	107%
Scenario 4	$180	$60	$8.02	175%

Note: These are indicative prices. Coastal route is 1,954 km in length between Melbourne and Brisbane and the proposed inland route would be approximately 1,700 km in length.

Note: Round trip prices have been used to avoid the large discrepancy in freight rates charged to customers in both directions so that access prices can move freely without appearing to unduly influence operator margins by too little or too much in each direction.

Source: Industry sources from ACIL Tasman market research

[12] This is the price elasticity of demand, a percentage change in demand for a good or service in response to a percentage change in price for that good or service. Usually the price elasticity is negative – a price increase causes a reduction in demand, and a price reduction causes increased demand.

[13] The cross elasticity of demand for a rail route is the response of demand on that route to a change in price of a competing service (e.g. a road service or a competing rail route). Usually cross-price elasticities are positive – a price increase on one service causes a demand increase (from diversion) on a competing service.

- The first scenario was to set the total cost of access of proposed route options equal to that of the coastal route, per tonne. This established an access charge that was 34% higher on the shorter proposed routes than the coastal route on a dollar per thousand GTK.
- The second scenario has the total roundtrip cost of access for a possible inland route arbitrarily being 25% higher on an end-to-end per tonne basis than that on the coastal route (or 67% higher on a $/000 GTK basis).
- The third scenario was based on the rail price to customers being 9% lower than the road freight rate to compensate for an inland route's lower service standards.
- The fourth scenario was to increase the roundtrip cost of access to equate the market price of $180 for road and rail services from Melbourne to Brisbane. This represented a 167% increase in access charges over the coastal route on a $/000 GTK basis.

Table 8 shows revenue is likely to be highest under these conditions with access charges lower than scenario 1 ($27.5 million) or between scenarios 1 and 2.

Table 8 - Annual revenue derived from Melbourne-Brisbane freight with Inland Route Price scenarios 1-4, no efficiency gains

Scenario	Market Share %	Access charges $/'000gtk	Round trip access charge ($/tonne)	Round trip Market price ($/tonne)	Annual access revenue in 2009
1	53%	$4.01	$30.00	$150.00	$27.5m
2	41%	$5.02	$37.50	$157.50	$25.1m
3	34%	$6.02	$45.00	$165.00	$22.1m
4	23%	$8.02	$60.00	$180.00	$16.7m

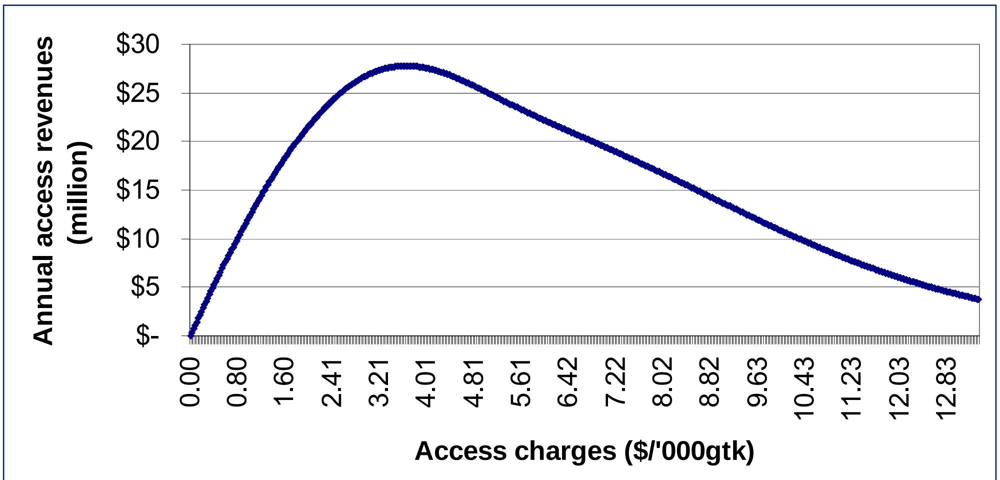
A fifth access charge – designed to maximise revenue of a proposed route option – was also estimated. Higher rail access charges on an inland route would deliver higher revenue per GTK but, beyond a certain point, would reduce revenue as freight diverted to the existing rail coastal route or to road transport. The maximising net revenue for the rail sector lies between scenarios 1 to 4; its exact position is determined by the relative service standards.

The following access charge scenarios were ruled out as unrealistic for an inland route:

- Current access charges on the existing coastal route on a $/GTK basis. Access charges of this nature would produce a lower price per tonne for a better route (compared with the Coastal Route);
- Rates equal to a floor price of operational plus maintenance expenditure. These costs would be low because much of the line would be new or rehabilitated, yet the service quality and capital cost would be high; and
- Full recovery of capital costs. Such rates would be likely to deter most traffic.

The relationship between annual revenues from the proposed route and access charges is shown in Chart 20. It shows that annual revenues peak at around $27.8 million, corresponding to an access charge of approximately $27.40 per tonne or $3.66/'000 GTK. It assumes that access prices are passed onto customers, but that operator efficiency gains (from using a shorter and less congested route) are not. This assumption of train operator pass-through of operating cost advantages from operating costs on the existing coastal route is expanded upon below.

Chart 20 - Annual revenue and access charges for Melbourne-Brisbane freight on an inland route (2009)



The combination of shorter transit distance and improved infrastructure is likely to lead to lower train operator costs than the existing coastal route from Melbourne to Brisbane (and return). If efficiency gains from the shorter route are passed on to the customer by train operators in terms of lower prices, there is a further increase in the rail market share and hence higher access revenues are generated.

The effects are combined in Chart 21 and consolidated with the Study Team's modal share model described earlier in this chapter. Chart 21 shows access revenue on an inland route with no cost advantages for train operators over the existing route, and then 5, 10, 15 and 20% cost advantages over the existing route. The underlying assumption in this analysis is that train operators pass the cost savings to end customers.

Chart 21 - Access charge revenue on an inland route from Melbourne-Brisbane freight 2009

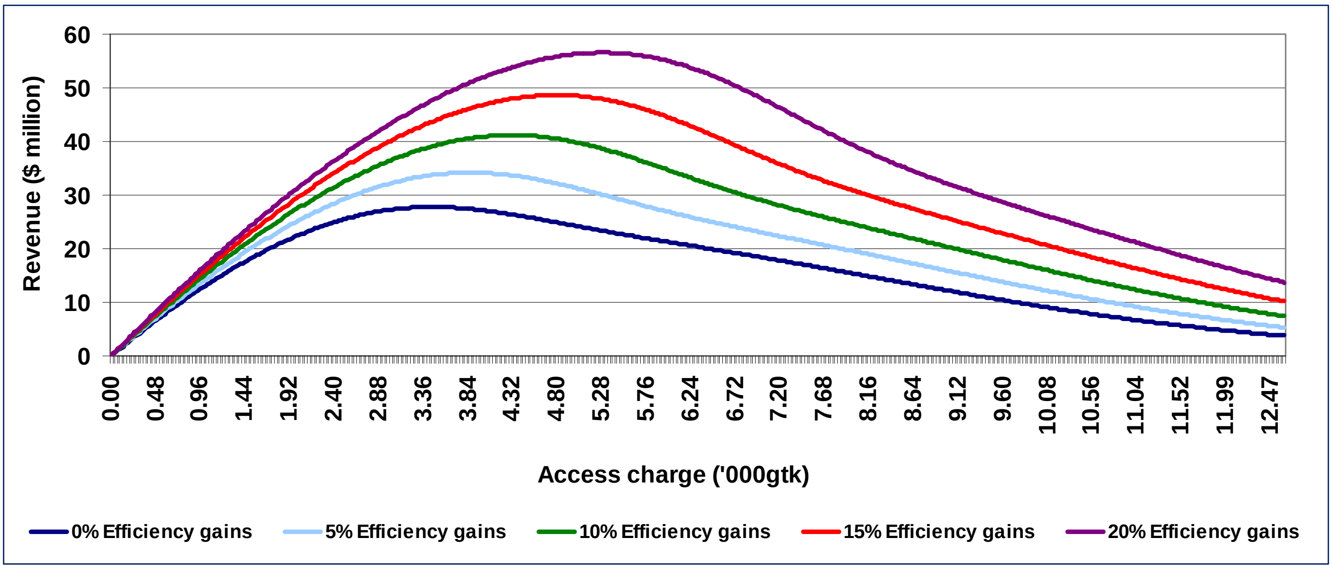


Table 9 shows the revenue-maximising access charge for cost-efficiency gains to train operators on an inland vis-à-vis the existing coastal route ranging between 0 to 20%.

Table 9 - Revenue-maximising access charges for a given level of train operating cost savings on an inland route over the existing route

	0%	5%	10%	15%	20%
Maximum revenue	$27.8m	$34.2m	$41.2m	$48.7m	$56.6m
Access charge $/'000GTK	$3.66	$4.09	$4.57	$5.08	$5.59

The revenue-maximising charge ranges from $3.66 per '000/GTK to $5.59 per '000/GTK. Access charges of this magnitude are approximately 22 to 86% above average access charges found on the existing coastal route. On an end-to-end basis, the access charges in Table 9 ranged from $27 to $42 per tonne. The corresponding access revenue for total Melbourne-Brisbane return freight ranged between $27.8 million and $56.6 million, depending on the level of cost savings available from an inland route relative to the train operating costs on the existing coastal route.

4.2.7 Time lags

The AusLink/ARTC rail investment program is expected to start impacting on rail freight operator performance within three years once most of the passing loops and lanes are in place, and will have its full impact within four years when the whole program is completed in 2009. There could be lags between infrastructure improvement and the effect on modal share for several reasons:

- A general feeling in the industry, which came out in several interviews, of "I'll believe it when it happens", reflecting long-standing frustration with performance in the rail sector. The scepticism was reinforced by several weeks of performance problems on the Nullarbor, the most successful interstate rail freight route, in the period leading up to Christmas last year. It can be inferred that it may take months or even a year or two of improved performance before some are convinced that improved rail freight performance will be sustained;
- Train operators may need time to adapt their operations to best suit the market's requirements; and
- If there is a substantial potential shift of freight from road to rail once infrastructure is improved, additional locomotives and rolling stock would be necessary, offset partly by the effect of reduced cycle times. Given the two-year lead-time between ordering and receiving rolling stock, robust forecasts of future rail demand and modal shift are required to base locomotive and rolling stock orders.

These impacts can be minimised by planning and customer education, but a prudent sensitivity test would be to allow a one-year lag before the full estimated diversion was achieved. In practice, there is no impact on the Study's numbers as the first forecast year is 2009.

Independent analysis of time-series data showed that the market response took up to seven years after rail infrastructure upgrades allowed for improved price and service quality by train operators.[14] For this exceedingly long time-lag to exist, it stands that large freight customers must require sustained performance improvements over five or more years before being convinced to switch their freight to rail services.

[14] This analysis was undertaken by ARTC.

Evidence from stakeholder consultations indicated that this time-lag is overstated. Freight forwarders suggested most of their smaller customers do not know which land transport mode their freight travels on; rather they pick a service standard at a given price from a suite of service options (either by road or rail). Under those operating conditions, changes in service standards and/or relative prices could be reflected within several months of infrastructure upgrades being complete.

During the consultative process, all large freight customers (who determine what proportions of freight are moved by road or rail) suggested they assess the relative performances and prices of road and rail prior to contract negotiations with transport suppliers.[15] Typically, contracts are for one to two years; an exception is some steel freight contracts that extend for 10 years. Thus the average response time for freight customers – both large and small – to react to changes in relative service standards and prices can be assumed to be less than two years.

4.3 Analytical approach

The approach to analysing modal choice was to:

- Review overseas literature;
- Review Australian literature[16];
- Discuss with others who had studied the issue within their organisations (ARTC and BTRE);
- Consult with train and track operators, freight forwarders and customers involving both;
  - In-depth interviews; and
  - Detailed surveys;
- Develop two complementary modelling approaches building on the survey information;
- Perform separate regression analysis of modal choice in the recent past, allowing a comparison of stated (future hypothetical scenarios) and revealed preference (actual past market outcomes);
- Select the appropriate model for mode share modelling, validate model inputs and peer review the model by:
  - Cross-checking survey results;
  - Cross-checking individual model outputs;
  - Peer reviewing within the Study Team and the consulting consortium;
  - Peer reviewing by the BTRE; and
  - Seeking feedback from individuals within organisations represented on the Steering Committee; and
- Perform sensitivity analysis, using variations to assumptions as discussed earlier, rather than a simple +/- 10% approach.

[15] This type of behaviour is indicated in the BIS Shrapnel Report, which shows a high proportion of freight customers considering the option of rail transport even if they use road services.

[16] Including papers by Margaret Starrs, Meyricks, BTRE, Booz Allen Hamilton and BIS Shrapnel.

4.4 Previous Australian work

This section provides a brief overview of Australian and international studies of road and rail own-price elasticities and cross-price elasticities. It provides an indication of the plausible range of elasticity measures for the drivers of freight transport.

4.4.1.1 International and Australian elasticity ranges by attribute

A report by MM Starrs (2005) provides a review of mode split modelling literature and in particular the previous elasticity findings. Table 10 consolidates data sourced from that literature review to determine minimum and maximum elasticity measures (ranges) for road and rail, by attribute.

Table 10 - International and Australian freight elasticity ranges by attribute

Region	Corridor/Descriptor	Elasticity measure
	Road	**Price**
International	Entire range	-1.34 to -0.05
	Most likely range	-1.10 to -0.7
Australian	Short-haul	-0.7 to -0.5
	Medium-haul	-0.9 to -0.7
	Long-haul	-1.1 to -0.9
	Rail	**Price**
International	Entire range	-1.52 to -0.09
	Most likely range	-1.20 to -0.4
	Type	**Quality/reliability**
International	Rail	2.00
	Road	0.6 to 1.47
	Type	**Flexibility/service availability**
International	Rail	0.4 to 1.79
	Road	1.27

Source: MM Starrs (2005), Effect of Truck Charges on Rail Information Paper.

The most likely international road price elasticity range is -1.1 to -0.7 compared to an overall Australian range of -1.1 to -0.5. The international rail price elasticity ranges from -1.52 to -0.09 with a most likely range of -1.20 to -0.4.

The literature regarding the elasticity measures for service characteristics is not as prolific as that of price elasticities. In summary:

- The international ranges for quality/reliability were:
  - Road: 0.6 to 1.47
  - Rail: 2.0
- The international ranges for flexibility/service availability were:
  - Road: 1.27
  - Rail: 0.4 to 1.79.

4.4.1.2 Booz Allen Hamilton (BAH) elasticity results

The BAH (2001) evaluation of investments to upgrade the interstate rail system produced a price elasticity of demand measure for road of -1.1. The results here were used to estimate changes in demand for road as a result of investment in rail infrastructure. The Study implemented a consumer choice methodology, from which the elasticity measures are normally higher than those produced using aggregate demand models. This result, however, is in keeping with the most likely international rail price elasticity range of -1.20 to -0.4.

Table 11 - BAH elasticity estimates used for the consumer utility functions for road and rail services

Road and Rail	Price	Transit time	Reliability	Service Availability
Long-haul	-1.1	-0.3	0.6	0.4
Short-haul	-1.1	-0.4	0.6	0.5

Note: Short-haul corridors are those of less than 1,000km.

Source: Booz Allen Hamilton (2001), Interstate Rail Network Audit, Evaluation Methodology Appendix A.

Elasticities were produced for price and three service characteristic variables, none of which had a higher absolute value than the price elasticity. It is interesting to note that in total they do have a higher *absolute* value than the price elasticity, giving limited support to the notion that the service levels are more important than price (MM Starrs, 2005).

4.4.1.3 Rail own-price elasticities

Meyrick and Associates (2006) use international and Australian literature as a guide to rail freight price elasticities. Meyrick use these to estimate values for the Victorian rail freight market. Oum *et. al*. (1990) is used as the lower bound, while Bureau of Transport Economics (BTE) (1999) and Booz Allen Hamilton (BAH) (2001) set the upper bound at -0.9. The details of elasticities are shown in Table 12.

The consensus range is weighted according to the percentage shares of the three main freight groupings within the total Victorian freight volume. These are commodities (excluding grains), grains and elaborately transformed goods. The purpose is to tailor the literature-based elasticity range by the degree of road/rail contestability of Victoria's main freight groupings (Meyrick and Associates, 2006).

Table 12 - Meyrick's estimates of Victorian rail access price elasticity ranges

Elasticity Estimates	Elasticity
Oum et al (1990)	-1.2 to -0.4
Kells (1997)	-1.7
BTE (1999)	-0.9
BAH (2001)	-0.9
Consensus	-0.9 to -0.4
Weighted Vic Total Rail Freight Price Elasticity	-0.9 to -0.7
Victorian Access Price (% of total rail freight price)	25%

Elasticity Estimates	Elasticity
Vic Access Price Elasticity (-0.8 times a quarter)	-0.2

Source: Meyrick and Associates (2006), Rail Freight Price Elasticities.

4.4.1.4 *Road price elasticities and road cross price elasticities*

The elasticities presented in Table 13 are lower for short-haul routes because the existing road freight is less contestable. Rail is viewed as an imperfect or inferior substitute to road on short-haul routes. With imperfect substitutability, price movements have smaller impacts on mode. That is, a price increase for road has less of an impact on road freight demand for a short-haul route than a medium or long-haul route as road's door-to-door service standards are far superior to rail's on short-haul routes (MM Starrs, 2005).

Table 13 - Australian road price elasticities by corridor

Corridor	Type	Road Price Elasticity	Cross Price Elasticity	
			Minimum	Maximum
Short-haul	short run	-0.5	4.03	5.39
	long run	-0.7	5.64	7.54
Medium-haul	short run	-0.7	3.62	3.62
	long run	-0.9	4.65	4.65
Long-haul	short run	-0.9	0.61	0.61
	long run	-1.1	0.75	0.75

Note: The long-haul corridor relates to the Melbourne to Perth route (over 3,000km) and the medium-haul corridor relates to the Melbourne to Brisbane route (less than 2,000km). Short haul denotes routes around 1,000km or less

Source: MM Starrs (2005), Effect of Truck Charges on Rail Information Paper.

Cross price elasticity (shown in Table 13) relates to how the demand for one mode (in this case rail) is affected by changes in the price of another mode (in this case road).[17] For example, for the short-run short-haul value (-0.5), an increase in the price of road freight of one unit results in a decrease in road freight demand by 0.5 of a unit and an increase in rail freight demand of 4.03 units (min) and 5.39 units (max). The cross price elasticities are larger for the shorter corridors, mainly due to low rail market shares in these corridors (MM Starrs, 2005).

4.5 Industry consultation on the future market

Major freight firms and a cross-section of customers were the source of information about current modal choice decisions for different commodities, as well as likely future decisions. The Study Team used interviews and surveys to obtain information and data to facilitate analysis of current and future freight markets. The team asked the firms about

[17] The cross elasticity of demand for a rail route is the response of demand on that route to a change in price of a competing service (e.g. a road service or a competing rail route). Usually cross price elasticities are positive – a price increase on one service causes a demand increase (from diversion) on a competing service.

the types of freight they handled, the main origins of destinations, the mode(s) used and why, and service characteristics, costs and prices.

The firms and other organisations interviewed by the Study Team are listed in Box 3. Customers and freight forwarders also responded to the questionnaire.

Box 3 - Organisations interviewed and surveyed by the Study Team

Train operators	Track operators	Freight forwarders	Freight customers	Other stakeholders
Lachlan Valley Rail Freight	ARTC	FCL	Amcor	Australian Logistics Council
Pacific National	QR Access	K&S	Australia Post	Australian Shipowners Association
Patrick Portlink	RailCorp	Linfox	AWB	National Transport Commission
PN Rural & Bulk		Patrick Autocare	BlueScope Steel	Port of Melbourne
QR National		Patrick Logistics	Coca-Cola Amatil	Shipping Australia
QR (Rural)		Sadleirs	ColesMyer	Thompson Clarke
SCT Logistics		Toll (six divisions)	Fisher & Paykel	
			Foster's Group	
			GrainCorp	
			Incitec Pivot	
			Smorgon Steel	
			Toyota	
			Woolworths	

The Study Team engaged these stakeholders on a range of issues relating to the current infrastructure upgrade programs and future requirements of rail infrastructure in the Corridor. Common themes were:

- Sydney metropolitan area rail congestion is a major obstacle to overcome before rail freight offers high service standards;
- Rail freight has little chance of ever competing strongly in terms of service standards with road on short-haul routes;
- Infrastructure upgrades should be targeted to capture traffic on routes where distances extend beyond 1,500 kilometres;
- Though the private sector may contribute to an inland route, government input is required to help finance its construction at current freight volumes;

- Significant capital expenditure is required to increase rail terminals' efficiency so they receive and release freight more effectively and improve train departure reliability;
- Melbourne-Brisbane traffic is the largest and most commercially attractive freight movement that would use a new inland route option; and
- Some suggested the method for allocating the costs of future road investment is flawed, because it is one that disadvantages rail and benefits road.

The most significant messages stemming from the interviews were the scepticism about rail freight's ability to be competitive – with a few exceptions – on the short-haul routes (Melbourne-Sydney and to a lesser extent Sydney-Brisbane) and the strong likelihood of rail freight winning much more of the Melbourne-Brisbane freight market if suitable infrastructure is provided. The message was consistent and did not appear biased: firms that were sceptical about the shorter routes were optimistic about Melbourne-Brisbane.

Some interviewees held the view that the threshold route distance for rail to be able to compete effectively in terms of its price and service, for the main types of freight in the Corridor, is approximately 1,500 kilometres[18]. Rail freight's competitiveness is hampered by the large costs customers incur for PUD (monetary and time) at both ends of the rail linehaul transit over distances shorter than about 1,500 kilometres. As Melbourne-Sydney and Sydney-Brisbane routes are each roughly 1,000 kilometres, the additional PUD costs make rail freight too expensive relative to its service standards. Some commented that PUD costs add at least 50% to the rail linehaul costs for customers on the shorter routes.

The Melbourne-Brisbane route of 1,650 to 2,000 kilometres (depending on mode of transport) is of sufficient length for rail freight to become a stronger competitor to road freight. The proportion of PUD monetary costs decreases relative to rail's linehaul monetary costs as the route increases in length, so rail freight's door-to-door price falls a substantial margin below that of road freight (for example, 20% on the Melbourne-Brisbane route). Firms also commented that longer distances also reduce the detrimental effect of elapsed time for PUD services at each end of inter-capital city linehaul routes; thus rail's service standards are closer to those offered by road.

It was suggested that coastal shipping becomes competitive with land freight for general and dense cargo on routes where distances exceed 2,000 kilometres.

[18] The threshold distance is much shorter for grain and coal.

Stakeholders' views on rail's future infrastructure requirements are represented in more detail in Box 4, below.

Box 4 - A selection of comments from interviews on rail's future infrastructure requirements in the Corridor

These comments were made in one or more interviews and are broadly consistent with some of the other interviews unless indicated otherwise.

Timing is important, so that the freight market supplies enough volume to allow access charges to be set at cost-effective levels. An inland route is an issue of timing but something which, eventually, will be necessary.

Train operators and freight forwarders considered an inland route option would need to be double stacked to increase above-rail efficiencies and lower costs. Some stated that making trains longer and longer is not the optimal strategy as trains of 1.5-1.8 kilometres are very difficult to deal with in terminals. Parkes could handle double stacked trains from Adelaide and Perth and then send them onto Brisbane on an inland route instead of restacking in Parkes or Sydney or putting the containers on the road from Parkes or Sydney to Brisbane.

Additional passing loops would reduce transit times further than by allowing trains to operate at higher speeds. This implies the time lost while waiting in sidings for other trains is larger than the transit time reductions expected from faster train speeds. The trade-off between performance and cost is the major issue when designing the performance parameters of an inland route.

A widespread view was that the 6-7 hour freight train curfew in Sydney's metropolitan rail system is the single largest problem for rail freight on the east coast as the curfew is at critical times for rail freight movements. Narrow train path windows in Sydney also frustrate freight forwarders as small delays on interstate tracks can turn into lengthy delays by the time trains reach Sydney terminals.

One problem with the current rail infrastructure (which disadvantages rail) is that transport companies can bunch or cluster trucks out of cities during the evening to meet market demand whereas rail freight is confined to the number of train paths currently available (which will arrive at the destination when the market requires). This issue should be solved after the AusLink/ARTC investment program is complete.

Views on likely significant future transport developments in the Corridor are represented in Box 5.

Box 5 - Interview comments on future import/export trade developments

Import volumes are increasing through the Port of Brisbane – a logical choice as it is the gravitational centre on the east coast and closest major city to Asia. This means the land bridging opportunities between Melbourne, Sydney and Brisbane are decreasing as world liner cargo vessel supply increases quicker than world freight demand. There may be a relative decline in throughput in Melbourne, and this could have some impact on the balance of domestic interstate freight patterns.

On changing industrial profile in Australia, the closure of Arnott's Burwood plant and relocation to Brisbane, and Foster's relocation of production facilities from Sydney to Brisbane, took advantage of relatively cheaper labour and land. This trend is expected to continue for awhile before Brisbane becomes just as expensive and the industry starts moving to cheaper regional centres.

Firms have had problems recruiting sufficient labour (of up to 300 workers) for processing facilities in regional areas.

Stakeholders' views on future mode shares in the Corridor are represented in Box 6.

Box 6 - Interview comments on future mode shares in the Corridor

Price and reliability are the fundamental performance characteristics when selecting whether to use road or rail. When price is almost the same between road and rail, then other parameters such as performance characteristics become very important. This was a consensus view.

The rail freight discount relative to road freight will fall from current levels if a new inland rail line is built, as rail's service standards will improve relative to road.

Prices will continue to fluctuate according to service levels demanded by the end customers. Freight forwarders will charge higher prices for services with higher performance characteristics and lower prices for freight with longer lead times and lower service standards. Thus rail prices are likely to rise with infrastructure upgrades as rail operators will increase their margins afforded to them by the market willing to pay more for improved service levels (especially if above-rail competition is not vigorous).

Rail freight has the potential for large modal share increases if big cost-efficiencies are achieved. These large cost-efficiency reductions are likely on an inland route, according to most interviewees.

Expectations of transit times by customers are determined by arrival and departure times. Therefore transit times aren't explicitly assessed by customers but they are implicitly through analysis of arrival and departure times.

Some freight companies consider reliability to be more important than price when deciding what customers' freight transport requirements are. If reliability was roughly equal then price would increase in importance. Price is still considered to be of high importance. The time/cost trade-off is the most important consideration when assessing customers' modal selection decisions. With today's Just-in-Time (JIT) and cost minimisation/high volumes strategies employed by larger firms, others contend that cost is the single biggest determinant of mode selection.

Perth to Brisbane is a real opportunity for rail to increase its market share. For example, some freight is currently transported by road from Brisbane to Parkes and then switched to rail for the trip to Perth. If an inland route was established, freight could travel the entire route on rail. This would be especially attractive to time-sensitive customers as rail would be able to offer faster services than road.

Express freight is all carried by road at the moment on the Melbourne-Brisbane route. If the correct price and service combination can be delivered by rail then there is a market for express rail freight on this route. Operators say the margins in express freight are attractive. Rail freight would not, however, stand much chance of getting much of the consolidated and express freight task with only a four-hour reduction in transit time. Rather 12 to 15-hour transit time reductions from the current 36-hour transit appear necessary.

Further estimates of rail's mode shares on an upgraded Melbourne-Brisbane route with 95% reliability, 24-hour transit times and slightly lower prices included:

- 80-100% for denser products;
- from 0 to 30-40% for express and time-sensitive products;
- 60-100% for general merchandise and retail goods (most responses were 80% and above); and
- automotive freight to 80-95%.

Optimism for mode share growth to rail on the Melbourne-Brisbane route was in stark contrast to expectations for growth on the Melbourne-Sydney and Sydney-Brisbane corridors. Because of significant PUD time and monetary costs, only customers who transport large volumes of low-value products expect growth on the short-haul routes. Freight forwarders expect only moderate mode share growth for rail from the AusLink/ARTC infrastructure upgrades on these routes.

Stakeholders' views on their preferred departure and arrival times of interstate transport services in the Corridor are represented in Box 7.

Box 7 - Preferred times for departure and arrivals – interview comments

Most freight needs to be at customers' doors by 7am so train operators need to work backwards from there to take account of unloading or terminal times, truck delivery (PUD) and train transit time to work out the departure time. As the structure of departures is designed to suit customers' arrival requirements, improvements in the track infrastructure will allow more competitive rail timeslots and also a higher frequency of timeslots, according to stakeholders.

The pattern of evening freight departures from Melbourne – the largest freight producing city in Australia – is typically dispatched by rail and road to Adelaide first, then Sydney, Brisbane and finally Perth.

Rail freight has a chance of getting closer to the service standards achieved by road on the Melbourne-Brisbane route than either the Melbourne-Sydney or Sydney-Brisbane routes. On average, road freight delivers roughly 10 and 14-hour transits on the short-haul routes which allows for late afternoon or early evening departures. Rail freight simply cannot compete with these door-to-door transit times on these routes and many contend that rail will never be able to offer dispatch and receive timeslots which suit time-sensitive customers as well as road does currently.

Customers and freight firms would ideally like trains to depart Melbourne at 10 pm (express freight prefers midnight) and arrive at Brisbane between 3-5 am a day and a half later. This would mean roughly a linehaul transit time of 25-31 hours (including PUD time). These departure and arrival times would be sufficient to cater for most freight and therefore offer competitive intermodal services with road.

Departure times of 8-9 pm out of Melbourne and Sydney are preferable for customers requiring overnight services. Current rail freight transit times make rail unable to compete for overnight freight. Current transit times would mean freight wouldn't arrive to customers until mid-afternoon if trains departed at 9 pm. On this route PUD costs are almost as large as rail line-haul costs; the PUD cost leaves rail slightly uncompetitive on price relative to road.

Sydney-Brisbane is a difficult route for both road and rail transport providers. Several interviewees suggested the most effective way for rail to compete more effectively against road would be to offer high reliability services. This would mean building plenty of slack into rail services (depart earlier) to increase the likelihood of not arriving late.

Some suggested train operators should build slack into their schedules on east coast services. If trains needed to leave two hours earlier to increase reliability then train operators would attract higher freight volumes. As most customers and freight forwarders only tolerate small delays of an hour or two, trains leaving earlier would improve on-time reliability and hence freight customers' satisfaction with rail services.

The interstate freight market essentially still operates on afternoon and evening departures, with travel through the night and day and night again depending on the length of the route. Early morning arrivals, which enable freight to arrive at customers' doors by around 7 am, are desirable. However, some larger customers and distribution centres are moving to 24/7 operation, which will reduce this constraint.

Stakeholders' views on what are the most likely significant future transport developments in the Corridor are represented in Box 8.

Box 8 - Future developments in transport markets

The high current risk profile and the existing road and rail competition mean commercial returns, especially on short-haul routes, are not commensurate with the risks. Future infrastructure upgrades and recent terminal acquisitions in the Corridor will have an impact. Having competition in the Corridor from PN, QR and potentially SCT is important as it will force better service offerings.

SCT is considered a strong niche market player but some stakeholders queried the competitiveness of its terminals in Altona as many customers in Melbourne are based in Dandenong. Dynon's central location is an advantage, as its proximity to Swanston Dock and customers is maximised. The same arguments hold with respect to SCT's Beaudesert terminal and Acacia Ridge around Brisbane.

Freight forwarders contend the margins are very small for interstate transport services in the Corridor. Segments such as refrigerated and automotive transport have largely had their margins competed away.

Virtually all interviewees said shortages in driver labour supply for road transport are becoming an issue in the transport sector. The ageing profile of truck drivers is hitting linehaul harder than the metropolitan sector. Fewer owner/driver contractors, driver shortages and higher fuel costs are hurting road freight's ability to carry the large volumes of freight now and increasingly so in future.

The recently introduced Chain of Responsibility legislation applying to truck drivers and rising fuel costs will also cause a modal shift away from road – and rail stands to gain the most. These developments will also place cost pressure on truck operators, which will flow through to customers (as road margins are already tight) and ultimately force freight transport from road to rail.

Rising fuel prices also impinge on rail's bottom line, especially on short-haul routes where PUD comprises a larger share of overall costs. On long-haul routes, higher fuel costs will provide larger cost advantages to rail over road.

Rail and even sea will receive increasing volumes as smaller truck operators and those that break driver regulations go out of business. The trucking industry simply won't have the capacity to cope with freight tasks that are forecast to double within 20 years. Trucks struggle to meet demand during the peak season between September and December. One interviewee said that 5,000 trucks were taken off the road in 2005 because of financial problems (for example, bankruptcy).

Coastal sea freight is currently marginally costed by the international lines. However, if an Australian flag carrier enters the market with a regular service, rates are expected to increase by 10 to 20% (as they are required to use crews under Australian awards rather than foreign awards). Sea freight – though it inherently offers variable prices – will position itself below the rail rates and its future prices will move in line with rail rates. With the number of single voyage permits rising and the emergence of PAN onto routes from Fremantle to the east coast, coastal shipping could even play a role in the price-sensitive end of the north-south freight market, according to some.

4.6 Surveys

4.6.1 Outline of survey approach

Major freight forwarders and a cross-section of customers were the primary source of information about current and future modal choice decisions for different commodities and infrastructure scenarios. The future infrastructure scenarios put to stakeholders in the surveys were similar to ARTC's estimates shown in Table 14. The Study Team used interviews and surveys to obtain information to analyse likely developments in the future freight task within the Corridor. The stakeholders were also questioned on the types of freight they handled, the main origins or destinations; the mode(s) used and why, service characteristics, market drivers, costs and prices.

The service quality levels used in the surveys are from ARTC estimates of what will be achieved after the upgrade program is completed (some stakeholders considered these estimates to be a little optimistic), and from 2001 estimates by ARUP consultants on the effect of a possible inland route.

Table 14 - Future reliability, availability and transit time from previous studies (notional time period of 2009)

	Reliability	Availability	Transit time
Melbourne-Brisbane (coastal post upgrade) (ARTC)	80%	85%	27 hours
Melbourne-Brisbane – inland (ARUP)	-	-	27 hours
Sydney-Brisbane, post upgrade (ARTC)	75%	50%	15.1 hours
Melbourne-Sydney, post–upgrade (ARTC)	75%	70%	11.5 hours

Source: *ARTC,* The North-South Corridor – Options for Future Investment in the Coastal Corridor*, October 2004 (updated April 2006). ARUP - TMG,* Audit of the Inland Rail Route between Parkes and Brisbane*, 2001.*

When the simulation modelling was completed and new data was available from dynamic modelling within this project, slightly different service quality improvements and impacts on modal share were estimated. The results are presented in section 4.9.

The questionnaire is summarised in Box 9.

Box 9 - Examples of typical freight survey questions

Freight types transported between city pairs per annum (calendar year)

Commodity or freight type*	Melbourne-Sydney	Melbourne-Brisbane	Sydney-Brisbane
	'000 net tonnes pa	'000 net tonnes pa	'000 net tonnes pa
Manufactured goods			
Steel			
Cars			

Note: during interviews the proportion of freight on forward and backhaul legs was discussed

What percentage of your freight tasks are transported by road and rail?

Commodity or freight type*	% by Road			% by Rail		
	Melb-Syd	Melb-Bris	Syd-Bris	Melb-Syd	Melb-Bris	Syd-Bris
Manufactured goods						
Steel						
Cars						

What are the current rail and road freight costs for containerised traffic in terms of $ per tonne?

	Weight of freight per container/wagon	Rail transit costs only $ per tonne*	Door-to-port rail costs $ per tonne	Door-to-port costs $ per tonne
Melbourne-Sydney	tonnes per container			
Melbourne-Brisbane	tonnes per container			

Box 9 - Examples of typical freight survey questions, continued

Time and price-sensitive freight

What percentage of the freight task is time-sensitive freight?									
0-4.9%	5-9.9%	10-14.9%	15-20%	20-30%	30-40%	40-60%	40-80%	80-100%	100%
What percentage of the freight task price-sensitive freight?									
0-4.9%	5-9.9%	10-14.9%	15-20%	20-30%	30-40%	40-60%	60-80%	80-100%	100%

The importance of factors that affect intermodal rail and road demand

Factors that influence choice between road & rail	Required service levels (please state preferred service levels where possible)	Relative importance – % weight out of 100%	Rating – rail current 10 – excellent 1 – dreadful	Rating – road current 10 – excellent 1 – dreadful
Price				
Journey time				
Reliability				
Availability				
Loss & damage				
Flexibility				

Scenario 1 – please state your likely percentage of intermodal freight tonnes transported by rail given the following circumstances

	If rail price is unchanged	If rail price increases 10%	If price reduces 10%	If price reduces 20%
Rail journey time decreases from 36 to 29 hours				
Rail reliability increases from 45% to 75%				
The chance of a train departure within an hour of when you prefer it increases 25% (60→85%)				
If journey time, reliability and availability **all** improve				

The Study Team interviewed all the key rail operators, major transport firms and many customers, and received detailed questionnaire responses from nearly all interviewees.

The responses received were consistent and not unexpected. For example, firms involved in time-sensitive products were more concerned about reliability issues and less sensitive to price than firms involved in bulk products. There did not appear to be an anti- or a pro-rail bias, given that interviewees who were sceptical about the effect of infrastructure improvements on shorter rail freight journeys such as Melbourne-Sydney were optimistic about the impact on longer runs such as Melbourne-Brisbane.

The Study Team was therefore able to use the survey results as a basis for simulation modelling of modal shift in response to service improvements. There were multiple cross-checks:

- Calibration of the model to ensure it produced current results consistent with the real data.
- Checks of each survey response for internal consistency and phone calls to follow up on a small number of problems.
- Comparison with earlier elasticity studies by other consulting firms.
- Comparison with modelling approaches overseas.
- Comparison with regression analysis of responsiveness over the last few years.

Central estimates were based on a weighted average (by tonnes currently transported). Additional analysis shows the range in which most of the responses fall.

4.6.2 Impact of parameters on modal shares

The surveys showed price to be the single most important determinant of freight mode decisions, apart from the legitimate express segment of the freight market (which comprises a maximum of 5% of the market). Around 70 to 75% of decisions of mode choice concerning manufactured goods were based on price, reliability or availability (the rest were based on flexibility, transit time, damage/loss, OHS regulations, connections to ports etc). The weightings operators and customers placed on demand factors of mode choice decisions were:

- Price – 39% (ranged between 36% to 45% across various commodities);
- Reliability – 20% (ranged between 8% to 24% across various commodities);
- Availability – 15% (ranged between 8% to 53% across various commodities);
- Transit time – 10%;
- Flexibility – 6%;
- Loss and damage – 7%; and
- OHS regulations/connectivity to ports – 3%.

Given that poor reliability and the lack of conveniently-timed transport services cost businesses money – through production downtime or capital costs incurred on finished goods sitting idle – all facets of transport services are ultimately borne as monetary costs to customers.[19]

[19] Some studies in Australia and India have attempted to quantify the cost of different levels of transport service standards in their mode share modelling to have all parameters defined in monetary terms.

4.6.2.1 Price

Regardless of the commodity, the weighting customers give to price when choosing mode choice is similar. Bulk goods and grain have slightly lower weighting than the rest.

Table 15 - Importance customers place on price based on inter-capital city and 500km trips from regional areas to ports

	Weighting placed on price	Typical container or truck payload weight	Typical door-to-door price per tonne (round-trip average)
Manufactured goods – Melb-Bris (1,650-1,950km)	37%	8-24 tonnes	$75-85
Manufactured goods – Syd-Melb (900km)	37%	8-24 tonnes	$50-60
Manufactured goods – Syd-Bris (1,000km)	37%	8-24 tonnes	$55-65
Agricultural goods from regional areas (200-600km)	50%	16-24 tonnes	$30-50
Grain (300-600km)	38%	50-60 tonnes	$15-35
Steel (800-1,500km)	40%	40-60 tonnes	Under contract
Bulk goods (100-500km)	38%	50-60 tonnes	$10-30

Source: Stakeholder survey responses from ACIL Tasman surveys

Table 15 shows prices vary depending on the typical weight of the commodity and the typical distances the commodity is carried. The heavier products are generally less expensive per tonne and commodities typically carried over shorter distances are less expensive.

4.6.2.2 Reliability

End customers consistently identify reliability as a key consideration in decisions on modal choice. Poor reliability results in significant additional costs where, for instance, trucks are left to wait at a terminal for a late running train. As unreliability is by its nature unpredictable, this further compounds the impact on cost and generally induces inefficiencies through the supply chain.

Different customers require different degrees of reliability. Table 16 shows that transporters of manufactured goods require precise delivery times (often referred to as 'time-slotted' deliveries), whereas steel, grain and agricultural freight customers require on-time delivery from between two and five hours.

Table 16 - Importance customers place on reliability and delivery windows

	Weighting placed on reliability	Delivery windows
Manufactured goods – Melb-Bris	20%	Within 15 minutes of scheduled arrival
Manufactured goods – Syd-Melb	19%	Within 15 minutes of scheduled arrival

Manufactured goods – Syd-Bris	19%	Within 15 minutes of scheduled arrival
Agricultural products	5%	2-3 hours
Grain	10%	2-3 hours
Steel	60%	5-6 hours
Bulk goods	10%	2-3 hours

Note: These delivery windows change if production delays are encountered or order lead-times unexpectedly decrease.

Source: Stakeholder survey responses from the Study Team's surveys.

Customers and freight firms commented that rail must increase its reliability, especially in the time-slotted or reliability-sensitive sectors, to increase its market share. With reliability levels below 50% on most routes in the Corridor, rail has a large gulf to bridge before competing effectively in the reliability-sensitive sector of the freight market. Freight forwarders commented that one or two late deliveries per month often jeopardise customer contracts. With that in mind, they cannot afford to use rail services with their current reliability problems.

4.6.2.3 Availability

Availability in this Study is defined as offering a departure within an hour of the customers' preferred time. As capacity on each north-south route is expanded by more frequent and longer passing loops, more train paths will become available for train operators. This will give them more flexibility in constructing a daily and weekly suite of train departures which cater for market demand. Moreover, the extra flexibility will allow train operators to more easily alter their schedules to adapt to changing market demands for dispatch/receive windows.

Table 17 - Importance customers place on availability of train services

	Weighting placed on availability	How customers demand train services
Manufactured goods – Melb-Bris	14%	Time slots at precise times of day
Manufactured goods – Syd-Melb	15%	Time slots at precise times of day
Manufactured goods – Syd-Bris	14%	Time slots at precise times of day
Agricultural products (regional)	22%	High capacity – 3-7 services per week (demand for some products is seasonal)
Grain	40%	High daily capacity to meet shipping services (partially seasonal)
Steel	Low	Daily trains with high capacity
Bulk goods	40%	High capacity to meet demand

Note: These delivery windows change if production delays or order lead-times unexpectedly decrease.

Note: Availability for regional agricultural products is defined as the availability on a particular day, not time of day.

Source: Stakeholder responses to the Study Team's survey.

The Study Team made the assumption that the 24-hour 'receive/dispatch' market will grow by 1 percentage point per annum over the course of the forecasting period (i.e. from 25% to 50%) or by 0.5% per annum (i.e. from 25% to 37.5%.[20])

The Chain of Responsibility legislation, OHS regulations, fatigue management and training expenses are causing the operating cost bases of trucking firms to increase significantly. It was put to the Study Team in interviews that these compliance obligations and cuts will force some owner/drivers out of business (or they could become employees).

It is assumed trucks' ability to offer capacity to the market will remain at 99% on all routes if the right price is offered to the customer (especially given the likely operation of B-triples on some east coast routes within five years).

4.6.2.4 Loss and damage in transit

The interviews indicated that damage on road and rail services in the Corridor are currently at similarly low levels. Experienced freight consigners now organise and pack freight into containers and pallets so that damage is minimised (for example, heavier freight beneath lighter freight). Survey responses showed that the weighting customers placed on damage ranged from 0 to 10% of mode choice decisions, with the average being 7%.

With relatively small weightings, and no readily available data, it was decided not to model damage and loss as a determinant of mode share of land transport.

[20] The starting base in 2004 of freight that is not sensitive to availability on the Melbourne-Brisbane route is 35% instead of 25% on the Melbourne-Sydney and Sydney-Brisbane routes.

4.7 Modelling methodology

4.7.1 Overview

This section describes the modelling techniques used to estimate road and rail's share of total land freight. It allows for improvements in rail freight service quality made possible by upgraded infrastructure.

4.7.1.1 Logit model

A logit model was used to determine road and rail's share of the land freight task (see annexure 4: ***Demand Analysis Annexures*** for a technical discussion of logit models). It was also used to estimate the modal share for automobile traffic and may be used for agricultural products, and to forecast modal shares for grain, steel or other bulk commodities.

The sea and air modal shares of the freight market between the three main cities were determined exogenously. Air services are assumed to carry less than 1% of the freight task, a continuation of past experience and reinforced by high fuel prices. The coastal shipping freight task was assessed on the basis of freight carried to and from the eight relevant ports in Victoria, New South Wales and Queensland over the past five years. The assessment took account of growth rates over the last five years and future likely growth

Discrete Choice models

Discrete choice models such as the logit model are widely used to simulate freight customers' mode choice processes. These approaches model the probability of a freight customer choosing a particular transport mode given certain price and service levels.[21] The Study Team's logit model is based on the relative size of utility functions for road and rail, the underlying premise being that the freight customer is most likely to select the transport mode that provides the highest utility.

Price, reliability and availability are the parameters used in the utility functions to help determine the probability of a freight customer selecting a road or rail service. Together with scaling factors or coefficients, the parameter values will determine the mode share estimate from the logit model.

The potential improvement in rail's mode share under investment options outlined in chapter 5: ***Infrastructure Assessment*** and chapter 6: ***Route Options*** will vary according to rail's improvement in relative service characteristics and movements in relative prices. On short-haul routes, (Melbourne-Sydney or Sydney-Brisbane) relative prices and rail's service standards are well below road's service standards. Hence the utility freight customers derive from rail services is well below that derived from road services. Given a lower utility than road, the logit equation will calculate a lower mode share for rail relative to road.

Where rail's price is lower than road prices (Melbourne-Brisbane) the utility rail customers receive per dollar spent increases and offsets rail's inferior service standards. Thus the utility levels and mode share outcomes predicted by the logit model are more balanced on the Melbourne-Brisbane route.

[21] The functional form is based on the assumption that the mode choice for freight transport services is made by utility maximising freight customers. Utility is defined as the total satisfaction a consumer receives from consuming a good or service.

4.7.2 Data inputs

To summarise information provided earlier in the chapter, the data sources were:

- Current sea and air transport data from official sources via BTRE;
- Current rail freight data from PN, PN Rural & Bulk, QR, QR Access, QR National, Patrick Portlink, Lachlan Valley Rail Freight and ARTC;
- Road freight information from FDF as adapted and updated by BTRE using ABS data and stakeholders;
- Stakeholder inputs from submissions; and
- Interviews and survey questionnaires.

4.7.3 Deriving the elasticities from survey responses

The surveys elicited important information from the survey respondents about how their freight movement decisions vary in response to changes in freight mode performance. As described in section 3.6, the freight performance improvements were specified in the scenarios for price, reliability and availability. For each percentage or value change in the performance characteristic specified, the survey respondents estimated a corresponding percentage change in rail's mode share. These outputs facilitated the estimation of a set of mode choice elasticities for use in the modelling exercise. These elasticities, for the shift from road to rail and vice versa with respect to price, reliability and availability; differ from regular aggregate demand elasticities. They differ because choice elasticities refer to a pure substitution effect between two choices, in this case road and rail freight choice, and assume a fixed aggregate quantity of freight. The issue of aggregate freight volume responses and the underlying demand elasticities that estimate that response have been described in the section on induced freight. For further information about the theory, please refer to Oum *et al* (1990).

The percentage change outputs of rail mode share in response to percentage changes in mode performance were calculated into mode choice elasticities. The elasticities estimated covered a range of values depending on the origin-destination, the commodity in question and the beginning amount of freight on road and rail. For example, only small increments (percentage changes) of rail freight were observed in response to a fall in rail freight price or improvements in reliability and availability in routes where a high proportion of freight is currently moved by rail. The ranges of values for these elasticities are presented in Table 18.

Table 18 - The range of mode choice elasticities estimated for freight on inter-capital routes on the Corridor

	Price	Reliability	Availability
Melbourne-Brisbane	-0.5-1.2	0.4-0.7	0.5-0.8
Melbourne-Sydney	-0.7-1.15	0.3-0.7	0.08-0.36
Sydney-Brisbane	-0.3-0.9	0.3-0.7	0.3-0.8
All routes	-0.3-1.2	0.3-0.7	0.08-0.8

Source: Study Team analysis.

A wide range of values was reported. Importantly, the coverage of survey respondents in terms of the freighted commodities enabled modelling between freight that is sensitive to particular service characteristics (for example, price-sensitive freight) and reliability/availability-sensitive freight. Different elasticities for different commodities have been used in the modelling.

4.7.4 Deriving the elasticities from empirical train operator and ABS data

The demand elasticities with respect to price, reliability, transit time and availability were estimated by running a series of regressions on actual observed train operating data. The elasticities derived from the regression analysis form a convincing validation of those derived from stakeholders' surveys.

The dependent variable was quantity of freight tonnes. The independent variable 'price' was the relative rail and road price from time series data from the ABS. Other independent variables include reliability, transit time and availability.

Yearly and monthly data was obtained for 2000-2005 from several industry sources. The data obtained was available at a disaggregated level, that is, by route and commodity. Data for lower-volume sectors was excluded on confidentiality grounds. Data regarding the following routes was included:

- Melbourne-Brisbane;
- Brisbane-Melbourne;
- Sydney-Brisbane;
- Brisbane-Sydney;
- Sydney-Melbourne; and
- Melbourne-Sydney.

4.7.4.1 Econometric models and results

Monthly data was obtained from three sources in the course of this study for the purpose of performing the above estimations with a larger time-series, that is, 72 months (as opposed to six years) for each commodity-route in the panel. It was intended that the larger time-series would allow for the examination of short-term effects and produce more reliable results.

Econometric analysis of the panel data set comprising economic drivers of rail freight tonnage by commodity-route was conducted using alternative aggregate demand models via regression analysis (fixed-effects ordinary least squares (OLS) estimation). In general, the linear models better explain the relationship between rail freight tonnage and the applied economic drivers than a logarithmic relationship.

4.7.4.2 Rail freight price and service characteristic elasticities

Elasticities for rail freight prices and service characteristics were derived for all five econometric models used in the regression analysis. The models and methods for calculating the elasticities are contained in annexure 4: ***Demand Analysis Annexures***

In summary, the elasticity ranges for each rail service characteristic and price were:[22]

- Price: -2.4653 to -1.155;

[22] The elasticity estimates are short-run, elasticity at mean value measures.

- Transit time: -2.3421 to -0.3872;
- Reliability: 0.0081 to 0.1247;
- Monthly capacity: 0.7354 to 0.7671; and
- Availability: 0.1587 to 0.243.

The R-squared or 'goodness of fit' of the regression estimates ranged between 0.92 and 0.96, indicating a very close or strong fit between rail tonnages and the factors of demand which drive rail volumes. This implies the factors of demand – price, reliability, availability, capacity and transit time – explain the level of rail demand to a high degree of accuracy.

Full documentation of the regression methodology and results is contained in annexure 4: ***Demand Analysis Annexures***

4.7.4.3 Observations of regression model outcomes

The results from this model indicate that price and monthly capacity are important factors in explaining the amount of freight transported by rail. This indicates that where transit time and reliability are important or applicable factors in the decision to transport freight, freight is sent by road.

The results for the model variants indicate that price was most often the significant variable. Capacity was regularly shown to be significant, as was availability on occasions. On-time reliability did not appear to be a significant factor in explaining rail volumes, which intuitively, makes sense as customers sensitive to reliability are very likely to use road services. The model outputs all had sensible signs (+/-), indicating the empirical analysis to be consistent with Australian literature on the rail industry.

Lagged reliability ($\mathrm{Re}\,l_{it-1}$) produced better results than the current period value of reliability ($\mathrm{Re}\,l_{it}$) and was therefore included. This is also expected since previous month (historical) rail reliability is potentially more likely to influence the decision to send freight by rail than current period reliability.

4.7.5 Constructing the logit modal share model

A mode assignment model was developed using the logit form as described in section 3.7.1. The logit function has been used extensively in transport economics to estimate mode share parameters based on a time-series dataset, revealed or stated preference, of mode choice decisions and values of important variables, for example, price, reliability or availability. In this Study, no such data was available and where it was available this was only for rail demand and not in the form of a comprehensive dataset for road and rail. A more deterministic approach was undertaken, using the logit equations and an externally derived set of model inputs, including:

- Mode choice elasticities as discussed in the previous section;
- Current mode shares for road and rail for the freight of each commodity on each origin-destination of interest (from the combined ACIL Tasman/*FreightInfo* database);
- Estimates of current road and rail freight performance characteristics (price, reliability, availability and transit time) from ACIL Tasman research;
- Calculated model coefficients and constants based on the above inputs (constants are employed to account for factors in the observed mode shares of freight unaccounted for by price, reliability and availability); and
- Projections of future road and rail freight performance characteristics, including alternative scenarios (for example, an inland rail route between Melbourne and Brisbane) from the Study Team's analysis.

Taking these inputs into account, a working model for mode share estimation was developed. The model was initially calibrated to reproduce the current mode share settings for each commodity and each freight route of interest and then used to assign mode shares to the *FreightSim* projections of land freight on the Corridor. For the case where a potential inland rail route was analysed, the nested logit structure as set out in section 3.7.1 was adopted. This structure allows mode assignment to two correlated modes (the coastal and inland rail routes for the same origin destination) and another mode (road freight) to be analysed.

The logit model was tested against the observed rail and road mode share outcomes on the east-west corridor. The latter data was obtained from the ARTC interstate network audit (2001) for the Melbourne-Perth route. Table 19 shows that rail was able to achieve 70% of the land freight task in that year given the observed performance and price characteristics.

Table 19 - Observed rail and road performance on the Melbourne-Perth route, 2000, from ARTC rail network audit

	Price (ave charge $/tonne)	Reliability	Service availability	Observed mode share
Road	186	95%	99%	30%
Rail	113	66%	80%	70%

Source: ARTC Interstate Rail network audit

Table 20 shows the comparable model outcomes from the logit model using the same input values.

Table 20 - Observed rail and road performance on the Melbourne-Perth route, 2000, using the Study's mode assignment model – non-bulk commodities

	Price (ave charge $/tonne)	Reliability	Service availability	Estimated mode share
Road	186	95%	99%	27%
Rail	113	66%	80%	73%

Source: ARTC Interstate Rail network audit

As shown in Table 19 and Table 20 above , the Study Team's logit model reproduces the observed outcome with a high degree of accuracy. It slightly overestimates the mode share for rail, but is close considering it was calibrated for a different route.

4.8 Future demand parameters

This section discusses the formation of the future price, reliability and availability parameters and their relative importance on modal share outcomes. The size of the parameter values is critical to the overall outcomes of the logit model and therefore forecasts of future mode shares.

4.8.1 Price

Future rail prices are estimated from the point of equilibrium found by the Dynamic Programming Model. Future road prices were estimated by forming a road cost model where future input cost movements (such as labour and fuel) were the basis for estimating total truck operating costs. Total operating costs for the forecasting period were then converted into an index from 2004 to 2029 to estimate future road transport prices based on observed prices in 2004.[23]

The Study Team's assumptions underpinning future road and rail price paths are encapsulated in Box 10.

Box 10 - The Study Team's future price path assumptions

Future price path assumptions

1. CPI was assumed to grow at 2.5% per annum.
2. Oil prices were assumed to be at levels forecast by the Energy Intelligence Administration to 2030 – a higher estimate of US$70 per barrel (real prices) and a lower estimate of US$40 per barrel (nominal prices) were used to sensitivity-test the influence of oil/diesel prices on mode share outcomes.
3. The exchange rate was assumed to average US$0.70 to A$1 from 2009 onwards, and to decline at 1 cent per annum from 73 to 70 US cents between 2006 and 2009.
4. Labour costs for truck drivers were assumed to increase by 6% annually until 2010 and 5% thereafter. Labour costs were also assumed to increase by 8% to 2010 and 6% thereafter if the driver shortage becomes acute. A lower road labour cost assumption of 4% was also used to test the downward movement of lower road labour costs.
5. Labour costs for train drivers were assumed to increase by 4% annually to 2010 and 3% thereafter.
6. PUD costs were assumed to increase by 3% per annum (nominal).
7. Further investment on the coastal route after 2014 – as foreshadowed by the ARTC's recent coastal route strategy report – was assumed to improve train operator efficiency by 4% from 2019 onwards.
8. Road prices were assumed to move in line with underlying input costs, road user charges and efficiency gains.
9. Road was assumed to procure efficiency savings of 1% per annum over the course of the forecasting period, which will flow through to lower prices of a similar magnitude, on average, over the course of the period. More bullish and bearish road efficiency gains of 0.5% and 2% were used for sensitivity testing.

[23] The future prices of road and rail transport are denominated in real terms.

4.8.2 Reliability

As outlined above in the survey analysis (section 4.6.2) and literature review (section 4.4), reliability is considered an important aspect of the mode share decisions faced by freight customers. The current differential between the on-time reliability of road and rail is very large. Forecast improvements to rail infrastructure in the Corridor should improve the rail freight reliability and reduce the differential. As demonstrated in chapter 3, an improved reliability performance will drive rail's mode share higher, especially on routes where it can compete effectively against road for availability-sensitive freight customers.

Box 11 lists the assumptions the Study Team used to estimate future road and rail reliability.

Box 11 - The Study Team's reliability assumptions

Reliability assumptions

1. The established industry standard of +/- 15 minutes reliability around the scheduled arrival time was used to measure train and truck on-time reliability.
2. The reliability of trucks was assumed to start out at 98% and remain at 98% for the forecasting period to 2029.
3. Train reliability figures for 2004 and 2005 are actual numbers (confidential).
4. Future capital expenditure in rail terminals was assumed to be sufficient to increase on-time departure reliability to 75% by 2009 and 95% by 2014 and beyond on a Melbourne-Brisbane inland route.
5. Future train reliability on intercapital city coastal routes in the corridor was based on ARTC's estimates and on consultations with industry.
6. Reliability on the Melbourne-Brisbane Coastal route is assumed to remain at 70% in 2019 and 2029.
7. A Melbourne-Brisbane inland route was assumed initially to provide 80% reliability. Reliability is expected to improve to 90% by 2014 and to 92% by 2019 and 2029.

4.8.3 Availability

Rail's future reliability will be determined by how train operators use faster transit times facilitated by improved track infrastructure. Train operators must decide whether to offer services to availability-sensitive customers when they demand them or to offer more reliable services.

If, for example, a particular route became four hours faster, train operators could use the transit time improvements to leave four hours later in the day and better serve the market and therefore improve rail's ability to serve availability-sensitive customers.[24] This would not improve reliability, other than through expected improvements because of extra passing loops. Alternatively, train operators may use the four hours saving to build 'robustness' into the schedule by departing at the same time with the scheduled arrival time. This would have the effect of significantly improving on-time reliability. There are also many combinations of different departure times between these two outlying positions with respect to a given scheduled arrival time.

[24] Transport operators and freight customers always plan their freight operations by working out the time freight needs to arrive at a retail or wholesale outlet, and work back from truck or train arrival times by deducting door-to-door transit times to calculate departure times.

After consulting with the requirements of stakeholders and how train operators expect themselves to behave with faster transit times, the Study Team established some broad assumptions of their future behaviour. The assumptions on the three principle routes in the North-South Rail Corridor are outlined in Table 21.

Table 21 - Assumptions of train operators' future behaviour

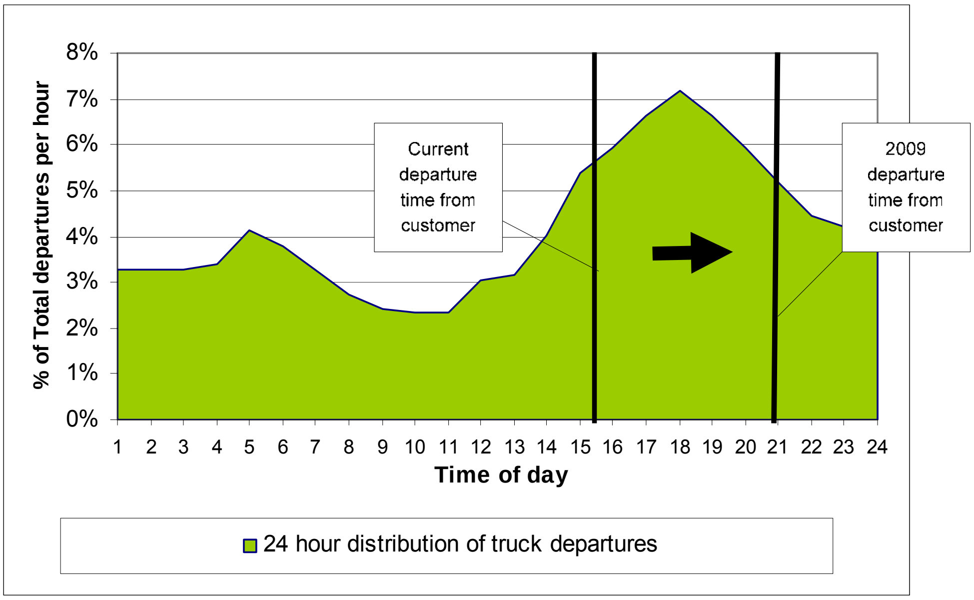
	Percentage of transit time to depart later	Percentage of transit time to improve reliability
Melbourne-Brisbane	70%	30%
Melbourne-Sydney	50%	50%
Sydney-Brisbane	50%	50%

Note: Depending on the magnitude of transit time savings, some of these assumptions may not always be achievable in practice as Sydney's freight train curfews inhibit mid-late afternoon departures from Sydney and also the times Melbourne-Brisbane trains can traverse the Sydney network.

Based on its own analysis and stakeholder feedback, the Study Team considered rail to have a much better chance at replicating the departure/arrival time operations of road on the Melbourne-Brisbane route. Thus a more aggressive strategy to compete for availability-sensitive freight was assumed by using 70% of the transit time saving to depart later. However, on the short-haul routes rail is still a significant distance away from matching the 10-14 hour door-to-door transit times of road (this would require rail to provide four to eight hour linehaul transit times). It was assumed that train operators would use 50% of improved transit times to better serve the market (for example, by leaving later) and 50% of the time to improve reliability on the Melbourne-Sydney and Sydney-Brisbane routes.

Rail's current and future ability to serve the freight market on the Melbourne-Brisbane route – based on the 70% 'depart later' assumption – is shown in Chart 22.

Chart 22 - Rail's current and future service availability on the Melbourne-Brisbane route

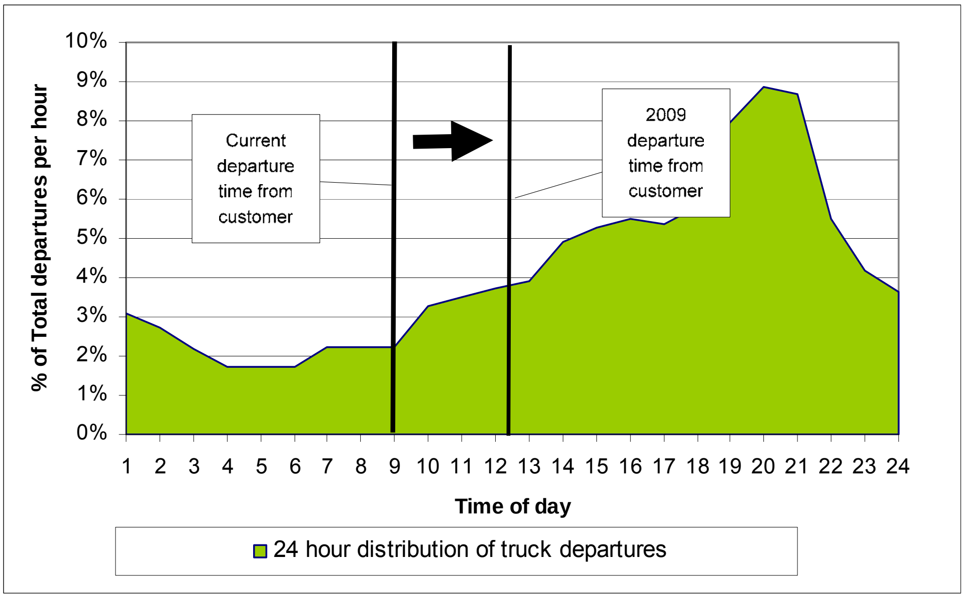


Note: The vertical black lines indicate when customers have to dispatch freight (three hours prior to scheduled train departures) not when the train departs.

Source: Interstate Rail Network Audit, Booz Allen & Hamilton, 2001 and Pacific National's 2004 InfoPak

Rail's current and future ability to serve the freight market on the Sydney-Brisbane route is shown in Chart 23.

Chart 23 - Rail's current and future service availability on the Sydney-Brisbane route

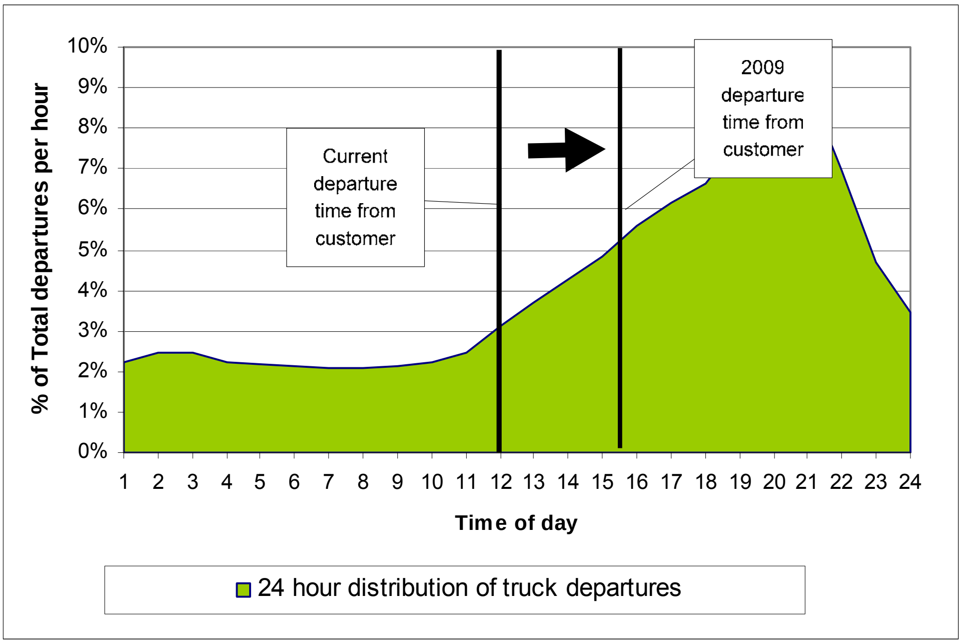


Note: The vertical black lines indicate when customers have to dispatch freight (three hours prior to scheduled train departures) not when the train departs.

Source: Interstate Rail Network Audit, Booz Allen & Hamilton, 2001 and Pacific National's 2004 InfoPak

Rail's current and future ability to serve the freight market on the Melbourne-Sydney route is shown in Chart 24.

Chart 24 - Rail's current and future service availability on the Melbourne-Sydney route



Note: The vertical black lines indicate when customers have to dispatch freight (three hours prior to scheduled train departures) not when the train departs.

Source: Interstate Rail Network Audit, Booz Allen & Hamilton, 2001 and Pacific National's 2004 InfoPak

The impact on total freight, mode shares and therefore future rail volumes of the three cases are captured in this section. Table 22 shows that the availability-sensitive section of the manufactured goods market is predicted to decline from 70% to 57.5% on the Melbourne-Sydney and Sydney-Brisbane routes and 60% to 47.5% on the Melbourne-Brisbane route. This reflects growth in the non-availability or price and reliability sensitive section of the manufacture goods market of 0.5% per annum. Thus this section of the market grows from 25% to 37.5% on the Melbourne-Sydney and Sydney-Brisbane routes and 35% to 47.5% on the Melbourne-Brisbane route.

Table 22 - Proportions of manufactured freight market in the Corridor in 2029

	Percentage of Melbourne-Brisbane	Percentage of Melbourne-Sydney	Percentage of Sydney-Brisbane
Express freight	5%	5%	5%
Availability and reliability sensitive freight	47.5%	57.5%	57.5%
Price and reliability sensitive freight	47.5%	37.5%	37.5%

If there is a faster change to the mixture of availability and non-availability sensitive segments of the manufactured market over the forecasting period – of 1% per annum (Case B) – rail's mode share is likely to increase quicker than estimated in Case A. Case C assumes there is no growth of the price and reliability (or non-availability) sensitive segment of the manufactured market.

Box 12 lists the assumptions which comprise the Study Team's estimates of future road and rail availability.

Box 12 - The Study Team's availability assumptions

Availability assumptions

1. Trucks are currently able to offer capacity to the market at 99% of occasions. Despite rising driver recruitment problems, the availability of road freight is assumed to decline by only one percentage point each interval to 95% in 2029.
2. Rail freight's high availability on an inland route implies rail operators' capital investment programs are bullish enough to make the necessary locomotive and wagon capacity available to the market.
3. PUD times were estimated at three hours in Sydney, Brisbane and Melbourne, which adds six hours to door-to-door rail transit times (which calculates availability).
4. The market demands an assumed arrival time of 6am into cities, so trains must arrive at 5am or earlier to get to customers' doors by 8am (an arrival time of midday on the Sydney-Brisbane route is maintained).
5. The Study Team assumed in its availability calculations that 30% of freight on inter-capital city routes is able to leave at any time during a 24 hour period, thus the availability floor is 30%.
6. The Study Team estimated the percentage of freight able to leave at any time during a 24-hour period will increase by 1% per annum, from 25% in 2004 to 50% in 2029, on short-haul routes; and from 35% to 60% on the Melbourne-Brisbane route by 2029.
7. Train operators will use 70% of transit time savings to depart later (and arrive at the same time) on the Melbourne-Brisbane route and 50% of transit time savings to depart later on the Melbourne-Sydney and Sydney-Brisbane routes.

4.8.4 Results

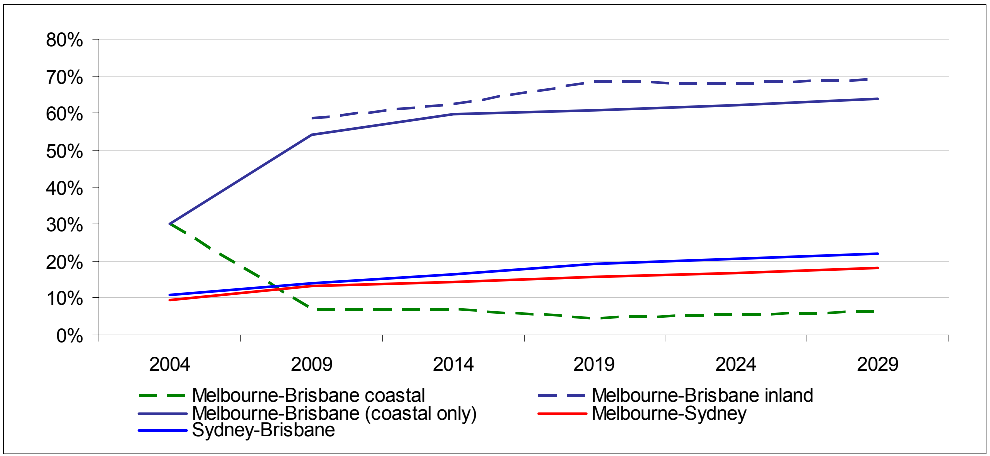
Table 23 outlines for the three assumptions in Cases A, B and C affecting modal share outcomes. Access charges are not included in this table as a revenue-maximising access charge is used in all three cases.

Table 23 - Cases A, B and C for sensitivity testing of forecast modal share outcomes over the forecasting period, 2004-29

Fuel prices	US$70 to $50 (real)	US$70 (held constant)	US$70 to US$40 (nominal)
Road labour costs	1.06 to 2009, 1.04 to 2029	1.08 to 2009, 1.06 to 2029	1.04 to 2029
Rail labour costs	1.04 to 2009, then 1.03 to 2029	1.04 to 2009, then 1.03 to 2029	1.04 to 2029
Availability sensitive market	25/35% to 37.5/47.5%	25/35% to 50/60%	25/35% (held constant)

Chart 25 shows forecasts of a mode share shift towards rail due to the ARTC investment program allowing train operators to improve their service standards, and with declining future rail prices relative to road. It shows the rail freight mode share on the Melbourne-Brisbane route increasing to 73% in 2029 with an inland route (inland plus coastal mode shares). Without an inland route, the rail freight mode share increases to just above 63% on the Melbourne-Brisbane route by 2029. Chart 25 also shows forecasts of steady increases in rail's mode share on the Melbourne-Sydney and Sydney-Brisbane routes to 18 and 22% respectively by 2029.

Chart 25 - Projected mode share for rail on the inter-capital freight routes, 2004-2029 (Case A)



4.8.5 Melbourne-Brisbane (no inland route)

Table 24 shows the forecast door-to-door prices, reliability, availability and door-to-door transit times for the Melbourne-Brisbane route.

Table 24 - Case A scenario for Melbourne-Brisbane route (averaged for round trip)

Case A	Road	Rail	
Door-to-door price (real)		Existing coastal	Proposed route
2004	$85.50	$74.99	-
2009*	$89.18	$66.51	$65.18
2014	$83.99	$62.21	$60.81
2019	$80.84	$59.00	$57.65
2029	$76.47	$53.95	$52.66

Case A	Road	Rail	
Reliability		Existing coastal	Proposed route
2004	98%	40%-45%	-
2009*	98%	70%	80%
2014	98%	70%	90%
2019	98%	70%	92%
2029	98%	70%	92%
Availability		Existing coastal	Proposed route
2004	99%	44%	-
2009*	98%	87%	90%
2014	97%	87%	95%
2019	96%	87%	95%
2029	95%	87%	95%
Door-to-door transit time (hours)		Existing coastal	Proposed route
2004	21-24	43	-
2009*	21-24	36	33
2014	21-24	35	33
2019	21-24	35	33
2029	21-24	35	33

Note: The figures provide averages across the forward and back legs for 2004, 2009, 2014, 2019 and 2029.

* For modelling purposes a commencement date of 2009 has been assumed.

Road prices are forecast to increase in real terms between 2004 and 2009 – due to high labour cost growth and relatively high fuel prices – before declining in real terms to 2029 due to lower fuel prices and 1% per annum technical efficiency gains.[25]

Rail's real prices are forecast to steadily decline over the forecasting period on both proposed inland routes and the existing Coastal Route. This future trend is consistent with historical rail prices observed in section 2.1.1. Declining fuel costs, 1% per annum technical efficiency gains, declining access charges (by 2% in real terms) and the AusLink upgrades (ARTC estimates rail's total cost will decline by nearly 7% on the Melbourne-Brisbane route).[26]

Door-to-door prices on an inland route are forecast to start 2% below the corresponding prices on the Coastal Route. If access charges on both routes were set at the same levels, the Study Team's forecasts show prices 7% lower on an inland route than the Coastal Route.[27] However, introducing the revenue maximising access charge ($4.28 per '000 GTK rather than $2.90-$3 per '000 GTK) reduced the price differential to 2%.

An inland route is forecast to have significantly higher reliability than a Coastal Route. Avoiding Sydney's network and operating on a less congested network should allow trains to achieve 90%-plus on-time reliability, assuming terminal efficiency improves. Road's reliability is forecast to remain at 98%.

Due to slightly faster transit times, the Study Team's model forecasts an inland route's availability to be higher than the Coastal Route. As the quantity of rail volumes increase over the forecasting period, additional trains each day are likely to be required to satisfy demand. More regular daily trains would increase availability to 95% on an inland route.

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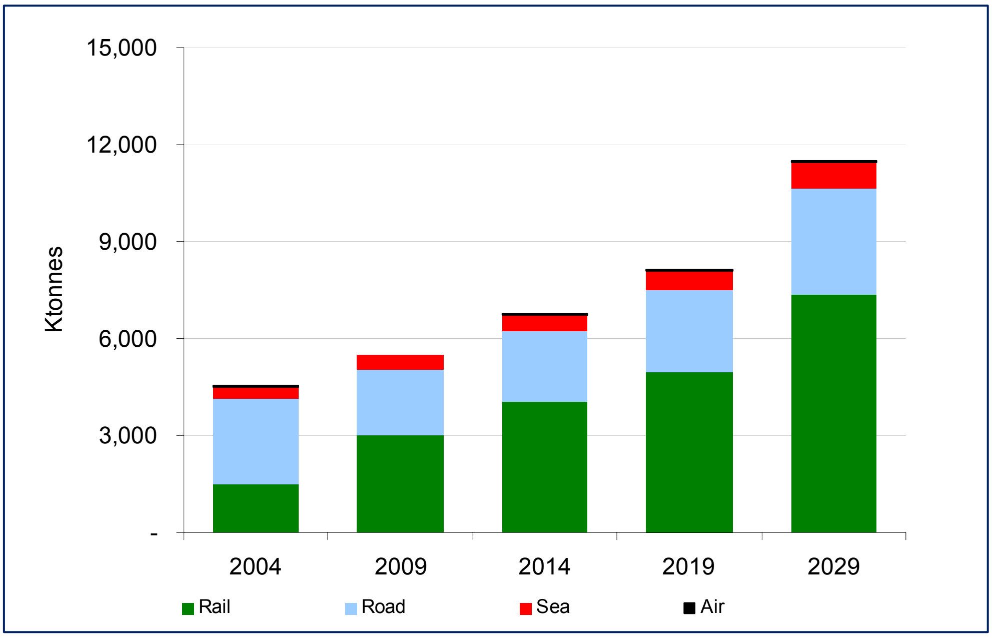
[25] Likely technical efficiency improvements are a possible move to B-triples on inter-capital city routes, strengthening of bridges to allow heavier loaded trucks and more efficient truck engines.

[26] ARTC, *North South Corridor future strategy*, April 2006.

[27] The line-haul price differential is forecast to be above 10%; however, the inclusion of PUD and terminal costs to both cost bases reduces the cost door-to-door cost advantage an inland route has over an inland route.

Chart 26 shows rail's mode share and volumes increasing strongly over the forecasting period on the Coastal Route (with no inland route option). Despite road losing mode share, the quantity of freight carried throughout the forecasting period remains relatively constant. The volumes carried by coastal shipping are forecast to more than double.

Chart 26 - Projection of freight between Melbourne-Brisbane (both ways) by mode, 2004-2029 ('000 tonnes)



Source: The Study Team, BTRE, FDF Management

Table 25 shows the forecast mode shares on the Melbourne-Brisbane route from 2009 to 2029. Sea and air are forecast to maintain relatively steady mode shares. Rail is forecast to increase its mode share to 63% by 2029 while road's declines to 29%.

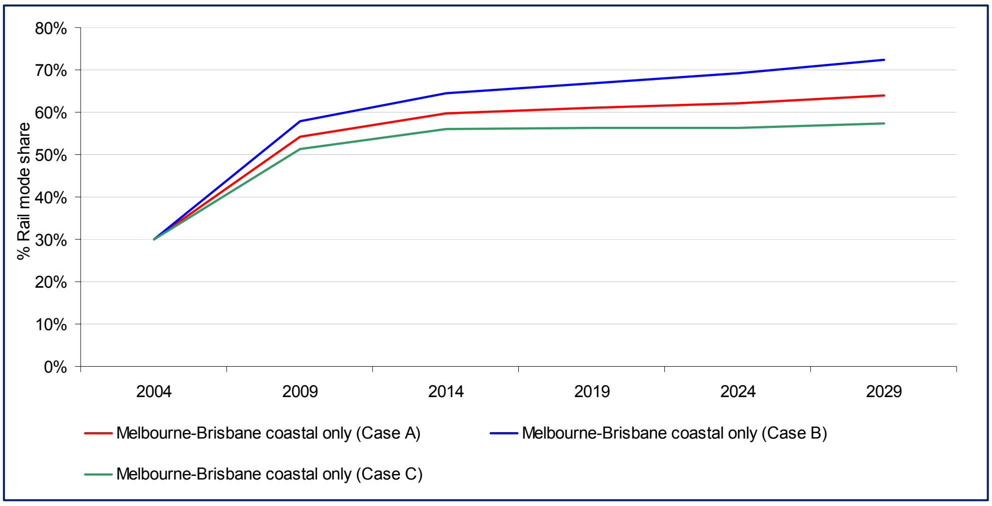
Table 25 - Estimated mode shares, Melbourne-Brisbane (both ways), all commodities, 2004-2029 – Case A

	Rail	Road	Sea	Air
2009	54%	37%	8%	1%
2014	59%	32%	8%	1%
2019	61%	31%	7%	1%
2029	63%	29%	7%	1%

Source: The Study Team, BTRE, FDF Management

Chart 27 demonstrates the sensitivity of mode shares outcomes on Cases A, B and C on the Melbourne-Brisbane route without a potential inland line. Rail's mode share increases to just above 70% in Case B and to just below 60% in Case C by 2029.

Chart 27 - Rail mode share on the Melbourne-Brisbane Coastal Route, Cases A, B and C, 2004-2029, (000 tonnes)

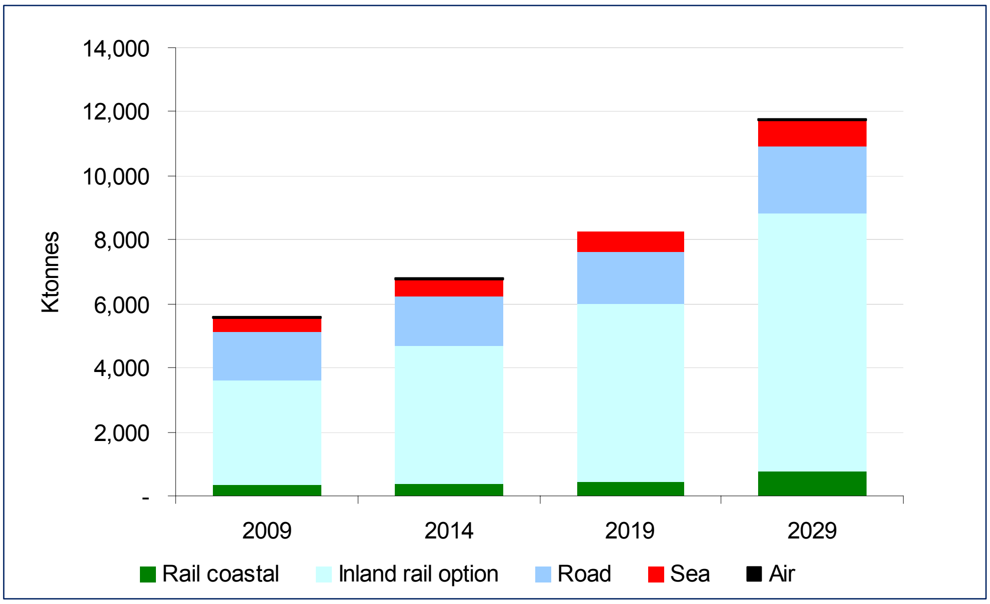


Source: The Study Team, BTRE, FDF Management

3.9.2 Melbourne-Brisbane (proposed inland rail option)

Chart 28 shows freight volumes for five transport options from 2009 to 2029. Road volumes are shown to rise from 2009 to 2029, as do the existing coastal route and sea's volumes, albeit off low bases. A potential inland route is shown to capture a very high proportion of the increasing freight market, growing from 3.3 million tonnes in 2009 to just under 8 million tonnes in 2029.

Chart 28 – Projection of freight by mode with an inland rail option (Far-Western or Central Inland), Melbourne-Brisbane, Case A, 2009-2029



Source: The Study Team, BTRE, FDF Management

Table 26 shows the forecast mode shares on the Melbourne-Brisbane route with a potential inland route from 2009 to 2029. The Coastal Route's mode share is forecast to decrease significantly to between 5 and 7% as soon as a potential inland route becomes operational (assumed for modelling purposes to be 2009).

Table 26 – Estimated mode shares with proposed inland rail option: Melbourne-Brisbane (both ways), all commodities, 2009-2029

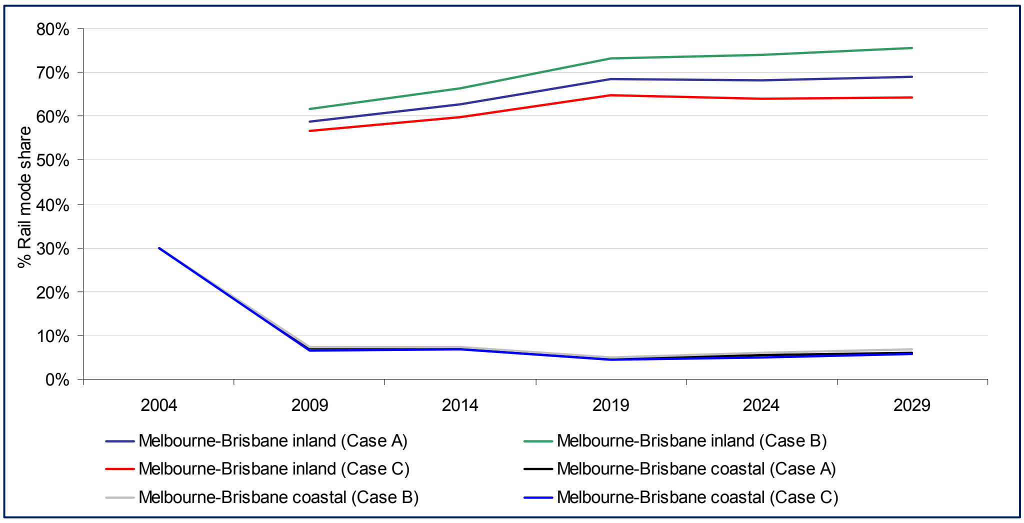
	Rail coastal	Proposed inland rail option	Road	Sea	Air
2009	7%	57%	27%	8%	1%
2014	7%	61%	23%	8%	1%
2019	5%	66%	21%	7%	1%
2029	6%	67%	19%	7%	1%

Source: The Study Team, BTRE, FDF Management

The Study Team's forecasts show an inland route is likely to capture 67% of the Melbourne-Brisbane freight market by 2029. Road's mode share is forecast to decline significantly to 19% by 2029 (total rail share on the route is 73% including coastal rail freight). Table 25 and Table 26 show that an inland route is expected to attract 57% of the freight market away from the Coastal Route and 10% away from road (largely by capturing more of the growing freight market rather than capturing road's traditional freight customers). These results are consistent with industry's views of likely market outcomes if an inland route was operational.

Chart 29 demonstrates the sensitivity of mode shares outcomes to Cases A, B and C on the Melbourne-Brisbane route with a potential inland line. Rail's mode share increases to 75% in Case B and to 65% in Case C by 2029. Mode share on the Coastal Route does not vary from 5-7% with an inland route operational under the three demand scenarios.

Chart 29 – Rail mode share on the Melbourne-Brisbane route with inland rail, Cases A ,B and C, 2004-2029, (000 tonnes)



Source*:* The Study Team, BTRE, FDF Management

4.8.6 Melbourne-Sydney

Table 27 shows the forecast door-to-door prices, reliability, availability and door-to-door transit times for the Melbourne-Sydney route.

Table 27 – Case A scenario for Melbourne-Sydney route (round trip)

Case A	Melbourne-Sydney	
Price (real)	Road	Rail
2004	$52	$57
2009	$51	$52
2014	$48	$49
2019	$46	$47
2029	$45	$44
Reliability	Road	Rail
2004	98%	45%-50%*
2009	98%	70%
2014	98%	70%
2019	98%	75%
2029	98%	80%
Availability	Road	Rail
2004	99%	25%
2009	98%	31%
2014	97%	38%
2019	96%	38%
2029	95%	39%

Case A	Melbourne-Sydney	
Door-to-door transit time (hours)	Road	Rail
2004	11	21
2009	11	17.5
2014	11	17.5
2019	11	17.5
2029	11	17.5

Note: The figures provide averages across the forward and back legs for 2004, 2009, 2014, 2019 and 2029.

* A range has been provided for commercial-in-confidence reasons.

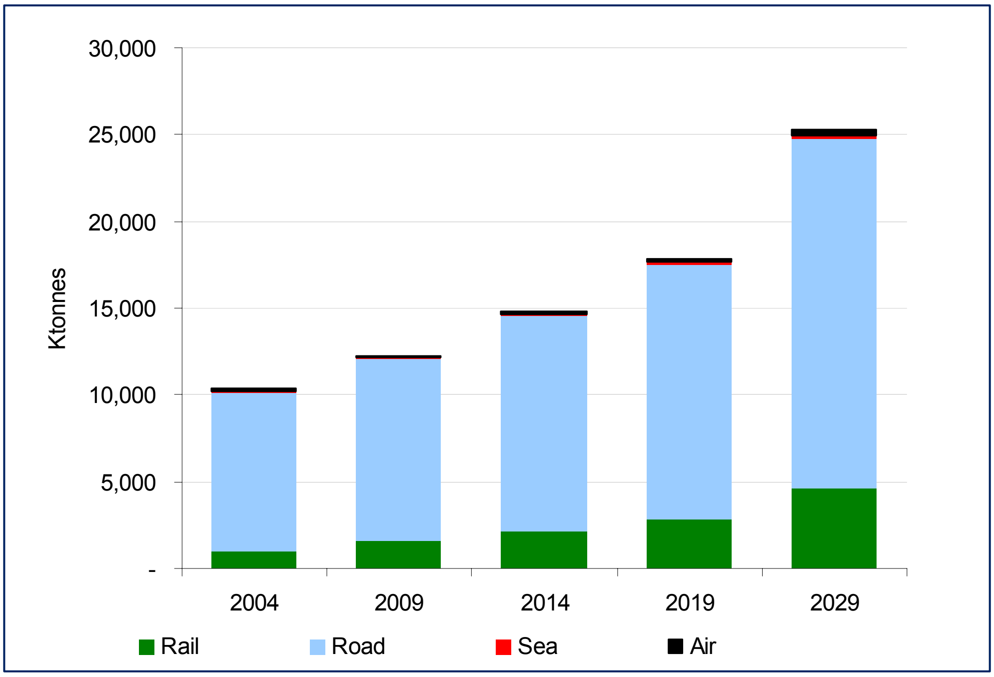
Road and rail prices on the Melbourne-Sydney route are forecast to follow very similar paths to the Melbourne-Brisbane due to the same price-related assumptions. Rail's door-to-door prices are assumed to start higher than road's in 2004 but decline faster than road's over the forecasting period.

Assuming train operators use 50% of transit time savings to build slack into their schedules to increase reliability (as assumed above), on-time reliability is forecast to increase from just below 50% to 80% by 2029.

Given rail's long door-to-door transit times relative to road, rail's availability on the Melbourne-Sydney remains low throughout the forecasting period, reaching 39% in 2029. Linehaul transit times below 10 hours would be required to lift rail's availability to competitive levels with road.

Both road and rail are shown to enjoy significant increases in freight volumes on the Melbourne-Sydney route over the forecasting period. As shown in Chart 30, the quantity of freight shifted on road by 2029 is expected to increase to above 18 million tonnes. Freight volumes on the rail network between Melbourne and Sydney are also forecast to rise significantly to beyond five million tonnes by 2029.

Chart 30 - Projection of freight between Melbourne-Sydney (both ways) by mode, Case A, 2004-2029 ('000 tonnes)



Source: The Study Team, BTRE, FDF Management

Table 28 shows projected mode shares over the forecasting period on the Melbourne-Sydney route. Rail is forecast to increase its mode share to 18% while road's mode share declines slightly to 80% by 2029.

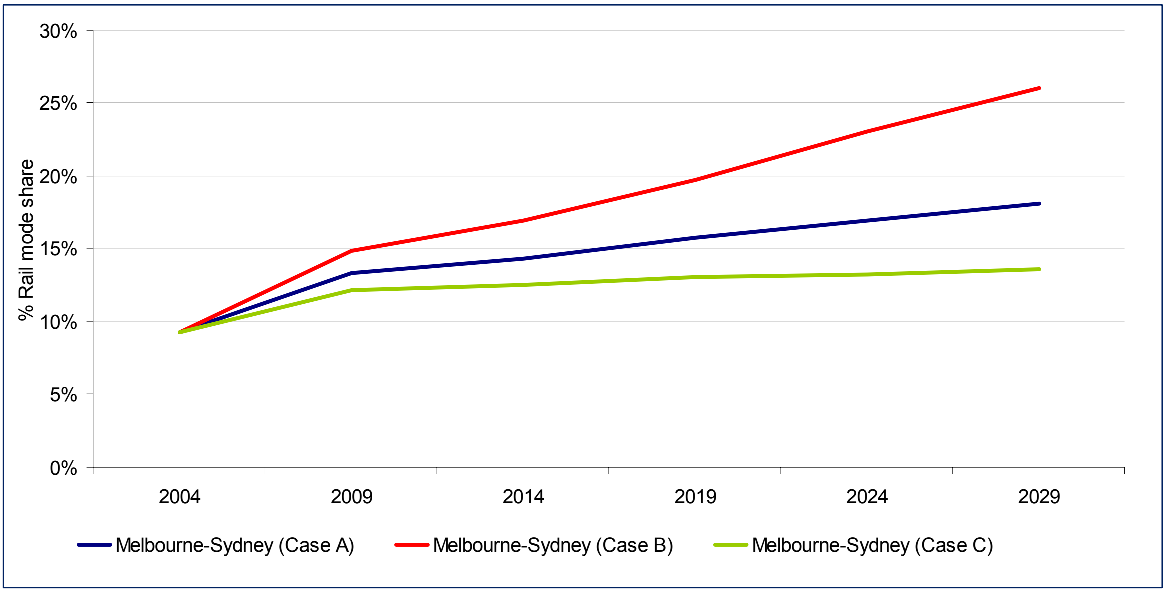
Table 28 - Projections of mode shares, Melbourne-Sydney (both ways), 2004-2029 – Case A

	Rail	Road	Sea	Air
2009	13%	85%	1%	1%
2014	14%	84%	1%	1%
2019	16%	82%	1%	1%
2029	18%	80%	1%	1%

Source: The Study Team, BTRE, FDF Management

Chart 31 demonstrates the sensitivity of mode shares outcomes to Cases A, B and C on the Melbourne-Sydney route. Rail's mode share in Case B increases to above 25%, much higher than the industry participants predicted, and increases modestly to 14% in Case C.

Chart 31 - Rail mode share on the Melbourne-Sydney route, Cases A, B and C, 2004-2029, (000 tonnes)



Source: The Study Team, BTRE, FDF Management

4.8.7 Sydney-Brisbane

Table 29 shows the forecast door-to-door prices, reliability, availability and door-to-door transit times for the Sydney-Brisbane route.

Table 29 - Case A scenario for Sydney-Brisbane (round trip)

Case A	Sydney-Brisbane	
Price (real)	Road	Rail
2004	$56	$63
2009	$57	$56
2014	$54	$53
2019	$52	$51
2029	$49	$47
Reliability	Road	Rail
2004	98%	40%-50%*
2009	98%	60%

2014	98%	65%
2019	98%	70%
2029	98%	70%
Availability	Road	Rail
2004	99%	25%
2009	98%	28%
2014	97%	30%
2019	96%	33%
2029	95%	38%
Door-to-door transit time (hours)	Road	Rail
2004	14	27
2009	14	23
2014	12-14	23
2019	12-14	23
2029	12-14	23

Note: The figures provide averages across the forward and back legs for 2004, 2009, 2014, 2019 and 2029.

* A range has been provided for Commercial-in-Confidence reasons.

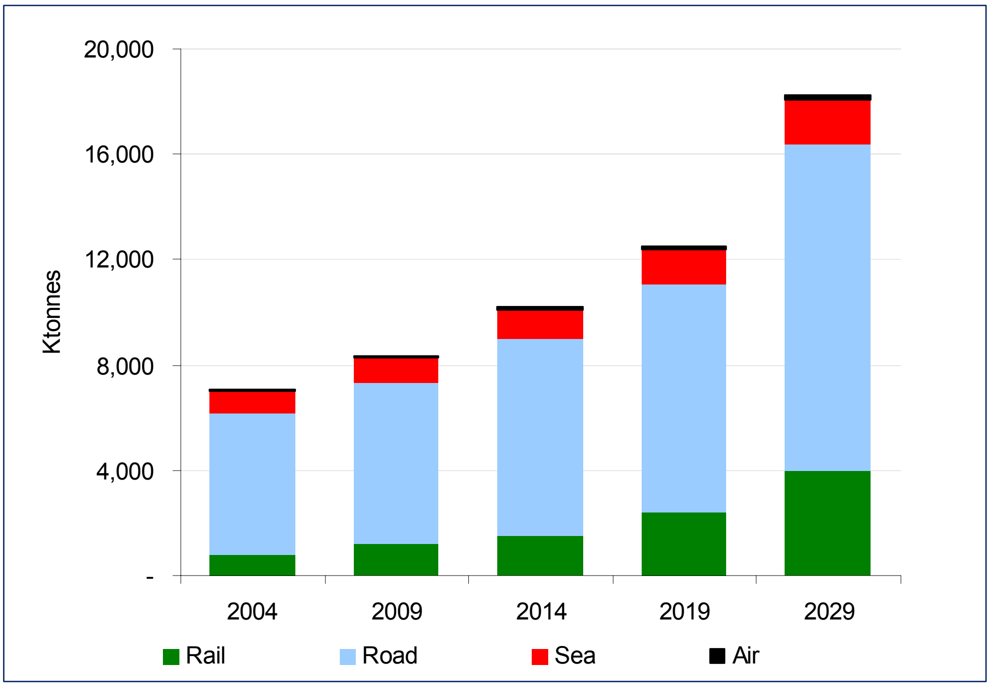
Road and rail prices on the Sydney-Brisbane route are forecast to follow very similar paths to the Melbourne-Brisbane due to the same price-related assumptions.

Assuming train operators use 50% of transit time savings to build slack into their schedules to increase reliability (as assumed above), on-time reliability is forecast to increase from 45% to 70% on the Sydney-Brisbane route by 2029. The future congestion problems north of Sydney are likely to limit the extent of reliability improvements on this route unless significant investments are made.

Given rail's long door-to-door transit times relative to road, rail's availability on the Sydney-Brisbane remains low throughout the forecasting period, reaching 38% in 2029.

Forecasts show significant increases in road and rail freight volumes on the Sydney-Brisbane route over the forecasting period. As shown in Chart 32, the quantity of freight shifted on road by 2029 is expected to increase to nearly 12 million tonnes. Freight volumes on the rail network between Sydney and Brisbane are also forecast to rise strongly to above four million tonnes by 2029.

Chart 32 - Projection of freight between Sydney-Brisbane (both ways) by mode, 2004-2029 ('000 tonnes)



Source: The Study Team, BTRE, FDF Management

Table 30 shows projected mode shares over the forecasting period on the Sydney-Brisbane route. Rail is forecast to increase its mode share to 22% while road's mode share declines slightly to 68% by 2029.

Table 30 - Projections of mode shares, Sydney-Brisbane (both ways), 2004-2029 – Case A

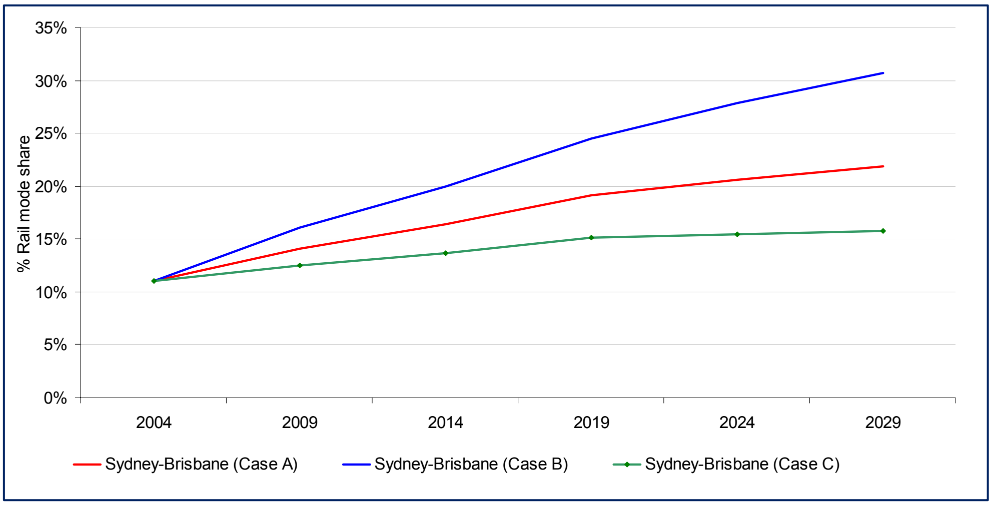
	Rail	Road	Sea	Air
2009	14%	73%	12%	1%
2014	17%	73%	11%	1%
2019	19%	70%	10%	1%
2029	22%	68%	9%	1%

Note: Land bridging rail volumes are excluded for the purposes of this analysis.

Source: The Study Team, BTRE, FDF Management

Chart 33 demonstrates the sensitivity of mode shares outcomes to Cases A, B and C on the Sydney-Brisbane route. Rail's mode share in Case B increases to just above 30% by 2029, higher than the industry participants predicted, and barely increases at all in Case C over the forecasting period. The variance on this route is particularly pronounced due to sensitivity to the assumed level of growth in the price/reliability sensitive (or non-availability sensitive) segment of the manufactured goods market.

Chart 33 - Rail mode share on the Sydney-Brisbane route, Cases A, B and C, 2004-2029, (000 tonnes)



Source: The Study Team, BTRE, FDF Management

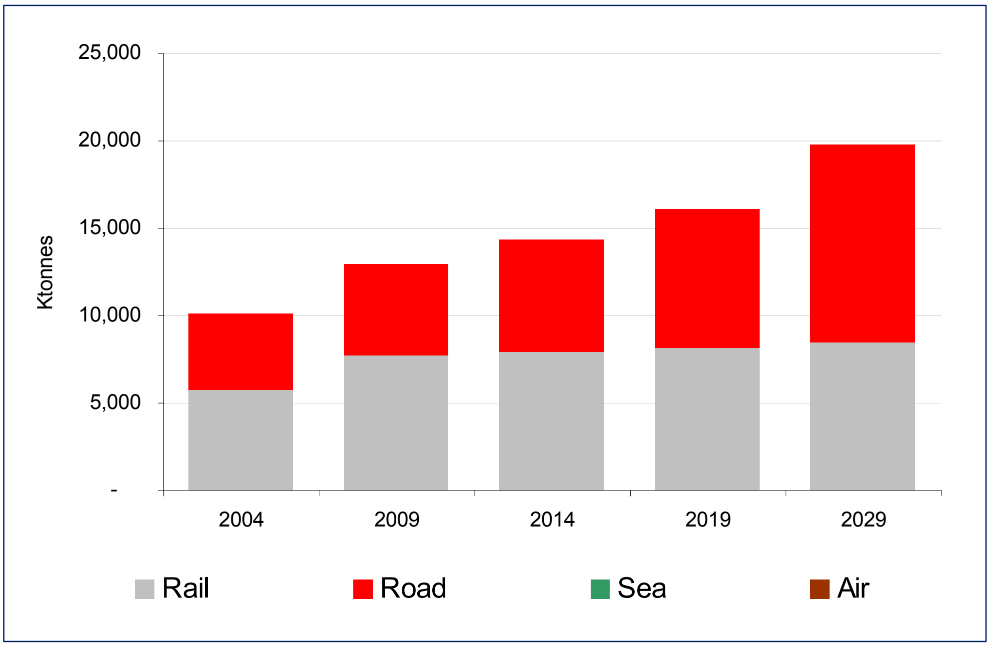
4.8.8 Regional freight mode shares

This section presents the forecast mode share outcomes for regional areas in the Corridor and regions into and out of the Corridor by the Study Team.

4.8.8.1 Southeast Queensland

Rail carried slightly more than 50% of freight to and from southeast Queensland in 2004, mainly due to rail's dominance of coal freight. Chart 34 shows rail's mode share is forecast to decline to just below 50% of the freight task through the forecasting period to 2029.

Chart 34 - Freight by mode: Southeast Queensland, 2004-2029, Case A, ('000 tonnes)



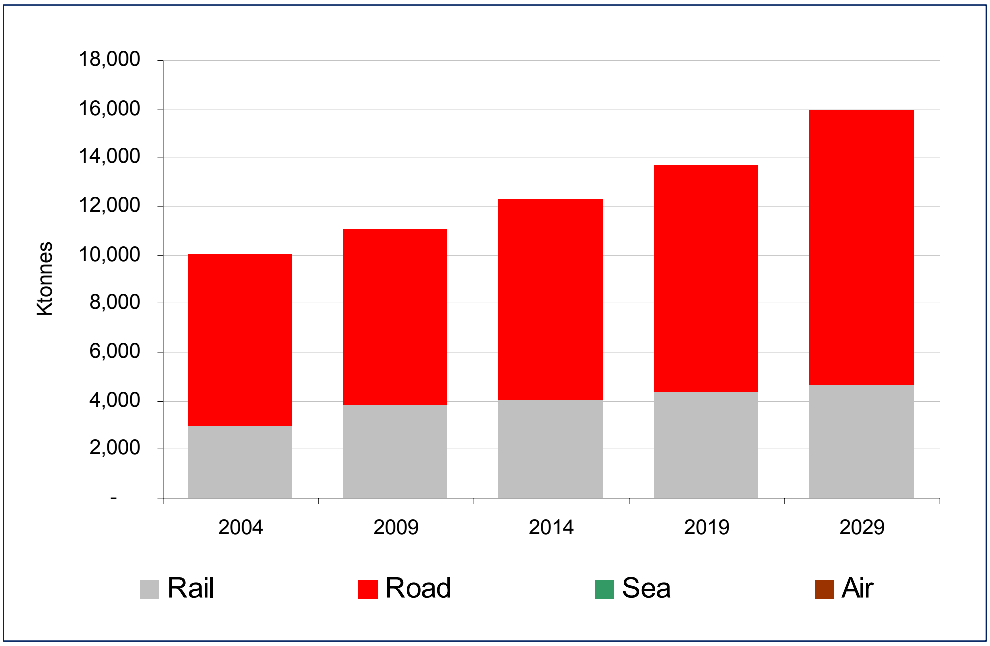
Note: This analysis excludes coal freight volumes.

Source: The Study Team, BTRE, FDF Management.

4.8.8.2 Northern New South Wales

Rail transported roughly one-third of freight to and from northern New South Wales in 2004. Chart 35 shows rail's mode share is expected to decline to below 30% of the freight task through the forecasting period to 2029.

Chart 35 - Freight by mode: Northern New South Wales, 2004-2029, Case A, ('000 tonnes)



Note: This analysis excludes coal freight volumes

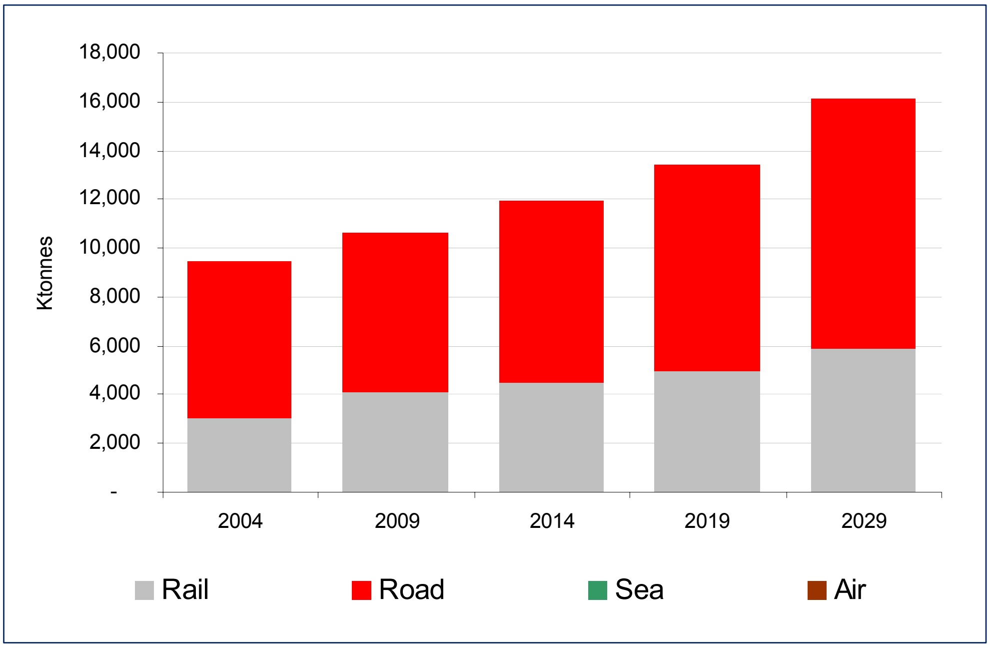
Source: The Study Team, BTRE, FDF Management.

Besides a modal shift, a new inland line would divert some rail freight from other lines. After industry consultation, the most plausible area of freight diversion appears to be northern New South Wales. A proportion of grain and agricultural freight generated in this region would likely be diverted to Brisbane along a new route through Narrabri and Moree, away from its current route from Narrabri/Moree to Newcastle and Sydney. It is expected that 28% of grain and approximately 50% of cotton produced in northern New South Wales would be diverted to Brisbane on any new rail route.

4.8.8.3 *Central New South Wales*

Rail transported approximately 35% of freight to and from central New South Wales in 2004. Chart 36 shows rail's mode share is expected to increase slightly to 38% of the freight task through the forecasting period to 2029.

Chart 36 - Freight by mode: Central New South Wales, 2004-2029, reference case, ('000 tonnes)



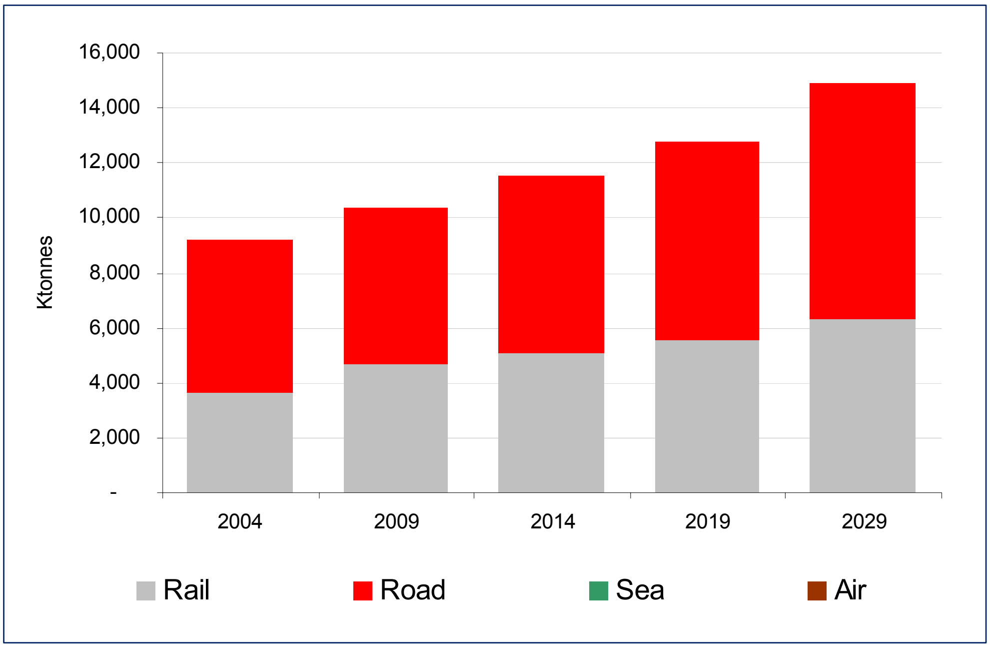
Note: This analysis excludes coal freight volumes

Source: The Study Team, BTRE, FDF Management.

4.8.8.4 *Southern New South Wales*

Rail transported approximately 41% of the freight task to and from southern New South Wales in 2004. Chart 37 shows rail's mode share is expected to increase marginally to 43% of the freight task through the forecasting period to 2029.

Chart 37 - Freight by mode: Southern New South Wales, 2004-2029, Case A, ('000 tonnes)



Note: This analysis excludes coal freight volumes

Source: The Study Team, BTRE, FDF Management.

It was assumed that approximately 70% of the freight originating in southern New South Wales would also divert to a new inland route through Narrandera, Tocumwal and Shepparton to Melbourne. The shorter distance to Melbourne from Narrandera to the west makes the new route a logical substitute to current routes. Like northern New South Wales, much would depend on the level access prices on the new track and shipping patterns.

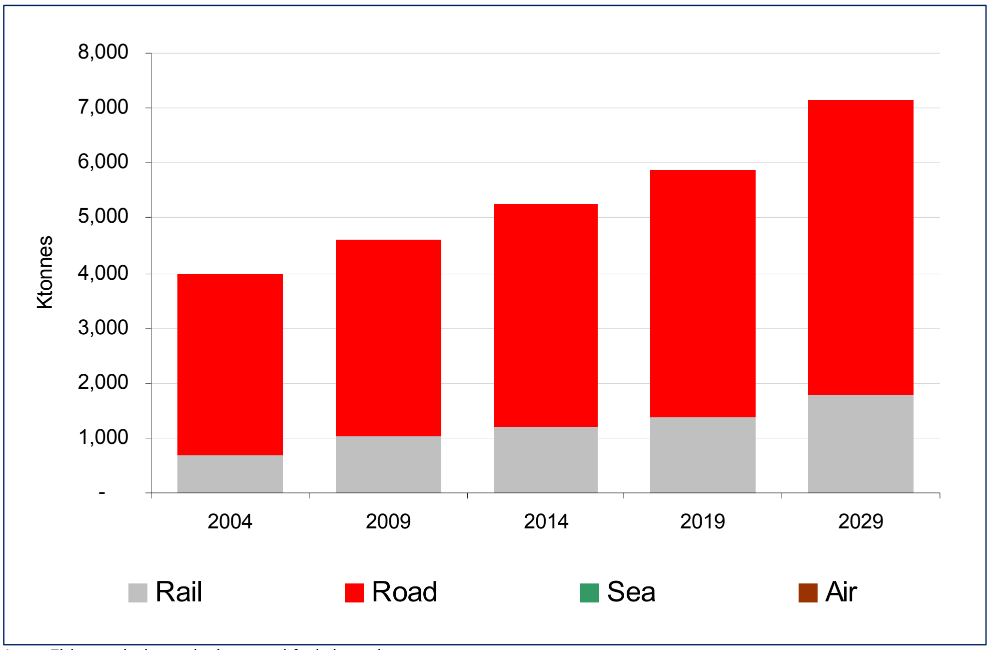
Industry consultations indicated the following freight movements could be attracted to a new route through southern New South Wales:

- Small amounts of freight would be diverted to Melbourne on a new route, away from Port Kembla.
- Most freight heading from Griffith to Melbourne would use the new route, as it offers train operators above rail cost savings (given access charges are roughly proportional).
- Grain freight of up to 300,000 tonnes per annum would use the new line (this grain has traditionally been transported by road).

4.8.8.5 Northern Victoria

Rail transported roughly 20% of freight to and from northern Victoria in 2004. Chart 38 shows rail is expected to maintain its 20% share of the freight task through the forecasting period to 2029.

Chart 38 - Freight by mode: Northern Victoria, 2004-2029, Case A, ('000 tonnes)



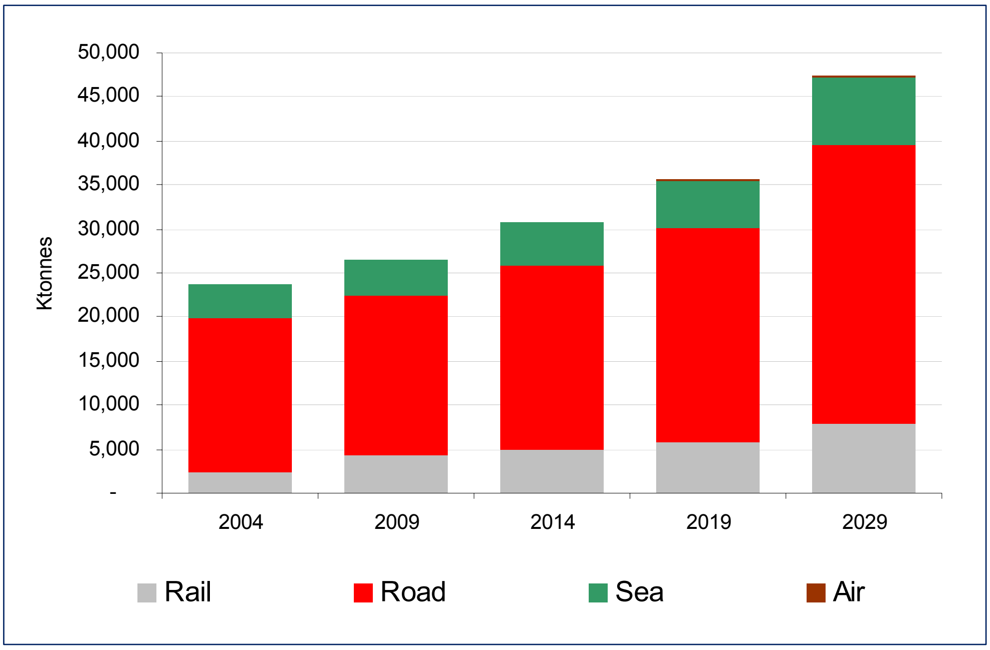
Note: This analysis excludes coal freight volumes

Source: The Study Team, BTRE, FDF Management.

4.8.9 Freight along existing Melbourne-Sydney-Brisbane corridor to/from intermediate points

Rail transported approximately 10% of the freight task to and from intermediate points along the existing Melbourne-Sydney-Brisbane corridor in 2004. Chart 39 shows rail's mode share is expected to increase to 15% through the forecasting period to 2029 (due mainly to steel freight from Westernport, Wollongong and Newcastle). Rail's potential for large mode share increases is limited between intermediate points along the existing corridor due to many routes of relatively short distance.

Chart 39 - Freight by mode: Coastal intermediate, 2004-2029, Case A, ('000 tonnes)



Note: This analysis excludes coal freight volumes.

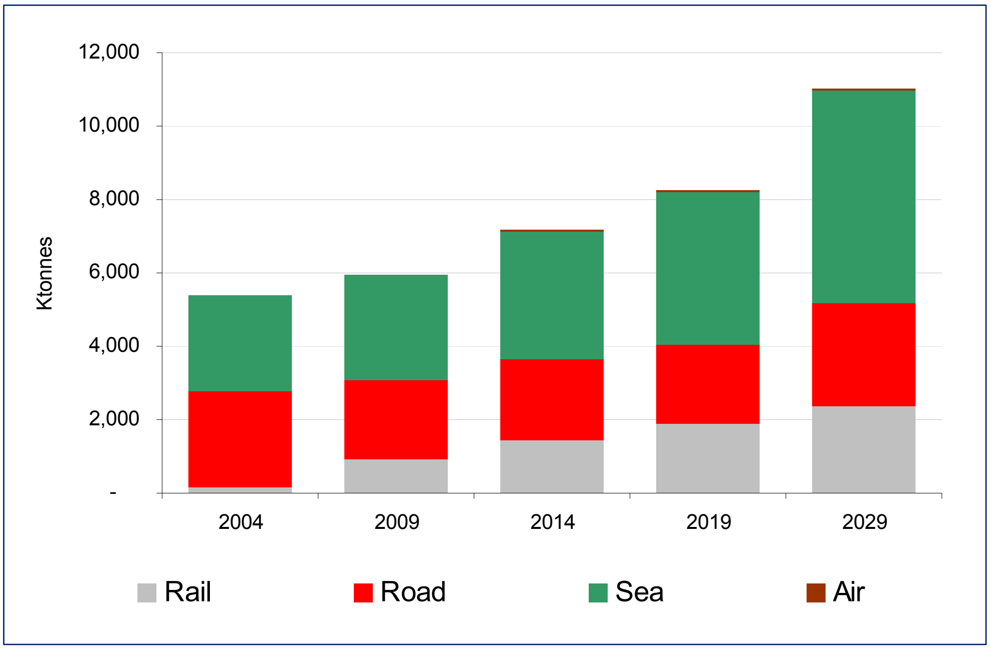
Source: The Study Team, BTRE, FDF Management.

4.8.9.1 *To and from northern Queensland*

Rail transported less than 5% of freight to and from northern Queensland in 2004. The very low mode share – attributed to fledgling rail services and problems with seamless transits from southern capitals to northern Queensland – is expected to grow significantly over the forecasting period to 2029. The long distance of the routes to and from northern Queensland – some equal to those in the east-west corridor –provide competitive advantages to rail due to the favourable economics of rail on long-haul routes.

Chart 40 shows rail's mode share is forecast to increase (at the expense of road) to 25% of the total freight task and 50% of the land freight task to and from northern Queensland and the Corridor. Coastal shipping is also expected to maintain around 50% of the freight task.

Chart 40 - Freight by mode: Northern Queensland, 2004-2029, Case A, ('000 tonnes)



Note: This analysis excludes coal freight volumes

Source: The Study Team, BTRE, FDF Management.

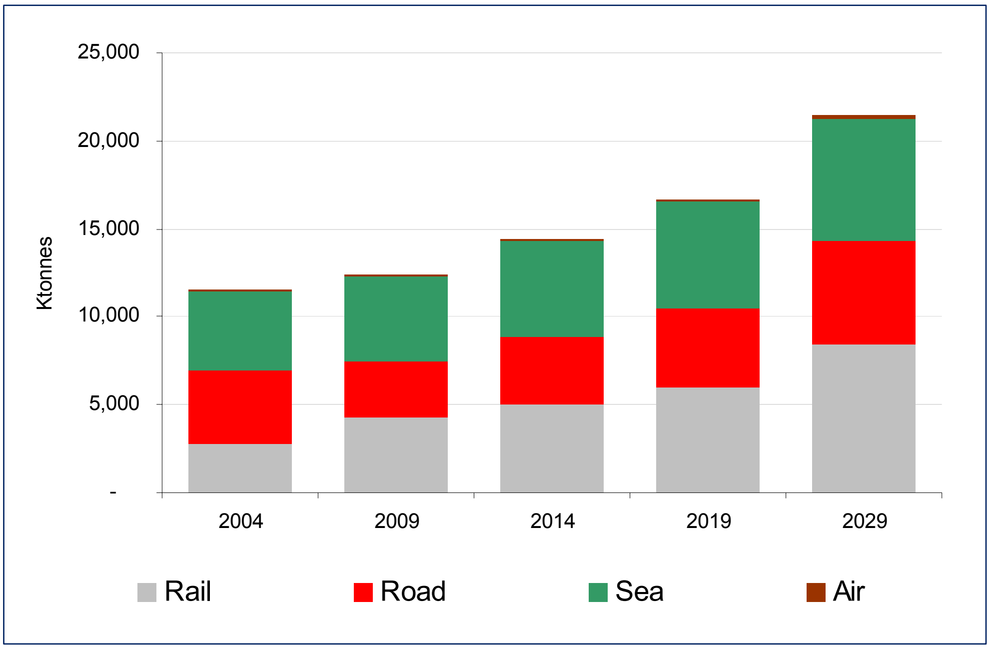
4.8.10 Traffic to and from South Australia and Western Australia

Freight on the Western Australia and South Australia to Brisbane routes appears likely to use an inland route in preference to the current movement through Sydney. Trains departing from Brisbane would be likely to travel south through Parkes and head west through Broken Hill and Tarcoola to Perth rather than the current route through Sydney. However, this diversion is no certainty as freight consolidation practices may force the freight to maintain its current route through Sydney. The same circumstances hold for steel freight originating in Whyalla, bound for Brisbane.

The Study Team has assumed that 80% of rail freight between Western Australia and Brisbane and 90% of rail freight between South Australia and Brisbane would use an inland route. The freight from the west would enter and exit the Corridor via Parkes (Western Australia) and Melbourne (South Australia).

Chart 41 shows the forecast volumes of freight on Western Australia-Brisbane and South Australia (predominantly Whyalla)-Brisbane routes from 2004 to 2029. Rail's mode share is forecast to increase significantly at the expense of road. Coastal shipping is also expected to increase its share of the freight task to and from the west into the Corridor.

Chart 41 - Freight by mode: WA/SA, 2004-2029, Case A, ('000 tonnes)



Note: This analysis excludes coal freight volumes

Source: The Study Team, BTRE, FDF Management

5 Total rail freight

5.1 Modal share integration with total freight forecasts

Section 2 provided forecasts of total freight in the different origin-destination markets in the Corridor and section 3 assessed forecast mode share outcomes. This section combines these forecasts, together with freight diverted from other rail lines, to provide estimates of total rail freight in the Corridor by origin, destination and commodity type. It covers the existing Coastal Route (in the form that it will be after the current AusLink/ARTC investment program) and a potential inland rail route.

The analysis assumes that the growing rail (and road) freight volumes can be accommodated. However, it is noted that:

- There may still be problems in the Sydney area, possibly eased by new investments.
- The existing route's capacity problems will have been greatly eased by the extra passing loops, passing lanes and signalling capability from the ARTC/AusLink investment program, planned for completion prior to the first forecast year of 2009.
- The potential inland route would have been designed with sufficient passing loops to provide plenty of capacity for the limited number of trains.

The estimated growth in rail freight, especially if there is no inland route, is such that the existing route (including the ARTC/AusLink upgrades) will again become capacity constrained at some point, around 2019. The consequences will either be more capital work to further augment capacity[28], or a deterioration in reliability (which will discourage demand) as the capacity constraint starts to bite.

The Study Team's three demand forecasting scenarios – Cases A, B and C – and the five demand assumptions embodied in each case are outlined in Table 31.

Table 31 - Cases A, B & C for sensitivity testing of forecast total freight and mode share outcomes over the forecasting period, 2004-29

	Case A	Case B	Case C
GDP growth (average over forecasting period)	3.25	3.6	2.75
Transport/GDP growth ratio	1.3 to 1.05	1.3	1 (held constant)
Fuel prices	US$70 to US$50 (real)	US$70 (real) (held constant)	US$70 to US$40 (nominal)
Road labour costs	1.06 to 2009, then 1.04 to 2029	1.08 to 2009, 1.06 to 2029	1.04 to 2029
Rail labour costs	1.04 to 2009, then	1.04 to 2009, then 1.03 to 2029	1.04 to 2029

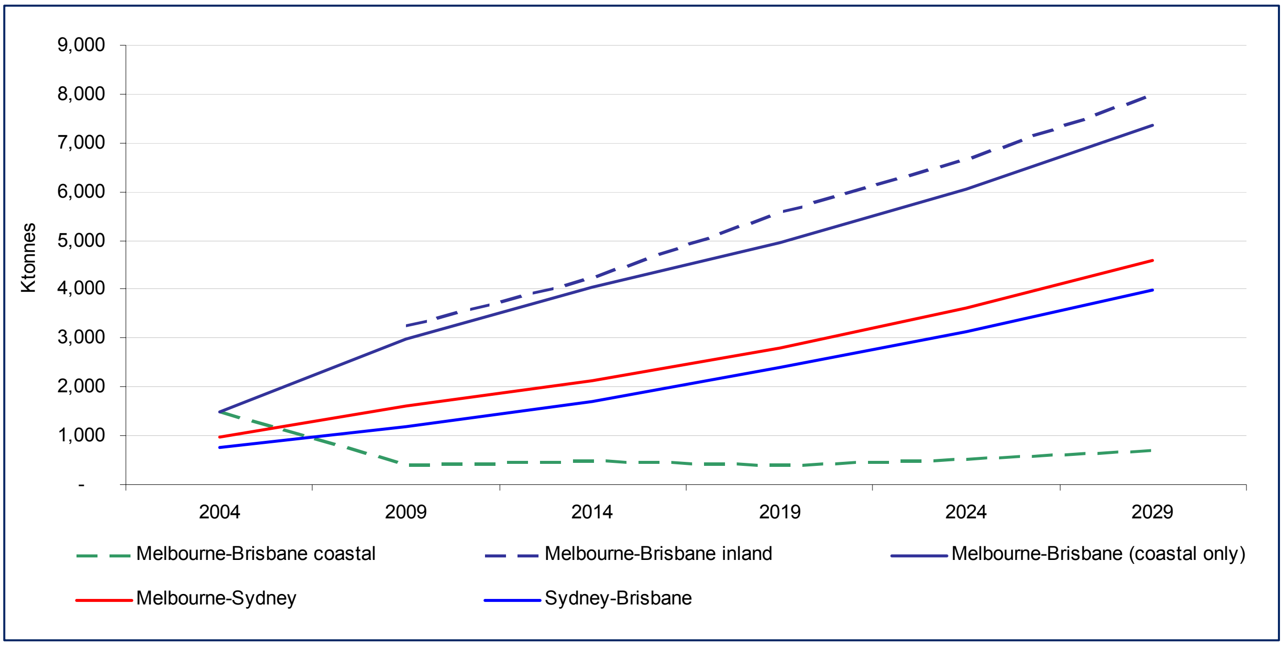
[28] See *The North-South Corridor -- Options for Future Investment on the Coastal Route*, ARTC April 2006

	Case A	Case B	Case C
	1.03 to 2029		
Availability sensitive market	25-35% to 37.5-47.5%	25-35% to 50-60%	25-35% (held constant)

5.2 Freight levels without an inland route

Chart 42 shows the forecast rail freight volumes on the three inter-capital city routes in the Corridor. The forecasts show significant growth on all the routes, except freight on the existing Melbourne-Brisbane coastal route when a potential inland route is assumed to be in operation. The modelling results show that growth in rail volumes through the forecasting period to 2029 is derived from two factors. Firstly, significant growth in the total freight market on inter-capital city routes and secondly, a mode share shift towards rail as a result of the AusLink investment program and declining future rail prices relative to road.

Chart 42 - Inter-capital rail tonnage on the Corridor by origin-destination, with and without proposed inland rail route, 2004-2029 (k/tonnes)



Source: The Study Team, BTRE, FDF Management

5.2.1.1 Melbourne-Brisbane

Table 32 outlines the increase in rail freight volumes on the Melbourne-Brisbane route on the existing coastal route without a potential inland route. Northbound traffic from Melbourne is forecast to grow to over four times its present level over the 25-year forecasting period. In contrast, the lower base of the southbound traffic means it is forecast to grow to over six times its present level.

Table 32 - Total rail tonnage on Melbourne-Brisbane coastal route: Case A, 2009-2029, '000 tonnes

Route/year	2009	2014	2019	2029
Melbourne-Brisbane	1,627	2,361	3,038	4,473
Brisbane-Melbourne	1,004	1,441	1,919	2,881
Total	2,631	3,803	4,957	7,353

Source: The Study Team, BTRE, FDF Management

5.2.1.2 Melbourne-Sydney

Table 33 details the increase in rail freight volumes on the Melbourne-Sydney route in both directions from 2004 to 2029. Northbound traffic from Melbourne is forecast to grow to over four times its present level, and southbound traffic is forecast to grow to five times its present level.

Table 33 - Total rail tonnage on Melbourne-Sydney coastal route: Case A, 2009-2029, '000 tonnes

Route/year	2009	2014	2019	2029
Melbourne-Sydney	786	1,024	1,344	2,181
Sydney-Melbourne	841	1,104	1,462	2,401
Total	1,627	2,128	2,806	4,581

Source: The Study Team, BTRE, FDF Management

5.2.1.3 Sydney-Brisbane

Table 34 details the increase in rail freight volumes on the Sydney-Melbourne route in both directions from 2009 to 2029. Rail freight volume in both directions is forecast to grow to approximately six times its present level.

Table 34 - Total rail tonnage on Sydney-Brisbane coastal route: Case A, 2004-2029, '000 tonnes

Route/year	2004	2009	2014	2019	2029
Sydney-Brisbane	376	579	599	1,128	1,862
Brisbane-Sydney	398	610	886	1,261	2,134
Total	775	1,189	1,484	2,389	3,995

Source: The Study Team, BTRE, FDF Management

5.3 Freight levels on the coastal rail route with an inland route in place

5.3.1.1 Melbourne-Brisbane

The future levels of rail freight on the existing Coastal Route and a potential inland route are estimated by the logit model, which reflects the results of the industry surveys.[29] Relative prices and service standards determine whether land freight will travel between Melbourne and Brisbane by a potential inland route, the existing Coastal Route or road. Table 35 shows the breakdown of end-to-end rail freight on the existing coastal route and a potential inland route with an inland route operational. The table also shows forecast levels of freight on a potential inland route to/from:

- Southeast Queensland to Brisbane;
- Northern New South Wales to Brisbane;
- Southern New South Wales to Melbourne;
- Northern Victoria to Melbourne; and
- Brisbane to Western Australia/South Australia.

Table 35 - Total rail tonnage with a potential inland route: Case A, 2009-2029, '000 tonnes

Route/year	2009	2014	2019	2029
Melbourne-Brisbane (inland)	2,113	2,603	3,375	4,693
Brisbane-Melbourne (inland)	1,129	1,626	2,188	3,262
Melbourne-Brisbane (coastal)	145	265	204	442
Brisbane-Melbourne (coastal)	244	210	177	265
Southeast QLD-Brisbane	10,708	10,924	11,173	11,547
Northern NSW-Brisbane (inland)	1,031	1,100	1,181	1,278
Southern NSW-Melbourne (inland)	1,678	1,831	2,002	2,278
Southern NSW-Melbourne (existing)	420	458	500	569
Northern Victoria-Melbourne (inland)	457	490	527	598
WA/SA to Brisbane (inland)	711	832	980	1,342

[29] To determine the proportion of freight carried by road, an inland route and the existing Coastal Route between Melbourne and Brisbane, the logit model was developed to allow three transport options. The road option was left as an independent choice and the two rail modes were 'nested' within the rail option. A further parameter (lambda) was added to correlate the shifts between the two rail modes and road that are not explained by price, reliability or availability (more inherent tendencies towards one mode or another). The lambda parameter correlated the logit model so that freight customers were more likely to substitute the existing Coastal Route for a new proposed inland route rather than a substituting between road and rail routes.

Route/year	2009	2014	2019	2029
WA/SA to Brisbane (coastal)	126	147	173	237

Source: The Study Team, BTRE, FDF Management

Table 35 shows that freight volumes on an inland route will increase significantly over the forecasting period. Rail volumes are forecast to at least double for most of the major freight generating transport flows. End-to-end rail volumes are forecast to reach 7.9 million tonnes on the Melbourne-Brisbane route by 2029, most of this at the expense of the existing Coastal Route.

Freight volumes from southeast Queensland are forecast to grow to 11.5 million tonnes by 2029 and approximately 1.3 million tonnes is forecast to be diverted from northern New South Wales to Brisbane on a potential inland route away from Newcastle and Sydney. Rail volumes from southern New South Wales to Melbourne are expected to double. Volumes from northern Victoria (Shepparton/Tocumwal) are also forecast to double over the forecasting period.

Table 35 also shows the forecast volumes on the Western Australia/South Australia to Brisbane route likely to utilise an inland route will reach 1.3 million tonnes by 2029.

Total rail volumes forecast to use an inland route will grow from 17.8 million tonnes in 2009 to 25 million tonnes in 2029.

5.3.1.2 Sydney-Brisbane

The Study Team estimates that all freight between Sydney and Brisbane will continue to use the coastal route, regardless of new rail infrastructure in interior regions. The rail freight volumes from section 4.2 also apply to section 4.3.

5.3.1.3 Melbourne-Sydney

The Study Team estimates that a potential inland route will have little effect on Melbourne-Sydney freight volumes over the forecasting period.

5.4 Toowoomba case

A variation to the inland route options is one that proceeds only as far as Toowoomba with freight taken by truck for the 130-kilometre journey to and from Brisbane. The rationale is that it would achieve most of the gains of an inland route while avoiding the significant cost of building the tunnel until later when traffic volumes and access revenues were higher.

By greatly reducing the cost, the economics of the inland options are improved, and it can be argued that the freight would have to move by truck at the end (or beginning) of the journey anyway, from wherever the rail terminal happens to be. On the other hand, the door-to-door rail service would be slower and possibly more expensive. The road is extremely steep north of Toowoomba (a bypass is under consideration) and congested closer to Brisbane.

The Study Team used its logit model to assess the effect of longer door-to-door journey times and the higher PUD costs on mode share outcomes. It was assumed that door-to-door journey times would be one hour longer than with the tunnel, although this would vary depending on customers' location in Brisbane.

The net door-to-door price charged to rail freight customers was assumed be $10 per tonne higher than otherwise. Increased PUD costs from Toowoomba of roughly $150 to $250 per consignment, correspond to roughly $15 per tonne more than if the train terminated in Brisbane. The increase in PUD costs of truck trips to and from Toowoomba and Brisbane would be partially offset by avoiding the above and below rail costs to and from Toowoomba and Brisbane. The offsetting reduction in rail costs is estimated at approximately $5 per tonne.[30]

The effect of slightly longer transit times and an increase in door-to-door prices for rail is a reduction in the rail mode share, rail tonnages and hence in access revenue. The comparison between end-to-end Melbourne-Brisbane freight with and without a Toowoomba Ranges rail tunnel is shown in Table 36.

Table 36 - Total rail tonnage on a potential inland route terminating at Toowoomba: Case A, 2009-2029, '000 tonnes

Route/year	2009	2014	2019	2029
Melbourne-Brisbane (inland)	2,113	2,603	3,375	4,693
Brisbane-Melbourne (inland)	1,129	1,626	2,188	3,262
Melbourne-Brisbane (Toowoomba inland)	1,779	2,151	2,932	3,910
Brisbane-Melbourne (Toowoomba inland)	635	1,030	1,536	2,302
South east QLD - Brisbane (Toowoomba inland)	7,689	7,902	8,148	8,515
Northern NSW - Brisbane (Toowoomba inland)	1	2	2	2
WA/SA to Brisbane (inland)	586	685	807	1,105
WA/SA to Brisbane (coastal)	251	294	346	474

Source: The Study Team, BTRE, FDF Management

The Study Team's mode share modelling showed that without a Toowoomba Ranges tunnel, the level of end-to-end freight between Melbourne and Brisbane declined by 15% or over 800,000 tonnes in 2009 and 1.6 million tonnes in 2029 (aggregated in both directions). The modelling showed that the slightly slower transit time had little or no impact on mode shares and the increased door-to-door costs of $10 per tonne caused the majority of the reduction in the mode share.

The benefits of using the tunnel to replace the current Gowrie to Grandchester section of the narrow gauge line would be lost. There would continue to be capacity constraints on movement of coal out of the Darling Downs and the Surat Basin, and grain out of southwest Queensland. Coal freight from the Surat Basin is estimated to decline by approximately 3 to 3.5 million tonnes per annum from 2009 if the tunnelling of the Toowoomba Ranges is not completed.

Agricultural products from southwest Queensland would remain at 2004 levels. Freight diversion from northern New South Wales would be most unlikely to occur without a tunnel as there would be no direct rail connection with the port. The lack of port connectivity from a rail line with a standard gauge would resemble the current situation. Thus the

[30] Depending on the level of access charges set for train access to a Toowoomba Ranges tunnel, this could increase towards $6-$7 per tonne, as access charges for this section of track could be priced above other sections given its high construction costs. Access charges may be smoothed across the interstate network but at present access charges are not set at uniform levels across different sections of the interstate network. Total Rail Tonnage includes some coal from the Surat Basin, cotton and grain from Southern Queensland.

Study Team assumes there would be no freight diversion from northern New South Wales if there was no Toowoomba Ranges tunnel. As shown in Table 36, this corresponds to a 1.3 million tonne reduction in 2029.

Freight between Western Australia/South Australia and Brisbane is forecast to be nearly 20% or 200,000 tonnes below freight levels with a Toowoomba Ranges tunnel operational by 2029.

Total freight on an inland route terminating at Toowoomba is forecast to reach 23.8 million tonnes by 2029.

6 Passenger demand

6.1 Introduction

Passenger demand has been assessed independently of freight demand because some of the factors causing growth are different. These factors include population growth in particular areas, competition from other passenger transport and government policies about levels of service.

Passenger numbers are relevant to Corridor options where there is competition with freight trains for track capacity, especially as passenger trains are usually given priority. The growth in passenger numbers would at some point become a growth in passenger train numbers and in the number of slots used. Growth in peak period passenger train numbers would have little impact on freight trains which are already excluded by curfews, but growth in off-peak periods could have a negative impact.

6.2 Future passenger rail market analysis

Australian urban and total rail passenger transport has grown by approximately 1.5% on average from 1992 to 2003. Non-urban rail passenger transport has had a slightly higher growth rate of approximately 2.3% through the same period. This has not affected the overall passenger rail growth rate, as the average non-urban passenger task (10 million passengers) is small relative to that of the average urban passenger rail task (452 million passengers) through the period.

The Bureau of Transport and Regional Economics' (BTRE) '*Demand Projections for AusLink Non-Urban Corridors*' report provides projected origin-destination passenger travel by corridor and transport mode between 1999 and 2025. For all major rail corridors, the BTRE estimates a projected annual growth rate in non-urban rail passenger kilometres of 0.3% between 1999 and 2025. This means that growth rates in national non-urban rail passenger journeys as stated above are not expected to continue.

Some possible explanations for rail's declining share of passenger transport in the future include:

- Strong growth in air travel (due in part to low-fare airlines) between most major capital city pairs with the exception of Sydney-Canberra. The Sydney-Brisbane corridor is projected to have one of the strongest rates of growth in air travel, reflecting strong population growth and international visitor movements;
- Strong growth in car travel between cities within 400 kilometres (for example, Sydney-Canberra, Sydney-Nowra and Sydney-Newcastle); and
- Strong growth in bus trips for the Sydney-Canberra corridor.

Rail's declining share of the transport market is also related to its competitiveness with other modes of passenger transport. The 2006 BTRE competitiveness indices for various modes of passenger transport indicate that[31]:

- For distances between 200 and 400 kilometres, rail is less competitive than bus and car, but slightly more competitive than air; and
- For distances over 400 kilometres, rail is as competitive as bus, but less competitive than air and car.

The growth rates projected by the BTRE for relevant Corridor origin-destination routes appear in Table 37 below. This table also includes, for comparison purposes, projected growth rates for alternative routes and modes.

Table 37 - Projected passenger travel growth rates by route and mode to 2025

North-South Rail Corridor routes	Air	Bus	Car	Other	Rail	All modes
Sydney-Wollongong	0.9	0.7	2.7	3.0	0.7	2.5
Sydney-Canberra	0.4	2.5	3.2	3.1	0.5	2.8
Sydney-Melbourne	3.9	0.3	-1.0	0.2	-1.8	3.1
Sydney-Dubbo	-0.6	0.7	2.5	0.4	-0.5	2.2
Sydney-Brisbane	4.2	-0.3	-0.8	-0.8	-1.4	3.3
Melbourne-Brisbane	3.6	-1.6	-1.4	-0.8	-0.9	3.1
Other routes						
Melbourne-Mildura	4.3	0.3	2.2	0.1	**0.3**	2.3
Melbourne-Geelong	3.9	0.7	2.5	1.3	**0.5**	2.4
Melbourne-Adelaide	3.7	0.8	1.6	1.8	**0.4**	2.8
Sydney-Adelaide	3.9	-1.1	-1.2	-2.3	-1.4	2.9
Adelaide-Perth	4.1	0.9	-0.8	-2.7	**1.4**	3.2

Source: BTRE (2006).

On the east-coast of Australia, the Sydney (north and south), Brisbane-Gold Coast and Melbourne areas contain the majority of the population and account for most of the current and future passenger train travel in each respective state (DeSanti, 2005). However, within these highly populated areas and considering only those on the Corridor, only the Sydney-Wollongong and Sydney-Canberra routes are projected to have positive annual growth in passenger rail travel, according to the BTRE. Despite not being included in the BTRE projections, the Sydney-Newcastle route should be added to this list based on the analysis undertaken in chapter 3: ***Market Assessment***. It is therefore included in later sections.

[31] BTRE (2006) passenger mode share competitiveness indices are used to project future mode shares given current market share data. The mode share competitiveness indices are assumed for domestic passenger trips, with car travel as the reference mode, that is, the competitiveness index of car passenger travel is equal to one.

In summary, growth in major east coast (North-South Rail Corridor) rail passenger routes to 2025 is expected to decline except for the Sydney-Canberra, Sydney-Wollongong and Sydney-Newcastle routes; that is, for all corridors except short distance corridors to/from the Sydney area, including the Sydney area urban rail network.

6.2.1 BTRE future passenger projections: a background

The BTRE domestic passenger travel projections are derived from the OZPASS model, which uses a constrained gravity-model relationship to project growth in total domestic resident inter-regional passenger travel via a competitiveness index. Further descriptions of OZPASS can be found in annexure 4: ***Demand Analysis Annexures***.

Therefore, the BTRE passenger mode share projections are the result of a logistic substitution equation using assumed mode competitiveness indices for domestic passenger trips, where car travel is the reference mode and equal to one (see Table 38 below).

Table 38 - BTRE passenger mode competitiveness indices (domestic residents)

	Distance (km)			
Mode	0-200	200-400	400-800	>800
Air	0.96	0.967	1.019	1.05
Car	1.00	1.00	1.00	1.00
Coach	0.98	0.98	0.98	0.98
Rail	0.98	0.97	0.98	0.98
Ferry	1.00	1.00	1.00	1.00
Other	0.98	0.98	0.98	0.99

Source: BTRE (2006).

The BTRE has utilised a total trip generating model to forecast future passenger numbers for particular routes and subsequently derived passenger mode share projections via a logistic substitution equation using assumed mode competitiveness indices.[32] Table 39 shows the results by route and mode for selected years. Annexure 4: ***Demand Analysis Annexures*** contains the results by route and mode for all years.

Table 39 - Projected passenger travel ('000s) by route and mode: 2006 to 2029

Route	Year	Air	Bus	Car	Other	Rail	All modes
Average annual growth rate		1.009	1.007	1.027	1.03	1.007	1.025
Sydney-Wollongong	2006	3.09	427.79	12915.13	19.19	1506.49	14951.76
	2010	3.20	439.89	14367.48	21.59	1549.12	16503.95
	2015	3.35	455.50	16414.69	25.03	1604.10	18672.71
	2020	3.50	471.67	18753.61	29.02	1661.04	21126.45
	2025	3.66	488.41	21425.81	33.64	1720.00	23902.64
	2029	3.79	502.23	23835.21	37.87	1768.66	26384.04
Average annual growth rate		1.004	1.025	1.032	1.031	1.005	1.028
Sydney-Canberra	2006	553.25	486.65	4202.46	4.33	164.13	5435.74
	2010	562.15	537.17	4766.75	4.90	167.44	6070.60
	2015	573.48	607.76	5579.83	5.70	171.67	6969.42
	2020	585.05	687.62	6531.60	6.65	176.00	8001.34
	2025	596.84	777.98	7645.71	7.74	180.45	9186.03
	2029	606.45	858.74	8672.35	8.75	184.08	10258.89

[32] These mode share projections have allowed average annual growth rates (per cent per annum) to 2025 to be determined for each passenger transport mode. The average annual growth rates by route have been applied to their respective passenger transport mode for each year to 2029.

Route	Year	Air	Bus	Car	Other	Rail	All modes
Average annual growth rate		1.039	1.003	0.99	1.002	0.982	1.031
Sydney-Melbourne	2006	5599.75	205.57	955.27	23.22	114.30	7012.37
	2010	6525.75	208.04	917.63	23.41	106.29	7923.18
	2015	7901.48	211.18	872.66	23.64	97.06	9229.81
	2020	9567.23	214.37	829.89	23.88	88.64	10751.92
	2025	11584.14	217.60	789.22	24.12	80.94	12525.05
	2029	13499.76	220.23	758.12	24.31	75.27	14151.88
Average annual growth rate		0.994	1.007	1.025	1.004	0.995	1.022
Sydney-Dubbo	2006	155.22	126.11	3387.16	27.15	110.94	3811.21
	2010	151.53	129.68	3738.79	27.59	108.74	4157.82
	2015	147.04	134.28	4230.10	28.14	106.04	4635.76
	2020	142.68	139.05	4785.97	28.71	103.42	5168.62
	2025	138.45	143.98	5414.88	29.29	100.86	5762.75
	2029	135.16	148.06	5977.02	29.76	98.86	6286.85
Average annual growth rate		1.042	0.997	0.992	0.992	0.986	1.033
Sydney-Brisbane	2006	2291.11	85.58	480.04	35.54	44.85	3012.41
	2010	2700.96	84.56	464.86	34.42	42.39	3430.16
	2015	3317.85	83.30	446.56	33.07	39.50	4034.75
	2020	4075.63	82.06	428.98	31.76	36.81	4745.89
	2025	5006.49	80.83	412.09	30.51	34.31	5582.38
	2029	5902.07	79.87	399.06	29.55	32.43	6356.54
Average annual growth rate		1.036	0.984	0.986	0.992	0.991	1.031
Melbourne-Brisbane	2006	1073.66	13.93	120.14	3.31	2.91	1229.46
	2010	1236.82	13.06	113.55	3.20	2.81	1389.16
	2015	1476.06	12.05	105.82	3.08	2.68	1618.24
	2020	1761.58	11.12	98.62	2.96	2.56	1885.11
	2025	2102.33	10.26	91.91	2.84	2.45	2195.99
	2029	2421.81	9.62	86.87	2.75	2.36	2481.22

Note: Projections are made using BTRE average annual growth rates which are applied to the 1999 base year data. Differences between the 2006 BTRE publication and the above values are due to rounding.

Source: BTRE (2006)

Within the Corridor, the summarised results presented in the previous two tables indicate a declining share of the non-urban passenger travel market for rail to 2029. The exceptions are short distance corridors (less than 400 kilometres) to/from the Sydney area, namely the Sydney-Wollongong, Sydney-Canberra, and (from the analysis conducted in chapter 3: ***Market Assessment***) the Sydney-Newcastle routes.

An analysis of the Sydney area rail network (north and south) and potential future demand is conducted in the following section.

6.2.2 The Sydney area passenger rail network

The Sydney rail passenger network is distinct and of particular importance for a number of reasons:

1. The Sydney area rail passenger task is projected to increase in future.
2. The Sydney area will be subject to above national average population growth rates in the future. This will have flow-on effects for rail passenger demand, rail freight and road congestion.
3. The Sydney area passenger rail task is subject to congestion as it is uses the same rail network/infrastructure as rail freight. Furthermore, this rail freight task is expected to increase in the future. This is in contrast to Melbourne and Brisbane which each have dedicated rail freight and passenger rail infrastructure/networks[33].

6.2.2.1 Sydney area passenger rail network corridors

The Sydney area passenger rail network consists of three main corridors:

- Sydney to Canberra – Southern Highlands corridor;
- Sydney to Nowra (via Wollongong) – South Coast corridor; and
- Sydney to Newcastle (via Woy Woy and Awaba) – Central Coast corridor.

These corridors are serviced by RailCorp, which comprises the CityRail and CountryLink services.

A curfew (that applies outside the metropolitan freight network) was introduced to the Sydney area rail infrastructure in 1985, whereby all freight trains must be clear of the RailCorp passenger network during the morning (6 am-9 am) and evening (2.30 pm-6 pm) peak times. The economic implications of this curfew are discussed below.

6.2.2.2 The economics of the Sydney area passenger rail task and the effect of curfews on rail freight transport

One of the main congestion issues concerning the Sydney area rail network is competition between passenger and freight rail for use of the same infrastructure. The congestion is expected to increase with future population growth.

Congestion in the Sydney area rail network takes two forms:

- During peak-time when a curfew on rail freight is enforced to allow passenger rail transport exclusive use of the rail infrastructure.

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[33] Brisbane and Melbourne's metropolitan passenger network consists of narrow gauge and broad gauge track respectively. The ARTC interstate network (the east coast rail freight task infrastructure) is a standard gauge rail line. Therefore, interstate rail freight trains traversing the Melbourne and Brisbane networks do not have to compete with passenger rail for train paths and the imposition of curfews on freight trains in the Melbourne and Brisbane areas is not required during peak times.

- During non-peak-time when rail passenger operations compete with rail freight for use of the rail infrastructure.

As discussed in chapter 3: ***Market Assessment***, additional congestion costs are more likely to be imposed when population growth affects the number of non-peak time rail passenger services as opposed to the number of peak-time services.

In contrast, no additional costs will be imposed if there is an increase in the number of rail passenger services during the peak-time period. Since the maximum possible congestion cost is already imposed on rail freight in the Sydney area during the peak-time curfew, population growth cannot have any further impact unless the curfew period was to increase. (There is, of course, a separate issue of whether the curfew, which is a service constraint for freight option, can be eased or eliminated by infrastructure enhancements.)

In gauging future rail demand growth and congestion, it is necessary to forecast the growth in demand for passenger rail services and in particular, estimating where population growth may result in an increase in the number of those non-peak time services around the Sydney area.

6.2.2.3 Forecasting an increase in the number of non-peak time services

The peak-time utilisation rates determined in chapter 3: ***Market Assessment*** are useful in determining where population growth may result in an increase in the number of non-peak time services by route.

It is to be expected that utilisation rates of trains are higher during peak time periods. Therefore, these peak time utilisation rates give a proxy for current maximum non-peak time utilisation rates. BTRE projected passenger rail and population growth rates are applied to these current route-specific utilisation rates to determine when current capacity levels may be surpassed.

The methodology for forecasting increased utilisation rates involves the application of the rates following to current route-specific utilisation rates:

- Population growth rates from the:
  - Australian Bureau of Statistics (2005) Sydney area population growth rates; and
  - Transport and Population Data Centre (2004) population growth rates for the Sydney-Newcastle area; and
- BTRE route specific passenger rail growth rates (where available).

These utilisation rates were examined in chapter 3: ***Market Assessment***. The results for selected years appear in Table 40 and Table 41, below.

Table 40 - Sydney-Newcastle route passenger and capacity utilisation projections: 2006 to 2029 (selected years)

Morning peak time rail services departing Woy Woy south: average seating capacity (2001-2005) = 12,874 seats				
Year	Newcastle area population growth rates TPDC (2004)		Sydney area population growth rates ABS (2005)	
	Passengers	Utilisation %	Passengers	Utilisation %
2006	8,994	0.70	9,036	0.70
2010	9,175	0.71	9,381	0.73
2015	9,519	0.74	9,800	0.76
2020	9,906	0.77	10,201	0.79
2025	10,309	0.80	10,586	0.82
2029	10,643	0.83	10,875	0.84
Evening peak time rail services departing Hornsby north: average seating capacity (2001-2005) = 12,728 seats				
Year	Newcastle area population growth rates TPDC (2004)		Sydney area population growth rates ABS (2005)	
	Passengers	Utilisation %	Passengers	Utilisation %
2006	9,237	0.73	9,281	0.73
2010	9,424	0.74	9,636	0.76
2015	9,777	0.77	10,065	0.79
2020	10,175	0.80	10,477	0.82
2025	10,588	0.83	10,873	0.85
2029	10,931	0.86	11,170	0.88

Note: Population (ABS and TPDC) and route-specific passenger rail growth rates are shown in annexure 4: Demand Analysis Annexures.

Source: The Study Team.

Table 41 - Sydney-Wollongong route passenger and capacity utilisation projections: 2006 to 2029 (selected years)

Evening peak time rail services departing Sutherland south: average seating capacity (2001-2005) = 6,122 seats		
Year	Sydney-Wollongong passenger rail growth	Sydney area population growth rates

	rates BTRE (2006)		ABS (2005)	
	Passengers	Utilisation %	Passengers	Utilisation %
2006	3,445	0.56	3,455	0.56
2010	3,543	0.58	3,587	0.59
2015	3,668	0.60	3,747	0.61
2020	3,799	0.62	3,900	0.64
2025	3,933	0.64	4,048	0.66
2029	4,045	0.66	4,158	0.68
Morning peak time rail services departing Helensburgh north: average seating capacity (2001-2005) = 6,222 seats				
Year	Sydney-Wollongong passenger rail growth rates BTRE (2006)		Sydney area population growth rates ABS (2005)	
	Passengers	Utilisation %	Passengers	Utilisation %
2006	3,912	0.63	3,923	0.63
2010	4,023	0.65	4,073	0.65
2015	4,166	0.67	4,254	0.68
2020	4,314	0.69	4,428	0.71
2025	4,467	0.72	4,596	0.74
2029	4,593	0.74	4,721	0.76

Note: Population (ABS and TPDC) and route-specific passenger rail growth rates are shown in annexure 4: Demand Analysis Annexures

Source: The Study Team.

The Study Team is confident in the methodology used to achieve these results since:

- RailCorp has stated that it “expects boardings between Awaba and Newcastle to grow approximately in line with population growth”. Furthermore, the TPDC (2004) estimates total population growth for this area of 5% between 2001 and 2011 and further total growth of 8% between 2011 and 2021.
- The BTRE (2006) has forecast growth rates of 0.5 and 0.7% per annum to 2025, for the Sydney-Canberra and Sydney-Wollongong passenger corridors, respectively (see Table 37).

These results indicate that for the Sydney-Newcastle and Sydney-Wollongong routes (both directions), current capacity levels will not be exceeded by 2029, regardless of the forecasting growth rates used. The results indicate that by 2029, utilisation rates by route are a maximum of:

- Sydney-Newcastle – 88%;
- Newcastle-Sydney – 84%;

- Sydney-Wollongong – 68%; and
- Wollongong-Sydney – 76%.

Importantly, this means that population growth to 2029 is unlikely to cause or require additional rail services during non-peak-times, north or south of Sydney.[34] This conclusion assumes that growth in current average passenger rail utilisation rates do not exceed projected population growth to 2029.[35] The Study Team sees this as unlikely since the BTRE (2006) has projected rail passenger growth in these corridors to be less than the population growth used to determine the maximum values here.

In conclusion, future *additional* rail congestion issues resulting from population growth and thus passenger rail demand around the Sydney area are minimal.[36] An exception would be the possibility of the curfew being extended by half an hour into the ‘shoulder’ period; however, the analysis does not indicate that this is likely, but if it happened there would be an additional negative impact on frequent rail operators.

6.2.2.4 Sydney-Canberra rail passenger route

Data matching passenger volumes and available seats – and therefore capacity utilisation – was not readily available for the Sydney-Canberra corridor. The Sydney-Canberra corridor is expected to be subject to less intensive population growth than the south coast and central coast routes. Demand growth on CityRail and CountryLink’s services to the Southern Highlands is expected to remain low. Table 37 indicated that the forecast average annual growth rate in passenger journeys for the Sydney-Canberra corridor was 0.5% per annum from 1999 through 2025.

Consultation with RailCorp has indicated that current services are lightly loaded and there is significant spare line capacity south of Macarthur. Furthermore, the completion of the southern Sydney freight line between the Macarthur and Sefton park junction will substantially reduce conflict between electric passenger trains and freight trains, and bypass the commuter curfew (RailCorp, 2006).

Given these statements as well as the projected utilisation rates for the Sydney-Wollongong route (the growth rate of which was higher), it can be concluded that the current passenger rail capacity on this route will not be exceeded prior to 2029. This means that future rail congestion issues resulting from growth in passenger demand on this route are minimal to non-existent.

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[34] If, however, extra off-peak services did occur, RailCorp would bunch them so the two passenger services would run close together (one branching off down the North Shore line and the other via Strathfield), leaving room for one freight train before the next pair of passenger trains were scheduled.

[35] An extreme scenario is one where there are no further improvements to the freeway, so that congestion eventually forces all traffic growth onto the rail service. This is plausible as eventually there will be a case for adding a third lane to those sections that now have only two.

[36] Growth in the other passenger services, which are mainly in the Sydney area, would impact North-South freight services at junctions. It was beyond the scope of the Study to determine whether the major simplification program planned for the Sydney network (full details of which had not been announced at the time this Study was written) would help mitigate the conflicts. It was also not possible to take account of expected capacity augmentation of the track between Strathfield and Hornsby/Cowan because it is still in the planning stage.

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