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1 Overview

1.1 Methodology and assumptions

The North-South Rail Corridor Study (the Study) has been designed to assess future demand and options in relation to rail freight transport along the North-South Rail Corridor (the Corridor) over a 25-year period. The Study investigated various route options in a region of Australia where total freight volumes are expected to grow strongly and rail services are limited by various infrastructure constraints, although these are being initially addressed by a five year Australian Government and Australian Rail Track Corporation (ARTC) major investment program.

The Study Area, shown in Figure 1, comprises an elliptically-shaped area roughly defined by the existing standard gauge rail line along the New South Wales coast, and a broad arc from Melbourne, through central Victoria (west of Shepparton), through western New South Wales to Toowoomba and Brisbane. The Study Area embraces all sections of the existing rail network in Victoria, New South Wales and Queensland that currently form, or could potentially form, part of a freight route between Melbourne and Brisbane.

The methodology incorporated interactions between the components of the Study, especially the effects of improved rail infrastructure on the quality of rail freight services and hence on demand. The freight demand and rail operational elements of the Study were brought together in an Optimisation Model that generated inputs directly into the financial and economic benefit cost analysis. A range of results has been produced, reflecting the different route options, demand scenarios and other assumptions. In particular, the methodology brought together analysis of:

- Total estimated current freight demand in the Corridor, and the factors influencing the rail share of that total;
- Total estimated freight projections for the Corridor to 2029;
- Upgrade and new rail infrastructure options, and their consequences for train operations;
- Environmental considerations related to the options;
- Terminal, port and other infrastructure issues; and
- Financial and economic analysis of the outcomes of the route options assessment.

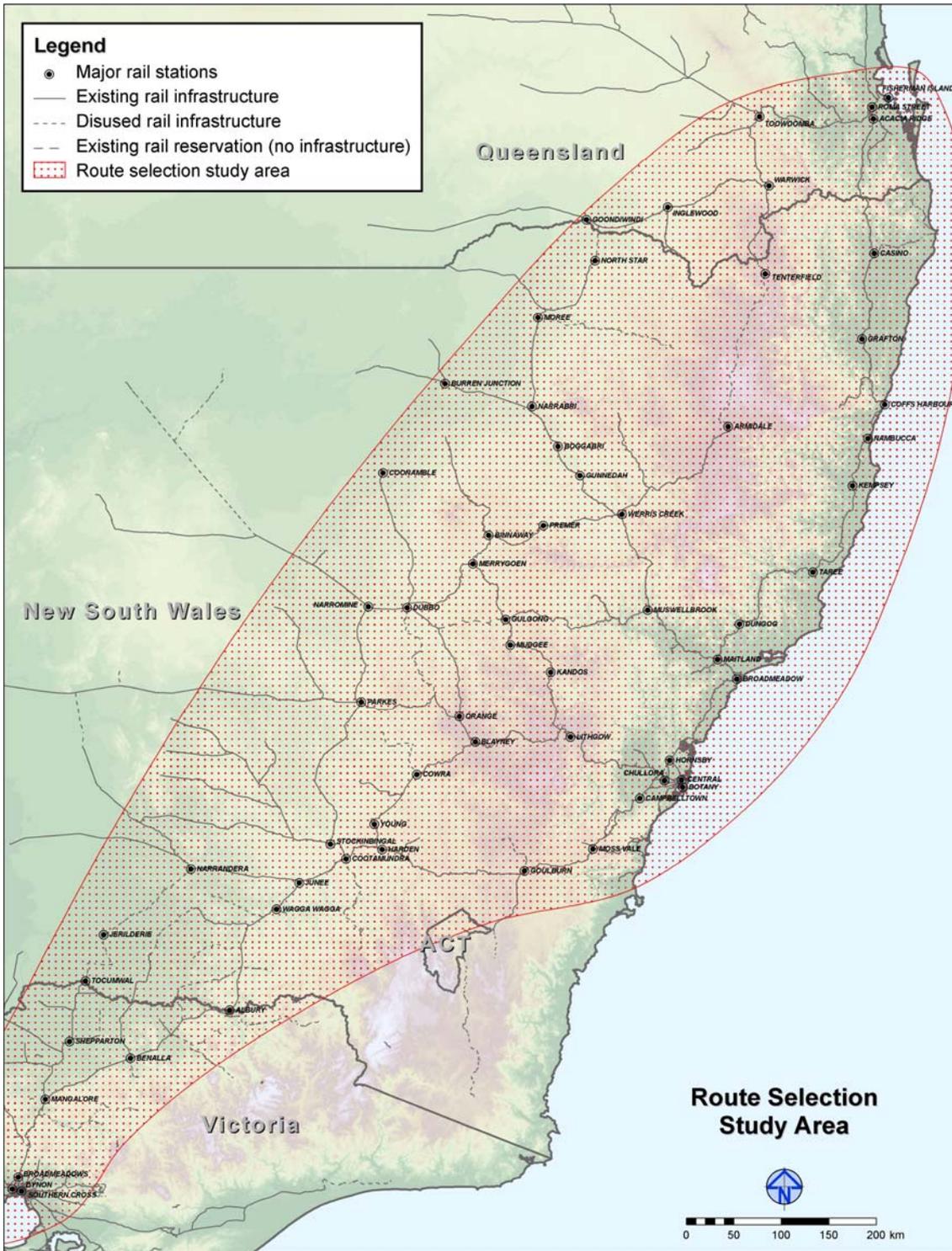
Extensive data was obtained from multiple sources for incorporation into the Study, including stakeholder submissions.

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Figure 1 - Study Area





1.2 Modular structure

The Study was divided into the following modules:

- **Market Assessment** – the collection and review of the base data and information, together with discussions with key stakeholders and potential clients, provided input for the assessment of the existing total freight market; this in turn provided key baseline inputs to the demand forecasting module;
- **Demand Analysis** – development of freight demand forecasts based on the Market Assessment data, historical trends, likely economic and demographic changes and a survey of key industry participants and customers; this provided inputs to the Route Options Assessment;
- **Infrastructure Assessment** – an assessment of the impacts on other transport infrastructure and associated issues along the corridors identified by the Route Options Assessment;
- **Route Options Assessment** – the collection and review of the base data and information, definition of alternative routes and analysis of the engineering and cost implications, together with inputs from the Market Assessment and Demand Analysis modules; the analysis was interactive with the other modules, including the impacts on the other transport infrastructure along the Corridor, and the environmental assessments; the Route Options Assessment also provided inputs to the Financial and Economic Assessment;
- **Environmental Assessment** – consideration of the environmental implications of the different route options; this in turn provided input to the Route Options Assessment and the Financial and Economic Assessment;
- **Financial and Economic Assessment** – this module drew together all elements of the Study – the various aspects of demand and cost – to produce a range of results for the different route options; and
- **Data Collection and Stakeholder Consultation** – identification and collection of base data and reports and familiarisation with constraints and consultation with stakeholders was an overarching element of the Study involving all of the above modules.

Some of the modules were executed in parallel and there were multiple interdependencies between the modules.

Figure 2 shows a diagram of the Study process. Subsequent sections summarise the key elements of, and the approach adopted, in the various modules. More detailed treatments are provided in the individual chapters.

Figure 2 - Study Module Flow Diagram





2 Market assessment and demand analysis

The methodologies for these two chapters are best considered together because of the relationships between them. The analysis covered:

- The present freight market in the Corridor served by road, rail and sea;
- The present passenger market in the Corridor;
- Factors external to transport which drive the total market;
- Factors which will influence the rail share of the total market; and
- Freight projections for the Corridor.

2.1 Summary of methodology

An extensive information gathering and assessment exercise was undertaken to evaluate total freight in the Corridor (including rail) which produced the current period set of data that formed the basis of modelling undertaken in **Chapter 4: Demand Analysis**. The information included:

- Total market (all modes) freight volumes (tonnes) by multiple origin-destination pairs, including:
 - Melbourne-Sydney;
 - Sydney-Brisbane;
 - Melbourne-Brisbane;
 - Freight fed in from elsewhere e.g. from SA, WA and Tas;
 - Freight to/from intermediate points on the coastal route; and
 - Freight to/from intermediate points on the inland routes.
- Breakdown of total data by commodity type;
- Breakdown by mode (rail, road and sea);
- Freight volumes moving within the Study Area direct to ports and which might divert to the rail corridor if infrastructure were improved; and
- Data on average transit times by rail, road and sea between the main origins and destinations in the Corridor, and data on reliability.

Data sources were rail operators and track managers, the Australian Bureau of Statistics (ABS) and the Bureau of Transport and Regional Economics (BTRE) (sea and air data) and BTRE and FDF Management (road data).

The process for completing the current market assessment and future demand analysis was to:

- Gather information, interview stakeholders to fill information gaps and prepare information for analysis;
- Adapt an existing model (FDF's *FreightInfo*) for estimating total freight to 2029;

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- Determine base and alternative GDP and other assumptions;
- Generate multiple model runs;
- Add freight determined by factors other than GDP e.g. grain;
- Interview industry representatives to understand reasons for choice of mode and develop a model for estimating modal share, drawing on the interview results;
- Obtain data on the factors identified by industry (e.g. price, reliability, availability) and integrate the data with the route options analysis;
- Analyse different likely regimes for rail access prices on an inland route, with assumptions about access prices on the coastal route and road user charges;
- Estimate future modal shares, with changes in response to:
 - route options that affect service quality e.g. reliability; and
 - assumptions about fuel prices and relative labour costs.
- Combine total and modal share analysis to estimate rail tonnages; and
- Adjust for other tonnages outside the model e.g. rail freight diverted from other routes.



3 Infrastructure assessment

The Study assessed infrastructure such as rail freight intermodal terminals and ports and reviewed train operations, infrastructure upgrades and major constraints and design criteria and costing.

3.1 Summary of methodology

The approach adopted involved a combination of:

- Desk research to obtain further particulars of intermodal terminal facilities, ports and train operations;
- Interviews with selected port and terminal operators;
- Discussions with relevant state government transport and planning officials and port authorities; and
- Strengths, Weaknesses Opportunities and Threats (SWOT) analysis to identify major planned infrastructure improvements and constraints.

The application of this methodology involved the Study Team considering the following key issues.

3.1.1 Intermodal terminals

Implications for intermodal terminals due to the expected rail freight demand and alternative route options were assessed and included:

- Existing throughput capacity;
- Proposed developments;
- Future throughput requirements;
- Potential for expansion of throughput;
- Requirement for intermodal facility expansion; and
- Road and rail access requirements.

3.1.2 Ports

Implications for transfer of freight to ports were assessed and included:

- Existing rail access and capacity;
- Proposed developments; and
- Requirements for future rail access and capacity.

3.1.3 Train operations

A number of train operation issues that affect the potential capacity of routes considered in the Study were assessed and included:

- Transit time;
- Reliability; and



- Availability.

3.1.4 Planned infrastructure projects and constraints

Infrastructure improvements and major constraints were assessed and included:

- Infrastructure configuration following the current ARTC investment program;
- Improvements planned by state governments; and
- Major rail network constraints including northern Sydney, Cowan Bank and the Hawkesbury region.

3.1.5 Design criteria and costing

The design criteria and costing of proposed improvements adopted for the Study were assessed and included:

- Establishing criteria for the design of proposed rail and associated infrastructure improvements; and
- Establishing a costing structure for proposed improvements so that comprehensive and consistent financial analysis can be undertaken.



4 Route options assessment

The Route Options Assessment provides an engineering assessment of alternative rail infrastructure options for the Corridor, and their consequences for train operations, capital costs and operating costs. The routes identified were the existing Coastal Sub-Corridor (with upgrading currently underway and possible further enhancements), the Far Western Sub-Corridor, the Central Sub-Corridor and the Hybrid Sub-Corridor, as defined in chapter 6: *Route Options Assessment*.

4.1 Summary of methodology

Assessment of the route options included a series of tasks to develop the Study databases and establish suitable parameters for the short-listing and evaluation of the improvements that best suited the key assessment criteria. To achieve a robust evaluation process, an Optimisation Model was established to determine the optimal route selection, taking into account the effects of demand, infrastructure capital and rail operational and access price of the different route alternatives. This involved the following:

4.1.1 Data collection and set up

Establishment of a database of information required for the Study, including:

- Collecting the latest, large-scale special mapping and photogrammetric data;
- Establishing a GIS database;
- Confirming Study parameters; and
- Identifying constraints e.g. topography, soils, groundwater, drainage, bridges and other features.

4.1.2 Investment plans

Identifying and investigating existing investment proposals, including:

- Current and proposed ARTC investment plans;
- Other state and Australian Government investment plans; and
- Validation of the information obtained.

4.1.3 Geographic issues

Identifying major geographic issues including:

- Major operational and capacity constraints such as metropolitan Sydney, Sydney-Newcastle, Gowrie-Grandchester; and
- Environmental issues identified through the GIS database including national parks, major rivers, etc.

4.1.4 Railway operating, engineering and costing issues

Identifying suitable engineering criteria to assess issues related to operational and engineering design and costs, including:

- Rail operations;



- Track design;
- Signals and communications;
- Structures;
- Drainage/hydraulics;
- Rolling stock;
- Geotechnical;
- Services/utilities;
- Maintenance; and
- Roads.

4.1.5 Development and evaluation of initial options

Identifying an initial range of options, including:

- Using information developed through previous studies that considered and assessed potential inland route options as well as information provided by ARTC and other infrastructure owners;
- Concept designs to meet minimum route configuration;
- Concept designs for upgrades to achieve established criteria for track curvature and grade; and
- Costs for all the proposed infrastructure improvements.

4.1.6 Refinement of options

The assessment considered outputs from the demand analysis, engineering design, train operations and cost modelling using an Optimisation Model based on the dynamic programming approach.

The methodology does not attempt to find a single recommended route option for the Corridor, but rather to find a combination of infrastructure that best achieves market, operational or financial/economic objectives for a select number of Sub-Corridors based on agreed assessment criteria.

To assess the benefits and costs of each route segment, the Optimisation Model considered the outputs from a number of separate models, including:

- Rail Operations Model;
- Demand Model;
- Operating and Maintenance Cost Model;
- Access Price Model;
- Capital Cost Model; and provided information for the
- Benefit Cost Model (Financial and Economic Assessment).



5 Environmental assessment

The Environmental Assessment provides an understanding of the potential environmental limitations along the proposed route options considered for the Study. Environmental factors have the potential to enhance or detract from particular route options developed within the Corridor.

5.1 Summary of methodology

To assist in identifying potential environmental issues, the Study Team developed a comprehensive GIS database incorporating publicly available information relating to specific environmental issues. Environmental issues have been grouped under the following headings:

- Protection areas and heritage;
- Flora and fauna;
- Water;
- Noise;
- Soils and contamination; and
- Land use.

The Study has identified potential environmental issues associated with the range of rail projects for all the route options. The Study Team has undertaken detailed mapping of specific environmental issues along each of the route options to identify issues that would need to be addressed through an Environmental Impact Assessment and where possible, to refine the route options so that the risk of environmental issues affecting the options is minimised. Issues associated with each of the options have been categorised and presented as:

- Major Environmental Limitations;
- Significant Environmental Limitations;
- Moderate Environmental Limitations; and
- Cumulative Impacts.

Where appropriate, possible mitigation measures were identified.



6 Financial and economic assessment

This component of the Study draws together all of the earlier inputs and the options evaluated against objective criteria with consideration for the optimal balanced outcome.

6.1 Summary of methodology

The Financial and Economic Assessment translated the largely comparative results produced from the dynamic programming process into coherent standalone views of the financial consequences of each option. There are three views of the net financial effects of a route upgrade strategy that are essential to the financial assessment process:

- **Government Budgetary Capacity** – considered the impact of the projects if funded by government borrowing, treating a route upgrade as essential infrastructure rather than an economic investment from which a commercial return should be derived;
- **Commercial Investment** – assessed the projects as candidates for private sector investment similar to recent toll road Build Own Operate Transfer (BOOT) transactions; and
- **Economic Cost Benefit** – reviewed possible wider external cost and benefits produced through the implementation of a route upgrade strategy and assessed whether these benefits were material to the viability of a route upgrade.

The key metric used to produce a financially consistent summary of these views is Net Present Value (NPV). NPV is the discounted value of net cash flows at a discount rate appropriate to the status of the cash flows. As private sector investment analysis and public sector budgetary processes focus on nominal cash flows, adjusting the real cash flow outputs from the dynamic programming model was essential to this analysis.

The steps detailed below were followed in performing the analysis.

6.1.1 Selection of appropriate discount rates

There are generally accepted market indicators available for the government budgetary impact and economic cost benefit analysis. For the former, it is the long-term cost of government debt, while for the latter it is the social time preference rate. The most significant effort has therefore been in estimating the appropriate discount rate to apply to the infrastructure owner's cash flow from a private sector viewpoint. The range used (10% to 15%) was based on the Weighted Average Cost of Capital (WACC) rates applied to private sector investment in demand risk-based transport projects and reviewed by the Study Team and the Study's steering committee.

6.1.2 Selection of appropriate inflation indices

Projections from a number of transport-related infrastructure projects indicate that market expectations are for a medium-term spike in major construction costs, leading to differentially inflated construction expenditure compared to other cost and revenue figures.

6.1.3 Consideration of external factors

The general structure of the Corridor characterised it as a renewal of economic infrastructure without significant social aims. Therefore, the focus was on identifying indirect general economic benefits to be included in the cost benefit analysis, allowing for estimates of the net external costs and benefits of the options.

6.1.4 NPV analysis

The final analysis task was to use the financial model developed to produce the NPV results for each project viewpoint, including sensitivity on selected key parameters.



7 Data collection and stakeholder consultation

The scope of the Study required data to be gathered across a range of subjects and stakeholders. This was divided into two complementary activities, one dealing primarily with information and data collection, and the other with stakeholder consultation.

7.1 Summary of methodology

7.1.1 Information and data collection and review

The Study required information to be accumulated from a variety of sources covering a broad range of topics. The Study Team collated reports, information, models, forecasts and ancillary data from sources identified during the course of the Study.

The Department of Transport and Regional Services (DOTARS) and the BTRE held a large body of information which formed part of the background to the Study, and also informed specific chapters of the Study, as described in chapter 9: **Data Collection and Stakeholder Consultation**. Other sources, including above and below rail operators, freight forwarders and state governments (and their agencies), and other parties with an interest in above and below rail operation, made available a vast array of information. Access to this information and data was critical to the Study, as discussed in chapter 9: **Data Collection and Stakeholder Consultation**.

7.1.2 Stakeholder consultation

The Study Team envisaged a considerable number of individuals and agencies/organisations/groups being interested in the Study, and this was borne out in practice, as discussed in chapter 9: **Data Collection and Stakeholder Consultation**. In order to maximise the possible contributions from stakeholders, the Study Team accepted submissions throughout the duration of the Study.

7.1.2.1 Identification of the stakeholders and establishment of communication strategy

Scoping the consultation requirements for the Study was a vital part of the process to ensure that the consultation strategy provided means for all interested parties to contribute as they wished. The preparation of the consultation strategy included identifying all key stakeholders, including data providers, to request data for the Study, and a list of departments, agencies and other community groups to be notified of the commencement of the Study.

The Steering Committee for the Study included representatives from DOTARS, the Australasian Rail Association Inc. (ARA), ARTC and rail industry operators, who contributed input across a broad range of interests, including supplying technical advice and industry perspectives.

7.1.2.2 Consultation processes

The commencement of the Study was publicly announced, and co-operation was requested from the identified key stakeholders. In addition, the Study was announced on the DOTARS website and the submissions mailbox and e-mail box set up.



The Study Team held workshops with representatives of the Steering Committee and key stakeholders. Stakeholder workshops and presentations were held at various stages of the Study:

- An inception workshop was held at the commencement of the Study to determine the types and levels of data that the key stakeholders were able to provide, and the conditions under which they were prepared to provide them. This also enabled the Study Team to identify data gaps, for which the Study Team sourced additional data;
- Progress presentations were given to representatives of the key stakeholders including industry and Australian/state government officials, at which the Study Team requested feedback, questions and information in relation to the progress to date and the planned next steps;
- A workshop was held partway through the Study to enable the Study Team and the key stakeholders to discuss the data provided, how it was used and the methodology adopted for analysing the data. This was critical in validating the data for the Study;
- A second workshop was held late in the Study to enable the Study Team and the key stakeholders to discuss and ratify the methodology, assumptions and preliminary outputs of the Study, with particular reference to the industry experience of the key stakeholders. This was critical to ensure the validity of the processes and the outputs; and
- Submissions received from a variety of local government, industry and interested parties were reviewed by a panel comprising senior representatives of the Study Team consortium. Each submission was summarised and particular specialist issues referred to the appropriate technical area for consideration.



8 Assumptions

The assumptions cover a wide range of issues and the basis of these finalised assumptions is outlined in more detail in the various sections of the main report.

8.1 Market assessment

The following table summarises the core assumptions were adopted for the Market Assessment chapter of the Study.

Market Assessment			
Item	Topic	Assumption or Adopted Value	Importance
MA 1	Road freight data from FDF	Study Team used FDF’s FreightInfo database to assess road volumes in 2004	High
MA 2	Rail data	Rail volumes based on publicly available sources with reference made to actual rail operator volumes in 2004	High
MA 3	Sea and air data	Coastal shipping data was obtained from DOTARS and air cargo data was obtained from the BTRE for 2004	Medium

8.2 Demand analysis

The following table summarises the core assumptions that were adopted for the Demand Analysis chapter of the Study.

Demand Analysis			
Item	Topic	Assumption or Adopted Value	Importance
DA 1	Increase of imports	Ratio of imports to GDP rising – see assumption DA3 for factoring into total freight market modelling	High
DA 2	Increase of industrial concentration	Concentration of development will slow from previous levels – see assumption 3 for factoring into total freight market modelling	High
DA 3	Transport to GDP growth	These two factors will combine to see transport and GDP growth ratio fall from 1.3:1 to 1:1.05 over the forecasting period	Low
DA 4	Future CPI growth	2.5% pa (midpoint of Reserve Bank of Australia’s (RBA) range)	Medium
DA 5	Future GDP growth	Adopt Treasury growth forecasts to 2008-09 and then ACIL Tasman’s general equilibrium model forecasts from 2009 to 2029	High



Demand Analysis

Item	Topic	Assumption or Adopted Value	Importance
DA 6	Mode share of domestic aviation	Air cargo will retain constant share total freight tonnes on inter-capital city routes	Low
DA 7	Mode share of sea	Coastal shipping tonnages on north-south routes will grow at the rate observed from 2000 to 2005	Medium
DA 8	Relevant sea freight ports	3 Victorian ports (Geelong, Melbourne and Westernport), 3 NSW ports (Newcastle, Botany and Port Kembla) and 1 Queensland port (Brisbane)	Medium
DA 9	Land mode shares will be broken into 6 commodities	Manufactured, steel, automotive, grain, agricultural products and other bulk	High
DA 10	Steel assumptions	Rail will never exceed 90% of the land freight task on any route – 5-10% of steel task considered urgent	Medium
DA 11	Grain assumptions	Rail will retain approx 20% of the domestic freight task and 90% of the export freight task	High
DA 12	Other bulk assumptions	Coal growth assumptions in the Surat Basin and Hunter Valley supplied by industry – some prospects of coal in New England have been identified but new minerals growth has not been identified	High
DA 13	Availability estimates	Derived from transit times and truck departures over 24-hour period. The departures will be based on departures from the customer's door and arrivals based on arrivals at the customer's door	High
DA 14	Manufactured goods freight market segmentation	25% of the market had either long lead times or operated on 24-hour dispatch/receive inventory systems in 2004 on Melbourne-Sydney and Sydney-Brisbane routes and 35% for Melbourne-Brisbane – this will be assumed to increase by 0.5% per annum to 37.5% and 47.5% respectively by 2029	Medium
DA 15	Estimates of price elasticity	<ul style="list-style-type: none"> ■ ACIL Tasman regression analysis (-1.2) ■ International literature search (-0.4 to 1.2) ■ ACIL Tasman survey responses (-0.3 to 1.2) 	High
DA 16	Train operator behaviour	<p>If offered a transit time reduction, trains will use 70% of the time to leave later and 30% to increase reliability on the Melbourne-Brisbane route until transit times reach 30 hours. 70% of transit time improvements under 30 hours would be used to increase reliability unless aiming for 'next day' express service</p> <p>50% of transit time improvements on the Melbourne-Sydney and Sydney-Brisbane routes will be used to improve reliability and 50% will be used to serve the market better (e.g. leave later in the day)</p>	High



Demand Analysis

Item	Topic	Assumption or Adopted Value	Importance
DA 17	Land bridging	Land bridging volumes on inter-capital city routes will remain at 2005 levels except for the Brisbane-Sydney route which is forecast to decline by 20% over the forecasting period	Medium
DA 18	Measure of reliability	Industry standard of plus or minus 15 minutes for manufactured goods – treat early arrivals as on-time arrivals	Medium
DA 19	Port assumptions	Port of Melbourne will be able to cater to all vessel sizes over the forecasting period (different scenarios will be tested)	High
DA 20	Access prices (rail)	Increase by CPI-2% until 2010, then CPI-1% until 2020 and CPI-0.5% until 2029	High
DA 21	Access prices (road)	To increase by annual adjustment formula – 2.7% nominal per ntk (or 0.2% real)	High
DA 22	Access charges	Access charges on a potential new route will be set at the revenue maximising point given the prices and performance standards of road and the existing rail route via the logit and access pricing models	High
DA 23	Transit time	Both road and rail transit times will be based on door-to-door transit times	Medium
DA 24	Truck service reliability	It will remain constant at 98% for the forecasting period (i.e. 98% of road freight services arrive within 15 minutes of expected time)	Medium
DA 25	Truck availability	It will remain at 99% for the forecasting period and decline by 1% per reporting period to 95% in 2029	Medium
DA 26	Train driver shortages	There will be sufficient drivers to drive linehaul trains from 2004 to 2029	Medium
DA 27	Future labour costs	Road labour costs will increase by 6% pa from 2004-10 and then 4% thereafter. Above rail labour costs will increase by 4% pa from 2004-10 and 3% thereafter	Medium
DA 28	Pickup and Delivery times	PUD times in Sydney, Brisbane and Melbourne will on average be 3 hours at each end of the linehaul rail trip. If a terminal is located at Toowoomba an extra hour is added to PUD times	Medium
DA 29	Oil prices	Crude oil prices (will have been) increased according to EIA forecasts to 2030 – these prices drive diesel prices. Sensitivity testing has been carried out with US\$70 per barrel (real) and US\$40 per barrel (nominal)	Medium
DA 30	Road efficiency	The Study Team assumes road transport’s technical efficiency will reduce unit costs down by 1% per annum (this is independent of increases to input costs)	Medium



Demand Analysis

Item	Topic	Assumption or Adopted Value	Importance
DA 31	Freight diversion	28% of grain in Northern NSW would divert to Brisbane away from Newcastle. 50% of agriculture (cotton) would divert to Brisbane away from Sydney. 80% of agriculture from Griffith would divert to a new track through Tocumwal away from the track through Junee. 5% of grain from Southern NSW would divert away from Port Kembla to Melbourne on the same route. 50% of grain currently on road in the Central Murray region would shift to rail on a new track from Narrandera to Tocumwal. 85% of WA/Whyalla/Adelaide-Brisbane freight would divert north from Parkes to Brisbane rather than south through Cootamundra to Brisbane	Medium

8.3 Infrastructure assessment

The following tables summarise the core assumptions that were adopted for the Infrastructure Assessment chapter of the Study.

Infrastructure Assessment – Construction Projects

Item	Topic	Assumption or Adopted Value	Importance
IC 1	ARTC \$1.67 billion program	All works will be completed by 2009	High
IC 2	Wodonga Rail Bypass	All works will be completed by 2009	Medium
IC 3	Dynon Port Rail Link	All works will be completed by 2009	Medium
IC 4	Grandchester-Gowrie works	Queensland Rail alignment adopted for concept design and costed as a route option	High



Infrastructure Considerations – Train Operations

Item	Topic	Assumption or Adopted Value	Importance
IC 5	Double stacking	Double stacking is not practical on the Coastal Route but could be an option for inland route options, but has not been costed as part of the options. All new works to provide for double stacking clearances	High
IC 6	Maximum train length	1,500m on Coastal Route and 1,800m on inland route options	High
IC 7	Rolling stock availability	Operators will provide the necessary rolling stock (locomotives and wagons)	Low
IC 8	Open access	Open access fully implemented	High

Infrastructure Considerations – Intermodal Terminals

Item	Topic	Assumption or Adopted Value	Importance
IC 9	Terminal capacity	Provide for 1,800m trains	High
IC 10	Terminal capacity	Provide for double stack trains if required	High
IC 11	Future terminals	Existing terminals will continue to be main facilities, but will require upgrading to support proposed train lengths and demand requirements. Others (e.g. Moorebank) that are expected to be required during the study timeframe have been discussed in report	High

Infrastructure Considerations – Ports

Item	Topic	Assumption or Adopted Value	Importance
IC 12	Rail access	Provide for 1,800m trains. Rail access to ports will be sufficient to provide for the forecast freight task	Medium
IC 13	Port capacity	Rail operation will be sufficient to provide for potential increases in the number of containers moved by rail	Medium



8.4 Route options

The following table summarises the core assumptions that were adopted for the Route Options Assessment chapter of the Study.

Route Options – Construction Costs			
Item	Topic	Assumption or Adopted Value	Importance
RO 1	Infrastructure criteria	Infrastructure design criteria adopted are those stated in the Infrastructure Assessment chapter	Medium
RO 2	Rates	All rates are based on 2006 costs	Medium
RO 3	Rates	All rates are exclusive of Goods and Services Tax (GST)	Medium
RO 4	Rates	Capital cost contingency is allocated to each element of the construction based on the level of uncertainty in determining both the quantity and cost rate for that element (using @Risk)	Medium
RO 5	Quantity	Existing track conditions are as stated in the ARTC Track Measurement Parameters – Raw Data spreadsheet dated 16 Nov 2005 stating ballast depths, sleeper type and general track condition	Medium
RO 6	Quantity	The area of land acquisition required is defined as areas outside of the existing corridors and is measured in square metres	Medium
RO 7	Rates	Unit costs for supply and delivery of materials split into three categories: Urban, Rural and Remote	Medium
RO 8	Rates	All sources for rates are assumed to be reliable	Medium
RO 9	Infrastructure criteria	All new and upgraded tracks and formation will be designed, built and maintained to drain freely with no impairment to operations from a storm of 1:100 year intensity	Medium
RO 10	Infrastructure criteria	Intermodal terminal upgrades have not been costed in the Capital Cost Model as they are independent of the route option analysis. The costs generated by the Capital Cost Model are supplied as a means of comparison between route options	Medium
RO 11	Infrastructure criteria	Post-2009 train signalisation will be provided via in-cab systems	High
RO 12	Infrastructure criteria	Communications requirements will be met by the leasing of capacity supplied by a third party. These access costs have been assumed to be a train operating expense, not a capital expense	Medium
RO 13	Rates	Project management, design fees, environmental and cultural heritage studies, contractor profit and overheads have been costed as a percentage of the base construction cost	Medium



Route Options – Construction Costs

Item	Topic	Assumption or Adopted Value	Importance
RO 14	Rates	An allowance for relocation of existing services has been made as a percentage of the base construction cost. Only those major services affected by a new track construction which are identifiable by the GIS have been individually costed. Examples are major water supply pipelines, major gas supply pipelines and underground high voltage power cables crossed by new track alignments	Medium
RO 15	Infrastructure criteria	Where basic track formation already exists there is no requirement to recreate the formation	Medium
RO 16	Quantity	Upgrade to consist of replacement of the track, sleepers, ballast and capping layer as required	Medium
RO 17	Infrastructure criteria	Upgrade of track will be to the ultimate 60kg/m head hardened rail	Medium
RO 18	Infrastructure criteria	Existing bridges/culverts will be retained without being upgraded unless they are specifically identified as a speed constraint due to poor condition. In this instance they have been analysed as a route upgrade option and costed accordingly	Medium
RO 19	Infrastructure criteria	Existing structures/bridges that may need to be strengthened to meet the new crash standards have been identified and allocated a nominal cost	Medium
RO 20	Infrastructure criteria	Improvements in existing track gradients will be costed as new track with land acquisition costs excluded unless the new alignment diverges from the existing rail corridor	Medium
RO 21	Infrastructure criteria	Existing level crossings are to remain. No grade separation is required on existing track alignments irrespective of whether the track is upgraded or used in its current condition. Allowance has been made for upgrading existing signage, flashing lights and/or boom gates depending on the type/importance of the road being crossed	Medium
RO 22	Infrastructure criteria	Track formation shall be the typical cross sections adopted for the Study	Medium
RO 23	Infrastructure criteria	Track infrastructure shall be as stated in the Infrastructure Assessment chapter, including ballast, sleepers, rail and rail fastenings	Medium
RO 24	Infrastructure criteria	Land acquisition requirements were based on a standard corridor width of 50m plus additional land to cater for cut and fill batters where necessary	Low
RO 25	Infrastructure criteria	Single track has been assumed for new installations unless a passing lane has been identified or the existing track being replaced is more than single	Medium



Route Options – Construction Costs

Item	Topic	Assumption or Adopted Value	Importance
RO 26	Infrastructure criteria	Crossing loops accommodating 1,800m trains will be provided every 80km	Medium
RO 27	Infrastructure criteria	Cut and fill batters are at 2:1 irrespective of local geological conditions. Further refinement of cut and fill volumes will be required at the feasibility stage of the project	Medium
RO 28	Infrastructure criteria	For costing purposes track infrastructure for minor water crossings has been deemed to be a minor bridge. Track infrastructure for major water crossings has been deemed a major bridge and costed at the higher rate	Medium
RO 29	Infrastructure criteria	For costing purposes track formation cut in excess of 30m deep and 500m long has been deemed to be a tunnel and costed at the tunnel rate	Medium
RO 30	Infrastructure criteria	Where evident it is assumed that route corridors have been adjusted to avoid significant environmental constraints. An additional allowance has been made to allow for potential costs associated with future environmental impacts	High
RO 31	Infrastructure criteria	For costing purposes track infrastructure for road crossings has been costed as either minor or major based on the size of the road	Medium
RO 32	Infrastructure criteria	Earthworks cut material is assumed to be suitable for reuse as fill material and cut bulk volume equals fill bulk volume	Medium
RO 33	Quantity	Fill volumes increased by 20% to cater for soft spots and unsuitable material	Medium
RO 34	Rates	Cut-to-waste rate equals the cut-to-fill rate	Medium
RO 35	Infrastructure Criteria	Grade separations will be required at all new major road crossings	High
RO 36	Infrastructure Criteria	Total length of new bridge structures generated from the GIS will be adopted with a standard rate per metre for overbridges and underbridges	Medium



Route Options – Operating Cost Modelling and Route Selection

Item	Topic	Assumption or Adopted Value	Importance
RO 38	Operating cost modelling	Annual operating and maintenance costs determined by transit time (affects crew-hours and capital requirements), fuel consumption, distance, trailing load	Medium
RO 39	Operating cost modelling	Assume crewing arrangements that lead to fastest transit time i.e. no stopping for crew changes, all crew required for acceptable shift arrangements will travel entire journey	High
RO 40	Operating cost modelling	Operating costs have been determined for average train configuration (trailing load, length and power) and the average configuration is determined by the annual tonnage from the demand model	High
RO 41	Operating cost modelling	Freight yard facilities have capacity, or will be upgraded, to accommodate the most operationally-efficient train configurations and arrival/departure patterns	Medium
RO 42	Route options development	Initial ‘starting point’ inland route comprises the minimum capital cost means of providing a continuous standard gauge track between Melbourne and Brisbane. This will involve new track construction (to an agreed engineering standard) to join the missing links only. All existing track will remain unaltered other than where there is a committed upgrade or improvement	Medium
RO 43	Route selection	Design based on adopted Infrastructure Design Criteria in next table	High
RO 44	Route selection	Deficiencies in the network identified based on posted speed limit and/or sub-standard geometry	High
RO 45	Route selection	The ‘optimal’ combination of improvements was based on the adopted optimisation criteria and budget constraints	Medium



Route Options – Infrastructure Design Criteria

Item	Topic	Assumption or Adopted Value	Importance
RO 46	Design criteria	Code of Practice for the Defined Interstate Rail Network (COP)	Low
RO 47	Track speed limitations	Design speed taken as the existing posted track speed adjusted for programmed improvements. Permanent and temporary speed restrictions are to be addressed through the ARTC upgrade program and maintenance works	High
RO 48	Desirable maximum speed for freight trains	115 km/h	High
RO 49	Desirable maximum speed for passenger trains	160 km/h	Low
RO 50	Maximum axle load for freight trains	30 tonnes	High
RO 51	Maximum axle load for passenger trains	20 tonnes	Medium
RO 52	Minimum vertical clearance above top of rail	7.1 m	High
RO 53	Track alignment Maximum train speed <ul style="list-style-type: none"> ■ 80 km/h ■ 100 km/h ■ 115 km/h ■ 160 km/h 	<ul style="list-style-type: none"> ■ Minimum 500m radius ■ Minimum 800m radius ■ Minimum 1,200m radius ■ Minimum 2,000m radius 	High
RO 54	Right-of-way (greenfield) width	50 m	Medium
RO 55	Maximum desirable gradient	1.25%	Medium
RO 56	Maximum allowable gradient	2.50%	Medium
RO 57	Minimum length of crossing loop	To accommodate 1,800m train	High
RO 58	Rail for new or upgraded track	60kg/m	High
RO 59	Sleepers for new or upgraded track	Concrete	High



Route Options – Infrastructure Design Criteria

Item	Topic	Assumption or Adopted Value	Importance
RO 60	Turnouts on mainline track	Diverge at not less than 1:24	Medium
RO 61	Bearers for main line turnouts and crossovers on new or upgraded track	Concrete	Low
RO 62	Drainage for new and upgraded track	Design based on 1:100 year flood	Medium
RO 63	Level crossing protection	Existing level crossings to remain Provision for grade separation on major roads No new level crossings except on minor roads	Medium
RO 64	New bridges	Designed to Australian Bridge Design Code	Low
RO 65	Approach to land acquisition costs	Land area based on option design in 50m wide reservation. Costs based on 85 th percentile valuations by 1:50,000 NSW topographical map series for NSW Department of Lands	Medium

8.5 Environmental assessment

The following table summarises the core assumptions that were adopted for the Environmental Assessment chapter of the Study.

Environmental Assessment

Item	Topic	Assumption or Adopted Value	Importance
EA 1	Integrity of data sources	Data provided by various Australian Government and state government agencies (and validated by the Study Team) is suitable for identifying environmental constraints and opportunities	Medium



8.6 Financial and economic assessment

The following table summarises the core assumptions that were adopted for the Financial and Economic Assessment chapter of the Study.

Financial and Economic Assessment			
Item	Topic	Assumption or Adopted Value	Importance
FE 1	Inflation on costs and revenue	Long-term inflation assumption adopted by Federal Treasury (sensitivity analysis will be performed)	High
FE 2	Risk-free rate	Long-term real government bond rate (sensitivity analysis will be performed)	High
FE 3	Construction Inflation	Triangular distribution Minimum CPI, most likely 6%, maximum 10%	High
FE 4	Social time preference rate	7% real (sensitivity analysis will be performed)	High
FE 5	Commercial return to owner	Range based on observed WACC of Professional Infrastructure Investors (10%-15%)	High
FE 6	GST	Assumed to be a pass through	Low
FE 7	Taxation status	Analysis will be performed on a pre-tax basis	High
FE 8	Risk envelopes for key cost/revenue cash flows	Dynamic model produces risk adjusted flows	High

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