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(Draft)

Freight Intermodal Terminal Systems for Port of Brisbane, Melbourne and Sydney

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Table of Contents

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Executive Summary

This report presents comparison of intermodal network capacities for Ports of Brisbane, Melbourne and Sydney, and how these ports are planning to meet their future demand prediction. In Queensland and New South Wales, there are obvious regions for economic growth and rapid urban development. In Queensland, South East Queensland region has been identified as the region for fast economic, industrial, residential and urban developments. In the past 20 years, urbanisation in Sydney has moved to Central West Sydney, Western Sydney and South West Sydney. In Victoria, the Victoria Government adopts the policy to manage growth to ensure sustainability for all urban and rural areas. Melbourne is planning the capacity of its metropolitan and surrounding areas to absorb estimated of 620,000 extra households over the next 30 years while protecting and enhancing existing suburbs.

The Australian Government Bureau of Transport and Regional Economics estimated that Australian ports that serve containerised cargoes in major capital cities including Adelaide, Brisbane, Melbourne, Perth and Sydney would handle the increase demand in containerised cargoes between 100 % and 300 % by 2025 compared with the current containerised cargoes handled by these ports in 2004/05. Most Australian major container ports are currently planning their port capacities to meet these estimates. Container ports face similar problems such as limited port lands, limited intermodal terminals, port access congestion, environmental issues, etc. Topics to be discussed and compared in this report include:

- Estimated demand for future containerised cargoes
- Port facilities
- Plans for freight terminals at port precincts
- Road and rail accessibility to ports
- Road and rail freight networks
- Current port-freight intermodal terminal networks
- Road and rail network infrastructure to support freight movements including AusLink networks
- Plans for future demand including;
    - Future port capacity
    - Future intermodal terminals
    - Future road and rail access

From the comparison study, there are apparent differences in freight intermodal network systems serving the Port of Melbourne and the Port of Botany. In Victoria, freight intermodal terminal network system is being developed toward a hieratical system in which there are super hub terminals located at ports and adjacent to ports; secondary super hub terminals located along the fringe of the metropolitan Melbourne acting as freight domestic and regional suppliers or proprietary to freight forwarders or shipping line operators; regional intermodal hubs acting as freight consolidators and for mix of domestic and international freight cargo movement; and regional intermodal terminals suppling freights to regional intermodal hubs.

In NSW, Freight cargoes are moved within 40 km between the Port of Botany and a number of small freight intermodal terminals located along the fringe of CBD Sydney to distribute and receive freight cargoes. An additional intermodal terminal is being planed at the port precinct

to become a super hub terminal adding the capacity to exceed 3 million TEU per annum. Additionally, freight intermodal terminals are being planed to be developed along the fringe of Sydney CBD at Enfield, Moorebank, Ingleburn, Eastern Creek and extension of Minto terminal to service freight cargoes for the growth areas of Central West Sydney, Western Sydney and South West Sydney. The combined capacity of the new freight intermodal terminals would exceed one million TEU per year. NSW also has freight intermodal terminals that handle interstate cargoes and regional cargoes. In future, the freight intermodal terminal network system in NSW would comprise of the super hub intermodal terminals at the Port of Botany; complemented by a number of intermodal terminals of capacities between 10,000 and 500,000 TEU per annum located along the fringe of Sydney CBD to serve the growth areas; freight intermodal terminals located close to the Port of Botany to serve interstate cargoes; and freight intermodal terminals at regional NSW to receive local produces for export and goods distribution for the regional NSW.

In Queensland, there are three primary freight intermodal terminals located in Metropolitan Brisbane including intermodal terminals located at Acacia Ridge, Tennyson and at Port of Brisbane that handle domestic, interstate and freight distribution within metropolitan Brisbane and surrounding areas. Most intermodal terminals are located in major regional towns including Cairns, Townsville, Mackay, Rockhampton, Cloncurry and Mount Isa acting as regional freight distributors and receive local mineral products such as coal, steel, etc. for export. Queensland Transport has commissioned a study to determine appropriate locations of future freight intermodal terminals in the growth region of South East Queensland. The first part of the study that is *'input and output freight generation with South East Queensland'* has been completed. This information will be important input for freight intermodal terminal study in future.

Rail access to Port of Melbourne and the Port of Botany face similar road and rail crossing problems. In Victoria, the Federal Government committed A$110 million under the AusLink program to construct grade separation at the road and rail crossing intersection on Footscray Road. In NSW, the Freight Infrastructure Advisory Board has recommended the NSW Government to urgently close the road and rail crossing at General Holmes Drive and construct grade separation to solve the road and rail crossing problem. Rail access to Port of Brisbane has a dual rail link along the Cleveland railway line which is branched off at Lindum to the Port of Brisbane. However, freight trains need to share with metropolitan passenger trains outside the dual rail line which is heavily congested. Passing loops and improving signalling systems have been proposed to facilitate freight rail transport entering the metropolitan rail networks in Brisbane.

Environmental and social impacts occurred as a result from port expansion and intermodal terminal developments that have been identified include:

- Dragging of sea floors to deepen shipping channels alters the original ecological system and can cause damage to sea reef and local ecological system.
- Port expansion would impact on the habitat of native flora, fauna, birds, frogs and so forth.
- Impact on road and rail accessibility to port precincts.
- Hours of operation which impact on general loss of amenity due to 24 hours port's operation.

Environmental and social impacts occurred as a result from intermodal terminal development include:

- Impact on demand of heavy vehicles using the same roads as motorists and increase congestion, pollution and compromise motorist safety.
- Impact road access to local business. The increase in numbers of trucks can discourage residents from using shops and local services.
- Impact on local business, businesses may depend on access and on-street parking for their customers, heavy vehicle traffic and may inevitably be a demand for on-street parking to be abolished which will affect local businesses.
- Hours of operation which impact on general loss of amenity due to 24 hour operation
- Heritage buildings
- Noise, vibration and air quality due to road traffics
- Site contamination
- Increase in rail transport movement and rail transport noise
- Visual impacts and landscape
- Hydrology, stormwater and drainage
- Land use

Port authorities are required to conduct environmental impact assessment and to develop environmental management plans to address and resolve the above issues. For instance, the Port of Melbourne has developed a safety and environment management plan (SEMP) and has put in place a safety and environment management framework to ensure safety and environmental obligations. The Port of Melbourne also actively engages communities and local governments to adopting programs of continuous improvement with respect to social and environmental impacts.

The Port of Botany has stated clear environmental protection plans including:

- Saltmarsh habitat surrounding the Port will be expanded to provide additional bird habitats and help attract wading birds.
- Seagrass habitat will be expanded to attract additional fish and marine life and replace seagrass removed in the 1970s.
- The existing intertidal sand and mud flats will be expanded and created by filling deeper areas of the estuary to provide fish feeding grounds for predatory birds like eagles.
- Foreshore Beach will be protected and remain open for people to enjoy, with a new boat ramp constructed. Upgrade works will include new native vegetation plantings and a pedestrian/cycle path.
- The 2003 Environmental Impact Statement (EIS) found that the expanded Port would not affect current or swell movements in Botany Bay. Nevertheless, this issue will be monitored as a condition of consent.

The Port of Sydney Corporation also conducted environmental impact assessment for a newly proposed intermodal logistics centre at Enfield to address environmental and social impacts.

Port of Brisbane Corporation has adopted an integrated management system which brings together environment management system, occupational health, safety systems and

engineering change management process. The Port of Brisbane Corporation uses environment performance indicators to measure and manage environment performance. These performance indicators include:

- Environment Condition Indicators, which provide information about the condition to assist in better understanding the impacts or potential impacts of port operation.
- Management Performance Indicators, which provide information about the management efforts the Port of Brisbane has taken to influence environmental performance of the port's operations.
- Operational Performance Indicators, which provide information about the environment performance of the port's operation.

According to the estimated increases in containerised cargoes of around 100 and 300 per cent for the next 30 years, Ports of Brisbane, Melbourne and Sydney are planning to develop super-hub intermodal terminals in the port precincts. This obviously will affect the logistic operations within the port precincts which include the concentration of cargoes at many super-hub terminals and congestion in road and rail movement of cargoes on the port rail and road systems. It is recommended that a holistic study should be conducted to develop decision framework for logistic operation within the port precinct and to study the efficiency of freight intermodal network systems outside the port for future operation. Port of Brisbane will be used as a case study.

- Develop decision framework for logistic operation within the port precinct for future port operation using Port of Brisbane as a case study.
- Assess efficiency of freight intermodal networks for port of Brisbane. Risk-based scenarios when containerised throughputs at the Port of Brisbane reach the current capacities of the Port of Botany and Port of Melbourne will be investigated.
- Assess strength and weakness of the freight intermodal systems for Port of Melbourne and Port of Botany when compared with the freight intermodal terminal systems for the Port of Brisbane;
- Assess an independent freight intermodal terminal system for the Port of Brisbane including freight intermodal terminals in South East Queensland region;
- Compare the three freight intermodal terminal systems;
- Suggest an appropriate freight intermodal system for the Port of Brisbane.
- Using the risk-based comparison to develop framework for freight intermodal terminal system for Australia wide.

1 Introduction

Freight intermodal terminals are port essential facilities for freight transportation. Freight intermodal terminals whether located within port precincts or located a long the fringe of metropolitan areas or located in regional centres or at major interstates are designed to provide seamless transfer of goods from one mode of transport to anther [1].

1.1 Modes of transport for servicing freight intermodal terminals

Common modes of transportation for freight movement between ports and freight intermodal terminals include:

Direct road movement to port: This mode of transport transfers goods from a freight intermodal terminal directly to port. This transport mode provides cost effective and quickest mean in transferring goods to port which daily cargo volumes are small. However, this mode of transport requires frequent delivery and the distance should be less than 300 km.

Road and rail to port: This transport mode is a combination of road and rail transports. Cargoes may be transported from local or regional producers to a regional intermodal terminal and rail is used to transport the cargoes from the regional freight intermodal terminal to port. This mode of transport is slower and cost efficient for full train volumes. The distance should be greater than 400 km.

Road and road to port: If cargo volumes are not large enough for train movement, road transport is a preferred mean of transferring goods from intermodal terminals to port. In this system, cargoes are transferred from producers by road to an inland or stopover intermodal terminal and transferred again from the stopover terminal to port. This mode of transport is necessary for seasonal movement of agricultural and horticulture products from producers for export or distribution.

Domestic Intermodal terminals: The domestic intermodal terminals are used for distributing cargoes for domestic consumptions. The transport modes can be the combination of road and rails for long distance transport. For instance, road transport may be used to transfer goods from producers to inland intermodal terminals and rail is used for the freight movements to other state capitals.

1.2 Criteria for establishing intermodal terminals

An intermodal terminal is usually located at a strategic location between a freight service user or exporter/importer and a destination usually a seaport. It offers customers road and rail transport access, and short-term storage. Substantial cargo volume in nearby catchments areas is the critical driver for financial and operational sustainability of an intermodal terminal. Viability in intermodal operation depends on six important criteria, including [2]:

Volume: To provide viable business for running an intermodal terminal, an intermodal terminal needs to provide freight services for at least 10,000 containerised TEU per annum. (TEU=Twenty foot equivalent unit). A throughput of approximately 15,000 to 20,000 TEU per year will be necessary to make a significant profit.

Distance: For regional intermodal terminals**,** an intermodal terminal should be located at least 250-300 km from port for rail transport to be able to complete with road transport. Road transport has low fixed cost compared with rail transport regardless whether the cargo volume is large or small. On the other hand, rail transport has high fixed cost. To be competitive with road transport, rail transport must offset the fixed cost by provide lower unit costs below the road transport costs and carry large volumes of cargoes over longer distances to attract freight transport customers.

Initial Investment and terminal capacity: The initial investment cost is important for the viability in running an intermodal terminal since the investment cost for land and intermodal terminal infrastructure can become very significant. Most intermodal terminals today are usually developed from 'Brownfield' sites such as unused railway precincts and upgraded to become an intermodal terminal where rail infrastructure is instantly available. For "Greenfield" investment of an intermodal terminal, more capital is required up front to build rail and other infrastructure.

Seasonality: For intermodal terminals targeting to serve agricultural and horticultural cargoes, it is necessary for the terminal to attract complementary cargoes to help offset for the terminal to operate throughout the year. Because the fixed cost in running an intermodal terminal is relatively high, flows of cargoes through the terminal during low agricultural and horticultural periods are necessary for the terminal to be viable and produce significant profits.

Competing Channels: For a terminal and its supply channel to succeed, the cost of the rail-based intermodal transport option must be lower than the cost of direct road transport or other competing supply channels. An exporter/importer will be inclined to use a logistics process involving a terminal when the service offers less value than competing supply channels - that is when it is the most efficient and cost effective alternative available.

Economic and Social impact: A freight intermodal terminal is an integral part of its local community, region and state. Its viability can be significantly enhanced when there are synergies between the terminal's operations and community and State objectives for economic and social development.

1.3 Australian intermodal terminal systems

In Australia, the demand for freight intermodal terminals is driven by three components, namely;

- the level of container trade passing through Australia container ports
- the increase in non-bulk freight demand along the main states,
- trade volume in Bass Strait

There are three freight intermodal terminal systems that interact to some extent in Australia. These intermodal systems include:

- The import and export system
- The inter-state (domestic) system
- The intra-state regional system

Import and Export System

In Australia, import and export cargoes through Australian ports account for over 99 per cent by volume. In 2005, the international freight containers passing through the major ports of Australia including Adelaide, Brisbane, Melbourne, Perth and Sydney were estimated in total of more than 4.5 million TEU. The Bureau of Transport and Regional Economics estimated that international freight containers would be 6.2, 8.3 and 11.1 million TEU for 2010, 2015 and 2020, respectively. In the next 15 years, it is expected that the total increase in international containers will be increased approximately between 100% and 300%.

Intermodal terminals servicing import and export cargoes are usually connected with small shuttle trains of around 600 m or less in length serving short haulage distances. However, some intermodal terminals can be located further away inland such as Narrabri in NSW or Merbein in Victoria. These intermodal terminals aim for receiving freight cargoes from regional areas and consolidate the cargoes before travelling by trains through metropolitan areas and to port. These long distance intermodal terminals can act as distribution centres of port cargoes to outer urban and regional regions.

At many of these long distance intermodal terminals, it is now possible to provide import and export related administrative services such as custom and quarantine services that have historically been undertaken within the port itself. Custom and quarantine services can be provided at any terminal location, subject to Australian Customs Service (ACS) and Australian Quarantine and Inspection Service (AQIS) terms and conditions. Intermodal terminal for import and export cargoes having these services are commonly referred to as Inland Clearance Depots (ICDs).

An ICD intermodal terminal can offer significant advantages to port operators including consignors and consignees for cargo handling since it can reduce the time for containerised cargoes to be stacked and handled at the expensive port land. This port land can be used for more remunerative purposes associated with servicing vessels. In addition, if a transport by rail from the port to the ICD intermodal terminal is arranged effectively, road traffic movements within and around the port can be greatly reduced. This benefits not only the port itself, but other road users around the port. For consignors and consignees of cargoes, the ICD intermodal terminal represents the point of import and export of goods and a point at which payment can be made and received for those goods [4].

Interstate intermodal (Domestic) system

This system comprises of freight intermodal terminals located in major capital cities for goods transfer. The interstate intermodal terminals are located in Perth, Adelaide, Melbourne, Sydney, Brisbane, and Darwin. There are road and rail links among these interstate terminals. The interstate intermodal system generally involves the operation of significantly larger trains of approximately 1200m running over very much longer distances.

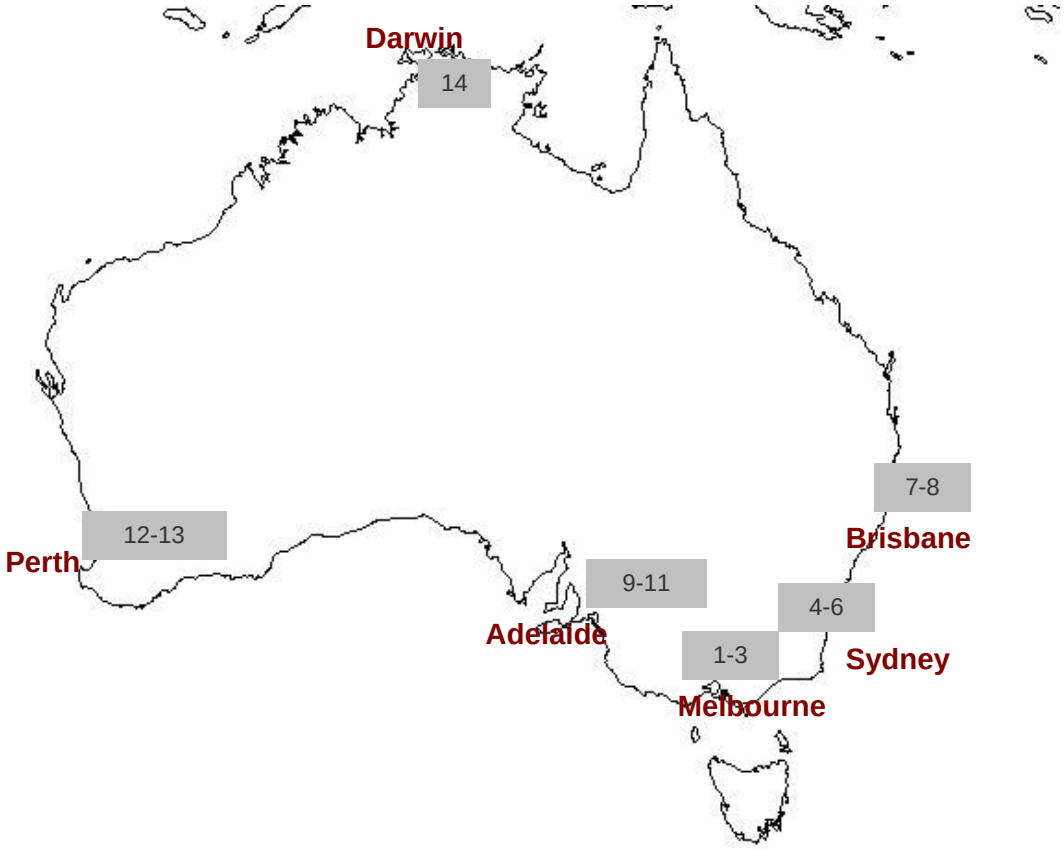

Figure 1 Interstate intermodal terminal network
Source: (Map: http://images.google.com.au/)

[1] South Dynon terminal **[2]** Altona north terminal **[3]** Altona terminal **[4]** Chullora terminal **[5]** Yennora terminal **[6]** Belfield terminal **[7]** Acacia Ridge terminal **[8]** Brisbane multi-intermodal terminal **[9]** Regency Park terminal **[10]** Dry Creek terminal **[11]** Islington terminal **[12]** Pacific National Kewdale terminal **[13]** Sadleirs Kewdale terminal **[14]** Berrimah Freightlink (Source reference[4])

The major hubs are in the state capital cities, but it is possible for strategically located in regional regions. For instance, the current interstate intermodal terminal is located at Parkes and possibly in the future will be located at Wodonga. Figure 1 shows the interstate intermodal terminal network.

Intra-state regional system

The intra-state intermodal system aims to transport export products within the state territory to port. Queensland and Victoria have the apparent form of intra-state intermodal systems. The most obvious example of this system is in Queensland where a well defined system of intra-state intermodal terminals on narrow gauge is primarily devoted to the movement of goods between Brisbane and both coastal and inland regional centres. In Queensland, these intra-state regional intermodal terminals are located in Cairns, Townsville, Mackay, Rockhampton, Acacia Ridge, Cloncurry and Mt Isa.

In Victoria, this intra-state intermodal system is less fully articulated. These intra-state intermodal terminals are located in Merbein, Shepparton, South Dynon.
This system is less certain in Western Australia. The distinct feature of the intra-state regional intermodal terminal networks is that the terminals are linked by rails operating on a gauge other than standard-gauge.

1.4 Rail freight network in Australia

Rail tracks in Australia are mainly managed by Australian Rail Track Corporation (ARTC), QR which is known as Queensland Rail and Westnet which manages Western Australia rail tracks.

The Australian Rail Track Corporation is a federal government owned corporation that owns, leases, maintains and control the majority of main line standard gauge railway lines on the mainland of Australia [5]. The Australian Rail Track Corporation Ltd (ARTC) was created after the Commonwealth and State Governments agreed in 1997 to the formation of a 'one stop' shop for all operators seeking access to the National interstate rail network.

ARTC currently has responsibility for the management of over 10,000 route kilometres of standard gauge interstate track, in South Australia, Victoria and Western Australia, and New South Wales. Figure 2 shows rail networks owned and leased by the Australian Rail Track Corporation. ARTC owned rail corridors include [5]:

- Adelaide to Wolseley
- Adelaide – Port Augusta – Kalgoorlie
- Port Augusta to Whyalla
- Tarcoola to Alice Springs (long term lease to ARTC)
- Broken Hill to Crystal Brook

In Victoria, ARTC leases two mainline interstate and standard gauge corridors from the Victorian Government. These are:

- Melbourne to Wolseley
- Melbourne to Albury

In New South Wales ARTC leases the mainline interstate corridors from the NSW Government. These are:

- Albury to Macarthur
- Newcastle to Queensland border
- Cootamundra to Broken Hill

ARTC has also leased from the NSW Government the Hunter Valley coal rail network:

- Newcastle Ports to Werris Creek
- Muswellbrook to Ulan

and the NSW regional rail network corridors:

- Parkes to Werris Creek
- Merrygoen to Ulan

- Brisbane to Queensland Border (Queensland Rail, QR)
- Sydney Metropolitan Region (RailCorp)
- Kalgoorlie to Perth (WestNet)

Figure 2 Australian Rail Track Corporation Network
Source: (Map: http://www.artc.com.au/about/about.htm)

There are currently nine major operators now using the ARTC owned or leased network. They are

- Queensland Rail
- CityRail
- Australian Southern Railroad
- CountryLink
- Great Southern Railway
- Pacific National
- Patrick Rail Operations
- Specialised Container Transport
- FreightLink

The remainder of the interstate rail network is still controlled by the various government agencies as follows:

QR, known as Queensland Rail, Queensland Railways or Queensland Government Railways, is the corporation responsible for the operation and maintenance of the railway system in the State of Queensland [5,6]. It is a State-owned corporation responsible to the Queensland Minister for Transport. QR maintains the physical infrastructure of the railway network and also directly operates all commuter trains (CityTrain) and long-distance (TravelTrain) passenger services and the vast majority of freight rail services. QR is the largest narrow gauge railway system in the world, operating on tracks with a 1067mm (3'6")

width between the rails. Queensland was also home to the first narrow gauge mainline railway in the world. Unlike the freight railway systems in all other Australian States, QR remains in full State ownership and private sector involvement in the operation of train services remains minimal. Pacific National, through subsidiary company Pacific National Queensland (PNQ) is the only private operator to run freight trains on QR rails, hauling container traffic between Brisbane and Cairns.

Westnet Rail is responsible for maintaining the track infrastructure, supply of the train control function and determination of track access fees for rail tracks in Western Australia. WestNet Rail leases rail tracks in Western Australia from the State Government and offers access to its track network to both Australian Rail Group (ARG)'s West Australian operations and other rail operators. ARG is one of Australia's largest private rail operators, operating across almost 10,000 km of track and began operating in Western Australia on December 17, 2000. ARG became a subsidiary of Queensland based rail company, Queensland Rail (QR). Under QR's ownership, ARG has above-rail operations in Western Australia and New South Wales [5,7].

RailCorp is a state owned corporation of the New South Wales Government. RailCorp was formed on 1 January 2004 after merging the metropolitan functions of the Rail Infrastructure Corporation and former State Rail Authority of NSW. The merger marked the start of a new era for passenger rail services in NSW. Part of the wide-ranging reform of the NSW public transport sector, the establishment of RailCorp was aimed at delivering a single point of accountability across the railways [8].

Figure 3 shows Australia long distance rail networks.

Figure 3 Long distance and interstate rail networks of Australia
Source: (Map:http://www.railmaps.com.au/austrail.htm)

1.5 Australian Land Transport Network (AusLink)

AusLink is the Australian Government's program for improved planning and accelerated development of Australia's land transport infrastructure. It revolutionises the planning and funding of Australia's national roads, railways and inter-modal terminals by taking a long-term, strategic approach to future needs.

AusLink is an Australian Government land transport funding program, established in June 2004 and administered by the Department of Transport and Regional Services. It was first proposed in a Green Paper issued in November 2002 [9]. In response, 550 submissions were lodged by State and Local Governments, Industry, Environment Groups, Tertiary Education and Research Groups, Bicycle Groups and interested members of the public. In May 2004 the Australian Government issued a White Paper setting out the policy to be adopted by the Government in response [10].

The White Paper states that AusLink is based on long-term planning, encouragement of the best ideas and solutions and targeting investment to achieve the best outcomes for people, the national economy, regions and communities and that it has the following core components:

- a defined **National Network** (superceding the former National Highway system) of important road and rail infrastructure links and their intermodal connections;
- the National Land Transport Plan which outlines the Government's approach to improving and integrating the National Network and the investments it will make;
- a single funding regime, under a new AusLink program, for the National Network
- separately earmarked funding for local and regional transport improvements;
- new legislative, intergovernmental and institutional mechanisms.

It is supported by a $15 billion programme of Australian Government investment over the five year period 2004-05 to 2008-09, together with partnering funding from State and Territory Governments and the private sector.

1.5.1 AusLink National Road Corridors

Figure 4 shows national AusLink corridors [11].

Melbourne-Sydney corridor links
AusLink corridor links for Melbourne and Sydney include Hume Highway (F5) and Hume Freeway from its connection with the South Western Motorway (M5) at Prestons in New South Wales to its junction with the Western Ring Road at Thomastown in Victoria.

Melbourne-Brisbane corridor links
AustLink corridor links between Melbourne and Brisbane include the Goulburn Valley Highway from its junction with the Hume Freeway at Seymour to Tocumwal then the Newell Highway and the Cunningham Highway to its intersection with the Leichhardt Highway, and the Leichhardt Highway between the Cunningham Highway and the Gore Highway, then the Gore Highway to its intersection with the Warrego Highway, the Warrego Highway to its intersection with the Ipswich Motorway at Brisbane.

Melbourne-Adelaide corridor links
AusLink corridor links between Melbourne and Adelaide include the Western Freeway from the intersection of the Western Ring Road then the Western Highway and the Dukes Highway to the intersection of the Princes Highway, then the Princes Highway, the South-East Freeway and the Adelaide-Crafters Highway to its intersection with Portrush Road.

Melbourne-Sale corridor links
AusLink corridors between Melbourne and Sale include Monash Freeway, Princes Freeway to Traralgon and Princes Highway from Traralgon to Sale.

Sydney-Brisbane corridor links
AusLink corridors between Sydney and Brisbane include the Pacific Highway between Newcastle and Brisbane, New England Highway to the Cunningham Highway and the Cunningham Highway from the new England Highway to the Ipswich Motorway, F3 Sydney to Newcastle.

Sydney-Adelaide corridor links
AusLink corridors between Sydney and Adelaide include Gawler Bypass from Main Road North to Sturt Highway from Adelaide to the Hume Highway and Hume Highway to Sydney.

Figure 4 AusLink National Network
Source: (Map: http://www.auslink.gov.au/whatis/network/index.aspx)

Adelaide-Perth corridor links
AusLink corridors between Adelaide and Perth include Great Eastern Highway from Roe Highway interchange to Coolgardie, Coolgardie Esperance Highway between Coolgardie and Norseman, Eyre Highway, and Princes Highway between Port Augusta and Adelaide.

Adelaide-Darwin corridor links
AusLink corridors between Adelaide and Darwin include Princes Highway between Adelaide and Port Augusta, Stuart Highway to Tiger Brennan Drive from Stuart Highway to Berrimah Road and Berrimah Road from Tiger Brennan Drive to East Arm Port.

Perth-Darwin corridor links
AusLink corridors between Perth and Darwin include Great Northern Highway from Roe Highway interchange to Victoria Highway, the Victoria Highway and the Stuart Highway from Katherine to Darwin

Brisbane-Darwin corridor links
AusLink corridors between Brisbane and Darwin include Warrego Highway to the Landsborough, Flinders and Barkly Highways and the Stuart Highway from Three ways to Darwin.

Brisbane-Cairns corridor links
AusLink corridors between Brisbane and Cairns include Caboolture motorway and the connection from the Bruce Highway to the Port of Gladstone.

1.5.2 AusLink Rail Corridors

AusLink rail corridors are also shown in Figure 4. Details of these corridors are described below.

Sydney-Brisbane
AusLink rail corridor between Sydney and Brisbane includes linking Acacia Ridge railway in Brisbane to Sydney

Sydney-Melbourne
AusLink rail link between Sydney and Melbourne includes Moss Vale to Port of Kembla.

Sydney-Adelaide
AusLink rail link include a railway between Sydney and Adelaide via Broken Hill, Parkes and Cootamundra.

Brisbane-Melbourne
AusLink rail links between Brisbane and Melbourne include a proposed inland railway linking Melbourne-Albury-Parkes-Dubbo-Hunter Valley rail network and rail links from Werris Creek-Moree-Toowoomba-Brisbane.

Brisbane-Cairns
This is a proposed inland railway of Toowoomba-Gladstone.

Adelaide-Perth
Adelaide and Perth AusLink rail link includes Port Augusta-Whyalla link.

Adelaide-Darwin
This link include Adelaide-Darwin railway.

1.6 Future intermodal capacity estimate

The Australian Government Bureau of Transport and Regional Economics (BTRE) has estimated containerised and non-containerised freight cargoes through major ports of Australia and published its estimate in June 2006. Table 1 and Table 2 give the summary of the freight cargo movements through major Australian ports [3].

The next sections present how major ports including Port of Melbourne, Port of Botany (Sydney) and Port of Brisbane prepare their port facilities and freight intermodal systems to meet these estimated demands.

Table 1 BTRE's estimated containerised cargo trade by port till 2025

Port	Containerised Cargoes (million TEU)		Average % increase per annum
	2004/05	2024/25	
Brisbane	0.726	3.047	7.4
Sydney	1.376	3.625	5.0
Melbourne	1.910	4.971	4.9
Adelaide	0.171	0.475	5.3
Fremantle	0.467	1.458	5.4

Table 2 BTRE's estimated non-containerised cargo trade by port till 2025

Port	Non-Containerised Cargoes (million tonnes)		Average % increase per annum
	2004/05	2024/25	
Brisbane	19.8	33.8	2.7
Sydney	14.5	18.8	1.3
Melbourne	9.9	19.6	3.5
Adelaide	7.9	15.7	3.5
Fremantle	20.7	26.8	1.3

2 Intermodal Terminal Model for Melbourne Port

This section presents port-related intermodal facilities in Victoria. In Victoria, there are four major ports including Port of Geelong, Port of Hastings, Port of Portland and Port of Melbourne. The Port of Geelong handles approximately 25 per cent of international export cargoes for Victoria. Export products comprise of raw material such as petroleum products, bulk and bagged grain, woodchips, crude oil, petroleum products and fertiliser raw material. Trade growth for the Port of Geelong has been around ten per cent for the last five years [6]

The Port of Hastings exports ferrous alloys, iron, LPG and steel. Import trade is petroleum products. The port also handles coastal movement of steel, crude petroleum and LPG. The Port of Hastings has been planned to become a model commercial port in Victoria as the integral part with Victoria's maritime, road and freight logistics network. Strategic land use and transport access corridor planning are being studied for the Port of Hastings. The Port of Portland handles dry, break and liquid bulk cargoes.

Port of Melbourne is the gateway to the rest of the nation and the export gateway to the world. The Port of Melbourne is the largest container port in Australia and handles about 39 per cent of the nation's container trade. Trade handled by the Port of Melbourne is estimated to be around A$ 70 billion a year. The Port of Melbourne contributes around A$ 5.4 billion a year to the Victoria economy.

Melbourne has excellent intermodal facilities. These excellent intermodal facilities continue to attract increases in export trade from other states to the Port of Melbourne. In the last two years the Port of Melbourne has increased its share of export products from every mainland state, particularly from South Australia. Queensland exports beef from north Cairns, cotton and vegetables through Melbourne. New South Wales exports rice, cotton, citrus, wine, meat and daily products through the Port of Melbourne. Australia Capital Territory (ACT) exports sheepskins through the Port of Melbourne. Tasmania exports onions and other vegetables, wine, dairy products, pulp and paper through Melbourne Port. South Australia exports wine, citrus and seafood via Melbourne Port. Western Australia exports wine from Margaret River, meat and textiles through Melbourne Port. Northern Territory exports plastic materials for re-cycling and mineral products (e.g. vermiculite) via Melbourne.

The Port of Melbourne is the primary containerised terminal port in Victoria. This report discusses Port of Melbourne's facilities, future planning, port intermodal terminal system and road and rail accessibility.

Trend

Since 1999/2000 containerised throughput through Port of Melbourne has increased from 1,294,000 TEU to 1,979,000 TEU in 2005/2006, increased by 53 per cent. In the next five years, it is estimated that containerised throughput will increase from 1,979,000 TEU to 2,636,000 in 2010/2011 which increases approximately 33 per cent. Since then, annual increase throughput is estimated to be between 4 and 5 per cent until 2024/2025 to reach approximately 4,971,000 TEU [3].

Currently, North Dynon intermodal terminal handles approximately 200,000 TEU a year. South Dynon terminal handles 680,000 TEU annually. West Swanson terminal handles 179,000 TEU per year. East Swanson terminal handles 85,000 TEU. Merbein Terminal handles 15,000 TEU a year. Shepparton terminal handles 24,000 TEU. Somerton terminal handles 40,000 TEU.

Facilities at Port of Melbourne

As Australia's leading container port in Victoria's freight transport network, Port of Melbourne is critical to Victoria's future economic growth and development. This section presents main facilities within the precinct of the Port of Melbourne.

Berth Facilities

Main berth facilities at the Port of Melbourne are shown in Figure 5. Figure 6 shows rail links within the Port of Melbourne precinct. Berth facilities are briefly presented below [12].

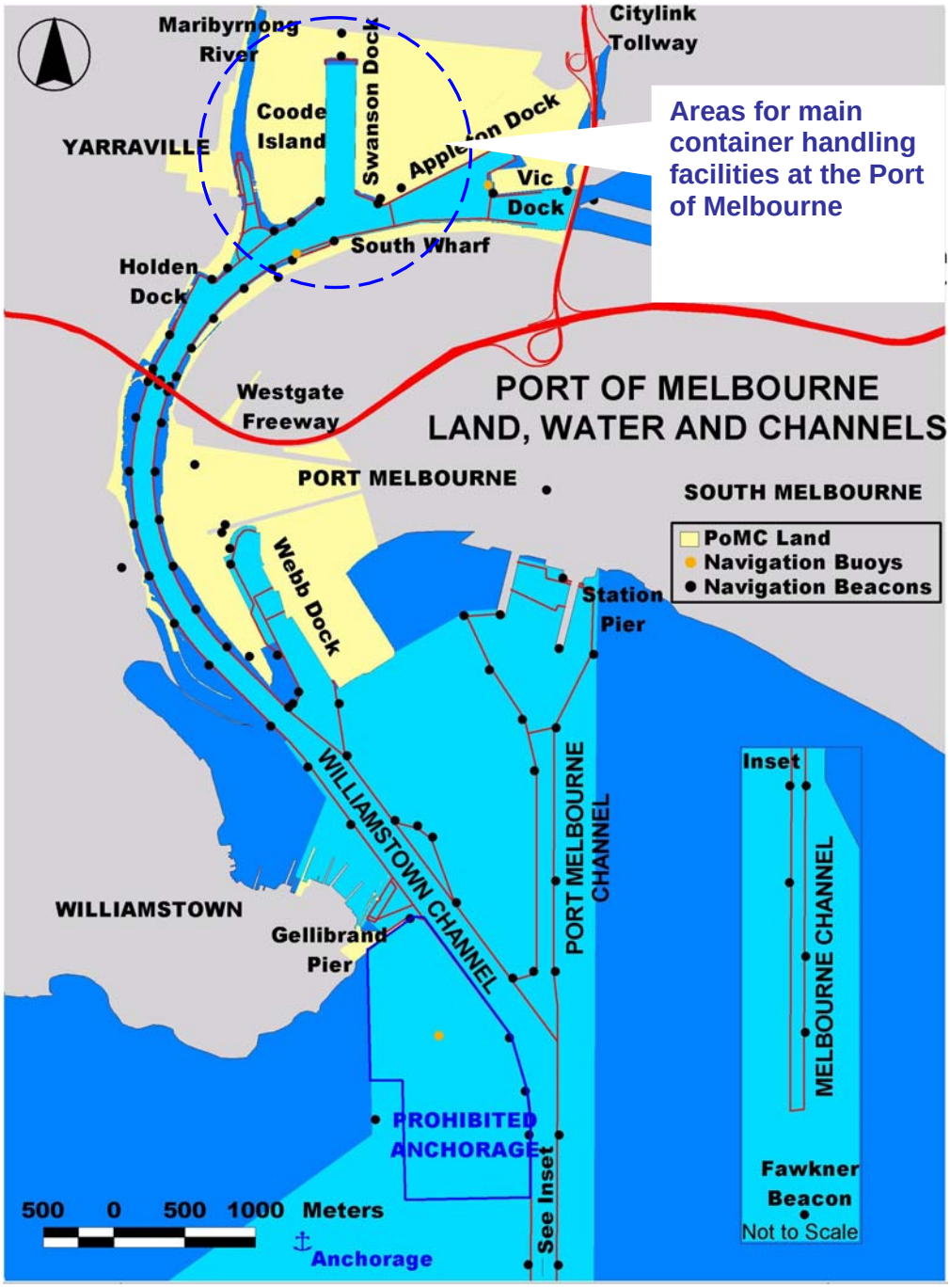

Figure 5 Dock and berth facilities in the Port of Melbourne
Source:
(Map:http://www.portofmelbourne.com/business/portmaps/melbourne_channel_map.asp)

Appleton Dock: The Appleton Dock handles general cargoes, Bass Strait general cargoes, bulk cargoes, containerised cargoes, steel products with heavy lifts up to 110 tonnes. Rail line is linked to the Appleton Dock.

South Wharf: South Wharf is used for a range of activities including break bulk, dry bulk, bulk cement cargoes and general cargoes.

Swanson Dock East/West: These Docks are used for containerised cargoes. Rail access is available at Swanson Dock West.

Victoria Dock: The Victoria Dock is used for general cargoes including timber, bulk handling, cement imports, steel and paper products.

Webb Dock East/West: The Webb Dock East is used for Bass Strait trade and general cargoes. The Webb Dock West is used for motor vehicle imports and exports.

Liquid bulk cargoes are handled by Gellibrand Pier, Holden Dock and Maribyrnong berth. Multi-purpose dry and liquid bulk cargoes are handled by Yarraville berth. Coode Island is used as a storage facility for importing and exporting bulk liquids. Ann Street Pier-Williamstown is used for the storage and mooring of marine equipment. Newport is used for petroleum industry.

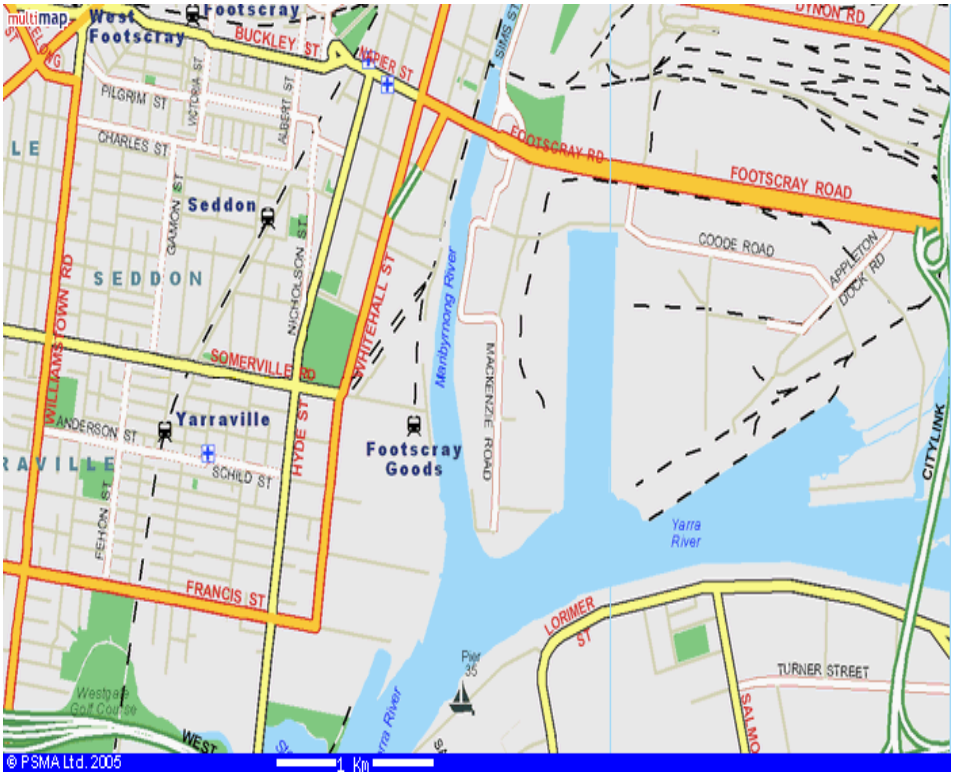

Figure 6 Rail links to the Port of Melbourne
Source: (Map: http://www.multimap.com/map/)

Port Roads

Figure 7 shows primary roads in the Port of Melbourne which include:

- Mackenzie Road
- Coode Road
- Appleton Dock Road
- Anderson Road

Responsibilities of Port of Melbourne

Port of Melbourne Corporation is the port authority responsible for managing the Port of Melbourne. The role of the organisation is to [12]:

- plan and coordinate future development
- ensure land and water infrastructure is available
- to make Melbourne the port of choice for cargo owners shipping lines and service providers
- promote and market the facilities and services of the port to existing and potential users
- generate sufficient funding for port investments to support trade growth and State economic growth
- secure the port in accordance with regulatory requirement

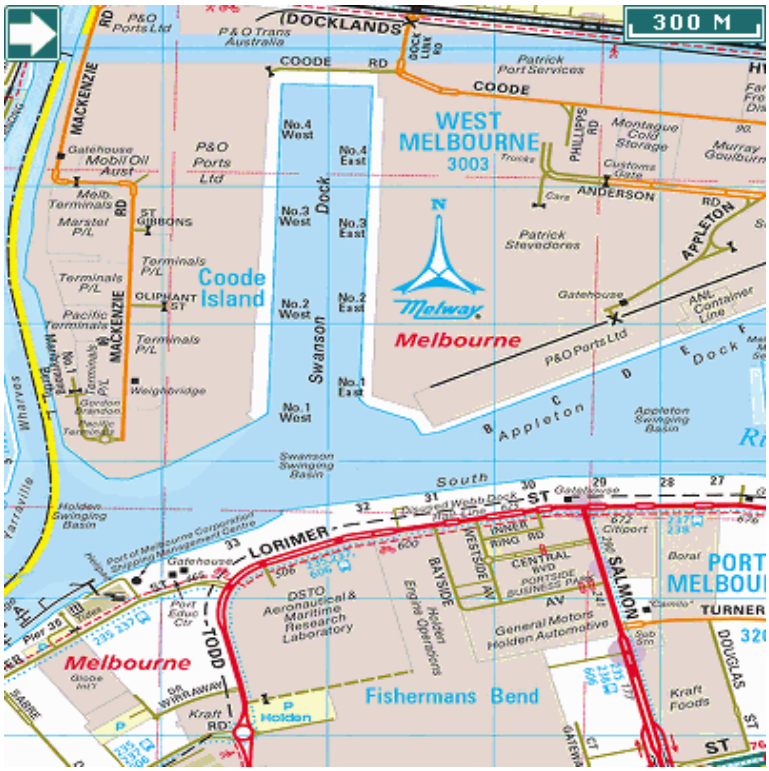

Figure 7 Roads in the Port of Melbourne
Source: (Map: http://truelocal.com.au/index.do)

Plan for Port Capacities and Government Policies

One of the Victoria Government policies relating to port infrastructure is to ensure that Victoria ports which include the Port of Melbourne is properly planned, structured and empowered for commercial operation and for the broader public interest. Projects being planned to support this commitment for the Port of Melbourne include:

- detailed investigations into deepening the shipping channels to the Port of Melbourne
- new organisation for the Port of Melbourne that integrates water and land management, with a focus on port efficiency in the broader freight and logistics system
- planning for the transformation of the Port of Melbourne and Dynon rail precinct into a world-class intermodal freight terminal
- reviewing the role of the Port of Hastings to prepare for its future part in the Victorian port and freight and logistics system
- strategic land-management planning for all ports
- more stringent safety and environmental standards.

As part of this work, the Victorian Government is committed to increasing the use of Victoria's rail infrastructure and helping to ensure it can offer a viable alternative to road for tasks such as bulk haulage and the movement of containers.

The Victoria Government and the private sector are working individually and together on initiatives aimed at putting more port-related freight onto rail. These include:

- the reinstatement of rail to West Swanson Dock
- calling for expressions of interest for redeveloping Victoria Dock, including a rail terminal
- investigations into the feasibility of reinstating rail to Webb Docks
- defining a role for government in the development of metropolitan and regional intermodal freight terminals - linking Victorian industries to rail, ports and world markets.

Issues about Port of Melbourne and port accessibility

At Port of Melbourne, there are a number of issues the Port of Melbourne Corporation and the Victoria Government are planning for the Port of Melbourne to remain as the leading commercial port of the country. Issues are discussed below.

Deepening Port Channels

Port of Melbourne has the capacity to become the leading container port of the nation for many years to come. One of primary issues relating to the Port of Melbourne is the inability for the Port of Melbourne to efficiently handle large ships. Because of the current channel depth of approximately 13 metres in the Port of Melbourne, over 30 per cent of large container ships are unable to load with their full capacities. Unless deepening the channel of the Port of Melbourne, Melbourne will experience less in international cargo shipments and may lose competitiveness in leading as the container port of the country. The industry has strong support in deepening of the channel access to Port Phillip Bay and the Yarra. It is expected that deepening the channel access for the Port of Melbourne could bring in larger

container ships which result in lower freight rates and lower export and import prices. More than A$ 20 million in Victoria Government and Port of Melbourne Corporation funding has been committed to date. The Victoria Government has earmarked channel deepening as a priority state project with completion target for 2007 [12,14,15].

Expansion and development of intermodal terminals within port precinct

Current containerised terminals at the Port of Melbourne are unlikely to handle the estimated increase in containerised cargoes. There is urgent need for expanding the containerised terminal capacity at the Port of Melbourne otherwise the Port of Melbourne will be experiencing inefficiency and increasing in port costs. Expansion of the Swanson intermodal terminal or early developments at Webb Dock and at Port of Hastings are the option. Since the Swanson intermodal terminal is located at the Swanson Dock within the Port of Melbourne precinct, the development of the Swanson terminal can increase the Port of Melbourne's capacity in two ways. Firstly, it will create an extra container ship berth on each side of the Swanson Dock which will improve the dock's flexibility and capacity. The expansion of the Swanson container areas will increase the port's container capacity by 300,000-400,000 TEU per year [14,15,16].

The international container cargoes handled at the Swanson Dock and the East and West Swanson container terminals are likely to grow beyond their capacities of these facilities sometime between 2015 and 2025. The Port of Melbourne Corporation has planed the Webb Dock precinct to become the next international container terminal. The Webb Dock currently handles Bass Strait shipping, motor vehicle import and export, break-bulk and a small volume of international container traffics. An extension of the rail link to service the Webb Dock is also planed. However, the extension of the Swanson Dock and the development of the Webb Dock have not been committed by the Victoria Government [14,15,16].

Ongoing investment by the Port of Melbourne Corporation, the Victoria Government and the private sector are expected to have a positive influence on the freight handling capacity of Melbourne Port. In 2004/2005, the Port of Melbourne Corporation invested $28 million in new and existing port infrastructure, land and facilities, where the private sector invested over $72 million in container, general and bulk cargo facilities. The Port of Melbourne Corporation is also redeveloping the 17.5 hectares Victoria dock site to make it world class general cargo terminal. The Eastside of the dock will be used for bulk break and cars and the West side will be used for coastal shipping [14].

Rail link with Port of Melbourne

The Port of Melbourne is serviced by both rail and road to move containers from the Port precinct. Generally, interstate cargoes are mainly moved by rail, whilst intrastate cargoes are primarily transported by road. Currently, only 18 per cent of containerised cargoes are transported by rail. The Victoria Government is targeting to increase the rail share in container movements by 30 per cent in 2010. The Port of Melbourne is linked by rail to its container terminals with a single, dual gauge track crossing at Footscray Road. A key issue in rail accessibility is that the Footscray Road crossing is given priority to road users. The Port of Melbourne Corporation and the Victoria Government have proposed an upgrade project to improve rail link with the Port of Melbourne under the Dynon Port Rail Link Project. The Dynon Port Rail Link is intended to remove this conflict between road users and rail access into the port. The Dynon Port Rail Link project has been recognised as a freight project of national importance. The Australian Government has allocated $110 million under

the AusLink program to improve rail access to the Melbourne Port area due to complete in 2008-09 [14,15,16].

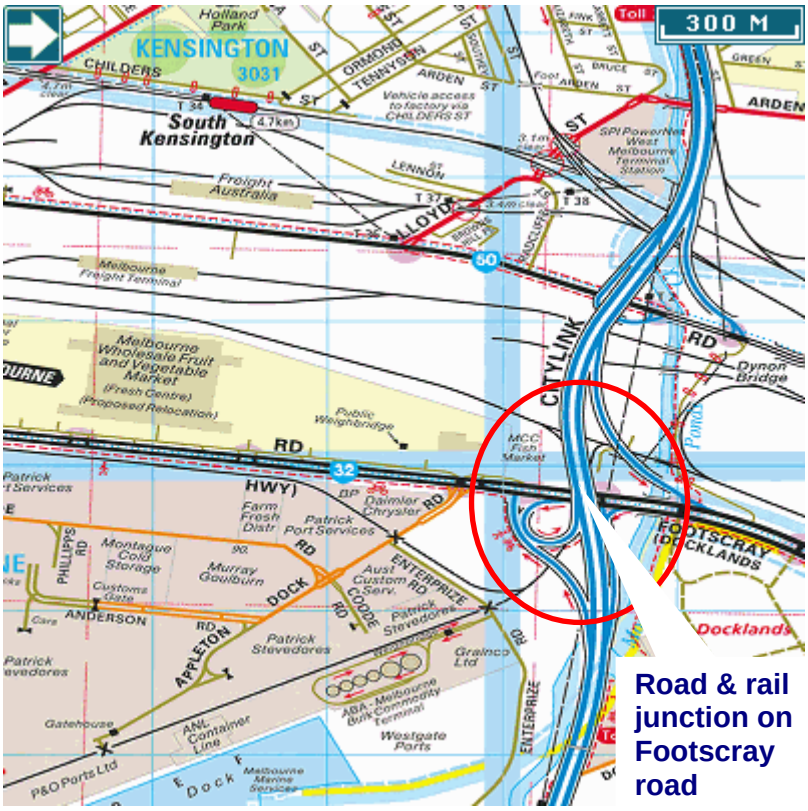

Figure 8 Road and rail junction on Footscray road
Source: (Map: http://truelocal.com.au/)

Road link within port precinct
Currently, the Port of Melbourne Corporation has committed a number of port-related road projects which include [12,16,17]:

Meckenzie Road: extension of Mackenzie Road to an intersection with Footscray Road at Sims street to provide road access to Swanson Dock West container terminal and Coode Island. This allows the Swanson Dock West container and rail terminals to be integrated. This new development allows Coode Road west of Dock Link Road to be closed and the Swanson Dock West terminal and rail terminals to be integrated.

Coode Road: closure of Coode Road east, this will allow integration of the Swanson Dock East terminal with the transport services, container freight stations and storage functions to the north of Coode Road.

Appleton Dock Road: grade separation at Appleton Dock Road from the port rail network as part of Dynon Port Rail Link project. Appleton Dock Road to the south of Anderson Road may be closed to allow completion of the Swanson Dock East rail terminal development.

Enterprize Road: grade separation of Enterprize Road from the port rail network as part of the Dynon Port Rail Link project.

Link Road: A link road will be constructed from Enterprize Road to service the Appleton Dock leaseholds and allow closure of the existing Appleton Dock Road rail Crossing.

Dockside Road: Dockside road works will be undertaken as required to complement other Webb Dock road works and provide integrated solution.

Port and Dynon connection: In conjunction with the Dynon Port Rail Link project, there is an opportunity to provide unrestricted movement of special vehicles between the port and Dynon rail terminals, this opportunity is being integrated into the Dynon Port Rail Link Project.

In conclusion, proposed projects to improve the capacity of Melbourne Port and port accessibility include [18]:

1) deepening Melbourne Port's channel to cater for larger ships,
2) extension of Swanson Dock to increase its capacities and
3) development of Webb Dock and its rail link, and
4) improvement of rail access to port through the Dock Link Rail Project including;
    - constructing an elevated section of Footscray Road over the rail track connecting into the Port precinct
    - constructing an elevated section Appleton Dock Road and Enterprize Road integrated with the Footscray Road overpass
    - constructing two dual gauge main lines between the new Port junction and the existing main line north of Footscray Road, associated signalling works and the reinstatement of the ground level service road along Footscray Road.
5) Improving port precinct roads
6) Improving roads outside port include;
    - upgrade Simms Street
    - upgrade Plummer Street as alternative route
    - use Francis Street as alternative route to alleviate congestion and curfew

Issues about intermodal terminals

The main container intermodal facilities of the Port of Melbourne are Swanson intermodal terminals located at the Swanson Dock and Dynon intermodal terminals located outside the port which are linked by rail with the port intermodal terminals. The combined capacities of these terminals when fully developed are estimated to be around 3 million and 4 million TEU a year. Webb Dock has been planed to become the next intermodal terminal for international containerised cargoes. However, an estimate of containerised cargoes of between 5 million and 8 million by 2030 suggests that even the development of the Webb Dock precinct, there is likely to be a need to develop a new container terminal outside the Port of Melbourne beyond this time. Port of Hastings has been designated as the preferred site for the next container terminal, once capacity at the Port of Melbourne is reached. The container terminal at the Port of Hastings would supplement the capacity of the Port of Melbourne. The container terminals at the Port of Melbourne and the Port of Hasting would continue to

operate in parallel. The Victoria Government commits its policy on the developments of these two ports as follows:

- Maintaining the Port of Melbourne as Australia's premier container port through support for developments to maximise the use of Swanson Dock container facilities until the facilities are substantially utilised and demand for container services warrants the development of the Webb Dock precinct
- Protecting the future potential of the Port of Hastings to allow container trade to be accommodated in the longer term when the Port of Melbourne is fully utilised

Hierarchical model of intermodal terminals

In Victoria, intermodal terminal networks are developed toward a hierarchical model which consists of super hub terminals, secondary super hubs, regional hubs and supporting intermodal terminals at strategic regional locations [14].

The super intermodal hub will be capable of receiving cargoes direct from the docks of goods under bond for metropolitan distribution and interstate transport. Goods will be able to be consigned direct to the hubs. The super intermodal hub terminal will be able to service a range of transport operators and freight forwarders and service all port terminals [14].

A secondary intermodal hub terminal will supply domestic and regional cargoes or may be proprietary to particular freight forwarders or shipping line operations. These intermodal hubs would utilise the intrastate network.

Regional intermodal hubs will continue to service a mix of domestic and international cargo movement, acting as freight consolidators for hinterlands.

This hierarchy of functionality will enable the public infrastructure to be utilised while ensuring private investment is encouraged, while protecting the infrastructure investment from proprietary operation through and open access, common user regulatory regime.

The intermodal hubs include the Melbourne Port as a super intermodal hub with major regional intermodal hubs of Wodonga, Merbein and Shepparton with support from intermodal hubs from Horsham, Ballarat and Morwell. There would be three super intermodal hubs in around the fringe of Melbourne including Dandenong, Laverton and Somerton.

Shuttle train services

It is recognised that rail can serve freight transport that operates for shorter distance than inter-city hauls is emerging. There is a growing trend for regional rails to operate from points of production to ports for export. Currently, intermodal terminals are developed by considering speed and relatively easy access to and from locations of production by road. As congestion and passenger traffic increases, short shuttle rail will be required to support cargo movement from regional intermodal terminals to ports for export [14].

Intermodal terminals that link with both ports and the interstate rail network become essential for cargo movement. The capacity to shuttle short haul cargoes to and from the intermodal terminals located in outer metropolitan locations will relieve the burden on port terminal space constraint. In Victoria, Altona intermodal terminal and Somerton terminal operate short

haul rail shuttle to the Port of Melbourne for export and interstate rail freight cargo services. The Somerton Intermodal terminal and the Altona intermodal terminal are capable of handling increased rail volumes through port shuttle trains to both stevedores at the Port of Melbourne and interstate rail operation between Melbourne, Sydney and Brisbane. These two intermodal terminals are capable of providing immediate relief in traffic congestion around the Port of Melbourne, Westgate Bridge and the Hume Highway without having to spend on infrastructure upgrades. Major progress can be made immediately towards achieving the Victoria government's target of 30 per cent freight on the rail while other regional intermodal terminals are being considered [14].

Issues about rail and road corridors

More than 80 per cent of containerised cargo movement to and from Port of Melbourne are by road and 89 per cent of containers handled in the port involve multiple moves before reaching their destination. Rail's share of Melbourne's port traffic is growing, assisted by a new rail link servicing West Swanson Dock. Increasing rail market share at the Port of Melbourne is vital to accommodating future trade, addressing road congestion and amenity concerns in nearby residential areas and improving the overall efficiency of the Victorian Freight and logistics sector. A key project, as mentioned, is the $110 million Dynon Port Rail Link due to completion in 2008-09 [14].

Rail corridors

There are a number of rail network projects the Australian Rail Track Corporation and the Australian Government under AusLink (National Land Transport Network) projects.

Interstate rail corridors

The Australian Rail Track Corporation and the Australian Government have allocated $79 million to develop extra standard-gauge capacity on the Melbourne-Sydney rail line. This will complement the joint State-Federal Wodonga rail bypass project and will greatly increase capacity and reduce travel times in the corridor [5,11,19].

Melbourne-Brisbane AusLink inland corridor rail projects
AusLink Melbourne-Brisbane corridor rails include inland railway from Melbourne-Albury-Parkes-Dubbo-Hunter Valley rail network and rail links from Werris Creek-Moree-Toowoomba-Brisbane.

Melbourne-Sydney AusLink corridor rail projects
AustLink Melbourne-Sydney corridor rails include Melbourne-Sydney railway and a link from Moss Vale to Port Kembla.

Melbourne-Adelaide AusLink corridor rail projects
AusLink Melbourne-Adelaide includes Melbourne-Adelaide railway via Geelong.

Intrastate AusLink rail link

The Australian Rail Track Corporation has been allocated $40 million under the AusLink for the installation of a new bi-direction rail line between Tottenham junction and West Footscray to reduce congestion for rail traffic entering and leaving the Port.

AusLink intrastate rail projects include Melbourne-Geelong standard-gauge railway, and Melbourne-Mildura rail line via Geelong and Ballarat.

Melbourne urban rail links

AusLink urban rail links in Melbourne include rail link from interstate railway from Craigieburn to Laverton via sunshine and the standard gauge railway from Sunshine to Dynon intermodal terminal and links to West Swanson and Appleton Docks.

Road Network

The Victoria Government and Australia Government have agreed to joint finding of $242 million towards a Pakenham bypass to provide an uninterrupted link between Melbourne and the Latrobe Valley and Gippsland [8].

Intrastate AusLink corridor projects

AusLink intrastate corridor links include;

- Melbourne-Mildura via Calder Freeway and Highway from the junction of the Calder Freeway and the Western Ring Road to its intersection with the Sturt Highway at Mildura;
- Melbourne-Sale via Princes Freeway from its intersection with the South Gippsland Highway at Hallam, then the Princes Freeway and Princes Highway to Traralgon, then the Princes Highway from Traralgon to its junction with the South Gippsland Highway at Sale;
- Melbourne-Geelong via the Princes Freeway and Princes Highway from the junction of the West Gate Freeway and Western Ring Road to Waurn Ponds via the proposed Geelong bypass.

Melbourne urban road projects

AusLink urban road projects
AusLink Melbourne urban road projects include;

- Metropolitan Ring Road from its intersection with the Hume Freeway at Thomastown, then the Western Ring Road to the Princes Freeway and West Gate Freeway junction
- West Gate Freeway connecting to:
    - the south Link Tollway, then the Monash Freeway to its intersection with the South Gippsland Highway at Hallam
    - the Port of Melbourne via Todd Road to its intersection with Williamstown Road

Figure 9 shows AusLink Melbourne urban road and rail networks.

Figure 9 Melbourne urban corridors (AusLink)
Source: (Map: http://www.auslink.gov.au/whatis/network/)

Other urban road developments and road development proposals

The Victoria Government has committed to a number of urban road developments to ease traffic movement. In April 2005, the Victoria Freight and Logistics Council's infrastructure working group consulted with shippers, transport providers and the logistics industry on the development of an infrastructure plan. The outcome of the study has identified priority for urban road for improvements which include [16]:

Clayton:	Fairbank Road reconstruction
Clayton:	Tootal Road reconstruction
Dandenong:	Bangalore-Abbotts Road Dandenong duplication 2 connection to provide link between Eastlink and South Gippsland freeway
Dandenong:	Upgrade Rutherford Road to improve connection to Eastlink
Dandenong:	Additional Eastlink interchange at Bangholme Road to provide access to Dandenong Southern industrial area
Dandenong:	Duplication of Hallam Road
Dandenong:	South Gippsland/ Pound Road intersection upgrade to relief current long delays
Dandenong:	Glasscocks Road construction – lings growth corridor to Dandenong south industrial area
Dandenong	Evans Road construction
Deer Park	Very high priority of stated project with significant freight benefits
Dingley	Dingley arterial (including Dandenong Southern Bypass) construction for Warrigal Road to South Gippsland freeway is important east-west route linking southern eastern industrial areas
Eastern Victoria	Link between Melbourne Airport and South-eastern Victoria
Eastern Victoria	Improve Melbourne east-west bypass links
Epping	Extend the Plenty Road duplication to Mernda
Epping	Findon Road 4 lane duplication
Frankston	Upgrade McClelland Drive for access to quarries
Geensborough/ Ringwood	Completion of ring road link between Geensborough and Ringwood
Laverton	The intermodal freight terminal requires Forsyth Road/ Old Geelong Road/ Boardwalk boulevard/ Princes Highway overpass and freeway ramp
Laverton	Improve road networks around Laverton/ Derrimut industrial areas
Moorabbin	Coachranes Road reconstruction
Thomastown	Preston High Street north to Thomastown link VicRoads are currently not sending much dimensional traffic down High Street, most is being diverted to Rosanna
Western Ring Road	Maximum 3 lanes on Western Ring Road

Source: Victoria Port Strategic Framework: Industry Priority, Freight Forward: An industry perspective on transport infrastructure requirements in Victoria

Current intermodal System in Victoria

Figure 5 show locations of intermodal terminals in Victoria. In Victoria, port intermodal terminals network include [4] :

- West Swanson terminal
- East Swanson terminal
- North Dynon terminal
- South Dynon terminal
- Altona terminal
- Altona North terminal
- Somerton terminal
- Merbein terminal
- Shepparton terminal

Dynon Terminals

The Dynon hub consists of two separate terminals including north Dynon and south Dynon terminals.

North Dynon

The North Dynon intermodal terminal handles freight between Melbourne and regional locations and exports freight from regional Victoria through the Port of Melbourne. Cargoes are moved from the terminal to the Port of Melbourne by road.

Table 3 Summary of north Dynon intermodal terminal

Office hours	5.00am – 6.00pm
Paved Area	45,000 m^2
Rail Paths	10
Rail Path Length	500 m
Throughput	200,000 TEU per year

South Dynon

The South Dynon intermodal terminal is a principal hub from interstate rail network. The terminal receives services from all other state capitals on a daily basis.

Table 4 Summary of South Dynon intermodal terminal

Office hours	5.00am – 6.00pm
Paved Area	25,000 m^2
Rail Paths	6
Rail Path Length	
• Four	850 m
• Two	1200 m
Throughput	680,000 TEU per year
Rail Services	80 trains per week

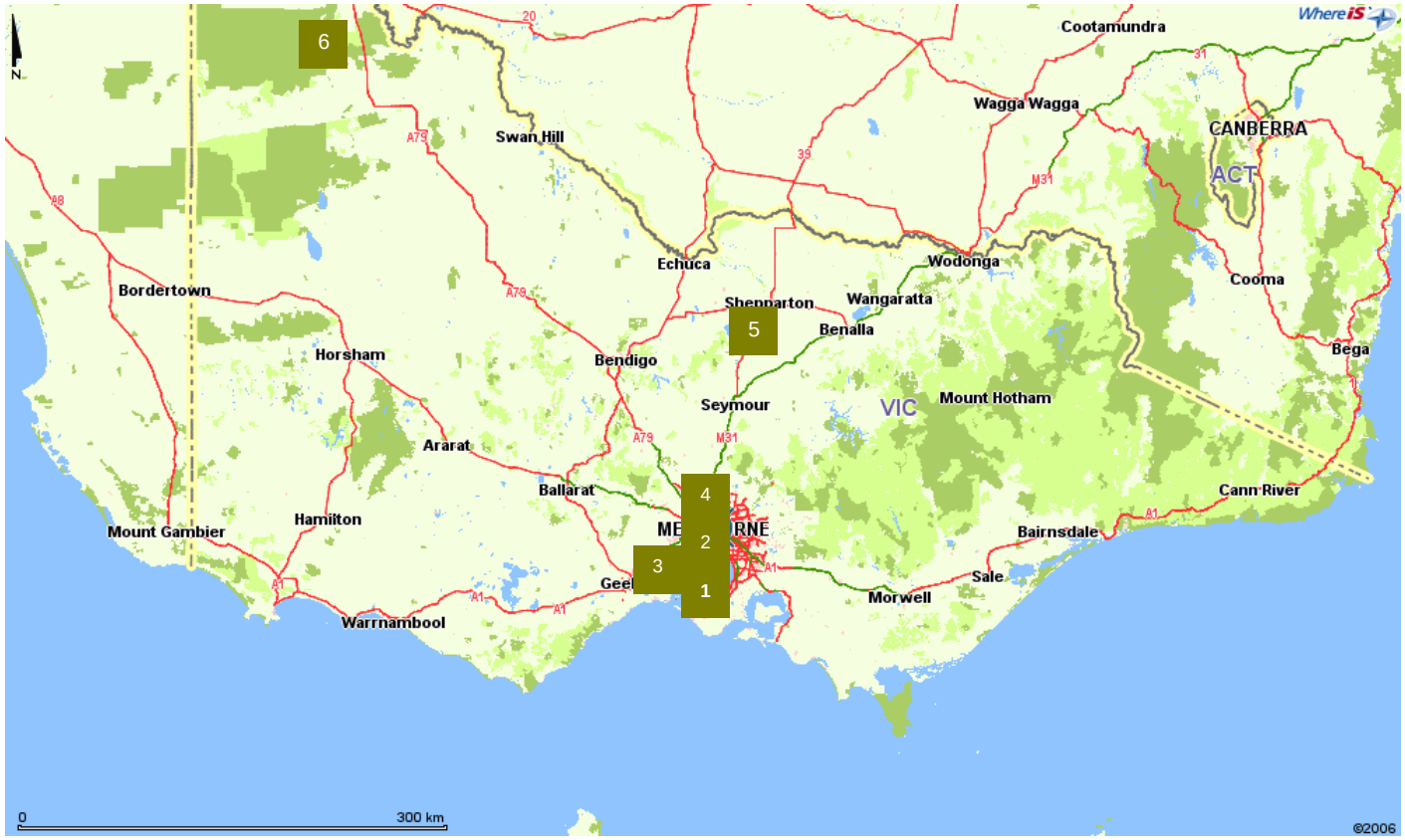

Figure 10 Port-relation intermodal terminals in Victoria
Source: (Map: http://www.whereis.com)

[1] West and East Swanson terminals within the Port of Melbourne
[2] North and south Dynon terminals
[3] Altona and Altona North terminals
[4] Somerton terminal
[5] Shepparton terminal
[6] Merbein terminal

Swanson terminals

There are two terminals located on each side of the Swanson Dock in the Port of Melbourne which include West Swanson terminal and East Swanson terminal.

West Swanson terminal

West Swanson terminal is located on the western side of Swanson Dock in the Port of Melbourne. All cargoes utilising this terminal are international cargoes. Rail services from this terminal extend to Altona, country Victoria and South Australia.

Table 5 Summary of West Swanson terminal

Office hours	24 hours, 6 days a week
Paved Area	103,000 m^2 (Total)
	9000 m^2 (Storage area)
Rail Path Length	565 m
Throughput	179,000 TEU per year
Five year growth	90,000 TEU

East Swanson terminal

The terminal is located on the eastern side of Swan Dock of the port of Melbourne. All cargoes utilising this terminal are international cargoes. Rail services from this terminal extend to Altona, country Victoria and South Australia.

Table 6 Summary of East Swanson terminal

Office hours	24 hours, 7 days a week
Paved Area	40,000 m^2
Rail Path Length	1500 m
Throughput	685,000 TEU
Growth	100,000 TEU

Somerton terminal

The terminal is located approximately 20 km from the port of Melbourne. The terminal handles international containers only. Cargoes are moved via road to Somerton and taken to the port of Port of Melbourne for export.

Table 7 Summary of Somerton terminal

Office hours	24 hours, 7 days a week
Paved Area	60,000 m^2
Rail Path Length	2 km
Throughput	40,000 TEU
Rail Services Growth	100,000 TEU within five year

Altona North terminal

Queensland Rail (QR) manages the intermodal terminal at Altona North. The facility handles approximately 35,000 TEU via rail (10% empty) and almost 40,000 TEU by road.

Table 8 Summary of Altona North terminal

Area	8,600 m^2 (paved area) 647,600 m^2 (unpaved area)
Rail Path Length	560m
Throughput	75,000 TEU per annum
Rail Services	9 trains per week
Growth	Double in five years

Altona terminal

The Altona intermodal terminal handles interstate containerised and non-containerised cargoes. The terminal handles 13,000 TEU by rail and approximately 9,000 TEU by road.

Table 9 Summary of Altona terminal

Office hours	24 hours, 7 days a week
Area	15,000 m^2 (Paved area) 647,000 m^2 (Unpaved area) 55,000 m^2 (Storage area)
Rail Path Length	1.5 km
Throughput	22000 TEU

Merbein terminal

The Merbein intermodal terminal handles regional goods for export. Rail services serve direct from Melbourne to and from Merbein. Produces from the local region are transported to the terminal by road, as well as to and from Adelaide. The facility handled 13,000 TEU by rail and 2000 TEU by road.

Table 10 Summary of Merbein terminal

Office hours	6.00am-7.00pm, 6 days a week
Area	15,000 m^2 (Pave area)
	44,000 m^2 (Unpaved area)
	20,000 m^2 (Storage area)
Rail Path Length	1.5 km
Throughput	15000 TEU

Shepparton terminal

The Shepparton intermodal terminal handles 90 per cent of regional commodity for export, including rice from southern NSW, goods from Kraft facility at Strathmerton and SPC/Ardmona facility. The remaining 10 per cent of the containerised cargoes exports to Western Australia for domestic market.

Table 11 Summary of Shepparton terminal

Office hours	7.00am-6.00pm
Area	11,500 m^2 (Paved area)
Rail Path Length	480 m
Throughput	24000 TEU
Rail Services	10 trains per week

Planned intermodal terminals in Victoria

Currently, Port of Melbourne handles about 1.98 million containerised TEU. In five-year time, the throughput at the Port of Melbourne is estimated to be around 2.64 million TEU, and will increase at the rate between 4 and 5 per cent to reach about 5.0 million TEU in 2025. The full capacities of Dynon and Swanson intermodal terminals are estimated to be around 3 million and 4 million TEU a year. After the Dynon and Swanson intermodal terminals handle with their full capacities, the Port of Melbourne Corporation is planning to develop Webb Dock area as a new terminal for containerised cargoes. For longer plan, the Victoria Government considers the Port Hastings to be the next intermodal terminal after the combined the Dynon, Swanson, and Webb dock intermodal terminals reach their capacity. The Port of Hastings will inevitably become Victoria's second largest deepwater port. The corridor between Dandenong and Hastings for rail and road are being proposed. The Victoria

Government Department of Infrastructure published sites for freight intermodal terminals under development and under consideration as follows [20,21]:

Sites under development

Barnawatha, Wodonga
The City of Wodonga is establishing a major new intermodal facility at Barnawatha, 20km south west of Wodonga, based on significant inputs from key stakeholders in both the private and public sectors. The site, zoned for industrial development by the City of Wodonga, is served by close proximity to the Hume Freeway, the standard gauge interstate rail network and the broad gauge intrastate rail network.

The Minister for Transport has approved a $4M grant towards the development and the Department of Innovation, Industry and Regional Development is providing Regional Infrastructure Development Funds for the purpose of connecting services.

Goulburn Valley Freight and Logistics Centre (GVFLC) - Shepparton
The Shepparton region is recognised as the fruit bowl of Victoria, and home to large exporters of canned and processed food product, such as SPC/Ardmona. In 2000 -2001, 12,000 TEU's containers were transported by rail to the Port of Melbourne from Shepparton.

The Greater Shepparton City Council is working with freight operators, industry, and the State Government to investigate the feasibility of developing a Goulburn Valley Freight and Logistics Centre.

Sites under consideration include:

Horsham
The current site at Horsham is limited in area for growth and requires upgrading of infrastructure. An alternative greenfield site at Dooen 11 km north-east of Horsham is under consideration which would provide improved operational efficiency, availability of land for growth and potential synergies to the grain industry. The business case for the project has been completed by Maunsell in conjunction with the Wimmera Development Association and the Freight Logistics and Marine Division. It will be used to support the application for funding the project from AusLink and the State Government's Regional Infrastructure Development Fund.

Greens Road, Dandenong
The development of a site at Greens Road, Dandenong is being investigated with key stakeholders, to provide an intermodal terminal capable of servicing industry in the eastern suburbs of Melbourne. Studies undertaken on behalf of the DOI have demonstrated that 25% of import containers through the Port of Melbourne are destined for the Dandenong area and that a further 6% of export boxes originate in the Dandenong area. A feasibility study has been completed which demonstrated such a terminal has the potential to offer rail shuttle services of containers to and from the Port of Melbourne. Other uses of the terminal could include shipping of cement quarry materials and general freight. However, there are a number of operational, infrastructure and commercial issues to be resolved.

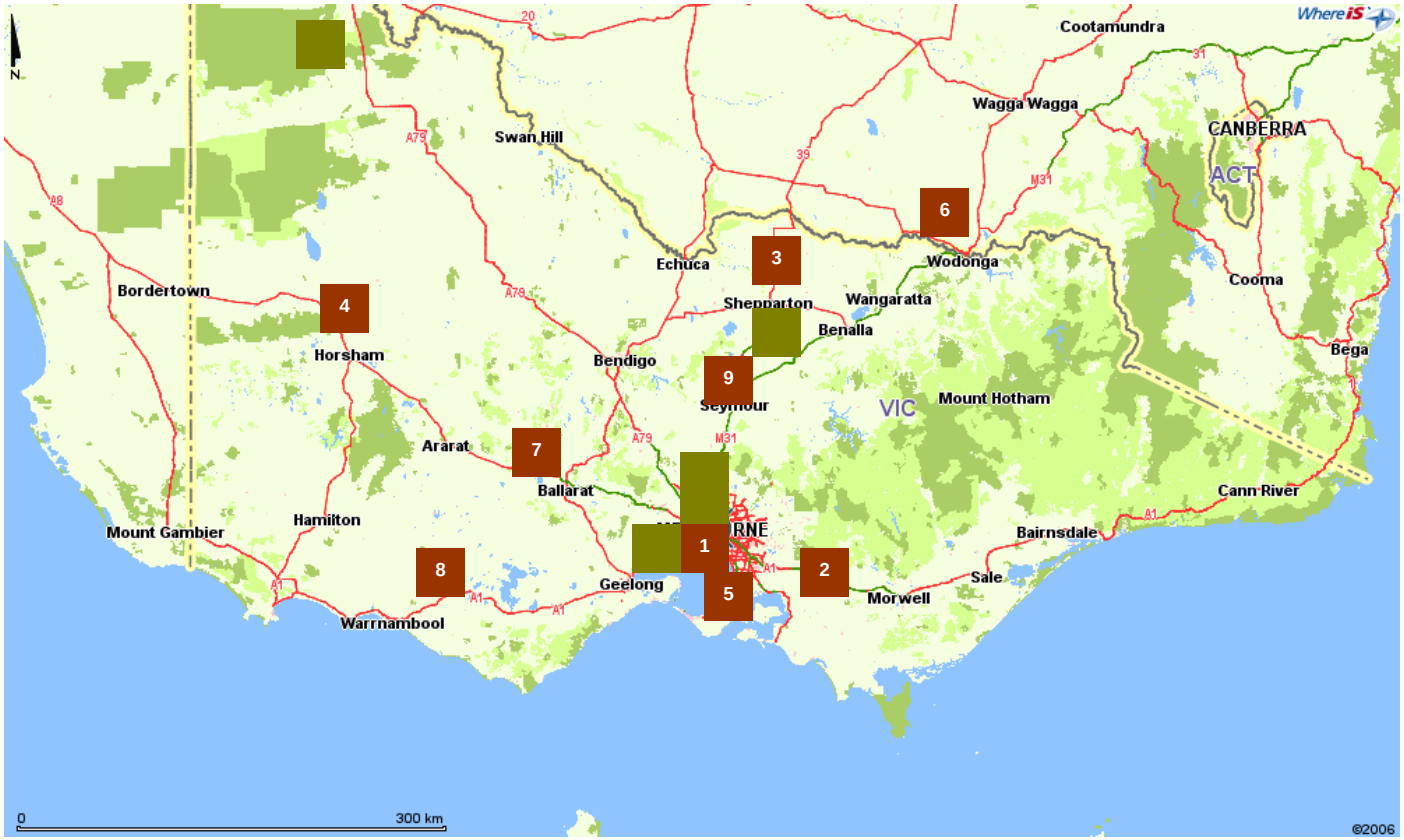

Figure 11 Planned intermodal terminals in Victoria
Source: (Map: http://www.whereis.com)

[1] Webb Dock
[2] Dandenong
[3] Shepparton (new)
[4] Horsham
[5] Long-term planned terminal at the Port of Hastings
[6] Wodonga
[7] Ballarat
[8] Allansford
[9] Mangalore

Existing terminals

Mangalore Food and Logistics Precinct
Mangalore sits within an area of high value agricultural and horticultural production and is located at the junction of the Hume Freeway and Goulburn Valley Highway. Proposals include encouraging value adding industry such as piggeries and broiler farms, processing and packaging warehouses and intermodal freight facilities based around Mangalore airport. The provision of services to the area is under consideration, as are negotiations to change the Victorian Planning Provisions to provide greater certainty for investment and development of the proposals.

Allansford
The Councils of Moyne, Corangamite and Warrnambool have combined to investigate the need for an integrated freight hub in the Allansford area given the significant growth forecast for export industries such as dairy over the next decade. Investigation of suitable sites for terminal and rail infrastructure is being undertaken as part of the development of a dairy industry business park located at the Allansford industrial estate.

Ballarat Intermodal Freight Hub
As part of the rationalisation of rail services at Ballarat, freight services are being considered for relocation to a more suitable site. Construction of a new intermodal freight terminal is being evaluated with contributions being sought from private enterprise, Local and State Governments.

Figure 6 shows the planned intermodal terminals in Victoria for both under development and under consideration.

Environmental and social impacts

The Victoria Environmental Protection Authority engaged GDH Pty Ltd to conduct an independent environmental audit of the Trail Dredge Program: Deep Reef Impact Assessment of the deepening shipping channel project in the Port Philip Bay. The impact assessment comprises of qualitative and quantitative surveys of the rock face below the northern perimeter of the Trail Dredge Area (the Trail Dredge Wall) [22]. The Trail Dredge Wall was defined as *'the area of the RIP that lies down-slop of and perpendicular to the northern perimeter of the Trail Dredge Area and extend to the floor of canyon*. *The surveys of the Trail Dredge Wall was conducted along the transects located along the 17, 27, 37, 47 and 57 metres isobaths'*. The Port of Melbourne Corporation has drawn conclusion regarding the ecological significance of the observed impacts and the ability of the sponge communities to recover to the original community structure that there is limited evidence that can be obtained from the surveys conducted over a five-month period to support the ability of the sponge community to recover to the original community structure. Further surveys to cover a greater period of time will be required [22].

The Port Services Act requires that Port of Melbourne Corporation (PoMC) to develop a safety and environment management plan (SEMP). The PoMC has developed a safety and environment management framework to ensure safety and environmental obligations. The PoMC actively engages communities and local governments to adopting programs of continuous improvement with respect to social and environmental impacts which incorporate [18]:

- community engagement through direct engagement and consultative forum
- the ongoing development of its vibrant education program

- support for community activities
- recognition of the port's ecological footprint and managing its impacts on the environment facilitated by port's SEMP and the proposed Port Environs Plan
- an appreciation of the port's landscapes facilitated by the port amenity enhancement program

Summary

In Victoria, three intermodal terminals cater for import and export. Two of them (i.e. West Swanson and East Swanson terminals) are located on both sides of the Swanson Dock in the port precinct. At the West Swanson terminal, 44,000 per annum TEU are handled via rail and over 135000 per annum by road. At the East Swanson terminal, 85,000 TEU are handled by rail. The containers that enter and exit the East Swanson terminal by road are predominately destined for metropolitan Melbourne and rural Victoria. Somerton terminal is used for international containers, located approximately 20 km from the port of Melbourne. Imported/exported containers are being moved via road to Somerton and taken to the port of Port of Melbourne for export.

Two Dynon road terminals handle interstate and intra-state cargo movement and some cargoes are for exports. The North Dynon terminal handles freight moving between Melbourne and regional locations, and export freight from regional Victoria that will be shipped through the Port of Melbourne. The south Dynon terminal handles interstate cargo movement. Majority of cargo movement is handled by rail for these two terminals.

Merbein and Shepparton terminals handle regional goods for export. Rail services travel direct from Melbourne to and from Merbein. Produces from regional locations are transported to the terminal by road. Merbein facility handled 13,000 TEU by rail and 2000 TEU by road. Shepparton terminal handles 90 per cent of the containers for export of regional commodity, whilst the remaining 10 per cent exports to Western Australia for domestic market.

Altona terminal caters for interstate containerised and non-containerised goods. The terminal handles 13,000 TEU by rail and approximately 9,000 TEU by road. Altona North is managed by Queensland Rail. This facility handles 40,000 TEU by road and 35,000 TEU via rail.

Victoria is developing its intermodal terminal network toward a hierarchy system where there are super intermodal hubs adjacent or within the port precinct and second-level super intermodal hubs located around the fringe of 20 to 30 km from the metropolitan Melbourne. The secondary hubs supply domestic and regional cargoes or act as proprietary of shipping line operators. The third-level intermodal hubs are regional hubs which act as freight consolidators and provide services for domestic and international cargo movements. The forth-level intermodal terminals are regional terminals which receive regional hinterland produces and forward them to appropriate intermodal hubs such as regional hubs for cargo consolidation.

East and West Swanson intermodal terminals act as super hubs located within the Port of Melbourne precinct. When these two intermodal terminals reach their full capacities of between 3 and 4 million TEU per annum, the Port of Melbourne will use Webb Dock which is located within the port precinct to become the next containerised cargo terminal. After the Webb Dock facility reaches its capacity which the combined Swanson and Webb Dock

intermodal terminals are around 8 million TEU per year, the Port of Melbourne is planning to use Port Hastings to be the next containerised cargo intermodal terminal. The secondary intermodal hubs are to be at Dandenong, Laverton and Somerton. The third-level regional hubs are to be at Wodonga, Merbein and Shepparton and Horsham. Ballarat and Morwell are the regional intermodal terminals.

One of the major projects at the Port of Melbourne is deepening Melbourne Port's channel to cater for larger ships. This project is aimed to be finished by 2007.

A key issue for the Melbourne port system is the quality of the rail access to the on-dock terminals. Currently, the Port of Melbourne's only rail access is via a single, dual gauge track crossing at Footscray Road, which gives priority to road traffic. The Victoria State Government has committed A$2.1 million to design and planning for the construction of a direct, uninterrupted rail link into the Port of Melbourne. The Victoria Government's policy is to increase rail freight from current share of 18 per cent to 30 per cent in 2010. The Port of Melbourne is improving rail access to port precinct through the Dock Link Rail Project funded by the Australian Government's AusLink Scheme. The Dock Link Rail Project includes constructing an elevated section of Footscray road over the rail track connecting into the Port precinct, and constructing an elevated section at Appleton Dock road and Exterprize Road integrated with the Footscray road overpass. The current rail line within the Port is connected to the Swanson Dock and Appleton Dock. The Port of Melbourne also has long-term plans to connect rail access to the Victoria Dock and the Webb Dock.

The Port of Melbourne is also improving roads within the Port precinct. Port precinct road improvement projects include extend Dockside Road to the West Gate Freeway interchange ramps; construct a road link from Enterprize Road to service the Appleton Dock leaseholds and allow the closure of the existing Appleton Dock Road rail crossing; extend Mackenzie Road to an intersection with Footscray Road at Sims street to provide road access to Swanson Dock West container terminal and Coode Island. This allows the Swanson Dock West container and rail terminals to be integrated.

More than 80 per cent of containerised cargo movement to and from Port of Melbourne are by road and 89 per cent of containers handled in the port involve multiple moves before reaching their destination. Improving road for Port of Melbourne access include;

- extend Dockside Road to the West Gate Freeway interchange ramps
- extend Mackenzie Road
- upgrade Simms Street
- upgrade Plummer Street as alternative route
- use Francis Street as alternative route to alleviate congestion and curfew

3 Intermodal Terminal Model for Port of Botany (Sydney)

In New South Wales, there are four major ports namely; Sydney Harbour Port (Port Jackson), Port of Botany, Port of Kembla and Port of Newcastle. The Sydney Harbour Port handles general cargoes, containerised cargoes, bulk dry cargoes, motor vehicle, passenger terminals including overseas passenger terminals. Port of Kembla is mainly used for steel export and grain export. Port of Newcastle exports coal and is the world's largest coal export port. Port of Botany is the main commercial shipping activities for New South Wales.
Even though, the Sydney Harbour Port handles containerised cargoes, however, it handles in small amount when compared with the Port of Botany. And leases for a number of port

facilities of the Sydney Harbour Port especially general cargo facilities at Darling Harbour and facilities at White Bay will expire in the near future. These facilities are proposed to be relocated at Port of Kembla. Car import facility at Glebe Island of the Sydney Harbour Port is also proposed to be moved to Port of Kembla [23].

At the Port of Botany, over 20 shipping lines use the port facility. These shipping lines transport cargoes from the Port of Botany to more than 100 destinations around the world.

Over the past decade, Port of Botany has experienced an average annual growth rate in throughput of 8 per cent. It handled 1.2 million TEU between 2003 and 04, 1.34 million TEU in 2004-05 and volume is forecast to grow at a rate of 5 to 6 per cent annually. The New South Wale Government announced strategic direction in 2003 including plan to further develop the Port of Botany to become the primary container port of New South Wales and the future expansion of Port of Newcastle as a major container terminal once Port Botany reaches its capacity.

Over the last 20 years, industrial growths and distribution of goods activities have moved from areas around the Port of Botany to suburbs in Sydney's central west. Western Sydney and South West Sydney are expected to provide the greatest long-term industrial and employment growths. There are plans to develop additional intermodal terminals to service Central West Sydney and Western Sydney [24].

Port Botany is currently the main container port in NSW, in this report Port Botany related intermodal terminals and Port Botany proposed development will be discussed in details.

Trend

Containerised throughput handled by Port of Botany increased from 1,016,000 TEU in 1999/2000 to 1,423,000 TEU in 2005/2006, increased by approximately 40 per cent. The Australian Government Bureau of Transport and Regional Economics (BTRE) estimated that containerised throughput would increase to be 1,874,000 TEU in 2010/2011 which is increased approximately 32 per cent from the year 2005/2006. Increase in containerised throughput would be between 4 and 5 per cent annually from 2010/2011 till 2024/2025 to approaching 3,625,000 TEU [3].

Currently, P&O Ports container terminal at the Port of Botany handles 80,000 TEU of containerised cargoes. Patrick at Port Botany handles 120,000 TEU. Camellia terminal handles 80,000 TEU. Yennora terminal handles 50,000 TEU. Leightonfield terminal handles 95,000 TEU. Minto handles 95,000 TEU. Blayney terminal handles 100,000 TEU. Narrabri handles 20,000 TEU. Griffith handles 20,000 TEU. Newcastle handles 30,000 TEU. St. Peters (Cook River) terminal handles 150,000 TEU. P&O Transport Australia at Port Botany handles 20,000 TEU.

Facilities at Port of Botany (Sydney)

Main facilities at Port Botany are located at the Brotherson Dock with nine container berths leased to P&O Ports and Patrick Corporation Ltd. Figure 12 shows Arial view of the Port of Botany. Figure 13 shows the Brotherson Dock at the Port of Botany. There are two intermodal terminals located on the Brotherson Dock, the P&O Ports intermodal terminal located on the southern side of the Dock and Patrick Corporation terminal located on the northern side.

Figure 12 Arial view of Port of Botany
Source: (Map: http://www.sydneyports.com.au/botany/images/BotanyBDview_large.jpg)

Figure 13 Brotherson dock at Port of Botany
Source: (Map: http://truelocal.com.au)

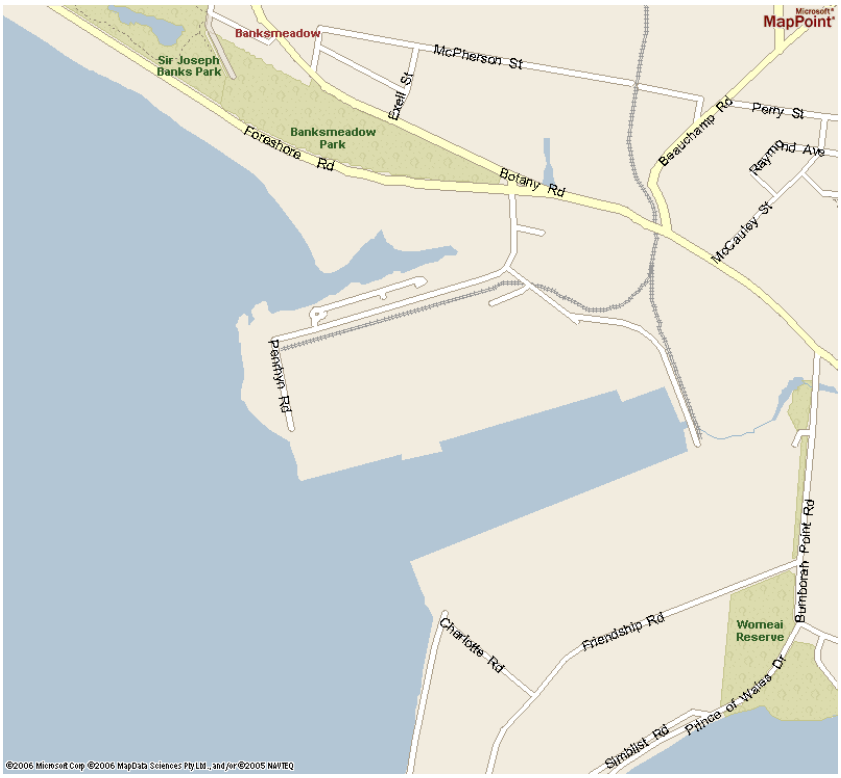

Figure 14 Rail link and road around Port of Botany
Source: (Map: http://maps.msn.com)

On-site transport facilities for P&O Port Botany Container Terminal consist of facilities for truck parking and 3 x 340m rail sidings linked to the NSW and interstate rail systems.

On-site transport facilities of Patrick Terminal consist of rail facilities including 2 x 600m sidings linked to the NSW and interstate rail systems. Both terminals have road access. Figure 14 shows the rail line access and road around the port.

Port of Botany has a modern bulk liquids facility, an adjacent bulk liquids storage and distribution complex and container support businesses. These facilities belong to Cartex Petroleum Pty Ltd, Origin Energy LPG Ltd, Elgas, Orica Australia Pty Ltd, Vopak Terminals, Warehouse Solutions International Pty Ltd, Australian Customs Services, Patrick Port Services and P&O Trans Australia Holdings Ltd [23].

Responsibilities of Sydney Port Corporation and Government Policies

The Sydney Ports Corporation is a state-owned corporation responsible in managing two Ports; the Port of Botany and Sydney Harbour Port. Sydney Ports Corporation was established in 1995 and aimed at bringing greater commercial focus, inter-port competition and customer responsiveness to the management of international shipping, becoming an internationally respected commercial port manager in all operational and environmental aspects, and providing facilities to promote and support trade growth for the benefit of the New South Wales economy.

One of major projects planned by the Sydney Ports Corporation is to expand the Port of Botany. The Port of Botany is a vital port for New South Wales in which 90 per cent of cargoes handles at the port packed and unpacked within the greater metropolitan area of Sydney. Two main containerised cargo terminals at Port Botany are expected to utilise their full capacities in 2010. Sydney Port Corporation is planning to expand a containerised cargo terminal at a 63 hectare of land north of the existing Patrick container terminal. Due to proximity to the Sydney market, the expansion of the Port of Botany, rather than alternative of NSW ports, would produce the most efficient economic outcome for NSW [23,24]. The NSW Government has approved the expansion of the Port of Botany that will meet the need for increased container capacity while preserving Botany Bay's environment [25]. Figure 15 shows the area for the port expansion.

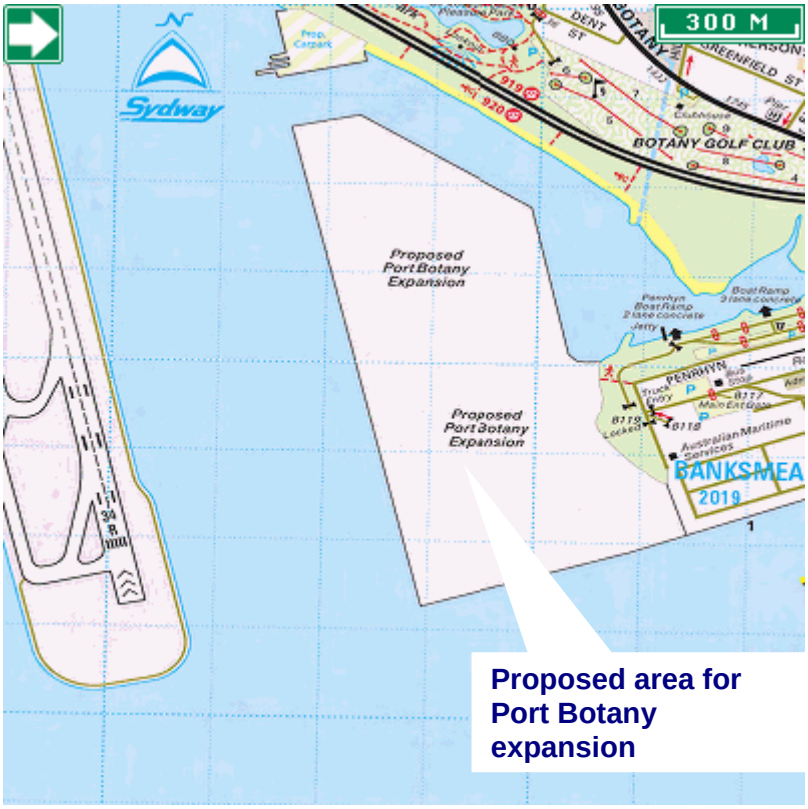

Figure 15 Area for proposed expansion at Port of Botany
Source: (Map: http://truelocal.com.au)

Over the last 20 years, industrial and distribution activities have moved from areas around the Port of Botany to suburbs in Sydney's central west. Western Sydney and South West Sydney are expected to provide the greatest long-term industrial and employment growth by 2027. In Sydney, the existing intermodal terminals network for import and export containers comprises four relatively small intermodal terminals including Camellia, Yennora, Leightonfield and Minto. Their combined annual throughput is 140,000 TEU. Sydney Ports Corporation is also planning to build large intermodal terminals in Macarthur and Western Sydney to reduce the current congestion level on roads linking to Port of Botany.

NSW Government policy is to increase rail freight share by 40 per cent in 2011. Rail freight share currently at Port Botany is around 19.5 per cent.

Issues about Port of Botany and port accessibility

Port of Botany is estimated to handle containerised cargoes of exceeding 3 million TEU in 2025. Current two container terminals are expected to reach their capacities in 2010. In 2003, Sydney Port Corporation lodged a development application for the development of a third container terminal at the Port of Botany. The new container terminal is estimated to handles containerised cargoes of around 1.6 million TEU per annum. The proposed expansion consists of a new container terminal at the port precinct located on the northern edge of Botany Bay. The site for the new terminal is situated between the existing port and the Parallel Runway at Sydney Airport. The new components of the port expansion would include [26]:

- a new container terminal with approximately 63 hectare of land extending approximately 550m west and 1,300m north of the existing Patrick Stevedores container terminal at Port Botany;
- approximately 1,850m of additional wharf face
- rail access to the new terminal area by means of an extension of the existing Botany freight rail line parallel to Foreshore Road including a rail bridge and culverts;
- a strip of existing land north of the existing Patrick Stevedores container terminal for an inter-terminal access road and for two additional rail sidings;
- reclamation adjacent to Foreshore Road to create a tug berth facility; and
- dedicated road access from Foreshore Road via an entrance bridge across the channel separating the existing shoreline from the new terminal including a set of new traffic lights on Foreshore Road.

At present, the majority of road transport to and from Port of Botany has to use Botany Road due to the delay at the intersections of Foreshore Drive-General Homes Drive and of General Holmes Drive-Mill Pond Road. And the airport tunnel and O'Riordan Street rail bride height is less than the rail bride height over the Botany Road forcing trucks to use the Botany Road. The issues of noise, pollution, safety, environment and vibration problems on the Botany Road have been raised [25]. Figure 16 shows details of the intersections of Foreshore Drive-General Homes Drive and of General Holmes Drive-Mill Pond Road.

The New Road Transport Association also acknowledged that traffic congestion remains a major problem in the Port of Botany area, making operations at the container terminal for road transport operators less reliable. The Association advocated the solutions as follows [27,28].

- a high quality road link between Foreshore Road and the M5 East to improve the economy, safety and reliability of road movements from the port to areas in the inner west and south west
- extending B-double access across the road network, transport yards, container terminals and industrial sites, and increasing mass limits to 45.5 tonnes on a standard six-axle prime mover semi-trailer to accommodate the emergence of 45-foot containers
- the development of intermodal terminals within greater Sydney and in the country

- developing rest areas and food service facilities adjacent to Foreshore Road to service the needs of truck drivers working out of Port Botany, to allow an opportunity for drivers to rest (especially country based drivers and those affected by significant delays) and to eliminate the need to park along Foreshore Road.

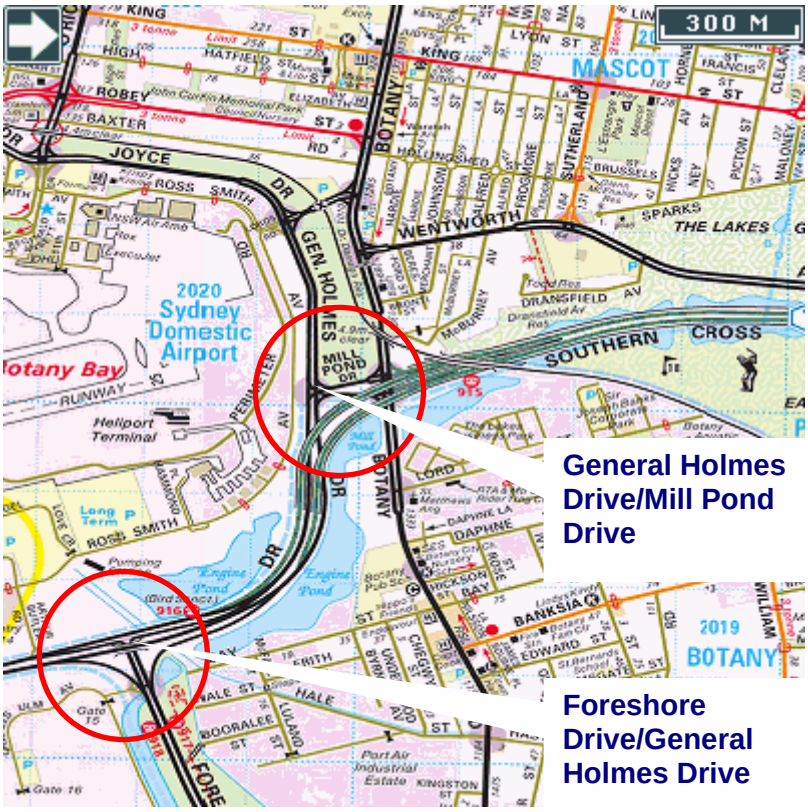

Figure 16 Foreshore Drive/General Holmes Drive and General Holmes Drive/Mill Pond Road
Source: (Map: http://truelocal.com.au/)

Issues about intermodal terminals

Urban development in Sydney has moved to Central West Sydney, Western Sydney and South West Sydney. Currently, intermodal terminals are mainly located in Central West Sydney. It has been estimated that Western Sydney and South West Sydney are expected to provide over 70 per cent of Sydney's industrial floor in these areas by 2027. The current intermodal terminal network is unlikely to be able to adequately service these areas. Plans for increasing the intermodal terminal capacity in these developed areas have been initiated [24,29,30,31].

Intermodal servicing Central West Sydney and South West Sydney

As, mentioned, the existing intermodal terminals network for import and export containers in Central West Sydney comprises four relatively small intermodal terminals including Camellia, Yennora, Leightonfield and Minto. Their combined annual throughput is 140,000 TEU.

Enfield intermodal terminal is being proposed an intermodal logistics centre which designates to handle containerised cargoes around 300,000 TEU per year.

Moorebank intermodal terminal is being proposed to be a state-of-the-art intermodal terminal with a capacity of at least 500,000 TEU. Moorebank is considered to be an ideal place in the South Western corridor since road and rail transports can get access to the proposed Southern Sydney Freight line, the M5 road corridor and Western Sydney through the M7 corridor. Moorebank also provide ready access to the interstate road and rail network, the WestLink ring road and connections to Sydney's ports via the proposed Southern Sydney rail freight line to be constructed under AusLink [24].

Ingleburn intermodal terminal has been proposed by Patrick Corporation to become a new intermodal terminal with estimated capacity between 43,000 and 54,000 TEU.

Minto intermodal precinct has been proposed to expand to have its capacity around 200,000 TEU per annum. The proposal incorporates an enlarged import/export facility to cater for port trains, with sidings of 600m, as well as an interstate facility, with sidings of 1800m.

Sydney RailPort Facility has proposed to develop an intermodal terminal and business park at Menangle. This facility would have the capacity to accommodate freight trains up to 1800m. Since the facility is located in the fringe of Sydney's metropolitan area, it has the potential to provide capacity for the domestic interstate non-bulk freight task.

Intermodal servicing Western Sydney

The NSW Government Department of Planning's Freight Infrastructure Advisory Board recommended a development of a large intermodal terminal to serve Western Sydney for future development. Eastern Creek was identified as an appropriate location. The location is accessible to the economic and industrial zones of the Western Sydney region via the M7 and the M4 arterial roads.

Issues about road and rail access

Rail access to port

At present, 85 per cent of cargoes handled at Port of Botany are generated or destined for locations within 40 km radius from the port. This is likely to continue for the foreseeable future. The Port of Botany is serviced by a dedicated freight rail line which currently has the capacity to handle 500,000 TEU per annum. The road network currently handles more than 750,000 TEU. The Botany dedicated freight rail line is the primary point of direct rail entry and exit at the Port of Botany. Because of limited siding capacity at the port's stevedoring terminals, trains arriving and departing the port need to be broken into smaller trains. These operations occur within the nearby Botany goods yard which itself has siding limitations. The constant shunting and marshalling of trains means that 50 per cent of the available tacking capacity to and from the port is currently wasted. It will be necessary to eliminate the constraints that currently exist at the Botany goods yard. This should include line separation between inward and outward train movements [24].

The existing road and rail level crossing at the General Holmes Drive has encountered road and rail inter-crossing issues. Trains have to make a stop before proceeding through the crossing. This practice cannot continue to operate as freight volumes increase on the rail

line. The Freight Infrastructure Advisory Board made a recommendation that the crossing be closed to road vehicles. The closure will be to be followed by grade separation with new road access between General Homes Drive and Botany Road in the vicinity Wentworth Avenue [24].

Road infrastructure servicing Western Sydney

Western Sydney is a particularly important manufacturing and distribution centre, and a significant destination and origin for container freight in NSW. To meet the increasing freight task, the NSW has committed to the completion of an orbital network of motorways throughout Sydney to improve efficiency of road transport. The missing parts of the orbital network are now under development including the Lane Cove Tunnel, Cross City Tunnel and Westlink M7 [24]. Figure 17 shows AusLink urban corridors for Sydney.

Rail Infrastructure Servicing Port of Botany

Port of Botany is serviced by the Metropolitan goods railway line and dedicated freight lines. Freight services operate over most of the suburban railway lines in Sydney, however due to the high frequency of passenger services and the lack of freight only tracks, there is a curfew on freight movements during peak hours. The Metropolitan goods railway line and the Botany dedicated freight line starts from the Port of Botany, and joins the Bankstown railway line at Sydenham. The Metropolitan goods railway line and the Botany dedicated freight line then runs beside the Bankstown Line to the suburb of Dulwich Hill where the Metropolitan goods railway line branches off and heads north through Lewisham, Lilyfield to the Glebe Island port and Rozelle Goods yard. A branch of the line then passes through Glebe Jubilee Park, then through a tunnel beneath the suburb of Glebe, to pass over another brick viaduct over Wentworth Park. The line then swings north to loop through the former industrial suburb of Pyrmont, before passing beside Darling Harbor. Here, it served the former large Darling Harbor Goods yard. It then passes south beside the Powerhouse Museum and Ultimo tram depot, under Railway Square to join the railway lines south of Central station. The Botany dedicated freight line heads south to Sefton, Chullora, Villawood, Leightonfield, Minto, Macarthur and to Canberra and Melbourne.

In August 2004, the Australian Rail Track Corporation (ARTC) and Rail Corporation New South Wales entered into an agreement for ARTC to lease the Metropolitan Freight Network, specified as being the dedicated freight lines within the rail corridors which include

- Sefton Park to Chullora
- Flemington South to Belmore
- Belmore to Marrickville (shared passenger and freight corridor)
- Marrickville to Botany and Dulwich Hill to Rozelle.

This dedicated freight line runs between Port of Botany and Enfield/Chullora, a distance of about 18 km. The freight line extension to the south west runs from Chullora to Sefton Junction about 2.5 km to the west of Enfield. From Sefton Junction, the freight trains share with passenger network to Macarthur on the main southern line. A further freight line extension to the north runs from Enfield to Flemington Junction, Strathfield and North Strathfield about 5 km to the north of Enfield, where freight trains share the passenger rail network on the main northern line to Hornsby via Epping. Freight trains from Enfield/Chullora travel to Western Sydney and Western NSW using the passenger rail network of the main

western line from Lidcombe to St Marys and beyond [24,29,30,31,33]. Under the present configuration of the rail network, the increase in rail volumes cannot be achieved without conflicting with Sydney's rail passenger services. The priority given to passenger rail, peak hour curfews on the movement of freight services and limitations on daily cycles impede growth in freight rail volumes.

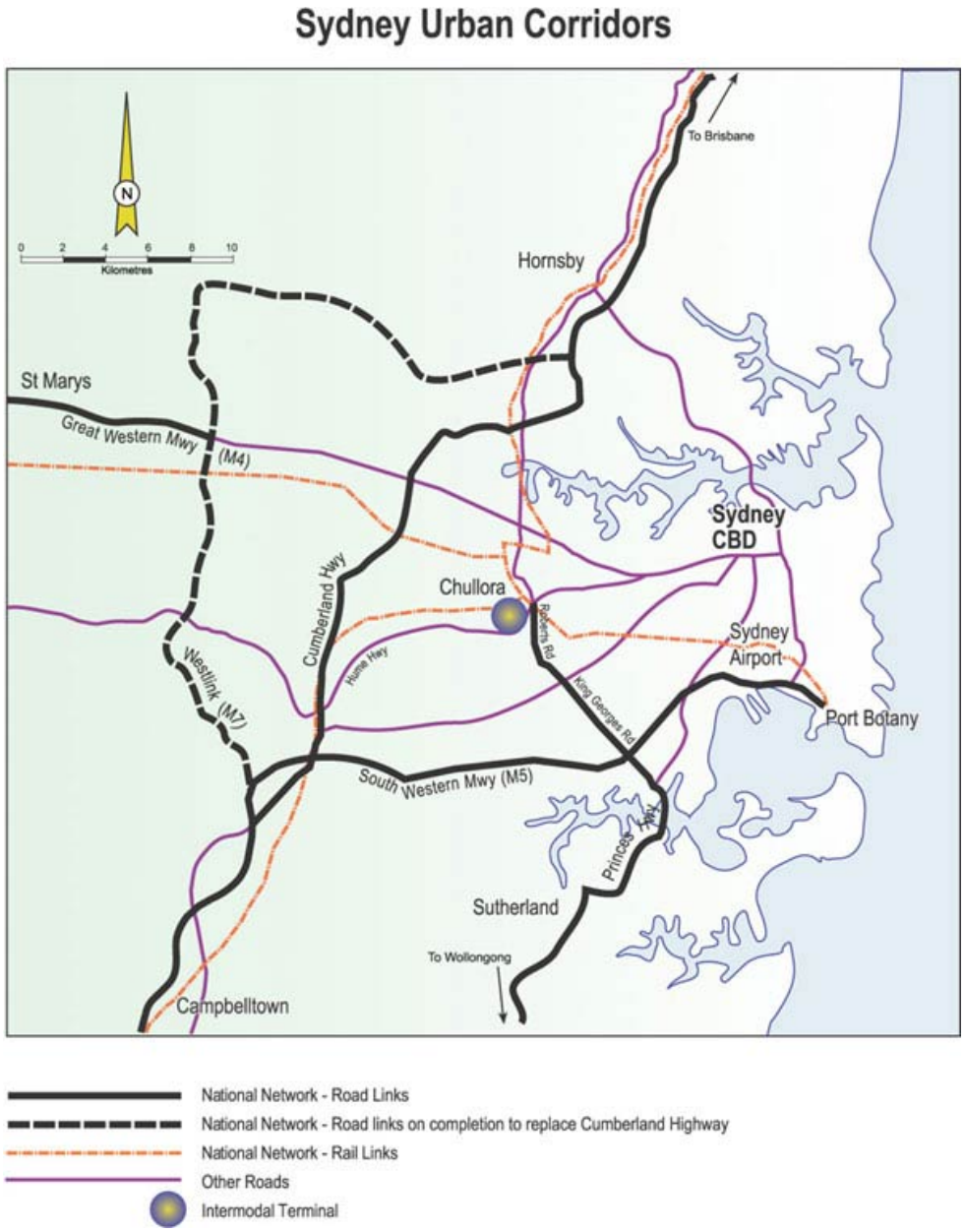

Figure 17 Sydney urban corridors (AusLink)
Source: (Map: http://www.auslink.gov.au/whatis/network/)

There are plans to construct a freight rail bypass of the southern part of Sydney (*Southern Sydney Freight Line*). The Southern Sydney Freight Line is critical infrastructure, as it will provide a dedicated freight route between Sefton and Macarthur and connect to the Botany dedicated freight line. The Southern Sydney freight line is new dedicated freight line running from south of Macarthur Station to east of Sefton Station within the existing corridor. Freight

trains currently share the rail lines with passenger trains in this section. In conjunction with the Botany dedicated freight line, it will allow freight trains to operate between Port of Botany and Macarthur on a line that is completely separate from Sydney's passenger train network. The NSW Government considers the Southern Sydney Freight Line as critical infrastructure.

Within Sydney areas, the intermodal terminals with rail access to Port of Botany are Minto, Yennora, Leightonfield, Camellia and Cooks River. Over the past four years, approximately $37 million had been invested in the Enfield/Chullora rail line servicing Port of Botany. The capacity of rail freight from the Port of Botany to Enfield/Chullora could increase to 1.2 million TEU. However, this would require two major engineering upgrades including:

- Duplication of the current single line track that runs from Port of Botany through to Port of Mascot which is the last section of the dedicated freight line from Port of Botany through to Enfield /Chullora that is not duplicated;
- Installation of a cross over crossing at General Holmes Drive to remove the current at-grade level crossing

Current intermodal terminal system in New South Wales

Current intermodal terminals include two intermodal terminals located within the precinct of the Port of Botany, four intermodal terminals located in Central West and one in South West and one at Cooks River. The intermodal terminal for domestic freight movements is located at Chullora and Belfield. Regional intermodal terminals are located at Griffith, Parkes and Newcastle. Figure 18 shows the intermodal terminal network in New South Wales. Figure 19 shows intermodal terminals located in Sydney areas. Details of these intermodal terminals are discussed below [4,34].

P&O Ports terminal (Brotherson Dock within Port of Botany)

P&O Ports intermodal terminal is located and operates on the southern side of Brotherson Dock within the Port of Botany. The terminal is used primarily for international cargoes with rail services predominately originating from regional areas (including Dubbo, Namoi, Wee Waa and Warren). Total volume of containerised throughput is estimated at around 80,000 TEU per annum. The main hindrance to the efficiency of the terminal is that there is only one rail line and out from Cook's River to Port Botany. This subsequently causes excessive shunting delays by the rail provider and in turn reduces the efficiency of the terminal.

Table 12 Summary of P&O Ports terminal

Office hours	24 hours, 7 days a week
Area	350,000 m^2 (Total)
	40,000 m^2 (Rail Operations)
Rail siding	360 m
Rail Path Length	1000 m
Throughput	80,000TEU
Train services	50 Trains per week
Growth	50% - 70% increase in rail service in next five years

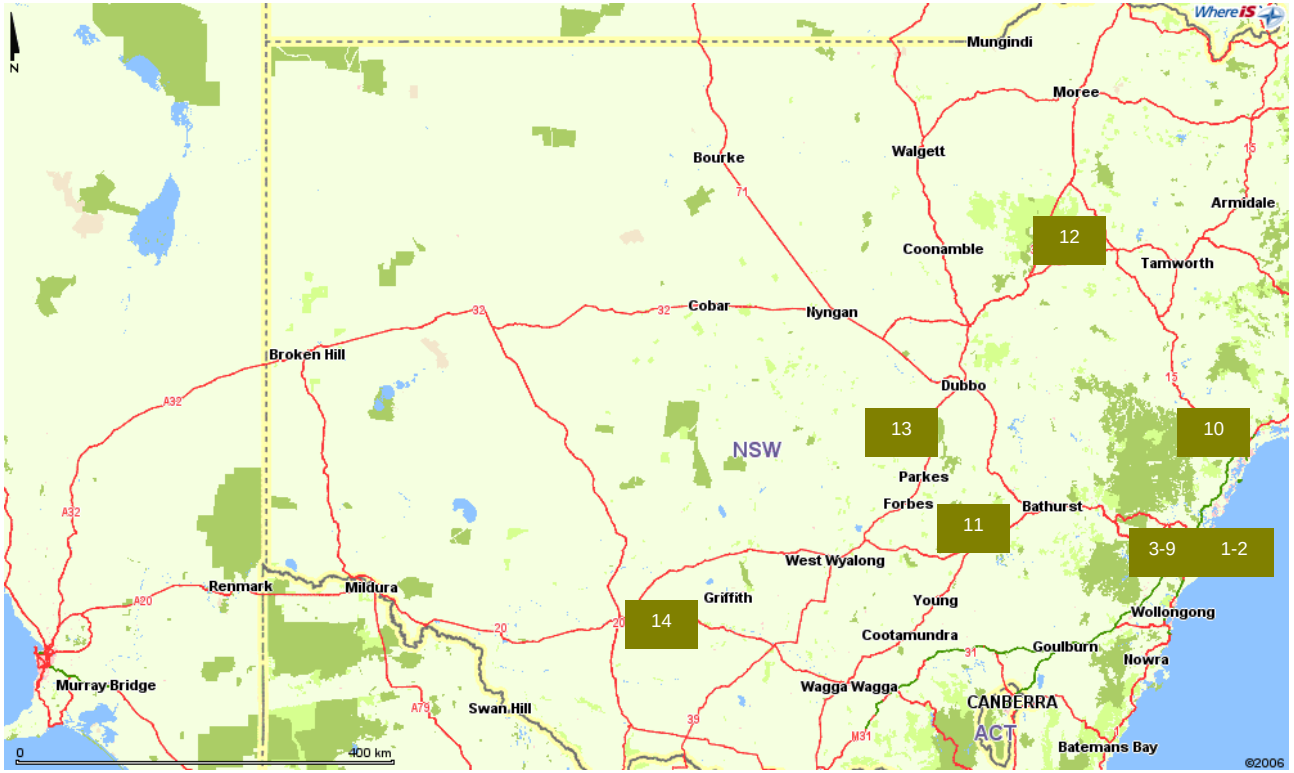

Figure 18 Intermodal terminals in New South Wales
Source: (Map: http://www.whereis.com)

[1] P&O Ports terminal **[2]** Patrick terminal at Port Botany **[3]** Camellia **[4]** Yennora **[5]** Leightonfield **[6]** Minto **[7]** St. Peters (Cook River) **[8]** Chullora **[9]** Belfield **[10]** Newcastle **[11]** Blayney **[12]** Narrabri **[13]** Parkes **[14]** Griffith

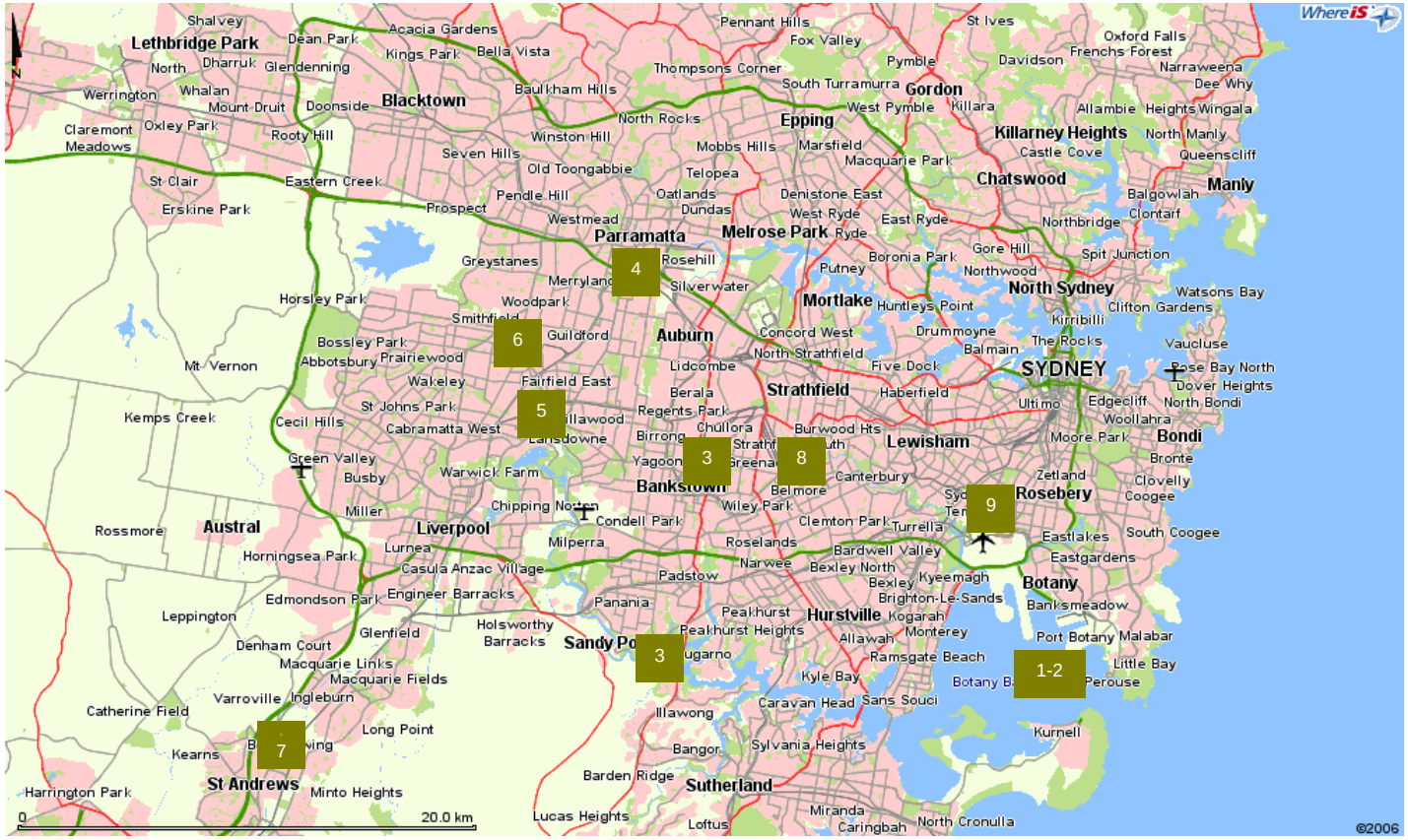

Figure 19 Urban intermodal terminals in New South Wales
Source: (Map: http://www.whereis.com)

[1] P&O Ports terminal **[2]** Patrick terminal **[3]** Chullora **[4]** Camellia **[5]** Leightonfield **[6]** Yennora **[7]** Minto **[8]** Belfield **[9]** St. Peters (Cook River)

Patrick terminal (Brotherson Dock within Port of Botany)

Patrick Corporation has an intermodal terminal on the north side of Brotherson Dock, opposite the P&O Ports terminal. Annual throughput for this terminal is around125,000 TEU. The terminal is served by the inland rail connections from regional origins.

Table 13 Summary of Patrick terminal

Office hours	24 hours, 7 days a week
Area	900 m^2 (Paved area)
Rail siding	950 m
Rail Path Length	950 m
Throughput	120,000TEU
Train services	85 Trains per week

Camellia

Camellia intermodal terminal is located approximately 20 km northwest of Sydney CBD. The terminal serves as a container freight station as well as operating two empty container storage facilities. Export and import services are conducted daily to Port Botany.

Table 14 Summary of Camellia terminal

Office hours	7 days a week
Area	7,000 m^2 (Paved area)
	1,925 m^2 (Storage area)
Rail Path Length	680 m
Throughput	80,000TEU
Train services	36 Trains per week

Leightonfield

The Leightonfield intermodal terminal is located in Villawood close to Leightonfield rail station within 25 km from Port Botany. BuleScope Steel is the primary customers using this terminal to export its products. The terminal throughput in 2005/05 was estimated to be around 15,000-20,000 TEU.

Table 15 Summary of Leightonfield terminal

Office hours	24 hours 7 days a week
Area	64,000 m^2 (Paved area)
	23,600 m^2 (Storage area)
Rail Path Length	390 m
Throughput	95,000TEU

Minto

The Minto intermodal terminal is located approximately 35 km south west of the Sydney CBD. This terminal mainly serves import and export containers for the Port of Botany.

Table 16 Summary of Minto terminal

Office hours	24 hours 7 days a week
Area	30,000 m^2 (Paved area)
	8,000 m^2 (Unpaved area)
	18,000 m^2 (Storage area)
Rail Path	1
Throughput	95,000TEU
Train services	2 Trains per week

Yennora

The Yennora intermodal terminal is located approximately 23 km west of the Sydney CBD. It serves import and export cargoes to the Port of Botany. It also serves as the Sydney terminal for Queensland's Rail interstate services. The annual throughput by rail at this terminal is approximately 50,000 TEU, most of which is the international cargo.

Table 17 Summary of Yennora terminal

Office hours	6.00am-6.00pm
Area	12,000 m^2 (Paved area)
	38,500 m^2 (Storage area)
Rail Paths	8
Rail Path Length	950 m
Throughput	50,000TEU
Train services	10 Trains per week

Belfield

The Belfield intermodal terminal is located within 15 km from Port Botany. It's main operation is to serve the movement of rail freight to and from Sadleirs intermodal terminal located in Kewdale in Western Australia. The terminal also serves as a truck depot for interstate trucks to and from Perth and Kalgoorlie. Annual throughput by rail is around 10,000 TEU.

Table 18 Summary of Belfield terminal

Office hours	5.30am-7.30pm hours, 5 days a week
Area	10,500 m^2 (Paved area)
Rail Path Length	260 m
Throughput	10,000TEU
Train services	4.5 Trains per week

Chullora

The Chullora intermodal terminal is located approximately 18 km west of the Sydney CBD. Annual containerised throughput by rail for the terminal is in approximately 300,000 TEU. The facility is used only for domestic freight movement.

Table 19 Summary of Chullora terminal

Office hours	24 hours, 6 days a week
Area	20,000 m^2 (Paved area)
Rail Paths	4
Rail Path Length	450 m
Throughput	300,000TEU
Train services	38 Trains per week

St. Peters (Cook River)

The St Peters intermodal terminal is located approximately 15 km from Port of Botany. This intermodal terminal is primarily used as an empty container storage depot. Total throughput by rail was around 150,000 TEU between July 2004 and June 2005. The majority of rail services go to Port Botany, whilst the majority of containerised cargoes go to the Sydney Metropolitan Area.

Table 20 Summary of St. Peters terminal

Office hours	7.00am-5.00pm hours
Area	58,300 m^2 (Paved area)
Rail Path	8
Rail Path Length	400 m
Throughput	150,000 TEU (Total) 10,000 TEU (Loaded containers)
Train services	50 Trains per week

P&O Transport Australia Terminal (Port of Botany)

This intermodal terminal is located in the precinct of the Port of Botany. This facility is primarily used for empty container storage. Annual throughput handled by rail is around 20,000-30,000 TEU. The terminal also handles loaded containers which are evenly split between export and import.

Table 21 Summary of P&O Transport Australia terminal

Office hours	24 hours, 7 days a week
Area	81,000 m^2 (Total area)
	78,000 m^2 (Paved area)
	1200 m^2 (Covered storage)
Rail Path Length	950 m
Throughput	20,000-30,000 TEU
Train services	20 Trains per week

Blayney

The Blayney intermodal terminal is a regional terminal located approximately 30 km south west of Bathurst in Western NSW. The terminal is mainly used for export with rail services from the terminal to Port Botany. Annual rail throughput is over 100,000 TEU. The facility also serves as a road depot, which handles of around 45,000 tonnes of non containerised cargoes and 50,000 tonnes for containerised cargoes.

Table 22 Summary of Blayney terminal

Area	30,000 m^2 (Paved area)
	8,000 m^2 (Unpaved area)
	18,000 m^2 (Storage area)
Rail Path Length	600 m
Throughput	100,000 TEU (by rail)
	90,000 tonnes (by road)
Train services	10 Trains per week

Narrabri

The Narrabri intermodal terminal is located approximately 400 km northwest of Sydney. This terminal is mainly used for exporting cotton from Narrabri and its surrounding area to the Port of Botany and Port of Brisbane. Annual throughput for containerised cargoes by rail is around 20,000 TEU.

Table 23 Summary of Narrabri terminal

Area	20,000 m^2 (Paved area)
	18,000 m^2 (Storage area)
Rail Path Length	300 m
Throughput	20,000 TEU
Train services	5 Trains per week

3.7.13 Griffith

Griffith intermodal terminal is located in the Griffith region of NSW approximately 400 km from Sydney. The Griffith intermodal terminal primarily handles wine cargoes from Griffith and Riverina areas for export. The terminal has an annual throughput of around 20,000 TEU. Cargoes are usually transported to the terminal by road and then are transported by rail to Melbourne.

Table 24 Summary of Griffith terminal

Office hours	6.00am – 6.00pm
Area	30,500 m^2 (Paved area)
Rail Path Length	520 m
Throughput	20,000 TEU
Train services	4 Trains per week

3.7.14 Parkes

Parkes intermodal terminal is located approximately 365 km west of Sydney. It mainly serves domestic cargoes. This terminal is located on a crossroad of Australia which links Melbourne, Sydney, Brisbane and Perth. Annual throughput by rail is nearly 20,000 TEU during July 2004 to June 2005. Total annual throughput by road was 800 TEU for containerised cargoes and 70,000 tonnes of non containerised cargoes.

Table 25 Summary of Parkes terminal

Office hours	24 hours, 6 days a week
Area	50,000 m^2 (Paved area)
	4,000 m^2 (Storage area)
Rail Path Length	600 m
Throughput	20,000 TEU (Rail)
	800 TEU (Road)
	70,000 tonnes (Non containerised)
Train services	7 Trains per week

3.7.15 Newcastle

There is one major intermodal site in Newcastle located at Carrington on Newcastle's Hunter River. Toll SPD operates this terminal as the Eastern Basin Distribution Centre (EBDC). Toll SPD is a business unit of Toll and is responsible for multimodal transportation of full container loads between all capital cities and large regional locations. The EBDC is a multi purpose cargo handling facility provides a wide range of break-bulk ad containerised cargo handling services. Containers from Newcastle to Port Botany were more than 30,000 TEU by rail in 2004/05.

3.8 Planned intermodal terminals in NSW

Currently Port of Botany handles cargo throughput of around 1.5 million TEU a year. Total cargo throughput is estimated to exceed 3 million TEU in 2025. Sydney Ports Corporation is planning to develop two intermodal terminals; one is located within the port precinct on a 63 hectare of land and an Intermodal Logistics Centre (ILC) at Enfield. The combined containerised cargo capacities of P&O Ports terminal, Patrick terminal and the new terminal at Port Botany are estimated to exceed 3 million TEU per year which would be sufficient to accommodate the expected increases in container trade beyond 2025 [24,31].

Sydney Ports Corporation is planning to build a new Intermodal Logistics Centre (ILC) on the Enfield Marshalling yards with a containerised cargo capacity of 300,000 TEU per year. The proposals for other facilities consist of [29,30]:

- a facility where containers will be moved on and off trains and trucks
- warehouses where containers from trains can be stored and unpacked for delivery and where freight coming into the Centre can be packed into containers for export.
- empty container storage facilities:
- a light industrial/commercial area along Cosgrove Road
- a Community and Ecological Area which would provide the opportunity to increase the enhancement and community activities. The area would also serve as a buffer between operations on the site and residence on the south of the site.
- a road bridge over the new Enfield Marshalling Yards for access to Wentworth Street onto the Roberts Road
- A noise wall on the RailCorp land to the north west of the site

As mentioned, 85 per cent of cargoes from Port of Botany are generated and destined within 40 km of Port of Botany, additional intermodal terminals are planning to develop to support future containerised growth for Central West Sydney and Western Sydney. The additional intermodal facilities planed to service Central West Sydney include:

- Moorebank intermodal terminal with capacity of 500,000 TEU per annum,
- Ingleburn intermodal terminal with capacity between 43,000 and 54,000 TEU per annum, and
- an extension of Minto intermodal precinct to have the total capacity of around 200,000 TEU per annum

A large intermodal terminal at Eastern Creek has been identified as a new intermodal terminal to service Western Sydney. Figure 20 shows planed intermodal terminal facilities in Sydney areas.

Once the capacities of containerised cargo terminals in the Port of Botany reach their capacities, Newcastle is proposed to be the next location as the major hub for containerised cargoes.

3.9 Environmental and social impacts

Expansion Port of Botany has raised environmental and social issues as follows [35,37]:

- Port of Botany is currently hemmed by over populated, traffic chocked on M5-Airport-Alexandra-Banksmeadow. Future population increase would put more pressure in this area. For instance, the Airport alone will treble its annual passengers to an estimated of 63 million over the next two decades. Expansion of the Port of Botany to handle containers from 1.1 million to 3 million TEU would put more pressure on road transports in this area.
- Port of Botany expansion would impact on the struggling ecology and historic Botany Bay. The migratory birds that visit the Botany Bay and the heritage place which is known as the birthplace of Modern Australian where Aboriginal and European Culture was first met may be affected by the port expansion.
- Port of Botany expansion would increase hazardous potential of Botany-Banksmeadow areas.

Port of Botany environmental protections announced by Sydney Ports Corporation include [23,25,26]:

- Saltmarsh habitat surrounding the Port will be expanded by up to six hectares, to provide additional bird habitat and help attract wading birds.
- Seagrass habitat will be expanded by eight hectares to attract additional fish and marine life and replace seagrass removed in the 1970s.
- The existing intertidal sand and mud flats will be expanded to 12.5 hectares. Areas of shallow water will be created by filling deeper areas of the estuary to provide fish feeding grounds for predatory birds like eagles.
- Foreshore Beach will be protected and remain open for people to enjoy, with a new boat ramp constructed. Upgrade works will include new native vegetation plantings and a pedestrian/cycle path.
- The 2003 Environmental Impact Statement (EIS) found that the expanded Port would not affect current or swell movements in Botany Bay. Nevertheless, this issue will be monitored as a condition of consent.

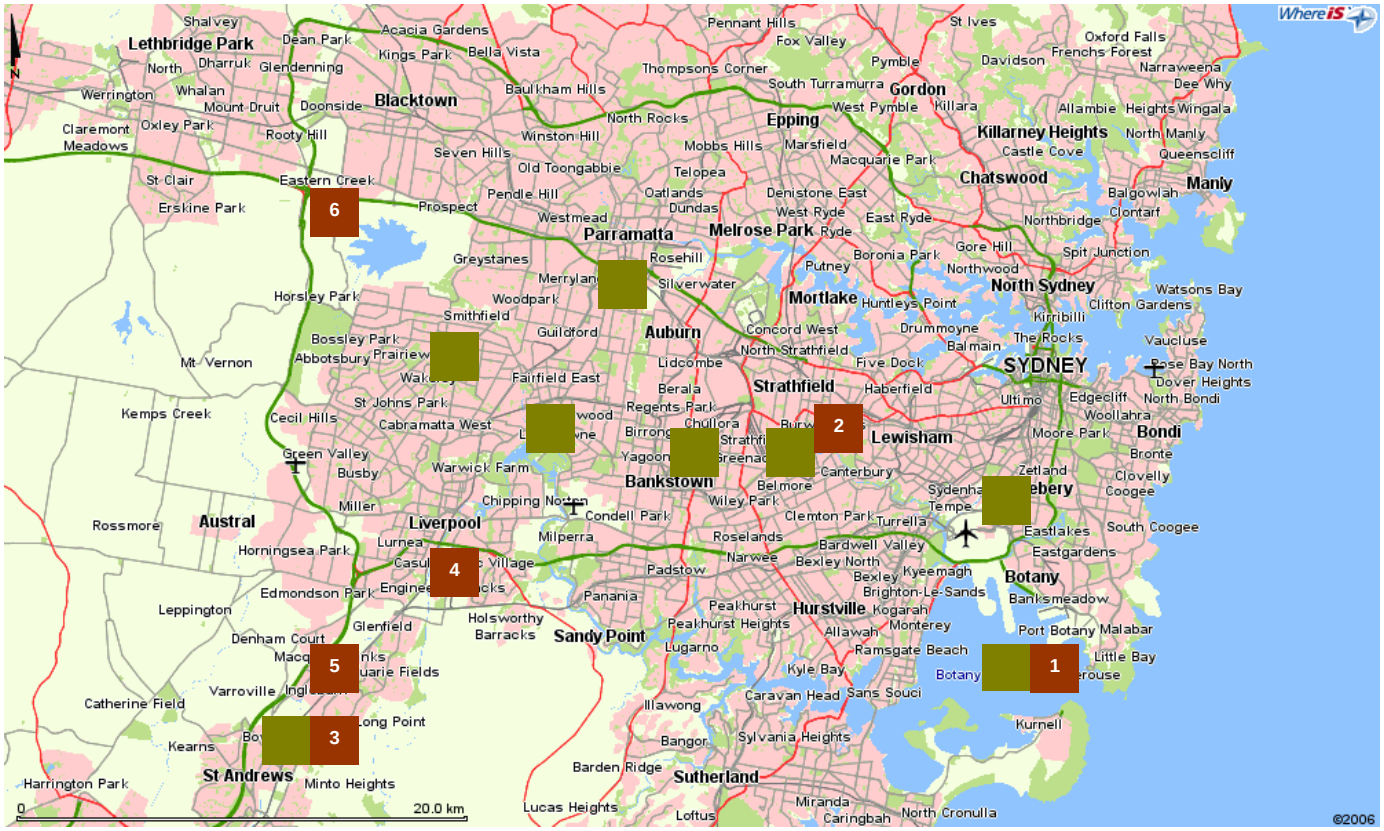

Figure 20 Urban intermodal terminals in New South Wales
Source: (Map: http://www.whereis.com)

[1] Intermodal terminal at Port Botany [2] Enfield [3] Minto (expansion) [4] Moorebank [5] Ingleburn [6] Eastern Creek

Existing terminals

The environmental and social impacts as a result from the proposed intermodal logistics centre (ILC)at Enfield has raised. Historically, when the Enfield Marshalling Yards were established there was minimal residential development in areas close to this such as Belfield, Strathfield South, Enfield and even Strathfield West. The establishment of the Marshalling Yards provided local employment and encouraged residential development in areas close to the Yards. Currently, the former Enfield Marshalling Yards is located close to many residential areas. The development of Enfield intermodal logistics centre will pose social and environmental impacts as follows [36,37,38]:

- Increase demand of heavy vehicles using the same roads as motorists and increase congestion, pollution and compromise motorist safety. To ease the problem, it was suggested that the State Government should investigate intersection congestions by building overpasses or underpasses.
- The Enfield development will increase heavy trucks on motorways. Dedicated heavy vehicle lanes to minimise traffic conflicts with light vehicles should be considered.
- The Enfield development will have detrimental impact on road access to local business. Access by heavy truck vehicles will have impact on both residential and commercial properties in Strathfield and Strathfield South. The increase in numbers of trucks can discourage residents from using shops and local services. Urban consolidation which is primary focused on increasing residential dwellings can result in the reduction in commerce and industry which provide services and employment to the local community.
- The Enfield development may impact existing Enfield industrial area. There are dedicated industrial areas in parts of Enfield and Homebush areas. Businesses in these areas depend on access and on-street parking for their customers. The Enfield development will increase heavy vehicle traffic and may inevitably be a demand for on-street parking to be abolished which will affect local businesses.
- The Enfield development will create noise pollution. The Society is concerned about the existing viability of the existing Enfield industrial area due to the impact of heavy vehicle traffic. The Enfield intermodal logistics centre proposal states that ‘Commercial and light industry activities at the southeast of the site will act as a buffer for residents.
- The operational hours at the Enfield development would be 24 hours a day 7 days a week. This proposal is considered unacceptable by the community.
- There are a numbers of heritage buildings at the Enfield development site. These heritage sites should be conserved, which include the Administration Building built in 1940, the former Ford Factory, the Weston Milling, the Yard Master’s office and the Tarpaulin Factory.
- Noise, vibration and air quality issues, the modelling of noise and air quality impacts from road traffic should be included in the bigger picture in the assessment.
- Site contamination, investigations are required to determine significance and extent of contamination.
- Should the Enfield development site be transferred to private interests or privatised, limits on rail transport movement shall not be increased.

3.10 Summary

Intermodal terminals

Two intermodal terminals namely P&O and Patrick terminals are located in the Port of Botany that handle regional cargoes for import and export. The combined annual throughput of these two intermodal terminals is estimated around 200,000 TEU.

Four intermodal terminals that handle the international cargo located within 20km to 35km from Sydney CBD include Camellia located approximately 20 km northwest of Sydney CBD: Yennora located 23 km west of Sydney CBD; Leightonfield located 25 km west of Sydney CBD; Minto located 35 km southwest of the CBD. The combined throughput of these four intermodal terminals is around 420,000 TEU per annum.

There are four intermodal terminals located in regional NSW that handle international cargoes. These terminals receive cargoes from surrounding areas and interstates, then, cargoes are transported to Port of Botany. These terminals include Blayney, Griffith, Narrabri and Newcastle. The Blayney terminal located 30 km from Bathurst in western NSW and approximately 200km west of Sydney. The Blayney terminal receives cargoes from interstates. Cargoes from this terminal are transported by rail to Port of Botany for export. The Griffith terminal located approximately 400km southwest of Sydney receives wine cargoes from the Griffith and Riverina areas for export. Cargoes from this terminal are transported by rail to Port of Melbourne for export. The Narrabri intermodal terminal is located approximately 400km west of Sydney receiving cotton cargoes within surrounding areas for export. Cargoes from this terminal are transported by rail to Port of Botany for export. The intermodal terminal at Newcastle is a distribution centre and responsible for multimodal transportation of full container loads between all capital cities, large regional locations and export. Annual throughput for these three intermodal terminals for export is around 170,000 TEU.

Intermodal terminals that handle domestic cargoes include Newcastle and Parkes located in the regional NSW, Belfield and Chullora terminals located in the fringe of the Sydney metropolitan area. The domestic intermodal terminal network generally involves the operation of significant large trains running over much longer distances. The major hubs are interstate capitals and strategically located regional terminals. The Newcastle terminal is one of the terminals that handle domestic cargo movement to other states and regional areas. Parkes intermodal terminal is also handles domestic cargoes located approximately 365 km west of Sydney. Chullora terminal is located 18 km west of Sydney CBD and Belfield terminal located 15km southwest of Sydney CBD. The combined annual throughput of these intermodal terminals is approximately 331,000 TEU.

There are two main intermodal terminals that handle empty container storage located in Sydney areas. These terminals are St. Peters terminal at Cook River located 15 km from Port Botany and P&O Transport Australia terminal located in the Port of Botany. The combined throughput of these two terminals is around 180,000 TEU. Camellia terminal also provides empty container storage facility.

Rail access to port

Port of Botany is serviced by the dedicated fright line and the Metropolitan goods railway line. The dedicated freight line and the Metropolitan goods railway line starts from the Port of Botany and braches it off to serve goods yards in metropolitan Sydney areas and some intermodal terminals in Sydney and connected to interstate rail networks. The line starts from the Port of Botany and joins the Bankstown railway line at Sydenham. The Metropolitan goods railway line then runs north to Glebe Island port, Rozelle Goods yard and Darling Harbor Goods yard. The dedicated freight line heads south to Sefton, Chullora, Villawood, Leightonfield, Minto and Macarthur and to Canberra and Melbourne. The Australian Rail Track Corporation (ARTC) and Rail Corporation New South Wales entered into an agreement to lease the Metropolitan Freight Network, specified as being the dedicated freight lines within the rail corridors which include, Sefton Park to Chullora; Flemington South to Belmore ; Belmore to Marrickville (shared passenger and freight corridor); Marrickville to Botany and Dulwich Hill to Rozelle.

The Southern Sydney freight line has been proposed to be a new dedicated freight line running from south of Macarthur Station to east of Sefton Station within the existing corridor. The Southern Sydney freight line is considered as critical infrastructure, as it will provide a dedicated freight route between Sefton and Macarthur and connect to the Botany dedicated freight line. Freight trains currently share the rail lines with passenger trains in this section. In conjunction with the Botany dedicated freight line, it will allow freight trains to operate between the Port of Botany and Macarthur on a line that is completely separate from Sydney's passenger train network.

Road

Western Sydney is a particularly important manufacturing and distribution centre, and a significant destination and origin for container freight in NSW. To meet the increasing freight task, the NSW has committed to the completion of an orbital network of motorways throughout Sydney to improve efficiency of road transport. The missing parts of the orbital network are now under development including the Lane Cove Tunnel, Cross City Tunnel and Westlink M7. Figure

New port terminal

A third container terminal is planed to develop at the Port Botany precinct. The new terminal will add approximately 1.6 million TEU to the current capacity. It is expected that the combined throughput for these three container terminals would be in excess of 3 million TEU which will be able to provide containerised cargo services beyond 2025. When the capacity of container terminals at Port Botany reaches their full capacity, Newcastle is consider to be the next containerised cargo terminal.

The New South Wales Government Plans are the proposed further development of the Port of Botany as the primary container port in NSW, the transfer of general cargo stevedoring from Darling Harbour to Port Kembla as existing leases expire and the future expansion of Port of Newcastle as a major container terminal once Port Botany reaches its capacity.

4 Intermodal Terminal Model for Port of Brisbane

Port of Brisbane is the third largest container port in Australia. The Port of Brisbane is a purpose-built port and is not landlocked. Specific port user needs have been taken into consideration in designing the port. Brisbane is also the fastest growing economy. Drivers of this growth include the proximity of the port to Asian and other international markets. Each year over 2,300 ships use the port facilities. The port business generates a total annual contribution to the Queensland economy of $770 million. The Port of Brisbane covers geographically from Caloundra to the southern tip of Moreton Island, including the 90km shipping channel. The Port's role is to facilitate trade growth through the commercial management of an efficient and customer-focussed port [39].

4.1 Trend

Since 1999/2000 to 2005/2006, containerised throughput for import export through the Port of Brisbane has been increased from 422,000 TEU to 727,000 TEU, increased by approximately 72 per cent. It is estimated that a total containerised throughput through the Port of Brisbane will increase in the next five years from 727,000 TEU in 2005/2006 to approximately 1,096,000 TEU in 2010/2011 which is approximately 51 per cent. After that it is estimated that annual increases will be approximately 7 per cent until 2024/2025 which would reach approximately 2,907,000 TEU [3].

4.2 Responsibilities of Port of Brisbane

The Port of Brisbane is managed by Port of Brisbane Corporation. The main port complex is located at the mouth of the Brisbane River. The Port of Brisbane's responsibility covers 16 km up the Brisbane River to Breakfast Creek. Port facilities extend to upriver for about 15km and include bulk commodity and general cargo wharves, a cruise terminal, and dockyard facility [39].

Port of Brisbane Corporation is a Government Owned Corporation responsible for the operation and management of the Port of Brisbane. The Corporation is a publicly owned entity, but operates on a commercial basis and in a competitive environment. The objective of corporatisation under the *Government Own Corporation Act* is 'to improve Queensland's overall economic performance'.

The vision of the Port of Brisbane is to be Australia's leading port. The responsibilities of the Port of Brisbane include [39]:

- provide and maintain port infrastructure and facility
- operate the Brisbane Multimodal Terminal (BMT) - the rail head for container movements into and out of the port
- lease and manage land for port-related purposes
- act as an assessment manager for assessing and approving developments on strategic port land
- maintain navigable access to the port for commercial shipping
- manage four boat harbors
- operate the Visitors Centre

4.3 Facilities at the Port of Brisbane

Over the past 25 years, Port of Brisbane has invested more than A$600 million in developing its state-of-the-art port facilities. The Port of Brisbane is a deep-water port including the 90km shipping channel, which is dredged to a minimum of 14m LAT (Lowest Astronomical Tide). The Port of Brisbane has a range of 30 commodity berths and nearly 7,500 metres of quay line. Summarised facilities at the Port of Brisbane are given below [39].

Container Terminals

Currently, there are nine container berths. Patrick Corporation leases and operates Berths 1-3. Patrick Corporation also leases Berths 7 and 8. P&O Ports leases and operates Berths 4-6. In early 2006 Patrick will relocate from Berths 1-3 to Berths 7-9. Berths 1-3 will be redeveloped to cater for motor vehicles, general and break-bulk cargoes. Australian Amalgamated Terminals (AAT) will operate the facility.

Dry-Bulk Terminals

The port has dry-bulk facilities and has flexible operational arrangements, with some fully dedicated to a particular user and others sharing wharf facilities with non-bulk trades.

Figure 21 Arial view of Port of Brisbane
Source:
(Map:http://www.portbris.com.au/gallery/portfacilities/FISHERMAN+ISLANDS+OBLIQUE+23+DEC+2005+MEDIUM+RES.JPG.html)

Wet-Bulk Terminals

Most wet-bulk facilities at the port are either crude-oil or refined-products berths.

Brisbane has two oil refineries which include Caltex at Lytton and BP at Bulwer Island. Each has a crude-oil berth and a products berth. The crude-oil berth is used principally for imports and the products berth used chiefly for refined exports. Shell and Neumann Petroleum also handle refined products through the port.

Animal and vegetable oils and chemicals are used through the port's terminals at Pinkenba and Hamilton. Figure 21 shows an Arial view of the Port of Brisbane.

4.4 Road and Rail Links to Port of Brisbane

Port of Brisbane has a dual rail gauge rail link serving the port which the freight rail networks gain direct access to the Port of Brisbane and link to north, west and south railway lines. Queensland Rail (QR) is the main rail service provider at the Port of Brisbane. Presently, rail accounts for 13 per cent of the port's container movements. QR National and Pacific National run services to the Brisbane Multi-Modal Terminal (BMT), connecting the port to major and regional Queensland as well as the eastern capital cities of Sydney and Melbourne. Figure 22 shows detailed road and rail links to the Port of Brisbane.

Figure 22 Rail and road links to Port of Brisbane
Source: (Map: http://www.multimap.com/map/)

Road transport is one part of the logistics chain at the Port of Brisbane. Over 80% of the containers arrive at and depart from the Port of Brisbane by road. The Port of Brisbane has direct road access connecting to the north, south and west which include [39]: Figure 23 shows road and rail urban corridors connecting to the Port of Brisbane.

- The Pacific links the port to Sydney.
- The Bruce Highway links the port to Queensland's regional cities and their vast mining and agricultural industries.
- The Port of Brisbane Motorway links to the Gateway Motorway and connects to the Ipswich and Loan Motorways. This road network provides links to the nearby regional growth areas of the Gold Coast, Ipswich, Toowoomba and the Sunshine Coast. Kingsford Smith Drive, Nudgee Road, Breakfast Creek Road, Sandgate Road, Lytton road and the Gateway Motorway are the major local roads that provide access to the Port of Brisbane.
- The Warrego, Moonie and Cunningham Highlights linked to the Ipswich and Gateway Motorways provide important inland links to Queensland's rural areas.

4.5 Plan for Port Capacities and Government Policies

The development of the Port of Brisbane over the past 25 years has focused on the port's facilities at the river mouth. This is the strategic planning aimed at relocating associated industry away from residential areas.

The Port of Brisbane Corporation proposed further expansion at the Fisherman Islands port area. This expansion is considered essential for the port to continue to serve Brisbane and the surrounding region in the future, and to develop as a major Australian port into the twenty-first century [39].

The main reasons for the expansion of Fisherman Islands are as follows [22]:

- The growths in trade are exceeding projections. These trade growths are both from trade generated within the region and cargoes that transport to southern states.
- There is growing pressure on port facilities at Hamilton as leases expire and from urban encroachment. The Port of Brisbane Corporation will progressively relocate port's facility at the Hamilton to Fisherman Islands port area.
- The Port of Brisbane will need berth facilities that can handle bigger ships for the port to be competitive. Otherwise the Port of Brisbane will lose trade to other major ports that can provide services to larger vessels.

The key attractions in considering the expansion of port facilities at the Fisherman Islands over other potential locations are water depth and the fisherman Islands is well buffered from nearby residential areas. Water depths at other potential locations have constrained at 9.1 metres, and port operations at the Fisherman Islands can be carried out 24-hour basis without interfering with residential amenity in these areas.

Approximately 270 hectares at the northern end of Fisherman Islands to form an extension to the existing port area was reclaimed by the Port of Brisbane Corporation. This expansion was initially projected in 1992. The Corporation's Key Port Brisbane - Strategic Plan 2005 and Beyond was released which was endorsed by the Government of the day.

Figure 23 Queensland urban road corridor networks
Source: (Map: http://www.auslink.gov.au/whatis/network/index.aspx)

The reclaimed land was proposed to be used principally for container and general cargo wharves and terminals, off-wharf container and cargo storage, transport facilities including roads, railways and intermodal handling yards, and port service industries.

The development will be carried out using [39]:

- material, mainly from on site, to construct bunds around the perimeter of the reclamation area;
- quarry rock from quarries in the Brisbane area to face the bunds and protect them from sea erosion; and
- material dredged from navigation channels in the Brisbane River and Moreton Bay (as part of the routine maintenance of these channels) to reclaim the area within the bunds.

In December 2004, the first step in the major expansion of the port at the mouth of the Brisbane River was completed which provides an additional 230 hectares of land for the rapid commercial growth of the port. The steps of the port expansion project involved constructing a perimeter seawall and filling the enclosed area over approximately 15 years using material from maintenance dredging. The Port of Brisbane Corporation is seeking to extract sand from the Spitfire Channel in Northern Moreton Bay. This project will take place over the next 10-15 years and will enable the Corporation to expand its facilities to meet the demands associated with Queensland's strong economic growth [39].

4.6 South East Queensland Regional Development

South East Queensland development is expected to give direct impact to the Port of Brisbane's operation in relation to import and export activities and goods distribution to these areas. South East Queensland (SEQ) has been growing strongly for the past 20 years. The region's population has grown by almost one million people over this period. To respond to this growth, in 1990 the Queensland Government initiated regional planning through the SEQ 2001 project. After a 10-year review in 2000, the regional planning program was renamed SEQ 2021. In April 2004, the Queensland Government established the Office of Urban Management to guide regional planning and infrastructure coordination in South East Queensland [40,41,42].

To provide a statutory basis for regional planning in South East Queensland, the *Integrated Planning Act 1997* (IPA) was amended in September 2004 to:

- recognise the Regional Coordination Committee
- allow for the preparation of the South East Queensland Regional Plan
- provide the Minister responsible for regional planning in South East Queensland with powers under the IPA.

Under the amended legislation, State agencies and local governments will be obliged to ensure all planning or development initiatives give consideration to and reflect the requirements of the South East Queensland Regional Plan.

A study was commissioned by Queensland Transport working in partnership with the Departments of State Development and Innovation, Queensland Main Roads, Queensland

Rail Network Access and the Port of Brisbane Corporation and conducted by Strategic Design and Development Pty Ltd to provide estimates for current and future freight flow in the South East Queensland region [43].

One of the objectives of the study is to provide initial input into the assessment of future locations of intermodal freight terminals. The outcome of the study has two implications namely:

- Household will grow in significance relative to SEQ firms as attractors of freight;
- Flows of freight into the region would be approximately 3 times of current consumption in 2026 regardless of the level of SEQ production. The current consumption is around 29 million tones.

The study predicted that freight transports within SEQ region will continue to be focused on centres of Brisbane, Ipswich and Gold Coast. It is prominent that new industrial and residential development may lead to other city centres. However, the transportation of freight between Brisbane and Ipswich and Brisbane and the Gold Coast will continue to represent the most significant freight corridors for the SEQ region.

It is also expect that the growth in freight flows from outside the SEQ regions is likely to increase the demand for distribution facilities within the SEQ region. These facilities will serve as focal points for the movement of freight and represent attractors of freight flows in to SEQ region.

4.7 Issues about Brisbane Port and port accessibility

The Port of Brisbane is expected to handle containerised cargoes of 3 million TEU in 2025. The current capacity of the Port of Brisbane is unlikely to handle the expected high volume of cargoes over the forecast period to 2025 [3]. The capacity needs to be increased to meet high demand for port facilities to facilitate the smooth movement of containers and ships through the Port of Brisbane. The Port of Brisbane and the stevedoring companies operating at the Port of Brisbane have already taken many initiatives in this regard. Currently the Port of Brisbane Corporation is developing additional 5 to 7 wharfs in the existing port area to handle future high growth in its trade volume. Patrick Corporation has established a semi-automated container terminal at the Port of Brisbane and is expected to have annual capacity of 500,000 TEU [39].

A major expansion initiative currently being undertaken by the Port of Brisbane Corporation is the reclamation of 230 hectares of land at Fisherman Islands. This reclamation project will provide 1.8 km of quay line which will help the Port of Brisbane Corporation to develop an additional five to seven wharves for future port expansion purposes.

Other Port of Brisbane developments include the development of wharf 9 and 10, the completion of Patrick Autostrad terminal behind Wharfs 8 and 9, the construction of a new Motor Vehicle Precinct, the development of the Australian Amalgamated Terminals (AAT) at Terminals 1-3 [39].

Brisbane has a dual standard gauge rail link serving the Port of Brisbane which allows the freight rail networks to gain direct access to the Port of Brisbane and links with north, west and south railway lines. However, the capacity on the Brisbane metropolitan rail network is

heavily utilised due to the operation of suburban passenger (Citytrain) services, interstate (XPT) and regional (Traveltrain) passenger services, and freight services accessing major intermodal facilities and the Port of Brisbane.

The Port of Brisbane has road accessibility connecting to the north, south and west regions. However, there are a range of transport issues in the west and northwest of Brisbane which require further investigation, including increasing traffic congestion within the area, insufficient road connectivity and poor orbital road networks [40,41].

4.8 Issues about intermodal terminals

South East Queensland is the most populated region in Queensland, and one of the fastest growing regions in Australia. The growth in population in SEQ increases consumer demands and significant freight transports within the region and surrounding areas. Queensland Transport, along with the Queensland department of Main Roads and State Development and Innovation, Port of Brisbane Corporation and Queensland Rail Network Access commissioned a study on input and output freight generation within SEQ [44]. The purpose of the study is to establish if additional inter-modal land transport freight terminals are needed by 2026, and if so, the preferred locations for terminals. The study area for potential terminal sites will be within the area defined by Gympie in the north, Yatala in the south, Miles in the west and Carrington in the south-west. A key output from this study will be a strategy for inter-modal freight facilities for south-east Queensland. Proposed states of the study include:

Stage 1: Completed

Examined and estimated:

- The volume of freight, the types of freight commodities, and the markets for input and output commodities generated by existing and future industry and businesses within the study area.

Stage 2:

Will examine and evaluate the need and preferred locations for additional inter-modal land transport (road-rail) freight terminals within south-east Queensland over the next 25 years.

Stage 2 will examine and estimate:

- Inter-modal contestability in south-east Queensland.
- Inter-modal freight terminal capacity in south-east Queensland.
- Potential future inter-modal freight terminals.
- The need for additional terminals in south-east Queensland (identifying development triggers and preferred locations).

4.9 Issues about road and rail

Freight movements across Queensland are forecasted to double by 2020 and Import and export activities are expected to be mainly generated within the growth region of South East Queensland (SEQ) and along the Australia Trade-Coast area. The ability to easily move freight into and around SEQ will be essential for economic growth. There are challenges in managing of road freight including ensuring road space is shared effectively between heavy vehicles, passenger vehicles and other road users [45,46]. This will have significant impacts on the road and rail transport corridors that service the Australia Trade Coast areas. Freight routes have been identified as priority one and priority two. Priority-one routes facilitate high-volume, business-to-business freight movements. Priority-two routes allow freight to be distributed from distribution centre to retail outlets or warehouses. The Premier and Treasurer announced the South East Queensland Infrastructure Plan and Program 2006-2026 (SEQIPP) on 24 May 2006 revealing investment in the region would grow to $66 Billion over the next twenty years. For the rail network, projects identified in the SEQIPP include additional rollingstock and tracks, new rail corridors and corridor extensions, improvements to existing track infrastructure to increase capacity to meet increase in patronage and freight growth [47,48,49,50]. Figure 24 and Figure 25 show strategic freight networks for South East Queensland.

For rail, there are challenges in improving rail's share of the freight task, particularly for heavy long distance loads, and in managing the demand from rail passengers and freight on a limited number of rail lines in the metropolitan network.

For rail freight key activities include:

- Expanding capacity of the Acacia Ridge rail terminal by grade separating the intersection of the rail line with Beaudesert Road;
- Increase rail capacity through the metropolitan network to the port of Brisbane with signaling upgrades and passing loops. During 2005-06, concept designs are underway
- Increasing capacity on the northern line by duplicating the rail line north of Caboolture; and
- Increasing capacity on the western line by an upgrade from Gowrie to Grandchester.
- Investigation of a Southern infrastructure Corridor between Ebenezer and Yatala, including the critical intersection with the standard gauge rail line is continuing.
- To the south, on completion of Brisbane to Melbourne rail plan, trains would travel from Brisbane to Melbourne without going through the major traffic bottleneck of Sydney.

Northern Bowen Basin rail link
This rail link has now been completed and will facilitate the development of coal deposits within the Northern Bowen Basin by providing an efficient and reliable transport facility linked to Dalrymple Bay and Hay Point terminals near Mackay.

The Bauhinia regional rail network extension
The establishment of the Rolleston coal mine has required an approximately 110km extension of the existing rail network from Blackwater to the new mine site. Construction of the new rail link has now been completed and commercial operations commenced in early

October 2005. Queensland Rail is expecting to haul from the mine up to eight million tonnes of domestic and export coal to Gladstone by 2008.

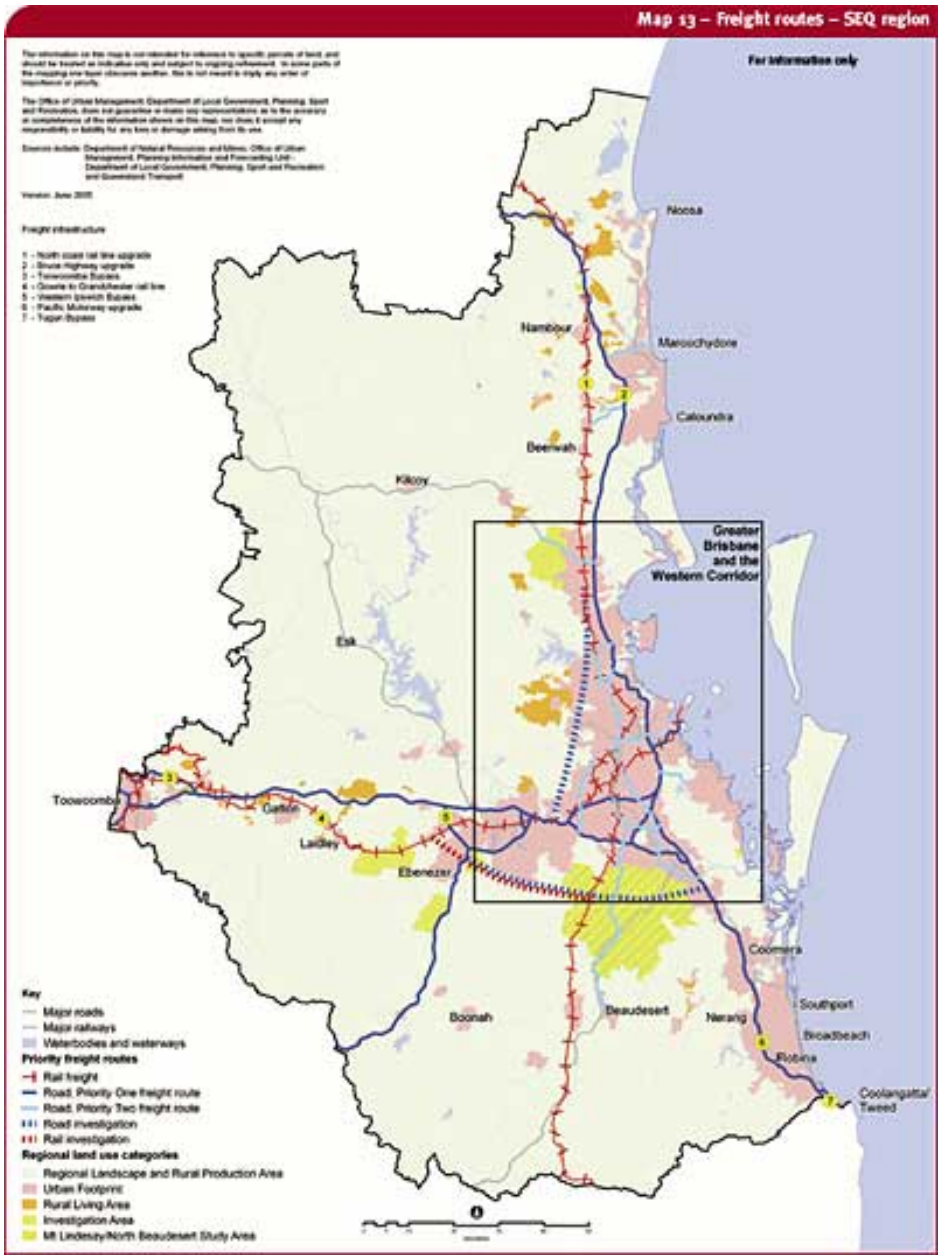

Figure 24 - Freight routes - SEQ region
Source: (Map: http://www.oum.qld.gov.au)

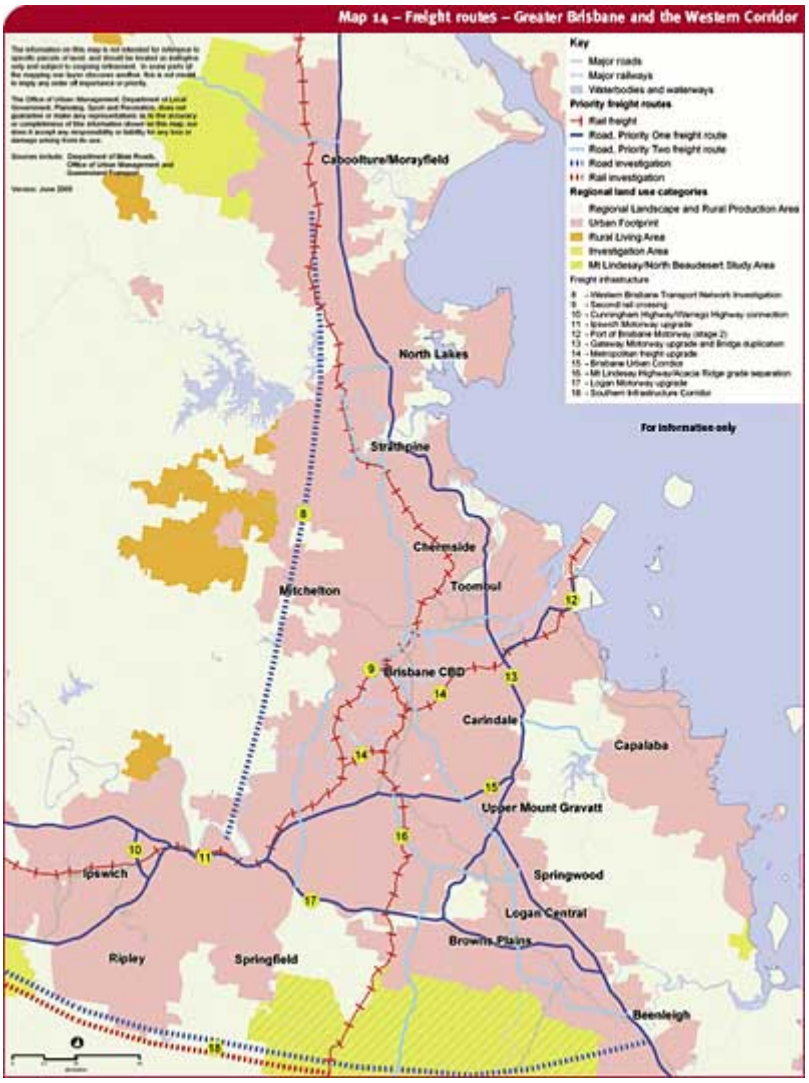

Figure 25 - Freight routes – Greater Brisbane and the Western Corridor
Source: (Map: http://www.oum.qld.gov.au)

Draft Brisbane - Cairns Corridor Strategy
The Australian Government Minister for Transport and Regional Services, Warren Truss, and Queensland Minister for Transport and Main Roads, Paul Lucas, released a draft joint study of transport options and issues for the Brisbane to Cairns corridor for public comment on 15 June 2006.

This study is the first of 24 corridor strategies being developed for the AusLink National

Transport Network, the national transport plan for the principal road and rail system linking capital cities and major population centres. All the strategies will be completed by mid-2007.

Rail corridor direction statements

Rail Corridor Direction Statements provide a vision for the management and ongoing development of the rail network and assist in the achievement of the government's objectives, including those relating to regional development.

Australian Land Transport Network (AusLink)

AusLink is a new approach of investment adopted by the Australian Government. The AusLink Network is an integrated network of land transport corridors of national importance. Key transport corridors of interest to AusLink in SEQ are the:

- Ipswich Motorway
- Bruce Highway
- Brisbane Urban Corridor
- Cunningham Highway
- Port of Brisbane Motorway
- Sydney to Brisbane Railway
- Pacific Motorway/Pacific Highway
- Warrego Highway
- Gateway Motorway and Bridge
- Logan Motorway
- Proposed inland rail freight corridor; and
- North coast rail line.

Queensland Government freight road initiatives

Queensland Government Office of Urban Management has published plans and programs for South East Queensland infrastructure development for the period 2006 to 2026 [41]. Initiative freight road projects include:

- Upgrading the Ipswich Motorway and Cunningham Highway;
- Improving the connection between the Cunningham and Warrego Highways and progressing the second Toowoomba range crossing;
- Improving freight flow around the Australia TradeCoast by duplicating the Gateway Bridge, upgrading the Gateway Motorway and the next stage of the Port of Brisbane Motorway;
- Improving road freight connections to the north and south by building the Tugun Bypass
- Construction is underway on six-laning of the Bruce Highway between Boundary Road and Caboolture.

Investigation of potential transport infrastructure investment

Transport investigations are underway or proposed by the Queensland Government include [41];

- **Ipswich Motorway alternative northern corridor:** The Australian Government has allocated $10 million of AusLink funds for detailed investigation of the alternative northern route between the Warrego Highway and Logan Motorway interchanges.

- **Southern infrastructure corridor:** This investigation examines the options for road and rail linkages for both freight and passenger movement between Ebenezer/Swanbank and the area around Yatala/Ormeau.
- **Gateway Motorway extension south of Browns Plains:** This investigation will examine the need to extend the Gateway Motorway beyond the intersection with the Logan Motorway south to improve road freight connection between emerging industrial areas and the Australian TradeCoast.
- **Sunshine Motorway extension:** This investigation will examine a new link from the Mooloolah River interchange to Kawana Way.

4.10 Current intermodal terminal system in Queensland

This section presents current intermodal terminals in Queensland. Figure 26 shows intermodal terminals located in Queensland [4]. Figure 27 shows intermodal terminals located adjacent to the Port of Brisbane.

4.10.1 Acacia Ridge

Acacia Ridge intermodal terminal is the largest Brisbane rail/road intermodal terminal. It is located 14 km south from Brisbane. The acacia Ridge facility is in two separate terminals:

- A standard-gauge terminal, owned by QR but leased to pacific National
- A narrow-gauge terminal, serving the intrastate network: operated by Queensland Rail National.

The standard-gauge terminal handles the majority of interstate container traffic moved by rail between Brisbane-Sydney and Brisbane-Melbourne (via Sydney). The narrow-gauge terminal handles a large volume of the container freight moving northbound to a ward variety of Queensland Destination. The estimated throughput handled by this terminal is around 380,000 TEU for the combined standard-gauge and narrow-gauge rails.

Table 26 Summary of Acacia Ridge terminal

Office hours	6.00am – 6.00pm (Mon.-Fri.) 6.00am - 2.00pm (Sat.)
Rail Path Length	1,500 m (Standard-gauge) 650m (Narrow-gauge)
Throughput	380,000 TEU
Train services	8 trains daily (Interstate and intrastate via standard-gauge rails) 4 trains per week to Fisherman Islands 71 trains per week (narrow-gauge)

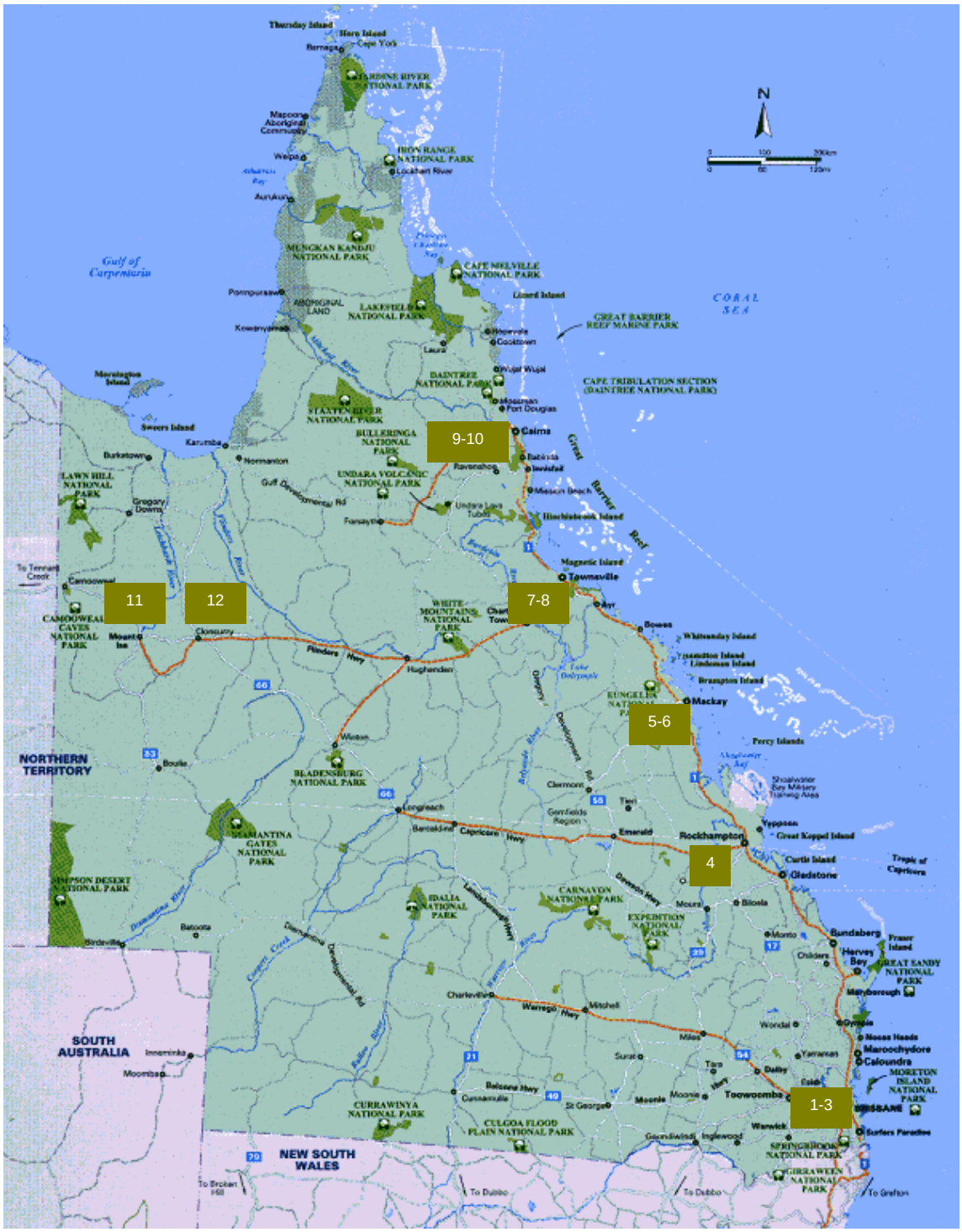

Figure 26 Intermodal Terminals in Queensland
Source: (Map: http://images.google.com.au)

[1] Intermodal terminals at the Port of Brisbane **[2]** Acacia Ridge terminal **[3]** Tennyson terminal **[4]** Rockhampton terminal **[5]** QRX Mackay terminal **[6]** QR Mackay terminal **[7]** QRX Townsville terminal **[8]** QR Townsville terminal **[9]** QRX Cairns terminal **[10]** QR Cairns terminal **[11]** QR Mount Isa terminal **[12]** QR Cloncurry terminal

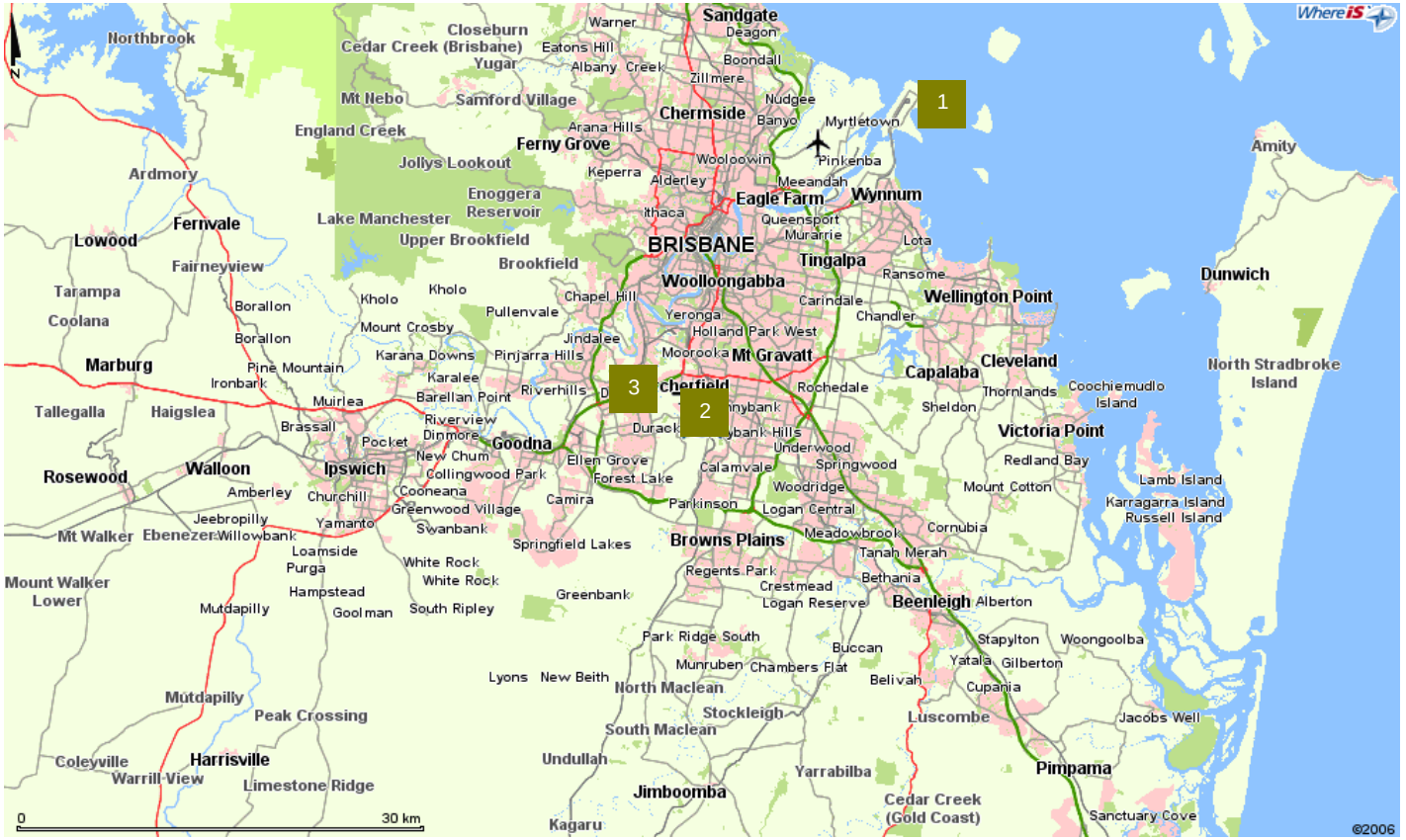

Figure 27 Urban intermodal terminals in Brisbane
Source: (Map: http://www.whereis.com)

[1] Intermodal terminals at Port of Brisbane **[2]** Acacia Ridge terminal **[3]** Tennyson terminal

4.10.2 Brisbane Multimodal Terminal: Port of Brisbane Corporation

The Brisbane multi modal terminal (BMT) is operated by the Port of Brisbane Corporation and is located on Fisherman Island. Total containerised throughput at the terminal is estimated around 100,000 TEU. The terminal is predominately used for the movement of international cargoes with no empty storage or other ancillary services. Recently, business located close to the port have begun trucking containers from nearby industrial sites around the trade coast areas to the terminal for rail onward to North Queensland or inter-state. Consequently, the proportion of domestic cargoes at the terminal has risen in recent years to 20% of total annual throughput. Cotton, meat and containerised grain are the main commodities handled at this terminal.

Table 27 Summary of Brisbane Multimodal Terminal

Office hours	7.00am – 8.00pm (Mon.-Fri.) 8.00am - 12.00pm (Sat.)
Area	27,000 m^2 (Paved area)
Rail Path Length	850 m
Throughput	100,000 TEU
Train services	21 trains per week 44,740 trucks per year

4.10.3 Tennyson: Queensland Rail Express (QRX)

The QRX intermodal terminal at Tennyson is located approximately 10 km south of Brisbane CBD. Total annual throughput by rail is approximately 40,000 TEU. The facility is operated by Pacific National serving a wide range of destination along the Queensland coast.

Table 28 Summary of Tennyson terminal

Office hours	6.00am – 6.00pm (Mon.-Fri.) 6.00am - 2.00pm (Sat.)
Area	32,000 m^2 (Paved area) 10,400 m^2 (Storage)
Rail Path	12 (Total) 8 (loading and unloading)
Rail Path Length	400-500 m
Throughput	40,000 TEU
Train services	18 trains per week
Growth	7%-10%

4.10.4 Cairns: Queensland Rail (QR) National

This terminal is located at Portsmith. The terminal is used principally for forwarding domestic traffic with some import and export volumes. Total annual containerised throughput by rail is around 45,000 TEU. The terminal handles substantial volumes of break-bulk cargoes, with the main commodities being oil, steel, cement and timber. Rail services predominately come from Brisbane and Townsville. The road component of the terminal services includes pick up and delivery to and from surrounding regions. The terminal has an empty container storage facility, however there are no other ancillary services.

Table 29 Summary of Cairns: Queensland Rail (QR) National Terminal

Office hours	6.00am – 8.00pm (Mon.-Fri.) 8.00am - 2.00pm (Sat.)
Throughput	45,000 TEU
Growth	10%-20% over the next 5 years

4.10.5 Cairns: Queensland Rail Express (QRX)

The QRX intermodal terminal at Cairns is located in Jackson Drive, Worree. The annual throughput is estimated 20,000 TEU.

Table 30 Summary of Cairns: Queensland Rail Express (QRX) terminal

Train path length	650 m
Throughput	20,000 TEU
Train services	18 trains per week

4.10.6 Cloncurry: Queensland Rail (QR)

The Cloncurry intermodal terminal is located 100km east of Mount Isa. The terminal is operated by Queensland Rail National. Total annual containerised throughput by rail is around 15,000 TEU. The terminal is used primarily for the importation of inputs for the local minding industry within some general freight movement from Townsville and Mount Isa. The main commodities that are handled at this facility include ammonium nitrate, sulphuric acid, cement and copper cathode. There is an empty containers area, but no other ancillary services.

Table 31 Summary of Cloncurry: Queensland Rail (QR) terminal

Office hours	4.00am – 7.00pm (Mon.-Fri.)
Throughput	15,000 TEU
Growth	10% over the next five years

4.10.7 Mackay: Queensland Rail (QR)

This intermodal terminal is located in the northern region of Queensland approximately half way between Townsville and Rockhampton. Total annual throughput by rail is around 40,000 TEU. The terminal acts as a general freight distribution facility for cargoes from and to Brisbane, Townsville and Cairns.

Table 32 Summary of Mackay: Queensland Rail (QR) terminal

Office hours	6.00am – 10.00pm (Mon.-Fri.)
Throughput	40,000 TEU
Growth	10% over the next five years

4.10.8 Mackay: Queensland Rail Express (QRX)

This intermodal terminal is located half way between Townsville and Rockhampton. The total annual throughput is around 20,000 TEU.

Table 33 Summary of Mackay: Queensland Rail Express (QRX) of terminal

Train Path Length	650m
Throughput	20,000 TEU
Train services	18 trains per week

4.10.9 Mount Isa: Queensland Rail (QR)

This intermodal terminal is located in central west Queensland and is operated by QR. The terminal is used for handling export of mineral ore and metals and well as having a consistent flow of domestic containerised freight into the Northern Territory. Copper anode and lead ingots are the major outbound commodities. Cement, industrial chemicals and grinding balls comprise the majority of inbound commodities. There is an empty containers storage facility but no other ancillary services.

Table 34 Summary of Mount Isa: Queensland Rail (QR) terminal

Office hours	24 hours, 7 days
Throughput	50,000 TEU
Growth	10% over the next 5 years

4.10.10 Rockhampton: Queensland Rail (QR) National

The Rockhampton intermodal terminal is located on the central coast of Queensland and is operated by Queensland Rail National. The facility acts as a domestic freight forward for Queensland Rail. The main commodities handled at the terminal are cement, steel, export meat and magnesia. Total annual containerised throughput is around 50,000 TEU.

Table 35 Summary of Rockhampton: Queensland Rail (QR) terminal

Office hours	5.00am – 7.00pm (Mon.- Fri.) 5.00am – 1.00pm (Sat.)
Throughput	50,000 TEU
Growth	10% over the next 5 years

4.10.11 Townsville: Queensland Rail (QR) National

This intermodal terminal is located in Townsville and acts as an input centre for the local mining industry which is forwarded to Cloncurry, Mount Isa and Brisbane. The main commodities which are handled at the terminal include ammonium nitrate, sulphuric acide, copper cathode, lead and cement. It also handles empty containers storage facility, but not other ancillary services. Annual throughput of the containerised cargo is around 100,000 TEU.

Table 36 Summary of Townsville: Queensland Rail (QR) terminal

Office hours	5.30am – 6.00pm (Mon.-Fri.) 6.00am - 1.00pm (Sat.)
Area	30,700 m^2 (Paved area)
Throughput	100,000 TEU
Growth	20%

4.10.12 Townsville: Queensland Rail Express (QRX) National

QRX also has an intermodal terminal in Townsville. Annual throughput is estimated around 50,000 TEU.

Table 34 Summary of Townsville: Queensland Rail Express (QRX) terminal

Rail Path Length	650m
Throughput	50,000 TEU
Train services	18 trains per week

4.11 Planed Intermodal Terminals

A study was commissioned by Queensland Transport working in partnership with the Departments of State Development and Innovation, Queensland Main Roads, Queensland Rail Network Access and the Port of Brisbane Corporation and conducted by Strategic Design and Development Pty Ltd to provide estimates for current and future freight flow in the South East Queensland region [43].

The initial study concluded that it was expected that the freight task within the South East Queensland (SEQ) region would continue to be dominated by intra-city centre movements, focused on Brisbane and Ipswich and the Gold Coast. The study commented in relation to the rail intermodal terminal at Acacia Ridge and the Brisbane Multi-modal terminal, that it was not necessary true that large facilities would be required to meet the demands of future freight flows. Nor was necessarily a need for additional inter-modal terminals given the relative short distances between points of production and consumption within the SEQ region. It would be more important in the first instance to ensure the efficiency of the intermodal terminal operations both within the terminals and in their inter-face with road transport. However, this study is the starting point for more detailed freight generation and attraction analyses [43].

Queensland Transport also required the study to examine the merit for considering intermodal terminals at four key rural locations, namely Goondiwindi, Miles, Toowoomba city and Gympie. The study area for potential terminal sites will be within the area defined by Gympie in the north, Yatala in the south, Miles in the west and Carrington in the south-west. Figure 28 shows purposed locations for future intermodal terminals [43,44] .

4.12 Environmental and social impacts

Historically, the Moreton Bay was seen as a major asset for commerce and industry. However, the lower port of the Brisbane River and parts of the bay were shallow and this impeded the movement of trading ships. The Queensland Government took the initiative in dredging and modification of the Brisbane River to ensure its suitability of shipping. The natural course of the Brisbane River was altered considerably as a result. The Port of Brisbane Corporation continued major programmes of dredging navigational channels in Moreton Bay and in the Brisbane River— to keep shipping lanes at a safe navigable depth. Dredging and dumping of spoil have been features of seaport activities in Brisbane for nearly 130 years and will continue for years to come [51]. The expansion of the Port of Brisbane at the North of the Fisherman Islands precinct will be another artificial disturbance in Moreton Bay. Mangrove forests and seagrass meadows in this intertidal area have been, and remain, significant to marine and estuarine ecosystems, particularly as roosting habitat for migratory

wading birds and as food sources and nurseries for marine fauna such as dugong, turtles and fish populations. As a result from the expansion of the Port of Brisbane, it is necessary to [51]:

- exploring the environmental impacts of navigational dredging and dumping of spoil;
- assessing the impacts of the proposed Fisherman Islands development on mangrove forests, saltmarsh and seagrass meadows surrounding the FI precinct and linking this with loss of food sources and habitat for marine fauna such as dugong and for bird populations, especially migratory wading birds;
- assessing impacts on fisheries.

Currently, Port of Brisbane Corporation has adopted an integrated management system which brings together environment management system, occupational health, safety systems and engineering change management process. Port of Brisbane Corporation uses environment performance indicators to measure and manage environment performance. These indicators include [52]:

- **Environment Condition Indicators**, which provide information about the condition to assist in better understanding the impacts or potential impacts of port operation.
- **Management Performance Indicators**, which provide information about the management efforts the Port of Brisbane has taken to influence environmental performance of the port's operations.
- **Operational Performance Indicators**, which provide information about the environment performance of the port's operation.

The Port of Brisbane has measured and managed environment performance including;

- **Dragged material and dragging:** aiming to manage contaminated dragged sediment and reduce potentials for operations of the Port of Brisbane to harm marine turtles.
- **Water:** aiming to prevent storm water run-off from port lands from adversely affecting surrounding environment.
- **Waste management:** aiming to maximise opportunity to recycle wastes generation by the Port of Brisbane and prevent potentials for litter on Fisherman Islands to adversely affecting adjacent environment.
- **Landcare:** aiming to improve visual amenity and fauna habitat values for newly developed areas.
- **Flora and fauna:** aiming to minimise effect of port activities on the ecological functioning of adjacent mangrove habitats, to present introduction of exotic or pest plant species by port activities, to present contamination of adjacent wetlands by port activities and to present feral animals from praying on native flora and fauna and or spreading disease.
- **Energy:** aiming to maximise opportunities to become more energy efficient.
- Environmental compliance: aiming to comply with all relevant environmental legislation.
- **Oil spill response:** aiming to respond quickly and effectively to oil spills.
- **Environmental training:** aiming to ensure staff and interested stakeholders having adequate environment knowledge and understanding of the port's Environment Management Program.

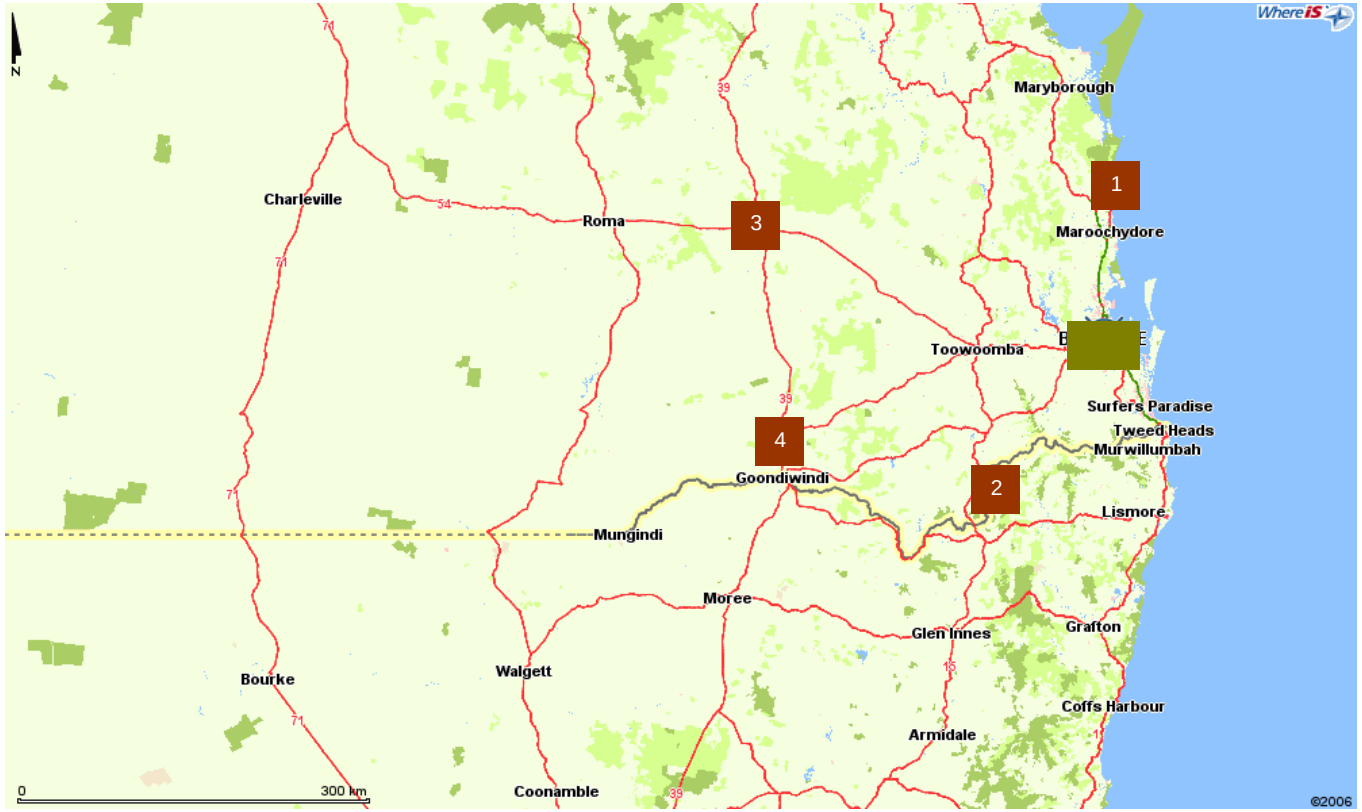

Figure 28 Plan intermodal terminals
Source: (Map: http://www.whereis.com)

[1] Gympie **[2]** Warwick **[3]** Miles **[4]** Carrington Existing terminals

The introduction of a dual freight rail line has raised concern about noise pollution along the Cleveland railway line. The affected residents along the stations including Yeerongpilly, Yeronga, Fairfield, Buranda, Norman Park, Morningside, Cannon Hill, Murarrie, Hemmant and Lindum [53]. Noise barriers have been constructed along the affected railway line.

4.13 Summary

Intermodal terminals

Brisbane has three inner-city freight intermodal terminals which include the intermodal terminals at Acacia Ridge, Tennyson and at the Port of Brisbane. Currently these intermodal terminals handle annual throughput of around 727,000 TEU. It is estimated that containerised cargoes passing through the Port of Brisbane would reach approximately 1,096,000 TEU in 2010/2011 and 2,907,000 TEU in 2024/25. It is unlikely the current capacity of the Port of Brisbane intermodal networks would be able to handle the estimated demand increase. Patrick Corporation has established a semi-automated container terminal at the Port of Brisbane and is expected to have annual capacity of 500,000 TEU to cater for the increased demand. For long-term plan, the Port of Brisbane has reclaimed a 230 hector of land on the Fisherman Islands and planed for future port expansion.

South East Queensland is the most populated region in Queensland, and one of the fastest growing regions in Australia. A study was commissioned by Queensland Transport to assess freight demand and potential locations for freight intermodal terminals. The outcome of the study suggested that freight movement would continue to dominate along Brisbane, Ipswich and Gold Coast corridors. The outcome of the freight demand study will be essential input for further study for future freight intermodal terminals in the SEQ region. The proposed locations for freight intermodal terminals are within the area defined by Gympie in the north, Yatala in the south, Miles in the west and Carrington in the south-west.

Rail access to port

The Port of Brisbane has a dual rail gauge running along the Cleveland railway line to the Port of Brisbane precinct which provides links to north, west and south rail networks. However, outside the dual rail line, the capacity on the Brisbane metropolitan rail network is heavily utilised due to the operation of suburban passenger (Citytrain) services, interstate (XPT) and regional (Traveltrain) passenger services, and freight services accessing major intermodal facilities. Key activities in improving rail fright within the metropolitan areas include;

- Expanding capacity of the Acacia Ridge rail terminal by grade separating the intersection of the rail line with Beaudesert Road;
- Increase rail capacity through the metropolitan network to the port of Brisbane with signaling upgrades and passing loops. During 2005-06, concept designs are underway.

Improving rail freight capacity to enhance Queensland rail freight networks include;

- Increasing capacity on the northern line by duplicating the rail line north of Caboolture; and

- Increasing capacity on the western line by an upgrade from Gowrie to Grandchester;
- Northern Bowen Basin rail link: This rail link has now been completed and will facilitate the development of coal deposits within the Northern Bowen Basin by providing an efficient and reliable transport facility linked to Dalrymple Bay and Hay Point terminals near Mackay;
- The Bauhinia regional rail network extension; The establishment of the Rolleston coal mine has required an approximately 110km extension of the existing rail network from Blackwater to the new mine site. Construction of the new rail link has now been completed.
- Draft Brisbane - Cairns Corridor Strategy; The Australian Government Minister for Transport and Regional Services, Warren Truss, and Queensland Minister for Transport and Main Roads, Paul Lucas, released a draft joint study of transport options and issues for the Brisbane to Cairns corridor for public comment on 15 June 2006.
  Investigation of a Southern infrastructure Corridor between Ebenezer and Yatala;
- To the south, on completion of Brisbane to Melbourne rail plan, trains would travel from Brisbane to Melbourne without going through the major traffic bottleneck of Sydney;

Road

The Port of Brisbane has direct road access connecting to the north, south and west which include:

- The Pacific links the port to Sydney.
- The Bruce Highway links the port to Queensland's regional cities and their vast mining and agricultural industries.
- The Port of Brisbane Motorway links to the Gateway Motorway and connects to the Ipswich and Loan Motorways.
- The Warrego, Moonie and Cunningham Highlights linked to the Ipswich and Gateway Motorways and to Queensland's rural areas.

Improvements are underway to enhance freight movements. These projects are as follows:

- Upgrading the Ipswich Motorway and Cunningham Highway;
- Improving the connection between the Cunningham and Warrego Highways and progressing the second Toowoomba range crossing;
- duplicating the Gateway Bridge, upgrading the Gateway Motorway
- Improving road freight connections to the north and south by building the Tugun Bypass
- Constructing six lanes of the Bruce Highway between Boundary Road and Caboolture.

Investigations are underway for improving freight transport. These investigation projects are as follows:

- Ipswich Motorway alternative northern corridor
- Southern infrastructure corridor
- Gateway Motorway extension south of Browns Plains

- Sunshine Motorway extension

5 Comparison of port intermodal systems for Melbourne, Sydney and Brisbane ports

Currently, there are contrasts in freight intermodal terminal network systems for the Ports of Melbourne, Sydney and Brisbane. The States of New South Wales and Queensland have clearly identified regions for major economic growths. In New South Wales, regions for major economic growth include Central West Sydney and Western Sydney. The region for major economic growth in Queensland is the South East Queensland. In both states, freight intermodal terminals are located and being developed in these areas of economic growth. In New South Wales, 90 per cent of the cargo servicing by Port of Botany is destined or originated within 40 kilometres from the port, thus existing freight intermodal terminals and intermodal terminals to be developed in future are and will be located within these areas of economic development. In Queensland, there are three locations that freight intermodal terminals are situated namely; Acacia Ridge, Tennyson and the Port of Brisbane to service freight cargoes in Brisbane and surrounding major growth areas. There are no other freight intermodal terminals in the areas of growth or surrounding metropolitan Brisbane. A study is being conducted to identify the need for freight intermodal terminals in the major economic growth in South East Queensland.

In Victoria, freight intermodal terminals are being developed toward hierarchical systems where freight intermodal terminals located at the Port of Melbourne and adjacent to the port are being developed to be super-hub terminals. Most of interstate cargoes including Western Australian, South Australia, New South Wales and Queensland use the Port of Melbourne for import and export. The super hub terminals at the Port of Melbourne and adjacent to the port provide freight services in the greater metropolitan Melbourne, regional areas and interstates. Freight intermodal terminals also are located away from the metropolitan Melbourne to service interstate freight cargoes. Both Queensland and New South Wales have freight intermodal terminals to service interstate cargoes, however most interstate cargoes are not for export. In Victoria, Victoria Government announced in its publication '*Melbourne 2030'* that the Victoria Government is to manage growth to ensure sustainability for all urban and rural areas. Melbourne will grow substantially over the next 30 years. Melbourne is planning the capacity to absorb comfortably estimated of 620,000 extra households over that time while protecting and enhancing existing suburbs.

Figure 29 shows freight intermodal terminals, road and rail systems for freight transport in Melbourne. In contrast, there are fewer freight intermodal terminals in Melbourne metropolitan areas than in Sydney metropolitan areas. As mentioned, fright intermodal terminals in Melbourne are to be developed toward super hub terminals. Whilst in Sydney, there are many freight intermodal terminals located along the fringe of Sydney CBD mainly to distribute and receive freight cargoes within 40 kilometres from Port of Botany. Figure 30 shows freight intermodal terminals, road and rail freight systems in Sydney. In Brisbane, there are fewer freight intermodal terminals in Brisbane metropolitan areas. Acacia Ridge intermodal terminal acts as the interstate freight hub and distributing centre of cargoes. A study is being conducted to assess locations of freight intermodal terminals as distributing freight terminals in the major economic growth in the South East Queensland. Figure 31 shows freight intermodal terminals, road and rail for freight transport in Brisbane.

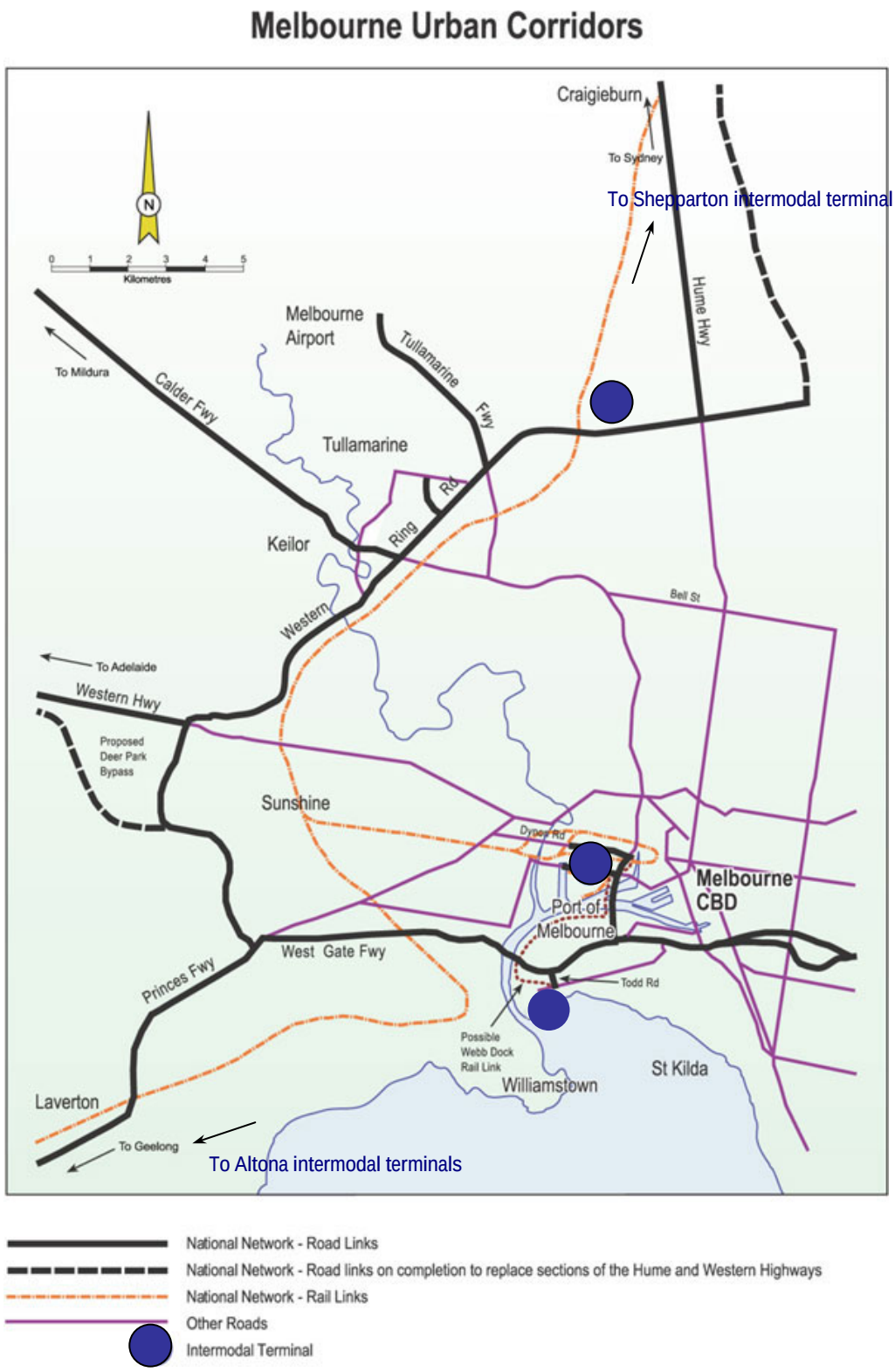

Figure 29 Freight intermodal terminals, road and rail links for urban Melbourne
Source: (Map: http://www.auslink.gov.au/whatis/network/index.aspx)

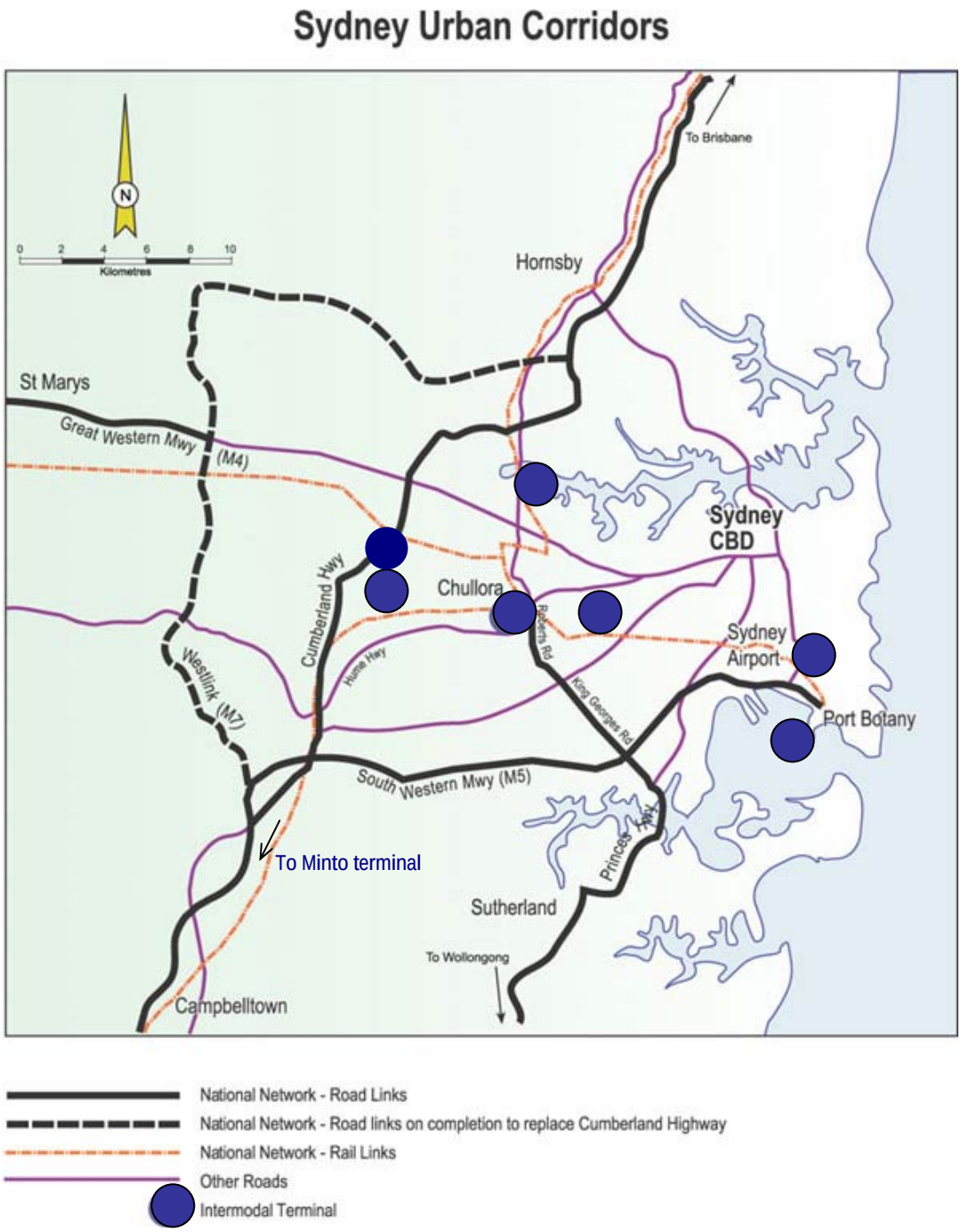

Figure 30 Freight intermodal terminals, road and rail links for urban Sydney
Source: (Map: http://www.auslink.gov.au/whatis/network/index.aspx)

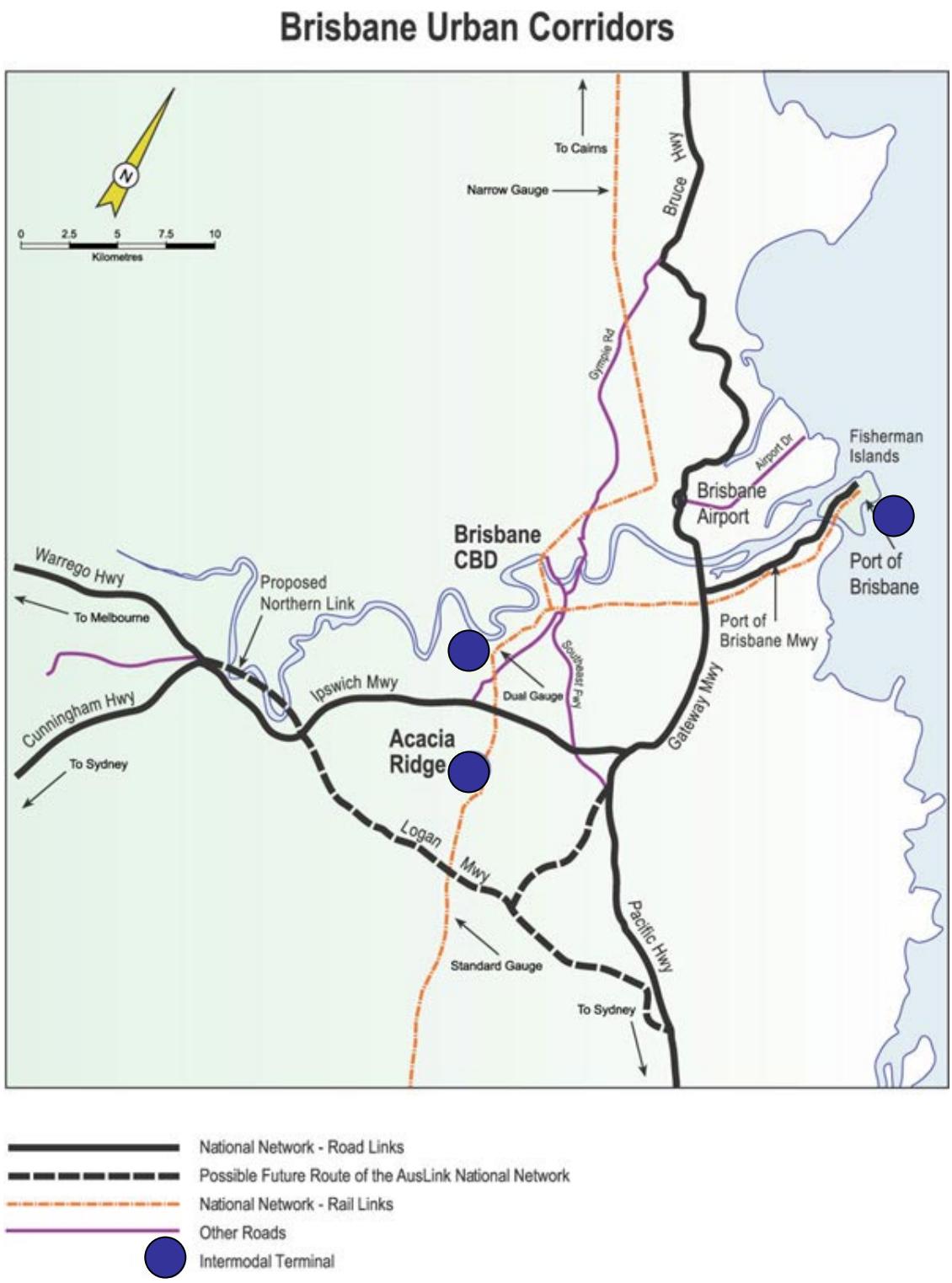

Figure 31 Freight intermodal terminals, road and rail links for urban Brisbane
Source: (Map: http://www.auslink.gov.au/whatis/network/index.aspx)

Table 34 compares current and future supply and demand for freight intermodal terminals, accessibility and other important parameters for fright intermodal networks for the Ports of Melbourne, Sydney and Brisbane. Parameters for comparison include;

- Current and future demand (TEU)
- No. of containerised intermodal terminals at ports
- Capacity of containerised intermodal terminals at ports (TEU)
- No. of containerised intermodal terminals close to city areas
- Capacity of containerised intermodal terminals close to city areas (TEU)
- No. of containerised intermodal terminals in regional areas
- Capacity of containerised intermodal terminals in regional areas (TEU)
- Channel Depth (m)
- Rail freight transport (%)
- Rail accessibility issues (road and rail crossing)
- Rail accessibility to ports
- Major Gateway Links to ports
- Regions of growth
- Freight intermodal system
- Regional freight terminals

Port of Melbourne handles the largest containerised cargoes in the country and Port of Botany is ranked second. Brisbane is the third largest containerised port in the country. The Port of Melbourne and Port of Botany have their plans in place in developing freight intermodal terminal networks to handle the increase in demand of freight until 2025. In Queensland, Queensland Transport commissioned a study to determine appropriate locations of freight intermodal terminals in the fastest growing region of South East Queensland. The study is in early stage. The study on input and output of freight generation within the South East Queensland region has been completed. Currently, freight cargoes in Brisbane and surrounding areas handled by freight intermodal terminals at Acacia Ridge, Tennyson and Port of Brisbane. Current throughput handled by the Port of Brisbane is around 0.726 million TEU in 2004/05. In 2012/13, containerised cargoes estimated to be handled by the Port of Brisbane will reach the amount that currently handled by Port of Botany which will exceed 1.3 million TEU, and in 2018/19 it is estimated that the Port of Brisbane will handle containerised cargoes as of the Port of Melbourne currently handles. Patrick has developed a semi-automated container terminal at the Port of Brisbane and is expected to have annual capacity of 500,000 TEU which is expected that the Port of Brisbane will be able to handle containerised cargoes until 2011/12. The Port of Brisbane has reclaimed a 230 hector of land on the Fisherman Islands for further development of berth facilities, containerised terminals and other port facilities for longer plan.

Melbourne uses freight intermodal terminals adjacent to the Port of Melbourne to distribute freight cargoes to metropolitan Melbourne and surrounding areas, whiles Sydney uses a small number of freight intermodal terminals located along the fringe of the CBD Sydney to distribute and receive cargoes for the growing areas of Central West, Western Sydney and South West Sydney. Brisbane uses primary Acacia Ridge terminal to distribute and receive cargoes for distribution for metropolitan Brisbane and surrounding areas.

Brisbane has dual rail link to the Port of Brisbane and connected to the south, west and north rail networks. The Port of Botany in Sydney has a good rail way line to distribute goods within CBD Sydney and dedicated freight rail links to the south rail way line and branched off north

to Newcastle and Brisbane. Melbourne has a good railway line connect to Sydney and Brisbane and to Adelaide and Western Australia via Geelong.

Port of Melbourne has a rail access issue at rail and road crossing on Footscray Road. Priority is given to the road users. The Australian Government has allocated $110 million under the AusLink program to improve rail access to the Port of Melbourne. The Port of Botany in Sydney has a rail access issue at the rail and road crossing on General Holmes Drive. The Freight Infrastructure Advisory Board recommended vehicular closing at General Holmes Drive without delay and the NSW Government plan and construct a new road link under the rail line in the vicinity of Wentworth Avenue. To facilitate rail freight transport, the Advisory Board further recommended the Rail Track Corporation take control of the Sydney Freight network as soon as possible as a single entity to manage the freight rail networks in NSW. The Port of Brisbane has a dual rail link, however rail freight transport faces congestion during peak hours in the metropolitan rail networks. Plans for improve rail links within the metropolitan Brisbane include grade separation at the intersection of the rail lines to expand capacity at Acacia Ridge rail terminal, increase signalling and passing loops within the metropolitan network to the Port of Brisbane.

The Port of Melbourne is currently improving road links within the port precinct to allow road access and rail links to be integrated and easy access of road to the West Gate Freeway. For road freight transport for the Port of Botany in Sydney, the missing parts of the orbital network are now under development including the Lane Cove Tunnel, Crossing City Tunnel and Westlink M7. For road freight transport connecting to the Port of Brisbane, investigations are underway or being proposed including Ipswich Motorway alternative northern corridor, Southern Infrastructure corridor, Gateway Motorway extension south of Browns Plains and Sunshine Motorway extension.

Environment and social impacts as a result from port expansion and intermodal terminal development include;

- Dragging of sea floors to deepen shipping channels alters the original ecological system and can cause damage to sea reef and local ecological system.
- Port expansion would impact on the habitat of native flora, fauna, birds, frogs and so forth.
- Impact on demand of heavy vehicles using the same roads as motorists and increase congestion, pollution and compromise motorist safety.
- Impact road access to local business. The increase in numbers of trucks can discourage residents from using shops and local services.
- Impact on local business, businesses may depend on access and on-street parking for their customers, heavy vehicle traffic and may inevitably be a demand for on-street parking to be abolished which will affect local businesses.
- Hours of operation which impact on general loss of amenity due to 24 hour operation
- Heritage buildings
- Noise, vibration and air quality due to road traffics
- Site contamination
- Increase in rail transport movement and rail transport noise
- Visual impacts and landscape
- Hydrology, stormwater and drainage
- Land use

Table 34 Comparison of freight intermodal terminal issues for Melbourne, Sydney and Brisbane Ports

Parameters Considered	Current Year (2004/05)			Forecast for 2024/25		
	Melbourne	Sydney	Brisbane	Melbourne	Sydney	Brisbane
Demand TEU (million)	1.910	1.376	0.726	4.971	3.625	3.047
No. Containerised Intermodal terminals at Ports	2	2	3	+2	+1	+1
Capacity of containerised intermodal terminals at Ports (TEU million)	0.864	0.23	0.15	5.0-8.0	3.0	Information not found
No. of containerised intermodal terminals close to city areas	5	7	2	+1	+5	Being studied
Capacity of containerised intermodal terminals close to city areas (TEU million	1.017	0.88	0.42	Information not found	1.054	Being studied
No. of containerised intermodal terminals in regional areas	2	5	9	3	1	Being studied

Table 34 Comparison of freight intermodal terminal issues for Melbourne, Sydney and Brisbane Ports (cont.)

Parameters Considered	Current Year (2004/05)			Forecast for 2024/25		
	Melbourne	Sydney	Brisbane	Melbourne	Sydney	Brisbane
Capacity of containerised intermodal terminals in regional areas (TEU million)	0.039	0.19	0.39	Information not yet found	Information not yet found	Being studied
Channel Depth (m)	9.0m Proposed deepening	Deep	14.0m	No action mentioned	No action mentioned	No action mentioned
Rail freight transport (%)	18%	19.5%	13%	30%	40%	Information not found
Rail accessibility issues	Road and rail crossing at Footscray road	Road and rail crossing at General Holmes Drive	Non	-	-	-
Rail accessibility to ports	Single dual gauge rail track to port	Dedicated freight line	Dual standard rail track to port	A$110 million Dynon/Port rail link project	Southern dedicated freight rail project	Grade separation at Acacia Ridge & passing loop through metropolitan network

Table 34 Comparison of freight intermodal terminal issues for Melbourne, Sydney and Brisbane Ports (cont.)

Parameters Considered	Current Year (2004/05)			Forecast for 2024/25		
	Melbourne	Sydney	Brisbane	Melbourne	Sydney	Brisbane
Major Gateway Links	West Gate Freeway	M5 Motorway	Gateway Motorway	Multiple road projects (see section 2.7 for details)	Completion of Orbital network of motorways, Lane Cove and Cross city tunnels	Duplicate Gateway Bridge & multiple road projects (see section 4.9 for details)
Regions of growth	Victoria Government (in Melbourne 2030) is to manage growth to ensure sustainability for all urban and rural areas	Central West and Western Sydney	South East Queensland	Victoria Government (in Melbourne 2030) is to manage growth to ensure sustainability for all urban and rural areas	Central West and Western Sydney	South East Queensland
Freight intermodal system	Super hubs at ports and close to ports, freight terminals in outer urban and regional areas	Intermodal terminals at port and many freight terminals in growth areas	Intermodal terminals at port and two freight terminals in metropolitan Brisbane	Hierarchical systems with super hubs close to ports, secondary super hubs in metropolitan fringe, regional hubs and regional terminals	Super hubs at port and many freight terminals in growth areas	Intermodal terminals at port, freight terminals in metropolitan Brisbane and proposed development of freight terminals in South East Queensland region

Table 34 Comparison of freight intermodal terminal issues for Melbourne, Sydney and Brisbane Ports (cont.)

Parameters Considered	Current Year (2004/05)			Forecast for 2024/25		
	Melbourne	Sydney	Brisbane	Melbourne	Sydney	Brisbane
Regional freight terminals	There are a number of regional terminals handle regional produces for export and distributing goods	There are a number of regional terminals handle regional produces for export and distributing goods	There are a number of regional terminals handle regional produces for export and distributing goods	Develop regional hubs at Wodonga, Merbein, Shepparton and Ballarat	Develop large- scale transport, warehousing, manufacturing and storage of freight at Parkes, NSW	Develop freight intermodal terminals at South East Queensland region

6 Recommendation

It is clearly evident that there are two instinct freight intermodal terminal systems for the Port of Melbourne and Port of Botany in Sydney.

In Victoria, freight intermodal terminal system is being developed toward hieratical system where there are super hub terminals located at the ports and adjacent to ports; secondary super hub terminals located a long the fringe of the metropolitan Melbourne acting as freight suppliers to domestic and regional areas or proprietary to freight forwarders or shipping line operators; regional intermodal hubs acting as freight consolidators and mix of domestic and international freight cargo movement; and regional intermodal terminals suppling freights to regional intermodal hubs.

In NSW, Freight cargoes are moved from the Port of Botany to a number of small freight intermodal terminals located along the fringe of CBD Sydney to distribute and receive freight cargoes within 40 km from the Port of Botany. However, the Port of Sydney Corporation is developing a super intermodal terminal at the Port of Botany adding the capacity to the Port of Botany of more than 3 million TEU per annum. Additional intermodal terminals are planed to be located along the fringe of Sydney CBD at Enfield, Moorebank, Ingleburn, Eastern Creek and extension of Minto terminal. The combined throughput of these planned freight intermodal terminals is estimated more than one million TEU. There are a couple of freight intermodal terminals, namely Belfield and Chullora terminals located in the outskirt of Sydney CBD to service interstate cargoes. There are four regional intermodal terminals in NSW to receive local produces for export and act as distribution centres for regional areas.

In Queensland, there are three main freight intermodal terminals located adjacent to at the Port of Brisbane that handle domestic, interstate and freight distribution within metropolitan Brisbane and surrounding areas. Most intermodal terminals are located in major regional town including Cairns, Townsville, Mackay, Rockhampton, Cloncurry and Mount Isa acting as regional freight distributors and receive local mineral products such as coal, steel, cement, etc. for export.

Ports of Brisbane, Melbourne and Sydney are developing super hub terminals within the port precincts which will contribute to congestion for road and rail movement and concentration of freight cargoes within the ports. Port of Melbourne is being planed to increase containerised cargo terminals from approximately 1 million TEU to 5-8 millions TEU for the next 20 years. Port of Botany is planning to increase the container cargo terminals from approximately 1 million TEU to 3 million for the same period. Port of Brisbane is currently reclaimed 270 hectare of land for future berth and cargo terminal expansions within the port precinct. These port expansions will affect logistic operation within the port areas. To ensure efficient logistic operation in the port precinct, framework for logistic operation within the port should be developed for major ports. Currently, major ports in Australia handles different amount of cargoes and being developed in different stages. For instance, in 2012/13, estimated containerised throughput at the Port of Brisbane will reach the same amount as of the current containerised throughput at the Port of Botany and in 2018/19 will reach the amount of the current containerised throughput at the Port of Melbourne. Port of Melbourne has more advances in servicing freight cargoes than the Port of Brisbane and Sydney. It is recommended research studies using Port of Brisbane as a case study to

- Develop decision framework for logistic operation within the port precinct for future port operation.
- Compare risk-based scenarios when containerised throughputs at the Port of Brisbane reach the current capacities of the Port of Botany and Port of Melbourne.
- Assess strength and weakness of the freight intermodal systems for Port of Melbourne and Port of Botany when compared with the freight intermodal terminal systems for the Port of Brisbane;
- Using the risk-based scenarios to develop appropriate intermodal terminal system for the Port of Brisbane;
- Using the risk-based comparison to develop framework for freight intermodal terminal system for Australia wide.

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