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Sydney Ports Corporation

Traffic and Landside Transport Study for Proposed Port Botany Expansion

Final Report

NOVEMBER 2002

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Traffic and Landside Transport Study for Proposed Port Botany Expansion

Final Report

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Executive Summary

1 Introduction

Sydney Ports Corporation (SPC) is proposing to expand the port facilities at Port Botany by creating a new container terminal, in order to meet predicted growth in container trade.

SPC is currently preparing an Environmental Impact Statement for the proposal and has engaged Maunsell Australia to provide an assessment of the traffic and (landside) transport impacts (excluding environmental impacts, which will be undertaken by others) of the expanded port.

2 Proposed Port Expansion

Trade forecasts suggest that volumes through the Port Botany container terminals are expected to triple over the next 20 years. Container traffic at Port Botany is forecast to grow from 877,000 TEUs in 2000-01 to 3.2 million in 2025. Given the forecast growth rates, the existing container terminals are likely to reach capacity by 2010. This growth will cause a significant increase in the landside transport task.

SPC's goal to expand Port Botany is set out in its strategic plan, *First Port…Future Port.* From a traffic and transport perspective the main features of the proposed new terminal are:

- new road and rail infrastructure;
- construction of a new access point onto Foreshore Road for truck traffic to/from the new terminal; and
- relocation of the existing public boat ramp, which is likely to involve the construction of an additional intersection onto Foreshore Road.

There are additional port related developments in the area, the traffic and transport impacts of which need to be considered in conjunction with the impacts of the proposed new terminal.

The SPC strategic plan also sets out strategies to improve rail's mode share and truck efficiency. Rail mode share is expected to grow from 25% currently to 30% in 2006 and 40% by 2011. In order to achieve the target rail mode share of a minimum of 40%, there will need to be a significant increase in the amount of metropolitan freight that travels by rail.

Transport efficiency is expected to increase with:

- backloading of trucks increasing from 8% of truck calls in 2001 to 23% by 2021;
- road working hours increasing from 16 hours per day, 5 ½ days per week currently to 7 days per week, 24 hours per day; and
- rail working hours increasing from 5 ½ days per week (24 hours per day) currently to 7 days per week (24 hours per day).

3 Existing Conditions

Road

Port Botany is reasonably well serviced by road infrastructure, but some routes, particularly sections of Botany Road, are not best suited to heavy truck traffic due to conflict with other traffic such as pedestrians and local amenity issues.

The area includes several roads that provide a major arterial function, with Foreshore Road, Botany Road, Wentworth Avenue, Beauchamp Road and Bunnerong Road all carrying more than 15,000 vehicles on average per weekday. The busier intersections in the area include:

- Millpond Road/Botany Road/Southern Cross Drive;
- General Holmes Drive/Foreshore Road;
- Southern Cross Drive/Wentworth Avenue;
- Botany Road/Foreshore Road/Penrhyn Road;
- Botany Road/Beauchamp Road; and
- Joyce Drive/O'Riordan Street.

Container truck volumes are concentrated on Foreshore and Botany Roads, with "high volume" intersections including General Holmes Drive/Foreshore Road, Botany Road/Beauchamp Road, Botany Road/Bumborah Point Road, Botany Road/Penrhyn Road/Foreshore Road and to a lesser extent Botany Road/Stephen Road.

Heavy vehicle traffic levels are fairly constant during business hours, but light vehicle traffic tends to peak in the mornings and afternoon.

The intersections along the Foreshore Road – Botany Road route currently provide a good level of service, with minor vehicle delays and considerable spare capacity.

Key issues of concern for stakeholders are the perception that the road network is already operating at capacity, the need to increase rail's mode share, and the intrusive effects of truck traffic on local communities.

Rail

Rail freight currently accounts for 25% of all container movements in and out of Port Botany.

With regards to the port container terminals, the longest siding at the Patrick terminal is 600m while at P&O it is around 350m. Despite the longer siding at Patrick, the length of trains is often limited by siding lengths at origin/destination or by the smaller of the two-container terminals capacity.

The port is serviced by a dedicated rail link that connects the port with the Cooks River intermodal terminal and Enfield marshalling yard. The line is duplicated between Enfield and Cooks River, and there are plans to further extend the duplication. Beyond Enfield, priority is given to passenger trains on the shared lines, which represents a significant constraint for rail freight efficiency.

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On a typical day Patrick generates around 800 truck visits, while P&O generates around 600. The evening hours are under-utilised in term of truck servicing, with most truck trips generally occurring during normal business hours. Around 8% of daily visits occur during the AM Peak and 4% during the PM Peak.

The P&O terminal currently generates 7 train visits per day and Patrick around 6 train visits per day. In addition, P&O Trans Australia attracts on average 2 train visits per day but in the cotton season this increases to around 4 per day.

4 Transport Demand

Freight Origins and Destinations

Around 85% of Port Botany throughput will continue to have an origin/destination within 40km of Port Botany, however the distribution within the area will change.

Freight volumes between Port Botany and the local Botany area will be constrained by the finite amount of land that is available for new development, and will decrease from around 20% of total port throughput currently to around 15% in 2021, although volumes will continue to grow in absolute terms.

The western and south western areas of Sydney will increase in importance, attracting around 65% of port throughput by 2021. Around 40% of this cargo would travel by rail from Port Botany to metropolitan intermodal terminals.

Road Volumes

Assuming that the new terminal will attract a 40% share of total port throughput, total truck visits in the AM and PM peak hours are as shown below.

	Current Situation	2011			2016			2021		
		New Terminal	Existing Facilities	Total	New Terminal	Existing Facilities	Total	New Terminal	Existing Facilities	Total
AM Peak	120	39	89	128	63	95	158	75	113	188
PM Peak	55	18	41	59	29	43	72	47	70	117

1) assumes the new terminal has a market share of 40% by 2021; and
2) One truck "visit" generates two truck "trips" (an inbound trip and an outbound trip).

Truck volumes would be concentrated on Foreshore, Botany, Bumborah Point and Penrhyn Roads. In general, the increase in port traffic is expected to have a negligible effect on the performance of roads at a subregional level, as port trucks make up a small proportion of total traffic outside the local Botany area.

Notwithstanding the future constraints on land availability, the Botany area is expected to remain a significant generator for port related road freight. Several new container freight station (CFS) developments are planned within the City of Botany Bay area in the near future.

Rail Volumes

Assuming that the new terminal will attract a 40% share of total port throughput, the forecast number of train visits per day is as shown below. The number of train trips to and from Port Botany is also shown, recognising that each train visit represents two train movements.

Terminal	Existing	2006	2011	2016	2021
Patrick	6*	9	11	12	14
P&O	7	11	11	15	17
New Terminal	0	0	9	16	18
P&O Trans	2	3	4	4	5
Total Train Visits	15	23	35	47	54
Total Train Trips	**30**	**46**	**70**	**94**	**108**

* Currently the Patrick terminal handles trains of differing lengths. The number shown above is based on a standard train length that is used in the future forecasting model (refer **Appendix H**).

The forecast train volumes assume that all terminals will operate for a minimum of 6 days per week after the year 2011.

In order to cater for the forecast growth in rail traffic, new intermodal terminal(s) with sufficient rail access to Port Botany would be required in the Sydney Metropolitan area. It is estimated that by 2021, new intermodal terminal(s) would generate 11 train visits per day, representing 20% of the total train visits to Port Botany. The remaining 80% would be split evenly between rural areas and the six existing metropolitan intermodal terminals.

5 Transport Network Performance Assessment

Road

The analyses of road based traffic impacts has been undertaken on the basis of a mode share between rail and road of 20% and 80% respectively (refer **Section 5.1.6**). That is, the analysis assumes a worst case (and an unlikely case) scenario whereby only 20% of port related freight is transported by rail, the remainder being transported by road. Whilst this conservative approach is not uncommon in traffic engineering and transport planning investigations of this type, care must be taken in interpreting the outputs of the analyses, particularly the intersection analyses which paint a picture worse than that which will actually be the case in future years. For the reasons outlined in this report, a future rail mode share of at least 40% is anticipated, with consequent negligible road based traffic impacts over time. (Rail freight currently accounts for 25% of all container movements in and out of Port Botany). In the unlikely event a rail mode share of 40% is not achieved over time, the analysis demonstrates that the traffic impacts of an expanded port will not be adverse and will be manageable.

Rail

The impacts on the rail system of achieving a 40% mode share are:

- the unduplicated section of the dedicated freight line (between Cooks River and the Port Botany container terminals) would need to be duplicated prior to 2016;

- the Patrick and new Port Botany container terminal would have sufficient capacity to 2021. However, the P&O terminal would be operating at capacity due to its shorter siding lengths;
- shunting on the main line at Cooks River will constrain the efficient operation of the dedicated freight line by 2016;
- Botany Yard has sufficient siding lengths and capacity to process future train volumes to 2021;
- demand for the Camellia and Cooks River terminals would exceed capacity by 2016, and demand for the Yennora terminal would exceed capacity by 2021; and
- there would be some effect on rural operations, assuming that train lengths will be increased to 900m by 2021.

The impacts assume no upgrading works are undertaken. The proposed system requirements (improvements) to accommodate growth are summarised in "6" below.

Cumulative Transport Impacts
Based on the analysis of preliminary data on future traffic generation, the broader transport implications of the combined developments outlined in **Section 2.4** are:

1 based on existing trends peak demand for the road network in the Mascot area will exceed capacity by 2011, and a deterioration in the level of service is probable;

2 the State Government is addressing this through a road development program and through demand management. (Action for Transport and Draft Statement Environmental Planning Policy No 66);

3 notwithstanding this, some adjustment of peak travel demands through peak spreading is likely to take place;

4 the Airport Rail Link is likely to play an increased role in serving the passenger transport needs of the area;

5 Port Botany traffic represents only a small proportion (approximately 1%) of forecast peak traffic volumes; and

6 the achievement of SPC's objective of a rail mode share of 40% (for freight transport) will attenuate the impact of port related traffic on the road system.

The forecast deterioration in the road system's level of service is not caused by the new terminal, as port traffic represents a very minor proportion of total traffic. Most of the increased traffic is caused by private vehicle travel associated with the Airport, Green Square and general background traffic growth.

The capacity constraints on the road network, although not caused by port traffic, would impact on the efficiency of road-based transport to and from the port. This in turn will promote rail transport of cargo.

Executive Summary

6 System Requirements

Road
A mode share scenario of 40% by rail and the maximum market share for the Patrick terminal of 50% in 2011 and 40% from 2016, would see the Foreshore Road/Botany Road/Penrhyn Road intersection operate at an acceptable level of service.

No intersection upgrades would be required till some time after 2016, and duplicating the right turn from Botany Road (south) into Botany Road (north) may be necessary if the rail mode share was restricted to 20%.

Rail
Duplication of the dedicated freight line between Cooks River and Botany Yard would be required prior to 2016 to accommodate future volumes of 94 – 108 train paths per day.

Increasing the length of the sidings at P&O to 600m would increase capacity at the port, however it would not negate the need to duplicate the dedicated freight line.

Rail operations could also be improved by building trains at the intermodal terminals that are destined for only one port terminal (i.e. no splitting).

It may be appropriate to increase the number of staff undertaking inspections of wagons in Botany Yard in order to cater for future demand.

Cooks River intermodal terminal would need to operate 400-450m trains in order to accommodate future demand. This would however exacerbate the problem of using the main line as a shunting neck.

The forecast capacity problems at Camellia and Yennora could be addressed by increasing siding length, increasing terminal capacity and improving the efficiency of container handling operations. Upgrading of the intermodal terminals would be a commercial decision to be taken by the terminal operators.

Capacity on the metropolitan shared network, particularly the main western line may need to be improved by:

- increasing intermodal terminal capacity and/or developing additional new intermodal terminals in the metropolitan area;
- increasing train lengths from the intermodal terminals outside the dedicated freight network;
- reducing headways (through signalling changes); and
- providing more dedicated lines for freight.

Passing loops in the rural area may need to be upgraded to allow for 900m trains.

If detailed train operational planning cannot mitigate the effect of shunting on the main line at Cooks River through timetabling, then a new shunting neck would need to be constructed by 2021.

7 Reducing Private Car Travel

The current transport context in the port precinct is dominated by high levels of car use and a network of major arterial roads that surround the study area. This pattern is exacerbated by the precincts lengthy bus travel times and a pedestrian and cyclist network that in most locations is inadequate.

There are some opportunities for reducing car dependency as part of the port expansion. These opportunities are however limited and the greatest opportunities for change rest with State and Local governments. It is recognised that there are likely to be difficulties in achieving improved public transport outcomes in the relatively remote locations of the port facilities.

8 Conclusions

Road and Rail Traffic and Network Improvements

Table E.1 summarises the forecast truck and train trips per day, and the associated infrastructure requirements to meet future transport demand. The figures in the tables assume that:

- rail mode share increases in line with SPCs strategy from 25% currently to 30% in 2006 and 40% from 2011; and
- the new terminal captures a market share of 30% of total port throughput by 2011 and 40% in 2016 and 2021.

The following points are highlighted:

- the forecast train volumes assume that there will be new intermodal terminal(s) with sufficient network access connecting to the port terminals;
- the dedicated freight line between Cooks River and the Port Botany container terminals would need to be duplicated by 2016;
- Cooks River intermodal terminal would need to operate 400m – 450m trains in order to accommodate future demand. This would however exacerbate the problem of using the main line as a shunting neck;
- the most reasonable options to reduce demand at the existing metropolitan intermodal terminals would be to:
  - increase throughput at new intermodal terminal(s). This may be necessary as some of the existing terminals will be over capacity even with the new terminal(s) handling the volumes that are currently proposed; and
  - increase operations at the existing intermodal terminals and Port Botany to 7 days per week.

- future capacity problems at Camellia and Yennora could be addressed by increasing siding length, increasing terminal capacity and improving the efficiency of container handling operations. Upgrading of the intermodal terminals would be a commercial decision to be taken by the terminal operators;
- capacity on the shared metropolitan network can be improved by:
  - increasing throughput at new intermodal terminal(s) with sufficient network access to the port terminal;
  - increasing train lengths from the existing intermodal terminals outside the dedicated freight network;
  - reducing headways (through signalling changes); and
  - providing more dedicated lines for freight.
- passing loops in the rural area may need to be upgraded to allow for 900m trains;
- the new intermodal terminal(s) should provide for shuttle services of at least 600m in length; and
- if detailed train operational planning cannot mitigate the effect of shunting on the main line at Cooks River through timetabling, then a new shunting neck would need to be constructed by 2021.

Road Traffic Impacts

With a 40% rail mode share, road infrastructure upgrades will not be required. Only where the rail mode share is closer to 20% would upgrades of the Foreshore Road/ Botany Road/ Penrhyn Road intersection be warranted by around 2016. Duplicating the right turn from Botany Road (south) into Botany Road (north) may be necessary in order to provide an acceptable level of service in the longer term.

Table E.1– Summary of Road Trips, Rail Trips and Infrastructure Requirements

Year	TEU (,000)		Road Trips (No. per ave day)		Rail Trips [4] (No. per ave day)		Infrastructure and Operational Requirements
	New Terminal [1]	Total Port	New Terminal	Total Port [2]	New Terminal	Total Port	
Existing	N/A	877	N/A	2,913	N/A	30	
2006	N/A	1,250	N/A	3,327	N/A	46	▪ Construction of new intermodal container terminal(s) with sufficient network access connecting with the port terminals.
2011	525	1,750	941	3,115	18	70	
2016	1,000	2,500	1,546	3,862	32	94	▪ Duplication of dedicated freight line between Cooks River and Botany Yard ▪ Improvements to Camellia and Yennora metropolitan intermodal terminals such as increased siding lengths.
2021	1,280	3,200	1,882	4,700	36	108	▪ New shunting neck at Cooks River ▪ Improvements to the Shared Metropolitan Network [3]

1) Results are shown for terminal market share 1, which maximises the number of road and rail trips to/from the new terminal, i.e., assumes that the new terminal captures 30% of total Port Botany Container Traffic by 2011 and 40% in 2016 and 2021;

2) Daily truck trips decrease between 2006 and 2011 because of the assumption that days of operation per annum increase from 286 to 312;

3) Potential solutions include:
   - Increasing market share taken by new metropolitan intermodal terminal(s);
   - Increasing train lengths;
   - Signalling changes to reduce headways; and
   - Additional dedicated freight lines.

4) One train generates two train/rail trips (i.e. 1 in and 1 out).

1 Introduction

1 Introduction

1.1 Background

Sydney Ports Corporation (SPC) is proposing to expand the port facilities at Port Botany by creating a new container terminal, in order to meet predicted growth in container trade.

SPC is currently preparing an Environmental Impact Statement for the proposal and has engaged Maunsell Australia to provide an assessment of the traffic and (landside) transport impacts (excluding environmental impacts, which will be undertaken by others) of the expanded port.

1.2 Requirements of the Brief

The scope of work specified in SPC's brief for the project includes the following broad work categories:

- formulate a model for forecasting road and rail traffic generated by activities in the Port Botany Precinct for varying levels of port activities;
- undertake a road traffic study, which includes network modelling of current and predicted movements in 2006, 2011, 2016 and 2021, and detailed intersection analysis;
- undertake a rail traffic study, which assesses operational and network issues such as the management of generated rail traffic and the capability of Botany Rail Yard and port infrastructure to accommodate predicted traffic movements; and
- prepare a summary report which links the operational aspects of the two modes, including mode shift analysis and cumulative impact assessment.

The stakeholder comments on road transport issues, as raised through the Director-General's requirements, have formed a contextual input to this study. A summary of the issues, along with relevant references, is provided at **Appendix F**.

1.3 Report Structure

This study takes a multi-modal approach in that road and rail issues are considered in an integrated fashion. Future truck and train volumes associated with the expanded port are estimated on the basis of rail achieving an increased mode share of 30% by 2006 and 40% by 2011. Sensitivity testing was also undertaken to assess road network performance under a "worst case road scenario", which assumes a rail mode share of 20% for the entire 20 year analysis period.

In addition, three alternative market share splits between the port terminals were assessed so that a worst case situation could be adopted for forecasting intersection performance.

1 Introduction

This report is divided into eight sections.

Section 2 discusses the locational context, the proposal to expand Port Botany and related traffic generating developments in the area.

Section 3 reviews existing conditions including the existing road and rail networks and the usage of these infrastructure facilities.

Section 4 forecasts traffic levels for road freight, rail freight and general traffic. Road traffic volumes are assigned to the network using a strategic modelling process.

Section 5 assesses the implications of the forecast truck and train volumes for the road and rail transport systems. The section includes an assessment of intersection performance and the capacity of the Botany Yard.

Section 6 identifies the infrastructure upgrading works that may be required in order to accommodate the future increase in port related traffic.

Section 7 addresses options to reduce the dependency of employees and contractors on the private car as the primary means of transport to and from work.

Finally, **Section 8** sets out the main conclusions of the study.

1.4 Site Visits

Site visits by the Maunsell team were undertaken on 3rd and 4th June 2002 in order to gain a detailed understanding of the operations of the Patrick and P&O terminals, container parks and container packing/unpacking stations. The following organisations were visited:

- P&O Ports Container Terminals;
- Patrick Container Terminals;
- Patrick Port Services;
- Smith Bros/P&O Trans Australia; and
- Maritime Container Services.

The site visits provided valuable information regarding current situation and future trends.

The issues that were raised are summarized in **Appendix A**. In general, the key issues are:

- existing short rail sidings (300m – 350m) and the management of rail access to and from the port container terminals are the main constraints on rail efficiency;
- at the terminals, rail could comfortably accommodate significantly higher volumes by simply utilising spare capacity in human resources, adjusting capital resources such as forklifts and extending operating hours;

- similarly, there is some scope for road to accommodate higher volumes by increasing vehicle servicing hours and adjusting resources;
- backloading is not common despite measures by both terminals to encourage its adoption;
- expected future trends at both terminals include increased backloading, wider use of B-Doubles and other high productivity trucks (such as road trains and "super Bs") within the port precinct, and extended road/rail servicing hours; and
- truck turnaround times do not appear to be considered a major constraint.

1.5 Stakeholder Consultation

In addition, several key stakeholders were consulted by Maunsell as part of this study, including Rockdale City Council, Randwick City Council, City of Botany Bay Council, Rail Infrastructure Corporation and the Roads and Traffic Authority. The issues that were raised are summarised in **Appendix B**.

1.6 Previous Studies

A literature review undertaken by Maunsell indicated that there have been several previous studies into traffic and landside transport issues at the port. The findings of each of the following studies have been taken into account in the study.

A 2001 study by Masson Wilson Twiney investigated the traffic aspects of the Molineux Point development. The study estimated that the road system serving the port operates at a satisfactory level of service during peak periods. The study forecast that Molineux Point could generate up to 200 truck visits per day.

The current and future performance of the following intersections was assessed:

- Bumborah Point Road/Simblist/Military Road;
- Bumborah Point Road/Friendship Road;
- Bumborah Point Road/Botany Road;
- Botany Road/Beauchamp Road; and
- Botany Road/Penrhyn Road/Foreshore Road.

It was found that the forecast intersection performance is satisfactory and that the "southern port area" could generate 25% more traffic without creating any capacity problems on the surrounding road network. The study concluded that there are no traffic related impediments to the development of the site at Molineux Point.

A 2002 study by Arup Transportation Planning developed concept designs for access to Foreshore Road from the new terminal, and forecast the performance of the port access road/Foreshore Road intersection and the boat ramp access/Foreshore Road intersection.

1 Introduction

The intersection performance analysis (INTANAL modelling) indicates a good to satisfactory level of service up to 2019, however the right turn exit from the boat ramp junction would be approaching capacity in the PM peak. This result compares with the Masson Wilson Twiney (2001a) gap acceptance assessment which indicated that right turn exits from the boat ramp access road should be prohibited in the PMpeak.

Colston Budd Hunt and Twiney (1997) undertook an internal traffic study for Port Botany which included an assessment of current intersection performance, identification of transport issues from the viewpoint of port users, and development of a traffic management plan.

It was found that the following intersections were all operating at LOS B or better:

- Botany Road/Foreshore Road/Penrhyn Road;
- Botany Road/Beauchamp Road;
- Botany Road/Sydney Haulage Access Road;
- Botany Road/Bumborah Point Road;
- Bumborah Point Road/Friendship Road;
- Bumborah Point Road/Military Road/Prince of Wales Drive; and
- Penrhyn Road/Inter Terminal Access Road.

A traffic impact report (SKM 2002) for a proposed subdivision in Bumborah Point Road adjacent to the Australian Customs x-ray facility investigated the cumulative impacts of the proposed subdivision, the x-ray facility, the MolineuxPoint redevelopment and the proposed rescue helicopter base at the Bumborah Point Road/Military Road intersection.

The study investigated the current and future performance of four intersections (Bumborah Point Road/Simblist Road, Bumborah Point Road/New Access Road, Bumborah Point Road/Friendship Road, Bumborah Point Road/Botany Road) and concluded that future traffic flows as a result of the proposed subdivision are acceptable and intersections would continue to operate at a good level of service.

Travers Morgan (1994) assessed the issues affecting rail efficiency at Port Botany. It was found that the capacity of the Botany line was not a constraint and train volumes (then 14 train trips per day) could increase by 50% by 2010. The report recommended the adoption of the fixed train configuration arrangement (this had also been recommended in an earlier report by George Deutsch Consulting) and the remodeling of Botany Yard to provide the necessary storage and buffer requirements. The report also recommended the development of a rail operating plan to improve co-ordination between the port terminal operators and other players.

Booz Allen and Hamilton (2000) investigated restrictions in the rail logistics chain and measures to meet medium term demand. The report emphasised the need for a consolidated operating plan for Botany Yard, to meet medium term demand (310,000 containers by rail in 2004-05) without major infrastructure investment. **Affleck (2002)** further pursued this approach by developing a specification for a *Rail Planning Protocol for Botany Yard Management.*

2 Proposed Port Expansion

2 Proposed Port Expansion

2.1 Locational Context

Port Botany is located on Botany Bay and straddles the Botany and Randwick Local Government Areas (LGAs). The Patrick Stevedore terminal is located in Botany LGA and the P&O Port terminal is located in Randwick LGA. Major land uses in the vicinity include:

- Kingsford Smith Airport;
- industrial areas around Botany and Matraville including container freight stations, empty container parks and warehouses/factories;
- residential areas in Botany and Randwick; and
- the Botany rail yard.

The photo at **Figure 2.1** shows the locational context of the port.

2.2 The Proposal

The possible need to expand Port Botany has been recognised since the port was initially constructed in the 1970s (SPC 2002c).

The expansion proposal involves the reclamation of approximately 60 hectares of land in Botany Bay between the Patrick Stevedore terminal and Sydney Airport. A new container terminal would be constructed with additional port facilities including new berths, hardstand areas for container handling, transport networks and utilities. **Appendix K** shows a proposed layout for the new terminal.

SPC proposes that the new terminal be constructed around 2008-2010, to provide the additional capacity that is required in order to meet future trade needs.

From a traffic and transport perspective the main features of the expansion are:

- new road and rail infrastructure;
- construction of a new access point onto Foreshore Road for truck traffic to/from the new terminal; and
- relocation of the existing public boat ramp, which is likely to involve the construction of an additional intersection onto Foreshore Road.

Figure 2.1
Locational Context

SYDNEY PORTS

Maunsell

Related Port Botany Developments

The continued growth in trade volumes is stimulating additional developments besides the proposed new terminal at Port Botany. The proposed new developments include:

- an expansion of the Patrick terminal in order to increase capacity, due for completion around 2004;
- a P&O container packing/unpacking facility at Molineux Point; and
- a new customs facility at Lot 103 Bumborah Point Road for x-raying random samples of full containers.

2.4 Other Major Developments in the Region

This traffic and transport assessment includes the cumulative impacts of the above developments, the proposed new terminal and other major transport generating activities, including:

- a potential aviation business park in the airport's "South-East Sector";
- a potential warehousing/business park facility on the former Pacific Power site;
- a potential multi-modal cargo facility on Sydney Airport Corporation Limited's (SACL's) "Northern Lands" site;
- a recreation, recycling/waste management and light industrial facility at the adjacent Tempe tip site (under the control of Marrickville Council);
- the Cooks Cove redevelopment; and
- Sydney Airport.

3 Existing Conditions

3 Existing Conditions

Chapter Summary

Trade
Trade forecasts suggest that volumes through the Port Botany container terminals are expected to triple over the next 20 years. Given the forecast growth rates, the existing container terminals are likely to reach capacity within ten years.

SPCs strategic plan, *First Port…Future Port,* sets out strategies to improve rail's mode share and truck efficiency. In order to achieve the target rail mode share of a minimum of 40%, there will need to be a significant increase in the amount of metropolitan freight that travels by rail. The increased rail mode share will serve to moderate the growth in total truck traffic to and from Port Botany.

Road
The Port Botany area includes several roads that provide a major arterial function, including Foreshore Road, Botany Road, Wentworth Avenue, Beauchamp Road and Bunnerong Road.

Container truck volumes are concentrated on Foreshore and Botany Roads. The intersections along the Foreshore Road – Botany Road route currently provide a good level of service, with minor vehicle delays.

On a typical day Patrick Stevedore generates around 800 truck visits, while P&O Ports generates around 600. Most truck movements occur during business hours, with around 8% of daily visits occurring during the AM Peak and 4% during the PM Peak.

Rail
Rail currently accounts for 25% of container movements to/from Port Botany.

The P&O Ports terminal currently generates on average 7 train visits per day and Patrick Stevedore around 6 train visits per day. In addition, P&O Trans Australia attracts on average 2 train visits per day.

The port is serviced by a dedicated rail link that connects the port with the Cooks River intermodal terminal and Enfield marshalling yard. The line is duplicated between Enfield and Cooks River, and there are plans to further extend the duplication. Beyond Enfield, priority is given to passenger trains on the shared lines, which represents a significant constraint for rail freight efficiency.

Stakeholder Issues
Key issues of concern for stakeholders are the perception that the road network is already operating at capacity, the need to increase rail's mode share, and the intrusive effects of truck traffic on local communities.

3 Existing Conditions

3.1 Trade

3.1.1 Existing Trade and Predicted Growth

In 2000-01, Sydney Ports handled approximately one million TEUs[1] of containerised cargo (SPC 2001a). The 2000-01 throughput for the Port Botany container terminals was 877,000 TEUs – almost 90% of the Sydney Ports total (including Sydney Harbour facilities). The major containerised imports were manufactured goods, chemicals, paper products and machinery. Major containerised exports included cereals, non-ferrous materials, chemicals and cotton.

Between 1992-93 and 2000-01, containerised trade grew by 60% (Maunsell 2002). The average historical growth rate of nearly 7.5% pa is significantly higher than growth in the general economy. The strong growth in containerised trade is being driven by factors such as increased globalisation of industry and increased use of containers for import/export goods.

Forecasts provided by SPC, and based on work recently undertaken by Maunsell and Access Economics; suggest that trade volumes are expected to triple over the next 20 years. Sydney Ports has advised that, given these growth rates, the existing container terminals are likely to reach capacity within ten years.

3.1.2 Trade Imbalance

Sydney is an import dominant port with imports representing 51% of total TEU throughput. The trade imbalance results in a net outflow of over 150,000 empty (MT) TEU per annum. **Table 3.1** overleaf shows a summary of trade volumes for 2000-01 for all Sydney Ports, i.e., Botany plus Sydney Harbour facilities. If only full containers are taken into consideration then imports are 62% of total volumes.

Table 3.1 – Sydney Ports Trade Figures, 2000-01

	TEU	
	Total (Including Empties)	**Total (Excluding Empties)**
Imports	512,867	493,345
Exports	477,787	306,071
Total/Net Flow	990,654	799,416

According to SPC 2002g, for planning purposes it is appropriate to assume 50% imports, 30% full export containers and 20% empty export containers.

3.2 Transport Strategy

3.2.1 Current Mode Shares

Rail freight currently accounts for about 25% of all container movements in and out of Port Botany. Containers are transported between the port container terminals and either intermodal terminals in the Sydney metropolitan area or to regional centres. Some of the Sydney intermodal terminals are connected to the rail network via the dedicated freight network within the Sydney metropolitan network, others are required to operate on the shared passenger lines for which passenger services have priority.

[1] TEU twenty-foot equivalent unit. One 40-foot container equals two TEU.

Rail mode share is forecast to grow to a point whereby by 2006 it will have a 30% share, increasing to 40% by 2011. This coupled with the general increase in the overall freight task amounts to a significant increase in train movements. The number of train movements is governed by the length of the trains that can be accommodated either at the port or metropolitan intermodal terminals. Ultimate capacity is governed by the ability of the rail infrastructure to handle the volume of trains with efficient rail operations.

The stimulus for growth in rail mode share comes from a number of factors including a commitment in the form of government initiatives to achieve such growth. Rail privatisation (such as the recent formation of Pacific National) and the general desire to better integrate rail across state boundaries (ATC initiatives and ARTCs proposal to lease interstate track for NSW) will all be key drivers in achieving such growth.

3.2.2 Future Port Strategy for Mode Share

Sydney currently has six intermodal terminals that service Port Botany, with an estimated capacity of 5-600,000 TEUs. This includes the terminal at Chullora, which predominantly serves the interstate market. The strategy to increase the mode share of rail will require an increase in metropolitan intermodal terminal capacity in the medium term. By 2020 it is estimated that the combined interstate and port demand for intermodal terminal capacity in Sydney will be between 1.5 million and 2 million TEUs. The capacity shortfall is being considered by Transport NSW and will require private sector investment over time. Additionally Sydney Ports has plans to build an intermodal terminal at Enfield that is connected by the dedicated freight line to Botany. The Enfield project is currently under Government review.

This study assumes that new metropolitan intermodal facilities will be built to meet demand but it is not dependent on such a terminal being specifically located at Enfield. It will be important that the new intermodal terminal(s) be built at a location/s that has both sufficient cargo demand and appropriate/sufficient access to the rail network to reach the port. More specifically, it should be located on the dedicated freight network to avoid any interaction with passenger services.

3.2.3 Road Transport Efficiency

Even with an increase in rail mode share, road transport will remain the dominant land transport mode for the Botany terminals. In terms of road transport future improved truck efficiency is a key element of SPC's strategy. This could be achieved by initiatives such as increased backloading and increased use of high productivity vehicles such as B-Doubles. SPC's strategic plan, *First Port…Future Port*, establishes a target to increase truck utilisation from 1.3 to 1.8 containers per truck "*through improved co-ordination of the trucking industry*".

3.2.4 Geographic Distribution of Trade

Data provided by SPC on road and rail volumes (SPC 2002h, i) indicates that around 80% of the container activity has an origin/destination in the greater Sydney area, with only 20% from outside this area. In addition, rail already has a 75% mode share for rural cargo, but only 8% for imports to the metropolitan area, so it can be seen that to achieve the target rail mode share of a minimum of 40%, there will need to be a significant increase in the amount of metropolitan freight that travels by rail.

3 Existing Conditions

3.3 Road Network

3.3.1 Introduction

There are two main systems that are used to classify roads in New South Wales. They are the *functional* classification system and the *funding* classification system. The functional classification categories roads into arterial, sub-arterial, collector and local roads, depending on traffic volumes.

The funding Classification categorises roads as State (RTA managed), Regional (council managed with RTA funding assistance) or Local (council managed). Further details of the classification systems are shown in **Appendix G**.

3.3.2 Road System

The existing road network is shown in **Figure 3.1**. The roads of most significance are Foreshore Road, Botany Road, Southern Cross Drive, Beauchamp Road and Wentworth Road, which are all arterial roads. Secondary roads include Stephen Road, Page Street and Denison Street. Some roads, such as Foreshore Road and Southern Cross Drive are well suited to truck traffic but others, particularly Botany Road are less suited to heavy trucks due to conflict with other traffic and local amenity issues.

Figure 3.2 shows the network at a subregional level, highlighting main truck routes for port related traffic. The routes were identified in consultation with the Roads and Traffic Authority, NSW Road Transport Association, and Rockdale, Randwick and Botany councils.

3.3.3 Heavy Vehicle Restrictions

Restrictions on truck access include the tunnel on General Holmes Drive under the airport, which has a height limit of 4.4m and is hence is restricted to overheight vehicles. Dangerous goods are also prohibited from being transported in tunnels, including the General Holmes Drive and M5 East tunnels.

There are several load limits on local streets in the Botany and Randwick area (refer to **Figure 3.3**)**,** which are designed to ensure that heavy vehicle traffic stays on the main road network. In addition, Botany Council has advised that a 3 tonne load limit will soon be imposed on Page Street between the rail overbridge and Wentworth Avenue.

The port precinct is well serviced by B-Double routes, with the port container terminals, major container parks and major container freight stations having B-Double access. **Figure 3.4** shows approved B-Double routes in the Botany area. The most notable restriction on B-Double access in terms of the main road network is Botany Road between Wentworth Avenue and Gardeners Road, which is not approved due to concerns about B-Double traffic interacting with other road users, especially pedestrians. In terms of council roads, Botany Council has approved routes that provide access to container parks and container freight stations (CFSs), including Hill/McPherson and Exell Streets. Randwick Council has temporarily approved access to one site on Military Road, however this is the only council road in Randwick that is approved for use by B-Doubles.

3.3.4 Existing Intersection Performance

Road intersections within the study area were analysed by Maunsell Australia with Scats Computer Aided Traffic Engineering System (SCATES) software, from observed turning volumes. Details of the signal phasing and staging were obtained from the RTA Transport Management Centre.

The intersections in the study area operate within the Sydney Coordinated Adaptive Traffic System (SCATS) urban traffic control system. The SCATS system coordinates a network of intersections and is responsive to demand, varying the timing of signal phases to ensure that capacity is maximised. This responsive tuning of a network of intersections makes it difficult to determine the signal timings for a single intersection at a given time.

For signals that are co-ordinated, it is preferable to simulate their operation using the SCATES capacity assessment tool. SCATES is a proven and advanced analytical software product, that is used and accepted by the RTA (RTA 1999).

SCATES output data includes:

- degree of saturation – a measure of the ratio between traffic volumes and the capacity of the intersection;
- average delay – how long in seconds the average vehicle waits at the intersection; and
- level of service – a measure of the overall performance of the intersection.

Table 3.2 shows the performance criteria and how it relates to the different traffic control devices. **Table 3.3 and 3.4** rates selected intersections within the study area by showing the current level of service. The intersections at General Holmes Drive/Foreshore Road were assessed separately to the other intersections along the route. This is because the General Holmes Drive/Foreshore Road intersections are not coordinated with the other intersections further along Foreshore Road due to the distance that separates them.

Table 3.2 – Performance Criteria for Intersections

Level of Service	Average Delay/ Vehicle (secs/veh)	Traffic Signals, Roundabouts	Give Way and Stop Signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity; at signals incidents will cause excessive delays	At capacity; requires other control mode
F	>70	Roundabouts require other control mode	At capacity; requires other control mode

Source: Guide to Traffic Generating Developments, Roads and Traffic Authority, 1993.

3 Existing Conditions

Table 3.3 – Current Intersection Performance, AM Peak

Location	Traffic Controlling Signal No. (TCS)	Co-ordinated Degree of Saturation (CORD DS)	Average Delay (seconds/vehicle) (S/V)	Level of Service (LOS)
Foreshore Road/General Holmes Drive	1,524	0.48	6	A
Foreshore Road/Airport Access	1,616	0.81	3	A
Foreshore Road and Botany Road	1,525	0.89	16	B
Botany Road and Beauchamp Road	1,526	0.73	11	A
Botany Road and McCauley Street	2,647	0.23	3	A
Botany Road and Container Road Access	2,648	0.36	1	A
Botany Road and Bumborah Point Road	1,528	0.30	1	A

Table 3.4 – Current Intersection Performance, PM Peak

Location	Traffic Controlling Signal No. (TCS)	Co-ordinated Degree of Saturation (CORD DS)	Average Delay (seconds/vehicle) (S/V)	Level of Service (LOS)
Foreshore Road/General Holmes Drive	1,524	0.48	6	A
Foreshore Road/Airport Access	1,616	0.81	3	A
Foreshore Road and Botany Road	1,525	0.89	16	B
Botany Road and Beauchamp Road	1,526	0.73	11	A
Botany Road and McCauley Street	2,647	0.23	3	A
Botany Road and Container Road Access	2,648	0.36	1	A
Botany Road and Bumborah Point Road	1,528	0.30	1	A

The results indicate that the intersections provide a good level of service, with minor vehicle delays. The intersections also have considerable spare capacity.

The results are consistent with observed traffic flows and previous studies (refer to **Section 1.6**).

3.4 Road Traffic

3.4.1 Existing Road Traffic Volumes

Existing traffic volumes in the area were obtained from counts commissioned by Maunsell Australia and SPC. **Appendix C** contains details on the locations and timing of the counts. **Figures 3.5 and 3.6** provide details of the intersection turning movements, as obtained from the counts. Where data is available, the number of container trucks is also shown.

The busier intersections in the area include:

- Millpond Road/Botany Road/Southern Cross Drive;
- General Holmes Drive/Foreshore Road;
- Southern Cross Drive/Wentworth Avenue;
- Botany Road/Foreshore Road/Penrhyn Road;
- Botany Road/Beauchamp Road; and
- Joyce Drive/O'Riordan Street.

3 Existing Conditions

Container truck volumes are concentrated on Foreshore and Botany Roads, with "high volume" intersections including:

- General Holmes Drive/Foreshore Road;
- Botany Road/Beauchamp Road;
- Botany Road/Bumborah Point Road;
- Botany Road/Foreshore Road/Penrhyn Road; and
- And to a lesser extent Botany Road/Stephen Road.

The counts also collected data on hourly vehicle flows. **Figure 3.7** shows the two-way traffic volume profile per hour for Bumborah Point Road, Botany Road and Foreshore Road. It can be seen that most heavy vehicle traffic occurs during business hours and volumes are fairly constant throughout the working day. This is consistent with the findings reported by Colston Budd Hunt and Twiney (1997).

The peaks for total vehicles using Bumborah Point Road and Botany Road (between Beauchamp Road and Bumborah Point Road) are heavily influenced by the shift pattern at the P&O terminal, which is 0630-1430, 1430-2230 and 2230-0630.

Figure 3.1
Existing Road Network

SYDNEY PORTS

Maunsell

Figure 3.2

Truck Routes for Port Related Traffic

SYDNEY PORTS

Maunsell

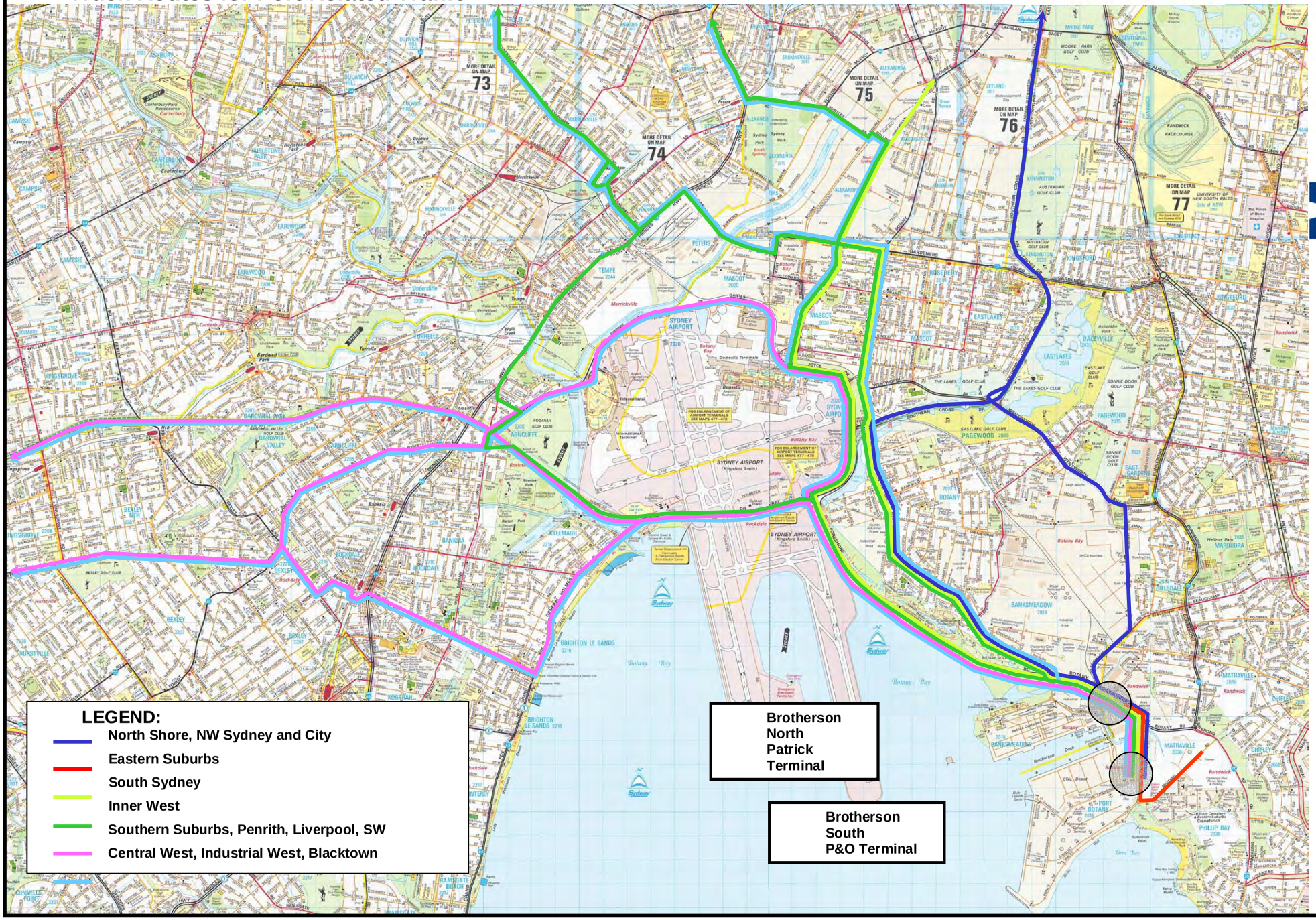
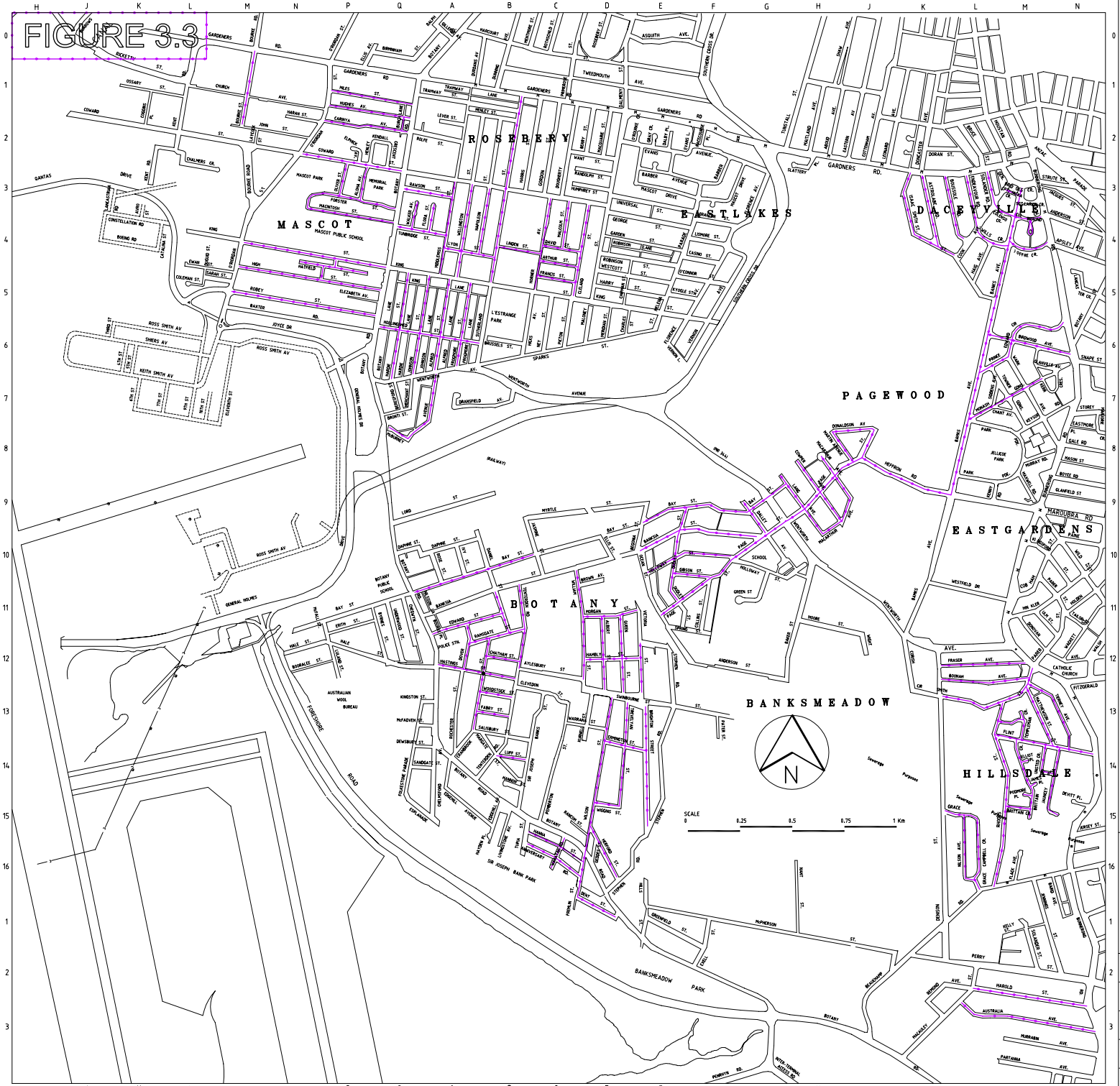


FIGURE 3.3



		UBD MAP REF
ALBERT ST.	BOTANY	276 D12
ALFRED ST.	MASCOT	276 A6
ALOHA ST.	MASCOT	275 P3
ANDERSON ST.	BANKSMEADOW	276 F12
ANNIVERSARY RD.	BOTANY	276 C16
ARTHUR ST.	MASCOT	275 L4
ASTROLABE RD	DACEYVILLE	276 K3
AYLESBURY ST.	BOTANY	276 C12
BAKER ST	BANKSMEADOW	276 G12
BANKS AV	DACEYVILLE	276 L8
BANKSIA ST	BOTANY	276 A11
BARBER AV	EASTLAKES	276 E3
BAXTER RD	MASCOT	275 M5
BAY ST.	BOTANY	276 A11
BEAUCHAMP RD.	HILLSDALE	276 L16
BEGONIA ST.	PAGEWOOD	276 E18
BERESFORD ST.	MASCOT	275 Q7
BERRY ST	ROSEBERY	276 C2
BIRDWOOD AV	PAGEWOOD	276 H6
BOONAH AV	HILLSDALE	276 L12
BOORALEE ST	BOTANY	275 N12
BOTANY LA	MASCOT	275 Q6
BOTANY RD.	MASCOT	275 Q5
BOURKE PL.	BOTANY	276 E13
BOURKE RD.	MASCOT	275 M3
BOURKE ST.	MASCOT	275 M2
BOUSSOLE RD.	DACEYVILLE	276 K3
BRIGHTON ST.	BOTANY	276 D12
BRITTAIN CR.	HILLSDALE	276 M14
BROWN AV	MASCOT	275 D11
BRONTI ST	MASCOT	275 Q7
BRUSSELS ST	MASCOT	276 B6
BUNNERONG RD.	PAGEWOOD	276 H6
BURCH LA.	MASCOT	275 Q2
BYRNES ST	BOTANY	275 Q11
CAPTAIN JACKA CR	DACEYVILLE	276 L3
CARNYA AV.	MASCOT	275 P2
CASINO ST	EASTLAKES	276 F4
CHALMERS CR	MASCOT	275 L2
CHANT AV	PAGEWOOD	276 H7
CHARLES ST	EASTLAKES	276 D6
CHATHAM ST.	BOTANY	276 B12
CHEGWYN ST	BOTANY	275 Q11
CHEGWYN LA	BOTANY	275 Q12
CHELMSFORD AV	BOTANY	276 A15
CHIPMAN ST	EASTLAKES	276 D5
CHURCH AV.	MASCOT	275 L1
CLELAND ST	MASCOT	276 C5
CLEVEDON ST	BOTANY	276 C13
COGGINS PL.	MASCOT	275 K2
COLEMAN ST.	MASCOT	275 L5
COLENSO CR.	DACEYVILLE	276 L3
COLLINS LA.	PAGEWOOD	276 F11
COLLINS ST.	PAGEWOOD	276 F11
COLONEL BRAUND CR.	DACEYVILLE	276 M3
CONSTELLATION RD	AIRPORT	275 K6
COOK AV	DACEYVILLE	276 L4
CORISH CIRCLE	HILLSDALE	276 K12
COWARD ST.	MASCOT	275 J2
COWPER AV.	PAGEWOOD	276 H8
CRANBROOK ST.	BOTANY	276 A13
DALBY PL	EASTLAKES	276 E2
DALLEY AV.	PAGEWOOD	276 G9
DALLEY LA.	PAGEWOOD	276 G10
DANIEL ST.	BOTANY	276 B10
DAPHNE ST.	BOTANY	275 Q10
DAVID ST.	MASCOT	276 C4
DENISON ST	HILLSDALE	276 M13
DENT ST	BANKSMEADOW	296 D1
DEVITT PL	HILLSDALE	276 N15
DEWSBURY ST	BOTANY	275 Q14
DONALDSON ST	PAGEWOOD	276 J6
DOUGHERTY ST	ROSEBERY	276 C3
DOVER RD	BOTANY	276 A12
DRANSFIELD AV	MASCOT	276 A7
DUDLEY ST	PAGEWOOD	276 E10
DUGUID ST.	MASCOT	275 L5
EDGEHILL AV	BOTANY	276 A15
EDWARD ST	BOTANY	276 A11
ELIZABETH AV	MASCOT	275 P5
ELLIOT PL	HILLSDALE	276 M14
ELLIS ST	BOTANY	276 D10
ELPHICK AV	MASCOT	275 P2
ENDEAVOUR RD	DACEYVILLE	276 L3
ERITH ST	BOTANY	276 A12
ERMINGTON ST	BANKSMEADOW	276 D14
ESPLANADE	BOTANY	276 A15
EVANS AV	EASTLAKES	276 D2
EWAN ST	MASCOT	275 L5
EXELL ST	BANKSMEADOW	276 F2
FABRY ST	BOTANY	276 B13
FLACK AV	HILLSDALE	276 M16
FLINT ST.	HILLSDALE	276 M13
FLORA ST	MASCOT	275 Q4
FLORENCE AV	EASTLAKES	276 F4
FOLKSTONE PD	BOTANY	275 Q14
FORESHORE RD	BOTANY	275 N13
FORSTER ST	MASCOT	275 P3
FRANCIS ST.	MASCOT	275 C2
FRASER AV	EASTLAKES	276 L12
FRASER LA	EASTLAKES	276 L12
FREMLIN ST	BOTANY	276 D16
FROGMORE LA	MASCOT	276 A6
FROGMORE ST	MASCOT	276 A6
GARDEN RD	EASTLAKES	276 D4
GARDENERS RD	EASTLAKES	276 G2
GEDDES ST	BANKSMEADOW	276 D16
GEN. BRIDGES CR	DACEYVILLE	276 M3
GENERAL HOLMES DR	SYD.AIRPORT	275 B16
GEORGE ST	EASTLAKES	276 D4
GIBSON ST	PAGEWOOD	275 E10
GLANVILLE AV	PAGEWOOD	276 M6
GORDON ST	ROSEBERY	276 C3
GRACE CAMPBELL CR	HILLSDALE	276 L15
GRAFTON ST	EASTLAKES	276 F4
GRAY CRES	EASTLAKES	276 E2
GREEN ST	BANKSMEADOW	276 G10
GREENFIELD ST	BANKSMEADOW	296 E1
GWEA AV	DACEYVILLE	276 L4
HAIG AV	DACEYVILLE	276 L4
HALE ST	BOTANY	275 N12
HAMBLY ST	BOTANY	276 D12
HANNA ST	BOTANY	276 C16
HANNON ST	BOTANY	276 B14
HARAN ST	MASCOT	275 N2
HARDIE LA	MASCOT	275 Q6
HARDIE ST	MASCOT	275 Q6
HARRIS ST	ROSEBERY	276 B3
HARRY ST	EASTLAKES	276 D5
HASTINGS ST	BOTANY	276 A12
HATFIELD ST	MASCOT	275 P5
HAYDEN PL	BOTANY	276 B16
HEARNE CL	EASTLAKES	276 E2
HEFFRON RD	PAGEWOOD	276 J8
HENLEY ST	ROSEBERY	276 A2
HENRY KENDAL CR	MASCOT	275 P2
HEREFORD ST	BANKSMEADOW	276 D16
HICKS AV	MASCOT	276 B6
HICKSON ST	BOTANY	275 Q10
HIGH ST	MASCOT	275 M5
HILLARY CR	EASTLAKES	276 F3
HILLS ST	BANKSMEADOW	296 E1
HOLLINGSHED ST	MASCOT	275 Q6
HOLLOWAY LA	PAGEWOOD	276 G10
HOLLOWAY ST	PAGEWOOD	276 G10
HORNER AV	MASCOT	276 B5
HUGHES AV	MASCOT	275 P2
HUMPHREY ST	ROSEBERY	276 D3
ISAAC SMITH ST	DACEYVILLE	276 K3
IVY ST	BOTANY	276 A10
JAMES PL	HILLSDALE	276 M14
JASMINE ST	BOTANY	276 B10
JAUNCEY PL	HILLSDALE	276 N6
JOFFRE CR	DACEYVILLE	276 M4
JOHN ST	MASCOT	275 M2
JOHNSON LA	MASCOT	275 Q6
JOHNSON ST	MASCOT	275 Q6
JOYCE DR	SYD.AIRPORT	275 M6
KENNY RD	PAGEWOOD	276 L9
KENT RD	MASCOT	275 L1
KERR CR	PAGEWOOD	276 M7
KEYSOR RD	PAGEWOOD	276 M7
KING LA	MASCOT	276 A5
KING ST	MASCOT	276 A5
KINGSTON ST	BOTANY	275 Q13
KURNELL ST	BOTANY	276 D13
KYOGLE ST	EASTLAKES	276 E12
LANCASTRIAN RD	SYD.AIRPORT	275 J4
LANG AV	PAGEWOOD	276 G9
LAYCOCK ST	MASCOT	275 M2
LEVER ST	ROSEBERY	276 A2
LINDEN ST	MASCOT	276 B4
LISMORE ST	EASTLAKES	276 F4
LIVINGSTONE AV	BOTANY	276 B15
LIVINGSTONE LA	BOTANY	276 B15
LONGWORTH AV	EASTLAKES	276 E3
LORD ST	BOTANY	275 Q9
LUFF ST	BOTANY	276 B14
LULAND ST	BOTANY	275 P12
LYON ST	MASCOT	276 A4
MACARTHUR AV	PAGEWOOD	276 H8
McBURNEY AV	MASCOT	275 Q8
McFADYEN ST	BOTANY	275 Q13
McPALL ST	BOTANY	275 P12
MACPHERSON ST.	BANKSMEADOW	296 E1
MACINTOSH ST.	MASCOT	275 P4
MACQUARIE ST	ROSEBERY	276 D2
MALCOLM ST	MASCOT	276 C4
MALONEY ST	EASTLAKES	276 E5
MARGATE ST	BOTANY	276 B14
MARTIN AV	PAGEWOOD	276 H8
MASCOT DR	EASTLAKES	276 D3
MATHESON ST	HILLSDALE	276 M13
MAXWELL RD	PAGEWOOD	276 M9
MERCHANT ST	MASCOT	275 Q7
MERIDAN ST.	EASTLAKES	276 D6
MIDDLEMISS ST	MASCOT	276 A4
MILES ST	MASCOT	275 P1
MILPOND RD	MASCOT	275 P8
MONASH GDNS	PAGEWOOD	276 L7
MOORE ST	BANKSMEADOW	276 H11
MORGAN ST	BOTANY	276 D11
MURRAY RD	PAGEWOOD	276 M8
MYRTLE ST	BOTANY	276 C9
NANT ST.	BANKSMEADOW	296 H1
NAPOLEON ST	MASCOT	276 A4
NEY ST	MASCOT	276 C6
NILSON AV	HILLSDALE	276 L15
NILSSON LANE	BOTANY	276 A11
NINTH ST	SYD.AIRPORT	275 L7
OCEAN ST	PAGEWOOD	276 E10
OCONNOR ST	EASTLAKES	276 E5
OLIVER ST	MASCOT	275 P3
ORIORDAN ST	MASCOT	275 M5
OROURKE CR	EASTLAKES	276 D2
OSSARY ST	MASCOT	275 K1
PAGE ST	PAGEWOOD	276 E11
PARK PD	PAGEWOOD	276 L8
PARK LA	MASCOT	275 Q3
PATER ST	BANKSMEADOW	276 F13
PEMBERTON ST	BOTANY	276 C15
PENRHYN RD	BANKSMEADOW	296 E4
PICTON ST	MASCOT	276 C6
POOMORE PL	HILLSDALE	276 M14
PRINCE EDWARD CIR	DACEYVILLE	276 L6
PROTHERO PL	PAGEWOOD	276 J8
QANTAS DR	SYD.AIRPORT	275 J3
QUEEN ST	BOTANY	276 D12
RACECOURSE PL	EASTLAKES	276 F2
RAILWAY RD	BOTANY	276 E12
RAMGATE ST	BOTANY	276 B12
RANCOM ST	BOTANY	276 C15
RANDOLPH ST	ROSEBERY	276 B3
RAWSON ST	MASCOT	275 Q3
RHODES ST	HILLSDALE	276 M16
RICKETTY ST	MASCOT	275 J1
ROBEY ST	MASCOT	276 C6
ROBINSON ST	EASTLAKES	276 D4
ROCHESTER ST	BOTANY	276 A13
ROLFE ST	ROSEBERY	275 Q2
ROSE ST	BOTANY	276 A10
ST HELENA PDE	EASTLAKES	276 E5
SALISBURY ST	BOTANY	276 B14
SANDGATE ST	BOTANY	276 A14
SARAH ST	MASCOT	275 L5
SERGEANT LARKIN CR	DACEYVILLE	276 M3
SIDDONS AV	PAGEWOOD	276 L7
SIR JOSEPH BANKS ST	BOTANY	276 B15
SLATTERY PL	EASTLAKES	276 H3
SMITH ST	HILLSDALE	276 L13
SOLANDER RD	DACEYVILLE	276 L3
SPARKES ST	MASCOT	276 B6
SPRING ST	PAGEWOOD	276 E11
STEPHEN RD	BOTANY	276 E12
SUTHERLAND ST	MASCOT	276 A6
SWINBOURNE ST	BOTANY	276 D13
TEMPLEMAN CR	HILLSDALE	276 M13
TENTERDEN RD	BOTANY	276 B11
TIERNEY AV	HILLSDALE	276 M13
TOWNER GDNS	PAGEWOOD	276 L7
TRAMWAY ST	ROSEBERY	276 A1
TREVELYAN ST	BANKSMEADOW	276 D13
TUNBRIDGE ST	MASCOT	275 Q4
TUPIA ST	BOTANY	276 B16
UNDERWOOD AV	BOTANY	275 Q11
UNIVERSAL ST	EASTLAKES	276 D3
UNSTED CRES	HILLSDALE	276 M14
VERNON AV	EASTLAKES	276 F6
VICKERS AV	SYD.AIRPORT	275 K7
VICTORIA ST	BOTANY	276 E12
WALKER AV	MASCOT	275 Q4
WANT ST	ROSEBERY	276 C2
WARATAH RD	BOTANY	276 C16
WARK AV	PAGEWOOD	276 M6
WARRANA ST	BOTANY	276 D13
WELLINGTON ST	MASCOT	276 A4
WENTWORTH AV	HILLSDALE	276 P8
WESTCOTT ST	EASTLAKES	276 D5
WESTFIELD DR	PAGEWOOD	276 L11
WHITE RD	PAGEWOOD	276 M6
WIGGINS ST	BANKSMEADOW	276 D15
WIGHT ST	BANKSMEADOW	276 J12
WILLIAM ST	BOTANY	276 C11
WILLS CRES	DACEYVILLE	276 L4
WILSON ST	BOTANY	276 D15
WOODSTOCK ST	BOTANY	276 B13

City of Botany Bay

Administration Centre
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Mascot NSW 2020
PO Box 331 Mascot
Telephone: (02) 9366 3666
Facsimile: (02) 9366 3777
DX 4108 Maroubra Junction

DESIGNED	O.W.
DRAWN	K.N.
CHECKED	W.M.
APPROVED	
DATE	

TITLE

3 TONNE LIMITED ROAD

DRG NO 100-208 REV B

CADREF G:\Eng\Cad\Dwgs\Maps\3t-limit

Figure 3.4

Approved B-Double Routes

Source: Heavy Vehicle Information Maps

Figure 3.5

AM Peak Intersection Turning Movements

Total Vehicles
Container Trucks

SYDNEY PORTS

Maunsell

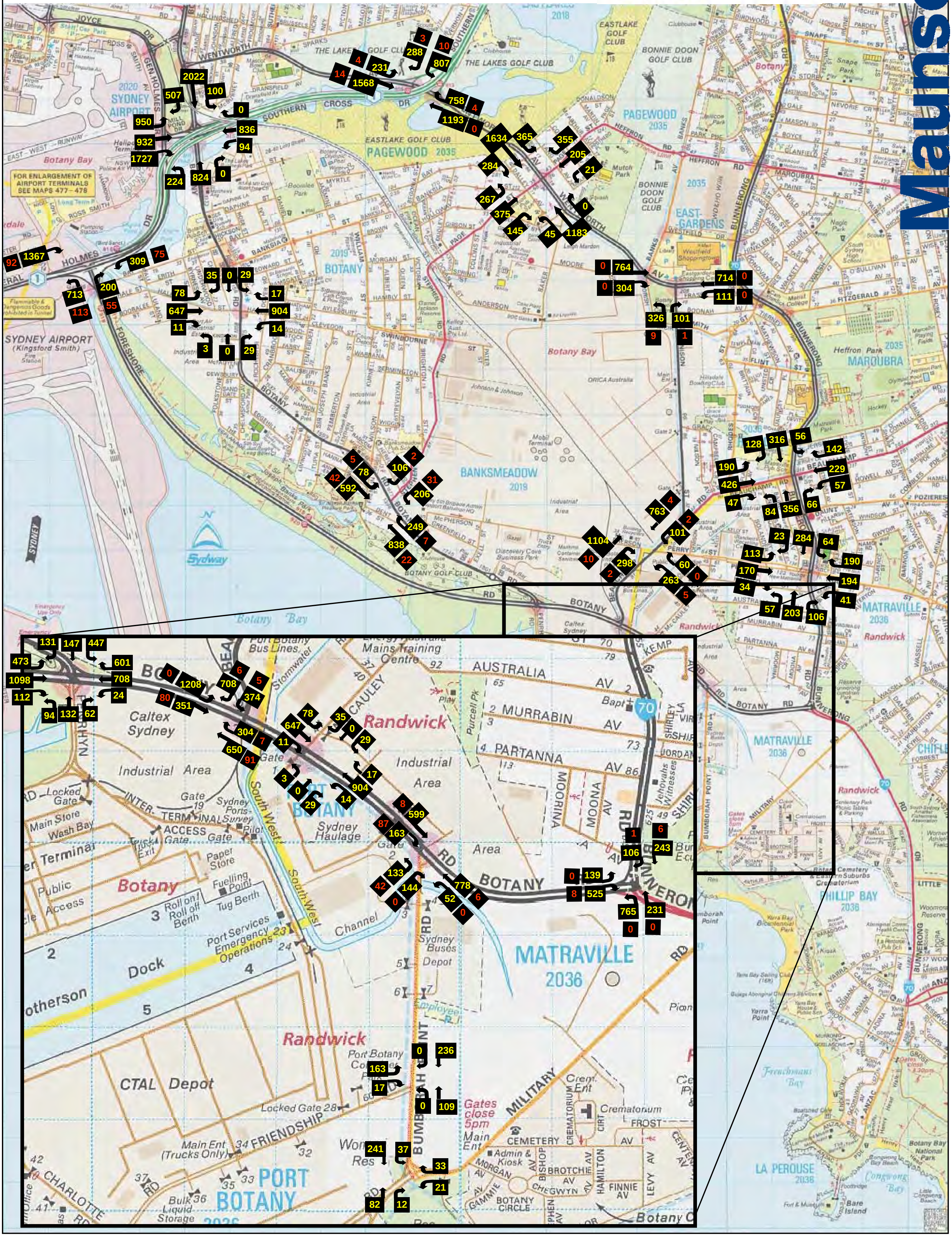


Figure 3.6
PM Peak Intersection Turning Movements

Light Vehicles
Container Trucks

SYDNEY PORTS

Maunsell

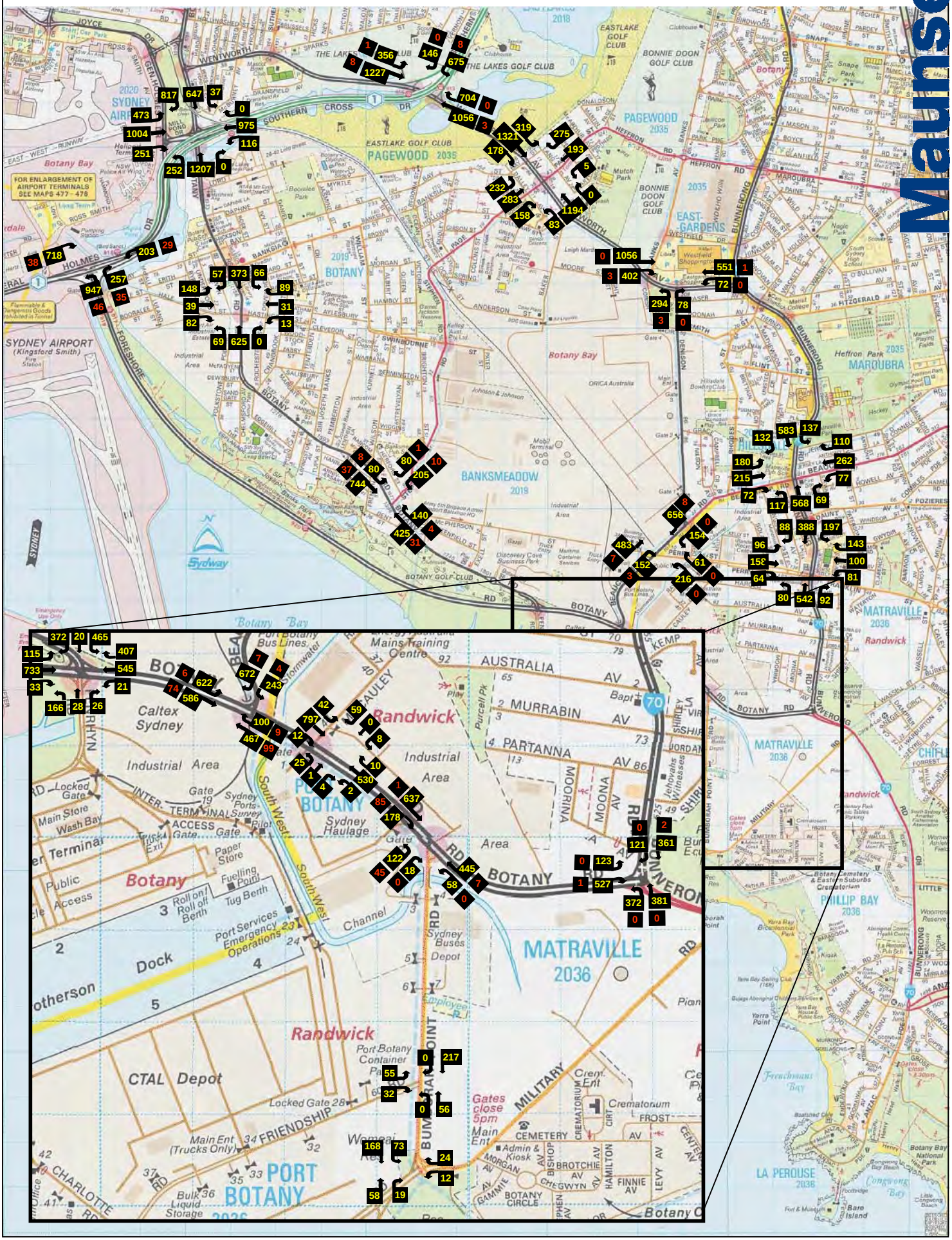
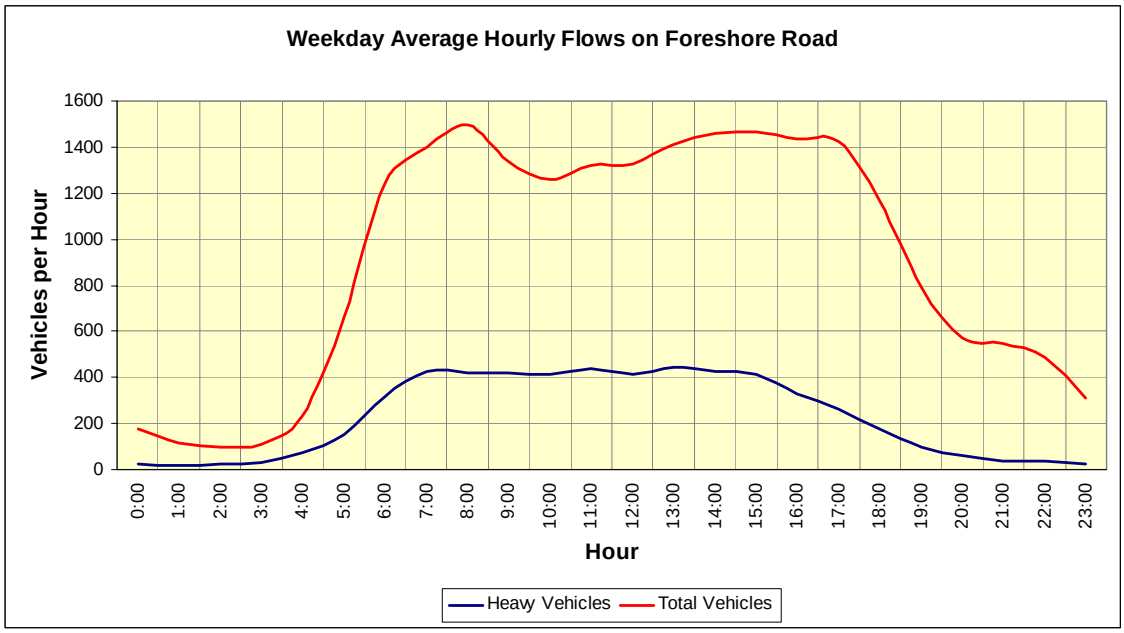
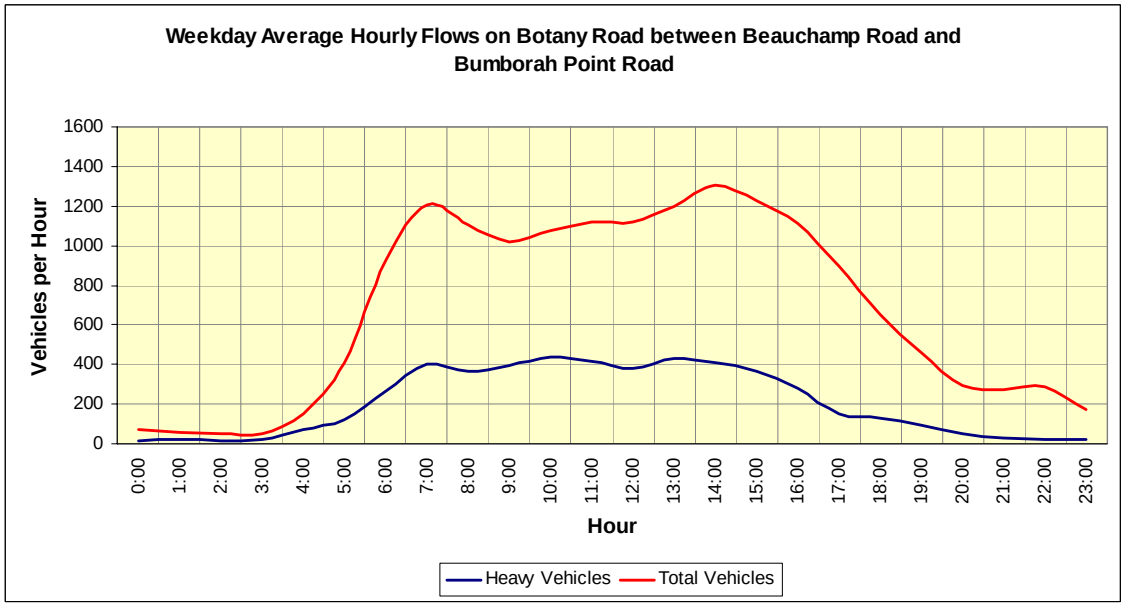
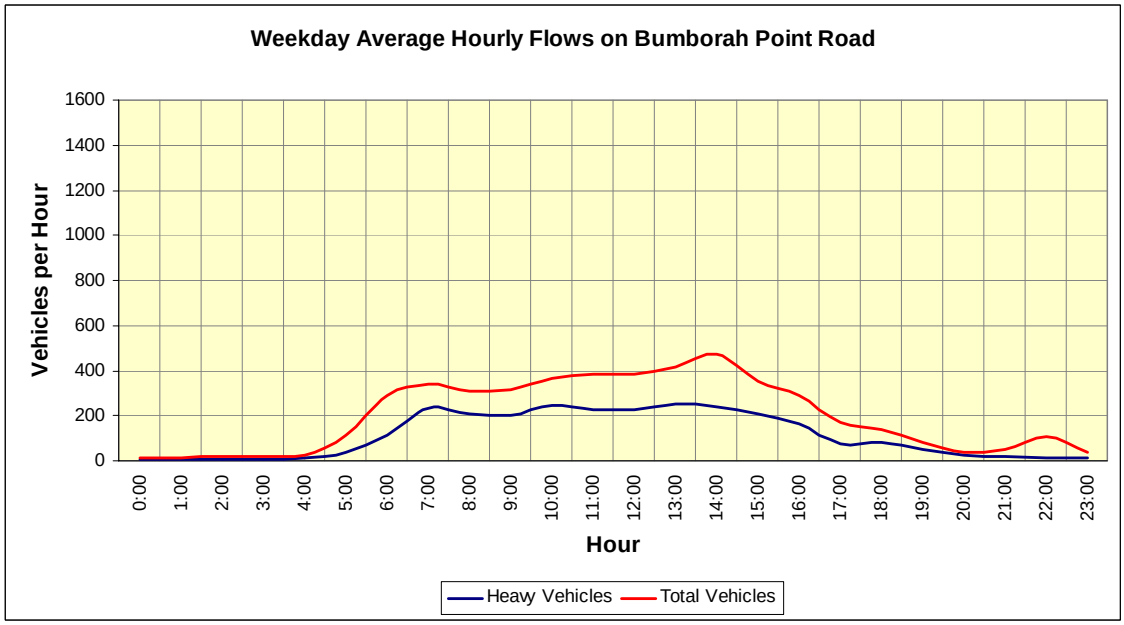


Figure 3.7
Selected Traffic Flows







3 Existing Conditions

Road Movements at the Port Container Terminals

Truck Visits

Container traffic represents about 4% of total road freight tonnage moved in Sydney, or 6.6 million tonnes in 1998 (SPC 2002b).

The terminal operators (P&O and Patrick) each provided data on road volumes for:

- the days on which the intersection counts were undertaken (4th and 7th June 2002);
- a representative "average" day; and
- a representative "peak" day.

The results are summarised in **Table 3.5** and indicate that on a typical day Patrick generates around 800 truck visits, while P&O generates around 600. Data from the terminal operators indicates that the AM peak flows (0800-0900) are 8% of the daily port truck flows, while PM peak flows (1700-1800) are 4%. The data is consistent with the classification counts, which indicate that hourly heavy vehicle flows on the surrounding road network are fairly uniform between 0700 and 1500 at 7-9% of daily flows, but tail off to 4-5% of daily flows at 1700 and virtually nil by 2100 (see **Figure 3.7**).

Table 3.5 – Port Botany Road Volumes

	Patrick	P&O	Total
No. of Containers moved by Road			
4 June 2002 (1)	911	851	1,762
7 June 2002 (1)	1,032	480	1,512
"Typical" Day (2)	1,032	714	1,746
"Busy" Day (3)	1,352	Data not provided	N/A
No. of Truck Visits (4)			
4th June 2002 (1)	736	714	1,450
7th June 2002 (1)	808	399	1,207
"Typical" Day (2)	808	600	1,408
"Busy" Day (3)	1,024	Data not provided	N/A

1) The figure for P&O does not include "block runs" (i.e. movements of containers enmasse between the port container terminals and container parks/CFSs usually during a pre-arranged off-peak time period such as Saturday morning). Cummins (2002) advised that there are around 200 moves per day on block runs, from Smith Bros (full containers) and P&O Trans Australia (empty containers).

2) "Typical" day is defined as 7th June 2002 for Patrick and 5th June 2002 for P&O. The number of trucks for P&O (600) was estimated using the number of containers per truck ratio (1.19), which was calculated from the data for 4th and 7th June 2002.

3) 9th November 2001 for Patrick.

4) One truck "visit" generates two truck "trips" (an inbound trip and an outbound trip)

Block runs are encouraged as they reduce pressure on timeslotting arrangements. At Patrick block runs account for up to 300 trucks per day, while at P&O block runs account for around 200 truck visits per day.

Truck Queuing
Truck queuing at the port has historically been a significant problem. However, improved truck management practices, for example electronic vehicle booking systems, have substantially addressed the problem.

Road Servicing (Receival and Delivery) Hours
At P&O road servicing is undertaken five days a week between 0700 and 2200. At Patrick road servicing hours are currently 0500 to 2100. Block runs are currently undertaken on Saturday mornings. Data from the terminal operators indicates that the evening hours are under-utilised, with most truck movements generally occurring during "normal" business hours. This finding is also reflected in the hourly count data shown in **Figure 3.7**.

During the site visits, the terminal operators indicated that road servicing hours could be extended if volumes justified.

Truck Turnaround Times
The terminal operators have advised that truck turnaround times are currently 40-45 minutes at P&O and 35-40 minutes at Patrick. Both terminal operators are planning measures that will reduce turnaround times, for example, Patrick propose to adopt a paperless processing arrangement.

Timeslots at P&O are 1 hour in duration, and from July 2001 transporters have been penalised for late arrivals.

Figures 3.8, 3.9 and 3.10 show photographs of truck holding bays and servicing areas.

Figure 3.8 – Internal Truck Waiting Bays, P&O Terminal	**Figure 3.9 – Patrick Terminal looking east towards truck entry and waiting bays**
	

3 Existing Conditions

Figure 3.10 – Patrick Terminal looking west at truck servicing area and truck exit

Backloading
The terminal operators advised that backloading is currently less than 10% and this is confirmed by VBS data that was provided by Patrick. Measures have been implemented to encourage backloading such as processing the in and out movement at the same time, and allowing backloads to be picked up without advance bookings.

Car Parking
The existing Patrick terminal currently contain 190 car parking spaces[2], which equates to around 1.5 spaces per dayshift employee, assuming that 40% of total employees work the morning shift. The proposed upgrading of the Patrick terminal includes increasing the number of car parking spaces to 205.

3.5 Rail Network

3.5.1 Introduction
Figure 3.14 shows the regional context including the dedicated freight line, shared lines and intermodal terminals. The diagram at **Appendix I** depicts the location of the rail sidings at each container terminal, the Botany Yard and the dedicated freight line within the Botany area.

Port Botany (and White Bay/Rozelle) is currently served by a dedicated freight line from the Enfield marshalling area. This freight line connects to the shared metropolitan network at Concord West (Main North Line), Flemington Junction (Main West Line) and Sefton (Main South Line).

With respect to this study, the most operationally significant line is that which connects Port Botany with the Cooks River intermodal terminal and the Enfield marshalling yard. This dedicated freight line is the main artery through which all Port rail traffic passes.

At the port end of the freight line is Botany Yard, which facilitates shunting activities and the breaking up of trains prior to entering the port terminals. Safety inspections on rollingstock are also undertaken at the yard.

[2] Data was not obtained for the P&O terminal.

Intermodal terminals located within the Sydney greater metropolitan area are accessible by the shared (passenger and freight) network.

3.5.2 Dedicated Freight Line

The dedicated freight line connects Port Botany with the Enfield Marshalling Yard, and is duplicated between Enfield and Cooks River. The section between Cooks River and Port Botany remains unduplicated. This section includes the bridges over Robey Street, O'Riordan Street, Botany Road, Southern Cross Drive and Mill Pond Creek, as well as level crossings at General Holmes Drive and Banksia Street (for pedestrians).

Rail Infrastructure Corporation is progressively upgrading the dedicated freight line under a four-stage program. Stages 1, 2 and 3 have been completed and provided duplication of the track between Marrickville and Cooks River, and an upgraded connection between Botany Yard and the Patrick terminal.

Stage 4 is currently being developed and involves duplicating the section between Cook River and Port Botany. When completed, the Stage four works will provide full duplication of the dedicated freight line between Port Botany and Enfield Marshalling Yard.

3.5.3 Port Intermodal Terminals

Trains are received into the port terminals via sidings or spurs. The length of these sidings or spurs is a direct contributor to rail efficiency and port side logistics. The existing siding/spur lengths at each of the terminals are shown in **Table 3.6** below.

Table 3.6 – Existing spur lengths at port terminals

Operator	No. of Sidings	Length
P&O	3	350m
Patrick	2	600m
P&O Trans	2	445m

The length of trains servicing the terminals is dependent upon the siding/spur length at either the port terminal or intermodal terminal and the power configuration of the train. In terms of spur length, 'Portlink' trains for example, from Minto and Leightonfield serve both P&O and Patrick on the same trip, without shunting, and hence are restricted by the length of the shortest siding.

Some trains operate a distributed power configuration where a power unit is at either end of the train. This facilitates easier handling of the train by allowing it to be 'reversed' without having to run the locomotive around the train in order for it to be pulled back out. The 'Portlink' services from Minto and Leightonfield utilise a distributed power configuration.

In these respects any future enhancement to any terminal must consider the constraints that may exist at either the origin or destination terminal with regards to the train configurations they manage.

3 Existing Conditions

Figure 3.11 – P&O Siding	Figure 3.12 – Patrick Siding
	

3.5.4 Botany Yard

The Botany Yard is located near the port at Banksmeadow and consists of a master siding, a transit siding and other breakdown sidings. RIC have shift terminal managers at Botany and Cooks River who plan and co-ordinate train and yard operations (refer to **Figure 3.13** for site photographs).

Figure 3.13 – Botany Yard	
	

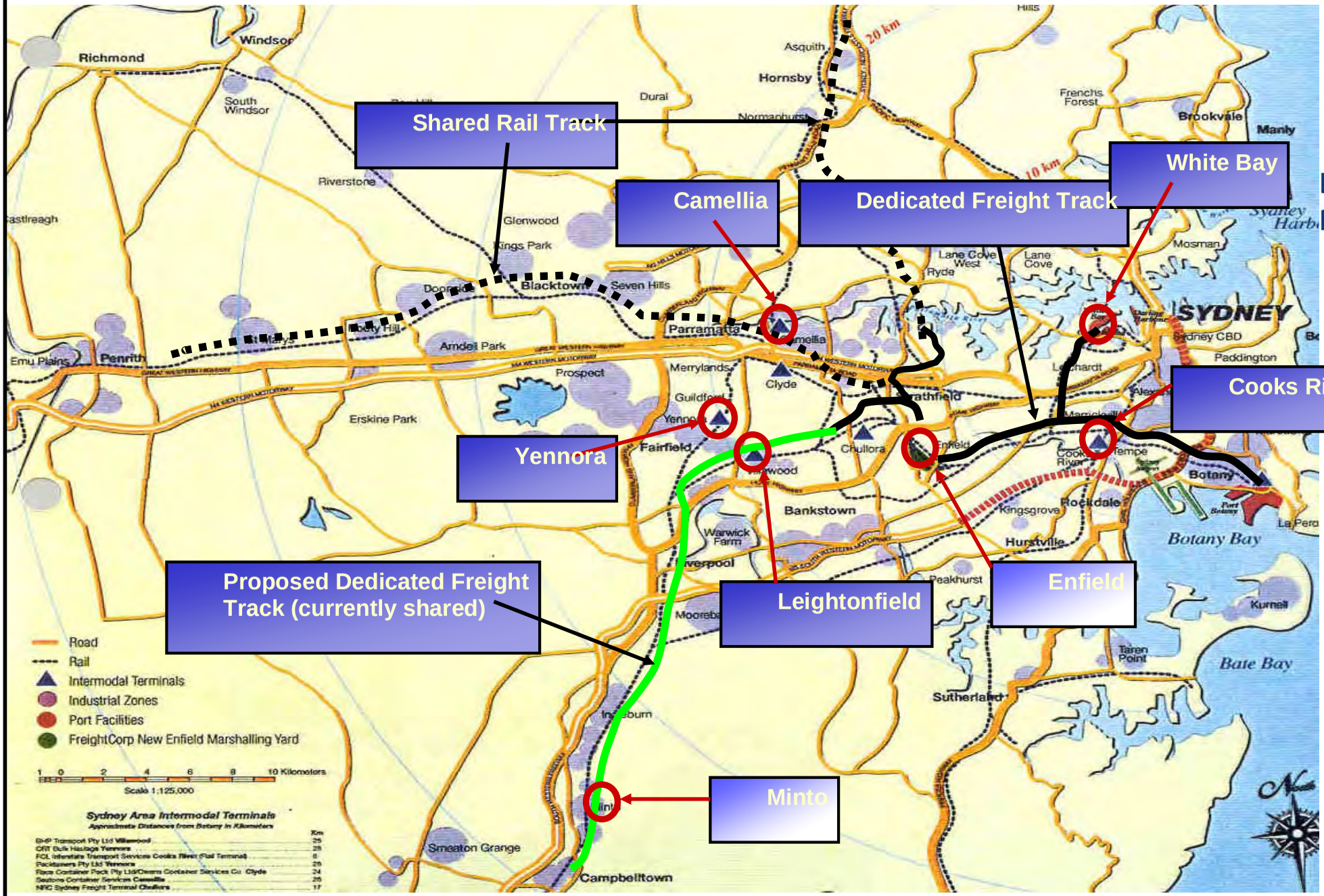
Some container rail services arriving at Botany have traffic destined for both container terminals. This requires the train locomotives to be detached on arrival at Botany Yard and run around to attach to the rear of the train (except Portlink services).

The train is then propelled to the first Terminal (depending on which Terminal traffic leads) and placed in its siding. The remainder of the train is then pulled out and propelled to the next Terminal Siding.

The time required to carry out these movements from the time of the arrival of the train at the yard until all movements are completed at Port Botany averages approximately 50 to 60 minutes. Portlink trains also service both port container terminals and have to shunt and wait for unloading and loading to be completed before going to the next port terminal.

Figure 3.14

Sydney's Dedicated Freight Track and Intermodal Terminals



3 Existing Conditions

Metropolitan Intermodal Terminals

There are five metropolitan intermodal terminals that service Port Botany throughout the Sydney metropolitan area:

- Cooks River
- Yennora
- Minto
- Camellia
- Leightonfield

Cooks River serve the port via the dedicated rail network. The remaining terminals that serve the port (Yennora, Minto, Camellia and Leightonfield) do so via a combination of the shared and dedicated network, and hence must accommodate trains that are required to operate outside the metropolitan curfew hours. Priority is given to passenger trains on the shared lines and this represents a significant constraint for rail freight efficiency.

Details of the Cooks River terminal is listed below. Details of the other terminals are included in **Appendix H**.

Cooks River

Cooks River Terminal is used predominantly for the storage and transfer of empty containers. It operates 8 sidings of varying length up to a maximum of 490m. For trains greater than 490m (country trains) the main line between Enfield and Botany is used as a shunting neck. This hinders main line operations and is detailed further in **Section 5.2.6** of this report.

3.6 Rail Traffic

3.6.1 Train Numbers

Advice from the port container terminal operators (Hulme 2002) indicates that P&O has on average 7 train visits per day (14 train trips). Estimates based on shift log scans provided by Patrick (Phillips 2002) indicated that Patrick attracts around 6 train visits (12 train trips) per day. It is to be noted that the Patrick terminal currently handles trains of differing lengths. The number shown above is based on the future forecasting model (refer **Appendix H**).

In addition, advice from Tzaneros (2002) suggests that P&O Trans Australia attracts (on average) 2 train visits per day (100-150 TEU per day at 60 TEU per train), for transferring empty containers to rural areas for packing and to White Bay for export. However, in the 4-month cotton season the number of train visits increases to around 4 per day (220-240 TEU per day).

3.6.2 Operating Hours

The P&O Terminal rail sidings operate continuously (24 hours) for 5 ½ days per week. The terminal operator has advised that they would be prepared to operate the siding on a 7 day 24 hour basis if volumes necessitated.

The Patrick Terminal rail sidings are already available on a 7 day 24 hour basis, however they are under utilised. According to Bilston (2002), only 16 shifts out of an available 21 over the week are fully utilised. This results in approx 55 to 70 hours per

week of non-productive time with regards to their rail operations and means that up to 12 hours per day is available to accommodate increased volumes.

Botany Yard is manned from approximately 2100 hours Sunday night to approximately 1500 hours Saturday. Botany has an AM and PM supervising manager who overseas Botany/Port Botany and Cooks River and liaises with freight rail operators and State Rail Network Train Control to plan and organise train programmes for both depots.

Cooks River is staffed by shifts approximately 0500 hours to approximately 2200 hours Monday to Friday and approximately 0500 hours to 1400 hours Saturday.

3.6.3 Turnaround Times

Because of the time variation in loading and unloading at each Terminal (P&O rate being a lift every 4 minutes compared to Patrick being 1 lift a minute) trains are held waiting for P&O to complete its requirements before the train consist can be reformed and returned to the intermodal terminal. This poses a major constraint to the rail operations which involve the port container terminal operators.

4 Transport Demand

4 Transport Demand

Chapter Summary

Basis of Forecasts
Trade throughput at Port Botany is assumed to increase from 877,000 TEU in 2001 to 1.25m TEU in 2006, 1.75m TEU in 2011, 2.5m TEU in 2016 and 3.2m TEU in 2021. It is assumed that a rail mode share of 30% by 2006 and 40% by 2011 is achieved though a "worst case" road traffic scenario has been tested for a rail mode share of 20%.

Freight Origins and Destinations
Around 80% of Port Botany throughput will continue to have an origin/destination in the greater Sydney area, however the distribution within this area will change.

Freight volumes between Port Botany and the local Botany area will be constrained by the finite amount of land that is available for new development, and will decrease from around 20% of total port throughput currently to around 15% in 2021, although volumes will continue to grow in absolute terms. The western and south western areas of Sydney will increase in importance, attracting around 65% of port throughput by 2021. Around 40% of this cargo would travel by rail from Port Botany to metropolitan intermodal terminals.

Road Volumes
Assuming that the new terminal will attract a 40% share of total port throughput, total truck visits in the AM and PM peak hours are as shown below.

	No. of Truck Visits to the Port [1]									
	Current Situation	2011			2016			2021		
		New Terminal	Existing Facilities	Total	New Terminal	Existing Facilities	Total	New Terminal	Existing Facilities	Total
AM Peak	120	39	89	128	63	95	158	75	113	188
PM Peak	55	18	41	59	29	43	72	47	70	117

1) assumes the new terminal has a market share of 40% by 2021.
2) One truck "visit" generates two truck "trips" (an inbound trip and an outbound trip)

Truck volumes would be concentrated on Foreshore, Botany, Bumborah Point and Penrhyn Roads. In general, the increase in port traffic is expected to have a negligible effect on the performance of roads at a subregional level, as port trucks make up a small proportion of total traffic outside the local Botany area.

Rail Volumes
Assuming that the new terminal will attract a 40% share of total port throughput, the forecast number of train visits per day are as shown below. The number of train trips to and from Port Botany is also shown, recognising that each train visit represents two train movements.

4 Transport Demand

Terminal	Existing	2006	2011	2016	2021
Patrick	6*	9	11	12	14
P&O	7	11	11	15	17
New Terminal	0	0	9	16	18
P&O Trans	2	3	4	4	5
Total Train Visits	15	23	35	47	54
Total Train Trips	**30**	**46**	**70**	**94**	**108**

* Currently the Patrick terminal handles trains of differing lengths. The number shown above is based on a standard trains length that is used in the future forecasting model (refer **Appendix H**).

4 Transport Demand

4.1 Basis of Demand Forecasts

4.1.1 Growth in Port Container Trade

The forecast trade volumes that were adopted for this study are shown in **Table 4.1.**

Table 4.1 – Trade Forecasts

Year	Trade Volume (TEU)
2006	1.25 million
2011	1.75 million
2016	2.50 million
2021	3.20 million

* 2025 trade figures used to model 2021, 2020 trade figures used to model 2016 having regard to background traffic limitations.

4.1.2 Study Areas

Road Core Study Area

For the purposes of this study, a "core" study area has been identified in consultation with the RTA and SPC. The proposed study area (depicted in **Figure 4.1**) was selected to focus on those routes that carry the highest volumes of port trucks, and has been agreed to by the RTA**.**

Generally speaking, the proportion of port traffic on the road network decreases as the distance from the port increases. For routes where port trucks make up a low proportion of total traffic, increases in port traffic would have a negligible effect on road performance.

Forecasts for the AM peak, PM peak and daily flows have been produced for the current year and from 2006-2021 at five-year intervals. The underlying background traffic forecasts are capped at 2016 levels, as the Transport Data Centre trip tables on which the model is based do not extend beyond this date. The 2021 port traffic forecasts are therefore overlaid on 2016 estimates of background traffic.

The critical proportion has been assumed to be where the 2021 forecasts for port trucks in the AM peak are around 5% of the 2016 background traffic level morning peak hour flow, based on IHTA (1994). For roads where the total flow in the AM peak is below 1000 vehicles, the critical proportion was assumed to be around 10% (IHTA 1994). **Tables 4.4 and 4.5** shows that the roads within the core study area generally tend to have a much higher proportion of port traffic than those outside the area.

Road Subregional Study Area

Road traffic volumes beyond the core study area were taken into consideration in developing traffic forecasts at the subregional level. The subregional study area, shown in **Figure 4.1**, extends from the port precinct to Metroad 3 (King Georges Road). Although it is not feasible to identify every individual origin/destination for port related trucks at the subregional level, the study uses a strategic Sydney-wide model to forecast total traffic and port truck numbers.

Rail Study Area
The assessment of port generated rail traffic focuses on the dedicated freight line and the metropolitan intermodal terminals. In this sense, the rail study area essentially covers the entire Sydney region, as shown in **Figure 3.14**.

4.1.3 Port Generated Road and Rail Traffic Movement

Within the Port Botany precinct there is a range of port-generated rail and road freight movements. For rail, these include the carriage of import and export containers to/from the terminals and also the movement of empty containers to/from the P&O Trans Australia site.

Road movements are significantly more complex. As well as delivering exports and picking up import containers, studies have shown that currently 85% of empty containers are picked up/returned to container yards in the port area (including MCS and Tynes at St Peters which is outside the core study area). Trucks also service the two major container freight stations (CFS) adjacent to the port. They pack and unpack containers for clients and the unpacked products are moved in trucks of various sizes to/from these facilities. For modelling purposes, all these truck movements have been calculated on the basis of moves per TEU.

The origin/destination (O/D) analysis forecasts trip numbers for the wide variety of transport movements that are generated by the port, including:

- truck trips to and from the port container terminals to either pick up import containers or deliver export containers;
- truck trips to and from the local container parks to either pick up or deliver empty containers;
- commercial vehicle trips which pickup/deliver “less than container loads” (LCL) of freight at local container packing/unpacking stations;
- rail trips transporting imports from the port container terminal to the hinterland (primarily the metropolitan intermodal terminals);
- rail trips transporting empty containers to the hinterland for packing, or to the port container terminals for export; and
- rail trips carrying exports to the port container terminals (usually from the rural area).

Appendix J provides an overview of the different types of road movements occurring within the port precinct and to/from the hinterland.

4.1.4 Forecasting Approach

Future transport demands were estimated on the basis of SPC achieving its stated objective of 30% mode share by rail in 2006 and 40% by 2011. In order to test a “worst case” road scenario in terms of network performance, forecasts were also prepared assuming a rail mode share of 20%. Intersection analyses were undertaken at the bases of the 20% rail mode share.

4 Transport Demand

Forecasts of rail and road traffic were prepared for three terminal market shares, as identified in **Table 4.2**, in order to provide a likely "envelope" of future transport demand for each mode.

Table 4.2 – Terminal Market Shares

	2006	2011	2016	2021
Market Share 1				
Patrick	50%	40%	30%	30%
P&O	50%	30%	30%	30%
New	-	30%	40%	40%
Market Share 2				
Patrick	50%	40%	30%	30%
P&O	50%	40%	40%	40%
New	-	20%	30%	30%
Market Share 3				
Patrick	60%	50%	40%	40%
P&O	40%	30%	30%	30%
New	-	20%	30%	30%

Note: Generally Market Share 1 maximises the New Terminal
Market Share 2 maximises P&O
Market Share 3 maximises Patrick

Processes were developed for forecasting truck and train volumes based on trade throughput forecasts and other assumptions that were agreed with SPC. The accompanying *Assumptions Paper* (**Appendix C**) sets out the details of the assumptions used in the forecasting processes.

The truck and train traffic forecasting process involved four broad steps:

1 forecasting total growth in container movements;

2 forecasting volumes by origin/destination (the "O/D analysis");

3 forecasting the number of road and rail trips for given operating assumptions such as mode split assumptions; and

4 assigning road traffic forecasts to the future road network. This step included overlaying port related truck traffic forecasts over future background traffic levels (the "road traffic analysis").

The existing period (2000-01) flows in the model were calibrated with data from the port container terminals, container yard and CFS operators.

The forecasting process for the O/D analysis is outlined in **Figure 4.2**.

Figure 4.1
Core Road Study Area

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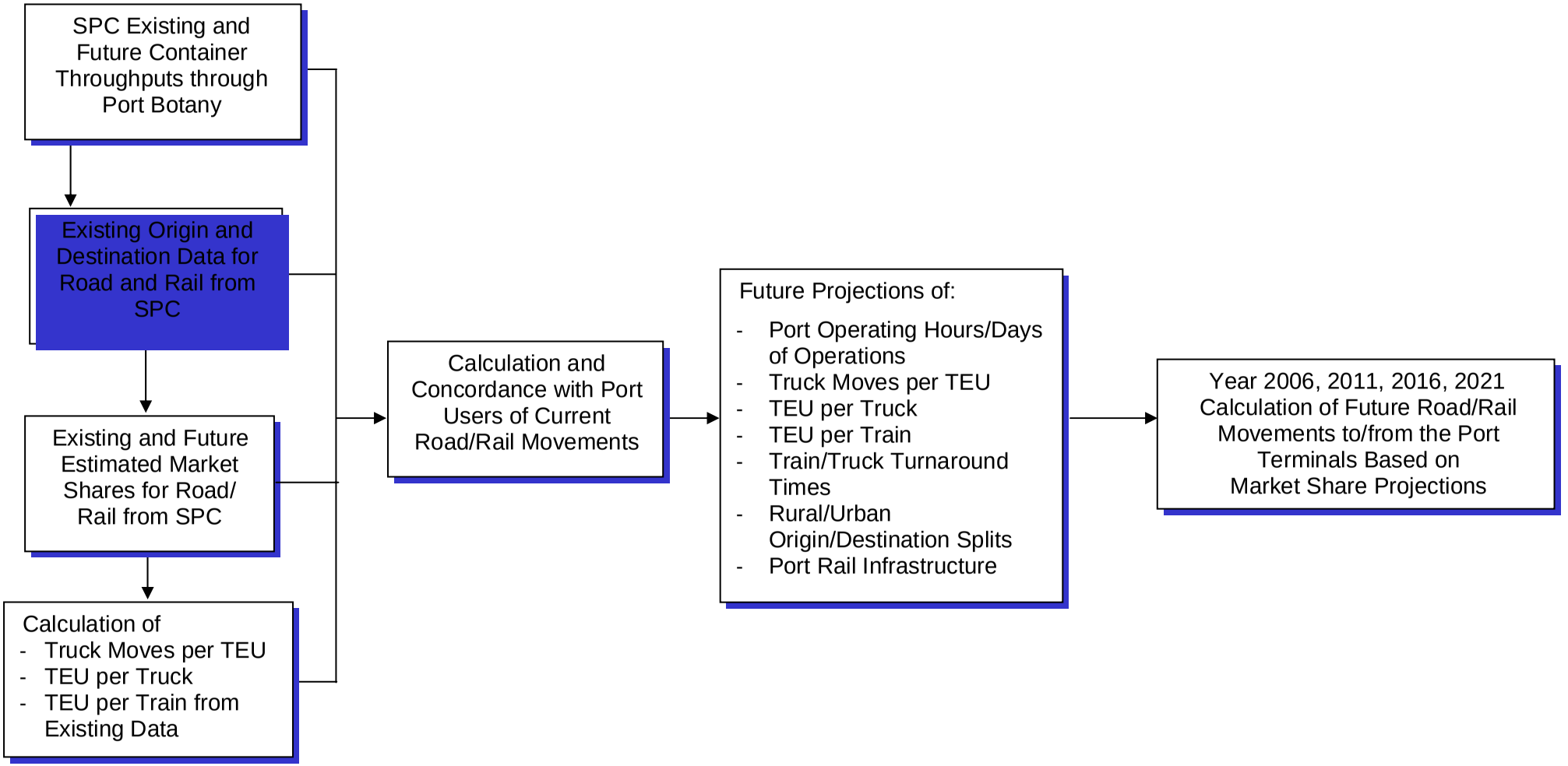
Figure 4.2 – Process for Estimating Road/Rail Flows 2001-2021



4 Transport Demand

4.2 Origin Destination of Port Generated Traffic

4.2.1 General

The existing origins and destinations of container movements around Sydney and New South Wales were sourced from a report to SPC dated September 2000 (the Thompson Clarke study). This took an estimated 20% sample of deliveries in March of that year aggregated to the level of Local Government Areas. SPC provided data on the minor flow of containers outside the metropolitan area.

For the future scenarios, Maunsell estimated the O/D proportions based on our knowledge of future trends in industrial land uses across Sydney. Data was sought from PlanningNSW and Transport NSW, but it was found that the State Government no longer produces employment land forecasts. The last publication of Employment Land Development Forecasts is 4 or 5 years old.

In general, the western and south western areas (including Blacktown, Liverpool and Fairfield) are expected to increase in importance due to new land releases and their proximity to transport improvements such as the Western Sydney Orbital. The proportion of port throughput that travels to/from these outer suburbs is expected to increase from 55% to 65% by 2021.

The inner suburbs, however, are expected to decrease in prominence since there is limited additional land to release. Total volumes to/from the Botany area would be constrained by the capacity of container parks and container freight stations (CFSs), and the finite amount of land available for new developments. The proportion of total port throughput travelling to/from the Botany area is expected to decrease from around 20% to 15% by 2021, although absolute volumes would continue to increase. As this traffic would continue to travel via road it results in an increase in the proportion of road traffic to/from Botany.

Table 4.4 provides a detailed analysis of the future prospects for each region.

The O/D proportions for road traffic were adjusted to take account of the changes that would occur due to the increased rail mode share. The distribution of truck trips to/from the port would change, as large volumes of cargo for the inner western and outer suburbs would travel by rail between the port and metropolitan intermodal terminals by rail, with a road transport leg between the intermodal terminal and origin/destination. It is estimated that rail's mode share for the outer suburbs would increase from around 17% currently to 40% by 2021. Cargo bound for the Port Botany precinct would, however, still travel by road. As a result, the distribution of truck trips across Sydney would change so that a larger proportion remains within the Botany area.

Table 4.3 overleaf shows the current and future O/D proportions for road. It can be seen that the percentage of total road trips that stay within the Botany area increases to 2016, due to rail's increased mode share. However, after 2016 the capacity and land availability constraints take effect and the proportion of total road trips that stay within Botany begins to decrease, indicating a plateauing of total volumes that stay within Botany.

4 Transport Demand

Table 4.3 – Origin/Destination Matrix for Road Traffic

	Existing	2006	2011	2016	2021
Interstate					
Intra-State	4.0%	4.0%	4.0%	4.0%	4.0%
Botany	22.1%	24.6%	25.0%	25.3%	23.5%
City and Eastern Suburbs	0.2%	0.2%	0.1%	0.1%	0.1%
South Sydney	2.6%	2.3%	2.2%	1.3%	1.1%
Southern Suburbs	1.1%	0.8%	0.7%	0.7%	0.7%
North Shore	3.6%	2.9%	2.1%	2.2%	2.2%
NW Sydney	1.4%	0.8%	0.7%	0.7%	0.7%
Inner West	10.9%	9.2%	10.1%	8.8%	7.8%
Central West	16.1%	15.1%	13.7%	12.8%	12.6%
Industrial West	10.8%	10.7%	11.3%	11.5%	12.6%
Blacktown	9.0%	10.2%	10.2%	12.0%	13.5%
Penrith	2.2%	2.2%	2.0%	2.0%	2.0%
Liverpool	7.0%	7.8%	8.0%	8.0%	8.1%
South West	9.0%	9.7%	10.0%	10.2%	10.8%
Total	100%	100%	100%	100%	100%
Sydney Total	96%	96%	96%	96%	96%

Table 4.4 – Issues Affecting the Estimation of Future Road O/Ds in Sydney

Area	Considerations	Expected % share
Botany	▪ Significant new developments planned or in hand, e.g., 2-8 and 10-16 McPherson Street. ▪ Council is encouraging port related heavy industrial land uses. ▪ However faster growth in western Sydney will result in a reduction in % of freight moving within Botany in the long term.	Increasing from 22.1% to 25.3% in 2016 then decreasing to 23.5% by 2021.
City and Eastern Suburbs	▪ Industrial land will continue to be converted to residential uses.	Minor reduction from 0.2% to 0.1% over forecasting period.
South Sydney	▪ There is expected to be a shift away from port related industrial land uses to commercial/residential land uses. For example, the Green Square redevelopment.	Decreasing from 2.6% to 1.1% over forecasting period
Southern Suburbs	▪ Well established industrial areas such as Taren Point will remain, but most new development is expected to be residential (especially Hurstville).	Minor reduction from 1.1% to 0.7% by 2011
North Shore	▪ Industrial areas at Frenchs Forest and near Warringah Mall will remain as is. ▪ However the significant industrial area at Artarmon will decline due to rising land values.	Reduction from 3.6% to 2.2% by 2016
NW Sydney	▪ Castle Hill industrial area will remain. ▪ Some new land releases in Baulkham Hills but will mainly be offices. No significant industrial development anticipated over the next 20 years.	Reducing from 1.4% to 0.7% by 2011
Inner West	▪ In general, industrial activities are expected to move further west as the M5 east makes cheaper land more accessible. ▪ Concord is rapidly losing its industrial base to residential redevelopment, Ashfield is expected to transform more gradually. ▪ Freight movements will continue to be generated by the Cooks River and Marrickville areas.	Gradual reduction from 10.9% to 7.8% over forecasting period.

Area	Considerations	Expected % share
Central West	▪ Chullora and Camellia industrial areas are expected to continue to generate freight movements. ▪ Silverwater industrial area is likely to grow due to its proximity to the M4. ▪ Rydalmere industrial area may shift towards residential land uses.	Gradual reduction from 16.1% to 12.6% over forecasting period.
Industrial West	▪ Wetherill Park industrial area may be further developed. ▪ There is likely to be some new warehousing facilities at the Boral quarry site. ▪ Proximity to Western Sydney Orbital and M4 is likely to stimulate new industrial area.	Increasing from 10.8% to 12.6% over the forecasting period.
Blacktown	▪ Includes SEPP 59 Central Western Sydney Economic and Employment Zone, which will generate significant amounts of new industrial land over the next 15 years. ▪ Proximity to M4 and WSO will stimulate development. ▪ Existing industrial areas at Sunnyholt Road and Seven Hills will continue to operate.	Increasing from 9% to 13.5% by 2021.
Penrith	▪ Population growth expected but no substantial new industrial land anticipated. Erskine Park industrial area unlikely to be as attractive as the SEPP 59 area for new developments.	Minor decrease from 2.2% to 2% over the forecasting period.
Liverpool	▪ Significant growth expected in areas close to M5 and WSO, such as Prestons, Casula and Moorebank.	Increasing from 7% to 8.1% by 2021.
South West	▪ Gradual growth in existing industrial developments at Campbelltown, Minto and Ingleburn. ▪ Further growth expected around Camden.	Increasing from 9% to 10.8% by 2021

4.2.2 Botany Area

Notwithstanding the capacity constraints discussed earlier, the Botany area is expected to remain a significant generator of port related freight.

The Botany Local Environmental Plan (LEP) recognises the importance of the Botany LGA as a "gateway" to Sydney, given its proximity to the airport and Port Botany and the contribution that industry makes to economic and employment growth in the area. The LEP aims to achieve a balance between various land uses, recognising the importance of port related developments.

It is envisaged that port related, heavy industry, and transport land uses will increase into the future. Council representatives have advised that the number of container packing/unpacking, warehousing and distribution facilities around the port is expected to increase in the near future, with new developments including:

- 2 – 8 McPherson Street;
- 10 – 16 McPherson Street;
- 47 Swinbourne Street; and
- the Johnson and Johnson site.

The ongoing need for CFSs and empty container parks within Botany was also highlighted by the industry, which pointed out key drivers including the:

- trade imbalance and associated excess of empty containers; and
- increased cost of transporting containers to/from the port precinct for packing/unpacking in other areas. Tzaneros (2002) cited an example where transporting a box to Alexandria for packing would add $100 per box to transport costs.

For this study, the new developments were treated as CFSs and their capacity was forecast based on their estimated floorspaces and advice received from SPC on maximum throughput TEUs per hectare per annum. Adjustments were made to reflect Council's advice that the new developments would not be utilised exclusively for container packing/unpacking but may support other uses as well. As indicated in the previous section, the capacity of CFSs in the port precinct would be adequate for the trade forecasts until 2016 but further growth to 2021 would be constrained.

4.3 Road Traffic Forecasts

4.3.1 Truck Trips to/from the Port Container Terminals

The container trade forecasts for Port Botany were converted into truck numbers using key operating assumptions including:

- ***TEU to container ratio:*** A figure of 1.35 TEUs per container was used for the current situation, and it was assumed that the ratio would increase to 1.6 by 2021, reflecting the expected continuation in the trend towards a higher proportion of 40' containers compared to 20' containers. The assumptions adopted for this report are consistent with those used in Maunsell (2002).

- ***Containers per truck:*** For the existing situation, a figure of 1.19 containers per truck visit was used, based on data received from the port container terminals. This figure is consistent with data obtained during the intersection counts. For example, at the Bumborah Point Road/Friendship Road intersection on 4th June 2002, there were 283 container-carrying trucks between 1,500 and 1,800 carrying 343 containers. This equates to 1.21 containers per truck.

  In recognition of the probable introduction of more efficient B-double truck capacity (3 TEU) in the future, this has been scaled up in the future. It was assumed that the figure would increase over the analysis period, in line with historical trends, to 1.33 containers per truck by 2021.

- ***Backloading:*** Data provided by the port container terminals indicated that the current level of backloading is around 8% of truck visits. This figure is assumed to increase to 27% in 2021, based on advice from the port container terminals.

Assuming that the rail mode share increases over time in accordance with SPC's strategy to 30% in 2006 and 40% by 2011, and assuming that the new terminal will attract a 40% share of total port throughput, total truck movements in the AM and PM peak hours are as shown in **Table 4.5**.

Table 4.5 – Forecast Truck Visits to and from the Port Container Terminals (1)

	No. of Truck Visits (2)									
	Current Situation	2011			2016			2021		
		New Terminal	Existing Facilities	Total	New Terminal	Existing Facilities	Total	New Terminal	Existing Facilities	Total
AM Peak	120	39	89	128	63	95	158	75	113	188
PM Peak	55	18	41	59	29	43	72	47	70	117

1) assumes the new terminal has a market share of 40% by 2021.
2) One truck "visit" generates two truck "trips" (an inbound trip and an outbound trip)

4.3.2 Other Truck Trips

The volumes of empty container trucks, LCL trips to/from the CFSs and trips to/from the x-ray facility were forecast as part of the O/D analysis

4.3.3 Cumulative Effects of New Developments

The development of an x-ray facility by Australian Customs Service at Lot 103 Bumborah Point Road will generate additional truck movements in the precinct. ACS estimate that the facility will generate 6 trucks per hour for 16 hours per day, which indicates up to 100 trucks, would be generated per day. Up to 10% of the trucks will come from Port Jackson and the remainder from Port Botany (SPC 2002a).

More significantly, the development of a warehousing and CFS facility at Molineux Point will generate up to 700 trucks per day, according to Tzaneros 2002.

The preliminary cumulative analyses embraced an estimation of truck numbers within the Botany area that took into consideration the effects of these developments. The trucks attracted by the x-ray facility were included by the use of a factor of 0.08, i.e., for every full TEU through the port container terminals there is 0.08 of a TEU to/from the x-ray facility. Similarly, the traffic generated by the Molineux Point development was taken into consideration in the factors for LCL trucks.

The factors for LCL trucks are based on the capacity of the Molineux Point development and the other CFS developments identified in **Section 4.2.2**.

Regional Developments
The preliminary data on cumulative traffic levels generated by major regional developments including the airport, Green Square and Cooks Cove are estimated to increase from 11,700 currently to 20,600 vehicles in the peak hour in 2011 and 27,000 in 2021, a growth rate of nearly 8% pa. This is inclusive of an expanded Port Botany, which by 2021 would represent less than 1% of total forecast peak hourly traffic flow.

4.3.4 Hourly distributions

In order to measure the impact of increasing road movements on the infrastructure, daily flows were broken down into hourly intervals. For port traffic, terminal operators indicated that with increasing demand, hours of road servicing would increase and we have assumed in the model that road flows would be spread over 24 hours in 2021. However, it was assumed that for future years, the AM peak would continue to represent 8% of daily flows (same as the current situation). It was also assumed that the PM Peak would increase from 4% of daily flows currently to 5% in 2021. This is considered to provide a conservatively high estimate of peak flows for use in intersection analysis.

The peak daily ratios assumed for this study are consistent with the approach adopted in the EIS for the extension of the Patrick terminal, which adopted 9% as the AM peak hour's share of daily movements for 2016 (PPK 2002). The Patrick EIS does not analyse the PM peak, but data presented in the report indicates that 5% of total daily truck flows to/from the terminal occur during the 1700 – 1800 road system peak.

For background traffic, the AM peak also represents 8% of total daily flows on average. However the proportion varies according to the route. For example, on Bumborah Point Road, 5% of the daily flow occurs in the AM peak while on Botany Road (north of Hills Street), the AM peak represents 9% of the daily flow. These variations were taken into consideration in the modelling process.

4.3.5 Modelling Approach for Road Traffic

The traffic generated by the Port and associated activities have been modelled to produce future year road network flows with and without the new terminal in operation. Inherent in the approach has been the assumption to allow port growth up to the capacity of the two existing terminals and to consider the effects of the new terminal traffic on top of this base growth.

Trip growth in the base situation has also included the growth in traffic to and from the existing and planned container parks, container freight stations and the x-ray facility.

The modelling approach has involved the use of the Maunsell Model. This is an 800-zone morning peak hour assignment model covering the whole of the Sydney Metropolitan area. The model operates at a base year of 2001 and for the future years of 2006 and 2016.

It has been used previously for a wide variety of applications ranging from the transport implications of the 2000 Olympics to a number of major toll road proposals.

The future year trip tables used by the model are based upon the Transport Data Centre (TDC) population and employment growth forecasts for the metropolitan area and then used in the production of morning peak hour flow. The employment model provides a fairly even blanket coverage at local government levels across the area as a whole except in areas where there are known to be large-scale developments.

The TDC forecasts do not include any specific growth in the port per se.

The modelling approach is described in detail in **Appendix E.**

Light Vehicle Trips at the Port

Light vehicle traffic generated by the port was estimated using the intersection counts. Light vehicle trips are lower in number than heavy vehicle trips for both the AM and PM peaks. This is because shift changeover times do not correspond with the road system peaks, so the light vehicle traffic generated by the port would be limited to those generated by visits such as business meetings and tradespeople.

For the new terminal, it was assumed that the number of light vehicle trips would be similar to the existing terminals (see **Table 4.6**). Also, it was assumed that light vehicle trips generated by the port would not grow significantly in the future.
It is considered that, in the context of this study, the impact of light traffic generated by the third terminal is fairly negligible.

Table 4.6 – Light Vehicle Trips during Road System Peak, Vehicles per Hour

Terminal	AM [1]
Patrick	62 (33 out, 29 in)
P&O	34 (24 out, 10 in)
New	48 (29 out, 19 in)

1) The PM peak is assumed to mirror the AM peak.

4.3.6 Future Road Network

The opening of the M5 East has delivered a significant improvement to the efficiency of road freight operations that service Port Botany, with travel times to/from the south western suburbs reduced by around 15 minutes. The M5 East has also relieved some routes of truck traffic including the Bay Street/Stoney Creek Drive route for southwest-bound traffic and the Sydneham Road route for westbound traffic.

It is understood that the RTA is currently implementing measures on the “overland” route (Qantas Drive, Marsh Street, Forest Road, Stoney Creek Road) through Bexley such as reducing the number of lanes and changing signal phasing in order to further encourage heavy vehicles to use the M5 East.

There are several additional road development and traffic management proposals that would impact on road access to Port Botany.

Foreshore Road Access
Botany Council has a longstanding objective to minimise the number of truck movements on Botany Road. To this end Council has prepared a plan to improve access between Foreshore Road and Southern Cross Drive, including an:

- underpass from Foreshore Road onto the Southern Cross Drive northbound carriageway;
- exit ramp from the Southern Cross Drive southbound viaduct onto General Holmes Drive, to facilitate access to Foreshore Road;
- overpass/underpass connecting Southern Cross Drive with Joyce Drive in order to bypass the existing General Holmes Drive/Millpond Road intersection;
- extension of Hale Street with overpass and connections to Foreshore Road, which would allow the development of port related land uses in the Hale Street area without an increase in truck traffic on Botany Road.

However, Council has recommended that, in order to assess a worst case scenario in terms of road network performance, it would not be prudent to include this proposal in the future road network, as the RTA raised issues about the road geometry and proximity to Southern Cross Drive.

Port Feeder Road
Botany Council has prepared a proposal to construct a new road linking McPherson Street with Swinbourne Street, to service port related developments including the new developments at 47 Swinbourne Street and the Johnson and Johnson site. Development approval for these sites was conditional upon industry constructing the Port Feeder Road, and it is anticipated that construction will commence shortly.

The objective of the proposal from Council's viewpoint is to reduce the number of truck movements on Stephen Road, which has residential frontage and is not approved for B-Doubles.

As noted previously, Page Street, which is part of the Stephen Road route to the port, is to become a light vehicle route when the Port Feeder road is completed.

Potential associated roadworks include streamlining the Botany Road/Exell Street intersection and the Botany Road/Hills Street intersection, and in the longer term a potential new road running parallel to the railway line and linking McPherson Street with Botany Road.

Marrickville Truck Tunnel
Marrickville Council recently assessed the feasibility of constructing a tunnel under Marrickville to cater for port/airport truck traffic travelling to/from Parramatta Road. The primary objective of the proposal was to reduce the number of trucks using the Sydneham Road route, which is considered to be substandard for use by road hauliers. As the M5 East has relieved the Sydneham Road route of some truck traffic, the traffic modelling undertaken for this study has assumed that the Marrickville tunnel will not be constructed in the foreseeable future. This assumption provides a more conservative assessment in terms of the impacts of port traffic at the subregional level.

Cross City Tunnel
The future road network adopted for this study includes the Cross City Tunnel, which is planned for completion in 2005. The Cross City Tunnel could potentially attract some port trucks travelling to/from western Sydney to use Beauchamp Road-Wentworth Avenue-Southern Cross Drive-Eastern Distributor-Cross City Tunnel instead of the Mascot-Marrickville truck route. However, the analysis indicates that very few trucks are expected to make this diversion and hence the impact of the Cross City Tunnel will be minimal.

St Peters Industrial Route
The 2016 model includes the "St Peters Industrial Route", which extends from the Princes Highway near Cooks River to Canal Road at St Peters, via the proposed F6 corridor.

4.4 Local Area Traffic Management

A formal Local Area Traffic Management Plan relating to the expanded Port Botany is to be developed. Relevant issues are discussed below.

4.4.1 Proposed Traffic Management Scheme for Mascot/Green Square

Botany Council is proposing a traffic management scheme for the Mascot/Green Square area that includes:

One Way Traffic Flows on Bourke Road and O'Riordan Street
A plan was developed to convert Bourke Road to northbound flow only, and O'Riordan Street to southbound flow only. It is understood that the proposal is currently on hold due to concerns by the RTA about the potential impacts on the Green Square development.

One Way Traffic Flows on Kent Road, Gardeners Road, Bourke Road and Coward Street
Botany Council's proposal is to introduce one-way clockwise traffic flow from Ricketty Street around Kent Road, Gardeners Road, Bourke Road, Coward Street and back onto Kent Road. This would improve the safety/efficiency of the Coward Street/Kent Road intersection as it would be used for right turns only. However, Council's discussions with RTA have indicated that the RTA is not receptive to the proposal; hence it has not been included in the Maunsell model.

4.4.2 Truck Access to Botany Road

The transport analysis indicates that Botany Road will continue to be utilised by both local and regional truck traffic. In the event that Botany Council and/or the RTA should restrict the movement of trucks on Botany Road north of McPherson Street, regional truck trips would be affected but local truck trips would be largely unaffected. The following sections discuss the implications for port trucks if truck movements were to be restricted on Botany Road north of McPherson Street.

Local Traffic
In terms of local traffic, the local CFSs and container yards that generate truck movements on Botany Road include Maritime Container Services and the new developments listed in **Section 4.2.2**.

4 Transport Demand

Trucks travelling between the port container terminals and these local freight generators would use the relatively short section of Botany Road between Foreshore Road and Hills/Exell Streets. Trucks travelling to/from developments on Swinbourne Street would use the proposed port feeder road, which connects with Botany Road via McPherson and Hills/Exell Streets.

Regional Traffic
For regional traffic, the transport analysis indicates that the following truck movements would make use of Botany Road in 2021, and would therefore need to find an alternative route should restrictions be placed on truck traffic through Botany Road.

- 25% of trips to/from the Inner West;
- 30% of trips to/from South Sydney;
- 25% of trips to/from the City/North Shore/North Western Sydney; and
- 20% of trips to/from industrial areas in Central Western Sydney and Blacktown.

Implications of Truck Restrictions on Botany Road
It is estimated that in 2021, there would be 48 regional truck trips (24 northbound and 24 southbound) on Botany Road in the AM Peak and 30 (15 northbound and 15 southbound) in the PM Peak. These trips would therefore need to use alternative routes, such as Joyce Drive-O'Riordan Street.

The alternative routes (shown in **Appendix E)** are considered to provide a comparable if not better level of service compared to Botany Road.

The worst impact in terms of road performance would be for all trucks that would otherwise access Botany Road to use Joyce Drive – O'Riordan Street instead. This would result in the number of port related trucks using Joyce Drive in 2021 increasing from 62 to 110 (55 westbound and 55 eastbound) in the AM peak and from 40 to 70 (35 westbound and 35 eastbound) in the PM peak. In proportional terms, port trucks would increase from 2% to 3% of the total AM peak flow in 2021 and from 1% to 2% in the PM peak.

Proposed Hale Street Extension
Botany Council's proposed extension of Hale Street through to Foreshore Road would facilitate the development of port related land uses in the Hale Street/Luland Street area. The amount of land available for redevelopment is quite limited, however, there would be some limited scope for additional CFS/container yard facilities in the Botany area. To a certain extent this would reduce the need for additional port related development outside the road core study area. The proposal would thus help to contain truck traffic impacts within the core area, with consequent benefits for the general community.

The Hale Street extension would allow increased development without a corresponding increase in truck traffic on Botany Road, as trucks would be able to access Foreshore Road directly. However it would not provide an alternative route to Botany Road for regional truck traffic.

The proposal includes the provision of a grade-separated intersection with ramp connections between Foreshore Road and Hale Street, so there would be no constraints on right turn movements. However, the close proximity of the proposed Hale Street intersection to the existing General Holmes Drive/Foreshore Road intersection would require careful assessment of intersection geometry to enable the proposed intersection to perform satisfactorily.

4.4.3 Plans for Mascot/Green Square Area

The proposed traffic management scheme for the Mascot/Green Square area would affect trucks travelling between Port Botany and the Inner West, South Sydney, and a proportion of trucks travelling to/from the Central West/Industrial West/Blacktown area. Maunsell forecasts indicate that in 2021, there will be 66 truck trips to/from Port Botany in the AM peak and 40 in the PM peak that would be affected by the altered traffic arrangements.

In general, the proposed traffic flow arrangements would improve conditions for port traffic travelling through the area by improving safety (particularly at the Kent Road/ Coward Street intersection) and traffic efficiency. The Bourke Road/Gardeners Road intersection currently experiences some delays for northbound traffic and this may become an issue for port traffic heading north to South Sydney/Rosebery. However this possibility is considered to be minor in the context of the general improvements in safety and efficiency that the proposal would provide. We have assumed that the one way flows on Bourke Road and O'Riordan Street would be implemented in 2016.

4.4.4 Results

Subregional Level

The peak flows for both port trucks and total traffic are shown in **Tables 4.7, 4.8 and 4.9**. The highest volumes of port trucks are on Foreshore Road, Botany Road and Bumborah Point Road. This is reflected in **Figure 4.3** which shows the results of the assignment process for port related traffic. It is forecast that port trucks will make up a relatively small proportion of the total future traffic on routes outside the study area including Airport Drive, Canal Road and O'Riordan Street. These routes will be affected more by growth in traffic generated by regional developments such as the airport, Green Square and Cooks Cove, rather than growth in Port Botany traffic.

The opening of the M5 East has reduced the number of trucks using the parallel Forest Road-Stoney Creek Road route. **Table 4.7** indicates that there will be approximately 40 port trucks using Stoney Creek Road in the AM peak in 2011. This is consistent with the M5 East EIS (RTA 1996), which found that there would be 113 trucks (total trucks including those generated by the port) using the route in 2011. The M5 East EIS forecasts that in 2011 truck volumes on Stoney Creek Road will still be nearly half the 1996 (pre M5 East) volumes.

Routes Within the Core Study Area

Table 4.10 shows the forecast hourly flows in 2011 and 2021 for major links in the core road study area. It can be seen that heavy vehicle volumes will be concentrated on Foreshore and Botany Roads. Similarly, total volumes (including light vehicles) are heaviest on Foreshore Road, Beauchamp Road and Botany Road (between Penrhyn Road and Beauchamp Road).

The link flows tend to indicate that the crucial intersections will be those along the Foreshore and Botany Road route due to the high volumes of total traffic and the high proportion of heavy vehicles.

4.5 Rail Traffic Forecasts

4.5.1 Modelling Approach

The rail traffic forecasts detailed in this report were developed using the rail analysis model shown in **Appendix H**. The model forecasts rail volumes for the years 2006, 2011, 2016 and 2021 using base data and assumptions provided by SPC and RIC. The forecasts included rail volumes through Port Botany, Botany Yard, Sydney's metropolitan intermodal terminals and rural areas of NSW.

Key assumptions include:

Import/Export Split

Most rail freight is currently export cargo, however as noted in **Section 3.2.4,** the achievement of SPC's mode share target requires increased use of rail for import cargo. It is assumed that imports will increase from 20% of total rail freight currently to 32% by 2021 (see **Appendix H**).

Rural/Urban Split

The achievement of SPC's mode share targets will also require a significant increase in the use of rail for metropolitan container traffic. Currently around 25% of export cargo that is transported by rail has an origin/destination in the metropolitan area, however it is assumed that this will increase over the analysis period to 53% by 2021. It is assumed that rail does not carry any imports to the rural area, i.e., 100% of the import cargo that is transported by rail has an origin/destination in the metropolitan area.

Operational Days Per Year

It was assumed that for this study, the rail operations at the metropolitan intermodal terminals and Port Botany would run 286 days per year (5.5 days per week) until 2011 when operations would increase to 312 days per year (6 days per week). However rail operations at Port Botany would be able to operate 7 days/wk, 24hrs/day.

New Metropolitan Intermodal Terminal(s)

It is assumed that the new intermodal terminal(s) will handle 192 TEU per day in 2006, 770 TEU per day in 2011, 1,106 TEU per day in 2016 and 1,410 TEU per day in 2021, and that the throughput volumes will be split evenly between imports and exports.

Siding Lengths

For the existing Port Botany container terminals (including P&O Trans Australia) it was assumed that siding lengths would not change over the analysis period. For the new port terminal, two 600m sidings were assumed.

It was also assumed that the current siding lengths for the existing metropolitan intermodal terminals would not change over the analysis period. For the new terminal(s), a siding length of 900m was assumed.

Figure 4.3

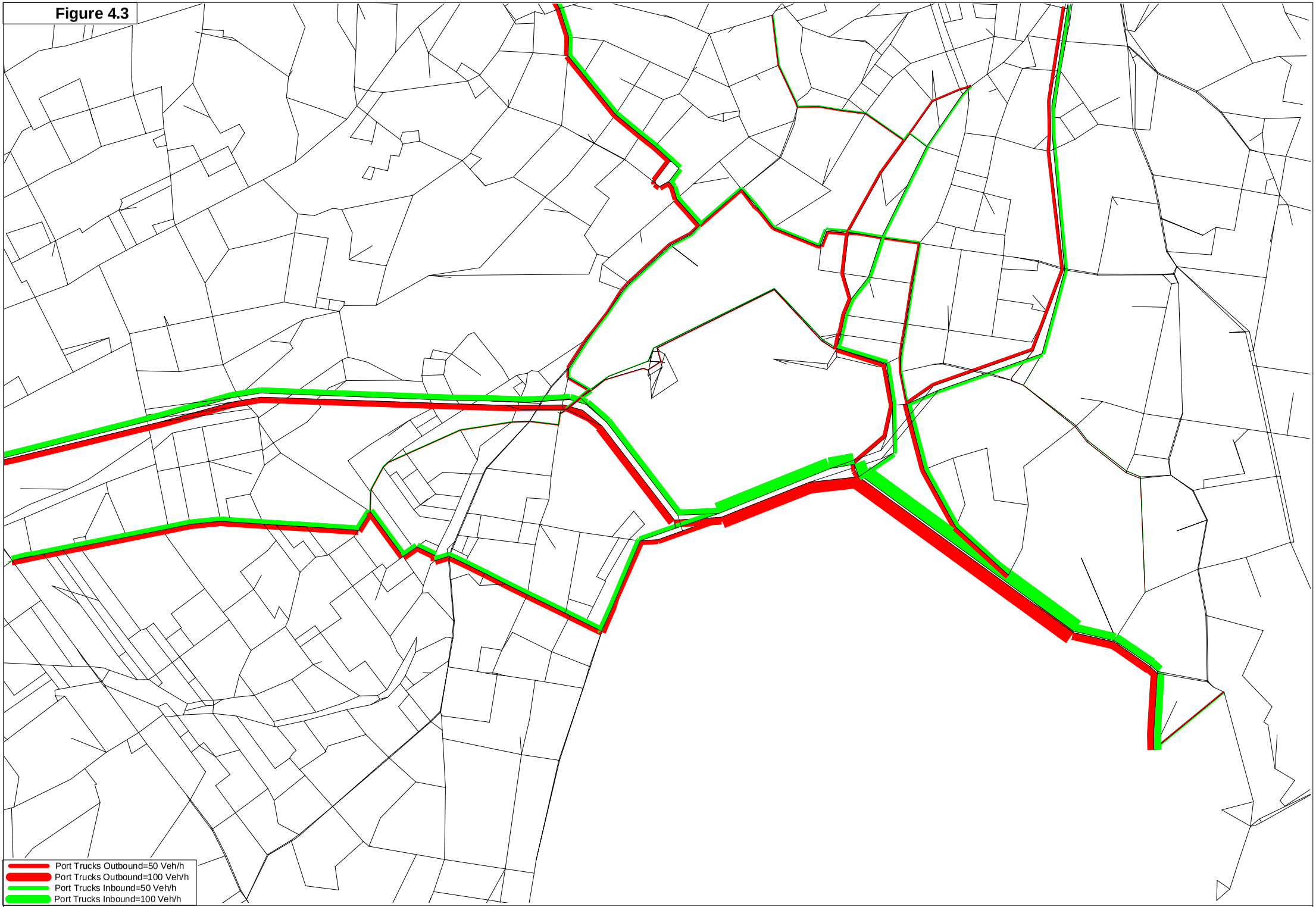

Port Trucks Outbound=50 Veh/h
Port Trucks Outbound=100 Veh/h
Port Trucks Inbound=50 Veh/h
Port Trucks Inbound=100 Veh/h

Table 4.7 – Existing Traffic Volumes at the Subregional Level

Road and Location	Road Type*	Total Vehicles		Total Ports Trucks		New Terminal		Existing Terminals		Port / Total	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Airport Drive, north of International Terminal	1	2,046	1,576	4	2	-	-	4	2	0.2%	0.1%
Bay Street, west of West Botany Street	2	791	603	46	32	-	-	46	32	5.8%	5.3%
Botany Road, north of Stephen Road	2	1,842	1,744	31	20	-	-	31	20	1.7%	1.1%
Bourke Street, north of Gardeners Road	2	581	408	14	8	-	-	14	8	2.4%	2.0%
O'Riordan Street, north of Gardeners Road	2	1,734	1,706	12	8	-	-	12	8	0.7%	0.5%
Canal Road, east of Princes Highway	2	2,741	2,756	13	7	-	-	13	7	0.5%	0.3%
Forest Road, west of Princes Highway	2	2,539	2,348	4	2	-	-	4	2	0.2%	0.1%
General Holmes Drive, east of M5-east	1	11,167	10,866	97	61	-	-	97	61	0.9%	0.6%
General Holmes Drive, north of Mill Pond	1	3,414	3,099	31	20	-	-	31	20	0.9%	0.6%
Joyce Drive, east of O'Riordan Street	1	3,546	3,268	40	26	-	-	40	26	1.1%	0.8%
King Street, north of Sydney Park Road	2	2,664	2,705	10	7	-	-	10	7	0.4%	0.2%
M5-east, east of Marsh Street	1	5,450	5,401	72	48	-	-	72	48	1.3%	0.9%
M5-east, west of the Princes Hwy	1	6,211	6,321	58	40	-	-	58	40	0.9%	0.6%
Mill Pond Drive	2	4,769	4,255	0	0	-	-	0	0	0.0%	0.0%
Princes Highway, north of West Botany Street	2	5,883	5,280	14	8	-	-	14	8	0.2%	0.2%
Southern Cross Drive, north of Wentworth Avenue	1	8,191	7,995	21	13	-	-	21	13	0.3%	0.2%
Stoney Creek Road, west of Forest Road	2	1,711	1,299	30	16	-	-	30	16	1.8%	1.2%
Sydneham Road, west of Buckley Street	2	1,756	1,577	27	15	-	-	27	15	1.5%	1.0%
The Grand Parade, north of Bay Street	2	4,336	3,986	35	22	-	-	35	22	0.8%	0.6%
Wentworth Avenue, east of Southern Cross Drive	2	2,195	2,411	3	2	-	-	3	2	0.1%	0.1%

***Road Type:**

1	State Road
2	Regional Road
3	Local Road
4	Privately Owned

Table 4.8 – Forecast Traffic Volumes at the Subregional Level, 2011

Road and Location	Road Type*	Total Vehicles		Total Ports Trucks		New Terminal		Existing Terminals		Port / Total	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Airport Drive, north of International Terminal	1	2943	2401	5	3	3	2	3	1	0.2%	0.1%
Bay Street, west of West Botany Street	2	1312	1106	36	18	12	8	24	10	5.0%	3.0%
Botany Road, north of Stephen Road	2	1982	2190	31	19	9	5	22	14	1.5%	0.8%
Bourke Street, north of Gardeners Road	2	1996	1077	13	8	1	1	12	6	0.8%	0.8%
O'Riordan Street, north of Gardeners Road	2	1696	1722	13	8	1	1	12	7	0.8%	0.6%
Canal Road, east of Princes Highway	2	3452	3648	17	9	8	4	9	5	0.6%	0.3%
Forest Road, west of Princes Highway	2	2814	2659	5	3	3	2	3	2	0.2%	0.1%
General Holmes Drive, east of M5-east	2	12959	12415	124	78	36	22	88	56	1.1%	0.7%
General Holmes Drive, north of Mill Pond	2	3678	3600	42	27	12	8	30	19	1.7%	0.9%
Joyce Drive, east of O'Riordan Street	2	3785	4601	40	26	12	8	29	18	2.6%	1.2%
King Street, north of Sydney Park Road	2	2970	3389	10	6	3	3	7	4	0.4%	0.2%
M5-east, east of Marsh Street	2	6146	5932	90	60	27	18	63	42	1.6%	1.1%
M5-east, west of the Princes Hwy	2	6756	6910	70	48	22	14	48	34	1.2%	0.8%
Mill Pond Drive	1	5504	5740	0	0	0	0	0	0	0.0%	0.0%
Princes Highway, north of West Botany Street	1	6080	5846	18	10	5	3	13	8	0.3%	0.2%
Southern Cross Drive, north of Wentworth Avenu	1	9016	9529	27	17	9	5	18	12	0.3%	0.2%
Stoney Creek Road, west of Forest Road	1	1827	1422	40	22	11	7	29	15	2.5%	1.8%
Sydneham Road, west of Buckley Street	1	2103	2061	35	19	16	9	19	10	2.0%	1.1%
The Grand Parade, north of Bay Street	2	5196	4915	45	29	12	8	33	21	1.0%	0.7%
Wentworth Avenue, east of Southern Cross Drive	2	2242	2622	4	3	1	1	3	1	0.2%	0.1%

***Road Type:**

1	State Road
2	Regional Road
3	Local Road
4	Privately Owned

Table 4.9 – Forecast Traffic Volumes at the Subregional Level, 2016 (1)

Road and Location	Road Type*	Total Vehicles		Total Ports Trucks		New Terminal		Existing Terminals		Port / Total	
		AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Airport Drive, north of International Terminal	1	2871	2270	8	4	4	3	4	3	0.3%	0.2%
Bay Street, west of West Botany Street	2	1365	934	70	44	19	12	52	32	7.6%	6.9%
Botany Road, north of Stephen Road	2	2020	2245	48	30	14	8	32	22	2.2%	1.2%
Bourke Street, north of Gardeners Road	2	2199	1114	20	12	2	2	18	11	1.1%	1.1%
O'Riordan Street, north of Gardeners Road	2	1700	1843	20	13	2	2	19	11	1.2%	0.8%
Canal Road, east of Princes Highway	2	3181	3312	26	14	12	6	14	8	0.8%	0.4%
Forest Road, west of Princes Highway	2	2960	2879	8	4	4	3	4	3	0.3%	0.2%
General Holmes Drive, east of M5-east	1	13068	12546	194	122	56	34	138	88	1.6%	1.0%
General Holmes Drive, north of Mill Pond	1	3617	3568	62	40	18	12	44	28	2.4%	1.3%
Joyce Drive, east of O'Riordan Street	1	3735	4345	62	40	18	12	44	28	3.9%	1.9%
King Street, north of Sydney Park Road	2	3025	3483	15	10	4	4	11	6	0.5%	0.3%
M5-east, east of Marsh Street	1	6202	6066	124	76	42	28	82	50	2.1%	1.3%
M5-east, west of the Princes Hwy	1	7039	7218	94	58	34	22	62	38	1.5%	0.9%
Mill Pond Drive	2	5900	6427	0	0	0	0	0	0	0.0%	0.0%
Princes Highway, north of West Botany Street	2	6817	6612	28	16	8	4	22	12	0.5%	0.3%
Southern Cross Drive, north of Wentworth Avenu	1	9292	9815	42	26	14	8	28	18	0.5%	0.3%
Stoney Creek Road, west of Forest Road	2	1910	1561	78	50	17	11	62	39	4.6%	3.7%
Sydneham Road, west of Buckley Street	2	2087	2027	54	30	24	14	30	16	3.0%	1.7%
The Grand Parade, north of Bay Street	2	5172	4759	70	44	19	12	52	32	1.5%	1.0%
Wentworth Avenue, east of Southern Cross Drive	2	2315	2649	6	4	2	2	4	2	0.3%	0.1%

Flows are 2016 AM Peak Average Hour Vehicle Flows

***Road Type:**

1	State Road
2	Regional Road
3	Local Road
4	Privately Owned

1) background traffic estimates are for 2016, port traffic forecasts are for 2021.

Table 4.10 – Forecast Traffic Volumes in Core Study Area

2016 (1)	Total Vehicles			Total Trucks			Total Port Trucks			New Terminal			Existing Terminals			Port/Total Traffic			Port
ROAD	**AM**	**PM**	**Avg hr**	**AM**	**PM**	**Avg hr**	**AM**	**PM**	**Avg hr**	**AM**	**PM**	**Avg hr**	**AM**	**PM**	**Avg hr**	**AM**	**PM**	**Avg Hr**	**AM**
Foreshore WB	1,287	1,340	717	555	419	320	119	74	68	28	18	16	90	56	52	9.2%	5.5%	9.5%	21.4%
Foreshore EB	2,113	1,296	1,099	643	354	327	119	74	60	28	18	14	90	56	46	5.6%	5.7%	5.5%	18.4%
Botany (N of Foreshore) WB	1,537	694	820	410	194	225	35	22	19	11	7	6	23	15	13	2.3%	3.1%	2.3%	8.4%
Botany (N of Foreshore) EB	951	1,003	618	349	244	189	35	22	19	11	7	6	23	15	13	3.6%	2.2%	3.0%	9.9%
Botany (NW of Beauchamp) WB	1,753	1,097	945	519	166	298	63	40	36	8	5	4	56	35	32	3.6%	3.6%	3.8%	12.2%
Botany (NW of Beauchamp) EB	1,970	1,474	1,091	523	250	278	66	41	35	8	5	4	58	36	31	3.3%	2.8%	3.2%	12.6%
Botany (SE of Beauchamp) WB	1,194	490	679	409	160	247	59	37	36	5	3	3	54	34	33	5.0%	7.5%	5.2%	14.4%
Botany (SE of Beauchamp) EB	867	914	445	399	218	216	63	39	34	5	3	3	58	36	31	7.3%	4.3%	7.7%	15.8%
Penrhyn Road NB	343	156	173	199	123	109	75	47	41	0	0	0	75	47	41	21.9%	30.0%	23.7%	37.7%
Penrhyn Road SB	352	91	205	195	55	102	75	47	39	0	0	0	75	47	39	21.3%	> 50%	19.1%	38.4%
Bumborah Point Road NB	337	137	196	218	94	125	58	36	34	4	3	2	54	34	31	17.3%	26.5%	17.1%	26.8%
Bumborah Point Road SB	317	169	174	249	124	137	61	38	34	4	3	2	57	36	31	19.2%	22.6%	19.2%	24.5%
Beauchamp Road NB	1,863	879	639	213	59	118	3	2	2	1	1	1	2	1	1	0.2%	0.2%	0.3%	1.6%
Beauchamp Road SB	1,305	1,043	1,009	207	46	108	3	2	2	1	1	1	2	1	1	0.3%	0.2%	0.2%	1.6%
Botany Road E of Bumborah Point WB	1,029	486	563	295	111	163	0	0	0	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Botany Road E of Bumborah Point EB	746	758	412	266	110	146	0	0	0	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Military Road S of Bunnerong NB	81	380	47	10	6	6	10	6	6	2	2	1	8	4	5	12.3%	1.6%	12.1%	> 50%
Military Road S of Bunnerong SB	419	181	230	10	6	5	10	6	5	2	2	1	8	4	4	2.4%	3.3%	2.4%	> 50%

2011	AM	PM	Avg hr	AM	PM	Avg hr	AM	PM	Avg hr	AM	PM	Avg hr	AM	PM	Avg hr	AM	PM	Avg hr	AM
Foreshore WB	1,125	1,292	625	407	390	258	78	36	54	13	6	12	65	30	41	7.0%	2.8%	8.6%	19.3%
Foreshore EB	1,935	1,163	1,008	494	240	271	78	36	47	13	6	11	65	30	36	4.0%	3.1%	4.6%	15.9%
Botany (N of Foreshore) WB	1,431	762	764	325	271	186	24	11	15	5	2	4	19	8	11	1.7%	1.4%	2.0%	7.3%
Botany (N of Foreshore) EB	856	903	565	264	158	150	24	11	15	5	2	4	19	8	11	2.8%	1.2%	2.6%	9.0%
Botany (NW of Beauchamp) WB	1,651	1,177	886	440	264	264	44	20	27	4	2	3	40	18	24	2.7%	1.7%	3.1%	10.0%
Botany (NW of Beauchamp) EB	1,862	1,400	1,033	443	200	247	46	21	26	4	2	3	42	19	23	2.4%	1.5%	2.6%	10.3%
Botany (SE of Beauchamp) WB	1,108	461	625	338	137	210	30	19	19	2	1	2	28	18	17	2.7%	4.1%	3.1%	8.9%
Botany (SE of Beauchamp) EB	787	865	399	327	181	185	44	20	25	2	1	2	42	19	23	5.6%	2.3%	6.4%	13.4%
Penrhyn Road NB	318	171	160	177	138	113	60	27	38	0	0	0	60	27	38	18.9%	16.0%	24.0%	34.0%
Penrhyn Road SB	327	78	192	173	43	106	60	27	37	0	0	0	60	27	37	18.4%	35.2%	19.3%	34.8%
Bumborah Point Road NB	275	118	161	157	75	102	41	19	27	2	1	2	39	18	25	14.9%	15.8%	16.9%	26.0%
Bumborah Point Road SB	255	148	141	187	103	115	43	20	27	2	1	2	41	19	25	16.8%	13.2%	19.1%	22.9%
Beauchamp Road NB	1,823	860	625	205	56	114	2	1	1	1	0	1	2	1	1	0.1%	0.1%	0.2%	1.1%
Beauchamp Road SB	1,277	1,021	987	199	43	104	2	1	1	1	0	1	2	1	1	0.2%	0.1%	0.1%	1.1%
Botany Road E of Bumborah Point WB	1,008	477	552	289	109	160	0	0	0	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Botany Road E of Bumborah Point EB	731	743	404	260	107	143	0	0	0	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Military Road S of Bunnerong NB	66	326	39	7	5	5	7	3	5	1	1	1	6	2	4	10.0%	0.8%	11.9%	> 50%
Military Road S of Bunnerong SB	337	158	186	8	5	5	7	3	4	1	1	1	6	2	4	2.0%	1.7%	2.4%	> 50%

Table 4.10 – Forecast Traffic Volumes in Core Study Area – cont'd

							AM	PM	Avg hr	AM	PM	Avg hr	AM	PM	Avg hr	AM	PM	Avg hr	AM
Foreshore WB	931	996	516	338	222	195	65	34	37	0	0	0	65	34	37	7.0%	3.4%	7.2%	19.1%
Foreshore EB	1,607	889	837	408	112	207	65	34	33	0	0	0	65	34	33	4.0%	3.8%	3.9%	15.9%
Botany (N of Foreshore) WB	1,153	424	615	269	66	149	20	11	11	0	0	0	20	11	11	1.8%	2.5%	1.8%	7.6%
Botany (N of Foreshore) EB	715	721	472	219	102	119	20	11	11	0	0	0	20	11	11	2.9%	1.5%	2.3%	9.3%
Botany (NW of Beauchamp) WB	1,353	835	728	381	95	218	51	25	29	0	0	0	51	25	29	3.8%	3.0%	4.0%	13.5%
Botany (NW of Beauchamp) EB	1,558	1,175	864	385	151	205	52	26	28	0	0	0	52	26	28	3.3%	2.2%	3.2%	13.5%
Botany (SE of Beauchamp) WB	939	375	520	294	82	167	33	25	19	0	0	0	33	25	19	3.5%	6.6%	3.6%	11.3%
Botany (SE of Beauchamp) EB	642	704	340	286	124	154	51	25	28	0	0	0	51	25	28	8.0%	3.6%	8.2%	18.0%
Penrhyn Road NB	276	118	138	152	95	83	52	30	28	0	0	0	52	30	28	18.7%	25.4%	20.4%	34.0%
Penrhyn Road SB	273	24	161	139	7	73	52	30	27	0	0	0	52	30	27	18.9%	> 50%	16.9%	37.2%
Bumborah Point Road NB	242	53	141	140	19	81	51	27	30	0	0	0	51	27	30	21.3%	> 50%	20.9%	36.8%
Bumborah Point Road SB	224	122	123	167	47	92	52	25	29	0	0	0	52	25	29	23.3%	20.8%	23.3%	31.2%
Beauchamp Road NB	1,526	720	834	172	46	95	2	1	1	0	0	0	2	1	1	0.1%	0.2%	0.1%	1.2%
Beauchamp Road SB	998	784	482	167	35	87	2	1	1	0	0	0	2	1	1	0.2%	0.1%	0.2%	1.2%
Botany Road E of Bumborah Point WB	844	399	462	242	91	134	0	0	0	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Botany Road E of Bumborah Point EB	614	612	339	218	90	120	0	0	0	0	0	0	0	0	0	0.0%	0.0%	0.0%	0.0%
Military Road S of Bunnerong NB	58	147	34	6	1	4	6	1	4	0	0	0	6	1	4	14.4%	2.7%	14.8%	> 50%
Military Road S of Bunnerong SB	296	130	163	7	2	4	7	2	4	0	0	0	7	2	4	2.7%	2.8%	2.9%	> 50%

1) background traffic estimates are for 2016, port traffic forecasts are for 2021.
2) based on Market Share three for the third terminals (30% New, 40% Patrick, 30% P&O).

Train Configuration and Lengths
It was necessary to make some simplifying assumptions regarding existing and forecast train lengths and configurations, due to the complicated nature of existing arrangements at some of the metropolitan intermodal terminals. As an example, two different configurations and lengths are currently run at Yennora and Leightonfield. As it was not appropriate to model all potential configurations at this level of analysis, an average train length was assumed for each terminal.

Wagon lengths were also assumed for each port container terminal and metropolitan intermodal terminal.

The average train and wagon lengths were assumed not to change over the analysis period.

Train Movements
Similarly, it was necessary to make some simplifying assumptions regarding the train paths taken in the model, due to the complex nature of existing movements between Port Botany, P&O Trans Australia (POTA), Cooks River and White Bay, particularly for train to/from rural areas. It was assumed that rural trains went straight to Port Botany and unloaded, continued to POTA where they reloaded with empty containers before returning to the rural area.

Wagon Slot Utilisation
It was assumed that wagon slot utilisation would increase from 75% currently to 80% in 2006 and 85% from 2011 onwards.

4.5.2 Future Rail Network

For the purpose of this study it was assumed that there would be no new track infrastructure, with the exception of infrastructure associated with the new metropolitan intermodal terminal(s).

The forecast number of train visits for each port container terminal is shown in **Table 4.11** (noting that each train visit results in two train movements).

Table 4.11 – Daily Train Visits to Port Botany (1)

Terminal	Existing	2006	2011	2016	2021
Patrick	6	9	11	12	14
P&O	7	11	11	15	17
New Terminal	0	0	9	16	18
P&O Trans	2	3	4	4	5
Total Train Visits	15	23	35	47	54
Total Train Trips	30	46	70	94	108

1) assumes that rail has a market share of 40% by 2021.

5 Transport Network Performance Assessment

5 Transport Network Performance Assessment

Chapter Summary

This section assesses the impacts on the road and rail networks of forecast container traffic assuming no upgrading work is undertaken. The proposed System Requirements (improvements) to accommodate growth are summarised in **Section 6** following.

Road Network
The analyses of road based traffic impacts was undertaken on the basis of a mode share between rail and road of 20% and 80% respectively. That is the analyses assumes a worst case scenario of 20% by rail, and maximum market share for the Patrick terminal of 50% in 2011 and 40% from 2016, the impacts of the new terminal on this basis would be:

- by 2016, the Patrick terminal entry/exit at the Foreshore Road/Penrhyn Road/ Botany Road intersection would be operating at a poor level of service (LOS E) in the PM peak;
- by 2011, the performance of the Botany Road/Beauchamp Road intersection would deteriorate slightly, but it would still provide an acceptable level of service (LOS D), and
- the other intersections along Foreshore Road would remain at an acceptable LOS.

However, for reasons outlined in the report, a future rail mode share of at least 40% is anticipated, with consequent negligible road based traffic impacts in the long term.

The mid-block capacity of roads within the port precinct is unlikely to be a problem to 2021, however the demand for arterial roads in the area including General Holmes Drive, the M5 East, Southern Cross Drive and Princes Highway may be above capacity during the peak period. This issue has potential implications for the access/egress of port related traffic but is unrelated to any expansion of current port capacity.

Rail Network
The impacts on the rail system of achieving a 40% mode share are:

- the unduplicated section of the dedicated freight line (between Cooks River and the Port Botany container terminals) would reach its capacity prior to 2016;
- the Patrick and new Port Botany container terminals would have sufficient capacity to 2021. However, the P&O terminal would be operating at capacity due to its shorter siding length;
- shunting on the main line at Cooks River will constrain the efficient operation of the dedicated freight line;
- Botany Yard has sufficient siding lengths and capacity to process future train volumes to 2021; and
- there may be some effect on passing loops in rural areas, assuming that train lengths will be increased to 900m by 2021.

5 Transport Network Performance Assessment

5.1 Road Network

The performance of the road system in urban areas is normally dictated by intersection capacity. Estimating the expected delays at intersections during peak periods provides a good indication of future network performance.

5.1.1 Intersections Under Consideration

Given that port traffic generally makes up a relatively low proportion of total traffic on routes outside the core study area, it is highly unlikely that the forecast increase in port traffic would significantly influence the performance of intersections outside the core study area. As a result the following eight intersections within the core study area were chosen for assessment:

- Foreshore Road/General Holmes Drive;
- Foreshore Road/General Holmes Drive/Airport access;
- Foreshore Road/New Terminal access;
- Foreshore Road/Botany Road/Penrhyn Road;
- Botany Road/Beauchamp Road;
- Botany Road/McCauley Street;
- Botany Road/Container Road Access; and
- Botany Road/Bumborah Point Road.

In addition, the cumulative traffic impacts were estimated by assessing the future performance of the following five key intersections:

- General Holmes Drive/Mill Pond Road;
- Joyce Drive/O'Riordan Street;
- Gardeners Road/O'Riordan Street;
- Botany Road/Gardeners Road; and
- Canal Road/Princes Highway.

5.1.2 Intersection Turning Movements

Future year turning movements at the intersections along the Foreshore Road – Botany Road corridor were forecast with the new terminal and without the new terminal. The "with new terminal" scenario assumes that there will be a new intersection onto Foreshore Road from the new terminal.

Based on the trade forecasts provided by SPC, the capacity of the existing port (1.8m) is reached in approximately 2010. Therefore, the "without new terminal" traffic assignment capped port truck volumes at the 2011 levels, i.e., it was assumed that there is no further growth in port truck traffic after 2011. The "with new terminal" traffic assignment was based on truck volumes continuing to increase beyond 2011.

Figure 5.1 shows the AM peak turning movements for the major intersections in 2016 (including 2021 port traffic) without the new terminal, while **Figure 5.2** shows forecast turning movements with the new terminal.

The figures presented are for the (80% road, 20% rail) mode share scenario and assuming Patrick maximises its market share at 40% of total port throughput by 2021 (i.e. terminal market share 3).

The "worst case road" mode share scenario was adopted in order to identify the "upper limit" impact of the new terminal on the road system. The use of terminal market share 3 also provides an upper limit in terms of the impact on road performance, because it maximises the number of trucks accessing the road system at the Foreshore Road/Botany Road/Penrhyn Road intersection, which currently has a lower level of service than the other intersections along the route (see **Table 3.3**).

5.1.3 Access To Boat Ramp

The proposed new intersection for the relocated boat ramp was ignored in the analysis because its forecast volumes in the AM peak hour are negligible. Arup (2002) estimate that the proposed new boat ramp intersection would only generate 12 trips per hour in the AM and PM peaks. Masson Wilson Twiney (2001a) propose that an unsignalised intersection would be suitable for the boat ramp access road. Minor intersections of this type are not suited to SCATES analysis.

5.1.4 Truck Storage

The proposed new terminal makes provision for approximately 170 on-site truck storage spaces including 30 waiting bays, 120 loading/unloading bays and 20 parking spaces. This equates to 2-3 spaces per truck visit in the AM peak in 2021 (depending on terminal market share), which is more than adequate given that most trucks are turned around within an hour.

By comparison, the Patrick terminal currently contains only 24 truck parking and loading/unloading spaces, but the planned terminal upgrade includes 199 truck spaces.

5.1.5 Car Parking

It is estimated that the new terminal will employ up to 350 people over three shifts, and that 40% of total employees (i.e. 140) would work the morning shift. Peak demand for car parking would occur at the changeover between morning and afternoon shift (assumed to be 1400).

Botany Council's Development Control Plan (DCP) for Container Terminals indicates that parking is to be provided at the rate of one space per employee. In order to comply with the DCP and cater for peak demand at shift changeover, around 200 car parking spaces should be provided at the new terminal. Assuming a strategic estimate of $30m^2$ per parking space, this equates to a car park of around $6,000m^2$ in size.

The proposed layout for the new terminal includes some land adjacent to the boundary with the Patrick terminal that could accommodate the required number of spaces. In addition, there appears to be some land at the northern end of the site (adjacent to the administration buildings) that could be used as a car park.

Figure 5.1

Selected Intersection Counts, AM Peak, 2016*
Worst Case Road Mode Share Scenario
40% Market Share for Patrick Terminal
Without New Terminal (*2021 for Port Traffic)

SYDNEY PORTS

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	Light	HV
Total	1282	373
Port	9	77

	Light	HV	
177	203	Total	
3	25	Port	

	HV		HV	
Light	313	77	167	25
Total	620	10	97	3
Port			Total	Port

	Light	HV
Total	1328	152
Port	1	2

	Light	HV
Total	116	342
Port	14	76

	HV	
Light	162	Total
752	2	Port
1		

	HV	
Light	42	Total
346	0	Port
0		

Light	HV	
322	58	Total
0	0	Port

Light	HV	
469	349	Total
15	72	Port

	HV	
Light	94	Total
68	0	Port
0		

	HV	
Light	60	Total
109	16	Port
20		

	HV	
Light	154	Total
422	13	Port
2		

Light	HV	
590	188	Total
2	13	Port

Light	HV	
637	293	Total
9	50	Port

Light	HV	
15	16	Total
4	11	Port

	Light	HV
Total	424	136
Port	0	0

	Light	HV
Total	1002	320
Port	8	50

	Light	HV
Total	33	120
Port	4	52

	HV	
Light	108	52
17	5	Total
		Port

	HV	
Light	46	16
107	23	Total
		Port

	HV	
Light	46	11
20	5	Total
		Port

	Light	HV
Total	411	196
Port	0	0

	Light	HV
Total	59	196
Port	12	76

Light	HV	
726	247	Total
0	0	Port

Light	HV	
7	48	Total
0	0	Port

	HV	
Light	138	68
52	18	Total
		Port

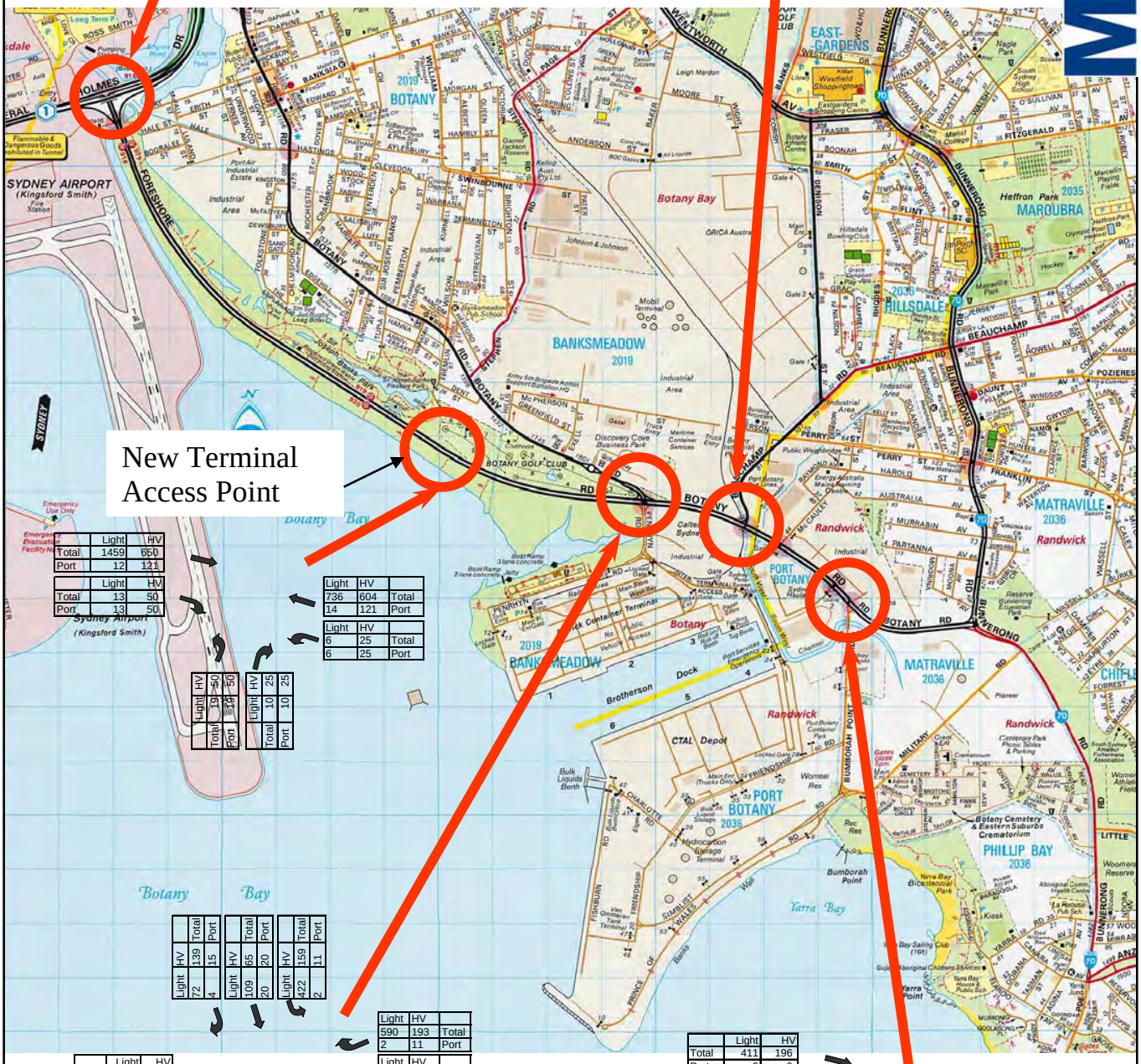
	HV	
Light	69	0
69	12	Total
		Port

Figure 5.2

Selected Intersection Counts, AM Peak, 2016*
Worst Case Road Mode Share Scenario
40% Market Share for Patrick Terminal
With New Terminal (*2021 for Port Traffic)

SYDNEY PORTS

Maunsell



	Light	HV
Total	1291	467
Port	19	129

Light	HV	
180	233	Total
6	41	Port

HV		
Light	635	406
Total	25	129

Light	HV	
Total	101	197
Port	8	41

	Light	HV
Total	1329	154
Port	2	5

	Light	HV
Total	119	381
Port	17	87

Light	HV	
322	60	Total
0	0	Port

Light	HV	
471	386	Total
17	80	Port

HV		
Light	752	164
Total	1	5

Light	HV	
Total	346	44
Port	0	0

	Light	HV
Total	1459	650
Port	12	121

	Light	HV
Total	13	50
Port	13	50

Light	HV	
736	604	Total
14	121	Port

Light	HV	
6	25	Total
6	25	Port

HV		
Light	19	50
Total	19	50
Port		

Light	HV	
Total	10	25
Port	10	25

Light	HV	
590	193	Total
2	11	Port

Light	HV	
640	326	Total
12	62	Port

Light	HV	
15	16	Total
4	11	Port

	Light	HV
Total	430	182
Port	6	15

	Light	HV
Total	1006	353
Port	12	62

	Light	HV
Total	33	140
Port	4	69

HV		
Light	17	128
Total	5	69
Port		

Light	HV	
Total	107	50
Port	23	20

HV		
Light	20	47
Total	5	11
Port		

	Light	HV
Total	411	196
Port	0	0

	Light	HV
Total	61	224
Port	13	81

Light	HV	
726	247	Total
0	0	Port

Light	HV	
7	48	Total
0	0	Port

HV		
Light	53	165
Total	18	73
Port		

Light	HV	
Total	69	69
Port	12	0

HV		
Light	72	139
Total	4	15
Port		

Light	HV	
Total	109	65
Port	20	20

HV		
Light	422	159
Total	2	11
Port		

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Intersection Analysis

Table 5.1 shows the results of the intersection analysis for the AM Peak in 2011 and 2016 (including the 2016 background traffic estimates with the 2021 port traffic forecasts overlaid) without the new terminal. **Table 5.2** shows the results for the "with new terminal" scenario. **Tables 5.3 and 5.4** show the results for both scenarios for the PM peak.

For the "with new terminal" scenario, the new intersection was set up in the model based on the concept design in Masson Wilson Twiney (2001a).

The Botany Local Environmental Plan (LEP) states that developments along designated major roads (including Foreshore Road) are not to adversely affect the efficiency of the road. During consultation with the RTA, it was agreed that an "acceptable" level of service can be defined as LOS D or better. This criteria has been adopted by the RTA for other developments in Sydney.

Table 5.1 – Future intersection performance without new terminal, AM Peak [(1)]

Location	Traffic Controlling Signal No. (TCS)	Co-ordinated Degree of Saturation (CORD DS)	Average Delay (seconds/ vehicle) (S/V)	Level of Service (LOS)
2011				
Foreshore Road/General Holmes Drive	1,524	0.59	6	A
Foreshore Road/Airport access	1,616	0.82	3	A
Foreshore Road and Botany Road	1,525	0.89	45	D
Botany Road and Beauchamp Road	1,526	0.84	40	C
Botany Road and McCauley Street	2,647	0.20	3	A
Botany Road and Container Road Access	2,648	0.39	1	A
Botany Road and Bumborah Point Road	1,528	0.37	3	A
2016 [(2)]				
Foreshore Road/General Holmes Drive	1,524	0.6	6	A
Foreshore Road/Airport access	1,616	0.82	3	A
Foreshore Road and Botany Road	1,525	0.96	47	D
Botany Road and Beauchamp Road	1,526	0.85	39	C
Botany Road and McCauley Street	2,647	0.20	3	A
Botany Road and Container Road Access	2,648	0.42	2	A
Botany Road and Bumborah Point Road	1,528	0.38	3	A

1) assumes (80% road, 20% rail) mode share scenario; and
2) 2016 background traffic levels with 2021 port traffic forecasts overlaid.

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Table 5.2 - Future intersection performance with new terminal, AM Peak (1)

Location	Traffic Controlling Signal No. (TCS)	Co-ordinated Degree of Saturation (CORD DS)	Average Delay (seconds/ vehicle) (S/V)	Level of Service (LOS)
2011				
Foreshore Road/General Holmes Drive	1,524	0.59	6	A
Foreshore Road/Airport access	1,616	0.82	3	A
New terminal access	N/A	0.58	0	A
Foreshore Road and Botany Road	1,525	0.94	46	D
Botany Road and Beauchamp Road	1,526	0.84	47	D
Botany Road and McCauley Street	2,647	0.20	3	A
Botany Road and Container Road Access	2,648	0.39	1	A
Botany Road and Bumborah Point Road	1,528	0.34	3	A
2016 (2)				
Foreshore Road/General Holmes Drive	1,524	0.64	6	A
Foreshore Road/Airport access	1,616	0.82	3	A
New terminal access	N/A	0.62	1	A
Foreshore Road and Botany Road	1,525	0.97	53	D
Botany Road and Beauchamp Road	1,526	0.86	47	D
Botany Road and McCauley Street	2,647	0.20	3	A
Botany Road and Container Road Access	2,648	0.42	2	A
Botany Road and Bumborah Point Road	1,528	0.38	3	A

1) assumes (80% road, 20% rail) mode share scenario; and
2) 2016 background traffic levels with 2021 port traffic forecasts overlaid.

Table 5.3 – Future Intersection Performance without new terminal, PM Peak (1)

Location	Traffic Controlling Signal No. (TCS)	Co-ordinated Degree of Saturation (CORD DS)	Average Delay (seconds/ vehicle) (S/V)	Level of Service (LOS)
2011				
Foreshore Road/General Holmes Drive	1,524	0.54	3	A
Foreshore Road/Airport access	1,616	0.62	2	A
Foreshore Road and Botany Road	1,525	0.91	41	C
Botany Road and Beauchamp Road	1,526	0.82	37	C
Botany Road and McCauley Street	2,647	0.21	3	A
Botany Road and Container Road Access	2,648	0.32	11	A
Botany Road and Bumborah Point Road	1,528	0.30	2	A
2016 (2)				
Foreshore Road/General Holmes Drive	1,524	0.55	4	A
Foreshore Road/Airport access	1,616	0.62	3	A
Foreshore Road and Botany Road	1,525	0.94	45	D
Botany Road and Beauchamp Road	1,526	0.84	39	C
Botany Road and McCauley Street	2,647	0.21	3	A
Botany Road and Container Road Access	2,648	0.31	11	A
Botany Road and Bumborah Point Road	1,528	0.32	3	A

1) assumes (80% road, 20% rail) mode share scenario; and
2) 2016 background traffic levels with 2021 port traffic forecasts overlaid.

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Table 5.4 - Future intersection performance with new terminal, PM Peak (1)

Location	Traffic Controlling Signal No. (TCS)	Co-ordinated Degree of Saturation (CORD DS)	Average Delay (seconds/ vehicle) (S/V)	Level of Service (LOS)
2011				
Foreshore Road/General Holmes Drive	1,524	0.54	3	A
Foreshore Road/Airport access	1,616	0.62	2	A
New terminal access	N/A	0.38	1	A
Foreshore Road and Botany Road	1,525	0.89	31	C
Botany Road and Beauchamp Road	1,526	0.81	53	D
Botany Road and McCauley Street	2,647	0.21	3	A
Botany Road and Container Road Access	2,648	0.31	11	A
Botany Road and Bumborah Point Road	1,528	0.29	2	A
2016 (2)				
Foreshore Road/General Holmes Drive	1,524	0.56	4	A
Foreshore Road/Airport access	1,616	0.64	3	A
New terminal access	N/A	0.58	2	A
Foreshore Road and Botany Road	1,525	0.94	63	E
Botany Road and Beauchamp Road	1,526	0.84	53	D
Botany Road and McCauley Street	2,647	0.21	3	A
Botany Road and Container Road Access	2,648	0.31	10	A
Botany Road and Bumborah Point Road	1,528	0.33	3	A

1) assumes (80% road, 20% rail) mode share scenario; and
2) 2016 background traffic levels with 2021 port traffic forecasts overlaid.

Interpretation of Forecast Performance

The results show that most intersections would continue to provide an acceptable level of service after the opening of the new terminal. However, the Foreshore Road/Botany Road/Penrhyn Road intersection would deteriorate to LOS E in the PM peak in 2016. The critical turning movement is the right turn into Botany Road. Duplicating the right turn would achieve LOS C, however this also requires widening of Botany Road (for between 50 to 70m) to accommodate two lanes of northbound traffic.

Vehicles turning right from Foreshore Road into General Holmes Drive turn into a slip lane at a signalised intersection, then merge with other General Holmes Drive traffic in the vicinity of the Mill Pond Road intersection. The SCATES analysis models the operation of the signalised intersection but not the merging manoeuvres. Observation of the existing traffic flows indicates that the merging arrangement is not expected to present any capacity or safety problems for the predicted future volumes.

Consistent with accepted traffic engineering practice, the results are based on the "worst case road" mode share scenario of rail achieving only a 20% mode share. In actual fact, rail is likely to achieve a much higher mode share, which would mean that the new terminal would have a negligible impact on intersection performance. In this regard one can expect more efficient intersection operations than that forecast in **Tables 5.2 and 5.4**.

The above findings are reasonably consistent with other studies. For example:

- Arup (2002) found that the proposed new terminal intersection would operate at LOS A for 1999-2019; and
- PPK (2002) predicts that the Foreshore Road/Botany Road/Penrhyn Road intersection would operate at LOS D by 2016.

5.1.7 Queuing

Queue lengths at the proposed Foreshore Road/New Terminal intersection would not exceed 12m on any of the approaches by 2016. This result is intuitive given the forecast short delays at the intersection.

5.1.8 Cumulative Traffic Impacts

Based on the analysis of preliminary data on future traffic generation, the broader transport implications of the combined developments outlined in **Section 2.4** are:

1 based on existing trends peak demand for the road network in the Mascot area will exceed capacity by 2011, and a deterioration in the level of service is probable;

2 the State Government is addressing this through a road development program and through demand management. (Action for Transport and Draft Statement Environmental Planning Policy No 66);

3 notwithstanding this, some adjustment of peak travel demands throught peak spreading is likely to take place;

4 the Airport Rail Link is likely to play an increased role in serving the passenger transport needs of the area;

5 Port Botany traffic represents only a small proportion (approximately 1%) of forecast peak traffic volumes; and

6 the achievement of SPC's objective of a rail mode share of 40% (for freight transport) will attenuate the impact of port related traffic on the road system.

The forecast deterioration in the road system's level of service is not caused by the new terminal, as port traffic represents a very minor proportion of total traffic. Most of the increased traffic is caused by private vehicle travel associated with the Airport, Green Square and general background traffic growth.

The capacity constraints on the road network, although not caused by port traffic, would impact on the efficiency of road-based transport to and from the port. This in turn will promote rail transport of cargo.

5.1.9 Construction Traffic Impacts

Assuming project approval in 2004, dredging and reclamation works for the new terminal are expected to take place during 2005 and 2006. Land consolidation and surface works will subsequently be undertaken during 2007 and 2008.

5 Transport Network Performance Assessment

Sydney Ports has advised that the surface works phase will generate more truck trips than the other construction phases. The main road transport task will be the delivery of stones, piling equipment and concrete to the site.

The exact sources of supply for the various types of construction materials are not known at this stage. However, based on advice from SPC, it is expected that the majority of vehicles will access the site from the south. The probable route for most construction traffic would therefore be via Penrhyn Road and Foreshore Road. Construction traffic would arrive at the site via the major arterial roads, i.e., using the same routes as those already used by port trucks. It is expected that there would be little if any use of local residential streets by construction generated traffic.

At this stage, detailed data is not available regarding the amount of material that will need to be delivered to the site, or the number of construction workers on site. Based on advice from SPC, it is expected that the construction generated traffic volumes would be in the magnitude of 60 to 110 daily, or 6 to 11 vehicles per hour, during the first two and a half years of the construction phase (i.e. 2005 to 2007). At the later stage of the construction period (2007 to 2008-09), it is expected that approximately 30 construction vehicles or less will be generated daily. Compared with the existing volume of truck trips generated by the port (120 for the AM peak and 55 for the PM peak, (see **Section 4.3**), the volume of construction generated vehicles is significantly lower, and would hence represent a very small proportion of peak traffic volumes (<10%). As a result, the impact of construction vehicles on the performance of the road system is likely to be negligible.

The materials to be delivered to the site (stones, piling equipment and concrete) are generally transported by standard articulated and rigid trucks. The use of restricted access oversize/overmass vehicles is unlikely to be necessary.

It is assumed that normal construction working hours will apply, 7am to 6pm Monday to Friday; 7am to 1pm Saturday; no work on Sundays or public holidays. This is generally considered as “daytime” working hours and is in line with EPA guidelines and working hours of other construction projects around Sydney.

As pedestrian and cyclist activity on Foreshore Road is very low, the construction traffic is expected to have a negligible impact on these road users.

A detailed Construction Traffic Management Plan is to be developed. The plan should include detailed consideration of:

- access routes and signage, and access arrangements at the site;
- measures to ensure that all vehicles can be contained on-site and that Foreshore Road will not be affected by:
  - loading/unloading from the carriageway;
  - queuing; and
  - reversing manoeuvres.
- the need for restrictions on delivery hours and/or routes;

- the need for measures to protect pedestrians and cyclists in the vicinity of the site; and
- provision of cleaning facilities for vehicles exiting the site.

5.2 Rail Network

5.2.1 Port Container Terminals

Patrick proposes to redevelop and expand their Port Botany terminal and are currently preparing an EIS. They believe that the terminal can achieve a 50% rail mode share.

For the modelling purpose of this study it was assumed that the sidings at the port container terminals would not be physically extended or altered. Both port terminal operators have indicated that they do have draft plans to expand their sidings however no definite time frame was provided.

The **P&O Terminal** currently has 3 sidings however only 2 can be operated at any one time as loading/unloading is carried out using standard forklifts. Current capacity at the P&O terminal is 660 lifts per day (using two forklifts) however only 300 – 400 moves/day are undertaken at present. According to P&O, shifting more forklifts to the rail operations area could increase this number.

The rail infrastructure at the **Patrick Terminal** also operates below its capability. Here the terminal operator can operate both sidings simultaneously, if required, due to their loading/unloading method. Patrick operates two “reach stackers” to load/unload with ample room adjacent to the siding for the temporary stacking of containers in a “herringbone” configuration two containers high.

The **P&O Trans Australia Depot** operates as an empty container handling depot, similar to Cooks River Terminal. It currently generates approximately 2 trains per day or 35,000 TEU per annum. P&O Trans Australia move empty containers to rural destinations to be packed then transported back full to the port for export.

Both the P&O Trans Australia and the Cooks River depots run empty containers to rural intermodal terminals. The rural split between terminals is approximately 66% through Cooks River and 33% through P&O Trans (RIC).

5.2.2 Botany Yard

The capacity of Botany yard is not a significant constraint as trains are not stabled there for extended periods of time and there are no aspects of the yard that inhibit throughput. Any shunting time or time for inspections are offset by the turnaround time at the port. Throughput is therefore considered as being the same as throughput of the combined port container terminals.

There are currently two sidings at Botany (No’s 1 and 2 Sidings) that will eventually connect to the duplicated track from Cooks River to Botany (and become through roads). These together with the master siding and transit siding between Botany and Port Botany will in fact provide a duplicated line between Botany Yard and Port Botany.

This means that the yard infrastructure is capable of handling the same train throughput as the main line between Cooks River and Botany. However, the terminal throughput capacity then becomes dependant on other factors including:

1 Port Container Terminal throughput and train turnaround time at each Terminal depending on their respective container lift rates;

2 Train Operators departing trains safety requirement allowances at Botany for Train Examination requirements; and

3 Operator incoming train shunting requirements on non point-to-point trains.

Inspections at Botany Yard
All outgoing trains from Botany undergo train examination. These examinations consist of general consist configuration, security of fixing of containers to wagons and brake inspection and tests.

The time required to complete these tasks can be between 45 and 90 minutes depending on the train lengths and the amount of work required in fixing defective brakes. This inspection time is largely dependent to the number of personnel attributed to the task. In this respect these are not considered an impediment to increasing capacity as more personnel can be employed to meet demand.

Other Operators at Botany Yard
CRT (Col Reece Transport) utilises No. 3 Goods Siding to load 13 wagons per day (5 days) for Orica. These wagons are attached to the Patrick trains for transit to Yennora intermodal terminal for onward transit by Pacific National to connect with their Melbourne services.

The Kelloggs Siding is located on the Sydney end of Botany Yard with access being off Botany Yard's No. 1 Siding. Kelloggs traffic arrives and departs Botany Yard on Pacific National services approximately three times per week and is placed and cleared by Pacific National's Botany Yard shunting locomotive.

5.2.3 Metropolitan Intermodal Terminals

There have been no plans tabled that indicate any proposed upgrading of these terminals due to current requirements. Some terminals do however have scope to expand depending on future demand. Additionally, operation procedures could be enhanced to accommodate increased demand; this includes additional plant and staff plus hours of operation.

There are two common sized wagons being used to transport containers, 14.6m and 21.9m. The majority of terminals currently service 14.6m wagons however it has been indicated that the trend will be for rail operators to run 21.9m wagons in the future.

For this study it has been assumed that the following terminals will run the longer wagons:

- P&O Trans Australia
- Yennora
- Camellia
- Enfield
- Cooks River
- All rural areas

The longer wagons have no effect on train lengths however they can influence the number of TEU being carried per train on rural services. Specifically some "3 slot" wagons may be limited to carry only 2 containers (reducing utilisation) due to rolling stock weight restrictions (see **Section 6.2.4**).

Cooks River
Cooks River currently moves approximately 100,000 TEU per annum. These are predominantly empty containers but not all come from Botany terminal by rail, some are transported straight to Cooks River by road then onto metropolitan and rural areas by rail via Enfield Yard.

5.2.4 Rural Intermodal Terminals

Rural destinations including locations such as Moree, Narrabri, Blaney, Sandgate and the Riverina have been aggregated into the 3 regions – Northern, Southern and Western Regions of NSW.

All rural intermodal freight movements have been considered as being export traffic only. Physically there are the same numbers of import trains to export trains however the import direction trains are generally used for transporting empty containers.

Pacific National is proposing to introduce longer (40 wagon) trains. To meet the future volume requirements it would be necessary to run 900m trains to rural areas (i.e. 40 wagons) to reduce the number of trips. These trains (loaded with empty containers for the rural destinations) would be made up at either P&O Trans Australia or Cooks River terminals.

Currently rural trains do not all operate 6 days a week as demand does not require it. An assumption made in the calculations is that, 6 day per week operation would occur. Also, the available space on these trains is not fully utilised (i.e. not all slots on the wagons are filled with containers). This may not change in the future, especially with rural trains, as the limiting factor in loading wagons is often the weight restrictions on rolling stock.

5.2.5 Dedicated Freight Lines

Rail Infrastructure Corporation (RIC) have advised in a 'Capacity' paper that with Stages 1 to 3 of the rail line upgrade completed, train headways have now reduced to 15 minutes and the current theoretical bi-directional capacity of the unduplicated line between Cooks River and Botany is 96 movements per day (one up and one down). However, two other constraints affect this capacity:

1 trains traversing Botany Yard take 10 minutes - including the headway, a total of 25 minutes per train reduces the line capacity to 57 movements per day; and

2 activities at Cooks River (shunting on the main line) further reduce this capacity to 52 movements per day. This equates to rail volumes of 500,000 TEU per annum.

The duplicated section of the line can handle significantly more than 52 train movements per day (Enfield to Cooks River), the controlling section is therefore between Cooks River and Botany.

The capacity of the section between Cooks River and Botany could be further improved through increased operational efficiencies, reducing the current headway requirements to 12 minutes and reducing the time taken to traverse the Botany Yard to between 5 and 8 minutes. This combined with improvements to shunting practices at Cooks River would increase the available train paths to between 72 and 84 train movements per day. This section of the track would need to be duplicated when capacity is reached prior to 2016.

The capacity would increase to around 90-110 train movements per day on the Cooks River and Botany yard section if the line were fully duplicated. This equates to rail volumes of 1.3 million teu per annum. RIC is currently investigating this option as part of Stage 4 of the upgrading program, to determine the timing staging and funding requirements needed to meet demand.

Level Crossings

The increase in train volumes may affect the efficiency of the level crossings on the route, particularly the potential delays to vehicles at the General Holmes Drive level crossing. Information from RIC indicates that Stage 4 of the upgrading program includes the provision of new pedestrian access at Banksia Street and an investigation of possible grade separation or closure of the General Holmes Drive level crossing.

South Sydney Dedicated Freight Line

There is also an option, known as the South Sydney Freight Line (SSFL), to extend the current dedicated freight network from where it finishes at Chullora through to Macarthur. This option, if it proceeds, will allow rural trains from the South and trains from Minto and Leightonfield to utilise it. This will reduce loading on the passenger network between these locations and Port Botany and improve their operational flexibility.

5.2.6 Cooks River Junction

A significant constraint exists at the junction to Cooks River terminal where, due to recent yard rationalisation, shunting movements necessitate the use of the main line. This rationalisation involved the removal of the shunting neck near Cooks River yard forcing all shunting movements to now occur on the duplicated main line. While these shunting movements are occurring they occupy the main line.
This reduces the benefits of the duplication works and allows only one line to operate, hence affecting throughput. If the Enfield to Port Botany section were operating at capacity then these shunting movements at Cooks River would considerably impede capacity.

Data gathered by RIC (O'Loughlin, 23rd June 2002) over the period 1st to 5th July 2002 indicated that more than 20 shunting movements are made each day lasting between 5 to 8 minutes each (see **Table 5.5)**.

Table 5.5 – Shunting movements at Cooks River, 1st to 5th July 2002

Day	No. of Shunts	Time on Main Line (Minutes)	Hours Occupying Main Line
Monday	21	125	2.1
Tuesday	31	218	3.4
Wednesday	33	196	3.2
Thursday	25	119	2.0
Friday	26	205	3.3

Each line occupation reduces the number of paths available for train running. Based upon minimum (efficient) headway operation (7mins), this could be up to 16 paths per 2 hour occupation and up to 27 paths per 3.3 hour occupation.

Although this does not currently present an operational problem, it will for future train volumes.

6 System Requirements

6 System Requirements

Chapter Summary

Road
A road mode share scenario of 40% by rail and the maximum market share for the Patrick terminal of 50% in 2011 and 40% from 2016, would see the Foreshore Road/Botany Road/Penrhyn Road intersection operate at an acceptable level of service.

No intersection upgrades would be required till some time after 2016. Duplicating the right turn from Botany Road (south) into Botany Road (north) may be necessary were the rail mode share to approach 20%.

Rail
Operational and management improvements of the existing rail line would enable it to carry forecast traffic close to 2016, after which, duplication of the section between Cooks River and Botany Yard would be required to accommodate future traffic.

Increasing the length of the sidings at P&O to 600m would increase capacity at the port, however it would not negate the need to duplicate the dedicated freight line.

Cooks River intermodal terminal would need to operate 400-450m trains in order to accommodate future demand. This would however exacerbate the problem of using the main line as a shunting neck.

The forecast capacity problems at Camellia and Yennora could be addressed by increasing siding length, increasing terminal capacity and improving the efficiency of container handling operations. Upgrading of the intermodal terminals would be a commercial decision to be taken by the terminal operators.

Capacity on the metropolitan shared network, particularly the main western line may need to be improved by:

- increasing intermodal terminal capacity and/or developing new intermodal terminals in the metropolitan area;
- increasing train lengths from the intermodal terminals outside the dedicated freight network;
- reducing headways (through signalling changes); and
- providing more dedicated lines for freight.

Passing loops in the rural area may need to be upgraded to allow for 900m trains.

If detailed train operational planning cannot mitigate the effect of shunting on the main line at Cooks River through timetabling, then a new shunting neck would need to be constructed by 2021.

6 System Requirements

6.1 Roads

6.1.1 Impacts of Port Traffic in the Local Area

As noted in **Section 5.1.4**, the Botany Road/Foreshore Road/Penrhyn Road intersection is unlikely to require upgrading if the target modal split of 40% by rail is achieved. Duplicating the right turn from Botany Road (south) into Botany Road (north) may be necessary were the rail mode share to approach 20%.

In relation to the broader issue of truck traffic on Botany Road, port trucks that do not have an origin or destination in the Botany area have alternative routes available. For example, traffic for Marrickville could use the M5 East-Princes Highway route, which is likely to be faster than Botany Road-Gardeners Road in any case.

Randwick council prefers port related trucks to avoid the use of Bunnerong Road because of potential conflict with the Matraville shopping strip. The new terminal is not expected to generate any significant truck traffic on Bunnerong Road as:

- there are very few freight generators that would cause trucks to travel through Matraville shopping strip; and
- development approvals on Military Road require trucks to gain access via Bumborah Point Road rather than Bunnerong Road.

6.1.2 Access to the New Terminal

The proposed arrangement for road access to the new terminal is a new intersection onto Foreshore Road. A concept design has been prepared for the intersection, which features:

- traffic signal control, in order to safely accommodate the heavy vehicle movements into and out of the site;
- adequate geometry to cater for a 90km/h design speed including provision of a 125m left turn lane into the site, a 150m right turn bay into the site 250m acceleration lane for traffic turning right out of the site, and 320m acceleration lane for traffic turning left out of the site; and
- adequate separation from the adjacent intersections at Botany Road/Penrhyn Road/Foreshore Road and a proposed (unsignalised) intersection from the relocated boat ramp onto Foreshore Road.

The provision of a new access point from the new terminal onto Foreshore Road would provide the following benefits:

- it would allow traffic generated by the new terminal to avoid the Penrhyn Road/Botany Road/Foreshore Road intersection, thereby avoiding premature capacity problems at this intersection;
- it would provide an alternative access point for the Patrick terminal (via an inter-terminal access road connecting with the new terminal), in the event of incidents/delays occurring at the Penrhyn Road/Botany Road/Foreshore Road intersection; and

- it would facilitate a reduction in the number of port trucks using Botany Road north of Foreshore Road, as this would become a less direct route for trucks travelling to/from South Sydney and the Inner West.

6.1.3 Mitigative Measures

The number of truck trips to and from the port is forecast to grow at a much slower rate than container throughput. Container throughput is expected to grow by 265% to 2021, but the number of truck trips to and from the port in the AM peak is forecast to increase by only 57%.

This is due to substantial mitigative measures that are being proposed by SPC, including:

- increasing rail's mode share for transporting containers to/from Port Botany from 25% currently to 30% by 2006 and 40% by 2011;
- increasing truck utilisation (i.e., the number of containers per truck) through the use of high productivity vehicles such as B-Doubles;
- significantly increasing the level of backloading from 8% currently to 27% by 2021; and
- increasing road working hours from 16 hours per day, 5 ½ days per week currently to 16 hours/6 days per week in 2011 and 24 hours/7 days per week in 2021.

It is important to note that SPC has no jurisdiction over trucks when they are operating outside the port precinct, and as such cannot restrict or approve public roads for use by port trucks. However, as discussed above, the construction of a new port access road for the new terminal will help to facilitate a reduction in the number of port trucks using Botany Road north of Foreshore Road.

6.1.4 Management of Road System as it reaches Capacity

The government's key State and Regional strategic policies, including *Action for Transport 2010*, *Shaping our Cities* and State Environmental Planning Policy 66 – *Integrating Land Use and Transport,* establish goals for promoting freight efficiency, limiting the growth of private vehicle travel and increasing the use of rail freight in Sydney.

SPC's forward plan, *First Port…Future Port*, includes goals that support the above strategic policies, including improving truck efficiency and increasing rail's mode share. The achievement of SPC's goals will contribute towards limiting the demand for road-based travel in the vicinity of the port.

However, given that the port contributes such a small proportion of total regional road traffic in the area, other measures (including the provision of infrastructure) would be required in order to address the forecast capacity problems.

Recognising that the forecast road capacity problems are primarily caused by private vehicle travel, it would be consistent with government policy for scarce road capacity to be managed by allocating priority to port traffic.

In this regard, the forecast high levels of private vehicle demand in the area should not be seen as a reason for restricting the proposed port expansion.

Furthermore, as port users stand to be a beneficiary of any improvements to the State road network, potential measures should focus on facilitating port traffic while seeking to contain the growth in private car travel in the area.

6.2 Rail

6.2.1 Port Container Terminals

Traffic through P&O and the new terminal in particular, is very high in 2016 and 2021 compared to the current situation. Both these terminals must turn a train around in approximately 2 hours, which is achievable at the siding; however, train timetabling must also be able to accommodate this frequency.

Table 6.1 below shows the subsequent train trips that would occur through Botany Yard as a result of these trains recognising that each train visit represents two train movements (one up and one down). These forecasts assume that rail services will operate on a 24-hour basis and that new intermodal terminal(s) are provided with sufficient network access to the port terminals.

Section 4.5 also contains details of the assumptions that were adopted in calculating these figures and a copy of the model is shown in **Appendix H**.

Table 6.1 – Trains movements through Botany Yard (1)

	Existing	2006	2011	2016	2021
Botany Yard	30	46	70	94	108

1) assumes that rail has a market share of 40% by 2021.

The capacity of the existing dedicated freight line, which is governed by the unduplicated section between Port Botany and Cooks River, would be reached prior to 2016. Duplication of this section of track would be required in order to accommodate the forecast 94 – 108 train movements per day.

If container traffic were to capture more market share or grow at a rate greater than anticipated, increasing the length of sidings at the P&O terminal could increase capacity at the Port.

By increasing the siding length to be in line with an inland port terminal (i.e. 600m), train movements would be reduced to 102 movements per day providing operators choose to operate longer, less frequent trains to take advantage of infrastructure. This small reduction in train movements is due to P&O services making up only a relatively small proportion of the total port movements. Additional reductions in train movements could be found by improving rail operations through the port and better managing trains. This includes building trains that are only destined for one stevedore (no splitting) and reducing the need for shunting in the port precinct.

There may be future plans by P&O to extend their sidings so as to mirror the Patrick terminal and new Terminal however, these are not definite and have not been considered in detail in this study.

6.2.2 Botany Yard

Botany yard itself has sufficient capacity to process future train volumes as the shunting that occurs here does not infringe on the ports operations. It is more an issue of capacity at the port terminals.

Operations within the yard will include inspections and separating and rejoining longer trains so as to accommodate siding lengths within the port area. The majority of shunting, predominantly for rural destinations, would probably occur elsewhere in the future if additional inland intermodal terminals are developed. In this situation the shunting within Botany Yard would possibly decrease if additional inland intermodal terminals were to come on-line.

Botany yard poses no operation constraint to running the train numbers indicated above in **Section 4.4.2**. The only issue that may arise involves the inspection of wagons that can be accelerated by increasing the number of staff undertaking the inspections. The operational efficiency will however depend on good information flow. It may therefore be necessary to appoint a "terminal co-ordinator" or similar role to manage all train movements in and out of the port precinct.

6.2.3 Metropolitan Intermodal Terminals

Table 6.2 below indicates the number of trains that would be required to meet the proposed future container volumes each day. The forecasts assume that the splits between the terminals will not change in the future. **Appendix H** shows the calculating details.

Table 6.2 – Trains per day through metropolitan intermodal terminals

Metropolitan Intermodal Terminals					
Terminal	**Existing**	**2006**	**2011**	**2016**	**2021**
Yennora	1	1	2	3	4
Minto	1	1	1	2	2
Camellia	2	1	2	4	4
Leightonfield	1	1	1	2	2
Cooks River	1	1	2	4	4

Cooks River

Cooks River terminal is also capable of increasing operations to service 3 trains per day, as there are adequate sidings within the terminal. To accommodate this volume Cooks River would need to run 400m – 450m trains as opposed to the current 300m trains that were modelled.

The problem that exists however is that the shunting movements required to make up these trains requires part of the main line to be used as a shunting neck (see **Section 5.2.6**).

This issue would need to be resolved not only with regards to running the longer trains but also when considering general rail operations along the main line.

6 System Requirements

Under the current track configuration and available access times, most intermodal terminals are able to handle a maximum of 2 – 3 trains per day (i.e. 4 – 6 movements).
Thus the train numbers shown in **Table 6.2** for 2016 and 2021 do not appear achievable, under the existing track configuration, at all of the terminals. In particular, Camellia and Yennora terminals both exceed their capacity.

The problem at Camellia and Yennora could be reduced somewhat by increasing siding lengths, increasing terminal capacity and ensuring local container handling operations gain some efficiency improvement. Increasing siding lengths would however mean that Port Botany/ Botany Yard would be required to handle trains greater than 600m in length (i.e. 800m – 900m).

Any improvements to the metropolitan intermodal terminals will be dependent upon container throughput growth and changes made to either infrastructure or container operations at the port container terminals. It is envisaged that any upgrading at these intermodal terminals will be reactive to other changes. However if demand grows, the operators of these terminals will act to maintain their market share.

Improvements to these terminals will also be dependent upon the operator and which Port terminal they deal with. For example, if an intermodal terminal only deals with one of the Botany terminal operators and they require trains to be a certain capacity to meet efficiency goals, then the terminal operator may be expected to work with the rail operator and accommodate growth. Additionally a number of these intermodal terminals are operated by a stevedore (e.g. Patrick at Yennora) or an associated company. It is therefore in their best interests to operate as efficiently as possible by running trains of optimal capacity and length. This will be particularly evident with Patrick and their interest in Pacific National and its associated infrastructure.

6.2.4 Rural Intermodal Terminals

Table 6.3 below indicates the number of trains that would be required to meet the proposed future container volumes each day. Refer to **Appendix H** for calculation details and **Section 4.4.1** for the assumptions adopted.

Table 6.3 – Trains per day through regional terminals

Regional Terminals					
Region	**Existing**	**2006**	**2011**	**2016**	**2021**
North	3	5	6	7	8
South	2	2	3	3	3
West	4	6	7	8	9

It can be seen in **Table 6.3** that increased mode share has some effect on rural operations, and the subsequent increase in container volumes. This is mainly due to the assumption by the port container terminals that train lengths will increase to 900m in the future. Generally rural destinations will be able to cope with the increase in train numbers.

A problem that may however become evident, especially with heavy container freight, is the utilisation of wagon space. Even though 21.9m wagons will be used, it may not be possible to run trains with 100% container slot utilisation for two reasons:

- rolling stock capabilities; and
- axle load limits.

A great deal of freight from rural areas is heavy including rice, flour and bailed cotton and wool. This presents a problem with rolling stock that is limited in the weight that it can carry and results in some wagons only carrying 2 of a possible 3 containers. If new rolling stock was able to cater for the additional weight, then axle load limitations and the associated speed restrictions will become the issue. We have assumed a maximum utilisation of 85%.

Another problem that will become apparent with rural services in the future is the existing rail infrastructure to these areas, namely passing loops. Many of the existing passing loops are not capable of handling the 900m trains modelled. These passing loops would therefore need to be extended to allow for the passing of 900m trains.

6.2.5 New Intermodal Terminal(s)

Table 6.4 below shows the trains generated per day at possible new metropolitan intermodal terminal(s) based upon throughput figures provided by SPC, 7th August 2002. These volumes would be in addition to those shown in **Table 6.2** for the existing intermodal terminals.

Table 6.4 – Trains per day proposed through new intermodal terminal(s)

	Existing	2006	2011	2016	2021
New Intermodal Terminal(s)	0	2	6	9	11

The demand on the existing metropolitan intermodal terminals is directly dependant upon the container volumes handled at the new intermodal terminal(s). The new facility(ies) effectively reduce the freight task at the other metropolitan intermodal terminals, which as indicated above, are approaching or exceeding capacity by 2021.

In this respect any increase in the throughput through the proposed new intermodal terminal(s) would further reduce the trains per day through the existing metropolitan intermodal terminals (see **Table 6.2**). The follow-on benefit is that the more containers processed at the new terminal(s), the less freight traffic there is on the shared metropolitan network.

Further reductions in train volumes at the existing inland intermodal terminals could be achieved by increasing operations to 7 days per week.

It is assumed that 600m trains would operate this shuttle service between the new intermodal terminal(s) and Port Botany. Although it would be possible to build trains greater than 600m at the terminal, the port terminals would not be able to accommodate this length efficiently.

At the Port it is more efficient to run 600m shuttle services straight in and out of the siding rather than a 900m train that would need shunting to fit within the sidings.

During the shunting manoeuvres container operations are not possible and staff and plant would be idle.

The new intermodal terminal(s) should be designed with optimum capacity in mind. This should include the maximum number of sidings, sidings of adequate length and allow maximum operational flexibility. By providing this, the train numbers predicted for the existing metropolitan terminals (see **Table 6.2**) and along the shared network (indicated in **Appendix H**), could be significantly reduced. If on the other hand additional intermodal terminal(s) were not introduced, the existing terminals and the shared network would reach capacity prior to 2016.

6.2.6 Dedicated Freight Lines

RIC is currently investigating the feasibility and associated timeframe for the upgrade of the dedicated line between Enfield and Port Botany. This mainly involves new sections of duplicated track and its timing is dependent on the predicted future rail volume. The main issues for the upgrade are a number of large bridges that would require rebuilding to widen the corridor sufficiently.

RIC has advised that they intend full duplication of the line to be completed by the time the new terminal commences operation around 2010. Once duplication is completed, the capacity of the dedicated line is expected to be around 1.3 million TEUs based on 90 to 110 train movements a day, which is adequate to accommodate the 40% mode share of forecast growth.

The only other constraint that exists in this area is the shunting movements on the main line at Cooks River (as discussed in **Section 5.2.6**). If detailed train operational planning cannot mitigate this through timetabling then a new shunting neck would need to be constructed to isolate shunting form the main line.

6.2.7 Metropolitan Network

Appendix H indicates the number of train movements that would be required to meet the proposed future container volumes each day.

This table shows that there are a number of sections where train numbers will increase significantly.

One area of concern is the increased volume on the Main Western Line, in particularly the section between Clyde and Lidcombe. The consequence of servicing the predicted future volumes at the Yennora and Camellia intermodal terminal has a significant effect on the needs of the metropolitan network.

Appendix H shows the traffic volume on the Main Western Line will increase significantly. The introduction of a South Sydney Freight Line (SSFL) from Macarthur will not assist this, as trains leaving Yennora must travel via the Main West and Flemington to Port Botany.

If it was found that capacity will be a problem on some of theses sections then solutions may include:

- increasing train lengths from the intermodal terminals outside the dedicated freight network;
- reduce headways (through signalling changes); and
- provide more dedicated lines for freight.

6.2.8 Impacts During Construction Phase

With regard to operational impacts during construction, this will be negligible and would be carried out during periods of relative inactivity at the port.

The construction of new rail infrastructure for the proposed new terminal would have minimal impact at the interface with the existing line. Considering the proposed plans, an additional spur line would be constructed joining onto the existing siding prior to it entering the Patrick terminal.

The only disruption to this service would be during the installation of the new turnout. This could be undertaken during a night possession, minimising the operational impact, and could be completed over a 12 hour period.

During the time that the line is not operational, alternative "one-off" arrangements could be made whereby trucks transport the containers between the Port and an alternative intermodal loading site at Enfield.

6.2.9 Conclusion

It was found that the target of rail achieving a 40% mode share by 2011 is achievable, however the dedicated freight line would need to be duplicated by 2016 for rail's mode share to remain at 40%. The achievement of the target rail mode share would mean that the new terminal has a negligible impact on the performance of the road system.

Table 6.5 below summarises the rail freight analysis undertaken in this study.

Table 6.5 – General Analysis

	Existing	2006	2011	2016	2021
Rail Volume Through Port Botany (TEU/day)	767	1,311	2,244	3,205	4,103
No. Trains Through Port Botany (Trains/day)	15	23	35	47	54
Train Movements Through Port Botany (Trains/ day)	30	46	70	94	108
Track Capacity Between Marrickville and Port Botany (Train movements/day)*	52	52	90-110	90-110	90-110

* assuming the line is duplicated between Cooks River and Mascot prior to 2016.

6 System Requirements

Considering the forecast trade growth, the dedicated freight section servicing the port is incapable of satisfying future demand based upon reliable rail operations. It would be necessary for RIC to proceed with the duplication proposal. The works could be staged as growth occurs.

If the port throughput is to be maximised, both port container terminals should be capable of handling 600m size trains. Should these arrangements be in operation and the train arriving was a mixed consist, the incoming train could divide the train consist at Botany and run direct with the lead portion to the first terminal operator. The Botany Yard shunting locomotive could then attach to the rear portion and run direct to the other terminal. The operation would then take between 20/25 minutes to complete.

It has been recognised that the major rail related issue with regards to the increase in future container volumes will be the impact on the shared metropolitan network. Therefore rather than increasing capacity at the intermodal terminals it is more beneficial that fewer trains are required to use the shared network. The most effective action to lessen this problem is to increase throughput at the new intermodal terminal(s). This reduces the need for trains to travel on the shared network and decreases the demand on the existing metropolitan intermodal terminals.

It will also be necessary for the freight operators to clear all incoming wagons from Port Botany/Botany immediately after the wagons are empty in order not to congest the terminal (unless being placed in P&O Trans). This will require them to plan in advance the next trip for all of their incoming rolling stock, as Botany will not be able to store empty wagons waiting assignment.

7 Reducing Private Car Travel

7 Reducing Private Car Travel

Chapter Summary

The impact assessment has been undertaken having regard to the wider strategic context. This increases the likelihood that the transport and land use outcomes of the port expansion will be more effectively integrated and more consistent with the strategic planning goals of both the NSW Government and local Councils.

This section of the report concludes that there are some opportunities for reducing car dependency as part of the port expansion. The analyses do, however, conclude that these opportunities are limited and that the greatest opportunities for change rest with State and Local governments.

7.1 State and Regional Strategic Policies

The goals and philosophies underpinning the Government's approach to land use and transport throughout Sydney are detailed within:

- the metropolitan strategy, *Shaping Our Cities*, prepared by PlanningNSW;
- the integrated transport plan, *Action for Transport 2010*, jointly prepared by Transport NSW and the Roads and Traffic Authority; and
- the air quality management plan, *Action for Air*, prepared by the Environment Protection Authority.

The fundamental messages contained in these strategies were reinforced with the release of *Integrating Land Use and Transport – A Planning Policy Package*.

7.2 Existing Transport Scenario

A brief study of existing operations and transport trends at Port Botany has identified the following:

7.2.1 Employment

- Patrick employs around 320 staff, P&O employs an estimated 410;
- both employers carry a high proportion of casual staff (around 30-40%); and
- shift times for workers at Patrick changeover at 0600, 1400 and 2200. P&O shifts changeover half an hour later.

7.2.2 Public Transport

- the site is currently served by the STAs 391, 309 and L09 bus services;
- these services stop at points along Botany Road and Bumborah Point Road that are more than 400m from the Port Botany container terminals;
- the 391 provides connection between the site and the city via Museum and St James stations in approximately 50 minutes. The 309 and L09 connect the site to Central and Redfern respectively in approximately 40 minutes; and

- timetables for each of these services have been reviewed to determine the frequency of each route to and from the site around shift changeover times (0600-0630, 1400-1430 and 2200-2230). These are given below:

Monday to Friday **Bus Headways around Shift Changes (mins)**

Route	Direction	Morning	Afternoon	Night
391	To City	none	60	none
	From City	18-44	60	none
309	To City	15-18	20	60
	From City	10-12	20	45-60
L09	To Redfern	none	none	none
	From Redfern	10-22	none	none

Saturday **Bus Headways around Shift Changes (mins)**

Route	Direction	Morning	Afternoon	Night
391	To City	none	60	none
	From City	none	60	none
309	To City	20-32	20	60
	From City	22-11	20	60
L09	To City	none	none	none
	From City	none	none	none

Sunday **Bus Headways around Shift Changes (mins)**

Route	Direction	Morning	Afternoon	Night
391	To City	none	60	none
	From City	none	60	none
309	To City	30	30	60
	From City	30-45	30	60
L09	To City	none	none	none
	From City	none	none	none

There is scope to improve the bus services in the vicinity of the site, however, this responsibility rests with STA. The main drawback of these services is that they can take up to an hour to provide connection to the city and other destinations due to the length of each route. Further, most employees do not live in the city or along the bus routes. As a result, travel times for journey to work trips by private vehicle are significantly lower – particularly as shift changeover times do not occur during peak traffic periods.

7.2.3 Pedestrian and Cycle Amenity

- there is a lack of adequate pedestrian and cycle paths in the area;
- the environment is unfriendly to these alternative modes; and
- few employees live within walking distance of the site.

7.2.4 Private Vehicle Usage

- private car is the predominant mode for worker travel to and from the site;
- there is a healthy supply of on site car parking; and
- accessing the site by car is many times faster than by any other mode.

7 Reducing Private Car Travel

7.3 Options for Reducing Car Dependence

Possible options fall into one of three distinct, but related, fields.

7.3.1 Policy Initiatives

This package of measures contains policy recommendations on the following topics:

- a policy framework for the provision of facilities for cyclists and pedestrians; and
- options for preparation and implementation of "workplace travel plans".

Pedestrians and Cyclists

As the Port precinct continues to expand and develop, the opportunity exists for State and Local Governments to provide improved pedestrian and cycle networks. In addition, there is also scope for on site shower and change facilities to be developed as part of the port expansion. This will encourage bicycle use and reduce the impact of private vehicle use.

Workplace Travel Plans

Responsibility for implementing measures to encourage higher levels of public transport use, cycling and walking rest with State Government and local councils. However, there is scope for the larger companies and organisations locating in the expanded port precinct to prepare workplace travel plans prior to them occupying new or existing developments.

A workplace travel plan is typically a package of practical measures to encourage and enable staff and visitors to a particular building or company to choose alternatives to single-occupancy car-use, and promote greener, cleaner and healthier travel choices. In order for a travel plan to be successful, it should be tailored to suit the needs of the particular organisation in question, and have the full backing of management and staff at all levels.

The Port precinct offers an opportunity to pilot the implementation of workplace travel plans.

7.3.2 Infrastructure Initiatives

The funding for and approval of any future infrastructure upgrades are the responsibility of State and Local government agencies. Sydney Ports Corporation is, however, in a position to encourage investment in infrastructure but is not in a position to fund infrastructure that has a regional function.

7.3.3 Transport Service Responses

The lengthy route and frequent stops of STA bus services compromise their effectiveness. Given the time-specific transport needs of the shift-work environment, consideration could be given to implementing a shuttle bus service in the longer term. The service would need to be tailored to the needs of employees, having regard to their place of residence, work times and other factors.

7 Reducing Private Car Travel

7.4 Conclusion

The current transport context in the port precinct is dominated by high levels of car use and a network of major arterial roads that surround the study area. This pattern is exacerbated by the precinct's lengthy bus travel times and a pedestrian and cyclist network that in most locations is inadequate.

There are some opportunities for reducing car dependency as part of the port expansion. These opportunities are limited and the greatest opportunities for change rest with State and Local governments. A number of measures should be considered in more detail in future to improve the sustainability of the sites' transport patterns – bringing it in line with government strategic policies.

It is recognised that there are likely to be difficulties in achieving improved public transport outcomes in the relatively remote locations of the port facilities.

8 Conclusions

8 Conclusions

8.1 Trade Growth

Container traffic at Port Botany is forecast to grow from 877,000 TEU in 2001 to 3.2 million in 2021, as shown in **Table 8.1**. This growth will cause a significant increase in the landside transport task.

Table 8.1 – Forecast Trade Volumes

Year	TEU
2001	877,000
2006	1,250,000
2011	1,750,000
2016	2,500,000
2021	3,200,000

8.2 Mode Share and Transport Efficiency

Rail mode share is expected to grow in line with SPC's strategy from 25% currently to 30% in 2006 and 40% from 2011. Transport efficiency is expected to increase with backloading of trucks increasing from 8% of truck calls in 2001 to 23% by 2021.

Road working hours are expected to increase from 16 hours per day, 5 ½ days per week currently to 16 hours per day, 6 days per week in 2011 and 2016 and 7 days per week, 24 hours per day in 2021. Rail working hours are expected to increase from 5 ½ days per week (24 hours per day) currently to 6 days per week (24 hours per day) from 2011. However, rail operations at Port Botany would be able to operate 24 hours per day, 7 days per week.

8.3 Transport Demand and Mitigative Measures

Container throughput is expected to grow by 265% by 2021, but the number of truck trips to and from the port in the AM peak is forecast to increase by only 57%. This is due to substantial mitigative measures that are being proposed by SPC, including:

- increasing rail's mode share for transporting containers to/from Port Botany from 25% currently to 30% by 2006 and 40% by 2011;
- increasing truck utilisation (i.e., the number of containers per truck) through the use of high productivity vehicles such as B-Doubles;
- significantly increasing the level of backloading from 8% currently to 23% by 2021; and
- increasing road working hours from 16 hours per day, 5 ½ days per week currently to 16 hours/6 days per week in 2011 and 24 hours/7 days per week in 2021.

8 Conclusions

8.4 Road and Rail Traffic and Network Improvements

Table 8.2 summarises the forecast truck and train trips per day, and the associated infrastructure requirements to meet future transport demand. For the purposes of this assessment, a worst case impact of the new terminal has been assumed with the new terminal capturing 30% market share of total Port Botany container traffic by 2011 and 40% in 2016 and 2021.

The following points are highlighted:

- the forecast train volumes assume that there will be new intermodal terminal(s) with sufficient network access connecting to the port terminals;
- the dedicated freight line between Cooks River and the Port Botany container terminals would need to be duplicated by2016;
- Cooks River intermodal terminal would need to operate 400m-450m trains in order to accommodate future demand. This would however exacerbate the problem of using the main line as a shunting neck;
- the best options to reduce demand at the existing metropolitan intermodal terminals would be to:
  - increase throughput at new intermodal terminal(s). This may be necessary as some of the existing terminals will be over capacity even with the new terminal(s) handling the volumes that are currently proposed; and
  - increase operations at the terminals and Port Botany to 7 days per week.
- additional capacity problems at Camellia and Yennora could be addressed by increasing siding length, increasing terminal capacity and improving the efficiency of container handling operations. Upgrading of the intermodal terminals would be a commercial decision to be taken by the terminal operators.
- capacity on the shared metropolitan network can be improved by:
  - increasing throughput at new intermodal terminal(s) with sufficient network access to the port;
  - increasing train lengths from the existing intermodal terminals outside the dedicated freight network;
  - reducing headways (through signalling changes); and
  - providing more dedicated lines for freight.
- passing loops in the rural area may need to be upgraded to allow for 900m trains;
- the new intermodal terminal(s) should provide for shuttle services of at least 600m in length; and
- if detailed train operational planning cannot mitigate the effect of shunting on the main line at Cooks River through timetabling, then a new shunting neck would need to be constructed by 2021.

8 Conclusions

8.5 Road Traffic Inputs

Table 8.3 summarises the forecast truck and train trips per day, and the associated infrastructure requirements, for the "worst case" road traffic scenario of a 20% rail mode share.

Assuming the 80/20 road mode share scenario and the maximum market share for the Patrick terminal of 50% in 2011 and 40% from 2016, the Foreshore Road/Botany Road/Penrhyn Road intersection would require upgrading some time after 2016. Duplicating the right turn from Botany Road (south) into Botany Road (north) would not be necessary where rail mode share approaches 40%.

The analyses of road based traffic impacts has been undertaken on the basis of a mode share between rail and road of 20% and 80%respectively. That is, the analysis assumes a worst case (and an unlikely case) scenario whereby only 20% of port related freight is transported by rail, the remainder being transported by road. Whilst this is not uncommon in traffic engineering and transport planning investigations of this type, care must be taken in interpreting the outputs of the analyses, particularly the intersection analyses which paint a picture worse than that which will actually be the case in future years. For the reasons outlined in this report, a future rail mode share of at least 40% is anticipated, with consequent negligible road based traffic impacts over time. (Rail freight currently accounts for 25% of all container movements in and out of Port Botany). In the unlikely event a rail mode share of 40% is not achieved over time, the analysis demonstrates that the traffic impacts of an expanded port will not be adverse and will be manageable.

8.6 Cumulative Transport Impacts

Based on the analysis of preliminary data on future traffic generation, the broader transport implications of the combined developments outlined in **Section 2.4** are:

1 based on existing trends peak demand for the road network in the Mascot area will exceed capacity by 2011, and a deterioration in the level of service is probable;

2 the State Government is addressing this through a road development program and through demand management. (Action for Transport and Draft Statement Environmental Planning Policy No 66);

3 notwithstanding this, some adjustment of peak travel demands throught peak spreading is likely to take place;

4 the Airport Rail Link is likely to play an increased role in serving the passenger transport needs of the area;

5 Port Botany traffic represents only a small proportion (approximately 1%) of forecast peak traffic volumes; and

6 the achievement of SPC's objective of a rail mode share of 40% (for freight transport) will attenuate the impact of port related traffic on the road system.

8 Conclusions

The forecast deterioration in the road system's level of service is not caused by the new terminal, as port traffic represents a very minor proportion of total traffic. Most of the increased traffic is caused by private vehicle travel associated with the Airport, Green Square and general background traffic growth.

The capacity constraints on the road network, although not caused by port traffic, would impact on the efficiency of road-based transport to and from the port. This in turn will promote rail transport of cargo.

Table 8.2 – Summary of Road Trips, Rail Trips and Infrastructure Requirements

Year	TEU (,000)		Road Trips (No. per ave day)		Rail Trips [4] (No. per ave day)		Infrastructure and Operational Requirements
	New Terminal [1]	Total Port	New Terminal	Total Port [2]	New Terminal	Total Port	
Existing	N/A	877	N/A	2,913	N/A	30	
2006	N/A	1,250	N/A	3,327	N/A	46	▪ Construction of new intermodal container terminal(s) with sufficient network access connecting with the port terminals.
2011	525	1,750	941	3,115	18	70	
2016	1,000	2,500	1,546	3,862	32	94	▪ Duplication of dedicated freight line between Cooks River and Botany Yard ▪ Improvements to Camellia and Yennora metropolitan intermodal terminals such as increased siding lengths.
2021	1,280	3,200	1,882	4,700	36	108	▪ New shunting neck at Cooks River ▪ Improvements to the Shared Metropolitan Network [3]

1) Results are shown for terminal market share 1, which maximises the number of road and rail trips to/from the new terminal, i.e., assumes that the new terminal captures 30% of total Port Botany Container Traffic by 2011 and 40% in 2016 and 2021;

2) Daily truck trips decrease between 2006 and 2011 because of the assumption that days of operation per annum increase from 286 to 312;

3) Potential solutions include:
   - Increasing market share taken by new metropolitan intermodal terminals;
   - Increasing train lengths;
   - Signalling changes to reduce headways; and
   - Additional dedicated freight lines.

4) One train generates two train/rail trips (i.e. 1 in and 1 out)

8 Conclusions

Table 8.3 – Summary of Road Trips, Rail Trips and Infrastructure Requirements, 80% Road Mode Share Scenario (1)

	TEU (,000)		Road Trips per Day		Rail Trips per Day		Infrastructure Requirements
	New Terminal (2)	Total Port	New Terminal	Total Port (3)	New Terminal	Total Port	
Existing	N/A	877	N/A	2,913	N/A	30	
2006	N/A	1,250	N/A	3,797	N/A	32	
2011	525	1,750	1,124	3,746	10	40	
2016	1,000	2,500	2,062	5,154	16	48	Upgrading of Foreshore Road/Botany Road/ Penrhyn Road intersection
2021	1,280	3,200	2,509	6,273	18	54	

1) assumes rail mode share of 20%;
2) results are shown for terminal market share 1, which maximises the number of road and rail trips to/from the new terminal, i.e., assumes that the new terminal captures 30% of total Port Botany Container Traffic by 2011 and 40% in 2016 and 2021; and
3) daily truck trips decrease between 2006 and 2011 because of the assumption that days of operation per annum increase from 286 to 312.

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9 Bibliography

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10 Glossary and Abbreviations

10 Glossary and Abbreviations

ARTC	Australian Rail Track Corporation Ltd, which 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 manages 4430 route kilometres of interstate track, mainly in South Australia, Victoria and Western Australia. ARTC is currently negotiating with the other States to obtain wholesale access agreements that will allow it to provide a one-stop shop for train operators seeking access to the National interstate standard gauge rail network.
ATC	Australian Transport Council, a body made up of Federal and State Ministers with responsibility for the roads and transport portfolios.
Backloading	The practice of utilising a truck so that it carries a load on both directions of its journey, i.e., a truck that carries export container(s) to the port and returns carrying import container(s).
CFS	Container Freight Station – Warehouse/freight forwarding facilities at which containers are packed/unpacked and transferred to/from the port terminals.
Heavy Vehicle	Any vehicle that is a two axle rigid truck or larger.
Intermodal Terminal	A facility at which containers are transferred between road and rail transport modes.
LEP	Local Environmental Plan
Mid Block Capacity	The theoretical capacity of a link in the road system, used in traffic models to assign traffic volumes to the road network. Mid-block capacities are a function of the number of lanes and the downstream intersection.
Pacific National	During 2001 Lang Corporation (now Patrick Corporation) and Toll Holdings formed the National Rail Consortium to purchase freight operators FreightCorp and National Rail. This group now operates as Pacific National and is the largest freight operator in NSW.
POTA	P&O Trans Australia

10 Glossary and Abbreviations

RIC	Rail Infrastructure Corporation
SCATS	Stands for *Sydney Co-ordinated Adaptive Traffic System*, which is the RTA's system that controls around 3,000 intersections in NSW. It continually adjusts the phasing of the traffic lights adapting to the demands of the traffic flow.
SCATES	Is a traffic simulation program for modelling signalised intersections within a coordinated system. It is used to develop appropriate signal plans and to evaluate traffic management measures.
SPC	Sydney Ports Corporation
TDC	Transport Data Centre – A Branch within Transport NSW that collects and maintains data sets and performs travel demand forecasting for personal and freight travel patterns in Sydney.
Trip	A "trip" (by truck or train) is defined as either an inbound movement or an outbound movement. One truck/train visit to the port equals two truck/train trips to/from the port.

Appendix A Summary of Site Visits

COPY NO. [ ]

Sydney Ports Corporation

Traffic and Landside Transport Study for Proposed Port Botany Expansion

Summary of Site Visits

JULY 2002

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Our Reference: 20018502.00

Traffic and Landside Transport Study for Proposed Port Botany Expansion

Summary of Site Visits

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
A	14/06/02		Philip Brogan, Director Planning	Approved

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11 Summary of Site Visits

Site visits were held on 3rd and 4th June 2002. The key issues are summarised below.

12 P&O Ports Issues

12.1 Rail Issues

- The existing rail siding is 300-350m long and consists of 3 lines. This length can handle 17 wagons (51 TEU). In the medium term they would like to have a 700-800m siding to match the capacity of the inland depots (Enfield has 800m sidings).
- An alternative is to provide a 1km siding that loops around the site, however this would require acquisition of the Patrick Port Services site (operated by Patrick but on SPC owned land) and the Alcatel cable laying operation.
- Both these options have the problem of bisecting the Patrick Port Services site and crossing Friendship Road.
- The rail siding operates continuously (24 hours) for 5 ½ days per week. P&O would be prepared to operate the siding on a 7 day 24 hour basis if volumes necessitated (same goes for road).
- Current capacity is 660 lifts per day, using two forklifts. However this could be doubled by simply shifting more forklifts onto the rail operations.
- P&O charge for a 4-hour window, which typically handles 120 containers.
- Rail is currently handling 80,000 boxes per annum.
- Management of access to and from the site is the main constraint on rail.
- The capacity of the terminal is thought to be around 1.25m TEU per annum (1.2m key capacity, 1.23m yard capacity). Capacity is influenced by issues such as key length, number of cranes and crane rate.

12.2 Road Issues

- 75% of TEU movements are by truck.
- On average there are 750 trucks per day but it varies between 500 and 1,300.
- Road servicing is undertaken 5 days a week between 0700 and 2200. Also, stack runs are undertaken on Saturday mornings. The evening hours are under-utilised, as the transport industry generally operates between 0700 and 1700.
- Timeslots are 1 hour in duration, and from July last year transporters are penalised if they arrive late.
- Current capacity is 75 trucks per hour, but this could be increased by adjusting resources. In general, capacity exceeds demand.
- Could move to 7 day 24 hour road servicing operations if volumes justified.

- There are around 200 moves per day on stack runs, from Smith Bros (generally full containers) and P&O Trans Australia (generally empty containers). Stack runs are encouraged as they reduce pressure on timeslotting arrangements.
- There are currently 280 carriers on the vehicle booking system (VBS) – P&O expects a significant rationalisation of carrier numbers over the future.
- Backloading is currently less than 10%, despite measures to encourage the practice such as allowing backloads without booking in advance.
- Carriers do not pay for individual slots but are charged an annual subscription of $1,000 per annum, which equates to less than $1 per box.
- In addition to a consolidation in the number of carriers, P&O expect to see increasing use of backloading and B-Doubles in the future, and use of road trains within the port precinct.
- Truck turnaround times are currently 40-45 mins. There is no push from industry to make turnaround times faster but improved reliability is more important. The automation of gates has helped in this regard.
- Other measures to improve productivity include use of transponders (10-15% takeup presently), and the potential to use a keypad in the future instead of manual processing. This would save around 7 mins per truck.
- There is potential to improve truck traffic flows by providing truck access off Charlotte Road via Lot 13, which would allow a one-way flow through the site.
- The terminal could handle up to 4,000 truck movements per day. Increased operating hours and the use of larger trucks are the main issues for increasing the number of that could be turned around per day.

13 Patrick

13.1 Rail Issues

- The terminal operates 2 x 600m rail spurs. Train size is 24 wagons, i.e., 72 TEUs on each line. The Minto shuttle is 17 wagons.
- Some trains are broken up at Botany Yard.
- There are around 10 trains each day, with 3-4 trains on the midnight shift (2200-0600).
- In all, 16 shifts out of the available 21 over the week are utilised.
- Rail capacity is 250,000 TEU per annum. For the 12 months from June 01 to May 02 there were 133,000 TEU. Last calendar year the figure was 117,000 TEU.
- It is possible to strip 100 boxes in a 1-hour turnaround time. Turnaround times average 1 box per minute (using two machines) but this can be reduced to 1 box every 30 seconds using more machines.
- The constraint is getting the straddles to the train from the yard.
- The shuttle push-pull arrangement services P&O in the morning and Patrick in the afternoon. Its length is limited by the siding at P&O.

- Down time for rail is around 56 hours per week, but can be as high as 70 hours per week. This indicates that up to 12 hours per day can be down time, which implies there is plenty of scope to handle higher volumes.
- Shift times are 0600 – 1400, 1400-2200, 2200-0600. P&O shifts start/finish ½ hour later.
- Rail mode share is currently 25-27%.

13.2 Road

- Road servicing hours are 0500 to 2100.
- There is a pool of 29 straddles of which 8 are normally servicing trucks. At a capacity of 80-85 containers per machine per man, this implies a capacity of 765 containers per day.
- Daily average truck numbers are 800-1,000.
- There are 26 truck grids.
- Backloading is facilitated by processing the in and out movement at the same time. In the future it is proposed that the transaction will be paperless, which will reduce turnaround times from 35-40 mins to 17-18 minutes. Currently 10-20% of trucks backload.
- Patrick has no commercial relationship with the trucking companies. The VBS is outsourced to LOGICHIP, which charges carriers $4/box for the technology. Charges do not vary by time of day, but there may be potential to do this in order to improve slot utilisation in the off-peak times.
- By improving utilisation of the back shift and extending road servicing hours to include the midnight shift, road could handle double the current numbers.
- Current design capacity of the terminal is 550-600 TEU. The proposed $300m extension, which is expected to be completed by 2004, will increase capacity to 1.3m TEU pa.
- Patrick use a container to TEU ratio of 1.25, but expect this to increase to 1.3 – 1.35 over the next 10 years.
- Stack runs can account for up to 300 trucks per day.
- The terminal has a workforce of 220 permanent and 100 casual staff.

14 Patrick Port Services

- The facility includes a container park (storage and repair of empty containers), container freight station and storage of full containers.
- The container park generates around 150 trucks in and 150 trucks out per day.
- The Container Freight Station (CFS) and storage area generates around 80 trucks in and 80 trucks out per day, but this varies between 20 on Mondays to 250 on Fridays.
- In addition, 23 trucks come in per day to have quarantine inspections.

- Stack runs generate around 170 truck movements per week using their own truck fleet of 25 prime movers (including 8 B-Doubles). If other carriers are taken into consideration the 170 figure should be multiplied by 4.
- A new storage 4 ha area is currently being developed which would have a capacity of 4,000 TEU.
- Molineaux Point generated 1,215 inbound TEU movements and 897 outbound TEU movements during April 2002.
- Patrick will remain at Molineaux Point for another 4 years as Vopak do not need the facility until then. The capacity of Molineaux Point is 4,000 TEU (assuming 6 high stacks). Without Molineaux Point, the Friendship road terminal would be at capacity.
- Future trends include an increase in the number of inland container parks, associated with the increased use of rail. However, the trade imbalance at Sydney means there will always be a need for container parks at Port Botany.
- The use of “super Bs” (which carry 2 x 40 foot containers) within the port precinct is also foreseen, however axle mass limits are currently a constraint.
- P&O’s rail easement is not seen to be feasible as it bisects the Patrick Port Services Site and crosses Friendship Road.

15 Smith Bros / P&O Trans Australia

15.1 Smith Bros

- Budget for a growth rate of 6% per annum.
- Generates 600-700 truck movements per day, 50% of which are LCL trucks and 50% stack run trucks.
- Smith Bros have their own fleet of 50 trucks, 6 of which are B-Doubles. The number of B-Doubles has increased from 2 to 6 in recent years.
- Are Australia's largest export packing facility, packing around 1,600 boxes per month.
- Handle 50,000 TEUs pa., up to 80,000 if empties are included.
- Services include container packing, unpacking and transport. P&O Trans Australia handles empties, rail transport, storage and repair.
- Stack runs are undertaken on a daily basis – 100 boxes at a time. 65% of movements are to/from Patrick, 35% P&O.
- Have requested SPC to make Bumborah Point Road and Friendship Road a mass free zone, to allow the use of "super Bs".
- Most movements are via Bumborah Point Rd, Friendship Rd and Foreshore Rd. In the future they may undertake movements to/from the P&O terminal through the back gate across the Inter-Terminal Access Road, which would obviate the need for traveling on public roads.
- 95% of import containers are double handled, i.e., moved from the port to the CFS then onto the customer.
- The facility is currently running at 35% of capacity, which is 4,000 TEUs. There has been a significant reduction in turnaround times, reflecting logistics trends. Last year they were operating at capacity, but total volumes were lower.
- They are looking at establishing a similar facility in western Sydney to service the Enfield development. However, expect to see an increasing trend for packing/unpacking in the Botany area as it is cheaper to pack locally. For example transporting a box to Alexandria for packing would add $100 per box to transport costs.
- Operating hours are 20 hours per day, 5 days a week. Peak movements occur between 0700 and 0830, when average turnaround times are 45 minutes door to door. During the day turnaround times are around 30 minutes.
- 55% of the containers handled would be 40 footers, and this proportion is expected to increase over time as the major importers (including Woolworths and Sanyo) make further use of 40 footers.

15.2 Molineux Point

- Will be developed as a 44,000 sqm logistics and FCL storage park by mid 2003.
- Will generate 600-700 trucks per day, 75% of which will be LCL trucks.
- Is expected to be running at capacity in 2-3 years.

15.3 P&O Trans Australia

- Capacity is comfortably 6,000 TEU, possibly up to 8,500 TEU if roadways and open spaces are used. The facility is currently holding around 4,500 TEU.

15.3.1 Road

- Generate 800-850 trucks per day (1,000 TEU), most of which are empties. Around 40-50 full boxes per day go into a storage area.
- Capacity is around 1,500 TEU (1,200 trucks) per day.
- Turnaround time door to door is 20 minutes.
- 70% of movements are stack runs out, while 30% are empty containers to be packed for export.

15.3.2 Rail

- Rail is used to transport empty containers that are already in the container park to rural areas for packing. Average volumes are 100-150 TEU per day (60 TEU per train) but during the 4-month cotton season this increases to 220-240 TEU per day (these figures include some empties that go to White Bay).
- Rail capacity is 250-300 TEU per day. The constraints are the number of shunts per day – 4-5 shunts per day.
- If it was possible to operate full length 600m trains there would be no need to split trains and this would improve efficiency. However, providing a longer siding may require the acquisition and closure of some warehouses.

15.4 Maritime Container Services

- Banksmeadow facility generates 400 truck movements per day on average.
- Operations include stack runs into the terminals (100 trucks per day), LCL trucks (200 trucks per day), movements of empty containers to St Peters for packing or loading on trains (50-60 trucks per day).
- Operations include empty storage (capacity of 1000 TEU at Botany), cleaning and pre-tripping, packing/unpacking, stack runs.
- Rail operation at St Peters:
- Serves rural areas - cotton country, abattoirs
- 2 trains per week to Melbourne
- 3 trains per week to Adelaide
- Daily port shuttle.
- Currently operating at 40% of capacity.

Appendix B Summary of Stakeholder Consultation

COPY NO. [ ]

Traffic and Landside Transport Study for Port Botany Expansion

Summary of Stakeholder Consultation

JUNE 2002

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Summary of Stakeholder Consultation

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
A	14/06/02		Philip Brogan, Director Planning	Approved

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1 Summary of Stakeholder Consultation

Consultation is being undertaken on an ongoing basis throughout the study. The outcomes of the consultation that has been undertaken to date are summarised below.

2 Rockdale City Council

- Very few origins/destinations for port traffic in Rockdale, but a large amount of port related traffic crosses the LGA.
- Most port traffic through Rockdale uses the M5, however, oversize or dangerous goods travel via March Street, Qantas Drive, Forest Road and Stoney Creek Road (the overland route).
- RTA is currently reducing the capacity of the overland route through Bexley by changing signal phasing and times, and reducing the number of lanes in order to encourage heavy vehicles to use the M5.
- RTA is undertaking cordon counts around the M5, including classification counts, in order to determine its impact on the surrounding road network. The results should be available in July.
- There is currently a mass limit on the bridge over Cooks River on the Princes highway. This is causing trucks bound for Tempe to use Botany and Canal Roads instead of the preferred route of M5 East-March Street interchange (including Flora Street – a local road)-Princes Highway. The Botany Road route is less desirable due to local community and council concerns about heavy vehicle intrusion. Council is attempting to discourage use of Flora Street by requesting RTA to facilitate use of Wickham Street instead, by allowing right turns from Wickham Street onto Princes Highway.
- The road network is currently operating at capacity (M5 East was operating at capacity as soon as it opened) and is unable to accommodate any increase in truck numbers.
- The airport is forecasting a tripling of traffic movements by 2020 and a doubling by 2010. The airport has associated truck generators around Mascot (freight forwarders, etc) similar to the container freight services and container parks around Botany, and truck movements to/from these will grow at the same rate as the airport.
- A new development at Wolli Creek will include 10,000 residences and a few commercial sites. The high tech industrial park at Cooks Cove will generate new employment of 11,000, which will access the road network at Marsh Street.
- The airport has 30,000 employees and nearly all drive to work.
- Even with 40% rail mode share, the number of trucks on the network will more than double over 20 years due to increasing trade growth. The objective should be to retain road movements at the current level or the system may choke.
- The Illawarra rail line is at crush capacity in peak periods so any growth in peak movements would be by road.

- The physical constraints of the area including only three bridges across the Cooks River (Grand Parade, Marsh Street, Princes Highway) and the location of the airport means that traffic movements are concentrated onto a few routes.
- The local community is highly aware of transport issues and are likely to react unfavourably if it is perceived that the benefits of the M5 are eroded by increased truck traffic from the port.

3 Randwick City Council

3.1 General

- Council's main objective in relation to the port is to encourage the use of Foreshore Road, Botany Road and Bumborah Point Road as preferred routes for port traffic, and to encourage the use of rail.
- Council has engaged a consultant to undertake a "Stage 2" traffic study, which will include the port area. The P&O terminal is within Randwick Council area, while the Patrick terminal is in Botany Council area.

3.2 Truck Routes

- Bumborah Point Road has recently been upgraded and it is proposed to be handed to the RTA and become a State road. The first 80m of Friendship Road is Council road, the remainder is SPC road.
- Council is also seeking to discourage truck movements on Bunnerong Road because of conflict with the Matraville shopping strip. This is not a major issue, however, as trucks already tend to avoid the route. Also there are virtually no freight generators at the northern end of the LGA.

3.3 New Developments

- No rezonings are planned in the vicinity of the port.
- There have been up to 12 DAs on Military Road over the last 2-3 years including warehousing and container packing facilities. The main applicants have been Walkers. Council has imposed conditions that trucks are to access Military Road via Bumborah Point Road in order to avoid residences at the northern end of Military Road. Several developments are located on Millenium Circuit, a private road that runs off Military Road.
- Amcor is planning to expand their operation towards McCauley Road.
- The State Government is planning to redevelop the Prince Henry Hospital site and provide 1,000 new dwellings.

4 City of Botany Bay Council

4.1 Development Applications

- Extension to Discovery Cove, 1801 Botany Road. Distribution centre for a transport company has already been completed.
- 2 - 8 and 10 - 16 McPherson Street. Warehousing, distribution, container packing/unpacking. Already under construction, expected to be finished later this year.
- 47 Swinbourne Street. Warehousing, distribution and container storage. Approval depends on construction of Port Feeder Road.
- Johnson and Johnson site. Freight forwarding, warehousing container packing/unpacking. DA has been approved but facility cannot operate until Port Feeder Road has been constructed.
- Leader Holdings, 3 - 5 Moore Street. Possible consolidation of smaller lots into a freight forwarding facility.
- 75 Corish Circle. Small 100-200 sqm industrial uses that are ancillary to the port.
- 1 – 1a Hale Street. Possible consolidation of light industry to port related functions, but depends on construction of Hale Street/Foreshore Drive intersection. 36 Lewland Street is earmarked for a freight forwarding facility.

4.1.1 Other Land Use Issues

- Industrial developments in the Mascot area are generally airport related, with a few minor port related developments (no container parks/CFSs). However, there are a number of port related developments in the South Sydney Council area around Rosebery, that generate movements along Botany Road.
- There are a number of small industrial holdings (plumbers, mechanics, etc) around Tenterden Road, which support the larger industries in the area (Kelloggs, Johnson and Johnson, etc).
- In general the light industrial land uses will be under pressure to be rezoned for residential uses. However, port related, heavy industry and transport land uses will increase into the future. Botany Council sees no constraints to the area being able to accommodate the projected increases in container volumes.
- Botany Council has objected to the Cooks Cove development, on the grounds that the land should be used for port related and urban service (e.g. waste) operations.
- New development approvals usually contain conditions to limit the use of Botany Road, e.g., by using the Port Feeder Road or Foreshore Drive instead. The conditions can be enforced by charging a bond.

4.2 Road Issues

- Council's main objectives in relation to port traffic appear to be to:
  - minimise truck movements on Botany Road;
  - minimise truck movements on Stephen Road/Page Street; and
  - improve traffic efficiency and safety in the Kent Road/Coward Street area.

4.2.1 Foreshore Drive Access

- The inability to turn right from Foreshore Drive directly onto the General Holmes Drive constrains the use of Foreshore Drive as an alternative to Botany Road. Northbound truck movements are generally via Botany Road or Denison Road/Wentworth Avenue.
- Similarly, the inability to turn left from Southern Cross Drive onto Foreshore Drive is an obstacle to increased use of Foreshore Drive.
- Botany Council has prepared a plan for an:
  - underpass from Foreshore Drive onto the Southern Cross Drive northbound carriageway;
  - exit ramp from the Southern Cross Drive southbound viaduct onto General Holmes Drive, to facilitate access to Foreshore Drive;
  - overpass/underpass connecting Southern Cross Drive with Joyce Drive in order to bypass the existing General Holmes Drive/Millpond Road intersection; and
  - extension of Hale Street with overpass and connections to Foreshore Drive.
- The extension of Hale Street to Foreshore Drive would allow the development of port related land uses in the Hale Street area. It is inappropriate for the developments to proceed without the Hale Street extension as it would result in increased truck traffic on Botany Road.
- Officer level discussions indicate that the RTA is not receptive to the proposal.

4.2.2 One Way Traffic Flows on Bourke Road and O'Riordon Street

- A plan was developed some years ago to convert Bourke Road to northbound flow only, and O'Riordon Street to southbound flow only. It is considered that this proposal would reduce the number of trucks using the Kent Road/Coward Street intersection, however it was put on hold due to concerns about the potential impacts on the Green Square development.

4.2.3 One Way Traffic Flows on Kent Road, Gardeners Road, Bourke Road and Coward Street

- Another proposal is to introduce one-way clockwise traffic flow from Ricketty Street around Kent Road, Gardeners Road, Bourke Road, Coward Street and back onto Kent Road. This would improve the safety/efficiency of the Coward Street/Kent Road intersection as it would be used for right turns only. However, Council's discussions with RTA have indicated that the RTA is not interested in the proposal.

4.2.4 Port Feeder Road

- Proposal is to construct a new road linking McPherson Street with Swinbourne Street, to service port related developments including the new developments at 47 Swinbourne Street and the Johnson and Johnson site.
- The road would also allow 24 hour access to the Johnson and Johnson site and the Mobil site.
- The DA has been submitted and is to be discussed next week.
- The objective of the proposal from Council's viewpoint is to reduce the number of truck movements on Stephen Road, which has residential frontage and is not approved for B-Doubles. Page Street, which is part of the Stephen Road route to the port, is to become a light vehicle route when the Port Feeder road is completed.
- Proposed associated works include streamlining the Botany Road/Exell Street intersection and the Botany Road/Hills Street intersection, and in the longer term a potential new road running parallel to the railway line and linking McPherson Street with Botany Road.

4.2.5 Other Issues

- It is estimated that 20-30% of northbound traffic uses Botany Road with the remainder using Wentworth/Denison Street. Botany Road is slower but straighter, which makes it more attractive to some drivers.
- Botany Road north of Wentworth Avenue is not approved for B-Doubles.

5 Rail Infrastructure Corporation

- RIC have engaged Bob O'Loughlin and John Burton to look at options for maximising the efficiency of existing infrastructure. The report will document:
  - Where goods come from;
  - How they get to the port;
  - What happens in the port area;
  - Infrastructure requirements to cater for 1m or more TEU on rail;
  - Business case for alternative funding; and
  - Operating practices ad potential improvements.
- Currently around 250,000 TEUs travel by rail per annum, expected to double in the next few years.
- Train shunting on the main line is inefficient and needs to be addressed.
- The potential to cater for 600m long trains needs to be addressed.
- $50 million has been committed to upgrading the dedicated freight line, most of which has now been expended.
- Rail already has a 75% mode share for regional cargo, so most growth in rail's mode share needs to occur in the metropolitan area.
- For imports to the metropolitan area, only 8% travel by rail.

- The breakdown for metropolitan rail freight is 50% imports full, 30% exports full and 20% exports empty.
- The third terminal is to be configured so that it is conducive to rail – e.g., 600m sidings.
- RIC have engaged SKM to develop multi-modal freight forecasts. The study will produce broad level forecasts by mode and commodity by end July 2002.

6 RTA

- Trucks carrying dangerous goods are prohibited from traveling in tunnels, including the M5 East and Eastern Distributor. The oil and chemical facilities have prescribed routes for road movements. However, dangerous goods account for only 3% of total road movements.
- Confirmed that it is appropriate for the study area to be bounded by:
  - McPherson Street to the north.
  - Bunnerong Road to the east.
  - The port precinct and Military Road/Millennium Avenue to the south.
  - The proposed boat ramp access road to the west.
- Confirmed that Level of Service D is the threshold at which intersection performance becomes unacceptable, based on work undertaken for the ADI StMarys site.
- RTA has provided written confirmation to SPC that it is agreeable to the proposal for a new unsignalised intersection on Foreshore Road, including a right turn seagull, to provide access to the relocated public boat ramp.
- The proposed new intersection on Foreshore Road to provide access to the third terminal would be signalised.
- The issue of whether the boat ramp intersection should be separate to the third terminal intersection is to be addressed. SPC's preference is to keep both intersections separate. The issues are likely to be safety related rather than capacity related, as the peak movements for the boat ramp occur at different times to the peaks for port traffic and general traffic.
- RTA preferred practice is for a minimum of 500m separation between intersections.
- Botany Council area contains major industrial facilities including Caltex, Kellogs, Mobil and Maritime Container Services. There are 40,000 residents and 200,000 employees in the area.
- The proposed Southern arterial is a long-term proposition and need not be considered as part of this study.

- South Sydney Development Corporation has engaged Masson Wilson Twiney to assess the traffic implications of continuing development in the Green Square area. RTA has contributed one-third of the cost of the study, and may be able to make the traffic counts available to Maunsell for use in the Port Botany study.
- The RTA will provide base forecasts from its NETANAL model for the Port Botany area, for comparison with Maunsell's strategic model.
- The capacity of the existing port is 1.7m – 1.8m TEUs per annum.

7 Bob O'Loughlin, Rail Transport Consultant

- The dedicated freight line is duplicated between Marrickville Loop and Cooks River.
- Many trains are currently only 300m long due to siding capacity in the terminals. The siding capacity at Minto is also only 300m.
- Safety inspections are undertaken in Botany Yard but not customs inspections.
- There are currently 22 trains to Botany per day and 14 trains to Cooks River per day.
- The critical productivity issue is how long it takes to turnaround a train at the terminals.
- The current capacity of the dedicated line is 45 trains per day (i.e. with ½ duplication). The capacity would increase to around 90 trains per day if the line was duplicated.

Appendix C Assumptions Paper

COPY NO. [ ]

Sydney Ports Corporation

Landside Traffic and Transport Study for Expansion of Port Botany

Assumptions Paper

JUNE 2002

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Our Reference: 20018502.00

Landside Traffic and Transport Study for Expansion of Port Botany

Assumptions Paper

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
A	20/05/02	Draft Report	Philip Brogan	Signed
B	28/05/02	Including revisions from client and section on SCATES analysis	Philip Brogan	
C	28/05/02	• Minor wording change in Section 2.6 Trade Splits between Terminals • Updated list of intersection and classification counts • Revised Section 2.8 – factors for Early Deliverables – Road • Included Section 2.10 on traffic modelling process	Philip Brogan	
D	19/06/02	Updated Sections: • 2.4 – Conversion of TEU to Truck Numbers • 2.5 – Date for commissioning new terminal • 2.7 – Origins/destinations • 2.10 – Traffic Modelling Process • 2.11 – Traffic generators • 2.13 SCATES assessment	Philip Brogan, Director Planning	

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1 Introduction

Sydney Ports Corporation (SPC) is proposing to expand the port facilities at Port Botany by creating a new container terminal, in order to meet predicted growth in container trade.

SPC is currently preparing an Environmental Impact Statement for the proposal and has engaged Maunsell Australia to provide advice on the traffic and (landside) transport implications of the expanded port.

This paper sets out the assumptions relating to a number of key parameters for the road and rail transport analysis.

2 Assumptions

2.1 Trade Volumes

The assumed trade forecasts (see table below) were sourced from a graph that was provided by Sydney Ports Corporation (SPC) to Maunsell on 16 May 2002.

Year ended	Assumed Trade Volume (TEU)
2006	1.25 million
2011	1.75 million
2016	2.5 million
2021	3.2 million

2.2 Mode Split Scenarios

The following scenarios will be tested:

	Rail Mode Share			
	2006	2011	2016	2021
Scenario 1	20%	20%	20%	20%
Scenario 2	30%	40%	40%	40%

Note: Scenario 1 maximises road transport; Scenario 2 maximises rail transport.

2.3 Container to TEU Ratio

2006	1.35
2011	1.42
2016	1.5
2021	1.6

2.4 Conversion of TEU to Truck Numbers

For the existing period 2001-02 a ratio of 1.87 TEU per round trip was used, based on data received from SPC. In recognition of the probable introduction of more efficient B-double truck capacity (3 TEU) and increased backloading in the future, this has been scaled up in the future as per the following.

	2006	2011	2015	2021
TEU per round trip	1.89	1.92	1.95	2

2.5 Commissioning of New Developments at the Port

Patrick Upgrade 2006
New Terminal 2010

2.6 Trade Splits Between Terminals

The following alternatives will be tested, in order to provide a worst-case scenario in terms of intersection performance for each of the three port access points.

	2006	2011	2016	2021 (optional)
Scenario 1				
Brotherson North	50%	40%	30%	30%
Brotherson South	50%	30%	30%	30%
New	-	30%	40%	40%
Scenario 2				
Brotherson North	50%	40%	30%	30%
Brotherson South	50%	40%	40%	40%
New	-	20%	30%	30%
Scenario 3				
Brotherson North	60%	50%	40%	40%
Brotherson South	40%	30%	30%	30%
New	-	20%	30%	30%

Note: Generally Scenario 1 maximises New Terminal
Scenario 2 maximises P&O
Scenario 3 maximises Patrick

Note that the 2021 port traffic needs to be modeled on the 2016 background traffic as this is the latest year for which a recognized network model exists.

2.7 Origins/Destinations

Existing road O/Ds were determined from the Thomson Clark O/D report. Projections were made based on Maunsell's knowledge of future industrial land releases across Sydney and specific developments within the Botany LGA. The spreadsheet model for estimating freight volumes by OD includes a crosscheck function to ensure that the assumed OD proportion within Botany is consistent with the capacities of individual container freight stations and empty container yards within the Botany LGA. The OD matrix utilized for the transport analysis is currently being finalized.

The following table provides an analysis of future trends in industrial land uses across Sydney.

2.8 "Early Deliverables" – Road Information

2.8.1 Hourly distributions

Hourly factors to be estimated from the traffic counts.
It is assumed that in 2021 road servicing is undertaken on a 24hr basis.

2.8.2 Peak Movements

Future peak hour movements will be estimated from the strategic model.

2.8.3 Daily Movements

Peak week: Average week factor 1.33.
Peak day: Average day factor to be determined from traffic counts/data from terminal operators.

2.9 "Early Deliverables" – Rail Information

The assumptions regarding TEU's per train, train numbers and turnaround times are specified in the Excel computer model that was forwarded to the client by email on 7th June 2002.

2.10 Traffic Modelling Process

The approach to the transport modelling has been reviewed in consultation with the technical director Denis Johnston in an effort to increase the opportunity for manual interrogation of model outputs and to enhance accuracy. Given the importance of the local traffic implications of the increased freight activity anticipated through the Botany area and the need for the analyses to identify the nature of heavy vehicle impacts at critical intersections the following revised approach has been adopted.

The count information will form the base flows with port traffic removed. Future year assessments will be based upon flows factored to future year on the basis of screenline flow growth model outputs. This will involve the use of our 2001, 2006 and 2016 models and the 2011 base flows will be produced by interpolation of factors from the Model.

For example, production of the 2006 flows will involve assessing screenline flow growth from 2001-2006 in the model and the production of general link growth factors. The 2001 flows to and from the port will be stripped from the 2002 count scenario and the future year growth applied. The future year flows to and from the port will then be included in the peak hour and assigned based having regard to known origin-destination routes. Movements to/from the container ports and the external area (containers being loaded for export/returned and LCL vehicles with goods to be loaded at the container parks) and employment growth in line with increased tonnage handled at the port is best assessed through iterative manual interrogation.

The screenline will extend from Foreshore Road to Bunnerong Road and include Beauchamp and Botany Roads.

This approach will provide accurate results as assessment and analyses is undertaken on the basis of the actual observed (counted) flows on the existing network.

2.10.1 Definition of Traffic Generated by Port Expansion

The capacity of the existing port is 1.8m TEU (source SPC), and the new development increases capacity to above 3.2m TEU. Based on SPC's trade forecasts, the capacity of the existing port is reached in 2010. Therefore, the "without development" traffic assignment and intersection modelling should use the 2006 and 2011 truck forecasts but assume there is no further growth in truck traffic after 2011. The "with development" traffic assignment and intersection analysis would be based on truck volumes continuing to increase beyond 2011 in line with the trade forecasts.

2.10.2 Traffic Generated by Other Developments in the Local Area

In addition to the Patrick, P&O and new terminals, the following traffic generators within the port precinct will be considered in the study (refer attached site plan):

Existing Traffic Generators	New Developments
Container Parks ▪ P&O Trans Australia ▪ Smith Bros ▪ Patrick Port Services ▪ Cargo Link Port Botany ▪ Maritime Container Services (Banksmeadow) Consultation with other traffic generators in the port precinct, including Vopak, Elgas, Origin, etc, indicates that they do not generate traffic to/from the stevedores terminals. Hence, traffic from these facilities will be modelled as background traffic.	▪ Molineux Point ▪ Lot 103 Bumborah Point Road ▪ 2-8 McPherson Street ▪ 10-16 McPherson Street ▪ 47 Swinbourne Street ▪ Johnson & Johnson site

2.11 "Core" Study Area

The assessment of road and rail transport requirements will focus on the "core" study area, which is roughly bounded by:

- McPherson Street to the north.
- Bunnerong Road to the east.
- The port precinct and Military Road/Millennium Avenue to the south.
- The proposed boat ramp access road to the west.

2.12 Traffic Counts

Traffic counts undertaken for the study comprise intersection counts and automated classification counts. The locations for the counts are:

Intersection Counts [1]		Classification Counts [2]	
1	Bumborah Point Road/Botany Road	1	Botany Road near Lord Street
2	Bumborah Point Road/Friendship Road	2	Botany Road near Tenterden Road
3	Bumborah Point Road/Military Road	3	Stephen Road near Mobil Oil terminal
4	Penrhyn Road/Botany Road/Foreshore Road	4	Banksia Street near Tenterden Road
5	Foreshore Road/Southern Cross Drive	5	Stephen Road near Swinbourne Street
6	Southern Cross Drive/General Holmes Drive/Botany Road	6	Wentworth Avenue between Southern Cross Drive and Page Street
7	Southern Cross Drive/Wentworth Avenue	7	Wentworth Avenue between Page Street and Denison Street
8	Page Street/Wentworth Avenue	8	Wentworth Avenue between Denison Street and Bunnerong Road
9	Denison Street/Wentworth Avenue	9	Bunnerong Road near Beauchamp Road
10	Beauchamp Road/Botany Road	10	Beauchamp Road near Bunnerong Road
11	Bunnerong Road/Beauchamp Road	11	Denison Street near Beauchamp Street
12	Stephen Road/Botany Road	12	Beauchamp Street near Foreshore Road
13	Botany Road/Hale Street	13	Foreshore Road between Beauchamp Road and Bumborah Point Road
14	Botany Road/McCauley Street/Sydney Haulage access road	14	Penrhyn Road at entrance to Patrick Terminal
15	Beauchamp Street/Perry Street	15	Foreshore Road west of Penrhyn Road/Botany Road intersection
16	Bunnerong Road/Perry Street/Franklin Street	16	Bumborah Point Road at entrance to P&O terminal. (Entrance to P&O is through Friendship Road)
17	Botany Road/Bunnerong Road	17	Botany Road east of Exell Street

The intersection surveys will provide:

- Counts between 7-9am and 3-6pm.
- Turning movements.
- Counts classified into cars, rigid trucks and articulated trucks.
- Estimates of the proportion of total trucks that are port related.
- Estimates of the number of TEU per truck.
- Estimates of the proportion of skeletal and flat top trucks that are empty.

The intersection counts were undertaken on Tuesday 4 June and Friday 7 June 2002. All the intersections were surveyed at the same time.

The classification counts were undertaken on a continuous basis over seven consecutive days.

2.13 SCATES Intersection Assessment

Assessment of intersection performance (LOS) for existing, 2011 and 2021 with and without the proposed new terminal.

Existing count data will be obtained from the intersection counts. Current and future port related traffic flows would be sourced from Maunsell's transport analysis.

Treatment of boat ramp access road assumes there will be two new access points onto Foreshore Road - one for the new terminal (signalised) and one for the relocated public boat ramp (unsignalised).

The intersections to be assessed are:

1 Foreshore Road/Botany Road/Penrhyn Road
2 Botany Road/Beauchamp Road
3 Botany Road/Bumborah Point Road
4 Foreshore Road/new terminal access (to the west of Penryhn Road)
5 (Possibly) Foreshore Road/boat ramp access (to the west of Foreshore Road new terminal access Road)

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Appendix D Forecast Daily Traffic Levels

Figure D1 – Forecast Truck and Train Numbers by Terminal Market Shares

	Existing	2006	2011	2016	2021
Rail Market Share	**25%**	**30%**	**40%**	**40%**	**40%**
Road Market Share	**75%**	**70%**	**60%**	**60%**	**60%**
Terminal Scenario 1					
Brotherson North MS	**50%**	**50%**	**40%**	**30%**	**30%**
Daily Rail movements	13	19	25	26	33
Daily Road movements	1602	1666	1233	1156	1407
Brotherson South MS	**50%**	**50%**	**30%**	**30%**	**30%**
Daily Rail movements	11	20	20	26	33
Daily Road movements	1311	1661	941	1160	1411
New Terminal MS			**30%**	**40%**	**40%**
Daily Rail movements	0	0	18	35	44
Daily Road movements	0	0	941	1546	1882
Other Daily Rail Movement	5	5	8	8	9
Other Daily Road movements	3389	4078	4486	6402	7575
Total Rail movements	29	44	71	96	119
Total Truck Movements	6303	7405	7601	10264	12275
Terminal Scenario 2					
Brotherson North MS	**50%**	**50%**	**40%**	**30%**	**30%**
Daily Rail movements	13	19	25	26	33
Daily Road movements	1602	1666	1233	1156	1407
Brotherson South MS	**50%**	**50%**	**40%**	**40%**	**40%**
Daily Rail movements	11	20	26	35	44
Daily Road movements	1311	1661	1255	1546	1882
New Terminal MS			**20%**	**30%**	**30%**
Daily Rail movements	0	0	12	26	33
Daily Road movements	0	0	627	1160	1411
Other Daily Rail Movement	5	5	8	8	9
Other Daily Road movements	3389	4078	4486	6402	7575
Total Rail movements	29	44	72	96	119
Total Truck Movements	6303	7405	7601	10264	12275
Terminal Scenario 3					
Brotherson North MS	**50%**	**60%**	**50%**	**40%**	**40%**
Daily Rail movements	13	23	32	35	44
Daily Road movements	1602	1999	1541	1541	1876
Brotherson South MS	**50%**	**40%**	**30%**	**30%**	**30%**
Daily Rail movements	11	16	20	26	33
Daily Road movements	1311	1329	941	1160	1411
New Terminal MS			**20%**	**30%**	**30%**
Daily Rail movements	0	0	12	26	33
Daily Road movements	0	0	627	1160	1411
Other Daily Rail Movement	5	5	8	8	9
Other Daily Road movements	3389	4078	4486	6402	7575
Total Rail movements	29	43	72	96	119
Total Truck Movements	6303	7406	7596	10263	12273

Note: MS - Market Share, all movements return moves, "other rail movments" is the movement of empties to the north and west for cotton exports

Figure D2 – Forecast Truck and Train Numbers, "Worst Case" Road Mode Scenario

	Existing	2006	2011	2016	2021
Rail Market Share	**25%**	**20%**	**20%**	**20%**	**20%**
Road Market Share	**75%**	**80%**	**80%**	**80%**	**80%**
Terminal Scenario 1					
Brotherson North MS	**55%**	**50%**	**40%**	**30%**	**30%**
Daily Rail movements	13	13	18	13	17
Daily Road movements	1602	1899	1498	1546	1882
Brotherson South MS	**45%**	**50%**	**30%**	**30%**	**30%**
Daily Rail movements	11	13	14	13	17
Daily Road movements	1311	1899	1124	1546	1882
New Terminal MS			**30%**	**40%**	**40%**
Daily Rail movements	0	0	13	18	23
Daily Road movements	0	0	1124	2062	2509
Other Daily Rail Movement	5	3	6	4	4
Other Daily Road movements	3389	4656	5976	7591	7704
Total Rail movements	29	29	52	49	61
Total Truck Movements	6303	8454	9722	12745	13977
Terminal Scenario 2					
Brotherson North MS	**50%**	**50%**	**40%**	**30%**	**30%**
Daily Rail movements	13	10	18	13	22
Daily Road movements	1602	1899	1498	1261	1882
Brotherson South MS	**50%**	**50%**	**40%**	**40%**	**40%**
Daily Rail movements	11	13	19	18	18
Daily Road movements	1311	1899	1498	1682	2509
New Terminal MS			**20%**	**30%**	**30%**
Daily Rail movements	0	0	9	13	17
Daily Road movements	0	0	749	1261	1882
Other Daily Rail Movement	5	3	6	4	4
Daily Road movements	3389	4656	5976	7591	7704
Total Rail movements	29	27	52	49	61
Total Truck Movements	6303	8454	9722	11795	13977
Terminal Scenario 3					
Brotherson North MS	**50%**	**60%**	**50%**	**40%**	**40%**
Daily Rail movements	13	15	23	18	23
Daily Road movements	1602	1899	1498	1546	2509
Brotherson South MS	**50%**	**40%**	**30%**	**30%**	**30%**
Daily Rail movements	11	11	14	13	17
Daily Road movements	1311	1899	1498	2062	1882
New Terminal MS			**20%**	**30%**	**30%**
Daily Rail movements	0	0	9	13	17
Daily Road movements	0	0	749	1546	1882
Other Daily Rail Movement	5	3	6	4	4
Other Daily Road movements	3389	4656	5976	7591	7704
Total Rail movements	29	29	52	49	61
Total Truck Movements	6303	8454	9722	12745	13977

Note: MS - Market Share, all movements return moves, "other rail movments" is the movement of empties to the north and west for cotton exports

Appendix E Details of Road Traffic Model

Model Calibration/Validation

The Maunsell model has not been used explicitly to produce the traffic assignments. As such, no formal model calibration and validation has been undertaken to produce the link flows and turning movements.

An informal model validation has been undertaken by comparing the origin-destination flows for the model zones in the Botany area with the same model zones in the RTA EMME2 assignment model. The latter model operates for a two hour morning peak as opposed to the peak hour operation of the Maunsell model. The comparison can be seen in **Table E.1** below. As can be seen, both models show similar trip characteristics, demonstrating that the Maunsell model is not out of step with the RTA information and that the basis for producing the forecasts of background growth are robust.

Table E.1 – Comparison of RTA and Maunsell Model

Zone No		Maunsell Model Trips	RTA Model Trips	Maunsell/RTA
134	Origin	799	1,721	46.4%
	Destination	446	807	55.3%
135	Origin	524	859	61.0%
	Destination	360	630	57.1%
136	Origin	603	827	72.9%
	Destination	680	1,041	65.3%
137	Origin	848	1,625	52.2%
	Destination	1,312	2,292	57.2%
138	Origin	1,885	2,038	92.5%
	Destination	802	1,349	59.5%
139	Origin	473	1,188	39.8%
	Destination	1,221	2,709	45.1%
140	Origin	1,507	1,822	82.7%
	Destination	2,232	3,346	66.7%

1) 100% compliance between the models would give percentages in the range 50-60%.

Modelling Approach

The modelling approach has involved taking the intersection and classification count information as a basis for producing the required future year traffic flows. The traffic flow information has been supplemented by trips in the peak hour for container parks and freight stations for movements that do not have an origin or destination at the port, including Molineux Point and the other future developments.

The modelling approach has been assembled in a number of stages. The methodology has followed the following steps in order:

1 The freight routes to and from the Port have been discussed and agreed with the NSW Road Transport Association, Roads and Traffic Authority and Rockdale, Randwick and Botany Councils on a road by road basis out of the Botany area. The assumed volumes of traffic for 2002 have been assigned manually to these routes for each terminal. The assumed split of trucks on each route is shown in **Table E.1**.

2 In a similar manner, LCL trips and empty container runs to and from the container parks and freight terminals have been estimated and manually assigned for the morning peak hour. These have been based upon the same routes as the port traffic and the same assumed origins and destinations outside the Botany area. The total estimated number of LCL and empty runs have been calculated and distributed based upon the capacity of each container park and freight station on a pro rata basis.

3 The trips in 1 and 2 above were then removed from the 2002 junction count information, so that separate growth rates could be applied to port related traffic (including LCL and empty container trips) and background traffic.

4 The Maunsell Model has then been employed to generate an underlying growth for the Botany area. This has involved taking peak hour model assignments at 2001 and 2006 to produce five year growth totals from a model screenline comprising:

- Foreshore Road;
- Botany Road;
- Beauchamp Road; and
- Bunnerong Road

This growth has been adjusted to four year growth on a pro rata basis and applied to the residual traffic information in 3 above. The growth to 2011 has been produced by interpolating the model growth between 2006 and 2016. The underlying growth has been capped at 2016, with the 2021 scenario using the 2016 background volumes. This approach was adopted because the Transport Data Centre (TDC) population and employment forecasts do not extend beyond 2016.

5 Port road traffic has been projected for 2006 with the corresponding adjustments to the origins and destinations. This information has been manually assigned to the network based upon the agreed freight routes. Additionally, the growth in other container traffic and LCL movements has been calculated. These trip types are generally expected to increase in line with the growth in Port freight and have been manually assigned in the same manner.

6 Trips to and from the new commercial developments noted above have also been included in the 2006 traffic flows. These flows include truck movements but also newly generated car trips, generally home to work in purpose but also some employers' business trips. However, it is not simply a case of taking these trips and assigning them to the road network under consideration as the underlying growth from the Maunsell TRIPS model will include new developments in the Botany area. It has been assumed that the generated light vehicles are included in the underlying growth, whereas the LCL and empty vehicle trips are increasing at a rate far in excess of the underlying rate and are not included in the background growth. These heavy vehicle trips have therefore been added to the trips under consideration.

7 These new developments will not exclusively handle container traffic for the port. Some of these developments will inevitably handle air freight due to the proximity to the airport. The addition of trips to and from these developments is not simply a case of assuming all heavy vehicle movements are to be included as extra trips. Trips related to the growth in the Port traffic grow from a smaller base for these new developments and their operating capacity is obtained from other sources.

8 LCL and empty commercial vehicle journeys vary for each mode scenario examined. The number of LCL and empty container runs by road will vary where the proportion of freight transported by rail increases or decreases.

9 For 2011 the new terminal has been introduced into the assessment. The trips generated by the new terminal have been given the same trip distribution characteristics as trips to and from the two existing terminals. Again, the 2011 scenarios have been manually assigned to the network for each terminal based upon the forecast freight origin-destination splits for the port as a whole.

10 Growth in LCL and empty container traffic has also been increased based upon the port traffic growth, but constrained in future years as existing facilities reach their capacity.

11 Employment growth at the port and surrounding container parks has been assumed to be restricted to the new terminal, with the Patrick and P&O terminals having no growth above 2002 levels. This scenario assumes that all port growth at the existing terminals will be driven by increases in productivity.

12 The new terminal will generate peak hour home to work trips. In the absence of available figures on these trips it has been assumed that the levels of employment will be similar to the employment at the other terminals. The new terminal is assumed to handle equivalent volumes and hence generate a corresponding number of light as well as heavy vehicles.

13 The distribution of employment trips is expected to be similar but not identical to the freight movement patterns within the study area. It is expected that a proportion of trips associated with the port and container park will take different routes to reflect the more localised nature of home to work trips with some car trips from the surrounding districts. It should be borne in mind that existing shift patterns do not involve journeys to work at the port in the morning peak hour and that it is not envisaged that these working practices will change in the foreseeable future.

Daily traffic profiles on each link in the core study area were derived using the automatic traffic count information. As with the peak hour modelled flows, these flows are based upon the count information with adjustments made to include port traffic plus traffic from the container parks and CFSs in the port area.

The port related traffic has been quantified at a subregional level using the Maunsell model.

Table E.1 – Truck Routes for Port Botany Traffic Assessment

Note Inbound trips are assumed to be via the same routes in the opposite direction
The routes apply to the Patrick, P&O and New Terminals. For P&O, Bumborah Point Road is also included

Destination	Route	Alternative Route	Alternative Route	Alternative Route	Alternative Route
North Shore North Western Sydney	Botany Road Southern Cross Drive northbound (25% of movements)		Botany Road Beauchamp Road Denison Street Wentworth Avenue Southern Cross Drive (50% of movements)		
City	As above		As above		
South Sydney	Botany Road Gardeners Road O'Riorden Street (30% of movements)	Foreshore Road General Holmes Drive Joyce Drive O'Riorden Street (70%)			
Inner West	Foreshore Road General Holmes Drive Joyce Drive O'Riorden Street Marrickville Truck Route (25% of movements)	Botany Road Gardeners Road Kent Road Rickety Street Canal Road Marrickville Truck Route (25% of movements)	Foreshore Road Southern Cross Drive M5 East Wickham Street Princes Highway Marrickville Truck Route (50% of movements)		
Southern Suburbs Penrith Liverpool South West	Foreshore Road Southern Cross Drive westbound M5 East (75% of movements)	Foreshore Road Southern Cross Drive Bay Street Stoney Creek Road (20% of movements)	Foreshore Road General Holmes Drive Joyce Drive Stoney Creek Road (High vehicles – 5% of movements)		
Central West Industrial West Blacktown	Foreshore Road Southern Cross Drive westbound M5 East King Georges Road (35% of movements)	Foreshore Road Southern Cross Drive Bay Street Stoney Creek Road King Georges Road (20% of movements)	Foreshore Road General Holmes Drive Joyce Drive Stoney Creek Road (High vehicles – 5% of movements)	Foreshore Road General Holmes Drive O'Riorden Street Marrickville Truck Route (20% of movements)	Botany Road Gardeners Road Canal Road Princes Highway Marrickville Truck Route (20% of movements)
Botany	Botany Road Port Feeder Road Bumborah Point Road Military Road (%s determined by capacities of container parks and CFSs)				

Appendix F Director-General's Requirements

Issues raised through Director-General's requirements.

	Issues	Reference
	Rockdale City Council	
1.	describe travel and haulage routes	**Section 4.5**
2.	sub-regional traffic study of land transport including effects of growth in air traffic, local development, economic growth driven by air and port growth, travel and haulage routes, transport personnel employed.	**Section 4.5**
3.	Plan for discouraging road transport and encouraging rail transport.	**Section 3.4, 6.1**
4.	A plan to provide public commuter transport for employees and thereby discouraging use of private cars.	**Section 7.0**
	City of Botany Bay	
1.	Effect on the road network of increase in freight transport on roads.	**Section 5.1**
2.	Effect of truck queuing on road network, including Penrhyn Road.	**Section 3.4.2**
3.	Consider access into Botany Road, Foreshore Drive and General Holmes Drive, connection into Eastern Distributor, Hale Street connection to Foreshore Drive, restrictions on use of Botany Road, construction of area on Botany Road for RTA inspectors, contribution towards construction of McPherson Street to Foreshore Drive road link.	**Section 4.5.2**
	Botany Environment Watch	
1.	Type and number of road vehicles, routes, alteration to road infrastructure.	**Section 4.4, 5.1.4 and 6.1**
2.	Assess road and rail impacts.	**Section 5.0**
	PlanningNSW	
1.	Assess the proposal against SEPP 11 – Traffic Generating Developments, {*SEPP 33 – Hazardous and offensive developments, SEPP 55 – Remediation of Land*}, draft SEPP 66 – Integrated Land Use and Transport, Botany LEP.	**Section 5.3 and 7.0**

2.	Assess the impact of the proposal on land, water and air transportation and the infrastructure upgrade that would be required.	**Section 5.0 and 6.0**
	SSROC 15	
1.	Need to demonstrate efforts to encourage additional employees to reduce car commuting.	**Section 7.0**
	Randwick City Council – RCC 3	
1.	Address how trucks will be directed away from residential areas.	**Section 6.1**
	RTA	
1.	Traffic and transport study should be prepared which takes into account access (concept design, management and funding responsibilities to be identified), alternative access points, impacts of traffic signal construction and operation, effect of boat ramp traffic, truck storage and stopping areas, haulage routes of trucks, peak traffic movements generated, type of traffic and its cumulative effects, a consideration of the need for a local traffic management plan, C211, car parking provisions for employees. Should also prepare a plan of management for the construction phase.	**All sections of report**
	Transport NSW	
1.	Need an integrated road and rail strategic plan which takes into account containers movements and locations.	**Section 6.0**
2.	Transport NSW, RIC, SRA and RTA should be consulted as part of the scoping of the transport issues at the start of the EIS and throughout the study.	**Section 3.13**
	Kogarah City Council	
1.	EIS should address whether the rail network is able to handle the increased load resulting from the proposed development.	**Section 6.0**
	Sydney Airports Corporation Limited	
	EIS should examine all current and future impacts on road transportation and integrate the current and future ground access needs of the airport	**Section 6.1**

Appendix G Road Classification Systems

Road Classification Systems

In 1978, the Traffic Authority of New South Wales (now the Roads and Traffic Authority) published guidelines for the classification of roads using a functional system. The objectives of these guidelines are set out in a document titled *The Functional Classification of Roads*. They can be summarised as:

- in planning terms – the classification of streets and development of an operational hierarchy is seen as "an essential component of structural planning at the neighbourhood level"; and
- in operational terms – the concept of functional classification is seen as "an endeavour to match the class of road to its use and to the environmental needs of the community".

The functional classification system is based on an assessment of traffic volumes, composition and management. Four road types are defined. They are arterial, sub-arterial, collector, and local roads. The following guidelines are used in the functional classification of roads:

- **arterial road** – typically a main road carrying over 15,000 vehicles per day and fulfilling a role as a major inter-regional link (over 1,500 vehicles per hour);
- **sub-arterial road** – defined as secondary inter-regional links, typically carrying volumes between 5,000 and 20,000 vehicles per day (500 to 2,000 vehicles per hour);
- **collector road** – provides a link between local roads and regional roads, typically carrying between 2,000 and 10,000 vehicles per day (250 to 1,000 vehicles per hour). At volumes greater than 5,000 vehicles per day, residential amenity begins to decline. Trunk collector and spine roads with limited property access can carry traffic flows greater than 5,000 vehicles per day; and
- **local road** – provides access to individual properties, carrying low volumes, typically less than 2,000 vehicles per day (250 vehicles per hour).

Table G.1 summaries the road characteristics under the functional classification system.

Table G.1 – Functional Classification of Roads

Road Type	Traffic Volume (AADT)	Through Traffic	Inter-Connections	Speed Limit (km/h)
Arterial/Freeway	No limit	Yes	Sub-arterial	70-110
Sub-arterial	<20,000	Some	Arterial/Collector	60-80
Collector	<5,000	Little	Sub-arterial/Local	40-60
Local	<2,000	No	Collector	40

Source: Updated Guidelines for Functional Classification of Roads in Urban Areas, RTA, 1993

Peak hour flows are typically 8-12% of daily flows.

Funding Classification

In recent years, the RTA has adopted a new "funding related" classification system. It defines roads as:

- **state roads** – roads performing an important state function and for which the RTA funds 100% of the maintenance cost. State roads are essentially arterial roads;
- **regional roads** – roads performing a significant regional function and for which the RTA and Council contribute 50% each towards maintenance. Regional roads are essentially sub-arterial roads; and
- **local roads** – roads performing a local or collector function and for which the Councils fund 100% of the maintenance cost. Additional funding is available from the RTA in certain circumstances on grounds of urban amenity and road safety.

In general terms, the RTA is responsible for the state network while local councils are responsible for the regional and local road network. The RTA has an input to the local and regional road system through the council local traffic committee and through direct contact with council officers. Changes to the local road system by Council which influence traffic flows require the submission of a Traffic Management Plan to the RTA for approval.

Appendix H Rail Data

Existing Conditions

Further details of the relevant rail facilities are provided below:

Intermodal Terminals

Rail sidings at intermodal terminals

Intermodal Terminal	No. of Sidings	Max Length (m)
Yennora	4	680
Minto	1	370
Camellia	3	200
Leightonfield	3	360
	1	330
Cooks River	8	220 – 490
Rural Terminal	N/A	900

Yennora
Yennora is operated by Patrick and run 600m trains to Port Botany via the Main West and Flemington junctions. It consists of 4 sidings, the longest being 680m long. This terminal can only be accessed by trains operating in the Down direction that, after passing through Granville on the Main West Line, continue onto the Old South Line. Trains then return to Port Botany via Granville and the Main West Line.

Minto
This terminal consists of a single 370m spur siding off the main line and can only be accessed by trains travelling in the Down direction. The terminal is now operated by Pacific National and runs a 300m shuttle ("Portlink") service to Port Botany.

Camellia
Camellia terminal is operated by Jack Seaton Transport and has 3 x 200m sidings. This is located on a spur line off the Carlingford Line. Trains operating from Camellia are 560m in length and are shunted together on the spur line from three smaller sidings.

Leightonfield
Two separate operators, Lachlan Valley Rail Freight and BHP, run this terminal. Both run either a "Portlink" service or a variable length trains to Port Botany. Lachlan Valley operates 1 x 330m siding but is able to build 525m trains when using Leightonfield yard. BHP operates 3 x 360m sidings and run the "Portlink" trains to Botany. This terminal can only be accessed by trains that travel in the Down direction along the Main South Line.

Other Terminals
Clyde, Chullora and St Marys are other intermodal terminals within the metropolitan area but do not currently service Port Botany.

Port Intermodal Terminals

The existing rail siding at the P&O terminal consists of 3 x 350m rail sidings and can accommodate 17 x 14.6m wagons. The rail siding at the Patrick terminal consists of 2 x 600m rail sidings and can accommodate 35 x 14.6m wagons. Trains access the Patrick terminal via a level crossing at the inter-terminal access road.

There are an additional 2 rail sidings at the P&O Trans Australia site. This is used primarily to transport empty containers to rural areas for packing and operates longer 21.9m wagons. These two sidings at the P&O Trans Australia terminal are 445m in length and can accommodate up to 18 x 21.9m wagons.

Botany Yard

Existing siding lengths at Botany Yard

	No. of Sidings	Max Length (m)
No.1 Siding	1	1,492
No.2 Siding (Through Road)	1	1,492
No.3 Siding	1	872
No.4 Siding	1	876

Between Botany Yard and Port Botany, the Port Botany Master Siding runs from No. 2 Siding to Port Botany P&O and Patrick Terminal Sidings. Four other Sidings, No.'s 1, 2, 3 and 4 Exchange sidings (approximately 400 metres), have access to No.'s 1 and 2 Siding. Number 1 Exchange Siding also connects to the Port Master Siding and No. 2 Exchange Siding to the transit Siding at the Port Botany end. The No. 3 and 4 Exchange Sidings are both terminating dead ends.

Connections exist from the Master Siding to P&O Trans Siding (formerly Sydney Haulage) and the run around loop (358 metres) prior to entering the P&O Siding. There is also a connection from the Master Siding to the Transit Siding.

Network Assessment

The operational performance of the metropolitan intermodal terminals is described below:

Yennora
Yennora terminal operates below capacity currently only handling one train per day. Under its current configuration RIC has advised that it has the capacity to operate up to 3 trains per day.

Minto
This terminal consists of a single spur siding that can only be accessed by trains travelling in the Down direction. This is not a problem as intermodal trains only operate as a shuttle between the port and the terminal and hence are not required to travel south of Minto.

Currently Minto operates 1 train per day using the infrastructure available. There is capacity for more trains to operate each day and train lengths can be increased as additional land has been recently purchased which can be used to extend the existing siding. In summary, it has been advised by RIC that Minto terminal could increase operations to service up to 3 trains per day.

Camellia
This terminal operates below capacity and services up to 1 train per day. With an increase in demand, RIC has indicated that the Camellia terminal could increase its operation up to 3 trains per day without any change to infrastructure.

Leightonfield
Leightonfield terminal operates below capacity and could increase capacity without altering its infrastructure configuration. By running the same length of train RIC have advised that it could service up to 3 trains per day.

System Requirements

Further details of the relevant intermodal terminals are provided below:

Yennora
Table 6.2 indicates that the Yennora intermodal terminal will be required to operate 3 trains per day by the year 2021 if container volumes increase as predicted. As this terminal is capable of servicing at least 3 trains per day with its current infrastructure then no changes should be necessary.

Minto
The maximum number of trains that Minto siding will be required to manage in 2021 is 2 trains per day (**Table 6.2**). It is currently capable of facilitating 3 trains per day with the existing infrastructure. Minto intermodal terminal should therefore not pose any operation constraint however it does have the potential of increasing the length of its siding if growth occurs at a rate higher that assumed. This terminal may also be pressured by the Stevedores or rail operators to increase its length so as to reduce the number of trains on the network.

Camellia
Of the intermodal terminals, Sandown will experience the greatest increase in traffic if container volumes increase in line with the Scenario 2 figures. Most of the intermodal terminals are capable of handling 3 trains per day comfortably however Sandown will be required to operate 4 trains per day (**Table 6.2**). This will require loading/unloading operations to be increased to meet demand so that a full 600m train can be turned around in 6 hours. Production could be increased by assigning more cranes to the siding operations, which would warrant a review of local operations at the terminal.

Leightonfield
Leightonfield terminal will only be required to increase its operations to a maximum of 2 trains per day in 2021. As it currently runs 1 train per day comfortably then it should not find any problem increasing to 2 provided that Lachlan Valley are able to use BHP's infrastructure for shunting operations.

Metropolitan Network

Table H.1 – Container Train Movements per day Through The Metropolitan Network

Scenario 1

Section	Exist	2006	2011	2016	2021
Western Region to Harris Park Y-Link	8	8	10	14	16
Harris Park Y-Link to Junction (Yennora)	4	2	4	4	8
Southern Region to Junction (Minto)	4	4	4	6	6
Junction (Minto) to Cabramatta Junction	8	8	8	12	14
Cabramatta Junction to Junction (Villawood)	8	8	8	12	14
Junction (Villawood) to Sefton Junction	10	10	10	14	16
Harris Park Y-Link to Carlingford Junction	12	10	14	18	24
Carlingford Junction to Clyde Yard	16	12	18	22	30
Clyde Yard to Lidcombe Junction	16	12	18	22	30
Lidcombe Junction to Flemington Junction	16	12	18	22	30
Sefton Junction to Chullora West Junction	10	10	10	14	16
Chullora West Junction to Chullora South Junction	10	10	10	14	16
Flemington Junction to Chullora South Junction	22	20	26	34	44
Flemington Junction to Strathfield Triangle	6	8	8	12	14
Strathfield Triangle to Concord West	6	8	8	12	14
Concord West to Northern Region	6	8	8	12	14
Chullora South Junction to Enfield Yard	32	30	36	48	60
Enfield Yard to Wardell Road Junction	34	36	44	56	62
Wardell Road Junction to Cooks River Junction	32	34	42	52	58
Cooks River Junction to Botany Yard	30	32	40	48	54
Botany Yard to Port Botany Junction	30	32	40	48	54

Scenario 2					
Section	**Exist.**	**2006**	**2011**	**2016**	**2021**
Western Region to Harris Park Y-Link	8	12	14	16	18
Harris Park Y-Link to Junction (Yennora)	4	2	4	6	8
Southern Region to Junction (Minto)	4	4	6	6	6
Junction (Minto) to Cabramatta Junction	8	8	8	10	14
Cabramatta Junction to Junction (Villawood)	8	8	8	10	14
Junction (Villawood) to Sefton Junction	10	10	10	14	18
Harris Park Y-Link to Carlingford Junction	12	14	18	22	26
Carlingford Junction to Clyde Yard	16	16	22	30	34
Clyde Yard to Lidcombe Junction	16	16	22	30	34
Lidcombe Junction to Flemington Junction	16	16	22	30	34
Sefton Junction to Chullora West Junction	10	10	10	14	18
Chullora West Junction to Chullora South Junction	10	10	10	14	18
Flemington Junction to Chullora South Junction	22	26	34	44	50
Flemington Junction to Strathfield Triangle	6	10	12	14	16
Strathfield Triangle to Concord West	6	10	12	14	16
Concord West to Northern Region	6	10	12	14	16
Chullora South Junction to Enfield Yard	32	36	44	58	68
Enfield Yard to Wardell Road Junction	34	50	78	108	122
Wardell Road Junction to Cooks River Junction	32	48	74	102	116
Cooks River Junction to Botany Yard	30	46	70	94	108
Botany Yard to Port Botany Junction	30	46	70	94	108

PORT BOTANY - Traffic & Landside Transport Study (Rail Analysis)

Port Throughput (TEU)

	Existing		2006		2011		2016		2021	
	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import
Scenario 1 (%) - Mode Split	25%		20%		20%		20%		20%	
Scenario 2 (%) - Mode Split	25%		30%		40%		40%		40%	
Total (TEU) - Road & Rail	877000		1250000		1750000		2500000		3200000	
Rail ONLY - Scenario 1	219250		250000		350000		500000		640000	
Rail ONLY - Scenario 2	219250		375000		700000		1000000		1280000	
Export / Import	80%	20%	79%	21%	78%	22%	75%	25%	68%	32%
Annual TEU (Rural) - Scenario 1	129796	0	152075	0	210210	0	288750	0	335104	0
Annual TEU (Metro) - Scenario 1	45604	43850	45425	52500	62790	77000	86250	125000	100096	204800
Annual TEU (Total) - Scenario 1	**175400**	**43850**	**197500**	**52500**	**273000**	**77000**	**375000**	**125000**	**435200**	**204800**
Annual TEU (Rural) - Scenario 2	129796	0	171825	0	256620	0	352500	0	409088	0
Annual TEU (Metro) - Scenario 2	45604	43850	124425	78750	289380	154000	397500	250000	461312	409600
Annual TEU (Total) - Scenario 2	**175400**	**43850**	**296250**	**78750**	**546000**	**154000**	**750000**	**250000**	**870400**	**409600**
Scenario 1 - Rail Only (Daily)	**613**	**153**	**691**	**184**	**875**	**247**	**1202**	**401**	**1395**	**656**
Scenario 2 - Rail Only (Daily)	**613**	**153**	**1036**	**275**	**1750**	**494**	**2404**	**801**	**2790**	**1313**
Patricks - Scenario 1 (Daily)	337	84	345	92	350	99	361	120	418	197
Patricks - Scenario 2 (Daily)	337	84	518	138	700	197	721	240	837	394
CTAL - Scenario 1 (Daily)	276	69	345	92	263	74	361	120	418	197
CTAL - Scenario 2 (Daily)	276	69	518	138	525	148	721	240	837	394
3rd Terminal - Scenario 1 (Daily)					263	74	481	160	558	263
3rd Terminal - Scenario 2 (Daily)					525	148	962	321	1116	525

Port Split

	Existing	2006	2011	2016	2021
Patrick	55%	50%	40%	30%	30%
CTAL	45%	50%	30%	30%	30%
New	0%	0%	30%	40%	40%

Rural/Urban Split

	Existing		2006		2011		2016		2021	
Scenario 1	Export	Import	Export	Import	Export	Import	Export	Import	Export	Import
Rural	74%	0%	77%	0%	77%	0%	77%	0%	77%	0%
Metro	26%	100%	23%	100%	23%	100%	23%	100%	23%	100%
Scenario 2										
Rural	74%	0%	58%	0%	47%	0%	47%	0%	47%	0%
Metro	26%	100%	42%	100%	53%	100%	53%	100%	53%	100%

Days of Operation per Year

Existing	2006	2011	2016	2021
286	286	312	312	312

Container Slot Utilisation

	Existing	2006	2011	2016	2021
% of Train Loaded	75%	80%	85%	85%	85%

Train Lengths

			Existing			2006			2011			2016			2021		
	Loco Length	Wagon Length	No. Loco.	No. Wagon	Train Length	No. Loco.	No. Wagon	Train Length	No. Loco.	No. Wagon	Train Length	No. Loco.	No. Wagon	Train Length	No. Loco.	No. Wagon	Train Length
Patrick	22	14.6	2	38	598.8	2	38	598.8	2	38	598.8	2	38	598.8	2	38	598.8
P&O	22	14.6	2	30	482	2	30	482	2	30	482	2	30	482	2	30	482
New Terminal	22	14.6							2	38	598.8	2	38	598.8	2	38	598.8
P&O Trans Australia	22	20.1	2	27	586.7	2	27	586.7	2	27	586.7	2	27	586.7	2	27	586.7
Yennora	22	20.1	2	25	546.5	2	25	546.5	2	25	546.5	2	25	546.5	2	25	546.5
Minto	22	14.6	2	20	336	2	20	336	2	20	336	2	20	336	2	20	336
Sandown	22	25.6	2	21	581.6	2	21	581.6	2	21	581.6	2	21	581.6	2	21	581.6
Leightonfield	22	14.6	2	35	555	2	35	555	2	35	555	2	35	555	2	35	555
Enfield	22	14.6				2	40	628	2	40	628	2	40	628	2	40	628
White Bay	22	14.6	2	20	336	2	20	336	2	20	336	2	20	336	2	20	336
Cooks River	22	14.6	2	20	336	2	20	336	2	20	336	2	20	336	2	20	336
Rural Trains	22	20.1	2	40	848	2	40	848	2	40	848	2	40	848	2	40	848

Siding Length/ TEU per Train

	Existing			2006			2011			2016			2021		
	Siding Length	Train Length	TEU per Train	Siding Length	Train Length	TEU per Train	Siding Length	Train Length	TEU per Train	Siding Length	Train Length	TEU per Train	Siding Length	Train Length	TEU per Train
Patrick	2 x 600	598.8	57	2 x 600	598.8	60	2 x 600	598.8	64	2 x 600	598.8	64	2 x 600	598.8	64
P&O	3 x 350	482	45	3 x 350	482	48	3 x 350	482	51	3 x 350	482	51	3 x 350	482	51
New Terminal							2 x 600	598.8	64	2 x 600	598.8	64	2 x 600	598.8	64
P&O Trans Australia	2 x 445	586.7	60	350	586.7	64	350	586.7	68	350	586.7	68	350	586.7	68
Yennora	680	546.5	56	680	546.5	60	680	546.5	63	680	546.5	63	680	546.5	63
Minto	370	336	30	370	336	32	370	336	34	370	336	34	370	336	34
Sandown	3 x 200	581.6	63	3 x 200	581.6	67	3 x 200	581.6	71	3 x 200	581.6	71	3 x 200	581.6	71
Leightonfield	4 x 360	555	52	4 x 360	555	56	4 x 360	555	59	4 x 360	555	59	4 x 360	555	59
Enfield				900	591.5	60	900	628	68	900	628	68	900	628	68
White Bay	2 x 265	336	30	2 x 265	336	32	2 x 265	336	34	2 x 265	336	34	2 x 265	336	34
Cooks River	490	336	30	490	336	32	490	336	34	490	336	34	490	336	34
Rural Locations	900	848	60	900	848	64	900	848	68	900	848	68	900	848	68

SYDNEY PORTS

Maunsell

PORT BOTANY - Traffic & Landside Transport Study (Rail Analysis)

SCENARIO 1

Terminal Throughput	Existing				2006		2011		2016		2021	
	Export TEU/ Day	Import TEU/ Day	% Export	% Import	Export TEU/ Day	Import TEU/ Day	Export TEU/ Day	Import TEU/ Day	Export TEU/ Day	Import TEU/ Day	Export TEU/ Day	Import TEU/ Day
Yennora	49	62	*25%*	*31%*	45	57	50	77	69	125	80	204
Minto	14	38	*7%*	*19%*	13	35	14	48	20	77	23	126
Sandown	63	64	*32%*	*32%*	58	59	65	79	89	128	103	210
Leightonfield	18	17	*9%*	*8%*	17	15	19	21	26	33	30	55
Enfield	0	0	0	0	0	0	0	0	0	0	0	0
White Bay	23	18	*12%*	*9%*	21	17	24	23	33	37	38	61
Cooks River	29	0	*15%*	*0%*	26	0	30	0	41	0	47	0
Metro Sub-Total	197	200	*100%*	*100%*	26%	100%	23%	100%	23%	100%	23%	100%
North	164	0	*39%*	*0%*	198	0	261	0	358	0	415	0
South	63	0	*15%*	*0%*	76	0	100	0	138	0	160	0
West	197	0	*46%*	*0%*	237	0	313	0	430	0	499	0
Rural Sub-Total	424	0	*100%*	*0%*	74%	0%	77%	0%	77%	0%	77%	0%
Total (TEU/ day)	**621**	**200**			**691**	**184**	**875**	**247**	**1202**	**401**	**1395**	**656**

SCENARIO 2

Terminal Throughput	Existing				2006		2011		2016		2021	
	Export TEU/ Day	Import TEU/ Day	% Export	% Import	Export TEU/ Day	Import TEU/ Day	Export TEU/ Day	Import TEU/ Day	Export TEU/ Day	Import TEU/ Day	Export TEU/ Day	Import TEU/ Day
Yennora	49	62	***25%***	***31%***	43	56	87	34	179	77	192	189
Minto	14	38	***7%***	***19%***	12	35	25	21	51	48	55	117
Sandown	63	64	***32%***	***32%***	56	57	113	35	232	80	248	195
Leightonfield	18	17	***9%***	***8%***	16	15	33	9	68	21	72	51
Enfield	0	0	0	0	**96**	**96**	**385**	**385**	**553**	**553**	**705**	**705**
White Bay	23	18	***12%***	***9%***	21	17	42	10	86	23	92	56
Cooks River	29	0	***15%***	***0%***	25	0	51	0	106	0	113	0
Sub-Total	197	200	***100%***	***100%***	26%	100%	42%	100%	53%	100%	53%	100%
North	164	0	***39%***	***0%***	296	0	393	0	437	0	507	0
South	63	0	***15%***	***0%***	114	0	151	0	168	0	195	0
West	197	0	***46%***	***0%***	356	0	472	0	525	0	609	0
Sub-Total	424	0	***100%***	***0%***	74%	0%	58%	0%	47%	0%	47%	0%
Total (TEU/ day)	**621**	**200**			**1036**	**275**	**1750**	**494**	**2404**	**801**	**2790**	**1313**

TRAINS PER DAY

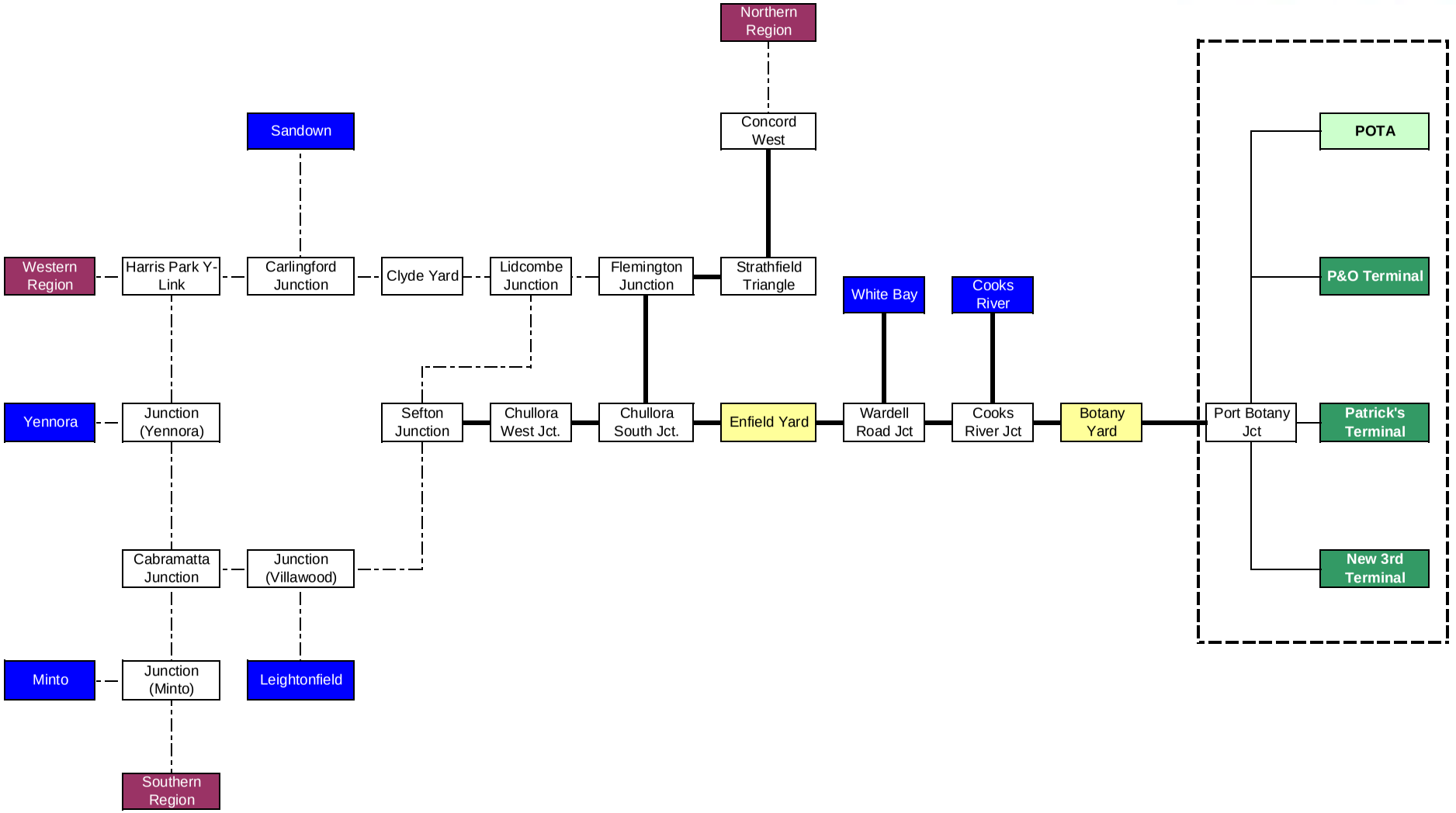
	Existing			2006			2011			2016			2021		
	Export	Import	Movement	Export	Import	Movement	Export	Import	Movement	Export	Import	Movement	Export	Import	Movement
Patricks - Scenario 1	6	2	12	6	2	12	6	2	12	6	2	12	7	4	14
Patricks - Scenario 2	6	2	12	9	3	18	11	4	22	12	4	24	14	7	28
CTAL - Scenario 1	7	2	14	8	2	16	6	2	12	8	3	16	9	4	18
CTAL - Scenario 2	7	2	14	11	3	22	11	3	22	15	5	30	17	8	34
3rd Terminal - Scenario 1							5	2	10	8	3	16	9	5	18
3rd Terminal - Scenario 2							9	3	18	16	6	32	18	9	36
P&O Container - Scenario 1	2	2	4	2	2	4	3	3	6	2	2	4	2	2	4
P&O Container - Scenario 2	2	2	4	3	3	6	4	4	8	4	4	8	5	5	10
Yennora - Scenario 1	1	2	4	1	1	2	1	2	4	2	2	4	2	4	8
Yennora - Scenario 2	1	2	4	1	1	2	2	1	4	3	2	6	4	4	8
Minto - Scenario 1	1	2	4	1	2	4	1	2	4	1	3	6	1	4	8
Minto - Scenario 2	1	2	4	1	2	4	1	1	2	2	2	4	2	4	8
Sandown - Scenario 1	2	2	4	1	1	2	1	2	4	2	2	4	2	3	6
Sandown - Scenario 2	2	2	4	1	1	2	2	1	4	4	2	8	4	3	8
Leightonfield - Scenario 1	1	1	2	1	1	2	1	1	2	1	1	2	1	1	2
Leightonfield - Scenario 2	1	1	2	1	1	2	1	1	2	2	1	4	2	1	4
Enfield - Scenario 1															
Enfield - Scenario 2				2	2	4	6	6	12	9	9	18	11	11	22
White Bay - Scenario 1	1	1	2	1	1	2	1	1	2	1	2	4	2	2	4
White Bay - Scenario 2	1	1	2	1	1	2	2	1	4	3	1	6	3	2	6
Cooks River - Scenario 1	1	0	2	1	0	2	1	0	2	2	0	4	2	0	4
Cooks River - Scenario 2	1	0	2	1	0	2	2	0	4	4	0	8	4	0	8
North - Scenario 1	3	0	6	4	0	8	4	0	8	6	0	12	7	0	14
North - Scenario 2	3	0	6	5	0	10	6	0	12	7	0	14	8	0	16
South - Scenario 1	2	0	4	2	0	4	2	0	4	3	0	6	3	0	6
South - Scenario 2	2	0	4	2	0	4	3	0	6	3	0	6	3	0	6
West - Scenario 1	4	0	8	4	0	8	5	0	10	7	0	14	8	0	16
West - Scenario 2	4	0	8	6	0	12	7	0	14	8	0	16	9	0	18

Train Paths Required Through Port Botany

	Existing	2006	2011	2016	2021
Scenario 1	30	32	40	48	54
Scenario 2	30	46	70	94	108

PORT BOTANY - Traffic & Landside Transport Study (Rail Analysis)

MODELLED NETWORK

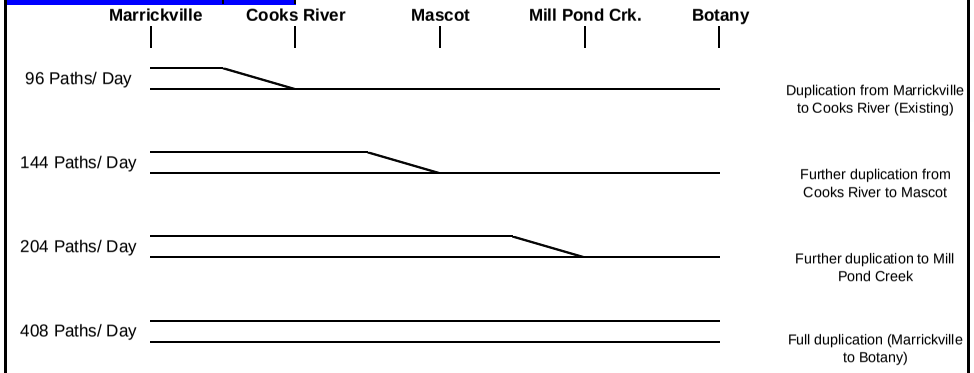


NETWORK DATA

Rural Regions
Western Region
Southern Region
Northern Region
Metropolitan Intermodal Depots
Yennora
Minto
Sandown
Leightonfield
White Bay
Cooks River
Marshalling Yards
Clyde Yard
Enfield Yard
Botany Yard
Stevedores
P&O Terminal
Patrick's Terminal
New 3rd Terminal
POTA

Junctions
Harris Park Y-Link
Junction (Yennora)
Cabramatta Junction
Junction (Minto)
Carlingford Junction
Junction (Villawood)
Sefton Junction
Lidcombe Junction
Chullora West Jct.
Flemington Junction
Chullora South Jct.
Concord West
Strathfield Triangle
Wardell Road Jct
Cooks River Jct
Port Botany Jct

BOTANY LINE CAPACITY



Note:
1. These capacities are based on the assumption of a 7 minute headway between trains (source RIC).
2. 1 train path allows 1 train movement.

SCENARIO 1

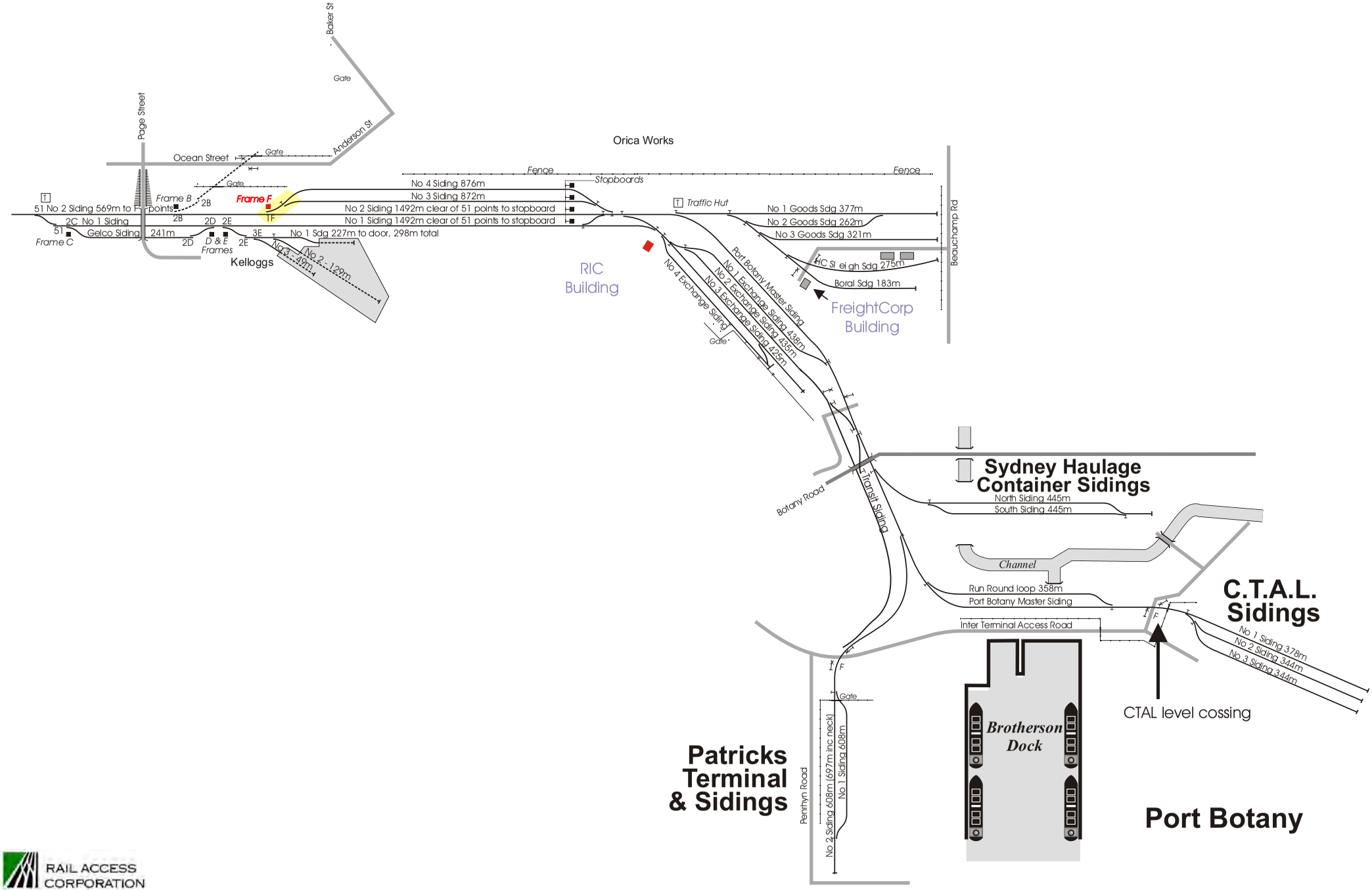
Sections	Dedicated to Freight (Yes/No)	Current Paths (approx) Export trains/ Day	Import trains/ Day	Total trips/ Day	Paths Requ. In 2006 Export trains/ Day	Import trains/ Day	Total trips/ Day	Paths Requ. In 2011 Export trains/ Day	Import trains/ Day	Total trips/ Day	Paths Requ. In 2016 Export trains/ Day	Import trains/ Day	Total trips/ Day	Paths Requ. In 2021 Export trains/ Day	Import trains/ Day	Total trips/ Day	INCREASE Existing	2006	2011	2016	2021
Western Region to Harris Park Y-Link	No	4	0	8	4	0	8	5	0	10	7	0	14	8	0	16	0%	0%	25%	75%	100%
Harris Park Y-Link to Junction (Yennora)	No	1	2	4	1	1	2	1	2	4	2	2	4	2	4	8	0%	0%	0%	0%	100%
Southern Region to Junction (Minto)	No	2	0	4	2	0	4	2	0	4	3	0	6	3	0	6	0%	0%	0%	50%	50%
Junction (Minto) to Cabramatta Junction	No	3	2	8	3	2	8	3	2	8	4	3	12	4	4	14	0%	0%	0%	50%	75%
Cabramatta Junction to Junction (Villawood)	No	3	2	8	3	2	8	3	2	8	4	3	12	4	4	14	0%	0%	0%	50%	75%
Junction (Villawood) to Sefton Junction	No	4	3	10	4	3	10	4	3	10	5	4	14	5	5	16	0%	0%	0%	40%	60%
Harris Park Y-Link to Carlingford Junction	No	5	2	12	5	1	10	6	2	14	9	2	18	10	4	24	0%	0%	17%	50%	100%
Carlingford Junction to Clyde Yard	No	7	4	16	6	2	12	7	4	18	11	4	22	12	7	30	0%	0%	13%	38%	88%
Clyde Yard to Lidcombe Junction	No	7	4	16	6	2	12	7	4	18	11	4	22	12	7	30	0%	0%	13%	38%	88%
Lidcombe Junction to Flemington Junction	No	7	4	16	6	2	12	7	4	18	11	4	22	12	7	30	0%	0%	13%	38%	88%
Sefton Junction to Chullora West Jct.	Yes	4	3	10	4	3	10	4	3	10	5	4	14	5	5	16	0%	0%	0%	40%	60%
Chullora West Jct. to Chullora South Jct.	Yes	4	3	10	4	3	10	4	3	10	5	4	14	5	5	16	0%	0%	0%	40%	60%
Flemington Junction to Chullora South Jct.	Yes	10	4	22	10	2	20	11	4	26	17	4	34	19	7	44	0%	0%	18%	55%	100%
Flemington Junction to Strathfield Triangle	Yes	3	0	6	4	0	8	4	0	8	6	0	12	7	0	14	0%	33%	33%	100%	133%
Strathfield Triangle to Concord West	Yes	3	0	6	4	0	8	4	0	8	6	0	12	7	0	14	0%	33%	33%	100%	133%
Concord West to Northern Region	No	3	0	6	4	0	8	4	0	8	6	0	12	7	0	14	0%	33%	33%	100%	133%
Chullora South Jct. to Enfield Yard	Yes	14	7	32	14	5	30	15	7	36	22	8	48	24	12	60	0%	0%	13%	50%	88%
Enfield Yard to Wardell Road Jct	Yes	17	7	34	18	7	36	22	10	44	27	12	56	31	17	62	0%	6%	29%	65%	82%
Wardell Road Jct to Cooks River Jct	Yes	16	6	32	17	6	34	21	9	42	26	10	52	29	15	58	0%	6%	31%	63%	81%
Cooks River Jct to Botany Yard	Yes	15	6	30	16	6	32	20	9	40	24	10	48	27	15	54	0%	7%	33%	60%	80%
Botany Yard to Port Botany Jct	Yes	15	6	30	16	6	32	20	9	40	24	10	48	27	15	54	0%	7%	33%	60%	80%

SCENARIO 2

Sections	Dedicated to Freight (Yes/No)	Current Paths (approx) Export trains/ Day	Import trains/ Day	Total trips/ Day	Paths Requ. In 2006 Export trains/ Day	Import trains/ Day	Total trips/ Day	Paths Requ. In 2011 Export trains/ Day	Import trains/ Day	Total trips/ Day	Paths Requ. In 2016 Export trains/ Day	Import trains/ Day	Total trips/ Day	Paths Requ. In 2021 Export trains/ Day	Import trains/ Day	Total trips/ Day	INCREASE Existing	2006	2011	2016	2021
Western Region to Harris Park Y-Link	No	4	0	8	6	0	12	7	0	14	8	0	16	9	0	18	0%	50%	75%	100%	125%
Harris Park Y-Link to Junction (Yennora)	No	1	2	4	1	1	2	2	1	4	3	2	6	4	4	8	0%	0%	0%	50%	100%
Southern Region to Junction (Minto)	No	2	0	4	2	0	4	3	0	6	3	0	6	3	0	6	0%	0%	50%	50%	50%
Junction (Minto) to Cabramatta Junction	No	3	2	8	3	2	8	4	1	8	5	2	10	5	4	14	0%	0%	0%	25%	75%
Cabramatta Junction to Junction (Villawood)	No	3	2	8	3	2	8	4	1	8	5	2	10	5	4	14	0%	0%	0%	25%	75%
Junction (Villawood) to Sefton Junction	No	4	3	10	4	3	10	5	2	10	7	3	14	7	5	18	0%	0%	0%	40%	80%
Harris Park Y-Link to Carlingford Junction	No	5	2	12	7	1	14	9	1	18	11	2	22	13	4	26	0%	17%	50%	83%	117%
Carlingford Junction to Clyde Yard	No	7	4	16	8	2	16	11	2	22	15	4	30	17	7	34	0%	0%	38%	88%	113%
Clyde Yard to Lidcombe Junction	No	7	4	16	8	2	16	11	2	22	15	4	30	17	7	34	0%	0%	38%	88%	113%
Lidcombe Junction to Flemington Junction	No	7	4	16	8	2	16	11	2	22	15	4	30	17	7	34	0%	0%	38%	88%	113%
Sefton Junction to Chullora West Jct.	Yes	4	3	10	4	3	10	5	2	10	7	3	14	7	5	18	0%	0%	0%	40%	80%
Chullora West Jct. to Chullora South Jct.	Yes	4	3	10	4	3	10	5	2	10	7	3	14	7	5	18	0%	0%	0%	40%	80%
Flemington Junction to Chullora South Jct.	Yes	10	4	22	13	2	26	17	2	34	22	4	44	25	7	50	0%	18%	55%	100%	127%
Flemington Junction to Strathfield Triangle	Yes	3	0	6	5	0	10	6	0	12	7	0	14	8	0	16	0%	67%	100%	133%	167%
Strathfield Triangle to Concord West	Yes	3	0	6	5	0	10	6	0	12	7	0	14	8	0	16	0%	67%	100%	133%	167%
Concord West to Northern Region	No	3	0	6	5	0	10	6	0	12	7	0	14	8	0	16	0%	67%	100%	133%	167%
Chullora South Jct. to Enfield Yard	Yes	14	7	32	17	5	36	22	4	44	29	7	58	32	12	68	0%	13%	38%	81%	113%
Enfield Yard to Wardell Road Jct	Yes	17	7	34	25	10	50	39	15	78	54	20	108	61	31	122	0%	47%	129%	218%	259%
Wardell Road Jct to Cooks River Jct	Yes	16	6	32	24	9	48	37	14	74	51	19	102	58	29	116	0%	50%	131%	219%	263%
Cooks River Jct to Botany Yard	Yes	15	6	30	23	9	46	35	14	70	47	19	94	54	29	108	0%	53%	133%	213%	260%
Botany Yard to Port Botany Jct	Yes	15	6	30	23	9	46	35	14	70	47	19	94	54	29	108	0%	53%	133%	213%	260%

Appendix I Rail Diagram

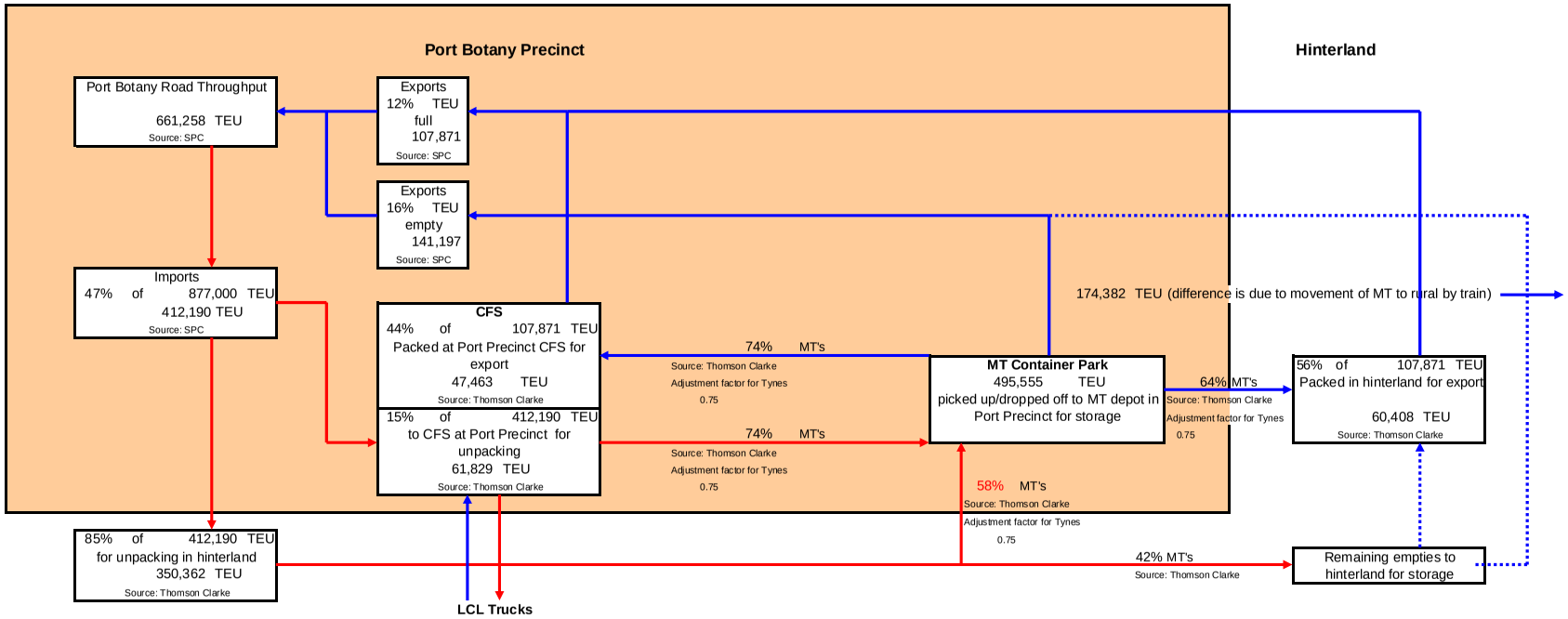
Botany Yard



RAIL ACCESS CORPORATION

Appendix J Road TEU Movements

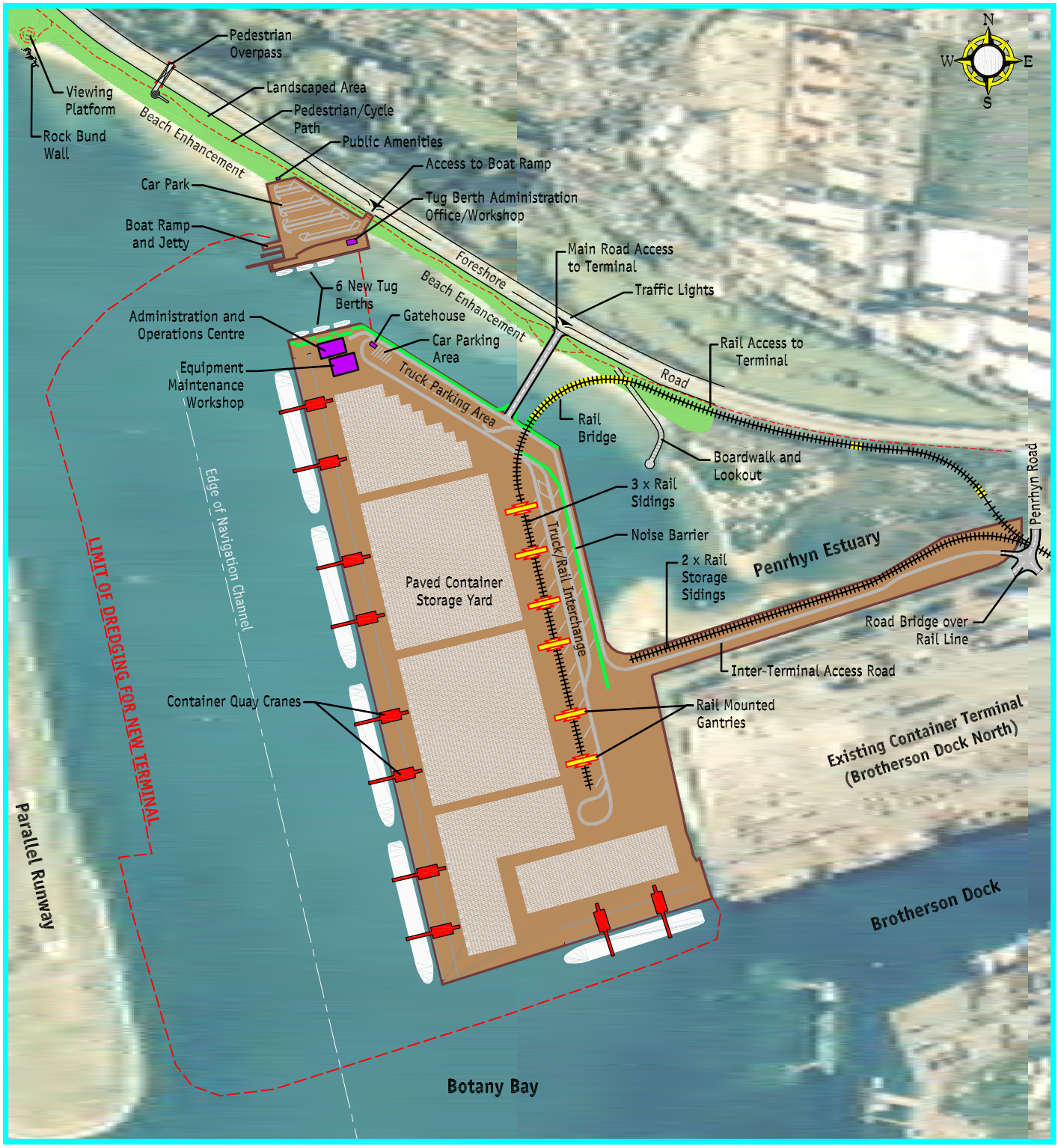
Road TEU Movements



Reference Year: 2000-01

Source: Sydney Ports Corporation
Thompson Clarke Thompson Clarke 2000

Appendix K Proposed Layout for New Terminal


N
W
E
S
Pedestrian Overpass
Viewing Platform
Rock Bund Wall
Landscaped Area
Pedestrian/Cycle Path
Public Amenities
Beach Enhancement
Car Park
Access to Boat Ramp
Tug Berth Administration Office/Workshop
Boat Ramp and Jetty
Foreshore
Beach Enhancement
Main Road Access to Terminal
Traffic Lights
6 New Tug Berths
Administration and Operations Centre
Gatehouse
Car Parking Area
Rail Access to Terminal
Road
Equipment Maintenance Workshop
Truck Parking Area
Rail Bridge
Boardwalk and Lookout
3 x Rail Sidings
Penrhyn Road
Noise Barrier
Edge of Navigation Channel
Truck/Rail Interchange
Penrhyn Estuary
2 x Rail Storage Sidings
Paved Container Storage Yard
LIMIT OF DREDGING FOR NEW TERMINAL
Road Bridge over Rail Line
Inter-Terminal Access Road
Container Quay Cranes
Rail Mounted Gantries
Existing Container Terminal (Brotherson Dock North)
Parallel Runway
Brotherson Dock
Botany Bay
0 50 300m

Site Layout

Report Addendum

memo

maunsell

Addendum

to:	Colin Rudd	date:	15 October 2003
copy to:	Tony Navaratne	file/ref no:	20010104.00
from:	Stuart Webster	page **1** of	**3**
subject:	Traffic and Landside Transport Study for Proposed Port Botany Expansion Supplement Note to Report		

1.0 Introduction

As requested we have undertaken the following assessment in relation to the proposed new container terminal rail sidings at Port Botany:

- An assessment of the operational implications of reducing the length of the container sidings from 600m to a shorter length (notionally 400m) utilising the operational modelling spreadsheet developed during our earlier commission (Maunsell Report: *Traffic and Landside transport Study for Proposed Port Botany Expansion, Rev D, November 2002*);
- A brief technical assessment of the alignment arrangements possible for the shorter siding arrangements; and
- Preparation of a short report, as detailed in this memo, documenting our findings.

2.0 Siding Layout

The new terminal sidings are located to the eastern edge of the terminal and are orientated in approximately a north south direction and include two sidings and one run around track. Two turnouts are provided at the northern end of the site as the single branch line fans out into the three roads. It should be possible to locate the two turnouts clear of both the external and internal feeder roads and achieve a minimum siding length of 414m. It has been assumed that all trains will operate a distributed power configuration where a power unit (locomotive) is at either end of the train.

3.0 Operational Assessment

RIC has stated that if the section of track between Botany Yard and Cooks River were to be duplicated, the capacity of track would increase to 1.3 million TEUs per year (which is equivalent to 40% of the total throughput of 3.2 million TEUs forecast for 2021) based on 90 – 110 train paths a day.

An operational assessment was made utilising the spreadsheet model developed during Maunsell's 2002 commission to Sydney Ports Corporation. Utilising this model the number of train paths were computed for train lengths of 598.8m as modelled originally as well as with reduced train lengths of 409m.

The port split traffic figures were modified for the 409m siding scenario to reflect the assumption made that one fifth of new terminal container traffic would be fed through the Patrick terminal with the remaining four fifths being handle by the 409m siding arrangement.

The results of the analysis for both sidings have been reassessed based on 24 hours a day, 7 day operations a week is summarised as follows (results of Maunsell 2002 study were conservatively based on the current 6 day per week operations)

Table 2.1 Summary of Train Path Requirements

	2011		**2016**		**2021**	
	All Terminals	New Terminal	All Terminals	New Terminal	All Terminals	New Terminal
600m[#1] Long Sidings at New Terminal	62	*16*	80	*26*	94	*30*
400m[#2] Long Sidings at New Terminal	66	*18*	92	*32*	108	*38*
Additional Train Paths required	***4***	***2***	**12**	***6***	**14**	***8***

Notes:
#1 (2x22m locos + 38 x 14.6m wagons =598.8m)
#2 (2x22m locos + 25 x 14.6m wagons =409m)

The shorter siding length of 409 m would require some 14 additional train paths per day by 2021. However, the total number of train paths of 108 required is within the 110 train path per day capacity of the Cooks River to Botany Yard duplication stated by RIC.

From the above table it can be seen that:

1. The duplication of the track between Botany Yard and Cooks River would need to be carried out before 2016 since even with operational improvements foreshadowed in Section 5.2.5 of the Maunsell report, the capacity of the unduplicated section is only of the order of 72 – 84 train paths a day.

2. Once duplicated, it appears there would be sufficient capacity would be available for the requisite number of train paths beyond 2016.

4.0 Conclusions

The key conclusions of this exercise are:

- It is feasible to provide two siding lengths, of 414m minimum, however all train consists would have to comprise a distributed power system (a locomotive is provided at either end of the train);
- It is also feasible to provide a run around loop track to serve other train consists however additional trackwork to connect the three sidings and provide a shunt neck would be required at the southern end of the sidings;
- The reduction in siding length from 598.8 to 409 m would result in an additional 14 train paths per day, by 2021, to achieve the 40% rail mode share;
- The resultant increase in train paths would require (as was the case for the 600m siding) that the Cooks River to Botany Yard dedicated Freight line be duplicated to achieve a capacity of 110 train paths per day between 2011 and 2016; and,
- Upon duplication of the section of track between Botany Yard and Cooks River sufficient capacity would be available to handle the forecast train paths beyond 2016 provided that the hours of operation are increased from the current 6 day a week operation of Botany Yard to 24 hours a day, 7 days a week, 365 days a year.

Our Reference: 51.5314
Your Reference:
Contact: Tricia Zapanta-Mostyn
Telephone: 9672 2577
Thursday 1 November 2001

Roads and Traffic Authority
www.rta.nsw.gov.au
ABN 64 480 155 255
Sydney Client Services
83 Flushcombe Road
Blacktown NSW 2148
Telephone 131 782
Facsimile (02) 9831 0155
PO Box 558
Blacktown NSW 2148
DX 8120 Blacktown

Sydney Ports Corporation
P.O. Box 25
MILLERS POINT NSW 2000

Attention: Tony Navaratne

Dear Tony

ACCESS TO RELOCATED BOAT RAMP AT PORT BOTANY

I refer to our letter 27 September 2001 and the meeting of 1 November 2001 in relation to the above matter, the following is submitted for your information.

The RTA raise no objection in principle to the proposed vehicular access point on Foreshore Drive, for the relocated boat ramp, as shown on Figure 3 of the Traffic Impact Assessment (Masson Wilson Twiney, September 2001). In principle support is subject to further detailed traffic modelling incorporating traffic analysis for level of service, intersection operation and a safety assessment for the proposed right turn out of the site. The RTA notes the option of restricting right turns out of the site during the morning peak period. A more thorough assessment of the right turn egress movement will be possible as part of the EIS process for the boat ramp site or consolidated Ports expansion site.

Please refer further queries to Tricia Zapanta-Mostyn on (02) 9672 2577.

Yours faithfully

Charles Wiafe
Manager, Landuse Development
Transport Planning Unit, Sydney Client Services Branch

SYDNEY PORTS
www.sydneyports.com.au

COPY

POSTED 27/9/01

27 September, 2001

SYDNEY PORTS CORPORATION
ABN 95 784 452 933
Level 8, 207 Kent Street
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P.O. Box 25, Millers Point
NSW 2000 Australia
Phone: 61 2 9296 4999
Facsimile: 61 2 9296 4742

Mr Charles Wiafe
Sydney Development Services
Roads & Traffic Authority
83 Flushcombe Rd
Blacktown 2148
NSW Australia

Dear Charles

RE: ACCESS TO RELOCATED BOAT RAMP AT PORT BOTANY

We recently met to discuss access options for a relocated boat ramp at Port Botany. At the meeting we agreed to present you with an analysis of options. In this regard we enclose herewith a report prepared by Masson Wilson Twiney.

We request you to examine the report and will call to arrange a meeting to further discuss the matter in a week or so.

We confirm that we seek the Roads and Traffic Authority's advice on the acceptability of direct access to Foreshore Road for the relocated boat ramp. Resolution of this is needed as an input to the further planning of the expansion of the port.

We look forward to discussing this with you.

Yours faithfully,

Tony Navaratne
Senior Port Planner

File: h:\foreshore rd beach\traffic\01-rta-27-9-01.doc
Contact: Tony Navaratne
Tele: 9296 4694

PRELIMINARY TRAFFIC REPORT

Proposed Replacement Boat Ramp on Foreshore Road at Port Botany

September 2001

Prepared for
Sydney Ports Corporation

MASSON | *WILSON* | TWINEY

TRAFFIC AND TRANSPORT CONSULTANTS

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Contents

1. Introduction

This report has been prepared on behalf of Sydney Ports Corporation to examine the traffic implications of alternative access options for a relocated boat ramp at Port Botany. The local road system and the location of the existing boat ramp are indicated on Figure 1. Relocation will be necessary because the port is expected to need additional capacity within the next ten years. Expansion of the port is expected to be towards the west (the direction of the airport's third runway) and this would displace the existing boat ramp.

A possible location for a replacement boat ramp is at the western end of reclamation for the expanded port. This would retain the boat ramp in generally the same location, in an area of sheltered waterway between the port and the airport which would be well suited to boat launching.

The proposed port expansion has not yet been subject to the full environmental impact assessment process. When it does, this will include the boat ramp. However, to progress conceptual planning it is necessary to explore the feasibility of a replacement boat ramp in this location.

A major issue in this regard is how to provide vehicular access to the ramp. Important considerations are the safety and efficiency of the external public road system, interactions with port traffic including large heavy truck movements within the port and security for cargo and ships within the port.

The objective of this report is to canvas site access options with a view to achieving Roads and Traffic Authority agreement to a preferred access option. This would then become an input to the development of plans for a replacement boat ramp and for port expansion.

The report hypothesises possible traffic increases in the area relating to port expansion and other development in the area. This has been undertaken to provide a context within which to examine possible access options. It must be stressed that explicit assessments of the traffic consequences of port expansion have not been undertaken yet but will be done as part of the EIS preparation.

Chapter 2 of this report outlines potential boat ramp access options against the background of a possible port expansion plan. Chapter 3 provides information on the traffic generation of the boat ramp and on origins and destinations of boat ramp traffic. It also presents information on traffic levels on Foreshore Road. Chapter 4 assesses the access options. Chapter 5 presents conclusions.

2. Boat Ramp Access

Figure 2 of this report provides an indicative layout for the expansion of the western (Penrhyn Road) section of Port Botany with a new boat ramp area in the north-west. At this stage it is envisaged that a second access to the expanded port would be provided off Foreshore Road.

Reasons for this are to:

- avoid overloading the Foreshore Road/Botany Road/Penrhyn Road intersection;
- provide a second point of access to the port to overcome its current vulnerability to disruption to a single point of access;
- reduce the tendency for port trucks to use Botany Road north of Foreshore Road, in accordance with the wishes of Botany Council; and
- provide flexibility for the management of traffic within the port.

As indicated on Figure 2, it is proposed to retain a strip of water between Foreshore Road and the expanded port area. This is proposed for environmental, drainage and port security reasons.

Two general boat ramp access options would be available, as indicated on Figure 3:

1) via a road along the northern edge of the expanded port area connecting to the proposed new port access road; and
2) via a direct access connection from the boat ramp area to Foreshore Road. This could have various combinations of configurations on Foreshore Road as follows:
   - left in/left out
   - left and right in/left out
   - left and right in and out

These options are assessed in Chapter 4.

3. Traffic Volumes

3.1 Boat Ramp

A survey of boat ramp activity was undertaken in January 2001. This is a peak time for boat usage. The survey recorded the numbers of boats launched each hour. Results are provided in Table 3.1.

Table 3.1 indicates a concentration of launchings in the early morning before 7.00 am with 35 per cent of all launchings taking place at these times. The table also indicates considerable variations from day to day that would be weather related. It also indicates, as would be expected, that a public holiday (Australia Day) was the busiest day.

Table 3.1 – Survey of Boat Launching Times, January 2001

Time	Sea Craft Entering the Water						
Hour Starting	**Fri 12**	**Sat 13**	**Sun 14**	**Fri 26**	**Sat 27**	**Sun 28**	**Mon 29**
05.00	18	12	26	29	17	7	6
06.00	13	14	24	19	6	3	5
07.00	7	9	12	11	3	4	5
08.00	6	0	12	9	2	1	3
09.00	4	1	6	13	10	5	3
10.00	6	5	14	9	1	1	1
11.00	8	0	5	10	3	0	1
12.00	6	3	7	7	4	2	1
13.00	1	1	11	14	3	2	3
14.00	1	2	5	5	7	2	4
15.00	6	7	3	11	2	3	3
16.00	6	3	10	7	2	1	3
17.00	5	1	1	4	2	3	0
18.00	2	1	2	4	0	0	2
Total	89	59	138	152	62	34	40

Boat retrievals were not surveyed. Hourly numbers would be similar to those for launchings but occurring later in the day.

A check of car licence plate numbers was also undertaken to determine their origins and hence routes to and from the site. The spread was essentially as follows:

East (Randwick, Waverley Woollahra) – arrive/depart via Botany Road east of Foreshore Road – 30%.

North (Botany, South Sydney, Sydney, North Shore) – arrive/depart via Southern Cross Drive or Botany Road – 20%.

North-west (north of Georges River) – arrive/depart along or across Princes Highway and thence Botany Road – 20%.

West (south-west) – M5 East, Princes Highway and Grand Parade leading to General Holmes Drive and Foreshore Road – 30%.

3.2 Foreshore Road Existing Traffic

There is an RTA permanent count station on Foreshore Road east of General Holmes Drive. The RTA publishes records of daily traffic volumes throughout the year in each direction as well as hourly traffic volumes in each direction over a typical week for such count stations.

Of interest from the daily records are that average weekend and public holiday traffic flows on Foreshore Drive (when boat ramp activity is heaviest) are considerably lower than those on weekdays, as follows:

	Northbound	Southbound	Two Way
Average weekday traffic (veh/day)	13,931	14,424	28,355
Average weekend traffic (veh/day)	9,128	9,074	18,202
Average public holiday traffic (veh/day)	7,550	7,735	15,285

Table 3.2 below summarises average weekday and weekend/public holiday hourly traffic volumes in each direction on Foreshore Road.

Table 3.2 – Average Hourly Traffic Flows on Foreshore Road (1999)

Hour commencing	Northbound		Southbound	
	Weekday	Weekend	Weekday	Weekend
0:00	88	177	68	138
1:00	48	106	40	80
2:00	34	79	36	63
3:00	35	65	49	42
4:00	83	60	119	55
5:00	201	140	502	22
6:00	434	255	1311	410
7:00	610	267	1496	382
8:00	743	316	1612	407
9:00	574	405	1066	478
10:00	615	503	755	574
11:00	696	592	844	636
12:00	789	657	758	647
13:00	832	636	808	616
14:00	1087	691	838	615
15:00	1450	578	701	465
16:00	1371	628	669	524
17:00	1275	624	677	539
18:00	923	409	533	392
19:00	525	311	340	332
20:00	355	290	251	329
21:00	345	315	289	355
22:00	347	328	280	270
23:00	215	187	138	141

Table 3.2 indicates that hourly flows on Foreshore Road on a weekend are also much lower than weekday flows. The table indicates that northbound flows are heavy between 2.00 and 6.00 pm while southbound flows are heavy between 6.00 and 10.00 am on weekdays.

Comparison of the boat ramp activity indicated on Table 3.1 with the hourly volumes on Foreshore Road indicated on Table 3.2 indicates that boat ramp volumes are of negligible consequence in terms of the total volume of traffic on and hence the capacity of Foreshore Road. Thus the issue in relation to alternative access options relates principally to safety.

3.3 Future Foreshore Road Traffic Flows

Traffic volumes on Foreshore Road are likely to grow as a result of growth in port traffic, industrial development and redevelopment in the Botany and Randwick industrial areas and higher residential densities in selected areas.

Since 1985, traffic volumes on Foreshore Road have grown but with considerable variation, as follows:

Year	**Annual Average Daily Traffic (veh/day)**
1998	15,407
1987	21,501
1989	24,028
1991	28,882
1993	24,821
1996	21,794
1999	25,166

The 1999 volume represents vehicle numbers while the other volumes represent axle pairs and hence slightly over represent vehicle numbers.

While the traffic growth pattern on Foreshore Road is not clear, assumption of a 2.5 per cent per annum linear growth pattern is considered appropriate for planning purposes. This suggests a 50 per cent increase in traffic volumes on Foreshore Road over a 20 year planning horizon.

Table 3.3 below presents the RTA's 1999 recorded average hourly traffic flows on Foreshore Road growthed by 50 per cent to represent indicative 2019 future traffic flows. This future year is considered to be sufficiently far into the future to represent a reasonable planning horizon for the consideration of the boat ramp.

Table 3.3 – Indicative Future Average Hourly Traffic Flows on Foreshore Road (2019)

Hour commencing	Northbound		Southbound	
	Weekday	Weekend	Weekday	Weekend
0:00	132	266	102	207
1:00	72	159	60	120
2:00	51	119	54	94
3:00	53	98	73	63
4:00	125	90	178	82
5:00	302	210	753	33
6:00	651	383	1966	615
7:00	915	401	2244	573
8:00	1115	474	2418	610
9:00	861	308	1599	717
10:00	923	755	1133	801
11:00	1044	888	1266	954
12:00	1184	986	1137	920
13:00	1248	954	1212	924
14:00	1630	1037	1257	922
15:00	2175	867	1051	697
16:00	2056	942	1003	786
17:00	1913	936	1015	808
18:00	1385	64	799	588
19:00	788	467	510	498
20:00	533	435	376	493
21:00	518	473	433	532
22:00	521	492	420	405
23:00	323	281	207	211

4. Assessment of Access Options

Different considerations apply in the assessment of the two different potential access types. Option 1, entry via the new port access road, concerns largely the relationship of the new port road intersection with Foreshore Road to that of an intersection of the new port road to a spur road to serve the boat ramp. This option is further influenced by the construction sequence, since the land on which the new port road is to be constructed needs to be reclaimed first.

Option 2, entry directly to Foreshore Road, concerns the adequacy of the geometric design of the elements of the access intersection; and for sub-options involving right turn movements, the availability of gaps in the Foreshore Road traffic stream through which right turns might be made. Effects of restricting access/egress from certain directions due to right turn prohibitions are also relevant for this alternative.

4.1 Access Via New Port Road (Option 1)

Figure 3 indicates the likely relationship of the port second access intersection with Foreshore Road to the boat ramp access. To minimise sterilisation of new port land, the access road would be located along the bank of the stormwater channel. This would yield a separation of only about 50 metres from Foreshore Road. Thus if there were more than two semi-trailers queuing on the approach to the Foreshore Road intersection, access to and from the boat ramp access road would be blocked. Additionally, the available length would afford little advanced warning to drivers of the boat ramp turn off and of the need to move into a right turn lane before turning.

Moreover, while the replacement boat ramp would need to be available preferably before dredging and reclamation work for the port extension commences, it is unlikely that the land on which to construct this access road would be available. Therefore direct access from Foreshore Road (Option 2) would need to be implemented at least during the construction phase of the port expansion which will be about 3 years.

Because of these geometric difficulties, the difficulties that a boat ramp access road would have in terms of port security and potential loss of port land and the need to rely on Option 2 during the initial 3 years of the facility, this option is not favoured by Sydney Ports Corporation.

4.2 Access Via Foreshore Road (Option 2)

Figure 4 indicates the required configuration of a direct access intersection with Foreshore Road. Depending on the option, the right turn entry or right turn exit lanes in the Foreshore Road median may not be constructed.

Left In/Left Out
As far as an option with left turn entry and left turn exit only is concerned, the principal issue would be that the left turn deceleration and left turn acceleration lanes were sized in accordance with requirements of the RTA's *Road Design Guide*. In this case the *Guide*

would be adhered to and this would ensure that safety and efficiency considerations were satisfactorily taken care of.

In terms of impacts on boat ramp users, there would be minimal impact on the 70 per cent of drivers who would approach from the north, east and north-west, as they would not have to go significantly out of their way to reach the access on Foreshore Road. Users arriving from the south-west would need to approach via Botany Road and so would have about 2km extra travel distance.

Drivers exiting to the south-west and north-west would have no extra travel distance. Drivers travelling to the north would also be minimally inconvenienced as they would travel via General Holmes Drive rather than Botany Road but generally in the same direction. Drivers travelling to Waverley and Woollahra in the east would most likely use Southern Cross Drive via Foreshore Road, General Holmes Drive and Mill Pond Drive with minimal inconvenience. However, those living in Randwick and Botany would need to loop back after a left turn exit using General Holmes Drive and Mill Pond Drive, then use either Botany Road or Wentworth Avenue. For these people the extra travel distance could be 5 to 7km.

Thus left in/left out access is considered to be safe and workable, but would slightly inconvenience drivers arriving from the west/south-west and exiting to the east. This means that right turn entry and exit would be desirable if it could be safely provided.

Right In Access

If right turn access was provided it would be necessary to provide a right turn deceleration lane in the Foreshore Road median as indicated on Figure 4. Drivers making the right turn would need to negotiate gaps in the southbound traffic stream.

The normal average gap accepted by a driver turning across two lane traffic flow is 5 seconds. Because this situation would involve vehicles towing trailers an appropriate allowance would be 6 seconds. Table 4.1 below indicates the approximate number of suitable gaps that would be available for different southbound traffic volumes on Foreshore Road.

Table 4.1 – Right Turn Gaps Available For Different Southbound Traffic Volumes on Foreshore Road

Foreshore Road Volume (veh/hr)	Number of Right Turn Gaps Available in Hour
100	800
200	700
300	600
400	550
500	500
600	425
700	375
800	325
900	300
1000	275
1200	250
1400	175
1600	100
1800	75
2000	50

The gaps indicated in Table 4.1 are based on a statistical analysis assuming random traffic flow. In practice, traffic signals provided for the second port access road would cause platooned rather than random traffic flow. Consequently right turn opportunities would be greater than stated, as bunched traffic caused by red and green periods at traffic signals leaves longer gaps between platoons of vehicles.

Based on the distribution of boat ramp users discussed above, at most 50 per cent of vehicles would turn right in or out of the access. Assuming this, Table 4.2 compares the number of gaps in the southbound traffic stream of Foreshore Road (based on random traffic flows) for the future traffic volumes presented in Table 3.3, with the likely right turn demand. The demand is indicated for the busiest hour surveyed for either weekday or weekend/public holidays.

Table 4.2 – Comparison of Right Turn Entry Demand with Available Gaps For Future Situation

	Weekday		Weekend/Public Holiday	
Hour Starting	Demand	Gaps	Demand	Gaps
5:00	9	350	15	800
6:00	7	50	12	400
7:00	4	50	6	400
8:00	3	10	6	400
9:00	2	100	7	350
10:00	3	250	7	325
11:00	4	225	5	280
12:00	3	260	4	280
13:00	2	240	7	290
14:00	2	225	4	290
15:00	3	260	6	375
16:00	3	275	5	330
17:00	3	270	2	325
18:00	1	325	2	435

Table 4.2 indicates that on weekends the right turn entry demand would typically represent only about two per cent of capacity for these movements.

Thus on these peak usage days there would be a very generous excess of capacity and very little delay to vehicles turning right into the boat ramp access.

On weekdays the number of right turn entry opportunities in future would reduce to less than one per minute during the period 6:00 to 9:00 am. The table indicates that the greatest limitation would occur between 8:00 and 9:00 am, when there would theoretically only be about 10 gaps per hour. As indicated above, traffic signals at the new port access road would bunch traffic such that at least one or two vehicles would be able to turn right each signal cycle. With the signals likely to be set at a maximum length of about two minutes per cycle, there would be at least 30 right turn opportunities per hour.

With demands for only 3 to 7 right turn entry movements per hour during the critical weekday morning peak period the situation would also be acceptable.

Right Turn Exit

As indicated on Figure 4, if a right turn exit was provided it would be necessary to give this a "seagull" configuration with a northbound acceleration lane in the median of Foreshore Road. This would allow right turn exit movements to be made in stages, with first a crossing movement over the southbound traffic stream and then a merge with the northbound traffic stream. The critical constraint would be the movement across the southbound traffic stream, as this would need to use the same gaps as right turn entry traffic if both movements were allowed.

To assess the effects of combined entry/exit movements it was assumed that exit movements would mirror entry movements with a lag of 6 hours. Table 4.3 presents the resultant analysis for both right turn entry/exit movements using the same gaps in the southbound traffic stream of Foreshore Road.

Table 4.3 – Comparison of Combined Right Turn Entry/Exit Demand with Available Gaps For Future Situation

	Weekday		Weekday/Public Holiday	
Hour Starting	**Demand**	**Gaps**	**Demand**	**Gaps**
5:00	9	350	15	800
6:00	7	50	12	400
7:00	4	25	6	400
8:00	3	10	6	400
9:00	2	100	7	350
10:00	3	250	7	325
11:00	13	225	20	280
12:00	10	260	16	280
13:00	6	240	13	290
14:00	4	225	10	290
15:00	5	260	13	375
16:00	6	275	12	330
17:00	7	270	7	325
18:00	4	325	6	435

Table 4.3 indicates that because there would be negligible right turn exit movements during the critical weekday morning peak period, there would be sufficient gaps throughout the day to allow both right turn entry and right turn exit movements.

A final consideration in relation to right turn exits is that after turning right and merging from the median acceleration lane into the right hand northbound lane of Foreshore Road, some drivers would seek to weave across to the left hand lane to turn left into Botany Road. A length of over one kilometre would be available for such a lane change after the merge and hence this would not be a problem.

Thus because the boat ramp traffic generation would be comparatively very low, there would be adequate capacity to allow both right and left turn access movements to/from a direct boat ramp access road.

5. Discussion and Conclusions

It is concluded that there would be significant drawbacks from a land sterilisation and port security perspective of providing boat ramp entry and exit from a new port access road. For the most likely layout there would also be operational problems as a separation of only 50m between a boat ramp access intersection and the Foreshore Road intersection would at times lead to queue interference with the boat ramp access intersection. There would also be minimal forewarning available for persons needing to turn right into the boat ramp access road after turning into the new port access road. Moreover, the necessary phasing of construction work of the new port facility would dictate that this access may not be available during the construction period which is about 3 years.

These problems could be mitigated by moving the boat ramp access intersection further from Foreshore Road. To the extent that this happened it would further sterilise port land which would not be desirable given costs involved in its reclamation.

The analysis in this report indicates that provision of direct access to a boat ramp from Foreshore Road is both physically and operationally feasible. The only potential concern would be for right turns during the period 6:00 to 9:00 am on weekdays, at which time heavy southbound traffic flows on Foreshore Road would allow only a small number of right turn movements.

At this time there would generally only be right turn entry movements. However, to promote safety it would be prudent nevertheless to actually prohibit right turn exit movements during this period.

Thus it is concluded that direct access to Foreshore Road from the boat ramp would be acceptable subject to:

- provision of a "seagull" type intersection as indicated on Figure 4;
- design of the intersection to fully accord with the RTA's *Road Design Guide*; and
- prohibition of right turn exit movements during the period 6:00 to 9:00 0am on weekdays.

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Figure 1
Location Plan

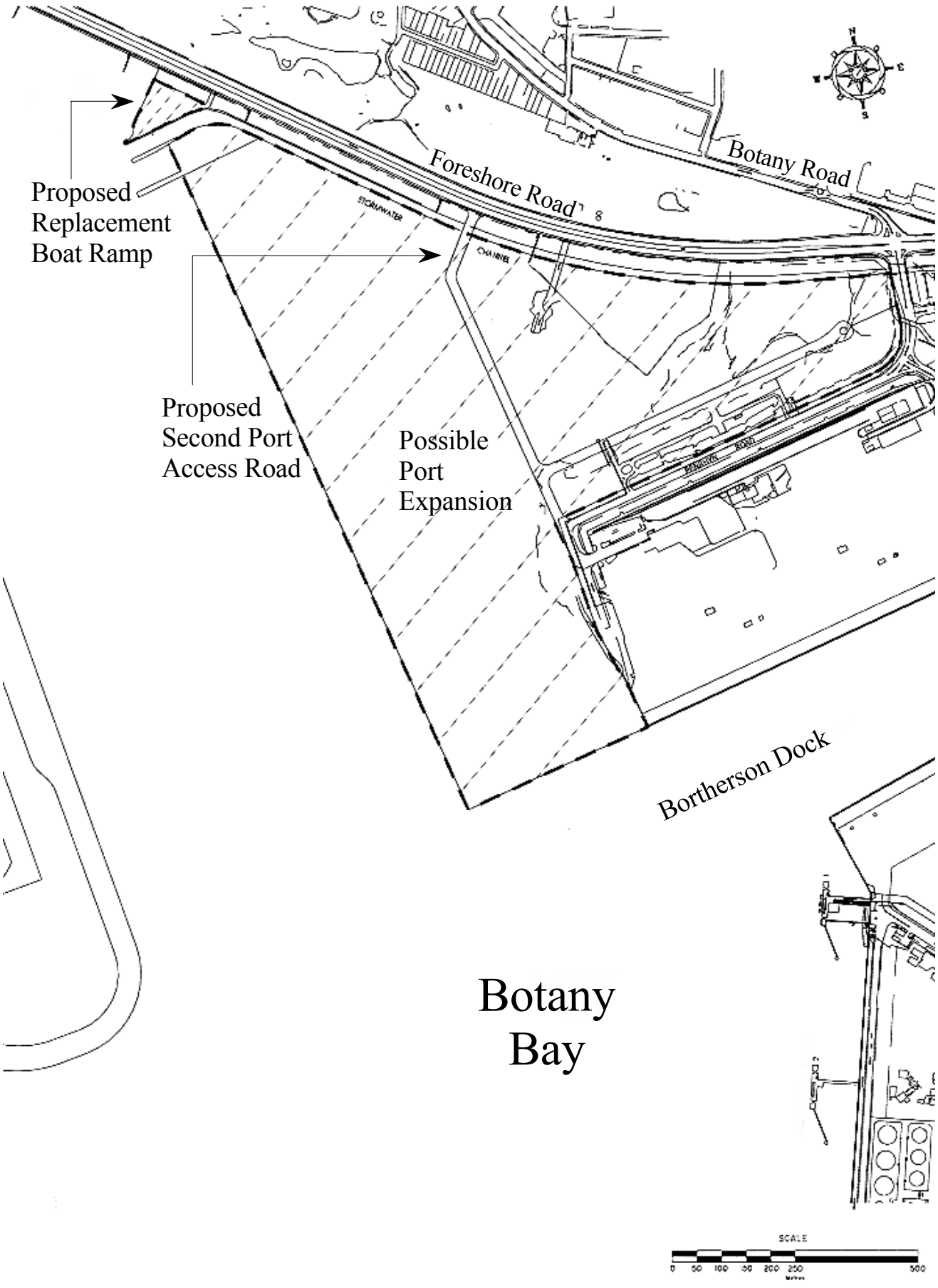

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Figure 2
Potential Western Expansion of Port Botany

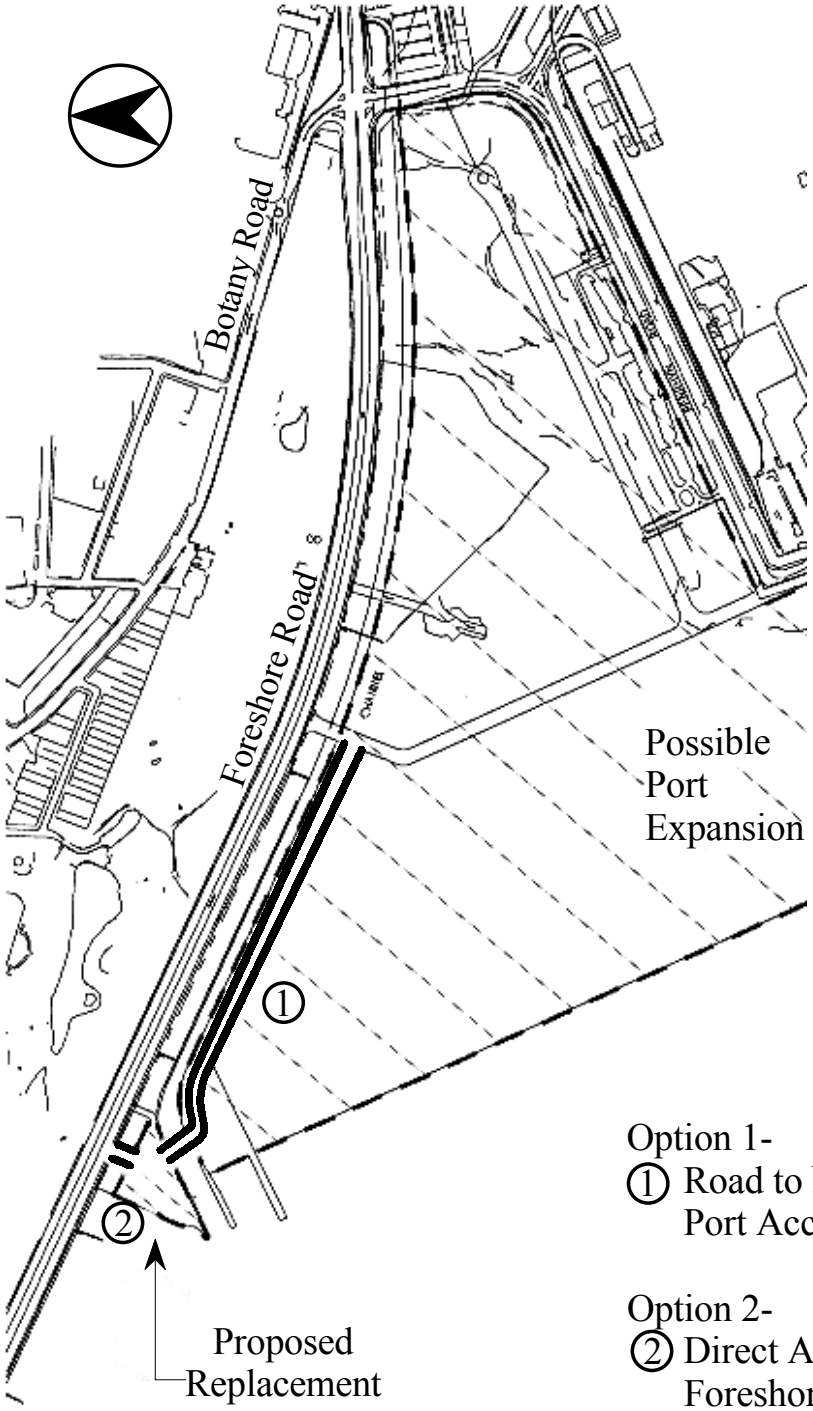

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Figure 3
Potential Boat Ramp Access Options

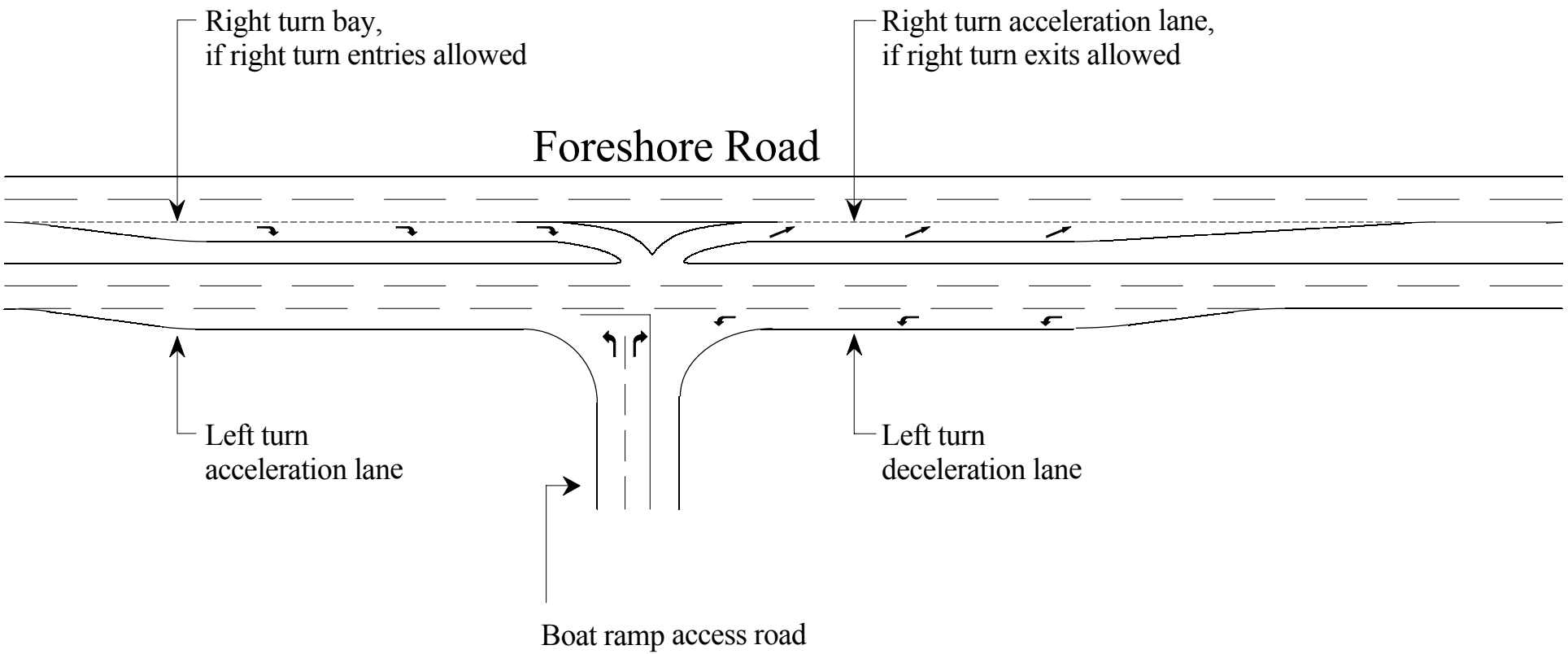

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Figure 4
Possible Direct Access Intersection With Forseshore Road