Appendix D

Technical Note 1
Strategic Freight Demand

SIMTA

SYDNEY INTERMODAL TERMINAL ALLIANCE

Part 3A Concept Plan Application

Traffic and Transport

August 2011

SYDNEY INTERMODAL TERMINAL ALLIANCE (SIMTA)

MOOREBANK INTERMODAL TERMINAL FACILITY (MITF)

Technical Note 1

Strategic Freight Demand

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SYDNEY INTERMODAL TERMINAL ALLIANCE (SIMTA)

MOOREBANK INTERMODAL TERMINAL FACILITY (MITF)

TECHNICAL NOTE 1

STRATEGIC FREIGHT DEMAND

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REVISIONS

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CONTENTS

1 INTRODUCTION

Hyder has prepared this technical note to determine the overall movement of container trucks to/from Port Botany and other intermodal terminals with and without SIMTA.

1.1 BACKGROUND

The Sydney Intermodal Terminal Alliance (SIMTA) is a joint venture between Stockland, Qube Logistics and QR National. The SIMTA Moorebank Intermodal Terminal Facility (SIMTA proposal) is proposed to be located on the land parcel currently occupied by the Defence National Storage and Distribution Centre (DNSDC) on Moorebank Avenue, Moorebank, south west of Sydney. SIMTA proposes to develop the DNSDC site into an intermodal terminal facility and warehouse/distribution facility, which will offer container storage and warehousing solutions with direct rail access

The SIMTA site, approximately 83 hectares in area, is currently operating as a Defence storage and distribution centre. The SIMTA site is legally identified as Lot 1 in DP1048263 and zoned as General Industrial under Liverpool City Council LEP 2008.

The parcels of land to the south and south west that would be utilised for a proposed rail link are referred to as the rail corridor. The proposed rail corridor covers approximately 65 hectares and adjoins the Main Southern Railway to the north. Existing land use includes vacant land, golf course, extractive industries, and a waste disposal depot.

The SIMTA site is located in the Liverpool Local Government Area. It is 27 kilometres west of the Sydney CBD, 16 kilometres south of the Parramatta CBD, five kilometres east of the M5/M7 Interchange, two kilometres from the main north-south rail line and future Southern Sydney Freight Line, and 600 metres from the M5 motorway.

Figure 1-1 shows the SIMTA proposal in the context of road and rail network.

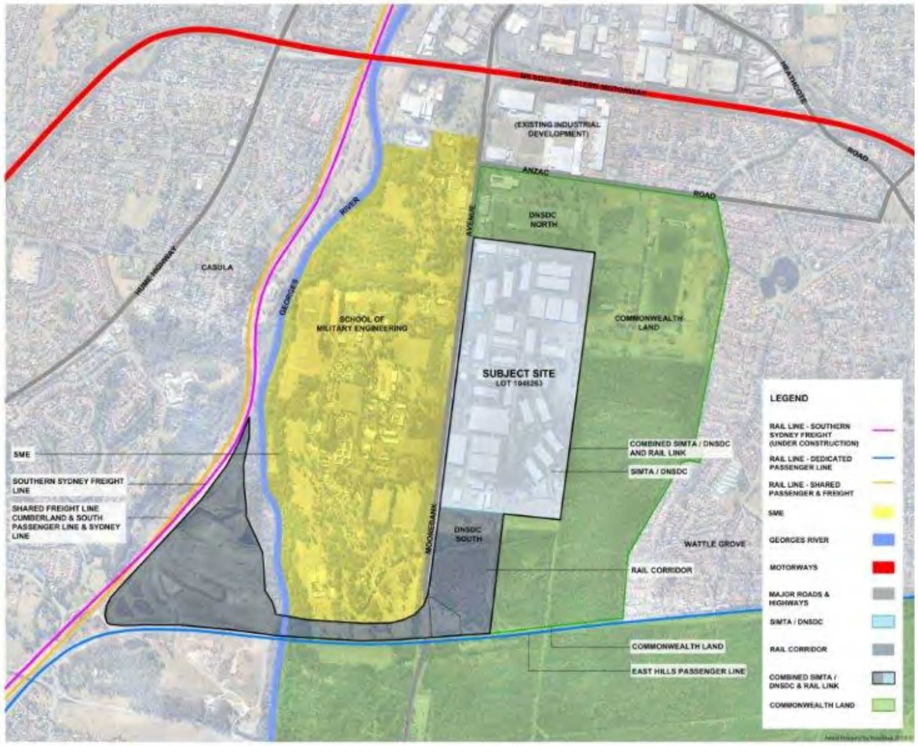


Figure 1-1 Moorebank Intermodal Terminal Site

The SIMTA proposal comprises the following key components:

- **Rail Link** – connecting the SIMTA site with the Southern Sydney Freight Line. The detailed design of the rail infrastructure comprising the rail link will be subject to a further application and approval process.
- **Intermodal Terminal** – proposed to include on-site freight rail sidings to accommodate local freight trains to Port Botany. Containerised import freight will arrive from Port Botany by rail and be transported to the warehouse and distribution facilities within the SIMTA site, or be directly loaded on to trucks for transport to warehouses and nearby logistics centres. Exports and empty freight containers will be transported to the facility by truck and then loaded onto rail for transport back to Port Botany. The terminal is expected to contain four rail sidings, with areas for container handling and storage, and is anticipated to have the capacity to handle a throughput of up to 1 million twenty foot equivalent units (TEUs) per annum.
- **Empty Container Storage** – will be provided within the site. Empty containers would either be packed on-site ready for transport to the port by rail, or trucked to off-site locations where they would be packed and returned to the SIMTA site to be loaded onto rail and transported to the port.
- **Warehouse and Distribution Facilities** – with approximately 300,000m2 of warehouses and ancillary offices will be constructed to the east of the intermodal terminal. These buildings are proposed to be constructed in stages in response to site servicing availability and market demands. It is expected that warehouses will range in size, depending on tenant needs.
- **Freight Village** – approximately 8,000m2 of support services will be provided on site. These may include site management and security offices, meeting rooms, driver facilities and convenience retail and business services.

The project will be undertaken as a staged development and it is intended that an overall Master Plan, for the entire site, be undertaken for the purpose of applying for Concept Plan approval under Part 3A of the Environmental Planning and Assessment Act 1979.

1.2 PURPOSE OF TECHNICAL NOTE 1

This technical note has been prepared to assist in addressing issues raised in the Director General's Requirements, particularly in regard to the container supply chain, both for import and export containers. This supply chain evaluation includes:

- demonstrating the overall market for the facility in the context of anticipated market growth and competing supply chains, and hence the catchment area expected to be served by the IMT
- quantifying the movement of containers by rail between the IMT and Port Botany
- quantifying the movement of containers by truck between the IMT and its regional customer base and defining the demand in a format suitable for use in the strategic traffic model (see Appendix E in Volume 2 of Hyder's Main Traffic Report), and
- describing the movements of containers once they are unpacked, designated for export either as empty export or full export containers, with inputs suitable for traffic modelling as for import containers.

The quantification of the metropolitan container market has been controlled by the anticipated growth in trade through Port Botany. The location of container receival within the metropolitan area is somewhat more complex to define as it will be subject to many factors which are not fully established at this time, including:

- the location and capacity of as yet unplanned intermodal facilities
- the timing and capacity of transport infrastructure improvements (both road and rail) which would influence industry's locational decision.

In particular, the potential quantum of the shift in container unpacking and packing activities away from its current "home" in relatively close proximity to the port into western Sydney is not well quantified. It will certainly be influenced by the growth in intermodal terminals and rail services that will be essential to attract container traffic away from road transport and onto rail transport. The degree of this impact is yet to be established.

However, the primary purpose of this note is to derive a reasonable (and potentially conservative) estimate of the catchment that would be served by the SIMTA IMT. The assumption of no marked redistribution of the containers end market within Sydney will have no impact on the total throughput of the facility. The facility's road distribution catchment will be largest if the west and south west market share remains as it is today. If more containers are attracted into the western suburbs, for the same throughput the SIMTA catchment would contract.

Therefore, the assumption that container distribution follows current patterns has been made throughout this report and is considered to provide a conservative outcome in terms of the extent of road based traffic.

2 OVERVIEW OF ANALYSIS

1. The first step is to quantify the total container task, that is, estimates of all containers moved through Port Botany, both historically and in forecast years for import and export containers.

2. Determine the distribution of import container unpacking across the metropolitan area for base year and forecast years

   a. All forecast years are based on the most recently published survey data from March 2000, adjusted to match forecast changes in several key employment types

   b. Calculate the number of TEUs attracted to each small area within Sydney (strategic modelling travel zones – TZs) for 2016 and 2025 (including the planned level of unpacking activity at SIMTA)

3. Calculate the cost of the TEU supply chain between Port Botany and each TZ, for each possible supply chain option, by rail and road via each existing or planned IMT or direct from Port Botany by road

4. Determine the catchment area of each IMT assuming that each IMT has unconstrained capacity (the "natural" catchment) and of the residual direct road haul from Port Botany based on the least-cost supply chain

5. Apply IMT capacity capping, reallocating TEUs to the next most efficient supply chain, iterating until no IMT exceeds its notional capacity

6. On the basis of the above, determine the catchment that is served by SIMTA (and each other IMT) in 2016 (notionally SIMTA at 750000 TEU) and 2025 (SIMTA at full capacity). These two years are chosen to be consistent with external sources of forecast data (Sydney Strategic Model forecast years and Port Botany forecast horizon). The application to SIMTA is equally applicable to alternative future years when testing localised impacts.

7. Determine the distribution of container truck movements within the SIMTA catchment as input into detailed traffic engineering evaluation of the project

8. Determine the overall movement of container trucks to/from Port Botany and other IMTs without and with SIMTA as input into metropolitan-wide project impacts.

This report documents the key steps outlined above.

3 BACKGROUND ASSUMPTIONS

3.1 PORT BOTANY GROWTH PROFILE

Sources of information for current and future container movements through Port Botany are:

- Sydney Ports Annual Reports,
- Sydney Ports, ***Metropolitan Sydney International Container Origin/Destination Analysis,*** August 2000
- Sydney Ports Corporation***, Port Freight Logistics Plan A framework to improve road and rail performance at Port Botany*** June 2008

- Freight Infrastructure Advisory Board, Railing Port Botany's Containers July 2005[1]
- SKM***, Intermodal Logistics Centre at Enfield ENVIRONMENTAL ASSESSMENT,*** October 2005, Sections 3 and 8
- Booz and Co for NTC, ***Capacity Constraints & Supply Chain Performance – Intermodal Working Paper #1 – Understanding the Intermodal supply chain***, January 2008

All historical and current data is tabulated over in Table 3-1 and graphed below in Figure 3-2.

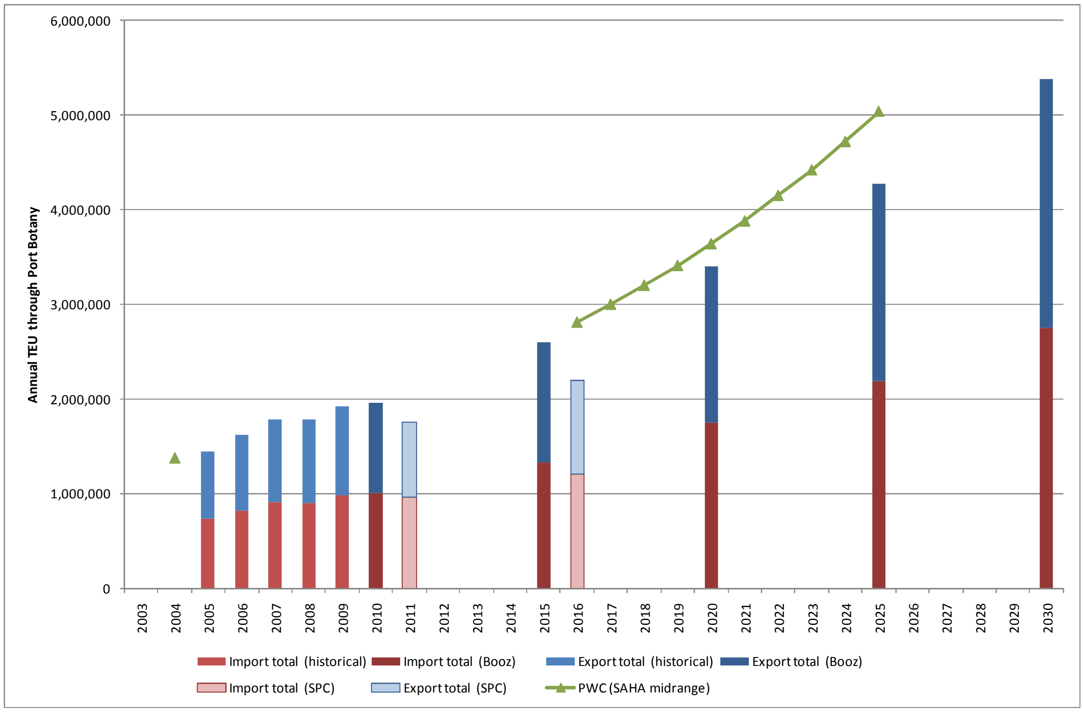


Figure 3-2 Historical and projected containers through Port Botany

[1] http://www.planning.nsw.gov.au/plansforaction/pdf/fiab_report.pdf

Table 3-1 Port Container Projections – all sources

Year	Import + Export				Import total		Export			
	Historical (SPC)	Enfield EA (2005) and SPC (2008)	PWC (SAHA midrange)	Booz	Total (SPC)	Import total (Booz)	Full	MT	Total (SPC)	Total (Booz)
2003										
2004	1,376,239									
2005	1,445,318	1,300,000			740,014		344,924	360,380	705,304	
2006	1,620,114				819,218		369,622	431,281	800,903	
2007	1,778,370				906,519		385,079	486,772	871,851	
2008	1,784,017				902,310		442,426	439,058	881,484	
2009	1,927,507				976,215		442,567	508,725	951,292	
2010				1,956,000		1,002,000				954,100
2011		1,750,000			962,500		356,760	430,740	787,500	
2012										
2013										
2014										
2015				2,593,000		1,328,000				1,265,000
2016		2,200,000	2,810,000		1,210,000		448,498	541,502	990,000	
2017			3,000,000							
2018			3,200,000							
2019			3,410,000							
2020			3,640,000	3,403,000		1,743,000				1,660,000
2021		2,600,000	3,880,000							
2022			4,150,000							
2023			4,420,000							
2024			4,720,000							
2025		3,200,000	5,040,000	4,278,000		2,191,000				2,087,000
2026										
2027										
2028										
2029										
2030				5,377,000		2,754,000				2,623,000

Several anomalies are apparent when various forecasts are compared:

- Sydney Port's own forecasts, used in the Enfield EA, are conservatively low, with the volume forecast for 2011 being lower than observed in 2010
- Sydney Port's forecasts also appear to under-estimate the number of export containers
- The Booz forecasts appear more reasonable in following historical trends and in representing the balance between import and export containers
- The more recent forecasts used by PWC (and produced by SAHA) are slightly higher than the Booz forecasts, but also represent a reasonable trend.
- All forecasts other than those produced by SPC show demand exceeding the current level approved for Port Botany (3.2 million TEU) by about 2018.

For the purposes of estimating the distribution of containers shipping through the SIMTA proposal, the PWC forecasts have been adopted, tabulated below. As external forecasts extend only to 2025, the SIMTA forecasts are based on this year.

Table 3-2 Adopted Port Container Projection

Year	Import	Export full	Export MT	Total export	Total TEU
2004	696,000	341,000	339,000	680,000	1,376,000
2005	740,014	344,924	360,380	705,304	1,445,318
2009	976,215	442,567	508,725	951,292	1,927,507
2016	1,421,000	697,000	692,000	1,389,000	2,810,000
2017	1,517,000	744,000	738,000	1,482,000	2,999,000
2018	1,618,000	794,000	788,000	1,582,000	3,200,000
2019	1,725,000	846,000	839,000	1,685,000	3,410,000
2020	1,841,000	903,000	896,000	1,799,000	3,640,000
2021	1,962,000	962,000	955,000	1,917,000	3,879,000
2022	2,099,000	1,029,000	1,021,000	2,050,000	4,149,000
2023	2,236,000	1,096,000	1,088,000	2,184,000	4,420,000
2024	2,387,000	1,171,000	1,162,000	2,333,000	4,720,000
2025	2,549,000	1,250,000	1,241,000	2,491,000	5,040,000

The proportion of import, full export and empty export containers has been based on recent historical data which has exhibited a consistent pattern over at least five years: imports 50.6%, full exports 24.8%, empty exports 24.6%.

It is assumed that all import containers are unstuffed within the Sydney metropolitan area.

Of the full exports, about half (12% of all TEUs) are packed in the metropolitan area. The remainder are shipped to rural areas where they are stuffed and freighted directly to the point of export.

3.2 INTERMODAL TERMINALS IN SYDNEY

The market catchment for distribution of containers through an IMT is largely a function of the total cost of the container supply chain. The location and capacity of all intermodal facilities therefore influences demand in each facility (assuming that facilities operate efficiently and in a competitive environment). Current and assumed future IMTs are tabulated below.

Table 3-3 Sydney Intermodal Terminals capacity assumptions

IMT location	Notional capacity (TEU pa)	Status
Camellia		closed
Yennora	170,000	
Villawood	80,000	
Minto	150,000	
Enfield	300,000	Approved capacity, terminal under construction, expected to be fully operational by 2012
SIMTA/Moorebank	1,000,000	Notional capacity of the Moorebank facility
Western Sydney		Location, capacity and timing are uncommitted. Additional IMT capacity will be necessary somewhere in western Sydney in order to meet the 40% rail mode share target should Port Botany obtain approval to move more than the current plan for 3.2million TEU pa.

4 CONTAINER DISTRIBUTION WITHIN SYDNEY AND BEYOND

4.1 BASE YEAR DISTRIBUTION

The most recent data on the distribution of container activity within the Sydney metropolitan area is now quite dated, being based on a survey undertaken in March 2000. The survey sampled full container movements by road between the port and unpacking locations and between metropolitan packing locations and the port. The survey represented about 25% of container road movements.

At the time of the survey, about 22% of containers moved by rail, of which 40% was destined for Sydney. No information is available on the distribution of these railed containers.

Additionally, the survey included containers moved through Port Jackson and reported their destinations separately from Port Botany movements. As Port Jackson no longer handles containers, the distribution for Botany and Port Jackson combined has been used as input into the analysis, tabulated below.

Table 4-4 Container distribution from 2000 port OD survey

Reporting area[2]	% of metropolitan containers to/from region		
	Import	Export	All
Botany	14.1	39.5	21.8
City and East	0.3		0.2
South Sydney	6.1	8.8	6.9
Southern Suburbs	1.2	0.7	1.1
North Shore	4.7	0.6	3.4
NW Sydney	1.3	1.4	1.4
Inner West	10.2	12.9	11
Central West	20	9.1	16.7
Industrial West	13.2	4.2	10.4
Blacktown	10.8	3.8	8.6
Penrith	3.2	0.4	2.4
Liverpool	8.7	1.8	6.6
South West	6.2	16.8	9.5
TOTAL	100	100	100

Note: Regions exclude some outer SLAs

The survey documented which SLAs are within each area but did not provide data for individual SLAs

4.2 FUTURE YEAR CONTAINER DISTRIBUTION

The precise future distribution of import and export containers within the metropolitan area will be determined by a complex series of factors, including the market's response to transport policy and the provision of port supply chain infrastructure.

Sydney's employment distribution is changing, with a distinct shift westwards as a consequence of population growth. A shift in the focus of employment opportunities could be sufficient to attract more container packing and unpacking in the western suburbs; intermodal movement of containers can support and reinforce this shift.

The precise distribution of container activity observed in 2000 will not prevail into the future. However, the extent to which a westwards shift will occur is unable to be quantified as all external market forces are not fully understood.

The process undertaken for the purposes of estimating the catchment and truck patterns to and from the SIMTA terminal is somewhat simplified, taking into account the current forecasts of changing employment types in Sydney, without considering any further attraction that may occur as a result of changes in the intermodal delivery system.

[2] Reporting areas are those used to document the Sydney Ports Container Survey, March 2000. See Appendix A for details.

In summary:

- Port commodities 2006/7 (latest year of detailed data) allocated to first level ANZSIC categories of the receiving industry (manufacturing, wholesale, warehousing) to determine the proportion of containers destined for each of the three major employment categories (see Table 4-5)
- On average, 59% of container tonnages are calculated to be destined for manufacturing employment, 28% wholesale and 12% warehousing.
- In order to derive regional distribution factors, volumes were allocated to each SLA according to the number of jobs in each category (from the 2006 Census).
- Volumes were then re-weighted on a regional basis to match the 2000 container survey destination pattern.
- This reweighting resulted in a set of "container attraction rates" based on employment type and varying by region within Sydney. These rates are proxies for proximity to the port, the efficiency of transport links and the nature of regional employment.
- As employment is expected to grow non-uniformly across the metropolitan area, these factors were then used to estimate the percentage of import containers that would be destined for each SLA in forecast years, with a summary of the container distribution shown in Table 4-6 below.

Table 4-5 Current containerised import commodities

Import commodity	Tonnes (2006/07)	% of import commodities	% of commodity consumed by local employment type		
			Manufacturing	Wholesale	Warehousing
Machinery & Transport Equipment	1,045,639	15%	80%	20%	
Miscellaneous Manufactured Articles	1,096,033	15%		100%	
Chemicals	1,167,173	16%	80%		20%
Paper & Paper Products	920,665	13%	50%	50%	
Textile Fabrics & Yarns	266,018	4%	80%		20%
Non-metallic Minerals	314,534	4%	100%		
Food Preparations	387,364	5%	60%		40%
Iron & Steel	291,583	4%	80%		20%
Beverages & Tobacco	228,148	3%	60%		40%
Timber	150,485	2%	80%		20%
Other	1,315,044	18%	60%	20%	20%
TOTAL	7,182,686	100%	4,269,919	2,028,502	884,265
			59%	28%	12%

Table 4-6 Forecast import container distribution

Reporting area	% import containers			% export containers		
	2006	2006	2016	2006	2006	2016
Botany	14.1%	14.2%	13.6%	39.5%	38.6%	37.1%
City and East	0.3%	0.3%	0.3%	0.0%	0.0%	0.0%
South Sydney	6.1%	6.3%	6.3%	8.8%	8.7%	8.3%
Southern Suburbs	1.2%	1.1%	1.0%	0.7%	0.7%	0.6%
North Shore	4.7%	4.4%	4.1%	0.6%	0.6%	0.5%
NW Sydney	1.3%	1.2%	1.1%	1.4%	1.3%	1.3%
Inner West	10.2%	9.4%	8.6%	12.9%	12.2%	11.4%
Central West	20.0%	18.8%	18.0%	9.1%	8.6%	8.2%
Industrial West	13.2%	13.3%	13.2%	4.2%	4.5%	4.7%
Blacktown	10.8%	11.5%	12.3%	3.8%	4.6%	5.6%
Penrith	3.2%	3.5%	3.7%	0.4%	0.5%	0.6%
Liverpool	8.7%	9.1%	9.6%	1.8%	1.9%	2.0%
South West	6.2%	7.0%	8.1%	16.8%	17.7%	19.7%
TOTAL	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Adopting the assumption that container distribution will be a function of the redistribution of jobs, the change in employment contained in current government forecasts does not result in a major skewing of the distribution of container destinations within metropolitan Sydney. The south west and outer west regions could grow their share of the import container market from 18% to about 21% with a decline in the inner west and port precinct.

Using the same analytic approach, full export containers follow a similar pattern in terms of a slight growth in the south west and outer west regions at the expense of slight contraction in inner area. However, with a higher number of import containers able to be made available in the western suburbs and with cost- and time- competitive rail options emerging, it is highly likely that Botany’s key role in container packing will diminish significantly in future years. The movement of export containers is discussed later in this report.

As outlined in the introductory section of the Technical Note, the assumptions regarding the distribution of containers produces a conservative outcome in terms of the overall extent of truck movements within the catchment area of the SIMTA IMT.

4.3 FUTURE YEAR CONTAINER VOLUMES WITHIN METROPOLITAN SYDNEY

The above section outlines the overall proportion of container origins and destinations on a regional basis. In order to fully evaluate container movements at SIMTA, estimates were then derived of demand for containers at a fine geographic level using the modelling standard Travel Zones (TZs). TZs aggregate neatly into Statistical Local Areas (SLAs) which are reported in this and subsequent sections. Information at the finer TZ level has been produced as input into the regional traffic modelling.

In order to allocate containers to SLAs and TZs within each region, the regional demand was apportioned based on the small area employment forecasts produced by the Bureau of Transport Statistics. These forecasts measure blue collar, white collar and retail employment. To allocate containers, industrial (blue collar) employment was selected as the most appropriate available forecast variable against which to measure container activity.

Table 4-7 below summarises total annual import container demand by reporting areas and the same information is shown graphically on Figure 4-3. Details by SLA are tabulated in Appendix 1. The full analysis for SIMTA has been undertaken at the very fine geographic level of TZ, which are too numerous to report herein.

Table 4-7 Import container forecasts by reporting region

Reporting area	Annual import containers (TEU)		
	2006	2016	2025
Botany	115,510	187,334	320,335
City and East	2,458	3,691	6,207
South Sydney	49,972	83,733	148,901
Southern Suburbs	9,831	14,316	23,386
North Shore	38,503	57,711	95,791
NW Sydney	10,650	15,734	26,560
Inner West	83,560	123,533	201,674
Central West	163,844	248,045	422,296
Industrial West	108,137	175,373	310,801
Blacktown	88,476	151,945	289,613
Penrith	26,215	45,706	87,685
Liverpool	71,272	220,827	424,479
South West	50,792	93,052	191,272
Grand Total	819,218	1,421,000	2,549,000

Note: Liverpool for 2016 and 2025 includes planned unpacking and warehouse activity on the SIMTA site, which is additional to the growth in containers derived from general employment growth.

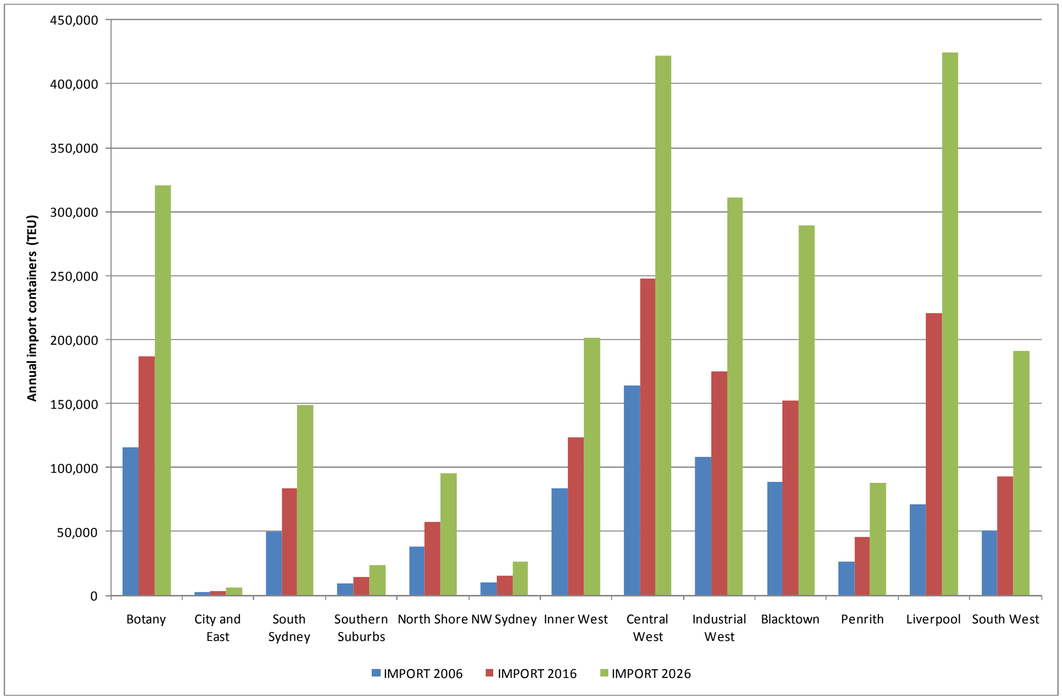


Figure 4-3 Import container forecasts by reporting region

5 INTERMODAL TERMINAL CATCHMENTS

The catchment area that will be served by SIMTA and other IMTs is a function of two factors:

- the demand for containers in each sub-region of the metropolitan area and
- the competing supply chains that serve the market.

This section outlines how the future catchment area for SIMTA has been estimated in the context of not only the total container market but the competing supply chains that are expected to be in place to service that market. These supply chains include all transport options between the port and the importer, the return of the empty container and the ensuing movement of containers to be packed for export.

For simplicity, the import supply chain is modelled in detail. The export supply chain, although it will differ slightly due to serving a different set of clients, is assumed to mirror the import supply chain operating through SIMTA.

A diagrammatic representation of the import-export container supply chain is shown in Figure 5-4 below.

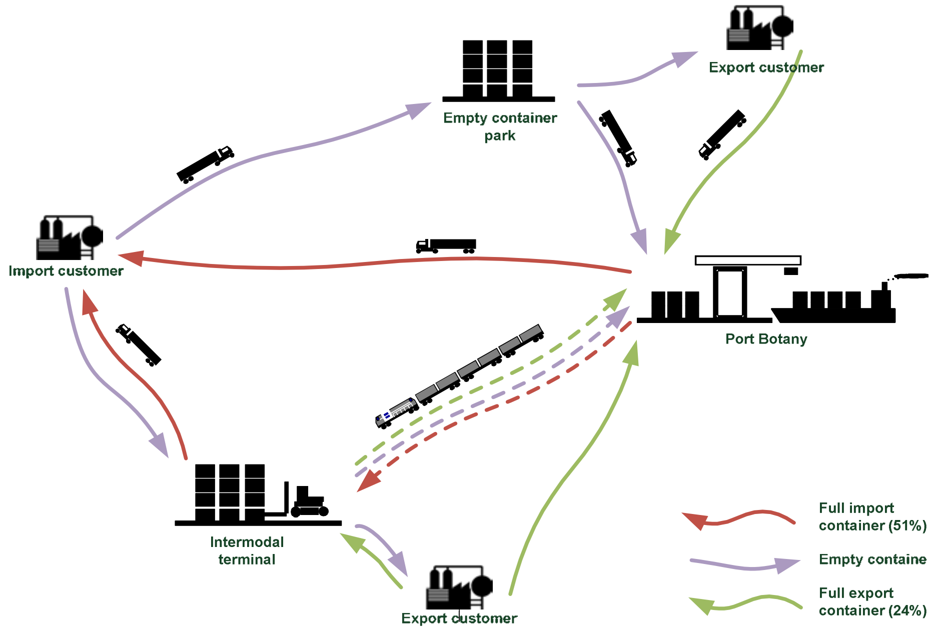


Figure 5-4 Container supply chain diagram

The price structure for import container movements generally incorporates the cost of repositioning the empty container to the container park nominated by the shipping company that owns the container. It has the following key elements:

Table 5-8 Alternative supply chains

Container movement (notional market share)	IMT supply chain		Direct road supply chain
	MT to IMT	MT to container park	Mt to container park
Full import containers (51%)	Load at port	Load at port	Load at port
	Rail to IMT	Rail to IMT	Truck direct to unpacking location (import customer)
	Transfer to truck	Transfer to truck	
	Truck to unpacking location (import customer)	Truck to unpacking location (import customer)	
	Unload and unpack	Unload and unpack	Unload and unpack
Empty import container (51%)	Load onto truck	Load onto truck	Load onto truck
	Truck to IMT	Truck to empty container park	Truck to empty container park
Empty export container (25%)	Hold at IMT (normally short duration)	Hold at empty container park	Hold at empty container park
	Rail to port (in mixed run with full export containers)	Truck to port (normally as a bulk run)	Truck to port (normally as a bulk run)
	Unload at port	Unload at port	Unload at port
Export container – empty to exporter (24%)	Transfer to truck	Transfer to truck	Transfer to truck
	Truck to packing location (export customer)	Truck to packing location (export customer)	Truck to packing location (export customer)
	Unload and pack	Unload and pack	Unload and pack
Full export container (24%)	Truck to IMT		
	Transfer to rail		
	Rail to port	Truck to port	Truck to port
	Unload at port	Unload at port	Unload at port

Shaded activities are included in supply chain cost model.

5.1 SUPPLY CHAIN MODEL OVERVIEW

The supply chain is a competing set of options which includes direct trucking and railing via a choice of intermodal terminals. For strategic planning purposes, several simplifying assumptions were made regarding the choice of supply chain:

- in the long term, it is assumed that the choice of supply chain will be based purely on lowest cost
- direct road haulage to/from the port will only occur within the catchment for which it is the most cost competitive compared to rail
- intermodal terminals are each assumed to serve a discrete catchment, whereas in reality there would be a degree of overlap between the catchments of each terminal driven by commercial arrangements
- all intermodal terminals would, in the long-term, operate on a similar, efficient rail and road cost basis.

The catchment that is served by each IMT has been derived using a competitive haulage cost model, based on the cost of serving each travel zone (TZ) as follows:

- the cost of hauling a full import and empty export container was calculated between Port Botany and each TZ within the metropolitan area
- candidate supply chains included direct road as well as rail to an IMT and road haulage to the unpack location
- IMTs included in the model were each current and approved IMT, plus SIMTA/Moorebank and a notional western suburbs terminal in the Eastern Creek area was introduced for the last year of the forecast (2025).

This process defined the geographic area that would, in theory, be served by each IMT, disregarding any capacity constraints within the system.

In a second stage, the model then took account of the maximum throughput of each IMT. Using the forecast regional container demand documented in Section 4.3, the total uncapped demand for each IMT was derived for each forecast year.

Any demand in excess of the capacity of each IMT was redirected to the next most cost-effective supply chain. The locations that would be affected by the diversion were those closest to the boundary between the over-capacity IMT and the next best alternative.

The choice of supply chain forecast years is determined by other data used in the forecasts. In particular, the Sydney Ports trade forecasts extend only as far as 2025, at which time a total of over 5 million TEU is forecast. This year has been chosen to represent the situation in which SIMTA would operate at full capacity. The entire container supply chain, including planned and future IMTs and port throughput, is needed to determine IMT catchment boundaries. The resultant catchment served by SIMTA is valid for use in traffic impact analysis, notionally based on a forecast year of 2031.

5.2 RESULTING IMT CATCHMENTS

The catchments that would be served by each location in the Container supply chain are documented in this section of the report for the forecast years 2016 and 2025 (which notionally represents the year at which SIMTA would operate at full capacity). The values for 2025 have been applied to evaluate the road network impacts of SIMTA through to 2031.

Several key assumptions are repeated here to provide context for interpreting the forecasts:

- The total number of containers through Port Botany is assumed to be 2.81 million and 5.04 million in 2016 and 2025 respectively (see Section 3.1)
- The analysis has been based on estimating the destination of all ***import*** containers, which total approximately half of the total Port Botany throughput. Conversion to truck movements is undertaken as a final stage in the analysis.
- By 2025, the total capacity of current and known IMTs would be exceeded and it is assumed that an additional facility will be operating in the Eastern Creek area. The precise location of this facility is not determined, nor is it a committed project. However, if it is not in operation, then either current IMT's would need to have their capacity increased, or more deliveries would be made by road direct from Port Botany in order to achieve the NSW government's mode share target of 40% container movements on rail.

IMT Catchment Outcomes

In this section, the results of catchment analysis are presented for two forecast years, 2016 and 2025, with four scenarios built up from two components:

- Without and with SIMTA, which demonstrates the impact of SIMTA, the key purpose of this analysis.
- Whether or not each IMT is subject to a cap on its capacity. No capacity constraint demonstrates the "natural" least cost options for servicing the metropolitan area, but is not a realistic scenario. Restricting the throughput of each IMT has the effect of redefining catchments or forcing direct service from the port by road. The latter (capacity constrained) values have been used in the SIMTA project evaluation.

Results of the forecasting are presented as follows:

- Firstly, a summary of the total import TEU assumed to pass through each metropolitan IMT for the forecast years 2016 and 2025 (Table 5-9)
- This table is followed by a more detailed quantification description of each of the four scenarios which includes regional TEU totals assumed to be served by each supply chain, using the Port Botany container survey regions (Table 5-10 and Table 5-11)
- Then follows detailed catchment maps for each of the four scenarios and the two forecast years (Figure 5-5 and Figure 5-6).
- Commentary on the forecasts follows the maps.

Table 5-9 Overall IMT throughputs – summary values

Year	IMT constraint	With /without SIMTA	Pt Botany	Villawood	Yennora	Minto	Enfield	SIMTA	Eastern Ck	Total
2016	N	N	**638**	**6**	**451**	**97**	**229**			**1,422**
			45%	0%	32%	7%	16%			100%
		Y	**462**	**6**	**330**	**25**	**229**	**371**		**1,422**
			32%	0%	23%	2%	16%	26%		100%
	Y	N	**1,030**	**41**	**99**	**98**	**152**			**1,422**
			72%	3%	7%	7%	11%			100%
		Y	**557**	**39**	**85**	**89**	**153**	**499**		**1,422**
			39%	3%	6%	6%	11%	35%		100%
2025	N	N	**1,096**	**10**	**393**	**196**	**392**		**459**	**2,548**
			43%	0%	15%	8%	15%		18%	100%
		Y	**779**	**10**	**363**	**47**	**392**	**562**	**391**	**2,548**
			31%	0%	14%	2%	15%	22%	15%	100%
	Y	N	**1,382**	**52**	**84**	**75**	**153**		**801**	**2,548**
			54%	2%	3%	3%	6%		31%	100%
		Y	**1,022**	**39**	**87**	**132**	**151**	**512**	**608**	**2,548**
			40%	2%	3%	5%	6%	20%	24%	100%

Table 5-10 Import containers – 2016 (‘000 TEU per annum)

	2016 No SIMTA, no IMT constraints							2016 with SIMTA, no IMT constraints							
	Pt Botany	**Villawood**	**Yennora**	**Minto**	**Enfield**	**SIMTA**	**Eastern Ck**	**Pt Botany**	**Villawood**	**Yennora**	**Minto**	**Enfield**	**SIMTA**	**Eastern Ck**	**Total**
Botany	187	0	0	0	0			187	0	0	0	0	0		187
City and East	4	0	0	0	0			4	0	0	0	0	0		4
South Sydney	84	0	0	0	0			84	0	0	0	0	0		84
Southern Suburbs	14	0	0	0	0			14	0	0	0	0	0		14
North Shore	55	0	0	0	3			55	0	0	0	3	0		58
NW Sydney	4	0	9	0	2			4	0	7	0	2	3		16
Inner West	67	0	0	0	57			67	0	0	0	57	0		124
Central West	47	6	28	0	167			47	6	28	0	167	0		248
Industrial West	0	0	175	0	0			0	0	167	0	0	9		175
Blacktown	0	0	152	0	0			0	0	107	0	0	45		152
Penrith	0	0	46	0	0			0	0	0	0	0	46		46
Liverpool	176	0	41	4	0			0	0	21	0	0	200		221
South West	0	0	0	93	0			0	0	0	25	0	68		93
Total	**638**	**6**	**451**	**97**	**229**			**462**	**6**	**330**	**25**	**229**	**371**		**1,422**
% of containers	**45%**	**0%**	**32%**	**7%**	**16%**			**32%**	**0%**	**23%**	**2%**	**16%**	**26%**		**100%**
	2016 No SIMTA, IMT constraints							**2016 with SIMTA, IMT constraints**							
	Pt Botany	**Villawood**	**Yennora**	**Minto**	**Enfield**	**SIMTA**	**Eastern Ck**	**Pt Botany**	**Villawood**	**Yennora**	**Minto**	**Enfield**	**SIMTA**	**Eastern Ck**	**Total**
Botany	187	0	0	0	0			187	0	0	0	0	0		187
City and East	4	0	0	0	0			4	0	0	0	0	0		4
South Sydney	84	0	0	0	0			84	0	0	0	0	0		84
Southern Suburbs	14	0	0	0	0			14	0	0	0	0	0		14
North Shore	58	0	0	0	0			58	0	0	0	0	0		58
NW Sydney	14	0	0	0	1			9	0	0	0	1	5		16
Inner West	106	0	0	0	17			89	0	0	0	35	0		124
Central West	102	12	0	0	134			80	29	22	0	117	0		248
Industrial West	63	17	95	0	0			0	0	62	0	0	113		175
Blacktown	152	0	0	0	0			32	0	1	0	0	119		152
Penrith	45	0	0	1	0			0	0	0	0	0	46		46
Liverpool	201	12	4	4	0			0	10	0	0	0	211		221
South West	0	0	0	93	0			0	0	0	89	0	5		93
Total	**1,030**	**41**	**99**	**98**	**152**			**557**	**39**	**85**	**89**	**153**	**499**		**1,422**
% of containers	**72%**	**3%**	**7%**	**7%**	**11%**			**39%**	**3%**	**6%**	**6%**	**11%**	**35%**		**100%**

Table 5-11 Import containers – 2025 (‘000 TEU per annum)

	2025 No SIMTA, no IMT constraints							2025 with SIMTA, no IMT constraints							
	Pt Botany	**Villawood**	**Yennora**	**Minto**	**Enfield**	**SIMTA**	**Eastern Ck**	**Pt Botany**	**Villawood**	**Yennora**	**Minto**	**Enfield**	**SIMTA**	**Eastern Ck**	**Total**
Botany	320	0	0	0	0		0	320	0	0	0	0	0	0	320
City and East	6	0	0	0	0		0	6	0	0	0	0	0	0	6
South Sydney	149	0	0	0	0		0	149	0	0	0	0	0	0	149
Southern Suburbs	23	0	0	0	0		0	23	0	0	0	0	0	0	23
North Shore	91	0	0	0	4		0	91	0	0	0	4	0	0	96
NW Sydney	6	0	2	0	3		14	6	0	2	0	3	0	14	26
Inner West	107	0	0	0	95		0	107	0	0	0	95	0	0	202
Central West	77	10	45	0	290		0	77	10	45	0	290	0	0	422
Industrial West	0	0	218	0	0		93	0	0	214	0	0	7	89	311
Blacktown	0	0	66	0	0		223	0	0	66	0	0	0	223	290
Penrith	0	0	0	0	0		88	0	0	0	0	0	22	65	88
Liverpool	317	0	62	5	0		41	0	0	36	0	0	389	0	424
South West	0	0	0	191	0		0	0	0	0	47	0	144	0	191
Total	**1,096**	**10**	**393**	**196**	**392**		**459**	**779**	**10**	**363**	**47**	**392**	**562**	**391**	**2,548**
% of containers	**43%**	**0%**	**15%**	**8%**	**15%**		**18%**	**31%**	**0%**	**14%**	**2%**	**15%**	**22%**	**15%**	**100%**
	2025 No SIMTA, IMT constraints							**2025 with SIMTA, IMT constraints**							
	Pt Botany	**Villawood**	**Yennora**	**Minto**	**Enfield**	**SIMTA**	**Eastern Ck**	**Pt Botany**	**Villawood**	**Yennora**	**Minto**	**Enfield**	**SIMTA**	**Eastern Ck**	**Total**
Botany	320	0	0	0	0		0	320	0	0	0	0	0	0	320
City and East	6	0	0	0	0		0	6	0	0	0	0	0	0	6
South Sydney	149	0	0	0	0		0	149	0	0	0	0	0	0	149
Southern Suburbs	23	0	0	0	0		0	23	0	0	0	0	0	0	23
North Shore	96	0	0	0	0		0	96	0	0	0	0	0	0	96
NW Sydney	10	0	0	0	0		16	9	0	1	0	1	0	16	26
Inner West	202	0	0	0	0		0	196	0	0	0	6	0	0	202
Central West	225	21	6	0	153		16	195	39	37	0	144	0	8	422
Industrial West	0	14	50	0	0		247	0	0	32	0	0	100	179	311
Blacktown	0	0	0	0	0		290	0	0	0	0	0	0	290	290
Penrith	0	0	0	0	0		88	0	0	0	0	0	0	88	88
Liverpool	319	17	28	0	0		60	28	0	17	0	0	353	27	424
South West	32	0	0	75	0		84	0	0	0	132	0	59	0	191
Total	**1,382**	**52**	**84**	**75**	**153**		**801**	**1,022**	**39**	**87**	**132**	**151**	**512**	**608**	**2,548**
% of containers	**54%**	**2%**	**3%**	**3%**	**6%**		**31%**	**40%**	**2%**	**3%**	**5%**	**6%**	**20%**	**24%**	**100%**

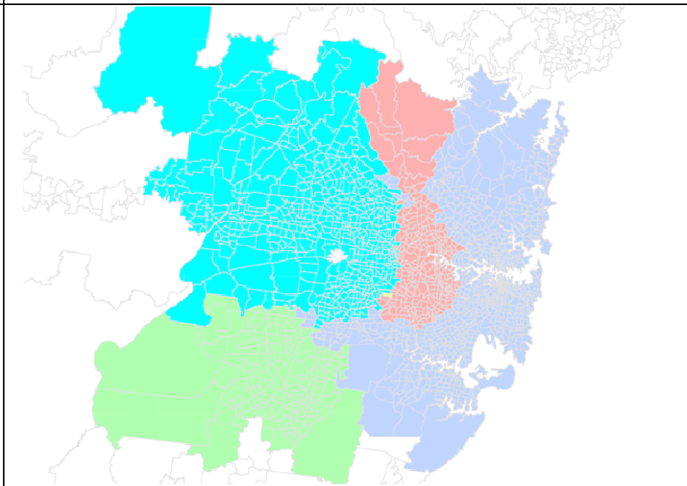
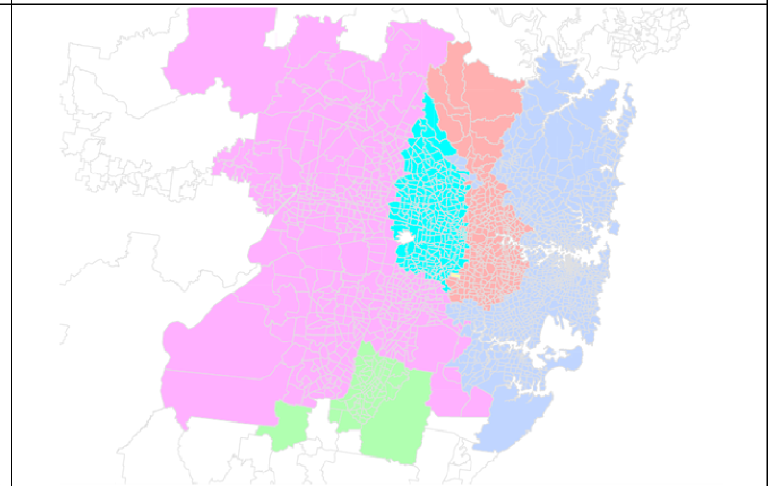
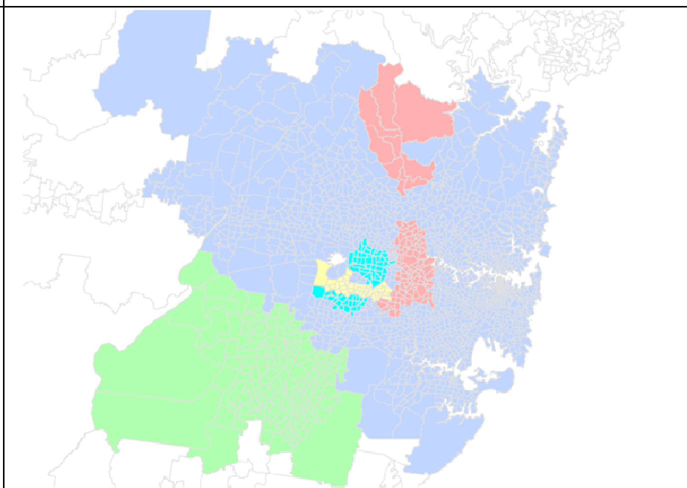
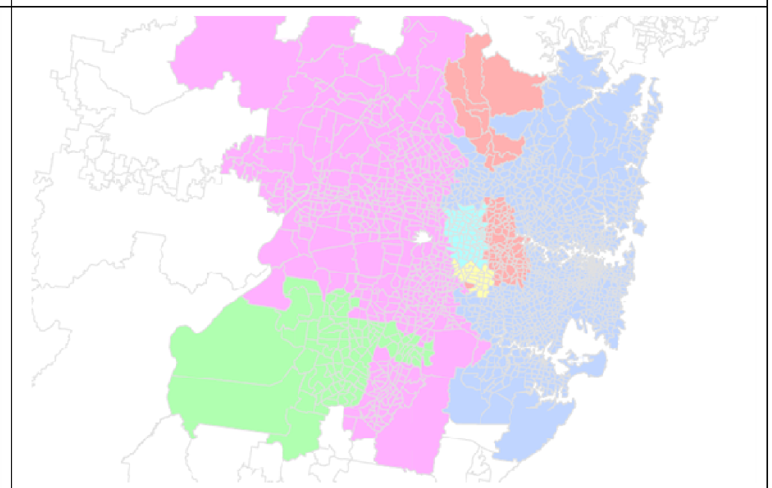
	Without SIMTA	With SIMTA
IMT capacities unconstrained Port Botany Villawood Yennora Minto Enfield SIMTA		
IMT capacities constrained Notes: Catchment boundaries are simplified and do not allow for overlap between IMT service areas. Boundaries are indicative, and assume "perfect" knowledge and decision-making.		

Figure 5-5 IMT Catchment maps - 2016

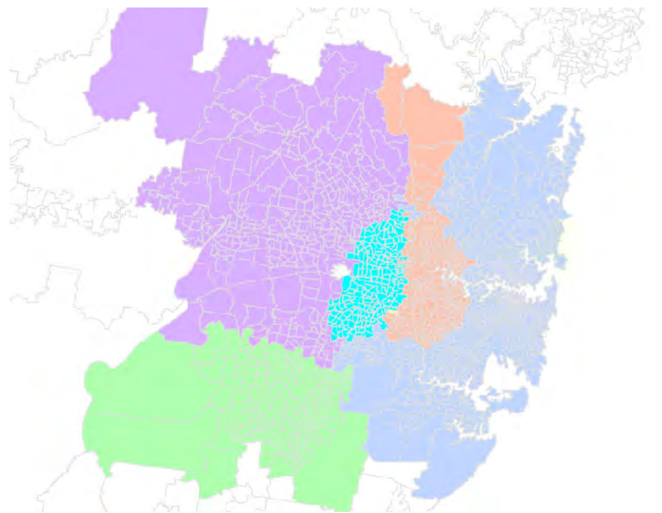
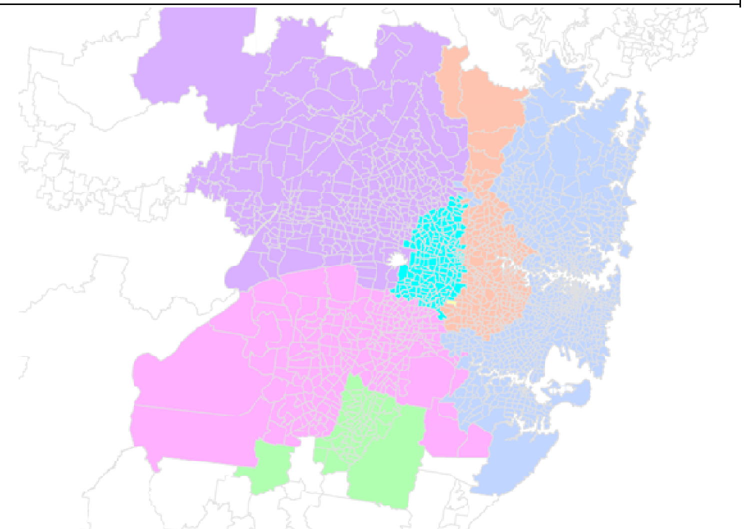
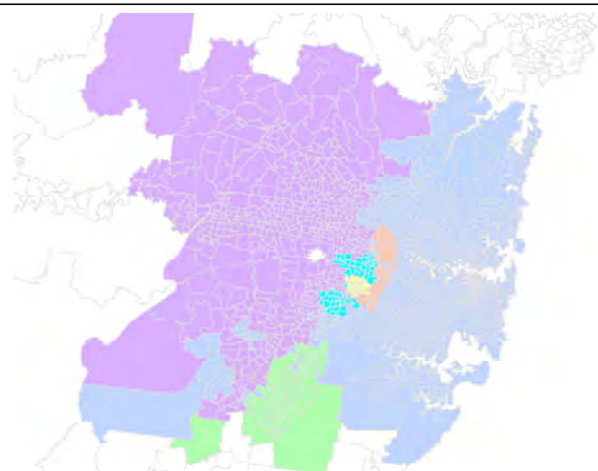
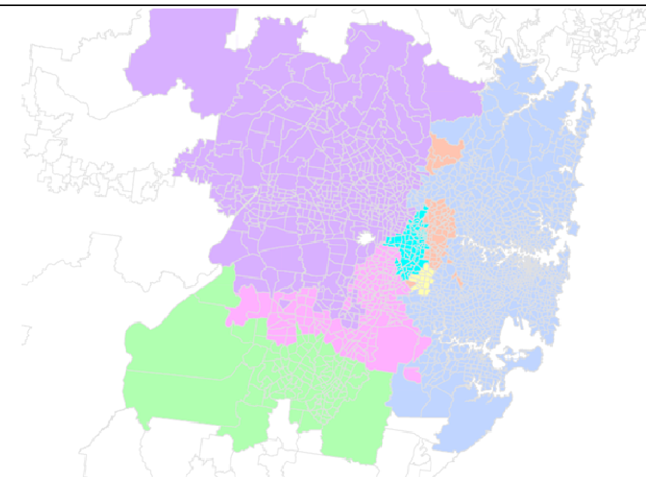
	Without SIMTA	With SIMTA
IMT capacities unconstrained Port Botany Villawood Yennora Minto Enfield SIMTA Eastern Ck		
IMT capacities constrained Notes: Catchment boundaries are simplified and do not allow for overlap between IMT service areas. Boundaries are indicative, and assume "perfect" knowledge and decision-making.		

Figure 5-6 IMT Catchment maps – 2025

5.2.1 OBSERVATIONS FROM IMT CATCHMENT ANALYSIS

The impact of SIMTA on container movements in Sydney is shown clearly in the analysis. Key points to note are:

- The natural cost-competitive catchments of the current system of IMTs far exceed their capacity. This results in a contraction of the catchment of each and a consequent forced use of truck haulage from Port Botany into western Sydney.
- In 2016, if SIMTA is not operational, direct trucking from Port Botany would deliver over 70% of the market, largely as a result of inadequate IMT capacity, not because they are uncompetitive in terms of supply chain costs.
- With SIMTA in operation, it has the capability to attract a significant proportion of the TEU market (up to 35%), thus reducing the trucking demand from Port Botany to as little as 40% of the total import market.
- Even in 2016, when SIMTA would still be in start-up mode, it is sufficiently cost-competitive to attract its long-term target throughput of 500,000 import TEUs per annum. The timing of the staged development of SIMTA may somewhat reduce its market capture in early years, but the latent demand nevertheless would still exist.
- Note, in 2016, there is sufficient demand forecast for SIMTA to operate at 100% of its final capacity, taking the demand for Yennora and Enfield in excess of the capacity of these terminals.
- By 2025, additional IMT capacity will be essential to deliver the forecast 5 million TEU through Port Botany. A location in west-northwest Sydney has been assumed.
- In 2025, SIMTA would attract containers from a reasonably clearly defined and localised catchment including Liverpool and part of the South West and Industrial West.
- Without SIMTA, much of Liverpool would be served by road direct from the Port.
- By 2025, the demand for containers in the South West would exceed the current capacity of Minto IMT. In the analysis it has been assumed that sufficient IMT facilities would be available to meet this demand, although none is currently being planned.

6 EVALUATION OF LOCAL ROAD NETWORK IMPLICATIONS

The primary purpose of the analysis documented in this report is to provide input into the evaluation of the traffic impacts of the SIMTA proposal. This evaluation was undertaken at two levels:

- the metropolitan-wide changes in truck movements, and resultant changes in vehicle kilometres of travel and other environmental indicators
- the additional truck traffic generated by container movements from and to the SIMTA proposal, including the number and geographic distribution of truck trips.

The container models developed provide data for Hyder's Strategic Road Network model of Sydney. This model is documented in Appendix E in Volume 2 of Hyder's Main Traffic Report.

Annual container movements were converted into average truck movements per weekday. The following areas were quantified:

2031 case, without SIMTA:

- An adjustment was made in the total truck trip generation of the Port Botany area, as the base model contained insufficient truck trips to represent the container movement task. This comprised additional trips between the two TZs representing Port Botany and all TZs in the metropolitan area.
- Additional truck trips were added to/from the Enfield IMT, as the base truck forecasts did not include any growth in trips to/from this area.
- IMT activity was added to the base industrial activity in the assumed Eastern Creek IMT TZ.

2031 case, with SIMTA:

- A reduction in trips to/from the two Port Botany TZs
- A reduction in trips to/from the Eastern Creek TZ
- A compensatory increase in trips to/from the SIMTA TZ
- Very small adjustments around Enfield, Yennora, Villawood and Minto were ignored, as they do not impact at all on the change in traffic surrounding SIMTA and would have virtually immeasurable metropolitan-wide impacts. The ignored trips amounted to 236 truck movements per day.

Table 6-12 Summary of truck trip table adjustments used in traffic model

Port/IMT	Sydney model TZ	2031 trip table adjustment (trucks per day, two-way trips)	
		Without SIMTA	With SIMTA
Port Botany	TZ426	878 total trips	-192 fewer trips
	TZ556	7936 total trips	-1739 fewer trips
Enfield	TZ1598	818 additional trips	0
Eastern Creek	TZ2189	4281 additional trips	-1040 fewer trips
SIMTA	TZ1120	-	2735additional trips

7 APPENDIX 1 – FORECAST IMPORT CONTAINER DISTRIBUTION BY SLA

Reporting area	SLA	Annual import containers (TEU)		
		2006	2016	2025
Botany	Botany Bay	115,510	187,334	320,335
Botany Total		115,510	187,334	320,335
City and East	Sydney - East	276	385	599
	Sydney - Inner	1,725	2,657	4,542
	Sydney - West	278	414	694
	Waverley	107	142	226
	Woollahra	71	93	146
City and East Total		2,458	3,691	6,207
South Sydney	Randwick	14,141	21,684	38,183
	Rockdale	5,476	9,342	15,990
	Sydney - South	30,356	52,707	94,728
South Sydney Total		49,972	83,733	148,901
Southern Suburbs	Hurstville	2,899	4,304	7,046
	Kogarah	369	499	773
	Sutherland Shire - East	4,852	6,958	11,425
	Sutherland Shire - West	1,711	2,556	4,141
Southern Suburbs Total		9,831	14,316	23,386
North Shore	Hunters Hill	356	549	937
	Ku-ring-gai	1,281	1,788	2,974
	Lane Cove	3,746	5,580	9,274
	Manly	465	615	986
	Mosman	181	245	397
	North Sydney	3,812	5,148	8,017
	Pittwater	2,786	4,310	7,364
	Ryde	10,081	16,023	26,756
	Warringah	9,326	14,117	23,721
	Willoughby	6,468	9,336	15,366
North Shore Total		38,503	57,711	95,791
NW Sydney	Baulkham Hills - Central	3,761	5,718	9,949
	Baulkham Hills - North	515	836	1,545
	Baulkham Hills - South	649	898	1,445
	Hawkesbury	1,997	2,881	4,733
	Hornsby - North	1,850	2,741	4,594
	Hornsby - South	1,878	2,660	4,295
NW Sydney Total		10,650	15,734	26,560

Reporting area	SLA	Annual import containers (TEU)		
		2006	2016	2025
Inner West	Ashfield	1,500	1,979	3,002
	Burwood	1,500	2,054	3,191
	Canada Bay - Concord	8,159	12,950	21,203
	Canada Bay - Drummoyne	2,608	3,794	6,235
	Canterbury	16,023	23,736	38,371
	Leichhardt	8,480	13,782	22,489
	Marrickville	22,405	31,741	50,915
	Strathfield	22,885	33,498	56,268
Inner West Total		83,560	123,533	201,674
Central West	Auburn	52,679	82,236	147,241
	Bankstown - North-East	13,138	20,205	34,497
	Bankstown - North-West	25,785	39,015	64,687
	Bankstown - South	24,416	37,257	61,703
	Parramatta - Inner	29,290	43,077	71,166
	Parramatta - North-East	9,340	13,208	21,826
	Parramatta - North-West	4,384	6,357	10,321
	Parramatta - South	4,812	6,690	10,855
Central West Total		163,844	248,045	422,296
Industrial West	Fairfield - West	47,705	83,177	154,565
	Holroyd	60,432	92,196	156,236
Industrial West Total		108,137	175,373	310,801
Blacktown	Blacktown - North	7,464	14,513	31,752
	Blacktown - South-East	60,306	98,599	178,946
	Blacktown - South-West	20,706	38,833	78,915
Blacktown Total		88,476	151,945	289,613
Penrith	Penrith - East	16,422	30,533	61,833
	Penrith - West	9,793	15,173	25,853
Penrith Total		26,215	45,706	87,685
Liverpool	Fairfield - East	16,146	25,283	43,506
	Liverpool - East	45,798	179,374	345,488
	Liverpool - West	9,328	16,170	35,484
Liverpool Total		71,272	220,827	424,479
South West	Camden	20,560	42,345	96,039
	Campbelltown - North	24,983	41,741	78,534
	Campbelltown - South	5,248	8,966	16,699
South West Total		50,792	93,052	191,272
Total		**819,218**	**1,421,000**	**2,549,000**

Note: Liverpool - East for 2016 and 2025 includes planned unpacking and warehouse activity on the SIMTA site.

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Appendix E

Technical Note 5
Strategic Modelling Calibration / Validation and Forecasting Results.

SIMTA SYDNEY INTERMODAL TERMINAL ALLIANCE

Part 3A Concept Plan Application

Traffic and Transport

August 2011

Hyder

SYDNEY INTERMODAL TERMINAL ALLIANCE (SIMTA)

MOOREBANK INTERMODAL TERMINAL FACILITY (MITF)

TECHNICAL NOTE 5

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SYDNEY INTERMODAL TERMINAL ALLIANCE (SIMTA)

MOOREBANK INTERMODAL TERMINAL FACILITY (MITF)

TECHNICAL NOTE 5

STRATEGIC MODELLING

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Report No	5
Date	August 2011

REVISIONS

Revision	Date	Description	Prepared By	Approved By
A	8 Aug 2011	DRAFT for internal Review	MR	JF
B	31 Aug 2011	Final Report	MR	NM

CONTENTS

1 TRAFFIC FORECASTING MODEL

A strategic traffic model was developed for the specific purpose of investigating traffic impact from SIMTA proposal. The demand in Hyder's strategic model is based on the Sydney-wide Strategic Travel Model (STM) developed by the Bureau of Transport Statistics (BTS).

Paramics model was developed to assess the network capacity with and without the SIMTA proposal.

1.1 Overview of Strategic Traffic Modelling Approach

Hyder has produced the overall strategic traffic forecasting model for the specific SIMTA project purpose with inputs from STM model. The STM model adopts a four-step approach for determining transport demand.

- Trip generation – calculating the number of trips originating from each geographical area – based on land use, population and employment forecasts;
- Trip distribution – determining the linkages between trip origins and destinations;
- Mode choice – estimating the proportion of travel by each transport mode (eg. car, public transport) between each origin and destination;
- Assignment – determining the roads and public transport services used by each traveller between each origin and destination.

Hyder's strategic traffic model is based on BTS's 2006 travel zone system covering the Sydney Metropolitan Area. Hyder's base and future year models were developed using STM trip tables. The land use assumptions in STM was based on recent population and employment forecast (October 2009 Release). The population and employment forecast was compatible with Department of Planning (now call Department of Planning and Infrastructure) 2008 Release Population Projections and the 2010 Metropolitan Plan.

Hyder's Sydney Strategic Traffic Modelling (SSTM) process is comprised the following key elements:

- A representation of the physical road network/system. The basic network in Hyder's model was sourced from the RTA's Strategic Model (Emme2).
- A representation of the trips that take place on that system. Trip tables (also known as demand matrices) are used to quantify the demand for travel across the entire model area between each small geographic area (travel zone or TZ). Vehicle demand for existing and future years was obtained from BTS's STM model. Future year travel demand matrices represent the government's forecast of future land use development in Sydney.
- A software package that can assign the demand to the network in a way which accurately reflects the constraints of the network, economic and behavioural decisions made by motorists. The demand model is a multi-class highway assignment model. The model has been developed by Hyder using TransCAD modelling software.

For validation/calibration purposes, the model was constructed for a "current" year for which widespread traffic count data on Sydney's' network was available (2008/2010). This was the year used for Hyder's model calibration/validation purpose:

- The RTA had collected comprehensive traffic data on 184 permanent sites across Sydney in year 2008. This was the latest data available on RTA's major screenlines. For STM model, BTS conducted traffic survey at some 66 sites in year 2008. All 2008 data was used in Hyder's major screenlines validation purpose.

- The RTA's Emme2 base year represented 2008 network condition.
- Consistent with screenlines counts, travel time data on RTA's regional routes was obtained for year 2008. RTA provided travel time data for 18 routes.
- Hyder's comprehensive traffic survey for the Moorebank study area was undertaken in 2010 and 2011.

The model specifically quantifies traffic for an average weekday, by way of modelling the morning and evening peaks explicitly, then applying factors to expand to represent an average weekday traffic.

- AM 7:00 am to 9:00 am; and
- PM 3:00 pm to 6:00 pm.

These time periods coincide with those adopted by BTS's STM model.

The calibrated/validated model was then used to assess impact from full SIMTA development for future year 2031 for both AM and PM peak period.

1.2 Fit for Purpose

Hyder's Sydney Strategic Traffic Model (SSTM) was updated for the specific purpose of investigating traffic impact from SIMTA Site. There are several main purposes in developing the traffic forecasting model for SIMTA proposal:

- Creating a tool capable of forecasting the traffic volumes on Moorebank study area under different access and network scheme scenarios, with outputs sufficiently detailed to provide demand and growth estimates as input to micro simulation models (Paramics).
- Providing input for intersection geometry analysis, for pavement design, and to assist in the decision process quantifying network impact from full development.
- Assessing background traffic growth for core and inner area with and without the SIMTA proposal considering the characteristics of catchment employees/residents.
- Prepare a traffic report which can be used as a basis for infrastructure upgrade attributable to SIMTA development.

1.3 Model Software

Hyder's Sydney Strategic Model (SSTM) was built and operated in TransCAD Transportation GIS software. Version 4.7 was used for SSTM. TransCAD fully integrates GIS with planning, modelling and logistics applications. It combines the capabilities of digital mapping, geographic database management and presentation graphics with sophisticated transport models. TransCAD provides a full complement of traffic assignment procedures that are used for modelling urban traffic. TransCAD is widely used in both the public and private sectors. Hyder has updated two large scale strategic models for the RTA including Lower Hunter and Central Coast. Hyder used TransCAD software for modelling impact analysis from large developments for Wyong Shire Council and private developers. Hyder recently used SSTM model for assessing a large complex development in West Menai, Heathcote Ridge.

1.4 Years and Time Periods Modelled (Strategic Model)

The DGR's for Concept Plan Study identified that traffic analysis should include a base case model and a separate model with full development and background traffic growth (to year 2031).

In general. STM model reflects the long-term growth potential of the region and forecasts are available for Australian Population Census years (2001, 2006, 2011, 2016, 2026, 2031 etc). In line with STM and DGR's requirements for SIMTA proposal, Hyder's strategic network traffic modelling has been undertaken for:

- 2008/2010 base year;
- 2031 the last year for which full development is expected for SIMTA Site.

The starting point for producing trip tables for the project is the output of the STM model. This is a traditional four-step model (generation, distribution, mode choice, and assignment) developed and operated by the State Government's Bureau of Transport Statistics (BTS). Both data and models output produced by the BTS are available for commercial purchase.

Detailed modelling for SIMTA Site was undertaken for an average weekday, split into two time periods comprising:

- Morning peak two hours (7:00 – 9:00 am); and
- Evening peak three hours (3:00 – 6:00 pm).

1.5 Traffic Data

Considerable work was undertaken to compile and process traffic volume and travel time data for use in strategic network model calibration/validation purpose. Hyder sourced traffic data at various levels for about 200 locations around the Sydney Metropolitan Area. Consistent with trip tables AM and PM time period, traffic counts comprised AM for 2 hours (7-9) and PM for 3 hours. The data and its level of detail are summarised in Table 1-1 below.

Table 1-1 Summary of Traffic Data Used in Hyder's Model

Data Source	Sites	Vehicle Types	Counting Unit	Count Type	Year of Count
RTA Permanent Sites	184	Total	Vehicles	7 Days, Hourly	2008
BTS Sites	65	Cars and HV	Vehicles	7 Days, Hourly	2008
ATS Sites(1)	41	Cars and HV	Vehicles	AM & PM, Daily	2010/2011

Note: 1= Section 3 documented traffic survey undertaken for Moorebank study. About 33 intersections were counted and 8 mid block locations.

Hyder purchased 2008 travel time data from RTA for about 18 routes across the Sydney. The travel time data was aggregated by direction for the modelling time periods (i.e. AM and PM). The travel time survey data was used to assess the performance of speed flow curves of the model.

1.6 Network

The base network for Hyder's model covers the Sydney Metropolitan Area. The initial source of road networks was the network adopted by the RTA for their Greater Sydney Metropolitan (GMA) EMME road network model. The basic road network purchased from the RTA represented the road network in the year 2008. It comprised all relevant roads, including motorway, freeway, arterial, sub-arterial, collector roads and key local roads. Road attributes were obtained from the RTA's EMME data base included:

Nodes	Links	Turn bans
Node number	A-node number	About 1092 turn bans across the entire network.
X coordinate	B-node number	
Y coordinate	Length (kms)	
Node type	Mode	
	Link type	
	Number of lanes	
	LGA code (Sydney)	
	Region code (Sydney)	

The RTA's EMME data base did not include posted speed data. The additional data including posted speed was purchased from Sensis "Whereis™ StreetNet database". During the building of the Hyder's SSTM model, comprehensive consistency checking (between RTA and Sensis) and adding of other modelling attributes (capacity, free flow travel time, speed flow function, tolling, value of travel time saving, etc) were undertaken to complete the Hyder's base network. An internal network review was undertaken for the purpose of checking its data quality as part of the network validation.

Several adjustments were made to the base network to ensure adequate modelling for SIMTA development for wider study area and surrounding M5 corridor:

- For the base year calibration model, projects that were opened between 2008 and early 2011 were added to base network; the most significant was the F5 Duplication - Camden Valley Way to Brook Road, opened to traffic in 2008. F5 Duplication - Brook Road to Raby Road opened to traffic in Feb 2011; these projects were then re-introduced for future year networks.
- Speed flow functions were created for each link class for the entire Sydney Metropolitan network.
- Tolls were added (2008 values) at all existing toll plazas including distance based/capped toll at M7. These tolls are added to the composite cost of trips passing through the toll plaza during the assignment process. The M4 toll was modelled given that counts on M4 represented year 2008 traffic condition.
- Penalties were added to provide a refinement to link-based volume-delay functions by adding a network entering penalty depending on the relative ranking of the approach roads hierarchy.

Further travel zone refinements were undertaken for SIMTA core catchment study area. The model was sufficiently detailed in core area for replicating intersection turn movements. About 10 additional travel zones were added which improved base network loading points. In the future year network, about 3 travel zones were added for explicitly modelling SIMTA development traffic.

Table 1-2 below shows travel zones for Hyder's SSTM model.

Table 1-2 Travel Zone for SSTM for Sydney Metropolitan Area

2006 Travel Zones	2008 Base	2031 Future
Internal	2132	2135
Externals	11	11
Totals	2143	2146

Note: STM had some 2690 travel zones covering Greater Metropolitan Area (GMA) of NSW. The GMA includes Sydney Metropolitan Area, Blue Mountains, Newcastle, Gosford Wyong, Wollongong and Illawarra.

Figure 1-1 shows the base year road network in the context of SIMTA development and surrounding M5 corridor.

Figure 1-1 Existing Base Case Road Network

1.7 Trip Tables

In general trip tables represent the travel demand or number of trips that occur between each origin-destination ("O-D pair"). Hyder's SSTM trip tables are based on those produced by the BTS and use the same zoning system. The trip table comprised both car and truck travel demand. The truck trip matrices are based on Freight Movement Model (FMM) produced by BTS. Future year travel matrices were provided by BTS and demand data represented the government's forecasts on future land use development in Sydney. Individual trip tables are developed for cars and trucks so that each can be modelled separately. As car travel patterns differ, car trip tables are further split into three trip tables each of which represents a different user class and travel purpose as follows:

- Commuting – travel to and from work;
- Business; and
- Other (a mix of predominantly home based personnel travel, but includes NHB personnel trips).

BTS's trip tables were obtained for:

- Morning peak two hours (7:00 – 9:00 am); and
- Evening peak three hours (3:00 – 6:00 pm).

The morning and afternoon peaks were explicitly calibrated and modelled for SIMTA proposal. Expansion factors have been developed to produce daily traffic estimates.

Trip tables are used in two key areas:

- Model calibration purposes, current year trip tables, adjusted to match observed traffic volumes in key screenline locations and are used. The initial 2008 trip table is estimated by interpolating between 2006 and 2011 BTS trip tables (by purpose). Trip tables were adjusted by undertaking a large number of select link runs on groups of roads comprising screenlines. Adjustments to trip tables were required to match the number of crossings observed on trip tables.
- Future year trip tables are developed to match the BTS model forecast year also taking into account the calibration adjustment to the base year.

The container models developed for SIMTA provided input to Hyder's SSTM truck trip tables. Annual container movements were converted into average truck movements per weekday. The future truck trip table was adjusted with and without SIMTA proposal. Technical Note 1 (Chapter 6, Appendix D in Volume 2 of Hyder's Main Traffic Report) documented truck trip table adjustment process.

1.8 Network Assignment

Hyder's Sydney Strategic Traffic Model (SSTM) is a multi class vehicle assignment model covering the Sydney Metropolitan Area. The vehicle demand obtained from Bureau of Transport Statistics (BTS)'s Sydney Strategic Travel model (BTS). The method used to assign the trip tables to the networks is via a standard transport planning technique: multi-class stochastic user equilibrium assignment process (SUE). The generalised cost of travel is defined as a composite cost, reflecting both travel time and toll, where the toll is expressed in terms of a time penalty incurred by the use of the toll road. The value of travel time by trip purpose varied with a higher value was used for business trips. The $33.00 average value of time (2008 value) applied in the SSTM model and is consistent with research applied in analysis of the Sydney[1].

1.9 Model calibration and validation

A base year (2008/2010) highway model was calibrated, covering both cars and heavy vehicles. This base year is selected because it represents the most recent set of comprehensive network-wide traffic counts undertaken by the RTA and BTS. The following set of calibration and validation standards was adopted for Sydney Strategic Model (SSTM). Hyder's SSTM is in progressive state of improvements.

Table 1-3 below summarises model calibration and validation compliance against target.

[1] The RTA has indicated that an average all-vehicle value of time of $30 per hour is required to replicate observed traffic volumes on Sydney toll roads. Western Sydney Employment Hub, Proposed Erskine Park Link Road Network, May 2007, Prepared for Roads and Traffic Authority, Prepared by Maunsell Australia Pty Ltd.

Table 1-3 Summary of SSTM Model Compliance

Calibration Objective	Calibration Target	Model Compliance	
		AM peak period	PM peak period
1. Trip table matches observed travel demand using screenline comparisons	± 10% on major screenlines	Most screenlines <10% See Figure 1-2 and 1-3 for screenline locations. Detailed comparison are shown in Table 1-4	Most screenlines <10% See Figure 1-2 and 1-3 for screenline locations. Detailed comparison are shown in Table 1-5
2. Road traffic characteristics lead to realistic route choice using scatter plot analysis (R^2)	R^2 > 0.85 for observed-modelled traffic in screenlines - 163 directional links	R^2 > 0.98 See Figure 1-4	R^2 > 0.95 See Figure 1-5
3. Road traffic characteristics lead to realistic route choice using % Root Mean Square Error (%RSME)	≤ 30%	%RSME = 9%	%RSME = 12%
4. GEH Statistics Screenline flows			
≤ 5	Most screenlines	100%	92%
Individual flows			
≤ 5	≥ 60% of links	94%	93%
≤ 10	≥ 95% of links	99%	100%
≤ 20	100% of links	100%	100%
6. Validation of modelled travel times on key strategic routes in and around proposed development. See Figure 1-6		Modelled travel times for 3 routes by direction to lie within the bands of observed travel times, following the same trends. See Figure 1-7	Modelled travel times for 3 routes by direction to lie within the bands of observed travel times, following the same trends. See Figure 1-8

Sources:

1. Model Validation and Reasonableness Checking Manual, FHWA 1997 (USA)
2. Design Manual for Roads and Bridges (DMRB), Volume 12, Section 2, Department for Transport 1996 (UK)
3. Project Evaluation Manual, Transfund New Zealand, 2001
4. M5 West Widening Project, Environment Assessment RTA September 2010

Model code: V3R1_SSTM F:\AA003210\D-Calculations\Traffic and Modelling_POST DGR\Data Processing\Model Calibration\V3_SSTM_SIMTA model calibration results

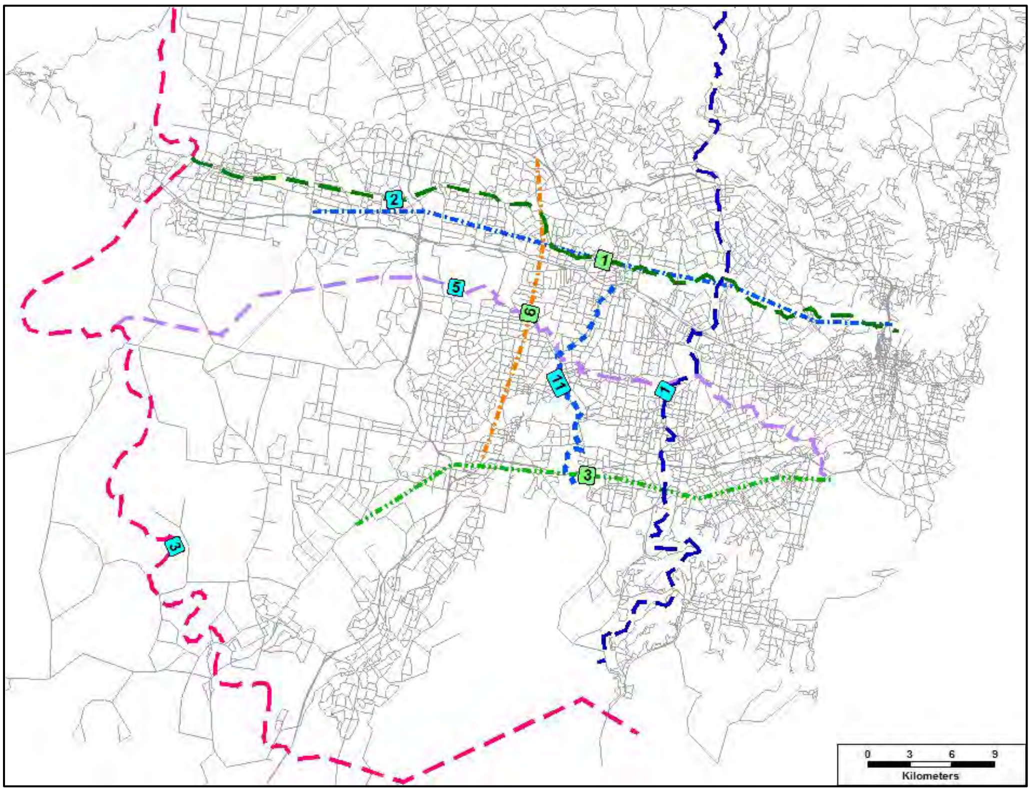


Figure 1-2 Screenlines Locations – RTA and BTS

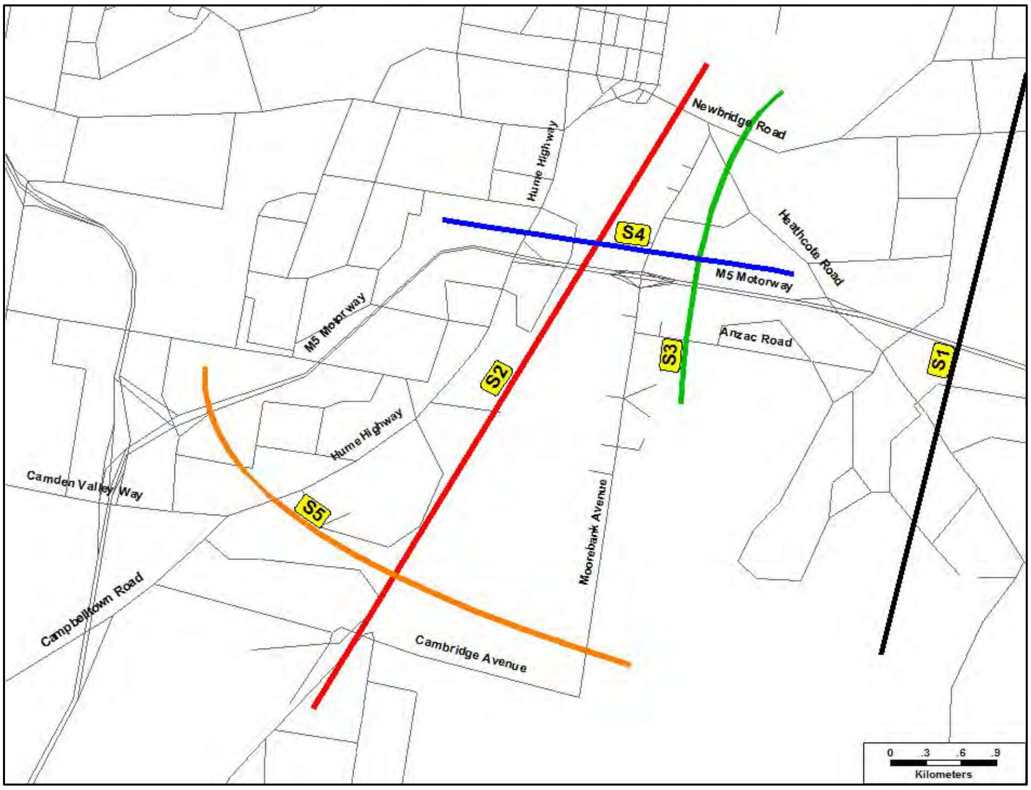


Figure 1-3 Screenlines Locations – Moorebank Sub Screenlines

Figures 1-4 and 1-5 compare observed flows and modelled flows at individual locations for AM and PM peak period respectively.

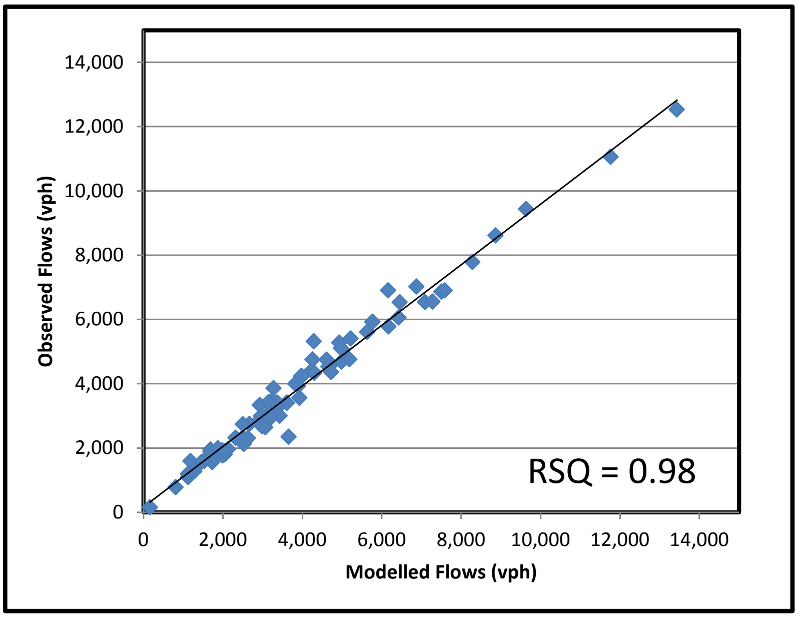


Figure 1-4 **Scatter Plot of Observed versus Individual Link Flows (AM) – within screenlines**

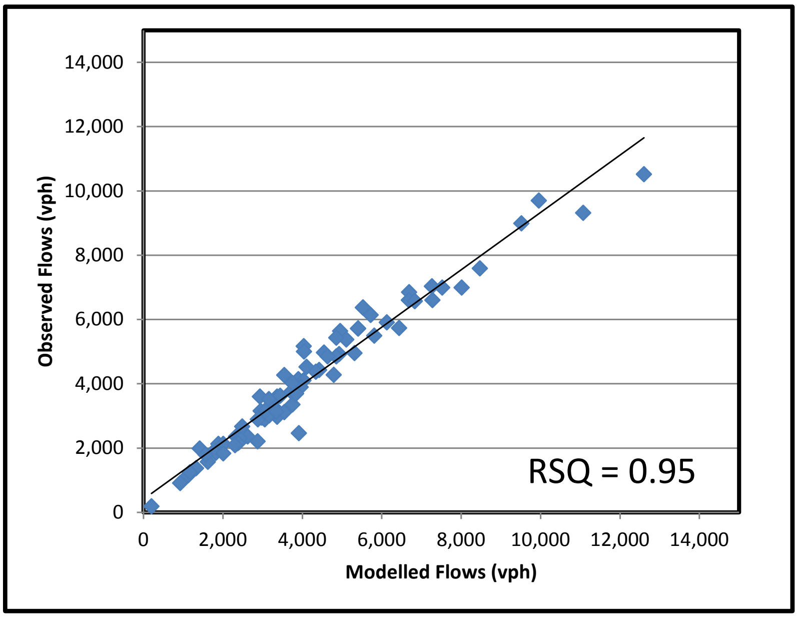


Figure 1-5 **Scatter Plot of Observed versus Individual Link Flows (PM) – within screenlines**

The above network model calibration and validation results provide the following outcomes:

- Most statistical criteria tests have been achieved for both AM and PM peak period models. Screenline comparisons are within the 10% target in most of cases. R^2 values for are between 0.95 and 0.98 respectively, showing a very close match between counts and model at individual site (see Figures 1-4 to 1-5).
- The model has been validated to an appropriate detailed for the wider network in the context of SIMTA site.

- The calibration/validation results demonstrate that Hyder's SSTM model has been calibrated and validated appropriately in accordance with the industry practice acceptance criteria. A robust calibration and validation has been achieved for both AM and PM peak period strategic models, providing confidence that network traffic models are appropriate for assessing the SIMTA development and associated road improvement options and strategies for the Site.

The detailed calibration and validation outcomes from strategic model are shown in below.

Table 1-4 Screenline Calibration - AM Peak

Screenline Comparisons	Observed		Model		Achieved Values		
	All - AM 1Hr		All - AM 1Hr		All - AM 1Hr		
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	Two-way
RTA Screenline No.							
R1	22,114	14,743	21,700	15,300	-2%	4%	0%
R2	32,216	37,097	31,800	35,800	-1%	-4%	-2%
R3	4,079	7,339	4,000	7,000	-2%	-4%	-3%
R5	32,050	16,262	30,900	16,400	-4%	1%	-2%
R11	7,339	4,914	7,100	5,000	-4%	3%	-1%
BTS Screenline No.							
B1	20,371	19,566	19,500	18,900	-4%	-4%	-4%
B3	17,684	8,648	18,300	8,800	4%	1%	3%
B6	18,711	14,024	18,600	12,900	0%	-8%	-4%
Sub Screenlines.							
S1	7,473	5,821	8,100	5,400	8%	-8%	7,473
S2	7,349	6,557	7,500	6,400	2%	-2%	7,349
S3	7,134	6,279	7,000	5,700	-2%	-10%	7,134
S4	5,291	2,396	5,100	2,400	-4%	1%	5,291
S5	7,671	4,898	7,200	4,900	-6%	0%	7,671

Model code: V3R1_SSTM F:\AA003210\D-Calculations\Traffic and Modelling_POST DGR\Data Processing\Model Calibration\V3_SSTM_SIMTA model calibration results

Table 1-5 Screenline Calibration - PM Peak

Screenline Comparisons	Observed		Model		Achieved Values		
	All - PM 1Hr		All - PM 1Hr		All - PM 1Hr		
	NB/EB	SB/WB	NB/EB	SB/WB	NB/EB	SB/WB	Two-way
RTA Screenline No.							
R1	16,329	20,988	17,800	21,300	9%	2%	5%
R2	36,817	34,798	36,400	33,200	-1%	-5%	-3%
R3	7,597	5,030	7,400	4,900	-2%	-2%	-2%
R5	19,488	27,517	18,800	26,000	-3%	-5%	-5%
R11	5,595	7,672	6,700	7,700	20%	0%	9%
BTS Screenline No.							
B1	20,005	19,846	20,000	19,900	0%	0%	0%
B3	10,058	17,808	9,500	17,800	-6%	0%	-2%
B6	15,157	19,540	14,900	18,700	-2%	-4%	-3%
Sub Screenlines.							
S1	6,423	8,604	6,500	7,900	1%	-8%	-4%
S2	6,724	7,521	6,900	7,400	3%	-1%	1%
S3	6,436	7,477	6,000	6,900	-7%	-8%	-7%
S4	2,976	5,324	3,000	5,100	2%	-4%	-2%
S5	5,221	7,658	5,300	8,500	2%	11%	7%

Model code: V3R1_SSTM F:\AA003210\D-Calculations\Traffic and Modelling_POST DGR\Data Processing\Model Calibration\V3_SSTM_SIMTA model calibration results

Table 1-6 Link Validation for Core Area - AM Peak

Roads/Locations	Observed			Modelled			Difference (veh)			Difference (%)			GEH		
	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way
Moorebank Avenue-South of Anzac Road	1,114	622	1,735	1,230	620	1,850	120	0	110	10%	0%	7%	3	0	3
Anzac Road-East of Moorebank Avenue	354	458	812	370	410	780	20	-50	-30	5%	-10%	-4%	1	2	1
Moorebank Avenue-South of Jacquinot Road	1,098	372	1,471	1,160	410	1,570	60	40	100	6%	10%	7%	2	2	3
M5 Motorway-West of Moorebank Avenue	5,249	4,390	9,638	5,430	4,010	9,440	180	-380	-200	3%	-9%	-2%	2	6	2
M5 Motorway-East of Moorebank Avenue	4,071	4,214	8,285	4,190	3,590	7,790	120	-620	-490	3%	-15%	-6%	2	10	6

Model code: V3R1_SSTM F:\AA003210\D-Calculations\Traffic and Modelling_POST DGR\Data Processing\Model Calibration\V3_SSTM_SIMTA model calibration results

Table 1-7 Link Validation for Core Area - PM Peak

Roads/Locations	Observed			Modelled			Difference (veh)			Difference (%)			GEH		
	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way	NB/ EB	SB/ WB	Two-Way
Moorebank Avenue-South of Anzac Road	546	1,170	1,716	700	1,270	1,970	150	100	250	28%	9%	15%	6	3	6
Anzac Road-East of Moorebank Avenue	447	476	923	410	500	910	-40	20	-10	-8%	5%	-1%	2	1	0
Moorebank Avenue-South of Jacquinot Road	376	1,190	1,566	530	1,270	1,800	150	80	230	41%	7%	15%	7	2	6
M5 Motorway-West of Moorebank Avenue	4,483	5,477	9,960	4,340	5,360	9,700	-140	-120	-260	-3%	-2%	-3%	2	2	3
M5 Motorway-East of Moorebank Avenue	4,107	4,367	8,474	3,600	3,990	7,590	-510	-380	-880	-12%	-9%	-10%	8	6	10

Model code: V3R1_SSTM F:\AA003210\D-Calculations\Traffic and Modelling_POST DGR\Data Processing\Model Calibration\V3_SSTM_SIMTA model calibration results

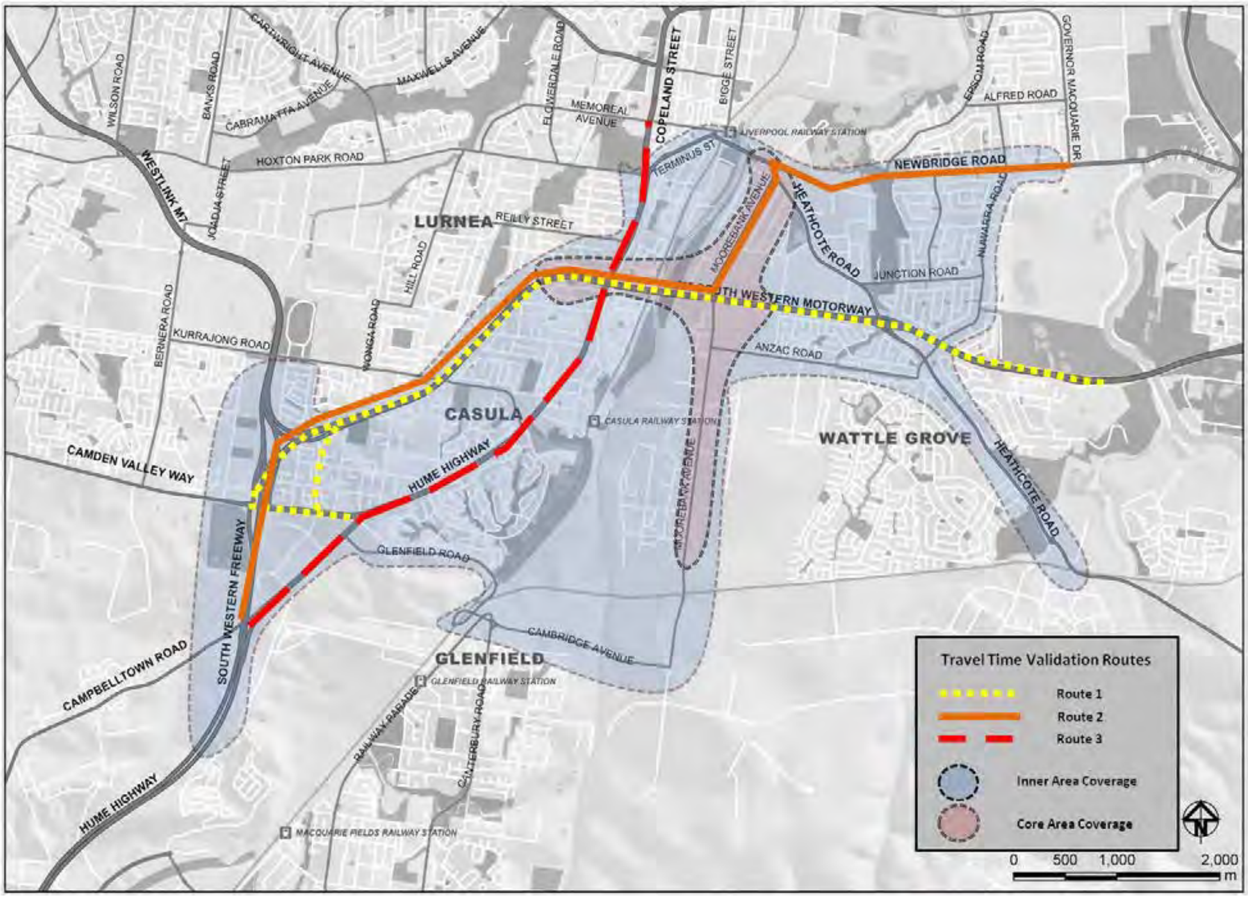
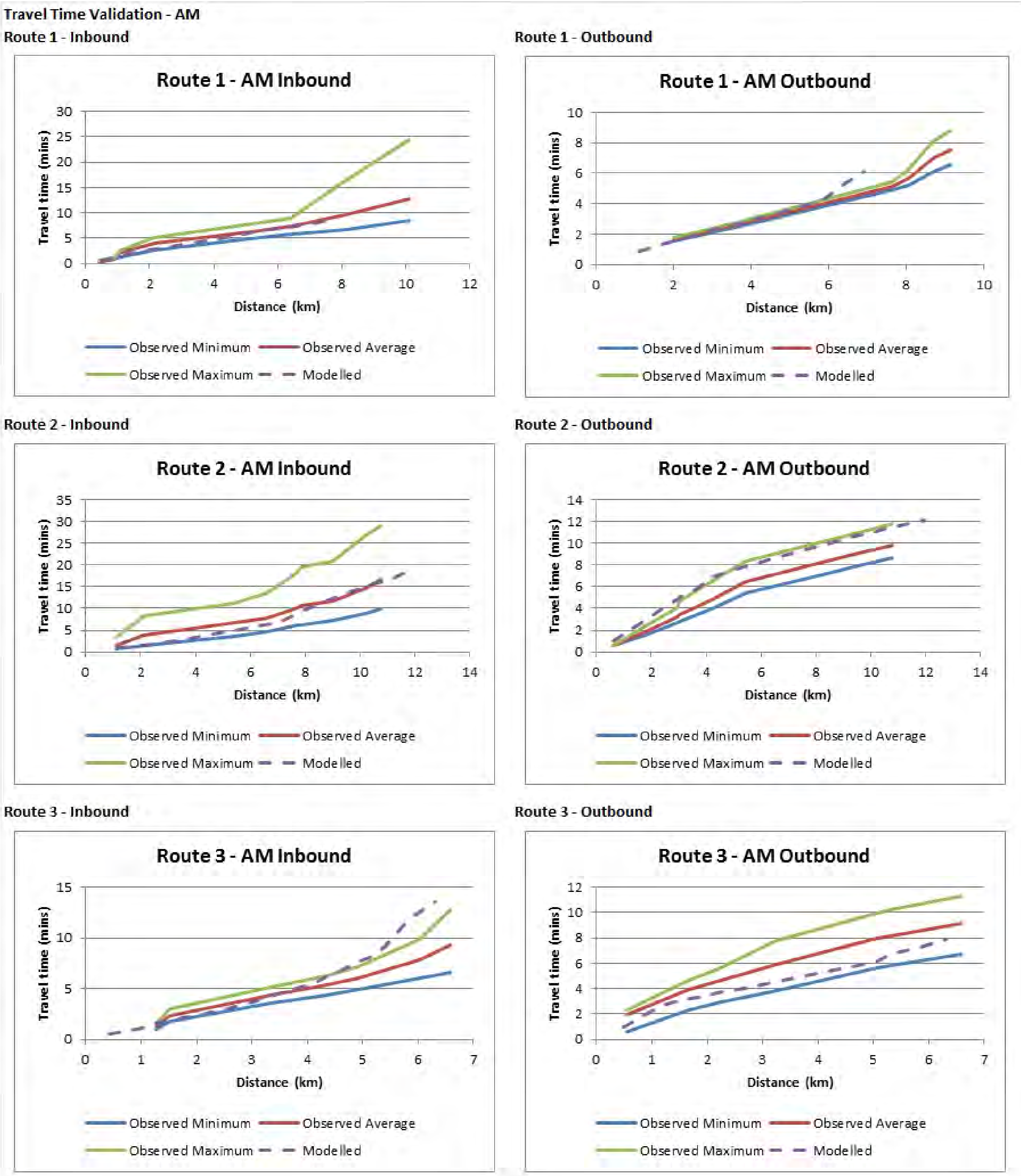


Figure 1-6 Travel Time Validation Routes

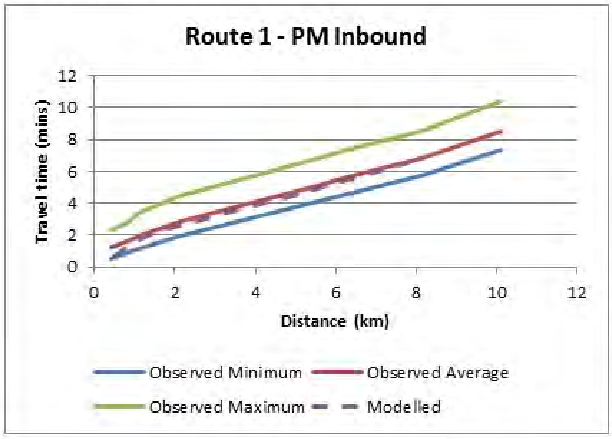


Model code: V3R1_SSTM F:\AA003210\D-Calculations\Traffic and Modelling_POST DGR\Data Processing\Model Calibration\V3_SSTM_SIMTA model calibration results

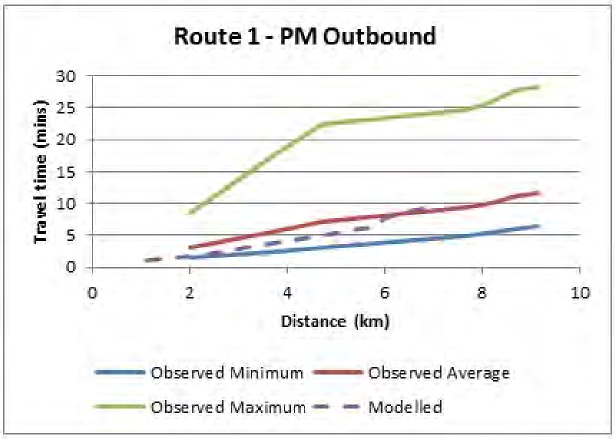
Figure 1-7 Travel Time Validation Results – AM Peak

Travel Time Validation

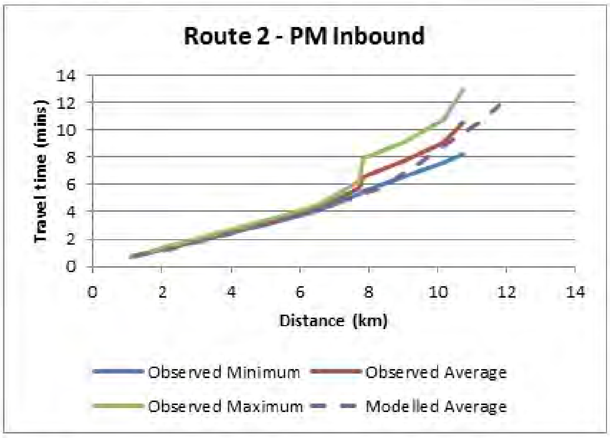
Route 1 - Inbound



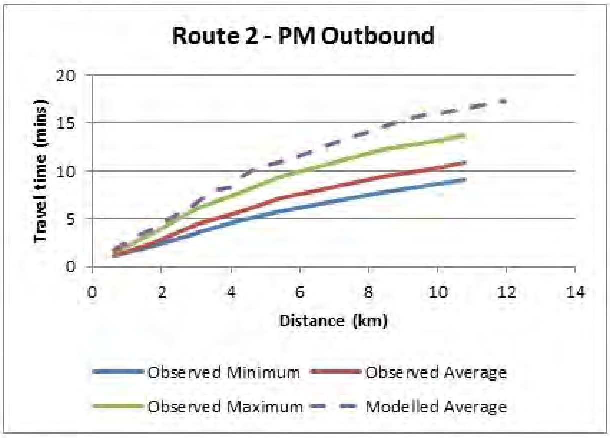
Route 1 - Outbound



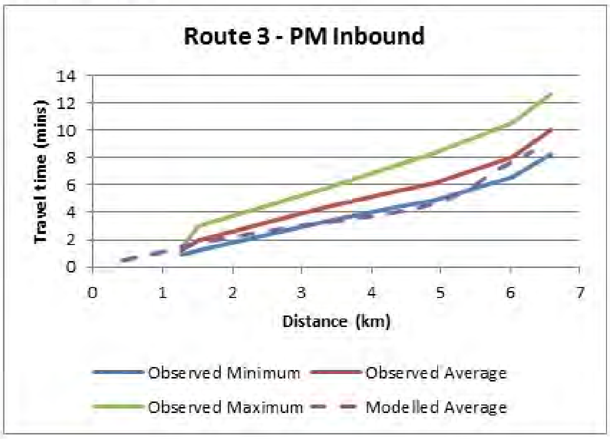
Route 2 - Inbound



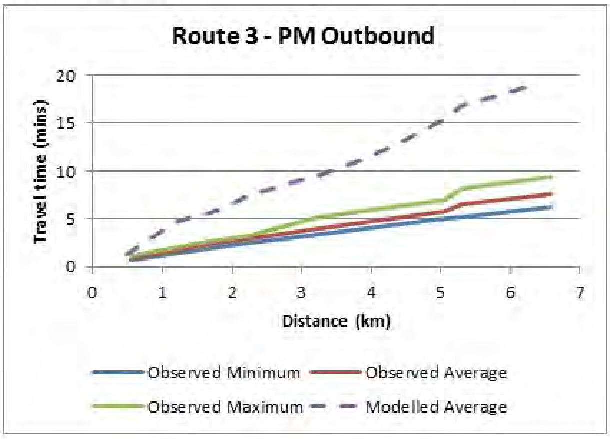
Route 2 - Outbound



Route 3 - Inbound



Route 3 - Outbound



Model code: V3R1_SSTM F:\AA003210\D-Calculations\Traffic and Modelling_POST DGR\Data Processing\Model Calibration\V3_SSTM_SIMTA model calibration results

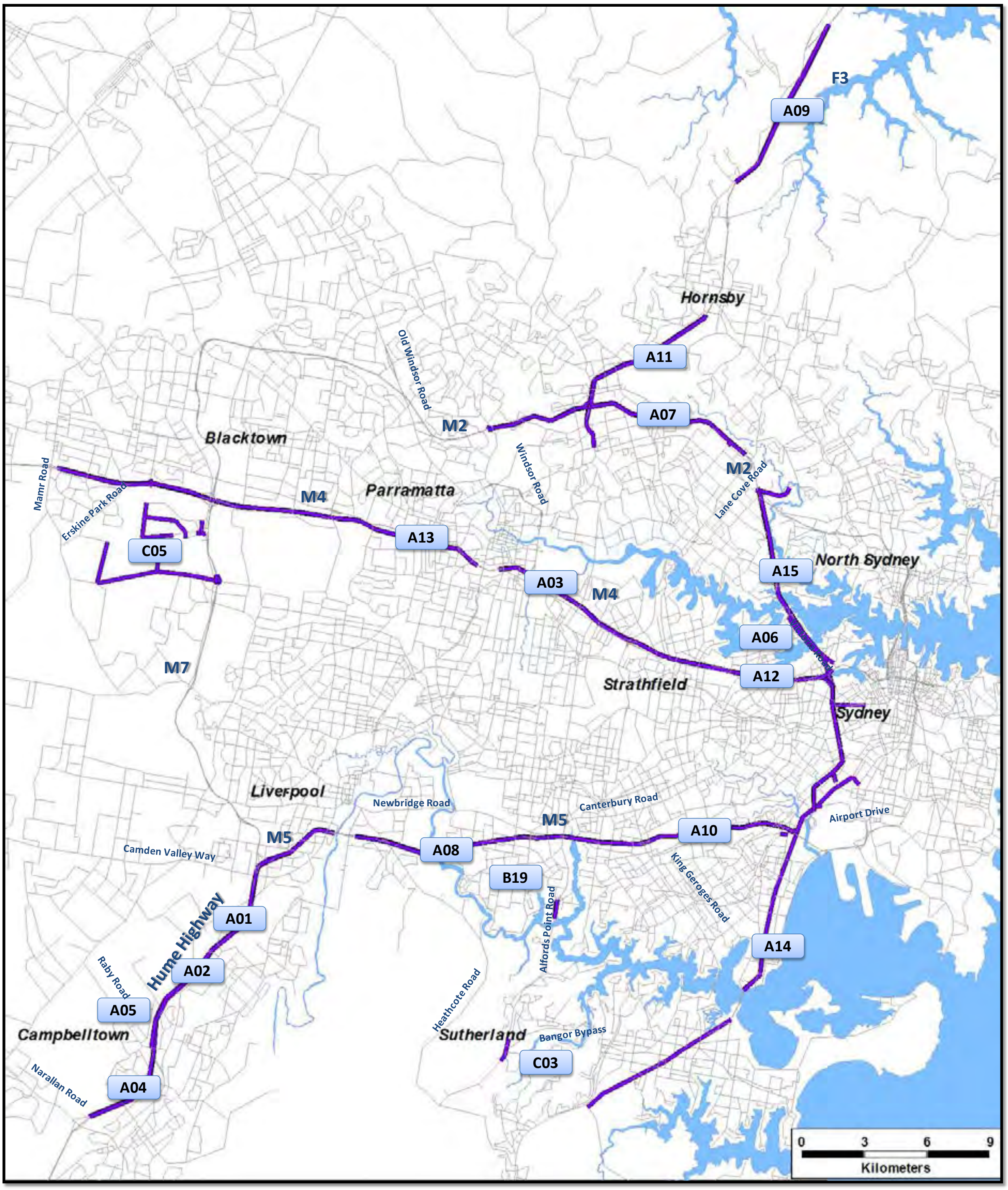
Figure 1-8 Travel Time Validation Results – PM Peak

1.10 Future Road Improvement Project

Table 1.4 summarises the future road improvement projects and time frame used for modelling purpose. Figure 1 shows road improvement projects.

Table 1-4 Future road improvement projects

Hyder Reference ID	Project/Description	Improvement Scope	Modelled years				
			2016	2021	2026	2031	2036
A01	F5 Duplication - Camden Valley Way to Brook Road - 8 Lanes	8 lanes from Camden Valley Way to Brook Road - Opened to traffic in 2008.	✓	✓	✓	✓	✓
A02	F5 Duplication - Brook Road to Raby Road - 8 Lanes	8 lanes from Brook Road to Raby Road - Opened to traffic in late 2010.	✓	✓	✓	✓	✓
A03	M4 Toll Removal	Toll free was implemented in February 2010	✓	✓	✓	✓	✓
A04	F5 Upgrade - Raby Road to Narellan Road - 6 Lanes	6 lanes from Raby Road to Narellan Road - Expected for completion in late 2011.	✓	✓	✓	✓	✓
A05	New F5 north facing on ramp	New F5 north facing on-ramp from Raby Road to F5	✓	✓	✓	✓	✓
A06	Inner West	Tidal flow, bus lanes and duplication of Iron Cove Bridge, Victoria Road	✓	✓	✓	✓	✓
A07	M2 Widening	1. Add the third eastbound lane from Windsor Road to Lane Cove Road 2. Add the third westbound lane from Beecraft Road to Cumberland Highway 3. New westbound off ramp from M2 to Herring Rd 4. New eastbound on ramp from Christie Rd to M2 5. New eastbound off ramp from M2 to Windsor Rd 6. New westbound on ramp from Windsor Rd to M2	✓	✓	✓	✓	✓
A08	M5 West Widening	Preferred option description. Widening M5 South West Motorway to three lanes each way (3/3) between Camden Valley Way, Prestons to King Georges Road, Beverly Hills.	✓	✓	✓	✓	✓
A09	F3 Widening	Upgrade from 4 to 6 lanes from Mount Kuring-gai to Cowan	✓	✓	✓	✓	✓
A10	M5 East Duplication	Preferred option description. Widening of the M5 East to four lanes each way (4/4) between King Georges Road, Beverly Hills to Bexley Road, Earlwood. New M5 east tunnel between Bexley Road, Earlwood to Marsh Street, Arncliffe. A new surface arterial road from M5 East to the airport and inner southern Sydney.		✓	✓	✓	✓
A11	F3 to M2	New link between F3 Freeway and M2 Motorway				✓	✓
A12	M4 Extension	Completion of works from Strathfield to Airport/Port, including Qantas Drive and O'Riordan St Intersection and M4 8-laning from North Strathfield to Church Street			✓	✓	✓
A13	M4 Widening	8 lanes from Church Street and Mamre Road			✓	✓	✓
A14	F6	4 lanes from Loftus to St Peters, with connection to M4 Extension				✓	✓
C05	Western Sydney Employ Hub, Erskine Park	New development land	✓	✓	✓	✓	✓
C03	Banjor Bypass Stage 2, West Menai	Extension of New Illawarra Rd, South of Banjor Bypass (Stage 2), Opened to traffic in April 2011.	✓	✓	✓	✓	✓
Note: (A15) M2 to M4 - Extension from Macquarie Park via Glagesville Bridge to M4 East at White Bay is expected for 2041							
F:\AA003695\D-Calculations\Traffic and Modelling\Calculations\Network Development\Future Road Projects\Future Road Improvement Projects.xlsx							



Future1-9 Road improvement projects

2 FUTURE TRAFFIC PROJECTIONS

Tables 2-1 and 2-2 show the results of the network modelling with and without SIMTA, for selected roads within the study area during the AM peak hour and PM peak hour respectively.

With SIMTA proposal, the highest increase in traffic is forecast on the Moorebank Avenue north of SIMTA site (M-1). Anzac Road is expected not to carry trucks generated by the SIMTA proposal but will carry small employee related traffic to and from SIMTA. Beyond the core area, the increasing in peak hour traffic resulting from the SIMTA is small.

With the SIMTA proposal the container model forecasts reductions in truck trips to and from Port Botany and Eastern Creek. The modelling analysis suggests that the operation of SIMTA at Moorebank would have the potential to reduce the volumes of heavy vehicles movements along the M5 corridor. These heavy vehicle movements would be primarily redistributed to the west of M5/Moorebank interchange in Liverpool, part of South West and Industrial West of Sydney. Beyond the core area, where the SIMTA heavy vehicle volume increases, it is generally by a small margin. The additional truck activity generated by the SIMTA proposal would be concentrated on key arterial roads such as M5 Motorway, Hume Highway and M7 Motorway.

The results in Table 2-1 and 2-2 showed that Moorebank Avenue showed contra flow traffic distribution. The northbound traffic showed the highest peaks in the AM. The reverse distribution was observed in the southbound direction in PM. In 2031, SIMTA site traffic would counterbalance traffic flows on the Moorebank Avenue. Model forecasts that in the AM, SIMTA employee cars would be dominant in the southbound direction, as they would be destined for the site. Similarly, in the PM, SIMTA employee car would be dominant in the northbound direction.

Table 2-5 Predicted Traffic Volume on Key Roads– AM Peak (2010- 2031)

ID	Roads/ Locations	2010 Existing	2031 Base Without SIMTA	2031 With SIMTA	Annual Growth 2010-2031 (%)	
					Without SIMTA	With SIMTA[(1)]
Northbound/Eastbound						
M-1	Moorebank Avenue - South of Anzac Road	1,110	1,530	1,600	1.8%	2.1%
M-2	Anzac Road - East of Moorebank Avenue	350	430	440	1.1%	1.2%
M-3	Moorebank Avenue - South of Jacquinot Road	1,100	1,130	1,185	0.1%	0.4%
M-4	M5 Motorway - West of Moorebank Avenue	5,250	8,230	8,440	2.7%	2.9%
M-5	M5 Motorway - East of Moorebank Avenue	4,070	6,380	6,340	2.7%	2.7%
M-7	M5 Motorway - South of Campbelltown Road	4,440	5,930	5,980	1.6%	1.7%
M-8	Hume Highway -between Myall Road and Pine Road	2,580	2,630	2,645	0.1%	0.1%

ID	Roads/ Locations	2010 Existing	2031 Base Without SIMTA	2031 With SIMTA	Annual Growth 2010-2031 (%)	
					Without SIMTA	With SIMTA(1)
Southbound/Westbound						
M-1	Moorebank Avenue - South of Anzac Road	620	860	1,250	1.8%	4.8%
M-2	Anzac Road - East of Moorebank Avenue	460	560	600	1.0%	1.4%
M-3	Moorebank Avenue - South of Jacquinot Road	370	380	435	0.1%	0.8%
M-4	M5 Motorway - West of Moorebank Avenue	4,390	6,880	6,960	2.7%	2.8%
M-5	M5 Motorway - East of Moorebank Avenue	4,210	6,600	6,680	2.7%	2.8%
M-7	M5 Motorway - South of Campbelltown Road	3,080	4,110	4,140	1.6%	1.6%
M-8	Hume Highway -between Myall Road and Pine Road	1,240	1,260	1,285	0.1%	0.2%

Note 1: The 2031 base without SIMTA, proposed network upgrades were assumed as per Table 1-4.) In 2031 with SIMTA traffic forecasts includes both truck redistribution effect and additional employee car.

Table 2-6 Predicted Traffic Volume on Key Roads– PM Peak (2010-2031)

ID	Roads/ Locations	2010 Existing	2031 Base Without SIMTA	2031 With SIMTA	Annual Growth 2010-2031 (%)	
					Without SIMTA	With SIMTA(1)
Northbound/Eastbound						
M-1	Moorebank Avenue - South of Anzac Road	550	730	1,110	1.6%	4.8%
M-2	Anzac Road - East of Moorebank Avenue	440	530	570	1.0%	1.4%
M-3	Moorebank Avenue - South of Jacquinot Road	380	390	445	0.1%	0.8%
M-4	M5 Motorway - West of Moorebank Avenue	4,490	7,600	7,700	3.3%	3.4%
M-5	M5 Motorway - East of Moorebank Avenue	4,110	6,960	7,020	3.3%	3.4%
M-7	M5 Motorway - South of Campbelltown Road	3,870	5,340	5,380	1.8%	1.9%

ID	Roads/ Locations	2010 Existing	2031 Base Without SIMTA	2031 With SIMTA	Annual Growth 2010-2031 (%)	
					Without SIMTA	With SIMTA(1)
M-8	Hume Highway -between Myall Road and Pine Road	1,440	1,470	1,485	0.1%	0.1%
Southbound/Westbound						
M-1	Moorebank Avenue - South of Anzac Road	1,170	1,560	1,690	1.6%	2.1%
M-2	Anzac Road - East of Moorebank Avenue	480	580	590	1.0%	1.1%
M-3	Moorebank Avenue - South of Jacquinot Road	1,190	1,210	1,235	0.1%	0.2%
M-4	M5 Motorway - West of Moorebank Avenue	5,470	9,260	9,450	3.3%	3.5%
M-5	M5 Motorway - East of Moorebank Avenue	4,360	7,380	7,370	3.3%	3.3%
M-7	M5 Motorway - South of Campbelltown Road	3,660	5,040	5,090	1.8%	1.9%
M-8	Hume Highway -between Myall Road and Pine Road	2,600	2,650	2,705	0.1%	0.2%

Note 1: The 2031 base without SIMTA, proposed network upgrades were assumed as per Table 1-4.) In 2031 with SIMTA traffic forecasts includes both truck redistribution effect and additional employee car.

Appendix F

Technical Note 3
Traffic Generation

SIMTA SYDNEY INTERMODAL TERMINAL ALLIANCE

Part 3A Concept Plan Application

Traffic and Transport

August 2011

SYDNEY INTERMODAL TERMINAL ALLIANCE (SIMTA)

MOOREBANK INTERMODAL TERMINAL FACILITY (MITF)

TECHNICAL NOTE 3

TRAFFIC GENERATION

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SYDNEY INTERMODAL TERMINAL ALLIANCE (SIMTA)

MOOREBANK INTERMODAL TERMINAL FACILITY (MITF)

TECHNICAL NOTE 3

TRAFFIC GENERATION

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Report No	3	
Date	August 2011	

This report has been prepared for Sydney Intermodal Terminal Alliance (SIMTA) in accordance with the terms and conditions of appointment for Moorebank Intermodal Terminal Facility: Technical Note 3 dated July 2010. Hyder Consulting Pty Ltd (ABN 76 104 485 289) cannot accept any responsibility for any use of or reliance on the contents of this report by any third party.

REVISIONS

Revision	Date	Description	Prepared By	Approved By
A	15/04/11	DRAFT for client review	NC	MR
B	17/06/11	DRAFT	MR	
C	05/08/11	Updated in line with Halcrow's review and comments	MR	NM

EXECUTIVE SUMMARY

The Sydney Intermodal Terminal Alliance (SIMTA) is a joint venture between Stockland, Qube Logistics and QR National. The SIMTA Moorebank Intermodal Terminal Facility (SIMTA proposal) is proposed to be located on the land parcel currently occupied by the Defence National Storage and Distribution Centre (DNSDC) on Moorebank Avenue, Moorebank, south west of Sydney. SIMTA proposes to develop the DNSDC site into an intermodal terminal facility and warehouse/distribution facility, which will offer container storage and warehousing solutions with direct rail access. Hyder has prepared this technical note to document the trip generation methodology and key assumptions used for the SIMTA proposal.

The SIMTA site is located in the Liverpool Local Government Area. It is 27 kilometres west of the Sydney CBD, 16 kilometres south of the Parramatta CBD, 5 kilometres east of the M5/M7 Interchange, 2 kilometres from the main north-south rail line and future Southern Sydney Freight Line, and 0.6 kilometres from the M5 motorway.

The project will be undertaken as a staged development. An annual operating capacity of one million TEUs is anticipated in the ultimate stage, when fully developed.

Freight will arrive by rail and be transported to the warehouse and distribution facilities within the SIMTA site, or be directly loaded on to trucks for transport to warehouses and nearby logistics centres. Exports and empty freight containers will be transported within the facility by truck and then loaded onto rail for transport back to Port Botany.

The site will generate articulated trucks (B-doubles, semi-trailers) and rigid trucks related to freight movements, and car trips related to direct employment at the site. When SIMTA site is fully developed and reaches its one million TEU capacity, approximately 2,600 daily truck movements are expected to be generated to and from site.

The analysis has found that approximately 3,600 daily car movements are expected to be generated to and from site. The key “business as usual” assumptions are documented within the report.

Sensitivity analysis was carried out to understand the impact of three key assumptions: (a) increasing the proportion of 40ft equivalent containers, (b) improving vehicle utilisation, and (c) increased employment. Testing shows that the current trend towards larger containers and larger vehicles results in reduced truck generation from the site. It also showed that since employee numbers are directly related to car trip rates, an increase in staff numbers will result in a pro-rata increase in car trip generation.

CONTENTS

APPENDICES

1 INTRODUCTION

Hyder has prepared this technical note to document the methodology and key assumptions underpinning the calculation of SIMTA truck and employee car trip generation.

1.1 Background

The Sydney Intermodal Terminal Alliance (SIMTA) is a joint venture between Stockland, Qube Logistics and QR National. The SIMTA Moorebank Intermodal Terminal Facility (SIMTA proposal) is proposed to be located on the land parcel currently occupied by the Defence National Storage and Distribution Centre (DNSDC) on Moorebank Avenue, Moorebank, south west of Sydney. SIMTA proposes to develop the DNSDC site into an intermodal terminal facility and warehouse/distribution facility, which will offer container storage and warehousing solutions with direct rail access

The SIMTA site, approximately 83 hectares in area, is currently operating as a Defence storage and distribution centre. The SIMTA site is legally identified as Lot 1 in DP1048263 and zoned as General Industrial under Liverpool City Council LEP 2008.

The parcels of land to the south and south west that would be utilised for a proposed rail link are referred to as the rail corridor. The proposed rail corridor covers approximately 65 hectares and adjoins the Main Southern Railway to the north. Existing land use includes vacant land, golf course, extractive industries, and a waste disposal depot.

The SIMTA site is located in the Liverpool Local Government Area. It is 27 kilometres west of the Sydney CBD, 16 kilometres south of the Parramatta CBD, 5 kilometres east of the M5/M7 Interchange, 2 kilometres from the main north-south rail line and future Southern Sydney Freight Line, and 0.6 kilometres from the M5 motorway.

Figure 1 shows the SIMTA proposal in the context of road and rail network.

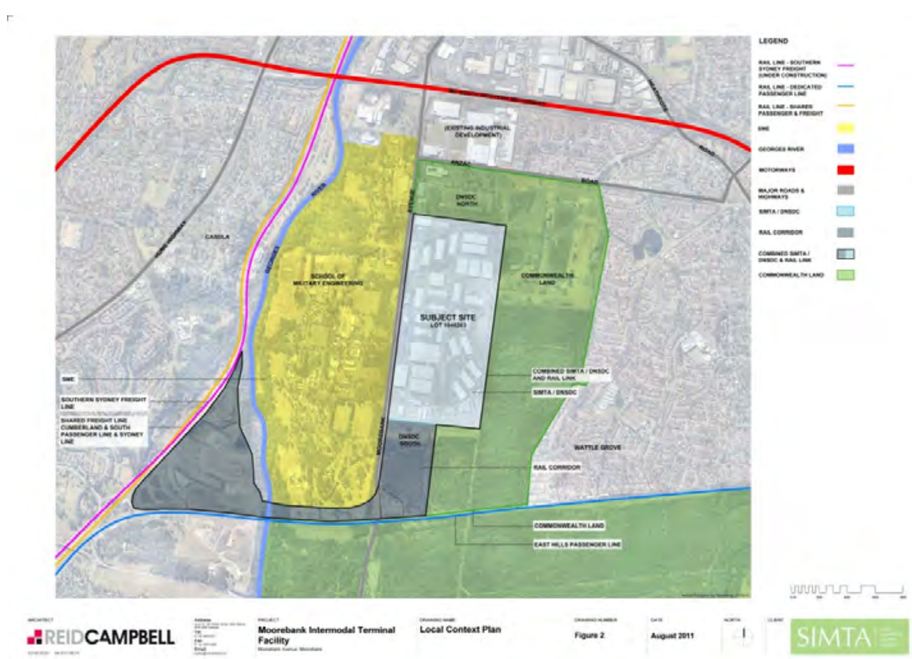

Figure 1-1 Moorebank Intermodal Terminal Site (SIMTA proposal)

The SIMTA proposal comprises the following key components:

- **Rail Link** – connecting the SIMTA site with the Southern Sydney Freight Line. The detailed design of the rail infrastructure comprising the rail link will be subject to a further application and approval process.
- **Intermodal Terminal** – proposed to include on-site freight rail sidings to accommodate local freight trains to Port Botany. Containerised import freight will arrive from Port Botany by rail and be transported to the warehouse and distribution facilities within the SIMTA site, or be directly loaded on to trucks for transport to warehouses and nearby logistics centres. Exports and empty freight containers will be transported to the facility by truck and then loaded onto rail for transport back to Port Botany. The terminal is expected to contain four rail sidings, with areas for container handling and storage, and is anticipated to have the capacity to handle up to 1 million twenty foot equivalent units (TEUs) per annum.
- **Empty Container Storage** – will be provided within the site. Empty containers would either be packed on-site ready for transport to the port by rail, or trucked to off-site locations where they would be packed and returned to the SIMTA site to be loaded onto rail and transported to the port.
- **Warehouse and Distribution Facilities** – with approximately 300,000m^2 of warehouses and ancillary offices will be constructed to the east of the intermodal terminal. These buildings are proposed to be constructed in stages in response to site servicing availability and market demands. It is expected that warehouses will range in size, depending on tenant needs.
- **Freight Village** – approximately 8,000m^2 of support services will be provided on site. These may include site management and security offices, meeting rooms, driver facilities and convenience retail and business services.

The project will be undertaken as a staged development and it is intended that an overall Master Plan, for the entire site, be undertaken for the purpose of applying for Concept Plan approval under Part 3A of the Environmental Planning and Assessment Act 1979.

1.2 Purpose of Technical Note

The Director-General, along with the RTA, Transport NSW and Liverpool City Council are interested in understanding the potential impact of the SIMTA proposal in Moorebank. These authorities have outlined their key concerns in their responses to the Director-General's Requirements (DGR's 24 December 2010). Transport network capacity issues are highlighted as a key area of interest in each response. This technical note has been prepared in order to document the methodology and key assumptions underpinning the calculation of SIMTA trip generation to be applied during the transport impact assessment.

1.2.1 Scope of the report

As part of the transport impact assessment it is necessary to predict the volume of traffic that the site will generate across the day, and distribute across the immediate state and local road network. This technical note sets out the method by which that traffic generation is a calculated. It includes:

- A summary of the traffic surveys already undertaken to understand the traffic volumes in the study area.
- The method and assumptions used to calculate the truck and private vehicle traffic generation for each hour of a typical weekday.

- An outline of the assumed truck and private vehicle distribution throughout the study network; and
- The results of independent traffic generation calculations in order to validate (i.e. reality check) the traffic generation results for the SIMTA proposal.
- Sensitivity testing of key trip generation assumptions, as proposed by RTA's Officers on 3 March 2011[1].

1.3 Document Structure

This technical note is composed of the following sections:

Executive Summary – provides a concise summary of the trip generation and distribution methodology and assumptions.

Chapter 1: Introduction – outlines the project context and purpose of this report.

Chapter 2: Trip Generation – describes the methodology and "business as usual" assumptions behind the calculation of trip generation for the full development of the SIMTA site.

Chapter 3: Validation of Truck Generation – provides a comparison between traffic generation calculations in this report and independent sources of data.

Chapter 4: Sensitivity Testing – describes the sensitivity tests undertaken around some of the key assumptions.

[1] SIMTA Moorebank Intermodal Terminal Facility Meeting Minutes - RTA, TNSW, Hyder, Stockland. 03/03/11.

2 TRIP GENERATION

The primary purpose of the SIMTA proposal will be the transfer of shipping containers to and from Port Botany by rail and the distribution of freight throughout south western Sydney. The SIMTA proposal allows for the unpacking of a proportion of the containers on site and the distribution of their contents. These freight-based activities will generate heavy goods vehicle (rigid trucks, semi-trailers and B-doubles) trips. The calculation of freight-generated vehicle trips is discussed in Section 2.1.

In addition to freight activities, the site will provide employment in the operation of the Intermodal Terminal, in the warehouses and ancillary freight village. The calculation of employee generated vehicle trips is discussed in Section 2.2.

2.1 Freight Generated Traffic

Freight generated traffic was calculated from first principles based on a set of empirical parameters[2]. This section describes the calculation methodology and assumptions used for SIMTA.

2.1.1 Movement of Containers and Freight

Freight will arrive by rail and be transported to the warehouse and distribution facilities within the SIMTA site, or be directly loaded on to trucks for transport to warehouses and nearby logistics centres. Exports and empty freight containers will be transported to the facility by truck and then loaded onto rail for transport back to Port Botany.

An annual operating capacity of one million TEUs is anticipated in the ultimate stage to meet NSW Government objectives[3]. SIMTA have provided the following breakdown of site operations for the full development "business as usual" scenario:

- The volume of container activity through terminal is proposed to be approximately one million TEU per annum moving to and from Port Botany and SIMTA site.
- Containers arriving by rail from Port Botany (500,000 TEUs) will be unloaded onto rail stacks within the intermodal facility. The 500,000 TEUs would be returned to the port by rail. Containers that were unloaded on site (200,000 TEUs), now empty will be loaded onto trains for return to Port Botany.
- Of those 500,000 TEUs containers arriving by rail, 200,000 TEUs will be transported to warehouses within the intermodal facility and unloaded onsite. The remaining 300,000 TEUs will be transferred directly onto trucks for transport offsite.
- Of the containers that were transported offsite (300,000 TEUs), 175,000 TEUs will be unloaded at external depots and returned to SIMTA for loading onto trains for return to Port Botany. The remaining containers that were transported offsite (125,000 TEUs) will return full, to be loaded onto trains for return to Port Botany and export.

SIMTA have advised that some imported containers (125,000TEUs) will be transported to external depots and re-packed off-site ready to be returned to SIMTA for export. This assumes that depots receiving full containers (importing) will also use those same containers for export.

[2] Intermodal Logistics Centre at Enfield-Environmental Assessment, 2005, Sinclair Knight Merz (SKM)

[3] NSW State Plan 2010 sets an objective to ensure 40% of container movements out of Port Botany are transported via rail by 2016.

Current industry practice is for the majority of containers unloaded at external depots to return to an empty container store, before being called up for stuffing by customers for export.

Figure 2-2 shows the annual movement of containers and freight through the MITF.

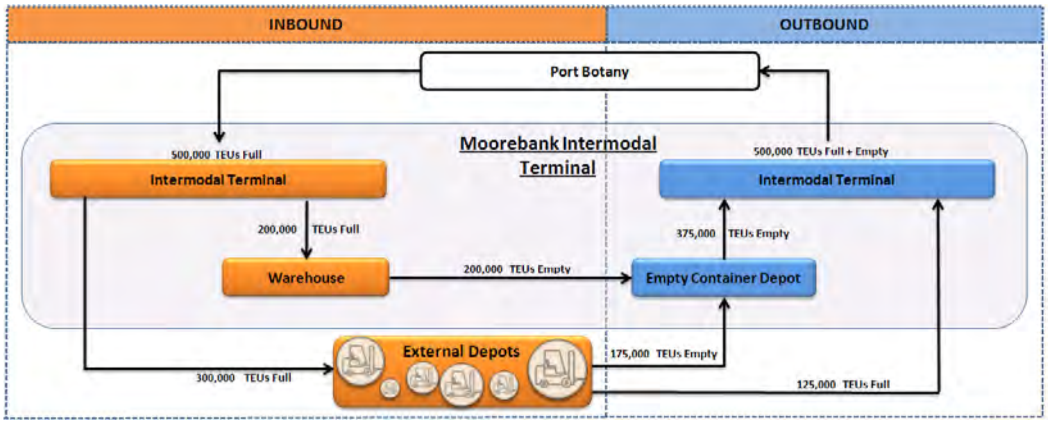

Figure 2-2 Container Movement through MITF

In addition to truck movements generated by the transport of shipping containers offsite, rigid truck trips will be generated by the transport of freight which will be unpacked within SIMTA (200,000 TEUs). This freight will either be distributed directly to customers, or to customers via other distribution warehouses outside of SIMTA.

The calculation of daily articulated truck (i.e. carrying containers) generation from annual TEUs is presented in Section 2.1.2. The calculation of rigid truck (i.e. unpacked freight) generation from annual TEUs is presented in Section 2.1.3.

2.1.2 Calculation of Daily Articulated Truck Generation

A total of 600,000 TEUs (two-way total) was assumed for articulated truck generation.

The calculation of articulated trucks from 600,000 TEUs are:

1 Of the total containers 60% will be 40ft containers and 40% 20ft containers (i.e. one TEU). Therefore on average each shipping container is equivalent to 1.6 TEUs. Therefore to convert the TEUs throughput to individual containers:

$$600{,}000\ TEUs\ per\ year \div 1.6\ TEUs\ per\ container = 375{,}000\ containers\ per\ year$$

2 The facility will operate 52 weeks of the year, therefore the number of containers each week is calculated as:

$$375{,}000\ containers\ per\ year \div 52\ weeks = 7{,}212\ containers\ per\ week$$

3 Containers will arrive every day of the year. In a typical week 85% of containers are processed on weekdays (Monday-Friday), with the remaining 15% processed on Saturday and Sunday. Therefore the number of containers generated each weekday is:

$$7{,}212\ containers\ per\ week \times 85\%\ in\ weekdays \div 5\ weekdays = 1{,}226\ containers\ per\ weekday$$

4 Semi-trailers will carry one 40ft container and B-doubles will carry a 20ft container and a 40ft container. Based on a 2004 survey of Swanston and Webb Docks (Melbourne) each truck (semi-trailers and B-doubles combined) was assumed to carry 1.3 containers on average. This implies a 70/30% split between semi-trailers and B-Doubles. The number of truckloads per day is calculated as:

$$1{,}226\ containers\ per\ weekday \div 1.3\ containers\ per\ truck = 943\ truckloads\ per\ weekday$$

5 The majority of articulated trucks will carry a load in one direction only, either to or from the Terminal. Therefore each container movement will result in 2 truck trips. However, 30% of articulated trucks will carry containers in both directions (i.e. back-loading). Therefore, accounting for back-loading, the total number of truck movements per weekday is calculated as:

$$943\ truckloads \times 2\ directions - (30\% \times 943\ truckloads) = 1{,}603\ truck\ movements\ per\ weekday$$

Therefore, at ultimate development the SIMTA site will generate 1,603 articulated truck movements (both directions) each weekday.

2.1.3 Calculation of Daily Rigid Truck Generation

The analysis assumed that about 200,000 TEUs would be unpacked into warehouses within the Terminal. The unpacked freight will be transported off-site by rigid trucks.

A total of 200,000 TEUs of freight will be generated by this activity.

The calculation of daily rigid trucks is shown below. The calculation is identical to that used for the articulated trucks for steps 1 to 3, albeit with a different TEU volume.

1 Of the total containers 60% will be 40ft containers and 40% 20ft containers (i.e. one TEU). Therefore on average each shipping container is equivalent to 1.6 TEUs. Therefore to convert the TEUs throughput to individual containers:

$$200{,}000\ TEUs\ per\ year \div 1.6\ TEUs\ per\ container = 125{,}000\ containers\ per\ year$$

2 The facility will operate 52 weeks of the year, therefore the number of containers each week is calculated as:

$$125{,}000 \text{ containers per year} \div 52 \text{ weeks} = 2{,}404 \text{ contain}ers\ per\ week$$

3 Containers will arrive every day of the year. In a typical week 85% of containers are processed on weekdays (Monday-Friday), with the remaining 15% processed on Saturday and Sunday. Therefore the number of containers generated each weekday is:

$$2{,}404\ containers\ per\ week \times 85\%\ in\ weekdays \div 5\ weekdays = 409\ containers\ per\ weekday$$

4 Each container will carry 12.66 tonnes of unpacked freight on average and rigid trucks transporting unpacked freight will carry 10 tonnes each. Therefore the number of truckloads generated per weekday is calculated as:

$$409\ containers \times 12.66\ tonnes \div 10\ tonnes\ per\ truck = 517\ truckloads\ per\ weekday$$

5 All rigid trucks will carry a load in one direction only, either to or from the Terminal. Therefore each container movement will result in 2 truck trips.

$$517\ truckloads\ per\ weekday \times 2\ directions = 1035\ truck\ movements\ per\ weekday$$

Therefore, at ultimate development the SIMTA site will generate 1,035 rigid truck movements (both directions) each weekday.

For simplicity the above calculations assume that all trucks that carry un-packed freight from the SIMTA site to off-site customers will be rigid trucks. It is likely that a small proportion, (10-20%), of these trucks will be articulated trucks instead of rigid trucks. While this may change the proportion split between articulated and rigid trucks, the total number of truck movements will not be changed by this assumption.

2.1.4 Daily Truck Generation

According to the “business as usual” assumptions a total of 2,638 truck movements (i.e. both directions) will be generated by the Moorebank Terminal each weekday. This total is composed of 1,603 articulated truck movements carrying containers and 1,035 rigid truck movements carrying unpacked freight. The daily truck generation is split down into hourly demand as described in the following section.

2.1.5 Peak Hour Truck Generation

AM and PM peak hour truck generation was calculated based on total daily generation (2,638 per weekday) and a daily truck activity profile. The SIMTA site is anticipated to operate 24 hours a day, 7 days a week. Semi-trailer, B-double and rigid truck movements have individual profiles.

There are no intermodal terminals within NSW that have the same size and function as SIMTA and therefore no identical daily trip profile of truck movements could be used. The daily profile used for the Enfield Traffic Study has instead been adopted. The daily truck activity profile used in the Enfield Traffic Study was originally based on truck movements to/from Port of Melbourne. While it is recognised that Port of Melbourne does not include significant warehousing facilities, and does not operate as an intermodal terminal, the profile has been adopted as the most likely “business as usual” profile of daily truck movements.

The SIMTA site is planned to operate 24 hours per day, 7 days a week. B-Double, semi-trailer and rigid truck movements pick up in the morning from about 05:00 onwards and remain fairly consistent throughout the day. Semi-trailer and B-double movements continue into the evening with reasonable volumes, however the number of rigid truck trips drop off significantly in the evening from about 17:00 onwards.

It is assumed that site maintenance activities will be carried out between 3:00am and 5:00am based on typical intermodal terminal operation. Consequently, traffic generation over these two hours is expected to be low.

The hourly truck generation profile for SIMTA site is shown in Figure 2-3 and provided as a table in Appendix A.

The profile shows that the AM and PM peak hour for truck movements will occur at 07:00-08:00 with 204 trucks per hour and 14:00-15:00 with 245 trucks per hour respectively. AM and PM peak hour truck movements will represent 7.7% and 9.3% of total daily truck movements respectively.

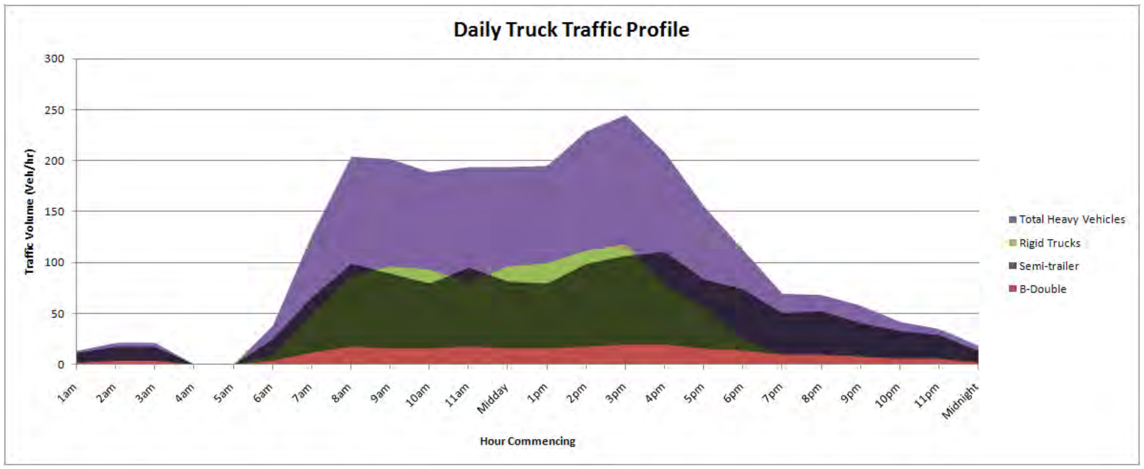

Figure 2-3 SIMTA Daily Truck Generation Profile

Truck generation during the AM peak will coincide with the AM road peak (07:00-08:00), while the PM road peak (16:00-17:00) occurs two hours after the PM truck peak. The total truck generation during the PM road peak period is 155 trucks per hour, representing 5.9% of total daily truck movements.

Peak hour truck generation is summarised in Table 2-1.

Table 2-1 Peak Hour Truck Generation Summary

	Road Peak (07:00-08:00; 16:00-17:00)		Truck Peak (07:00-08:00; 14:00-15:00)	
Truck Type	**AM**	**PM**	**AM**	**PM**
Semi-trailer	99	83	99	107
B-Double	17	16	17	19
Artic. Total	**116**	**99**	**116**	**126**
Rigid	87	56	87	118
Total	**204**	**155**	**204**	**245**

Trucks will be arriving and departing throughout the day, with only short periods stationary within the Terminal. In some cases trucks will enter and exit within the same hour. The in/out split of trucks was therefore assumed to be a 50%/50% split.

2.2 Employee Traffic Generation

Employee traffic generation was calculated based on Gross Floor Areas (GFAs) proposed in the SIMTA proposal Masterplan.

2.2.1 Employment Activities

In addition to the trips generated by freight related activities, employee trips are generated by warehouse and ancillary freight village and train terminal operational staff.

Warehouse and Distribution Centres

The majority of staff will work in the warehouses and distribution centres unpacking containers or preparing the contents for distribution. The warehouse is planned to have a GFA of 292,000 m^2. Using a warehouse employment density rate determined for existing facilities (160m^2 per employee), it is estimated that there would be about 1,825 staff working in the warehouses and distribution centres.

The analysis assumed that SIMTA (terminal warehouses) will operate in two shifts over part of the day. It is expected that the first shift will start prior to 07:00 and finishing around 16:00. The second shift would start at around 16:00 and finish after 12:00 midnight. Actual start and finish times is expected to be staggered to spread out parking and traffic demand.

Office and Ancillary

The majority of office and ancillary staff would work during the normal working hours, with some staff required to support early morning and late evening shifts. Based on an estimated office GFA of 4,400m^2 provided in the Master Plan and an employment density rate of 18m^2 per employee, 244 administration staff will be required on a weekday.

Retail

Retail facilities will mainly be services such as food outlets and convenience stores for other staff. The facilities will be required to provide services during each of the main warehouse shifts. Based on a retail GFA provided in the Master Plan (about 1,700m^2 and an employment density rate of 20m^2 per employee), about 85 retail staff will be required. Within the SIMTA proposal, a small hotel is proposed. About 64 staff is estimated for operation of the 80 room hotel facility. A total of 149 staff has been estimated.

Train Terminal

It is expected that additional 40 staff will be required to operate the SIMTA train terminal.

In summary, a total of 2,258 staff will be required for each weekday spread across the sites normal operating hours. Table 2-2 summarises the on-site employee requirements based on GFA provided in the Master Plan.

Table 2-2 On-site Employee Requirements

Function	Area (m^2)[1]	Employment density rate[2]	Number of employees
Warehouse and office inside warehouse	292,000	160m^2 / employee	1,825
Office and Ancillary	4,400	18m^2 / employee	244
Retail - support staff on site, café (including 64 hotel staff[3])	1,700	20m^2 / employee	149
Operational staff - train terminal[4]			40
		Total	**2,258**

Note: **1.** Area information is based on Master plan Option 5 prepared by Reidcampbell in Sept 2010; **2.** Staffing ratios determined from existing developments; **3.** Most hotel guests will be intermodal business related. The proposed hotel will contain up to 80 rooms. The World Tourist Organization suggests 8 staff per 10 rooms for a 3 star hotel. http://www.city-of-hotels.com/165/hotel-staff-en.html; **4.** Information provided by SIMTA .

The ***Needs Assessment for Moorebank Intermodal Facility*** (PWC, March 2011) has estimated a maximum ongoing direct operational employment of 2,840. This estimate is about 25% higher than the calculated staff totals calculated from GFA contained in the Master Plan. . A higher staff total has been considered as a sensitivity test in Section 4.3.

2.2.2 Travel Mode Split

Journey to Work (JTW) data 2006 compiled by the Bureau of Transport Statistics (BTS) has been used to determine existing mode share of Moorebank area. The JTW data relates to trips to places of employment within travel zones 1108, 1110, 1113 and 1120 in Moorebank. The zones comprise employment areas along Moorebank Avenue and include the Intermodal site. The zones also include some residential land between Moorebank Avenue and Heathcote Road, and south of Cambridge Avenue. The extent of the zones are shown in Figure 2-4.

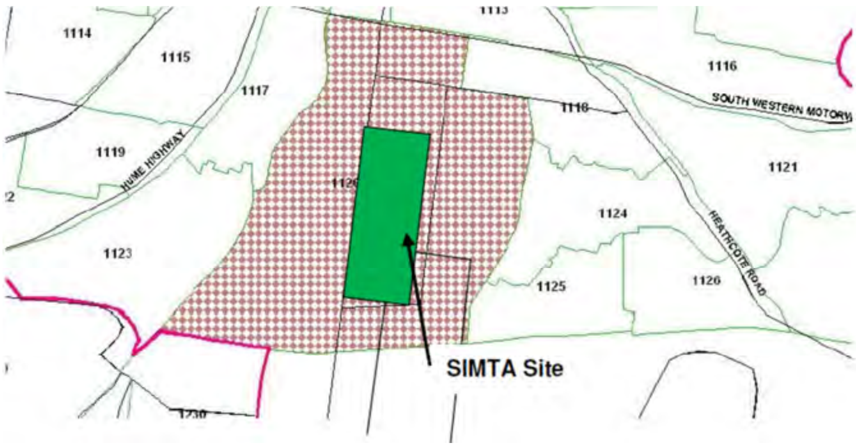

Figure 2-4 Extent of Travel Zone in Study Area

Analysis of the Journey-to-Work data, shown in Table 2-3 indicated that around 85% of people surveyed travelled to work by private vehicle (driver and passenger), while 3% of workers travelled by public transport. The remainder were walk/cycle trips (5%), indicating that a proportion of employees live locally. The remainder worked from home, did not travel, or not stated (8%).

Table 2-3 Daily Work Trip Model Share to and from Moorebank Study Area

Travel Mode	Study Area as Workplace (Inbound trips)	% Study Area as Workplace
Car Driver	5,444	78%
Car Passenger	466	7%
Public Transport	213	3%
Others (walk, cycle, etc)	328	5%
Work at home, did not travel, or not stated	534	8%
Total	6,985	100%

Source: TDC 2006 TZ06: 1108,1110, 1113 and 1120

The low public transport usage (3%) is due to the fact that the site is poorly served by public transport.

One bus service (Route 901) connects Liverpool Station with the development site, before continuing to Wattle Grove and terminating at Holsworthy Rail Station. The route is shown in

Figure 2-5. One morning service before 07:00 and one afternoon service before 16:00 are extended to include the DNSDC site.

The first bus leaves Liverpool Station at approximately 05:30 with the last bus returning to Liverpool Station at 20:50. The service frequency ranges from half hourly in the morning and evening peak periods and hourly between the peaks. The existing service could be of direct benefit to staff of SIMTA.

Figure 2-5 Existing Bus Route (190) on Moorebank Avenue

Longer distance trips to the DNSDC site are served by rail with the site located near to Liverpool, Casula and Holsworthy train stations. Liverpool and Casula are served by the South and Inner West Lines. The Bankstown and Cumberland Lines start and terminate at Liverpool, while Holsworthy station is located on the Airport and East Hills Line.

Liverpool Station is approximately 3 kilometres north west of the Intermodal site with the 901 bus service providing a connection between them.

Casula Station is approximately 1 kilometre west of the SIMTA proposal. There is currently no direct connection. Holsworthy Station is approximately 3.4 kilometres south east of the Intermodal site. The sites are linked by the 901 bus service on Anzac Road.

There is significant scope for improving public transport services to Moorebank as part of the SIMTA proposal. A Transport Management and Accessibility Plan (TMAP) have been prepared for the site (see Section 8 of Hyder's Main Traffic Report) which outlines the measures required to increase the public transport mode share.

For the impact assessment purpose, it was assumed that about 80% of employee trips would be made by private vehicle (car driver, car passenger) when the SIMTA site is fully developed. The employee car mode share is considered to be a conservative estimate in the long term for modelling purpose. There is scope to encourage a more favourable employee public transport mode share where a Travel Demand Management (TDM) approach is adopted on the site and measures put in place to better link the site to the nearby passenger rail network.

2.2.3 Daily Employee Trip Generation

With 2,258 personnel working on site, a total of 4,516 car movements will be generated to or from the site each weekday. Assuming 80% of these movements will be made by private car (driver or passenger), about 3,613 car movements will be generated.

2.2.4 Peak Hour Trip Generation

Based on assumptions around the individual daily shift patterns for warehousing and ancillary freight village (office, retail and train terminal operations), the total daily car trips were distributed throughout the day. Shift assumptions for the warehousing and freight village facilities are summarised in Appendix B. Figure 2-6 shows the assumed distribution of car trips throughout the day.

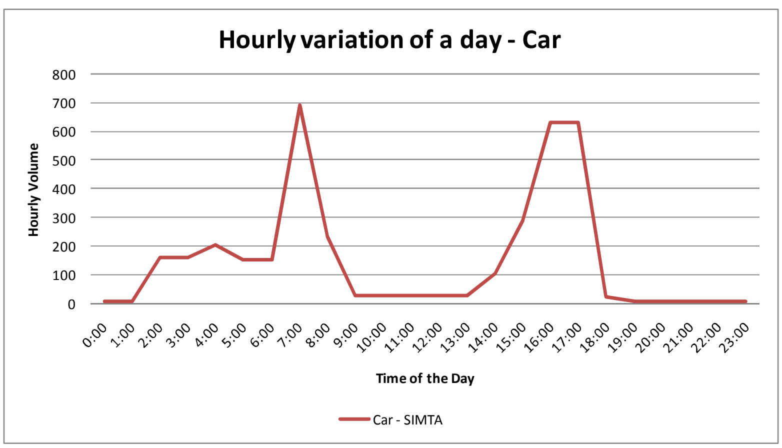

Figure 2-6 Weekday Distribution of Car Trips

The profile shows that the AM and PM peak hour for private car movements will occur at 07:00-08:00 and 16:00-18:00 (flat 2-hrs) respectively. Peak hour car movements will represent 19.1% and 17.4% of total daily car movements respectively. The total car movements during the AM and PM peak hours are 692 and 630 cars per hour respectively.

Private car trip generation during the AM and PM peaks will coincide with the general AM and PM road peaks observed at 07:00-08:00 and 16:00-17:00.

Peak hour car generation is summarised in Table 2-4.

Table 2-4 Peak Hour Private Car Generation Summary

	Road Peak (07:00-08:00; 16:00-17:00)		Truck Peak (07:00-08:00; 14:00-15:00)	
	AM	PM	AM	PM
Private Car	**692**	**630**	**692**	**630**

Note: The directional split of trips into and out of the Terminal was determined through analysis of employee shifts. The assumptions that determine this in/out split are provided in Appendix B.

2.3 Development Staging

For trip generation estimation purpose, it was assumed that up to 500, 000 TEUs (per annum) throughput could be achieved by 2021. The full one million TEU's could be achieved by 2031.

2.3.1 Traffic Generation Staging

Table 2-5 lists the predicted traffic volumes for 500,000 and one million TEUs.

Table 2-5 Weekday Daily Traffic Generation Forecasts in each stage

Indicative Year	TEU Processed in total	Average Daily (Weekday)		AM Peak 1 hour (7-8am)		PM Peak 1 hour (4-5pm)	
		Car	Truck	Car[1]	Truck	Car[1]	Truck
2021	500,000	2,492	1,313	317	104	435	76
2031	1,000,000	3,614	2,638	692	204	630	155

Note: 1. Car trips for one peak hour is estimated to be 50% of two peak hour trips

The resulting traffic generation is shown in Figure 2-7.

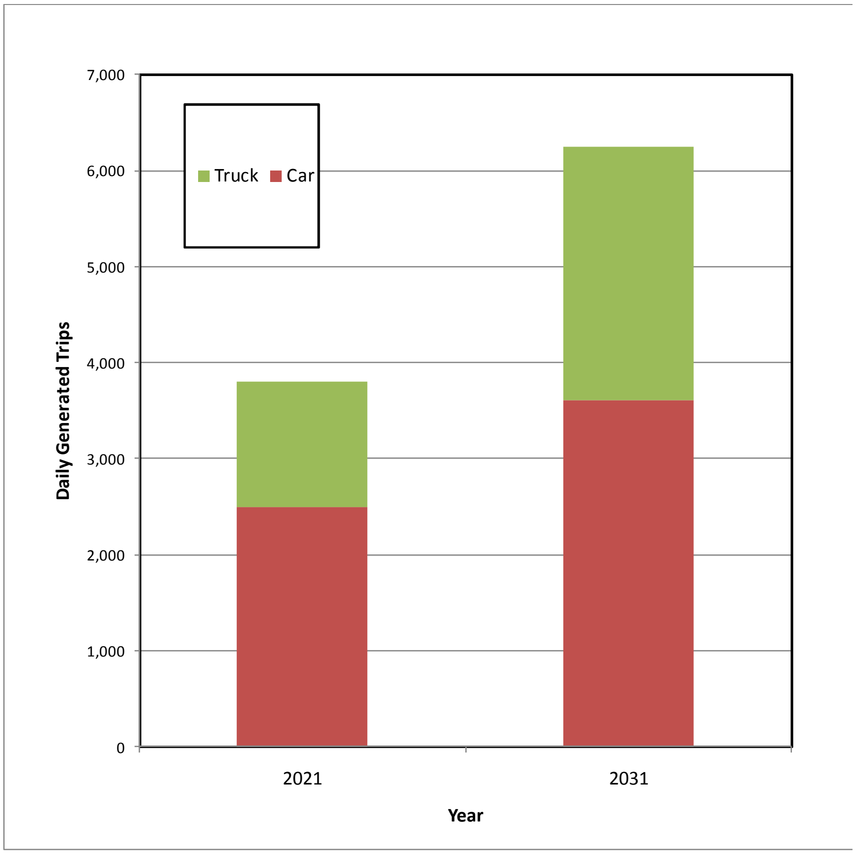

Figure 2-7 Weekday Daily Traffic Generation Forecasts

The estimates of future traffic volumes are based on current vehicle types, container sizes and existing commuter travel. Sensitivity testing of some key assumptions is described in Section 4.

3 VALIDATION OF TRUCK GENERATION

This chapter outlines an exercise to validate the calculated truck generation for the SIMTA proposal against other similar developments, and related work.

3.1 Port Botany EIS Truck Generation

The Port Botany Environmental Impact Statement[4] sets out the growth in container movements and traffic expected at the Port through to 2021.

The report indicated in 2021 forecast year the EIS forecasted 3.2 million TEUs would come through the Sydney Port. Under the assumption (worst-case) that only 20% of these containers would be transported by rail, the report forecasts a traffic generation of 6,273vpd, with 376vph and 234vph in the AM and PM peak hours respectively. Peak hour traffic represented 6.0% and 3.7% of total daily truck generation.

This corresponds to a daily traffic generation rate (per million TEUs) of:

$$\frac{6{,}273\ vehicles\ per\ day}{(3.2\ million\ TEUs - 20\%\ by\ rail)} = 2{,}450\ vpd\ per\ million\ TEUs$$

If we assume that the SIMTA proposal generates truck traffic at a similar rate to the Port Botany, it would be possible to compare this figure against the SIMTA traffic generation.

The intermodal nature of the SIMTA proposal will therefore result in the generation of smaller rigid trucks, collecting unpacked freight (40% of TEUs) from on-site warehousing facilities. Consequently, for the same volume of freight as transported through the Port Botany, the SIMTA proposal is likely to generate a larger total number of trucks (i.e. more smaller rigid trucks).

3.2 Analysis of Enfield Truck Generation

On behalf of the Sydney Ports Corporation, SKM prepared an analysis of the traffic impacts of the proposed Enfield Intermodal Logistics Centre. The EIS traffic report[5] calculated the total traffic generation from first principles. The Enfield ILC and SIMTA will serve the same intermodal function, albeit with different capacities. The Enfield ILC is planned to have a maximum capacity of 300,000 TEUs per annum, in contrast to the 1,000,000 TEU capacity of SIMTA. Otherwise, both terminals are expected to operate in a very similar way, receiving freight containers from Port Botany via rail, transferring directly off-site via articulated trucks, unpacking freight on site for distribution by rigid trucks, and receiving full and empty containers for return to Port Botany.

Truck generation from the 300,000 TEU per annum Enfield ILC was calculated to be 826 truck movements per day, with 60 and 45 trucks per hour in the AM and PM peak hours respectively. This “generation rate” equates to 2,753 daily trucks movement per million TEUs. The peak hours represented 7.3% and 5.4% of daily traffic in the AM and PM peaks respectively.

---

[4] Port Botany Environmental Impact Statement, Sydney Ports Corporation, 2004.

[5] Enfield Intermodal Logistics Centre – Final Transport Working Paper, Appendix B – Traffic and Transport (July 2005)

3.3 Summary

A summary of daily and peak hour truck generation rates is provided in Table 3-6. It shows that daily truck generation estimates (per million TEUs) from independent sources are very close to the daily truck generation calculated using the SIMTA proposal “business as usual” assumptions. When fully developed, SIMTA is expected to generate about 2,638 trucks movements per day. The estimated truck movements for SIMTA site is in line with the Port Botany EIS estimate and the Enfield Traffic Report estimate.

The peak hour factors, as percentage of daily traffic, are also within the range of other independent data sources/estimates.

Table 3-6 Summary of Daily Truck Generation Comparisons

Source	Daily Truck Generation (per 1 million TEUs)	AM Peak Hour (% of daily traffic)	PM Peak Hour (% of daily traffic)
Port Botany EIS	2,450	6.0%	3.7%
Enfield ILC Traffic Report	2,753	7.3%	5.4%
SIMTA Proposal	**2,638**	**7.7%**	**9.3%**

This conclusion provides confidence in the assumptions used and the resulting outcome for daily truck generation to and from SIMTA.

4 SENSITIVITY TESTING

The RTA have indicated that sensitivity testing should be carried out around key assumption values. This section summarises results from sensitivity testing exercise to assess the impact of changing container size, vehicle utilisation and employee totals.

The “business as usual” daily traffic generation from SIMTA can be summarised as:

- 1,603 articulated trucks per week day
- 1,035 rigid trucks per week day
- (2,638 total trucks per week day)
- 3,613 cars per week day

4.1 Change in Container Size

There is a trend towards the use of larger containers, increasing the proportion of 40ft containers. The “business as usual” analysis assumes that 60% of containers are 40ft containers. The Sydney Ports Corporation (SPC) Port Freight Logistics Plan (2008), which outlines the key forecast efficiency indicators, predicts a change in the ratio of 40ft and 20ft containers from 60%/40% (2006) to 65%/35% by 2016.

Sensitivity testing showed that if the proportion of 40ft containers increased to 70% the total articulated truck generation would reduce by 4%. There is no change in the number rigid trucks required since the total freight volume remains constant. Increasing the proportion of 40ft containers will therefore reduce the number of articulated trucks required. Our current “business as usual” assumption is therefore considered conservative.

4.2 Vehicle Utilisation

B-doubles are assumed to carry a 20ft container and a 40ft container. Semi-trailers are assumed to carry one 40ft container only. The “business as usual” truck utilisation of 1.3 containers per truck (equivalent to 2.08 TEUs per truck) represents a split between B-doubles and semi-trailers of about 30% and 70% respectively.

The SPC Freight Logistics Plan forecasts an increase in truck utilisation from 2.1 (2006) to 2.3 by 2016. Sensitivity testing was carried out on a range of vehicle utilisation parameters. Table 4-7 shows the impact of changing truck utilisation, increasing the proportion of B-doubles to 40%, 50%, 60% and 70%.

Table 4-7 Sensitivity to Vehicle Utilisation

Vehicle Utilisation (containers per truck)	Vehicle Utilisation (TEUs per truck)	Total Truck Generation (per week day)	% Change in Truck Generation compared to BAU
1.3 (Business as usual)	2.1	2,638	-
1.4	2.2	2,523	4% reduction
1.5	2.4	2,424	8% reduction
1.6	2.6	2,337	11% reduction
1.7	2.7	2,261	17% reduction

Sensitivity testing showed that increasing the truck utilisation has the potential to reduce the total truck generation. Again, there was no reduction in the total number of rigid trucks.

4.3 SIMTA Site Employee Totals

The “business as usual” assessment assumed a total of 2,258 employees, generating a total of 3,613 car movements per week day. However the Needs Assessment for Moorebank Intermodal Terminal Facility (PWC, March 2011) estimates a maximum of 2,840 employees; about 26% increase. Assuming the same proportion of employment between the warehouse and ancillary freight village staff, this number of employees would result in about 4,544 movements per week day.

The sensitivity of car movements is directly related to total employment on site. Therefore an increase in employment will result in a pro-rata increase in week day car movements.

APPENDIX A

DAILY PROFILE OF TRUCK ACTIVITY

	Total Movements									
	Semi-trailer		B-Double		Total Container Trucks		Rigid Trucks		Total Heavy Vehicles	
Hour Commencing	Count	%	Count	%	Count	%	Count	%	Count	%
Midnight - 1am	12	0.9%	2	0.8%	14	0.5%	0	0.0%	14	0.5%
1am - 2am	17	1.3%	4	1.6%	21	0.8%	0	0.0%	21	0.8%
2am - 3am	17	1.3%	4	1.6%	21	0.8%	0	0.0%	21	0.8%
3am - 4am	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
4am - 5am	0	0.0%	0	0.0%	0	0.0%	0	0.0%	0	0.0%
5am - 6am	25	1.9%	4	1.6%	29	1.1%	9	0.9%	38	1.5%
6am - 7am	66	4.9%	12	4.7%	78	2.9%	50	4.8%	128	4.8%
7am - 8am	99	7.3%	17	7.0%	116	4.4%	87	8.4%	204	7.7%
8am - 9am	89	6.6%	16	6.3%	105	4.0%	97	9.3%	201	7.6%
9am - 10am	80	5.9%	16	6.3%	95	3.6%	93	9.0%	189	7.1%
10am - 11am	95	7.0%	17	7.0%	113	4.3%	81	7.8%	194	7.3%
11am - Midday	82	6.0%	16	6.3%	97	3.7%	97	9.3%	194	7.3%
Midday - 1pm	80	5.9%	16	6.3%	95	3.6%	100	9.6%	195	7.4%
1pm - 2pm	99	7.3%	17	7.0%	116	4.4%	112	10.8%	229	8.7%
2pm - 3pm	107	7.9%	19	7.8%	126	4.8%	118	11.4%	245	9.3%
3pm - 4pm	111	8.2%	19	7.8%	130	4.9%	78	7.5%	208	7.9%
4pm - 5pm	83	6.2%	16	6.3%	99	3.8%	56	5.4%	155	5.9%
5pm - 6pm	74	5.4%	14	5.5%	87	3.3%	25	2.4%	112	4.3%
6pm - 7pm	50	3.7%	10	3.9%	60	2.3%	9	0.9%	70	2.6%
7pm - 8pm	52	3.9%	10	3.9%	62	2.4%	6	0.6%	68	2.6%
8pm - 9pm	41	3.0%	8	3.1%	49	1.8%	9	0.9%	58	2.2%
9pm - 10pm	33	2.4%	6	2.3%	39	1.5%	3	0.3%	42	1.6%
10pm - 11pm	29	2.1%	6	2.3%	35	1.3%	0	0.0%	35	1.3%
11pm - Midnight	14	1.0%	2	0.8%	16	0.6%	3	0.3%	19	0.7%
Total	1355	100.0%	248	100.0%	1603	60.8%	1035	100.0%	2638	100.0%
% of type of trucks	51%		9%				39%			100.0%

Source: Based on Enfield Intermodal Centre EIS traffic distribution in a weekday

APPENDIX B

EMPLOYEE SHIFT WORK ASSUMPTIONS

				To the site (Inbound)					From the site (Outbound)				
Function	Working Periods	Function %	Projected Number of staff	Before 7am	AM Peak (7-9am)	Before 4pm	PM Peak (4-6pm)	After 6pm	Before 7am	AM Peak (7-9am)	Before 4pm	PM Peak (4-6pm)	After 6pm
Warehouse (See Note 5)	Normal working hour (8am-5pm)	38%	694	10%	90%					2%	10%	88%	
	Day-shift (5am-4pm)	39%	712	70%	30%					2%	30%	68%	
	Night-shift (4pm-3am)	23%	420			70%	30%						100%
	Subtotal	100%	1,825										
Office (See Note 6)	Normal working hour (8am-5pm)	80%	196		100%							100%	
	Day-shift (5am-4pm)	10%	24	70%	30%					2%	10%	88%	
	Night-shift (4pm-3am)	10%	24			70%	30%						100%
	Subtotal	100%	244										
Retail (Support staff on site) (See Note 5)	Normal working hour (8am-5pm)	38%	57		100%							100%	
	Day-shift (5am-4pm)	39%	58	70%	30%						30%	70%	
	Night-shift (4pm-3am)	23%	34			70%	30%						100%
	Subtotal	100%	149										
Operational staff - train terminal (See Note 7)	Normal working hour (8am-5pm)	20%	8		100%							100%	
	Day-shift (5am-4pm)	40%	16	90%	10%						10%	90%	
	Night-shift (4pm-3am)	40%	16			90%	10%						100%
	Subtotal	100%	40										
	Grand Total	N/A	2,258										

Note (5) Warehouse and retail shift info is based on Intermodal Logistics Centre at Enfield EIS (prepared in October 2005)

Note (6) The majority of office staff would work during the day but some staff would be requried to support monring and night shifts. Their shift split is from Hyder's assumption.

Note (7) The terminal would be staffed 24 hours per day. The major shift would be a morning and night shift. Their shift split is from Hyder's asseumption.

Note (8) Hyder estimates their percentage of arrival and leaving rate.

Appendix G

Paramics (Traffic) Model Audit Report by Halcrow

SIMTA

SYDNEY INTERMODAL TERMINAL ALLIANCE

Part 3A Concept Plan Application

Traffic and Transport

August 2011

SIMTA Moorebank Intermodal Terminal Proposal

Paramics (Traffic) Model Audit

29 July 2011

Prepared for

Sydney Intermodal Terminal Alliance (SMITA)

Halcrow

SIMTA Moorebank Intermodal Terminal Proposal
Paramics (Traffic) Model Audit

Prepared for

Sydney Intermodal Terminal Alliance (SMITA)

This report has been issued and amended as follows:

Rev	Description	Date	Prepared by	Approved by
V01	Draft for internal review	28/7/2011	AH	SK
V02	Draft for Client Review	29/7/2011	AH	JR

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Contents

1 Introduction

1.1 Overview of SIMTA Proposal

The Sydney Intermodal Terminal Alliance (SIMTA) is a joint venture between Stockland, Qube Logistics and QR National.

The SIMTA Moorebank Intermodal Terminal Facility (SIMTA proposal) is proposed to be located on the land parcel currently occupied by the Defence National Storage and Distribution Centre (DNSDC) on Moorebank Avenue, Moorebank, south west of Sydney.

SIMTA proposes to develop the DNSDC occupied site into an intermodal terminal facility and warehouse/distribution facility, which will offer container storage and warehousing solutions with direct rail access.

The SIMTA site is located in the Liverpool Local Government Area. It is 27 kilometres west of the Sydney CBD, 16 kilometres south of the Parramatta CBD, 5 kilometres east of the M5/M7 Interchange, 2 kilometres from the main north-south rail line and future Southern Sydney Freight Line, and 0.6 kilometres from the M5 motorway.

1.2 Purpose of Paramics Model Audit

As part of the traffic and transport planning process of the SIMTA proposal, a Paramics model has been developed by Hyder Consulting.

In order to understand and quantify the current road network performance around the SIMTA site, Hyder consulting have undertaken road network capacity assessment for the core area.

The assessment undertaken by Hyder involved the development and interrogation of a purpose-built micro-simulation model (Paramics) of the core Moorebank road network.

The purpose of the Paramics Model audit (as presented in this report) is to:

- audit the Paramics base case models undertaken by Hyder Consulting for the SIMTA Proposal;
- Review the traffic generation assumptions and associated methodology used in the development of the Paramics model inputs; and
- Provide recommendations for model improvements and modifications (if required).

It is understood that the Paramics base models will be used for assessment of future development scenarios. Therefore this audit has been undertaken to provide commentary as to the appropriateness of the base model for its intended use prior to further model development and future scenario testing.

We note that no information has been provided to Halcrow regarding "traffic distribution of future freight traffic flows". As such no comment has been provided in this report regarding future traffic scenarios (ie. with SIMTA proposal operating).

1.3 Information Reviewed

The audit presented in this report has been based in the following information:

- AA003210 Technical Note 3_Rev B – Traffic Generation xisting Road Network Capacity Issues (with Rev D also subsequently provided)
- AA003210 Technical Note 4_Rev B & D – Existing Road Network Capacity Issues
- AM peak Paramics Base Model
- PM Peak Paramics Base Model

1.4 Audit Approach

It is an ideal practice to have core Paramics network/control files consistent between models and also conform to the RTA standard. However, Paramics files controlling signal timing, traffic demand, lane changing behaviour and other calibration parameters are expected to be adjusted throughout the course of model development. This is to mimic and cater for different traffic conditions exhibited between modelled periods.

In some instances, slight differences between models (although not ideal) do not pose any significant impact on the validity of models from a practical point of view. For example, a difference of 0.5 metres in locating a kerb point between AM and PM peak period models would have insignificant impacts to the overall network operation. Indeed, the stochastic nature of microsimulation models will introduce variability which is encountered in real life daily traffic.

This audit will focus on aspects which are important to the operation and validity of the models. Halcrow believes this will be more beneficial to SIMTA than merely conforming to the RTA audit guidelines (which require a substantial amount of effort on documenting minor aspects of the model that will have no real bearing on model operation).

2 Paramics Model Setup

2.1 Configuration file

The configuration file is generally in accordance with the RTA standard file:

- Route Selection: Perturbation has been disabled in the models with an all-or-nothing route assignment. This is in general contrary to the RTA standards. However, the current models provide almost no alternative routings for traffic. Therefore, this is deemed acceptable. (However, note that this may not be appropriate in the expanded models where route selection is available).

- Split Random Seed and Streams: This option has been selected in both models. According to the RTA Paramics Manual, this option could provide some level of consistency for comparison purposes and is deemed to be acceptable.

- Closest Destination Carpark: This option has been selected in both models. However, there is no carpark specified in the models. Therefore it has no effect on simulation results.

- TWOPAS: Gradients have been incorporated in the models together with TWOPAS option selected. No information has been provided to Halcrow for verification of node heights. However, visual inspection together with Paramics auditing tool show no obvious abnormalities. (Relatively high values of 46m – 140m are on nodes outside of the core network).

2.2 Vehicles File

The vehicles file is generally in accordance with the RTA standard file. However, periodic vehicles files have been installed in both models. This is not necessary given that heavy vehicles are specified in separate matrices within each demand period. This setup also contributes to the following discrepancies:

- Periodic Vehicles File: In the AM peak model only "vehicles.1" and "vehicles.2" files are present. Whereas in the PM peak model "vehicles.1", "vehicles.2" and "vehicles.3" files for all three defined periods are present.
- Sum of vehicles proportion: The sum of vehicles proportion for matrix 1 in "vehicles.1" file adds up to 99.99%. "vehicles.2" adds up to 100.02%

For correctness and to avoid confusion, the vehicles proportion should add up to 100%. However, it is believed that the difference is small enough to have no significant impact on the modelling results.

2.3 Arrival Profile

With regard to the arrival profile:

- No information has been provided in regard to the development of vehicle arrival profiles in the technical note.
- A single profile has been installed each for the AM and PM peak models for all zones generating traffic.

It is generally good practice to have multiple arrival profiles for zones which are different in nature, provided data is available to substantiate this profiling. This will provide a more realistic profile of traffic arriving at intersections and queue behaviour. Therefore, it is recommended to install multiple profiles and more crucially in the expanded models.

2.4 Intersection Lane Configuration

Visual comparison on lane configuration at major intersections has been made with reference to the latest information from Google map and Nearmap on the internet. The comparison shows that the lane configuration is correct.

2.5 Signal Timing

There is no documentation in Technical Note 4 in regard to the development of signal timing in the models. Signal timing could generally be adopted based on real-life SCATS data such as IDM records or based on information sampled from site investigation. Nonetheless, queue length and congestion level validation could provide some assurance to the correctness of signal timing installed.

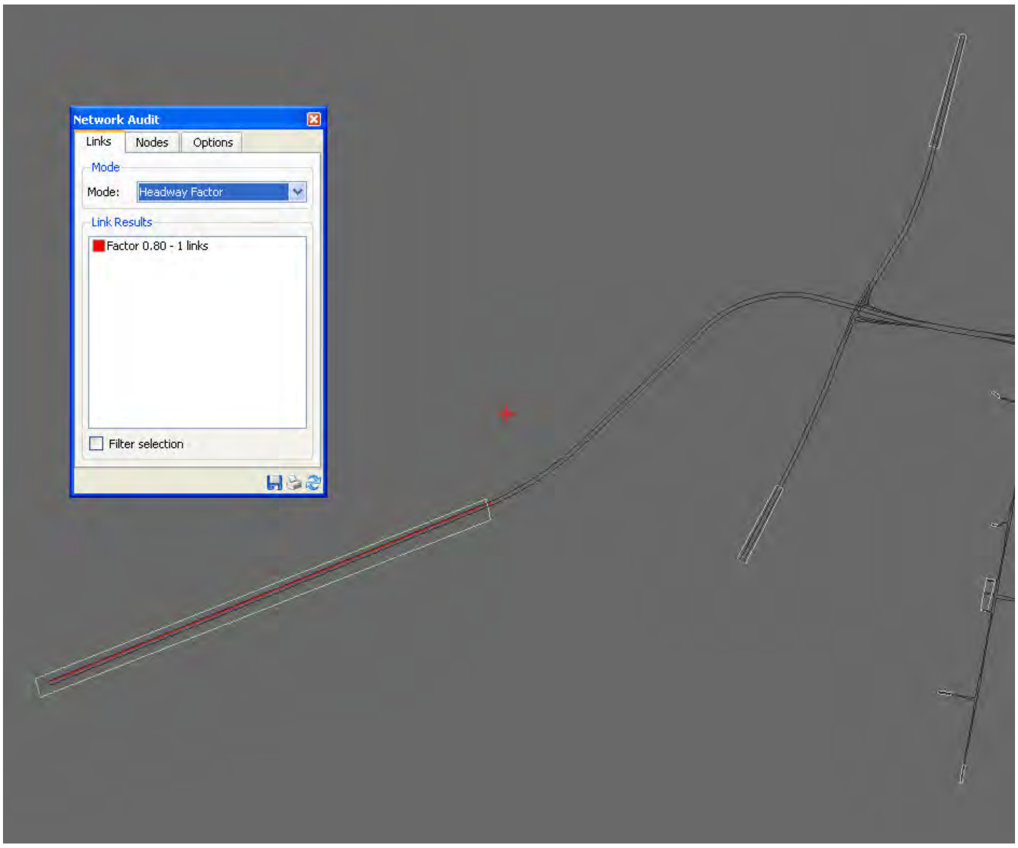
The eastbound off-ramp from M5 into Moorebank Avenue northbound is signal controlled according to our information. However, in the models this movement appears to be operating under free flow condition.

2.6 Bus Routes

Bus routes such as 855 and 870 operating along Hume Highway appear to be missing in the models.

2.7 Headway Factor

The lowest link headway factor adopted in the model is 0.8. This is installed on link 103:180 on M5 eastbound for both models and is considered to be acceptable.



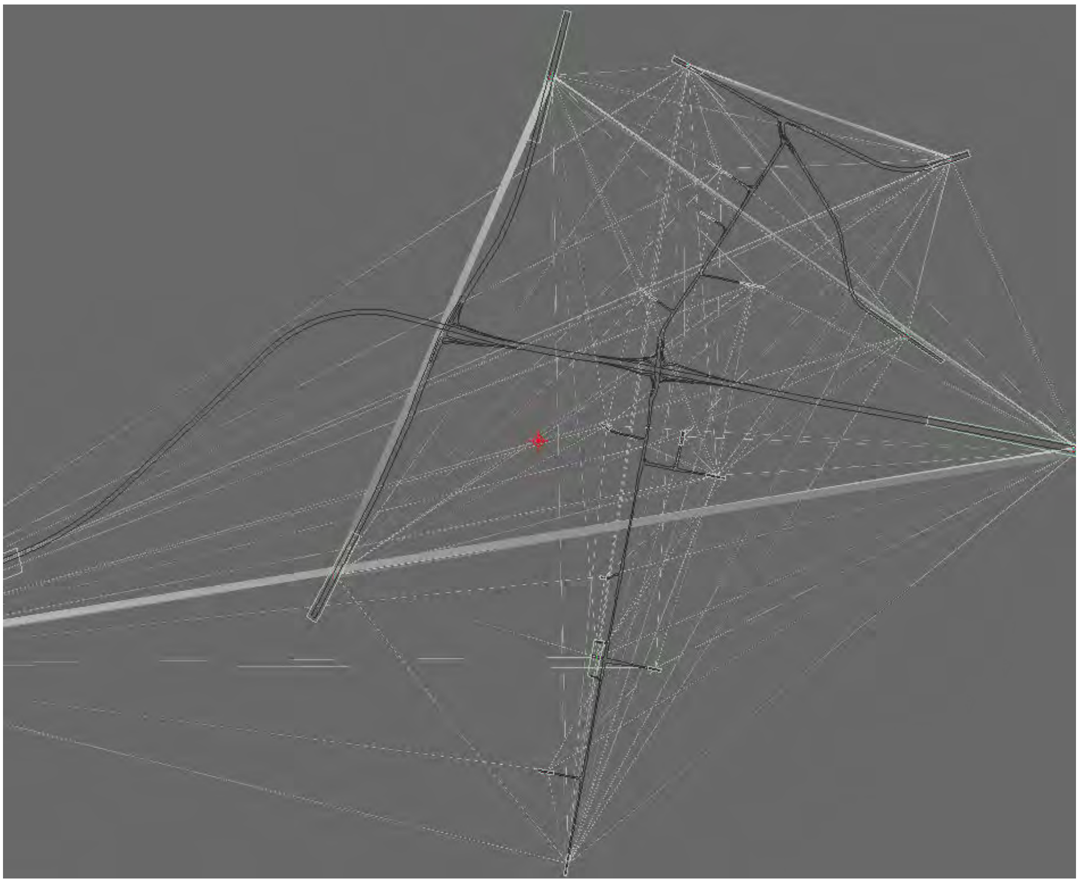
2.8 *Reaction Factor*

Reaction factors have been adjusted to 0.80 in the PM base model only on links at the east approach of Moorebank/Newbridge intersection. This is perceived as acceptable given the expected increase of driver aggressiveness under congested traffic conditions.

2.9 *Travel Demand Data*

It is documented in the technical note that the prior trip matrix and subsequent matrix estimation is undertaken using TransCAD transport planning software.
Based on anecdotal understanding of the travel pattern in the region, the demands appear to be reasonably distributed in the models. Visual inspections have also been conducted to ensure internal to internal short trips are in reasonable numbers.

The sample snapshot below shows the trip distribution for the PM base model:



2.10 Network File Consistency between AM and PM Peak Models

The core network files are in general consistent between the AM and PM peak periods.

The main difference is highlighted below:

- The position of node 118 is different by approximately 18 metres between models. This translates to the calculated gradient on links associated with this node being different between models. However, given that there is no acute change in heights of adjoining nodes, the impacts to the modelling is believed to be insignificant.

3 Overview of Technical Note 4 – Existing Road Network Capacity

3.1 Calibration

Based on the calibration summary in Table A4 – A5 of Appendix A, the models meet the calibration criteria at a satisfactory level. However, comparison of modelled traffic volume against observed count data is not shown. Therefore, our assessment can only be based on the statistical summary.

3.2 Validation

The validation of the models is conducted based on queue length survey and in addition, a weaving analysis on M5 eastbound carriageway between Hume Highway and Moorebank Avenue.

- Overall the modelled queue length in Paramics appears to be in good correlation with the surveyed data. Although on a few approaches the modelled queue length on all traffic lanes are slightly shorter than observed.
- The weaving analysis provides comparable outputs such as weaving speed, density and LoS based on HCM 2000 against the models.

3.3 Reporting

Under section 3.3.2 of the technical note, network operational issues have been identified based on the modelling. Issues 8 and 9 refer to the operation of M5/Moorebank intersection where the southbound right turn and northbound left turn movements along Moorebank Avenue are identified.

Both issues are shown as described in the actual simulation runs of the PM peak model. However, the LoS Summary for this intersection in Table 4 shows contrary information. The south approach through movement (instead of the movements described in issues 8 and 9) is recorded with the highest delay of 101s for this intersection. Further clarification is required for the reported delays.

(Note that during the process of finalising the Audit report, an update to the Technical Note – Revision D has been provided to us by Hyder Consulting.

Table 3 and 4 of the technical note have been updated with revised delays for the south approach through movement. Although the update partial resolve our query, it remains counter intuitive that the problematic movements reported in issues 8 and 9 are recorded with the lowest delays of all movements with 9s and 12s respectively.)

4 Overview of Technical Note 3 – Traffic Generation

Overall the traffic generation assumptions and calculations appear to be appropriate for the proposal.

However, there are a number of uncertainties regarding the reporting of particular issues which would benefit from further explanation and clarification. These are discussed below.

4.1 Truck Generation

4.1.1 Articulated Truck

- The ultimate design capacity of the proposed SIMTA proposal is anticipated to be 1 million twenty foot equivalent units (TEUs) per annum. In actual trip calculation, this translates to 500,000 TEUs arriving at the intermodal facility from Port Botany.

  - *It is assumed that 1 million TEUs accounts for containers arriving and departing the facility, thus only 500,000 are considered in the actual calculation. This is unclear and would benefit from further explanation and clarification.*

- 200,000 TEUs is assumed to be transported to warehouses on site and once off-loaded will be returned to Port Botany. Thus, no articulated truck trips will be generated from these containers, but rigid trucks only.

- The remaining 300,000 TEUs is assumed to be transported offsite that articulated truck trips will be generated.

    - *It is unclear how the split of 200,000 & 300,000 TEUs are derived from Hyder's report. However, section 3.3 of the report appears to validate the final truck generation – both articulated and rigid, satisfactorily with other similar facilities..*

- 30% articulated trucks will carry containers in both directions, i.e. back-loading which reduces the total generation from 1886 to 1603 truck movements per weekday.

    - *It is not clear where the 30% back-loading derives from and not examined in the sensitivity test either.*

4.1.2 Rigid Truck

- Similar calculation employed as for the articulated trucks above, except:
    - No back-loading
    - Container and rigid truck loadings (12.66 and 10 tonnes respectively) have been adopted to derive the total trip number.

4.1.3 Peak Hour Profile

- The daily/peak hour profile is based on the Enfield Traffic Study for truck movements to/from Port of Melbourne.

    - *Section 2.1.5 stated that there is no similar facility suitable in NSW for profile. Thus, while Port Melbourne does not include significant warehouse facilities and not operating as intermodal terminal, its profile is still adopted.*

- The in/out split of all trucks is assumed to be 50/50.

    - *Section 2.1.5 "trucks will be arriving and departing throughout the day, with only short periods stationary within the Terminal….."*

4.2 Employee Traffic Generation

4.2.1 General Assumption

- The employee traffic generation is calculated base on Gross Floor Areas (GFAs) from the SIMTA proposal Master Plan.

- Table 2-2, page 10 of the report shows the employment density rate adopted to derive the total number of employees.

    - *Note that the "Needs Assessment for Moorebank Intermodal Terminal Facility" by PricewaterhouseCoopers in March 2011 estimates a maximum of 2,840 employees instead if calculated 2,258. This is accounted in section 4 of the report under sensitivity testing.*

- 80% split on private car is subsequently adopted based on Journey to Work data 2006 by Bureau of Transport Statistics (BTS) and the assumption of increase mode share from 3% to 6% on public transport.

    - *It is unclear exactly how the figure of 80% is calculated.*

4.2.2 Peak Hour Profile

- Based on shift pattern for warehousing and ancillary village, such as office, retail and train terminal operations.

- The in/out split for employee is not tabulated in the report. Although it can be worked out based on the information from Appendix B.

4.3 Traffic Generation Staging

- Section 2.3.1 outlines the traffic generation in stages of 500,000 TEUs by 2021 and 1 million TEUs by 2031.

- ➢ *This assumption is taken as given at face value. However, some commentary would be beneficial around the assumptions used to come up with these figures and the implications of reaching the staged volumes prior to or after the anticipated years.*

- There is no mentioning of background traffic growth.

- ➢ *It is unclear whether this is due to existing capacity constraints under current road conditions?*

We note that we believe there is a typo in Table 2-4 and 2-5 as shown below.

Truck Peak should be 14:00-15:00?

Table 2-4 Peak Hour Private Car Generation Summary

	Road Peak (07:00-08:00; 16:00-17:00)		Truck Peak (07:00-08:00; 16:00-17:00)	
	AM	PM	AM	PM
Private Car	**692**	**630**	**692**	**630**

692?

Table 2-5 Weekday Daily Traffic Generation Forecasts in each stage

Indicative Year	TEU Processed in total	Average Daily (Weekday) Car	Average Daily (Weekday) Truck	AM Peak 1 hour (7-8am) Car[1]	AM Peak 1 hour (7-8am) Truck	PM Peak 1 hour (4-5pm) Car[1]	PM Peak 1 hour (4-5pm) Truck
2021	500,000	2,492	1,313	317	104	435	76
2031	1,000,000	3,614	2,638	461	204	630	155

5 Conclusion and Recommendations

Halcrow concludes that the audited base models provide a reasonable representation of the existing road network conditions.

However, it is suggested that the following summary of recommendations be considered and in particular for the development of an expanded model.

- Review the suitability of adopting All-or-Nothing route assignment
- Review the sum of vehicle proportion and justify the need of periodic vehicles files
- Consider the adoption of multiple arrival profiles for origin zones
- Review the coding of priority control for eastbound off-ramp at M5/Moorebank intersection
- Verify the correctness of bus operation along Hume Highway
- Review the physical location of node 118 in the models
- Provide explanation on reported operational issues 8 and 9, and their corresponding delays

Technical Note 4 states that the extent of the existing model network will be expanded to provide a wider coverage in an attempt to capture other potential network capacity issues. Although the exiting base models will be used to form the basis, Halcrow envisages that significant modifications will be introduced in terms of zoning system, traffic demands and route selection.

Therefore, Halcrow's comments on the existing base models do not necessarily correlate to any future expanded models and Halcrow accepts no responsibility for any subsequent modification of these base models undertaken by others.