Intermodal Logistics Centre at Enfield

APPENDIX B

Traffic and Transport

PREFACE

The technical working papers for the proposed ILC at Enfield were prepared during the first half of 2005. These were prepared in response to the requirements for the preparation of an Environmental Impact Statement (EIS) under Part 4 of the Environmental Planning & Assessment Act, 1979 (EP&A Act). Specific requirements for the EIS were issued on 1 March 2005 by the (then) Director- General of Infrastructure, Planning and Natural Resources.

The EP& A Act was amended on 1 August 2005 by the creation of Part 3A of the Act, and the Department of Infrastructure, Planning and Natural Resources was dissolved on 26 August 2005 and replaced by the Department of Planning and the Department of Natural Resources.

The proposed ILC at Enfield has since been declared a major project, pursuant to SEPP (Major Projects) 2005 and Sydney Ports has subsequently lodged an application under Part 3A of the Act.

Editorial changes to the technical working papers to reflect the changes in legislation or changes in Government departments have not been made.

The following should be considered when reading the technical papers:

- The Director-General's requirements issued under Part 4 are now deemed to have been issued under Part 3A, and any reference to the Director-General's requirements should be read as a reference to Director-General's requirements issued under Part 3A;

- Any reference to an EIS under Part 4 of the Act should be read as a reference to an Environmental Assessment under Part 3A of the Act;

- Any reference to the Department of Infrastructure, Planning and Natural Resources should be read as a reference to either the Department of Planning or the Department of Natural Resources, as appropriate.

Traffic Impact Assessment Intermodal Logistics Centre, Enfield

TRANSPORT WORKING PAPER

- 5 July 2005

Traffic Impact Assessment
Intermodal Logistics Centre, Enfield

TRANSPORT WORKING PAPER

- 5 July 2005

Sinclair Knight Merz
ABN 37 001 024 095
100 Christie Street
PO Box 164
St Leonards NSW
Australia 1590
Tel: +61 2 9928 2100
Fax: +61 2 9928 2500
Web: www.skmconsulting.com

Contents

Document history and status

Version	Date issued	Reviewed by	Approved by	Date approved	Revision type
00	4 April 2005	K Pettigrew	K Pettigrew	4 April 2005	
01	09 April 2005	K Pettigrew	K Robinson	12 April 2005	Draft to Draft Final
02	18 May 2005	K Pettigrew	K Robinson	18 May 2005	Draft Final to Final
03	17 June 2005	J Stanley	K Robinson	17 June 2005	Final
04	30 June 2005	J Stanley	K Robinson	30 June 2005	Final
05	5 July 2005	J Stanley	K Robinson	5 July 2005	Final

Distribution of copies

Revision	Copy no	Quantity	Issued to
00		1 PDF	Ken Robinson
01		1 PDF	Ken Robinson
02		1 PDF	Ken Robinson
03		1 PDF	Ken Robinson
04		1 PDF	Ken Robinson
05		1 PDF	Ken Robinson

Printed:	30 June 05
Last saved:	5 Jul 2005 2:47 PM
File name:	I:\ENVR\Projects\EN01709\Traffic\Deliverables\Final Report June 05\R04\EN01709.350 R05.doc
Author:	Julie Stanley / Tim Bickerstaff / Kumutha Srisivalingam
Project manager:	Keith Pettigrew
Name of organisation:	Sydney Ports Corporation
Name of project:	Traffic Impact Assessment, Intermodal Logistics Centre, Enfield
Name of document:	Transport Working Paper
Document version:	Final R05
Project number:	EN01709.350

Executive Summary

This Working Paper on traffic and transport issues relating to the proposed Enfield Intermodal Logistics Centre (ILC) has been prepared by Sinclair Knight Merz (SKM) as part of an Environmental Impact Statement (EIS) process on behalf of Sydney Ports Corporation (SPC).

Proposed Intermodal Logistics Centre

The proposed ILC would be used for the transfer and storage of freight containers that are transported by rail to and from Port Botany, packing and unpacking of containers within the proposed warehouses and storage of empty containers for later re-use or for return to the Port. In brief, the ILC at Enfield comprises:

- An Intermodal Terminal;
- Warehousing;
- Empty Container Storage Facilities;
- A Light Industrial / Commercial Area; and
- A Community and Ecological Area.

The proposed ILC helps support the NSW Government policy to increase the proportion of freight transported by rail to and from Port Botany to 40% by 2011. This policy is also supported in key freight initiatives. A Freight Infrastructure Advisory Board (FIAB) has also recently been established to advise the Government on infrastructure and operational improvements required to address this freight task. These actions will ensure that freight is moved around Sydney and NSW in a safer and more efficient manner.

Key Objectives

The key objectives of this traffic impact assessment was to realistically identify the probable traffic and transport impact of the proposed ILC and to investigate mitigation of impacts, particularly in the local area. The likely traffic generation and profile has been estimated and the impacts on the local and regional network assessed, taking into consideration the concerns of the local community, representative councils and the requirements of the NSW Government.

Site Location

Enfield Intermodal Logistics Centre is located within Strathfield Council on the border of Bankstown Council. Regional road access for the site is from Centenary Drive from the north, Hume Highway from the north east and north west, Punchbowl and Canterbury Roads from the south leading from the M5 Motorway and Roberts Road from the south. Local access to the site is

via Cosgrove Road and Norfolk Road / Wentworth Street. The site is ideally located in terms of accessibility to the local and regional network.

Local Impact Area

For the purpose of assessing local impacts, a study area has been defined as being bounded by the following roads:

- Hume Highway (north and west);
- Coronation Parade (east);
- Punchbowl Road (east);
- Boronia Road / Juno Parade (south); and
- Centenary Drive (north).

The selected study area includes all major roads that could be used to access the site.

Existing Traffic and Transport Conditions

Intersection Analysis

Intersection and classification counts were taken at key locations surrounding the study area. These intersections were selected because they were identified as being on key routes to and from Enfield. Surveys were taken over the full 24 hour / 7day period to reflect the anticipated schedule of the proposed ILC.

These counts were used to assess the existing operation of the surrounding intersections. The analysis showed that most of the intersections are currently operating satisfactorily. However, the intersections of Roberts Road / Juno Parade and Hume Highway / Roberts Road / Centenary Drive are currently over capacity in the morning peak at Level of Service E and F respectively, and the operation of the King Georges Road / Punchbowl Road is saturated in both peak periods at Level of Service F.

Network Analysis

A regional network model was developed using NETANAL to assess the impact of the proposed development on the surrounding road network. The 2005 base model was calibrated based on the traffic count data collected for this study. This model was used to assess the future impacts of the Enfield Intermodal Logistics Centre on the surrounding road network.

Public Transport Network

The existing public transport network in the vicinity of the site is minimal, with only a few bus routes operating in the Enfield area. The closest routes to the site are the 447 (operated by Pleasure Tours) and 484 (operated by Transit First).

All routes operate between approximately 6:00am and 9:00pm on weekdays, except for route 484, which runs from 7:00am to 7:00pm. Weekend services, with reduced hours of operation, are provided on most of these routes except for route 447 (no Sunday runs) and route 484 (no weekend runs).

Enfield is situated between two metropolitan railway lines, the Inner West Line and the Bankstown Line. The closest stations are Belmore and Lakemba on the Bankstown Line, which are both approximately 2.3km from the proposed site entrances on Cosgrove Road and Wentworth Street respectively. Without direct bus services linking the railway stations to the development site, the railway services do not adequately serve the site.

There are several cycle routes established within the vicinity of Enfield, although there appears to be no easy/direct link to it from the site, as it runs on the far side of Cooks River and river crossings are not conveniently located. Local on-road paths on Maiden Street and Noble Avenue, in Greenacre, are easily accessible from the Norfolk Road entrance. These routes link to a path shared with pedestrians, which runs on the north side of Hume Highway linking to Bankstown to the west and the Ryde - Botany Bay path to the east.

Road Safety Assessment

Road safety is a critical issue and one that has been highlighted by the community, particularly with regard to the effect of heavy vehicle movements. Crash data were obtained from the RTA for the five key councils surrounding the study area. Initial analysis of the data was undertaken for a selection of roads within the study area, to include major roads and key routes to and from the proposed development. As the proposed ILC is an industrial development the key vehicle types of interest are heavy and light goods vehicles. Heavy goods vehicles accounted for just under 6% of accidents whilst approximately 17% of accidents involve light goods vehicles.

Asset Condition Assessment

A pavement inspection was undertaken to provide an assessment of pavement condition on selected key roads within the study area. The selected roads were generally in good condition, with some exceptions where maintenance is required. These include sections of Hume Highway, Cosgrove Road, Roberts Road and Wentworth Avenue.

On-Site Activity Profile

Container Activity

The volume of container activity through Enfield Intermodal Logistics Centre is proposed to be approximately 300,000 TEU per annum moving to and from Port Botany and the proposed ILC. These movements are described below. Volumes are indicative only.

- 150,000 TEUs per annum would be sent by rail from the port to Enfield. Of these:

- 50,000 full TEUs would be unpacked at the Logistics Centre Warehouse and the contents dispatched by road on small trucks;
- 100,000 TEUs would be dispatched full directly to importers; and
- 145,000 empty TEUs would be returned to the Empty Container Depot at Enfield from the Logistics Centre Warehouse and from importers/exporters. Around 5,000 TEUs would leak from the system i.e. containers to other ports / locations.

- 150,000 TEUs per annum would be returned to the port by rail. Of these:
  - 10,000 TEUs would come from the Logistics Centre Warehouse where they were packed with goods brought to Enfield by small trucks;
  - 60,000 full TEUs would be trucked direct from exporters. Most of the containers filled by the exporters would have come from the Empty Container Depot; and
  - 80,000 empty TEUs would be returned to the port from the Empty Container Depot.

The number of staff required to load / unload containers for the trains and trucks was estimated as well as on-site container movement.

Site Staff Profile

Estimates have been made of the number of staff required on-site during each shift. Shift times have been assumed to be 5:00am – 4:00pm and 4:00pm – 3:00am. Staff are required in the Enfield Intermodal Logistics Centre, to operate and supervise loading and unloading of trains, loading and unloading of trucks (both containers and loose freight), and for general management and administration. Over a 24-hour period, it is assumed there would be approximately 10-20 train movements.

The staff profile is a combination of staff related to the movement of goods to/from trains; warehousing; intermodal rail facility operations; empty depots and office based administration / general staff. The total staff requirements shows a total weekday force of 378 persons working on site during the total workday, with 291 during the day (149 day-shift plus 142 working normal office hours) and 87 during the night.

In assessing the impact of the operational workforce on the surrounding road network, it has been assumed that the majority of staff will drive their own car to/from work. This reflects the absence of suitable public transport at the start of the main shift (5:00am), and at the finish of the second shift (3:00am). The peak of staff movements would be when the 87 night-shift workers arrive to replace the 149 day-shift workers. This would occur between 3:30pm and 4:30pm. Volumes at the other shift changeover would be less focussed, due to the extended time between the end of the night shift and the start of the day shift.

These times are outside or just overlapping with the peak period on the wider road network, which are generally between 7:00am - 9:00am and 4:00pm - 6:00pm, although the afternoon shift

changeover would occur close to the after-school peak. Although there are seven schools in the immediate vicinity, the bulk of staff traffic would occur after the main after-school peak, where the impact would be reduced.

Proposed Access Arrangements

Two access points for the Enfield Intermodal Logistics Centre have been proposed, via Cosgrove Road to the Hume Highway, and via Wentworth Street and Norfolk Road to Roberts Road. Previous proposals for the site showed that there could be potential problems associated with only providing one site access point. Providing two site access points creates an opportunity for a more even distribution of traffic coming into and out of the site and provision of emergency services.

The key entry point would be via the Roberts Road / Norfolk Road intersection and then via Wentworth Street. This entry point would be linked to the eastern part of the site via a bridge across the Enfield Marshalling Yards. Internally, this would link with the secondary access point at Cosgrove Road. The main origins and destinations of truck traffic forecast for the development are located west of the site. As such, the access onto Roberts Road would generally be the most attractive.

Dangerous Goods Vehicles

Dangerous goods vehicles will travel on the main arterial road network. An on-site incident management and response plan and a response to a dangerous goods incidence requiring the closure of major roads adjacent to the site would be prepared as part of a hazard and risk assessment.

On-Site Management

Parking

The likely number of parking spaces should be based on the anticipated number of employees on the site. This number is recommended as a maximum rather than a minimum number of parking spaces. Actual parking arrangements for trucks and cars on site would be addressed as part of the detailed design stage.

On-Site Queuing

During the peak of activity, there would be approximately 52 truck arrivals in a one-hour period. Each truck would travel to the relevant part of the site for access to a particular activity. All traffic will be accommodated on-site through on-site traffic management plans.

Heavy Vehicle Management

The operation of the site is likely to involve a number of different lessees, operating independently but with similar objectives. The development of site traffic management plans is one mechanism

that could bind all lessees and transport operators to a central objective of developing the site as a model of good practice and would consider the following issues:

- Consideration of a vehicle booking system (VBS) or a similar system that provides for even and structured arrival of trucks to the site for loading and unloading, and accommodates the optimum number of trucks on-site waiting service. This might also create arrival schedules that minimise impact on local demand peaks;
- Development of local area traffic management initiatives to guide trucks to using the major arterial road network; and
- Compliance with safe loading practices and addressing vehicle weight-of-load thresholds on the road network in accordance with the *Road Transport (General) Act, 2005*.

The requirements for heavy vehicle management under a traffic management plan would be developed in consultation with the RTA.

Operational Traffic Impact Assessment

Site Traffic Generation

The generation of vehicular activity (trucks and cars) from the proposed Enfield Intermodal Logistics Centre was estimated from first principles. A fundamental assumption was the annual volume of containers (expressed as TEUs) moving between the port, the ILC and importers / exporters. For each movement of containers,the volume of truck acivity was estimated. The peak activity for the site is between 2:00pm and 3:00pm with approximately 103 truck movements (in and out). The peak activity in the AM peak period between 7:00am and 8:00am is approximately 88 truck movements. On an average weekday, approximately 30% of truck movements would be small trucks. The analysis shows that the impact of the vehicular traffic associated with the development of the Enfield Intermodal Logistics Centre has a minimal effect on the road network.

Office Traffic Generation

Based on the level of on-site office activity, it is estimated that approximately 142 office workers will access the site during the network peak periods (morning and evening). It has been assumed that these office activities are associated with the warehousing activity.

Cosgrove Road Light Industrial / Commercial Area Traffic Generation

Approximately three hectares of light industrial land adjacent to Cosgrove Road would be developed as part of the proposal. This development would be consistent with the existing land uses on the western side of Cosgrove Road. Assuming a 50%/50% split of warehouse type developments and factories, traffic generation rates published by the RTA indicate a peak hour traffic generation of approximately 169 trips (in and out) associated with this site.

Traffic Distribution

The traffic generated by the proposed ILC was distributed onto the surrounding road network, based on the forecast market area for the ILC. In order to model this distribution of truck activity from the ILC, representative industrial zones in each local government area were identified, and the NETANAL model adjusted to reflect these origins and destinations.

The bulk of container movement to and from Enfield is expected to be in the area west of Enfield. The local government areas of Bankstown and Parramatta account for the largest proportions of activity. The nature of this market area is reflected in the distribution of trucks to/from the ILC. Key access routes include the M5 Motorway, Roberts Road, the Hume Highway and M4 Motorway.

Future Traffic Impact

The impact of the development was derived from a NETANAL model calibrated by local traffic surveys, modelling natural growth projections for the area (base 2005 and future 2016), and assigning the traffic generated by the site onto the future road network based on projected commercial activity. Measures of link capacity (between intersections) and intersection operation were used to identify the impact of the proposed development on the road network.

The road network was analysed both with and without the future development of Enfield to compare the effect of background traffic growth with the impact of the development.

Two scenarios were tested for 2016:

- The “do nothing” scenario including the Port Botany and Sydney Airport growth but no Intermodal Logistics Centre at Enfield; and
- The development of an Intermodal Logistics Centre at Enfield scenario. Some of the movements previously undertaken to and from Port Botany directly by road would replaced by the train between Port Botany and Enfield, and a separate truck trip between Enfield and the ultimate origin/destination in the Enfield Market area.

These results show that on most key roads, the impact in peak hour traffic (morning and afternoon) resulting from the development of the ILC is minimal. In some instances, a reduction in traffic volumes occurs as vehicles switch to alternative routes. Changes in traffic volume at some locations, particularly intersections, can change travel times, making alternate routes more attractive.

Future Intersection Analysis

The operation of key intersections within the identified study area has been assessed both with and without an Enfield Intermodal Logistics Centre for the year 2016. The results show that

background growth in traffic to 2016 would result in several intersections operating at an unsatisfactory level of service. It also shows that generally there is very little difference in intersection operation in 2016 when comparing the with and without Enfield Intermodal Logistic Centre scenarios. Saturated intersections include Roberts Road / Juno Parade, King Georges Road / Punchbowl Road, Hume Highway / Roberts Road / Centenary Drive, Hume Highway / Coronation Parade, Hume Highway / Cosgrove Road and Centenary Drive / Arthur Street.

The Hume Highway / Cosgrove Road intersection is forecast to be saturated, operating unsatisfactorily at Level of Service F in the future, regardless of any development of the ILC. The link capacity assessment also shows that this section of the highway would be congested in the future, regardless of the ILC. Based on this forecast, widening of this section of the Hume Highway is warranted, and would improve intersection operation. With three through lanes provided in each direction on the Hume Highway, acceptable operation could be achieved. This configuration would also be suitable for the forecast traffic with the ILC in operation. The Roberts Road / Norfolk Road intersection is operating with spare capacity and no intersection enhancement is required.

Regional Impact Zone

An assessment was undertaken to ascertain the regional impact of the Enfield Intermodal Logistics Centre on the road network. The most significant findings are:

- Where the heavy vehicle volume increases, it is generally only by a small margin. In most cases, the change in peak hour traffic volume is negligible. The greatest increase in heavy vehicles is on Roberts Road, with heavy vehicles associated with the Intermodal Logistics Centre accounting for just over 1% of total traffic;
- The additional truck activity generated by the development would be concentrated on key arterial roads such as M5 Motorway, Roberts Road , M4 Motorway and Hume Highway; and
- There would be reduced growth in heavy vehicle traffic on the M5 Motorway between Sydney Airport and King Georges Road, due to an increase in rail transport of freight containers from Port Botany to Enfield.

The low volumes of heavy vehicles generated by the Enfield ILC indicate that no infrastructure is required to support a stand alone road freight corridor for the movement of heavy vehicles from the site.

Mitigation Measures

The traffic modelling has shown that

- The proposed ILC will have a minimal impact on traffic volumes and the performance of intersections in the immediate area;

- The number of additional movements on the regional road network from the Enfield development is very low and does not detrimentally affect network performance; and
- The impact of natural traffic growth in the study area will be the major contributor to the poor performance of some intersections and roads in the future.

It is suggested that the RTA investigate options to improve the operation of the following intersections for the benefit of all road users. These include:

- King Georges Road / Punchbowl Road;
- Hume Highway / Roberts Road / Centenary Drive;
- Hume Highway / Coronation Parade;
- Centenary Drive / Arthur Street;
- Roberts Road / Juno Parade; and
- Cosgrove Road / Hume Highway

The operation of the Hume Highway / Cosgrove Road intersection will directly impact the Enfield Intermodal Logistics Centre. Satisfactory operation in 2016 could be achieved through the provision of three through lanes in each direction on the Hume Highway between Centenary Drive and Cosgrove Road. This would alleviate the forecast Level of Service F to achieve satisfactory intersection operation with the Intermodal Logistics Centre in place. The Roberts Road / Norfolk Road intersection is operating with spare capacity and no intersection enhancement is required.

Local Area Traffic Management

Local Area Traffic Management (LATM) measures can be utilised to reinforce the characteristics of roads in the local highway network. With appropriate LATM measures for through traffic using the local road system, it is unlikely that traffic will have any significant impact on local amenity. In this specific case, the objective for introducing measures would be to ensure that heavy vehicles travelling to and from ILC use appropriate routes and do not travel through unsuitable residential areas. Light traffic thoroughfares are already in place in Norfolk Road and Rawson Road, west of Roberts Road. Sydney Ports Corporation will work with Bankstown and Strathfield Councils and the RTA to develop appropriate strategies for the local area.

Sensitivity Assessment

A sensitivity assessment was undertaken to ascertain a worst-case scenario with the number of vehicles generated from the site. Sensitivities that affect container truck numbers include the container/truck ratio, backloading rates and the weekday activity profile. Light truck numbers are affected by truck size and load size. Realistic potential variations on the baseline would result in changes ranging from –6 to +12 container truck movements and –10 to +28 light truck movements in the peak hour. The overall impact of this number of truck movements would have a minimal

impact on the surrounding road network, and would not significantly change the findings of the traffic impact assessment presented in this report. The forecasts presented are also likely to be conservative in the long term, as the operators of the site will strive to achieve operational efficiencies in order to reduce their transport costs.

Construction Traffic Impact Assessment

Construction Traffic

It is anticipated that construction activity for the Enfield Intermodal Logistics Centre will occur over a period of approximately 27 months. Traffic volumes generated by the construction employees on the site would vary depending on the construction timetable.

The indicative timetable is as follows:

- Stage 1 – Site Preparation – months 1-4;
- Stage 2 – Earthworks and Drainage – months 2 – 12;
- Stage 3 – Road and Rail Infrastructure – months 8-15; and
- Stage 4 – Warehousing and Final Works – months 15-27.

There is a fifth stage, Commercial and Light Industrial Buildings, that will commence as market demand requires.

The main road transport task during construction of the new terminal would be the delivery of materials and concrete to the site and removal of stockpile and contaminated material from the site. Based on the indicative construction program, the construction impact is not considered to be substantial. The average vehicle activity during the construction period is around 29 construction vehicles per day. The peak vehicle is likely to be in month 15 when Stage 3 and Stage 4 overlaps, with an average of 75 vehicles per day during this period.

The main routes used for the movement of key materials from the site would be via the Hume Highway or via Roberts Road. Heavy construction traffic would be restricted to arterial routes with trucks prohibited from using local streets in residential areas.

The construction staff traffic impact is not considered to be significant. It is anticipated that construction would employ 150 to 170 workers for 12 months continuous construction, with a peak of 240 workers for two months. If it were assumed that all staff would be on site at any one time and that each occupied one car, the peak traffic generation to and from the site would be acceptable.

Traffic Management during Construction

The traffic modelling has indicated that the proposed Enfield ILC will have a minimal impact during the construction phase. Appropriate traffic management plans will be developed to manage construction traffic during the site construction period.

Conclusions and Recommendations

Conclusions

The key conclusion as a result of the investigations undertaken as part of this traffic and transport analysis shows that there is no significant adverse impact on the local or regional road network following the introduction of the Enfield Intermodal Logistics Centre.

The traffic generation was based on the total volume of 300,000 TEU moving to and from Port Botany. On-site activity (movement of containers, vehicle and train movement) was modelled assuming 24 hours operations with two shifts. The impact of the staff travelling to work would be minimal due to these shift arrangements. There is additional activity on the site in the form of offices (normal working hours) which will increase the traffic in the peak period but this will not adversely impact the existing and future operation of the surrounding intersections. The peak hourly number of truck movements for the site is outside the AM and PM peak hours.

Impact on Local Network

The impact on the surrounding local road network is not significant, as the total truck volume does not adversely affect the level of service at the intersections in 2016.

However, the following intersections require upgrading regardless of the Enfield Intermodal Logistics Centre development:

- King Georges Road / Punchbowl Road;
- Hume Highway / Roberts Road / Centenary Drive;
- Hume Highway / Cosgrove Road;
- Hume Highway / Coronation Parade;
- Centenary Road / Arthur Street; and
- Roberts Road / Juno Parade.

Impact on Regional Network

The impact on the regional network is not significant. The key findings of the analysis are the following:

- In most cases, the change in peak hour traffic volume is negligible;

- The additional truck activity generated by the development would be concentrated on key arterial roads such as Roberts Road, M4 Motorway, M5 Motorway and the Hume Highway; and
- There would be reduced growth in heavy vehicle traffic on the M5 Motorway between Sydney Airport and King Georges Road, due to the increase in rail transport of freight containers from Port Botany to Enfield.

Recommendations

Local Area Traffic Management (LATM)

Light traffic thoroughfares are already in place in Norfolk Road and Rawson Road, west of Roberts Road. Heavy vehicle routes to and from the Norfolk Road access will therefore use Roberts Road and Hume Highway to access the wider road network. Site access is also proposed on Cosgrove Road. The southern end of this road has residential land use and it is recommended that options be investigated to route heavy vehicles away from this area. Sydney Ports Corporation will work with Bankstown and Strathfield Councils and the RTA to develop appropriate strategies for the local area.

Intersection Improvement Upgrades

The traffic modelling results show that background growth in traffic to 2016 would result in some intersections operating at an unsatisfactory level of service. The Hume Highway / Cosgrove Road intersection is forecast to operate at Level of Service F in the future, regardless of any development of the Enfield Intermodal Logistics Centre. It is recommended that this intersection be enhanced to improve traffic operations. The Roberts Road / Norfolk Road intersection is operating with spare capacity, and no intersection enhancement is required.

1 Introduction

This Working Paper on traffic and transport issues relating to the proposed Enfield Intermodal Logistics Centre has been prepared by Sinclair Knight Merz (SKM) as part of an Environmental Impact Statement (EIS) process on behalf of Sydney Ports Corporation (SPC).

1.1 Background Information

A major NSW Government policy is to increase the percentage of freight transported by rail from Port Botany significantly in the future. This policy is supported in key freight initiatives such as the NSW Ports Growth Plan, the Metropolitan Freight Strategy and the Ports Freight Plan for Sydney, which aim to ensure that the Governments objective of increasing the proportion of freight containers moved by rail to 40% by 2011. These documents are referenced as Appendix A.

A Freight Infrastructure Advisory Board (FIAB) has recently been established to advise the Government on infrastructure and operational improvements required to address this freight task, ensuring freight is moved around Sydney and NSW in a safer and more efficient manner. The FIAB will advise the government on:

- the design of an intermodal terminal network to improve freight distribution;
- the infrastructure required to service the intermodal network and the potential changes to work practices such as 'truck tracking' to minimise queuing at the port gate;
- 'container in/container out' to maximise the efficiency of truck haulage; and
- other strategies to minimise unnecessary movements of containers across Sydney.

In 2001, Sydney Ports had a proposal to establish an intermodal terminal at Enfield with a 500,000 TEU capacity. The NSW Government conducted an Independent Review of the proposal. In the new concept, Sydney Ports Corporation has taken into account recommendations made in the Review, which includes a reduced intermodal capacity and the establishment of complementary facilities on site. The Director-General also issued a series of requirements for the site, which included concerns by other key stakeholders such as the Roads and Traffic Authority (RTA) and Councils. These are address addressed as part of this report as Appendix B.

1.2 Overview of the Enfield Intermodal Logistics Centre Proposal

The proposed Enfield Intermodal Logistics Centre would be used for the transfer and storage of freight containers transported by rail to and from Port Botany, packing and unpacking of containers

within the proposed warehouses and storage of empty containers for later re-use or for return to the Port. In brief, the Intermodal Logistics Centre at Enfield comprises:

- An Intermodal Terminal - for the loading and unloading of containers between road and rail and short term storage of containers;
- Warehousing - for the packing and unpacking of containers and short-term storage of cargo;
- Empty Container Storage Facilities – for the storage of empty containers for later packing or transfer by rail;
- A Light Industrial / Commercial Area - for light industrial / commercial use, preferably complementary to operations at the Intermodal Logistics Centre. The area would also act as an interface to adjacent uses along Cosgrove Road;
- An Ecological / Community Area - would provide the opportunity to incorporate ecological enhancement and community opportunities. The area would also serve as a buffer between operations on the site and residences to the south of the site; and
- Off site works - comprising construction of a road bridge over the existing New Marshalling Yards and dedicated freight rail line for access to Wentworth Street.

1.1 Key Objectives

The key objectives of this traffic impact assessment were to realistically identify the probable traffic and transport impact of the proposed Enfield Intermodal Logistics Centre and to investigate mitigation of impacts, particularly in the local area. The likely traffic generation and profile has been estimated and the impacts on the local and regional network assessed, taking into consideration the concerns of the local community, representative councils and the requirements of the Government.

1.2 Contents of the Report

The key sections within this report are:

- Section 2 - Review of existing road network conditions, including characteristics of the network in terms of key local roads, public transport, road safety assessment, asset conditions assessment and intersection analysis;
- Section 3 - The on-site activity profile assumed including container activity, workforce profile, proposed access arrangements and parking;
- Section 4 - Traffic impact assessment related to the development, including local and regional impacts, mitigation measures and sensitivity assessment;
- Section 5 – Construction traffic associated with the anticipated construction program; and
- Section 6 - Conclusions and recommendations.

There are six appendices associated with this Working Paper as follows.

- Appendix A – Background Documents;
- Appendix B – Director Generals Requirements;
- Appendix C – Model Verification;
- Appendix D – Pavement Inspection Record;
- Appendix E – Future RTA Projects; and
- Appendix F – Glossary of Terms.

A separate volume contains details of traffic surveys undertaken for this report and details of intersection analysis.

2 Existing Road Network Conditions

2.1 Regional Road Network

The Enfield Intermodal Logistics Centre is located within Strathfield Council on the border of Bankstown Council. Regional road access for the site is from Centenary Drive from the north, Hume Highway from the north east and north west, Punchbowl and Canterbury Roads from the south leading from the M5 Motorway and Roberts Road from the south. Local access to the site is via Cosgrove Road and Norfolk Road / Wentworth Street. The site is ideally located in terms of accessibility to the local and regional road network and the proposed land use matches the existing land use for the area, such as

- Railway operations including the existing freight lines and marshalling yards to the west and the Pacific National terminal at Chullora;
- Industrial land uses and transport related companies on Cosgrove Road to the east and Roberts Road to the west; and
- Commercial / industrial strip development along Punchbowl Road to the south of the site.

The site is shown within its regional context in Figure 2-1. The site has major road links to all Sydney regions with the Hume Highway within 1km of the key access / egress point to the site, providing direct links to the central western region and south western regions including Bankstown and Liverpool. Roberts Road connects the site with the southern and north western areas of Sydney as well as with the M4 Motorway to Sydney's west and the M5 Motorway to Sydney's south west. These road connections are considered to be well suited to the proposed future use of the site.

2.2 Local Impact Study Area

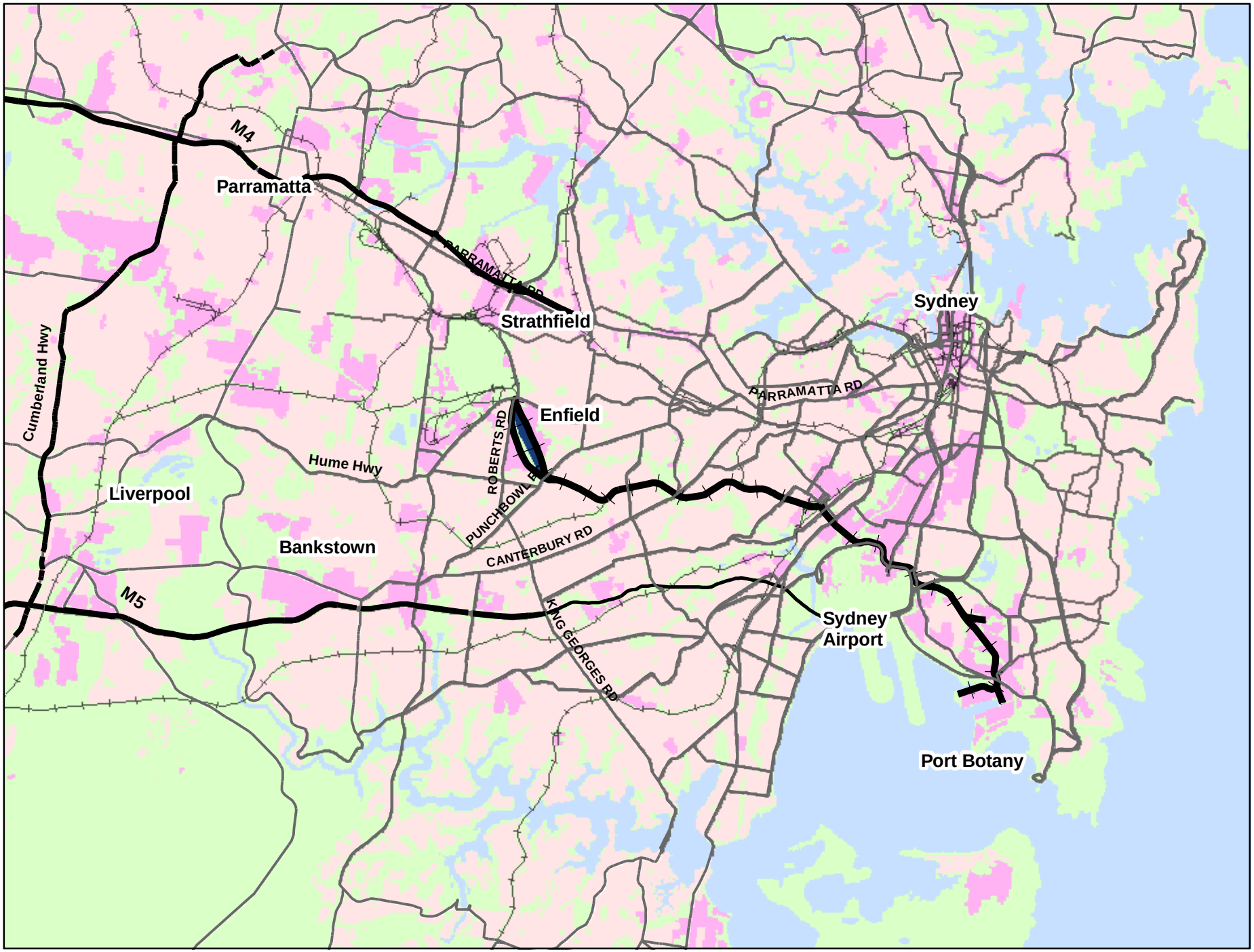
For the purpose of assessing local impacts, a study area has been defined as being bounded by the following roads:

- Hume Highway (north and west);
- Coronation Parade (east);
- Punchbowl Road (east);
- Boronia Road / Juno Parade (south); and
- Centenary Drive / Arthur Street (north).

The selected study area includes all major roads that could be used to access the site, including Roberts Road / Norfolk Road and Cosgrove Road. The study area is illustrated in Figure 2-2.

Enfield Intermodal Logistics Centre

Figure 2.1
Regional Context

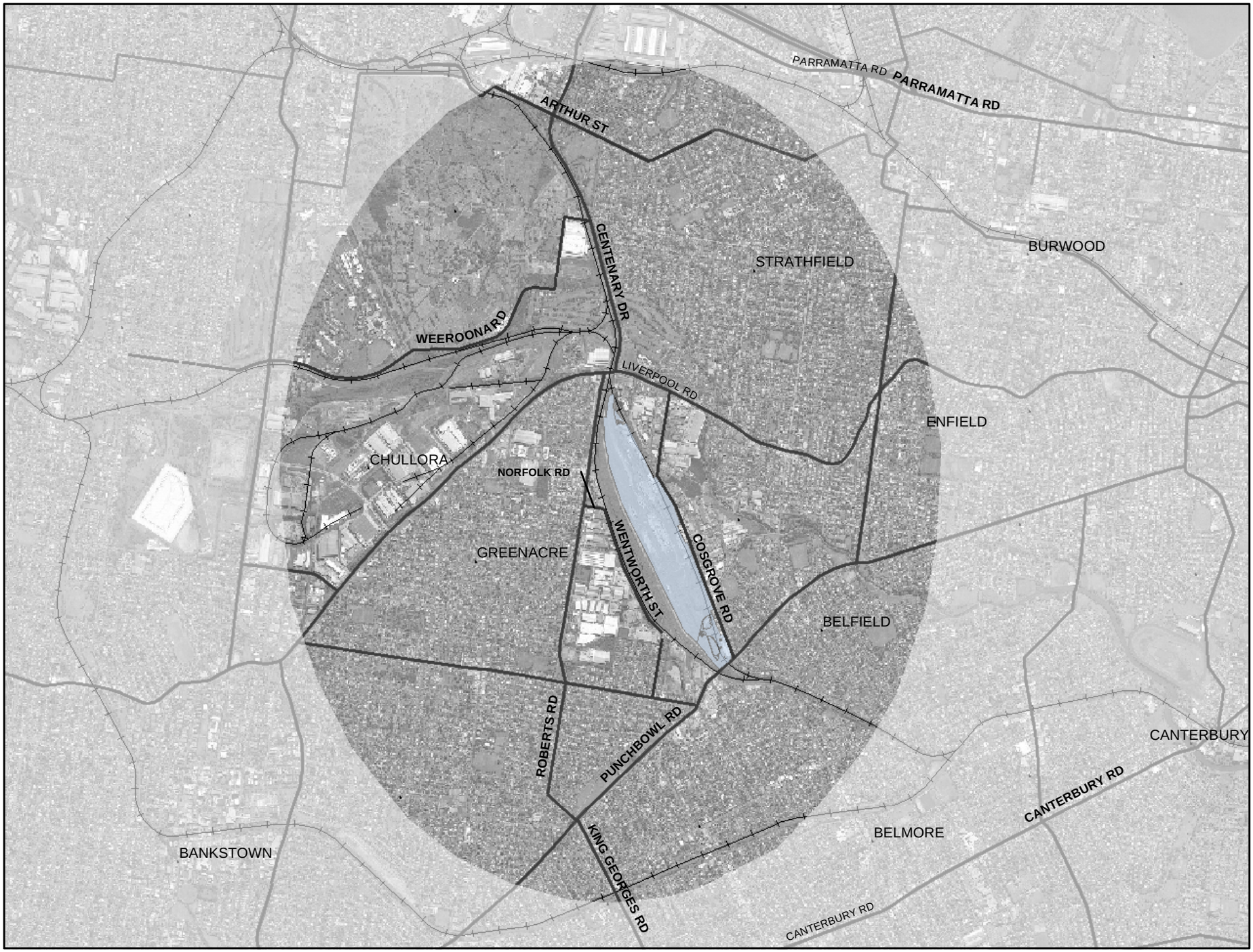


Projection: MGA 56
Page Size: A4
File Name:EN01709_Tr_007g.mxd
Location:\\EN01709\Technical\GIS\Template\
Date: 16/4/2005

SKM

Enfield Intermodal Logistics Centre

Figure 2.2
Local Area Impact



Legend

- Enfield Site
- Major Road
- Railway Line

N

0 0.250.5
Kilometres

Projection: MGA 56
Page Size: A4
File Name:EN01709_Tr_010f.mxd
Location:\\EN01709\Technical\GIS\Template\
Date: 24/3/2005

SKM

2.2.1 Road Network

Key roads in the study area are described below:

- **Hume Highway** – The Hume Highway (also known as Liverpool Road) is a major arterial road running from the south west to the north east between Liverpool and Ashfield; (Parramatta Road). It is a 4-6 lane divided highway. It carries around 44,000 vehicles per day near Cosgrove Road, including 8-9% heavy vehicles in the morning peak;
- **Centenary Drive / Roberts Road** – Centenary Drive / Roberts Road is a major north-south arterial, with generally 3 lanes in each direction and a median. Daily traffic is around 60,000 vehicles, including up to 12% heavy vehicles in the morning peak;
- **Punchbowl Road** – Punchbowl Road runs basically parallel to the Hume Highway through the study area. It is a 4-lane arterial road, carrying around 35,000 vehicles per day, with 5-7% heavy vehicles in the morning peak;
- **Boronia Road / Juno Parade** – This road runs east-west between Roberts Road and the Hume Highway. It carries around 15,000 vehicles per day in four lanes of traffic. During the morning peak, heavy vehicles make up around 9% of traffic;
- **Cosgrove Road** – Cosgrove Road is a collector road running north-south between the Hume Highway and Punchbowl Road. It carries around 14,000 vehicles per day through a predominantly industrial area. Heavy vehicles make up around 18% of morning peak hour traffic;
- **Wentworth Street** – Wentworth Street is a local industrial road between Norfolk Road and the proposed Enfield Intermodal Logistics Centre site. Peak hour volumes are around 200 vehicles per hour, with around 60% heavy vehicles that originate from the existing industrial development served by Wentworth Street; and
- **Norfolk Road –** Norfolk Road is a local road that connects Wentworth Street with Roberts Road, and extends into the residential area west of Roberts Road. It intersects with Roberts Road at a signalised junction. Peak hour volumes west of Roberts Road are around 500 vehicles per hour, with 4-5% heavy vehicles. This road has a 3 tonne load limit, which does not preclude all heavy vehicles such as buses and small trucks.

The morning peak period on the network is generally between 7:00am – 9:00am, and the afternoon peak period is between 4:00 – 6:00pm. The peak hour will occur within the network peak period, and will vary from location to location.

2.3 Existing Traffic Flows – Base Traffic Modelling

2.3.1 Data Collection

Traffic counts were undertaken in early February 2005 in order to calibrate the base model. Examination of RTA permanent count station data from previous years, indicates that early February is representative of "average conditions", taking into account seasonal fluctuations.

Surveys were taken over the full 24 hour / 7day period to reflect the anticipated schedule of the Enfield Intermodal Logistics Centre. Full period classification counts were completed and significant intersections surveyed.

2.3.2 Intersection Counts

Classified intersection surveys were undertaken at a number of locations within the study area for the morning and evening peak periods. The intersections surveyed were:

- Centenary Drive / Arthur Street;
- Centenary Drive / Weeroona Road;
- Hume Highway / Centenary Drive;
- Hume Highway / Boronia Road;
- Hume Highway / Cosgrove Road;
- Hume Highway / Coronation Parade;
- Georges River Road / Coronation Parade;
- King Georges Road / Punchbowl Road;
- Roberts Road / Juno Parade; and
- Roberts Road / Norfolk Road.

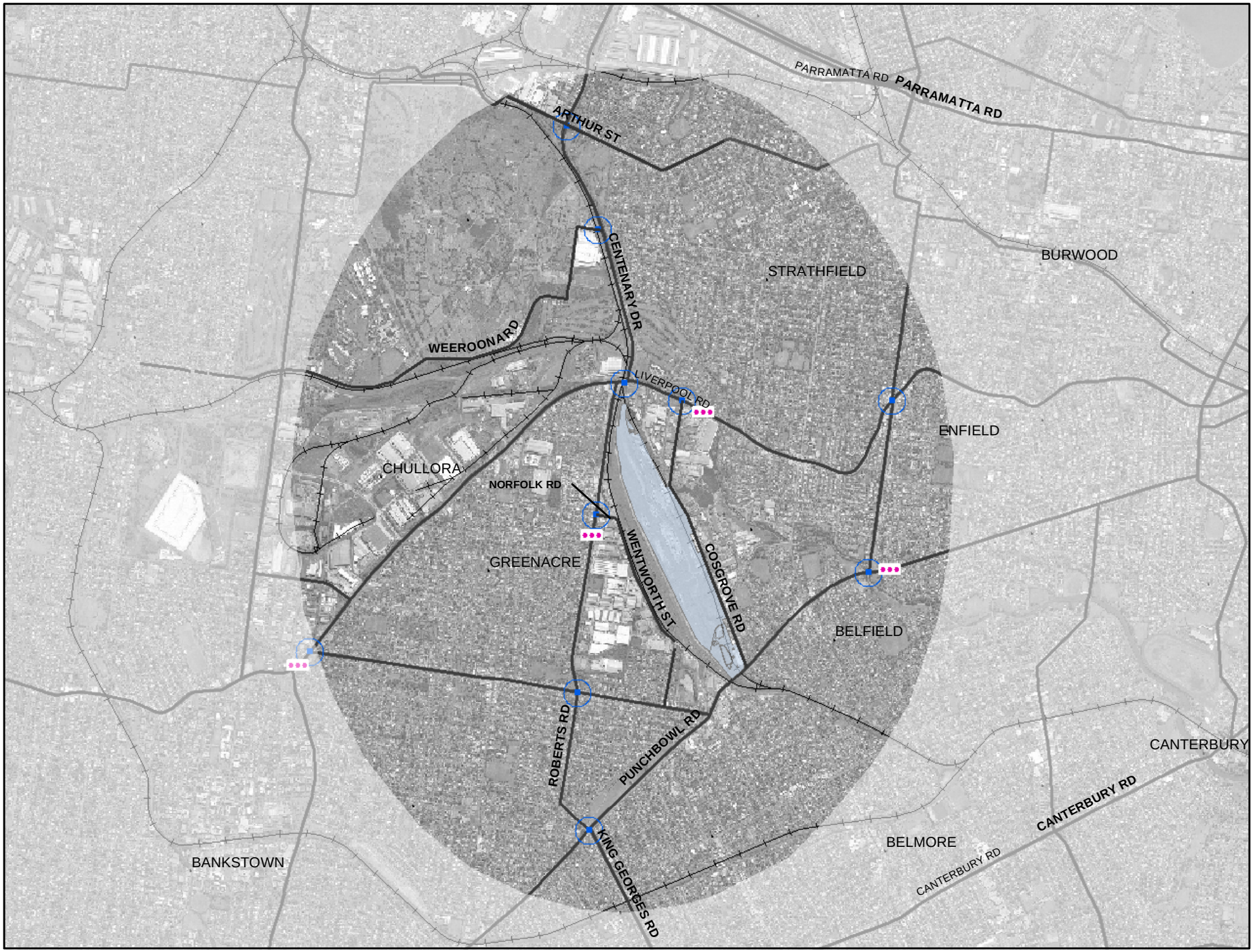
These intersections were selected because they were identified as being the key intersections which could be affected by the development.

2.3.3 Classification Counts

Classified tube counts were also collected for 7 days to obtain 24-hour profiles at the following locations:

- Hume Highway, between Boronia Road and Stacey Street;
- Hume Highway, between Cosgrove Road and Fitzgerald Crescent;
- Roberts Road, between Shannon Street and Naughton Street;
- Georges River Road, between Blenheim Street and Kembla Street; and
- Centenary Drive, just south of Weeroona Road.

The locations of the intersection and classification counts are illustrated in Figure 2-3.



Enfield Intermodal Logistics Centre

Figure 2.3 Survey Locations

Legend

- Enfield Site
- Major Road
- Railway Line
- Classified Intersection Count Location
- Tube Count Location

N

0 0.25 0.5

Kilometres

Projection: MGA 56
Page Size: A4
File Name:EN01709_Tr_009e.mxd
Location:\\EN01709\Technical\GIS\Template\
Date: 16/5/2005

SKM

2.4 Existing Intersection Operation

The operation of key intersections in the vicinity of Enfield under existing conditions was assessed using INTANAL (INTersection ANALysis) software, based on the intersection counts collected for this study (see Section 2.3.2).

Intersections can be analysed using the criteria outlined in Table 2-1. In the short term, intersections should be designed for Level of Service (LoS) C or better. In the longer term, where future conditions have been taken into account, the RTA considers Level of Service D or better to be acceptable. Level of Service is a factor of the average delay (in seconds) experienced by all vehicles passing through an intersection.

INTANAL models the effect of heavy vehicles in the traffic stream by converting heavy vehicles to a passenger car unit (PCU). The INTANAL default PCU factor is 2, which is industry standard practice and has not been changed for this project.

Table 2-1 Level of Service Criteria for Intersections

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

Source: Guide to Traffic Generating Developments, RTA 2002.

Table 2-2 shows existing intersection operation at key intersections.

Table 2-2 Existing Intersection Operation

Intersection	Control	AM Peak		PM Peak	
		Level of Service	Average Delay (sec/veh)	Level of Service	Average Delay (sec/veh)
Roberts *Road* / Juno Parade	Signals	E	57	D	48
King Georges Road / Punchbowl Road	Signals	F	>200	F	119
Georges River *Road* / Coronation Parade	Signals	B	17	A	13
Roberts *Road* / Norfolk Road	Signals	B	20	B	20
Hume Highway / Boronia Road	Signals	B	18	B	27
Hume Highway / Roberts Road / Centenary Drive	Signals	F	>200	D	44
Hume Highway / Cosgrove Road	Signals	C	29	D	52
Hume Highway / Coronation Parade	Signals	C	31	B	24
Centenary Drive / Arthur Street	Signals	C	37	C	39
Centenary Drive / Weeroona Road	Signals	A	12	A	8

Most of these intersections are operating satisfactorily, but Roberts Road / Juno Parade and Hume Highway / Roberts Road / Centenary Drive are over capacity in the morning peak, operating at Level of Service E and F respectively, and King Georges Road / Punchbowl Road is over saturated in both peak periods at Level of Service F. Several intersections (Roberts Road / Juno Parade, Hume Highway / Roberts Road / Centenary Drive and Hume Highway / Cosgrove Rd) are at Level of Service D in the PM peak, which is unsatisfactory in the short term.

2.5 Network Modelling (NETANAL)

A regional road network model was developed using NETANAL to assess the impact of the proposed development on the surrounding road network.

“NETANAL” is a shortening of NETwork ANALysis Assignment Modelling Program. The NETANAL model is a computer based traffic forecasting software program used extensively for assessment of road projects in Sydney.

NETANAL assigns all trip origins and destinations in the network area (i.e. Metropolitan Sydney) to a number of zones (represented by centroids). These centroids are connected to the road network, and a trip matrix assigns the number of trips travelling between each origin – destination

pair for a particular time period e.g. AM, PM or Business Peak. The road network consists of a series of nodes (intersections) and links (roads) that connect nodes to each other. Links and nodes can be coded with various assumptions, for example, regarding their capacities, free-flow speed and number of lanes. The NETANAL model uses two trip matrices, one with all vehicles and the other with commercial (heavy) vehicles.

2.5.1 Base Model Development

The 2005 base model was calibrated based on the traffic count data collected for this study (see **Section 2.3**).

2.5.2 Model Verification and Calibration

The model verification method and calibration results are shown in Appendix C. The results of the calibration process show that the model used is acceptable to use in this analysis.

2.6 Existing Freight Rail Network

The existing rail lines to the Enfield marshalling yards provide a direct freight rail connection with Port Botany, approximately 18km away. These will be the primary origin and destination for rail freight. The site also has rail connections to the other freight rail networks in Sydney and NSW. The freight rail network is not available for passengers.

2.7 Existing Public Transport Network

2.7.1 Bus Network

The existing bus network does not adequately service the site, with only a few bus routes operating in the Enfield area. The closest routes to the site are the 447 (operated by Pleasure Tours) and 484 (operated by Transit First). Route 447 only serves Roberts Road northbound, en route from Belmore to Greenacre. Route 484 runs along the length of Roberts Road and provides links to the centres of Greenacre and Strathfield. The recommended maximum walk distance to access a local bus service is 400 metres or 5 minutes at average walking speed (RTA Guide to Traffic Generating Developments). The closest bus stops for both routes are located on Roberts Road, at the intersection with Russell Street, and are approximately 500 metres from the proposed site entrance on Norfolk Road. Four other routes run within 800 metres of the proposed site entrances. Table 2-3 provides a summary of these routes and their key attributes. Figure 2-4 shows bus routes and locations of the bus stops within 800 metres of the site entrances. The frequency of buses during the AM, PM and Business Peaks are shown in buses per hour (rounded).

Enfield Intermodal Logistics Centre

Figure 2.4
Bus Stop Access

Legend

- Bus Stops

Bus Route

- 415
- 447
- 450
- 484
- 485
- 941
- Major Road
- Enfield Site
- 800m Entrance Buffer

N

0 0.5 1
Kilometres

Projection: MGA 56
Page Size: A4
File Name:EN01709_Tr_002f.mxd
Location:\\EN01709\Technical\GIS\Template\
Date: 18/5/2005

SKM

Table 2-3 Local Bus Services

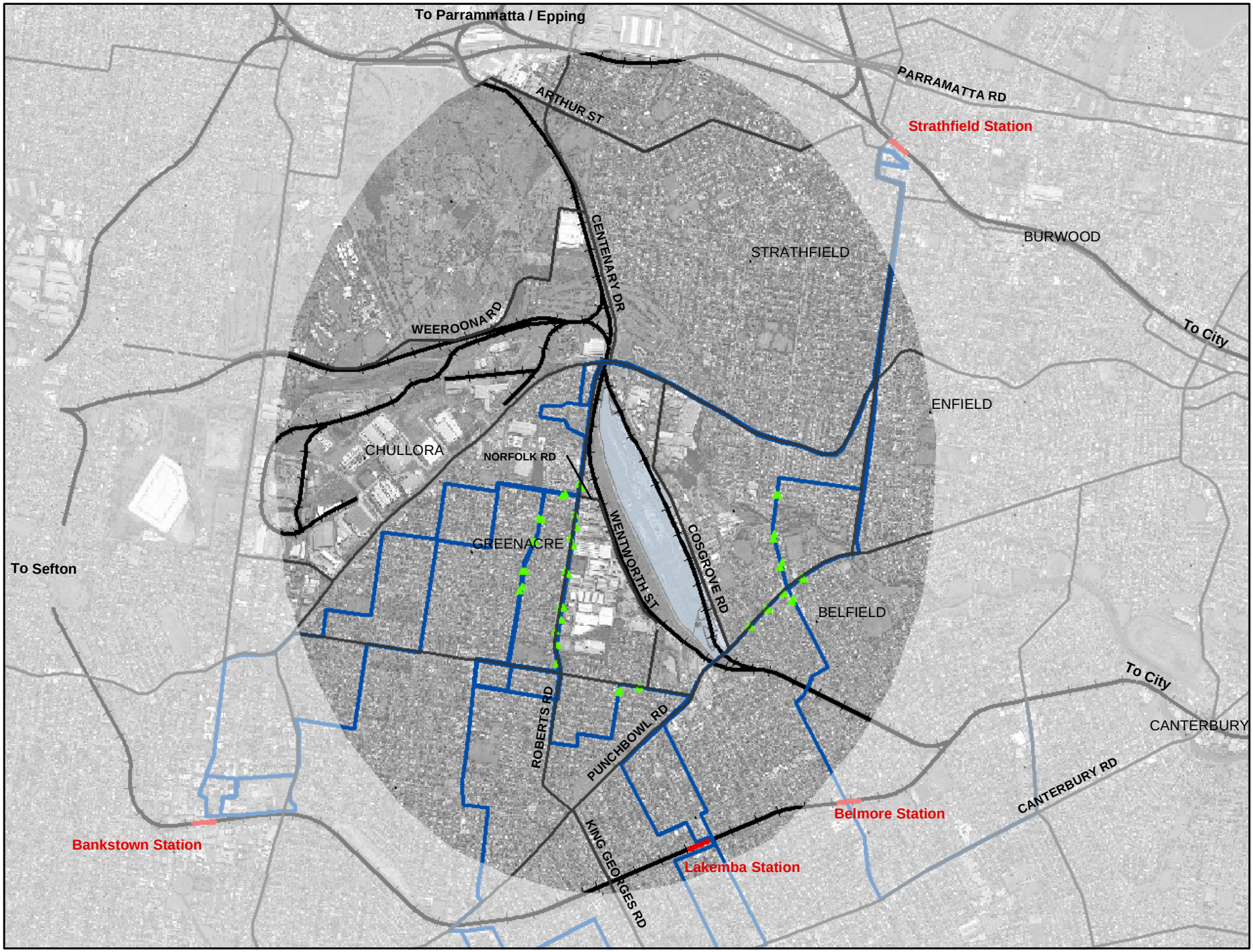
Route	Operator	Distance from proposed entrances	Between	And	Weekday frequency (buses per hour) in each direction			Saturday service	Sunday service
					7am – 10am	12pm – 3pm	4pm – 7pm		
415	Sydney Buses	800 metres	Burwood	Campsie	4	2	3	Y	Y
447	Pleasure Tours	800 metres	Greenacre	Belmore	2	1	2	Y	N
450	Punchbowl	800 metres	Strathfield	Hurstville	2	2	2	Y	Y
484	Transit First	500 metres	Strathfield	Greenacre	2	1	1	N	N
485	Transit First	700 metres	Strathfield	Bankstown	2	1	2	Y	Y
941	Punchbowl	800 metres	Hurstville	Bankstown	2	2	2	Y	Y

All routes operate between approximately 6:00am and 9:00pm on weekdays, except for route 484, which runs from 7:00am to 7:00pm. Weekend services, with reduced hours of operation, are provided on most of these routes except for route 447 (no Sunday runs) and route 484 (no weekend runs).

2.7.2 Rail Network

Enfield is situated between two metropolitan railway lines, the Inner West Line and the Bankstown Line. The closest stations are Belmore and Lakemba on the Bankstown Line, which are both approximately 2.3km from the proposed site entrances on Cosgrove Road and Wentworth Street respectively. Several other stations are marginally further from the site, notably Strathfield, which is served by Inner West, Northern, South, Western, Regional and Intercity trains. The recommended maximum walk distance to access heavy rail services is 800 metres or 10 minutes at average walking speed. Without direct bus services linking the railway stations to the development site, the railway services do not adequately serve the site.

Table 2-4 shows the service provided at the local stations. The frequency of trains during the AM, PM and Business Peaks are shown in trains per hour (rounded). The right hand column in the table identifies bus routes that serve each station and pass within 800 metres of the proposed site entrances. Bankstown Station has also been included, as it is a major centre for the area and may therefore attract trips with multiple purposes, and it has a slightly higher frequency of service than other stations on the Bankstown Line. All four stations are served by the Nightride bus network and therefore have 24-hour public transport coverage. Figure 2-5 shows access to rail services from the site.



Enfield Intermodal Logistics Centre

Figure 2.5
Access to Rail Services

Legend

- Bus Stops
- Bus Routes
- Railway Line
- Major Road
- Enfield Site
- Railway Stations

N

0 0.5 1
Kilometres

Projection: MGA 56
Page Size: A4
File Name:EN01709_Tr_006e.mxd
Location:\\EN01709\Technical\GIS\Template\
Date: 18/5/2005

SKM

Table 2-4 Local Rail Services

Station	Line(s)	Approximate distance from site entrances	Weekday frequency (trains per hour) in each direction			Direct bus route between study area and station
			7am – 10am	12pm – 3pm	4pm – 7pm	
Belmore	Bankstown	2,300 metres	5	5	5	415
Lakemba	Bankstown	2,300 metres	5	5	5	447 & 450
Bankstown	Bankstown	3,800 metres	6	5	6	485
Strathfield	Inner West, Northern, South, Western, Regional and Intercity	3,300 metres	33	23	30	415,450,484 and 485

2.7.3 Cycling and Pedestrian Network

The NSW Government has produced an action plan for cycling, *BikePlan 2010*, to help achieve the two goals of:

- Making it easier and more convenient for people to get to places where they want to go; and
- Reducing the rate at which the demand for car travel increases in future, thereby helping to improve air quality.

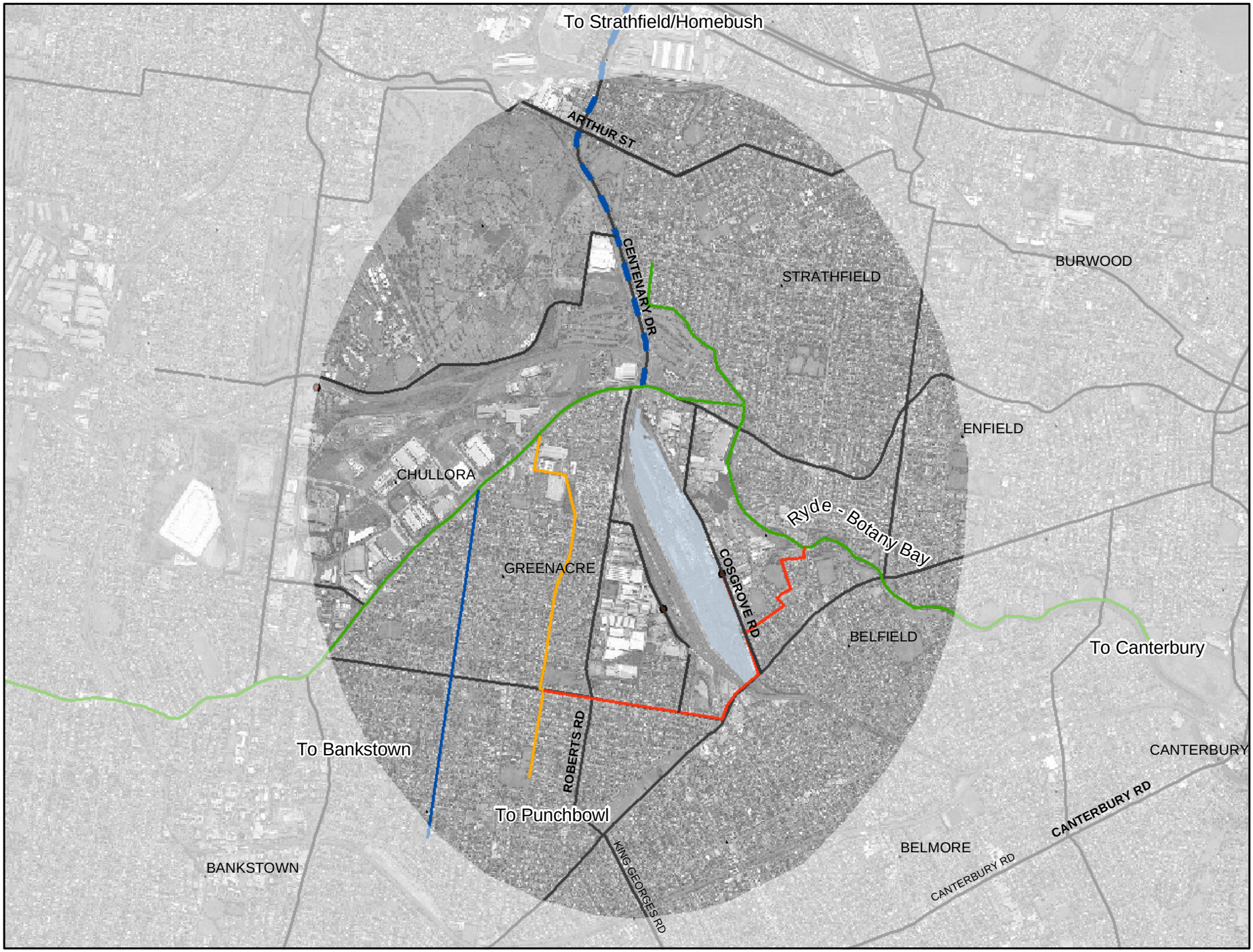
The action plan focuses on four areas to achieve these goals:

- Improving the bike network;
- Making it safer to cycle;
- Improving personal and environmental health; and
- Raising community awareness.

There are several cycle routes established within the vicinity of Enfield. The Ryde – Botany Bay walking and cycling track runs to the east of the site. There appears to be no easy/direct link to it from the site, as it runs on the far side of Cooks River and river crossings are not conveniently located. Local on-road paths on Maiden Street and Noble Avenue, in Greenacre, are easily accessible from the Norfolk Road entrance. These routes link to a path shared with pedestrians, which runs on the north side of Hume Highway linking to Bankstown to the west and the Ryde - Botany Bay path to the east. A new on-highway route is proposed on Centenary Drive as part of the Draft NSW Bicycle Network Strategy. It would run between Hume Highway, just north of the site, and Homebush West, linking into the M4 Motorway shoulder route.

If the Enfield Intermodal Logistics Centre is developed, cycling and pedestrian links to the eastern side of the site could include routes along Coronation Parade, Georges River Road and Cosgrove Road, and links to the western side of the site could be via Norfolk Road and Wentworth Street.

The regional cycle route is shown on Figure 2-6.



Enfield Intermodal Logistics Centre

Figure 2.6

Cycle Network

Projection: MGA 56
Page Size: A4
File Name:EN01709_Tr_011f.mxd
Location:\\EN01709\Technical\GIS\Template\
Date: 11/4/2005

SKM

2.8 Road Safety Assessment

Road safety is a critical issue and one that has been highlighted by the community, particularly with regard to the effect of heavy vehicle movements. Crash data were obtained from the RTA for the five key councils surrounding the study area. All analysis that follows is based on the full five years of data received, covering the period 1999 to 2004.

Initial analysis of the data was undertaken for a selection of roads within the study area, to include major roads and key routes to and from the proposed development. The selected roads can be seen in Table 2-5 and were chosen on the basis of those likely to receive traffic from the Enfield Intermodal Logistics Centre. Over the five-year data period 1,213 accidents were recorded, of which 10 (0.8%) involved a fatality and 559 (46.1%) resulted in injuries and 644 (53.1%) were classified as tow-away.

Table 2-5 Accidents on Key Local Roads

Road	Total accidents	% of grand total	Fatal accidents	% of grand total	Injuring accidents	% of grand total
Boronia Road	49	4.0%	1	0.1%	19	1.6%
Juno Parade	104	8.6%	1	0.1%	46	3.8%
Punchbowl Road *	159	13.1%	0	0.0%	56	4.6%
Coronation Parade	96	7.9%	0	0.0%	51	4.2%
Hume Highway *	488	40.2%	5	0.4%	209	17.2%
Roberts Road	282	23.2%	3	0.2%	159	13.1%
Wentworth Street	6	0.5%	0	0.0%	2	0.2%
Cosgrove Road	6	0.5%	0	0.0%	2	0.2%
Total	**1,213**	**100%**	**10**	0.8%	**559**	46.1%

* Only the length of this road within the study area was reported. Percentages may not sum due to rounding

Table 2-6 shows the accidents by vehicle type on key local roads. As the Enfield Intermodal Logistics Centre is an industrial development, the key vehicle types of interest are heavy and light commercial vehicles. Heavy vehicles accounted for just under 6% of accidents whilst approximately 17% of accidents involved light commercial vehicles. The vast majority of accidents (over 75%) involved passenger vehicles.

Table 2-6 Accidents by Vehicle Type – Key Local Roads

Vehicle type	Total accidents	% of grand total	Fatal accidents	% of grand total	Injuring accidents	% of grand total
Semi Trailer / Low loader	29	2.4%	0		13	
Large Rigid Lorry	40	3.3%	1		24	
B Double	1	0.1%	0		0	
Rigid Tanker	1	0.1%	0		0	
Heavy vehicles total	**71**	5.9%	**1**	**0.1%**	**37**	**3.1%**
Light truck / panel van	98	8.1%	1		35	
Station Wagon	42	3.5%	1		16	
Passenger Van	38	3.1%	0		18	
4WD not based on car	36	3.0%	0		18	
Light commercial vehicles total	**214**	17.6%	**2**	**0.2%**	**87**	**7.2%**
Other (private cars, motorcycles, others)	**928**	76.5%	**7**	**0.6%**	**435**	**35.9%**
Total	**1,213**	**100%**	**10**	**0.8%**	**559**	**46.1%**

*Percentages may not sum due to rounding.

Table 2-7 shows the key intersections within the study area and a summary of the accidents occurring at them over the five-year data period. From a total of 76 accidents at these intersections 22 involved heavy vehicles and 29 involved light commercial vehicles.

Table 2-7 Accidents at Key Intersections

Intersection	Total accidents	Heavy vehicles	Light commercial vehicles	Other vehicles
Hume Highway / Boronia *Road*	13	1	9	3
Hume Highway / Roberts *Road* / Centenary Drive	16	7	4	5
Hume Highway / Cosgrove *Road*	3	1	1	1
Hume Highway / Coronation Parade	5	0	2	3
Centenary Drive / Weeroona *Road*	7	4	2	1
Centenary Drive / Arthur Street	9	4	2	3
Coronation Parade / Punchbowl *Road*	9	2	5	2
Juno Parade / Roberts *Road*	7	1	3	3
Roberts *Road* / Norfolk *Road*	7	2	1	4
Total	76	22	29	25

Seven schools are located within the study area, as shown in Table 2-8. The five-year data set has been analysed to assess the accident incidence in the immediate vicinity of these schools. The data were interrogated for all accidents occurring on schooldays, between 8:00am and 4:00pm, and

within 200 metres walking distance of the schools' entrances. A total of 32 accidents were recorded that met these criteria, but none involved heavy vehicles.

Table 2-8 Accidents within 200m of Schools during School Hours

School	Road(s)	Total Accidents	Heavy vehicles	Light commercial vehicles	Other vehicles
Banksia Road Public	Banksia *Road* / Boronia *Road*	7	0	1	6
Chullora Public	Norfolk *Road* / Waterloo *Road*	5	0	0	5
Malek Fahd Private Islamic	Waterloo *Road*	3	0	0	3
St Anne's Catholic	St Anne's Square	0	0	0	0
St John Vanney Primary	Tempe Street / Pandora Street	3	0	1	2
Strathfield South High	Hume Highway	5	0	0	0
Strathfield South Public	Hume Highway	9	0	5	4
Total		**32**	**0**	**7**	**25**

2.9 Asset Condition Assessment

A pavement inspection was undertaken to provide an assessment of pavement condition on selected key roads within the study area. SKM carried out a visual inspection of the pavement surface on 15 March 2005. The following streets were inspected as a representative sample of the roads in the vicinity of the site:

- Roberts Road (between Hume Highway and Punchbowl Road) including Wiley Avenue;
- Boronia Road;
- Juno Parade;
- Hume Highway (between Boronia Road and Homebush Road);
- Norfolk Road;
- Wentworth Street;
- Cosgrove Road; and
- Punchbowl Road (between Wiley Avenue and Coronation Parade).

For the purpose of this section, where appropriate, roads were divided into sections with the distinctive pavement properties and condition. The visual inspection involved a broad assessment of pavement condition and identification of various pavement deficiencies visible on the pavement surface. It was focused on the pavement surface distresses such as cracking, local defects, unsuccessful repairs, noticeable rutting and roughness, rather than on the pavement structural

deficiencies. It is noted that the visual inspection cannot provide sufficient information to qualify the structural property of pavements and that only an adequate pavement structural testing would provide relevant information.

2.9.1 Pavement Condition Summary

The inspected road sections consist of a mix of various road categories (collector, arterial and major) built to different standards in terms of road geometry and pavement properties, with various maintenance regimes applied in accordance with the road category. In general, it was found that all inspected sections appear well maintained.

The pavement condition summary for identified roads is provided:

- Roberts Road - Heavy-duty pavement (asphalt overlay over concrete slabs) is generally in good condition with an exception of the pavement area north and south of Norfolk Road. The pavement there is deteriorating and shows signs of structural problems. Apart from surface rehabilitation, maintenance should include structural improvements (slab jacking or slab replacement) in selected areas;
- Hume Highway - Heavy-duty pavement (different compositions) is predominantly in good condition with evidences of extensive maintenance. The pavement between Cosgrove Road and Braidwood Street, which is in poor condition and requires rehabilitation. The section between Como and Shellcote Roads requires resurfacing;
- Boronia Road and Juno Parade - Pavement surface appears in good condition and well maintained. Occasional “soft” spots and slight rutting indicate potential structural issues in the long term. This should be confirmed with the structural testing of pavement;
- Norfolk Road - Pavement surface is good condition including the section east of Roberts Road;
- Wentworth Street - The pavement on section north of Mayvic Street is in good and appears suitable for significant heavy vehicle traffic. The section south of Mayvic Street has deteriorated and pavement needs rehabilitation in addition to upgrade works (widening);
- Cosgrove Road - Whilst the southern part of the road is in very good condition (recently rehabilitated), the northern part pavement has deteriorated and is in need for rehabilitation. The rehabilitation may require substantial structural improvements that should be determined after a structural testing/geotechnical investigation; and
- Punchbowl Road - Most of the pavement is in relatively good condition and appears robust for the current traffic loading. An exception is a short section between Wiley Avenue and Colin Street, which is due to rehabilitation.

Further detailed information on pavement condition is provided in Appendix D.

2.9.2 Analysis of RTA Condition Data

For the purpose of this study, RTA provided the road surface condition data for relevant sections of Hume Highway, Roberts Road and Punchbowl Road. The RTA information was used to confirm/crosscheck findings from the visual assessment undertaken by SKM. With the exception of Punchbowl Road, the analysed RTA data is consistent with SKM findings. The data confirmed the pavement deficiencies that were identified by SKM in particular at Roberts Road, south of Norfolk Road and Hume Highway, section between Cosgrove and Roberts Roads. The data also confirmed the good condition on other sections.

The latest available road condition data was collected using two automated survey devices:

- Multi Laser Profiler (Roughness, Rutting and Texture); and
- RoadCrack™ (Cracking).

The profile data was surveyed in February 2004 and RoadCrack™ data in October 2004. The detailed survey data was reported in 100m interval and includes numerous condition indicators and relevant statistics (e.g. distribution, mean values).

The road surface condition data is summarised in Table 2-9. The table includes average roughness, rutting, texture and cracking values by sections of road, which correspond to the sections from the visual assessment undertaken by SKM.

Hume Highway

Data for sections of Hume Highway west and east of intersection with Cosgrove Road indicate low riding quality (i.e. high roughness). Whilst the section between Homebush and Cosgrove Roads have been extensively maintained since the survey (February 2004), the section between Cosgrove and Roberts Roads have further deteriorated.

The condition parameters for the section of Hume Highway between Roberts and Boronia Roads indicate good condition. The moderate rutting was recorded in westbound carriageway. Closer inspection of profile data for the section shows very high rutting between Brunker Road and Boronia Road. The texture values are relatively low probably due to a large percentage of concrete surfacing tested.

Roberts Road

The riding quality on all sections of Roberts Road is generally good. On section south of Norfolk Road (southbound) a couple of high roughness peaks, over 120 counts/km were recorded as well as extensive cracking. Extensive wide reflective cracking in southbound carriageway was also recorded during the visual assessment. The texture values indicate adequate texture depth of the asphalt wearing course.

Punchbowl Road

The condition data for Punchbowl road were averaged from values recorded in two directions. The data shows relatively high roughness and moderate cracking over the length of the road. Closer inspection of data indicates very high roughness readings particularly between Juno Parade and Coronation Parade where also the high cracking percentage was recorded.

It should be noted that the data values for this section of Punchbowl Road indicate that the surface condition is worse than that observed during the field inspection. This was discussed with the RTA, whom advised that there was no need for major maintenance works on this section of Punchbowl Road.

Table 2-9 Average Condition by Section / Carriageway (RTA data)

Road	From	To	Length (m)	Carriageway	Roughness (NRM Counts)	Rutting (mm)	Texture (mm)	Crack Area (%)	Crack Width (mm)
Hume Highway	Homebush Road	Cosgrove Road	1035	Westbound	127	7.6	0.45	13.2	1.8
				Eastbound	118	8.8	0.54	16.3	1.8
Hume Highway	Cosgrove Road	Roberts Road	540	Westbound	122	11.3	0.60	8.0	1.9
				Eastbound	83	8.7	0.66	8.4	2.1
Hume Highway	Roberts Road	Boronia Road	3245	Westbound	76	11.5	0.45	7.9	1.5
				Eastbound	80	7.3	0.61	9.3	1.8
Roberts Road	Punchbowl Road	Juno Parade	1180	Northbound	70	7.5	0.50	14.6	2.0
				Southbound	79	11.7	0.58	15.0	1.8
Roberts Road	Juno Parade	Norfolk Road	1410	Northbound	78	7.8	0.55	9.1	1.7
				Southbound	92	6.3	0.61	19.7	2.3
Roberts Road	Norfolk Road	Hume Highway	1060	Northbound	75	7.4	0.80	8.4	1.8
				Southbound	80	7.8	0.72	6.4	1.4
Punchbowl Road	Wiley Avenue	Coronation Parade	3060	Single	112	5.9	0.51	13.2	2.0

Notes

1. The Crack Area is calculated as percentage of frames with all crack types in total number of frames tested.

2. Rutting calculated as an average of higher rut depth values in inner/outer wheelpath

3. Texture shown is the mean texture depth at passenger side wheelpath

3 On-site Activity Profile

3.1 General Methodology

The on-site activity profile assumed for the traffic generation was derived from the anticipated container flow proposed by Sydney Ports. The site will operate over 24 hours, 7 days per week. (Figure 3-1). Assumptions were made about the on-site personnel operating regime to achieve the anticipated TEU throughput of 300,000 per annum in terms of:

- Proposed container activity;
- Train arrival and turnaround, and hence resources for loading/unloading;
- Warehouse resourcing to process the target packing and unpacking activity;
- On-site movement of containers; and
- Support personnel for administrative activity;

3.2 Container Activity

The volume of container activity through Enfield Intermodal Logistics Centre is proposed to be approximately 300,000 TEU per annum moving to and from Port Botany and Enfield Intermodal Logistics Centre. These movements are illustrated in Figure 3-1, and described below. These volumes are indicative only and have been prepared for modelling purposes.

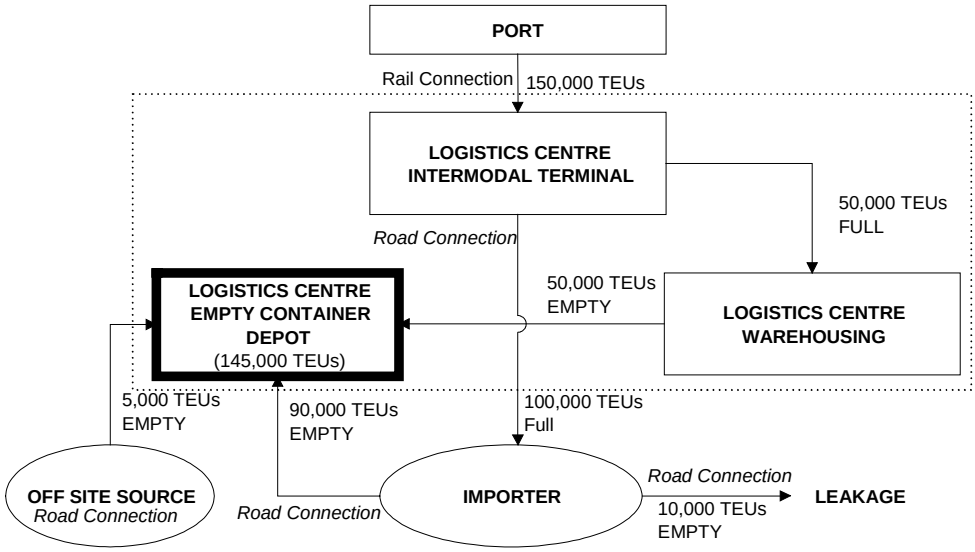
- 150,000 TEUs per annum would be sent by rail from the port to Enfield.
  - 50,000 full TEUs would be unpacked at the Logistics Centre Warehouse and the contents dispatched by road on light trucks;
  - 100,000 TEUs would be dispatched full directly to importers; and
  - 145,000 empty TEUs would be returned to the Empty Container Depot at Enfield from the Logistics Centre Warehouse and from importers/exporters. Around 5,000 TEUs would leak from the system (i.e. containers to other ports / locations).

- 150,000 TEUs per annum would be returned to the port by rail.
  - 10,000 TEUs would come from the Logistics Centre Warehouse where they were packed with goods brought to Enfield by light trucks;
  - 60,000 full TEUs would be trucked direct from exporters. Most of the containers filled by the exporters would have come from the Empty Container Depot; and
  - 80,000 empty TEUs would be returned to the port from the Empty Container Depot.

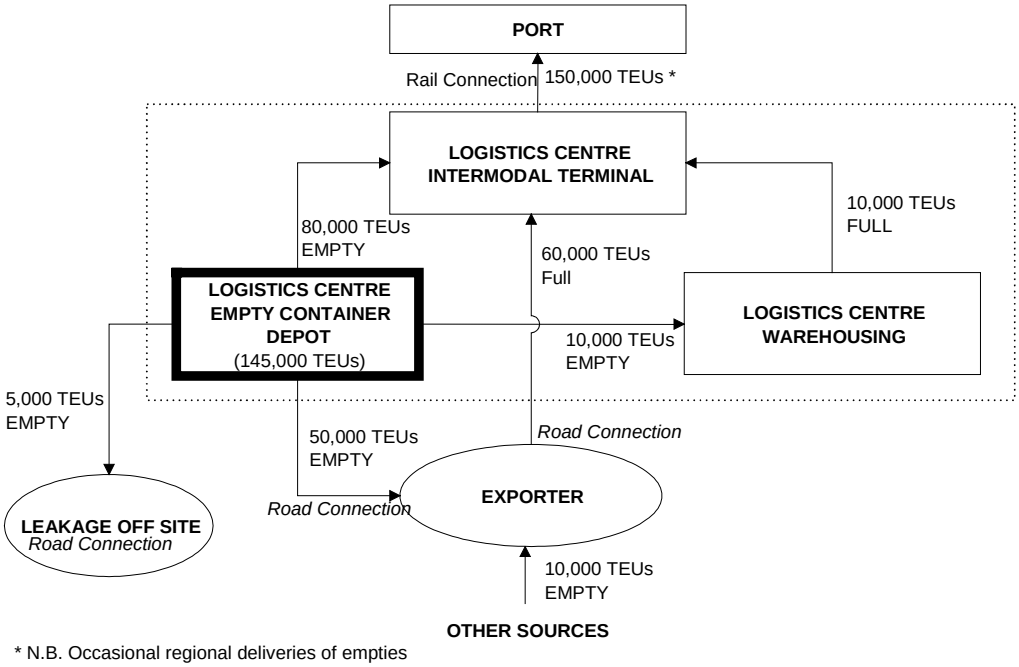
The number of staff required to load / unload containers for the trains and trucks was estimated as well as on-site container movement. The volume of trucks associated with the container movement is discussed in Section 4.

Figure 3-1 Movement of Containers (Annual)

INBOUND MOVEMENT OF CONTAINERS



OUTBOUND MOVEMENT OF CONTAINERS



* N.B. Occasional regional deliveries of empties

3.3 Site Staff Profile

Estimates have been made of the number of staff required on-site during each shift. Staff are required in the Logistics Centre Warehouse, to operate and supervise loading and unloading of trains, loading and unloading of trucks (both containers and loose freight), and for general management and administration.

3.3.1 Train Activity

Over a 24-hour period, it is assumed there would be approximately 10-20 train movements.

The number of boxes per train was calculated based on average TEUs/box and a day-of-week activity profiles (weekday / Saturday / Sunday). Reach stackers would be used to transfer boxes from the train to the terminal floor. From there, they would be transferred again by reach stackers or forklifts to either waiting trucks or the warehouse. The number of reach stackers (and therefore staff) has been calculated for each of these tasks, based on assumed service times per box, the total number of person-hours per train, and the turnaround time for each train. It has further been assumed that the same staff would be used to load and unload trains. Table 3-1 shows a summary of the staff requirements for each shift. Supervisors and clerks have been allocated based on one person each per five reach stackers or forklifts.

An additional 10 to 12 persons are required for operation of the trains.

Table 3-1 Staff Required for Loading / Unloading Trains

	Shift 1 (Day)				
	Loading onto Train	Unloading from Train	Staff Required	Forklifts and Reach Stackers	Supervisors and Clerks
Weekdays	10	10	**10**	6	4
Saturdays	6	5	**6**	4	2
Sundays	4	4	**4**	2	2
	Shift 2 (Night)				
	Loading onto Train	Unloading from Train	Staff Required	Forklifts and Reach Stackers	Supervisors and Clerks
Weekdays	10	10	**10**	6	4
Saturdays	6	5	**6**	4	2
Sundays	4	4	**4**	2	2

3.3.2 Warehousing

The number of staff required in the warehouse for each shift is shown in Table 3-2. This has been developed using the following assumptions:

- Assuming four person-hours to pack or unpack one TEU;

- The day shift would see approximately 70% of daily activity, and would therefore require 70% of the total person-hours required;
- Additional staff for general warehousing duties (25% contingency factor); and
- Other Logistics Centre staff, such as forklift drivers and administration, is not included.

Table 3-2 Warehouse Staff Required

	Shift 1 (Day)				
	Packing	**Unpacking**	**Sub-total**	**Contingency (warehousing, picking orders etc)**	**Total**
Weekdays	10	50	60	25%	**75**
Saturdays	6	29	35	25%	**44**
Sundays	3	15	18	25%	**23**
	Shift 2 (Night)				
	Packing	**Unpacking**	**Sub-total**	**Contingency (warehousing, picking orders etc)**	**Total**
Weekdays	5	23	28	25%	**35**
Saturdays	3	13	16	25%	**20**
Sundays	1	7	8	25%	**10**

3.3.3 General Staff

In addition to warehousing and loading/unloading staff, there would be some staff involved in management and supervision at the site. The following assumptions for each shift have been made:

- 1 x Site Manager;
- 2 x Inventory Control;
- 1 x Warehouse Manager (x 3 warehouses); and
- 25% contingency.

3.3.4 Office Based Administration Staff

It is assumed that administration staff would be approximately 142 personnel, based on 120 for offices associated with the warehouse operations, 11 associated with the Enfield Intermodal Logistics Centre Terminal and 11 associated with the Enfield Intermodal Logistic Centre Facility Road Operations. These numbers have been based on similar operations at Port Botany.

3.3.5 Empty Depot Staff

It is assumed that the Empty Depots will required 19 personnel during Shift 1 and 9 personnel during Shift 2. This is based on similar operations at other Intermodal and empty container facilities.

3.3.6 Intermodal Facility Rail Operations

There are some facilities (such as Macarthur Intermodal Shipping Terminal (MIST) at Minto and Maritime Container Services (MCS) at Cooks River) that have an Intermodal Facility Road Operator based on site. The office staff and truck drivers for this operation would be part of the intermodal site. Staff numbers as follows:

- Road Operations: Shift 1 - 11 office staff (incorporated above) plus 24 drivers; and
- Shift 2 - 1 office based staff plus 16 drivers.

3.3.7 Summary of Operational Staffing

The total staff requirements for each shift are shown in Table 3-3. This shows a total weekday force of 378 persons working on site during the total workday, with 291 during the day (149 day-shift plus 142 working normal office hours) and 87 during Shift 2.

In assessing the impact of the operational workforce on the surrounding road network, it has been assumed that the majority of staff will drive their own car to/from work. This reflects the absence of suitable public transport at the start of the main shift (5:00am), and at the finish of the second shift (3:00am). The peak of staff movements would be when the 87 night-shift workers (Shift 2) arrive to replace the 149 day-shift workers. This would occur between 3:30pm and 4:30pm. Volumes at the other shift changeover would be less focussed, due to the extended time between the end of the night shift and the start of the day shift.

These times are outside the general peak on the wider network, although the afternoon shift changeover would occur close to the after-school peak. Although there are seven schools in the immediate vicinity, the bulk of staff traffic would occur after the main after-school peak, where the impact would be reduced.

The administration staff however would mirror the normal working day profile and therefore impact on the surrounding road network during peak periods. The administration staff accounts for 142 persons during the normal daytime activities. This movement has been included in the traffic impact assessment.

- **Table 3-3 Total On-site Staff Requirements**

Shift 1 (Day)	Logistics Centre Warehousing	Loading / Unloading from Trains, Trucks and Warehouse	General Staff	Rail Operations	Administration Staff (normal office hours only)	Empty Depots	Intermodal Facility Road Operations	AQIS / Customs	Total
Weekdays	75	10	12	5	142	19	24	4	**291**
Saturdays	44	6	12	5	0	19	20	4	**67**
Sundays	23	4	12	5	0	19	26	4	**44**
Shift 2 (Night)	**Logistics Centre Warehousing**	**Loading / Unloading from Trains, Trucks and Warehouse**	**General Staff**	**Rail Operations**	**Administration Staff (normal office hours only)**	**Empty Depots**	**Intermodal Facility Road Operations**	**AQIS / Customs**	**Total**
Weekdays	35	10	12	5	0	9	16	0	**87**
Saturdays	20	6	12	5	0	9	12	0	**43**
Sundays	10	4	12	5	0	9	8	0	**31**

3.4 Proposed Access Arrangements

3.4.1 Access During Operation

Two local access points have been proposed for the Enfield Intermodal Logistics Centre, via Cosgrove Road to the Hume Highway, and via Wentworth Street / Norfolk Road to Roberts Road. This reflects some concern expressed during previous site development proposals and community consultation. It creates an opportunity for a more even distribution of traffic coming into and out of the site, operational flexibility for site access and alternate entry points for emergency services.

The key entry point would be via the Roberts Road / Norfolk Road intersection and then via Wentworth Street. This entry point would be linked to the eastern part of the site via a bridge across the Enfield Marshalling Yards. Internally, this would link with the secondary access point at Cosgrove Road.

The main origins and destinations of truck traffic forecast for the development are located west of the site (see Section 4.2.5). As such, the access onto Roberts Road would generally be the most attractive. However, it is reasonable to expect that there would be some truck activity via Cosgrove Road, particularly for trucks going to or from that part of the Enfield Intermodal Logistics Centre closest to Cosgrove Road.

3.4.2 Emergency Access

The emergency access points to the site would be the same as the entry / exit points to the site during normal operation.

3.5 Dangerous Goods

Dangerous goods vehicles will travel on the main arterial road network. An on-site incident management and response plan and a response to a dangerous goods incidence requiring the closure of major roads adjacent to the site would be prepared as part of a hazard and risk assessment.

3.6 On-Site Management

3.6.1 Parking

The likely number of parking spaces should be based on the anticipated number of employees on the site. This number is recommended as a maximum rather than a minimum number of parking spaces. Actual parking arrangements for trucks and cars on site would be addressed as part of the detailed design stage.

3.6.2 On-site Queuing

During the peak of activity, there would be approximately 52 truck arrivals in a one-hour period (for details see Section 4.2). Each truck, upon arriving at one of the access points, would travel to the relevant part of the site. All traffic will be accommodated on-site through traffic management plans.

3.6.3 Heavy Vehicle Management

The operation of the site is likely to involve a number of different lessees, operating independently but with similar objectives. The development of a traffic management plan is one mechanism that could bind all lessees and transport operators to a central objective of developing the site as a model of good practice and would consider the following issues:

- Consideration of a vehicle booking system (VBS) or a similar system that provides for even and structured arrival of trucks to the site for loading and unloading, and accommodates the optimum number of trucks on-site waiting service. This might also create arrival schedules that minimise impact on local demand peaks;
- Development of local area traffic management initiatives to guide trucks to using the major arterial road network; and
- Compliance with safe loading practices and addressing vehicle weight-of-load thresholds on the road network in accordance with the *Road Transport (General) Act, 2005*.

The requirements for heavy vehicle management under a traffic management plan would be developed in consultation with the RTA.

4 Operational Traffic Impact Assessment

4.1 General Methodology

The impact of the development was derived from a NETANAL model calibrated by local traffic surveys, modelling natural growth projections for the area (base 2005 and future 2016), and assigning the traffic generated by the site onto the future road network based on projected commercial activity. Measures of link capacity (between intersections) and intersection operation were used to identify the impact of the proposed development on the road network.

The road network was analysed both with and without the future development of Enfield to compare the effect of background traffic growth with the impact of the development.

The background traffic growth reflects a number of factors including:

- Population trends;
- Vehicle ownership trends; and
- Projected traffic generation by planned future developments including the growth of Port Botany and Sydney Airport.

4.2 Future Scenario Modelling

The base trip matrices for 2016 were modified to include additional traffic generation:

- Population and employment forecasts provided by the Department of Infrastructure, Planning and Natural Resources (DIPNR);
- Port Botany growth with a total of 316 AM peak and 144 in the PM peak trips in 2016 and;
- Sydney Airport growth of 8,100 vehicles during the AM peak hour by 2021, with an assumption that 70% of this traffic will be generated by 2016.

Two scenarios were tested for 2016:

- The “do nothing” scenario including the Port Botany and Sydney Airport growth but no Intermodal Logistics Centre at Enfield; and
- The development of an Intermodal Logistics Centre at Enfield scenario. Some of the movements previously undertaken to and from Port Botany directly by road would replaced by the train between Port Botany and Enfield, and a separate truck trip between Enfield and the ultimate origin/destination in the Enfield Market area.

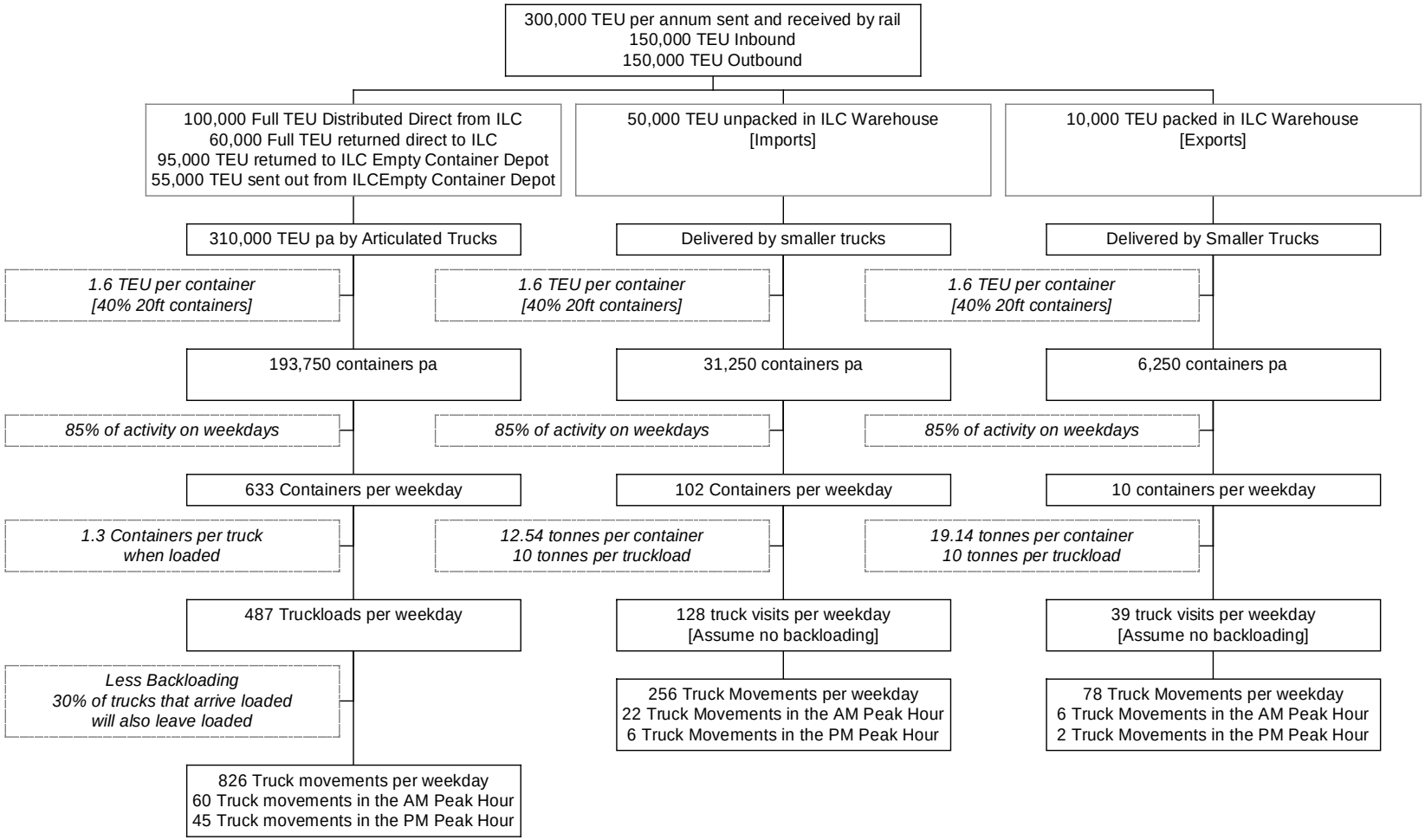
4.2.1 Site Traffic Generation

The generation of vehicular activity (trucks and cars) from the proposed Enfield Intermodal Logistics Centre was estimated from first principles. A fundamental assumption was the annual volume of containers (expressed as TEUs) moving between the port, the Logistics Centre and importers/exporters. For each movement of containers (see Section 3.2), the volume of truck acivity was estimated using the following steps. A full list of assumptions and sources is provided in Table 4-1.

- The annual volume (TEUs) was broken down into daily volumes for weekdays, Saturdays and Sundays, assuming 24/7 operation, 85% of activity on weekdays, 10% of activity on Saturdays and 5% of activity on Sundays;
- The TEU volume was converted into numbers of boxes, ie 20ft and 40ft containers;
- For modelling purposes, shifts have indicatively been defined as 5:00am to 4:00pm and 4:00pm to 3:00am, with the period from 3:00 to 5:00 am for site maintenance, reflecting site efficiencies and typical intermodal activity;
- The number of trucks (articulated and B-Double) required to move those containers was then estimated, assuming average containers per truck and TEUs per container ratios;
- Numbers of smaller trucks that would deliver and dispatch “goods unpacked” goods to/from the warehouse were estimated based on average weights per truck for import and export goods, and weights of containers for import and export;
- Adding all these movements provided an estimate of daily truck activity required to move freight to and from the Intermodal Logistics Centre;
- Accounting for backloading reduced the daily volume of truck activity. A backloading rate of 30% was assumed for container trucks only (i.e. 30% of trucks that arrive carrying a container will also depart carrying a container); and
- A daily profile of truck arrivals was based on the Port of Melbourne, which has a similar operating profile to that proposed. Departure of trucks was also calculated, assuming the same daily profile. Large and small trucks have different assumed profiles, with less small truck activity at night.

This process is illustrated in Figure 4-1.

Figure 4-1 Volume of Truck Activity



SINCLAIR KNIGHT MERZ

Table 4-1 Traffic Generation Assumptions

Assumption	Source
Truck Utilisation 1.3 Containers per truck	2004 survey of Swanston and Webb Docks, Melbourne.
Hours of Activity 365 days per year 24 hours per day on-site activity 22 hours per day movement to site 2 11-hour shifts for packing and unpacking (less meal breaks)	East and West Swanson terminals, Dynon and Kewdale rail freight terminals, CRT and SCT Altona terminals, Yennora and Qenos NSW operations.
Profile of Vehicular Activity 85% of activity on weekdays 10% of activity on Saturdays 5% of activity on Sundays 74% of activity 7am-5pm 15% of activity 5pm-8pm 11% of activity 8pm-7am	Dynon and Kewdale rail freight terminals, Port Botany, CRT and SCT Altona terminals, Yennora and importer exporter service level demands.
Container Types 60% of Containers are 40ft (1.6 TEU / container) Truck Types 25% of trucks entering site (exports) are B-Doubles 10% of trucks leaving the site (imports) are B-Doubles	Sydney Ports, Yennora, CRT Altona, AusTrack Somerton business planning and modelling from Dandenong intermodal terminal feasibility assessment.
Backloading 30% ie of all trucks that arrive loaded, 30% will also leave loaded.	Based on Port Botany EIS
Container Weights Imported 20ft container = 13.5 tonnes Imported 40ft container = 11.9 tonnes Exported 20ft container = 18.3 tonnes Exported 40ft container = 19.7 tonnes Average Import = 12.5 tonnes Average Export = 19.1 tonnes	SPC 2004/2005 Data
Bulking Factor - Weight for smaller trucks carrying non-containerised goods 10 tonnes Workload Profile 2 people in a gang, 1 gang per container 4 person-hours to pack or unpack 1 20ft container 8 person-hours to pack or unpack 1 40ft container 25% contingency for general warehouse staffing	CRT Altona, Yennora, AusTrack Somerton, Chalmers Yarraville and Fishermans Island, modelling from Dandenong intermodal terminal assessment, and data from Melbourne and Fremantle container movement studies.

Note that between 3:00am and 5:00am, it has been assumed for modelling purposes that there would be no truck arrivals or departures. The primary activity on site during this time would be maintenance.

There are expected to be approximately 1,160 truck movements to and from the Intermodal Logistics Centre each day. Table 4-2 shows a peak of 103 truck movements between 2:00pm and 3:00pm. The peak activity during the AM and PM peak periods is between 7:00am and 8:00am with 88 truck movements.

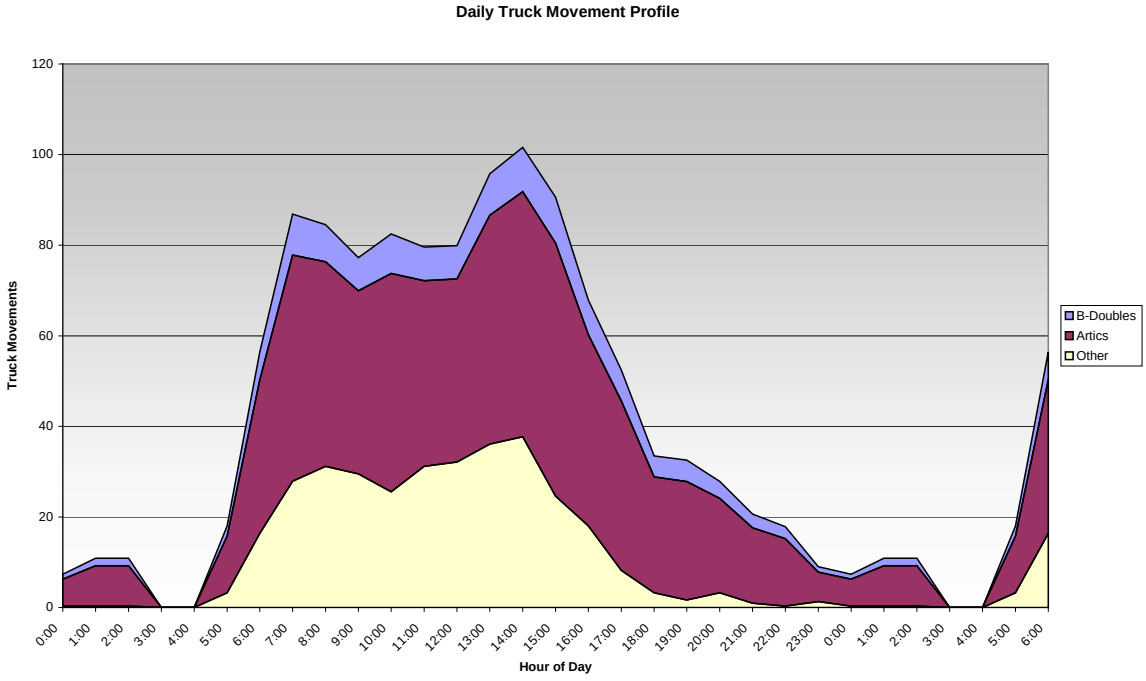
On a weekday, approximately 30% of truck movements (in and out) over a 24-hour period would be small trucks. The indicative profile is shown in Figure 4-2. The impact of this traffic is shown in Section 4.2.7, which concludes that in the AM and PM peak periods, traffic associated with the development of the Enfield Intermodal Logistics Centre has a minimal effect on the road network.

Table 4-2 Weekday Volume of Truck Activity

	Total Movements				
Hour Commencing	B-Doubles	Articulated Trucks	Total Container Trucks	Small Trucks	Total
0:00	1	6	**7**	0	**7**
1:00	2	9	**11**	0	**11**
2:00	2	9	**11**	0	**11**
3:00	0	0	**0**	0	**0**
4:00	0	0	**0**	0	**0**
5:00	2	13	**15**	3	**18**
6:00	6	34	**41**	16	**57**
7:00	9	51	**60**	28	**88**
8:00	8	46	**54**	31	**86**
9:00	8	41	**49**	30	**78**
10:00	9	49	**58**	26	**84**
11:00	8	42	**49**	31	**81**
12:00	8	41	**49**	32	**81**
13:00	9	51	**61**	36	**97**
14:00	10	55	**65**	38	**103**
15:00	10	57	**67**	25	**92**
16:00	8	43	**51**	18	**69**
17:00	7	38	**45**	8	**53**
18:00	5	26	**31**	3	**34**
19:00	5	27	**31**	2	**33**
20:00	4	21	**25**	3	**28**
21:00	3	17	**20**	1	**21**
22:00	3	15	**18**	0	**18**
23:00	1	7	**8**	1	**9**
Daily Total	**128**	**698**	**826**	**334**	**1,160**

Note: Totals may appear not to add due to rounding

- **Figure 4-2 Daily profile of on-site truck activity**



4.2.2 Office Traffic Generation

From the activity profile discussed in Section 3, it is assumed that there are approximately 142 office workers who will access the site during the AM and PM peak periods. It has been assumed that these office activities are associated with the warehousing activity.

As a worst-case scenario, it has been assumed that the majority of these office workers will drive to the site. It is assumed that these staff will also drive individually to the site, as the local industrial bus services will not meet their typical work patterns. With an assumed car occupancy of 1 (again a worst-case scenario), this equates to 142 vehicle trips in the peak period. The impact of this traffic on the network would be minimised due to the central location of the site at the confluence of major arterial roads, leading to diverse routes used to access the site.

4.2.3 Cosgrove Road Light Industrial Area Traffic Generation

Approximately three hectares of light industrial land adjacent to Cosgrove Road would be developed as part of the proposal. This development would be consistent with the existing land uses on the western side of Cosgrove Road. Assuming a 50%/50% split of warehouse type developments and factories, traffic generation rates published by the RTA indicate a peak hour traffic generation of approximately 169 trips (in and out) associated with this site.

4.2.4 Fuel Deliveries

A three-day supply of around 25,000 litres is required in on-site storage tanks. This equates to one fuel tanker every three days.

4.2.5 Traffic Distribution

The distribution of heavy vehicle traffic onto the surrounding network is based on the forecast market area for the Enfield Intermodal Logistics Centre. This distribution is shown in Table 4-3. In order to model this distribution of truck activity from the Enfield Intermodal Logistics Centre, representative industrial zones in each local government area were identified, and the NETANAL model adjusted to reflect these origins and destinations.

The bulk of container movement to and from Enfield is expected to be in the area immediately west of Enfield. The local government areas of Bankstown and Parramatta account for the largest proportions of activity. The nature of this market area is reflected in the distribution of trucks to/from the Enfield Intermodal Logistics Centre. Key access routes include Roberts Road, the Hume Highway and the M4 Motorway.

Table 4-3 Principal Market Area for Imported and Exported Containers

Local Government Area	Exports	Imports
Auburn	9%	9%
Bankstown	38%	40%
Baulkham Hills	0%	0%
Blacktown	1%	4%
Fairfield	6%	10%
Holroyd	4%	8%
Liverpool	3%	6%
Parramatta	30%	19%
Ryde	0%	2%
Strathfield	9%	2%
Total	**100%**	**100%**

Source: New South Wales Sea Freight Council (2004); Sydney Ports Corporation (2005)

4.2.6 Future Road Projects

A number of future projects to be undertaken by the RTA have been assumed for modelling purposes and included in the 2016 NETANAL Base networks are shown in Appendix E. Relevant projects include upgrades to King Georges Road and the M5 Motorway.

4.2.7 Results of Future Traffic Modelling

Table 4-4 and Table 4-5 show the results of the network modelling with and without the Enfield Intermodal Logistics Centre, for selected roads within the study area during the AM peak hour and PM peak hour respectively.

These results show that on most key roads, the increase in peak hour traffic resulting from the development of the Enfield Intermodal Logistics Centre is small. In some instances, a reduction in traffic volumes occurs as vehicles switch to alternative routes. This occurs as vehicles attempt to find the quickest path through the network. Changes in traffic volume at some locations, particularly intersections, can change travel times, making alternate routes more attractive in the model.

Figure 4-3 (AM peak) and Figure 4-4 (PM peak) shows the volume of trucks associated with the Enfield Intermodal Logistics Centre, relative to the total volume forecast on key links in 2016 with the Logistics Centre in operation. The absolute number of heavy vehicles is small, particularly relative to the total volume of traffic (generally less than 1% of total traffic).

4.3 Road Network Link Capacity Assessment

Based on the network modelling results, an assessment of the road link capacity was undertaken. Link capacity refers to the ability of a road to cater for demand at mid-block (between intersection) locations, and is a factor of the number of lanes, type of road, and adjacent development. Theoretical link capacities have been estimated for key roads in the study area. The results in Table 4-6 show that in 2005, roads such as the Hume Highway are at or approaching their theoretical capacity, represented by a degree of saturation of 0.9 or greater (the practical capacity of a link, when traffic flow begins to break down, is typically around 90% of the theoretical capacity). Most roads within the study area are anticipated to be operating within their theoretical capacity both with and without the Enfield Intermodal Logistics Centre in place. In the 2016 base case, the Hume Highway and Roberts Road are the most saturated links.

The impact of the Enfield Intermodal Logistics Centre on link capacity is a marginal change in degree of saturation. Roads such as Cosgrove Road and Wentworth Street experience a relatively large increase in degree of saturation compared with other roads. This is due to the smaller base volume of traffic on these roads, resulting in a larger proportional increase in traffic, although the absolute increase is small.

- **Table 4-4 Modelled Future Traffic Volume AM Peak – All Vehicles**

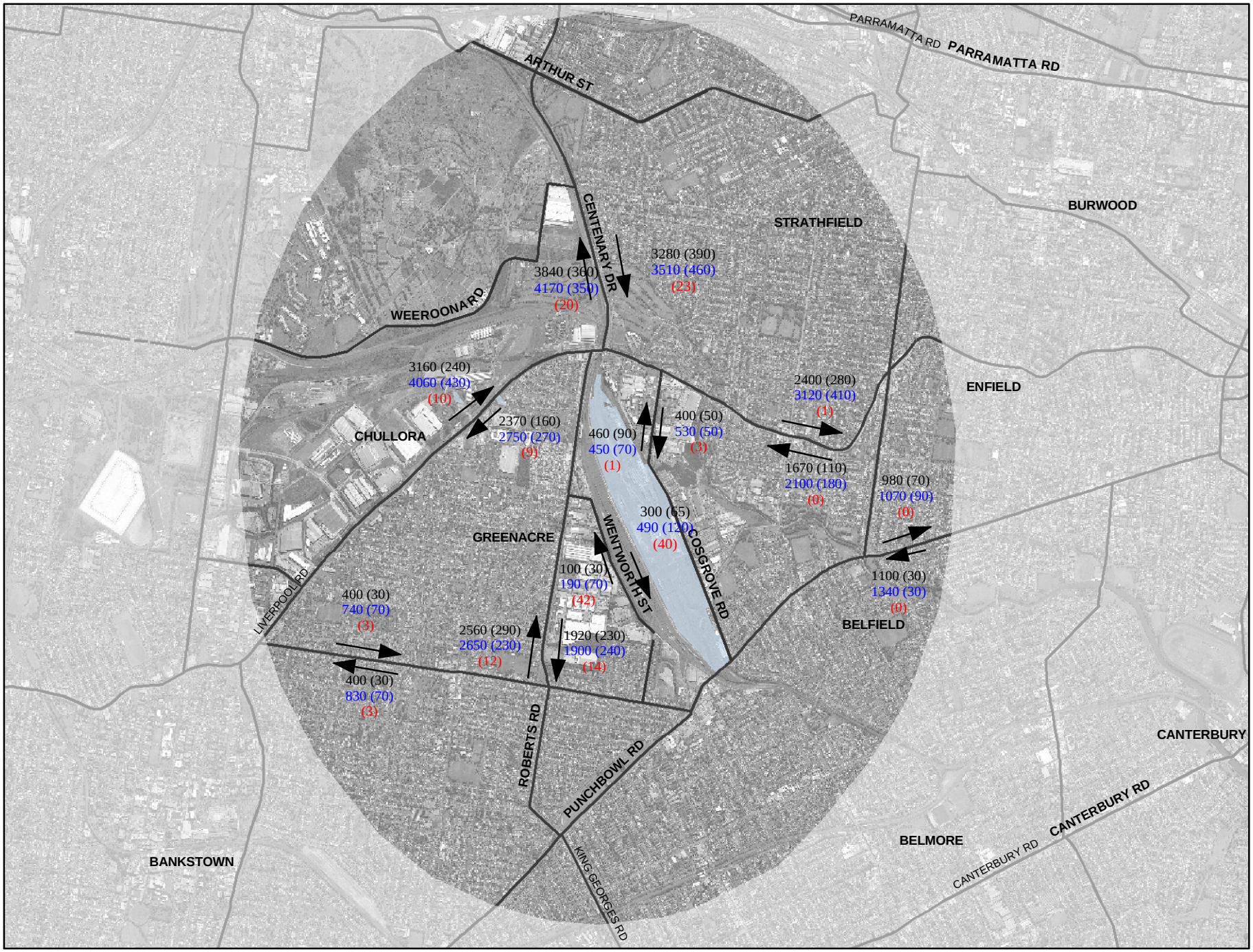
Street Name	Location	Direction	2005 Existing	2016 Base Without Enfield ILC	2016 With Enfield ILC	Change from Base	2016 ILC Trucks	2016 ILC Cars
Boronia Road	E of Hume Highway	EB	457	725	736	2%	3	6
Boronia Road	E of Hume Highway	WB	403	821	827	1%	3	0
Centenary Drive	S of Weeroona Road	NB	3,836	4,192	4,172	0%	20	0
Centenary Drive	S of Weeroona Road	SB	3,283	3,459	3,513	2%	23	19
Cosgrove Road	S of Hume Highway	NB	464	429	450	5%	1	0
Cosgrove Road	S of Hume Highway	SB	395	384	525	37%	3	52
Georges River Road	E of Coronation Parade	EB	981	1,044	1,067	2%	0	0
Georges River Road	E of Coronation Parade	WB	1,103	1,356	1,340	-1%	0	18
Hume Highway	W of Centenary Drive	NB	3,160	4,038	4,059	1%	10	3
Hume Highway	W of Centenary Drive	SB	2,367	2,747	2,745	0%	9	0
Hume Highway	E of Cosgrove Road	EB	2,407	3,124	3,124	0%	1	0
Hume Highway	E of Cosgrove Road	WB	1,665	2,027	2,100	4%	0	50
Hume Highway	N of Stacey Street	NB	2,461	2,507	2,507	0%	3	6
Hume Highway	N of Stacey Street	SB	1,622	1,754	1,752	0%	3	0
Roberts Road	S of Norfolk Road	NB	2,564	2,648	2,649	0%	12	37
Roberts Road	S of Norfolk Road	SB	1,924	1,905	1,905	0%	14	0
Wentworth Street	S of Norfolk Road	NB	96	147	189	29%	42	0
Wentworth Street	S of Norfolk Road	SB	304	395	489	24%	40	57

- **NB = northbound, SB = southbound, EB = eastbound, WB = westbound**

- **Table 4-5 Modelled Future Traffic Volume PM Peak – All Vehicles**

Street Name	Location	Direction	2005 Existing	2016 Base Without Enfield ILC	2016 With Enfield ILC	Change from Base	2016 ILC Trucks	2016 ILC Cars
Boronia Road	E of Hume Highway	EB	335	390	387	-1%	2	0
Boronia Road	E of Hume Highway	WB	469	816	865	6%	3	2
Centenary Drive	S of Weeroona Road	NB	3,172	3,835	3,864	1%	10	13
Centenary Drive	S of Weeroona Road	SB	3,826	3,916	3,897	0%	13	0
Cosgrove Road	S of Hume Highway	NB	517	551	769	40%	1	83
Cosgrove Road	S of Hume Highway	SB	594	645	623	-3%	3	0
Georges River Road	E of Coronation Parade	EB	782	755	751	-1%	0	12
Georges River Road	E of Coronation Parade	WB	1,167	1,129	1,181	5%	0	0
Hume Highway	W of Centenary Drive	NB	2,292	2,912	2,903	0%	6	0
Hume Highway	W of Centenary Drive	SB	2,791	3,669	3,574	-3%	8	2
Hume Highway	E of Cosgrove Road	EB	1,910	2,787	2,940	5%	1	83
Hume Highway	E of Cosgrove Road	WB	2,119	2,879	2,778	-4%	1	0
Hume Highway	N of Stacey Street	NB	1,617	1,612	1,578	-2%	2	0
Hume Highway	N of Stacey Street	SB	2,675	2,640	2,531	-4%	3	2
Roberts Road	S of Norfolk Road	NB	2,146	2,801	2,802	0%	8	0
Roberts Road	S of Norfolk Road	SB	2,470	2,178	2,243	3%	9	19
Wentworth Street	S of Norfolk Road	NB	150	223	286	28%	25	34
Wentworth Street	S of Norfolk Road	SB	114	167	192	15%	23	0

- **NB = northbound, SB = southbound, EB = eastbound, WB = westbound**



Enfield Intermodal Logistics Centre

Figure 4.3 Estimates of ILC Heavy Vehicle and Total Traffic Volumes (AM)

Legend

- Major Road
- Enfield Site

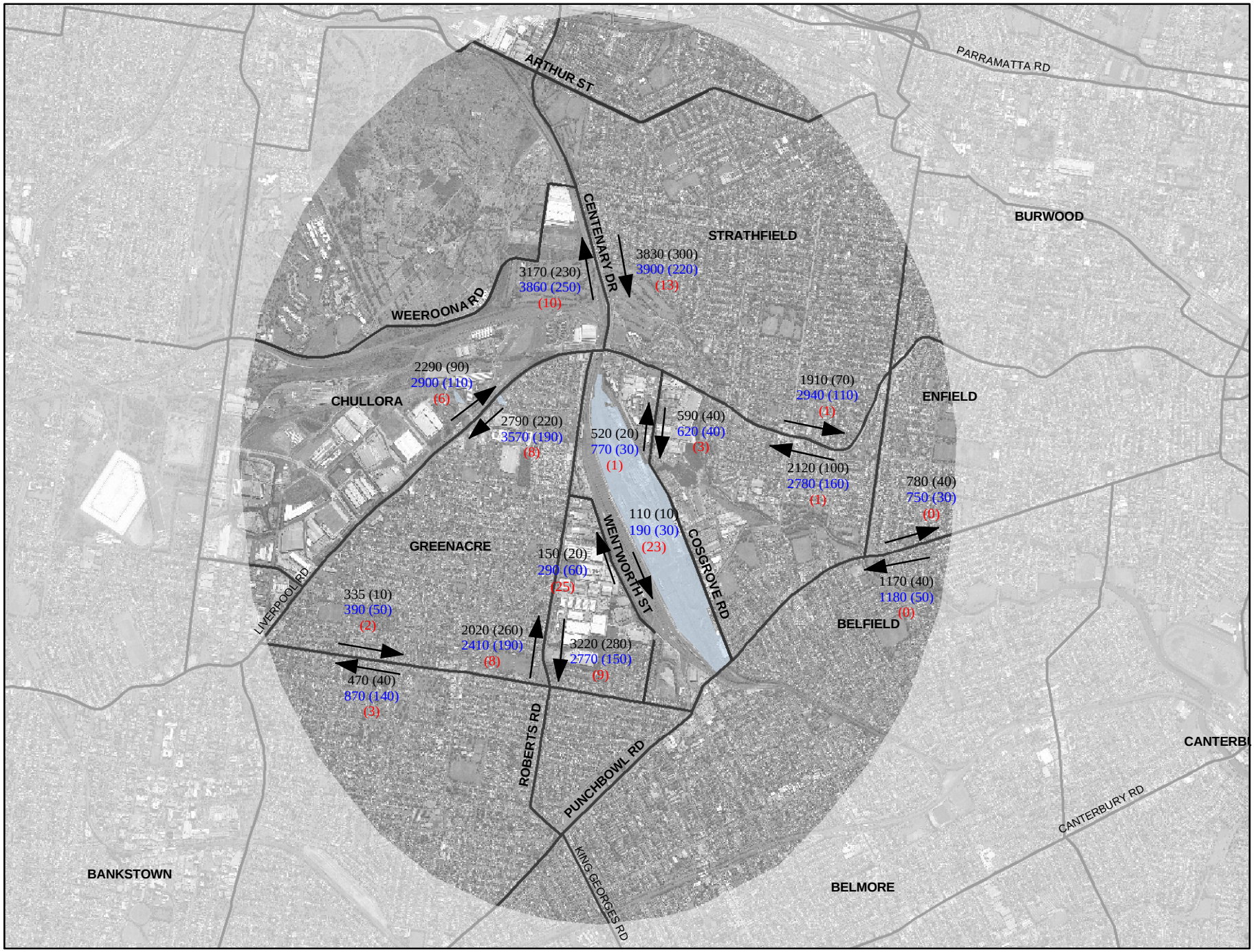
2400 (280): 2005 Total (HV)
3120 (410): 2016 with ILC (HV)
(42): 2016 ILC HV

N

0 0.5
Kilometres

Projection: MGA 56
Page Size: A4
File Name:EN01709_Tr_012ai.mxd
Location:\\EN01709\Technical\GIS\Template\
Date: 01/8/2005

SKM



Enfield Intermodal Logistics Centre

Figure 4.4
Estimates of ILC Heavy Vehicle and Total Traffic Volumes (PM)

Legend

- Major Road
- Enfield Site

2400 (280): 2005 Total (HV)
3120 (410): 2016 with ILC (HV)
(42): 2016 ILC HV

N

005
Kilometres

Projection: MGA 56
Page Size: A4
File Name:EN01709_Tr_012bi.mxd
Location:\\EN01709\Technical\GIS\Template\
Date: 01/8/2005

SKM

Table 4-6 Link Capacity Assessment

Street	Location	Direction	Capacity per hour	Degree of Saturation					
				AM			PM		
				2005 Existing	2016 Base	2016 With Enfield	2005 Existing	2016 Base	2016 With Enfield
Boronia Road	E of Hume Highway	EB	1,800	0.25	0.40	0.41	0.19	0.22	0.22
Boronia Road	E of Hume Highway	WB	1,800	0.22	0.46	0.46	0.26	0.45	0.48
Centenary Drive	S of Barker Road	NB	4,800	0.80	0.87	0.87	0.66	0.80	0.81
Centenary Drive	S of Barker Road	SB	4,800	0.68	0.72	0.73	0.80	0.82	0.81
Cosgrove Road	S of Hume Highway	NB	900	0.52	0.48	0.50	0.57	0.61	0.85
Cosgrove Road	S of Hume Highway	SB	900	0.44	0.43	0.58	0.66	0.72	0.69
Georges River Road	E of Coronation Parade	EB	1,800	0.55	0.58	0.59	0.43	0.42	0.42
Georges River Road	E of Coronation Parade	WB	1,800	0.61	0.75	0.74	0.65	0.63	0.66
Hume Highway	W of Centenary Drive	NB	2,900	**1.09**	**1.39**	**1.40**	0.79	**1.00**	**1.00**
Hume Highway	W of Centenary Drive	SB	2,900	0.82	**0.95**	**0.95**	**0.96**	**1.27**	**1.23**
Hume Highway	E of Cosgrove Road	EB	1,900	**1.27**	**1.64**	**1.64**	**1.01**	**1.47**	**1.55**
Hume Highway	E of Cosgrove Road	WB	1,900	0.88	**1.07**	**1.11**	**1.12**	**1.52**	**1.46**
Hume Highway	N of Stacey Street	NB	2,900	0.85	0.86	0.86	0.56	0.56	0.54
Hume Highway	N of Stacey Street	SB	2,900	0.56	0.60	0.60	**0.92**	**0.91**	0.87
Roberts Road	S of Norfolk Road	NB	2,900	0.88	**0.91**	**0.91**	0.74	**0.97**	**0.97**
Roberts Road	S of Norfolk Road	SB	2,900	0.66	0.66	0.66	0.85	0.75	0.77
Wentworth Street	E of Roberts Road	NB	900	0.11	0.16	0.21	0.17	0.25	0.32
Wentworth Street	E of Roberts Road	SB	900	0.34	0.44	0.54	0.13	0.19	0.21

Note: The text in bold indicates where volume/capacity ratio exceeds 0.9, which indicates congested conditions.

NB = northbound, SB = southbound, EB = eastbound; WB = westbound

4.4 Intersection Assessment

The operation of key intersections within the identified study area has been assessed both with and without an Enfield Intermodal Logistics Centre for the year 2016. Input to the INTANAL models for each intersection were modelled flows extracted from the NETANAL model. The results of the intersection assessment are presented in Table 4-7.

Table 4-7 Future Intersection Operation

	AM Peak					PM Peak				
	2005	2016 Base		2016 With Enfield ILC		2005	2016 Base		2016 With Enfield ILC	
Intersection	LoS	Av Del	LoS	Av Del	LoS	LoS	Av Del	LoS	Av Del	LoS
Roberts Road / Juno Parade	**E**	**97**	**F**	**102**	**F**	D	**191**	**F**	**182**	**F**
King Georges Road / Punchbowl Road	**F**	**>200**	**F**	**>200**	**F**	**F**	**>200**	**F**	**>200**	**F**
Georges River Road / Coronation Parade	B	19	B	19	B	A	13	A	13	A
Roberts Road / Norfolk Road	B	24	B	31	C	B	35	C	41	C
Hume Highway / Boronia Road	B	51	D	55	D	B	44	D	44	D
Hume Highway / Roberts Road / Centenary Drive	**F**	**>200**	**F**	**>200**	**F**	D	**178**	**F**	**168**	**F**
Hume Highway / Cosgrove Road	C	**>200**	**F**	**>200**	**F**	D	**>200**	**F**	**>200**	**F**
Hume Highway / Coronation Parade	C	**>200**	**F**	**159**	**F**	B	**57**	**E**	**51**	**E**
Centenary Drive / Arthur Street	C	**57**	**E**	**65**	**E**	C	45	D	46	D
Centenary Drive / Weeroona Road	A	14	B	14	B	A	9	A	9	A

Table 4-7 shows that background growth in traffic to 2016 would result in several intersections operating at an unsatisfactory level of service. It also shows that generally there is very little difference in intersection operation in 2016 when comparing the with and without Enfield Intermodal Logistics Centre scenarios. Saturated intersections include Roberts Road / Juno Parade, King Georges Road / Punchbowl Road, Hume Highway / Roberts Road / Centenary Drive, Hume Highway / Coronation Parade, Hume Highway / Cosgrove Road and Centenary Drive / Arthur Street. These intersections would be saturated in 2016 with or without the Enfield Intermodal Logistics Centre.

The Hume Highway / Cosgrove Road intersection is forecast to operate at Level of Service F in the future, regardless of any development of the ILC. The link capacity assessment (Table 4-6) also shows that this section of the highway would be congested in the future, regardless of the ILC. Based on this forecast, widening of this section of the Hume Highway is warranted and would improve intersection operation. With three through lanes provided in each direction on the Hume Highway, the Level of Service improves to D in the PM peak. This configuration would also be suitable for the forecast traffic with the proposed Enfield Intermodal Logistics Centre in operation.

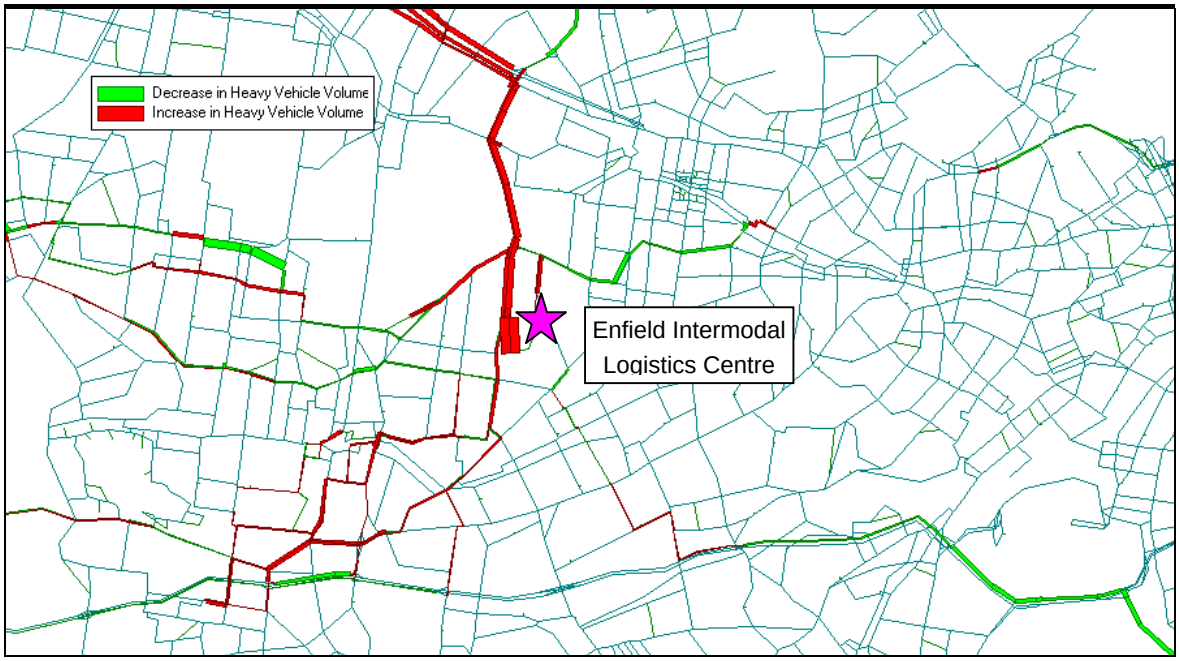
However, the nature of the NETANAL model, assigning traffic on a quickest path basis, and the location of the core market area to the west of the site, results in very few trucks being modelled using Cosgrove Road. Although the main site access point would be via Wentworth Street, up to 25% of trucks are expected to use the Cosgrove Road site access. As a sensitivity test, assessment of the Cosgrove /Hume Highway intersection assuming various levels of truck activity via Cosgrove Road was undertaken. If 100% of truck activity were via Cosgrove Road, then operation of the upgraded intersection (with 6 lanes on the Hume Highway) would be at Level of Service E in the PM peak. A similar level of service was found with 50% of truck activity via Cosgrove Road, although the average delays in this case were very close to an acceptable level. However, the anticipated level of truck activity via Cosgrove Road is much less than this, and the intersection is therefore expected to operate at a satisfactory level of service in the majority of instances of upgrades.

The Roberts Road / Norfolk Road intersection is operating with spare capacity and no intersection enhancement is required from a traffic perspective.

4.5 Regional Impact Zone

An assessment was undertaken to ascertain the regional impact of the Enfield Intermodal Logistics Centre on the road network. A plot of the difference in total volumes arising from the operation of the Enfield Intermodal Logistics Centre during the AM peak is shown in Figure 4-5. A similar pattern is found in the PM peak.

- **Figure 4-5 Change in AM Peak Traffic Volume with Enfield ILC compared to 2016 Base Case**



The most significant points to be drawn from the above plot include:

- Where the heavy vehicle volume increases, it is generally only by a small margin (the increase in heavy vehicles on Roberts Road, which has the highest increase in the number of heavy vehicles associated with the Intermodal Logistics Centre, is less than 1% of the total traffic stream);
- The additional truck activity generated by the development would be concentrated on key arterial roads such as Roberts Road / Centenary Drive, M4 Motorway and Hume Highway; and
- There would be reduced growth in heavy vehicle traffic on the M5 Motorway, due to some truck activity from Port Botany being replaced by the rail movements to the intermodal facility at Enfield.

It should be noted, with reference to the Director-General Requirements (see Appendix B), that the low volumes of heavy vehicles generated by the Enfield ILC indicates that no dedicated infrastructure is required to support a stand alone road freight corridor for the movement of heavy vehicles from the site.

4.6 Local Area Traffic Management

Local Area Traffic Management (LATM) measures can be utilised to reinforce the characteristics of roads in the local highway network. With appropriate LATM measures to inhibit through traffic

using the local road system, it is unlikely that traffic will have any significant impact on local amenity. In this specific case, the objective for introducing measures would be to ensure that heavy vehicles travelling to and from Enfield Intermodal Logistics Centre use appropriate routes and do not travel through unsuitable residential areas.

Light traffic thoroughfares are already in place in Norfolk Road and Rawson Road, west of Roberts Road. Heavy vehicle routes to and from the Norfolk Road access will use Roberts Road and Hume Highway to access the wider road network away from this area. Site access is also proposed on Cosgrove Road. The southern end of this road has residential land uses and it is therefore desirable to route heavy vehicles away from this area. These combined measures will ensure that heavy vehicle access to and from the site is made on the arterial road network and not on local roads.

4.7 Night Time Heavy Vehicle Movements

Although the ILC site will operate over 24 hours, heavy vehicle activity will not be spread evenly throughout the day. It is expected that there will be less truck activity at night compared to the daytime.

Night time heavy vehicle movements were derived from the hourly truck arrival and departure profile (see Table 4-2). Based on this profile, it is anticipated that around 6% of heavy vehicle movements are likely to occur between 10:00pm and 6:00am. This is not inconsistent with the surrounding network, such as Roberts Road, within an average of 12-13% existing heavy vehicle movement from 10:00pm to 6:00am.

4.8 Sensitivity Assessment

A sensitivity assessment has been undertaken on a number of the assumptions used to estimate on-site activity. The effect of these variations on the number of truck visits generated in the weekday AM peak hour is shown in Table 4-8. It should be noted that the baseline (shaded rows) refers to the assumptions detailed in Table 4-1 and used in the analyses described above.

Table 4-8 Sensitivity Assessment

Variable	Source	Morning Peak Container Truck Movements			Morning Peak Light Truck Vehicle Movements		
		Change	%Change	Total	Change	%Change	Total
20ft vs 40ft containers							
70% of containers are 40ft	Best-case estimate	0	0%	58	-2	-7%	26
60% of containers are 40ft	SPC Forecast	0	0%	58	0	0%	28
42% of containers are 40ft	SPC Data 2004/05	0	0%	58	+4	14%	32
TEU per loaded truck							
2.4	Optimistic Assumption	-6	-10%	52	0	0%	28
2.1	Assume same containers / truck as existing	0	0%	58	0	0%	28
1.77	Existing	+12	21%	70	0	0%	28
Container Weights							
Imported 20ft = 13.5t Imported 40ft = 19.5t Exported 20ft = 16.5t Exported 40ft = 21.5t	SKM Estimate	0	0%	58	+8	29%	36
Imported 20ft = 13.5t Imported 40ft = 11.9t Exported 20ft = 18.3t Exported 40ft = 19.7t	SPC Data 2004/05	0	0%	58	0	0%	28
Weight carried by small trucks							
5 tonnes		0	0%	58	+28	100%	56
10 tonnes		0	0%	58	0	0%	28
15 tonnes		0	0%	58	-10	-36%	18
Proportion of activity occurring on weekdays							
80%		-4	-7%	54	-2	-7%	26
85%	Baseline	0	0%	58	0	0%	28
100%	Worst Case	+10	17%	68	+4	14%	32
Backloading							
50%	Optimistic Assumption	-6	-10%	52	0	0%	28
30%	Baseline	0	0%	58	0	0%	28
20%	Worst Case	+4	7%	62	0	0%	28

Table 4-8 shows that generally each factor on its own has only a minor impact on peak hour truck activity generation. Realistic potential variations on the baseline, as outlined in Table 4-8, would

result in changes ranging from –6 to +12 container truck movements and –10 to +28 light truck movements in the peak hour. The overall impact of this number of truck movements would have a minimal impact on the surrounding road network, particularly relative to the baseline volumes on the road, and would not significantly change the findings of the traffic impact assessment presented in this report.

The sensitivities that influence container truck activity include the container/truck ratio, backloading rates and the weekday activity profile. The sensitivities that influence light truck vehicle activity include the weekday activity profile, as well as the 20ft/40ft container ratio, weight per container and weight carried by each truck.

It is likely that a commercial operator of the Enfield Intermodal Logistics Centre would strive to achieve efficiencies in their operation so as to reduce costs associated with transport. These would include increasing the number of containers or weight of freight carried on each truck and increasing backloading. Thus, these forecasts are likely to be conservative in the long term.

4.9 Mitigation Measures

The traffic modelling has shown that the proposed Enfield Intermodal Logistics Centre will have a minimal impact on traffic volumes and the performance of intersections in the immediate area. The modelling has also shown that the number of additional movements on the regional road network from the Enfield development is low and does not detrimentally affect network performance.

The modelling highlights the impact of natural traffic growth in the study area and suggests that intersection performance will be poor in many locations during peak periods without the proposed Enfield Intermodal Logistics Centre.

It is suggested that the RTA investigate options to improve the operation of a number of intersections to improve travel times for all road users. These include:

- King Georges Road / Punchbowl Road;
- Hume Highway / Roberts Road / Centenary Drive;
- Hume Highway / Coronation Parade;
- Roberts Road / Juno Parade;
- Cosgrove Road / Hume Highway; and
- Centenary Road/Arthur Street.

The operation of the Hume Highway / Cosgrove Road intersection will directly impact the Enfield Intermodal Logistics Centre. Satisfactory operation in 2016 could be achieved through the provision of three through lanes in each direction on the Hume Highway between Centenary Drive and Cosgrove Road. This would alleviate the forecast Level of Service F to achieve acceptable

operation at Level of Service D. The Roberts Road/Norfolk Road intersection is operating with spare capacity and no intersection enhancement is required.

5 Construction Traffic

5.1 Construction Activity

It is anticipated that construction activity for the Enfield Intermodal Logistics Centre will occur over a period of approximately 27 months. Assuming that construction commences in 2006, it is expected that operations would commence in late 2008. Traffic volumes generated by the construction employees on the site would vary depending on the construction timetable.

The indicative timetable is as follows:

- Stage 1 – Site Preparation – months 1-4;
- Stage 2 – Earthworks and Drainage – months 2 – 12;
- Stage 3 – Road and Rail Infrastructure – months 8-15; and
- Stage 4 – Warehousing and Final Works – months 15-27.

There is a fifth stage, Commercial and Light Industrial Buildings, that will commence as the market demand requires.

The activities associated with each phase are shown below in Table 5-1.

Table 5-1 Indicative Key Construction Phases

Phase	Description of Activities	Timeframe
Stage 1 – Site Preparation	■ Removal of contaminated material / land farming on site ■ Removal of unsuitable material from site ■ Construction of all internal sealed haul roads ■ Construction of the stormwater detention ponds ■ Construction of landscaping mounds ■ Preparation of light industrial / commercial area along Cosgrove Road	■ 4 months
Stage 2 – Earthworks and Drainage	■ Site grading including cut and fill works to level site ■ Construction of retaining walls / embankments ■ Site stabilisation works ■ Construction of stormwater trunk drainage system ■ Development of ecological / community area ■ Relocation of services	■ 11 months
Stage 3 – Road and Rail Infrastructure	■ Construction of off-site access points ■ Construction of reinforced earth wall for road embankment ■ Installation of services ■ Relocation of existing rail access to wheel lathe ■ Construction of new railway line and sidings ■ Pave container storage areas and internal roads	■ 8 months
Stage 4 –	■ Construct warehouses, administration and maintenance	■ 13 months

Phase	Description of Activities	Timeframe
Warehousing and Final Works	buildings ▪ Final landscaping	
Stage 5 – Commercial / Light Industrial Buildings	▪ Construct buildings along Cosgrove Road for commercial / light industrial and ancillary retail / refreshment uses	▪ As market demand requires

The Conditions of Consent for the proposed development will set the permissible hours for construction. It is expected to be between 7:00am to 6:00pm Monday to Saturday. For the purpose of this report, no construction work would be undertaken on Sundays and public holidays. However, should this be a requirement in the future, separate approval will be sought from the Department of Infrastructure, Planning and Natural Resources (DIPNR). The activities undertaken during each stage is shown below.

5.1.1 Stage 1 – Site Preparation

The first stage of the construction would involve preparation of the internal haul roads. Suitable materials available on site in the existing stockpiles would be utilised as base for the haul roads. Roads would be sealed with a flush aggregate, to assist in reducing dust emissions during construction. Remediation of contaminated soil would also be undertaken during this stage of the project. Contaminated soil would either be landfarmed on site or transported off site for disposal at a licensed waste receiving facility.

Two types of material are to be transported off site during this stage as follows:

- Contaminated Material – total of 13,500 m^3 of which 12,000 m^3 of material from DELEC site and 1,500 m^3 from the remainder of the site (to be land farmed or disposed); and
- Unsuitable Material – mainly from Stockpile 5 – approximately 37,000 m^3.

It is intended that the estimated 13,500 m^3 of contaminated soil be retained on-site and be placed under new landscaping mounds, after the landfarming operation is complete. Note that it is desirable that the 37,000 m^3 of unsuitable material be retained on site, but a worst case scenario has been assumed for the purposes of this traffic assessment.

5.1.2 Stage 2 – Earthworks and Drainage

Earthworks are required primarily to level, manipulate or remove existing stockpiles to create appropriate site levels. Design levels have been determined to maximise the reuse of stockpile material.

Stockpiles 1-4 will be used primarily for on-site fill. Stockpile 5 (approximately 132,000 m^3) is to be re-used or taken off-site. While it is desirable that the 50,500 m^3 of unsuitable material be retained on site, a worst case scenario has been assumed for the purpose of this assessment.

The stormwater drainage system would be constructed at appropriate timing during the earthworks. It is anticipated that the earthworks phase would be completed within 45 weeks with two work fronts progressing simultaneously.

5.1.3 Stage 3 – Road and Rail Infrastructure

Road works will be undertaken during this stage including construction of the site access points including:

- Norfolk Road Access – construction of a bridge across the Marshalling Yards to connect the internal haul roads to Wentworth Street / Norfolk Road. The preferred bridge structure features pre-cast Super Tee girders, which can be lifted into position with minimum disturbance to rail operations; and
- Cosgrove Road Access – would be located in the vicinity of the existing access point on Cosgrove Road.

The main railway line and two rail sidings would be constructed along the western boundary of the site. The rail sidings would be constructed in concrete chases cast in-situ with the main railway line on sleepers and ballast. Construction of the railway line and sidings would require the use of track laying machinery and a concrete pump.

Pavement works undertaken as part of this stage of construction would cover the area proposed for the Enfield Intermodal Logistics Centre Terminal, Warehouse and Empty Container Storage areas and the internal road haul roads. The Enfield Intermodal Logistics Centre Terminal would be paved with flexible pavement materials and would have an asphalt concrete seal capable of withstanding a load of 50Kpa. Pavement for the internal haul roads would be flexible with an asphaltic concrete seal designed to the specified equivalent standard axles.

5.1.4 Stage 4 – Warehousing and Final Works

Warehouses would be constructed utilising cranes and piling equipment. In addition, a number of administration buildings would be constructed.

Pavement works associated with the warehouses and administration buildings would be undertaken utilising flexible pavement with asphaltic concrete seal capable of withstanding loading / unloading operations and designed to the specified equivalent standard axles.

Final landscaping works would be undertaken as part of the overall site finishing works.

5.1.5 Stage 5 – Commercial / Light Industrial Areas along Cosgrove Road

Developments along Cosgrove Road would be undertaken, as market demand requires. Separate development applications for construction of the buildings only would be required prior to construction. The material required for the construction of Stage 5 has not been included in this assessment.

5.2 Construction Traffic Impact

The main road transport task during construction of the new terminal would be the delivery of materials and concrete to the site and removal of stockpile and contaminated material from the site. Based on the indicative construction program shown in Table 5-2 and projected material volumes shown in Table 5-3, the construction traffic impact is not substantial. The average vehicle activity during the construction period is around 29 construction vehicles per day. The peak vehicle activity is likely to be in month 15 when Stage 3 overlaps with Stage 4 with an average of 75 vehicles per day during this period. It should be noted that although the site is immediately adjacent to the rail network, construction traffic has been gauged as providing all construction material movement, thus describing a worst case.

- **Table 5-2 Indicative Construction Program**

Month	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27
Stage 1																											
Stage 2																											
Stage 3																											
Stage 4																											
Stage 5	As market demand requires																										

This construction activity for the Enfield Intermodal Logistics Centre would include trucks involved in materials delivery, and delivery or relocation of specialist plant such as cranes, pavers and excavators. Construction staff would use light four-wheel drive vehicles for survey and construction management purposes. Control of construction traffic would be in accordance with the requirements of the RTA's *Traffic Control at Worksites Manual*.

Table 5-3 Construction Material and Truck Movements

Construction Material	Quantity	Density	Trucks
Material off-site			
Contaminated	13,500 m^3	18 m^3/truck	750
Stockpile 5 Material	37,000 m^3	18 m^3/truck	2,056
Sub Total			*2,806*
Material on-site			
Reinforced Concrete	20,100 m^3	6 m^3/truck	3,350
Asphalt Concrete	114,500 m^3	10 m^3/truck	11,450
Soil	800 m^3	18 m^3/truck	44
Railway	5km		50
Turnouts - Yard	4		4
Turnouts - Main	2		12
Bridge	150m		20
LPG + Diesel Tanks	6		9
Warehouses			
Precast walls	6000 m^3		130
Sheet Metal	18000 m^3		8
Roof cladding	60,000 m^3		25
Purlins Roof	60,000 m^3		42
Girt - Walls	18,000 m^3		13
Structural Steel	60,000 m^3		90
Utilities			200
Drainage			101
Sub Total			*15,548*
Total			***18,354***

5.2.1 Construction Routes

The origin and destination of material varies for material coming on to the site (construction material) and material being taken off-site (contaminated and other spoil material). Material could indicatively come from / go to the following locations:

- Concrete – could be sourced from various locations including Lakemba (south west of the site) – accessed via Roberts Road or Punchbowl Road; Strathfield (north east of the site) – accessed via Hume Highway; or Smithfield (north west of site) – accessed via M4 Motorway;
- Asphalt – could be sourced from Seven Hills;
- Pipes – could be sourced from various locations including Camelia, Emu Plains and Rooty Hill; and

- Spoil (contaminated and other) - could be destined, for example, for Glenmore Park (west along the M4 Motorway). An indicative route could be along Roberts Road to Hume Highway, continuing on to the Cumberland Highway (M7) or north past the Hume Highway towards the Great Western Highway and the north on to Cumberland Highway.

It is anticipated that heavy vehicle construction traffic would be restricted to arterial routes and would not be allowed to traverse residential areas around the site.

5.2.2 Traffic Management During Construction

The traffic modelling has indicated that the proposed Enfield ILC will have a minimal impact during the construction phase. Appropriate traffic management plans will be developed to manage construction traffic during the site construction period.

5.2.3 Construction Staff

The construction workforce profile has been derived from construction of similar warehousing, bond store and quarantine operations. This was scaled from 60,000m^2 warehousing plus 60,000 m^2 of pavement, with an estimated construction duration of 12 months continuous construction. This implies an average of 150 to 170 workers for 12 months continuous construction, with a peak of 240 workers for two months.

5.2.4 Construction Staff Parking Requirements and Traffic Impact

As a worst case scenario it was assumed that all staff would be on site at any one time. Due to the hours of work and relative isolation of the site, an occupancy rate of one person per vehicle was assumed. Based on these assumptions, a peak generation traffic of 150 to 170 vehicles per day to and from the site is expected. This is less than the expected workforce during operation, which was shown in Section 4 to have only a minimal impact on the surrounding road network.

6 Conclusions and Recommendations

6.1 Conclusions

The key conclusion as a result of the investigations undertaken as part of this traffic and transport analysis shows that there is no significant adverse impact on the local or regional road network following the introduction of the Enfield Intermodal Logistics Centre.

6.1.1 Operations / Traffic Generation

The traffic generation was based on the total volume of 300,000 TEU moving to and from Port Botany. The breakdown of activity is shown below:

- 150,000 TEUs per annum would be sent by rail from the port to Enfield.
- 50,000 full TEUs would be unpacked at the Logistics Centre Warehouse and the contents dispatched by road on light trucks;
- 100,000 TEUs would be dispatched full directly to importers; and
- 145,000 empty TEUs would be returned to the Empty Container Depot at Enfield from the Logistics Centre Warehouse and from importers/exporters. Around 5,000 TEUs would leak from the system (i.e. containers to other ports / locations).

- 150,000 TEUs per annum would be returned to the port by rail.
- 10,000 TEUs would come from the Logistics Centre Warehouse where they were packed with goods brought to Enfield by light trucks;
- 60,000 full TEUs would be trucked direct from exporters. Most of the containers filled by the exporters would have come from the Empty Container Depot; and
- 80,000 empty TEUs would be returned to the port from the Empty Container Depot.

The key on-site activity (movement of containers, vehicle and train movement) is between 5:00am to 3:00am, split into two shifts. The impact of the staff travelling to work would be minimal due to these shift arrangements. There is additional activity on the site in the form of offices (normal working hours) which will increase the traffic in the peak period but this will not adversely impact the existing and future operation of the surrounding intersections. It was calculated that the peak hourly number of truck movements would be around 103, although this would be outside the road network peak periods. There would be around 88 and 53 truck movements in the AM peak hour and PM peak hour respectively.

6.1.2 Impact on Local Network

The impact on the surrounding local road network is not considered to be significant (trucks going to/from the Intermodal Logistics Centre make up less than 1% of total traffic on the arterial road network), as the total truck volume does not adversely affect the level of service at key intersections in 2016. However, the following intersections do require upgrading even without the development of the Enfield Intermodal Logistics Centre:

- King Georges Road / Punchbowl Road;
- Hume Highway / Roberts Road / Centenary Drive;
- Hume Highway / Cosgrove Road;
- Hume Highway / Coronation Parade; and
- Centenary Road / Arthur Street.

6.1.3 Impact on Regional Road Network

The impact on the regional road network is not significant. The key findings of the analysis are the following:

- Where traffic volume increases, it is generally only by a small margin. In most cases, the change in peak hour traffic volume is negligible. Intermodal Logistics Centre trucks make up less than 1% of traffic on the surrounding road network;
- The additional truck activity generated by the development would be concentrated on key arterial roads such as Roberts Road / Centenary Drive and the Hume Highway; and
- There would be reduced growth in heavy vehicle traffic on the M5 Motorway, due to some truck activity at Port Botany being replaced by the rail movements to the intermodal facility.

6.1.4 Impact on Safety

Although the peak traffic generation generally coincides with school hours, the number of accidents involving heavy vehicles is not considered to be significant. However, it is recommended that the safe school zones be enforced during school hours.

6.1.5 Public Transport

Existing public transport services do not directly serve the Enfield site, although there are bus services that are within the walking catchment for the proposed Enfield Intermodal Logistics Centre. Public transport is unlikely to be a mode of choice for the employees connected to the key activities on site due to the shift changeovers occurring in periods of low or no public transport coverage. Public transport may be a mode of choice for administration staff on site as it corresponds to periods of good public transport coverage. It is suggested that discussions be held with local bus operators to increase the service frequencies or re-route selected services to better

serve the Enfield site. A dedicated bus shuttle from nearby train stations may also be a benefit to staff at Enfield.

6.1.6 Road Conditions Assessment

The inspected road sections consist of a mix of various road categories (collector, arterial and major) built to different standards in terms of road geometry and pavement properties with various maintenance regimes are applied in accordance with the road category. In general, it was found that all inspected road sections appear well maintained.

6.2 Recommendations

6.2.1 Access Provisions

Two access points have been proposed, via Cosgrove Road to the Hume Highway, and via Wentworth Street and Norfolk Road to Roberts Road. This reflects some concern expressed during previous site development proposals and community consultation. It creates an opportunity for a more even distribution of traffic coming into and out of the site, operational flexibility for site access and alternate entry points for emergency services.

It is recommended that the key entry point be via the Roberts Road / Norfolk Road intersection and then via Wentworth Street. This entry point would be linked to the eastern part of the site via a bridge across the Enfield Marshalling Yards. Internally, this would link with the secondary access point at Cosgrove Road.

6.2.2 Local Area Traffic Management (LATM)

Light traffic thoroughfares are already in place in Norfolk Road and Rawson Road, west of Roberts Road. Heavy vehicle routes to and from the Norfolk Road access will therefore use Roberts Road and the Hume Highway to access the wider road network. Site access is also proposed on Cosgrove Road. The southern end of this road has residential land uses and it is recommended that options be investigated to route heavy vehicles away from this area.

6.2.3 Intersection Improvement Upgrades

The traffic modelling results show that background growth in traffic to 2016 would result in several intersections operating at an unsatisfactory level of service. It also shows that generally there is very little difference in intersection operation in 2016 when comparing the with and without Enfield Intermodal Logistics Centre scenarios. Saturated intersections include Roberts Road / Juno Parade, King Georges Road / Punchbowl Road, Hume Highway / Roberts Road / Centenary Drive, Hume Highway / Coronation Parade, Hume Highway / Cosgrove Road and Centenary Drive /

Arthur Street. It is suggested that the Roads and Traffic Authority (RTA) investigate options to the operation of these intersections for all road users.

The Hume Highway / Cosgrove Road intersection is forecast to operate at Level of Service F in the future, regardless of any development of the Enfield Intermodal Logistics Centre. It is recommended that this intersection be enhanced to improve traffic operations. Traffic modelling shows that with three through lanes provided in each direction on the Hume Highway, the Level of Service improved to an acceptable Level of Service D in the PM peak period. The Roberts Road / Norfolk Road intersection is operating with spare capacity, and no intersection enhancement is required.

Appendix A Background Documents

Documents referenced include:

- NSW Ports Growth Plan – Summary Sheet, 2003 (NSW Government);
- New South Wales Sea Freight Council (2004);
- Port Botany Expansion – Environmental Impact Statement – Volume 1, 2003 (URS);
- Guide to Traffic Generating Developments, 2002 (RTA); and
- Action for Bikes - Bikeplan 2010, 1999 (NSW Roads and Traffic Authority).

Appendix B Director General Requirements

Director-General Requirements for EIS for the proposed Enfield Intermodal Logistics Centre

Comment	Response	Reference
Director General Requirements – letter to Ken Robinson (1 March 2005) ref: 9036312 from Gordon Kirkby – A/Director Strategic Industrial Assessment		
A Traffic Impact Study (TIS) should be prepared which considers local and regional impacts especially due to the proposed 24 hours / 7 days per week operation. The study must be prepared in accordance with the Roads and Traffic Authority's publication: *Guide to Traffic Generating Developments.* The EIS must include:	A traffic impact assessment has been prepared for the Enfield Intermodal Logistics Centre on behalf of Sydney Ports Corporation	Traffic Impact Assessment, Intermodal Logistics Centre, Enfield – Final Transport Working Paper – June 2005
An investigation into the provision of segregated freight only traffic infrastructure and the identification of potential corridors to alleviate amenity impacts on the surrounding areas	The provision of segregated freight only infrastructure was not considered necessary, as the volume of the traffic from the site does not warrant this infrastructure.	Section 4.5
Traffic generation and proposed traffic routes on arterial road networks, and measures for avoiding residential areas and sensitive land uses. The EIS must including number of truck movements and timing; freight origin and destination; types of road of transport likely to be used (for example B-Doubles) and the capability of routes (both road and intersection) to handle the predicted increase in traffic	The traffic impact assessment has taken into consideration these comments	Section 4
Information on the bulking factor used (refer to letter from the Roads and Traffic Authority (Attachment 2)	The traffic impact assessment will report on the bulking factor used – see RTA response to comments.	Table 4-1

Details of access to site for motor vehicles, pedestrians and cyclists. Also internal road arrangements, including parking arrangements for both trucks and cars	Access for motor vehicles, pedestrians and cyclists has been considered as part of this document. SKM traffic team has not done any detailed work on internal road layout, but have estimated movements for noise and air quality requirements. The number of parking spaces required has been provided in the document.	Section 3.4 and Section 3.6
Methods of addressing possible queuing issues	This will be discussed in the context of a vehicle booking system and site management system by SPC. It has been assumed that all queuing will take place on site and that adequate queuing space on the shoulders of roads will be provided by SPC in internal road network.	Section 3.4
Details of possible road infrastructure upgrades and timing including consultation conducted with the RTA	This will be considered as part of the traffic impact assessment	Section 4.2
Risk impacts and proposed routes for any dangerous goods transport must be included in the EIS (a Route Evaluation Study may be required as detailed in the Department's Applying SEPP33 and draft Route Selection)	It is considered that the handling of dangerous goods will be addressed as part of a Hazard / Risk Assessment. This is not part of the traffic impact assessment.	Shown in Risk Assessment
Likely impacts on residential areas including road safety measures for residents and employees	The RTA is providing crash data for the area – for all vehicles and heavy vehicles. These will be mapped as clusters. SKM will qualitatively assess whether truck routes will impact on these crash sites. Management will address the OH&S issues on site. LATM measures will be recommended as required	Section 2.8 and Section 4.6
Public transport arrangements including location of bus stops	Public transport assessment will be undertaken and location of bus stops will be shown.	Section 2.7
Heavy vehicle management, including the scheduling of these movements outside peak traffic flows	Heavy vehicle management issues will be addressed in traffic management plans and will be developed in	Sections 2.9 & 3.6

and sensitive road users (school related traffic) and identification for any potential to damage local road infrastructure by heavy vehicle movements, and measures to rehabilitate these roads	consultation with the RTA and will ensure compliance with the *Road Transport (General) Act, 2005*. The site will operate over 24hrs but the majority of the activity will take place during normal daytime hours. Heavy vehicle activity during school hours will be mentioned in the context of the safety assessment and effective vehicle management. A conditions assessment has been undertaken as part of this study. Consumption of the road resource is provided through normal vehicle operating charges.	
A study into the amenity impacts on the surrounding area and any mitigation measures required to alleviate these impacts	The traffic impact assessment will consider the impacts of the traffic on the surrounding area and mitigation measures recommended as required.	Section 4.4 and Section 4.9
Cumulative impacts, particularly with regard to other freight distribution facilities in the locality and potential cumulative mitigation measures.	The impacts of other developments in the area have been taken into consideration in the modelling exercise, including the expansion of Port Botany and any airport expansion. Other freight distribution centres in the locality will have already been considered in the base future forecasts for the area.	Section 4.2
RTA Requirements (attached to DG requirements) – letter to Patricia Cabezas (DIPNR) from Mike Hannon (RTA) – no date but signed 14 February 2005		
1) A traffic study including network modelling to consider local and wider-area impacts; including proposed 24 hours/7 days per week operation. The study should in particular address:	1) See below	
a The current and projected (future) origin and destination of the	A) Agreed.	A) Section 4.2

	movements of trucks and include details of the anticipated route of trucks on both the arterial and local road networks.		
b	The likely impact of truck traffic upon nearby residential areas and the need for the preparation of a local traffic management plan.	B) Agreed. There is no intention for heavy vehicle traffic to route through the residential area. It is intended that heavy vehicles use the key arterial routes. We will specify and map truck routes	B) Section 4.4
c	Public transport accessibility for employees and the predicted number of vehicle movements in and out of the site eg. Employee movements to and from the site, both at the start and end of each shift and also over the "lunch break" when employees might be expected to travel beyond the site to attend to personal issues such as banking and retail purchases.	C) Public transport requirements will be addressed. SPC to consider the on-site facilities to be provided. The traffic impact assessment will be undertaken in the AM and PM peak – the shift changes are unlikely to impact on this.	C) Section 2.7
d	Road safety impacts on the overall road network as well as within the site itself.	D) The RTA is providing crash data for the area – for all vehicles and heavy vehicles. These will be mapped as clusters. SKM will qualitatively assess whether truck routes will impact on these crash sites. The OH&S issues on site will be addressed by management	D) Section 2.8

e	Traffic impacts on intersections and major arterial roads surrounding the site in terms of level of service and proposed improvements required.	E) Agreed	E) Section 4.4
f	The 'bulking factor' adopted for the warehousing and container packing/unpacking operations. In this context, 'bulking factor' refers to the number of freight vehicle movements associated with delivering the contents of a container to the next destination in the logistics chain (or the number of freight vehicle movements associated with assembling at Enfield, the products to be packed into an export container).	F) Agreed	F) Table 4-1
g	Details of the locations of vehicular and pedestrian/cyclist access, internal road network, the movement of employees around the site and the requirements of the emergency services for access to and through the site.	G) Vehicular and pedestrian / cyclist access to the site will be considered and mapped. SKM traffic team is not doing detailed work on internal road layout, however will estimate movements for noise and air quality requirements. How employees move around site and requirements of emergency services are considered to be part of detailed design). It is considered that the emergency access locations will be the same as the key access points.	G) Section 3.4 H) Section

	h Details of vehicular access arrangements such as queuing on public roads and the location of bus stops serving the site and the immediate surrounds.	H) This will be discussed in the context of a vehicle booking system and site management system by SPC. Location of bus stops will be identified	2.7and Section 3.4
	i Parking rates and parking arrangements for trucks and cars.	I) Parking will need to be managed. The number of employees has been used as a maximum rather than minimum rate. Parking arrangements for trucks and cars on site is considered to be part of detailed design and not the EIS stage	I) Section 3.6.1
2)	Cumulative impacts that may arise from any proposed airport expansion, port expansion and other land use developments.	Cumulative impacts will be considered, including the proposed airport and port expansion	Section 4.2
3)	Contingency plans if the warehouse unpacking/packing operation exceeds the ability of rail to transport the required number of containers; i.e. the 40% rail mode share target is not met.	The base case assumes no transport of containers to Enfield and all equivalent activity emanating from Port Botany, including unpacking / packing. This is an extreme sensitivity assessment of failure to meet mode share target.	Section 4.5
4)	Details of how dangerous goods would be handled on site and an incident management /response plan in particular -will the response to a dangerous goods incidence require closure of the major roads passing the site? In general, such closure would be unacceptable to RTA.	It is considered that the handling of dangerous goods will be addressed as part of a Hazard / Risk Assessment. This is not part of the traffic impact assessment	Section 3.5

5)	Consideration of routes for dangerous goods vehicles.	This will flow from #4 above.	Section 3.5
6)	development of a heavy vehicle management plan that would consider the following issues: a) Provision of a heavy vehicle inspection site to ensure drivers and vehicles are complying with regulation. This facility potentially could be used 24/7 and should be located so as to minimise avoidance. b) Provision of adequate and secure parking and rest area facility with amenities for heavy vehicle drivers with 24/7 access. c) Provision of weighbridge and gantry to monitor heavy vehicle compliance with mass and dimension regulations. d) Provision of facility for decanting overweight containers. e) Load and vehicle limits on feeder roads eg 4.6m height, weight and combinations. f) consideration of height limits, weight limits, width limits, etc of heavy vehicles	Heavy vehicle management is an important aspect for the effective operation of the site. SPC will liaise with operators to ensure compliance with the *Road Transport (General) Act, 2005* and develop an appropriate plan in consultation with the RTA.	

Bankstown Council Requirements (attached to DG requirements) – letter to Gordon Kirby (DIPNR) from Luke Nicholls (Manager Strategic Planning – Bankstown Council) – dated 14 February 2005		
Access		
A range of options for access to the site should be identified and investigated within the EIS. Appropriate access should consider the impact in relation to increased traffic volumes, noise, emissions and vibrations on residential land uses (primarily residential 2(a) along Roberts Road, and within the residential precincts of Chullora and Greenacre to the west	There are two main access points to the site. The main point of access is off Norfolk Road with the secondary access point off Cosgrove Road. The traffic impacts of these two access points have been assessed	Section 3.4
Alternate scenarios should be tested that do not rely on the Wentworth Street / Roberts Road access point, which under previous proposals was to accommodate 75% of traffic movements to the site. This should involve the development and assessment of alternate infrastructure enhancement options to allow for improved access to the north of the site to the Hume Highway, potentially through existing access at Cosgrove Road and its Hume Highway intersection. Modelling of the vehicle share and potential congestion from these options should be provided	Previous modelling was for 500,000 TEU. This development is for 300,000 and therefore the traffic impact will be significantly less. The traffic impacts of these access points have been assessed	Section 4.4
Concerns have been previously raised by Council regarding the increased freight volumes in Juno Parade / Boronia Road, Rawson Road and Norfolk Road. The EIS should model traffic volume increase and resulting impacts on these	Local traffic impacts are being considered. Changes to intersections will be recommended if this is required. LATM measures will be recommended if required. Freight activity that is not directly	Section 4.4

streets and propose management methods and infrastructure changes to ensure that freight movement in these areas does not increase. This is particularly important at the intersection of Roberts Road and Norfolk Road, with Norfolk already subjected to increased freight levels partly due to intersection configuration. Load limits alone would not in Council's opinion constitute an acceptable solution to preventing freight intrusion to residential precincts.	related to the site is not being addressed.	
Hours of operation of the terminal and traffic volume entering and leaving the site with distribution over the time of operation should be stated. Consideration to the potential introduction of reduced hours of operation, and a night curfew on access should be investigated.	The site is intended to operate over 24 hours / 7 days per week. The vehicle profile associated with this level of activity has been assessed	Section 4
Traffic Volumes		
The EIS should model traffic implications for the surrounding residential areas due to proposed entry points to the site, particularly with the suburbs of Greenacre and Chullora and compare these projected traffic volumes to existing and acceptable levels in regards to road capacity, role and residential amenity / safety.	The traffic impact assessment has taken into consideration the impacts on traffic capacity of the surrounding network, local amenity and safety issues if directly related to traffic generation from the site. It is not proposed that heavy vehicles use the local street network. The traffic and safety impact of the development has been considered	Section 2.8 and Section 4.4
Heavy vehicle volume increase on arterials and implications for key intersections in Bankstown LGA including but not limited to Roberts Road / Hume Highway / Centenary Drive; Hume Highway / Stacey Street / Rookwood Road Bypass; Juno Parade / Roberts Road and implications for traffic flow and infrastructure improvements at	Intersection analysis has been undertaken for all relevant junctions for which SKM have survey data for. Previous studies showed that Stacey Street / Hume Highway / Rookwood Bypass was already congested and therefore not reanalysed.	Section 4.4

intersections.		
Impact on surrounding road network to 2025 should be demonstrated with capacity and road improvement works proposed.	It has been assumed that the Enfield Intermodal Logistics Centre will be fully operational before 2016. The modelling has considered the impacts up to 2016. It was not considered necessary to extend the modelling beyond 2016.	N/A

Appendix C Model Verification

The statistical measure of the suitability of this model is taken from the *UK Design Manual* for *Roads and Bridges (Volume 12, Section 2, Part 1 Traffic Appraisal of Roads Schemes - Traffic Appraisal in Urban Areas Assignment Validation: Acceptability Guidelines).* These criteria are described below:

Statistic 1: GEH Statistic: less than 5 for greater than 85% of cases

Statistic 2:

1) Individual flows within 15% for flows 700-2,700vph
2) Individual flows within 100vph for flows < 700vph
3) Individual flows within 400vph for flows >2,700vph

} greater than 85% of cases

The GEH Statistic (a form of Chi-squared statistic) is given by the formula:

$$GEH = \sqrt{\frac{(M - C)^2}{(M + C)/2}}$$

Where: GEH is the GEH statistic

M is the modelled flow; and

C is the observed flow.

The results of the calibration process are shown in the tables below for the AM and PM peak.

AM Peak Calibration Results – All Vehicles

Street Name	Location	Direction	Actual Volume	Modelled Volume	GEH Statistic
Boronia Road	E of Hume Highway	Eastbound	428	540	5.09
Boronia Road	E of Hume Highway	Westbound	481	593	4.83
Centenary Drive	S of Barker Road	Northbound	3,597	3,836	3.92
Centenary Drive	S of Barker Road	Southbound	3,127	3,283	2.76
Cosgrove Road	S of Hume Highway	Eastbound	531	464	3.00
Cosgrove Road	S of Hume Highway	Westbound	444	395	2.39
Georges River Road	E of Coronation Parade	Eastbound	1,507	1,415	2.41
Georges River Road	E of Coronation Parade	Westbound	1,234	1,102	3.86
Hume Highway	W of Centenary Drive	Northbound	3,791	3,160	10.70
Hume Highway	W of Centenary Drive	Southbound	2,575	2,367	4.18
Hume Highway	E of Cosgrove Road	Eastbound	2,264	2,407	2.96
Hume Highway	E of Cosgrove Road	Westbound	1,780	1,665	2.77
Hume Highway	N of Stacey Street	Northbound	2,804	2,461	6.69
Hume Highway	N of Stacey Street	Southbound	1,684	1,622	1.52
Roberts Road	S of Norfolk Road	Northbound	2,724	2,564	3.11
Roberts Road	S of Norfolk Road	Southbound	2,049	1,924	2.80
Wentworth Street	E of Roberts Road	Northbound	80	96	1.71
Wentworth Street	E of Roberts Road	Southbound	185	304	7.61

- **PM Peak Calibration Results – All Vehicles**

Street Name	Location	Direction	Actual Volume	Modelled Volume	GEH Statistic
Boronia Road	E of Hume Highway	Eastbound	534	505	1.27
Boronia Road	E of Hume Highway	Westbound	492	623	5.55
Centenary Drive	S of Barker Road	Northbound	2,749	3,172	7.77
Centenary Drive	S of Barker Road	Southbound	3,552	3,826	4.51
Cosgrove Road	S of Hume Highway	Eastbound	583	517	2.81
Cosgrove Road	S of Hume Highway	Westbound	413	594	8.07
Georges River Road	E of Coronation Parade	Eastbound	1,139	1,000	4.25
Georges River Road	E of Coronation Parade	Westbound	1,484	1,447	0.97
Hume Highway	W of Centenary Drive	Northbound	2,416	2,292	2.56
Hume Highway	W of Centenary Drive	Southbound	3,028	2,791	4.39
Hume Highway	E of Cosgrove Road	Eastbound	1,559	1,910	8.43
Hume Highway	E of Cosgrove Road	Westbound	2,241	2,119	2.61
Hume Highway	N of Stacey Street	Northbound	1,691	1,617	1.82
Hume Highway	N of Stacey Street	Southbound	2,646	2,675	0.56
Roberts Road	S of Norfolk Road	Northbound	2,121	2,146	0.54
Roberts Road	S of Norfolk Road	Southbound	2,512	2,470	0.84
Wentworth Street	E of Roberts Road	Northbound	153	151	0.16
Wentworth Street	E of Roberts Road	Southbound	67	114	4.94

The 2005 base model achieved the following results:

AM Peak Hour

- Statistic 1: The GEH statistic was less than 5 for 78% of cases
- Statistic 2: Individual flow criteria was satisfied in 78% of cases

PM Peak Hour

- Statistic 1: The GEH statistic was less than 5 for 78% of cases
- Statistic 2: Individual flow criteria was satisfied in 78% of cases

Both the AM Peak and PM Peak models fall slightly short of the desired criteria. However, the model is generally consistent with the count data, and this level of calibration was accepted due to limited time and resources and the difficulty of calibrating total vehicles and heavy vehicles in parallel.

In addition to the calibration of the total hourly flow during the AM peak period and PM peak period, an attempt was made to reasonably represent the heavy vehicle movement within the study area. The results of the heavy vehicle calibration process (modelled vs actual flows) are shown in the tables below for the AM and PM peak periods.

AM Peak Calibration Results – Heavy Vehicles

Street Name	Location	Direction	Actual Volume	Modelled Volume	GEH Statistic
Boronia Road	E of Hume Highway	Eastbound	73	44	3.79
Boronia Road	E of Hume Highway	Westbound	41	59	2.55
Centenary Drive	S of Barker Road	Northbound	361	363	0.11
Centenary Drive	S of Barker Road	Southbound	337	389	2.73
Cosgrove Road	S of Hume Highway	Eastbound	97	92	0.51
Cosgrove Road	S of Hume Highway	Westbound	68	54	1.79
Georges River Road	E of Coronation Parade	Eastbound	91	85	0.64
Georges River Road	E of Coronation Parade	Westbound	48	40	1.21
Hume Highway	W of Centenary Drive	Northbound	306	240	3.99
Hume Highway	W of Centenary Drive	Southbound	198	162	2.68
Hume Highway	E of Cosgrove Road	Eastbound	131	282	10.51
Hume Highway	E of Cosgrove Road	Westbound	73	113	4.15
Hume Highway	N of Stacey Street	Northbound	252	145	7.59
Hume Highway	N of Stacey Street	Southbound	138	204	5.05
Roberts Road	S of Norfolk Road	Northbound	230	294	3.95
Roberts Road	S of Norfolk Road	Southbound	219	230	0.73
Wentworth Street	E of Roberts Road	Northbound	48	29	3.06
Wentworth Street	E of Roberts Road	Southbound	57	65	1.02

- **PM Peak Calibration Results – Heavy Vehicles**

Street Name	Location	Direction	Actual Volume	Modelled Volume	GEH Statistic
Boronia Road	E of Hume Highway	Eastbound	27	8	4.54
	E of Hume Highway	Westbound	34	56	3.28
Centenary Drive	S of Barker Road	Northbound	238	228	0.66
Centenary Drive	S of Barker Road	Southbound	188	297	7.00
Cosgrove Road	S of Hume Highway	Eastbound	41	17	4.46
Cosgrove Road	S of Hume Highway	Westbound	63	39	3.36
Georges River Road	E of Coronation Parade	Eastbound	33	50	2.64
Georges River Road	E of Coronation Parade	Westbound	45	20	4.39
Hume Highway	W of Centenary Drive	Northbound	113	86	2.71
Hume Highway	W of Centenary Drive	Southbound	168	223	3.93
Hume Highway	E of Cosgrove Road	Eastbound	47	65	2.41
Hume Highway	E of Cosgrove Road	Westbound	100	96	0.40
Hume Highway	N of Stacey Street	Northbound	84	122	3.74
Hume Highway	N of Stacey Street	Southbound	179	201	1.60
Roberts Road	S of Norfolk Road	Northbound	147	174	2.13
Roberts Road	S of Norfolk Road	Southbound	170	130	3.27
Wentworth Street	E of Roberts Road	Northbound	10	23	3.20
Wentworth Street	E of Roberts Road	Southbound	10	9	0.32

The 2005 base model achieved the following results for heavy vehicles:

AM Peak Hour

- Statistic 1: The GEH statistic was less than 5 for 83% of cases
- Statistic 2: Individual flow criteria was satisfied in 89% of cases

PM Peak Hour

- Statistic 1: The GEH statistic was less than 5 for 94% of cases
- Statistic 2: Individual flow criteria was satisfied in 94% of cases

In the AM Peak, Statistic 1 is marginal, although all other criteria are met adequately. This level of calibration was considered acceptable.

Appendix D Pavement Inspection Record

- **Roberts Road (between Hume Highway and Norfolk Road)**

Street: Roberts Road (between Hume Highway and Norfolk Road)	
Length: 1,060m	
Pavement Type: Asphalt Concrete (AC) overlay over concrete base.	
Comments: Pavement at wider intersection area with Hume Highway is new and in excellent condition. Further south there are signs of surface deterioration. Typical surface distresses include reflective cracking over concrete joints and some patching. There are signs of extensive maintenance (crack sealing, patching).	
Extensive reflective cracking north of intersection with Norfolk Road.	

Extensive wide reflective cracking north of intersection with Norfolk Road. At the intersection area a couple depressed slabs visible (structural deficiency).	

- **Roberts Road (between Norfolk Road and Juno Parade)**

Street: Roberts Road (between Norfolk Road and Juno Parade)	
Length: 1,410m	
Pavement Type: AC overlay over concrete base.	
Comments: Pavement surface in good to fair condition. Typical surface distresses include reflective cracking over concrete joints and some patching. There are signs of extensive maintenance (crack sealing, patching)	
Wide reflective cracking south of intersection with Norfolk Road (southbound).	

A section in good condition, at Northbound carriageway, free of cracking or other distresses.	

- **Roberts Road (between Juno Parade and Punchbowl Road)**

Street: Roberts Road (between Juno Parade and Punchbowl Road)	
Length: 1,180m	
Pavement Type: AC overlay over concrete base.	
Comments: Pavement surface in good condition on both carriageways.	

(Southbound) (Northbound)	

- **Boronia Road (between Hume Highway and Waterloo Road)**

Street: Boronia Road (between Hume Highway and Waterloo Road) Length: 1,430m Pavement Type: Flexible AC	

Comments: Pavement surface is generally in good condition and regularly maintained. There are occasional distresses as detailed below.	
Rutting developed at approach to Hume Highway intersection.	
"Soft" spots associated with rough surface and cracking.	

Approach to intersection with Noble Avenue. Heavy patching and cracking at the intersection.	

- **Juno Parade (between Waterloo Road and Punchbowl Road)**

Street: Juno Parade (between Waterloo Road and Punchbowl Road)	
Length: 1,710m	
Pavement Type: Flexible AC	
Comments: Pavement surface is generally in good condition and regularly maintained. There are occasional distresses as detailed below. "Soft" spots associated with rough surface, cracking and rutting.	

Minor repairs and rutting.	

- **Hume Highway (between Homebush and Cosgrove Roads)**

Street: Hume Highway (between Homebush Road and Cosgrove Road)	
Length: 1,035m	
Pavement Type: Rigid (Concrete)	
Comments: Pavement is generally in good condition and regularly maintained. There are visible signs of maintenance works	

including slab replacement and joint/crack sealing.	

- **Hume Highway (between Cosgrove Road and Roberts Road)**

Street: Hume Highway (between Cosgrove Road and Roberts Road)	
Length: 540m	
Pavement Type: Predominantly Flexible (AC)	
Comments: Between Cosgrove Road and Braidwood Street pavement is in poor condition and requires rehabilitation. Pavement within the intersection area with Roberts Road is new and in good condition. Pavement defect at Gould Street (Westbound).	

- **Hume Highway (between Roberts Road and Boronia Road)**

Street: Hume Highway (between Roberts Road and Boronia Road)	
Length: 3,245m	
Pavement Type: AC overlay over concrete base.	
Comments: Generally, pavement appears to be in good condition. There are no visible signs of structural deficiencies. No major surface distresses recorded within this section. The exception is section between Como and Shellcote Roads where pavement appears older and rough, and probably due for rehabilitation.	

- **Norfolk Road (between Waterloo Road and Wentworth Street)**

Street: Norfolk Road (between Waterloo Road and Wentworth Street)	
Length: 810m	

Pavement Type: Flexible (AC)	
Comments: Generally, pavement appears well maintained and in good condition. There are no visible signs of structural deficiencies. Minor surface distresses were recorded within this section. Section from Maiden St recently resurfaced.	
Longitudinal cracks developing and patch between Hankins Court and Maiden Street.	
Cracking developing around heavy patch (same area as above).	

Section west of Roberts Road in good condition.	

- **Wentworth Street (between Norfolk Road and Mayvic Street)**

Street: Wentworth Street (between Norfolk Road and Mayvic Street)	
Length: 350m	
Pavement Type: Flexible (AC)	
Comments: Generally, pavement appears well maintained and in good condition. There are no visible signs of structural problems. Minor distresses were recorded within this section. Pavement in good condition.	

Local defect south of Ford Street.	
Local defects north of Mayvic Street.	

- **Wentworth Street (from Mayvic Street to end)**

Street: Wentworth Street (from Mayvic Street to south end)	
Length: 550m	
Pavement Type: Flexible (AC)	
Comments: This is a narrow section of road with the pavement in fair to poor condition. Various surface defects recorded including cracking, edge breaks and local defects. Local defect south of Mayvic Street.	 

Edge breaks, cracking and heavy patched at the middle of the section.	
Extensive cracking and heavy patching towards the end of the section.	

Cosgrove Road – North

Street: Cosgrove Road (north of Cleveland Street to Hume Highway)	
Length: 750m	
Pavement Type: Flexible (AC)	
Comments: Pavement visibly deteriorated on this busy part of the road. Defects include extensive cracking, local defects, unsuccessful patching and shoving.	
Extensive cracking, rutting and an unsuccessful heavy patch south of the bend.	

Extensive cracking, rutting and heavy patching north of the bend.	
Local defect (shoving) south of intersection with Hume Highway.	

Cosgrove Road – South

Street: Cosgrove Road (Punchbowl Road to north of Cleveland Street)	
Length: 1,450m	
Pavement Type: Flexible (AC)	
Comments: AC surface appears new, recently rehabilitated. It is in very good condition, smooth and practically free of distresses. A longitudinal crack developed south of Hope Street. Wet gutter indicates potential drainage problem in the area.	

- **Punchbowl Road (between Wiley Avenue and Coronation Parade)**

Street: Punchbowl Road (between Wiley Avenue and Coronation Parade)	
Length: 3,060m	
Pavement Type: Flexible (AC)	
Comments: Generally, pavement surface is in relatively good condition. The pavement within the section between Wiley Avenue and Colin Street shows signs of fatigue (cracks, pothole patches and heavy patching) and appears due to rehabilitation. The rest of pavement appears in good condition. Continuous slight rutting is visible along the section. Punchbowl Road was briefly inspected, by driving the road only.	

Appendix E Future RTA Projects

Area	Route	From	To	Details
Inner				
Inner	Cross City Tunnel			
Inner West				
Inner West	*City West Link Stage 5*	*Boomerang Street*	*Great Western Highway*	
North				
North	Lane Cove Tunnel			Plus widening Gore Hill Fwy & new ramps at Falcon Street
North	Mona Vale Road	Terry Hills	Mona Vale	4 lanes completed
North	Mona Vale Road	Bahai'i Temple	Ingleside Road	4 lanes
North	Rutledge Street			upgrade and extension
North West				
North West	Garfield Road	Riverstone		Bridge replacing level crossing
North West	Garfield Road	Windsor Road	Richmond Road	4 lanes
North West	Old Windsor Road / Windsor Road	Garfield Road	Seven Hills Road	4 lanes completed
North West	Quakers Hill Parkway	Pye Road	Sunnyholt Road	4 lanes
North West	Richmond Road			Upgrade - 4 lanes to St Marys Road
North West	Schofields Road			4 lanes
North West	Sunnyholt Road	James Cook Drive	Malvern Road	4 lanes
North West	Windsor Road	Roxborough Park Road	Showground Road	4 lanes
North West	Windsor Road	Garfield Road	South Creek Crossing	4 lanes
South				
South	Alfords Point Road	Alfords Point		Bridge duplication
South	Bangor Bypass + Old	Illawarra Road		
South	Forest Road	Bexley		Traffic management (reduce capacity)
South	King Georges Road			Upgrade - 6 lanes
South West				
South West	Bringelly Road (eastern section)	Rossmore	Cross Roads	4 lanes
South West	Camden Bypass	Narellan Road	Camden Valley Way	Extension
South West	Cowpasture Road	Greenway Drive	Western Sydney Orbital	4 lanes

Area	Route	From	To	Details
South West	Cowpasture Road	North Liverpool Road	Elizabeth Drive	4 lanes
South West	Cowpasture Road	North Liverpool Road	Western Sydney Orbital	4 lanes
South West	Cowpasture Road	Greenway Drive	Camden Valley Way	4 lanes
South West	Hoxton Park Road	Cowpasture Road	Hume Highway	4 lanes
South West	M5 Motorway	Crossroads	Casula	Eastbound off-ramp to Hume Highway, and extra lane eastbound
South West	M5 Motorway	King Georges Road	Casula	6 lanes
South West	Narellan Road	Camden Valley Way	The Northern Road	Extension
South West	The Horsley Drive	Cowpasture Road	Fairfield	4 lanes
West				
West	The Northern Road	ADI site	Great Western Highway	4 lanes
West	Western Sydney Orbital	M5 Motorway	M2 Motorway	With tolls

Appendix F Glossary of Terms

Term	Description
4WD	A four-wheel drive vehicle, typically of a sports utility style.
Arterial road	A main road fulfilling a role as a major inter-regional link.
B double	A 2 or 3 axle heavy vehicle with additional 3 or 4 axle trailer
Business peak	The busiest time period in terms of traffic during standard working hours (9am – 5pm)
Centroid	A point used by the NETANAL model to represent an area (zone) that generates traffic. Centroids are connected the network at a point most appropriate for the zone represented.
Collector road	A road providing links between arterial and local roads
Concrete chases	A system for laying railway lines set in concrete.
Container	A standard freight transfer vessel that can be transported by sea, rail and road.
Heavy vehicle	Trucks and buses, typically with more than 2 axles.
Intermodal terminal	A goods transfer facility that is designed for use by more than one mode of transport – eg: rail and road.
LATM	Local Area Traffic Management is a scheme to manage the movement of vehicles in a defined area to improve safety and amenity.
Light commercial vehicle	Smaller vehicles used for commercial or industrial purposes, such as vans or station wagons.
Light traffic thoroughfare	A road that is designated for use by vehicles that are under a defined weight limit only. It is illegal for a vehicle of greater weight to use these roads
Local road	A road that provides access to individual allotments.
LoS	Level of Service is a measure of the operation of an intersection based on the average delay experienced by vehicles traversing it.
Low loader	A heavy vehicle designed to carry heavy vehicles or materials, with a low trailer to make loading and unloading easier.
Marshalling yard	Railway lines used for the storage and shunting of goods wagons. A marshalling yard already exists at Enfield, adjacent to the proposed ILC.
Raised thresholds	Road treatment, usually adjacent to intersections, comprising of a short section of raised road pavement designed to slow vehicles down.
Reach stackers	A crane style vehicle designed to lift and stack standard freight containers.
Semi-trailer	A heavy vehicle of articulated design typically consisting of a driver's cab and trailer.
Slab jacking	A process for re-mediating concrete slabs that have sunk. It involves pumping material under the slab to raise it back to it's desired position.
TEU	Twenty-foot Equivalent Unit. A unit for measuring freight containers based on a standard container size of twenty feet. Containers are generally 20ft (1 TEU) or 40ft (2 TEU).
Train turnaround	The time between arrival and departure, usually comprising of the time taken to unload and/or load a train within the ILC and any other preparation required.
Trip matrices	A table of trip origins and destinations used by computer based modelling programs in reviewing and assessing traffic scenarios.
Tube count	A method of counting traffic volumes using pneumatic tubes placed on the road to record vehicle axles.