Moorebank Intermodal Terminal Project Environmental Impact Statement

Volume 3

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PARSONS BRINCKERHOFF

Technical Paper 1
Traffic and Transport Impact Assessment

Technical Paper 1 – Traffic and Transport Impact Assessment

Contents of the EIS

Contents

VOLUME 1A – MAIN VOLUME

VOLUME 1B – MAIN VOLUME

VOLUME 2 – APPENDICES

VOLUME 3

VOLUME 4

VOLUME 5A

VOLUME 5B

VOLUME 6

VOLUME 7

VOLUME 8

VOLUME 9

Moorebank Intermodal Terminal Traffic, Transport and Accessibility Impact Assessment Report

September 2014

Moorebank Intermodal Company

PARSONS BRINCKERHOFF

Parsons Brinckerhoff Australia Pty Limited
ABN 80 078 004 798

Level 27, Ernst & Young Centre
680 George Street
Sydney NSW 2000
GPO Box 5394
Sydney NSW 2001
Australia
Telephone *+61 2 9272 5100*
Facsimile *+61 2 9272 5101*
Email *sydney@pb.com.au*

Certified to ISO 9001, ISO 14001, AS/NZS 4801
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Author: Robert Dunn, John Webster, Ryan Miller, Chris Chun, Claire Mead

Signed: R. Miller ....

Reviewer: Delyth Toghill..........

Signed: ....

Approved by: Anthea Sargeant..........

Signed: Sargeant..........

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Contents

Contents (Continued)

Contents (Continued)

List of tables

List of figures

Page number

Appendices

Glossary

AADT	Annual Average Daily Traffic
ADT	Average Daily Traffic
AEP	Annual Exceedance Probability
BITRE	(Commonwealth) Bureau of Infrastructure, Transport and Regional Economic
BOOT	Build Own Operate Transfer
BTS	Bureau of Transport Statistics, a division of Transport for NSW
CBD	Central Business District
CEMP	Construction Environmental Management Plan
CCC	Campbelltown City Council
DNSDC	Defence National Storage and Distribution Centre
DoD	Department of Defence
DoE	(Commonwealth) Department of the Environment
DoS	Degree of Saturation
DP&I	(NSW) Department of Planning and Infrastructure
DSEWPaC	(Commonwealth) Department of Sustainability, Environment, Water, Population and Communities
DUAP	(NSW) Department of Urban Affairs and Planning
EAR	Environmental Assessment Requirements
EIS	Environmental Impact Statement
EMME/2	Equilibrium Multi Modal Equilibrium
EP&A	Environmental Planning & Assessment
EPBC	Environment Protection & Biodiversity Conservation
FAK	Freight All Kinds
FBTS	Freight Bureau of Transport Statistics
FCL	Full Container Load
FMM	Freight Movement Model
GFA	Gross Floor Area
GLFA	Gross Leasable Floor Area
ha	hectare
HV	Heavy vehicle
IMEX	Import/Export
IMT	Intermodal terminal
IS	Inter-state
ITVs	In-terminal vehicles
km	Kilometre
km/h	Kilometre per hour

LCC	Liverpool City Council
LCVM	Light Commercial Vehicle Model
LGA	Local Government Area
LoS	Level of Service
LV	Light vehicle
MIC	Moorebank Intermodal Company
MIMT	Moorebank Intermodal Terminal
MUR	Moorebank Units Relocation
MT	Empty Container
OTR	over the road vehicles
PCU	Passenger Car Unit
ROL	Road Occupancy Licence
RMS	Roads and Maritime Services
SEPP	State Environmental Planning Policy
SIDRA	Signalised and unsignalised Intersection Design Research Aid
SIMTA	Sydney Intermodal Terminal Alliance
SME	School of Military Engineering
SSD	Stage Significant Development
SSFL	Southern Sydney Freight Line
STM	Sydney Strategic Transport Model
SZA	Speed Zone Authorisation
TEU	Twenty-foot equivalent unit containers
TCP	Traffic Control Plan
TDT	Traffic Technical Direction
VHT	Vehicle hours travelled
VKT	Vehicle kilometres travelled
VMS	Variable message sign

Executive summary

This Technical Paper has been prepared to inform the Moorebank Intermodal Terminal (IMT) Project Environmental Impact Statement (EIS). The purpose of the EIS is to seek approval for the Moorebank IMT Project ‘concept’ under both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as a controlled action; and the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) as a state significant development (SSD).

This Technical Paper presents the results of investigation into the traffic impact of the Moorebank IMT Project (‘the Project’ or ‘the Moorebank IMT’) on the surrounding existing and future transportation network. The paper also assesses the operation of the proposed upgrades to Moorebank Avenue within the concept design.

The need for the Project

Sydney’s need for additional IMT capacity in the IMEX and interstate markets is being driven by the following factors:

- Strong growth in containerised IMEX freight

  The Australian Government’s Bureau of Infrastructure, Transport and Regional Economics (BITRE) have forecast that container trade through Port Botany will grow at a compound annual growth rate of 4.25% to 2030. This forecast growth is the consequence of a growing population, changing consumer demands and the increasing needs of business and industry. Without additional IMT capacity it is unlikely that Port Botany would be able to cater for this future demand.

- Easing the Port Botany bottleneck

  Most of the containerised freight transported between Port Botany and other parts of Sydney is moved by road. It is estimated that only 14% of container freight through Port Botany is currently transported by rail. However, Sydney’s freight handling capacity is being increasingly constrained by a heavily congested road network. To cope with future growth, more freight needs to be moved to and from Port Botany by rail. If the current rail mode share is not improved, heavy vehicle traffic at Port Botany may have to increase by as much as 400% by 2029/30 to cope with demand.

- Growth in containerised interstate freight

  Only a small proportion of east coast interstate freight in NSW is currently transported by rail. For the Sydney – Melbourne corridor, the rail mode share is approximately 10% and for the Sydney – Brisbane corridor, the rail mode share is approximately 20% (Deloitte analysis 2014). However the volume of interstate freight moving through Sydney is expected to grow at 3.6% a year over the next 20 years (with road and rail freight at 3.8% and 3.5% a year, respectively) (BITRE, 2010).

- Road congestion

  Heavy congestion is already being experienced at Port Botany and on the M5 Motorway. This would be aggravated by future growth in port volumes and associated truck movements. It is estimated that truck traffic at Port Botany would increase by 400% by 2029/30 if the current rail mode share is not improved (*Port Botany and Sydney Airport Transport Improvement Program*, NSW Government submission to Infrastructure Australia, 2011) (NSW Government 2011b). If containers moving between Port Botany and south-west Sydney were able to be transported by rail (due to development of an IMT in south-west Sydney), this would reduce the projected growth in road freight traffic from Port Botany, resulting in 3,000 fewer truck journeys to and from Port Botany each day, or 1.05 million truck trips a year, once the IMT is operating at capacity.

Moorebank Intermodal Terminal Project

The Moorebank IMT would be a key asset in increasing the future share of the rail freight task from Port Botany and thereby better managing the increase in heavy vehicles expected on the network.

The Project site is situated in the Sydney suburb of Moorebank; approximately 35 km south-west from the centre of Sydney and approximately 2 km south of Liverpool CBD. The Moorebank IMT is proposed to be located on land currently occupied by the Department of Defence's School of Military Engineering (SME). The Project site is approximately 220 hectares (ha) in area.

The Project site is bounded by Moorebank Avenue to the east, the East Hills passenger rail line to the south, the Georges River to the west and the commercial property occupied by ABB Australia (a power and automation technology manufacturer) and the M5 Motorway (M5) to the north. The M5 provides access to other Sydney motorways, with the M7 Interchange approximately 5 km west of the Project site.

Construction of the Southern Sydney Freight Line (SSFL) has recently been completed on the western side of Georges River adjacent to the Main South Line and would be used for access to service the terminal by rail.

The Moorebank IMT would focus transport and traffic activity within a relatively small area. It would generate traffic to and from a diverse range of origins and destinations generally spread throughout western Sydney. The focused transport and traffic activity associated with the Moorebank IMT would have an impact along Moorebank Avenue, but relatively minor impacts elsewhere on the surrounding transport network. How the logistics industry would respond to the Moorebank IMT, through changes in surrounding land use such as the relocation of warehousing throughout western Sydney, is currently unknown. These warehouses are likely to be widely spread and therefore the individual impacts associated with transport and traffic activity at the local level would be relatively minor.

When completed, the Moorebank IMT Project would include:

- an import/export (IMEX) freight terminal to cater for around 1.05 million twenty-foot equivalent units (TEU) intermodal shipping container movements a year (525,000 TEU in and 525,000 TEU out) to and from Port Botany
- a warehousing development along Moorebank Avenue of approximately 300,000 m^2 gross floor area (GFA)
- an interstate freight terminal to cater for around 500,000 TEU a year, to receive or handle freight before distribution outside the Sydney metropolitan region
- rail and road infrastructure to support the Moorebank IMT including the enhancement of Moorebank Avenue, between the M5 Interchange and the southernmost entry to the Moorebank IMT, to a dual carriageway, four-lane road with new intersections at Anzac Road and at four Moorebank IMT access locations (refer to Figure ES.2).

As part of the Moorebank IMT operation, freight would be transferred between interstate and Port Botany trains, moved to storage facilities and onsite warehouses, or transported from the facility by truck.

Without the Moorebank IMT the freight task would probably be undertaken by road. The transfer of the freight task from road to rail has a number of benefits to the broader Sydney region. Approximately 56,125 truck kilometres would be saved every day leading to a reduction in vehicle emissions, highway maintenance and congestion.

A staged approach is proposed for delivery of the Moorebank IMT. The Project design is currently developed to a concept level and would be subject to further detailed design processes and planning approval.

Development of the Moorebank IMT would occur in five stages, as outlined in Figure ES.1.

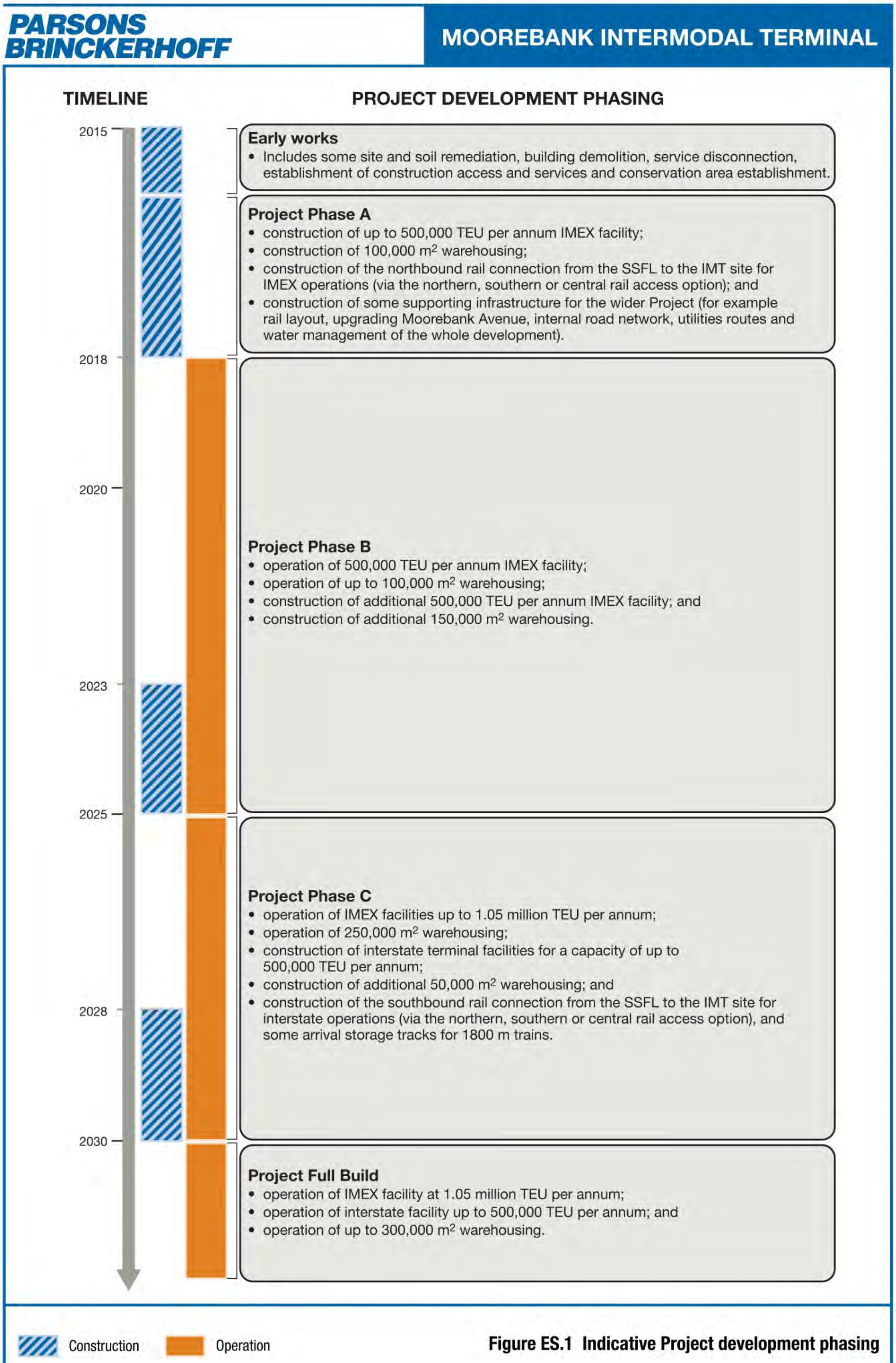

Figure ES.1 Indicative Project development phasing

Existing traffic conditions

Moorebank Avenue

Moorebank Avenue is a local road owned and maintained by Liverpool City Council (LCC) between the M5 interchange and Anzac Road. To the south of Anzac Road, it is a private road on Commonwealth land. Adjacent to the eastern side of the Project site, Moorebank Avenue is a two-lane undivided road with one lane in each direction (refer to Figure 1.1).

The key characteristics of Moorebank Avenue include the following:

- The majority of the traffic currently using Moorebank Avenue is travelling to and from the Glenfield area (south of the Project site). This background traffic has limited growth potential due to the limited capacity of the Cambridge Avenue causeway over the Georges River and intersection capacity issues in Glenfield.
- Traffic flow is unbalanced with high northbound volumes in the AM peak, reversing during the PM peak to high southbound volumes.
- Single lane sections of the road between Cambridge Avenue and Anzac Road are at or near to capacity during peak periods.
- The intersection of Moorebank Avenue and Anzac Road operates at a good Level of Service (LoS) during the existing peak periods.

Strategic Highway Network

The section of the M5 over the Georges River between Moorebank Avenue and the Hume Highway can be a bottleneck within the motorway network. This is due in part to the substandard distance available for the weaving movement of vehicles joining and leaving the motorway. This is expected to become worse with the planned widening of the M5 to the east and west of this location.

The issues associated with the capacity of the M5 over the Georges River would arise regardless of any intermodal terminal developments along Moorebank Avenue.

Public Transport

Private vehicle use is the predominant transport mode in the area due to the diffuse destinations of existing trips and the Project site being on the fringe service area of four rail stations – Casula Station, Liverpool Interchange, Glenfield Interchange and Holsworthy Station. Casula Station is 4.8 km by car and 7.2 km by walking, Liverpool Interchange 4.1 km by car and 3.8 km by walking, Glenfield Interchange 4.8 km by car and 5.6 km by walking and Holsworthy Station 5.9 km by car and 4.8 km by walking. Current bus services on Moorebank Avenue are limited with only one service (Transdev bus route 901) operating in the weekday AM and peaks. This bus route operates between Liverpool and Holsworthy via Wattle Grove.

There is a shared path for pedestrians and cyclists on the eastern side of Moorebank Avenue north of Anzac Road. However there are limited pedestrian and cyclist facilities on Moorebank Avenue to the south. Footpath is provided on the western side between Anzac Road and Chatham Avenue.

Assessment approach

The RMS Road Assignment Model (EMME/2) was used to forecast future year traffic growth within the study area.

The future performance of Moorebank Avenue has been predicted with and without the Moorebank IMT development. It is important to note that the proposed upgrade of Moorebank Avenue would only occur with the proposed Moorebank IMT development.

As the development of the Project would occur progressively in stages over a 15 year period, five stages of predicted traffic flow have been developed to assess the impact of the Project and to reflect the highest potential activity on site for the staging shown in Figure ES.1:

- Early Works – 2015: this considers construction only impacts.
- Phase A – 2016: this considers construction only impacts.
- Phase B – 2023: this considers a combination of construction and operation impacts.

  During this stage operations on-site would be 24 hours a day, 7 day a week. The operation of the truck gate is the exception – this would only be operational for 16 hours a day, 5 days a week.
- Phase C – 2028: this considers a combination of construction and operation impacts.

  During this stage, operations on-site would be 24 hours a day.7 day a week. The operation of the truck gate is the exception - this would only be operational for 16 hours, 5 days a week.
- Full Build – 2030: this considers operational impacts only.

  During this stage, operations on-site would be 24 hours a day.7 days a week and truck movements would also be 24 hours a day.

For the purpose of investigating the full capabilities of the IMT, it is assumed that the IMEX and Interstate terminals and warehouses would be operating at full capacity by 2030.

As part of a cumulative impact assessment, three scenarios have been analysed to determine their traffic impacts on the wider road network.

Potential impacts of the Moorebank IMT development

Traffic generation

As a high end forecast, the Moorebank IMT development would generate approximately 13,884 car and truck movements a day (i.e. 6,942 trips to the Project site and 6,942 trips from the Project site) when fully operational in 2030.

In the 2030 AM peak, this equates to approximately 84 cars and 169 trucks into the development and 169 trucks from the development. Truck movements from the IMEX and Interstate operations are not new trips – without the Moorebank IMT these movements would be associated with trips to and from Port Botany and so would already be on the highway network.

Moorebank Avenue Intersection performances – without Moorebank IMT development

The assessment of the Moorebank study area without the Project identified that, based on the predicted yearly background traffic growth rates on Moorebank Avenue and Anzac Road provided by the Roads and Maritime Services (RMS *Background Traffic Annual Growth Rates 2016 to 2031 for a 2hr and PM peak period Moorebank Area – email 2/5/2014, 6/5/2014, 21/7/2014 and 15/9/2014*) the following existing intersection layouts would operate unsatisfactorily:

- Moorebank Avenue and Bapaume Road intersection would operate unsatisfactorily during both the AM and PM peak hours from 2015 onwards
- Moorebank Avenue and Anzac Road intersection would operate unsatisfactorily in the PM peak in 2030
- Moorebank Avenue and Defence Support Access intersection would operate poorly in the PM peak from 2016 and in the AM peak from 2028
- Moorebank Avenue and DNDSC Access intersection would operate poorly in the PM peak from 2023
- Moorebank Avenue and Chatham Avenue intersection would operate poorly in the AM and PM peaks from 2023.

These intersections are shown in Figure 2.1.

Intersection performance during construction

It is anticipated that the maximum delay to traffic during construction may occur in 2016 (Phase A) due to an increase in vehicle movements and the physical disruption to the road network required to increase the capacity of Moorebank Avenue. The Construction Environmental Management Plan (CEMP) would implement traffic management measures to prevent queues affecting the operation of the M5 interchange and Moorebank Avenue during peak construction activity.

Intersection performance during operation of Moorebank IMT

The traffic volumes forecast for 2030 have led to major capacity and operation improvements to Moorebank Avenue as part of the Project concept plan so that motorists using Moorebank Avenue would not be delayed more than at present.

These improvements include:

- Moorebank Avenue to become a dual carriageway between the M5 intersection and the southernmost entry to the Moorebank IMT
- substantial upgrades to the existing intersections especially the intersection of Moorebank Avenue and Anzac Road to include the realignment of Bapaume Road creating a four way signalised intersection; and
- new access points to the Moorebank IMT to separate trucks from other light vehicles.

Regional and Local Roads

In 2030 at the highest forecast levels of activity on Project site, the Moorebank IMT traffic is not predicted to have a significant impact on most of the intersections in the vicinity of Moorebank. Any increase in congestion at these intersections is expected to be offset by the significant wider network benefits, especially around the Airport/Port Botany area, that would result from the diversion of container traffic from the roads in this area.

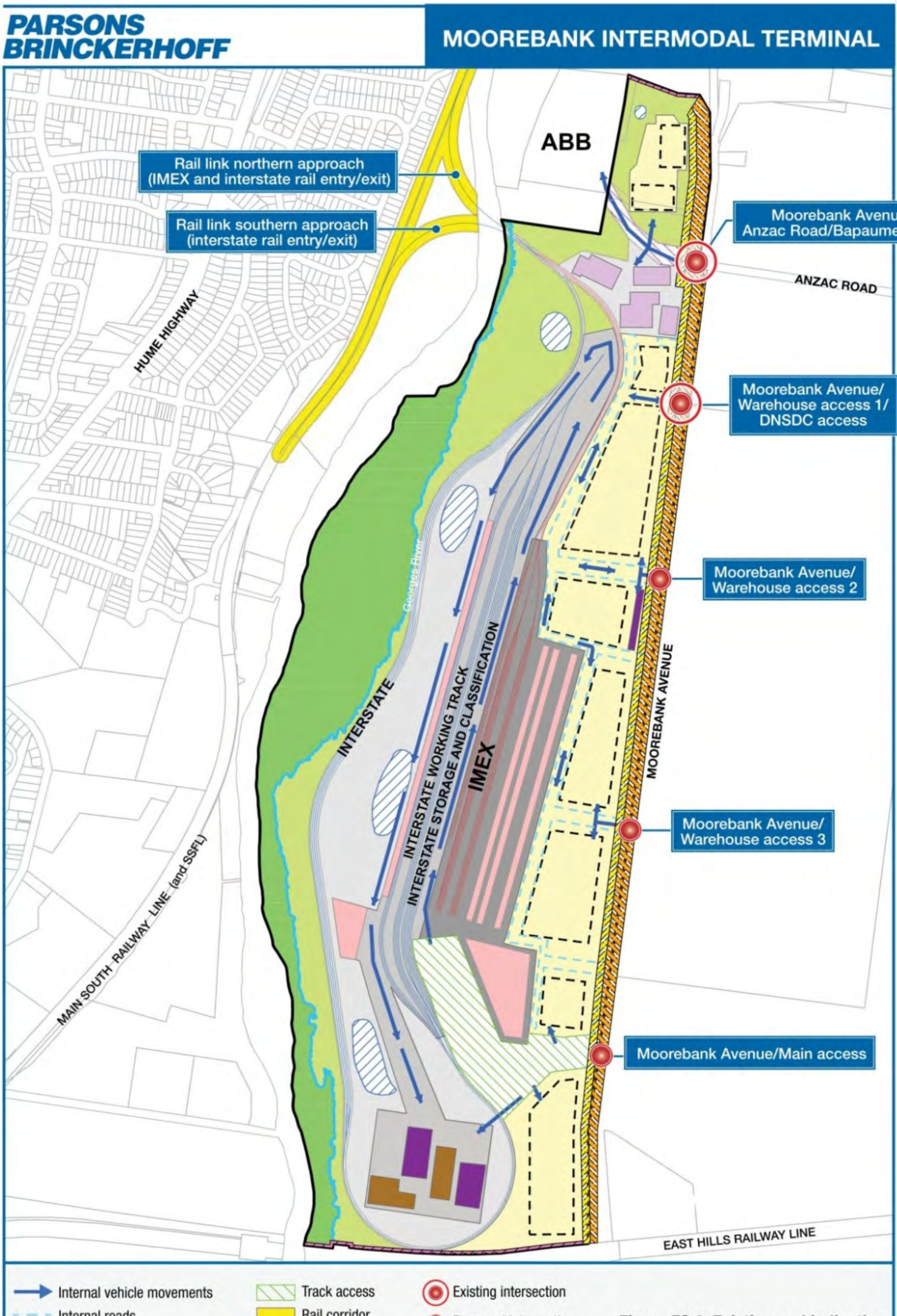

Figure ES.2 Existing and indicative intersection locations for site access at Full Build (2030) IMT operations

Strategic Highway Network

The majority of the traffic generated by the IMEX and Interstate facilities would have been on the Sydney strategic highway network anyway – but originating mostly at Port Botany. This difference in articulated traffic is summarised in Figure ES.3 on the following page.

Figure ES.3 illustrates the modelling results that indicate a significant reduction in future truck traffic around Port Botany, on the M5 and the M4 (including the proposed WestConnex project from the Airport precinct to the eastern end of the M4). There are some relatively minor increases in truck traffic in the proximity of the Moorebank IMT mostly associated with Moorebank Avenue, the Hume Highway north of the M5 and the western section of Newbridge Road.

There is little change to truck traffic on 'local' roads other than access impacts on Moorebank Avenue as the majority of trucks are expected to use the strategic and regional road network.

Wider network impacts

Strategic modelling using Bureau of Transport Statistics (BTS) models undertaken indicated that by 2031, metropolitan Sydney would experience the following network-wide benefits of transferring containers to Moorebank by rail:

- a saving of approximately 56,125 truck vehicle kilometres travelled (VKT) per day; and
- a saving of approximately 1,265 truck vehicle hours travelled (VHT) per day.

This is accompanied by a daily saving of approximately 2,530 VHT by non-truck traffic across the Sydney road network. The vehicle kilometres for non-truck traffic would increase by approximately 10,670 VKT. This is probably caused by traffic migrating from adjacent routes which are more direct, but more congested, to take advantage of the reduction in the truck numbers and congestion along the M5 and the other routes, as indicated in Figure ES.3.

While overall traffic volumes are expected to increase in the study area from traffic generated by the warehouse developments on the Project site, this increase would have little impact on the performance of the road network beyond Moorebank Avenue due to the proposed upgrades to Moorebank Avenue.

As the Project, even at the high end of forecast activity levels, would generate only a relatively minor volume of additional traffic on the motorway network (less than 3% of total M5 traffic during weekday AM and PM peak hours), no road infrastructure modifications beyond Moorebank Avenue are proposed.

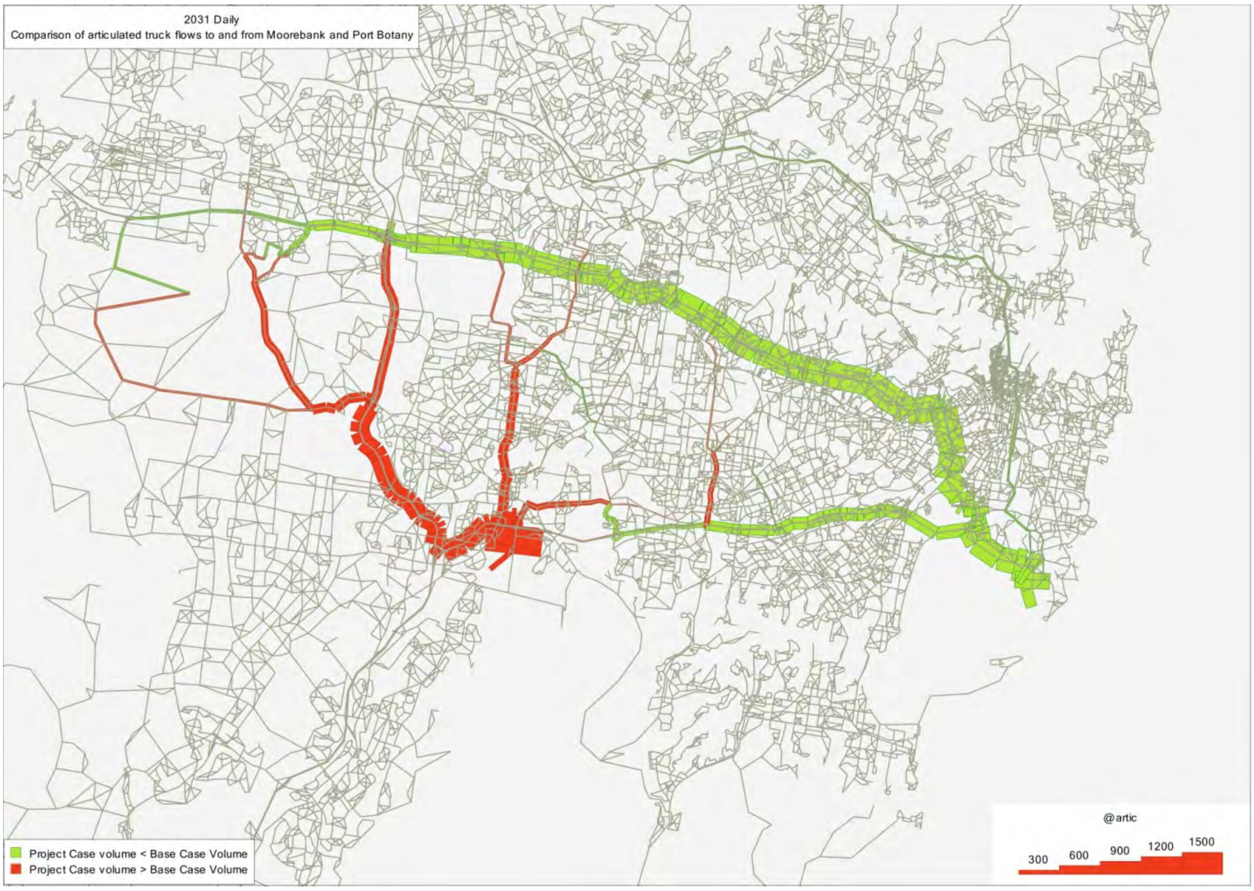

Figure ES.3 2031 AM daily comparison of articulated truck volumes to/from Port Botany and Moorebank only (project case versus base case)

Traffic accidents

The percentage of vehicle related accidents for the section of Moorebank Avenue being upgraded was assessed in accordance with the RMS *Accident Reduction Guide, Version 1.1 (*August 2005*)*. The proposed treatments and their potential individual impacts on types of accident indicate that the upgrade of Moorebank Avenue within the study area should reduce the accident potential on the road.

The reduction in travel distance and time for heavy vehicles has the potential to reduce the impact of the contributing factors associated with accidents (fatigue and speeding). The Moorebank Avenue upgrades would also assist in reducing the number of potential conflicts between light and heavy vehicles along existing travel routes

Cycleway and pedestrian links

Temporary impacts on pedestrians would occur during the upgrade of Moorebank Avenue. Pedestrian facilities will continue to be provided, but they may be relocated to enable construction activity.

The concept plan has provided 4.3 m borders on both sides of Moorebank Avenue (as per Austroads 2009*, Guide to Road Design Part 3: Geometric Design*) to accommodate proposed footpath/shared use paths.

The majority of kerbside lanes are designed to be 4.5 m wide to accommodate cyclists and vehicles in the same lane in accordance with Austroads 2009*, Guide to Road Design Part 3: Geometric Design*.

Parking

The Project has sufficient parking on-site to cater for the expected staff numbers during each shift. The issue of truck parking on Moorebank Avenue has been mitigated by the design of the internal road system which includes service road designed to accommodate trucks which arrive at the Project site, but are unable to proceed directly to the entry gates.

Cumulative impact

Three cumulative scenarios were analysed to determine their traffic generating impact on the road network and include:

- Cumulative scenario 1 – 1.05 million TEU IMEX, 500,000 TEU interstate, 300,000 m^2 warehouse on Moorebank IMT site and 300,000 m^2 standalone warehouse operation on the SIMTA site. Access from SSFL via the northern rail access option.
- Cumulative scenario 2 – 500,000 TEU IMEX, 500,000 TEU interstate, 300,000 m^2 warehouse on Moorebank IMT site and 500,000 TEU IMEX, 300,000 m^2 warehouse operation on the SIMTA site. Access from SSFL via the southern rail access option.
- Cumulative scenario 3 – 500,000 TEU interstate, 300,000 m^2 warehouse on Moorebank IMT site and 1.0 million TEU IMEX, 300,000 m^2 warehouse operation on the SIMTA site. Access from SSFL via the southern rail access option.

Each of these cumulative scenario impacts is described in further detail below.

Cumulative Scenario 1

This scenario considers the impacts of the Moorebank IMT operating at full capacity from 2030 onwards, in parallel with a 300,000 m^2 warehouse operation operating from the adjacent SIMTA site on Moorebank Avenue under the northern rail access option.

Assessment of the combined traffic associated with the Moorebank IMT and an adjacent SIMTA warehouse operation indicates that the traffic volumes generated could be accommodated within the proposed upgrades to Moorebank Avenue. Consequently, this scenario is not considered likely to have a substantial impact on the operation of the M5 Motorway or the regional road network.

The Moorebank IMT would also help mitigate traffic impacts through spreading the peak of traffic generation from the Project site, such that there would be more traffic activity generated by the Project site during the middle of the day when there is more capacity in the surrounding road network to handle these traffic volumes.

Cumulative Scenario 2

This scenario considers the impacts of the Moorebank IMT operating with 500,000 TEU IMEX, 500,000 TEU interstate and 300,000m^2 warehousing from 2030 onwards, in parallel with a 500,000 TEU IMEX, 300,000 m^2 warehouse operations operating from the adjacent SIMTA site on Moorebank Avenue under the southern rail access option.

Assessment of the combined traffic associated with the Moorebank IMT and adjacent SIMTA IMT operation indicates that the traffic volumes generated could be accommodated within the proposed upgrades to Moorebank Avenue. Consequently, this scenario is not considered likely to have a substantial impact on the operation of the M5 Motorway or the regional road network.

The Moorebank IMT would also help mitigate traffic impacts through spreading the peak of traffic generation from the Project site, such that there would be more traffic activity generated by the Project site during the middle of the day when there is more capacity in the surrounding road network to handle these traffic volumes.

Cumulative Scenario 3

This scenario considers the impacts of the Moorebank IMT operating with 500,000 TEU interstate and 300,000m^2 warehousing from 2030 onwards, in parallel with a 1.0 million TEU IMEX, 300,000 m^2 warehouse operations operating from the adjacent SIMTA site on Moorebank Avenue under the southern rail access option.

Assessment of the combined traffic associated with the Moorebank IMT and adjacent SIMTA IMT operation indicates that the traffic volumes generated could be accommodated within the proposed upgrades to Moorebank Avenue with the exception of the Moorebank Avenue, Anzac Road and Bapaume Road intersection. Mitigation measures in the form of intersection upgrades are proposed to accommodate the traffic generated under cumulative scenario 3 at this intersection. Due to the distribution of traffic from the M5 Motorway and Moorebank Avenue intersection, this scenario is not considered likely to have a substantial impact on the operation of the M5 Motorway or the regional road network.

The Moorebank IMT would also help mitigate traffic impacts through spreading the peak of traffic generation from the Project site, such that there would be more traffic activity generated by the Project site during the middle of the day when there is more capacity in the surrounding road network to handle these traffic volumes.

Benefits of the Moorebank IMT facility when compared to alternate land uses on the Project site

The School of Military Engineering (SME) is moving to new premises at Holsworthy irrespective of whether the Moorebank IMT is built. It is almost certain that this land would not be left unused. This assessment has considered the traffic impacts of a range of alternative uses, all of which generate more traffic in the AM peak hour than the proposed Moorebank IMT project. The Moorebank IMT also has the benefit of removing traffic from the Sydney highway network through the movement of containers by rail. The concentrated traffic profile associated with other land uses would make the congestion worse in the immediate area and there would be limited options to prevent much of this traffic from using Anzac Road or Cambridge Avenue.

Mitigation measures

The operation of the Moorebank IMT site would be supported by the upgrade of Moorebank Avenue and its associated intersections.

The upgrade to Moorebank Avenue and the staged construction of Moorebank IMT would be coordinated to minimise the impact on Moorebank Avenue traffic.

The following mitigation measures are to be considered during detailed design to improve the operation of the Moorebank IMT and reduce its impacts:

- Consider the provision of permanent Variable Message Signs (VMS) on Moorebank Avenue to manage traffic movement to and from the various areas of the Project site. VMS systems to direct heavy vehicles should be installed within the facility to provide additional directional information.
- The IMEX, interstate and the warehouse developments should provide storage and shower areas for cyclists to promote cycling as mode of transport.

- Consider the potential for increased bus services between the Moorebank IMT and nearby public transport interchange hubs to reduce the volume of light vehicles generated by staff. There is potential for buses to service the Project site via the main truck access and exit the Project site at the most southern access. This would require bus stop locations to be identified on the eastern side of the service road to reduce the requirement for pedestrians to cross the road. It will be the responsibility of the Moorebank IMT operators to negotiate the services changes provided by bus operators.

- Undertake inspections and monitoring of traffic congestion on Moorebank Avenue at Full Build in 2030 and report any project specific impacts on Moorebank Avenue operation.

- Create a working subgroup of the Moorebank IMT and SIMTA developments, should both developments proceed, to work closely with the LCC traffic committee. This subgroup would ensure a best practice approach to future bus and rail link provision for workers and visitors to both the sites.

- Facilitated discussion with Transdev and TfNSW regarding future bus services for the Moorebank IMT site.

1. Introduction

The Moorebank Intermodal Terminal (IMT) Project (the Project) involves the development of approximately 220 hectares (ha) of land at the Project site (refer to Figure 1.1) for the construction and operation of an IMT and associated infrastructure, facilities and warehousing. The Project includes a rail link connecting the Project site to the Southern Sydney Freight Line (SSFL) and road entry and exit points along Moorebank Avenue.

The primary function of the IMT is to be a transfer point in the logistics chain for shipping containers and to handle both international IMEX cargo, and domestic interstate and intrastate (regional) cargo. The key aims of the Project are to increase Sydney's rail freight mode share including: promoting the movement of container freight by rail between Port Botany and western and south-western Sydney; and reducing forecast road freight on Sydney's congested road network.

The Project proponent is Moorebank Intermodal Company (MIC), a Government Business Enterprise set up to facilitate the development of the Project.

The Project site is currently largely occupied by the Department of Defence's (Defence) School of Military Engineering (SME). Under the approved Moorebank Units Relocation (MUR) Project, the SME is planned to be relocated to Holsworthy Barracks by mid-2015, which would enable the construction of the Project to commence.

The key features/components of the Project are:

- *an IMEX freight terminal* – designed to handle up to 1.05 million TEU per annum (525,000 TEU inbound and 525,000 TEU outbound) of IMEX containerised freight to service 'port shuttle' train services between Port Botany and the Project;
- *an Interstate freight terminal* – designed to handle up to 500,000 TEU per annum (250,000 TEU inbound and 250,000 TEU outbound) of interstate containerised freight to load on and off freight trains travelling to and from regional and interstate destinations; and
- *warehousing facilities* – with capacity for up to 300,000 square metres (m^2) of warehousing to provide an interface between the IMT and commercial users of its facilities such as freight forwarders, logistics facilities and retail distribution centres.

The proposal concept described in the main EIS (refer Chapters 7 and 8) provides an indicative layout and operational concept for the Project, while retaining flexibility for future developers and operators of the Project. The proposal concept is indicative only and subject to further refinement during detailed design. The EIS considers three rail access options (northern, southern and central) for the Project site with one of these options being constructed.

1.1 Project location and study area

The Project is situated in the Sydney suburb of Moorebank, NSW located approximately 35 km south west from the centre of Sydney and approximately 2 km south of Liverpool CBD. It is located in the Liverpool City Council (LCC) local government area (LGA). The Moorebank IMT is proposed to be located on land currently occupied by the SME. The Project Site is approximately 220 hectares (ha) in area.

The Project site is bounded by Moorebank Avenue to the east, the East Hills Railway Line to the south, the Georges River to the west and the commercial site for ABB Australia (a power and automation technology manufacturer) and the M5 Motorway (M5) to the north. The M5 provides access to other Sydney motorways, with the M7 interchange approximately 5 km by motorway west of the Project site.

The Southern Sydney Freight Line has been constructed on the western side of the Georges River along the South Line/Bankstown Line and would be used to service the terminal by rail.

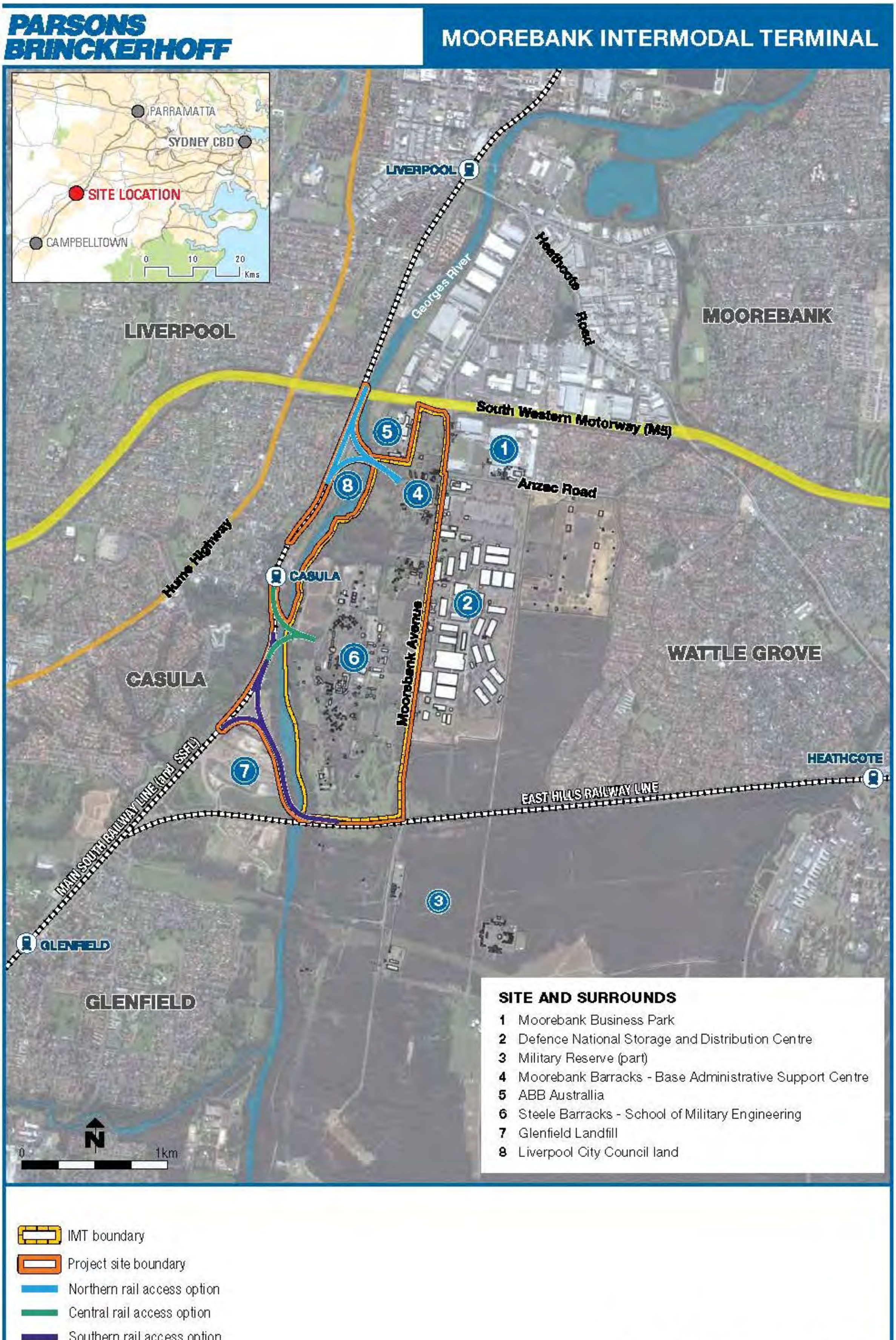

Figure 1.1 Project site and context

1.2 Planning and environmental approvals

The Project is subject to both Commonwealth and NSW State Government approvals, and this Environmental Impact Statement (EIS) has been prepared to support applications for both approvals (EPBC number 2011/6086 and SSD-5066). The Project is a ‘controlled action’ under the (Commonwealth) *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Therefore, MIC is seeking approval for the construction and operation of the Project from the (Commonwealth) Department of the Environment (DoE) under Part 9 of the EPBC Act.

Under the (NSW) Environmental Planning and Assessment Act 1979 (EP&A Act), MIC is seeking a staged development approval for the Project as state significant development (SSD). At this stage, MIC is seeking Stage 1 SSD approval for the proposal concept (as described in EIS) from NSW Planning and Infrastructure (NSW P&I) under Part 4, Division 4.1 of the EP&A Act (hereafter referred to as the Stage 1 SSD approval). The Stage 1 SSD approval application also includes a package of ‘early works’ that comprises remediation, clean-up and demolition or relocation of existing buildings, and establishment of a conservation area. The EIS is seeking approval for these early works without the need for any further approvals. Subject to Stage 1 SSD approval being received, the Project (with the exclusion of the early works) will be subject to further development applications and environmental assessment under the EP&A Act (hereafter referred to as the Stage 2 SSD approvals).

1.3 IMT operating and design principles

An intermodal terminal is made up of a rail yard, trucking terminal and warehouses, which allow for shipping containers to be transferred between rail and road. Containers that arrive at the terminal by rail will either be transferred to their final destinations by truck or broken down on-site or at associated warehousing and transported to their final destinations by smaller vehicles. Containers that arrive at the terminal by truck will be transferred to their final destinations by rail.

The general operation of an IMT facility including IMT container flows for IMEX, interstate and warehousing logistics is shown in Figure 1.2 to Figure 1.4. Figure 1.2 shows the process of IMEX containers arriving at the terminal by rail and departing the Project site by truck and IMEX containers arriving at the terminal by truck and departing the Project site by rail. Figure 1.3 shows a similar process for the interstate operation. Figure 1.4 shows the logistics of a warehouse operation if located off site to the terminal and on site to the terminal.

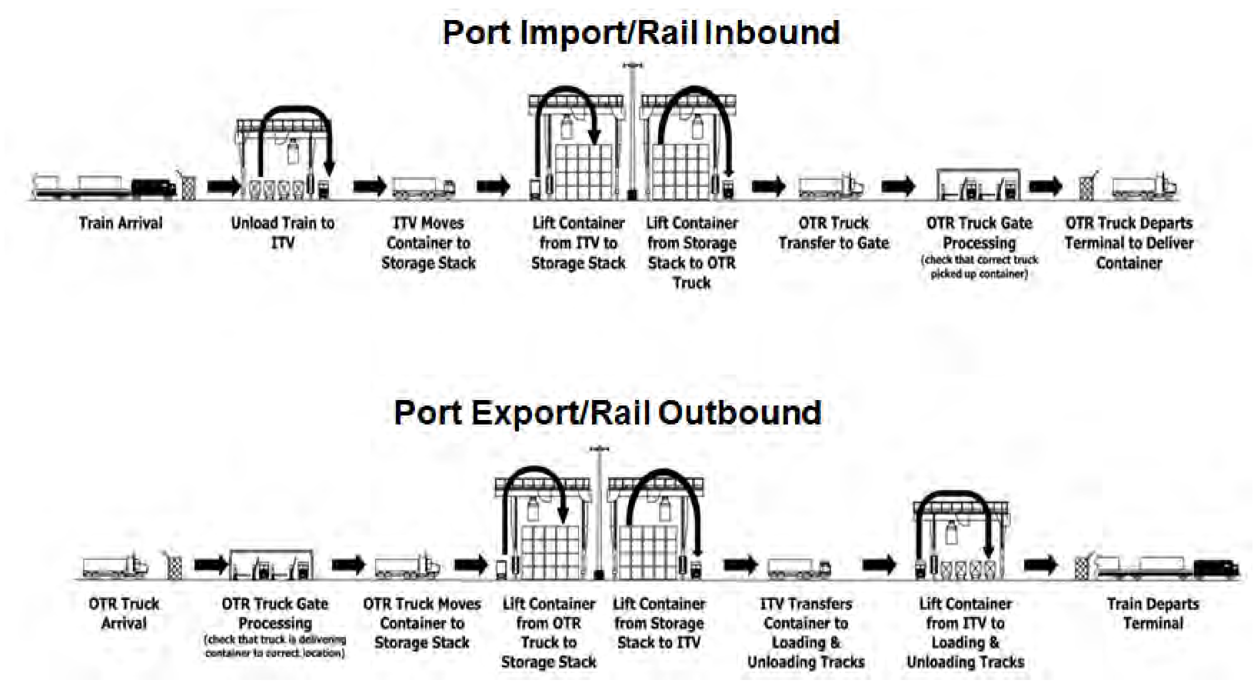

Figure 1.2 IMT Container Flows – IMEX

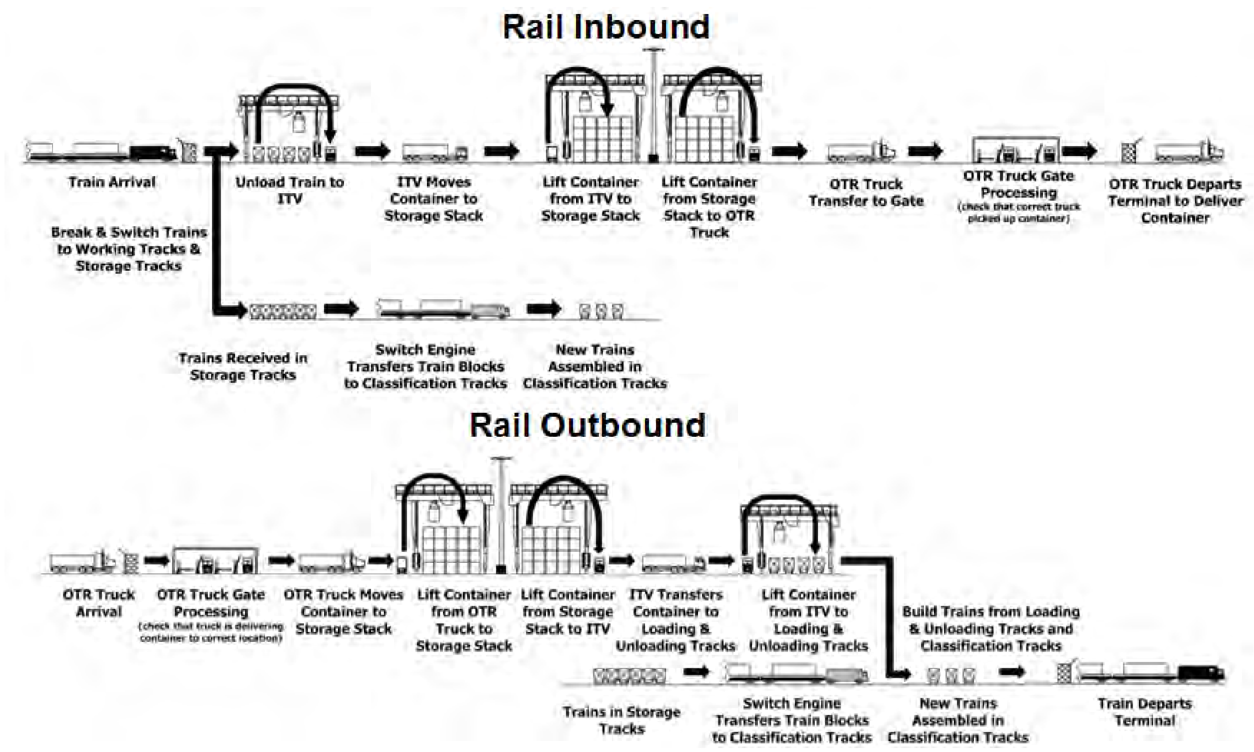

Figure 1.3 IMT Container Flows – Interstate

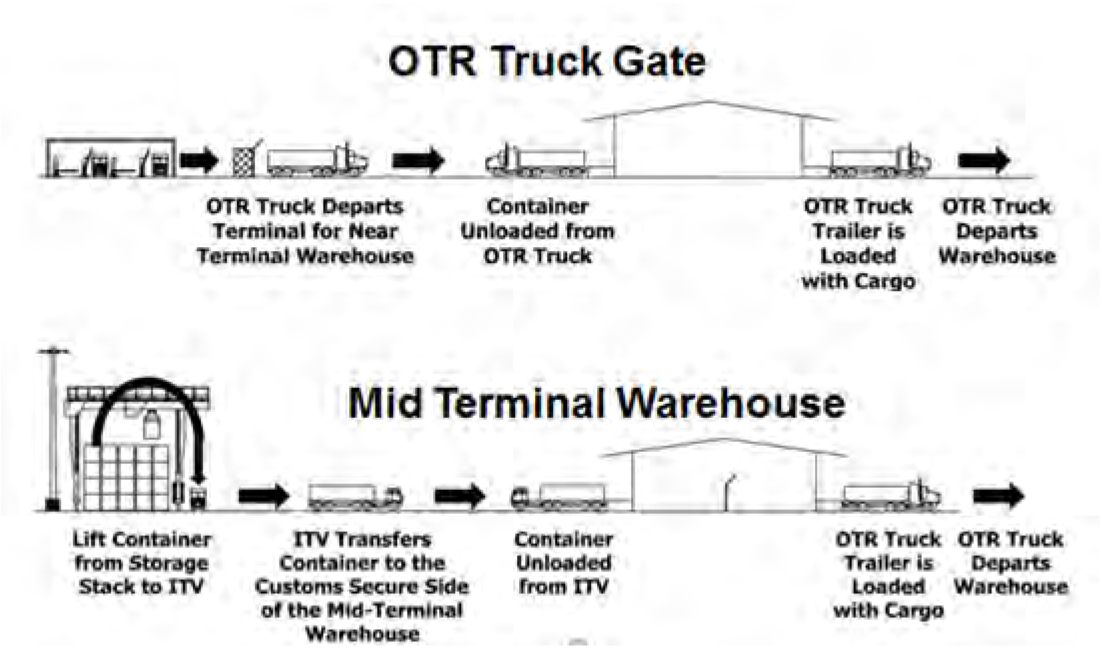

Figure 1.4 IMT Container Flows – Warehousing and Logistics

Figure 1.5 below provides a schematic overview of how the IMT would operate.

The proposal concept has been designed to achieve efficient operation of the IMT and includes the following:

- rail access from the SSFL to the western boundary of the Project site via a crossing of the Georges River
- heavy vehicle access to the facility via Moorebank Avenue at the eastern boundary of the Project site
- warehousing located to allow efficient access to the IMEX terminal and Moorebank Avenue
- support functions (terminal administration, maintenance and repair) for the IMT located close to the IMEX and interstate terminals and close to container stacks
- rail track occupying the available space between the warehousing and the conservation area
- warehousing located immediately adjacent to the proposed IMEX terminal for operational efficiency and direct access between IMEX and warehousing.

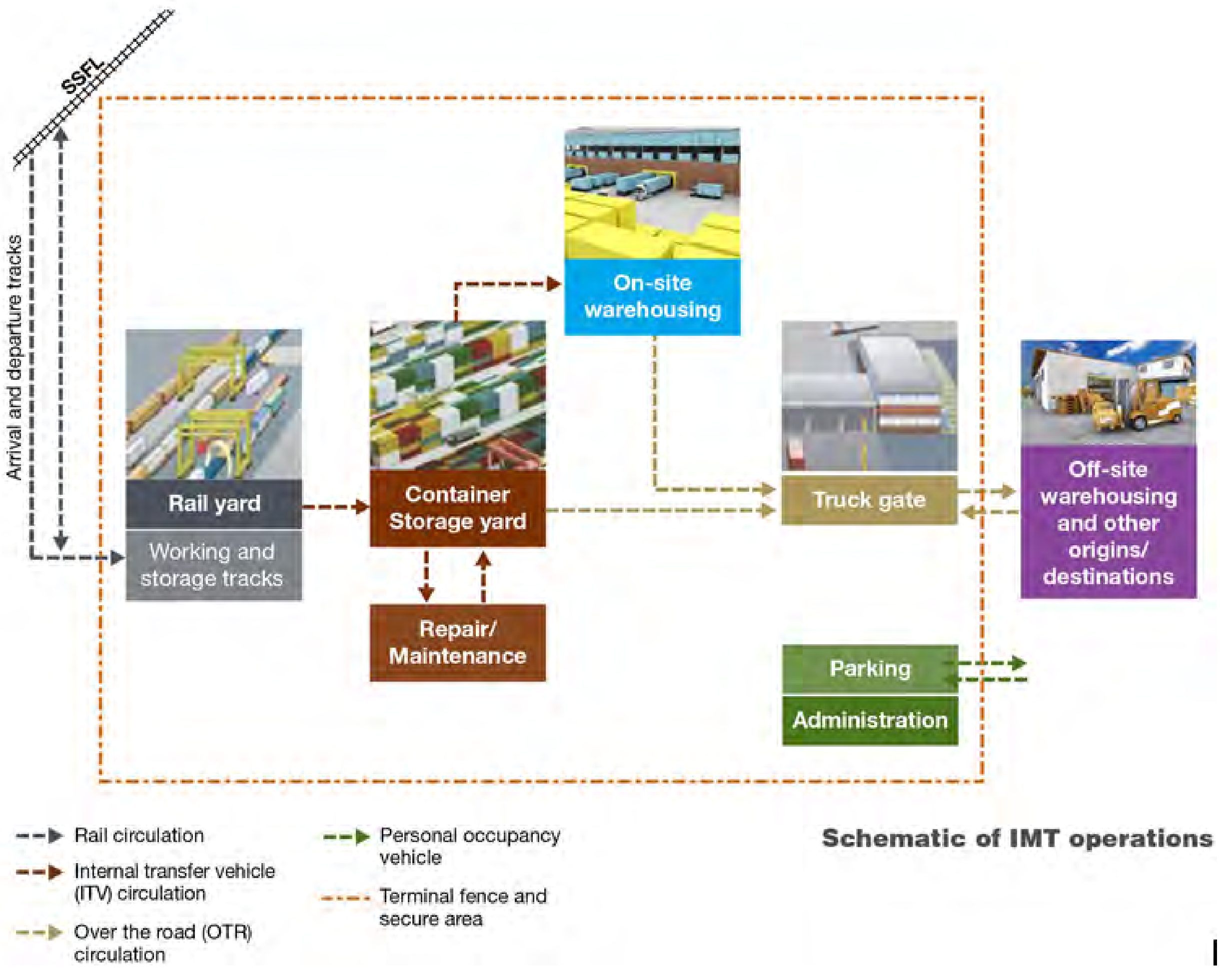

Figure 1.5 Schematic of IMT operations

1.4 Project background

1.4.1 Strategic need for additional IMT infrastructure

Sydney's need for additional IMT infrastructure is driven by a number of factors (listed below) that, if not addressed, are predicted to add substantial costs to the national and regional supply chain, as well as have negative impacts on wider economic and environmental conditions associated with road congestion in Sydney.

In relation to the IMEX container market, the need for additional IMT capacity is driven by:

- Continued strong growth in containerised freight volumes, with growth close to 7% through Port Botany over the past 5 years and comparable growth rates predicted into the future.
- Constraints on freight processing and distribution from Port Botany, including road congestion.
- Road congestion on the M5 Motorway.
- Future capacity constraints within the current and planned IMT network.

- Freight destinations within Sydney, including Sydney Airport and industrial areas in the Sydney region's growth centres.
- Environmental and social impacts of road freight (DBC, 2012).

In relation to the interstate container market, the need for additional IMT capacity is driven by an expected 3.6% per annum growth in interstate freight volumes between 2011/2012 and 2029/2030, as well as the need to take advantage of the substantial operating cost savings and environmental benefits that can be achieved through the greater use of rail for long distance freight transport (DBC). The Australian Government has already made a $4.8 billion investment in improving the national rail freight network and the competitiveness of rail freight, which the interstate component of the Project would augment.

Overall, insufficient intermodal rail freight capacity is recognised as a key barrier to the future development of Sydney and improvements in national productivity (Moorebank Project Office 2012).

The Project effectively addresses Sydney's critical shortage of IMT capacity. Specifically, it would facilitate the redistribution of up to 1.05 million twenty-foot equivalent units (TEU) of IMEX road freight from Port Botany to the Project Site, and up to 500,000 TEU of interstate road freight. This would present a number of associated benefits, including better managing road congestion associated with transport of container freight from Port Botany to Sydney's west (including along the M5 Motorway), complementing other IMTs in the Sydney region (e.g. Enfield and Ingleburn), and allowing for an increase in freight handling capacity at Port Botany. It would also complement other State government rail investments and mode share policies.

As described further in section 3, the Project includes development of warehousing facilities within the Project site along Moorebank Avenue. The warehousing component of the Project is needed because of the role it would play in an efficient logistics chain for locally destined goods. The warehousing would also provide efficient revenue streams for the Project, thereby supporting the cost competitiveness of rail against road. The warehousing facility would also reduce traffic generation in comparison to a scenario where the functions were separated (stand-alone facility) and would need to be accessed by the road network.

1.4.2 Project objectives

The following six long-term objectives have been established for the Project by the Australian Government:

1. Boost national productivity over the long-term through improved freight network capacity and rail utilisation.
2. Create a flexible and commercially viable facility and enable open access for rail operators and other terminal users.
3. Minimise impact on the Department of Defence's operational capability during the relocation of its facilities from the Moorebank site.
4. Attract employment and investment to south-west Sydney.
5. Achieve sound environmental and social outcomes that are considerate of community views.
6. Optimise value for money for the Commonwealth having regard to the other stated Project objectives.

The project will assist Port Botany achieve the NSW Government target (Action 1F of the TfNSW Freight and Port Strategy) of doubling the percentage of containers moved by rail through the transfer of up 1.2 million containers annually from road to rail.

1.4.3 Transport network gains

An intended outcome of the Moorebank IMT is to reduce the reliance on Port Botany and relieve congestion in the Port Botany freight terminal and the surrounding road network. In addition, the Moorebank IMT provides closer links to the industrial land uses of south western Sydney. As Port Botany expands it is important that more container freight moves by rail to efficient distribution centres for transhipment to roads closer to outer metropolitan and regional destinations. The *Port Botany Expansion Environmental Impact Statement* (URS, November 2003) identified that the recent expansion of the Port Botany Terminal was required to cater for the expected growth in container trade. To effectively move the greatly expanded volume of containers across the state's road network, it was necessary to shift the portion carried by rail from the port to outer intermodal terminals from 25% to 40%. The *Sydney Metropolitan Strategy* supports this goal in shifting freight transport from road to rail.

The M5 Motorway is the key road link between Port Botany and Western Sydney. The *M5 West Widening Project Traffic and Transport Report* (Halcrow, September 2010) confirmed the importance of the M5 Motorway to the movement of freight to and from Port Botany. *Freight Movements in Sydney* (Bureau of Transport Statistics, July 2010) forecast freight volumes would increase by 51% by 2026 from the base case (this is an increase of 2.2% per annum). This is twice the growth of light commercial trips, population and employment. The increase in freight movements by rail within this corridor would assist in reducing the growth in truck movements on the M5 generated by Port Botany. As a result, the increase in truck movements on the M5 would be minimal as the proportion generated by Port Botany would be dispersed from the Moorebank IMT.

1.5 Traffic impact assessment scope and methodology

This report presents the results of preliminary investigation into the traffic impact of the Moorebank IMT on the surrounding transportation network and assesses the operation of the road upgrades to Moorebank Avenue required to manage the increased demand at acceptable performance levels.

In preparing this report, our analysis follows the principles of the Roads and Maritime Services (RMS) *Guide to Traffic Generating Developments (2002).* Where appropriate, different rates and requirements have been adopted to either make use of more recent and applicable information or to better reflect the local planning environment.

- IMEX and interstate traffic generations were sourced from Deloitte analysis based on a comprehensive analysis of internal warehouse operations.
- Warehouse traffic generation rates sourced from both Deloitte and the RMS *Guide to Traffic Generating Developments Technical Direction TDT 2013/04 Traffic Surveys* (May 2013).
- Staff parking space requirements were taken from the Liverpool City Council (LCC) *Development Control Plan* (DCP).

The general principles of the Department of Urban Affairs and Planning DUAP (2001) *Land Use and Transport Package* guideline have been considered to support development that is accessible by walking, cycling and public transport.

The Moorebank IMT would facilitate the distribution of road freight to western Sydney by transferring the origin of truck hauled containers from Port Botany to Moorebank. These movements would be present on the road network originating from Port Botany if the Moorebank IMT were not developed. The traffic modelling has been developed with the environmental impact assessment in mind with providing responses to Environmental Assessment requirements.

The methodology used for the investigation comprised:

- Collecting of data including traffic surveys to determine the existing traffic network demands and performance by times of day.
- Determining the expected traffic generation from all developments proposed within the Project site for both operation and construction phases.
- Distributing the expected traffic generated to the network via a number of intersections along Moorebank Avenue.
- Determining the peak traffic years to be tested depending on peak operational and construction traffic demands and assess the AM peak hour and PM peak hour.
- Determining the future level of background traffic based on yearly traffic growth rates provided by RMS from various years of the EMME/2 model.
- Simulating the proposed future intersection upgrades of Moorebank Avenue within SIDRA 6 intersection analysis software to forecast the operation of the network for the following design years:
  - Early works – 2015 – Scenario 1: this considers construction only impacts.
  - Phase A – 2016 – Scenario N1: this considers construction only impacts.
  - Phase B – 2023 – Scenario N2: this considers a combination of construction and operation impacts.
  - Under this stage operations on-site would be 24 hours/7 day a week with the exception of the operation of the truck gate which would only be operational 16 hours/5days a week.
  - Phase C – 2028 – Scenario N3: this considers a combination of construction and operation impacts.
  - Under this stage operations on-site would be 24 hours/7 day a week with the exception of the operation of the truck gate which would only be operational 16 hours/5days a week.
  - Full Build – 2030 – Scenario N4: this considers operational impacts only.
  - Under this stage operations on-site would be 24 hours/7 day a week and truck movements would be 24 hours.
- Modelling the proposed Moorebank Avenue and Moorebank IMT access intersections using the northern rail access option only for the Moorebank IMT only scenario. The northern rail access option is considered the highest traffic impact scenario as it has the greatest volume of project trips entering and exiting the southernmost Moorebank IMT access intersection on Moorebank Avenue (also referred to as the Main Access) which would then have to pass through the remaining access intersections.
- Modelling cumulative scenarios utilising the northern rail access option for scenario 1 and the southern rail access option for scenarios 2 and 3.

- Reviewing the results and provide recommendations for future intersection and other required upgrades to mitigate traffic impacts from the project.

1.6 Purpose of this report

The purpose of this Technical Paper is to inform the Environmental Impact Statement (EIS) being prepared to seek approval for the Moorebank IMT Project 'concept' under both the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) as a controlled action; and the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

This Technical Paper responds to the EIS Guidelines (EPBC Act) and the Environmental Assessment Requirements (EARs) (EP&A Act) and in doing so prepares responses to community concerns relating to traffic and transport related issues.

Therefore, this Technical Paper and the EIS assesses the impacts of all five proposed development stages of the Project to a concept level, but with more detailed assessment of matters protected under the EPBC Act. Both construction and operation phase impacts have been assessed and are presented. Further details of the Project would be the subject of future development applications as the project is refined, with environmental impact assessments to be conducted in detail at that time.

In seeking approval, MIC is establishing a staged approval process, whereby successive stages of development on the Project Site would be subject to further environmental assessment and separate planning approval once further detailed Project information is developed. That is, the MIC is currently seeking approval for the Project 'concept' (i.e. the broad parameters of the Project), sufficient to satisfy both:

- A Stage 1 SSD application under the NSW EP&A Act.
- Commonwealth EPBC Act requirements for the Project, in relation to impacts of the proposed controlled action on matters protected under the EPBC Act (which comprise listed threatened specials and communities and impacts on the environment by a Commonwealth agency).

In summary, this Technical Paper addresses the requirements outlined in the Table 1.1.

Table 1.1 EIS requirements addressed within this Technical Paper

Requirement	Where addressed in the technical paper
EPBC Act – Final EIS Guidelines	
Details of any proposed public transport services which will operate throughout the site	Section 3.1.6
Provide a description of the current traffic conditions in the vicinity of the proposed site and along proposed road transport routes, including traffic volumes, peak times, points of congestion and road conditions	Section 2
Provide a detailed analysis of the contribution or changes to existing vehicle traffic at the local and regional scale resulting from the construction and operation of the proposed facility. The analysis must be carried out in accordance with the Guide to Traffic Generating Developments and the Integrating Land Use and Transport Package, NSW Roads and Traffic Authority (now known as the NSW Roads and Maritime Services)	Section 4 Section 6
Comprehensive monitoring of traffic congestion	Section 2.3 Section 8.1

Requirement	Where addressed in the technical paper
NSW EP&A Act –EARs[1]	
Traffic, transport and access – including but not limited to:	
▪ A Transport and Accessibility Impact Assessment demonstrating how the development will facilitate freight transport objectives, meet freight infrastructure requirements and address impacts to local and regional road and rail transport networks.	Section 3 Section 4 Section 5 Section 6 Section 10 Chapter 3 and 11 of the EIS also demonstrates how the development will facilitate freight transport objectives and meet freight infrastructure requirements
▪ Access to and from the development (including truck routes and rail access to the Southern Sydney Freight Line), and interaction and integration with existing and planned transport infrastructure and services; and details of internal transport and logistic requirements to minimise external transport impacts and maximise access to public transport for employees.	Section 3 Section 8.4
▪ The number of train and truck movements, origin and destination, time of movements, modal split targets, types of road transport likely to be used (for example B-Doubles) and the capacity of existing and proposed road and rail routes to handle predicted increases in traffic, based on appropriate empirical analysis and modelling, including freight and non-freight movements and vehicle utilisation.	Section 4 Section 5 Section 6
▪ A breakdown of the split of import and export container movements by rail, including the proportion of empty container movements.	Section 4.2
▪ Proportion of port shuttle services, regional and interstate rail being serviced by the Moorebank IMT, including predicted daily port shuttle movements.	Section 4.2
▪ Demonstrate plans and capacity for empty container storage within the site, including the transport of empty containers to regional areas (if required).	Section 4.2
▪ Consideration of the cumulative impacts of this proposal with the adjacent SIMTA proposal and other existing and proposed freight distribution facilities in the locality and on local and regional road and rail networks	Section 7
▪ Identification of required road and rail infrastructure upgrades within proximity of the site, including the M5 and M7 motorways and interchanges, the Moorebank Avenue/Heathcote Road intersection, the Moorebank Avenue/Newbridge Road intersection and Cambridge Avenue.	Section 3
▪ A consideration of road safety in the vicinity of the site including the identification of any 'black spots'.	Section 2.7, 2.8 and 6.4
▪ Identification of cycleway and pedestrian links between Liverpool, Holsworthy, Wattle Grove, Moorebank, M5 corridor, Casula and Macquarie Fields to maximise active transport options to the site.	Section 2.6 Section 8.4
▪ Impacts on users of the Georges River, including an assessment of bridge clearance to ensure safe passage of water vessels.	Refer to Chapter 24 of the EIS report
▪ Taking into account the *Guide to Traffic Generating Developments* (RMS) and the *Integrating Land Use and Transport Package* (DUAP).	Section 4 Section 8.4

[1] *EARs –Environmental Assessment Requirements*

1.7 Document structure

This traffic, transport and accessibility impact assessment report is structured as follows:

- Section 2 describes the existing traffic and transport conditions for the area surrounding the proposed Moorebank IMT. This includes public transport, pedestrian and cycle infrastructure conditions, review of crash data and an assessment of the performance of the existing intersections along Moorebank Avenue.
- Section 3 describes the proposed development, including the proposed staging, the upgrade of Moorebank Avenue and intersections into the Moorebank IMT site, pedestrian and cyclist facilities and public transport.
- Section 4 describes the expected traffic generation. The input assumptions to derive these values are also provided.
- Section 5 provides the distribution of traffic generated through the road network on a strategic level.
- Section 6 presents the results of the traffic impact assessment and the modelling used to perform the analysis. The assessment includes analysis of intersection performance, mid-block road capacity and weaving on the M5 Motorway. The impacts relate to the construction and operation of the facility during modelled years 2015, 2016, 2023, 2028 and 2030. An assessment of accident reduction and safety benefits considering all road users is also included in this section. This section also describes the future traffic conditions without the Moorebank IMT being developed.
- Section 7 provides a cumulative analysis of three scenarios with varying land uses types and sizes on both the Moorebank IMT and SIMTA sites.
- Section 8 provides the mitigation measures for detailed design and operations.
- Section 9 explains the scope of the construction of the Moorebank IMT and items to be included in the construction traffic management plan.
- The conclusions of the report findings are summarised in section 10.

2. Existing situation

2.1 Existing land use

Currently the Project site is occupied by the School of Military Engineering (SME) and other minor Defence units. The Project site contains a number of buildings used for administration, teaching and instructing, tactical operations, storage and accommodation. There are training facilities associated with skills and trade training for the SME located around the Project site. The Project site also has a number of recreational facilities, including playing fields and a golf course. There are a total of 13 Defence units that currently utilise the Project site.

On the western side of Moorebank Avenue, off-street car parks at grade have been provided for the staff of the facility and the neighbouring facility, the Defence National Storage and Distribution Centre (DNSDC). The DNSDC is currently in the process of relocating to a new site at West Wattle Grove. The relocation is expected to be completed by early 2015. The new site will be accessed from Moorebank Avenue and Anzac Road.

2.2 Surrounding road network

This assessment considers the impact on the following roads within the study area as shown in Figure 2.1:

- Moorebank Avenue is a local road owned and maintained by Liverpool City Council (LCC) between the M5 interchange and Anzac Road with a 2010 ADT of 17,581 with 6% heavy vehicles (HV). South of Anzac Road, Moorebank Avenue is a private road on Commonwealth land (2010 ADT 15,777) with 4.2% heavy vehicles. This section of Moorebank Avenue south of the M5 interchange is generally two lane undivided road with one lane in each direction. The posted speed limit along Moorebank Avenue on both these road sections is 60 km/h.

- Anzac Road is a local road owned and maintained by LCC. It is primarily a two-lane undivided road with one lane in each direction. The posted speed limit on this road is 60 km/h. The intersection with Moorebank Avenue at the western end of Anzac Road is a signalised T-intersection. The intersection has designated turn bays, with a left turn slip lane from Moorebank Avenue southbound into Anzac Road.

- Bapaume Road is a local road owned and maintained by LCC that provides access to ABB Australia Pty Ltd. It is a two lane undivided road with one lane in each direction. The intersection with Moorebank Avenue is a T-intersection with right of way given to vehicles on Moorebank Avenue. There are no turning bays at this intersection. However there is ample storage within Bapaume Road to accommodate queuing of exiting vehicles.

- There are a number of private roads located in the subject SME site with some connecting to Moorebank Avenue, including Chatham Avenue. Some of these intersections are controlled gates. The majority of the intersections have dedicated turning lanes along Moorebank Avenue into the Project site. The majority of these internal roads are two lane undivided roads with one lane in each direction. All of these roads will be removed as part of the proposed development.

- Cambridge Avenue to the east of the causeway (low level bridge subject to flooding) is a local road owned and maintained by LCC. It is a two-lane undivided road with one lane in each direction. This road crosses the Georges River to the south of the Project site via a narrow low lying bridge with a limited vehicle loading capacity that is prone to flooding. The posted speed limit on this road is 60 km/h.

The nearby major roads in the area include the Hume Highway, the M5 South Western Motorway, Newbridge Road, Heathcote Road and the Westlink M7 Motorway.

The Hume Highway is classified as a National Road. It is a six-lane divided road with three-lanes of traffic in each direction. The posted speed limit on the Hume Highway is 70 km/h in this area. The Hume Highway links Sydney to Canberra and provides a local arterial route through this area.

The M5 Motorway is classified as a State Road until it reaches the Camden Valley Way Interchange (northbound traffic) and the Hume Highway on ramp (southbound traffic) where it is classified as a National Road. The M5 Motorway was built under a Build Own Operate Transfer (BOOT) scheme with Interlink Roads Pty LTD. They are currently responsible for the operation and maintenance of the motorway. This road opened in 1992 and, following several project variations including the M5 Motorway widening, the contract is due to be transferred to State Government ownership in 2026. From 2026 the NSW Government will benefit from road to rail transfer resulting from the Moorebank IMT project and the reduction in truck movements around Port Botany and the airport.

The lane configuration on the M5 depends on the location. To the east of Heathcote Road, the M5 is a four lane divided road with two lanes in each direction. Between Heathcote Road and Moorebank Avenue the M5 widens to a six lane divided road with three lanes in each direction and had a 2010 AADT of 102,766. Between Moorebank Avenue and the Hume Highway the M5 is widened further to an eight lane divided road with four lanes in each direction (2010 AADT 123,780). The additional lanes in this section of road are due to a continuation of entry and exit merge lanes from the two interchanges. To the west of the Hume Highway the M5 reduces to a four lane divided road with two lanes in each direction. The M5 posted speed limit in the vicinity of the Project site is 100 km/h.

The section of the M5 over the Georges River between Moorebank Avenue and the Hume Highway acts as a bottleneck within the motorway network. This is due in part to the substandard distance available for the weaving movement of vehicles joining and leaving the motorway. Congestion from weaving movements is expected to be become worse with the planned widening of the M5 to the east and west of this location.

A number of rat-runs have developed through the area in order to avoid using the M5. Turning volumes from Cambridge Avenue into Moorebank Avenue indicate it is used as an alternative to the M5 for access from the Hume Highway and suburbs further south. In addition, Anzac Road may be used to access Heathcote Road to avoid using the M5.

Newbridge Road is classified as a State Road. From Henry Lawson Drive it is a six lane divided road with three lanes of traffic in each direction until Heathcote Road (westbound) where it becomes a four lane divided road with two lanes of traffic in each direction, crossing the Georges River and continuing along Terminus Street to Macquarie Street. The post speed limit on Newbridge Road is 60 km/h from Terminus Street to Bridges Road and 70 km/h between Bridges Road and Henry Lawson Road. Newbridge Road provides a local arterial route between Bankstown Airport, Milperra and the Liverpool CBD.

Heathcote Road is classified as a State Road. It is a four lane road with two lanes of traffic in each direction. Heathcote Road narrows to one lane in each direction between Junction Road and the M5 Motorway (north of the interchange). The posted speed limit on Heathcote Road is 60 km/h in this area. Heathcote Road provides access to most of the Moorebank industrial precinct.

The Westlink M7 Motorway is classified as a motorway and is a privately operated Toll Road with distance-based tolling. The Westlink M7 Motorway was built under a Build Own Operate Transfer (BOOT) scheme with the Westlink Motorway consortium and opened in 2005. This contract is due to be transferred back to the State Government in 2037. It is consistently a four lane divided road with two lanes of traffic in each direction. The posted speed limit on the Westlink M7 is 100 km/h with variable speed limit signs.

2.3 Existing traffic conditions

Intersection surveys of traffic and pedestrians were undertaken on Tuesday 7 December 2010 during the AM peak (between 6.00 am and 9.00 am) and the PM peak (between 4.00 pm and 7.00 pm) at the following intersections:

- M5 Motorway and the Hume Highway.
- Moorebank Avenue and the M5 Motorway.
- Moorebank Avenue and Bapaume Road.
- Moorebank Avenue and Anzac Road.
- Moorebank Avenue and Defence Support access (and a secondary access to the DNSDC).
- Moorebank Avenue and DNSDC access (including car park access on the western side of Moorebank Avenue).
- Moorebank Avenue and Chatham Avenue.

The location of these intersections is shown in Figure 2.1.

Seven-day classified tube counts were also undertaken for the week from Tuesday 7 December to Monday 13 December 2010, at the following locations:

- Moorebank Avenue between the M5 Motorway and Bapaume Road.
- Moorebank Avenue north of Cambridge Avenue.
- Anzac Road east of Moorebank Avenue.

Further intersection surveys on the wider road network adjacent to the Project site were undertaken on Tuesday 18 March 2014 during the AM peak (between 6.00 am and 9.00 am) and the PM peak (between 4.00 pm and 7.00 pm) and also included the following intersections:

- Hume Highway and Orange Grove Road
- Hume Highway and Elizabeth Drive
- Hume Highway and Memorial Avenue
- Hume Highway, Hoxton Park Road and Macquarie Street
- Hume Highway and Reilly Street
- Moorebank Avenue and Newbridge Road

- Moorebank Avenue and Heathcote Road
- Moorebank Avenue and Industrial Park Access
- Moorebank Avenue and Church Road
- Heathcote Road, Wattle Grove Road and Nuwarra Road
- Newbridge Road and Nuwarra Road
- Newbridge Road, Governor Macquarie Drive and Brickmakers Drive
- Cambridge Avenue, Canterbury Road, Glenfield Road and Railway Parade.

All counts were conducted outside of school and university holidays. Intersection and tube counts indicated average daily and peak hour traffic, light and heavy vehicle proportions and pedestrian volumes. For this study, traffic growth rates have been obtained by extrapolating changes in traffic volume growth from the Sydney STM EMME/2 model to estimate the traffic volumes for intersections surveyed in 2010.

Intersection diagnostic monitor (IDM) data was obtained from RMS for all signalised intersection to determine traffic signal phasing and cycle times for the weekday AM and PM peak periods. Traffic signal phasing and cycle times were also verified during the site inspection. This data was then utilised into the SIDRA intersection modelling.

The intersection surveys indicate that the majority of the traffic currently using Moorebank Avenue is through traffic travelling between the Glenfield area and the M5/Moorebank Avenue interchange. The network peaks for Moorebank Avenue are between 6.45 am and 7.45 am and between 5.00 pm and 6.00 pm. Both the AM and PM peaks have unbalanced traffic flows where the majority of traffic is northbound on Moorebank Avenue in the AM peak and southbound in the PM peak.

Data retrieved from the additional surveys undertaken on March 2014 indicate that the network peaks on the wider road network (beyond Moorebank Avenue) generally occurs between 7.45 am and 8.45 am and between 4.30 pm and 5.30 pm.

Figures 2.2 and 2.3 show the intersection turning movement volumes in vehicles per hour (vph) during the analysed peak AM and PM periods, respectively.

Figure 2.1 Location of existing key intersections on Moorebank Avenue

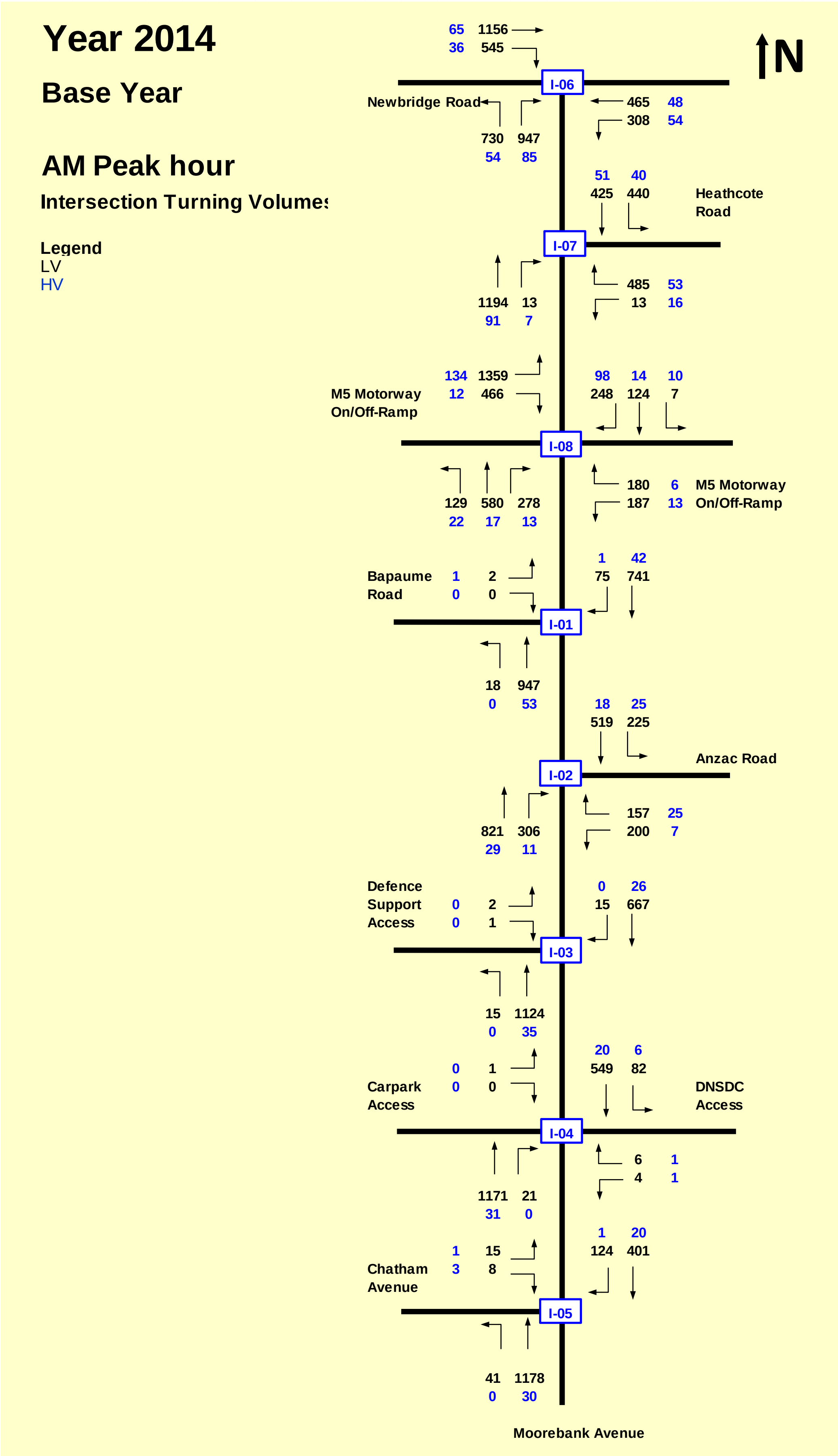

Figure 2.2 Existing AM peak hour intersection turning volumes – Year 2014

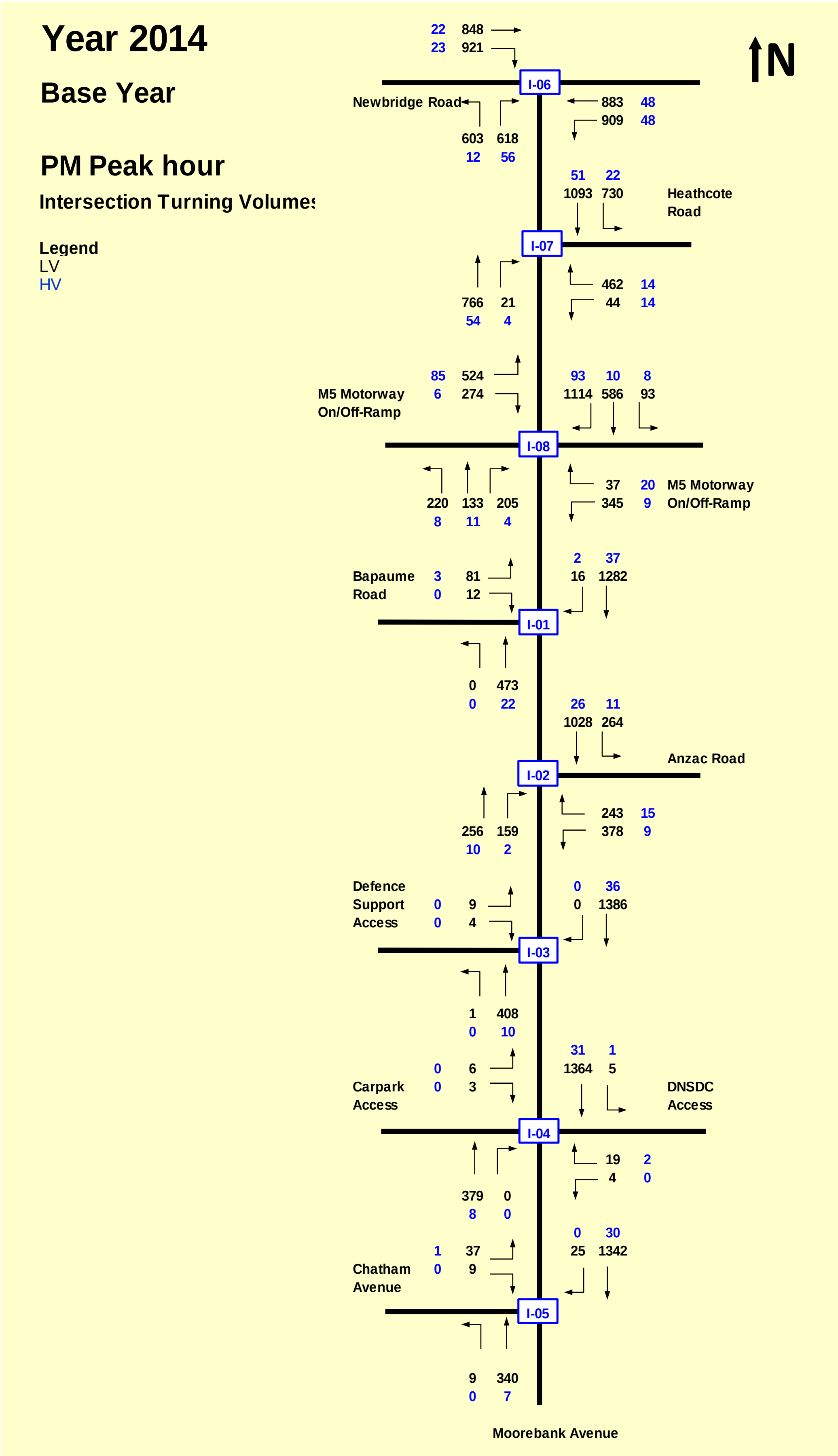

Figure 2.3 Existing PM peak hour intersection turning volumes – Year 2014

Traffic flows on Moorebank Avenue are tidal with high northbound volumes in the AM peak hour (1,024 vehicles per hour), reversing during the PM peak hour to high southbound volumes (1,156 vehicles per hour). As a result sections of the road with one lane are at or near to capacity during the peak periods.

The full traffic survey results can be found in Appendix A.

2.3.1 Existing intersection performance

A base case SIDRA Intersection analysis was undertaken to provide an understanding of the current traffic operations along Moorebank Avenue and provide a basis for the qualitative and quantitative assessments of the proposed Moorebank IMT.

SIDRA Intersection is a traffic engineering micro-analytical traffic evaluation tool used for intersection design and analysis. It stands for Signalised and unsignalised Intersection Design and Research Aid. It is used for the analysis of intersection capacity, level of service and performance.

This package provides several useful indicators to determine the level of intersection performance. These are known as Level of Service (LoS), Degree of Saturation (DoS), Average Delay (seconds) and Maximum Queue Length (metres). An explanation of these intersection assessment criteria is provided in Appendix B. The LoS criteria for intersections are also shown in Table 2.1.

Table 2.1 Level of Service criteria for intersections

Level of Service	Average delay (seconds per vehicle)	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; roundabouts require other control mode	at capacity; requires other control mode
F	Greater than 71	unsatisfactory with excessive queuing	unsatisfactory with excessive queuing; requires other control mode

Source: RMS Guide to Traffic Generating Developments

Table 2.2 shows the SIDRA modelling results of the performance of the intersections along Moorebank Avenue under existing traffic conditions. Refer to Figure 2.1 for the location of the key intersections.

Table 2.2 Existing intersection performance (2014)

Intersection	Intersection control type	Peak hour	Degree of Saturation	Average Delay (sec)	Level of Service	95th percentile queue (m)
Moorebank Avenue and Bapaume Road	Priority – give way	AM	0.56	>100	F	28
		PM	0.42	>100	F	40
Moorebank Avenue and Anzac Road	Signalised	AM	0.69	18	B	193
		PM	0.94	28	B	219
Moorebank Avenue and Defence Support Access	Signalised	AM	0.84	8	A	253
		PM	0.96	26	B	409
Moorebank Avenue and DNSDC Access	Signalised	AM	0.70	6	A	140
		PM	0.95	24	B	598
Moorebank Avenue and Chatham Avenue	Signalised	AM	0.98	41	C	646
		PM	0.98	39	C	669

The level of service at the intersection of Moorebank Avenue and Bapaume Road reflects the delays experience by vehicles turning right from Bapaume Road into Moorebank Avenue. As those vehicles must give-way to the high volumes of traffic on Moorebank Road, they find few opportunities to exit and experience poor performance of the intersection. The through lanes on Moorebank Avenue have good operation.

The intersection of Moorebank Avenue and Anzac Road has a good LoS with acceptable delays.

The high DoS and long queues at the other intersections on Moorebank Avenue are a result of their existing designs and the unbalanced traffic flows of the northern and southern approaches.

The full results of the existing intersection SIDRA analysis can be found in Appendix C.

2.4 Southern Sydney Freight Line

The Southern Sydney Freight Line (SSFL) has been constructed between Birrong and Macarthur and forms a dedicated freight rail corridor between Port Botany and Macarthur. The SSFL was opened in 2013 and improves the efficiency and cost effectiveness of rail freight services by removing current restrictions created due to the sharing of the railway lines operated by RailCorp.

The SSFL provides an additional freight only railway track that allows passenger and freight services to operate separately. This permits freight movements to be transported by rail at any time.

2.5 Public transport

Whilst there is no rail station on or adjacent to the site, bus route 901 runs along Moorebank Avenue during peak traffic periods providing a link to the passenger rail network. Trips to the Project site using existing public transport must therefore be by bus only or by rail and bus. Further discussion on the existing public transport network is provided below.

2.5.1 Train services

The Project site is accessible via four nearby railway stations: Liverpool, Casula, Glenfield and Holsworthy. Travel distance to each station and station accessibility is shown in Table 2.3. The locations of Liverpool, Casula and Holsworthy railway stations are shown in Figure 2.4.

Table 2.3 Travel distance and accessibility to local railway stations

Station/Interchange	Train line	Distance by car (travel time)	Distance by walking (travel time)	Accessible by bus (average trip time)
Casula Station	Cumberland Line (T5) Inner West and South Line (T2)	4.8 km (7 minutes)	7.2 km (1.5 hrs)	No
Liverpool Interchange	Cumberland Line (T5) Inner West and South Line (T2) Bankstown Line (T3)	4.1 km (6 minutes)	3.8 km (50 minutes)	Yes (11 minutes)
Glenfield Interchange	Cumberland Line (T5) Airport, Inner West and South Line (T2)	4.8 km (7 minutes)	5.6 km (1.2 hrs)	No
Holsworthy Station	Airport, Inner West and South Line (T2)	5.9 km (9 minutes)	4.8 km (1 hr)	Yes (19 minutes)

Note: distances and travel times were measured from the centre point of the Moorebank IMT area, or equivalent location on Moorebank Avenue. Distances and travel times may vary slightly, depending on Project site access location.

Table 2.3 shows that while there are four stations within a 10 minute drive from the Moorebank IMT site, only two stations are accessible by bus and would be difficult to access by walking. While Casula station is less than 1 km from the Project site, it is a 1.5 hour walk or 7 minute drive from the site, without a bus connection to Moorebank Avenue. In terms of options for commuting to the Project site, Liverpool and Holsworthy stations are currently the only viable options with bus connections to Moorebank Avenue.

2.5.2 Bus services

Moorebank Avenue is currently serviced by one bus route provided by Transdev (Route 901). The bus route operates between Liverpool and Holsworthy via Wattle Grove (using Anzac Road) with a single AM and PM diverted service which travels further south along Moorebank Avenue to Chatham Avenue. The route map and bus stop locations on Moorebank Avenue are shown in Figure 2.4.

On a weekday, bus services operate between 5.30 am and 9.30 pm at half hourly intervals during the AM and PM peaks. Hourly services run outside peak periods. Weekend and Public Holiday services are provided (7.00 am to 7.00 pm Saturday, 8.30 am to 7.00 pm Sunday and Public holidays) where buses operate hourly with no diverted bus services to Chatham Avenue.

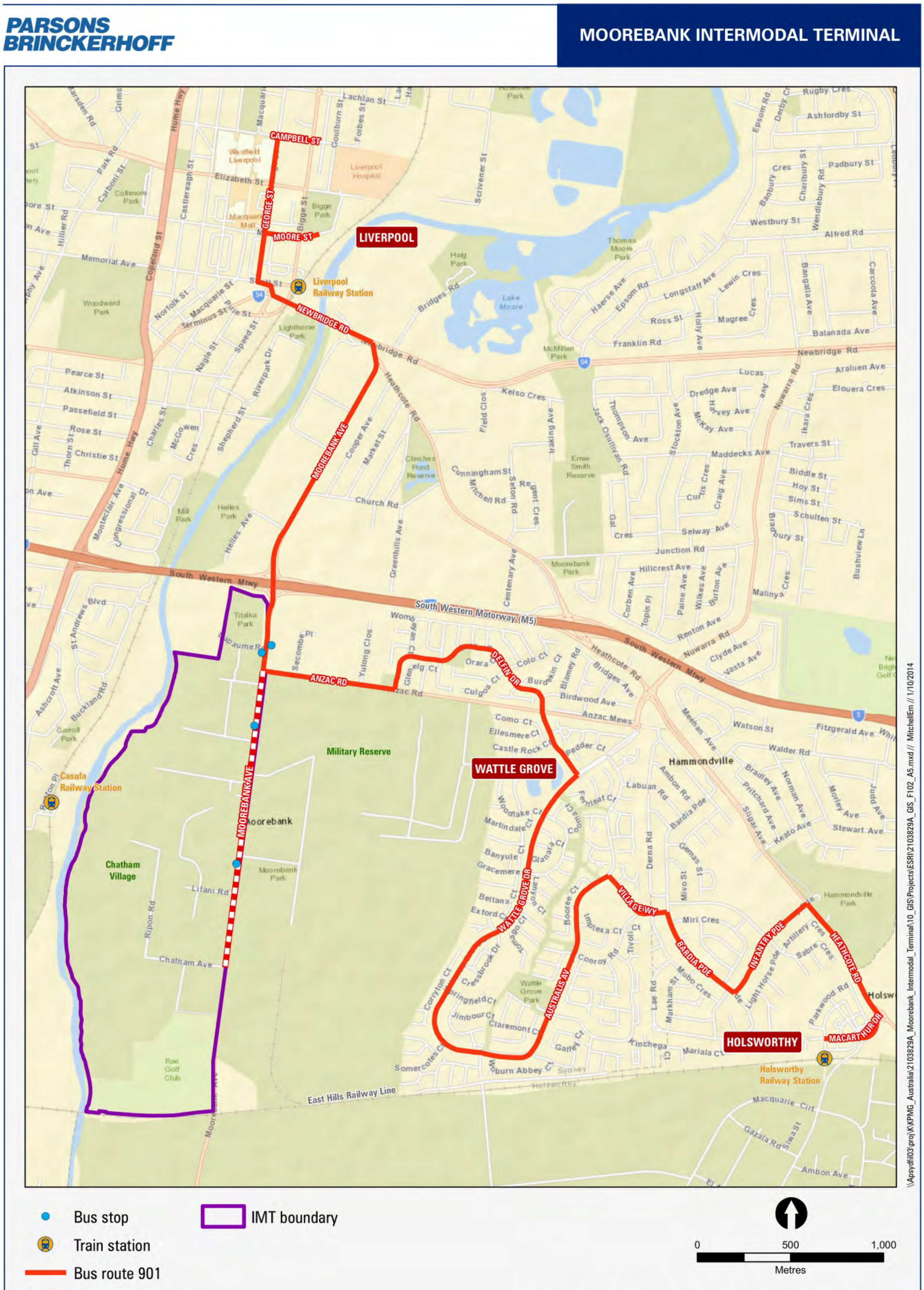

Figure 2.4 Local bus service route and train station locations

2.6 Pedestrian and cyclist facilities

A shared path is provided on the eastern side of Moorebank Avenue between the M5 and Anzac Road. The shared path then continues on the southern side of Anzac Road to connect to Holsworthy Station. This is the only identified cycleway in the area.

There are limited pedestrian and cyclist facilities on Moorebank Avenue south of Anzac Road. There is no shared path along Moorebank Avenue in front of the Project site. A footpath is provided on the western side of Moorebank Avenue between Anzac Road and Chatham Avenue. There is a wide shoulder (except for the locations of the signalised intersections) along Moorebank Avenue that can accommodate cyclists; however is not a designated cycle lane.

LCC have identified a number of proposed routes in its *Bike Plan 2009* for new on and off road paths in the LGA. These routes would include provision of off-road cycleways from the northern end of the Project site to provide additional options for cycling. As a result this may improve the connection between the Project site, neighbouring destinations and suburbs, and the local train stations.

Figure 2.5 shows the existing footpaths, cycleways and proposed LCC cycleways in proximity to the Project site.

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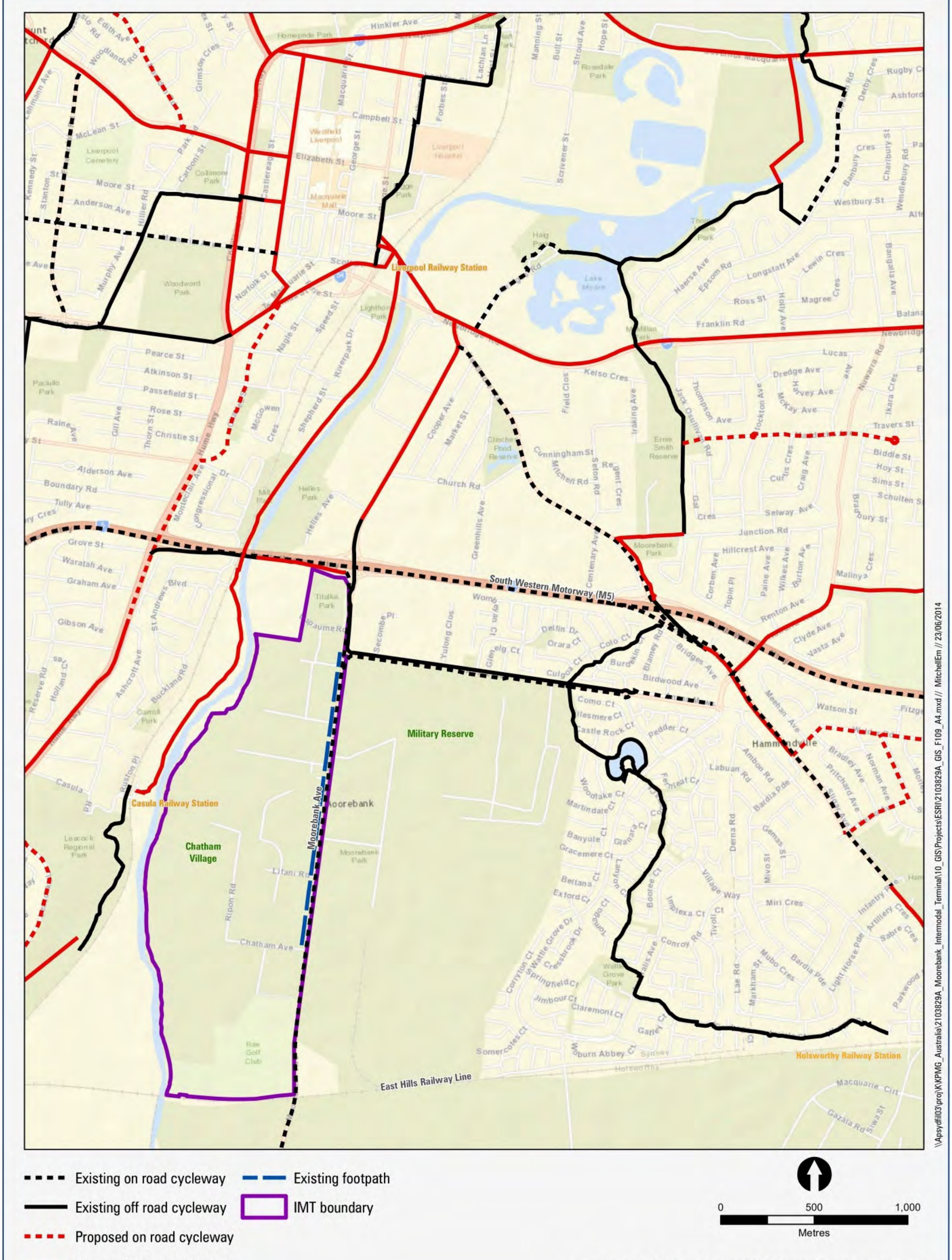

Figure 2.5 Existing and proposed footpaths and cycleways

2.7 Crash analysis

2.7.1 Moorebank Avenue crash analysis

Crash data were obtained from RMS for a five year period (2008–2013) for the section of Moorebank Avenue between the East Hills Railway Line and south of the intersection with the M5. The crash locations are shown in Figure 2.6.

An analysis of the accident data is provided below:

- A total of 61 reported accidents occurred on Moorebank Avenue involving a total of 127 vehicles.
- Of the 61 analysed accidents, 33 (54%) were at intersections and 28 (46%) occurred midblock. Out of the 33 recorded accidents at intersections, 15 accidents occurred that the intersection of Moorebank Avenue and the M5 and 18 accidents occurred at the intersection of Moorebank Avenue and Anzac Road.
- On Moorebank Avenue, accidents involving vehicles from opposite directions were the most common accident type with 21 accidents constituting 34% of accidents. A further 18 involved rear end collisions.
- There were no accidents that resulted in a fatality.
- There were no accidents involving pedestrians or cyclists.
- 85% of road users involved in accidents were light vehicles (cars, utilities, vans) and 15% were heavy vehicles.
- 18% of crashes involved three or more vehicles.
- 78% of the accidents occurred during fine conditions.
- 78% of accidents occurred during the day (46% AM, 32% PM), of which the majority occurred during daylight.
- 88% of accidents occurred on weekdays.

2.7.2 M5 crash analysis

Crash data was obtained from RMS for a five year period (2008–2013) for the section of the M5 between the Hume Highway and Heathcote Road intersections.

An analysis of the accident data is provided below:

- A total of 171 reported accidents occurred on the M5, involving a total of 368 vehicles.
- Overall, accidents involving rear end collisions were the most common accident type with 77 accidents constituting 45% of all accidents. A further 16% were vehicles leaving the road and colliding with an object and 12% as a result of a lane change.
- There were no accidents that resulted in a fatality.
- There was one cyclist crash and no pedestrian crashes.

- 86% of road users involved in accidents were light vehicles (cars, utilities, vans) and 14% were heavy vehicles.
- 80% of crashes involved more than one vehicle.
- 75% of the accidents occurred during fine conditions.
- 69% of accidents occurred during the day (30% AM, 39% PM), of which the majority occurred during daylight.
- 78% of accidents occurred on weekdays.

2.8 Black spot analysis

The following guidelines apply to nominating black spots in NSW under the National Black Spot Programme and sourced from the *NSW Black Spot Program, How to apply for funding* (Roads and Maritime Services).

Black Spot sites

A Black Spot can be up to 3 km in length. The minimum criteria for eligibility is at least 2 casualty crashes in the most recent 5 years of crash data.

Black Lengths sites

A Black Length is any section of road being treated that is longer than 3 km. The minimum criteria for eligibility are an average 0.13 casualty crashes per kilometre per annum over the last 5 years of crash data.

The above guidelines have been applied to Moorebank Avenue between the East Hills Railway Line and the M5 Motorway, and the M5 Motorway between the Hume Highway and Heathcote Road interchanges.

2.8.1 Moorebank Avenue

The section of Moorebank Avenue between the East Hills Railway Line and the M5 Motorway is approximately 2.8 km and is generally two-lane two-way with lane widening to accommodate movements at the M5 Motorway intersection.

The crash data as supplied by RMS indicate that 38 casualty crashes have occurred over the last 5 year period between 2008 and 2013.

By converting these crash rates per kilometre per annum, this results in 2.71 casualty crashes per kilometre per annum. This is in excess of the 0.13 casualty crashes per kilometre per annum and therefore considered a black spot.

2.8.2 M5 Motorway

The section of the M5 Motorway between the Hume Highway and Heathcote Road interchanges is approximately 2.7 km and is generally three lanes in either direction at this location.

The crash data as supplied by RMS indicate that 66 casualty crashes have occurred over the last 5 year period between 2008 and 2013.

By converting these crash rates per kilometre per annum, this results in 4.89 casualty crashes per kilometre per annum. This is in excess of the 0.13 casualty crashes per kilometre per annum and therefore considered a black spot.

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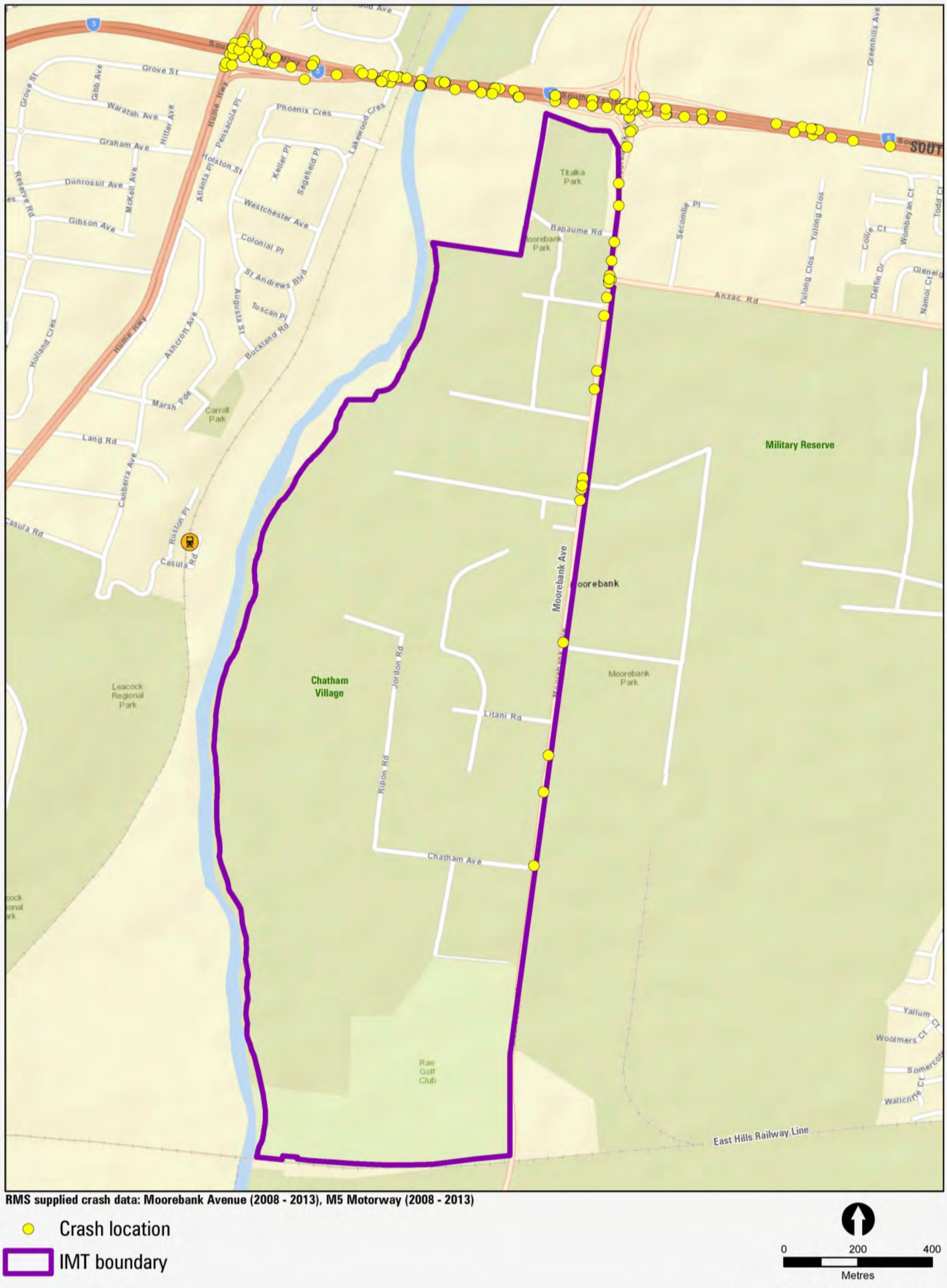


Figure 2.6 Location of crashes on Moorebank Avenue and the M5 Motorway

3. Proposed development

3.1 Moorebank Intermodal Terminal overview

As set out in section 1, the Moorebank Intermodal Terminal (IMT) Project (the Project) involves the development of approximately 220 hectares (ha) of land at the Project site (refer to Figure 1.1) for the construction and operation of an IMT and associated infrastructure, facilities and warehousing.

The Project includes a rail link connecting the Project site to the Southern Sydney Freight Line (SSFL) and road entry and exit points from Moorebank Avenue. The proposal concept described in the main EIS (refer Chapters 7 and 8) provides an indicative layout and operational concept for the Project, while retaining flexibility for future developers and operators of the Project. The proposal concept is indicative only and subject to further refinement during detailed design.

3.1.1 Rail access options and layouts

The Project has to connect to the SSFL, which was commissioned in January 2013 within the Main South Railway Line corridor. It is separated from the Project site by the Georges River and varied land holdings not controlled by the proponent. The SSFL connects Port Botany to west and south-western Sydney, and would provide a direct route for freight trains from Port Botany to the Project site and back again.

Three separate rail access options are included as part of the proposal concept as detailed in this EIS but only one option will be constructed, as shown in Figure 3.1 to Figure 3.3. These options are:

- *northern rail access option* — with rail access from the north-western corner of the Project site, passing through the former Casula Powerhouse Golf Course (which is currently owned by Liverpool City Council (LCC)) and crossing the Georges River and floodplain;
- *central rail access option* — with rail access from the centre of the western boundary of the Project site, passing through Commonwealth land on the western bank of the Georges River (referred to as the ‘hourglass land’); and
- *southern rail access option* — rail access from the south-western corner of the Project site, passing through the Glenfield Landfill site (owned by Glenfield Waste Services) and crossing the Georges River and floodplain.

In order to maintain flexibility for future developers and operators of the Project, the proposal concept, as presented in this EIS, provides three indicative IMT internal layouts; one for each of three proposed rail access options. Once a developer/operator has been appointed, the Project would progress to the detailed design phase and one of the three rail access options identified above would be selected.

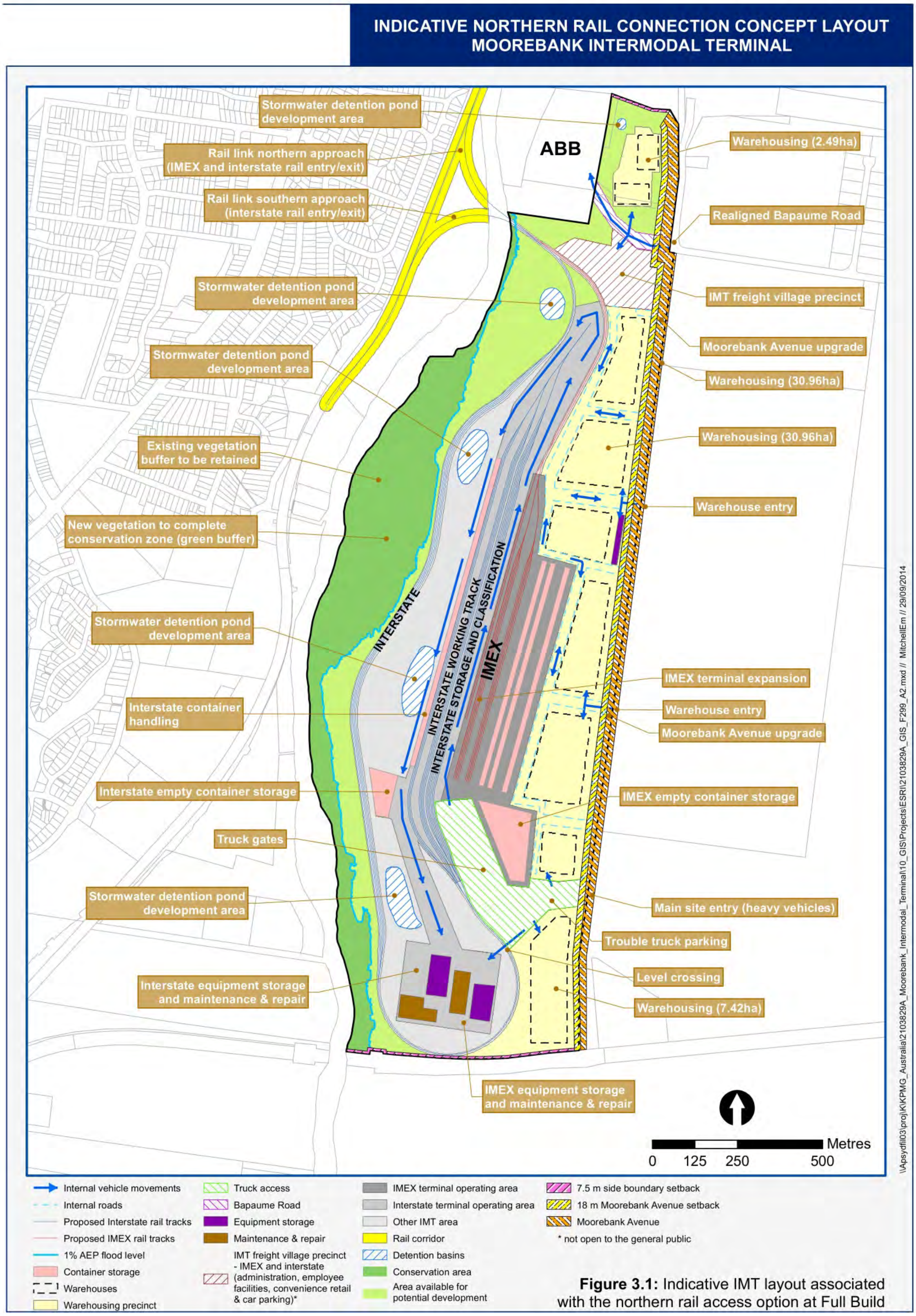


Figure 3.1: Indicative IMT layout associated with the northern rail access option at Full Build

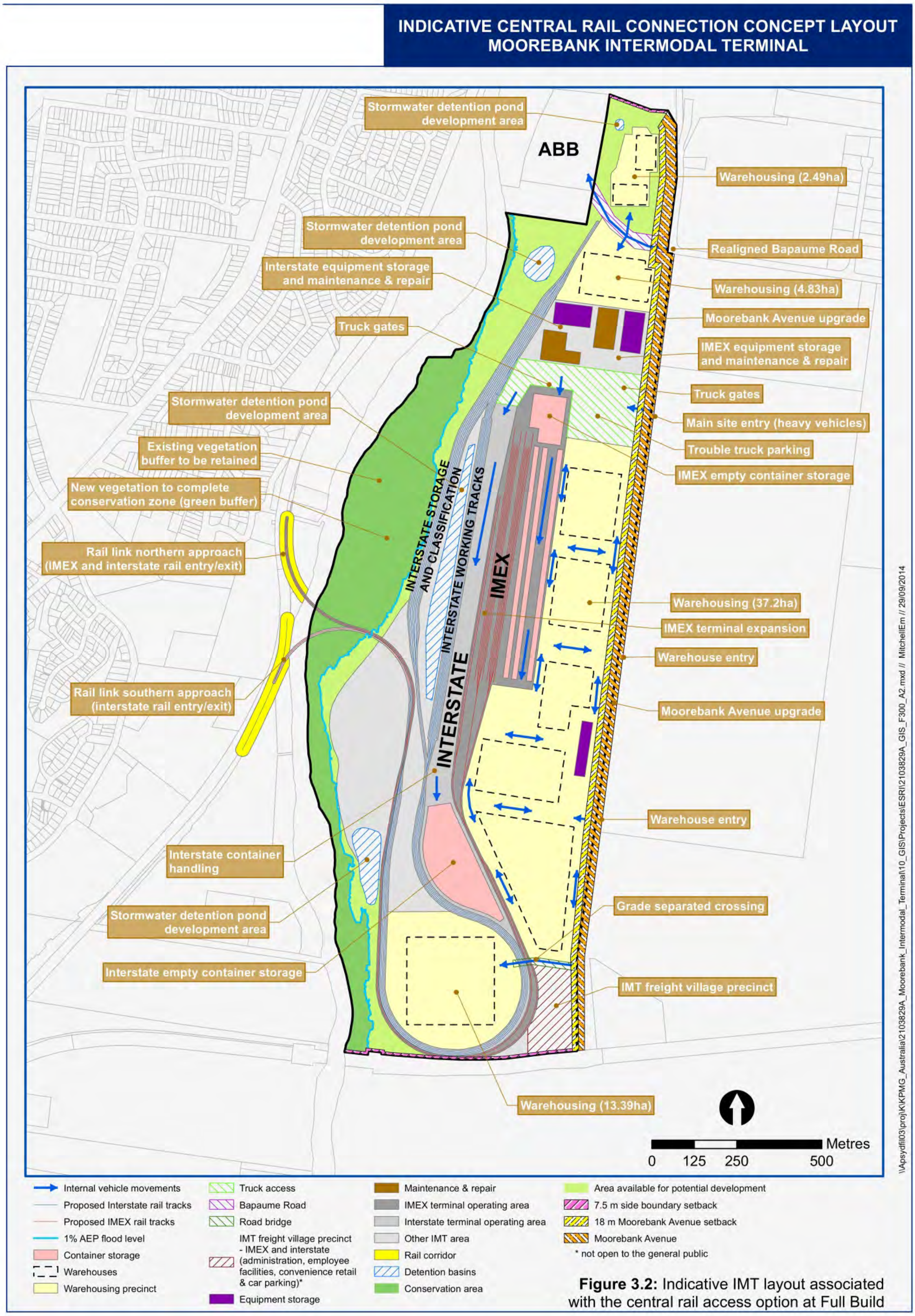


Figure 3.2: Indicative IMT layout associated with the central rail access option at Full Build

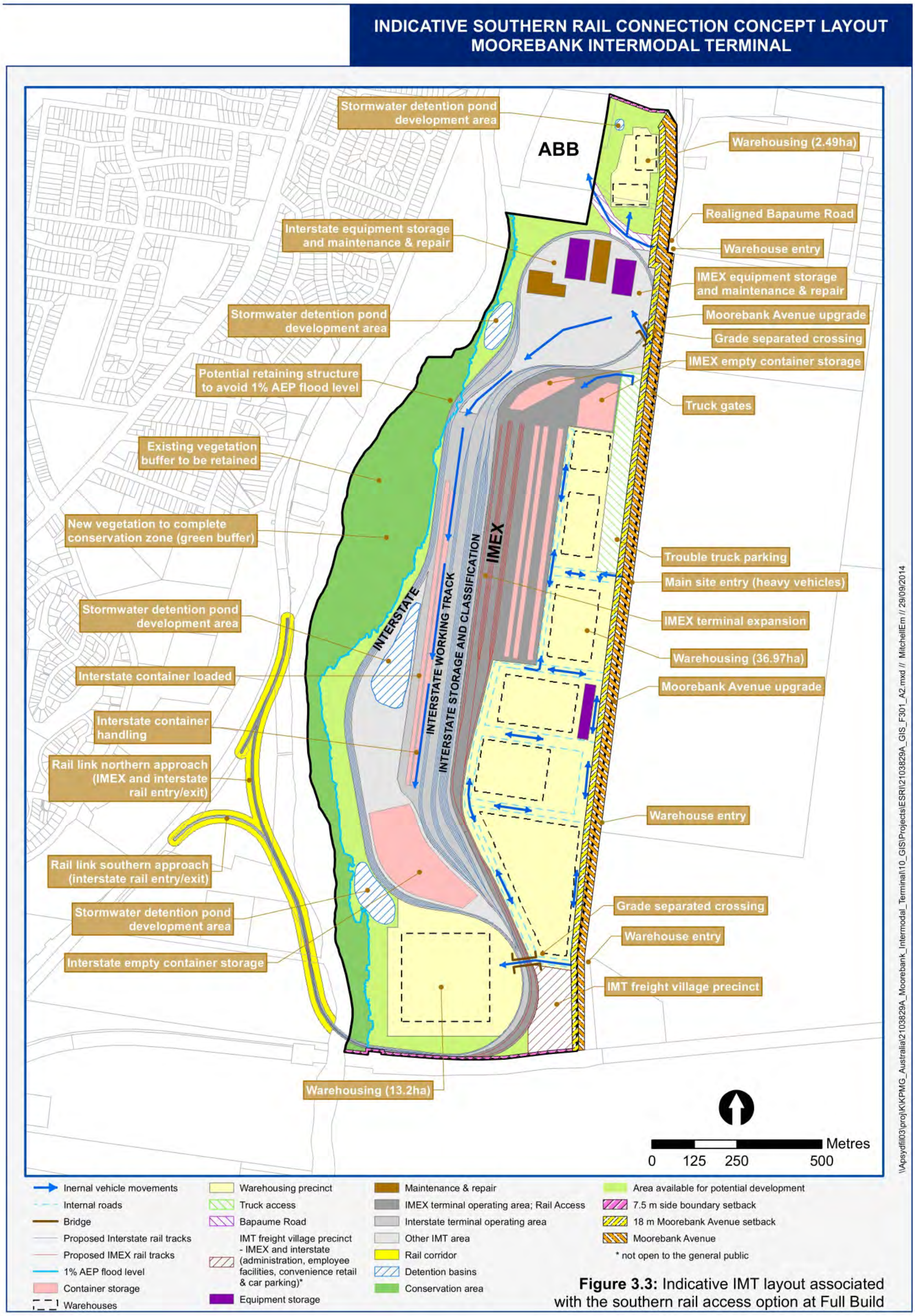


Figure 3.3: Indicative IMT layout associated with the southern rail access option at Full Build

3.1.2 Road access to the Project site

Road access to the Project site would be via new access points on Moorebank Avenue, with entering traffic segregated according to vehicle type and destination within the terminal (refer to Figure 3.4). Trucks travelling to and from the Moorebank IMT site would access Moorebank Avenue via the M5 Motorway. All proposed road connections from the Moorebank IMT onto Moorebank Avenue would be within the Project site.

The existing Moorebank Avenue and Anzac Road intersection would be upgraded to include the realignment of Bapaume Road to create a four way signalised intersection.

The internal road layout for the IMEX terminal includes:

- a main entrance (main IMT access gate) for heavy vehicles associated with IMEX, interstate and warehouse traffic – the possible locations for this are shown in Figure 3.1 to Figure 3.3);
- a separate entrance for light vehicles, primarily administrative and maintenance staff vehicles, which would also be designed to permit emergency vehicle access and movement of heavy vehicles as a secondary access, should the main IMT access gate be unable to be used);
- trouble truck parking – a truck parking and holding area to accommodate up to 25 trucks, to accommodate trucks while investigating instances where inbound over the road (OTR) heavy vehicles are not validated by the optical character recognition; and to serve as a turnaround facility for trucks that arrive early and need to wait for their allocated container collection time slot;
- access and egress for emergency service vehicles; and
- warehouse access roads – an internal road system would run adjacent to the warehouse precinct, providing access to the warehouses for heavy vehicles (separate from light vehicles) and inter terminal vehicles ITVs (which would access the warehouse road via an express gate and would use the warehouse access road for direct container transfer between the terminal and warehouses). This section of internal road may also, when needed, provide additional layover areas for OTR vehicles in addition to the trouble truck parking area.

The potential future intersection layouts have been developed using traffic modelling to ensure that adequate capacity is provided in the design. The traffic analysis information is provided in section 6.

Past the main entrance, heavy vehicle movements would be segregated from light vehicle movements. The approach road to the main IMT access gate and movement through the terminal area, have also be designed to segregate OTR vehicles from IMT plant and equipment as much as possible.

For the central and southern rail access IMT layouts, a grade separated crossing over the IMEX and interstate rail track would be developed at the south of the Project site to provide access to the warehousing precinct in the south-western corner. A grade separated crossing is required for safety reasons due to the expected frequency of IMEX trains. In addition, the IMT layout associated with the southern rail access option requires an additional grade separated crossing at the northern end of the Project site, to provide road access over the interstate arrival/departure tracks.

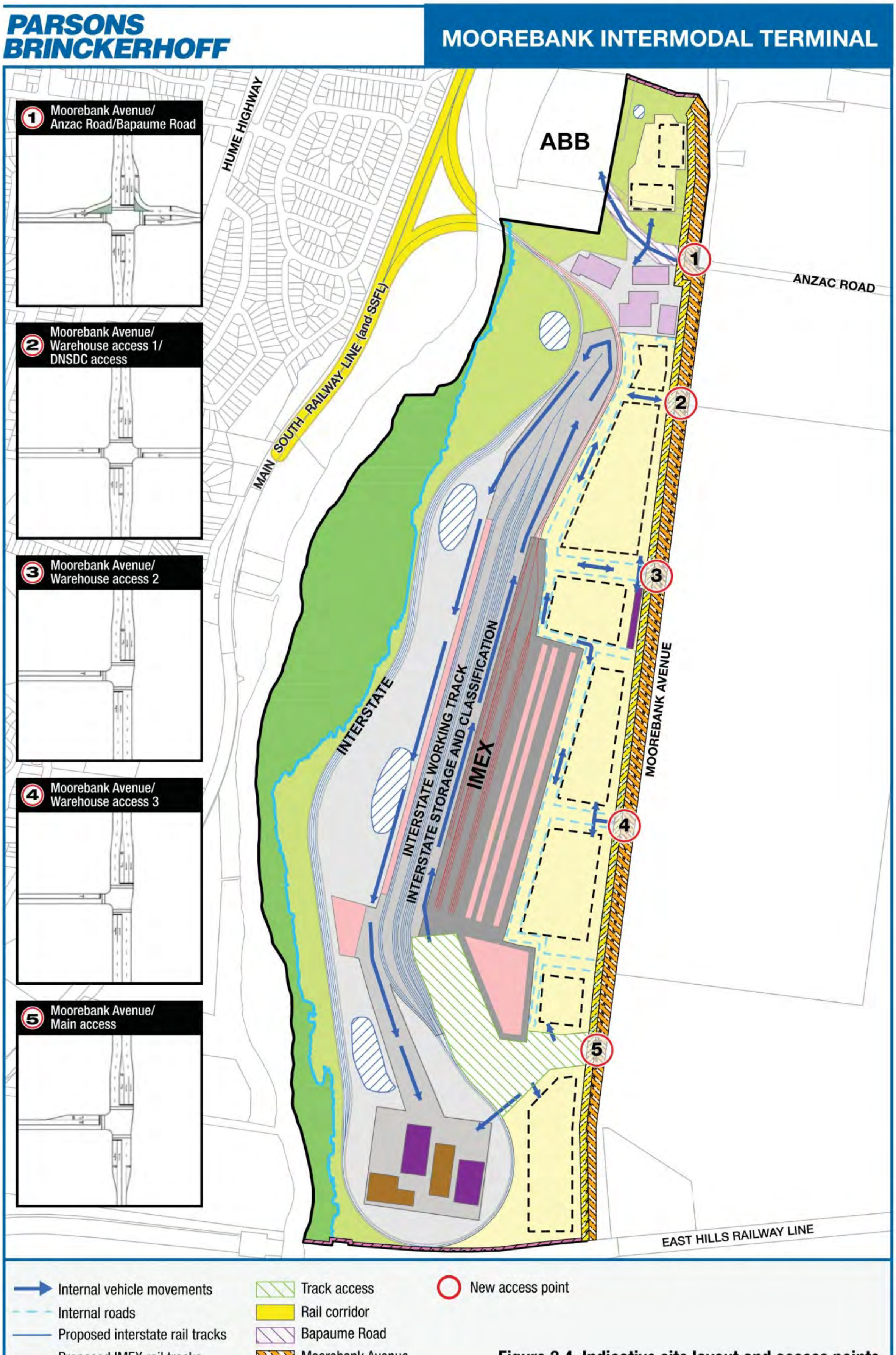


Figure 3.4 Indicative site layout and access points

3.1.3 Moorebank Avenue upgrades

Existing (2014) intersection performances indicate that intersections along Moorebank Avenue between Cambridge Avenue and the M5 are performing near or at capacity at present. Future year background traffic growth on Moorebank Avenue as discussed further in section 6.1, would lead to increased traffic volumes on Moorebank Avenue and further deteriorating intersection performance. Intersection and roadway capacity will worsen and hence the need for an upgrade of Moorebank Avenue. The Moorebank Avenue upgrade would be required purely on background traffic growth alone based on existing intersection operation and vehicle movements.

Moorebank Avenue is proposed to be upgraded to a four lane divided roadway from the M5 interchange to the southernmost entry to the Moorebank IMT. Five new intersections are proposed to provide access to the Moorebank IMT site and the existing intersection at Anzac Road will be retained with the realignment of Bapaume Road included to create a four way signalised intersection. All intersections would be traffic signal controlled with indented right and left turn lanes as required. Generally pedestrian footpaths or shared paths are proposed on both sides of the road with signalised pedestrian crossings at the intersections.

As the DNSDC will have completed relocation to its new site by early 2015, traffic volumes into and out of the old DNSDC access has been reallocated to the new DNSDC access for the future with Moorebank Avenue upgrade scenarios.

The proposed intersection layouts are provided in Figure 3.5 to Figure 3.9 below including warehouse access and main access intersections to the Project site for the northern rail option.

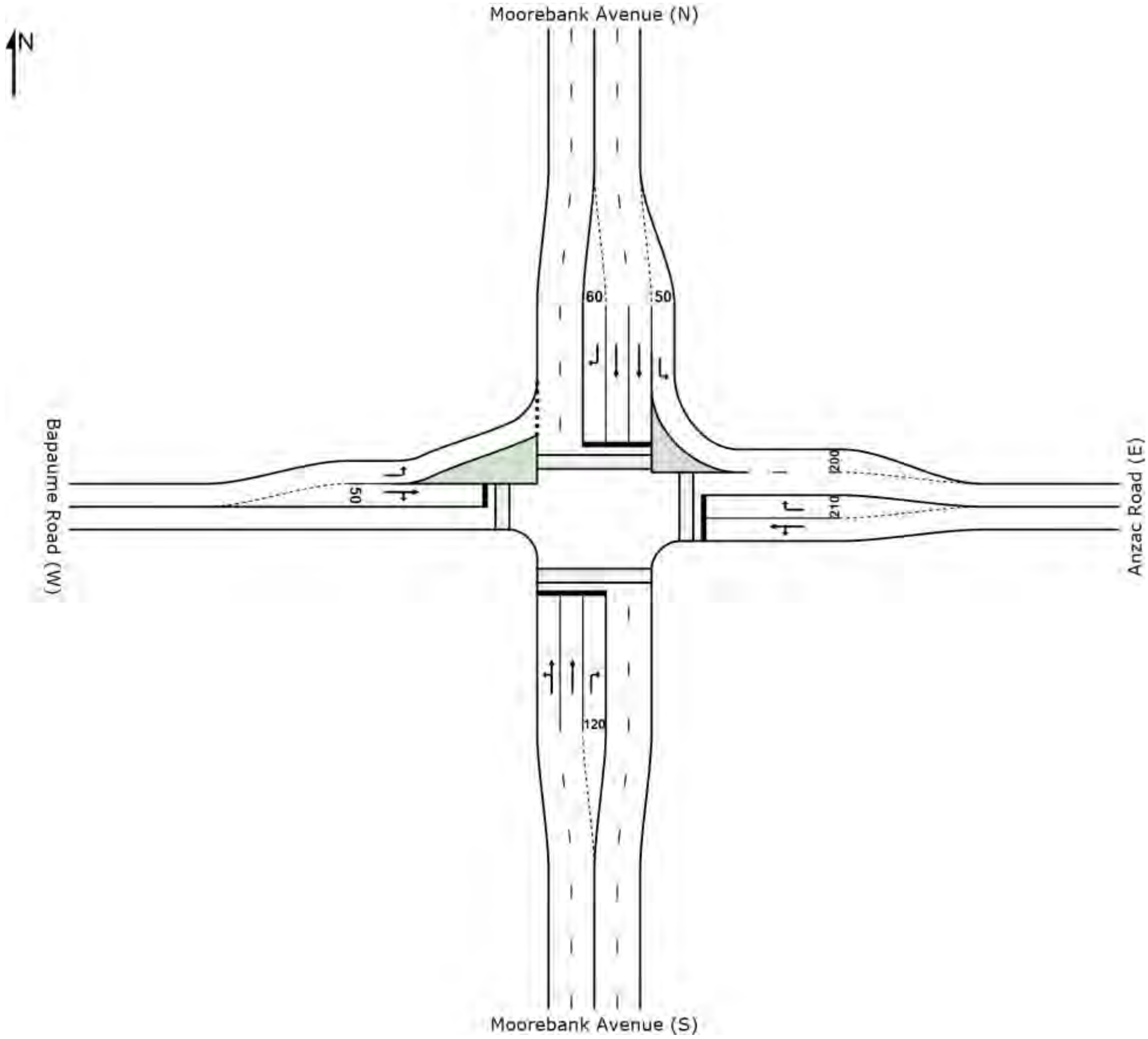


Figure 3.5 Proposed Moorebank Avenue, Anzac Road and Bapaume Road intersection

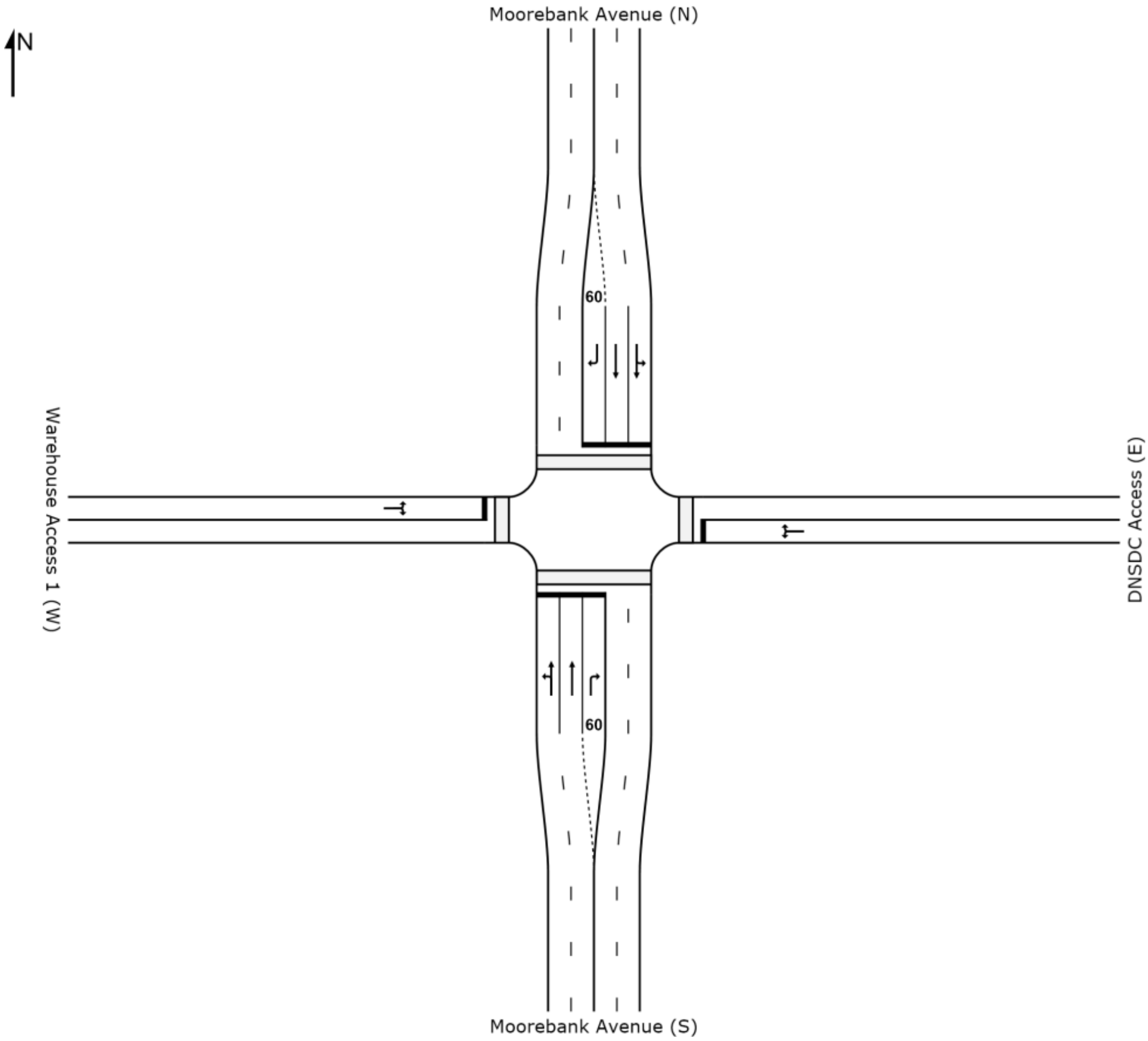


Figure 3.6 Proposed Moorebank Avenue and Warehouse Access 1 intersection

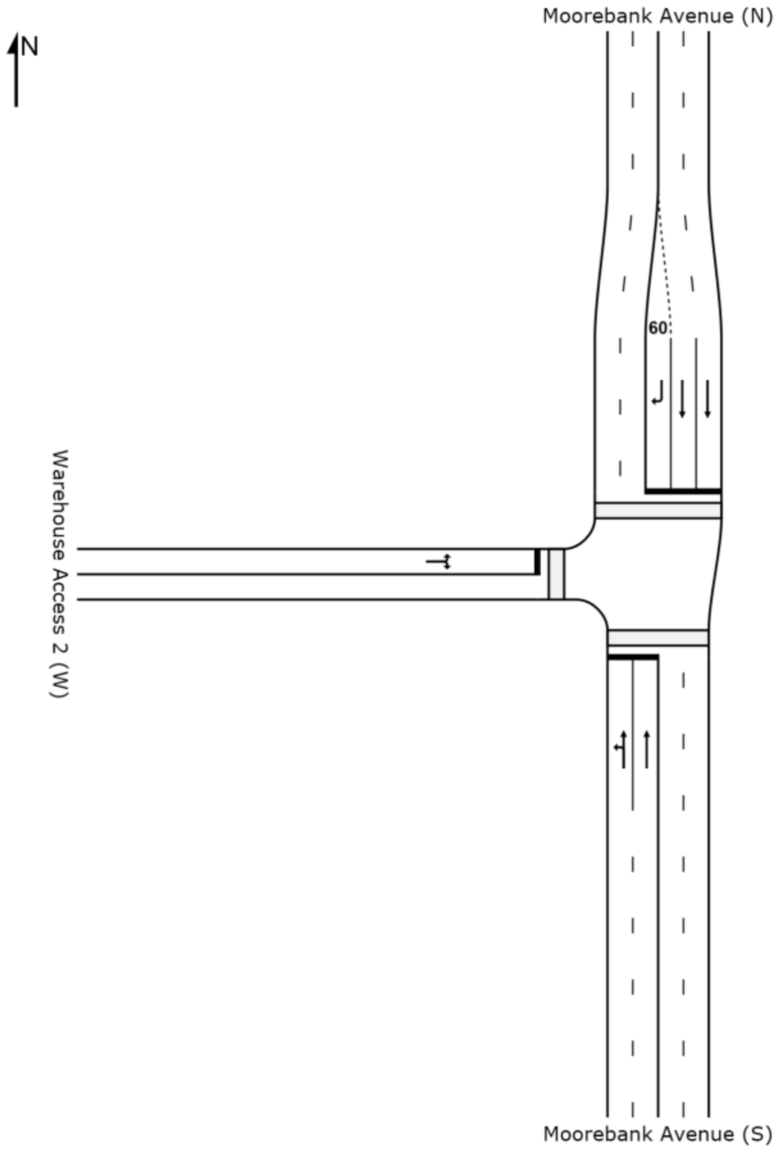


Figure 3.7 Proposed Moorebank Avenue and Warehouse Access 2 intersection

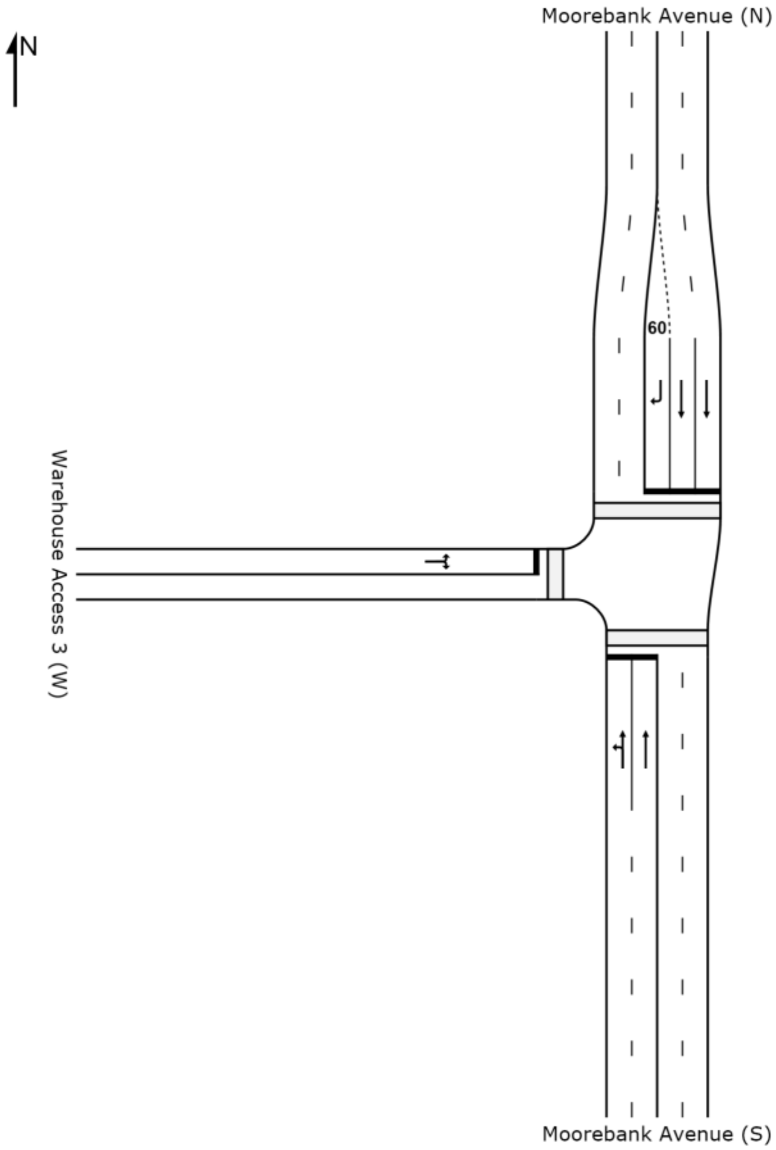


Figure 3.8 Proposed Moorebank Avenue and Warehouse Access 3 intersection

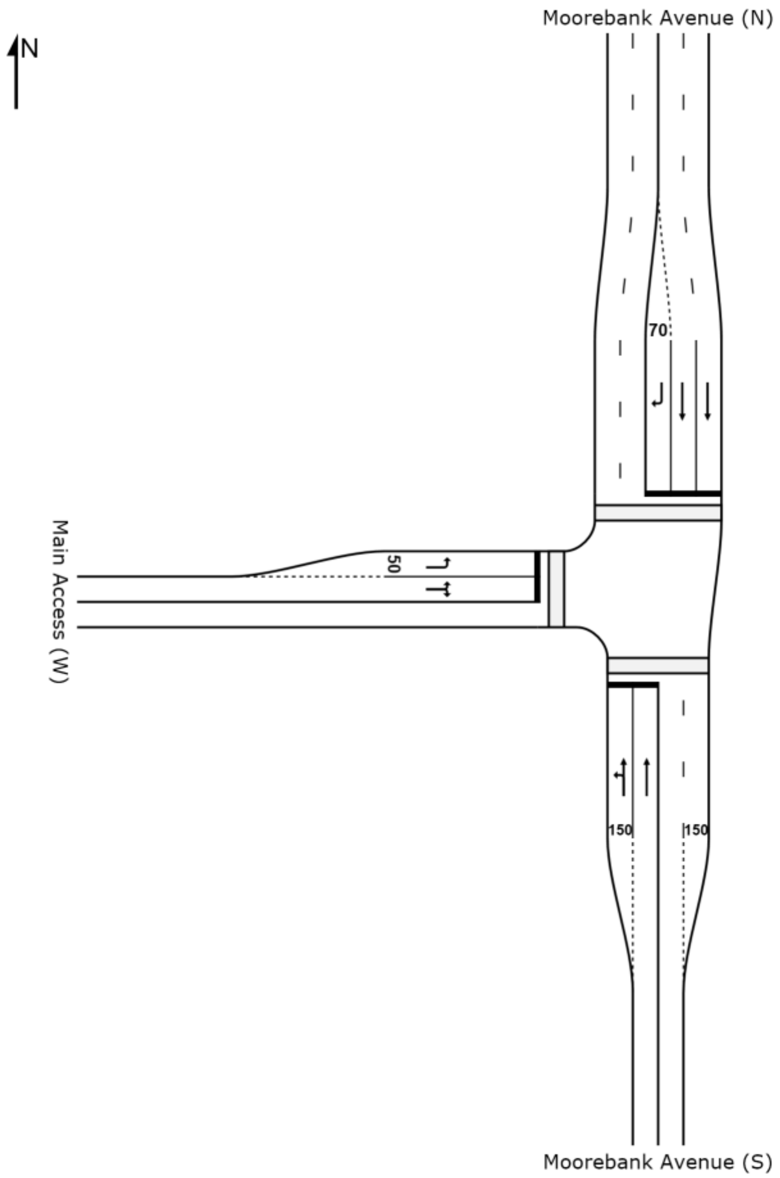


Figure 3.9 Proposed Moorebank Avenue and Main Access intersection

3.1.4 Cambridge Avenue

The Moorebank IMT facility will not generate any heavy vehicles travelling to or from Cambridge Avenue. All heavy vehicle movement will be to and from the north along Moorebank Avenue to access the state road network. There are forecast to be some Moorebank IMT light vehicle movement to and from Cambridge Avenue which equates to 30% of light vehicle traffic generated by the facility. The greatest amount of light vehicle traffic to and from Cambridge Avenue would be up to 74 light vehicles (one-way peak hour flow) in the year 2023 (which includes operational and construction traffic) and is expected to reduce to 24 light vehicles (one-way peak hour flow) in the year 2030 (operational traffic only at full build). This increase in light vehicle volumes is minimal and would not impact on Cambridge Avenue road capacity into the future; hence there is no requirement for the project to upgrade Cambridge Avenue.

3.1.5 Staff parking

All staff parking for IMEX, interstate, warehouse and commercial operations would be provided within the Project site at dedicated parking areas. The concept design has provided warehouse IMEX and interstate parking at the northern end of the Project site, to be accessed via the re-aligned Bapaume Road.

The number of parking spaces proposed has been based on LCC *Development Control Plan 2008 Part 1.2 Additional General Controls for Development* (LCC, 2008) for industrial land use. This requires a greater number of parking spaces when compared to the RMS *Guide to Traffic Generating Developments.*

3.1.6 Bus services

The Project site will be designed to accommodate for potential regular bus or shuttle bus services internal to the site. Site access at intersections and adequate turnaround facility will be provided should these services occur. Ideally the provision of bus services and bus stop facilities on Moorebank Avenue adjacent to the Project site would be preferred.

3.1.7 Pedestrian and cyclist facilities

To accommodate the increase in background traffic and the Moorebank IMT development, 4.3 m borders are included on both sides of Moorebank Avenue in the road reserve cross-section. A border is the distance between the right–of–way and the property boundary. The width is based on an arterial road standard allowance as per Austroads 2009, *Guide to Road Design Part 3: Geometric Design*. The 4.3 m border would accommodate the proposed footpath/shared use path.

The majority of kerbside lanes are designed to be 4.5 m wide to accommodate cyclists and vehicles in the same lane in accordance with Austroads 2009*, Guide to Road Design Part 3: Geometric Design*.

3.1.8 Indicative Project development phasing

The Project is proposed to be phased (staged) in its development, as summarised in Figure 3.10. The proposed indicative phasing includes both construction and operational phases, which are likely to overlap at certain times. For the purposes of assessment of the Project, five project development phases have been identified and modelled for traffic impact in this EIS. These are indicative only, but illustrate the type of construction and operation activities that could occur over time at the Project site.

The Project would likely commence in 2015 with the Early Works development phase and would progress with concurrent construction and operation through to the Project Full Build Phase (operation of full IMEX terminal, warehousing and interstate terminal) by approximately 2030.

The development phasing is proposed in line with the forecast market demand for processing of containers through the Project. The staging of the Project in relation to areas to be developed in each stage is shown in Figure 3.10.

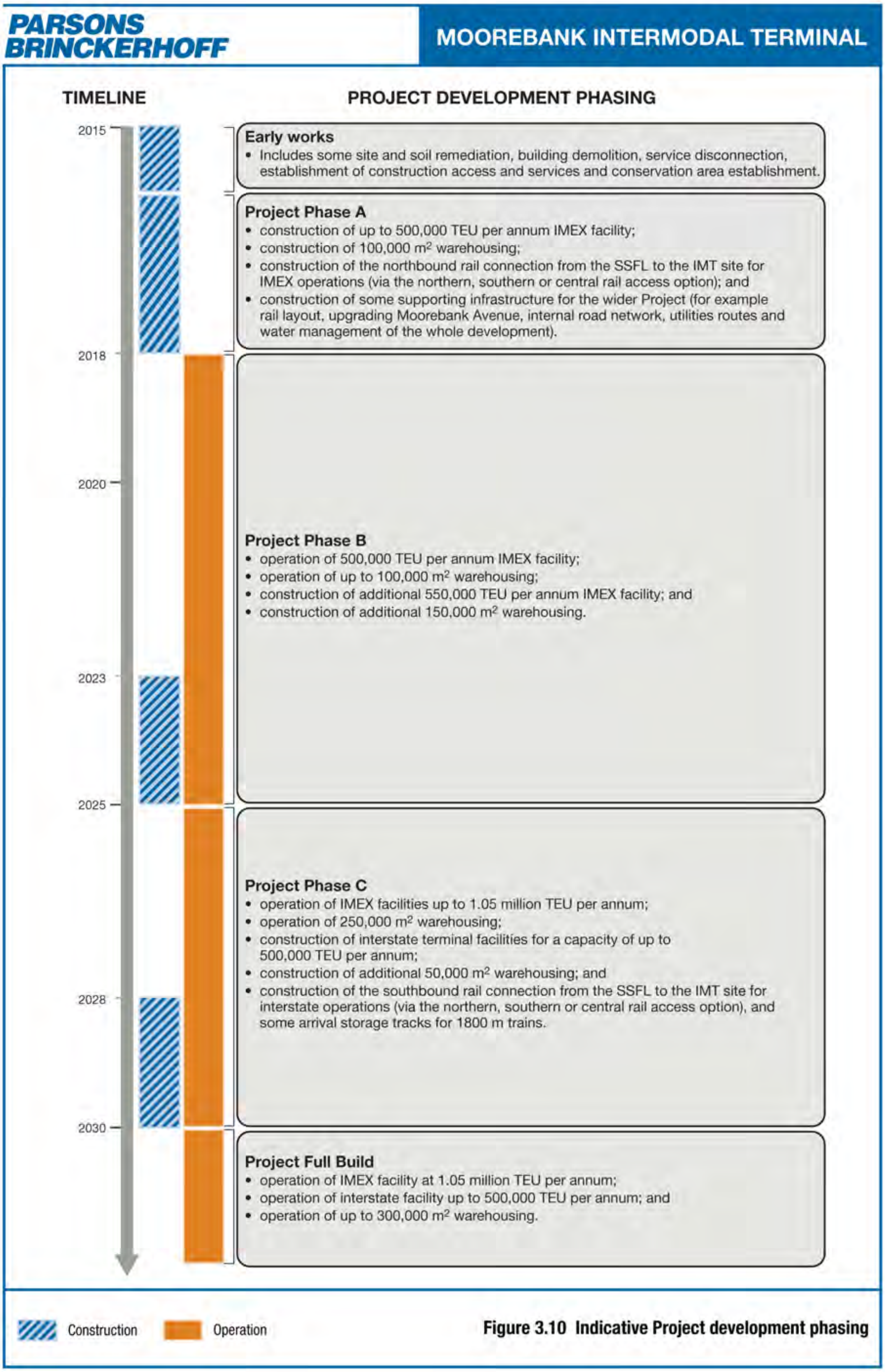


Figure 3.10 Indicative Project development phasing

This traffic impact assessment analyses the following development years as detailed in Table 3.1.

Table 3.1 Development years for traffic impact assessment

Stage	Year	Description
Early Works	2015	Construction activity generated by remedial earthworks and demolition of site buildings.
Phase A	2016	Peak construction activity occurring for Phase A generated by spoil removal and the upgrade of Moorebank Avenue (and associated intersections).
Phase B	2023	500,000 TEU per annum IMEX and 100,000 m^2 warehousing at full capacity (16 hour truck gate operation). Peak construction activity occurring for Phase B, generated by the remainder of construction for IMEX and construction of 150,000 m^2 warehousing.
Phase C	2028	1.05 million TEU IMEX and 250,000 m^2 of warehouse developments operating at full capacity (16 hour truck gate operation). Traffic generated by the construction of interstate (Phase C).
Full Build	2030	Moorebank IMT at full operation including 300,000 m^2 of warehousing. 24 hour truck gate operation for IMEX and interstate.

Information on traffic generation and analysis is provided in section 4 and section 6.

4. Traffic generation

This section outlines the forecast traffic generation from the developments on the Project site and traffic generation rates from alternate land uses for comparison purposes. This includes the operation and construction phases for the IMEX, interstate and the warehouse developments. The assumptions behind these calculations are provided in this section.

The RMS *Guide to Traffic Generating Developments, technical direction TDT 2013/04 Traffic Surveys* (May 2013) has been considered in accordance with the Environmental Assessment Requirements (EARs). The use of more recent or appropriate data is discussed as appropriate.

In general, the traffic generated by the Moorebank IMT development will include:

- construction trucks and staff movements;
- IMEX and interstate truck and staff movements; and
- warehousing truck and staff movements.

It was assumed there would be no significant commercial vehicle traffic generated by this development as the freight associated with this terminal would be transported to and from the Project site as pallets or containers on trucks.

4.1 Construction

The construction vehicle volumes are based on an indicative construction schedule and the estimated volume of material to be shifted during the various stages of construction. The maximum traffic generator for the Project site is the removal of spoil and delivery of fill. These volumes may differ to the eventual volume experienced by the Project site depending on the capacity of machinery used.

Heavy vehicle movements generated by construction activities were assumed to be consistent throughout the hours of construction during the day, with 25% of the hourly heavy vehicle volume arriving just before and after construction start and finish each day to align with construction working hours.

The number of construction staff onsite was determined according to the indicative construction schedule. It was assumed that 90% of staff would drive to work, where:

- 80% of workers arrive before morning peak hour and leave after the afternoon peak hour;
- 20% of workers arrive during the morning peak hour and leave during the afternoon peak hour;
- 50% of workers leave the Project site and return in the middle of the day; and
- Each staff member will generate three light vehicle trips a day on average.

Hours of construction are assumed as follows:

- Monday to Friday – 7.00 am to 6.00 pm.
- Saturday – 8.00 am to 3.00 pm.
- No work will be undertaken on Sundays or public holidays.

Based on the construction schedule and the volume of material, the assumed maximum daily volume of construction vehicle trips calculated for each stage is shown in Table 4.1.

Table 4.1 Construction vehicle volumes

Stage	Daily vehicle movements		Peak hourly vehicle movements	
	Cars	HV	Cars	HV
Early Works (2015)	810	64	54	10
Phase A (2016)	2906	1930	194	210
Phase B (2023)	3337	1944	222	212
Phase C (2028)	1280	394	85	42

4.2 Operations

4.2.1 Intermodal terminal traffic generation – IMEX and Interstate facilities

The train and traffic generation of the Moorebank IMT was sourced from the *Moorebank Intermodal Terminal Demand Estimate Summary – Trip Generation Modelling* (Deloitte April 2014), based on the annual TEU forecast freight movements for the IMEX and interstate facilities.

Traffic generation rates for the Moorebank IMT are described in greater detail in the Moorebank Intermodal Company, EIS – Supporting Information, 18 September 2014 Final as prepared by Deloitte. This document is provided in Appendix K of this report. It should be noted that the traffic generation rates for the Moorebank IMT are continually being updated as the operational characteristics of the terminal develop; this has resulted in a small discrepancy between the traffic figures in the Deloitte report and this report. The traffic volumes analysed in this report represent a conservative approach as they are slightly higher than the most recent traffic generation rates in the Deloitte report.

Train generation

Deloitte demand modelling estimated that IMEX would have a capacity of approximately 1.05 million TEU per annum split between imports and exports (approximately 525,000 TEU in/525,000 TEU out) in 2030. As a result of this demand, IMEX would generate approximately 273 train trips per week with the IMEX facility operating 24 hours 7 days a week. The forecast TEU is comprised of the following:

- 52.3% import, TEU
- 16.5% export TEU
- 31.2% empty TEU.

The demand model estimated that interstate would cater for around 500,000 TEU per annum by 2030, (approximately 30 train trips per week with the interstate facility operating 24 hours 7 days a week) where freight is received or handled prior to distribution outside the Sydney metropolitan region. Of this around 406,000 TEU were assumed to be associated with truck movements to and from the Moorebank IMT.

4.2.1.1 Derivation of truck numbers from TEU demand

The forecast train movements and their container loading will result in the generation of truck demand to transport those containers. Deloitte derived the relationship between TEU demand and truck movements in and out of the Moorebank IMT based on the following process:

Approach to estimating daily truck trips generated from Moorebank IMT

In order to estimate the daily heavy vehicles generated from the Moorebank IMT, the forecast container volumes for the terminal at 2030 were derived. These estimates were broken down into three categories for containers both arriving and departing the Project site by rail:

- Full container load (FCL) movements arriving or departing the terminal by rail and moving directly offsite or onsite by road.
- FCLs moving within the Project site between the rail terminal and associated warehousing with all cargo arriving or leaving the warehouses by truck as deconsolidated or palletised cargo.
- Empty (MT) containers.

Warehouse related FCLs were further broken down equally into two segments: Freight all kinds (FAK) to be deconsolidated and delivered; and inventory, which was assumed to be held in the warehouse for a period prior to delivery. It has been assumed that FCLs and MTs would leave the Project site on a combination of semi-trailers and B-doubles whilst FAK and Inventory would leave the Project site on a mix of semi-trailers and rigid trucks.

Consultation with Roads and Maritime Services (RMS)

Two sessions were undertaken in February and April 2014, with representatives from the RMS - Network Optimisation and Road Network Analysis team to review both the approach and results. The RMS undertook its own analysis based on the underlying demand volumes and assumptions as documented and reached very similar outcomes.

2030 Traffic – IMEX and Interstate

The terminal is anticipated to handle 500,000 TEU of interstate and close to 1.05 m TEU of IMEX throughput when it reaches full capacity. For the purposes of investigating the full capabilities of the IMEX and Interstate terminals, it is assumed that these terminals and the warehouses will be operating at full capacity in 2030.

The following steps were taken to derive the daily truck movements in and out of Moorebank IMT:

1. Of the 1.546 m TEU expected to be handled through the terminal in 2030, the breakdown between IMEX and interstate is:

   1,546,000 TEU = 1,046,000 IMEX TEU + 500,000 interstate TEU

2. Of the 1.046 m IMEX TEU handled, the breakdown between full imports, full exports and empty containers is:

   1,046,000 TEU = 547,000 full import TEU + 173,000 full export TEU + 326,000 empty TEU

3. Of the 500,000 Interstate TEU handled, the proportion not unloaded from the inbound train and the proportion unloaded from the train, to be transported via the road network are:

   500,000 TEU = 406,000 TEU via the road network + 94,000 TEU not transferred to the terminal

4. Of the 406,000 m Interstate TEU to be transported via the road network, the breakdown between full inbound, full outbound and empty containers is:

   406,000 TEU = 149,000 full inbound TEU + 149,000 full outbound TEU + 108,000 empty TEU

   This leads to a new total of:

   1,452,000 TEU by road = 1,046,000 IMEX TEU + 406,000 Interstate TEU

5. Of the 1.452 m total TEU by road in 2030, the breakdown between containers leaving the Project site by road and containers arriving at the Project site by road are as follows:

   1,452,000 TEU = 702,000 inbound TEU + 750,000 outbound TEU

6. Of the 702,000 TEU containers arriving at the Project site by road the breakdown between loaded and empty containers is as follows:

   702,000 TEU = 321,500 loaded TEU + 380,500 empty TEU

7. Of the 750,000 TEU containers leaving the Project site by road the breakdown between loaded and empty containers is as follows:

   750,000 TEU = 695,500 loaded TEU + 54,500 empty TEU

8. It was assumed that 80% of the loaded combined TEU would move to and from the Project site as containers and 20% of the loaded combined TEU would move through the onsite warehousing. The empty containers were all assumed to move directly to and from the Project site:

   321,500 loaded TEU inbound = (321,500 x 80% direct to the Project site) + (321,500 x 20% to onsite warehousing)

   = 257,200 loaded TEU direct + 64,400 TEU via warehouses

   695,500 loaded TEU outbound = (695,500 x 80% direct from the Project site) + (695,500 x 20% from onsite warehousing)

   = 556,400 loaded TEU direct + 139,200 TEU via warehouses

   435,000 empty TEU inbound and outbound = 380,500 empty TEU inbound + 54,500 empty TEU outbound

9. As outlined above it was assumed that all of the empty containers and 80% of the loaded total TEU would move off the Project site as containers. The 20% going via warehouses was split equally resulting in 10% going to warehousing onsite for destuffing (FAK) and direct delivery and 10% going to warehousing for destuffing and placement into inventory for later delivery.

   1,249,000 Direct TEU = 435,000 empty TEU + 257,200 loaded direct into terminal + 556,400 loaded TEU direct out of terminal

   203,400 TEU via warehouses = 139,200 TEU out of warehouses + 64,400 TEU into warehouses = (139,200 x 50% FAK) + (139,200 x 50% Inventory) + (64,400 x 50% FAK) + (64,400 x 50% Inventory)
   = (69,600 FAK and 69,600 Inv) leaving the Project site from warehouses + (32,200 FAK and 32,200 Inv) arriving at Project site warehouses
   = 102,000 TEU to and from the warehouses and 102,000 TEU inventory

10. This can be further summarised into the total number of IMEX and Interstate TEU (1.452 m) split into total FCL Direct (1.249 m) and total TEU via the warehousing onsite (0.204 m):

    1,452,000 TEU = 1,249,000 containers direct to/from customers + 102,000 FAK TEU + 102,000 Inventory TEU

Direct FCL and empty container movements by road

1. The demand analysis has determined likely future demand for both IMEX and interstate markets where Sydney is either an origin or a destination. For the purposes of simplification all international and interstate cargo destined for the Sydney market is referred to in the following as imports – all international and interstate cargo leaving the Sydney market is referred to as exports.

   610,900 TEU leaving the Project site by road (imports) = 556,400 full import TEU + 54,400 empty import TEU
   637,700 TEU arriving at the Project site by road (exports) = 257,200 full export TEU + 380,500 empty export TEU

2. It is assumed that the terminal would be operational 52 weeks per year.

   11,748 TEU leaving the IMT by road per week = 610,900 import TEU ÷ 52
   12,263 TEU arriving at the IMT by road per week = 637,700 export TEU ÷ 52

3. It was assumed that trucks moving containers in and out of Moorebank IMT will comprise 80% semi-trailers and 20% B-Doubles based on similar intermodal operations:

   Semi-Trailer TEU (80% of TEU arriving at or leaving the terminal):

   9,398 TEU out on a Semi = 11,748 TEU x 80%
   9,810 TEU in on a Semi = 12,263 TEU x 80%

   B-Double TEU (20% of TEU arriving at or leaving the terminal):

   2,350 TEU out on a B-Double = 11,748 TEU x 20%
   2,453 TEU in on a B-Double = 12,263 TEU x 20%

4. Each Semi-Trailer truck is assumed to have the capacity to carry 2 TEU with an utilisation of 80% on average resulting in an average 1.6 TEU per Semi-Trailer truck. B-double trucks will have the capacity to carry 3 TEU, and with an average utilisation of 80% the resulting average TEU per B-Double truck is 2.4. Using these factors, the weekly total loaded truck movements can be derived.

   5,874 Semis out of terminal per week = 9,398 TEU out on a Semi ÷ 1.6 TEU per Semi

   6,132 Semis into terminal per week = 9,810 TEU in on a Semi ÷ 1.6 TEU per Semi

   979 B-Doubles out of terminal per week = 2,350 TEU out on B-Double ÷ 2.4 TEU per B-Double

   1,022 B-Doubles into terminal per week = 2,453 TEU in on B-Double ÷ 2.4 TEU per B-Double

5. In addition, each outbound movements outlined above will also generate an inbound movement. It is assumed that some load matching would occur, i.e. rather than every truck having to do an empty return journey to its origin, a portion of the journeys could be loaded both ways. For example, some outbound full import movements could be matched with full export or empty containers inbound, the remainder of the trucks would arrive empty. It was assumed that this load matching would be limited to only 30% of loaded semi-trailer truck movements (generated off the direction with the more significant volume). The 30% load matching has been advised by freight logistics specialists in Deloitte and the same load matching factor was adopted by the SIMTA Traffic and Transport Assessment prepared by Hyder Consulting. There is currently no intermodal terminals in Australia of the nature and scale proposed at the Project site to use as a reference. However, the load matching being achieved at the Fremantle Ports precinct (incorporating empty container park facilities and warehousing) which was 43% in 2013, an increase from 39% in 2012 (Fremantle Ports, July 2014). It is therefore considered that the 30% load matching is a realistic estimate for the Moorebank IMT. All other movements would generate an empty running leg into or out of the terminal.

   To generate the empty running trips for each truck type:

   Empty running trips in = loaded trips out X (1 – % load matching factor):
   4,112 semis empty into terminal per week = 5,874 loaded semis outbound X (1 - 30% matched loads)
   979 B-Doubles empty into terminal per week = 979 loaded B-Doubles outbound X (1 - 0% matched loads)

   Empty running trips out = loaded trips in – (loaded trips out – empty running trips in):

   4,369 semis empty out of terminal = 6,132 loaded semis inbound - (5,874 loaded semis outbound – 4,112 empty semis inbound)

   1,022 B-Doubles empty out of terminal per week = 1,022 loaded B-Doubles inbound - (979 loaded B-Doubles outbound – 979 empty B-Doubles inbound)

   By adding the total inbound and outbound movements the total truck movements can be estimated. To generate total number of trips for each truck type:

   Total trips per week = loaded trips out + empty trips out + loaded trips in + empty trips in

   Total B-Double movements = 979 loads out + 1,022 empty out + 1,022 loads in + 979 empty in
   = 2,001 trips out + 2,001 trips in
   = 4,002 trips

   Total semi movements = 5,874 loads out + 4,369 empty out + 6,132 loads in + 4,112 empty in
   = 10,243 trips out + 10,243 trips in
   = 20,487 trips

6. It was then assumed that 85% of container truck movements would occur on weekdays and 15% would occur on weekends based on current profiles at Port Botany. The proportion on weekdays was then divided by 5 to reach an average number of truck moves per weekday, assuming two truck movements per truck trip.

   (4,002 B-Double trips per week X 85%) ÷ 5 = 680 B-Double movements per weekday
   (20,487 semi trips per week X 85%) ÷ 5 = 3,483 Semi movements per weekday

Total inbound and outbound moves per weekday for 2030 is summarised in Table 4.2.

Table 4.2 Moorebank terminal daily truck movements

Truck status	Direction	Truck type	2030
IMEX			
Loaded	Inbound	B-double	127
		Semi	759
	Outbound	B-double	119
		Semi	715
Empty	Inbound	B-double	121
		Semi	509
	Outbound	B-double	124
		Semi	532
Total	Inbound	B-double	248
		Semi	1268
	Outbound	B-double	244
		Semi	1247
Interstate			
Loaded	Inbound	B-double	47
		Semi	283
	Outbound	B-double	47
		Semi	283
Empty	Inbound	B-double	45
		Semi	190
	Outbound	B-double	49
		Semi	211
Total	Inbound	B-double	92
		Semi	473
	Outbound	B-double	96
		Semi	494

Source: Moorebank Intermodal Terminal Trip Generation Estimate, Version 9, 28 April 2014 (Deloitte)

7. Daily truck volumes were multiplied by 4.2% to generate indicative peak hourly truck volumes for each vehicle class, both inbound and outbound. The peak hourly proportion of 4.2% is one 24th of the daily value. While the daily hours of operation may be less than 24, 4.2% is used because there is an expectation that there would be a desire to avoid peak hour congestion so the proportion of truck activity during peak hours would reduce. This approach was agreed with RMS and FBTS in March 2014.

   Average trucks per weekday in each direction x 4.2% = trucks on and off site per hour in AM peak:

   340 B-Double movements per weekday x 4.2% = 14 B-Double truck movements in AM peak hour in each direction
   1,741 Semi movements per weekday x 4.2% = 73 Semi truck movements in AM peak hour in each direction

Table 4.3 Moorebank terminal peak hour truck movements

Facility	Direction	Truck type	2030
IMEX	Inbound	B-double	10
		Semi	53
	Outbound	B-double	10
		Semi	52
Interstate	Inbound	B-double	4
		Semi	20
	Outbound	B-double	4
		Semi	21
Total	Inbound	B-double	87
		Semi	
	Outbound	B-double	87
		Semi	

Source: Moorebank Intermodal Terminal Trip Generation Estimate, Version 9, 28 April 2014 (Deloitte)

The arrival of trucks to the terminal would be controlled by a booking system managed by the terminal operators. The proposed booking system is assumed to have a similar operation to that used by Port Botany. This tends to create an even arrival profile of trucks collecting and delivering containers throughout the day. Trucks that arrive early to the terminal may be required to wait on the internal Project site service road. No parking of trucks would be permitted on Moorebank Avenue.

4.2.2 Warehouse traffic generation

The total proposed warehouse GFA as part of the concept plan is approximately 308,000 m^2. It is proposed that this would be separated into eight warehousing zones.

Warehouse generated truck traffic movements were estimated using a similar methodology to the derivation of container truck movements through the IMEX and Interstate operations, with some variation to the underlying assumptions. The most significant changes to the assumptions were:

- the makeup of the fleet
- the proportion of movements occurring during the week
- the level of load matching.

The following steps were taken to derive the daily truck movements in and out of Moorebank IMT for cargo handled through the warehouses:

1. The Moorebank IMT will have enough on-site warehousing capacity to handle approximately 20% of all full TEU. It is assumed that half of these will be held in inventory in onsite warehousing for a period of weeks with the rest being general cargo (FAK) which would be deconsolidated and distributed offsite within a few days or arrive onsite for consolidation and export.

   69,600 TEU FAK for distribution from the Project site = 695,500 full inbound TEU x 10% FAK
   69,600 TEU Inventory for distribution from the Project site = 695,500 full inbound TEU x 10% Inventory
   32,200 TEU FAK arriving at the Project site for consolidation = 321,500 full outbound TEU x 10% FAK

32,200 TEU Inventory arriving at the Project site for consolidation = 321,500 full outbound TEU x 10% Inventory

2. It is assumed that the terminal would be operational 52 weeks per year.

   2,675 TEU into warehouse and distributed off site each week = 69,600 FAK + 69,600 Inventory TEU ÷ 52
   1,237 TEU arrive onto the Project site and into warehouse each week = 32,200 FAK + 32,200 Inventory TEU ÷ 52

3. It is assumed that each TEU, when deconsolidated will generate approximately 25 pallet loads for domestic distribution:

   66,879 equivalent pallet loads into warehouse and distributed off site by road each week = 2,675 TEU x 25 equivalent pallet loads per TEU

   30,917 equivalent pallet loads into warehouse by road and railed offsite each week = 1,237 x 25 equivalent pallet loads per TEU

4. The truck fleet profile for palletised cargo would be different to that for direct FCL and MT container movements to and from the Moorebank terminal. It is assumed that trucks moving pallets out of Moorebank IMT warehousing will comprise of 34% semi-trailers and 66% rigid trucks whilst 100% of the palletised cargo arriving at the Project site will be carried by rigid trucks:

   Deliveries from Moorebank warehouses:

   22,739 pallets out on semi-trailer trucks = 66,879 pallets per week x 34%
   44,140 pallets out on rigid trucks = 66,879 pallets per week x 66%

   Deliveries to Moorebank warehouses:

   30,917 pallets in on rigid trucks = 30,917 pallets per week x 100%

5. Semi-trailer trucks are likely to carry, on average 20 pallets per truck whilst rigid trucks have been assumed to carry, on average 8 pallets per load. Dividing the number of pallets by each average load determines the average number of loaded truck movements per week into and out of the warehouses.

   Deliveries from Moorebank warehouses:
   1,137 loaded semi-trailer truck movements out per week = 22,739 pallets in semis per week ÷ 20 pallets per truck
   5,517 loaded rigid truck movements out per week = 44,140 pallets in rigids per week ÷ 8 pallets per truck
   Deliveries to Moorebank warehouses:
   3,865 loaded rigid truck movements in per week = 30,917 pallets in rigids per week ÷ 8 pallets per truck

6. It is assumed that there will be no truck load matching for palletised cargo movement to and from the Moorebank IMT warehouses. Therefore all movements would generate an empty running leg into or out of the terminal. By adding the total inbound and outbound movements the total truck movements can be estimated.

Empty running trips in = loaded trips out X (1 – % load matching factor):

1,137 semis empty into terminal per week = 1,137 loaded semis outbound X (1 - 0% matched loads)
5,517 empty rigids into terminal per week = 5,517 loaded rigids outbound X (1 - 0% matched loads)
3,865 empty rigids out of terminal per week= 3,865 loaded rigids inbound X (1 - 0% matched loads)

By adding the total inbound and outbound movements the total truck movements can be estimated. To generate total number of trips for each truck type:

Total trips per week = loaded trips out + empty trips out + loaded trips in + empty trips in

Total semi movements = 1,137 loads out + 0 empty out + 0 loads in + 1,137 empty in
= 1,137 trips out + 1,137 trips in
= 2,274 trips per week
Total rigid movements = 5,517 loads out + 3,865 empty out + 3,865 loads in + 5,517 empty in
= 9,382 trips out + 9,382 trips in
=18,764 trips per week

7. It was then assumed that 95% of container truck movements would occur on weekdays and 5% would occur on weekends. The proportion on weekdays was then divided by 5 to reach an average number of truck moves per weekday

   432 semi-trailer movements per weekday = (2,274 semi-trailer movements per week X 95%) ÷ 5
   3,565 rigid truck movements per weekday = (18,764 rigid truck movements per week X 95%) ÷ 5

Total inbound and outbound truck movements per weekday for 2030 is summarised in Table 4.4.

Table 4.4 Moorebank warehouse daily truck movements

Truck status	Direction	Truck type	2030
Loaded	Inbound	Semi	0
		Rigid	734
	Outbound	Semi	216
		Rigid	1048
Empty	Inbound	Semi	216
		Rigid	1048
	Outbound	Semi	0
		Rigid	734
Total	Inbound	Semi	216
		Rigid	1783
	Outbound	Semi	216
		Rigid	1783

Source: Moorebank Intermodal Terminal Trip Generation Estimate, Version 9, 28 April 2014 (Deloitte)

8. Daily truck volumes were multiplied by 4.2% to generate indicative peak hourly truck volumes for each vehicle class, both inbound and outbound. The peak hourly proportion of 4.2% is one 24th of the daily value. While the daily hours of operation may be less than 24, 4.2% is used because there is an expectation that there would be a desire to avoid peak hour congestion so the proportion of truck activity during peak hours would reduce. This approach was agreed with RMS and FBTS in March 2014.

   Trucks on and off site per hour in AM peak in each direction = Average trucks per weekday x 4.2%

   9 semi-trailer movements in AM peak hour in each direction = 216 semi movements per weekday x 4.2%

   75 rigid truck movements in AM peak hour in each direction = 1,783 rigid movements per weekday x 4.2%

Table 4.5 Moorebank warehouse peak hour truck movements

Facility	Direction	Truck type	2030
Total	Inbound	Semi	9
		Rigid	75
	Outbound	Semi	9
		Rigid	75

Source: Moorebank Intermodal Terminal Trip Generation Estimate, Version 9, 28 April 2014 (Deloitte)

The shift pattern of the warehouses is expected to follow the terminal operations with a 24 hour operation from 2030.

4.2.3 Staff traffic generation

Staff traffic generation is based on the number of staff for the IMEX and interstate terminals and Warehouses. The number of staff assumed for each facility is provided in Table 4.6.

Table 4.6 Terminal staff numbers

Staff type	IMEX	Interstate	Warehouse[1]	Total daily
Administration	35	35	22	92
Operations (by shift – 3/day)	104	78	496	2,082
Maintenance (by shift – 3/day)	9	7		

Source: Staff numbers based on Moorebank IMT Staffing Requirements – Version 4, August 18, 2011 (Deloitte)

1. Warehouse staffing sourced via RMS Guide to Traffic Generating Developments, 2013

Warehouse staff numbers were estimated using data from the RMS *Guide to Traffic Generating Developments,* 2013 traffic surveys. The total number of staff was calculated using a daily trip rate of 2.1 trips per 100 m^2, assuming approximately 70% of all trips are light vehicle (staff) and an average trip rate of three trips per person per day, assuming 50% of staff would travel offsite and return during the middle of the day:

6,468 vehicle trips per day = 308,000 m2 GFA x 2.1 trips per 100 m2

1509 staff (further broken down into 22 administration staff, 496 operations staff per shift) = 6,468 trips x 70% (light vehicles) ÷ 3 trips per staff

The following assumptions have been made in the calculation of traffic generation for staff vehicles:

- Shift hours would be as follows:
  - administration – 8.30 am to 5.00 pm
  - operations and maintenance:
    - 6.00 am to 2.00 pm
    - 2.00 pm to 10.00 pm
    - 10.00 pm to 6.00 am.
- It is assumed that 90% of the staff for both IMEX and interstate would drive to the Project site. This assumes that 10% of staff may carpool, catch public transport or walk/cycle to the terminal. This is a conservative estimate. There is considerable scope to reduce reliance on car travel further by car share programs and the use of other transport modes such as public transport through the development of work place travel plans/green travel plans.
- All staff would arrive just prior to the start of their shift and depart directly after the shift.
- Traffic generated by interstate staff would commence from the year 2030.
- Traffic generated by IMEX and Warehouse staff in the intermediate years of operation would be based on the proportion of operations active at that time.

Based on the above assumptions, the administration staff would be the only light vehicle generator during both AM (6.45 am to 7.45 am) and PM (5.00 pm to 6.00 pm) peak hours on the road network. This traffic generation is shown in Table 4.7.

Table 4.7 Peak hour staff light vehicle traffic generation in the weekday AM and PM peak hours

	IMEX	Interstate (starting 2030)	Warehouse
AM peak (inbound)	32	32	20
PM peak (outbound)	32	32	20

The maximum staff generation period would be during the shift change over of the operation and maintenance staff. When both IMEX and interstate are in operation (from year 2030 onwards), the shift change over would generate 625 vehicle trips. However, this is likely to occur outside the peak period (at 6.00 am, 2.00 pm and 10.00 pm) when there would be sufficient capacity on the road network and at intersections, and therefore has not been assessed.

4.2.3.1 Service vehicle generation

Service vehicles would be generated by the operational requirements of the Moorebank IMT. These vehicles are likely to be small or medium rigid vehicles that are used by contractors to service electrical, machinery or other items. This number is anticipated to be relatively low. These movements would probably occur outside peak periods and have been excluded from the assessment.

4.2.4 Truck stop/retail facility

A truck stop or small retail facility has been considered for the Project IMT site to provide goods and services to staff and visitors of the Project site. Although the proposed facility has not been designed, land within the Project site on the concept plan has been allocated for this land use.

Considering the current availability of fast food outlets elsewhere and the remoteness of this facility, this facility is not expected to attract traffic from outside of the immediate development area. It is therefore assumed that the potential facility would not generate any additional traffic other than catering for vehicles already on the adjacent road network and within the Project site.

4.3 Traffic generation summary

A summary of the total traffic generated by the Moorebank IMT development during the construction and operation phase based on the information contained within section 4 is shown in Table 4.8 for the different years of analysis. Table 4.9 and Table 4.10 show the weekday AM peak and PM peak volumes for these phases for the different years.

While a reduction of 30% due to load matching was applied to semi-trailer movements generated by the IMEX and Interstate terminals, load matching is accounts for 13% of the total vehicle trips generated by the development (including light vehicle movements).

Table 4.8 shows one-way weekday trips. For example 50 trips would involve 25 trips in and 25 trips out.

Table 4.8 Summary of total daily weekday trips generated by Moorebank IMT

	Early Works 2015		Phase A 2016		Phase B 2023		Phase C 2028		Full Build 2030	
	LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Construction	810	64	2,906	1,930	3,337	1,944	1,280	394	0	0
IMEX	0	0	0	0	336	1,420	674	3,012	674	3,007
Interstate	0	0	0	0	0	0	0	0	522	1,155
Warehouse	0	0	0	0	1,510	774	3,774	1,644	4,528	3,998
Total trips	**810**	**64**	**2,906**	**1,930**	**5,183**	**4,138**	**5,728**	**5,050**	**5,724**	**8,160**

Table 4.9 Summary of total weekday AM peak hour traffic movements

		Early Works 2015		Phase A 2016		Phase B 2023		Phase C 2028		Full Build 2030	
		LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Construction	Inbound	54	5	194	105	222	106	85	21	0	0
	Outbound	0	5	0	105	0	106	0	21	0	0
IMEX	Inbound	0	0	0	0	16	30	30	63	32	62
	Outbound	0	0	0	0	0	30	0	63	0	64
Interstate	Inbound	0	0	0	0	0	0	0	0	32	25
	Outbound	0	0	0	0	0	0	0	0	0	23
Warehouse	Inbound	0	0	0	0	10	16	20	35	20	82
	Outbound	0	0	0	0	0	16	0	35	0	82
Total trips	**Inbound**	**54**	**5**	**194**	**105**	**248**	**152**	**135**	**119**	**84**	**169**
	Outbound	**0**	**5**	**0**	**105**	**0**	**152**	**0**	**119**	**0**	**169**

Table 4.10 Summary of total weekday PM peak hour traffic movements

		Early Works 2015		Phase A 2016		Phase B 2023		Phase C 2028		Full Build 2030	
		LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
Construction	Inbound	0	5	0	105	0	106	0	21	0	0
	Outbound	54	5	194	105	222	106	85	21	0	0
IMEX	Inbound	0	0	0	0	0	30	0	63	0	62
	Outbound	0	0	0	0	16	30	30	63	32	64
Interstate	Inbound	0	0	0	0	0	0	0	0	0	25
	Outbound	0	0	0	0	0	0	0	0	32	23
Warehouse	Inbound	0	0	0	0	0	16	0	35	0	82
	Outbound	0	0	0	0	10	16	20	35	20	82
Total trips	**Inbound**	**0**	**5**	**0**	**105**	**0**	**152**	**0**	**119**	**0**	**169**
	Outbound	**54**	**5**	**194**	**105**	**248**	**152**	**135**	**119**	**84**	**169**

4.4 Traffic generation from alternate land uses

Parsons Brinckerhoff has undertaken a review of alternate land uses for the Project site. The purpose of this review is to compare traffic generation from the Project site based on various land uses occupying the site on developable land only.

Traffic generation for alternative land uses have been estimated in accordance with the RMS's *Guide to Traffic Generating Developments* (August 2013) which provides guidelines regarding the likely traffic generation potential of various types of development. In most cases, traffic volumes generated by developments are determined by applying multipliers that are either specific to the floor areas or other unit rates specific to the developments. These representative rates were determined through surveys undertaken by the RMS.

The overall area of the Project site is 191.88 hectares. For this study, it is assumed that the Project site has approximately 166 hectares of developable land which excludes the 1% AEP flood line and confirmed conservation areas. The adopted peak hour vehicle trips for the different land use developments are as follows:

- Residential dwellings – trip generation of 0.95 and 0.99 per dwelling based on RMS rates for low density residential dwellings within the Sydney urban area were adopted for the AM and PM peak hour respectively. It is assumed that 20 dwellings could be constructed per hectare based on Landcom's *Residential Density Guide* (May 2011).

- Business parks and industrial estates – trip generation rate of 5.35 peak hour vehicle trips per hectare was adopted based on RMS rates for the similar size development of business parks in the Sydney area.

- Shopping centres – it is assumed that the Gross Leasable Floor Area (GLFA) for the proposed development site would be approximately 150,000 m^2 which equivalents the size of the Westfield Parramatta shopping centre. Trip generation of 1.47 and 3.16 peak hour vehicle trips per 100 m^2 GLFA was adopted for the AM and PM peak hour respectively.

Table 4.11 shows the adopted trip generation rate and the inbound/outbound distribution assumed for the AM and PM peak periods.

Table 4.11 Summary of traffic generated by alternate land uses

Development		Distribution	Vehicle trips
Moorebank Intermodal Terminal – Full Build 2030 (IMEX, Interstate and Warehouse)			
AM peak hour	Inbound	-	253
	Outbound	-	169
PM peak hour	Inbound	-	169
	Outbound	-	253
Low density residential dwellings – Approximately 3320 dwellings			
AM peak hour (0.95 per dwelling)	Inbound	20%	631
	Outbound	80%	2523
PM peak hour (0.99 per dwelling)	Inbound	80%	2629
	Outbound	20%	657

Development		Distribution	Vehicle trips
Business parks and industrial estates – 166 hectares			
AM peak hour (5.35 per hectare)	Inbound	80%	710
	Outbound	20%	178
PM peak hour (5.35 per hectare)	Inbound	20%	178
	Outbound	80%	710
Shopping centres – Approximately 150,000m^2 GLFA			
AM peak hour (1.47 per 100m^2 of GLFA)	Inbound	50%	1103
	Outbound	50%	1103
PM peak hour (3.16 per 100m^2 of GLFA)	Inbound	50%	2370
	Outbound	50%	2370

Source: RMS Guide to Traffic generating Developments (2013)

Table 4.11 shows that the estimated traffic that generated by the Moorebank IMT development during the peak hours would be significantly lower than the generated traffic by alternative land uses. It indicates that a less significant traffic impact would be expected on the adjacent road network when compared to the alternate land uses.

5. Traffic distribution

This section outlines the distribution of traffic generated by the Moorebank IMT development based on information extracted from a strategic model developed for the project (described in section 5.1). Traffic generated by the Project site (as explained in section 4) is distributed to the different access points based on the indicative concept design shown in Figure 3.4.

5.1 Strategic modelling

Strategic modelling has been undertaken to investigate the traffic related changes associated with the Moorebank IMT Project. This analysis has been based on utilising the Transport for New South Wales (TfNSW) strategic models to examine the projected changes on truck volumes resulting from the operations of the 'with Moorebank IMT' as compared to the 'base case' without Moorebank IMT.

The travel demand sources available to the study include:

- Sydney Strategic Travel Model (STM)
- Light Commercial Vehicle Model (LCVM)
- Freight Movement Model (FMM) for rigid and articulated commercial vehicles.

These three components provide the travel demand across the highway network. The supply of highway network has been based on:

- Roads and Maritime Services (RMS) highway network as used in the STM.

These four data sources are outlined in Table 5.1.

Table 5.1 Strategic model components

Demand/Supply	Data	Class of vehicles	Sources
Demand	Background traffic	Car	STM
		Light commercial vehicles	LCVM
		Rigid trucks	FMM
		Articulated trucks (non Port Botany and Moorebank IMT)	FMM
	Port Botany and Moorebank IMT	Articulated trucks	FMM
Supply	Highway Network	All	RMS networks as used in the STM highway assignment

These data sources have all been developed with the same geographic coverage and modelling zoning system (2006 travel zones) to provide a compatible set of travel demand trip tables.

Details of the strategic modelling are provided in the Strategic Traffic Modelling report in Appendix J.

The STM was supplied with a 2011 base year and future networks for 2016 to 2041 in 5 year increments. Table 5.2 lists the changes that the STM road network should contain as per the documentation supplied with the model. It is noted that the form/alignment of some of the projects identified in Table 5.2 may differ from the latest planning documentation and this is because the detailed investigations around these projects are still underway.

Table 5.2 Official network changes

Year	Road	Detail
2016	Hunter Expressway	Four-lane expressway from the M1 Pacific Motorway to Branxton.
	M2 widening	Widen from Windsor Road to Delhi Road.
	M5 widening	Widening Camden Valley Way to King Georges Road.
	Western Sydney Employment Hub	Link roads to the M7 Motorway.
	Great Western Highway widening	Widening the highway to four/three lanes between Emu Plains and Mount Victoria.
	South West Rail Link via East Hills	There are some changes to the road network around Edmondson Park that are likely to be related to this project (i.e. links to rail stations, etc.).
2021	WestConnex Stage 2: M5 East Duplication	Duplication from M5 East to King Georges Road It is noted that the changes included in the 2021 network extend to parts of the WestConnex project beyond the M5 East duplication such as the Sydney Airport Access Link, etc. (as per the WestConnex – Sydney's next motorway priority, October 2012, RMS document).
	North West Rail Link to Rouse Hill	There are changes to the 2021 model road network around Kellyville which is likely to be associated with this project.
2026	WestConnex Stage 2: M4 Extension and M4 Widening	M4 widening and extension from Parramatta to Haberfield.
	NW Growth Centre	The 2026 model road network includes changes to links in the area to the north west of the M7 which are likely to be related to this project.
2031	M2 to M1 Tunnel (NorthConnex)	Connection between M2 and M1 at Wahroonga.
	SW Growth Centre	This is seen in the model as various network changes (i.e. new links, upgraded links, etc.) to the west of the Hume Highway and the M7.

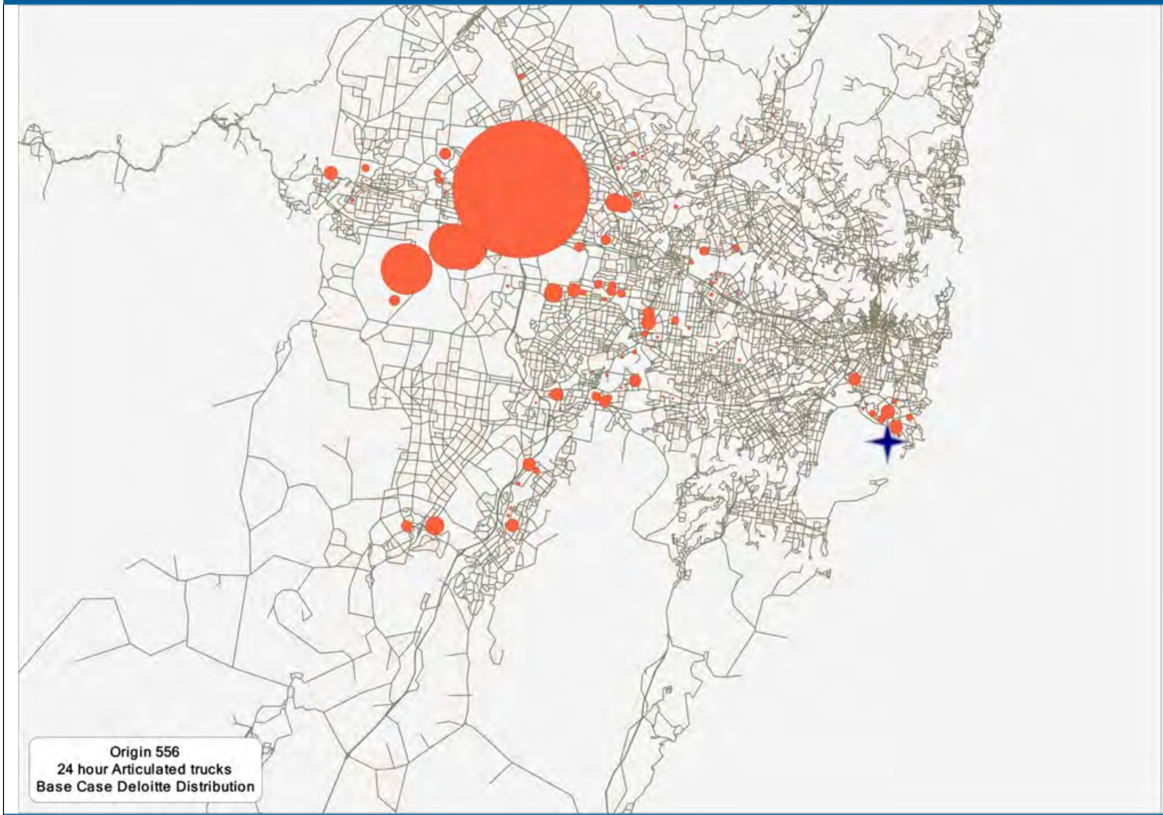
Source: STM network changes (BTS)

The changes between each of the forecast years are shown in the Strategic Traffic Modelling report in Appendix J. However there are changes to the road network which are not covered in Table 5.2 (i.e. not discussed in the documentation provided with the model). The most notable of these changes is the extension of Cambridge Avenue to Campbelltown Road which first appears in 2026 and is also present in the 2031 network. This is the only change that is likely to have a significant bearing on the results of the investigations relating to the Moorebank IMT. Discussions with Roads and Maritime Services indicate that this extension is not currently part of the future 2031 network. Therefore the modelling undertaken for this study has removed this extension from the model network.

The future STM road network changes have been included in the strategic modelling undertaken for the Project. The relevant road network upgrades as stated in Table 5.2 have been included in future 2031 strategic modelling to assess the impacts of the Project traffic on the road network in terms of volume change, as well as vehicle kilometres travelled (VKT) and vehicle hours travelled (VHT).

The strategic model was used to compare the demand with and without the Moorebank IMT based on the 2031 daily forecasts of articulated vehicles associated with container freight based on information provided by Deloitte. Plots of the comparisons are shown in Figure 5.1 to Figure 5.3.

From Port Botany



To Port Botany

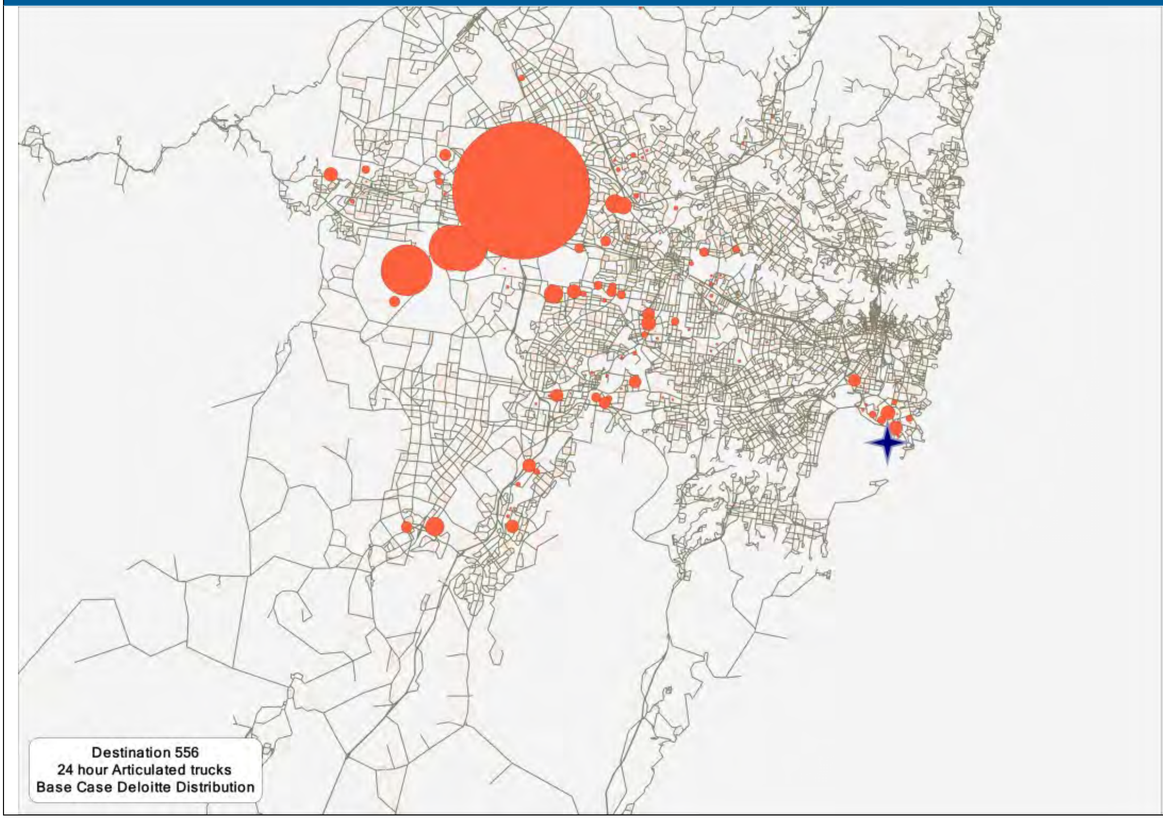
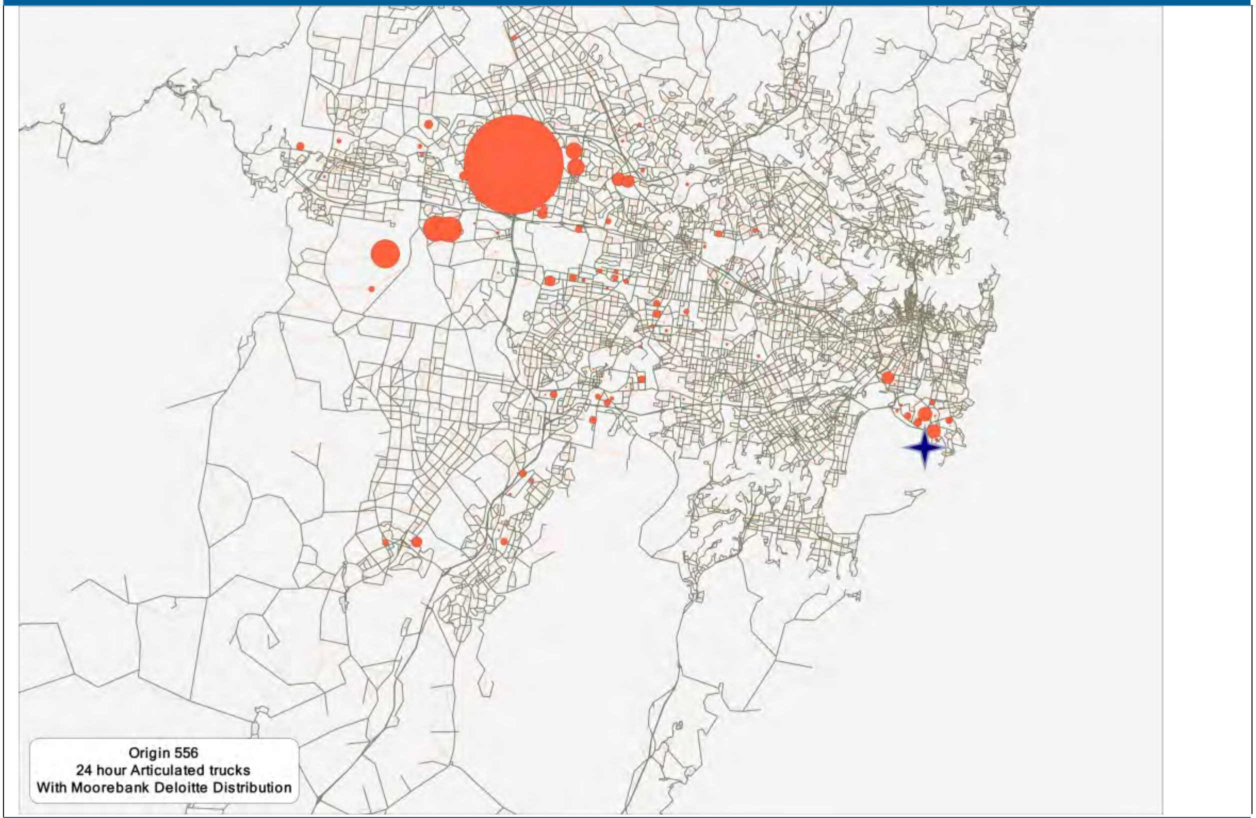


Figure 5.1 Base case articulated truck distributions to/from Port Botany

From Port Botany



To Port Botany

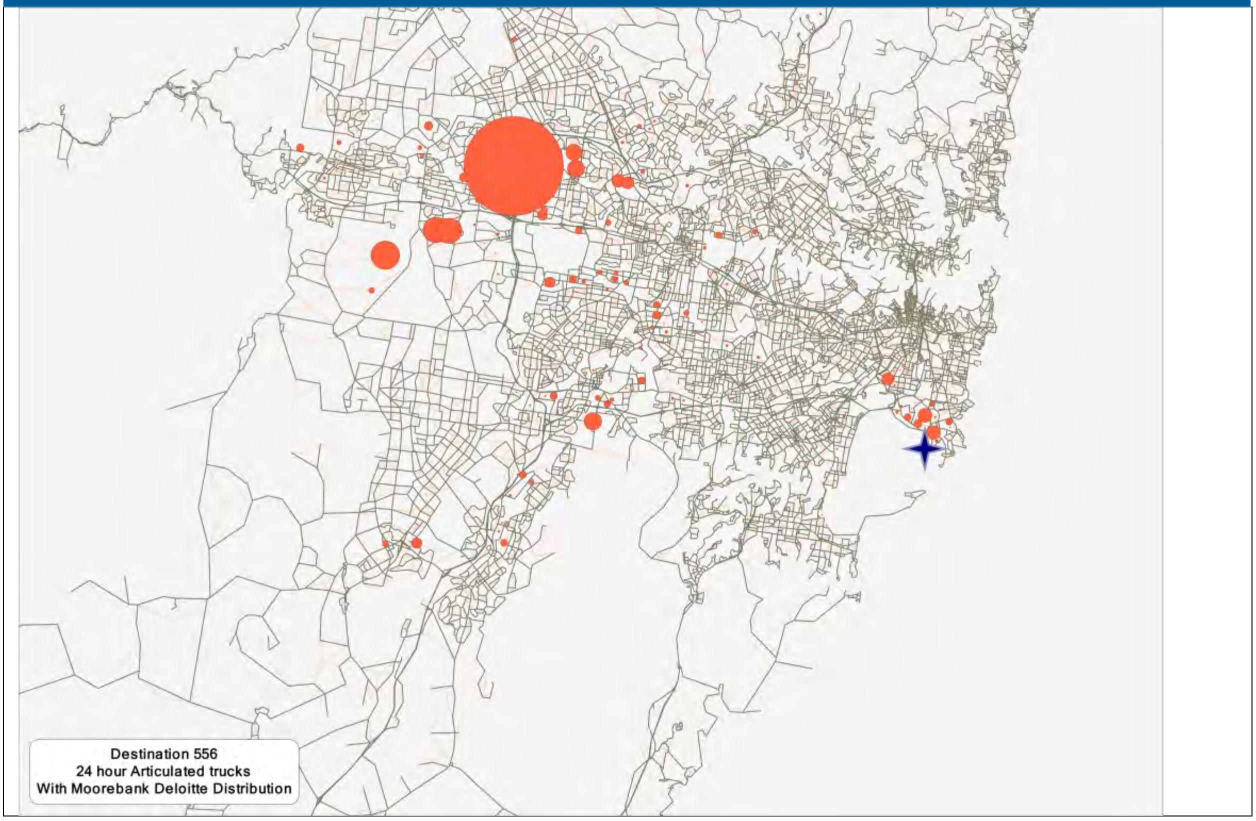
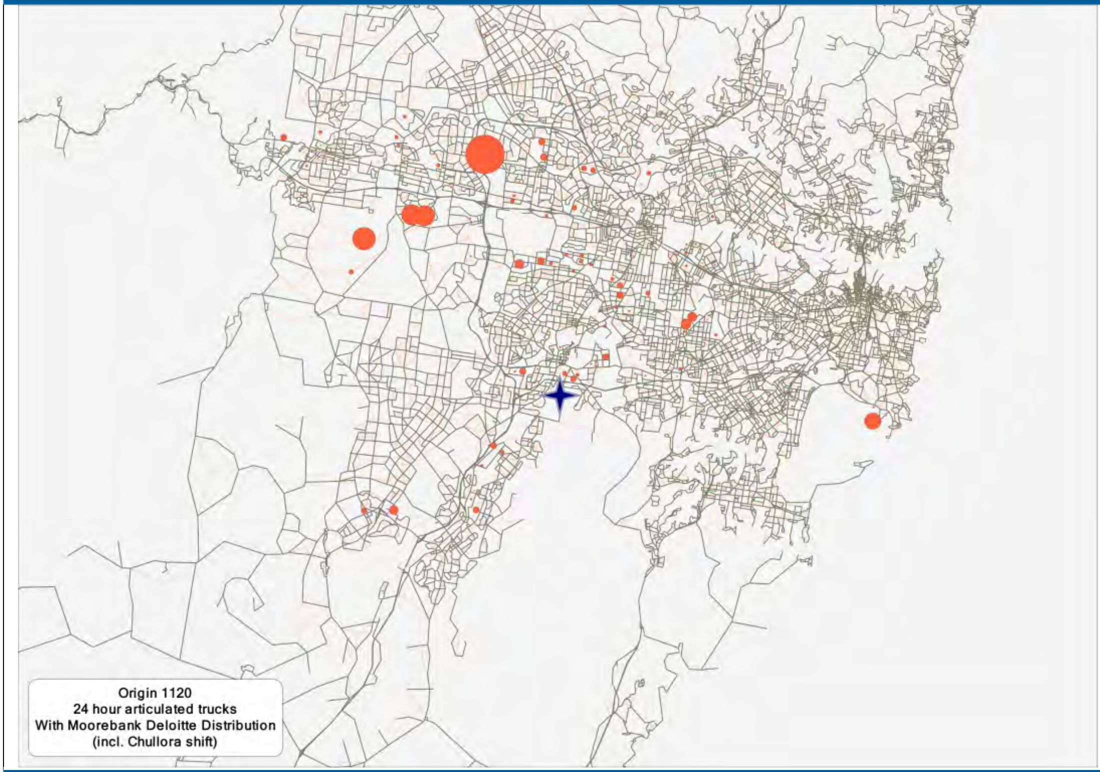


Figure 5.2 Articulated truck distributions to/from Port Botany with Moorebank IMT

From Moorebank



To Moorebank

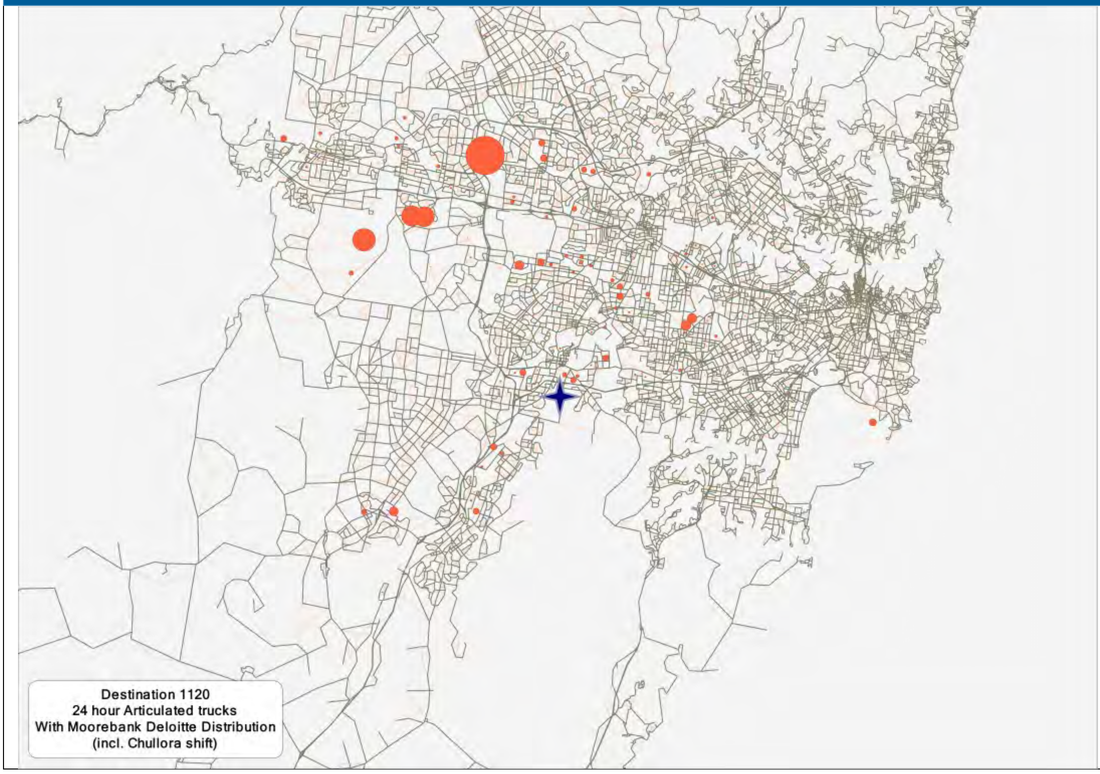


Figure 5.3 Articulated truck distributions to/from Moorebank with Moorebank IMT

5.1.1 Network performance

The performance of the whole network can be assessed by considering the VKT and VHT travelled in each of the assignments by the users of the road network in 2031.

The results indicate that:

- With Moorebank IMT there will be a decrease in both VKT and VHT across the network as a whole, with most of the reductions seen in articulated truck movements. Although articulated truck trips to and from Port Botany see the greatest reduction in VKT and VHT, other (i.e. background) articulated truck traffic are also expected to see decreases in VKT and VHT under the with Moorebank IMT case.
- On an average weekday the implementation of the Moorebank IMT will result in a reduction of 56,125 vehicle kilometres travelled and 1,265 vehicle hours travelled by trucks across the network.
- At Moorebank and Port Botany, the Moorebank IMT will result in 36,185 fewer vehicle kilometres travelled and 670 fewer vehicle hours travelled by articulated trucks to and from Port Botany and Moorebank per day.

This is accompanied by a daily saving of approximately 2,530 VHT for non-truck traffic across the Sydney road network. The vehicle kilometres for non-truck traffic increased by approximately 10,670 VKT, this is probably caused by traffic migrating from adjacent routes to take advantage of the reduction in congestion along the M5.

Further details of the forecast changes in VKT and VHT for other key roads in the Sydney network are discussed in the Strategic Traffic Modelling Report in Appendix J.

5.1.2 Moorebank IMT traffic distribution

The distribution of traffic generated by the Moorebank IMT (as identified in Table 4.8, 4.9 and Table 4.10) and associated developments is based on the results of strategic modelling discussed in section 5.1.1. For the purposes of the modelling it is assumed that the origin and destination for vehicles would be similar. This is based on the assumption that vehicles would return to their origin after travelling to the Moorebank IMT. The distribution of traffic may be different for light and heavy vehicles. Heavy vehicles generated by the Project site would travel to and from the M5 interchange where they would be distributed amongst the road network to travel to their destinations throughout the Sydney region.

The design of the Moorebank IMT proposed truck access does not allow for southbound heavy vehicle movements. This is to prevent heavy vehicles generated by the Moorebank IMT travelling south along Moorebank Avenue to areas of the road network (Cambridge Avenue) which may not be able to able to cater for the vehicle types generated by the Moorebank IMT.

B-Double vehicles are not permitted to use Anzac Road.

Table 5.3 shows the assumed distribution of traffic generated by the Project site in 2030. This distribution of light and heavy vehicles is based upon the STM and FMM model which does not distribute freight related heavy vehicle traffic onto Anzac Road.

Table 5.3 Moorebank IMT traffic distribution in 2030

Direction	Distribution (%) weekday AM peak		Distribution (%) weekday PM peak	
	Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
Moorebank Avenue – West (M5)	20.0%	45.3%	20.0%	44.8%
Moorebank Avenue – West (Hume Highway)	18.5%	19.6%	18.5%	20.0%
Moorebank Avenue – North (Moorebank Avenue)	7.7%	27.9%	7.7%	13.9%
Moorebank Avenue – East (M5)	13.3%	7.2%	13.3%	21.3%
Moorebank Avenue – East (Anzac Road)	10.5%	0.0%	10.5%	0.0%
Moorebank Avenue – South (Moorebank Avenue)	30.0%	0.0%	30.0%	0.0%

Source: STM and FMM models (BTS)

5.2 Access distribution

The light and heavy vehicles would be distributed to the access points discussed in section 3.1.1. Vehicles generated by the warehouse have been distributed based on the GFA positioned on site. Table 5.4 and Table 5.5 show the percentage of light and heavy vehicles generated by the different land uses for each access based on the northern rail option.

In summary:

- 100% of light vehicles (LV) from IMEX and interstate traffic would access the Project site via the Moorebank Avenue and Anzac Road intersection as the administration buildings are accessed from this intersection (northern rail option).
- 100% of heavy vehicles (HV) from IMEX and interstate traffic would access through the Moorebank Avenue and Main Truck Access.
- Warehouse traffic has been distributed based on the size and location of each warehouse facility.

Table 5.4 Light vehicle access distribution (northern rail access option)

Land use	Moorebank IMT access location				
	1 Moorebank Avenue and Anzac Road	2 Moorebank Avenue and Warehouse Access 1	3 Moorebank Avenue and Warehouse Access 2	4 Moorebank Avenue and Warehouse Access 3	5 Moorebank Avenue and Main Access
IMEX	100%	–	–	–	–
Interstate	100%	–	–	–	–
Warehouse	8%	15%	20%	33%	24%

Table 5.5 Heavy vehicle access distribution (northern rail access option)

Land use	Moorebank IMT access location				
	1 Moorebank Avenue and Anzac Road	2 Moorebank Avenue and Warehouse Access 1	3 Moorebank Avenue and Warehouse Access 2	4 Moorebank Avenue and Warehouse Access 3	5 Moorebank Avenue and Main Access
IMEX	–	–	–	–	100%
Interstate	–	–	–	–	100%
Warehouse	8%	15%	20%	33%	24%

As shown in Table 5.5, the majority of heavy vehicles access through the Main Truck Access (access 5). This is to separate the light and heavy movements and decrease the impact on the other intersections along Moorebank Avenue and improve their safety, as well as assisting with the operation of the terminal.

5.3 Traffic distribution

The traffic generation from section 4 has been distributed in accordance with the information contained in Table 5.4 and Table 5.5 and is shown in Table 5.6 for the different access locations during peak periods.

Table 5.6 Moorebank IMT total vehicle volumes by access intersection (northern rail access option)

Year	Peak hour	Direction	Moorebank IMT access location									
			1 Moorebank Avenue and Anzac Road		2 Moorebank Avenue and Warehouse Access 1		3 Moorebank Avenue and Warehouse Access 2		4 Moorebank Avenue and Warehouse Access 3		5 Moorebank Avenue and Main Access	
			LV	HV	LV	HV	LV	HV	LV	HV	LV	HV
2016	AM	Inbound	39	21	20	11	20	11	39	21	77	42
		Outbound	0	21	0	11	0	11	0	21	0	42
	PM	Inbound	0	21	0	11	0	11	0	21	0	42
		Outbound	39	21	20	11	20	11	39	21	77	42
2023	AM	Inbound	51	16	33	16	44	21	10	16	111	83
		Outbound	0	16	0	16	0	21	0	16	0	83
	PM	Inbound	0	16	0	16	0	21	0	16	0	83
		Outbound	51	16	33	16	44	21	10	16	111	83
2028	AM	Inbound	59	9	4	7	4	8	8	14	61	81
		Outbound	0	9	0	7	0	8	0	14	0	81
	PM	Inbound	0	9	0	7	0	8	0	14	0	81
		Outbound	59	9	4	7	4	8	8	14	61	81
2030	AM	Inbound	63	6	3	13	4	16	7	27	4	107
		Outbound	0	6	0	13	0	16	0	27	0	107
	PM	Inbound	0	6	0	13	0	16	0	27	0	107
		Outbound	63	6	3	13	4	16	7	27	4	107

6. Traffic assessment

This section outlines the impact assessment for the Moorebank IMT proposal. Moorebank Avenue was tested with and without the upgrade and with and without Moorebank IMT development traffic to enable an understating of potential impacts from the Project. Traffic generation calculations of the different components are explained in section 4.

The traffic modelling analysis of the impact of the construction and operational activities was undertaken using the computer program SIDRA 6 for the following future assessment scenarios as shown in Table 6.1.

Table 6.1 Development years for traffic impact assessment

Stage	Year	Description
Early Works	2015	Construction activity generated by remedial earthworks and demolition of site buildings.
Phase A	2016	Peak construction activity occurring for Phase A generated by spoil removal and the upgrade of Moorebank Avenue (and associated intersections).
Phase B	2023	500,000 TEU per annum IMEX and 100,000 m^2 warehousing at full capacity (16 hour truck gate operation). Peak construction activity occurring for Phase B, generated by the remainder of construction for IMEX and construction of 150,000 m^2 warehousing.
Phase C	2028	1.05 million TEU IMEX and 250,000 m^2 of warehouse developments operating at full capacity (16 hour truck gate operation). Traffic generated by the construction of Interstate (Phase C).
Full Build	2030	Moorebank IMT at full operation including 300,000m^2 of warehousing. 24 hour truck gate operation for IMEX and Interstate.

Major staff movements generated by the IMEX, interstate and warehouses are likely to occur outside peak periods as discussed in section 4. Administration staff are expected to arrive and depart during the peak periods of 6.45 am to 7.45 am and 5.00 pm to 6.00 pm.

6.1 Moorebank Avenue and Anzac Road annual traffic growth rates

For the purpose of this study, and in consultation with RMS, traffic growth rates have been obtained by from the RMS road assignment EMME/2 model. Table 6.2 shows the linear traffic growth rates that have been applied to this assessment to estimate future background traffic volumes on the road network adjacent to the Project site.

Table 6.2 Annual weekday peak period growth rates on Moorebank Avenue and Anzac Road

Location	Period	Direction	Annual growth rates between		
			2016–2021	2021–2026	2026–2031
Moorebank Avenue, south of Anzac Road	AM (7–9 am)	Northbound	1.8%	1.9%	0.5%
		Southbound	0.8%	0.8%	0.8%
	PM (4–6 pm)	Northbound	0.7%	1.4%	0.5%
		Southbound	1.1%	2.2%	0.6%
Moorebank Avenue, between Anzac Road and M5 Motorway	AM (7–9 am)	Northbound	0.8%	1.9%	0.0%
		Southbound	1.7%	1.1%	0.5%
	PM (4–6 pm)	Northbound	1.5%	1.2%	0.4%
		Southbound	0.7%	1.7%	0.8%
Anzac Road, east of Moorebank Avenue	AM (7–9 am)	Northbound	6.1%	2.5%	4.6%
		Southbound	0.4%	1.4%	1.8%
	PM (4–6 pm)	Northbound	0.3%	3.4%	2.1%
		Southbound	3.0%	3.6%	1.1%

Source: RMS (2014)

6.2 Future year intersection performance

The performance of Moorebank Avenue in the future has been assessed using the following scenarios:

- Existing Moorebank Avenue without Moorebank IMT development.
- With the Moorebank IMT development and the upgrade to Moorebank Avenue.

The scenario of Moorebank Avenue without the upgrade and with Moorebank IMT has not been assessed. As discussed in section 3.1.3, Moorebank Avenue between the M5 and the southernmost entry to the Moorebank IMT will need to be upgraded to four lanes (two lanes in either direction) and associated intersection upgrades purely on background traffic growth alone into the future. The intersections along Moorebank Avenue currently operate near or at capacity in 2014 and therefore the addition of Moorebank IMT traffic to these intersections without the upgrade would further exacerbate the deteriorating intersection performance and road capacity constraints.

The upgrade of Moorebank Avenue as shown in Figure 6.1 would only occur with the proposed Moorebank IMT development, and is proposed for 2016.

A description of the intersection assessment criteria used can be found in Appendix B.

6.2.1 Existing network in the future without Moorebank IMT

The assessment of the existing road network forecasts how the network and intersections would operate in the future without the Project. The performance of each of the following intersections were analysed under the future assessment scenarios (refer to Table 6.1):

- intersection of Moorebank Avenue and Bapaume Road
- intersection of Moorebank Avenue and Anzac Road
- intersection of Moorebank Avenue and Defence Support Access (SME site)
- intersection of Moorebank Avenue and old DNSDC Access
- intersection of Moorebank Avenue and Chatham Avenue.

Based on the RMS intersection performance criteria specified in Appendix B, the results of the existing intersection layouts with future traffic forecasts are provided in Table 6.3. Detailed SIDRA output results have been provided in Appendix C.

Table 6.3 Existing network future intersection performance (without the Moorebank IMT)

Intersection	Year	Peak hour	Degree of Saturation	Average Delay (sec)	Level of Service	95th percentile queue (m)
Moorebank Avenue and Bapaume Road	2015	AM	0.57	>100	F	29
		PM	0.45	>100	F	42
	2016	AM	0.58	>100	F	30
		PM	0.47	>100	F	43
	2023	AM	0.63	>100	F	30
		PM	0.77	>100	F	54
	2028	AM	0.67	>100	F	26
		PM	1.00	>100	F	66
	2030	AM	0.68	>100	F	25
		PM	1.00	>100	F	68
Moorebank Avenue and Anzac Road	2015	AM	0.73	19	B	188
		PM	0.85	28	B	296
	2016	AM	0.74	19	B	194
		PM	0.85	29	C	302
	2023	AM	0.90	24	B	306
		PM	0.96	35	C	387
	2028	AM	1.04	54	D	732
		PM	1.18	54	D	522
	2030	AM	1.04	56	D	752
		PM	1.21	59	E	577

Intersection	Year	Peak hour	Degree of Saturation	Average Delay (sec)	Level of Service	95th percentile queue (m)
Moorebank Avenue and Defence Support Access	2015	AM	0.84	7	A	255
		PM	0.96	24	B	397
	2016	AM	0.85	9	A	281
		PM	1.04	50	E	796
	2023	AM	0.97	32	C	632
		PM	1.08	76	F	917
	2028	AM	1.04	63	E	932
		PM	1.16	>100	F	1237
	2030	AM	1.05	68	E	972
		PM	1.18	>100	F	1292
Moorebank Avenue and DNSDC Access	2015	AM	0.70	5	A	138
		PM	0.95	23	B	595
	2016	AM	0.71	5	A	143
		PM	0.96	26	B	644
	2023	AM	0.89	11	A	250
		PM	1.06	78	F	1161
	2028	AM	1.00	36	C	573
		PM	1.14	>100	F	1580
	2030	AM	1.01	38	C	600
		PM	1.15	>100	F	1647
Moorebank Avenue and Chatham Avenue	2015	AM	0.98	42	C	672
		PM	0.99	44	D	721
	2016	AM	1.00	51	D	784
		PM	1.00	50	D	823
	2023	AM	1.13	>100	F	1305
		PM	1.11	>100	F	1262
	2028	AM	1.21	>100	F	1631
		PM	1.19	>100	F	1676
	2030	AM	1.22	>100	F	1683
		PM	1.21	>100	F	1744

From the results in Table 6.3, the analyses of the existing road network without the Project indicate that the Moorebank intersections would become progressively worse without an upgrade over time. The results indicate that the intersections would operate with long delays and queuing for at least one of the peak hours. Analysis of the intersection performance indicates:

- The intersection of Moorebank Avenue and Bapaume Road is forecast to operate at LoS F; this is due to the delay on vehicles exiting Bapaume Road. As traffic increases on Moorebank Avenue between Anzac Road and the M5, opportunities for vehicles to leave this Bapaume Road would decrease.

- The intersection of Moorebank Avenue and Anzac Road is forecast to operate at capacity beyond 2028 with DoS of higher than 1.00. The queuing in Anzac Road would get progressively worse and would block access to neighbouring intersections during both AM and PM peak hours by 2030.
- The intersections of Moorebank Avenue with Defence Support Access, DNSDC Access and Chatham Avenue would operate at an unsatisfactory level of service (LoS F) with long queues beyond 2023 for at least one of the peak hours.

6.2.2 Proposed network with the Project

6.2.2.1 Prior to Moorebank Avenue upgrade (2015)

The performance of each of the key intersections was analysed for the Early Works stage based on the assumption that the intersection arrangements on Moorebank Avenue would remain as existing in 2015. The Moorebank Avenue upgrades are proposed for 2016.

- It has been assumed that all the construction vehicles would travel on Moorebank Avenue through the intersections with Bapaume Road and Anzac Road, with half the construction vehicles accessing the site via the DNSDC access and the remainder access the site via Bapaume Road and Chatham Avenue.
- The results of this analysis for the Early Works stage are summarised in Table 6.4 and detailed SIDRA output results have been provided in Appendix D.

Table 6.4 Construction phase intersection performance (2015)

Intersection	Peak hour	Degree of Saturation	Average Delay (sec)	Level of Service	95th percentile queue (m)
Moorebank Avenue and Bapaume Road	AM	0.58	>100	F	23
	PM	0.62	>100	F	44
Moorebank Avenue and Anzac Road	AM	0.71	18	B	204
	PM	0.97	29	C	219
Moorebank Avenue and Defence Support Access	AM	0.87	11	A	309
	PM	0.97	28	B	425
Moorebank Avenue and DNSDC Access	AM	0.71	6	A	142
	PM	0.97	30	C	693
Moorebank Avenue and Chatham Avenue	AM	0.97	36	C	657
	PM	0.99	44	D	780

The SIDRA analysis indicates that the increased volumes from construction activities would decrease the performance of the existing intersections.

There would potentially be extensive queuing on Moorebank Avenue in the northern approach during the PM peak, with queuing potentially impacting on the operation of the adjacent intersections along Moorebank Avenue. The CTMP would need to consider this possibility and implement measures to prevent it occurring.

The construction during the Early Works would need to be monitored during the peak periods to ensure that the queuing at intersections does not impact on other road users.

The results of the construction intersection SIDRA analysis is attached to Appendix D.

6.2.2.2 After Moorebank Avenue upgrades

Moorebank Avenue would be upgraded in 2016. The proposed intersections and road configuration along Moorebank Avenue within the study area would be operational before commencement of IMEX operations in 2018.

Table 6.5 shows the SIDRA modelling results of the performance of the intersections along Moorebank Avenue for the following future year scenarios based on the northern rail option (Refer to Figure 6.1 for the location of the key intersections):

- Phase A – 2016 – Scenario N1
- Phase B – 2023 – Scenario N2
- Phase C – 2028 – Scenario N3
- Full Build – 2030 – Scenario N4.

These years were selected as they represent the worst case scenario where peak construction traffic and operational traffic occur simultaneously.

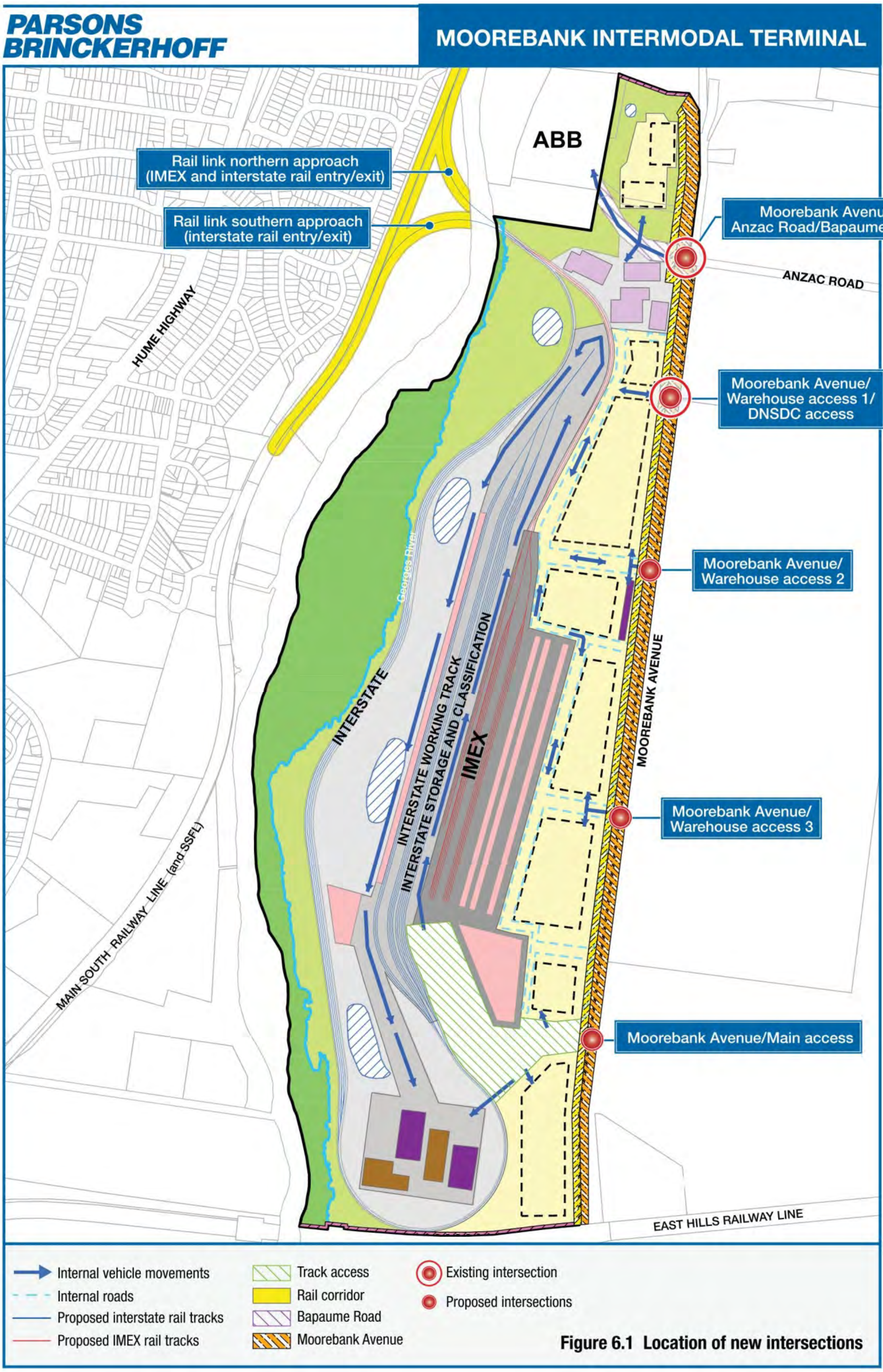


Figure 6.1 Location of new intersections

Table 6.5 Proposed network future intersection performance

Intersection	Year	Peak hour	Degree of Saturation	Average Delay (sec)	Level of Service	95th percentile queue (m)
Moorebank Avenue and Anzac Road	2016	AM	0.64	19	B	117
		PM	0.91	23	B	154
	2023	AM	0.77	22	B	173
		PM	0.90	26	B	196
	2028	AM	0.78	24	B	191
		PM	0.93	33	C	270
	2030	AM	0.84	24	B	200
		PM	0.97	37	C	312
Moorebank Avenue, Warehouse Access 1 and DNSDC Access	2016	AM	0.56	7	A	70
		PM	0.56	6	A	115
	2023	AM	0.66	8	A	86
		PM	0.65	6	A	149
	2028	AM	0.69	7	A	94
		PM	0.68	6	A	163
	2030	AM	0.74	8	A	112
		PM	0.71	6	A	185
Moorebank Avenue and Warehouse Access 2	2016	AM	0.60	8	A	136
		PM	0.57	4	A	45
	2023	AM	0.71	9	A	179
		PM	0.66	4	A	54
	2028	AM	0.74	9	A	194
		PM	0.69	4	A	53
	2030	AM	0.77	10	A	214
		PM	0.72	4	A	56
Moorebank Avenue and Warehouse Access 3	2016	AM	0.59	9	A	132
		PM	0.56	7	A	108
	2023	AM	0.69	10	A	174
		PM	0.65	7	A	141
	2028	AM	0.73	10	A	190
		PM	0.69	7	A	159
	2030	AM	0.76	11	A	204
		PM	0.72	7	A	176
Moorebank Avenue and Main Access	2016	AM	0.59	11	A	132
		PM	0.52	9	A	131
	2023	AM	0.75	15	B	177
		PM	0.71	11	A	149
	2028	AM	0.74	13	A	176
		PM	0.77	11	A	166
	2030	AM	0.75	15	B	191
		PM	0.82	13	A	190

The SIDRA results show that the upgraded intersections along Moorebank Avenue would operate at a satisfactory level of service (LoS C or better) with an acceptable level of delay during both the AM and PM peak hours in all years tested. This compares favourably against the performance of the existing road network with the current traffic volumes. The results indicate that overall that the upgraded intersections would operate better than the existing road network.

The results of the upgraded intersection layout SIDRA analysis is attached to Appendices E to H.

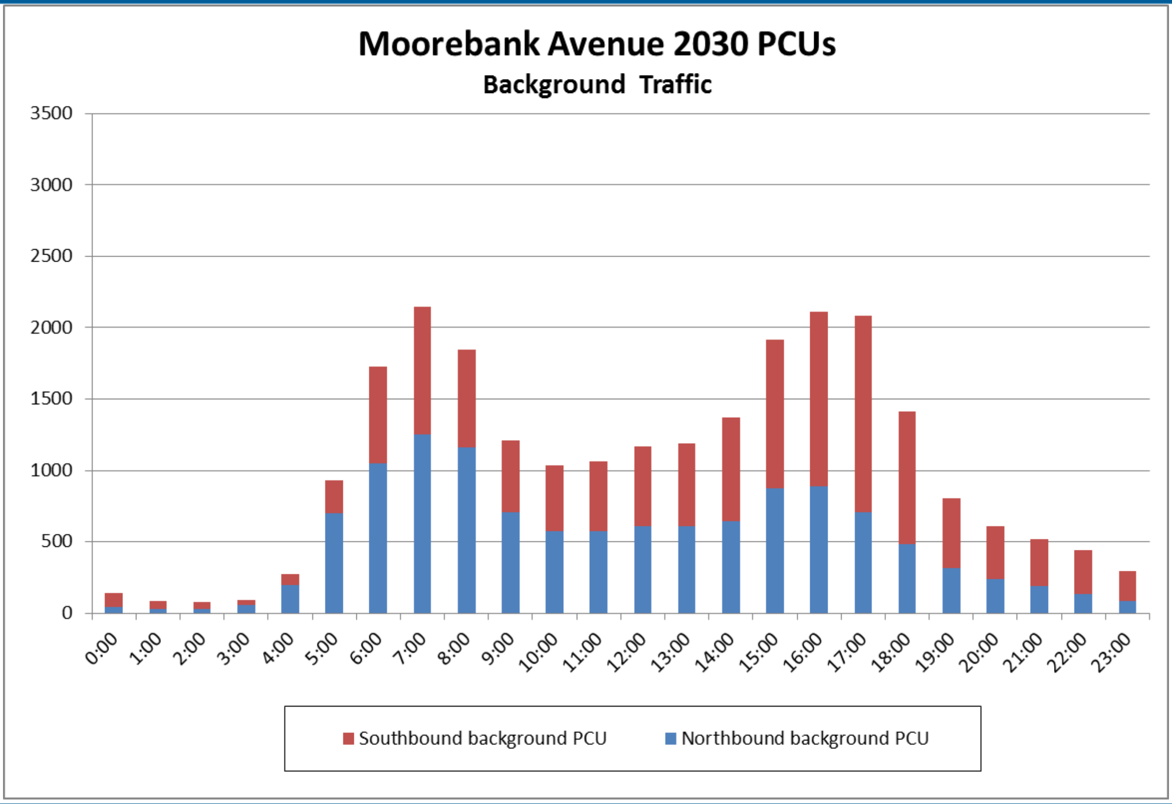
6.2.2.3 Moorebank Avenue Daily Traffic Volume Profiles

Daily traffic volume profiles for Moorebank Avenue between the M5 Motorway and Bapaume Road in 2030 with and without the Project are presented in Figure 6.2. Light and heavy vehicles were converted to Passenger Car Unit (PCU) equivalents to compare the difference between with and without Project traffic profiles. The following conversion factors were applied to generate PCU equivalents:

- 1.0 PCUs for cars
- 1.2 PCUs for light commercial vehicles (LCV)
- 2.0 PCUs for rigid trucks
- 4.0 PCUs for articulated trucks.

Figure 6.2 clearly differentiates the road traffic peak hours with and without the Project. The weekday road background traffic peak occurs between 7.00 am and 8.00 am and 5.00 pm and 6.00 pm. With the inclusion of Project traffic, it can be seen that the road traffic peak continues to occur at these times. The figure shows that the highest traffic volumes travel on Moorebank Avenue during the AM and PM peak hours and there would be less traffic during the off peak period even with the Moorebank IMT traffic. This daily profile suggests that the off peak traffic conditions still represents a more favourable condition than the peak hours, hence there would be no significant impact on the traffic conditions along Moorebank Avenue during off peak periods.

2030 Background traffic in PCUs



2030 with Moorebank IMT traffic in PCUs

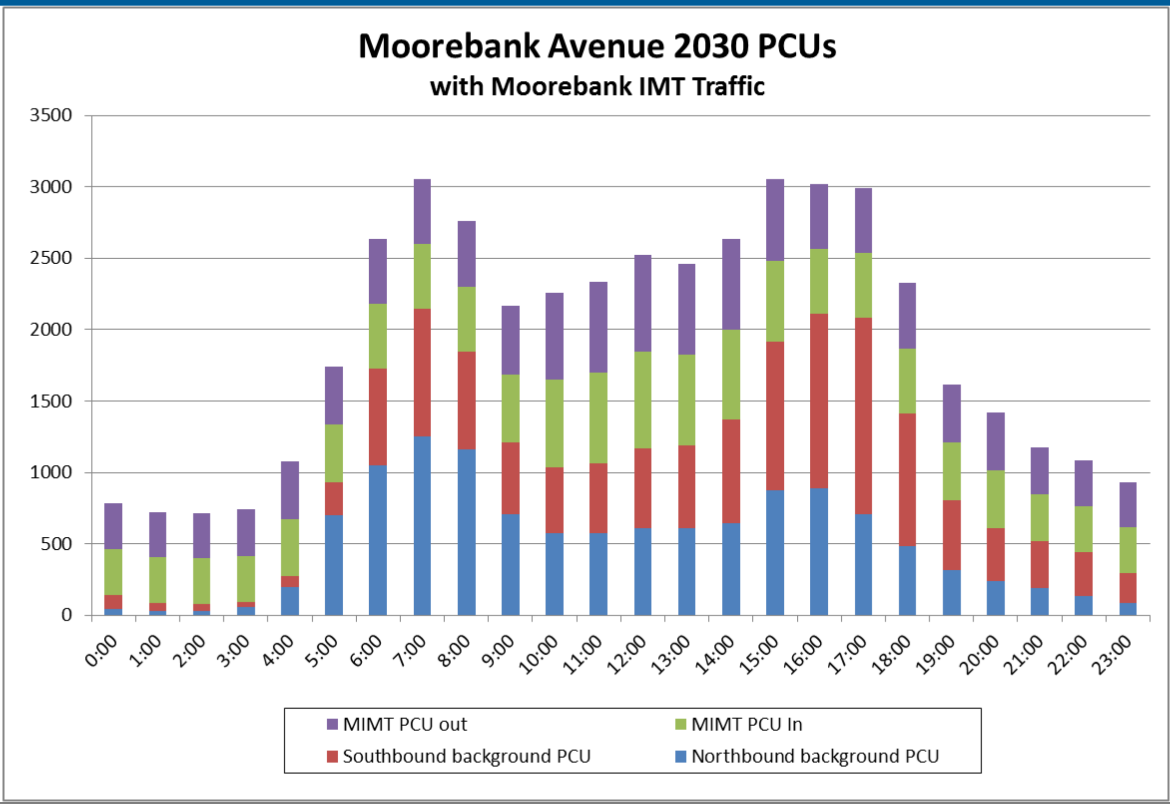


Figure 6.2 **Daily traffic volume profiles for Moorebank Avenue between the M5 Motorway and Bapaume Road in 2030 with and without Moorebank IMT in Passenger Car Unit (PCU) equivalents**

6.3 2030 Road network impact

6.3.1 Strategic road network impact

Figure 6.3 shows the change in daily articulated truck volumes on the network between the project case (with Moorebank IMT) and the base case (without Moorebank IMT). This plot shows that the introduction of the Moorebank IMT:

- would result in reductions in articulated truck volumes through the Sydney CBD and inner city suburbs, on the M4 and the M5 east of the Moorebank Avenue interchange.
- would result in an increase in articulated truck flows, particularly on the M7, Hume Highway and Mamre Road south of the M4 as well as the M5 between Moorebank avenue interchange and the M7.

Figure 6.4 shows the net difference of articulated truck volumes relating to Port Botany and Moorebank only on the network. Comparing this to Figure 6.3 confirms that the changes in articulated truck volumes on the network are generally the result of changes at Port Botany and Moorebank; the changes to background articulated truck traffic is not significant.

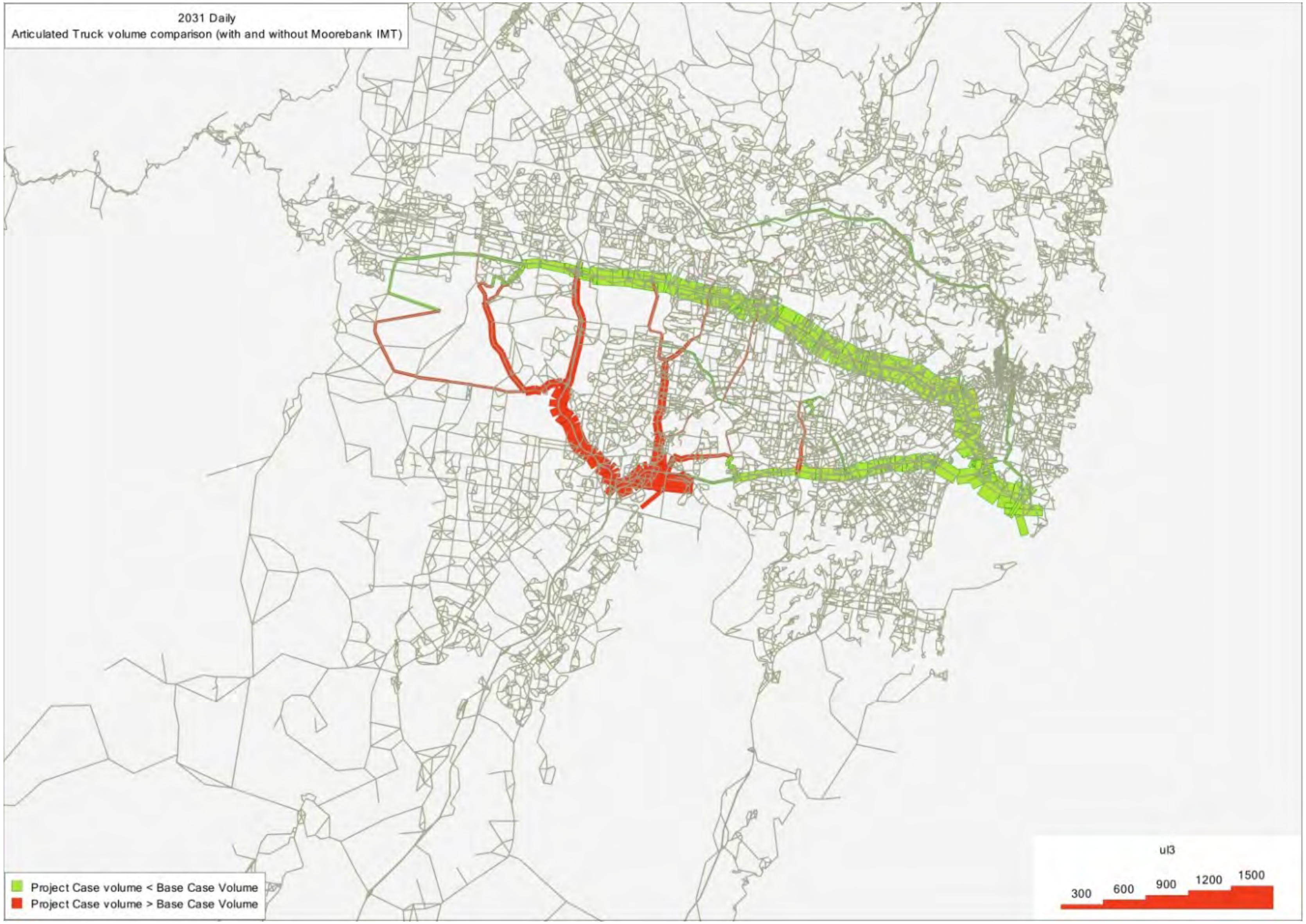


Figure 6.3 2031 daily comparison of articulated truck volumes (project case versus base case)

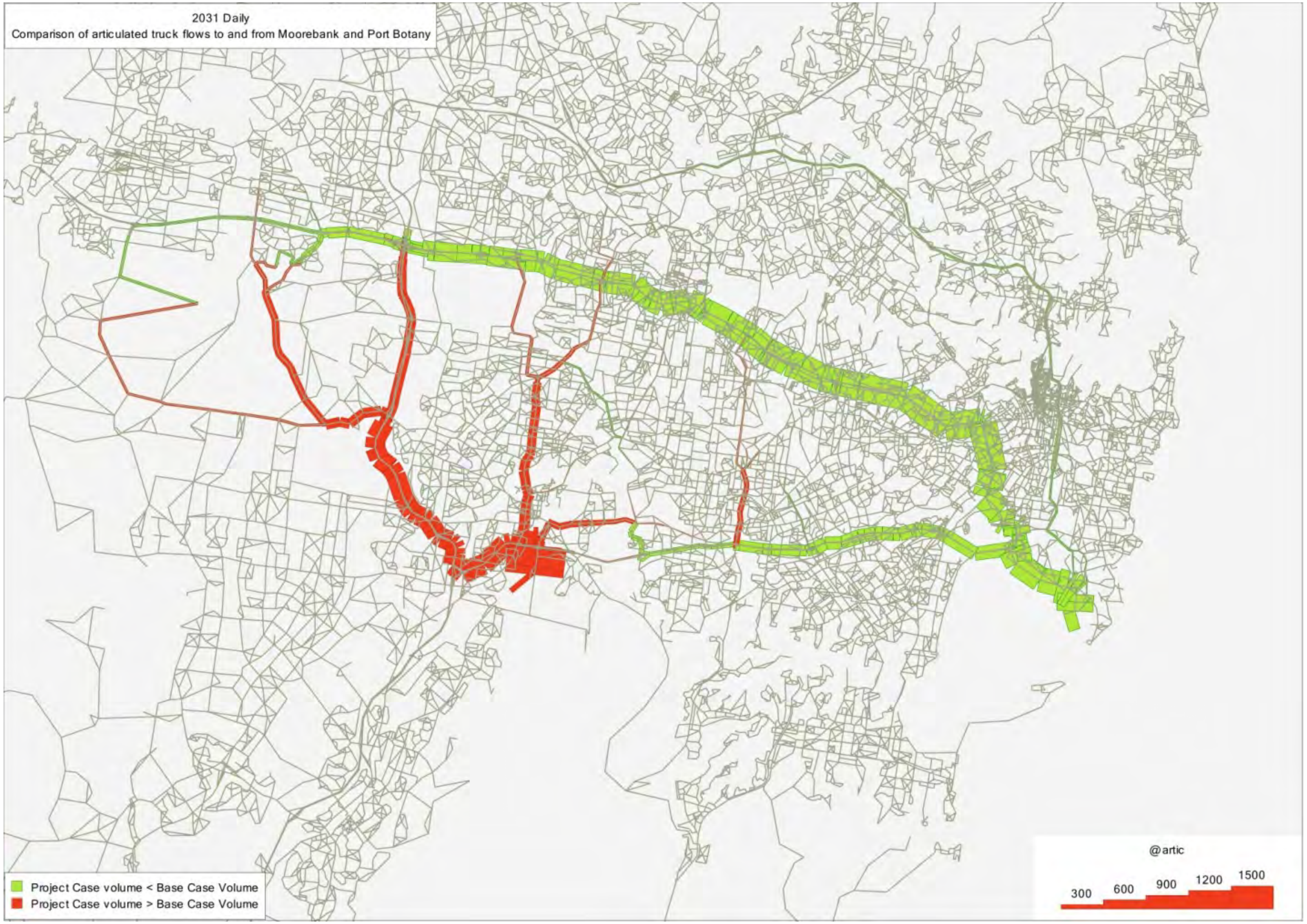


Figure 6.4 **2031 daily comparison of articulated truck volumes to/from Port Botany and Moorebank only (project case versus base case)**

6.3.2 Impact on the adjacent M5 Motorway network

To assess the impact of the Moorebank IMT on the M5 Motorway, the following was undertaken:

- Observed traffic volumes from the 2010 counts were factored to future year values based on growth rates taken from the STM.
- This was then compared to the traffic generated by the Moorebank IMT to calculate the percentage increase. The traffic generated by the IMEX and interstate facilities would already be present on the road network as it would have been mostly generated at Port Botany, therefore some of the additional traffic is double counted using this approach. These percentage increases are therefore likely to represent a slight over estimate of the increase. The percentage increase is provided in Table 6.6.

As identified in section 2.2, the M5 in the vicinity of Moorebank Avenue acts as a bottleneck within the motorway network. Congestion on the M5 is forecast to get worse on widening of the M5 as there are no plans to mitigate the congestion caused by the weaving movement between Moorebank Avenue and the Hume Highway. This may mean that the full benefits of the M5 widening scheme are not realised. Should congestion on the adjacent motorway network continue to be an issue then the operator of the Moorebank IMT could consider scheduling more movements to occur outside of peak periods when congestion is less likely to occur on the M5.

Table 6.6 Moorebank IMT percentage increase of M5 (traffic volumes between Heathcote Road and the Hume Highway) during peak periods

		Phase B			Phase C			Full Build		
		2023			2028			2030		
AM peak hour		**LV**	**HV**	**ALL**	**LV**	**HV**	**ALL**	**LV**	**HV**	**ALL**
M5 west of Moorebank Avenue	EB	1.52%	12.81%	2.79%	0.79%	9.76%	1.76%	0.47%	13.60%	1.88%
	WB	0.00%	18.86%	1.95%	0.00%	14.15%	1.48%	0.00%	19.64%	2.10%
M5 east of Moorebank Avenue	EB	0.00%	1.67%	0.21%	0.00%	1.35%	0.17%	0.00%	1.78%	0.22%
	WB	0.62%	4.85%	1.03%	0.33%	3.69%	0.66%	0.20%	5.14%	0.68%
PM peak hour		**LV**	**HV**	**ALL**	**LV**	**HV**	**ALL**	**LV**	**HV**	**ALL**
M5 west of Moorebank Avenue	EB	0.00%	35.45%	2.02%	0.00%	27.17%	1.55%	0.00%	37.93%	2.18%
	WB	1.35%	13.39%	2.48%	0.70%	10.30%	1.56%	0.42%	14.37%	1.68%
M5 east of Moorebank Avenue	EB	0.72%	9.66%	1.32%	0.38%	7.42%	0.85%	0.23%	10.60%	0.92%
	WB	0.00%	5.66%	0.29%	0.00%	4.51%	0.22%	0.00%	6.23%	0.30%

EB – Eastbound, WB – Westbound

LV – Light vehicle, HV – Heavy vehicle, ALL – All vehicles

The percentage increase from the traffic generated by Moorebank IMT on the M5 is under 2.2% of total M5 traffic during the 2030 AM and PM peak hours. In Phase B there is a temporary increase due to construction traffic, but the extra traffic still represents less than 3% of the forecast M5 traffic volume. Similar increases are shown in Phase C. The increase in the heavy vehicle proportion is an overestimate as no allowance has been made for heavy vehicles that would have been on the network anyway. The impact of this increase in heavy vehicles is reflected in the intersection analysis. The impact on the operation of the network and traffic conditions on the strategic road network will be examined in greater detail at the next stage of development approval. With greater certainty of the warehouse operations and layout it is likely that micro or mesoscopic models will be used to assess the impact on the road network on the proposed development.

6.3.3 Traffic weaving on the M5 Motorway at the Georges River Crossing

The HCM 2010 Highway Capacity Manual - Transportation Research Board defines weaving as follows:

'Weaving is generally defined as the crossing of two or more traffic streams travelling in the same direction along a significant length of highway without the aid of traffic control devices. Thus, weaving segments are formed when merge segments are closely followed by diverge segments. 'Closely' implies that there is not sufficient distance between the merge and diverge segments for them to operate independently.'

At the M5 Motorway crossing of the Georges River the Hume Highway and Moorebank Avenue Interchanges are located nearby on either side of the river. The proximity of the interchanges results in the easterly oriented ramps of the Hume Highway interchange to be close to the westerly oriented ramps from the Moorebank Avenue interchange.

In the westbound direction, traffic from M5 Motorway destined for the Hume Highway must weave over a distance of 450 m through the traffic coming from Moorebank Avenue destined for the M5. Similarly, in the eastbound direction, traffic from the Hume Highway and destined for the M5, must weave over a distance of 370 m through traffic from the M5 destined for Moorebank Avenue. This section of M5 must also cater for through traffic on the main carriageways and traffic moving directly between the entry and exit ramps.

Due to the proximity of the two interchanges the resultant traffic weaving tends to control operation during the peak hours rather than the individual exits and entries.

In order to establish the expected levels of service and hence the spare capacity available for Moorebank IMT traffic, a weaving analysis was undertaken using the HCM 2000 Highway Capacity Manual – Transportation Research Board. Traffic data for the design years was extracted from the Strategic Travel Model (STM, information provided by the Bureau of Transport Statistics). This model presented the projected background traffic and did not include any Moorebank IMT or Sydney Intermodal Terminal Alliance (SIMTA) related traffic.

It is acknowledged that since the analysis was undertaken, further modelling has been carried out and the Highway Capacity Manual weaving analysis methodology has been updated. However, it is considered that whilst results would change if the section were to be reanalysed the overall outcomes would be unlikely to be significantly different.

Based on background traffic growth from 2010 to 2030 the analysis indicates that the M5 at this location will be at and/or nearing capacity in future years as a result of the weaving manoeuvres between the two interchanges. The analytical outcomes are shown in the Table 6.7 below.

Table 6.7 Expected Levels of Service for Weaving at the M5 Motorway Georges River Crossing

Period	2010		2016		2030	
	Background		Background		Background	
	Density	LoS	Density	LoS	Density	LoS
Eastbound						
0.00–1.00	0.83	A	0.93	A	1.24	A
1.00–2.00	0.66	A	0.75	A	1.00	A
2.00–3.00	0.86	A	0.98	A	1.30	A
3.00–4.00	1.18	A	1.34	A	1.79	A
4.00–5.00	4.50	A	5.08	A	6.73	B
5.00–6.00	20.01	D	22.83	E	30.79	F
6.00–7.00	18.55	D	21.16	D	28.53	F
7.00–8.00	17.32	D	19.68	D	26.23	E
8.00–9.00	17.99	D	20.49	D	27.49	F
9.00–10.00	19.88	D	22.74	E	30.92	F
10.00–11.00	18.61	D	21.30	D	29.01	F
11.00–12.00	16.73	C	19.15	D	26.09	E
12.00–13.00	14.68	C	16.79	C	22.93	E
13.00–14.00	14.86	C	16.97	C	23.05	E
14.00–15.00	15.52	C	17.68	D	23.87	E
15.00–16.00	17.39	D	19.76	D	26.44	E
16.00–17.00	19.75	D	22.40	E	29.77	F
17.00–18.00	20.05	D	22.62	E	29.65	F
18.00–19.00	14.47	C	16.28	C	21.20	D
19.00–20.00	8.42	B	9.43	B	12.18	C
20.00–21.00	4.71	A	5.26	A	6.76	B
21.00–22.00	4.37	A	4.87	A	6.23	B
22.00–23.00	3.57	A	3.98	A	5.09	A
23.00–0.00	2.96	A	3.29	A	4.20	A

Period	2010		2016		2030	
	Background		Background		Background	
	Density	LoS	Density	LoS	Density	LoS
Westbound						
0.00–1.00	1.38	A	1.53	A	1.94	A
1.00–2.00	0.80	A	0.89	A	1.15	A
2.00–3.00	0.68	A	0.77	A	1.00	A
3.00–4.00	0.71	A	0.80	A	1.06	A
4.00–5.00	1.01	A	1.14	A	1.50	A
5.00–6.00	3.45	A	3.86	A	4.96	A
6.00–7.00	8.32	B	9.32	B	12.09	C
7.00–8.00	14.79	C	16.58	C	21.51	D
8.00–9.00	14.90	C	16.74	C	21.79	D
9.00–10.00	10.90	B	12.26	C	16.05	C
10.00–11.00	9.08	B	10.24	B	13.51	C
11.00–12.00	9.62	B	10.88	B	14.42	C
12.00–13.00	13.01	C	14.82	C	19.97	D
13.00–14.00	15.12	C	17.20	D	23.10	E
14.00–15.00	17.47	D	19.86	D	26.58	E
15.00–16.00	20.81	D	23.59	E	31.30	F
16.00–17.00	19.57	D	22.14	E	29.21	F
17.00–18.00	18.50	D	20.89	D	27.45	F
18.00–19.00	17.46	D	19.66	D	25.65	E
19.00–20.00	12.23	C	13.73	C	17.79	D
20.00–21.00	7.74	B	8.67	B	11.19	B
21.00–22.00	6.35	B	7.11	B	9.14	B
22.00–23.00	5.27	A	5.88	A	7.51	B
23.00–0.00	3.69	A	4.11	A	5.24	A

Weave at capacity

Available capacity of less than 250 vehicles

The weaving analysis indicates that:

- eastbound in year 2016 from 5.00 am to 12.00 pm and from 2.00 pm to 6.00 pm the weave is approaching or at capacity
- eastbound in year 2030 the weave will be at capacity between 5:00 am and 6:00 pm
- westbound in year 2016 from 2.00 pm to 7.00 pm the weave is approaching or at capacity
- westbound in year 2030 from 7.00 am to 9.00 am the weave is approaching capacity
- westbound in year 2030 from 1.00 pm to 7.00 pm the weave is at capacity.

It can be inferred from the above that by 2030 the background traffic growth alone would have resumed all spare capacity on M5 in both directions in the PM peak and all spare capacity in the eastbound direction in the AM peak. Consequently any Moorebank IMT traffic would experience considerable congestion during these times.

It is recognised that Moorebank IMT traffic will add to the weaving traffic on the M5 Motorway and the potential contribution of Moorebank IMT traffic to the weaving impact will be analysed in more detail at the next stage of more detailed planning.

6.3.4 Intersections analysed and road traffic growth rates

Analysis of intersections in the vicinity of the proposed development has been undertaken to assess their performances in 2030 without and with the Moorebank IMT. The following additional intersections were analysed:

- Hume Highway and Orange Grove Road
- Hume Highway and Elizabeth Drive
- Hume Highway and Memorial Avenue
- Hume Highway, Hoxton Park Road and Macquarie Street
- Hume Highway and Reilly Street
- Moorebank Avenue and Newbridge Road
- Moorebank Avenue and Heathcote Road
- Moorebank Avenue and Industrial Park Access
- Moorebank Avenue and Church Road
- Heathcote Road, Wattle Grove Road and Nuwarra Road
- Newbridge Road and Nuwarra Road
- Newbridge Road, Governor Macquarie Drive and Brickmakers Drive
- Moorebank Avenue and M5 interchange
- Hume Highway and M5 interchange

- Cambridge Avenue, Canterbury Road, Glenfield Road and Railway Parade.

A number of intersections in the wider area have not been included in the detailed analysis, these are:

- Hume Highway and Camden Valley Way
- Hume Highway and Kurrajong Road
- Hume Highway and De Meyrick Avenue
- M5 Motorway and Heathcote Road interchange

Based on the results of the recent strategic modelling undertaken, traffic generated by the Moorebank IMT facility would not include heavy vehicles travelling on the Hume Highway south of the M5 Motorway. While 7% of generated light vehicle traffic is predicted to travel this section of the Hume Highway, this equates to seven vehicles per hour during AM and PM peak hours. Similarly, the increase in vehicle volumes by the Moorebank IMT traffic at the M5 Motorway and Heathcote Road interchange would be minimal, hence no detailed analysis have been undertaken at this intersection.

The following information was used in this assessment:

- 2030 Moorebank IMT AM and PM hour traffic generation and distribution.
- Peak period traffic turning volume data extracted from the intersection traffic surveys that were conducted in March 2014 at above intersections except for the Moorebank Avenue/M5 interchange and the Hume Highway/M5 interchange which conducted in December 2010.
- Annual traffic growth rates on the adjacent road network that obtained from the RMS road assignment model (as described in section 6.1). Table 6.8 shows the linear yearly traffic growth rates that have been applied to this assessment to estimate future background traffic volumes on the road network.
- Intersection diagnostic monitor (IDM) for all signalised intersections as provided from RMS to determine existing traffic signal phasing and cycle times for the weekday AM and PM peak periods. It should be noted that the cycle time has not been modified for future year assessments.

Table 6.8 Annual growth rates on the road network in vicinity of the Project site (without Moorebank IMT traffic)

Location	Period	Direction	Annual growth rates between		
			2016–2021	2021–2026	2026–2031
Hume Highway, north of Elizabeth Drive	AM (7–9 am)	Northbound	0.5%	0.9%	1.3%
		Southbound	0.6%	0.2%	0.9%
	PM (4–6 pm)	Northbound	0.7%	0.0%	0.1%
		Southbound	0.7%	0.5%	0.3%
Orange Grove Road, north of Hume Highway	AM (7–9 am)	Northbound	0.4%	0.8%	1.1%
		Southbound	0.9%	0.6%	1.1%
	PM (4–6 pm)	Northbound	0.4%	0.3%	0.9%
		Southbound	0.2%	0.5%	0.8%

Location	Period	Direction	Annual growth rates between		
			2016–2021	2021–2026	2026–2031
Elizabeth Drive, West of Hume Highway	AM (7–9 am)	Eastbound	0.7%	1.1%	1.5%
		Westbound	1.6%	0.5%	1.6%
	PM (4–6 pm)	Eastbound	0.2%	0.8%	0.6%
		Westbound	0.0%	2.4%	0.7%
Hoxton Park Road, West of Hume Highway	AM (7–9 am)	Eastbound	2.4%	1.3%	1.4%
		Westbound	1.3%	3.9%	0.4%
	PM (4–6 pm)	Eastbound	1.0%	1.3%	0.5%
		Westbound	2.8%	0.6%	0.9%
Moorebank Avenue, north of M5 Motorway	AM (7–9 am)	Northbound	1.9%	1.5%	0.1%
		Southbound	1.6%	2.3%	1.6%
	PM (4–6 pm)	Northbound	1.9%	2.4%	0.0%
		Southbound	0.8%	1.7%	0.9%
Moorebank Avenue, south of Newbridge Road	AM (7–9 am)	Northbound	1.8%	2.5%	0.0%
		Southbound	3.2%	3.6%	1.4%
	PM (4–6 pm)	Northbound	2.8%	3.8%	0.6%
		Southbound	0.3%	2.1%	0.7%
Newbridge Road, east of Moorebank Avenue	AM (7–9 am)	Eastbound	2.7%	2.0%	0.5%
		Westbound	3.5%	1.7%	1.5%
	PM (4–6 pm)	Eastbound	2.0%	1.9%	0.9%
		Westbound	1.1%	1.5%	1.1%
Newbridge Road, west of Moorebank Avenue	AM (7–9 am)	Eastbound	2.5%	3.5%	2.1%
		Westbound	1.9%	2.6%	0.6%
	PM (4–6 pm)	Eastbound	0.8%	2.6%	1.1%
		Westbound	2.2%	3.2%	1.3%
Heathcote Road, south of M5 Motorway	AM (7–9 am)	Northbound	0.9%	2.9%	0.4%
		Southbound	1.1%	3.9%	1.6%
	PM (4–6 pm)	Northbound	1.2%	2.8%	0.9%
		Southbound	0.7%	2.4%	0.6%
Heathcote Road, south of Nuwarra Road	AM (7–9 am)	Northbound	0.8%	3.0%	0.4%
		Southbound	1.4%	4.4%	1.6%
	PM (4–6 pm)	Northbound	1.3%	3.4%	1.3%
		Southbound	0.5%	2.5%	0.8%
Nuwarra Road, North of Heathcote Road	AM (7–9 am)	Northbound	1.7%	0.3%	1.3%
		Southbound	0.7%	2.7%	1.1%
	PM (4–6 pm)	Northbound	1.2%	0.5%	1.1%
		Southbound	1.3%	0.7%	0.2%
M5 Motorway off ramp to Moorebank Avenue	AM (7–9 am)	Westbound	0.3%	0.4%	0.3%
		Eastbound	1.8%	0.7%	0.3%
	PM (4–6 pm)	Westbound	2.3%	1.9%	0.7%
		Eastbound	0.9%	1.3%	0.4%

Location	Period	Direction	Annual growth rates between		
			2016–2021	2021–2026	2026–2031
Hume Highway, north of M5 Motorway	AM (7–9 am)	Northbound	0.1%	1.3%	0.6%
		Southbound	0.2%	0.8%	0.2%
	PM (4–6 pm)	Northbound	0.0%	0.1%	0.3%
		Southbound	0.3%	0.8%	0.6%
Hume Highway, north of M5 Motorway	AM (7–9 am)	Northbound	0.1%	1.3%	0.6%
		Southbound	0.2%	0.8%	0.2%
	PM (4–6 pm)	Northbound	0.0%	0.1%	0.3%
		Southbound	0.3%	0.8%	0.6%
Hume Highway, south of M5 Motorway	AM (7–9 am)	Northbound	0.3%	1.8%	0.9%
		Southbound	1.2%	1.4%	1.2%
	PM (4–6 pm)	Northbound	0.6%	0.7%	0.4%
		Southbound	1.2%	1.2%	0.9%
M5 Motorway on and off ramp to Hume Highway	AM (7–9 am)	Eastbound	0.1%	1.7%	1.4%
		Westbound	0.3%	0.5%	3.0%
	PM (4–6 pm)	Eastbound	1.0%	1.1%	0.3%
		Westbound	2.0%	1.3%	0.6%
Cambridge Avenue, east of Canterbury Road	AM (7–9 am)	Eastbound	2.1%	2.1%	0.7%
		Westbound	1.7%	1.5%	1.3%
	PM (4–6 pm)	Eastbound	2.3%	5.1%	0.4%
		Westbound	1.3%	3.1%	0.4%
Canterbury Road, west of Cambridge Avenue	AM (7–9 am)	Northbound	0.4%	2.9%	0.6%
		Southbound	1.7%	2.7%	1.2%
	PM (4–6 pm)	Northbound	0.2%	3.3%	1.3%
		Southbound	0.2%	1.9%	0.8%
Glenfield Road, east of Canterbury Road	AM (7–9 am)	Eastbound	1.8%	4.8%	1.4%
		Westbound	0.5%	3.8%	1.1%
	PM (4–6 pm)	Eastbound	1.1%	4.2%	0.7%
		Westbound	1.7%	6.2%	1.2%
Railway Parade Road, north of Canterbury Road	AM (7–9 am)	Northbound	0.9%	2.8%	1.4%
		Southbound	2.2%	2.2%	1.0%
	PM (4–6 pm)	Northbound	1.5%	2.0%	0.9%
		Southbound	3.2%	3.1%	1.6%

Source: RMS (2014)

The following tasks have been undertaken to analyse the intersections for the two scenarios:

1. Apply the annual growth to the 2010 and 2014 AM and PM intersection counts to calculate 2030 future background traffic volumes.

2. Analyse the intersections in SIDRA for the 2030 without the generated traffic from the Project site. Intersection phasing and cycle times were based on the IDM SCATS data provided by RMS.

3. The EMME/2 strategic model was used to determine the difference in heavy vehicle flows between the ‘with’ and ‘without’ Moorebank IMT. The difference in heavy vehicle volumes on the road network was then applied to the 2030 with Moorebank IMT intersection volumes. This therefore takes into account the redistribution of heavy vehicles which would no longer travel to and from the Port Botany after the completion of Moorebank IMT facility.

4. Add traffic generated by the Moorebank IMT (IMEX and IS staff, heavy vehicles and warehouse generators).

5. Analysis of the intersections in SIDRA for the 2030 with Moorebank IMT. The number of lanes on the southern approach and departure on Moorebank Avenue were changed to reflect the connection to the concept design for this scenario only, as Moorebank Avenue will remain unchanged without the Moorebank IMT.

SIDRA Intersection version 6 software was used as the modelling tool to undertake the modelling for this project as agreed with RMS. This version of SIDRA allows intersections to be modelled as a network, allowing the interaction of queues between intersections to be modelled. Due to the close spacing of the Moorebank Avenue/Newbridge Road intersection and Moorebank Avenue/ Heathcote Road intersection and Moorebank Avenue and Industrial Park Access intersection, these have been grouped into network models in SIDRA.

6.3.5 Impacts on the wider area road network

This section describes the impact of Moorebank IMT on the wider road network.

6.3.5.1 Moorebank IMT traffic distribution and generation in 2030

Figure 6.5, 6.6 and 6.7 present the light and heavy traffic flow distributions (distribution is measured as a percentage %) of the generated Moorebank IMT traffic on the wider area road network in 2030 based on the results of the recent strategic modelling undertaken

The traffic volumes of the Moorebank IMT development in 2030 full build case were assigned to the wider area road network as shown in Figure 6.8 and 6.9.

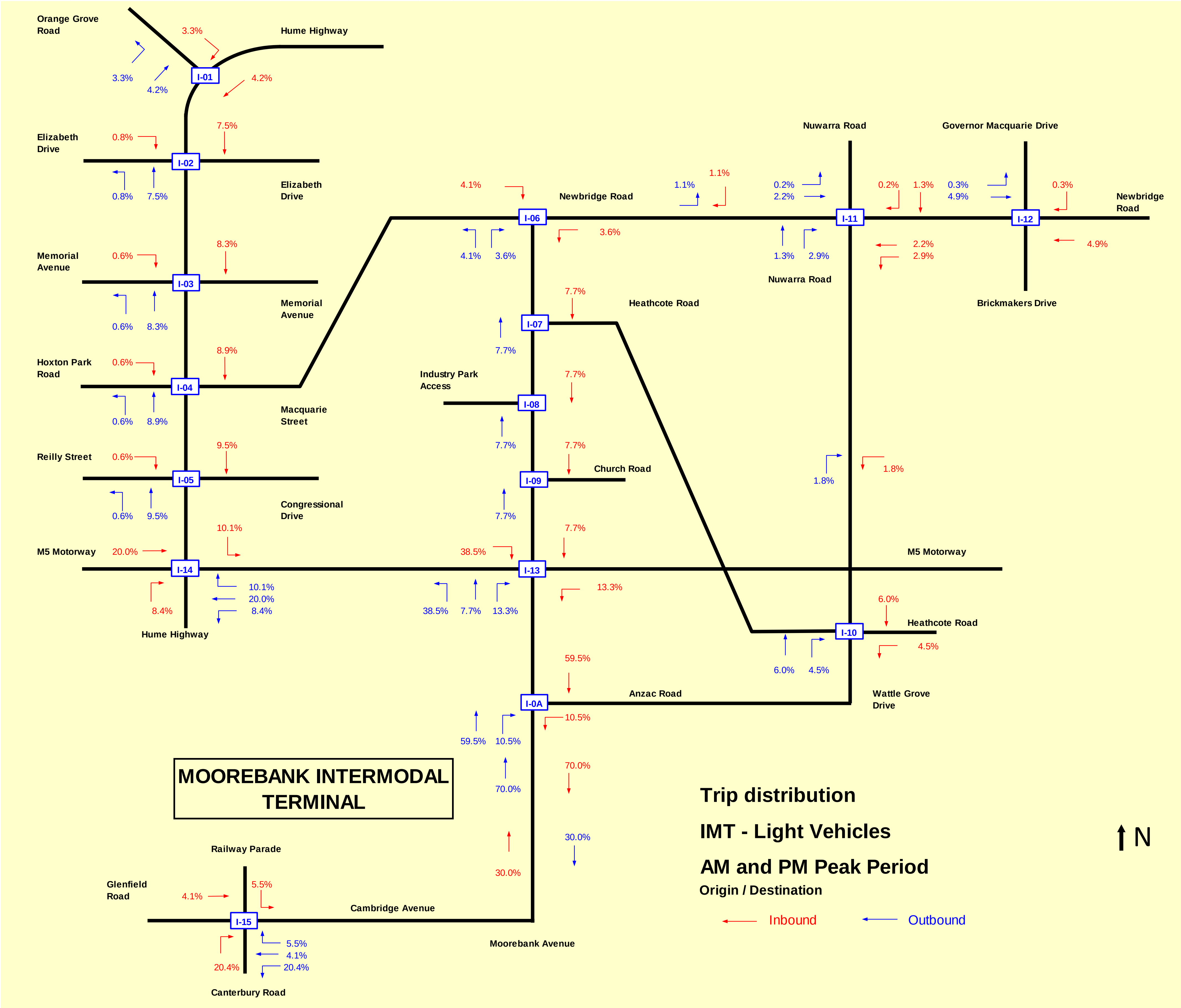


Figure 6.5 2030 weekday AM and PM peak Moorebank IMT light vehicle trip distribution on the wider area road network

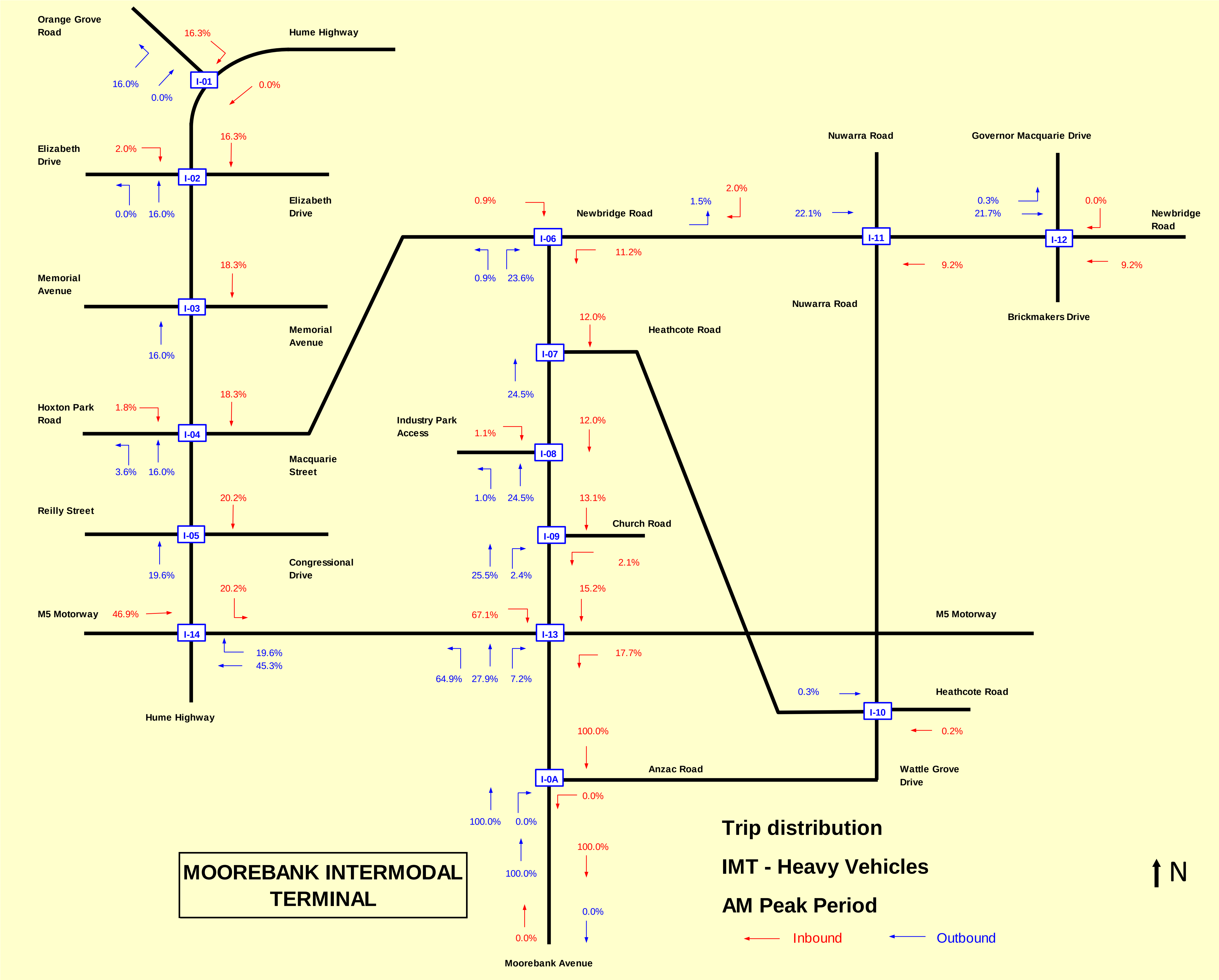


Figure 6.6 **2030 weekday AM peak Moorebank IMT heavy vehicle trip distribution on the wider area road network**

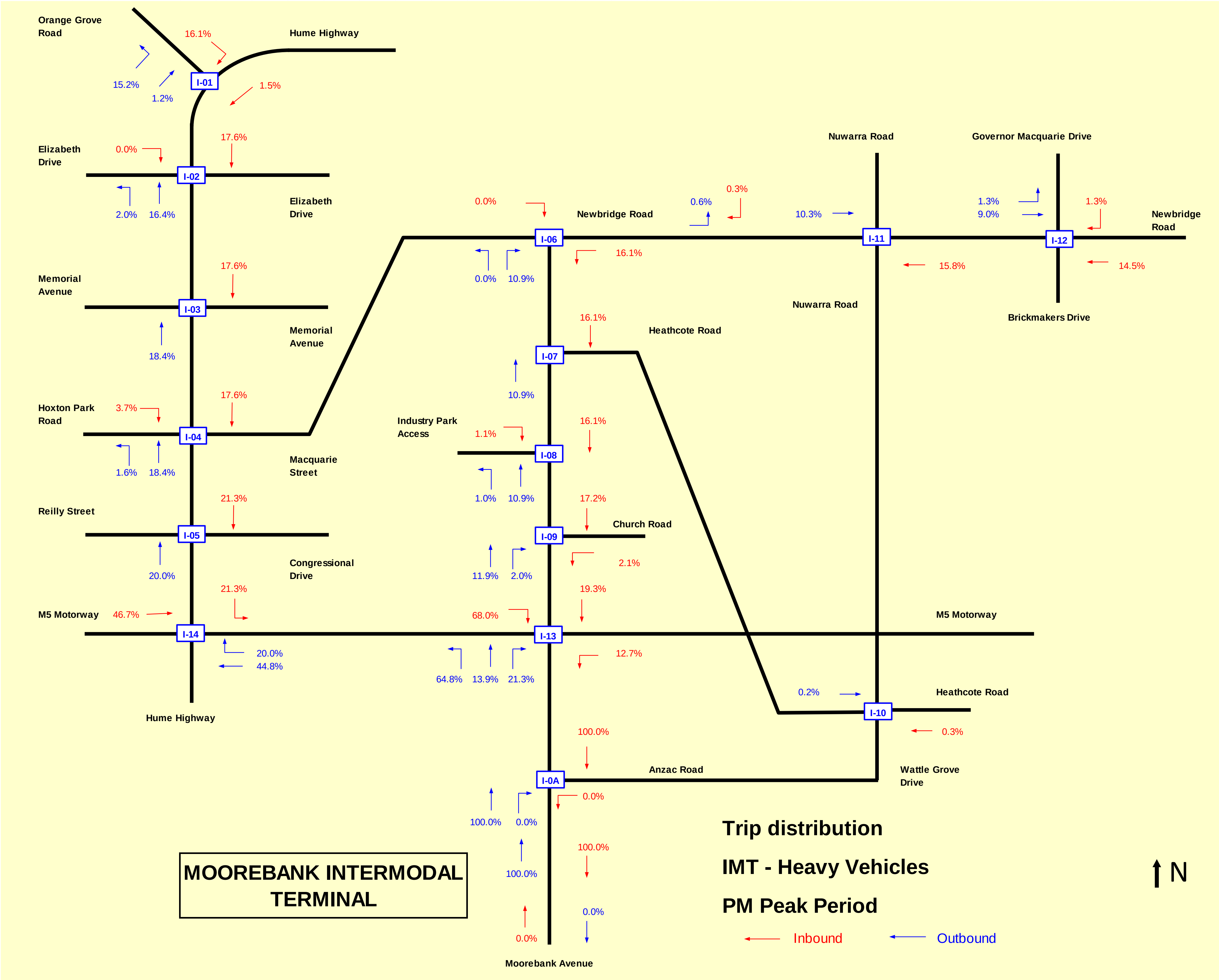


Figure 6.7 2030 weekday PM peak Moorebank IMT heavy vehicle trip distribution on the wider area road network

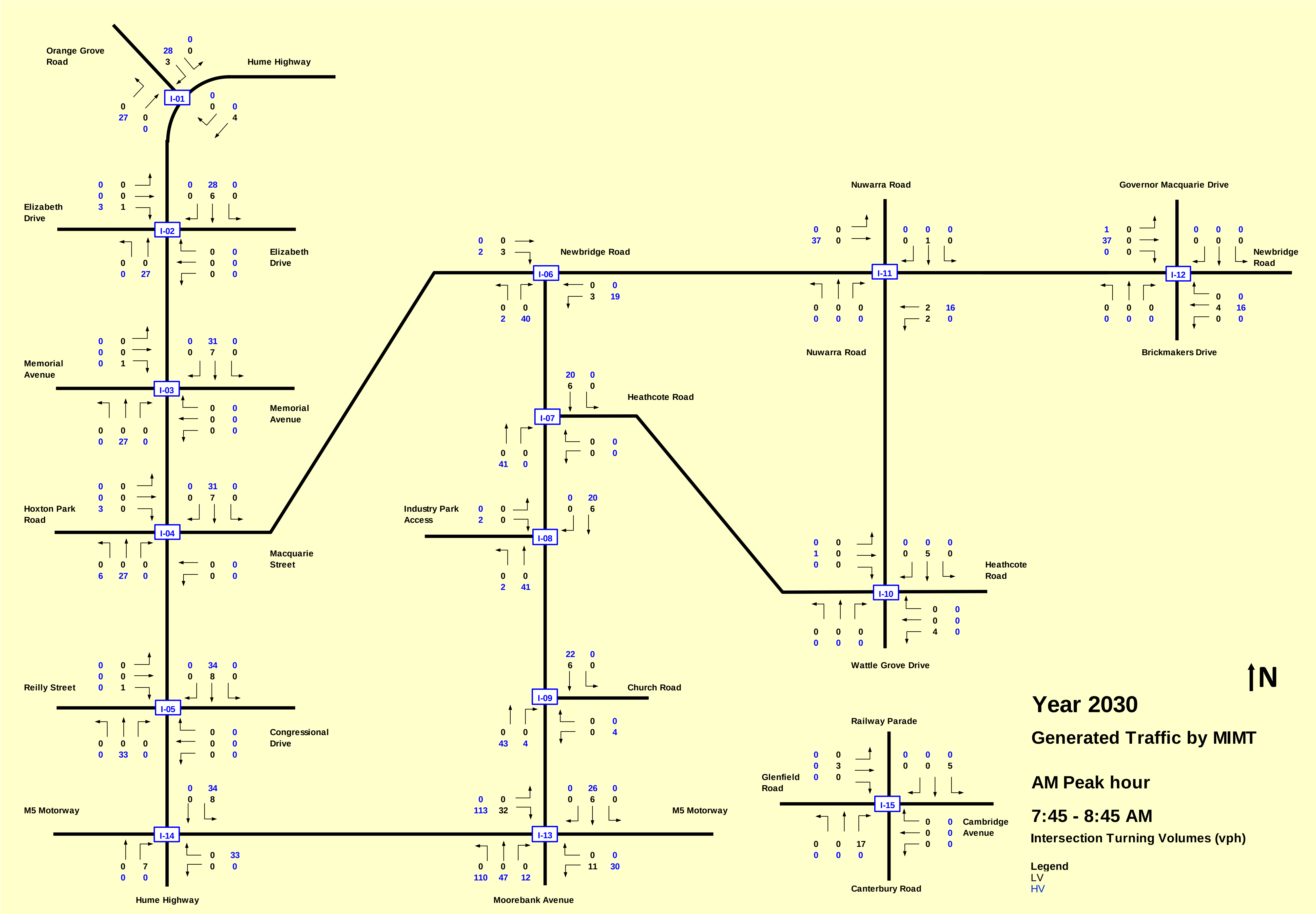


Figure 6.8 2030 Moorebank IMT traffic generated on the wider area road network in the AM peak

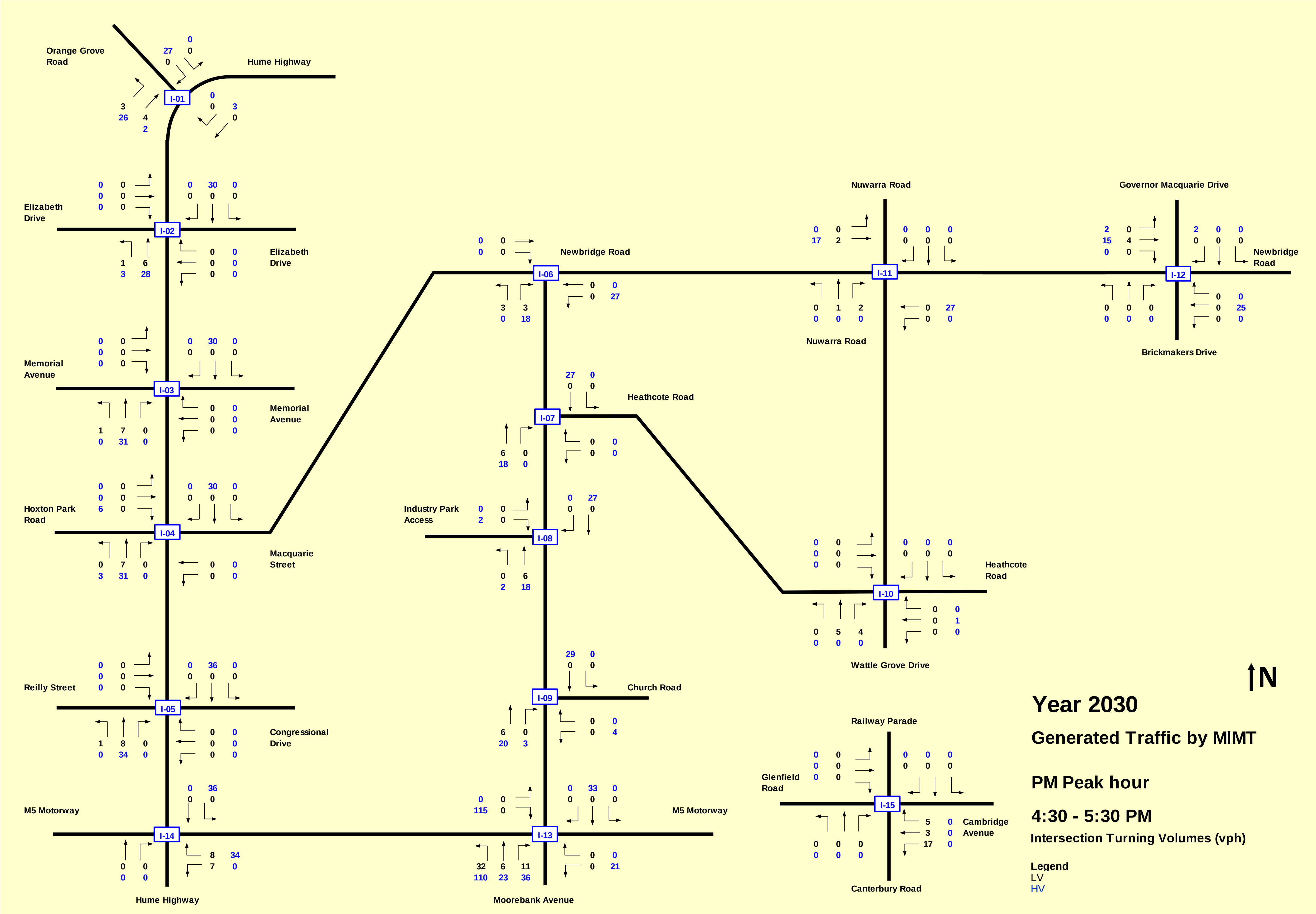


Figure 6.9 **2030 Moorebank IMT traffic generated on the wider area road network in the PM peak**

6.3.5.2 Intersection performance

The comparisons of the intersections performances with and without Moorebank IMT are shown in Table 6.9.

Table 6.9 Intersection performance on the wider road network with and without Moorebank IMT

Scenario	AM peak				PM peak			
	DoS	Delay	LoS	Queue	DoS	Delay	LoS	Queue
I-01 Hume Highway and Orange Grove Road								
2014 Existing Year	0.88	31	C	220	0.96	44	D	269
2030 Future Background	0.94	35	C	288	1.04	63	E	372
2030 with Moorebank IMT	1.05	43	D	353	1.09	70	E	440
I-02 Hume Highway and Elizabeth Drive								
2014 Existing Year	1.10	58	E	313	0.99	47	D	235
2030 Future Background	1.17	93	F	474	1.07	57	E	307
2030 with Moorebank IMT	1.17	97	F	535	1.07	60	E	327
I-03 Hume Highway and Memorial Avenue								
2014 Existing Year	1.00	51	D	314	1.18	45	D	258
2030 Future Background	1.18	92	F	504	1.24	57	E	422
2030 with Moorebank IMT	1.26	101	F	559	1.23	58	E	475
I-04 Hume Highway and Hoxton Park Drive								
2014 Existing Year	0.94	48	D	268	1.16	45	D	298
2030 Future Background	1.27	110	F	485	1.41	81	F	507
2030 with Moorebank IMT	1.26	115	F	503	1.41	84	F	574
I-05 Hume Highway and Reilly Street								
2014 Existing Year	0.89	17	B	273	0.93	16	B	280
2030 Future Background	1.03	26	B	464	1.13	28	B	439
2030 with Moorebank IMT	1.03	29	C	539	1.12	37	C	729
I-06 Newbridge Road and Moorebank Avenue								
2014 Existing Year	0.90	26	B	186	0.90	31	C	196
2030 Future Background	1.58	134	F	650	1.19	99	F	520
2030 with Moorebank IMT	1.67	147	F	733	1.20	115	F	606
I-07 Moorebank Avenue and Heathcote Road								
2014 Existing Year	0.93	27	B	239	0.89	16	B	176
2030 Future Background	1.39	207	F	706	1.42	107	F	690
2030 with Moorebank IMT	1.44	209	F	769	1.42	111	F	692
I-08 Moorebank Avenue and Industry Park Access								
2014 Existing Year	0.53	6	A	105	0.49	7	A	68
2030 Future Background	1.22	187	F	1144	0.52	7	A	75
2030 with Moorebank IMT	1.26	213	F	1274	0.52	7	A	76

I-09 Moorebank Avenue and Church Road								
2014 Existing Year	0.69	67	E	60	0.91	92	F	183
2030 Future Background	0.95	845	F	83	1.29	374	F	567
2030 with Moorebank IMT	0.98	878	F	92	1.38	565	F	661
I-10 Heathcote Road and Nuwarra Road								
2014 Existing Year	1.04	50	D	260	0.97	54	D	327
2030 Future Background	1.44	178	F	1182	1.32	144	F	854
2030 with Moorebank IMT	1.44	178	F	1183	1.34	146	F	855
I-11 Newbridge Road and Nuwarra Road								
2014 Existing Year	0.99	48	D	320	0.96	27	B	178
2030 Future Background	1.25	168	F	1038	1.08	38	C	298
2030 with Moorebank IMT	1.24	175	F	1105	1.09	39	C	304
I-12 Newbridge Road and Governor Macquarie Drive								
2014 Existing Year	0.98	49	D	400	1.02	40	C	264
2030 Future Background	1.24	161	F	1180	1.15	62	E	389
2030 with Moorebank IMT	1.24	166	F	1241	1.60	79	F	646
I-13 M5 Motorway and Moorebank Avenue								
2014 Existing Year	0.83	19	B	73	0.88	28	B	212
2030 Future Background	0.99	21	B	90	0.93	32	C	264
2030 with Moorebank IMT	0.98	22	B	122	0.92	34	C	255
I-14 M5 Motorway and Hume Highway								
2014 Existing Year	1.03	30	C	276	0.89	29	C	295
2030 Future Background	1.21	81	F	1101	1.15	79	F	641
2030 with Moorebank IMT	1.29	91	F	1109	1.24	89	F	646
I-15 Cambridge Avenue and Canterbury Road								
2014 Existing Year	0.62	17	B	34	0.48	11	A	15
2030 Future Background	1.14	114	F	287	0.59	14	A	28
2030 with Moorebank IMT	1.19	135	F	336	0.60	14	A	28

From the results in Table 6.9, additional capacity would be required at all of intersections in the vicinity of the proposed development, except the Hume Highway/Reilly Street intersection and Moorebank Avenue/M5 Motorway interchange, in order to accommodate future background traffic growth. The results indicate that the intersections would operate unsatisfactorily with long delays for at least one of the peak hours. Assessment of the results indicates:

- Intersections with the Hume Highway and Newbridge Road would operate at unsatisfactory level of service (LoS E or worse) in at least one of the peak hours.
    - These intersections would experience exceptionally long delays and queues as result of the heavy background traffic growth in this region.
    - A minor increase in congestion due to the generated traffic by Moorebank IMT would be expected on the wider road network but there is no significant intersection performance changes between the 'with' and 'without' Moorebank IMT scenario.

- Intersections along Moorebank Avenue (north of the M5 Motorway) would operate unsatisfactorily during both the AM and PM peak hours without the Moorebank IMT traffic.
  - Due to the higher background traffic growth on Moorebank Avenue and turning traffic from Newbridge Road onto Moorebank Avenue during the peak hours, this intersection would operate at an unsatisfactory level of service (LoS F).
  - It should be noted that Moorebank Avenue and Newbridge Road intersection would operate unsatisfactorily in 2030 even without the generated traffic by Moorebank IMT. The amount of generated Moorebank IMT traffic that is expected to use this intersection is very low (6 light vehicles and up to 63 heavy vehicles for the AM and PM peak hours).
  - The northbound queue from the intersection of Moorebank Avenue and Heathcote Road would be exacerbated due to the background traffic growth during the AM peak hour and it will affect operation of nearby intersections along Moorebank Avenue.
  - It should be noted that 1.2 km queues identified in the assessment are unlikely to be realised as traffic would seek alternate routes and redistribute to other routes in the network. However the potential for interference with adjacent intersection remains a likely impact, thus this intersection would operate unsatisfactorily.
- The interchange of Moorebank Avenue and the M5 Motorway would perform satisfactorily, maintaining a LoS C or better performance during the AM and PM peak hours in 2030. However, the DoS of 0.99 during the AM peak hour indicates that the interchange would operate at capacity.
- The interchange of the Hume Highway and M5 Motorway would operate at an unsatisfactory level of service (LoS F) for the PM peak hours with and without the generated traffic by Moorebank IMT.
  - The volume of generated Moorebank IMT traffic that travel through this interchange is approximately 85 during the peak hours which is a relatively small portion of demand compared to the future background traffic volumes.
  - Therefore it is expected that the generated traffic by Moorebank IMT would not cause significant negative impact at this interchange.
- The intersection of Cambridge Avenue and Canterbury Road would operate at an unsatisfactory level of service (LoS F) during the AM peak hour in 2030 as result of the heavy growth of right turning traffic from Canterbury Road onto Cambridge Avenue.

The results of the intersection SIDRA analysis is attached at Appendix H.

The comparison of intersection level of service, delay and queue lengths between ‘with’ and ‘without’ Moorebank IMT is presented in Figure 6.10 to 6.13.

During the 2030 AM peak, each movement at the intersections surveyed would operate at the same level of service with or without Moorebank IMT with the exception of the following (refer to Figure 6.10):

- the left turn from the Hume Highway onto Reilly Street would go from a LoS B to LoS C with Project traffic
- the right turn from Moorebank Avenue onto Church Road would go from a LoS B to LoS C with Project traffic.

During the 2030 pm peak (refer to Figure 6.11):

- the northbound through movement on the Hume Highway at the Elizabeth Drive intersection would go from a LoS D to LoS E with Project traffic
- the northbound through movement and the northbound right turn on the Hume Highway at the Reilly Street intersection would go from a LoS A to LoS B and LoS B to LoS C respectively
- the southbound left and through movement and the southbound right turn on the Hume Highway at the Reilly Street intersection would go from a LoS B to LoS C and LoS D to LoS E respectively
- the southbound left turn on the Hume Highway at the M5 Motorway intersection would go from a LoS A to LoS B with Project traffic
- the southbound through movement on Moorebank Avenue at the M5 Motorway intersection would go from a LoS C to LoS D with Project traffic
- the northbound right turn on Moorebank Avenue at the M5 Motorway intersection would go from a LoS B to LoS C with Project traffic
- the westbound left turn on the M5 Motorway at the Moorebank Avenue intersection would go from a LoS A to LoS B with Project traffic.

Figure 6.12 shows the change (difference) in overall intersection level of service, average vehicle delay and maximum queue lengths with and without the Project for the 2030 AM peak. This figure indicates that the Hume Highway and Orange Grove Road intersection would go from a LoS C to LoS D and the Hume Highway and Reilly Street from LoS B to LoS C. All remaining intersections would operate at the same LoS with or without the Project.

Figure 6.13 shows the change (difference) in overall intersection level of service, average vehicle delay and maximum queue lengths with and without the Project for the 2030 pm peak. This figure indicates that the Hume Highway and Reilly Street intersection would go from a LoS B to LoS C and the Newbridge Road and Governor Macquarie Drive intersection from LoS E to LoS F. All remaining intersections would operate at the same LoS with or without the Project.

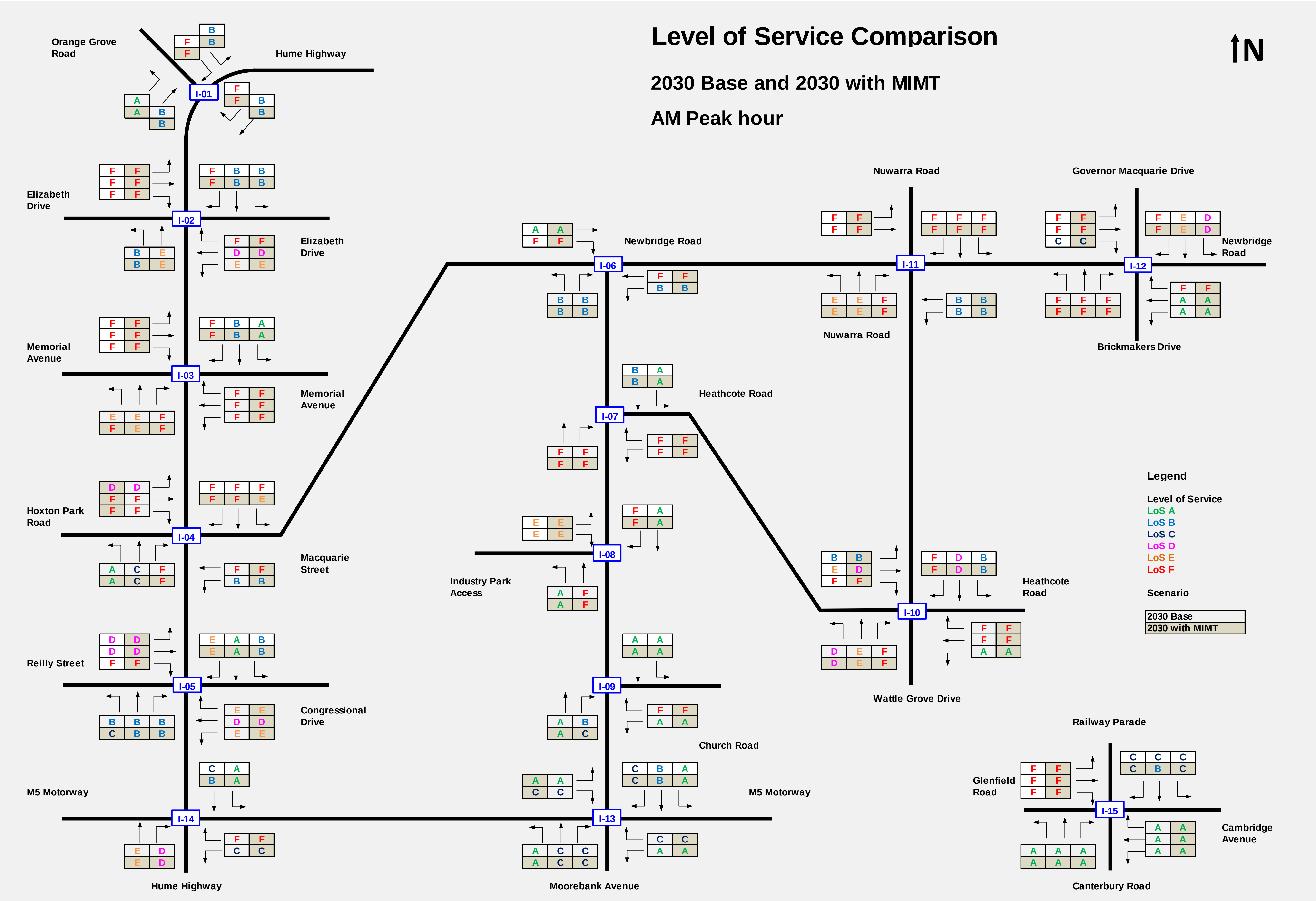


Figure 6.10 Intersection LoS Comparison 2030 weekday AM peak

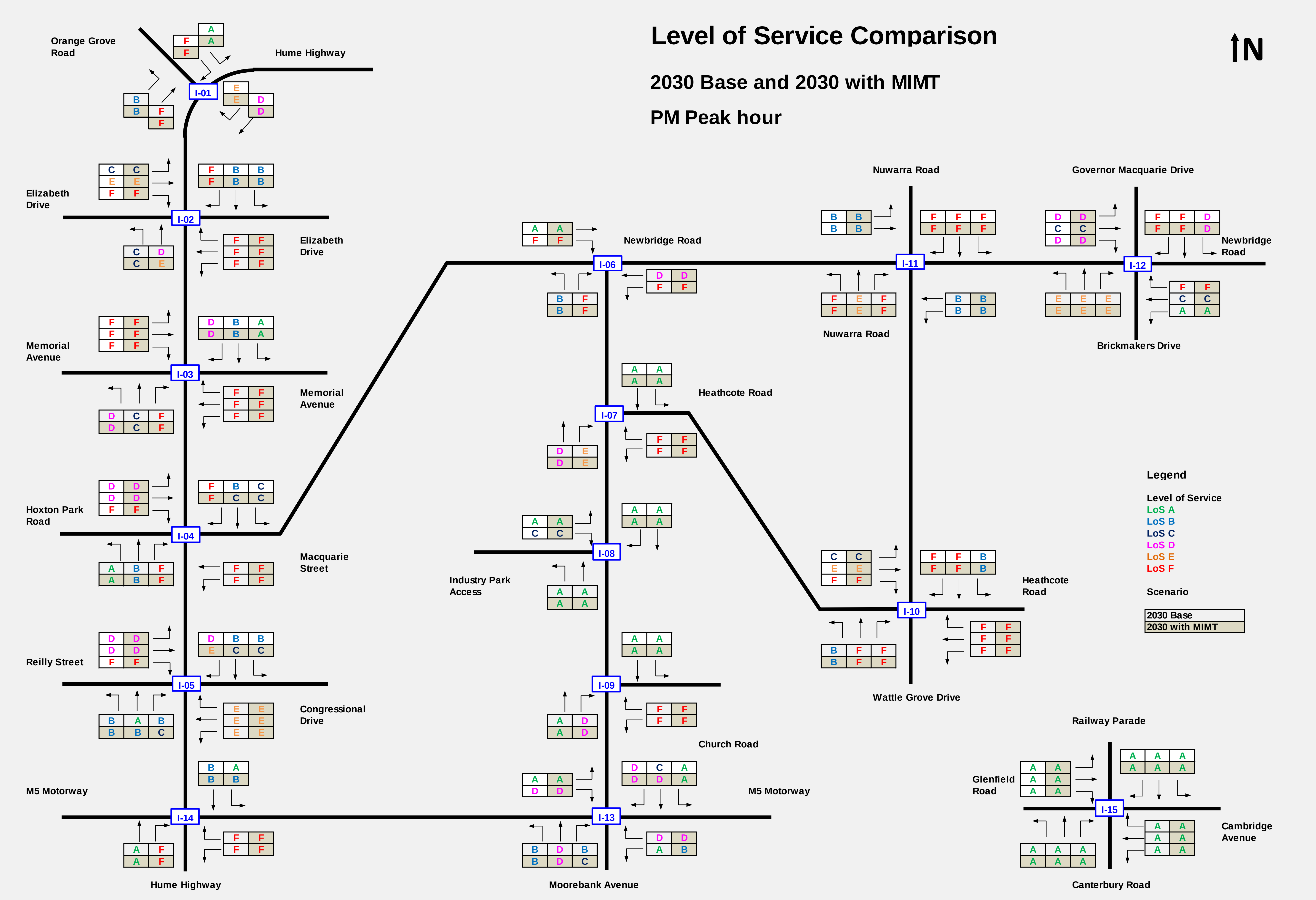


Figure 6.11 Intersection LoS Comparison 2030 weekday PM peak

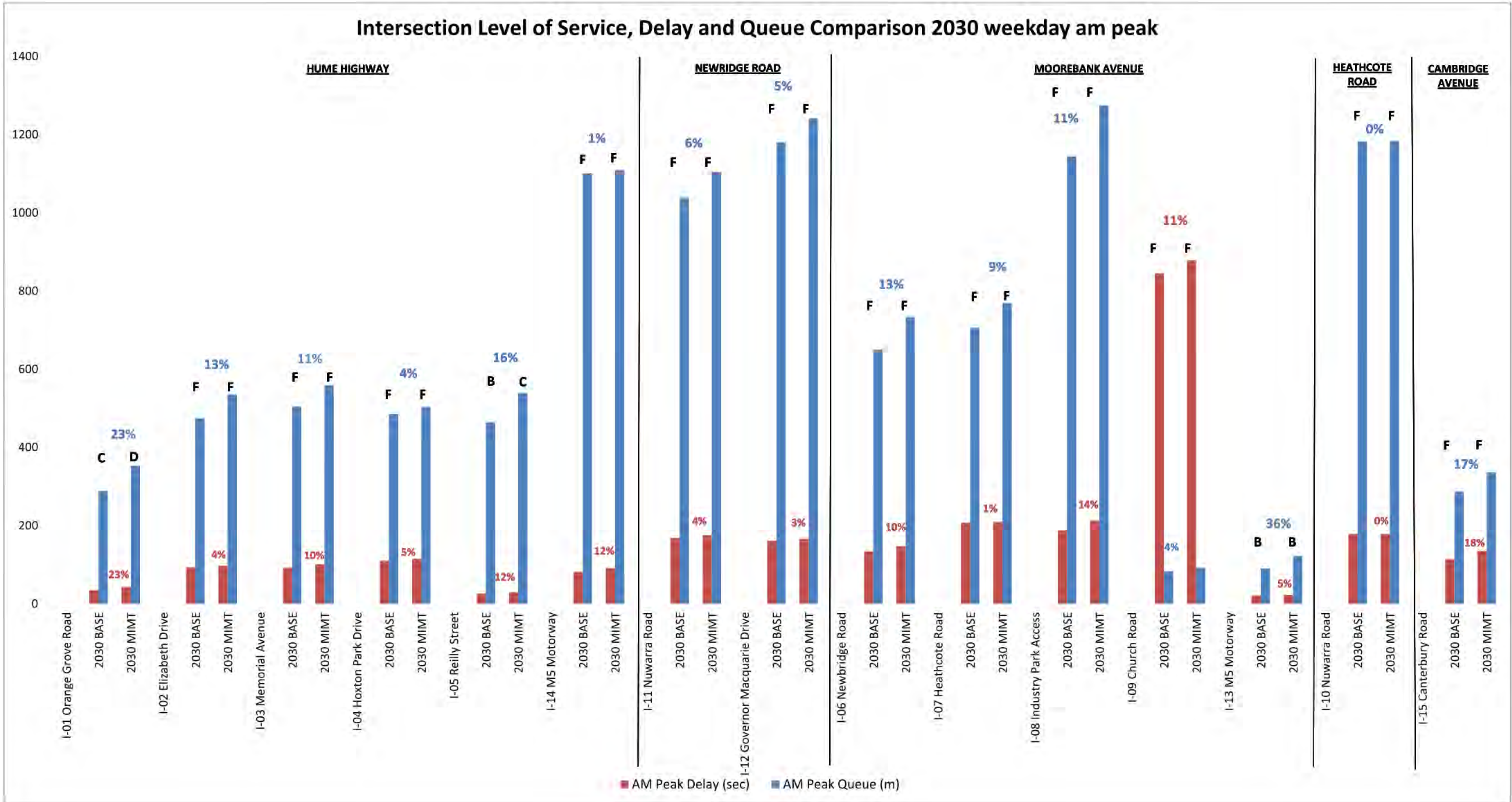


Figure 6.12 Intersection LoS, Delay and Queue Comparison 2030 weekday AM peak

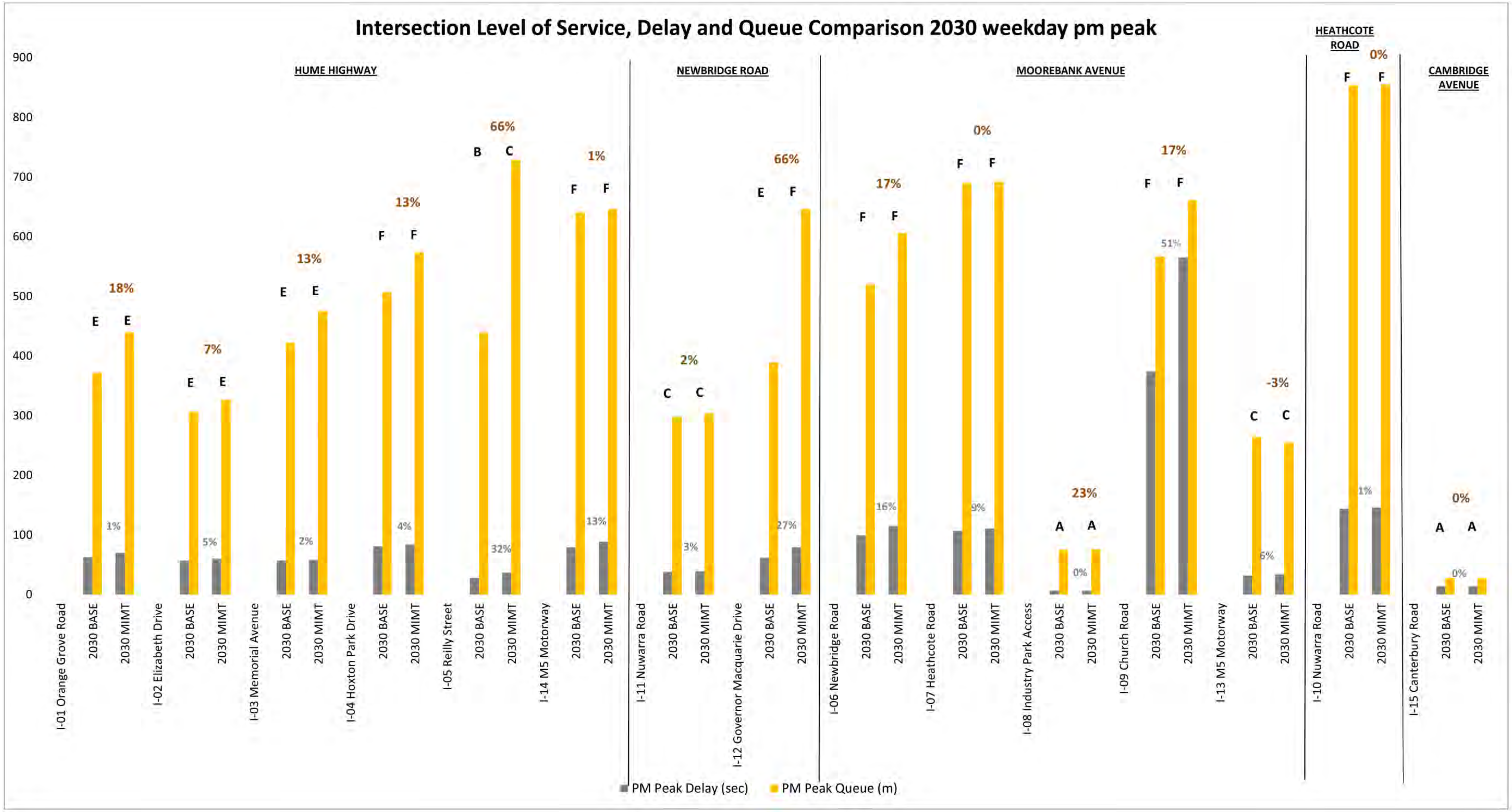


Figure 6.13 **Intersection LoS, Delay and Queue Comparison 2030 weekday PM peak**

6.3.5.3 Mid-block V/C ratios

Mid-block capacity assessment has been determined to analyse the link capacity on wider road network based on Austroads *Guide to Traffic Management part 3: Traffic Studies and Analysis, Table 5.1*. The typical mid-block capacities for various types of urban road with interrupted flow, with unflared major intersections and with interruptions form cross and turning traffic at minor intersections are shown in Table 6.10.

Table 6.10 Typical mid-block capacities for urban roads with interrupted flow

Type of lane	One-way mid-block capacity (pc/hr)
Median or inner lane	
Divided road	1000
Undivided road	900
Middle lane (of a three lane carriageway)	
Divided road	900
Undivided road	1000
Kerb lane	
Adjacent to parking lane	900
Occasional parked vehicle	600
Clearway conditions	900

Source: Austroads *Guide to Traffic Management Part 3: Traffic Studies and Analysis, Section 5.2.1, Table 5.1*

The modelled traffic volumes were compared with the following nominal lane capacity of the subject road:

- divided three lane road (e.g. Hume Highway and Newbridge Road): 2,800 vehicles/three lanes/hr
- divided two lane road (e.g. Heathcote Road, south of Nuwarra Road): 1,900 vehicles/two lanes/hr
- undivided two lane road (e.g. Moorebank Avenue): 1,800 vehicles/two lanes/hr
- divided one lane road (e.g. Nuwarra Road): 1,000 vehicles/lane/hr
- undivided one lane road (e.g. Cambridge Road): 900 vehicles/lane/hr.

The peak hour directional traffic flows for the key mid-block sections on the wider road network and the results of volume-to-capacity (V/C) ratios assessments are presented in Table 6.11. A V/C ratio greater than 1.00 indicates the section of roadway is over capacity and will not operate efficiently.

Table 6.11 shows that there are several mid-block road sections that are currently performing near capacity (V/C between 0.90 and 1.00) or over capacity (V/C greater than 1.00). Much of the road network is or will be experiencing congestion without the Project and the addition of Project traffic would have a negligible contribution to that congestion.

Table 6.11 Mid-block V/C ratio on the wider road network

Road section	Peak hour	Available capacity (veh/hr)	2014 Existing				2030 Background				2030 with Moorebank IMT				(%) Difference with Moorebank IMT	
			Peak hour traffic volume (veh/hr)		V/C		Peak hour traffic volume (veh/hr)		V/C		Peak hour traffic volume (veh/hr)		V/C			
			NB or EB	SB or WB	NB or EB	SB or WB	NB or EB	SB or WB	NB or EB	SB or WB	NB or EB	SB or WB	NB or EB	SB or WB	NB or EB	SB or WB
Hume Highway, east of Orange Grove Road	AM	2800	2338	1169	0.84	0.42	2651	1275	0.95	0.46	2649	1279	0.95	0.46	-0.08%	0.28%
	PM	2800	1325	2241	0.47	0.80	1402	2449	0.50	0.87	1408	2453	0.50	0.88	0.40%	0.14%
Hume Highway, south of Orange Grove Road	AM	2800	2902	1938	1.04	0.69	3267	2151	1.17	0.77	3293	2184	1.18	0.78	0.80%	1.53%
	PM	2800	2126	2714	0.76	0.97	2245	2964	0.80	1.06	2279	2995	0.81	1.07	1.51%	1.04%
Hume Highway, north of Elizabeth Drive	AM	2800	2606	1861	0.93	0.66	2979	2042	1.06	0.73	3009	2075	1.07	0.74	1.01%	1.61%
	PM	2800	1779	3007	0.64	1.07	1895	3298	0.68	1.18	1928	3329	0.69	1.19	1.74%	0.93%
Hume Highway, south of Elizabeth Drive	AM	2800	2073	1945	0.74	0.69	2364	2152	0.84	0.77	2395	2188	0.86	0.78	1.31%	1.67%
	PM	2800	1620	2512	0.58	0.90	1721	2739	0.61	0.98	1760	2769	0.63	0.99	2.27%	1.09%
Hume Highway, north of Memorial Avenue	AM	2800	1962	1647	0.70	0.59	2240	1840	0.80	0.66	2271	1879	0.81	0.67	1.39%	2.11%
	PM	2800	1684	2881	0.60	1.03	1803	3133	0.64	1.12	1835	3157	0.66	1.13	1.78%	0.76%
Hume Highway, north of Hoxton Park Road	AM	2800	2075	1603	0.74	0.57	2341	1816	0.84	0.65	2373	1852	0.85	0.66	1.37%	2.01%
	PM	2800	1644	2753	0.59	0.98	1710	3038	0.61	1.09	1752	3064	0.63	1.09	2.43%	0.85%
Hume Highway, south of Hoxton Park Road	AM	2800	2887	1840	1.03	0.66	3269	2065	1.17	0.74	3300	2108	1.18	0.75	0.95%	2.08%
	PM	2800	1967	3432	0.70	1.23	2084	3779	0.74	1.35	2128	3813	0.76	1.36	2.10%	0.90%
Hume Highway, south of Reilly Street	AM	2800	2772	1805	0.99	0.64	3077	1989	1.10	0.71	3104	2033	1.11	0.73	0.88%	2.19%
	PM	2800	2085	3453	0.74	1.23	2139	3771	0.76	1.35	2183	3802	0.78	1.36	2.07%	0.82%
Newbridge Road, west of Moorebank Avenue	AM	1800	1608	1798	0.89	1.00	2324	2376	1.29	1.32	2332	2375	1.30	1.32	0.34%	-0.06%
	PM	1800	1772	1740	0.98	0.97	2133	2253	1.19	1.25	2137	2255	1.19	1.25	0.19%	0.11%
Newbridge Road, east of Moorebank Avenue	AM	2800	2072	1086	0.74	0.39	2797	1571	1.00	0.56	2833	1589	1.01	0.57	1.28%	1.14%
	PM	2800	1534	2071	0.55	0.74	1976	2483	0.71	0.89	1989	2514	0.71	0.90	0.68%	1.26%
Moorebank Avenue, south of Newbridge Road	AM	3800	2149	973	0.57	0.35	2755	1477	0.73	0.53	2788	1502	0.73	0.54	1.21%	1.69%
	PM	2800	1327	1896	0.35	0.68	1856	2243	0.49	0.80	1868	2274	0.49	0.81	0.64%	1.39%
Moorebank Avenue, south of Heathcote Road	AM	1800	1467	534	0.82	0.30	1847	772	1.03	0.43	1873	801	1.04	0.44	1.43%	3.72%
	PM	1800	851	1234	0.47	0.69	1151	1453	0.64	0.81	1171	1482	0.65	0.82	1.73%	2.01%
Moorebank Avenue, north of Church Road	AM	1800	1625	537	0.90	0.30	2003	716	1.11	0.40	2032	752	1.13	0.42	1.45%	4.97%
	PM	1800	873	1355	0.49	0.75	1119	1616	0.62	0.90	1132	1648	0.63	0.92	1.12%	1.98%
Moorebank Avenue, south of Church Road	AM	1800	1836	673	1.02	0.37	2264	871	1.26	0.48	2295	910	1.28	0.51	1.38%	4.50%
	PM	1800	952	1687	0.53	0.94	1221	2006	0.68	1.11	1236	2041	0.69	1.13	1.23%	1.73%
Heathcote Road, north of Nuwarra Road	AM	1900	1182	2149	0.62	1.13	1461	3060	0.77	1.61	1456	3059	0.77	1.61	-0.38%	-0.02%
	PM	1900	1810	1726	0.95	0.91	2305	2078	1.21	1.09	2305	2083	1.21	1.10	0.01%	0.22%
Heathcote Road, south of Nuwarra Road	AM	1900	1316	1990	0.69	1.05	1640	2822	0.86	1.49	1637	2825	0.86	1.49	-0.21%	0.11%
	PM	1900	1986	1687	1.05	0.89	2567	2031	1.35	1.07	2573	2031	1.35	1.07	0.24%	-0.02%
Nuwarra Road, north of Heathcote Road	AM	1000	1095	868	1.10	0.87	1373	1112	1.37	1.11	1372	1117	1.37	1.12	-0.07%	0.45%
	PM	1000	838	1445	0.84	1.45	1000	1724	1.00	1.72	1005	1732	1.01	1.73	0.50%	0.46%
Newbridge Road, west of Nuwarra Road	AM	2800	1807	954	0.65	0.34	2461	1386	0.88	0.50	2481	1397	0.89	0.50	0.83%	0.77%
	PM	2800	1285	1961	0.46	0.70	1687	2369	0.60	0.85	1700	2379	0.61	0.85	0.74%	0.41%

Road section	Peak hour	Available capacity (veh/hr)	2014 Existing				2030 Background				2030 with Moorebank IMT				(%) Difference with Moorebank IMT	
			Peak hour traffic volume (veh/hr)		V/C		Peak hour traffic volume (veh/hr)		V/C		Peak hour traffic volume (veh/hr)		V/C			
			NB or EB	SB or WB	NB or EB	SB or WB	NB or EB	SB or WB	NB or EB	SB or WB	NB or EB	SB or WB	NB or EB	SB or WB	NB or EB	SB or WB
Newbridge Road, west of Governor Macquarie Drive	AM	2800	2240	1094	0.80	0.39	2971	1576	1.06	0.56	2989	1581	1.07	0.56	0.61%	0.31%
	PM	2800	1646	2360	0.59	0.84	2133	2853	0.76	1.02	2129	2928	0.76	1.05	-0.20%	2.62%
Newbridge Road, east of Governor Macquarie Drive	AM	2800	3252	1681	1.16	0.60	4258	2268	1.52	0.81	4270	2278	1.52	0.81	0.27%	0.43%
	PM	2800	2157	3317	0.77	1.18	2775	3982	0.99	1.42	2799	3989	1.00	1.42	0.88%	0.16%
Cambridge Avenue, west of Moorebank Avenue	AM	900	1110	323	1.23	0.36	1442	420	1.60	0.47	1463	420	1.63	0.47	1.47%	0.00%
	PM	900	340	1293	0.38	1.44	487	1638	0.54	1.82	487	1663	0.54	1.85	0.00%	1.54%
Orange Grove Road, north of Hume Highway	AM	1900	1399	1604	0.74	0.57	1559	1819	0.82	0.65	1586	1847	0.83	0.66	1.73%	1.56%
	PM	2800	1864	1536	0.98	0.55	1989	1661	1.05	0.59	2017	1688	1.06	0.60	1.43%	1.64%
Elizabeth Drive, west of Hume Highway	AM	2800	1814	791	0.65	0.28	2119	943	0.76	0.34	2120	942	0.76	0.34	0.05%	-0.11%
	PM	2800	1033	1977	0.37	0.71	1111	2242	0.40	0.80	1106	2245	0.40	0.80	-0.45%	0.14%
Hoxton Park Road, west of Hume Highway	AM	1800	1509	617	0.84	0.34	1981	850	1.10	0.47	2002	855	1.11	0.48	1.04%	0.60%
	PM	1800	1091	932	0.61	0.52	1277	1127	0.71	0.63	1288	1129	0.72	0.63	0.88%	0.19%
Heathcote Road, east of Moorebank Avenue	AM	1800	719	506	0.40	0.28	933	777	0.52	0.43	932	777	0.52	0.43	-0.11%	0.00%
	PM	1800	578	758	0.32	0.42	842	885	0.47	0.49	843	886	0.47	0.49	0.12%	0.11%

V/C ratio greater than 1.00
V/C ration between 0.90 and 1.00
V/C ratio less than 0.90

Table 6.12 shows that traffic generated by the Moorebank IMT is expected to increase total intersection traffic volumes by less than 2.5% for the majority of intersections when compared to 2030 base traffic volumes. This indicates that the generated traffic is not likely to have a substantial impact on the operation of intersections on the wider road network.

At the intersection of Moorebank Avenue and the M5 Motorway, an additional 388 vehicles equates to approximately 9% of total intersection traffic in the peak hours when compared to the 2030 base traffic volumes. It should be noted that the intersection of Moorebank Avenue and the M5 Motorway would achieve a satisfactory level of service during the AM and PM peak hours in 2030.At the intersection of M5 Motorway and Hume Highway, an additional 85 vehicles equates to approximately 1% of total intersection traffic in the peak hours when compared to the 2030 base traffic volumes. The modelling result indicates that the intersection of the Hume Highway and M5 Motorway would operate at an unsatisfactory level of service even without the Moorebank IMT generated traffic for the PM peak hour in 2030. This shows that the additional Moorebank IMT traffic at this intersection is not the determining factor for the poor intersection operating conditions.

Table 6.12 The impact of Moorebank IMT traffic on the wider road network (Moorebank IMT traffic as a percentage of total intersection traffic in 2030)

Intersection	Peak	2030 base total intersection traffic		2030 traffic generated by MIMT at each intersection		Percentage of Total Intersection Traffic
		LV	HV	LV	HV	
Hume Highway/ Orange Grove Road	AM	5,922	436	6	55	0.96%
	PM	6,131	225	6	57	1.00%
Hume Highway/ Elizabeth Drive	AM	6,735	452	7	58	0.90%
	PM	7,187	253	7	61	0.91%
Hume Highway/ Memorial Avenue	AM	4,870	394	7	58	1.24%
	PM	5,646	189	7	61	1.17%
Hume Highway/ Hoxton Park Road	AM	7,441	499	8	67	0.95%
	PM	7,557	262	8	70	0.99%
Hume Highway/ Reilly Street	AM	5,193	249	8	67	1.39%
	PM	6,133	171	8	70	1.24%
Moorebank Avenue/ Newbridge Road	AM	6,153	488	6	62	1.03%
	PM	6,154	313	6	46	0.81%
Moorebank Avenue/ Heathcote Road	AM	3,915	350	6	62	1.60%
	PM	3,977	235	6	46	1.24%
Moorebank Avenue/ Industrial Park Access	AM	2,416	269	6	65	2.67%
	PM	2,594	172	6	49	2.01%
Moorebank Avenue/ Church Road	AM	2,857	311	6	73	2.50%
	PM	3,004	224	6	56	1.94%
Heathcote Road/ Wattle Grove Road	AM	6,369	392	9	1	0.14%
	PM	6,772	233	9	1	0.14%
Newbridge Road/ Nuwarra Road	AM	5,009	437	6	53	1.07%
	PM	5,449	294	6	44	0.87%
Newbridge Road/ Governor Macquarie Drive	AM	6,574	554	4	53	0.80%
	PM	7,130	469	4	44	0.64%

Intersection	Peak	2030 base total intersection traffic		2030 traffic generated by MIMT at each intersection		Percentage of Total Intersection Traffic
		LV	HV	LV	HV	
Moorebank Avenue/ M5 Motorway interchange	AM	3,917	378	50	338	9.03%
	PM	4,039	280	50	338	8.98%
M5 Motorway/ Hume Highway interchange	AM	7,515	385	16	67	1.05%
	PM	8,546	268	16	70	0.97%
Cambridge Avenue/ Canterbury Road	AM	3,060	124	25	0	0.79%
	PM	3,256	109	25	0	0.75%
SUM (AVERAGE %)		**161,521**	**9,415**	**345**	**2,090**	**1.42%**

6.3.6 Summary of potential road network capacity issues in 2030

Capacity issues are reflected through the presence of congestion during peak periods. The analysis of the traffic generated by Moorebank IMT compared to the congestion forecast to be present on the road infrastructure is summarised in Table 6.13.

Table 6.13 The impact of Moorebank IMT traffic on road infrastructure congestion

Road Infrastructure	Peak hour congestion in 2030	Contribution of Moorebank IMT traffic to congestion issue	Mitigation Measure and Impact
Moorebank Avenue (East Hills line to M5)	Some	Significant adverse impact	Project includes widening of Moorebank Avenue to four lanes and provision of new intersections which reduces congestion to 2011 levels
Moorebank Avenue north of M5	Yes	Minor adverse impact	Minor Intersection modifications may be required
Cambridge Avenue	Yes	Insignificant impact	None required
M5 Westbound between Moorebank Avenue & Hume Highway	Yes	The M5 is heavily congested without Moorebank IMT traffic	TfNSW to explore how to resolve congestion issue on M5 caused by inadequate weave distance as this is not a direct Project impact.
M5 Eastbound between Moorebank Avenue & Hume Highway	Yes	The M5 is heavily congested without Moorebank IMT traffic	TfNSW to explore how to resolve congestion issue on M5 caused by inadequate weave distance as this is not a direct Project impact.
Hume Highway north of M5	Yes	Insignificant impact	None required
M7 Motorway	Yes	Insignificant impact	None required
M2 Motorway	Yes	Insignificant impact	None required
M1 Pacific Motorway	Yes	Insignificant impact	None required

The influence of the Moorebank IMT traffic on the surrounding road network can be further mitigated by using the managing the arrival and departure of trucks through the terminal gateline during peak periods of congestion.

The localised impact on congestion around Moorebank is offset by the broader network benefits:

- a saving of 56,125 truck vehicle kilometres travelled (VKT) per day
- a saving of 1,265 truck vehicle hours travelled (VHT) per day.

The potential contribution of Moorebank IMT traffic to the congestion around Moorebank and at a regional level will be revisited at the next stage of more detailed planning. At this later stage, several elements will be more defined allowing many of the issues discussed in this report to be analysed in more detail.

6.4 Potential crash reduction

The impact of the Moorebank Avenue upgrade on accidents was assessed in accordance with the RMS *Accident Reduction Guide, Version 1.1, TD2004/RS01 (August 2005)*. The proposed treatments and their potential individual impact on the type of accidents that occur within the study area are shown in Table 6.14.

Table 6.14 Potential crash reduction

Treatment location	Accident type		
Intersections	**Vehicles from opposing direction**	**Vehicles from one direction**	**Off path on straight**
Fully control right turn with arrows	80%	–	–
Upgrade signal display (mast arm/additional lanterns	10%	25%	–
Protected right turn lane	40%	60%	–
Separated left turn deceleration lane	15%	60%	–
Midblock			
Install street lighting	20%	25%	25%
RRPM's on Centre and Edge lines	–	15%	15%
Limit access to roadside developments	–	50%	–
Duplicate road	–	30%	–
New signing	–	–	10%
Non–skid surfacing	–	50%	5%

Source – RMS Accident Reduction Guide, Version 1.1

The percentage reduction indicates that the upgrade of Moorebank Avenue within the study area is predicted to have a positive result on reducing accidents. The combinations of some of these treatments at certain locations are also likely to reduce the severity of accidents.

The Moorebank IMT reduces truck VKT on the network (section 5.1) and would lead to a potential reduction in heavy vehicle related crashes. The reduction of heavy vehicle numbers on the road network would also assist in reducing the number of potential conflicts along existing travel routes between light and heavy vehicles.

6.4.1 Other safety benefits

Whilst there are no recorded instances over the five year period between 2008 and 2013 of accidents involving pedestrians or cyclists on Moorebank Avenue, the proposed enhancements include footpaths/shared use paths. This would provide an improved and safer environment for pedestrian and cyclists.

6.5 Economic benefits

Moorebank IMT is expected to generate a number of economic, social and environmental benefits for the community and economy, as outlined below and discussed in greater detail in section 3 of the EIS:

- *Economic benefits* – close to $9 billion in economic benefits (before costs and in net present value terms), over a 30-year operational period of the Project, including $120 million a year for the south-western Sydney economy through improved productivity; reduced operating costs; reduced costs associated with road damage, congestion and accidents; and better environmental outcomes;
- *Job creation* – up to 2,600 jobs during construction (1,350 jobs during the IMEX terminal construction and 1,250 during the interstate terminal construction), and approximately 1,700 long-term jobs when the Project is fully operational. Jobs created by the Project and its construction would be located at the IMT itself, as well as within the broad range of industries that would service the IMT construction and operations and its staff, including construction suppliers to retail, financial services, food outlets and health services;
- *Better environment through reduced road congestion* – up to 1,500 fewer truck journeys to and from Port Botany each day, with associated reductions in greenhouse gas emissions and other air pollutants;
- *Social benefits of reducing road traffic and associated noise* along key road freight routes between Moorebank and Port Botany and interstate;
- *Easing the Port Botany bottleneck* to enable the Port to cope with future growth and provide large-scale freight capacity; and
- *Enabling the movement of freight around Australia* – interstate freight is expected to grow by 3.6% a year over the next 20 years.

7. The Moorebank IMT and SIMTA site development cumulative traffic impact assessment

The Sydney Intermodal Terminal Alliance (SIMTA) is proposing to develop an IMT facility on the site currently occupied by DNSDC on Moorebank Avenue, Moorebank. In light of this, the Environmental Assessment Requirements (EARs) require a cumulative assessment of the impacts that would occur in the event that both projects were developed. This chapter provides a description of the approach to the cumulative impact assessment of the Moorebank IMT and the proposed development on the SIMTA site and the potential traffic impacts identified from the assessment. The cumulative assessment has been completed based on the Moorebank IMT northern rail access option for scenario 1 and the southern rail access option for scenarios 2 and 3.

The SIMTA proposal has been assessed by the NSW Department of Planning and Environment and has been given Concept Approval. The *SIMTA Traffic and Transport Assessment* prepared by Hyder Consulting in 2013 documents the proposed facility. Parsons Brinckerhoff has extracted some of the information from this report in preparation of this cumulative impact assessment including traffic generation, shift operation, warehouse development yields and site access locations onto Moorebank Avenue.

The site for the SIMTA development is to the immediate east of the Project site and the two projects would, if both approved, operate simultaneously. In accordance with the EARs an assessment of potential cumulative impacts levels is required to assess these simultaneous operations.

7.1 Scenarios analysed

Three cumulative scenarios were analysed to determine their traffic generating impact on the road network and include:

- Cumulative scenario 1 – 1.05 million TEU IMEX, 500,000 TEU Interstate, 300,000 m^2 warehouse on Moorebank IMT site and 300,000 m^2 standalone warehouse operation on the SIMTA site utilising Moorebank IMT northern rail access option
- Cumulative scenario 2 - 500,000 TEU IMEX, 500,000 TEU Interstate, 300,000 m^2 warehouse on Moorebank IMT site and 500,000 TEU IMEX, 300,000 m^2 warehouse operation on the SIMTA site utilising Moorebank IMT southern rail access option
- Cumulative scenario 3 - 500,000 TEU Interstate, 300,000 m^2 warehouse on Moorebank IMT site and 1.0 million TEU IMEX, 300,000 m^2 warehouse operation on the SIMTA site utilising Moorebank IMT southern rail access option.

For these scenarios it is assumed that:

- the traffic generated by warehousing by Moorebank IMT is based upon Deloitte traffic generation rates for heavy vehicles and staffing requirements for light vehicles
- the traffic generated by standalone warehousing on the SIMTA site or surplus warehousing on the Project site utilises the RMS daily trip generation rate, with 4.2% of daily trips occurring during peak hours

- the SIMTA site would be developed in accordance with the concept layout identified in Figure 7.1 with three access roads connection with Moorebank Avenue (northern, central and southern accesses)
- the traffic generated by the SIMTA standalone warehouse operation is based upon RMS trip generation rates
- the heavy vehicle distribution for the Moorebank IMT and SIMTA site is based upon the Freight Movement Model (FMM) distribution
- the light vehicle distribution for Moorebank IMT is based upon the Sydney Strategic Travel Model (STM) for Moorebank Avenue and from intersection traffic volume distributions on the wider road network (beyond Moorebank Avenue)
- the light vehicle distribution for SIMTA is based upon the SIMTA EIS for Moorebank Avenue and from intersection traffic volume distributions on the wider road network (beyond Moorebank Avenue)
- both sites are assumed to be operational 24 hours a day seven days a week
- the majority of staff would arrive and depart outside the peak periods on the road network and the maximum traffic generation would occur during the shift changeover (at 6.00 am, 2.00 pm and 10.00 pm) for the Project site
- the majority of staff would arrive and depart within the peak periods on the road network and the maximum traffic generation would occur during the shift changeover (at 8.00 am and 5.00 pm) for the SIMTA site
- light vehicle trip generation was assumed to be tidal during peak hours, i.e. all inbound in the AM peak and all outbound in the PM peak, and heavy vehicles were assumed to be evenly distributed between inbound and outbound movements
- different peak hour traffic profile percentages utilised for Moorebank and SIMTA sites
- the assessment would consider cumulative operations of the two developments at year 2030 – when both are at full build operational levels. This allows for an assessment of potential ‘worst case’ impacts resulting from the two developments.

7.2 Cumulative impact assessment

7.2.1 Traffic generation

7.2.1.1 Standalone or surplus warehousing

Traffic generated by standalone or surplus warehousing has been estimated using the RMS *Guide to Traffic Generating Developments (2013) – Appendix A Business Parks and Industrial Estates – Site details and trip generation,* as follows:

- Daily vehicle trips = 2.1 per 100 m^2 GFA.
- Warehouse operations peak hour vehicle trips = 0.1825 per 100 m^2 GFA.
- Trips occurring during the peak hour of the adjacent road network = 4.2%.

- Heavy vehicle trip proportion of 27.1% for the warehouse facility.

Daily and warehouse peak hour vehicle trips were taken as an average of two similar warehouse sites from the RMS *Guide to Traffic Generating Developments*, as follows:

- Site 1 Erskine Park Industrial Estate, Erskine Park:
  - 0.163 peak vehicle trips per 100 m^2 GFA
  - warehouse peak hour 2.45–3.45 pm
  - 1.892 total daily trips per 100 m^2 GFA
  - 28.3% heavy vehicle trips
- Site 3 Wonderland Business Park, Eastern Creek:
  - 0.202 peak vehicle trips per 100 m^2 GFA
  - warehouse peak hour 8.00–9:00 am
  - 2.308 total daily trips per 100 m^2 GFA
  - 25.9% heavy vehicle trips.

7.2.1.2 Cumulative scenario traffic generations

The cumulative scenario traffic generation is shown in Table 7.1.

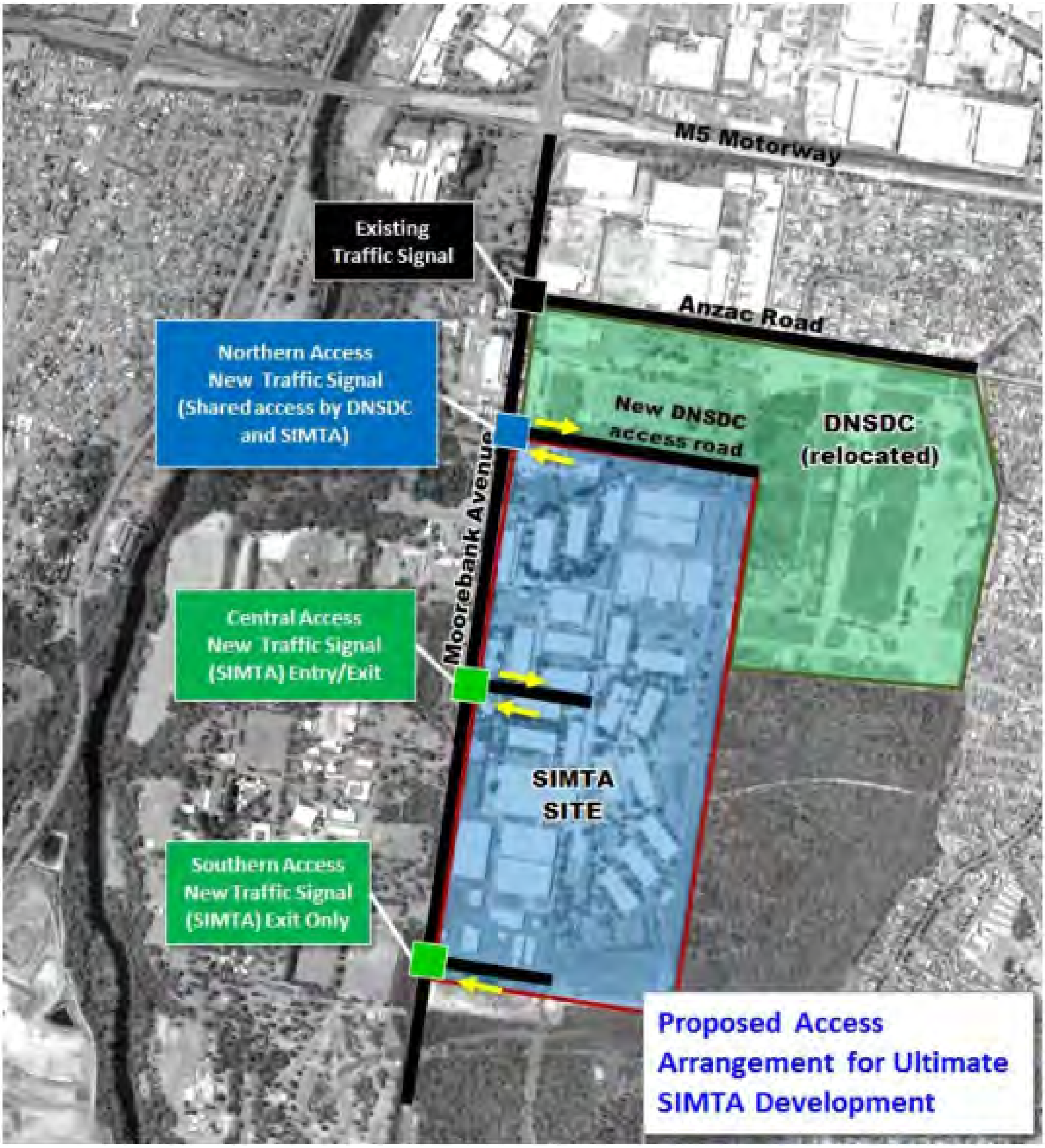
Table 7.1 Cumulative scenario daily and peak hourly traffic generation

Cumulative traffic			LV	HV
Site	**Scenario 1**			
Moorebank IMT	AM peak hour traffic movements	Inbound	84	169
		Outbound	0	169
	PM peak hour traffic movements	Inbound	0	169
		Outbound	84	169
	Total daily vehicle trips		**5,724**	**8,160**
SIMTA	AM peak hour traffic movements	Inbound	191	36
		Outbound	0	36
	PM peak hour traffic movements	Inbound	0	36
		Outbound	191	36
	Total daily vehicle trips		**4,593**	**1,707**
Combined	Total cumulative AM peak traffic movements	Inbound	275	205
		Outbound	0	205
	Total cumulative PM peak traffic movements	Inbound	0	205
		Outbound	275	205
	Total cumulative daily vehicle trips		**10,317**	**9,867**

Cumulative traffic			LV	HV
Site	**Scenario 2**			
Moorebank IMT	AM peak hour traffic movements	Inbound	128	116
		Outbound	0	116
	PM peak hour traffic movements	Inbound	0	116
		Outbound	128	116
	Total daily vehicle trips		**6,826**	**5,575**
SIMTA	AM peak hour traffic movements	Inbound	317	52
		Outbound	0	52
	PM peak hour traffic movements	Inbound	0	38
		Outbound	435	38
	Total daily vehicle trips		**2,492**	**1,313**
Combined	Total cumulative AM peak traffic movements	Inbound	445	168
		Outbound	0	168
	Total cumulative PM peak traffic movements	Inbound	0	154
		Outbound	563	154
	Total cumulative daily vehicle trips		**9,318**	**6,888**
Site	**Scenario 3**			
Moorebank IMT	AM peak hour traffic movements	Inbound	182	74
		Outbound	0	74
	PM peak hour traffic movements	Inbound	0	74
		Outbound	182	74
	Total daily vehicle trips		**8,179**	**3,556**
SIMTA	AM peak hour traffic movements	Inbound	692	102
		Outbound	0	102
	PM peak hour traffic movements	Inbound	0	78
		Outbound	630	78
	Total daily vehicle trips		**3,614**	**2,638**
Combined	Total cumulative AM peak traffic movements	Inbound	875	176
		Outbound	0	176
	Total cumulative PM peak traffic movements	Inbound	0	152
		Outbound	812	152
	Total cumulative daily vehicle trips		**11,793**	**6,194**

7.2.2 Site access locations for the SIMTA

Proposed access locations for the SIMTA site are shown in Figure 7.1. Based on the SIMTA Traffic and Transport Assessment prepared by Hyder Consulting, the Northern and Central accesses would be utilised by both light and heavy vehicle for ingress and egress and the Southern access for heavy vehicle egress only. These accesses have been assumed for all three cumulative scenarios.



Source: SIMTA Traffic and Transport Assessment, Hyder Consulting 2013

Figure 7.1 Proposed SIMTA site access locations

7.2.3 Access under the northern rail access option (scenario 1)

Figure 7.2 to Figure 7.4 show the intersections that have been modified where required from the Moorebank IMT northern rail access option concept design to accommodate access to the SIMTA site. The Moorebank IMT Warehouse Access 2 would form a four way intersection with the SIMTA Central Access and the Moorebank IMT Main Access would form a four way intersection with the SIMTA Southern Access should both projects be developed.

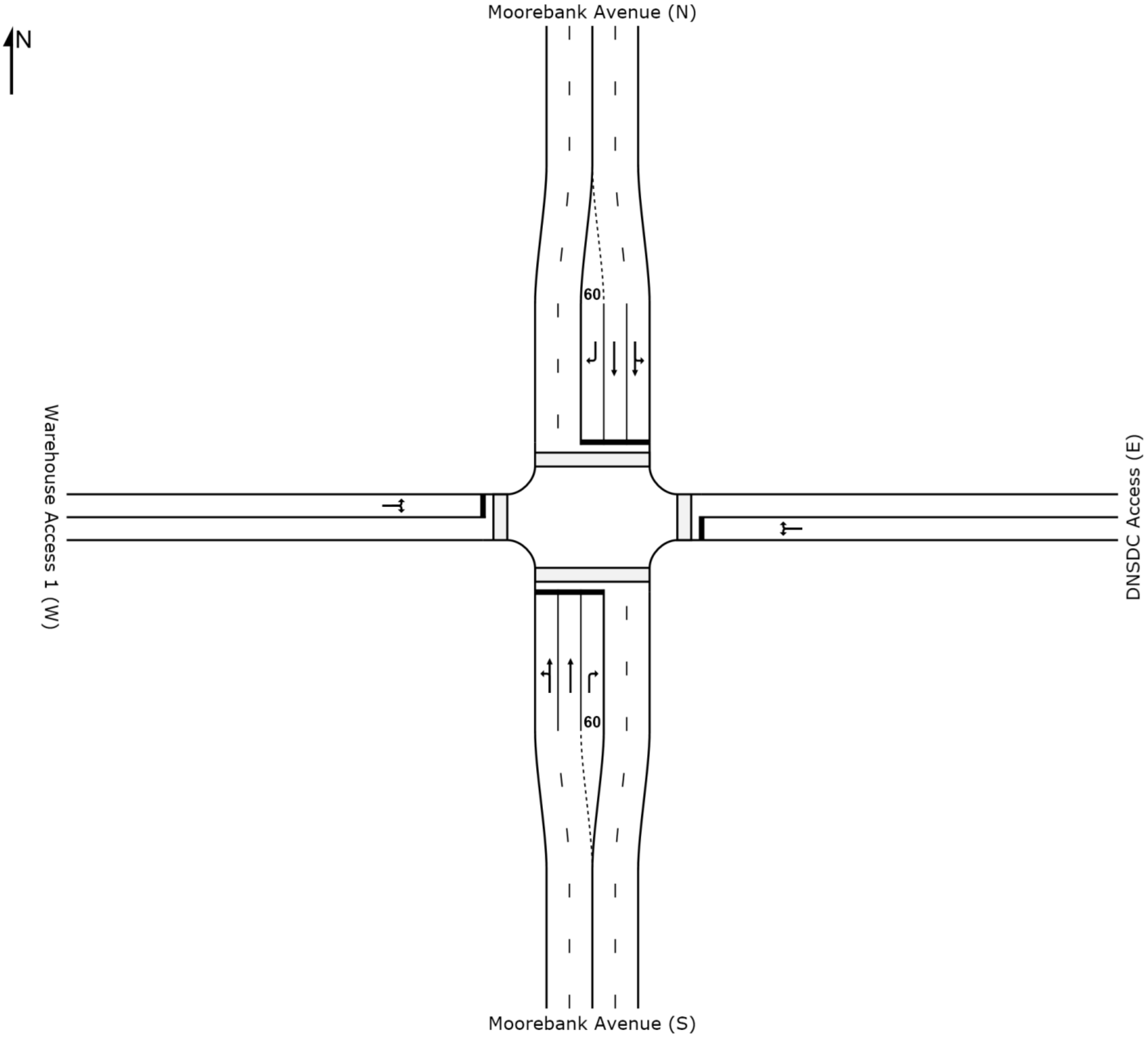


Figure 7.2 Moorebank Avenue, Warehouse Access 1,DNSDC Access and SIMTA Northern Access intersection – cumulative scenario 1

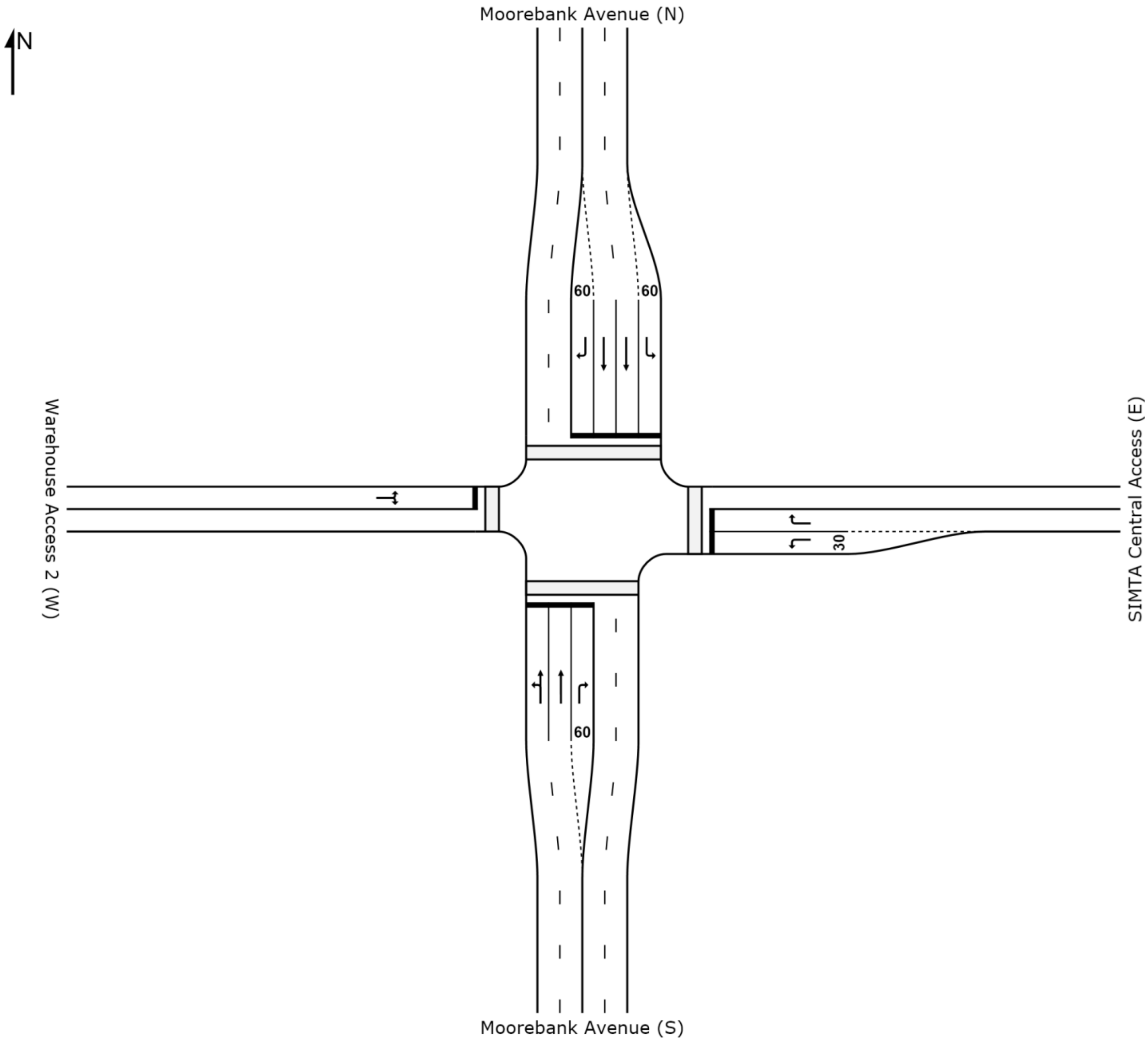


Figure 7.3 Moorebank Avenue, Warehouse Access 2 and SIMTA Central Access intersection – cumulative scenario 1

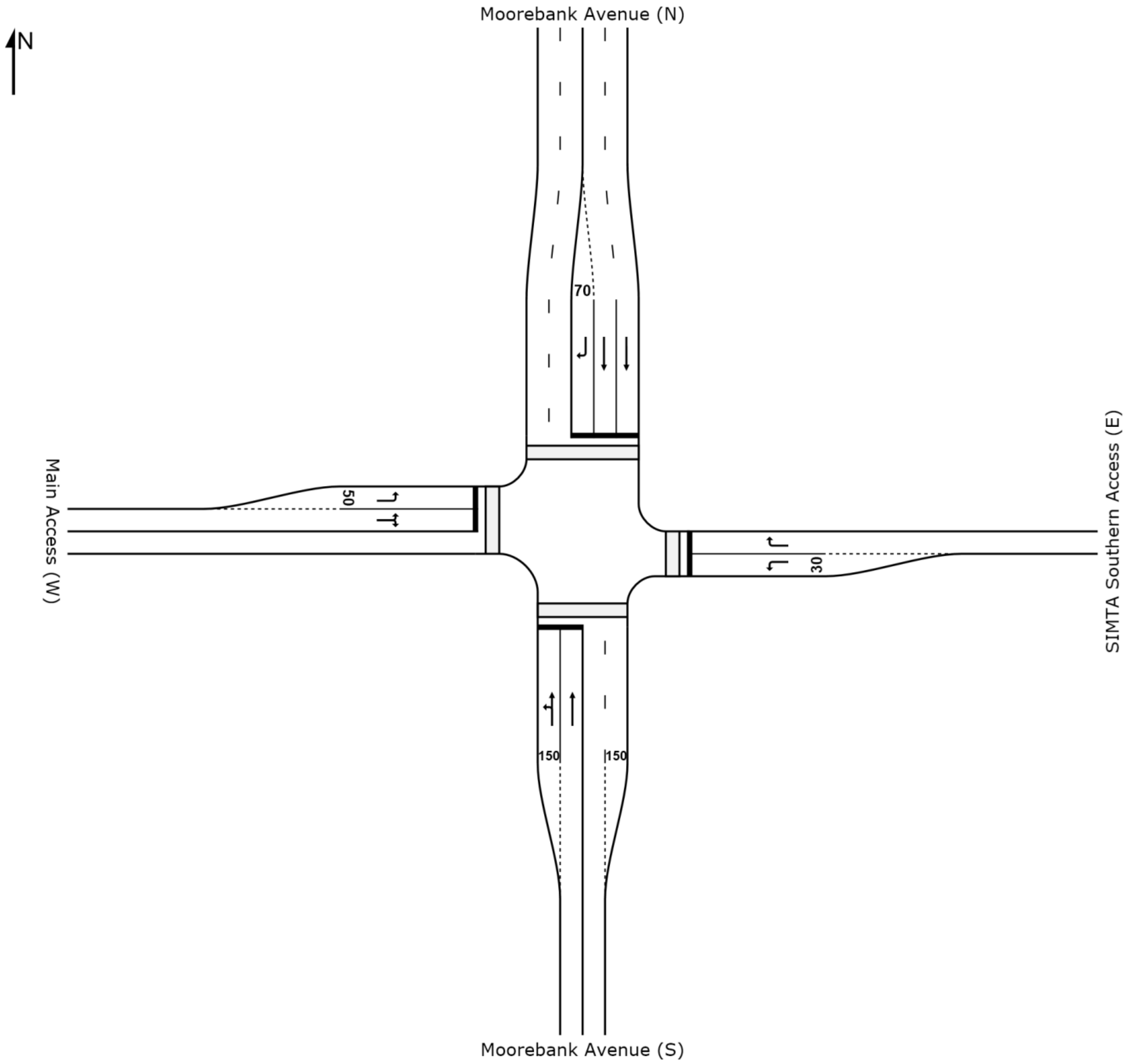


Figure 7.4 Moorebank Avenue, Main Access and SIMTA Southern Access intersection – cumulative scenario 1

7.2.4 Access for scenarios using the southern rail access option (scenarios 2 and 3)

Figure 7.5 to 7.9 shows the intersections that have been modified where required from the Moorebank IMT southern rail access option concept design to accommodate access to the SIMTA site.

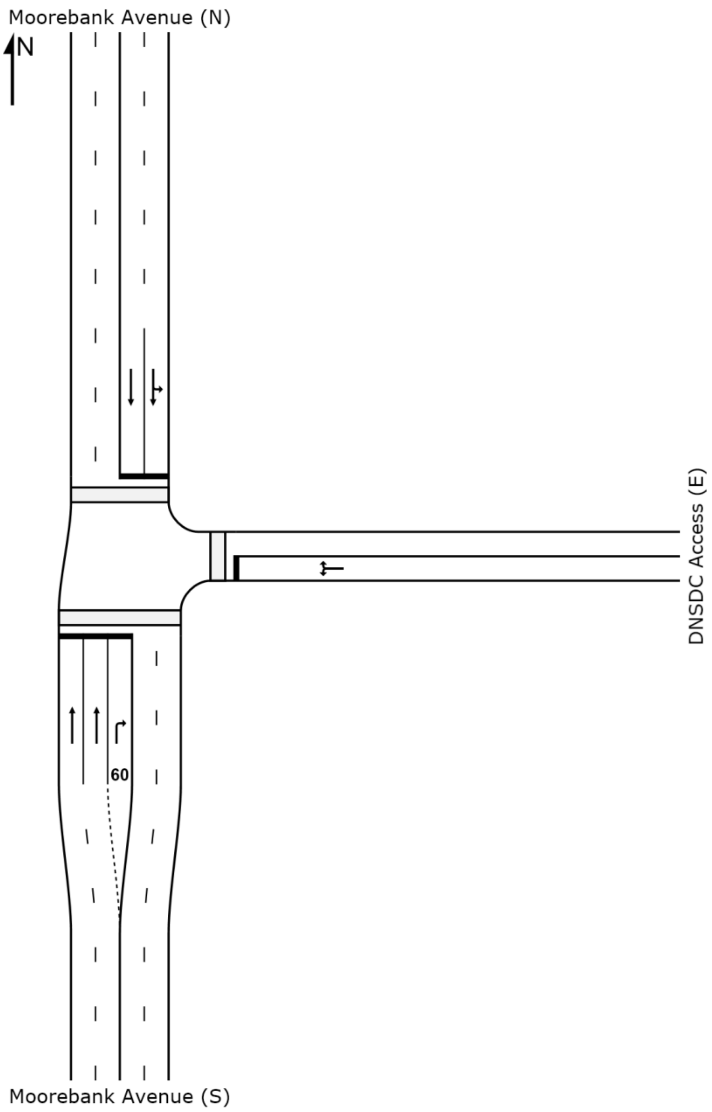


Figure 7.5 Moorebank Avenue, DNSDC Access and SIMTA Northern Access intersection – cumulative scenario 2 and 3

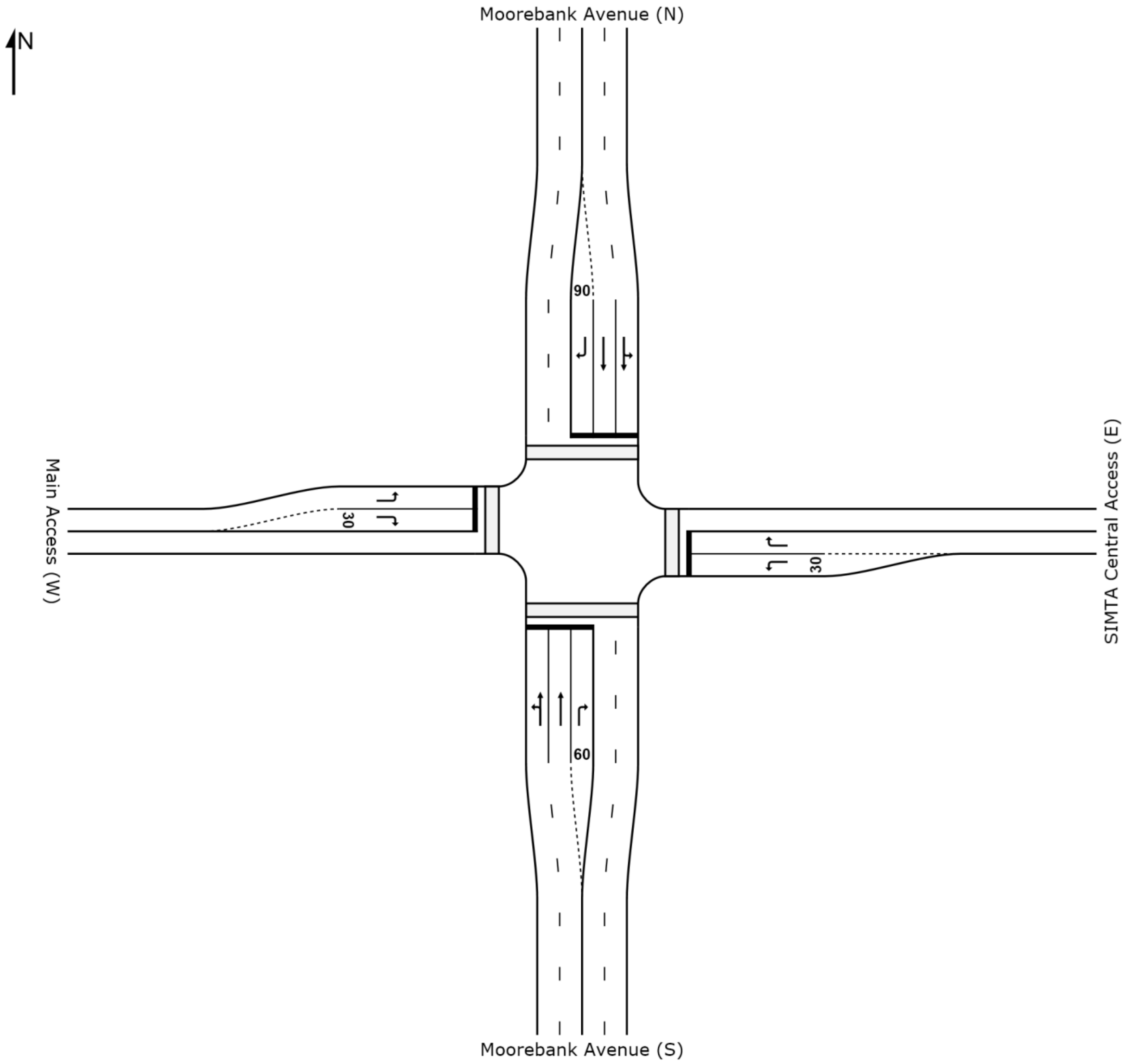


Figure 7.6 Moorebank Avenue, Moorebank IMT Main Access and SIMTA Central Access intersection – cumulative scenario 2 and 3

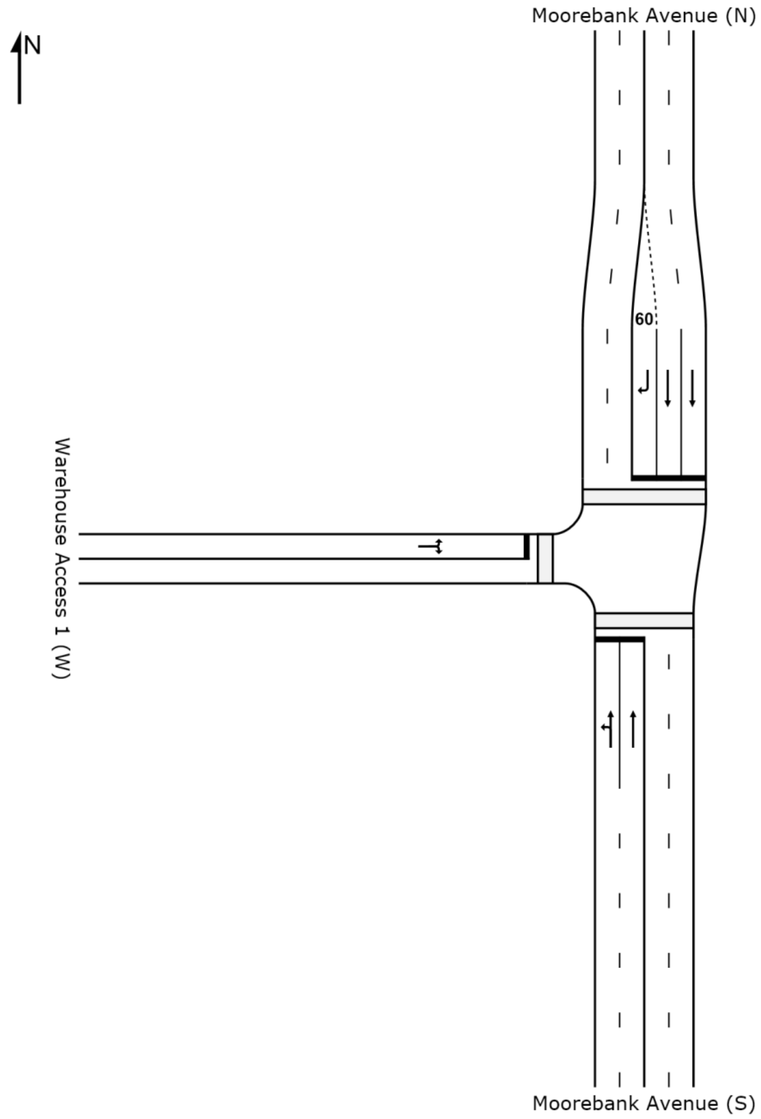


Figure 7.7 Moorebank Avenue and Moorebank IMT Warehouse Access 1 intersection – cumulative scenario 2 and 3

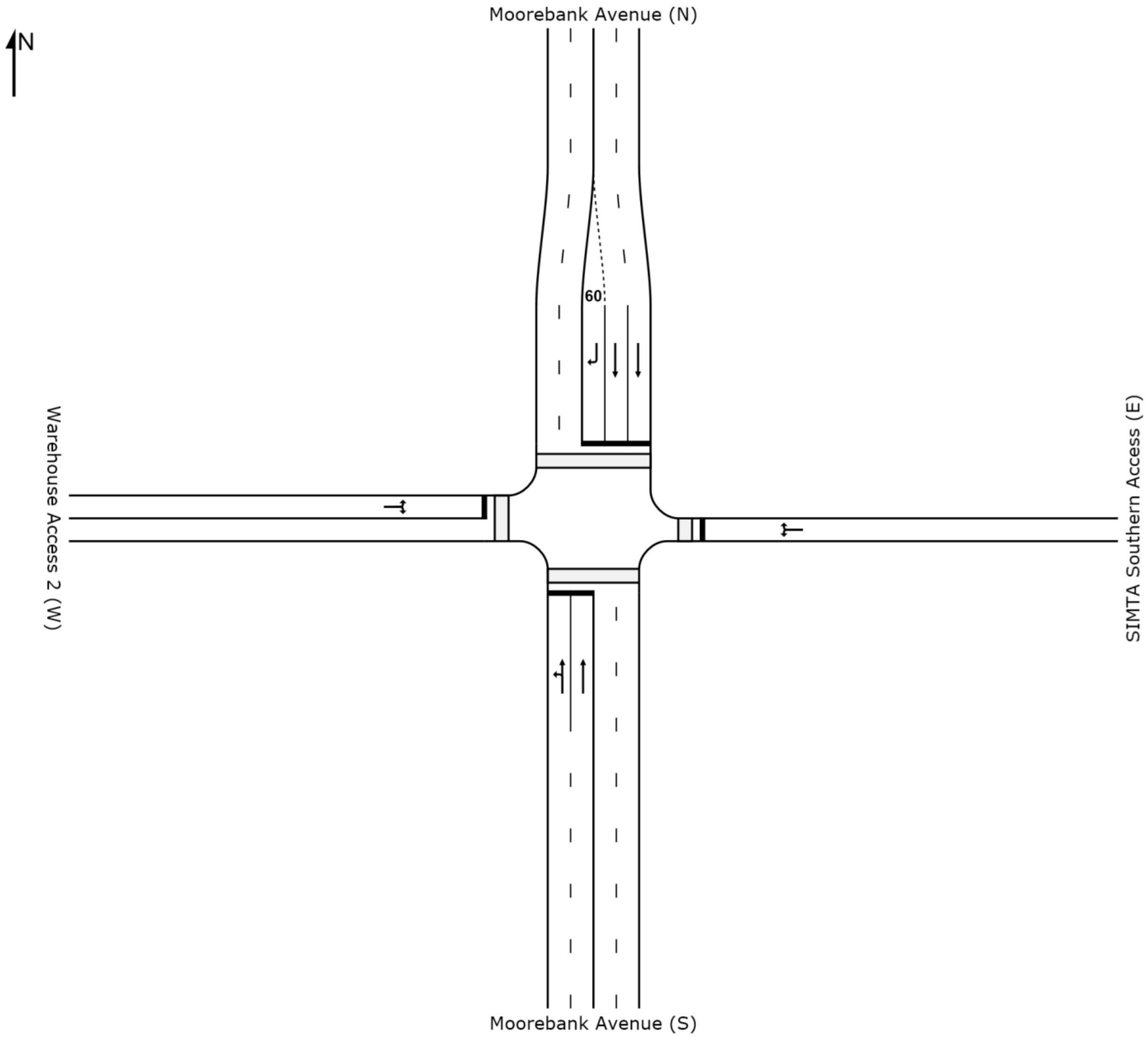


Figure 7.8 Moorebank Avenue, Moorebank IMT Warehouse Access 2 and SIMTA Southern Access intersection – cumulative scenario 2 and 3

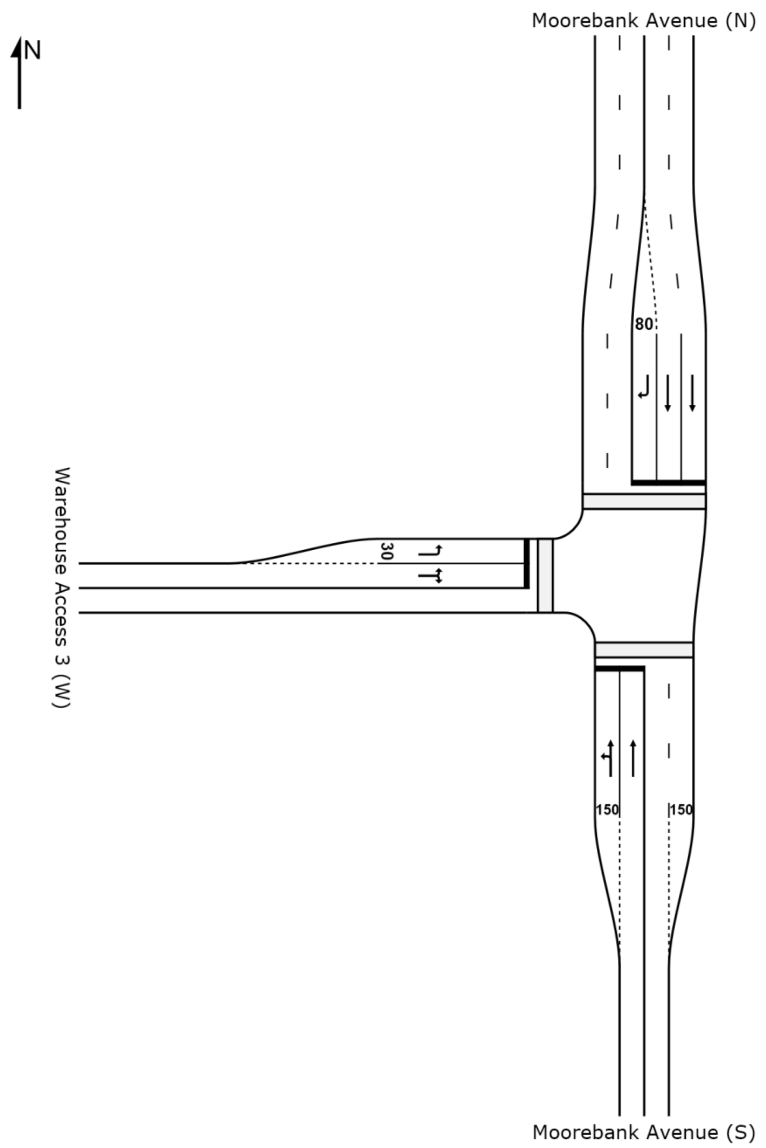


Figure 7.9 Moorebank Avenue and Moorebank IMT Warehouse Access 3 intersection – cumulative scenario 2 and 3

7.2.5 Intersection analysis

SIDRA has been used to forecast the impact of the operation of the Moorebank IMT and a SIMTA warehouse precinct on the performance of the intersections along Moorebank Avenue. The results of the SIDRA analysis are provided in Table 7.2 and 7.3.

Table 7.2 Intersection performance – Cumulative scenario 1 (2030)

Scenario	AM peak				PM peak			
	DoS	Delay	LoS	Queue	DoS	Delay	LoS	Queue
Moorebank Avenue, Anzac Road and Bapaume Road								
Cumulative Scenario 1	0.86	27	B	254	1.12	48	D	336
Moorebank Avenue, Warehouse Access 1 and SIMTA Northern Access								
Cumulative Scenario 1	0.76	9	A	124	0.83	10	A	217
Moorebank Avenue, Warehouse Access 2 and SIMTA Central Access								
Cumulative Scenario 1	0.88	21	B	324	0.78	6	A	66
Moorebank Avenue and Warehouse Access 3								
Cumulative Scenario 1	0.79	12	A	226	0.76	8	A	197
Moorebank Avenue, MIMT Main Access and SIMTA Southern Access								
Cumulative Scenario 1	0.77	15	B	203	0.88	16	B	231

Table 7.3 Intersection performance – Cumulative scenarios 2 and 3 (2030)

Scenario	AM peak				PM peak			
	DoS	Delay	LoS	Queue	DoS	Delay	LoS	Queue
Moorebank Avenue, Anzac Road and Bapaume Road								
Cumulative Scenario 2	0.98	34	C	266	1.20	53	D	379
Cumulative Scenario 3	1.48	114	F	598	1.21	52	D	389
Moorebank Avenue, DNSDC Access and SIMTA Northern Access								
Cumulative Scenario 2	0.64	4	A	111	0.87	11	A	192
Cumulative Scenario 3	0.77	6	A	201	0.94	24	B	390
Moorebank Avenue, MIMT Main Access and SIMTA Central Access								
Cumulative Scenario 2	0.72	9	A	128	0.81	14	A	187
Cumulative Scenario 3	0.70	8	A	110	0.92	32	C	374
Moorebank Avenue and Warehouse Access 1								
Cumulative Scenario 2	0.71	4	A	104	0.67	2	A	22
Cumulative Scenario 3	0.72	4	A	107	0.66	2	A	22
Moorebank Avenue, Warehouse Access 2 and SIMTA Southern Access								
Cumulative Scenario 2	0.73	6	A	135	0.70	3	A	27
Cumulative Scenario 3	0.73	6	A	132	0.69	3	A	32
Moorebank Avenue and Warehouse Access 3								
Cumulative Scenario 2	0.68	11	A	182	0.69	6	A	52
Cumulative Scenario 3	0.67	9	A	179	0.71	5	A	44

The results predict that during periods of peak commuting pressure on the road network the DoS and delay at some of the intersections would increase, all intersections would still operate with a satisfactory LoS of C or better except the intersection of Moorebank Avenue and Anzac Road.

Under Scenario 3, the intersection of Moorebank Avenue and Anzac Road is the only intersection that would operate at an unsatisfactory level (LoS F) during the AM peak hour and satisfactorily at (LoS D) in the PM peak hour. This intersection would experience long delay and queues and this is expected to interrupt the operation of the intersection of Moorebank Avenue and M5 Motorway.

The overall intersection performance at the Moorebank Avenue/DNSDC Access intersection and the Moorebank Avenue/SIMTA Central Access intersection would achieve the satisfactory level. However, a queue of approximately 200 m queue is expected on the SIMTA access road at these intersections during the PM peak hour.

Based on these results, further mitigating strategies appear to be required. These are discussed in section 7.2.6 below.

7.2.6 Mitigation measures for cumulative scenario 3

The following suggested modifications to the affect intersections would be required to improve intersection performance and reduce queue lengths under this scenario:

- Moorebank Avenue/Anzac Road intersection:
  - increased traffic signal cycle times
  - provision of a dual right turn lane on the Moorebank Avenue southern approach
  - extend the length of left turn slip lane on the Moorebank Avenue northern approach
- Moorebank Avenue/DNSDC Access intersection and Moorebank Avenue/Moorebank IMT Main Access/SIMTA Central Access intersection:
  - provision of a shared left and right turn kerbside lane on the DNSDC Access and on the SIMTA Central Access.

These changes are shown in Figure 7.10 to 7.12.

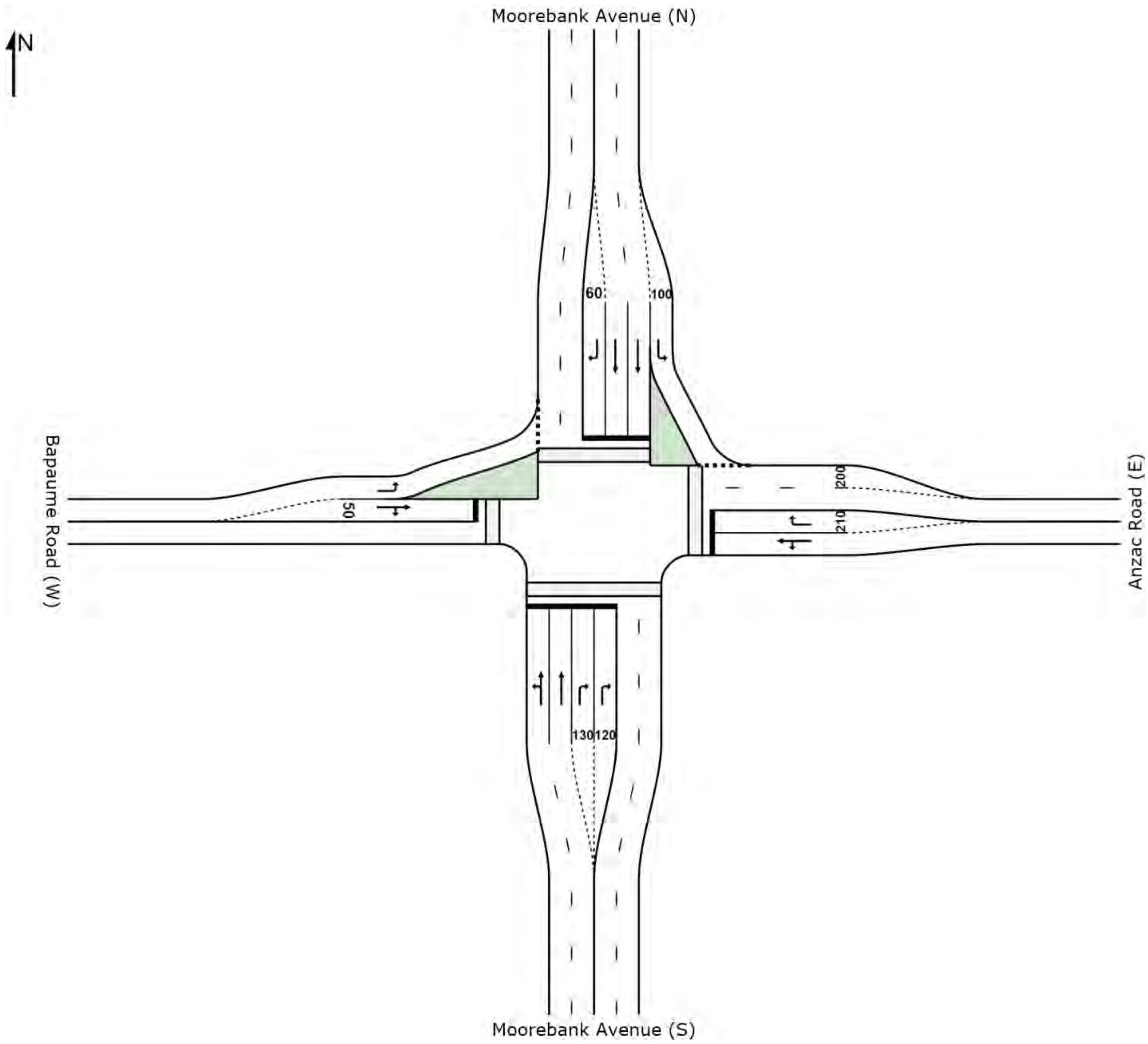


Figure 7.10 Modified intersection of Moorebank Avenue, Anzac Road and Bapaume Road for cumulative scenario 3

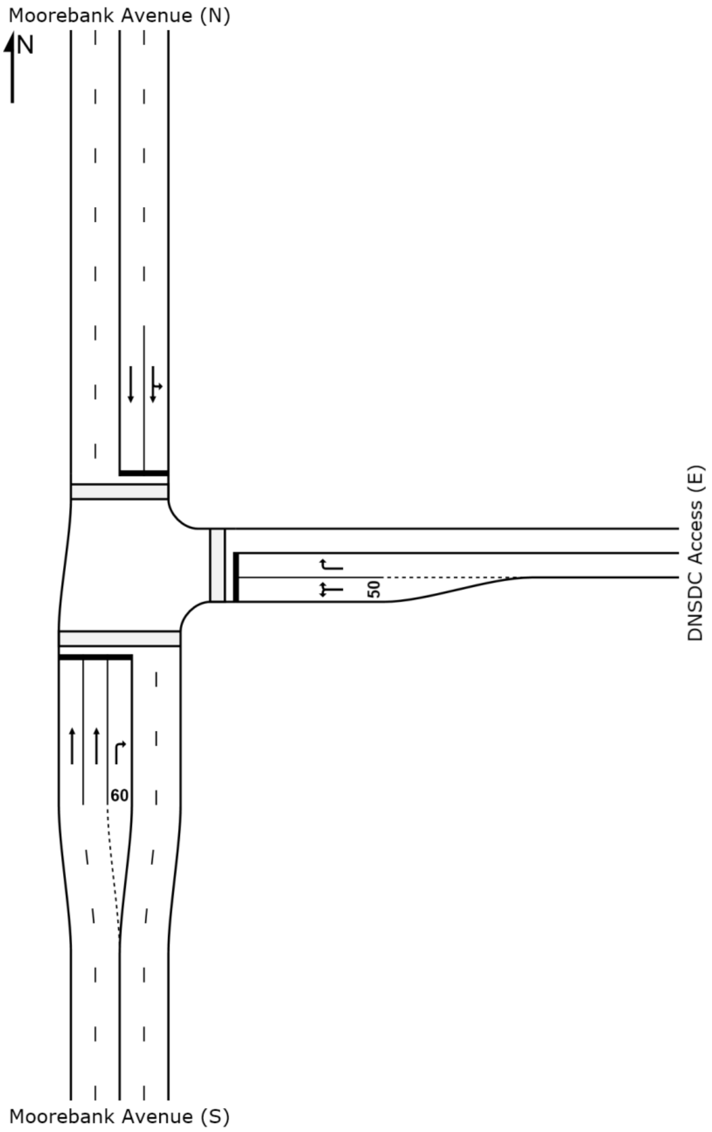


Figure 7.11 Modified intersection of Moorebank Avenue and DNSDC Access for cumulative scenario 3

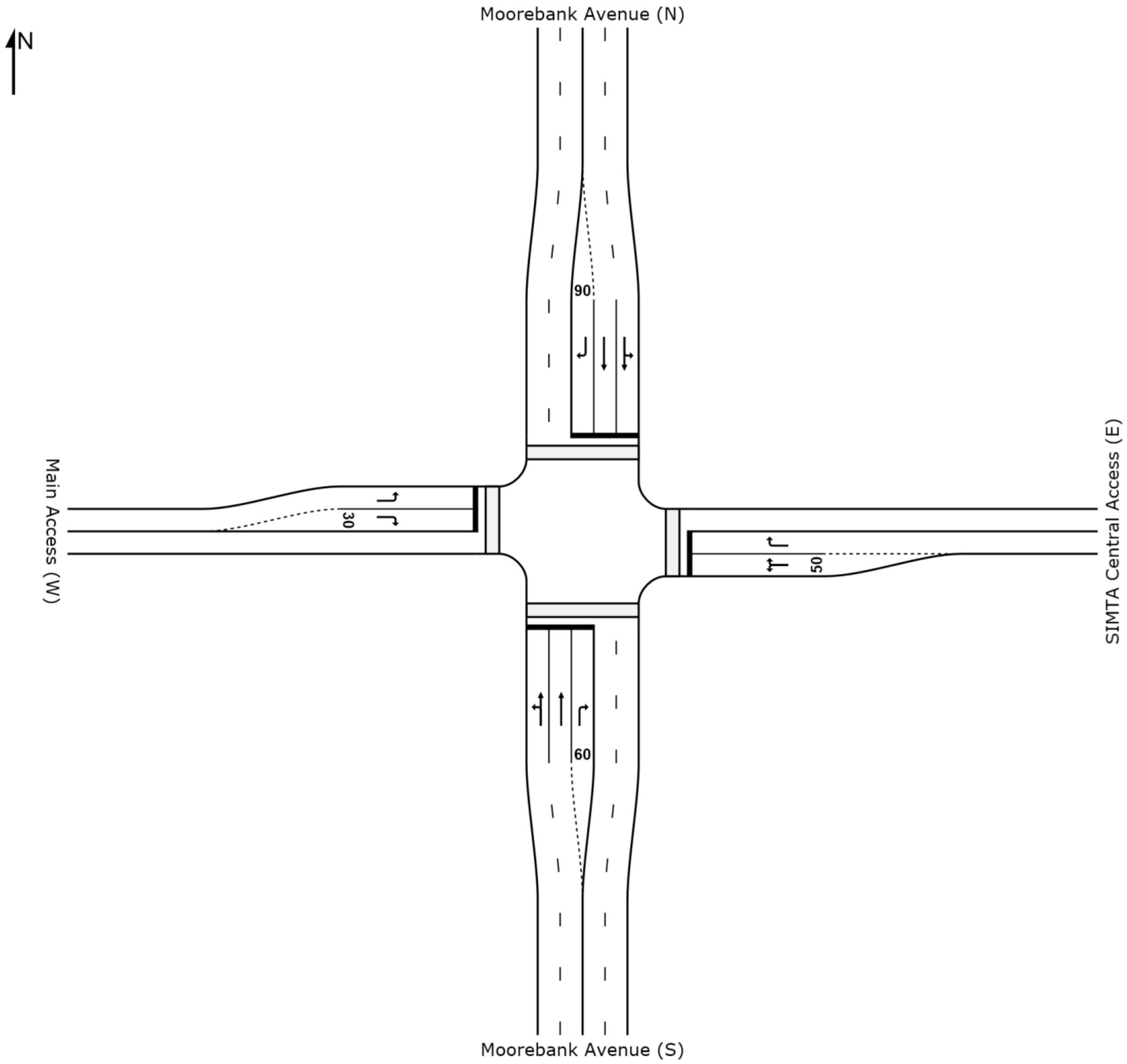


Figure 7.12 Modified intersection of Moorebank Avenue Moorebank IMT Main Access and SIMTA Central Access for cumulative scenario 3

The performance of these modified intersections as shown in Figure 7.10 to Figure 7.12 above is provided in Table 7.4.The modifications improve intersection operation with:

- the Moorebank Avenue, Anzac Road and Bapaume Road intersection going from a LoS F to LoS C and queue lengths from 598 m to 317 m in the 2030 AM peak
- the Moorebank Avenue and DNSDC Access intersection going from a queue length of 390 m to 139 m in the 2030 PM peak
- the Moorebank Avenue, Moorebank IMT Main Access and SIMTA Central Access intersection going from a LoS C to LoS B and queue lengths from 374 m to 311 m in the 2030 PM peak.

Table 7.4 Cumulative scenario 3 intersection performance with intersection modifications (2030)

Moorebank Avenue Intersection with	Peak hour	Degree of Saturation	Average Delay (sec)	Level of Service	95th percentile queue (m)
Anzac Road and Bapaume Road	AM	0.92	33	C	317
	PM	1.05	43	D	342
DNSDC Access	AM	0.77	6	A	201
	PM	0.86	10	A	139
MIMT Main Access and SIMTA Central Access	AM	0.70	8	A	110
	PM	0.91	23	B	311

The SIDRA analysis of the cumulative assessment with intersection modifications is attached to Appendix I.

7.3 Strategic impact on wider network

7.3.1 Intersection performance

The comparisons of the cumulative scenario intersections performances are shown in Table 7.5.

Table 7.5 Cumulative scenarios intersection performance on wider road network in 2030

Scenario	AM peak				PM peak			
	DoS	Delay	LoS	Queue	DoS	Delay	LoS	Queue
I-01 Hume Highway and Orange Grove Road								
2030 Future Background	0.94	35	C	288	1.04	63	E	372
Cumulative Scenario 1	1.07	44	D	368	1.09	72	F	451
Cumulative Scenario 2	1.06	41	C	334	1.09	62	E	371
Cumulative Scenario 3	1.07	41	C	344	1.09	62	E	370
I-02 Hume Highway and Elizabeth Drive								
2030 Future Background	1.17	93	F	474	1.07	57	E	307
Cumulative Scenario 1	1.17	98	F	544	1.07	61	E	341
Cumulative Scenario 2	1.30	76	F	511	1.07	58	E	334
Cumulative Scenario 3	1.31	76	F	512	1.07	58	E	346
I-03 Hume Highway and Memorial Avenue								
2030 Future Background	1.18	92	F	504	1.24	57	E	422
Cumulative Scenario 1	1.26	102	F	570	1.23	59	E	486
Cumulative Scenario 2	1.26	77	F	528	1.23	48	D	464
Cumulative Scenario 3	1.26	77	F	529	1.23	48	D	462
I-04 Hume Highway and Hoxton Park Drive								
2030 Future Background	1.27	110	F	485	1.41	81	F	507
Cumulative Scenario 1	1.26	117	F	503	1.41	85	F	588
Cumulative Scenario 2	1.26	89	F	436	1.41	67	E	551
Cumulative Scenario 3	1.26	91	F	461	1.41	67	E	549

Scenario	AM peak				PM peak			
	DoS	Delay	LoS	Queue	DoS	Delay	LoS	Queue
I-05 Hume Highway and Reilly Street								
2030 Future Background	1.03	26	B	464	1.13	28	B	439
Cumulative Scenario 1	1.03	30	C	555	1.12	38	C	799
Cumulative Scenario 2	1.04	28	B	527	1.12	29	C	646
Cumulative Scenario 3	1.05	28	B	532	1.12	29	C	634
I-06 Newbridge Road and Moorebank Avenue								
2030 Future Background	1.58	134	F	650	1.19	99	F	520
Cumulative Scenario 1	1.71	152	F	769	1.20	119	F	625
Cumulative Scenario 2	1.72	153	F	778	1.21	117	F	607
Cumulative Scenario 3	1.70	152	F	855	1.20	115	F	591
I-07 Moorebank Avenue and Heathcote Road								
2030 Future Background	1.39	207	F	706	1.42	107	F	690
Cumulative Scenario 1	1.44	207	F	776	1.43	116	F	699
Cumulative Scenario 2	1.44	210	F	772	1.44	121	F	707
Cumulative Scenario 3	1.44	207	F	770	1.46	126	F	716
I-08 Moorebank Avenue and Industry Park Access								
2030 Future Background	1.22	187	F	1144	0.52	7	A	75
Cumulative Scenario 1	1.27	219	F	1301	0.52	7	A	76
Cumulative Scenario 2	1.26	212	F	1272	0.47	8	A	97
Cumulative Scenario 3	1.26	211	F	1281	0.51	8	A	100
I-09 Moorebank Avenue and Church Road								
2030 Future Background	0.95	845	F	83	1.29	374	F	567
Cumulative Scenario 1	1.00	803	F	94	1.40	658	F	676
Cumulative Scenario 2	0.99	693	F	90	1.37	647	F	383
Cumulative Scenario 3	1.02	590	F	89	1.22	373	F	301
I-10 Heathcote Road and Nuwarra Road								
2030 Future Background	1.44	178	F	1182	1.32	144	F	854
Cumulative Scenario 1	1.44	178	F	1190	1.37	148	F	855
Cumulative Scenario 2	1.44	115	F	864	1.42	108	F	658
Cumulative Scenario 3	1.44	116	F	872	1.47	109	F	658
I-11 Newbridge Road and Nuwarra Road								
2030 Future Background	1.25	168	F	1038	1.08	38	C	298
Cumulative Scenario 1	1.24	177	F	1122	1.09	39	C	307
Cumulative Scenario 2	1.24	109	F	826	1.06	33	C	295
Cumulative Scenario 3	1.25	109	F	828	1.06	33	C	295
I-12 Newbridge Road and Governor Macquarie Drive								
2030 Future Background	1.24	161	F	1180	1.15	62	E	389
Cumulative Scenario 1	1.24	168	F	1258	1.61	79	F	649
Cumulative Scenario 2	1.23	104	F	932	1.60	57	E	429
Cumulative Scenario 3	1.23	104	F	933	1.60	57	E	428

Scenario	AM peak				PM peak			
	DoS	Delay	LoS	Queue	DoS	Delay	LoS	Queue
I-13 M5 Motorway and Moorebank Avenue								
2030 Future Background	0.99	21	B	90	0.93	32	C	264
Cumulative Scenario 1	0.98	23	B	130	0.94	37	C	256
Cumulative Scenario 2	0.98	23	B	122	0.97	39	C	347
Cumulative Scenario 3	1.01	33	C	241	1.08	51	D	585
I-14 M5 Motorway and Hume Highway								
2030 Future Background	1.21	81	F	1101	1.15	79	F	641
Cumulative Scenario 1	1.30	93	F	1109	1.27	95	F	670
Cumulative Scenario 2	1.29	92	F	1109	1.28	99	F	706
Cumulative Scenario 3	1.29	93	F	1109	1.30	105	F	738
I-15 Cambridge Avenue and Canterbury Road								
2030 Future Background	1.14	114	F	287	0.59	14	A	28
Cumulative Scenario 1	1.33	194	F	443	0.62	14	A	29
Cumulative Scenario 2	1.48	478	F	957	0.65	14	A	30
Cumulative Scenario 3	1.87	441	F	756	0.68	15	B	32

Table 7.5 shows the change (difference) in overall intersection level of service, average vehicle delay and maximum queue lengths between the future base condition and future cumulative scenarios in 2030. Table 7.5 indicates that the following intersections operation would slightly deteriorate under the cumulative scenario:

- Hume Highway and Orange Grove Road from LoS C to LoS D in the AM peak and from LoS E to LoS F in the PM peak for scenario 1
- Hume Highway and Reilly Street from LoS B to LoS C in the AM peak for scenario 1 and from LoS B to LoS C in the PM peak for scenarios 1, 2 and 3
- Newbridge Road and Governor Macquarie Drive from LoS E to LoS F in the PM peak for scenario 1
- M5 Motorway and Moorebank Avenue from LoS B to LoS C in the AM peak and from LoS C to LoS D in the PM peak for scenario 3
- Cambridge Road and Canterbury Road from LoS A to LoS B in the PM peak for scenario 3.

All remaining intersections would operate at the same LoS with or without the Project.

No mitigation measures would be required for any of the intersections in Table 7.5 above for the cumulative scenario assessment.

The results of the cumulative intersection SIDRA analysis is attached to Appendix I.

7.3.2 M5 Motorway

A cumulative assessment with and without the Moorebank IMT and the SIMTA development on the crossing of the Georges River on the M5 was undertaken for both directions of travel during the AM and

PM peak periods to identify the projects' impact. The percentage increase in overall traffic volumes is provided in Table 7.6.

Table 7.6 Cumulative traffic percentage increase to the M5 Motorway from the Moorebank IMT and SIMTA development during weekday peak periods in 2030

		Moorebank IMT only	Cumulative scenario 1	Cumulative scenario 2	Cumulative scenario 3
AM peak hour					
M5 west of Moorebank Avenue	Eastbound	1.88%	3.17%	3.66%	5.89%
	Westbound	2.10%	2.54%	2.10%	2.17%
M5 east of Moorebank Avenue	Eastbound	0.22%	0.27%	0.22%	0.23%
	Westbound	0.68%	1.22%	1.47%	2.45%
PM peak hour					
M5 west of Moorebank Avenue	Eastbound	2.18%	2.63%	1.99%	1.95%
	Westbound	1.68%	2.83%	3.74%	4.86%
M5 east of Moorebank Avenue	Eastbound	0.92%	1.59%	2.12%	2.75%
	Westbound	0.30%	0.38%	0.29%	0.28%

These results suggest that the combined development of Moorebank IMT and SIMTA is not likely to have a substantial impact on the operation of the M5 Motorway with the following percentage increases in total traffic volumes:

- up to a 3% increase in total traffic volumes under cumulative scenario 1
- up to a 4% increase in total traffic volumes under cumulative scenario 2
- up to a 6% increase in total traffic volumes under cumulative scenario 3.

7.4 Summary of cumulative impacts

The combined traffic associated with the Moorebank IMT and an adjacent SIMTA operation could be accommodated within the proposed upgrades to Moorebank Avenue for cumulative scenarios 1 and 2 and the majority of cumulative scenario 3. However cumulative scenario 3 would require further modifications to the following intersections:

- Moorebank Avenue, Anzac Road and Bapaume Road
- Moorebank Avenue and DNSDC Access
- Moorebank Avenue, Moorebank IMT Main Access and SIMTA Central Access.

The cumulative scenarios are not likely to have a substantial impact on the operation of the M5 Motorway or the regional road network.

8. Mitigation measures for detailed design and operations

8.1 General detailed design considerations

The operation of the Project site would be supported by the upgrade of Moorebank Avenue and its associated intersections. Moorebank Avenue would be increased to a four-lane two-way road with two lanes in both directions between the M5 and the southernmost entry to the Moorebank IMT. In association with the increase in lanes, access locations into the Project site would be signalised and all intersections and have designated turn bays on Moorebank Avenue.

The upgrade to Moorebank Avenue and the staged construction of Moorebank IMT would be coordinated to minimise the impact on Moorebank Avenue traffic.

The following mitigation measures are to be considered during detailed design stage to improve the operation of the Moorebank IMT and reduce its impacts:

- Consider the provision of permanent Variable Message Signs (VMS) on Moorebank Avenue to manage traffic movement to and from the various areas of the Moorebank IMT. VMS systems to direct heavy vehicles should be installed within the facility to provide additional directional information.
- IMEX, Interstate and the warehouse developments provide storage and shower areas for cyclists to promote cycling as mode of transport.
- Consider the potential for increased bus services between the Moorebank IMT and nearby public transport interchange hubs to reduce the volume of light vehicles generated by staff. There is potential for buses to service the Project site via the main truck access and exit the Project site at the most southern access. This would require bus stop locations to be identified on the eastern side of the service road to reduce the requirement for pedestrians to cross the road. It is the responsibility of the Moorebank IMT operators to negotiate the services changes provided by bus operators.
- Undertake inspections and monitoring of traffic congestion on Moorebank Avenue at Full Build in 2030 and report on any project specific impacts to Moorebank Avenue operation.
- Creation of a working subgroup of the Moorebank IMT and SIMTA developments, should both developments proceed, whereby the subgroup work closely with the LCC traffic committee to ensure that a best practice approach is taken to future bus (and rail link) provision for workers and visitors to both the sites and the operation of Moorebank Avenue.
- Facilitated discussion with Transdev and TfNSW regarding future bus servicing the Project site.

The *Integrated Land Use and Transport Package* (DUAP, 2001) should be consulted during the detailed design stage to achieve the identified ‘best practice’ for the different planning principles.

8.2 Detailed design of Project Development Phasing

During the respective detailed design and subsequent approvals and assessment processes for the development phasing, refining traffic, transport and access impact assessment would be undertaken to confirm forecasts and the required mitigation measures on the local network and for the vehicle distribution impacts on the wider road network.

8.3 Outside the study area – M5 Motorway

The Moorebank IMT would facilitate the distribution of freight to western Sydney by transferring the origin of road vehicles from Port Botany to Moorebank.

Some of the traffic generated by the IMEX and Interstate facilities would have been on the M5 motorway anyway – but originating at Port Botany.

The Project traffic would not have a significant impact on the operation of the M5.

8.4 Travel demand management

For forecasting, a mode split was used for the Moorebank Intermodal Terminal, as discussed in section 4, of 90% of staff travelling to and from the Project site by car and 10% travelling by public transport, car share, walking, cycling or other alternative transport modes. This is considered a reasonable future target for the project as the currently limited public transport access to and from the Project site with only two bus services near the Project site during the peak hours, and the closest train stations more than a 40 minute walk.

Up to approximately 2,200 staff are estimated to work at the terminal each day during full operation. There is potential to reduce the reliance on private car travel, through implementation of initiatives to maximise employee access to public transport in the local area. A number of opportunities to improve employee access to public transport are identified in the following sections.

Reduced reliance on private car travel could also reduce the amount of car parking required on site, freeing up land for other uses. Increased walking and cycling has the potential for improving employee health and fitness levels and employee travel by alternative modes would reduce car ownership costs.

The health aspects of promoting greater use of walking and cycling both as sole and feeder modes should be considered as part of the Project site workplace travel plan.

8.4.1 Buses

Access to nearby train stations with frequent service is currently facilitated by the 901 (Transdev) bus service between Liverpool and Holsworthy. Options to improve bus service to the Project site and access to these train stations might include:

- increased peak period bus service that coordinate with train services at Liverpool and Holsworthy
- extension of the 901 route to the main terminal access points on Moorebank Avenue
- a review and upgrade of bus stops on Moorebank Avenue to include shelter, seating and bus timetabling information

- an employee shuttle bus to Liverpool train station for the peak periods and before/after staff shifts
- bus access into the Project site should a shuttle service or public bus service operate from the Project site
- increased bus services in the local area or an express bus between Liverpool and Holsworthy Stations and the Moorebank IMT
- bus priority at key intersections should the need arise.

8.4.2 Walking and cycling links

Improved access to public transport and alternative transport modes would be further supported through provision of accessible and safe walking and cycling links to the Project site. The current concept plan includes provision for a shared path along Moorebank Avenue, which would connect with pedestrian and bicycle infrastructure in the local area. In addition the proposed upgrades to Moorebank Avenue and future intersections include provision of signalised pedestrian crossings.

Pedestrian and cyclist connections could be further supported through:

- footpath upgrades along Anzac Road with a continuous footpath link to Wattle Grove
- a pedestrian and cyclist link along Cambridge Avenue
- improved pedestrian and cyclist connections to Newbridge Road and Liverpool
- walkways and cycleways from Moorebank Avenue to on-site facilities, and through the Project site as necessary.

There may also be potential for a pedestrian/cyclist link from the Project site to Casula Powerhouse and Casula Station. This would require detailed investigation should there be demand for the link.

8.4.3 Employee focussed programs

Other initiatives which MIC could explore as part of the Project site management plan to offer travel choice and be responsible environmental managers include:

- Reduction of the supply of car parking to terminal employees as availability of viable transport choices increases.
- Travel behaviour change program for terminal employees, including programs and campaigns to increase employee awareness of public transport services and local walking/cycling links.
- Staff carpooling program.
- Car share scheme, funded by tenants or site management.
- End of trip facilities including bicycle parking, change rooms, showers and lockers.

9. Construction traffic management

This section outlines some of the concepts which would need to be included in the construction management plan of the Project site to mitigate likely construction impacts to road users during the proposed upgrade of Moorebank Avenue. This plan would evolve as construction methods become more certain.

9.1 Scope of construction works

The proposed indicative construction timeline is as follows:

- Early works: from 2015.
- Phase A: from 2015 to 2018 with construction traffic peaking in 2016.
- Proposed upgrade on Moorebank Avenue: from 2016.
- Phase B: from 2018 to 2025 with construction traffic peaking in 2023.
- Phase C: from 2025 to 2030 with construction peaking in 2028.

9.2 Project construction footprint

The construction footprint represents the area within which construction activities would occur. For the purposes of assessment, the construction footprint for each Project phase has been assumed to be entirely cleared of vegetation, providing for the construction of buildings, hard surfaces and infrastructure.

The construction footprint includes:

- the entire Project site for the development of the Moorebank IMT, with the exception of most of the conservation zone and some additional areas within which vegetation would be retained;
- a section of the Georges River and its banks for construction of the rail bridge and for construction access;
- areas to accommodate drainage channels across the conservation area between the Moorebank IMT and the Georges River;
- The entire Moorebank Avenue for the upgrade to four lanes; and
- Bapaume Road reconstruction.

All rail access options are likely to be constructed using access for labour, plant and materials predominantly from the Project site on the eastern bank of the Georges River. However, some construction will be undertaken on the western bank including the tie-ins to the existing SSFL.

For the northern access option it is anticipated that approximately 60% of the rail bridge and approach viaduct structures (including the piles, piers and deck) would be constructed from the eastern bank (from the Project site), while 40% would be constructed from the western bank. The construction period for a northern rail access option is likely to be approximately 18 months.

For the central rail access option, approximately 75% of the rail bridge and approach viaduct structures would utilise access from the eastern bank (Project site) and 25% from the western bank, on the 'hourglass' land.

For the southern rail access option, approximately 90% of the rail bridge and approach viaduct structures would utilise access from the eastern bank (Project site) and 10% from the western bank, on the Glenfield Landfill site.

For both central and southern rail access options the construction period is estimated at 24 months.

9.2.1 Moorebank Avenue upgrades

Moorebank Avenue is proposed to be upgraded to a four lane divided roadway from the M5 interchange to the southernmost entry to the Moorebank IMT. New intersections are proposed to provide access to the Project site and the existing intersection at Anzac Road will be retained. All intersections will be traffic signal controlled with indented right and left turn lanes as required. Generally pedestrian footpaths are proposed on both sides of the road with signalised pedestrian crossings at the intersections.

The existing Moorebank Avenue is a two lane two-way road. It is proposed that this will become the ultimate southbound carriageway and a new northbound carriageway would be constructed on the west side of the existing road. Traffic would remain on the existing road whilst the new northbound carriageway is constructed clear of traffic.

Upon completion of the northbound carriageway, the two way traffic would be transferred from the existing Moorebank Avenue to the new carriageway. The existing Moorebank Avenue would then be reconstructed clear of traffic to form the new southbound carriageway. Construction related traffic for both the Moorebank Avenue upgrades and Project site would, as far as is possible, be confined to off peak hours to minimise the impact of the works. During construction existing accesses, public transport and pedestrian facilities would be retained at all times.

9.3 Construction workforce

The construction workforce would vary depending on the phase of construction and associated activities. Anticipated peak in construction workforce numbers by phase of project are shown in Table 9.1.

Table 9.1 Indicative peak daily construction workforce

Project Stage	Peak daily workforce
Early Works	300
Phase A	1,076
Phase B	1,236
Phase C	474

9.4 Haulage routes and Project site access

The haulage routes during construction are to remain on state and national roads where possible. As the Project site is close to the M5 South Western Motorway, it has been assumed that construction vehicles will travel between the construction vehicle access and the M5 interchange.

Light vehicles associated with construction activities, including construction staff, are assumed to have the same distribution as assumed for the operational phase traffic distribution.

Depending on the scheduling of the upgrade to Moorebank Avenue, the access locations into the Project construction site would vary. However, due to the volume of spoil to be removed and material to be imported to the Project site, it would likely require multiple locations to improve the efficiency of construction logistics. This will require coordination between the two construction activities.

Likely access points for construction vehicles have been identified in Figures 9.1 and 9.2 during the Early Works and Project phases respectively. Access to the Project site would predominately be via the M5 Motorway and Moorebank Avenue. Moorebank Avenue south of the East Hills Railway Line would not be utilised by construction traffic other than for light vehicles only.

Haulage routes for the rail access options on the western side of the Georges River would most appropriately be via:

- Charles Street or Mill Road
- Mill Road
- Speed Street
- Shepherd Street
- Powerhouse Road.

It is expected that up to 25 trucks would utilise this route on a daily basis. During this time, residences may experience potential traffic, vibration and access impacts such as congestion from the movement of heavy vehicles and construction machinery. This low number of trucks on a daily basis will only have a minor impact on intersection performance along the haulage route. A four metre height clearance is located at the rail over road bridge on Shepherd Street. Speed Street and Shepherd Street are designated B-double routes.

Haulage routes for the southern rail access to and from Cambridge Avenue would be via Moorebank Avenue or Glenfield Road. An increase of up to 25 trucks along Cambridge Avenue over a daily basis is negligible given that Cambridge Avenue carries in excess of 1,600 vehicles per hour (combined two-way traffic flow) during peak periods at present.

All required car parking would be provided on-site. Access would be maintained for ABB throughout the Project and road construction.

Some partial and full road closures may be required during construction. Where possible, these would occur at night during quieter traffic periods. Road closures would occur in consultation with the RMS and Liverpool City Council.

Moorebank Avenue between the M5 Motorway and the southern-most entry to the Project site would be upgraded as part of the Project, with the majority of works assumed to occur around 2016. Prior to the full upgrade of Moorebank Avenue and during the Early Works development phase and part of Phase A, the existing Project site access points would be used.

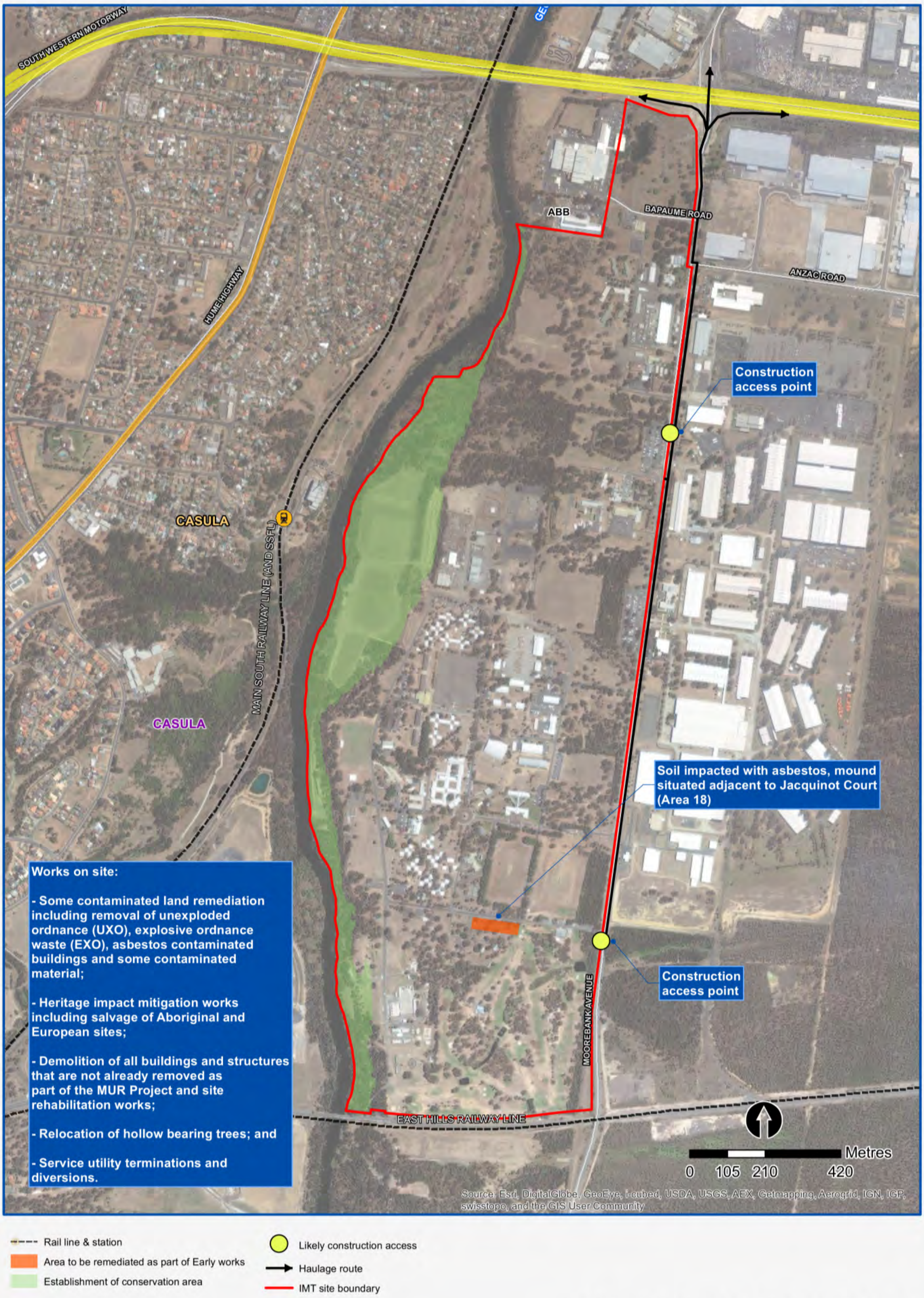
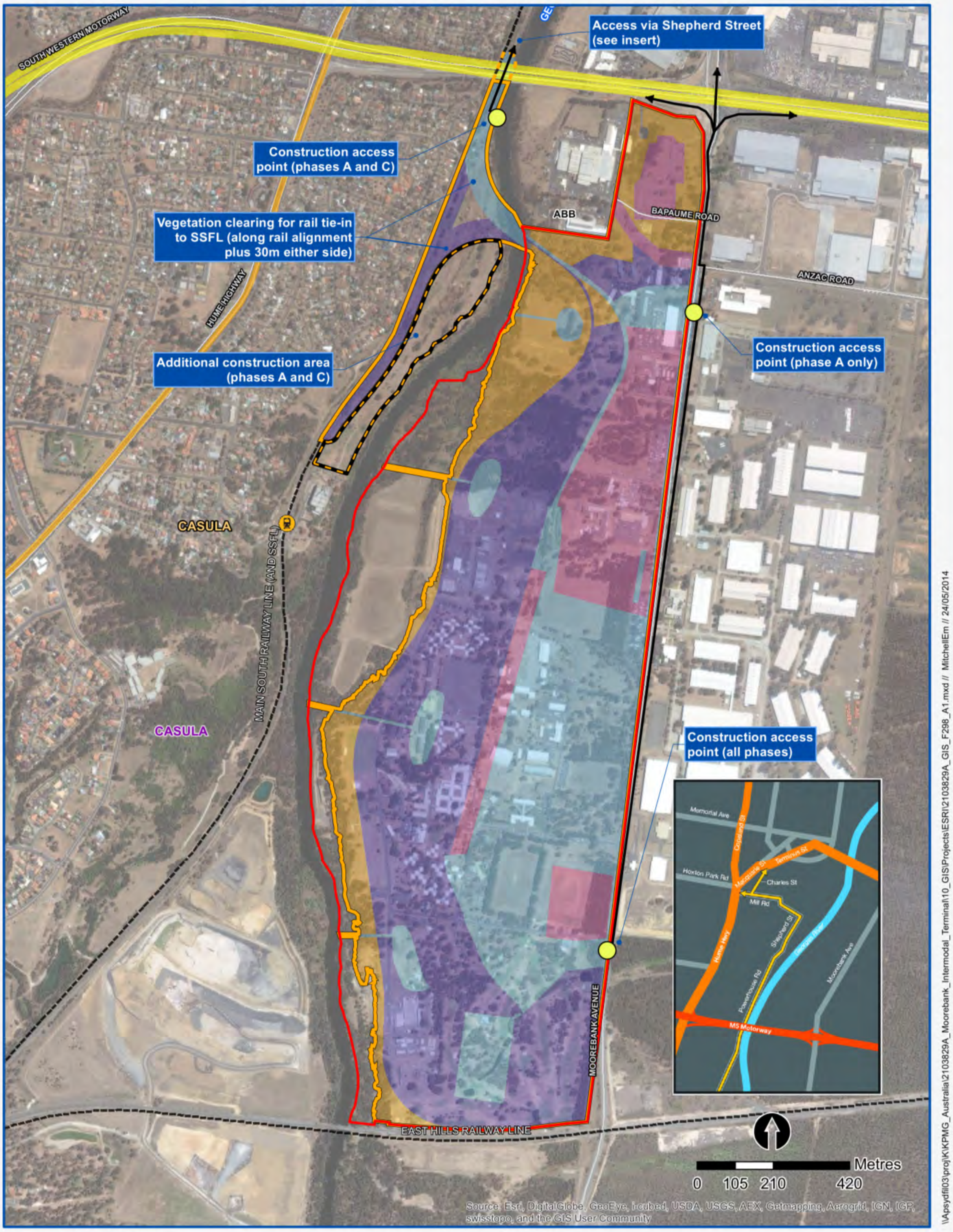


Figure 9.1: Early works development phase - construction footprint, access and haulage



Rail line & station
Northern rail access option construction area
Northern rail access option additional construction area for access, laydown, stockpiling and parking. Area excludes Georges River Riparian Forest (on riverbank). Vegetation within remainder of this area retained where possible.

Construction Footprint
Phase A
Phase B
Phase C
Area available for potential development

Likely construction access
Haulage route
IMT site boundary

Figure 9.2: Northern rail access option - Indicative construction footprint, access and haulage

9.5 Parking

All construction workers would park within the Project site where possible. It is anticipated that there will be a number of access points along Moorebank Avenue that will allow construction staff in light vehicles to enter and leave the site compound at safe locations. It is anticipated that these parking locations would change over the course of construction. Depending on the different stages of construction, formal access may be provided from either the existing or proposed intersections.

9.6 Pedestrian and cyclist impacts

Pedestrian and cyclist impacts are expected to be minimal during the Early Works stage. Pedestrian movements generated by the public bus service would be catered for by providing a safe corridor for movement to and from the bus stop throughout the construction phase. It may be necessary to temporarily relocate bus stops during the construction phase of Moorebank Avenue. The volume of passengers using the bus service is likely to reduce during the Early Works stage with the relocation of SME.

During Phases B and C and Project Full Build, the volume of pedestrians and cyclists are expected to be equal or greater than the existing situation. This is due to the operation of the Moorebank IMT and the improvement in facilities along Moorebank Avenue that will be constructed during the early works and Phase A stages.

9.7 Construction mitigation measures

The greatest traffic impacts created by the Moorebank IMT would occur during Phase A construction. During this period there would be a high volume of heavy vehicles travelling to and from the Project site combined with the disruption to traffic from the upgrade of Moorebank Avenue in Phase A.

Construction Traffic Management Plans (CTMP) would be developed for each development phase to provide additional information for the construction planning of the Moorebank IMT and the upgrade of Moorebank Avenue. Numerous CTMPs are potentially required to address the traffic impacts of individual components of the different stages.

The following mitigation measures to provide additional information during the construction stages should be considered in developing the CTMPs:

- Modify access locations in response to the development of the Moorebank Avenue upgrade. During this stage numerous access locations may be required for the transportation of spoil and material.
- Maximise use of the Project site for the construction of the Georges River rail bridge to minimise heavy vehicle movements through Casula’s residential roads.
- Reducing the volumes of construction vehicles travelling during peak periods, especially if the increase in traffic generated by construction activities impedes on the operation of Moorebank Avenue.
- Maintain access to neighbouring properties. It is particularly important that the ABB site has access throughout the construction stages as the proposed works have potential to affect its operation.

- Provision of alternate suitable pedestrian, cycle and public transport facilities during the construction of Moorebank Avenue upgrades retaining well defined and well signed routes, paths and bus stop locations.
- Develop a communication plan to provide information to the relevant authorities, bus operators and local community. This is particularly important as there is potential for multiple contractors to be present on Project site at any one time. The communication plan will need to incorporate a contact list with the chain of command.
- The implementation of Traffic Control Plans (TCP) to inform drivers of the construction activities and locations of heavy vehicle access locations. Variable Message Signs (VMS) and advertisements in local papers may be required to provide advanced warning of the proposed works.
- Obtain Road occupancy licences (ROL) for the upgrade of Moorebank Avenue. A TCP and potentially a Speed Zone Authorisation (SZA) application will need to be prepared for the ROL applications.
- Develop an emergency response plan for the upgrade of Moorebank Avenue during Phase A. During this stage, emergency vehicles using Moorebank Avenue as a transport route will need to be considered, as well as emergency access to adjoining properties.

10. Conclusion

The Moorebank IMT Project will contribute to meeting freight transport objectives, address freight infrastructure requirements and reduce future impacts on local and regional road and rail transport networks by:

- boosting national productivity over the long-term through improved freight network capacity and rail utilisation
- creating a flexible and commercially viable facility and enabling open access for rail operators and other terminal users
- minimising constraints on Defence's operational capability during the relocation of Defence facilities from the Moorebank site
- attracting employment and investment to south-west Sydney
- achieving sound environmental and social outcomes that are considerate of community views; and
- optimising value for money for the Commonwealth having regard to the other stated Project objectives.

The Project will assist Port Botany achieve the NSW Government target (Action 1F of the TfNSW Freight and Port Strategy) of doubling the percentage of containers moved by rail through the transfer of 1.05 million containers annually from road to rail in the central metropolitan area.

10.1 Moorebank Intermodal Terminal Traffic Impacts

The M5 between Moorebank Avenue and the Hume Highway suffers from congestion in part caused by the substandard distance available for the weaving movement of vehicles joining and leaving the motorway. This will get worse when the motorway is widened towards the west and the east creating a pinch point between Moorebank Avenue and the Hume Highway. The Commonwealth and NSW Governments are working together to identify network options to improve the performance of this section of the M5. Should congestion on the adjacent motorway network continue to be an issue then the operator of the Moorebank IMT could consider scheduling more movements to occur outside of peak periods when congestions is less likely to occur on the M5.

- The impact of traffic from the Moorebank IMT represent less than 3% of the total traffic already on the M5 Motorway, the Project would therefore not have a substantial impact on the motorway operation.
- The trucks from the IMEX development would have been on the highway network anyway – but associated with Port Botany.
- Periods of construction represent the greatest increase in traffic numbers .The initial construction phase in 2016 would require careful management to ensure construction traffic did not queue back to the M5 intersection. Once the modified Moorebank Avenue/Anzac Road intersection is complete, the risk of congestion is greatly reduced.

- The proposed modifications to Moorebank Avenue include:
  - widening Moorebank Avenue to a dual carriageway, four-lane road (two lanes in each direction), between the M5 intersection and the southernmost Project site access road
  - the expansion of the Moorebank Avenue/Anzac Road intersection
  - expansion or provision of new intersections for the remaining access points along Moorebank Avenue
  - this capacity enhancement combined with the ability to program the movement of trucks through the Moorebank IMT results in intersection performances which are generally similar to those experienced currently.
- There are sufficient parking spaces to cater for the forecast staff numbers both during construction and operation.
- There are opportunities to provide enhanced public transport services in the form of more regular bus services or an employee shuttle bus to service the Project site. The increased workforce may make such operations viable.

10.2 Cumulative assessment of Moorebank IMT and SIMTA

The combined traffic associated with the Moorebank IMT and an adjacent SIMTA operation could be accommodated within the proposed upgrades to Moorebank Avenue for cumulative scenarios 1 and 2 and the majority of cumulative scenario 3. However cumulative scenario 3 would require further modifications to the following intersections:

- Moorebank Avenue, Anzac Road and Bapaume Road
- Moorebank Avenue and DNSDC Access
- Moorebank Avenue, Moorebank IMT Main Access and SIMTA Central Access.

The cumulative scenarios are not likely to have a substantial impact on the operation of the M5 Motorway or the regional road network.

10.3 Wider network impacts

Strategic modelling using BTS models indicated that in 2031 the following approximate daily road network-wide benefits of transferring containers to Moorebank by rail would be realised:

- a saving of 56,125 truck vehicle kilometres (VKT); and
- a saving of 1,265 truck vehicle hours (VHT).

This is accompanied by a daily saving of approximately 2,530 VHT for non-truck traffic across the Sydney road network. The vehicle kilometres for non-truck traffic increased by approximately 10,670 VKT, which is believed to be caused by traffic migrating from adjacent routes to take advantage of the reduction in congestion along the M5.

These improvements in road network efficiency achieve the project's stated objective of boosting national productivity over the long-term through improved freight network capacity and rail utilisation.

The project would add efficiency to the Commonwealth Government's investment in the Southern Sydney Freight Line. It is expected to give the NSW transport objective of shifting container truck movements off roads and onto rail around Port Botany a much greater chance of success.

11. References

- Austroads, Guide to Road Design Part 3: Geometric Design (November 2009).
- Austroads, Guide to Traffic Management Part 3: Traffic Studies and Analysis (November 2009)
- Bureau of Transport Statistics, Freight Movements in Sydney (July 2010).
- Bureau of Transport Statistics, Sydney Freight Movement Model (2006).
- Bureau of Transport Statistics, Sydney Light Commercial Vehicle Model (2006).
- Bureau of Transport Statistics, Sydney Strategic Travel Model (2006).
- Deloitte, Moorebank Intermodal Terminal Demand Estimate Summary – Trip Generation Modelling (April 2014).
- Deloitte, Staff numbers based on Moorebank IMT Staffing Requirements – Version 4 (August 2001).
- Deloitte, Moorebank Intermodal Company, EIS – Supporting Information, Final Report (September 2014).
- Department of Urban Affairs and Planning, Integrated Land Use and Transport Package (August 2001).
- Fremantle Ports, Truck Productivity Study (July 2014).
- Halcrow, M5 West Widening Project Traffic and Transport Report (September 2010).
- Hyder Consulting, Sydney Intermodal Terminal Alliance Part 3A Concept Plan Application Traffic and Transport, Traffic and Accessibility Impact Assessment (August 2011).
- KPMG, Parsons Brinckerhoff and Deloitte, Moorebank Intermodal Terminal Project Summary: Detailed Business Case (April 2012).
- Landcom, Residential Density Guide for Landcom Project Teams (May 2011).
- Liverpool City Council, Bike Plan 2009 (2009).
- Liverpool City Council, Development Control Plan 2008 Part 1.2 Additional General Controls for Development (April 2012).
- New South Wales Government, The Sydney Metropolitan Strategy (December 2010).
- New South Wales Government, Port Botany and Sydney Airport Transport Improvement Program (2011).
- Roads and Maritime Services, Accident Reduction Guide, Version 1.1, TD2004/RS01 (August 2005).
- Roads and Maritime Services, Crash id dataset 4434 - Selected crashes along Moorebank Avenue between Cambridge Avenue and Church Road intersections. 2006–2010 (November 2011).

- Roads and Maritime Services, Crash id dataset 4434 - Selected crashes along South Western Motorway (M5) between Hume Highway and Heathcote Road intersections. 2006–2010 (November 2011).
- Roads and Maritime Services, Guide to Traffic Generating Developments, Version 2.2 (October 2002).
- Roads and Maritime Services, Guide to Traffic Generating Developments, Updated Traffic Surveys TDT 2013/04 (May 2013).
- Roads and Maritime Services, NSW Black Spot Program, How to apply for funding.
- Roads and Maritime Services, Background Traffic Annual Growth Rates 2016 to 2031 for a 2hr AM and PM peak period Moorebank Area – email 2/5/2014, 6/5/2014, 21/7/2014 and 15/9/2014.
- Transport Research Board, Highway Capacity Manual (HCM) (2010).
- Urbis, SIMTA Environmental Assessment (EA) - Part 3A Concept Application (March 2012).
- URS, Port Botany Expansion Environmental Impact Statement (November 2003).