

Wilton Rezoning Landowners Group

Wilton Junction Development

Transport Management and Accessibility Plan

30 June 2014

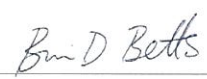


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Author, Reviewer and Approver details

Prepared by:	DB BB	Date: 30/06/2014	Signature:  
Reviewed by:	TvD	Date: 30/06/2014	Signature:
Approved by:	GI	Date: 30/06/2014	Signature: 

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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

Tel: +61 2 9272 5100

Fax: +61 2 9272 5101

Email: sydney@pb.com.au

www.pbworld.com

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Contents

	Page number
Executive summary	vii
1. Introduction	1
1.1 Project background	1
1.2 Study area	2
1.3 Study objectives	4
1.4 Report structure	4
1.5 Study requirements	5
2. Existing situation	7
2.1 Travel behaviour	7
2.2 Road network	12
2.3 Traffic volumes	14
2.4 Traffic conditions	18
2.5 Public transport	19
2.6 Pedestrian and cycle infrastructure	23
2.7 Picton Road safety	24
2.8 Summary of transport network issues	26
3. Wilton Junction development	27
3.1 Land owners	27
3.2 Project description	29
3.3 Employment scenarios	33
3.4 Staging	34
4. Strategic context	37
4.1 State planning context	37
4.2 Local plans	47
4.3 Population and employment forecasts	48
4.4 Redistribution of regional growth forecasts	52

Contents (Continued)

	Page number
5. Traffic impact assessment	55
5.1 Introduction	55
5.2 2013 Base model development	56
5.3 Development of future year base matrices	58
5.4 Future base network performance	62
5.5 Upgraded road network performance	69
5.6 Development of with-Wilton Junction matrices	69
5.7 Trip generation	70
5.8 Wilton Junction Road network	76
5.9 Street design	82
5.10 With-Wilton Junction network performance	87
5.11 Infrastructure staging	93
6. Public transport, pedestrians, cyclists and parking	97
6.1 Connections to rail services	97
6.2 Bus network	98
6.3 Cycling	114
6.4 Pedestrians	114
6.5 Parking	117
6.6 Travel plan	120
7. Economic analysis	123
7.1 Proposed Picton Road upgrade	124
7.2 Methodology	126
7.3 Traffic forecast results	126
7.4 Economic parameters and expansion factors	126
7.5 Project costs	127
7.6 Economic benefits	127
7.7 Results	127
8. Transport management and accessibility plan	129
8.1 Package of transport measures	129
8.2 Funding and delivery	132

List of tables

	Page number
Table 1.1	State Environment Planning Policy Study Requirements – Roads, Traffic and Transport
	5
Table 2.1	Trip purpose percentages by time of day for Sydney GMA
	8
Table 2.2	AM peak period mode split examples for trips to surrounding employment
	9
Table 2.3	AM peak period mode split examples for trips from surrounding population
	9
Table 2.4	Destination and origin council area for commute trips to/from Wollondilly LGA
	10
Table 2.5	Destination and origin council area for commute trips to/from Camden/Campbelltown LGA
	11
Table 2.6	Destination and origin council area for commute trips to/from Wingecarribee LGA
	11
Table 2.7	2013 intersection performance for the AM and PM peak hours
	18
Table 2.8	Train service frequency and hours of operation
	19
Table 2.9	2012 daily passenger movements at local stations
	20
Table 3.1	Wilton Junction Development summary
	27
Table 3.2	Wilton Junction retail centres
	32
Table 3.3	Retail space and employment
	33
Table 3.4	Wilton Junction employment forecasts (2041)
	33
Table 3.5	Employment floor space (2041)
	34
Table 3.6	Preliminary staging plan
	34
Table 4.1	Draft Metropolitan Strategy for Sydney targets for South West Subregion
	37
Table 4.2	BTS dwelling forecasts by LGA
	48
Table 4.3	BTS population ¹ forecasts by LGA
	48
Table 4.4	BTS employment forecasts by LGA
	49
Table 4.5	Wollondilly identified future employment growth
	50
Table 4.6	Population numbers for proposed land use scenarios
	52
Table 4.7	Employment scenarios
	52
Table 5.1	Modelled scenarios
	56
Table 5.2	BTS Population & Employment Forecasts by sub-area within the model area
	58
Table 5.3	BTS population forecasts by Council area
	59
Table 5.4	BTS employment forecasts by Council area
	60
Table 5.5	Adjusted 2036 AM peak growth (2011 to 2036) by sub-area
	61
Table 5.6	Adjusted 2036 PM peak growth (2011 to 2036) by sub-area
	61
Table 5.7	Additional trips generated by the Maldon Aggregate facility
	62
Table 5.8	Traffic volume forecasts (pcu/h) for 2013 existing and future 'no Wilton' scenarios
	65
Table 5.9	Summary of link performance for 2013 existing and future 'without Wilton' scenarios
	66
Table 5.10	Intersection performance for 2024 future base scenario in the AM and PM peak hours
	67
Table 5.11	Intersection performance for 2036 future base scenario in the AM and PM peak hours
	67
Table 5.12	Intersection performance for 2036 with-upgrade scenario in the AM and PM peak hours
	69
Table 5.13	Adjustments to growth in other areas due to Wilton Junction
	70
Table 5.14	STM estimate of trip containment within Wilton Junction for employment containment scenarios
	70
Table 5.15	Trip numbers (all modes, production and attraction) by quadrant and time period (full development)
	72
Table 5.16	Assumed directional split for peak hour trips
	72
Table 5.17	Mode share of trips (all purposes)
	72
Table 5.18	Vehicle trip numbers (production and attraction) by land use and time period
	73
Table 5.19	Trip direction based on STM model results
	73

Table 5.20	Indicative street cross-sections	82
Table 5.21	Traffic volume forecasts (pcu/h) for 2013 existing and future 'with Wilton' scenarios	88
Table 5.22	Summary of link performance for 2013 existing and future 'with Wilton' scenarios	89
Table 5.23	Intersection performance for 2024 with Wilton scenario in the AM and PM peak hours	92
Table 5.24	Intersection performance for 2036 with Wilton scenario in the AM and PM peak hours	92
Table 5.25	Proposed road infrastructure staging for Wilton Junction	94
Table 6.1	Potential peak hour demand for bus services at different stages of development	101
Table 6.2	Potential peak hour bus loads at different stages of development	102
Table 6.3	Estimated bus journey times	108
Table 6.4	Proposed peak hour bus frequencies at different stages of development	109
Table 6.5	Interchange facilities	111
Table 6.6	Wollondilly DCP 2011 car parking rates for residences	119
Table 6.7	Wollondilly DCP 2011 car parking rates for other land uses	120
Table 6.8	Average Household TravelSmart mode split change	121
Table 7.1	Economic parameters and expansion factors	126
Table 7.2	Values of travel time	127
Table 8.1	Transport network mitigation measures summary	130
Table 8.2	Summary of infrastructure offer	132

List of figures

		Page number
Figure 1.1	Wilton Junction Development area	2
Figure 1.2	Regional context	3
Figure 2.1	Road network	12
Figure 2.2	2013 AM peak Surveys Traffic Volumes	16
Figure 2.3	2013 PM peak surveys traffic volumes	16
Figure 2.4	Road network flows (modelled) for 2013 base scenario (PCUs)	17
Figure 2.5	Historic change in traffic volumes on Hume Highway and Picton Road	18
Figure 2.6	Picton bus services	21
Figure 2.7	Busways Camden bus services	22
Figure 2.8	Proposed shared cycle pathways for Wilton	23
Figure 2.9	Road safety upgrade of Picton Road	24
Figure 2.10	Crash history on Picton Road at Wilton	25
Figure 2.11	Tyre tracks in the grass across traffic island at Hume Highway/Picton Road Interchange	26
Figure 3.1	Wilton Junction land ownership	28
Figure 3.2	Wilton Junction master plan	31
Figure 3.3	Wilton Junction dwelling types	32
Figure 3.4	Indicative residential staging plan	35
Figure 3.5	Indicative employment staging plan	36
Figure 4.1	South West Subregion	38
Figure 4.2	Regional connections to Sydney	39
Figure 4.3	Protected corridors to support urban growth	40
Figure 4.4	Committed network infrastructure tasks across NSW	43
Figure 4.5	Maldon-Dombarton Rail Link corridor in Wilton Junction Development area	46
Figure 4.6	Location of other developments	51
Figure 5.1	Aimsun model network – 2013 existing conditions	57
Figure 5.2	Sub areas within the model area	59
Figure 5.3	Road network flows for 2024 without Wilton scenario (PCUs)	63
Figure 5.4	Road network flows for 2036 without Wilton scenario (PCUs)	64
Figure 5.5	Estimated timing of road upgrades without Wilton Junction Development	68
Figure 5.6	External road network flows for 2024 with Wilton scenario (PCUs)	74
Figure 5.7	External road network flows for 2036 with Wilton scenario (PCUs)	75
Figure 5.8	Key components of the proposed Wilton Junction road network	77
Figure 5.9	Proposed Hume Highway/Picton Road interchange upgrade	78
Figure 5.10	Proposed internal link road	79
Figure 5.11	Proposed north-facing ramps to the Hume Highway	80
Figure 5.12	Internal road hierarchy	81
Figure 5.13	Internal road network flows for 2024 AM peak hour with Wilton scenario (PCUs/hr)	84
Figure 5.14	Internal road network flows for 2024 PM peak hour with Wilton scenario (PCUs/hr)	85
Figure 5.15	Internal road network flows for 2036 AM peak hour with Wilton scenario (PCUs/hr)	86
Figure 5.16	Internal road network flows for 2036 PM peak hour with Wilton scenario (PCUs/hr)	87
Figure 5.17	Access locations and intersection control	91
Figure 5.18	Proposed road infrastructure staging for Wilton Junction	95
Figure 6.1	Initial bus network – 2021/2,500 dwellings	104
Figure 6.2	Proposed bus network – 2024/4,000 dwellings	105
Figure 6.3	Proposed bus network – 2031/7,800 dwellings	106
Figure 6.4	Proposed bus network – Full development/11,900 dwellings	107
Figure 6.5	Proposed bus interchange infrastructure	112
Figure 6.6	Local pedestrian facilities	115
Figure 6.7	Pedestrian and cycle crossing opportunities	116

Figure 7.1 Recommended upgrades of Picton Road affecting major freight movements

125

List of appendices

Appendix A	Traffic survey results
Appendix B	Intersection performance criteria
Appendix C	Aimsun model calibration and validation report
Appendix D	Mid-block capacity sensitivity test
Appendix E	Highway Capacity Manual (HCM) analysis

Executive summary

This study

A new town is planned at Wilton Junction, strategically located around the Hume Highway/Picton Road Interchange. The new town will comprise residential dwellings, a town centre, schools, enterprise employment areas, retail and light industrial areas. This report constitutes a Transport Management and Access Plan (TMAP) in support of an application for the rezoning of lands known as the Wilton Junction Precinct. The purpose of this report is to assess the transport requirements of the proposed rezoning and to suggest a range of measures to support the levels of growth proposed to the NSW Government for further assessment.

The three proponents, who are landowners at Wilton Junction, are Bradcorp Pty Ltd, Walker Corporation and Governors Hill. Lend Lease, currently delivering the adjacent Bingara Gorge community, is working with the Proponents of this rezoning application to plan and deliver the new town at Wilton Junction and its associated infrastructure.

The development

The Wilton Junction Development would comprise:

- Employment and commercial drivers. The delivery of approximately 11,000 jobs focused around a new town centre and in close proximity to the Hume Highway and Picton Road surrounded by employment generating uses for business, bulky goods and light industry, comprising of approximately 120 - 130ha of land.
- Housing. Providing between 11,000 and 13,000 new dwellings (approximately 35,000 residents) across the precinct, inclusive of the 1,165 dwellings already approved at Bingara Gorge.
- Retail. A Town Centre of 17ha with primary retail and, 30,000 m² GFA bulky goods and highway oriented retail, three village centres (approximately 10,000 to 12,000 m² GFA) and local shops to support a self-sustaining community. The total retail space proposed is 70,000 m² GFA.
- Community facilities. Provide a diverse range of high quality community facilities including a schools, library, community centre in a town centre and three neighbourhood centres across the precinct.

The Wilton Junction Development is planned to take several decades to develop to its planned ultimate potential by approximately 2041. Simultaneous to Bingara Gorge, the next stage is being sought by the beginning of 2015 to support the NSW Government's targets for new housing construction per year.

The Wilton Junction Development will be a staged development. The Bingara Gorge component is already under construction. The development of other land within Wilton Junction would follow, with ultimate development anticipated by 2041. An indicative residential dwelling rate is approximately 20% by 2021 and 65% by 2031. Employment land development is expected to lag the release of dwellings by approximately 10% by 2031 due to market conditions.

Transport assessment

The method of assessing the traffic and transport impacts for the Wilton Junction Development was developed in consultation and agreed with representatives of Transport for NSW, Roads and Maritime Services and Wollondilly Shire Council.

To assess the transport infrastructure requirements and traffic impacts of Wilton Junction, an Aimsun Mesoscopic traffic model was developed for the AM and PM peaks. The Aimsun modelling has also been utilised to determine the infrastructure staging requirements as Wilton Junction develops over time. The Aimsun Mesoscopic traffic model was developed, calibrated and validated in accordance with RMS traffic modelling guidelines. When considering the infrastructure staging, SIDRA modelling was also used to test intersection configurations and supplement the Aimsun modelling.

In developing this suite of models, Parsons Brinckerhoff worked closely with TfNSW (including BTS and RMS) to agree modelling assumptions and inputs throughout the process. The BTS STM model was used to assist with the development of the future year modelling. During the modelling process some issues were identified with the BTS future forecasts. Where these issues could not be reconciled, Parsons Brinckerhoff worked with TfNSW to agree on alternative first principal inputs. Future year base models were developed for the intermediate years of 2024 and 2031, and the year assumed (for modelling purposes only) for ultimate development of 2036.

An upgrade of the Hume Highway/Picton Road Interchange is currently being considered by RMS, and is required regardless of the Wilton Junction Development. However, an alternative interchange upgrade is proposed to provide free-flow movement for the heaviest traffic and freight movements between Sydney to Port Kembla, minimise land take and reduce the need for wide bridges over the Hume Highway. The proposed interchange would include:

- retention of the slip lane for movements from Hume Highway southbound to Picton Road eastbound
- a new fly-over ramp for the Picton Road westbound to Hume Highway northbound movement (also heavily used by existing car traffic)
- new traffic signals for the remaining right-turn movements, but not affecting left-turn movements or the right-turn movement referred to above.

The traffic modelling analysis for the future base scenario identified that the elements in the road network would reach operating levels that require upgrading, regardless of the Wilton Junction Development. The following upgrades are recommended to maintain suitable network performance:

- upgrade the Hume Highway/Picton Road interchange – due by 2015
- upgrade the intersection of Picton Road and Pembroke Parade – due by 2015
- widen one lane section of Picton Road to two lanes, east of Pembroke Parade – due by 2021
- upgrade the intersection of Picton Road and Almond Street – due by 2016.

Traffic generation

Traffic generation was evaluated, where appropriate to be consistent with the rates for residential, employment and retail rates from the Roads and Maritime Service (RMS) Technical Direction TDT13-04a – Guide to Traffic Generating Developments Updated traffic surveys (RMS, August 2013) for regional areas.

Overall, the development was estimated to generate approximately 160,000 trips across the day and 24,000 during the morning and afternoon peaks (including all modes of transport, e.g. walking, bus, car, etc.). While these are large numbers, as Wilton Junction is being planned as a new town with a high degree of self-sufficiency, approximately half of these trips are contained within the Wilton Junction development itself.

Road network

The road network for Wilton Junction is proposed to minimise the impact on the Hume Highway and Picton Road. This includes new north-facing ramps between the Hume Highway and Wilton Junction to preserve capacity at the Hume Highway/Picton Road Interchange for regional trips. Two grade separated overpasses each of Picton Road and the Hume Highway are proposed to allow traffic moving around Wilton Junction to do so without affecting the arterial roads.

The major components of the proposed road network include:

- upgrading of the intersection of Picton Road and Wilton Park Road to traffic signals
- upgrading of the intersection of Picton Road and Pembroke Parade to traffic signals
- provision of a new internal north-south road grade separated from Picton Road at a point 400 m west of Pembroke Parade
- upgrading of the intersection of Picton Road and Almond Street to a give-way seagull intersection in the interim and conversion to grade separation with left-in/left-out access once the area south of Picton Road is developed
- a new intersection on Picton Road, at Wilton Park Road (which will be realigned) with signalised access into the development
- retention of the current east-west road grade separated from the Hume Highway, south of the Nepean River
- new east-west road, grade separated over the Hume Highway, north of Picton Road
- new north-facing ramps from the Hume Highway to Wilton Junction internal roads.

An internal road network has been proposed with:

- a series of internal distributor and collector roads to compliment the State Road Network and manage connections to it at a discrete number of locations
- additional lanes to match the demand requirements, whilst retaining local amenity and promoting active transport modes such as walking and cycling
- intersection controls for internal intersections, including traffic signals and (give-way and stop) sign controlled intersections
- grade-separated connections between development areas across the Hume Highway and Picton Road.

Traffic modelling for a 2036 full development scenario indicates that the internal and external road provisions can mitigate the impacts of the Wilton Junction Development and operate with acceptable levels of performance. A capacity assessment of the proposed future Hume Highway and Picton Road Interchange using the Highway Capacity Manual (HCM) method has indicated that the proposed ramp arrangements could work from an operational perspective with a Level of Service of D or better. This analysis indicates that the Hume Highway, north of Wilton Junction would operate at a satisfactory Level of Service D during the peak periods.

The traffic modelling also indicates that Picton Road, east of Pembroke Parade, would require upgrading to two lanes each way as identified in the Picton Road Corridor Strategy (RMS, 2011). However, the upgrade is recommended sooner than indicated in the Strategy to maintain adequate performance, with or without the Wilton Junction Development.

The staging of road infrastructure for Wilton Junction has been assessed using the Aimsun models for design years (2013, 2024, 2031 and 2036), as well as SIDRA intersection modelling. Table ES.1 shows how the infrastructure would be staged over time, as well as the approximate proportion of dwellings assumed. The infrastructure staging may change depending on the rate and location of development within Wilton Junction. The recommendations made are suggestions to Government to support the Wilton Junction Development. Recommendations for new traffic signals require further assessment at development application stage to determine whether they meet RMS traffic signal warrants and are subject to approval by RMS.

Table ES.1 Proposed road infrastructure staging for Wilton Junction

Percentage of dwellings built	Approximate year	Road upgrades
5%	2015	■ Hume Highway/Picton Road Interchange – preliminary upgrade ■ Pembroke Parade/Picton Road intersection signals ■ Wilton Park Road/Picton Road intersection signals ■ Wilton Park Road to Governor's Hill land release ■ Almond Street/Picton Road intersection preliminary ■ Connection of Bradcorp land to Pembroke Parade ■ Connection of Walker Corp land to Pembroke Parade ■ Pembroke Parade pedestrian bridge
20%	2021	■ Picton Road widening east of Pembroke Parade ■ Connection of Bradcorp land to Wilton Park Road
40%	2024	■ Hume Highway/Picton Road Interchange – full upgrade ■ Internal link road ■ North-facing ramps ■ Grade separation over Picton Road between Hume Highway Interchange and Pembroke Parade
50%	2028	■ Picton Road widening west to western edge of site ■ New access intersection on Picton Road, west of Wilton Park Road, and intersection signals ■ Extension of internal collector roads
65%	2031	■ Extension of internal collector roads

It is noted that the proposed infrastructure upgrades indicated on the Master Plan are not approved by RMS, TfNSW, or Council. The Hume Highway/Picton Road interchange upgrade indicated on the Master Plan is not an approved design. The proposed layouts and configurations illustrated have been adopted for the purposes of traffic modelling / traffic assessment only. This TMAP and the rezoning process that it supports, does not confirm a final design for any of the proposed infrastructure upgrades on the local or State Road Network.

Public transport

Improvements to public transport services and infrastructure are recommended to reduce the amount of car use and meet State Government targets for sustainable transport. The major component of the public transport network would be a greatly expanded bus network, with a mixture of regional, local, school and rural services and service levels commensurate with a town of the size planned for Wilton Junction. Connections to the Sydney Trains and NSW Trains network would be achieved by bus services to Picton in the short-term, and then Campbelltown/Macarthur by 2018, as passenger demand increases. Regional services would also be provided to Wollongong for employment, education and recreational trips.

Park and ride for train journeys is likely to occur at the major stations of Campbelltown and Macarthur. However, park-and-ride facilities would be provided at the Wilton Junction Town Centre in conjunction with the new Campbelltown/Macarthur regional service. An adjustment to the Metropolitan Region Bus Network boundary could be considered in the future to incorporate Wilton Junction within the fare scheme of the rest of Sydney, and support the measures proposed to attract people away from car-based travel.

The bus network would develop over time as development proceeds and new areas and sources of passengers become available. A trunk regional/local service to Picton, combined with local services serving the northern, eastern and southern areas of the development is proposed to provide self-sufficiency and reduce car-based travel for local trips. This would also reduce the impact of local traffic on the arterial road network. A bus network plan is proposed with:

- bus routes, service frequencies and journey time estimates
- estimates of the bus fleet required to service the bus plan
- interchange and layover focussed within the Town Centre
- facilities for passengers at the Town Centre, neighbourhood centres and along the bus routes.

Walking and cycling

New cycleways and pedestrian paths are planned within the development connecting to, and compatible with, Wollondilly Shire Council's planned network of shared cycle and pedestrian paths. The pedestrian and cycle networks are designed to have a greater level of permeability than provided to vehicles to promote their greater use. The cycle routes proposed are a mixture of shared paths, mixed traffic, and on-street cycle lanes.

The pedestrian network would concentrate on connecting high trip generating land uses, such as retail centres, community and recreation facilities and schools. Paths would be safe and well lit, with pedestrian crossing treatments on strong pedestrian desire lines at road crossings. All streets (except laneways) would have 1.2 m minimum footpaths, on one or both sides of the street.

Streets within the proposed Town Centre would be designed to reinforce the high pedestrian activity area and improve pedestrian safety. Treatments proposed include entry thresholds (using textured pavement/pavers), road width changes, raised thresholds, street lighting and lower speed limits. Bicycle racks would be provided in the Town Centre, at neighbourhood centres, community centres and recreation facilities. Commercial buildings would be required to provide cyclist end of trip facilities, including bike locking and showers.

Funding

The delivery of the package of measures outlined in this TMAP may require funding from a range of sources including State government, Section 94 funds and contributions from developers. An infrastructure works strategy, to be provided with the rezoning application, has been developed for the funding and delivery of road and transport infrastructure by the Wilton Junction Landowner. The aim of the infrastructure plan is to achieve 'no additional cost to government', apportioning cost based on the amount the Wilton Junction development contributes to the need for infrastructure upgrades.

A rapid economic analysis of the proposed road upgrades of the Hume Highway and Picton Road interchange and Picton Road has been undertaken to investigate the benefits of additional grade separation. The dominant freight movement between Sydney and Port Kembla via the Hume Highway and Picton Road was selected and analysed due to its impact on freight efficiency. The analysis indicated that the grade separation of the existing Picton Road and Pembroke Parade intersection, instead of the proposed signalised upgrade, would have a positive benefit cost ratio (BCR) of 1.9. However, it is noted that the proposed signalised upgrade is adequate to mitigate the impacts of the Wilton Junction Development.

Package of mitigation measures

To address the transport impacts of the Project, and to achieve the mode share targets, a package of mitigation measures are proposed. Timeframes and delivery mechanisms for the recommended strategic and local transport planning measures are proposed and would need to be confirmed by the relevant agencies.

It is proposed that travel plans would be developed to provide personalised travel information that highlights the diversity of transport options on offer. The Development Control Plan (DCP) for the Precinct will require that Work Travel Plans (WTP) and Travel Access Guides (TAG) be produced by the developers and businesses.

1. Introduction

This report constitutes a Transport Management and Access Plan (TMAP) in support of an application for the rezoning of lands known as the Wilton Junction Precinct. The Wilton Junction Development comprises the rezoning of several land holdings around the junction of the Hume Highway and Picton Road in south-west Sydney for a new community including residential dwellings, a town centre, schools, enterprise employment areas, retail and light industrial areas.

Parsons Brinckerhoff were commissioned by Elton Consulting on behalf of the Wilton Rezoning Landowners Group to assess the transport impacts of the proposed new development and provide advice on a range of transport measures that could be implemented to support the growth proposed under the rezoning proposal. The report has been prepared to address the road, traffic and transport-related issues raised in the NSW Department of Planning and Environment (DP&E – formerly Department of Planning and Infrastructure (DP&I)) State Environment Planning Policy (SEPP) study requirements, issued on the basis of the project Master Plan.

1.1 Project background

In November 2011, the State Government invited landowners with large properties in suitable locations to nominate sites which might be able to deliver additional housing to address Sydney's housing supply shortfall.

A number of major landholders in the Wilton area responded to the NSW Government's invitation and nominated land adjoining the Hume Highway and Picton Road intersection for consideration as part of the Potential Housing Opportunities Program. This area has subsequently become known as Wilton Junction, and sits within the Wollondilly Shire. Following a Council resolution in May 2012, four major landowners (known as the Wilton Junction Landowners' Group) signed an agreement to work cooperatively with Council in the preparation of a high level master plan for Wilton Junction to deliver high quality new housing, jobs close to homes, supporting social and utilities infrastructure and services, and a range of complementary land uses.

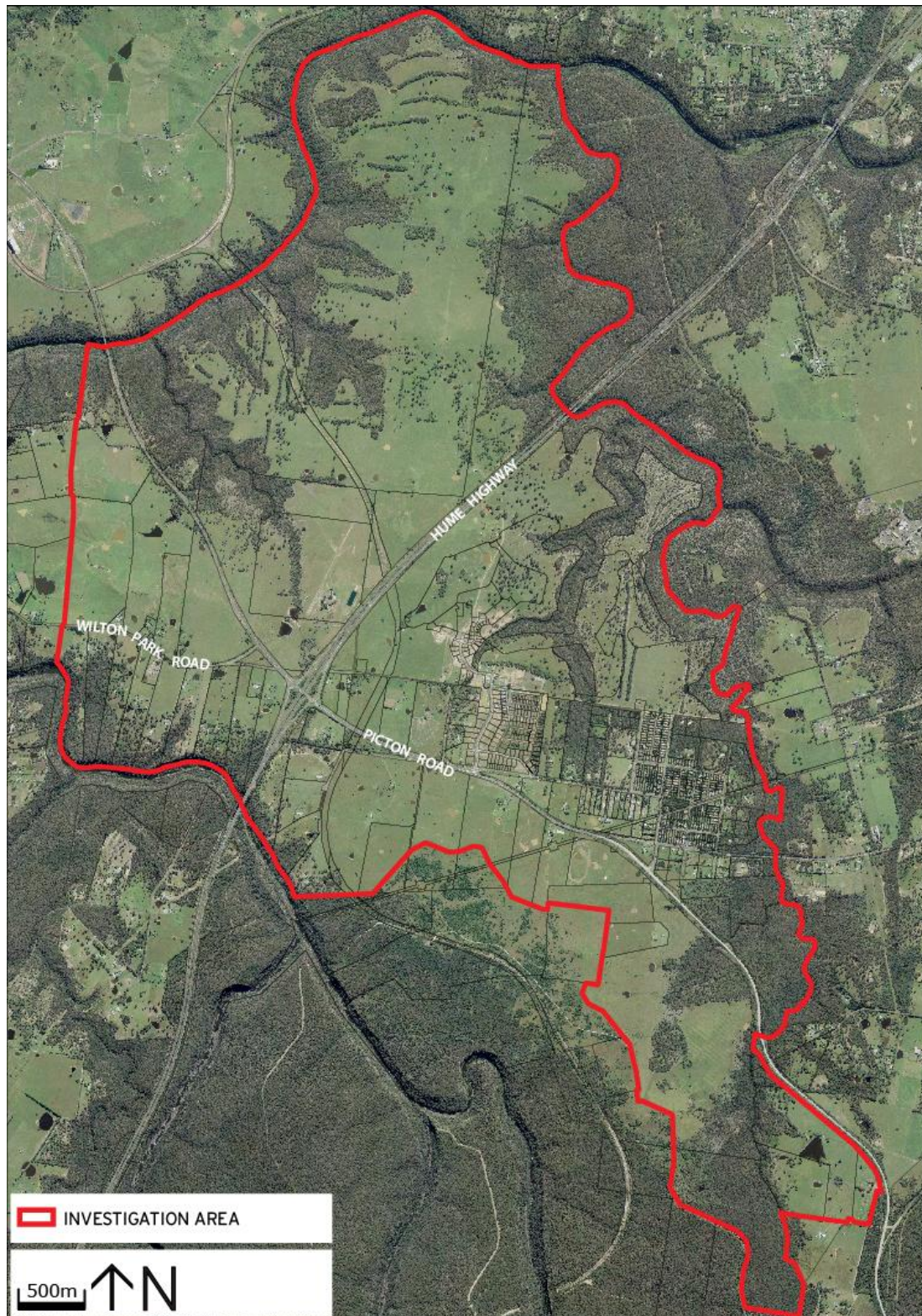
A High Level Master Plan and a Preliminary Infrastructure Requirements Report were considered by Wollondilly Shire Council on 17 December 2012, with Council resolving to give in-principle support to the proposal. The Council also resolved to request that the rezoning be a state driven process.

Subsequently, the NSW Government decided to coordinate the statutory planning process, led by the NSW Department of Planning & Infrastructure (now the Department of Planning and Environment, DP&E). The Minister for Planning and Infrastructure (now the Minister for Planning and Environment) proposed to prepare a State Environmental Planning Policy (SEPP), as per Section 24 and Section 37 of the *Environmental Planning and Assessment Act 1979*, with a view to rezone the land through an amendment to the Wollondilly Local Environmental Plan (LEP) 2011. The amendment to the LEP would facilitate the early delivery of housing and infrastructure, linked to an agreed Infrastructure, Servicing and Staging Plan for the Wilton Junction Precinct.

The DP&I (now DP&E) issued [Director-General's Requirements](#) (DGRs) to guide planning investigations for a new town at Wilton Junction. The DGRs set the criteria for carrying out environmental investigations across the site. The investigations examine the potential for the site at Wilton Junction to be rezoned under a state environmental planning policy (SEPP).

1.2 Study area

Wilton Junction is located within Wollondilly Shire Council and is approximately 80 km from Sydney Central Business District, and 30 km north-west of Wollongong. The development area, shown in Figure 1.1, includes the existing village of Wilton and the recently approved suburb of Bingara Gorge.



Source: Connor Holmes, 2014

Figure 1.1 Wilton Junction Development area

In the wider regional context, shown in Figure 1.2, Wilton Junction is located south of the South West Growth Centre around Leppington. The Precinct is crossed by two potential rail lines, including the Maldon to Dombarton Freight Rail Line and a potential alignment for a high-speed rail between Melbourne, Canberra and Sydney.

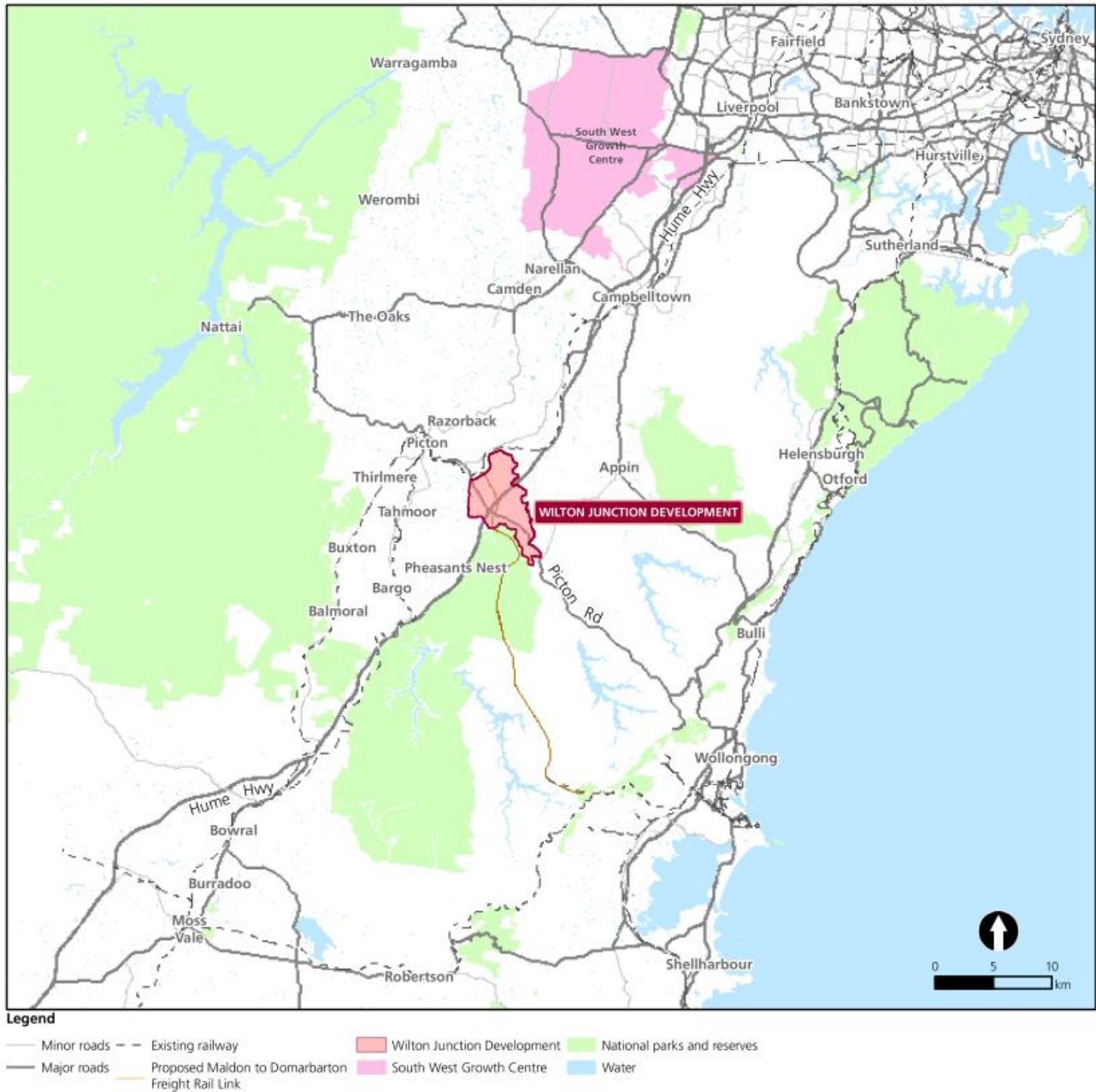


Figure 1.2 Regional context

Wilton is currently a small village with a population of 1,890 in 595 homes¹. In addition to the historic village, development has started at the Bingara Gorge development, which has already been rezoned for residential uses, with approval for 1,165 dwellings, a primary school, and local shops.

¹ 2011 Census, Australian Bureau of Statistics

1.3 Study objectives

This report outlines the travel requirements of the Wilton Junction Precinct by road, public transport, walking and cycling. The objective of this TMAP is to:

- adopt and recommend the implementation of transport planning principles to maximise the use of public transport, walking and cycling
- identify and manage the transport impacts of the Wilton Junction Precinct Project on surrounding sites and transport networks
- help reduce reliance on the private car
- address the SEPP study requirements for the Precinct.

1.4 Report structure

This report forms part of the studies required to be undertaken to meet the DGR'S outlined by the DP&E (formerly DP&I) as part of the investigations for the release and rezoning through a SEPP. The study outcomes and report has also informed the development and preparation of a Master Plan for Wilton Junction.

This report is structured as follows:

- Section 2 presents information on existing transport conditions, including:
 - ▶ existing travel behaviour
 - ▶ road network characteristics, including a description of the surrounding road network, existing traffic volumes, local intersection performance and a description of how the road network operates
 - ▶ current levels and details of public transport services
 - ▶ pedestrian and cycle networks and a description of the issues experienced
 - ▶ existing safety issues.
- Section 3 details the proposed development.
- Section 4 contains a:
 - ▶ review of the relevant State and Local government plans and strategies, and recent studies for other developments
 - ▶ review of population and employment forecasts
 - ▶ strategic assessment of the transport issues forecast for the Wilton area.
- Section 5 describes the modelling process, assesses the impact of the Project on the surrounding road network, analyses the proposed development and provides information on accesses and street design.
- Section 6 assesses the project in terms of its provision for and impact on public transport, pedestrians, cyclists and parking.
- Section 7 provides a rapid economic assessment of the benefits of upgrading Picton Road with grade separated intersections to the Development east of the Hume Highway.
- Section 8 provides an outline of measures proposed to mitigate the impacts of the development, and provides information on their delivery.

1.5 Study requirements

On 2 May 2013, the Director General, DP&E (formerly DP&I) issued a list of State Environment Planning Policy (SEPP) study requirements for the Wilton Junction Precinct. The TMAP has been developed in consideration of the study requirements for roads, traffic and transport. The location in the TMAP in which each of the study requirements is addressed is outlined in Table 1.1.

Table 1.1 State Environment Planning Policy Study Requirements – Roads, Traffic and Transport

Requirement	Reference
Base assumptions relating to population, employment, transport generation, degree of employment self-containment and travel mode splits are to be generally agreed by TfNSW prior to the commencement of the Study	5.3, 5.4
Strategic modelling shall then be undertaken in the Sydney Strategic Transport Model (STM). TfNSW shall undertake this modelling in consultation with the proponent and then provide the outputs to the proponent. The STM shall be used to determine the likely growth in travel demand associated with the proposal and assist to refine the mode split between vehicular trips and public transport trips.	5.3
The proponent shall undertake mesoscopic modelling for the purpose of determining route assignment and identifying infrastructure upgrades required using the outputs of the STM modelling (it is noted that TfNSW, RMS and the proponent have agreed that AIMSUN will be used for the mesoscopic modelling). The mesoscopic model must be able to demonstrate that due consideration has been given to a range of factors including weave movements and lengths.	Section 5
- The proponent's modelling must consider the implications of the development on the functionality of Picton Road and specifically the impact to freight, recognising that the Long Term Transport Master Plan acknowledges the need to provide efficient freight connections to Port Kembla. In this regard, the modelling must consider two infrastructure scenarios for Picton Road: - Picton Road with no new at grade intersections and a free flow arrangement of Hume Highway and Picton Road. The layout of the interchange of the Hume Highway and Picton Road to be modelled shall be determined in consultation with TfNSW and RMS. - Picton Road with at grade intersections east of the Hume Highway.	5.8
Based on the results of the modelling, the proponent shall undertake an economic assessment on the impact of the two separate options on freight activity and access to and from the Illawarra Region.	Section 7
An assessment of mitigating measures to accommodate the proposal with an agreed scope and costs (at a strategic level) with TfNSW and RMS.	Section 8
- A Transport Management and Accessibility Plan (TMAP) must be prepared in consultation with TfNSW to identify and assess: - the provision and staging of the required traffic and transport infrastructure, including regional and local intersection and road improvements required. - how the works required are to be funded and any proposed contributions to local and State or regional infrastructure. - public transport needs and the capacity of existing services. - scenarios including road works.	This report, Section 8
The TMAP shall identify a road hierarchy and access strategy that minimises local trips on Picton Road between the four quadrants of the development and safely manages pedestrian and cyclists desire lines in a high speed environment. Consideration must be given to the management of east west crossings of the Hume Highway and north south crossings of Picton Road (particularly east of the Hume Highway).	5.11
The TMAP shall identify vehicular, pedestrian and cyclist infrastructure on (and above) both the Hume Highway and Picton Road required to accommodate the proposal as well as suitable public transport infrastructure, cognisant of the public transport infrastructure and services modelled in the Sydney Travel Model.	8.1
The TMAP shall identify (and preserve) land required for future road infrastructure upgrades. The extent of land required shall be determined in consultation with RMS.	6.2
	5.10
The TMAP shall identify a road hierarchy and access strategy that minimises local trips on Picton Road between the four quadrants of the development and safely manages pedestrian and cyclists desire lines in a high speed environment. Consideration must be given to the management of east west crossings of the Hume Highway and north south crossings of Picton Road (particularly east of the Hume Highway).	5.8, 5.9, 6.3, 6.4
The TMAP shall identify vehicular, pedestrian and cyclist infrastructure on (and above) both the Hume Highway and Picton Road required to accommodate the proposal as well as suitable public transport infrastructure, cognisant of the public transport infrastructure and services modelled in the Sydney Travel Model.	5.8, 5.9, 5.10, 6.2, 6.3, 6.4
The TMAP shall identify (and preserve) land required for future road infrastructure upgrades. The extent of land required shall be determined in consultation with RMS.	Section 8

2. Existing situation

This section outlines the existing travel behaviour of residents and employees in the area around the proposed Development. It also looks at locations with characteristics similar to how Wilton Junction could develop, to provide guidance in the potential travel behaviour of the residents and employees in the Development. It describes the current transport capacity and performance of the surrounding roads, the public transport network and services and the walking and cycling network.

2.1 Travel behaviour

The travel behaviour of existing nearby residents and employees can provide a guide to how the future residents and employees of the Development may travel. Travel behaviour varies widely, but certain characteristics can be grouped depending on the:

- purpose for the journey
- the time period of the journey
- the mode or combination of modes of transport used from the origin to the destination.

Three sets of data exist for assessing these travel characteristics:

- Australian Bureau of Statistics publishes broad travel data gathered from the questions asked in the five-yearly Census. Useful data includes the population, number of dwellings, amount of workers and students, mode of travel to work and time of work trips made.
- The Census results for NSW are further analysed by the Bureau of Transport Statistics (BTS), within Transport for NSW. The Journey to Work (JTW) data set analyses work commuting trips and links their origin and destination zones, creating a matrix of movements around the Sydney Greater Metropolitan Area (GMA). This is useful to determine the current directions of travel to and from an area and mode share.
- BTS also undertakes a continuous Household Travel Survey (HTS) which samples households in the Greater Metropolitan Area (GMA). The survey involves respondents completing a diary of their travel patterns for all trip purposes. The results are compiled on an annual basis, but can be combined to form a large pool of data.

Due to the sample size, only certain types of data are available from each data set. Weekend data was not available.

Number of daily trips per person

The 2010/2011 release of HTS data (BTS, 2012) indicates that people in Sydney GMA made 3.77 trips per person per weekday, whilst people in Wollondilly LGA made an average of 3.9 trips.

Reason for travelling

Trips generated from dwellings can be made for several purposes. Trip purposes can include: commute to work, work related business, education/childcare, shopping, personal business, social/recreation, serve passenger or other. For the purposes of this study, these categories have been amalgamated to those shown in Table 2.1. Data from the 2010/2011 release of HTS data for Sydney GMA were used to estimate these rates. Travel behaviour during the peaks can be different from patterns for the whole day, so percentages are presented for daily, AM peak and PM peak trips.

Table 2.1 Trip purpose percentages by time of day for Sydney GMA

Trip purpose	Daily	AM peak	PM peak
Commute, work related business	28%	41%	29%
Education/childcare	10%	28%	14%
Shopping, personal business	29%	16%	26%
Other, social/recreational	32%	14%	31%
Total	100%	100%	100%

Source: Household Travel Survey (HTS) 2010/11 Release, Bureau of Transport Statistics, Transport for NSW (2012)

Note: Trips to serve passenger were apportioned across the other four categories and included in their percentages

Car ownership

The number of cars owned per dwelling is a measure of residents in an area's ability to choose to travel other than by transit. Many new land release areas have a high number of vehicles per dwelling, indicating that more people in the household have the ability to drive. Car ownership is influenced by the number of people per dwelling as well as the level of alternative transport options, affluence, job type and the availability of free parking. The average number of cars per household for the Wollondilly LGA measured in the 2010/2011 HTS survey was 2.2, compared to a Sydney GMA average of 1.55 vehicles per household. Based on the 2011 Census data, Wilton had a slightly higher average of 2.3 vehicles per dwelling.

Based on a per capita basis, Wollondilly LGA with 0.73 vehicles per person has one of the highest number of vehicles per person of all local government areas across Sydney GMA, but is on par with Camden and lower than Wingecarribee (0.76 – the highest in the Sydney GMA). The Sydney GMA average was 0.59 vehicles per person.

Transport mode share

The choice of travel mode varies depending on the range of transport services available, car availability, need for predictable arrival time, the length of the journey and the reason for travelling. The mode split for trips to work during the AM peak to employment precincts in the outer south-west Sydney area are shown in Table 2.2. The mode split percentages are calculated using data from the BTS 2011 JTW dataset.

Table 2.2 AM peak period mode split examples for trips to surrounding employment

Travel mode/ Destination	Wilton, Maldon, Razorback	Picton, Thirlmere, Tahmoor	Appin	Wollondilly LGA	Camden LGA	Campbell- town LGA
2011 Travel zones	3008, 3010	3013, 3015, 3016, 3017	3009	3000 to 3025	3100 to 3131	3200 to 3307
Train	0%	1%	1%	1%	1%	3%
Bus	0%	0%	0%	0%	1%	1%
Taxi	1%	0%	0%	0%	0%	0%
Car as driver	81%	85%	90%	84%	85%	82%
Car as passenger	6%	7%	5%	7%	8%	8%
Truck	8%	2%	1%	3%	2%	1%
Motorbike	0%	1%	1%	1%	0%	0%
Bicycle	0%	0%	0%	0%	0%	0%
Other mode	0%	1%	0%	1%	0%	0%
Walked only	3%	3%	1%	4%	2%	2%
Total	100%	100%	100%	100%	100%	100%

Source: 2011 Journey to Work (BTS, 2013), selected travel zones

The corresponding mode share for work trips from the selected residential precincts near Wilton are shown in Table 2.3. They show the potential range of mode shares that the future residents of the Wilton Junction Development could achieve. Factors influencing this range include the level of access to public transport, the supply of parking and road congestion in the surrounding area.

Table 2.3 AM peak period mode split examples for trips from surrounding population

Travel mode/ Origin	Wilton, Maldon, Razorback	Picton, Thirlmere, Tahmoor	Appin	Wollondilly LGA	Camden LGA	Campbell- town LGA
2011 Travel zones	3008, 3010	3013, 3015, 3016, 3017	3009	3000 to 3025	3100 to 3131	3200 to 3307
Train	6%	5%	5%	5%	7%	18%
Bus	1%	0%	1%	1%	1%	1%
Taxi	0%	0%	0%	0%	0%	0%
Car as driver	82%	82%	83%	83%	82%	69%
Car as passenger	5%	6%	4%	5%	5%	7%
Truck	4%	3%	4%	3%	2%	2%
Motorbike	0%	1%	0%	1%	1%	0%
Bicycle	0%	0%	0%	0%	0%	0%
Other mode	0%	0%	0%	1%	0%	0%
Walked only	2%	2%	2%	2%	1%	2%
Total	100%	100%	100%	100%	100%	100%

Source: 2011 Journey to Work (BTS, 2013), selected travel zones

In addition to the modes of travel outlined above, an additional 7% of Wilton residents worked from home, which is higher than the SMA average of 5%.

Of the residents who use the train to get to work (from Camden, Campbelltown, Wollondilly LGAs and the Southern Highlands), on average 49% walked to the station, 32% drove to the station, 8% were car passengers and 9% caught the bus and 2% used other modes. While the percentage for bus to rail was low for the existing Wilton township, this is due to the limited bus service available.

Direction of travel

The trip distribution for JTW trips (all modes) in the AM peak from and to Wollondilly LGA is listed in Table 2.4. Trips within Wollondilly LGA represent the largest share of all destinations/origins. However, based on these percentages, there is a net surplus of workers in Wollondilly LGA, causing many to travel elsewhere for employment. For those travelling outside the LGA, the majority travel north to Camden, Campbelltown and Liverpool. The pattern of worker trips coming to Wollondilly LGA reveals a significant movement of workers from the Illawarra region to Wollondilly employment.

Table 2.4 Destination and origin council area for commute trips to/from Wollondilly LGA

To LGA	% of trips from Wollondilly LGA	From LGA	% of trips to Wollondilly LGA
Wollondilly	30%	Wollondilly	61%
Camden	13%	Wollongong	10%
Campbelltown	13%	Camden	7%
Liverpool	6%	Campbelltown	6%
Wingecarribee	4%	Wingecarribee	4%
Penrith	4%	Shellharbour	2%
Sydney	3%	Penrith	2%
Blacktown	3%	Other LGAs	9%
Fairfield	2%	Total	100%
Wollongong	2%		
Bankstown	2%		
Other LGAs	18%		
Total	100%		

Source: 2011 Journey to Work (BTS, 2013), Wollondilly LGA, all modes

Table 2.5 shows the corresponding information for Camden and Campbelltown LGAs. The majority of the trips made by their workers either stay in the area or travel north. Similar to Wollondilly, there is a net surplus of employees. While Wollondilly LGA is a destination for only 1% of employees, Wollondilly workers make up 9% of the workforce in Camden/Campbelltown.

Table 2.5 Destination and origin council area for commute trips to/from Camden/Campbelltown LGA

To LGA	% of trips from Camden/Campbelltown LGA	From LGA	% of trips to Camden/Campbelltown LGA
Campbelltown	30%	Campbelltown	43%
Camden	13%	Camden	22%
Liverpool	10%	Wollondilly	9%
Sydney	9%	Liverpool	6%
Fairfield	4%	Fairfield	3%
Bankstown	4%	Wollongong	2%
Auburn	2%	Penrith	2%
Botany Bay	2%	Other LGAs	13%
Holroyd	2%	Total	100%
Blacktown	2%		
Other LGAs	17%		
Total	100%		

Source: 2011 Journey to Work (BTS, 2013), Campbelltown & Camden LGAs, all modes

Wingecarribee LGA shows a more self-contained worker trip pattern, with the majority of workers living and working in the area. Of the remaining workers, there is a similar north migration pattern, with workers from Wingecarribee working in Sydney, Campbelltown and Wollondilly and workers from Goulburn and Wollongong taking local positions.

Table 2.6 Destination and origin council area for commute trips to/from Wingecarribee LGA

To LGA	% of trips from Wingecarribee LGA	From LGA	% of trips to Wingecarribee LGA
Wingecarribee	73%	Wingecarribee	83%
Sydney	3%	Wollondilly	6%
Campbelltown	3%	Wollongong	2%
Wollondilly	2%	Goulburn Mulwaree	2%
Other LGAs	19%	Other LGAs	7%
Total	100%	Total	100%

Source: 2011 Journey to Work (BTS, 2013), Wingecarribee LGA, all modes

2.2 Road network

The road network providing access to the Wilton Junction Development is dominated by two roads – the Hume Highway and Picton Road, which divide the development into four quadrants. Other roads provide access to neighbouring villages, but their alignment is constrained by the need to cross deep river gorges.

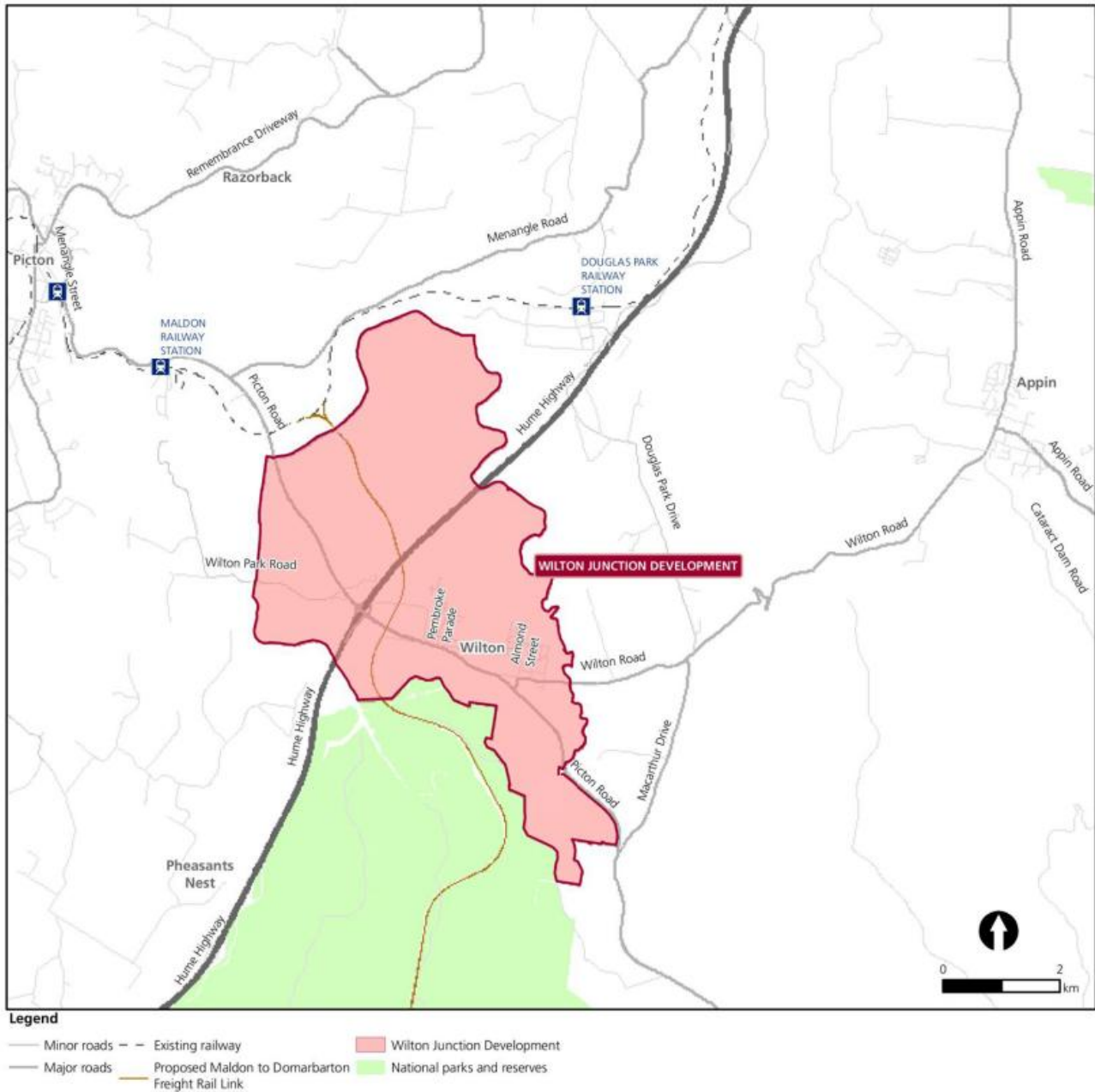


Figure 2.1 Road network

Hume Highway

Hume Highway (M31) is part of the major interstate highway linking Sydney and Melbourne. The upgrading of its 800 km length to dual carriageway was completed in mid-2013. In the vicinity of Wilton, it has two lanes in each direction with a wide median and shoulder lanes. The Hume Highway widens to three lanes in each direction, north of Narellan Road, and four lanes in each direction north of Raby Road.

Roads crossing the Hume Highway are grade separated and access to the Highway is limited to interchange points. The Wilton Junction Development surrounds the interchange between the Hume Highway and Picton Road. The next interchange north is at Narellan Road (22km north) near Camden and Campbelltown, while the next interchange south is at Remembrance Drive near Bargo, 11 km south. Hume Highway is designated as a B-double route and allows vehicles with a maximum vertical height clearance of 4.6 m. This route is signposted as a 110 km/h speed zone.

Picton Road

Picton Road (B88) is a State road travelling between Picton and Mount Ousley Road (M1) that serves as a freight route to Port Kembla and a commuter traffic route on weekdays. Picton Road generally has one travel lane in each direction, with overtaking lanes at selected locations. Its twisting alignment, relatively high traffic volume and undivided carriageway has resulted in a poor crash history. Picton Road (apart from the section between Picton and Maldon Road) is designated as a B-double route and allows vehicles with a maximum vertical height clearance of 4.6 m (entire length). Picton Road is signposted with a mixture of 60 km/h, 80 km/h and 100 km/h sections, with speed advisory signs on tight bends. The section around the Hume Highway is signposted as 80km/h. Along with Appin Road, Picton Road provides a bypass for vehicles from the Illawarra region bypassing Sydney roads or wishing to access the Westlink M7.

Remembrance Drive

Regional route 89 Remembrance Drive is a route running parallel to the Hume Highway between Camden and Yanderra that previously formed part of the Hume Highway route until bypassed in 1984. Remembrance Drive passes through the townships of Bargo, Tahmoor and Picton before connecting to the Camden Bypass. Remembrance Drive generally has one travel lane in each direction with overtaking opportunities and some overtaking lanes. It is a designated B-Double route in the event of a temporary closure of the Hume Highway due to an incident, and allows vehicles with a maximum vertical height clearance of 4.6 m.

Appin Road/Bulli Appin Road

State route B69 connects Campbelltown and Appin with the Southern (Princes) Freeway (M1). It provides access to a colliery and sand mine. Appin Road generally has one travel lane in each direction, however long sections have overtaking lanes. Its carriageway is undivided, with a mixture of 60 km/h, 80 km/h and 100 km/h speed limit sections. Appin Road is designated as a B-double route and allows vehicles with a maximum vertical height clearance of 4.6 m.

Wilton Road

Regional route 610 is a Regional road connecting Picton Road (via Almond Street) at Wilton to Appin. It is a single carriageway road with one lane in each direction. At its crossing of the Cataract River (Broughton Pass), tight (15 km/h speed advisory) hairpin bends and a bridge with a restriction of one vehicle at any one time limit its capacity. East of Broughton Pass its speed limit is 100 km/h until it reaches Appin township. West of Broughton Pass it has a speed limit of 80 km/h due to a tighter alignment and narrow shoulders. Wilton Road, between Picton Road and Douglas Park Drive, is a designated B-Double route for vehicles up to 19 m in length. Wilton Road (Wilton to Appin) has a 12 tonne load limit and 15m length limit for trucks/buses.

Douglas Park Drive

Douglas Park Drive is a rural road connecting Douglas Park to Wilton via a crossing of the Nepean River. It has one lane each way, with a speed limit of up to 100 km/h. However, similar to Wilton Road, its capacity is limited by a narrow causeway at the Nepean River, with tight bends and steep gradients either side. Douglas Park Drive connects to Menangle Road via Camden Road through Douglas Park, including a level-crossing of the Southern Highlands Line. Douglas Park Drive has a 3 tonne load limit and 10 m length limit for trucks and buses. A small section of Douglas Park Drive is approved for 19 metre long B-Doubles near Wilton Road.

Menangle Road

Regional route 56, Menangle Road, has one lane each way and connects Picton Road to Campbelltown. It runs parallel to the Hume Highway and Remembrance Drive. It has a mixture of speed limits from 60 km/h to 100 km/h. It crosses the Hume Highway (without connection) via an overbridge south of Narellan Road. Further north it passes areas of new residential development at Macarthur as well as Macarthur Station. Menangle Road, between Picton Road and Finns Road, is a designated B-Double route in the event of a temporary closure of the Hume Highway due to an incident.

Wilton Park Road

Wilton Park Road is a local road consisting of two 'No Through Road' sections that connect to Picton Road in (one to the north and one to the south of Picton Road). East of the Nepean River it provides access to rural residential properties and has a speed limit of 80 km/h. West of the Nepean River it provides access to the Maldon industrial area via a level-crossing of the Southern Highlands Line. The connection between the two sections of road has been closed, but consisted of a causeway with steep gradients and tight turns either side.

2.3 Traffic volumes

Traffic data from several sources were used to obtain an understanding of current traffic conditions, including RMS data, traffic counts commissioned for this assessment, and traffic data from previous studies and reports. In March 2013 classified intersection turn counts were undertaken at a number of locations around the network. The purpose of these surveys was to assist in calibrating the mesoscopic traffic model (see section 5 for more details), however they provide an indication of local traffic conditions as well. Counts were separated into light and heavy vehicles in 15-minute intervals on a weekday during the AM peak period (6.30–9.30) and PM peak period (15.30–18.30).

The sites surveyed for traffic volumes include:

1. The Northern Road/Camden Valley Way (signalised intersection)
2. The Northern Road/Camden Bypass (interchange)
3. Hume Highway/Narellan Road (interchange)
4. Narellan Road/Blaxland Road/Gilchrist Drive (signalised intersection)
5. Narellan Road/Appin Road/Oxley Street (signalised intersection)
6. Remembrance Drive and Macarthur Road (interchange)
7. Remembrance Drive and Old Hume Highway (signalised intersection)
8. Appin Road/Church Street (give-way)
9. Appin Road/M1 Princes Motorway (interchange)
10. Mount Ousley Road/Picton Road (interchange)

11. Picton Road/Hume Highway (interchange)
12. Menangle Street/Remembrance Drive/Argyle Street (give-way)
13. Barkers Lodge Road/Remembrance Drive (give-way)
14. Hume Highway/Remembrance Drive (interchange).

In addition, intersection approach queue length surveys were undertaken at the following intersections:

1. The Northern Road/Camden Valley Way
2. Hume Highway/Narellan Road
3. Narellan Road/Appin Road/Oxley Street.

The volumes surveyed at the sites along Picton Road, within the Development area are shown in Figures 2.2 and 2.3 for the AM and PM peak hours respectively. Mid-block volumes are shown in Figure 2.4, represented in passenger car units (PCU), where one truck equals two PCU.

Refer to Appendix A for detailed traffic survey results.

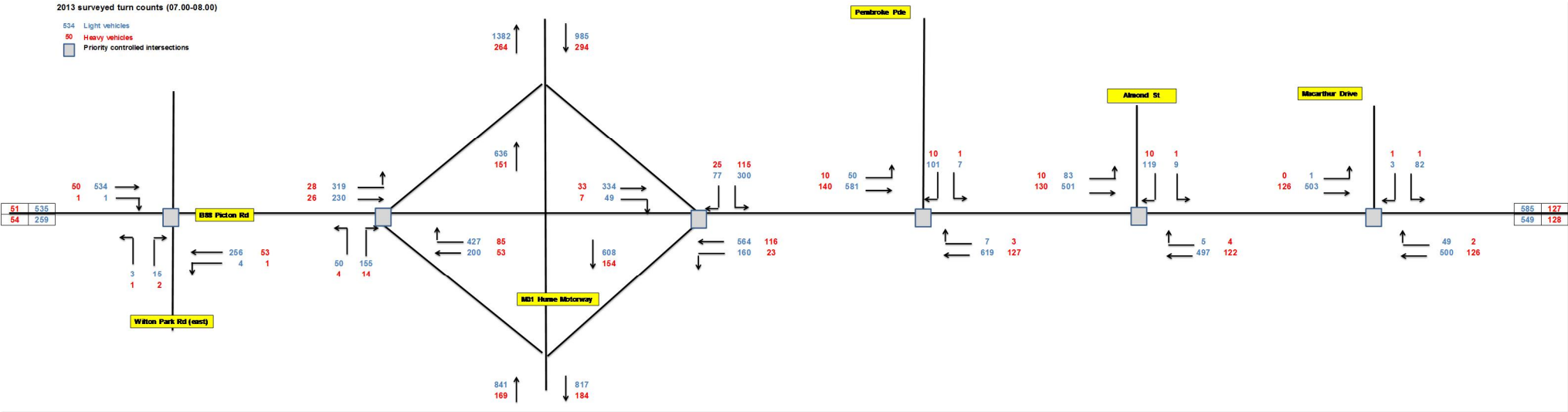


Figure 2.2 2013 AM peak Surveys Traffic Volumes

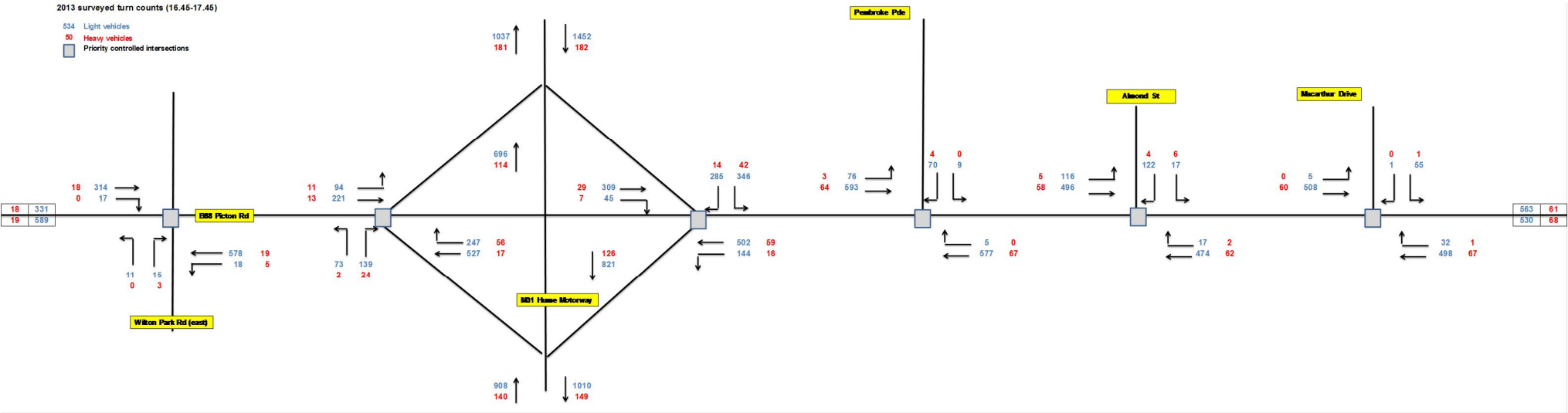


Figure 2.3 2013 PM peak surveys traffic volumes

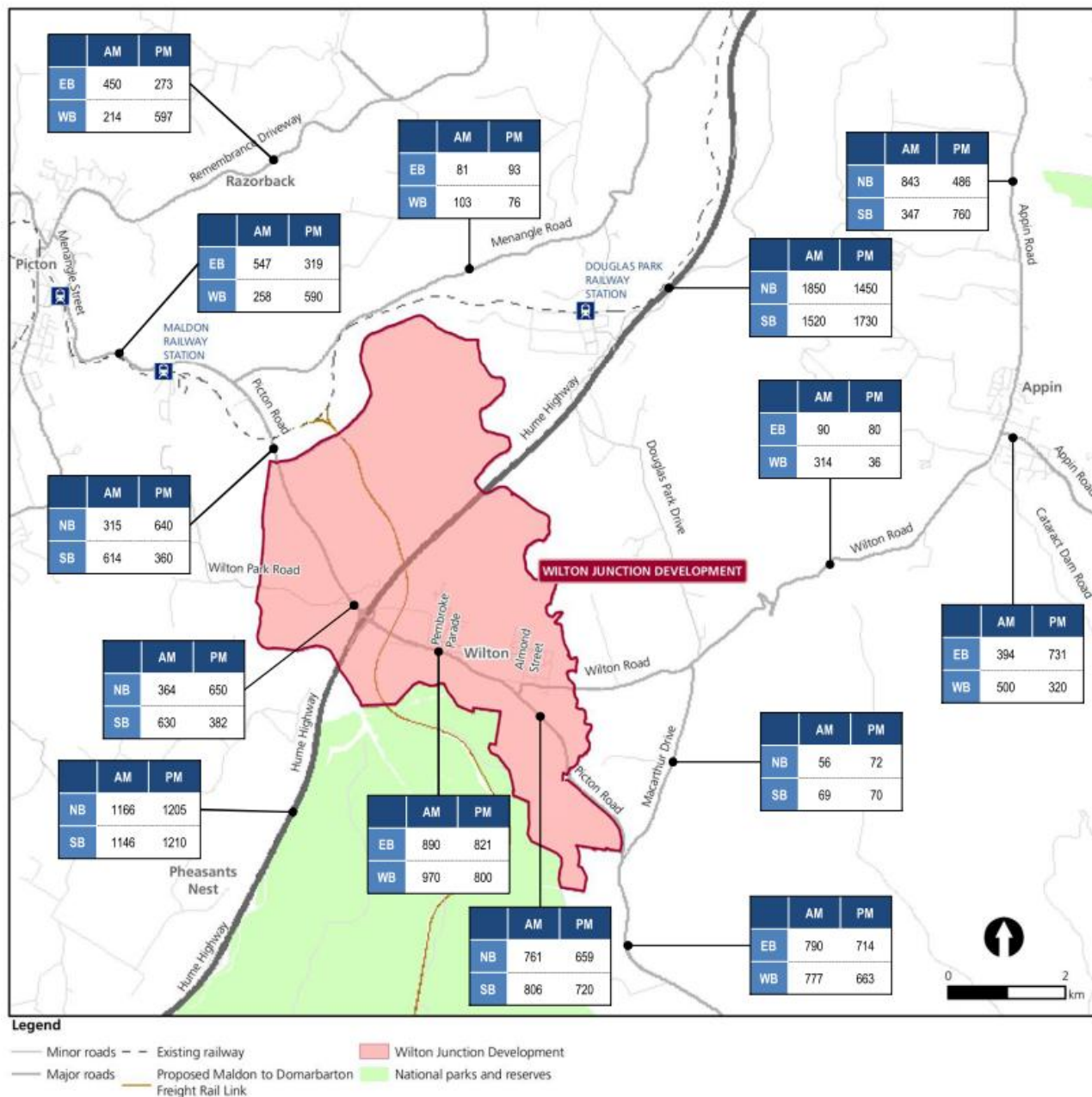


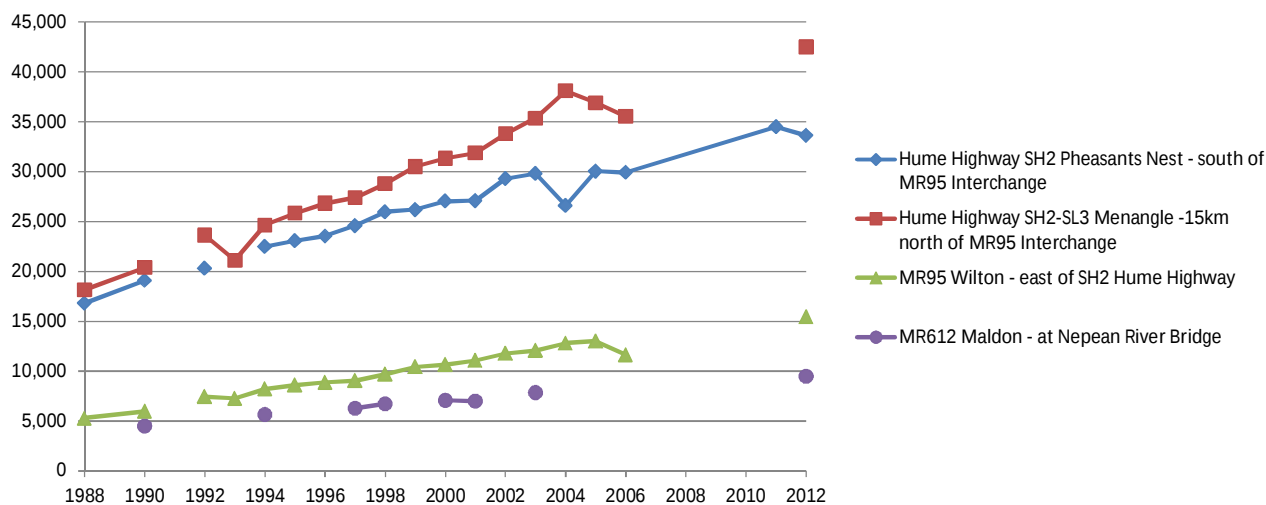
Figure 2.4 Road network flows (modelled) for 2013 base scenario (PCUs)

Historic growth in traffic on the Hume Highway and Picton Road

The Hume Highway has been undergoing an extensive upgrade to improve safety and travel efficiency since the 1970s. This has included the 22 major bypasses and completion of a dual carriageway with a minimum of two lanes per direction in mid-2013. This continual improvement has resulted in a decrease in travel times (totalling over three hours between Sydney and Melbourne), making travel along the Hume Highway easier, especially between the cities of Sydney and Canberra. Associated with this upgrade program and the introduction in 2007 of higher mass limits for heavy goods vehicles, has been growth in traffic volumes.

The historic trend in traffic growth for the Hume Highway and Picton Road is shown in Figure 2.5. The figure shows relatively constant growth between 1988 and 2004 on both roads. However, since 2005, traffic has changed with less predictability.

Historic Growth in ADT Traffic Volumes



Source: RMS count data

Figure 2.5 Historic change in traffic volumes on Hume Highway and Picton Road

2.4 Traffic conditions

The existing performance of the following intersections was extracted from the 2013 AM and PM base Aimsun models:

1. Hume Highway/Picton Road (eastern intersection)
2. Hume Highway/Picton Road (western intersection)
3. Picton Road/Wilton Park Road, east of Menangle Road
4. Picton Road/Pembroke Parade
5. Picton Road/Almond Street
6. Picton Road/Macarthur Road.

Table 2.7 shows the existing intersection performance in average vehicle delay (seconds/vehicle) and Level of Service (LoS) for the AM peak hour (07.00–08.00) and PM peak hour (16.45–17.45). Definitions of the intersection performance criteria are included in Appendix B.

Table 2.7 2013 intersection performance for the AM and PM peak hours

Intersection	AM peak (07.00–08.00)		PM peak (16.45–17.45)	
	Ave. delay (sec/veh)	LoS	Ave. delay (sec/veh)	LoS
Hume Highway/Picton Road (Eastern intersection) ¹	26	B	33	C
Hume Highway/Picton Road (Western intersection) ¹	10	A	13	A
Picton Road/Wilton Park Road ¹	13	A	14	A
Picton Road/Pembroke Parade ¹	28	B	16	B
Picton Road/Almond Street ¹	18	B	12	A
Picton Road/Macarthur Road ¹	15	B	9	A

(1) priority controlled intersections, LoS and average delay reported is for the worst performing approach

The 2013 model results show that all the key intersections perform at LoS C or better for both peak hours. This is considered a satisfactory level of performance. However, anecdotal evidence indicates that right-turning traffic at the interchange of Hume Highway and Picton Road experiences delays during peak times, resulting in vehicles bypassing queues and making illegal manoeuvres across grassed medians.

2.5 Public transport

Existing public transport services in the area are limited, reflecting the small population currently living and working in the area, and the dispersed nature of settlement.

Rail

The Southern Highlands Line has limited numbers of inter-city services, with Picton and Douglas Park being the closest Stations. More frequent services are available at Macarthur and Campbelltown Stations, on the Macarthur and Southern Highlands line. Both stations also have commuter car park facilities.

The station with the most frequent services is Campbelltown Station with 15 trains departing towards Sydney in the AM peak hour, followed by Macarthur Station with 9 trains and Picton and Douglas Park with a maximum of 2 trains. Passengers on the Southern Highlands Line are required to change trains at Campbelltown from a diesel train to an electric-powered train.

Table 2.8 Train service frequency and hours of operation

Description	Hours of operation (weekdays)	Frequency per hour/no. services
Airport & East Hills Line	From Campbelltown/Macarthur (departing 3.57 am to 11.54 pm)	AM peak: 8 services per hour PM peak: 4 services per hour Off peak: 2 services per hour
	From Lidcombe (arriving 5.19 am to 12.42 pm)	AM peak: 4–5 services per hour PM peak: 7 services per hour Off peak: 2 services per hour
South Line	From Campbelltown/Macarthur (departing 4.01 am to 11.54 pm)	AM peak: 3–6 services per hour PM peak: 2–4 services per hour Off peak: 2–5 services per hour
	From Museum (arriving at Campbelltown 6.09 am to 1.37 am)	AM peak: 2 services per hour PM peak: 2–4 services per hour Off peak: : 2–4 services per hour
Cumberland Line	From Campbelltown (departing 6.41 am to 7.11 am)	AM peak: 2 trains (total) PM peak: no service Off peak: no service
	From Blacktown/Schofields (departing Blacktown 4.32 am to 5.32 pm)	AM peak: no service PM peak: 3 trains (total) Off peak: no service
Southern Highlands	From Moss Vale/Goulburn (departing Picton 4.17 am to 9.17 pm)	AM peak: 1–2 services per hour PM peak: 1 service per hour Off peak: 1 service per hour
	From Town Hall (arriving Picton 5.47 am to 11.07 pm)	AM peak: 1 service per hour PM peak: 1–2 services per hour Off peak: 1 service per hour

Source: CityRail timetables, viewed July 2013

Table 2.9 presents the 2012 number of passenger movements through local stations across a typical weekday. Comparing these numbers from 2011 figures there has been a shift in passengers from Macarthur Station to Campbelltown Station.

Table 2.9 2012 daily passenger movements at local stations

Time period	Picton		Douglas Park		Macarthur ¹		Campbelltown	
	Entries	Exits	Entries	Exits	Entries	Exits	Entries	Exits
02.00 to 06.00	10	0	10	0	50	30	100	50
06.00 to 09.30	160	20	40	0	1,010	410	3,660	770
09.30 to 15.00	70	30	0	10	600	570	1,120	1,160
15.00 to 18.30	30	140	0	20	420	950	1,210	3,270
18.30 to 02.00	0	80	0	20	190	310	280	1,120
24 Hours	270	270	50	50	2,270	2,270	6,370	6,370

Source: Bureau of Transport Statistics website, 2013, Station Ins & Outs

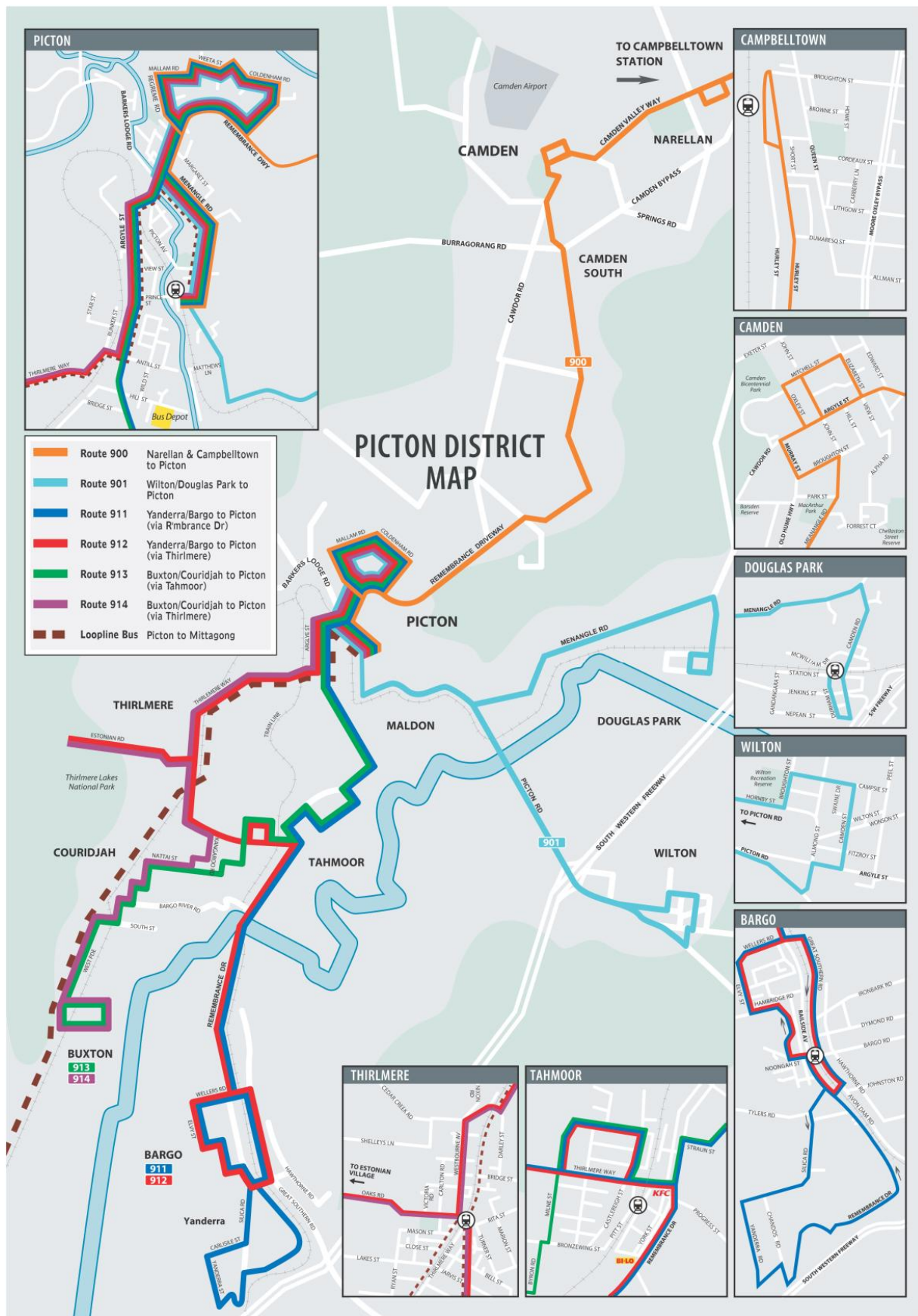
Bus

Bus services to Wilton township are currently limited to route 901, operated by Picton Buslines, between Douglas Park, Wilton, Maldon and Picton as a loop service. Two services per day operate per weekday. There is no service on weekends. Trips between Wilton and Picton take 20 minutes and 15 minutes between Picton and Wilton.

In the wider network, bus services are focussed around Picton (Picton Buslines), Camden, Macarthur and Campbelltown (Busways). Travelling south from Campbelltown, Route 889 extends as far as Menangle, while from Camden, Routes 894 and 895 travel as far south as Camden South. From here, Routes 38, 39, 40, 47 and 49 operate limited services. Route 900, operated by Picton Buslines is the only regular passenger service route that bridges the gap between Picton and the Macarthur area, operating via Camden to Campbelltown. This service has five services per weekday in each direction, with two services per day on Saturday. There is no service on Sunday.

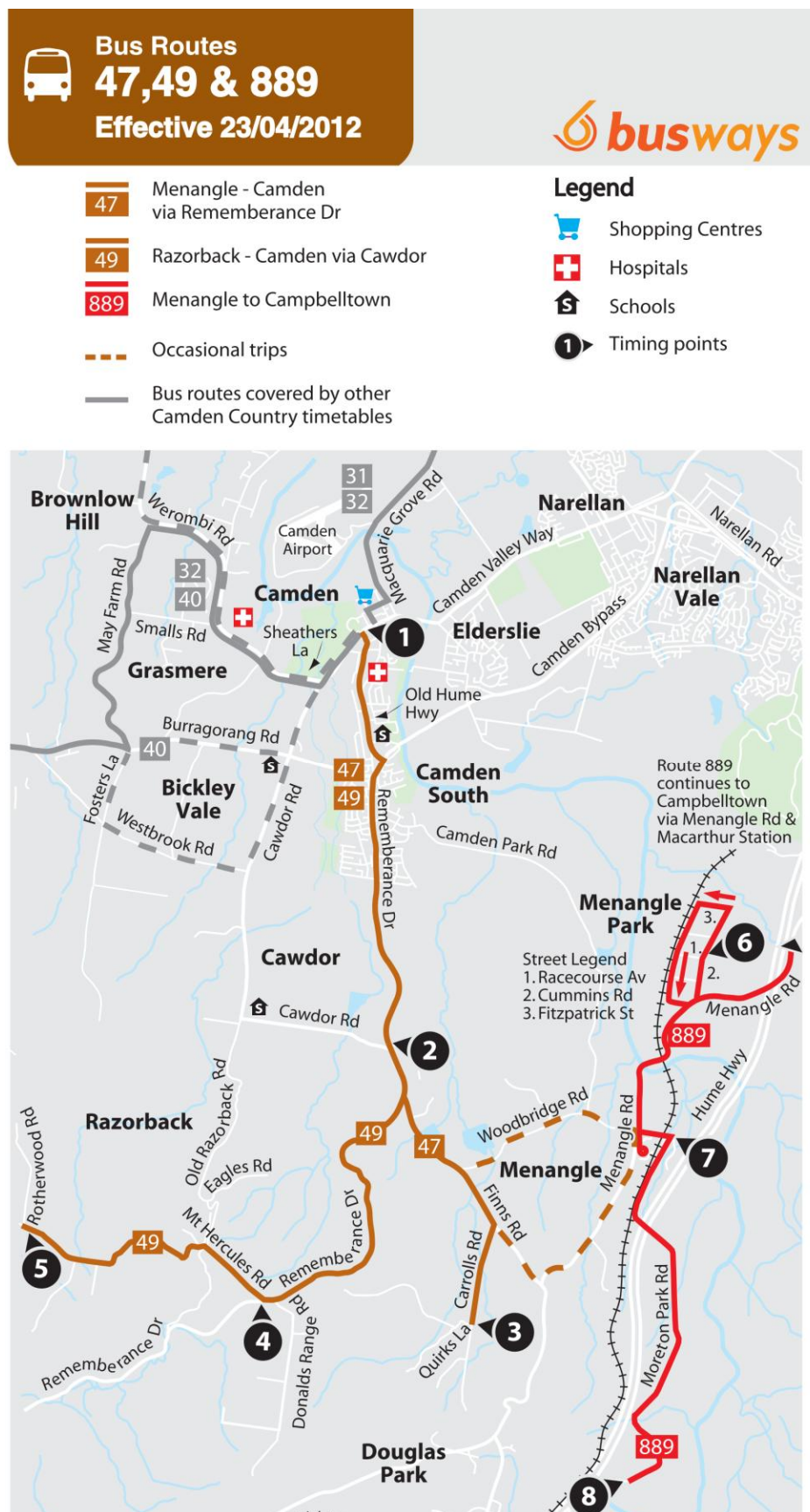
These bus routes and the surrounding network are shown in Figures 2.6 and 2.7.

School buses operate to 15 schools outside Wilton.



Source: Picton Buslines, (Viewed 13 May 2013)

Figure 2.6 Picton bus services



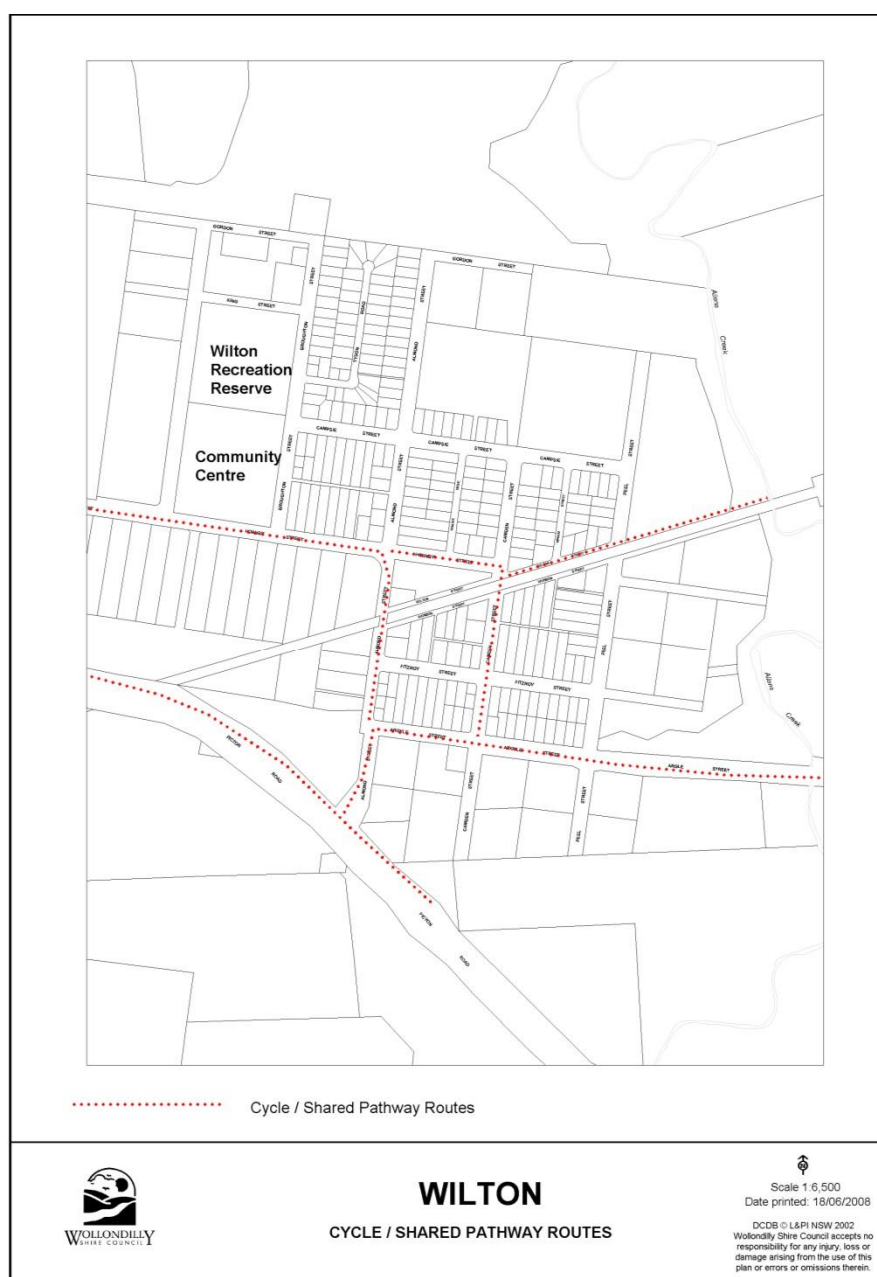
Source: Busways website, (Viewed 13 May 2013)

Figure 2.7 Busways Camden bus services

2.6 Pedestrian and cycle infrastructure

Pedestrian and cycle facilities in the existing township of Wilton are limited. However, as part of the Bingara Gorge Development, new facilities are being installed, including footpaths on both sides of the street, pedestrian refuges on Oxenbridge Avenue and Chisholm Street, and a school crossing on Greenbridge Drive.

Because of the long distances between townships, walking and cycling trips are typically restricted to short distances. Wollondilly Shire Council has nominated routes within the Shire for shared cycle/pedestrian paths. On a wider scale, routes are planned between Wilton and Picton, Appin and Douglas Park via Wilton Park Road (including through the section currently closed to traffic), Picton Road, Menangle Road, Wilton Road, and Douglas Park Drive. Crossing the Hume Highway, routes are planned along Picton Road and over a new crossing between the Picton Road Interchange and the alignment of the Maldon to Dombarton Rail Link.



Source: Wollondilly Shire Council

Figure 2.8 Proposed shared cycle pathways for Wilton

From information on Council's website, the principles for developing shared cycleway routes include:

- connecting logical start and end points (e.g. schools to residential areas, towns to each other etc.)
- maximising/using off-road routes wherever feasible
- on-road routes along major connecting roads may be considered in rural areas to reduce construction costs and increase useability
- target known future land release areas for off-road routes
- link tourist and other places of interest to encourage visitors and residents into recreational cycling.

2.7 Picton Road safety

RMS has recently completed a \$53 million program of improvements along Picton Road to improve safety, including the installation of median barriers to separate the opposing directions of traffic (see Figure 2.9).



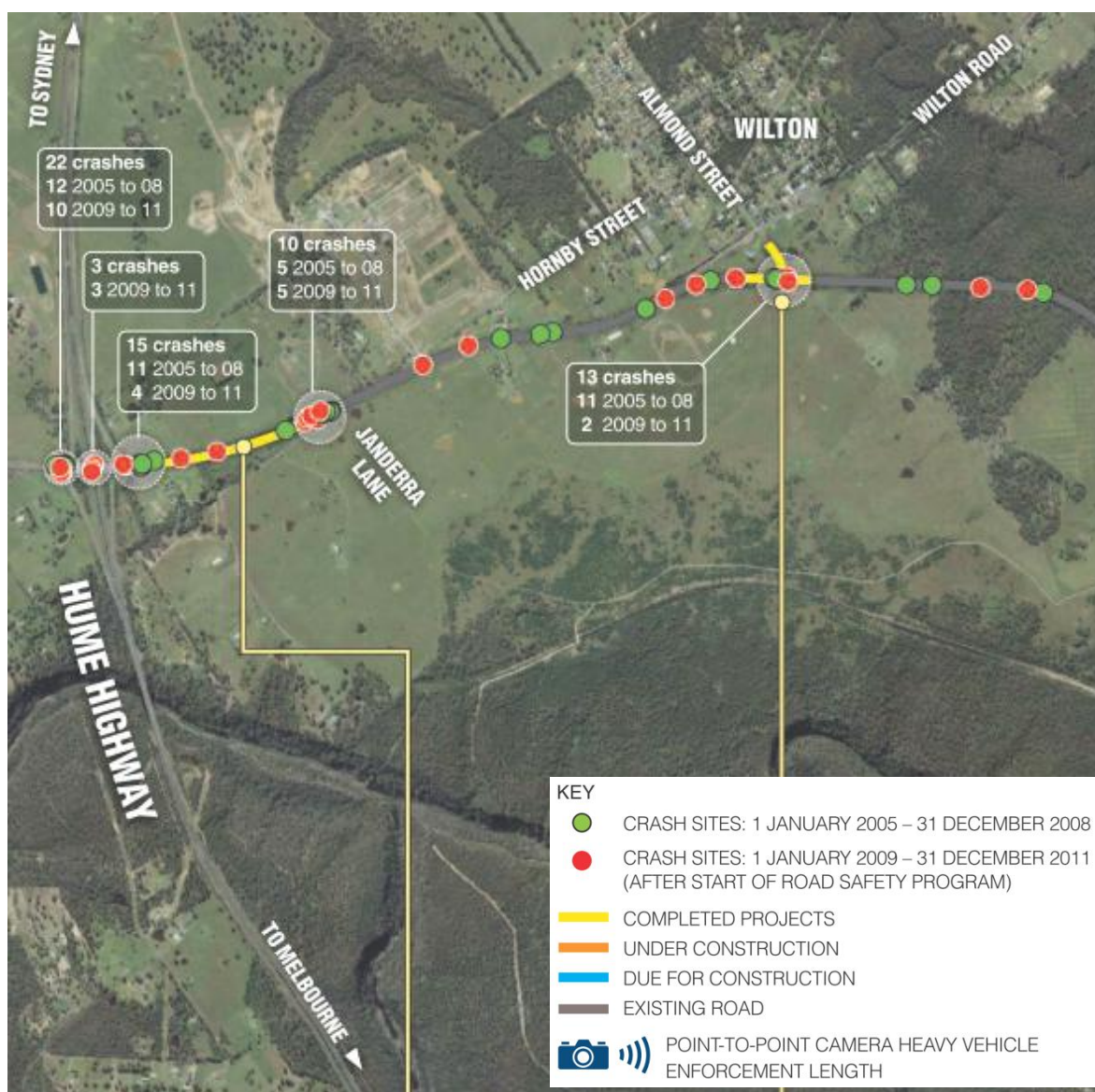
Source: RMS website, Picton Road Safety Improvement Program

Figure 2.9 Road safety upgrade of Picton Road

Within the study area completed projects include:

- Janderra Lane to Hume Highway – separation of traffic by rebuilding the concrete median west of Janderra Lane and improvements to line marking and delineation in the right hand lanes.
- Almond Street, Wilton Intersection improvements – widening the road, realigning the eastbound left turn lane into Wilton, improving road drainage, delineation improvements and the installation of street lighting to improve safety at this intersection.

The existing road geometry at the Hume Highway and Picton Road Interchange is contributing to driver confusion resulting in crashes. Between 2005 and 2011, 40 crashes were recorded at the Interchange². Figure 2.10 shows the location of recent crashes on Picton Road. It also illustrates the impact of the two improvement projects listed previously, with crashes per annum reducing by half between Janderra Lane and the Hume Highway and by three quarters at the Almond Street intersection since the completion of these projects.



Source: Picton Road safety improvements Community update, (RMS, May 2012)

Figure 2.10 Crash history on Picton Road at Wilton

² Picton Road safety improvements Community update, (RMS, May 2012)

Road safety issues at the Hume Highway/Picton Road Interchange include:

- uncertain priority for vehicles turning right onto the on-ramps and vehicles turning right onto Picton Road from the off-ramps
- evidence that drivers are selecting the wrong exit and crossing over grassed traffic islands to re-join the Hume Highway (see Figure 2.11).



Source: Google Streetview, 2013

Figure 2.11 Tyre tracks in the grass across traffic island at Hume Highway/Picton Road Interchange

The Picton Road Corridor Strategy (RMS, 2011) includes short and long term strategies to improve road safety and capacity at the Hume Highway and Picton Road Interchange.

2.8 Summary of transport network issues

Current travel patterns at Wilton and within Wollondilly Shire are dominated by car-based travel, due to a combination of long distances, limited public transport services and limited current population/employment/shopping/education opportunities. This currently manifests in high levels of car ownership and low transport mode share for non-car modes.

The local road network is based around the Hume Highway with lower-order roads running parallel and connections east to the Illawarra Region crossing the escarpment. Picton Road is operating close to its traffic capacity due to a combination of freight and commuter traffic and traffic bypassing other congested roads within the Sydney network. As a consequence, the interchange between the Hume Highway and Picton Road is also operating close to its capacity. Safety concerns also exist at this interchange with high numbers of crashes recorded. As part of the Picton Road Corridor Strategy, upgrades are planned to address the current capacity and safety issues. See section 4 for further details.

Both train and bus services are limited in the local vicinity, with most residents required to drive to Campbelltown or Macarthur Stations to access frequent train services. Local pedestrian and cycling facilities are also limited due to the small population and lack of pedestrian generators. However, this situation is improving with the construction of Bingara Gorge township.

3. Wilton Junction development

Wilton Junction presents a good opportunity to facilitate the creation of new housing and local employment opportunities which addresses significant housing supply shortages and affordability pressures in Sydney. The new town will comprise housing choice through a variety of dwelling sizes and locations, will encourage new business and will provide both physical and social infrastructure.

The area is strategically located around the Hume Highway/Picton Road Interchange, and represents the next potential major town along this transport corridor south of Campbelltown – Macarthur. Moreover, Wilton Junction has the distinct advantage of a consolidated land ownership of more than 2,700 ha in the control of recognised developers, with the resources and capability to expedite housing delivery, roll out enabling infrastructure, deliver social services and provide local employment.

3.1 Land owners

The three proponents, who are landowners at Wilton Junction, are:

- Bradcorp Pty Ltd (land at Wilton West)
- Walker Corporation (lands south of Picton Road and east of the Hume Highway)
- Governors Hill (land including the Wilton Aerodrome and lands on both sides of Picton Road west of the Hume Highway).

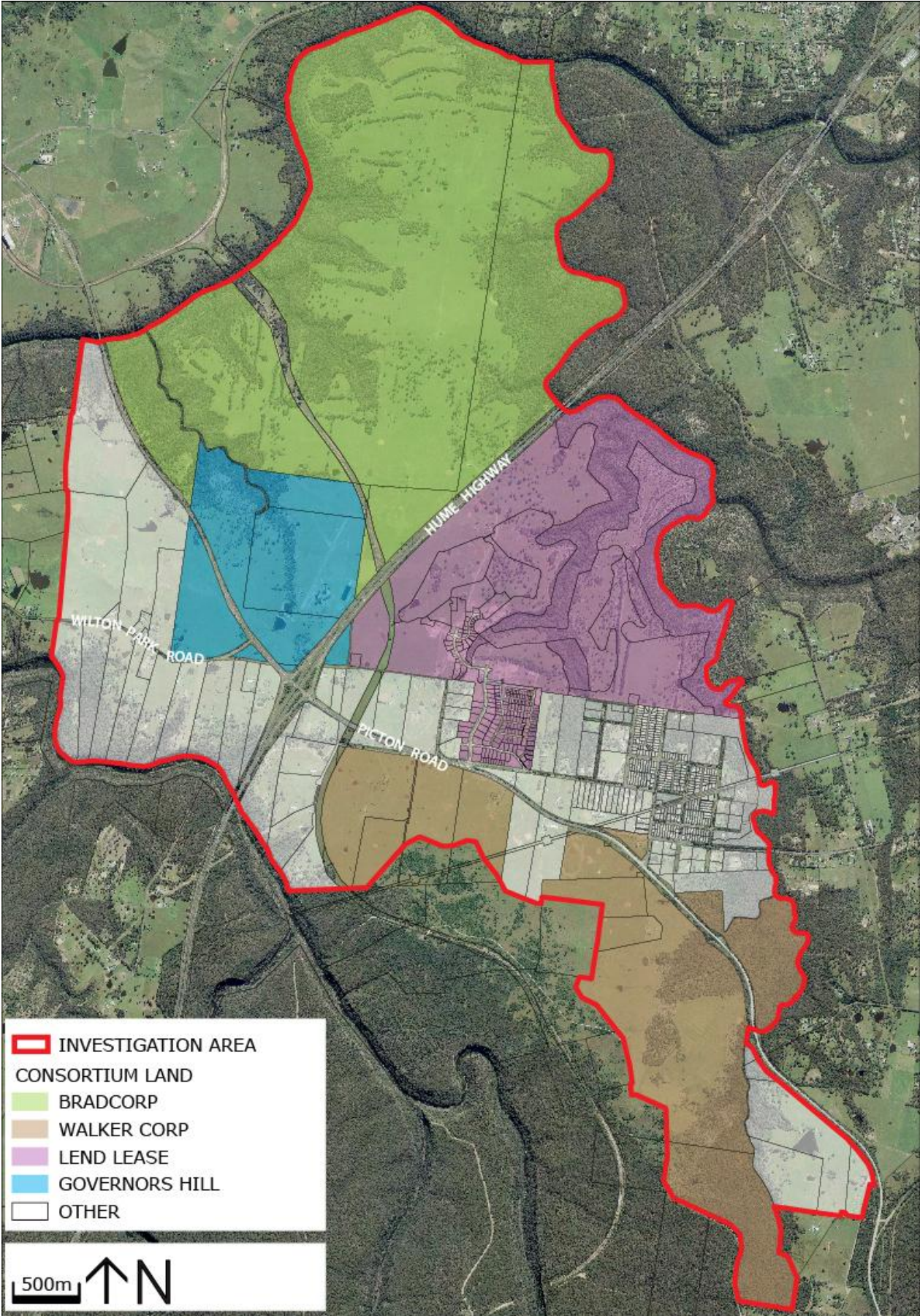
The Investigation Study area includes the Proponents and other private landowners land as outlined in the Table 3.1 below, and shown on Figure 3.1.

Table 3.1 Wilton Junction Development summary

Landowner	Gross area (ha)	Net developable area (ha)
Lend Lease	455	240
Bradcorp	872	459
Governors Hill	175	124
Walker Corporation	405	230
Other Land	572	489
Total	2,480	1,542

Source: Wilton Junction New Town High Level Infrastructure Business Case (Elton Consulting on behalf of the Wilton Junction Landowners' Group, February 2013 – Updated May 2014)

Lend Lease will continue with the planning and delivery of its Bingara Gorge community in Wilton, which is already zoned for residential development. This development has approval for approximately 1,165 dwellings, a new village centre, primary school and golf course. Lend Lease is working with the Proponents of this rezoning application to plan and deliver the new town at Wilton Junction and its associated infrastructure.



Source: Connor Holmes, 2014

Figure 3.1 Wilton Junction land ownership

3.2 Project description

The project seeks to create a new town with between 11,000 and 13,000 new homes and 11,000 jobs. Residential neighbourhoods will be created around green spaces providing a range of housing choice and facilitating healthy lifestyles options for all new residents. A new town, comprising of approximately 17 ha, will be established within the north-west quadrant of the study area and will be surrounded by employment generating uses for business, bulky goods and light industry, comprising of approximately 120–130 ha of land. Smaller neighbourhood centres will be created within the residential neighbourhoods to cater for convenient daily shopping choices. Community facilities and physical infrastructure will be provided facilitating the creation of a self-sustaining community. Existing significant environmental features and heritage items will be preserved commemorating the natural and historical setting of the study area.

The proposed Master Plan will be informed by the following key principles:

- **Employment and commercial drivers.** The delivery of approximately 11,000 jobs focused around a new town centre and in close proximity to the Hume Highway and Picton Road
- **Housing.** Providing between 11,000 and 13,000 new dwellings across the precinct, inclusive of the 1,165 already approved at Bingara Gorge
- **Community facilities.** Provide a diverse range of high quality community facilities including a schools, library, community centre in a town centre and three neighbourhood centres across the precinct
- **Environment.** Conserving ecological features and biodiversity and establishing a Trust to rehabilitate and manage approximately 615 ha of bushland
- **Place making.** Delivering high quality and connected network of streets, spaces and squares throughout the development
- **Activity centres.** Focus on the delivery of a new town centre and three smaller neighbourhood centres with a diverse mix of retail, commerce, business and light industry
- **Traffic and transport.** Providing strategic motorway and bus access to surrounding areas, legible movement throughout the development
- **Infrastructure.** Integrated water, waste water and stormwater management systems and access to all other utilities including gas and NBN.

Specifically for traffic and transport, the key principles are:

- self-containment in services and employment to reduce trip numbers and length
- accommodate and promote work from home opportunities
- integrate land uses to limit trip generation and vehicle movements
- provide for non-car travel modes
- facilitate a bus network comprising local internal bus services to connect local residents with their town centre and community facilities, district routes to other centres (i.e. Picton, Tahmoor & Bargo etc.) and regional services to connect higher order centres such as Campbelltown
- early delivery of public transport infrastructure to establish and reinforce sustainable transport habits
- provision of higher density development and trip generators on bus routes
- establishment of a centralised and accessible public transport interchange
- establish opportunities for Kiss-and-Drop, Park-and-Ride/Park-and-Share
- establish bus priority measures

- ensure multi-modal integration with accessible bus routes and stops connected to the cycling and pedestrian network
- implementation of parking management practices
- ensure connectivity between the four quadrants, especially for non-vehicular movement.

The Master Plan, shown in Figure 3.2, outlines the location of the town centre, retail, schools, employment and residential components, as well as the proposed access arrangements.

From an access viewpoint, the Master Plan includes:

- A town centre located north-west of the Hume Highway/Picton Road Interchange, but connected to the majority of the remaining development via internal roads that do not interact with the State Road Network.
- Local village centres and primary schools within the three major quadrants of the development to contain local trips, as much as possible, to short distances.
- Two grade-separated crossings of the Hume Highway, north of Picton Road, and two grade-separated crossings of Picton Road, east of the Hume Highway, to enable internal vehicle trips to move about the development without delaying regional traffic.
- Grade separated pedestrian and cyclist crossings of the Hume Highway and Picton Road, including a pedestrian bridge over the Hume Highway linking Bingara Gorge with Wilton Junction land.
- New north-facing ramps from the Wilton Junction Development to the Hume Highway, enabling safe and efficient access for regional trips travelling to and from the area.
- Four at-grade intersections with Picton Road, two each side of the Hume Highway Interchange, located:
 - ▶ Northwest of the interchange at Wilton Park Road and a new access road approximately 750 m north of Wilton Park Road.
 - ▶ Southeast of the interchange at Pembroke Parade and Almond Street.
- An upgrade of the Hume Highway/Picton Road Interchange (not part of the Development) to increase capacity and reduce delays for regional traffic.

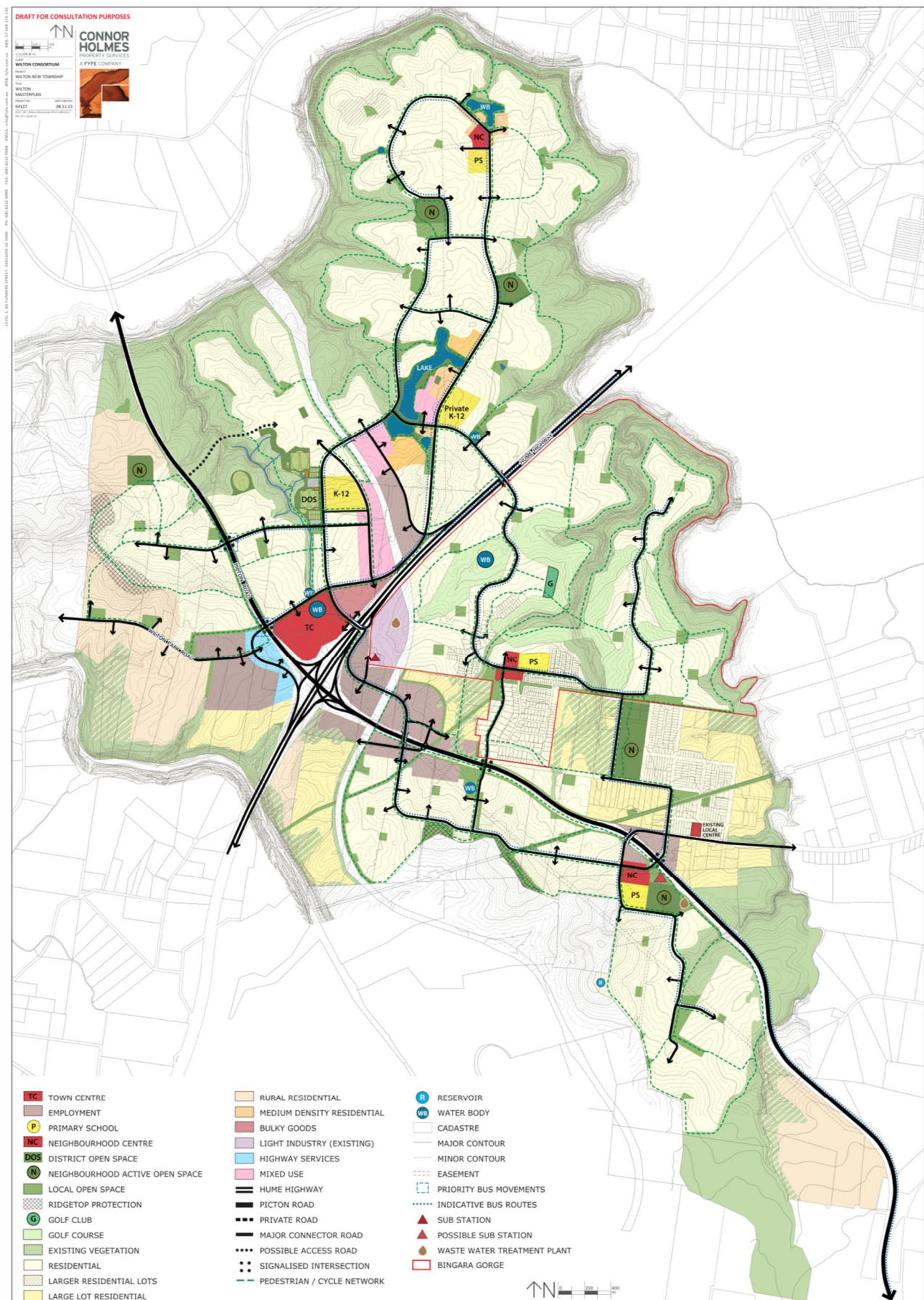
Overlaid on top of this will be a network of streets suitable for bus services and pedestrian / cycle links between the major trip generating areas.

All proposed modifications or additions to existing road networks are subject to review and approval by relevant authorities including RMS, TfNSW, and Council. The Wilton Junction team will continue to participate in workshops with these stakeholders to achieve suitable designs.

The proposed infrastructure upgrades along the Hume Highway and Picton Road, including the Hume Highway/Picton Road interchange, indicated on the Master Plan are not approved by RMS. The proposed layouts and configurations illustrated have been adopted for the purposes of traffic modelling / traffic assessment only. This TMAP and the rezoning process that it supports, does not confirm a final design for any of the proposed infrastructure upgrades on the State Road Network.

The proposed internal road network has been developed to separate and minimise the conflicts – and consequent impacts of these conflicts – between local and regional traffic on the State Road Network. The Wilton Junction team will continue to participate in discussions with relevant authorities to investigate further opportunities to minimise conflicts between local and regional traffic, while also providing an appropriate level of access between the local and State Road Networks.

Opportunities to further refine and optimise the proposed road network will also be possible at the detailed design/development application stage, as more detailed land use plans are defined.



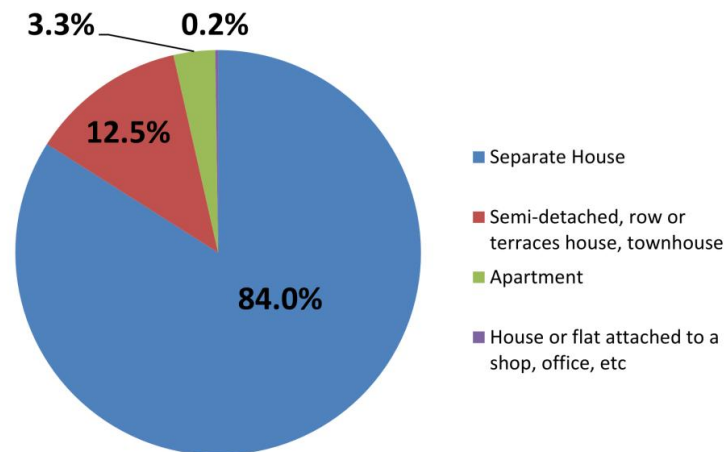
Source: Connor Holmes, 30 May 2014

Figure 3.2 Wilton Junction master plan

Residential development type

The Wilton Junction Development will essentially involve the creation of a major new town in the northwest quadrant of the proposed development. The Development therefore needs to plan for all of the facilities required by the future community that need to be conveniently located without the need to travel to the Sydney Metropolitan area.

To reflect the diverse needs of the future community, a mixture of dwelling types is proposed to provide a range of accommodation options. The anticipated break-down of the dwelling types is shown in Figure 3.3.



Source: MacroPlan Dimasi, 2013

Figure 3.3 Wilton Junction dwelling types

A mixture of retail areas are planned in the town centre, the village centres and along Picton Road. It is envisaged that each village centre will contain a small supermarket, as well as speciality stores and services. A description of the types of retail centres planned within the Development is provided in Table 3.2.

Table 3.2 Wilton Junction retail centres

Retail centre	Role & function	Total size (m ² GFA)	Land area (net) (ha)	Timing	Land uses
Town Centre	Primary retail and commercial centre	25,000 m ² GFA	7.5 to 10 ha	2017 onwards (various stages)	1 x DDS, 2 x supermarkets, specialty retail and secondary retail
Bulky Goods	Local services and employment as well as serving passing traffic	30,000 m ² GFA	7.5 to 10 ha	2020 onwards	Bulky goods and highway oriented retail
Village Centre(s)	Supporting convenience retail and business services	10,000 to 12,000 m ² GFA	5 ha	2017 onwards (various stages)	Small supermarket/s plus retail and non-retail specialties
Local shops	Small shop/s and offices	4,000 m ² GFA	1 to 2 ha	2017 onwards (various stages)	Convenience shops and local services
Total		65,000 to 70,000 m² GFA	20 to 25 ha		

Source: MacroPlan Dimasi, 2014

(1) Net of local roads and parks etc.

(2) Town centre FSR = 0.35; village centre FSR = 0.4; bulky = 0.4

The total quantities of retail space and retail employment are summarised in Table 3.3.

Table 3.3 Retail space and employment

Retail type	Town centre	Other ¹	Total
Floor space (m ² GFA)			
Bulky goods	0	30,000	30,000
Discount department store	7,000	0	7,000
Supermarkets	8,200	8,000	16,200
Mini-majors	2,500	1,000	3,500
Retail specialities	5,800	4,600	10,400
Non-retail specialities	1,200	1,100	2,300
Total	24,700	44,700	69,400
Employment (jobs)	798	1,183	1,961

Source: MacroPlan Dimasi, 2014

(1) Includes village centres and road-side retail

3.3 Employment scenarios

As mentioned in section 2.1, Wollondilly Shire currently has a net surplus of workers. The Wilton Junction Development has the potential to rebalance this surplus by creating a significant amount of employment within a short travel distance for residents, as opposed to the long travel distances currently undertaken by many residents.

The amount of employment and how many of the residents take up the local jobs are key influences on how much impact on traffic conditions outside the site the development will have. To cover the range of possibilities, upper and lower employment scenarios, summarised in Table 3.4, have been considered.

Table 3.4 Wilton Junction employment forecasts (2041)

Description	Lower	Upper
Total Residents	34,955	
Employed Residents	12,000	13,200
Jobs in Wilton Junction	10,440	11,770
Employed residents working in Wilton Junction	8,400	9,240
- Work from home & not fixed	1,566	1,766
- Work in designated Employment Lands	6,834	7,474
Non-Wilton Junction residents working in Wilton Junction	2,040	2,530

Source: MacroPlan Dimasi, 2014

The estimate of residents and non-residents taking the jobs within Wilton Junction is an estimate only. Additional analysis has been undertaken using the BTS' STM to assess the journey to work travel patterns of residents and workers in the development using the scenarios outlined in Table 3.4. More details are provided in section 5.

The floor space of the employment land use types are shown in Table 3.5.

Table 3.5 Employment floor space (2041)

Land use	Lower	Upper
Retail	65,000	75,000
Commercial ¹	86,343	101,592
Industrial	334,305	384,285
Total	485,648	560,877

Source: MacroPlan Dimasi, 2014

(1) Excludes school/education and community

3.4 Staging

Due to its size, the Wilton Junction Development will take several decades to develop to its planned ultimate potential. The Bingara Gorge component is already under construction, with occupation starting in 2010. Due to the NSW Government's targets for new housing construction per year, approval for the next stages of the Wilton Junction Development is being sought by the beginning of 2015, in tandem with the continuing development of the Bingara Gorge development.

The staging of the Wilton Junction Development is designed to match the influx of residents and the creation of jobs, to begin containing trips as early as possible. The percentages of total development shown in Table 3.6 indicate an employment lag of approximately 10% by 2031 due to market conditions.

Table 3.6 Preliminary staging plan

Stage	Time period	Dwellings	Retail floor space	Employment ¹
0	≤ 2014	420 (3%)	2,400 (3%)	250 (2%)
1	2015–2021	2,540 (21%)	13,300 (19%)	2,060 (18%)
2	2022–2031	7,700 (65%)	44,500 (64%)	7,131 (61%)
3	> 2031	11,900 (100%)	69,400 (100%)	11,770 (100%)

Source: Connor Holmes / MacroPlan Dimasi, 2014

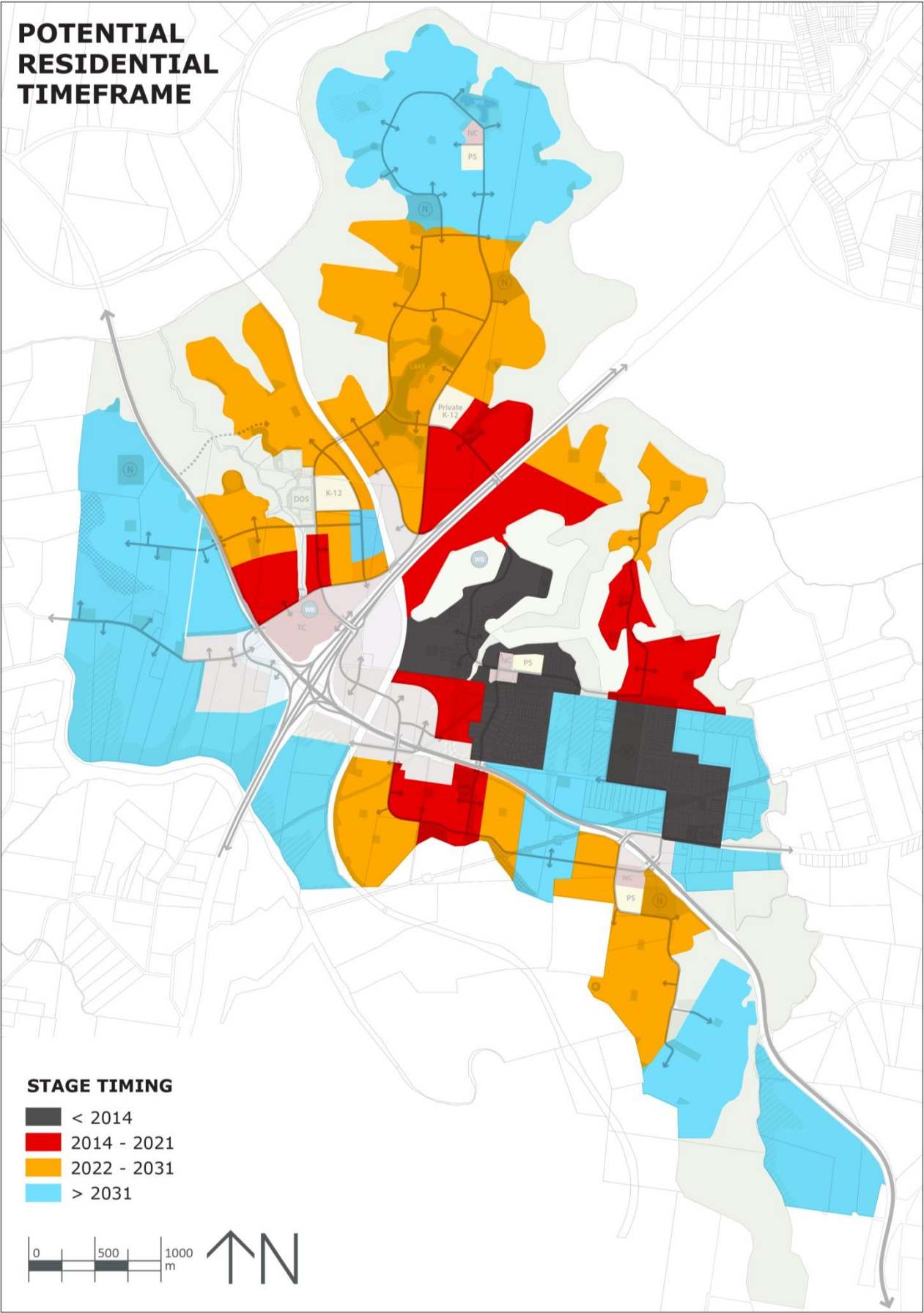
(1) Based on upper employment scenario

Spatially, following the completion of Bingara Gorge, development is expected to continue:

- along the local internal road that utilises the existing bridge over the Hume Highway
- on the southern side of Picton Road near the intersection of Pembroke Parade
- on the northern side of Picton Road near the intersection of Wilton Park Drive.

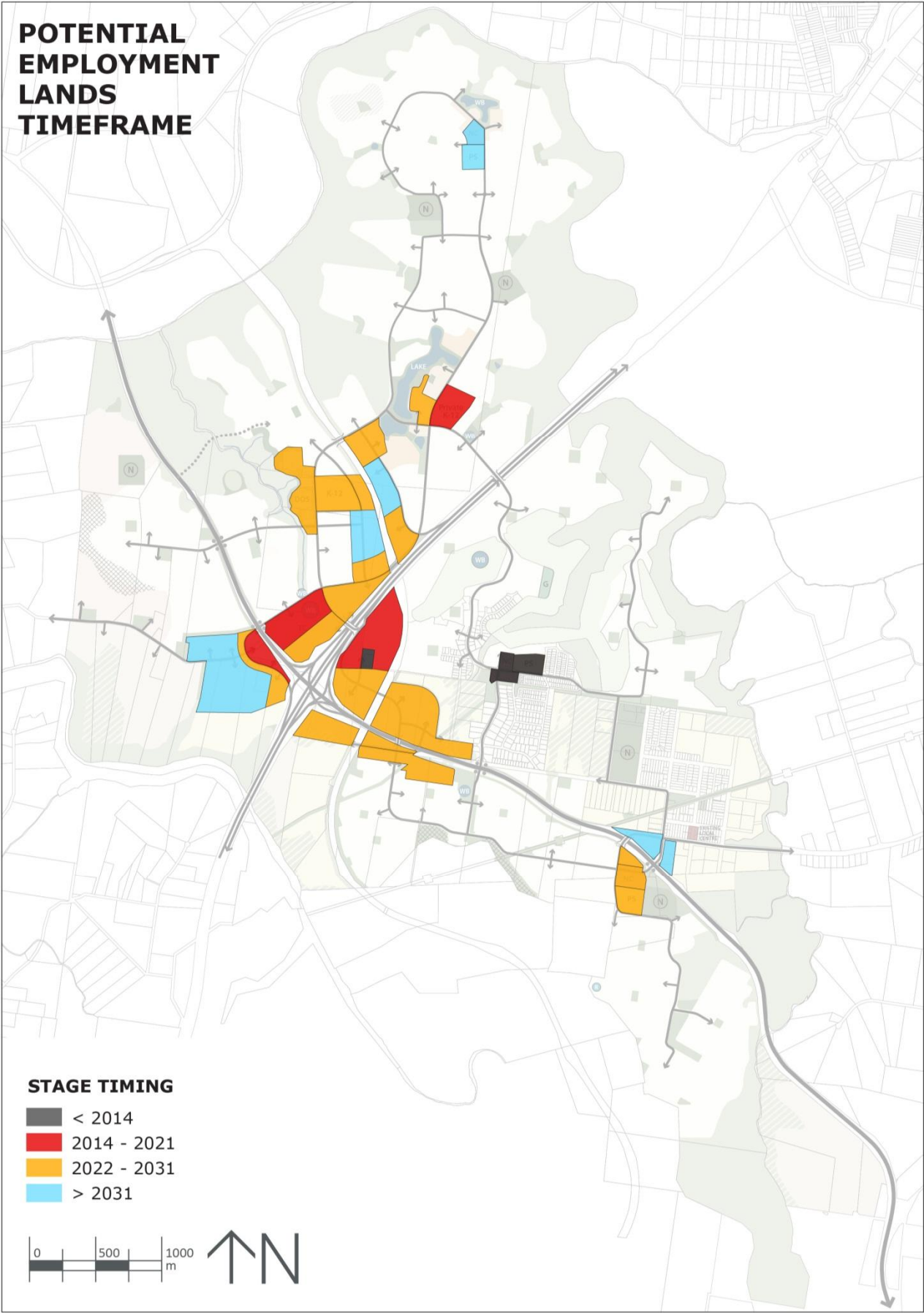
Over time, development would 'fill in' the gaps between these areas and then expand to the extremities of the area. Figures 3.4 and 3.5 indicate the anticipated development staging for residential and employment land. A staging plan for access and internal connections is described in more detail in section 5.

It is noted that the Maldon-Dombarton Rail Link (MDRL – refer section 4.1) traverses the Wilton Junction Development, and as a result may impact development in the area during its construction and operation. However, as the Wilton Junction Development does not encroach upon land reserved for the MDRL, and could in the future consider a grade separated transport network, the construction of the MDRL would not impact the proposed transport network or TMAP for the development. The program of planning and pre-construction design work for the MDRL, including the environmental assessment, is due to be finished by mid-2014.



Source: Connor Holmes, 2014

Figure 3.4 Indicative residential staging plan



Source: Connor Holmes, 2014

Figure 3.5 Indicative employment staging plan

4. Strategic context

4.1 State planning context

The most relevant State Government planning documents are reviewed in this section.

Draft Metropolitan Strategy for Sydney to 2031 (NSW Government, March 2013)

Sydney is growing rapidly, with current forecasts suggesting that more than 1.3 million additional people will live in Sydney by 2031, requiring 545,000 more homes and 625,000 more jobs³. The challenge for government is to make sure communities are provided with the infrastructure to support the growth.

The Metropolitan Strategy is a long-term land use, urban and transport plan. It identifies the location of future urban development and strives for a balance between urban infill and new greenfield development. For employment, it generally seeks to strengthen existing regional and major centres (of which Campbelltown-Macarthur is an existing example and Leppington is a planned future example). The exception is the Western Sydney Employment Area, which builds upon an employment precinct currently being developed, but is not tied to a centre.

The Metropolitan Strategy outlines total growth targets by subregion, with the distribution of that growth to be determined by Subregional Delivery Plans. Wilton Junction is located in the South West Subregion, shown in Figure 4.1. However, as it is a newly proposed site (in its current magnitude) it is not specifically identified in the South West Subregion plan. The 2021 and 2031 targets for this subregion are shown in Table 4.1.

Table 4.1 Draft Metropolitan Strategy for Sydney targets for South West Subregion

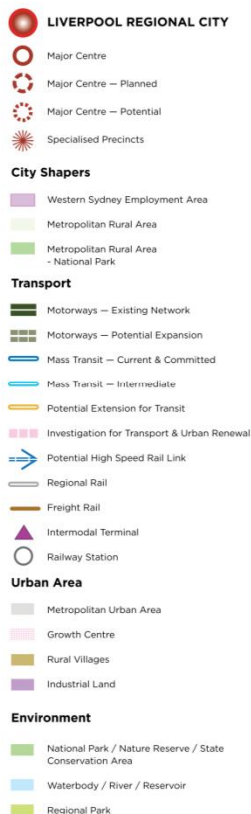
Measure	Current	Target to 2021 (2011–2021)	Target to 2031 (2011–2031)
Population	829,000	1,048,000 (218,000)	1,298,000 (469,000)
Housing	286,000	346,000 (60,000)	427,000 (141,000)
Employment	298,000	362,000 (64,000)	432,000 (134,000)

Source: Draft Metropolitan Strategy for Sydney to 2031 (NSW Government, March 2013)

The major housing growth area in the South West Subregion is the South West Growth Centre, where 64,000 of the 110,000 new dwellings planned for the surrounding area over the next 20 years are located. The employment targets would be met with increases in several existing and planned centres, including Campbelltown–Macarthur (10,000 new jobs by 2031) and Leppington planned Major Centre (13,000 new jobs by 2031).

³ Department of Planning & Infrastructure Urban Activation website

Metropolitan Priorities for South West Subregion



Source: Draft Metropolitan Strategy for Sydney to 2031 (NSW Government, March 2013)

Figure 4.1 South West Subregion

Based on the criteria for major centres in Appendix A of the Draft Metropolitan Strategy for Sydney, the Wilton Junction Development is on the threshold of being considered as a future major centre. One of the key areas for improvement to be considered as a potential future major centre is in relation to the transport criteria, i.e.:

- transport catchment: subregional
- linked to the metropolitan rail network directly or very high volume trunk bus services
- focal point as a destination and origin for subregional public transport services (typically bus)
- focal point of subregional arterial and collector road network
- freight access links with Sydney freight network.

The road network (and freight) connections will be served by upgrades to Picton Road and the Hume Highway connection planned as part of the Development. However, public transport service improvements beyond the needs of the Development would need to be considered to meet the above criteria.

The Draft Metropolitan Strategy for Sydney makes reference to the priorities and planned transport improvements in the NSW Long Term Transport Master Plan (LTTMP). For the South West Subregion, the most important improvements identified include:

- M9 Outer Sydney Orbital
- South West Rail Line extension (potentially with a transit line to Campbelltown)
- high speed rail in collaboration with Federal Government.

The Draft Metropolitan Strategy for Sydney builds upon the LTTMP strategies for Sydney's Metropolitan Rural Areas, including improved capacity and service quality on major commuting corridors into Sydney. The major connections between Sydney and regional areas are identified, as shown on Figure 4.2. The Strategy includes the M9 Outer Sydney Orbital as part of this network, as well as a corridor between the Hume Highway and Illawarra area in the vicinity of Picton Road/Appin Road.



Source: Draft Metropolitan Strategy for Sydney to 2031 (NSW Government, March 2013)

Figure 4.2 Regional connections to Sydney

NSW Long Term Transport Master Plan (Transport for NSW, December 2012)

The *NSW Long Term Transport Master Plan* (LTTMP) provides a framework for addressing transport challenges over the next 20 years. It identifies the Hume Highway to Campbelltown and Narellan Road as corridors under pressure. It also forecasts high levels of congestion on the Airport and East Hills Line by 2031, with 'passenger displacement' (passengers unable to board the full train at peak times) from Revesby to Green Square.

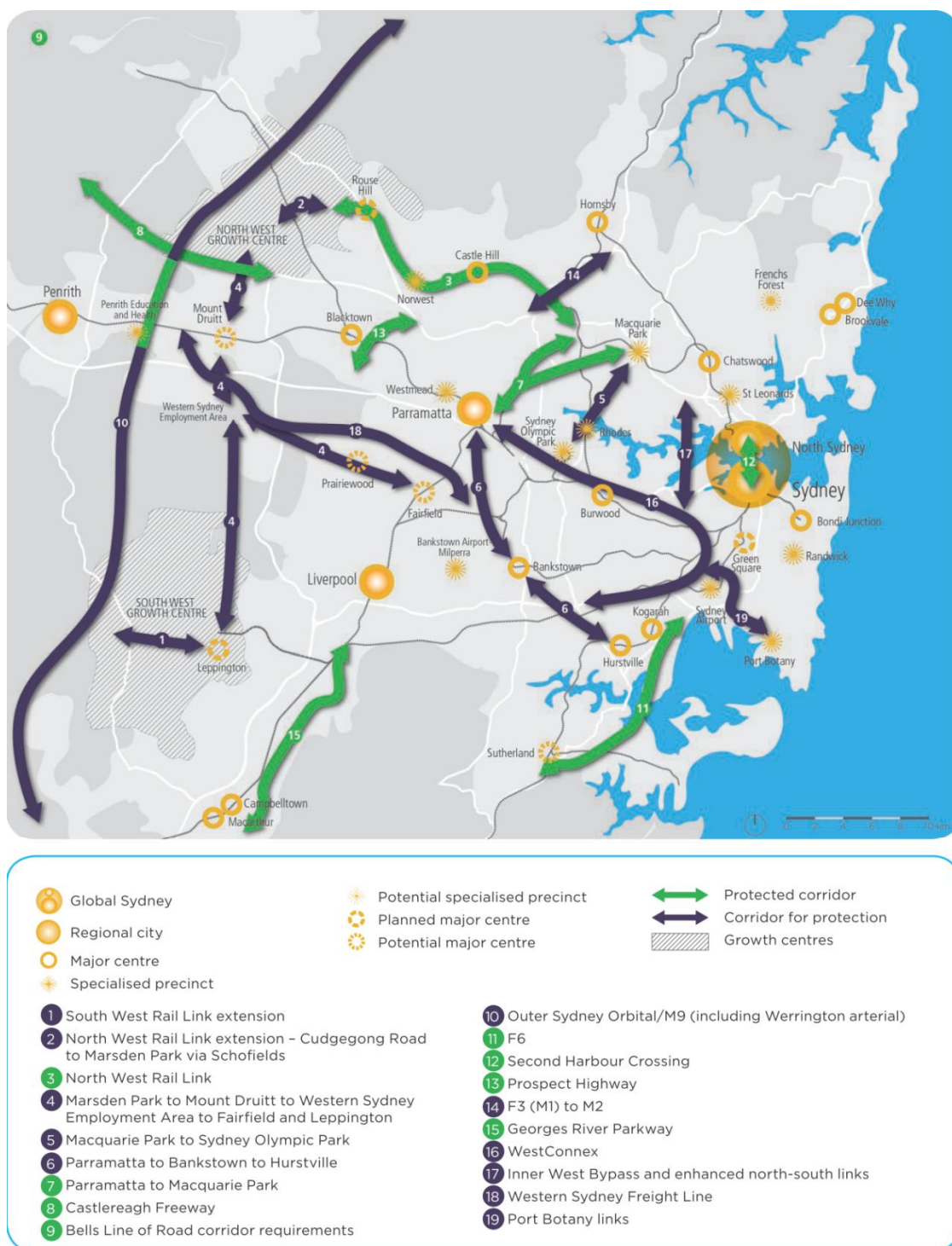
Figure 2.9 of the LTTMP (Regional NSW road hierarchy) identifies the Hume Highway as part of the National Road Network, Picton Road and Appin Road as State Roads, and Remembrance Drive, Menangle Road, Wilton Road as Regional roads.

Funding for road projects included in the LTTMP includes:

- M5 West widening \$400 million project cost (private sector funded); \$30 million allocated in 2012–13 budget; major works commenced October 2012 and completion by end 2014
- Camden Valley Way upgrade \$300 million committed; upgrade of section between Oran Park Drive and Bringelly Road to be completed by end 2015
- Narellan Road upgrade \$15.4 million commitment; first stage August 2012, completion in 2015.

The expansion of Port Kembla commenced in August 2011 and will provide a multi-purpose berth, comprising two separate container facilities, each serviced by two berths. Further upgrades will provide for further reclamation, enhanced rail and road infrastructure, two additional multi-purpose berths and four container berths. To support this expansion more efficient freight connections and safety upgrades to Picton Road are already underway, with further capacity upgrades planned in the medium to long term.

Figure 4.3 shows the corridors planned to be protected in the LTTMP. In addition to this, the protection of a corridor for high speed rail (that travels close to the Wilton Junction Development) will be facilitated by collaboration with the Federal Government.



Source: Long Term Transport Master Plan (TfNSW, December 2012)

Figure 4.3 Protected corridors to support urban growth

The Plan contains an action item to seek to establish connections between the Illawarra Region and the South West Growth Centre with upgrade works to Picton Road, the Princes Highway (A1) and the Illawarra Highway (A48) as required.

The LTTMP includes improvements to bus services across the Sydney Metropolitan area and changes to allow buses to meet passenger requirements in regional areas. It defined tiers for all types of public transport as part of the Strategic Transit Network:

- Mass Transit – high frequency, high capacity services that provide access to major destinations, such as heavy rail
- Intermediate Transit – high frequency but moderate capacity
- Local Transit – getting around locally or providing access to the Mass or Intermediate Transit levels.

Future changes to local bus services to support the Wilton Junction Development should seek to fill the Intermediate and Local Transit tiers.

NSW 2021, a 10-year plan (NSW Government, 6 September 2011)

The State Government's *NSW 2021 10-year plan* contains targets for improving transport services and shifting trips away from the use of private vehicles towards public transport, walking and cycling. The plan provides target mode shares for public transport of 28% across the Sydney Metropolitan Region. Increasing the use of walking and cycling for trips is advocated, with the specific targets of more than doubling the mode share of bicycle trips and increasing the mode share of walking trips to 25% by 2016.

It includes the planning policy to encourage job growth in centres close to where people live and to provide access by public transport. It focuses on increasing the percentage of the population living within 30 minutes by public transport of a city or major centre in metropolitan Sydney. For the Wilton Junction Development, this means a target of connecting it to the Campbelltown-Macarthur Major Centre by a 30 minute travel time bus service. For rail, the Plan identifies more express train services for commuters from South Western Sydney.

Picton Road Corridor Strategy (Roads & Traffic Authority, April 2011)

The Picton Road corridor connects the coast and the Southern Highlands via the Hume Highway, and provides the major link between the communities of the Southern Highlands and the major employment centres of the Illawarra Region, particularly Wollongong.

Picton Road is generally a two-lane undivided rural road. Traffic volumes along the route vary from approximately 15,300 vehicles per day just east of the Hume Highway to approximately 8,000 vehicles per day west of the Hume Highway.

A large number of heavy vehicles use the road to access commercial and industrial areas in the region, particularly Port Kembla and related areas. Heavy vehicles represent, on average, 18% of all traffic using Picton Road east of the Hume Highway and 11% of all traffic on Picton Road west of the Hume Highway.

Traffic volumes along the full extent of corridor are growing at approximately 3% per annum, and are expected to continue to grow from increasing housing within the area and increasing freight volumes being transported to Port Kembla.

The road has a poor crash history, with contributing factors including:

- frustration for drivers caught behind slower vehicles leading to unsafe overtaking attempts
- inappropriate speed, especially in the wet
- narrow sealed shoulder widths, in conjunction with grades and curves

- substandard curves in sections.

Actions identified for the Corridor that are directly relevant to the Wilton Junction Development (aside from the general improvement in road safety along the corridor), include:

Short-term priorities (2011–2016)

- continue to provide additional overtaking opportunities, particularly within sections 2 and 3 of the corridor (between the Hume Highway and the Wollondilly/Wollongong local government boundary)
- continue to investigate the need and timing for the construction of additional lanes along the route via the use of strategic network modelling such as TRACKS
- continue development of a treatment to address road safety and traffic efficiency concerns at the Hume Highway/Picton Road Interchange.
- continue to work with the DP&E (formerly DP&I) and local Councils to manage the impact of land releases, particularly within Appin and Wilton, may have on the performance of the corridor.

Long-term priorities (beyond 2016)

- Through prioritisation based on traffic growth, adopt a staged approach to the provision of additional lanes along the corridor
- Address road safety and traffic efficiency concerns at the Hume Highway/Picton Road Interchange.

Sydney- Canberra Corridor Regional Strategy 2006-2031 (NSW Government - Department of Planning)

The Sydney–Canberra Corridor Regional Strategy applies to the local government areas of Wingecarribee, Goulburn Mulwaree, Upper Lachlan, Yass Valley, Palerang and Queanbeyan, and is one of a number of regional strategies prepared by the Department of Planning. The Sydney–Canberra Corridor Regional Strategy builds on previous planning work, including the 1995 Sydney–Canberra Corridor Strategy as well as the Australian Capital Territory (ACT) and Subregion Planning Strategy.

The Regional Strategy represents an agreed NSW Government position on the future of the Sydney–Canberra Corridor. It is the pre-eminent planning document for the Sydney–Canberra Corridor Region and has been prepared to complement other relevant State and local strategies and planning instruments.

Many parts of the Sydney–Canberra Corridor Region continue to experience significant growth given the strategic location of the Region between two capital cities, although in other parts of the Region there is less immediate demand for growth. The primary purpose of the Regional Strategy is to accommodate and manage growth while ensuring that the rural landscapes and environmental settings that define the Region's character are not compromised.

It will do this by ensuring that land is available and appropriately located to sustainably accommodate the projected population growth and associated housing, employment and environmental needs over the period until 2031.

The Strategy acknowledges the importance of a coordinated approach to settlement, whilst taking into account demand for different types of housing and the adequacy of supply. The broad elements of the Strategy are represented on the Regional Strategy Map, which identifies the overall structure of the Region.

NSW Freight and Port Strategy (Transport for NSW, November 2013)

The Freight and Ports Strategy is the 20 year road map that will ensure freight is at the forefront of the NSW economy. Current commitments to date on network infrastructure tasks across NSW are illustrated in Figure 4.4.

Figure 16 Current commitments to date on network infrastructure tasks across NSW



Source: NSW Freight and Port Strategy (Transport for NSW, November 2013)

Figure 4.4 Committed network infrastructure tasks across NSW

Strategies which are relevant to the Wilton Junction Development are summarised below.

Port Kembla

The land controlled by Port Kembla Port Corporation was successfully leased to NSW Ports Consortium as part of the Port Botany transaction. Port Kembla is:

- Currently the primary port in NSW for motor vehicle imports, projected to grow from an import capacity of around 280,000 vehicles to 460,000 vehicles by 2021.
- Likely to continue to support export trades such as coal, minerals and grains.
- Currently Australia's leading port for steel and is one of its largest grain export ports.
- Identified as the location for the development of a future container terminal to augment the capacity of Port Botany when required.

Planning for the accommodation of these trades, and providing long term security of access to port facilities, are a core part of current expansion plans for Port Kembla, which include:

- Outer Harbour expansion project:
 - ▶ Stage 1, will provide the first multi-purpose, common-user berth. Stages 2 and 3 will provide enhanced rail and road infrastructure, and additional berths.
 - ▶ Port Kembla Port Corporation's Outer Harbour Concept Plan also proposes the development of two separate container facilities, providing a total capacity of 1.2 million TEU per annum.
- Coal export infrastructure expansion:
 - ▶ Current coal throughput capacity at Port Kembla is around 17–18 Mtpa. The Port Kembla Coal Terminal proposes to upgrade its capacity in two stages to around 25.5 Mtpa.
- Biodiesel facility:
 - ▶ As part of the diversification of Port Kembla, National Biofuels Pty Ltd, is in the process of establishing a biodiesel production facility.
 - ▶ It is estimated that the facility will process 1.1 million tonnes of soy bean per annum.

Ultimately, port growth plans will clarify the way in which NSW Ports will expand to meet future growth in freight volumes. The plans will be consistent with the National Port Strategy, together with other key State and regional plans.

Planning for growth in Port Kembla will address the limitations of existing planning approvals by providing increased certainty through integrated planning of port and landside infrastructure needs. This includes the Maldon to Dombarton Rail Link (MDRL) which is currently in the planning and pre-construction design phase, as discussed below.

Maldon to Dombarton Rail Link

Rail access to Port Kembla from the western coalfields is currently available through the Illawarra Line and the Main South Line. There are capacity issues on both of these lines, with limited available freight paths on both corridors.

The Maldon to Dombarton Rail Link (MDRL) project was proposed to provide improved linkages between the southern and western coalfields and the newly constructed Port Kembla coal terminal. The construction of the MDRL would create a third option to move trains from the western coalfields to Port Kembla. Construction on the line started in 1983, with the line forecast to transport 17 Mtpa of coal.

An expansion of Port Kembla for high intensity container operations when Port Botany reaches throughput capacity may require containers to be moved by both road and rail. The MDRL would provide a rail route between Port Kembla and intermodal facilities in south and western Sydney.

Duplication of the Moss Vale to Unanderra line between Dombarton to Unanderra was completed and commissioned prior to work on the project being suspended in 1988. Current estimates by ARTC are that construction on the project is approximately 15 per cent complete (by value) and in 2010 a review by ACIL Tasman estimated between \$624 million and \$667 million to complete the line.

The Australian Government recently provided TfNSW with \$25.5M to undertake planning and preconstruction development. This planning work, due to be completed mid-2014, encompasses assessment of design, engineering, safety, operations, environmental, economic, cost and stakeholder issues. The construction will involve laying 35 kilometres of standard gauge track to enable the connection of Port Kembla directly to the Main South Line via Dombarton at Maldon. It is likely that future operations on the MDRL will be freight only, and involve diesel locomotives.

Of greatest significance to the Wilton Junction Development, the currently proposed alignment of the MDRL traverses the investigation area in a north-south alignment, as shown in Figure 4.5. Consequently its construction and operation may impact development in the area.

The *Wilton Junction New Town: SEPP Rezoning – Infrastructure Proposal to NSW Government* (Elton Consulting, May 2014) discusses the integration of the proposed development with the MDRL, and the funding and delivery of infrastructure. The Wilton Junction master plan includes provision to protect the identified corridor for the future MDRL. At the request of TfNSW the corridor is proposed to be rezoned SP2, with a buffer identified between the identified corridor and residential and other noise sensitive land uses.

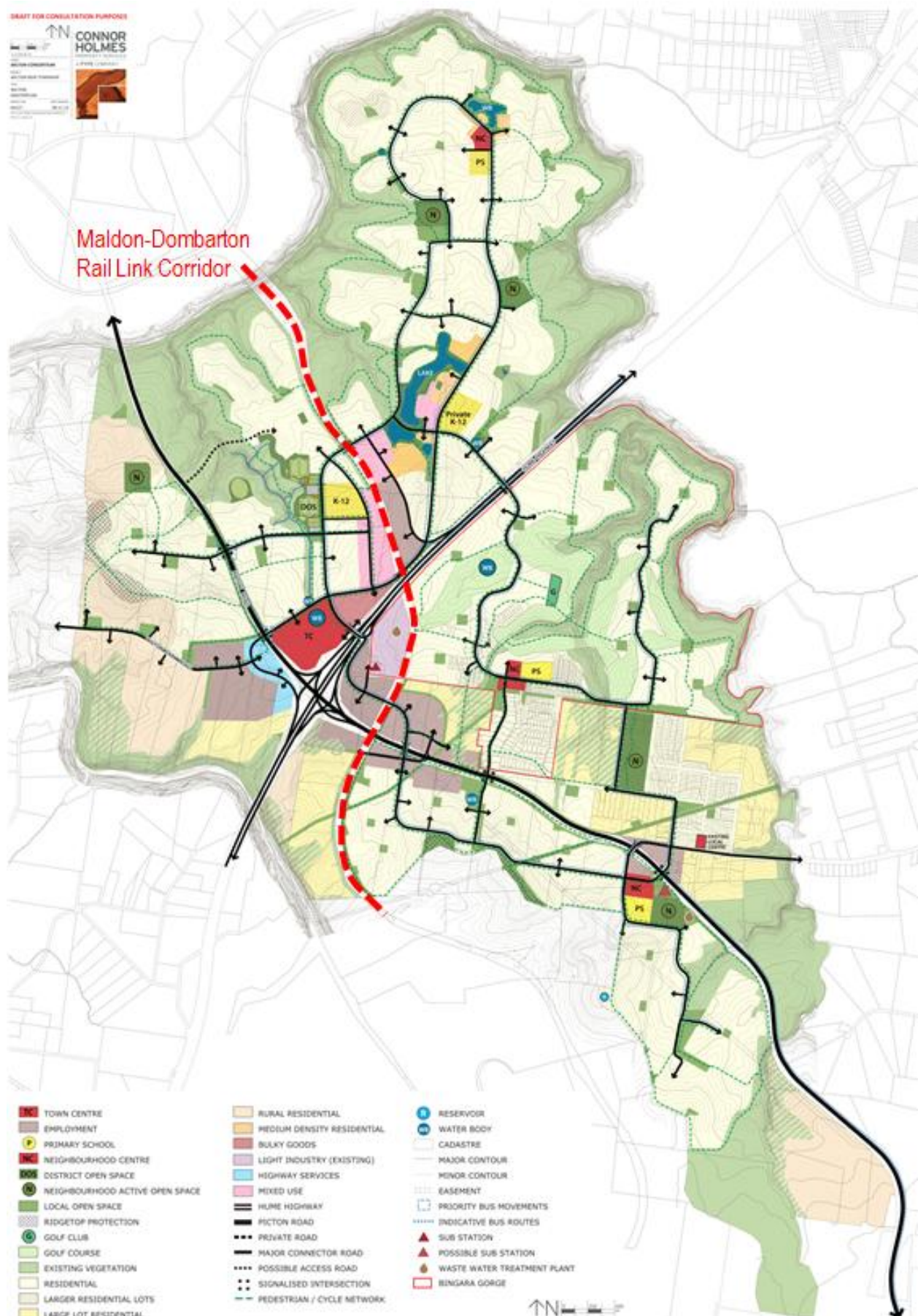


Figure 4.5 Maldon-Dombarton Rail Link corridor in Wilton Junction Development area

Hume Highway and Picton Road

The following projects on the Hume Highway and Picton Road are also of relevance to the Wilton Junction Development:

- Hume Picton:
 - ▶ RMS has undertaken modelling to assess alternative interchange layouts that could resolve the long term capacity and road safety concerns associated with the existing Hume Highway/Picton Road interchange layout.
 - ▶ The preferred option for upgrading the interchange involves constructing an additional bridge to provide a six lane configuration of Picton Road over the Hume Highway and two continuous off-ramp trumpets from the Hume Highway, reducing conflicting traffic movements and maintaining traffic flow.
- Picton Road – Road Safety Treatments:
 - ▶ This \$43.6M project provides essential improvements to upgrade Picton Road between the Hume Highway intersection at Wilton and the Mt Ousley Road intersection at Mt Keira Road.
- Hume Highway Bridges - access for B-Triple, Higher Mass Limit and Higher Productivity Vehicles:
 - ▶ The Sheahan and Badgally Road bridges on the Hume Highway have been identified by NSW Government as unsuitable for B-Triple and other high productivity vehicles.
 - ▶ The initiative is to strengthen these bridges to improve interstate and local freight route continuity on the Hume Highway.
 - ▶ Detail structural analysis is completed on Badgally and remedial works required have been identified and costed. Detailed analysis for Sheahan Bridge is currently being undertaken.

4.2 Local plans

Wollondilly Shire Local Environment Plan 2011 includes the aim 'to encourage development that provides for an integrated transport and infrastructure system and adequate facilities and service provision for future growth'.

The Wollondilly Development Control Plan 2011 (DCP) includes the objective 'to encourage the integration of land use and transport, and provide for environments that are highly accessible and conducive to walking, cycling and the use of public transport'. Volume 7 contains transport planning objectives for the development at Wilton that are generally consistent with the transport planning objectives for the Shire, including:

- a) promote a hierarchy and network of publicly accessible roads, shared pathways and trails within the site and linking the site with existing Wilton village
- b) provide an access network for public transport
- c) provide safe and efficient movement of vehicles, pedestrians and other transport modes within, to and from the area including access for waste servicing vehicles and vehicles servicing non-residential land uses
- d) promote permeability and connectivity and create opportunities for movement other than by private motor vehicles.

It recommends that a network of public roads and shared pathways should be planned for new developments such as the Wilton Junction Development. The existing plan for shared pathways in Wilton is shown in Figure 2.8. For new development it requires a plan to be submitted that nominates major circulation routes and major intersections for public roads (see section 5.1), bus routes and bus stops (see section 7.2) and shared pathways (see sections 7.3).

The DCP specifies parking provision for residential and non-residential land uses. The rates specified are generally minimum parking numbers. Parking for the Wilton Junction Development is discussed in more detail in section 5.4.

4.3 Population and employment forecasts

Population and employment forecasts for the area have been obtained from both State Government and Wollondilly Council to determine how the Wilton Junction Development will fit with the growth planned.

BTS population and employment forecasts

The BTS Population and Employment forecasts for the travel zones within the surrounding area were investigated to determine whether the Wilton Junction Development is within current growth forecasts. The forecasts by LGA are shown in Table 4.2, 4.3 and 4.4 for dwellings, population and employment respectively.

Table 4.2 BTS dwelling forecasts by LGA

LGA	2006	2011	2016	2021	2026	2031	2036	2041
Camden	16,551	20,722	33,082	43,743	61,908	80,643	93,372	103,635
Campbelltown	49,026	53,021	58,840	65,846	72,958	80,083	86,963	93,721
Wingecarribee	16,844	18,535	20,249	21,740	23,084	24,282	25,312	26,126
Wollondilly	13,651	15,378	16,880	18,788	20,661	22,642	24,732	26,921
Total	96,072	107,656	129,051	150,117	178,611	207,650	230,379	250,402

Source: BTS Population and Employment Forecasts (August 2012 Release)

The total number of new dwellings for the areas selected between 2011 and 2041 (the anticipated year of full development of Wilton Junction) is approximately 143,000. For Wollondilly Shire it is approximately 11,500. The forecast for Wilton Junction (11,900) is higher than the total number of new dwellings for Wollondilly Shire. The travel zone representing Wilton Junction was forecast to have growth of 1,400 dwellings – approximately the total in the Bingara Gorge development plus some additional in-fill in the current Wilton village.

Table 4.3 BTS population¹ forecasts by LGA

LGA	2006	2011	2016	2021	2026	2031	2036	2041
Camden	50,940	63,158	99,299	129,111	178,910	229,323	261,886	288,791
Campbelltown	147,440	157,887	172,647	191,286	209,770	228,161	245,699	262,816
Wingecarribee	44,374	47,515	50,663	53,629	56,397	58,893	61,079	63,046
Wollondilly	41,221	45,992	49,766	54,839	59,665	64,766	70,125	75,729
Total	283,975	314,552	372,375	428,865	504,742	581,142	638,789	690,383

Source: BTS Population and Employment Forecasts (August 2012 Release)

(1) Population in occupied dwellings

The total population growth for the areas selected between 2011 and 2041 is approximately 376,000. For Wollondilly Shire it is approximately 29,800, i.e. less than the forecast population (34,955) for Wilton Junction.

Table 4.4 BTS employment forecasts by LGA

LGA	2006	2011	2016	2021	2026	2031	2036	2041
Camden	17,318	19,811	24,273	30,598	39,236	48,962	56,115	62,185
Campbelltown	45,926	53,422	59,529	65,438	71,019	76,784	82,945	89,587
Wingecarribee	17,832	20,342	22,176	23,900	25,711	27,569	29,559	31,719
Wollondilly	10,920	13,495	14,980	15,910	16,884	17,845	18,864	19,958
Total	91,997	107,071	120,959	135,846	152,850	171,161	187,483	203,449

Source: BTS Population and Employment Forecasts (August 2012 Release)

The total employment growth for the areas selected between 2011 and 2041 is approximately 96,000. For Wollondilly Shire it is approximately 6,500. The medium and high employment scenarios for Wilton Junction from MacroPlan are both higher than the total growth for Wollondilly Shire. The travel zone representing Wilton Junction (TZ1450) was forecast to have employment growth of 108 jobs.

The BTS population and employment forecasts do not include provision for the Wilton Junction Development beyond what has already been approved for the Bingara Gorge development. These forecasts also form the basis of the assumptions in the STM, which is used for future transport planning by TfNSW.

Wollondilly Shire Council forecast

Wollondilly Shire Council has supplied forecasts of population growth in the Shire for three scenarios (low, high and maximum scenarios). All three scenarios have growth which is higher than the BTS projections analysed above. However, excluding the Wilton Junction Development that was included in all three scenarios:

- the low scenario has 10% lower growth than the BTS projections in the Shire – 7,275 dwellings versus 8,076 dwellings
- the high scenario has 18% higher growth than the BTS projections in the rest of the Shire – 9,570 dwellings versus 8,076 dwellings
- the maximum scenario has an additional 137% growth in the Shire compared to the BTS projections – 19,170 dwellings versus 8,076 dwellings.

At a detailed level, the differences are not evenly distributed:

- in the low scenario: Warragamba, Silverdale/Orangeville and Appin are higher than BTS, but Cawdor/Razorback and Bargo are lower
- in the high scenario: Picton, Thirlmere, Tahmoor, Warragamba, Silverdale/Orangeville and Appin are higher than BTS, but Cawdor/Razorback and Bargo are lower
- in the max scenario: Picton, Thirlmere, Tahmoor, Warragamba, Silverdale/Orangeville, The Oaks/Oakdale, Cawdor/Razorback, Menangle, Douglas Park and Appin are higher than BTS, only Bargo is noticeably lower.

The location of other developments, either currently in production or planned are shown in Figure 4.6.

In terms of employment, Council has advised of the developments listed in Table 4.5.

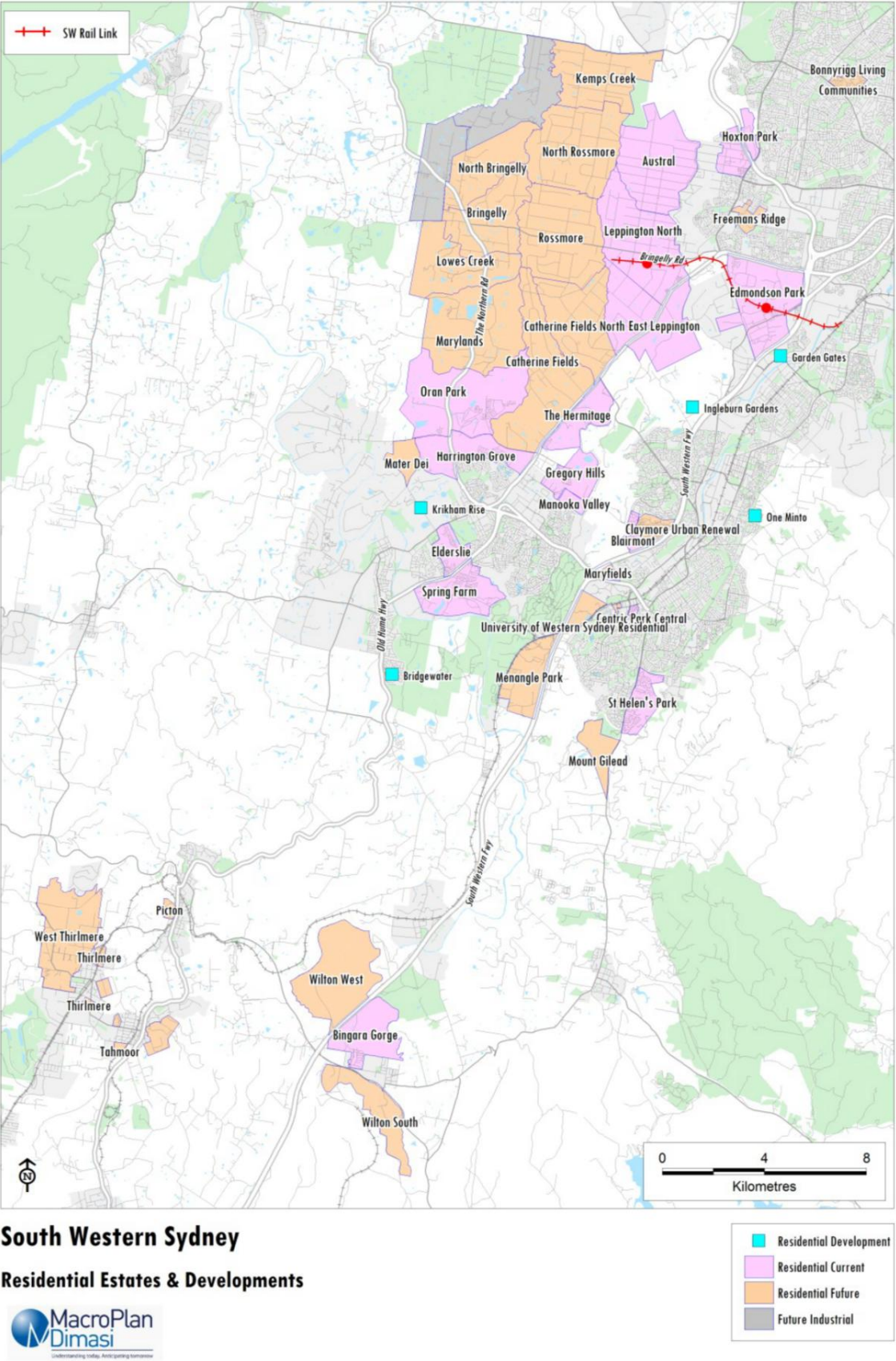
Table 4.5 Wollondilly identified future employment growth

Planning proposal	Estimated potential jobs
Maldon Employment Generating Lands	825–900
Tahmoor South Business Development Lands	90
Argyle Street Business Development Lands	125
North Silverdale Commercial, Industrial and Residential Lands	45
Warradale Road	20
Cliffe & Elizabeth Streets Commercial Lands	~190
Cawdor	1,000
Total	2,295–2,370

Source: Wollondilly Shire Council, email 26 April 2013

- (1) Employment Generation Rate is based on figures from EDLP (Economic Land Development Programme) 2010 Overview Report by the Department of Planning
- (2) In this report the rate of employment generation is listed as follows:
- Sydney Metropolitan - Average – 43 jobs/ha
 - Inner North - 146 jobs/ha
 - Sydney City - 131 jobs/ha
 - North West - 31 jobs/ha
 - South West - 25 jobs/ha

These employment increases are within the planned growth for Wollondilly Council area as a whole (18,864 jobs), the two large developments – Maldon and Cawdor are not included in their specific zones. STM assumes most of the growth will be in the existing centres of Picton, Tahmoor and Appin. The overall employment numbers in the STM in these areas generally seem appropriate for modelling purposes.



Source: ABS, MacroPlan Dimasi, 2013

Figure 4.6 Location of other developments

4.4 Redistribution of regional growth forecasts

A development the size of Wilton Junction has the potential to alter the growth in population and employment for a wide surrounding area. Past trends indicate that there is a stable demand for new dwellings and employment space, and production of new development in excess of this demand is likely to have wider consequences in the market.

It was agreed with TfNSW that the planned growth in the LGAs of Camden, Campbelltown, Wollondilly and Wingecarribee would be reduced to accommodate the growth planned for the Wilton Junction Development, so that there would be no net change from current growth forecasts in the South West Subregion. Notionally this could be due to slower than anticipated take up within the South West Growth Centre and the delaying of other projects in other Council areas.

As an overall picture, the BTS housing projections used to develop STM seem reasonable (and comparable with the Council low forecast), apart from the Wilton Junction Development zone which is significantly underestimated. It is therefore proposed to reduce the growth in other Wollondilly zones in the model by 10% to match Council's low scenario, drop growth in Camden and Campbelltown by approximately 10% (and add Wilton, 34,955 people) resulting in no net change to what is currently in the STM model.

Table 4.6 Population numbers for proposed land use scenarios

Area	2036 Base (No Wilton)	2036 with Wilton	Reduction of all other areas
Camden	261,886	242,453	90.2% growth
Campbelltown	245,699	237,112	90.2% growth
Wingecarribee	61,079	59,752	90.2% growth
Wollondilly	70,125	99,472	Additional 31,355 people in TZ1450 90.2% growth in other zones
Total	638,789	638,789	100%

Source: Parsons Brinckerhoff

A range of employment scenarios were tested to determine their impact on trip patterns in the surrounding area. The amounts of employment tested covered a greater range than indicated in section 3 (Table 3.4), however the maximum employment tested is consistent with the upper employment scenario described.

The employment levels were adjusted based on the ratio of jobs to employed residents, expressed as a percentage, i.e. the percentage of local employment satisfied within the Wilton Junction Development. An additional amount of employment for people living outside the Development was added. The scenarios considered are outlined in Table 4.7.

Table 4.7 Employment scenarios

Percentage of local employment satisfied	35%	50%	70% (High employment)
Employed residents	13,200	13,200	13,200
Employed residents working in Wilton Junction	4,620	6,600	9,240
Residents working from Home	3,355	4,793	1,766
Non-residents working in Wilton Junction	1,265	1,807	2,530
Total jobs	5,885	8,407	11,770

Source: MacroPlan Dimasi, 2013

The number of residents and non-residents taking the jobs within Wilton Junction is an estimate only. Additional analysis has been undertaken using the BTS' STM to assess the JTW travel pattern of residents. All scenarios assume the same resident population numbers within Wilton Junction.

Maintaining the overall number of jobs in the area so that there is no net increase in the South West Subregion can be achieved by factoring the employment growth in Camden, Campbelltown, Wollondilly and Wingecarribee Council areas by the following factors:

- 70% employment scenario – factor growth between 2011 and 2036 by 85.5%
- 50% employment scenario – factor growth between 2011 and 2036 by 89.6%
- 35% employment scenario – factor growth between 2011 and 2036 by 92.8%.

Based on agreements with TfNSW, the traffic modelling undertaken for this assessment is based on the 50% employment scenario – i.e. a total of 8,407 jobs. This scenario dropped the population and employment growth in Camden, Campbelltown, Wollondilly and Wingecarribee by 10% to result in no net change to the projections for the South West Subregion.

5. Traffic impact assessment

5.1 Introduction

In order to determine the infrastructure requirements for Wilton Junction a significant amount of traffic modelling has been undertaken. The modelling has informed the configuration of the internal road network, the layout of intersections within the development plus access points to/from Picton Road and the Hume Highway. Additionally, the modelling was used to determine appropriate upgrades for the Picton Road/Hume Highway Interchange.

In this section, proposed upgrades to the State Road Network are discussed. It is noted that the proposed infrastructure upgrades along the Hume Highway and Picton Road indicated on the Master Plan are not preferred or approved by RMS. The Hume Highway/Picton Road interchange upgrade indicated on the Master Plan is not an approved design.

The proposed layouts and configurations illustrated have been adopted for the purposes of traffic modelling/traffic assessment only. This TMAP and the rezoning process that it supports, does not confirm a final design for any of the proposed infrastructure upgrades on the State Road Network.

All proposed modifications or additions to existing road networks are subject to review and approval by responsible authorities including RMS, TfNSW, and Council. The Wilton Junction team will continue to participate in workshops with relevant authorities to achieve suitable designs.

The proposed internal road network has been developed to separate and minimise the conflicts – and consequent impacts of these conflicts – between local and regional traffic on the State Road Network. The Wilton Junction team will continue to participate in discussions with relevant authorities to investigate further opportunities to minimise conflicts between local and regional traffic, while also providing an appropriate level of access between the local and State Road Networks. Opportunities to further refine and optimise the proposed road network will also be possible at the detailed design / development application stage, as more detailed land use plans are defined.

Assessing the transport infrastructure requirements and traffic impacts of Wilton Junction has been undertaken using an Aimsun Mesoscopic traffic model specifically developed for the task. The Aimsun modelling has also been utilised in identifying the infrastructure staging requirements to support the Wilton Junction development into the future. The infrastructure staging assessment has been supplemented with SIDRA intersection modelling.

In developing this suite of models, Parsons Brinckerhoff worked closely with TfNSW (including BTS and RMS) to agree assumptions and inputs throughout the process. The BTS STM model was used to assist with the development of the future year modelling. However, during the modelling process some issues were identified with the BTS future forecasts. Where these issues could not be reconciled, Parsons Brinckerhoff worked with TfNSW to agree on alternative first principal inputs.

Aimsun models were developed to consider both AM and PM peak periods. The scenarios in Table 5.1 were considered.

Table 5.1 Modelled scenarios

Year	Without Wilton Junction	With Wilton Junction
2013	Existing situation ¹	-
2024 ²	Base case	Modelled with staged development ⁴
2031 ³	Base case	Modelled with staged development ⁴
2036	Base case	Modelled with full development ⁵

(1) includes Bingara Gorge development to date

(2) modelled as the estimated year when the north-facing ramps for the Wilton Junction Development to the Hume Highway are required as part of the staging of road network upgrades

(3) modelled as an intermediate year

(4) as per Table 3.6

(5) while Wilton Junction is not expected to be complete until 2041, it was required by TfNSW to use 2036 as the completion year for the purposes of modelling due to limitations in the STM forecasting beyond 2036

5.2 2013 Base model development

Aimsun Mesoscopic traffic models have been developed, calibrated and validated in accordance with RMS traffic modelling guidelines (March 2013). The study area (as agreed with TfNSW, seen in Figure 5.1) includes a section of Narellan Road along the northern boundary of the model and the M1 route along the eastern edge of the model. The model extends south of Yanderra and West of Picton.

The Aimsun modelling processes including development, calibration and validation are described in the Calibration and Validation report provided in Appendix C. Traffic volumes, measured in light and heavy vehicles were converted to Passenger Car Unit (PCU) for the purpose of modelling, based on the surveyed turn counts data.

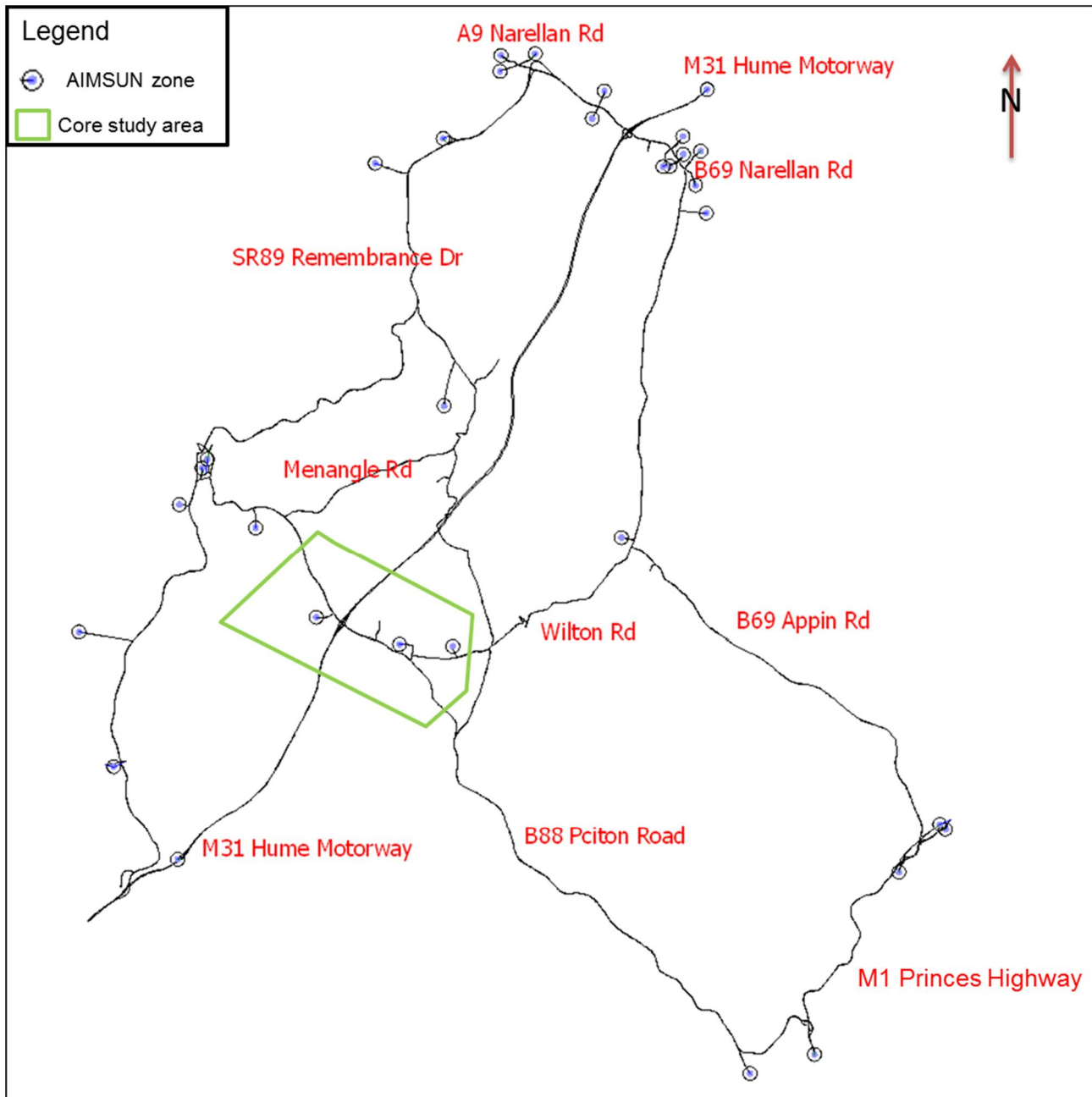


Figure 5.1 Aimsun model network – 2013 existing conditions

From anecdotal evidence, it is understood that the existing road network currently experiences:

- congestion on Narellan Road and around the Camden Valley Way/Camden Bypass Interchange
- congestion around the Hume Highway/Picton Road Interchange
- heavy but moving flows along Hume Highway and Picton Road.

As outlined in Section 2.4 and Table 2.7, the intersections modelled within the study area are currently operating at Level of Service C or better. During the site inspection, it was observed that M31 Hume Motorway/B88 Picton Road Interchange operated well during both AM and PM peak conditions, although right turning vehicles on both northbound and southbound off-ramps experience some delays when waiting for suitable gaps to merge onto B88 Picton Road.

5.3 Development of future year base matrices

Initially, it was agreed (with TfNSW) to utilise the BTS STM model to determine the 2036 Base trip matrices. However an analysis of the sub-area matrices extracted from STM identified several changes between the 2011 and 2036 matrices that appear to be counter intuitive and not reflective of the BTS population and employment forecasts in this area. As a result of these anomalies, Parsons Brinckerhoff proposed an alternative methodology for developing base 2036 matrices, using BTS population and employment forecasts as the basis for traffic growth. This alternative approach was agreed with TfNSW.

Table 5.2 shows BTS Population and Employment forecasts for sub areas within the study area. Figure 5.2 shows the corresponding areas (approximate).

Table 5.2 BTS Population & Employment Forecasts by sub-area within the model area

Sub-area	2011		2036 Base		Growth (2011–2036)		Growth % (2011–2036)	
	Residents	Jobs	Residents	Jobs	Residents	Jobs	Residents	Jobs
Campbelltown	57,037	25,141	92,835	37,893	35,799	12,752	63%	51%
Camden	56,723	17,820	103,962	26,883	47,239	9,063	83%	51%
Wollondilly North	7,067	1,714	9,910	2,245	2,844	531	40%	31%
Appin/Wilton	3,267	2,170	9,100	3,035	5,833	865	179%	40%
Picton, Thirlmere, Tahmoor (PTT)	15,357	6,015	21,564	8,049	6,206	2,034	40%	34%
Wingecarribee (South)	5,674	1,001	7,223	1,300	1,549	299	27%	30%

Source: BTS Population & Employment Forecasts (August 2012 Release) aggregated for travel zones within the study area

(1) Residents = Estimated Resident Population (ERP)

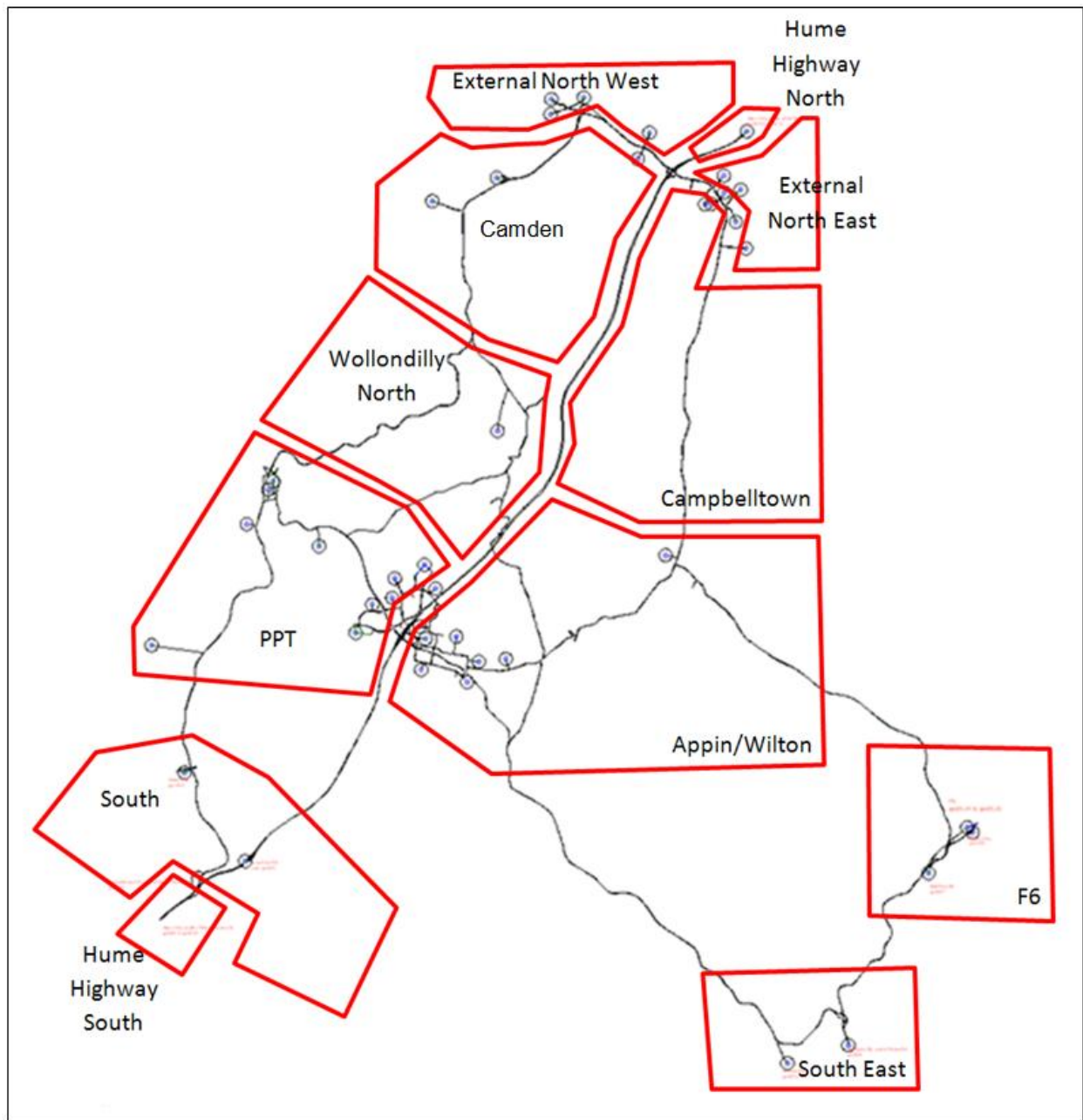


Figure 5.2 Sub areas within the model area

On an LGA-wide basis, the changes are summarised for population and employment in Tables 5.3 and 5.4 respectively.

Table 5.3 BTS population forecasts by Council area

Local Government Area	2011	2036	Total growth (%)	Growth per annum (%)
Camden/Campbelltown	221,045	507,585	130%	5.2%
Wollondilly/Wingecarribee	93,507	131,204	40%	1.6%
Illawarra	441,956	540,573	22%	0.9%

Source: BTS Population & Employment Forecasts (August 2012 Release)

Table 5.4 BTS employment forecasts by Council area

Local Government Area	2011	2036	Total growth (%)	Growth per annum (%)
Camden/Campbelltown	73,233	139,060	90%	3.6%
Wollondilly/Wingecarribee	33,837	48,423	43%	1.7%
Illawarra	164,631	206,028	25%	1.0%

Source: BTS Population & Employment Forecasts (August 2012 Release)

Alternative methodology – for developing Future Year Base Matrices

The alternative methodology, as agreed with TfNSW, is outlined below.

- Growth of the sub-areas (see Figure 5.2) within the model boundary are calculated according to the BTS population forecasts between 2011 and 2036 shown in Table 5.1 (BTS Population and Employment forecasts):
 - A matrix balancing exercise was undertaken to balance the Population growth (rows (trips from)) with the Employment growth (columns (trips to)) to achieve BTS growth figures in the AM peak. In the PM peak the rows were factored to Employment growth and the columns to Population growth. Each row and column total has been refined to within 10% of the BTS growth forecast for both Population and Employment (however most are within 1–2%).
- External zones (roads at the model boundary) would grow as follows:
 - Northern end of the model (External North West and External North East) to the Camden and Campbelltown sub-areas would grow by 5% per annum based on Table 5.3.
 - External zones in the south-eastern corner of the model (near Wollongong) would grow by 1% per annum based on Tables 5.3 and 5.4.
 - External zones to areas within the Wollondilly area and other areas would grow by 1.7% per annum based on Tables 5.3 and 5.4.
- The total trip numbers to remain similar to that extracted from the STM 2036 Base model.
- Additional trips were also added into the model to account for the Malden Aggregate Facility on Picton Road (see section 5.3.1 for more detail)

Based on the methodology outlined above, 2036 AM and PM peak future base models were developed.

Tables 5.5 and 5.6 below show the resulting percentage increase between 2011 and 2036 that was applied to the validated Aimsun Base trip matrices to determine 2036 Base Case (do nothing) traffic volumes. Both tables show how the Population and Employment growth figures compare against the STM forecasts.

Table 5.5 Adjusted 2036 AM peak growth (2011 to 2036) by sub-area

From\To	External North-West	External North-East	Campbelltown	Camden	Hume Highway North	Wollondilly North	Appin/Wilton	PTT	Hume Highway South	South	F6	South-East	Total	BTS Population Forecast
External North-West	250%	250%	60%	60%	0%	31%	43%	34%	50%	27%	50%	50%	74%	
External North-East	250%	250%	60%	60%	0%	31%	43%	34%	50%	27%	50%	50%	70%	
Campbelltown	75%	75%	63%	50%	75%	31%	63%	34%	63%	63%	63%	63%	66%	63%
Camden	120%	120%	60%	65%	120%	31%	83%	34%	100%	63%	100%	100%	85%	83%
Hume Highway North	125%	0%	43%	43%	0%	31%	43%	34%	50%	27%	0%	50%	45%	
Wollondilly North	40%	40%	40%	40%	40%	40%	40%	34%	40%	40%	40%	40%	40%	40%
Appin/Wilton	250%	250%	40%	40%	250%	40%	200%	34%	250%	40%	250%	250%	175%	179%
PTT	40%	40%	40%	40%	40%	40%	40%	40%	40%	27%	40%	40%	40%	40%
Hume Highway South	50%	50%	43%	43%	50%	31%	43%	34%	0%	27%	43%	50%	47%	
South	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%	27%
F6	50%	50%	25%	25%	0%	25%	25%	25%	25%	25%	-100%	-11%	-37%	
South-East	50%	50%	25%	25%	25%	25%	25%	25%	25%	25%	-50%	1786%	-18%	
Total	118%	91%	58%	59%	73%	32%	41%	35%	51%	30%	-46%	36%	57%	
BTS Employment Forecast			51%	51%		31%	40%	34%		30%	Compared to STM Total – 97%			

Table 5.6 Adjusted 2036 PM peak growth (2011 to 2036) by sub-area

From\To	External North-West	External North-East	Campbelltown	Camden	Hume Highway North	Wollondilly North	Appin/Wilton	PTT	Hume Highway South	South	F6	South-East	Total	BTS Employment Forecast
External North-West	250%	250%	63%	120%	0%	40%	250%	40%	43%	27%	50%	50%	119%	
External North-East	250%	250%	63%	120%	0%	40%	250%	40%	43%	27%	50%	50%	82%	
Campbelltown	60%	60%	60%	83%	30%	40%	40%	40%	43%	27%	25%	25%	60%	51%
Camden	75%	75%	60%	65%	50%	40%	40%	40%	50%	27%	50%	50%	64%	51%
Hume Highway North	0%	0%	150%	120%	0%	40%	250%	40%	60%	27%	25%	25%	87%	
Wollondilly North	25%	25%	40%	40%	25%	40%	40%	40%	25%	27%	25%	25%	35%	31%
Appin/Wilton	40%	43%	63%	83%	40%	40%	200%	40%	40%	27%	40%	40%	50%	40%
PTT	25%	25%	63%	83%	25%	40%	40%	40%	25%	27%	25%	25%	39%	34%
Hume Highway South	75%	75%	63%	100%	50%	40%	250%	40%	0%	27%	50%	50%	54%	
South	25%	25%	63%	83%	25%	40%	40%	40%	25%	27%	25%	25%	36%	30%
F6	75%	75%	63%	100%	0%	40%	250%	40%	50%	27%	-100%	-72%	-51%	
South-East	75%	75%	63%	100%	50%	40%	250%	40%	50%	27%	-11%	0%	31%	
Total	88%	72%	65%	85%	43%	40%	174%	40%	51%	27%	-38%	-29%	59%	
BTS Population Forecast			63%	83%		40%	179%	40%		27%	Compared to STM Total – 94%			

5.3.1 Maldon Aggregate facility

In addition to the population and employment forecasts, the Aimsun modelling has also taken into account the Maldon Aggregate facility located south of Picton Road between Picton and the Hume Highway. The proposed facility which is expected to be operational in late 2013 (post agreement of the forecasting approach) will generate a significant amount of heavy vehicle trips throughout the day. The facility has been included in all future year models (with and without Wilton Junction). It is understood that the vehicles associated with this facility are 32 tonne heavy vehicles. The table below shows the expected trip generation to/from the facility during the AM and PM peaks. This information has been extracted from the Traffic Impact Assessment undertaken for the facility. Due to the size of the vehicles expected (32 tonnes) a conversion factor of 1 Heavy Vehicles to 4 PCU has been applied to the Aimsun modelling (based on the Roads and Maritime Services *Modelling Guidelines Version 1 February 2013, Section 10: Highway Assignment Modelling*).

Table 5.7 Additional trips generated by the Maldon Aggregate facility

Direction	AM peak		PM peak	
	HGV (32t)	PCU	HGV (32t)	PCU
Inbound	23	92	19	76
Outbound	23	92	19	76
Total	46	184	38	152

Source: Traffic Impacts Assessment - Maldon Rail Terminal (AECOM)

5.4 Future base network performance

To ensure that all the future traffic demand is released onto the road network the modelling of the future year scenarios have assumed significant upgrades to Narellan Road. The population and employment growth around Narellan Road is forecast at approximately 5% per annum. Given that Narellan Road is currently congested, the existing configuration is unable to cater for the high levels of growth expected. This acts a significant constraint within the model network resulting in substantial unreleased demand within the model. Releasing this demand is required to allow the full impacts of Wilton Junction to be assessed. It should be noted that the assumed Narellan Road upgrades are required to cater for the background growth and not as a direct result of the Wilton Junction.

The resulting traffic flows for the 2024 and 2036 scenarios are shown in Figures 5.3 and 5.4 respectively. The models indicate increasing flows on most road sections, including the Hume Highway, Picton Road and Broughton Pass.

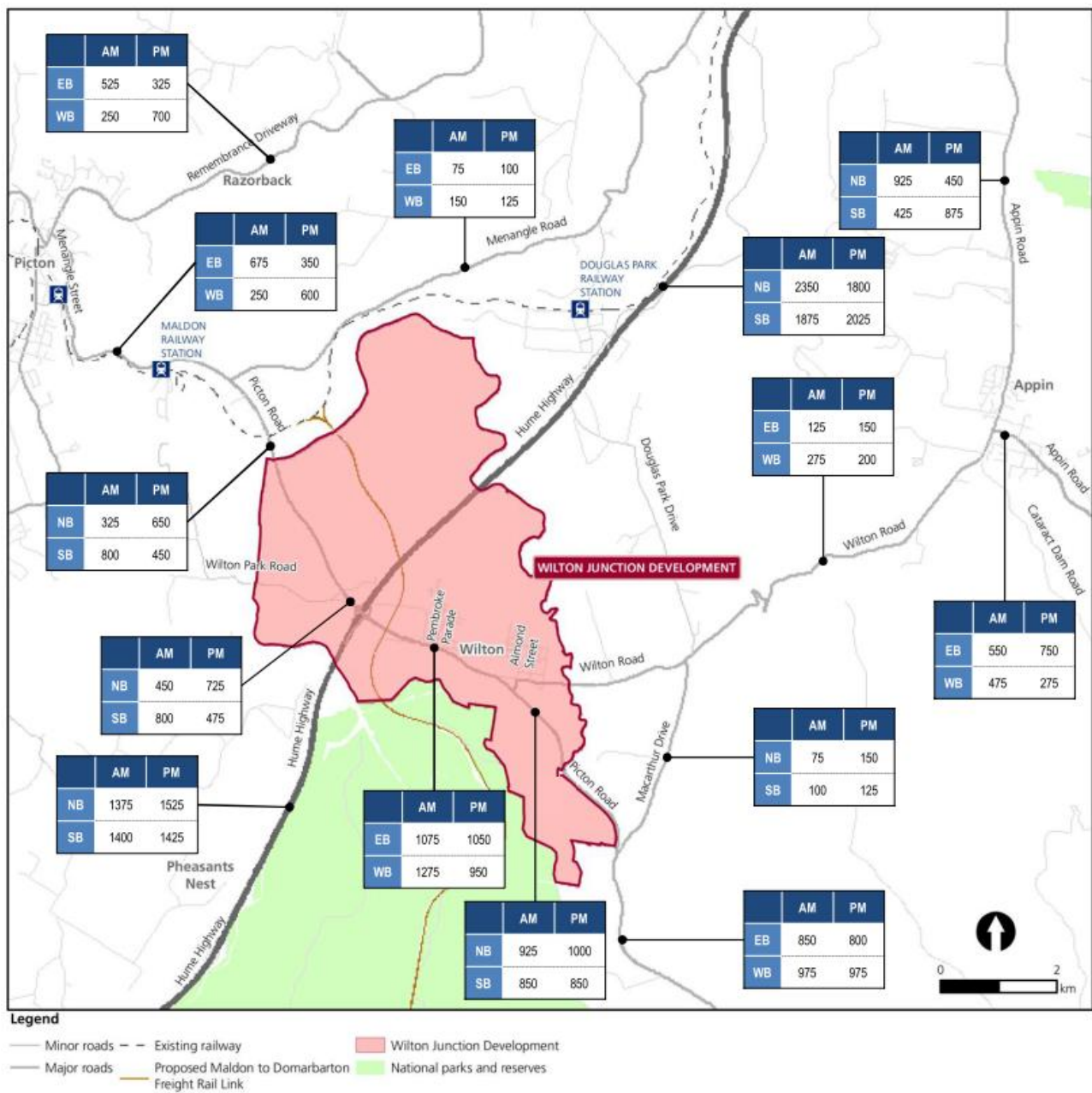


Figure 5.3 Road network flows for 2024 without Wilton scenario (PCUs)

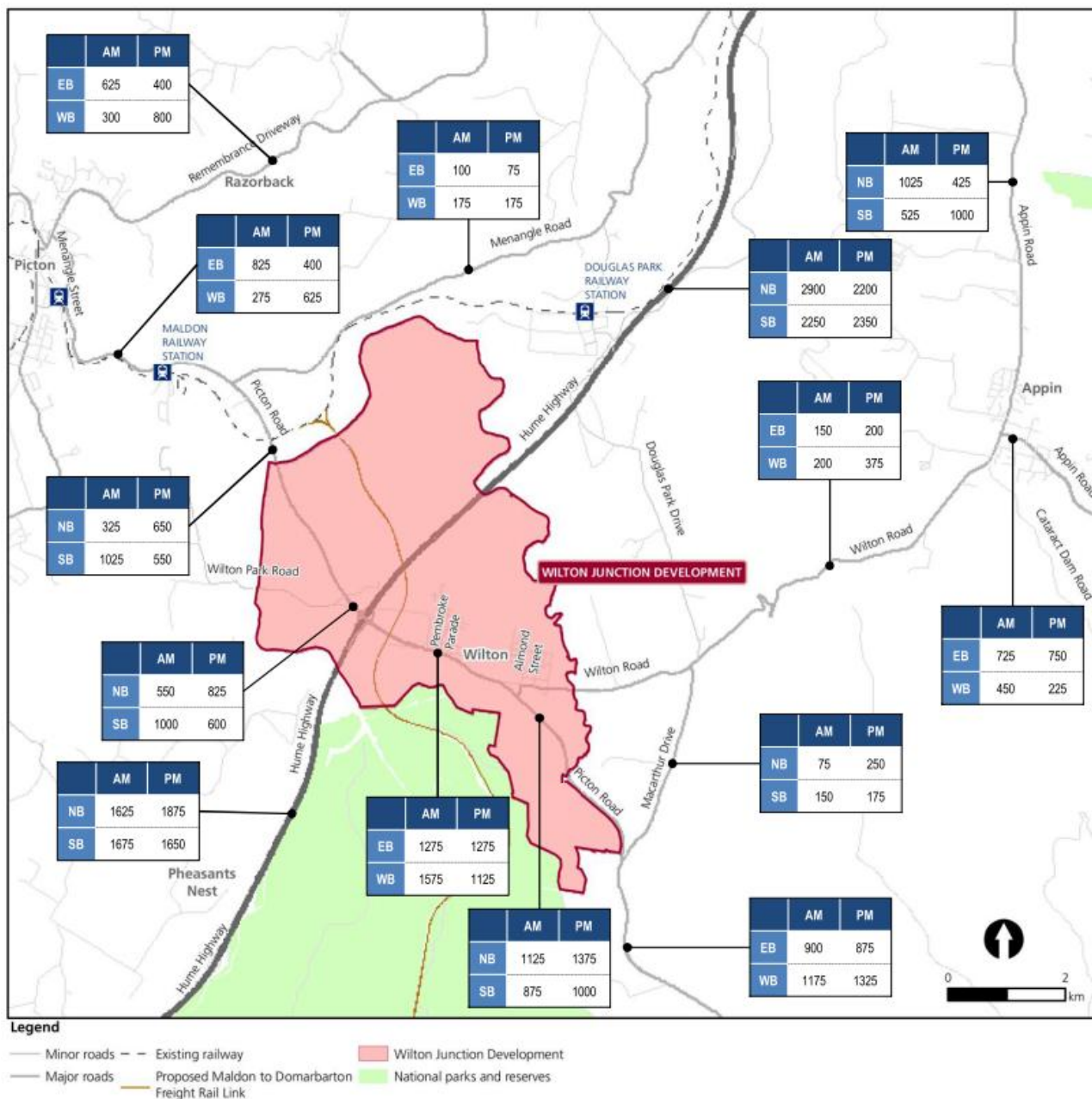


Figure 5.4 Road network flows for 2036 without Wilton scenario (PCUs)

Mid-block performance

Traffic forecasts from the Aimsun model for the 'without Wilton' scenarios, assuming the required infrastructure (described in this section) is in place, are summarised in Table 5.8.

The capacity of Broughton Pass (with its "One vehicle at any one time" restriction) has been estimated by simulating it as a set of traffic signals with an all-red period equal to the clearance time for the 90 m long bridge. It was assumed that it would remain in its current configuration until the level of delay reached LoS F (i.e. by 2031). However, congestion levels may mean upgrading is required before this time.

Table 5.8 Traffic volume forecasts (pcu/h) for 2013 existing and future ‘no Wilton’ scenarios

Highway section	Direction	2013 Modelled		2024 No Wilton		2031 No Wilton		2036 No Wilton	
		AM peak	PM peak	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
Hume Highway, north of Picton Road	Northbound	1,850	1,450	2,250	1,900	2,600	2,125	2,900	2,200
	Southbound	1,525	1,725	1,875	2,150	2,125	2,275	2,250	2,350
Hume Highway, south of Picton Road	Northbound	1,175	1,200	1,375	1,575	1,525	1,775	1,625	1,875
	Southbound	1,150	1,200	1,400	1,425	1,550	1,600	1,700	1,650
Picton Road, at Nepean River bridge	Eastbound	325	650	825	550	900	550	950	550
	Westbound	600	350	475	750	500	675	550	700
Picton Road west of Hume Highway	Eastbound	625	375	850	550	950	575	1,000	600
	Westbound	350	650	500	825	550	775	550	825
Picton Road east of Hume Highway	Eastbound	900	825	1,075	1,100	1,200	1,200	1,275	1,275
	Westbound	975	800	1,275	975	1,500	1,075	1,650	1,150
Picton Road east of Pembroke Parade	Eastbound	750	750	1,050	1,000	1,150	1,050	1,250	1,100
	Westbound	800	575	1,025	925	1,175	1,025	1,275	1,100
Picton Road east of Almond Street	Eastbound	800	725	1,025	925	1,125	1,000	1,225	1,050
	Westbound	750	650	875	825	900	925	925	975
Picton Road east of Macarthur Drive	Eastbound	800	700	975	825	1,075	925	1,150	950
	Westbound	775	650	875	900	950	925	975	1,000
Wilton Road, at Broughton Pass	Northbound	50	100	125	175	150	200	150	200
	Southbound	50	100	150	175	175	175	200	200

To assess the impact of these increasing volumes on the road network, mid-block Levels of Service have been estimated based on standard Austroads lane capacities for different types of roads (the level of service thresholds used are outlined in Table A.2). The results are provided in Table 5.9.

Table 5.9 Summary of link performance for 2013 existing and future 'without Wilton' scenarios

Highway Section	Road type	Direction	2013 Modelled		2024 No Wilton ¹		2031 No Wilton ¹		2036 No Wilton ¹	
			AM peak	PM peak	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
Hume Highway, north of Picton Road	Freeway	Northbound	B	A	B	B	C	B	C	B
		Southbound	A	B	B	B	B	B	B	B
Hume Highway, south of Picton Road	Freeway	Northbound	A	A	A	B	A	B	B	B
		Southbound	A	A	A	A	B	B	B	B
Picton Road, at Nepean River bridge	2-lane 2-way	Combined	C	C	D	D	D	D	D	D
Picton Road west of Hume Highway	Multi-lane arterial	Eastbound	A	A	A	A	A	A	A	A
		Westbound	A	A	A	A	A	A	A	A
Picton Road east of Hume Highway	Multi-lane arterial	Eastbound	A	A	A	A	B	B	B	B
		Westbound	A	A	B	A	B	A	B	B
Picton Road east of Pembroke Parade	2-lane 2-way	Combined	D	D	E	E	E	E	E	E
Picton Road east of Almond Street	2-lane 2-way	Combined	D	D	E	D	E	E	E	E
Picton Road east of Macarthur Drive	2-lane 2-way	Combined	D	D	E	D	E	E	E	E
Wilton Road, at Broughton Pass	One lane bridge	Combined	E	E	E	E	A ²	A ²	A	A

(1) Includes current approval for Bingara Gorge

(2) Cataract River Bridge at Broughton Pass widened to one lane in each direction

The analysis of the 'without Wilton' scenario indicates that Picton Road between Pembroke Parade and Almond Street will reach LoS E by 2021 and east of Almond Street will reach LoS E by 2024. This is slightly sooner than the Picton Road Corridor Strategy (RMS, 2011) findings, which recommended that Picton Road be upgraded by 2026.

Intersection performance – Future base

In the first instance 2024 and 2036 future base scenarios were assessed to isolate the impacts resulting from the growth in background traffic from the impacts of the proposed development. The road network in the 2024 and 2036 future base models remained the same as per the existing layout. Tables 5.10 and 5.11 show the forecast intersection performance for the 2024 and 2036 future base scenarios respectively in the AM and PM peak hours.

Table 5.10 Intersection performance for 2024 future base scenario in the AM and PM peak hours

Intersection	AM peak (07.00–08.00)		PM peak (16.45–17.45)	
	Ave. delay (sec/veh)	LoS	Ave. delay (sec/veh)	LoS
Hume Highway/Picton Road (Eastern intersection) ¹	152	F	430	F
Hume Highway/Picton Road (Western intersection) ¹	18	B	23	B
Picton Road/Wilton Park Road ¹	23	B	16	B
Picton Road/Pembroke Parade ¹	235	F	24	B
Picton Road/Almond Street ¹	141	F	30	C
Picton Road/Macarthur Road ¹	20	B	19	B

(1) priority controlled intersections, LoS and average delay reported is for the worst performing approach

The 2024 future base model highlights that the Hume Highway/Picton Road Interchange would operate significantly over capacity in both peaks, as a result of background traffic growth.

Pembroke Parade and Almond Street would both operate at LoS F in the AM peak with traffic experiencing extensive delays. This is mainly due to the increased traffic volumes on Picton Road in both directions, which would significantly reduce the number of gaps available for traffic exiting at both intersections.

Table 5.11 Intersection performance for 2036 future base scenario in the AM and PM peak hours

Intersection	AM peak (07.00–08.00)		PM peak (16.45–17.45)	
	Ave. delay (sec/veh)	LoS	Ave. delay (sec/veh)	LoS
Hume Highway/Picton Road (Eastern intersection) ¹	180	F	775	F
Hume Highway/Picton Road (Western intersection) ¹	40	C	33	C
Picton Road/Wilton Park Road ¹	22	B	17	B
Picton Road/Pembroke Parade ¹	609	F	35	C
Picton Road/Almond Street ¹	365	F	191	F
Picton Road/Macarthur Road ¹	29	C	37	C

(1) priority controlled intersections, LoS and average delay reported is for the worst performing approach

The Aimsun intersection modelling for the 2024 and 2036 ‘without Wilton’ scenarios indicated the following:

- By 2015 the Hume Highway Picton Road Interchange is forecast to require upgrading due to deteriorating intersection performance and existing safety concerns.⁴

⁴ This is the assessment of Parsons Brinckerhoff as part of its traffic modelling and analysis. This has not been confirmed by RMS and upgrading of the interchange has not been committed to.

- By 2024 or sooner:
 - ▶ The Pembroke Parade and Almond Street intersections with Picton Road would both operate at LoS F in the AM peak with traffic experiencing extensive delays.
 - ▶ Picton Road should be upgraded as per the Picton Road corridor strategy.
- By 2036 the northern part of the model network around Narellan Road would be over capacity and significant upgrades would be required to cater for the expected growth in that area.

It is noted that the bottleneck created on Narellan Road would restrict the traffic flows travelling to the Hume Highway/Picton Road Interchange. Without this constraint in the network, the performance of the interchange is likely to deteriorate further.

The Aimsun model results in conjunction with SIDRA intersection models have been used to estimate when road upgrades are required. The timeframe for road upgrades are indicated on Figure 5.5. Interpolation has been used to estimate the timing of upgrades between 2013, 2024 and 2036.

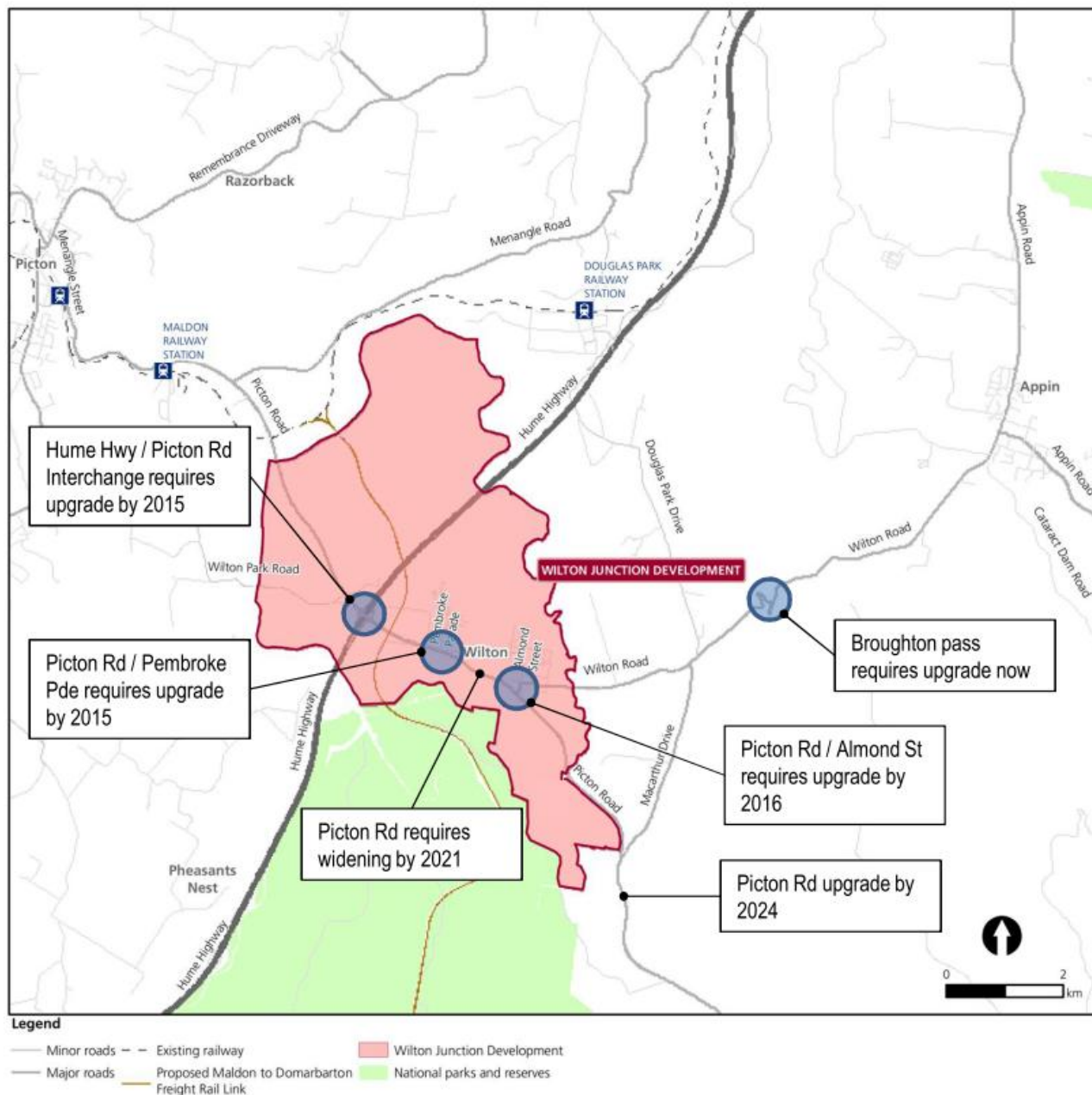


Figure 5.5 Estimated timing of road upgrades without Wilton Junction Development

5.5 Upgraded road network performance

A 2036 do-minimum model was subsequently developed to address the capacity constraints identified in the 2036 future base scenario. The following upgrades within the core study area were included in the model network:

- Hume Highway/Picton Road – signalising both western and eastern intersections, adding an extra ahead lane in both directions on the bridge, adding an extra right turn lane on the bridge in the westbound direction, adding an extra right turn short lane on both the northbound and southbound off-ramps
- Picton Road/Pembroke Parade – signalising this intersection, adding an extra right turn short lane on Pembroke Parade
- Picton Road/Almond Street – signalising this intersection, adding an extra left turn short lane on Almond Street.

Table 5.12 shows the intersections performance for 2036 with-upgrade scenario in the AM and PM peak hours. Note that the Picton Road/Wilton Road and Picton Road/Macarthur Road intersections are priority controlled intersections, and therefore the LoS shown is based on the worst performing approach.

Table 5.12 Intersection performance for 2036 with-upgrade scenario in the AM and PM peak hours

Intersection	AM peak (07.00–08.00)		PM peak (16.45–17.45)	
	Ave. delay (sec/veh)	LoS	Ave. delay (sec/veh)	LoS
Hume Highway/Picton Road (Eastern intersection) ²	19	B	17	B
Hume Highway/Picton Road (Western intersection) ²	19	B	22	B
Picton Road/Wilton Park Road ¹	23	B	13	A
Picton Road/Pembroke Parade ²	15	B	16	B
Picton Road/Almond Street ²	25	B	16	B
Picton Road/Macarthur Road ¹	19	B	15	B

(1) priority controlled intersections, LoS and average delay reported is for the worst performing approach

(2) signalised intersection, LoS and average delay reported is for the average of all movements based on traffic volume

The 2036 with-upgrade model results show that the proposed road upgrades would be able to accommodate the background traffic growth by 2036 for both peak hours. The *Picton Road Corridor Strategy* indicates that the widening of Picton Road is required by 2026. Traffic modelling undertaken for this study, indicates that this upgrade is required as soon as 2021.

5.6 Development of with-Wilton Junction matrices

As part of the modelling process, Wilton Junction was initially modelled in the STM. The purpose of this was to inform a number of high level outputs (including modal split, trip distribution, trip containment) to be used in the Aimsun modelling. Three employment scenarios were considered and analysed in STM:

- Low employment scenario: 6,456 jobs
- Medium employment scenario: 11,769 jobs
- High employment scenario: 13,450 jobs.

For all three scenarios, a forecast population of 34,955 people (11,900 dwellings) was included for Wilton Junction.

In the STM modelling, the population and employment growth in the surrounding areas was reduced marginally. This change was made on the assumption that the overall BTS growth forecasts are accurate and therefore to achieve no net change to the BTS figures in the STM model, some population and employment growth would be redistributed to Wilton. This approach was agreed with TfNSW.

Table 5.13 Adjustments to growth in other areas due to Wilton Junction

Area	Reduced growth in other areas due to Wilton
Camden	90.2% growth
Campbelltown - North	90.2% growth
Campbelltown - South	90.2% growth
Wingecarribee	90.2% growth
Wollondilly	Additional 31,355 people in TZ1450, 90.2% growth in other zones
Total	100%

Trip containment

The STM modelling was utilised to determine the level of trip containment which can be expected within Wilton Junction, depending on the mix of population and employment. Table 5.14 shows the percentage of trip containment estimated from the STM model for each of the three employment scenario.

Table 5.14 STM estimate of trip containment within Wilton Junction for employment containment scenarios

Time period	Movement	Low employment (35%)	Medium employment (50%)	High employment (70%)
AM peak	Trips starting in Wilton	48%	52%	56%
	Trips finishing in Wilton	76%	74%	70%
PM peak	Trips starting in Wilton	75%	73%	71%
	Trips finishing in Wilton	56%	58%	61%

(1) Output calculated from 2036 STM model runs

Following discussion with TfNSW it was agreed to use a conservative 50% employment containment figure in the Aimsun Modelling. This does not imply that the high employment containment option cannot be achieved.

5.7 Trip generation

The STM model was to be used to determine the trip generation rates to be used in the Aimsun Model. Upon investigation, the trip generation rates produced by the STM model appeared to be low (at 0.5 vehicles trips per dwelling), compared with existing RMS guidelines and from surveys of similar development in the area. Therefore it was agreed to revert to exiting survey data collected in the area to determine what trip rates to use (this was agreed with TfNSW).

Residential

Traffic surveys undertaken on Pembroke Parade for the existing Wilton township as part of approved Bingara Gorge⁵ indicated an average trip rate of 0.7 vehicle trips per dwelling during the peak hour. Due to the position of the surveys, local trips, i.e. those residential trips to the local shops, primary schools or visiting friends were not included. It is estimated that these local trips could add between 0.08 and 0.14 vehicle trips per dwelling during the peak hour. This vehicle trip rate is broadly consistent with RMS Technical Direction TDT13-04a – Guide to Traffic Generating Developments Updated traffic surveys (RMS, August 2013) for regional areas.

For the Wilton Junction Development, this rate of 0.7 vehicle trips per dwelling during the peak hour has been assumed, with the additional allowance of 0.08 vehicle trips per dwelling during the AM peak hour and 0.14 vehicle trips per dwelling during the PM peak hour for local trips (to the nearest local shops, primary school, etc.). Therefore the total vehicle trip generation rate applied was 0.78 vehicle trips per dwelling during the AM peak hour and 0.84 vehicle trips per dwelling during the PM peak hour. The daily traffic generation rate estimated from TDT13-04a was 5.65 vehicle trips per dwelling.

Employment

An analysis of RMS Technical Direction TDT13-04a – Guide to Traffic Generating Developments Updated traffic surveys (RMS, August 2013) vehicle and person trip generating rates for offices has been used to estimate the number of vehicle trips per employee during the peak periods of:

- 0.6 trips per employee during the AM peak hour
- 0.45 trips per employee during the PM peak hour.

A similar process was undertaken for the business park component, which indicated a slightly higher afternoon trip rate of:

- 0.6 trips per employee during the AM peak hour
- 0.5 trips per employee during the PM peak hour.

Retail

Similarly, the RMS TDT2013-04a rate for a small shopping centre (i.e. less than 10,000 m² GFA) and large shopping centre (20,000–30,000 m² GFA) has been used. This equated to:

- 12.3 trips per 100 m² GFA during the Thursday evening peak hour for local retail centres
- 6.0 trips per 100 m² GFA during the Thursday evening peak hour for town centre retail.

During the peak, it is assumed that some of trips will be linked, i.e. stopping at the shop on their way to somewhere else, as opposed to trips exclusively for shopping.

Total trips

The total numbers of trips (all modes) for the AM and PM peaks as well as the typical weekday are shown in Table 5.15. These have been broken down into four quadrants dissected by the Hume Highway and Picton Road.

⁵ Traffic Review of Proposed Wilton Junction Development (Colston Budd Hunt & Kafes Pty Ltd, November 2012)

Table 5.15 Trip numbers (all modes, production and attraction) by quadrant and time period (full development)

Quadrant	Daily		AM peak hour		PM peak hour	
	In	Out	In	Out	In	Out
North quadrant	45,463	45,463	5,411	8,156	7,452	5,800
East quadrant	11,717	11,717	1,411	2,287	1,979	1,494
South Quadrant	18,051	18,051	1,431	3,686	3,345	1,689
West Quadrant	5,217	5,217	949	1,057	832	929
Total	80,449	80,449	9,201	15,187	13,608	9,913

Internal trip containment and directional split

The percentage of trips into and out of the developments was estimated by land use type based on the results of the STM modelling. The percentages assumed for the AM and PM peak hours are shown in Table 5.16. The directional split assumed across the day is 50% trips in/50% trips out. Internal trip containment was as per the STM numbers reported in Table 5.14.

Table 5.16 Assumed directional split for peak hour trips

Time period	Direction	Residential	Local retail	Bulky goods, Large retail	Employment, Business park
AM peak	In	30%	50%	60%	75%
	Out	70%	50%	40%	25%
	Total	100%	100%	100%	100%
PM peak	In	70%	50%	50%	15%
	Out	30%	50%	50%	85%
	Total	100%	100%	100%	100%

Mode split

The potential mode shares for the development in the area was based on the percentages for surrounding areas, calculated from 2011 JTW and HTS data. The proposed mode shares for the area by land use, trip purpose and time of day are shown in Table 5.17. The corresponding all-purpose mode share for Wollondilly LGA from the 2010-2011 HTS data is provided for comparison.

Table 5.17 Mode share of trips (all purposes)

Transport mode	Daily	AM peak	PM peak	Daily HTS data for Wollondilly ¹
Vehicle Driver	68%	60%	65%	60%
Vehicle Passenger	15%	19%	17%	21%
Train	2%	3%	3%	2%
Bus	4%	6%	4%	5%
Walk	10%	10%	11%	9%
Cycle	1%	1%	1%	2%
Total	100%	100%	100%	100%

(1) From: Bureau of Transport Statistics: 2010/11 Household Travel Survey (HTS), five years pooled

The resulting number of trips for the Wilton Junction Development for the AM peak, PM peak and typical weekday are shown in Table 5.18.

Table 5.18 Vehicle trip numbers (production and attraction) by land use and time period

Land use		Daily		AM peak hour		PM peak hour	
		In	Out	In	Out	In	Out
Residential	Work	10,481	10,481	1,021	4,085	2,317	772
	Education	382	382	68	270	116	39
	Shopping	9,201	9,201	333	1,333	1,901	634
	Other	8,635	8,635	252	1,007	1,943	648
	Local Primary School + Other	1,854	1,854	182	182	259	259
Retail	Bulky	2,935	2,935	0	0	289	289
	Small	8,302	8,302	291	291	582	582
	Large	4,649	4,649	231	154	385	385
Employment		8,849	8,849	3,783	1,261	544	3,084
Business park		956	956	0	0	28	156
Total		56,245	56,245	6,161	8,584	8,365	6,847

Trip distribution

The trip distribution for trips external to from the Wilton Junction development was determined from the STM model. Table 5.19 shows the directional splits to and from Wilton in the AM and PM peaks.

Table 5.19 Trip direction based on STM model results

Direction	Out of Wilton		Into Wilton	
	AM peak	PM peak	AM peak	PM peak
Hume Highway (north)	47%	49%	48%	48%
Hume Highway (south)	11%	7%	7%	10%
Illawarra (east)	23%	16%	16%	21%
Wollondilly LGA (Picton, west)	10%	15%	16%	11%
Wollondilly LGA	3%	5%	6%	3%
Wollondilly LGA (north east)	6%	7%	7%	6%
Total	100%	100%	100%	100%

Traffic flows assigned to the road network

The traffic volumes generated by the Wilton Junction Development have been assigned to the road network within the Aimsun models. The resulting traffic flows for the 2024 and 2036 scenarios on the external road network are shown in Figures 5.6 and 5.7 respectively. Traffic flows within the Wilton Junction internal road network are outlined in section 5.9.1.

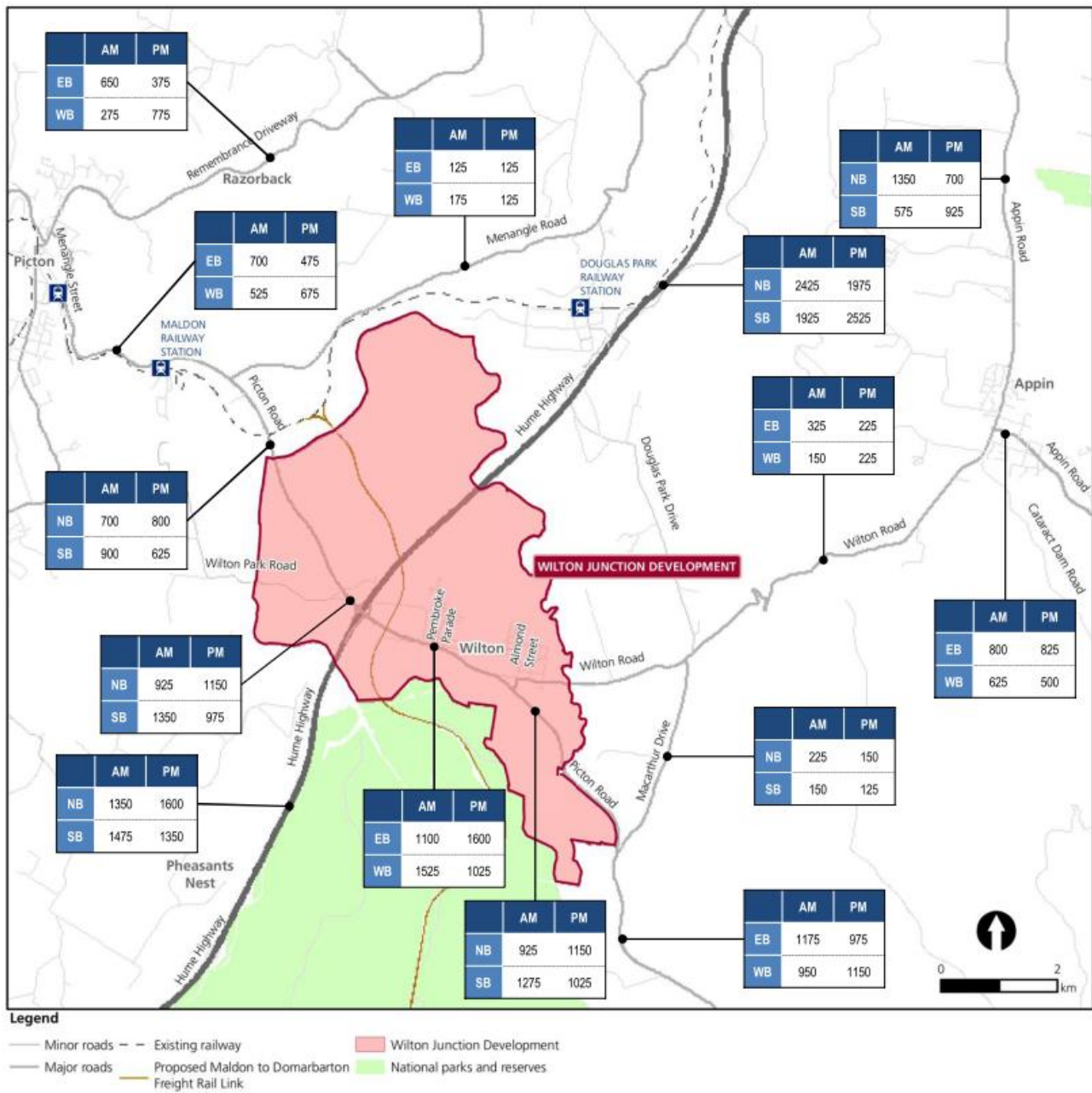


Figure 5.6 External road network flows for 2024 with Wilton scenario (PCUs)

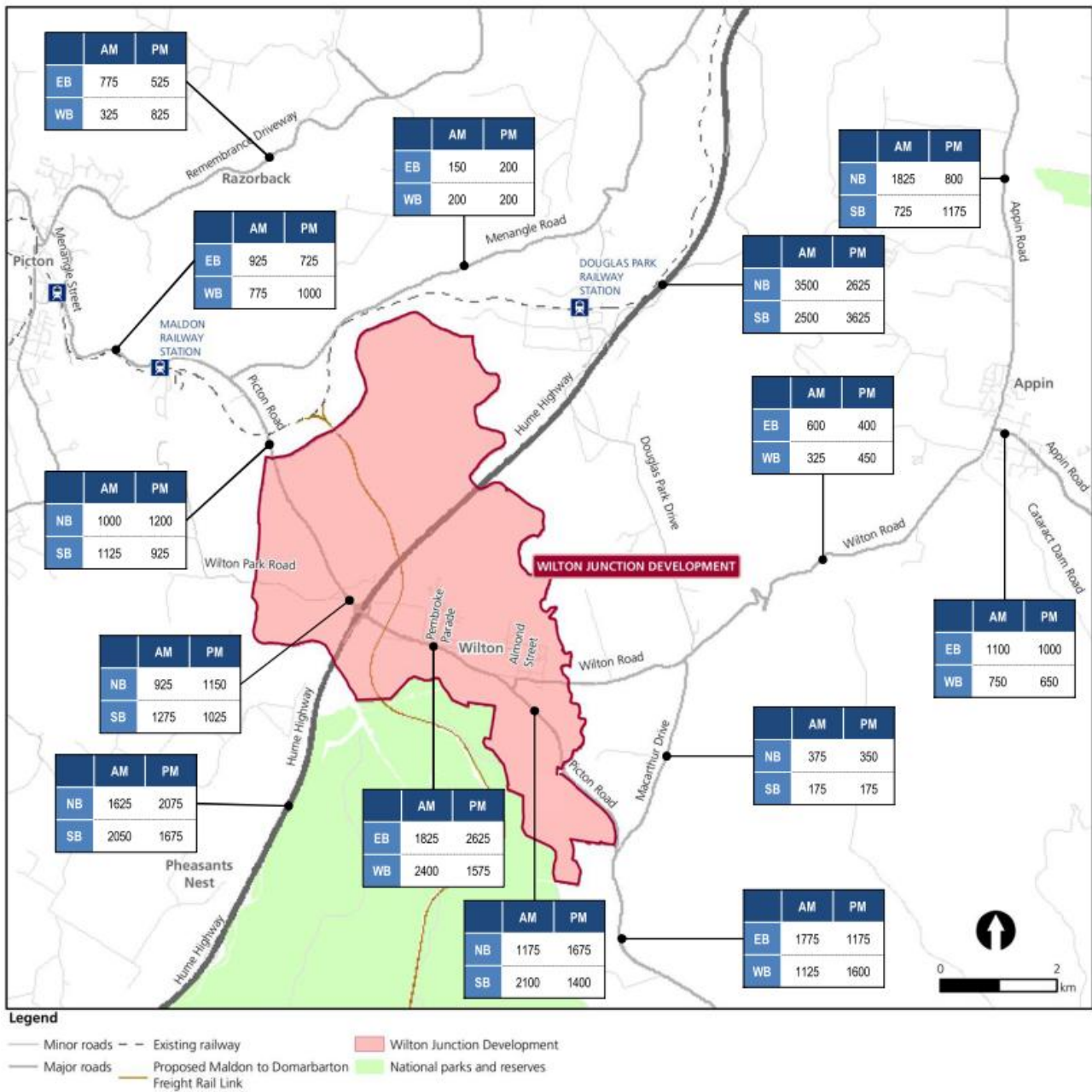


Figure 5.7 External road network flows for 2036 with Wilton scenario (PCUs)

5.8 Wilton Junction Road network

The AIMSUM modelling has been used to develop the road network within Wilton Junction and the interfaces with Picton Road and the Hume Highway. A number of key features are proposed, which seek to maximise local access whilst minimising the impacts on Picton Road and at the Picton Road/Hume Highway Interchange.

The road network for the Project has been developed based on the need to:

- separate state road traffic (Picton Road and Hume Highway) from local (internal) traffic
- provide a permeable network that reduces travel distances
- slow traffic as it moves through the village centre to improve amenity and pedestrian safety
- match road capacity and standard to the anticipated traffic volume
- facilitate access for trucks to employment lands without having to travel past residential properties
- enable the movement of bus services through the network
- enable and promote walking and cycling as a transport mode for short trips
- use minor local streets for short streets only.

Based on the above principals the key components of the proposed road network include:

1. Hume Highway/Picton Road upgrade
2. internal connector road
3. north facing ramps
4. upgrades to Picton Road east
5. grade separation at Almond Street.

Figure 5.8 shows the location of these key components.

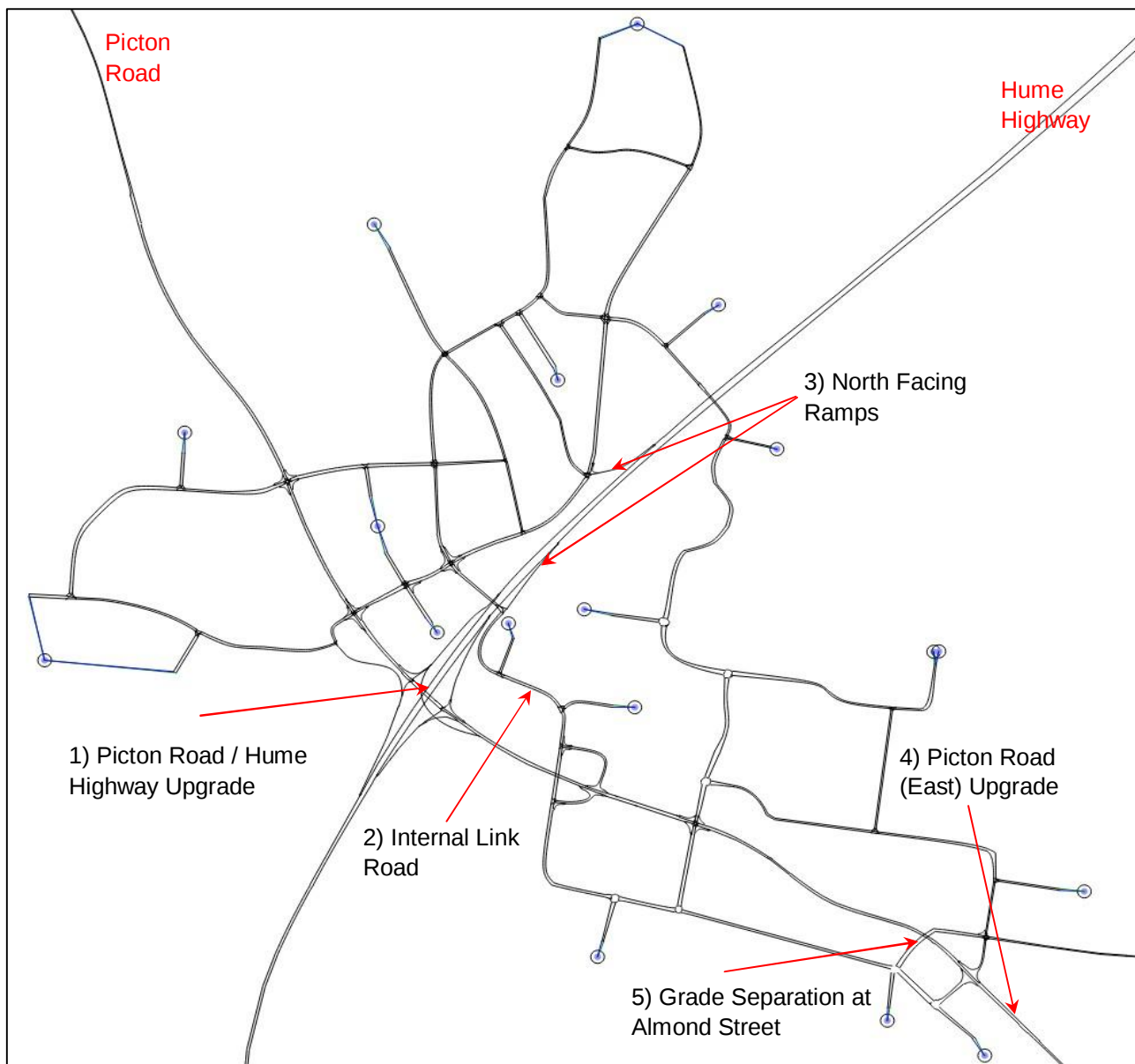


Figure 5.8 Key components of the proposed Wilton Junction road network

Hume Highway/Picton Road upgrade

An upgrade of the Hume Highway/Picton Road Interchange is currently being considered by RMS. The existing interchange has safety issues (see section 2.7) and capacity issues during peak times. Recognising that this interchange needs upgrading, RMS recently applied for Infrastructure Australia funding to upgrade this interchange. RMS has undertaken some preliminary modelling work at this location and has considered a number of different upgrade options. However a preferred option is yet to be identified.

Under the 'with Wilton Junction' scenario, it is proposed that the interchange will need to be upgraded, regardless of whether Wilton Junction proceeds or not. However, a configuration different to that included in the Infrastructure Australia funding application is proposed. The proposed upgrade seeks to provide free flow movements to/from the north/east which is currently (and expected to remain in 2036) the largest car and truck movement using the interchange.

The Infrastructure Australia funding application configuration would require an additional bridge to be constructed over the Hume Highway. The proposed design shown in Figure 5.9 maintains the current bridge

whilst allowing for future widening if required. It includes a new elevated ramp for the westbound to northbound movement that caters for freight traffic from Sydney to Port Kembla. It also includes two new sets of traffic signals. However the westbound to northbound ramp diverges before the new signals, avoiding delay to freight and general traffic.

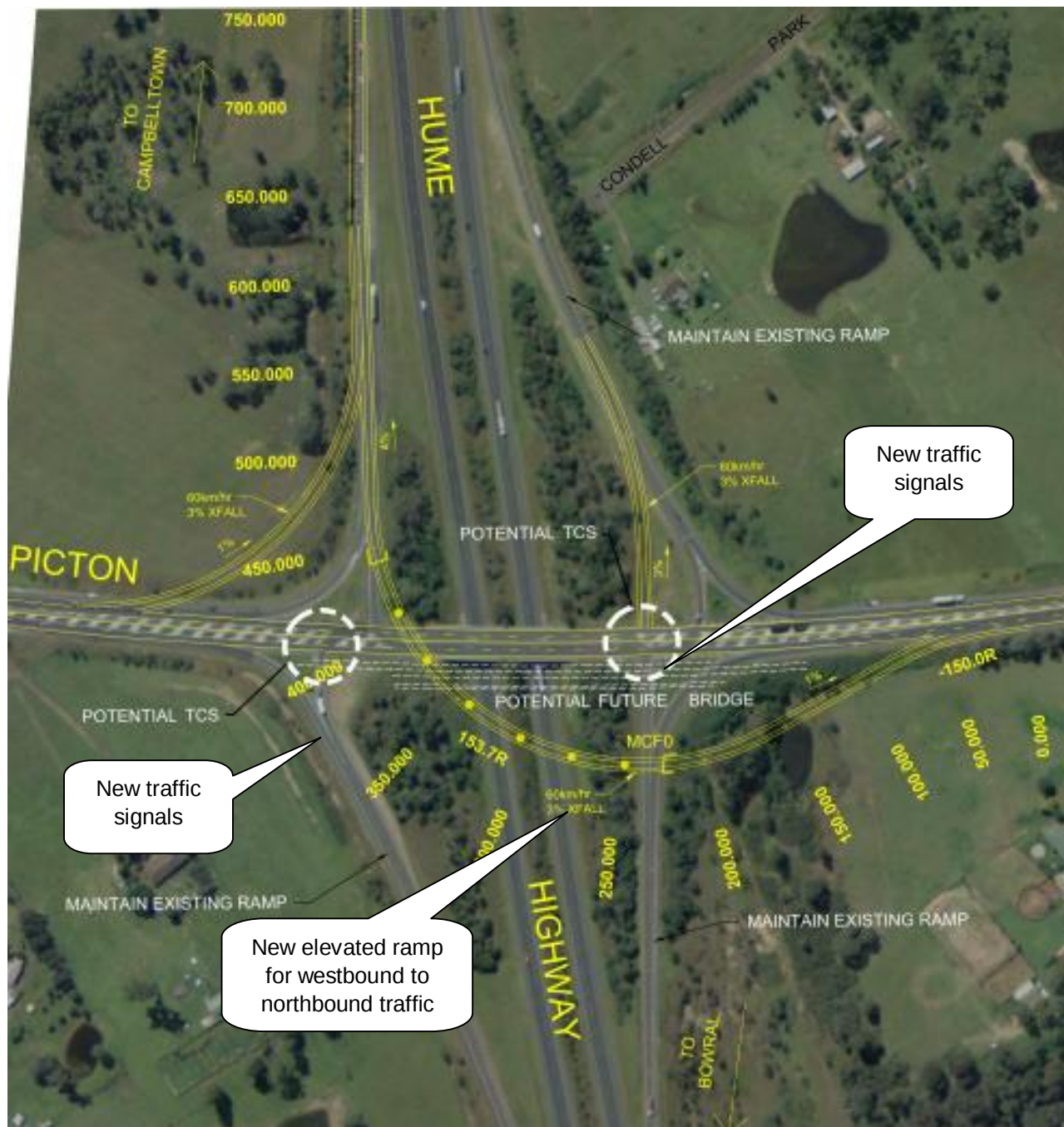


Figure 5.9 Proposed Hume Highway/Picton Road interchange upgrade

The Hume Highway/Picton Road Interchange shown in Figure 5.9 has been included in the Aimsun model. The configuration included in the model, shown in Figures 5.8 and 5.10, allowed for free-flow movement from Picton Road westbound to the Hume Highway northbound, but required this traffic to pass through the new traffic signals. The switch to the new layout is not expected to have a significant influence on the traffic volumes using the interchange.

Internal Link Road

With a high level of job/trip containment expected within Wilton Junction, the need for a strong internal connector road is imperative. The proposed internal link road connects three of the land quadrant (dissected by the Hume Highway and Picton Road), allowing residents to travel within Wilton without the need to use Picton Road.

Grade separation across the Hume Highway and Picton Road maintains the integrity for longer and more strategic trips, such as the freight movement to Port Kembla. This provides a significant benefit to internal trips which can move around Wilton without delaying vehicles on the Hume Highway and Picton Road.

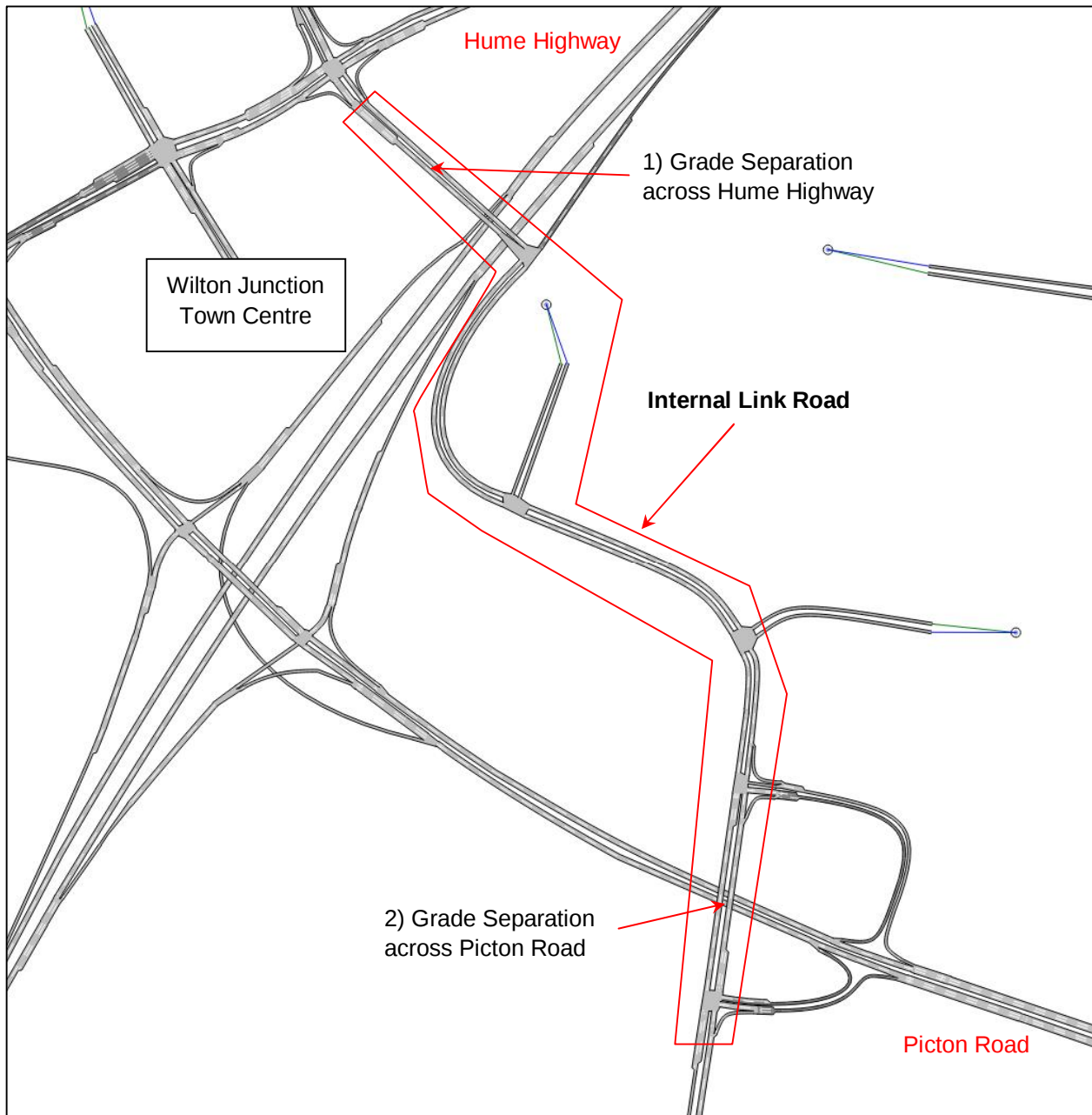


Figure 5.10 Proposed internal link road

North-facing ramps from Wilton Junction to Hume Highway, north of Picton Road

The north facing ramps provide access for Wilton Junction to and from the Hume Highway (north) without the need to use the Picton Road/Hume Highway Interchange, thereby preserving more capacity at this interchange for regional and strategic traffic. The north facing slips roads also link with internal link road helping to minimise travel distance (reduce vehicle kilometres of travel) throughout Wilton, whilst providing direct access to Wilton Town Centre.

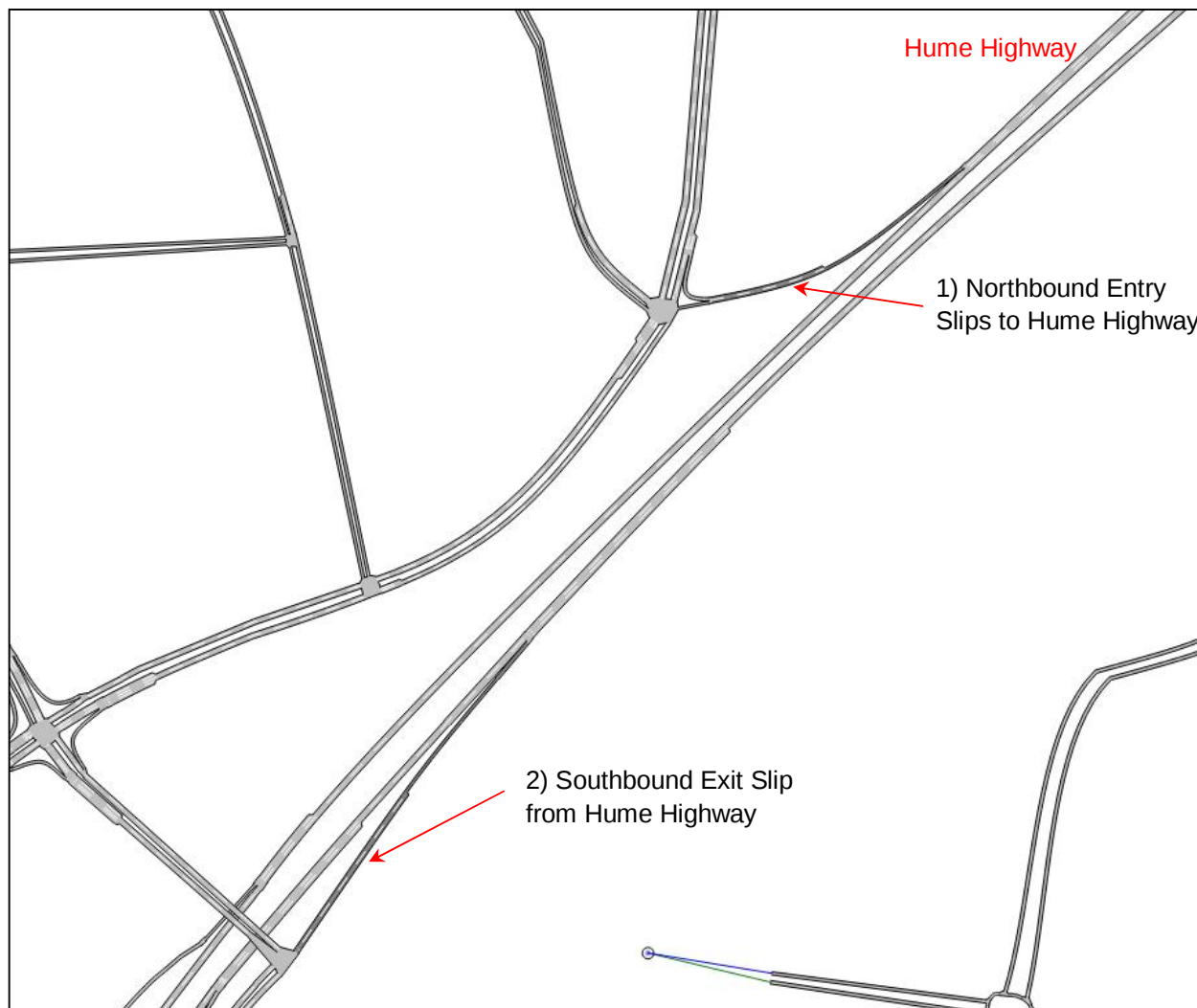


Figure 5.11 Proposed north-facing ramps to the Hume Highway

Grade separation at Almond Street

In order to preserve the integrity of Picton Road it is proposed to make Almond Street left-in-left-out, whilst providing a new grade separated link across Picton Road. The grade separation also links with the Wilton Junction internal link road.

Picton Road upgrade

The upgrading of Picton Road to two lanes in each direction (between Wilton Park Road and Macarthur Drive) is assumed to occur by 2026 based on RMS' Picton Road Safety Improvement Program. Modelling for the future base and with Wilton Junction scenarios indicates that this should occur before this year.

5.8.1 Wilton Junction road hierarchy

Based on the forecast traffic volumes for the AM and PM peaks, the access requirements and the principals outlined in section 5.8 and incorporating the key infrastructure components, the road hierarchy for Wilton Junction was developed. Figure 5.12 shows the proposed road hierarchy.

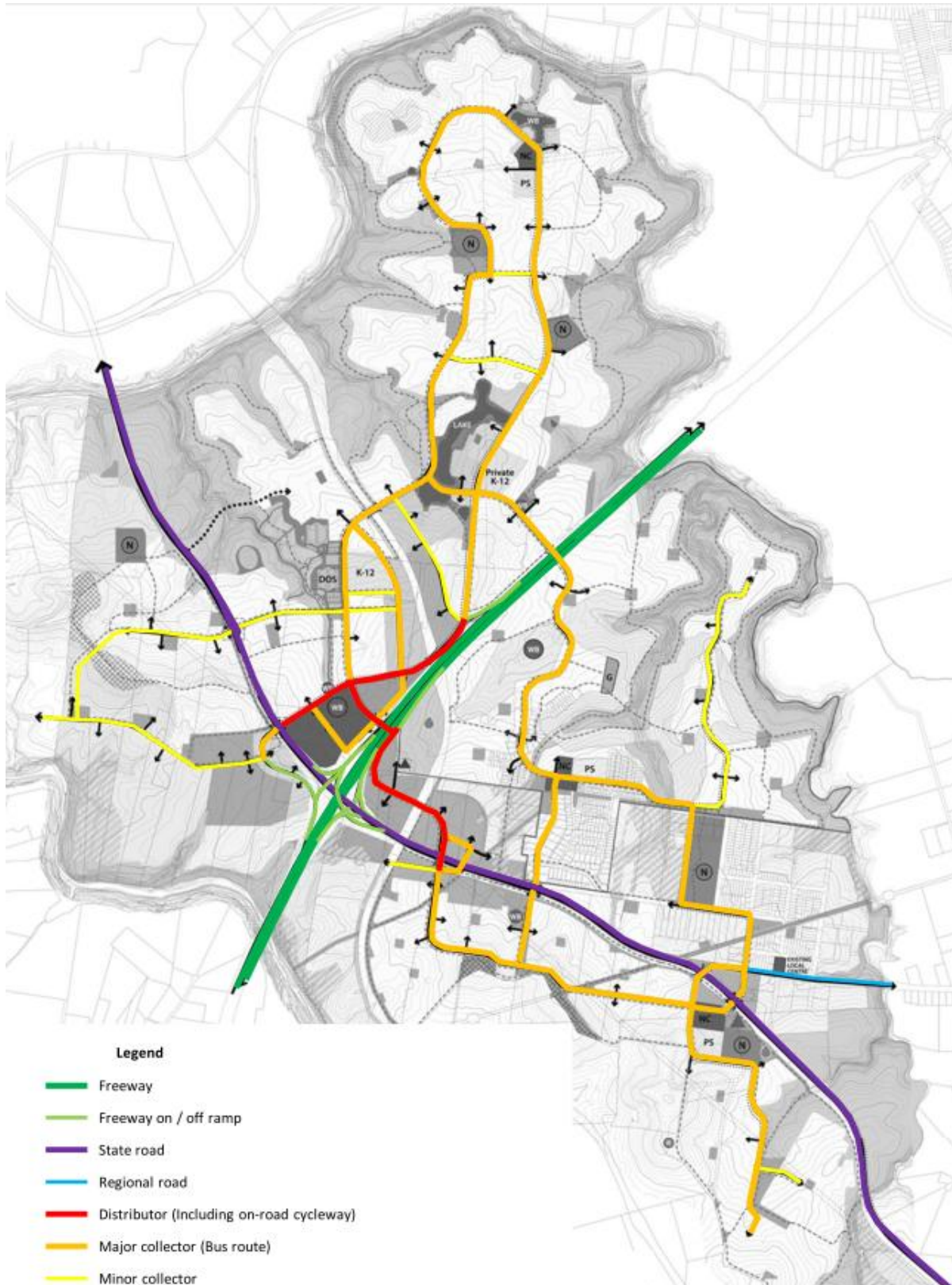


Figure 5.12 Internal road hierarchy

To provide enough capacity between intersections, some of the busiest road links within the development would require three traffic lanes in each direction. The number of lanes required for safe and efficient road network operation would be proactively provided to accommodate demand, determined by further detailed modelling at the Development Application stage of the project. As a minimum roads within the development would have one traffic lane in each direction plus parking, but would be constructed with sufficient width to be converted to two traffic lanes in each direction in the future.

5.9 Street design

The typical street cross-sections within Wilton Junction have been designed based on the RMS and Wollondilly Shire Council standards. Indicative street sections are provided in Table 5.20. These street types relate to the road hierarchy indicated in Figure 5.12.

Table 5.20 Indicative street cross-sections

Road type and dimensions	
SUB ARTERIAL - 6 LANE	
SUB ARTERIAL - 4 LANE	
DISTRIBUTOR ON ROAD CYCLEWAY - TYPE 1	
COLLECTOR BUS ROUTE - TYPE 4	
COLLECTOR - TYPE 7	

Source: BG&E Civil Engineering, June 2014

Basic design elements for internal roads include:

- Lane width = 3.0 m to 3.5 m
- Kerbside parking lane width = 3.0 m
- On-street cycle lane width = 1.5 m
- Verge width = 4.0 to 4.5 m
- Footpath width = 1.2 m.

Streets within the town centre could have a carriageway width based on the 'Distributor on road cycleway' street type, enabling use by buses and cyclists and on-street parking. Footpaths in the town centre would generally be wider to cater for the higher numbers of pedestrians and footpath activity. A road safety audit would be undertaken during the detailed design process to eliminate safety issues before construction.

5.9.1 Forecast traffic volumes within Wilton Junction

Forecast 2024 and 2036 traffic volumes with Wilton Junction in place are shown in Figures 5.13 to 5.16.

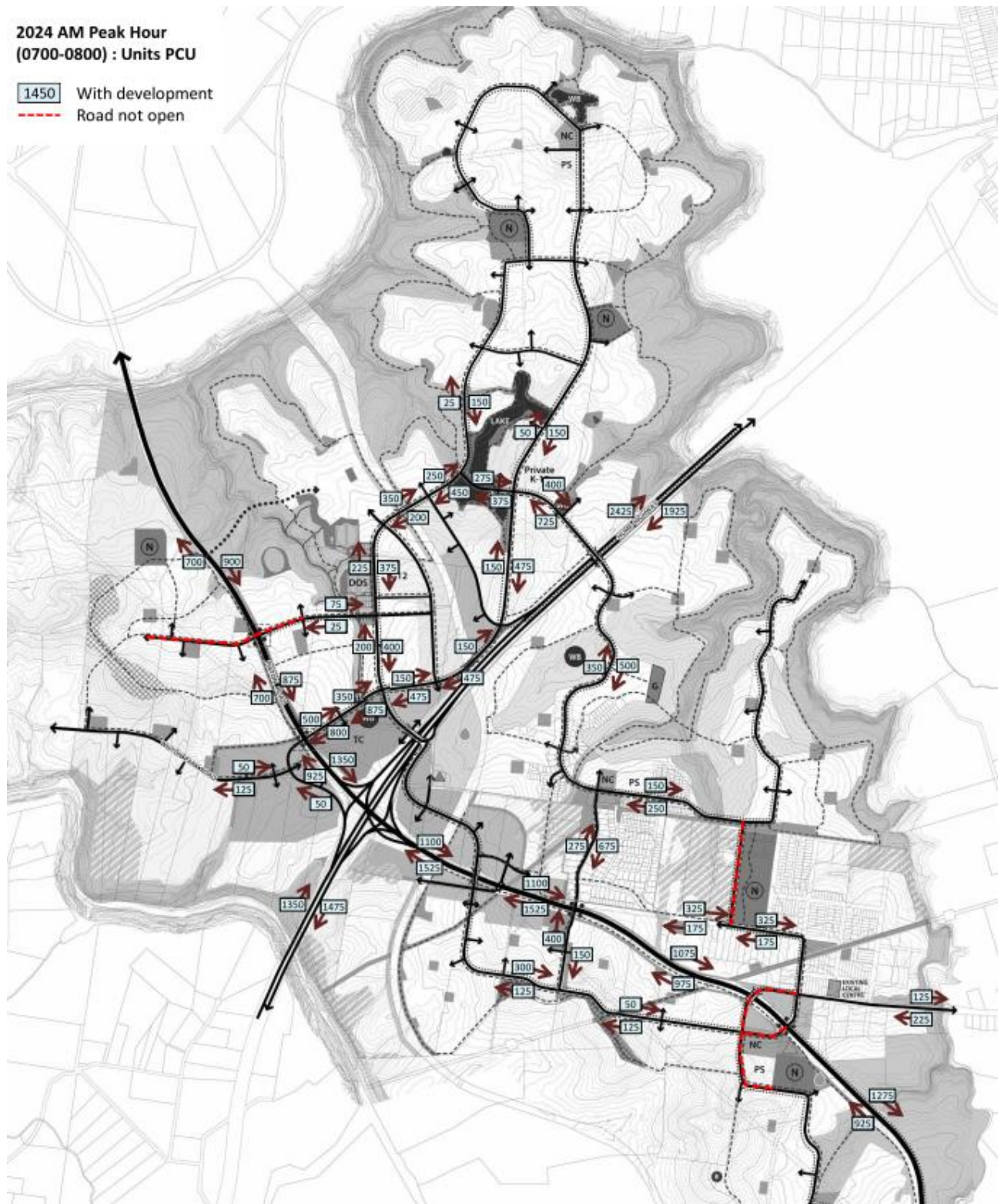


Figure 5.13 Internal road network flows for 2024 AM peak hour with Wilton scenario (PCUs/hr)

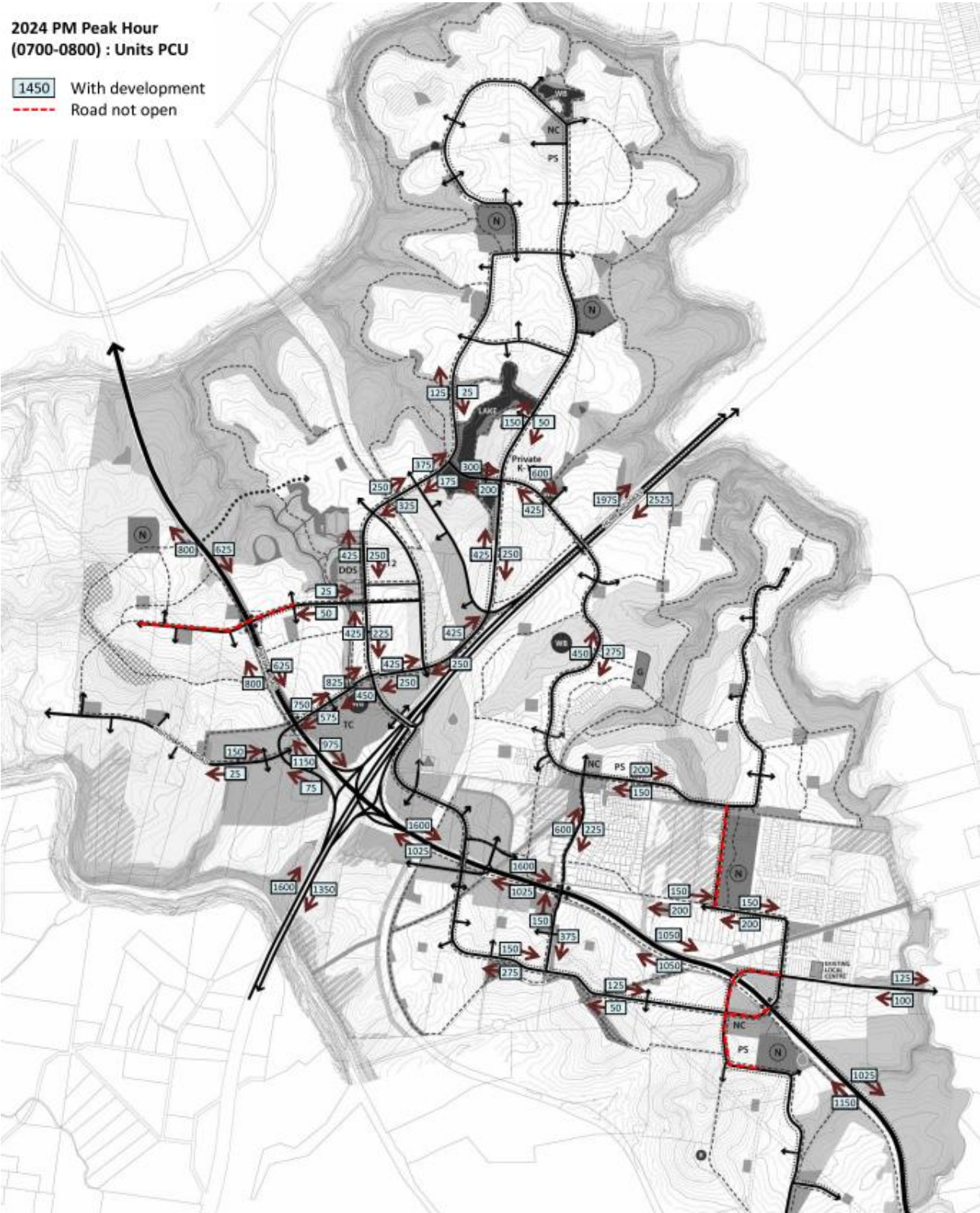


Figure 5.14 Internal road network flows for 2024 PM peak hour with Wilton scenario (PCUs/hr)

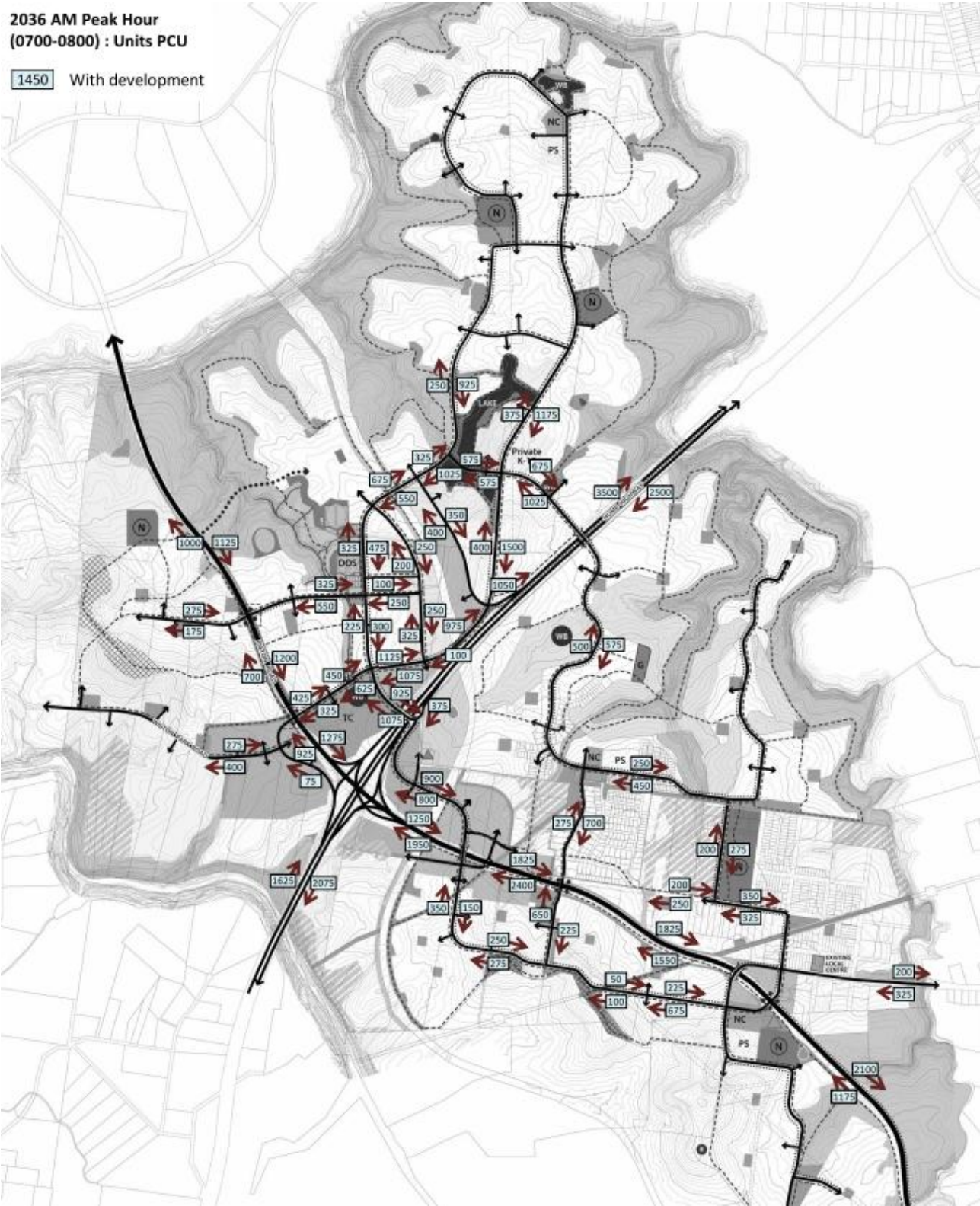


Figure 5.15 Internal road network flows for 2036 AM peak hour with Wilton scenario (PCUs/hr)

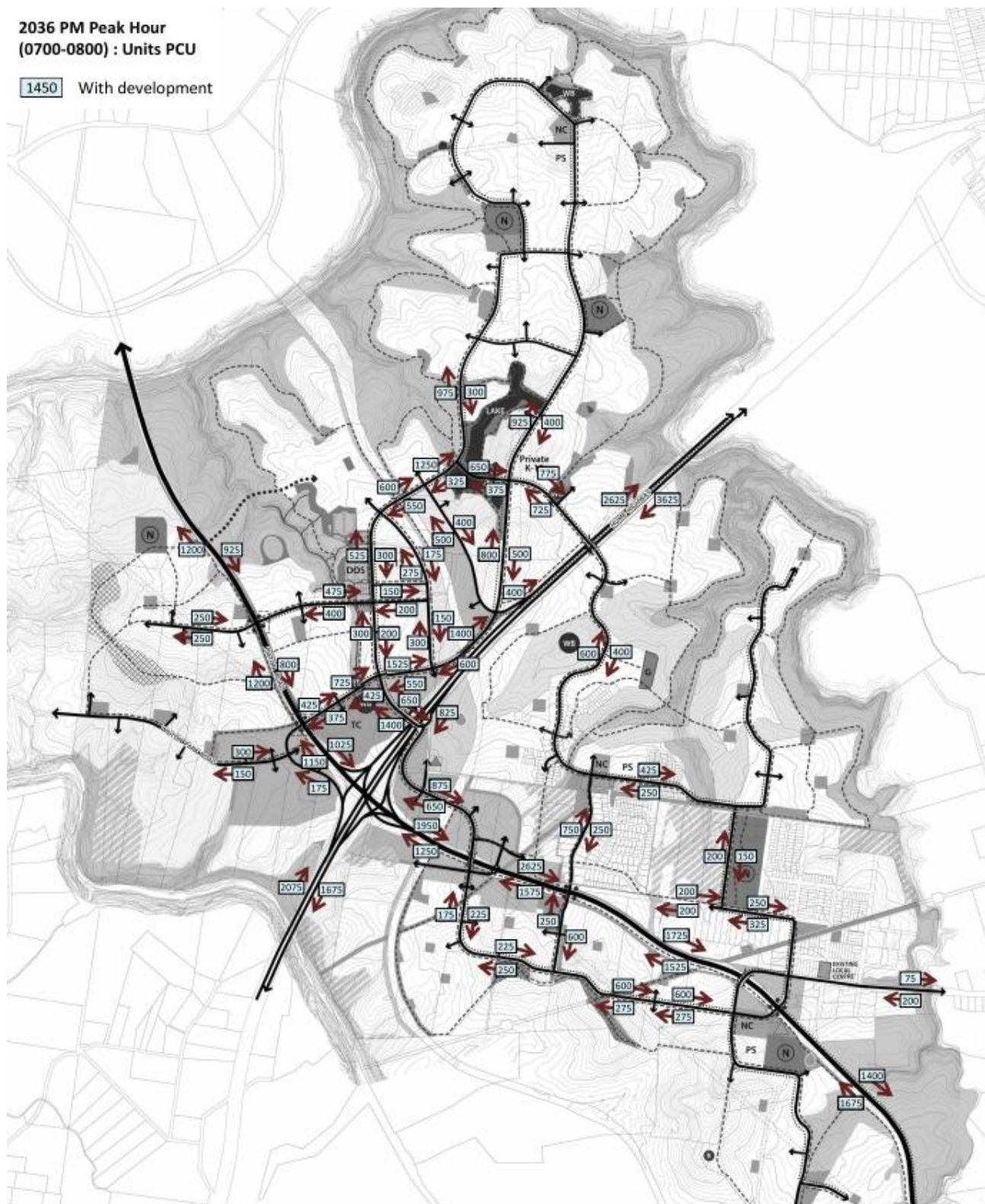


Figure 5.16 Internal road network flows for 2036 PM peak hour with Wilton scenario (PCUs/hr)

5.10 With-Wilton Junction network performance

The mid-block levels of service have been estimated using the same Austroads lane capacities for different types of roads, to assess the impact of the Wilton Junction Development. Table 5.21 shows the traffic volumes forecast by Aimsun for the 'with-Wilton' scenarios, assuming the required infrastructure (described in this section) is in place.

Table 5.21 Traffic volume forecasts (pcu/h) for 2013 existing and future ‘with Wilton’ scenarios

Intersection	Direction	2013 Modelled		2024 with Wilton		2031 with Wilton		2036 with Wilton	
		AM peak	PM peak	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
Hume Highway, north of Picton Road	Northbound	1,850	1,450	2,425	1,975	3,150	2,475	3,500	2,625
	Southbound	1,525	1,725	1,925	2,525	2,350	3,250	2,500	3,625
Hume Highway, south of Picton Road	Northbound	1,175	1,200	1,350	1,600	1,525	1,900	1,625	2,075
	Southbound	1,150	1,200	1,475	1,350	1,900	1,550	2,075	1,675
Picton Road, at Nepean River bridge	Eastbound	325	650	900	625	1,000	850	1,125	925
	Westbound	600	350	700	800	900	1,025	1,000	1,200
Picton Road west of Hume Highway	Eastbound	625	375	1,350	975	975	725	1,275	1,025
	Westbound	350	650	925	1,150	700	900	925	1,150
Picton Road east of Hume Highway	Eastbound	900	825	1,100	1,600	1,150	1,600	1,250	1,950
	Westbound	975	800	1,525	1,025	1,175	1,125	1,950	1,250
Picton Road east of Pembroke Parade	Eastbound	750	750	1,075	1,050	1,600	1,575	1,825	1,725
	Westbound	800	575	975	1,050	1,400	1,400	1,550	1,525
Picton Road east of Almond Street	Eastbound	800	725	1,275	1,025	1,900	1,275	2,100	1,400
	Westbound	750	650	925	1,150	1,075	1,575	1,175	1,675
Picton Road east of Macarthur Drive	Eastbound	800	700	1,175	975	1,700	1,100	1,775	1,175
	Westbound	775	650	950	1,150	1,100	1,500	1,125	1,600
Wilton Road, at Broughton Pass	Northbound	50	100	325	225	500	325	600	400
	Southbound	50	100	150	225	250	375	325	450

The mid-block Level of Service for the road links analysed has been assessed based on the on standard Austroads lane capacities for different types of roads shown in Table A.2 and the traffic volumes shown in Table 5.21. The results are provided in Table 5.22.

Table 5.22 Summary of link performance for 2013 existing and future 'with Wilton' scenarios

Intersection	Road type	Direction	2013 Modelled		2024 with Wilton		2031 with Wilton		2036 with Wilton	
			AM peak	PM peak	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
Hume Highway, north of Picton Road	Freeway	Northbound	B	A	C	B	C	C	D	C
		Southbound	A	B	B	C	B	C	C	D
Hume Highway, south of Picton Road	Freeway	Northbound	A	A	A	B	A	B	B	B
		Southbound	A	A	A	A	B	B	B	B
Picton Road, at Nepean River bridge	2-lane 2-way	Combined	C	C	D	D	E	E	E	E
Picton Road west of Hume Highway	Multi-lane arterial	Eastbound	A	A	B	A	C	B	C	C
		Westbound	A	A	A	B	B	C	C	C
Picton Road east of Hume Highway	Multi-lane arterial	Eastbound	A	A	A	B	B	B	B	C
		Westbound	A	A	B	A	B	B	C	B
Picton Road east of Pembroke Parade	Multi-lane arterial	Eastbound	D	D	A	A	B	B	C	B
		Westbound			A	A	B	B	B	B
Picton Road east of Almond Street	Multi-lane arterial	Eastbound	D	D	B	A	C	B	C	B
		Westbound			A	B	A	B	B	B
Picton Road east of Macarthur Drive	2-lane 2-way	Combined	D	D	E	E	E	E	E	E
Wilton Road, at Broughton Pass	One lane bridge	Combined	E	E	A ¹	A ¹	B ¹	B ¹	C ¹	C ¹

(1) Cataract River Bridge at Broughton Pass widened to one lane in each direction

With the additional Wilton Junction traffic, the capacity of Broughton Pass (with its 'One vehicle at any one time' restriction) is likely to be exceeded before 2024. Other upgrades, such as the widening of Picton Road are likely to be required sooner than they would for the future without Wilton Junction Development scenarios.

Traffic modelling indicates that the Hume Highway, north of the new north-facing ramps for Wilton Junction would be operating close to, but still within acceptable performance criteria (Level of Service D).

5.10.1 Impact of PCU factor

The Aimsun model was developed based on the assumption that the range of heavy vehicle sizes would result in the approximation that:

- one light vehicle equals one PCU
- one heavy vehicle equals two PCUs.

The Roads and Maritime Services *Traffic Modelling Guidelines (Version 1 February 2013, Section 10: Highway Assignment Modelling)*:

- one passenger car equals one PCU
- one light commercial vehicle equals one PCU
- one rigid heavy equals two PCUs
- one bus equals two PCUs
- one articulated truck equals four PCUs.

Classified traffic counts supplied by RMS following the development of the Aimsun model indicate an average number of PCUs per heavy vehicle of approximately three on both the Hume Highway and Picton Road.

As a sensitivity test, the mid-block Levels of Service have been recalculated based on the assumption that one heavy vehicle equals three PCUs. The results are shown in Appendix D. The impact of the change in PCU factor is summarised below:

- all roads are generally within the same Level of Service as the original PCU factor
- the Hume Highway remains at Level of Service D – i.e. it remains within acceptable performance parameters regardless of the PCU factor used
- some upgrades are required sooner, such as Picton Road east of Pembroke Parade.

The traffic analysis undertaken for the mid-block analysis for the future base, shown in section 5.4 indicates that, with the assumption of the 2 PCU conversion factor for heavy vehicles, Picton Road east of Pembroke Parade would require upgrading in 2021 with no Wilton Junction Development. With the Wilton Junction Development, the upgrade would be required in 2018.

The sensitivity tests using the 3 PCU factor indicates that Picton Road, east of Pembroke Parade would reach the limit of Level of Service D performance based on current traffic volumes, and reach Level of Service E east of Almond Street in the eastbound direction during the morning peak. It would require upgrading in the next few years regardless of the Wilton Junction development.

The traffic modelling undertaken is still considered a robust assessment of the impacts of the Wilton Junction development. It is noted that as a predominantly residential, retail and town centre development, the trip generation of trucks from Wilton Junction is expected to be small, and therefore the PCU factor used does not have a large effect on the amount of impact the development has on the road network.

5.10.2 Access and internal intersections

An access strategy has been sought that balances between permeability, impacts on arterial traffic flow and protecting the development streets from high levels of through traffic. The access arrangements and the proposed intersection controls within the internal road network are shown in Figure 5.17.

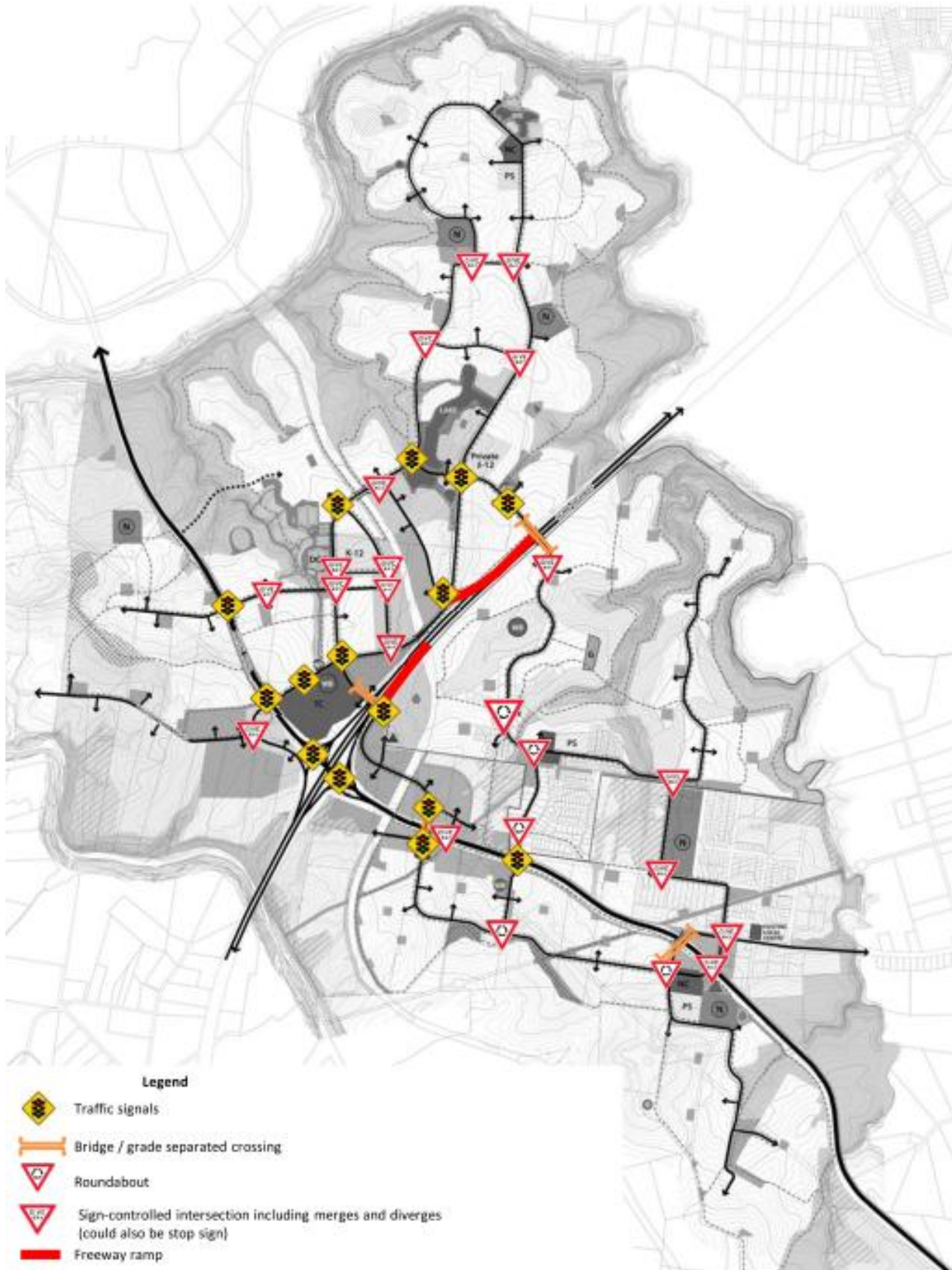


Figure 5.17 Access locations and intersection control

Intersection performance

Table 5.23 shows the performance of key intersections within the study area for the 2024 with-Wilton scenario for both peak hours. The results show that the proposed road infrastructures would be able to cater for the Wilton development in 2024. The signalisation of the intersections of Picton Road with Wilton Park Road, Pembroke Parade and Almond Street would be required.

Table 5.23 Intersection performance for 2024 with Wilton scenario in the AM and PM peak hours

Intersection	Control	AM peak (07.00–08.00)		PM peak (16.45–17.45)	
		Ave. delay (sec/veh)	LoS	Ave. delay (sec/veh)	LoS
Hume Highway/Picton Road (Eastern intersection) ²	signals	18	B	17	B
Hume Highway/Picton Road (Western intersection) ²	signals	8	A	10	A
Picton Road/Wilton Park Road ²	signals	27	B	29	B
Picton Road/Pembroke Parade ²	signals	25	B	28	B
Picton Road/Almond Street ²	signals	10	A	11	A
Internal link Road/Wilton Park Road extension	signals	20	B	18	B
Picton Road/Macarthur Road ¹	give-way	14	B	10	A

(1) priority controlled intersections, LoS and average delay reported is for the worst performing approach

(2) signalised intersection, LoS and average delay reported is for the average of all movements based on traffic volume

Table 5.24 shows the forecast intersection performance for the 2036 'with Wilton' scenario.

Table 5.24 Intersection performance for 2036 with Wilton scenario in the AM and PM peak hours

Intersection	Control	AM peak (07.00–08.00)		PM peak (16.45–17.45)	
		Ave. delay (sec/veh)	LoS	Ave. delay (sec/veh)	LoS
Hume Highway/Picton Road (Eastern intersection) ²	signals	19	B	17	B
Hume Highway/Picton Road (Western intersection) ²	signals	8	A	9	A
Picton Road/Wilton Park Road ²	signals	29	C	36	C
Picton Road/Bradcorp Access Road ²	signals	25	B	26	B
Picton Road ramp/Walker Corp new Bridge (Northern intersection) ²	signals	3	A	5	A
Picton Road ramp/Walker Corp new Bridge (Southern intersection) ²	signals	16	B	14	A
Picton Road/Pembroke Parade ²	signals	24	B	24	B
Picton Road/Almond Street ¹	give-way	14	A	12	A
Internal link Road/Wilton Park Road extension	signals	24	B	25	B
Internal link Road/New south facing off-ramp	signals	14	A	19	B
Internal link Road/New north facing on-ramp	signals	14	A	11	A
Picton Road/Macarthur Road ¹	give-way	25	B	13	B

(1) priority controlled intersections, LoS and average delay reported is for the worst performing approach

(2) signalised intersection, LoS and average delay reported is for the average of all movements based on traffic volume

The Aimsun and SIDRA modelling for 2036 shows that the proposed road network would adequately accommodate the traffic generated and attracted to the proposed development at Wilton Junction without any performance issues.

Highway Capacity Manual (HCM) analysis

HCM analysis has been undertaken to determine if the proposed arrangements for on and off ramp connections to the Hume Highway perform from an operational perspective. The HCM analysis considers a number of variables including traffic volumes, gradients, ramp lengths, ramp spacing and design speed. The HCM analysis shows the following operational LoS results:

- northbound:
 - ▶ the main carriageway is expected to operate at LoS D downstream of the two entry ramps
 - ▶ the proposed entry ramp (with Wilton Junction) is expected to operate at LoS D at the merge
 - ▶ the Picton Road entry ramp is expected to operate at LoS C
- southbound:
 - ▶ the main carriageway is expected to operate at LoS D upstream of the two exit ramps
 - ▶ the new exit ramp expected to operate at LoS D at the diverge
 - ▶ the Picton road entry ramp is expected to operate at LoS C at the diverge.

The HCM analysis can be found in Appendix E.

5.11 Infrastructure staging

Parsons Brinckerhoff has assessed the appropriate road infrastructure staging for Wilton Junction. To assist with this analysis, Aimsun models for design years (2013, 2024, 2031 and 2036), as well as SIDRA modelling was undertaken to determine when certain parts of the infrastructure would be required (with interpolating between different design years).

Table 5.25 and Figure 5.18 show how the infrastructure would be staged over time, including the approximate year which the infrastructure will be required, as well as the approximate number of dwellings assumed. The infrastructure staging may change depending on the rate and location of development within Wilton Junction.

The upgrade of the Hume Highway/Picton Road interchange could be undertaken in a staged process, with the installation of the traffic signals by 2015 and the addition of the flyover ramp between 2017 and 2019.

During the early stages of development, opportunities would be considered to improve interim pedestrian and cycling connections between the Town Centre and areas to the east of the Hume Highway, to both the north and south of Picton Road.

Table 5.25 Proposed road infrastructure staging for Wilton Junction

Percentage of dwellings built	Approximate year	Road upgrades
5%	2015	■ Hume Highway/Picton Road Interchange – preliminary upgrade ■ Pembroke Parade/Picton Road intersection signals ■ Wilton Park Road/Picton Road intersection signals ■ Wilton Park Road to Governor's Hill land release ■ Almond Street/Picton Road intersection preliminary ■ Connection of Bradcorp land to Pembroke Parade ■ Connection of Walker Corp land to Pembroke Parade ■ Pembroke Parade pedestrian bridge
20%	2021	■ Picton Road widening east of Pembroke Parade ■ Connection of Bradcorp land to Wilton Park Road
40%	2024	■ Hume Highway/Picton Road Interchange – full upgrade ■ Internal link road ■ North-facing ramps ■ Grade separation over Picton Road between Hume Highway Interchange and Pembroke Parade)
50%	2028	■ Picton Road widening west to western edge of site ■ New access intersection on Picton Road, west of Wilton Park Road, and intersection signals ■ Extension of internal collector roads
65%	2031	■ Extension of internal collector roads

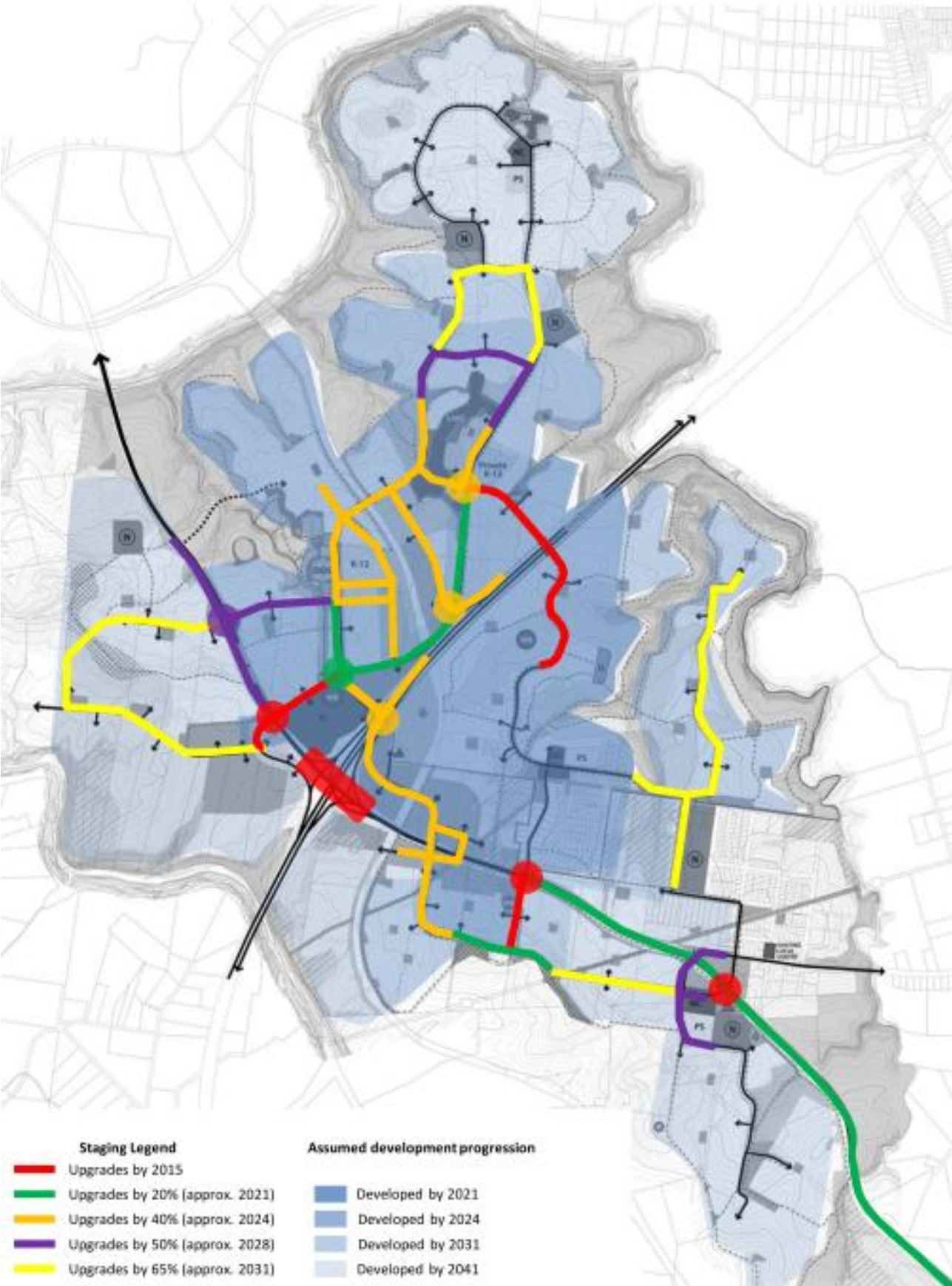


Figure 5.18 Proposed road infrastructure staging for Wilton Junction

6. Public transport, pedestrians, cyclists and parking

The Wilton area currently has a lack of public transport services that reinforces the reliance on car-based travel for the majority of trips. The magnitude of the Wilton Junction Development offers the opportunity to provide high-quality alternative transport services and infrastructure to substantially change the travel behaviour of residents and workers.

The public transport strategy seeks to strengthen connections to rail at stations with frequent services, to connect Wilton to the surrounding regional centres and to promote the self-sufficiency of Wilton Junction. Within the Development sites, footpaths and shared cycle paths and lanes, and on-street cycle lanes would be provided along with public bicycle parking facilities. The provision of parking in the Development will also support sustainable travel behaviour. The provision of Park-and-Ride facilities will encourage the use of public transport. The sensible positioning of off-street parking will discourage multi-trips and encourage walking within the town centre (described below).

6.1 Connections to rail services

Southern Highlands Line train services are available at Picton and Douglas Park, but with no plans to increase the frequency of services in Sydney's Rail Future, Campbelltown and Macarthur are likely to remain the most important stations for residents of Wilton Junction by rail. Opportunity exists to influence how people get to these stations through the provision of a Park-and-Ride area near the bus interchange and express bus services.

Due to the way the transport mode is recorded in the JTW and HTS data sets, people using the train are recorded as train regardless of how they get to the station. An analysis of the detailed mode tables within the 2011 JTW data indicates that, for train passengers from Camden, Campbelltown, Wollondilly LGAs, excluding people who walked to the station (unlikely from Wilton Junction), the access modes used were:

- Bus to Rail 20%
- Car driver to Rail 62%
- Car passenger to Rail 16%
- Other mode to Rail 2%.

While the percentage for bus to rail was lower for the existing Wilton township, this is due to the limited bus service available. As discussed in section 6.2, an express bus route is planned to offer an efficient connection to Campbelltown and Macarthur Stations, along with a network of connecting local routes.

A Park-and-Ride facility at Wilton Town Centre may encourage residents who do not live within easy walking distance of a bus route to drive to the town centre and use the express bus service to Campbelltown Station rather than driving all the way to Campbelltown. The success of a three-stage journey (car to bus to rail) needs to overcome the penalty of multiple interchanges. This can be achieved through the quality of the interchange facilities at Wilton Junction interchange, efficient timetabling for connecting services and integrated ticketing between bus and rail.

Based on the forecasts of trip numbers outlined in section 5, it is anticipated that up to approximately 410 people could seek to drive to a train station (Park-and-Ride) in 2036 (165 in 2024). The ability to attract people to Park-and-Ride at Wilton Junction could be influenced by the amount of bus priority and the availability of commuter parking at Campbelltown and Macarthur Stations.

6.2 Bus network

The Wilton Junction Landowners Group commissioned Cardno to produce a Public Transport Strategy for the Wilton Junction Development in October 2012. The study considered the current public transport service levels, the current travel behaviour of the area and the future requirements of the Wilton Junction Development. It determined that a target of achieving 10% public transport mode share for all trip types by 2036 should be set for the Development. Its vision for public transport for the Development was that:

The residents and visitors of Wilton Junction will enjoy an accessible, connected public transport network that will be seen as a viable alternative to private car use. Equitable and efficient access to services and facilities will be supported by attractive, practical and convenient public transport and integrated with the active transport network.

It developed a list of guiding principles to be used in planning the future public transport service:

- development of a self-sufficient township
- provision of an integrated and responsive public transport network
- development of urban form and land uses that supports accessible and effective public transport provision
- transport/road network design that provides for accessible, safe and efficient public transport services
- ensuring high quality supporting infrastructure
- appropriate multi-modal integration of transport networks.

The results of the Wilton Junction Public Transport Strategy have been adapted and applied to the currently proposed Development. This has involved revising the service frequencies and external destinations based on the latest traffic modelling. Residential densities of approximately 15 dwellings per hectare and higher around the town centre are considered suitable to support bus services.

Ultimately the planning and implementation of bus services will be undertaken by TfNSW, based on the rate of development in the area to ensure that services are aligned with demand and available road infrastructure.

6.2.1 Types of services

For Wilton Junction, a combination of services is planned to cater for the different types of travel purposes:

- local services
- regional services
- rural services/community transport
- school specials.

Local services

The most important principle for the bus network was seen to be supporting self-sufficiency. This should start with a local service that links residential areas to the nearest district centre and a strategic transport corridor. This local service would focus on the key attractors e.g. the town centre, village centres, community facilities, schools and employment lands.

The first service introduced (from Wilton to Picton) would have both local and regional functions, catering for travel to the regional services and train connections at Picton and facilitating travel between residential areas and the new Wilton Town Centre. Following this, three local bus services would be added as development proceeds. Each route would be introduced once the roads become available and the shops & businesses start to open. As development increases, the frequency and coverage of the service can increase to match demand. The local bus routes would operate to the southern (Walker), eastern (Bingara Gorge), and northern (Bradcorp) developments along the ridge lines.

Regional services

Whilst Wilton Junction will be largely self-supporting, travel to other areas will be required for employment, education and services. The major destinations and their attractions include:

- | | |
|--|--|
| <ul style="list-style-type: none"> ■ Campbelltown <ul style="list-style-type: none"> ▶ Employment ▶ Regional services and shopping ▶ Frequent Sydney Trains services ▶ Health services ■ Picton <ul style="list-style-type: none"> ▶ Employment ▶ Employees for Wilton Junction businesses ▶ Regional services and shopping | <ul style="list-style-type: none"> ■ Macarthur <ul style="list-style-type: none"> ▶ Employment ▶ University/TAFE ▶ Services and shopping ▶ Frequent Sydney Trains services ■ Wollongong <ul style="list-style-type: none"> ▶ Employment ▶ University/TAFE ▶ Beaches/recreation. |
|--|--|

Camden is also an important destination for employment and regional services. However with connecting bus services available from Picton and Campbelltown, a direct service from Wilton is not considered necessary at this stage.

Towns within Wingecarribee Shire may also be sources of employees for Wilton Junction businesses. However, their dispersed nature makes it difficult to sustain a viable bus services on their own. Once travel patterns are established, the bus network for Wilton Junction can be reviewed to tailor the services to the needs of residents, employees and students.

Initially, the public transport strategy proposes to connect Wilton to existing rail services at Picton until the number of passengers justifies additional/longer bus services to Macarthur and Campbelltown Train Stations, where regular train services are available. Three options are available for the bus routes to Campbelltown/Macarthur via the Hume Highway, via Appin Road or via Menangle Road. The route via the Hume Highway is quickest but does not offer the possibility of picking up additional passengers along the way (this helps make the service more viable, and offers the benefits of the improved bus frequency to other areas outside Wilton Junction).

The travel times of these options are⁶:

- Hume Highway: 26 to 28 minutes
- Wilton Road and Appin Road: 30 minutes
- Menangle Road: 36 minutes.

The Wilton Road/Appin Road route requires buses to traverse Broughton Pass with its steep gradients and tight hairpin bends. This route is not considered suitable for bus services in its current form. The Menangle Road route is slower, but would allow the bus services to pick up passengers in Douglas Park, Menangle and Menangle Park.

Based on the strategy outlined in *NSW 2021, a 10 year plan* to increase the percentage of the population living within 30 minutes by public transport of a city or major centre in metropolitan Sydney, the Menangle Road route would not be quick enough, hence the Hume Highway route has been selected as the preferred route.

Rural services/community transport

The existing bus service (with two/three scheduled trips per day) falls within the definition of a rural service. In the future, rural services could be used to connect low patronage areas to the Wilton Junction Town Centre. Options for rural bus services include:

- local fixed route services
- timetabled services operating on a set route with base frequency of 120 minutes
- flexible transport services such as dial-and-ride and divert-on-demand.

In addition to regularly scheduled services, community transport can be used to meet the transport needs of transport disadvantaged people (such as isolated families, the frail aged, younger people with disabilities, and their carers) by connecting them to recreation, shopping, medical care, social services and social contact.

Services every two hours have been used as a starting basis, but the conversion of this service to a flexible service should be considered to meets the needs of rural communities and those requiring community transport.

School specials

Wilton and Bingara Gorge are currently linked to 15 schools by school specials. As the Development proceeds, with additional schools and school children traveling shorter distances, it is anticipated that the focus of school services will change to connecting the local residential areas to the local schools.

Depending on how wide an area the new schools draw students from, some school specials may need to travel to Douglas Park or further afield. Future development may influence school bus requirements to other centres including Bowral, Camden, and Campbelltown. These routes, and the modes of travel, would be at the discretion of TfNSW's School Student Transport Scheme.

Based on the anticipated number of education trips for a population of approximately 35,000, it is anticipated that 15–18 school bus trips could be required both before and after school. This does not include trips to university, which have been included in the regional service calculations to Campbelltown and Wollongong.

⁶ Google Maps approximate travel times for car, for comparison purposes

6.2.2 Bus passenger demand

Based on the trip calculations for Wilton Junction outlined in section 5, the number of bus passengers on local services and heading to/from regional centres has been estimated. The process followed is outlined below:

- total trip generation calculated by land use using the using rates provided section 5.7
- residential trips were divided by trip purpose using HTS data
- the mode share split was applied by trip purpose using a combination of HTS and JTW data, based on the mode shares of surrounding region. The output was numbers of train and bus trips by purpose
- trip direction was estimated based on:
 - ▶ train trips were assumed to travel via Macarthur or Campbelltown Stations to access the rest of the Sydney Trains network with frequent services
 - ▶ local worker trips by bus were assumed to arrive 50/50 from internal sources and Picton
 - ▶ resident work commute bus trips were assigned 50% to internal destinations, 25% to Campbelltown and 25% to Wollongong
 - ▶ education trips were assigned to internal routes for primary and secondary students (assumed 80% education bus journeys), and split 50/50 between Campbelltown and Wollongong for tertiary students (assumed 20% education bus journeys)
 - ▶ retail trips were assigned to local trips (during the weekday peaks)
- access modes for rail were determined based on an analysis from JTW excluding mode combinations that were unlikely from Wilton
- trips to each destination were summarised and used to estimate a trip frequency in each direction
- bus trip numbers were benchmarked against other cities in NSW with similar populations.

The resulting bus trip numbers are shown in Table 6.1. These numbers are approximate based on the above assumptions. Service patterns and frequencies should be reviewed periodically as the development proceeds and travel patterns become established.

Table 6.1 Potential peak hour demand for bus services at different stages of development

Destination	2021	2024	2031	Full development
Local (total)	50	90	140	220
Picton (to Wilton, from Wilton)	10, 5	20, 10	30, 10	50, 20
Campbelltown and Macarthur (to Wilton, from Wilton)	5, 30	10, 60	10, 100	20, 150
Wollongong(to Wilton, from Wilton)	-	5, 50	5, 70	10, 110
School (total)	150	280	450	700

Assuming a target occupancy of 40 passengers per bus, the passenger numbers in Table 6.1 have been converted to numbers of buses (refer Table 6.2). These calculations assume no turnover of seats along the route – i.e. each seat is only used once.

Table 6.2 Potential peak hour bus loads at different stages of development

Destination	2021	2024	2031	Full development
Local (total)	2	3	4	6
Picton (to Wilton, from Wilton)	1, 1	1, 1	1, 1	2, 1
Campbelltown and Macarthur (to Wilton, from Wilton)	0, 1	0, 2	0, 3	1, 4
Wollongong(to Wilton, from Wilton)	-	0, 1	0, 2	1, 3
School (total)	4	7	12	18

These bus load numbers have been used as the basis of the bus service frequency and staging plans. For the service assumptions later in this section, a small amount of turnover in seats is assumed.

6.2.3 Staged introduction of services

To match the development of Wilton Junction, it is proposed that the bus network would evolve with routes added over time as new areas get developed and new roads get opened, and frequencies increase to match demand. The 2021, 2024, 2031 and full development bus networks (assumed to correspond to the development demand at 2,500 dwellings, 4,000 dwellings, 7,800 dwellings and 11,900 dwellings respectively) are shown on Figures 6.1 to 6.4 respectively. The 2024 network indicated is after the opening of the grade separated interchange on Picton Road, east of the Hume Highway. Express buses to Campbelltown/Macarthur would use the new north-facing ramps, avoiding the interchange of Picton Road and the Hume Highway and saving travel time.

2021 (2,500 dwellings) bus network

- establish a core (full time) service linking Wilton (Town Centre, East and North) with Picton:
 - ▶ Picton provides the core connection point for Wilton with the rail network, building on the existing service, buses scheduled to connect with train
 - ▶ also provides local connections to the Wilton Town Centre from Wilton East
 - ▶ short working local trips (Wilton East to Wilton Town Centre) can be introduced as demand grows
 - ▶ establishes a core route through Wilton, which will remain as Wilton develops, but which can be extended to Wilton South as roads are constructed
 - ▶ preliminary alignment until roads north of town centre are constructed
 - ▶ layover adjacent to existing Wilton shops
- provide an additional peak service from Wilton East direct to Campbelltown via Wilton Town Centre and the Freeway:
 - ▶ provides a more direct connection to Campbelltown at times when demand is greatest
 - ▶ provides a single transfer option during peak hours for travel between Wilton and points on the rail network north of Campbelltown
 - ▶ follows the core route through Wilton, which will remain as Wilton develops, but which can be extended to Wilton South as roads are constructed
 - ▶ preliminary alignment until roads north of town centre are constructed
 - ▶ layover adjacent to existing Wilton shops
- school special services operated as required, in combination with Wilton to Picton service.

2024 (4,000 dwellings) bus network

- reinforce core service from Wilton (Town Centre, East and North) to Picton with additional frequency
- increase number of peak trips on service from Wilton East direct to Campbelltown via Wilton Town Centre and the Freeway
- adjust routes to incorporate new road north of the town centre
- introduce new local service, adjust service levels on school services as required:
 - ▶ Town Centre to Wilton East and Wilton South
 - ▶ layover at Town Centre
- introduce Wilton to Wollongong service via Picton Road:
 - ▶ layover at Town Centre.

2031 (7,800 dwellings) bus network

- increase frequency on all routes
- increase hours of operation
- introduce new local services, adjust service levels on school services as required:
 - ▶ Town Centre to Wilton East (final route)
 - ▶ Town Centre to Wilton South
 - ▶ Town Centre to Wilton North
 - ▶ out & in services with layover at Town Centre
 - ▶ services inter-work at the Town Centre.

Full development (11,900 dwellings) bus network

- increase frequency on all routes
- increase hours of operation
- extend the Picton to Wilton service to the Wilton South neighbourhood centre and the Campbelltown express to a southern turn around in Wilton South
- extend routes to serve the new growth areas:
 - ▶ Town Centre to Wilton South – extend as far south as possible within Wilton South (final route)
 - ▶ Town Centre to Wilton North – extend to northern loop (final route)
 - ▶ both services connect two residential areas to the town centre and employment lands.

The potential to combine the Wilton to Campbelltown and Wilton to Wollongong services exists to provide another Campbelltown to Wollongong service. However, due to the directional nature of trips from Wilton Junction, this is not required for the purposes of servicing the proposed development. Connecting the two services would require contra-peak direction services for part of its journey. Whilst numbers of trips to Wollongong are less than Campbelltown, some subsidy of the reverse journey would be required.

NSW metropolitan bus service contracts contain guidelines that a minimum of 90% of residences should be located within 400 metres of a bus service (usually identified at the bus stop). At this stage of planning for Wilton Junction, the location of bus stops is not known. To estimate the coverage of the proposed bus network, a 400 m buffer was applied around each bus route and the percentage of lane zoned for residential use was estimated.

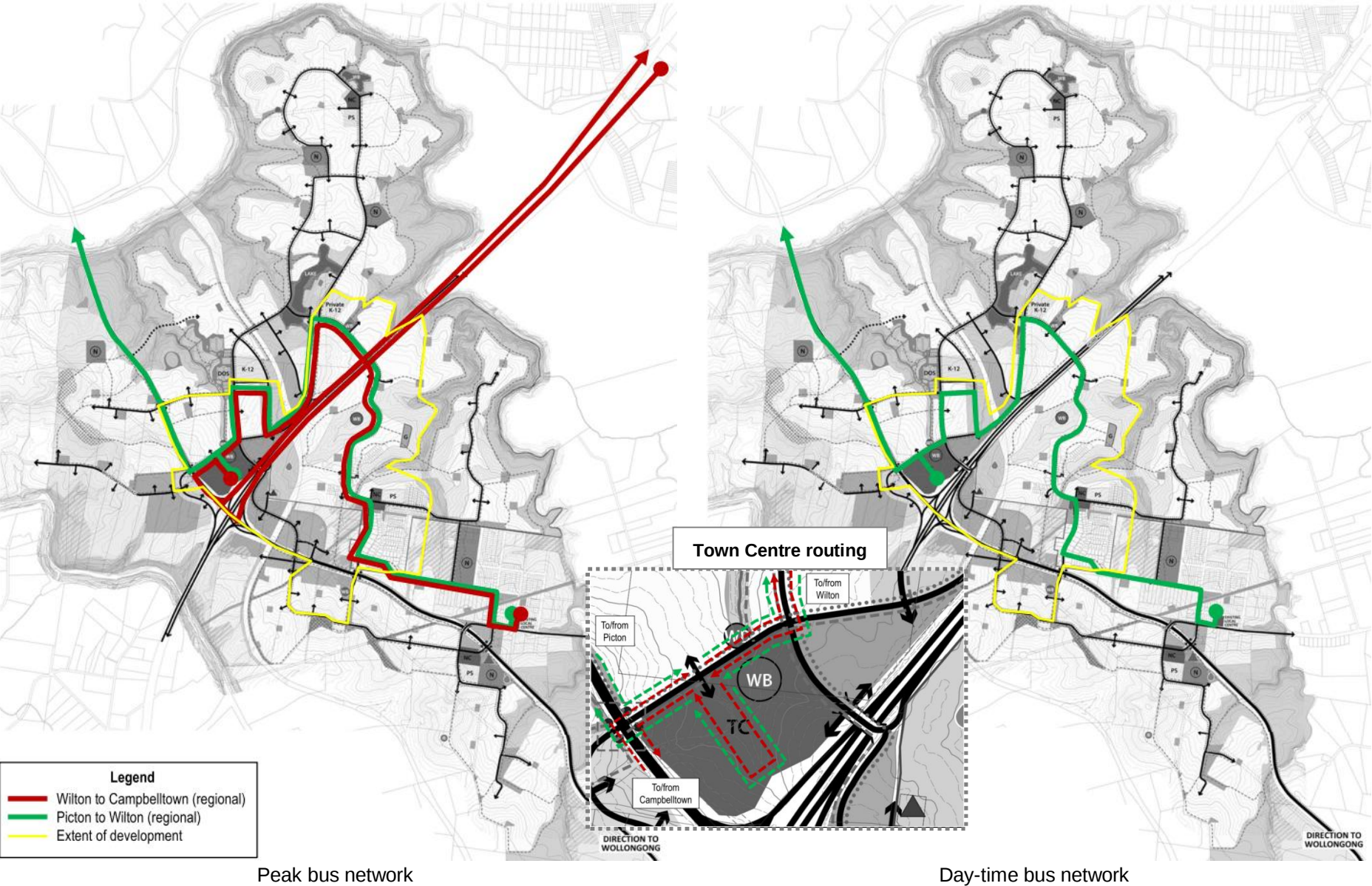


Figure 6.1 Initial bus network – 2021/2,500 dwellings

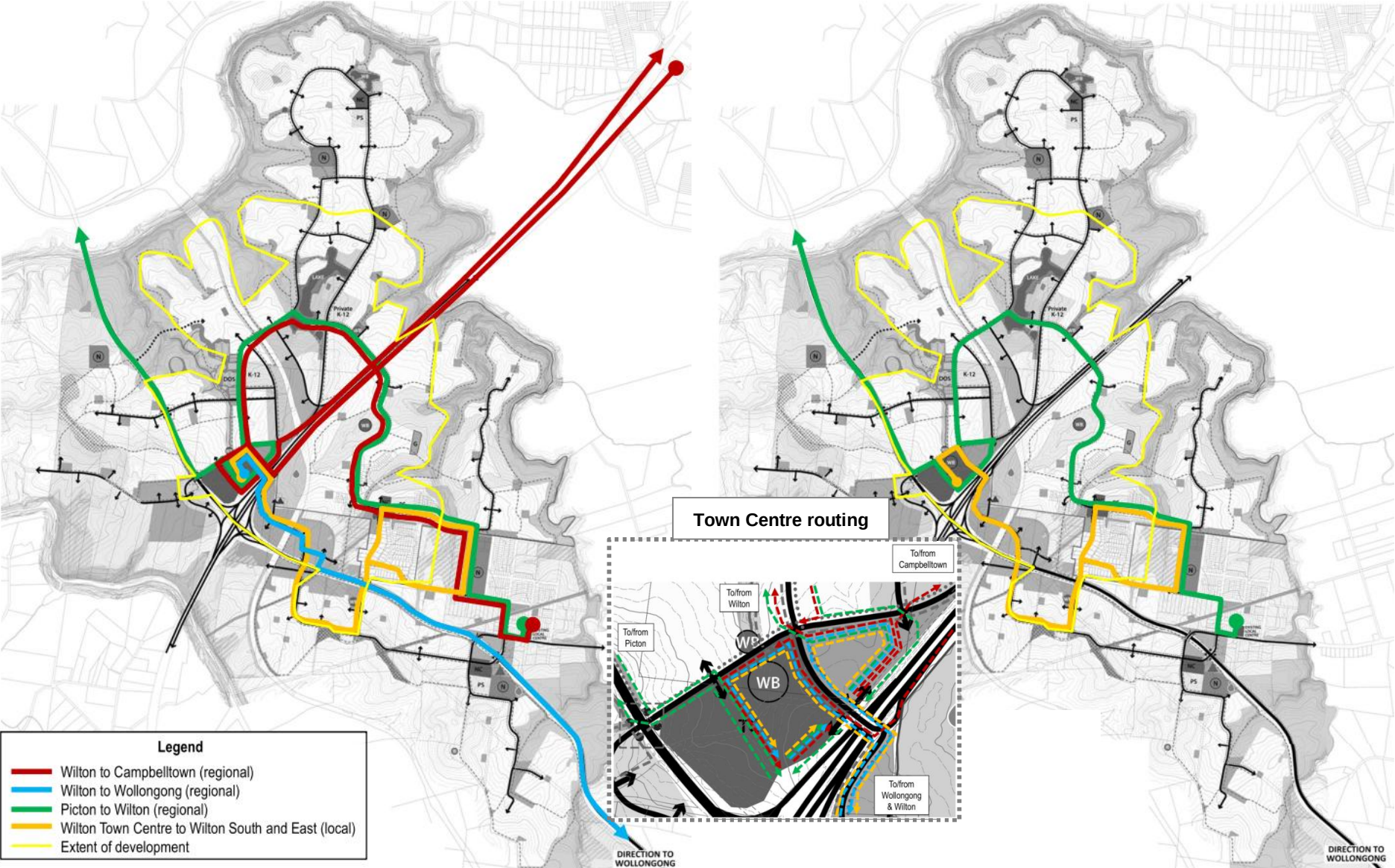


Figure 6.2 Proposed bus network – 2024/4,000 dwellings

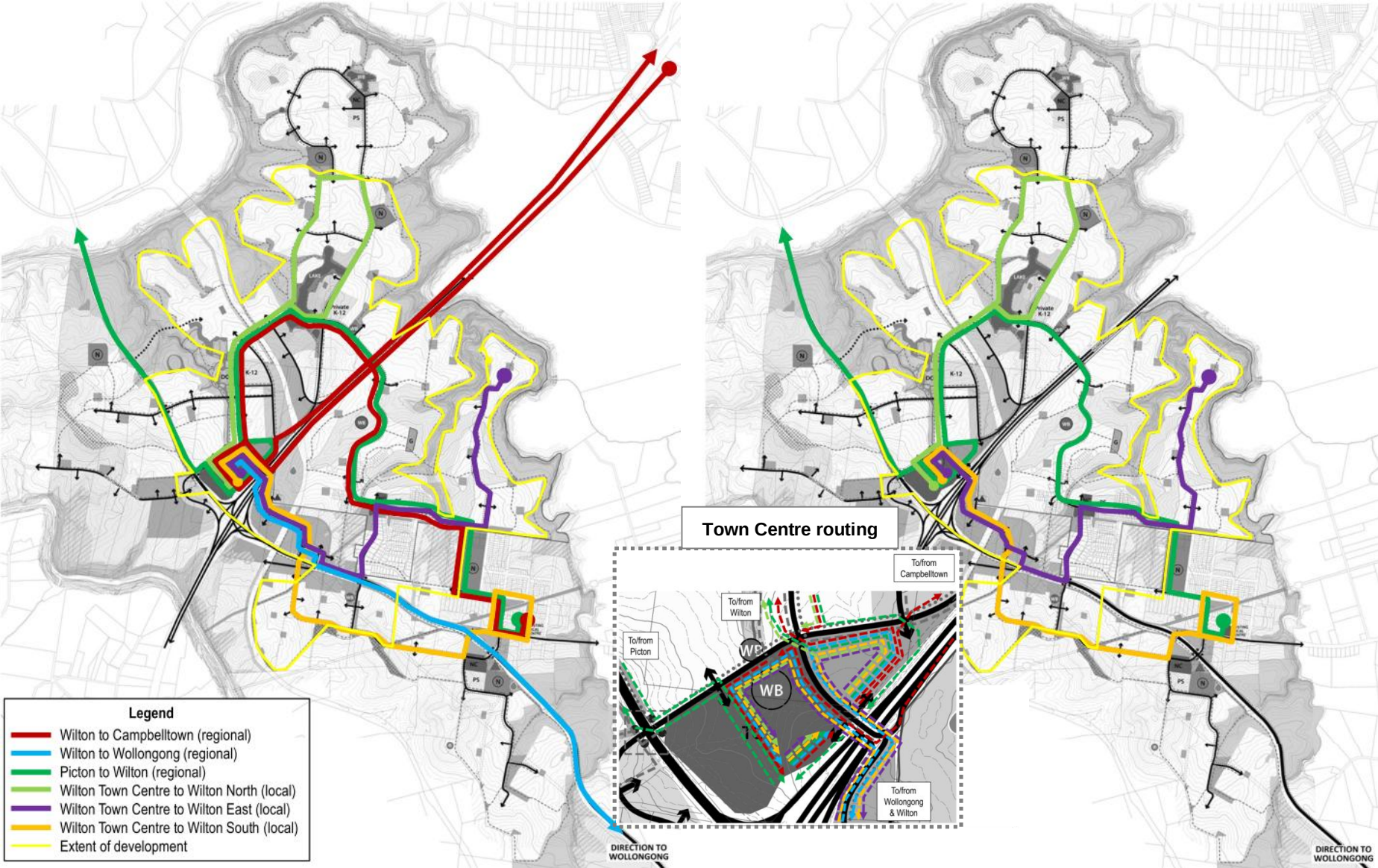


Figure 6.3 Proposed bus network – 2031/7,800 dwellings

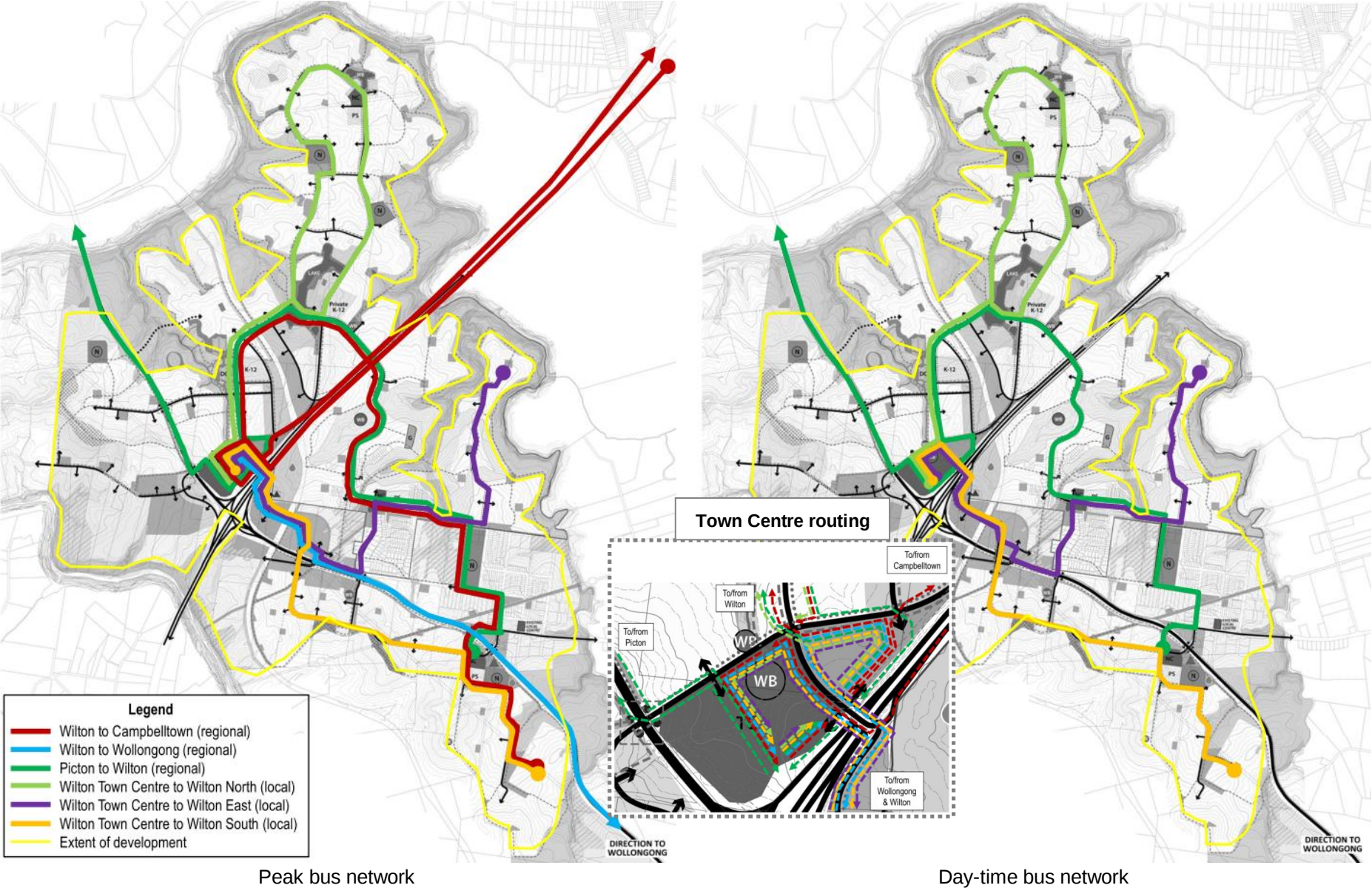


Figure 6.4 Proposed bus network – Full development/11,900 dwellings

The analysis has shown that 81% of the dwellings within the development will be within 400 m of a bus route. Increasing this percentage would be difficult:

1. The largest number of dwellings outside the 400 m buffer is along two ridge lines. Serving these ridges would require diverting the Wilton North bus and backtracking to get back to the original route, delaying the other passengers and adding to operating costs.
2. Another large number of dwellings in Wilton North lie just outside the 400 m walk distance.
3. The low density rural residential area on the south-western side of Picton Road around Wilton Park Road represents a large area that is served via Picton Road only. Adding a route through this area is possible, but due to the low density and road network the patronage potential is low.
4. The southern end of the Walker Corporation land (south of Picton Road near Almond Street) is presently outside the 400 m buffer where the turnaround for the Wilton South service.
5. Routes ending on dead-end streets are difficult to service in both an economically and operationally attractive manner, and have been avoided where possible.

Changes to the local road structure may be able to assist in increasing the percentage of dwellings within a 400 m walk of a bus service.

6.2.4 Bus journey times

Bus journey times have been estimated for the proposed routes (in their final arrangement). The times are indicated in Table 6.3. The times for local bus journeys would enable buses to make two journeys during the peak hour, assisting with the proposed service frequencies and simplifying scheduling. The assumptions made in these calculations are listed below.

- 25 km/h in Wilton Junction and Picton when picking up and setting down passengers (assumes low levels of traffic congestion)
- 20 km/h in Campbelltown/Macarthur and Wollongong
- 80 km/h on the Hume Highway and ramps
- 70 km/h on Picton Road
- 40 km/h on the Illawarra Escarpment.

Table 6.3 Estimated bus journey times

Route	Length (km)	Journey time (mins)
Local services		
Town Centre to Wilton East and back	12.5	30
Town Centre to Wilton South and back	12.0	29
Town Centre to Wilton North and back	9.2	22
Regional services		
Wilton to Picton (one-way)	16.9	29
Wilton to Campbelltown and Macarthur (one way)	35.5	48
Wilton to Wollongong (one way)	41.3	54

6.2.5 Bus service frequency

The trip number calculations presented in section 5 have been used to develop estimates of required bus frequencies on the range of bus routes proposed for Wilton Junction. An average of 40 passengers per bus has been assumed to convert passenger loads into numbers of bus trips. The proposed bus service frequencies, shown in Table 6.4, have been rounded up to the nearest standard bus frequency.

Table 6.4 Proposed peak hour bus frequencies at different stages of development

Route	Starting year ¹	Peak frequency				
		2021	2024	2031	Full dev.	Details
Local services						
Town Centre to Wilton South	2024 ²	none	2	2	2	per hour each way
Town Centre to Wilton East	2032 ³	none	none	2	2	per hour each way
Town Centre to Wilton North	2032 ³	none	none	2	2	per hour each way
Regional services						
Picton	2015	2	2	2	3	per hour each way
Campbelltown and Macarthur	2018	1	2	3	4	per hour in peak direction
Wollongong	2024	none	1	2	3	per hour in peak direction
Rural						
As required based on demand	2027 ⁴	none	none	1	2	per hour
School specials						
As required	with opening of schools	Frequencies as required, in balance with local route frequencies				before school and after school

(1) Starting year is based on the currently assumed release of lots. There are no currently approved plans for the proposed bus network starting years. Modifications to currently assumed timing will result in changes to starting year assumptions.

(2) Commenced when road connecting Wilton South across Picton Road and the Hume Highway to the Town Centre is opened. Progressively expended as new sections become available, then split into two

(3) Based on release timetable of and construction of northern neighbourhood centre.

(4) Anticipated when town centre reaches 50% development

For comparison, other towns in New South Wales with similar populations now to the 2041 forecast for Wilton Junction (full development) are Bowral/Mittagong, Dubbo, Nowra/Bomaderry and Bathurst⁷. A count of the peak hour bus services servicing these towns range from 9 to 12 (based on website timetabled services, viewed 27 August 2013). The 25 services proposed for full development is higher than this range. However, given the low public transport usage in these other regional areas (1% or less⁸), for Wilton Junction to achieve the target of 10% public transport usage contained in the Wilton Junction Development Public Transport Strategy (Cardno, October 2012), higher bus frequencies are required. Wilton Junction bus services have the additional potential to attract demand for bus to rail trips to access the rail services between Campbelltown and Sydney. These frequencies should be reviewed periodically as travel patterns become established. The number of school special buses could be reduced in favour of higher frequencies on the local bus services.

⁷ ABS publication: 3218.0 Regional Population Growth, Australia Table 1. Estimated Resident Population, Significant Urban Areas (30 April 2013)

⁸ BTS Journey to Work data, online JTW Explorer (viewed 4 September 2013)

Based on these service numbers, frequencies and lengths, it is estimated that a bus fleet of 14 buses would be required by 2021, 18 buses by 2024, 25 buses by 2031 and 33 buses by full development. These calculations assume approximately 10% spare buses and two school trips per hour per school bus.

6.2.6 Regional interchange

The location of the regional interchange is proposed in the town centre to enable it to serve the highest trip-generating land uses. Various locations have been considered for the interchange based on the following characteristics:

- proximity to town centre, employment lands, and other trip generators
- proposed development staging (including consideration of staged development of town centre)
- proximity to potential land (or other car parking facilities) available for Park-and-Ride
- traffic volumes, considering passive surveillance and passenger amenity (including conflicts between bus and passenger movements).

A location within the town centre is proposed as the preferred location as:

- it would integrate public transport with the town centre in a highly visible way
- it would be integrated with the first stage of development, as a potential Park-and-Ride site
- it is centrally located between – and has good access to and from – employment lands located to the northeast, south, and southwest.

The proposed bus interchange would be designed to adequately support the arrival of multiple buses simultaneously to allow the potential for interchange between services. It is possible that Kiss-and-Ride could occur on the road immediately north of the Town Centre, avoiding the need for additional vehicles to enter the high pedestrian area.

6.2.7 Facilities

The Wilton Junction Development Public Transport Strategy (Cardno, October 2012) contained recommendations for guiding principles for infrastructure to support bus services. To promote the use of public transport, the facilities are to be of high quality, convenient to use and of a consistent standard. The following principles apply within the development along each of the bus routes:

- bus stops will be optimally located along bus routes to meet demand, ideally spaced every 400 metres⁹
- locate bus stops within 400 m to 500 m of 80–90% of the population
- stops should be located adjacent to side streets where possible and should be connected in to the local footpath network
- bus stops shall be provided with seating, shelter, lighting and public transport service information
- safe and accessible crossing points should be located adjacent to bus stop facilities
- bus stops in town, neighbourhoods and rural centres will be placed within walking distance of key destinations
- co-locate inbound and outbound stops where appropriate
- locate town centre bus stops near areas following Crime Prevention Through Environmental Design (CPTED) principles

⁹ It should be noted that for local residential routes, bus stops may be placed at closer intervals to appropriately service local facilities and residents, while for regional routes, bus stops may be spaced further apart in order to achieve service efficiencies.

Additional considerations for the provision of supporting infrastructure for schools are also recommended:

- bus stops placed directly outside schools (in some cases, within school grounds may be appropriate)
- shelters to cater for larger number of passengers
- pedestrian and cycle networks within local area of all schools will be priorities for implementation.

A higher level of infrastructure is required at interchanges, where higher numbers of passengers will use the stop, and where buses will be using the infrastructure for a longer duration. Two categories of interchanges are planned – regional (in the town centre) and local. The infrastructure to be provided is shown in Table 6.5.

Table 6.5 Interchange facilities

Infrastructure	Regional interchange	Local interchange
Bus stops	Two in each direction (one local/rural/school, one regional)	One in each direction
Bus shelters	High quality, high capacity	High quality
Bus layover	Yes, in adjacent street	Yes, behind stop
Bike racks	Yes	Yes
Kiss-and-Ride	Yes	Yes
Park-and-Ride	Formal Park-and-Ride	Informal
Bus driver facilities	Toilets, meal room	Toilets (existing Wilton township only)

At both types of interchanges, facilities are required to enable people to transfer between modes, as well as to facilitate bus operations. For example, increased numbers of bike racks at neighbourhood shops could be provided if demand for bike to bus is demonstrated in the area. Bus layover and driver facilities would be provided as close as possible to interchanges, dependant on adjacent land uses.

Based on the service frequency and opportunities to link journeys at Wilton Junction, the number of layover spaces required at Wilton Town Centre is estimated at three at full development. This number will need to be re-assessed once the number of services is confirmed and timetable scheduling of bus services is undertaken.

For the initial stages, it is assumed that the proposed bus services for Wilton Junction could be provided from the Picton Buslines Depot in Picton, and additional depot space would not be required. In the long term, additional depot space may be required to accommodate the buses required to service the proposed bus plan.

The location of any future depot would not necessarily be located within the Wilton Junction Development, as it would be influenced by several factors, including the space required, accessibility to the road network, amount of out-of service running and efficiency gained from amalgamating maintenance and administration functions of one large depot versus several smaller depots. It may be possible to operate a depot from Wilton as a satellite depot, with major servicing and administration provided at the main depot at Picton.

Based on the estimated figure of 33 buses to operate the proposed bus network at full development and a rule-of-thumb value of 120 m² land required per bus¹⁰, it is estimated that a depot size of approximately 4,000 m² would be required. A suitable location, if required, would be identified at a later date, in consultation with the local bus operator and TfNSW, and funded in accordance to current development contribution policies.

Figure 6.5 shows the proposed location and nature of public transport infrastructure within Wilton Junction.

¹⁰ Information from Transport for NSW

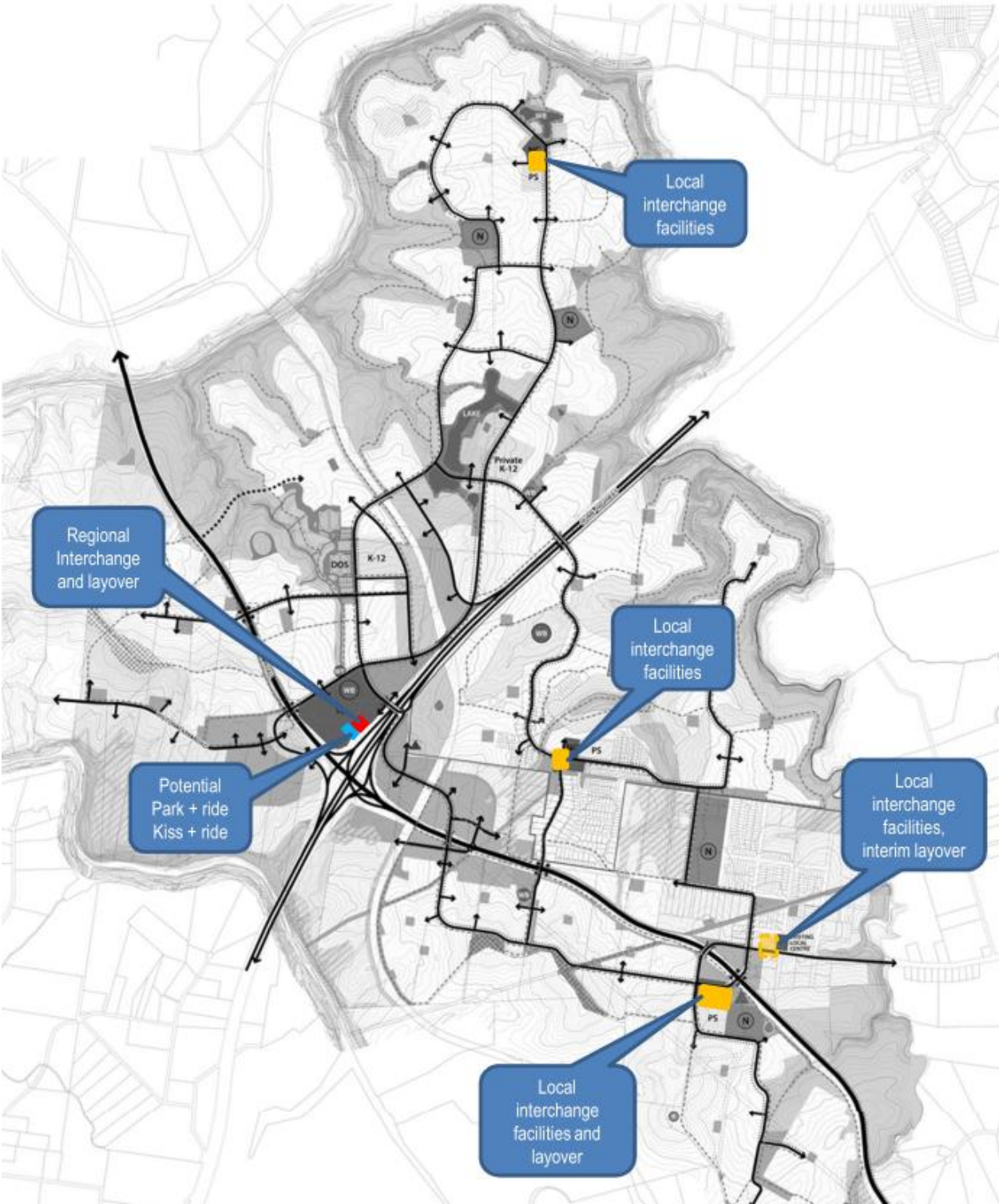


Figure 6.5 Proposed bus interchange infrastructure

6.2.8 Park-and-Ride and Kiss-and-Ride

As the point where all five bus routes intersect, and where the frequency of services to Campbelltown combine, the regional interchange is likely to be the location that has the most potential for Park-and-Ride (and Kiss-and-Ride). The exact number of spaces required is difficult to quantify, as the relative attractiveness of using the express regional buses to Campbelltown versus driving to Campbelltown is untested and is influenced by many factors.

Based on 2011 JTW statistics for bus trips, the majority of passengers walk to the bus stop (approximately 75%–80%). The percentage of passengers getting a lift to the bus stop (approximately 15%–20%) is larger than the percentage of people driving to the bus stop and parking before boarding the bus (approximately 5%), indicating that Kiss-and-Ride facilities will also be important, especially near the regional interchange.

Combining the anticipated drive to bus numbers with an estimate of the Park-and-Ride at Campbelltown and Macarthur Stations that could be diverted to Wilton Junction, an indicative size of the Park-and-Ride facility is 50 spaces by 2024 and 100 spaces by 2036. The number of spaces required should be monitored once the bus service to Campbelltown is established and travel patterns become settled.

6.2.9 Bus region contracts

Currently, the Picton and Wilton region is covered by a rural bus contract, whereas the Campbelltown area is covered by a metropolitan region contract. This has implications for both bus passengers and bus operators in terms of fares, minimum service frequencies and funding of services. The contractual and funding arrangements will need to be confirmed should development proceed in the area.

A short summary of the difference between rural and metropolitan region contract areas is provided below:

- rural and regional contract areas:
 - ▶ two Contract Models: A (Individual, non- commercial school routes), and B (commercial contracts including route buses)
 - ▶ service guidelines for Regional towns are based on population bands of Country Town Size (7,500 to 30,000) and indicate a target number of return journeys per day, varying with distance of the terminus from the town Centre
 - ▶ there are also guidelines for village to town services (up to four weekday return trips)
 - ▶ there are no town to town service guidelines. This is left to the discretion of the operator
 - ▶ rural and regional fare scale
- Metropolitan and Outer Metropolitan:
 - ▶ service guidelines are closer to those in Metro area, which include:
 - a contract services plan and passenger relation plan
 - TfNSW works with operators to determine levels of frequency and coverage
 - service guidelines set specific principles for network coverage and legibility
 - use Metropolitan fare scale (e.g. Travel 20 and My Multi tickets).

6.2.10 Bus priority

At this stage, bus priority is not anticipated to be required, as bus numbers are unlikely to reach the levels that would justify special provisions (one bus every two minutes). While traffic conditions around the town centre are likely to be busy during peak times, blockages within Wilton Junction streets that would necessitate bus priority are not anticipated. Specific measures to restrict general traffic that benefit bus operations (e.g. 'No right turn, buses excepted') could be considered to protect amenity within the town centre. The north-facing ramps to the Hume Highway will provide access to the Hume Highway for express buses between Wilton and Campbelltown without the need to pass through the Hume Highway/Picton Road interchange, avoiding conflicts with freight vehicles.

6.3 Cycling

Wollondilly Council has planned a network of shared cycle and pedestrian paths. Currently, Picton Road, Almond Street, Camden Road, Argyle Street and Hornby Street in Wilton have been identified to form part of the cycle network. The plan of the shared pedestrian and cycle routes is shown in green dashed lines in Figure 3.2. Bike routes would be designed in accordance with the RTA's NSW Bicycle Guidelines (July 2005) and Austroads' Cycling on Higher Speed Roads (2012).

The cycle routes are proposed with a mixture of shared paths, mixed traffic and on-street cycle lanes. This has been done to avoid mixing cyclists with traffic on the streets with the highest traffic volumes, where possible.

Bicycle racks would be provided in the Town Centre, at neighbourhood centres, community centres and recreation facilities. Commercial buildings would be required to provide cyclist end of trip facilities, including bike locking and showers, as per the requirements of the *Planning guidelines for walking and cycling* (NSW Planning, December 2004).

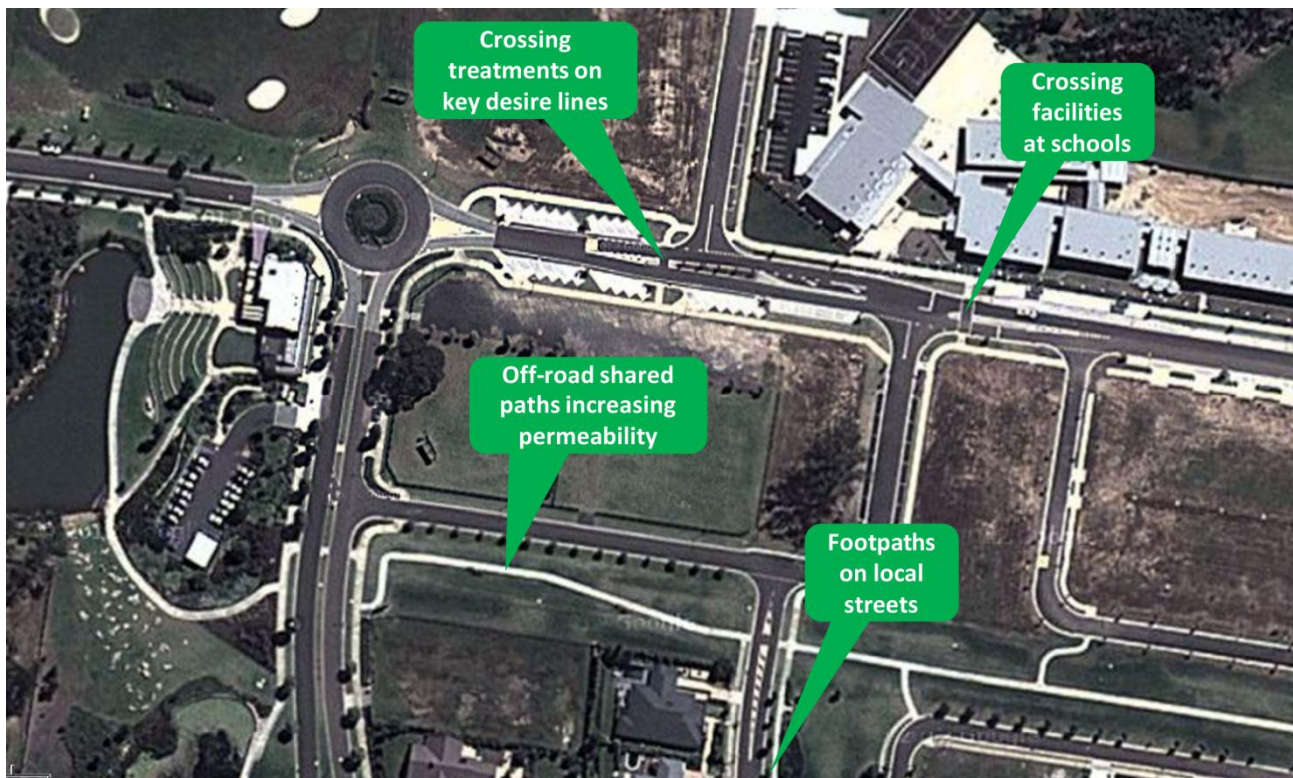
6.4 Pedestrians

Town centre

Appropriate urban design and traffic management measures are planned along the streets within the Town Centre to reinforce the high pedestrian activity area and improve pedestrian safety. Treatments proposed include entry thresholds (using textured pavement/pavers), road width changes, raised thresholds, street lighting and lower speed limits.

Local facilities

The pedestrian and cycle networks are designed to have a greater level of permeability than provided to vehicles to further promote their greater use. Off-street shared paths are planned to complement Wollondilly Council's cycle/pedestrian paths scheme and increase permeability for pedestrians and cyclists. All streets (except laneways) would have 1.2 m minimum footpaths, on one or both sides of the street. Footpaths and shared paths would be designed with regard to the *Planning guidelines for walking and cycling* (NSW Planning, December 2004). Figure 6.6 shows local pedestrian facilities that have already been installed in Bingara Gorge. A similar level of infrastructure is planned for the remaining areas of development with Wilton Junction.



Base image source: DigitalGlobe, 2013

Figure 6.6 Local pedestrian facilities

Crossing opportunities

The pedestrian network would concentrate on connecting high trip generating land uses, such as retail centres, community and recreation facilities and schools. Paths would be safe and well lit, with pedestrian crossing treatments on strong pedestrian desire lines at road crossings.

A key consideration is the crossing opportunities across the major barriers within the development, including the Hume Highway, Picton Road and the Maldon to Dombarton Rail Link. Figure 6.7 shows the location of crossing opportunities of major elements of the pedestrian and cycle network. Additional local crossing opportunities would be identified during detailed design of the development areas.



Figure 6.7 Pedestrian and cycle crossing opportunities

The active transport network has been developed to corral pedestrians and cyclists to safe crossing locations, with grade separated crossings of both Picton Road and the Hume Highway. A signal controlled pedestrian crossing of Picton Road at Pembroke Parade is proposed due to the distance to the bridge crossings in this area.

The provision of safe crossing locations, and the active transport network which would guide pedestrians and cyclists to and from these locations, is proposed to prevent uncontrolled, unsafe crossings of the State Road Network. Additional measures to further reduce this risk would be developed at the detailed design/development application stage.

A shared pathway will be provided along Picton Road in accordance with the Wollondilly DCP 2011 Volume 5 – Industrial & Infrastructure Uses and Wollondilly Bike Plan both east and west of the Hume Highway. The speed environment and unsignalised entry ramps make pedestrian crossing movements at the Hume Highway and Picton Road Interchange unsafe. Pedestrians and cyclists will be directed towards the new grade separated crossing of the Hume Highway north of Picton Road, which would include a shared pathway.

All bridge crossings of the Hume Highway and Picton Road would include pedestrian and cycle facilities to minimise the separation impact.

During the early stages of development, opportunities would be considered to improve interim pedestrian and cycling connections between the Town Centre and areas to the east of the Hume Highway, to both the north and south of Picton Road.

6.5 Parking

In addition to Park-and-Ride provision, (described above), car parking will be provided to meet Council's requirements, to facilitate local movement and provide for a competitive business environment, whilst not detracting from the transport initiatives to reduce the amount of trips made by car. Car parking solutions that do not dominate the street frontage are proposed such as:

- centralised parking enabling the sharing of parking facilities
- early provision followed by increasing density with reduced additional parking
- allocation of on-street parking in the town centre to priority uses and timed parking to stimulate parking turnover.

These are discussed in further detail below.

Centralised parking

Centralising the parking and provision on a precinct basis rather than a property by property basis has several advantages:

- it keeps parking supply in critical locations under tighter policy control
- it reduces the demand by allowing for multi-use trips from a single parking space (given an appropriate mix of uses)
- it encourages park once and walk behaviour which stimulates economic and social activity/vitality within the centre
- it allows for transition from the current high to more sustainable long term rates, which will also encourage alternative transport (public transport, walk and cycle)
- it banks land that can be used for more economical productive purposes at a later date.

Different land uses make their highest demand for car parking at different times of the day: commercial during the morning, retail in the afternoon, and residential at night. These different peak periods allow some of the parking to be used for different purposes at different times of the day. This reduces the amount of land required to fulfil parking needs and restricts supply to make other modes of transport more competitive.

Centralised parking can be above ground but visual amenity of street frontages should be protected. Location of any centralised parking should not occupy vital core space but fringe the town centre encouraging 'park once and walk' behaviour.

As a means of staging longer-term development, centralised car parking can also be used as 'temporary' central car parking. In this case such 'temporary' car parking should be located at or near the site of proposed future public transport; over time as development intensity may occur around the town centre these car parking areas can be redeveloped with a greater mix of uses (as well as providing the necessary 'existing' car parking function). Temporary car parking facilities in these locations can be interim uses on sites to be developed later for residential development.

Early provision followed by increasing density without additional parking

The town centre will not have the critical mix of land uses in its initial stages to provide shared trips. To promote the overall success of the Project, and establish its vitality, in the initial phases of the development parking should be provided at slightly higher rates through the early provision of centralised parking.

However, these early concessions to allow parking should not be allowed to impact on the long term sustainability of the town centre. This allows short term concessions on the amount of parking allowed without discriminating against applicants who develop either earlier or later. They all have the same maximum on-site provision, but the rate of centralised parking to be provided would slightly diminish over time so that the overall parking provision finishes with the long-term sustainable rate. This will achieve the 'park once and walk' behaviour desirable in a village centre and successful Transit Oriented Development (TOD) and it will encourage public transport trips for commuters.

On-site parking

Some level of on-site parking will be required for residential dwellings, some staff parking, and short term visitors such as tradesman. Residential parking should be located within the building. Staff parking for retail and commercial development can be provided within the building, or as dedicated spaces within a centralised facility.

To improve the urban amenity, on-site parking should be located away from street frontages. At grade car parks should preferably be provided at the rear of sites where they are not visible from active streets, and car park entries across active footpaths should be rationalised.

On-street parking

Kerb-side parking manages speed by providing traffic friction. It generally stimulates street activity, can contribute to casual surveillance, and provides a buffer between the verge/footpath and moving traffic. However, on-street parking provision has to be sensitive to bus routes, not encouraging 'cruising and waiting' and targeted to support local businesses.

Provision for Park-and-Ride should be made within walking distance of the bus interchange to manage commuter parking. Time limits of 2 hours on-street and 4 hours off-street would be appropriate for the public town centre parking areas, as it would restrict commuter use and allow enough time for shopping/other business. Time limited parking is not proposed for residential streets.

Parking rates

The primary guidelines for parking rates within the Wilton Junction Development are:

- Wollondilly Development Control Plan (DCP) 2011
- Roads and Maritime Services *Guide to Traffic Generating Developments Version 2.2* (October 2002).

Wollondilly DCP provides special rates for the Bingara Gorge Development, in addition to its standard rates for residential dwellings. A mixture of dwellings types are planned within the Wilton Junction Development, including separate houses, semi-detached/townhouses, apartments and shop-top housing. For the separate houses the Bingara Gorge parking rates are considered to be appropriate. For other housing types, the standard rates in the DCP are recommended. The proposed residential rates are listed in Table 6.6.

Table 6.6 Wollondilly DCP 2011 car parking rates for residences

Housing type	Parking rate
Bingara Gorge dwellings (single dwelling houses)	■ greater than 450 m² lot size: At least two vehicle spaces ■ less than or equal to 450 m² lot size: At least one vehicle space
Dual occupancy and semi-detached dwellings	■ one parking space must be provided per dwelling up to 125m² in gross floor area ■ two parking spaces must be provided per dwelling 125m² or greater in gross floor area
Multi dwelling housing, Attached dwellings and Residential flat buildings	■ one covered space per one bedroom dwelling or unit ■ 1.5 covered spaces per two bedroom dwellings ■ two covered spaces per dwellings three bedrooms and above ■ one visitor space must be provided in addition to the above requirements per five dwellings ■ one bicycle park must be provided per five units plus one visitor bicycle park per ten units ■ every dwelling must be provided with a secure covered storage space suitable for bicycles, in addition to any required car parking spaces ■ all developments must provide one disabled car space, as well as one additional disabled space per total 50 spaces on site
Shop top housing	■ one space per unit ■ one visitor space per five dwellings ■ one disabled space for up to 10 parking spaces required, 2 spaces for 10–20 parking spaces required and 5% of the total provision, where 21 parking spaces or more are required as part of the development

Source: Wollondilly Development Control Plan 2011

For other land uses, the DCP requires that the parking rates from the RMS' Guide to Traffic Generating Developments are used for some land uses. The applicable rates are listed in Table 6.7. For the retail centres, centralised parking for the precinct is proposed.

Table 6.7 Wollondilly DCP 2011 car parking rates for other land uses

Land use	Parking rate
Commercial/office	one space per 40 m² GFA
Retail	- Town Centre: 4.3 spaces per 100 m² GFA - Neighbourhood Centre: 6.1 spaces per 100 m² GFA
Bulky goods retail	As per RMS' Guide to Traffic Generating Developments
Light Industrial	- one space per 70 m² GFA of net floor area with a minimum of three spaces per industrial unit - one space per 40 m² of net floor area for ancillary office space - minimum 1 space per 100 spaces for disabled persons

Source: Wollondilly Development Control Plan 2011, RMS Guide to Traffic Generating Developments Version 2.2 (October 2002)

Based on the projected floor areas, the rates in Table 6.6, and applying a 10% discount to the town centre and 5% discount to the neighbourhood centres for complimentary use, the anticipated numbers of off-street public and designated staff parking spaces are:

- Town centre: 2,360 spaces
- Wilton North neighbourhood centre: 340 spaces
- Wilton South neighbourhood centre: 460 spaces.

For the town centre, it is recommended that parking be provided at the neighbourhood centre rate until the amount of retail floor space reaches 10,000 m² GFA (approximately 610 spaces) and then at the town centre rate thereafter (assessed at a precinct level).

6.6 Travel plan

The Project is a mixed land use TOD style development. Achieving success as a liveable community will be greatly enhanced by promoting diversity in transport that caters for the needs of the residents, employees, businesses and visitors whilst promoting positive behaviour.

Personalised marketing strategies have the potential to assist in modifying travel behaviour through communicating relevant travel choice information to the community. Marketing would begin through the provision of travel information kits (including a Travel Access Guide (TAG)) which would be provided to all new residents in the Project. The DCP will require that each development would be required to produce a Workplace Travel Plan (WTP) and provide the relevant information to employees. The successful travel plans implemented for the relocation of Optus to Macquarie Park would be used as a template for business WTPs. Producing these plans would be the responsibility of the developer and businesses.

These TAG and WTP strategies are similar to the TravelSmart schemes. Experience from the introduction of TravelSmart schemes in other locations was reported in 'Evaluation of Australian TravelSmart Projects in the ACT, South Australia, Queensland, Victoria and Western Australia: 2001–2005' (Australian Greenhouse Office located in the Department of the Environment and Heritage, 2005). The average mode split change recorded for households is shown in Table 6.8.

Table 6.8 Average Household TravelSmart mode split change

Mode	Before	After	Change
Car (driver)	58%	53%	-5%
Car (passenger)	24%	24%	0%
Motorcycle	0%	0%	0%
Cycling	2%	3%	1%
Bus and Train	5%	6%	1%
Walking	11%	13%	2%

The following is taken from the TravelSmart Australia web site:

The TravelSmart program includes the development of a Travel Plan. A travel plan is a short, simple document that outlines a range of site-specific actions to encourage the use of more sustainable transport options. It focuses on the way people travel and develops a strategic approach to changing travel behaviour. It is not a one-off event to be undertaken and completed, nor is it a document to be produced and put on the shelf.

A travel plan includes going through a process of gathering information about how people travel, identifying the issues, barriers and opportunities, and coming up with actions to improve travel options. Travel plans produce many benefits. They help reduce the impact of travel on the environment but also make good business sense. They can cut traffic congestion around a local area and help people save money on travel by identifying more efficient use of the car whether for commuting or in-work travel.

The plan incorporates analysis from a range of sources such as surveys, focus groups and workshops in order to clarify issues and identify the best approach forward. Travel plans are flexible and regularly evaluated to ensure they continue to reflect site-specific issues.

It is expected that an outline travel plan can be prepared at an early stage in the development design process, and that the development incorporates the necessary infrastructure and facilities to support the use of non-car modes of transport, particularly access by pedestrians and cyclists. The level of detail within the outline travel plan will be informed by the development design process and the knowledge of the end occupier.

Generally an outline travel plan would be expected to cover:

- type and size of development
- number of employees (estimated or actual)
- the type of work that will be undertaken and hours of operation
- the expected date of building completion and then subsequent occupation
- on-site facilities including:
 - ▶ cycle parking
 - ▶ change rooms
 - ▶ showers
 - ▶ pedestrian and cycle paths within the development and connections to the networks in the surrounding area
 - ▶ parking spaces and parking management measures

- off-site facilities including:
 - ▶ public transport stops and service information
 - ▶ local bike paths and lanes
 - ▶ footpaths and crossing points
- the expected 'business as usual' mode split (how people will travel in the absence of a travel plan) and the target mode split showing a shift to public transport, walking, cycling and ride share
- an outline travel plan should clearly identify objectives and targets for the travel plan
- incentives offered to change from car driver travel.

Targets must be measureable, however, it should also be recognised that it is a challenge for a developer to commit to targets on behalf of the eventual occupier or tenant of the building. If the end occupier is known and the developer has entered into a contractual arrangement with a prospective tenant then a greater level of detail can be expected with the tenant/occupier committing to specific travel plan actions, activities and outcomes.

Actions identified to be undertaken by the developer, for example, installation of secure cycle parking, must be implemented before the building is occupied to support desirable travel behaviour from the outset.

The WTP and TAG would include brochures to be given to new residents and employees. It could include a website with links to transport agencies, operators, information, and download files.

7. Economic analysis

This technical note outlines the approach and results of a rapid cost benefit analysis comparing the benefit and costs of the free flow option at Wilton Junction to the at-grade option.

In this section upgrades to the State Road Network are discussed. It is noted that the proposed infrastructure upgrades along the Hume Highway and Picton Road indicated on the Master Plan are not preferred or approved by RMS. The Hume Highway/Picton Road interchange upgrade indicated on the Master Plan is not a preferred or approved design.

The proposed layouts and configurations illustrated have been adopted for the purposes of traffic modelling which informs this economic assessment. This TMAP and or the rezoning process that it supports, does not confirm a final design for any of the proposed infrastructure upgrades on the State Road Network.

All proposed modifications or additions to existing road networks are subject to review and approval by responsible authorities including RMS, TfNSW, and Council. The Wilton Junction team will continue to participate in workshops with relevant authorities to achieve suitable designs.

The list of State Environment Planning Policy (SEPP) study requirements for the Wilton Junction Precinct included:

The proponent's modelling must consider the implications of the development on the functionality of Picton Road and specifically the impact to freight, recognising that the Long Term Transport Master Plan acknowledges the need to provide efficient freight connections to Port Kembla. In this regard, the modelling must consider two infrastructure scenarios for Picton Road:

- *Picton Road with no new at grade intersections and a free flow arrangement of Hume Highway and Picton Road. The layout of the interchange of the Hume Highway and Picton Road to be modelled shall be determined in consultation with TfNSW and RMS.*
- *Picton Road with at grade intersections east of the Hume Highway.*

Based on the results of the modelling, the proponent shall undertake an economic assessment on the impact of the two separate options on freight activity and access to and from the Illawarra Region.

The timing and nature of the upgrades proposed for Picton Road and the Hume Highway/Picton Road interchange are discussed in section 5.8. The proposed scheme largely addresses the concerns behind these items in the list of study requirements, by minimising the impact of local Wilton Junction traffic on the arterial road network. This section outlines the implications for freight and the results of an agreed simplified economic analysis method.

7.1 Proposed Picton Road upgrade

The recommended scheme for Picton Road includes the following by completion of the Wilton Junction Development:

- upgrading of the interchange of the Hume Highway and Picton Road with a free-flow configuration for the major freight movement from Sydney to Port Kembla:
 - ▶ retention of the slip lane for movements from Hume Highway southbound to Picton Road eastbound
 - ▶ a new fly-over ramp for the Picton Road westbound to Hume Highway northbound movement (also heavily used by existing car traffic)
 - ▶ new traffic signals for the remaining right-turn movements, but not affecting left-turn movements or the right-turn movement referred to above.
- grade-separation of the new north-south internal road across Picton Road between Hume Highway and Pembroke Parade
- widening of Picton Road between the new grade separation and Pembroke Parade to three lanes in each direction
- signalisation of the existing intersection of Picton Road and Pembroke Parade
- widening of Picton Road between Pembroke Parade and Almond Street to two lanes in each direction
- grade-separation of the new internal road to the west of Almond Street
- conversion of the intersection of Almond Street to left-in/left-out with no impediment to through traffic (note: interim upgrading to traffic signals until construction of grade-separation)
- widening of Picton Road between Almond Street to Macarthur Drive to two lanes in each direction
- widening of Picton Road east of Macarthur Drive to two lanes in each direction.

These projects are illustrated in Figure 7.1. Based on current truck volumes and the strategic links between the Broader Western Sydney Employment Area and Port Kembla, the movements between points A and B (shown on this figure) have been identified as the critical movements for freight. The assessment of the economic impact on the movement of freight has been undertaken for these two critical movements.

During the consultation process for this study, RMS has provided concept plans for full and partial free-flow upgrades of the Hume Highway and Picton Road Interchange. A different layout, shown in the inset in Figure 7.1, is suggested to:

- provide free-flow movement for the heaviest traffic and freight movements
- minimise land take
- reduce the need for wide bridges over the Hume Highway.

The minimisation of the impacts have been provided for to such an extent that there is only one impediment to the two movements shown in red on Figure 7.1 from A to B and B to A is the proposed traffic signals at the existing intersection of Picton Road and Pembroke Parade. Thus the economic analysis has been confined to the relative benefits of providing an additional grade-separation at this intersection. i.e. the two scenarios assessed are:

- partially grade-separated option: The currently proposed scheme listed previously
- free-flow option: Picton Road with grade separated intersections along Picton Road (include proposed grade separated Pembroke Parade).

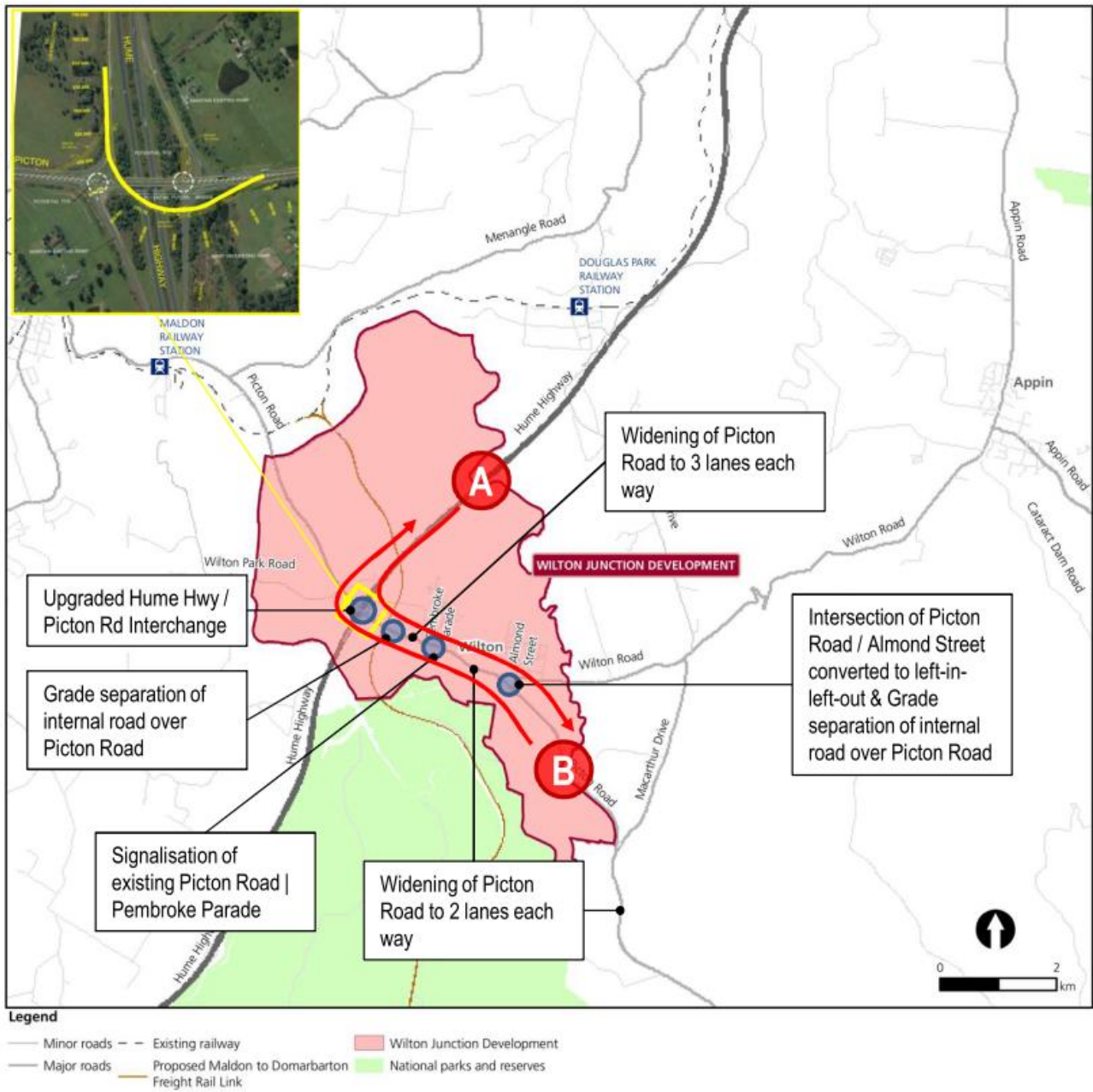


Figure 7.1 Recommended upgrades of Picton Road affecting major freight movements

7.2 Methodology

The method used to evaluate the relative economic benefits of grade separating the intersection of Picton Road and Pembroke Parade is:

1. Extract vehicle travel times from the Aimsun model between the Hume Highway, at the northern boundary of the development (at point A on Figure 7.1) and Picton Road at the eastern boundary of the development (at point B on Figure 7.1), being the predominant freight movement for the proposed road network with signals at Pembroke Parade for the AM and PM peaks in both directions.
2. Estimate what the travel time for the free flow option would be with no traffic signals using average link speeds.
3. Estimate freight vehicle time and operating costs for the two scenarios.
4. Undertake an economic analysis comparison using the difference in construction costs and upgrade timing.

It is acknowledged that there are other benefits not quantified in this process which may influence the analysis. However, as the study requirements specifically mention freight access to Port Kembla, this analysis process has been adopted with agreement from TfNSW.

7.3 Traffic forecast results

The intersection delay reductions by the free flow option when compared to the partially grade-separated option were estimated from the 2031 and 2036 modelling results. The possible grade-separation of the Pembroke Parade intersection was assumed to open in 2022. In line with TfNSW guidelines, benefits were counted over 30 years from project opening. It was assumed that the delay reductions would grow linearly between the two modelling years, and extrapolation was used to forecast benefits in years before 2031 and after 2036. The traffic model outputs used in this analysis were for one AM peak hour and one PM peak hour on a typical weekday. These were converted to an annual total using the expansion factors listed in Table 7.2.

7.4 Economic parameters and expansion factors

Table 7.2 shows the economic parameters and expansion factors used in the analysis. They are consistent with the Principles and Guidelines for the Appraisal of Transport Initiatives economic appraisal guidelines by Transport NSW (version 1.5, November 2013).

Table 7.1 Economic parameters and expansion factors

Parameters/factors	Value	Source
Discount rate	7%	TfNSW guidelines, page 54
Opening year	2022	PB assumption
Appraisal period	30 years from opening year	TfNSW guidelines, page 20
Base year for discounting	2013	PB assumption
Price base	2013	PB assumption
Expand 1 hour AM peak and 1 hour PM peak to weekday	6.13	TfNSW guidelines, page 269
Expand weekday to annual	347	TfNSW guidelines, page 269

7.5 Project costs

The estimated cost of the grade separation is \$9,500,000¹¹. This was offset against a second-stage upgrade of the intersection of Picton Road and Pembroke Parade of \$1,847,500. Therefore, the free flow option was estimated to be \$7,652,500 more expensive than the partially grade-separated option. The difference in maintenance costs would be minimal and therefore is not included in the cost benefit analysis.

7.6 Economic benefits

Travel time benefits were based on the projected delay savings estimated from the modelling results. They were calculated separately for light vehicles and heavy vehicles. The adopted values of travel times under rural environment are listed in Table 7.3. They are consistent with the economic appraisal guidelines by Transport NSW.

Table 7.2 Values of travel time

Vehicle type	Value of time (\$/hour)
Light vehicles	\$33.17
Heavy vehicles	\$47.94

Source: Page 227, TfNSW guidelines

Potential savings in vehicle operating costs, environmental externalities, and crash costs have not been included in this rapid economic assessment.

7.7 Results

Based on the estimated travel time savings and the net cost between the free flow option and the partially grade-separated option, the upgrade would achieve a BCR of 1.9 exceeding the cut-off value of 1. This demonstrates that the incremental benefit of the free flow option over the partially grade-separated option outweigh the incremental cost.

A number of sensitivity tests were undertaken to test the impact of critical inputs into economic appraisal:

- increasing discount rate from 7% to 10% would reduce the BCR to 1.4
- increasing capital cost by 20% would reduce the BCR to 1.6
- reducing travel time savings by 20% would reduce the BCR to 1.6.

The above sensitivity tests based on conservative assumptions would still achieve a BCR of more than 1.

Although the rapid analysis focuses on the capital cost and the travel time benefits, in our view it is unlikely that including other insignificant items (e.g. maintenance cost, vehicle operating cost) would materially affect the BCR.

¹¹ Estimate by BG&E Civil, November 2013

The economic analysis presented is based on the results of traffic forecasting and modelling undertaken in December 2013. Traffic modelling for the project was updated in June 2014, with forecast traffic volumes on the Hume Highway-Picton Road route, which is a key input of this analysis, altered by no more than 5% as a result of the update process. The traffic modelling which has been completed generally indicates that travel times are not sensitive to changes in traffic volumes of this magnitude. Subsequently the sensitivity testing described above indicates that the relatively small change in travel times as a result of the revised traffic modelling would not affect the overall findings of the economic analysis. As a result, the economic analysis previously completed is representative of the latest traffic forecasting results.

While the rapid economic analysis has identified a potential economic benefit for the additional grade-separation, this additional upgrade is not required to mitigate the impacts of the Wilton Junction development. The intersection of Picton Road and Pembroke Parade can operate within acceptable performance parameters in a signalised configuration.

8. Transport management and accessibility plan

8.1 Package of transport measures

This section summarises the strategies proposed for the Wilton Junction Development to manage the demands it places on local transport infrastructure and encourage positive travel behaviour. It is noted that the proposed infrastructure upgrades along the Hume Highway and Picton Road indicated on the Master Plan are not approved by RMS. The Hume Highway/Picton Road interchange upgrade indicated on the Master Plan is not an approved design.

The proposed layouts and configurations illustrated have been adopted for the purposes of traffic modelling / traffic assessment only. This TMAP and the rezoning process that it supports, does not confirm a final design for any of the proposed infrastructure upgrades on the State Road Network.

All proposed modifications or additions to existing transport networks are subject to review and approval by responsible authorities including RMS, TfNSW, and Council. The Wilton Junction team will continue to participate in workshops with relevant authorities to achieve suitable designs.

The *Wilton Junction New Town SEPP Rezoning – Infrastructure Proposal to NSW Government* (Elton Consulting, May 2014) provides details of estimated costs, responsibilities, and funding mechanisms for identified transport network upgrades.

The package of proposed mitigation measures, implementation timeframes, and responsibilities is summarised in Table 8.1. Once agreement has been reached on the package of measures, lead agencies, timeframes and delivery mechanisms can be confirmed.

The contractual and funding arrangements of bus services and infrastructure will need to be confirmed should development proceed in the area. The Infrastructure Proposal includes the contribution of \$8.5M from Wilton Junction Developments to fund public transport facilities, with capital items to be confirmed by TfNSW.

Table 8.1 Transport network mitigation measures summary

Upgrade	Indicative timeframe			Triggered by Wilton Junction Development? ¹	Funding responsibility ²
	Short term (2014–2018)	Medium term (2019–2024)	Long term (2025–2041)		
Arterial road upgrades					
Hume Highway/Picton Road Interchange (Preliminary)				No	NSW Gov
Picton Road/Wilton Park Road intersection				Yes	WJLO
Picton Road/Pembroke Parade intersection (Preliminary)				Partially	NSW Gov/WJLO
Picton Road/Almond Street intersection (Preliminary)				Partially	NSW Gov/WJLO
Broughton Pass bridge upgrade				No	NSW Gov
Picton Road widening, east to Almond Street				Partially	NSW Gov/WJLO
Hume Highway/Picton Road Interchange (Ultimate)				No	NSW Gov
Picton Road/Pembroke Parade intersection (Ultimate)				Partially	NSW Gov/WJLO
Picton Road/Almond Street intersection grade separation				Yes	WJLO
New access intersection on Picton Road west of Wilton Park Road				Yes	WJLO
Picton Road widening, east of Almond Street				No	NSW Gov
Local road upgrades					
New entry road at Wilton Park Road				Yes	WJLO
Connection of Bingara Gorge to Town Centre				Yes	WJLO
Extension of Pembroke Parade south of Picton Road				Yes	WJLO
Expansion of local collector roads in Wilton North				Yes	WJLO
New east-west road across Hume Highway north of Picton Road				Yes	WJLO
Access ramps between Wilton Junction and the Hume Highway				Yes	WJLO
New north-south road and grade separation over Picton Road				Yes	WJLO
Expansion of internal collector roads				Yes	WJLO

Upgrade	Indicative timeframe			Triggered by Wilton Junction Development? ¹	Funding responsibility ²
	Short term (2014–2018)	Medium term (2019–2024)	Long term (2025–2041)		
Bus					
Develop bus plan				Yes	NSW Gov/ WJLO ³
Establish core Wilton–Picton service				Yes	
Existing Wilton township interim terminus				Yes	
Bus stops and shelters				Yes	
Establish service to Campbelltown/Macarthur				Yes	
Town Centre interchange				Yes	
Park-and-Ride at Wilton				Yes	
Neighbourhood centre interchanges				Yes	
Establish service to Wollongong & Wilton South				Yes	
Establish service to Wilton East & Wilton North				Yes	
Active transport					
Cycle parking at town centre				Yes	WJLO
Install wayfinding and directional signage				Yes	WJLO
Shared paths and footpaths				Yes	WJLO
Cycle parking at neighbourhood centres				Yes	WJLO
Travel plans/Access guides					
Travel Access Guides to new residents				Yes	WJLO
Workplace Travel Plans to new business owners				Yes	WJLO

(1) 'Yes' indicates upgrades required to address existing/impending network traffic issues regardless of Wilton Junction development.

(2) Funding responsibilities consistent with *Wilton Junction New Town SEPP Rezoning – Infrastructure Proposal to NSW Government* (Elton Consulting, May 2014). WJLO = Wilton Junction Land Owners. NSW Gov = NSW Government.

(3) Contractual and funding arrangements of bus services and infrastructure will need to be confirmed should development proceed. Infrastructure Proposal includes the contribution of \$8.5M from Wilton Junction Developments to fund public transport facilities, with capital items to be confirmed by TfNSW.

8.2 Funding and delivery

The delivery of the package of measures outlined in this TMAP may require funding from a range of sources including State government, Section 94 funds and contributions from developers. An infrastructure works strategy, included in the *Wilton Junction New Town SEPP Rezoning – Infrastructure Proposal to NSW Government* (Elton Consulting, May 2014), has been developed for the funding and delivery of road and transport infrastructure.

A funding plan is proposed that apportions the cost of the infrastructure based on the amount the development contributes to the need for that piece of infrastructure. For example, direct contributions involving the full cost recovery (i.e. no apportionment) can only be used where the public facility is provided to meet the level of demand anticipated by new development only and there is no facility or spare capacity available in the area. If the proposed public facility satisfies not only the demand of new development, but also some regional demand, demand by people from outside the area, or makes up for some existing deficiency, only the portion of demand created by new development can be charged.

The principles underlying the methodology for apportionment are:

- Government cost. Infrastructure required to addressing current infrastructure deficiencies and future requirements to service background growth. (i.e. all current anticipated costs for government without any consideration of Wilton Junction).
- Developer cost. Necessary augmentation of government infrastructure to service Wilton Junction, cost of bringing forward government expenditure, and costs over and above current anticipated costs for government.

The aim of the infrastructure plan is to achieve 'no additional cost to government'. It is understood that the Wilton Junction development will bring forward the requirement for government to expend funds on transport works on Picton Road. Where this occurs, a contribution based on the net present value will be determined.

The Infrastructure Proposal includes an offer of \$97,273,726 by the Wilton Junction Landowners to fund transport network upgrades in the area, as shown in Table 8.2. Further details of individual items and responsibilities are provided in Table 8.1.

Table 8.2 Summary of infrastructure offer

Item	Funded amount
New Northern On-Ramps, off ramps and bridge over Hume Highway	\$44,936,703
Pedestrian bridge over the Hume Highway linking Bingara Gorge with Wilton Junction land	\$7,327,273
Picton Road west	\$12,779,750
Picton Road East - 20% of the traffic movement	\$8,280,000
North South link bridge over Picton Road	\$15,400,000
Public transport	\$8,550,000
Total	\$97,273,726

Source: *Wilton Junction New Town SEPP Rezoning – Infrastructure Proposal to NSW Government* (Elton Consulting, May 2014)

Appendix A

Traffic survey results



Intersection of The Northern Road and Camden Bypass

Wednesday, 3 April 2013

Austrafic

Survey Start 6:30 AM 15:30 PM

Intersection Type T Junction

Intersection No. 2

North Approach

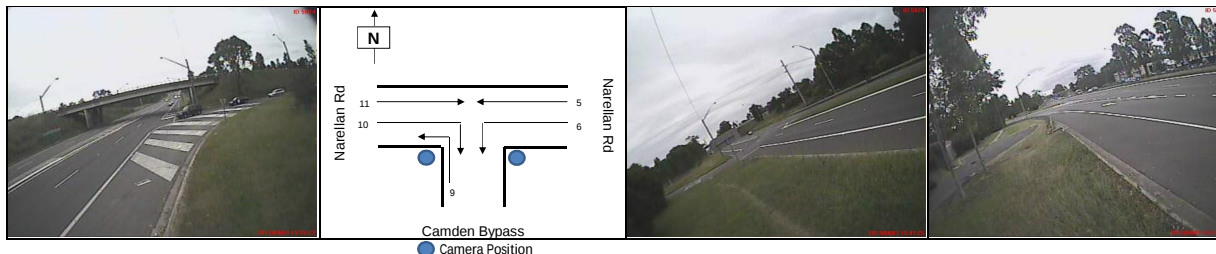
East Approach Narellan Rd

South Approach Camden Bypass

West Approach Narellan Rd

Date 3/04/13

Classification Light Heavy



TIME PERIOD	VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL			
	1			2			3			4			5			6			7			8			9			10			11			12						
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ							
6:30 - 6:45													128	17	145	87	7	94								72	3	75	31	6	37	156	24	180				474	57	531
6:45 - 7:00													187	7	194	78	6	84								81	3	84	22	8	30	142	14	156				510	38	548
7:00 - 7:15													166	15	181	61	2	63								66	2	68	27	6	33	169	22	191				489	47	536
7:15 - 7:30													196	12	208	72	12	84								74	2	76	29	6	35	182	22	204				553	54	607
7:30 - 7:45													177	9	186	77	11	88								83	6	89	33	7	40	232	20	252				602	53	655
7:45 - 8:00													239	18	257	101	7	108								94	3	97	42	5	47	219	18	237				695	51	746
8:00 - 8:15													234	11	245	99	7	106								113	3	116	42	10	52	210	7	217				698	38	736
8:15 - 8:30													287	23	310	115	8	123								88	2	90	33	4	37	208	19	227				731	56	787
8:30 - 8:45													255	11	266	120	11	131								112	8	120	42	4	46	179	18	197				708	52	760
8:45 - 9:00													279	19	298	141	10	151								98	4	102	47	2	49	193	9	202				758	44	802
9:00 - 9:15													280	17	297	104	15	119								69	4	73	36	8	44	234	17	251				723	61	784
9:15 - 9:30													197	18	215	84	14	98								66	4	70	28	7	35	197	15	212				572	58	630
Σ													2625	177	2802	1139	110	1249								1016	44	1060	412	73	485	2321	205	2526				7513	609	8122
7:00 - 9:00	0	0		0	0		0	0		0	0		1833	118		786	68		0	0		0	0			728	30		295	44		1592	135		0	0				5629

TIME PERIOD	VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL		
	1			2			3			4			5			6			7			8			9			10			11			12					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ			
15:30 - 15:45													266	16	282	153	16	169								48	9	57	72	10	82	258	16	274			797	67	864
15:45 - 16:00													291	20	311	195	10	205								53	7	60	80	9	89	285	15	300			904	61	965
16:00 - 16:15													299	10	309	196	6	202								47	3	50	94	9	103	255	17	272			891	45	936
16:15 - 16:30													300	16	316	178	13	191								53	1	54	95	5	100	269	12	281			895	47	942
16:30 - 16:45													270	12	282	210	8	218								47	8	55	131	8	139	292	17	309			950	53	1003
16:45 - 17:00													302	10	312	179	11	190								48	4	52	107	6	113	236	15	251			872	46	918
17:00 - 17:15													280	10	290	260	10	270								47	3	50	119	5	124	296	6	302			1002	34	1036
17:15 - 17:30													266	9	275	218	10	228								65	1	66	106	3	109	254	5	259			909	28	937
17:30 - 17:45													351	10	361	201	1	202								32	1	33	109	2	111	242	3	245			935	17	952
17:45 - 18:00													252	9	261	213	1	214								33	4	37	113	5	118	213	5	218			824	24	848
18:00 - 18:15													278	12	290	186	7	193								35	2	37	104	3	107	232	5	237			835	29	864
18:15 - 18:30													230	11	241	195	4	199								31	1	32	74	0	74	209	5	214			739	21	760
Σ													3385	145	3530	2384	97	2481								539	44	583	1204	65	1269	3041	121	3162	####	472	####		
15:45 - 17:45	0	0		0	0		0	0		0	0		2359	97		1637	69		0	0		0	0			392	28		841	47		2129	90		0	0			7689

Intersection of Hume Highway and Narellan Road

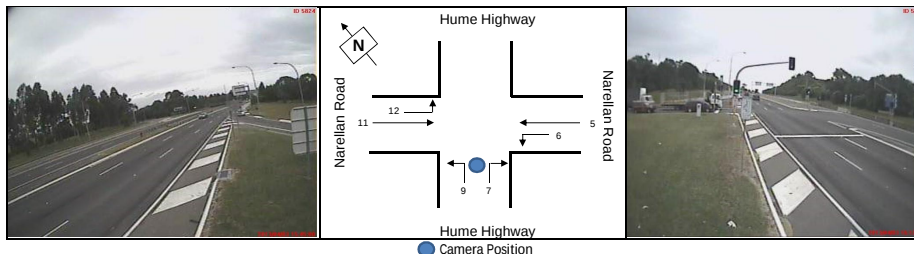
Wednesday, 3 April 2013

Austraffic

Survey Start 6:30 AM 15:30 PM
Intersection Type Cross Junction
Intersection No. 3A
North Approach Hume Highway
East Approach Narellan Road
South Approach Hume Highway
West Approach Narellan Road

Date 3/04/13

Classification Light Heavy



TIME PERIOD	VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL		
	1			2			3			4			5			6			7			8			9			10			11			12					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ			
6:30 - 6:45													313	36	349	142	4	146	58	7	65				30	5	35				352	21	373	364	18	382	1259	91	1350
6:45 - 7:00													320	33	353	145	10	155	59	4	63				34	5	39				343	25	368	346	16	362	1247	93	1340
7:00 - 7:15													301	28	329	169	6	175	46	1	47				37	7	44				409	21	430	384	24	408	1346	87	1433
7:15 - 7:30													334	28	362	186	11	197	40	1	41				33	4	37				446	26	472	386	17	403	1425	87	1512
7:30 - 7:45													355	33	388	169	4	173	58	4	62				40	5	45				414	26	440	340	21	361	1376	93	1469
7:45 - 8:00													410	38	448	156	3	159	60	4	64				47	9	56				469	24	493	347	15	362	1489	93	1582
8:00 - 8:15													415	38	453	131	5	136	77	5	82				32	6	38				486	26	512	275	11	286	1416	91	1507
8:15 - 8:30													501	33	534	136	5	141	73	3	76				54	6	60				479	19	498	243	10	253	1486	76	1562
8:30 - 8:45													375	36	411	122	5	127	51	1	52				37	10	47				513	24	537	289	24	313	1397	100	1487
8:45 - 9:00													436	39	475	69	4	73	53	3	56				30	6	36				383	21	404	220	29	249	1191	102	1293
9:00 - 9:15													375	33	408	92	10	102	66	5	71				36	11	47				399	33	432	177	34	211	1145	126	1271
9:15 - 9:30													349	44	393	80	7	87	34	3	37				29	6	35				357	19	376	147	19	166	996	98	1094
Σ													4484	419	4903	1597	74	1671	675	41	716				439	80	519				5050	285	5335	3518	238	3756	####	1137	####
7:00 - 9:00	0	0		0	0		0	0		0	0		3127	273		1138	43		458	22		0	0		310	53		0	0		3599	187		2484	151				####

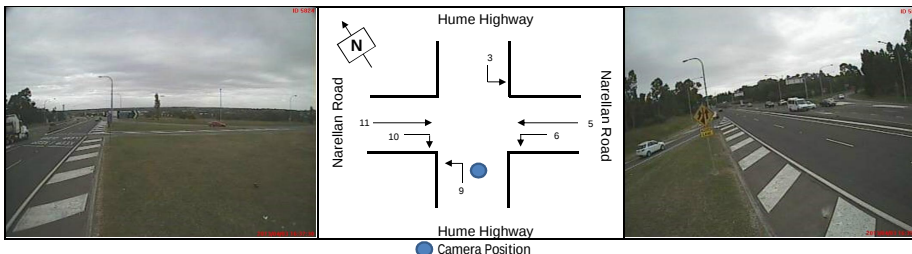
TIME PERIOD	VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL		
	1			2			3			4			5			6			7			8			9			10			11			12					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ			
15:30 - 15:45													756	46	802	127	9	136	23	1	24				33	7	40				389	13	402	125	23	148	1453	99	1552
15:45 - 16:00													677	39	716	123	6	129	38	1	39				37	7	44				358	29	387	122	34	156	1355	116	1471
16:00 - 16:15													773	24	797	155	6	161	32	3	35				42	2	44				401	19	420	118	21	139	1521	75	1596
16:15 - 16:30													780	24	804	162	4	166	35	1	36				37	9	46				373	23	396	122	21	143	1509	82	1591
16:30 - 16:45													806	35	841	119	4	123	34	2	36				42	8	50				356	13	369	115	9	124	1472	71	1543
16:45 - 17:00													813	26	839	147	1	148	36	0	36				48	6	54				361	11	372	154	11	165	1559	55	1614
17:00 - 17:15													882	18	900	157	4	161	22	4	26				30	5	35				390	13	403	184	15	199	1665	59	1724
17:15 - 17:30													869	23	892	156	2	158	34	0	34				45	4	49				387	7	394	147	6	153	1638	42	1680
17:30 - 17:45													861	20	881	132	2	134	29	0	29				40	4	44				368	13	381	130	7	137	1560	46	1606
17:45 - 18:00													876	14	890	128	2	130	24	1	25				42	7	49				362	9	371	121	5	126	1553	38	1591
18:00 - 18:15													777	11	788	124	4	128	28	2	30				37	7	44				352	10	362	112	7	119	1430	41	1471
18:15 - 18:30													735	19	754	125	1	126	21	1	22				35	4	39				286	8	294	114	4	118	1316	37	1353
Σ													9605	299	9904	1655	45	1700	356	16	372				468	70	538				4383	168	4551	1564	163	1727	####	761	####
15:45 - 17:45	0	0		0	0		0	0		0	0		6461	209		1151	29		260	11		0	0		321	45		0	0		2994	128		1092	124				####

Intersection of Hume Highway and Narellan Road

Wednesday, 3 April 2013

Austraffic

Survey Start 6:30 AM 15:30 PM
Intersection Type Cross Junction
Intersection No. 3B
North Approach Hume Highway
East Approach Narellan Road
South Approach Hume Highway
West Approach Narellan Road
Date 3/04/13
Classification Light Heavy



TIME PERIOD	VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL		
	1			2			3			4			5			6			7			8			9			10			11			12					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ						
6:30 - 6:45							81	12	93				347	16	363	13	2	15							109	25	134	31	7	38	378	23	401			959	85	1044	
6:45 - 7:00							92	9	101				365	26	391	18	8	26							101	17	118	30	5	35	368	24	392			974	89	1063	
7:00 - 7:15							78	6	84				368	21	389	26	5	31							99	13	112	32	3	35	422	16	438			1025	64	1089	
7:15 - 7:30							80	10	90				414	25	439	25	2	27							103	16	119	51	12	63	430	18	448			1103	83	1186	
7:30 - 7:45							98	7	105				425	14	439	33	1	34							100	21	121	50	8	58	427	22	449			1133	73	1206	
7:45 - 8:00							132	5	137				420	18	438	28	2	30							140	24	164	39	5	44	491	23	514			1250	77	1327	
8:00 - 8:15							147	7	154				416	20	436	27	2	29							135	22	157	26	7	33	534	23	557			1285	81	1366	
8:15 - 8:30							185	7	192				483	17	500	18	4	22							149	21	170	26	1	27	529	22	551			1390	72	1462	
8:30 - 8:45							194	7	201				474	21	495	17	5	22							121	22	143	27	5	32	535	20	555			1266	80	1346	
8:45 - 9:00							153	4	157				388	26	414	18	5	23							111	18	129	22	7	29	413	16	429			1105	76	1181	
9:00 - 9:15							123	4	127				363	27	390	29	4	33							105	15	120	26	11	37	442	28	470			1088	89	1177	
9:15 - 9:30							123	4	127				312	24	336	27	1	28							119	25	144	26	4	30	372	18	390			979	76	1055	
Σ							1486	82	1568				4675	255	4930	279	41	320							1392	239	1631	386	75	461	5341	253	5594			####	945	####	
7:00 - 9:00	0	0		0	0		1067	53		0	0		3288	162		192	26		0	0		0	0		958	157		273	48		3781	160		0	0		####		

TIME PERIOD	VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL		
	1			2			3			4			5			6			7			8			9			10			11			12					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ						
15:30 - 15:45							166	8	174				591	28	619	56	0	56							291	26	317	37	2	39	371	11	382			1512	75	1587	
15:45 - 16:00							163	8	171				543	29	572	54	6	60							260	17	277	30	2	32	369	26	395			1419	88	1507	
16:00 - 16:15							130	6	136				642	10	652	63	2	65							289	18	307	36	4	40	402	17	419			1562	57	1619	
16:15 - 16:30							130	5	135				609	16	625	57	8	65							338	14	352	36	5	41	373	20	393			1543	68	1611	
16:30 - 16:45							131	8	139				601	16	617	72	1	73							324	24	348	39	9	48	352	9	361			1519	67	1586	
16:45 - 17:00							142	3	145				628	13	641	71	5	76							336	13	349	42	2	44	359	9	368			1578	45	1623	
17:00 - 17:15							126	4	130				675	10	685	63	2	65							363	10	373	34	1	35	374	16	390			1635	43	1678	
17:15 - 17:30							151	2	153				634	18	652	70	1	71							394	9	403	46	2	48	376	5	381			1671	37	1708	
17:30 - 17:45							144	5	149				616	9	625	74	1	75							372	12	384	21	3	24	372	8	380			1599	38	1637	
17:45 - 18:00							126	5	131				619	8	627	62	2	64							390	7	397	43	1	44	344	11	355			1584	34	1618	
18:00 - 18:15							143	4	147				556	12	568	60	1	61							343	4	347	23	2	25	352	10	362			1477	33	1510	
18:15 - 18:30							124	4	128				559	11	570	47	2	49							299	10	309	23	2	25	285	7	292			1337	36	1373	
Σ							1676	62	1738				7273	180	7453	749	31	780							3999	164	4163	410	35	445	4329	149	4478			####	621	####	
15:45 - 17:45	0	0		0	0		1117	41		0	0		4948	121		524	26		0	0		0	0		2676	117		284	28		2977	110		0	0		####		

Intersection of Remembrance Drive and Macarthur Road

Wednesday, 3 April 2013

Austrafic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 6A
North Approach Macarthur Road
East Approach Remembrance Drive
South Approach Macarthur Road
West Approach

Date 3/04/13

Classification Light Heavy



TIME PERIOD			VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL		
			1			2			3			4			5			6			7			8			9			10			11			12					
			Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ						
6:30	-	6:45				6	0	6	55	1	56	20	1	21				9	1	10	7	4	11	4	2	6									101	9	110				
6:45	-	7:00				9	0	9	53	0	53	17	1	18				19	2	21	4	4	8	18	2	20									120	9	129				
7:00	-	7:15				8	0	8	75	2	77	27	0	27				10	4	14	8	4	12	23	0	23										151	10	161			
7:15	-	7:30				12	0	12	71	2	73	15	1	16				9	1	10	7	5	12	26	1	27										140	10	150			
7:30	-	7:45				9	1	10	80	1	81	20	0	20				17	0	17	13	6	19	27	3	30										166	11	177			
7:45	-	8:00				11	0	11	59	3	62	26	1	27				20	1	21	30	4	34	36	0	36										182	9	191			
8:00	-	8:15				10	3	13	76	1	77	22	0	22				17	1	18	31	7	38	37	0	37										193	12	205			
8:15	-	8:30				18	0	18	71	1	72	42	2	44				12	1	13	25	1	26	70	1	71										238	6	244			
8:30	-	8:45				9	0	9	75	2	77	46	1	47				26	0	26	26	6	32	87	0	87										269	9	278			
8:45	-	9:00				12	0	12	74	0	74	39	1	40				20	0	20	25	4	29	80	0	80										290	5	295			
9:00	-	9:15				11	1	12	71	0	71	31	1	32				16	1	17	16	11	27	45	0	45										190	14	204			
9:15	-	9:30				6	0	6	75	1	76	29	0	29				17	2	19	17	11	28	31	1	32										175	15	190			
Σ						121	5	126	835	14	849	334	9	343				192	14	206	209	67	276	484	10	494									2175	119	2294				
7:00	-	9:00	0	0		89	4		581	12		237	6		0	0		131	8		165	37		386	5		0	0		0	0		0	0				1661			

TIME PERIOD	VEHICLE MOVEMENT												VEHICLE MOVEMENT												GRAND TOTAL												
	1			2			3			4			5			6			7			8				9			10			11			12		
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ			
15:30 - 15:45				19	2	21	60	0	60	29	0	29				23	3	26	17	19	36	53	2	55									201	26	227		
15:45 - 16:00				14	1	15	58	3	61	29	0	29				13	0	13	23	5	28	86	3	89									223	12	235		
16:00 - 16:15				17	1	18	64	1	65	21	0	21				20	0	20	38	9	47	55	3	58									215	14	229		
16:15 - 16:30				13	0	13	54	0	54	37	0	37				21	1	22	30	9	39	74	0	74									229	10	239		
16:30 - 16:45				12	0	12	62	1	63	19	1	20				20	0	20	24	9	33	69	1	70									206	12	218		
16:45 - 17:00				12	0	12	73	1	74	25	0	25				19	1	20	23	1	24	57	4	61									209	7	216		
17:00 - 17:15				16	0	16	78	2	80	33	0	33				15	1	16	31	0	31	62	2	64									235	5	240		
17:15 - 17:30				13	0	13	57	0	57	25	0	25				24	1	25	22	0	22	60	0	60									201	1	202		
17:30 - 17:45				22	1	23	56	1	57	35	0	35				13	1	14	28	0	28	69	0	69									223	3	226		
17:45 - 18:00				11	0	11	64	0	64	31	0	31				31	0	31	15	2	17	53	1	54									205	3	208		
18:00 - 18:15				10	0	10	58	0	58	25	0	25				14	1	15	12	2	14	66	0	66									185	3	188		
18:15 - 18:30				12	0	12	43	0	43	27	0	27				11	0	11	15	0	15	48	1	49									156	1	157		
Σ				171	5	176	727	9	736	336	1	337				224	9	233	278	56	334	752	17	769									2488	97	2585		
15:45 - 17:45	0	0		119	3		502	9		224	1		0	0		145	5		219	33		532	13		0	0		0	0		0	0				1805	

Intersection of Remembrance Drive and Macarthur Road

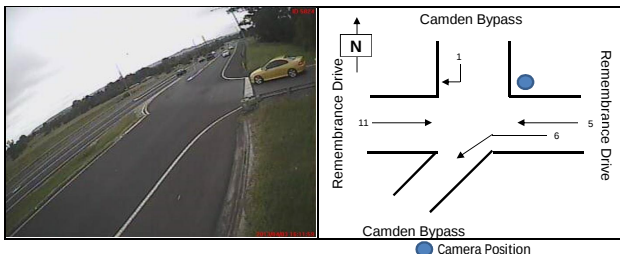
Wednesday, 3 April 2013

Austrafic

Survey Start 6:30 AM 15:30 PM
Intersection Type Cross Junction
Intersection No. 6B
North Approach Remembrance Drive
East Approach Camden Bypass
South Approach Camden Bypass
West Approach Camden Bypass

Date 3/04/13

Classification Light Heavy



TIME PERIOD			VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
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			Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								
6:30	-	6:45	12	4	16								85	8	93	15	4	19																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																												

TIME PERIOD	VEHICLE MOVEMENT															VEHICLE MOVEMENT															GRAND TOTAL									
	1			2			3			4			5			6			7			8			9			10				11			12					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ		Light	Heavy	Σ						
15:30 - 15:45	43	2	45										192	13	205	39	6	45															141	8	149	415	29	444		
15:45 - 16:00	59	3	62										222	8	230	68	14	82															138	11	149	487	36	523		
16:00 - 16:15	72	2	74										231	9	240	43	8	51															131	5	136	477	24	501		
16:15 - 16:30	50	4	54										266	4	270	60	3	63															153	4	157	529	15	544		
16:30 - 16:45	54	3	57										263	9	272	61	9	70															106	4	110	484	25	509		
16:45 - 17:00	67	1	68										292	6	298	45	9	54															130	6	136	534	22	556		
17:00 - 17:15	68	1	69										329	12	341	50	7	57															147	6	153	584	28	612		
17:15 - 17:30	49	0	49										268	6	274	54	4	58															158	1	159	529	11	540		
17:30 - 17:45	42	0	42										296	2	298	57	0	57															121	2	123	516	4	520		
17:45 - 18:00	54	0	54										295	6	301	47	2	49															108	5	113	504	13	517		
18:00 - 18:15	40	0	40										279	5	284	59	3	62															108	3	111	486	11	497		
18:15 - 18:30	45	0	45										227	4	231	44	1	45															114	1	115	430	6	436		
Σ	643	16	659										3160	84	3244	627	66	693															1555	56	1611	5985	222	6207		
15:45 - 17:45	461	14		0	0		0	0		0	0		2167	56		438	54		0	0		0	0		0	0		0	0		0	0		1084	39		0	0		4313

Intersection of Appin Road and Church Street

Thursday, 4 April 2013

Austrafic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 7
North Approach Appin Road
East Approach Church Street
South Approach Appin Road
West Approach

Date 4/04/13

Classification Light Heavy



TIME PERIOD	VEHICLE MOVEMENT												VEHICLE MOVEMENT												GRAND TOTAL																		
	1			2			3			4			5			6			7			8				9			10			11			12								
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ									
6:30 - 6:45				9	1	10	41	14	55	56	7	63				11	0	11	10	0	10	9	2	11										136	24	160							
6:45 - 7:00				8	1	9	33	11	44	70	6	76				8	1	9	8	0	8	14	2	16											141	21	162						
7:00 - 7:15				9	3	12	52	7	59	90	5	95				12	1	13	6	0	6	12	0	12												181	16	197					
7:15 - 7:30				10	1	11	72	7	79	96	5	101				15	1	16	6	1	7	16	3	19													215	18	233				
7:30 - 7:45				16	3	19	71	9	80	145	10	155				12	1	13	11	1	12	19	1	20														274	25	299			
7:45 - 8:00				12	3	15	83	10	93	159	9	168				9	0	9	3	1	4	17	0	17														283	23	306			
8:00 - 8:15				18	1	19	68	6	74	145	10	155				11	2	13	4	1	5	16	0	16														262	20	282			
8:15 - 8:30				9	2	11	64	5	69	140	10	150				18	0	18	10	0	10	21	2	23															262	19	281		
8:30 - 8:45				10	2	12	48	5	53	80	12	92				7	1	8	7	0	7	14	2	16															166	22	188		
8:45 - 9:00				13	1	14	51	9	60	90	5	95				9	0	9	8	1	9	19	2	21																190	18	208	
9:00 - 9:15				14	1	15	36	11	47	63	1	64				9	0	9	12	0	12	21	1	22																155	14	169	
9:15 - 9:30				14	2	16	43	10	53	52	8	60				4	0	4	6	0	6	15	1	16																134	21	155	
Σ				142	21	163	662	104	766	1186	88	1274				125	7	132	91	5	96	193	16	209																2399	241	2640	
7:00 - 9:00	0	0		97	16		509	58		945	66		0	0		93	6		55	5		134	10		0	0		0	0		0	0		0	0								1994

TIME PERIOD	VEHICLE MOVEMENT												VEHICLE MOVEMENT												GRAND TOTAL														
	1			2			3			4			5			6			7			8				9			10			11			12				
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ					
15:30 - 15:45				31	0	31	110	2	112	70	5	75				5	4	9	11	2	13	11	1	12											238	14	252		
15:45 - 16:00				17	2	19	123	3	126	69	5	74				11	2	13	12	1	13	23	1	24											255	14	269		
16:00 - 16:15				15	1	16	101	6	107	77	7	84				21	0	21	12	0	12	25	0	25											261	14	265		
16:15 - 16:30				26	0	26	121	2	123	60	3	63				11	1	12	9	0	9	16	2	18											243	8	251		
16:30 - 16:45				18	1	19	103	4	107	60	4	64				5	1	6	20	0	20	25	0	25											231	10	241		
16:45 - 17:00				16	0	16	114	5	119	59	3	62				14	0	14	15	0	15	22	0	22											240	8	248		
17:00 - 17:15				24	0	24	105	5	110	54	5	59				13	0	13	10	0	10	26	0	26											232	10	242		
17:15 - 17:30				21	1	22	120	6	126	68	4	72				9	1	10	10	0	10	16	0	16											244	12	256		
17:30 - 17:45				23	0	23	104	1	105	71	2	73				12	0	12	6	1	7	16	0	16											232	4	236		
17:45 - 18:00				20	0	20	118	5	123	64	4	68				10	0	10	7	0	7	18	0	18											237	9	246		
18:00 - 18:15				12	0	12	67	2	69	64	3	67				8	0	8	11	0	11	10	0	10											172	5	177		
18:15 - 18:30				9	0	9	47	2	49	49	4	53				13	1	14	8	0	8	11	0	11											137	7	144		
Σ				232	5	237	1233	43	1276	765	49	814				132	10	142	131	4	135	219	4	223											2712	115	2827		
15:45 - 17:45	0	0		160	5		891	32		518	33		0	0		96	5		94	2		169	3		0	0		0	0		0	0							2008

Intersection of Appin Road and M1 Princes Motorway

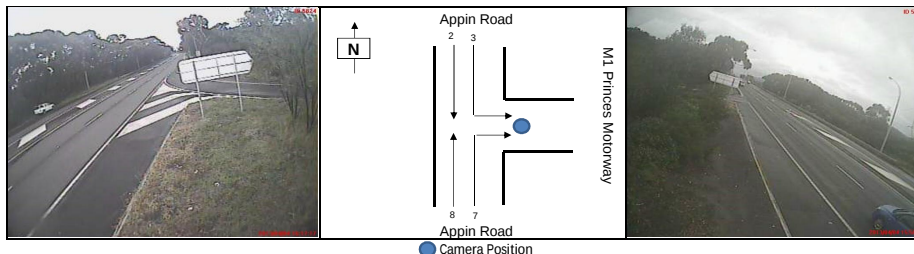
Thursday, 4 April 2013

Austraffic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 8A&B
North Approach Appin Road
East Approach M1 Princes Motorway
South Approach Appin Road
West Approach

Date 4/04/13

Classification Light Heavy



TIME PERIOD			VEHICLE MOVEMENT															VEHICLE MOVEMENT															GRAND TOTAL								
			1			2			3			4			5			6			7			8			9			10						11			12		
			Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ				Light	Heavy	Σ			
6:30	-	6:45				59	11	70	19	4	23								1	0	1	83	11	94										182	26	208					
6:45	-	7:00				33	15	48	16	0	16								0	0	0	97	10	107										146	25	171					
7:00	-	7:15				41	13	54	12	2	14								1	0	1	111	13	124										165	28	193					
7:15	-	7:30				48	24	72	23	0	23								0	0	0	151	15	166										222	39	261					
7:30	-	7:45				67	15	82	11	0	11								0	0	0	160	16	176										238	31	269					
7:45	-	8:00				101	11	112	12	0	12								0	0	0	173	16	189										286	27	313					
8:00	-	8:15				130	15	145	11	3	14								0	0	0	135	14	149										276	32	308					
8:15	-	8:30				69	13	82	14	2	16								0	0	0	103	24	127										186	39	225					
8:30	-	8:45				59	9	68	12	0	12								0	0	0	87	10	97										156	19	175					
8:45	-	9:00				39	13	52	11	1	12								1	0	1	82	5	87										133	19	152					
9:00	-	9:15				43	16	59	6	3	9								0	0	0	61	13	74										110	32	142					
9:15	-	9:30				29	8	37	13	4	17								0	0	0	69	10	79										111	22	133					
Σ						718	163	881	160	19	179								3	0	3	1312	157	1469										2193	339	2532					
7:00	-	9:00	0	0		554	113		106	8		0	0		0	0		0	0		1002	113		0	0		0	0		0	0		0	0		1898					

TIME PERIOD	VEHICLE MOVEMENT															VEHICLE MOVEMENT															GRAND TOTAL						
	1			2			3			4			5			6			7			8			9			10				11			12		
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ		Light	Heavy	Σ			
15:30 - 15:45				97	6	103	7	0	7							0	0	0	66	11	77												170	17	187		
15:45 - 16:00				150	9	159	12	1	13							2	0	2	96	6	102												260	16	276		
16:00 - 16:15				141	7	148	14	0	14							0	0	0	63	12	75												218	19	237		
16:15 - 16:30				136	7	143	16	0	16							0	0	0	62	8	70												214	15	229		
16:30 - 16:45				133	8	141	11	0	11							1	0	1	63	7	70												208	15	223		
16:45 - 17:00				134	7	141	15	0	15							3	0	3	58	5	63												210	12	222		
17:00 - 17:15				115	10	125	7	0	7							1	0	1	75	10	85												198	20	218		
17:15 - 17:30				121	9	130	18	0	18							0	0	0	76	6	82												215	15	230		
17:30 - 17:45				128	4	132	8	0	8							2	0	2	68	7	75												206	11	217		
17:45 - 18:00				93	3	96	12	0	12							2	0	2	74	9	83												181	12	193		
18:00 - 18:15				99	8	107	10	0	10							0	0	0	69	7	76												178	15	193		
18:15 - 18:30				65	6	71	9	0	9							0	0	0	44	8	52												118	14	132		
Σ				1412	84	1496	139	1	140							11	0	11	814	96	910												2376	181	2557		
15:45 - 17:45	0	0		1058	61	1119	101	1	102	0	0		0	0		9	0	9	561	61	622	0	0		0	0		0	0		0	0		1852			

Intersection of Mount Ousley Road and Picton Road

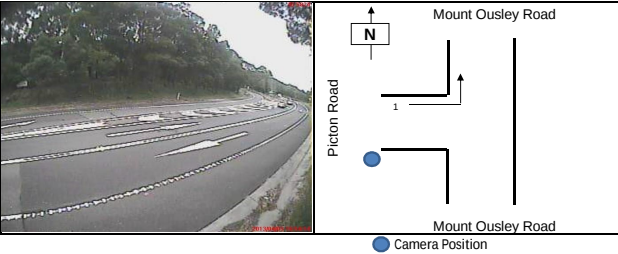
Wednesday, 3 April 2013

Austraffic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 9A
North Approach Mount Ousley Road
East Approach
South Approach Mount Ousley Road
West Approach Picton Road

Date 3/04/13

Classification Light Heavy



TIME PERIOD			VEHICLE MOVEMENT		
			1		
			Light	Heavy	Σ
6:30	-	6:45	1	0	1
6:45	-	7:00	2	1	3
7:00	-	7:15	2	1	3
7:15	-	7:30	2	2	4
7:30	-	7:45	3	0	3
7:45	-	8:00	1	0	1
8:00	-	8:15	2	0	2
8:15	-	8:30	4	0	4
8:30	-	8:45	3	0	3
8:45	-	9:00	2	2	4
9:00	-	9:15	0	0	0
9:15	-	9:30	1	0	1
Σ			23	6	29
7:00	-	9:00	19	5	24

0

TIME PERIOD			VEHICLE MOVEMENT		
			1		
			Light	Heavy	Σ
15:30	-	15:45	2	0	2
15:45	-	16:00	2	1	3
16:00	-	16:15	5	0	5
16:15	-	16:30	7	0	7
16:30	-	16:45	1	0	1
16:45	-	17:00	3	0	3
17:00	-	17:15	2	0	2
17:15	-	17:30	4	0	4
17:30	-	17:45	1	0	1
17:45	-	18:00	3	0	3
18:00	-	18:15	2	0	2
18:15	-	18:30	3	0	3
Σ			35	1	36
15:45	-	17:45	25	1	26

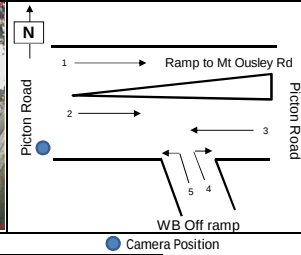
0

Intersection of Mount Ousley Road and Picton Road

Wednesday, 3 April 2013

Austraffic

Survey Start **6:30 AM 15:30 PM**
 Intersection Type **T Junction**
 Intersection No. **9A&B**
 North Approach
 East Approach **Picton Road**
 South Approach **WB Off ramp**
 West Approach **Picton Road**
 Date **3/04/13**
 Classification **Light Heavy**



TIME PERIOD		VEHICLE MOVEMENT															GRAND TOTAL		
		1			2			3			4			5					
		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
6:30	- 6:45	0	0	0	106	36	142	6	1	7	4	2	6	0	0	0	116	39	155
6:45	- 7:00	2	2	4	92	42	134	0	0	0	4	1	5	0	0	0	98	45	143
7:00	- 7:15	2	1	3	70	33	103	6	0	6	1	0	1	0	0	0	79	34	113
7:15	- 7:30	2	2	4	96	26	122	8	0	8	2	0	2	0	0	0	108	28	136
7:30	- 7:45	3	0	3	127	31	158	8	3	11	3	1	4	0	0	0	141	35	176
7:45	- 8:00	1	0	1	201	39	240	3	1	4	0	0	0	0	0	0	205	40	245
8:00	- 8:15	2	0	2	174	32	206	6	2	8	2	0	2	0	0	0	184	34	218
8:15	- 8:30	4	0	4	132	23	155	2	0	2	2	2	4	0	0	0	140	25	165
8:30	- 8:45	3	0	3	116	34	150	2	1	3	7	0	7	0	0	0	128	35	163
8:45	- 9:00	2	2	4	101	24	125	4	1	5	0	1	1	0	0	0	107	28	135
9:00	- 9:15	0	0	0	94	18	112	4	0	4	3	0	3	0	0	0	101	18	119
9:15	- 9:30	1	0	1	73	26	99	7	1	8	0	0	0	0	0	0	81	27	108
Σ		22	7	29	1382	364	1746	56	10	66	28	7	35	0	0	0	1488	388	1876
7:00	- 9:00	19	5	24	1017	242	1259	39	8	47	17	4	21	0	0	0	1051	254	1305

TIME PERIOD		VEHICLE MOVEMENT															GRAND TOTAL		
		1			2			3			4			5					
		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
15:30 - 15:45	2	0	2	103	27	130	0	0	0	2	0	2	0	0	0	107	27	134	
15:45 - 16:00	3	1	4	122	24	146	2	0	2	3	0	3	0	0	0	130	25	155	
16:00 - 16:15	5	0	5	150	21	171	7	2	9	3	0	3	0	0	0	165	23	188	
16:15 - 16:30	7	0	7	152	25	177	5	2	7	0	0	0	0	0	0	164	27	191	
16:30 - 16:45	1	0	1	120	23	143	6	0	6	1	0	1	0	0	0	128	23	151	
16:45 - 17:00	3	0	3	121	24	145	1	0	1	3	0	3	0	0	0	128	24	152	
17:00 - 17:15	2	0	2	144	23	167	1	0	1	2	0	2	0	0	0	149	23	172	
17:15 - 17:30	4	0	4	144	15	159	2	0	2	1	1	2	0	0	0	151	16	167	
17:30 - 17:45	1	0	1	150	9	159	5	1	6	0	0	0	0	0	0	156	10	166	
17:45 - 18:00	3	0	3	139	16	155	5	0	5	2	0	2	0	0	0	149	16	165	
18:00 - 18:15	2	0	2	102	6	108	3	1	4	1	1	2	0	0	0	108	8	116	
18:15 - 18:30	3	0	3	111	13	124	1	0	1	1	0	1	0	0	0	116	13	129	
Σ		36	1	37	1558	226	1784	38	6	44	19	2	21	0	0	1651	235	1886	
15:45 - 17:45	26	1	27	1103	164	1267	29	5	34	13	1	14	0	0	0	1141	174	1315	

Intersection of Mount Ousley Road and Picton Road

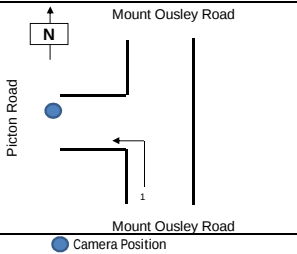
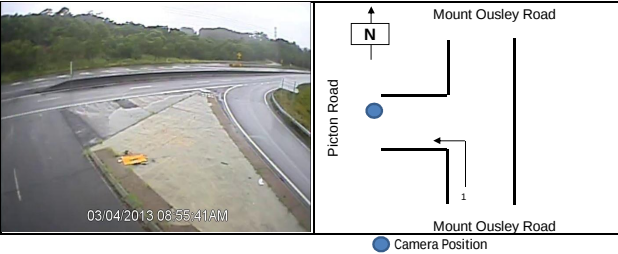
Wednesday, 3 April 2013

Austraffic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 9C
North Approach Mount Ousley Road
East Approach
South Approach Mount Ousley Road
West Approach Picton Road

Date 3/04/13

Classification Light Heavy



TIME PERIOD			VEHICLE MOVEMENT		
			1		
			Light	Heavy	Σ
6:30	-	6:45	198	40	238
6:45	-	7:00	120	26	146
7:00	-	7:15	133	27	160
7:15	-	7:30	126	35	161
7:30	-	7:45	109	33	142
7:45	-	8:00	103	29	132
8:00	-	8:15	91	27	118
8:15	-	8:30	81	31	112
8:30	-	8:45	81	28	109
8:45	-	9:00	66	28	94
9:00	-	9:15	64	41	105
9:15	-	9:30	76	46	122
Σ			1248	391	1639
7:00	-	9:00	790	238	1028

Zone 1	LV	HV	Total PCU
7:00-7:30	1012	103	1218
7:30-8:00	811	112	1035
8:00-8:30	642	107	856
8:30-9:00	574	110	794

TIME PERIOD			VEHICLE MOVEMENT		
			1		
			Light	Heavy	Σ
15:30	-	15:45	112	20	132
15:45	-	16:00	98	21	119
16:00	-	16:15	99	22	121
16:15	-	16:30	110	13	123
16:30	-	16:45	118	20	138
16:45	-	17:00	128	16	144
17:00	-	17:15	125	22	147
17:15	-	17:30	129	10	139
17:30	-	17:45	120	11	131
17:45	-	18:00	101	11	112
18:00	-	18:15	92	7	99
18:15	-	18:30	52	12	64
Σ			1284	185	1469
15:45	-	17:45	927	135	1062

15:45-16:15	LV	HV	Total PCU
15:45-16:15	672	76	824
16:15-16:45	756	59	874
16:45-17:15	766	56	878
17:15-17:45	811	46	903

Intersection of Mount Ousley Road and Picton Road

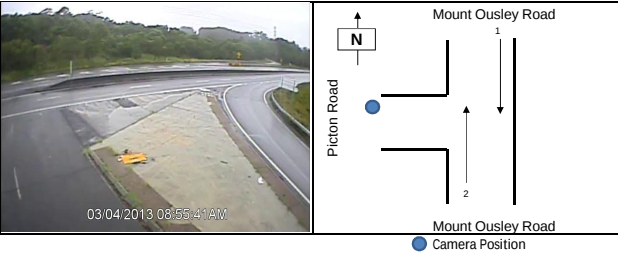
Wednesday, 3 April 2013

Austraffic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 9D
North Approach Mount Ousley Road
East Approach
South Approach Mount Ousley Road
West Approach Picton Road

Date 3/04/13

Classification Light Heavy



TIME PERIOD	VEHICLE MOVEMENT								
	1			2			GRAND TOTAL		
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
6:30 - 6:45	167	32	199	430	35	465	597	67	664
6:45 - 7:00	152	18	170	279	11	290	431	29	460
7:00 - 7:15	161	21	182	418	18	436	579	39	618
7:15 - 7:30	165	14	179	335	23	358	500	37	537
7:30 - 7:45	254	13	267	315	27	342	569	40	609
7:45 - 8:00	362	24	386	284	23	307	646	47	693
8:00 - 8:15	357	15	372	231	24	255	588	39	627
8:15 - 8:30	275	23	298	239	25	264	514	48	562
8:30 - 8:45	217	32	249	213	22	235	430	54	484
8:45 - 9:00	225	18	243	214	32	246	439	50	489
9:00 - 9:15	228	16	244	212	18	230	440	34	474
9:15 - 9:30	243	30	273	232	40	272	475	70	545
Σ	2806	256	3062	3402	298	3700	6208	554	6762
7:00 - 9:00	2016	160		2249	194		4265	354	4619

0

TIME PERIOD	VEHICLE MOVEMENT								
	1			2			GRAND TOTAL		
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
15:30 - 15:45	307	25	332	245	20	265	552	45	597
15:45 - 16:00	314	12	326	241	15	256	555	27	582
16:00 - 16:15	310	19	329	234	18	252	544	37	581
16:15 - 16:30	326	26	352	242	10	252	568	36	604
16:30 - 16:45	346	10	356	286	16	302	632	26	658
16:45 - 17:00	423	23	446	260	11	271	683	34	717
17:00 - 17:15	367	18	385	253	7	260	620	25	645
17:15 - 17:30	364	16	380	296	9	305	660	25	685
17:30 - 17:45	332	16	348	266	16	282	598	32	630
17:45 - 18:00	348	19	367	259	14	273	607	33	640
18:00 - 18:15	350	13	363	199	11	210	549	24	573
18:15 - 18:30	302	8	310	167	10	177	469	18	487
Σ	4089	205	4294	2948	157	3105	7037	362	7399
15:45 - 17:45	2782	140		2078	102		4860	242	5102

0

Intersection of **Picton Road and Hume Highway**

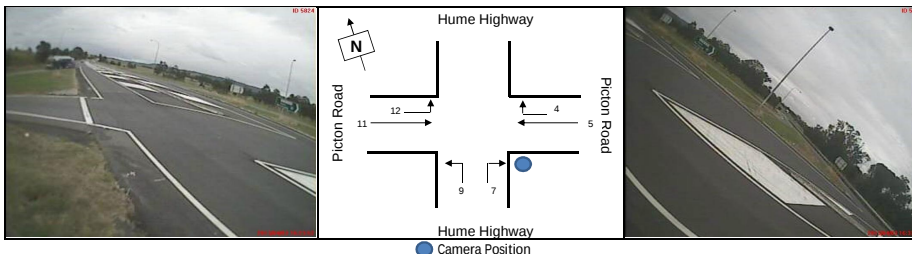
Wednesday, 3 April 2013

Austraffic

Survey Start **6:30 AM 15:30 PM**
Intersection Type **Cross Junction**
Intersection No. **10A**
North Approach **Hume Highway**
East Approach **Picton Road**
South Approach **Hume Highway**
West Approach **Picton Road**

Date **3/04/13**
 4/04/13

Classification **Light Heavy**



TIME PERIOD			VEHICLE MOVEMENT															VEHICLE MOVEMENT															GRAND TOTAL							
			1			2			3			4			5			6			7			8			9			10					11			12		
			Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ			Light	Heavy	Σ	Light	Heavy	Σ
6:30	-	6:45									89	25	114	37	12	49				13	5	18				14	0	14				30	3	33	66	6	72	249	51	300
6:45	-	7:00									92	22	114	45	14	59				30	7	37				7	0	7				33	4	37	80	8	88	287	55	342
7:00	-	7:15									99	18	117	34	14	48				30	4	34				9	2	11				49	5	54	85	4	89	306	47	353
7:15	-	7:30									112	15	127	45	10	55				53	7	60				10	1	11				75	10	85	84	9	93	379	52	431
7:30	-	7:45									115	28	143	62	17	79				44	1	45				9	1	10				55	8	63	76	6	82	361	61	422
7:45	-	8:00									101	24	125	59	12	71				28	2	30				22	0	22				51	3	54	74	9	83	335	50	385
8:00	-	8:15									68	22	90	53	9	62				31	2	33				11	2	13				59	7	66	51	3	54	273	45	318
8:15	-	8:30									71	27	98	55	3	58				38	3	41				14	1	15				50	3	53	56	1	57	284	38	322
8:30	-	8:45									63	19	82	54	12	66				26	4	30				15	0	15				49	3	52	45	5	50	252	43	295
8:45	-	9:00									52	22	74	50	8	58				18	3	21				15	0	15				44	9	53	35	3	38	214	45	259
9:00	-	9:15									42	17	59	42	4	46				24	7	31				9	2	11				37	3	40	33	6	39	187	39	226
9:15	-	9:30									49	21	70	51	8	59				29	6	35				12	0	12				38	3	41	25	5	30	204	43	247
Σ											953	260	1213	587	123	710				364	51	415				147	9	156				570	61	631	710	65	775	3331	569	3900
7:00	-	9:00	0	0		0	0		0	0	681	175		412	85		0	0		268	26		0	0		105	7		0	0		432	48		506	40				2785
7:30	-	8:30									355	101		229	41				141	8					56	4					215	21		257	19					

TIME PERIOD	VEHICLE MOVEMENT															VEHICLE MOVEMENT															GRAND TOTAL									
	1			2			3			4			5			6			7			8			9			10				11			12					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ		Light	Heavy	Σ						
15:30 - 15:45										91	17	108	71	5	76				42	5	47				11	1	12				41	6	47	19	1	20	275	35	310	
15:45 - 16:00										78	19	97	83	11	94				44	4	48				15	3	18				44	5	49	23	2	25	287	44	331	
16:00 - 16:15										55	13	68	108	13	121				46	6	52				14	1	15				46	2	48	29	4	33	298	39	337	
16:15 - 16:30										62	17	79	104	12	116				39	5	44				21	2	23				55	4	59	24	2	26	305	42	347	
16:30 - 16:45										64	15	79	127	4	131				44	5	49				11	0	11				46	5	51	23	2	25	315	31	346	
16:45 - 17:00										65	18	83	128	5	133				40	5	45				13	1	14				63	5	68	28	1	29	337	35	372	
17:00 - 17:15										71	16	87	138	5	143				37	7	44				21	1	22				61	2	63	25	3	28	353	34	387	
17:15 - 17:30										56	13	69	132	4	136				28	6	34				19	0	19				57	4	61	26	4	30	318	31	349	
17:30 - 17:45										55	9	64	129	3	132				34	6	40				20	0	20				40	2	42	15	3	18	293	23	316	
17:45 - 18:00										46	11	57	113	2	115				32	3	35				10	0	10				39	4	43	18	1	19	258	21	279	
18:00 - 18:15										40	8	48	105	7	112				34	3	37				10	1	11				34	2	36	15	1	16	238	22	260	
18:15 - 18:30										30	10	40	102	1	103				28	2	30				5	1	6				33	1	34	13	1	14	211	16	227	
Σ										713	166	879	1340	72	1412				448	57	505				170	11	181				559	42	601	258	25	283	3488	373	3861	
15:45 - 17:45	0	0		0	0		0	0		506	120		949	57		0	0		312	44		0	0		134	8		0	0		412	29		193	21					2785

Intersection of Picton Road and Hume Highway

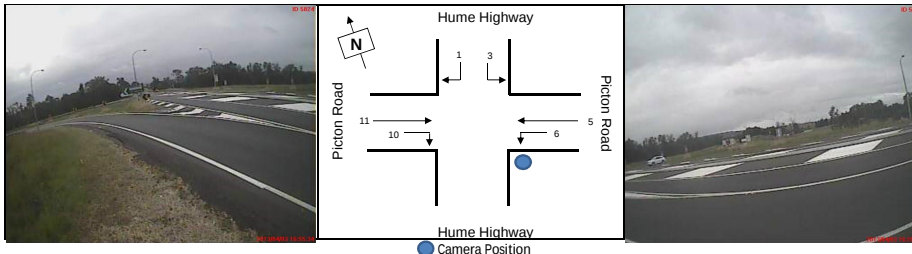
Wednesday, 3 April 2013

Austraffic

Survey Start 6:30 AM 15:30 PM
Intersection Type
Intersection No. 10B
North Approach Hume Highway
East Approach Picton Road
South Approach Hume Highway
West Approach Picton Road

Date 3/04/13
 4/04/13

Classification Light Heavy



TIME PERIOD			VEHICLE MOVEMENT															VEHICLE MOVEMENT															GRAND TOTAL								
			1			2			3			4			5			6			7			8			9			10						11			12		
			Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ				Light	Heavy	Σ	Light	Heavy	Σ
6:30	-	6:45	19	9	28				51	33	84				112	31	143	32	4	36							7	2	9	36	8	44				257	87	344			
6:45	-	7:00	20	7	27				44	28	72				114	29	143	41	6	47							6	2	8	56	9	65				281	91	372			
7:00	-	7:15	14	9	23				53	35	88				121	24	145	45	4	49							11	1	12	69	8	77				313	81	394			
7:15	-	7:30	22	3	25				71	24	95				140	25	165	30	6	36							12	4	16	114	13	127				389	75	464			
7:30	-	7:45	20	8	28				85	26	111				160	37	197	32	8	40							11	1	12	86	8	94				394	88	482			
7:45	-	8:00	21	5	26				91	30	121				143	30	173	53	5	58							15	1	16	65	4	69				388	75	463			
8:00	-	8:15	26	4	30				64	20	84				99	28	127	40	6	46							22	2	24	66	6	72				317	66	383			
8:15	-	8:30	22	1	23				56	32	88				101	28	129	26	3	29							12	2	14	78	5	83				295	71	366			
8:30	-	8:45	20	1	21				54	17	71				96	30	126	31	4	35							11	2	13	64	6	70				276	60	336			
8:45	-	9:00	21	2	23				53	19	72				81	29	110	33	13	46							9	3	12	53	8	61				250	74	324			
9:00	-	9:15	19	3	22				41	17	58				67	19	86	25	8	33							11	1	12	52	9	61				215	57	272			
9:15	-	9:30	19	4	23				39	25	64				78	24	102	25	12	37							9	1	10	56	8	64				226	74	300			
Σ			243	56	299				702	306	1008				1312	334	1646	413	79	492							136	22	158	795	92	887				3601	889	4490			
7:00	-	9:00	166	33		0	0		527	203		0	0		941	231		290	49		0	0		0	0		103	16		595	58		0	0				3212			
7:30	-	8:30	89	18					296	108					503	123		151	22								60	6		295	23										

TIME PERIOD		VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL	
		1			2			3			4			5			6			7			8			9			10			11			12				
		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ					
15:30	-	15:45	56	3	59				62	18	80				108	22	130	37	5	42							9	3	12	74	9	83				346	60	406	
15:45	-	16:00	55	5	60				80	19	99				105	24	129	35	1	36							7	4	11	86	6	92				368	59	427	
16:00	-	16:15	63	5	68				89	12	101				102	20	122	36	2	38							7	1	8	83	6	89				380	48	428	
16:15	-	16:30	59	6	65				88	13	101				105	25	130	43	8	51							11	2	13	80	6	86				386	60	446	
16:30	-	16:45	68	5	73				70	13	83				128	17	145	32	3	35							8	5	13	85	5	90				391	48	439	
16:45	-	17:00	56	3	59				81	7	88				135	18	153	30	2	32							13	4	17	85	8	93				400	42	442	
17:00	-	17:15	78	6	84				79	14	93				136	17	153	38	2	40							14	1	15	83	6	89				428	46	474	
17:15	-	17:30	75	2	77				88	10	98				119	16	135	37	6	43							7	0	7	75	9	84				401	43	444	
17:30	-	17:45	76	3	79				98	11	109				112	8	120	39	6	45							11	2	13	66	6	72				402	36	438	
17:45	-	18:00	53	0	53				95	6	101				105	13	118	35	1	36							11	1	12	65	6	71				364	27	391	
18:00	-	18:15	45	6	51				72	8	80				99	9	108	36	1	37							9	1	10	63	3	66				324	28	352	
18:15	-	18:30	42	1	43				74	9	83				93	10	103	23	4	27							8	0	8	51	4	55				291	28	319	
Σ			726	45	771				976	140	1116				1347	199	1546	421	41	462							115	24	139	896	76	972				4481	525	5006	
15:45	-	17:45	530	35		0	0		673	99		0	0		942	145		290	30		0	0		0	0		78	19		643	54		0	0				3538	

Intersection of **Picton Road and Hume Highway**

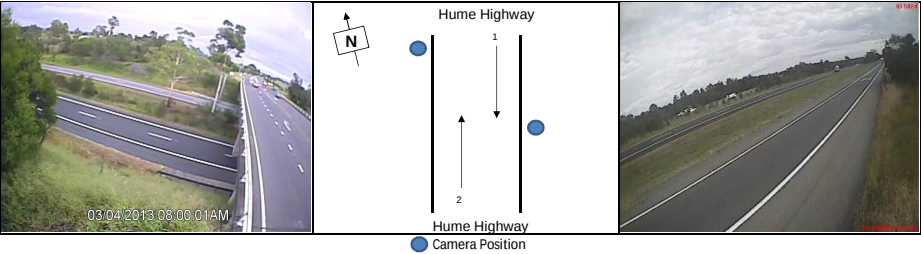
Wednesday, 3 April 2013

Austraffic

Survey Start **6:30 AM 15:30 PM**
Intersection Type **Midblock**
Intersection No. **10C**
North Approach **Hume Highway**
East Approach
South Approach **Hume Highway**
West Approach

Date **3/04/13**
 4/04/13

Classification **Light Heavy**

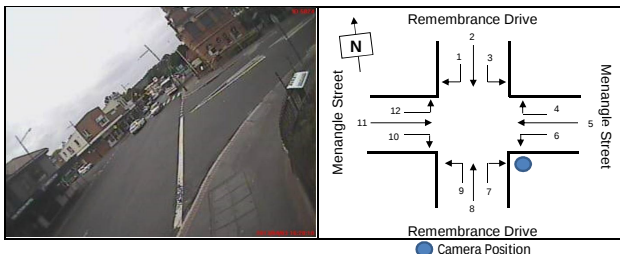


TIME PERIOD		VEHICLE MOVEMENT								
		1			2			GRAND TOTAL		
		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
6:30	- 6:45	123	26	149	162	35	197	285	61	346
6:45	- 7:00	139	29	168	156	17	173	295	46	341
7:00	- 7:15	156	45	201	144	32	176	300	77	377
7:15	- 7:30	148	37	185	157	37	194	305	74	379
7:30	- 7:45	161	41	202	168	45	213	329	86	415
7:45	- 8:00	143	31	174	167	37	204	310	68	378
8:00	- 8:15	156	33	189	185	26	211	341	59	400
8:15	- 8:30	147	33	180	155	40	195	302	73	375
8:30	- 8:45	154	31	185	140	41	181	294	72	366
8:45	- 9:00	124	33	157	161	44	205	285	77	362
9:00	- 9:15	98	24	122	135	32	167	233	56	289
9:15	- 9:30	106	28	134	156	34	190	262	62	324
Σ		1655	391	2046	1886	420	2306	3541	811	4352
7:00	- 9:00	1189	284		1277	302		3052		
7:30	- 8:30	607	138		675	148				

TIME PERIOD		VEHICLE MOVEMENT								
		1			2			GRAND TOTAL		
		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
15:30	- 15:45	169	46	215	174	33	207	343	79	422
15:45	- 16:00	168	37	205	209	35	244	377	72	449
16:00	- 16:15	160	38	198	203	28	231	363	66	429
16:15	- 16:30	174	37	211	158	37	195	332	74	406
16:30	- 16:45	181	33	214	205	31	236	386	64	450
16:45	- 17:00	179	34	213	189	43	232	368	77	445
17:00	- 17:15	199	23	222	174	22	196	373	45	418
17:15	- 17:30	204	41	245	172	24	196	376	65	441
17:30	- 17:45	239	28	267	161	25	186	400	53	453
17:45	- 18:00	217	39	256	153	28	181	370	67	437
18:00	- 18:15	206	42	248	139	27	166	345	69	414
18:15	- 18:30	187	33	220	136	15	151	323	48	371
Σ		2283	431	2714	2073	348	2421	4356	779	5135
15:45	- 17:45	1504	271		1471	245		2975	516	3491

Intersection of Menangle Street, Remembrance Drive and Argyle St Wednesday, 3 April 2013

Survey Start 6:30 AM 15:30 PM
Intersection Type Cross Junction
Intersection No. 11
North Approach Remembrance Drive
East Approach Menangle Street
South Approach Remembrance Drive
West Approach Menangle Street
Date 3/04/13
Classification Light Heavy



TIME PERIOD	VEHICLE MOVEMENT												VEHICLE MOVEMENT												GRAND TOTAL															
	1			2			3			4			5			6			7			8				9			10			11			12					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ						
6:30 - 6:45	0	0	0	29	4	33	13	0	13	5	1	6	0	2	2	9	9	18	24	7	31	97	5	102	0	0	0	0	0	0	0	0	0	0	177	28	205			
6:45 - 7:00	0	0	0	33	3	36	18	2	20	5	2	7	1	0	1	5	5	10	24	5	29	68	9	77	0	0	0	0	1	1	0	0	0	1	1	154	28	182		
7:00 - 7:15	2	0	2	35	6	41	22	1	23	5	0	5	0	0	0	4	9	13	17	2	19	73	4	77	0	0	0	2	0	2	1	0	1	0	0	161	22	183		
7:15 - 7:30	1	0	1	42	3	45	32	2	34	8	2	10	2	0	2	8	1	9	35	11	46	95	5	100	1	0	1	1	1	2	0	0	0	0	0	225	25	250		
7:30 - 7:45	4	0	4	38	2	40	12	0	12	6	4	10	2	0	2	11	7	18	29	8	37	103	4	107	3	0	3	0	0	0	1	0	1	1	0	1	210	25	235	
7:45 - 8:00	3	0	3	56	7	63	17	0	17	6	0	6	2	0	2	10	4	14	34	2	36	93	1	94	2	0	2	3	0	3	1	0	1	1	0	1	228	14	242	
8:00 - 8:15	7	0	7	58	1	59	14	2	16	9	2	11	0	0	0	12	1	13	32	3	35	115	4	119	1	0	1	0	0	0	0	0	0	3	0	3	251	13	264	
8:15 - 8:30	5	0	5	51	5	56	20	0	20	4	0	4	1	0	1	19	6	25	32	2	34	123	3	126	7	0	7	0	0	0	0	0	0	2	0	2	264	16	280	
8:30 - 8:45	4	0	4	72	4	76	26	1	27	10	0	10	1	0	1	14	4	18	37	2	39	91	6	97	10	0	10	0	0	0	0	0	2	0	2	267	17	284		
8:45 - 9:00	6	1	7	62	4	66	21	1	22	10	1	11	2	0	2	13	9	22	57	7	64	101	11	112	18	1	19	0	0	0	0	1	0	1	6	2	8	297	37	334
9:00 - 9:15	4	0	4	58	4	62	20	0	20	15	1	16	1	0	1	20	7	27	33	1	34	137	3	140	4	0	4	0	0	0	0	0	0	2	0	2	294	16	310	
9:15 - 9:30	2	0	2	76	5	81	19	1	20	8	0	8	2	0	2	17	5	22	37	2	39	97	3	100	6	0	6	2	0	2	1	0	1	4	0	4	271	16	287	
Σ	38	1	39	610	48	658	234	10	244	91	13	104	14	2	16	142	67	209	391	52	443	1193	58	1251	52	1	53	8	2	10	5	0	5	21	3	24	2799	257	3056	
7:00 - 9:00	32	1		414	32		164	7		58	9		10	0		91	41		273	37		794	38		42	1		6	1		4	0		15	2			2072		
7:00 - 8:00	10	0	10	171	18	207	83	3	89	25	6	37	6	0	6	33	21	75	115	23	161	364	14	392	6	0	6	1	8	3	0	3	2	0	2					

TIME PERIOD	VEHICLE MOVEMENT												VEHICLE MOVEMENT												VEHICLE MOVEMENT												VEHICLE MOVEMENT												GRAND TOTAL		
	1			2			3			4			5			6			7			8			9			10			11			12																	
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ												
15:30 - 15:45	2	0	2	130	5	135	14	2	16	14	0	14	1	0	1	21	3	24	30	6	36	119	5	124	8	0	8	4	0	4	0	0	0	1	0	1	344	21	365												
15:45 - 16:00	4	0	4	132	2	134	21	1	22	16	0	16	0	0	0	32	9	41	29	5	34	91	1	92	2	0	2	1	0	1	0	0	0	8	0	8	336	18	354												
16:00 - 16:15	5	0	5	137	6	143	14	0	14	11	3	14	3	0	3	22	4	26	20	3	23	95	1	96	0	0	0	2	0	2	0	0	0	2	0	2	311	17	328												
16:15 - 16:30	6	0	6	156	5	161	12	1	13	10	2	12	2	0	2	35	7	42	21	5	26	67	5	72	2	0	2	2	0	2	1	0	1	4	0	4	318	25	343												
16:30 - 16:45	4	0	4	139	5	144	17	0	17	8	0	8	1	0	1	49	6	55	23	4	27	66	0	66	3	0	3	1	0	1	1	0	1	6	0	6	318	15	333												
16:45 - 17:00	1	0	1	141	2	143	9	1	10	10	0	10	0	0	0	35	5	40	20	2	22	85	2	87	1	0	1	4	0	4	2	0	2	4	0	4	312	12	324												
17:00 - 17:15	3	1	4	142	4	146	19	0	19	11	0	11	1	0	1	38	7	45	18	3	21	81	1	82	3	0	3	2	0	2	1	0	1	6	0	6	325	16	341												
17:15 - 17:30	2	0	2	150	1	151	20	0	20	17	1	18	1	0	1	39	6	45	21	3	24	77	3	80	7	0	7	6	1	7	1	0	1	12	0	12	353	15	368												
17:30 - 17:45	1	0	1	141	2	143	20	0	20	10	0	10	0	0	0	30	2	32	20	1	21	72	2	74	0	0	0	5	0	5	1	0	1	5	0	5	305	7	312												
17:45 - 18:00	2	0	2	132	4	136	26	0	26	16	1	17	2	0	2	29	2	31	17	4	21	89	2	91	1	0	1	2	0	2	1	0	1	1	0	1	318	13	331												
18:00 - 18:15	4	0	4	126	2	128	13	1	14	19	0	19	4	0	4	35	3	38	15	0	15	68	2	70	0	0	0	1	0	1	0	0	0	3	0	3	288	8	296												
18:15 - 18:30	1	0	1	92	1	93	13	0	13	8	0	8	1	0	1	21	3	24	11	0	11	78	0	78	2	0	2	4	0	4	3	0	3	6	0	6	240	4	244												
Σ	35	1	36	1618	39	1657	198	6	204	150	7	157	16	0	16	386	57	443	245	36	281	988	24	1012	29	0	29	34	1	35	11	0	11	58	0	58	3768	171	3939												
15:45 - 17:45	26	1		1138	27		132	3		93	6		8	0		280	46		172	26		634	15		18	0		23	1		7	0		47	0			2703													
16:45 - 17:45	7	1	9	574	9	592	68	1	70	48	1	50	2	0	2	142	20	182	79	9	97	315	8	331	11	0	11	17	1	19	5	0	5	27	0	27															

Intersection of Menangle Road and Camden Road

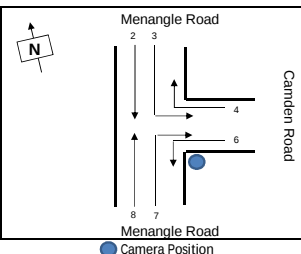
Wednesday, 3 April 2013

Austraffic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 12
North Approach Menangle Road
East Approach Camden Road
South Approach Menangle Road
West Approach

Date 3/04/13

Classification Light Heavy



TIME PERIOD	VEHICLE MOVEMENT												VEHICLE MOVEMENT												GRAND TOTAL													
	1			2			3			4			5			6			7			8				9			10			11			12			
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ				
6:30 - 6:45				10	1	11	2	0	2	14	1	15				2	0	2	1	0	1	26	2	28										55	4	59		
6:45 - 7:00				11	1	12	10	0	10	23	1	24				2	0	2	2	1	3	21	3	24											69	6	75	
7:00 - 7:15				17	2	19	9	1	10	28	0	28				3	0	3	2	0	2	19	0	19												78	3	81
7:15 - 7:30				29	2	31	19	0	19	23	2	25				2	0	2	0	1	1	18	1	19												91	6	97
7:30 - 7:45				21	2	23	25	0	25	30	4	34				2	0	2	4	4	8	34	1	35												116	11	127
7:45 - 8:00				28	1	29	19	1	20	40	2	42				1	0	1	2	0	2	37	4	41												127	8	135
8:00 - 8:15				24	1	25	8	1	9	42	0	42				4	1	5	1	1	2	42	1	43												121	5	126
8:15 - 8:30				24	2	26	5	0	5	30	0	30				4	1	5	4	0	4	39	2	41												106	5	111
8:30 - 8:45				27	3	30	17	0	17	34	0	34				4	0	4	7	0	7	31	0	31												120	3	123
8:45 - 9:00				15	0	15	11	1	12	26	1	27				5	1	6	6	1	7	32	3	35												95	7	102
9:00 - 9:15				16	0	16	16	0	16	25	0	25				3	0	3	7	0	7	28	0	28												95	0	95
9:15 - 9:30				15	0	15	13	0	13	26	0	26				6	0	6	3	1	4	26	0	26												89	1	90
Σ				237	15	252	154	4	158	341	11	352				38	3	41	39	9	48	353	17	370												1162	59	1221
7:00 - 9:00	0	0		185	13		113	4		253	9		0	0		25	3		26	7		252	12		0	0		0	0		0	0		0	0			902

TIME PERIOD	VEHICLE MOVEMENT												VEHICLE MOVEMENT												GRAND TOTAL												
	1			2			3			4			5			6			7			8				9			10			11			12		
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ			
15:30 - 15:45				17	1	18	34	2	36	14	0	14				4	3	7	4	0	4	16	1	17										89	7	96	
15:45 - 16:00				26	1	27	26	1	27	20	0	20				3	0	3	9	1	10	30	0	30										114	3	117	
16:00 - 16:15				22	1	23	23	1	24	18	0	18				6	3	9	3	0	3	26	1	27										98	6	104	
16:15 - 16:30				29	0	29	32	3	35	5	0	5				6	0	6	3	0	3	24	0	24											99	3	102
16:30 - 16:45				39	1	40	34	0	34	15	0	15				4	0	4	9	0	9	33	1	34											134	2	136
16:45 - 17:00				41	2	43	39	0	39	18	0	18				5	0	5	9	0	9	17	0	17											129	2	131
17:00 - 17:15				48	0	48	31	0	31	19	0	19				6	0	6	6	0	6	28	0	28											138	0	138
17:15 - 17:30				40	0	40	32	0	32	23	0	23				3	0	3	6	0	6	30	0	30											134	0	134
17:30 - 17:45				44	0	44	30	1	31	17	0	17				3	0	3	1	0	1	27	0	27											122	1	123
17:45 - 18:00				35	0	35	27	0	27	15	0	15				5	0	5	3	0	3	26	1	27											111	1	112
18:00 - 18:15				27	1	28	27	0	27	16	1	17				3	0	3	6	0	6	22	1	23											101	3	104
18:15 - 18:30				19	1	20	22	1	23	15	0	15				6	0	6	2	0	2	28	1	29											92	3	95
Σ				387	8	395	357	9	366	195	1	196				54	6	60	61	1	62	307	6	313											1361	31	1392
15:45 - 17:45	0	0		289	5		247	6		135	0		0	0		36	3		46	1		215	2		0	0		0	0		0	0				985	

Intersection of Hume Highway and Remembrance Drive

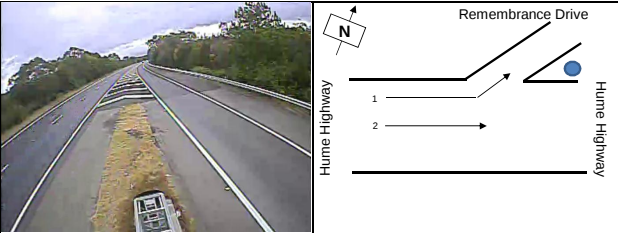
Wednesday, 3 April 2013

Austraffic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 13A
North Approach Remembrance Drive
East Approach Hume Highway
South Approach
West Approach Hume Highway

Date 3/04/13

Classification Light Heavy



● Camera Position

TIME PERIOD		VEHICLE MOVEMENT								
		1			2			GRAND TOTAL		
		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
6:30	- 6:45	8	3	11	121	33	154	129	36	165
6:45	- 7:00	12	2	14	111	26	137	123	28	151
7:00	- 7:15	8	0	8	122	32	154	130	32	162
7:15	- 7:30	10	4	14	148	52	200	158	56	214
7:30	- 7:45	16	2	18	143	27	170	159	29	188
7:45	- 8:00	25	3	28	165	27	192	190	30	220
8:00	- 8:15	16	0	16	136	38	174	152	38	190
8:15	- 8:30	15	1	16	143	39	182	158	40	198
8:30	- 8:45	12	1	13	171	40	211	183	41	224
8:45	- 9:00	15	1	16	139	45	184	154	46	200
9:00	- 9:15	12	3	15	138	33	171	150	36	186
9:15	- 9:30	23	1	24	172	44	216	195	45	240
Σ		172	21	193	1709	436	2145	1881	457	2338
7:00	- 9:00	117	12		1167	300		1284	312	1596

0

Zone 1	LV	HV	Total PCU
7.00-7.30	288	88	464
7.30-8.00	349	59	467
8.00-8.30	310	78	466
8.30-9.00	337	87	511

TIME PERIOD	VEHICLE MOVEMENT								
	1			2			GRAND TOTAL		
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
15:30 - 15:45	46	4	50	199	42	241	245	46	291
15:45 - 16:00	51	1	52	246	42	288	297	43	340
16:00 - 16:15	46	2	48	207	36	243	253	38	291
16:15 - 16:30	37	5	42	231	36	267	268	41	309
16:30 - 16:45	41	2	43	211	43	254	252	45	297
16:45 - 17:00	46	2	48	211	31	242	257	33	290
17:00 - 17:15	50	1	51	201	26	227	251	27	278
17:15 - 17:30	48	3	51	198	27	225	246	30	276
17:30 - 17:45	45	0	45	195	26	221	240	26	266
17:45 - 18:00	40	2	42	159	31	190	199	33	232
18:00 - 18:15	26	0	26	180	20	200	206	20	226
18:15 - 18:30	23	1	24	143	26	169	166	27	193
Σ	499	23	522	2381	386	2767	2880	409	3289
15:45 - 17:45	364	16		1700	267		2064	283	2347

0

0

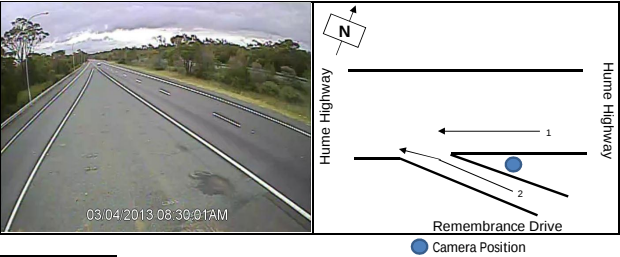
	LV	HV	Total PCU
15.45-16.15	550	81	712
16.15-16.45	520	86	692
16.45-17.15	508	60	628
17.15-17.45	486	56	598

Intersection of Hume Highway and Remembrance Drive

Wednesday, 3 April 2013

Austraffic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 13B
North Approach
East Approach Hume Highway
South Approach Remembrance Drive
West Approach Hume Highway
Date 3/04/13
Classification Light Heavy



TIME PERIOD	VEHICLE MOVEMENT								
	1			2			GRAND TOTAL		
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
6:30 - 6:45	125	43	168	27	4	31	152	47	199
6:45 - 7:00	140	21	161	26	4	30	166	25	191
7:00 - 7:15	171	45	216	34	4	38	205	49	254
7:15 - 7:30	175	41	216	29	4	33	204	45	249
7:30 - 7:45	178	44	222	46	3	49	224	47	271
7:45 - 8:00	183	52	235	34	1	35	217	53	270
8:00 - 8:15	203	33	236	68	4	72	271	37	308
8:15 - 8:30	175	41	216	53	5	58	228	46	274
8:30 - 8:45	180	27	207	53	1	54	233	28	261
8:45 - 9:00	152	39	191	26	2	28	178	41	219
9:00 - 9:15	132	44	176	30	4	34	162	48	210
9:15 - 9:30	125	33	158	30	2	32	155	35	190
Σ	1939	463	2402	456	38	494	2395	501	2896
7:00 - 9:00	1417	322		343	24		1760	346	2106

0

TIME PERIOD	VEHICLE MOVEMENT								
	1			2			GRAND TOTAL		
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
15:30 - 15:45	168	47	215	23	2	25	191	49	240
15:45 - 16:00	179	45	224	21	0	21	200	45	245
16:00 - 16:15	145	38	183	24	2	26	169	40	209
16:15 - 16:30	148	43	191	30	1	31	178	44	222
16:30 - 16:45	156	34	190	27	1	28	183	35	218
16:45 - 17:00	159	50	209	26	0	26	185	50	235
17:00 - 17:15	185	32	217	26	1	27	211	33	244
17:15 - 17:30	172	38	210	16	1	17	188	39	227
17:30 - 17:45	215	34	249	29	1	30	244	35	279
17:45 - 18:00	208	45	253	21	0	21	229	45	274
18:00 - 18:15	178	39	217	15	2	17	193	41	234
18:15 - 18:30	177	44	221	20	0	20	197	44	241
Σ	2090	489	2579	278	11	289	2368	500	2868
15:45 - 17:45	1359	314		199	7		1558	321	1879

0

Intersection of Picton Road and Menangle Road Wednesday, 3 April 2013 Autraffic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 14
North Approach Picton Road
East Approach Menangle Road
South Approach Picton Road
West Approach

Date 3/04/13

Classification Light Heavy



TIME PERIOD			VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL		
			1			2			3			4			5			6			7			8			9			10			11			12					
			Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ						
6:30	-	6:45				94	8	102	21	0	21	5	0	5				7	2	9	5	1	6	42	11	53									174	22	196				
6:45	-	7:00				106	11	117	8	2	10	7	1	8				8	1	9	10	2	12	46	11	57									185	28	213				
7:00	-	7:15				122	6	128	8	0	8	3	0	3				11	1	12	13	3	16	33	13	46										190	23	213			
7:15	-	7:30				140	14	154	15	3	18	9	1	10				20	2	22	16	2	18	36	9	45										236	31	267			
7:30	-	7:45				114	13	127	23	1	24	10	1	11				15	2	17	15	5	20	52	12	64										229	34	263			
7:45	-	8:00				113	15	128	14	0	14	11	0	11				14	0	14	17	3	20	64	9	73										233	27	260			
8:00	-	8:15				95	11	106	25	1	26	14	0	14				19	1	20	14	2	16	52	7	59										219	22	241			
8:15	-	8:30				88	2	90	23	0	23	12	1	13				15	2	17	13	1	14	58	5	63										209	11	220			
8:30	-	8:45				73	6	79	22	1	23	11	2	13				16	0	16	10	1	11	57	9	66										189	19	208			
8:45	-	9:00				66	7	73	23	0	23	15	1	16				16	2	18	13	1	14	53	6	59										186	17	203			
9:00	-	9:15				64	8	72	26	0	26	12	1	13				4	0	4	13	1	14	41	3	44										160	13	173			
9:15	-	9:30				50	5	55	16	1	17	7	0	7				13	0	13	11	0	11	49	8	57										146	14	160			
Σ						1125	106	1231	224	9	233	116	8	124				158	13	171	150	22	172	583	103	686										2356	261	2617			
7:00	-	9:00	0	0		811	74		153	6		85	6		0	0		126	10		111	18		405	70		0	0		0	0		0	0			1875				

TIME PERIOD	VEHICLE MOVEMENT												VEHICLE MOVEMENT												GRAND TOTAL												
	1			2			3			4			5			6			7			8				9			10			11			12		
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ			
15:30 - 15:45				57	7	64	18	0	18	11	1	12				6	0	6	10	2	12	73	7	80										175	17	192	
15:45 - 16:00				59	8	67	28	1	29	16	1	17				7	1	8	9	0	9	93	12	105										212	23	235	
16:00 - 16:15				62	5	67	14	1	15	21	1	22				11	1	12	11	0	11	112	11	123										231	19	250	
16:15 - 16:30				57	5	62	12	0	12	16	2	18				19	0	19	12	0	12	118	10	128											234	17	251
16:30 - 16:45				54	9	63	15	0	15	14	0	14				15	0	15	22	2	24	117	6	123											237	17	254
16:45 - 17:00				63	4	67	15	0	15	17	1	18				23	1	24	17	0	17	122	6	128											257	12	269
17:00 - 17:15				75	6	81	11	0	11	38	1	39				16	0	16	23	0	23	130	5	135											283	12	295
17:15 - 17:30				65	7	72	13	1	14	23	0	23				20	0	20	22	0	22	127	3	130											270	11	281
17:30 - 17:45				38	4	42	10	0	10	24	1	25				21	0	21	24	0	24	128	2	131											246	7	253
17:45 - 18:00				45	3	48	19	1	20	31	0	31				12	0	12	15	1	16	110	6	116											232	11	243
18:00 - 18:15				32	3	35	9	0	9	18	0	18				13	1	14	18	1	19	99	2	101											189	7	196
18:15 - 18:30				43	3	46	9	0	9	15	1	16				7	0	7	20	0	20	84	5	89											178	9	187
Σ				650	64	714	173	4	177	244	9	253				170	4	174	203	6	209	1314	75	1389											2754	162	2916
15:45 - 17:45	0	0		473	48		118	3		169	7		0	0		132	3		140	2		948	55		0	0		0	0		0	0				2098	

Intersection of Picton Road and Wilton Park Road

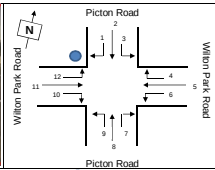
Wednesday, 1 May 2013

Austraffic

Survey Start 6:30 AM 15:30 PM
Intersection Type Cross Junction
Intersection No. 15
North Approach Picton Road
East Approach Wilton Park Road
South Approach Picton Road
West Approach Wilton Park Road

Date 1/05/13

Classification Light Heavy



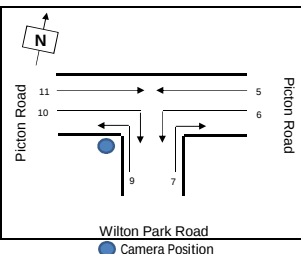
TIME PERIOD	VEHICLE MOVEMENT												VEHICLE MOVEMENT												GRAND TOTAL														
	1			2			3			4			5			6			7			8				9			10			11			12				
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ					
6:30 - 6:45	0	0	0	110	14	124	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	69	12	81	0	0	0	4	1	5	0	0	0	1	184	27	211		
6:45 - 7:00	1	0	1	110	12	128	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	61	10	71	2	0	2	4	1	5	0	0	0	0	184	23	207		
7:00 - 7:15	0	0	0	122	7	129	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	57	0	57	0	1	1	2	1	3	0	0	0	1	183	15	198		
7:15 - 7:30	0	0	1	166	8	173	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	43	13	56	0	0	0	0	3	1	4	0	0	1	1	211	22	233	
7:30 - 7:45	0	0	0	135	8	143	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4	8	10	0	0	3	5	0	5	0	0	1	215	18	233		
7:45 - 8:00	1	0	1	112	7	119	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	89	11	100	1	0	1	5	0	5	0	0	0	1	211	18	229		
8:00 - 8:15	1	0	1	114	4	118	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	8	10	2	0	2	0	0	0	0	0	0	3	185	12	197		
8:15 - 8:30	1	1	2	80	10	90	0	0	0	0	0	0	0	0	0	0	0	0	3	0	3	70	6	76	2	0	2	0	1	4	0	0	1	180	18	198			
8:30 - 8:45	0	0	0	116	6	122	1	0	1	0	0	0	0	0	0	0	0	0	2	0	2	64	10	74	1	0	1	5	0	5	0	0	0	0	3	189	16	205	
8:45 - 9:00	0	0	0	99	16	115	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	56	10	66	2	0	2	0	0	0	0	0	0	0	0	185	29	214	
9:00 - 9:15	0	0	0	87	16	103	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	46	10	56	3	0	3	5	0	5	0	0	0	0	0	185	29	214	
9:15 - 9:30	4	0	4	76	9	85	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	51	10	61	4	0	4	2	1	3	0	0	0	2	0	2	141	20	161
Σ	8	2	10	1322	117	1439	4	0	4	1	0	1	0	0	0	1	0	1	18	0	18	745	114	859	20	3	23	39	6	45	0	0	0	18	1	19	2176	249	2419
7:00 - 9:00	3	2	5	933	66	1000	3	0	3	0	0	0	0	0	0	1	0	1	18	0	18	518	72	590	11	1	12	3	25	3	0	0	0	10	1	11	1917	255	2172

TIME PERIOD	VEHICLE MOVEMENT												VEHICLE MOVEMENT												GRAND TOTAL														
	1		2		3		4		5		6		7		8		9		10		11		12																
	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy	Light	Heavy															
15:30 - 15:45	2	0	2	85	10	95	0	0	0	0	0	9	5	0	109	12	121	5	3	0	3	0	0	1	213	22	235												
15:45 - 16:00	2	0	2	70	17	87	0	0	0	0	0	0	0	0	113	6	119	0	2	0	2	0	0	0	205	29	234												
16:00 - 16:15	2	0	2	73	5	78	0	0	0	0	0	0	0	0	115	6	121	0	2	0	2	0	0	0	206	29	235												
16:15 - 16:30	2	0	2	75	7	82	0	0	1	0	1	0	0	2	0	134	11	145	2	1	3	1	2	0	0	217	21	238											
16:30 - 16:45	0	0	0	74	5	79	0	0	0	0	0	0	0	0	0	126	11	137	6	3	9	0	1	0	0	0	3	210	19	229									
16:45 - 17:00	3	0	3	66	6	72	0	0	0	0	0	0	0	0	1	136	8	144	2	0	2	5	6	0	0	0	0	0	6	220	17	237							
17:00 - 17:15	3	0	3	65	4	69	0	0	0	0	0	0	0	0	0	134	8	142	2	0	2	0	0	0	0	2	0	0	0	2	218	10	228						
17:15 - 17:30	6	0	6	85	6	91	0	0	0	0	0	0	0	0	0	134	5	139	6	0	6	1	2	0	0	0	0	0	0	1	261	15	276						
17:30 - 17:45	4	0	4	74	2	76	0	0	0	0	0	0	0	0	0	152	8	160	5	1	6	2	0	2	0	0	0	2	2	239	11	250							
17:45 - 18:00	2	0	2	56	4	60	0	0	0	0	0	0	0	1	0	1	124	4	128	6	0	6	2	1	3	0	0	0	0	0	0	191	9	200					
18:00 - 18:15	2	0	2	50	3	53	0	0	0	0	0	0	0	0	0	0	140	4	144	1	0	1	2	0	2	0	0	0	0	0	0	0	188	12	200				
18:15 - 18:30	2	0	2	53	1	54	0	0	0	0	0	0	0	0	0	0	140	3	143	1	0	1	2	0	2	0	0	0	0	0	0	0	189	6	195				
Σ	31	1	32	848	70	918	0	0	0	3	0	3	1	0	1	18	0	18	1	0	1	1510	96	1606	46	11	57	32	5	37	2	0	2	25	1	26	2517	184	2701
15:45 - 17:45	23	1	24	606	52	658	0	0	0	3	0	3	0	0	1	0	1	1040	66	1106	31	11	42	4	24	2	0	0	0	17	1	18	2517	184	2701				

TIME PERIOD	VEHICLE MOVEMENT												VEHICLE MOVEMENT												GRAND TOTAL																		
	1			2			3			4			5			6			7			8						9			10			11			12						
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ							
6:30 - 7:00	1	1	2	513	41	554	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	230	39	269	2	1	3	13	4	17	0	0	0	2	1	3	762	87	849	
7:00 - 7:15	1	1	2	530	36	566	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	5	230	37	267	0	0	0	14	3	17	0	0	0	1	3	793	76	869		
7:15 - 7:30	2	1	3	534	36	564	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	6	0	6	266	38	284	4	1	5	16	2	18	0	0	0	0	3	1	4	830	75	905
7:30 - 7:45	1	1	2	520	27	547	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	261	40	301	6	0	6	13	1	14	0	0	0	0	0	0	6	1	7	831	65	896	
7:45 - 8:00	3	1	4	545	23	568	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	261	30	291	6	0	6	13	1	14	0	0	0	0	0	0	6	1	7	831	65	896	
8:00 - 8:15																																											
8:15 - 8:30	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
8:30 - 9:00	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
9:00 - 9:15	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
9:15 - 9:30	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
9:30 - 9:45	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
9:45 - 10:00	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
10:00 - 10:15	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
10:15 - 10:30	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
10:30 - 10:45	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
10:45 - 11:00	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
11:00 - 11:15	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
11:15 - 11:30	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
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11:45 - 12:00	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
12:00 - 12:15	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
12:15 - 12:30	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
12:30 - 12:45	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
12:45 - 1:00	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
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1:45 - 2:00	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
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2:15 - 2:30	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
2:30 - 2:45	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
2:45 - 3:00	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
3:00 - 3:15	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
3:15 - 3:30	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
3:30 - 3:45	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
3:45 - 4:00	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
4:00 - 4:15	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
4:15 - 4:30	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
4:30 - 4:45	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
4:45 - 5:00	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
5:00 - 5:15	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	0	10	246	36	282	8	2	10	14	3	17	0	0	0	9	6	15	686	88	774	
5:15 - 5:30	1	1	2	572	48	620	0	0	0	0	0	0	0	0	0	0	0</																										

Intersection of Picton Road and Wilton Park Road Wednesday, 3 April 2013 Austrafic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 15
North Approach
East Approach Picton Road
South Approach Wilton Park Road
West Approach Picton Road
Date 3/04/13
Classification Light Heavy



TIME PERIOD	VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL		
	1			2			3			4			5			6			7			8			9			10			11			12					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ						
6:30 - 6:45													32	10	42	12	1	13	0	4	4				2	0	2	3	0	3	118	5	123				187	20	187
6:45 - 7:00													37	8	45	14	4	18	0	4	4				0	1	1	2	1	3	113	9	122				166	27	193
7:00 - 7:15													30	5	35	5	7	12	1	3	4				1	1	2	3	0	3	127	6	133				167	22	189
7:15 - 7:30													40	5	45	3	0	3	1	7	8				0	0	0	1	0	1	157	10	167				202	22	224
7:30 - 7:45													64	7	71	1	6	7	2	1	3				1	1	2	1	0	1	138	10	148				207	25	232
7:45 - 8:00													73	4	77	5	6	11	3	2	5				0	0	0	0	0	0	129	14	143				210	26	236
8:00 - 8:15													65	4	69	4	3	7	1	6	7				1	1	2	2	1	3	124	5	129				197	20	217
8:15 - 8:30													62	3	65	4	2	6	0	1	1				2	0	2	3	0	3	109	1	110				180	7	187
8:30 - 8:45													61	4	65	4	7	11	0	5	5				0	1	1	0	2	2	96	3	99				161	22	183
8:45 - 9:00													66	3	69	4	4	8	2	4	6				2	0	2	0	1	1	85	5	90				159	17	176
9:00 - 9:15													50	1	51	1	2	3	2	3	5				1	2	3	2	0	2	86	2	88				142	10	152
9:15 - 9:30													51	6	57	1	3	4	0	2	2				3	0	3	1	1	2	71	3	74				127	15	142
Σ													631	60	691	58	45	103	12	42	54				13	7	20	18	6	24	1353	73	1426				2085	233	2318
7:00 - 9:00	0	0		0	0		0	0		0	0		461	35		30	35		10	29		0	0		7	4		10	4		965	54		0	0				1644

TIME PERIOD	VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL
	1			2			3			4			5			6			7			8			9			10			11			12			
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ				
15:30 - 15:45												80	4	84	2	2	4	3	1	4				4	0	4	1	0	1	74	6	80			164	13	177
15:45 - 16:00												105	9	114	1	2	3	0	1	1				2	0	2	0	0	0	82	9	91			190	21	211
16:00 - 16:15												129	11	140	1	2	3	4	2	6				5	0	5	3	0	3	69	3	72			211	18	229
16:15 - 16:30												127	7	134	3	4	7	5	1	6				3	0	3	2	0	2	66	4	70			206	16	222
16:30 - 16:45												131	3	134	3	1	4	3	5	8				5	0	5	1	0	1	65	3	68			208	12	220
16:45 - 17:00												135	7	142	3	2	5	7	3	10				5	1	6	1	0	1	67	1	68			218	14	232
17:00 - 17:15												164	5	169	0	0	0	9	5	14				2	0	2	0	0	0	79	2	81			254	12	266
17:15 - 17:30												150	4	154	1	0	1	9	1	10				3	0	3	5	0	5	65	5	70			233	10	243
17:30 - 17:45												149	3	152	2	0	2	2	2	4				1	0	1	2	0	2	50	2	52			206	7	213
17:45 - 18:00												138	3	141	1	3	4	2	2	4				3	0	3	2	0	2	61	1	62			207	9	216
18:00 - 18:15												121	2	123	0	1	1	1	2	3				4	0	4	0	0	0	39	1	40			165	6	171
18:15 - 18:30												95	5	100	0	0	0	1	2	3				1	0	1	2	0	2	55	1	56			154	8	162
Σ												1524	63	1587	17	17	34	46	27	73				38	1	39	19	0	19	772	38	810			2416	146	2562
15:45 - 17:45	0	0		0	0		0	0		0	0	1090	49		14	11		39	20		0	0		26	1		14	0		543	29		0	0			1836

Wednesday, 3 April 2013

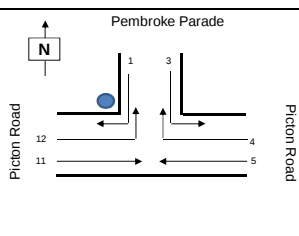
Wednesday, 3 April 2013

Austraffic

Survey Start	6:30 AM	15:30 PM
Intersection Type	T Junction	
Intersection No.	16	
North Approach	Pembroke Parade	
East Approach	Picton Road	
South Approach		
West Approach	Picton Road	

Date 3/04/13

Classification **Light Heavy**



TIME PERIOD			VEHICLE MOVEMENT															VEHICLE MOVEMENT															GRAND TOTAL								
			1			2			3			4			5			6			7			8			9			10						11			12		
			Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ				Light	Heavy	Σ			
6:30	-	6:45	17	0	17				0	0	0	2	0	2	121	36	157															81	39	120	7	6	13	228	81	309	
6:45	-	7:00	12	2	14				0	0	0	1	0	1	140	34	174															86	32	118	12	4	16	251	72	323	
7:00	-	7:15	20	2	22				1	1	2	1	0	1	144	27	171															100	38	138	17	6	23	283	74	357	
7:15	-	7:30	14	0	14				1	0	1	1	1	2	155	30	185															172	34	206	12	2	14	355	67	422	
7:30	-	7:45	38	7	45				3	0	3	3	2	5	157	33	190															167	32	199	9	2	11	377	76	453	
7:45	-	8:00	29	1	30				2	0	2	2	0	2	163	37	200															142	36	178	12	0	12	350	74	424	
8:00	-	8:15	28	0	28				3	0	3	3	1	1	2	113	33	146														127	22	149	6	2	8	278	58	336	
8:15	-	8:30	16	2	18				1	0	1	0	0	0	0	109	27	136														127	37	164	4	1	5	257	67	324	
8:30	-	8:45	21	3	24				1	0	1	4	0	4	111	33	144															112	22	134	5	0	5	254	58	312	
8:45	-	9:00	25	3	28				3	0	3	2	1	3	85	40	125															96	25	122	13	1	14	224	71	295	
9:00	-	9:15	17	0	17				0	0	0	1	0	1	76	26	102															80	26	106	11	1	12	185	53	238	
9:15	-	9:30	18	1	19				3	1	4	0	0	0	84	37	121															84	30	114	12	2	14	201	71	272	
Σ			255	21	276				18	2	20	18	5	23	1458	393	1851															1374	374	1748	120	27	147	3243	822	4065	
7:00	-	9:00	191	18		0	0		15	1		14	5		1037	260		0	0		0	0		0	0		0	0		0	0	1043	247		78	14		2923			

TIME PERIOD		VEHICLE MOVEMENT																								VEHICLE MOVEMENT																								GRAND TOTAL		
		1			2			3			4			5			6			7			8			9			10			11			12																	
		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ																		
15:30	- 15:45	25	0	25				2	0	2	0	0	0	115	29	144																123	28	151	15	1	16	280	58	338												
15:45	- 16:00	15	0	15				0	1	1	2	0	0	2	121	22	143															148	25	173	18	2	20	304	50	354												
16:00	- 16:15	11	1	12				2	1	3	2	0	0	2	129	22	151															158	18	176	17	1	18	319	43	362												
16:15	- 16:30	13	1	14				1	2	3	0	0	0	0	138	31	169															153	17	170	13	2	15	318	53	371												
16:30	- 16:45	20	2	22				1	0	1	3	0	0	3	140	17	157															140	19	159	15	0	15	319	38	357												
16:45	- 17:00	17	0	17				2	0	2	2	0	0	2	145	18	163															152	15	167	18	1	19	336	34	370												
17:00	- 17:15	28	1	29				3	0	3	1	0	1	1	148	17	165															154	19	173	12	1	13	346	38	384												
17:15	- 17:30	11	2	13				1	0	1	0	0	0	0	144	22	166															149	16	165	16	1	17	321	41	362												
17:30	- 17:45	14	1	15				3	0	3	2	0	0	2	140	10	150															138	14	152	30	0	30	327	25	352												
17:45	- 18:00	9	0	9				0	0	0	1	0	0	1	136	17	153															131	8	139	25	1	26	302	26	328												
18:00	- 18:15	10	0	10				1	0	1	1	0	0	1	121	8	129															119	12	131	20	1	21	272	21	293												
18:15	- 18:30	8	0	8				2	0	2	0	0	0	0	112	11	123															111	10	121	17	2	19	250	23	273												
Σ		181	8	189				18	4	22	14	0	14	1589	224	1813																1676	201	1877	216	13	229	3694	450	4144												
15:45	- 17:45	129	8	137	0	0	0	13	4	17	12	0	0	1105	159	1264	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1192	143	1335	239	8	247	2931	579	2912												

Intersection of Picton Road and Almond Street

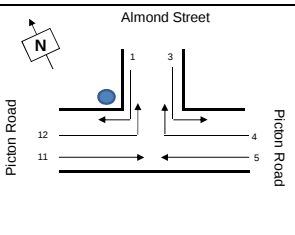
Wednesday, 3 April 2013

Austrafic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 17
North Approach Almond Street
East Approach Picton Road
South Approach
West Approach Picton Road

Date 3/04/13

Classification Light Heavy



● Camera Position

TIME PERIOD		VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL				
		1			2			3			4			5			6			7			8			9			10			11			12							
		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ					
6:30	-	6:45	23	2	25				3	1	4	3	1	4	110	35	145																									
6:45	-	7:00	20	2	22				5	2	7	1	1	2	120	34	154																									
7:00	-	7:15	27	2	29				3	0	3	0	2	2	119	26	145																									
7:15	-	7:30	21	2	23				2	0	2	2	0	2	132	30	162																									
7:30	-	7:45	26	1	27				2	1	3	1	2	3	129	31	160																									
7:45	-	8:00	45	5	50				2	0	2	2	0	2	117	35	152																									
8:00	-	8:15	24	2	26				6	1	7	3	1	4	92	29	121																									
8:15	-	8:30	27	2	29				4	0	4	2	0	2	83	24	107																									
8:30	-	8:45	26	4	30				2	0	2	1	2	3	85	30	115																									
8:45	-	9:00	25	4	29				3	0	3	1	0	1	62	33	95																									
9:00	-	9:15	20	5	25				3	2	5	2	1	3	60	23	83																									
9:15	-	9:30	19	3	22				2	1	3	2	0	2	60	36	96																									
Σ			303	34	337				37	8	45	20	10	30	1169	366	1535																									
7:00	-	9:00	221	22		0	0		24	2		12	7		819	238		0	0		0	0		0	0		0	0		0	0		904	229		153	20				2651	

TIME PERIOD			VEHICLE MOVEMENT															VEHICLE MOVEMENT															GRAND TOTAL					
			1			2			3			4			5			6			7			8			9			10						11		
Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ
15:30	-	15:45	32	2	34				1	2	3	1	0	1	87	28	115										104	22	126	25	5	30	250	59	309			
15:45	-	16:00	28	1	29				4	0	4	6	0	6	94	19	113										118	26	144	25	2	27	275	48	323			
16:00	-	16:15	21	1	22				1	1	2	7	0	7	108	23	131										129	18	147	35	1	36	301	44	345			
16:15	-	16:30	25	5	30				2	0	2	5	0	5	110	24	134										122	19	141	34	2	36	298	50	348			
16:30	-	16:45	22	2	24				4	2	6	6	0	6	122	16	138										108	18	126	31	3	34	293	41	334			
16:45	-	17:00	25	1	26				2	3	5	3	0	3	126	17	143										126	15	141	32	2	34	314	38	352			
17:00	-	17:15	33	0	33				7	1	8	6	1	7	116	17	133										130	16	146	29	2	31	321	37	358			
17:15	-	17:30	22	2	24				5	1	6	4	1	5	120	19	139										128	13	141	25	1	26	304	37	341			
17:30	-	17:45	32	1	33				3	1	4	4	0	4	112	9	121										112	14	126	30	0	30	293	25	318			
17:45	-	18:00	23	3	26				6	0	6	5	0	5	111	14	125										101	7	108	28	1	29	274	25	299			
18:00	-	18:15	18	0	18				3	0	3	3	0	3	107	9	116										98	10	108	23	2	25	252	21	273			
18:15	-	18:30	22	2	24				2	0	2	2	2	4	84	7	91										83	5	88	30	3	33	223	19	242			
Σ			303	20	323				40	11	51	52	4	56	1297	202	1499										1359	183	1542	347	24	371	3398	444	3842			
15:45	-	17:45	208	13		0	0		28	9		41	2		908	144		0	0		0	0		0	0		973	139		241	13					2719		

Intersection of Picton Road and Macarthur Drive

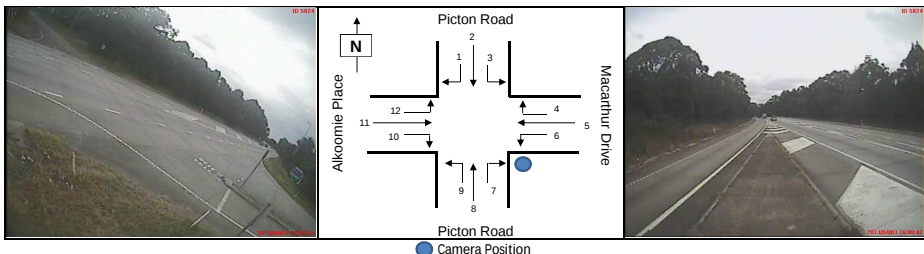
Wednesday, 3 April 2013

Austraffic

Survey Start 6:30 AM 15:30 PM
Intersection Type Cross Junction
Intersection No. 18
North Approach Picton Road
East Approach Macarthur Drive
South Approach Picton Road
West Approach Alkoomie Place

Date 3/04/13

Classification Light Heavy

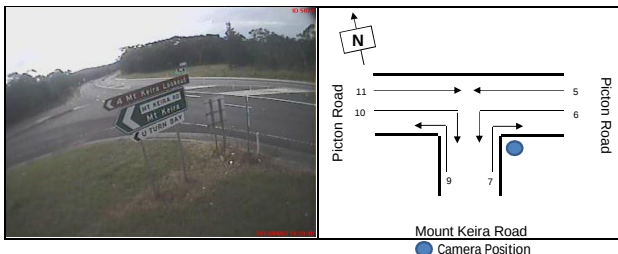


TIME PERIOD	VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL	
	1			2			3			4			5			6			7			8			9			10			11			12				
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ					
6:30 - 6:45	0	0	0	70	38	108	0	1	1	1	0	1	0	0	0	2	1	3	15	1	16	111	37	148	0	0	0	0	0	0	0	0	0	199	78	277		
6:45 - 7:00	0	0	0	72	36	108	0	0	0	1	0	1	1	0	1	1	0	1	15	0	15	119	36	155	0	0	0	0	0	0	0	0	0	209	72	281		
7:00 - 7:15	0	0	0	79	32	111	0	0	0	0	0	0	0	0	0	10	0	10	8	0	8	120	31	151	0	0	0	1	0	1	0	0	0	218	63	281		
7:15 - 7:30	0	0	0	139	26	165	1	0	1	1	1	2	0	0	0	9	0	9	11	2	13	130	28	158	0	0	0	0	0	0	0	0	0	291	57	348		
7:30 - 7:45	0	0	0	151	38	189	0	0	0	0	0	0	0	0	0	26	0	26	15	0	15	135	35	170	0	0	0	0	0	0	0	0	0	327	73	400		
7:45 - 8:00	0	0	0	134	30	164	0	0	0	2	0	2	1	0	1	37	1	38	15	0	15	115	32	147	0	0	0	0	0	0	0	0	0	304	63	367		
8:00 - 8:15	0	0	0	120	22	142	0	1	1	1	1	0	0	0	0	21	1	22	10	0	10	96	31	127	0	1	1	0	0	0	0	0	0	248	56	304		
8:15 - 8:30	0	0	0	108	26	134	0	0	0	2	0	2	0	0	0	14	0	14	12	0	12	79	26	105	0	0	0	0	0	0	0	0	0	215	52	267		
8:30 - 8:45	0	0	0	96	22	118	1	0	1	1	0	1	0	0	0	10	1	11	6	1	7	82	34	116	0	0	0	0	0	0	0	0	1	196	59	255		
8:45 - 9:00	0	0	0	88	18	106	0	0	0	2	0	2	0	0	0	7	0	7	9	0	9	64	26	90	0	0	0	0	0	0	0	0	0	170	44	214		
9:00 - 9:15	0	0	0	71	24	95	1	2	3	1	0	1	0	0	0	2	0	2	7	0	7	61	25	86	0	0	0	0	0	0	0	0	0	143	51	194		
9:15 - 9:30	0	0	0	71	27	98	0	0	0	0	0	0	1	0	1	9	0	9	2	2	4	65	35	100	0	0	0	0	0	0	0	0	0	148	64	212		
Σ	0	0	0	1199	339	1538	3	4	7	12	1	13	3	0	3	148	4	152	125	6	131	1177	376	1553	0	1	1	1	0	1	0	0	0	1	1	2668	732	3400
7:00 - 9:00	0	0		915	214		2	1		9	1		1	0		134	3		86	3		821	243		0	1		1	0		0	0		0	1		2436	
7:00 - 8:00	0	0		503	126	755		1	0	1	3	1	5	1	0	1	82	1	84	49	2	53	500	126	752	0	0	0	1	0	0	1	0	0	0	0	0	

TIME PERIOD	VEHICLE MOVEMENT																								VEHICLE MOVEMENT																								GRAND TOTAL	
	1			2			3			4			5			6			7			8			9			10			11			12																
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ														
15:30 - 15:45	0	0	0	0	102	24	126	0	0	0	0	0	0	0	0	17	1	18	5	1	6	91	25	116	0	0	0	0	0	0	1	0	1	0	0	0	216	51	267											
15:45 - 16:00	0	0	0	0	124	22	146	2	1	3	0	0	1	1	0	0	36	1	37	8	0	8	102	20	122	0	0	0	0	0	0	0	0	0	0	0	272	45	317											
16:00 - 16:15	0	0	0	0	129	22	151	1	0	1	0	1	1	0	0	24	0	24	9	0	9	113	20	133	0	0	0	0	0	0	0	0	0	0	0	0	276	43	319											
16:15 - 16:30	0	0	0	0	120	21	141	0	0	0	0	0	0	0	0	9	1	10	7	1	8	116	23	139	1	0	1	0	0	0	0	0	0	1	0	1	254	46	300											
16:30 - 16:45	0	0	0	0	116	22	138	0	0	0	1	1	2	0	0	7	0	7	12	1	13	123	14	137	0	0	0	0	0	0	0	0	0	1	0	1	260	38	298											
16:45 - 17:00	0	0	0	0	129	21	150	2	0	2	0	0	0	0	0	11	0	11	7	0	7	130	20	150	0	0	0	0	0	0	1	0	1	0	0	0	280	41	321											
17:00 - 17:15	0	0	0	0	132	13	145	2	0	2	0	0	0	0	0	19	1	20	8	0	8	123	18	141	0	0	0	0	0	0	0	0	0	0	0	0	284	32	316											
17:15 - 17:30	0	0	0	0	129	12	141	1	0	1	0	0	0	0	0	16	0	16	7	1	8	126	21	147	1	0	1	0	0	0	0	0	0	0	0	0	280	34	314											
17:30 - 17:45	0	0	0	0	118	14	132	0	0	0	1	0	1	0	0	9	0	9	10	0	10	119	8	127	0	0	0	0	0	0	1	0	1	0	0	0	258	22	280											
17:45 - 18:00	0	0	0	0	105	8	113	0	0	0	0	0	0	0	0	6	0	6	11	0	11	112	12	124	0	0	0	0	0	0	0	0	0	0	0	234	20	254												
18:00 - 18:15	0	0	0	0	104	9	113	0	0	0	1	0	1	0	0	9	1	10	9	1	10	110	12	122	0	0	0	0	0	0	0	0	0	0	0	233	23	256												
18:15 - 18:30	0	0	0	0	83	6	89	2	0	2	1	1	2	0	0	5	0	5	7	0	7	89	5	94	0	0	0	0	0	0	0	0	0	0	0	187	12	199												
Σ	0	0	0	0	1391	194	1585	10	1	11	4	4	8	0	0	168	5	173	100	5	105	1354	198	1552	2	0	2	0	0	0	3	0	3	2	0	2	3034	407	3441											
15:45 - 17:45	0	0	0	0	997	147		8	1		2	3		0	0		131	3		68	3		952	144		2	0		0	0		2	0		2	0		2465												
16:45 - 17:45	0	0	0	0	508	60	628	5	0	5	1	0	1	0	0	55	1	57	32	1	34	498	67	632	1	0	1	0	0	0	2	0	2	0	0	0	0													

Intersection of Picton Road and Mount Keira Road Wednesday, 3 April 2013
Austrafic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 19
North Approach
East Approach Picton Road
South Approach Mount Keira Road
West Approach Picton Road
Date 3/04/13
Classification Light Heavy



TIME PERIOD		VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL			
		1			2			3			4			5			6			7			8			9			10			11			12						
		Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ							
6:30	-	6:45											192	43	235	2	0	2	0	0	0					2	0	2	1	0	1	113	45	158				310	88	398	
6:45	-	7:00											121	30	151	0	0	0	1	0	1					4	0	4	1	0	1	83	35	118				210	65	275	
7:00	-	7:15											115	29	144	1	0	1	0	0	0					1	0	1	1	0	1	82	35	117				200	64	264	
7:15	-	7:30											140	33	173	1	0	1	0	0	0					5	2	7	0	0	0	100	28	128				246	63	309	
7:30	-	7:45											119	33	152	0	0	0	2	0	2					3	2	5	1	1	2	130	29	159				255	65	320	
7:45	-	8:00											99	34	133	0	0	0	0	0	0					6	1	7	4	1	5	202	39	241				311	75	386	
8:00	-	8:15											89	20	109	1	1	2	2	0	2					5	1	6	5	1	6	168	36	204				270	59	329	
8:15	-	8:30											90	25	115	0	1	1	0	0	0					8	1	9	3	2	5	138	24	162				239	53	292	
8:30	-	8:45											63	32	95	2	0	2	2	1	3					5	1	6	3	0	3	121	30	151				196	64	260	
8:45	-	9:00											73	28	101	1	0	1	0	1	1					2	1	3	1	1	2	100	21	121				177	52	229	
9:00	-	9:15											59	37	96	0	0	0	1	0	1					2	0	2	3	0	3	84	19	103				149	56	205	
9:15	-	9:30											73	45	118	0	0	0	0	0	0					2	0	2	1	0	1	78	25	103				154	70	224	
Σ													1233	389	1622	8	2	10	8	2	10					45	9	54	24	6	30	1399	366	1765				2717	774	3491	
7:00 - 9:00			0	0		0	0		0	0		0	0	0	0		788	234		6	2		6	2		0	0		35	9		18	6		1041	242		0	0		2389

TIME PERIOD	VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL		
	1			2			3			4			5			6			7			8			9			10			11			12					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ						
15:30 - 15:45													95	21	116	1	0	1	1	1	2					3	0	3	4	0	4	106	26	132			210	48	258
15:45 - 16:00													103	22	125	1	0	1	2	2	4					2	0	2	3	3	6	127	23	150			238	50	288
16:00 - 16:15													96	26	122	2	0	2	1	0	1					4	0	4	10	0	10	158	23	181			271	49	320
16:15 - 16:30													109	14	123	0	0	0	1	0	1					2	0	2	3	0	3	143	24	167			258	38	296
16:30 - 16:45													112	18	130	1	0	1	0	0	0					2	0	2	6	0	6	142	25	167			263	43	306
16:45 - 17:00													122	17	139	1	0	1	3	0	3					2	0	2	5	0	5	107	23	130			240	40	280
17:00 - 17:15													123	23	146	0	0	0	0	0	0					3	0	3	3	0	3	146	20	166			275	43	318
17:15 - 17:30													126	10	136	0	0	0	1	0	1					2	0	2	4	0	4	150	13	163			283	23	306
17:30 - 17:45													125	13	138	2	0	2	0	0	0					1	0	1	2	0	2	164	12	176			294	25	319
17:45 - 18:00													106	9	115	0	0	0	0	0	0					2	0	2	2	0	2	112	15	127			222	24	246
18:00 - 18:15													98	12	110	0	0	0	1	0	1					2	0	2	2	0	2	113	7	120			216	19	235
18:15 - 18:30													61	11	72	0	0	0	1	0	1					0	0	0	3	0	3	99	13	112			164	24	188
Σ													1276	196	1472	8	0	8	11	3	14					25	0	25	47	3	50	1567	224	1791			2934	426	3360
15:45 - 17:45	0	0		0	0		0	0		0	0		916	143		7	0		8	2		0	0			18	0		36	3		1137	163		0	0			2433

Intersection of Wilton Road and Macarthur Drive

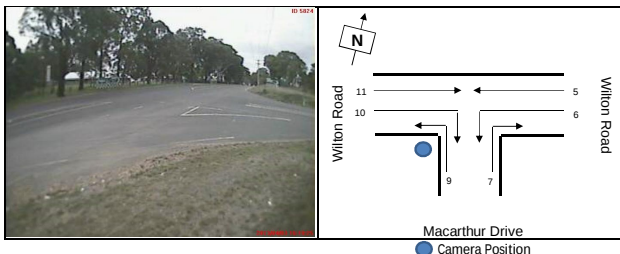
Wednesday, 3 April 2013

Austrafic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 20
North Approach
East Approach Wilton Road
South Approach Macarthur Drive
West Approach Wilton Road

Date 3/04/13

Classification Light Heavy

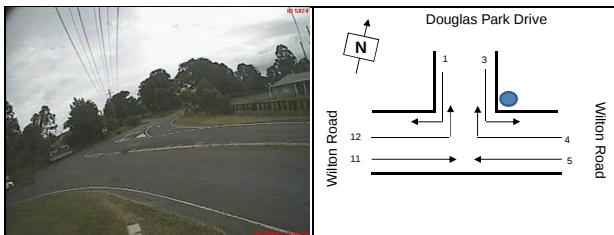


TIME PERIOD	VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL	
	1			2			3			4			5			6			7			8			9			10			11			12				
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ					
6:30 - 6:45													15	1	16	3	0	3	12	2	14				1	0	1	0	1	1	14	1	15	45	5	50		
6:45 - 7:00													10	2	12	1	0	1	17	0	17				3	0	3	1	0	1	18	2	20	50	4	54		
7:00 - 7:15													25	0	25	11	0	11	11	0	11				1	0	1	3	0	3	18	0	18	69	0	69		
7:15 - 7:30													20	0	20	10	0	10	10	2	12				1	0	1	1	0	1	29	1	30	71	3	74		
7:30 - 7:45													27	2	29	35	0	35	16	0	16				0	0	0	0	0	0	24	0	24	102	2	104		
7:45 - 8:00													37	1	38	32	2	34	16	0	16				1	0	1	1	0	1	26	4	30	113	7	120		
8:00 - 8:15													20	1	21	17	0	17	13	1	14				1	0	1	0	1	1	22	0	22	73	3	76		
8:15 - 8:30													23	1	24	12	0	12	13	0	13				1	0	1	0	1	1	37	2	39	86	4	90		
8:30 - 8:45													19	1	20	11	1	12	5	0	5				1	0	1	1	0	1	22	3	25	59	5	64		
8:45 - 9:00													20	1	21	9	0	9	11	1	12				1	0	1	1	0	1	22	0	22	64	2	66		
9:00 - 9:15													23	4	27	6	0	6	8	1	9				0	0	0	0	0	0	13	0	13	50	5	55		
9:15 - 9:30													27	1	28	4	0	4	5	1	6				0	1	1	1	0	1	18	1	19	55	4	59		
Σ													266	15	281	151	3	154	137	8	145				11	1	12	9	3	12	263	14	277	837	44	881		
7:00 - 9:00	0	0		0	0		0	0		0	0		191	7		137	3		95	4		0	0		7	0		7	2		200	10		0	0		663	
7:00 - 8:00	0	0		0	0	0							109	3	115	88	2		92	53	2	57				3	0	3	5	0	5	97	5	107				

TIME PERIOD	VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL	
	1			2			3			4			5			6			7			8			9			10			11			12				
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ					
15:30 - 15:45													40	1	41	26	1	27	3	1	4				1	0	1	1	0	1	29	3	32			100	6	106
15:45 - 16:00													35	1	36	33	0	33	7	0	7				1	0	1	1	1	2	27	3	30			104	5	109
16:00 - 16:15													30	0	30	18	1	19	7	0	7				0	0	0	0	0	0	32	2	34			87	3	90
16:15 - 16:30													32	5	37	10	2	12	8	0	8				1	0	1	0	0	0	41	1	42			92	8	100
16:30 - 16:45													29	2	31	3	0	3	10	0	10				1	1	2	1	0	1	27	1	28			71	4	75
16:45 - 17:00													34	0	34	15	0	15	10	0	10				1	0	1	0	0	0	34	0	34			84	0	84
17:00 - 17:15													35	0	35	18	0	18	7	0	7				0	0	0	1	0	1	28	0	28			89	0	89
17:15 - 17:30													30	0	30	12	0	12	6	1	7				1	0	1	3	0	3	27	1	28			79	2	81
17:30 - 17:45													24	2	26	7	0	7	7	0	7				1	0	1	2	0	2	25	1	26			66	3	69
17:45 - 18:00													36	1	37	7	0	7	15	0	15				1	0	1	2	0	2	24	0	24			85	1	86
18:00 - 18:15													24	0	24	9	1	10	9	1	10				0	0	0	0	0	0	18	1	19			60	3	63
18:15 - 18:30													24	0	24	4	0	4	7	0	7				0	0	0	0	0	0	18	2	20			53	2	55
Σ													373	12	385	162	5	167	96	3	99				8	1	9	11	1	12	330	15	345			980	37	1017
15:45 - 17:45	0	0		0	0		0	0		0	0		249	10		116	3		62	1		0	0		6	1		8	1		241	9		0	0		707	
16:45 - 17:45	0	0		0	0	0							123	2	127	52	0	52	30	1	32				3	0	3	6	0	6	114	2	118					

Intersection of Wilton Road and Douglas Park Drive Wednesday, 3 April 2013
Austrafic

Survey Start 6:30 AM 15:30 PM
Intersection Type T Junction
Intersection No. 21
North Approach Douglas Park Drive
East Approach Wilton Road
South Approach Wilton Road
West Approach Wilton Road
Date 3/04/13
Classification Light Heavy



TIME PERIOD	VEHICLE MOVEMENT																		VEHICLE MOVEMENT																		GRAND TOTAL		
	1			2			3			4			5			6			7			8			9			10			11			12					
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ			
6:30 - 6:45	6	1	7				4	0	4	3	0	3	12	0	12																								
6:45 - 7:00	3	2	5				2	0	2	7	0	7	9	0	9																								
7:00 - 7:15	20	0	20				6	0	6	6	0	6	16	0	16																								
7:15 - 7:30	16	1	17				5	0	5	1	0	1	13	0	13																								
7:30 - 7:45	40	1	41				11	0	11	3	0	3	23	0	23																								
7:45 - 8:00	46	3	49				13	0	13	3	0	3	22	0	22																								
8:00 - 8:15	29	0	29				5	0	5	5	0	5	10	1	11																								
8:15 - 8:30	18	1	19				2	0	2	8	0	8	15	0	15																								
8:30 - 8:45	14	2	16				1	0	1	6	1	7	15	0	15																								
8:45 - 9:00	14	1	15				3	1	4	6	0	6	15	1	16																								
9:00 - 9:15	12	1	13				7	0	7	7	1	8	17	2	19																								
9:15 - 9:30	17	1	18				7	0	7	8	0	8	15	0	15																								
Σ	235	14	249				66	1	67	63	2	65	182	4	186																								
7:00 - 9:00	197	9		0	0		46	1		38	1		129	2		0	0		0	0		0	0		0	0		0	0		150	5		142	9		729		
7:00 - 8:00	122	5	132				35	0	35	13	0	13	74	0	74																	74	2	78	74	5	84		

TIME PERIOD	VEHICLE MOVEMENT												VEHICLE MOVEMENT												GRAND TOTAL												
	1			2			3			4			5			6			7			8			9			10			11			12			
	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ	Light	Heavy	Σ				
15:30 - 15:45	39	1	40				14	0	14	9	0	9	26	1	27																						
15:45 - 16:00	51	1	52				19	0	19	5	0	5	18	0	18																						
16:00 - 16:15	29	1	30				8	0	8	9	0	9	19	0	19																						
16:15 - 16:30	22	5	27				7	0	7	2	0	2	17	2	19																						
16:30 - 16:45	15	0	15				5	0	5	7	0	7	18	2	20																						
16:45 - 17:00	24	0	24				5	0	5	5	0	5	26	0	26																						
17:00 - 17:15	29	0	29				2	0	2	5	0	5	25	0	25																						
17:15 - 17:30	23	0	23				4	0	4	3	0	3	20	0	20																						
17:30 - 17:45	14	1	15				4	0	4	5	0	5	17	1	18																						
17:45 - 18:00	24	1	25				0	0	0	9	1	10	19	0	19																						
18:00 - 18:15	15	1	16				1	0	1	3	0	3	19	0	19																						
18:15 - 18:30	17	0	17				1	0	1	4	0	4	11	0	11																						
Σ	302	11	313				70	0	70	66	1	67	235	6	241																						
15:45 - 17:45	207	8		0	0		54	0		41	0		160	5		0	0		0	0		0	0		0	0		0	0		158	3		146	7		789
16:45 - 17:45	90	1	92				15	0	15	18	0	18	88	1	90																	83	0	83	62	3	68

Appendix B

Intersection performance criteria



B1. Intersection performance criteria

Level of Service (LoS)

Level of Service (LoS) is a basic performance parameter used to describe the operation of an intersection. Levels of service range from A (indicating good intersection operation) to F (indicating over-saturated conditions with long delays and queues). At signalised intersections, the LoS criteria are related to average intersection delay (seconds per vehicle). At priority controlled (give-way and stop controlled) and roundabout intersections, the LoS is based on the modelled delay (seconds per vehicle) for the most delayed movement (refer to Table A.1).

Table A.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 would 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, 2002

Degree of saturation (DoS)

The Degree of Saturation (DoS) is the ratio of demand flow to capacity, and therefore has no unit. As it approaches 1.0, extensive queues and delays could be expected. For a satisfactory situation, DoS should be less than the nominated practical degree of saturation, usually 0.9. The intersection DoS is based on the movement with the highest value.

Average vehicle delay

This is the difference between interrupted and uninterrupted travel times through the intersection and is measured in seconds per vehicle. At signalised intersections and roundabouts, the average intersection delay is usually reported. At priority controlled intersections, the average delay for the most delayed movement is usually reported.

Queue length

Queue length is measured in metres reflecting the number of vehicles waiting at the stop line and is usually quoted as the 95th percentile back of queue, which is the value below which 95% of all observed queue lengths fall. It reflects the number of vehicles per traffic lane at the start of the green period, when traffic starts moving again after a red signal. The intersection queue length is usually taken from the movement with the longest queue length.

Table A.2 Austroads lane capacities (in PCU)

LoS	2-lane 2-way	Multi-lane arterial	Freeway
A	490	560	770
B	780	880	1,210
C	1,190	1,280	1,740
D	1,830	1,705	2,135
E	3,200	2,000	2,350
F	Greater than 3,200	Greater than 2,000	Greater than 2,350

Source: Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis

Appendix C

Aimsun model calibration and validation report



Elton Consulting

**Wilton Junction Transport Management and Accessibility Plan
AIMSUN Mesoscopic Model Calibration and Validation Report**

18 October 2013



**PARSONS
BRINCKERHOFF**

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Prepared by:	Bill Chen	Date: 18/10/2013	Signature: <i>Bill Chen</i>
Reviewed by:	Graeme Inglis	Date: 18/10/2013	Signature: <i>Graeme Inglis</i>
Approved by:	Graeme Inglis	Date: 18/10/2013	Signature: <i>Graeme Inglis</i>

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Document owner

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
Tel: +61 2 9272 5100
Fax: +61 2 9272 5101
Email: sydney@pb.com.au
www.pbworld.com
Certified to ISO 9001, ISO 14001, AS/NZS 4801
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Contents

	Page number
1. Introduction	1
1.1 Background	1
1.2 Report structure	1
2. Data sources	3
2.1 Traffic data	3
2.2 Site inspection	6
3. 2013 Base year model development	7
3.1 Modelling software	7
3.2 AIMSUN template	7
3.3 Base models	8
3.4 Model network and zoning system	8
3.5 Traffic signals	10
3.6 Base year traffic demand	10
3.7 Traffic assignment	13
4. Model calibration and validation	15
4.1 Introduction	15
4.2 Model calibration	15
4.3 Travel time validation	18
4.4 Model confidence and stability	19
5. Summary and conclusions	23
5.1 Summary	23
5.2 Conclusions	23

List of tables

		Page number
Table 3.1	Adjustment of vehicle parameters for DPTI car	7
Table 3.2	Dynamic traffic assignment settings in the model	13
Table 4.1	Mesoscopic modelling link and turn standard calibration criteria (network wide)	16
Table 4.2	Mesoscopic modelling link and turn standard calibration criteria (core area)	17
Table 4.3	AM and PM peaks flow calibration summary	17
Table 4.4	Flow calibration summary for the AM and PM peak hours	18
Table 4.5	AM peak validation summary	19
Table 4.6	PM peak validation summary	19
Table 4.7	AM and PM peak network wide statistics	19

List of figures

		Page number
Figure 2.1	Study area and key intersections	4
Figure 3.1	AIMSUN model network and zoning system	10
Figure 3.2	2013 AM peak (7.00–9.00) Static Adjustment regression plot	12
Figure 3.3	2013 PM peak (15.45–17.45) Static Adjustment regression plot	12
Figure 4.1	AM and PM peak – current number of vehicles (current nV)	21

List of appendices

Appendix A	Flow calibration results
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1. Introduction

1.1 Background

Parsons Brinckerhoff were commissioned by Elton Consulting on behalf of the Wilton Junction Landowners Group to undertake traffic simulation modelling for the Wilton Junction precinct to assess the traffic impacts resulting from the proposed new development.

A key component of the assessment is the development of existing condition Mesoscopic simulation models to develop a strong understanding of current traffic operations on the surrounding road network and to provide a robust platform on which to assess future year development scenarios.

The purpose of this report is to detail the development of the 2013 base year AIMSUN Mesoscopic models and report on the model calibration and validation process. The purpose of the modelling is twofold:

1. to assist in determining the infrastructure requirements for the Wilton Junction development, and
2. to assess the traffic impacts of the proposed development on existing infrastructure.

The modelling will help to inform the rezoning process.

1.2 Report structure

The report is structured as follows:

- Section 2:** Data sources
- Section 3:** Model development
- Section 4:** Model calibration and validation
- Section 5:** Summary and conclusions.

2. Data sources

2.1 Traffic data

Parsons Brinckerhoff collected a significant amount of traffic data to assist in the development of the base year model. The information provided is detailed below:

- classified intersection turning movement counts
- motorway flow counts
- intersection approach queue lengths
- travel time.

In addition to the above information, Parsons Brinckerhoff was provided the following data from Bureau of Transport Statistics (BTS) and Roads and Maritime Services (RMS):

- the 2011 Sydney Travel Model (STM) outputs (from BTS)
- traffic signal and SCATS count data (from RMS).

2.1.1 Classified intersection turning movement counts

The intersection turning movement counts was undertaken by Austraffic (traffic survey specialist) on 4 April 2013 at the following locations (these are noted in Figure 2.1):

3. A9 Narellan Road/Camden Bypass (interchange)
4. M31 Hume Motorway/A9 Narellan Road (interchange)
5. SR89 Remembrance Driveway and Macarthur Road (interchange)
6. B69 Appin Road/Church Street (priority controlled)
7. B69 Appin Road/M1 Princes Highway (interchange)
8. M1 Princes Highway/B88 Picton Road (interchange)
9. M31 Hume Motorway/B88 Picton Road (interchange)
10. Menangle Street/SR89 Remembrance Driveway (priority controlled)
11. Menangle Road/Camden Road (priority controlled)
12. M31 Hume Motorway/SR89 Remembrance Driveway (interchange)
13. B88 Picton Road/Menangle Road (priority controlled)
14. B88 Picton Road/Wilton Park Road, west of Menangle Road (priority controlled)
15. B88 Picton Road/Pembroke Parade (priority controlled)
16. B88 Picton Road/Almond Street (priority controlled)
17. B88 Picton Road/Macarthur Drive (priority controlled)
18. B88 Picton Road/Mount Keira Road (priority controlled)
19. Wilton Road/Macarthur Drive (priority controlled)
20. Wilton Road/Douglas Park Drive (priority controlled)

21. B88 Picton Road/Wilton Park Road, east of Menangle Road (priority controlled, data collected on May 1 2013)

Turn counts were undertaken between 06.30–09.30 for the AM peak and 15.30–18.30 for the PM peak. Counts were classified into light and heavy vehicles with data binned into 15-minute intervals.

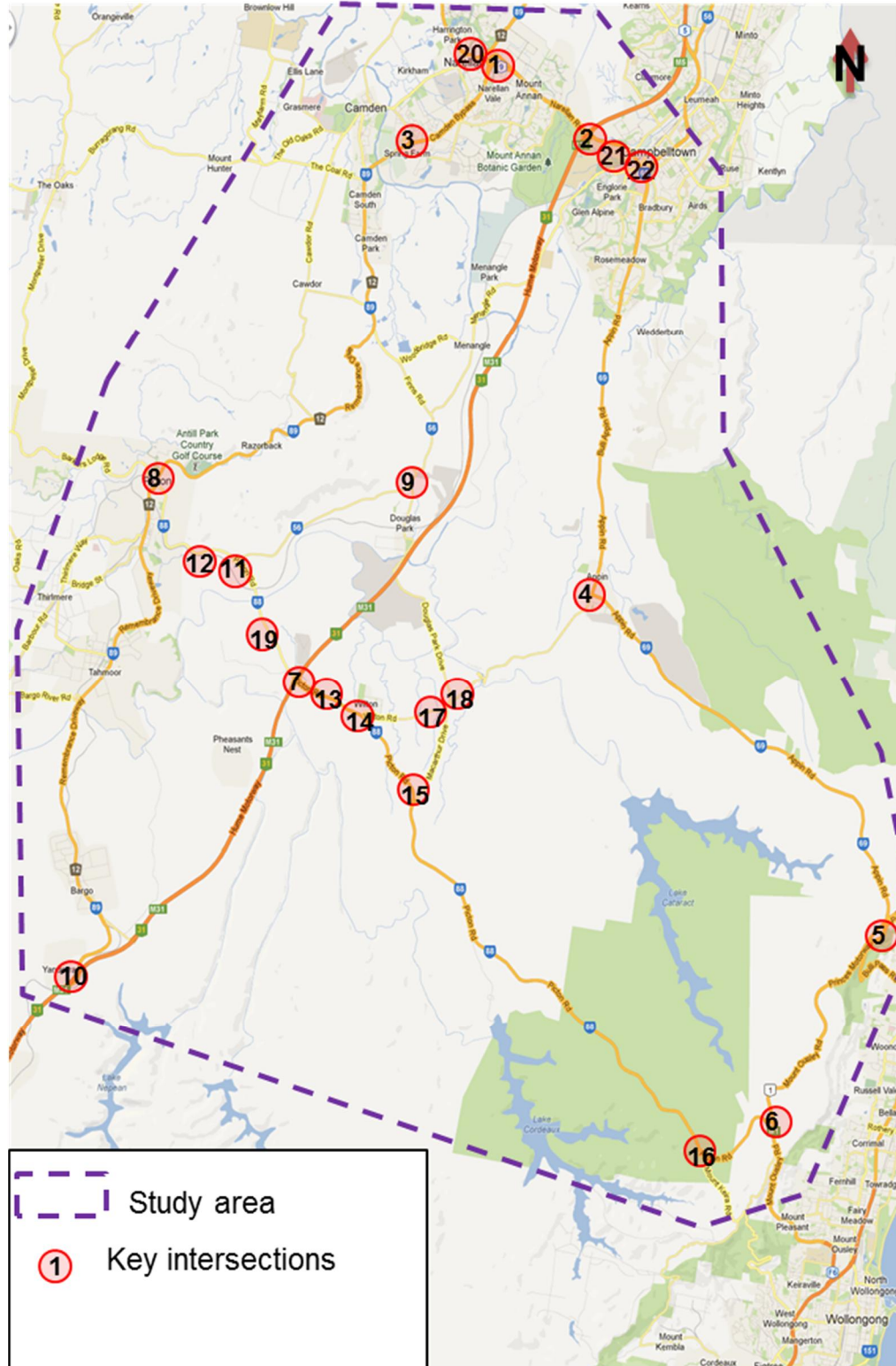


Figure 2.1 Study area and key intersections

2.1.2 Motorway flow counts

Motorway flow counts were undertaken by Austraffic on April 4 2013 at the following locations:

- M31 Hume Motorway under B88 Picton Road
- M1 Princes Highway at its intersection with B88 Picton Road.

Flow counts were undertaken between 06.30–09.30 for the AM peak and between 15.30–18.30 for the PM peak. Counts were classified into light and heavy vehicles with data binned into 15-minute intervals.

2.1.3 Queue lengths

Queue lengths surveys were undertaken by Austraffic on April 4 2013 at each approach at the following intersections:

- M31 Hume Motorway/B88 Picton Road
- M31 Hume Motorway/A9 Narellan Road
- B69 Narellan Road/B69 Appin Road/Oxley Street.

The maximum queue lengths (in vehicle) on each approach were recorded every signal cycle for the signalised intersections and every minute for the priority controlled intersections.

2.1.4 Travel times

Parsons Brinckerhoff undertook travel time surveys on 4 April 2013 to obtain travel time validation information. Surveys were taken by 'floating car' method of driving throughout the study area. Video footage of the surveys was recorded and this provided further information on network operation that proved extremely valuable for the model development process.

2.1.5 Traffic signal and SCATS count data

A total of four key signalised intersections were modelled in the 2013 base year AIMSUN model. These intersections are noted in Figure 2.1, including:

2. M31 Hume Motorway/A9 Narellan Road (western intersection)
22. A9 Narellan Road/SR89 Remembrance Driveway/A9 the Northern Road
23. B69 Narellan Road/Blaxland Road/Gilchrist Drive
24. B69 Narellan Road/B69 Appin Road/Oxley Street.

Parsons Brinckerhoff was supplied with the following signal data by RMS for these intersections:

- traffic control site (TCS) graphics plots depicting the phasing plans and signal groups and detector locations
- intersection diagnostic monitor (IDM) containing the information on phase times, phase frequencies and cycle lengths
- SCATS traffic counts in 30-minute interval.

2.1.6 STM model data

BTS provided the following data from their STM model to assist in the model development and option testing.

- STM zoning structure for the study area
- 2011 STM cordon matrices of the study area.

2.2 Site inspection

Site inspection was undertaken by Parsons Brinckerhoff to observe the current traffic conditions in the study area during both the AM and PM periods. Specific note was made of the following:

- restrictions
- intersection and lane configuration
- lane usage
- driver behaviour.

During the site inspection, it was observed that M31 Hume Motorway/B88 Picton Road interchange operated well in both AM and PM peak, with the right turning vehicles on both northbound and southbound off-ramps experiencing some delays when waiting for suitable gaps to merge onto B88 Picton Road.

DRAFT

3. 2013 Base year model development

3.1 Modelling software

Through extensive consultations with the Transport for New South Wales (TfNSW), AIMSUN software (version 8.0) was selected as the modelling tool of choice to undertake the traffic Mesoscopic modelling for this project.

3.2 AIMSUN template

As currently there is no AIMSUN template available in NSW, the template developed by the Department of Planning, Transport and Infrastructure South Australia (DPTI) in conjunction with TSS-Transport Simulation Systems (AIMSUN software vendor) has been used for the development of the base year model. The following notes any changes that have been made to the DPTI's AIMSUN template to assist with model development and calibration:

- vehicle characteristic
- road type.

3.2.1 Vehicle characteristics

Different from microsimulation, the Mesoscopic simulator in AIMSUN does not model the overtaking manoeuvre within a model section/link. This leads to unrealistically high delay time for some long highway sections in the model when there are slow vehicles travelling through these locations. Therefore, the default values of speed variability parameters including the **Desired Speed** and **Speed Acceptance** for the DPTI car were adjusted to reflect realistic delays on these locations in the model.

The parameter of the **Maximum Giveaway Time** for the DPTI car has been modified to reflect the observed giveaway behaviour. This is further discussed in section 4.2.1.

Table 3.1 shows the adjustments of the parameters related to vehicle characteristics.

Table 3.1 Adjustment of vehicle parameters for DPTI car

Vehicle parameter	Standard value	Adjusted value
Deviation of maximum desired speed	10 km/hr	0 km/hr
Minimum desired speed	80 km/hr	110 km/hr
Maximum desired speed	120 km/hr	110 km/hr
Mean speed acceptance	0.96	1.00
Deviation of speed acceptance	0.09	0.02
Minimum speed acceptance	0.75	0.98
maximum speed acceptance	1.12	1.02
maximum give way time	30s	60s

3.2.2 Road types

The parameter of **Visibility Along Main Stream** related to give way behaviour for all the road types has been increased from the standard value of 20 metres to be 150 metres to represent the observed driver behaviour.

In AIMSUN Mesoscopic model, the link capacity parameter influences a driver's perception of the travel costs for alternative routes. This parameter for all the road types has been modified in accordance with *Austrroads Guide to Traffic Management (Part 3: Traffic Studies and Analysis 2009)* to aid in the calibration of route choices in the model.

The DPTI's AIMSUN template only provides a limited number of road types. Therefore, some new road types were created to better reflect various posted speed limits within the study area.

3.3 Base models

Models representing the following time periods for 2013 base year were developed:

- AM peak: 07.00–09.00
- PM peak: 15.45–17.45.

Both the peak periods were determined based on the surveyed turning movement counts and motorway flow counts.

Each model was also built with a one-hour warm up period to ensure a good representation of traffic conditions in the network at the beginning of the peak period. In addition, a one-hour cool down period was included to replicate the 'clear out' of the study area after the peak period.

3.4 Model network and zoning system

The model network is shown in Figure 3.1 using aerial photography as an overlay. The network includes the M31 Hume Motorway between B69 Narellan Road and SR89 Remembrance Drive, B88 Picton Road, SR 89 Remembrance Drive, B69 Appin Road, Wilton Road, Menangle Drive, and the M1 Princes Highway between B69 Appin Road and B88 Picton Road.

3.4.1 Zoning structure

The zoning layout is also highlighted in Figure 3.1. Zones are defined as locations where vehicle trips originate and terminate, i.e. trip ends.

The foremost component in defining the zoning structure for the AIMSUN Mesoscopic model was the existing structure utilised in the higher tier STM model. Aggregation and Disaggregation of these STM zones were undertaken where considered applicable.

Aggregation of the STM zones was undertaken for the outer (non-core) study areas, which are far away from the proposed development sites at Wilton and therefore, require less detailed modelling. These areas include Campbelltown, Narellan, Camden and etc.

There is only one zone (TZ 1450) in STM covering the whole core study area highlighted in blue in Figure 3.1. Therefore, additional zones were created in the AIMSUN model to provide a more realistic behavioural representation of vehicle trips entering and exiting this area.

In total, 41 zones have been coded into the model.

The following key intersections were also included in the model, which are shown below:

1. A9 Narellan Road/Camden Bypass
2. M31 Hume Motorway/A9 Narellan Road
3. SR89 Remembrance Driveway and Macarthur Road
4. B69 Appin Road/Church Street
5. B69 Appin Road/M1 Princes Highway
6. M1 Princes Highway/B88 Picton Road
7. M31 Hume Motorway/B88 Picton Road
8. Menangle Street/SR89 Remembrance Driveway
9. Menangle Road/Camden Road
10. M31 Hume Motorway/SR89 Remembrance Driveway
11. B88 Picton Road/Menangle Road
12. B88 Picton Road/Wilton Park Road, west of Menangle Road
13. B88 Picton Road/Pembroke Parade
14. B88 Picton Road/Almond Street
15. B88 Picton Road/Macarthur Drive
16. B88 Picton Road/Mount Keira Road
17. Wilton Road/Macarthur Drive
18. Wilton Road/Douglas Park Drive
19. B88 Picton Road/Wilton Park Road, east of Menangle Road (priority controlled)
20. A9 Narellan Road/Remembrance Driveway/A9 the Northern Road
21. B69 Narellan Road/Blaxland Road/Gilchrist Drive
22. B69 Narellan Road/B69 Appin Road/Oxley Street.

Noted that some dummy intersections were also coded in the model for the purpose of balancing midblock inflows and outflows.

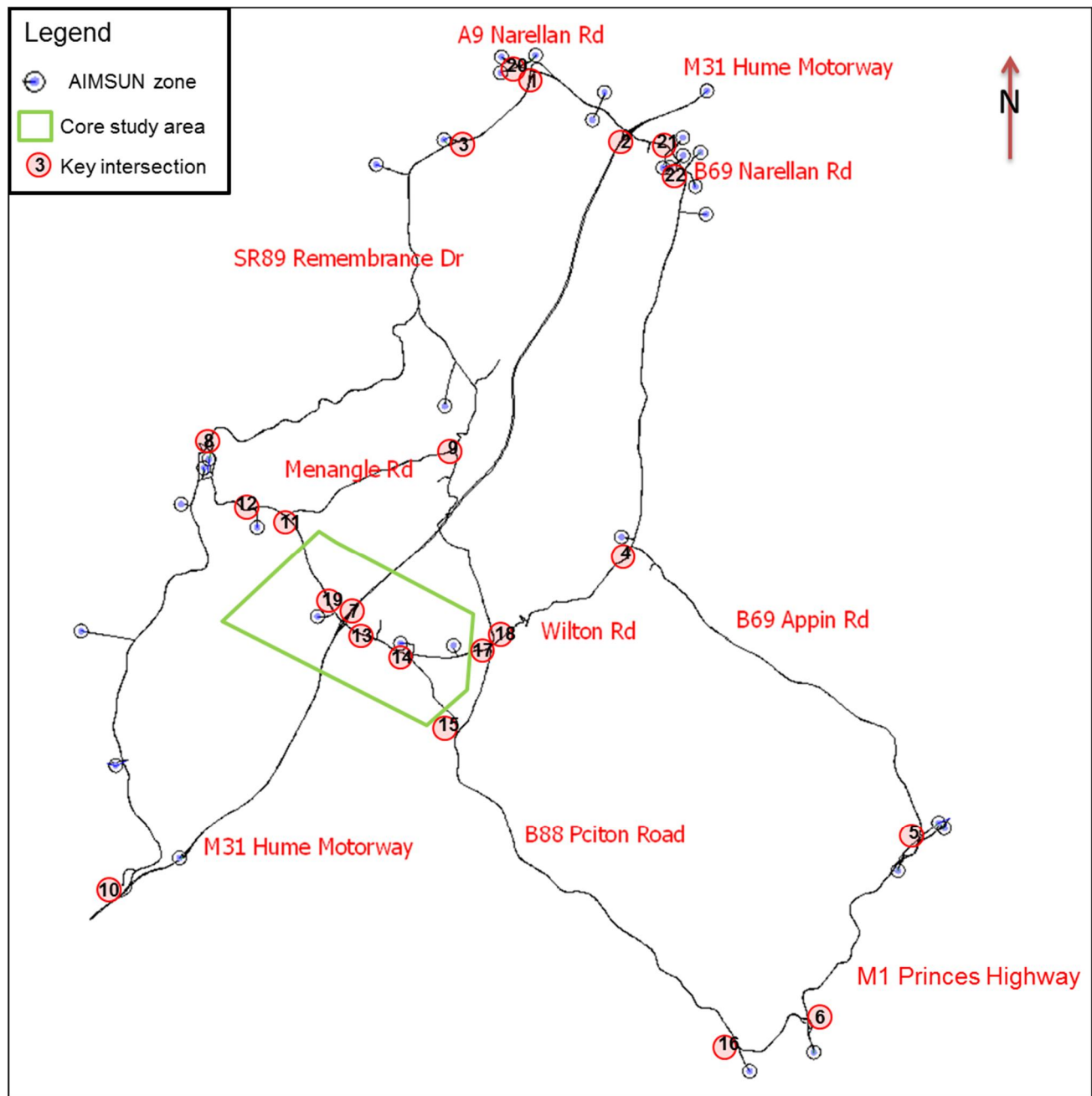


Figure 3.1 AIMSUN model network and zoning system

3.5 Traffic signals

Traffic signals were coded using the default AIMSUN fixed time method. The IDM phasing and phase timings were developed based on the information provided by RMS.

3.6 Base year traffic demand

The traffic demand matrices for 2013 AM and PM peak periods have been calculated from the following sources:

- STM cordon matrices
- classified intersection turning movement counts

- intersection SCATS counts
- motorway flow counts.

The methodology for the development of the base demand matrices is summarised below.

3.6.1 Demand matrix development

The cordon Origin-Destination (OD) demand matrices were extracted from the 2011 STM model, which cover the 2-hour AM peak and 2-hour PM peak. These demands were used as a base to develop the demand matrices suitable for the AIMSUN mesoscopic modelling.

3.6.1.1 OD Matrix adjustment at macroscopic level

In the first place, the STM cordon OD matrices were manipulated to reflect the AIMSUN zone structure. These STM matrices were considered coarse in the core study area with only one zone covering the area. Therefore, trip disaggregation was undertaken to better reflect trip generation and attraction within the area. For the outer study area, STM demand was aggregated based on the simpler AIMSUN zone structure within the area.

The demand matrices were then adjusted to the survey data using the Furness method in AIMSUN. Trip generation and attraction totals for each AIMSUN zone were formed from the surveyed turning movement counts, SCATS counts and motorway flow counts.

As the STM cordon matrices use the Passenger Car Unit (PCU) to represent demand, the collected turn counts data was converted into PCU based on the following factors specified in the Roads and Maritime Services *Traffic Modelling Guidelines (Version 1 February 2013, Section 10: Highway Assignment Modelling)*:

- one light vehicle equals one PCU
- one heavy vehicle equals two PCUs.

As part of the calibration process the matrices were further adjusted with the Static Adjustment function in AIMSUN to better match the surveyed counts.

The AM and PM regression plots for the initial static adjustment are provided in Figure 3.2 and 3.3 respectively. The regression plots show a good match between the adjusted matrices and the survey data.

It should be noted that the adjusted OD matrices were further fine-turned at Mesoscopic level in the model calibration, which is discussed in section 4.2.3.1.

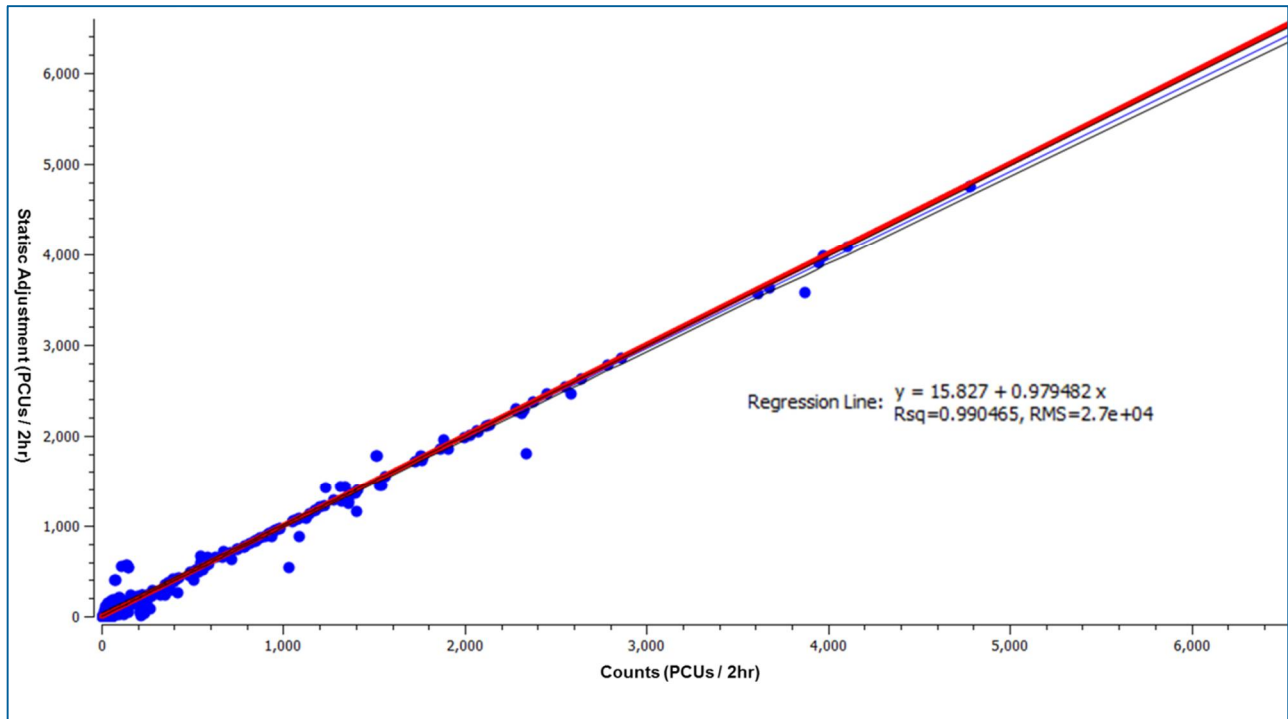


Figure 3.2 2013 AM peak (7.00–9.00) Static Adjustment regression plot

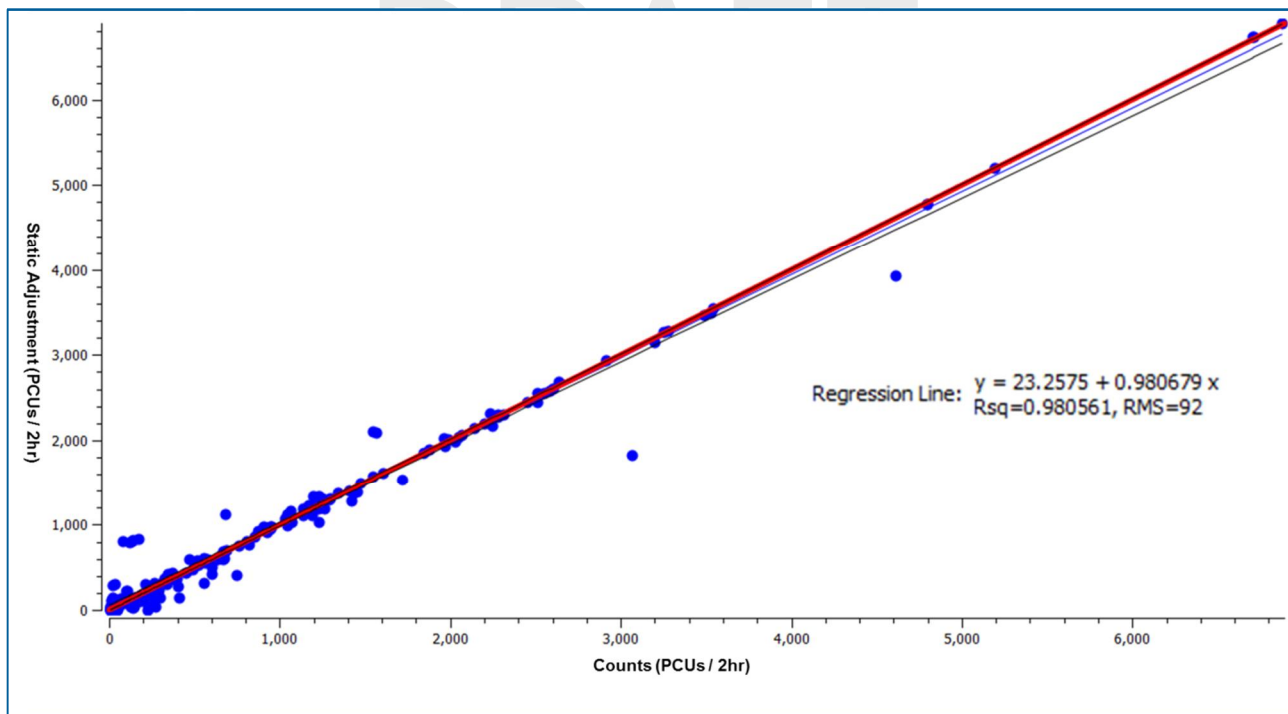


Figure 3.3 2013 PM peak (15.45–17.45) Static Adjustment regression plot

3.6.1.2 Demand profile

Demand profiles were developed for each of peak periods. These profiles specify the timing of proportional release of vehicles into the models. Hourly global profiles were estimated based on the surveyed turn counts and motorway flow counts data and then applied to all zones in the AIMSUN model.

3.7 Traffic assignment

Stochastic assignment with a feedback period of 5 minutes was adopted for the AIMSUN mesoscopic model. This assignment method uses dynamic travel cost information at both past and current points of time in the simulation to estimate the routing for each vehicle. Thus, each vehicle selects the optimal route when being released into model network. It then reacts to changes in traffic conditions and dynamically changes its current route to a lower cost route if available.

It should be also noted that by applying the stochastic assignment each vehicle in the model perceives their travel cost through the network slightly differently. This adds a random element to the cost calculation for individual drivers and provides more realistic representation of the actual drivers' behaviour in the model network.

The settings of traffic assignment used in the AIMSUN model are shown in Table 3.2.

Table 3.2 Dynamic traffic assignment settings in the model

Item	Parameter	Value
Assignment method	Stochastic dynamic assignment	selected
Dynamic assignment	Cycle (feedback period)	00:05:00
	Number of intervals	3
	Attractiveness weight	2
	User defined cost weight	1
Route choice model	Route choice model	Proportional
	Initial K-SPs	3
	Max number paths in memory	10
	Max number of paths from path assignment results	3
	Maximum paths per interval	3
	Alpha	4

4. Model calibration and validation

4.1 Introduction

After the initial model development, Parsons Brinckerhoff considered the base model calibration and validation. Model calibration entails matching observed traffic conditions with the AIMSUN model to provide confidence that the model is representative existing traffic conditions. Model calibration has focused on observed network conditions and observed traffic volumes.

Model validation, whilst similar to model calibration, consists of matching an independent set of data (not used in the model build process) with model outputs. In this case, travel time information has been used to validate the model.

Parsons Brinckerhoff has adhered to the Roads and Maritime Services *Traffic Modelling Guidelines (Version 1 February 2013, Section 10: Highway Assignment Modelling)* when calibrating and validating the AIMSUN model.

In line with good modelling practice the results of the calibration exercise were considered over five different seed values. It is considered that five seed values is sufficient for this modelling exercises.

4.2 Model calibration

4.2.1 Network calibration

A major element of successful calibration was to ensure the priority-controlled M31 Hume Motorway/B88 Picton Road interchange was being simulated accurately and the giveway operations at this location were realistically represented. Therefore, the default values of gap acceptance parameters including initial safety margin, final safety margin, maximum giveway time and visibility along main stream were adjusted to reflect the observed conditions during the site inspection.

4.2.2 Traffic assignment calibration

4.2.2.1 Road/link hierarchy and localised link cost

Link hierarchy influences driver's perception of travel costs for alternative paths in the AIMSUN model. The link hierarchy/category was coded in the model in accordance with Roads and Maritime Services *Network and Corridor Planning (Practice Note 2, November 2008)* to reflect logical and realistic route choices.

In addition, the localised link costs have been adjusted on several locations within the model to aid in the further calibration of localised route choices. These locations include Macarthur Drive, Wilton Road, Douglas Park Drive, Menangle Road and Camden Road.

4.2.2.2 Qualitative assessment of traffic assignment

As a part of model calibration process, qualitative assessment of traffic assignment was carried out using a combination of select link analysis and the visual check of travel routes for individual OD pair. The qualitative assessment shows the route choices are generally logical and realistic in both AM and PM models.

4.2.3 Traffic flow calibration

In reality, traffic volumes vary from day to day and from location to location. The GEH statistic was developed to cope with these types of different ranges in flows. Instead of comparing absolute or relative flow differences; a wide range of flows can confidently be deemed as being statistically accurate using the GEH formula. For example, where an absolute difference of 100 vehicles/hr can be important in a flow of 200 vehicles/hr, it is largely irrelevant in a flow of several thousand vehicles/hr.

GEH compares the differences between observed flows and modelled flows on a link by using the following formula:

$$GEH = \sqrt{(V_O - V_A)^2 / (0.5 \times (V_O + V_A))}$$

Where:

V_O = Observed traffic flow (vehicles/hour)

V_A = Assigned (or modelled) hourly traffic flow (vehicles/hour)

The calibration of traffic flows were undertaken in the following two steps to match the flows in the base model with the surveyed data for both peak periods:

- Step 1 – calibrating 2-hourly modelled flows within the whole study area against standard target criteria
- Step 2 – calibrating peak hourly modelled flows for the core area against standard target criteria.

Table 4.1 and 4.2 show the standard flow calibration criteria for the whole study area and core area respectively. These criteria are sourced from the Roads and Maritime Services *Traffic Modelling Guidelines (Version 1 February 2013, Section 10: Highway Assignment Modelling)*.

Table 4.1 Mesoscopic modelling link and turn standard calibration criteria (network wide)

Item	Criteria
Turn volumes	Tolerance limits for individual turn volumes: ■ 85% of individual turn volumes to have a GEH <= 5.0 ■ all individual turn volumes to have a GEH <= 10. Plots of observed versus modelled flows: ■ R square value to be included with plots and to be >0.9 ■ slope equation to be included with plots (intercept to be set to zero). All counts RMSE should be 30.0 or lower.
Screenline volumes	Each of directional screenline total to have GEH < 4.0.

Table 4.2 Mesoscopic modelling link and turn standard calibration criteria (core area)

Item	Criteria
Turn volumes	Tolerance limits for individual turn volumes: 85% of individual turn volumes to have a GEH ≤ 5.0 - all individual turn volumes to have a GEH ≤ 10. Plots of observed versus modelled flows: - R square value to be included with plots and to be >0.9 - slope equation to be included with plots (intercept to be set to zero). All counts RMSE should be 30.0 or lower.

4.2.3.1 OD matrix adjustment at Mesoscopic level

As discussed in section 3.6, the STM cordon demand matrices were initially adjusted using the Static Adjustment function in AIMSUN to match the surveyed flows at the macroscopic level of modelling.

As Mesoscopic AIMSUN modelling applies different techniques (e.g. shockwave and queue propagation algorithms) to assign the demand to the model network and accounts for more accurately vehicle interaction and time dependant capacity constraints, the demand matrices were further fine-tuned to meet standard target criteria in calibrating the Mesoscopic model.

4.2.3.2 Network wide calibration results

The summary results of network wide flow calibration are presented in Table 4.3. The results show the calibration criteria have been met for each of the peak periods.

Table 4.3 AM and PM peaks flow calibration summary

Peak period	Calibration criteria	Results
AM peak (7.00–9.00)	85% of individual turn volumes to have a GEH ≤ 5.0	91%
	all individual turn volumes to have a GEH ≤ 10	100%
	R square value to be included with plots and to be >0.9	0.990
	Slope equation to be included with plots (intercept to be set to zero)	included
	All counts RMSE should be 30.0 or lower	11
	100% directional screenline total to have GEH < 4.0	100%
PM peak (15.45–17.45)	85% of individual turn volumes to have a GEH ≤ 5.0	85%
	all individual turn volumes to have a GEH ≤ 10	100%
	R square value to be included with plots and to be >0.9	0.990
	Slope equation to be included with plots (intercept to be set to zero)	included
	All counts RMSE should be 30.0 or lower	12
	100% directional screenline total to have GEH < 4.0	100%

More detailed information is provided in Appendix A.

4.2.3.3 Calibration results for core area

The summary results of core area flow calibration are presented in Table 4.4. The results show the calibration criteria have been met for both AM and PM peak hours.

Table 4.4 Flow calibration summary for the AM and PM peak hours

Peak period	Calibration criteria	Results
AM peak (7.00-8.00)	85% of individual turn volumes to have a GEH $\leq$ 5.0	92%
	all individual turn volumes to have a GEH $\leq$ 10	100%
	R square value to be included with plots and to be >0.9	0.996
	Slope equation to be included with plots (intercept to be set to zero)	included
	All counts RMSE should be 30.0 or lower	8
PM peak (16.45-17.45)	85% of individual turn volumes to have a GEH $\leq$ 5.0	92%
	all individual turn volumes to have a GEH $\leq$ 10	100%
	R square value to be included with plots and to be >0.9	0.989
	Slope equation to be included with plots (intercept to be set to zero)	included
	All counts RMSE should be 30.0 or lower	11

More detailed information is provided in Appendix A.

4.3 Travel time validation

Once the AIMSUN model was calibrated, a data set separate to that used during the calibration process was used to validate the model. The method used was to compare the modelled travel times of vehicles through the network with the observed times.

The required criterion for travel time validation was:

- 95% of movements to have average modelled journey time to be within 15% or one minute (whichever is greater) of average observed journey time for full length of route.

The road sections that were subject to travel time validation for both peak periods are:

- B88 Picton Road between SR89 Remembrance Drive and Mount Keira Road (in both directions)
- M31 Hume Motorway between A9 Narellan Rd and Avon Dam Road (in both directions).

Note that the validation was undertaken for each peak period using the average of five seed runs.

4.3.1 Validation results

Table 4.5 and 4.6 show the validation summary results for each of the peak periods. As can be seen, the validation criterion has been met for each peak period.

Table 4.5 AM peak validation summary

Item	B88 Picton Road		M31 Hume Motorway	
	eastbound	westbound	northbound	southbound
average observed travel time (s)	1515	1361	1160	1121
average modelled travel time (s)	1418	1416	1092	1053
difference (s)	-97	55	-68	-68
% difference	-7%	4%	-6%	-6%
95% modelled travel time within 15% or 1 minute of observed travel time	Yes	Yes	Yes	Yes

Table 4.6 PM peak validation summary

Item	B88 Picton Road		M31 Hume Motorway	
	eastbound	westbound	northbound	southbound
average observed travel time (s)	1470	1380	1140	1020
average modelled travel time (s)	1415	1417	1098	1054
difference (s)	-55	37	-42	34
% difference	-4%	3%	-4%	3%
95% modelled travel time within 15% or 1 minute of observed travel time	Yes	Yes	Yes	Yes

4.4 Model confidence and stability

4.4.1 Demand release

In addition to the above model calibration and validation, the quantitative assessment of model confidence was undertaken by checking demand release during both peak periods. The assessment results are shown in Table 4.7, which indicate that there was no vehicle left waiting in and outside of the network as a result of unrealistic congestion and all the demand were released at the end of both modelled periods.

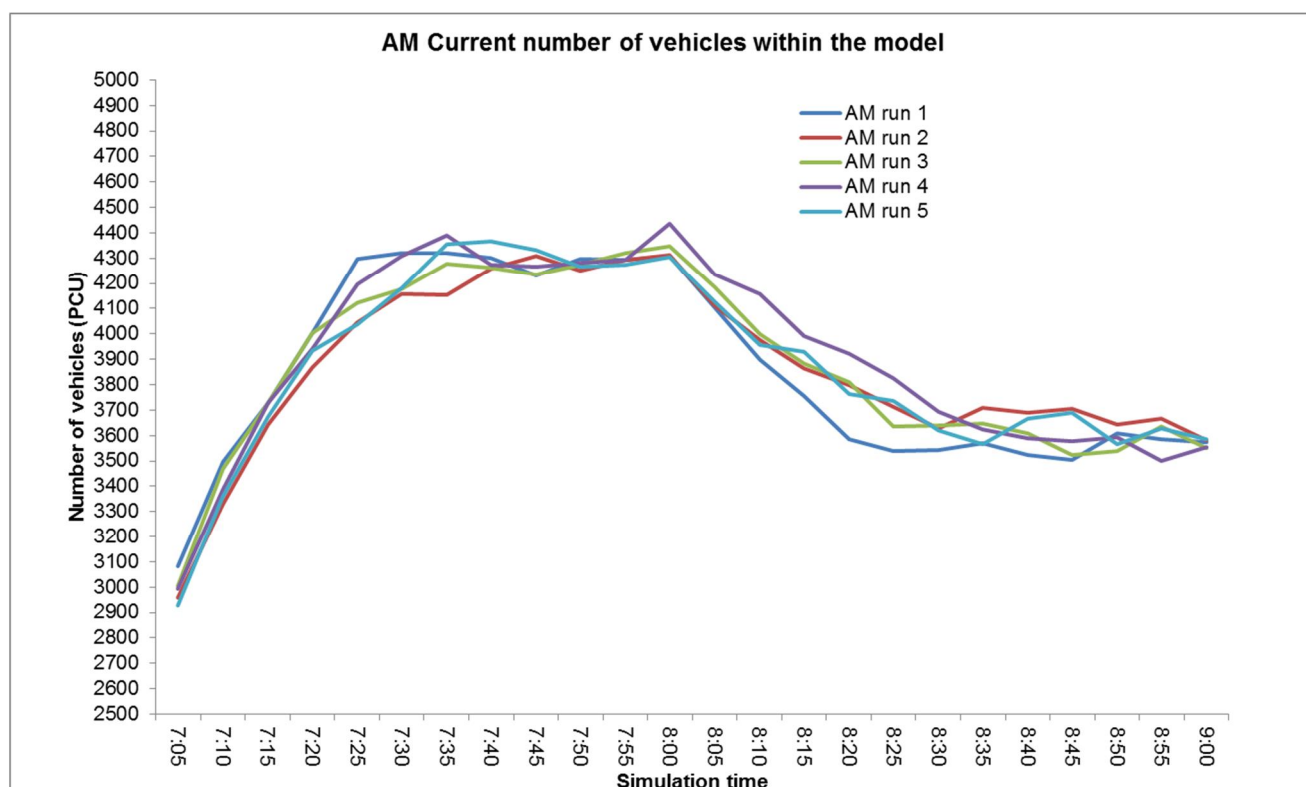
Table 4.7 AM and PM peak network wide statistics

Item	AM peak	PM peak
vehicles lost (PCU)	0	0
unreleased vehicles (PCU)	1	1

4.4.2 Model stability

A repeatability of model results across different seed values is an important consideration in the verification of model's stability. Although multiple seed runs were undertaken to produce a small level of variability for the purposed of assessing the impacts on model results, the results between the seed values should be relatively consistent.

The seed values used in the model calibration and validation process were also used to test the stability and sensitivity of the model. Figure 4.1 shows a comparison of the network vehicles within the model for each seed run in both peak periods. They show that the model is stable across the different seed values used for model reporting.



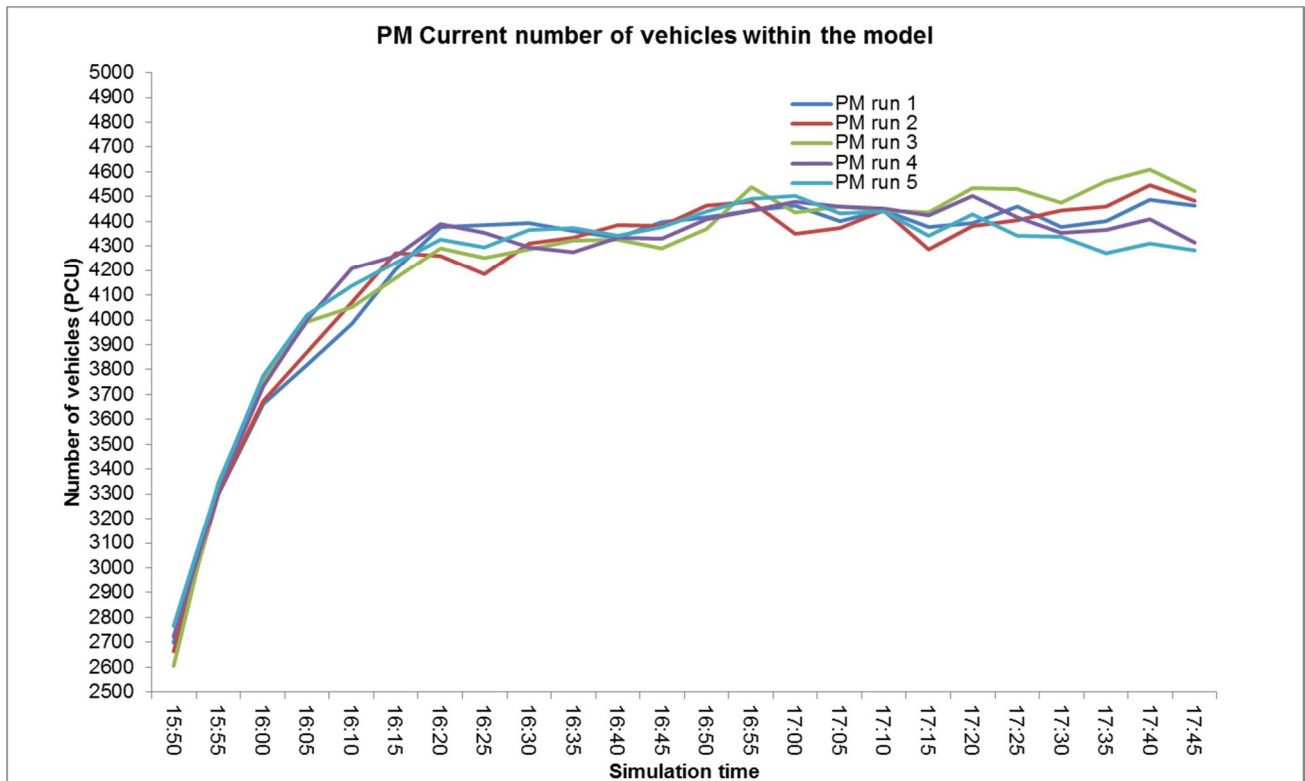


Figure 4.1 AM and PM peak – current number of vehicles (current nV)

5. Summary and conclusions

5.1 Summary

The AIMSUN mesoscopic models for the study area have been calibrated to the surveyed traffic flows and observed traffic conditions in accordance with the RMS modelling criteria.

Both the AM and PM AIMSUN models have been also validated to observed travel times in accordance with the RMS modelling criteria.

5.2 Conclusions

The model developed will provided a robust basis on which to consider the potential traffic impacts of the Wilton Junction New Town development.

DRAFT

Appendix A

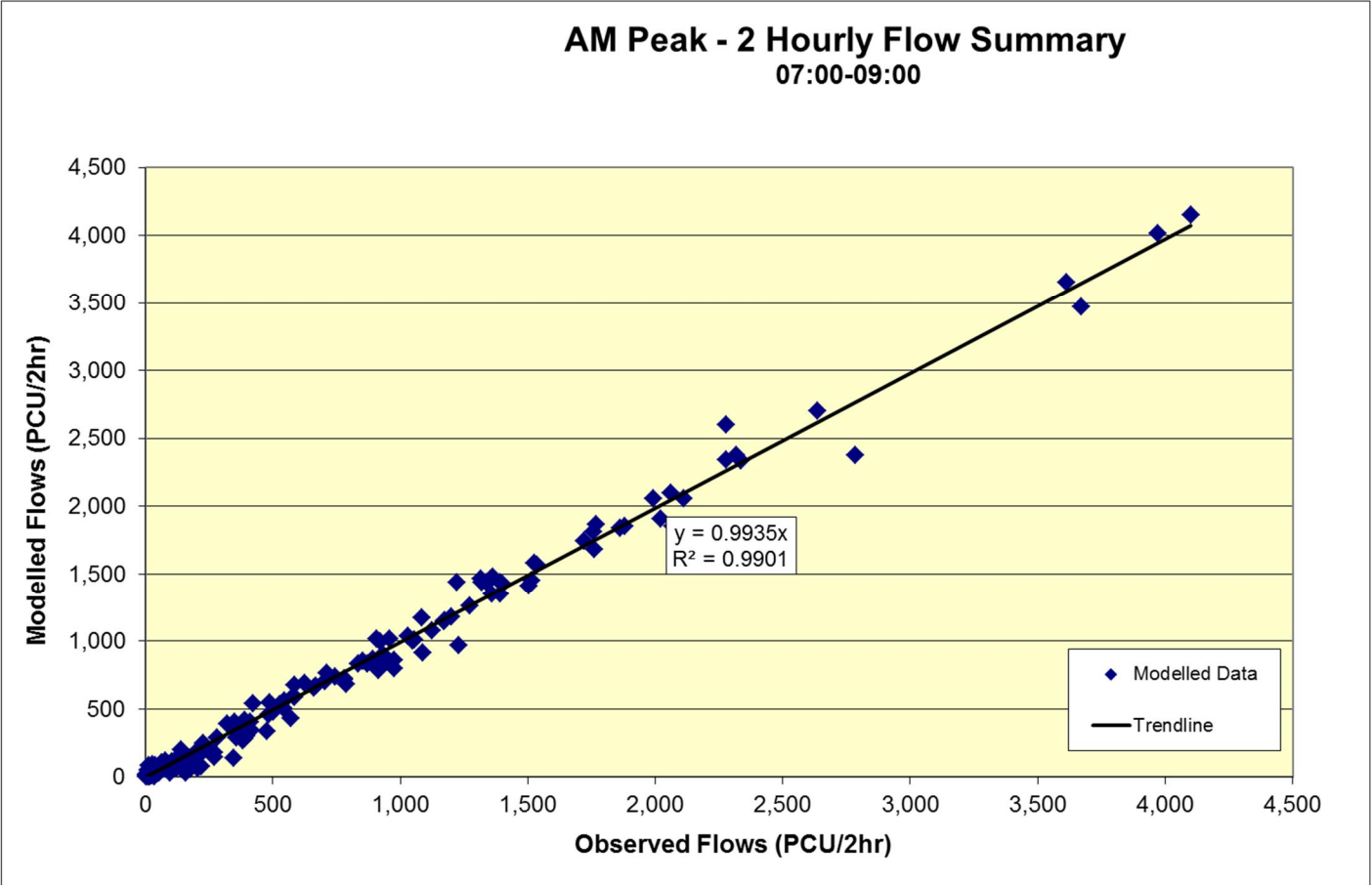
Flow calibration results



A1. AM peak network wide turn flow (PCU/2 hr) calibration results

Intersection	Movement	Observed	Average modelled	Diff (Obs-Mod)	GEH
A9 Narellan Road / Remembrance Driveway / A9 the Northern Road	Remembrance Driveway SB RT	135	132	3	0.16
	Remembrance Driveway SB Thru	836	830	6	0.14
	Remembrance Driveway SB LT	584	591	-7	0.20
	Narellan Road WB RT	977	856	121	2.82
	Narellan Road WB Thru	893	869	24	0.56
	Narellan Road WB LT	977	801	176	4.17
	Remembrance Driveway NB RT	743	734	9	0.22
	Remembrance Driveway NB Thru	1172	1146	26	0.54
	Remembrance Driveway NB LT	48	64	-16	1.55
	Northern Road EB Thru	915	787	128	3.11
	Northern Road EB LT	227	219	8	0.40
A9 Narellan Rd / Camden Bypass	Narellan Road WB Thru	2069	1850	219	3.49
	Narellan Road WB LT	922	996	-74	1.69
	Camden Bypass NB Through	1723	1742	-19	0.32
	Camden Bypass NB LT	788	683	105	2.73
	Narellan Road EB RT	383	267	116	4.55
	Narellan Road EB Thru	1862	1841	21	0.35
M31 Hume Motorway / A9 Narellan Road (western intersection)	Narellan Road WB RT	1224	1440	-216	4.18
	Narellan Road WB Thru	3673	3473	200	2.37
	Hume Motorway NB RT	502	481	21	0.66
	Hume Motorway NB LT	416	340	76	2.75
	Narellan Road EB Thru	3973	4014	-41	0.46
	Narellan Road EB LT	2786	2379	407	5.67
M31 Hume Motorway / A9 Narellan Road (eastern intersection)	Hume Motorway SB RT	1272	1259	13	0.26
	Hume Motorway SB LT	1199	1182	17	0.35
	Narellan Road WB Thru	3612	3655	-43	0.50
	Narellan Road WB LT	244	207	37	1.74
	Narellan Road EB RT	369	333	36	1.37
	Narellan Road EB Thru	4101	4151	-50	0.55
B69 Narellan Road / Blaxland Road / Gilchrist Drive	Blaxland Road SB RT	907	1014	-107	2.44
	Blaxland Road SB Thru	660	654	6	0.18
	Blaxland Road SB LT	571	433	138	4.36
	Narellan Road WB RT	486	461	25	0.82
	Narellan Road WB Thru	1762	1681	81	1.38
	Narellan Road WB LT	26	80	-54	5.22
	Gilchrist Drive NB RT	29	93	-64	5.81
	Gilchrist Drive NB Thru	704	706	-2	0.05
	Gilchrist Drive NB LT	1394	1349	45	0.85
	Narellan Road EB RT	1176	1152	24	0.51
	Narellan Road EB Thru	1994	2058	-64	1.01
	Narellan Road EB LT	1360	1352	8	0.16
B69 Narellan Road / B69 Appin Road / Oxley Street	Oxley Street SB RT	363	374	-11	0.40
	Oxley Street SB Thru	853	856	-3	0.08
	Oxley Street SB LT	196	174	22	1.17
	The Parkway WB RT	353	337	16	0.61
	The Parkway WB Thru	411	404	7	0.25
	The Parkway WB LT	50	45	5	0.47
	Appin Road NB RT	44	55	-11	1.11
	Appin Road NB Thru	2113	2059	54	0.84
	Appin Road NB LT	1050	1001	49	1.09
	Narellan Road EB RT	424	539	-115	3.72
	Narellan Road EB Thru	280	292	-12	0.49
	Narellan Road EB LT	389	416	-27	0.95
	Remembrance Driveway ramp SB RT	356	291	65	2.57
SR89 Remembrance Driveway and Macarthur Road	Remembrance Driveway ramp SB LT	488	546	-58	1.79
	Remembrance WB Thru	946	853	93	2.20
	Remembrance WB LT	349	404	-55	2.00
	Remembrance EB Thru	2023	1907	116	1.86
	Remembrance EB LT	396	305	91	3.44
	Appin Road SB Thru	79	115	-36	2.60
B69 Appin Road / Church Street	Appin Road SB LT	625	692	-67	1.85
	Church Street WB RT	1125	1080	45	0.96
	Church Street WB LT	105	83	22	1.57
	Wilton Road NB RT	65	102	-37	2.85
	Wilton Road NB Thru	136	75	61	4.20
	Appin Road SB Thru	780	720	60	1.55
M1 Princes Highway / B69 Appin Road (northern intersection)	Appin Road SB LT	122	65	57	4.15
	Appin Road NB RT	2	0	2	1.41
	Appin Road NB Thru	1228	970	258	5.49
	Appin Road SB Thru	780	720	60	1.54
M1 Princes Highway / B69 Appin Road (southern intersection)	Appin Road SB LT	15	0	15	3.87
	M1 WB RT	143	57	86	6.10
	M1 WB LT	2278	2598	-320	4.58
	Appin Road NB Thru	1087	915	172	3.85
B88 Picton Road/ M1 Princes Highway	M1 SB RT (left ramp)	55	27	28	3.07
	M1 SB Thru	2336	2336	0	0.00
	M1 NB Thru	2637	2704	-67	0.91
	M1 NB LT	1356	1462	-106	2.00
	Picton Road EB RT (ramp)	1506	1411	95	1.76
	Picton Road EB LT	29	56	-27	2.95
	Picton Road WB Thru (from ramp)	55	27	28	3.07
B88 Picton Road/ Right turnaround facility	Picton Road WB Thru	1321	1436	-115	2.19
	M1 NB RT	25	27	-2	0.22
	Picton Road WB RT	1031	1036	-5	0.12
M31 Hume Motorway / B88 Picton Road (western intersection)	Picton Road WB Thru	582	592	-10	0.28
	Hume Motorway NB RT	320	392	-72	2.69
	Hume Motorway NB LT	119	108	11	0.70
	Picton Road EB Thru	528	531	-3	0.10
	Picton Road EB LT	586	679	-93	2.63
	Hume Motorway SB RT	232	207	25	1.17
M31 Hume Motorway / B88 Picton Road (eastern intersection)	Hume Motorway SB LT	933	901	32	0.74
	Picton Road WB Thru	1403	1422	-19	0.36
	Picton Road WB LT	388	403	-15	0.53
	Picton Road EB RT	135	155	-20	1.16
	Picton Road EB Thru	711	768	-57	1.48
	Remembrance Driveway SB RT	34	1	33	5.68
Menangle Street / SR89 Remembrance Driveway	Remembrance Driveway SB Thru	478	334	144	5.04
	Remembrance Driveway SB LT	178	57	121	7.88
	Menangle Street WB RT	76	65	11	0.91
	Menangle Street WB Thru	10	27	-17	2.79
	Menangle Street WB LT	173	141	32	1.79
	Remembrance Driveway NB RT	347	138	209	9.50
	Remembrance Driveway NB Thru	870	834	36	0.88
	Remembrance Driveway NB LT	44	21	23	2.91
	Menangle Street EB RT	8	11	-3	0.60
	Menangle Street EB Thru	4	13	-9	2.25
	Menangle Street EB LT	19	1	18	3.96

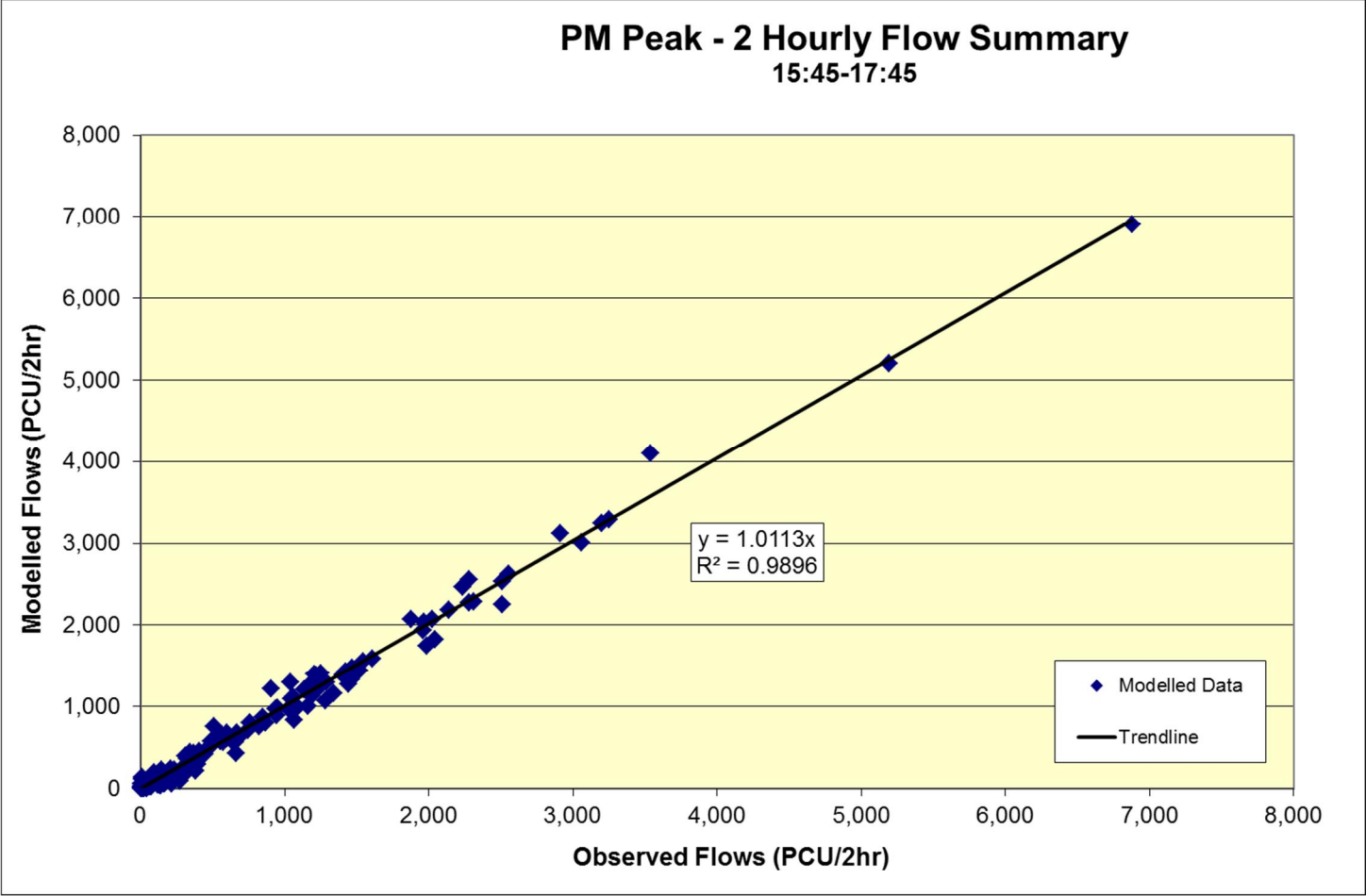
Menangle Road and Camden Road	Menangle Road SB Thru	211	150	61	3.22
	Menangle Road SB LT	121	63	58	4.29
	Camden Road WB RT	271	178	93	4.41
	Camden Road WB LT	31	47	-16	1.85
	Menangle Road NB RT	40	20	20	2.55
	Menangle Road NB Thru	272	145	127	6.23
M31 Hume Motorway / SR89 Remembrance Driveway	Hume Motorway SB Thru	2061	2099	-38	0.60
	Hume Motorway NB Thru	1767	1863	-96	1.60
	Hume Motorway NB LT	141	200	-59	3.19
	Remembrance Driveway EB RT	391	280	111	4.29
B88 Picton Road / Menangle Road	Menangle Road SB RT	97	27	70	6.24
	Menangle Raod SB LT	146	168	-22	1.25
	Picton Road WB RT	147	107	40	2.52
	Picton Road WB Thru	545	562	-17	0.52
	Picton Road EB Thru	959	1018	-59	1.32
	Picton Road EB LT	165	61	104	6.93
B88 Picton Road/Wilton Park Road, east of Menangle Road	Picton Road WB Thru	670	672	-2	0.06
	Picton Road WB LT	13	28	-15	2.34
	Wilton Park Road NB RT	31	38	-7	0.84
	Wilton Park Road NB LT	12	2	10	2.53
	Picton Road EB RT	25	7	18	3.23
	Picton Road EB Thru	1084	1173	-89	1.87
B88 Picton Road and Pembroke Parade	Pembroke Parade SB RT	227	245	-18	0.84
	Pembroke Parade SB LT	17	34	-17	2.33
	Picton Road WB RT	24	51	-27	3.14
	Picton Road WB Thru	1527	1580	-53	0.95
	Picton Road EB Thru	1537	1564	-27	0.49
	Picton Road EB LT	106	102	4	0.31
B88 Picton Road and Almond Street	Almond Street SB RT	265	170	95	4.55
	Almond Street SB LT	28	38	-10	1.19
	Picton Road WB RT	26	10	16	2.71
	Picton Road WB Thru	1315	1465	-150	2.85
	Picton Road EB Thru	1362	1482	-120	2.25
	Picton Road EB LT	193	111	82	4.72
B88 Picton Road and Macarthur Drive	Macarthur Drive SB RT	11	47	-36	4.76
	Macarthur Drive SB LT	140	90	50	3.33
	Picton Road WB RT	92	43	49	4.26
	Picton Road WB Thru	1337	1435	-98	1.85
	Picton Road EB Thru	1392	1436	-44	0.82
	Picton Road EB LT	14	81	-67	6.87
B88 Picton Road and Mount Keira Road	Picton Road WB Thru	1354	1450	-96	1.82
	Picton Road WB LT	10	6	4	0.94
	Mt Keira Road NB RT	10	21	-11	2.01
	Mt Keira Road NB LT	68	75	-7	0.60
	Picton Road EB RT	30	41	-11	1.35
	Picton Road EB Thru	1515	1449	66	1.22
Wilton Road and Macarthur Drive	Wilton Road SB Thru	205	62	143	8.78
	Wilton Road SB LT	143	125	18	1.10
	Macarthur Drive WB RT	103	112	-9	0.59
	Macarthur Drive WB LT	7	10	-3	0.77
	Wilton Road NB RT	11	13	-2	0.33
	Wilton Road NB Thru	220	76	144	8.34
Wilton Road and Douglas Park Drive	Wilton Road SB RT	40	86	-46	4.07
	Wilton Road SB Thru	133	111	22	1.38
	Wilton Road NB Thru	160	156	4	0.23
	Wilton Road NB LT	160	32	128	9.28
	Douglas Park Drive EB RT	215	75	140	8.25
	Douglas Park Drive EB LT	48	25	23	2.69
B88 Picton Road/Wilton Park Road, west of Menangle Road	Picton Road WB Thru	542	506	36	1.10
	Picton Road WB LT	100	82	18	1.33
	Wilton Park Road NB RT	68	73	-5	0.39
	Wilton Park Road NB LT	15	4	11	2.58
	Picton Road EB RT	18	27	-9	1.37
	Picton Road EB Thru	1056	1012	44	0.97
	Hume Motorway (under Picton Road) NB	1881	1855	26	0.42
	Hume Motorway (under Picton Road) SB	1757	1811	-54	0.90
	Hume Motorway (near Remembrance Driveway) NB	2320	2378	-58	0.84
	Hume Motorway (near Remembrance Driveway) SB	2280	2341	-61	0.89



A2. PM peak network wide turn flow (PCU/2 hr) calibration results

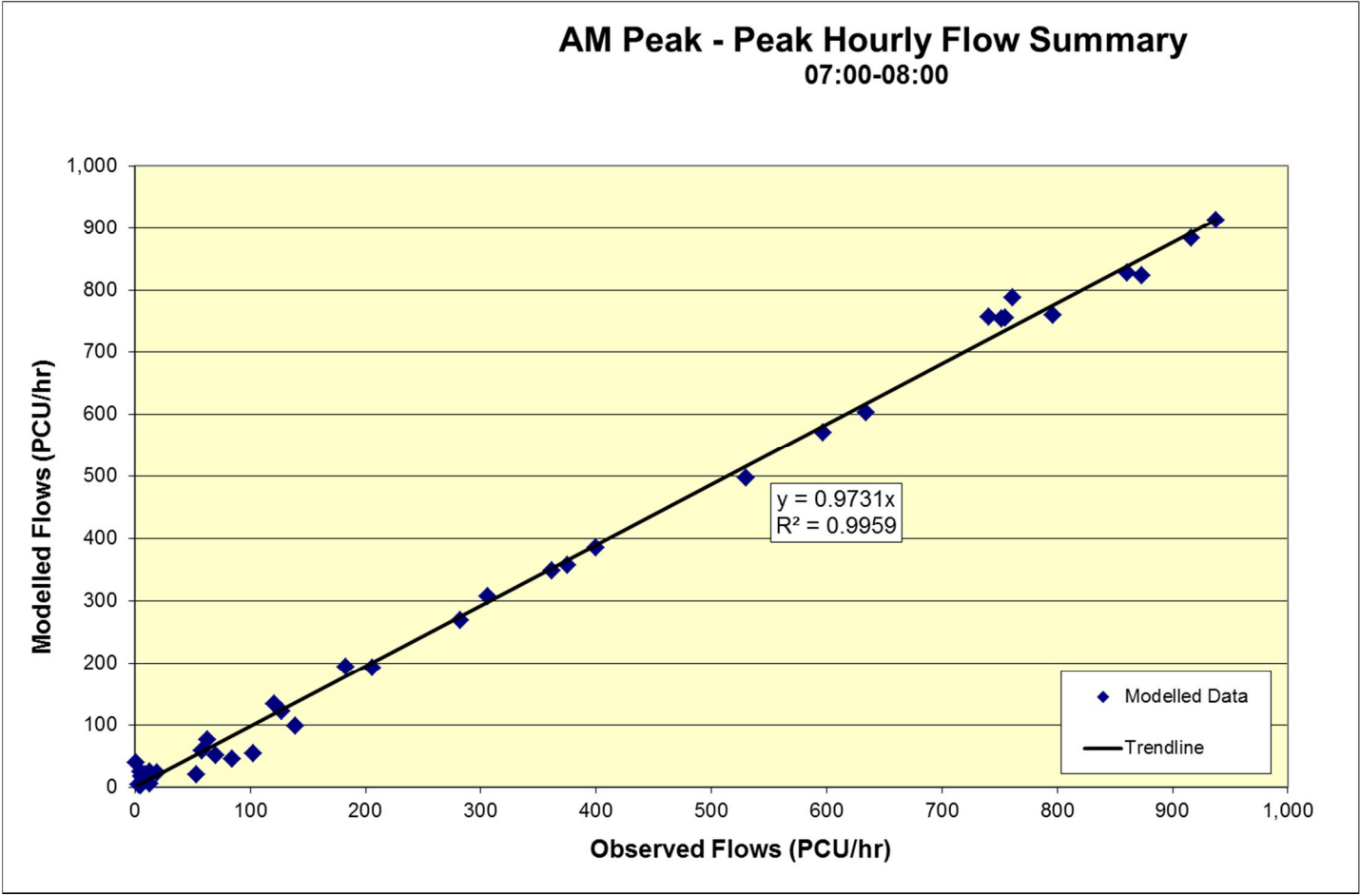
Intersection	Movement	Observed	Average modelled	Diff (Obs-Mod)	GEH
A9 Narellan Road / Remembrance Driveway / A9 the Northern Road	Remembrance Driveway SB RT	226	205	20	0.98
	Remembrance Driveway SB Thru	1405	1389	16	0.29
	Remembrance Driveway SB LT	953	975	-22	0.49
	Narellan Road WB RT	665	663	2	0.06
	Narellan Road WB Thru	1043	1290	-247	5.11
	Narellan Road WB LT	1285	1073	212	4.37
	Remembrance Driveway NB RT	1220	1383	-163	3.20
	Remembrance Driveway NB Thru	1213	1182	32	0.64
	Remembrance Driveway NB LT	94	134	-40	2.61
	Northern Road EB Thru	1067	834	233	5.33
	Northern Road EB LT	187	183	4	0.20
	Narellan Road WB Thru	2553	2622	-69	0.95
A9 Narellan Rd / Camden Bypass	Narellan Road WB LT	1875	2073	-198	3.15
	Camden Bypass NB Through	1030	969	61	1.37
	Camden Bypass NB LT	448	416	32	1.07
	Narellan Road EB RT	945	889	56	1.30
	Narellan Road EB Thru	2309	2291	18	0.27
	Narellan Road WB RT	1209	1396	-187	3.66
M31 Hume Motorway / A9 Narellan Road (western intersection)	Narellan Road WB Thru	6879	6905	-26	0.22
	Hume Motorway NB RT	282	230	52	2.30
	Hume Motorway NB LT	411	451	-40	1.37
	Narellan Road EB Thru	3250	3285	-35	0.43
	Narellan Road EB LT	1340	1164	176	3.52
	Hume Motorway SB RT	2910	3121	-211	2.71
M31 Hume Motorway / A9 Narellan Road (eastern intersection)	Hume Motorway SB LT	1199	1171	28	0.57
	Narellan Road WB Thru	5190	5199	-9	0.09
	Narellan Road WB LT	576	565	11	0.31
	Narellan Road EB RT	340	268	72	2.93
	Narellan Road EB Thru	3197	3241	-44	0.55
	Blaxland Road SB RT	1470	1474	-4	0.07
B69 Narellan Road / Blaxland Road / Gilchrist Drive	Blaxland Road SB Thru	1194	1195	-1	0.03
	Blaxland Road SB LT	822	759	63	1.57
	Narellan Road WB RT	659	566	93	2.65
	Narellan Road WB Thru	2025	2078	-53	0.82
	Narellan Road WB LT	14	130	-116	9.68
	Gilchrist Drive NB RT	123	174	-51	2.96
	Gilchrist Drive NB Thru	850	865	-15	0.35
	Gilchrist Drive NB LT	1607	1593	14	0.25
	Narellan Road EB RT	1543	1552	-9	0.15
	Narellan Road EB Thru	1966	2033	-67	1.07
	Narellan Road EB LT	942	965	-23	0.53
	Oxley Street SB RT	500	528	-28	0.87
B69 Narellan Road / B69 Appin Road / Oxley Street	Oxley Street SB Thru	2140	2183	-43	0.65
	Oxley Street SB LT	635	583	52	1.48
	The Parkway WB RT	288	227	61	2.69
	The Parkway WB Thru	326	361	-35	1.33
	The Parkway WB LT	76	90	-14	1.06
	Appin Road NB RT	104	92	12	0.84
	Appin Road NB Thru	1207	1216	-9	0.17
	Appin Road NB LT	514	752	-238	6.68
	Narellan Road EB RT	906	1211	-305	6.63
	Narellan Road EB Thru	553	603	-50	1.48
	Narellan Road EB LT	346	434	-88	3.16
	Remembrance Driveway ramp SB RT	489	572	-83	2.55
SR89 Remembrance Driveway and Macarthur Road	Remembrance Driveway ramp SB LT	316	390	-74	2.78
	Remembrance WB Thru	2279	2271	8	0.12
	Remembrance WB LT	546	664	-118	3.38
	Remembrance EB Thru	1162	1005	157	3.37
	Remembrance EB LT	381	214	167	6.87
	Appin Road SB Thru	144	222	-78	4.10
B69 Appin Road / Church Street	Appin Road SB LT	1135	1210	-75	1.55
	Church Street WB RT	601	678	-77	2.16
	Church Street WB LT	77	24	53	5.32
	Wilton Road NB RT	98	193	-95	5.57
	Wilton Road NB Thru	175	70	105	6.71
	Appin Road SB Thru	1180	1275	-95	1.93
M1 Princes Highway / B69 Appin Road (northern intersection)	Appin Road SB LT	103	75	28	2.07
	Appin Road NB RT	9	2	7	2.27
	Appin Road NB Thru	683	621	62	1.72
M1 Princes Highway / B69 Appin Road (southern intersection)	Appin Road SB Thru	1180	1274	-94	1.91
	Appin Road SB LT	19	0	19	4.36
	M1 WB RT	134	51	83	6.14
	M1 WB LT	3541	4102	-561	6.42
	Appin Road NB Thru	558	573	-15	0.43
B88 Picton Road/ M1 Princes Highway	M1 SB RT (left ramp)	39	18	21	2.78
	M1 SB Thru	3062	3003	59	0.76
	M1 NB Thru	2282	2553	-271	3.90
	M1 NB LT	1227	1328	-101	1.99
	Picton Road EB RT (ramp)	1446	1273	173	3.33
	Picton Road EB LT	28	59	-31	3.34
B88 Picton Road/ Right turnaround facility	Picton Road WB Thru (from ramp)	39	18	21	2.84
	Picton Road WB Thru	1214	1312	-98	1.95
	M1 NB RT	15	16	-1	0.14
M31 Hume Motorway / B88 Picton Road (western intersection)	Picton Road WB RT	746	706	40	1.06
	Picton Road WB Thru	1063	1114	-51	1.08
	Hume Motorway NB RT	400	403	-3	0.11
	Hume Motorway NB LT	150	166	-16	0.88
	Picton Road EB Thru	470	500	-30	0.97
	Picton Road EB LT	235	225	10	0.45
M31 Hume Motorway / B88 Picton Road (eastern intersection)	Hume Motorway SB RT	600	606	-6	0.18
	Hume Motorway SB LT	871	795	76	1.87
	Picton Road WB Thru	1232	1214	18	0.37
	Picton Road WB LT	350	333	17	0.66
	Picton Road EB RT	116	104	12	0.80
	Picton Road EB Thru	757	800	-43	1.09
Menangle Street / SR89 Remembrance Driveway	Remembrance Driveway SB RT	28	3	25	4.39
	Remembrance Driveway SB Thru	1092	996	96	2.10
	Remembrance Driveway SB LT	138	113	25	1.56
	Menangle Street WB RT	105	84	21	1.51
	Menangle Street WB Thru	8	24	-16	2.83
	Menangle Street WB LT	372	424	-52	1.84
	Remembrance Driveway NB RT	224	82	142	8.09
	Remembrance Driveway NB Thru	664	424	240	7.29
	Remembrance Driveway NB LT	18	6	12	2.50
	Menangle Street EB RT	25	35	-10	1.34
	Menangle Street EB Thru	7	56	-49	6.17
	Menangle Street EB LT	47	3	44	6.26

Menangle Road and Camden Road	Menangle Road SB Thru	274	86	188	9.90
	Menangle Road SB LT	259	132	127	6.43
	Camden Road WB RT	149	111	38	2.34
	Camden Road WB LT	42	59	-17	1.67
	Menangle Road NB RT	48	101	-53	4.34
	Menangle Road NB Thru	214	54	160	9.79
M31 Hume Motorway / SR89 Remembrance Driveway	Hume Motorway SB Thru	1987	1747	240	3.93
	Hume Motorway NB Thru	2234	2468	-234	3.42
	Hume Motorway NB LT	396	290	106	4.03
	Remembrance Driveway EB RT	213	204	9	0.42
B88 Picton Road / Menangle Road	Menangle Road SB RT	183	103	80	4.72
	Menangle Raod SB LT	138	39	99	7.42
	Picton Road WB RT	144	115	29	1.80
	Picton Road WB Thru	1045	1094	-49	1.06
	Picton Road EB Thru	560	651	-91	2.60
	Picton Road EB LT	124	43	81	6.27
B88 Picton Road/Wilton Park Road, east of Menangle Road	Picton Road WB Thru	1167	1212	-45	0.92
	Picton Road WB LT	53	65	-12	1.12
	Wilton Park Road NB RT	32	44	-12	1.36
	Wilton Park Road NB LT	19	3	16	3.30
	Picton Road EB RT	25	3	22	4.26
	Picton Road EB Thru	673	682	-9	0.23
B88 Picton Road and Pembroke Parade	Pembroke Parade SB RT	145	125	20	1.22
	Pembroke Parade SB LT	21	112	-91	7.88
	Picton Road WB RT	12	26	-14	2.32
	Picton Road WB Thru	1423	1428	-5	0.09
	Picton Road EB Thru	1518	1442	76	1.40
	Picton Road EB LT	245	146	99	5.01
B88 Picton Road and Almond Street	Almond Street SB RT	234	198	36	1.72
	Almond Street SB LT	46	23	23	2.77
	Picton Road WB RT	45	11	34	4.51
	Picton Road WB Thru	1196	1260	-64	1.30
	Picton Road EB Thru	1251	1408	-157	3.04
	Picton Road EB LT	267	142	125	6.19
B88 Picton Road and Macarthur Drive	Macarthur Drive SB RT	8	11	-3	0.69
	Macarthur Drive SB LT	137	114	23	1.46
	Picton Road WB RT	64	24	40	4.21
	Picton Road WB Thru	1230	1272	-42	0.85
	Picton Road EB Thru	1291	1299	-8	0.15
	Picton Road EB LT	10	115	-105	9.41
B88 Picton Road and Mount Keira Road	Picton Road WB Thru	1262	1318	-56	1.11
	Picton Road WB LT	7	4	3	0.84
	Mt Keira Road NB RT	12	8	4	0.85
	Mt Keira Road NB LT	18	20	-2	0.32
	Picton Road EB RT	42	41	1	0.11
	Picton Road EB Thru	1463	1329	134	2.53
Wilton Road and Macarthur Drive	Wilton Road SB Thru	269	171	98	4.68
	Wilton Road SB LT	122	116	6	0.42
	Macarthur Drive WB RT	64	128	-64	4.63
	Macarthur Drive WB LT	8	9	-1	0.34
	Wilton Road NB RT	10	12	-2	0.34
	Wilton Road NB Thru	304	167	137	6.29
Wilton Road and Douglas Park Drive	Wilton Road SB RT	41	74	-33	3.09
	Wilton Road SB Thru	170	166	4	0.20
	Wilton Road NB Thru	210	242	-32	1.50
	Wilton Road NB LT	166	54	112	7.58
	Douglas Park Drive EB RT	223	121	102	5.51
	Douglas Park Drive EB LT	54	30	24	2.67
B88 Picton Road/Wilton Park Road, west of Menangle Road	Picton Road WB Thru	1188	1123	65	1.34
	Picton Road WB LT	53	72	-19	1.68
	Wilton Park Road NB RT	79	87	-8	0.59
	Wilton Park Road NB LT	28	10	18	2.92
	Picton Road EB RT	14	9	5	1.00
	Picton Road EB Thru	601	609	-8	0.22
	Hume Motorway (under Picton Road) NB	1961	1936	25	0.40
	Hume Motorway (under Picton Road) SB	2046	1829	217	3.49
	Hume Motorway (near Remembrance Driveay) NB	2511	2532	-21	0.30
	Hume Motorway (near Remembrance Driveay) SB	2512	2249	263	3.81



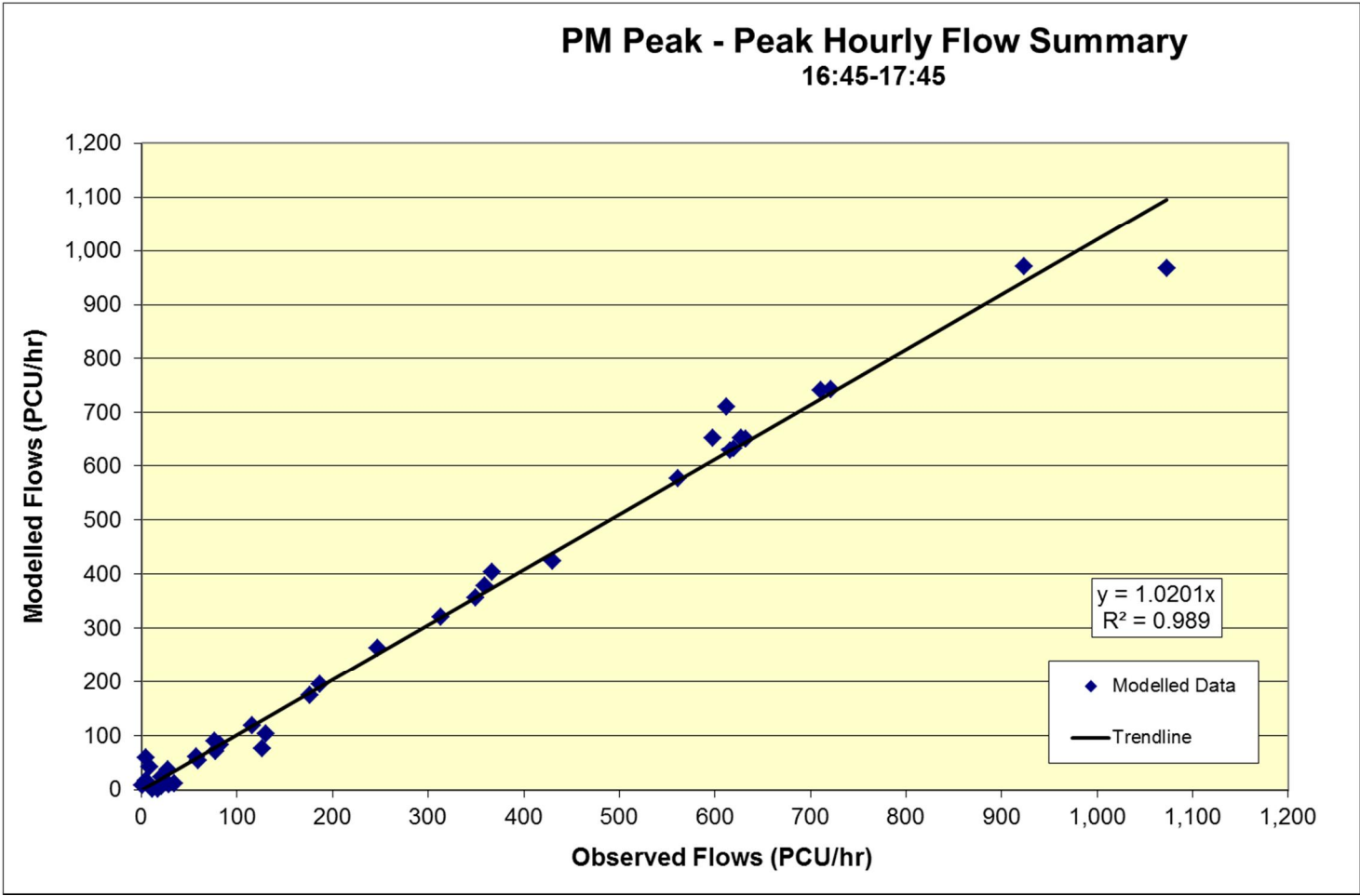
A3. AM peak hourly turn flow (PCU/hr) calibration results for core study area

Intersection	Movement	Observed	Average modelled	Diff (Obs-Mod)	GEH
M31 Hume Motorway / B88 Picton Road (western intersection)	Picton Road WB RT	597	571	26	1.06
	Picton Road WB Thru	306	307	-1	0.05
	Hume Motorway NB RT	183	194	-11	0.79
	Hume Motorway NB LT	58	59	-1	0.08
	Picton Road EB Thru	282	269	13	0.81
	Picton Road EB LT	375	357	18	0.96
M31 Hume Motorway / B88 Picton Road (eastern intersection)	Hume Motorway SB RT	127	122	5	0.43
	Hume Motorway SB LT	530	497	33	1.45
	Picton Road WB Thru	796	759	37	1.33
	Picton Road WB LT	206	192	14	0.98
	Picton Road EB RT	63	76	-13	1.51
	Picton Road EB Thru	400	385	15	0.75
B88 Picton Road and Wilton Park Road, east of Menangle Road	Picton Road WB Thru	362	348	14	0.74
	Picton Road WB LT	6	17	-11	3.20
	Wilton Park Road NB RT	19	22	-3	0.75
	Wilton Park Road NB LT	5	2	3	1.60
	Picton Road EB RT	3	3	0	0.22
	Picton Road EB Thru	634	604	30	1.22
B88 Picton Road and Pembroke Parade	Pembroke Parade SB RT	121	133	-12	1.06
	Pembroke Parade SB LT	9	20	-11	2.89
	Picton Road WB RT	13	24	-11	2.64
	Picton Road WB Thru	873	823	50	1.72
	Picton Road EB Thru	861	828	33	1.14
	Picton Road EB LT	70	51	19	2.44
B88 Picton Road and Almond Street	Almond Street SB RT	139	98	41	3.79
	Almond Street SB LT	11	21	-10	2.42
	Picton Road WB RT	13	5	8	2.75
	Picton Road WB Thru	741	756	-15	0.56
	Picton Road EB Thru	761	787	-26	0.94
	Picton Road EB LT	103	54	49	5.53
B88 Picton Road and Macarthur Drive	Macarthur Drive SB RT	5	24	-19	4.99
	Macarthur DriveSB LT	84	45	39	4.88
	Picton Road WB RT	53	20	33	5.54
	Picton Road WB Thru	752	754	-2	0.06
	Picton Road EB Thru	755	755	0	0.01
	Picton Road EB LT	1	39	-38	8.52
	Hume Motorway (under Picton Rd) NB	938	912	26	0.84
	Hume Motorway (under Picton Rd) SB	916	883	33	1.11



A4. PM peak hourly turn flow (PCU/hr) calibration results for core study area

Intersection	Movement	Observed	Average modelled	Diff (Obs-Mod)	GEH
M31 Hume Motorway / B88 Picton Road (western intersection)	Picton Road WB RT	359	378	-19	1.00
	Picton Road WB Thru	561	577	-16	0.65
	Hume Motorway NB RT	187	195	-8	0.55
	Hume Motorway NB LT	77	90	-13	1.46
	Picton Road EB Thru	247	263	-16	0.98
	Picton Road EB LT	116	119	-3	0.31
M31 Hume Motorway / B88 Picton Road (eastern intersection)	Hume Motorway SB RT	313	322	-9	0.48
	Hume Motorway SB LT	430	424	6	0.31
	Picton Road WB Thru	620	634	-14	0.54
	Picton Road WB LT	176	175	1	0.06
	Picton Road EB RT	59	54	5	0.61
	Picton Road EB Thru	367	403	-36	1.84
B88 Picton Road and Wilton Park Road, east of Menangle Road	Picton Road WB Thru	616	630	-14	0.54
	Picton Road WB LT	28	38	-10	1.77
	Wilton Park Road NB RT	21	24	-3	0.71
	Wilton Park Road NB LT	11	2	9	3.43
	Picton Road EB RT	17	2	15	5.05
	Picton Road EB Thru	350	357	-7	0.36
B88 Picton Road and Pembroke Parade	Pembroke Parade SB RT	78	71	7	0.83
	Pembroke Parade SB LT	9	43	-34	6.61
	Picton Road WB RT	5	17	-12	3.62
	Picton Road WB Thru	711	741	-30	1.10
	Picton Road EB Thru	721	743	-22	0.81
	Picton Road EB LT	82	84	-2	0.20
B88 Picton Road and Almond Street	Almond Street SB RT	130	103	27	2.48
	Almond Street SB LT	29	11	18	4.14
	Picton Road WB RT	21	7	14	3.81
	Picton Road WB Thru	598	652	-54	2.18
	Picton Road EB Thru	612	710	-98	3.82
	Picton Road EB LT	126	76	50	4.95
B88 Picton Road and Macarthur Drive	Macarthur Drive SB RT	1	9	-8	3.47
	Macarthur Drive SB LT	57	61	-4	0.57
	Picton Road WB RT	34	12	22	4.59
	Picton Road WB Thru	632	652	-20	0.78
	Picton Road EB Thru	628	653	-25	1.00
	Picton Road EB LT	5	60	-55	9.67
	Hume Motorway (under Picton Rd) NB	924	970	-46	1.51
	Hume Motorway (under Picton Rd) SB	1073	968	105	3.30



A5. Screenline flow calibration for AM and PM peaks

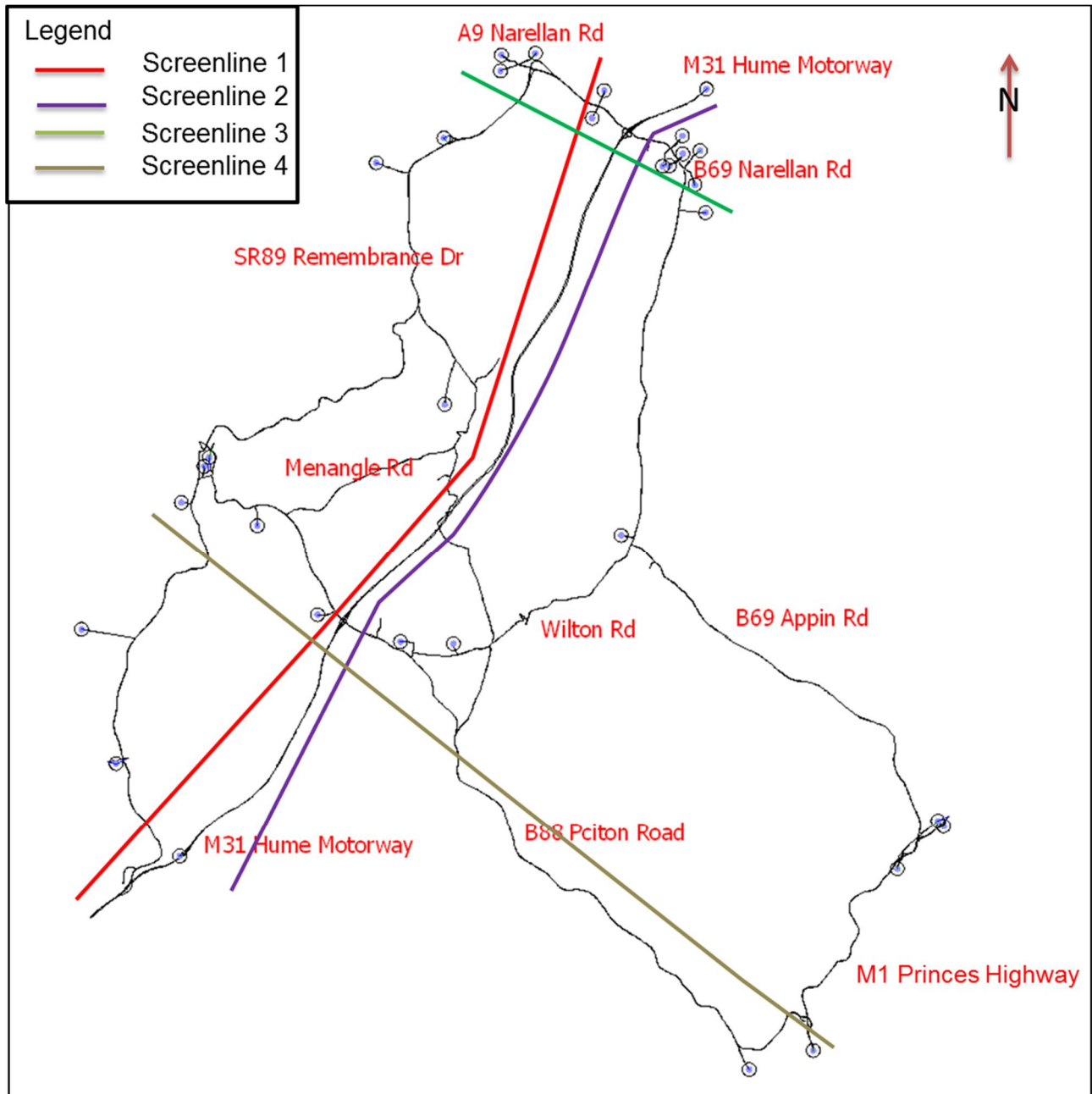


Figure A5.1 Locations of the screenlines

Table A–1 Screenline calibration results for AM peak

Screenline	Direction	Observed flows (PCU/2hr)	Mean modelled flows (PCU/2 hr)	GEH
1	EB	8527	8012	4.00
	WB	5131	4861	2.70
2	EB	7207	7095	0.94
	WB	5847	5805	0.39
3	NB	9216	9007	1.55
	SB	5554	5680	1.19
4	NB	9005	8992	0.1
	SB	8339	8136	1.58

Table A–2 Screenline calibration results for PM peak

Screenline	Direction	Observed flows (PCU/2hr)	Mean modelled flows (PCU/2 hr)	GEH
1	EB	5785	5532	2.38
	WB	9106	9049	0.42
2	EB	6295	6143	1.36
	WB	7539	7438	0.83
3	NB	6245	6194	0.46
	SB	9459	9765	2.21
4	NB	8222	8200	0.17
	SB	9937	9394	3.91

Appendix D

Mid-block capacity sensitivity test



Table D.1 Traffic volume forecasts (pcu/h) for 2013 existing and future 'no Wilton' scenarios – Heavy vehicles = 3 PCU

Intersection	Direction	2013 Modelled		2024 No Wilton		2031 No Wilton		2036 No Wilton	
		AM peak	PM peak	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
Hume Highway, north of Picton Road	Northbound	2,100	2,750	2,475	2,050	2,850	2,325	3,200	2,400
	Southbound	1,800	2,125	2,125	2,300	2,400	2,425	2,550	2,525
Hume Highway, south of Picton Road	Northbound	1,325	1,500	1,575	1,750	1,750	1,975	1,850	2,100
	Southbound	1,325	1,650	1,600	1,575	1,800	1,775	1,950	1,825
Picton Road, at Nepean River bridge	Eastbound	350	950	800	500	900	500	950	525
	Westbound	700	725	425	725	475	650	500	650
Picton Road west of Hume Highway	Eastbound	675	1,450	850	525	925	550	1,000	575
	Westbound	425	950	450	800	525	750	550	775
Picton Road east of Hume Highway	Eastbound	1,025	1,200	1,250	1,200	1,400	1,300	1,475	1,400
	Westbound	1,100	1,675	1,450	1,050	1,700	1,175	1,875	1,275
Picton Road east of Pembroke Parade	Eastbound	975	1,175	1,200	1,100	1,350	1,150	1,450	1,200
	Westbound	975	1,075	1,175	1,000	1,350	1,125	1,450	1,200
Picton Road east of Almond Street	Eastbound	950	1,400	1,175	1,025	1,325	1,100	1,425	1,150
	Westbound	900	1,025	1,025	925	1,050	1,025	1,075	1,075
Picton Road east of Macarthur Drive	Eastbound	900	1,275	1,125	900	1,225	1,000	1,325	1,050
	Westbound	900	1,050	1,000	975	1,100	1,025	1,125	1,100
Wilton Road, at Broughton Pass	Northbound	50	325	125	175	150	200	175	200
	Southbound	25	150	150	175	175	175	200	200

Table D.2 Summary of link performance for 2013 existing and future ‘without Wilton’ scenarios – Heavy vehicles = 3 PCU

Intersection	Road type	Direction	2013 Modelled		2024 No Wilton ¹		2031 No Wilton ¹		2036 No Wilton ¹	
			AM peak	PM peak	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
Hume Highway, north of Picton Road	Freeway	Northbound	B	C	C	B	C	B	C	B
		Southbound	B	B	B	B	B	C	C	C
Hume Highway, south of Picton Road	Freeway	Northbound	A	A	B	B	B	B	B	B
		Southbound	A	A	B	B	B	B	B	B
Picton Road, at Nepean River bridge	2-lane 2-way	Combined	C	D	D	D	D	C	D	C
Picton Road west of Hume Highway	Multi-lane arterial	Eastbound	A	B	A	A	A	A	A	A
		Westbound	A	A	A	A	A	A	A	A
Picton Road east of Hume Highway	Multi-lane arterial	Eastbound	A	A	B	B	B	B	B	B
		Westbound	A	B	B	A	B	B	C	B
Picton Road east of Pembroke Parade	2-lane 2-way	Combined	E	E	E	E	E	E	E	E
Picton Road east of Almond Street	2-lane 2-way	Combined	E	E	E	E	E	E	E	E
Picton Road east of Macarthur Drive	2-lane 2-way	Combined	D	E	E	E	E	E	E	E
Wilton Road, at Broughton Pass	One lane bridge	Combined	E	E	E	E	A ²	A ²	A	A

(1) Includes current approval for Bingara Gorge

(2) Cataract River Bridge at Broughton Pass widened to one lane in each direction

Table D.3 Traffic volume forecasts (pcu/h) for 2013 existing and future ‘with Wilton’ scenarios – Heavy vehicles = 3 PCU

Intersection	Direction	2013 Modelled		2024 with Wilton		2031 with Wilton		2036 with Wilton	
		AM peak	PM peak	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
Hume Highway, north of Picton Road	Northbound	2,100	2,750	2,625	2,125	3,400	2,675	3,800	2,825
	Southbound	1,800	2,125	2,150	2,650	2,625	3,400	2,800	3,775
Hume Highway, south of Picton Road	Northbound	1,325	1,500	1,550	1,775	1,750	2,100	1,900	2,350
	Southbound	1,325	1,650	1,700	1,525	2,150	1,725	2,325	1,850
Picton Road, at Nepean River bridge	Eastbound	350	950	875	575	975	800	1,125	875
	Westbound	700	725	650	750	875	975	975	1,150
Picton Road west of Hume Highway	Eastbound	675	1,450	1,325	950	975	700	1,275	1,000
	Westbound	425	950	900	1,100	675	850	900	1,100
Picton Road east of Hume Highway	Eastbound	1,025	1,200	1,275	1,700	1,350	1,700	1,450	2,075
	Westbound	1,100	1,675	1,700	1,125	1,375	1,225	2,175	1,350
Picton Road east of Pembroke Parade	Eastbound	975	1,175	1,250	1,150	1,775	1,675	2,025	1,825
	Westbound	975	1,075	1,125	1,125	1,575	1,500	1,725	1,625
Picton Road east of Almond Street	Eastbound	950	1,400	1,450	1,125	2,100	1,375	2,300	1,500
	Westbound	900	1,025	1,075	1,250	1,225	1,675	1,325	1,775
Picton Road east of Macarthur Drive	Eastbound	900	1,275	1,325	1,050	1,875	1,175	1,950	1,275
	Westbound	900	1,050	1,100	1,250	1,250	1,600	1,275	1,700
Wilton Road, at Broughton Pass	Northbound	50	325	325	225	500	325	600	400
	Southbound	25	150	150	225	250	375	325	450

Table D.4 Summary of link performance for 2013 existing and future ‘with Wilton’ scenarios – Heavy vehicles = 3 PCU

Intersection	Road type	Direction	2013 Modelled		2024 with Wilton		2031 with Wilton		2036 with Wilton	
			AM peak	PM peak	AM peak	PM peak	AM peak	PM peak	AM peak	PM peak
Hume Highway, north of Picton Road	Freeway	Northbound	B	C	C	B	C	C	D	C
		Southbound	B	B	B	C	C	C	C	D
Hume Highway, south of Picton Road	Freeway	Northbound	A	A	B	B	B	B	B	B
		Southbound	A	B	B	A	B	B	B	B
Picton Road, at Nepean River bridge	2-lane 2-way	Combined	C	D	D	D	E	D	E	E
Picton Road west of Hume Highway	Multi-lane arterial	Eastbound	A	B	B	A	C	B	C	C
		Westbound	A	A	A	A	B	B	C	D
Picton Road east of Hume Highway	Multi-lane arterial	Eastbound	A	B	B	B	B	B	B	C
		Westbound	A	B	B	B	B	B	C	B
Picton Road east of Pembroke Parade	Multi-lane arterial	Eastbound	E	E	B	B	C	B	C	C
		Westbound			B	B	B	B	B	B
Picton Road east of Almond Street	Multi-lane arterial	Eastbound	E	E	B	B	C	B	C	B
		Westbound			A	B	B	B	B	C
Picton Road east of Macarthur Drive	2-lane 2-way	Combined	D	E	E	E	E	E	F	E
Wilton Road, at Broughton Pass	One lane bridge	Combined	E	E	A ¹	A ¹	B ¹	B ¹	C ¹	C ¹

(1) Cataract River Bridge at Broughton Pass widened to one lane in each direction

Appendix E

Highway Capacity Manual (HCM) analysis



E1. HCM analysis

An analysis of the expected levels of service to the north of the Picton Road overpass of M31 (Hume Highway) has been undertaken using the Highway Capacity Manual 2010 (Version 6.41). The analysis is based on the following:

- Year 2036 peak hour volumes in PCPH (i.e. heavy vehicle proportion already included in volumes).
- Level terrain.
- 100 km/hr free speeds on main carriageways and 80 km/hr on the ramps.
- Four lane divided main carriageway.
- One lane at the nose for the ramps.
- Merge and diverge lengths are as per the draft layouts.
- Random arrivals at the entry ramp noses.

Figure E1.1 shows locations at which the HCM analysis was undertaken. The analysis considered the northbound movements during the AM peak and the Southbound in the PM peak.

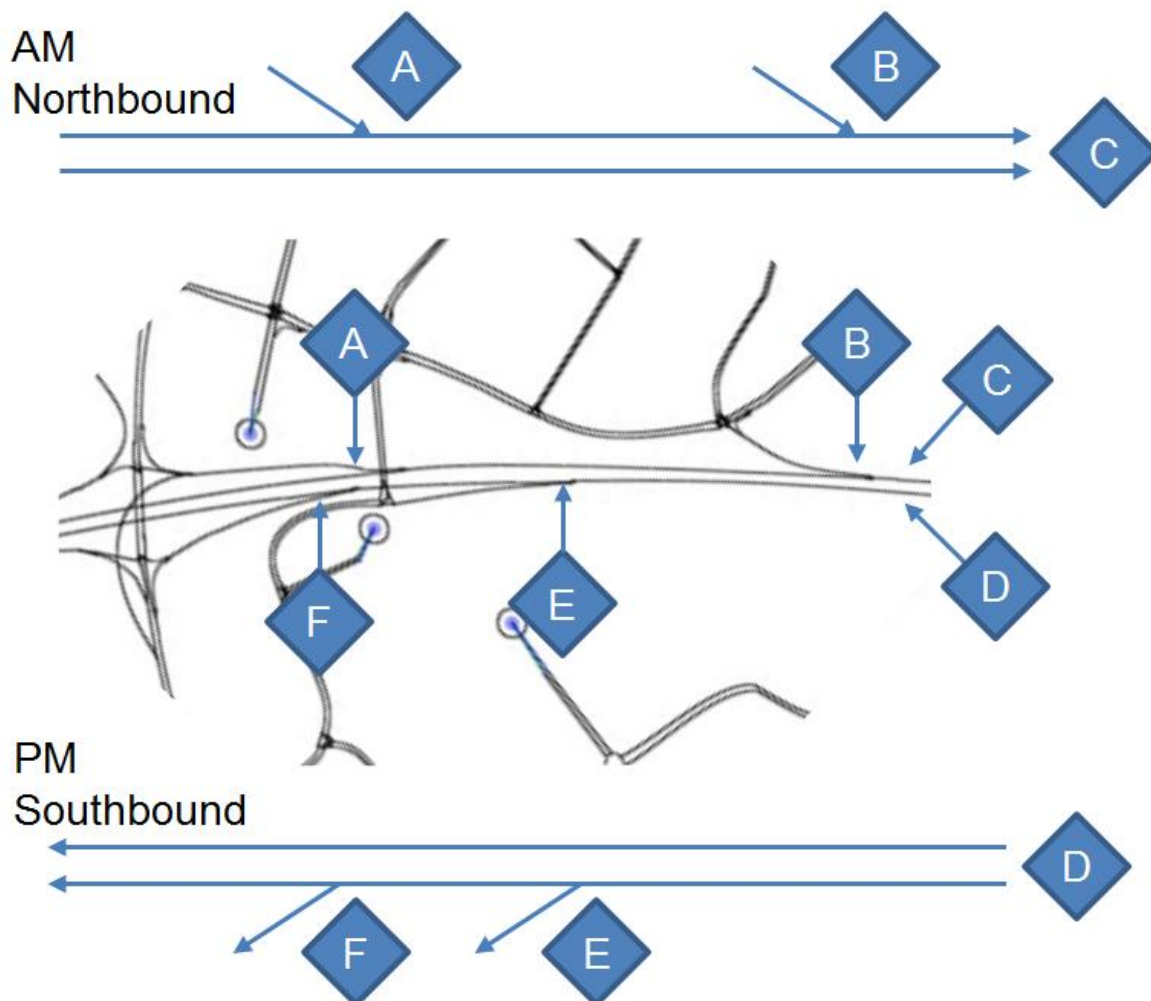


Figure E1.1 HCM analysis locations

The results are shown in the corresponding HCM worksheets attached. The analysis indicates:

- Northbound AM peak hour performance :
 - ▶ A: the Picton road entry ramp is expected to operate at LoS C at the merge
 - ▶ B: the new entry ramp is expected to operate at LoS D at the merge
 - ▶ C: the main carriageway is expected to operate at LoS D downstream of the two entry ramps
- southbound PM peak hour performance :
 - ▶ D: the main carriageway is expected to operate at LoS D upstream of the two exit ramps
 - ▶ E: the new exit ramp is expected to operate at LoS D at the diverge
 - ▶ F: the Picton road entry ramp is expected to operate at LoS C at the diverge.

These results indicate that from a planning perspective the proposed layout has sufficient capacity to meet the expected demand and would provide satisfactory operating conditions under the design year volumes.

The HCM analysis also highlighted that improvements and refinements could be made to the design to improve the operations further.

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst		David Bohm		Freeway/Dir of Travel		North Bound			
Agency or Company		File: A36NbEAM		Junction		North bound entry ramp A			
Date Performed		17/06/14		Jurisdiction		Lane Scenario 1			
Analysis Time Period		AM Peak		Analysis Year		2036			
Project Description Wilton TMAP Rev F									
Inputs									
Upstream Adj Ramp ☐ Yes ☐ On ☒ No ☐ Off $L_{up} =$ ft $V_u =$ veh/h		Freeway Number of Lanes, N				2		Downstream Adj Ramp ☒ Yes ☒ On ☐ No ☐ Off $L_{down} =$ 4100 ft $V_D =$ 1032 veh/h	
		Ramp Number of Lanes, N				1			
		Acceleration Lane Length, L_A				1000			
		Deceleration Lane Length L_D							
		Freeway Volume, V_F				1426			
		Ramp Volume, V_R				1466			
Freeway Free-Flow Speed, S_{FF}				60.0					
Ramp Free-Flow Speed, S_{FR}				35.0					
Conversion to pc/h Under Base Conditions									
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$	
Freeway	1426	1.00	Level	0	0	1.000	1.00	1426	
Ramp	1466	1.00	Level	0	0	1.000	1.00	1466	
UpStream									
DownStream	1032	1.00	Level	0	0	1.000	1.00	1032	
Merge Areas					Diverge Areas				
Estimation of v_{12}					Estimation of v_{12}				
$V_{12} = V_F (P_{FM})$ $L_{EQ} =$ (Equation 13-6 or 13-7) $P_{FM} =$ 1.000 using Equation (Exhibit 13-6) $V_{12} =$ 1426 pc/h V_3 or V_{av34} 0 pc/h (Equation 13-14 or 13-17) Is V_3 or $V_{av34} > 2,700$ pc/h? ☐ Yes ☒ No Is V_3 or $V_{av34} > 1.5 * V_{12}/2$ ☐ Yes ☒ No If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ $L_{EQ} =$ (Equation 13-12 or 13-13) $P_{FD} =$ using Equation (Exhibit 13-7) $V_{12} =$ pc/h V_3 or V_{av34} pc/h (Equation 13-14 or 13-17) Is V_3 or $V_{av34} > 2,700$ pc/h? ☐ Yes ☐ No Is V_3 or $V_{av34} > 1.5 * V_{12}/2$ ☐ Yes ☐ No If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19)				
Capacity Checks					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V_{FO}	2892	Exhibit 13-8		No	V_F		Exhibit 13-8		
					$V_{FO} = V_F - V_R$		Exhibit 13-8		
					V_R		Exhibit 13-10		
Flow Entering Merge Influence Area					Flow Entering Diverge Influence Area				
	Actual	Max Desirable		Violation?		Actual	Max Desirable		Violation?
V_{R12}	2892	Exhibit 13-8	4600:All	No	V_{12}		Exhibit 13-8		
Level of Service Determination (if not F)					Level of Service Determination (if not F)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$ $D_R =$ 21.1 (pc/mi/ln) $LOS =$ C (Exhibit 13-2)					$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$ $D_R =$ (pc/mi/ln) $LOS =$ (Exhibit 13-2)				
Speed Determination					Speed Determination				
$M_S =$ 0.321 (Exhibit 13-11) $S_R =$ 54.2 mph (Exhibit 13-11) $S_0 =$ N/A mph (Exhibit 13-11) $S =$ 54.2 mph (Exhibit 13-13)					$D_S =$ (Exhibit 13-12) $S_R =$ mph (Exhibit 13-12) $S_0 =$ mph (Exhibit 13-12) $S =$ mph (Exhibit 13-13)				

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst		David Bohm		Freeway/Dir of Travel		North Bound			
Agency or Company		File: B36NbEAM		Junction		North bound entry ramp B			
Date Performed		17/06/14		Jurisdiction		Lane Scenario 1			
Analysis Time Period		AM Peak		Analysis Year		2036			
Project Description Wilton TMAP Revision F									
Inputs									
Upstream Adj Ramp ☒ Yes ☒ On ☐ No ☐ Off $L_{up} = 4100$ ft $V_u = 1466$ veh/h		Freeway Number of Lanes, N 2				Downstream Adj Ramp ☐ Yes ☐ On ☒ No ☐ Off $L_{down} =$ ft $V_D =$ veh/h			
		Ramp Number of Lanes, N 1							
		Acceleration Lane Length, L_A 1000							
		Deceleration Lane Length L_D							
		Freeway Volume, V_F 2892							
		Ramp Volume, V_R 1032							
		Freeway Free-Flow Speed, S_{FF} 60.0							
		Ramp Free-Flow Speed, S_{FR} 35.0							
Conversion to pc/h Under Base Conditions									
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f_{HV}	f_p	$v = V/PHF \times f_{HV} \times f_p$	
Freeway	2892	1.00	Level	0	0	1.000	1.00	2892	
Ramp	1032	1.00	Level	0	0	1.000	1.00	1032	
UpStream	1466	1.00	Level	0	0	1.000	1.00	1466	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v_{12}					Estimation of v_{12}				
$V_{12} = V_F (P_{FM})$ $L_{EQ} =$ (Equation 13-6 or 13-7) $P_{FM} = 1.000$ using Equation (Exhibit 13-6) $V_{12} = 2892$ pc/h V_3 or $V_{av34} = 0$ pc/h (Equation 13-14 or 13-17) Is V_3 or $V_{av34} > 2,700$ pc/h? ☐ Yes ☒ No Is V_3 or $V_{av34} > 1.5 * V_{12}/2$ ☐ Yes ☒ No If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19)					$V_{12} = V_R + (V_F - V_R)P_{FD}$ $L_{EQ} =$ (Equation 13-12 or 13-13) $P_{FD} =$ using Equation (Exhibit 13-7) $V_{12} =$ pc/h V_3 or $V_{av34} =$ pc/h (Equation 13-14 or 13-17) Is V_3 or $V_{av34} > 2,700$ pc/h? ☐ Yes ☐ No Is V_3 or $V_{av34} > 1.5 * V_{12}/2$ ☐ Yes ☐ No If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19)				
Capacity Checks					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V_{FO}	3924	Exhibit 13-8		No	V_F		Exhibit 13-8		
					$V_{FO} = V_F - V_R$		Exhibit 13-8		
					V_R		Exhibit 13-10		
Flow Entering Merge Influence Area					Flow Entering Diverge Influence Area				
	Actual	Max Desirable		Violation?		Actual	Max Desirable		Violation?
V_{R12}	3924	Exhibit 13-8	4600:All	No	V_{12}		Exhibit 13-8		
Level of Service Determination (if not F)					Level of Service Determination (if not F)				
$D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$ $D_R = 29.3$ (pc/mi/ln) LOS = D (Exhibit 13-2)					$D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$ $D_R =$ (pc/mi/ln) LOS = (Exhibit 13-2)				
Speed Determination					Speed Determination				
$M_S = 0.448$ (Exhibit 13-11) $S_R = 51.9$ mph (Exhibit 13-11) $S_0 =$ N/A mph (Exhibit 13-11) $S = 51.9$ mph (Exhibit 13-13)					$D_S =$ (Exhibit 13-12) $S_R =$ mph (Exhibit 13-12) $S_0 =$ mph (Exhibit 13-12) $S =$ mph (Exhibit 13-13)				

BASIC FREEWAY SEGMENTS WORKSHEET					
General Information			Site Information		
Analyst	David Bohm		Highway/Direction of Travel North bound		
Agency or Company	File: C36NbAM		From/To Loc'n C at Local Overpass		
Date Performed	17/06/14		Jurisdiction Lane Scenario 1		
Analysis Time Period	AM Peak		Analysis Year 2036		
Project Description Wilton TMAP - Revision F					
☒ Oper.(LOS)		☐ Des.(N)		☐ Planning Data	
Flow Inputs					
Volume, V	3924	veh/h	Peak-Hour Factor, PHF	1.00	
AADT		veh/day	%Trucks and Buses, P _T	0	
Peak-Hr Prop. of AADT, K			%RVs, P _R	0	
Peak-Hr Direction Prop, D			General Terrain:	Level	
DDHV = AADT x K x D		veh/h	Grade % Length	mi	
			Up/Down %		
Calculate Flow Adjustments					
f _p	1.00		E _R	1.2	
E _T	1.5		f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	1.000	
Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f _{LW}	mph	
Number of Lanes, N	2		f _{LC}	mph	
Total Ramp Density, TRD		ramps/mi	TRD Adjustment	mph	
FFS (measured)	60.0	mph	FFS	60.0	mph
Base free-flow Speed, BFFS		mph			
LOS and Performance Measures			Design (N)		
<u>Operational (LOS)</u>			<u>Design (N)</u>		
v _p = (V or DDHV) / (PHF x N x f _{HV})			Design LOS		
	1962	pc/h/ln	v _p = (V or DDHV) / (PHF x N x f _{HV})		
x f _p)			pc/h/ln		
S	57.6	mph	S		
D = v _p / S	34.1	pc/mi/ln	D = v _p / S		
LOS	D		Required Number of Lanes, N		
Glossary			Factor Location		
N - Number of lanes	S - Speed		E _R - Exhibits 11-10, 11-12	f _{LW} - Exhibit 11-8	
V - Hourly volume	D - Density		E _T - Exhibits 11-10, 11-11, 11-13	f _{LC} - Exhibit 11-9	
v _p - Flow rate	FFS - Free-flow speed		f _p - Page 11-18	TRD - Page 11-11	
LOS - Level of service	BFFS - Base free-flow speed		LOS, S, FFS, v _p - Exhibits 11-2, 11-3		
DDHV - Directional design hour volume					

BASIC FREEWAY SEGMENTS WORKSHEET					
General Information			Site Information		
Analyst	David Bohm		Highway/Direction of Travel	South bound	
Agency or Company	File: D36SbPM		From/To	Loc'n D at Local Overpass	
Date Performed	17/06/14		Jurisdiction	Lane Scenario 1	
Analysis Time Period	PM Peak		Analysis Year	2036	
Project Description Wilton TMAP - Revision F					
☒ Oper.(LOS)		☐ Des.(N)		☐ Planning Data	
Flow Inputs					
Volume, V	3787	veh/h	Peak-Hour Factor, PHF	1.00	
AADT		veh/day	%Trucks and Buses, P _T	0	
Peak-Hr Prop. of AADT, K			%RVs, P _R	0	
Peak-Hr Direction Prop, D			General Terrain:	Level	
DDHV = AADT x K x D		veh/h	Grade % Length	mi	
			Up/Down %		
Calculate Flow Adjustments					
f _p	1.00		E _R	1.2	
E _T	1.5		f _{HV} = 1/[1+P _T (E _T - 1) + P _R (E _R - 1)]	1.000	
Speed Inputs			Calc Speed Adj and FFS		
Lane Width		ft			
Rt-Side Lat. Clearance		ft	f _{LW}	mph	
Number of Lanes, N	2		f _{LC}	mph	
Total Ramp Density, TRD		ramps/mi	TRD Adjustment	mph	
FFS (measured)	60.0	mph	FFS	60.0	mph
Base free-flow Speed, BFFS		mph			
LOS and Performance Measures			Design (N)		
<u>Operational (LOS)</u>			<u>Design (N)</u>		
v _p = (V or DDHV) / (PHF x N x f _{HV})			Design LOS		
	1894	pc/h/ln	v _p = (V or DDHV) / (PHF x N x f _{HV})		
x f _p)			x f _p)		
S	58.4	mph	S		
D = v _p / S	32.4	pc/mi/ln	D = v _p / S		
LOS	D		Required Number of Lanes, N		
Glossary			Factor Location		
N - Number of lanes	S - Speed		E _R - Exhibits 11-10, 11-12	f _{LW} - Exhibit 11-8	
V - Hourly volume	D - Density		E _T - Exhibits 11-10, 11-11, 11-13	f _{LC} - Exhibit 11-9	
v _p - Flow rate	FFS - Free-flow speed		f _p - Page 11-18	TRD - Page 11-11	
LOS - Level of service	BFFS - Base free-flow speed		LOS, S, FFS, v _p - Exhibits 11-2, 11-3		
DDHV - Directional design hour volume					

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst		David Bohm		Freeway/Dir of Travel		South Bound			
Agency or Company		File: E36SbXPM		Junction		South Bound Exit E			
Date Performed		17/06/14		Jurisdiction		Lane scenario 1			
Analysis Time Period		PM Peak		Analysis Year		2036			
Project Description Wilton TMP - Revision F									
Inputs									
Upstream Adj Ramp ☐ Yes ☐ On ☒ No ☐ Off L _{up} = ft V _u = veh/h		Freeway Number of Lanes, N 2				Downstream Adj Ramp ☒ Yes ☐ On ☐ No ☒ Off L _{down} = 1400 ft V _D = 1452 veh/h			
		Ramp Number of Lanes, N 1							
		Acceleration Lane Length, L _A							
		Deceleration Lane Length L _D 400							
		Freeway Volume, V _F 3787							
		Ramp Volume, V _R 825							
Freeway Free-Flow Speed, S _{FF} 55.0									
Ramp Free-Flow Speed, S _{FR} 35.0									
Conversion to pc/h Under Base Conditions									
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF × f _{HV} × f _p	
Freeway	3787	1.00	Level	0	0	1.000	1.00	3787	
Ramp	825	1.00	Level	0	0	1.000	1.00	825	
UpStream									
DownStream	1452	1.00	Level	0	0	1.000	1.00	1452	
Merge Areas					Diverge Areas				
Estimation of v₁₂					Estimation of v₁₂				
V ₁₂ = V _F (P _{FM}) L _{EQ} = (Equation 13-6 or 13-7) P _{FM} = using Equation (Exhibit 13-6) V ₁₂ = pc/h V ₃ or V _{av34} pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? ☐ Yes ☐ No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 ☐ Yes ☐ No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)					V ₁₂ = V _R + (V _F - V _R)P _{FD} L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 1.000 using Equation (Exhibit 13-7) V ₁₂ = 3787 pc/h V ₃ or V _{av34} 0 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? ☐ Yes ☒ No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 ☐ Yes ☒ No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)				
Capacity Checks					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V _{FO}		Exhibit 13-8			V _F	3787	Exhibit 13-8	4500	No
				V _{FO} = V _F - V _R	2962	Exhibit 13-8	4500	No	
				V _R	825	Exhibit 13-10	2000	No	
Flow Entering Merge Influence Area					Flow Entering Diverge Influence Area				
	Actual	Max Desirable		Violation?		Actual	Max Desirable		Violation?
V _{R12}		Exhibit 13-8			V ₁₂	3787	Exhibit 13-8	4400:All	No
Level of Service Determination (if not F)					Level of Service Determination (if not F)				
D _R = 5.475 + 0.00734 v _R + 0.0078 V ₁₂ - 0.00627 L _A D _R = (pc/mi/ln) LOS = (Exhibit 13-2)					D _R = 4.252 + 0.0086 V ₁₂ - 0.009 L _D D _R = 33.2 (pc/mi/ln) LOS = D (Exhibit 13-2)				
Speed Determination					Speed Determination				
M _S = (Exhibit 13-11) S _R = mph (Exhibit 13-11) S ₀ = mph (Exhibit 13-11) S = mph (Exhibit 13-13)					D _S = 0.502 (Exhibit 13-12) S _R = 48.5 mph (Exhibit 13-12) S ₀ = N/A mph (Exhibit 13-12) S = 48.5 mph (Exhibit 13-13)				

RAMPS AND RAMP JUNCTIONS WORKSHEET									
General Information					Site Information				
Analyst		David Bohm		Freeway/Dir of Travel		South Bound			
Agency or Company		File: F36SbXPM		Junction		South Bound Exit F			
Date Performed		17/06/14		Jurisdiction		Lane scenario 1			
Analysis Time Period		PM Peak		Analysis Year		2036			
Project Description Wilton TMP - Revision F									
Inputs									
Upstream Adj Ramp ☒ Yes ☐ On ☐ No ☒ Off L _{up} = 1400 ft V _u = 825 veh/h		Freeway Number of Lanes, N				2		Downstream Adj Ramp ☐ Yes ☐ On ☒ No ☐ Off L _{down} = ft V _D = veh/h	
		Ramp Number of Lanes, N				1			
		Acceleration Lane Length, L _A							
		Deceleration Lane Length L _D				400			
		Freeway Volume, V _F				2962			
		Ramp Volume, V _R				1452			
Freeway Free-Flow Speed, S _{FF}				55.0					
Ramp Free-Flow Speed, S _{FR}				35.0					
Conversion to pc/h Under Base Conditions									
(pc/h)	V (Veh/hr)	PHF	Terrain	%Truck	%Rv	f _{HV}	f _p	v = V/PHF × f _{HV} × f _p	
Freeway	2962	1.00	Level	0	0	1.000	1.00	2962	
Ramp	1452	1.00	Level	0	0	1.000	1.00	1452	
UpStream	825	1.00	Level	0	0	1.000	1.00	825	
DownStream									
Merge Areas					Diverge Areas				
Estimation of v₁₂					Estimation of v₁₂				
V ₁₂ = V _F (P _{FM}) L _{EQ} = (Equation 13-6 or 13-7) P _{FM} = using Equation (Exhibit 13-6) V ₁₂ = pc/h V ₃ or V _{av34} pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? ☐ Yes ☐ No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 ☐ Yes ☐ No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)					V ₁₂ = V _R + (V _F - V _R)P _{FD} L _{EQ} = (Equation 13-12 or 13-13) P _{FD} = 1.000 using Equation (Exhibit 13-7) V ₁₂ = 2962 pc/h V ₃ or V _{av34} 0 pc/h (Equation 13-14 or 13-17) Is V ₃ or V _{av34} > 2,700 pc/h? ☐ Yes ☒ No Is V ₃ or V _{av34} > 1.5 * V ₁₂ /2 ☐ Yes ☒ No If Yes, V _{12a} = pc/h (Equation 13-16, 13-18, or 13-19)				
Capacity Checks					Capacity Checks				
	Actual	Capacity		LOS F?		Actual	Capacity		LOS F?
V _{FO}		Exhibit 13-8			V _F	2962	Exhibit 13-8	4500	No
				V _{FO} = V _F - V _R	1510	Exhibit 13-8	4500	No	
				V _R	1452	Exhibit 13-10	2000	No	
Flow Entering Merge Influence Area					Flow Entering Diverge Influence Area				
	Actual	Max Desirable		Violation?		Actual	Max Desirable		Violation?
V _{R12}		Exhibit 13-8			V ₁₂	2962	Exhibit 13-8	4400:All	No
Level of Service Determination (if not F)					Level of Service Determination (if not F)				
D _R = 5.475 + 0.00734 v _R + 0.0078 V ₁₂ - 0.00627 L _A D _R = (pc/mi/ln) LOS = (Exhibit 13-2)					D _R = 4.252 + 0.0086 V ₁₂ - 0.009 L _D D _R = 26.1 (pc/mi/ln) LOS = C (Exhibit 13-2)				
Speed Determination					Speed Determination				
M _S = (Exhibit 13-11) S _R = mph (Exhibit 13-11) S ₀ = mph (Exhibit 13-11) S = mph (Exhibit 13-13)					D _S = 0.559 (Exhibit 13-12) S _R = 47.7 mph (Exhibit 13-12) S ₀ = N/A mph (Exhibit 13-12) S = 47.7 mph (Exhibit 13-13)				