BUNNINGS PENRITH
PROPOSED ALTERATIONS AND ADDITIONS
301 – 355 MULGOA ROAD, JAMISONTOWN
Assessment of Traffic and Parking Implications

April 2015
(Rev C)

Reference 14201

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1. INTRODUCTION

This report has been prepared to accompany a Development Application to Penrith City Council for proposed alterations and additions to the existing Bunnings on Mulgoa Road, Jamisontown (Figure 1).

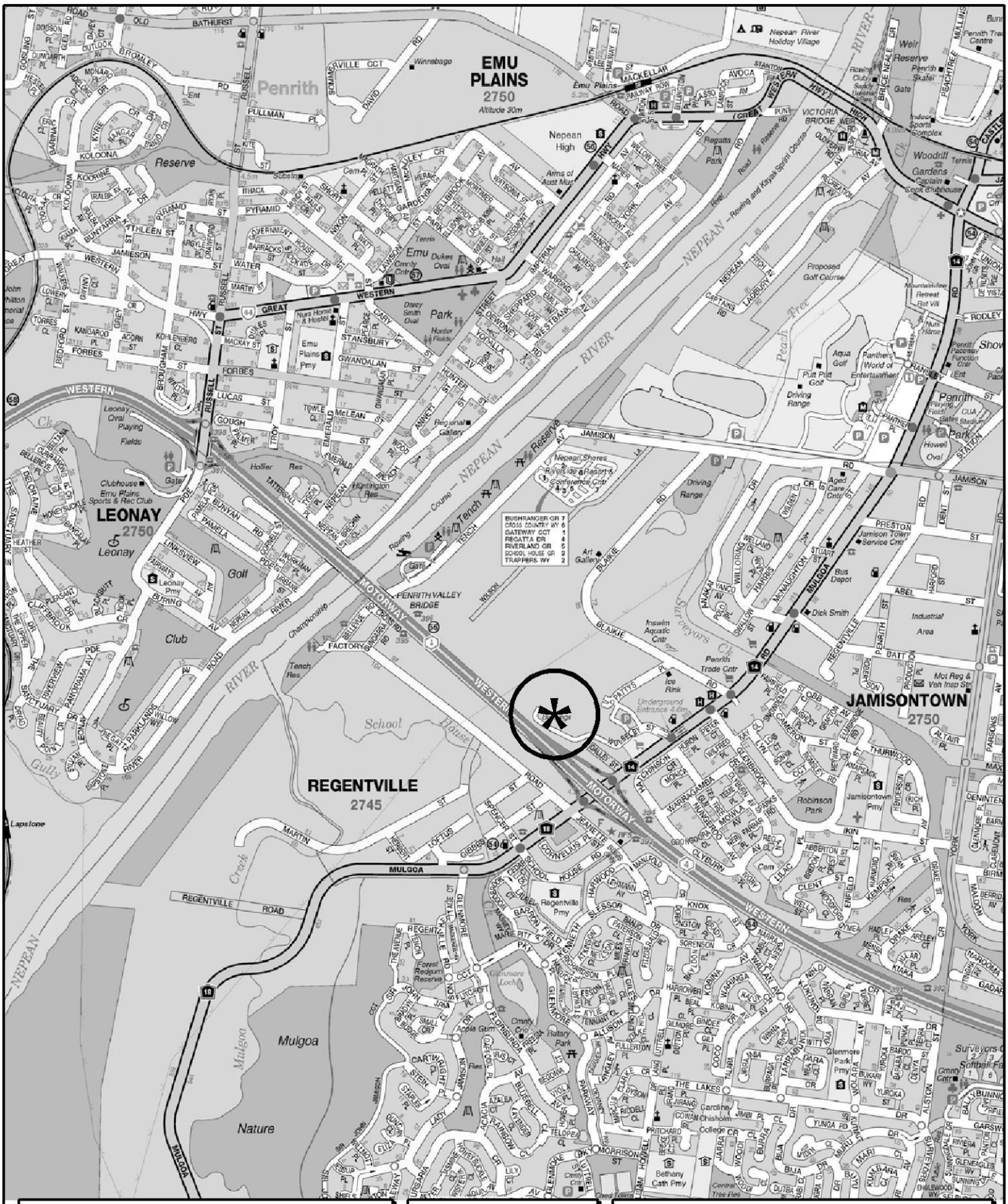
The existing Bunnings trades successfully however the new high level competition in the market place presented by "Masters" (which has approval for a new outlet nearby) has highlighted the need for Bunnings to upgrade some existing outlets. The existing Bunnings at Penrith suffers from the inability to present a full range of products as achieved in contemporary Bunnings developments of some 13,000 to 16,000m^2 (retail area) and the proposed alterations to the Penrith outlet will enable Bunnings to provide a larger product range. The site is strategically located in relation to the developing Penrith area and presents significant 'traffic' advantages due to its convenient signal controlled access to the arterial road system and co-location with a large established bulky goods complex.

The proposed scheme involves alterations and additions which will provide a contemporary mid-size Bunnings warehouse as follows:

	Existing	**Proposed**	**Additional**
Total Retail Area	11,832 m^2	14,280 m^2	+ 2,448 m^2

The purpose of this report is to:

* describe the site, the existing use/context and the development proposal
* describe the road network serving the site and traffic conditions on that network
* assess the adequacy of the proposed parking provision
* assess the traffic potential implications of the development
* assess the proposed access, internal circulation and servicing arrangements



2. DEVELOPMENT SCHEME

2.1 SITE, CONTEXT AND EXISTING DEVELOPMENT

The Bunnings site (Figure 2) is Lot 1 and common property SP72448 which along with Lot 322 in DP1037757 forms an irregular shaped total area of 7.298ha. The overall site has frontages to Western Motorway, Mulgoa Road, Wolseley Street and Gibbes Street being located within the Penrith Riverbank Precinct.

The Riverbank Precinct is bounded by Western Motorway, Nepean River, Mulgoa Road and the Railway Line and the Bunnings is incorporated in a large bulky goods complex located in the southern part of the precinct which comprises the Harvey Norman Centre and the Penrith Homemaker Centre. Details of this BG's complex are provided on the diagram overleaf while the surrounding uses comprise:

* the industrial uses adjoining to the north
* the vacant rural and flood prone lands adjoining to the west
* the residential suburbs of Regentville and Jamisontown extending to the south and east

The existing Bunnings development is shown on the plans in Appendix A and comprises:

* Warehouse 8,356m^2
* Trade Area 2,298m^2
* Nursery/Bagged Goods 1,178m^2

  Total Retail Area 11,832m^2

There are a total of 193 parking spaces in the immediate vicinity of the Bunnings Warehouse and the existing vehicle access arrangements comprise ingress/egress connections to Gibbes Street/Wolseley Street and Pattys Place/Blaikie Road which are shared with the other bulky goods users.

LEGEND

N

SITE

FIG 2

Over **30** stores to choose with all the leading brands in **ONE** location

PENRITH HOMEMAKER CENTRE

SHOP NAME	PHONE :
17. Accent Blinds	4731 8440
23. Adairs	4733 1385
1. Anaconda	4733 0250
6. Baby Bunting	4733 0122
4. Beacon Lighting	4733 5922
26. Beds N Dreams	4737 9300
25. Bing Lee	4733 7502
16. Blue Haven Lifestyle	4733 4444
14. Carpet Call	4733 1699
20. Chemist Warehouse	4733 1838
15. Corningware, Corelle, Pyrex	4733 0366
24. Curtain Wonderland	4733 7800
19. Deco Rug	4737 8611
10. Early Settler	4733 0400
9. Fantastic Furniture	4733 2333
29. Frame Today	4733 3380
28. JB Hi-Fi	4733 0571
27 Kresta	4737 9046
13. Parrabey Gourmet Kitchen	4737 8303
3. Petbarn	4733 5930
7. Plush Sofas	4733 6682
12. Recline Furniture	TBC
5. Sleeping Giant	4737 9807
8. Snooze	4733 7911
11. Spotlight	4733 7407
2. Super Cheap Auto	4733 3322
18. New Store Coming soon	XXX
21. New Store Coming soon	XXX
22. The Interior Outlet	4733 1842

HARVEY NORMAN CENTRE

30. Bunnings	4737 5400
35. CB'S Cafe	4737 9777
36. Domayne	4737 5000
34. Floor Depot	4733 7360
33. Forty Winks	4733 0466
32. Harvey Norman	4737 5111
37. Harvey Norman Factory Outlet	4737 5000
38. Harvey Norman Lighting	4737 8960
39. Lincraft	4733 2800
31. New Store Coming Soon	XXX
40. Plus Fitness	4733 3222

Upstairs Centre Management · Stairs · Escalator/ Travelator · Lifts · Toilets · Parents Room · Telephone · Auto Teller · Underground Carpark · Bus Stop · Taxi Bay

2.2 PROPOSED ALTERATIONS AND ADDITIONS

The development scheme involves relocation and extension of the existing nursery/bagged goods elements to the southern side of the warehouse and relocation and extension of the trade area to the northern side with some minor reconfiguration of carparking and vehicle circulation arrangements.

The proposed development scheme comprises:

Warehouse	8,498 m^2
Trade Sales including Landscape/Building Materials	3,207 m^2
Nursery/Bagged Good	2,575 m^2
Total Retail Area	**14,280 m^2 (+ 2,448 m^2)**

A total of 195 parking spaces will be provided at grade (in the eastern frontage part of the site) and in the Timber Trade area retaining the existing vehicle access connections of:

* the ingress/egress driveways on Gibbes Street connecting to Wolseley Street
* the ingress/egress driveways on Pattys Place connecting to Blaikie Road

Details of the proposed development are provided on the plans prepared by Michael Carr Architects which accompany the Development Application and are reproduced in part in Appendix B.

3. ROAD NETWORK AND TRAFFIC CONTROLS

3.1 ROAD NETWORK

The road network serving the site (Figure 3) comprises:

* *Western Motorway* – a State Road and major arterial route linking between Sydney and the Blue Mountains crossing

* *Mulgoa Road/Castlereagh Road* – a State Road and arterial route linking between Penrith and Wallacia

* *Jamison Road/Tench Avenue* – a Regional Road (in part) and major collector road linking between Parker Street and Nepean River

* *Blaikie Road* – a minor collector route connecting between Mulgoa Road and Jamison Road

* *Pattys Place and Wolseley Road/Gibbes Street* – dead end local access roads connecting to Blaikie Road and Mulgoa Road respectively

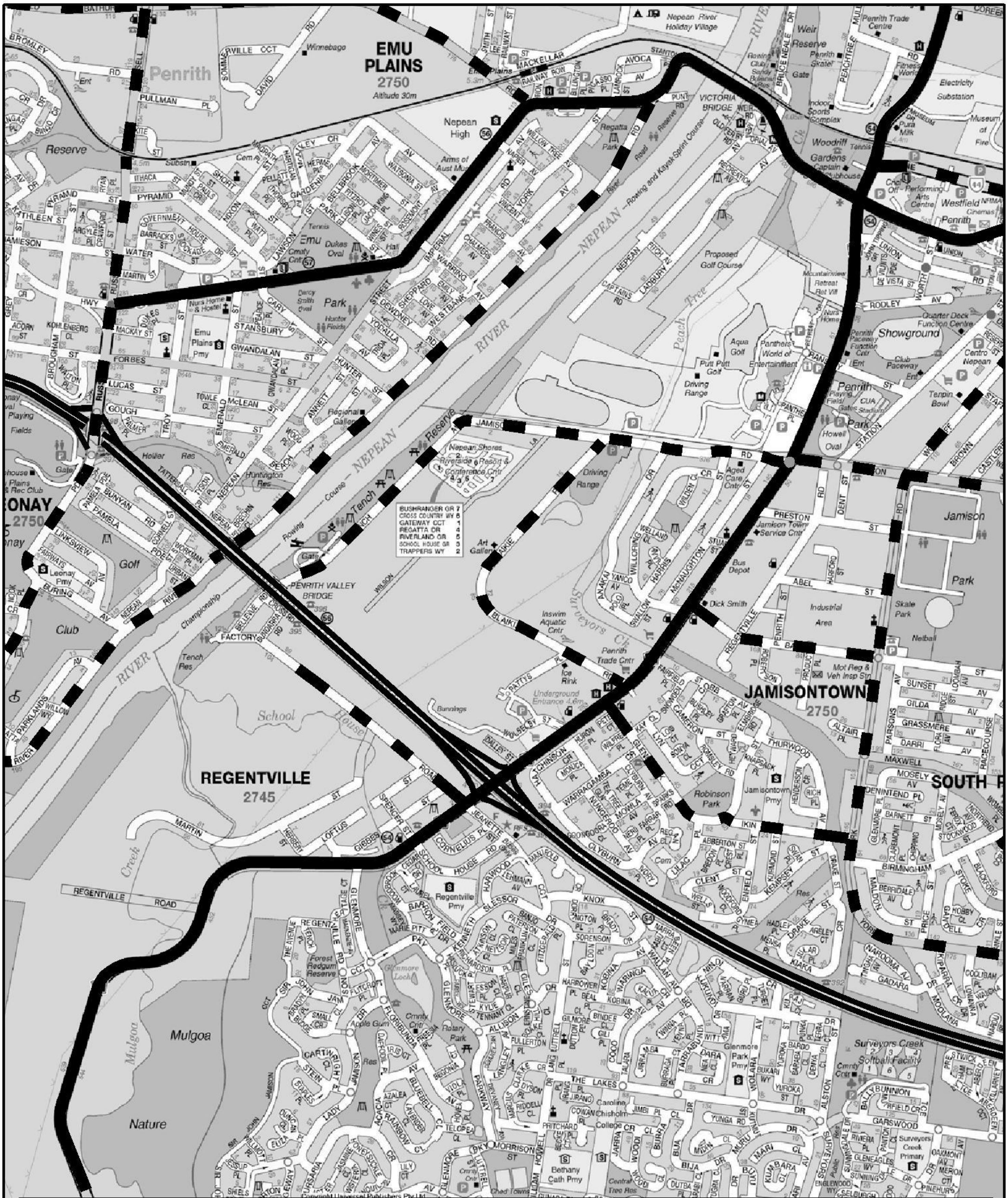
There is an underpass inbound right turn connection from Mulgoa Road to Wolseley Street for southbound vehicles.

3.2 TRAFFIC CONTROLS

The existing traffic controls in the vicinity of the site (Figure 4) comprise:

* the traffic signals at the Mulgoa Road/Wolseley Street and Mulgoa Road/Blaikie Road intersections (Details are provided in Appendix C.)

* the traffic signals along Mulgoa Road at the Motorway ON and OFF ramps, Glenbrook Street, Batt Street and Jamison Road intersections



Legend

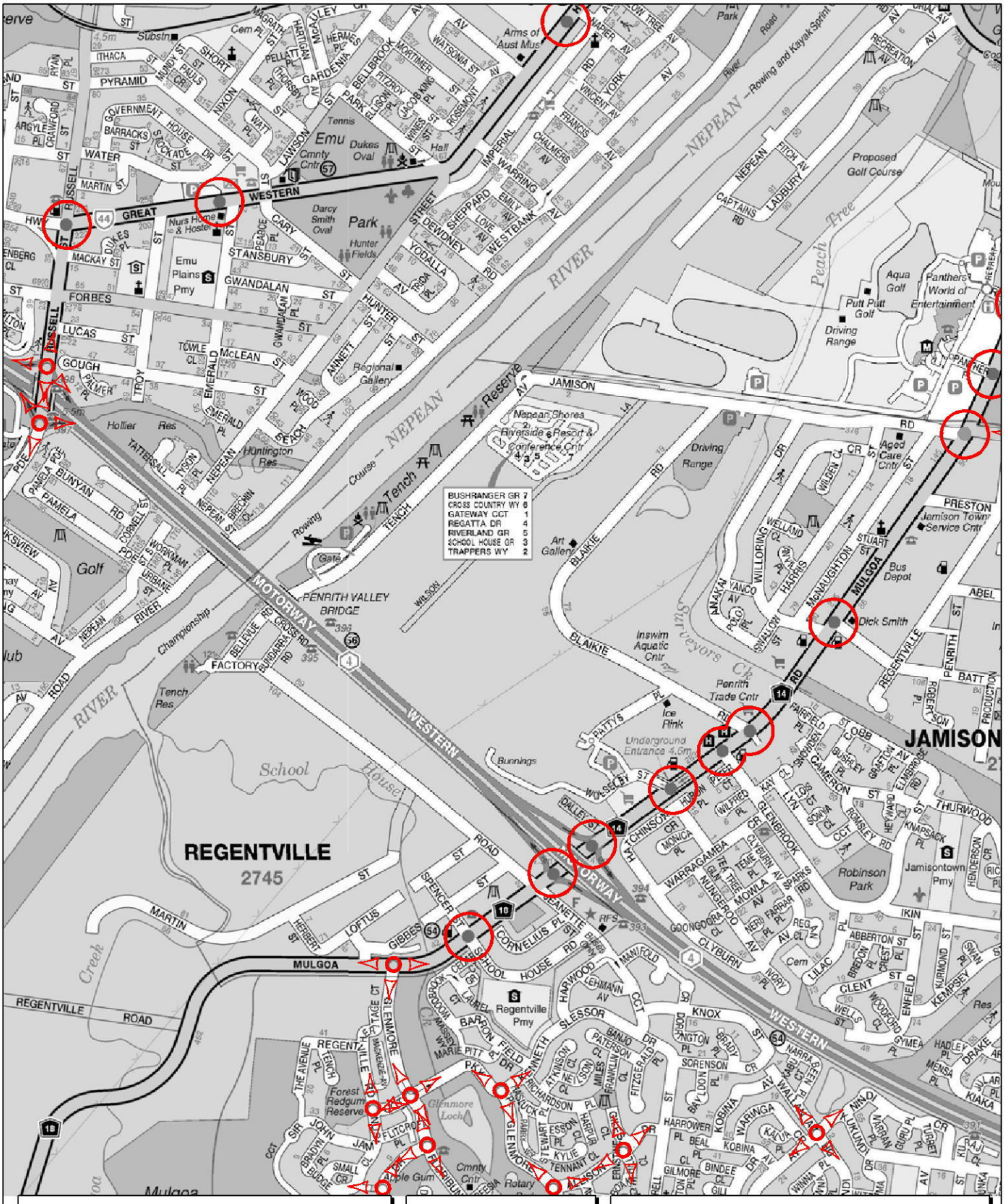
ARTERIAL

SUB-ARTERIAL

COLLECTOR

Road Network

FIG 3



LEGEND

- TRAFFIC SIGNAL CONTROL
- ROUNDABOUT
- RESTRICTED TURNING MOVEMENT

TRAFFIC CONTROLS

FIG 4

* the central median island along Mulgoa Road

* the 60 kmph speed restriction on Mulgoa Road and 50 kmph restriction on the local and collector roads

* the NO STOPPING restrictions along both sides of Mulgoa Road.

3.3 TRAFFIC CONDITIONS

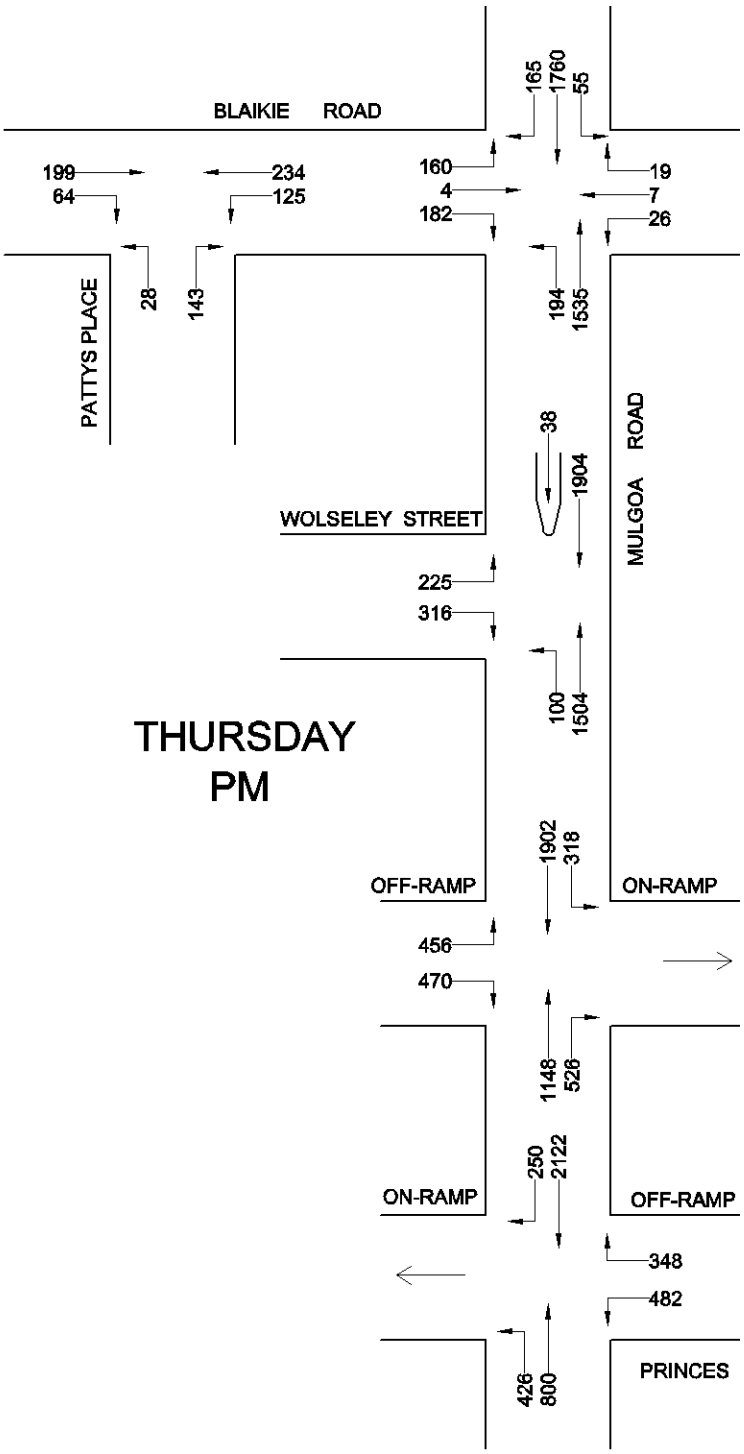
An indication of the prevailing traffic conditions on the road system serving the site is provided by data published by the RMS and other surveys. This data is expressed in terms of Annual Average Daily Traffic (AADT) and the most recently published volumes indicate:

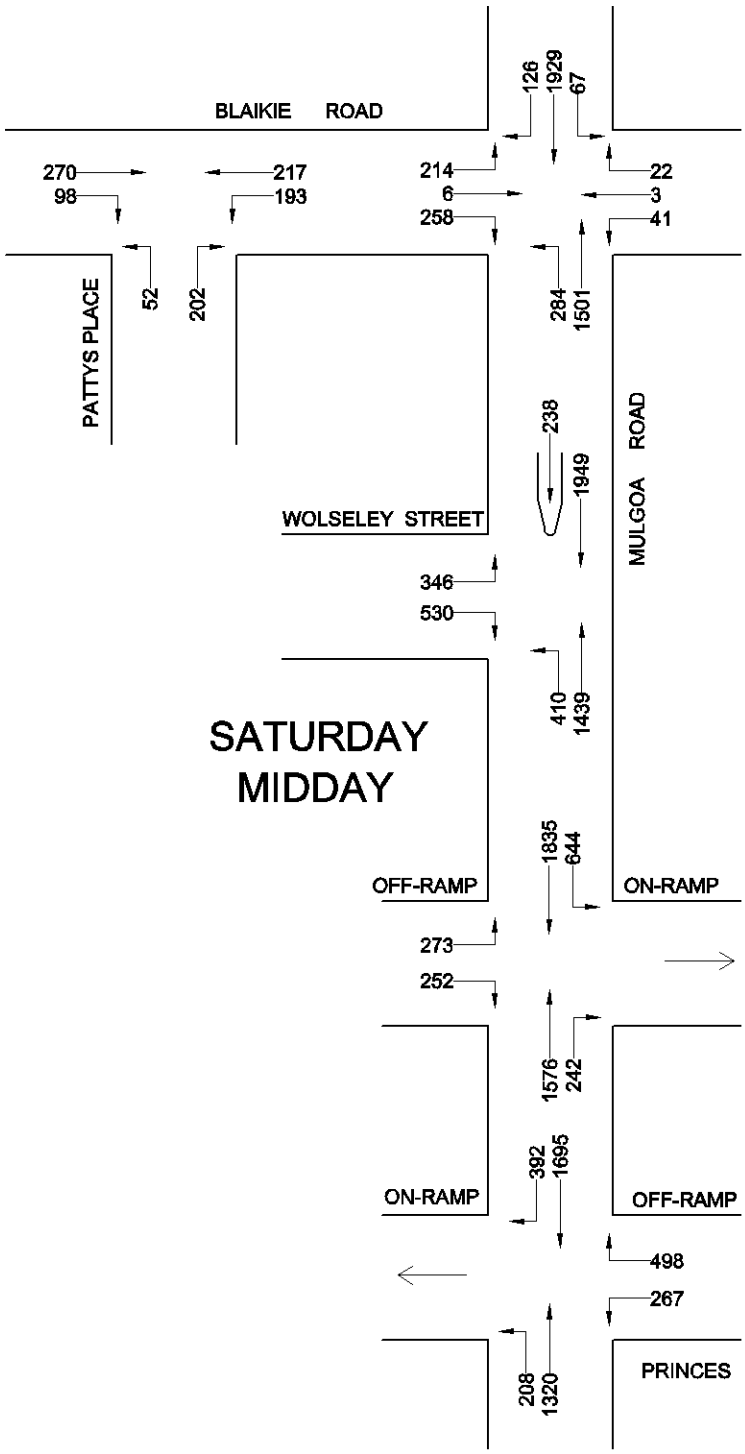
	AADT
Mulgoa Road, Jamisontown	38,266

Traffic surveys have been undertaken at a number of intersections in the area during the Thursday afternoon and Saturday midday peak periods. The results of these surveys are provided in Figure 5 and the operational performance of the Mulgoa Road/Wolseley Street and Mulgoa Road/Blaikie Street intersections has been assessed using SIDRA. The results of that assessment are provided in Appendix D and are summarized in the following while the criteria for interpreting SIDRA results is reproduced overleaf.

	WDPM			**WEMD**		
	LOS	**DS**	**AVD**	**LOS**	**DS**	**AVD**
Mulgoa/Wolseley	A	0.659	9.7	A	0.761	12.8
Mulgoa/Blaikie	A	0.714	7.9	A	0.793	11.1

The results indicate that satisfactory operational conditions, however observations indicate some congestion during the weekday afternoon periods at the Western Freeway ON/OFF Ramp intersections.





LEGEND

EXISTING PEAK TRAFFIC FLOWS

FIG 5

Criteria for Interpreting Results of SIDRA Analysis

1. *Level of Service (LOS)*

LOS	Traffic Signals and Roundabouts	Give Way and Stop Signs
'A'	Good	Good
'B'	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
'C'	Satisfactory	Satisfactory but accident study required
'D'	Operating near capacity	Near capacity and Accident Study required
'E'	At capacity; at signals incidents will cause excessive delays. Roundabouts require other control mode	At capacity and requires other control mode
'F'	Unsatisfactory and requires additional capacity	Unsatisfactory and requires other control mode

2. *Average Vehicle Delay (AVD)*

The AVD provides a measure of the operational performance of an intersection as indicated on the table below, which relates AVD to LOS. The AVD's listed in the table should be taken as a guide only as longer delays could be tolerated in some locations (ie inner city conditions) and on some roads (ie minor side street intersecting with a major arterial route).

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

3. *Degree of Saturation (DS)*

The DS is another measure of the operational performance of individual intersections.

For intersections controlled by **traffic signals**[1] both queue length and delay increase rapidly as DS approaches 1, and it is usual to attempt to keep DS to less than 0.9. Values of DS in the order of 0.7 generally represent satisfactory intersection operation. When DS exceeds 0.9 queues can be anticipated.

For intersections controlled by a **roundabout or GIVE WAY or STOP signs**, satisfactory intersection operation is indicated by a DS of 0.8 or less.

[1] *the values of DS for intersections under traffic signal control are only valid for cycle length of 120 secs*

3.4 TRANSPORT SERVICES

Local bus services are provided by Busways and there are bus stops on Mulgoa Road close to the site with:

- Route 781 connecting St Marys, Penrith and Orchard Hills providing a limited morning and afternoon peak period service on weekdays.
- Route 795 connecting Warragamba with Penrith providing some 10 services in each direction on weekdays and some four services in each direction on weekends.
- Route 797 connecting Glenmore Park with Penrith providing on a 60-minute service in each direction, Monday to Sunday, with more frequent services during weekday peak periods.

3.5 FUTURE CIRCUMSTANCES

Council has adopted the Riverlink Precinct Plan 2008 which identifies future development for lands west of Mulgoa Road, between the railway line, M4 Motorway and Nepean River. A planning proposal has since been lodged with Council for the Penrith Panthers site, which forms part of the Riverlink Precinct. The transport assessment for the Panthers planning proposal identifies an upgrade for Mulgoa Road to six lanes to accommodate future development and RMS has advised that the Mulgoa Road widening is being planned.

It is proposed to also undertake a number of intersections upgrades including the provision of a second lane for the right turn from Mulgoa Road to Blaikie Road. Details of the proposed road hierarchy and walking/cycling routes along with the assessed intersection performances (with development) are provided in Appendix E.

Another element of the future circumstances in the area is the recent approval given for redevelopment of the former Westbus depot site on Mulgoa Road north of Batt Street. This approval provides for a Masters Home Improvement Centre of some 13,500m^2 together with separate bulky goods tenancies of some 2,700m^2 involving a new traffic signal controlled access on Mulgoa Road.

4. TRAFFIC

It is not possible to isolate and survey the traffic generation of the existing Bunnings at Penrith due to the shared access and parking arrangements with the adjacent large bulky goods elements. However, comprehensive evidence in relation to Bunnings peak traffic generation rates is documented in the TTPA analysis provided in Appendix F indicating peak "trend line" rates of 2.4vtph on Thursday and 5.66vtph for Saturday for a Bunnings floor area of some 11,600m^2 (as existing).

Application of the rates to the existing floorspace indicate the following peak traffic generation:

Thursday PM	278 vtph
Saturday MD	656 vtph

The same "trend lines" indicate that:

* the peak traffic generation rates (per 100m^2) decrease as the floor area increases and this is a quite universal retail phenomena
* the peak traffic generation rates for a Bunnings of some 14,280m^2 (as proposed) are:

Thursday PM	**Saturday MD**
2.1 vtph / 100m^2	5.1 vtph / 100m^2

Application of these rates to the proposed floorspace indicates the following peak traffic generation outcomes:

	TOTAL	**IN**	**OUT**
Thursday PM	300 (+22)	150 (+11)	150 (+11)
Saturday MD	728 (+72)	355 (+36)	355 (+36)

A recent comprehensive study published by ARRB revealed pass-by/drop-in rates for Home Improvement Warehouse use of 27% for Thursday and 28% for Saturday (see Appendix F extract) while there is also a significant element of "dual use" visitation with the other bulky goods elements.

Putting aside the mitigating "passing trade" and "dual use" issues the additional traffic movements can be distributed in accordance with the existing recorded access movements for the bulky goods complex as follows:

	Wolseley Street	**Pattys Place**
Thursday PM	66%	34%
Saturday MD	50%	50%
	Additional Movements (vtph)	
Thursday PM		
RT IN	2	1
LT IN	5	3
RT OUT	4	3
LT OUT	3	1
Total:	**22 vt**	
Saturday MD		
RT IN	5	5
LT IN	14	14
RT OUT	10	10
LT OUT	7	7
Total:	**72 vt**	

It is quite apparent that these potential "worst case" minor additional traffic movements will have no perceptible impact on the access intersections. It is quite likely, in reality, that the additional floorspace (with the competition of the nearby new Masters) will counteract any additional traffic movements from the proposed additional floorspace.

5. PARKING

There is a total of more than 1,500 parking spaces provided in the various elements of this bulky goods precinct including some 193 spaces adjacent to the existing Bunnings and some 480 spaces adjoining to the south-east. Recent surveys have established the following peak parking utilisation in these areas:

	Thursday	**Saturday**
190 spaces	110	142
480 spaces	334	377

It is proposed to provide 195 parking spaces with the proposed changes and the total provision will include 6 disabled driver bays and 2 trailer bays. It is apparent that the proposed parking provision will be quite suitable and appropriate particularly given the flexibility available with the other parking spaces available with the BG's complex.

6. ACCESS, INTERNAL CIRCULATION AND SERVICING

ACCESS

The vehicle access provisions for the revised Bunnings will comprise:

* the existing shared ingress and egress driveways on Gibbes Street for carpark access

* the existing shared ingress and egress driveways on Patty Place for carpark and service vehicle access

The access provisions comply with the requirements of AS 2890.1 and 2 and will accommodate all vehicles requiring to access the site.

INTERNAL CIRCULATION

The carpark areas are designed to accord to the design requirements of AS 2890.1 and 6 with generous parking bay and aisle provisions and a flexible two-way circulation arrangement will be available throughout the carpark and a ONE-WAY system through the Timber Trade element.

SERVICING

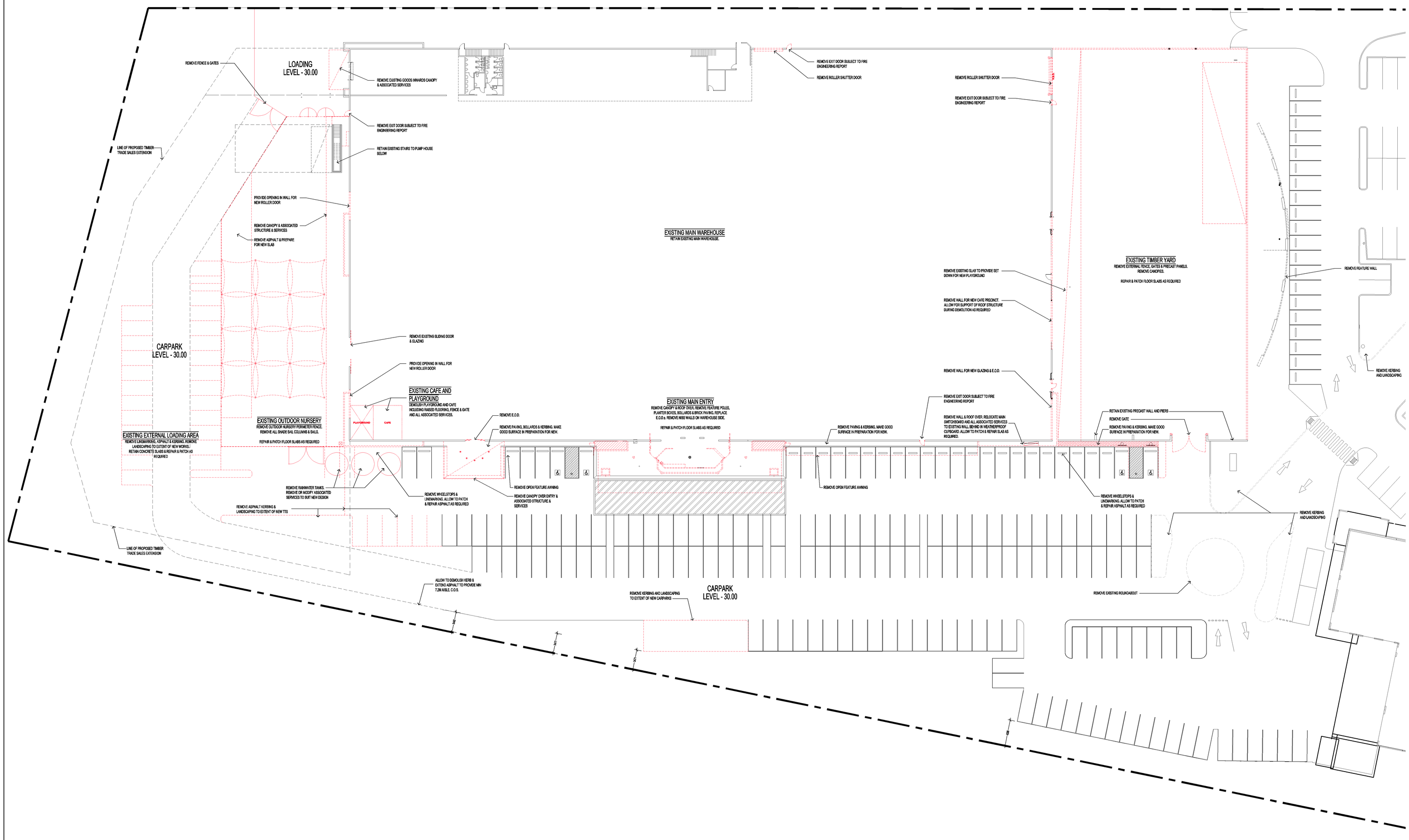
The Bunnings delivery and service vehicles will ingress and egress on Pattys Place. The Bunnings delivery vehicles will be semi-trailers (AV) and HRV's with some MRV's and vans. Details of the turning path implications of the movements of the AV vehicles are provided in Appendix G indicating a satisfactory provision for access and circulation.

7. CONCLUSION

It is proposed to undertake alterations and additions at the Bunnings warehouse development at Penrith which has convenient controlled access to the arterial road system. This assessment has concluded that the design of the development in terms of vehicle access, circulation, parking and servicing will be appropriate and that there will not be any adverse traffic impacts on the road system serving the site.

Appendix A

PLANS OF EXISTING



EXISTING & DEMOLITION: SITE PLAN
SCALE 1:250

DATE	REV	AMENDMENT	BY
22.23.15	P3	PRELIMINARY ISSUE	CG
26.02.15	P2	PRELIMINARY ISSUE	CG
23.02.15	P1	PRELIMINARY ISSUE	CG

PLANNING ISSUE

CONTRACTOR TO CHECK ALL DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK OR PREPARING ANY SHOP DRAWINGS.

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CLIENT
BUNNINGS warehouse

FOR TOWN PLANNING PURPOSES ONLY

PROJECT
BUNNINGS WAREHOUSE PENRITH
301-335 MULGOA ROAD
JAMISONTOWN NSW 2750

DRAWING TITLE
EXISTING/DEMOLITION PLAN

SCALE	AS SHOWN @ A0
DATE	FEBRUARY 2015
FILE	
DESIGNED	
DRAWN	CG
CHECKED	
PROJECT No.	13054
VERIFICATION	THIS DRAWING HAS BEEN REVIEWED & VERFIED BY
DRAWING No.	TP-02
REVISION	P3

Appendix B

DEVELOPMENT PLANS

PROPOSED SITE PLAN
SCALE 1:250

AREA ANALYSIS			
	EXISTING	PROPOSED	DIFFERENCE
MAIN WAREHOUSE	7783m²	7783m²	0m²
MAIN ENTRY	60m²	81m²	21m²
WAREHOUSE AREA	7843m²	7864m²	21m²
OUTDOOR NURSERY	947m²	1259m²	312m²
OUTDOOR BAGGED GOODS CANOPY (NURSERY)	231m²	1325m²	1094m²
TOTAL NURSERY AREA	1178m²	2584m²	1406m²
TIMBER TRADE SALES	2298m²	2016m²	-282m²
BUILDING MATERIALS AND LANDSCAPE YARD	0m²	1191m²	1191m²
BULK TRADE AREA	0m²	0m²	0m²
BULK TRADE STAGING AREA	0m²	0m²	0m²
TOTAL TIMBER TRADE AREA	2298m²	3207m²	909m²
TOTAL RETAIL AREA	10959m²	13655m²	2696m²
GOODS INWARDS CANOPY	231m²	182m²	-49m²
MEZZANINE OFFICES	450m²	121m²	-329m²
TOTAL AREA	11640m²	13958m²	2318m²
STANDARD CARPARKS (WITHIN SCOPE OF WORKS)	189	187	-2
DISABLED BAYS, 1:50 MIN	4	6	2
TRAILER BAYS	0	2	2
TOTAL SITE CARPARKS	193	195	2
TROLLEY BAYS	3	5	2

DATE	REV	AMENDMENT	BY
15.04.15	P10	PRELIMINARY ISSUE	AZ
13.04.15	P9	PRELIMINARY ISSUE	AZ
07.04.15	P8	PRELIMINARY ISSUE	MD
02.04.15	P7	PRELIMINARY ISSUE	MD
31.03.15	P6	PRELIMINARY ISSUE	TV
30.03.15	P5	PRELIMINARY ISSUE	MD
11.03.15	P4	PRELIMINARY ISSUE	CG
02.03.15	P3	PRELIMINARY ISSUE	CG
26.02.15	P2	PRELIMINARY ISSUE	CG
23.02.15	P1	PRELIMINARY ISSUE	CG

PLANNING ISSUE

CONTRACTOR TO CHECK ALL DIMENSIONS ON SITE BEFORE COMMENCING ANY WORK OR PREPARING ANY SHOP DRAWINGS

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CLIENT
BUNNINGS warehouse

FOR TOWN PLANNING PURPOSES ONLY

PROJECT
BUNNINGS WAREHOUSE PENRITH
301-335 MULGOA ROAD
JAMISONTOWN NSW 2750

DRAWING TITLE
PROPOSED SITE PLAN

SCALE AS SHOWN @ A0
DATE FEBRUARY 2015
FILE
DESIGNED
DRAWN CG
CHECKED

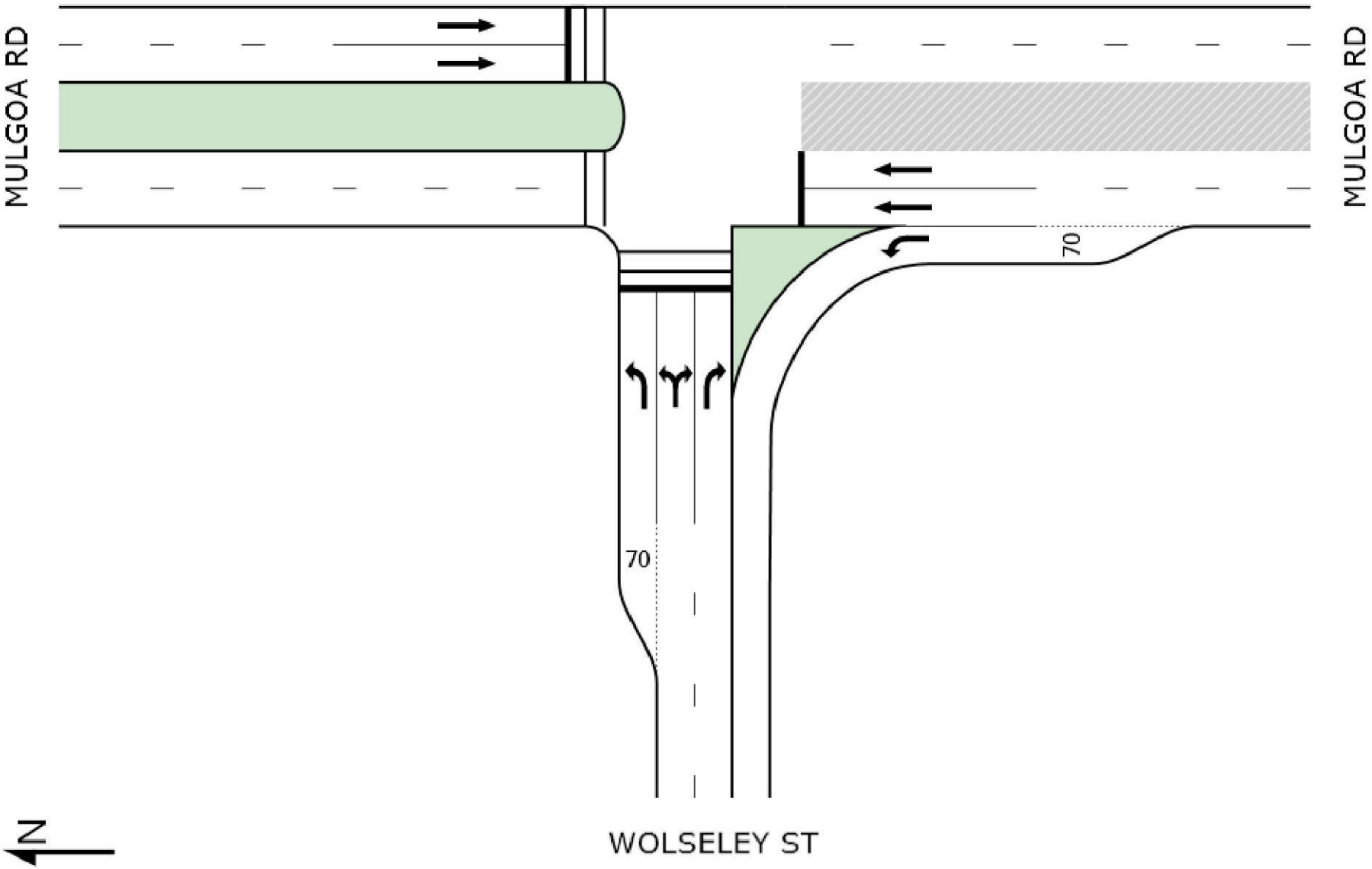
PROJECT No. 13054
VERIFICATION THIS DRAWING HAS BEEN REVIEWED & VERIFIED BY
DRAWING No. TP-03
REVISION P10

Appendix C

INTERSECTION DETAILS

Appendix D

SIDRA RESULTS



MOVEMENT SUMMARY

Site: WOLSELEY ST PM EX

Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: MULGOA RD											
1	L	100	2.0	0.055	9.5	X	X	X	X	0.65	54.6
2	T	1504	2.0	0.521	1.3	LOS A	4.3	30.3	0.11	0.10	66.5
Approach		1604	2.0	0.521	1.8	LOS A	4.3	30.3	0.10	0.13	65.6
North: MULGOA RD											
8	T	1904	2.0	0.659	1.6	LOS A	7.3	52.0	0.15	0.14	65.7
Approach		1904	2.0	0.659	1.6	LOS A	7.3	52.0	0.15	0.14	65.7
West: WOLSELEY ST											
10	L	225	2.0	0.657	61.8	LOS E	10.3	73.2	0.99	0.83	22.2
12	R	316	2.0	0.657	61.7	LOS E	10.3	73.2	0.99	0.83	22.2
Approach		541	2.0	0.657	61.7	LOS E	10.3	73.2	0.99	0.83	22.2
All Vehicles		4049	2.0	0.659	9.7	LOS A	10.3	73.2	0.24	0.23	52.7

X: Not applicable for Continuous movement.

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P5	Across N approach	53	46.8	LOS E	0.2	0.2	0.88	0.88
P6	Across N approach	53	46.8	LOS E	0.2	0.2	0.88	0.88
P7	Across W approach	53	6.7	LOS A	0.1	0.1	0.33	0.33
All Pedestrians		159	33.4	LOS D			0.70	0.70

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: WOLSELEY ST SAT EX

Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: MULGOA RD											
1	L	410	2.0	0.224	9.5	X	X	X	X	0.65	54.6
2	T	1439	2.0	0.561	1.7	LOS A	4.4	31.5	0.12	0.11	65.7
Approach		1849	2.0	0.561	3.4	LOS A	4.4	31.5	0.09	0.23	62.9
North: MULGOA RD											
8	T	1949	2.0	0.759	2.1	LOS A	10.1	71.6	0.20	0.18	64.3
Approach		1949	2.0	0.759	2.1	LOS A	10.1	71.6	0.20	0.18	64.3
West: WOLSELEY ST											
10	L	346	2.0	0.761	56.0	LOS D	18.5	131.9	0.95	0.87	23.6
12	R	530	2.0	0.761	56.9	LOS E	18.5	131.9	0.99	0.88	23.4
Approach		876	2.0	0.761	56.6	LOS E	18.5	131.9	0.98	0.88	23.5
All Vehicles		4674	2.0	0.761	12.8	LOS A	18.5	131.9	0.30	0.33	48.8

X: Not applicable for Continuous movement.

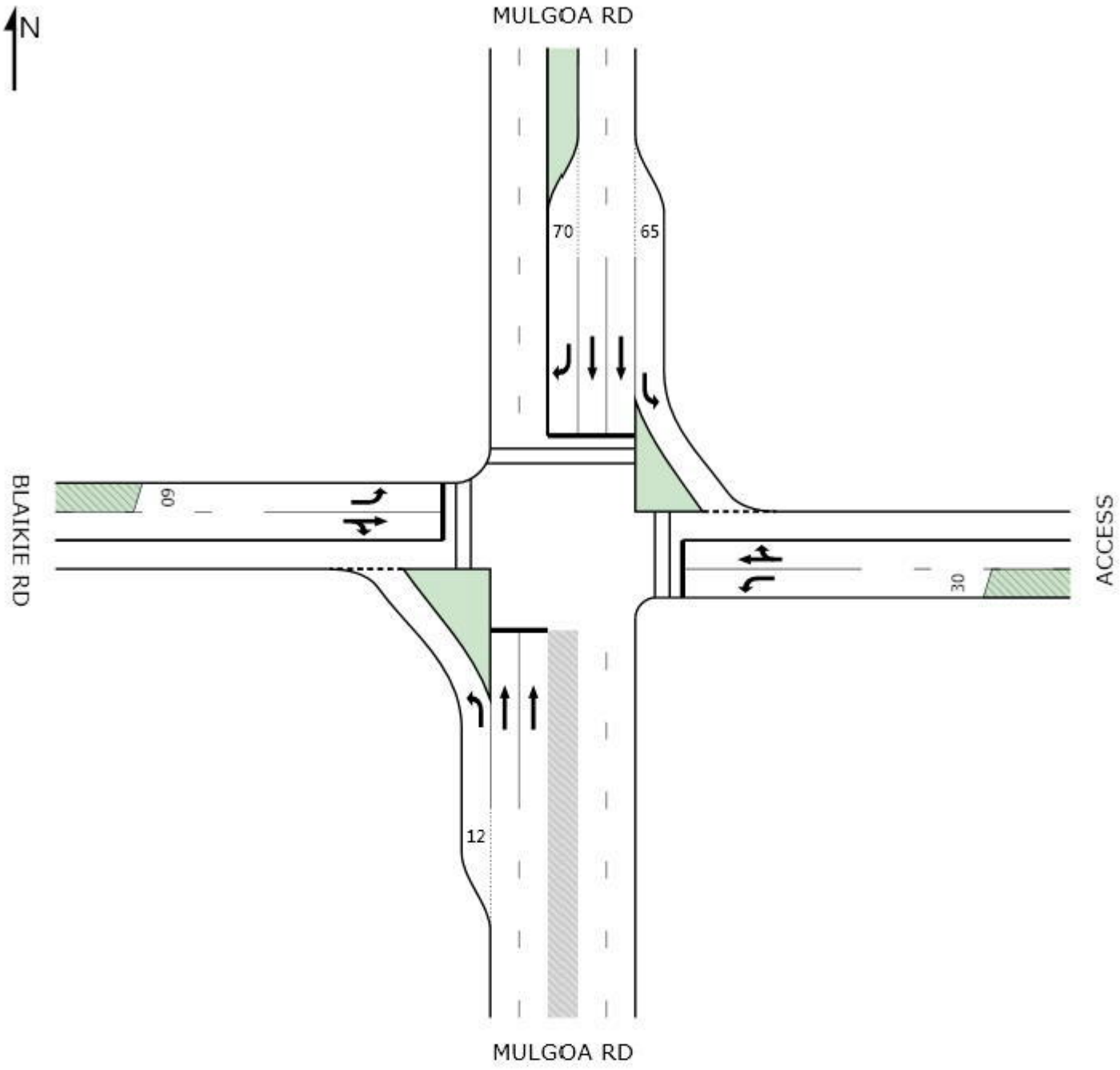
Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P5	Across N approach	53	38.4	LOS D	0.1	0.1	0.80	0.80
P6	Across N approach	53	38.4	LOS D	0.1	0.1	0.80	0.80
P7	Across W approach	53	10.4	LOS B	0.1	0.1	0.42	0.42
All Pedestrians		159	29.1	LOS C			0.67	0.67

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA INTERSECTION



MOVEMENT SUMMARY

Site: BLAIKIE RD PM EX

Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: MULGOA RD											
1	L	194	2.0	0.244	9.8	LOS A	0.3	2.3	0.12	0.67	53.9
2	T	1535	2.0	0.714	3.2	LOS A	9.1	65.1	0.22	0.20	62.2
Approach		1729	2.0	0.714	4.0	LOS A	9.1	65.1	0.21	0.26	61.1
East: ACCESS											
4	L	26	2.0	0.195	52.0	LOS D	1.3	9.0	0.86	0.71	24.7
5	T	7	2.0	0.098	44.4	LOS D	1.3	9.1	0.86	0.64	25.2
6	R	19	2.0	0.098	52.5	LOS D	1.3	9.1	0.86	0.74	24.8
Approach		52	2.0	0.195	51.2	LOS D	1.3	9.1	0.86	0.71	24.8
North: MULGOA RD											
7	L	55	2.0	0.044	8.0	LOS A	0.2	1.2	0.11	0.62	49.2
8	T	1760	2.0	0.638	1.7	LOS A	6.4	45.6	0.14	0.13	65.6
9	R	165	2.0	0.487	12.5	LOS A	1.4	10.1	0.15	0.74	50.8
Approach		1980	2.0	0.638	2.7	LOS A	6.4	45.6	0.14	0.19	63.5
West: BLAIKIE RD											
10	L	160	2.0	0.533	38.7	LOS C	6.7	47.8	0.76	0.78	29.0
11	T	4	2.0	0.704	52.4	LOS D	10.8	76.7	0.99	0.85	22.6
12	R	182	2.0	0.704	60.6	LOS E	10.8	76.7	0.99	0.86	22.5
Approach		346	2.0	0.704	50.4	LOS D	10.8	76.7	0.89	0.82	25.1
All Vehicles		4107	2.0	0.714	7.9	LOS A	10.8	76.7	0.24	0.28	54.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P3	Across E approach	53	54.2	LOS E	0.2	0.2	0.95	0.95
P5	Across N approach	53	51.3	LOS E	0.2	0.2	0.93	0.93
P7	Across W approach	53	15.0	LOS B	0.1	0.1	0.50	0.50
All Pedestrians		159	40.2	LOS E			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: BLAIKIE RD SAT EX

Signals - Fixed Time Cycle Time = 120 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: MULGOA RD											
1	L	284	2.0	0.338	10.0	LOS A	0.5	3.7	0.19	0.69	53.5
2	T	1501	2.0	0.780	8.7	LOS A	20.7	147.1	0.51	0.47	52.8
Approach		1785	2.0	0.780	8.9	LOS A	20.7	147.1	0.46	0.50	52.9
East: ACCESS											
4	L	41	2.0	0.286	46.1	LOS D	1.9	13.2	0.81	0.73	26.4
5	T	3	2.0	0.079	38.1	LOS C	1.1	8.1	0.80	0.60	27.2
6	R	22	2.0	0.079	46.2	LOS D	1.1	8.1	0.80	0.73	26.6
Approach		66	2.0	0.286	45.7	LOS D	1.9	13.2	0.81	0.72	26.5
North: MULGOA RD											
7	L	67	2.0	0.054	8.0	LOS A	0.2	1.5	0.11	0.62	49.2
8	T	1929	2.0	0.761	2.2	LOS A	10.0	71.3	0.20	0.18	64.2
9	R	126	2.0	0.419	18.4	LOS B	2.3	16.4	0.32	0.77	44.8
Approach		2122	2.0	0.761	3.3	LOS A	10.0	71.3	0.20	0.23	62.1
West: BLAIKIE RD											
10	L	214	2.0	0.658	34.7	LOS C	8.5	60.6	0.72	0.79	30.7
11	T	6	2.0	0.793	52.2	LOS D	15.9	112.9	1.00	0.91	22.6
12	R	258	2.0	0.793	60.5	LOS E	15.9	112.9	1.00	0.91	22.5
Approach		478	2.0	0.793	48.8	LOS D	15.9	112.9	0.88	0.86	25.6
All Vehicles		4451	2.0	0.793	11.1	LOS A	20.7	147.1	0.39	0.42	50.3

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P3	Across E approach	53	54.2	LOS E	0.2	0.2	0.95	0.95
P5	Across N approach	53	45.1	LOS E	0.2	0.2	0.87	0.87
P7	Across W approach	53	18.7	LOS B	0.1	0.1	0.56	0.56
All Pedestrians		159	39.3	LOS D			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SIDRA INTERSECTION

Appendix E

RIVERLINK PRECINCT STUDY EXTRACTS

1:12,000

240 120 0 240 Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

Legend

- Riverlink Boundary
- Highways
- Arterial Roads
- Collector Roads
- Local Roads
- Railways

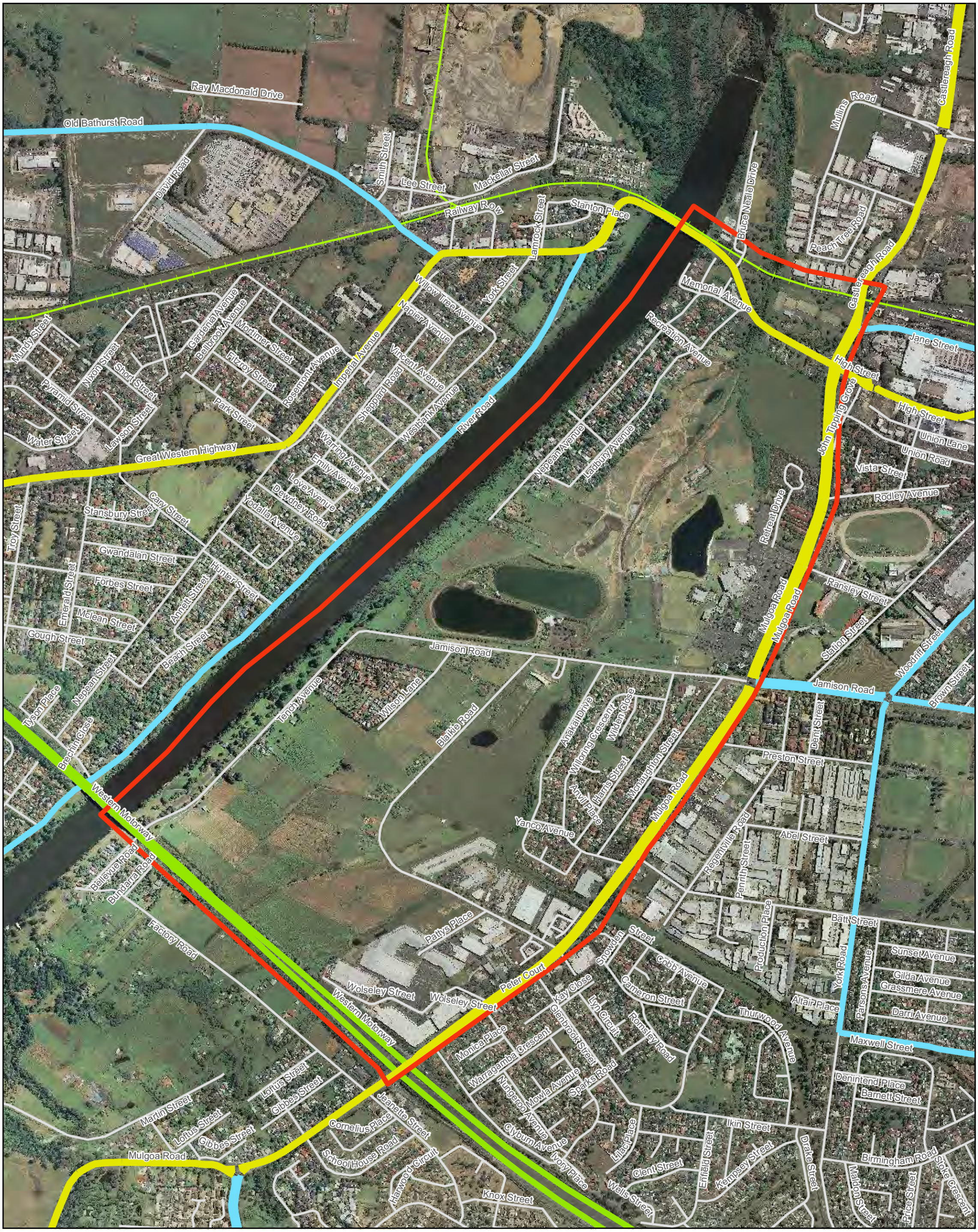
Penrith City Council
Riverlink Study

Job Number	21-18430
Revision	A
Date	30 MAY 2009

Riverlink Precinct Locality Plan

Figure 1

10 Bond Street Sydney NSW 2000 Australia T 61 2 9239 7000 F 61 2 9239 7199 E sydmail@ghd.com.au W www.ghd.com.au



1:12,000

240 120 0 240 Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

Legend

- Riverlink Boundary
- Highways
- Arterial Roads
- Collector Roads
- Local Roads
- Railways

Penrith City Council
Riverlink Study

Job Number 21-18430
Revision A
Date 30 MAY 2009

Riverlink Precinct Locality Plan

Figure 1

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10 Bond Street Sydney NSW 2000 Australia **T** 61 2 9239 7000 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

Old Bathurst Road
Smith Street
Railway Street
Lee Street
Mackellar Street
Railway Row
Stanton Place
Lamrock Street
Punt Road
David Road
Bruce Neale Drive
Mullins Road
Peach Tree Road
Memorial Avenue
Castlereagh Road
Mcauley Crescent
Gardenia Avenue
Bellbrook Avenue
Mortimer Street
Fitzroy Street
Rosemont Avenue
Willow Tree Avenue
York Street
Napier Avenue
Great Western Highway
Imperial Avenue
Vincent Avenue
Sheppard Road
Westbank Avenue
River Road
Recreation Avenue
Nixon Street
Short Street
Pyramid Street
Park Street
Warring Avenue
Emily Avenue
Love Avenue
Dewdney Road
Yodalla Avenue
Nepean Avenue
Ladbury Avenue
Mulgoa Road
Union Road
Rodley Avenue
Retreat Drive
Emerald Street
Stansbury Street
Cary Street
Gwandalan Street
Forbes Street
Hunter Street
Annett Street
Mclean Street
Gough Street
Beach Street
Nepean Street
Ransley Street
Station Street
Jamison Road
Tench Avenue
Wilson Lane
Blaikie Road
Anakai Drive
Willoring Crescent
Wilden Close
Harris Street
Mcnaughton Street
Regentville Road
Dent Street
Preston Street
Anvil Place
Yanco Avenue
Swallow Street
Abel Street
Penrith Street
Batt Street
Production Place
Western Motorway
Bellevue Road
Bundarra Road
Factory Road
Pattys Place
Snowden Street
Cobb Avenue
Cameron Street
Romsley Road
York Road
Parsons Avenue
Altair Place
Maxwell Street
Wolseley Street
Peter Court
Kay Close
Wilfred Place
Glenbrook Street
Lyn Circuit
Thurwood Avenue
Hatchinson Crescent
Monica Place
Warragamba Crescent
Teme Place
Sparks Road
Farrar Place
Nungeroo Avenue
Denintend Place
Glenmore Place
Loftus Street
Gibbes Street
Martin Street
Jeanette Street
Cornelius Place
Clyburn Avenue
Lilac Place
Abberton Street
Ikin Street

1:10,000

140 70 0 140 Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

Legend

- Highways
- Arterial Roads
- Sub Arterial Roads
- Collector Roads
- Local Roads

Penrith City Council
Riverlink Study

Job Number	21-18430
Revision	B
Date	29 MAY 2009

Proposed Riverlink Precinct Road Network Hierarchy

Figure 21

G:\21\18430\CADD\GIS\MapDocuments\28052009\22NewZ010_Penrith_Street Map.mxd

10 Bond Street Sydney NSW 2000 Australia **T** 61 2 9239 7000 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

1:10,000

190 95 0 190 Metres

Map Projection: Transverse Mercator
Horizontal Datum: Geocentric Datum of Australia (GDA)
Grid: Map Grid of Australia 1994, Zone 56

N

Legend

Proposed Links

- Panthers Riverlink
- Proposed Pedestrian/Bicycle Bridge
- Proposed Shared Path
- Proposed Cycle path
- Proposed Road

Penrith City Council
Riverlink Study

Job Number	21-18430
Revision	A
Date	14 MAY 2009

Proposed Walking and Cycling Routes

Figure 23

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10 Bond Street Sydney NSW 2000 Australia **T** 61 2 9239 7000 **F** 61 2 9239 7199 **E** sydmail@ghd.com.au **W** www.ghd.com.au

The proposed treatments, outlined in Table 18 afford increased green time to the through movements along Mulgoa Road while improving the throughput of highlighted critical movements to and from the side streets.

Sensitivity models were tested, at a micro level, utilising the Intanal program, and reported significant degradation of a number of intersections on Mulgoa Road when run with a modelled increase of 10% in through traffic volumes along the corridor.

The Year 2031 model, with a 9% increase in the development vehicle generation from the Riverlink Precinct, suggests widening of Mulgoa Road to six (6) lanes will be necessary.

9.3 Intersection Upgrades

The results of the modelling process revealed that intersection upgrades are necessary to provide additional capacity for the future traffic levels regardless of planned density of the future development of the Riverlink precinct. Proposed intersection treatments to improve operational performance for the intersections are given as follows:

- Mulgoa Road/Jamison Road – optimised traffic signal settings;
- Mulgoa Road/ Blaikie Road – dual right turn from Blaikie Road; and
- Mulgoa Road/Glenbrook Street – left turn slip lane in Mulgoa.

The proposed intersection treatments were modelled for 2026 traffic conditions and the results are shown in Table 25.

Table 25 Future Year 2026 Intersection Performance, with Mitigation

Intersection	AM Peak			PM Peak		
	DS	AVD	LOS	DS	AVD	LOS
Great Western Highway/Riverlink Access	0.3	13	A	0.52	17	B
Mulgoa Road / Union Road	0.14	0	A	0.12	0	A
Mulgoa Road / Ransley Street	0.85	21	B	0.78	20	B
Mulgoa Road / Panthers	0.86	19	B	0.5	11	A
Mulgoa Road / Jamison Road	0.87	36	C	0.8	31	C
Mulgoa Road / Blaikie Road	0.82	12	A	0.72	10	A
Mulgoa Road / Glenbrook Street	0.9	29	C	0.93	38	C
Mulgoa Road / Wolseley Street	0.78	27	C	0.88	35	C

Appendix F

BUNNINGS TRAFFIC CHARACTERISTICS

TRANSPORT AND TRAFFIC PLANNING ASSOCIATES

A division of Monvale Pty Ltd ACN 060 653 125
ABN 44 060 653 125

December 2014 (Issue G)
Ref: 120/2013

BUNNINGS TRAFFIC GENERATION

ROAR Data was engaged to undertake traffic generation surveys at recently constructed large format Bunnings sites in the Sydney Metropolitan Area. These surveys were completed in August 2013 in unusually sunny and warm weather essentially representing an "early spring" seasonal circumstance and the results are appended. ROAR Data has also recently undertaken similar surveys at Parramatta, Wollongong and Rydalmere in NSW as well as Oxenford and North Lakes sites in the Brisbane Metropolitan Area.

Other survey data for existing Bunnings is provided by the results of the RMS Study, a study by the Traffix Group (Mornington and Thomastown in Victoria) and surveys by Austraffic in S.A. These examples provide an escalating scale of floor areas as indicated in the following together with the "peak traffic generation" and "generation rate per 100m^2" for each of the locations.

		Thursday		Saturday	
		vtph	vtph/100m^2	vtph	vtph/100m^2
Balgowlah	8,106m^2	237	2.92	444	5.48
Parramatta (RMS)	9,800m^2	247	2.52	514	5.24
Nowra (RMS)	9,948m^2	198	1.99	447	4.49
Wollongong	10,619m^2	260	2.45	550	5.18
Noarlunga (SA)	11,365m^2	321	2.82	643	5.66
Chatswood	11,443m^2	267	2.33	605	5.28
Minchinbury (RMS)	11,915m^2	338	2.84	754	6.33
Mornington (VIC)	13,369m^2	248	1.86	682	5.10
Bankstown (RMS)	*15,853m^2	289	1.82	805	5.08
Thomastown (VIC)	15,851m^2	282	1.78	778	4.91
Woodville (SA)	16,364m^2	333	2.03	800	4.89
Rydalmere	16,732m^2	281	1.68	569	3.40
Oxenford (QLD)	16,763m^2	302	1.80	819	4.89
Castle Hill	18,860m^2	314	1.66	900	4.77
North Lakes (QLD)	19,340m^2	180	0.93	482	2.50

☐ *Variation to 'trend' (outlying)* * *RMS incorrectly adopts 14,111m^2*

Suite 502 Level 5 282 Victoria Avenue PO Box 1160 Chatswood NSW 2067 ph (02) 9411 5660 Fax (02) 9904 6622
Email ttpa@ttpa.com.au

These results (see attached graph deleting the 'outlying' results) evidences the very clear characteristic that the traffic generation rate per 100m^2 reduces as the floor area increases and the 'consistency' of the results, particularly being from a number of sources, gives a high level of confidence to this traffic generation characteristic. The RMS Minchinbury site was surveyed in 2009 and it is stated in the RMS study that it overtraded significantly due to absence of any competition in its catchment. The RMS Bankstown site stated an incorrect floorspace (14,111m^2) which has been revised in this document. The recent survey of the North Lakes site reveals that it currently trades very poorly largely due to the difficult accessibility circumstances although this is expected to improve as further development occurs in the catchment.

ARRB has published the results of a study which established "drop in trips" (passing trade) for large format hardware outlet indicating 27% on a weekday afternoon and 28% for Saturday. An extract from this paper is appended.

BUNNINGS PARKING DEMAND

The onsite parking demands were only recorded in the Saturday surveys (ROAR and RMS) as this represents the peak parking demand circumstance. The results of those surveys are as follows:

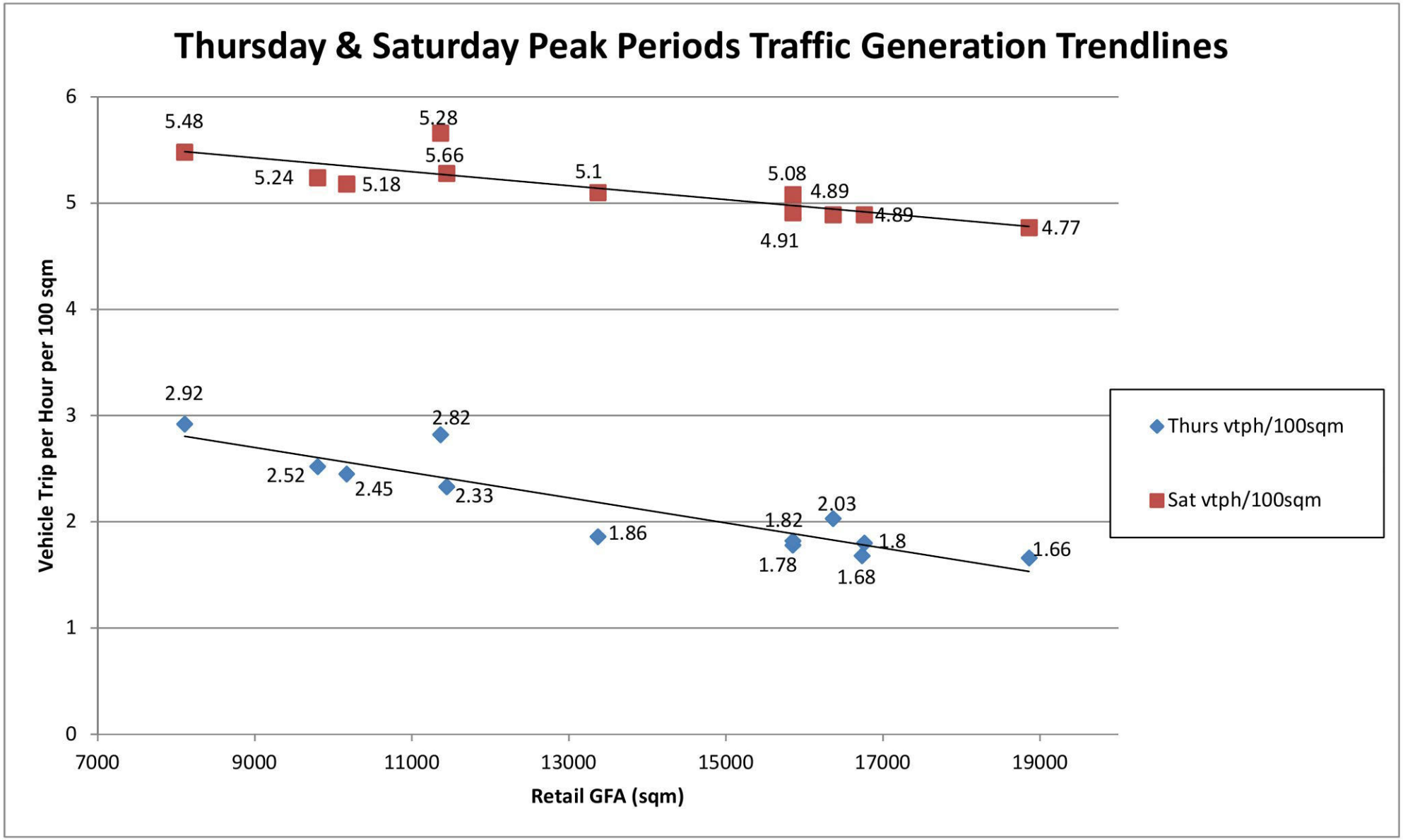
		Peak Parking	**Cars per m^2**
Balgowlah	8,106m^2	163 cars	1 space per 50m^2
Parramatta	9,800m^2	196 cars	1 space per 50m^2
Chatswood	11,443m^2	234 cars	1 space per 49m^2
Bankstown	15,853m^2	285 cars	1 space per 55.6m^2
Castle Hill	18,860m^2	397 cars	1 space per 48m^2

The attached TTM data for 15 surveys in Queensland supports this contention with the 1 exception of Stafford which, as with Minchinbury in NSW, overtrades significantly.

It is apparent that the peak parking demand for Bunnings is some 1 space per 50m^2 or less and the characteristic that Castle Hill retains a consistent parking demand (but lower traffic generation) reflects the longer stay pattern at the larger floor space Bunnings.

Yours faithfully

Ross Nettle
Director
Transport and Traffic Planning Associates



ARRB EXTRACT

SUPERMARKET AND HOME IMPROVEMENT RESULTS COMPARED

The lack of data pertaining to the trip type proportion estimates for non-supermarket large-format retail developments has meant that it is common practice to apply supermarket trip type proportions to other forms of large-format retail.

The surveys undertaken at the supermarket and home improvement warehouse reveal similar proportions for primary, pass-by and link diverted trips as can be seen in Figure 10. However, despite this similarity, there is not enough evidence to confidently say that these activities should be treated as one general large-format retail activity.

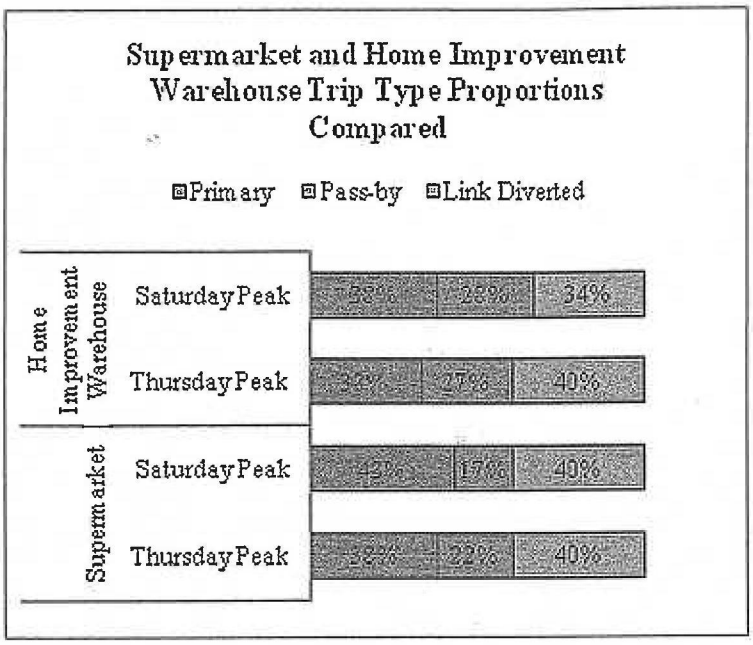


Figure 10: Surveyed trip type proportions for the supermarket and home improvement warehouse compared

CONCLUSIONS AND RECOMMENDATIONS

Given the results of the surveys, it is concluded that a higher proportion of pass-by and link diverted trips are generated by supermarket and home improvement warehouse developments than previously assumed in industry. This means that the effect of the developments surveyed on the surrounding road network is likely to be less than was estimated in the individual traffic impact assessments.

It is also concluded that through the comparison of the measured data to the international trip type proportion data, it is inappropriate to apply the supermarket proportion estimates of ITE (1991, 2008) and TRICS (1995) to a New Zealand based supermarket development. This would likely lead to an overestimate of primary trips.

The recommended trip type proportions for future supermarket developments in urban New Zealand for the Thursday evening and Saturday midday peak hour periods are outlined in Table 8 below.

Table 8: Recommended trip type proportions for supermarket developments

	Primary	Pass-by	Link diverted
Thursday PM Peak	35-45%	20-25%	40%
Saturday Midday Peak	40-50%	10-20%	40%

The recommended trip type proportion estimates to apply to future home improvement warehouse developments are outlined in Table 9 below.

Table 9: Recommended trip type proportions for home improvement warehouse developments

	Primary	Pass-by	Link diverted
Thursday PM Peak	30-35%	25-30%	40%
Saturday Midday Peak	35-40%	25-30%	30-35%

More research needs to be carried out in this area in order to make these estimates with higher confidence.

Despite the similarities in the trip results obtained at the two different developments surveyed here, it is not recommended that supermarket trip type proportions are applied to non-supermarket large-format retail. At this stage, there is not enough data to support this claim.

ACKNOWLEDGEMENTS

The authors wish to acknowledge the significant support of 'Traffic Design Group Ltd' staff which ensured this project was successful. This research was undertaken as part of the first two authors for their BE(Civil) Hons degrees.

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Douglass M. and McKenzie D. (2001), *Trips and Parking Related to Land Use,* Vol. 1 Report No. 209, Transfund New Zealand

RMS EXTRACT

Roads and Traffic Authority

Trip Generation and Parking Generation Surveys

Bulky Goods / Hardware Stores

Analysis Report

Table 2-2 Site Details of the Selected Sites – Hardware/DIY

Site ID	HW1	HW2	HW3	HW4	HW5	HW6	HW7	HW8	HW9
Name	Bunnings	Bunnings	Mitre10	Bunnings	Mitre10	Mitre10	Mitre10	Bunnings	Mitre10
Suburb	North Parramatta	Bankstown Airport	Windsor	Minchinbury	Narellan	Morisset	Picton	South Nowra	Orange
	2152	2200	2756	2770	2567	2264	2571	2541	2800
Region	Sydney	Sydney	Sydney	Sydney	Sydney	Northern	Northern	Northern	Southern
Network Peak Hours									
Year of Network Survey	2007	2005	2007	2007	2005	2004	2009	2009	2005
Dates							6/4-12/4	18/3-24/3	
AM Peak - Weekdays	0800-0900	0700-0800	0800-0900	0800-0900	0800-0900	0800-0900	0900-1000	0800-0900	0800-0900
PM Peak - Weekdays	1700-1800	1600-1700	1500-1600	1700-1800	1600-1700	1600-1700	1600-1700	1500-1600	1600-1700
Peak - Weekends	1200-1300	1200-1300	1100-1200	1100-1200	1100-1200	1100-1200	1200-1300	1100-1200	1100-1200
Site Details - Bulky Goods/Hardware									
Area Dimension (m^2)			6,700		3,500		3,600		Unknown
Gross floor area (m^2)	9,800	14,111	1,800	11,915	2,400	2,000	1,600	9,948	1,800
No. of Employee (Total)			42		20		12		23
No. of employee (at one time)			34		15	15	12		8
Year Constructed			1990		1991-1992		Unknown		1980
Accessibility Score	<79	<79	<79	<79	<79	0.5	1	0	2
Opening Hours									
Mon-Fri	0700-2100	0700-2100	0630-1700	0700-2100	0700-1730	0630-1730	0730-1700	0700-2100	0700-1730
Sat	0800-1800	0800-1800	0800-1600	0800-1800	0730-1600	0700-1600	0700-1600	0800-1800	0800-1600
Sun	0800-1800	0800-1800	0900-1500	0800-1800	0900-1600	0700-1600	0900-1400	0800-1800	0900-1600
Parking Spaces									
Customers	263	464	44	397	35	29	75	209	28
Disabled	2	8	0	6	2	1	0	4	2
Staff			0		0	0	0		10
Loading Bay			2		1	0	5		2
Total	265	472	46	403	38	30	80	213	42
Survey Results									
Date of Survey - Weekdays	12/03/09	26/03/09	19/03/09	19/03/09	19/03/09	12/03/09	26/03/09	26/03/09	19/03/09
	(Thurs)	(Thurs)	(Thurs)	(Thurs)	(Thurs)	(Thurs)	(Thurs)	(Thurs)	(Thurs)
Weather	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny/ Rain Evening	Sunny
Date of Survey - Weekend	14/03/09	28/03/09	21/03/09	21/03/09	21/03/09	14/03/09	28/03/09	28/03/09	21/03/09
	(Sat)	(Sat)	(Sat)	(Sat)	(Sat)	(Sat)	(Sat)	(Sat)	(Sat)
Weather	Sunny	Sunny	Sunny	Sunny	Sunny	Sunny/ Rain Evening	Sunny	Sunny	Sunny

Table 2-3 Site Details of the Selected Sites – Bulky Goods

Site ID	BG1	BG2	BG3	BG4	BG5	BG6
Name	Freedom/	Harvey Norman	Retravision	Domayne	Bing Lee	Fantastic
Suburb	Balgowlah	Auburn	Springwood	Kotara	Warilla	South Nowra
	2093	2144	2777	2289	2528	2541
Region	Sydney	Sydney	Blue Mountain	Newcastle	Southern	Southern
Network Peak Hours						
Year of Network Survey Dates	2005	2007	2005	2004	2007	2009
						18/3-24/3
AM Peak - Weekdays	0800-0900	0800-0900	0800-0900	0800-0900	0800-0900	0800-0900
PM Peak - Weekdays	1700-1800	1700-1800	1700-1800	1600-1700	1500-1600	1500-1600
Peak - Weekends	1200-1300	1200-1300	1100-1200	1200-1300	1100-1200	1100-1200
Site Details - Bulky Goods/Hardware						
Area Dimension (m^2)		Approx 9000	1,600			
Gross floor area (m^2)	4,300	25,384 (including car park)	600	6,029	1,200	1,700
No. of Employee (Total)	29	220	5			9
No. of employee (at one time)	10	100	5	50	20	9
Year Constructed	Unknown	2001			2008	
Accessibility Score	80-139	<79	<79	78	26	0
Opening Hours						
Mon-Fri	0900-1800	0900-1730	0900-1730	0900-1730	0900-1730	0900-1730
Sat	0900-1700	0900-1730	0900-1600	0900-1700	0900-1700	0900-1700
Sun	1000-1700	0900-1730	1000-1600	1000-1700	1000-1700	1000-1700
Parking Spaces						
Customers	43	338	13	151	51	30
Disabled	0	12	0	2	4	4
Staff	3	0	0	0	33	9
Loading Bay	4		1	1	4	2
Total	50	350	14	154	92	45
Survey Results						
Date of Survey - Weekdays	19/03/09	12/03/09	12/03/09	12/03/09	19/03/09	26/03/09
	(Thurs)	(Thurs)	(Thurs)	(Thurs)	(Thurs)	(Thurs)
Weather	Sunny	Sunny	Sunny	Sunny/Cloudy	Sunny/Cloudy	Sunny
Date of Survey - Weekend	21/03/09	14/03/09	14/03/09	14/03/09	21/03/09	28/03/09
	(Sat)	(Sat)	(Sat)	(Sat)	(Sat)	(Sat)
Weather	Sunny/Shower	Sunny	Sunny	Sunny/Cloudy	Sunny/Cloudy	Sunny

3.3.1 Hardware / DIY

Table 3-1 Traffic Results Summary – Hardware/DIY

	Sydney Metropolitan Area					Non-Metropolitan Area			
Site ID	**HW1**	**HW2**	**HW3**	**HW4**	**HW5**	**HW6**	**HW7**	**HW8**	**HW9**
Gross floor area (m2)	**9,800**	**14,111**	**1,800**	**11,915**	**2,400**	**2,000**	**1,600**	**9,946**	**1,800**
Weekdays									
Person-based Trips									
- Site Peak Hour	484	565	101	688	119	128	97	393	100
Trips/ 100m² GFA	4.94	4.00	5.61	5.77	4.96	6.40	6.06	3.95	5.56
- Vehicle Network AM Peak	162	92	49	273	65	49	76	127	61
Trips/ 100m² GFA	1.65	0.65	2.72	2.29	2.71	2.45	4.75	1.28	3.39
- Vehicle Network PM Peak	281	350	88	474	79	93	66	278	64
Trips/ 100m² GFA	2.87	2.48	4.89	3.98	3.29	4.65	4.13	2.79	3.56
Daily Total Person Trips	4,397	4,639	816	6,346	858	868	667	2,907	703
Trips/ 100m² GFA	44.87	32.88	45.33	53.26	35.75	43.40	41.69	29.22	39.06
Vehicle-based Trips									
- Site Peak Hour	403	444	84	491	98	112	75	273	83
Trips/ 100m² GFA	4.11	3.15	4.67	4.12	4.08	5.60	4.69	2.74	4.61
- Network AM Peak	140	84	40	243	51	42	62	108	53
Trips/ 100m² GFA	1.43	0.60	2.22	2.04	2.13	2.10	3.88	1.09	2.94
- Network PM Peak	225	289	64	338	66	76	50	198	58
Trips/ 100m² GFA	2.30	2.05	3.56	2.84	2.75	3.80	3.13	1.99	3.22
Daily Total LV Trips	3,441	3,643	514	4,558	605	718	523	2,055	575
Trips/ 100m² GFA	35.11	25.82	28.56	38.25	25.21	35.90	32.69	20.66	31.94
Daily Total HV Trips	122	139	111	178	51	45	19	69	33
Trips/ 100m² GFA	1.24	0.99	6.17	1.49	2.13	2.25	1.19	0.69	1.83
Daily Total Vehicle Trips	3,563	3,782	625	4,736	656	763	542	2,124	608
Trips/ 100m² GFA	36.36	26.80	34.72	39.75	27.33	38.15	33.88	21.35	33.78
% HV	3.4%	3.7%	17.8%	3.8%	7.8%	5.9%	3.5%	3.2%	5.4%
Peak Parking Accumulation	119	155	14	199	25	38	30	104	20
Peak Parking/ 100m² GFA	1.21	1.10	0.78	1.67	1.04	1.90	1.88	1.05	1.11
Weekend									
Person-based Trips									
- Site Peak Hour	1,000	1,331	123	1,256	205	184	122	739	147
Trips/ 100m² GFA	10.20	9.43	6.83	10.54	8.54	9.20	7.63	7.43	8.17
- Vehicle Network Peak	925	1,282	108	1,244	192	174	122	709	120
Trips/ 100m² GFA	9.44	9.09	6.00	10.44	8.00	8.70	7.63	7.13	6.67
Daily Total Person Trips	7,100	8,590	665	8,864	1,238	998	655	4,738	723
Trips/ 100m² GFA	72.45	60.87	36.94	74.39	51.58	49.90	40.94	47.63	40.17
Vehicle-based Trips									
- Site Peak Hour	656	844	77	754	151	112	78	447	111
Trips/ 100m² GFA	6.69	5.98	4.28	6.33	6.29	5.60	4.88	4.49	6.17
- Network Peak	593	805	65	754	119	104	78	426	96
Trips/ 100m² GFA	6.05	5.70	3.61	6.33	4.96	5.20	4.88	4.28	5.33
Daily Total LV Trips	4,780	5,493	396	5,440	882	644	489	2,809	571
Trips/ 100m² GFA	48.78	38.93	22.00	45.66	36.75	32.20	30.56	28.24	31.72
Daily Total HV Trips	27	115	16	60	3	5	0	15	2
Trips/ 100m² GFA	0.28	0.81	0.89	0.50	0.13	0.25	0.00	0.15	0.11
Daily Total Vehicle Trips	4,807	5,608	412	5,500	885	649	489	2,824	573
Trips/ 100m² GFA	49.05	39.74	22.89	46.16	36.88	32.45	30.56	28.39	31.83
% HV	0.6%	2.1%	3.9%	1.1%	0.3%	0.8%	0.0%	0.5%	0.3%
Peak Parking Accumulation	196	318	30	264	36	29	45	152	27
Peak Parking/ 100m² GFA	2.00	2.59	1.67	2.22	1.50	1.45	2.81	1.53	1.50

Table 3-2 Trips Rate Summary – Hardware/DIY

Trips/ 100m² GFA	Sydney Metropolitan Area HW1 to HW5			Non-Metropolitan Area HW6 to HW9			All Survey Sites HW1 to HW9			Avg Non-metro / Metro %
	Min	Max	Avg	Min	Max	Avg	Min	Max	Avg	
Weekdays										
Person-based Trips										
- Site Peak Hour	4.00	5.77	5.06	3.95	6.40	5.49	3.95	6.40	5.25	108.6%
- Vehicle Network AM Peak	0.65	2.72	2.01	1.28	4.75	2.97	0.65	4.75	2.43	147.9%
- Vehicle Network PM Peak	2.48	4.89	3.50	2.79	4.65	3.78	2.48	4.89	3.63	108.0%
Daily Total Person Trips	32.88	53.26	42.42	29.22	43.40	38.34	29.22	53.26	40.61	90.4%
Vehicle-based Trips										
- Site Peak Hour	3.15	4.67	4.03	2.74	5.60	4.41	2.74	5.60	4.20	109.6%
- Network AM Peak	0.60	2.22	1.68	1.09	3.88	2.50	0.60	3.88	2.05	148.7%
- Network PM Peak	2.05	3.56	2.70	1.99	3.80	3.03	1.99	3.80	2.85	112.5%
Daily Total LV Trips	25.21	38.25	30.59	20.66	35.90	30.30	20.66	38.25	30.46	99.0%
Daily Total HV Trips	0.99	6.17	2.40	0.69	2.25	1.49	0.69	6.17	2.00	62.0%
Daily Total Vehicle Trips	26.80	39.75	32.99	21.35	38.15	31.79	21.35	39.75	32.46	96.4%
Peak Parking Accumulation	0.78	1.67	1.16	1.05	1.90	1.48	0.78	1.90	1.30	127.8%
Weekend										
Person-based Trips										
- Site Peak Hour	6.83	10.54	9.11	7.43	9.20	8.11	6.83	10.54	8.66	89.0%
- Vehicle Network Peak	6.00	10.44	8.59	6.67	8.70	7.53	6.00	10.44	8.12	87.6%
Daily Total Person Trips	36.94	74.39	59.25	40.17	49.90	44.66	36.94	74.39	52.76	75.4%
Vehicle-based Trips										
- Site Peak Hour	4.28	6.69	5.91	4.49	6.17	5.28	4.28	6.69	5.63	89.3%
- Vehicle Network Peak	3.61	6.33	5.33	4.28	5.33	4.92	3.61	6.33	5.15	92.3%
Daily Total LV Trips	22.00	48.78	38.42	28.24	32.20	30.68	22.00	48.78	34.98	79.9%
Daily Total HV Trips	0.13	0.89	0.52	0.00	0.25	0.13	0.00	0.89	0.35	24.5%
Daily Total Vehicle Trips	22.89	49.05	38.94	28.39	32.45	30.81	22.89	49.05	35.33	79.1%
Peak Parking Accumulation	1.50	2.59	2.00	1.45	2.81	1.82	1.45	2.81	1.92	91.3%
Weekend/Weekdays %										
Person-based Trips										
- Site Peak Hour	170.7%	213.6%	245.4%	238.6%	187.1%	199.1%	241.9%	213.6%	224.0%	
Daily Total Person Trips	112.4%	139.7%	139.7%	137.5%	115.0%	116.5%	126.4%	139.7%	129.9%	
Vehicle-based Trips										
- Site Peak Hour	136.0%	143.4%	146.9%	163.7%	110.1%	119.8%	155.9%	119.5%	134.2%	
Daily Total LV Trips	87.3%	127.5%	125.6%	136.7%	89.7%	101.3%	106.5%	127.5%	114.8%	
Daily Total HV Trips	12.7%	14.4%	21.7%	0.0%	11.1%	8.6%	0.0%	14.4%	17.4%	
Daily Total Vehicle Trips	85.4%	123.4%	118.0%	133.0%	85.1%	96.9%	107.2%	123.4%	108.8%	
Peak Parking Accumulation	192.9%	155.3%	171.9%	138.7%	148.0%	122.9%	186.4%	148.0%	147.2%	

* LV – Light vehicles, HV – Heavy vehicles

* The units of parking accumulation are Peak parked cars / 100m² GFA.

The bottom section of this table expresses the weekend traffic characteristics as a percentage of the weekday traffic characteristics and the last column expresses the non metropolitan traffic characteristics as a percentage of the metropolitan traffic characteristics.

A review of the data reveals a number of observations

- The surveys were undertaken on a range of GFA from 1,600 to 14,111 square metres.
- The weekday site peak hour trip generation rate varied from 2.74 to 5.6 vehicle trips per 100 sq m GFA with an average of 4.2 trips.
- The weekday daily trip rate varied from 21.35 to 39.75 vehicle trips per 100 sq m GFA with an average of 32.46 trips.
- The non-metropolitan sites generally had higher trip rates than the metropolitan sites.

- The weekday peak parking demand was between 0.78 and 1.9 spaces per 100 sq m GFA. The weekend peak demand is generally higher than the weekday one.
- Higher trips rates were observed in PM network peak than AM network peak. Therefore, such stores would have a higher traffic impact in the PM peak than the AM peak.
- When comparing weekday and weekend data, all the sites are busier at the weekend.

Table 3-3 Trips Rate Summary –Bunnings and Mitre10

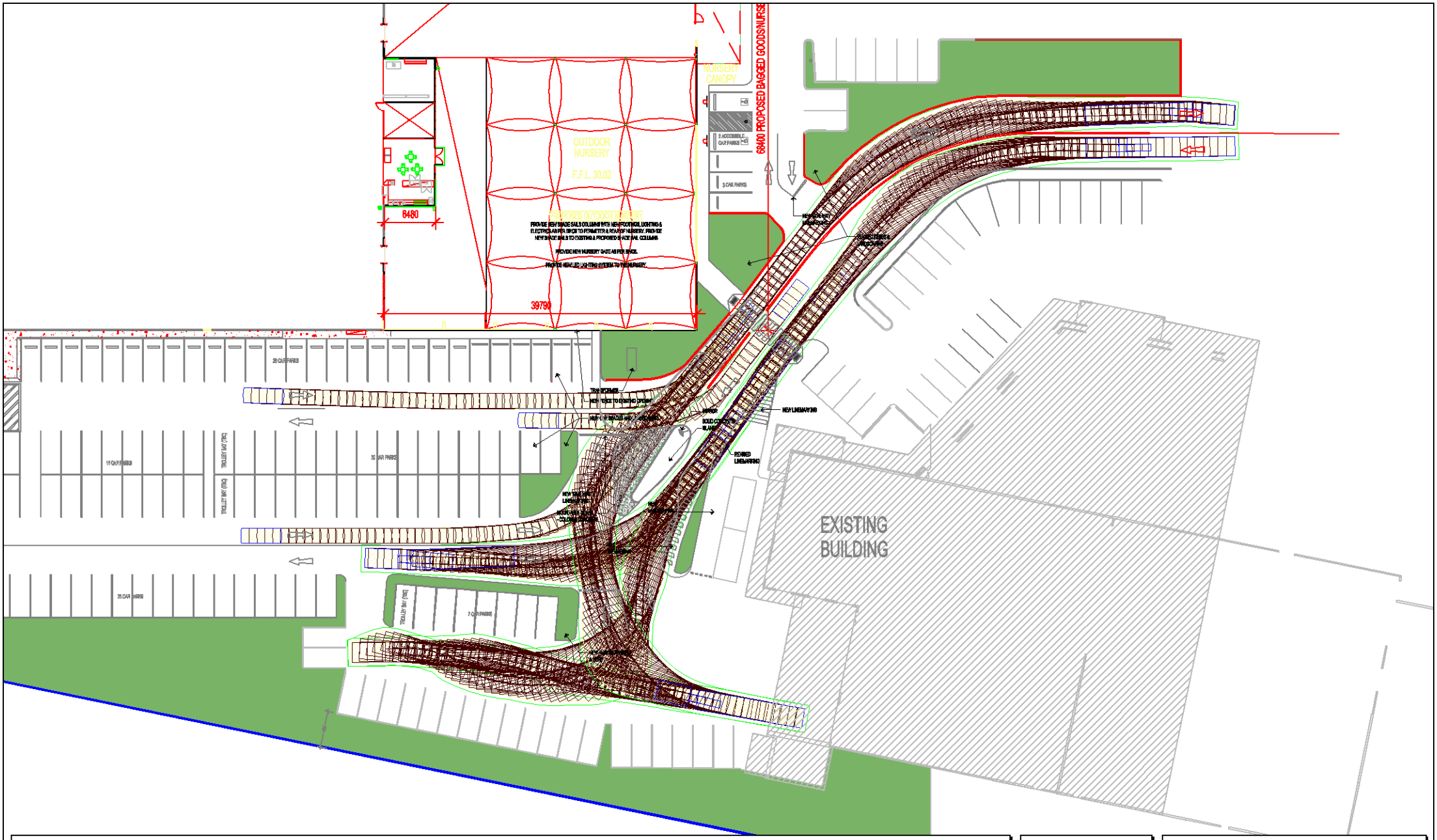
	Bunnings HW1, HW2, HW4, HW8			Mitre10 HW3, HW5, HW6, HW7, HW9			Avg Mitre10 / Bunnings
Trips/ 100m²GFA	Min	Max	Avg	Min	Max	Avg	%
Weekdays							
Person-based Trips							
- Site Peak Hour	3.95	5.77	4.67	4.96	6.40	5.72	122.5%
- Vehicle Network AM Peak	0.65	2.29	1.47	2.45	4.75	3.20	218.2%
- Vehicle Network PM Peak	2.48	3.98	3.03	3.29	4.89	4.10	135.4%
Daily Total Person Trips	29.22	53.26	40.06	35.75	45.33	41.05	102.5%
Vehicle-based Trips							
- Site Peak Hour	2.74	4.12	3.53	4.08	5.60	4.73	133.9%
- Network AM Peak	0.60	2.04	1.29	2.10	3.88	2.65	206.1%
- Network PM Peak	1.99	2.84	2.29	2.75	3.80	3.29	143.5%
Daily Total LV Trips	20.66	38.25	29.96	25.21	35.90	30.86	103.0%
Daily Total HV Trips	0.69	1.49	1.10	1.19	6.17	2.71	245.6%
Daily Total Vehicle Trips	21.35	39.75	31.06	27.33	38.15	33.57	108.1%
Peak Parking Accumulation	1.05	1.67	1.26	0.78	1.90	1.34	106.7%
Weekend							
Person-based Trips							
- Site Peak Hour	7.43	10.54	9.40	6.83	9.20	8.07	85.9%
- Vehicle Network Peak	7.13	10.44	9.02	6.00	8.70	7.40	82.0%
Daily Total Person Trips	47.63	74.39	63.84	36.94	51.58	43.91	68.8%
Vehicle-based Trips							
- Site Peak Hour	4.49	6.69	5.87	4.28	6.29	5.44	92.6%
- Vehicle Network Peak	4.28	6.33	5.59	3.61	5.33	4.80	85.8%
Daily Total LV Trips	28.24	48.78	40.40	22.00	36.75	30.65	75.9%
Daily Total HV Trips	0.15	0.81	0.44	0.00	0.89	0.28	63.0%
Daily Total Vehicle Trips	28.39	49.05	40.84	22.89	36.88	30.92	75.7%
Peak Parking Accumulation	1.53	2.59	2.08	1.45	2.81	1.79	85.7%
Weekend/Weekdays %							
Person-based Trips							
- Site Peak Hour	188.0%	262.4%	297.8%	182.3%	178.0%	180.3%	
Daily Total Person Trips	163.0%	139.7%	159.4%	103.3%	113.8%	107.0%	
Vehicle-based Trips							
- Site Peak Hour	163.7%	162.4%	166.4%	104.8%	112.4%	115.1%	
Daily Total LV Trips	136.7%	127.5%	134.8%	87.3%	102.4%	99.3%	
Daily Total HV Trips	21.7%	54.6%	39.5%	0.0%	14.4%	10.1%	
Daily Total Vehicle Trips	133.0%	123.4%	131.5%	83.7%	96.7%	92.1%	
Peak Parking Accumulation	146.2%	155.3%	165.8%	186.4%	148.0%	133.2%	

* LV – Light vehicles, HV – Heavy vehicles

* The units of parking accumulation are Peak parked cars / 100m² GFA.

Appendix G

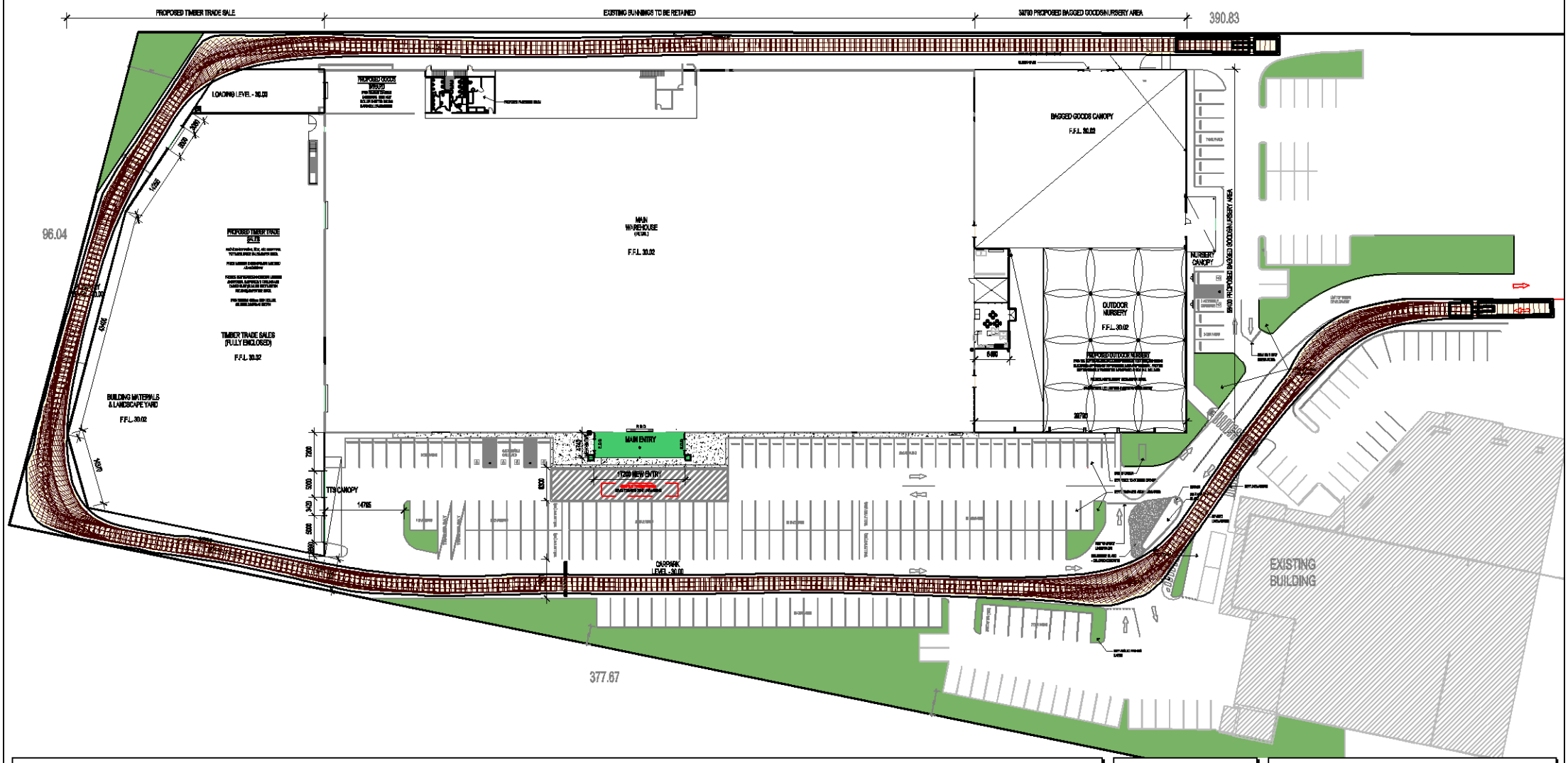
TRUCK TURNING PATHS



LEGEND

SWEPT PATH ANALYSIS OF 19m ARTICULATED VEHICLES AND 99th PERCENTILE CARS

SP 1



LEGEND

SWEPT PATH ANALYSIS OF 19m ARTICULATED VEHICLE CIRCULATING ON THE SITE

SP 2