PROPOSED BUNNINGS DEVELOPMENT

CNR ELIZABETH DRIVE
BONNYRIGG AVENUE, BONNYRIGG

Assessment of Traffic and Parking Implications

February 2015
(Rev E)

Reference 14144

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1. INTRODUCTION

This report has been prepared to accompany a Development Application to Fairfield City Council for a proposed new Bunnings on the north western corner of The Elizabeth Drive and Bonnyrigg Avenue intersection at Bonnyrigg. (Figure 1).

There is an existing Bunnings adjoining the development site to the north however, this has a constrained floor area and is not able to accommodate a contemporary range of Bunnings products. However, the location has ready access to the arterial road system and is strategically located in relation to the developing South Western Metropolitan Area.

The proposed new Bunnings development scheme comprises:

Warehouse	9,185 m^2
Timber Trade	3,000 m^2
Nursery	3,185 m^2
Total Retail Area	**15,370 m^2**

The purpose of this report is to:

* describe the site, its context and the proposed development scheme
* describe the road network serving the site and traffic conditions on that network
* describe the proposed changes to road network
* assess the potential traffic implications of the development
* assess the adequacy of the proposed parking provision
* assess the proposed vehicle access, internal circulation and servicing arrangements

LEGEND

LOCATION

FIG 1

2. PROPOSED DEVELOPMENT SCHEME

2.1 SITE, CONTEXT AND EXISTING USE

The site (Figure 2) is a generally rectangular shaped lot of some 22,164m^2 which has an extensive frontage to Bonnyrigg Avenue and a lesser frontage to Elizabeth Drive. The site is bounded to the west by the open space/parkland along Clear Paddock Creek and the Liverpool – Parramatta Bus Transitway.

The site is currently occupied by a depot facility for Westbus which has an administration building, some cleaning/servicing facilities. The depot can accommodate some 120 buses and has a combined ingress/egress driveway on Bonnyrigg Avenue towards the centre of the frontage.

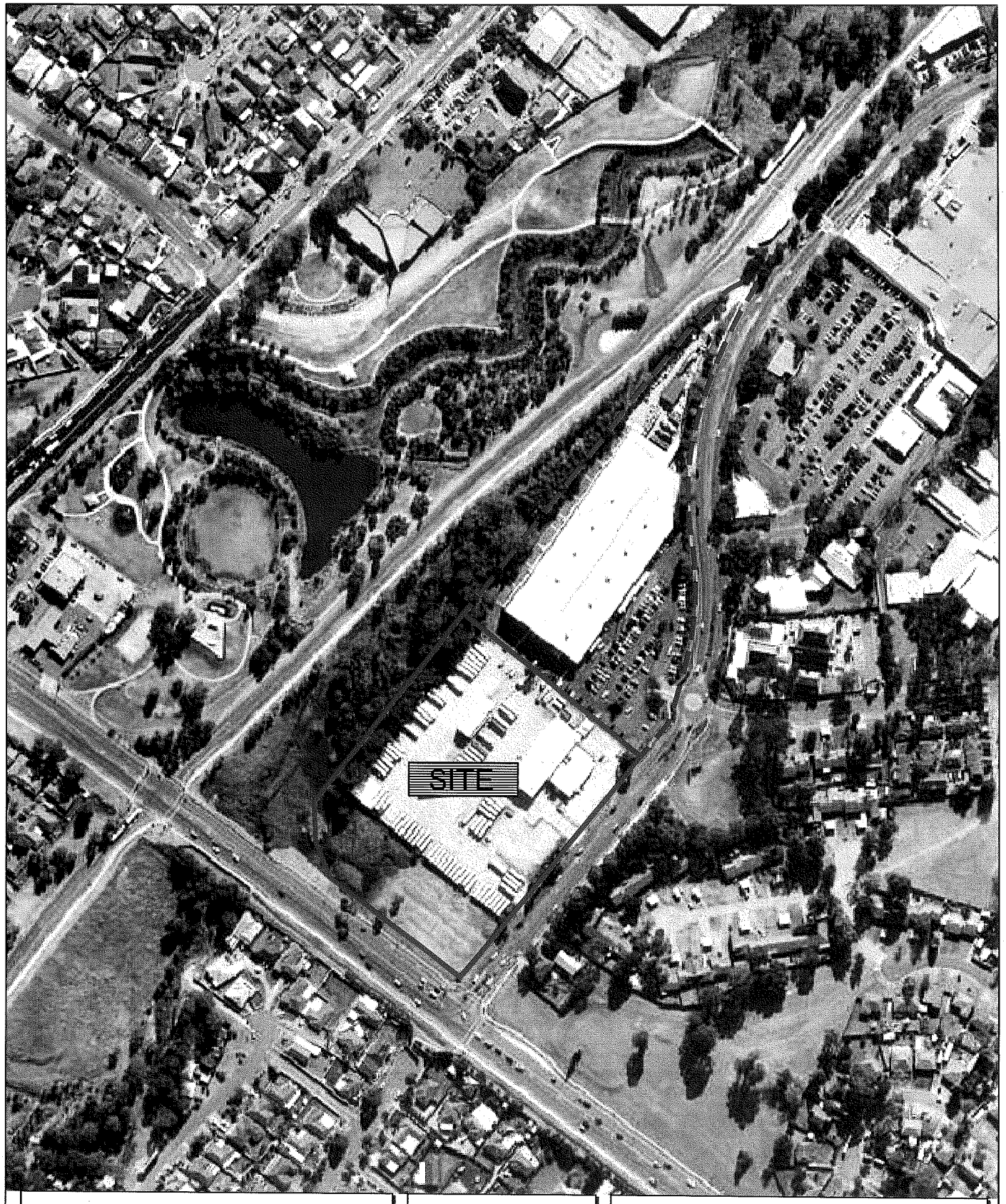
The surrounding uses comprise:

* the existing Bunnings which adjoins to the north which has a floor area of 8,916m^2
* the Bonnyrigg Plaza Shopping Centre located just to the north
* the residential areas extending to the north, south, east and west
* the Cabramatta Centre some 4km to the east and the large Liverpool centre some 4km to the south-east

2.2 PROPOSED DEVELOPMENT

The proposed Bunnings development scheme involves a single level warehouse with nursery, and bagged goods on the southern side and timber trade/building materials and loading dock along the northern side. The scheme will reflect a contemporary midsize Bunnings outlet comprising:

Warehouse	9,185 m^2
Nursery/Bagged Goods	3,185 m^2
Timber Trade/Building Materials	3,000 m^2
Total:	**15,370 m^2**



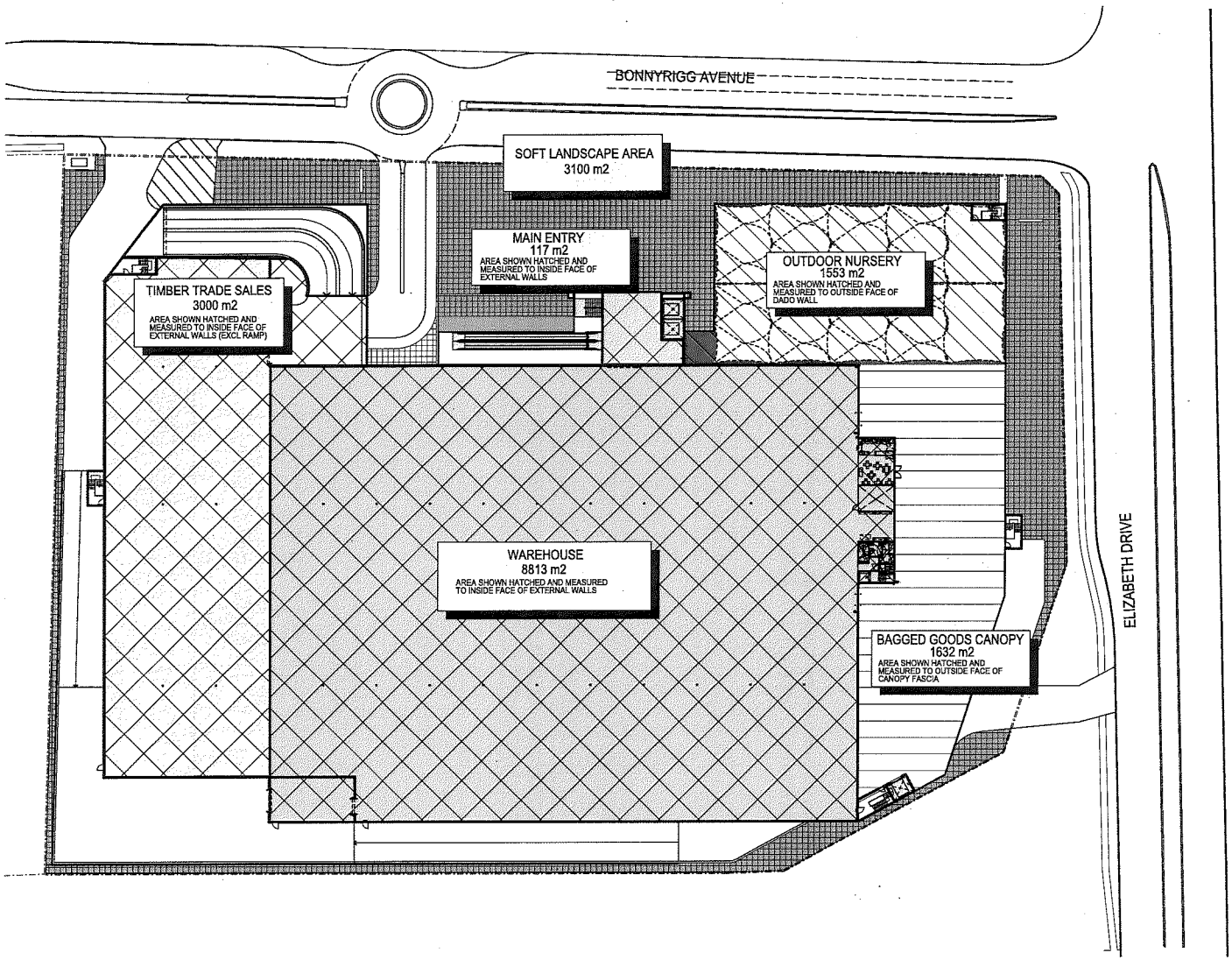
LEGEND

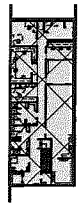
N

SITE

FIG 2

There are 410 undercroft parking spaces proposed with vehicle accesses for the car park (including a new roundabout) and service vehicles located on the Bonnyrigg Avenue frontage. Details of the development scheme are provided on the plans prepared by John R Brogan which accompany the Development Application and are reproduced in part overleaf.





MEZZANINE LEVEL
255 m2
AREA SHOWN HATCHED AND MEASURED TO INSIDE FACE OF EXTERNAL WALLS

AREA ANALYSIS
BUNNINGS BONNYRIGG

	AREAS
Main Entry	117 m2
Warehouse	8813 m2
Mezzanine	255 m2
Timber Trade Sales	3000 m2
Total Ground Floor Area (GFA)	**12 185 m2**
Outdoor Nursery Area	1553 m2
Bagged Goods Canopy	1632 m2
Total Nursery Area	**3 185 m2**
Total Bunnings Retail Area	**15 370 m2**
Total Parking	**410 cars**
Parking Ratio	**1/38 m2**
Soft Landscape Area	**3 100 m2**
Land Size - (approximate figures tbc)	
Total Land Area	**22 159 m2**

DA ISSUE
NOT FOR CONSTRUCTION

NO.	AMENDMENT	DATE	NO.	AMENDMENT	DATE
A	DA ISSUE	08.02.10			

CLIENT
BUNNINGS warehouse
BUNNINGS GROUP LTD

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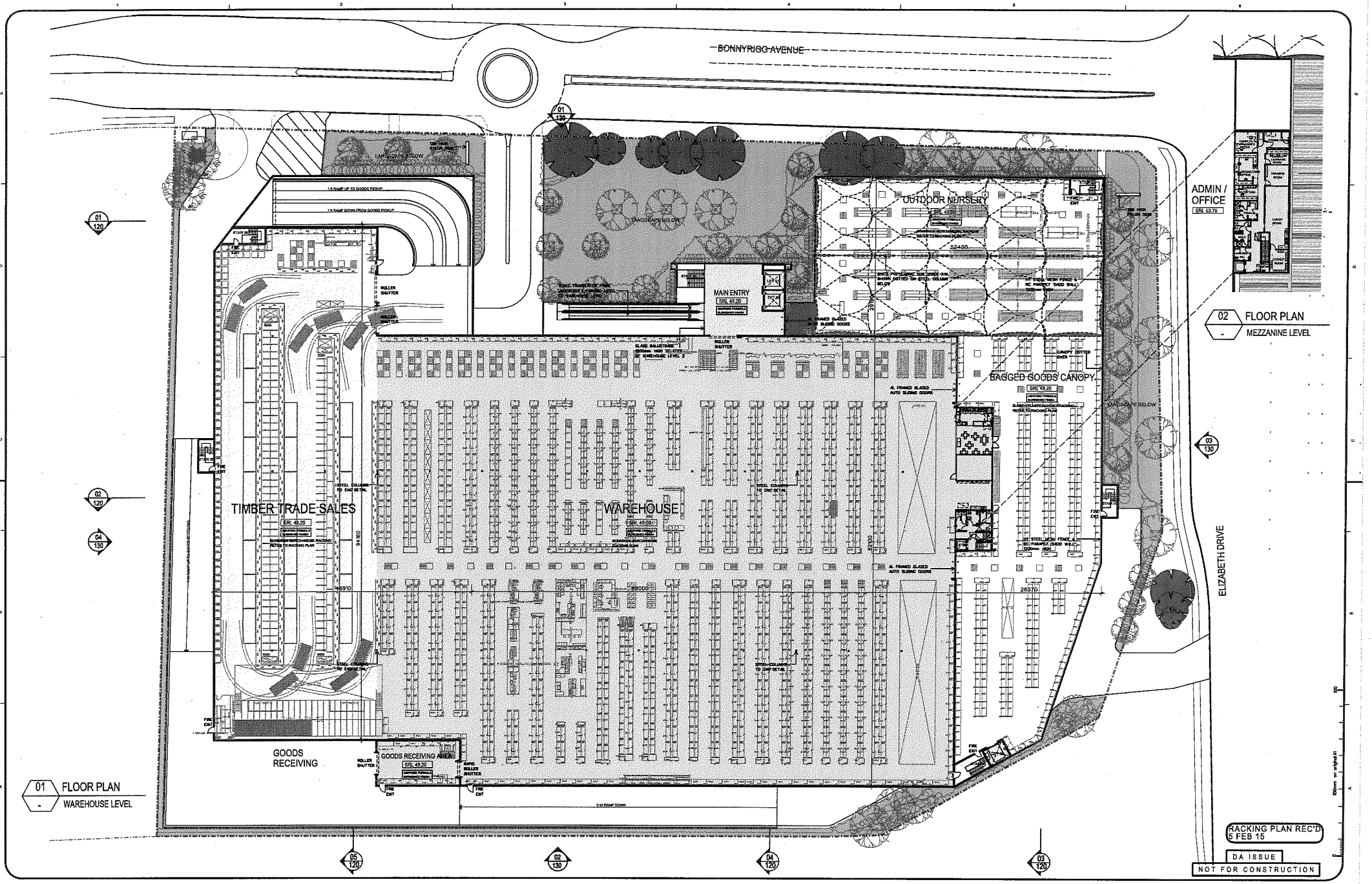
PROPOSED BUNNINGS WAREHOUSE
BONNYRIGG NSW 2177

AREAS DIAGRAM

SCALE : 1:400
DATE : JUL 09

PROJ. NO. 1062
DRG. NO. 040
AMD NO. A

CAD REF: Microstation V8i 32 PROPOSED BUNNINGS WAREHOUSE, BONYRIGG 1062 - PLOTTED 30/2/2010



NO.	AMENDMENT	DATE	NO.	AMENDMENT	DATE
A	DA ISSUE	09.02.15			

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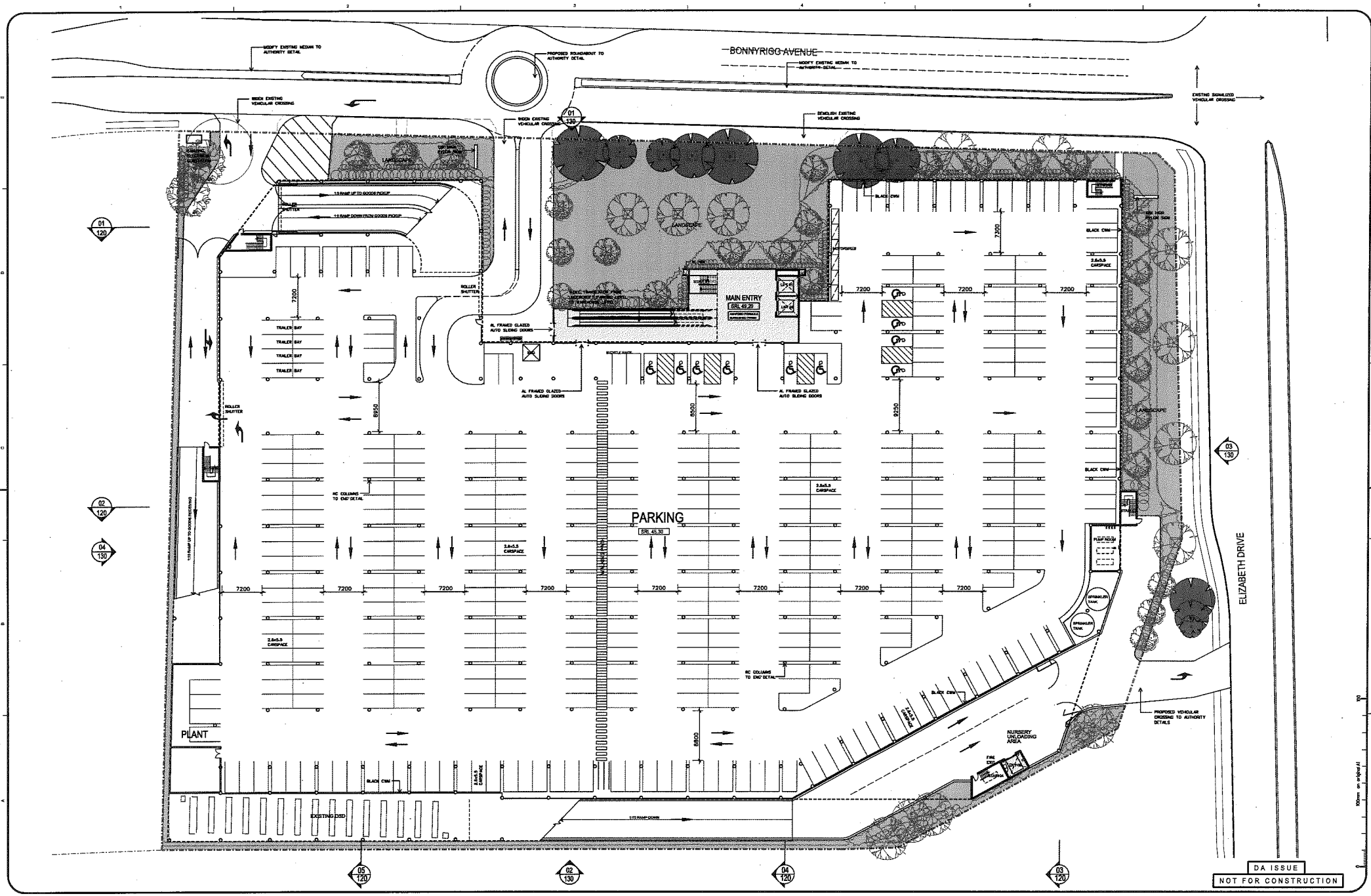
PROPOSED BUNNINGS WAREHOUSE
BONNYRIGG NSW 2177

FLOOR PLAN
WAREHOUSE / MEZZANINE LEVEL

SCALE : 1:300
DATE : JUL 09

PROJ. NO. 1062
DRG. NO. 101
AMD NO. A

CAD REF : Microstation V8i SS PROPOSED BUNNINGS WAREHOUSE, BONNYRIGG 1062 - PLOTTED 23A1S3



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Verify dimensions from site and refer any discrepancies to Architects for clarification.

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PROPOSED BUNNINGS WAREHOUSE
BONNYRIGG NSW 2177

FLOOR PLAN
UNDERCROFT PARKING LEVEL

SCALE : 1:300
DATE : JUL 09

PROJ. NO. 1062
DRG. NO. 100
AMD NO. A

CAD REF : Microstation V8i SS3 PROPOSED BUNNINGS WAREHOUSE, BONNYRIGG 1062 - PLOTTED 03/2/2015

3. ROAD NETWORK AND TRAFFIC CONDITIONS

3.1 ROAD NETWORK

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

* *Cumberland Highway* - a State Road and arterial route linking across the Metropolitan Area between Carlingford and Liverpool

* *Elizabeth Drive* - a State Road and arterial route linking between Liverpool and Luddenham

* *Cabramatta Road* - a State Road and sub-arterial route linking between the Hume Highway and Elizabeth Drive

* *Edensor Road* - collector road route connecting between Cowpasture Road and Cabramatta Road

* *Bonnyrigg Avenue* - a collector road connecting between Elizabeth Drive and Edensor Road

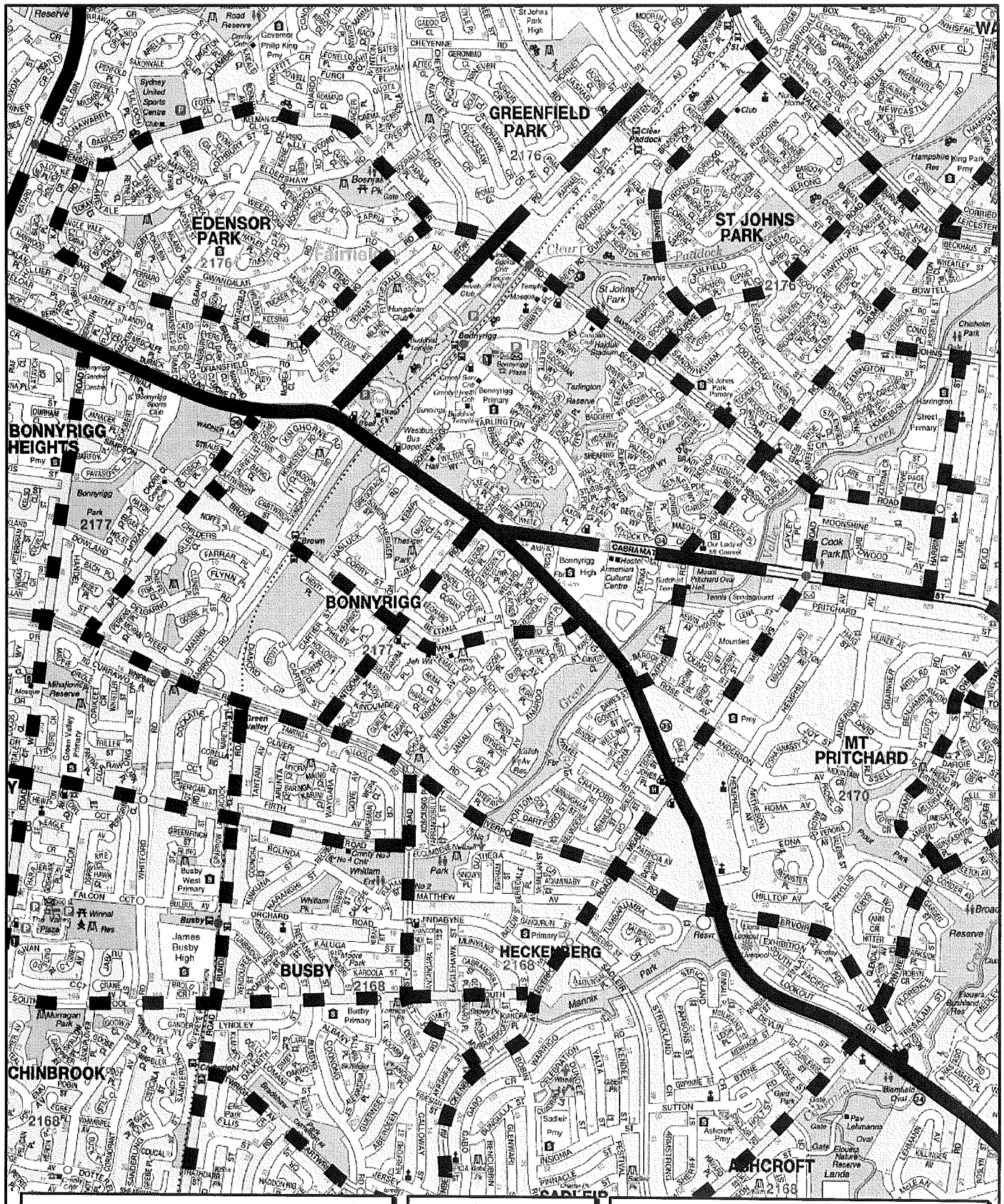
Both Elizabeth Drive and Bonnyrigg Avenue are relatively straight and level in the vicinity of the site and there are numerous other minor collector routes serving the Bonnyrigg area.

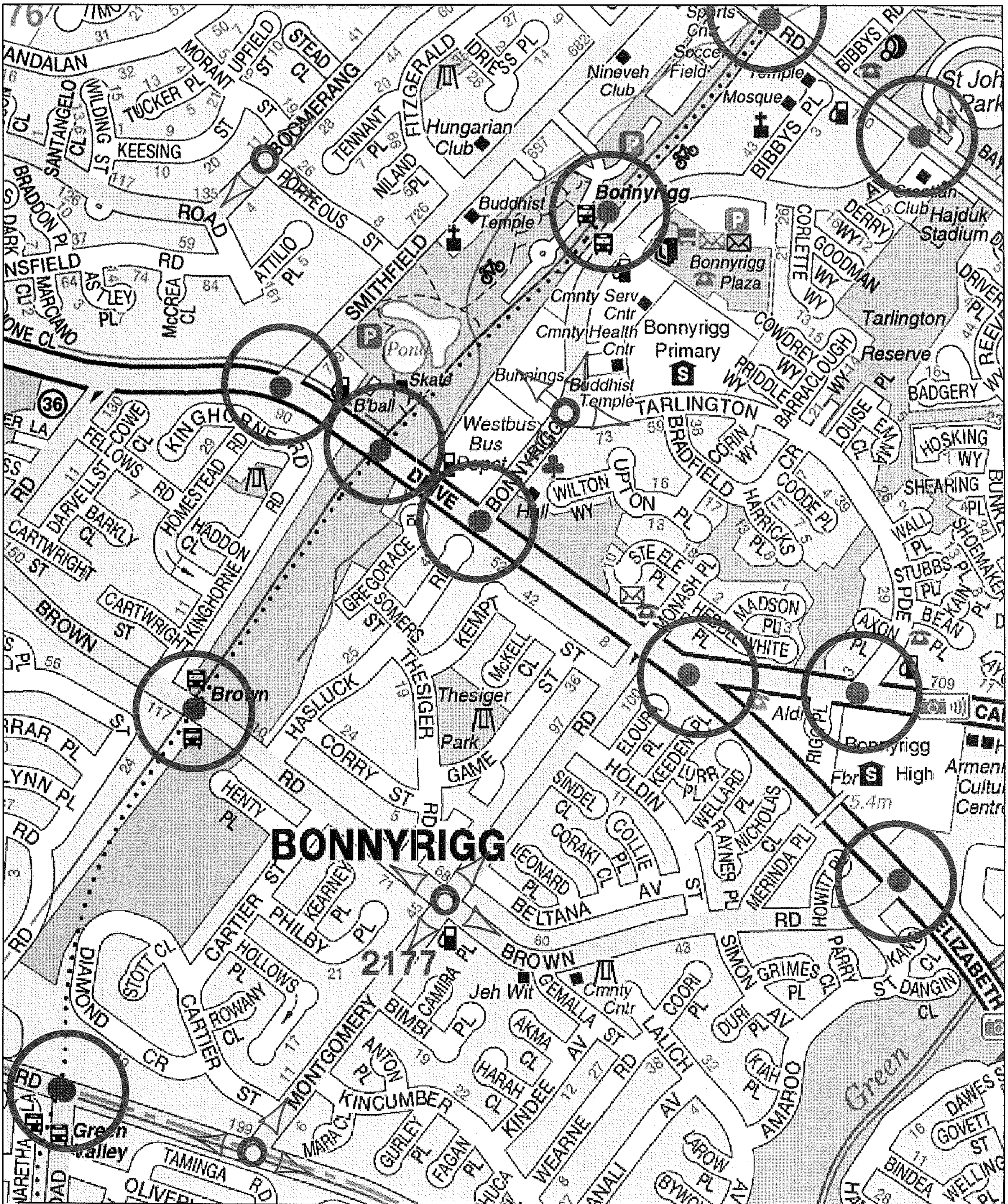
3.2 TRAFFIC CONTROLS

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

* the traffic signals at the Elizabeth Drive/Bonnyrigg Avenue intersection. See details in Appendix A image.

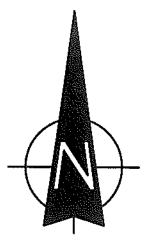
* the other traffic signals along Elizabeth Drive including the Cabramatta Road, Transitway and Smithfield Road intersections


GREENFIELD PARK
2176
EDENSOR PARK
2176
ST JOHNS PARK
2176
BONNYRIGG HEIGHTS
2177
BONNYRIGG
2177
MT PRITCHARD
2170
HECKENBERG
2168
BUSBY
2168
CHINBROOK
2168
ASHCROFT
2168
LEGEND
ARTERIAL
SUB-ARTERIAL
COLLECTOR
N
ROAD NETWORK
FIG 3



LEGEND

- TRAFFIC SIGNAL CONTROL
- ROUNDABOUT
- RESTRICTED TURNING MOVEMENT



TRAFFIC CONTROLS

FIG 4

* the roundabout at the Bonnyrigg Avenue, Tarlington Parade and Bunnings Access intersection. See details in Appendix A image.
* the traffic signals at the Cabramatta Road and Tarlington Parade intersection
* the 60 kmph speed restriction on Cabramatta Road and Elizabeth Drive and 50 kmph on the other roads with a 40kmph School Zone restriction in the vicinity of the Bonnyrigg Primary School
* the NO STOPPING restrictions along Elizabeth Drive and Bonnyrigg Avenue
* the B Double route along Elizabeth Drive but not along Bonnyrigg Avenue

3.3 TRAFFIC CONDITIONS

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

	AADT
Cabramatta Road east of Elizabeth Drive	14,794
Elizabeth Drive south of Cabramatta Road	26,122

Traffic surveys have been undertaken at the Elizabeth Drive/Bonnyrigg Avenue and Bonnyrigg Avenue/Tarlington Parade/Bunnings Access intersections during the peak Thursday afternoon and Saturday midday peak periods. The results of those surveys are provided in Appendix B and summarised in the following:

		Thursday PM	Saturday MD
Elizabeth Drive	EB	929	1,095
	LT	248	285
	WB	1,497	1,212
	RT	263	307
Bonnyrigg Avenue	RT	383	294
	LT	251	269
Bonnyrigg Avenue	NB	420	479
	RT	22	26
	LT	50	85
	SB	498	449
	RT	73	161
	LT	145	123
Bunnings Access	EB	12	23
	RT	60	101
	LT	54	113
Tarlington Parade	WB	14	14
	RT	76	136
	LT	22	40

NB – Northbound etc

Assessment of the operational performance of these intersections has been undertaken with SIDRA and the results are provided in Appendix C. The modelling reveals that satisfactory operational performances prevail as indicated in the following while the criteria for interpreting SIDRA output is reproduced overleaf.

	Thursday PM		Saturday MD	
	LOS	AVD	LOS	AVD
Elizabeth/Bonnyrigg	A	11.9	A	10.2
Bonnyrigg/Bunnings/Tarlington	A	8.9	A	11.3

LOS - Level of Service

AVD- Average Vehicle Delay (sec's)

The operational performance of the Elizabeth Drive intersection is relatively satisfactory, however the modelling has indicated capacity sensitivity related to cycle length suggesting a need to maximise the capacity of the Bonnyrigg Avenue approach.

3.4 TRANSPORT SERVICES

Public transport services are provided by the bus services which operate along Cabramatta Road and Elizabeth Drive (Routes 801, 806-8 and 815/816) providing regular services 7 days a week.

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.

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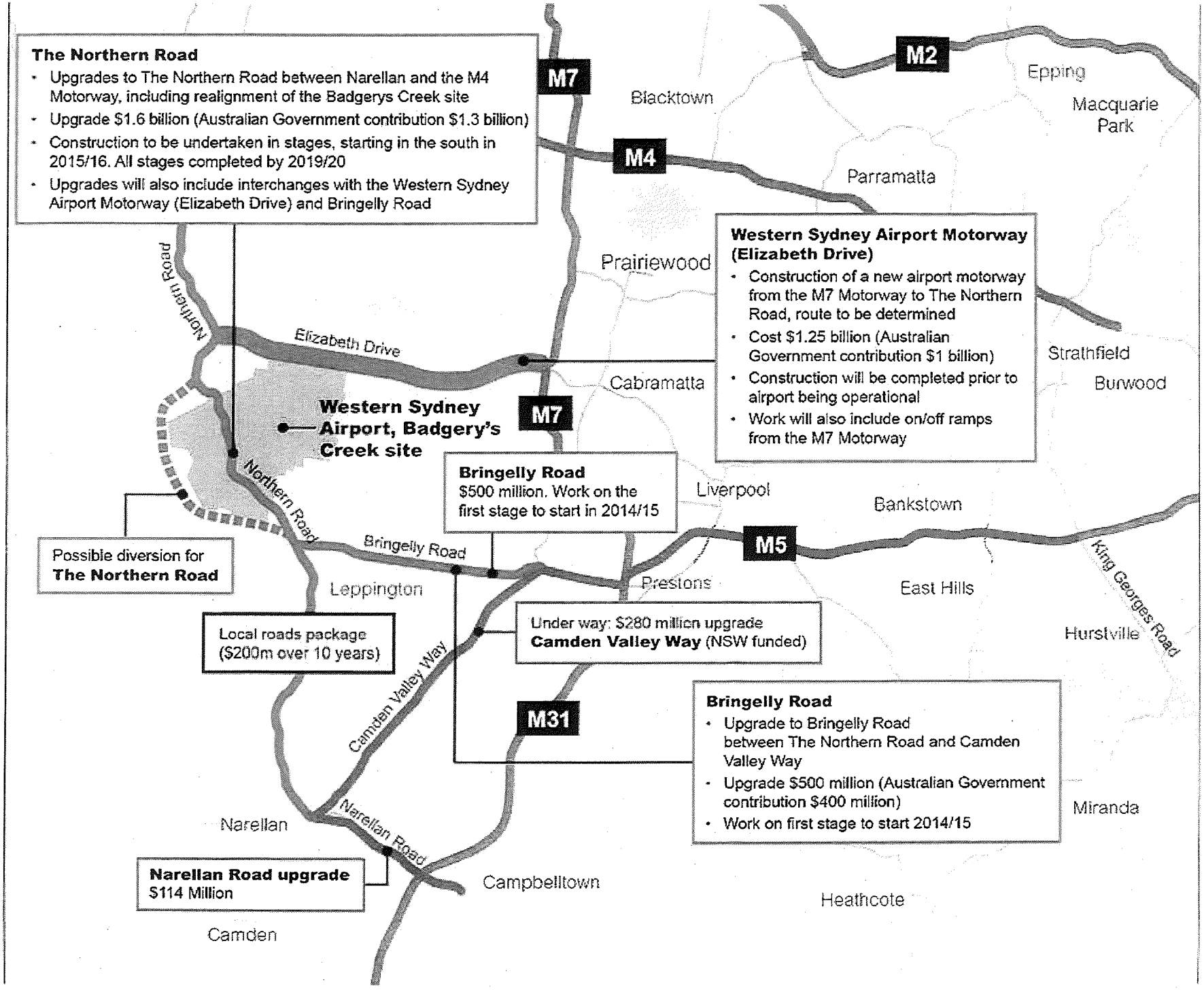
[1] *the values of DS for intersections under traffic signal control are only valid for cycle length of 120 secs*

4. FUTURE CIRCUMSTANCES

Council has advised that they do not have any plans for any roadworks or traffic management changes on their road network in the area. RMS are responsible for Elizabeth Drive and the only potential longer term implication are for increased type movements on Elizabeth Drive past the site as a 'flow on" from construction of envisage Western Sydney airport motorway. Details of this route along Elizabeth Drive between the M7 and the Northern Road are provided on an extract from the RMS website for the proposal reproduced overleaf.


The Northern Road
• Upgrades to The Northern Road between Narellan and the M4 Motorway, including realignment of the Badgerys Creek site
• Upgrade $1.6 billion (Australian Government contribution $1.3 billion)
• Construction to be undertaken in stages, starting in the south in 2015/16. All stages completed by 2019/20
• Upgrades will also include interchanges with the Western Sydney Airport Motorway (Elizabeth Drive) and Bringelly Road
M7
M2
M4
Blacktown
Epping
Macquarie Park
Parramatta
Prairiewood
Western Sydney Airport Motorway (Elizabeth Drive)
• Construction of a new airport motorway from the M7 Motorway to The Northern Road, route to be determined
• Cost $1.25 billion (Australian Government contribution $1 billion)
• Construction will be completed prior to airport being operational
• Work will also include on/off ramps from the M7 Motorway
Strathfield
Burwood
Cabramatta
Elizabeth Drive
Northern Road
Western Sydney Airport, Badgery's Creek site
M7
Bringelly Road
$500 million. Work on the first stage to start in 2014/15
Liverpool
Bankstown
M5
Possible diversion for The Northern Road
Bringelly Road
Leppington
Prestons
East Hills
King Georges Road
Hurstville
Local roads package ($200m over 10 years)
Under way: $280 million upgrade Camden Valley Way (NSW funded)
Camden Valley Way
M31
Bringelly Road
• Upgrade to Bringelly Road between The Northern Road and Camden Valley Way
• Upgrade $500 million (Australian Government contribution $400 million)
• Work on first stage to start 2014/15
Miranda
Narellan
Narellan Road
Narellan Road upgrade
$114 Million
Campbelltown
Heathcote
Camden

5. TRAFFIC

RMS have recently published traffic generation criteria in relation to "Hardware" use however this criteria is not relevant to large contemporary Bunnings developments as outlined in the TTPA assessment contained in Appendix D.

Comprehensive data and assessment in relation to Bunnings peak traffic generation rates is documented in the TTPA analysis provided in Appendix D indicating peak "trend line" rates for Thursday/Friday and Saturday peaks as follows:

vtph/100m^2	Existing 8,916m^2	Recorded	Proposed 15,370m^2
Thurs/Fri PM	2.80 (250 vtph)	(263)	2.00 (304 vtph)
Sat MD	5.40 (482 vtph)	(497)	5.5 (766 vtph)

The passing trade factor as also indicated in Appendix D is 27% on Thursday/Friday and 28% on Saturday.

Thus the projected "additional" Bunnings generated traffic at this location is:

Thurs/Friday PM	+ 54 vtph
Sat MD	+ 284 vtph

It is presumed that the existing Bunnings floorspace will revert to a traditional Bulky Goods use with peak generation rates of 1.0 vtph/100m^2 on Thursday/Friday PM and 2.0vtph/100m^2 on Saturday MD less 20% dual use (with new Bunnings) which for the 8,916m^2 equates to a projected traffic generation as follows:

	Additional Traffic		
Thurs/Fri PM	54 + 89 x 0.80	=	122vtph
Sat MD	178 + 284 x 0.80	=	370vtph

The projected future traffic movements have been derived by a process of:

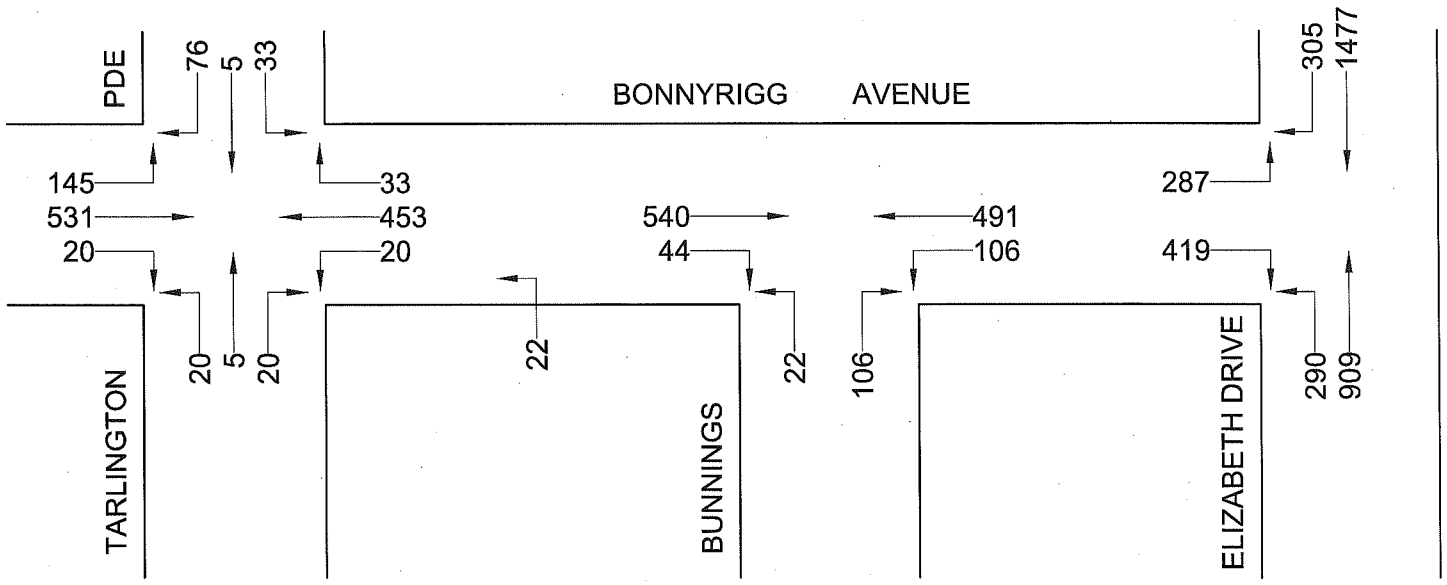
- deleting the existing Bunnings movements
- adding the replacement Bulky Goods movements
- dealing with passing trade for new Bunnings
- adding the new additional Bunnings volumes

The resultant projected volumes are shown on Figure 5.

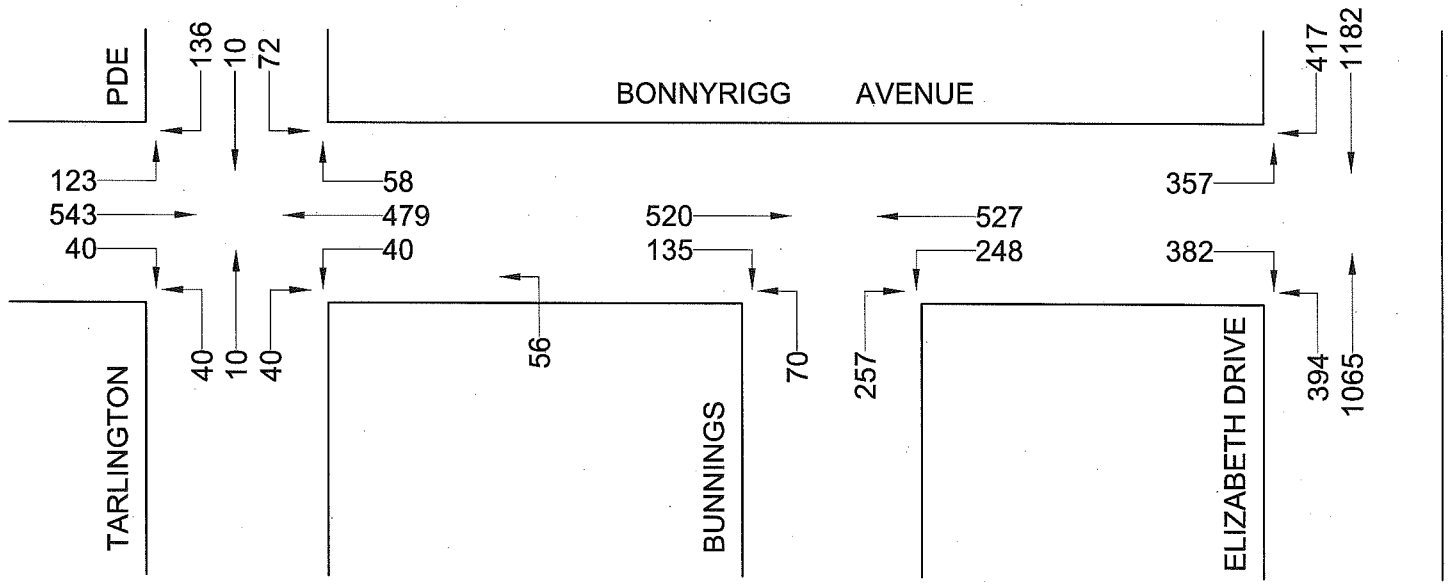
The potential implications of the traffic outcome for the Elizabeth Drive/Bonnyrigg Aveue, Bonnyrigg Avenue/Tarlington Drive and Bonnyrigg Avenue/Access intersections have been assessed with SIDRA and the results are provided in Appendix C and summarised in the following:

	WD PM		WE MD	
	LOS	AVD	LOS	AVD
Elizabeth/Bonnyrigg	A	13.8	A	14.7
Bonnyrigg/Tarlington	A	8.1	A	9.3
Bonnyrigg/Access	A	8.7	A	11.1

The results of this operational performance assessment indicate that the proposed development will not have any unsatisfactory traffic implications.

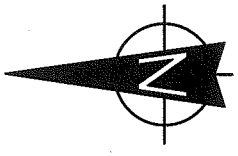


WEEKDAY PM



WEEKEND

LEGEND



PROJECTED FUTURE VOLUMES

FIG 5

6. PARKING

Fairfield City Councils' Development Control Plan specifies a parking provision for Hardware/Building Supplies use of 1 space per 50m^2 GFA and this also equates to the Appendix D assessment.

Application of this criteria to the proposed development would indicate the following:

15,370m^2	308 spaces

It is proposed to provide a total of 410 spaces including 8 accessible spaces and this will ensure adequate is available to meet seasonal peak demands.

7. ACCESS, INTERNAL CIRCULATION AND SERVICING

ACCESS

The proposed access arrangements will comprise:

* car park ingress/egress into a new roundabout on Bonnyrigg Avenue. This "single lane" circulating roadway will accommodate the movement of articulated vehicles and will be located well away from any traffic influence of the Elizabeth Drive or Tarlington Parade intersections.

* a driveway on Bonnyrigg Avenue at the northern boundary for the car park ingress/egress, Timber Trade ingress/egress and delivery vehicle ingress. Bonnyrigg Avenue at this location is straight and relatively level and there will be satisfactory sight distances available at this driveway which will have design provision compliant with AS280.1 & 2.

* an egress only driveway on the Elizabeth Drive frontage near the western boundary for delivery vehicles. Elizabeth Drive is straight and level at this location with a control median island which will restrict egress movements to left turn only.

  The provision of this access driveway has been discussed with RMS and agreement in principle provided. There are regular gaps provided in the eastbound traffic flow in Elizabeth Drive by the operation of the traffic signals at intersections to the west (eg. Smithfield Road).

  The movement of Bunnings delivery vehicles is relatively infrequent and the circumstances will enable the vehicles to exit without difficulty or delay and without presenting any adverse safety implications.

INTERNAL CIRCULATION

The design of the internal circulation and parking area including the aisles and parking bays etc will accord with the design criteria of AS2890.1 & 6 as well as Council's DCP and the circulation system will be very flexible due to the two-way traffic provisions.

SERVICING

There will be entirely separate internal circulation systems for cars and trucks with the Bunnings delivery vehicles ingressing through an access driveway on Bonnyrigg Avenue at the northern boundary and egressing to Elizabeth Drive at the western boundary.

The design provisions for service vehicles will accord with the AS2890.2 criteria and the requirements of all vehicles requiring to access the site as indicated on the turning path assessment provided in Appendix E.

8. CONCLUSION

The proposed new Bunnings development at Bonnyrigg will utilise a relatively large site which has convenient access to the arterial road system replacing an existing smaller Bunnings located at the same intersection. This assessment has concluded that the proposed development in terms of vehicle access, circulation, parking and servicing will be suitable and appropriate and that there will not be any adverse traffic impacts on the road system serving the site.

Appendix A

EXISTING INTERSECTION ARRANGEMENTS

Appendix B

TRAFFIC SURVEY RESULTS

Location	Intersection of Elizabeth Drive and Bonnyrigg Ave
Client	T.T.P.A.
Job No/Name	14007
Day/Date	Thursday, 09th October 2014

Roundabout

All Vehicles	EAST				SOUTH				WEST				NORTH				
	Tarlington Street				*Bonnyrigg Ave*				*Bunnings*				*Bonnyrigg Ave*				
15 MIN	L	T	U	R	L	T	U	R	L	T	U	R	L	T	U	R	TOTAL
1530 - 1545	9	4	2	27	11	81	2	5	12	2	0	15	18	97	0	7	**292**
1545 - 1600	11	5	3	33	13	79	1	8	14	3	0	20	21	111	0	2	**324**
1600 - 1615	5	1	1	34	14	75	3	5	16	4	0	17	24	119	2	10	**330**
1615 - 1630	5	3	2	18	12	84	5	6	11	6	0	9	12	104	4	20	**301**
1630 - 1645	7	2	1	31	13	98	3	5	7	3	0	13	13	131	5	18	**350**
1645 - 1700	5	5	1	14	16	141	2	7	16	0	0	13	42	144	4	18	**428**
1700 - 1715	8	2	2	16	11	96	3	4	13	5	0	15	53	118	2	20	**368**
1715 - 1730	9	4	4	25	13	75	2	5	12	4	0	18	22	111	0	18	**322**
1730 - 1745	0	3	3	21	10	108	5	6	13	3	0	14	28	125	0	17	**356**
1745 - 1800	3	4	0	18	12	144	3	3	15	5	0	14	33	121	2	26	**403**
1800 - 1815	9	3	1	15	8	75	3	3	24	3	0	16	42	129	0	9	**340**
1815 - 1830	4	3	0	17	9	99	4	11	8	1	0	10	24	87	0	11	**288**
Period End	**75**	**39**	**20**	**269**	**142**	**1155**	**36**	**68**	**161**	**39**	**0**	**174**	**332**	**1397**	**19**	**176**	**4102**

Roundabout

All Vehicles	EAST				SOUTH				WEST				NORTH				
	Tarlington Street				*Bonnyrigg Ave*				*Bunnings*				*Bonnyrigg Ave*				
HOURLY	L	T	U	R	L	T	U	R	L	T	U	R	L	T	U	R	TOTAL
1530 - 1630	30	13	8	112	50	319	11	24	53	15	0	61	75	431	6	39	**1247**
1545 - 1645	28	11	7	116	52	336	12	24	48	16	0	59	70	465	11	50	**1305**
1600 - 1700	22	11	5	97	55	398	13	23	50	13	0	52	91	498	15	66	**1409**
1615 - 1715	25	12	6	79	52	419	13	22	47	14	0	50	120	497	15	76	**1447**
1630 - 1730	29	13	8	86	53	410	10	21	48	12	0	59	130	504	11	74	**1468**
1645 - 1745	22	14	10	76	50	420	12	22	54	12	0	60	145	498	6	73	**1474**
1700 - 1800	20	13	9	80	46	423	13	18	53	17	0	61	136	475	4	81	**1449**
1715 - 1815	21	14	8	79	43	402	13	17	64	15	0	62	125	486	2	70	**1421**
1730 - 1830	16	13	4	71	39	426	15	23	60	12	0	54	127	462	2	63	**1387**
																	0
																	0
																	0
Period End	**213**	**114**	**65**	**796**	**440**	**3553**	**112**	**194**	**477**	**126**	**0**	**518**	**1019**	**4316**	**72**	**592**	**12607**

Intersection

All Vehicles	EAST		NORTH		WEST		
	Elizabeth Drive		*Bonnyrigg Ave*		*Elizabeth Drive*		
15 MIN	T	R	L	R	L	T	TOTAL
1530 - 1545	269	64	71	82	100	280	**866**
1545 - 1600	321	71	48	95	71	277	**883**
1600 - 1615	331	76	51	88	55	267	**868**
1615 - 1630	323	69	67	95	61	271	**886**
1630 - 1645	321	63	56	86	60	277	**863**
1645 - 1700	406	64	60	85	67	260	**942**
1700 - 1715	375	61	58	93	63	227	**877**
1715 - 1730	331	71	65	100	61	222	**850**
1730 - 1745	385	67	68	105	57	220	**902**
1745 - 1800	378	68	57	98	51	235	**887**
1800 - 1815	361	61	53	89	53	238	**855**
1815 - 1830	267	63	70	117	51	251	**819**
Period End	**4068**	**798**	**724**	**1133**	**750**	**3025**	**8824**

Intersection

All Vehicles	EAST		NORTH		WEST		
	Elizabeth Drive		*Bonnyrigg Ave*		*Elizabeth Drive*		
HOURLY	T	R	L	R	L	T	TOTAL
1530 - 1630	1244	280	237	360	287	1095	**3503**
1545 - 1645	1296	279	222	364	247	1092	**3500**
1600 - 1700	1381	272	234	354	243	1075	**3559**
1615 - 1715	1425	257	241	359	251	1035	**3568**
1630 - 1730	1433	259	239	364	251	986	**3532**
1645 - 1745	1497	263	251	383	248	929	**3571**
1700 - 1800	1469	267	248	396	232	904	**3516**
1715 - 1815	1455	267	243	392	222	915	**3494**
1730 - 1830	1391	259	248	409	212	944	**3463**
							0
							0
							0
Period End	**12591**	**2403**	**2163**	**3381**	**2193**	**8975**	**31706**

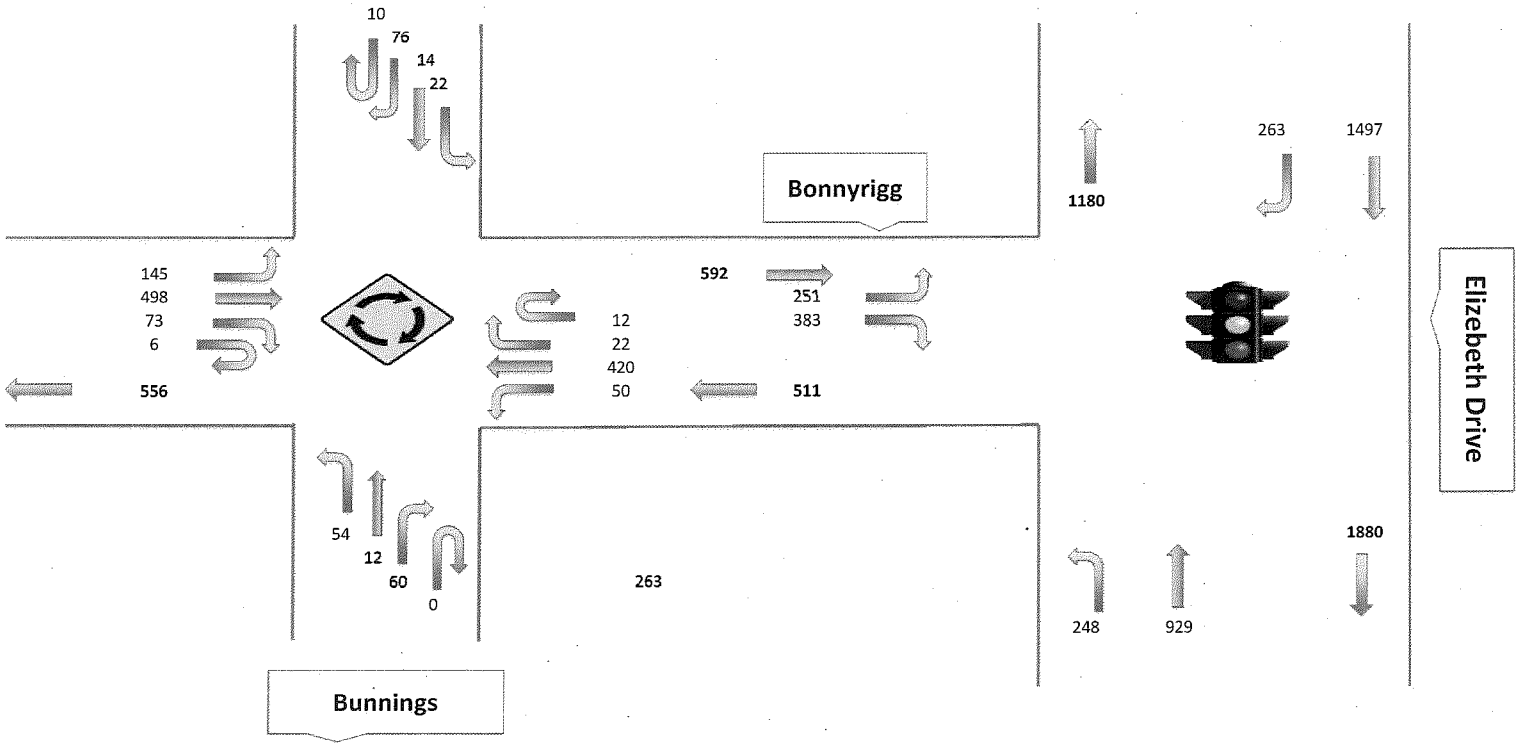
Location	Intersection of Elizabeth Drive and Bonnyrigg Ave
Client	T.T.P.A.
Job No/Name	14007
Day/Date	Thursday, 09th October 2014

Roundabout

All Vehicles	EAST				SOUTH				WEST				NORTH				
	Tarlington Street				*Bonnyrigg Ave*				*Bunnings*				*Bonnyrigg Ave*				
PEAK	L	T	U	R	L	T	U	R	L	T	U	R	L	T	U	R	TOTAL
1645 - 1745	22	14	10	76	50	420	12	22	54	12	0	60	145	498	6	73	**1474**

Intersection

All Vehicles	EAST		NORTH		WEST		
	Elizabeth Drive		*Bonnyrigg Ave*		*Elizabeth Drive*		
PEAK	T	R	L	R	L	T	TOTAL
1645 - 1745	1497	263	251	383	248	929	**3571**



Location	Intersection of Elizabeth Drive and Bonnyrigg Ave
Client	T.T.P.A.
Job No/Name	14007
Day/Date	Saturday, 11st October 2014

Roundabout

All Vehicles	EAST				SOUTH				WEST				NORTH				
	Tarlington Street				*Bonnyrigg Ave*				*Bunnings*				*Bonnyrigg Ave*				
15 MIN	L	T	U	R	L	T	U	R	L	T	U	R	L	T	U	R	TOTAL
1200 - 1215	12	7	0	27	22	96	6	2	31	11	0	24	33	112	6	42	**431**
1215 - 1230	8	5	1	14	18	111	7	3	34	6	0	26	39	113	3	39	**427**
1230 - 1245	11	2	0	44	24	109	0	3	27	5	0	30	28	117	5	41	**446**
1245 - 1300	12	3	0	47	22	121	2	7	26	7	0	22	25	108	0	42	**444**
1300 - 1315	9	4	0	31	21	138	5	13	26	5	0	23	31	111	4	39	**460**
1315 - 1330	11	4	2	30	24	114	0	17	21	9	0	20	29	106	3	36	**426**
1330 - 1345	8	6	0	36	23	118	6	12	18	5	0	23	38	104	6	41	**444**
1345 - 1400	12	5	0	33	30	117	3	9	23	3	0	21	33	96	0	37	**422**
1400 - 1415	10	8	1	37	24	103	0	9	24	6	0	25	25	98	5	43	**418**
1415 - 1430	9	5	0	27	24	99	3	6	29	4	0	23	39	103	4	39	**414**
1430 - 1445	7	3	1	21	27	95	2	4	25	4	0	28	28	113	4	42	**404**
1445 - 1500	5	1	0	25	24	83	0	5	26	2	0	30	23	106	3	38	**371**
Period End	**114**	**53**	**5**	**372**	**283**	**1304**	**34**	**90**	**310**	**67**	**0**	**295**	**371**	**1287**	**43**	**479**	**5107**

Roundabout

All Vehicles	EAST				SOUTH				WEST				NORTH				
	Tarlington Street				*Bonnyrigg Ave*				*Bunnings*				*Bonnyrigg Ave*				
HOURLY	L	T	U	R	L	T	U	R	L	T	U	R	L	T	U	R	TOTAL
1200 - 1300	43	17	1	132	86	437	15	15	118	29	0	102	125	450	14	164	**1748**
1215 - 1315	40	14	1	136	85	479	14	26	113	23	0	101	123	449	12	161	**1777**
1230 - 1330	43	13	2	152	91	482	7	40	100	26	0	95	113	442	12	158	**1776**
1245 - 1345	40	17	2	144	90	491	13	49	91	26	0	88	123	429	13	158	**1774**
1300 - 1400	40	19	2	130	98	487	14	51	88	22	0	87	131	417	13	153	**1752**
1315 - 1415	41	23	3	136	101	452	9	47	86	23	0	89	125	404	14	157	**1710**
1330 - 1430	39	24	1	133	101	437	12	36	94	18	0	92	135	401	15	160	**1698**
1345 - 1445	38	21	2	118	105	414	8	28	101	17	0	97	125	410	13	161	**1658**
1400 - 1500	31	17	2	110	99	380	5	24	104	16	0	106	115	420	16	162	**1607**
																	0
																	0
																	0
Period End	**355**	**165**	**16**	**1191**	**856**	**4059**	**97**	**316**	**895**	**200**	**0**	**857**	**1115**	**3822**	**122**	**1434**	**15500**

Intersection

All Vehicles	EAST		NORTH		WEST		
	Elizabeth Drive		*Bonnyrigg Ave*		*Elizabeth Drive*		
15 MIN	T	R	L	R	L	T	TOTAL
1200 - 1215	293	75	78	75	52	303	**876**
1215 - 1230	291	78	59	71	57	256	**812**
1230 - 1245	308	81	64	67	71	292	**883**
1245 - 1300	311	72	77	74	66	268	**868**
1300 - 1315	276	76	69	71	65	260	**817**
1315 - 1330	301	80	64	72	68	295	**880**
1330 - 1345	319	76	66	76	74	267	**878**
1345 - 1400	315	75	72	74	70	271	**877**
1400 - 1415	277	76	67	72	72	262	**826**
1415 - 1430	241	78	85	79	70	258	**811**
1430 - 1445	215	51	83	76	73	210	**708**
1445 - 1500	282	42	87	72	72	217	**772**
Period End	**3429**	**860**	**871**	**879**	**810**	**3159**	**8528**

Intersection

All Vehicles	EAST		NORTH		WEST		
	Elizabeth Drive		*Bonnyrigg Ave*		*Elizabeth Drive*		
HOURLY	T	R	L	R	L	T	TOTAL
1200 - 1300	1203	306	278	287	246	1119	**3439**
1215 - 1315	1186	307	269	283	259	1076	**3380**
1230 - 1330	1196	309	274	284	270	1115	**3448**
1245 - 1345	1207	304	276	293	273	1090	**3443**
1300 - 1400	1211	307	271	293	277	1093	**3452**
1315 - 1415	1212	307	269	294	284	1095	**3461**
1330 - 1430	1152	305	290	301	286	1058	**3392**
1345 - 1445	1048	280	307	301	285	1001	**3222**
1400 - 1500	1015	247	322	299	287	947	**3117**
							0
							0
							0
Period End	**10430**	**2672**	**2556**	**2635**	**2467**	**9594**	**30354**

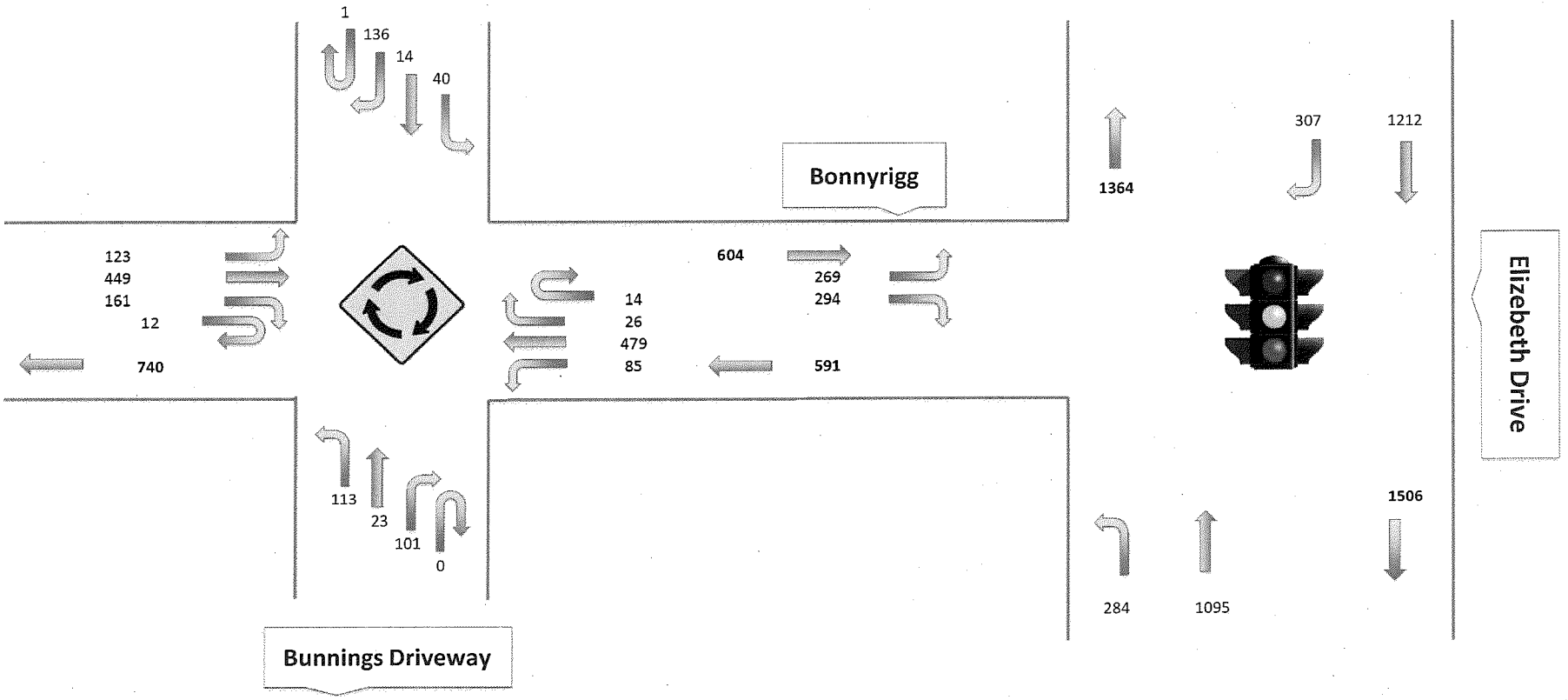
Location	Intersection of Elizabeth Drive and Bonnyrigg Ave
Client	T.T.P.A.
Job No/Name	14007
Day/Date	Saturday, 11st October 2014

Roundabout

All Vehicles	EAST				SOUTH				WEST				NORTH				
	Tarlington Street				*Bonnyrigg Ave*				*Bunnings*				*Bonnyrigg Ave*				
PEAK	L	T	U	R	L	T	U	R	L	T	U	R	L	T	U	R	TOTAL
1215 - 1315	40	14	1	136	85	479	14	26	113	23	0	101	123	449	12	161	1777

Intersection

All Vehicles	EAST		NORTH		WEST		
	Elizabeth Drive		*Bonnyrigg Ave*		*Elizabeth Drive*		
PEAK	T	R	L	R	L	T	TOTAL
1315 - 1415	1212	307	269	294	284	1095	3461



Appendix C

SIDRA RESULTS

MOVEMENT SUMMARY

Site: BONNYRIGG TARLINGTON
PM EX

Roundabout

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: BONNYRIGG AVE											
1	L	61	2.0	0.432	8.7	LOS A	3.1	21.9	0.48	0.65	47.8
2	T	420	2.0	0.432	7.8	LOS A	3.1	21.9	0.48	0.59	48.0
3	R	22	2.0	0.432	12.2	LOS A	3.1	21.9	0.48	0.77	45.8
Approach		503	2.0	0.432	8.1	LOS A	3.1	21.9	0.48	0.61	47.9
East: TARLINGTON											
4	L	22	2.0	0.152	11.6	LOS A	0.9	6.3	0.70	0.78	45.2
5	T	11	2.0	0.152	10.8	LOS A	0.9	6.3	0.70	0.75	45.5
6	R	76	2.0	0.152	15.1	LOS B	0.9	6.3	0.70	0.83	42.9
Approach		109	2.0	0.152	14.0	LOS A	0.9	6.3	0.70	0.81	43.6
North: BONNYRIGG AVE											
7	L	145	2.0	0.555	8.3	LOS A	5.0	35.9	0.44	0.60	47.9
8	T	498	2.0	0.555	7.4	LOS A	5.0	35.9	0.44	0.54	48.2
9	R	87	2.0	0.555	11.8	LOS A	5.0	35.9	0.44	0.72	45.8
Approach		730	2.0	0.555	8.1	LOS A	5.0	35.9	0.44	0.57	47.8
West: BUNNINGS ACCESS											
10	L	65	2.0	0.177	10.6	LOS A	1.0	7.2	0.64	0.74	46.3
11	T	12	2.0	0.177	9.8	LOS A	1.0	7.2	0.64	0.71	46.6
12	R	66	2.0	0.177	14.1	LOS A	1.0	7.2	0.64	0.81	43.8
Approach		143	2.0	0.177	12.2	LOS A	1.0	7.2	0.64	0.77	45.1
All Vehicles		1485	2.0	0.555	8.9	LOS A	5.0	35.9	0.49	0.62	47.2

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: BONNYRIGG TARLINGTON
SAT EX

Roundabout

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: BONNYRIGG AVE											
1	L	108	2.0	0.633	11.9	LOS A	6.2	44.4	0.77	0.84	45.6
2	T	479	2.0	0.633	11.1	LOS A	6.2	44.4	0.77	0.82	45.9
3	R	26	2.0	0.633	15.4	LOS B	6.2	44.4	0.77	0.90	43.3
Approach		613	2.0	0.633	11.4	LOS A	6.2	44.4	0.77	0.83	45.7
East: TARLINGTON											
4	L	40	2.0	0.312	13.2	LOS A	2.0	14.6	0.82	0.88	43.8
5	T	17	2.0	0.312	12.3	LOS A	2.0	14.6	0.82	0.86	44.0
6	R	136	2.0	0.312	16.7	LOS B	2.0	14.6	0.82	0.91	41.7
Approach		193	2.0	0.312	15.5	LOS B	2.0	14.6	0.82	0.90	42.3
North: BONNYRIGG AVE											
7	L	123	2.0	0.640	9.0	LOS A	6.4	45.8	0.63	0.64	47.0
8	T	449	2.0	0.640	8.1	LOS A	6.4	45.8	0.63	0.61	47.0
9	R	195	2.0	0.640	12.5	LOS A	6.4	45.8	0.63	0.72	45.3
Approach		767	2.0	0.640	9.4	LOS A	6.4	45.8	0.63	0.64	46.5
West: BUNNINGS ACCESS											
10	L	108	2.0	0.353	12.1	LOS A	2.3	16.7	0.79	0.86	44.8
11	T	23	2.0	0.353	11.3	LOS A	2.3	16.7	0.79	0.84	45.1
12	R	113	2.0	0.353	15.6	LOS B	2.3	16.7	0.79	0.89	42.6
Approach		244	2.0	0.353	13.7	LOS A	2.3	16.7	0.79	0.87	43.8
All Vehicles		1817	2.0	0.640	11.3	LOS A	6.4	45.8	0.72	0.76	45.4

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: ELIZABETH BONNYRIGG 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
East: ELIZABTH DR											
5	T	1497	2.0	0.591	1.8	LOS A	4.9	34.9	0.12	0.11	56.6
6	R	263	2.0	0.538	14.2	LOS A	3.7	26.6	0.27	0.79	43.2
Approach		1760	2.0	0.591	3.6	LOS A	4.9	34.9	0.15	0.22	54.1
North: BONNYRIGG AVE											
7	L	251	2.0	0.269	24.6	LOS B	6.5	46.3	0.48	0.76	35.8
9	R	383	2.0	0.596	50.7	LOS D	13.1	93.0	0.86	0.81	25.1
Approach		634	2.0	0.596	40.4	LOS C	13.1	93.0	0.71	0.79	28.4
West: ELIZABTH DR											
10	L	248	2.0	0.319	14.6	LOS B	3.0	21.0	0.22	0.71	42.6
11	T	929	2.0	0.568	7.3	LOS A	7.6	55.6	0.31	0.27	48.8
Approach		1177	2.0	0.568	8.8	LOS A	7.6	55.6	0.29	0.37	47.4
All Vehicles		3571	2.0	0.596	11.9	LOS A	13.1	93.0	0.29	0.37	44.8

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	45.1	LOS E	0.2	0.2	0.87	0.87
P5	Across N approach	53	28.0	LOS C	0.1	0.1	0.68	0.68
All Pedestrians		106	36.5	LOS D			0.78	0.78

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: ELIZABETH BONNYRIGG
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
East: ELIZABTH DR											
5	T	1212	2.0	0.439	1.3	LOS A	3.0	21.2	0.09	0.08	57.4
6	R	307	2.0	0.577	11.2	LOS A	2.9	20.4	0.18	0.75	46.0
Approach		1519	2.0	0.577	3.3	LOS A	3.0	21.2	0.11	0.22	54.7
North: BONNYRIGG AVE											
7	L	269	2.0	0.353	30.6	LOS C	8.6	61.4	0.59	0.78	32.6
9	R	294	2.0	0.569	56.1	LOS D	10.0	71.2	0.90	0.80	23.6
Approach		563	2.0	0.569	43.9	LOS D	10.0	71.2	0.75	0.79	27.2
West: ELIZABTH DR											
10	L	284	2.0	0.321	10.2	LOS A	1.2	8.4	0.08	0.68	46.9
11	T	1095	2.0	0.588	2.3	LOS A	3.6	25.6	0.12	0.11	55.8
Approach		1379	2.0	0.588	3.9	LOS A	3.6	25.6	0.11	0.23	53.7
All Vehicles		3461	2.0	0.588	10.2	LOS A	10.0	71.2	0.22	0.31	46.7

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	51.3	LOS E	0.2	0.2	0.93	0.93
P5	Across N approach	53	23.4	LOS C	0.1	0.1	0.63	0.63
All Pedestrians		106	37.4	LOS D			0.78	0.78

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.

MOVEMENT SUMMARY

Site: BONNYRIGG TARLINGTON
PM DEV

Roundabout

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: BONNYRIGG AVE											
1	L	20	2.0	0.399	8.2	LOS A	2.9	20.8	0.38	0.61	48.3
2	T	453	2.0	0.399	7.3	LOS A	2.9	20.8	0.38	0.55	48.6
3	R	33	2.0	0.399	11.7	LOS A	2.9	20.8	0.38	0.76	46.0
Approach		506	2.0	0.399	7.6	LOS A	2.9	20.8	0.38	0.56	48.4
East: TARLINGTON											
4	L	33	2.0	0.153	11.0	LOS A	0.9	6.1	0.64	0.75	45.9
5	T	12	2.0	0.153	10.1	LOS A	0.9	6.1	0.64	0.71	46.3
6	R	76	2.0	0.153	14.5	LOS A	0.9	6.1	0.64	0.81	43.4
Approach		121	2.0	0.153	13.1	LOS A	0.9	6.1	0.64	0.78	44.3
North: BONNYRIGG AVE											
7	L	145	2.0	0.490	7.9	LOS A	4.0	28.2	0.28	0.59	48.6
8	T	531	2.0	0.490	7.0	LOS A	4.0	28.2	0.28	0.51	49.1
9	R	20	2.0	0.490	11.3	LOS A	4.0	28.2	0.28	0.76	46.1
Approach		696	2.0	0.490	7.3	LOS A	4.0	28.2	0.28	0.54	48.9
West: BUNNINGS ACCESS											
10	L	20	2.0	0.057	10.6	LOS A	0.3	2.2	0.61	0.69	46.3
11	T	5	2.0	0.057	9.8	LOS A	0.3	2.2	0.61	0.66	46.7
12	R	20	2.0	0.057	14.1	LOS A	0.3	2.2	0.61	0.76	43.8
Approach		45	2.0	0.057	12.1	LOS A	0.3	2.2	0.61	0.72	45.2
All Vehicles		1368	2.0	0.490	8.1	LOS A	4.0	28.2	0.36	0.57	48.2

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: BONNYRIGG TARLINGTON
SAT DEV

Roundabout

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: BONNYRIGG AVE											
1	L	40	2.0	0.504	8.9	LOS A	4.0	28.8	0.55	0.66	47.5
2	T	479	2.0	0.504	8.1	LOS A	4.0	28.8	0.55	0.61	47.6
3	R	58	2.0	0.504	12.4	LOS A	4.0	28.8	0.55	0.77	45.7
Approach		577	2.0	0.504	8.5	LOS A	4.0	28.8	0.55	0.63	47.4
East: TARLINGTON											
4	L	72	2.0	0.297	11.8	LOS A	1.8	13.1	0.74	0.82	45.0
5	T	10	2.0	0.297	11.0	LOS A	1.8	13.1	0.74	0.80	45.3
6	R	136	2.0	0.297	15.3	LOS B	1.8	13.1	0.74	0.87	42.7
Approach		218	2.0	0.297	14.0	LOS A	1.8	13.1	0.74	0.85	43.6
North: BONNYRIGG AVE											
7	L	123	2.0	0.542	8.3	LOS A	4.6	33.0	0.43	0.61	48.0
8	T	543	2.0	0.542	7.5	LOS A	4.6	33.0	0.43	0.55	48.3
9	R	40	2.0	0.542	11.8	LOS A	4.6	33.0	0.43	0.74	45.9
Approach		706	2.0	0.542	7.9	LOS A	4.6	33.0	0.43	0.57	48.1
West: BUNNINGS ACCESS											
10	L	40	2.0	0.130	11.7	LOS A	0.8	5.4	0.71	0.77	45.2
11	T	10	2.0	0.130	10.9	LOS A	0.8	5.4	0.71	0.75	45.5
12	R	40	2.0	0.130	15.2	LOS B	0.8	5.4	0.71	0.83	42.9
Approach		90	2.0	0.130	13.2	LOS A	0.8	5.4	0.71	0.80	44.2
All Vehicles		1591	2.0	0.542	9.3	LOS A	4.6	33.0	0.53	0.64	46.9

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: BUNNINGS ACCESS PM FUT

Roundabout

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: BONNYRIGG											
1	L	106	2.0	0.425	8.8	LOS A	3.3	23.4	0.24	0.66	48.0
2	T	491	2.0	0.425	7.7	LOS A	3.3	23.4	0.24	0.56	48.7
Approach		597	2.0	0.425	7.9	LOS A	3.3	23.4	0.24	0.58	48.5
North: BONNYRIGG											
8	T	540	2.0	0.473	8.2	LOS A	3.9	27.5	0.42	0.59	47.8
9	R	44	2.0	0.473	11.5	LOS A	3.9	27.5	0.42	0.74	46.0
Approach		584	2.0	0.473	8.5	LOS A	3.9	27.5	0.42	0.60	47.6
West: BUNNINGS											
10	L	22	2.0	0.160	11.6	LOS A	0.9	6.1	0.60	0.76	45.3
12	R	106	2.0	0.160	13.9	LOS A	0.9	6.1	0.60	0.80	43.6
Approach		128	2.0	0.160	13.5	LOS A	0.9	6.1	0.60	0.79	43.9
All Vehicles		1309	2.0	0.473	8.7	LOS A	3.9	27.5	0.35	0.61	47.6

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: BUNNINGS ACCESS SAT FUT

Roundabout

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: BONNYRIGG											
1	L	248	2.0	0.649	9.9	LOS A	6.9	49.1	0.62	0.66	46.7
2	T	527	2.0	0.649	8.8	LOS A	6.9	49.1	0.62	0.61	46.7
Approach		775	2.0	0.649	9.1	LOS A	6.9	49.1	0.62	0.63	46.7
North: BONNYRIGG											
8	T	520	2.0	0.657	10.9	LOS A	7.0	49.6	0.77	0.76	46.0
9	R	135	2.0	0.657	14.2	LOS A	7.0	49.6	0.77	0.82	43.9
Approach		655	2.0	0.657	11.5	LOS A	7.0	49.6	0.77	0.77	45.6
West: BUNNINGS											
10	L	70	2.0	0.447	13.1	LOS A	3.2	22.7	0.78	0.88	43.9
12	R	257	2.0	0.447	15.3	LOS B	3.2	22.7	0.78	0.90	42.4
Approach		327	2.0	0.447	14.9	LOS B	3.2	22.7	0.78	0.89	42.7
All Vehicles		1757	2.0	0.657	11.1	LOS A	7.0	49.6	0.71	0.73	45.5

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: ELIZABETH BONNYRIGG PM DEV

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
East: ELIZABTH DR											
5	T	1477	2.0	0.606	1.9	LOS A	5.0	35.6	0.13	0.12	56.4
6	R	305	2.0	0.611	20.0	LOS B	7.3	52.2	0.46	0.88	38.7
Approach		1782	2.0	0.611	5.0	LOS A	7.3	52.2	0.19	0.25	52.3
North: BONNYRIGG AVE											
7	L	287	2.0	0.308	22.0	LOS B	6.7	48.0	0.44	0.75	37.4
9	R	419	2.0	0.600	48.5	LOS D	14.1	100.7	0.83	0.81	25.7
Approach		706	2.0	0.600	37.7	LOS C	14.1	100.7	0.67	0.79	29.5
West: ELIZABTH DR											
10	L	290	2.0	0.439	18.3	LOS B	5.3	38.0	0.34	0.73	39.9
11	T	909	2.0	0.603	11.1	LOS A	10.9	77.3	0.44	0.39	44.5
Approach		1199	2.0	0.603	12.8	LOS A	10.9	77.3	0.42	0.47	43.3
All Vehicles		3687	2.0	0.611	13.8	LOS A	14.1	100.7	0.35	0.42	43.0

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	42.5	LOS E	0.2	0.2	0.84	0.84
P5	Across N approach	53	30.8	LOS D	0.1	0.1	0.72	0.72
All Pedestrians		106	36.7	LOS D			0.78	0.78

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.

MOVEMENT SUMMARY

Site: ELIZABETH BONNYRIGG SAT DEV

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
East: ELIZABTH DR											
5	T	1182	2.0	0.444	1.4	LOS A	2.9	20.8	0.09	0.08	57.3
6	R	417	2.0	0.688	15.5	LOS B	7.3	52.0	0.36	0.86	42.1
Approach		1599	2.0	0.688	5.1	LOS A	7.3	52.0	0.16	0.29	52.4
North: BONNYRIGG AVE											
7	L	357	2.0	0.397	24.2	LOS B	9.6	68.4	0.50	0.77	36.0
9	R	382	2.0	0.671	55.0	LOS D	13.5	96.2	0.91	0.82	23.9
Approach		739	2.0	0.671	40.1	LOS C	13.5	96.2	0.71	0.80	28.5
West: ELIZABTH DR											
10	L	394	2.0	0.576	20.1	LOS B	7.4	52.5	0.46	0.76	38.7
11	T	1065	2.0	0.677	9.6	LOS A	12.7	90.5	0.44	0.39	45.9
Approach		1459	2.0	0.677	12.4	LOS A	12.7	90.5	0.45	0.49	43.7
All Vehicles		3797	2.0	0.688	14.7	LOS B	13.5	96.2	0.38	0.47	42.3

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	48.6	LOS E	0.2	0.2	0.90	0.90
P5	Across N approach	53	29.4	LOS C	0.1	0.1	0.70	0.70
All Pedestrians		106	39.0	LOS D			0.80	0.80

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.

Appendix D

BUNNINGS TRAFFIC CHARACTERISTICS

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 14,111m²*

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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:

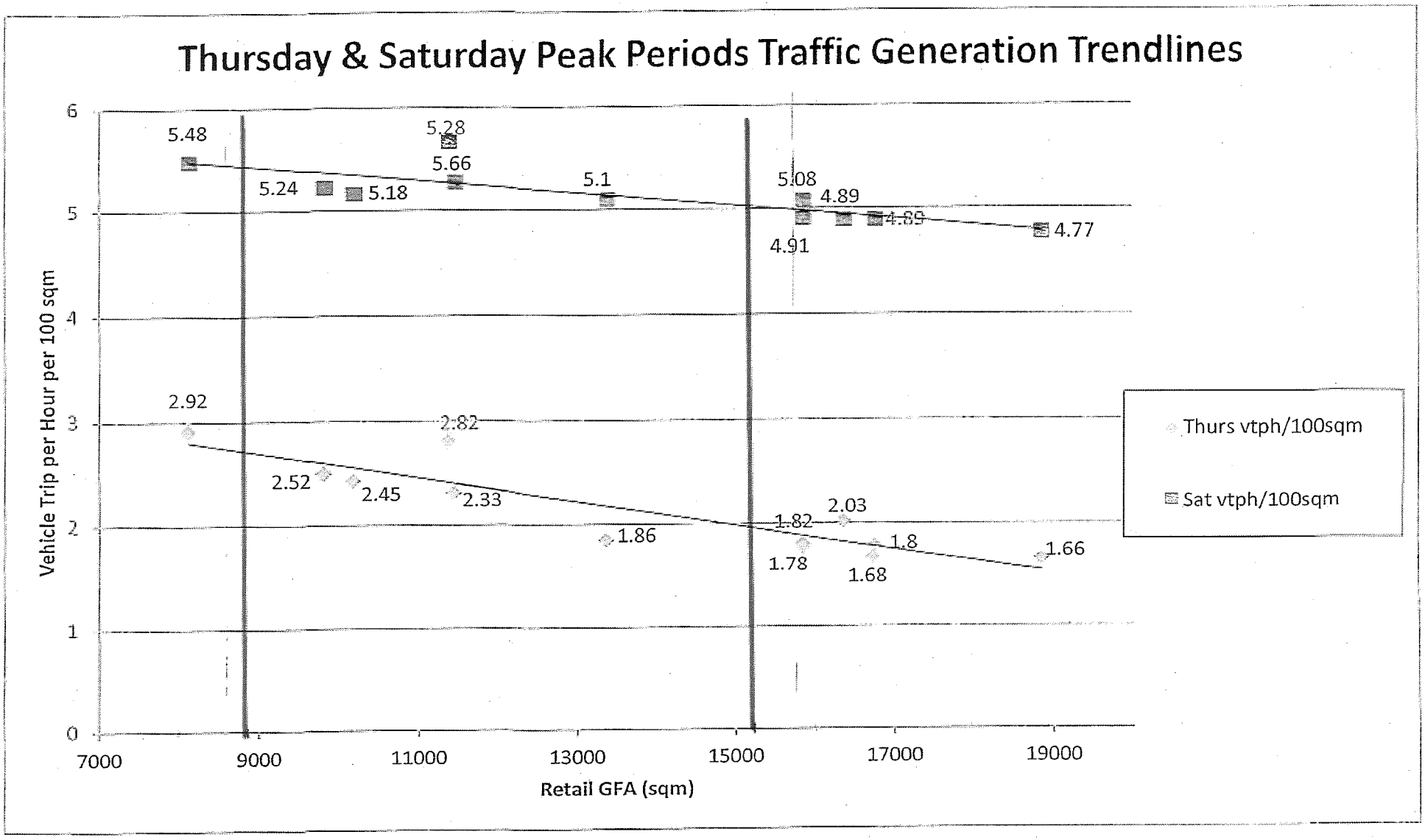
		Peak Parking	Cars per m^2
Balgowlah	8,106m^2	163 cars	1 space per 50m^2
Parramatta	9,800m^2	196 cars	1 space per 50m^2
Chatswood	11,443m^2	234 cars	1 space per 49m^2
Bankstown	15,853m^2	285 cars	1 space per 55.6m^2
Castle Hill	18,860m^2	397 cars	1 space per 48m^2

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


Thursday & Saturday Peak Periods Traffic Generation Trendlines
Vehicle Trip per Hour per 100 sqm
Retail GFA (sqm)
0
1
2
3
4
5
6
7000
9000
11000
13000
15000
17000
19000
5.48
5.24
5.18
5.28
5.66
5.1
5.08
4.89
4.91
4.77
2.92
2.52
2.45
2.82
2.33
1.86
1.82
2.03
1.78
1.8
1.68
1.66
Thurs vtph/100sqm
Sat vtph/100sqm

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.

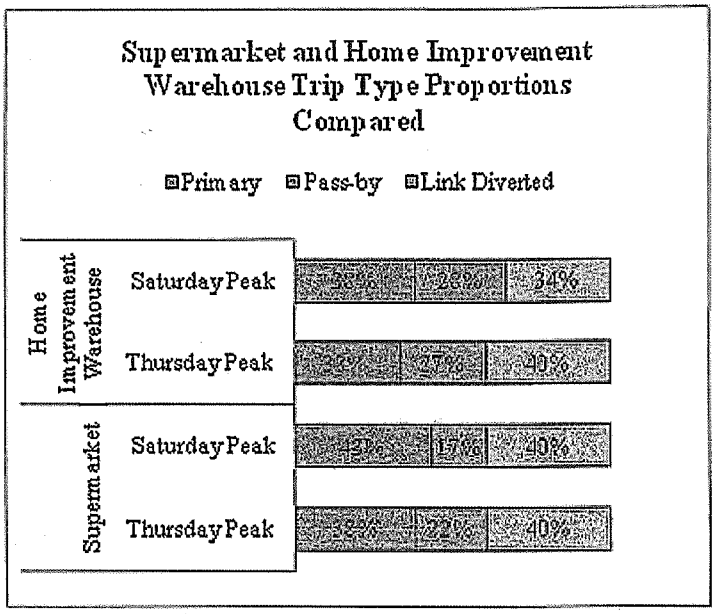


Figure 10: Surveyed trip type proportions for the supermarket and home improvement warehouse compared

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

TTM EXTRACT

5. Car Parking Supply

5.1 Council Parking Supply Requirement

The carparking requirements for the 'Mixed Industry and Business Area North Sector One', as outlined in the Sector Plan no 026-1000indicates that parking for both a 'hardware shop/centre', and a 'showroom' is 1 space per 30m^2 gfa (or 3.33 spaces / 100m^2). Application of this rate to the proposed development results in a total parking requirement of 647 spaces.

The above parking supply is to include PWD parking, which is required at a minimum rate of 1 PWD space per 50 standard spaces.

5.2 Surveyed Practical Parking Demand

TTM has conducted numerous parking demand surveys at existing Bunnings stores throughout Queensland over the past two years (note that the Rocklea store has been surveyed a number of times). The results indicate that the Saturday demand is significantly higher than the weekday demand.

The Saturday results (summarised in Figure5.1) indicate that (excluding the Stafford store) the 85th percentile parking demand rate was 1.78 spaces per 100m^2 gfa (or 1 space per 56.2m^2 gfa). The Stafford store was excluded as it is not considered representative of a normal Bunnings site in that there is a complete lack of alternative large format hardware stores in the vicinity. This is clearly not the case at the subject site, with other Bunnings stores located at Rothwell (6km), Morayfield (13km), Lawnton (13km); and a Masters to be located within the North Lakes town centre less than 3km away. Application of this rate to the proposed development results in a maximum parking demand of 345 spaces.

	GFA	Rate
Bundaberg	10532	1.10
Capalaba	12550	1.43
Capalaba	12550	1.43
Hervey Bay	11736	1.33
Mackay	11902	1.66
Mt Gravatt	9668	1.71
Nerang	13853	1.65
Oxley	13453	1.92
Rockhampton	11574	1.93
Rocklea	12540	1.59
Rocklea	12540	1.69
Rocklea	12540	1.71
Rocklea	12540	1.83
Rothwell	13679	1.08
Stafford	12564	2.86

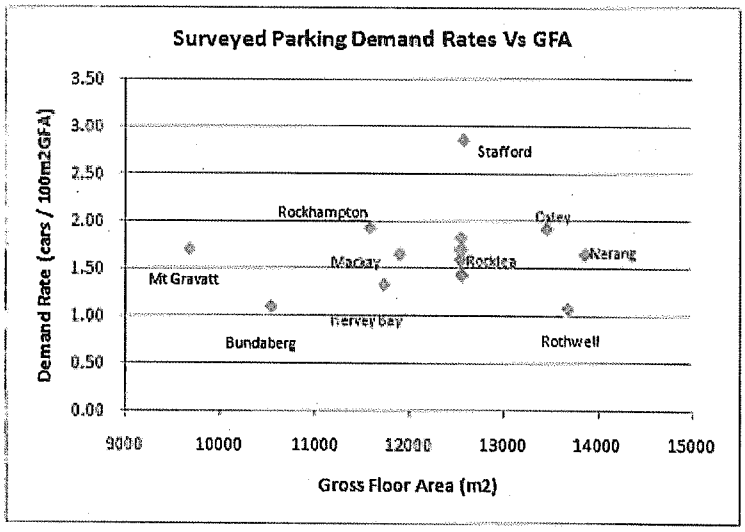


Figure 5.1: Surveyed Parking Demand Rates at Existing Bunnings Stores

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	253	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	87.8%
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

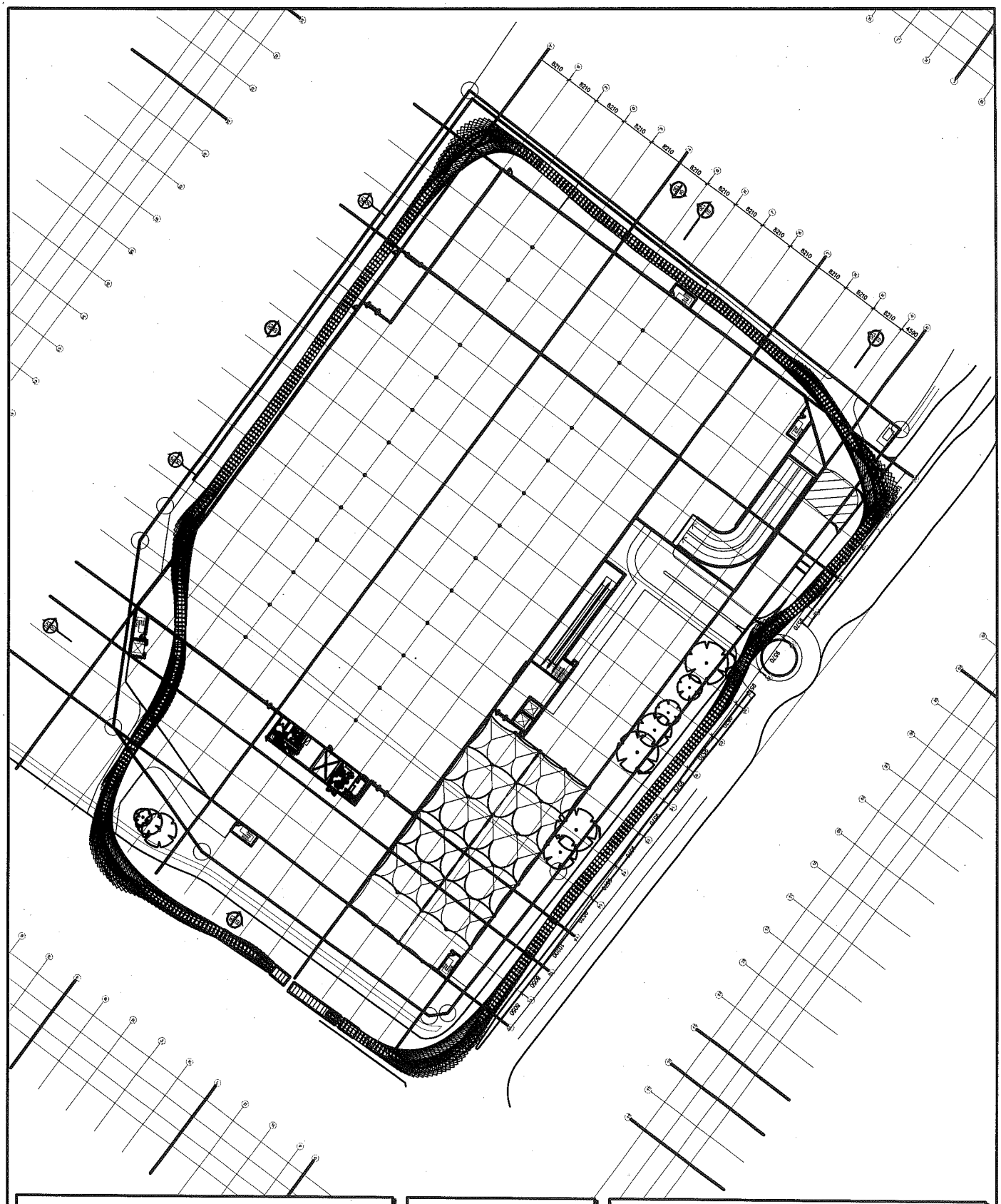
	Bunnings HW1, HW2, HW4, HW8			Mitre10 HW3, HW5, HW6, HW7, HW9			Avg Mitre10 / Bunnings
Trips/ 100m²GFA	Min	Max	Avg	Min	Max	Avg	%
Weekdays							
Person-based Trips							
- Site Peak Hour	3.95	5.77	4.67	4.96	6.40	5.72	122.5%
- Vehicle Network AM Peak	0.65	2.29	1.47	2.45	4.75	3.20	218.2%
- Vehicle Network 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 E

TURNING PATH ASSESSMENT



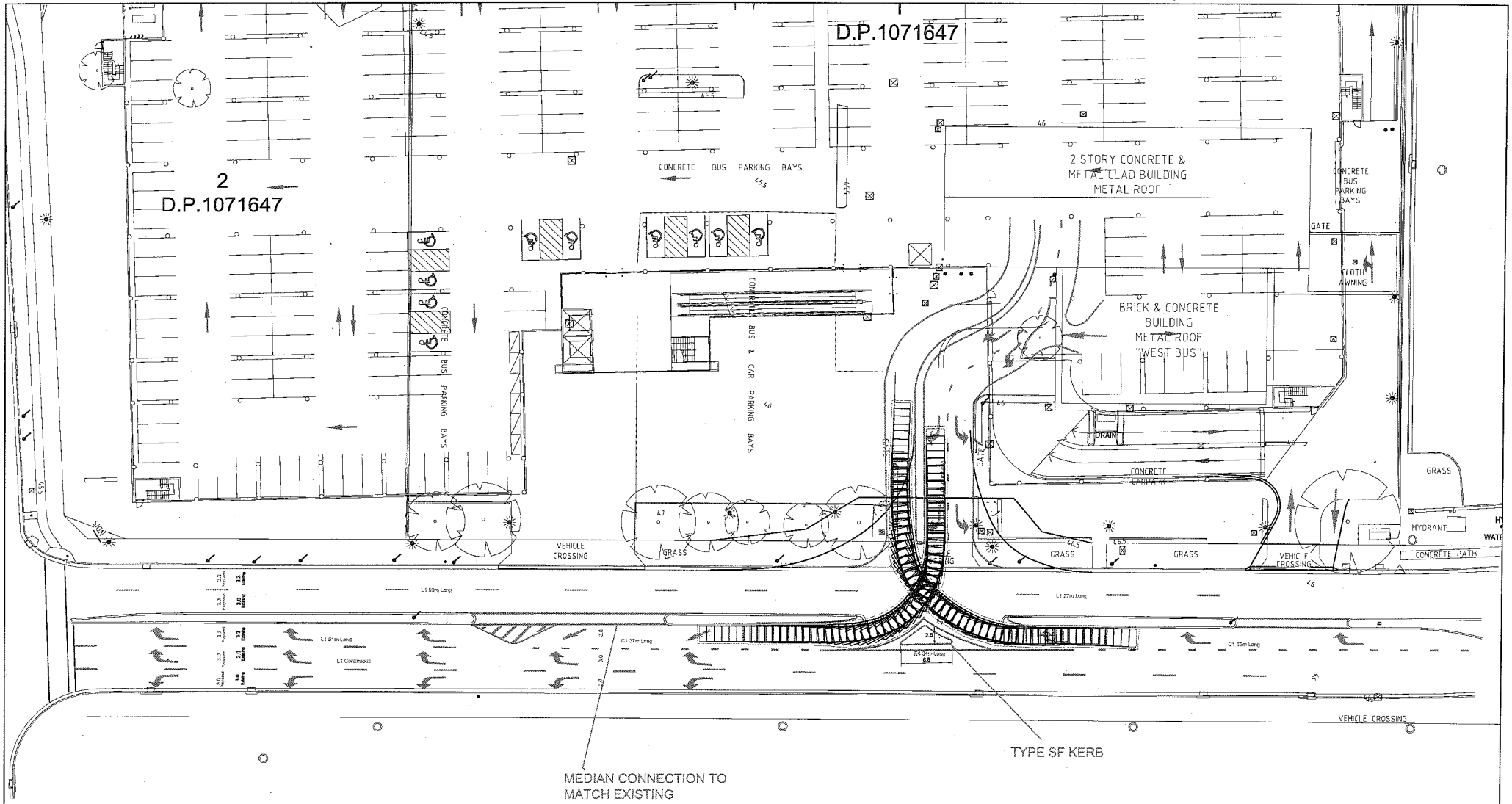
LEGEND

This drawing has been prepared using vehicle modelling computer software AutoTrack V9.21 in conjunction with AutoCAD 2013. The vehicle used is based upon vehicle data provided by Austroads and incorporates a reasonable degree of tolerance. However, it is not possible to account for all vehicle types/characteristics and/or driver ability.

N

SWEPT PATH ANALYSIS OF A 19m ARTICULATED VEHICLE ENTERING AND EXITING THE SITE

SP 1



LEGEND

SWEPT PATH ANALYSIS OF A CAR AND TRAILER ENTERING AND EXITING THE SITE

SP 1

Issue History

File Name	Prepared by	Reviewed by	Issued by	Date	Issued to
P2293.001T Bonnyrigg Avenue & Elizabeth Drive - SIDRA Analysis	J. Smith	T. Wheatley	J. Smith	16/10/2015	Ross Nettle, TTPA
P2293.002T Bonnyrigg Avenue & Elizabeth Drive - SIDRA Analysis	J. Smith	T. Wheatley	J. Smith	22/10/2015	Ross Nettle, TTPA

Bonnyrigg Avenue & Elizabeth Drive – SIDRA Analysis

1. INTRODUCTION AND SCOPE

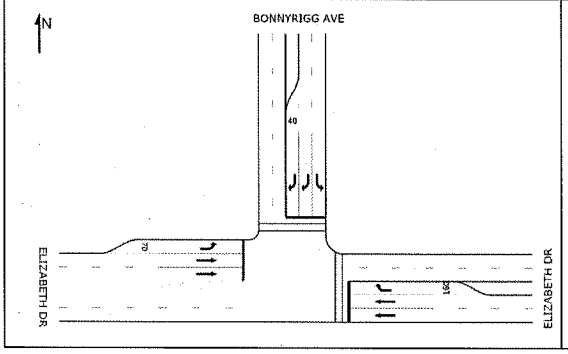
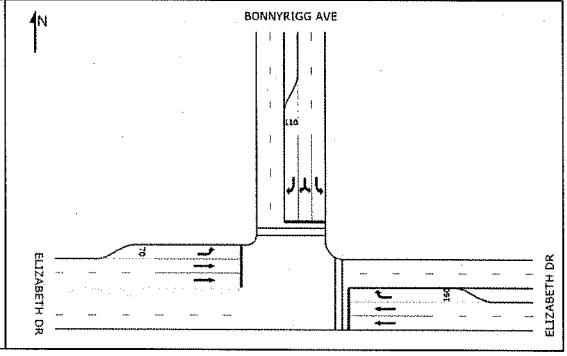
SIDRA intersection analysis has been done for the intersection of Bonnyrigg Avenue and Elizabeth Drive as part of the assessment of the traffic impacts associated with the proposed relocation of Bunnings Bonnyrigg.

The current configuration of the intersection consists of one left turn and a dual right turn. Given that the left and right turn volumes from Bonnyrigg Avenue onto Elizabeth Drive are relatively similar in both the PM and Saturday peaks, an option of converting the centre lane at the northern approach to a shared left and right turn has been tested using SIDRA analysis.

This technical note summarises the results of the SIDRA modelling.

2. INTERSECTION LAYOUT

The existing and proposed intersection layout is shown below.

Existing Layout	Proposed Layout
	

3. SIDRA ANALYSIS

The SIDRA results are summarised in Table 3.1.

Table 3.1: Intersection Analysis

Intersection	Approach	DoS (v/c)	Average Delay (sec)	LoS
Existing PM				
Bonnyrigg Avenue / Elizabeth Drive	North: Bonnyrigg Ave	0.588	44.1	D
	East: Elizabeth Drive	0.598	12.4	A
	West: Elizabeth Drive	0.593	30.3	C
Future PM				
Bonnyrigg Avenue / Elizabeth Drive	North: Bonnyrigg Ave	0.617	49.7	D
	East: Elizabeth Drive	0.611	10.2	A
	West: Elizabeth Drive	0.609	29.5	C
Existing Saturday				
Bonnyrigg Avenue / Elizabeth Drive	North: Bonnyrigg Ave	0.599	49.9	D
	East: Elizabeth Drive	0.584	10.6	A
	West: Elizabeth Drive	0.594	25.5	B
Future Saturday				
Bonnyrigg Avenue / Elizabeth Drive	North: Bonnyrigg Ave	0.629	51.4	D
	East: Elizabeth Drive	0.724	13.2	A
	West: Elizabeth Drive	0.722	28.6	C

The SIDRA analysis shows that the intersection continues to operate at an overall Level of Service B, and the introduction of the shared centre lane would obviate the need to weave.

ATTACHMENT A

SIDRA RESULTS

MOVEMENT SUMMARY

Site: ELIZABETH BONNYRIGG PM DEV (shared centre lane) - 15% Bunching (West) & 10% Bunching (East)

Signals - Fixed Time Cycle Time = 140 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
East: ELIZABETH DR											
5	T	1646	2.0	0.611	3.0	LOS A	8.5	60.8	0.17	0.16	54.6
6	R	320	2.0	0.590	47.3	LOS D	17.4	123.7	0.91	0.99	25.2
Approach		1966	2.0	0.611	10.2	LOS A	17.4	123.7	0.29	0.29	46.2
North: BONNYRIGG AVE											
7	L	306	2.0	0.404	32.5	LOS C	13.4	95.1	0.73	0.80	29.0
9	R	459	2.0	0.617	61.2	LOS E	14.3	101.9	0.96	0.83	21.0
Approach		765	2.0	0.617	49.7	LOS D	14.3	101.9	0.87	0.82	23.6
West: ELIZABETH DR											
10	L	305	2.0	0.569	16.3	LOS B	7.7	55.1	0.45	0.74	40.3
11	T	1022	2.0	0.609	33.4	LOS C	26.4	188.3	0.83	0.76	29.7
Approach		1327	2.0	0.609	29.5	LOS C	26.4	188.3	0.74	0.75	31.6
All Vehicles		4058	2.0	0.617	23.9	LOS B	26.4	188.3	0.55	0.54	34.7

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	54.0	LOS E	0.2	0.2	0.88	0.88
P5	Across N approach	53	30.2	LOS D	0.1	0.1	0.66	0.66
All Pedestrians		106	42.1	LOS E			0.77	0.77

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.

MOVEMENT SUMMARY

Site: ELIZABETH BONNYRIGG SAT DEV (shared centre lane) - 15% Bunching (West) & 10% Bunching (East)

Signals - Fixed Time Cycle Time = 140 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
East: ELIZABETH DR											
5	T	1333	2.0	0.471	1.7	LOS A	4.0	28.6	0.10	0.09	56.8
6	R	402	2.0	0.724	51.2	LOS D	21.7	154.4	0.96	1.04	24.0
Approach		1735	2.0	0.724	13.2	LOS A	21.7	154.4	0.30	0.31	43.5
North: BONNYRIGG AVE											
7	L	356	2.0	0.478	35.9	LOS C	16.7	119.1	0.78	0.81	27.8
9	R	401	2.0	0.629	65.2	LOS E	13.2	93.8	0.98	0.83	20.3
Approach		757	2.0	0.629	51.4	LOS D	16.7	119.1	0.89	0.82	23.2
West: ELIZABETH DR											
10	L	379	2.0	0.722	17.2	LOS B	10.4	74.4	0.48	0.75	39.5
11	T	1205	2.0	0.674	32.2	LOS C	31.6	225.1	0.84	0.78	30.2
Approach		1584	2.0	0.722	28.6	LOS C	31.6	225.1	0.76	0.77	32.0
All Vehicles		4076	2.0	0.724	26.3	LOS B	31.6	225.1	0.58	0.58	33.4

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	58.5	LOS E	0.2	0.2	0.91	0.91
P5	Across N approach	53	27.7	LOS C	0.1	0.1	0.63	0.63
All Pedestrians		106	43.1	LOS E			0.77	0.77

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.

PHASING SUMMARY

Site: ELIZABETH BONNYRIGG PM DEV (shared centre lane) - 15% Bunching (West) & 10% Bunching (East)

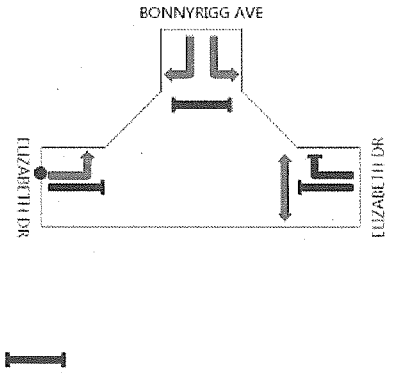
Signals - Fixed Time Cycle Time = 140 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Two-Phase
Input Sequence: A, B, C
Output Sequence: A, B, C

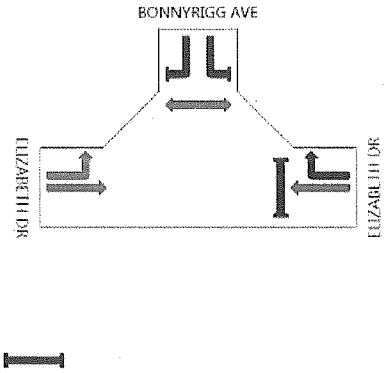
Phase Timing Results

Phase	A	B	C
Green Time (sec)	30	61	31
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	36	67	37
Phase Split	26 %	48 %	26 %

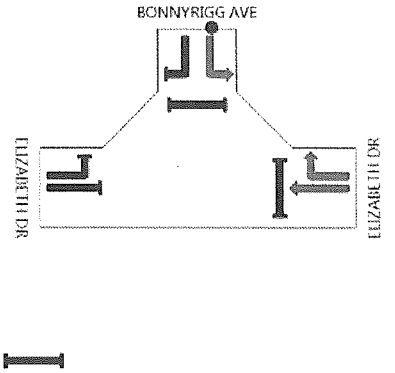
Phase A



Phase B



Phase C



Normal Movement
Slip-Lane Movement
Stopped Movement
Turn On Red
Permitted/Opposed
Opposed Slip-Lane
Continuous Movement
Undetected Movement
Phase Transition Applied

PHASING SUMMARY

Site: ELIZABETH BONNYRIGG SAT DEV (shared centre lane) - 15% Bunching (West) & 10% Bunching (East)

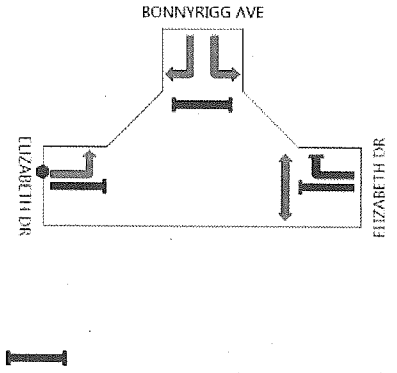
Signals - Fixed Time Cycle Time = 140 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Two-Phase
Input Sequence: A, B, C
Output Sequence: A, B, C

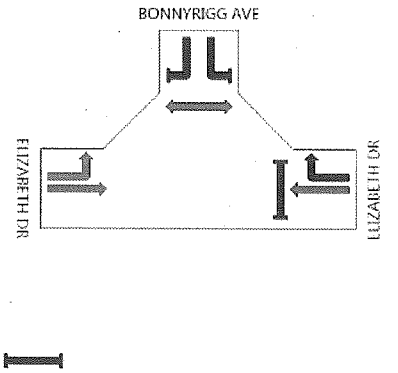
Phase Timing Results

Phase	A	B	C
Green Time (sec)	25	65	32
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	31	71	38
Phase Split	22 %	51 %	27 %

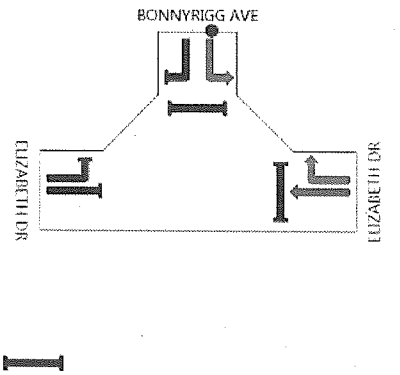
Phase A



Phase B



Phase C



Normal Movement
Slip-Lane Movement
Stopped Movement
Turn On Red
Permitted/Opposed
Opposed Slip-Lane
Continuous Movement
Undetected Movement
Phase Transition Applied

Issue History

File Name	Prepared by	Reviewed by	Issued by	Date	Issued to
P2293.001T Bonnyrigg Bunnings SIDRA Analysis	J. Smith	T. Wheatley	J. Smith	15/10/2015	Ross Nettle, TTPA
P2293.002T Bonnyrigg Bunnings SIDRA Analysis	J. Smith	T. Wheatley	J. Smith	16/10/2015	Ross Nettle, TTPA
P2293.003T Bonnyrigg Bunnings SIDRA Analysis	J. Smith	T. Wheatley	J. Smith	22/10/2015	Ross Nettle, TTPA

Bonnyrigg Bunnings SIDRA Analysis

1. INTRODUCTION AND SCOPE

SIDRA intersection analysis has been done for the following three (3) intersections to test the impacts of the proposed relocation of Bunnings Bonnyrigg:

- Bonnyrigg Avenue / Tarlington Parade / Existing Bunnings Access (Existing Roundabout);
- Bonnyrigg Avenue / Proposed Bunnings Access (Proposed New Access):
  - Option 1: Roundabout;
  - Option 2: Seagull; and
- Bonnyrigg Avenue / Elizabeth Drive (Existing Signalised Intersection).

This technical note summarises the results of the SIDRA modelling.

2. SIDRA ANALYSIS

The SIDRA results are summarised in Table 2.1 and 2.2.

Table 2.1: Intersection Analysis – Existing Scenario

Intersection	Approach	DoS (v/c)	Average Delay (sec)	LoS
Existing PM				
Bonnyrigg Avenue / Tarlington Parade / Existing Access	North: Bonnyrigg Avenue	0.574	6.5	A
	East: Tarlington Parade	0.180	12.3	A
	South: Bonnyrigg Avenue	0.453	6.6	A
	West: Bunnings Access	0.181	10.5	A
Bonnyrigg Avenue / Elizabeth Drive	North: Bonnyrigg Ave	0.588	44.1	D
	East: Elizabeth Drive	0.598	12.4	A
	West: Elizabeth Drive	0.593	30.3	C
Existing Saturday				
Bonnyrigg Avenue / Tarlington Parade / Existing Access	North: Bonnyrigg Avenue	0.656	7.7	A
	East: Tarlington Parade	0.323	13.9	A
	South: Bonnyrigg Avenue	0.651	10.1	A
	West: Bunnings Access	0.362	12.0	A
Bonnyrigg Avenue / Elizabeth Drive	North: Bonnyrigg Ave	0.599	49.9	D
	East: Elizabeth Drive	0.584	10.6	A
	West: Elizabeth Drive	0.594	25.5	B

Table 2.2: Intersection Analysis – Future Scenario

Intersection	Approach	DoS (v/c)	Average Delay (sec)	LoS
Future PM				
Bonnyrigg Avenue / Tarlington Parade / Existing	North: Bonnyrigg Avenue	0.632	5.8	A
	East: Tarlington Parade	0.212	13.2	A
	South: Bonnyrigg Avenue	0.508	6.1	A
	West: Access	0.067	11.5	A
Bonnyrigg Avenue / New Access Roundabout Option	North: Bonnyrigg Avenue	0.555	6.7	A
	South: Bonnyrigg Avenue	0.401	6.4	A
	West: Bunnings Access	0.137	12.0	A
Bonnyrigg Avenue / New Access Seagull Option	North: Bonnyrigg Avenue	0.166	1.3	A
	South: Bonnyrigg Avenue	0.163	0.6	A
	West: Bunnings Access	0.201	13.6	A
Bonnyrigg Avenue / Elizabeth Drive	North: Bonnyrigg Ave	0.617	49.7	D
	East: Elizabeth Drive	0.611	10.2	A
	West: Elizabeth Drive	0.609	29.5	C
Future Saturday				
Bonnyrigg Avenue / Tarlington Parade / Existing Access	North: Bonnyrigg Avenue	0.763	6.7	A
	East: Tarlington Parade	0.468	17.9	B
	South: Bonnyrigg Avenue	0.698	8.3	A
	West: Access	0.180	14.1	A
Bonnyrigg Avenue / New Access Roundabout Option	North: Bonnyrigg Avenue	0.780	9.5	A
	South: Bonnyrigg Avenue	0.563	8.0	A
	West: Bunnings Access	0.418	13.7	A
Bonnyrigg Avenue / New Access Seagull Option	North: Bonnyrigg Avenue	0.382	3.5	A
	South: Bonnyrigg Avenue	0.205	1.1	A
	West: Bunnings Access	0.762	31.2	C
Bonnyrigg Avenue / Elizabeth Drive	North: Bonnyrigg Ave	0.629	51.4	D
	East: Elizabeth Drive	0.724	13.2	A
	West: Elizabeth Drive	0.722	28.6	C

It should be noted that SIDRA cannot replicate the downstream weaving that would likely occur on Bonnyrigg Avenue at the northern approach at Elizabeth Drive as a result of vehicles turning right out of the proposed Bunnings Access that would then enter the left lane to turn left onto Elizabeth Drive.

However, given that the left and right turn volumes onto Elizabeth Drive are relatively similar in both PM and Saturday peaks, it is recommended that the centre approach lane to Elizabeth Drive be designated as a dual left and right turn, and this would obviate the need to weave.

ATTACHMENT A

SIDRA RESULTS

MOVEMENT SUMMARY

Site: BONNYRIGG TARLINGTON
PM EX

Roundabout

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: BONNYRIGG AVE											
1	L	61	2.0	0.453	7.1	LOS A	3.3	23.4	0.52	0.64	42.3
2	T	420	2.0	0.453	6.2	LOS A	3.3	23.4	0.52	0.57	42.4
3	R	32	2.0	0.453	10.9	LOS A	3.3	23.4	0.52	0.78	40.4
Approach		513	2.0	0.453	6.6	LOS A	3.3	23.4	0.52	0.59	42.3
East: TARLINGTON											
4	L	22	2.0	0.180	10.1	LOS A	1.1	7.6	0.72	0.77	40.1
5	T	18	2.0	0.180	9.1	LOS A	1.1	7.6	0.72	0.74	40.3
6	R	86	2.0	0.180	13.5	LOS A	1.1	7.6	0.72	0.83	38.2
Approach		126	2.0	0.180	12.3	LOS A	1.1	7.6	0.72	0.81	38.8
North: BONNYRIGG AVE											
7	L	145	2.0	0.574	6.7	LOS A	5.2	37.1	0.49	0.58	42.3
8	T	498	2.0	0.574	5.7	LOS A	5.2	37.1	0.49	0.51	42.5
9	R	92	2.0	0.574	10.1	LOS A	5.2	37.1	0.49	0.72	40.7
Approach		735	2.0	0.574	6.5	LOS A	5.2	37.1	0.49	0.55	42.2
West: BUNNINGS ACCESS											
10	L	65	2.0	0.181	9.0	LOS A	1.0	7.5	0.65	0.73	40.9
11	T	12	2.0	0.181	8.1	LOS A	1.0	7.5	0.65	0.69	41.3
12	R	66	2.0	0.181	12.4	LOS A	1.0	7.5	0.65	0.81	39.0
Approach		143	2.0	0.181	10.5	LOS A	1.0	7.5	0.65	0.76	40.0
All Vehicles		1517	2.0	0.574	7.4	LOS A	5.2	37.1	0.53	0.61	41.7

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: BONNYRIGG TARLINGTON SAT EX

Roundabout

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: BONNYRIGG AVE											
1	L	108	2.0	0.651	10.6	LOS A	6.7	47.8	0.79	0.86	40.2
2	T	479	2.0	0.651	9.6	LOS A	6.7	47.8	0.79	0.84	40.4
3	R	36	2.0	0.651	14.3	LOS A	6.7	47.8	0.79	0.93	38.2
Approach		623	2.0	0.651	10.1	LOS A	6.7	47.8	0.79	0.85	40.3
East: TARLINGTON											
4	L	40	2.0	0.323	11.6	LOS A	2.1	15.3	0.84	0.88	38.8
5	T	17	2.0	0.323	10.7	LOS A	2.1	15.3	0.84	0.86	39.0
6	R	137	2.0	0.323	15.0	LOS B	2.1	15.3	0.84	0.91	37.2
Approach		194	2.0	0.323	13.9	LOS A	2.1	15.3	0.84	0.90	37.7
North: BONNYRIGG AVE											
7	L	123	2.0	0.656	7.4	LOS A	6.7	47.4	0.66	0.63	41.6
8	T	449	2.0	0.656	6.4	LOS A	6.7	47.4	0.66	0.59	41.5
9	R	205	2.0	0.656	10.7	LOS A	6.7	47.4	0.66	0.72	40.4
Approach		777	2.0	0.656	7.7	LOS A	6.7	47.4	0.66	0.63	41.2
West: BUNNINGS ACCESS											
10	L	108	2.0	0.362	10.6	LOS A	2.4	17.3	0.81	0.86	39.7
11	T	23	2.0	0.362	9.6	LOS A	2.4	17.3	0.81	0.83	39.9
12	R	113	2.0	0.362	13.9	LOS A	2.4	17.3	0.81	0.90	38.0
Approach		244	2.0	0.362	12.0	LOS A	2.4	17.3	0.81	0.87	38.9
All Vehicles		1838	2.0	0.656	9.7	LOS A	6.7	47.8	0.74	0.76	40.2

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: ELIZABETH BONNYRIGG PM EX - 15% Bunching (West) & 10% Bunching (East)

Signals - Fixed Time Cycle Time = 140 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
East: ELIZABETH DR											
5	T	1497	2.0	0.598	6.5	LOS A	13.9	98.7	0.30	0.28	49.7
6	R	263	2.0	0.513	45.9	LOS D	14.6	103.7	0.90	0.93	25.6
Approach		1760	2.0	0.598	12.4	LOS A	14.6	103.7	0.39	0.37	43.8
North: BONNYRIGG AVE											
7	L	251	2.0	0.295	28.8	LOS C	9.9	70.4	0.66	0.77	30.5
9	R	383	2.0	0.588	54.0	LOS D	16.9	120.7	0.90	0.82	22.6
Approach		634	2.0	0.588	44.1	LOS D	16.9	120.7	0.80	0.80	25.2
West: ELIZABETH DR											
10	L	248	2.0	0.437	14.8	LOS B	5.6	39.8	0.40	0.72	41.5
11	T	929	2.0	0.593	34.5	LOS C	24.5	174.3	0.84	0.74	29.6
Approach		1177	2.0	0.593	30.3	LOS C	24.5	174.3	0.75	0.74	31.4
All Vehicles		3571	2.0	0.598	23.9	LOS B	24.5	174.3	0.58	0.57	34.7

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	48.1	LOS E	0.2	0.2	0.83	0.83
P5	Across N approach	53	32.9	LOS D	0.1	0.1	0.69	0.69
All Pedestrians		106	40.5	LOS E			0.76	0.76

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.

MOVEMENT SUMMARY

Site: ELIZABETH BONNYRIGG
SAT EX - 15% Bunching (West) & 10% Bunching (East)

Signals - Fixed Time Cycle Time = 140 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
East: ELIZABETH DR											
5	T	1212	2.0	0.432	1.7	LOS A	3.4	24.3	0.09	0.08	56.9
6	R	307	2.0	0.584	45.9	LOS D	16.9	120.5	0.92	0.98	25.6
Approach		1519	2.0	0.584	10.6	LOS A	16.9	120.5	0.26	0.26	46.0
North: BONNYRIGG AVE											
7	L	269	2.0	0.374	35.8	LOS C	12.3	87.3	0.76	0.80	27.8
9	R	294	2.0	0.599	62.8	LOS E	12.9	91.8	0.95	0.81	20.7
Approach		563	2.0	0.599	49.9	LOS D	12.9	91.8	0.86	0.80	23.6
West: ELIZABETH DR											
10	L	284	2.0	0.514	15.4	LOS B	6.8	48.5	0.42	0.73	40.9
11	T	1095	2.0	0.594	28.2	LOS B	26.8	190.9	0.79	0.70	32.4
Approach		1379	2.0	0.594	25.5	LOS B	26.8	190.9	0.71	0.71	33.8
All Vehicles		3461	2.0	0.599	23.0	LOS B	26.8	190.9	0.54	0.53	35.4

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	57.6	LOS E	0.2	0.2	0.91	0.91
P5	Across N approach	53	26.4	LOS C	0.1	0.1	0.61	0.61
All Pedestrians		106	42.0	LOS E			0.76	0.76

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.

MOVEMENT SUMMARY

Site: BONNYRIGG TARLINGTON
PM DEV

Roundabout

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: BONNYRIGG AVE											
1	L	20	2.0	0.508	6.6	LOS A	4.3	30.7	0.47	0.59	42.5
2	T	567	2.0	0.508	5.7	LOS A	4.3	30.7	0.47	0.52	42.7
3	R	49	2.0	0.508	10.3	LOS A	4.3	30.7	0.47	0.75	40.7
Approach		636	2.0	0.508	6.1	LOS A	4.3	30.7	0.47	0.54	42.5
East: TARLINGTON											
4	L	39	2.0	0.212	10.9	LOS A	1.3	9.2	0.76	0.81	39.3
5	T	5	2.0	0.212	9.9	LOS A	1.3	9.2	0.76	0.79	39.6
6	R	94	2.0	0.212	14.4	LOS A	1.3	9.2	0.76	0.86	37.6
Approach		138	2.0	0.212	13.2	LOS A	1.3	9.2	0.76	0.85	38.1
North: BONNYRIGG AVE											
7	L	159	2.0	0.632	6.5	LOS A	6.4	45.3	0.43	0.56	42.5
8	T	683	2.0	0.632	5.5	LOS A	6.4	45.3	0.43	0.48	42.8
9	R	26	2.0	0.632	10.1	LOS A	6.4	45.3	0.43	0.73	40.8
Approach		868	2.0	0.632	5.8	LOS A	6.4	45.3	0.43	0.50	42.7
West: BUNNINGS ACCESS											
10	L	20	2.0	0.067	10.1	LOS A	0.4	2.7	0.71	0.72	40.1
11	T	5	2.0	0.067	9.2	LOS A	0.4	2.7	0.71	0.69	40.3
12	R	20	2.0	0.067	13.5	LOS A	0.4	2.7	0.71	0.79	38.3
Approach		45	2.0	0.067	11.5	LOS A	0.4	2.7	0.71	0.75	39.3
All Vehicles		1687	2.0	0.632	6.7	LOS A	6.4	45.3	0.48	0.55	42.1

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: BONNYRIGG TARLINGTON SAT DEV

Roundabout

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: BONNYRIGG AVE											
1	L	40	2.0	0.698	8.7	LOS A	8.1	57.7	0.77	0.73	41.4
2	T	652	2.0	0.698	7.8	LOS A	8.1	57.7	0.77	0.70	41.2
3	R	77	2.0	0.698	12.3	LOS A	8.1	57.7	0.77	0.80	39.6
Approach		769	2.0	0.698	8.3	LOS A	8.1	57.7	0.77	0.71	41.1
East: TARLINGTON											
4	L	61	2.0	0.468	15.6	LOS B	3.7	26.6	0.94	1.04	36.1
5	T	10	2.0	0.468	14.6	LOS B	3.7	26.6	0.94	1.04	36.2
6	R	164	2.0	0.468	18.9	LOS B	3.7	26.6	0.94	1.05	34.8
Approach		235	2.0	0.468	17.9	LOS B	3.7	26.6	0.94	1.05	35.2
North: BONNYRIGG AVE											
7	L	146	2.0	0.763	7.3	LOS A	9.8	70.0	0.70	0.60	41.7
8	T	784	2.0	0.763	6.3	LOS A	9.8	70.0	0.70	0.56	41.6
9	R	52	2.0	0.763	10.9	LOS A	9.8	70.0	0.70	0.69	40.5
Approach		982	2.0	0.763	6.7	LOS A	9.8	70.0	0.70	0.57	41.5
West: BUNNINGS ACCESS											
10	L	40	2.0	0.180	12.7	LOS A	1.2	8.4	0.86	0.87	38.1
11	T	10	2.0	0.180	11.8	LOS A	1.2	8.4	0.86	0.85	38.3
12	R	40	2.0	0.180	16.0	LOS B	1.2	8.4	0.86	0.90	36.6
Approach		90	2.0	0.180	14.1	LOS A	1.2	8.4	0.86	0.88	37.4
All Vehicles		2076	2.0	0.763	8.9	LOS A	9.8	70.0	0.76	0.69	40.3

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: ELIZABETH BONNYRIGG PM DEV - 15% Bunching (West) & 10% Bunching (East)

Signals - Fixed Time Cycle Time = 140 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
East: ELIZABETH DR											
5	T	1646	2.0	0.611	3.0	LOS A	8.5	60.8	0.17	0.16	54.6
6	R	320	2.0	0.590	47.3	LOS D	17.4	123.7	0.91	0.99	25.2
Approach		1966	2.0	0.611	10.2	LOS A	17.4	123.7	0.29	0.29	46.2
North: BONNYRIGG AVE											
7	L	306	2.0	0.404	32.5	LOS C	13.4	95.1	0.73	0.80	29.0
9	R	459	2.0	0.617	61.2	LOS E	14.3	101.9	0.96	0.83	21.0
Approach		765	2.0	0.617	49.7	LOS D	14.3	101.9	0.87	0.82	23.6
West: ELIZABETH DR											
10	L	305	2.0	0.569	16.3	LOS B	7.7	55.1	0.45	0.74	40.3
11	T	1022	2.0	0.609	33.4	LOS C	26.4	188.3	0.83	0.76	29.7
Approach		1327	2.0	0.609	29.5	LOS C	26.4	188.3	0.74	0.75	31.6
All Vehicles		4058	2.0	0.617	23.9	LOS B	26.4	188.3	0.55	0.54	34.7

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	54.0	LOS E	0.2	0.2	0.88	0.88
P5	Across N approach	53	30.2	LOS D	0.1	0.1	0.66	0.66
All Pedestrians		106	42.1	LOS E			0.77	0.77

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.

MOVEMENT SUMMARY

Site: ELIZABETH BONNYRIGG
SAT DEV - 15% Bunching (West) & 10% Bunching (East)

Signals - Fixed Time Cycle Time = 140 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
East: ELIZABETH DR											
5	T	1333	2.0	0.471	1.7	LOS A	4.0	28.6	0.10	0.09	56.8
6	R	402	2.0	0.724	51.2	LOS D	21.7	154.4	0.96	1.04	24.0
Approach		1735	2.0	0.724	13.2	LOS A	21.7	154.4	0.30	0.31	43.5
North: BONNYRIGG AVE											
7	L	356	2.0	0.478	35.9	LOS C	16.7	119.1	0.78	0.81	27.8
9	R	401	2.0	0.629	65.2	LOS E	13.2	93.8	0.98	0.83	20.3
Approach		757	2.0	0.629	51.4	LOS D	16.7	119.1	0.89	0.82	23.2
West: ELIZABETH DR											
10	L	379	2.0	0.722	17.2	LOS B	10.4	74.4	0.48	0.75	39.5
11	T	1205	2.0	0.674	32.2	LOS C	31.6	225.1	0.84	0.78	30.2
Approach		1584	2.0	0.722	28.6	LOS C	31.6	225.1	0.76	0.77	32.0
All Vehicles		4076	2.0	0.724	26.3	LOS B	31.6	225.1	0.58	0.58	33.4

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	58.5	LOS E	0.2	0.2	0.91	0.91
P5	Across N approach	53	27.7	LOS C	0.1	0.1	0.63	0.63
All Pedestrians		106	43.1	LOS E			0.77	0.77

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.

MOVEMENT SUMMARY

Site: BUNNINGS ACCESS PM FUT

Roundabout

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: BONNYRIGG											
1	L	60	2.0	0.078	8.3	LOS A	0.4	2.5	0.31	0.64	41.6
2	T	565	2.0	0.401	6.2	LOS A	2.9	20.7	0.34	0.54	42.7
Approach		625	2.0	0.401	6.4	LOS A	2.9	20.7	0.34	0.55	42.6
North: BONNYRIGG											
8	T	639	2.0	0.555	6.2	LOS A	5.4	38.1	0.39	0.52	42.5
9	R	103	2.0	0.555	9.5	LOS A	5.4	38.1	0.39	0.71	40.9
Approach		742	2.0	0.555	6.7	LOS A	5.4	38.1	0.39	0.54	42.2
West: BUNNINGS											
10	L	30	2.0	0.137	10.4	LOS A	0.8	5.4	0.64	0.76	39.8
12	R	71	2.0	0.137	12.6	LOS A	0.8	5.4	0.64	0.80	38.5
Approach		101	2.0	0.137	12.0	LOS A	0.8	5.4	0.64	0.79	38.9
All Vehicles		1468	2.0	0.555	6.9	LOS A	5.4	38.1	0.39	0.56	42.1

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: BUNNINGS ACCESS PM FUT
SEAGULL - 20% Bunching

Giveway / Yield (Two-Way)

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: BONNYRIGG											
1	L	60	2.0	0.163	6.5	LOS A	0.0	0.0	0.00	0.84	43.3
2	T	565	2.0	0.163	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		625	2.0	0.163	0.6	NA	0.0	0.0	0.00	0.08	49.3
North: BONNYRIGG											
8	T	639	2.0	0.166	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
9	R	103	2.0	0.125	9.1	LOS A	0.5	3.7	0.53	0.73	41.0
Approach		742	2.0	0.166	1.3	NA	0.5	3.7	0.07	0.10	48.5
West: BUNNINGS											
10	L	30	2.0	0.044	9.6	LOS A	0.2	1.1	0.50	0.71	40.7
12	R	71	2.0	0.201	15.3	LOS B	0.8	5.4	0.66	0.87	36.5
Approach		101	2.0	0.201	13.6	LOS A	0.8	5.4	0.61	0.82	37.7
All Vehicles		1468	2.0	0.201	1.8	NA	0.8	5.4	0.08	0.14	47.9

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: BUNNINGS ACCESS SAT FUT

Roundabout

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: BONNYRIGG											
1	L	135	2.0	0.203	10.1	LOS A	1.1	8.0	0.56	0.74	40.2
2	T	646	2.0	0.563	7.5	LOS A	5.0	35.3	0.69	0.68	41.4
Approach		781	2.0	0.563	8.0	LOS A	5.0	35.3	0.66	0.69	41.2
North: BONNYRIGG											
8	T	632	2.0	0.780	8.5	LOS A	11.3	80.2	0.84	0.67	40.6
9	R	267	2.0	0.780	11.9	LOS A	11.3	80.2	0.84	0.72	39.6
Approach		899	2.0	0.780	9.5	LOS A	11.3	80.2	0.84	0.68	40.3
West: BUNNINGS											
10	L	100	2.0	0.418	12.4	LOS A	3.0	21.1	0.83	0.92	38.4
12	R	165	2.0	0.418	14.6	LOS B	3.0	21.1	0.83	0.93	37.2
Approach		265	2.0	0.418	13.7	LOS A	3.0	21.1	0.83	0.93	37.6
All Vehicles		1945	2.0	0.780	9.5	LOS A	11.3	80.2	0.77	0.72	40.2

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.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

MOVEMENT SUMMARY

Site: BUNNINGS ACCESS SAT
FUT SEAGULL - 20% Bunching

Giveway / Yield (Two-Way)

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: BONNYRIGG											
1	L	135	2.0	0.205	6.5	LOS A	0.0	0.0	0.00	0.78	43.3
2	T	646	2.0	0.205	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
Approach		781	2.0	0.205	1.1	NA	0.0	0.0	0.00	0.13	48.7
North: BONNYRIGG											
8	T	632	2.0	0.164	0.0	LOS A	0.0	0.0	0.00	0.00	50.0
9	R	267	2.0	0.382	11.8	LOS A	2.1	15.1	0.66	0.94	39.0
Approach		899	2.0	0.382	3.5	NA	2.1	15.1	0.20	0.28	46.1
West: BUNNINGS											
10	L	100	2.0	0.169	10.9	LOS A	0.6	4.5	0.57	0.83	39.6
12	R	165	2.0	0.762	43.5	LOS D	5.0	35.9	0.93	1.33	24.4
Approach		265	2.0	0.762	31.2	LOS C	5.0	35.9	0.80	1.14	28.5
All Vehicles		1945	2.0	0.762	6.3	NA	5.0	35.9	0.20	0.34	43.4

Level of Service (LOS) Method: Delay (RTA NSW).
Vehicle movement LOS values are based on average delay per movement
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model used.

PHASING SUMMARY

Site: ELIZABETH BONNYRIGG PM EX - 15% Bunching (West) & 10% Bunching (East)

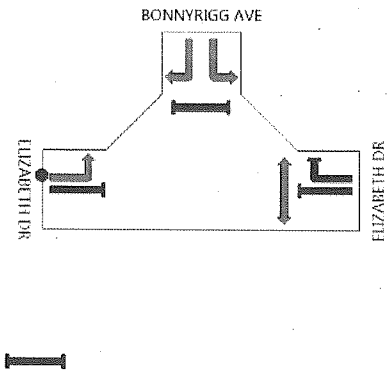
Signals - Fixed Time Cycle Time = 140 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Two-Phase
Input Sequence: A, B, C
Output Sequence: A, B, C

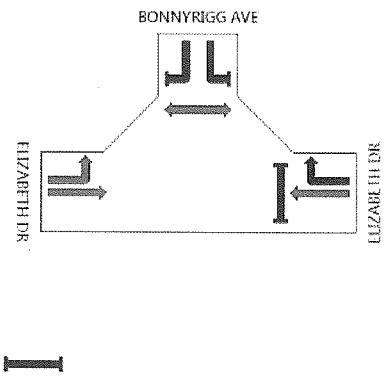
Phase Timing Results

Phase	A	B	C
Green Time (sec)	37	57	28
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	43	63	34
Phase Split	31 %	45 %	24 %

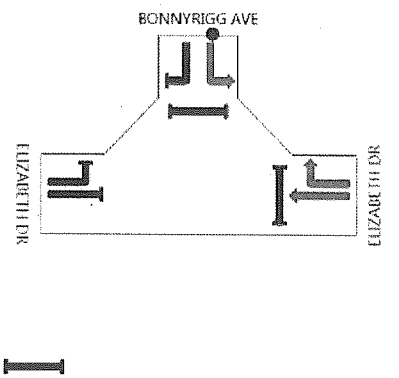
Phase A



Phase B



Phase C



Normal Movement
Slip-Lane Movement
Stopped Movement
Turn On Red
Permitted/Opposed
Opposed Slip-Lane
Continuous Movement
Undetected Movement
Phase Transition Applied

PHASING SUMMARY

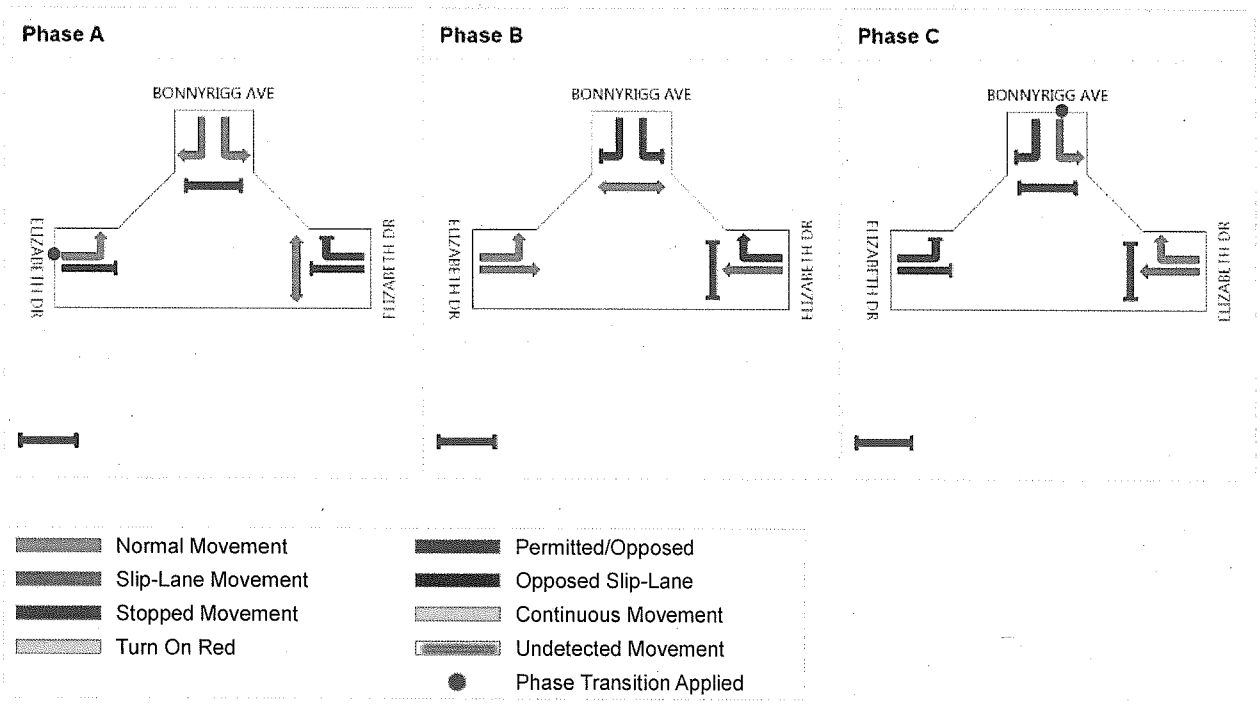
Site: ELIZABETH BONNYRIGG
SAT EX - 15% Bunching (West) &
10% Bunching (East)

Signals - Fixed Time Cycle Time = 140 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Two-Phase
Input Sequence: A, B, C
Output Sequence: A, B, C

Phase Timing Results

Phase	A	B	C
Green Time (sec)	26	67	29
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	32	73	35
Phase Split	23 %	52 %	25 %



PHASING SUMMARY

Site: ELIZABETH BONNYRIGG PM DEV - 15% Bunching (West) & 10% Bunching (East)

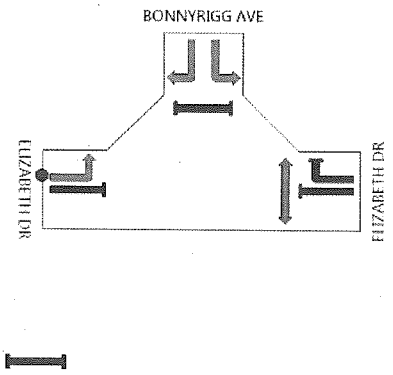
Signals - Fixed Time Cycle Time = 140 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Two-Phase
Input Sequence: A, B, C
Output Sequence: A, B, C

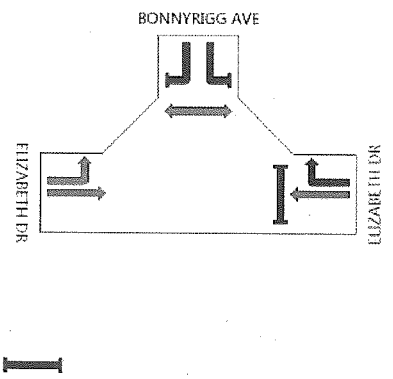
Phase Timing Results

Phase	A	B	C
Green Time (sec)	30	61	31
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	36	67	37
Phase Split	26 %	48 %	26 %

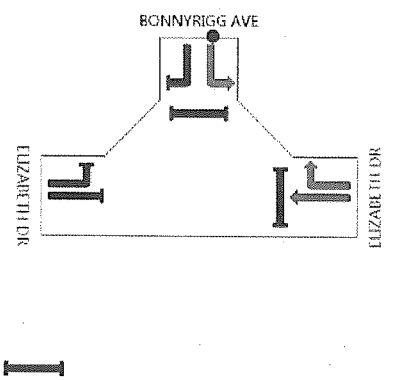
Phase A



Phase B



Phase C



Normal Movement
Slip-Lane Movement
Stopped Movement
Turn On Red
Permitted/Opposed
Opposed Slip-Lane
Continuous Movement
Undetected Movement
Phase Transition Applied

PHASING SUMMARY

Site: ELIZABETH BONNYRIGG
SAT DEV - 15% Bunching (West) &
10% Bunching (East)

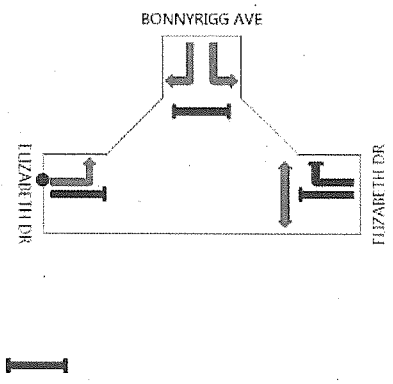
Signals - Fixed Time Cycle Time = 140 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Two-Phase
Input Sequence: A, B, C
Output Sequence: A, B, C

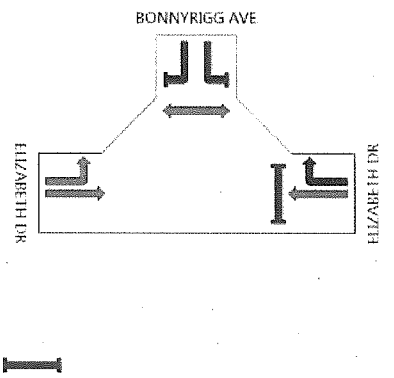
Phase Timing Results

Phase	A	B	C
Green Time (sec)	25	65	32
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	31	71	38
Phase Split	22 %	51 %	27 %

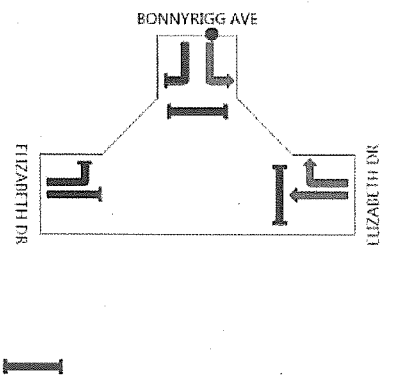
Phase A



Phase B



Phase C



Normal Movement
Slip-Lane Movement
Stopped Movement
Turn On Red
Permitted/Opposed
Opposed Slip-Lane
Continuous Movement
Undetected Movement
Phase Transition Applied