Traffic Impact Assessment

Wahroonga Seventh-Day Adventist Apartment Development

Prepared for Capital Bluestone Pty Ltd / 21 December 2017

171590 TAAA

Taylor Thomson Whitting (NSW) Pty Ltd, Consulting Engineers | ABN 81 113 578 377
48 Chandos Street, St Leonards NSW 2065 | +612 9439 7288 | ttw.com.au

Structural
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Contents

Revision Register

Rev	Date	Prepared By	Approved By	Remarks
1	08/12/17	JN	JS	Draft for comment
2	19/12/17	JN	JS	For Issue
3	21/12/17	JN	JS	For Issue

1.0 Introduction

Taylor Thomson Whitting (TTW) has been engaged by Capital Bluestone Pty Ltd to prepare a Traffic Impact Assessment for the Seventh-day Adventist (SDA) Apartment Development in Wahroonga. The purpose of this assessment is to accompany a Section 75W Modification Application to amend the parking rates under the terms of the Part 3A Concept Plan Approval MP07_1066.

The Traffic Impact Assessment estimates the traffic generated from the SDA Apartments and its impacts at the new proposed signalised intersection at Fox Valley Road and the new access road. It includes a comparison assessment of the approved concept plan parking rate by the Department of Planning and Environment (MP07_0166), and the revised proposal which proposes additional on-site parking.

Two SIDRA intersection scenarios have been undertaken to assess the impact of the additional on-site parking at the new proposed signalised intersection at Fox Valley Road and the new access road.

The first scenario assesses the initial SIDRA analysis completed by Transport, Traffic and Parking (TTPA) with consideration of parking restrictions on the both sides of Fox Valley Road and assuming the approved concept plan parking rate.

The second scenario assesses the proposed project parking rate for the development, at the proposed signalised intersection at Fox Valley Road and the new access road.

2.0 Parking Rates

2.1 Approved Concept Plan Parking Rates

Building A-D	Number of Units	Approved Concept Plan MP07_0166	Required
1 Bedroom	21	0.5 spaces per unit	10.5
2 Bedroom	86	1 space per unit	86
3 Bedroom	66	1 space per unit	66
Visitor Spaces		1 space per 4 units	43.25
Car Share Spaces		1 space per 6 units	29
Total	**173**		**234**

Building E	Number of Units	Approved Concept Plan MP07_0166	Required
1 Bedroom	0	0.5 spaces per unit	0
2 Bedroom	23	1 space per unit	23
3 Bedroom	4	1 space per unit	4
Visitor Spaces		1 space per 4 units	7
Car Share Spaces		1 space per 6 units	5
Total	**27**		**39**

2.2 Proposed Parking Rate

Building A-D	Number of Units	Proposed Parking Rate	Proposed Parking Spaces
1 Bedroom	21	1 space per unit	21
2 Bedroom	86	1.67 spaces per unit	144
3 Bedroom	66	2 spaces per unit	132
Visitor Spaces (on-street)		1 space per 6 units	29
Car Share Spaces		0 spaces	0
Total	**173**		**326**

Building E	Number of Units	Proposed Parking Rate	Proposed Parking Spaces
1 Bedroom	0	1 space/unit	0
2 Bedroom	23	1 spaces/unit*	24
3 Bedroom	4	2 spaces/unit	8
Visitor Spaces (on-street)		1 space per 6 units	5
Car Share Spaces		0 spaces	0
Total	**27**		**37**

(*) Approved Concept Plan MP07_0166 parking rate is proposed (23x1 = 23), however one additional parking space is proposed for the 2 bedroom units.

3.0 Proposed Parking Changes

3.1.1 Comparison of Parking Rates

Apartment	Approved - Concept Plan MP07_0166	Ku-ring-gai Development Control Plan Rate (minimum)(Part 22R.1 – Car Parking Rates)	Proposed Parking Rate
1-bedroom units	0.5 space per unit	1 space per unit	1 space per unit
2- bedroom units	1 space per unit	1.25 space per unit	1.67 spaces per unit for Buildings A-D and 1 space per unit for Building E
3-bedroom units	1 space per unit	2 spaces per unit	2 spaces per unit
Visitors parking	1 space per 4 units	1 per 4 units	1 per 6 units
Car sharing scheme	1 space per 6 units	0 spaces	0 spaces

The proposed parking rates are considered appropriate as they meet or exceed the minimum Ku-ring-gai Council's Development Control Plan Rates for Parking with the exception of visitor parking which is under the required rate as shown in the table above.

4.0 Assessment

4.1 SIDRA Intersection Assessment

4.1.1 Initial Assessment - TTPA

The original Traffic Impact Assessment completed by Transport, Traffic and Parking (TTPA) assumed 200 dwellings with a total on-site parking of 274 spaces to meet the proposed approved concept plan.

This assessment was submitted as part of a State Significant Development (SSD) Application to the Department of Planning and Environment (MP07_0166).

The original assessment assumed unimpeded full length lanes on Fox Valley Road, and two departure travel lanes on the new access road which provides access to the residential dwellings. It also assumes a 'No Right Turn' ban from Fox Valley Road into the southern access road.

The analysis has been undertaken for the morning, school pick-up and evening peaks.

Figure 1 below provides the traffic volumes used by TTPA in their SIDRA analysis.

		AM	5 – 6 PM	3 – 4 PM
Fox Valley Rd	NB	600	900	720
	LT	78	40	93
	RT*	-	-	-
	SB	1100	600	480
	RT	100	65	120
	LT	10	20	10
	* Right turn prohibited			
Access	EB	5	5	5
	RT	103	25	100
	LT	135	35	78
	WB	5	5	5
	RT	20	10	10
	LT	10	5	5

Figure 1 – Traffic Volumes from TTPA Report

Figure 2 below provides a summary of the SIDRA assessment based on the volumes provided in Figure 1 that was undertaken by TTPA. The results are based on full length lanes on Fox Valley Road and two travel lanes on the northern leg of the access road. The SIDRA results are provided in Appendix A of this report.

AM		5 – 6 PM		3 – 4 PM	
LOS	AVD	LOS	AVD	LOS	AVD
B	17.2	B	17.6	B	17.5

Figure 2 - Results from TTPA Report

4.1.2 Concept Plan Parking Rates Assessment – with Parking Restrictions

TTW have completed a SIDRA analysis which utilises the traffic volumes used by TTPA. However, this analysis has also taken into account kerbside parking on both sides of Fox Valley Road in order to retain on-street parking where possible.

The analysis includes a 175 metre 'No Stopping' and 'No Parking' zone on the both sides of Fox Valley Road, east and west of the proposed access road during the morning peak period.

For the two peak periods in the afternoon, the analysis includes a 175 metre 'No Stopping' and 'No Parking' zone on the northern side of Fox Valley Road, and a 100 metre 'No Stopping' and 'No Parking' zone on the southern side of Fox Valley Road, east and west of the proposed access road.

Figure 3 below shows a slight increase in the average vehicle delay for all three peak times in comparison to the initial assessment by TTPA, however the level of service has not changed.

AM		5-6 PM		3-4 PM	
LOS	AVD	LOS	AVD	LOS	AVD
B	25.6	B	21.3	B	25.1

Figure 3 – SIDRA Results, with No Parking and No Stopping

4.1.3 Proposed Parking Rate Assessment

Capital Bluestone Pty Ltd proposes 297 on-site parking spaces for Buildings A-D, 32 spaces for Building E, and 34 on-street parking spaces for visitors. A total of 363 parking spaces are proposed as part of the development.

The proposed parking spaces for Buildings A-E, meets the approved concept plan 273 spaces.

The proposed 297 on-site parking spaces for Buildings A-D and 34 on-street parking spaces would generate an additional 41 percent of usage on the new access road, when compared to the previous assessment, noting that this is a conservative assessment.

Given, the proposed parking spaces in Building E is slightly less than the approved DCP Concept Plan parking rate, it is assumed that there is no additional traffic generation from Building E onto Fox Valley Road. It is also noted that these trips associated with Building E do not use the new proposed access road as they have separate access onto Fox Valley Road.

It is assumed the result from the initial assessment completed by TTPA has considered the increase in traffic volume on Fox Valley Road from the proposed parking spaces in Building E.

A SIDRA analysis has been completed to assess the impact of the additional parking and subsequent traffic volume at the new proposed signalised intersection at Fox Valley Road and the new access road.

As a conservative approach for this assessment, it was assumed that the 41 percent increase in parking spaces would correlate to a 41 percent increase in traffic volumes associated with the residential apartment onto the new access road.

The original analysis completed by TTPA assumed the approved concept plan rate of 234 spaces for Buildings A-D would generate 90 vehicles/hour. TTW have assumed with the new proposed parking rate, an additional 37 vehicles/hour is generated at the proposed signalised intersection.

The turning movements are shown in Figure 4 below.

		AM	5-6 PM	3-4 PM
Fox Valley Road	NB	600	900	720
	LT	78	58	111
	RT*	-	-	-
	SB	1100	600	480
	RT	100	83	138
	LT	10	20	10
Access	EB	7	5	5
	RT	127	25	100
	LT	146	35	78
	WB	5	5	5
	RT	20	10	10
	LT	10	5	5

Figure 4 – 41 percent increase in traffic volumes

The SIDRA analysis results shown below in Figure 5 show the increase of parking slightly increases the average vehicle delay duration. There is no change to the Level of Service ‘B’.

The analysis considered a 175 metre 'No Stopping' and 'No Parking' zone on the both sides of Fox Valley Road, east and west of the proposed access road during the morning peak period.

For the two peak periods in the afternoon, the analysis includes a 175 metre 'No Stopping' and 'No Parking' zone on the northern side of Fox Valley Road, and a 100 metre 'No Stopping' and 'No Parking' zone on the southern side of Fox Valley Road, east and west of the proposed access road.

AM		5-6 PM		3-4 PM	
LOS	**AVD**	**LOS**	**AVD**	**LOS**	**AVD**
B	26.0	B	22.8	B	25.5

Figure 5 – Results from SIDRA

5.0 Conclusion

Overall, modifying the approved concept plan parking rate to the proposed parking rate will result in additional parking spaces for the development. The SIDRA assessment has indicated that the proposal to change the parking rate has minor impact on the Level of Service and average vehicle delay, at the new proposed signalised intersection at Fox Valley Road.

To facilitate a Level of Service 'B' in the morning peak, a 175 metre 'No Stopping' and 'No Parking' zone on the both sides of Fox Valley Road, east and west of the proposed access road is recommended.

To facilitate a Level of Service 'B' during the two afternoon peak periods, a 175 metre 'No Stopping' and 'No Parking' zone on the northern side of Fox Valley Road, and a 100 metre 'No Stopping' and 'No Parking' zone on the southern side of Fox Valley Road , east and west of the proposed access road is recommended.

Prepared by
TAYLOR THOMSON WHITTING (NSW) PTY LTD

James Nguyen

Civil/Traffic Engineer

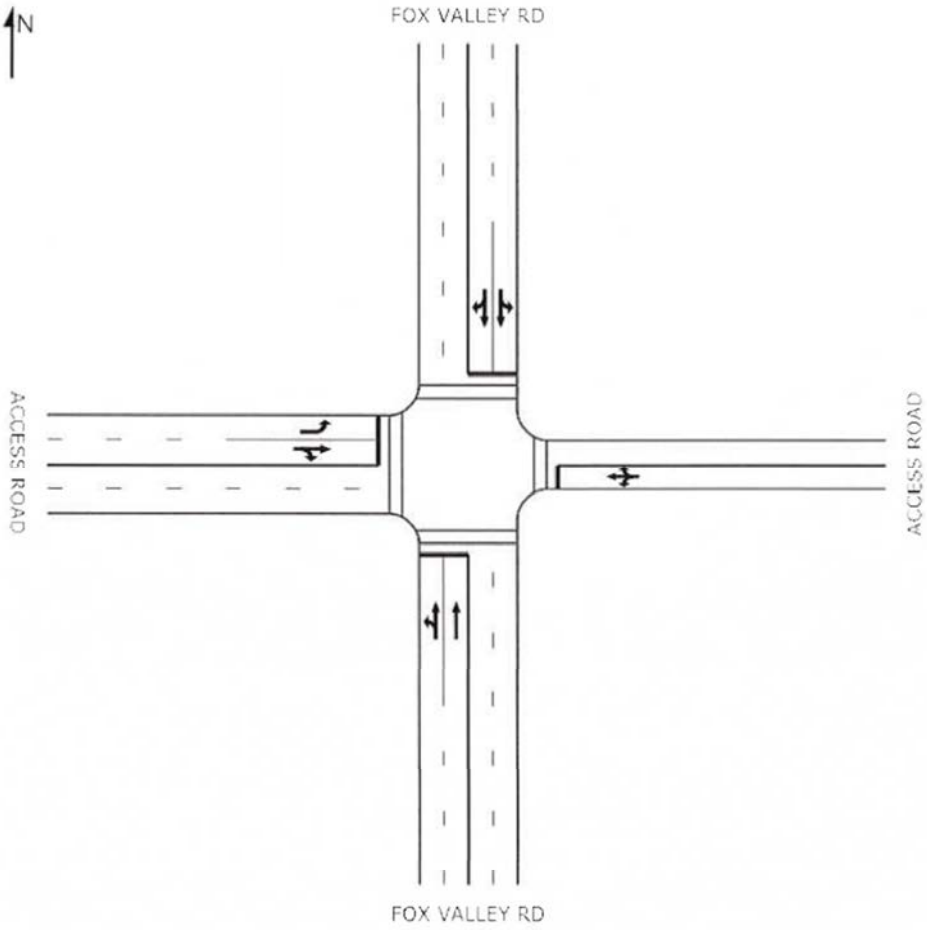
Authorised By
TAYLOR THOMSON WHITTING (NSW) PTY LTD

Jason Scoufis

Traffic Manager

Appendix A – Intersection Analysis

SIDRA Intersection Modelling Analysis – TTPA



MOVEMENT SUMMARY

Site: FOX VALLEY ROAD AND ACCESS AM

Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: FOX VALLEY RD											
1	L	78	2.0	0.664	30.7	LOS C	9.3	66.1	0.95	0.88	34.1
2	T	600	2.0	0.664	22.4	LOS B	9.4	66.8	0.95	0.82	34.9
Approach		678	2.0	0.664	23.3	LOS B	9.4	66.8	0.95	0.83	34.8
East: ACCESS ROAD											
4	L	10	2.0	0.085	26.5	LOS B	0.8	5.6	0.78	0.73	34.9
5	T	5	2.0	0.085	18.2	LOS B	0.8	5.6	0.78	0.58	36.1
6	R	20	2.0	0.085	26.6	LOS B	0.8	5.6	0.78	0.74	34.9
Approach		35	2.0	0.085	25.4	LOS B	0.8	5.6	0.78	0.72	35.1
North: FOX VALLEY RD											
7	L	10	2.0	0.664	19.3	LOS B	14.6	103.6	0.78	0.94	41.8
8	T	1100	2.0	0.664	11.8	LOS A	14.6	103.6	0.81	0.71	42.3
9	R	100	2.0	0.664	21.4	LOS B	12.2	86.7	0.85	0.88	39.7
Approach		1210	2.0	0.664	12.7	LOS A	14.6	103.6	0.81	0.72	42.1
West: ACCESS ROAD											
10	L	135	2.0	0.138	15.9	LOS B	2.0	14.2	0.53	0.75	41.8
11	T	5	2.0	0.258	19.3	LOS B	2.6	18.4	0.83	0.66	35.1
12	R	103	2.0	0.258	27.6	LOS B	2.6	18.4	0.83	0.78	34.2
Approach		243	2.0	0.258	20.9	LOS B	2.6	18.4	0.66	0.76	38.1
All Vehicles		2166	2.0	0.664	17.2	LOS B	14.6	103.6	0.84	0.76	38.9

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
P3	Across E approach	53	20.0	LOS C	0.1	0.1	0.82	0.82
P5	Across N approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
P7	Across W approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
All Pedestrians		212	23.2	LOS C			0.88	0.88

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.

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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: FOX VALLEY ROAD AND ACCESS PM

Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: FOX VALLEY RD											
1	L	40	2.0	0.734	29.3	LOS C	13.1	93.2	0.94	0.93	35.2
2	T	900	2.0	0.734	21.1	LOS B	13.1	93.6	0.94	0.87	35.8
Approach		940	2.0	0.734	21.4	LOS B	13.1	93.6	0.94	0.87	35.8
East: ACCESS ROAD											
4	L	5	2.0	0.046	26.2	LOS B	0.4	3.2	0.77	0.72	35.3
5	T	5	2.0	0.046	17.9	LOS B	0.4	3.2	0.77	0.55	36.6
6	R	10	2.0	0.046	26.3	LOS B	0.4	3.2	0.77	0.73	35.3
Approach		20	2.0	0.046	24.1	LOS B	0.4	3.2	0.77	0.68	35.6
North: FOX VALLEY RD											
7	L	20	2.0	0.419	17.3	LOS B	7.4	52.6	0.64	0.94	42.8
8	T	600	2.0	0.419	10.6	LOS A	7.4	52.6	0.69	0.58	43.7
9	R	65	2.0	0.419	22.0	LOS B	5.6	40.2	0.78	0.86	39.0
Approach		685	2.0	0.419	11.9	LOS A	7.4	52.6	0.69	0.62	43.2
West: ACCESS ROAD											
10	L	35	2.0	0.041	17.6	LOS B	0.6	3.9	0.57	0.71	40.5
11	T	5	2.0	0.070	18.1	LOS B	0.7	4.8	0.78	0.57	36.3
12	R	25	2.0	0.070	26.4	LOS B	0.7	4.8	0.78	0.73	35.1
Approach		65	2.0	0.070	21.0	LOS B	0.7	4.8	0.66	0.71	37.9
All Vehicles		1710	2.0	0.734	17.6	LOS B	13.1	93.6	0.83	0.76	38.5

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.
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
P1	Across S approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
P3	Across E approach	53	16.9	LOS B	0.1	0.1	0.75	0.75
P5	Across N approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
P7	Across W approach	53	20.8	LOS C	0.1	0.1	0.83	0.83
All Pedestrians		212	21.6	LOS C			0.85	0.85

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.

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SIDRA INTERSECTION

MOVEMENT SUMMARY

Site: FOX VALLEY ROAD AND ACCESS PM (3-4)

Signals - Fixed Time Cycle Time = 60 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: FOX VALLEY RD											
1	L	93	2.0	0.637	27.0	LOS B	10.3	73.2	0.90	0.87	36.1
2	T	720	2.0	0.637	18.7	LOS B	10.4	74.0	0.90	0.78	37.2
Approach		813	2.0	0.637	19.7	LOS B	10.4	74.0	0.90	0.79	37.1
East: ACCESS ROAD											
4	L	5	2.0	0.047	26.2	LOS B	0.4	3.2	0.77	0.72	35.3
5	T	5	2.0	0.047	17.9	LOS B	0.4	3.2	0.77	0.55	36.5
6	R	10	2.0	0.047	26.3	LOS B	0.4	3.2	0.77	0.73	35.3
Approach		20	2.0	0.047	24.2	LOS B	0.4	3.2	0.77	0.68	35.6
North: FOX VALLEY RD											
7	L	10	2.0	0.413	17.3	LOS B	7.5	53.2	0.64	0.95	42.8
8	T	480	2.0	0.413	9.9	LOS A	7.5	53.2	0.67	0.57	44.4
9	R	120	2.0	0.413	23.3	LOS B	4.2	29.6	0.84	0.82	37.3
Approach		610	2.0	0.413	12.7	LOS A	7.5	53.2	0.70	0.63	42.8
West: ACCESS ROAD											
10	L	78	2.0	0.091	17.9	LOS B	1.3	9.1	0.58	0.74	40.3
11	T	5	2.0	0.248	19.3	LOS B	2.5	17.8	0.82	0.66	35.2
12	R	100	2.0	0.248	27.5	LOS B	2.5	17.8	0.82	0.77	34.2
Approach		183	2.0	0.248	23.2	LOS B	2.5	17.8	0.72	0.76	36.6
All Vehicles		1626	2.0	0.637	17.5	LOS B	10.4	74.0	0.80	0.72	38.9

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

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
P3	Across E approach	53	16.9	LOS B	0.1	0.1	0.75	0.75
P5	Across N approach	53	24.3	LOS C	0.1	0.1	0.90	0.90
P7	Across W approach	53	20.8	LOS C	0.1	0.1	0.83	0.83
All Pedestrians		212	21.6	LOS C			0.85	0.85

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.

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SIDRA INTERSECTION

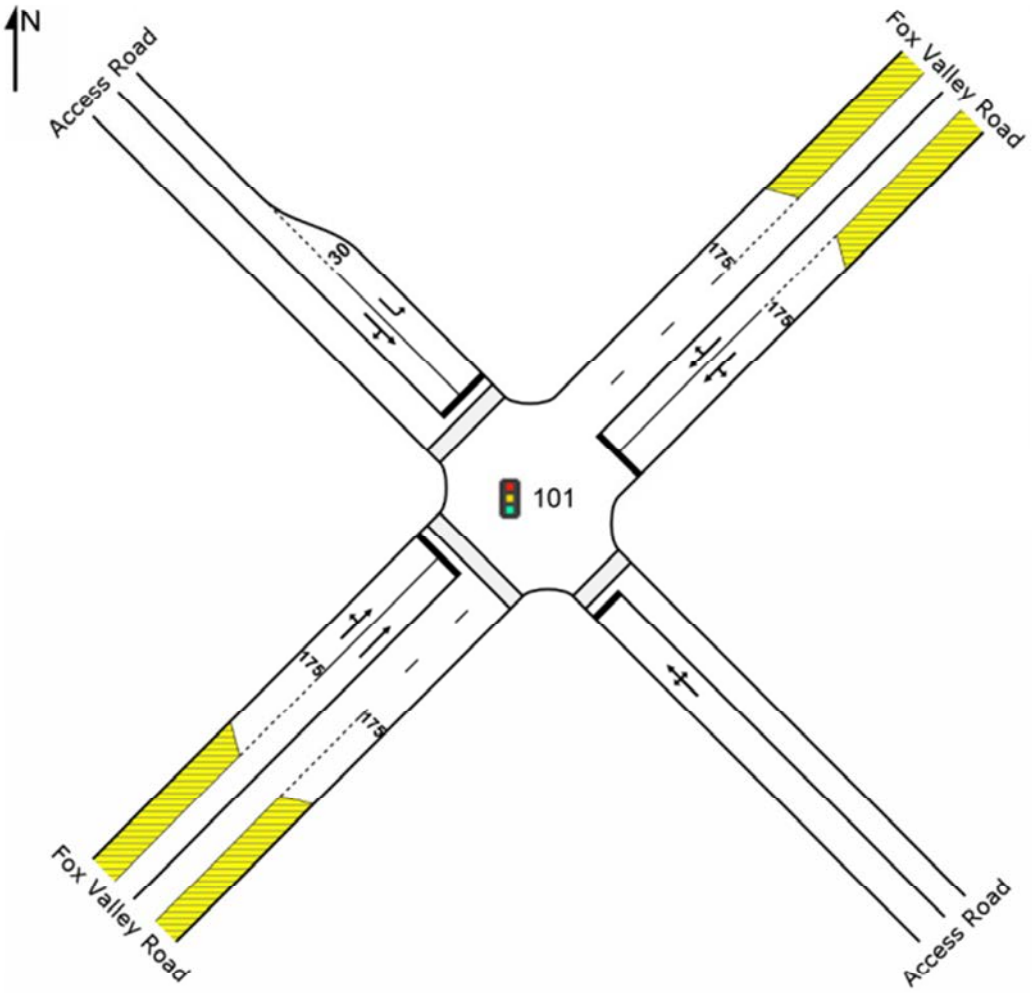
Appendix B – Intersection Analysis – TTW with TTPA volumes

SIDRA Intersection Modelling Analysis

SITE LAYOUT

Site: 101 [4 leg AM Fox Valley Road and Access Road - Copy]

New Site
Signals - Fixed Time Isolated



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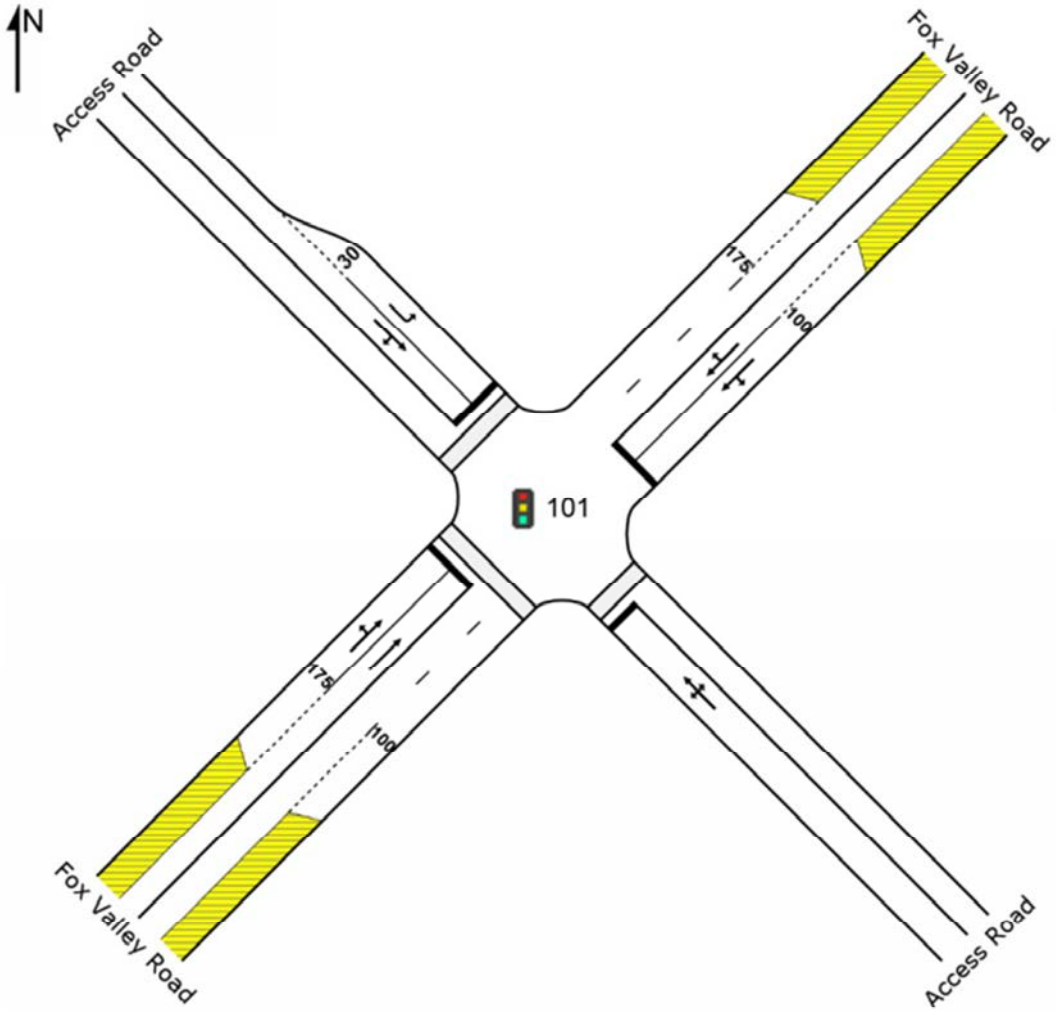
Project: P:\2017\1715\171590\Reports\TTW\Traffic\Fox Valley Road and Access Way.sip7

SITE LAYOUT

Site: 101 [4 leg PM (5-6) Fox Valley Road and Access Road - Copy]

New Site
Signals - Fixed Time Isolated



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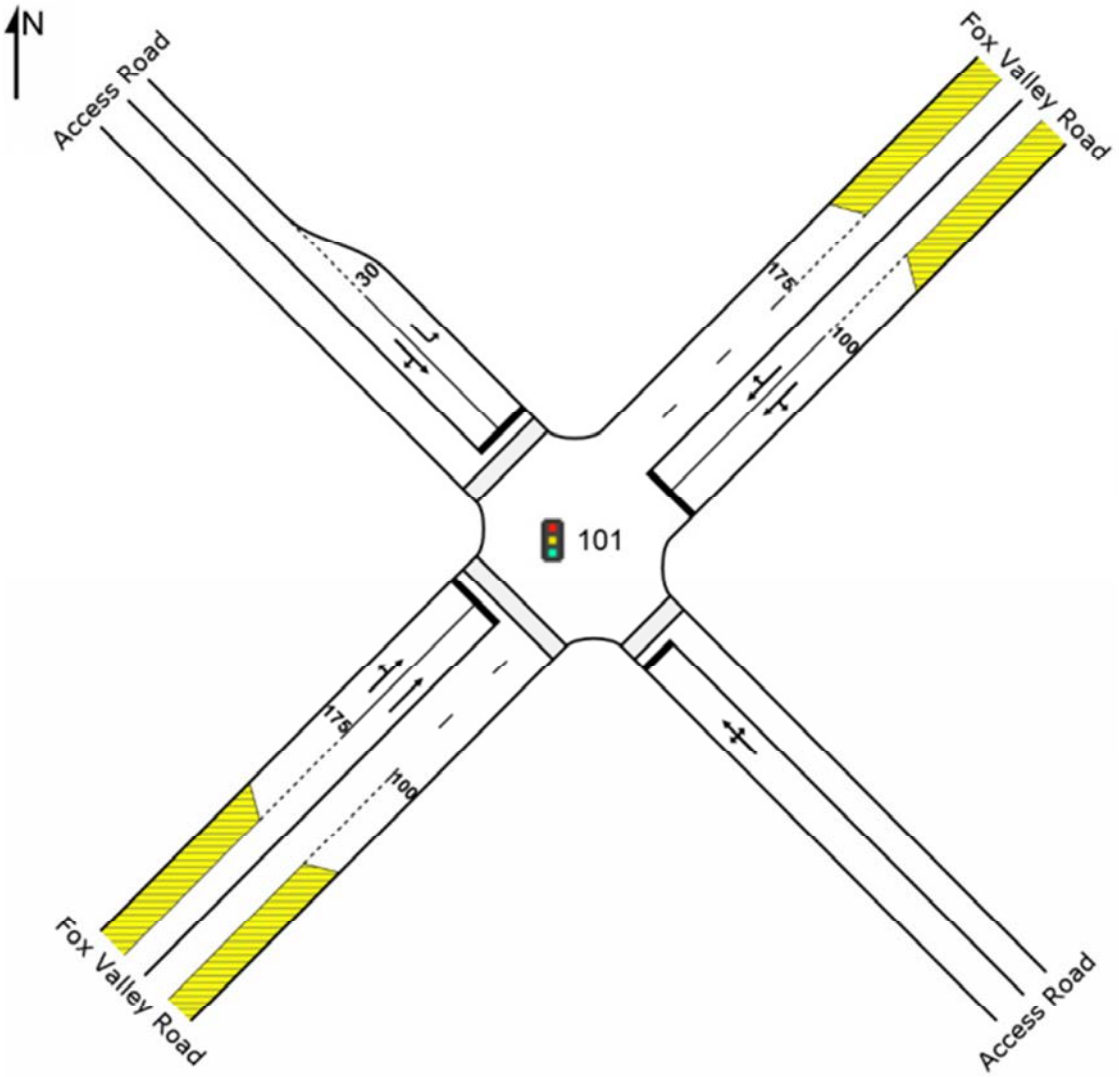
SITE LAYOUT

Site: 101 [4 leg PM (3-4) Fox Valley Road and Access Road - Copy]

New Site
Signals - Fixed Time Isolated



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MOVEMENT SUMMARY

Site: 101 [TTUPA - 4 leg AM Fox Valley Road and Access Road - Copy - Copy]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total 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
SouthEast: Access Road											
21	L2	11	0.0	0.253	43.4	LOS D	1.4	10.1	0.98	0.72	21.7
22	T1	5	0.0	0.253	42.7	LOS D	1.4	10.1	0.98	0.72	25.8
23	R2	21	0.0	0.253	43.5	LOS D	1.4	10.1	0.98	0.72	21.6
Approach		37	0.0	0.253	43.3	LOS D	1.4	10.1	0.98	0.72	22.1
NorthEast: Fox Valley Road											
24	L2	11	0.0	0.687	15.7	LOS B	21.4	149.7	0.75	0.68	31.8
25	T1	1158	0.0	0.733	16.7	LOS B	21.4	149.7	0.81	0.74	33.8
26	R2	105	0.0	0.733	29.3	LOS C	17.1	119.4	0.94	0.85	31.1
Approach		1274	0.0	0.733	17.7	LOS B	21.4	149.7	0.82	0.75	33.5
NorthWest: Access Road											
27	L2	142	0.0	0.673	43.2	LOS D	5.8	40.3	1.00	0.86	27.2
28	T1	5	0.0	0.552	41.3	LOS C	4.5	31.2	0.99	0.79	22.3
29	R2	108	0.0	0.552	41.9	LOS C	4.5	31.2	0.99	0.79	27.7
Approach		256	0.0	0.673	42.7	LOS D	5.8	40.3	1.00	0.83	27.3
SouthWest: Fox Valley Road											
30	L2	82	0.0	0.714	34.7	LOS C	13.0	91.2	0.97	0.87	29.7
31	T1	632	0.0	0.762	32.3	LOS C	14.3	100.0	0.98	0.90	29.5
Approach		714	0.0	0.762	32.5	LOS C	14.3	100.0	0.98	0.90	29.5
All Vehicles		2280	0.0	0.762	25.6	LOS B	21.4	149.7	0.89	0.80	31.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P5	SouthEast Full Crossing	53	9.0	LOS A	0.1	0.1	0.48	0.48
P7	NorthWest Full Crossing	53	29.0	LOS C	0.1	0.1	0.85	0.85
P8	SouthWest Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	24.1	LOS C			0.75	0.75

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.

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MOVEMENT SUMMARY

Site: 101 [TTUPA - 4 leg PM (5-6) Fox Valley Road and Access Road - Copy - Copy]

New Site
Signals - Fixed Time Isolated Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total 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
SouthEast: Access Road											
21	L2	5	0.0	0.126	39.3	LOS C	0.7	4.9	0.95	0.69	28.9
22	T1	5	0.0	0.126	33.8	LOS C	0.7	4.9	0.95	0.69	29.6
23	R2	11	0.0	0.126	39.3	LOS C	0.7	4.9	0.95	0.69	28.8
Approach		21	0.0	0.126	37.9	LOS C	0.7	4.9	0.95	0.69	29.0
NorthEast: Fox Valley Road											
24	L2	21	0.0	0.384	13.5	LOS A	8.1	56.5	0.59	0.53	40.6
25	T1	632	0.0	0.709	16.2	LOS B	9.8	68.7	0.73	0.65	40.8
26	R2	68	0.0	0.709	34.3	LOS C	9.8	68.7	0.98	0.88	35.0
Approach		721	0.0	0.709	17.8	LOS B	9.8	68.7	0.75	0.67	40.2
NorthWest: Access Road											
27	L2	37	0.0	0.229	39.0	LOS C	1.3	8.8	0.97	0.72	32.4
28	T1	5	0.0	0.200	35.3	LOS C	1.1	7.5	0.96	0.71	27.6
29	R2	26	0.0	0.200	39.0	LOS C	1.1	7.5	0.96	0.71	32.9
Approach		68	0.0	0.229	38.7	LOS C	1.3	8.8	0.96	0.72	32.3
SouthWest: Fox Valley Road											
30	L2	42	0.0	0.691	25.8	LOS B	14.5	101.3	0.91	0.81	38.3
31	T1	947	0.0	0.737	22.1	LOS B	15.9	111.6	0.92	0.84	38.3
Approach		989	0.0	0.737	22.3	LOS B	15.9	111.6	0.92	0.83	38.3
All Vehicles		1800	0.0	0.737	21.3	LOS B	15.9	111.6	0.85	0.76	38.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P5	SouthEast Full Crossing	53	8.8	LOS A	0.1	0.1	0.50	0.50
P7	NorthWest Full Crossing	53	20.1	LOS C	0.1	0.1	0.76	0.76
P8	SouthWest Full Crossing	53	27.5	LOS C	0.1	0.1	0.89	0.89
All Pedestrians		158	18.8	LOS B			0.72	0.72

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.

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MOVEMENT SUMMARY

Site: 101 [TTUPA - 4 leg PM (3-4) Fox Valley Road and Access Road - Copy - Copy]

New Site
Signals - Fixed Time Isolated Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total 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
SouthEast: Access Road											
21	L2	11	0.0	0.118	35.2	LOS C	0.8	5.9	0.93	0.70	25.0
22	T1	5	0.0	0.118	33.7	LOS C	0.8	5.9	0.93	0.70	30.0
23	R2	11	0.0	0.118	35.3	LOS C	0.8	5.9	0.93	0.70	24.9
Approach		26	0.0	0.118	34.9	LOS C	0.8	5.9	0.93	0.70	25.8
NorthEast: Fox Valley Road											
24	L2	11	0.0	0.379	13.4	LOS A	8.0	55.7	0.62	0.55	34.4
25	T1	505	0.0	0.699	14.6	LOS B	8.2	57.2	0.70	0.62	34.5
26	R2	126	0.0	0.699	34.7	LOS C	8.2	57.2	0.99	0.89	29.5
Approach		642	0.0	0.699	18.5	LOS B	8.2	57.2	0.75	0.67	33.3
NorthWest: Access Road											
27	L2	82	0.0	0.510	39.1	LOS C	2.9	20.3	1.00	0.77	28.1
28	T1	5	0.0	0.704	40.6	LOS C	4.1	28.7	1.00	0.88	24.0
29	R2	105	0.0	0.704	41.3	LOS C	4.1	28.7	1.00	0.88	27.8
Approach		193	0.0	0.704	40.3	LOS C	4.1	28.7	1.00	0.83	27.9
SouthWest: Fox Valley Road											
30	L2	98	0.0	0.714	28.4	LOS B	13.4	93.6	0.95	0.86	31.3
31	T1	758	0.0	0.762	26.1	LOS B	14.8	103.5	0.96	0.89	31.0
Approach		856	0.0	0.762	26.3	LOS B	14.8	103.5	0.96	0.89	31.1
All Vehicles		1717	0.0	0.762	25.1	LOS B	14.8	103.5	0.89	0.80	31.4

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P5	SouthEast Full Crossing	53	9.8	LOS A	0.1	0.1	0.53	0.53
P7	NorthWest Full Crossing	53	23.3	LOS C	0.1	0.1	0.82	0.82
P8	SouthWest Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
All Pedestrians		158	20.8	LOS C			0.75	0.75

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.

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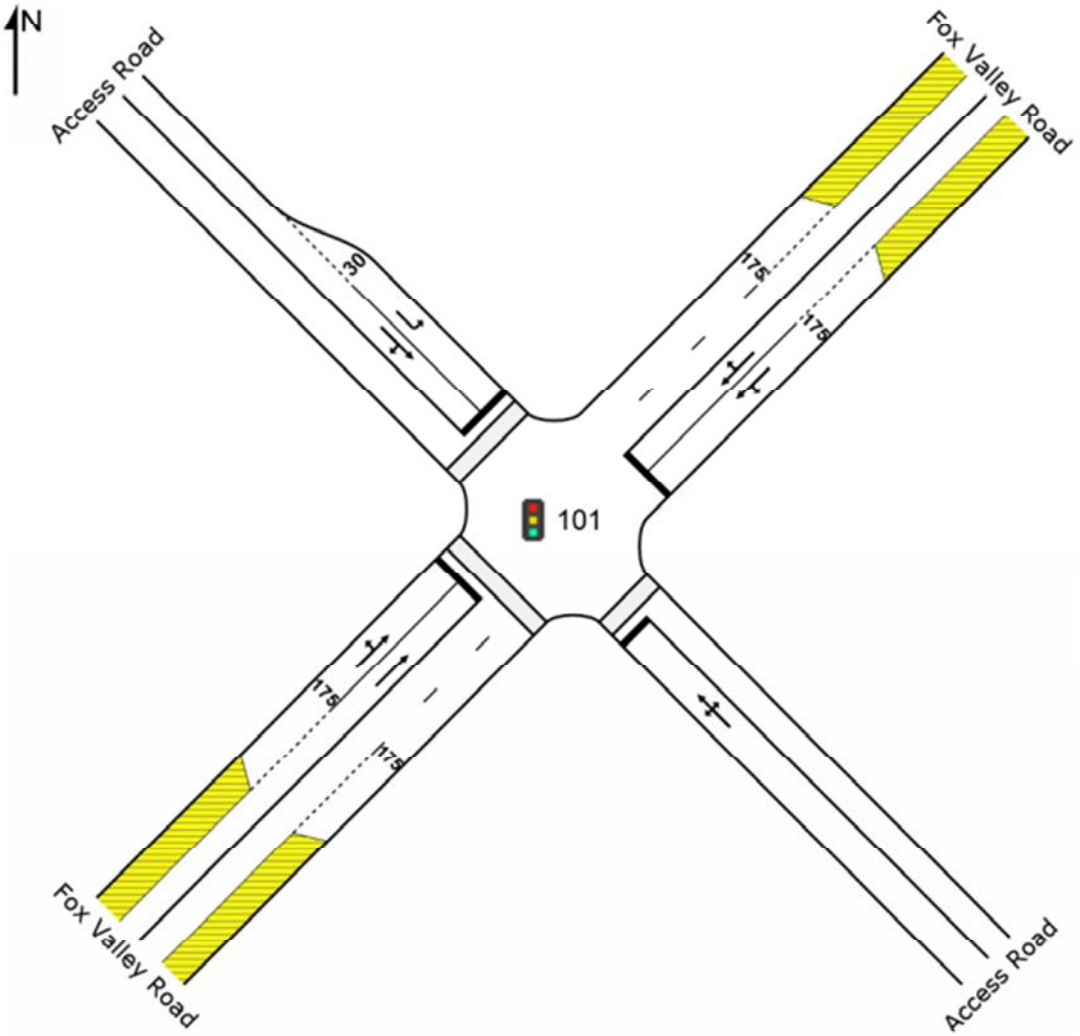
Appendix C – Intersection Analysis – Additional traffic volume from on-site parking

SIDRA Intersection Modelling Analysis

SITE LAYOUT

Site: 101 [4 leg AM Fox Valley Road and Access Road - Copy]

New Site
Signals - Fixed Time Isolated



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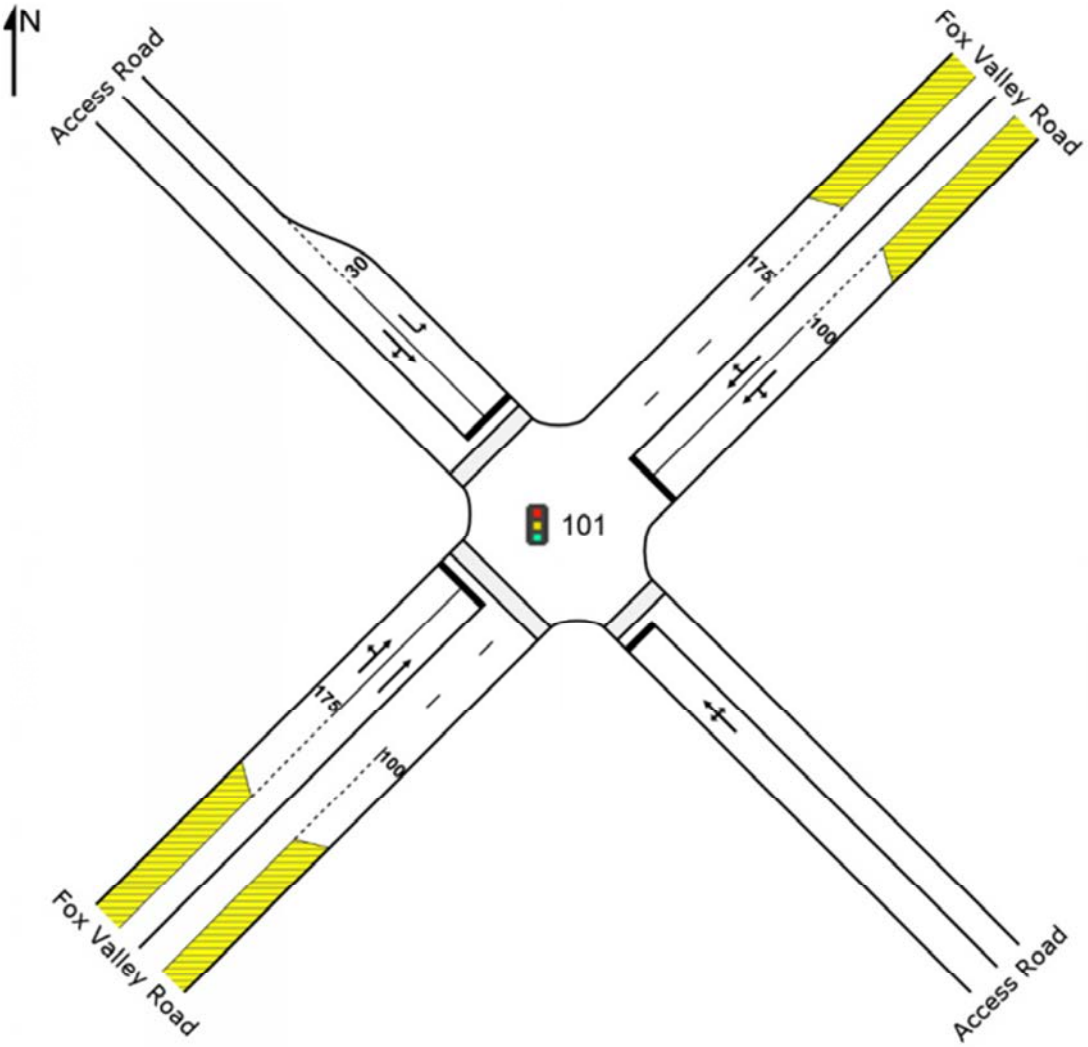
SITE LAYOUT

Site: 101 [4 leg PM (5-6) Fox Valley Road and Access Road - Copy]

New Site
Signals - Fixed Time Isolated



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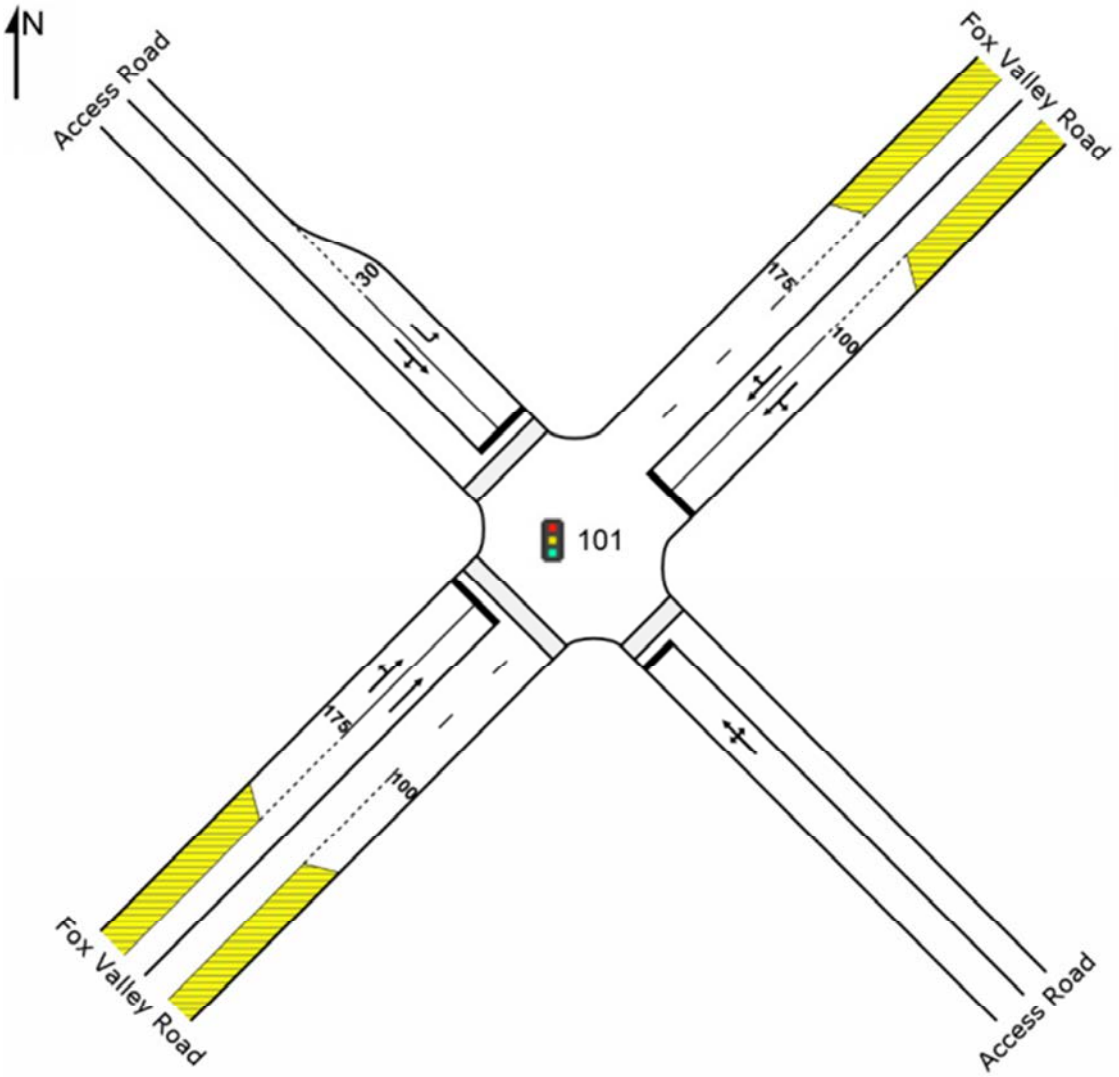
SITE LAYOUT

Site: 101 [4 leg PM (3-4) Fox Valley Road and Access Road - Copy]

New Site
Signals - Fixed Time Isolated



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MOVEMENT SUMMARY

Site: 101 [4 leg AM Fox Valley Road and Access Road - Copy]

New Site
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total 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
SouthEast: Access Road											
21	L2	11	0.0	0.253	43.4	LOS D	1.4	10.1	0.98	0.72	21.7
22	T1	5	0.0	0.253	42.7	LOS D	1.4	10.1	0.98	0.72	25.8
23	R2	21	0.0	0.253	43.5	LOS D	1.4	10.1	0.98	0.72	21.6
Approach		37	0.0	0.253	43.3	LOS D	1.4	10.1	0.98	0.72	22.1
NorthEast: Fox Valley Road											
24	L2	11	0.0	0.687	15.7	LOS B	21.4	149.7	0.75	0.68	31.8
25	T1	1158	0.0	0.733	16.7	LOS B	21.4	149.7	0.81	0.74	33.8
26	R2	105	0.0	0.733	29.3	LOS C	17.1	119.4	0.94	0.85	31.1
Approach		1274	0.0	0.733	17.7	LOS B	21.4	149.7	0.82	0.75	33.5
NorthWest: Access Road											
27	L2	154	0.0	0.728	44.3	LOS D	6.4	44.5	1.00	0.90	27.0
28	T1	7	0.0	0.684	43.0	LOS D	5.8	40.3	1.00	0.86	22.0
29	R2	134	0.0	0.684	43.7	LOS D	5.8	40.3	1.00	0.86	27.4
Approach		295	0.0	0.728	44.0	LOS D	6.4	44.5	1.00	0.88	27.1
SouthWest: Fox Valley Road											
30	L2	82	0.0	0.714	34.7	LOS C	13.0	91.2	0.97	0.87	29.7
31	T1	632	0.0	0.762	32.3	LOS C	14.3	100.0	0.98	0.90	29.5
Approach		714	0.0	0.762	32.5	LOS C	14.3	100.0	0.98	0.90	29.5
All Vehicles		2319	0.0	0.762	26.0	LOS B	21.4	149.7	0.89	0.81	31.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P5	SouthEast Full Crossing	53	9.0	LOS A	0.1	0.1	0.48	0.48
P7	NorthWest Full Crossing	53	29.0	LOS C	0.1	0.1	0.85	0.85
P8	SouthWest Full Crossing	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		158	24.1	LOS C			0.75	0.75

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.

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MOVEMENT SUMMARY

Site: 101 [4 leg PM (5-6) Fox Valley Road and Access Road - Copy]

New Site
Signals - Fixed Time Isolated Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total 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
SouthEast: Access Road											
21	L2	5	0.0	0.126	39.3	LOS C	0.7	4.9	0.95	0.69	28.9
22	T1	5	0.0	0.126	33.8	LOS C	0.7	4.9	0.95	0.69	29.6
23	R2	11	0.0	0.126	39.3	LOS C	0.7	4.9	0.95	0.69	28.8
Approach		21	0.0	0.126	37.9	LOS C	0.7	4.9	0.95	0.69	29.0
NorthEast: Fox Valley Road											
24	L2	21	0.0	0.402	13.6	LOS A	8.6	60.0	0.60	0.54	40.5
25	T1	632	0.0	0.742	15.9	LOS B	10.1	70.4	0.72	0.66	40.9
26	R2	87	0.0	0.742	35.4	LOS C	10.1	70.4	0.99	0.92	34.5
Approach		740	0.0	0.742	18.2	LOS B	10.1	70.4	0.75	0.68	40.0
NorthWest: Access Road											
27	L2	37	0.0	0.229	39.0	LOS C	1.3	8.8	0.97	0.72	32.4
28	T1	5	0.0	0.200	35.3	LOS C	1.1	7.5	0.96	0.71	27.6
29	R2	26	0.0	0.200	39.0	LOS C	1.1	7.5	0.96	0.71	32.9
Approach		68	0.0	0.229	38.7	LOS C	1.3	8.8	0.96	0.72	32.3
SouthWest: Fox Valley Road											
30	L2	61	0.0	0.734	28.0	LOS B	15.6	109.3	0.94	0.86	37.4
31	T1	947	0.0	0.783	24.6	LOS B	17.4	121.8	0.95	0.90	37.3
Approach		1008	0.0	0.783	24.8	LOS B	17.4	121.8	0.95	0.90	37.3
All Vehicles		1838	0.0	0.783	22.8	LOS B	17.4	121.8	0.87	0.80	38.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P5	SouthEast Full Crossing	53	8.8	LOS A	0.1	0.1	0.50	0.50
P7	NorthWest Full Crossing	53	20.9	LOS C	0.1	0.1	0.77	0.77
P8	SouthWest Full Crossing	53	27.5	LOS C	0.1	0.1	0.89	0.89
All Pedestrians		158	19.1	LOS B			0.72	0.72

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.

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MOVEMENT SUMMARY

Site: 101 [4 leg PM (3-4) Fox Valley Road and Access Road - Copy]

New Site
Signals - Fixed Time Isolated Cycle Time = 70 seconds (Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total 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
SouthEast: Access Road											
21	L2	11	0.0	0.118	35.2	LOS C	0.8	5.9	0.93	0.70	25.0
22	T1	5	0.0	0.118	33.7	LOS C	0.8	5.9	0.93	0.70	30.0
23	R2	11	0.0	0.118	35.3	LOS C	0.8	5.9	0.93	0.70	24.9
Approach		26	0.0	0.118	34.9	LOS C	0.8	5.9	0.93	0.70	25.8
NorthEast: Fox Valley Road											
24	L2	11	0.0	0.396	13.5	LOS A	8.4	58.9	0.62	0.55	34.3
25	T1	505	0.0	0.731	14.1	LOS A	8.4	58.9	0.69	0.62	34.6
26	R2	145	0.0	0.731	35.6	LOS C	8.4	58.8	1.00	0.92	29.2
Approach		661	0.0	0.731	18.8	LOS B	8.4	58.9	0.76	0.69	33.3
NorthWest: Access Road											
27	L2	82	0.0	0.510	39.1	LOS C	2.9	20.3	1.00	0.77	28.1
28	T1	5	0.0	0.704	40.6	LOS C	4.1	28.7	1.00	0.88	24.0
29	R2	105	0.0	0.704	41.3	LOS C	4.1	28.7	1.00	0.88	27.8
Approach		193	0.0	0.704	40.3	LOS C	4.1	28.7	1.00	0.83	27.9
SouthWest: Fox Valley Road											
30	L2	117	0.0	0.730	29.0	LOS C	13.9	97.1	0.96	0.88	31.1
31	T1	758	0.0	0.779	26.8	LOS B	15.4	108.0	0.97	0.92	30.8
Approach		875	0.0	0.779	27.1	LOS B	15.4	108.0	0.97	0.91	30.9
All Vehicles		1755	0.0	0.779	25.5	LOS B	15.4	108.0	0.89	0.81	31.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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 is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

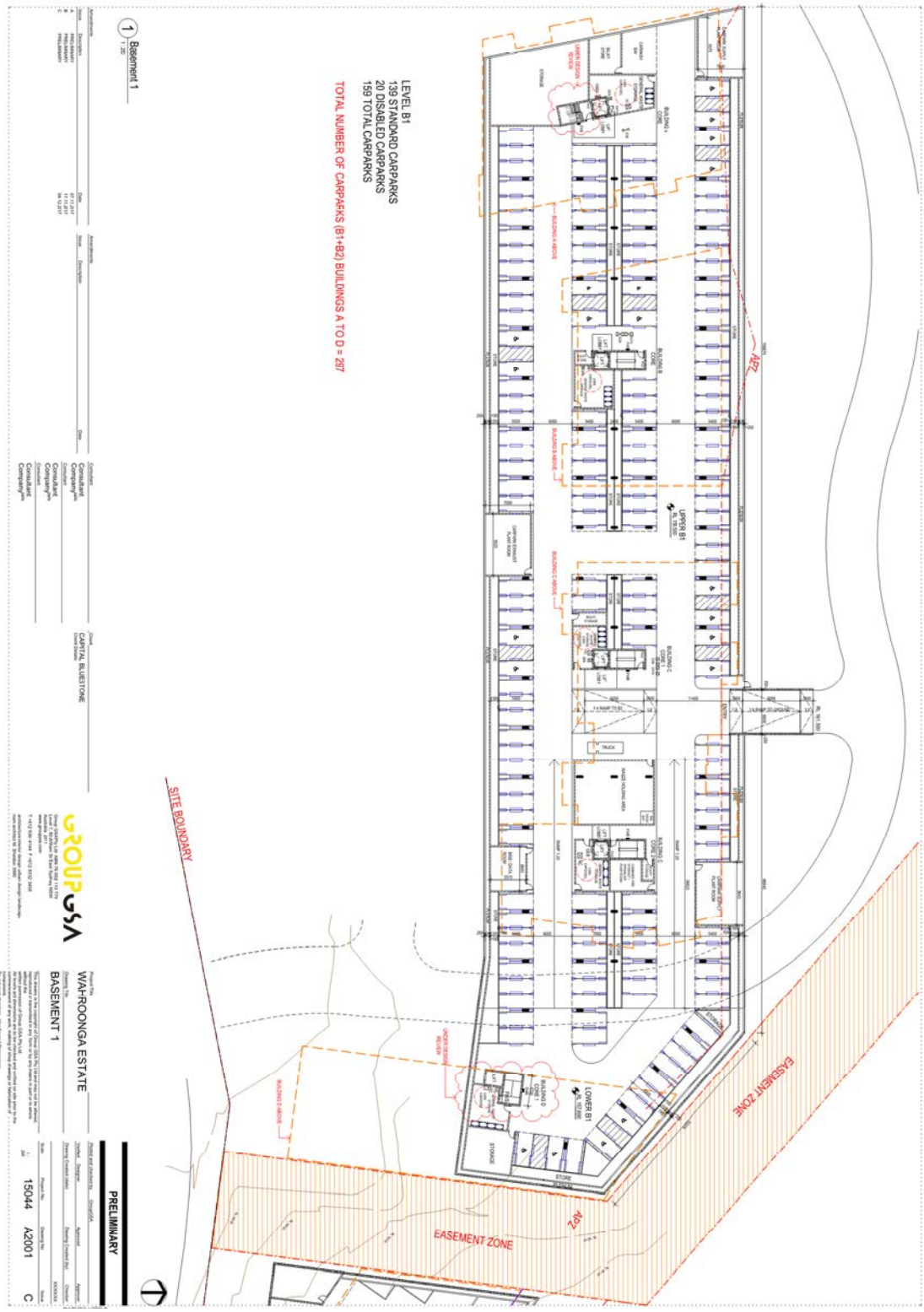
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P5	SouthEast Full Crossing	53	9.8	LOS A	0.1	0.1	0.53	0.53
P7	NorthWest Full Crossing	53	23.3	LOS C	0.1	0.1	0.82	0.82
P8	SouthWest Full Crossing	53	29.3	LOS C	0.1	0.1	0.92	0.92
All Pedestrians		158	20.8	LOS C			0.75	0.75

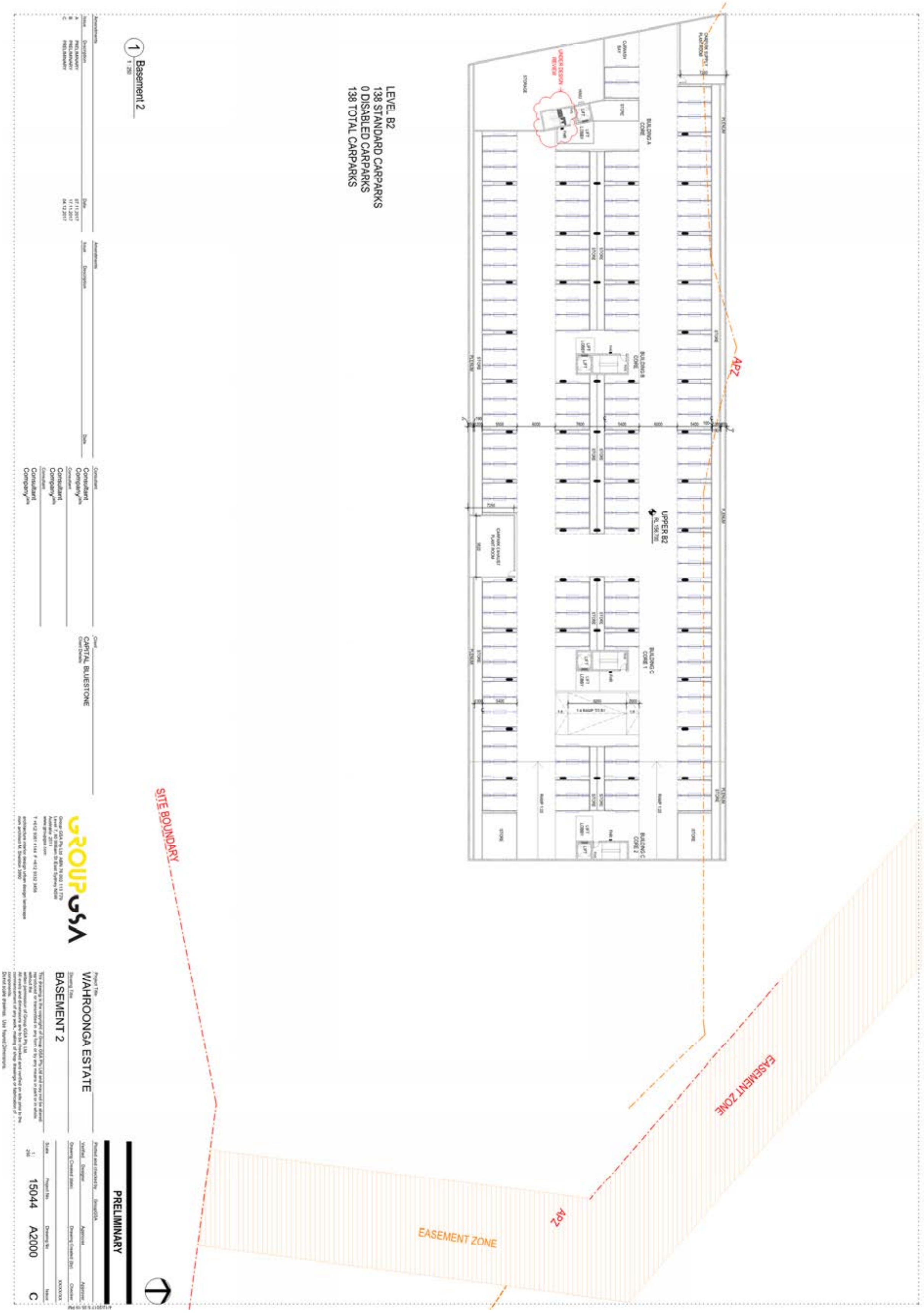
Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Organisation: TAYLOR THOMSON WHITTING (TTW) PTY LTD | Processed: Friday, 8 December 2017 3:56:32 PM
Project: P:\2017\1715\171590\Reports\TTW\Traffic\Fox Valley Road and Access Way.sip7

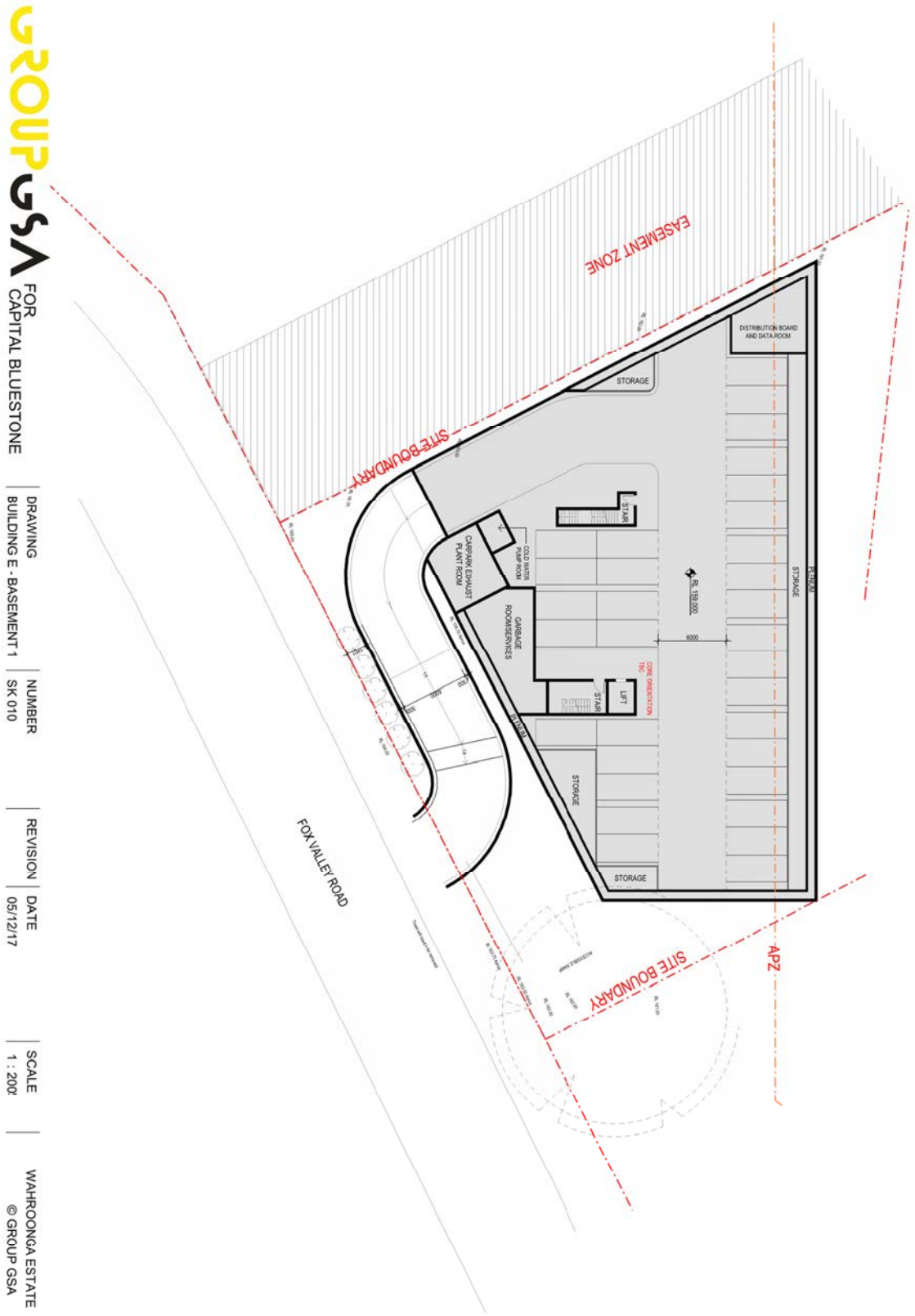
Appendix D – Proposed On-Site Carpark

Carpark Plan – Building A-D




Basement 2
LEVEL B2
138 STANDARD CARDPARKS
0 DISABLED CARPARKS
138 TOTAL CARPARKS
UPPER B2
APZ
SITE BOUNDARY
EASEMENT ZONE
EASEMENT ZONE
APZ
CAPITAL BLUESTONE
WAHROONGA ESTATE
BASEMENT 2
PRELIMINARY
15044
A2000
C

Carpark Plan – Building E



Appendix E – Proposed Street Parking

Access Road Street Parking Layout