Appendix 4

SIDRA Intersection Analysis
Rev A

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1. Introduction

This short report provides details on the SIDRA Analysis conducted to support the findings of the report KC00202.000_R01_Rev B. The intersections have been modelled in the PM peak hour for 2016 and 2026.

The dimensions of the intersection elements have been scaled from aerial imagery which was obtained through our commercial arrangement with Nearmaps and through publically available Intramaps. The aerial imagery which was utilised for this project is dated 27th June 2015. These images are suitable for use in concept drafting applications with a level of accuracy to within +/- 10 centimetres.

Base traffic data utilised for the modelling was obtained from MRWA and from the City of Wanneroo. The data was collected in September 2012 and November 2014. These results were utilised for creating base SIDRA models.

The review of available traffic data has shown that AM Peak on Joondalup Drive (West of Pinjar Road) is occurring between 07:30-08:30 while the PM Peak occurs between 16:15-17:15 (MRWA). It is therefore assumed the PM peak operating time for the proposed development will coincide with PM peak time for the traffic on Joondalup Drive (West of Pinjar Road). The expected traffic generated by the development in the Peak hour is 1,027 VPH in accordance with the WAPC's Volume 5: Technical Guidelines and the NSW RTA Guide to Traffic Generating Developments. For purposes of analysis it was assumed that Pad Sites are fully developed as well.

Based on the analysis of the nature of the businesses utilising the facilities within the subject area and the proposed designated access / egress points to the site, we believe the generated traffic from the development would be distributed onto the adjacent road network as follows:

- 26% on Joondalup Drive (north of the subject site) -> distributed to the residential area to the north and northeast of the subject site;
- 54% on Joondalup Drive (south of the subject site) -> distributed to the residential area to the south, southwest and southeast of the subject site (via Joondalup Drive and Pinjar Road);
- 6% on Pinjar Road and Golf Links Drive (northwest and west of the subject site) -> distributed to the residential area to the north, northwest and west of the subject site (via Joseph Banks Boulevard and Porrecta Link);
- 5% on Ghost Gum Boulevard (north of the subject site) -> distributed to the residential area to the north and northeast of the subject site;
- 3% on Joseph Banks Boulevard (northwest of the subject site) -> distributed to the residential area to the north and northwest of the subject site;
- 6% on Tumbleweed Drive (east of the subject site) -> distributed to the residential area to the east of the subject site.

The WAPC Transport Assessment Guidelines for Developments offers the following vehicle trip generation rates for the land uses proposed within the development:

- **Retail / shopping centres (with significant food retail component)** - 10 vehicular trips per 100m^2 of NLA for PM Peak and 2.5 trips per 100m^2 for the AM peak hour. A 50%IN / 50%OUT split has been adopted for the PM peak and an 80%IN / 20%OUT split for the AM peak hour;
- **Non-food Retail** - Trip rates also vary significantly for this land use as it covers a wide range of retail developments. The RTA surveys indicate a range from 0.1 to 6.4 trips per 100m^2 NLA for the weekday PM peak hour, with an average rate of 2.5 trips per 100m^2. These guidelines have adopted a PM peak

hour rate of 4 trips per 100m^2 NLA, in the upper middle of the range, (with AM rates around a quarter of this), but these rates should be used with caution in view of the large potential range in trip rates.

- **Offices** - PM Peak - 2 vehicular trips per 100m^2 of GFA. The same rate is assumed for the AM peak. An 80%IN / 20%OUT split has been assumed for the AM peak and the reverse for the PM peak.

Given that WAPC Transport Assessment Guidelines for Developments does not offer daily vehicle trip generation rates for the land uses proposed within the development, the following rates are provided in the NSW RTA Guide to Traffic Generating Developments:

- **Retail** - 121 vehicular trips per 100m^2 of NLA;
- **Gymnasium -** 45 vehicular trips per 100m^2 of GFA (Evening Peak Hour Trips - 9 vehicular trips per 100m^2). The peak generation generally occurs between 6.00pm and 7.00pm on a weekday evening;
- **Long day care –** AM peak between 07:00 and 09:00 with 0.8 per child and PM peak between 16:00 and 18:00 with 0.7 vehicle trip per child.
- **Office / Commercial** - 10 vehicular trips per 100m^2 of GFA (PM Peak - 2 per 100m^2 of GFA). An 80% / 20% IN/OUT split has been assumed for the AM peak and the reverse for the PM peak.

We have assumed an average traffic growth rate of 4% per annum given the significant volume of development in the area.

Summary of Results

SIDRA modelling has shown that the development will have minimal impact on the operation of the surrounding road network and namely the following intersections: -

- Joondalup Drive / Joseph Banks Boulevard / Tumbleweed Drive
- Joondalup Drive / Access Egress B
- Joondalup Drive / Access C
- Joondalup Drive / Ghost Gum Boulevard - East West
- Ghost Gum Boulevard - East West / Access Egress D
- Joseph Banks Boulevard / Access Egress A
- Joseph Banks Boulevard / Ghost Gum Boulevard - North South
- Ghost Gum Boulevard - North South / Access Egress E

Each intersection was analysed in the PM peak with the expected traffic volumes in 2016 and 2026. It has been determined that for this kind of development higher traffic volume occurs in the PM peak.

The intersection of Joondalup Drive and Joseph Banks Boulevard currently operates as a 4-way roundabout. The future passing traffic increased by the 4% annually with the additional traffic from the proposed development is likely to increase delays marginally in 2016.

Forward forecast of the traffic for 2026 was modelled with the current roundabout layout and an upgraded northern approach layout. Annual growth rate of 4% was assumed. Modelling of future base traffic shows that more significant delays can be expected for the Joondalup Drive northern approach leg. It is expected that with the current geometry the intersection will not perform to a satisfying level and that the Level of Service will be lowered to LOS F.

The performance of the roundabout can be improved through the upgrade of the northern approach leg. The modelling showed that two approach lanes and two exit lanes on the southern leg will be sufficient to cater traffic in 2026, with Level of Service B.

The results and findings of the SIDRA Intersection analysis show that the development has a notable impact on the adjacent road network however there is sufficient spare capacity in the surrounding network to cater for the proposed development.

A summary of the results of the SIDRA analysis are shown on the following pages. For purposes of clarity we will provide network summaries below. The full SIDRA output report can be provided on request.

2. Intersection Analysis

2.1 Intersection 1 – Joondalup Drive / Joseph Banks Boulevard / Tumbleweed Drive

Figure 1 – Location

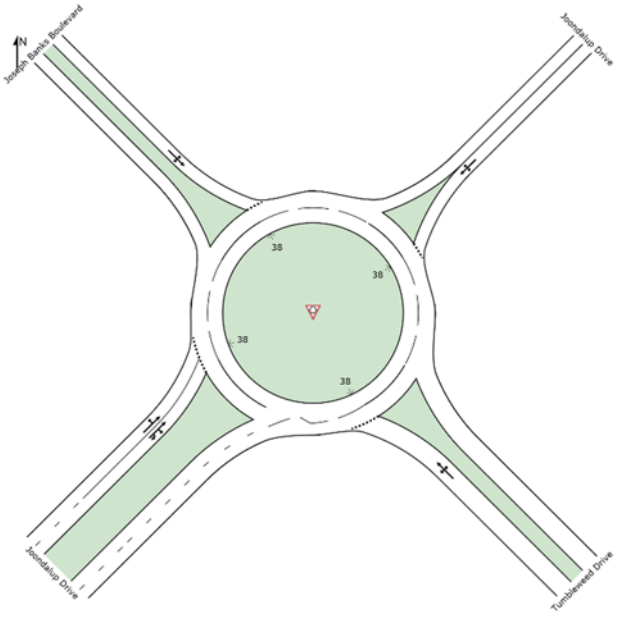

Figure 2- Schematic Geometry 2016

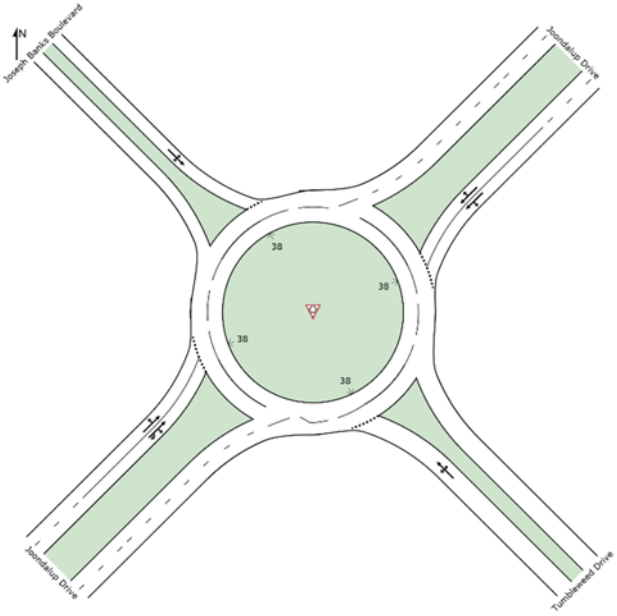

Figure 3- Schematic Geometry 2026

2.1.1 1.1p+ 2016 PM Peak (+ development)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV	Total	HV						Veh	Dist				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
SouthEast: Tumbleweed Drive															
Lane 1[d]	256	1.5	256	1.5	498	0.514	100	14.2	LOS B	4.3	31.7	Full	155	0.0	0.0
Approach	256	1.5	256	1.5		0.514		14.2	LOS B	4.3	31.7				
NorthEast: Joondalup Drive															
Lane 1[d]	785	2.9	785	2.9	878	0.895	100	22.1	LOS C	18.3	138.6	Full	330	0.0	0.0
Approach	785	2.9	785	2.9		0.895		22.1	LOS C	18.3	138.6				
NorthWest: Joseph Banks Boulevard															
Lane 1[d]	276	1.5	276	1.5	651	0.423	100	9.4	LOS A	2.7	20.0	Full	150	0.0	0.0
Approach	276	1.5	276	1.5		0.423		9.4	LOS A	2.7	20.0				
SouthWest: Joondalup Drive															
Lane 1	151	2.7	151	2.7	820	0.184	28[6]	6.0	LOS A	0.9	7.1	Full	125	0.0	0.0
Lane 2[d]	866	2.0	866	2.0	1320	0.656	100	9.7	LOS A	6.1	45.5	Full	125	0.0	0.0
Approach	1017	2.1	1017	2.1		0.656		9.2	LOS A	6.1	45.5				
Intersection	2334	2.2	2334	2.2		0.895		14.1	LOS B	18.3	138.6				

Figure 4 - LOS Table (Model 1.1p+ Joondalup Drive / Joseph Banks Boulevard / Tumbleweed Drive - 2016 - PM Peak - WD)

2.1.2 2.1p+ 2026 PM Peak (+ development)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV	Total	HV						Veh	Dist				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
SouthEast: Tumbleweed Drive															
Lane 1[d]	381	1.5	381	1.5	602	0.633	100	10.5	LOS B	4.3	32.1	Full	155	0.0	0.0
Approach	381	1.5	381	1.5		0.633		10.5	LOS B	4.3	32.1				
NorthEast: Joondalup Drive															
Lane 1[d]	622	2.7	622	2.7	965	0.644	100	10.9	LOS B	6.9	52.6	Full	330	0.0	0.0
Lane 2	513	2.7	513	2.7	796	0.644	100	13.6	LOS B	6.5	49.1	Full	330	0.0	0.0
Approach	1135	2.7	1135	2.7		0.644		12.1	LOS B	6.9	52.6				
NorthWest: Joseph Banks Boulevard															
Lane 1[d]	354	1.5	354	1.5	575	0.615	100	11.7	LOS B	4.1	30.6	Full	150	0.0	0.0
Approach	354	1.5	354	1.5		0.615		11.7	LOS B	4.1	30.6				
SouthWest: Joondalup Drive															
Lane 1[d]	739	2.7	739	2.7	1238	0.597	100	6.3	LOS A	5.1	38.7	Full	125	0.0	0.0
Lane 2	642	1.6	642	1.6	1075	0.597	100	12.6	LOS B	5.1	38.0	Full	125	0.0	0.0
Approach	1381	2.2	1381	2.2		0.597		9.2	LOS A	5.1	38.7				
Intersection	3251	2.2	3251	2.2		0.644		10.7	LOS B	6.9	52.6				

Figure 5 - LOS Table (Model 2.1p+ Joondalup Drive / Joseph Banks Boulevard / Tumbleweed Drive - 2026 - PM Peak - WD)

2.2 Intersection 2 – Joondalup Drive / Access Egress B

Figure 6 - Location

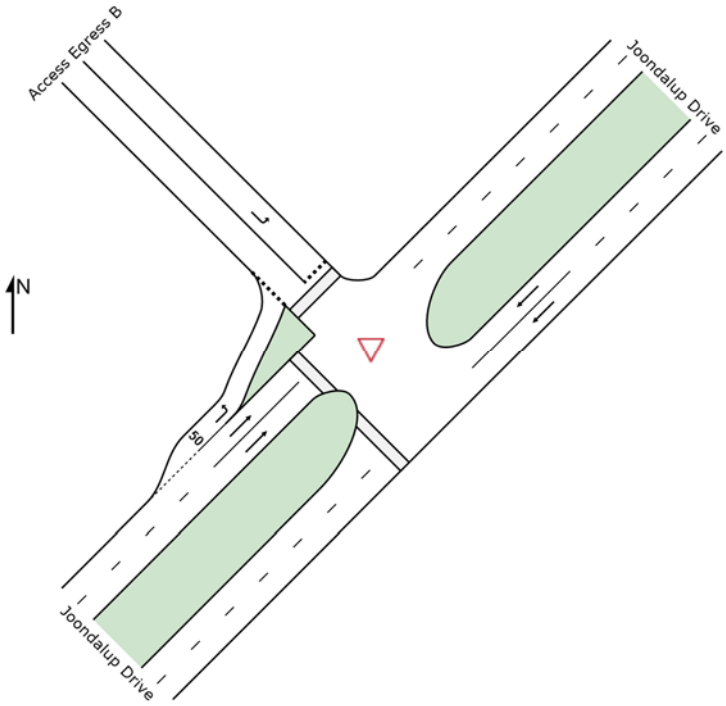

Figure 7- Schematic Geometry

2.2.1 1.2p+ 2016 PM Peak (+ development)

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV	Total	HV						Veh	Dist				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
NorthEast: Joondalup Drive															
Lane 1	545	3.0	545	3.0	1151	0.473	100	0.3	LOS A	3.7	28.1	Full	125	0.0	0.0
Lane 2	546	2.5	546	2.5	1154	0.473	100	0.3	LOS A	3.7	28.0	Full	125	0.0	0.0
Approach	1091	2.7	1091	2.8		0.473		0.3	NA	3.7	28.1				
NorthWest: Access Egress B															
Lane 1	158	1.5	158	1.5	782	0.202	100	2.8	LOS A	0.8	5.6	Full	120	0.0	0.0
Approach	158	1.5	158	1.5		0.202		2.8	LOS A	0.8	5.6				
SouthWest: Joondalup Drive															
Lane 1	86	2.5	86	2.5	1522	0.057	100	4.7	LOS A	0.2	1.8	Short	50	0.0	NA
Lane 2	429	3.0	429	3.0	1151	0.373	100	0.2	LOS A	2.5	19.0	Full	40	0.0	0.0
Lane 3	430	2.5	430	2.5	1154	0.373	100	0.2	LOS A	2.5	18.9	Full	40	0.0	0.0
Approach	945	2.7	945	2.7		0.373		0.6	LOS A	2.5	19.0				
Intersection	2194	2.7	2194	2.7		0.473		0.6	NA	3.7	28.1				

Figure 8 - LOS Table (Model 1.2p+ Joondalup Drive / Access Egress B - 2016 - PM Peak - WD)

2.2.2 2.2p+ 2026 PM Peak (+ development)

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV	Total	HV						Veh	Dist				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
NorthEast: Joondalup Drive															
Lane 1	749	2.9	749	2.9	1152	0.651	100	0.4	LOS A	7.2	54.9	Full	125	0.0	0.0
Lane 2	751	2.5	751	2.5	1154	0.651	100	0.4	LOS A	7.2	54.7	Full	125	0.0	0.0
Approach	1500	2.7	1500	2.7		0.651		0.4	NA	7.2	54.9				
NorthWest: Access Egress B															
Lane 1	158	1.5	158	1.5	601	0.263	100	5.1	LOS A	1.0	7.7	Full	120	0.0	0.0
Approach	158	1.5	158	1.5		0.263		5.1	LOS A	1.0	7.7				
SouthWest: Joondalup Drive															
Lane 1	86	2.5	86	2.5	1522	0.057	100	4.7	LOS A	0.2	1.8	Short	50	0.0	NA
Lane 2	610	2.9	610	2.9	1152	0.530	100	0.3	LOS A	4.6	34.7	Full	40	0.0	0.9
Lane 3	612	2.5	612	2.5	1154	0.530	100	0.3	LOS A	4.6	34.6	Full	40	0.0	0.8
Approach	1308	2.7	1308	2.7		0.530		0.6	LOS A	4.6	34.7				
Intersection	2966	2.6	2966	2.6		0.651		0.7	NA	7.2	54.9				

Figure 9 - LOS Table (Model 2.2p+ Joondalup Drive / Access Egress B - 2026 - PM Peak - WD)

2.3 Intersection 3 – Joondalup Drive / Access C

Figure 10 - Location

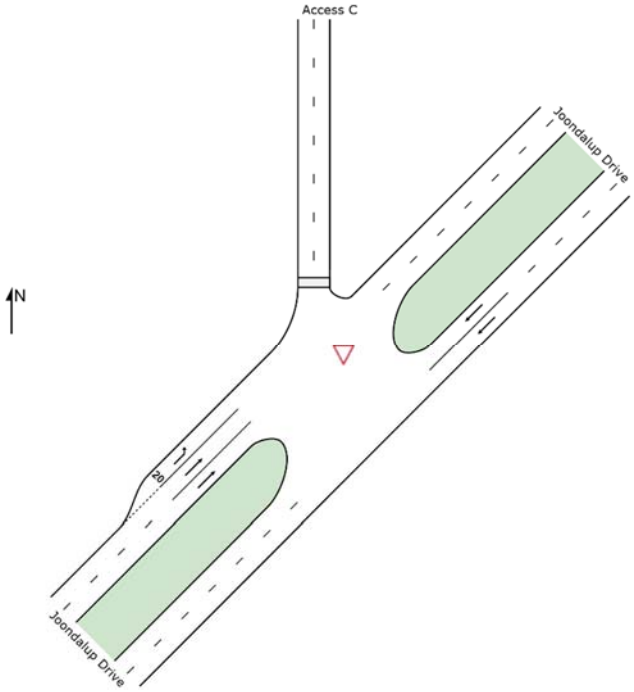

Figure 11- Schematic Geometry

2.3.1 1.3p+ 2016 PM Peak (+ development)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV	Total	HV						Veh	Dist				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
NorthEast: Joondalup Drive															
Lane 1	544	3.0	544	3.0	1953	0.279	100	0.0	LOS A	0.0	0.0	Full	40	0.0	0.0
Lane 2	546	2.5	546	2.5	1959	0.279	100	0.0	LOS A	0.0	0.0	Full	40	0.0	0.0
Approach	1091	2.8	1091	2.8		0.279		0.0	NA	0.0	0.0				
SouthWest: Joondalup Drive															
Lane 1	28	0.0	28	0.0	1723	0.016	100	4.9	LOS A	0.1	0.5	Short	20	0.0	NA
Lane 2	472	3.0	472	3.0	1953	0.242	100	0.0	LOS A	0.0	0.0	Full	85	0.0	0.0
Lane 3	473	2.5	473	2.5	1959	0.242	100	0.0	LOS A	0.0	0.0	Full	85	0.0	0.0
Approach	974	2.7	974	2.7		0.242		0.1	NA	0.1	0.5				
Intersection	2064	2.7	2064	2.7		0.279		0.1	NA	0.1	0.5				

Figure 12 - LOS Table (Model 1.3p+ Joondalup Drive / Access C - 2016 - PM Peak - WD)

2.3.2 2.3p+ 2026 PM Peak (+ development)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV	Total	HV						Veh	Dist				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
NorthEast: Joondalup Drive															
Lane 1	749	2.9	749	2.9	1954	0.383	100	0.0	LOS A	0.0	0.0	Full	40	0.0	0.0
Lane 2	751	2.5	751	2.5	1959	0.383	100	0.0	LOS A	0.0	0.0	Full	40	0.0	0.0
Approach	1500	2.7	1500	2.7		0.383		0.0	NA	0.0	0.0				
SouthWest: Joondalup Drive															
Lane 1	28	0.0	28	0.0	1723	0.016	100	4.9	LOS A	0.1	0.5	Short	20	0.0	NA
Lane 2	653	2.9	653	2.9	1954	0.334	100	0.0	LOS A	0.0	0.0	Full	85	0.0	0.0
Lane 3	655	2.5	655	2.5	1959	0.334	100	0.0	LOS A	0.0	0.0	Full	85	0.0	0.0
Approach	1337	2.6	1337	2.6		0.334		0.1	NA	0.1	0.5				
Intersection	2837	2.7	2837	2.7		0.383		0.1	NA	0.1	0.5				

Figure 13 - LOS Table (Model 2.3p+ Joondalup Drive / Access C - 2026 - PM Peak - WD)

2.4 Intersection 4 – Joondalup Drive / Ghost Gum Boulevard - East West

Figure 14 - Location

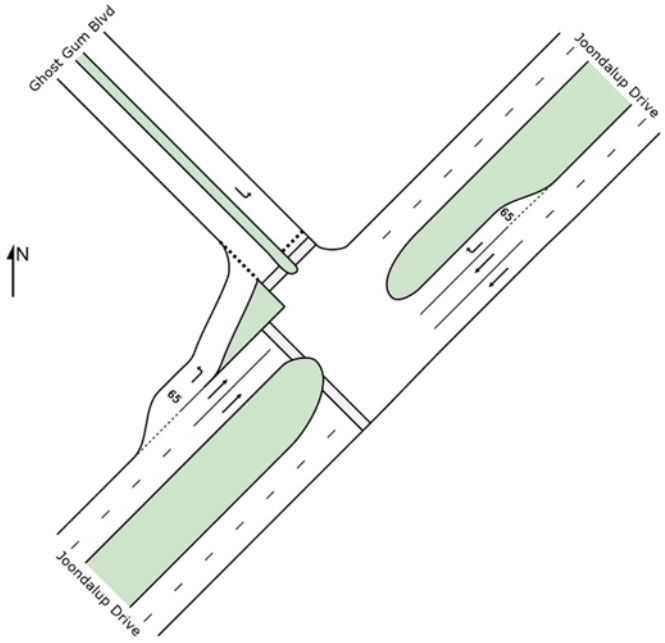

Figure 15- Schematic Geometry

2.4.1 1.4p+ 2016 PM Peak (+ development)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV	Total	HV						Veh	Dist				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
NorthEast: Joondalup Drive															
Lane 1	522	3.1	522	3.1	2286	0.228	100	0.1	LOS A	1.2	9.4	Full	85	0.0	0.0
Lane 2	523	2.5	523	2.5	2292	0.228	100	0.1	LOS A	1.2	9.4	Full	85	0.0	0.0
Lane 3	45	2.5	45	2.5	529	0.086	100	10.9	LOS B	0.3	2.3	Short	65	0.0	NA
Approach	1091	2.8	1091	2.8		0.228		0.6	NA	1.2	9.4				
NorthWest: Ghost Gum Blvd															
Lane 1	165	1.5	165	1.5	820	0.202	100	7.1	LOS A	0.8	5.7	Full	100	0.0	0.0
Approach	165	1.5	165	1.5		0.202		7.1	LOS A	0.8	5.7				
SouthWest: Joondalup Drive															
Lane 1	152	2.5	152	2.5	1459	0.104	100	7.0	LOS A	0.4	3.3	Short	65	0.0	NA
Lane 2	404	3.1	404	3.1	2252	0.179	100	0.2	LOS A	1.3	10.1	Full	150	0.0	0.0
Lane 3	405	2.5	405	2.5	2259	0.179	100	0.2	LOS A	1.3	10.0	Full	150	0.0	0.0
Approach	960	2.8	960	2.8		0.179		1.3	LOS A	1.3	10.1				
Intersection	2216	2.7	2216	2.7		0.228		1.3	NA	1.3	10.1				

Figure 16 - LOS Table (Model 1.4p+ Joondalup Drive / Ghost Gum Boulevard – East West - 2016 - PM Peak - WD)

2.4.2 2.4p+ 2026 PM Peak (+ development)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV	Total	HV						Veh	Dist				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
NorthEast: Joondalup Drive															
Lane 1	727	2.9	727	2.9	2288	0.318	100	0.1	LOS A	1.9	14.2	Full	85	0.0	0.0
Lane 2	728	2.5	728	2.5	2293	0.318	100	0.1	LOS A	1.9	14.2	Full	85	0.0	0.0
Lane 3	45	2.5	45	2.5	296	0.153	100	17.1	LOS C	0.5	3.9	Short	65	0.0	NA
Approach	1500	2.7	1500	2.7		0.318		0.6	NA	1.9	14.2				
NorthWest: Ghost Gum Blvd															
Lane 1	165	1.5	165	1.5	635	0.260	100	9.2	LOS A	1.0	7.6	Full	100	0.0	0.0
Approach	165	1.5	165	1.5		0.260		9.2	LOS A	1.0	7.6				
SouthWest: Joondalup Drive															
Lane 1	152	2.5	152	2.5	1459	0.104	100	7.0	LOS A	0.4	3.3	Short	65	0.0	NA
Lane 2	585	2.9	585	2.9	2254	0.260	100	0.2	LOS A	2.1	15.7	Full	150	0.0	0.0
Lane 3	586	2.5	586	2.5	2259	0.260	100	0.2	LOS A	2.1	15.6	Full	150	0.0	0.0
Approach	1323	2.7	1323	2.7		0.260		1.0	LOS A	2.1	15.7				
Intersection	2988	2.6	2988	2.6		0.318		1.3	NA	2.1	15.7				

Figure 17 - LOS Table (Model 2.4p+ Joondalup Drive / Ghost Gum Boulevard – East West - 2026 - PM Peak - WD)

2.5 Intersection 5 – Ghost Gum Boulevard - East West / Access Egress D

Figure 18 - Location

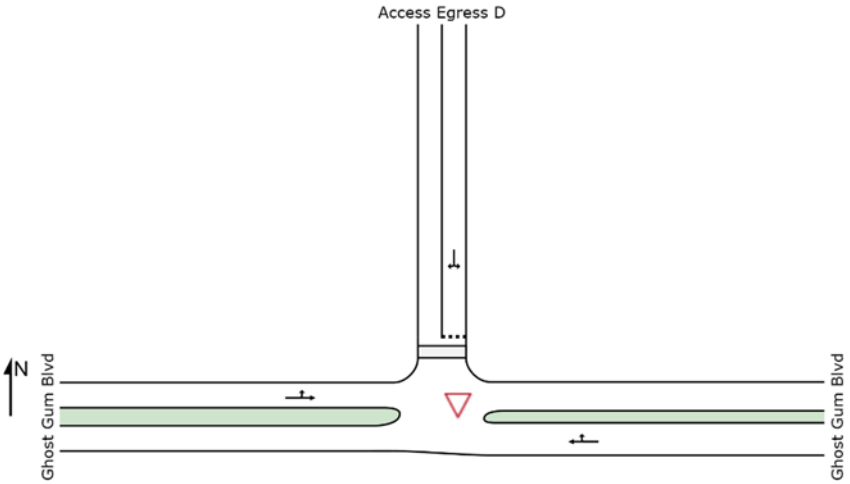

Figure 19- Schematic Geometry

2.5.1 1.5p+ PM Peak (+ development)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV	Total	HV						Veh	Dist				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
East: Ghost Gum Blvd															
Lane 1	197	2.0	197	2.0	2138	0.092	100	3.9	LOS A	0.5	3.7	Full	100	0.0	0.0
Approach	197	2.0	197	2.0		0.092		3.9	NA	0.5	3.7				
North: Access Egress D															
Lane 1	148	2.0	148	2.0	1840	0.081	100	4.8	LOS A	0.4	2.5	Full	100	0.0	0.0
Approach	148	2.0	148	2.0		0.081		4.8	LOS A	0.4	2.5				
West: Ghost Gum Blvd															
Lane 1	59	2.0	59	2.0	1865	0.032	100	1.8	LOS A	0.1	0.8	Full	200	0.0	0.0
Approach	59	2.0	59	2.0		0.032		1.8	NA	0.1	0.8				
Intersection	404	2.0	404	2.0		0.092		3.9	NA	0.5	3.7				

Figure 20 - LOS Table (Model 1.5p+ Ghost Gum Boulevard – East West / Access Egress D - PM Peak - WD)

2.6 Intersection 6 – Joseph Banks Boulevard / Access Egress A

Figure 21 - Location

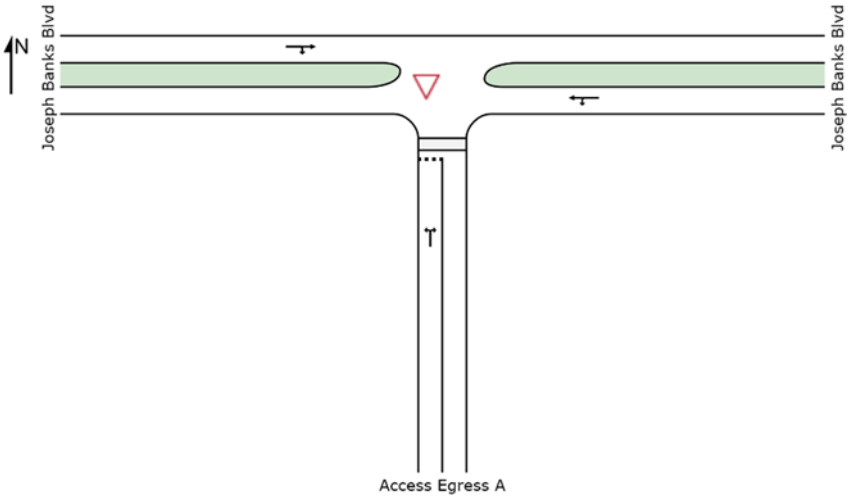

Figure 22- Schematic Geometry

2.6.1 1.6p+ 2016 PM Peak (+ development)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV	Total	HV						Veh	Dist				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Access Egress A															
Lane 1	101	2.0	101	2.0	1247	0.081	100	5.4	LOS A	0.2	1.5	Full	75	0.0	0.0
Approach	101	2.0	101	2.0		0.081		5.4	LOS A	0.2	1.5				
East: Joseph Banks Blvd															
Lane 1	276	2.0	276	2.0	1876	0.147	100	1.9	LOS A	0.6	4.4	Full	150	0.0	0.0
Approach	276	2.0	276	2.0		0.147		1.9	NA	0.6	4.4				
West: Joseph Banks Blvd															
Lane 1	199	2.0	199	2.0	2020	0.098	100	0.4	LOS A	0.1	0.7	Full	120	0.0	0.0
Approach	199	2.0	199	2.0		0.098		0.4	NA	0.1	0.7				
Intersection	576	2.0	576	2.0		0.147		2.0	NA	0.6	4.4				

Figure 23 - LOS Table (Model 1.6p+ Joseph Banks Boulevard / Access Egress A - 2016 - PM Peak - WD)

2.6.2 2.6p+ 2026 PM Peak (+ development)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV	Total	HV						Veh	Dist				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Access Egress A															
Lane 1	101	2.0	101	2.0	1138	0.089	100	5.7	LOS A	0.2	1.7	Full	75	0.0	0.0
Approach	101	2.0	101	2.0		0.089		5.7	LOS A	0.2	1.7				
East: Joseph Banks Blvd															
Lane 1	346	2.0	346	2.0	1906	0.182	100	1.5	LOS A	0.7	4.8	Full	150	0.0	0.0
Approach	346	2.0	346	2.0		0.182		1.5	NA	0.7	4.8				
West: Joseph Banks Blvd															
Lane 1	277	2.0	277	2.0	2019	0.137	100	0.4	LOS A	0.1	0.7	Full	120	0.0	0.0
Approach	277	2.0	277	2.0		0.137		0.4	NA	0.1	0.7				
Intersection	724	2.0	724	2.0		0.182		1.7	NA	0.7	4.8				

Figure 24 - LOS Table (Model 2.6p+ Joseph Banks Boulevard / Access Egress A - 2026 - PM Peak - WD)

2.7 Intersection 7 – Joseph Banks Boulevard / Ghost Gum Boulevard – North South

Figure 25 - Location

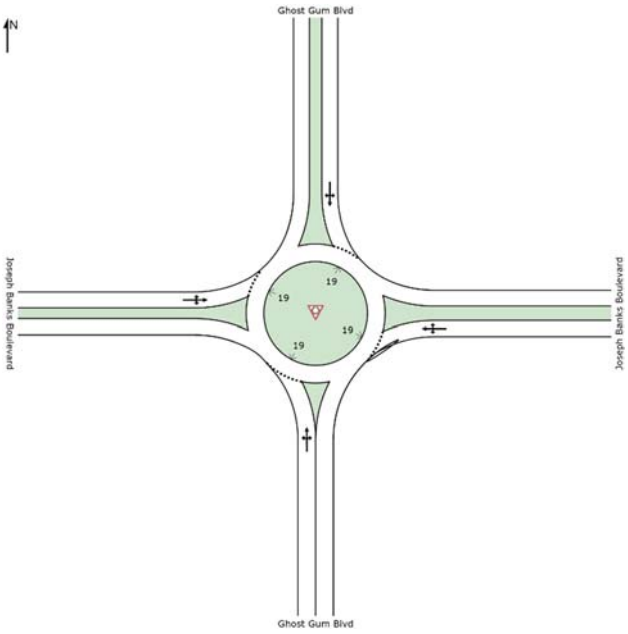

Figure 26- Schematic Geometry

2.7.1 1.7p+ 2016 PM Peak (+ development)

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV	Total	HV						Veh	Dist				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Ghost Gum Blvd															
Lane 1d	68	2.0	68	2.0	1240	0.055	100	6.0	LOS A	0.2	1.6	Full	65	0.0	0.0
Approach	68	2.0	68	2.0		0.055		6.0	LOS A	0.2	1.6				
East: Joseph Banks Boulevard															
Lane 1d	178	2.0	178	2.0	1416	0.126	100	4.5	LOS A	0.6	4.4	Full	120	0.0	0.0
Approach	178	2.0	178	2.0		0.126		4.5	LOS A	0.6	4.4				
North: Ghost Gum Blvd															
Lane 1d	119	4.0	119	4.0	1241	0.096	100	4.4	LOS A	0.4	3.3	Full	100	0.0	0.0
Approach	119	4.0	119	4.0		0.096		4.4	LOS A	0.4	3.3				
West: Joseph Banks Boulevard															
Lane 1d	122	4.9	122	4.9	1239	0.099	100	3.8	LOS A	0.4	3.4	Full	200	0.0	0.0
Approach	122	4.9	122	4.9		0.099		3.8	LOS A	0.4	3.4				
Intersection	487	3.2	487	3.2		0.126		4.5	LOS A	0.6	4.4				

Figure 27 - LOS Table (Model 1.7p+ Joseph Banks Boulevard / Ghost Gum Boulevard – North South - 2016 - PM Peak - WD)

2.7.2 2.7p+ 2026 PM Peak (+ development)

Lane Use and Performance															
	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV	Total	HV						Veh	Dist				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Ghost Gum Blvd															
Lane 1d	68	2.0	68	2.0	1177	0.058	100	6.3	LOS A	0.2	1.7	Full	65	0.0	0.0
Approach	68	2.0	68	2.0		0.058		6.3	LOS A	0.2	1.7				
East: Joseph Banks Boulevard															
Lane 1d	247	2.0	247	2.0	1402	0.176	100	4.7	LOS A	0.9	6.6	Full	120	0.0	0.0
Approach	247	2.0	247	2.0		0.176		4.7	LOS A	0.9	6.6				
North: Ghost Gum Blvd															
Lane 1d	175	3.4	175	3.4	1209	0.144	100	4.7	LOS A	0.7	5.2	Full	100	0.0	0.0
Approach	175	3.4	175	3.4		0.144		4.7	LOS A	0.7	5.2				
West: Joseph Banks Boulevard															
Lane 1d	183	4.1	183	4.1	1224	0.150	100	3.8	LOS A	0.7	5.3	Full	200	0.0	0.0
Approach	183	4.1	183	4.1		0.150		3.8	LOS A	0.7	5.3				
Intersection	674	2.9	674	2.9		0.176		4.6	LOS A	0.9	6.6				

Figure 28 - LOS Table (Model 2.7p+ Joseph Banks Boulevard / Ghost Gum Boulevard – North South - 2026 - PM Peak - WD)

2.8 Intersection 8 – Ghost Gum Boulevard – North South / Access Egress E

Figure 29 - Location

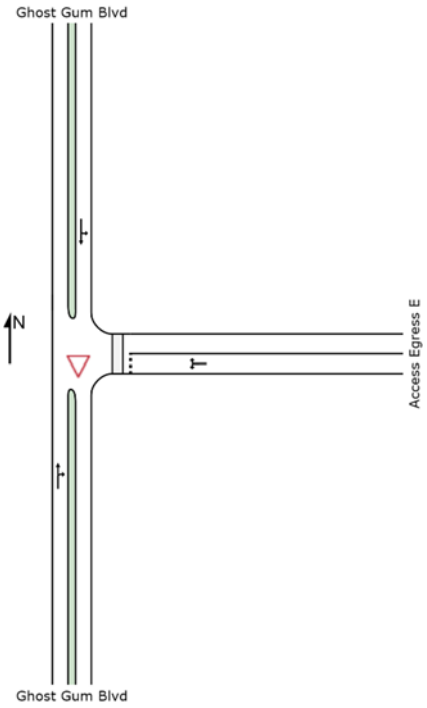

Figure 30- Schematic Geometry

2.8.1 1.8p+ PM Peak (+ development)

Lane Use and Performance

	Demand Flows		Arrival Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV	Total	HV						Veh	Dist				
	veh/h	%	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Ghost Gum Blvd															
Lane 1	57	2.0	57	2.0	2130	0.027	100	4.5	LOS A	0.1	1.0	Full	135	0.0	0.0
Approach	57	2.0	57	2.0		0.027		4.5	NA	0.1	1.0				
East: Access Egress E															
Lane 1	117	2.0	117	2.0	1652	0.071	100	4.8	LOS A	0.2	1.6	Full	110	0.0	0.0
Approach	117	2.0	117	2.0		0.071		4.8	LOS A	0.2	1.6				
North: Ghost Gum Blvd															
Lane 1	65	2.0	65	2.0	1715	0.038	100	4.2	LOS A	0.2	1.3	Full	65	0.0	0.0
Approach	65	2.0	65	2.0		0.038		4.2	NA	0.2	1.3				
Intersection	239	2.0	239	2.0		0.071		4.6	NA	0.2	1.6				

Figure 31 - LOS Table (Model 1.8p+ Ghost Gum Boulevard – North South / Access Egress E - PM Peak - WD)

3. Network Analysis

3.1 Network M03 2016

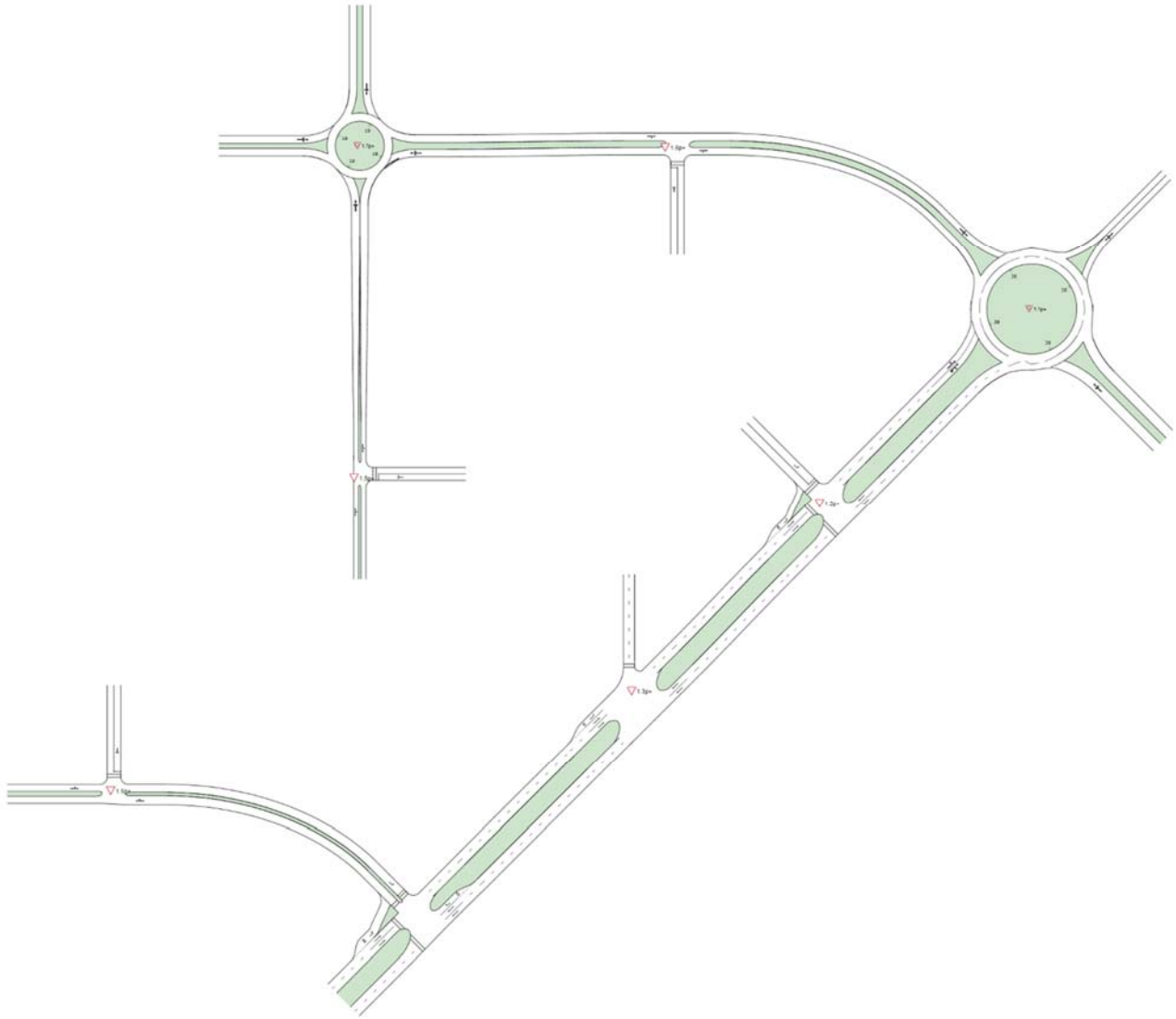

Figure 32- Schematic Geometry

SITES IN NETWORK	
Site ID	**Site Name**
1.1p+	1.1p+ Joondalup Drive / Joseph Banks Boulevard - 2016 - PM - WD
1.2p+	1.2p+ Joondalup Drive / Access Egress B - 2016 - PM - WD
1.3p+	1.3p+ Joondalup Drive / Access C - 2016 - PM - WD
1.4p+	1.4p+ Joondalup Drive / Ghost Gum Blvd - 2016 - PM - WD
1.5p+	1.5p+ Ghost Gum Blvd/ Access Egress D - 2016 - PM - WD
1.6p+	1.6p+ Joseph Banks Blvd / Access Egress A - 2016 - PM - WD
1.7p+	1.7p+ Joseph Banks Boulevard / Ghost Gum Blvd - 2016 - PM - WD
1.8p+	1.8p+ Ghost Gum Blvd / Access Egress E - 2016 - PM - WD

3.1.1 M03p+ 2016 PM Peak (1.1p+,1.2p+,1.3p+,1.4p+,1.5p+,1.6p+,1.7p+,1.8p+)

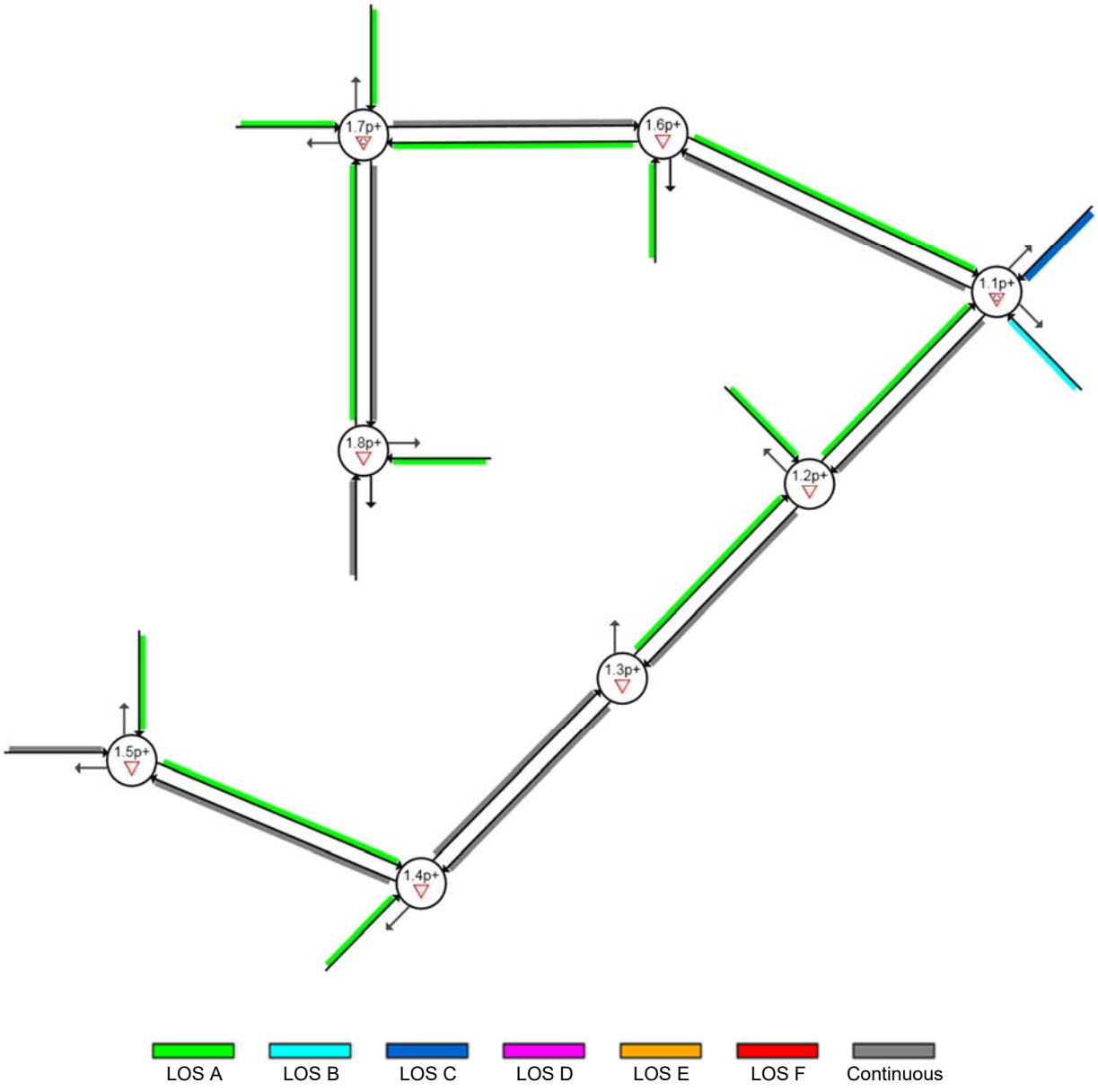

Figure 33 - Network LOS (Network M03p+ - 2016 - PM Peak - WD)

3.2 Network M03 2026

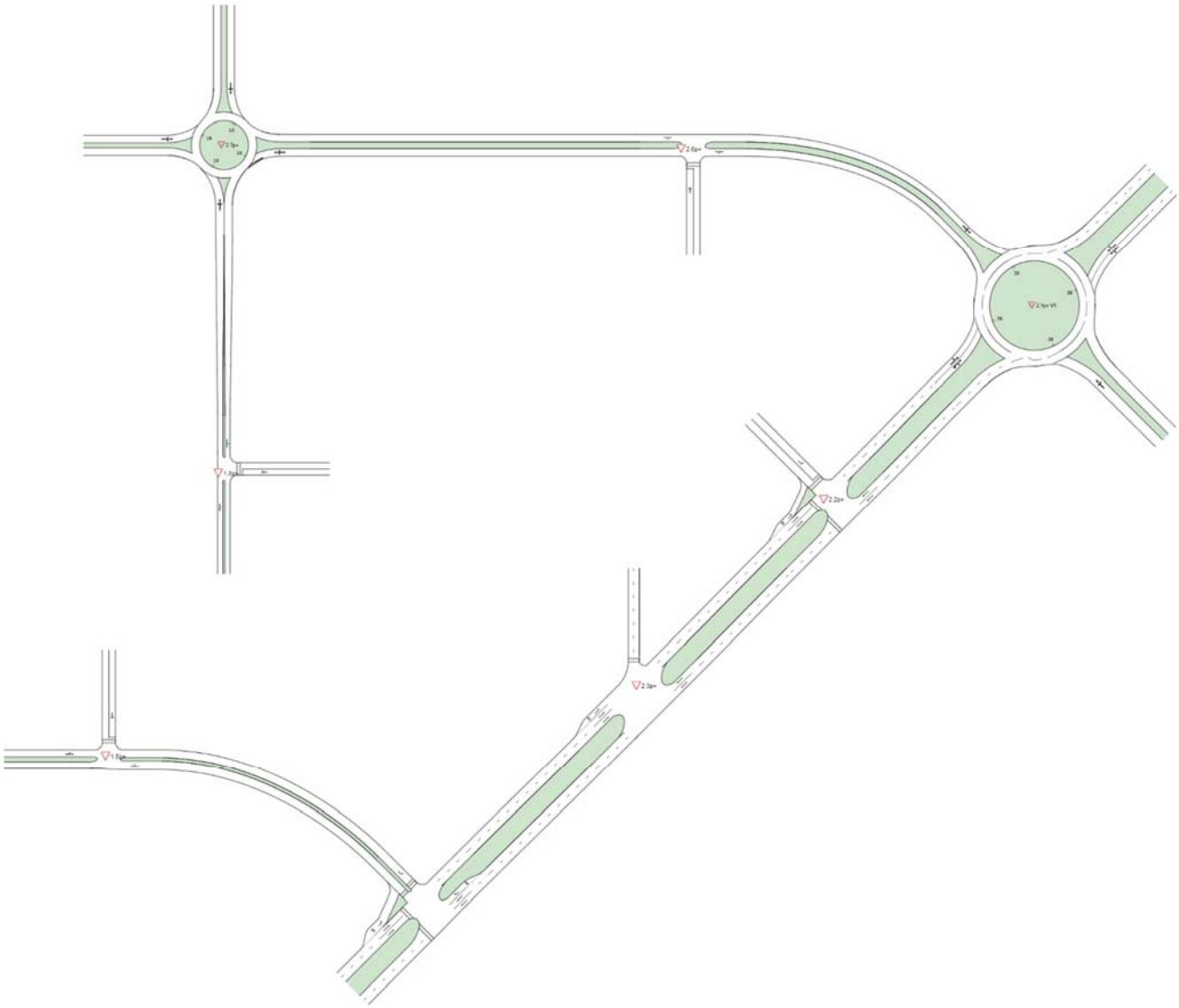

Figure 34- Schematic Geometry

SITES IN NETWORK	
Site ID	**Site Name**
2.1p+ V1.	2.1p+ V1. Joondalup Drive / Joseph Banks Boulevard - 2026 - PM - WD
2.2p+	2.2p+ Joondalup Drive / Access Egress B - 2026 - PM - WD
2.3p+	2.3p+ Joondalup Drive / Access C - 2026 - PM - WD
2.4p+	2.4p+ Joondalup Drive / Ghost Gum Blvd - 2026 - PM - WD
1.5p+	1.5p+ Ghost Gum Blvd/ Access Egress D - 2016 - PM - WD
2.6p+	2.6p+ Joseph Banks Blvd / Access Egress A - 2026 - PM - WD
2.7p+	2.7p+ Joseph Banks Boulevard / Ghost Gum Blvd - 2026 - PM - WD

3.2.1 M03p+ 2026 PM Peak (2.1p+, 2.2p+,2.3p+,2.4p+,1.5p+,2.6p+,2.7p+1.8p+)

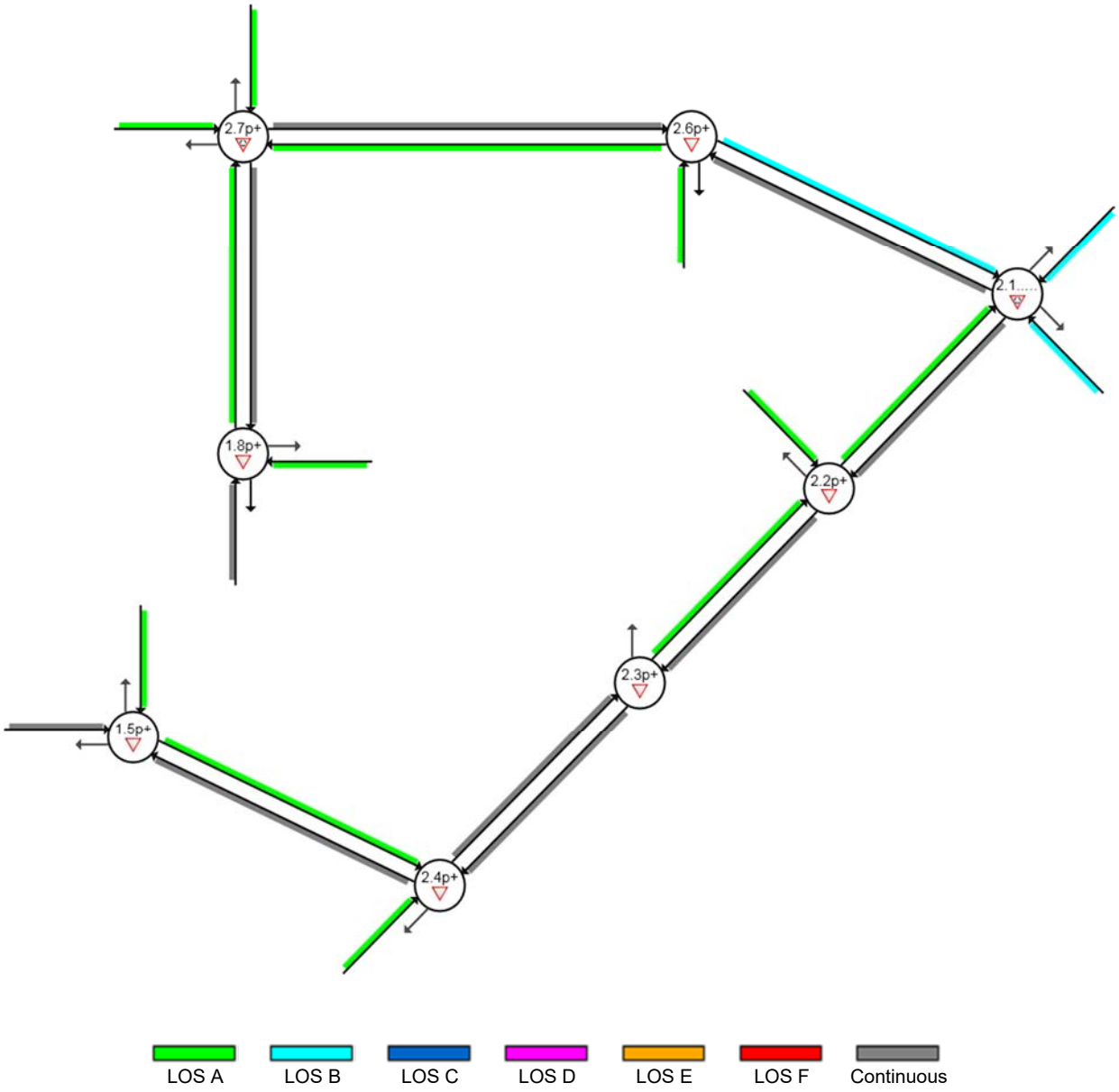

Figure 35 - Network LOS (Network M03p+ - 2026 - PM Peak - WD)