

Technical Memorandum

Title	Murdoch Drive Connection - Roundabout Analysis		
Client	City of Cockburn	Project No	CW1004500
Date	Prepared 17/10/2017	Status	Rev A
Author	Andrew Barry	Discipline	Civil Infrastructure and Property
Reviewer	Andreas Wang	Office	Perth

RE: Murdoch Drive Cardno Assessment of MRWA Option 2

MRWA have undertaken additional ROM modelling based on networks aligning to drawing 10-0100-010-RD-SK-1082 Rev A. This amended drawing limits access from the proposed Murdoch Drive Connection to Farrington road, however access from Roe Highway is still provided to Bibra Drive and Hope Road.

The MRWA ROM outputs suggests that there will be 51,700 (2 way) vehicles per day (vpd) routed to/from Roe Highway into the City of Cockburn and the City of Melville. These revised traffic figures reflect an additional approx. 8,000vpd (2 way) from the previously supplied ROM data aligning to drawing 10-0100-010-RD-SK-1050 Rev B.

Two key roundabouts have been assessed against MRWA 2021 & 2031 ROM data using Sidra as part of this review:

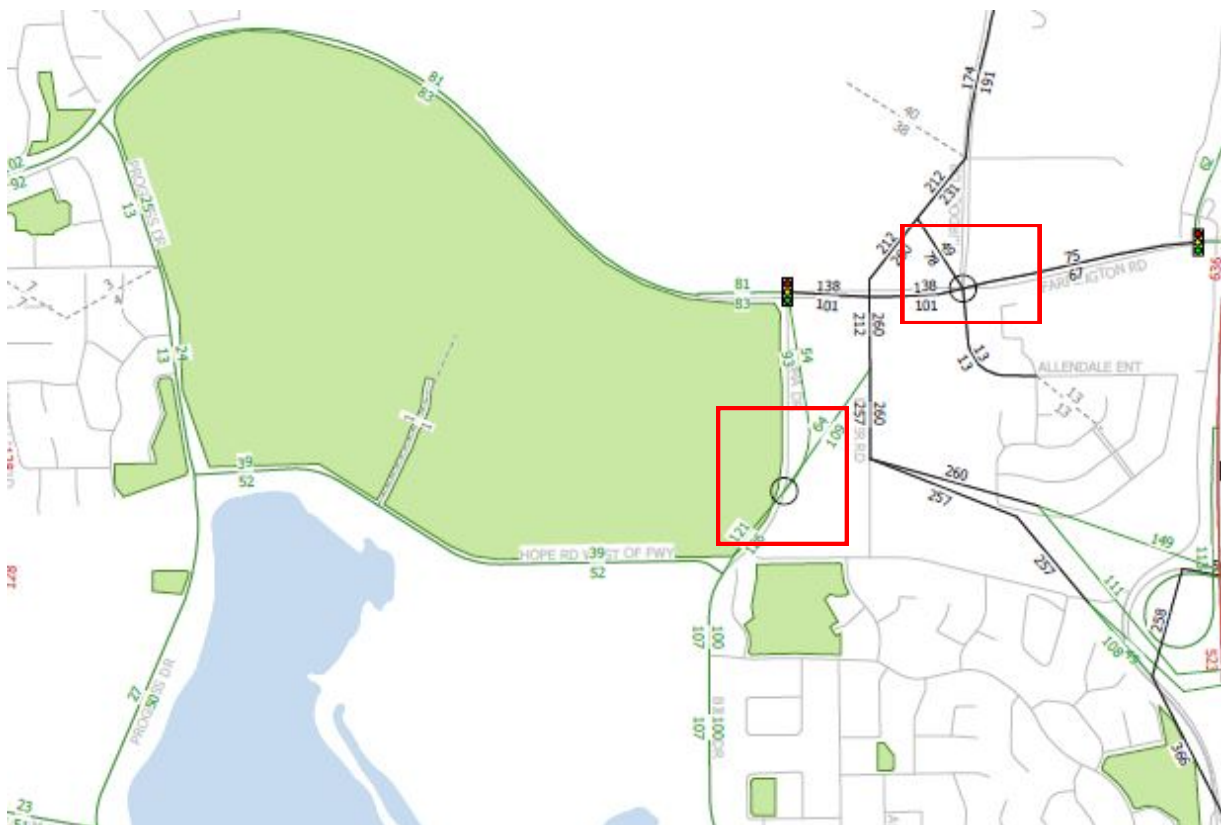
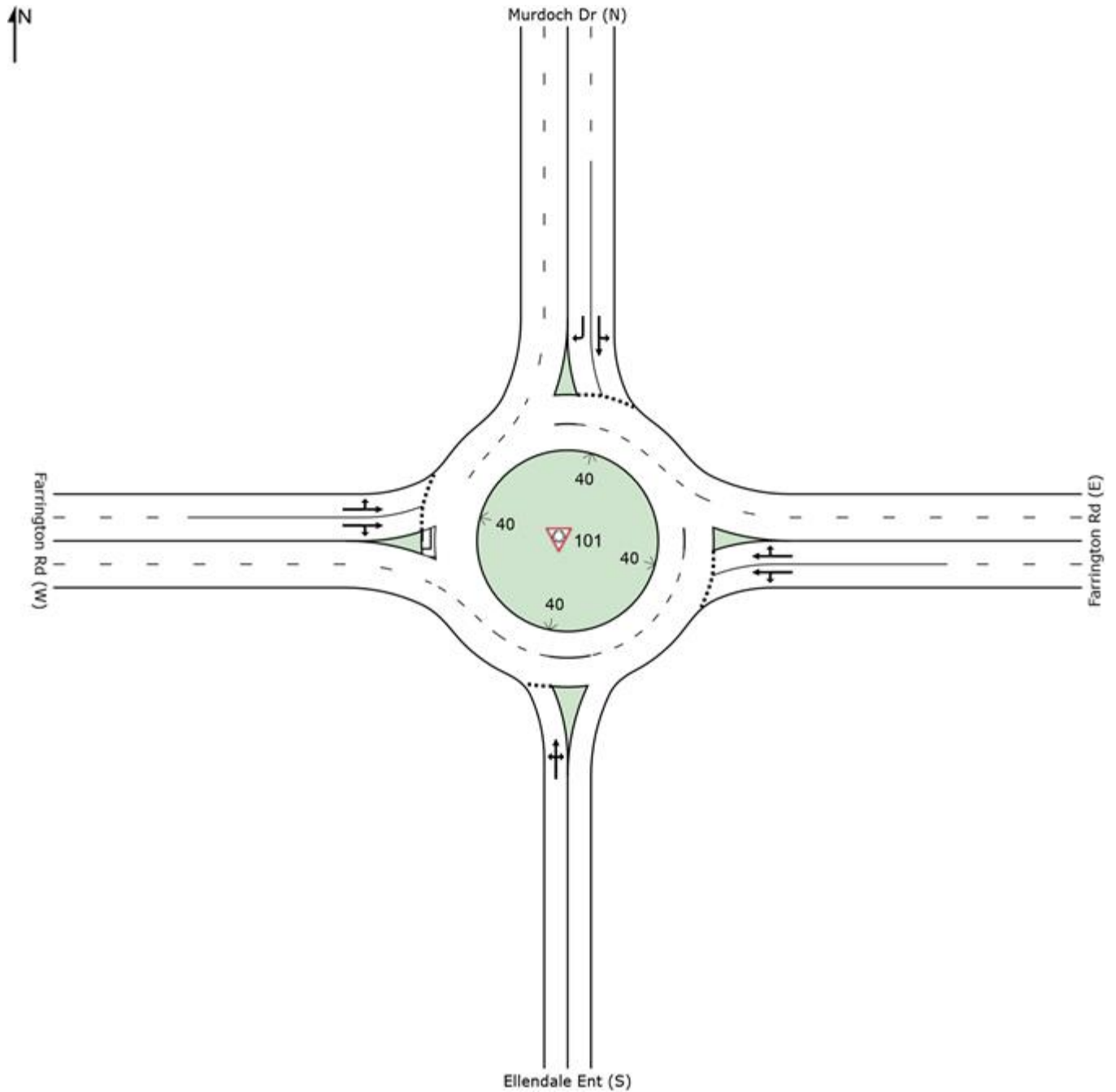


Figure 1: Study Area – Source: 2021 ROM 24 FS-BFS-Scen 13(MRIA Concept Design_Option2)

Roundabout 1 - Murdoch Drive / Farrington Road / Allendale Entrance



SIDRA layout:

2021 AM

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South: Ellendale Ent (S)												
1	L2	78	0.0	0.157	5.6	LOS A	0.7	4.7	0.60	0.69	53.7	
2	T1	35	0.0	0.157	5.5	LOS A	0.7	4.7	0.60	0.69	56.2	
3	R2	18	0.0	0.157	12.0	LOS B	0.7	4.7	0.60	0.69	57.0	
Approach		131	0.0	0.157	6.5	LOS A	0.7	4.7	0.60	0.69	54.8	
East: Farrington Rd (E)												
4	L2	16	0.0	0.296	4.0	LOS A	1.6	11.1	0.42	0.38	55.2	
5	T1	492	3.0	0.296	3.8	LOS A	1.6	11.1	0.43	0.43	56.3	
6	R2	224	3.0	0.296	10.5	LOS B	1.5	10.8	0.44	0.61	55.2	
Approach		732	2.9	0.296	5.9	LOS A	1.6	11.1	0.43	0.49	55.9	
North: Murdoch Dr (N)												
7	L2	47	6.0	0.082	6.8	LOS A	0.4	3.0	0.64	0.66	54.2	
8	T1	7	0.0	0.082	6.2	LOS A	0.4	3.0	0.64	0.66	56.4	
9	R2	201	6.0	0.205	12.1	LOS B	1.3	9.5	0.67	0.76	51.9	
Approach		254	5.8	0.205	10.9	LOS B	1.3	9.5	0.67	0.74	52.4	
West: Farrington Rd (W)												
10	L2	1021	6.0	0.665	5.0	LOS A	6.6	48.3	0.67	0.60	53.9	
11	T1	527	6.0	0.502	4.8	LOS A	3.9	28.2	0.61	0.51	55.3	
12	R2	73	0.0	0.502	11.2	LOS B	3.9	28.2	0.61	0.51	56.3	
Approach		1620	5.7	0.665	5.2	LOS A	6.6	48.3	0.65	0.56	54.4	
All Vehicles		2736	4.7	0.665	6.0	LOS A	6.6	48.3	0.59	0.56	54.7	

2021 PM

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h	
South: Ellendale Ent (S)												
1	L2	64	0.0	0.117	6.1	LOS A	0.5	3.8	0.64	0.74	53.2	
2	T1	7	0.0	0.117	5.9	LOS A	0.5	3.8	0.64	0.74	55.7	
3	R2	21	0.0	0.117	12.5	LOS B	0.5	3.8	0.64	0.74	56.5	
Approach		91	0.0	0.117	7.5	LOS A	0.5	3.8	0.64	0.74	54.1	
East: Farrington Rd (E)												
4	L2	14	0.0	0.218	4.9	LOS A	1.2	8.3	0.59	0.47	54.3	
5	T1	380	3.0	0.218	4.8	LOS A	1.2	8.3	0.59	0.51	55.6	
6	R2	40	3.0	0.218	11.7	LOS B	1.1	7.8	0.60	0.58	56.3	
Approach		434	2.9	0.218	5.4	LOS A	1.2	8.3	0.59	0.52	55.6	
North: Murdoch Dr (N)												
7	L2	170	6.0	0.244	6.3	LOS A	1.0	7.4	0.59	0.73	54.6	
8	T1	19	0.0	0.244	5.7	LOS A	1.0	7.4	0.59	0.73	56.9	
9	R2	508	6.0	0.466	12.3	LOS B	2.6	19.4	0.65	0.86	52.0	
Approach		697	5.8	0.466	10.6	LOS B	2.6	19.4	0.63	0.83	52.7	
West: Farrington Rd (W)												
10	L2	221	6.0	0.314	3.5	LOS A	2.1	15.7	0.23	0.34	55.8	
11	T1	710	6.0	0.314	3.2	LOS A	2.1	15.7	0.24	0.37	57.7	
12	R2	80	0.0	0.314	9.8	LOS A	2.1	15.3	0.25	0.39	58.2	
Approach		1011	5.5	0.314	3.8	LOS A	2.1	15.7	0.24	0.36	57.3	
All Vehicles		2232	4.9	0.466	6.4	LOS A	2.6	19.4	0.45	0.55	55.3	

2031 AM

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ellendale Ent (S)											
1	L2	68	0.0	0.165	6.3	LOS A	0.7	5.2	0.67	0.76	53.2
2	T1	34	0.0	0.165	6.1	LOS A	0.7	5.2	0.67	0.76	55.7
3	R2	19	0.0	0.165	12.7	LOS B	0.7	5.2	0.67	0.76	56.6
Approach		121	0.0	0.165	7.3	LOS A	0.7	5.2	0.67	0.76	54.5
East: Farrington Rd (E)											
4	L2	16	0.0	0.375	4.3	LOS A	2.2	15.8	0.52	0.41	54.7
5	T1	569	3.0	0.375	4.1	LOS A	2.2	15.8	0.53	0.46	55.7
6	R2	288	3.0	0.375	10.9	LOS B	2.1	15.2	0.54	0.66	54.6
Approach		873	2.9	0.375	6.4	LOS A	2.2	15.8	0.53	0.53	55.3
North: Murdoch Dr (N)											
7	L2	78	6.0	0.147	7.6	LOS A	0.8	6.1	0.74	0.76	53.5
8	T1	9	0.0	0.147	7.1	LOS A	0.8	6.1	0.74	0.76	55.7
9	R2	277	6.0	0.327	13.1	LOS B	2.4	17.5	0.82	0.84	51.3
Approach		363	5.9	0.327	11.8	LOS B	2.4	17.5	0.80	0.82	51.9
West: Farrington Rd (W)											
10	L2	1150	6.0	0.785	7.6	LOS A	11.9	87.8	0.84	0.78	53.0
11	T1	636	6.0	0.626	6.3	LOS A	6.2	45.5	0.75	0.68	54.5
12	R2	69	0.0	0.626	12.7	LOS B	6.2	45.5	0.75	0.68	55.4
Approach		1855	5.8	0.785	7.3	LOS A	11.9	87.8	0.81	0.74	53.6
All Vehicles		3210	4.8	0.785	7.6	LOS A	11.9	87.8	0.73	0.69	53.9

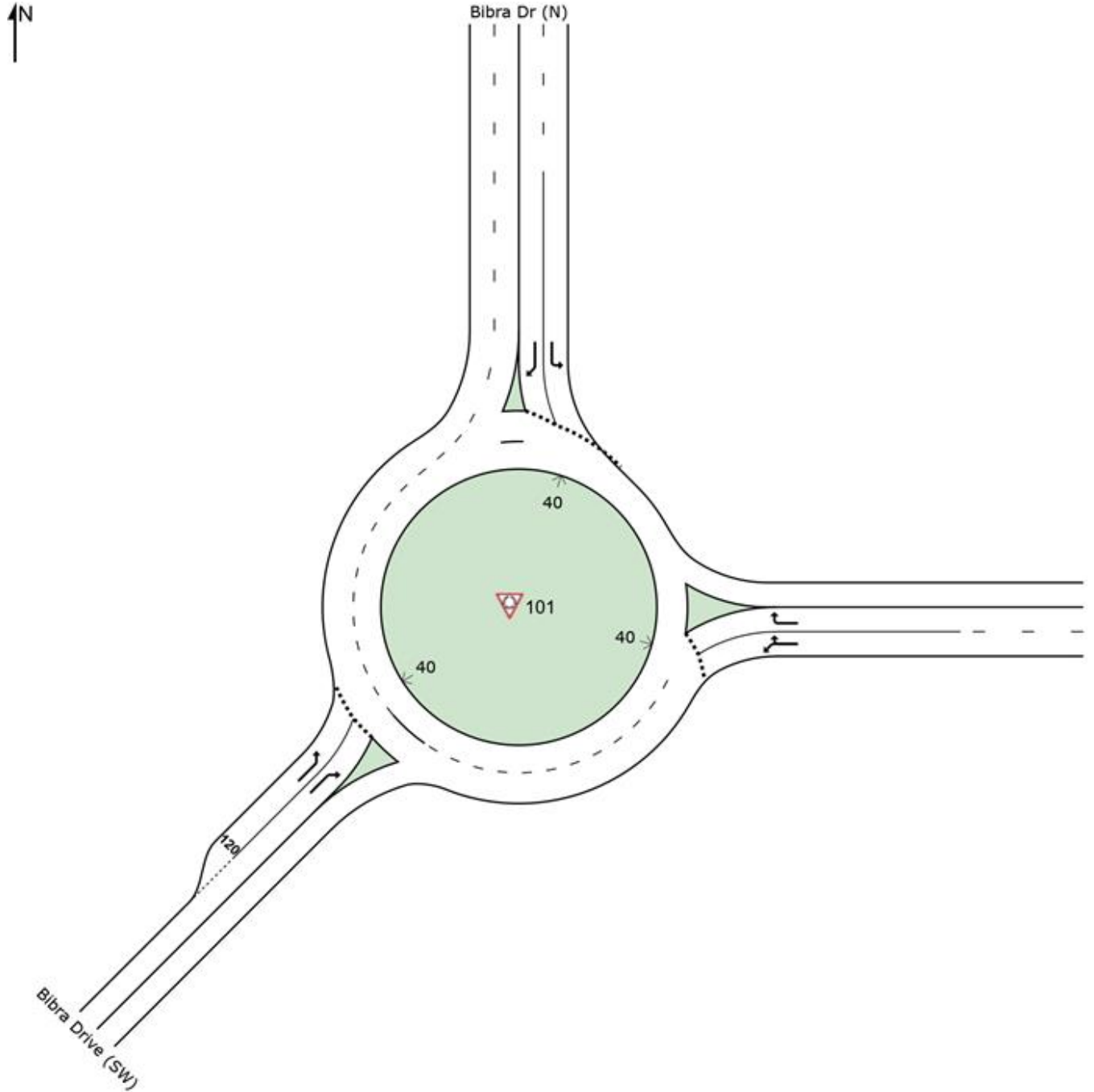
2031 PM

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Ellendale Ent (S)											
1	L2	54	0.0	0.133	7.3	LOS A	0.7	4.7	0.74	0.82	52.0
2	T1	7	0.0	0.133	7.2	LOS A	0.7	4.7	0.74	0.82	54.6
3	R2	23	0.0	0.133	13.7	LOS B	0.7	4.7	0.74	0.82	55.4
Approach		84	0.0	0.133	9.1	LOS A	0.7	4.7	0.74	0.82	53.2
East: Farrington Rd (E)											
4	L2	17	0.0	0.306	5.7	LOS A	1.9	13.5	0.73	0.55	53.6
5	T1	443	3.0	0.306	5.7	LOS A	1.9	13.5	0.73	0.60	54.7
6	R2	58	3.0	0.306	12.7	LOS B	1.7	12.4	0.73	0.69	55.3
Approach		517	2.9	0.306	6.5	LOS A	1.9	13.5	0.73	0.61	54.7
North: Murdoch Dr (N)											
7	L2	291	6.0	0.419	7.4	LOS A	2.1	15.6	0.68	0.83	53.8
8	T1	26	0.0	0.419	6.8	LOS A	2.1	15.6	0.68	0.83	56.0
9	R2	679	6.0	0.658	14.3	LOS B	5.1	37.7	0.77	1.02	50.9
Approach		995	5.8	0.658	12.1	LOS B	5.1	37.7	0.75	0.96	51.9
West: Farrington Rd (W)											
10	L2	253	6.0	0.367	3.6	LOS A	2.8	20.2	0.29	0.35	55.5
11	T1	833	6.0	0.367	3.3	LOS A	2.8	20.2	0.31	0.37	57.4
12	R2	72	0.0	0.367	9.9	LOS A	2.7	19.6	0.32	0.39	58.0
Approach		1158	5.6	0.367	3.8	LOS A	2.8	20.2	0.31	0.37	57.0
All Vehicles		2754	5.0	0.658	7.5	LOS A	5.1	37.7	0.56	0.64	54.5

Findings

For the Murdoch Drive / Farrington Road / Allendale Entrance roundabout, the Sidra analysis shows that this roundabout will operate with acceptable Level of Service (LOS) for all scenarios.

Roundabout 2 - Bibra Drive / Murdoch Drive Connection



SIDRA Layout

2021 AM

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
		Total veh/h	HV %				Vehicles veh	Distance m			
East: Hope Rd (E)											
4a	L1	515	5.0	0.371	4.3	LOS A	2.9	21.0	0.64	0.48	55.9
6	R2	346	5.0	0.328	11.7	LOS B	2.3	16.4	0.64	0.73	52.7
Approach		861	5.0	0.371	7.3	LOS A	2.9	21.0	0.64	0.58	54.5
North: Bibra Dr (N)											
7	L2	161	5.0	0.187	5.4	LOS A	1.0	7.1	0.55	0.62	54.9
9a	R1	406	5.0	0.351	10.0	LOS A	2.3	16.4	0.60	0.71	52.8
Approach		567	5.0	0.351	8.7	LOS A	2.3	16.4	0.58	0.68	53.4
SouthWest: Bibra Drive (SW)											
30a	L1	730	2.0	0.582	4.5	LOS A	4.9	34.6	0.67	0.52	55.8
32a	R1	427	2.0	0.423	10.1	LOS B	2.7	19.3	0.60	0.72	52.9
Approach		1157	2.0	0.582	6.6	LOS A	4.9	34.6	0.65	0.60	54.7
All Vehicles		2584	3.7	0.582	7.3	LOS A	4.9	34.6	0.63	0.61	54.3

2021 PM

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Flows		Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
		Total veh/h	HV %				Vehicles veh	Distance m			
East: Hope Rd (E)											
4a	L1	660	5.0	0.895	47.7	LOS D	26.4	193.0	1.00	1.79	34.7
6	R2	391	5.0	0.767	36.0	LOS D	10.9	79.7	1.00	1.33	40.2
Approach		1051	5.0	0.895	43.3	LOS D	26.4	193.0	1.00	1.62	36.6
North: Bibra Dr (N)											
7	L2	250	5.0	0.292	4.9	LOS A	1.5	11.3	0.48	0.57	55.2
9a	R1	989	5.0	0.732	10.5	LOS B	8.3	60.5	0.71	0.71	52.4
Approach		1238	5.0	0.732	9.4	LOS A	8.3	60.5	0.67	0.68	52.9
SouthWest: Hope Rd (SW)											
30a	L1	585	2.0	0.507	4.4	LOS A	4.0	28.8	0.71	0.50	55.6
32a	R1	250	2.0	0.286	10.2	LOS B	1.7	12.3	0.61	0.73	52.9
Approach		835	2.0	0.507	6.1	LOS A	4.0	28.8	0.68	0.57	54.7
All Vehicles		3123	4.2	0.895	19.9	LOS B	26.4	193.0	0.78	0.97	46.4

2031 AM

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Hope Rd (E)											
4a	L1	561	5.0	0.437	4.8	LOS A	3.7	27.2	0.75	0.54	55.3
6	R2	391	5.0	0.408	12.4	LOS B	3.0	22.2	0.75	0.79	52.3
Approach		951	5.0	0.437	7.9	LOS A	3.7	27.2	0.75	0.64	54.0
North: Bibra Dr (N)											
7	L2	204	5.0	0.254	5.9	LOS A	1.4	10.5	0.64	0.69	54.6
9a	R1	489	5.0	0.455	10.6	LOS B	3.3	24.1	0.72	0.77	52.4
Approach		693	5.0	0.455	9.2	LOS A	3.3	24.1	0.69	0.75	53.0
SouthWest: Hope Rd (SW)											
30a	L1	843	2.0	0.703	6.3	LOS A	8.0	57.3	0.81	0.78	55.1
32a	R1	505	2.0	0.525	10.9	LOS B	4.0	28.2	0.70	0.79	52.5
Approach		1348	2.0	0.703	8.0	LOS A	8.0	57.3	0.77	0.78	54.1
All Vehicles		2991	3.6	0.703	8.3	LOS A	8.0	57.3	0.75	0.73	53.8

2031 PM

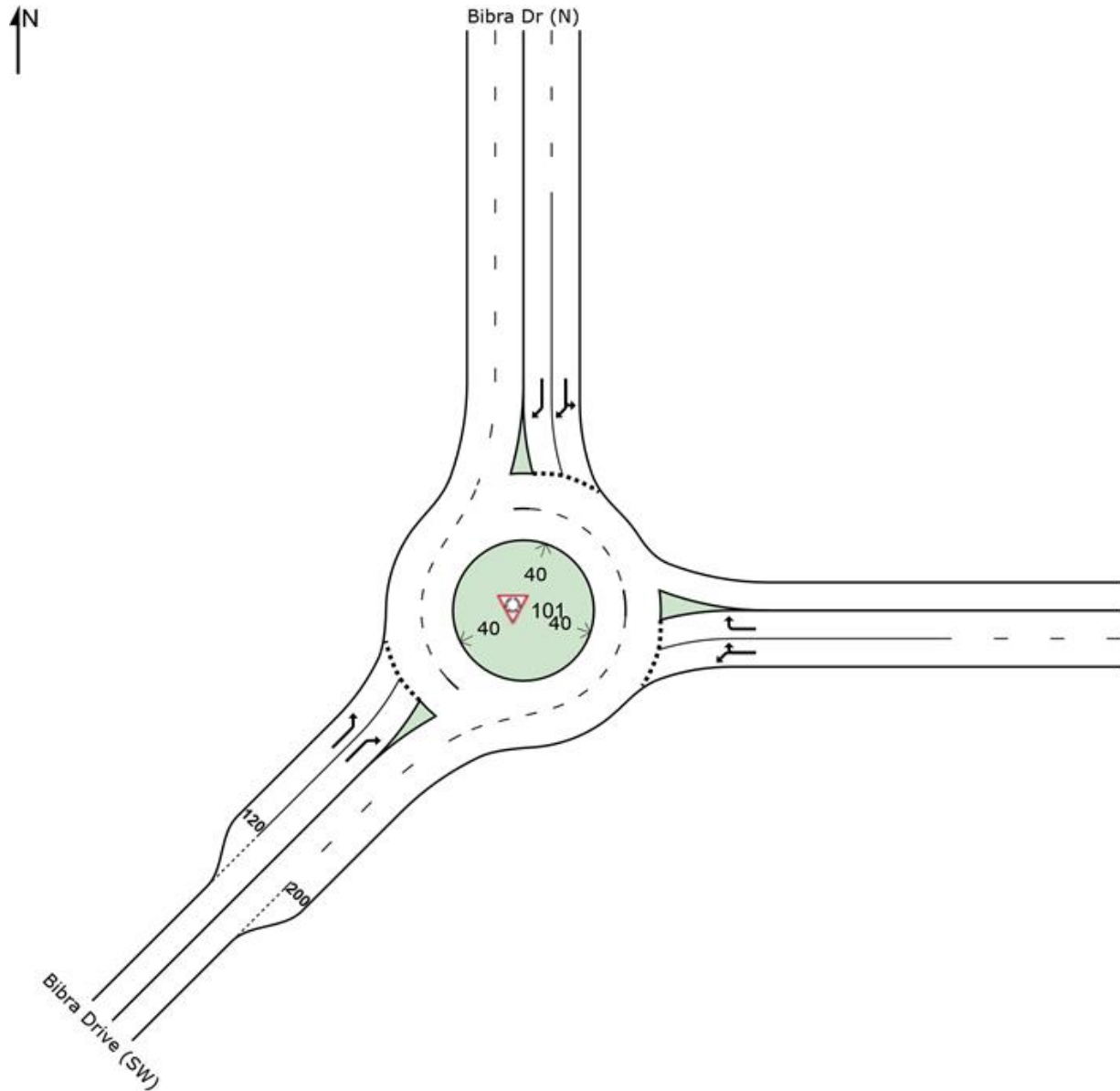
Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Hope Rd (E)											
4a	L1	710	5.0	1.623	2281.4	LOS F	703.4	5134.8	1.00	18.82	1.6
6	R2	447	5.0	1.532	1967.5	LOS F	404.2	2950.6	1.00	13.45	1.9
Approach		1157	5.0	1.623	2160.2	LOS F	703.4	5134.8	1.00	16.75	1.7
North: Bibra Dr (N)											
7	L2	324	5.0	0.380	5.3	LOS A	2.2	15.7	0.55	0.62	54.9
9a	R1	1189	5.0	0.904	16.0	LOS B	20.3	148.5	0.99	0.96	49.7
Approach		1513	5.0	0.904	13.7	LOS B	20.3	148.5	0.90	0.88	50.7
SouthWest: Hope Rd (SW)											
30a	L1	679	2.0	0.535	3.9	LOS A	4.4	31.4	0.64	0.45	55.9
32a	R1	294	2.0	0.306	9.7	LOS A	1.9	13.2	0.55	0.69	53.1
Approach		972	2.0	0.535	5.7	LOS A	4.4	31.4	0.61	0.52	55.0
All Vehicles		3642	4.2	1.623	693.3	LOS F	703.4	5134.8	0.85	5.82	5.0

Findings

For the Bibra Drive / Hope Road roundabout, the analysis shows that this will operate with acceptable LOS for the 2021 scenarios, noting that the eastern approach is operating with higher-than-desired Degree of Saturation (DOS) for the 2021 PM scenario. However, for the 2031 PM scenario, the forecast growth in southbound traffic on Bibra Drive will not provide sufficient gaps in traffic for the eastern approach, resulting in queue lengths extending back to Roe Highway and a LOS of F.

Noting the low level of service provided by the current MRWA design, Cardno undertook further analysis on the Bibra Drive / Murdoch Drive Connection roundabout factoring improvements for the southbound approach and exit. This is represented graphically in the Sidra layout below.

Roundabout 2 - Bibra Drive / Murdoch Drive Connection (Cardno Amended Geometric Design)



SIDRA Layout – Cardno Amended Roundabout Configuration

2021 AM

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Hope Rd (E)											
4a	L1	515	5.0	0.422	3.9	LOS A	2.4	17.5	0.55	0.45	56.4
6	R2	346	5.0	0.344	11.1	LOS B	1.7	12.8	0.53	0.75	53.1
Approach		861	5.0	0.422	6.8	LOS A	2.4	17.5	0.54	0.57	55.0
North: Bibra Dr (N)											
7	L2	161	5.0	0.264	4.8	LOS A	1.6	11.5	0.56	0.65	53.3
9a	R1	406	5.0	0.264	10.0	LOS B	1.6	11.5	0.57	0.69	53.7
Approach		567	5.0	0.264	8.6	LOS A	1.6	11.5	0.56	0.68	53.6
SouthWest: Bibra Drive (SW)											
30a	L1	730	2.0	0.576	4.5	LOS A	4.6	33.1	0.65	0.52	55.9
32a	R1	427	2.0	0.419	10.1	LOS B	2.6	18.6	0.58	0.72	53.0
Approach		1157	2.0	0.576	6.6	LOS A	4.6	33.1	0.63	0.59	54.8
All Vehicles		2584	3.7	0.576	7.1	LOS A	4.6	33.1	0.58	0.60	54.6

2021 PM

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Hope Rd (E)											
4a	L1	660	5.0	0.694	8.0	LOS A	5.8	42.6	0.84	1.00	54.7
6	R2	391	5.0	0.550	14.8	LOS B	3.4	25.0	0.78	0.99	51.4
Approach		1051	5.0	0.694	10.5	LOS B	5.8	42.6	0.82	1.00	53.4
North: Bibra Dr (N)											
7	L2	250	5.0	0.496	4.4	LOS A	3.6	26.2	0.53	0.61	52.9
9a	R1	989	5.0	0.496	9.5	LOS A	3.6	26.2	0.54	0.65	53.7
Approach		1238	5.0	0.496	8.5	LOS A	3.6	26.2	0.54	0.64	53.5
SouthWest: Hope Rd (SW)											
30a	L1	585	2.0	0.495	4.4	LOS A	3.7	26.6	0.67	0.50	55.8
32a	R1	250	2.0	0.279	10.2	LOS B	1.6	11.4	0.59	0.73	53.0
Approach		835	2.0	0.495	6.1	LOS A	3.7	26.6	0.65	0.57	54.9
All Vehicles		3123	4.2	0.694	8.5	LOS A	5.8	42.6	0.66	0.74	53.8

2031 AM

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Hope Rd (E)											
4a	L1	561	5.0	0.484	4.4	LOS A	3.0	22.1	0.63	0.50	56.0
6	R2	391	5.0	0.412	11.5	LOS B	2.2	16.2	0.61	0.78	52.8
Approach		951	5.0	0.484	7.3	LOS A	3.0	22.1	0.62	0.62	54.6
North: Bibra Dr (N)											
7	L2	204	5.0	0.349	5.4	LOS A	2.3	17.1	0.66	0.70	53.0
9a	R1	489	5.0	0.349	10.6	LOS B	2.3	17.1	0.67	0.75	53.3
Approach		693	5.0	0.349	9.1	LOS A	2.3	17.1	0.67	0.73	53.2
SouthWest: Hope Rd (SW)											
30a	L1	843	2.0	0.692	6.2	LOS A	7.6	54.0	0.78	0.76	55.2
32a	R1	505	2.0	0.517	10.9	LOS B	3.8	26.7	0.68	0.78	52.6
Approach		1348	2.0	0.692	7.9	LOS A	7.6	54.0	0.74	0.77	54.2
All Vehicles		2991	3.6	0.692	8.0	LOS A	7.6	54.0	0.69	0.71	54.1

2031 PM

Movement Performance - Vehicles											
Mov ID	OD Mov	Demand Total	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
East: Hope Rd (E)											
4a	L1	710	5.0	0.871	15.5	LOS B	11.1	81.3	0.98	1.32	49.3
6	R2	447	5.0	0.747	19.5	LOS B	6.0	44.1	0.90	1.13	48.4
Approach		1157	5.0	0.871	17.1	LOS B	11.1	81.3	0.95	1.25	49.0
North: Bibra Dr (N)											
7	L2	324	5.0	0.630	5.1	LOS A	5.7	41.5	0.67	0.68	52.5
9a	R1	1189	5.0	0.630	10.4	LOS B	5.7	41.5	0.68	0.72	53.2
Approach		1513	5.0	0.630	9.3	LOS A	5.7	41.5	0.68	0.71	53.0
SouthWest: Hope Rd (SW)											
30a	L1	679	2.0	0.610	5.7	LOS A	5.9	42.3	0.80	0.69	55.1
32a	R1	294	2.0	0.349	10.7	LOS B	2.2	15.6	0.67	0.77	52.7
Approach		972	2.0	0.610	7.2	LOS A	5.9	42.3	0.76	0.72	54.3
All Vehicles		3642	4.2	0.871	11.2	LOS B	11.1	81.3	0.79	0.88	52.0

Findings

The proposed improved design for the southbound approach and exit has resulted in an overall satisfactory performance. However, there is a higher than desired degree of saturation (DoS) in 2031 PM scenario (DoS 0.87, while max desired DoS is 0.85).