Dalyellup District Centre

TRAFFIC AND TRANSPORT ADDENDUM REPORT

- Final
- 6 March 2012

SKM

Dalyellup District Centre

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- Final
- 6 March 2012

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1.   Introduction and background

In January 2011, SKM prepared a comprehensive transport assessment for the proposed District Centre in the Dalyellup Estate, in the Shire of Capel.

The Satterley Property Group has now proposed some changes to the proposed development within the District Centre, which merits a review of the original transport assessment.

The modified draft Dalyellup town centre concept plan is shown in **Figure 1**, with the amended road network overlaid.

Major changes are:

- Introduction of bulk retail (hardware/homeware store) of up to 13,000 m^2 of NLA, east of the neighbourhood connector;
- Consequential decrease in business use of 10,711 m^2 of NLA from the same location;
- Deletion of the eastern local access street and replacement with a driveway access to the hardware/ homeware store.

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■ **Figure 1 Dalyellup Town Centre Concept Plan**

DALYELLUP DISTRICT CENTRE
Road hierarchy

FEBRUARY 2012

LEGEND

- - - Dalyellup District Centre
— Main street
— Intergrator arterial 'B'
— Neighbourhood connector
— Local access street
— Laneway

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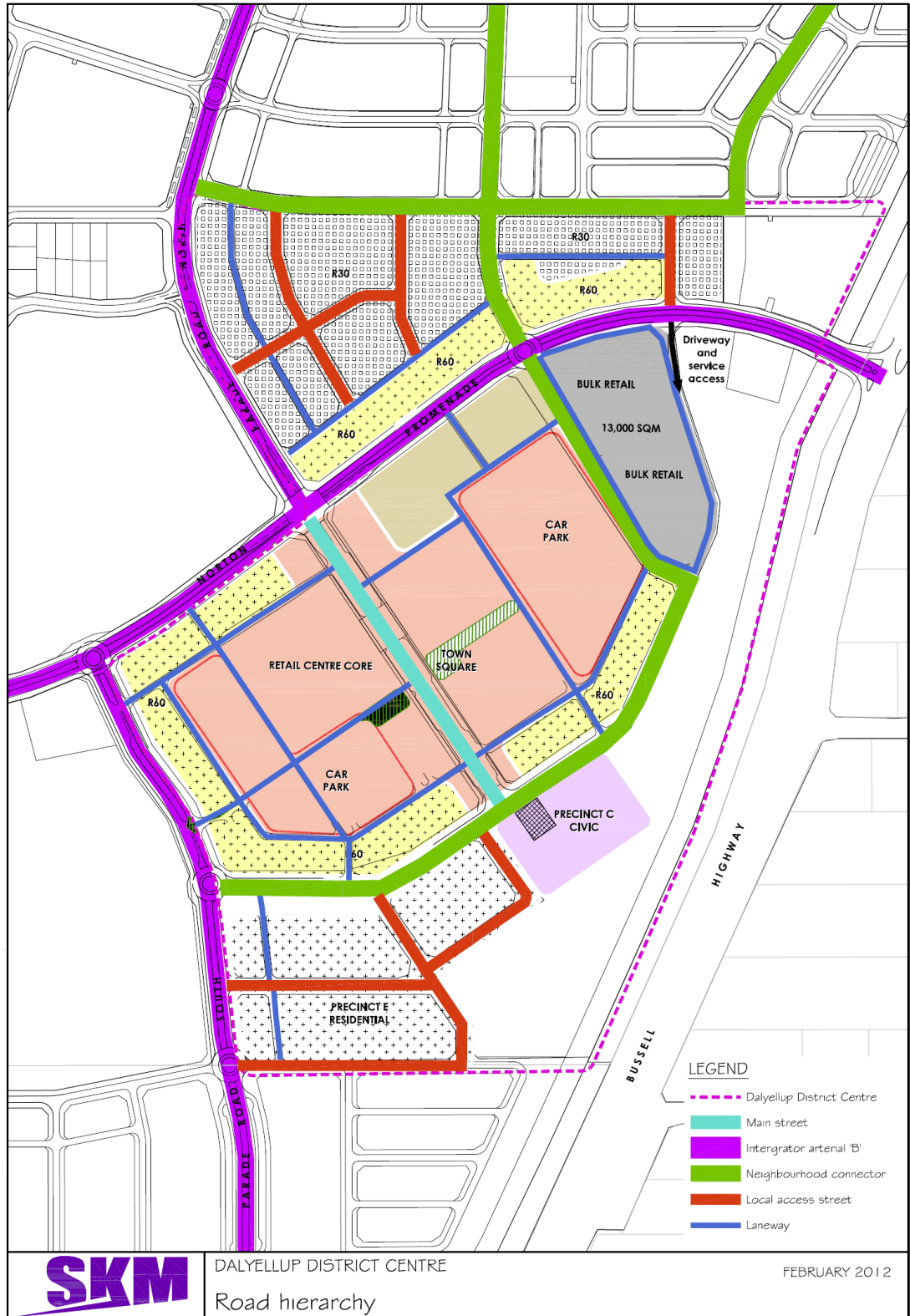
2. Additional traffic

Bulk retail generates more traffic on a square metre basis than does business uses. It is estimated that the change in uses will generate a little more than 5,000 additional trips per day as show in **Table 1**.
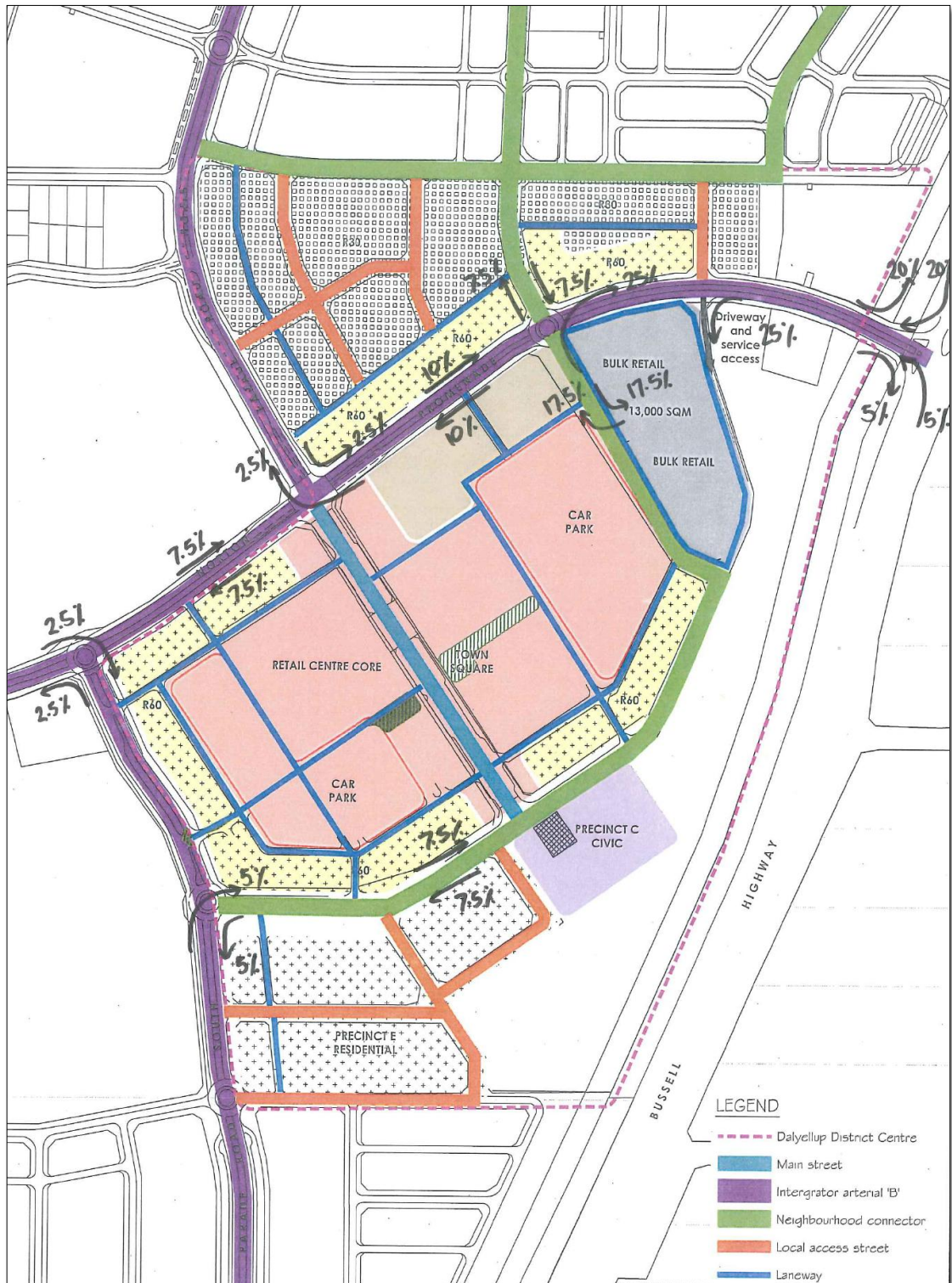
- **Table 1 Additional traffic generation**

Land Use	Trip Rate (Trips/NLA)	Net Leasable Floor Area (m^2)	Trips
Bulk Retail	0.5	13,000	6,500
Business	0.13	10,711	1,392
Additional Trips			**5,108**

The additional daily traffic has been distributed onto the road network as shown in **Figure 2**. This traffic distribution is broadly in accordance with the estimated traffic access to and egress from the district centre as outlined in SKM's January 2011 report.

Figure 3 provides an estimate of the additional daily traffic flow on the network.

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- **Figure 2 Forecasted distribution of additional traffic**

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■ **Figure 3 Forecasted additional daily traffic**

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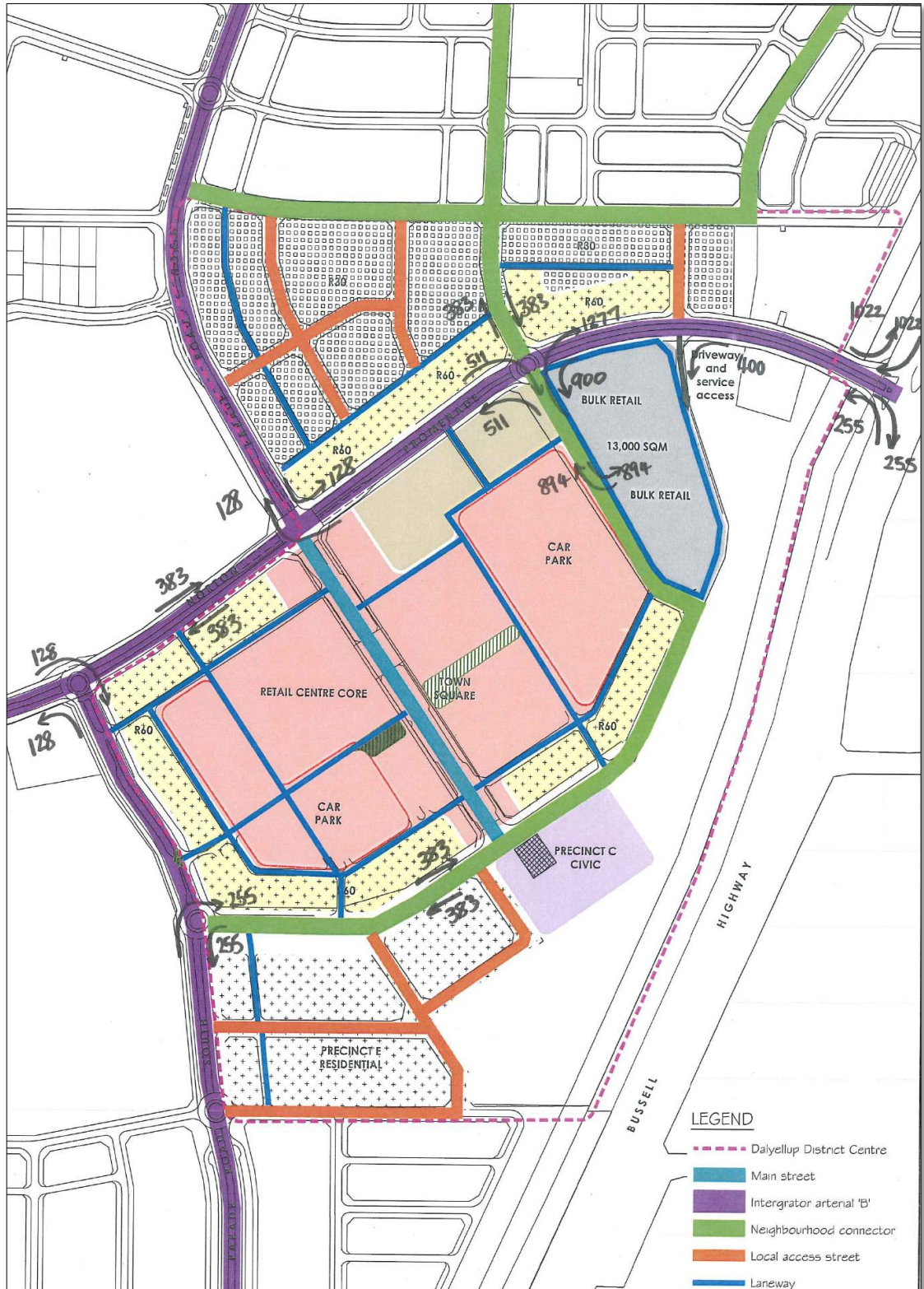
3. Traffic capacity and LOS analysis

SIDRA analysis has been undertaken for key intersections within the District Centre using the revised traffic volumes to assess the performance of the intersections assuming full development of the centre. As was the case in SKM's January 2011 transport assessment, the capacity and level of service analysis has been carried out for the evening peak period only as this is considered to reflect peak volumes for a predominately retail centre.

Peak hour traffic volumes used in this SIDRA analysis have been estimated by adding 10% of the additional daily traffic to the previously modelled intersection volume.

The following five intersections have been assessed:

- Parade Road North/ Norton Promenade/ Main Street
- Parade Road South/ Norton Promenade
- Norton Promenade/ Neighbourhood Connector
- Parade Road South/ Neighbourhood Connector
- Bussell Highway/ Norton Promenade

A summary of traffic capacity and LOS analysis for key intersections are provided in **Table 2**. The full SIDRA outputs for the analysis are provided in the **Appendix A**.

- **Table 2 Traffic capacity and LOS results**

Intersection	Degree of Saturation		Level of Service (LOS)	
	With Bypass	**Without Bypass**	**With Bypass**	**Without Bypass**
Parade Road North/ Norton Promenade/ Main Street	0.759	0.817	C	C
Parade Road South/ Norton Promenade	0.347	0.368	A	A
Norton Promenade/ Neighbourhood Connector	0.519	0.494	A	A
Parade Road South/ Neighbourhood Connector	0.196	0.207	A	A
Bussell Highway/ Norton Promenade	0.702	0.891	C	C

Note: Degree of Saturation is the ratio of demand to capacity at a particular intersection. Level of Service (LOS) is the measure of effectiveness of traffic operational condition and their perception by road users.

It can be seen from the above table that all of the intersections analysed are predicted to operate at a satisfactory level of service.

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4.   Potential transport network changes

The estimated daily traffic flows on the network, without and with the Bunbury Bypass, are shown in **Figure 4** and **Figure 5**.
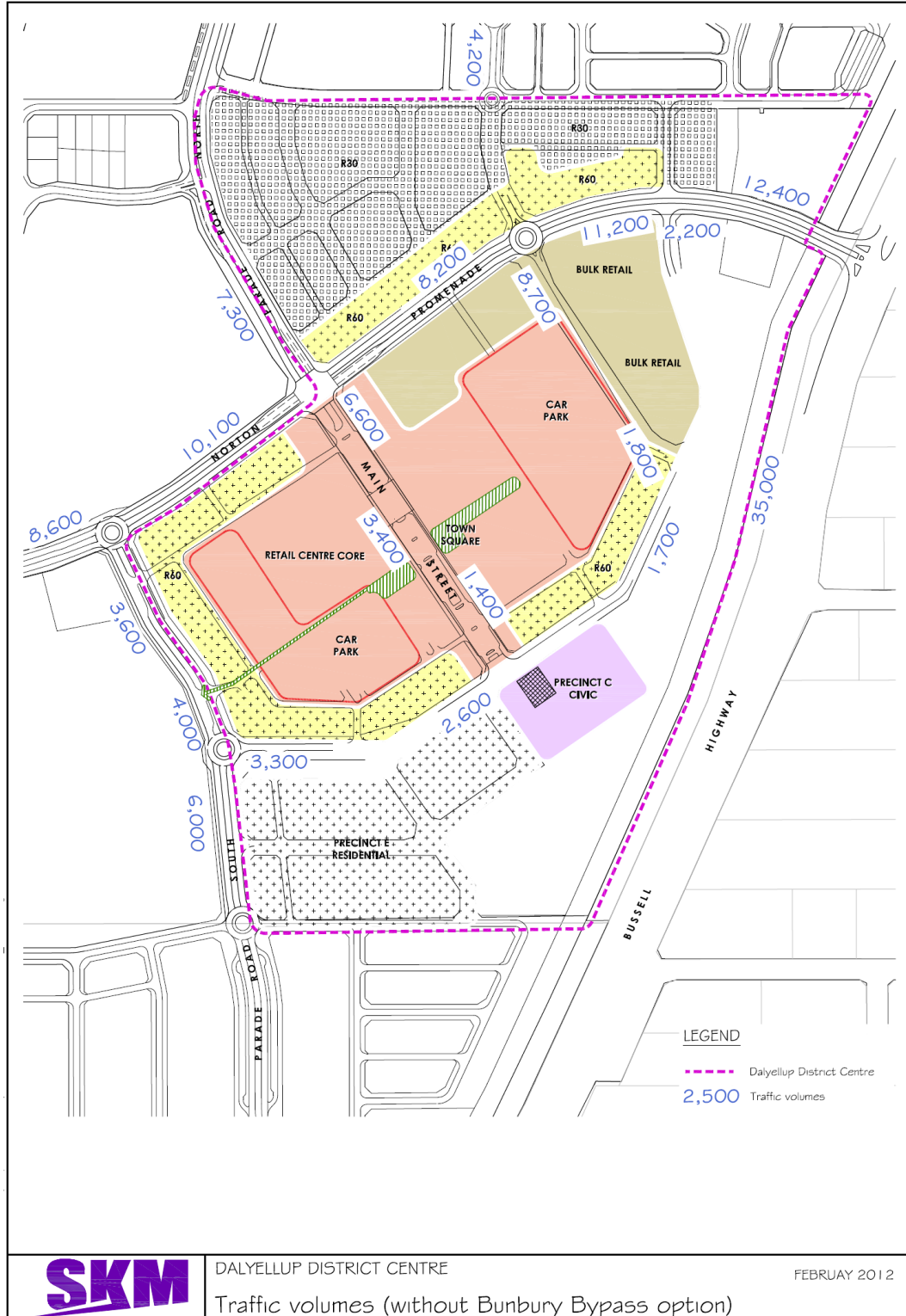
There are increases in estimated traffic volumes on a number of streets including Norton Promenade and the neighbourhood connector along the western side of the proposed bulk retail use. As an integrator arterial road, Norton Promenade has the capacity to accommodate this additional traffic. The neighbourhood connector along the western side of the proposed bulk retail area is estimated to carry between 8,500 and 9,000 vehicles per day at its northern end. Whilst this road will continue to function as a neighbourhood connector, it is recommended that access to parking on either side be controlled by roundabouts as shown conceptually below:
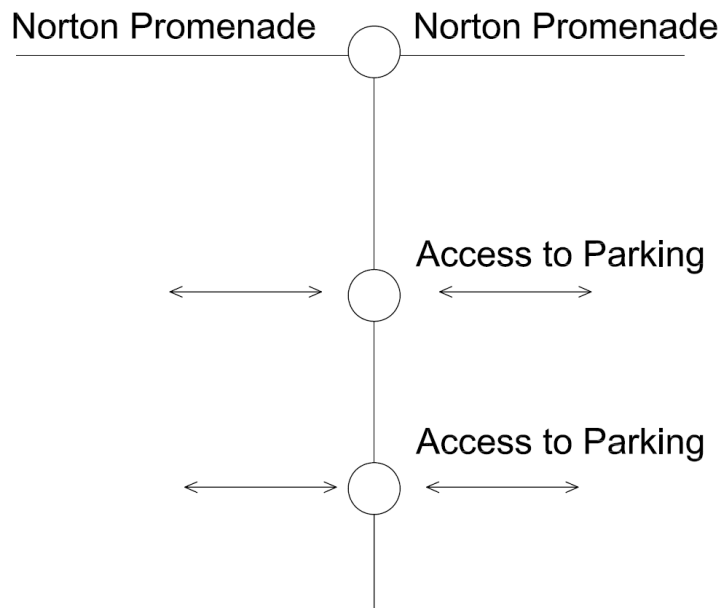
The increased estimated traffic volumes on the remainder of the network do not warrant any other changes to the transport network, including street cross-sections, the pedestrian and bicycle network and the proposed public transport routes.

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■ **Figure 4 Estimated daily traffic volumes (without Bunbury Bypass Option)**

DALYELLUP DISTRICT CENTRE

FEBRUAY 2012

Traffic volumes (without Bunbury Bypass option)

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■ Figure 5 Estimated daily traffic volumes (with Bunbury Bypass Option)

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5. Car parking

The car parking philosophy based on shared use and the recommended rates of parking contained in SKM's January 2011 report remain valid. In relation to bulk retail it is recommended that parking be provided at 80% of the rate required for standard retail. This is considered to be conservative.

By way of comparison, the City of Wanneroo's district planning scheme number 2 includes a definition of parking standards for a hardware store of 3.3 bays per 100 m^2 of NLA. This further confirms that the rate of parking assumed in this analysis is conservative.

On this basis an additional 520 parking bays would be required to meet the needs of the bulk retail. However, 268 less bays would be required because of the reduced business use. Thus there would be a need for an additional 252 parking bays as a result of the proposed change in uses.

The full parking requirement for the proposed change in use, based on conservative assumptions, is therefore 1,865 bays. The Satterley Property Group has confirmed that more than 1,865 bays can be provided with the amended plans.

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Appendix A   SIDRA outputs

Parade Road

Norton Promenade East

Norton Promenade West

Main Street

N

80   100

50

80

80

80

Parade Road

42
2.0%

157
2.0%

153
2.0%

50

Norton Promenade West

86
2.0%

345
2.0%

50

36
2.0%

Norton Promenade East

65
2.0%

50
229
2.0%

147
2.0%

50
171
2.0%

57
2.0%

114
2.0%

Main Street

MOVEMENT SUMMARY

Norton Promenade/ Parade Road with Bypass
PM Peak Hour
Signals - Fixed Time   Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

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	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Main Street											
1	L	57	2.0	0.738	45.9	LOS D	9.2	65.4	1.00	0.90	27.6
2	T	171	2.0	0.738	37.7	LOS D	9.2	65.4	1.00	0.90	27.7
3	R	114	2.0	0.759	52.2	LOS D	4.9	34.9	1.00	0.89	24.6
Approach		342	2.0	0.759	43.9	LOS D	9.2	65.4	1.00	0.89	26.6
East: Norton Promenade East											
4	L	147	2.0	0.693	36.6	LOS D	13.5	96.2	0.95	0.88	30.9
5	T	229	2.0	0.693	28.4	LOS C	13.5	96.2	0.95	0.83	31.2
6	R	65	2.0	0.353	44.1	LOS D	2.4	17.4	0.95	0.77	27.1
Approach		441	2.0	0.693	33.4	LOS C	13.5	96.2	0.95	0.84	30.4
North: Parade Road											
7	L	157	2.0	0.112	8.2	LOS A	0.5	3.7	0.17	0.64	48.8
8	T	153	2.0	0.489	34.1	LOS C	5.6	40.2	0.96	0.77	29.6
9	R	42	2.0	0.262	47.3	LOS D	1.6	11.6	0.97	0.73	26.1
Approach		352	2.0	0.489	24.1	LOS C	5.6	40.2	0.61	0.71	35.3
West: Norton Promenade West											
10	L	86	2.0	0.069	8.1	LOS A	0.3	1.9	0.17	0.63	48.9
11	T	345	2.0	0.623	27.1	LOS C	11.9	84.8	0.92	0.79	32.7
12	R	36	2.0	0.216	45.3	LOS D	1.4	9.7	0.94	0.74	26.7
Approach		467	2.0	0.623	25.0	LOS C	11.9	84.8	0.79	0.76	34.2
All Vehicles		1602	2.0	0.759	31.2	LOS C	13.5	96.2	0.84	0.80	31.4

Level of Service (LOS) Method: Delay (HCM 2000).
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	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
P3	Across E approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
P5	Across N approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
P7	Across W approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		212	34.2	LOS D			0.93	0.93

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.

Norton Promenade/ Parade Road with Bypass
PM Peak Hour
Signals - Fixed Time   Cycle Time = 80 seconds (Optimum Cycle Time - Minimum Delay)

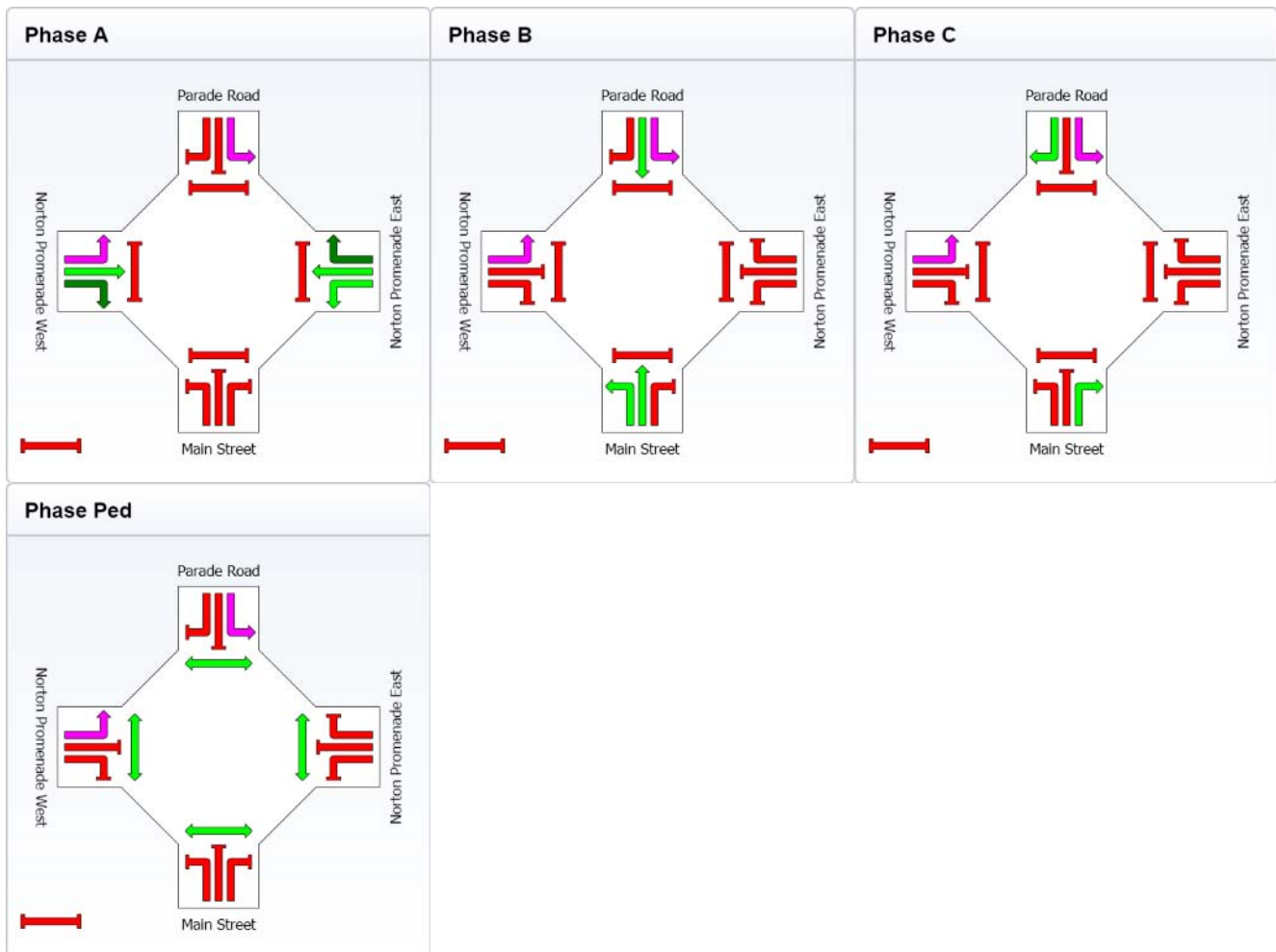**Phase times determined by the program**
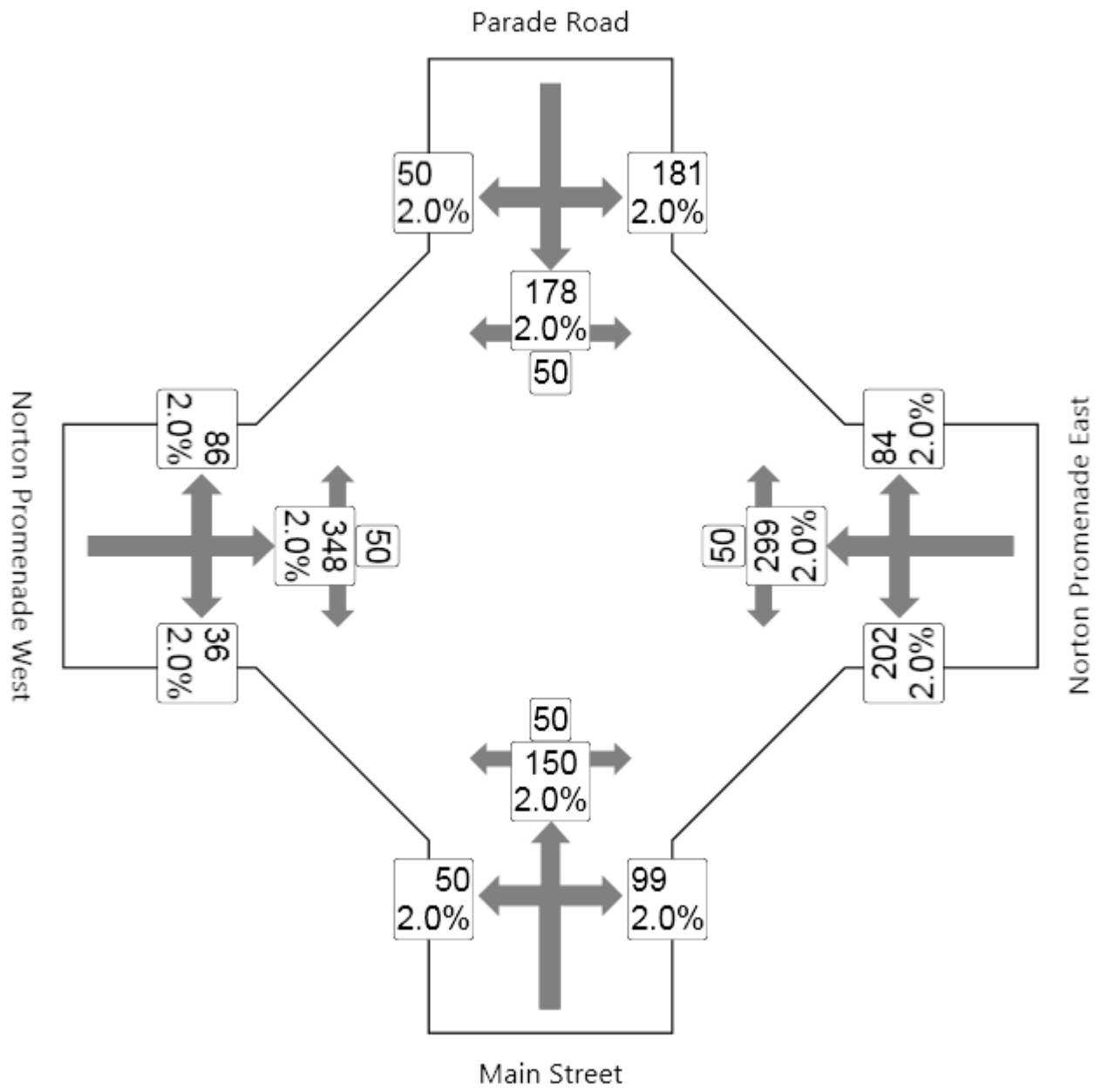**Sequence: Two-phase**
Input Sequence: A, B, C, Ped
Output Sequence: A, B, C, Ped

Phase Timing Results

Phase	A	B	C	Ped
Green Time (sec)	23	13	7	13
Yellow Time (sec)	4	4	4	4
All-Red Time (sec)	2	2	2	2
Phase Time (sec)	29	19	13	19
Phase Split	36 %	24 %	16 %	24 %

Phase A

Phase B

Phase C

Phase Ped

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

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INTERSECTION

Parade Road

50
2.0%

181
2.0%

178
2.0%

50

Norton Promenade West

86
2.0%

348
2.0%

50

36
2.0%

Norton Promenade East

84
2.0%

50

299
2.0%

202
2.0%

50

150
2.0%

50
2.0%

99
2.0%

Main Street

Norton Promenade/ Parade Road no Bypass
PM Peak Hour
Signals - Fixed Time   Cycle Time = 80 seconds (Practical Cycle Time)
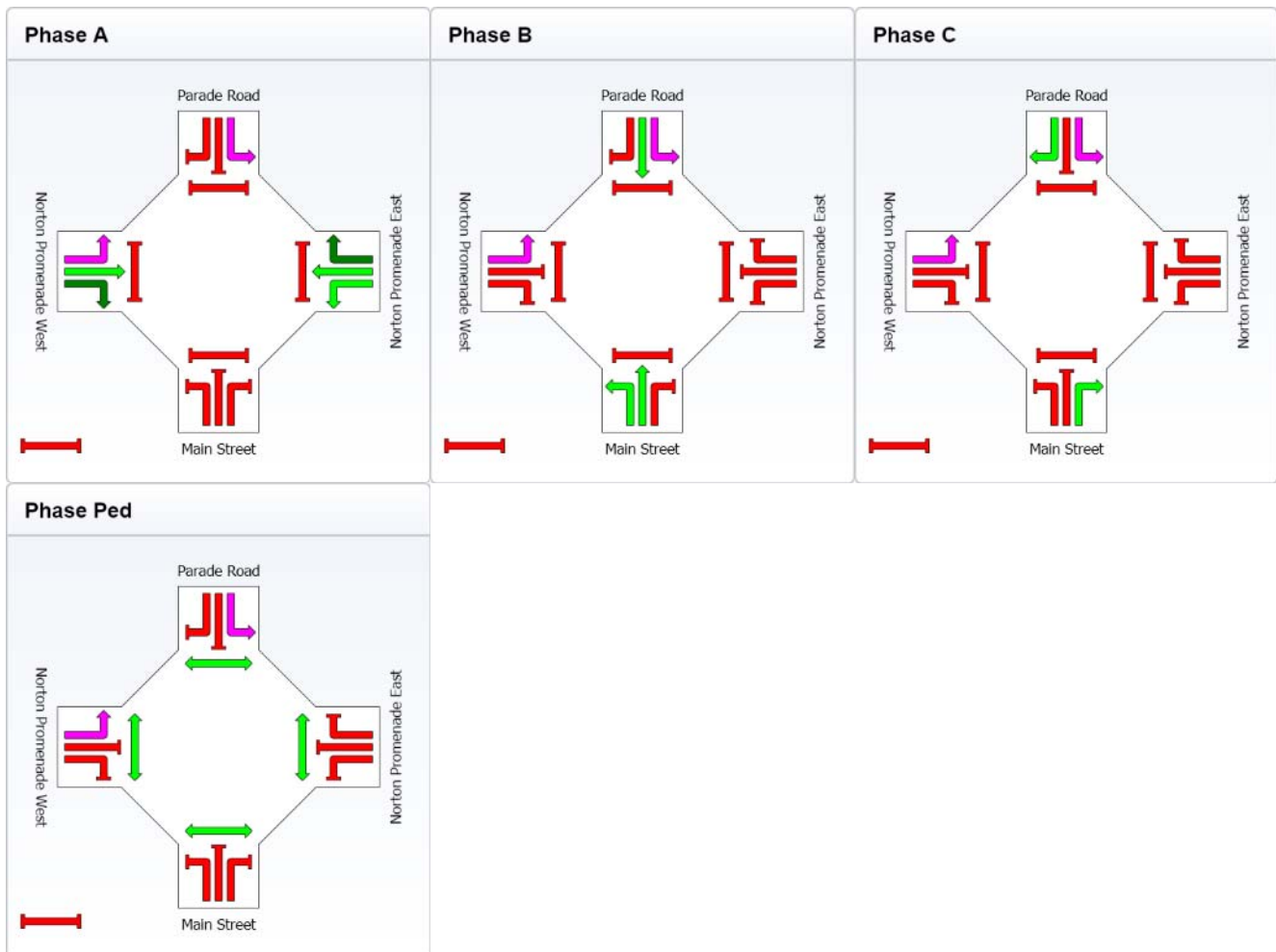
Phase times determined by the program
Sequence: Two-phase
Input Sequence: A, B, C, Ped
Output Sequence: A, B, C, Ped

Phase Timing Results

Phase	A	B	C	Ped
Green Time (sec)	26	11	6	13
Yellow Time (sec)	4	4	4	4
All-Red Time (sec)	2	2	2	2
Phase Time (sec)	32	17	12	19
Phase Split	40 %	21 %	15 %	24 %

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

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INTERSECTION

MOVEMENT SUMMARY

Norton Promenade/ Parade Road no Bypass
PM Peak Hour
Signals - Fixed Time   Cycle Time = 80 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	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Main Street											
1	L	50	2.0	0.765	48.4	LOS D	8.3	59.1	1.00	0.91	26.7
2	T	150	2.0	0.765	40.1	LOS D	8.3	59.1	1.00	0.91	26.9
3	R	99	2.0	0.744	52.7	LOS D	4.3	30.3	1.00	0.87	24.4
Approach		299	2.0	0.765	45.7	LOS D	8.3	59.1	1.00	0.90	26.0
East: Norton Promenade East											
4	L	202	2.0	0.817	40.1	LOS D	20.2	143.6	0.98	0.97	29.5
5	T	299	2.0	0.817	31.8	LOS C	20.2	143.6	0.98	0.96	29.7
6	R	84	2.0	0.376	40.5	LOS D	3.0	21.6	0.92	0.78	28.4
Approach		585	2.0	0.817	35.9	LOS D	20.2	143.6	0.97	0.94	29.4
North: Parade Road											
7	L	181	2.0	0.131	8.2	LOS A	0.6	4.4	0.18	0.64	48.8
8	T	178	2.0	0.673	37.9	LOS D	7.1	50.3	1.00	0.85	28.1
9	R	50	2.0	0.364	49.0	LOS D	2.0	14.2	0.99	0.74	25.5
Approach		409	2.0	0.673	26.1	LOS C	7.1	50.3	0.63	0.74	34.1
West: Norton Promenade West											
10	L	86	2.0	0.069	8.1	LOS A	0.3	1.9	0.17	0.63	48.9
11	T	348	2.0	0.556	24.3	LOS C	11.3	80.7	0.88	0.75	34.2
12	R	36	2.0	0.270	47.9	LOS D	1.4	10.1	0.97	0.73	25.8
Approach		470	2.0	0.556	23.1	LOS C	11.3	80.7	0.75	0.73	35.3
All Vehicles		1763	2.0	0.817	31.9	LOS C	20.2	143.6	0.84	0.83	31.1

Level of Service (LOS) Method: Delay (HCM 2000).
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

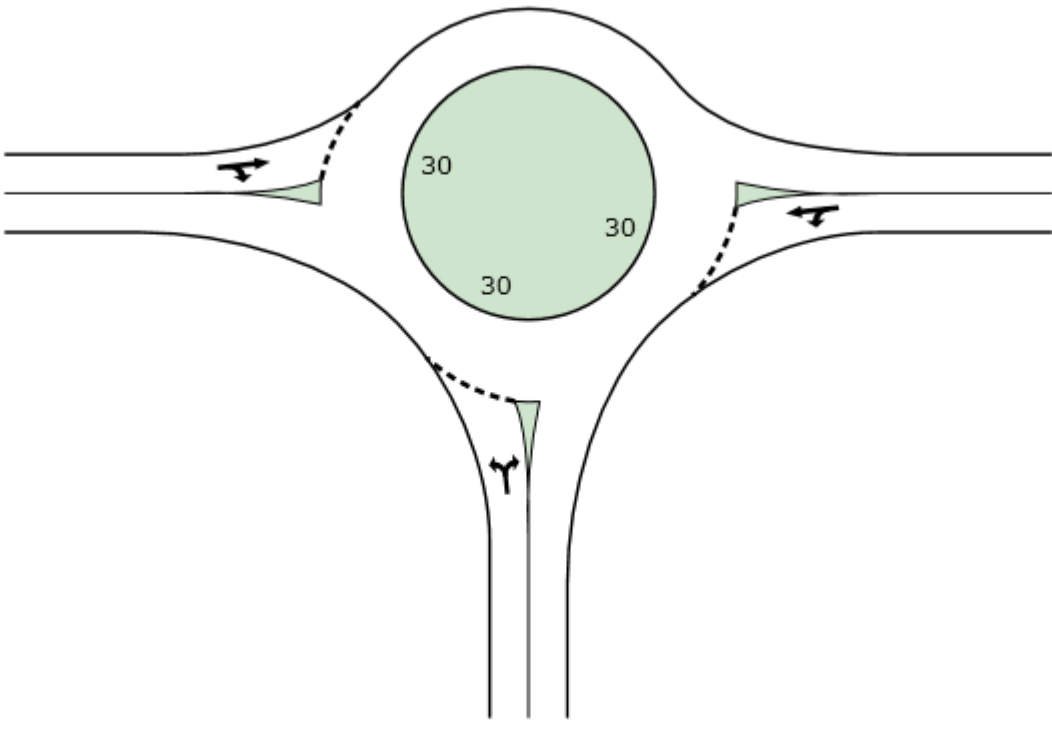| Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P1	Across S approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
P3	Across E approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
P5	Across N approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
P7	Across W approach	53	34.2	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		212	34.2	LOS D			0.93	0.93

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.
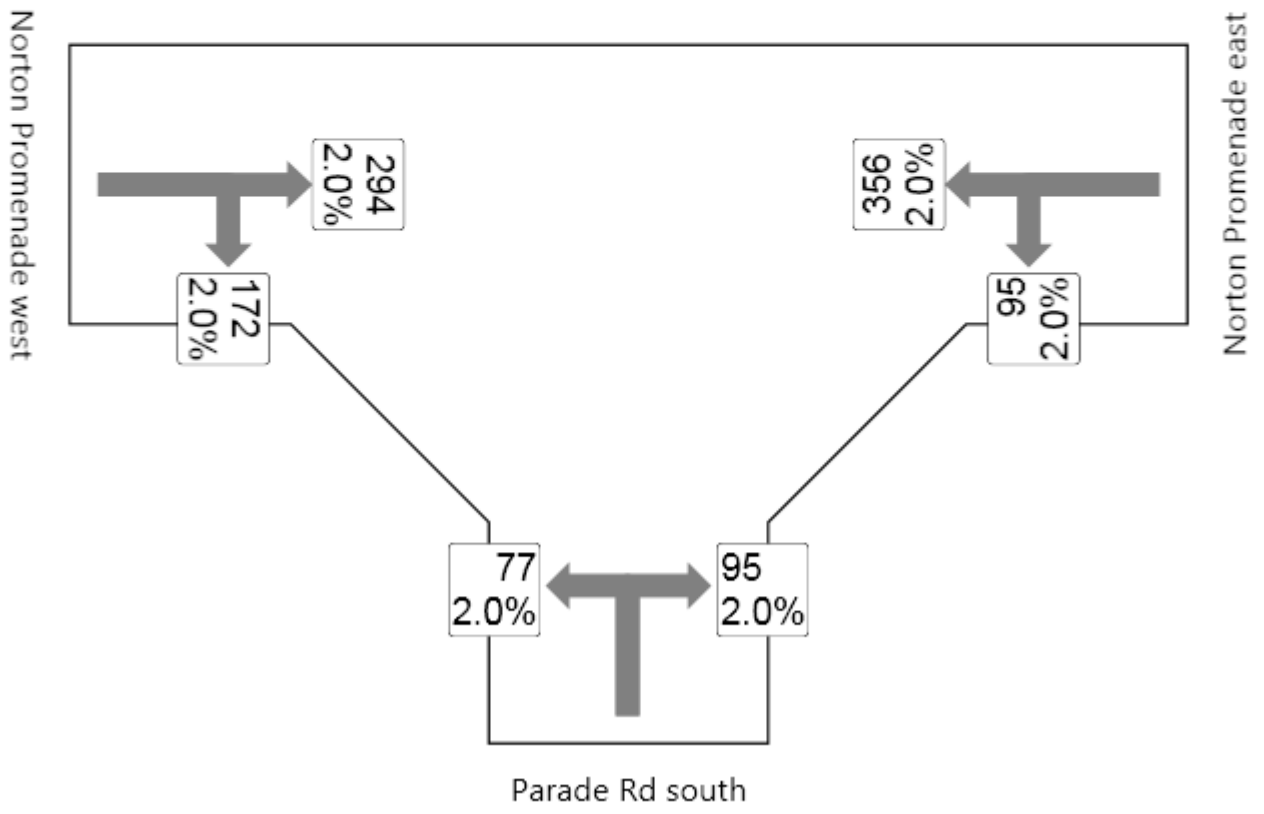
N

Norton Promenade west

Norton Promenade east

30

30

30

Parade Rd south

Norton Promenade west

Norton Promenade east

294
2.0%

172
2.0%

356
2.0%

95
2.0%

77
2.0%

95
2.0%

Parade Rd south

MOVEMENT SUMMARY

Parade Rd south/ Norton Prom
PM Peak
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: Parade Rd south											
1	L	81	2.0	0.169	7.4	LOS A	1.0	7.0	0.53	0.60	48.1
3	R	100	2.0	0.169	13.1	LOS B	1.0	7.0	0.53	0.74	45.1
Approach		181	2.0	0.169	10.5	LOS B	1.0	7.0	0.53	0.68	46.3
East: Norton Promenade east											
4	L	100	2.0	0.347	6.3	LOS A	2.3	16.4	0.42	0.55	49.8
5	T	375	2.0	0.347	5.2	LOS A	2.3	16.4	0.42	0.47	50.2
Approach		475	2.0	0.347	5.4	LOS A	2.3	16.4	0.42	0.49	50.1
West: Norton Promenade west											
11	T	309	2.0	0.331	4.9	LOS A	2.3	16.4	0.32	0.40	50.7
12	R	181	2.0	0.331	11.7	LOS B	2.3	16.4	0.32	0.75	46.3
Approach		491	2.0	0.331	7.4	LOS A	2.3	16.4	0.32	0.53	48.9
All Vehicles		1146	2.0	0.347	7.1	LOS A	2.3	16.4	0.39	0.54	48.9

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
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.

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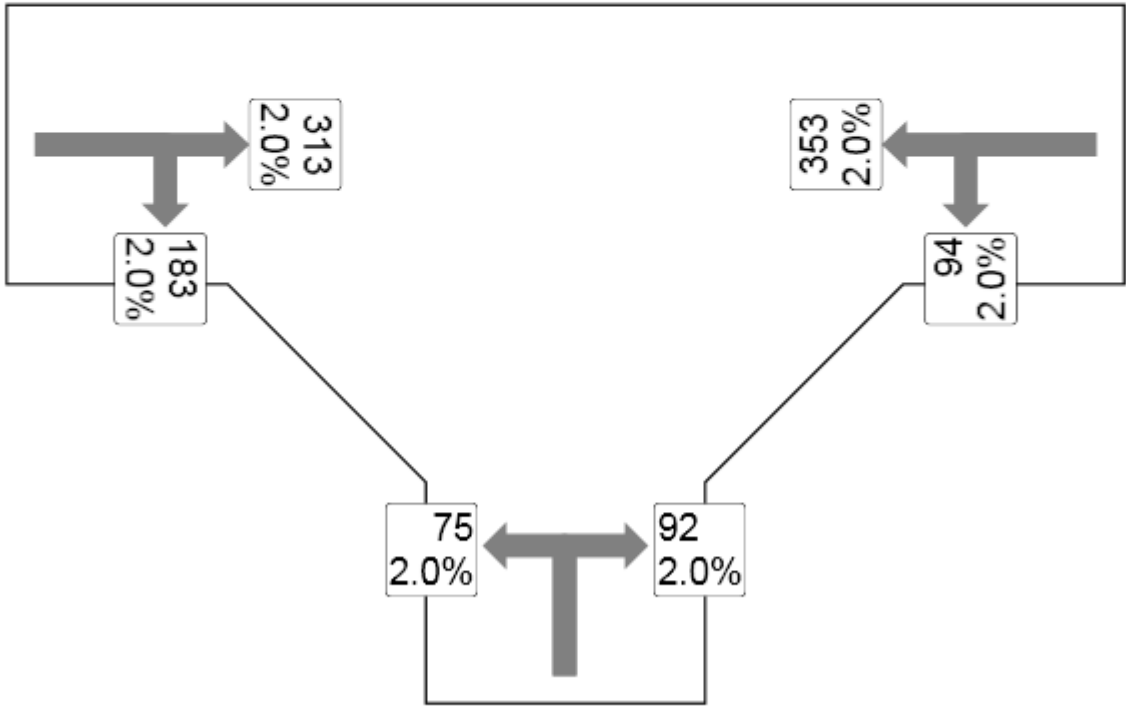SIDRA INTERSECTION 5.1.9.2068
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SIDRA
INTERSECTION

Norton Promenade west

Norton Promenade east

313
2.0%

353
2.0%

183
2.0%

94
2.0%

75
2.0%

92
2.0%
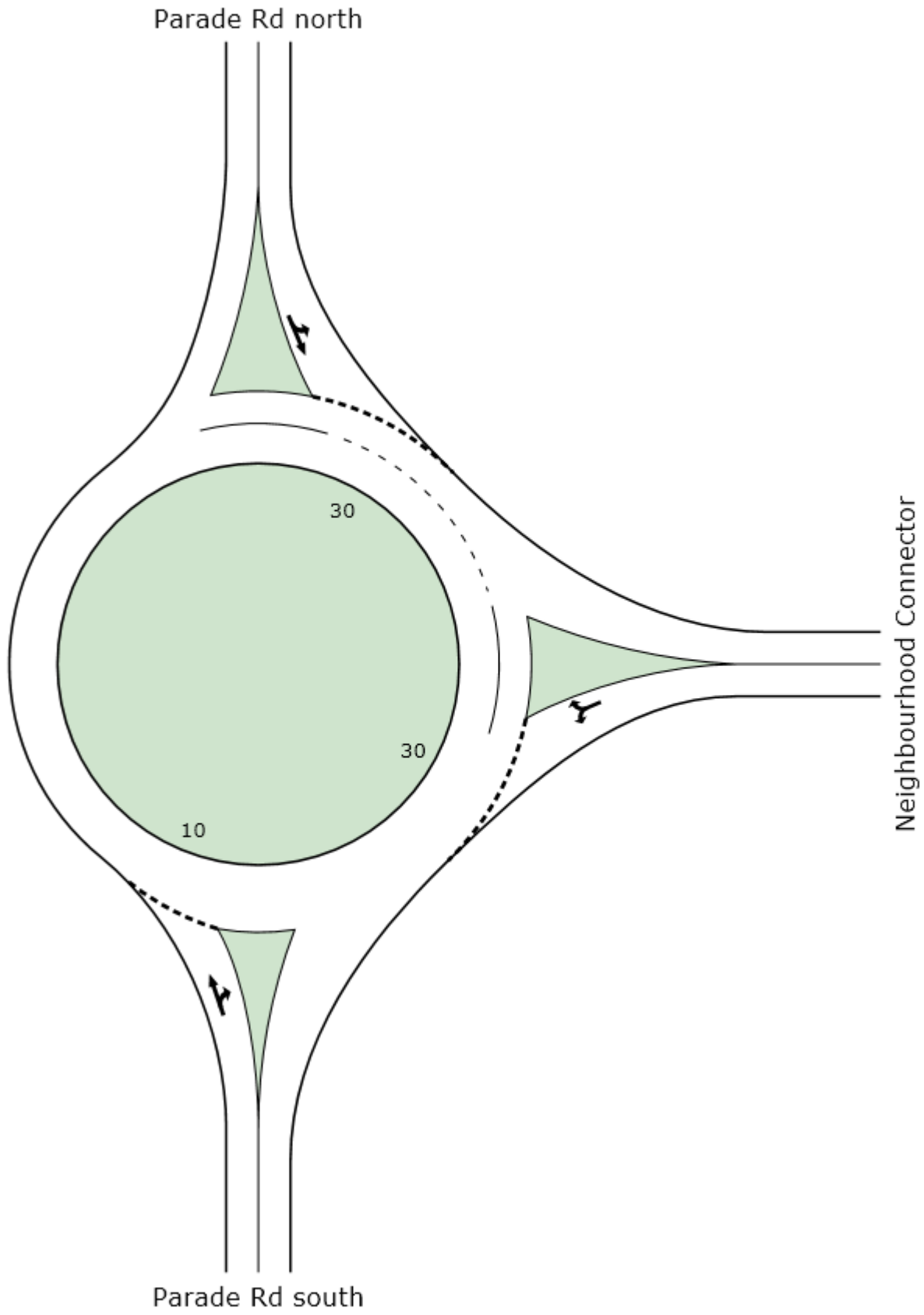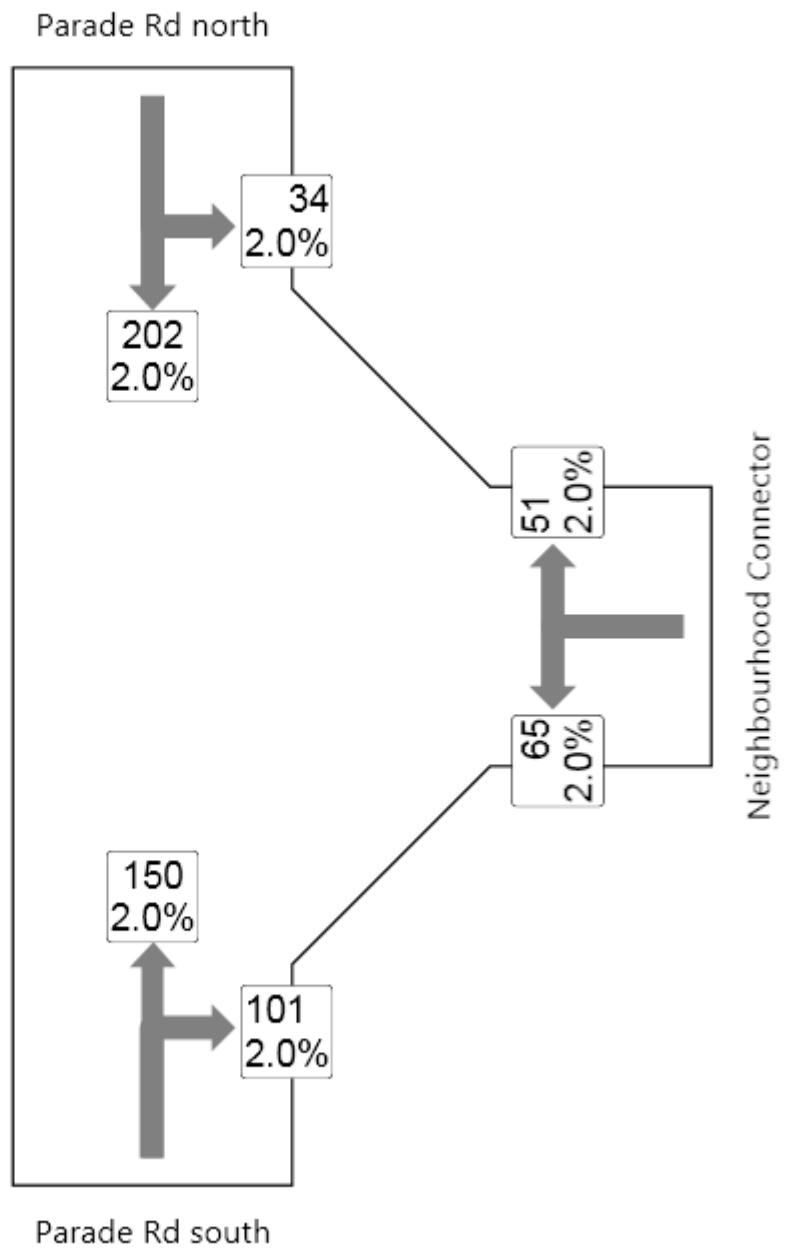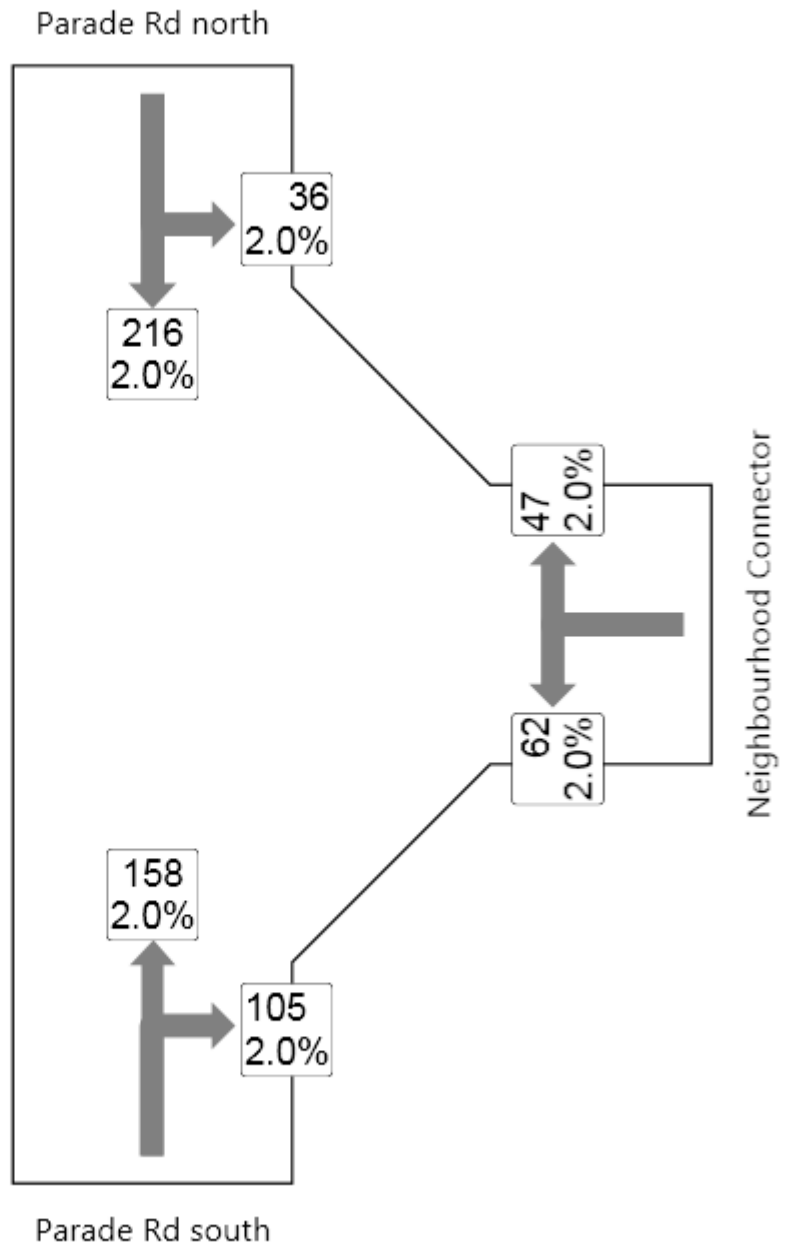
Parade Rd south

MOVEMENT SUMMARY

Site: Parade Rd south RB no BB

Parade Rd south/ Norton Prom
PM Peak
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	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Parade Rd south											
1	L	79	2.0	0.165	7.4	LOS A	1.0	6.8	0.53	0.59	48.1
3	R	97	2.0	0.165	13.0	LOS B	1.0	6.8	0.53	0.74	45.1
Approach		176	2.0	0.165	10.5	LOS B	1.0	6.8	0.53	0.68	46.3
East: Norton Promenade east											
4	L	99	2.0	0.368	6.7	LOS A	2.5	17.5	0.45	0.58	49.5
5	T	372	2.0	0.368	5.3	LOS A	2.5	17.5	0.45	0.48	50.1
Approach		471	2.0	0.368	5.6	LOS A	2.5	17.5	0.45	0.50	50.0
West: Norton Promenade west											
11	T	329	2.0	0.366	4.7	LOS A	2.6	18.8	0.33	0.40	50.7
12	R	193	2.0	0.366	11.8	LOS B	2.6	18.8	0.33	0.77	46.3
Approach		522	2.0	0.366	7.3	LOS A	2.6	18.8	0.33	0.53	48.9
All Vehicles		1168	2.0	0.368	7.1	LOS A	2.6	18.8	0.41	0.54	48.9

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
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.
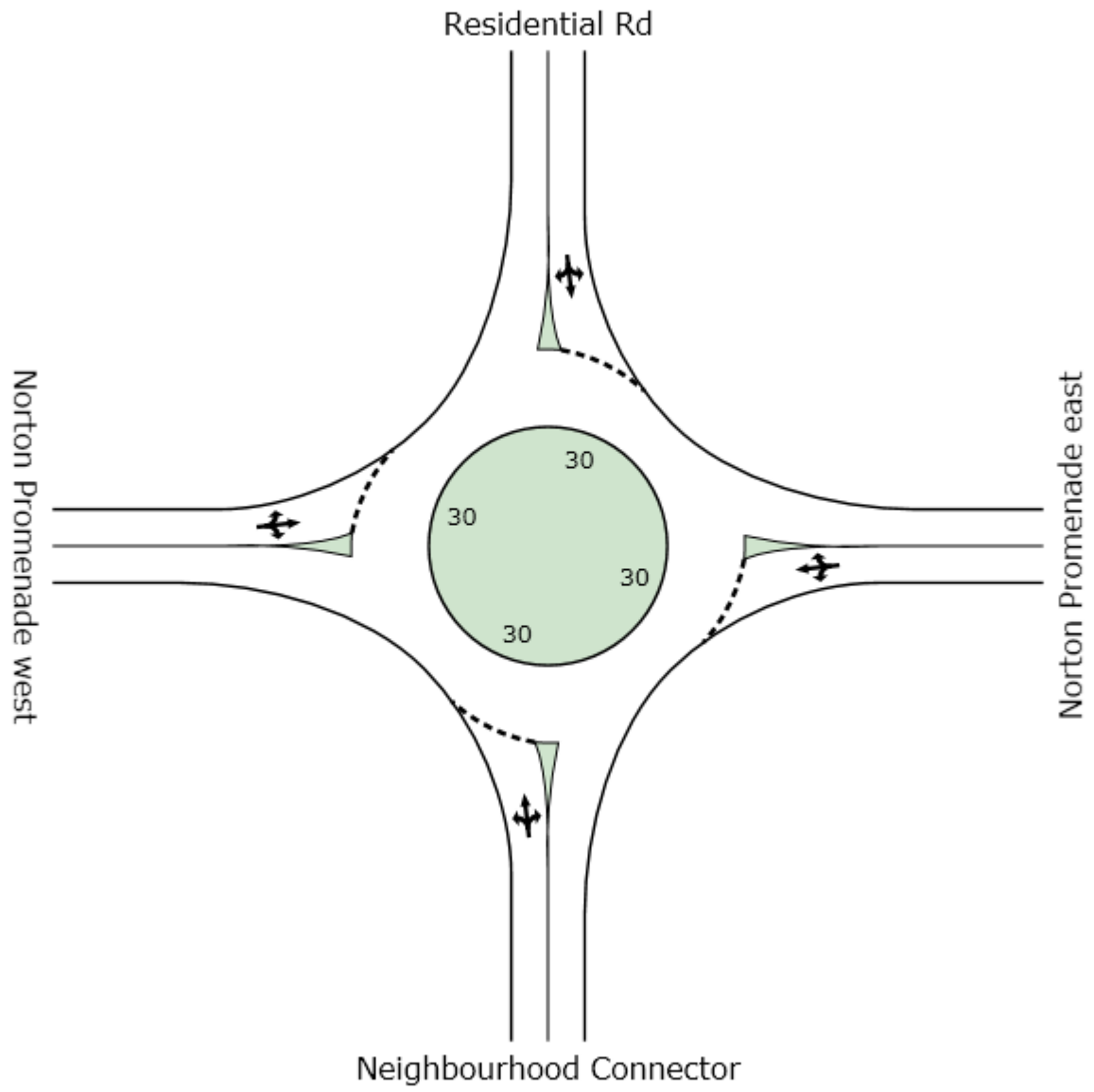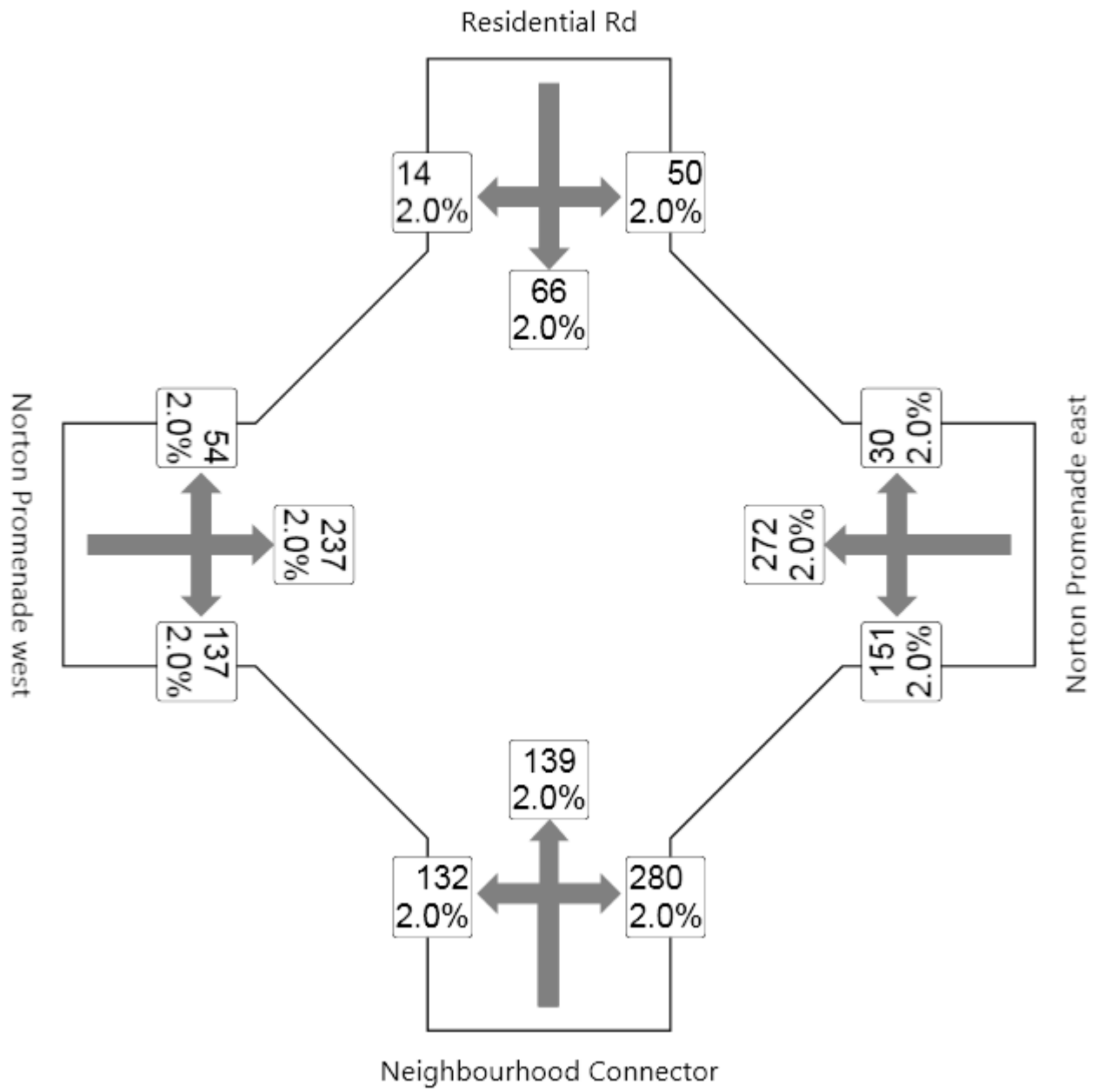Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

SIDRA
INTERSECTION

N

Residential Rd

Norton Promenade east

Norton Promenade west

30
30
30
30

Neighbourhood Connector

Residential Rd

14
2.0%

50
2.0%

66
2.0%

Norton Promenade west

54
2.0%

237
2.0%

137
2.0%

30
2.0%

272
2.0%

151
2.0%

Norton Promenade east

139
2.0%

132
2.0%

280
2.0%

Neighbourhood Connector

MOVEMENT SUMMARY

Norton Prom/ Residential Road
PM Peak
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	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Neighbourhood Connector											
1	L	139	2.0	0.519	7.9	LOS A	4.0	28.8	0.67	0.68	47.4
2	T	146	2.0	0.519	6.6	LOS A	4.0	28.8	0.67	0.61	47.4
3	R	295	2.0	0.519	13.5	LOS B	4.0	28.8	0.67	0.79	45.1
Approach		580	2.0	0.519	10.4	LOS B	4.0	28.8	0.67	0.71	46.2
East: Norton Promenade east											
4	L	159	2.0	0.367	6.6	LOS A	2.5	18.1	0.49	0.57	49.2
5	T	286	2.0	0.367	5.5	LOS A	2.5	18.1	0.49	0.50	49.5
6	R	32	2.0	0.367	12.4	LOS B	2.5	18.1	0.49	0.80	46.4
Approach		477	2.0	0.367	6.3	LOS A	2.5	18.1	0.49	0.54	49.2
North: Residential Rd											
7	L	53	2.0	0.155	8.9	LOS A	1.0	7.1	0.72	0.72	47.7
8	T	69	2.0	0.155	7.9	LOS A	1.0	7.1	0.72	0.69	47.6
9	R	15	2.0	0.155	14.8	LOS B	1.0	7.1	0.72	0.84	44.7
Approach		137	2.0	0.155	9.0	LOS A	1.0	7.1	0.72	0.71	47.3
West: Norton Promenade west											
10	L	57	2.0	0.436	8.1	LOS A	3.3	23.4	0.73	0.71	47.4
11	T	249	2.0	0.436	7.1	LOS A	3.3	23.4	0.73	0.65	47.3
12	R	144	2.0	0.436	14.0	LOS B	3.3	23.4	0.73	0.84	45.2
Approach		451	2.0	0.436	9.5	LOS A	3.3	23.4	0.73	0.72	46.6
All Vehicles		1644	2.0	0.519	8.8	LOS A	4.0	28.8	0.64	0.67	47.2

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
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.
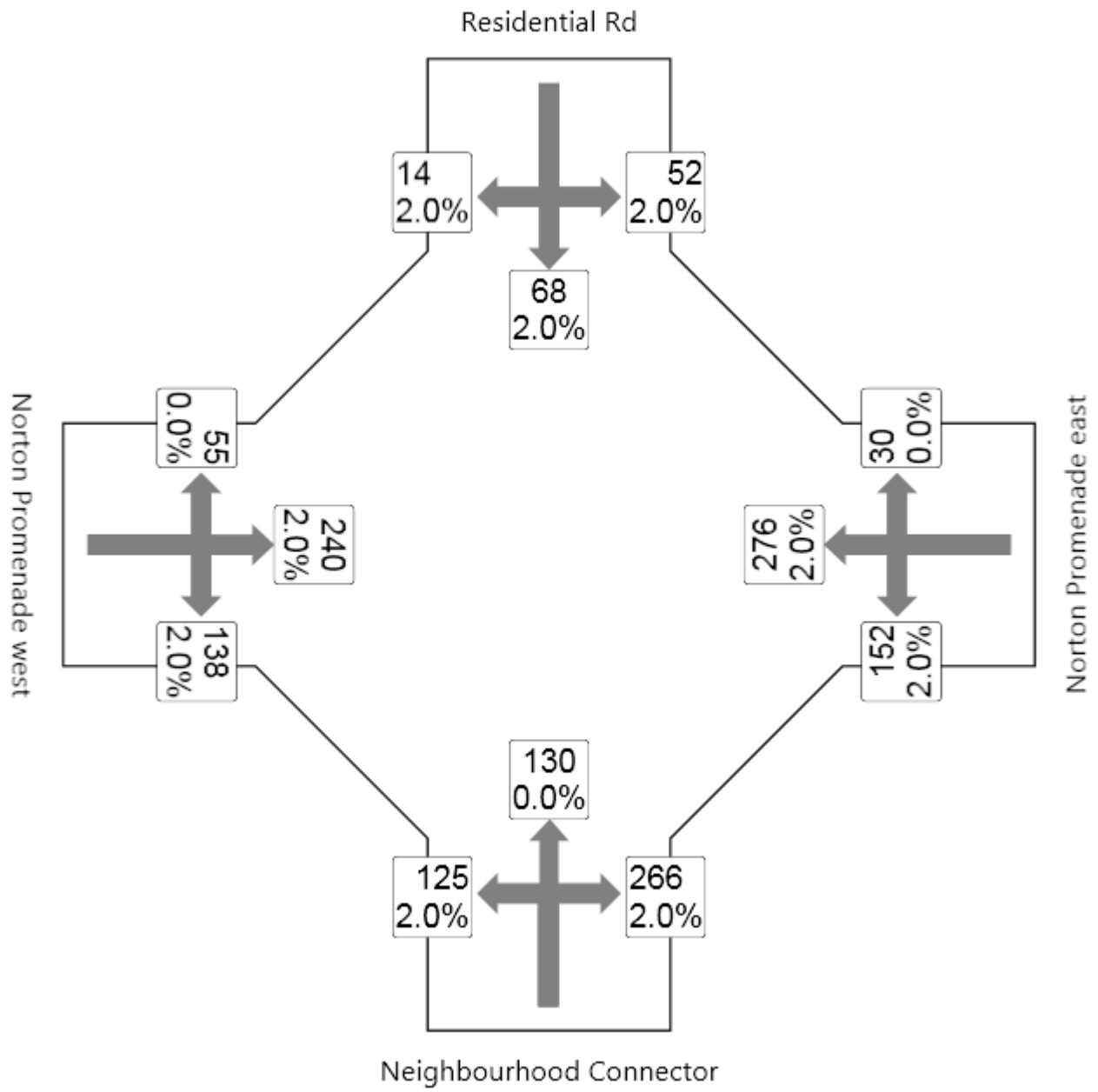Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

SIDRA
INTERSECTION

Residential Rd

14 2.0%	52 2.0%

68
2.0%

Norton Promenade west

55 0.0%	30 0.0%
240 2.0%	276 2.0%
138 2.0%	152 2.0%

Norton Promenade east

130
0.0%

125 2.0%	266 2.0%

Neighbourhood Connector

MOVEMENT SUMMARY

Norton Prom/ Residential Road
PM Peak
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	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Neighbourhood Connector											
1	L	132	2.0	0.494	7.8	LOS A	3.8	26.6	0.66	0.67	47.5
2	T	137	0.0	0.494	6.5	LOS A	3.8	26.6	0.66	0.61	47.5
3	R	280	2.0	0.494	13.5	LOS B	3.8	26.6	0.66	0.79	45.1
Approach		548	1.5	0.494	10.4	LOS B	3.8	26.6	0.66	0.71	46.2
East: Norton Promenade east											
4	L	160	2.0	0.372	6.6	LOS A	2.6	18.3	0.49	0.57	49.2
5	T	291	2.0	0.372	5.5	LOS A	2.6	18.3	0.49	0.50	49.5
6	R	32	0.0	0.372	12.4	LOS B	2.6	18.3	0.49	0.80	46.4
Approach		482	1.9	0.372	6.3	LOS A	2.6	18.3	0.49	0.55	49.2
North: Residential Rd											
7	L	55	2.0	0.158	8.8	LOS A	1.0	7.2	0.71	0.71	47.8
8	T	72	2.0	0.158	7.9	LOS A	1.0	7.2	0.71	0.68	47.6
9	R	15	2.0	0.158	14.7	LOS B	1.0	7.2	0.71	0.84	44.8
Approach		141	2.0	0.158	9.0	LOS A	1.0	7.2	0.71	0.71	47.3
West: Norton Promenade west											
10	L	58	0.0	0.432	7.9	LOS A	3.2	22.9	0.71	0.70	47.6
11	T	253	2.0	0.432	7.0	LOS A	3.2	22.9	0.71	0.64	47.4
12	R	145	2.0	0.432	13.8	LOS B	3.2	22.9	0.71	0.83	45.4
Approach		456	1.7	0.432	9.3	LOS A	3.2	22.9	0.71	0.71	46.7
All Vehicles		1627	1.7	0.494	8.8	LOS A	3.8	26.6	0.63	0.66	47.3

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
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

N

Parade Rd north

Neighbourhood Connector

30

30

10

Parade Rd south

Parade Rd north

34
2.0%

202
2.0%

51
2.0%

Neighbourhood Connector

65
2.0%

150
2.0%

101
2.0%

Parade Rd south

MOVEMENT SUMMARY

Parade Rd south/ Neighbourhood Connector
PM Peak
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: Parade Rd south											
2	T	158	2.0	0.196	7.1	LOS A	1.1	8.0	0.20	0.53	49.4
3	R	106	2.0	0.196	11.4	LOS B	1.1	8.0	0.20	0.69	45.9
Approach		264	2.0	0.196	8.8	LOS A	1.1	8.0	0.20	0.59	47.9
East: Neighbourhood Connector											
4	L	68	2.0	0.107	6.2	LOS A	0.5	3.3	0.33	0.49	49.7
6	R	54	2.0	0.107	12.0	LOS B	0.5	3.3	0.33	0.77	45.9
Approach		122	2.0	0.107	8.7	LOS A	0.5	3.3	0.33	0.61	47.9
North: Parade Rd north											
7	L	36	2.0	0.193	5.8	LOS A	0.9	6.3	0.24	0.51	50.9
8	T	213	2.0	0.193	4.8	LOS A	0.9	6.3	0.24	0.42	51.6
Approach		248	2.0	0.193	5.0	LOS A	0.9	6.3	0.24	0.43	51.5
All Vehicles		635	2.0	0.196	7.3	LOS A	1.1	8.0	0.24	0.53	49.2

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
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.

Parade Rd north

36
2.0%

216
2.0%

47
2.0%

Neighbourhood Connector

62
2.0%

158
2.0%

105
2.0%

Parade Rd south

MOVEMENT SUMMARY

Parade Rd south/ Neighbourhood Connector
PM Peak
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	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Parade Rd south											
2	T	166	2.0	0.203	7.0	LOS A	1.2	8.4	0.19	0.53	49.5
3	R	111	2.0	0.203	11.4	LOS B	1.2	8.4	0.19	0.69	45.9
Approach		277	2.0	0.203	8.8	LOS A	1.2	8.4	0.19	0.59	47.9
East: Neighbourhood Connector											
4	L	65	2.0	0.101	6.2	LOS A	0.4	3.1	0.34	0.50	49.6
6	R	49	2.0	0.101	12.0	LOS B	0.4	3.1	0.34	0.77	45.9
Approach		115	2.0	0.101	8.7	LOS A	0.4	3.1	0.34	0.61	47.9
North: Parade Rd north											
7	L	38	2.0	0.207	5.8	LOS A	1.0	6.8	0.25	0.51	50.8
8	T	227	2.0	0.207	4.8	LOS A	1.0	6.8	0.25	0.42	51.6
Approach		265	2.0	0.207	5.0	LOS A	1.0	6.8	0.25	0.43	51.5
All Vehicles		657	2.0	0.207	7.2	LOS A	1.2	8.4	0.24	0.53	49.3

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
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.

Bussell Hwy North

Norton Promenade

Bussell Hwy South

150

200

200

N

Bussell Hwy North

403
2.0%

1120
2.0%

Norton Promenade

460
2.0%

50

50

155
2.0%

942
2.0%

255
2.0%

Bussell Hwy South

PHASING SUMMARY

Bussell Hwy/Norton Promenade PM Peak
Signals - Fixed Time   Cycle Time = 120 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)	44	42	16
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	50	48	22
Phase Split	42 %	40 %	18 %

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

MOVEMENT SUMMARY

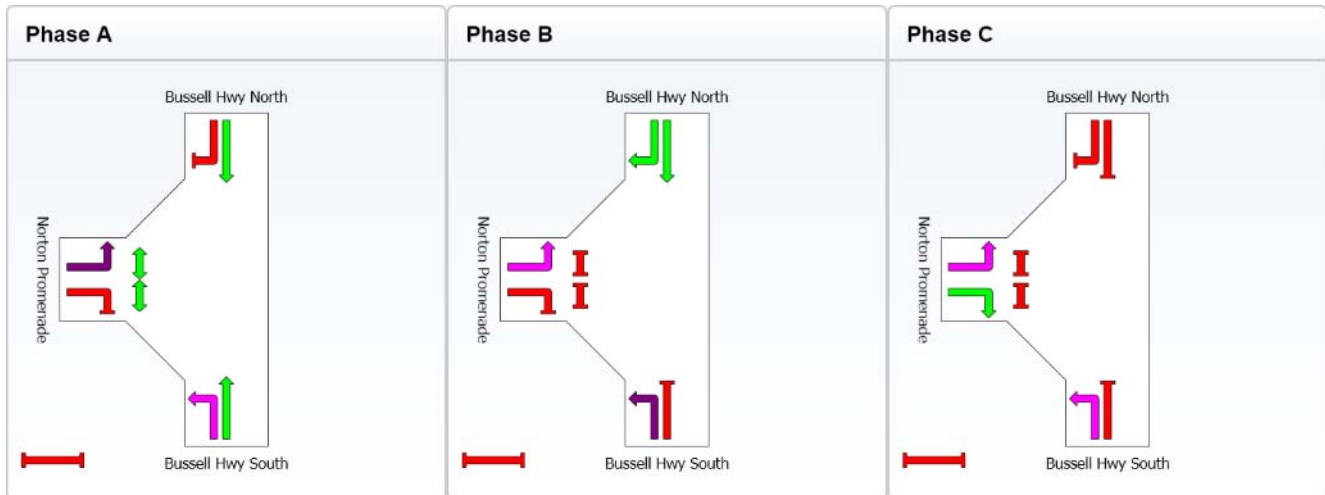**Site: With Bypass**

Bussell Hwy/Norton Promenade PM Peak
Signals - Fixed Time   Cycle Time = 120 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Bussell Hwy South											
1	L	268	2.0	0.225	12.4	LOS B	4.6	32.9	0.37	0.70	44.8
2	T	992	2.0	0.702	34.7	LOS C	24.7	175.6	0.92	0.81	29.3
Approach		1260	2.0	0.702	30.0	LOS C	24.7	175.6	0.80	0.79	31.7
North: Bussell Hwy North											
8	T	1179	2.0	0.399	4.9	LOS A	11.3	80.7	0.36	0.33	51.2
9	R	424	2.0	0.698	43.6	LOS D	20.9	148.9	0.90	0.85	27.3
Approach		1603	2.0	0.698	15.2	LOS B	20.9	148.9	0.51	0.47	41.6
West: Norton Promenade											
10	L	484	2.0	0.446	14.5	LOS B	11.0	78.1	0.49	0.74	43.0
12	R	163	2.0	0.668	63.8	LOS E	9.5	67.4	1.00	0.83	21.8
Approach		647	2.0	0.668	26.9	LOS C	11.0	78.1	0.62	0.77	34.6
All Vehicles		3511	2.0	0.702	22.7	LOS C	24.7	175.6	0.63	0.64	36.2

Level of Service (LOS) Method: Delay (HCM 2000).
Vehicle movement LOS values are based on average delay per movement
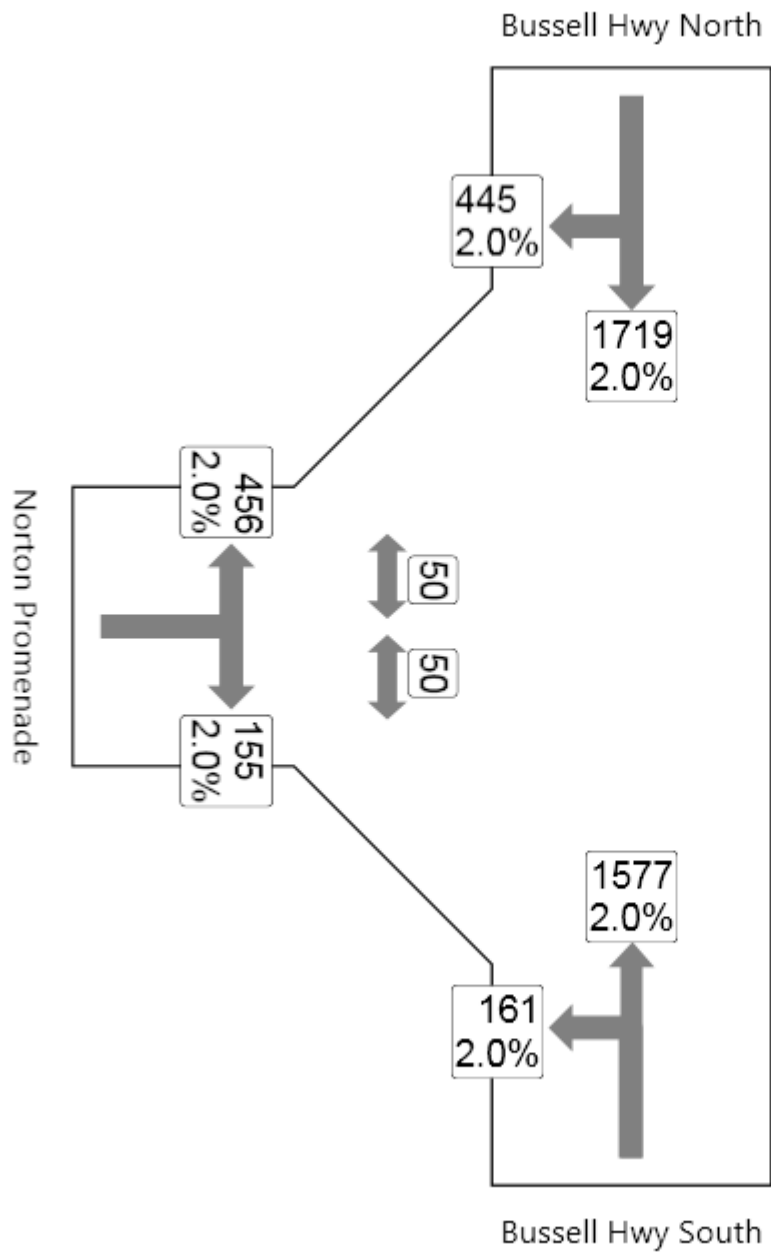Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model used.

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
P7	Across W approach	53	25.4	LOS C	0.1	0.1	0.65	0.65
P8	Across W approach	53	25.4	LOS C	0.1	0.1	0.65	0.65
All Pedestrians		106	25.4	LOS C			0.65	0.65

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.
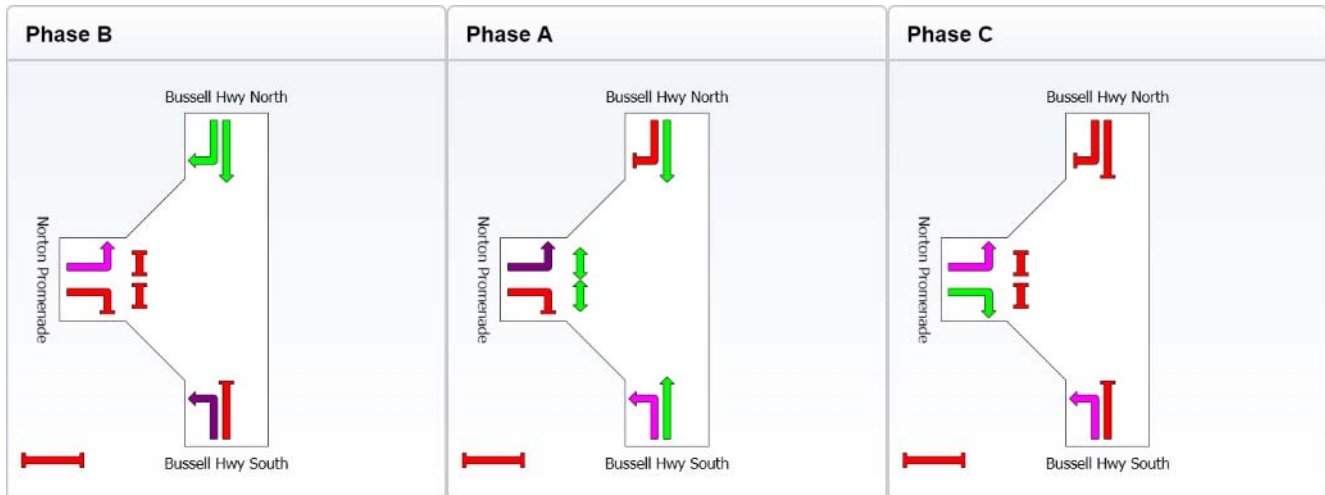Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Bussell Hwy North

445
2.0%

1719
2.0%

Norton Promenade

456
2.0%

50

50

155
2.0%

1577
2.0%

161
2.0%

Bussell Hwy South

PHASING SUMMARY

Bussell Hwy/Norton Promenade PM Peak
Signals - Fixed Time   Cycle Time = 140 seconds (Optimum Cycle Time - Minimum Delay)

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

Phase Timing Results

Phase	B	A	C
Green Time (sec)	40	68	14
Yellow Time (sec)	4	4	4
All-Red Time (sec)	2	2	2
Phase Time (sec)	46	74	20
Phase Split	33 %	53 %	14 %

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

MOVEMENT SUMMARY

Bussell Hwy/Norton Promenade PM Peak
Signals - Fixed Time   Cycle Time = 140 seconds (Optimum Cycle Time - Minimum Delay)

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: Bussell Hwy South											
1	L	169	2.0	0.164	14.9	LOS B	3.9	27.8	0.37	0.68	42.7
2	T	1660	2.0	0.888	42.0	LOS D	55.8	397.0	0.98	0.96	26.7
Approach		1829	2.0	0.888	39.5	LOS D	55.8	397.0	0.92	0.93	27.6
North: Bussell Hwy North											
8	T	1809	2.0	0.577	4.8	LOS A	21.1	150.1	0.38	0.36	51.4
9	R	468	2.0	0.886	70.2	LOS E	34.4	244.8	1.00	0.95	20.4
Approach		2278	2.0	0.886	18.2	LOS B	34.4	244.8	0.51	0.48	39.2
West: Norton Promenade											
10	L	480	2.0	0.580	34.8	LOS C	19.1	136.3	0.75	0.95	30.9
12	R	163	2.0	0.891	88.2	LOS F	12.6	89.4	1.00	0.96	17.5
Approach		643	2.0	0.891	48.4	LOS D	19.1	136.3	0.81	0.95	25.9
All Vehicles		4751	2.0	0.891	30.5	LOS C	55.8	397.0	0.71	0.72	31.8

Level of Service (LOS) Method: Delay (HCM 2000).
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
P7	Across W approach	53	19.6	LOS B	0.1	0.1	0.53	0.53
P8	Across W approach	53	19.6	LOS B	0.1	0.1	0.53	0.53
All Pedestrians		106	19.6	LOS B			0.53	0.53

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