Stantec

Memorandum

Project:	Intersection Analysis of Marshall DCP Item DI_IT_02	**Office:**	Melbourne, Bourke Street
Project/File:	300305412		
To:	Peter Schembri (Acting Coordinator, Strategic Implementation)	**Prepared by:**	Reece Humphreys / Lucy Farmer
Date:	17th June 2025	**Approved by:**	Reece Humphreys

Reference: Barwon Heads Road / Keystone Avenue (Intersection DI_IT_02) Intersection Analysis

1 Introduction

The City of Greater Geelong (the City) has recently completed the Marshall PSP Panel Hearing to incorporate Amendment C278 into the planning scheme. At the Marshall Panel Hearing, it was identified that further analysis of Marshall DCP item DI_IT_02 (DI_IT_02) is required, in the form of VITM modelling, to inform the design and costing of the intersection. It also identified that the apportionment should be revisited as part of the process.

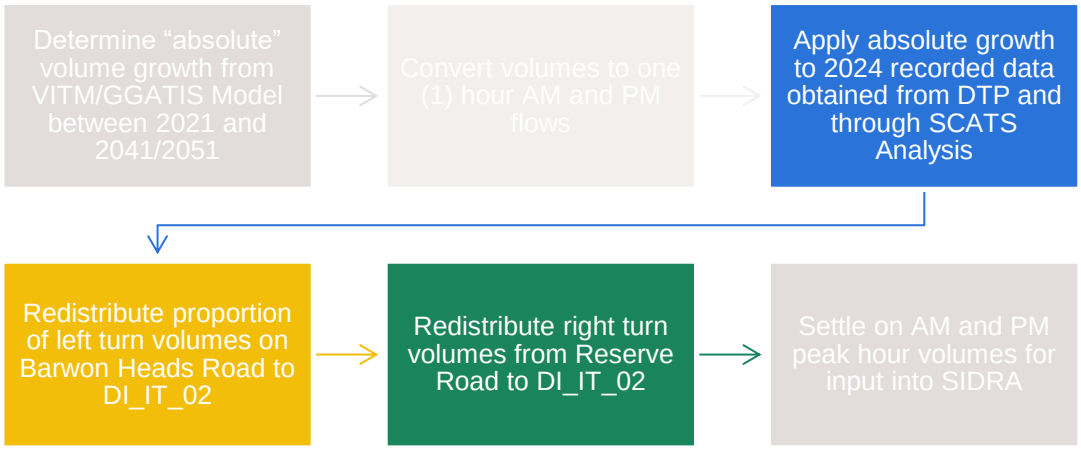
The Panel was occurring contemporaneously with a "Refresh" of the North East Industrial Precinct (NEIP) PSP and DCP including an update of the NEIP transport and access strategy being undertaken by Stantec for Re-Grow Geelong Pty Ltd (Re-Grow). The City and Re-Grow agreed that for efficiency, it would make sense for the review of DI_IT_02 for the purposes of Amendment C278, to be carried out by Stantec by accelerating and augmenting the intersection analysis that was planned to occur during the NEIP Refresh. The City and Re-Grow also agreed that the extra-over costs as a result would be treated as plan preparation costs shared 50/50 by the Marshall and refreshed NEIP DCPs.

This memorandum summarises the findings of the intersection (SIDRA) modelling for DI_IT-02 and concerns itself with the modelling and analysis that has informed the design of the intersection and the apportionment of costs. The cost estimate is being carried out by others (SMEC).

2 Approach

The approach undertaken to the preparation of turning movement volumes that informed the SIDRA analysis is outlined in Figure 2-1.

Figure 2-1: Approach to Intersection Assessment of DI_IT_02



The strategic volumes were obtained from the Victorian Integrated Transport Model (VITM) that was used as part of the Geelong Growth Area Transport Infrastructure (GGATIS) report that provided the expected demands on the network in 2041 and 2051. The design years represent:

- 2041 – 75% of the PSP land uses at full development
- 2051 –100% of the PSP land use at full development

The approach to the respective design years is consistent with the planning for interim and ultimate intersection designs for PSP's across Australia.

3 Turning Movement Volumes

The resulting AM and PM peak hour traffic volumes for the intersection is presented in Figure 3-1 to Figure 3-4.

Reference: Barwon Heads Road / Keystone Avenue (Intersection DI_IT_02) Intersection Analysis

Figure 3-1– 2041 AM Peak Hour Traffic Volumes

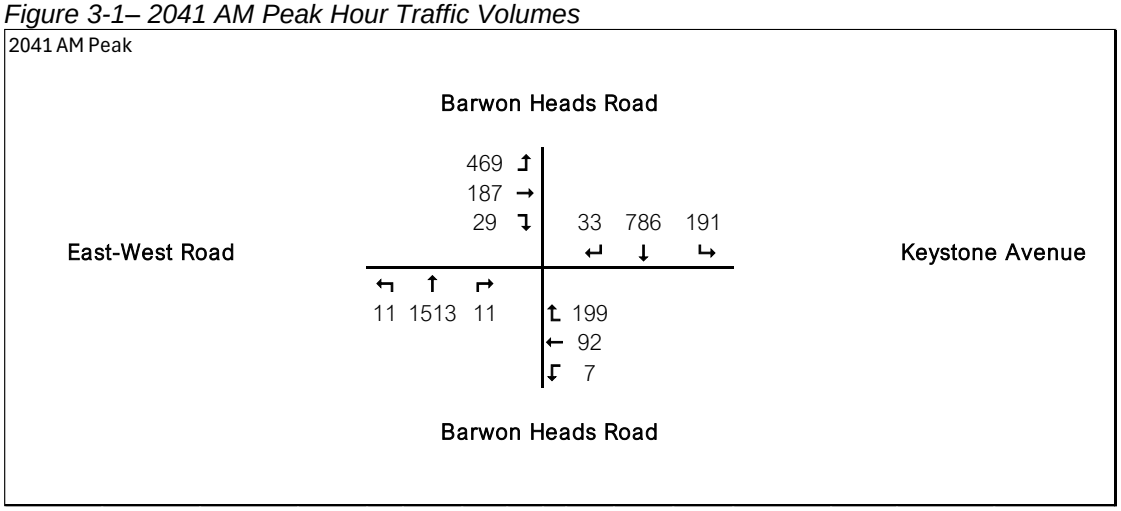


Figure 3-2– 2041 PM Peak Hour Traffic Volumes

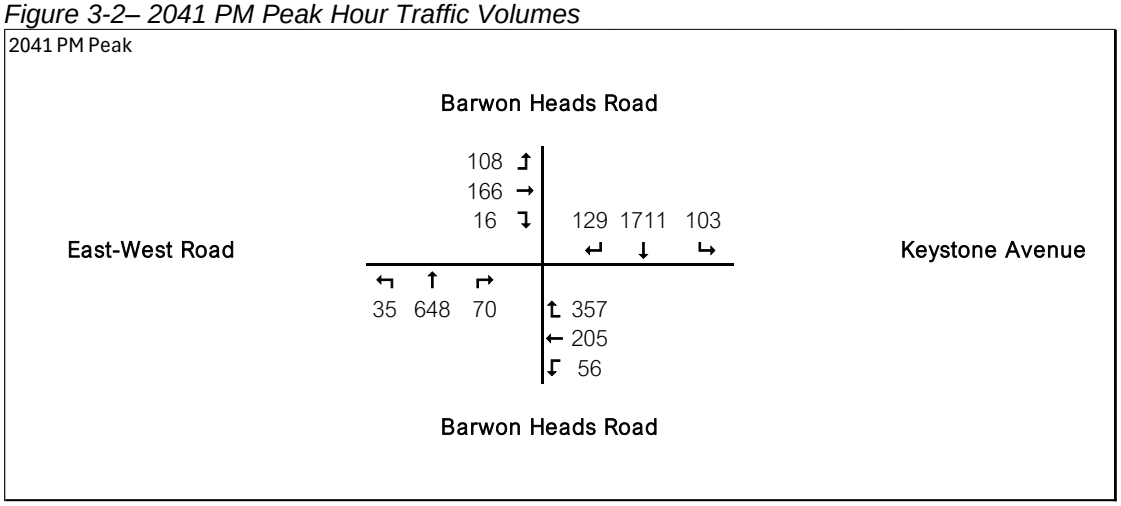


Figure 3-3–2051 AM Peak Hour Traffic Volumes

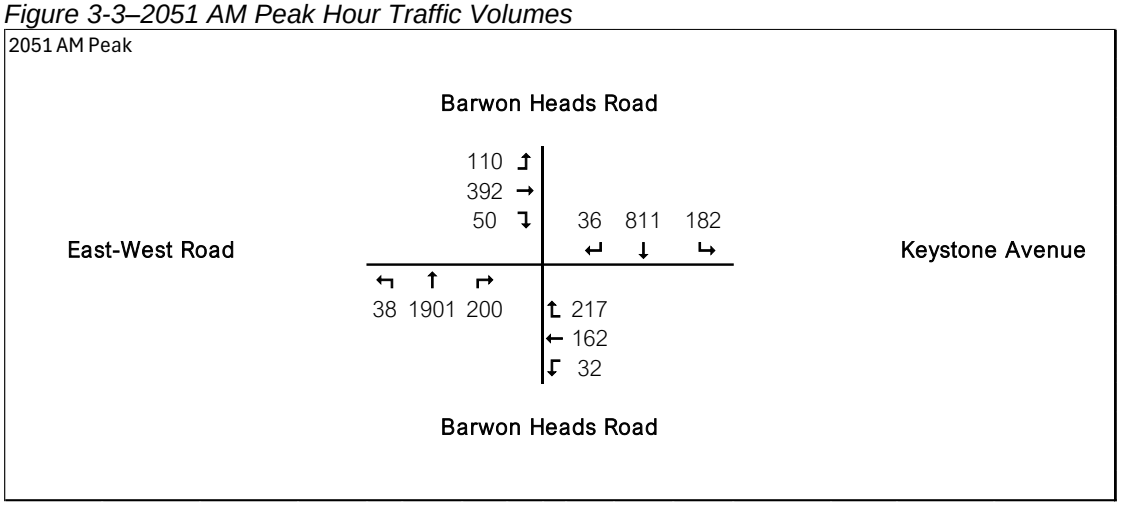
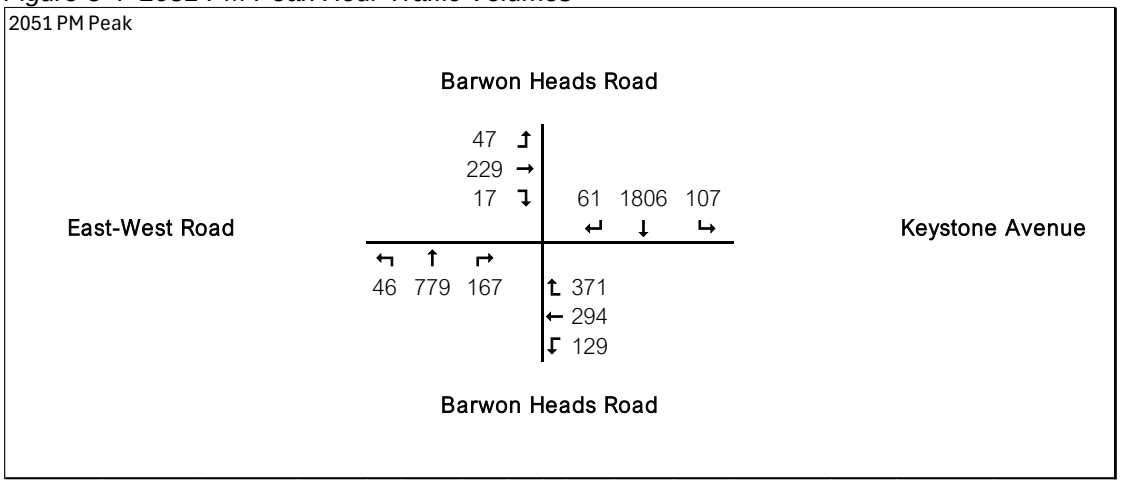


Figure 3-4–2051 PM Peak Hour Traffic Volumes



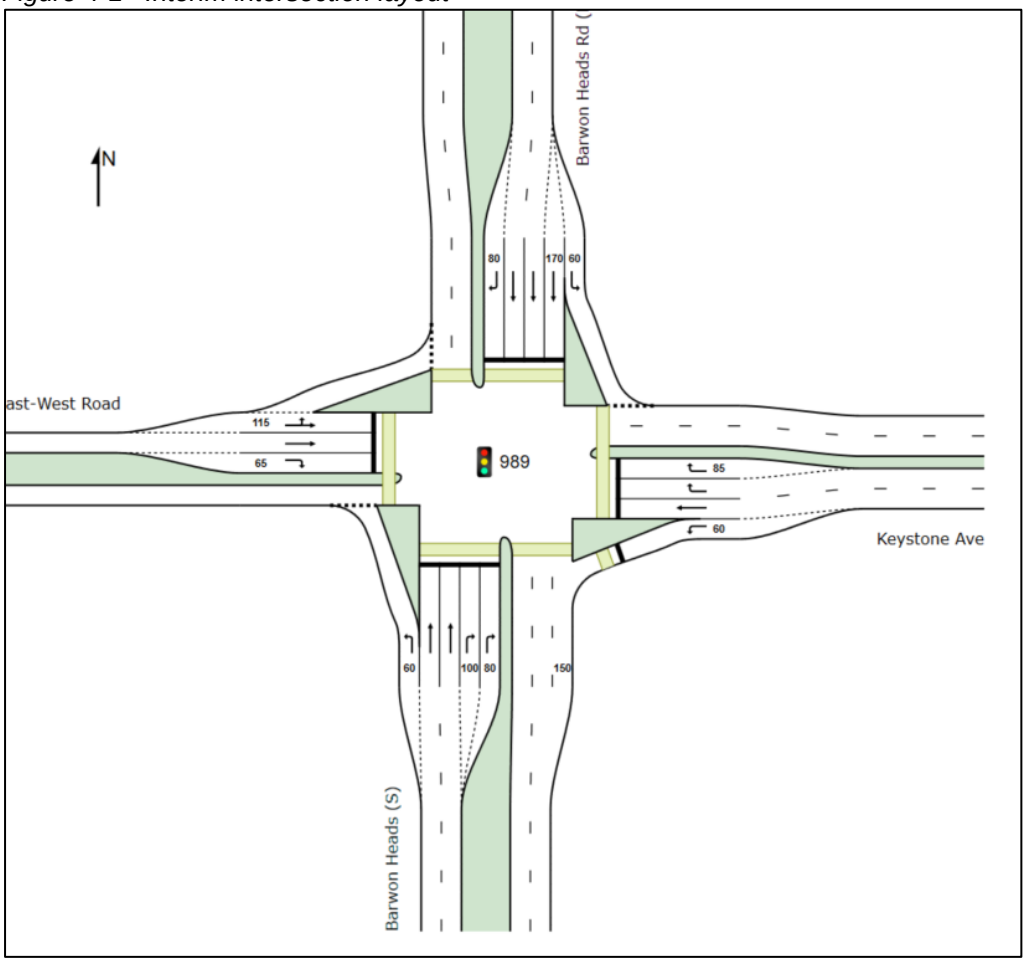
4 Layout Options

Two layout options for the eastern site access intersection have been assessed, as presented in the following sub sections.

Interim Intersection Layout

Figure 4-1 shows the SIDRA layout of the interim intersection, including the number of lanes, their configuration and length.

Figure 4-1– Interim intersection layout

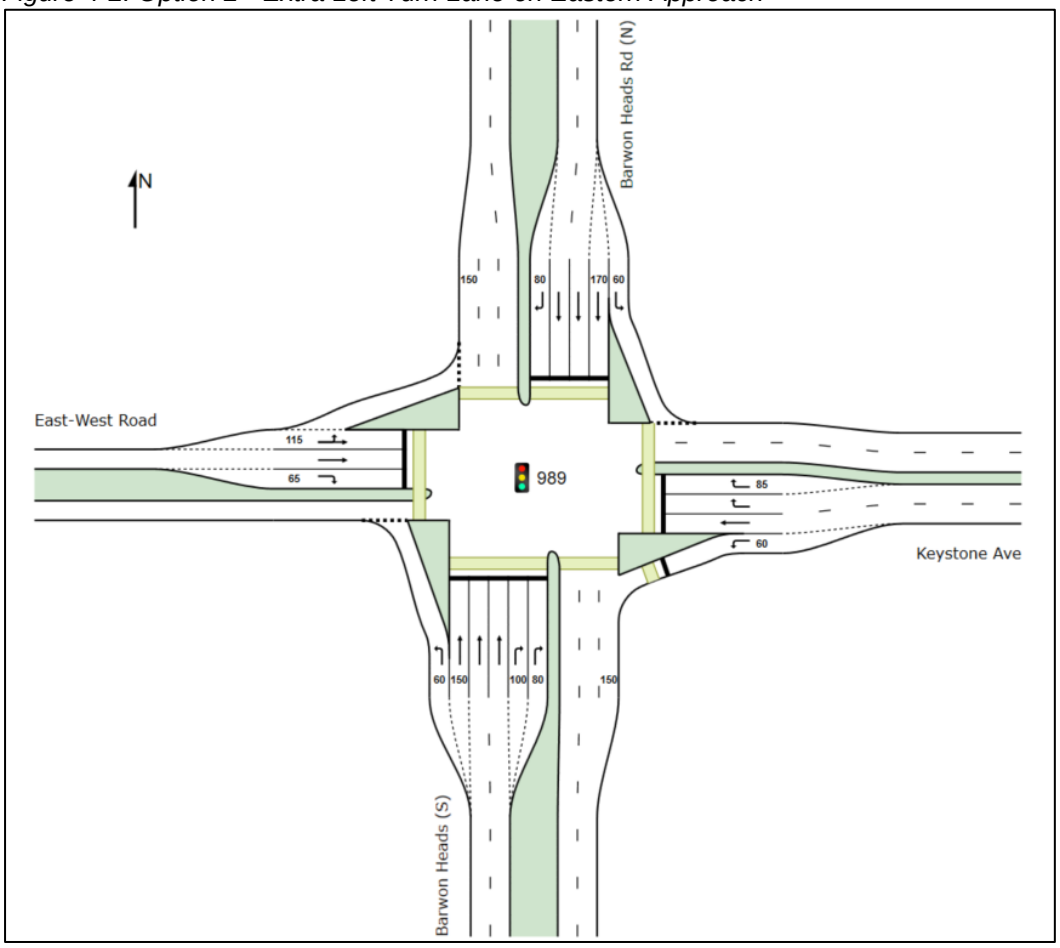


This arrangement maintains the two through lanes in each direction and includes an additional shorth through lane in the southbound direction.

Ultimate layout

Figure 4-2 shows the SIDRA layout of the ultimate intersection, including the number of lanes, their configuration and length.

Figure 4-2: Option 2 - Extra Left Turn Lane on Eastern Approach



The ultimate layout builds on the interim layout and includes an additional short through lane on Barwon Heads Road in the northbound direction.

The DCP will include the cost to deliver the interim intersection and the land take for the ultimate intersection (refer to Section 8 of this memorandum).

5 Intersection Analysis

The operation of the signalised site access intersection layout options for the various assessment scenarios has been assessed using SIDRA INTERSECTION, a computer-based modelling package which calculates intersection performance. For this assessment the Degree of Saturation (DOS) was assessed to understand the general capacity of the signalised intersections.

Traditionally, a DOS of around 0.95 for signalised intersections and 0.90 for unsignalised intersections has been considered the practical limit beyond which intersection performance is unsatisfactory, as beyond this value queues and delays increase disproportionately.

Moreover, the “DTP Transport modelling guidelines: Volume 5 Intersection modelling” suggests that a maximum intersection DOS for a signalised intersection in an urban environment is 0.95 and the desired limit is 0.90.

Results

A summary of the intersection modelling results of the signalised site access intersection layout options for the various assessment scenarios is presented in Table 5-1, with more detail provided in Appendix A.

Table 5-1: Intersection Analysis Results Summary

Approach	DoS	Ave Delay	LOS	DoS	Ave Delay	LOS
	2041 AM Peak			**2041 PM Peak**		
South: Barwon Heads (S)	0.895	35.8	D	0.545	25.0	C
East: Keystone Ave	0.876	54.5	D	0.838	44.3	D
North: Barwon Heads Rd (N)	0.320	14.9	B	0.883	31.4	C
West: East-West Road	0.791	34.8	C	0.526	27.5	C
Intersection	**0.895**	**31.3**	**C**	**0.883**	**31.9**	**C**
	2051 AM Peak			**2051 PM Peak**		
South: Barwon Heads (S)	0.895	36.7	D	0.735	24.9	C
East: Keystone Ave	0.819	47.6	D	0.904	47.8	D
North: Barwon Heads Rd (N)	0.373	18.1	B	0.881	32.4	C
West: East-West Road	0.803	43.5	D	0.683	37.8	D
Intersection	**0.895**	**34.1**	**C**	**0.904**	**34.0**	**C**

The 2041 interim arrangement for IN-02 will operate at a DOS of 0.895 in the AM peak and 0.883 in the PM peak

Interrogation of the detailed results in Appendix A, the following comments are provided in relation to the 2041 interim results:

- Maximum queue lengths of 295m occur on the south approach of BHR in the AM peak
- Maximum queue lengths of 219m occur on the north approach of BHR in the PM peak
- Keystone Avenue will have a maximum queue length of 62m which occurs in the PM peak
- The East-West Road in the Marshal PSP will have a maximum queue length of 147m which occurs in the AM peak

The 2051 ultimate arrangement adds an additional short through-lane to the northbound approach, operating with a DOS of 0.838 in the AM peak and 0.907 in the PM peak. The following comments are also provided:

- Maximum queue lengths of 270m occur on the south approach of BHR in the AM peak
- Maximum queue lengths of 250m occur on the north approach of BHR in the PM peak
- Keystone Avenue will have a maximum queue length of 116m which occurs in the PM peak
- The East-West Road in the Marshal PSP will have a maximum queue length of 80m which occurs in the AM peak

6 Consultation and approval

The modelling outputs were circulated to the City and the Department of Transport (DTP) in a pack dated 21st February 2025 and has been approved in separate emails from the City (dated 28th February 2025) and DTP (dated 28th February 2025).

The concept designs for 2041 (300305412_02_P1) and 2051 (300305412_01_P1) were circulated to the City and DTP on the 24th of April 2025 and have been approved in separate emails from the City (dated 2nd May 2025) and DTP (dated 22nd May 2025). It is noted that DTP requested the removal of the raised platform for the left turn slip lane from (north to east) which was provided in the updated plans for 2041 (300305412_02_P2) and 2051 (300305412_01_P2).

7 Apportionment

In our experience in determining apportionment for DCP items, there are two established approaches to calculating the apportionment of infrastructure:

1. Adopt the approach outlined in the DCP Guidelines[1]. This approach strictly adopts the DCP guidance based on the proportion of traffic using the respective approach to an intersection from each PSP, as well as assigning a proportion to external usage. This proportion is typically sourced from traffic modelling.
2. "Proximity" approach: the intersection apportionment is based on the boundaries of the PSP and the proximity to other PSP boundaries.

Based on our experience with recent PSP's in metropolitan Melbourne and Geelong, it is recommended that the Proximity Approach be adopted for DI_IT_02. This approach will ensure a transparent approach in how apportionment is calculated.

Given the above, it is recommended that DI_IT_02 be apportioned 50% to the Marshall PSP and 50% to the NEIP PSP.

8 Costs included in the DCP

Victorian Planning Authority (VPA) published the Guidelines for Precinct Structure Planning Guidelines: New Communities in Victoria (PSP 2.0). The PSP 2.0 Guidelines provide some guidance on the infrastructure required for a PSP. Guideline F17.3 indicates that

> *Land should be set aside and reserved to allow for all public land uses, including schools, community centres, health, emergency and justice facilities, road widening and grade separation of rail from all transport corridors (includes roads, pedestrian and bicycle paths) where a delivery agency has agreed to the commitment*

From a transport infrastructure perspective, the DCP will:

[1] The Department of Environment, Land, Water and Planning (DELWP) has published the Development Contributions Guidelines (June 2003, v5.9).

- determine the land required for the delivery of the transport infrastructure required for the ultimate of full development of the PSP, which is consistent with Guideline F17.3, and
- deliver the interim infrastructure required to facilitate the development. There is no guidance on how to determine the interim level of infrastructure, however the typical approach has been to determine the intersection requirements based on up to 75% of development occurring, which is what has been applied to the 2041 assessment for DI_IT_02.

The approach to determining the interim and ultimate layout has been adopted for DI_IT_02 and the design plans that have been prepared. This approach is consistent with intersection designs adopted for recent PSP's in Geelong and metropolitan Melbourne.

9 Concept layouts

Concept designs for the proposed intersection of DI_IT_02 that are based on the analysis provided in this memorandum and are attached in Appendix B. These include:

3. The proposed arrangements for in interim arrangement that will be suitable for the design year of 2041 (300305412_02_P3).
4. The proposed arrangements for an ultimate arrangement for the intersection that will be suitable beyond 2041 (300305412_01_P3), and
5. The land area required for the ultimate arrangement to be included in the DCP (300305412_03_P3).

10 Conclusion

Based on the results presented in this memorandum, it is clear that the proposed layouts for the interim and ultimate intersections would be able to cater for the expected demands for the respective years and their operation suitable for inclusion in the Marshal and NRIP DCP's.

Appendix A Modelling summary

USER REPORT FOR SITE

All Movement Classes

Project: 250205_marshall_psp_modelling_v2

Template: Default Site User Report

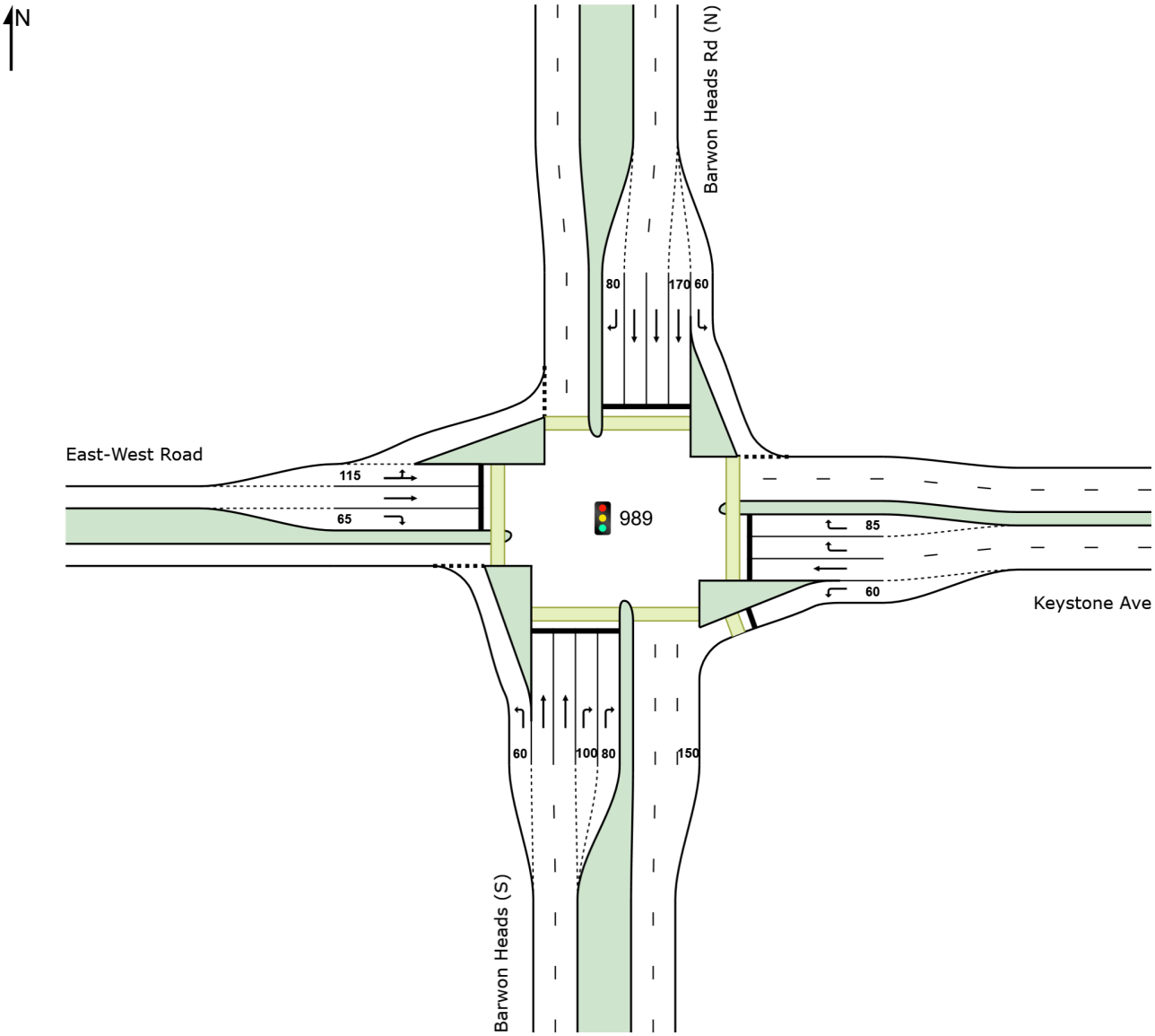
Site: 989 [AM Revised layout (2041) - Keystone Ave / Barwon Heads Rd / Connector 250206 optimised - Final NB (Site Folder: 250206 - 2041 (Revised volumes / Layout))]

Site Category: Signalised Intersection
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, E, E1*, E2*
Output Phase Sequence: A, B, C, D, E
(* Variable Phase)

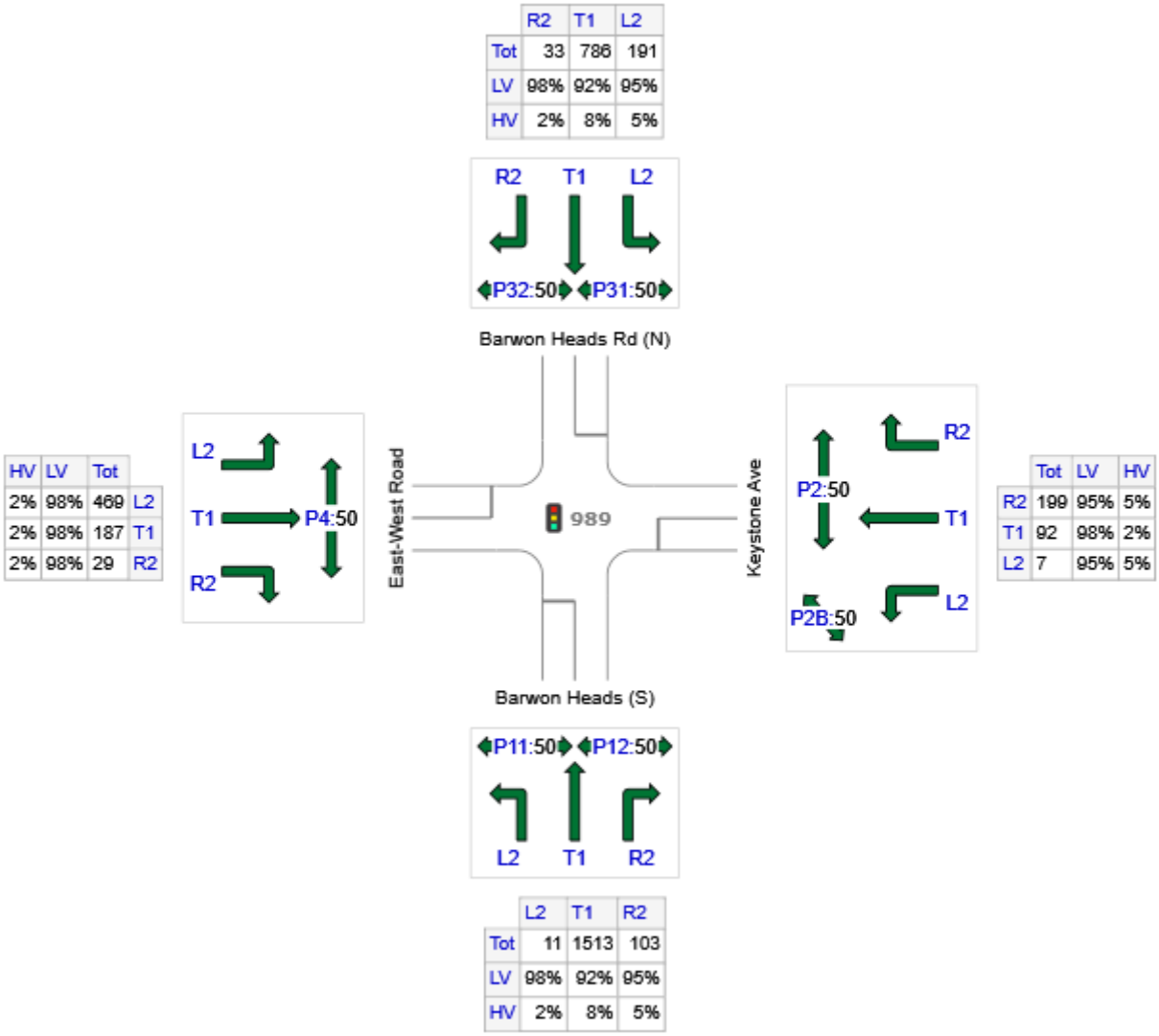
Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Barwon Heads (S)	1627	1501	126
E: Keystone Ave	298	286	12
N: Barwon Heads Rd (N)	1010	937	73
W: East-West Road	685	671	14
Total	3620	3395	225

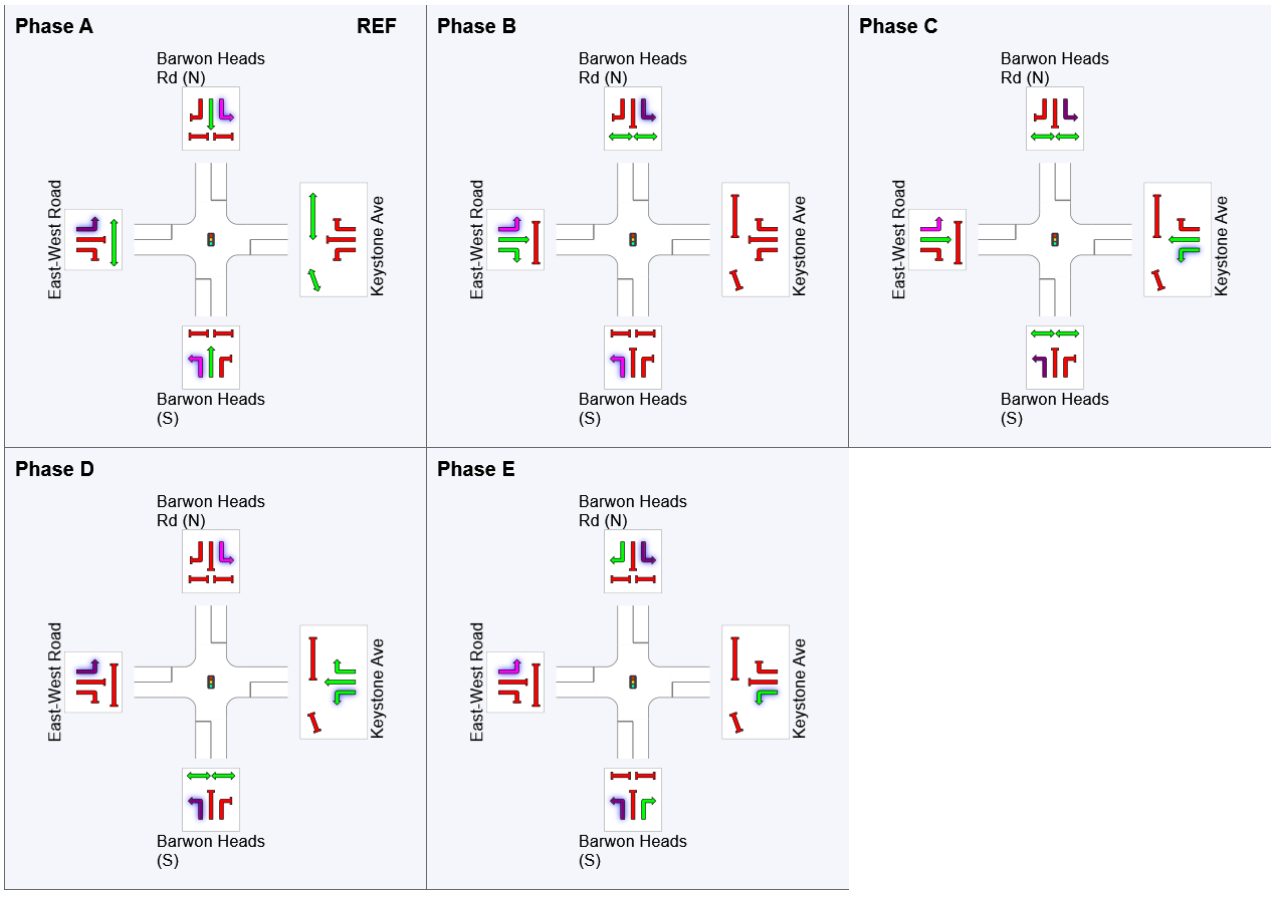
Phase Timing Summary

Phase	A	B	C	D	E
Phase Change Time (sec)	0	50	62	66	78
Green Time (sec)	44	6	***	6	6
Phase Time (sec)	50	12	4	12	12
Phase Split	56%	13%	4%	13%	13%

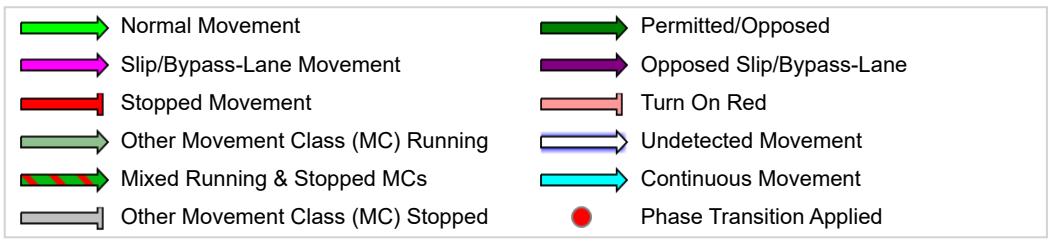
See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

*** No green time has been calculated for this phase because the next phase starts during its intergreen time. This occurs with overlap phasing where there is no single movement connecting this phase to the next, or where the only such movement is a dummy movement with zero minimum green time specified. If a green time is required for this phase, specify a dummy movement with a non-zero minimum green time.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Barwon Heads (S)													
Lane 1	12	2.0	1473	0.008	100	7.5	LOS A	0.1	0.4	Short	60	0.0	NA
Lane 2	804	8.0	899[1]	0.895	100	34.8	LOS C	39.5	295.7	Full	500	0.0	0.0
Lane 3	789	8.0	882[1]	0.895	100	34.7	LOS C	38.4	287.6	Full	500	0.0	0.0
Lane 4	52	10.4	115	0.453	100	53.8	LOS D	2.4	18.2	Short	100	0.0	NA
Lane 5	56	0.0	124	0.453	100	53.5	LOS D	2.6	17.9	Short	80	0.0	NA
Approach	1713	7.8		0.895		35.8	LOS D	39.5	295.7				
East: Keystone Ave													
Lane 1	7	5.0	438	0.017	100	33.3	LOS C	0.2	1.8	Short	60	0.0	NA
Lane 2	97	2.0	214	0.453	100	42.2	LOS D	4.2	29.7	Full	500	0.0	0.0
Lane 3	105	5.0	120	0.876	100	60.9	LOS E	5.4	39.2	Full	500	0.0	0.0
Lane 4	105	5.0	120	0.876	100	60.9	LOS E	5.4	39.2	Short	85	0.0	NA
Approach	314	4.1		0.876		54.5	LOS D	5.4	39.2				
North: Barwon Heads Rd (N)													
Lane 1	201	5.0	1359	0.148	100	8.6	LOS A	1.8	13.1	Short	60	0.0	NA
Lane 2	247	8.0	906	0.272	85[6]	14.6	LOS B	6.3	47.5	Short	170	0.0	NA
Lane 3	290	8.0	906	0.320	100	15.0	LOS B	7.7	57.4	Full	500	0.0	0.0
Lane 4	290	8.0	906	0.320	100	14.9	LOS B	7.7	57.4	Full	500	0.0	0.0
Lane 5	35	2.0	122	0.285	100	52.6	LOS D	1.6	11.1	Short	80	0.0	NA
Approach	1063	7.2		0.320		14.9	LOS B	7.7	57.4				
West: East-West Road													
Lane 1	521	2.0	660	0.791	100	29.7	LOS C	20.7	147.2	Short	115	0.0	NA
Lane 2	169	2.0	214	0.791	100	47.4	LOS D	8.0	57.1	Full	500	0.0	0.0
Lane 3	31	2.0	122	0.250	100	51.6	LOS D	1.4	9.7	Short	65	0.0	NA
Approach	721	2.0		0.791		34.8	LOS C	20.7	147.2				
Intersection	3811	6.2		0.895		31.3	LOS C	39.5	295.7				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects

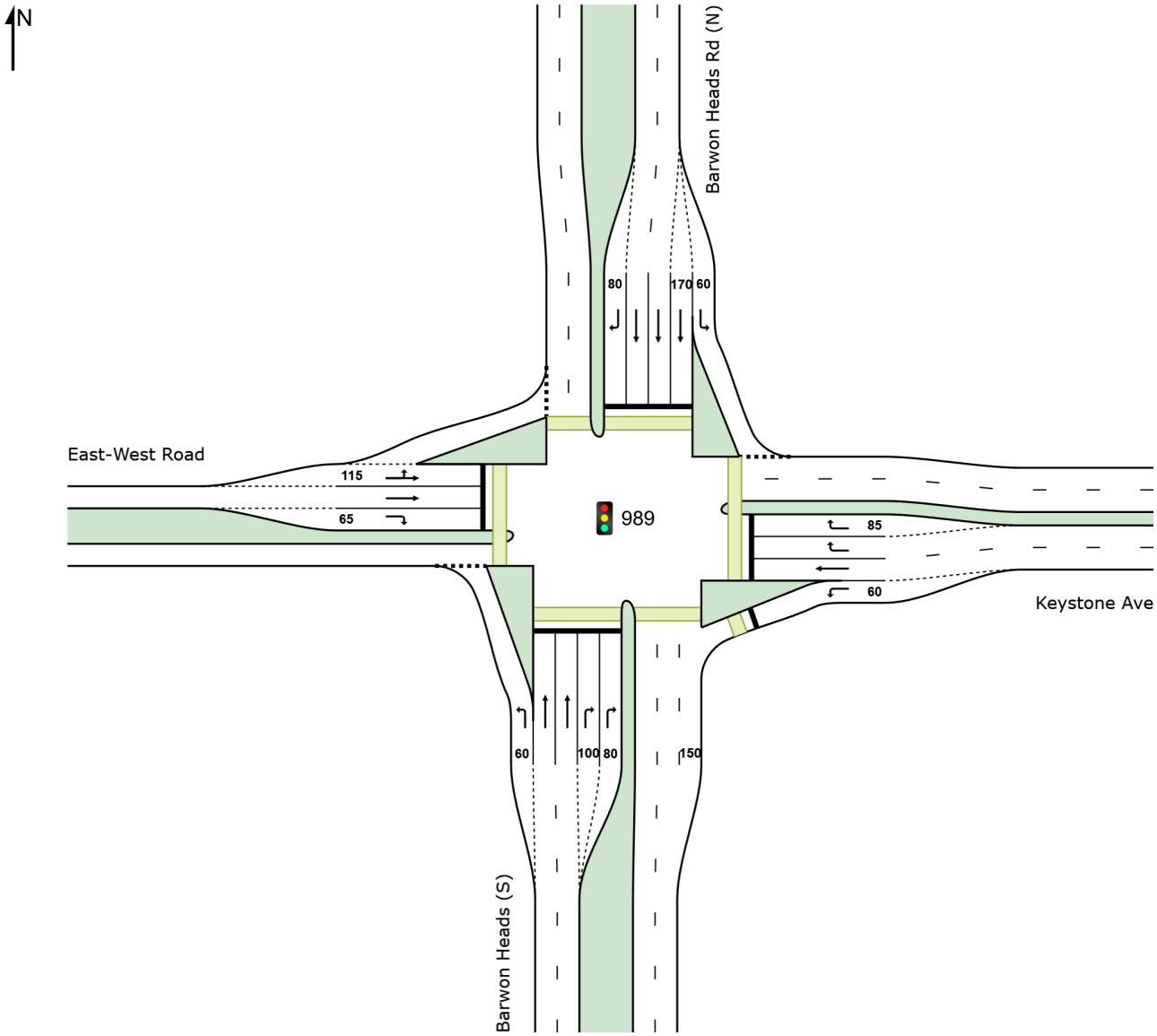
Site: 989 [PM Revised layout (2041) - Keystone Ave / Barwon Heads Rd / Connector 250206 optimised - Final NB (Site Folder: 250206 - 2041 (Revised volumes / Layout))]

Site Category: Signalised Intersection
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, E, E1*, E2*
Output Phase Sequence: A, B, C, D, E, E2*
(* Variable Phase)

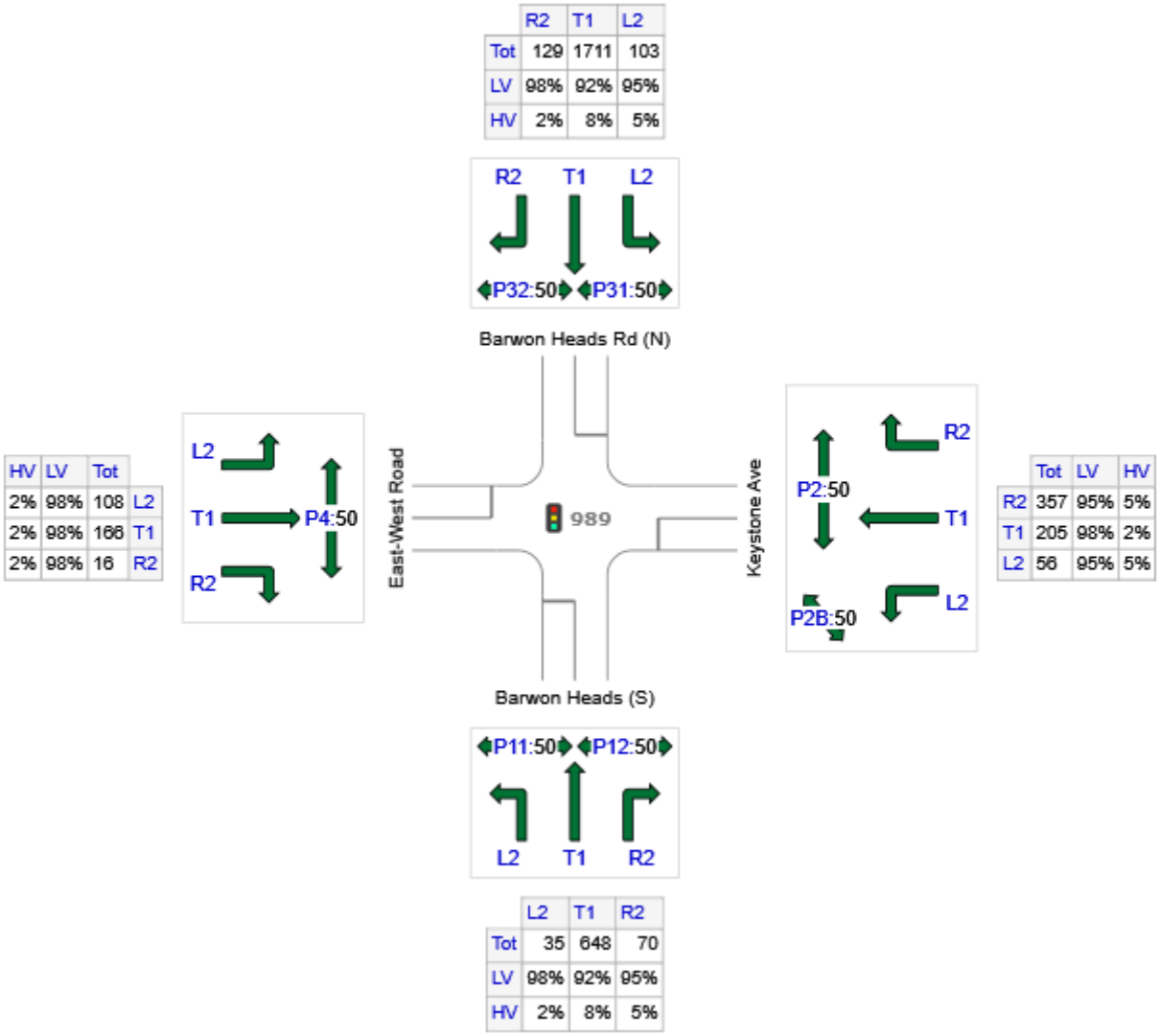
Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Barwon Heads (S)	753	697	56
E: Keystone Ave	618	593	25
N: Barwon Heads Rd (N)	1943	1798	145
W: East-West Road	290	284	6
Total	3604	3373	231

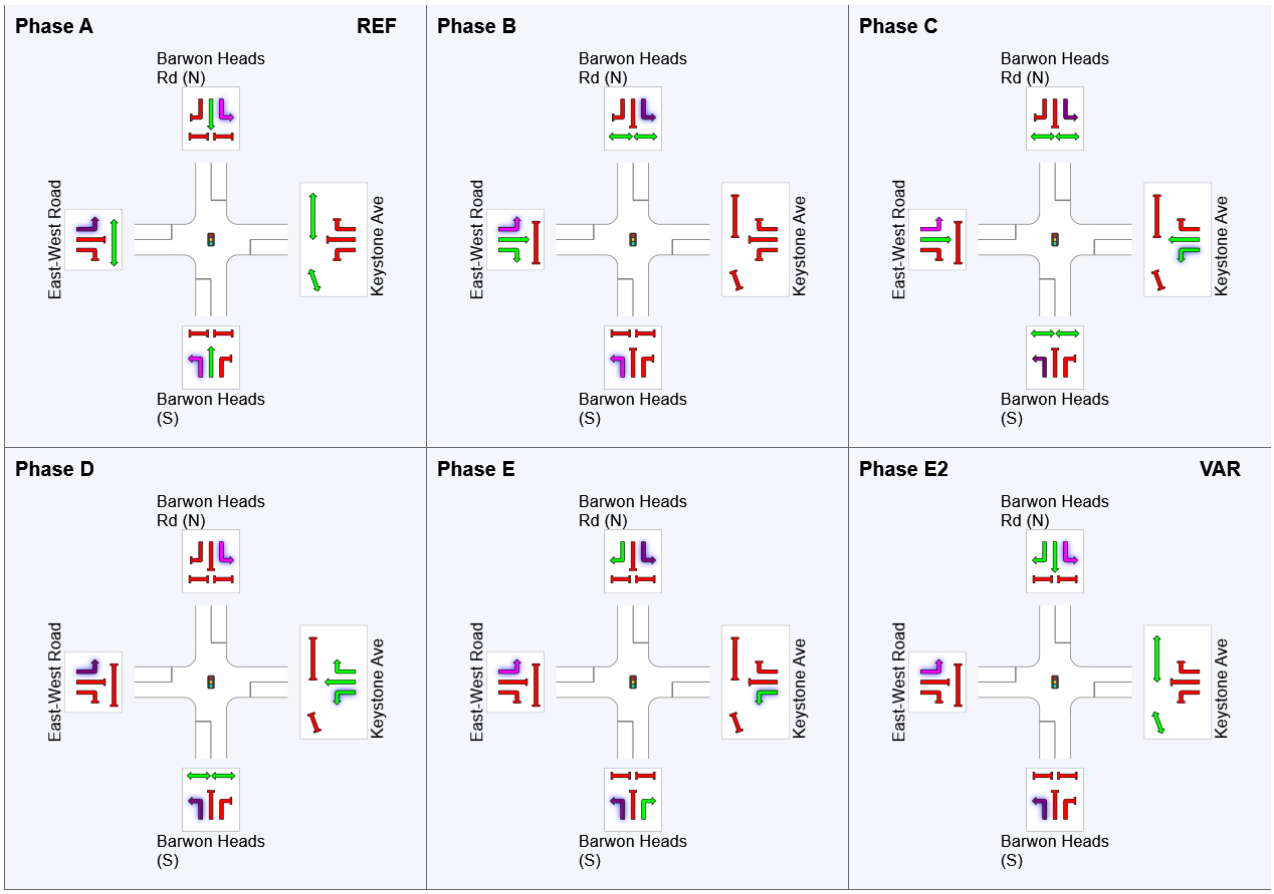
Phase Timing Summary

Phase	A	B	C	D	E	E2
Phase Change Time (sec)	0	33	45	47	63	75
Green Time (sec)	27	6	***	10	6	***
Phase Time (sec)	33	12	2	16	12	5
Phase Split	41%	15%	3%	20%	15%	6%

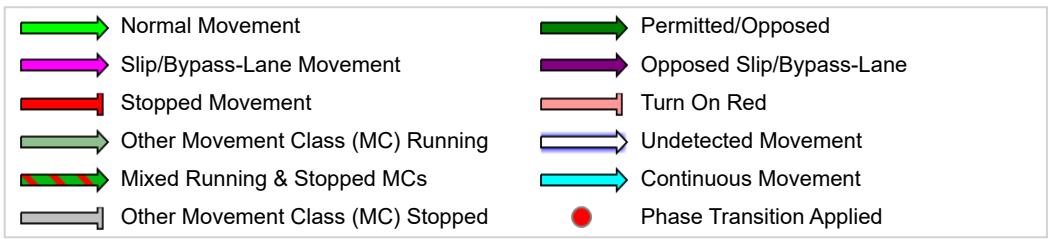
See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

*** No green time has been calculated for this phase because the next phase starts during its intergreen time. This occurs with overlap phasing where there is no single movement connecting this phase to the next, or where the only such movement is a dummy movement with zero minimum green time specified. If a green time is required for this phase, specify a dummy movement with a non-zero minimum green time.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Barwon Heads (S)													
Lane 1	37	2.0	1237	0.030	100	9.6	LOS A	0.4	2.7	Short	60	0.0	NA
Lane 2	341	8.0	626	0.545	100	23.5	LOS C	11.0	81.9	Full	500	0.0	0.0
Lane 3	341	8.0	626	0.545	100	23.5	LOS C	11.0	81.9	Full	500	0.0	0.0
Lane 4	36	10.4	130	0.274	100	47.2	LOS D	1.4	10.8	Short	100	0.0	NA
Lane 5	38	0.0	139	0.274	100	46.9	LOS D	1.5	10.6	Short	80	0.0	NA
Approach	793	7.4		0.545		25.0	LOS C	11.0	81.9				
East: Keystone Ave													
Lane 1	59	5.0	538	0.110	100	28.0	LOS C	1.7	12.2	Short	60	0.0	NA
Lane 2	216	2.0	289	0.747	100	38.7	LOS D	8.8	62.6	Full	500	0.0	0.0
Lane 3	188	5.0	224	0.838	100	50.0	LOS D	8.3	60.5	Full	500	0.0	0.0
Lane 4	188	5.0	224	0.838	100	50.0	LOS D	8.3	60.5	Short	85	0.0	NA
Approach	651	4.0		0.838		44.3	LOS D	8.8	62.6				
North: Barwon Heads Rd (N)													
Lane 1	108	5.0	1352	0.080	100	8.1	LOS A	0.7	5.4	Short	60	0.0	NA
Lane 2	533	8.0	710[1]	0.751	85[6]	23.9	LOS C	18.4	138.0	Short	170	0.0	NA
Lane 3	655	8.0	741	0.883	100	35.5	LOS D	29.4	219.6	Full	500	0.0	0.0
Lane 4	613	8.0	694[1]	0.883	100	35.0	LOS D	26.9	201.6	Full	500	0.0	0.0
Lane 5	136	2.0	252	0.539	100	42.8	LOS D	5.2	36.9	Short	80	0.0	NA
Approach	2045	7.4		0.883		31.4	LOS C	29.4	219.6				
West: East-West Road													
Lane 1	187	2.0	355	0.526	100	19.6	LOS B	3.9	27.9	Short	115	0.0	NA
Lane 2	101	2.0	192	0.526	100	39.1	LOS D	4.0	28.4	Full	500	0.0	0.0
Lane 3	17	2.0	137	0.123	100	45.1	LOS D	0.7	4.6	Short	65	0.0	NA
Approach	305	2.0		0.526		27.5	LOS C	4.0	28.4				
Intersection	3794	6.4		0.883		31.9	LOS C	29.4	219.6				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects

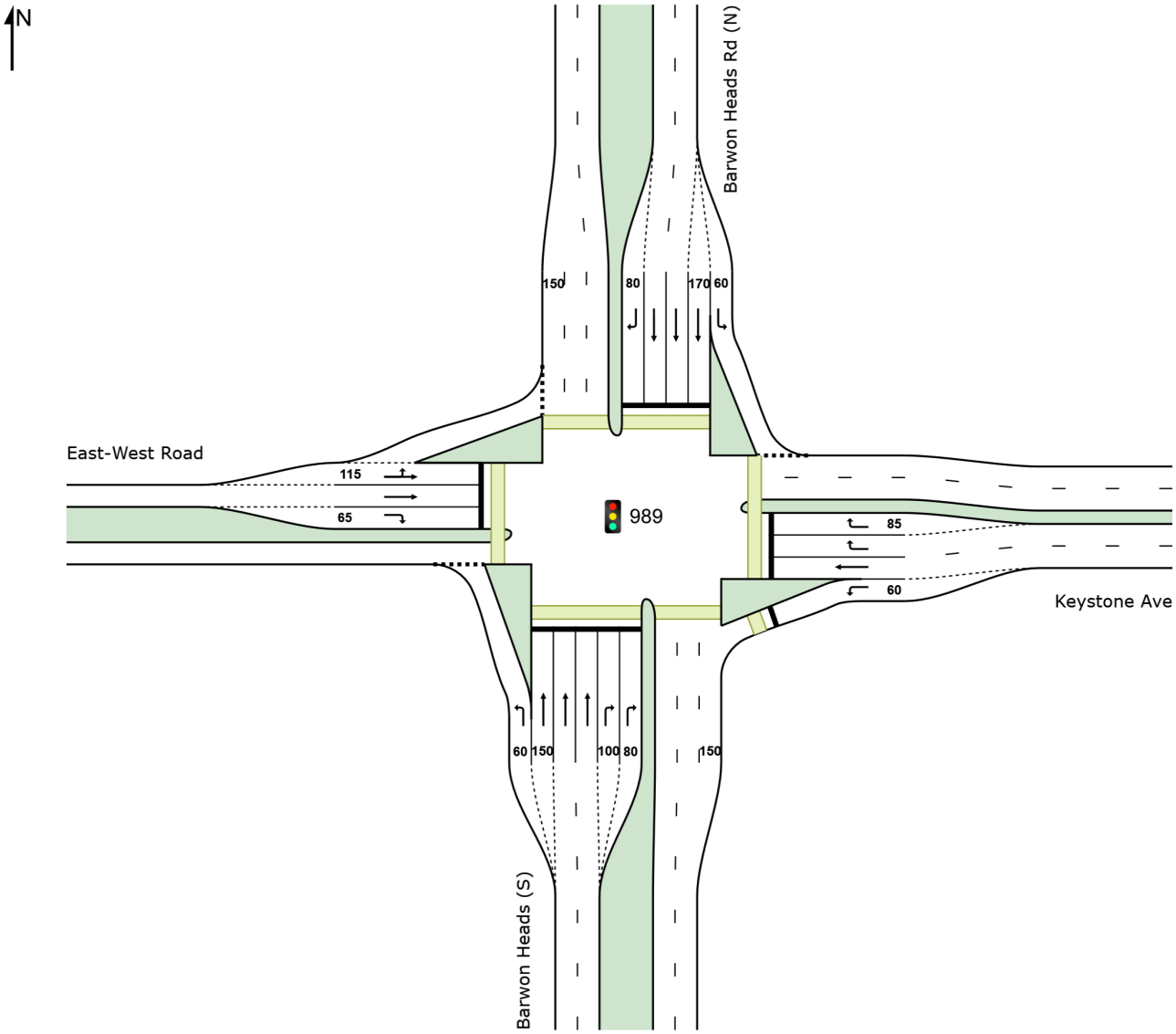
Site: 989 [AM Revised layout (2051) - Keystone Ave / Barwon Heads Rd / Connector 250206 optimised - Final (Site Folder: 250206 - 2051 (Revised volumes / Layout))]

Site Category: Signalised Intersection
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, E, E1*, E2*
Output Phase Sequence: A, B, C, D, E
(* Variable Phase)

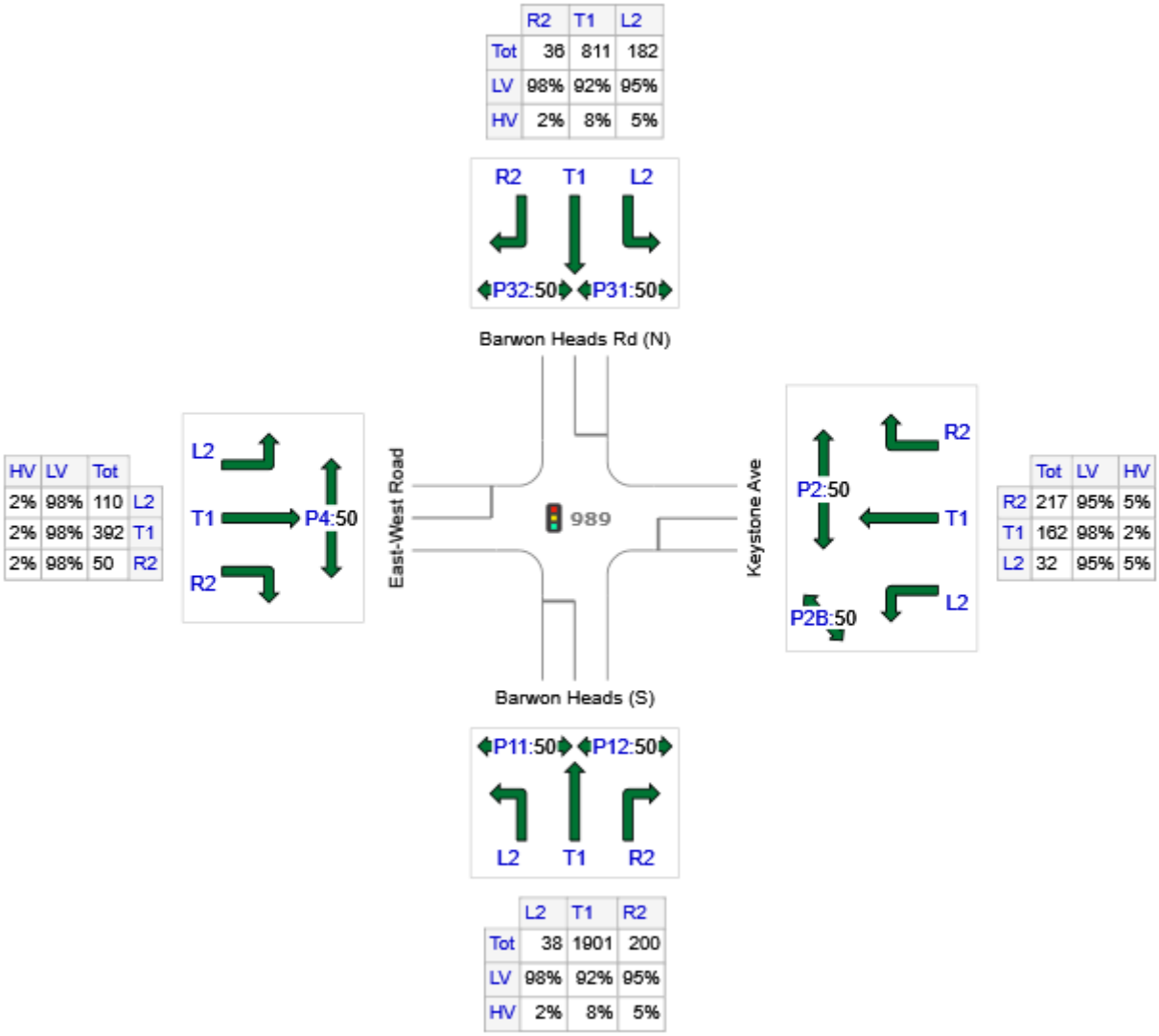
Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Barwon Heads (S)	2139	1976	163
E: Keystone Ave	411	395	16
N: Barwon Heads Rd (N)	1029	954	75
W: East-West Road	552	541	11
Total	4131	3867	264

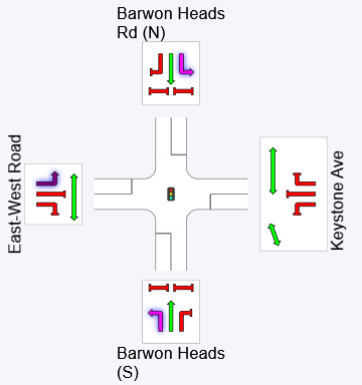
Phase Timing Summary

Phase	A	B	C	D	E
Phase Change Time (sec)	0	45	57	65	78
Green Time (sec)	39	6	2	7	6
Phase Time (sec)	45	12	8	13	12
Phase Split	50%	13%	9%	14%	13%

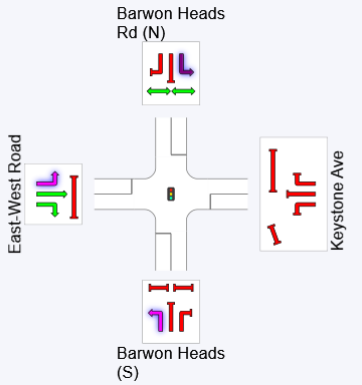
See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence

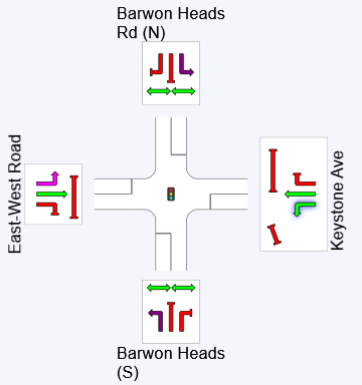
Phase A REF



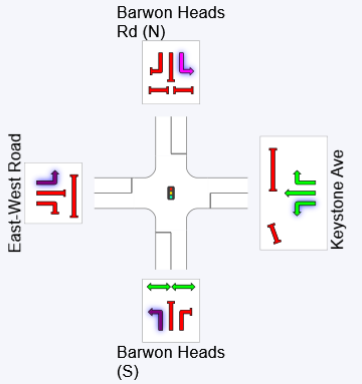
Phase B



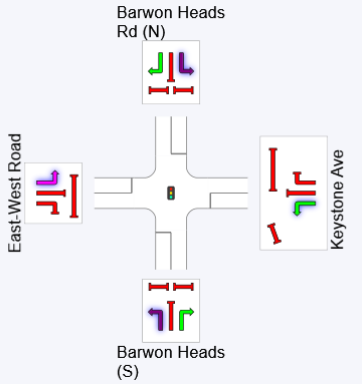
Phase C



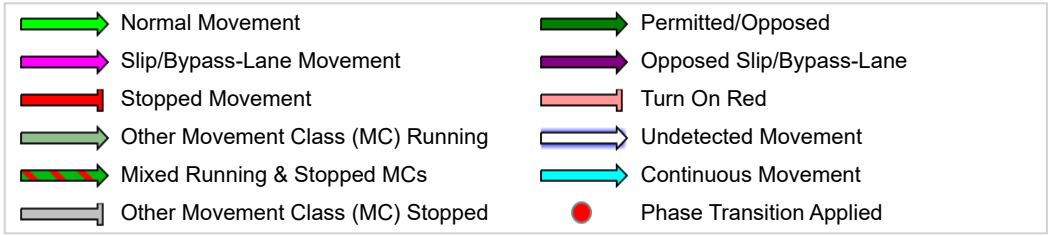
Phase D



Phase E



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Barwon Heads (S)													
Lane 1	40	2.0	1401	0.029	100	8.2	LOS A	0.3	2.2	Short	60	0.0	NA
Lane 2	596	8.0	784[1]	0.761	85[6]	25.3	LOS C	22.6	169.0	Short	150	0.0	NA
Lane 3	719	8.0	803	0.895	100	38.9	LOS D	36.2	270.5	Full	500	0.0	0.0
Lane 4	686	8.0	766[1]	0.895	100	38.0	LOS D	34.0	254.1	Full	500	0.0	0.0
Lane 5	102	10.4	115	0.881	100	62.5	LOS E	5.2	40.0	Short	100	0.0	NA
Lane 6	109	0.0	124	0.881	100	61.9	LOS E	5.6	39.2	Short	80	0.0	NA
Approach	2252	7.6		0.895		36.7	LOS D	36.2	270.5				
East: Keystone Ave													
Lane 1	34	5.0	538	0.063	100	29.9	LOS C	1.1	7.7	Short	60	0.0	NA
Lane 2	171	2.0	321	0.532	100	38.1	LOS D	7.1	50.3	Full	500	0.0	0.0
Lane 3	114	5.0	139	0.819	100	57.8	LOS E	5.6	41.1	Full	500	0.0	0.0
Lane 4	114	5.0	139	0.819	100	57.0	LOS E	5.6	41.1	Short	85	0.0	NA
Approach	433	3.8		0.819		47.6	LOS D	7.1	50.3				
North: Barwon Heads Rd (N)													
Lane 1	192	5.0	1239	0.155	100	10.2	LOS B	2.3	17.1	Short	60	0.0	NA
Lane 2	255	8.0	803	0.317	85[6]	18.1	LOS B	7.3	54.8	Short	170	0.0	NA
Lane 3	299	8.0	803	0.373	100	18.6	LOS B	8.9	66.4	Full	500	0.0	0.0
Lane 4	299	8.0	803	0.373	100	18.5	LOS B	8.9	66.4	Full	500	0.0	0.0
Lane 5	38	2.0	122	0.310	100	52.8	LOS D	1.7	12.1	Short	80	0.0	NA
Approach	1083	7.3		0.373		18.1	LOS B	8.9	66.4				
West: East-West Road													
Lane 1	288	2.0	359	0.803	100	40.7	LOS D	10.6	75.5	Short	115	0.0	NA
Lane 2	240	2.0	299	0.803	100	44.8	LOS D	11.3	80.4	Full	500	0.0	0.0
Lane 3	53	2.0	122	0.431	100	52.5	LOS D	2.4	17.1	Short	65	0.0	NA
Approach	581	2.0		0.803		43.5	LOS D	11.3	80.4				
Intersection	4348	6.4		0.895		34.1	LOS C	36.2	270.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects

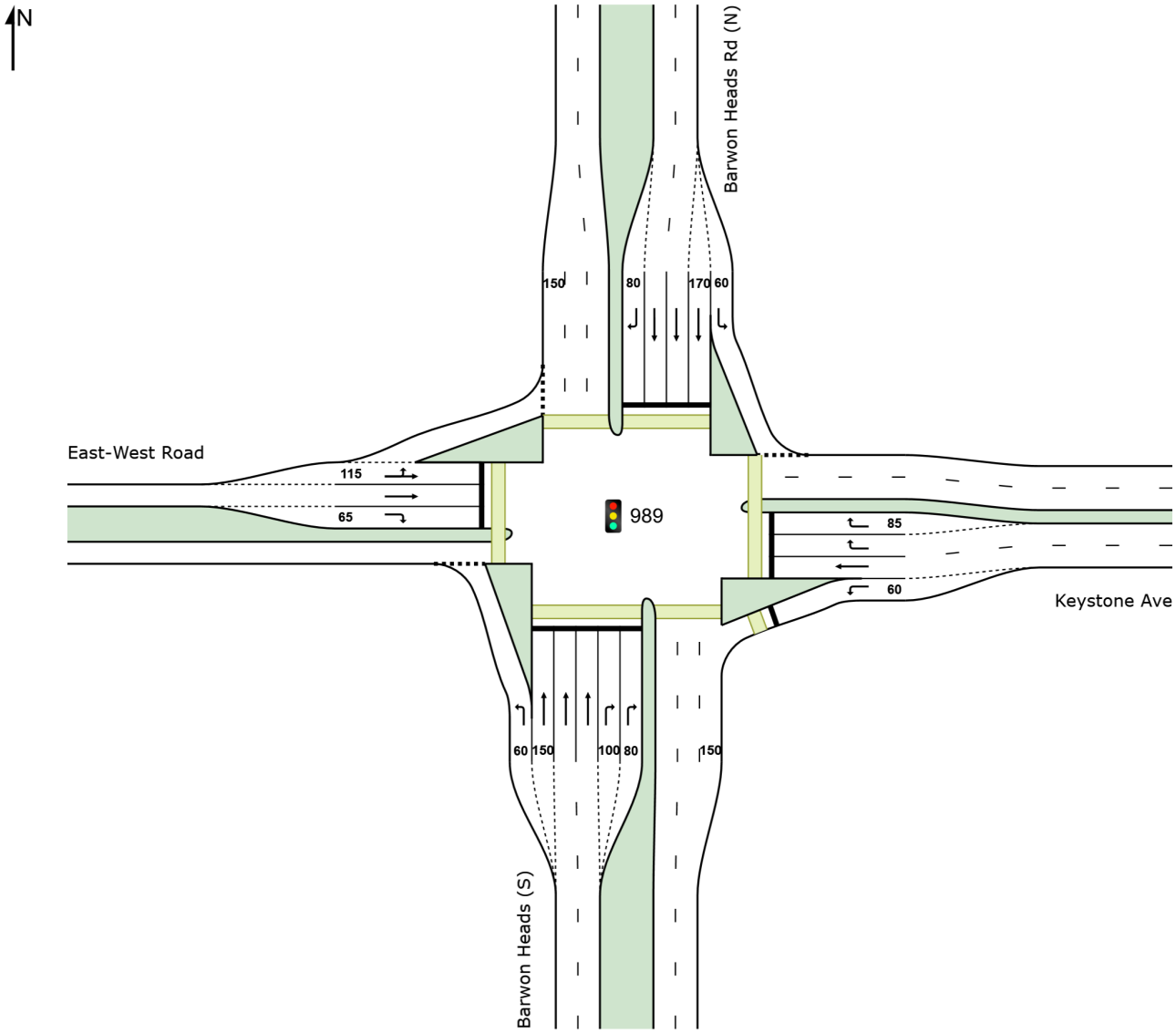
Site: 989 [PM Revised layout (2051) - Keystone Ave / Barwon Heads Rd / Connector 250206 optimised - Final (Site Folder: 250206 - 2051 (Revised volumes / Layout))]

Site Category: Signalised Intersection
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D, E, E1*, E2*
Output Phase Sequence: A, B, C, D, E
(* Variable Phase)

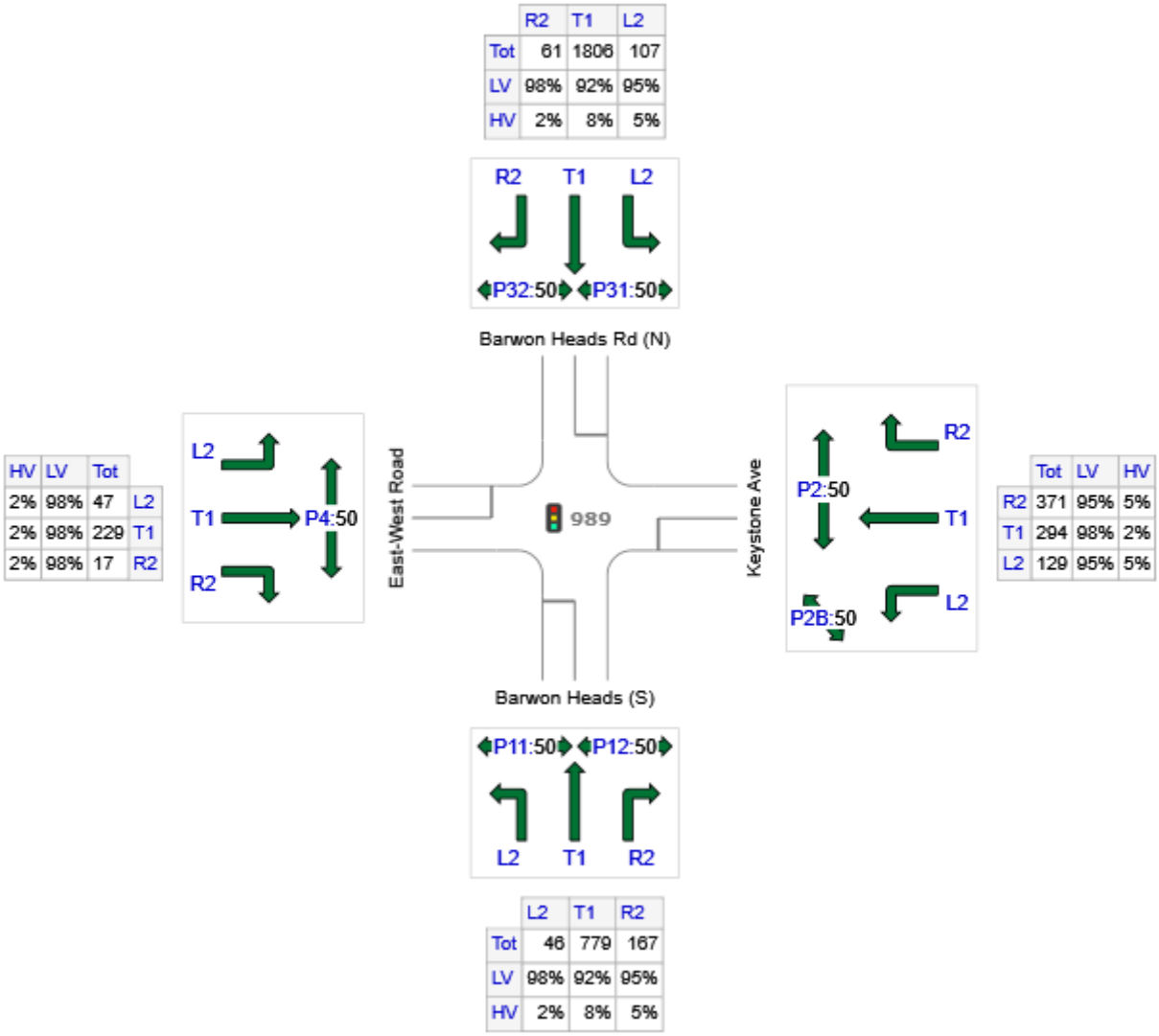
Site Layout

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Barwon Heads (S)	992	920	72
E: Keystone Ave	794	763	31
N: Barwon Heads Rd (N)	1974	1823	151
W: East-West Road	293	287	6
Total	4053	3794	259

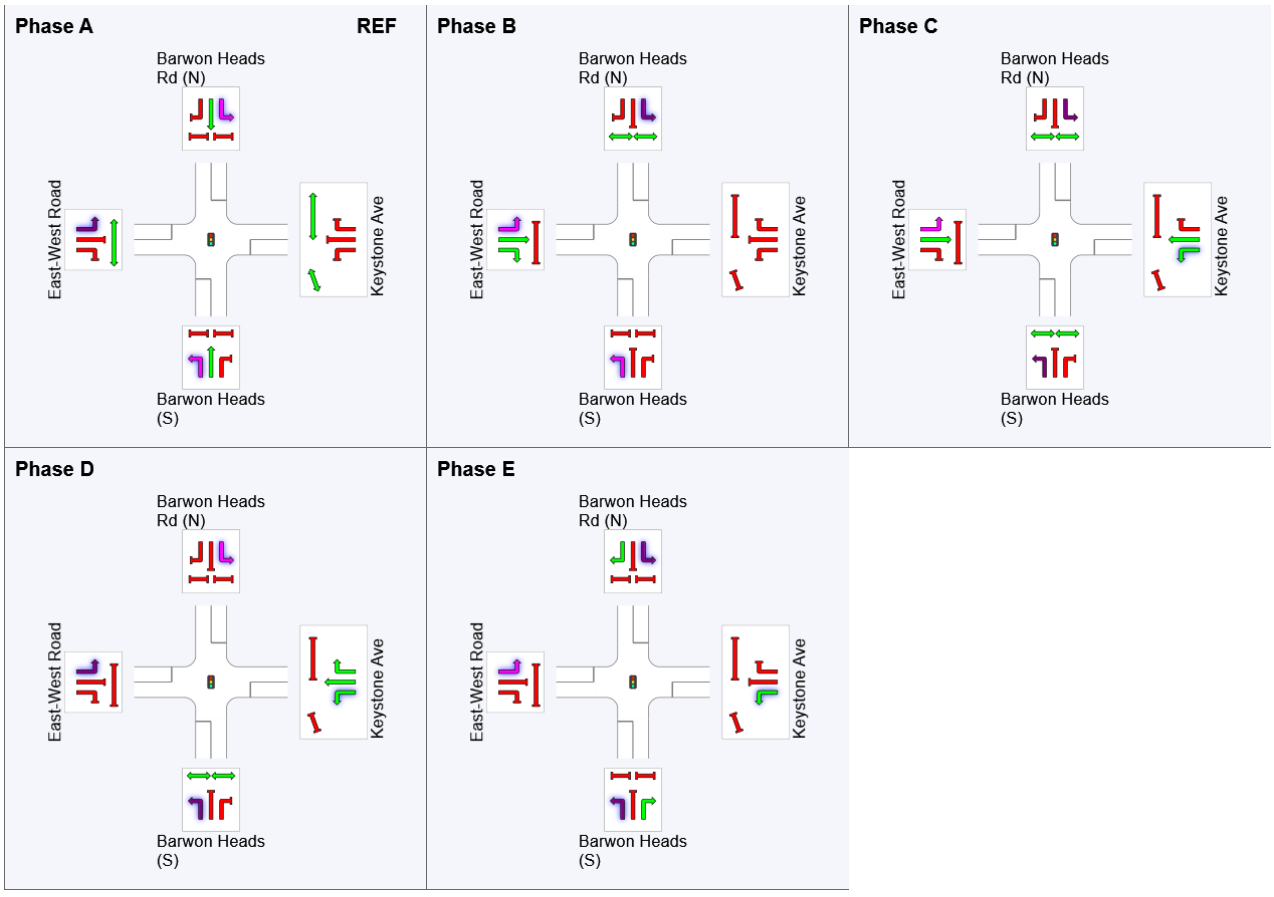
Phase Timing Summary

Phase	A	B	C	D	E
Phase Change Time (sec)	0	44	56	59	78
Green Time (sec)	38	6	***	13	6
Phase Time (sec)	44	12	3	19	12
Phase Split	49%	13%	3%	21%	13%

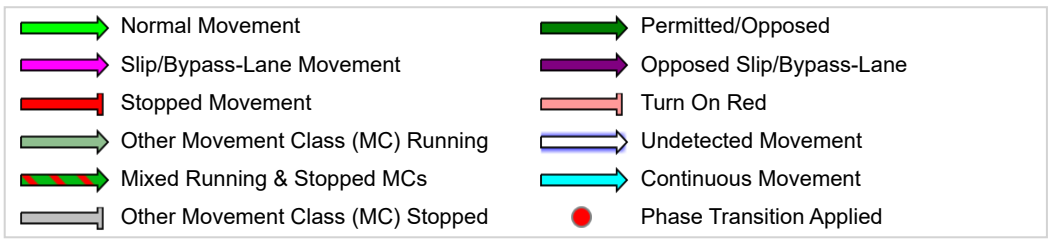
See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

*** No green time has been calculated for this phase because the next phase starts during its intergreen time. This occurs with overlap phasing where there is no single movement connecting this phase to the next, or where the only such movement is a dummy movement with zero minimum green time specified. If a green time is required for this phase, specify a dummy movement with a non-zero minimum green time.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Barwon Heads (S)													
Lane 1	48	2.0	1260	0.038	100	10.2	LOS B	0.6	4.1	Short	60	0.0	NA
Lane 2	245	8.0	783	0.313	85[6]	18.7	LOS B	7.1	53.4	Short	150	0.0	NA
Lane 3	288	8.0	783	0.368	100	19.2	LOS B	8.6	64.5	Full	500	0.0	0.0
Lane 4	288	8.0	783	0.368	100	19.1	LOS B	8.6	64.5	Full	500	0.0	0.0
Lane 5	85	10.4	115	0.735	100	56.8	LOS E	4.1	31.2	Short	100	0.0	NA
Lane 6	91	0.0	124	0.735	100	56.3	LOS E	4.4	30.6	Short	80	0.0	NA
Approach	1044	7.2		0.735		24.9	LOS C	8.6	64.5				
East: Keystone Ave													
Lane 1	136	5.0	558	0.243	100	31.2	LOS C	4.5	32.6	Short	60	0.0	NA
Lane 2	309	2.0	342	0.904	100	52.7	LOS D	16.3	116.2	Full	500	0.0	0.0
Lane 3	195	5.0	259	0.754	100	49.7	LOS D	9.0	65.5	Full	500	0.0	0.0
Lane 4	195	5.0	259	0.754	100	49.6	LOS D	9.0	65.5	Short	85	0.0	NA
Approach	836	3.9		0.904		47.8	LOS D	16.3	116.2				
North: Barwon Heads Rd (N)													
Lane 1	113	5.0	1390	0.081	100	7.9	LOS A	0.8	5.6	Short	60	0.0	NA
Lane 2	550	8.0	734[1]	0.749	85[6]	24.6	LOS C	20.4	152.9	Short	170	0.0	NA
Lane 3	689	8.0	783	0.881	100	36.9	LOS D	33.5	250.8	Full	500	0.0	0.0
Lane 4	661	8.0	751[1]	0.881	100	36.2	LOS D	31.7	237.3	Full	500	0.0	0.0
Lane 5	64	2.0	122	0.526	100	53.9	LOS D	3.0	21.0	Short	80	0.0	NA
Approach	2078	7.7		0.881		32.4	LOS C	33.5	250.8				
West: East-West Road													
Lane 1	159	2.0	233	0.683	100	29.9	LOS C	5.2	37.2	Short	115	0.0	NA
Lane 2	131	2.0	192	0.683	100	45.5	LOS D	6.0	42.8	Full	500	0.0	0.0
Lane 3	18	2.0	122	0.147	100	50.9	LOS D	0.8	5.6	Short	65	0.0	NA
Approach	308	2.0		0.683		37.8	LOS D	6.0	42.8				
Intersection	4266	6.4		0.904		34.0	LOS C	33.5	250.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects

Appendix B Concept Layouts

PLOTTED BY : rabraham ON 06-Jun-25 AT 1:08:00 PM

AMENDMENTS

ISSUE	DATE	DESCRIPTION	BY	CHK.	APP.
P3	06.06.25	MODIFICATIONS TO EAST WEST ROAD ALIGNMENT	R.A.	A.D.	R.H.
P2	06.05.25	MINOR MODIFICATIONS	R.A.	A.D.	R.H.
P1	22.04.25	INITIAL ISSUE	R.A.	A.D.	R.H.

GENERAL NOTES

1. BASE INFORMATION OBTAINED FROM NEARMAP AERIAL PHOTOGRAPHY. STANTEC DOES NOT TAKE ANY RESPONSIBILITY FOR THE ACCURACY OF THE EXISTING CONDITIONS BASE (AERIAL PHOTOGRAPHY) ON WHICH THE SETOUT DETAIL IS BASED. PRIOR TO COMMENCEMENT OF CONSTRUCTION, THE EXISTING CONDITIONS INCLUDING UNDERGROUND SERVICES SHOULD BE VERIFIED ON SITE.
2. ALL DIMENSIONS AND RADII ARE IN METRES AND ARE TO THE FACE OF KERB AND CHANNEL.
3. DECLARED MAIN ROAD - BARWON HEADS ROAD - SPEED ZONE 80KM/H
   LOCAL ROAD - KEYSTONE AVENUE - SPEED ZONE 60KM/H
   LOCAL ROAD - EAST WEST ROAD - SPEED ZONE 60KM/H

DESIGNED: R. ABRAHAM	DESIGN CHECK: A. DELL'ISOLA
DRAWN: R. ABRAHAM	DRAFTING CHECK: A. DELL'ISOLA
APPROVED BY: R. HUMPHREYS	DATE APPROVED FOR INITIAL ISSUE: 22 APRIL 2025
SCALE A3 Hor. 0 20 40	CUSTOM 2000 CAD FILE NO. 300305412_01_p3.dgn

Stantec

CLIENT CIVILISATION PTY LTD

ARMSTRONG CREEK GROWTH AREA

BARWON HEADS ROAD

MARSHALL

CONCEPT LAYOUT PLAN - ULTIMATE

MAP REF.	DRAWING NO.	ISSUE
466/C7	300305412_01_01	P3

PRELIMINARY PLAN
FOR DISCUSSION PURPOSES ONLY SUBJECT TO CHANGE WITHOUT NOTIFICATION

WARNING
BEWARE OF UNDERGROUND SERVICES
THE LOCATIONS OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

PLOTTED BY : rabraham ON 06-Jun-25 AT 4:02:51 PM

AMENDMENTS

ISSUE	DATE	DESCRIPTION	BY	CHK.	APP.
P3	06.06.25	MODIFICATIONS TO EAST WEST ROAD ALIGNMENT	R.A.	A.D.	R.H.
P2	06.05.25	MINOR MODIFICATIONS	R.A.	A.D.	R.H.
P1	22.04.25	INITIAL ISSUE	R.A.	A.D.	R.H.

GENERAL NOTES

1. BASE INFORMATION OBTAINED FROM NEARMAP AERIAL PHOTOGRAPHY. STANTEC DOES NOT TAKE ANY RESPONSIBILITY FOR THE ACCURACY OF THE EXISTING CONDITIONS BASE (AERIAL PHOTOGRAPHY) ON WHICH THE SETOUT DETAIL IS BASED. PRIOR TO COMMENCEMENT OF CONSTRUCTION, THE EXISTING CONDITIONS INCLUDING UNDERGROUND SERVICES SHOULD BE VERIFIED ON SITE.
2. ALL DIMENSIONS AND RADII ARE IN METRES AND ARE TO THE FACE OF KERB AND CHANNEL.
3. DECLARED MAIN ROAD - BARWON HEADS ROAD - SPEED ZONE 80KM/H
   LOCAL ROAD - KEYSTONE AVENUE - SPEED ZONE 60KM/H
   LOCAL ROAD - EAST WEST ROAD - SPEED ZONE 60KM/H

DESIGNED: R. ABRAHAM	DESIGN CHECK: A. DELL'ISOLA
DRAWN: R. ABRAHAM	DRAFTING CHECK: A. DELL'ISOLA
APPROVED BY: R. HUMPHREYS	DATE APPROVED FOR INITIAL ISSUE: 22 APRIL 2025
SCALE A3 Hor. 0 20 40	CAD FILE NO. CUSTOM 2000 300305412_02_p3.dgn

Stantec

CLIENT CIVILISATION PTY LTD

ARMSTRONG CREEK GROWTH AREA

BARWON HEADS ROAD

MARSHALL

CONCEPT LAYOUT PLAN - INTERIM

MAP REF.	DRAWING NO.	ISSUE
466/C7	300305412_02_01	P3

RESIDENTIAL

BARWON HEADS ROAD

KEYSTONE AVENUE

PROPOSED INDUSTRIAL

MATCH TO EXISTING

LIMIT OF WORK

APPROX. AREA OF LAND TAKE = 5412.25 sq.m.

MATCH TO EXISTING

LIMIT OF WORK

MATCH TO EXISTING

EAST WEST ROAD

LIMIT OF WORK

MATCH TO EXISTING

VACANT

APPROX. AREA OF LAND TAKE = 6924.21 sq.m.

RESIDENTIAL

LIMIT OF WORK

N

PRELIMINARY PLAN
FOR DISCUSSION PURPOSES ONLY SUBJECT TO CHANGE WITHOUT NOTIFICATION

WARNING
BEWARE OF UNDERGROUND SERVICES
THE LOCATIONS OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

PLOTTED BY : rabraham ON 06-Jun-25 AT 5:27:18 PM

AMENDMENTS

ISSUE	DATE	DESCRIPTION	BY	CHK.	APP.
P3	06.06.25	MODIFICATIONS TO EAST WEST ROAD ALIGNMENT	R.A.	A.D.	R.H.
P2	06.05.25	MINOR MODIFICATIONS	R.A.	A.D.	R.H.
P1	22.04.25	INITIAL ISSUE	R.A.	A.D.	R.H.

GENERAL NOTES

1. BASE INFORMATION OBTAINED FROM NEARMAP AERIAL PHOTOGRAPHY. STANTEC DOES NOT TAKE ANY RESPONSIBILITY FOR THE ACCURACY OF THE EXISTING CONDITIONS BASE (AERIAL PHOTOGRAPHY) ON WHICH THE SETOUT DETAIL IS BASED. PRIOR TO COMMENCEMENT OF CONSTRUCTION, THE EXISTING CONDITIONS INCLUDING UNDERGROUND SERVICES SHOULD BE VERIFIED ON SITE.
2. ALL DIMENSIONS AND RADII ARE IN METRES AND ARE TO THE FACE OF KERB AND CHANNEL.
3. DECLARED MAIN ROAD - BARWON HEADS ROAD - SPEED ZONE 80KM/H
   LOCAL ROAD - KEYSTONE AVENUE - SPEED ZONE 60KM/H
   LOCAL ROAD - EAST WEST ROAD - SPEED ZONE 60KM/H

DESIGNED: R. ABRAHAM	DESIGN CHECK: A. DELL'ISOLA
DRAWN: R. ABRAHAM	DRAFTING CHECK: A. DELL'ISOLA
APPROVED BY: R. HUMPHREYS	DATE APPROVED FOR INITIAL ISSUE: 22 APRIL 2025
SCALE A3 Hor. 0 20 40	CUSTOM 2000 CAD FILE NO. 300305412_03_p3.dgn

Stantec

CLIENT CIVILISATION PTY LTD

ARMSTRONG CREEK GROWTH AREA

BARWON HEADS ROAD

MARSHALL

LAND TAKE PLAN

MAP REF.	DRAWING NO.	ISSUE
466/C7	300305412_03_01	P3