Greater Geelong Planning Scheme Amendment 278ggee Marshall Precinct Structure Plan

Expert Witness Report

Stantec

Prepared for:
Re-Grow Geelong Pty Ltd c/o Maddocks

28 October 2024

Prepared by:
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Project/File:
300305031

Stantec Australia Pty Ltd

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1 Introduction

1.1 Background

Amendment C278ggee (referred to within this report as the "Amendment") to the City of Greater Geelong Planning Scheme proposes to implement the Marshall Precinct Structure Plan (PSP) and Development Contributions Plan (DCP). The PSP sets out the vision and a long-term plan to guide the development of the precinct, while the DCP identifies the need and apportionment of costs for the infrastructure required to support the anticipated development scenario as described in the PSP.

The Marshall PSP is the northern most residential development PSP in the Armstrong Creek Urban Growth Plan (ACUGP), originally adopted by the City of Greater Geelong (the City) in 2008. The ACUGP set the long-term strategic planning directions to guide the creation of sustainable urban growth within Armstrong Creek and is anticipated to provide housing for 54,000 people in 22,000 households. The majority of the Armstrong Creek Urban Growth Area (ACUGA) has since been planned, formalised and development has substantially commenced.

The Marshall precinct is located approximately seven kilometres south of central Geelong, and is bounded by significant transport infrastructure, including Marshall Railway Station on the Geelong to Waurn Ponds passenger rail line, and two significant arterial roads: Barwon Heads Road and the proposed Geelong Ring Road Extension (Bellarine Link).

When complete, the Marshall PSP will accommodate the land uses summarised in Table 1.1.

Table 1.1: Marshall Development Schedule

Land Use	Proposed
Residential	1,555 dwellings
Community Facilities	Potential community centre within the station precinct
Retail	2,750 sqm
Non-retail commercial	2,250 sqm

Cardno (now part of Stantec) were commissioned by the City of Greater Geelong (the City) in 2016 to provide transport advice as part of the Marshall PSP Master Planning process, as per the 2019 report that is currently on exhibition. This report was prepared by staff members who have since left Cardno and are not employed at Stantec and was prior to my own employment at Stantec. I have had no involvement in the preparation of the 2019 Cardno report.

1.2 Expert Witness Details

Name: Reece Humphreys BE (Civil)

Position: Business Lead, Transport Planning and Advisory, Stantec

Address: L28, 600 Bourke Street, Melbourne

Areas of Expertise: Traffic Engineering, Transport Modelling & Transport Planning

I have more than 20 years' experience in Transport and am currently Business Lead for Transport – Planning and Advisory (Vic/SA) and the Market Lead – Transport at Stantec. I have strong technical skills and business acumen, commercial astuteness and thorough understanding of project lifecycle including defining issues and developing solutions. This experience covers transport planning, engineering design and analysis (modelling) and has worked on large scale transport projects and assignments in Melbourne, Sydney and across Australia.

I have completed several projects for all transport agencies across Australia that include a series of large regional transport plans and strategies, integrated transport assessments, congested management and transport corridor planning. I often provide expert evidence for both Government and private sector clients and have provided evidence on several transport corridor and growth area panels. I also play an active role in industry and community organisations including as a board member and Chair of the AITPM. I am a Certified Engineer (CPEng) with Engineers Australia and a Committee Member for my local Football Club.

Further details of my experience are provided in **Error! Reference source not found.**.

1.3 Relationship to the Applicant

I have been retained to provide expert witness services at this hearing for a mutually agreed fee. Stantec are currently engaged by Re-Grow, who are owners of four landholdings within the North East Industrial Precinct (NEIP) Structure Plan.

I have previously provided advice to the City of Greater Geelong on a range of strategic transport matters for the planning and management of the transport network.

1.4 Instructions and Scope of this Report

I have been engaged to prepare and present expert traffic and transport evidence as part of the Panel Hearing to consider the Amendment. Prior to preparing this evidence I was briefed by Maddocks lawyers via both verbal and written instructions.

In undertaking an assessment of documents and background materials, I have been asked to prepare an expert witness statement which addresses the following:

1. *Design and costing of the proposed cross intersection between the east west connector and Barwon Heads Road and the NEIP (project ID DI_IT_02)*
2. *The unplanned commercial / bulky goods area located in the north eastern quadrant of the Marshall PSP, and*

1.5 References

In preparing this evidence, reference has been made to the following:

1. The City of Greater Geelong Planning Scheme
2. The Marshall PSP Transport Impact Assessment Report (TIAR) prepared by Ratio Consultants in March 2023
3. Precinct Structure Plan prepared by the City of Greater Geelong in July 2023 and updated in March 2024
4. Development Contributions Plan prepared by the City of Greater Geelong dated February 2024
5. Marshall Precinct Structure Plan – Preliminary Transport Infrastructure Assessment prepared by Cardno dated 2019
6. Marshall PSP Traffic Impact Assessment Report prepared by Ratio in March 2023
7. DCP and ICP Guidelines
8. Other documents as nominated in this report

1.6 Tests, Experiments & Assistance

In preparing this evidence, I received assistance from the following people:

Alex Blackett	Senior Principal Transport Planner	BE (Civil), GDip Behaviour Science
Liz Irvin	Senior Transport Planner	BSc (Hons), MEng (Chemical)

2 Marshall Precinct Structure Plan

2.1 The Amendment

Amendment C278ggee ('the Amendment') to the Greater Geelong Planning Scheme seeks to facilitate residential and commercial development in accordance with the Marshall PSP. The Amendment proposes to:

- apply the Urban Growth Zone Schedule 7 (UGZ7) to the Marshall Precinct (noting the precinct is currently zoned UGZ with no schedule);
- incorporate the Marshall PSP, the Marshall DCP and the Marshall Native Vegetation Precinct Plan;
- apply the Design and Development Overlay – Schedule 51 (DDO51) to 137 Barwarre Road, Marshall to safeguard future access to Marshall Railway Station from Barwarre Road; and
- apply an Environmental Audit Overlay (EAO) to potentially contaminated land.

This report focuses on the PSP and DCP documentation.

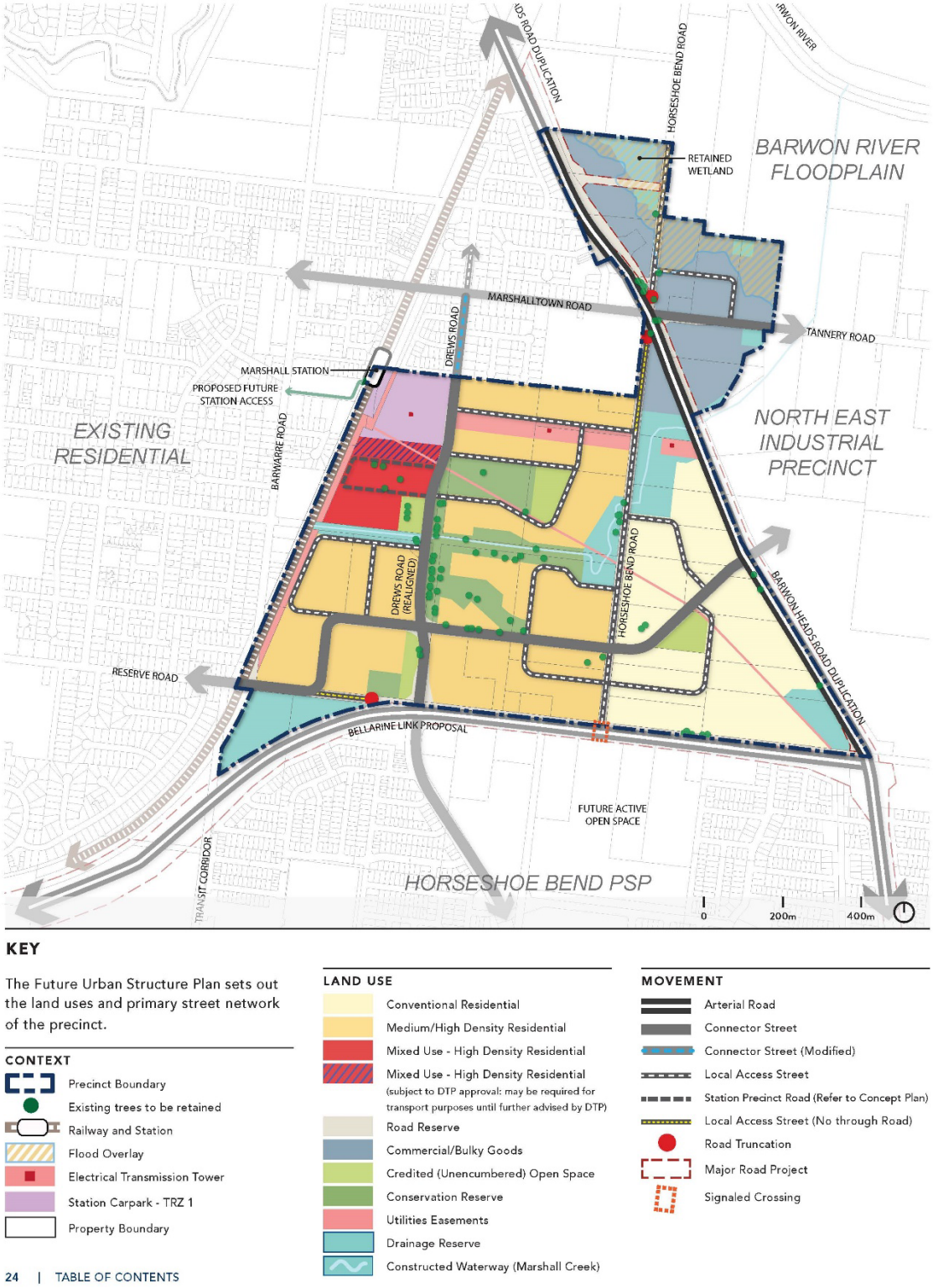
2.2 The Precinct

The Marshall Precinct is located approximately 7km southeast of central Geelong. It is the northernmost residential precinct in the Armstrong Creek Urban Growth Plan, which is anticipated to include 22,000 new homes in total. The Marshall precinct is generally bounded by the Geelong to Waurn Ponds passenger railway line to the west, Barwon Heads Roads to the east and the edge of existing residential development to the south. There is also a small area to the east of Barwon Heads Road near the intersection of Marshalltown Road and Tannery Road. The precinct covers approximately 123 hectares of land and is envisioned to be a distinctive residential and commercial neighbourhood set within a semi-natural environment.

The transport network of the PSP has been developed to align with the existing network and with the adjacent PSP areas. One main north-south and one east-west route is designated for future bus routes, which means all parts of the PSP would be within 400m of existing or future bus routes. In addition, approximately two-thirds of the PSP area is within 800m of the Marshall Railway Station. The cycling network will be delivered through a combination of on-road bicycle lanes and connector streets and off-road paths.

The proposed urban structure and road network, prepared by the City of Greater Geelong for Marshall PSP is shown in Figure 2.1.

Figure 2.1:Marshall PSP – Plan 5: Future Urban Structure



Source: Marshall PSP, March 2024

The PSP is characterised by a range of road typologies that respond to the existing and proposed environment. Connector roads will form the basis of the major traffic movement network, including the East-West Connector Road, Tannery Road, Drews Road, and Reserve Road. These will all be bus-capable roads, in addition to Marshalltown Road to the north of the precinct, and Barwon Heads Road to the east.

2.3 Road network

The existing road network is depicted by a mix of old and upgraded arterial roads, distributer roads, residential / urban roads and new roads to support new development within the Armstrong Creek Growth Area. The key roads relevant to my evidence are discussed in the following sub sections.

2.3.1 Barwon Heads Road

Barwon Heads Road (B121) functions as an arterial road controlled by the Victorian government and is part of the freight network (F2/F3 in Movement and Place and on the gazetted B Double network). The F2/F3 freight rating indicates its importance of the road in the overall network.

Barwon Heads Road has recently been duplicated and has two lanes in each direction with a sign posted speed of 70km/hr. A shared path is provided along the western side of the road, with on road cycle lanes provided on both the northbound and southbound carriageways.

Since the completion of the duplication, traffic volumes on Barwon Heads Road have increased significantly, with 2024 traffic counts recording volumes of between 22,000 and 24,000 vehicles per day.

2.3.2 Reserve Road

Reserve Road is classified as a secondary distributor between Torquay Road and Barwon Heads Road, and a local road to the east of Barwon Heads Road. The posted speed limit is 60km/h. Reserve Road will provide the interim east-west connection along the southern boundary of the Marshall PSP area before the Geelong Ring Road Extension (Bellarine Link) is delivered. The Horseshoe Bend PSP area is located to the south of Reserve Road so connections across this road will be important for access to school, community facilities and other amenities and services.

2.3.3 Geelong Ring Road Extension (Bellarine Link)

In the future, the Geelong Ring Road Extension (Bellarine Link) will extend the Geelong Ring Road between Baanip Boulevard (Surf Coast Highway) and Barwon Heads Road. When completed, the link has the potential to be constructed as a dual carriage way freeway standard road with two lanes in each direction.

The State Government has prepared a Business Case for the current planning area which is between the Surf Coast Highway and Barwon Heads Road, with future planning considering the extension of the link to Portarlington Road. The location of the link in the context of Geelong is reproduced in Figure 2.2.

Figure 2.2: Geelong Ring Road Extension (Bellarine Link) in the context of the Marshall PSP

The Geelong Ring Road Extension (Bellarine Link) would form the southern boundary of Marshall PSP and would use a similar alignment to Reserve Road. Initially, the Barwon Heads Road intersection was intended to be grade separated by the State. Future planning will investigate further extending Geelong Ring Road Extension (Bellarine Link) to Portarlington Road.

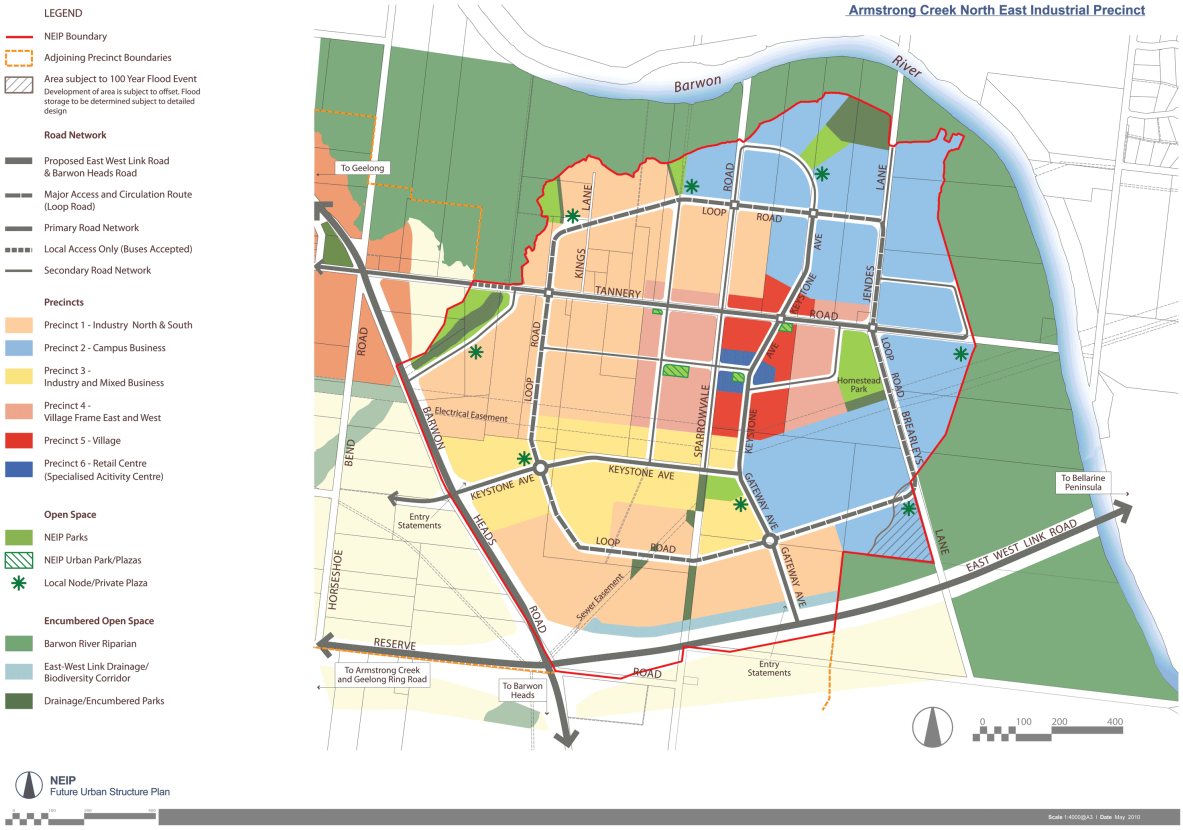
3 North East Industrial Precinct (NEIP)

3.1 Introduction

The North East Industrial Precinct (NEIP) is an employment precinct that was incorporated into the Geelong Planning Scheme in 2010. The NEIP covers approximately 180 hectares and is bounded by the Barwon River to the north and east, Barwon Heads Road to the west and the future Geelong Ring Road Extension (Bellarine Link) to the south.

When completed, the precinct will include a mix of retail and industrial land uses and is predicted to provide approximately 8,000 jobs. The Future Urban Structure of the PSP is shown in Figure 3.1.

Figure 3.1: NEIP Future Urban Structure



The NEIP will ultimately be the second largest employment precinct in Geelong, outside of the existing CBD.

3.2 Transport Impact Assessment

A Transport Impact Assessment Report (TIAR) was completed by GTA Consultants in 2009 that supported the Amendment for the NEIP. The key land use assumptions that underpinned the assessment include:

- A total of 8,000 employees across 53.8ha of redeveloped land
- 85,400sqm of retail floor use servicing the NEIP and surrounding area
- 90,200sqm of retail trade such as building supplies, repair workshops and printing IT services
- 350,000sqm of industry and business, education and short-term accommodation.
- 189,400sqm of industry and business with larger warehousing components

The total land uses and analysis at the time forecast a site traffic generation of 6,100vph in a peak hour (100 vehicles every minute) and 31,500vpd across the course of a day.

3.2.1 Approved Access Strategy

The approved access to the NEIP will provide three access points to the arterial road network as follows:

1. A signalised intersection at the Barwon Heads Road / Tannery Road / Marshalltown Road / Horseshoe Bend Road intersection.
2. It is noted that direct access to the NEIP at Tannery Road within the site is nominated as bus only – i.e. no vehicle access to the NEIP is permitted at this intersection.
3. A signalised intersection will be provided at the Keystone Avenue / Barwon Heads Road intersection. This intersection is referred to as Intersection IT-02 in the Marshall PSP and DCP documentation, and
4. An at grade signalised intersection will be provided at the intersection of Gateway Avenue / Geelong Ring Road Extension (Bellarine Link).

The location of the access points are shown in Figure 3.2.

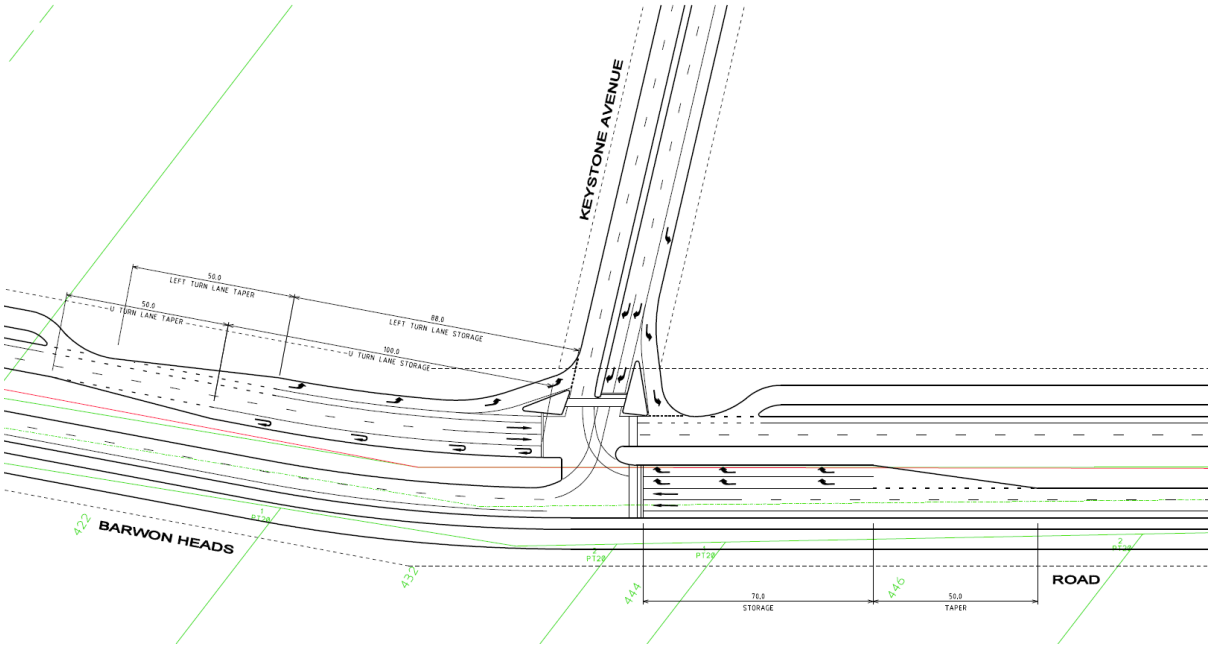
Figure 3.2: NEIP Approved Access Points

The two intersections that abut the Marshall PSP are those on Barwon Heads Road. The Keystone Avenue Intersection is discussed in the following Section, whilst the Horseshoe Bend Intersection is discussed in Section 4.

3.2.2 Barwon Heads Road Keystone Avenue Intersection

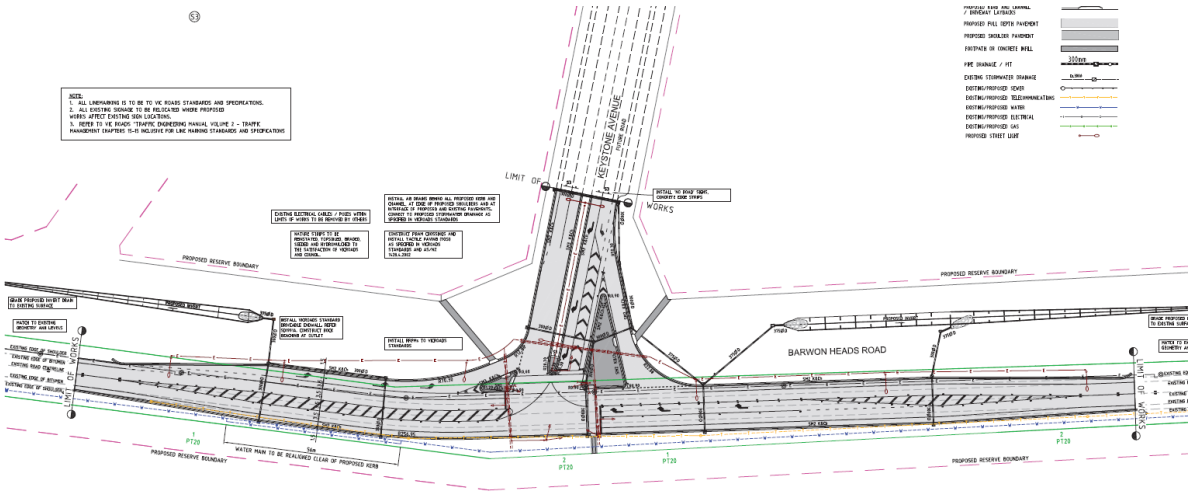
At the time of the preparation of the NEIP TIAR, the intersection of Barwon Heads Road and Keystone Avenue was a “T-intersection” and did not connect into the Mashall PSP. The traffic analysis considered the layout of the intersection at full development of the NEIP and a duplicated Barwon Heads Road, which is reproduced in Figure 3.3.

Figure 3.3: Barwon Heads Road / Keystone Avenue intersection at full development of the NEIP (as per the 2009 GTA Consultants Report)



The NEIP DCP includes an interim intersection arrangement that does not include the duplication of Barwon Heads Road and is shown in Figure 3.4.

Figure 3.4: Barwon Heads Road / Keystone Avenue Intersection as per the NEIP DCP



The DCP intersection included the construction of left and right turn lanes into and from Keystone Avenue with the ability to provide a second right turn lane on Keystone Avenue for when the duplication of Barwon Heads Road is delivered.

4 Marshall traffic analysis

4.1 Introduction

Traffic analysis for the Marshall PSP is underpinned by two reports:

1. The Marshall PSP Preliminary Transport Infrastructure Assessment prepared by Cardno for the City of Greater Geelong in 2019, and
2. The Marshall Precinct Structure Plan Traffic Impact Assessment prepared by Ratio Consultants dated March 2023.

The reports have accompanied the exhibited PSP and include analysis of the intersection of Barwon Heads Road and Keystone Avenue (IT-02). Neither report contemplates or assess the intersection of Marshalltown Road and Barwon Heads Road.

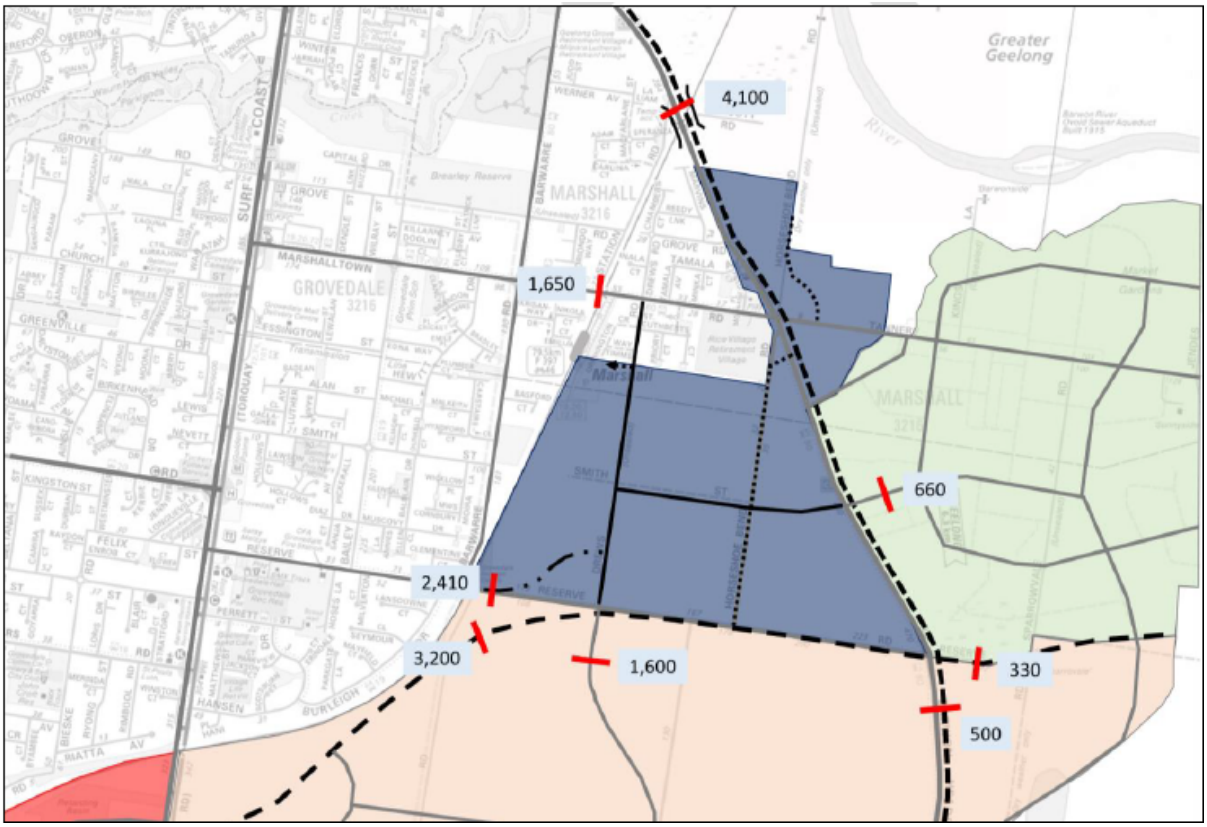
A review of the reports specific to IT-02 are discussed in the following sections.

4.2 Cardno Report

The Cardno report was completed using 2015 existing conditions data and intersection counts and was underpinned by a bespoke traffic model that applied traffic estimates from the Marshall PSP which appears to be completed in a spreadsheet type model. Two scenarios were considered for the road network being 2031 (interim) and 2046 (ultimate). The ultimate scenario relied upon traffic growth from a “Jacobs Ring Road Extension Model” of which I have had no access to.

As it related to the intersection of IT-02, the Cardno Report assumed that 660 vehicles per day would access the NEIP via Keystone Avenue, as shown in Figure 4.1.

Figure 4.1: Estimated Daily Volumes from Marshal PSP (Figure 7-1 of 2019 Cardno Report)



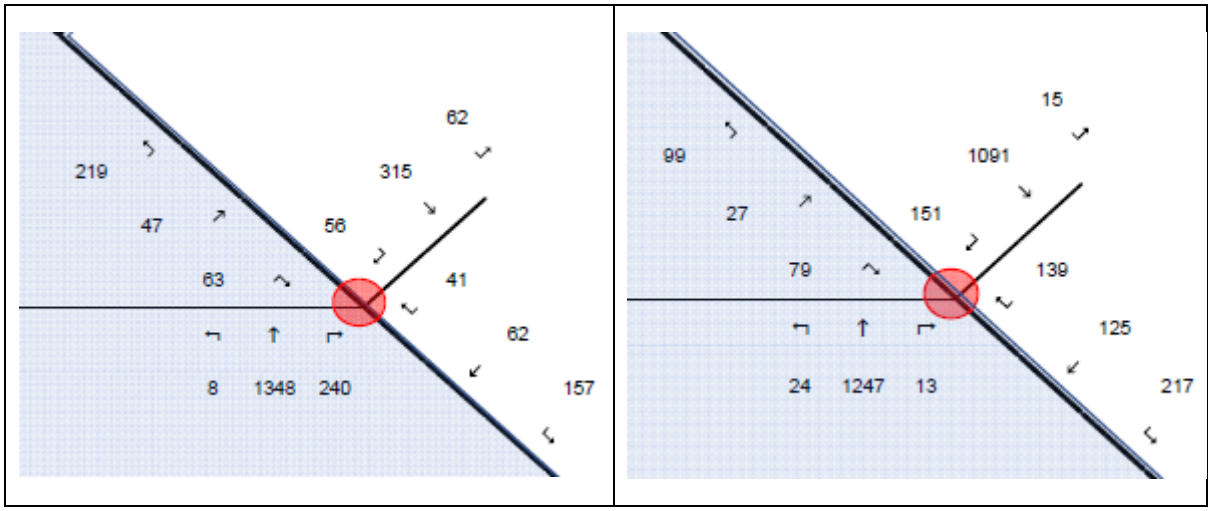
The peak period turning movement volumes in Appendix A of the Cardno Report assume that the NEIP would generate the following vehicle movements into and out of the precinct at Keystone Avenue:

1. 560 movements in the AM peak and 663 movements in the PM peak for the interim 2031 scenario, and
2. 609 movements in the AM peak and 536 movements in the PM peak for the ultimate 2046 scenario

The peak period volumes are very inconsistent with the daily volumes articulated in Figure 7-1 of the Cardno report. It is also unclear as to why the volumes reduce in 2046 from the NEIP, but it can only be assumed that this is based on the 2046 volumes ascertained from the Jacobs analysis.

The 2046 'Ultimate' scenario peak hour turning movements are reproduced in Figure 4.2.

Figure 4.2: 2046 AM (left) and PM (right) 'Ultimate' volumes at IT-02 as per the 2019 Cardno Report



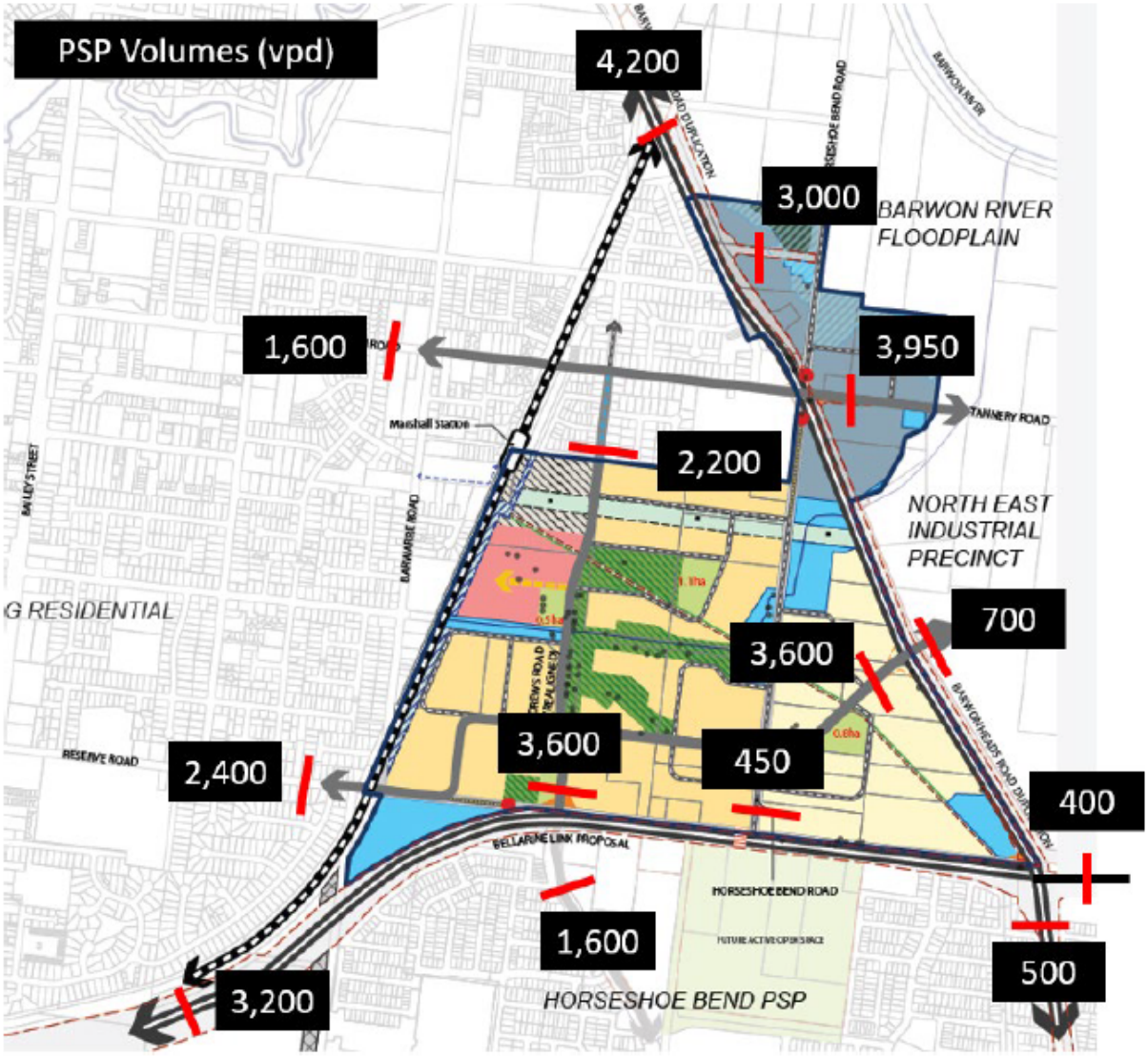
The Cardno Report also includes analysis of the intersection for the interim (2031) and ultimate (2046) design years in Section 8.4 of the report. This analysis indicated that the intersection would operate with a degree of saturation of 0.89 in the interim and 0.75 in the ultimate scenarios.

Based on the inputs and analysis presented in the Cardno report, I have concerns on the accuracy and veracity of the traffic analysis undertaken for IT-02 and by extension, the broader transport network.

4.2.1 Ratio Traffic Impact Assessment

Marshall Traffic Impact Assessment (TIA) prepared by Ratio relied upon first principles trip generation for the NEIP and 2046 volumes sourced from the 2019 Cardno Report. IT-02 was assumed to have 700 vehicles per day accessing the NEIP via Keystone Avenue, as shown in Figure 4.3.

Figure 4.3: Estimated Daily Volumes from Marshall PSP (Figure 6-1 of the Ratio Report)



The 700 vehicles per day is a higher estimate of daily traffic when compared to the 2019 Cardno Report.

A further review of the report indicated that the analysis for IT-02 was based on the 2046 'Ultimate' volumes in the Cardno report. I have reviewed the SIDRA analysis presented in the Ratio report and can confirm that the volumes used in the analysis are the same as those presented in Figure 4.2 of this report.

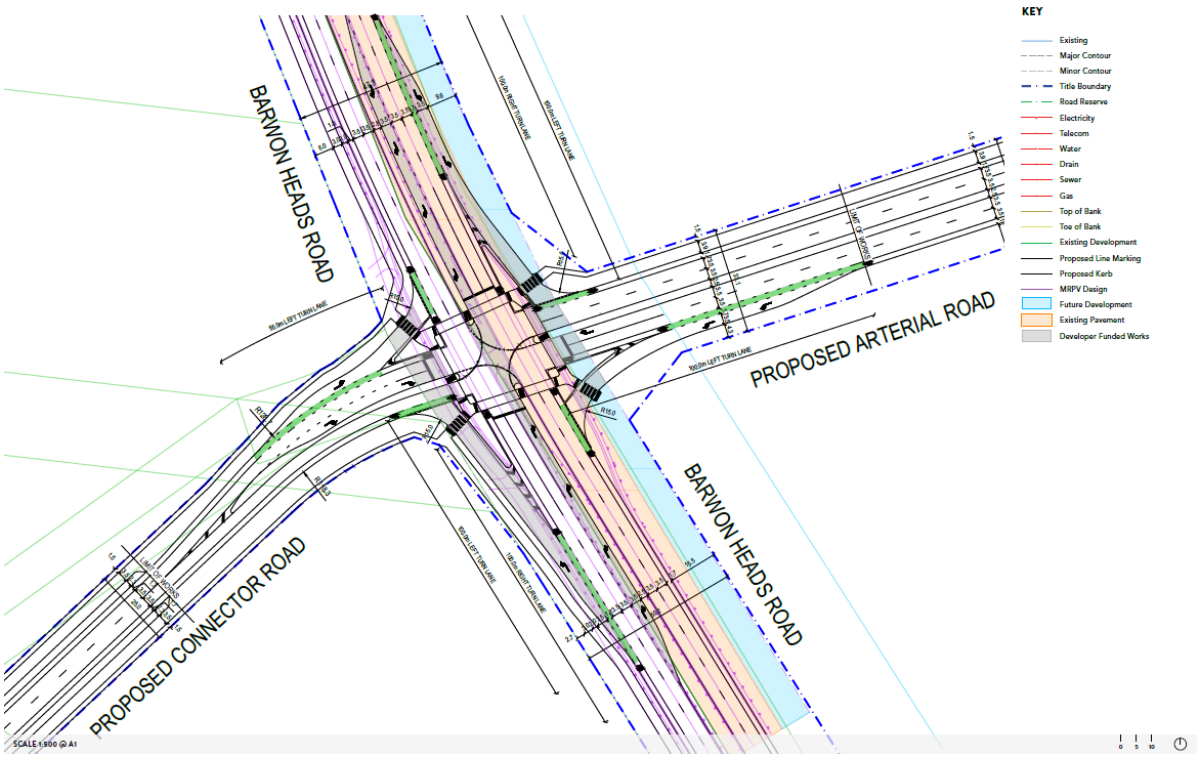
Based on my review, it is clear that the analysis completed for IT-02 does not consider the expected traffic generated by the NEIP. Further, the forecast volumes for Barwon Heads Road for the 2046 analysis are lower than counts undertaken on Barwon Heads Road in 2024 (refer to Section 5.2.1 of my report). As such, I still have concerns on the accuracy and veracity of the traffic analysis undertaken for IT-02 and by extension, the broader transport network

5 Intersection IT-02 (Barwon Heads Road/Keystone Avenue/Marshal Access)

5.1 Introduction

Requirement 40 of the Marshall PSP includes the provision of the East-West Connector / Barwon Heads Road / NEIP Connector intersection (IT-02), which is based on the concept plan within the DCP. The proposed layout of IT-02 is reproduced in Figure 5.1.

Figure 5.1: Intersection IT-02 (Barwon Heads Road / Keystone Avenue) as shown in the DCP



It is understood that this plan was prepared prior to the completion of the Barwon Heads Road upgrade and is based on an old concept of the road.

The traffic analysis for the NEIP was completed in 2009 and since that time a lot has changed, including:

- Network changes (i.e. Barwon Heads Road duplication, traffic signals delivered at Reserve Road and Tannery Road)
- Surrounding land use has been developed, including the Horseshoe Bend PSP
- Traffic analysis and modelling tools have evolved
- The Greater Geelong City Council and DTP have invested in more planning for the broader network, and
- The approach to DCP analysis has improved with the delivery of PSPs across Victoria.

These considerations should be included in an updated analysis of the intersection to ensure that the layout provided within the DCP is commensurate with the approved and expected traffic demand.

5.2 Intersection Analysis

In order to demonstrate the implications of the NEIP, updated analysis of intersection IT-02 has been undertaken based on a combination of:

1. Updated traffic data for Barwon Heads Road, including future year growth
2. Updated traffic generation for the NEIP, and
3. The traffic generation for the Marshall PSP as per the Cardno and Ratio reports.

I note that this analysis is based on a combination of data points and first principle techniques that have the potential to overstate the level of demand that could travel through the intersection. It does not consider broader land use development and growth within the Armstrong Creek Corridor, including the interaction of employment land uses (i.e. NEIP) with residential uses in Marshall.

Further, the intention of this analysis is to highlight the implications on the intersection design that should have been considered by Cardno and Ratio as part of their assessments.

5.2.1 Barwon Heads Road Traffic Volumes

As mentioned earlier in this report, the duplication of Barwon Heads Road between Settlement Road and Reserve Road was completed in mid-2023, after the completion of the March 2023 Traffic Impact Assessment by Ratio Consultants.

Additional count data has been provided from the City of Greater Geelong and SCATS data for the Barwon Heads Road / Marshalltown Road / Tannery Road which is summarised in the Table 5.1.

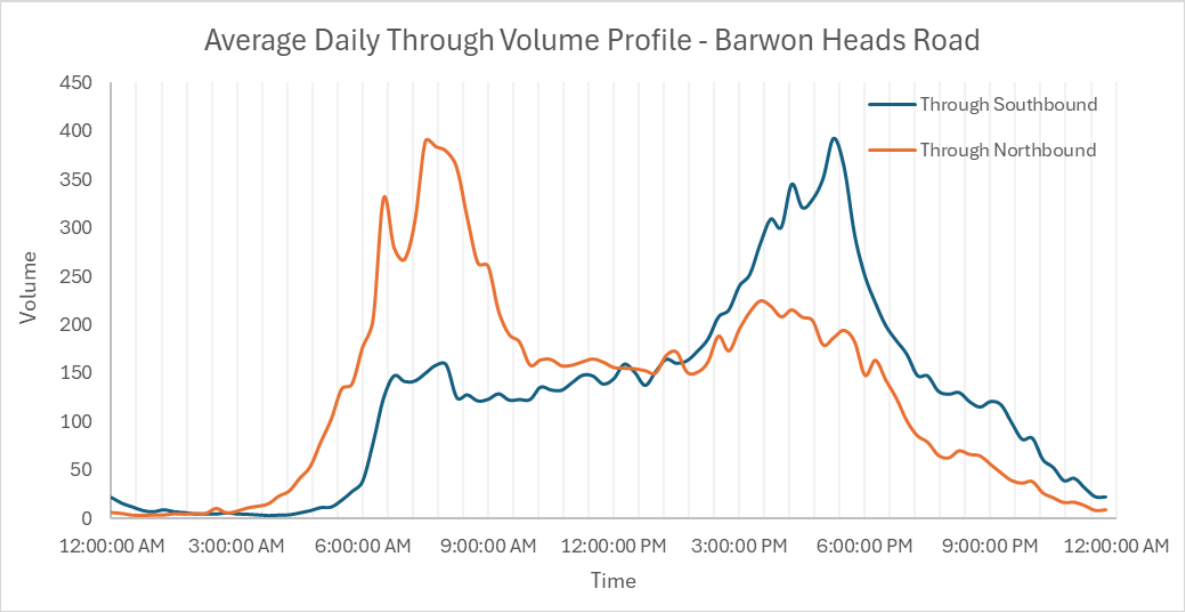
Table 5.1: Existing Traffic Data on Barwon Heads Road (Daily Bidirectional Flow)

Location	April 2024 Traffic Count	Tuesdays and Wednesdays in August 2024
Barwon Heads Road, North of Reserve Road	22,897 vpd	
Barwon Heads Road, South of Marshalltown Road	22,941 vpd	
Barwon Heads Road at Marshalltown Road (SCATS)		24,245 vpd

It is clear that the existing daily volumes on Barwon Heads Road are significantly higher than those used in the Ratio TIA. Indeed, the Cardno and Ratio report and analysis relied upon count data from 2015 that indicated daily volumes of 9,000 vehicles per day between Tannery Road and Reserve Road.

SCATS data has also been extracted with the daily profile presented Figure 5.2. Note that the presented SCATS data is an average of daily traffic volumes on Tuesdays and Wednesdays in the month of August 2024.

Figure 5.2: Barwon Heads Road / Marshalltown Road / Tannery Road Daily SCATS volumes



From the profile above, the peak hours have been determined to occur at 7.30 – 8.30am and 4.45 – 5.45pm. The resultant volumes are provided in Table 5.2.

Table 5.2: Peak and daily volumes on Barwon Heads Road at Marshalltown Road

Period	Southbound	Northbound	Total
AM Peak (7.30-8.30pm)	593 vph	1,512 vph	2,105 vph
PM Peak (4.45-5.45pm)	1,438 vph	764 vph	2,202 vph
Daily	11,870 vpd	12,375 vpd	24,245 vpd

The SCATS data presented in Table 5.2 shows that the PM peak is marginally higher than the AM peak, however both periods show a strong tidal inbound to Geelong (AM peak) and outbound from Geelong (PM peak). By way of comparison to the data used in the Cardno and Ratio analysis, the existing volumes are higher than the 2046 'Ultimate' scenario.

5.2.1.1 Future Year Growth

Traffic growth for Barwon Heads Road is based on a number of factors, with the primary influence being the level of development that has been delivered in the Armstrong Creek Growth Corridor. As shown in the analysis of traffic data on Barwon Heads Road, growth on the corridor has increased at a rapid rate from 2015.

The City's website indicates that the Armstrong Creek Growth Area will be fully developed within 25 years. The current estimate for Armstrong Creek is that it is approximately 50%[1] complete, and by

[1] https://forecast.id.com.au/geelong/population-summary

2041 the annual growth rate is estimated to be 4.55% per annum. The population growth will be distributed across the Growth Area, and as population increases the transport infrastructure will be delivered and distribute resultant traffic growth.

For the traffic growth on Barwon Heads Road, a rate of 2% per annum has been considered as this does not include traffic from the NEIP or Marshall PSP. Further, a design year of 2041 has been included which is consistent with 'interim' modelling of DCP related infrastructure items for recent PSPs in Geelong and across Metropolitan Melbourne.

The resultant volumes for Barwon Heads Road in 2041 are summarised in Table 5.3

Table 5.3: 2041 Peak and daily volumes on Barwon Heads Road at Marshalltown Road (@2% per annum)

Period	Southbound	Northbound	Total
AM Peak (7.30-8.30pm)	830 vph	2,118 vph	2,948 vph
PM Peak (4.45-5.45pm)	2,013 vph	1,070 vph	3,083 vph
Daily	16,621 vpd	17,328 vpd	33,949 vpd

Applying a 2%per annum growth rate to traffic on Barwon Heads Road will result in daily volumes of almost 34,000 vehicles by 2041. These volumes are within the theoretical capacity of a two lane arterial road which is 40,000 vehicles per day two way.

5.2.2 NEIP Traffic Generation and Distribution

The TIA for the NEIP PSP was completed in 2009 by GTA Consultants and estimated an overall peak hour traffic generation of some 6,100 vehicles per hour as summarised in Table 5.4.

Table 5.4: Approved NEIP PSP (Keystone TIA) traffic generation

Use	Size	Traffic Generation Rate		Traffic Generation	
		Peak Hour	Daily	Peak Hour	Daily
Keystone Retail Centre	3,300sqm	0.8 movements per sqm	3.2 movements per sqm	26	106
Keystone Village	20,800sqm	0.8 movements per sqm	3.2 movements per sqm	166	666
Keystone Village Frame	61,300sqm	0.8 movements per sqm	3.2 movements per sqm	490	1,962
Keystone Mixed Business and Industry	90,200sqm	1.1 movements per sqm	5.0 movements per sqm	992	5,510
Keystone Campus Business (Corporate Industry)	350,000sqm	1.0 movements per sqm	4.5 movements per sqm	3,502	15,759
Keystone Industry	189,400sqm	0.5 movements per sqm	4.5 movements per sqm	947	8,523
Total				**6,123 veh trips**	**31,526 veh trips**

The analysis also estimated that 40% of traffic would access the site via the Keystone Avenue intersection, resulting in some **2,450 vehicle movements** (in and out) accessing the NEIP during the AM and PM peak hours.

The peak hour traffic generation characteristics for the approved NEIP were based on data relevant to 2009 which primarily relied on the RTA NSW Guide to Traffic Generating Developments. Since 2009 the guide has been updated with more relevant and new survey data, particularly for the Business Park uses, which has reduced its peak hour rate from 1.1 movements per 100sqm of GLA to 0.56 movements per 100sqm of GLA, a reduction of up to 50%.

The Business Park uses combined represent some 440,000sqm of GLA and applying the new rate would result in reductions in peak hour traffic of more than 2,000 vehicles per hour, as summarised in the following table.

Table 5.5: Updated NEIP PSP (Keystone TIA) traffic generation

Use	Size	Traffic Generation Rate		Traffic Generation	
		Peak Hour	Daily	Peak Hour	Daily
Keystone Retail Centre	3,300sqm	0.8 movements per sqm	3.2 movements per sqm	26	106
Keystone Village	20,800sqm	0.8 movements per sqm	3.2 movements per sqm	166	666
Keystone Village Frame	61,300sqm	0.8 movements per sqm	3.2 movements per sqm	490	1,962
Keystone Mixed Business and Industry	90,200sqm	0.56 movements per sqm	2.5 movements per sqm	505	5,510
Keystone Campus Business (Corporate Industry)	350,000sqm	0.56 movements per sqm	2.5 movements per sqm	1,961	15,759
Keystone Industry	189,400sqm	0.5 movements per sqm	4.5 movements per sqm	947	8,523
Total				**4,096 veh trips**	**22,262 veh trips**

There are opportunities for further reductions in traffic generation with further interrogation of land use and data, however for the purposes of this assessment the biggest gains are realised with the business rate and as such are appropriate for use in this assessment.

Finally, the intersection volumes have been reduced by 25% for this analysis in line with standard practice for DCP analysis to consider 75% of development prior to further upgrades being delivered by the State. This has been applied in all DCP's across Victoria that I have been involved with in the last 15 years including Beveridge North-West, Wallan South, Sunbury South and Lancefield Road, Shenstone Park and Shepparton South-East.

This assumption means that in the order of 1,200 vehicles would be accessing the NEIP at Keystone Avenue.

5.2.3 Marshall PSP Traffic Volumes

Based on the Cardno and Ratio estimates for traffic for the Marshall PSP, the traffic movements in and out of the PSP at IT-02 have been applied, resulting in 371 vehicle movements in the AM peak hour and 364 vehicle movements in the PM peak hour.

5.2.4 Resultant Intersection Volumes

Table 5.6 shows the resultant turning movement volumes for the AM and PM peak for the Keystone Avenue / Barwon Heads Road intersection.

Table 5.6: Barwon Heads Road / Keystone Avenue (IT-02) estimated 2041 traffic volumes

Approach	Movement	AM Peak Hour	PM Peak Hour
North Approach (Barwon Heads Road)	Left	469 vph	201 vph
	Through	870 vph	2,115 vph
	Right	59 vph	159 vph
East Approach (Keystone Avenue)	Left	201 vph	469 vph
	Through	101 vph	235 vph
	Right	201 vph	469 vph
South Approach (Barwon Heads Road)	Left	8 vph	25 vph
	Through	2,120 vph	1,215 vph
	Right	469 vph	201 vph
West Approach (Marshall PSP)	Left	231 vph	104 vph
	Through	235 vph	101 vph
	Right	66 vph	83 vph
Total		5,030 vph	5,377 vph

The volumes in Table 5.6 indicate that the intersection could have in the order of 5,000 vehicle movements per hour in the AM peak and 5,400 vehicle movements per hour in the PM peak passing through it.

5.2.5 SIDRA Analysis

The future operation of the proposed signalised intersection has been assessed using *SIDRA INTERSECTION*[2] (a computer based modelling package which calculates intersection performance).

The commonly used measure of intersection performance is referred to as the *Degree of Saturation (DOS)*. The DOS represents the flow-to-capacity ratio for the most critical movement on each leg of

[2] Program used under license from Akcelik & Associates Pty Ltd.

the intersection. For signalised intersections, a DOS of around 0.95 has been typically considered the 'ideal' limit, beyond which queues and delays increase disproportionately.

A summary of the 'Level of Services' criteria adopted by SIDRA INTERSECTION are presented in Table 5.7

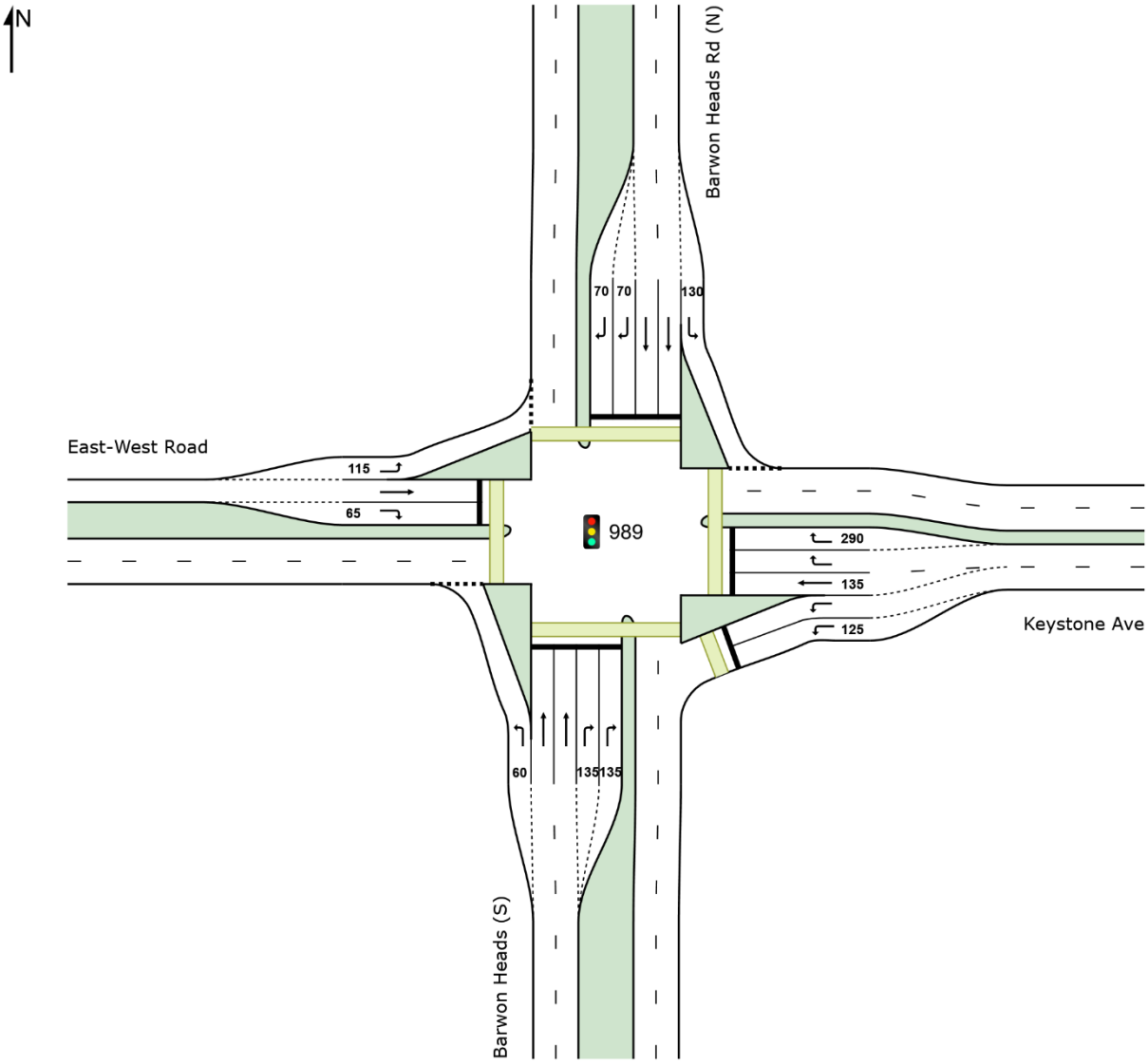
Table 5.7: SIDRA Intersection – Level of Service Criteria

Level of Service		Intersection Degree of Saturation (DOS)		
		Unsignalised Intersection	**Roundabout**	**Signalised Intersection**
A	Excellent	<=0.60	<=0.60	<=0.60
B	Very Good	0.60-0.70	0.60-0.70	0.60-0.70
C	Good	0.70-0.80	0.70-0.90	0.70-0.85
D	Acceptable	0.80-0.90	0.90-0.95	0.85-0.95
E	Poor	0.90-1.00	0.95-1.00	0.95-1.00
F	Very Poor	>=1.0	>=1.0	>=1.0

The proposed intersection layout was determined through an iterative approach to accommodate the demands using the same principles as the Ratio TIAR which is for a 120 second cycle, a target degree of saturation (DOS) of 0.95 and a level of service (LOS) D.

The proposed intersection layout for IT-02 presented in Figure 5.3.

Figure 5.3: Proposed SIDRA Intersection layout



The SIDRA Intersection results for the intersection is presented in Table 5.8, with full results provided in Appendix B.

Table 5.8: Barwon Heads Road / Keystone Avenue (IT-02) Intersection Performance

Approach	Movement	AM Peak Hour			PM Peak Hour		
		DOS	Average Delays (secs)	95th Percentile Queue (m)	DOS	Average Delays (secs)	95th Percentile Queue (m)
North Approach (Barwon Heads Road)	Left	0.437	16.4	107.3	0.147	8.5	17.1
	Through	0.610	33.9	185.4	1.224*	262.1	1,364.5
	Right	0.396	81.7	15.7	0.914	93.5	47.2
East Approach (Keystone Avenue)	Left	0.147	34.0	33.0	0.494	51.1	102.8
	Through	0.407	60.5	48.1	0.692	58.2	114.0
	Right	1.032*	134.7	76.5	1.204*	263.9	267.4
South Approach (Barwon Heads Road)	Left	0.005	7.6	0.4	0.019	10.0	2.7
	Through	1.079*	138.0	1,063.3	0.698	26.7	244.6
	Right	0.622	60.0	110.9	1.180*	245.3	108.0
West Approach (Marshall PSP)	Left	0.478	47.9	95.3	0.118	19.4	23.2
	Through	0.969	96.1	153.0	0.407	60.5	48.1
	Right	0.664	80.4	35.5	0.742	80.8	45.1
Intersection		**1.079***	**87.8**	**1063.3**	**1.223***	**153.7**	**1361.7**

The results show that the volumes anticipated for IT-02 as part of the first principles analysis would be too large and that the performance of the intersection would be compromised. Indeed, degrees of saturation of greater than 1.0 would be experienced on Barwon Heads Road and on Keystone Avenue within the NEIP that would result in queueing and congestion that would impact on adjacent intersections both within the NEIP and on the broader network.

This level of demand would require additional capacity to be provided, likely in the form of:

1. Additional through lanes on Barwon Heads Road in both directions
2. Increased length of the double right turn lane on Barwon Heads Road (north and south approaches)
3. An additional right turn lane on Keystone Avenue into Barwon Heads Road (totalling three right turn lanes).

It is clear that a more sophisticated analysis tool, such as VITM, would be better placed to undertake a more holistic assessment of the intersection and broader network. This analysis would consider the interaction of travel between Marshall, the NEIP, Geelong and the broader region, and would reduce the risk of overestimating traffic on Barwon Heads Road and the potential of double counting traffic movements, thus overstating the design of the intersection.

This approach is consistent with the approach adopted by the VPA and numerous Councils in the preparation of PSP's in Victoria and would include consultation and agreement from DTP as part of the process.

5.2.6 Analysis of IT-02

For completeness, the intersection layout of IT-02 as per the Marshall PSP (also shown in Figure 5.1 of this report) has been assessed in SIDRA with the results presented in Table 5.9. Full results provided in Appendix B.

Table 5.9: Barwon Heads Road / Keystone Avenue (IT-02) Intersection Performance with updated traffic volumes and the proposed layout within the Marshall PSP

Approach	Movement	AM Peak Hour			PM Peak Hour		
		DOS	Average Delays (secs)	95th Percentile Queue (m)	DOS	Average Delays (secs)	95th Percentile Queue (m)
North Approach (Barwon Heads Road)	Left	0.622	35.5	177.6	0.151	9.3	20.3
	Through	1.100	172.9	443.4	1.507	513.2	1,842.0
	Right	0.791	86.4	33.2	0.914	90.0	94.2
East Approach (Keystone Avenue)	Left	0.189	15.2	41.0	0.788	53.8	188.2
	Through	0.407	60.5	48.1	0.692	58.2	114.0
	Right	1.180	244.0	218.7	1.482	500.0	757.5
South Approach (Barwon Heads Road)	Left	0.006	7.8	0.5	0.021	11.6	3.3
	Through	1.224	261.4	1,509.3	0.908	54.7	378.0
	Right	1.094	175.6	454.0	1.502	517.5	328.0
West Approach (Marshall PSP)	Left	0.535	48.7	96.3	0.167	32.1	32.6
	Through	1.065	149.9	194.2	0.430	61.7	48.6
	Right	0.409	72.2	32.9	0.371	66.9	39.7
Intersection		**1.224***	**1.224***	**182.6**	**1509.3**	**1.507***	**290.3**

The results show that the volumes anticipated for IT-02 as part of the first principles analysis would result in the performance of the intersection proposed within the Marshall PSP to be significantly compromised. Indeed, degrees of saturation of greater than 1.5 would be experienced on Barwon Heads Road and on Keystone Avenue within the NEIP that would result in queueing and congestion of greater than 1.8km that would result in significant impact on the broader transport network.

5.3 Concept Design

A concept design of the intersection analysed has been prepared and is provided in Appendix A and includes the following characteristics:

1. North approach:
    - » The duplication of Barwon Heads Road in both directions
    - » A left turn deceleration lane and slip lane on the north approach into the NEIP (north to east)

- The provision of double right turn lanes on Barwon Heads Road north approach into the Marshall PSP.

2. East Approach:
    - Double right turn lanes of 290m from the NEIP PSP into Barwon Heads Road (east to north).
    - A through lane from the NEIP PSP into the Marshall PSP (east to west)
    - Double left turn lanes of 125m from the NEIP PSP into Barwon Heads Road (east to south).
3. West Approach:
    - A right turn lane of 65m on the west approach from the Marshall PSP (west to south)
    - A through lane from the Marshall PSP into the NEIP (west to east)
    - A left turn slip lane with appropriate queueing and deceleration distance of 115m from the Marshall PSP (west to north).
4. South Approach
    - The duplication of Barwon Heads Road in both directions
    - Double right turn lanes of 135m on Barwon Heads Road into the NEIP (south to east).
    - A left turn slip lane with appropriate queueing and deceleration distance of 65m into the Marshall PSP (south to west).

The concept has been based on a design speed of 80km/hr on Barwon Heads Road (noting that this is 10km/hr higher than the signposted speed).

5.4 Summary

The investigations included in this analysis are based on the available information and at the time of preparing this report have not been discussed with the City or DTP. It is recommended that the analysis of IT-02 be updated to rely upon a more sophisticated modelling tool, such as the Victorian Integrated Transport Model (VITM), to analyse the intersection in a more holistic manner that considers the broader network, access points to Marshall and NEIP, the duplication of Barwon Heads Road, recent traffic data and the likely NEIP traffic generation.

6 Bulky Goods Precinct

6.1 Introduction

The Future Urban Structure for the Marshall PSP has identified land in the northern extents of the precinct as commercial / bulky good land uses as shown in Figure 6.1.

Figure 6.1: Location of Commercial / Bulky Goods Precinct in Marshall PSP

It is understood that this land has been previously set aside for residential uses as per the Armstrong Creek Growth Area Plan. I have undertaken a review of the traffic generation and access implications of the change in use and its impact on the network.

6.2 Comparison of traffic generation

The PSP allows for commercial and bulky goods uses to be provided at the northern extent, which is a change from the previously planned residential uses. The two uses will result in vastly different traffic generation, with Table 6.1 prepared to summarise the differences for the two uses.

Table 6.1: Comparison of Traffic Generation for Bulky Goods and Residential Land Uses

Land Use	Size	Daily Traffic Generation	Daily Traffic Volumes	Peak Hour Traffic Generation	Peak Hour Traffic Volumes
Commercial / Bulky Goods	41,100sqm [1]	17 vpd/100 sqm	6,988 vehicles	2.7 vph/100 sqm	1,110 vehicles [3]
Medium-Density Housing	250 Dwellings [2]	6 vpd/dwelling	1,500 vehicles	0.6 vph/dwelling	150 vehicles

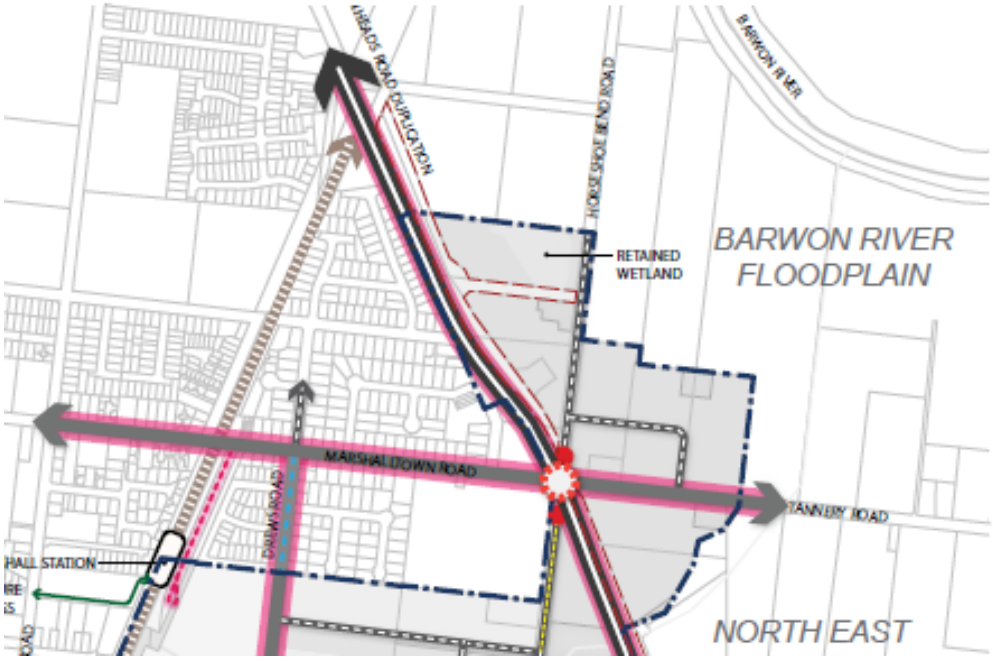
[1] Total land area assumed for the Bulky Goods / Commercial area has been based on the Marshall TIA prepared by Ratio, which is estimated as 10.15ha and 41,100sqm of developable area
[2] Should the 10.15ha area accommodate medium density housing, it would likely result in up to 250 dwellings based on a rate of 25 dwelling/ha, as per table on page 28 of the Marshall PSP
[3] PM peak hour only, no traffic assumed to be generated in AM peak hour (as assumed in the Marshall TIA)

Based on the generation rates provided in Table 6.1, the proposed Commercial / Bulky Goods uses have the potential to generate significantly higher traffic volumes than the medium-density housing uses across the day and in the PM peak hour. During the critical AM peak hour, the medium-density housing would generate more traffic as the bulky goods do not typically generate traffic during this period.

6.3 Access

Based on a review of the PSP documentation, it is understood that access to the bulky goods precinct will require access via Devine Street and Tannery Road as Figure P10 of the PSP document which is reproduced in Figure 6.2.

Figure 6.2: Figure P10 Road Network and Public Transport of the Marshall PSP



Requirement R40 of the Marshall PSP states:

> *Provide appropriate frontage local road(s) to the west of Barwon Heads Road within the boundary of the PSP. A service frontage road is not required on the eastern side of Barwon Heads Road to access the Commercial/Bulky Goods Area unless otherwise required and approved by the Head, Transport for Victoria.*

This requirement supports the assertion that the access will be provided via Devine Street and/or Tannery Road. I have concerns with the implications of each intersection, which are discussed in the following sections.

6.3.1 Barwon Heads Road / Devine Street intersection

I have concerns regarding the ability for the intersection to accommodate the potential bulky goods traffic based on capacity and safety implications due to the location of the access which is shown in the aerial photograph in Figure 6.3.

Figure 6.3: Barwon Heads Road / Devine Street intersection (reproduced with permission from Nearmap)

Whilst analysis has not been undertaken as part of this report, it is likely that the intersection would need to be signalised due to:

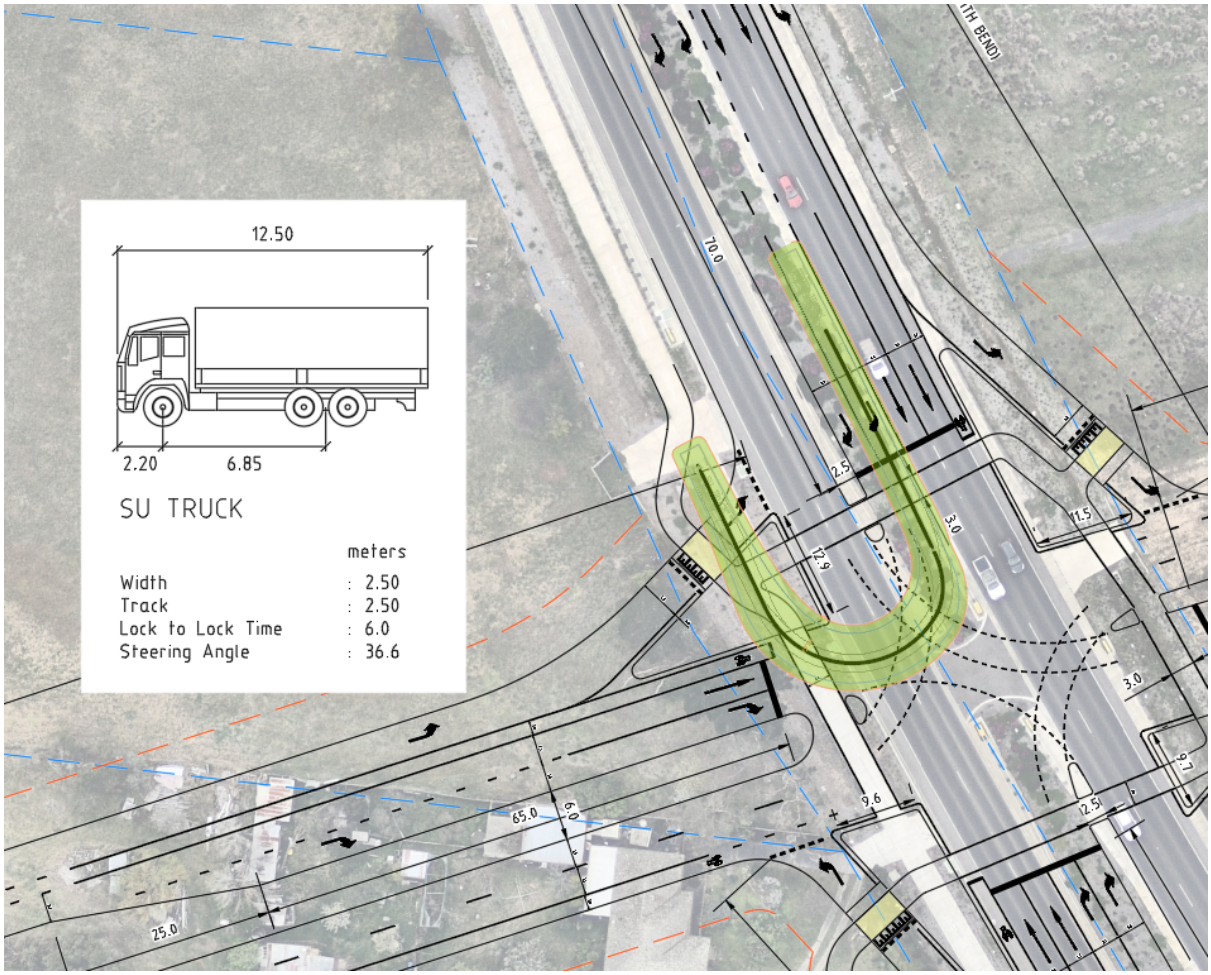
1. The safe stopping distance required for a left turn movement for queuing vehicles. There is limited ability to physically increase the length of the left turn deceleration due to the proximity to the bridge structure on Barwon Heads Road to the north of the site.
2. The proximity of the service road egress on the northbound carriageway of Barwon Heads Road is in close proximity to the right turn into Devine Street. The bulky goods precinct will attract higher traffic demand increasing the risk of motorists seeking to travel across the through lanes on Barwon Heads Road.
3. A right turn is not permitted from Devine Street into Barwon Heads Road to the north (i.e. into Geelong). Vehicles that are seeking to travel into Geelong would be required to perform a U-turn at the Marshalltown Road / Barwon Heads Road intersection which is unable to be achieved. It will also have implications on the performance and capacity of the Barwon Heads Road / Tannery Road intersection.

These considerations would require the approval of DTP.

6.3.2 Barwon Heads Road / Tannery Road / Marshalltown Road intersection

The intersection of Barwon Heads Road / Tannery Road has been tested to ascertain whether or not a vehicle is able to perform a U-turn on the north approach. This has been tested for a 12.5m rigid vehicle, which is a typical vehicle type for a delivery to and from Commercial / Bulky Goods precinct and is shown in Figure 6.4.

Figure 6.4: Swept Path for a 12.5m Rigid Vehicle



Due to the geometric configuration of Barwon Heads Road and Tannery Crescent, vehicles will not be able to perform a U-turn movement from the north. As such a redesign of the intersection will be required or alternatively, vehicles will be required to travel a further distance through the network to reach their destination.

The Marshall TIA prepared by Ratio does not include an assessment of the Marshalltown Road / Barwon Heads Road / Tannery Road intersection. It is not clear if the intersection has the capacity to accommodate the additional traffic generated from the Commercial / Bulky Goods uses. Given the change in land use and the level of traffic anticipated, it would be prudent to undertake an analysis of the intersection to understand the implications of the specific land use contemplated.

The analysis of Barwon Heads Road traffic and growth presented in Section 4 of this report highlights the potential for increased volumes into the future which would have implications on network performance.

Public transport implications for NEIP

A dedicated, public transport only, link is included on Tannery Road as part of the NEIP PSP. The increased demand resulting from the proposed bulky goods precinct has the potential for congestion at the Barwon Heads Road / Tannery Road intersection and the ability for the proposed public transport / bus only link to achieve its objective of prioritising public transport to and from the NEIP.

Given the above, it is recommended that the Marshall TIA be updated to include the analysis of the Barwon Heads Road / Tannery Road intersection so that it can identify any works required to facilitate the proposed Commercial / Bulky Goods uses. Further, it is requested the Greater Geelong City Council provide detail on how the bus only link will operate through the intersection with the additional Commercial / Bulky Goods traffic.

6.4 Delegates Report

I have reviewed the delegates report from Peter Schembri to Peter Smith both of the City of Greater Geelong dated the 28th of August 2024. The report has recommended a partial reallocation of the land use abutting Tannery Road to medium/high density residential identified in line 51:

> *Council considers the triangular property (#20) on the western side of Barwon Heads Road to be suitable for Medium/High Density Residential. This designation is preferred over Conventional Residential due to the lot's configuration and improved access.*

In reviewing the report and the proposed land use strategy, I still have concerns as follows:

1. The PSP does not indicate or show any connection between Horseshoe Bend Road and Tannery Road, meaning that access to the bulky goods would be provided to and from Devine Street.
2. The issues for Devine Street as detailed in the previous section still remain, including the inability for vehicles to perform a U-turn at the Marshalltown Road intersection.
3. The delegates report also states that DTP does not support any changes to the access arrangements on Barwon Heads Road. It is clear that the changes in land use would result in a higher level of traffic and vehicle composition, meaning that access changes would be required.
4. The interpretation of the use of Tannery Road (in Paragraph 56) with respect to the NEIP is incorrect. Their interpretation is that it is for vehicles and buses. However, the NEIP has a condition that Tannery Road is to be "Bus only" and not provide any vehicle access.
   The 'mock' subdivision layout for the residential seems appropriate, although it is noted that no analysis of the Barwon Heads Road / Tannery Road / Marshalltown Road intersection has been undertaken to determine upgrades and any DCP contributions. Given the fragmented land holdings it would be beneficial to include any upgrades as a DCP item.
   - I also note that the 'mock' subdivision also confirms that the bulky goods / commercial areas to the north will require direct access to BHR.

I support the proposal from the City to change the land use abutting Tannery Road (i.e. properties #38, #39, #40, #41, #42 and #43) to residential, however it does not resolve the access issues identified at the Devine Street intersection with Barwon Heads Road and the proposed Commercial / Bulky Goods uses north of Tannery Road (i.e. properties #34, #35, #36 and #37) are not supported.

7 Summary of Opinion & Other Statements

7.1 Summary of Opinion

On the basis of the information set out within this report, it is my opinion that the analysis of IT-02 should be revisited and updated as a network to the satisfaction of the City, DTP and the NEIP as it does not consider:

1. The duplication of Barwon Heads Road,
2. The latest traffic data of Barwon Heads Road,
3. The approved and/or updated traffic generation characteristics from the NEIP, and
4. The consideration of the interaction of residential traffic from the employment uses in NEIP and the residential uses in Marshall.

Further, the proposed Commercial / Bulky Goods land use for properties #34, #35, #36, #37, #38, #39, #40, #41, #42 and #43 are a change from the Armstrong Creek Growth Area Framework Plan and are not supported due to:

1. The higher level of traffic anticipated from the proposed Commercial / Bulky Goods uses when compared to residential,
2. The access constraints and at the Devine Street intersection and its proximity to adjacent access points and railway overpass,
3. The ability for the Marshalltown Road / Barwon Heads Road / Tannery Road intersection to accommodate the additional traffic, and
4. The implications on the approved public transport only connection on Tannery Road into the NEIP.

Based on the traffic and transport grounds indicated above, I am of the opinion that further work is required prior to the approval of the PSP and DCP and it should not proceed in its current format.

7.2 Declaration

I have made all the inquiries that I believe are desirable and appropriate and that no matters of significance that I regard as relevant have, to my knowledge, been withheld from the Panel.

Signed:

Reece Humphreys

Appendix A
Curriculum Vitae

Stantec

Reece Humphreys

Business Lead – Transport Planning and Advisory (Vic/SA)

Market Lead – Transport, Roads & Highways

Reece has more than 20 years' experience in Transport and is currently the Business Lead for Transport – Planning and Advisory (Vic/SA) and the Market Lead – Transport at Stantec. He has strong technical skills and business acumen, commercial astuteness and thorough understanding of project lifecycle including defining issues and developing solutions. His experience covers transport planning, engineering design and analysis and has worked on large scale transport projects and assignments in Melbourne, Sydney and across Australia.

He has completed several projects for all transport agencies across Australia that include a series of large regional transport models, strategic corridor planning, congested corridor management and transport corridor planning. Reece often provides expert evidence for both Government and the private clients and has provided evidence on several high-profile transport corridor and growth area panels. Reece also plays an active role in industry and community organisations; he is a board member and National and Deputy Chair of the AITPM, is a Certified Engineer (CPEng) and is a Committee Member for his local Football Club.

Qualifications/Memberships

- Victoria University, BE, Civil, Victoria, Australia, 2000
- CPEng – Institute of Engineers Australia
- Fellow - Australian Institute of Traffic Planning and Management Incorporated (AITPM)
- Board Member and National Deputy Chair of AITPM

Project Experience

Suburban Roads Project, MRPV, Technical Director (Transport)

The Western Roads Upgrade is a $1.8 billion project that will deliver a combination of road widening, duplications and intersection upgrades on eight arterial roads in the western suburbs. Stantec is part of the Netflow consortium that was successful in delivering the project. As Technical Director, Reece was responsible for leading the traffic and transport analysis of the eight corridors which comprised 48 intersections and freeway interchanges. The work completed through the bid phase included a range of solutions that resulted in the submission having no departures from the scope requirements, resulting in a successful award for the consortium.

Western Growth Corridor – Transport Network Plan, Project Director

Stantec completed the Strategic Transport Modelling of the Western Growth Corridor in Melbourne, which is forecast to accommodate an additional 500,000 people in the next 30 years. The project investigated short and medium-term transport improvements as well as a range of public transport enhancements designed to improve people's journeys on a day to day basis. The project was completed for the City of Wyndham and City of Melton who will experience the majority of the predicted growth. Leading the delivery of the project drew upon Reece's extensive range of experience in preparing transport assessments of PSPs and developments within Melbourne's growth corridors, including an understanding of the transport challenges that growth brings. This work was completed in close consultation with the Department of Transport (formerly Transport for Victoria) and VicRoads.

Geelong Growth Areas Transport Infrastructure Strategy, City of Greater Geelong, Project Director

Stantec were engaged to assist the City of Greater Geelong and the Department of Transport to develop a transport strategy for Gelong to support extensive growth as a result of its three growth areas. The work included the development of a transport strategy using scenario testing with the Victorian Integrated Transport Model (VITM) for all modes of transport in Geelong as a result of the Northern, Western and Armstrong Creek Growth Areas which will double the size of Geelong over the next 30 years.

Gunns Gully Interchange, Project Director and Technical Lead

The Gunns Gully Interchange on the Hume Freeway will unlock the development of the Cloverton and Merrifield City Centres in Melbourne's Northern Growth Corridor. The scope of the project includes the preparation of supporting traffic analysis and assessment that informs the design and economic benefit of the project using a bespoke VITM. The project is currently in progress working closely with the DoT, VPA and the Planning Minister in order to release GAIC WIC funding.

Calder Highway Traffic Analysis and Economic Assessment, Project Director and Modelling Lead

The Calder Highway between Maiden Gully and ironbark in Bendigo is experiencing increased congestion as a result of population growth. Regional Roads Victoria (RRV) developed a range of concept options and solutions for the upgrade of intersections and the corridor as a whole. A transport assessment was undertaken with the use of a multi-layered traffic model that was also used to inform an economic assessment that recommended the preferred option.

Northern Highway Economic Assessment, Department of Transport and Planning (DTP), Project Director

VicRoads is preparing a business case to upgrade a section of the Northern Highway between the Hume Freeway and Wallan township. As Project Director Reece was responsible for preparing an economic assessment using strategic transport modelling to understand the benefits of the upgrade. The project utilised and updated the Statewide Victorian Integrated Transport Model (S-VITM) and included several workshops with various stakeholders to develop the inputs into two project cases for testing. The economic assessment will form part of a business case that will be submitted to the State Government.

Beveridge North West PSP, Victorian Planning Authority, Director

VicRoads is preparing a business case to upgrade a section of the Northern Highway between the Hume Freeway and Wallan township. As Project Director Reece was responsible for preparing an economic assessment using strategic transport modelling to understand the benefits of the upgrade. The project utilised and updated the Statewide Victorian Integrated Transport Model (S-VITM) and included several workshops with various stakeholders to develop the inputs into two project cases for testing. The economic assessment will form part of a business case that will be submitted to the State Government.

Other PSP work that Reece has been involved with across Victoria include:

- Shepparton South East*
- Wallan South*
- Maiden Gully
- Marong
- Beveridge North West*
- Beveridge North East
- Donnybrook
- Woodstock
- Merrimu and Parwan
- Greenvale Central
- Merrifield
- Cloverton
- Rockbank
- Mt Atkinson*
- Aviators Field
- Geelong Growth Areas*
- Craigieburn (R2)
- Officer South*
- Minta Farm
- Wonthaggi North*
- Wollert
- Melton East
- Berwick Waterways
- Botanic Ridge (Stage 4)
- Shenstone Park*
- Sunbury South and Lancefield Road*

*Includes presentation of expert evidence at Panel or Advisory Committee

PRESENTATIONS

- Developing a Framework for modelling regional Australian cities. AITPM National Conference, 2019.
- Latest Developments in Australian Modelling. NZ Modelling User Group, 2014.
- Transport Planning or Land Use – Who Controls What?. AITPM National Conference, 2015.

Appendix B
SIDRA Analysis

USER REPORT FOR SITE

All Movement Classes

Project: 241001_marshall_psp_modelling_v1

Template: Default Site User Report

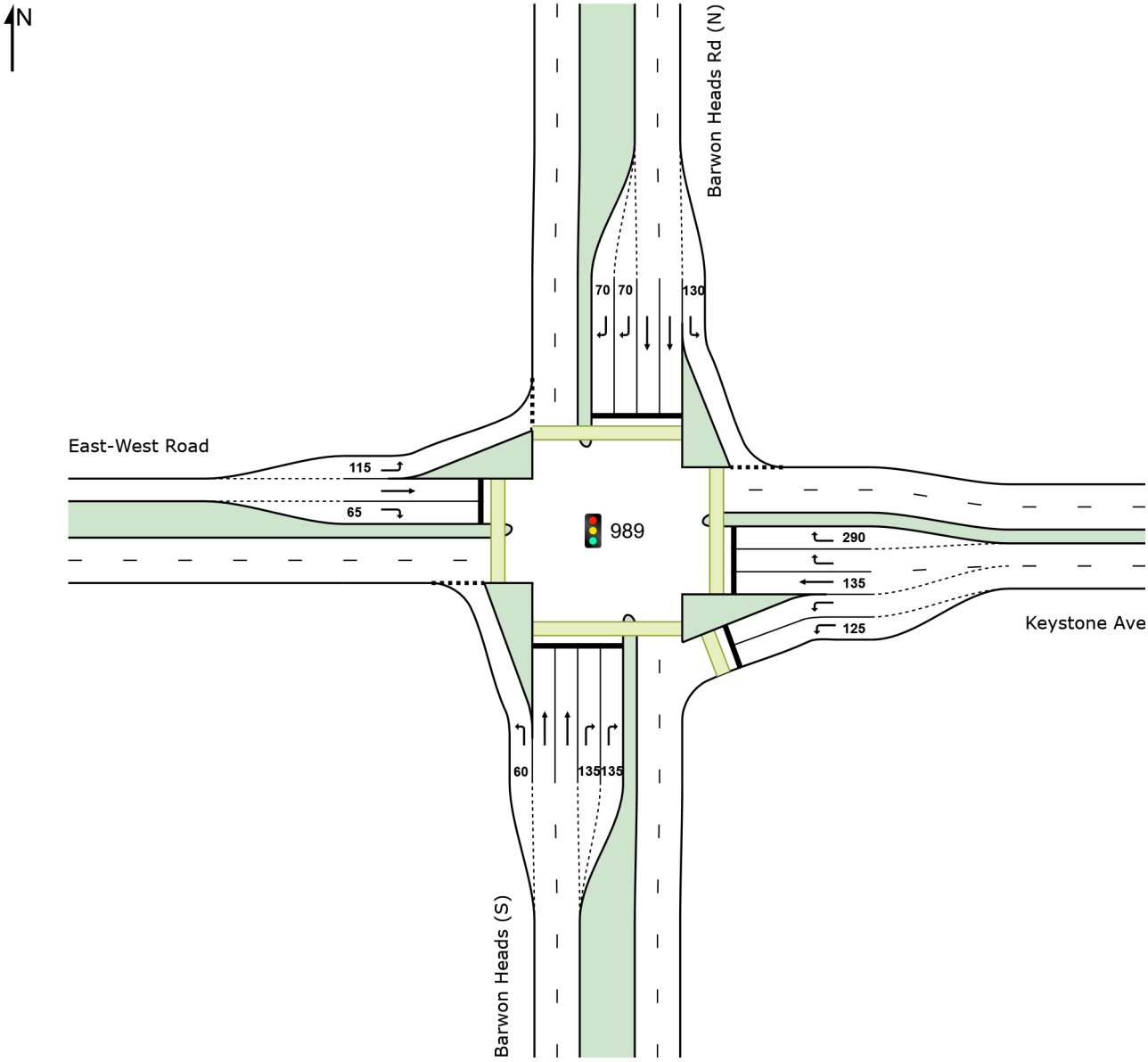
Site: 989 [AM Revised (2041) (-25% reduced NEIP + Mars PSP) - Keystone Ave / Barwon Heads Rd / Connector (Site Folder: Final Layout with Mitigations (2041) (Revised 241001 - 2% growth - 25% reduced NEIP + Marshall))]

Site Category: Signalised Intersection
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 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, E1*
(* Variable Phase)

Site Layout

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



Lane Use and Performance

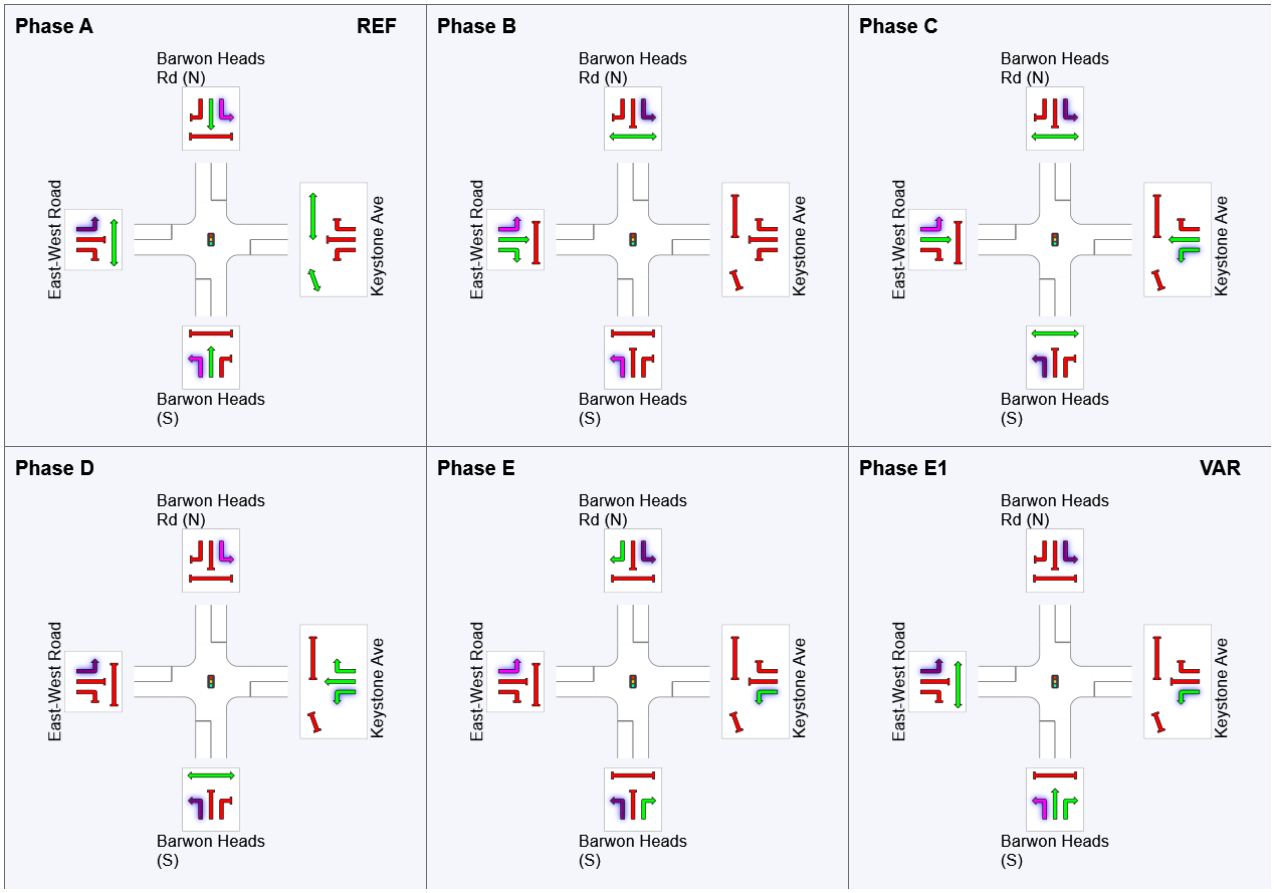
	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Barwon Heads (S)													
Lane 1	6	2.0	1567	0.004	100	7.3	LOS A	0.0	0.3	Short	60	0.0	NA
Lane 2	1166	8.0	1120[1]	1.040	100	105.7	LOS F	126.8	948.6	Full	500	0.0	64.3
Lane 3	1066	8.0	1025[1]	1.040	100	108.5	LOS F	117.4	878.5	Full	500	0.0	57.0
Lane 4	179	10.4	321	0.556	100	63.1	LOS E	11.2	85.6	Short	135	0.0	NA
Lane 5	192	0.0	345	0.556	100	62.8	LOS E	12.0	84.1	Short	135	0.0	NA
Approach	2608	7.6		1.040		100.5	LOS F	126.8	948.6				
East: Keystone Ave													
Lane 1	79	5.0	653	0.122	100	37.0	LOS D	3.6	25.9	Short	125	0.0	NA
Lane 2	79	5.0	653	0.122	100	37.0	LOS D	3.6	25.9	Full	500	0.0	0.0
Lane 3	80	2.0	261	0.306	100	59.5	LOS E	5.0	35.6	Short	135	0.0	NA
Lane 4	79	5.0	77	1.034	100	135.3	LOS F	7.9	57.5	Full	500	0.0	0.0
Lane 5	79	5.0	77	1.034	100	135.3	LOS F	7.9	57.5	Short	290	0.0	NA

Approach	398	4.4		1.034		80.8	LOS F	7.9	57.5				
North: Barwon Heads Rd (N)													
Lane 1	371	2.0	1264	0.293	100	12.0	LOS B	7.7	54.5	Short	130	0.0	NA
Lane 2	466	8.0	861	0.542	100	28.5	LOS C	22.5	168.0	Full	500	0.0	0.0
Lane 3	449	8.0	829[1]	0.542	100	28.1	LOS C	21.4	159.9	Full	500	0.0	0.0
Lane 4	23	5.0	77	0.301	100	81.2	LOS F	1.6	12.0	Short	70	0.0	NA
Lane 5	23	5.0	77	0.301	100	81.2	LOS F	1.6	12.0	Short	70	0.0	NA
Approach	1333	6.2		0.542		25.6	LOS C	22.5	168.0				
West: East-West Road													
Lane 1	182	2.0	509	0.358	100	46.4	LOS D	9.7	68.8	Short	115	0.0	NA
Lane 2	185	2.0	261	0.709	100	64.6	LOS E	12.5	89.2	Full	500	0.0	0.0
Lane 3	53	2.0	78	0.671	100	83.1	LOS F	3.9	27.5	Short	65	0.0	NA
Approach	420	2.0		0.709		59.0	LOS E	12.5	89.2				
Intersection	4759	6.4		1.040		74.2	LOS E	126.8	948.6				

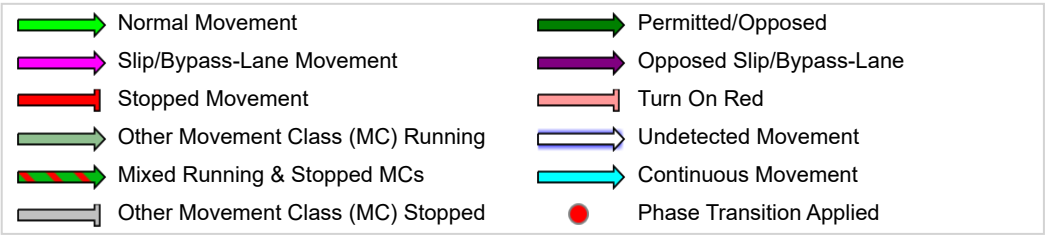
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay 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.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

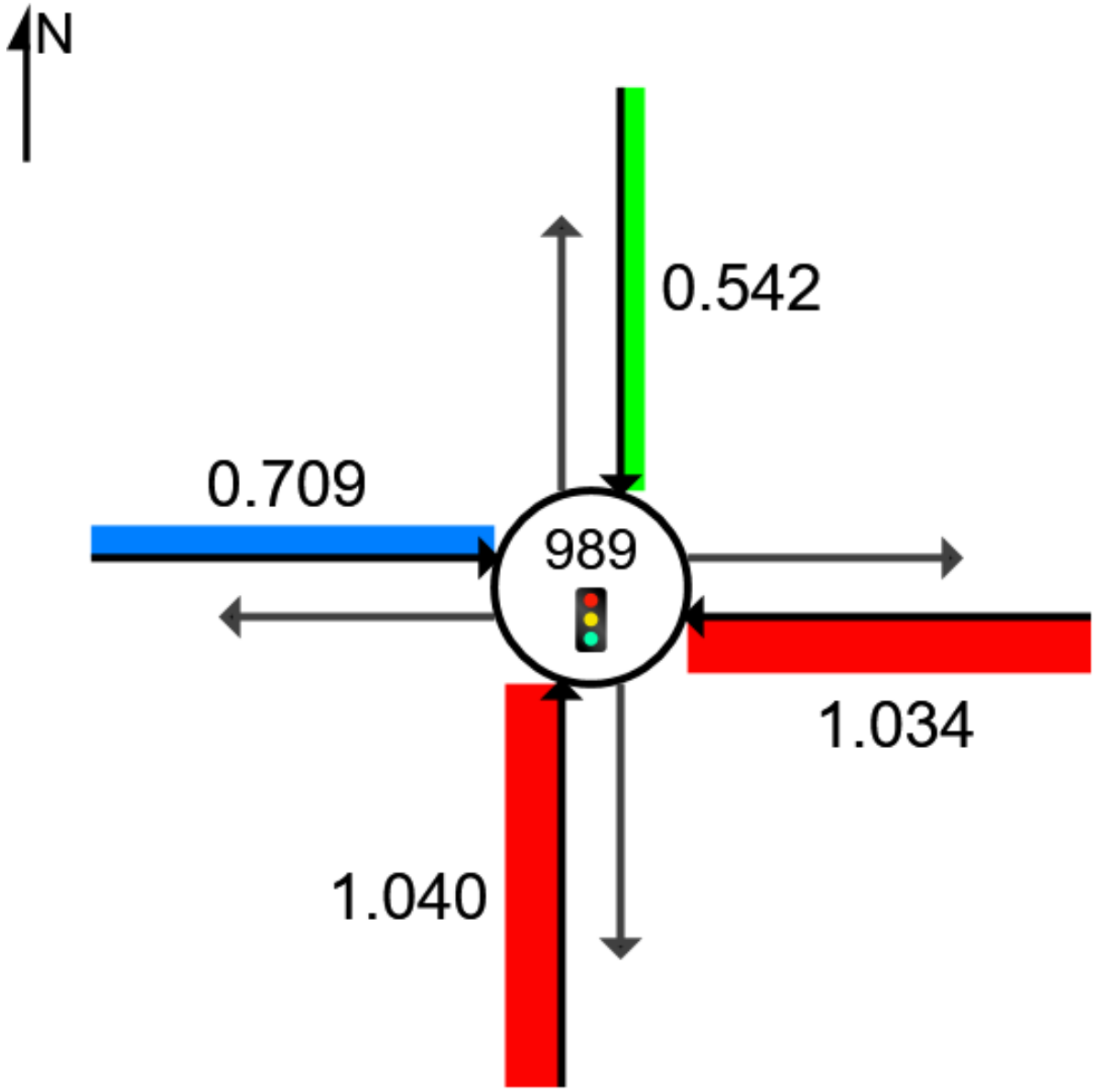


Phase Timing Summary

Phase	A	B	C	D	E	E1
Phase Change Time (sec)	0	71	83	96	108	120
Green Time (sec)	65	6	7	6	6	14
Phase Time (sec)	71	12	13	12	12	20
Phase Split	51%	9%	9%	9%	9%	14%

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%.

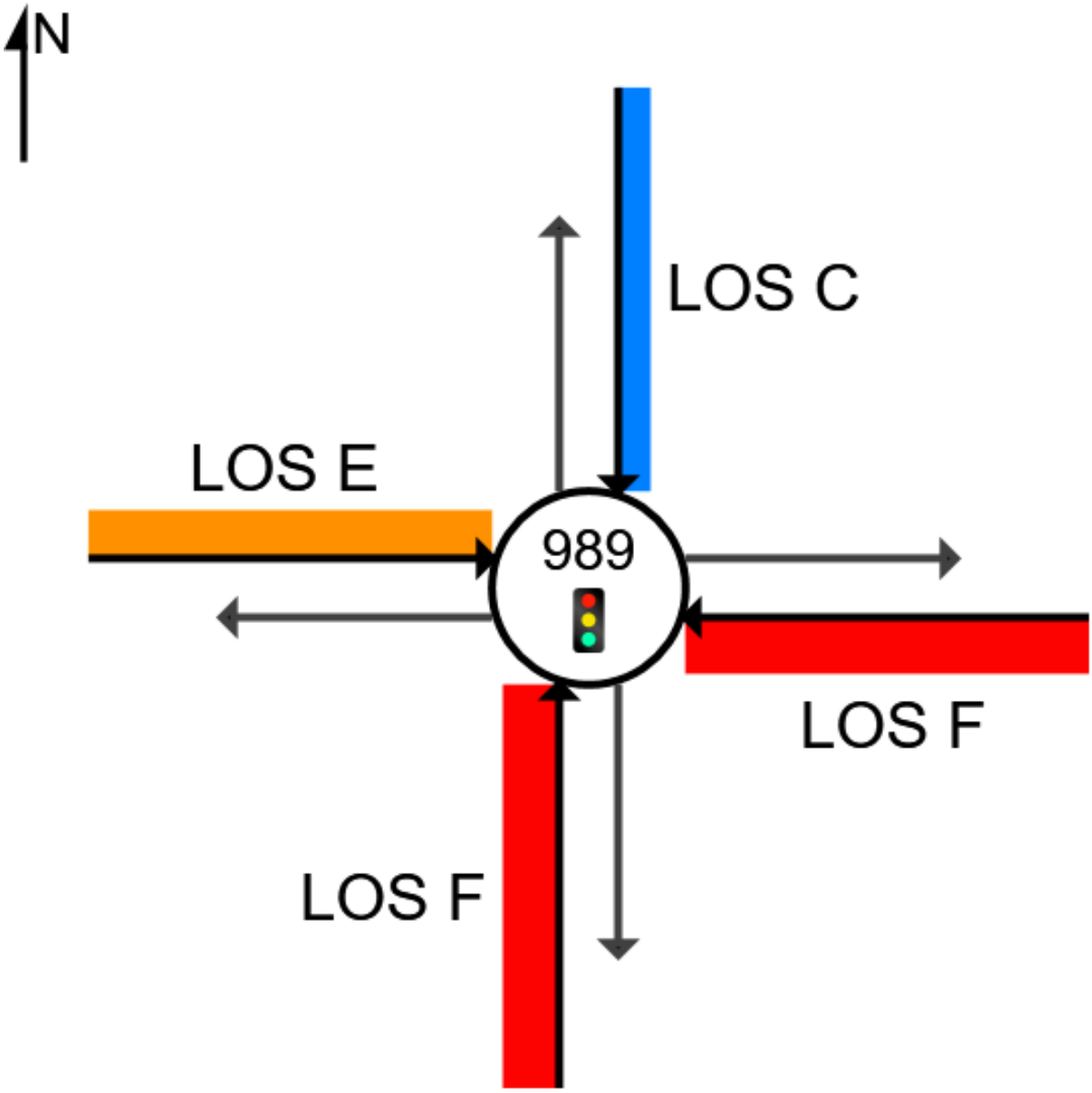
Degree of Saturation



Colour code based on Degree of Saturation

[< 0.6]	[0.6 – 0.7]	[0.7 – 0.8]	[0.8 – 0.9]	[0.9 – 1.0]	[> 1.0]

Level of Service

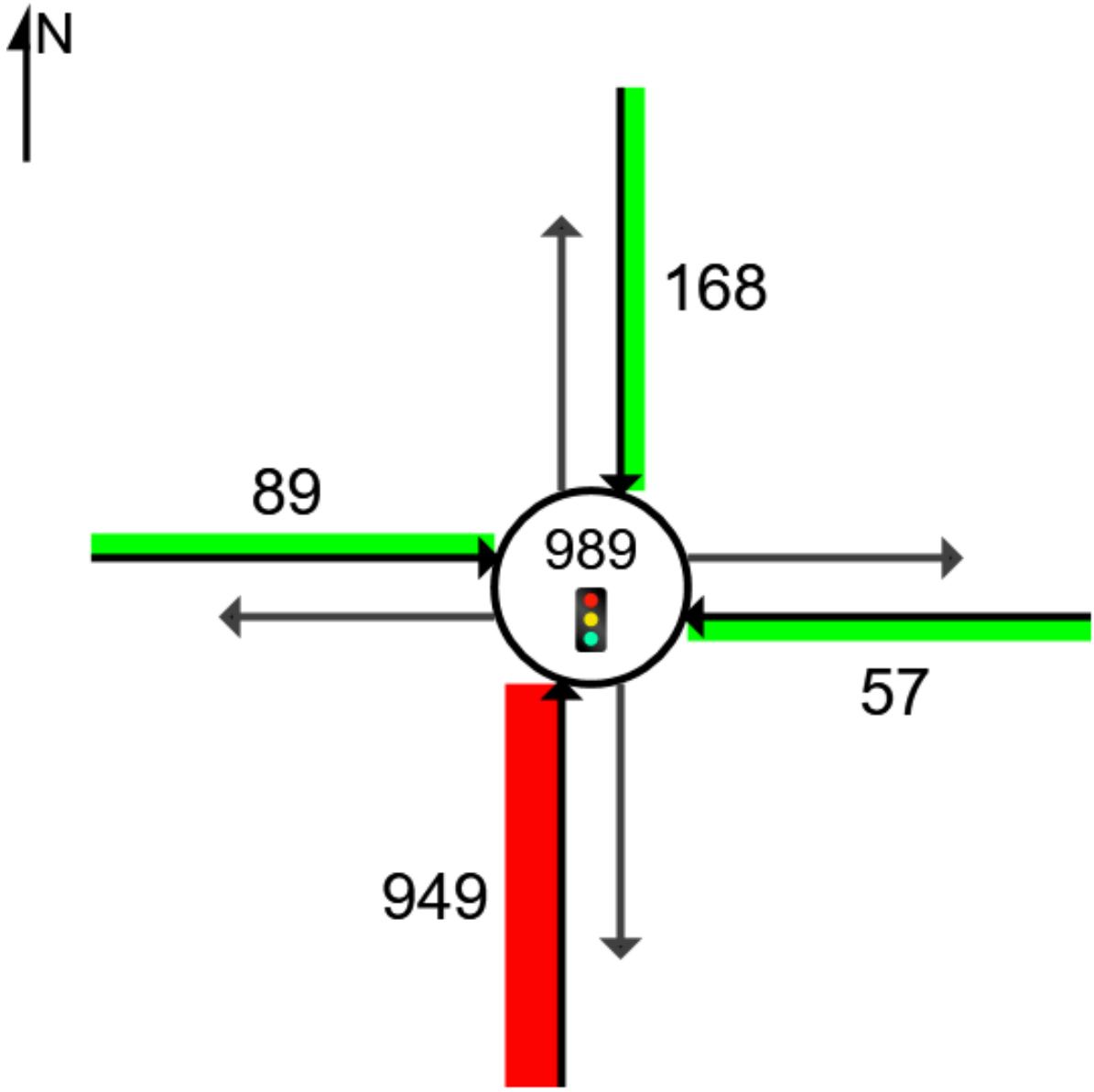


Colour code based on Level of Service

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Pedestrian Level of Service Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Distance (Percentile)



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

Queue Model: SIDRA Standard.

USER REPORT FOR SITE

All Movement Classes

Project: 241001_marshall_psp_modelling_v1

Template: Default Site User Report

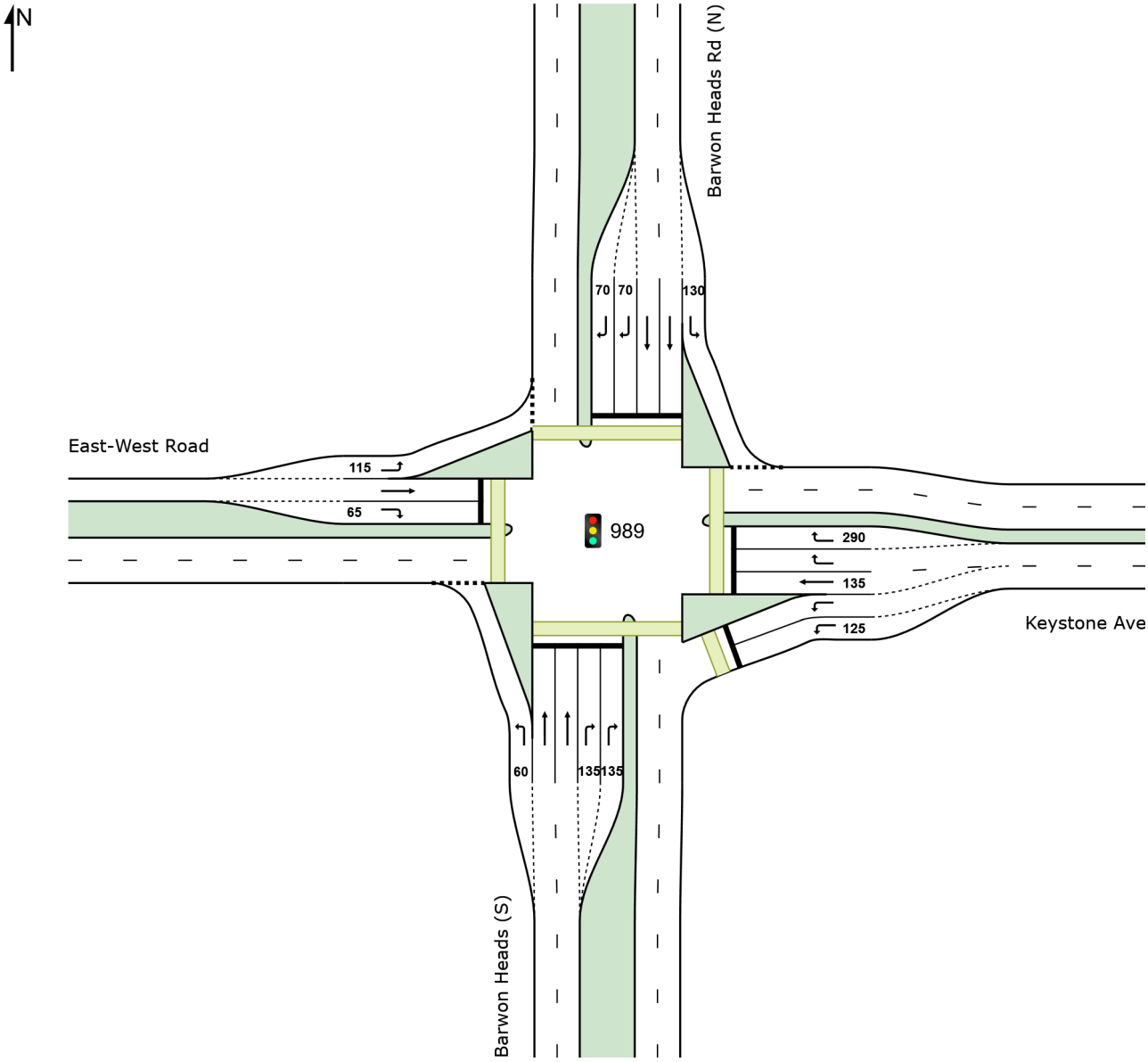
Site: 989 [PM Revised (2041) (-25% reduced NEIP + Mars PSP) - Keystone Ave / Barwon Heads Rd / Connector (Site Folder: Final Layout with Mitigations (2041) (Revised 241001 - 2% growth - 25% reduced NEIP + Marshall))]

Site Category: Signalised Intersection
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 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.



Lane Use and Performance

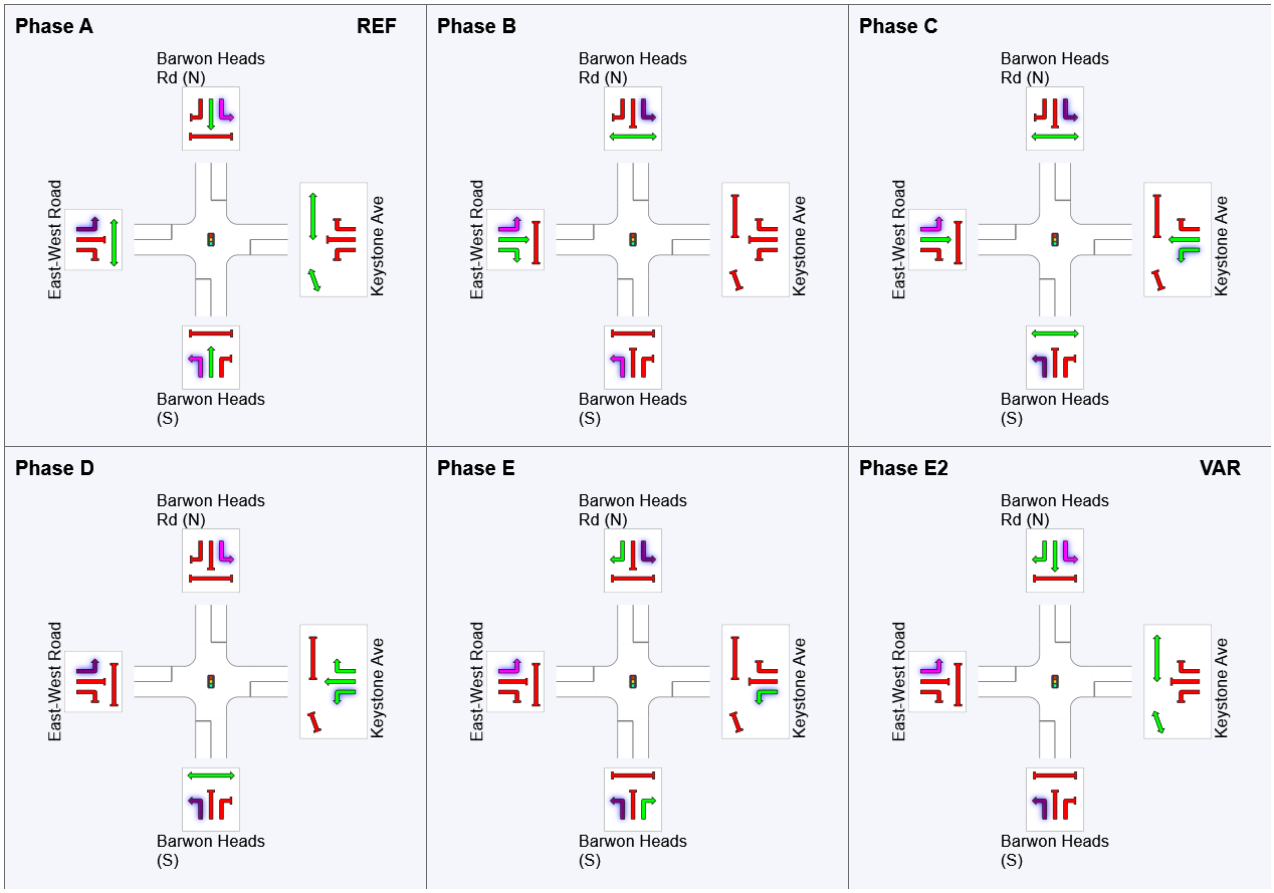
	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Barwon Heads (S)													
Lane 1	20	2.0	1425	0.014	100	9.0	LOS A	0.2	1.7	Short	60	0.0	NA
Lane 2	634	8.0	976[1]	0.650	100	24.3	LOS C	30.0	224.6	Full	500	0.0	0.0
Lane 3	645	8.0	993	0.650	100	24.5	LOS C	30.8	230.6	Full	500	0.0	0.0
Lane 4	77	10.4	74	1.034	100	136.8	LOS F	7.6	58.0	Short	135	0.0	NA
Lane 5	82	0.0	80	1.034	100	135.8	LOS F	8.1	56.9	Short	135	0.0	NA
Approach	1458	7.6		1.034		36.4	LOS D	30.8	230.6				
East: Keystone Ave													
Lane 1	185	5.0	448	0.413	100	52.9	LOS D	10.6	77.3	Short	125	0.0	NA
Lane 2	185	5.0	448	0.413	100	52.9	LOS D	10.6	77.3	Full	500	0.0	0.0
Lane 3	185	2.0	316	0.586	100	59.0	LOS E	11.9	84.4	Short	135	0.0	NA
Lane 4	185	5.0	167	1.113	100	190.9	LOS F	22.8	166.1	Full	500	0.0	0.0
Lane 5	185	5.0	167	1.113	100	190.9	LOS F	22.8	166.1	Short	290	0.0	NA

Approach	926	4.4		1.113		109.3	LOS F	22.8	166.1				
North: Barwon Heads Rd (N)													
Lane 1	125	2.0	1504	0.083	100	7.9	LOS A	1.1	7.9	Short	130	0.0	NA
Lane 2	1110	8.0	973[1]	1.141	100	190.3	LOS F	154.1	1152.7	Full	500	0.0	83.2
Lane 3	1116	8.0	978[1]	1.141	100	190.1	LOS F	154.9	1159.0	Full	500	0.0	83.7
Lane 4	79	5.0	115	0.689	100	80.7	LOS F	5.7	41.6	Short	70	0.0	NA
Lane 5	79	5.0	115	0.689	100	80.7	LOS F	5.7	41.6	Short	70	0.0	NA
Approach	2511	7.5		1.141		174.2	LOS F	154.9	1159.0				
West: East-West Road													
Lane 1	82	2.0	981	0.084	100	16.9	LOS B	2.2	15.6	Short	115	0.0	NA
Lane 2	80	2.0	261	0.306	100	59.5	LOS E	5.0	35.6	Full	500	0.0	0.0
Lane 3	65	2.0	118	0.554	100	77.7	LOS E	4.6	32.5	Short	65	0.0	NA
Approach	227	2.0		0.554		49.4	LOS D	5.0	35.6				
Intersection	5122	6.7		1.141		117.7	LOS F	154.9	1159.0				

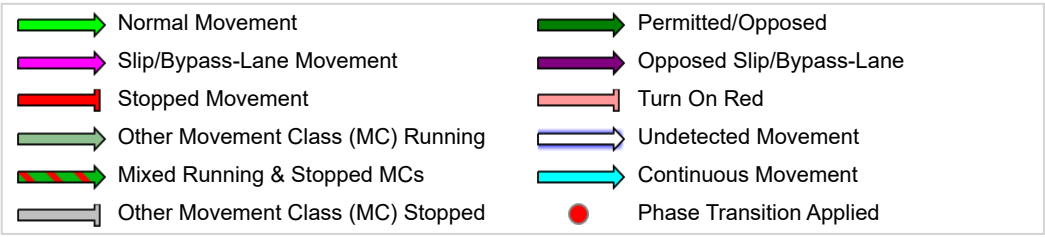
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay 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.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



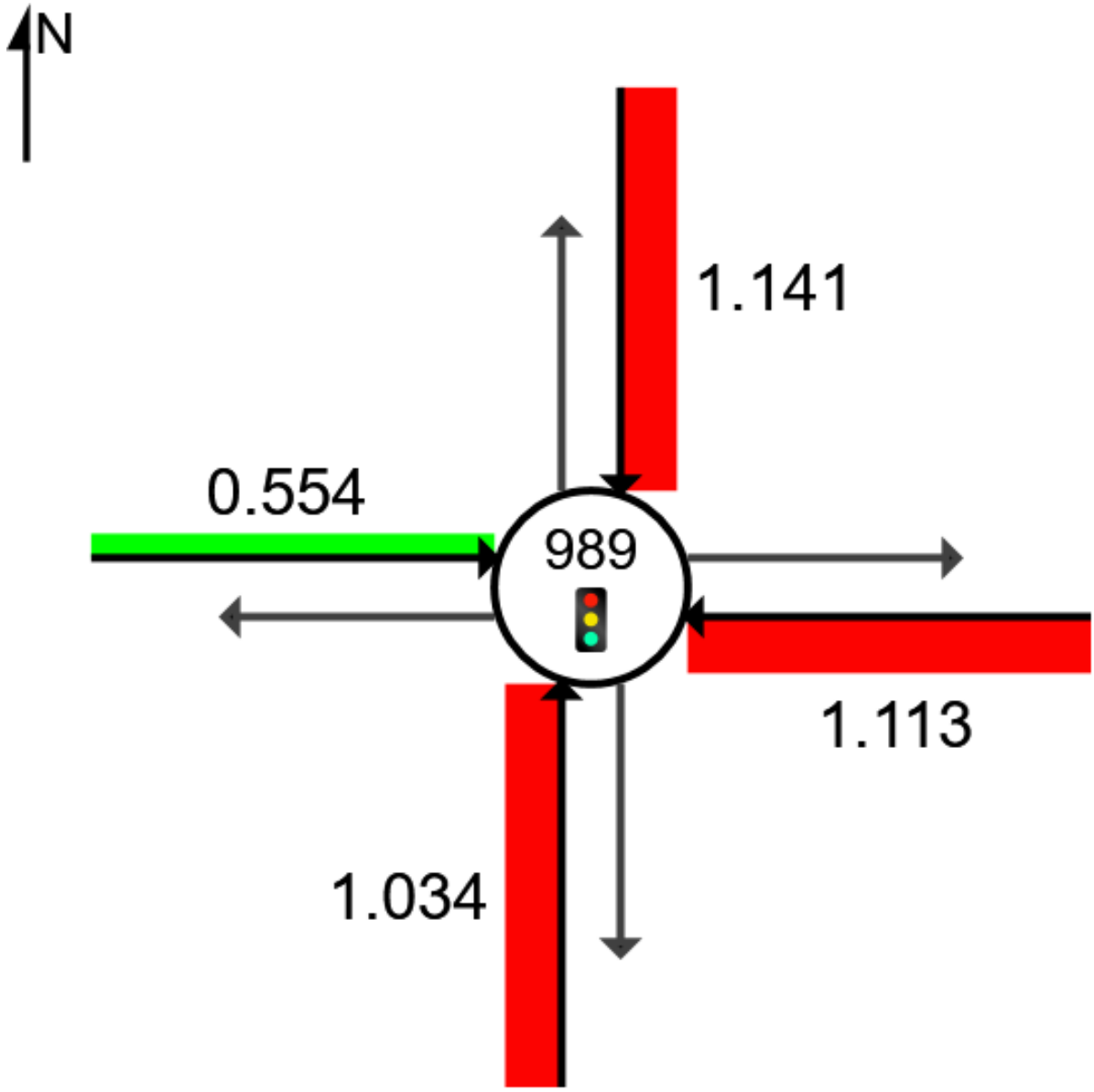
Phase Timing Summary

Phase	A	B	C	D	E	E2
Phase Change Time (sec)	0	81	96	106	125	137
Green Time (sec)	75	9	4	13	6	***
Phase Time (sec)	81	15	10	19	12	3
Phase Split	58%	11%	7%	14%	9%	2%

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.

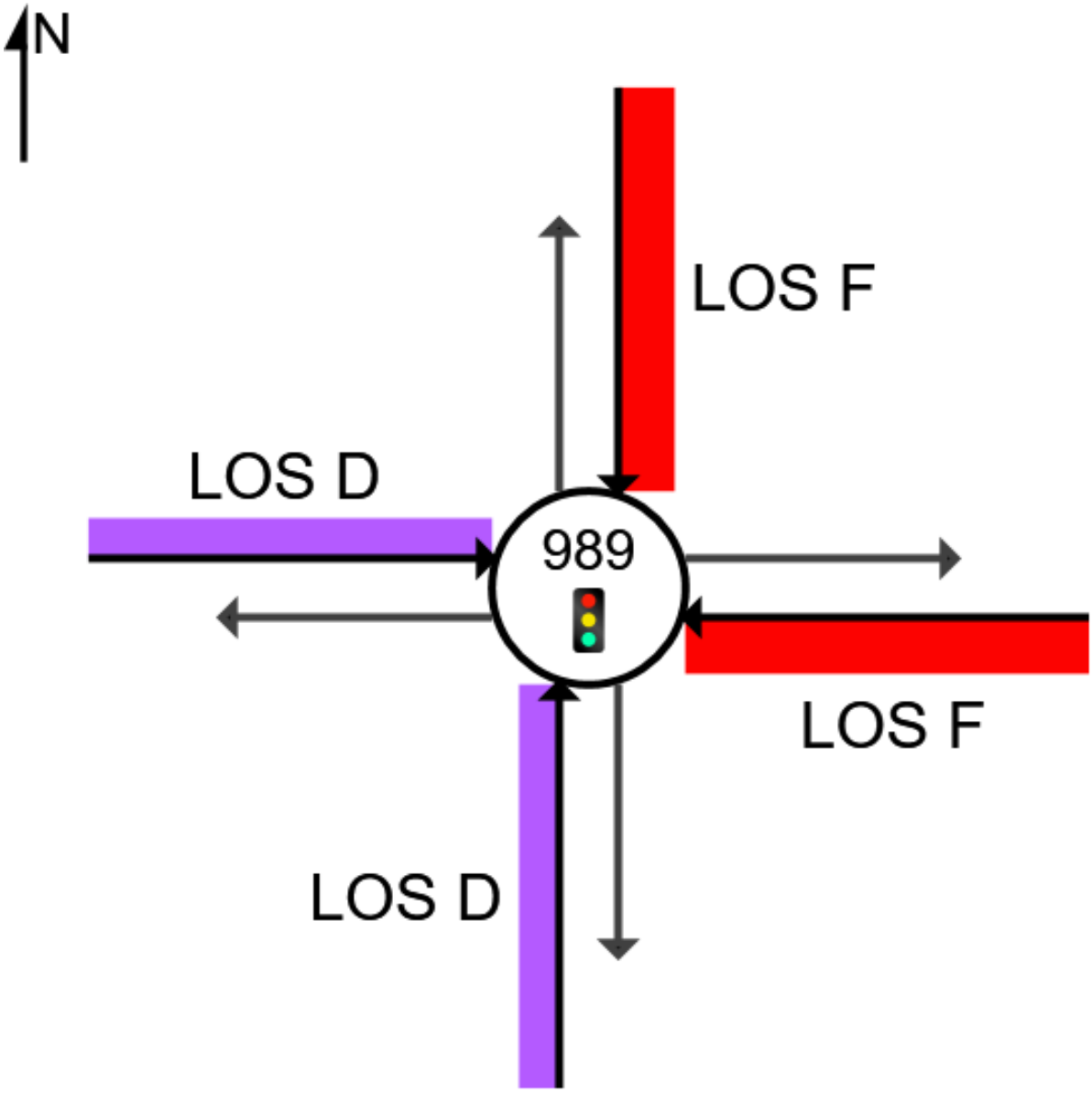
Degree of Saturation



Colour code based on Degree of Saturation

[< 0.6]	[0.6 – 0.7]	[0.7 – 0.8]	[0.8 – 0.9]	[0.9 – 1.0]	[> 1.0]

Level of Service

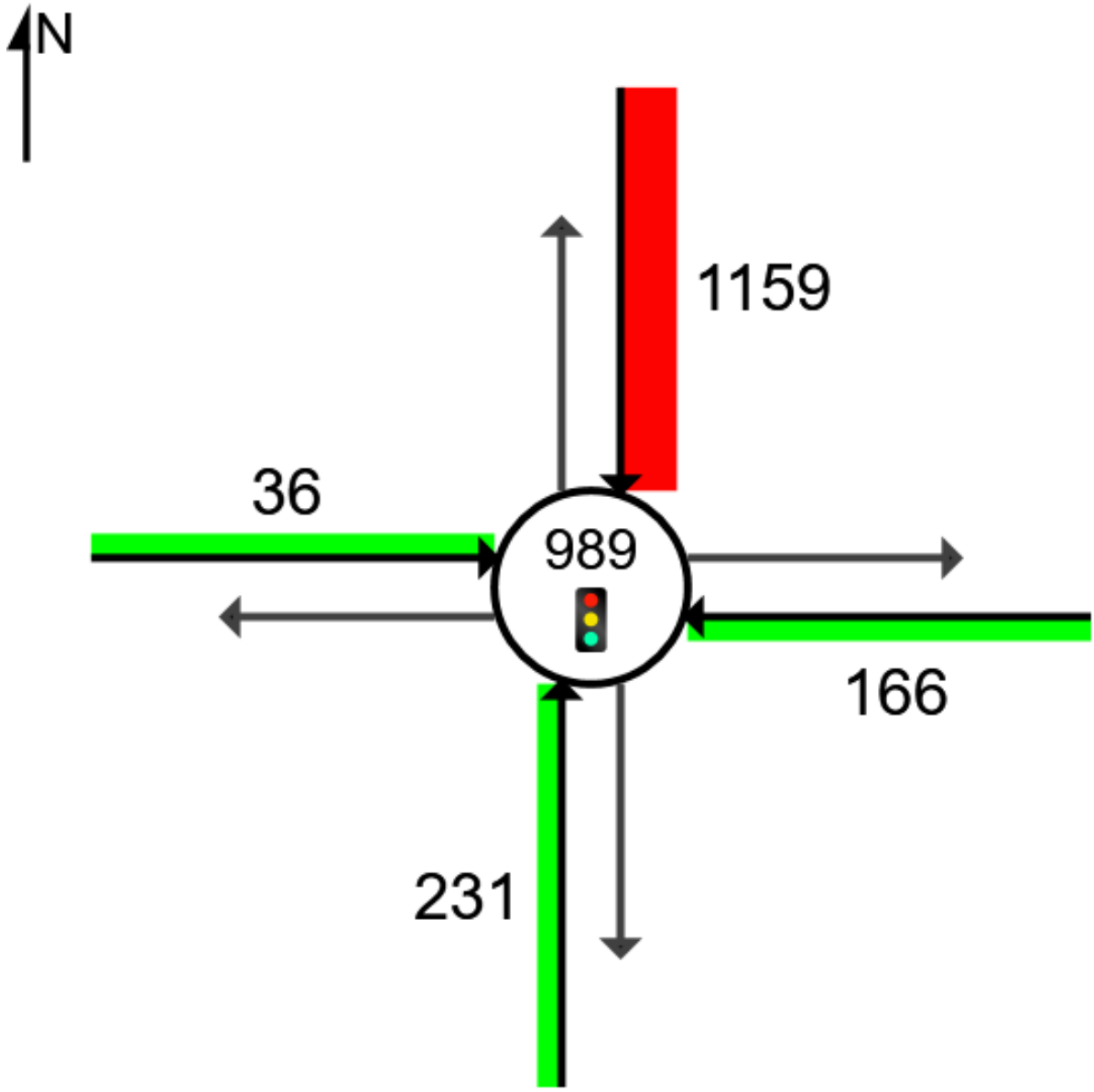


Colour code based on Level of Service

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Pedestrian Level of Service Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Distance (Percentile)



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

Queue Model: SIDRA Standard.

USER REPORT FOR SITE

All Movement Classes

Project: 241001_marshall_psp_modelling_v1

Template: Default Site User Report

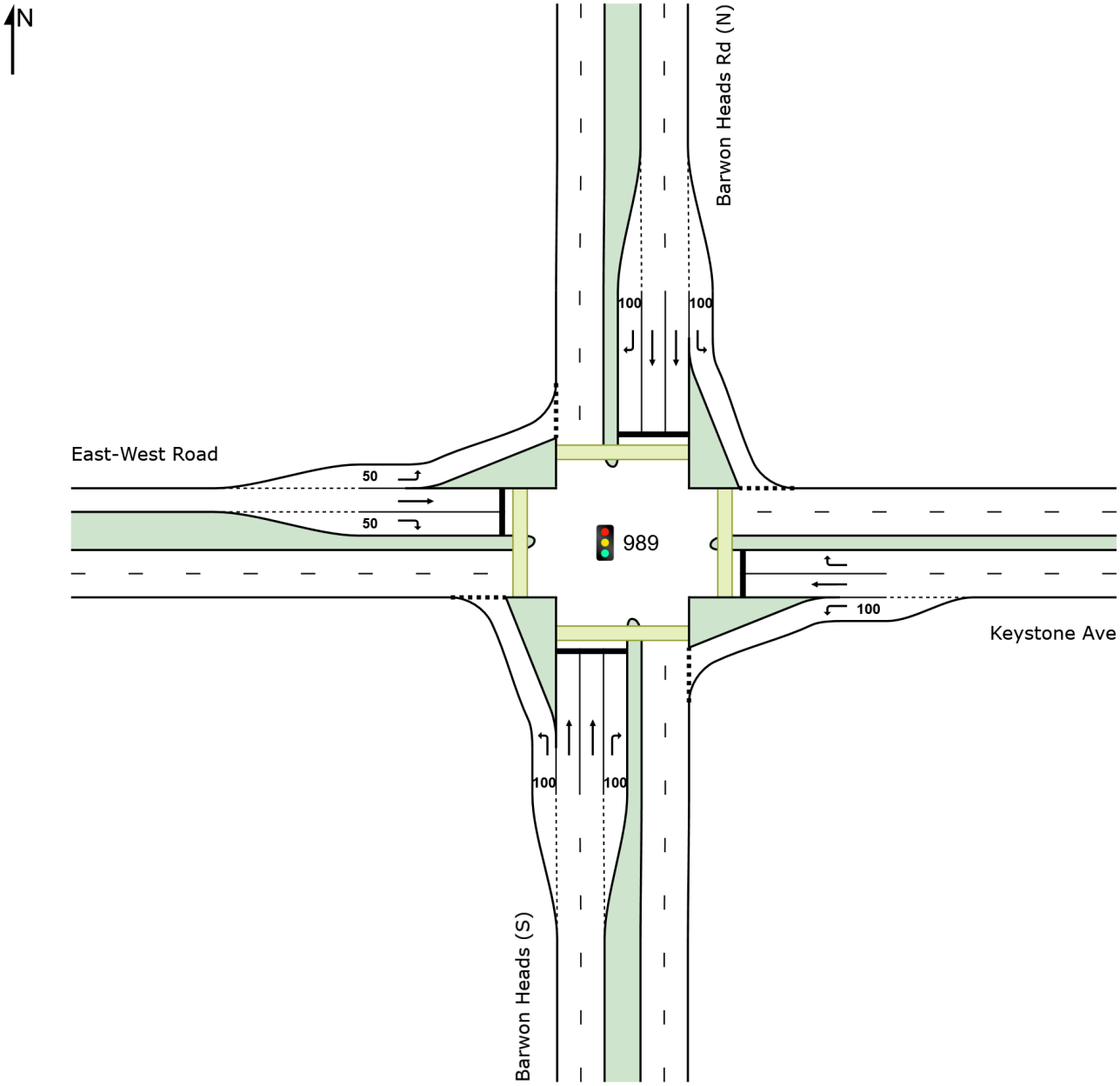
Site: 989 [AM (Final) - Revised w/ Mitigation (2041) - Keystone Ave / Barwon Heads Rd / Connector (Site Folder: Final Layout (2041) - 29/10/2024)]

Site Category: Signalised Intersection
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 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, E1*
(* Variable Phase)

Site Layout

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



Lane Use and Performance

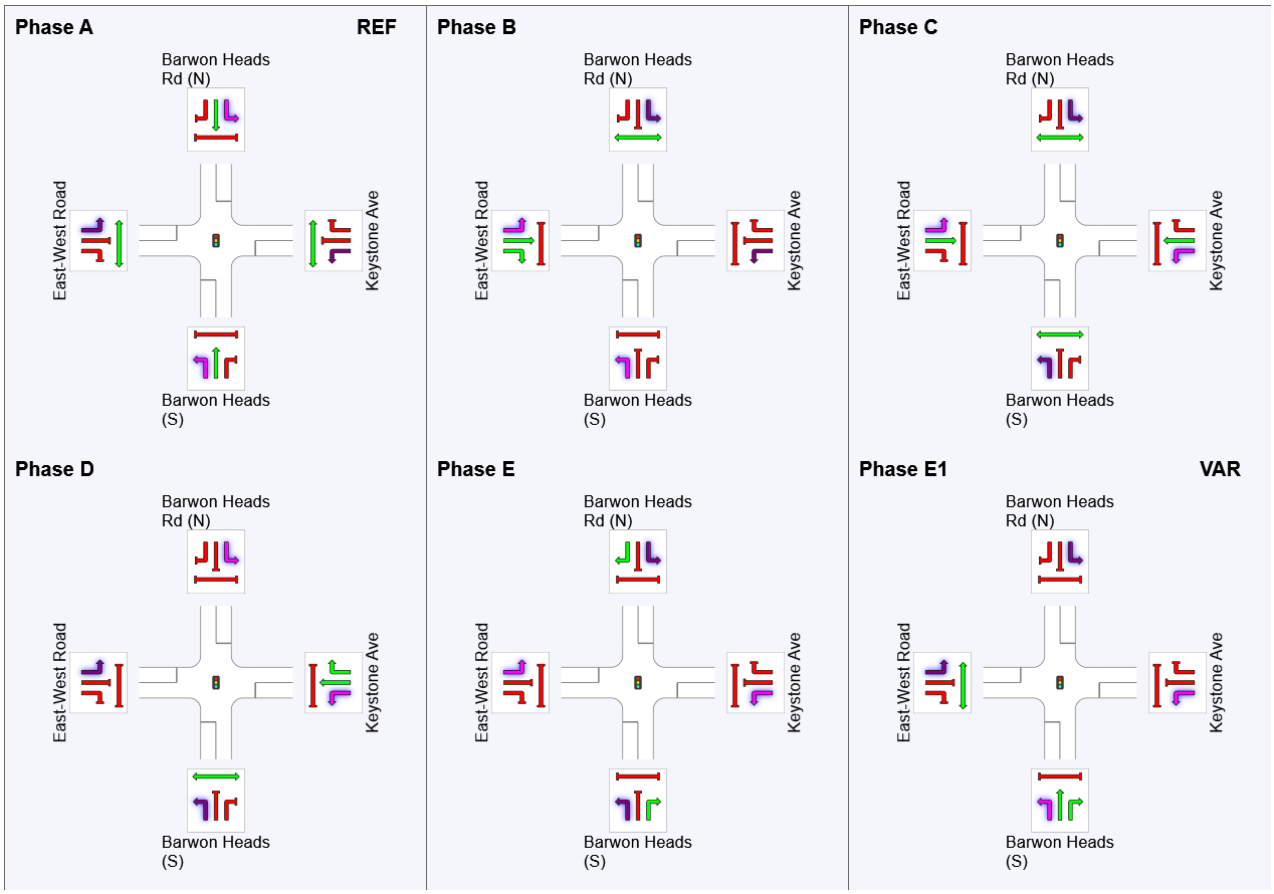
	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Barwon Heads (S)													
Lane 1	8	2.0	1508	0.006	100	7.8	LOS A	0.1	0.5	Short	100	0.0	NA
Lane 2	1258	8.0	1028[1]	1.224	100	259.3	LOS F	201.8	1509.3	Full	500	0.0	100.0
Lane 3	974	8.0	796[1]	1.224	100	264.2	LOS F	158.1	1182.8	Full	500	0.0	85.7
Lane 4	494	5.0	451[1]	1.094	100	175.6	LOS F	62.2	454.0	Short	100	0.0	NA
Approach	2734	7.4		1.224		245.1	LOS F	201.8	1509.3				
East: Keystone Ave													
Lane 1	212	5.0	1121	0.189	100	15.2	LOS B	5.6	41.0	Short	100	0.0	NA
Lane 2	106	2.0	261	0.407	100	60.5	LOS E	6.8	48.1	Full	500	0.0	0.0
Lane 3	212	5.0	179	1.180	100	244.0	LOS F	30.0	218.7	Full	500	0.0	0.0
Approach	529	4.4		1.180		115.7	LOS F	30.0	218.7				

North: Barwon Heads Rd (N)													
Lane 1	494	5.0	794	0.622	100	35.5	LOS D	24.3	177.6	Short	100	0.0	NA
Lane 2	434	8.0	395[1]	1.100	100	173.7	LOS F	53.7	401.3	Full	500	0.0	0.0
Lane 3	482	8.0	438[1]	1.100	100	172.2	LOS F	59.3	443.4	Full	500	0.0	0.0
Lane 4	62	2.0	78	0.791	100	86.4	LOS F	4.7	33.2	Short	100	0.0	NA
Approach	1472	6.7		1.100		123.2	LOS F	59.3	443.4				
West: East-West Road													
Lane 1	243	2.0	455[1]	0.535	100	48.7	LOS D	13.5	96.3	Short	50	0.0	NA
Lane 2	247	2.0	232[1]	1.065	100	149.9	LOS F	27.3	194.2	Full	500	0.0	0.0
Lane 3	69	2.0	170	0.409	100	72.2	LOS E	4.6	32.9	Short	50	0.0	NA
Approach	560	2.0		1.065		96.3	LOS F	27.3	194.2				
Intersection	5295	6.4		1.224		182.6	LOS F	201.8	1509.3				

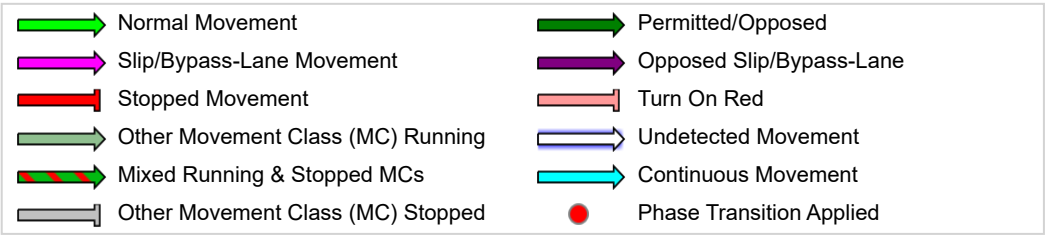
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay 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.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



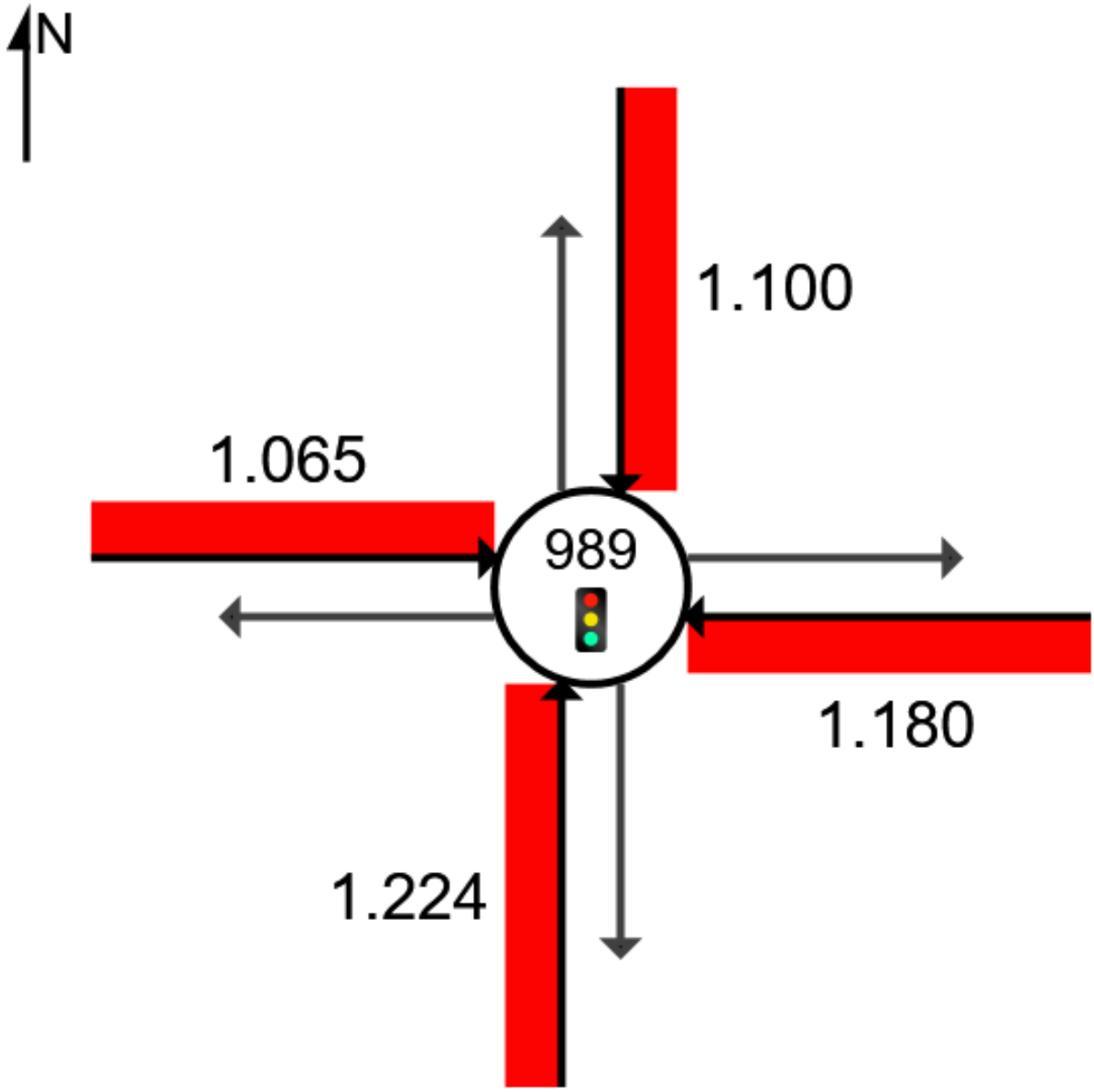
Phase Timing Summary

Phase	A	B	C	D	E	E1
Phase Change Time (sec)	0	40	59	64	84	96
Green Time (sec)	34	13	***	14	6	38
Phase Time (sec)	40	19	5	20	12	44
Phase Split	29%	14%	4%	14%	9%	31%

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.

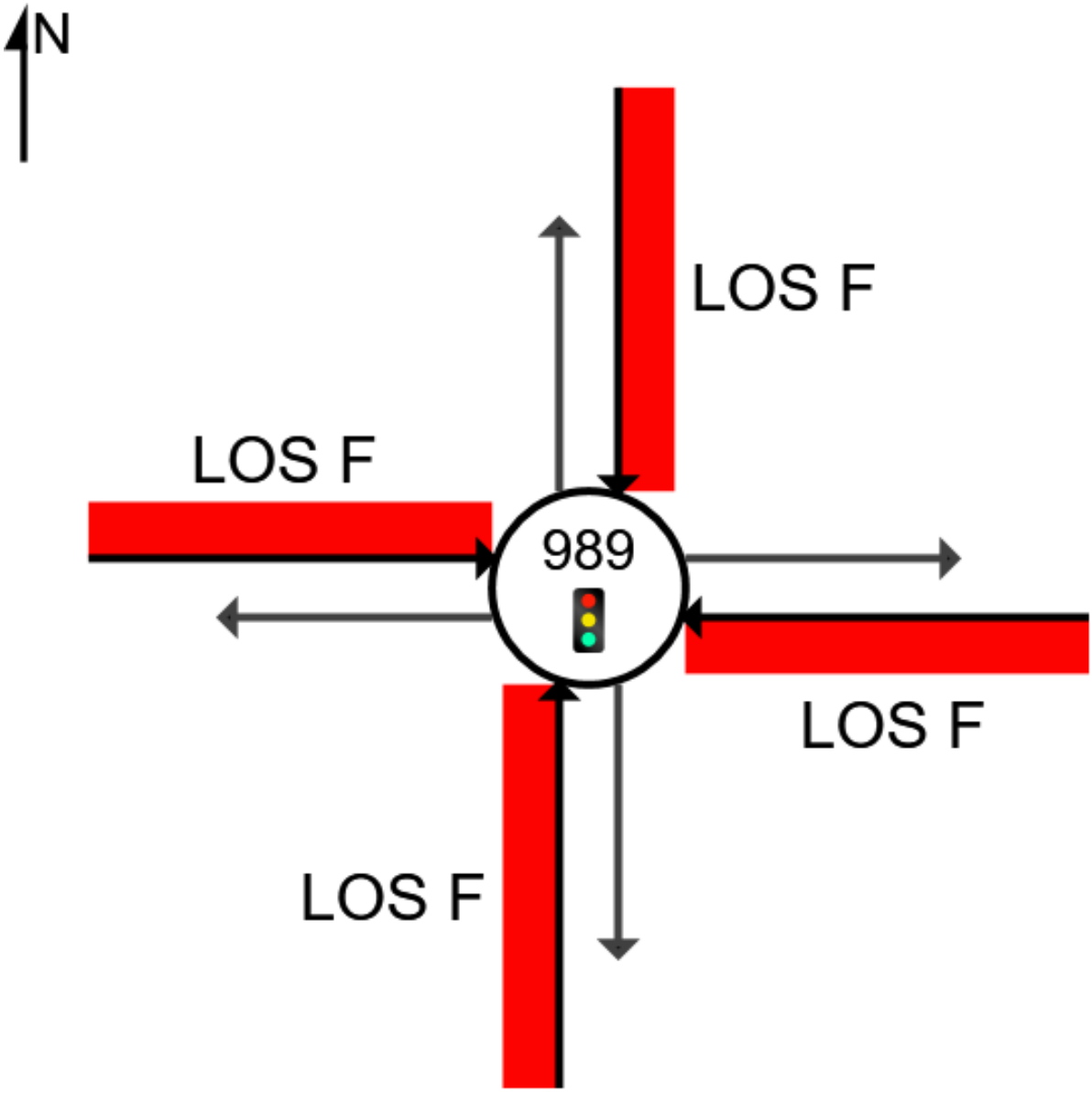
Degree of Saturation



Colour code based on Degree of Saturation

[< 0.6]	[0.6 – 0.7]	[0.7 – 0.8]	[0.8 – 0.9]	[0.9 – 1.0]	[> 1.0]

Level of Service

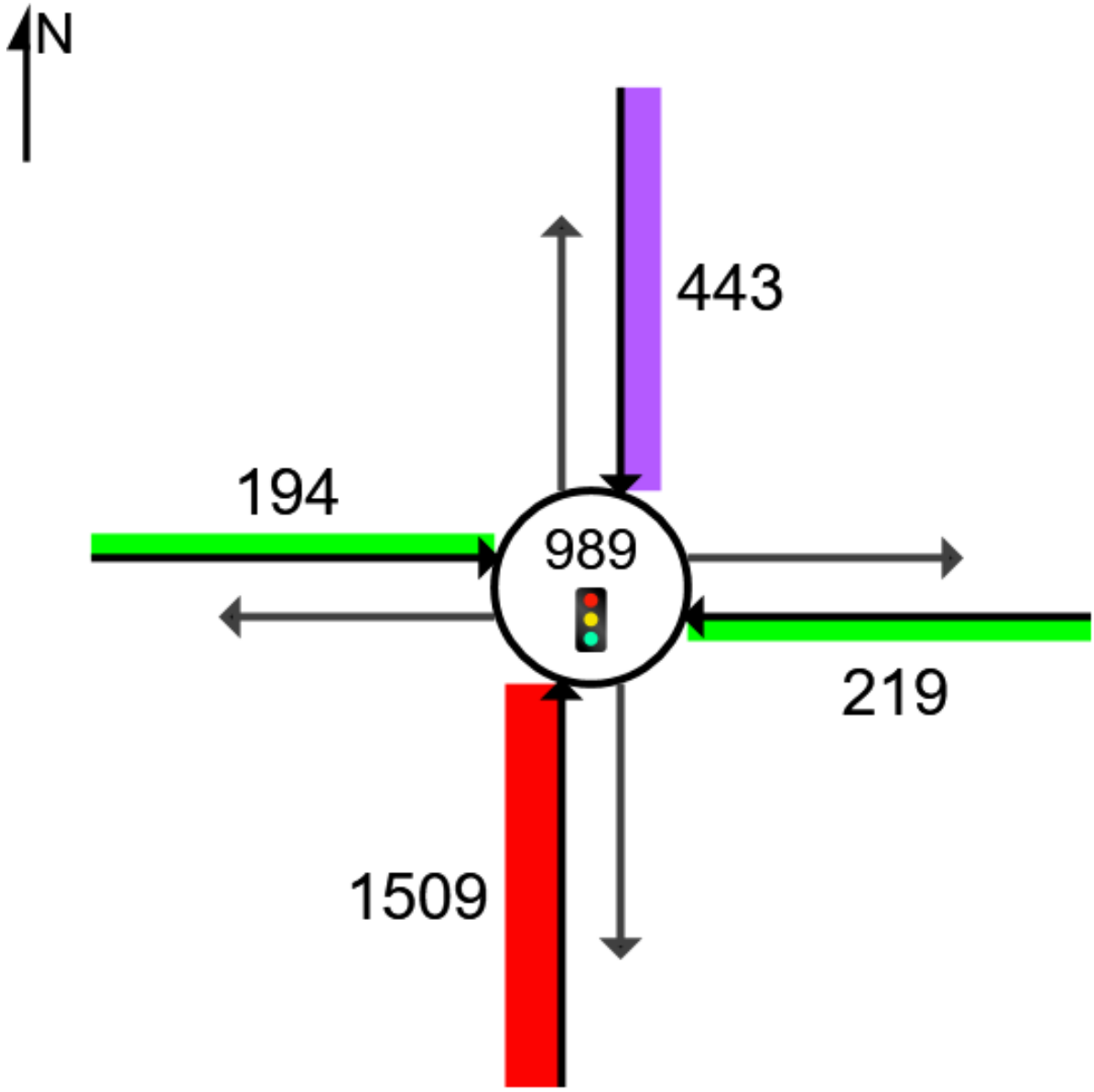


Colour code based on Level of Service

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Pedestrian Level of Service Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Distance (Percentile)



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

Queue Model: SIDRA Standard.

USER REPORT FOR SITE

All Movement Classes

Project: 241001_marshall_psp_modelling_v1

Template: Default Site User Report

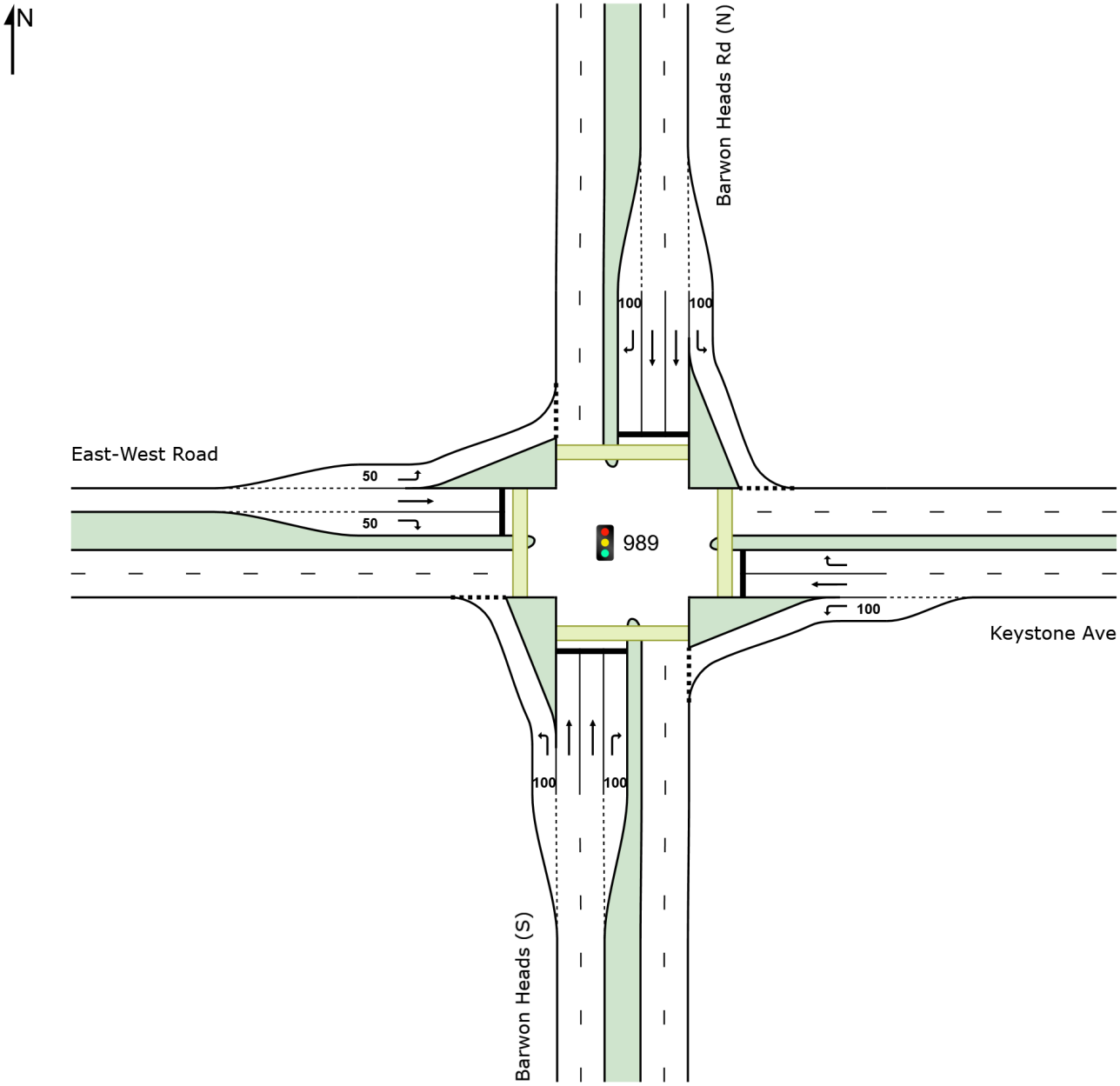
Site: 989 [PM (Final) - Revised w/ Mitigation (2041) - Keystone Ave / Barwon Heads Rd / Connector (Site Folder: Final Layout (2041) - 29/10/2024)]

Site Category: Signalised Intersection
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 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, D, E, E2*
(* Variable Phase)

Site Layout

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



Lane Use and Performance

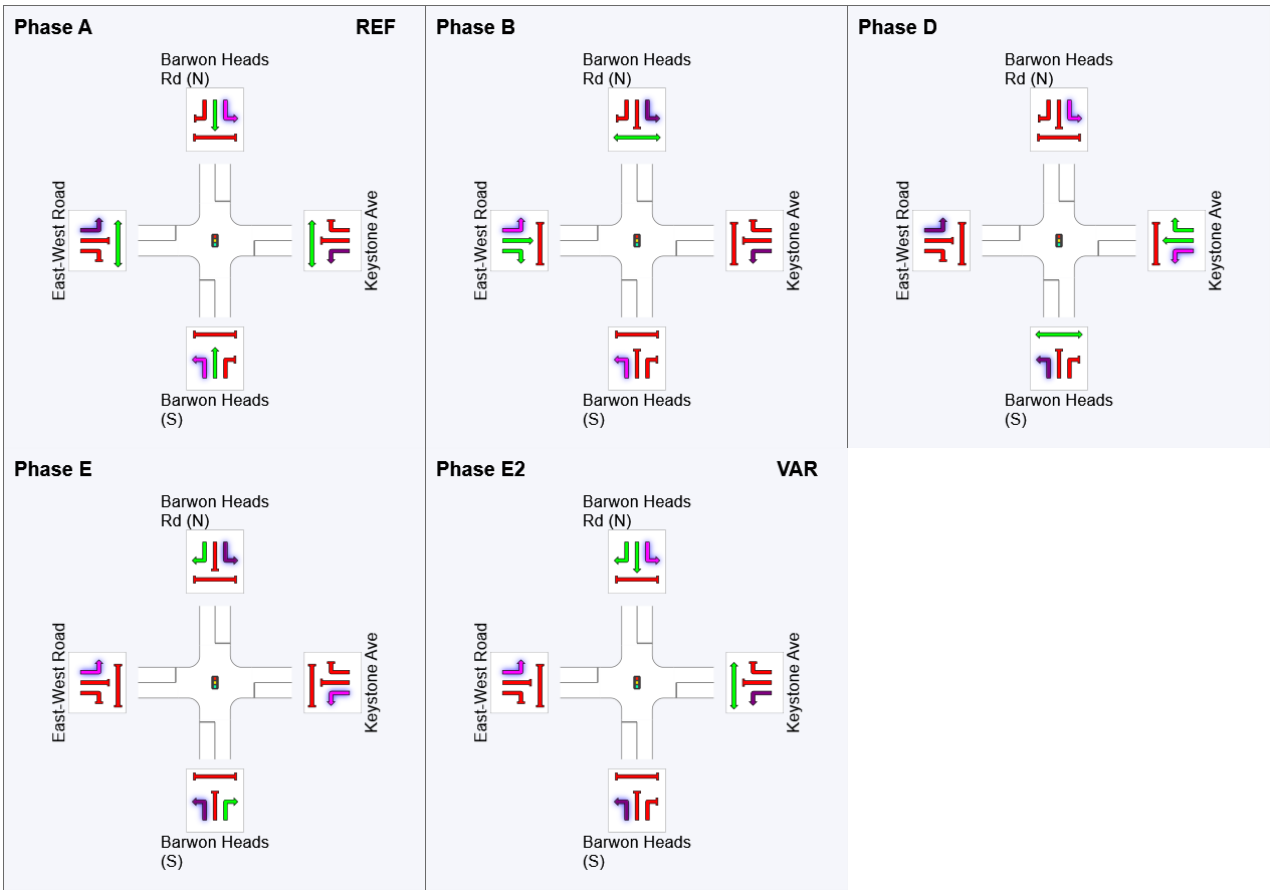
	DEMAND FLOWS [Total veh/h	HV] %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh	Dist] m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Barwon Heads (S)													
Lane 1	26	2.0	1275	0.021	100	11.6	LOS B	0.5	3.3	Short	100	0.0	NA
Lane 2	685	8.0	754[1]	0.908	100	54.8	LOS D	50.5	378.0	Full	500	0.0	0.0
Lane 3	594	8.0	654[1]	0.908	100	54.5	LOS D	42.1	314.9	Full	500	0.0	0.0
Lane 4	212	5.0	141	1.502	100	517.5	LOS F	44.9	328.0	Short	100	0.0	NA
Approach	1517	7.5		1.502		118.5	LOS F	50.5	378.0				
East: Keystone Ave													
Lane 1	494	5.0	627	0.788	100	53.8	LOS D	25.8	188.2	Short	100	0.0	NA
Lane 2	247	2.0	357	0.692	100	58.2	LOS E	16.0	114.0	Full	500	0.0	0.0
Lane 3	494	5.0	333	1.482	100	500.0	LOS F	103.8	757.5	Full	500	0.0	43.0
Approach	1235	4.4		1.482		233.1	LOS F	103.8	757.5				

North: Barwon Heads Rd (N)													
Lane 1	212	5.0	1401	0.151	100	9.3	LOS A	2.8	20.3	Short	100	0.0	NA
Lane 2	1101	8.0	731[1]	1.507	100	513.3	LOS F	241.0	1802.8	Full	500	0.0	100.0
Lane 3	1125	8.0	747[1]	1.507	100	513.0	LOS F	246.3	1842.0	Full	500	0.0	100.0
Lane 4	167	2.0	183	0.914	100	90.0	LOS F	13.2	94.2	Short	100	0.0	NA
Approach	2605	7.4		1.507		445.1	LOS F	246.3	1842.0				
West: East-West Road													
Lane 1	109	2.0	656	0.167	100	32.1	LOS C	4.6	32.6	Short	50	0.0	NA
Lane 2	106	2.0	247	0.430	100	61.7	LOS E	6.8	48.6	Full	500	0.0	0.0
Lane 3	87	2.0	235	0.371	100	66.9	LOS E	5.6	39.7	Short	50	0.0	NA
Approach	303	2.0		0.430		52.5	LOS D	6.8	48.6				
Intersection	5660	6.5		1.507		290.3	LOS F	246.3	1842.0				

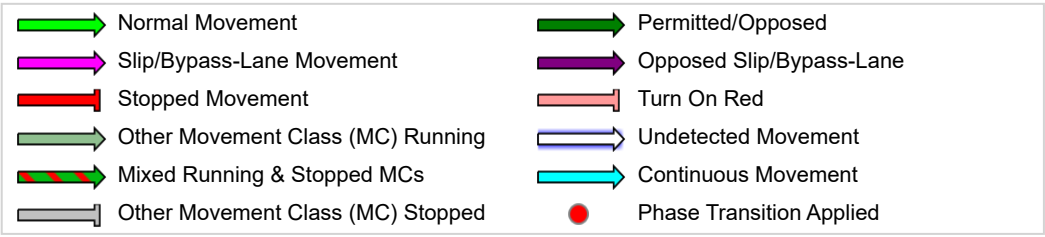
Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Delay Model: SIDRA Standard (Geometric Delay 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.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



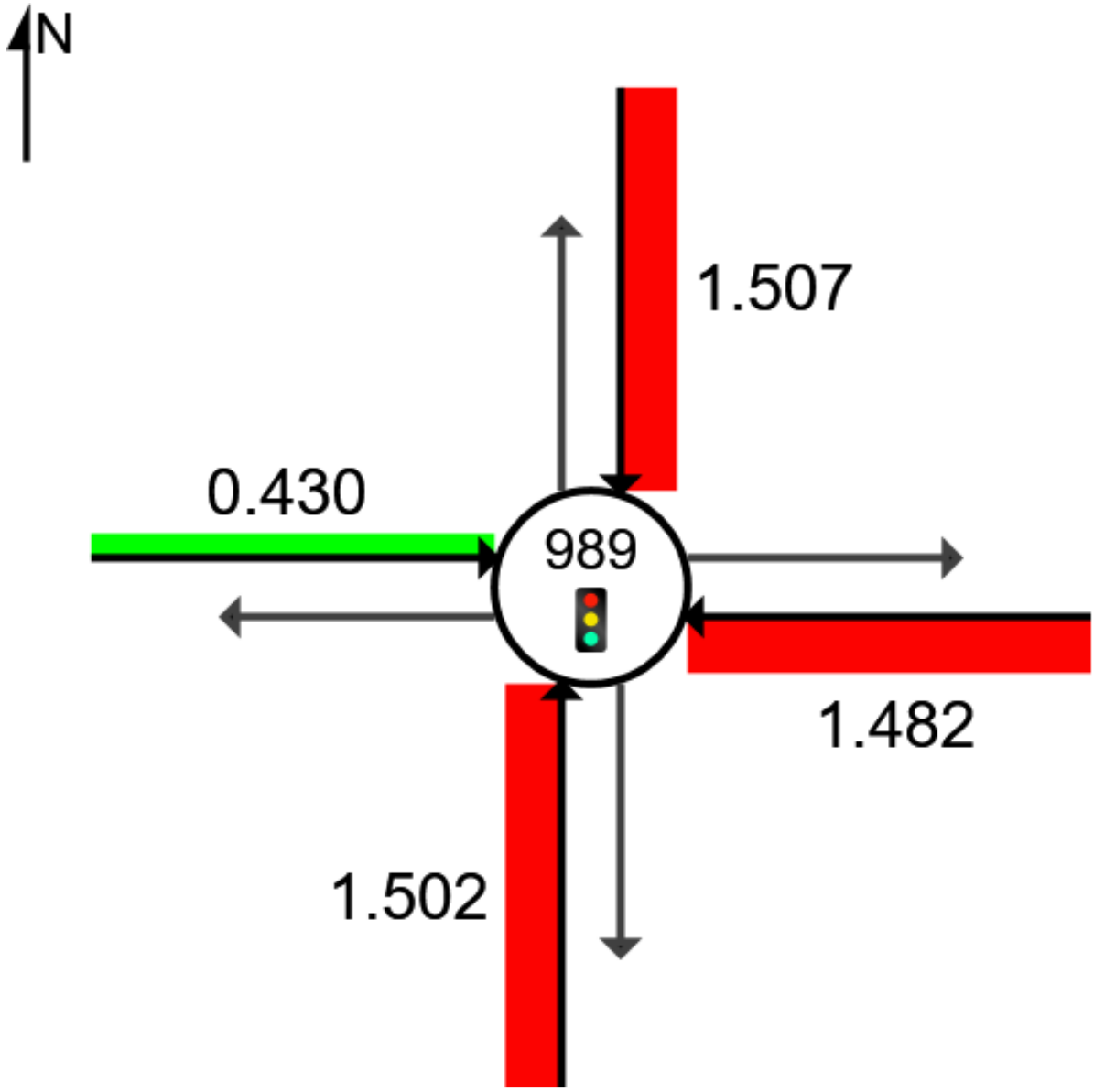
Phase Timing Summary

Phase	A	B	D	E	E2
Phase Change Time (sec)	0	64	88	120	137
Green Time (sec)	58	18	26	11	***
Phase Time (sec)	64	24	32	17	3
Phase Split	46%	17%	23%	12%	2%

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.

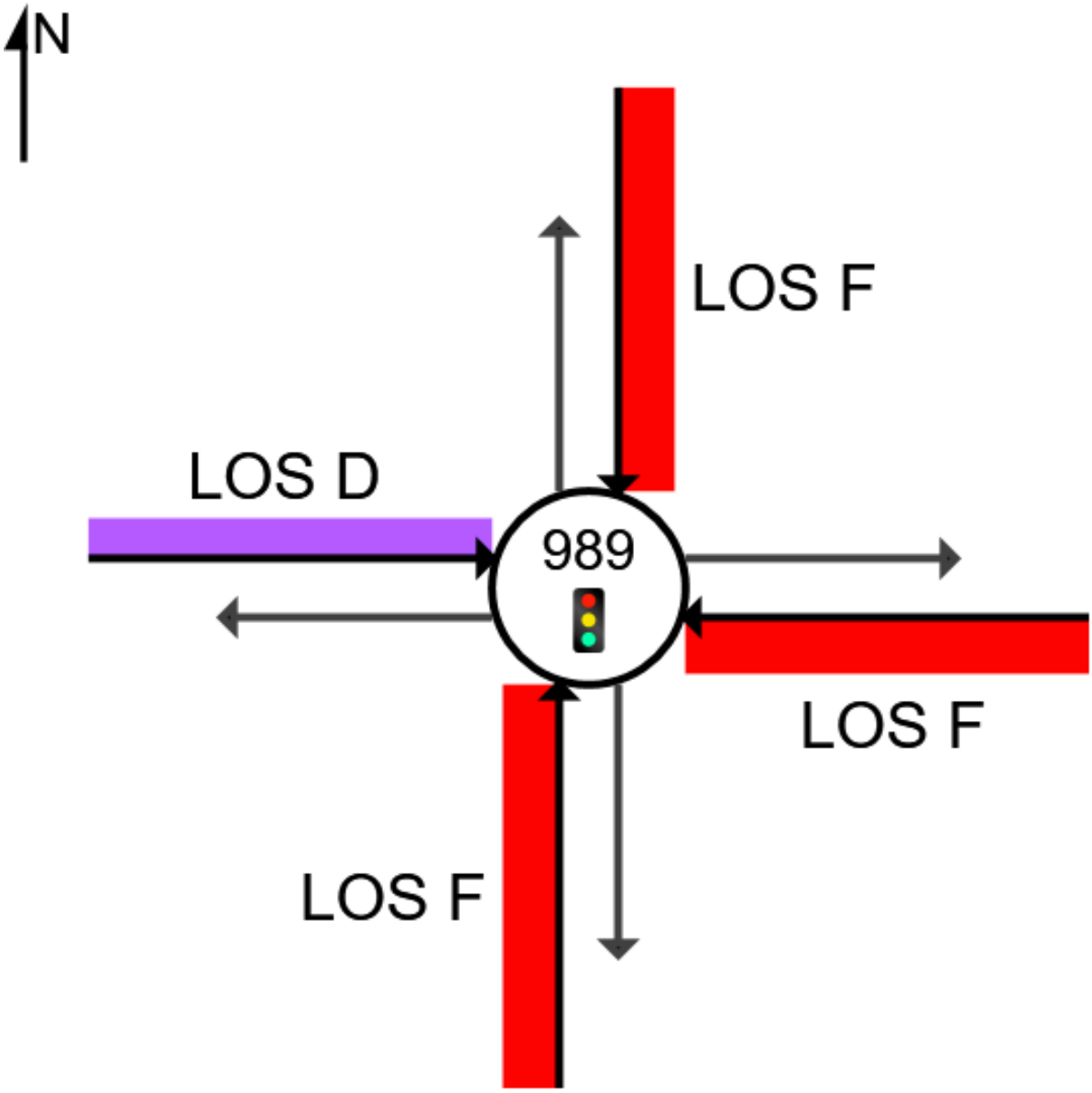
Degree of Saturation



Colour code based on Degree of Saturation

[< 0.6]	[0.6 – 0.7]	[0.7 – 0.8]	[0.8 – 0.9]	[0.9 – 1.0]	[> 1.0]

Level of Service

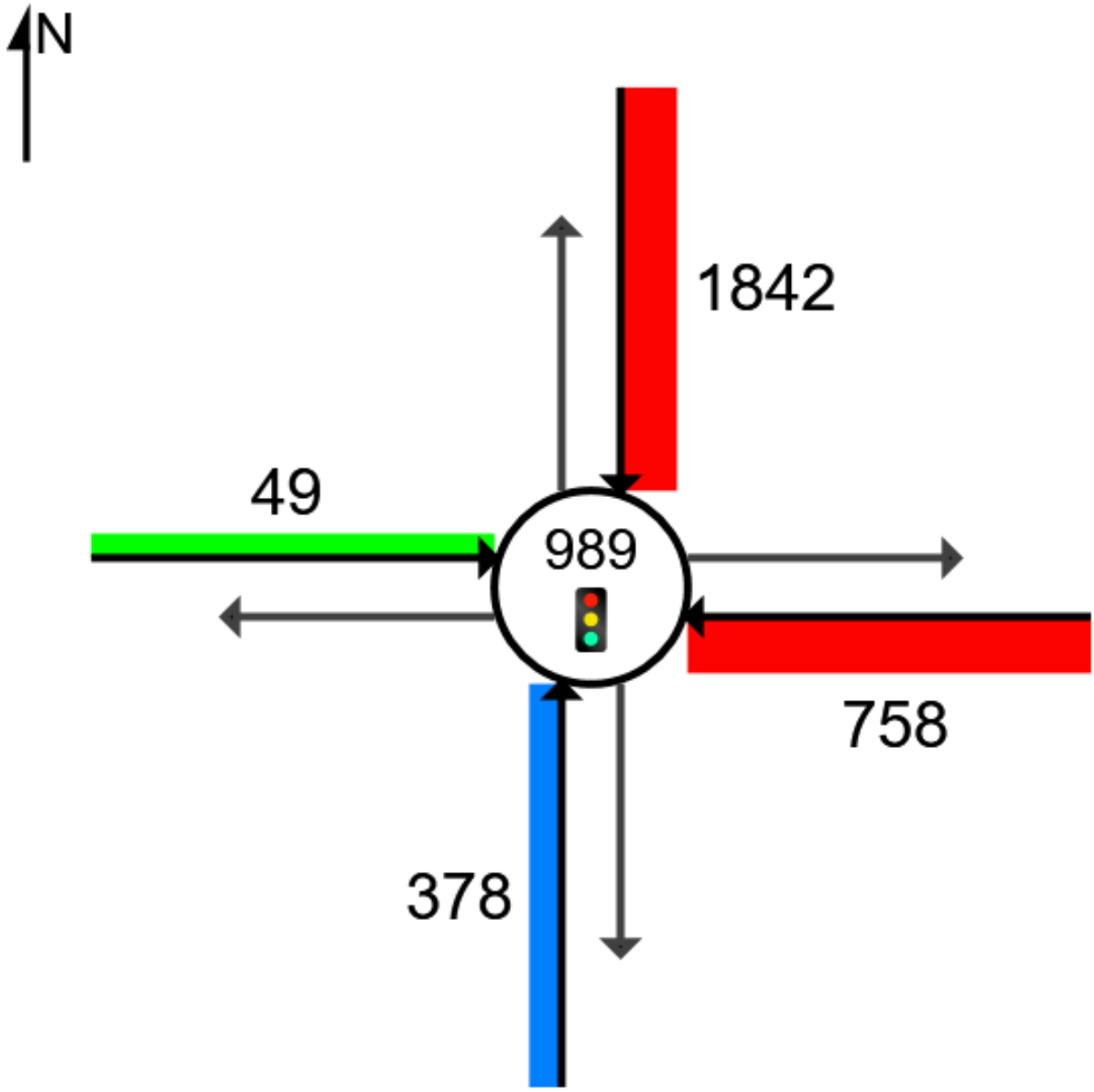


Colour code based on Level of Service

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Pedestrian Level of Service Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Delay Model: SIDRA Standard (Geometric Delay is included).

Queue Distance (Percentile)



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

Queue Model: SIDRA Standard.

Appendix C

Keystone Avenue / Barwon Heads Road Concept Design

DIAL BEFORE YOU DIG
www.1100.com.au

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

CONCEPT PLAN
FOR DISCUSSION PURPOSES ONLY
This draft plan has been prepared to show a concept for discussion purposes only and has no formal or official status.

AMENDMENTS

ISSUE	DATE	DESCRIPTION	BY	CHK.	APP.
P1	30.09.2024	CONCEPT DESIGN	JL	AD	AD

GENERAL NOTES

DESIGNED JL	DESIGN CHECK
DRAWN JL	DRAFTING CHECK
APPROVED BY AD	DATE APPROVED FOR INITIAL ISSUE
SCALE A1 0 10 20 40 1:1000	CAD FILE NO. SK01.DWG

Stantec

CLIENT CITY OF GREATER GEELONG

ARMSTRONG CREEK
NORTH INDUSTRIAL PRECINCT

CONCEPT DESIGN

MAP REF.	DRAWING NO.	SHEET	ISSUE
466/C6	300305031	01 OF 01	P1

\\AU2013-PPFSS02\SHARED_PROJECTS\300305031\TECHNICAL\DRAWINGS\XREF\PREVIOUS WORK\300305031-SK01.DWG PLOTTED BY LAING, JAMES ON 08/10/2024 AT 12:57

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