

Amendment C372 to the Geelong Planning Scheme

35 and 69-93 Hams Road, Waurn Ponds
Transport Evidence



Prepared by: GTA Consultants (VIC) Pty Ltd for Echin Pty Ltd and Waurn Ponds Unit Trust

on 15/08/19

Reference: V177700

Issue #: A

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CONTENTS

1. Introduction	1
1.1. Background	1
1.2. Purpose of Review	1
1.3. Expert Witness Details	2
1.4. References	2
2. Traffic Impacts	3
2.1. Overview	3
2.2. Existing Traffic Volumes	3
2.3. Predicted Future Traffic Volumes	5
2.4. Development Generated Traffic & Distribution	6
2.5. Traffic Impacts and Mitigation	7
2.6. Ghazeeopore Road Daily Traffic Volumes	11
2.7. Summary	12
3. Roundabout Design	13
3.1. Overview	13
3.2. Design Peer Review	13
3.3. Summary	14
4. Subdivision Layout	15
4.1. Overview	15
4.2. Internal Road Network Layout	15
4.3. Vehicle Access Arrangements	17
4.4. Summary	17
5. Response to Submissions	18
5.1. Overview	18
5.2. Submissions	18
5.3. Summary	20
6. Review of Draft DDO & Planning Permits	21
6.1. Overview	21
6.2. Draft DDO45	21

6.3. Draft Planning Permits	22
6.4. Summary	22
7. Conclusion	23

Appendices

- A. Curriculum Vitae
- B. Updated Masterplan
- C. Site Photos
- D. Existing Conditions
- E. SIDRA Assessment

Figures

Figure 2.1: Existing AM peak hour volumes (July 2019)	3
Figure 2.2 Existing PM peak hour volumes (July 2019)	3
Figure 2.3: Existing PM peak hour volumes (July 2019) – Sugargum Drive entry and exit volumes only	4
Figure 2.4: Future Base AM peak hour volumes (2029)	6
Figure 2.5 Future Base PM peak hour volumes (2029)	6
Figure 2.6: Development AM peak hour volumes (2029)	7
Figure 2.7 Development PM peak hour volumes (2029)	7
Figure 2.8: Post Dev. AM peak hour volumes (2029)	7
Figure 2.9 Post Dev. PM peak hour volumes (2029)	7
Figure 3.1: Traffic Group Design for Proposed Roundabout	13
Figure 4.1: Proposed Internal Street Cross-section	15
Figure 4.2: Example Roundabout Configuration	16
Figure 5.1: Hams Road Proposed Cross-section	19

Tables

Table 2.1: Intersection Operation – Future Base Traffic Conditions (2029) and Existing Intersection Configuration	8
Table 2.2: Intersection Operation – Post-Development Future Traffic Conditions (2029) and Existing Intersection Configuration	9
Table 2.3: Intersection Operation – Post-Development Future Traffic Conditions (2029) with Proposed Roundabout	10

1. INTRODUCTION

1.1. Background

A concurrent planning scheme amendment and residential subdivision application has been lodged for land located at 35 and 69-93 Hams Road, Waurin Ponds.

The amendment / application was initially lodged with the City of Greater Geelong (Council) in 2017 for a 258-lot residential subdivision with vehicle access onto Hams Road. This application was supported by a Traffic Engineering Assessment prepared by Traffix Group (October 2018), amongst other reports. The application was reviewed by Council's traffic engineers, and other officers, and was supported subject to various conditions.

During the exhibition of the amendment, numerous submissions were made to Council regarding the suitability of the subdivision in terms of its traffic impacts on the surrounding road network. The concerns within these submissions principally related to the adequacy of Ghazeepore Road to accommodate the level of traffic expected to be generated by the subdivision. In response to these concerns, the subdivision layout was amended to remove two medium density superlots and reduce the overall yield to 245 lots.

In July 2019, I was engaged by the Applicant to undertake a peer review of the application and prepare an associated evidence for presentation at the upcoming Panel Hearing for the project. Prior to undertaking this review, I was briefed by Norton Rose Fulbright via written and verbal instructions.

1.2. Purpose of Review

This evidence considers the proposal and sets out my assessment of the anticipated traffic and transport implications of the residential subdivision.

In undertaking this review, I have inspected the site and its surrounds, referenced the Traffic Engineering Assessment prepared by Traffix Group ('the Traffix report') and other relevant documents, and commissioned additional data collection to verify the assumptions of the Traffix report. This additional data collection has included new traffic volume counts at the Ghazeepore Road/Sugargum Drive/Hams Road intersection.

In my opinion, the three most relevant transport considerations for the proposal are:

1. The ability of the immediately adjacent road network to safely and satisfactorily accommodate the expected traffic generation of the subdivision. (*Chapter 2 of this evidence*)
2. The appropriateness of the proposed roundabout design, including associated improvements to the active travel network, at the Ghazeepore Road/Sugargum Drive/Hams Road intersection. (*Chapter 3 of this evidence*)
3. The appropriateness of the internal subdivision layout, including the proposed vehicle access arrangements onto Hams Road. (*Chapter 4 of this evidence*).

In preparing this evidence, I have also reviewed submissions made by authorities and third parties regarding the considerations outlined above and other matters. Discussion regarding these submissions is contained in *Chapter 5 of this evidence*. Finally, I have also considered the draft DDO and permit conditions for the site; refer to *Chapter 6 of this evidence*.

1.3. Expert Witness Details

This expert witness statement has been prepared by Timothy James De Young, Director of GTA Consultants (VIC) Pty Ltd (L25, 55 Collins Street, Melbourne, 3000) for the concurrent planning scheme amendment and subdivision application being sought for the land at 35 and 69-93 Hams Road, Waurin Ponds.

My qualifications include a Bachelor of Engineering (Civil), with Honours, and a Bachelor of Commerce from the University of Melbourne, and a Master of Business Administration from Monash University. I also hold various professional memberships and affiliations, including membership of Engineers Australia, Victorian Planning and Environmental Law Association (VPELA) and Australian Institute of Company Directors (AICD).

My core area of expertise is 'Traffic and Transport Engineering and Planning'. The details of my experience are set out in the Curriculum Vitae appended to this expert witness statement at **Appendix A of this evidence**. This CV highlights that my recent experience includes presentation of expert evidence in Victoria at VCAT and Planning Panels Victoria as well as in NSW at the Land and Environment Court.

In preparing this evidence, I received assistance from Tom Dwyer (Senior Consultant, GTA Consultants (BEng (CivInfra) GradDipUrbPlanEnv)). I also confirm that I have no private or business relationship with the Applicant and have been engaged to provide expert witness services at the Panel Hearing for a mutually agreed fee.

1.4. References

In preparing this evidence, I have referenced the following documents

- Greater Geelong Planning Scheme.
- Updated Masterplan for the proposed subdivision prepared by Taylors, dated 24 July 2019 (**refer to Appendix B of this evidence**)
- Transport Engineering Assessment report prepared by Traffix Group *Proposed Rezoning and Residential Subdivision as 35 & 69-93 Hams Road, Waurin Ponds* dated 2 July 2018.
- Draft C372 amendment to Schedule 45 to Clause 43.02 Design and Development Overlay of the Greater Geelong Planning Scheme *DDO45 – Hams Road, Waurin Ponds Residential Subdivision – Version 2* dated 1/8/2019.
- Draft Planning Permit No.: 662 /2017 – 35 Hams Road, Waurin Ponds, City of Greater Geelong – Version 2 dated 1/8/2019.
- Draft Planning Permit No.: 663 /2017 – 69-93 Hams Road, Waurin Ponds, City of Greater Geelong – Version 2 dated 1/8/2019.
- Draft S173 Agreement – Public Exhibition Version, 19 March 2019.
- Traffic surveys as referenced in the context of this report.
- Various other authority letters as referenced in this report.
- Other documents as nominated.

I also visited the site prior to preparing this evidence. This site inspection was completed on Monday 29th July 2019 from approx. 12:30pm to 1:30pm¹. Relevant photographs from my site inspection are included at **Appendix C** and a summary of the relevant existing transport conditions in the vicinity of the site are included at **Appendix D**.

¹ As this site inspection was unable to be undertaken during peak hours, I also reviewed video footage of the peak hour traffic surveys.

2. TRAFFIC IMPACTS

2.1. Overview

The additional traffic generated by the proposed subdivision can be expected to principally access the site via the Ghazeepore Road/ Sugargum Drive/Hams Road intersection, with minimal traffic likely to utilise Grange Park Drive². The operation of this intersection under post-development conditions is therefore a critical consideration as to whether the impacts of the subdivision are acceptable.

2.2. Existing Traffic Volumes

2.2.1. Traffic Movements

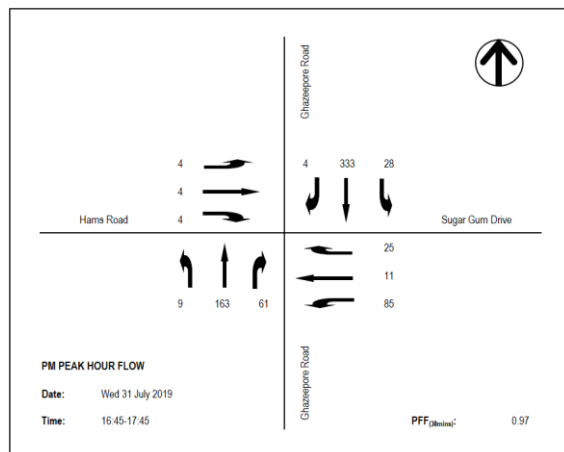
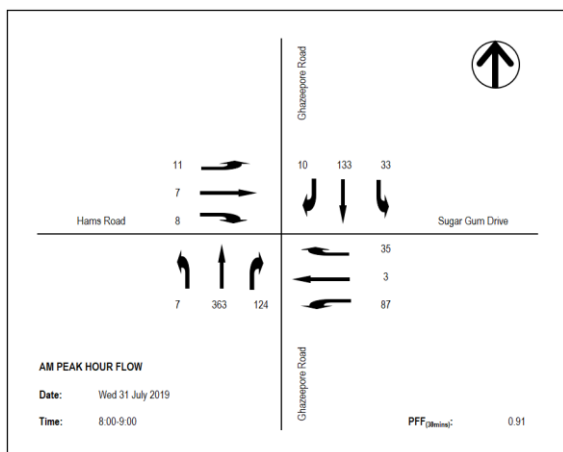
The Traffix report contained traffic surveys undertaken at the Ghazeepore Road/Sugargum Drive/Hams Road intersection during AM and PM peak hours in October 2016.

Since the completion of these surveys, I understand that the attractiveness of the commuter car parking at Waurm Ponds Train Station has increased and that traffic volumes through this intersection have consequentially also increased. (This is a common theme raised in the various submissions).

Accordingly, I thought it prudent to undertake new traffic surveys at the intersection, for a broader period of each peak hour. These surveys were undertaken (via video survey) on Wednesday 31st August 2019. The peak hour traffic volumes recorded during these surveys are shown in Figure 2.1 and 2.2 below.

Figure 2.1: Existing AM peak hour volumes (July 2019)

Figure 2.2 Existing PM peak hour volumes (July 2019)



The traffic volumes shown in the above figures are higher than those surveyed in October 2016 and suggest that traffic volumes have grown on the surrounding road network. I consider it appropriate to utilise these traffic volumes for the purposes of the traffic assessment in this evidence.

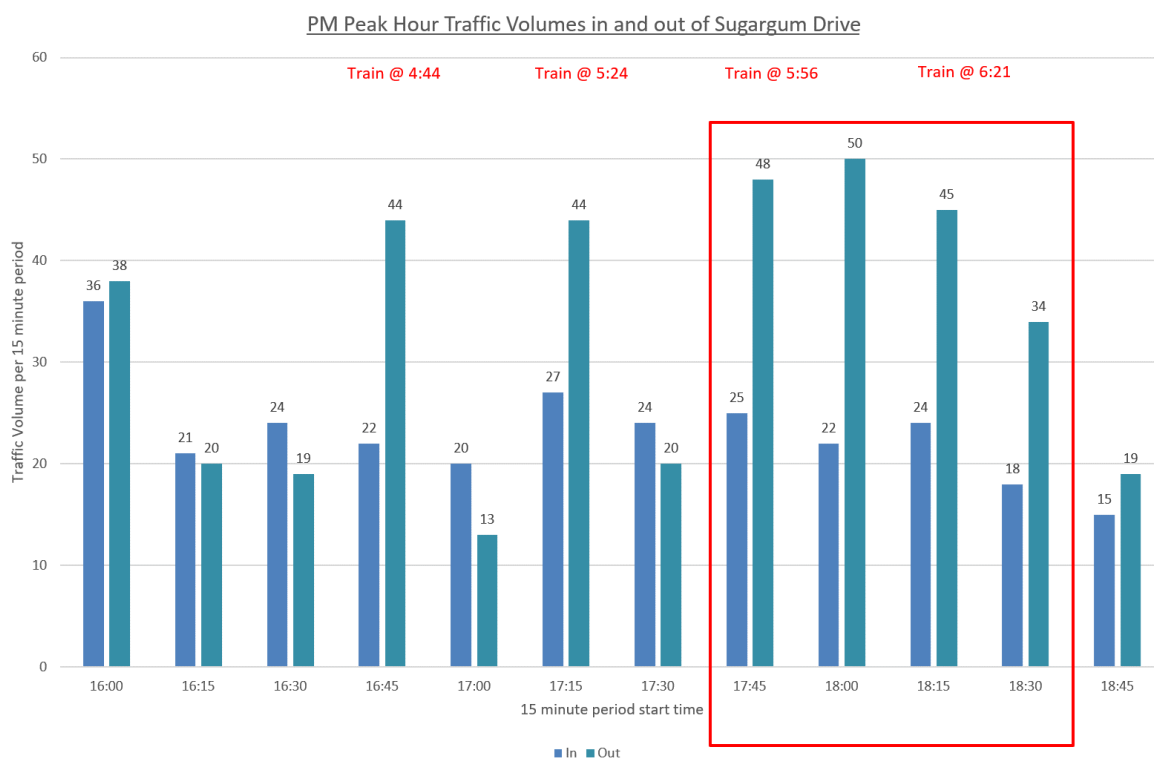
² The potential impacts on Grange Park Drive are discussed later in this evidence.

2.2.2. Other Observations

The traffic surveys undertaken in July 2019 indicate that the timing of traffic volumes into and out of Sugargum Drive is impacted by the train timetabling and the arrival and departure of cars in the commuter car park.

This is most notable in the PM peak hour where the highest traffic volumes from Sugargum Drive occur from 5:45pm to 6:45pm (being one hour after the actual overall peak hour at the Ghazeepore Road/Sugargum Drive/Hams Road intersection) and just after the arrival of trains from Geelong/Melbourne. The traffic volumes into and out of Sugargum Drive are shown in Figure 2.3.

Figure 2.3: Existing PM peak hour volumes (July 2019) – Sugargum Drive entry and exit volumes only



During the periods immediately after the arrival of the trains from Geelong/Melbourne, the traffic surveys indicate that exiting traffic flows peak from the Sugargum Drive approach and rolling queues are generated for westbound traffic³. These periods are generally limited to up to approximately 5 minutes. In my opinion, it is probable that the congestion during these peak periods will reduce in the future as:

1. The duplication of the rail line from Geelong to Waurn Ponds⁴ will allow more train services to Waurn Ponds and thus reduce the quantum of traffic (from the commuter car parking) arriving at the intersection in short periods (i.e. it will spread the traffic from the car parking).

³ It is noted that the SIDRA analysis presented later in this report is unable to perfectly represent this peak congestion, as it represents the operation of the intersection across the peak hour (which occurs earlier).

⁴ The duplication of the rail line is a committed infrastructure project supported by both the State and Federal governments.

2. The approved structure planning for Armstrong Creek West (September 2012) includes a proposed Local Activity Centre and commuter car park on the southern side of the rail line⁵. I expect this commuter car parking will be more attractive than the existing commuter car park on the northern side of the rail line, particularly for those persons arriving from the south. This opinion is informed by my understanding that the scale of this new commuter car parking is proposed to be far larger than that provided in the existing car park north of the rail line.

Importantly, I note that this opinion does not mean that I believe traffic volumes at the intersection will reduce in total; rather that the highly tidal nature of traffic flows to/from the commuter car parking off Sugargum Drive will reduce. Indeed, the following section of this report considers the likely growth of traffic at the intersection.

2.3. Predicted Future Traffic Volumes

Typically, a vehicle access to a new development would be designed to accommodate 10 years of traffic volume growth such that acceptable operating conditions are provided for a suitable future period.

In the context of the proposed subdivision, this requirement would technically apply to the vehicle access onto Hams Road, rather than the Ghazeepore Road/Sugargum Drive/Hams Road intersection. Notwithstanding this, I consider it appropriate transport planning to ensure that this latter intersection is designed with sufficient capacity for a 10-year horizon.

This approach was also adopted in the Traffix report, which adopted a 30% growth rate for traffic volumes along Ghazeepore Road. This growth rate was applied to the October 2016 traffic volumes to effectively predict Year 2026 traffic volumes along this road in the vicinity of the site.

In my view, the adoption of a growth rate of 3% per annum (30% over 10 years) is common practice in outer metropolitan areas. To validate this growth rate, I have sourced estimates of future year traffic volumes from the Victorian Integrated Transport Model (VITM). This model suggests that traffic growth rates in the vicinity of Wauran Ponds are generally consistent with this assumption.

Notwithstanding this, for conservatism, I have assumed a growth rate of 4% (40% over 10 years) which I have also applied to all traffic movements at the intersection, rather than only those heading north or south along Ghazeepore Road. This assumption is highly conservative for the following reasons:

1. It is at the upper end of nearby VITM predictions;
2. It is not common to apply growth rates to traffic to and from side roads;
3. It is possible that traffic volumes to and from the commuter car parking on Sugargum Drive may reduce in the future with the development of Armstrong Creek West (refer to discussion earlier).

Based on the assumption of 40% traffic volume growth, the anticipated future (pre-development) AM and PM traffic volumes are shown in Figure 2.4 and 2.5 below.

⁵ Refer to page 13 of https://stfbprodapp01.blob.core.windows.net/amendmentfiles/b106b583-6c70-e811-a858-000d3ad117e3_a0cb2c3c-c67b-424c-812f-cc84e532fe3b_Greater%20Geelong%20C240%20Incorp%20doc%20-%20Armstrong%20Creek%20West%20Precinct%20Structure%20Plan%20Sept%202012%20Approval%20Gazetted.pdf

Figure 2.4: Future Base AM peak hour volumes (2029)

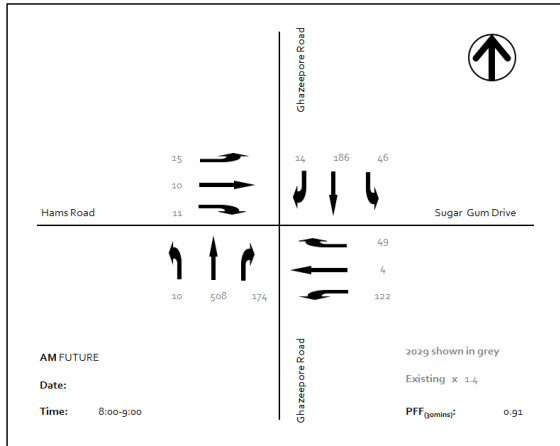
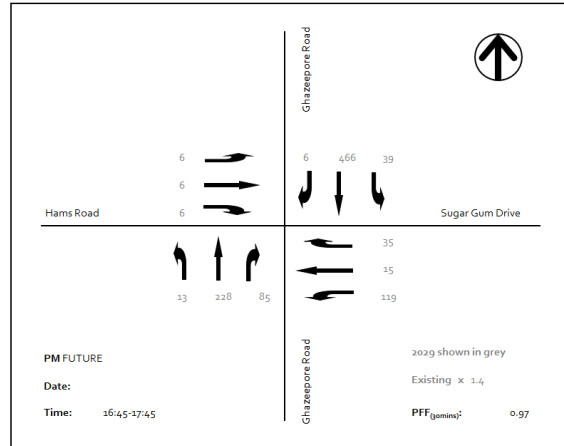


Figure 2.5 Future Base PM peak hour volumes (2029)



2.4. Development Generated Traffic & Distribution

2.4.1. Traffic Generation

The Traffix report assumes traffic generation rates of up to 9 daily vehicle movements per dwelling, including 0.85 peak hour vehicle movements per dwelling.

To assess the appropriateness of this rate, I have reviewed the *Northern & Western Geelong Growth Areas - Movement and Access* report (GTA Consultants, 2019). This report details a range of generation rates over the Geelong LGA and growth areas and includes a rate for the entire Greater Geelong local government area of 9 daily vehicle movements per dwelling. I consider this rate is likely to be conservative for the site, given its proximity to Wauran Ponds Train Station (which will run more frequent services upon duplication of this line to/from Geelong).

Notwithstanding, I have adopted rates of 9 daily vehicle movements per dwelling and 0.9 peak hour vehicle movements for this assessment. For 245 dwellings, this equates to the following traffic generation estimates:

- Daily: 2,200 vehicle movements per day (approx.)
- Peak Hour: 220 vehicle movements per hour (approx.).

2.4.2. Traffic Distribution

For the purposes of my assessment, I have assumed that all traffic uses the Ghazepore Road/Sugargum Drive/Hams Road intersection where it is distributed at 60% to/from the north, 10% to/from the east and 30% to/from the south. Moreover, I have also assumed splits between entering and exiting traffic of 20% inbound / 80% outbound in the AM peak hour and 60% inbound / 40% outbound in the PM peak hour. These assumptions slightly differ to those in the Traffix report, as I have purposefully adopted a more conservative distribution for traffic to and from the north.

2.4.3. Development Generated Traffic Volumes

Based on the above assumptions and stated conservatism, the additional peak hour traffic volumes expected to be generated by the subdivision are shown in Figure 2.6 and 2.7 below.

TRAFFIC IMPACTS

Figure 2.6: Development AM peak hour volumes (2029)

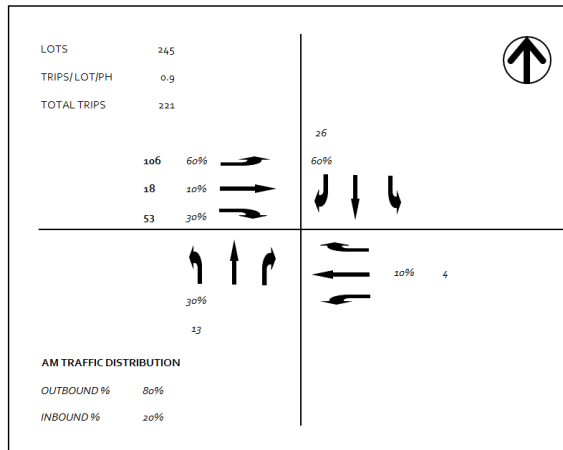
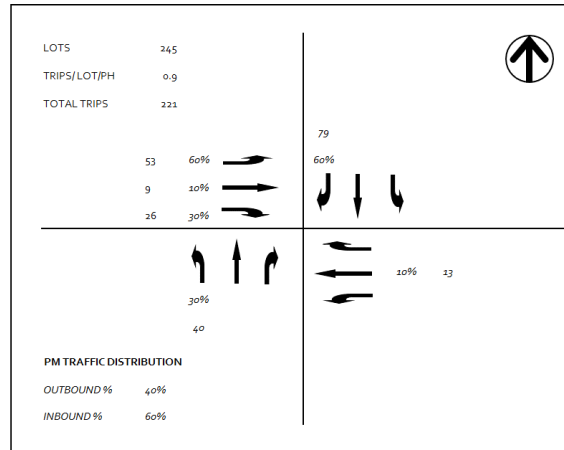


Figure 2.7 Development PM peak hour volumes (2029)



2.4.4. Future Post-Development Traffic Volumes

By adding the future (existing) traffic volumes in Figures 2.4 and 2.5 to the predicted additional traffic volumes shown in Figures 2.6 and 2.7, the future post-development traffic volumes can be estimated. These volumes are shown in Figure 2.8 and 2.9 below.

Figure 2.8: Post Dev. AM peak hour volumes (2029)

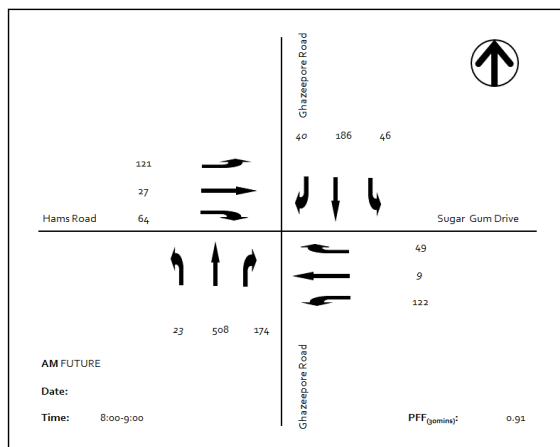
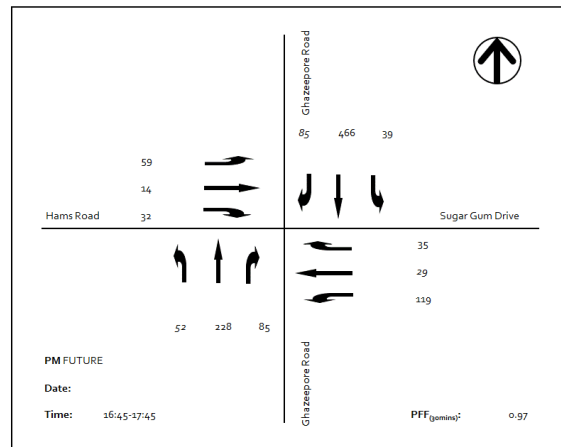


Figure 2.9 Post Dev. PM peak hour volumes (2029)



2.5. Traffic Impacts and Mitigation

2.5.1. Preamble

To test the impact of the proposal on the adjacent network, I consider it appropriate to assess the operation of the Ghazeeopore Road/Sugargum Drive/Hams Road intersection under future base traffic conditions (i.e. existing volumes plus background growth but no development growth) and post-development future traffic conditions (i.e. with additional development growth).

For post-development future traffic conditions, I have also assessed arrangements with and without the installation of the proposed roundabout to assess whether this mitigation is beneficial from a traffic operation perspective⁶.

2.5.2. Future Base Traffic Conditions (2029 without development)

The anticipated operation of the Ghazeepore Road/Sugargum Drive/Hams Road intersection under future base (2029) traffic volume conditions, with the existing intersection layout, has been assessed using a network model *SIDRA INTERSECTION 8*.

It is noted that 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 the intersection. For unsignalised intersections, a DOS of 0.9 is typically considered the ‘ideal’ limit, beyond which queues and delays increase disproportionately⁷.

The operation of the intersection under these conditions is detailed in Table 2.1, with full results presented in *Appendix E of this evidence*.

Table 2.1: Intersection Operation – Future Base Traffic Conditions (2029) and Existing Intersection Configuration

Peak Hour	Approach	DOS	Average Delay (sec)	95 th Percentile Queue (m)
AM	Ghazeepore Road (south)	0.43	2.4s	15.2m
	Surargum Road (east)	0.30	9.3s	9.0m
	Ghazeepore Road (north)	0.15	2.0s	2.1m
	Hams Road (west)	0.10	11.6s	2.3m
	Intersection	0.43	3.7s	15.2m
PM	Ghazeepore Road (south)	0.22	3.5s	7.1m
	Surargum Road (east)	0.50	10.9s	21.5m
	Ghazeepore Road (north)	0.29	0.5s	0.7m
	Hams Road (west)	0.04	10.2s	1.0m
	Intersection	0.50	4.3s	21.5m

⁶ I note that the installation of a roundabout has other road safety benefits and potential local area traffic management benefits.

⁷ SIDRA INTERSECTION adopts the following criteria for Level of Service assessment:

Level of Service		Intersection Degree of Saturation (DOS)		
		Unsignalised Intersection	Signalised Intersection	Roundabout
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

Table 2.2 indicates that the Ghazeepore Road/Sugargum Drive/Hams Road intersection can be expected to operate with an ‘excellent’ level of service under Year 2029 future base traffic conditions; as evidenced by the anticipated DOS of 0.43 in the AM peak hour and the anticipated DOS of 0.50 in the PM peak hour.⁸

2.5.3. Post Development Future Traffic Conditions (2029 with development)

The anticipated operation of the Ghazeepore Road/Sugargum Drive/Hams Road intersection under post-development future (2029) traffic volume conditions has also been assessed using a network model *SIDRA INTERSECTION 8*.

This assessment has been undertaken both for the existing intersection configuration and following installation of the proposed roundabout at the intersection. The roundabout design has been based on a version of the layout presented in the Traffix report, as discussed later in this evidence.

The operation of the intersection under the above conditions is detailed in Table 2.2 (existing intersection configuration) and Table 2.3 (proposed roundabout), with full results presented in **Appendix E of this evidence**.

Table 2.2: Intersection Operation – Post-Development Future Traffic Conditions (2029) and Existing Intersection Configuration

Peak Hour	Approach	DOS	Average Delay (sec)	95 th Percentile Queue (m)
AM	Ghazeepore Road (south)	0.44	2.5s	16.1m
	Surargum Road (east)	0.37	11.6s	12.5m
	Ghazeepore Road (north)	0.18	3.3s	5.3m
	Hams Road (west)	0.53	16.2s	20.7m
	Intersection	0.53	6.0s	20.7m
PM	Ghazeepore Road (south)	0.25	4.0s	8.2m
	Surargum Road (east)	0.63	14.5s	31.9m
	Ghazeepore Road (north)	0.35	1.8s	8.3m
	Hams Road (west)	0.24	11.2s	6.2m
	Intersection	0.63	6.2s	31.9m

⁸ I appreciate that the tidal nature of traffic flows at this intersection result in periods of longer delays and vehicle queuing than is presented in this evidence. The purpose of presenting this SIDRA analysis is to show the approximate magnitude of impact of the increased traffic volumes; rather than the exact intersection performance. As such, I recommend that greater focus is given to the change in the level of service (or the DOS) from one table to the other, rather than the level of service on its own.

Table 2.3: Intersection Operation – Post-Development Future Traffic Conditions (2029) with Proposed Roundabout

Peak Hour	Approach	DOS	Average Delay (sec)	95 th Percentile Queue (m)
AM	Ghazeepore Road (south)	0.61	6.4s	39.0m
	Surargum Road (east)	0.22	6.8s	10.4m
	Ghazeepore Road (north)	0.32	7.5s	16.4m
	Hams Road (west)	0.42	13.8s	25.1m
	Intersection	0.61	7.8s	39.0m
PM	Ghazeepore Road (south)	0.37	6.9s	16.7m
	Surargum Road (east)	0.56	13.2s	38.7m
	Ghazeepore Road (north)	0.52	6.4s	35.6m
	Hams Road (west)	0.13	7.4s	6.0m
	Intersection	0.56	8.3s	38.7m

Tables 2.2 and 2.3 indicate the Ghazeepore Road/Sugargum Drive/Hams Road intersection can be expected to continue to operate with an ‘excellent’ level of service under Year 2029 post-development traffic volumes for the existing intersection and proposed roundabout configurations. Specifically:

- For the existing intersection configuration, Table 2.2 indicates that a DOS of 0.53 (up from 0.43 in Table 2.1) can be expected in the AM peak hour and a DOS of 0.63 (up from 0.50 in Table 2.1) can be expected in the PM peak hour.
- For the proposed roundabout configuration, Table 2.3 indicates that a DOS of 0.61 (up from 0.43 in Table 2.1) can be expected in the AM peak hour and a DOS of 0.56 (up from 0.50 in Table 2.1) can be expected in the PM peak hour.

I conclude from the SIDRA analysis that the traffic impacts of the proposal will be relatively modest, with the post-development operation of the Ghazeepore Road/Sugargum Drive/Hams Road intersection expected to continue to operate with an “excellent” level of service.

Overall, I support the proposed installation of the roundabout at the intersection on the balance of the following benefits that it will provide:

1. The intersection can be expected to operate with an acceptable level of operation with the roundabout that is similar to the existing unsignalised intersection configuration.
2. The provision of a roundabout will improve the operation of the side roads, in favour of through traffic on Ghazeepore Road which currently do not have to give way to any traffic flows. This is likely to aid vehicles exiting Sugargum Drive, including traffic from the commuter car parking.
3. The installation of the roundabout will have other benefits including:
 - o It will reduce vehicle speeds on Ghazeepore Road; improving the safety of the intersection.
 - o It will potentially reduce the attractiveness of travel along Ghazeepore Road by non-local traffic.

Further discussion regarding the design of this roundabout is presented later in this evidence. This discussion focuses on the ability to improve the roundabout configuration to better control vehicle speeds and enhance pedestrian connectivity.

2.6. Ghazeepore Road Daily Traffic Volumes

I understand that concern has been raised regarding the future operation of Ghazeepore Road to the north of Hams Road, following the increase in traffic flows on that road section from the proposal.

Based on the existing peak hour traffic volumes presented earlier, as well as an assumed peak hour to daily traffic volume ratio of 10%, I have estimated the traffic volumes on this section of road. The estimated volumes per year and development scenario are presented below:

- Existing (Year 2019): 5,700 vehicle movements per day
- Future Base (Year 2029; no development): 8,000 vehicle movements per day⁹
- Post-Development (Year 2029; with development): 9,300 vehicle movements per day¹⁰

Reference to Council's Municipal Public Road Register indicates that the section of Ghazeepore Road north of Hams Road is classified as a 'Main Distributor (Category 4)'. According to the Council's Municipal Road Management Plan (June 2018), the key features of this road type are:

- "Supplementary to arterial road system
- Connector between arterial roads and lower order streets
- Cater for, but may restrain, service and heavy vehicles
- Provide access to significant public services
- Minimum two clear traffic lanes (excluding parking)
- 5,000–10,000 vehicles per day
- 60 km p/h speed limit (or less)"

Against this Council Management Plan, it is evident that the predicted future traffic volumes can be expected to fall within the anticipated traffic volume range for this road type. In this regard, I consider the post-development volumes will be acceptable, particularly given the conservatism associated with the assumed traffic volume growth rate.

Notwithstanding this, I do note that the carriageway width of Ghazeepore Road (approx. 10.0m) is somewhat unusual given that it is slightly too narrow to comfortably accommodate kerbside parking on both sides of the road in addition to clear traffic lanes. My observations of this road section, coupled with my review of Near Map aerial photographs, suggest that limited kerbside car parking exists, with most drivers instead preferring to park on the verge if on-street parking is sought. In my view, the absence of high on-street parking demands reduces the impact of the 10.0m width.

Nevertheless, I understand that the Applicant has agreed to contribute a sum of \$500,000 to Council for works on this road should they be required. In my view, this financial contribution is more than reasonable given I am not satisfied that there is a clear need for the improvement works as a consequence of the proposal.

⁹ This volume is considered highly conservative as it assumes the growth rate of 40% over 10 years.

¹⁰ This volume is also considered highly conservative given the assumption in the growth rate and the fact that the proposed roundabout at the Ghazeepore Road/Sugargum Drive/Hams Road intersection may reduce non-local traffic volumes.

2.7. Summary

Based on the discussions and analysis detailed in this evidence, coupled with my inspections of the site, I conclude:

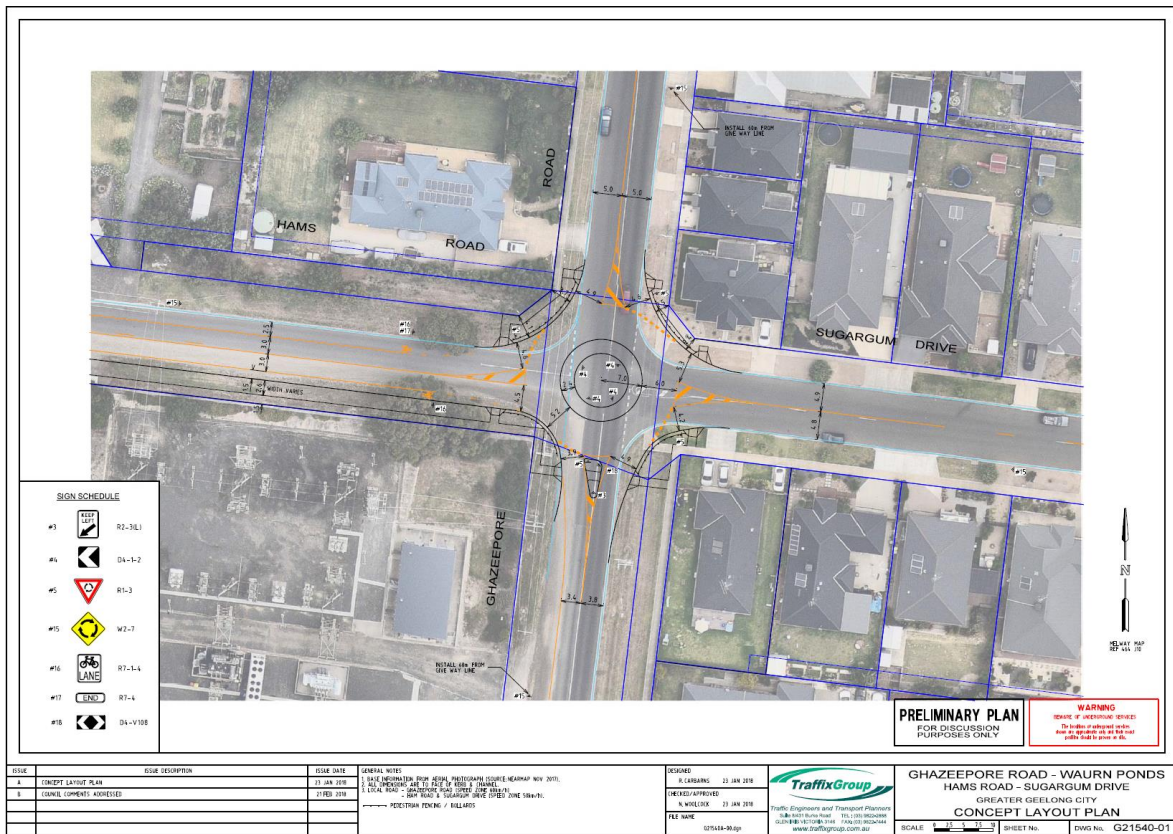
- I am satisfied that the abutting road network can be expected to operate safely and efficiently under post-development (Year 2029) traffic conditions.
- I support the installation of a roundabout at the Ghazeepore Road/Sugargum Drive/Hams Road intersection given it is expected to operate satisfactorily from an intersection capacity perspective, will improve road safety and may discourage non-local traffic on Ghazeepore Road.
- I consider a contribution of \$500,000 by the Applicant to future road works on Ghazeepore Road to more than reasonable given I am not satisfied that there is a clear need for the improvement works on this road section as a consequence of the proposal.

3. ROUNDAABOUT DESIGN

3.1. Overview

The Traffix report contains a recommended design for the proposed roundabout at Ghazeeapore Road/Sugargum Drive/Hams Road intersection; as shown in Figure 3.1 below. I understand that the configuration of this roundabout has been developed in collaboration with Council's traffic engineers. Notwithstanding this, I consider it appropriate to review this roundabout design to confirm its ability to safely accommodate pedestrian, cyclist and vehicle movements.

Figure 3.1: Traffix Group Design for Proposed Roundabout



3.2. Design Peer Review

The purpose of a roundabout is to principally to provide one or both of the following benefits:

1. To provide traffic management or control at an intersection (i.e. for intersection capacity benefits), and/or
2. To provide speed reduction and/ or decrease the crash severity at an intersection (i.e. for intersection safety benefits).

As outlined in the previous section of this evidence, it is evident that the proposed roundabout (as designed) will achieve the first benefit. However, I consider that minor improvements can be made to the design of the roundabout to further improve safety at the intersection, whilst also improving east-west pedestrian and cycling movements. These improvements include:

- Providing pedestrian refuge islands on the east, north and west approaches (in addition to the south approach as proposed) to better accommodate pedestrian movements;
- Increasing the size of the central mountable section of the traffic island to approx. 8.0m (by reducing the circulating carriageway width to approx. 5.0m), and altering the design of the approach lanes, to enhance deflection through the roundabout; and
- Providing “sharrow” line marking on the east and west approaches to better notify the presence of cyclists.

I expect these revisions will be feasible as part of the detailed design of the roundabout, which would normally be required by a condition of the permit for the subdivision, and therefore recommend that they be investigated at that time. In the event that they cannot be achieved for any reason, I would recommend that consideration be given to providing speed mitigation measures (such as a raised speed platform) on the north and south approaches to slow vehicle speeds. This would have similar safety benefits to the suggestions outlined above.

3.3. Summary

Based on the discussions detailed above, I conclude that the proposed roundabout design is suitable for its intended purpose, although its safety could be further enhanced by my recommended improvements. I recommend that these improvements be investigated as part of the detailed design process for the roundabout.

4. SUBDIVISION LAYOUT

4.1. Overview

The revised masterplan includes an internal road network which generally includes roads with reservation width of either 16.0m (standard; residential frontages on both sides of the road) or 13.0m (road directly abuts open space or a creek reservation; residential frontages on one side only). Vehicle access to the subdivision is also proposed at two locations: a central primary access with a reservation width of 20.0m and an eastern secondary access with a reservation width of 16.0m.

4.2. Internal Road Network Layout

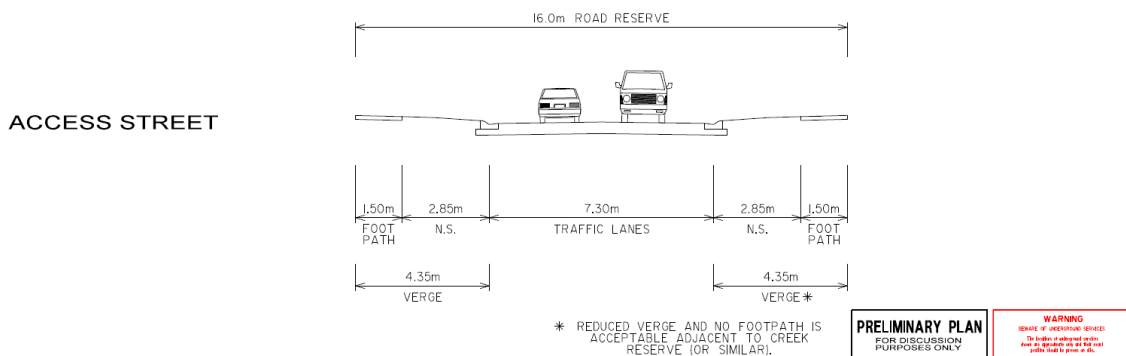
4.2.1. Street Widths

The Traffic report outlines a typical street reservation width of 16.0m, with a cross-section as shown in Figure 4.1. This cross-section includes a carriageway width of 7.3m which is typical for residential subdivisions and is suitable to accommodate car parking on both sides of the road.

This cross-section is suitable to accommodate vehicle volumes of 2,000 to 3,000 vehicles per day (based on Planning Scheme guidelines). As the proposed subdivision is expected to generate up to a total of approx. 2,200 vehicle movements per day, and therefore traffic volumes on all residential streets will be substantially below this threshold, I consider the proposed cross-section is acceptable for the subdivision.

Moreover, I consider the adoption of a narrower reservation width of 13.0m to be acceptable, noting my understanding that only the verge adjacent the open space or creek reserve will be reduced from 4.35m to 1.35m (i.e. I understand the carriageway width of 7.3m will remain on these streets).

Figure 4.1: Proposed Internal Street Cross-section



4.2.2. Intersections

Intersections within the subdivision are generally configured as T-intersections, except for two intersections: one within Stage 3 providing the main link road to/from Hams Road and the other within Stage 2.

For the Stage 3 cross-intersection, I recommend that the intersection be designed with a roundabout given it will carry most of the traffic that is generated by the subdivision as the main connection to Hams Road. An example roundabout (which is located nearby at the Oakwood Crescent / Blackheath Mews / Tannin Way intersection) is shown in Figure 4.2. I expect that this roundabout would fit within the available reservation widths shown in the master plan.

I consider this treatment is less critical for the Stage 2 cross-intersection and that a priority-controlled cross-section could be adopted. Alternatively, the example roundabout could be adopted.

Figure 4.2: Example Roundabout Configuration



4.2.3. Active Travel Network

The subdivision has been designed with 1.5m-wide footpaths on all residential streets, other than on the side of roads fronting open space or the creek reserve. Within the creek reserve, I understand that a shared path is to be provided to connect Ghazeeopore Road with the shared paths running along the side of Princes Freeway.

In addition to the internal pedestrian and shared paths, I understand that a 3.0m-wide shared path has been required by the Department of Transport along the southern side of Hams Road. This shared path will provide a connection from the subdivision to both Waurm Ponds Train Station and the shared path adjacent (and under) Princes Freeway.

Overall, I consider the active travel network contained within or immediately adjacent the proposed subdivision is appropriate and can be expected to encourage walking and cycling as modes of transport (particularly for linkages to nearby public transport services).

4.3. Vehicle Access Arrangements

With exception of 19 residential lots directly fronting Hams Road, vehicle access into the subdivision is proposed at two locations off Hams Road:

1. The primary access located opposite Champagne Court, and
2. The secondary access located approximately 200 metres west of Ghazeepore Road.

These access roads have been designed with width of 20.0m and 16.0m respectively, which I consider to be suitable for the volume of traffic expected to be generated by the subdivision. For the primary access road, this width will also allow a shared path to be provided between Hams Road and the east-west shared path proposed within the creek reserve.

I also note that the proposed master plan includes notation that turning bans are to be introduced at Grange Park Drive. I do not consider these turn bans to be necessary (or practicably enforceable) given any traffic volume increases on Grange Park Drive are likely to be modest and well within the acceptable thresholds of this road. Specifically, I note recent tube count surveys on this road in July 2019 indicate an existing volume of approx. 900 vehicle movements per day at its northern end (compared to a threshold for this road of approx. 2,000 to 3,000 vehicle movements per day).

4.4. Summary

I consider the proposed subdivision layout and vehicle access arrangements to be appropriate, subject to the provision of a roundabout at the cross-intersection on the main access road. However, I do not consider the proposed signs at Grange Park Drive to be necessary.

5. RESPONSE TO SUBMISSIONS

5.1. Overview

I understand that submissions to the amendment and subdivision have been lodged from nearby residents and relevant authorities. For completeness, I have undertaken a review of these submissions having regard to the key traffic and transport matters.

5.2. Submissions

5.2.1. Department of Transport (DoT)

DoT supported the proposal subject to conditions which covered two elements: the inclusion of a 3.0m-wide shared path on the southern side of Hams Road, and other drainage matters related to VicTrack's submission. I have considered the elements in relation to the shared path.

Overall, I support the inclusion of a shared path on the southern side of Hams Road, which would connect to the precinct on the western side of the freeway corridor through the use of the existing underpass (which provides one of the three safe pedestrian crossings of the corridor over a distance of approximately 2.2km).

5.2.2. Third Party Submissions

I understand that a significant number of nearby residents have made submissions in relation to the proposal. I have completed a thorough review of two of the most detailed submissions, as I consider that these capture the range of concerns and themes raised by other submissions as they relate to traffic and transport matters. These submissions were those made by Dr Jones and Mr Mullholland.

Dr David Jones Submission

- **Ghazeepore Road Traffic**

"I am concerned that the traffic modelling for this proposal is flawed..."

I have undertaken new surveys to confirm existing (Year 2019) traffic volumes in the vicinity of the site and then applied conservatively high growth rates and other assumptions to assess the operation of the Ghazeepore Road/Sugargum Drive/Hams Road intersection in the future. My analysis indicates that the intersection can be expected to operate satisfactorily under post-development (Year 2029) traffic conditions. I am satisfied that my assessment is robust and accurate.

I also note that reference is made in Dr Jones' submission to a GTA report prepared for Armstrong Creek West (2011). In preparing my evidence, I have reviewed this previous GTA report and am satisfied that my analysis is not inconsistent with its assumed traffic volumes. With specific regard to the reference made by Dr Jones, I note my understanding that the quoted volumes do not represent traffic flows on Ghazeepore Road (as is asserted in this submission) but rather traffic flows on Baanip Boulevard. Overall, I am satisfied that the assumed growth rate of 40% over 10 years is sufficient to account for the traffic volume growth from Armstrong Creek West.

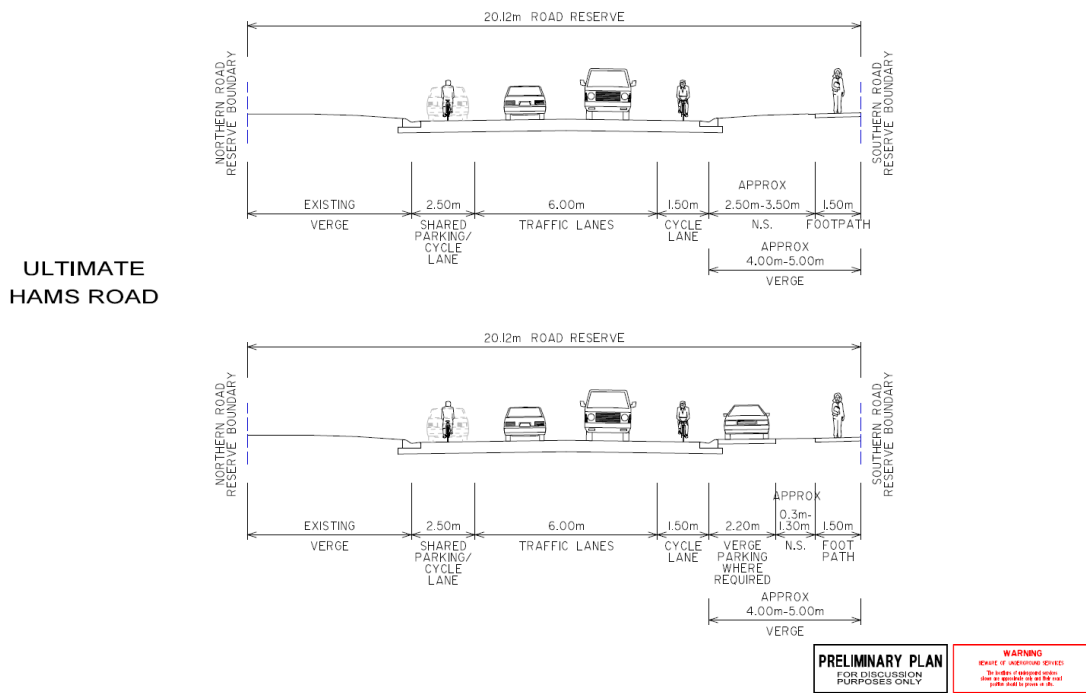
- **Hams Road Internal Traffic**

"... the Hams Road bitumen surface west of the Champagne Court intersection (should) be reduced..."

Reference to the Traffix report indicates that Hams Road is to be constructed with a pavement width of approx. 10m, as shown in the figure below.

This width is to include 6.0m for through traffic, a 2.5m wide shared parking and cycle lane on the northern side and 1.5m wide cycle lane on the southern side. Indented car parking is also proposed on the southern side of the road. I consider this cross-section to be acceptable for Hams Road.

Figure 5.1: Hams Road Proposed Cross-section



“The proposal by Traffic to propose specific turn bans at the Hams Road and Grange Park Road intersection will negate Council contractor rubbish truck movements”

As outlined in my evidence, I do not agree that these turn bans are necessary.

Mr Mullholland Submission

- **Ghazeeopore Road**
“(The operation of Ghazeeopore Road) needs to be addressed before any more development is allowed to choke this feeder road further”.

“This road needs to be upgraded before any new subdivision is granted approval.”

As outlined in my evidence, other than the proposed roundabout, I do not consider that mitigating works are required on Ghazeeopore Road to accommodate its predicted future traffic volumes. Notwithstanding, I note my understanding that the Applicant has agreed to provide a financial contribution of \$500,000 to Council for works on this road should it be required in the future. I envisage that this contribution could be used to formalise indented parking and/or widen the road at “pinch points”. In my view, this financial contribution is more than reasonable.

- **Sugargum Drive**
“This road needs to be upgraded before any new subdivision is granted.”

As outlined in my evidence, I appreciate that traffic flows on this road peak following the arrival of a train from Geelong / Melbourne (due to vehicle movements from the commuter car parking). Apart from this peak period congestion (which occurs for short periods of the peak hour),

I am not aware of other concerns regarding its operation. For the reasons outlined in my evidence, I note that this congestion could reduce in the future, as train frequencies increase and/or more commuter car parking is provided south of the rail line. For these reasons, I do not agree that Sugargum Drive needs to be upgraded.

- **Hams Road / Ghazeepore Road / Sugar Gum Drive intersection**

"Bikes and Pedestrians need to be separated from cars, busses & trucks to ensure safety for all users."

"...the Hams Rd /Ghazeepore rd/ Sugar Gum Drive route... would be a dangerous situation and expose cyclists to serious injury or death."

As outlined in my evidence, the introduction of a roundabout at the Ghazeepore Road/Hams Road/Sugar Gum Drive intersection would have safety benefits by reducing speed of vehicles and exposure to pedestrians through the pedestrian refuge island/s. A CrashStats review, and my site inspection, indicate that the intersection is currently operating in a safe manner, with the introduction of a roundabout being expected to further improve safety and reduce risks.

Regarding the site's internal road layout, and the proposed changes to Hams Road, I am satisfied that these road reserves would safely accommodate cyclists and pedestrians, in a manner similar to the surrounding area.

- **Emergency Vehicle and Waste Collection access**

"Will this environment in times of emergency in C372 and surrounding streets with access only via 1 outlet/inlet at the east end of Hams Rd be safe?"

"Can garbage trucks turn at the end of streets as there is no proper turn area for large units."

I expect that the proposed internal road reserves and cross-sections, and the two access points proposed to Hams Road, will be able to appropriately cater for emergency and waste collection vehicles. I note that the final detailed designs for intersections would normally be required by a condition of the permit for the subdivision and the turning requirements of large vehicles would be addressed at this stage. I am satisfied that that road reserve set aside for court bowls is sufficient to accommodate Council's requirements for their waste collection vehicle.

5.3. Summary

I consider the submitters concerns related to traffic and transport are appropriately addressed through the proposal's design responses, including the provision for a roundabout at the Ghazeepore Road/Sugargum Drive/Hams Road intersection and appropriate design of the Hams Road cross-section (incorporating a shared path) and internal road reserves and configurations.

6. REVIEW OF DRAFT DDO & PLANNING PERMITS

6.1. Overview

I have undertaken a review of the relevant transport elements of the draft Design and Development Overlay and the draft Planning Permits (662/2017 and 663/2017) that are relevant to the site. This review considers Version 2 of these documents, dated 1 August 2019.

6.2. Draft DDO45

The draft Development and Design Overlay includes the following design objective related to traffic and transport:

“To provide a safe and interconnected transport network that includes opportunities for walking and cycling, minimises impacts on adjoining streets and directs car traffic to an upgraded Hams Road / Ghazeepore Road intersection.”

I find this objective appropriate in its intent to manage the traffic and transport impact of the proposal, including provision for walking and cycling. More specifically, I also generally agree with the following requirements listed under *Traffic and Pedestrian Movements*:

- external and internal pedestrian and shared path links, including the shared path link along Hams Road and within the Creek Reserve;
- vehicle access controls to/from Hams Road and Ghazeepore Road (i.e. all vehicular access via Hams Road);
- the upgrade of the Ghazeepore Road/Hams Road/Sugar Gum Drive intersection (including the provision for a safe pedestrian and cycling crossing of Ghazeepore Road);
- a contribution to the upgrade of Ghazeepore Road between Hams Road and Burgundy Drive¹¹; and
- the upgrade of Hams Road between Ghazeepore Road and the court bowl.

However, whilst I agree in-principle to the requirement for *“local area traffic management treatments to discourage and minimise vehicle movements from the development into Grange Park Drive”*, I do not support the proposed turn bans. In my view, the potential traffic volume increase on Grange Park Drive is likely to be modest, with recent tube count surveys (July 2019) showing that the current traffic volumes on this road are relatively low and well within the typical threshold for a local street.

¹¹ Refer to discussion earlier in this evidence regarding this item.

6.3. Draft Planning Permits

I generally consider the draft Planning Permits for the respective lots to be appropriate in their response to traffic and transport impacts and matters.

However, I do not consider that the construction of the roundabout is required for construction in Stage 1, as indicated in the Planning Permits to both lots. As outlined in my evidence, based on relevant SIDRA analysis, the existing layout of the Ghazeepore Road/Sugargum Drive/Hams Road intersection would be expected to continue to operate with an 'excellent' level of service under Year 2029 post-development traffic volumes. In my view, it would be acceptable to defer the construction of this roundabout to a later stage.

Additionally, as indicated above, it is my understanding that the Applicant has agreed to contribute a sum of \$500,000 to Council for other improvement works on Ghazeepore Road. I therefore consider that conditions 35 and 36 to Planning Permit 662/2017 unnecessary, as they relate to the design and upgrade of Ghazeepore Road which would be undertaken by Council using these funds.

6.4. Summary

I consider that the draft Design and Development Overlay and Planning Permits are acceptable in their consideration and response to traffic and transport matters, except for the need for turn bans to discourage the use of Grange Park Drive, the required construction timing for the Ghazeepore Road/Sugargum Drive/Hams Road roundabout, and conditions 35 and 36 of draft Planning Permit 662/2017.

7. CONCLUSION

Based on the analysis and discussions presented within this evidence, I conclude the following:

- The abutting road network can be expected to operate safely and efficiency under post-development (Year 2029) traffic conditions.
- The installation of a roundabout at the Ghazeepore Road/Sugargum Drive/Hams Road intersection is supported given it is expected to operate satisfactorily from an intersection capacity perspective, will improve road safety and may discourage non-local traffic on Ghazeepore Road.
- The contribution of \$500,000 by the Applicant to future road works on Ghazeepore Road is more than reasonable, particularly given I am not satisfied that there is a clear need for the improvement works on this road section as a consequence of the proposal.
- The proposed roundabout design is suitable for its intended purpose, although its safety could be further enhanced by my recommended improvements. I recommend these improvements be investigated as part of the detailed design process for the roundabout.
- The proposed subdivision layout and vehicle access arrangements are appropriate, subject to the provision of a roundabout at the cross-intersection on the main access road. However, I do not consider the proposed turn bans at Grange Park Drive to be necessary.
- The submitters concerns related to traffic and transport matters are appropriately addressed through the proposed design, including the provision for a roundabout at the Ghazeepore Road/Sugargum Drive/Hams Road intersection and appropriate design of the Hams Road cross-section (incorporating a shared path) and internal road reserves and configurations.
- The draft Design and Development Overlay and Planning Permits are acceptable in their consideration and response to traffic and transport matters, except for the need for turn bans to discourage the use of Grange Park Drive, the required construction timing for the Ghazeepore Road/Sugargum Drive/Hams Road roundabout, and conditions 35 and 36 of draft Planning Permit 662/2017.

A. CURRICULUM VITAE



TIM DE YOUNG

Director

MBA

Monash University

BA, Commerce,

University of Melbourne

BE (Hons), Civil,

University of Melbourne



MY STORY

I am a transport planner and engineer with 17 years of experience in Victoria and New South Wales.

I initially joined GTA in 2002 following completion of a Bachelor of Engineering (with Honours) and Bachelor of Commerce at The University of Melbourne. In 2010, I completed a Master of Business Administration, where I studied elective subjects relevant to my profession including Planning Law and Transport Economics.

Over the past decade, I have directed numerous land use and transport infrastructure projects and have established expertise providing transport advice on complex sites / land use proposals such as major developments in congested inner urban environments. Notable projects include Chadstone Shopping Centre, Highpoint Shopping Centre, Victoria Gardens and Preston Market in Victoria, and Castle Towers and Chatswood Chase in New South Wales.

I take pride working collaboratively with varying stakeholder groups (including public and private stakeholders) as I believe that exceptional planning outcomes are derived from environments where diverse groups work together for mutual benefit. This often involves extensive engagement with relevant transport authorities, or the community more broadly.

As a project director, I often present expert witness statements in forums such as the Victorian Civil & Administrative Tribunal (VCAT) and Planning Panels Victoria and the NSW Land & Environment Court for private and public sector parties

PROJECT EXPERIENCE

Retail

- Castle Towers Shopping Centre, NSW (QIC)
- Chatswood Chase Shopping Centre, NSW (Vicinity)
- Warringah Mall Shopping Centre, NSW (Scente)
- Birkenhead Point Shopping Centre, NSW (Mirvac)
- Chadstone Shopping Centre, VIC (Vicinity)
- Highpoint Shopping Centre, VIC (GPT)
- Wendouree Shopping Centre, VIC (Stockland)
- Bunnings Warehouses, VIC & NSW (Bunnings)

Residential

- "Aerial", Camberwell, VIC (FKP)
- "Flemington Life", Flemington Racecourse, VIC (VRC/Greenland)
- "Yorkshire Brewery", Collingwood, VIC (SMA)

Commercial

- Australian Technology Park, Eveleigh, NSW (Mirvac)

Mixed Use

- Dooleys' Catholic Club Redevelopment, Lidcombe, NSW (Dooleys)
- "Thornton Marketplace", Penrith, NSW (St Hilliers)
- Victoria Gardens, Richmond, VIC (Salta)
- "Tooronga Village", Glen Iris, VIC (Stockland)

Other

- Sydney Ambulance Metropolitan Infrastructure Strategy project, NSW (NSW Health Infrastructure)
- Carey Baptist Grammar School Master Planning, VIC (Carey)

Transport Risk Assessment

- Auburn Train Maintenance Facility – Transport Risk Assessment Review, NSW (UGL)
- Various Shopping Centre Loading Dock Risk Assessments, VIC & NSW (Vicinity & GPT)

Car Parking Strategy & Management

- Blacktown Medical Precinct – Permit Parking Scheme, NSW (Blacktown Council)
- Brunswick Major Activity Centre Parking Strategy, VIC (Moreland Council)
- Bangkok Intelligent Parking System Study, Thailand

Integrated Transport Planning

- Northern Maribymong Integrated Transport Strategy, VIC (Maribymong Council)
- Brunswick Major Activity Centre Integrated Transport Strategy, Victoria (Moreland Council)

'I take pride in providing transport advice on complex land use and transport infrastructure projects, particularly those necessitating collaboration across diverse stakeholder groups'

SKILLS & EXPERTISE

- Transport Engineering
- Corridor and Area Traffic Management Project Development and Design
- Network Management and Optimisation
- Construction Transport Management Planning and Design
- Pedestrian Modelling
- Peer Review and Expert Witness
- Active Transport

ACHIEVEMENTS

"Paper or Presentation title", Journal or Conference name, more detail, You and any Co-authors

"Award Title", awarding body, year

MEMBERSHIPS AND AFFILIATIONS

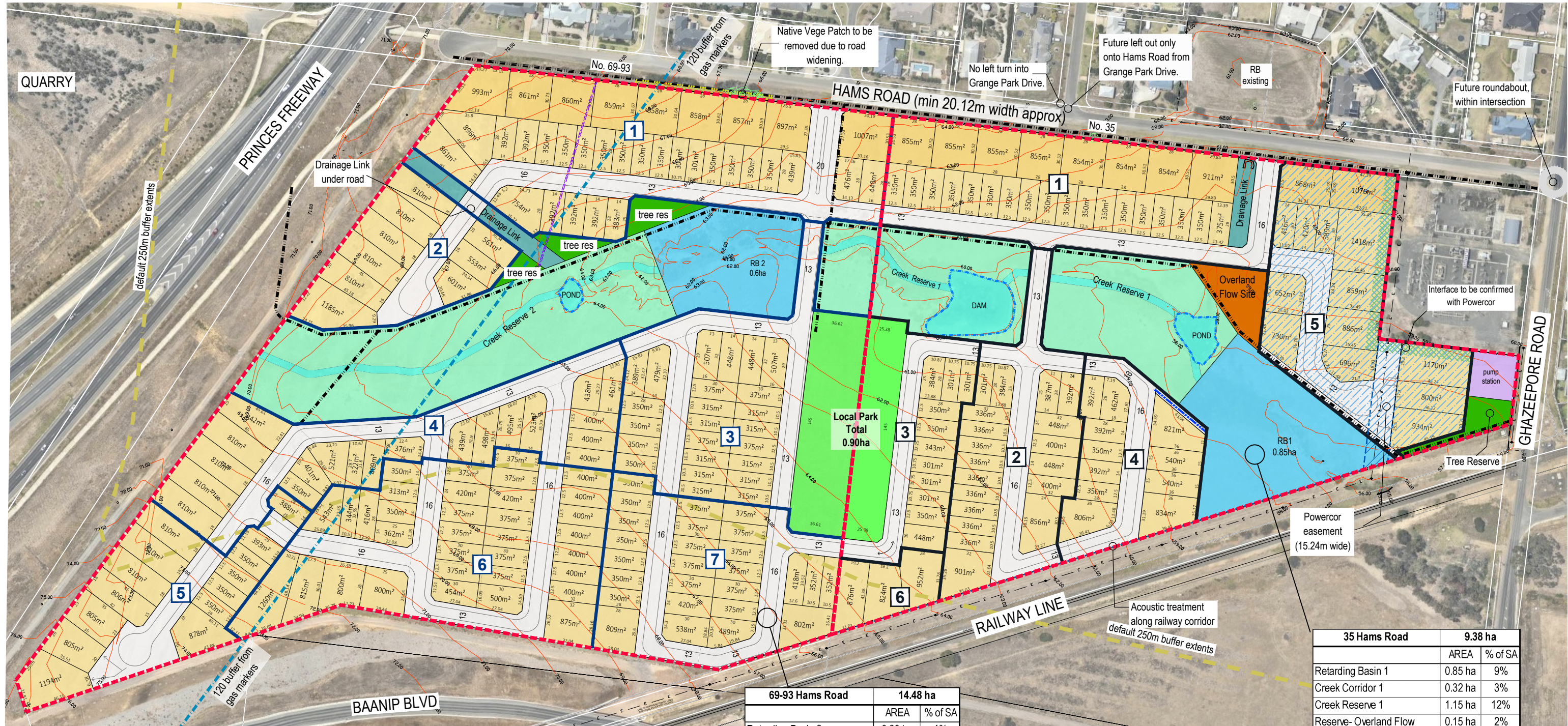
Engineers Australia

Australian Institute of Traffic Planning & Management (AITPM)

Victorian Planning and Environmental Law Association (VPELA)

B.UPDATED MASTERPLAN

B



PLAN NOTES

- Layout is subject to Council approval.
- Site Boundaries and Areas require confirmation via re-establishment survey.
- Further requirements may be needed but not finalized until the appropriate investigations have been reported, including but not limited to:
 - Feature Survey, Flora and Fauna, Arboricultural Survey,
 - Archaeological, Engineering Services, Traffic Engineering.

SOURCE DATA

- Surrounding boundary data via from supplied VICMAP digital data.
- Subject site details features via SMEC Urban Survey 3440895s-01.
- Aerial imagery via from Nearmap under agreement.
- Native Vege patch approx. via Practical Ecology Map 1 08/05/2018 (HZ3).
- Retarding Basin size and location via: Water technology 18/09/18.

DESIGN NOTES

- All existing trees to be removed unless capable of being retained at detailed design phase.
- Creek and RB sites still subject to detailed design approval.
- Larger Lots fronting Hams Rd in accordance with DPO.
- Flood zone area mitigated current Retarding Basin design.
- MD Superlot area adjacent to Power Substation TBC (south may be subject to overland flows).
- MD Superlot existing overhead electrical lines to be potentially relocated underground, subject to authority approval and detailed design.
- Courthead layout subject to detailed design Via Traffic Engineers.
- Location class of T1 (Residential as per AS 2885.1-2012) shall be maintained within 120m of the gas pipeline.

LEGEND

- SITE BOUNDARY
- 1 1 INDICATIVE RESIDENTIAL STAGING
- SHARED PATH
- ACCESS FOR RETARDING BASIN 1
- BUFFER DEFAULT (250m)
- BUFFER (120m offset gas markers)
- BUFFER (interface & treatment to be confirmed)
- EXISTING EASEMENT: TO BE REMOVED
- Ghazeeppore & Hams Road roundabout: subject to detailed design
- "Patch of Grassy Woodland" within Hams Road southern verge, to be removed due to road widening.
- Layout & interface over this area of No. 35 is subject to further discussions with Powercor and detailed design.

69-93 Hams Road		14.48 ha	
	AREA	% of SA	
Retarding Basin 2	0.60 ha	4%	
Creek Corridor 2	0.18 ha	1%	
Creek Reserve 2	1.70 ha	12%	
Drainage Link	0.12 ha	1%	
Open Space - Local Park 2	0.53 ha	4%	
sub total	3.14 ha	22%	

NET DEVELOPABLE AREA		11.35 ha	
Local Roads	3.11 ha	21%	
Tree Reserve	0.15 ha	1%	
Residential Interface Lots	0.81 ha	6%	
Residential Lot Area	7.28 ha	50%	
sub total	11.35 ha	78%	

RESIDENTIAL LOT YIELD	
Standard Residential	152
Average	479 m ²
Residential Interface Lots	9
Average	895 m ²
TOTAL:	161

COMBINED SITES	
Yield	245
Average	513 m ²
NDA	17.73 ha
Density	13.8 lots/NDA

35 Hams Road		9.38 ha	
	AREA	% of SA	
Retarding Basin 1	0.85 ha	9%	
Creek Corridor 1	0.32 ha	3%	
Creek Reserve 1	1.15 ha	12%	
Reserve- Overland Flow	0.15 ha	2%	
Pump Station	0.09 ha	1%	
Drainage Link	0.07 ha	1%	
Open Space: Local Park 1	0.37 ha	4%	
sub total	3.00 ha	32%	

NET DEVELOPABLE AREA		6.38 ha	
Local Roads	1.82 ha	19%	
Tree Reserve	0.09 ha	1%	
Residential Interface Lots	0.88 ha	9%	
Residential Lot Area	3.59 ha	38%	
sub total	6.38 ha	68%	

RESIDENTIAL LOT YIELD	
Standard Residential	74
Average	485 m ²
Residential Interface Lots	10
Average	883 m ²
TOTAL	84

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C. SITE PHOTOS



APPENDIX: SITE PHOTOS



APPENDIX: SITE PHOTOS



APPENDIX: SITE PHOTOS



D. EXISTING CONDITIONS



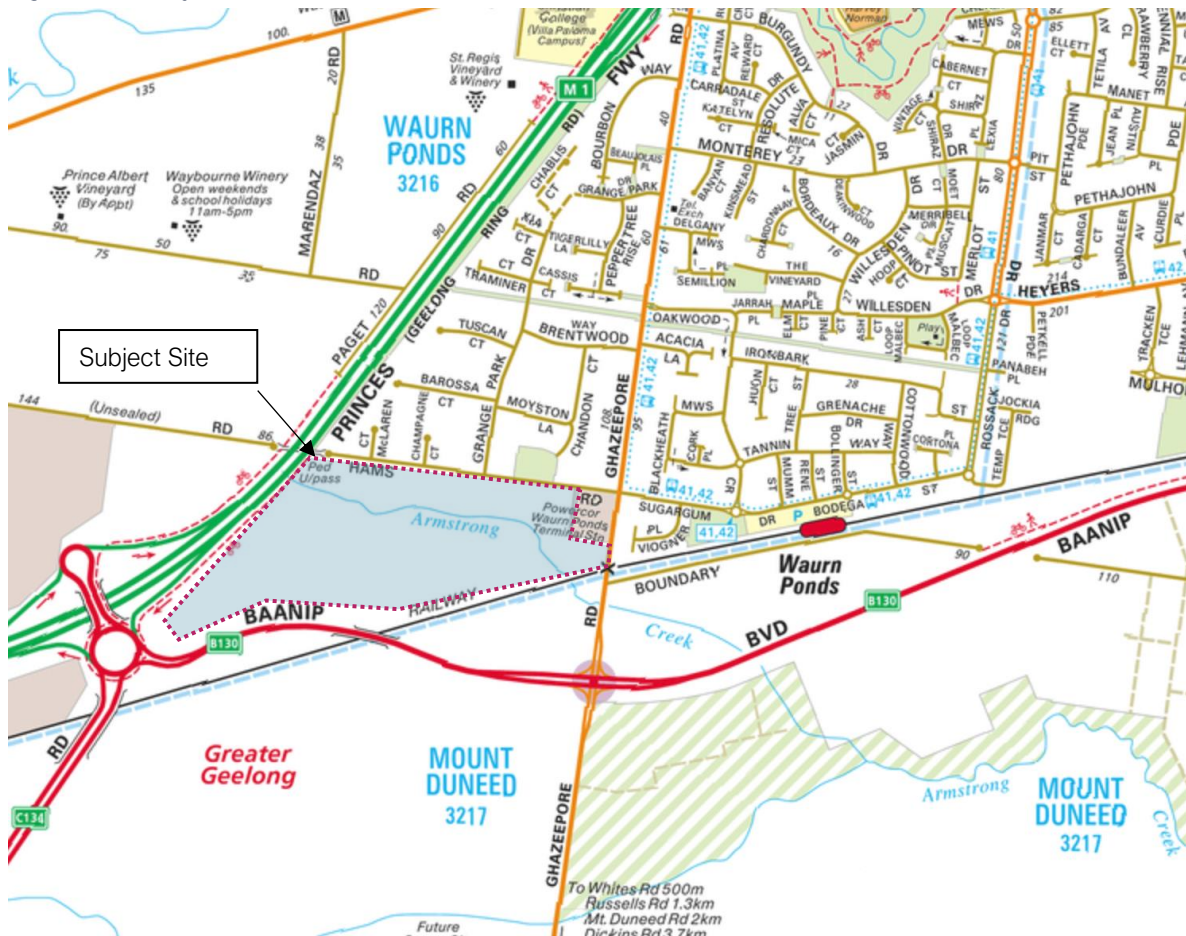
D.1. Site Context

The subject site (the site) is located as 35 and 69-93 Hams Road, Waurn Ponds. It has frontages to Hams Road of approximately 600 metres and Ghazeeopore Road of approximately 50 metres.

The site is currently located within a Farming Zone with land to the site’s north and east generally zoned residential. The site abuts Princes Freeway to the west and the rail corridor and Baanip Boulevard to the south. An electricity substation abuts the northeast of the site at the Hams Road / Ghazeeopore Road / Sugargum Drive intersection.

The location of the site and the surrounding envions is shown in Figure D.1.

Figure D.1: Subject Site and its Environs



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D.2. Transport Network

D.2.1. Road Network

The road classification, description and target volumes of roads in the vicinity of the site have been sourced from the City of Greater Geelong’s *Municipal Public Road Register* and *Municipal Road Management Plan* (viewed August 2019).

Hams Road is a council managed local street that runs along the site’s northern boundary in an east-west alignment between Ghazeeopore Road before terminating at a court bowl at the Princes Freeway.

APPENDIX: EXISTING CONDITIONS

It has a sealed carriageway of approximately 5.5 metres with kerb and channel on the north side and an unmade 3.5 metre wide verge of the southern (subject site) side. The default 50km/hr speed limit applies.

Ghazeeepore Road is a council managed road that runs in north-south alignment between Bellbrae to the south and the Princes Freeway to the north. In Waurm Ponds, adjacent to the site, it is classified as an *Urban Main Distributor – Category 4*. This type of road functions as a road that carries *heavy volumes of traffic, including commercial vehicles, and acts as a principal route for traffic flows in and around the municipality*. The volume threshold for this road is 5,000 to 10,000 vehicles per day. A posted speed limit of 60km/hr applies in the vicinity of the subject site.

Sugargum Drive is a council managed local street that forms the eastern leg of the Hams Road / Ghazeeepore Road intersection. It has a kerb-to-kerb width of approximately 10.0 metres.

Grange Park Drive is a council managed local street that runs between Hams Road and Ghazeeepore Road. It has a kerb-to-kerb width of approximately 7.3 metres and provides local access.

D.2.2. Public Transport

The site is located approximately 500 metres west of the Waurm Ponds Railway Station. The service provides a link to Geelong and onto Southern Cross station, with around five services for each peak period (i.e. five departures between 7 and 9am and arrivals 5 to 7pm), or around one service every 25 minutes.

Bus Routes 41 (Geelong Station - Deakin University via South Valley Rd) and 42 (Geelong Station - Deakin University via Grovedale) both operate along Ghazeeepore Road in the vicinity of the site, with the closest bus stop located on Sugar Gum Drive approximately 350 metres east of the site. The service frequency for both routes is generally every 20 minutes during weekdays, with reduced frequency during the evenings and weekends.

The location of these public transport services and their typical peak hour frequency is detailed in Table D1.

Table D1: Public Transport Provision

Service	Route / Stop	Description	Distance to Nearest Stop	Significant Destinations on Route	Weekday Frequency
Train	Waurm Ponds Station	Geelong – Melbourne Warrnambool - Melbourne Via Colac & Geelong	500m or a 10 min walk	Geelong, Melbourne (Southern Cross), Sunshine, Footscray, Warrnambool	20-40 mins (higher frequency departing AM and arriving PM)
Bus	41	Geelong Station - Deakin University via Grovedale	500m or a 10 min walk,	Geelong, Deakin University, Waurm Ponds Shopping Centre	20 mins
	42	Geelong Station - Deakin University via South Valley Rd	250m or a 5 min walk (towards Deakin – stop opposite Oakwood Crescent)		

D.2.3. Active Transport

A shared path connection is provided underneath Princes Freeway at the termination of Hams Road at the northeast corner of the site. This connection is the only safe pedestrian east-west link provided between both sides of the freeway corridor, except for along Baanip Boulevard (600 metres to the south) and at Colac Road (approximately 1.6 kilometres north). It offers an important link between future residential development to the west by providing a walking and cycling path across the freeway corridor to the Waurm Ponds railway station and bus services.

D.3. Accident History

A review has been undertaken of the CrashStats database for recorded casualty crashes in the vicinity of the site, including the Hams Road / Ghazeepore Road / Sugar Gum Drive intersection. The review indicates that no casualty crashes have occurred in the vicinity of the site in the last five years of available data.

E. SIDRA ASSESSMENT



MOVEMENT SUMMARY

Site: 101 [GTA 2019 AM Existing layout - Ghazeepore Road / Hams Road / Sugar Gum Drive Intersection]

AM Existing - July 2019 Volumes

Site Category: (None)

Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Ghazeepore Road												
1	L2	8	5.0	0.303	6.4	LOS A	1.1	7.8	0.19	0.16	0.19	49.2
2	T1	399	5.0	0.303	0.3	LOS A	1.1	7.8	0.19	0.16	0.19	56.9
3	R2	136	5.0	0.303	6.4	LOS A	1.1	7.8	0.19	0.16	0.19	47.7
Approach		543	5.0	0.303	1.9	NA	1.1	7.8	0.19	0.16	0.19	54.9
East: Sugar Gum Drive												
4	L2	96	5.0	0.157	5.1	LOS A	0.6	4.4	0.31	0.58	0.31	41.2
5	T1	3	5.0	0.157	8.2	LOS A	0.6	4.4	0.31	0.58	0.31	44.1
6	R2	38	5.0	0.157	10.9	LOS B	0.6	4.4	0.31	0.58	0.31	47.1
Approach		137	5.0	0.157	6.8	LOS A	0.6	4.4	0.31	0.58	0.31	43.4
North: Ghazeepore Road												
7	L2	36	5.0	0.107	6.1	LOS A	0.2	1.1	0.10	0.14	0.10	53.4
8	T1	146	5.0	0.107	0.2	LOS A	0.2	1.1	0.10	0.14	0.10	57.6
9	R2	11	5.0	0.107	7.3	LOS A	0.2	1.1	0.10	0.14	0.10	52.0
Approach		193	5.0	0.107	1.7	NA	0.2	1.1	0.10	0.14	0.10	56.2
West: Hams Road												
10	L2	12	5.0	0.045	6.1	LOS A	0.2	1.1	0.51	0.68	0.51	47.4
11	T1	8	5.0	0.045	7.7	LOS A	0.2	1.1	0.51	0.68	0.51	43.2
12	R2	9	5.0	0.045	10.9	LOS B	0.2	1.1	0.51	0.68	0.51	42.6
Approach		29	5.0	0.045	8.0	LOS A	0.2	1.1	0.51	0.68	0.51	45.1
All Vehicles		902	5.0	0.303	2.8	NA	1.1	7.8	0.20	0.24	0.20	52.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

DEGREE OF SATURATION

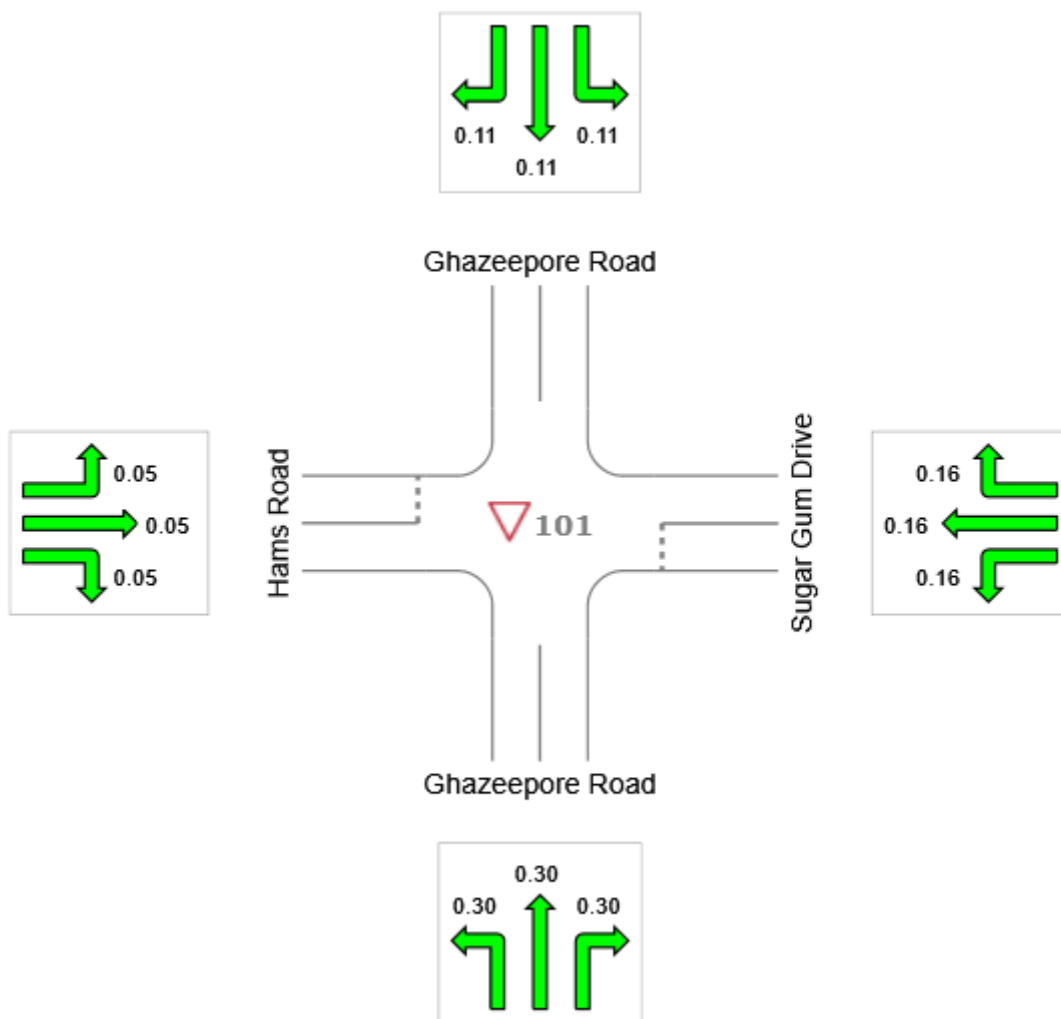
Ratio of Demand Volume to Capacity (v/c ratio)

▽ Site: 101 [GTA 2019 AM Existing layout - Ghazeeopore Road / Hams Road / Sugar Gum Drive Intersection]

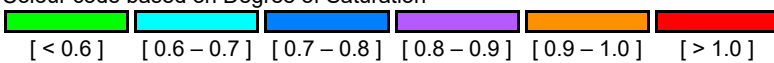
AM Existing - July 2019 Volumes
 Site Category: (None)
 Giveaway / Yield (Two-Way)

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.30	0.16	0.11	0.05	0.30



Colour code based on Degree of Saturation



MOVEMENT SUMMARY

Site: 101 [GTA 2029 AM Existing layout - Ghazeeopore Road / Hams Road / Sugar Gum Drive Intersection]

AM Existing - July 2019 Volumes

Site Category: (None)

Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Ghazeeopore Road												
1	L2	11	5.0	0.434	7.2	LOS A	2.1	15.2	0.26	0.17	0.28	48.9
2	T1	558	5.0	0.434	0.7	LOS A	2.1	15.2	0.26	0.17	0.28	56.5
3	R2	191	5.0	0.434	7.1	LOS A	2.1	15.2	0.26	0.17	0.28	47.2
Approach		760	5.0	0.434	2.4	NA	2.1	15.2	0.26	0.17	0.28	54.5
East: Sugar Gum Drive												
4	L2	134	5.0	0.301	5.7	LOS A	1.2	9.0	0.44	0.65	0.48	38.7
5	T1	4	5.0	0.301	13.6	LOS B	1.2	9.0	0.44	0.65	0.48	42.4
6	R2	54	5.0	0.301	17.8	LOS C	1.2	9.0	0.44	0.65	0.48	45.2
Approach		192	5.0	0.301	9.3	LOS A	1.2	9.0	0.44	0.65	0.48	41.2
North: Ghazeeopore Road												
7	L2	51	5.0	0.153	6.6	LOS A	0.3	2.1	0.13	0.13	0.13	53.2
8	T1	204	5.0	0.153	0.4	LOS A	0.3	2.1	0.13	0.13	0.13	57.2
9	R2	15	5.0	0.153	8.5	LOS A	0.3	2.1	0.13	0.13	0.13	51.8
Approach		270	5.0	0.153	2.0	NA	0.3	2.1	0.13	0.13	0.13	55.9
West: Hams Road												
10	L2	16	5.0	0.097	7.1	LOS A	0.3	2.3	0.67	0.80	0.67	45.3
11	T1	11	5.0	0.097	12.1	LOS B	0.3	2.3	0.67	0.80	0.67	40.9
12	R2	12	5.0	0.097	17.4	LOS C	0.3	2.3	0.67	0.80	0.67	40.1
Approach		40	5.0	0.097	11.6	LOS B	0.3	2.3	0.67	0.80	0.67	42.8
All Vehicles		1263	5.0	0.434	3.7	NA	2.1	15.2	0.27	0.25	0.29	52.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

DEGREE OF SATURATION

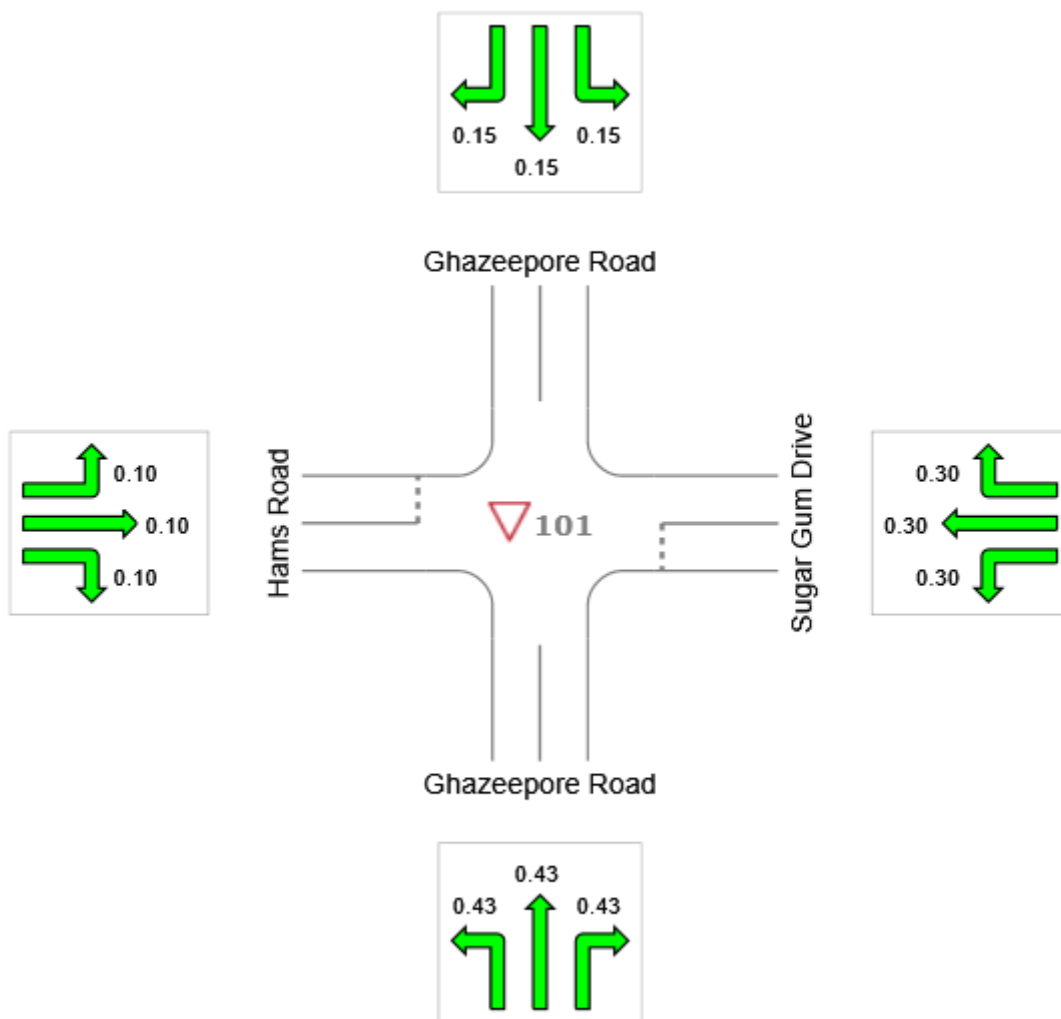
Ratio of Demand Volume to Capacity (v/c ratio)

▽ Site: 101 [GTA 2029 AM Existing layout - Ghazeepore Road / Hams Road / Sugar Gum Drive Intersection]

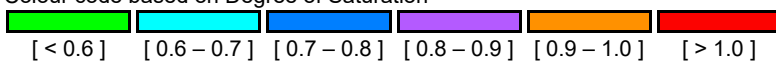
AM Existing - July 2019 Volumes
 Site Category: (None)
 Giveaway / Yield (Two-Way)

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.43	0.30	0.15	0.10	0.43



Colour code based on Degree of Saturation



MOVEMENT SUMMARY

▽ Site: 101 [GTA 2029 AM plus Dev Existing layout - Ghazeeopore Road / Hams Road / Sugar Gum Drive Intersection]

AM Existing - July 2019 Volumes

Site Category: (None)

Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Ghazeeopore Road												
1	L2	25	5.0	0.442	7.2	LOS A	2.2	16.1	0.26	0.18	0.29	48.8
2	T1	558	5.0	0.442	0.7	LOS A	2.2	16.1	0.26	0.18	0.29	56.4
3	R2	191	5.0	0.442	7.2	LOS A	2.2	16.1	0.26	0.18	0.29	47.1
Approach		775	5.0	0.442	2.5	NA	2.2	16.1	0.26	0.18	0.29	54.2
East: Sugar Gum Drive												
4	L2	134	5.0	0.369	6.7	LOS A	1.7	12.5	0.47	0.70	0.61	36.7
5	T1	10	5.0	0.369	15.6	LOS C	1.7	12.5	0.47	0.70	0.61	40.9
6	R2	54	5.0	0.369	23.2	LOS C	1.7	12.5	0.47	0.70	0.61	43.5
Approach		198	5.0	0.369	11.6	LOS B	1.7	12.5	0.47	0.70	0.61	39.3
North: Ghazeeopore Road												
7	L2	51	5.0	0.184	7.7	LOS A	0.7	5.3	0.30	0.17	0.30	51.9
8	T1	204	5.0	0.184	1.0	LOS A	0.7	5.3	0.30	0.17	0.30	55.6
9	R2	44	5.0	0.184	8.7	LOS A	0.7	5.3	0.30	0.17	0.30	50.9
Approach		299	5.0	0.184	3.3	NA	0.7	5.3	0.30	0.17	0.30	54.0
West: Hams Road												
10	L2	133	5.0	0.534	11.0	LOS B	2.8	20.7	0.75	1.06	1.22	42.8
11	T1	30	5.0	0.534	18.4	LOS C	2.8	20.7	0.75	1.06	1.22	38.3
12	R2	70	5.0	0.534	25.2	LOS D	2.8	20.7	0.75	1.06	1.22	37.4
Approach		233	5.0	0.534	16.2	LOS C	2.8	20.7	0.75	1.06	1.22	40.9
All Vehicles		1504	5.0	0.534	6.0	NA	2.8	20.7	0.37	0.38	0.48	49.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

DEGREE OF SATURATION

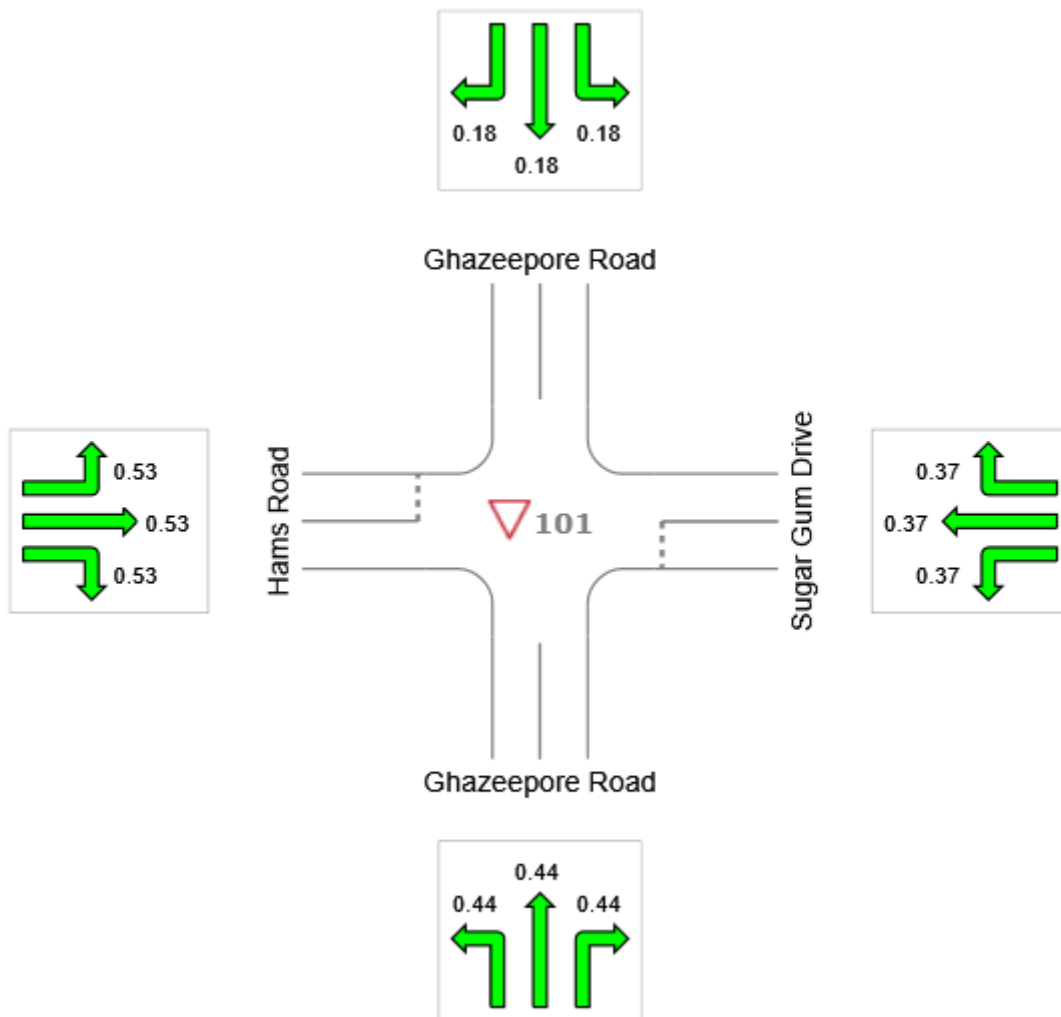
Ratio of Demand Volume to Capacity (v/c ratio)

▽ Site: 101 [GTA 2029 AM plus Dev Existing layout - Ghazeepore Road / Hams Road / Sugar Gum Drive Intersection]

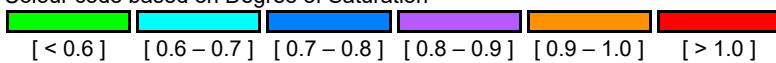
AM Existing - July 2019 Volumes
 Site Category: (None)
 Giveaway / Yield (Two-Way)

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.44	0.37	0.18	0.53	0.53



Colour code based on Degree of Saturation



MOVEMENT SUMMARY

 Site: 101v [GTA 2029 AM plus Dev RAB - Ghazeeopore Road / Hams Road / Sugar Gum Drive Intersection]

AM Existing - July 2019 Volumes
 Site Category: (None)
 Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Ghazeeopore Road												
1	L2	25	5.0	0.607	5.3	LOS A	5.3	39.0	0.44	0.54	0.44	45.1
2	T1	558	5.0	0.607	5.4	LOS A	5.3	39.0	0.44	0.54	0.44	50.7
3	R2	191	5.0	0.607	9.3	LOS A	5.3	39.0	0.44	0.54	0.44	44.2
Approach		775	5.0	0.607	6.4	LOS A	5.3	39.0	0.44	0.54	0.44	49.2
East: Sugar Gum Drive												
4	L2	134	5.0	0.223	5.8	LOS A	1.4	10.4	0.60	0.66	0.60	41.4
5	T1	10	5.0	0.223	5.8	LOS A	1.4	10.4	0.60	0.66	0.60	44.9
6	R2	54	5.0	0.223	9.6	LOS A	1.4	10.4	0.60	0.66	0.60	48.5
Approach		198	5.0	0.223	6.8	LOS A	1.4	10.4	0.60	0.66	0.60	44.1
North: Ghazeeopore Road												
7	L2	51	5.0	0.321	6.8	LOS A	2.2	16.4	0.61	0.65	0.61	48.0
8	T1	204	5.0	0.321	7.0	LOS A	2.2	16.4	0.61	0.65	0.61	49.8
9	R2	44	5.0	0.321	10.8	LOS B	2.2	16.4	0.61	0.65	0.61	49.3
Approach		299	5.0	0.321	7.5	LOS A	2.2	16.4	0.61	0.65	0.61	49.4
West: Hams Road												
10	L2	133	5.0	0.418	12.7	LOS B	3.4	25.1	0.94	0.93	0.98	44.3
11	T1	30	5.0	0.418	12.6	LOS B	3.4	25.1	0.94	0.93	0.98	40.4
12	R2	70	5.0	0.418	16.4	LOS B	3.4	25.1	0.94	0.93	0.98	39.9
Approach		233	5.0	0.418	13.8	LOS B	3.4	25.1	0.94	0.93	0.98	42.7
All Vehicles		1504	5.0	0.607	7.8	LOS A	5.3	39.0	0.57	0.64	0.58	47.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

DEGREE OF SATURATION

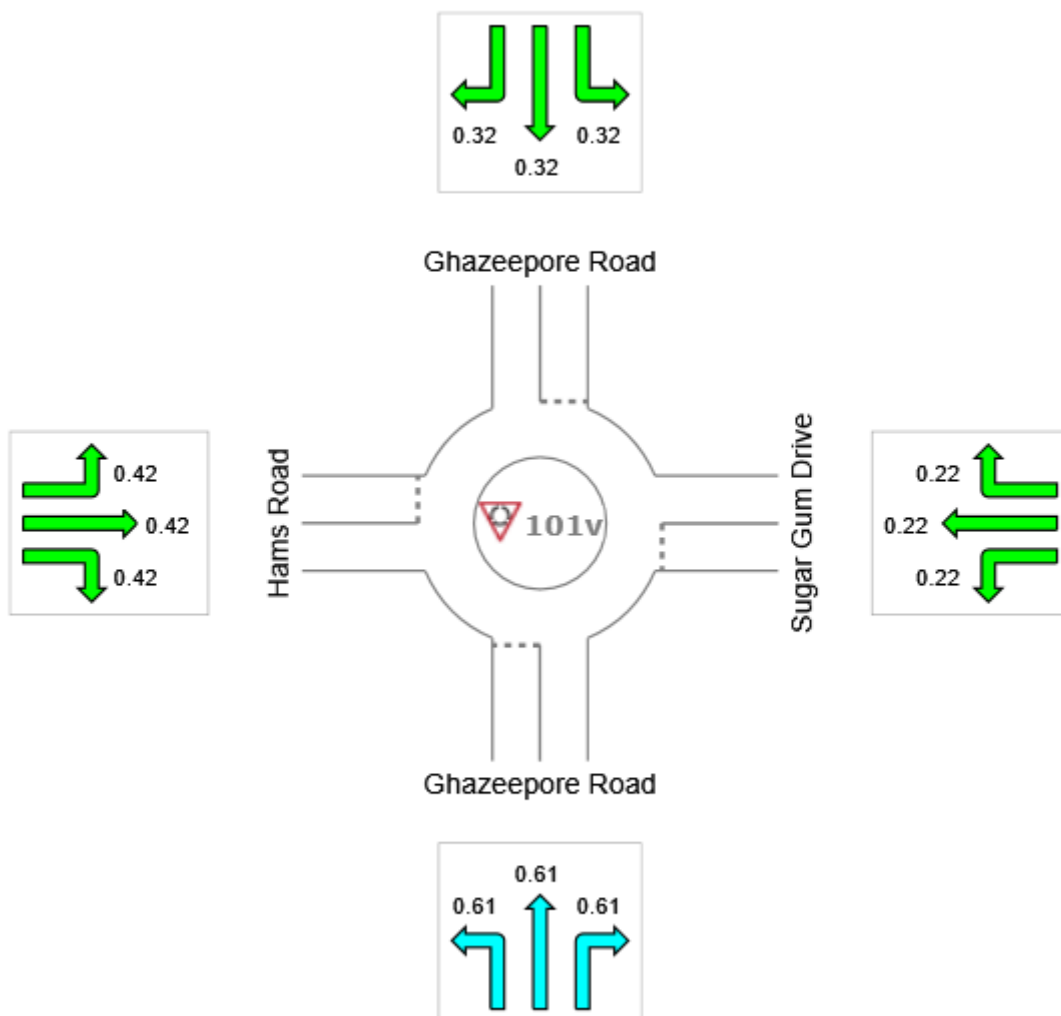
Ratio of Demand Volume to Capacity (v/c ratio)

Site: 101v [GTA 2029 AM plus Dev RAB - Ghazeeepore Road / Hams Road / Sugar Gum Drive Intersection]

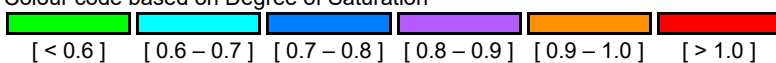
AM Existing - July 2019 Volumes
 Site Category: (None)
 Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.61	0.22	0.32	0.42	0.61



Colour code based on Degree of Saturation



MOVEMENT SUMMARY

▽ Site: 101 [GTA 2019 PM Existing layout - Ghazeeepore Road / Hams Road / Sugar Gum Drive Intersection]

PM Existing - July 2019 Volumes

Site Category: (None)

Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Ghazeeepore Road												
1	L2	9	5.0	0.148	7.2	LOS A	0.5	4.0	0.27	0.19	0.27	48.7
2	T1	172	5.0	0.148	0.8	LOS A	0.5	4.0	0.27	0.19	0.27	56.2
3	R2	64	5.0	0.148	7.2	LOS A	0.5	4.0	0.27	0.19	0.27	46.9
Approach		245	5.0	0.148	2.7	NA	0.5	4.0	0.27	0.19	0.27	53.9
East: Sugar Gum Drive												
4	L2	170	5.0	0.275	6.2	LOS A	1.1	8.4	0.50	0.70	0.50	40.9
5	T1	22	5.0	0.275	7.4	LOS A	1.1	8.4	0.50	0.70	0.50	43.9
6	R2	50	5.0	0.275	9.9	LOS A	1.1	8.4	0.50	0.70	0.50	46.8
Approach		242	5.0	0.275	7.1	LOS A	1.1	8.4	0.50	0.70	0.50	42.9
North: Ghazeeepore Road												
7	L2	29	5.0	0.205	5.7	LOS A	0.1	0.4	0.01	0.05	0.01	54.7
8	T1	351	5.0	0.205	0.0	LOS A	0.1	0.4	0.01	0.05	0.01	59.2
9	R2	4	5.0	0.205	6.3	LOS A	0.1	0.4	0.01	0.05	0.01	52.9
Approach		384	5.0	0.205	0.5	NA	0.1	0.4	0.01	0.05	0.01	58.7
West: Hams Road												
10	L2	4	5.0	0.019	5.1	LOS A	0.1	0.5	0.39	0.59	0.39	47.8
11	T1	4	5.0	0.019	6.6	LOS A	0.1	0.5	0.39	0.59	0.39	43.6
12	R2	4	5.0	0.019	10.4	LOS B	0.1	0.5	0.39	0.59	0.39	43.1
Approach		13	5.0	0.019	7.4	LOS A	0.1	0.5	0.39	0.59	0.39	45.1
All Vehicles		884	5.0	0.275	3.0	NA	1.1	8.4	0.22	0.27	0.22	52.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

DEGREE OF SATURATION

Ratio of Demand Volume to Capacity (v/c ratio)

▽ Site: 101 [GTA 2019 PM Existing layout - Ghazeeopore Road / Hams Road / Sugar Gum Drive Intersection - S G Drv]

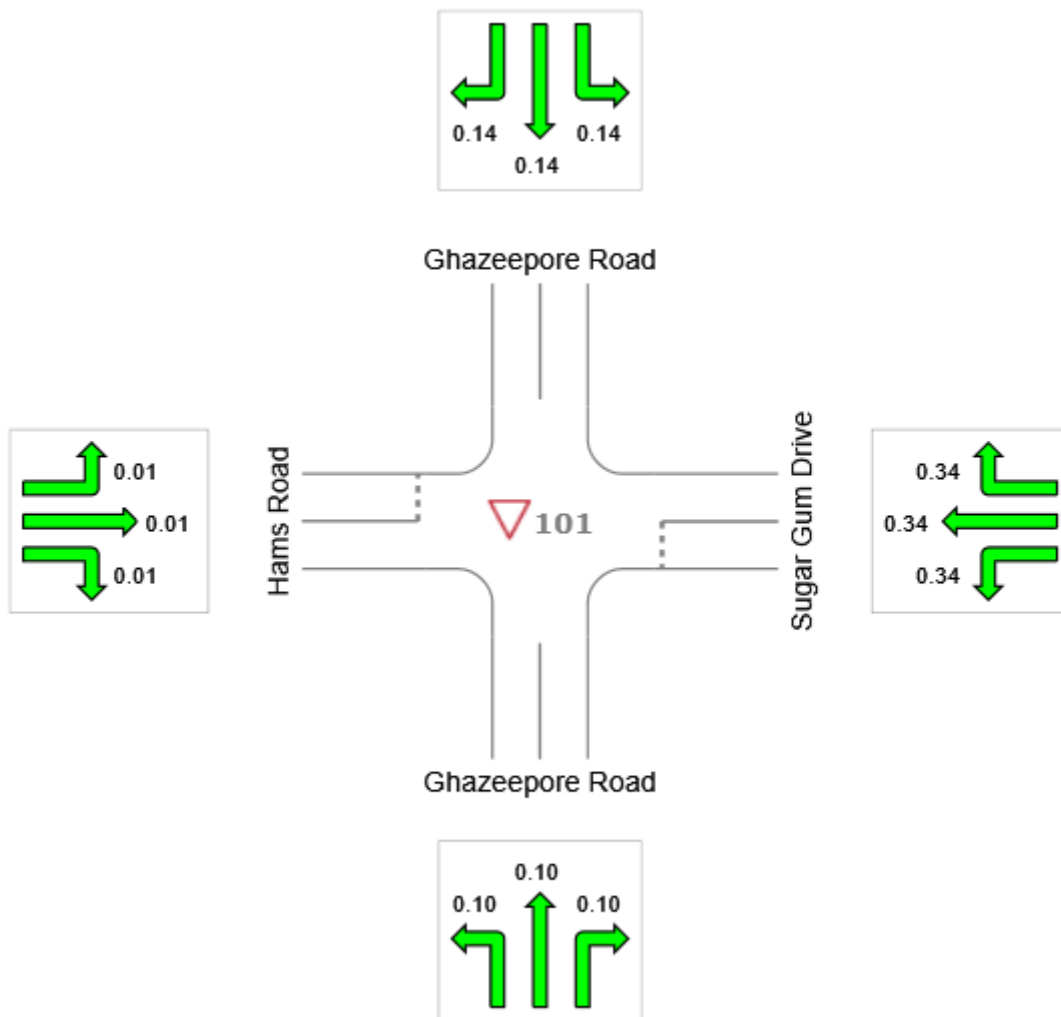
Sugar Gum Drive Peak Hour - July 2019 - 17:45-18:45

Site Category: (None)

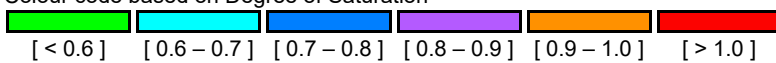
GiveWay / Yield (Two-Way)

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.10	0.34	0.14	0.01	0.34



Colour code based on Degree of Saturation



MOVEMENT SUMMARY

▽ Site: 101 [GTA 2029 PM Existing layout - Ghazeepore Road / Hams Road / Sugar Gum Drive Intersection]

PM Existing - July 2019 Volumes

Site Category: (None)

Giveaway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Ghazeepore Road												
1	L2	14	5.0	0.223	8.4	LOS A	1.0	7.1	0.35	0.20	0.35	48.0
2	T1	240	5.0	0.223	1.4	LOS A	1.0	7.1	0.35	0.20	0.35	55.3
3	R2	89	5.0	0.223	8.4	LOS A	1.0	7.1	0.35	0.20	0.35	45.9
Approach		343	5.0	0.223	3.5	NA	1.0	7.1	0.35	0.20	0.35	53.0
East: Sugar Gum Drive												
4	L2	238	5.0	0.497	9.0	LOS A	2.9	21.5	0.65	0.97	1.01	37.3
5	T1	30	5.0	0.497	13.0	LOS B	2.9	21.5	0.65	0.97	1.01	41.3
6	R2	70	5.0	0.497	16.5	LOS C	2.9	21.5	0.65	0.97	1.01	44.0
Approach		338	5.0	0.497	10.9	LOS B	2.9	21.5	0.65	0.97	1.01	39.5
North: Ghazeepore Road												
7	L2	41	5.0	0.287	5.8	LOS A	0.1	0.7	0.02	0.05	0.02	54.7
8	T1	491	5.0	0.287	0.0	LOS A	0.1	0.7	0.02	0.05	0.02	59.2
9	R2	6	5.0	0.287	6.8	LOS A	0.1	0.7	0.02	0.05	0.02	52.9
Approach		538	5.0	0.287	0.5	NA	0.1	0.7	0.02	0.05	0.02	58.7
West: Hams Road												
10	L2	6	5.0	0.042	5.4	LOS A	0.1	1.0	0.51	0.68	0.51	46.1
11	T1	6	5.0	0.042	9.3	LOS A	0.1	1.0	0.51	0.68	0.51	41.8
12	R2	6	5.0	0.042	15.8	LOS C	0.1	1.0	0.51	0.68	0.51	41.1
Approach		19	5.0	0.042	10.2	LOS B	0.1	1.0	0.51	0.68	0.51	43.3
All Vehicles		1238	5.0	0.497	4.3	NA	2.9	21.5	0.29	0.35	0.39	51.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

DEGREE OF SATURATION

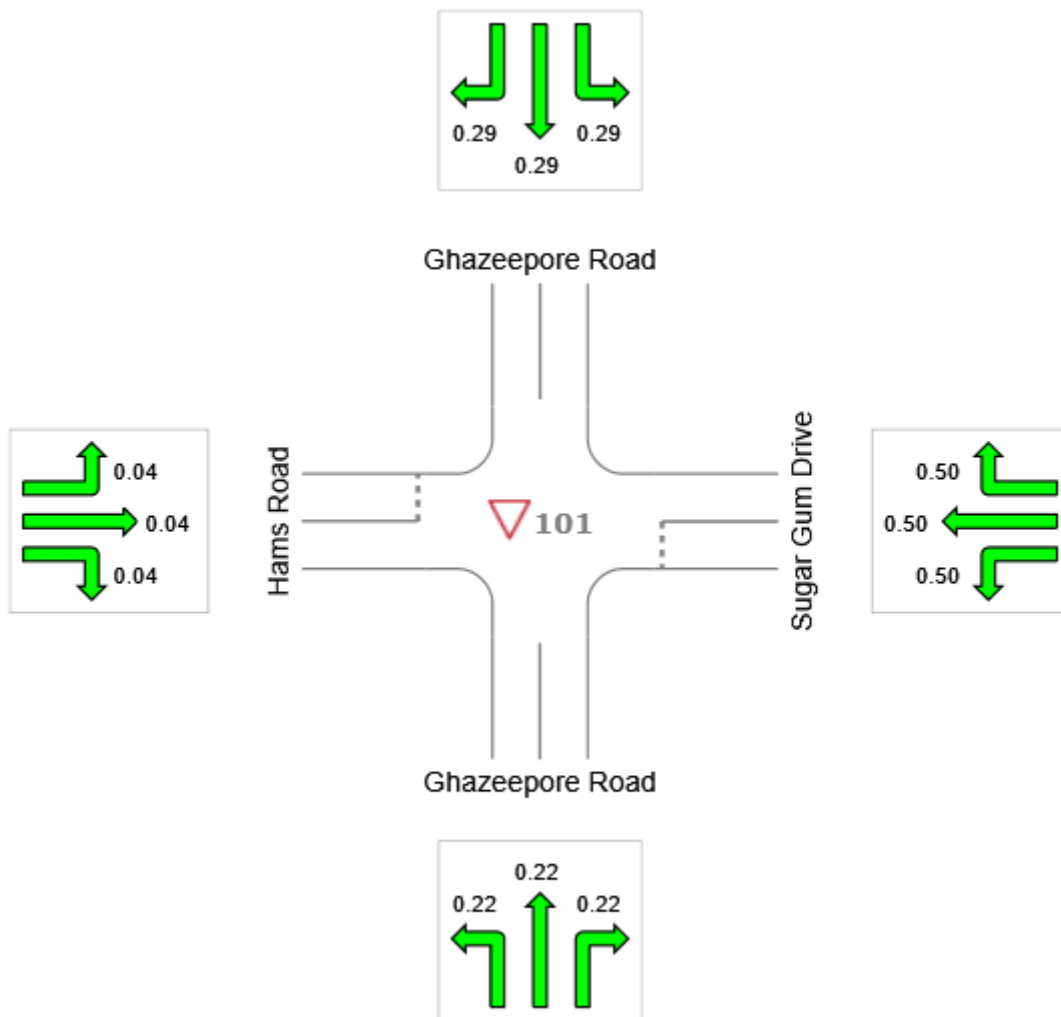
Ratio of Demand Volume to Capacity (v/c ratio)

▽ Site: 101 [GTA 2029 PM Existing layout - Ghazeeppore Road / Hams Road / Sugar Gum Drive Intersection]

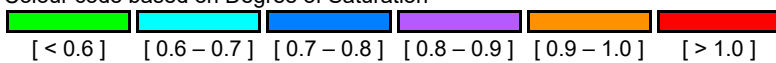
PM Existing - July 2019 Volumes
 Site Category: (None)
 Giveaway / Yield (Two-Way)

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.22	0.50	0.29	0.04	0.50



Colour code based on Degree of Saturation



MOVEMENT SUMMARY

▽ Site: 101 [GTA 2029 PM Plus Dev Existing layout - Ghazeepore Road / Hams Road / Sugar Gum Drive Intersection]

PM Existing - July 2019 Volumes

Site Category: (None)

Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Ghazeepore Road												
1	L2	55	5.0	0.245	8.1	LOS A	1.1	8.2	0.36	0.22	0.36	47.6
2	T1	240	5.0	0.245	1.4	LOS A	1.1	8.2	0.36	0.22	0.36	54.7
3	R2	89	5.0	0.245	8.5	LOS A	1.1	8.2	0.36	0.22	0.36	45.3
Approach		384	5.0	0.245	4.0	NA	1.1	8.2	0.36	0.22	0.36	51.8
East: Sugar Gum Drive												
4	L2	238	5.0	0.633	11.1	LOS B	4.4	31.9	0.72	1.13	1.39	34.4
5	T1	58	5.0	0.633	18.0	LOS C	4.4	31.9	0.72	1.13	1.39	39.2
6	R2	70	5.0	0.633	22.8	LOS C	4.4	31.9	0.72	1.13	1.39	41.6
Approach		366	5.0	0.633	14.5	LOS B	4.4	31.9	0.72	1.13	1.39	37.1
North: Ghazeepore Road												
7	L2	41	5.0	0.352	6.9	LOS A	1.1	8.3	0.20	0.12	0.20	53.2
8	T1	491	5.0	0.352	0.4	LOS A	1.1	8.3	0.20	0.12	0.20	57.2
9	R2	89	5.0	0.352	7.1	LOS A	1.1	8.3	0.20	0.12	0.20	51.8
Approach		621	5.0	0.352	1.8	NA	1.1	8.3	0.20	0.12	0.20	55.8
West: Hams Road												
10	L2	62	5.0	0.241	5.6	LOS A	0.9	6.2	0.50	0.67	0.52	45.5
11	T1	15	5.0	0.241	12.0	LOS B	0.9	6.2	0.50	0.67	0.52	41.1
12	R2	34	5.0	0.241	21.2	LOS C	0.9	6.2	0.50	0.67	0.52	40.4
Approach		111	5.0	0.241	11.2	LOS B	0.9	6.2	0.50	0.67	0.52	43.7
All Vehicles		1482	5.0	0.633	6.2	NA	4.4	31.9	0.39	0.44	0.56	48.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Vehicle movement LOS values are based on average delay per movement.

Minor Road Approach LOS values are based on average delay for all vehicle movements.

NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

DEGREE OF SATURATION

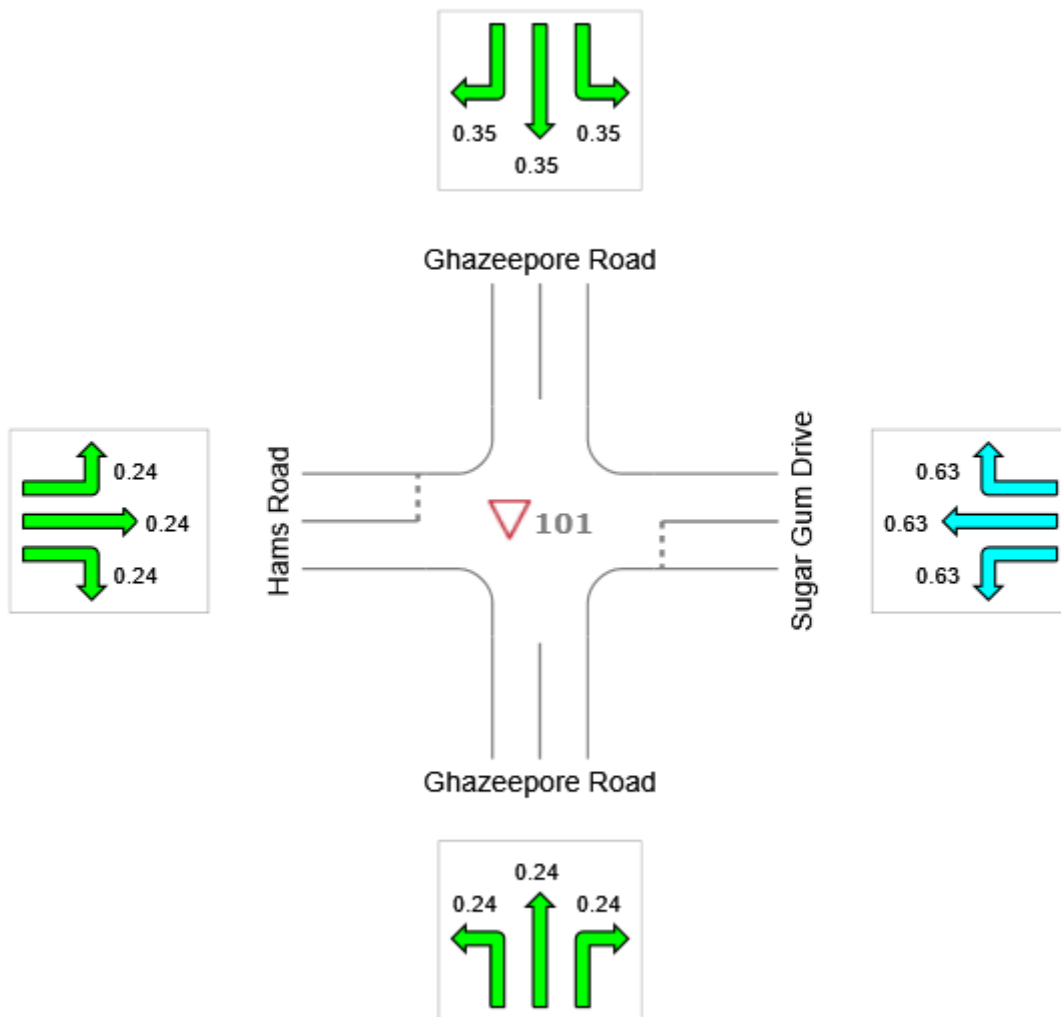
Ratio of Demand Volume to Capacity (v/c ratio)

▽ Site: 101 [GTA 2029 PM Plus Dev Existing layout - Ghazeepore Road / Hams Road / Sugar Gum Drive Intersection]

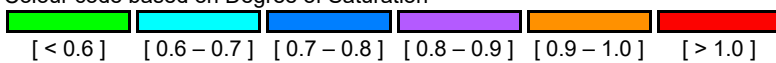
PM Existing - July 2019 Volumes
 Site Category: (None)
 Giveaway / Yield (Two-Way)

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.24	0.63	0.35	0.24	0.63



Colour code based on Degree of Saturation



MOVEMENT SUMMARY

 Site: 101v [GTA 2029 PM plus Dev RAB - Ghazeepore Road / Hams Road / Sugar Gum Drive Intersection]

PM Existing - July 2019 Volumes

Site Category: (None)

Roundabout

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Ghazeepore Road												
1	L2	55	5.0	0.368	5.9	LOS A	2.3	16.7	0.47	0.61	0.47	45.0
2	T1	240	5.0	0.368	6.0	LOS A	2.3	16.7	0.47	0.61	0.47	50.6
3	R2	89	5.0	0.368	9.8	LOS A	2.3	16.7	0.47	0.61	0.47	44.0
Approach		384	5.0	0.368	6.9	LOS A	2.3	16.7	0.47	0.61	0.47	48.5
East: Sugar Gum Drive												
4	L2	238	5.0	0.563	12.5	LOS B	5.3	38.7	0.91	1.03	1.14	35.6
5	T1	58	5.0	0.563	12.5	LOS B	5.3	38.7	0.91	1.03	1.14	40.7
6	R2	70	5.0	0.563	16.3	LOS B	5.3	38.7	0.91	1.03	1.14	43.6
Approach		366	5.0	0.563	13.2	LOS B	5.3	38.7	0.91	1.03	1.14	38.5
North: Ghazeepore Road												
7	L2	41	5.0	0.524	5.7	LOS A	4.9	35.6	0.54	0.56	0.54	48.4
8	T1	491	5.0	0.524	5.8	LOS A	4.9	35.6	0.54	0.56	0.54	50.3
9	R2	89	5.0	0.524	9.7	LOS A	4.9	35.6	0.54	0.56	0.54	49.6
Approach		621	5.0	0.524	6.4	LOS A	4.9	35.6	0.54	0.56	0.54	50.0
West: Hams Road												
10	L2	62	5.0	0.132	6.2	LOS A	0.8	6.0	0.61	0.65	0.61	48.0
11	T1	15	5.0	0.132	6.2	LOS A	0.8	6.0	0.61	0.65	0.61	44.6
12	R2	34	5.0	0.132	10.0	LOS B	0.8	6.0	0.61	0.65	0.61	44.4
Approach		111	5.0	0.132	7.4	LOS A	0.8	6.0	0.61	0.65	0.61	46.6
All Vehicles		1482	5.0	0.563	8.3	LOS A	5.3	38.7	0.62	0.70	0.68	46.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).

Roundabout LOS Method: SIDRA Roundabout LOS.

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

Roundabout Capacity Model: SIDRA Standard.

SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).

HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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Organisation: GTA CONSULTANTS | Processed: Thursday, 8 August 2019 3:44:08 PM

Project: P:\V17700-17799\177700 35 and 69-93 Hams Road, Waurin Po\Modelling\190808-SIDRA-FINAL-Ghazeepore-Hams-SGDrive - PM.sip8

DEGREE OF SATURATION

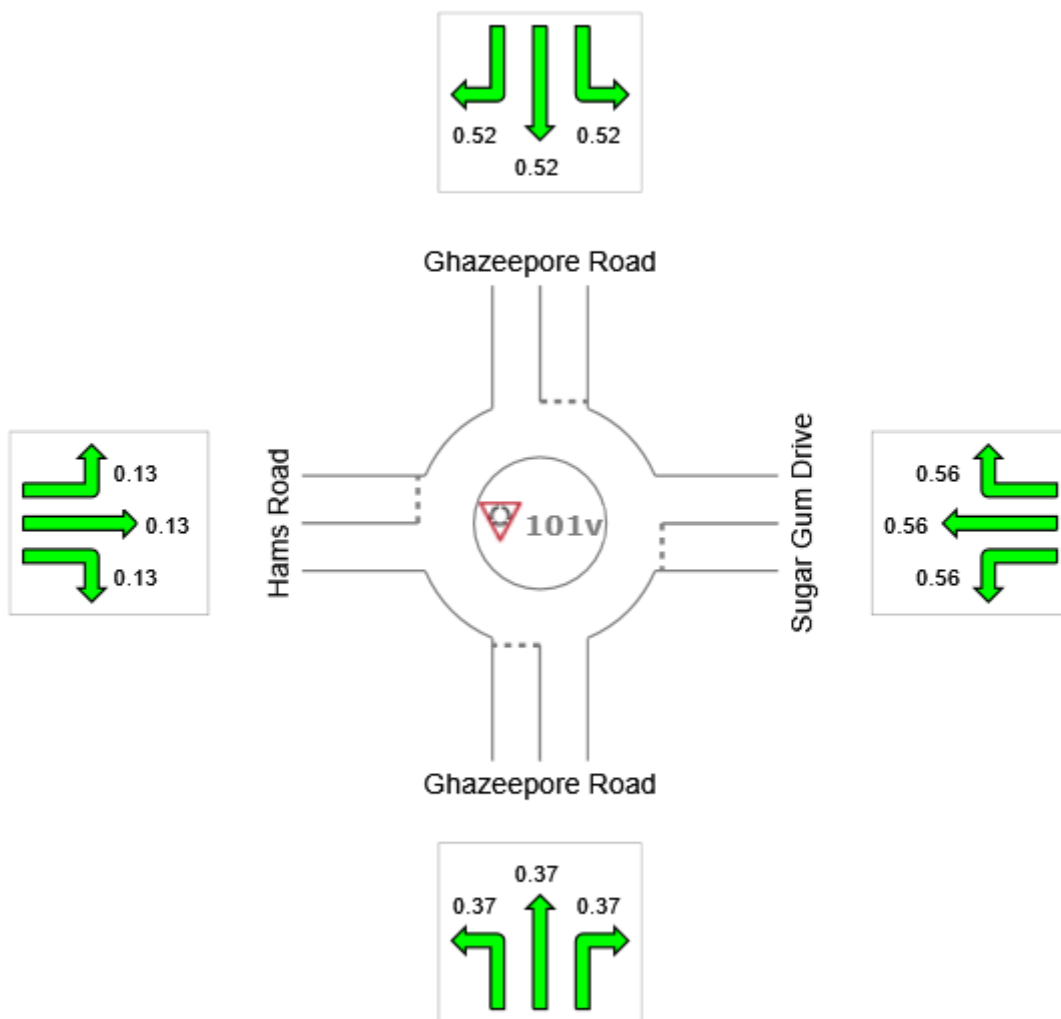
Ratio of Demand Volume to Capacity (v/c ratio)

Site: 101v [GTA 2029 PM plus Dev RAB - Ghazeeopore Road / Hams Road / Sugar Gum Drive Intersection]

PM Existing - July 2019 Volumes
 Site Category: (None)
 Roundabout

All Movement Classes

	Approaches				Intersection
	South	East	North	West	
Degree of Saturation	0.37	0.56	0.52	0.13	0.56



Colour code based on Degree of Saturation

