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Preliminary Transport Assessment

176-194 Thornhill Road
Highton

Prepared for: Barwon Water
October 2015

DOCUMENT CONTROL

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Approval	D. Barton	Design Manager	28/10/15

Details of Revisions

Rev	Date	Description	WVR No.	Approved
0	28/10/15	Final Report		

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1. INTRODUCTION

1.1 Background

SMEC Australia Pty Ltd (SMEC) has been engaged by Barwon Water to conduct a Preliminary Transport Assessment for the site located at 176-194 Thornhill Road, Highton, Victoria.

The aim of this Preliminary Transport Assessment is to assess the level of risk associated with the future development of this site. Risk in the context of this report is defined as the impact that potential future road network improvements may have on the viability of the development and the impact the development will have on the current operation of the road network.

The assessment will focus on any future road and intersection upgrades that may be attributable to the site and for which developer contributions may be sought.

2. DEVELOPMENT PROPOSAL

2.1 Site location

The proposed development site is located at 176-194 Thornhill Road, Highton, refer to Figure 1. The site is a vacant piece of land fronting Augustines Road. The land is 7.03ha in size, with a depth of 336.0m (approx.) and a width of 236.0m. The site is bounded by Thornhill Road to the east, Augustines Road to the south, vacant land to the west and existing residential dwellings to the north. The development site is currently undeveloped and is located within a well-established residential precinct.

NOTE: There is a discrepancy in the road naming of the east-west road that abuts the southern boundary of the subject land. This road is called "Augustines Road" by Google Maps and Open Street Map, which are the main map references used by the SMEC Traffic and Transport Team. It is understood that Land Victoria and Planning Maps Online call this same stretch of road "Thornhill Road". It is further noted that individual properties are addressed to Thornhill Road within this stretch of road. Notwithstanding these observations, please note that this Traffic Assessment report refers to this road as "Augustine's Road" throughout this report because of the map references used by Google and Open Street Map..

The site is located approximately 8km south-west of the Geelong town centre. In relation to Melbourne, the site is located approximately 85km south-east of the CBD.

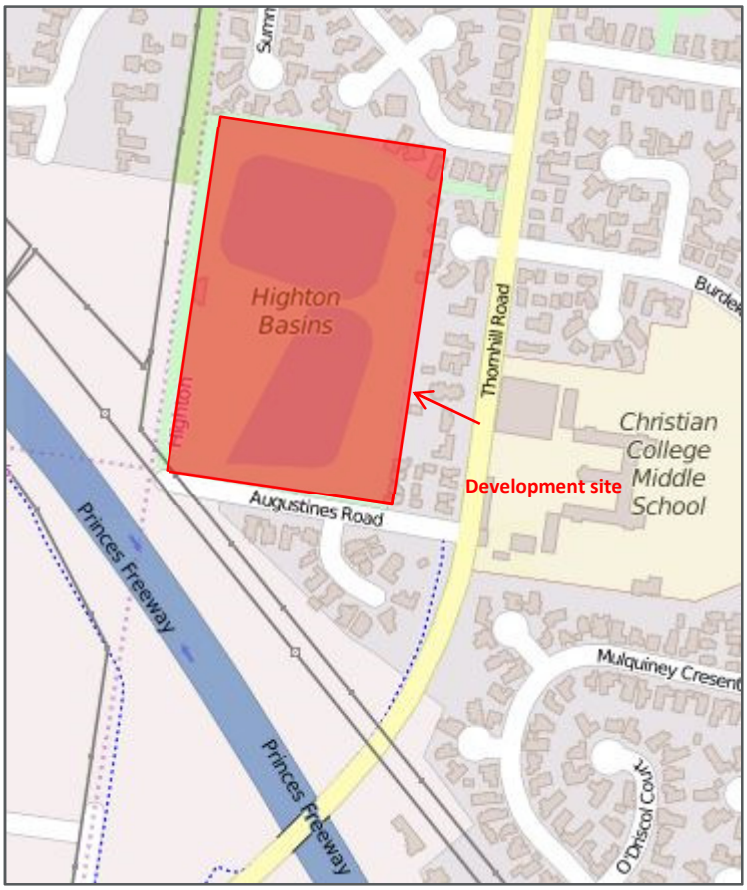


Figure 1: Locality plan (source: http://www.openstreetmap.org)

2.2 Concept Subdivision Plan

Barwon Water is seeking to develop the land for residential purposes, by subdividing the property into 67 lots (which includes 2 superlots that will further subdivide in 17 lots in the future) within Stage 1 and Stage 2. It is understood that the storage basin in Stage 2 will be resized.

The development is currently located within a Public Use Zone – Service and Utility (PUZ1) area. Various residential uses surround the site to the north, east, north-west and vacant land to the south west of the site and is zoned for farming purposes.

The average size of the lots within the proposed development is approximately 463m2. It is noted that depth of the lots varies from 30m to 35m. The design of the proposed residential lots is consistent with the subdivision of the existing residential precinct, creating a layout that is consistent with the surrounding land uses.

A proposed plan of subdivision showing the proposal is at Appendix A.

3. EXISITING CONDITIONS

3.1 Existing road network

A review of the proposed future development site, Thornhill Road, Augustines Road and the surrounding road network was undertaken to assess the general operational characteristics of the abutting road network.

3.1.1 Thornhill Road

Thornhill Road is a sealed two-lane, two-way undivided local road under the care and control of City of Greater Geelong Council.

It runs in a north-south direction between Geelong Ring Road to the south and Roslyn Road to the north. It consists of an 11.0m wide carriageway, made up of two traffic lanes, with on road bicycle lanes in each direction. Kerb and channel and formalised drainage is present within the road reserve. The road alignment is straight and flat at its intersection with Augustines Road.

The posted speed limit on Thornhill Road is 60km/h

3.1.2 Augustines Road

Augustines Road is a sealed two-lane, two-way undivided local road which runs in an east-west direction, between Thornhill Road to the east and Geelong Ring Road is truncated to the west. It consists of an 11.0m wide carriageway, made up of two traffic lanes, with on road bicycle lanes in each direction. Kerb and channel and formalised drainage is present within the road reserve. The road alignment is straight and flat.

There is no posted speed limit on Augustines Road; hence the default urban speed limit of 50km/h applies.

3.2 Existing intersections

3.2.1 Thornhill Road/ Augustines Road

The intersection of Thornhill Road/Augustines Road is a 3-leg unsignalised T-intersection operating under priority controlled 'give way' conditions. Thornhill Road forms the northern and southern legs with Augustines Road forming the western leg.

Thornhill Road is a two-lane, two-way undivided local road which runs in a north-south direction. At the intersection on the north approach, there is a dedicated through and right turn lane. On the south approach, there is a dedicated through, and left turn lane.

Augustines Road is a two-lane, two-way undivided local road which runs in an east-west direction. At the intersection on the west approach, there is a shared left and right turn lane.

3.3 Traffic data

3.3.1 Traffic volumes

Thornhill Road and Augustines Road are both local roads under the control and management of the City of Greater Geelong Council.

City of Greater Geelong Council provided midblock traffic volumes (south of Burdekin Road) along Thornhill Road in the vicinity of the subject site. Weekday traffic along Thornhill Road indicates the following approximate daily traffic volumes:

- Thornhill Road – 7,500 vpd.

3.3.2 Intersection traffic volumes

Manual traffic movement counts were conducted by Trans Traffic Survey Pty Ltd in August 2015. The traffic surveys were undertaken at the following locations:

- Thornhill Road/ Augustines Road

3.3.3 Thornhill Road/ Augustines Road

Manual turning movement counts indicated that the midweek intersection volumes are consistent showing minimal fluctuation throughout a typically working week. The corresponding AM and PM peak periods are 08:00 – 09:00 and 15:30 – 16:30 respectively.

Refer Figure 2 for existing AM and PM peak hour traffic volume summary

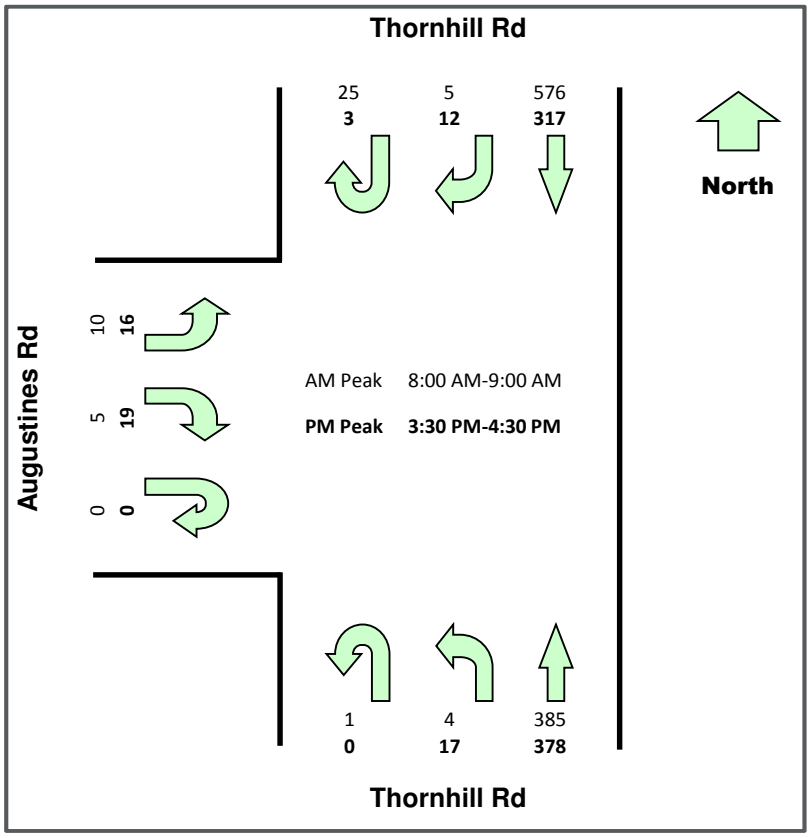


Figure 2: Existing traffic volumes – Thornhill Road/ Augustines Road

3.4 Intersection peak hour performance

Signalised and unsignalised Intersection Design Research Analysis (SIDRA) is a key tool used for this type of assessment as it helps identify the "Level of Service" and "Degree of Saturation" of the intersection. Level of Service is defined as a qualitative measure for ranking "operating conditions", based on factors such as speed, travel time, freedom to manoeuvre, interruptions, comfort and convenience. There are six levels of service, from A to F, with level of service A representing the best operating condition and level of service F the worst.

The Degree of Saturation is defined as the ratio of the arrival flow (demand) to the capacity of the approach during the same period. The degree of saturation of an intersection approach ranges from close to zero for very low traffic flows and up to one for saturated flow or capacity. Refer Table 1 for the level of service summary.

Table 1: Level of Service summary (vehicles)

Level of Service	Degree of Saturation
	Sign Controlled
A	x ≤ 0.60
B	0.60 < x ≤ 0.70
C	0.70 < x ≤ 0.80
D	0.80 < x ≤ 0.90
E	0.90 < x ≤ 1.00
F	1.00 < x

3.4.1 Thornhill Road/ Augustines Road

SIDRA analyses were undertaken for the unsignalised intersection of Thornhill Road/ Augustines Road in the AM and PM peak periods operating under existing conditions. Refer Table 2 for a summary of the SIDRA results. A copy of the detailed results can be found in Appendix C.

Table 2: SIDRA peak hour analysis – Thornhill Road/ Augustines Road (base year)

Approach	Movement	Degree of Saturation		Average Delay (sec)		95% Queue (m)	
		AM	PM	AM	PM	AM	PM
Thornhill Rd south	T	0.198	0.191	12.6	4.9	0.0	0.0
	L	0.002	0.010	8.2	8.2	5.4	3.4
	U	0.198	0.191	12.6	4.9	5.4	3.4
Thornhill Rd north	T	0.315	0.177	0.0	0.0	0.0	0.0
	R	0.051	0.019	27.0	16.1	0.2	0.1
	U	0.051	0.019	27.0	16.1	0.2	0.1
Augustines Rd west	L	0.036	0.073	8.1	7.0	0.1	0.3
	R	0.036	0.073	8.1	7.0	0.1	0.3

SIDRA analysis has shown that the intersection of Thornhill Road/ Augustines Road operates satisfactorily under current traffic volumes, showing minimal vehicle queues and delays along Thornhill Road in a typical peak hour period.

3.5 Public transport

The subject site is serviced reasonably well by public transport. A summary of the existing public transport services is provided below:

3.5.1 Train

Marshall Train Station is the closest train station to the development site and is located approximately 6.0km east of the development site.

3.5.2 Bus

Due to the opening of Regional Rail Link on 21 June 2015, PTV has created a new bus network in Geelong and the Bellarine Peninsula.

Bus Route 43 (Geelong Station to Deakin University via Highton) is the closest bus service to operate within the vicinity of the development site. Refer Figure 3 for a summary of the bus route in the vicinity of the development site. The closest bus stop is located on Thornhill Road, approximately 60m north of the intersection Thornhill Road/ Augustines Road.

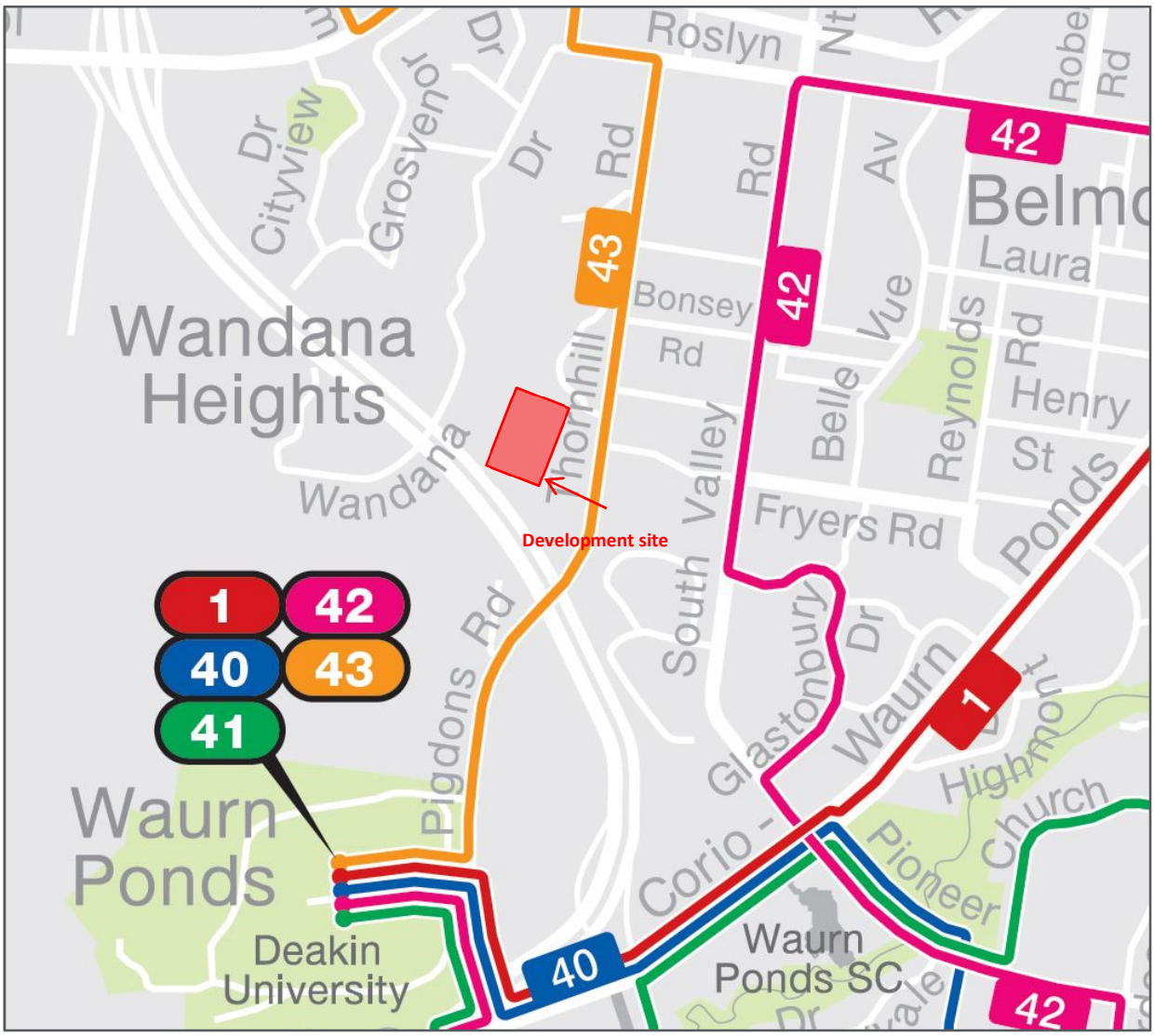


Figure 3: Bus routes (source www.ptv.com.au)

3.6 Active transport

3.6.1 Walking and cycling

There are pedestrian footpaths and cycle paths located in the vicinity of the development site. Footpaths are provided along both sides of the Thornhill Road and along the south side of Augustines Road.

4. TRAFFIC IMPACT ASSESSMENT

4.1 Trip generation

The RMS Guide to Traffic Generating Developments sets out the traffic generation rates for various land uses. This guide has been used to source the traffic generation rates for residential land uses.

The traffic generation rates applicable to this development are shown in Table 3:

Table 3: Traffic generation rates

Land Use	Daily Vehicle Trips	Peak Hour Vehicle trips
Residential		
Dwelling/Houses	9 per dwelling/ lot	1.0 per dwelling/ lot

Based on the trip generation rates specified above, the proposed development site is expected to generate approximately 603 vehicle trips per day, with 60 vehicle trips expected to occur in the peak hour.

4.2 Trip distribution

The majority of vehicle trips generated by the residential lots in the peak hour are home-to-work or work-to-home trips. Therefore, the distribution of traffic to/ from the site has been determined based on the location of the site in relation to the location of external employment areas.

Given the proposed plan of subdivision has only one external access point (i.e. Augustines Road/ Thornhill Road intersection), it is expected that all of the trips generated by the site would use Augustines Road abutting the development site based on its current distribution as follows;

For the AM peak:

- Only 55% of vehicle trips enter the site from the north approach;
- Only 45% of vehicle trips enter the site from the south approach;
- 65% of vehicle trips exit the site from the west approach and travels north; and
- 35% of vehicle trips exit the site from the west approach and travels south.

For the PM peak:

- Only 40% of vehicle trips enter the site from the north approach;
- Only 60% of vehicle trips enter the site from the south approach;
- 45% of vehicle trips exit the site from the west approach and travels north; and
- 55% of vehicle trips exit the site from the west approach and travels south.

Figure 4 shows the distribution of generated traffic volumes from the site to the surrounding road network.

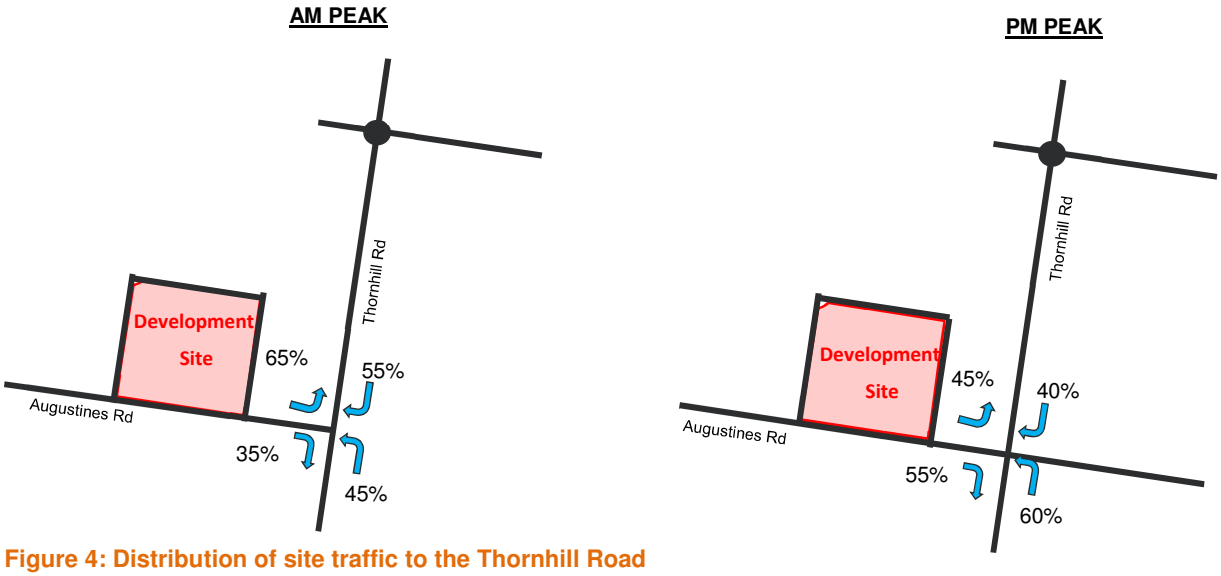


Figure 4: Distribution of site traffic to the Thornhill Road

The directional distribution of traffic accessing the site is based on the assumption that 80% exit and 20% enter the site during the AM peak, and 40% exit and 60% enter the site during the PM peak (source: Traffic Engineering and Management, K W Ogden and S Y Taylor, 1996, Section 8.1).

4.3 Distribution of site access points

As the subject site is currently undeveloped, the distribution of traffic to the site access points is primary based on the proposed road network and proximity of dwellings to the external road network. Refer to Figure 5.

Based on the concept subdivision plan, all 67 dwellings will use Augustines Road, to access/ egress the site. It is therefore assumed that 65% of vehicle trips per day will use Access Point 1 and 35% of vehicle trips per day will use Access Point 2.

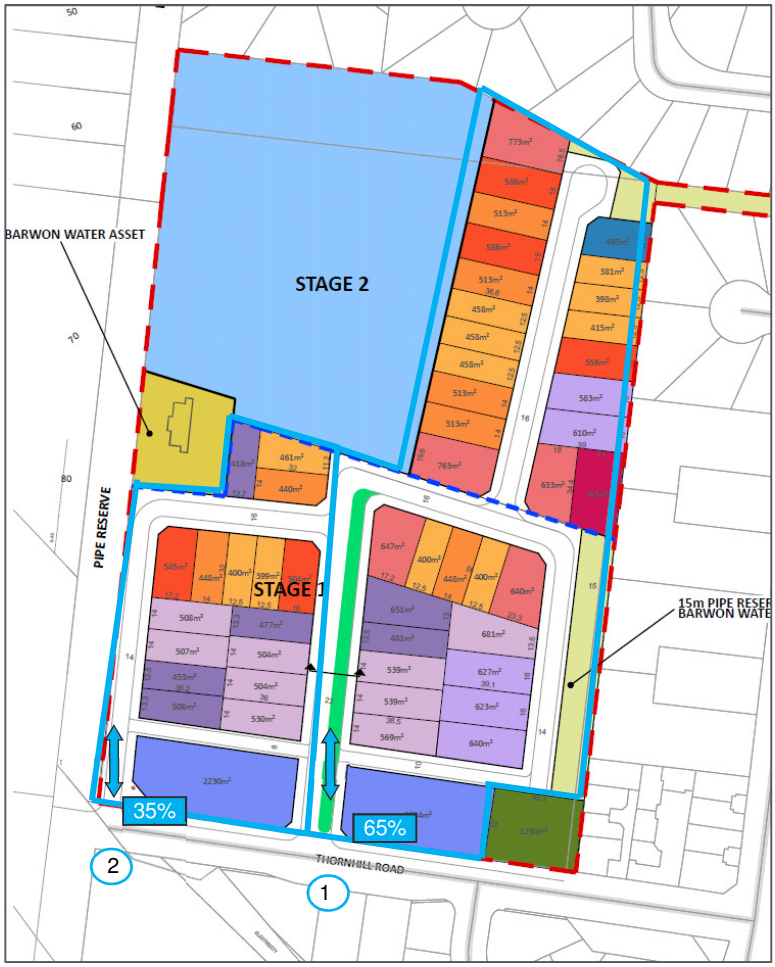


Figure 5: Distribution of traffic to site access points

4.4 Trip assignment

From the trip generation and distribution assumptions outlined above, traffic accessing the proposed development site can be assigned to Augustines Road.

Table 4 provides a summary of the number of trips expected to use each site access point.

Table 4: Private vehicle movements at each site access point

Access Point	Daily Trips (vehicles)	Peak Hour Trips (vehicles)
Access point 1	378	38
Access point 2	225	22
Total	**603**	**60**

Table 5 summarises the predicted peak hour traffic movements on the site access roads following full development of the site.

Table 5: Private vehicle movements at each site access point

Access Point	AM Peak			PM Peak		
	Total Peak Hour Vehicle Trips	80% Exit	20% Enter	Total Peak Hour Vehicle Trips	40% Exit	60% Enter
Access point 1	38	30	8	38	15	23
Access point 2	22	18	4	22	9	13
Total	**60**	**48**	**12**	**60**	**24**	**36**

The assignment of traffic during AM and PM peak hours accessing the site via Augustines Road is presented in Figures 6 and 7

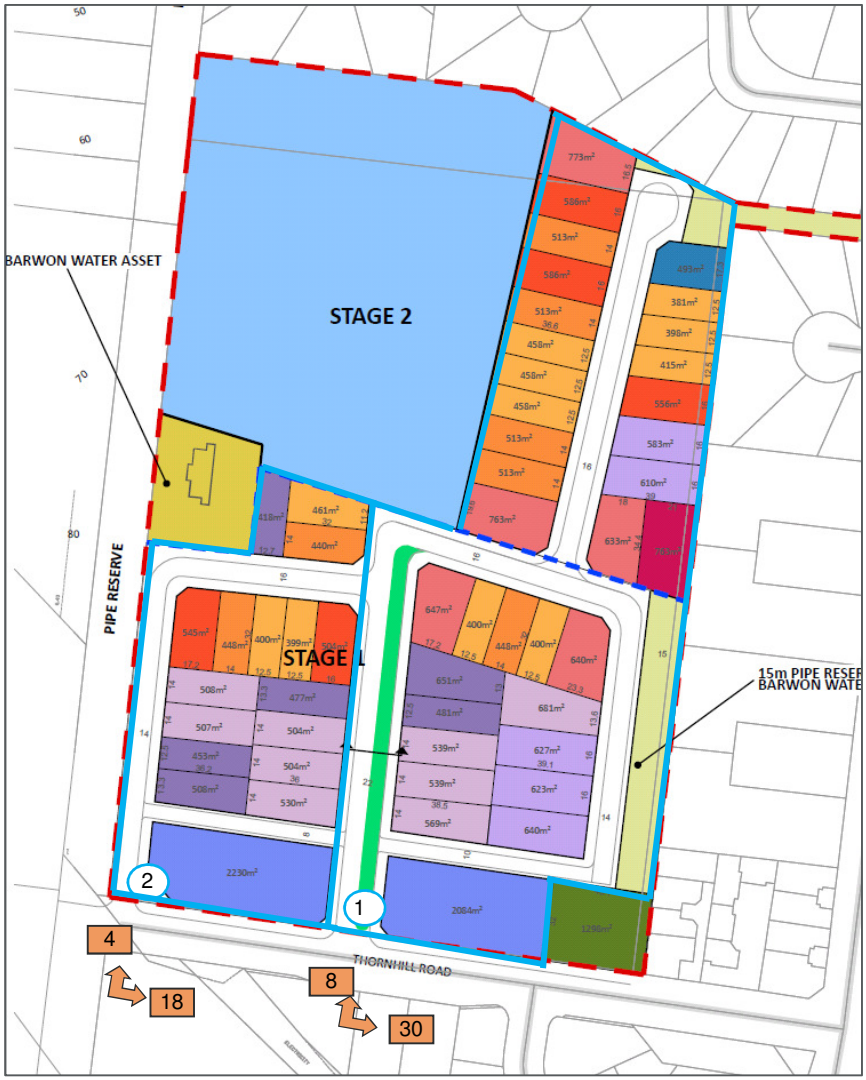


Figure 6: Assignment of Traffic – AM Peak

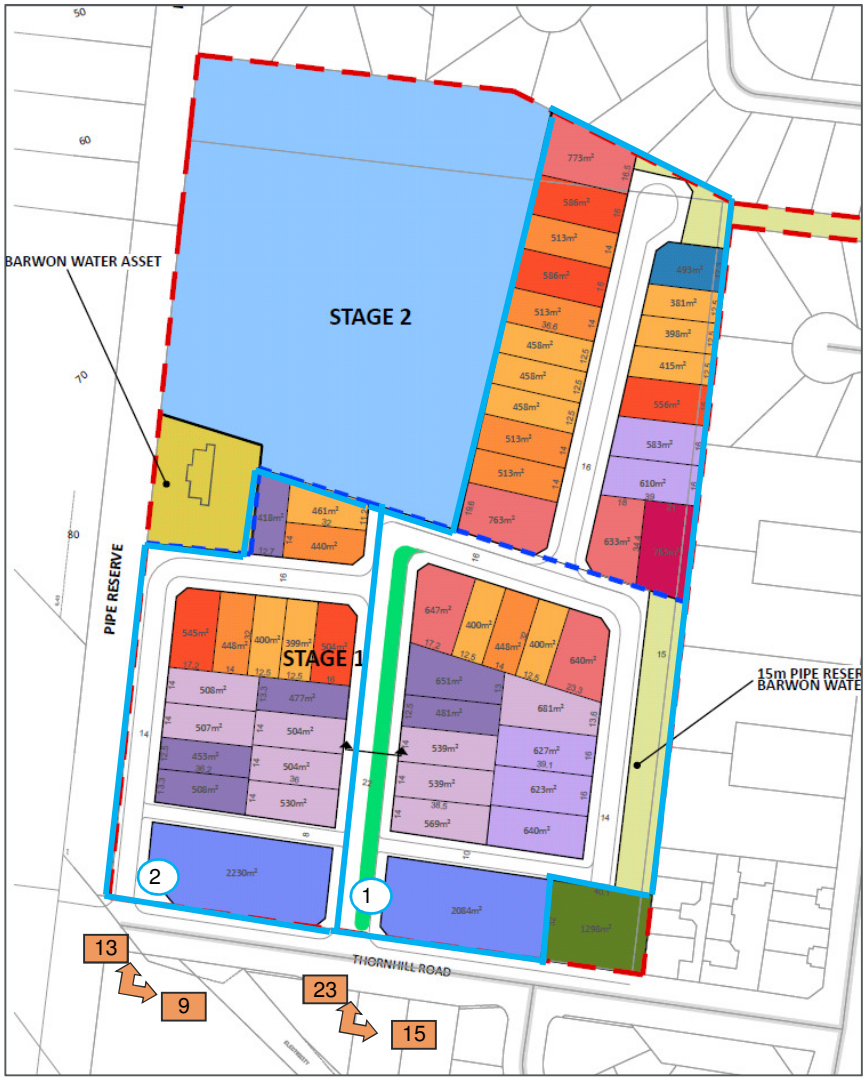


Figure 7: Assignment of Traffic – PM Peak

4.5 Traffic impact

4.5.1 Thornhill Road/ Augustines Road

The intersection of Thornhill Road/ Augustines Road has been analysed in SIDRA for the 2026 post development design year. In order to estimate the future year external traffic volumes, a 2.0% compounded growth rate per year has been added to the existing traffic volumes shown in Section 3.3.3.

The results show that under post development conditions in the design year 2026, the intersection will operate satisfactorily showing minor increases in degree of saturation, vehicle delays and queue lengths. The analysis indicates that the intersection would operate with an acceptable degree of saturation of 0.391 in the AM peak and 0.238 in the PM peak. The 2026 analysis indicates that the intersection experiences a slight decrease in operating performance compared to the current operation.

Refer Table 6 for a summary for a SIDRA results. A copy of the detailed results can be found in Appendix D.

Table 6: SIDRA peak hour analysis – Thornhill Road/ Augustines Road post development conditions

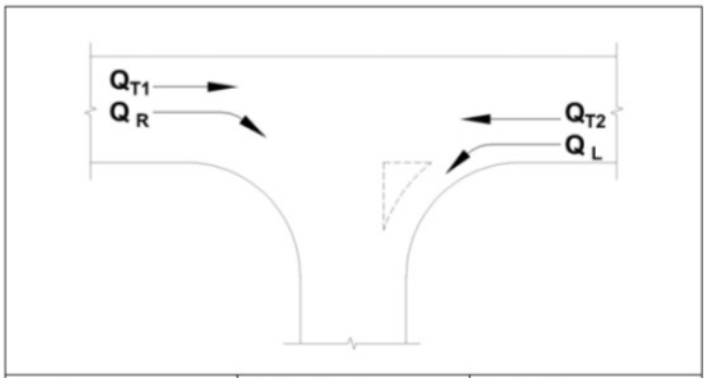
Approach	Movement	Degree of Saturation		Average Delay (sec)		95% Queue (m)	
		AM	PM	AM	PM	AM	PM
Thornhill Rd south	T	0.247	0.238	24.3	7.9	8.4	5.5
	L	0.003	0.012	8.2	8.2	0.0	0.0
	U	0.247	0.238	24.3	7.9	8.4	5.5
Thornhill Rd north	T	0.391	0.219	0.1	0.0	0.0	0.0
	R	0.075	0.028	28.5	17.1	0.3	0.1
	U	0.075	0.028	28.5	17.1	0.3	0.1
Augustines Rd west	L	0.067	0.122	12.9	9.9	0.2	0.4
	R	0.067	0.122	12.9	9.9	0.2	0.4

4.6 Turn Warrant Assessments

4.6.1 Site access points

Warrants for turn treatments are set out in Section 4.8 of the Austroads Guide to Road Design, Part 4A: Unsignalised and Signalised Intersections. These warrants apply to major road turn treatments for the basic, auxiliary lane and channelised layouts.

Figure 4.9(b) of the Austroads guide has been used to assess if turn treatments are required at the Thornhill Road/ Augustines Road intersection. The values of the following traffic volume parameters; Q_M, Q_L and Q_R, are calculated using Figure 4.10 of the Austroads guide, as shown below.



Turn type	Splitter island	Q_M (veh/h)
Right	No	= $Q_{T1} + Q_{T2} + Q_L$
Right	Yes	= $Q_{T1} + Q_{T2}$
Left	No/Yes	= Q_{T2}

The through movement volumes (i.e Q_M) have been calculated based on the volume of traffic expected to use Thornhill Road/ Augustines Road intersection at full development of the subject site only. The existing traffic volumes are utilising existing access point located further east of the development and would not have any impact on the development access points.

The traffic volumes utilising the existing road network are detailed in Section 3.3 of the report.

Refer Appendix B for this assessment and Table 7 for tabulated breakdown of the AM and PM peak turn movements at the proposed site access points located on Augustines Road at full development stage.

Table 7: Turn treatment assessment of the proposed site access points

Major Road	Existing Intersection Layout	Through Movement (Q_M)	Turn Movement (Q_L or Q_R)	Turn treatment Required
AM Peak				
Augustines Road at Access Point 1	-	0	Q_L=0	Basic left
	-	22	Q_R= 8	Basic right
Augustines Road at Access Point 2	-	0	Q_L=0	Basic left
	-	0	Q_R= 4	Basic right
PM Peak				
Augustines Road at Access Point 1	-	0	Q_L=0	Basic left
	-	22	Q_R=23	Basic right
Augustines Road at Access Point 2	-	0	Q_L=0	Basic left
	-	0	Q_R=13	Basic right

The results of turn warrant assessment indicate that basic left and basic right treatment would be required on Augustines Road at the proposed access points. Figure 8 and Figure 9 show typical basic right turn and basic left turn treatments for an urban road. Refer figures below:

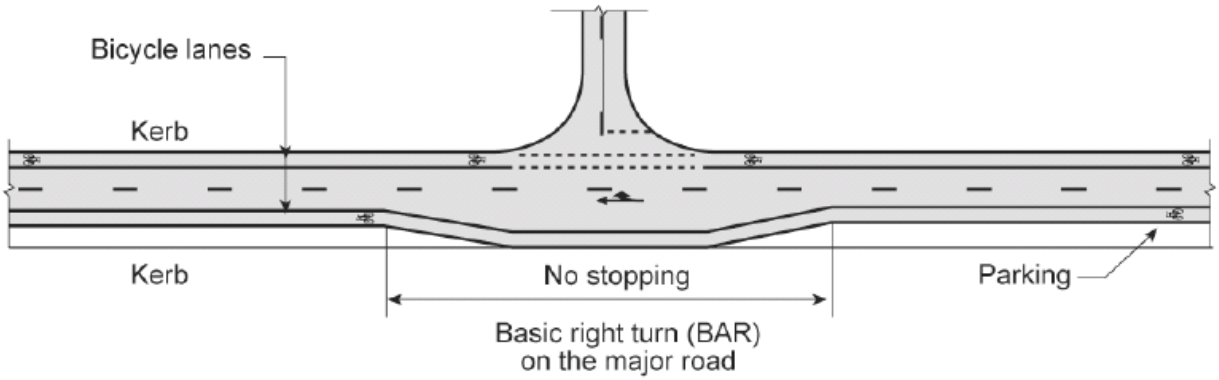


Figure 8: Urban Basic right turn treatment

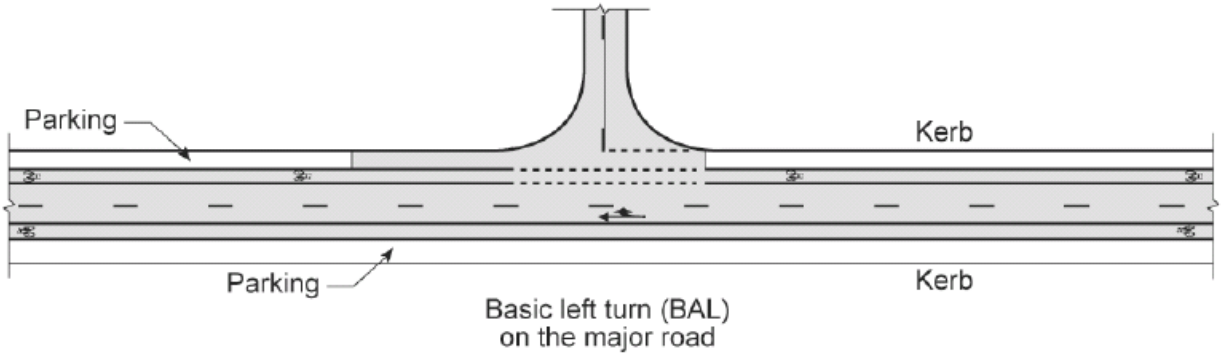


Figure 9: Urban Basic left turn treatment

5. FUTURE ACCESS POINTS

5.1 Site access points

The proposed concept plan shows that the site will be subdivided into 67 lots. It is noted that in the ultimate scenario, two separate access points would be required for proposed development. These access points are intended to face the Augustines Road abutting the southern boundary of the site.

The road alignment of Augustines Road is straight and flat along the frontage of the development site. It would be anticipated that providing future access points along this section of road is considered achievable and would accord with the minimum safe intersection sight distance requirements as specified in the Austroads Guidelines.

The exact location of these site access points will be further investigated for safety and operational effects once a proposed master plan is developed for the site.

6. FUTURE ROAD IMPROVEMENTS

6.1 Road improvements

Provisions for road network upgrades to Thornhill Road and Augustines Road in the form of road widening will not be required. As the traffic function for both of these roads will not change as a result of the proposed development, it is therefore anticipated that both roads are functionally and geometrically adequate of servicing additional traffic generated by the development site.

6.2 Intersection improvements

6.2.1 Thornhill Road/ Augustines Road

The intersection of Thornhill Road/Augustines Road is an established intersection that is currently operating under capacity. It is expected that the intersection arrangement of Thornhill Road/Augustines Road will have sufficient spare capacity to cater for the additional traffic demand generated from the proposed future development.

As such, an intersection upgrade may not be required to improve the overall traffic operational efficiency, intersection capacity and safety at the site.

6.3 Pedestrian/ cyclist improvements

Provisions for future pedestrian footpath will need to be considered to allow for the safe and effective movement of pedestrian around the development site.

It is noted that pedestrian and cycle path has already been constructed along Thornhill Road and Augustines Road. The existing pedestrian footpath located on north side of Augustines Road would require further extension to connect to the proposed development to the surround pedestrian/ cyclist network.

7. MAJOR ROAD INFRASTRUCTURE IMPROVEMENTS

7.1 Thornhill Road

SMEC Australia has had informal discussions with City of Greater Geelong Council team with regard to the proposed future upgrade of Thornhill Road. Council advises the following:

- Council has no plans for upgrading Thornhill Road; and
- The section of Thornhill Road south of the T intersection was constructed by VicRoads as part of the Geelong Bypass project in 2006/2007.

7.2 Smart Roads

There is no modal priority assigned to the road network surrounding the subject site as the 'VicRoads approved Road Use Hierarchy' maps do not extend to this region. It is not anticipated that these plans will be extended to incorporate the development site in the immediate future.

8. CONCLUSION

Our traffic and transport engineering findings for this Preliminary Transport Assessment of 176-194 Thornhill Drive, Victoria, is as follows:

- The proposed development site is expected to generate approximately 603 daily vehicle trips, with 60 vehicle trips occurring in the peak hour;
- It is anticipated that all additional trips generated by the site will generally be distributed to the surrounding network based on the sites current distribution as follows;

  AM peak

  - Only 55% of vehicle trips enter the site from the north approach;
  - Only 45% of vehicle trips enter the site from the south approach;
  - 65% of vehicle trips exit the site from the west approach and travels north; and
  - 35% of vehicle trips exit the site from the west approach and travels south.

  PM peak:

  - Only 40% of vehicle trips enter the site from the north approach;
  - Only 60% of vehicle trips enter the site from the south approach;
  - 45% of vehicle trips exit the site from the west approach and travels north; and
  - 55% of vehicle trips exit the site from the west approach and travels south.
- The development generated traffic will not impact on the operation of the existing unsignalised intersection of Thornhill Road/ Augustines Road as the additional traffic is negligible compared to the capacity of the intersection.
  - SIDRA analysis show that in the design year 2026, the intersection would operate satisfactorily with an intersection degree of saturation of 0.391 in the AM peak and 0.238 in the PM peak;
- A turn warrant assessment shows that a basic left turn and basic right turn treatments are required on Augustines Road;
- Provisions for road network upgrades to Thornhill Road and Augustines Road are not required;
- The concept sub division plan includes the provision of two separate site access points along Augustines Road to access proposed development site;
- No public transport network augmentation is required for the development site; and
- Provision of proposed footpath is required on the north side of the Augustines Road.

The proposed development of 176-194 Thornhill Drive, Highton will have an impact on the existing road network. However these impacts are minor, given that all of the likely impacts identified can be effectively mitigated.

APPENDIX A: CONCEPT SUBDIVISION PLAN

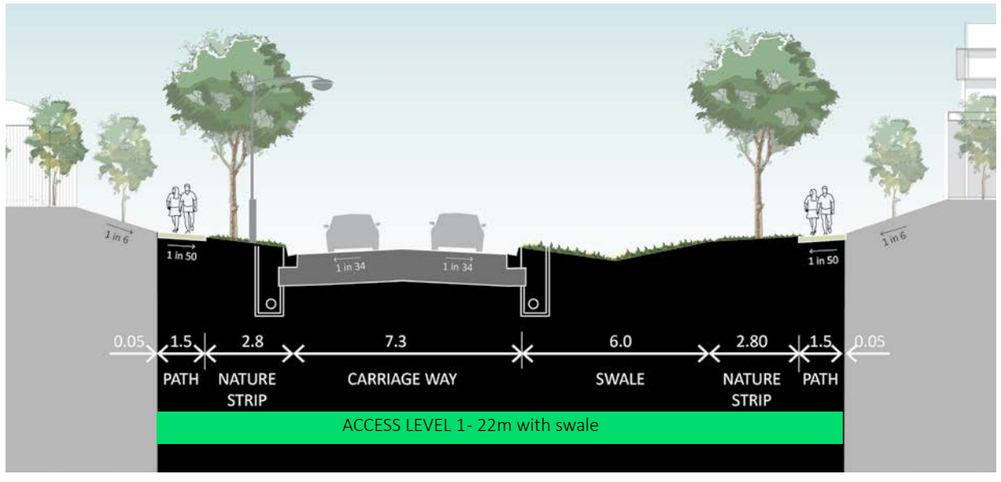
YIELD BREAKDOWN

Lot Width (35.0+ depth)	
18m	1
16m	5
14m	9
12.5m	6
Lot Width (32 depth)	
18m	5
16m	5
14m	7
12.5m	11
Lot Width (30 depth)	
14m	1
Total Lots	50
Superlot*	
	2

*** Likely future yield of 17 lots**

LEGEND

- Property Boundary
- Stage Boundary
- Storage Basin
- Retarding Basin
- Barwon Water Asset - Pump Station
- Open Space (encumbered)
- WSUD - Swale
- Existing brick building to be retained
- Contours (1m intervals)



Section A-A

Subdivision Concept Plan for Traffic
122A Thornhill Road, Highton

Scale: 1:2,000 @ A3
0 20 40 60m

ref.: 30048000F
date: 27 October 2015
rev.: I
drawn: LS
checked: CD

please note:
This plan is based on preliminary information only and may be subject to change as a result of formal Council/Authority advice, detailed site investigations and confirmation by survey

SMEC
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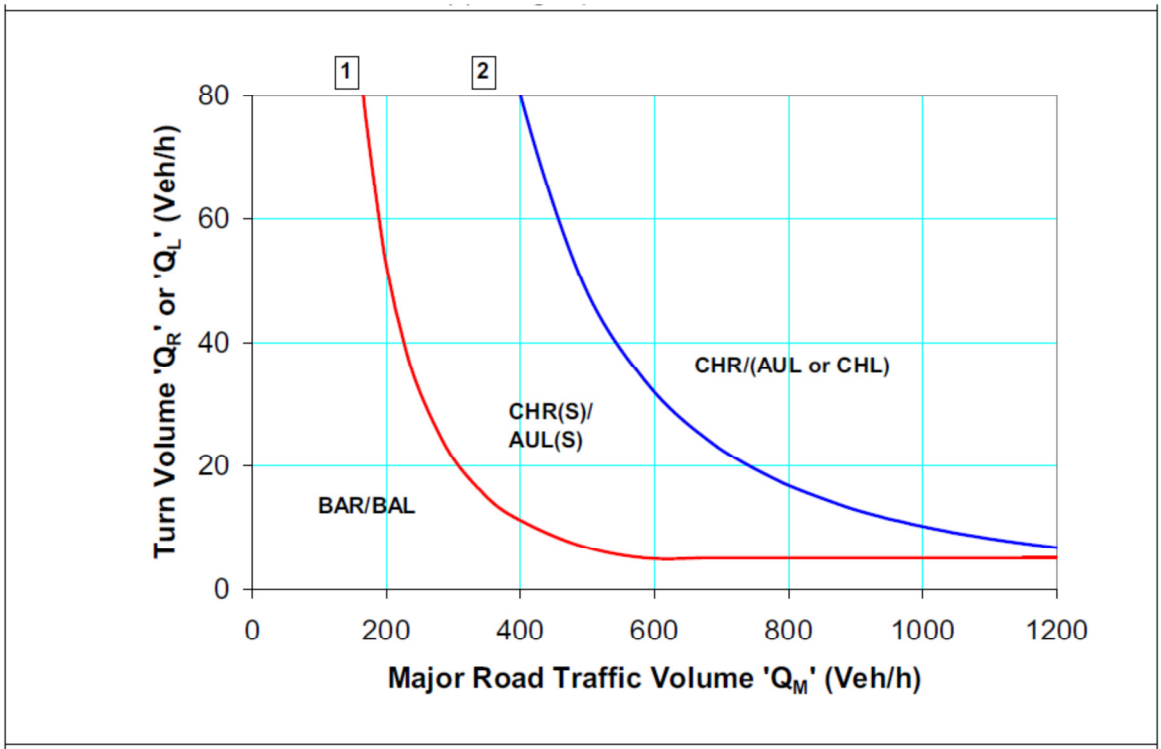
abn 47 065 475 149

APPENDIX B: TURN WARRANT ASSESSMENT



(b) Design speed < 100 km/h

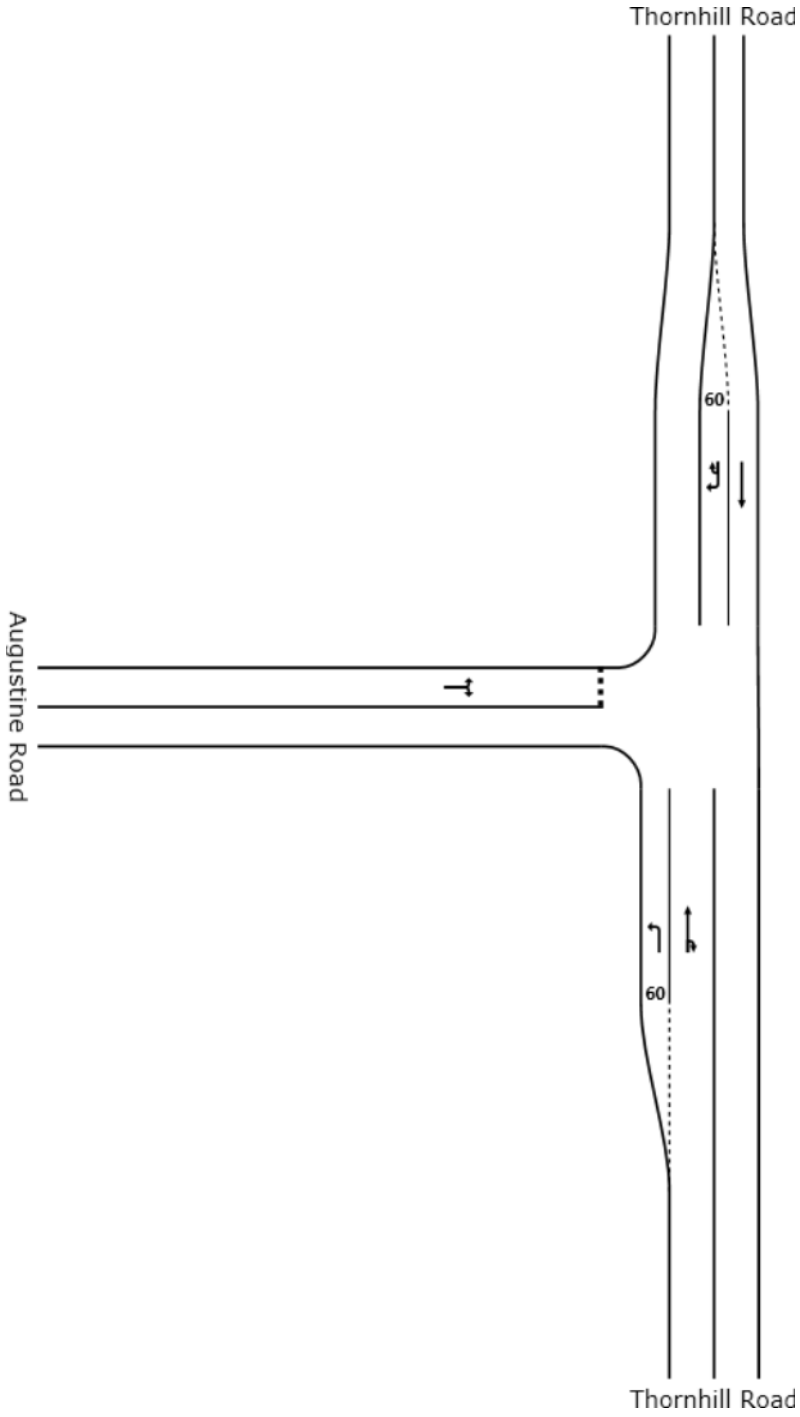
Source: Arndt and Troutbeck (2006).

APPENDIX C: SIDRA RESULTS, EXISTING CONDITIONS

SITE LAYOUT

Site: Thornhill Road/ Augustines Road - Base Year (AM Peak)

Thornhill Road/ Augustines Road
Base Year 2015
AM Peak



MOVEMENT SUMMARY

Site: Thornhill Road/ Augustines Road - Base Year (AM Peak)

Thornhill Road/ Augustines Road
Base Year 2015
AM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

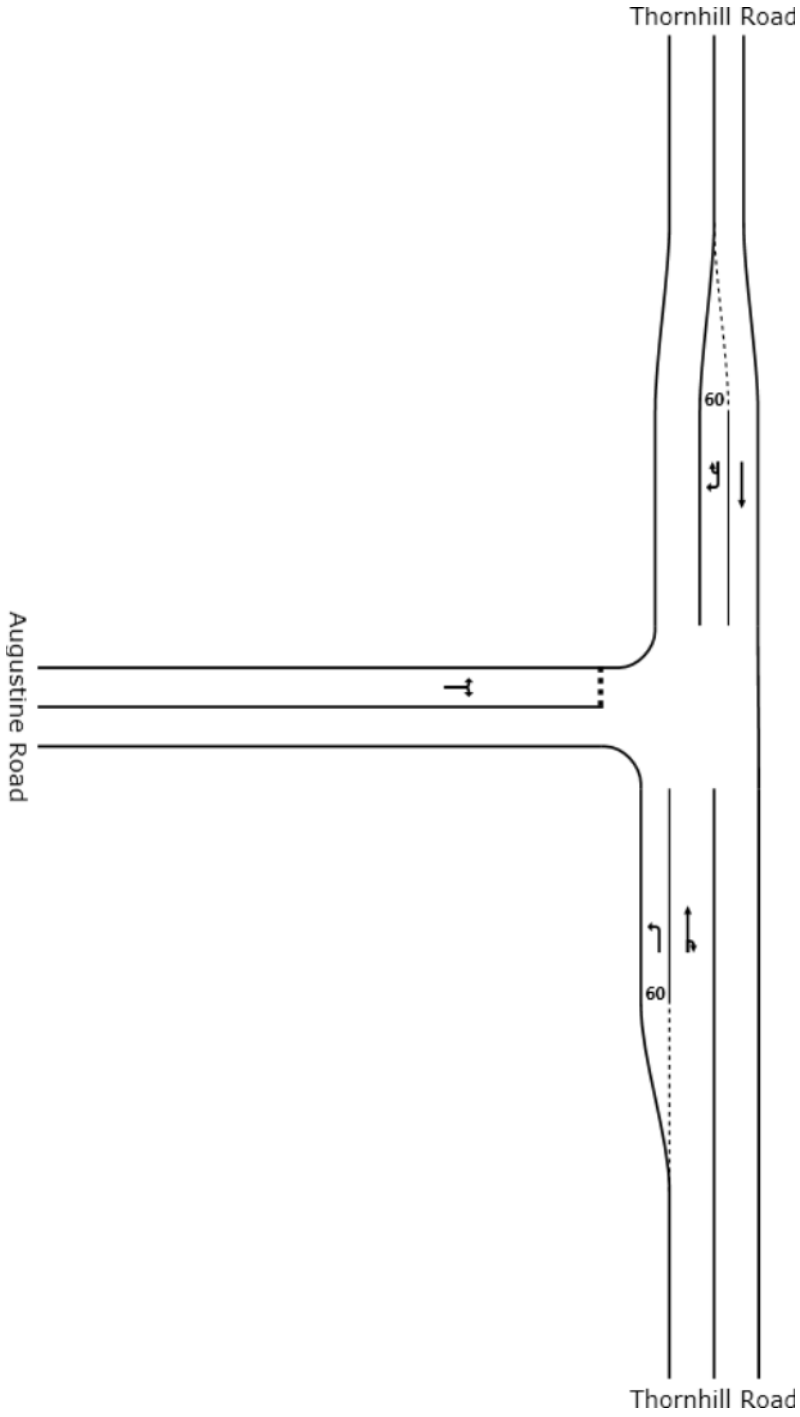
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Thornhill Road											
1	L2	4	0.0	0.002	8.2	LOS A	0.0	0.0	0.00	0.67	48.9
2	T1	405	3.3	0.198	12.6	LOS A	5.4	38.6	1.00	0.00	41.3
3u	U	1	0.0	0.198	12.6	LOS A	5.4	38.6	1.00	0.00	41.3
Approach		411	3.3	0.198	12.6	NA	5.4	38.6	0.99	0.01	41.3
North: Thornhill Road											
8	T1	606	1.8	0.315	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
9	R2	5	0.0	0.051	27.0	LOS A	0.2	1.3	0.50	0.85	43.3
9u	U	26	0.0	0.051	27.0	LOS A	0.2	1.3	0.50	0.85	43.3
Approach		638	1.7	0.315	1.4	NA	0.2	1.3	0.02	0.04	59.0
West: Augustine Road											
10	L2	11	0.0	0.036	8.1	LOS A	0.1	0.8	0.58	0.61	19.7
12	R2	5	0.0	0.036	8.1	LOS A	0.1	0.8	0.58	0.61	19.7
Approach		16	0.0	0.036	8.1	LOS A	0.1	0.8	0.58	0.61	19.7
All Vehicles		1064	2.3	0.315	5.8	LOS A	5.4	38.6	0.41	0.04	49.5

Level of Service (LOS) Method: Degree of Saturation (SIDRA METHOD).
Vehicle movement LOS values are based on degree of saturation per movement
Minor Road Approach LOS values are based on worst degree of saturation for any vehicle movement.
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.

SITE LAYOUT

Site: Thornhill Road/ Augustines Road- Base Year (PM Peak)

Thornhill Road/ Augustines Road
Base Year 2015
PM Peak



MOVEMENT SUMMARY

Site: Thornhill Road/ Augustines Road- Base Year (PM Peak)

Thornhill Road/ Augustines Road
Base Year 2015
PM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Thornhill Road											
1	L2	18	0.0	0.010	8.2	LOS A	0.0	0.0	0.00	0.67	48.9
2	T1	398	1.8	0.191	4.9	LOS A	3.4	24.0	0.69	0.00	47.4
3u	U	1	0.0	0.191	4.9	LOS A	3.4	24.0	0.69	0.00	47.4
Approach		417	1.7	0.191	5.0	NA	3.4	24.0	0.66	0.03	47.4
North: Thornhill Road											
8	T1	334	4.9	0.177	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R2	13	0.0	0.019	16.1	LOS A	0.1	0.5	0.46	0.73	46.9
9u	U	3	0.0	0.019	16.1	LOS A	0.1	0.5	0.46	0.73	46.9
Approach		349	4.6	0.177	0.7	NA	0.1	0.5	0.02	0.03	59.4
West: Augustine Road											
10	L2	17	0.0	0.073	7.0	LOS A	0.3	1.8	0.56	0.63	19.9
12	R2	20	0.0	0.073	7.0	LOS A	0.3	1.8	0.56	0.63	19.9
Approach		37	0.0	0.073	7.0	LOS A	0.3	1.8	0.56	0.63	19.9
All Vehicles		803	2.9	0.191	3.3	LOS A	3.4	24.0	0.38	0.06	48.9

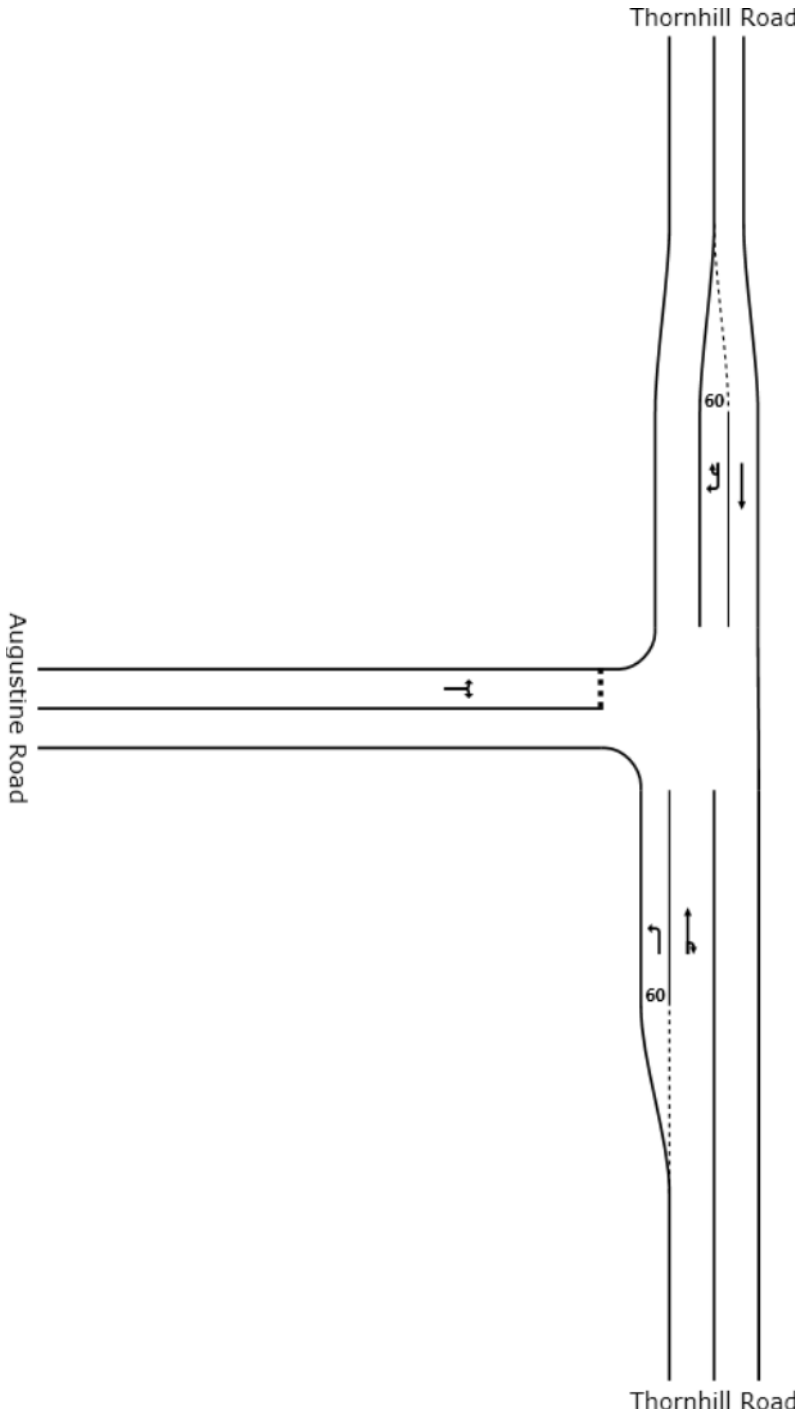
Level of Service (LOS) Method: Degree of Saturation (SIDRA METHOD).
Vehicle movement LOS values are based on degree of saturation per movement
Minor Road Approach LOS values are based on worst degree of saturation for any vehicle movement.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

APPENDIX D: SIDRA RESULTS, POST DEVELOPMENT CONDITIONS

SITE LAYOUT

Site: Thornhill Road/ Augustines Road - 2026 Post Development Year (AM Peak)

Thornhill Road/ Augustines Road
2026 Post Development Year
AM Peak



MOVEMENT SUMMARY

Site: Thornhill Road/ Augustines Road - 2026 Post Development Year (AM Peak)

Thornhill Road/ Augustines Road
2026 Post Development Year
AM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

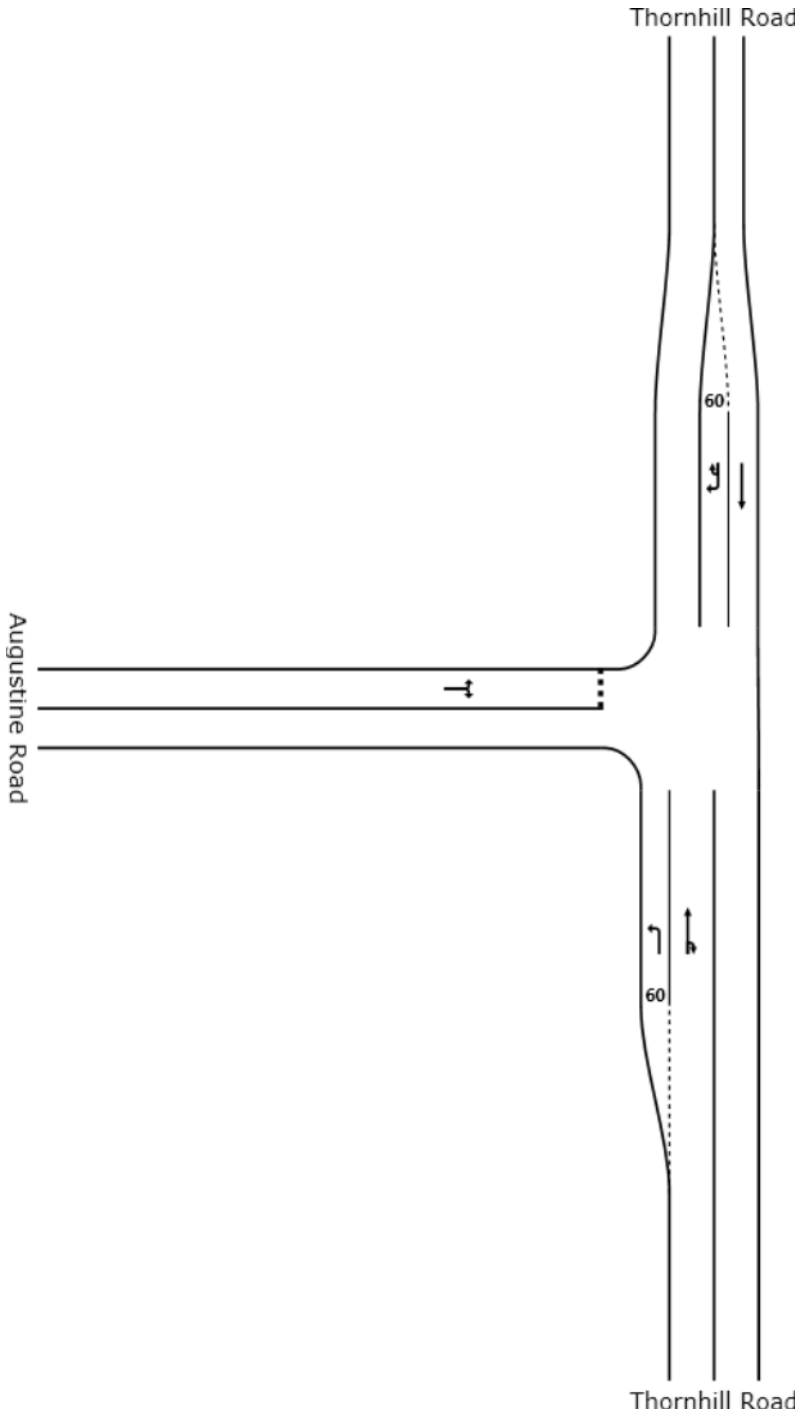
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Thornhill Road											
1	L2	5	0.0	0.003	8.2	LOS A	0.0	0.0	0.00	0.67	48.9
2	T1	504	3.3	0.247	24.3	LOS A	8.4	60.3	1.00	0.00	34.1
3u	U	1	0.0	0.247	24.3	LOS A	8.4	60.3	1.00	0.00	34.1
Approach		511	3.3	0.247	24.2	NA	8.4	60.3	0.99	0.01	34.2
North: Thornhill Road											
8	T1	754	1.8	0.391	0.1	LOS A	0.0	0.0	0.00	0.00	59.9
9	R2	6	0.0	0.075	28.5	LOS A	0.3	1.9	0.56	0.91	41.8
9u	U	33	0.0	0.075	28.5	LOS A	0.3	1.9	0.56	0.91	41.8
Approach		793	1.7	0.391	1.5	NA	0.3	1.9	0.03	0.04	58.9
West: Augustine Road											
10	L2	13	0.0	0.067	12.9	LOS A	0.2	1.5	0.71	0.74	18.8
12	R2	6	0.0	0.067	12.9	LOS A	0.2	1.5	0.71	0.74	18.8
Approach		19	0.0	0.067	12.9	LOS A	0.2	1.5	0.71	0.74	18.8
All Vehicles		1322	2.3	0.391	10.4	LOS A	8.4	60.3	0.41	0.04	45.0

Level of Service (LOS) Method: Degree of Saturation (SIDRA METHOD).
Vehicle movement LOS values are based on degree of saturation per movement
Minor Road Approach LOS values are based on worst degree of saturation for any vehicle movement.
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.

SITE LAYOUT

Site: Thornhill Road/ Augustines Road - 2026 Post Development Year (PM Peak)

Thornhill Road/ Augustines Road
2026 Post Development Year
PM Peak



MOVEMENT SUMMARY

Site: Thornhill Road/ Augustines Road - 2026 Post Development Year (PM Peak)

Thornhill Road/ Augustines Road
2026 Post Development Year
PM Peak
Giveway / Yield (Two-Way)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Thornhill Road											
1	L2	22	0.0	0.012	8.2	LOS A	0.0	0.0	0.00	0.67	48.9
2	T1	495	1.8	0.238	7.9	LOS A	5.5	39.3	0.89	0.00	44.6
3u	U	1	0.0	0.238	7.9	LOS A	5.5	39.3	0.89	0.00	44.6
Approach		518	1.7	0.238	7.9	NA	5.5	39.3	0.85	0.03	44.8
North: Thornhill Road											
8	T1	415	4.9	0.219	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R2	16	0.0	0.028	17.1	LOS A	0.1	0.7	0.52	0.77	45.8
9u	U	4	0.0	0.028	17.1	LOS A	0.1	0.7	0.52	0.77	45.8
Approach		435	4.6	0.219	0.8	NA	0.1	0.7	0.02	0.04	59.3
West: Augustine Road											
10	L2	21	0.0	0.122	9.9	LOS A	0.4	2.9	0.67	0.74	19.4
12	R2	25	0.0	0.122	9.9	LOS A	0.4	2.9	0.67	0.74	19.4
Approach		46	0.0	0.122	9.9	LOS A	0.4	2.9	0.67	0.74	19.4
All Vehicles		999	2.9	0.238	4.9	LOS A	5.5	39.3	0.48	0.07	47.2

Level of Service (LOS) Method: Degree of Saturation (SIDRA METHOD).
Vehicle movement LOS values are based on degree of saturation per movement
Minor Road Approach LOS values are based on worst degree of saturation for any vehicle movement.
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.