PLANNING AND ENVIRONMENT ACT 1987
WHITEHORSE PLANNING SCHEME

This plan is approved pursuant to Clause 43.04 Schedule 5 of the Whitehorse Planning Scheme. This document forms part of the Development Plan for Stage 3 of the site at 104 -168 Hawthorn Road, Forest Hill.

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Document: 2 of 2
Signed: Allison Egan
Date: 29/03/2018

Forest Ridge
Development Plan Assessment
Transport Impact Assessment

Client // E & P Comelli
Office // VIC
Reference // V103780
Date // 27/03/18

Forest Ridge

Development Plan Assessment

Transport Impact Assessment

Issue: C 27/03/18

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Quality Record

Issue	Date	Description	Prepared By	Checked By	Approved By	Signed
B	23/09/16	Final	Andrew Harmer	Hilary Papps	Chris Coath	
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1. Introduction

1.1 Development Proposal

The comprehensive redevelopment vision for the subject site is predominantly that of residential use, characterised by a broad and diverse choice of dwelling types and sizes.

For the purposes of evaluating the limitations and capacity of the existing local road network, an arbitrary maximum threshold of 800 new dwellings, or a population of approximately 1,600 to 1,800 persons has been adopted. It is noted that the eventual development yield is expected to be lower and will be subject to separate transport impact assessments when planning permits are being sought.

Primary access to the development is to be provided via a single access point to Hawthorn Road which will replace the two existing access points. The intersection is proposed to form a four-leg roundabout with Echunga Close.

It is also proposed to connect the development to the existing Forest Ridge – Stage 1 residential development on the corner of Hawthorn Road and Mahoneys Road, via a single connection to Magnolia Drive. Additionally, the recently approved access to Springvale Road (currently under construction) via the extension of the northbound service lane will provide a third access to the site.

The development proposal is shown in Figure 1.1.

Figure 1.1: Development Proposal

Source: SMEC

1.2 Subject Site

The subject site is located on the south side of Hawthorn Road in Forest Hill. The site has frontages of approximately 520 metres to Hawthorn Road and 90 metres to Springvale Road. Two existing access points are provided to the site from Hawthorn Road and are located approximately 80m and 200m west of Springvale Road. It is noted that the existing Forest Ridge – Stage 1 residential development to the west of the site (on the corner of Hawthorn Road / Mahoneys Road) has a road network that will permit the single proposed connection to the subject site.

Access to Springvale Road has recently been approved for the site via a subdivision application for 13 townhouses in the south east corner of the site. The Springvale Road northbound service lane is to be extended to provide access to the site with a new connection to Springvale Road (closing the existing median break) and modifications to the intersection of Springvale Road and Panorama Drive to improve safety.

The surrounding properties are predominantly residential with notable exceptions including the Burwood Heights Primary School and Forest Hill College to the west, St. Thomas Community Retirement Village and the Missionary Sisters of Service to the north and a medical centre to the immediate east.

The location of the subject site and the surrounding environs is shown in Figure 1.2, and the land zoning is shown in Figure 1.3.

Figure 1.2: Subject Site and its Environs

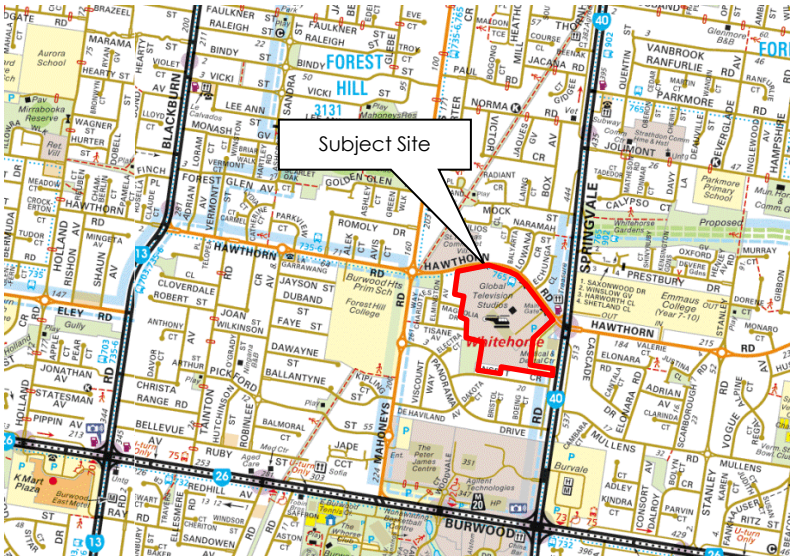

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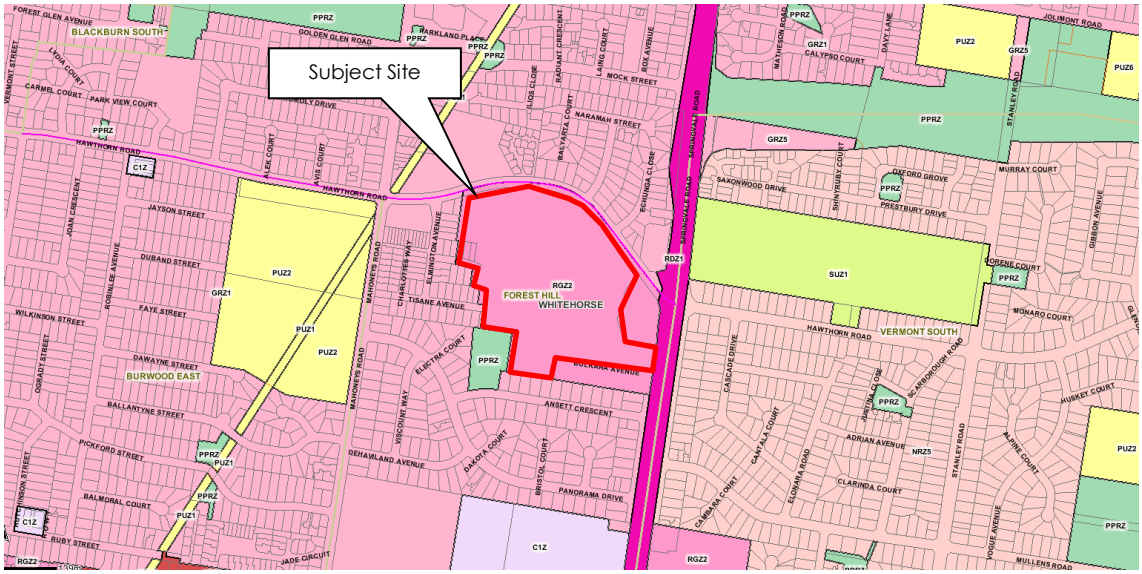
Figure 1.3: Land Zoning Map



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1.3 Purpose of this Report

The report sets out an assessment of the anticipated parking, traffic and transport implications of the proposed development, including consideration of the:

i the adequacy of the proposed internal road layout and hierarchy

ii the acceptability of the traffic impacts of the proposed development, including the need for mitigating road works and appropriate vehicular access.

2. Access Strategy

2.1 Previously Proposed Access Arrangements

The previously submitted Development Plan for the site included two site access points to Hawthorn Road. The eastern access was proposed in the same location as the existing eastern access to the Hawthorn Road and the western access ran directly north-south to the top end of the site. The submitted original application received several third party objections and concerns raised by Council or VicRoads, relating to the proposed access arrangements. The key points are included as follows:

- The western access was proposed opposite existing driveways on the northern side of Hawthorn Road, which would restrict the accessibility of these properties.
- The location of the western access was on a bend along Hawthorn Road and located nearby existing bus stops, which could cause additional traffic congestion.
- The proposed internal road layout may allow for "rat running" through the site.
- The queues back along Hawthorn Road from the intersection with Springvale Road could extend past the eastern access point.

2.2 Updated Proposed Access Arrangements

As previously noted, the updated Development Plan proposal includes a consolidated single access point from the subject site to Hawthorn Road. The access point is proposed to form a four-leg roundabout intersection with Echunga Close. With regard to the concerns outlined above, the updated arrangement is considered to address these matters as summarised below:

- The proposed location of the access point forming a roundabout with Echunga Close removes any impact on driveways on the opposite side of Hawthorn Road. Furthermore, combining with Echunga Close to create a four leg intersection is considered to be a more desirable outcome than separate T-intersections, as this allows for safer vehicle movements and generally better functionality.
- The new site access point is located in close proximity to the existing bus stops on Hawthorn Road. This promotes public transport usage by providing natural pedestrian connectivity between the bus stops and the site. The new site access point is not expected to impact the bus operation; however, minor amendments may be required during detailed design.
- The route through the site is considered to be circuitous and not likely to attract a significant amount of rat running. However, to discourage "rat running" through the site, local area traffic management (LATM) treatments could be included in selective locations through the site to reduce vehicle speeds and create a safer environment.
- The new location of the proposed site access is further west along Hawthorn Road than the previously proposed eastern access. Based on SIDRA Intersection assessment of the intersection of Springvale Road / Blackburn Road, there will be sufficient storage space between Springvale Road and the site access roundabout to store the queues back along Hawthorn Road. This is discussed in more detail in Section 5.

3. Performance Objectives

Under the VicRoads TIAR Guidelines, the proposed Development Plan is considered to be a 'Major Development'. Therefore, based on the guidelines, the transport performance objectives of the proposed development should ensure that:

- For new access arrangements, direct to a site - provision is made for all access arrangements to operate safely and efficiently into the future (at least 10 years after full development).
- For existing road infrastructure - any potential adverse effects from land use development proposals on road safety and operational efficiency are identified and, where necessary, developers provide mitigating road improvement works as part of the development costs to minimise these effects and retain, within practical limitations, the level of safety and operational efficiency that would have existed without the development.

A traffic distribution model has been developed for traffic generated by the proposed development. The model has considered how traffic may reach the arterial road network and has identified that there could be four (4) key intersections that are expected to experience an increase in movements. These intersections include:

- Hawthorn Road / Springvale Road (signalised)
- Hawthorn Road / Mahoneys Road (roundabout controlled)
- Hawthorn Road / Blackburn Road (signalised - pedestrian crossing)
- Mahoneys Road / Burwood Highway (unsignalised priority controlled).

Furthermore, it is noted that the recently approved access to Springvale Road via an extension to the northbound Springvale Road Service Road could also increase traffic movements at the following intersections:

- Springvale Road / Burvale Hotel (unsignalised priority controlled)
- Springvale Road / Panorama Road (unsignalised priority controlled).

The volume of additional traffic anticipated at these intersections and the intersection analysis is described in Section 5.

4. Existing Conditions

4.1 Existing Traffic Volumes

GTA Consultants undertook traffic movement counts at the intersections identified in Section 2 of this report on 26th November 2013[1] during the following peak periods:

- 7:00am - 9:00am
- 3:00pm - 6:00pm.

SCATS data was also obtained from VicRoads for the signalised intersections of Springvale Road / Hawthorn Road, Springvale Road / Burwood Highway and Burwood Highway / Blackburn Road for the week of 11-17 November 2013 to ascertain whether the survey days were representative of a typical day and to gain further information relating to lane utilisation.

The AM and PM peak hour traffic volumes are shown in Appendix A.

4.2 Existing Operating Conditions

The operation of the key intersections in the vicinity of the subject site has been assessed using *SIDRA INTERSECTION 6.1*[2], a computer based modelling package which calculates intersection performance.

The commonly used measure of intersection performance is referred to as the *Degree of Saturation (DOS)*. The DOS represents the flow-to-capacity ratio for the most critical movement on each leg of the intersection. For signalised intersections, a DOS of around 0.95 has been typically considered the 'ideal' limit, beyond which queues and delays increase disproportionately[3]. For unsignalised intersections, a DOS of around 0.9 has been typically considered the 'ideal' limit.

Table 4.1 presents a summary of the existing operation of the intersection, with full results presented in Appendix B of this report.

[1] Due to an error in the data, the surveys for Springvale Road / Burvale Hotel / Hewlett Packard were repeated on 27th November 2013.

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

[3] 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 4.1: Existing Operating Conditions in Peak Periods

Intersection	Approach	AM Peak			PM Peak		
		DOS	Average Delay (s)	95th Percentile Queue (m)	DOS	Average Delay (s)	95th Percentile Queue (m)
Hawthorn Rd & Springvale Rd (signalised)	South	0.81	28	189	0.87	25	345
	East	0.72	50	132	0.62	58	58
	North	# 0.83	27	271	# 0.90	35	282
	West	0.46	27	68	0.69	49	[1] 118
Hawthorn Rd & Mahoneys Rd (unsignalised)	South	0.21	9	9	0.18	8	7
	East	# 0.36	8	17	0.24	8	10
	North	0.33	7	15	# 0.29	8	13
	West	0.20	7	8	0.29	7	13
Hawthorn Rd & Blackburn Rd (unsignalised)	South	0.48	4	14	# 0.49	3	16
	East	#0.61	33	25	0.21	43	8
	North	0.37	0	0	0.30	1	0
Mahoneys Rd & Burwood Hwy (unsignalised)	North	# 0.76	30	36	# 0.62	33	18
	West	0.30	1	0	0.40	0	0

DOS – Degree of Saturation, # - Intersection DOS,
[1] It is noted that queues on the western approach of Hawthorn Road form in two lanes in the PM peak period, due to the wide lane.

Table 4.1 indicates that the majority of intersections currently operate well with minimal queues and delays on all approaches.

It is noted that modelling the Blackburn Road / Hawthorn Road intersection as an unsignalised intersection did not accurately represent the operation and suggesting a Degree of Saturation (DOS) of 0.86. In contrast, on site observations identified that:

- left-turn movements at the intersection of Blackburn Road / Hawthorn Road are high in the AM peak period however did not have to wait too long at the stop line.
- the intersection operated satisfactorily as drivers were observed to drive aggressively and accept smaller gaps.
- the pedestrian crossing to the north of the site provides a longer period of time for turning movements when they are not opposed therefore providing additional capacity.

In this regard, the analysis presented above of the Hawthorn Road / Blackburn Road intersection has been calibrated to account for the following:

- Additional capacity gained from left turn out and right turn in turning vehicles operating in the shadow of the Blackburn Road signalised pedestrian crossing, noting that the pedestrian crossing operated 10 times in the AM peak period on the survey day and 18 times in the PM peak and typically operates for a period of 30 seconds.
- Right turn out traffic from Hawthorn Road also benefits when the pedestrian crossing is activated as two vehicles can typically store in the central median before merging with northbound traffic.

Details of the calibration methods used are included in Appendix B.

5. Traffic Impact

5.1 Traffic Generation

Traffic generation estimates for the proposed development have been sourced from the RTA Guide to Traffic Generating Developments (2002) which indicates that dwellings contained within medium density residential developments can generate in the order of:

- 0.5 – 0.65 vehicle trips per dwelling in the peak periods for large units and townhouses (three or more bedrooms)
- 0.4 – 0.5 vehicle trips per dwelling in the peak periods for smaller units (up to two bedrooms)
- 5 – 6.5 vehicle trips per dwelling per day.

Although the proposed mix of dwelling sizes is currently unknown, it is expected that it will consist of a mixture of 1, 2 and 3 bedroom units. In this regard, it is considered that applying a general traffic generation rate of 0.6 movements per dwelling in the peak periods and 6 movements per dwelling per day provides a conservative assessment (on the high side) and reflects that car ownership within the development is likely to be high given that there is no convenient access to the rail networks.

On this basis, the theoretical 800 dwelling development could be expected to generate up to 480 and 4,800 vehicle movements in any peak hour and daily period respectively. Traffic estimates and the directional splits are set out in Table 5.1.

Table 5.1: Traffic Generation Estimates

Period	Traffic Generation Rate (Movements/Dwelling)	Traffic Generation Rate (Movements/Dwelling)		Vehicle Movements	
		In	Out	In	Out
AM Peak	480 mvmts / hr	20%	80%	96/hr	384/hr
PM Peak	480 mvmts / hr	60%	40%	288/hr	192/hr
Daily	4,800 mvmts / day	50%	50%	2,400/day	2,400/day

5.2 Traffic Distribution and Assignment

The directional distribution and assignment of traffic generated by the proposed development will be influenced by a number of factors, including the:

i configuration of the arterial road network in the immediate vicinity of the site
ii existing operation of intersections providing access between the local and arterial road network
iii surrounding employment centres, retail centres and schools in relation to the site
iv configuration of access points to the site.

More specifically the distribution of traffic for this site has considered the previous analysis undertaken by GTA Consultants for the residential development on the corner of Hawthorn Road / Mahoneys Road which assumed the following directional distribution on the basis of ABS data for employment locations:

- 15% to / from North
- 10% to/ from East
- 20% to/ from South
- 55% to / from West.

Further consideration has been given to the proximity of the site to the signalised intersection at Hawthorn Road / Springvale Road.

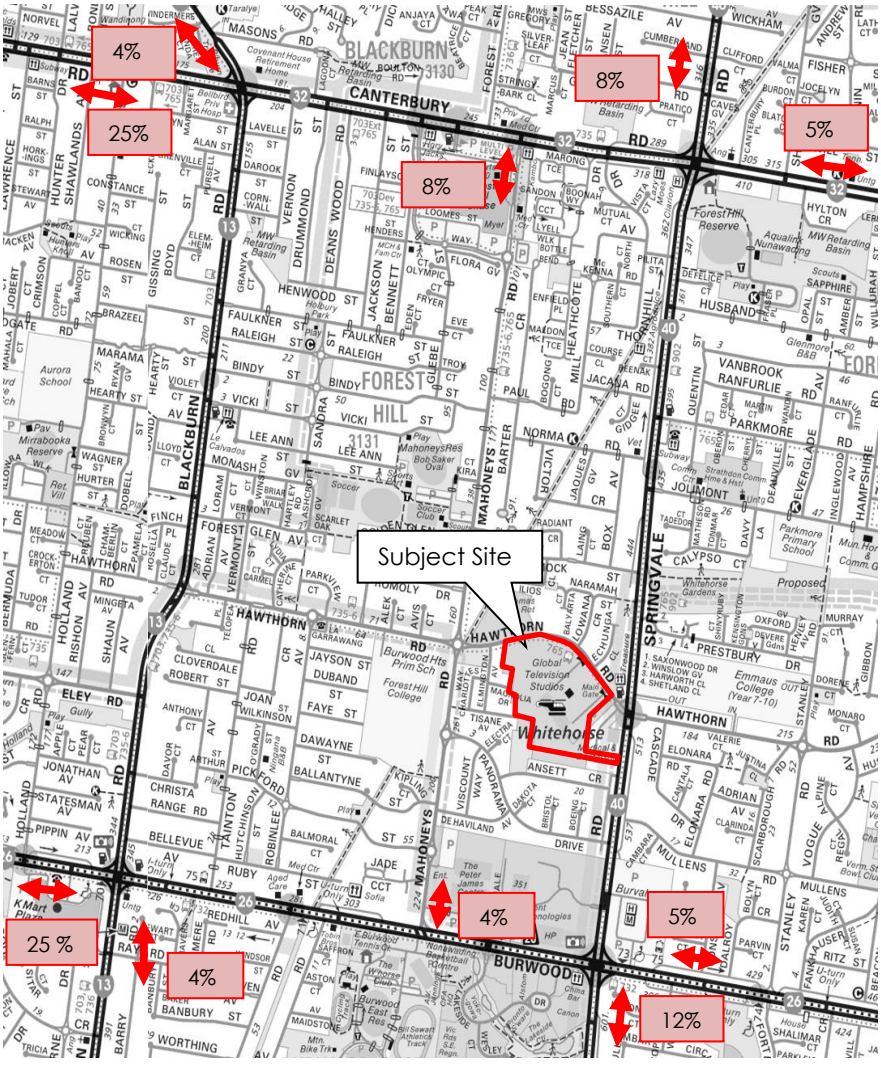
Having consideration to the above, for the purposes of estimating vehicle movements, the directional distributions assumed are as follows:

- 20% to / from North
- 10% to/ from East
- 20% to/ from South
- 50% to / from West.

In addition to the above general distributions, traffic has been distributed to the four key intersections which currently exist in the vicinity of the subject site.

In this regard, the general distribution of site generated traffic at the nearby intersections is shown in Figure 5.1.

Figure 5.1: Traffic Distribution



Based on the above, figures have been prepared to show the estimated increase in turning movements in the vicinity of the subject site following full site development in the AM and PM peak hours.

These figures are shown in Appendix C.

5.3 Post Development Traffic Volumes

By adding the development traffic to the existing traffic flows we can obtain the 'Design' or Post-Development traffic volumes. These figures are shown in Appendix D. It is noted that the post development scenario includes the proposed roundabout intersection of the site access / Hawthorn Road / Echunga Close. As no traffic surveys have been completed at Echunga Close, a conservative traffic generation rate of 1 movement per dwelling has been assumed for the 17 dwellings located on Echunga Close. This equates to a total of 17 vehicle movements in any peak hour which has been incorporated into the anticipated traffic volume summary.

5.4 Post Development Intersection Operation

The impact of the development traffic upon intersections in the vicinity of the site was assessed using SIDRA INTERSECTION. On the basis of the turning movement estimates presented above, Table 5.2 presents a summary of the anticipated future operation of the nominated intersections following the full development of the site. Detailed results of this analysis are provided in Appendix E of this report.

Table 5.2: Post-Development Intersection Operation

Intersection	Approach	AM Peak			PM Peak		
		DOS	Average Delay (s)	95th Percentile Queue (m)	DOS	Average Delay (s)	95th Percentile Queue (m)
Hawthorn Rd & Springvale Rd (signalised)	South	0.79 (0.81)	32 (28)	222 (189)	# 1.0 (0.87)	77 (25)	621 (345)
	East	0.72 (0.2)	44 (50)	132 (132)	0.93 (0.62)	62 (58)	58 (58)
	North	**1.0 (0.82)**	**84 (27)**	**499 (271)**	0.93 (0.90)	25 (35)	219 (282)
	West	0.98 (0.46)	52 (27)	127 (68)	0.82 (0.69)	57 (49)	144 (118) [1]
Hawthorn Rd & Mahoneys Rd (unsignalised)	South	0.25 (0.21)	10 (9)	12 (9)	0.20 (0.18)	9 (8)	8 (7)
	East	#0.51 (0.36)	9 (8)	28 (17)	0.31 (0.24)	8 (8)	14 (10)
	North	0.35 (0.33)	8 (7)	16 (15)	0.34 (0.29)	8 (8)	16 (13)
	West	0.23 (0.20)	7 (7)	10 (8)	#0.37 (0.29)	8 (7)	18 (13)
Hawthorn Rd & Blackburn Rd (unsignalised)	South	0.55 (0.48)	4 (4)	17(14)	#0.61 (0.49)	3 (3)	23 (16)
	East	#0.83 (0.61)	38 (33)	48 (25)	0.29 (0.21)	46 (43)	15 (9)
	North	0.37 (0.37)	0 (0)	0 (0)	0.30 (0.30)	1 (1)	0 (0)
Mahoneys Rd & Burwood Hwy (unsignalised) [2]	North	#0.87 (0.76)	43 (30)	53 (36)	#0.75 (0.62)	43 (33)	24 (18)
	West	0.31 (0.30)	1 (1)	0 (0)	0.42 (0.40)	1 (0)	0 (0)

DOS – Degree of Saturation, # - Intersection DOS, (X) – Existing Sidra Results, **BOLD –** denotes intersection exceeds theoretical practical capacity limits

[1] It is noted that queues on the western approach of Hawthorn Road form in two lanes in the PM peak period, due to the wide lane.

[2] This intersection has been modelled as two through lanes instead of three with volumes reduced by 1/3 to overcome the inadequacies of SIDRA when modelling left turn movements against three through lanes.

Note: These models are based on an existing conditions model which has broadly been calibrated to reflect queues and delays observed onsite.

As described earlier, a DOS of around 0.95 for signalised intersections and 0.90 for unsignalised intersections has traditionally been considered the practical limit beyond which intersection performance is unsatisfactory, as beyond this value queues and delays increase disproportionately. On this criterion, the calculated DOS for the intersections suggest that three of

the intersections analysed are likely to operate satisfactorily following full development of the site, whilst one will exceed their practical capacity limits.

In this regard, the following comments are made regarding the anticipated operation of the Hawthorn Road / Springvale Road intersection:

- In the AM peak period, the Hawthorn Road north approach is expected to experience a minor increase with respect to delays however can be expected to experience substantial increases to queuing due to substantial increases in traffic demands.
- Consideration of mitigation measures will be required in order to resolve the operation of this intersection.

5.5 Mitigating Measures and Intersection Works

In order for the key intersections surrounding the site to operate safely and efficiently, consideration should be made to the following mitigation measures at the intersection of Hawthorn Road / Springvale Road:

- Increasing the queue length available for the right turn lane on Hawthorn Road (west approach), near Springvale Road. As there are existing 'No Stopping' restrictions for approximately 120m on both the north and south side of Hawthorn Road (to the west of the intersection with Springvale Road) the right turn lane could be increased from 30m to 90m by modifying the existing line marking to more efficiently utilise the existing road width.

Table 5.3 summarises the anticipated post development operation of the existing intersection layout and the operation with the proposed mitigated layout.

Table 5.3: Post-Development Intersection Operation of Hawthorn Road Access Points

Intersection	Approach	AM Peak Existing Layout			AM Peak Mitigated Layout		
		DOS	Average Delay (s)	95th Percentile Queue (m)	DOS	Average Delay (s)	95th Percentile Queue (m)
Hawthorn Rd & Springvale Rd (signalised)	South	0.81	28	189	0.84	32	229
	East	0.72	50	132	0.86	56	164
	North	# 0.83	27	271	# 0.89	47	384
	West	0.46	27	68	0.89	42	109

Of particular note is that there is sufficient storage between Springvale Road and the proposed site access roundabout to store the 95th percentile queues on the western approach to the Springvale Road intersection.

5.6 Hawthorn Road Site Access Point

The impact of the development traffic upon the proposed roundabout of the site access / Hawthorn Road / Echunga Close was assessed using *SIDRA INTERSECTION*. On the basis of the turning movement outlined in Appendix D, Table 5.4 presents a summary of the anticipated future operation of the proposed intersection after the full development of the site. Detailed results of this analysis are provided in Appendix F of this report.

Table 5.4: Post-Development Intersection Operation of Hawthorn Road Access Point Roundabout

Approach	AM Peak			PM Peak		
	DOS	Average Delay (sec)	95th Percentile Queue (m)	DOS	Average Delay (sec)	95th Percentile Queue (m)
Site Access (South)	# 0.43	9 sec	20 m	0.20	8 sec	8 m
Hawthorn Road (East)	0.37	4 sec	19 m	0.41	5 sec	21 m
Echunga Close (North)	0.02	8 sec	1 m	0.01	9 sec	1 m
Hawthorn Road (West)	0.37	5 sec	18 m	# 0.51	5 sec	31 m

DOS – Degree of Saturation, # - Intersection DOS

Table 5.4 indicates that the proposed roundabout at the intersection of the site access / Hawthorn Road / Echunga Close is anticipated to operate well with minimal queues and delays on all approaches. In particular, it is noted that queuing on the south approach is less than the 50m of storage available and will not impact on the internal T-intersection. Furthermore, queuing on the east approach in the PM peak is only 21m and therefore will not impact on the operation of the Springvale Road / Hawthorn Road signalised intersection.

A concept design of the proposed roundabout is included in Appendix G. The current concept design includes Council's preference for the bike lanes to continue through the roundabout. A swept path assessment was conducted on the intersection which demonstrated that 9.8m service vehicles and buses encroach into the bike lane when traversing the roundabout. However, given the volumes of service vehicles and buses will be low, and there are no sight distance issues, it is considered acceptable for bikes lanes to continue through the intersection.

The existing speed cushions and a kerb outstand on Hawthorn Road, west of Echunga Close will need to be removed[4] in order to convert the intersection into a roundabout. The specifics relating to the intersection configuration will be confirmed during the detailed design phase.

5.7 Springvale Road Access Point

5.7.1 Overview

As mentioned in Section 1 of this report, an access to Springvale Road (via the service road) has recently been approved. The approved access involves the following:

- extending the existing Springvale Road (northbound only) Service Road to the site
- creating a new egress to Springvale Road, opposite the site and reinstating the existing service road egress with kerb and channel as part of the proposed development
- Creating a new service road ingress within the outer separator, to the north of Panorama Drive, to improve access and reduce conflict
- closing the existing service road ingress at Panorama Drive and reinstating the area with kerb and channel.

The approved amendments to Springvale Road are shown in Figure 5.2 and Figure 5.3, noting that it is understood that there are currently ongoing discussions with Council for a revised service lane ingress layout at Panorama Drive.

[4] Given the role of the roundabout in slowing vehicle speed, the relocation of the speed cushion is not considered necessary.

Figure 5.2: Springvale Road Service Road Ingress Arrangements

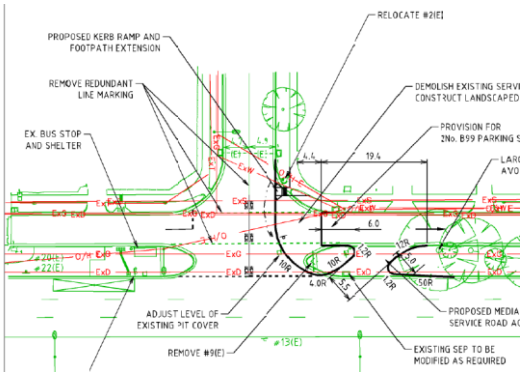
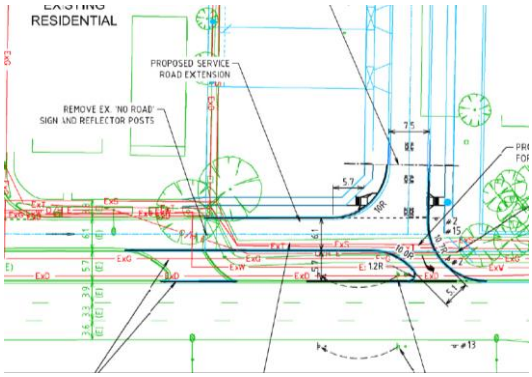


Figure 5.3: Springvale Road Service Road Egress Arrangements



Service Road Egress

The Springvale Road access point has currently been approved to provide connectivity to 13 townhouse dwellings. However, the subject site will ultimately have access through this point and an assessment must be completed to confirm it will operate satisfactorily following development of the site.

In this regard, reference is made to the anticipated post development traffic volumes included in Appendix D. The subject site is expected to generate 48 and 24 additional egress vehicle movements in the AM and PM peak hours respectively. When added to the existing traffic volumes, this equates to 54 and 28 total egress movements from the service road in the AM and PM peak hours respectively, following full development of the site.

The adequacy of traditional modelling techniques (i.e. SIDRA INTERSECTION) for assessing the operation of the intersection of Springvale Road/Springvale Service Road (exit) is limited as the associated computer program does not account for heavy platooning, queues and gaps created along Springvale Road by the nearby Burwood Highway intersection to south of the site.

In order to determine the traffic absorption capacity of Springvale Road/Springvale Service Road (exit) intersection, and in particular the left turn from Springvale Service Road Street into Springvale Road, GTA Consultants conducted peak period gap analysis surveys of the existing conditions at this location on Tuesday 26 November 2013 between 8:00am-9:00am and 5:00pm-6:00pm.

These surveys recorded the frequency and duration of gaps in the traffic stream along Springvale Road during both free flow and queued conditions to identify the total number of vehicles that could undertake this movement based on existing 'actual' opportunities.

The results of the gap acceptance surveys are summarised in Table 5.5.

Table 5.5: Gap Survey Results

Period	Movement	Available Capacity
AM Peak	Left Turn Out [1]	289 vehicles
PM Peak	Left Turn Out [1]	213 vehicles

[1] Critical Gap = 5 sec, Follow-up Headway = 3 sec

Table 5.5 identifies that there is capacity for 289 and 213 vehicles to exit the Service Road in the AM and PM peak hours respectively. In this regard, the additional traffic generated by the proposed development could not be expected to compromise the safety or function of the surrounding road network.

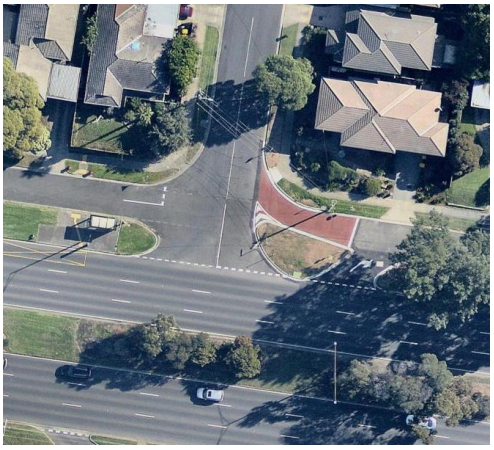
Service Road Ingress

A new service road access, as shown in Figure 5.2, is proposed to be created within the outer separator, to the north of Panorama Drive, in order to improve access and reduce conflict between vehicles. As part of these works, the existing service road access from Panorama Drive was proposed to be closed and reinstated with kerb and channel. It is understood that Council has since requested that left turn movements from Panorama Drive into the service road is permitted, however, left turn movements from Springvale Road will be required to travel past Panorama Drive and enter the service road via the new access, as per Figure 5.4.

The proposed works will provide direct access to the service road from Springvale Road and on this basis, it is not considered necessary to analyse the service road entry.

Notwithstanding, in addition to the service road ingress, consideration must be made to the ability for southbound traffic on Springvale Road to undertake a U-turn adjacent to the Burvale Hotel to travel north towards the site to enter the service road.

Figure 5.4: Current Springvale Road Service Road Ingress Arrangements



Springvale Road / Burvale Hotel / Hewlett Packard

The intersection of Springvale Road / Burvale Hotel / Hewlett Packard is a complex X-intersection with staged movements occurring for right turns. SIDRA has limitations when it comes to analysing x-intersections with staged movements, in addition to left turns against three through traffic lanes.

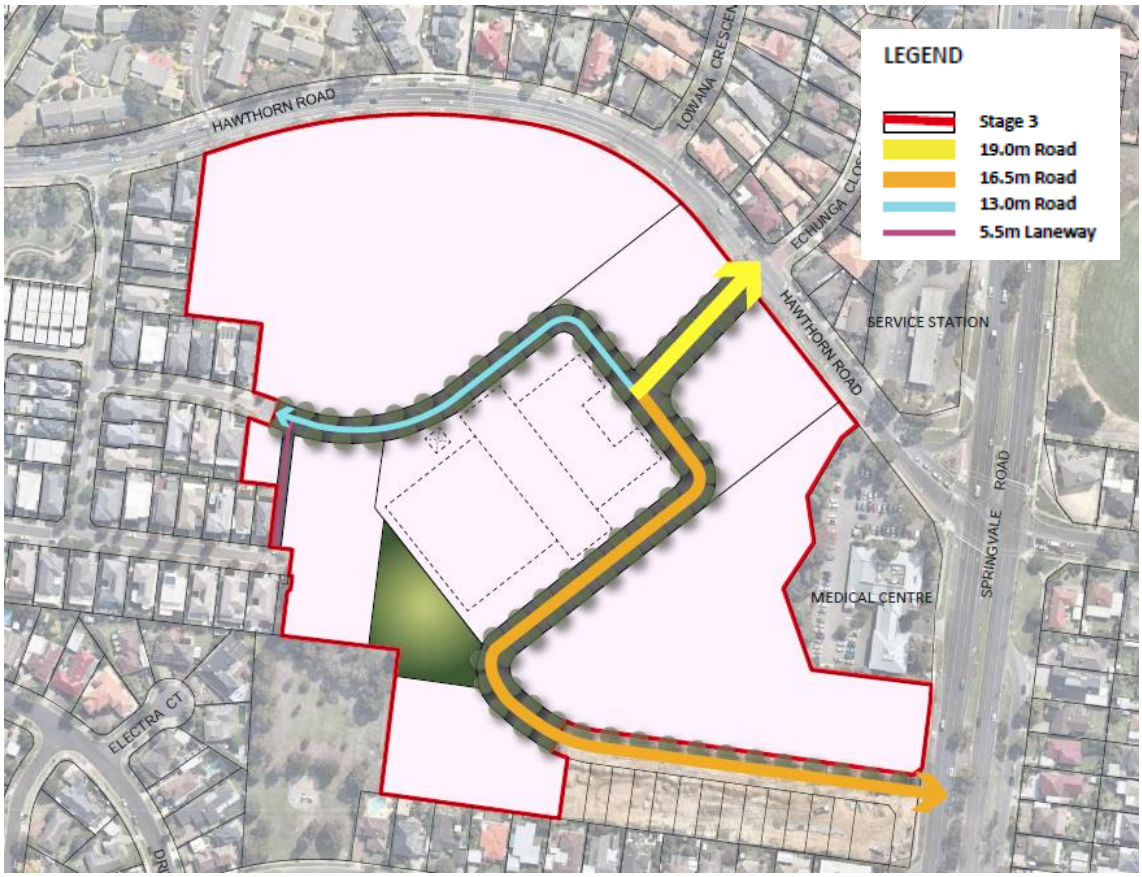
The Post Development traffic volumes indicated that 10 vehicles and 21 vehicles are anticipated to undertake a U-turn at this location in the AM and PM peak hours respectively. Given the relatively low volumes undertaking the U-turn (1 vehicle every 2.5 minutes approx.), the proximity of the U-turn slot to the signalised intersection of Springvale Road / Burwood Highway and the potential for platooning in traffic, it is considered that this movement should be able to operate satisfactorily in the AM and PM peak periods.

5.8 Internal Road Hierarchy

5.8.1 Proposed Layout and Cross Sections

The proposed internal road network and road hierarchy are shown in Figure 5.5, noting that the layout of the lower order internal local access roads has not yet been determined and subject to approval in future development applications.

Figure 5.5: Proposed Internal Road Hierarchy

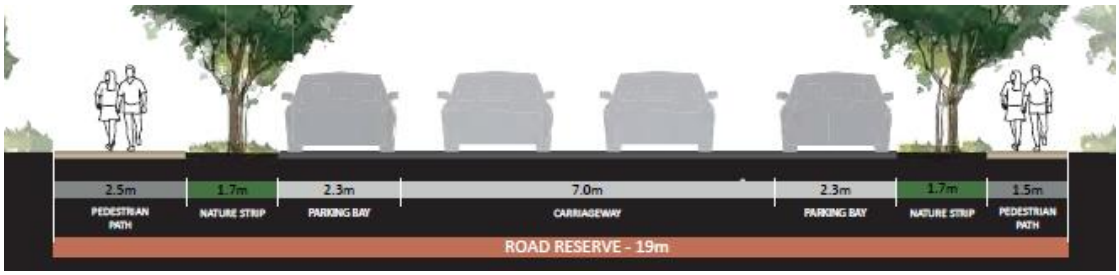


Source: SMEC

[1] The layout of the majority of the internal local access roads has not yet been determined.

The proposed road network has four hierarchy levels of roads with varying cross sections, which are shown in Figure 5.6 to Figure 5.9. Their compliance with the carriageway and pedestrian/bicycle path cross section requirements defined within Clause 56.06 of the Whitehorse Planning Scheme is discussed below.

Figure 5.6: 19m Road Reserve



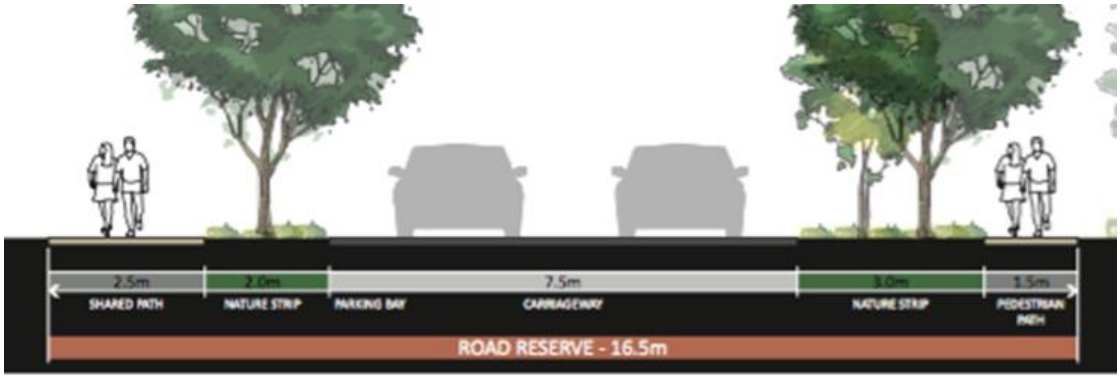
Source: SMEC

The 19m road reserve is generally consistent with the Whitehorse Planning Scheme classification of a Connector Street Level 2. The 19m road reserve:

- meets the planning scheme requirements for carriageway and parking lane widths
- provides a dedicated parking lane on both sides of the carriageway
- provides a verge width of 6.5m on one side and 5.5m on the other side (includes footpaths)

- provides 2.5m path on one side and a 1.5m pedestrian path on the other side, noting that the 2.5m path is sufficient to function as a shared path for pedestrians and cyclists.

Figure 5.7: 16.5m Road Reserve

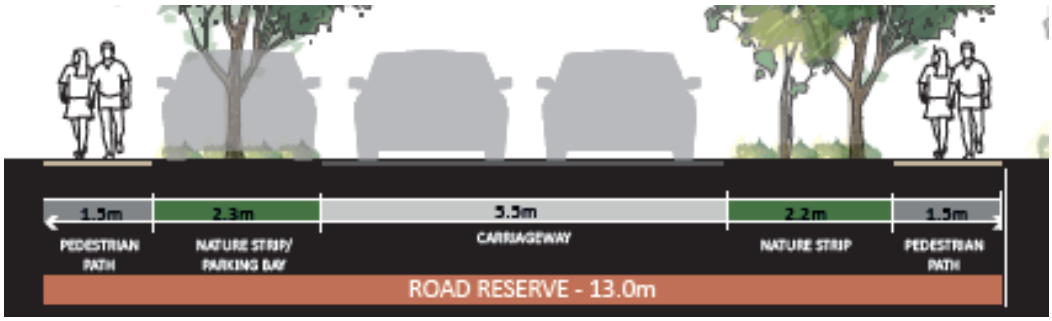


Source: SMEC

The 16.5m road reserve is generally consistent with the Whitehorse Planning Scheme classification of an Access Street Level 2. The 16.5m road reserve:

- meets the planning scheme requirements for carriageway width, noting that on-street parking can occur on both sides of the road within the 7.5m wide carriageway
- provides a minimum verge width of 4.5m on each side (includes footpaths)
- provides 1.5m footpaths on one side and a 2.5m shared path on the other side

Figure 5.8: 13m Road Reserve



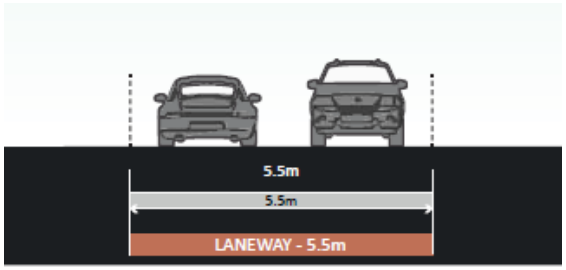
Source: SMEC

The 13m road reserve cross section is generally consistent with the Whitehorse Planning Scheme classification of an Access Street Level 1. The 13m road reserve:

- meets the planning scheme requirements for a 5.5m wide carriageway with 2.3m wide hardstand verge parking
- provides a 1.5m footpath on both sides
- provides a minimum 3.7m wide verge on both sides of the road (includes footpaths).

It is noted that the 13m cross section may need to be re-assessed during more detailed planning stages should it become apparent that traffic volumes on this road will likely to exceed the volume thresholds discussed later in this section. This may require upgrading to a 16.5m cross section. This will be dependent upon the internal housing densities and distributions.

Figure 5.9: 5.5m Laneway



Source: SMEC

The 5.5m laneway cross section is generally consistent with the Whitehorse Planning Scheme classification of an Access Lane. The 5.5m cross section:

- meets the planning scheme requirements for a 5.5m wide carriageway with no on-street parking provided
- is not required to provide footpaths or verge on either side.

The suitability of these road cross sections to accommodate the anticipated daily traffic volumes is assessed in Table 5.6.

Table 5.6: Road Capacity

Road	Street Level	Cross Section	Traffic Capacity [1]	Anticipated Daily Traffic Volume [2]
Access to Hawthorn Road	Connector Street Level 2	19m	3,000 – 7,000vpd	4,200vpd
East-West Road (east of main access)	Access Street Level 2	16.5m	2,000 – 3,000vpd	2,500vpd
East-West Road (west of main access) and Internal Access Roads	Access Street Level 1	13m	1,000 – 2,000vpd	Less than 2,000vpd [3]
Laneway	Access Laneway	5.5m	300vpd	Less than 300vpd [4]

[1] Indicative Maximum Daily Traffic Volume as defined in Whitehorse Planning Scheme Clause 56.06.
[2] Assuming a peak to daily traffic generation ratio of 10%
[3] The internal minor roads layout has not yet been determined, however vehicles movements will only be a portion of the volume along the internal east-west road.
[4] Based on the length of the laneway and no through route option, it is assumed it will carry minimal traffic volumes.

Table 5.6 indicates that the proposed cross sections have sufficient capacity to accommodate the anticipated traffic demands.

5.8.2 Swept Path Assessments

The internal road network has been designed to accommodate 9.8m service vehicles. A swept path assessment has been completed on key elements of the road network to validate the design, and to determine locations that require permanent parking restrictions.

The locations requiring permanent No Stopping restrictions based on the findings of the swept path assessments include:

- Intersection of Tisane Avenue and 'Proposed Laneway'
- Intersection of Magnolia Drive and 'Proposed Laneway'
- Intersection of Magnolia Drive, Bulkara Avenue and Hawthorn Link Drive
- The bend in the south-western corner of Bulkara Avenue.

The results of the swept path assessments can be found in Appendix G.

6. Other Considerations

6.1 Car Parking

It is expected that the provision of off-street car parking would be dealt with under existing statutory planning mechanisms, including Clause 52.06 of the Whitehorse Planning Scheme and associated decision guidelines. As such, matters relating to car parking for development sites would be considered on a case by case basis, at the time of planning permit applications for land use development.

6.2 Bicycle Parking

Similar to car parking matters, provision of bicycle parking for both residents and visitors will be subject to the requirements of Clause 52.34 of the Whitehorse Planning Scheme, which will be assessed on a case by case basis with each development application within the site.

6.3 Loading Facilities

The provision of loading facilities will be subject to the requirements of Clause 52.07 of the Whitehorse Planning Scheme, which will be assessed on a case by case basis with each development application within the site.

Waste collection arrangements would also be dealt with on a case-by-case basis at the time of planning permit applications.

7. Conclusion

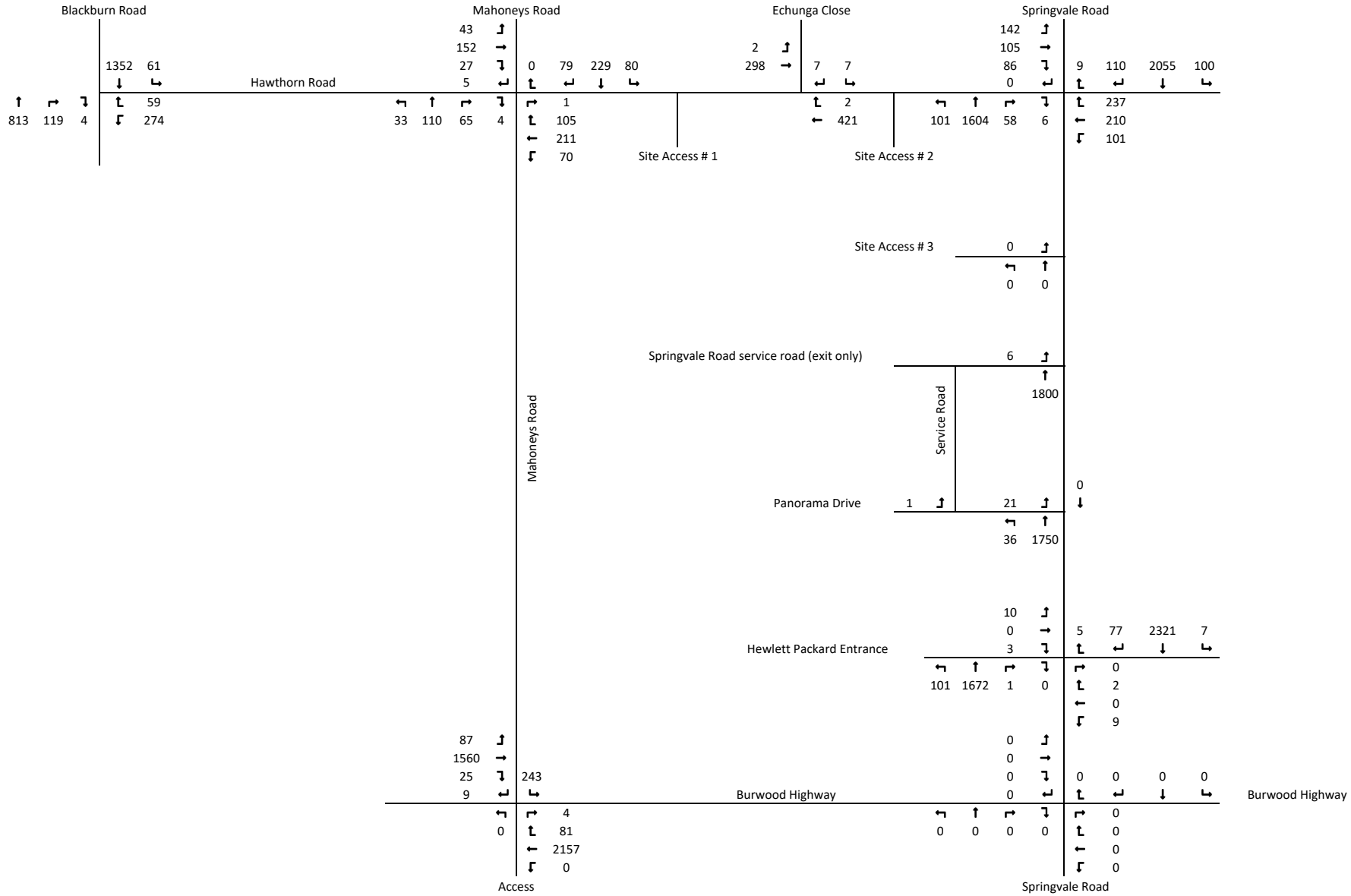
On the basis of the analysis presented in this Development Plan Assessment the following is summarised:

- Site access points have sufficient capacity to accommodate the traffic generated by the development of up to 800 dwellings.
- The proposed cross sections have sufficient capacity to accommodate the traffic generated by the subdivision.
- There are capacity constraints at the intersections of Hawthorn Road / Springvale Road that are likely to require mitigation measures as discussed in the body of this report.

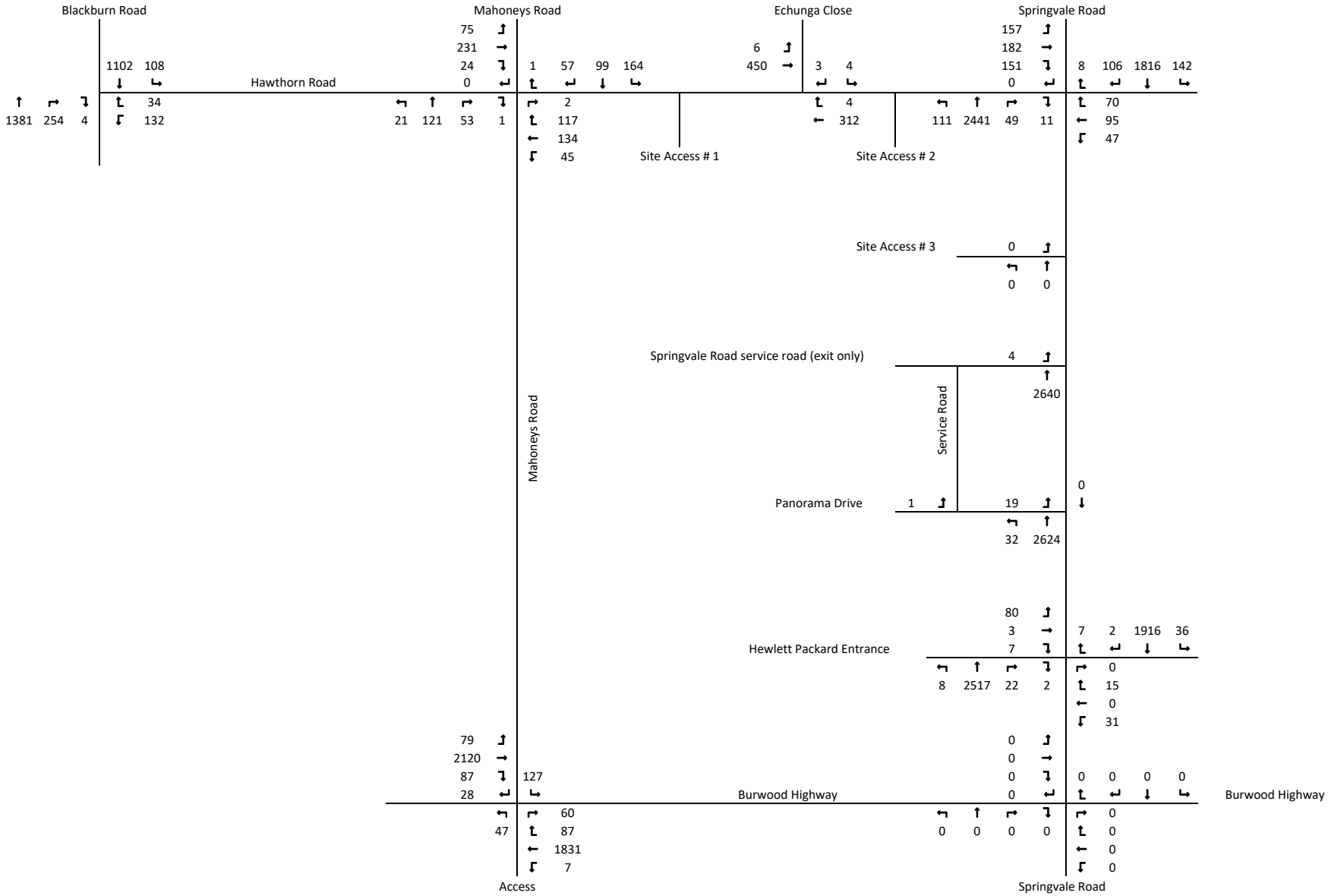
Appendix A

Existing Conditions Traffic Volumes

Existing AM Peak



Existing PM Peak

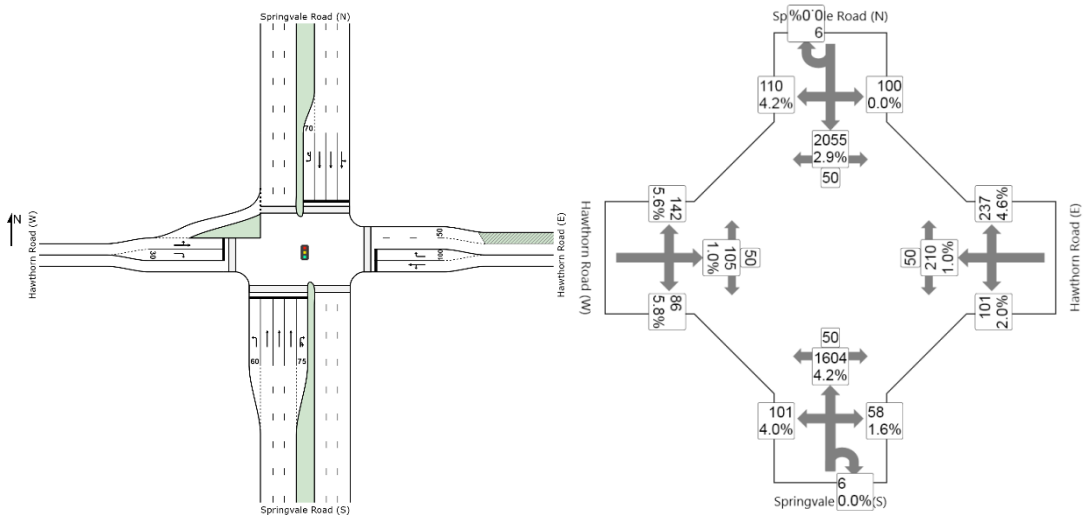


Appendix B

SIDRA Analysis: Existing Operating Conditions

Hawthorn Road/ Springvale Rd

AM Peak



PHASING SUMMARY

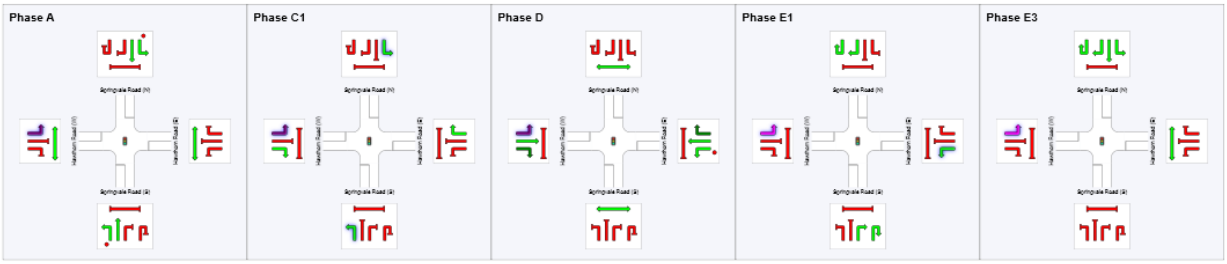
Site: Hawthorn Road / Springvale Road - Existing AM

Hawthorn Road / Springvale Road
Signals - Fixed Time Coordinated Cycle Time = 130 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Phase times determined by the program
Sequence: Two-Phase
Movement Class: All Movement Classes
Input Sequence: A, C1, C2, C3, D, E1, E2, E3
Output Sequence: A, C1, D, E1, E3

Phase Timing Results

Phase	A	C1	D	E1	E3
Reference Phase	Yes	No	No	No	No
Phase Change Time (sec)	0	63	75	111	123
Green Time (sec)	57	6	30	6	1
Yellow Time (sec)	4	4	4	4	4
All-Red Time (sec)	2	2	2	2	2
Phase Time (sec)	63	12	36	12	7
Phase Split	48 %	9 %	28 %	9 %	5 %



LANE SUMMARY

Site: Hawthorn Road / Springvale Road - Existing AM

Hawthorn Road / Springvale Road
Signals - Fixed Time Coordinated Cycle Time = 130 seconds (Practical Cycle Time)Variable Sequence Analysis applied. The results are given for the selected output sequence.

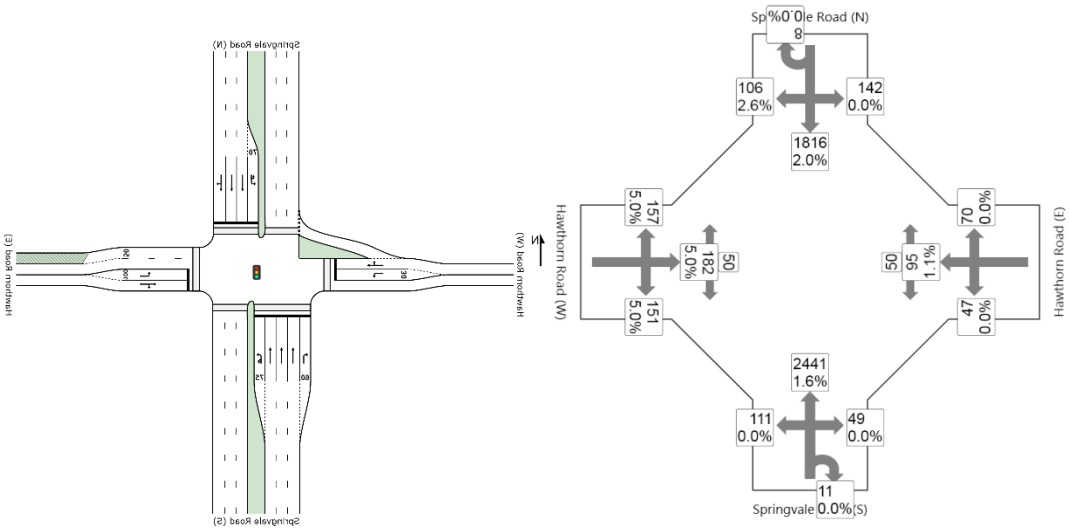
Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV						Veh	Dist				
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Springvale Road (S)													
Lane 1	106	4.0	875	0.121	100	18.4	LOS B	2.3	16.8	Short	60	0.0	NA
Lane 2	553	4.2	782[1]	0.706	100	26.0	LOS C	23.2	168.5	Full	500	0.0	0.0
Lane 3	588	4.2	832	0.706	100	26.9	LOS C	26.1	189.3	Full	500	0.0	0.0
Lane 4	548	4.2	776[1]	0.706	100	26.0	LOS C	23.1	167.4	Full	500	0.0	0.0
Lane 5	67	1.4	82	0.818	100	80.2	LOS F	4.7	33.3	Short	75	0.0	NA
Approach	1862	4.1		0.818		27.8	LOS C	26.1	189.3				
East: Hawthorn Road (E)													
Lane 1	327	1.3	452	0.724	100	47.9	LOS D	18.6	131.6	Full	500	0.0	0.0
Lane 2	249	4.6	400	0.623	100	51.1	LOS D	12.6	92.1	Short	100	0.0	NA
Approach	577	2.7		0.724		49.3	LOS D	18.6	131.6				
North: Springvale Road (N)													
Lane 1	798	2.5	962	0.829	100	24.2	LOS C	37.9	270.7	Full	500	0.0	0.0
Lane 2	781	2.9	942	0.829	100	24.4	LOS C	37.6	270.0	Full	500	0.0	0.0
Lane 3	689	2.9	831[1]	0.829	100	23.8	LOS C	29.9	214.2	Full	500	0.0	0.0
Lane 4	125	3.9	176	0.710	100	70.4	LOS E	8.0	58.2	Short	70	0.0	NA
Approach	2394	2.8		0.829		26.6	LOS C	37.9	270.7				
West: Hawthorn Road (W)													
Lane 1	260	3.6	582[1]	0.446	100	20.7	LOS C	9.5	68.3	Full	500	0.0	0.0
Lane 2	91	5.8	195	0.463	100	45.4	LOS D	4.5	32.8	Short	30	0.0	NA
Approach	351	4.2		0.463		27.1	LOS C	9.5	68.3				
Intersection	5183	3.4		0.829		29.6	LOS C	37.9	270.7				

Level of Service (LOS) Method: Delay (HCM 2000).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

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

PM Peak



PHASING SUMMARY

Site: Hawthorn Road / Springvale Road - Existing PM

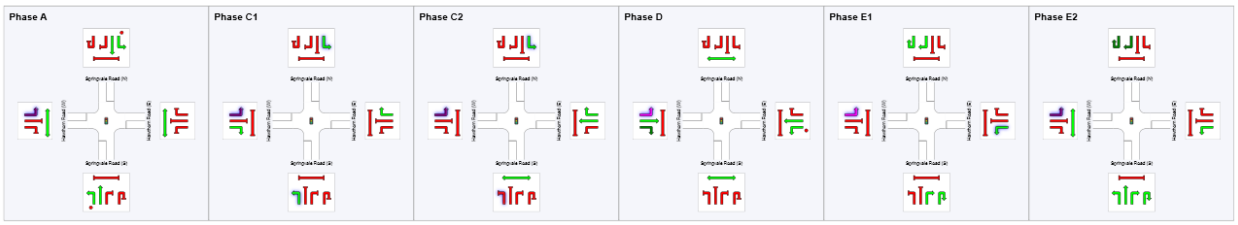
Hawthorn Road / Springvale Road
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Phase times determined by the program
Sequence: Two-Phase
Movement Class: All Movement Classes
Input Sequence: A, C1, C2, C3, D, E1, E2, E3
Output Sequence: A, C1, C2, D, E1, E2

Phase Timing Results

Phase	A	C1	C2	D	E1	E2
Reference Phase	Yes	No	No	No	No	No
Phase Change Time (sec)	0	68	80	83	116	128
Green Time (sec)	62	6	***	27	6	6
Yellow Time (sec)	4	4	4	4	4	4
All-Red Time (sec)	2	2	2	2	2	2
Phase Time (sec)	68	12	3	33	12	12
Phase Split	49 %	9 %	2 %	24 %	9 %	9 %

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



LANE SUMMARY

Site: Hawthorn Road / Springvale Road - Existing PM

Hawthorn Road / Springvale Road
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Practical Cycle Time)Variable Sequence Analysis applied. The results are given for the selected output sequence.

Lane Use and Performance

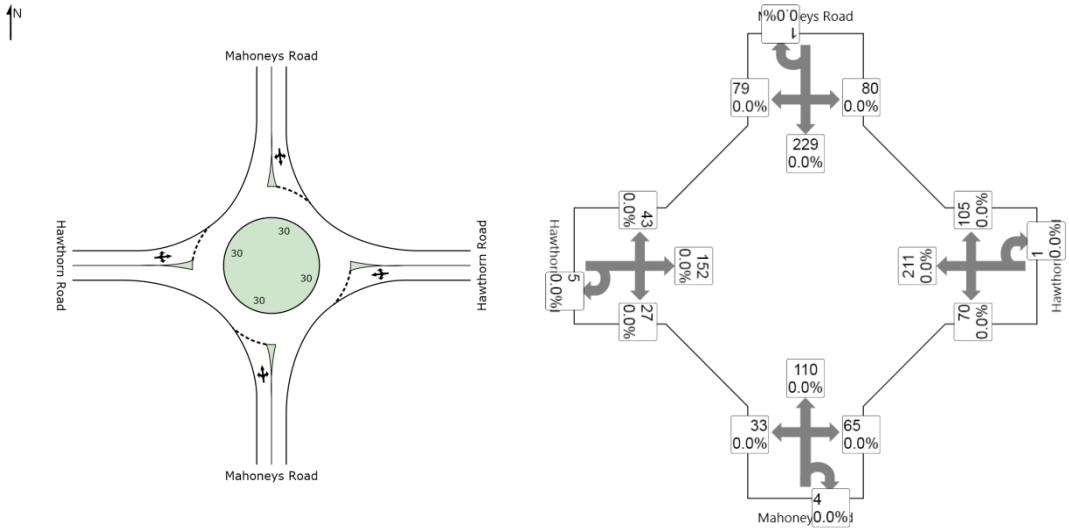
	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV						Veh	Dist				
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Springvale Road (S)													
Lane 1	117	0.0	1141	0.102	100	11.8	LOS B	1.5	10.7	Short	60	0.0	NA
Lane 2	827	1.6	946[1]	0.874	100	24.7	LOS C	40.4	286.6	Full	500	0.0	0.0
Lane 3	892	1.6	1020	0.874	100	25.3	LOS C	48.6	345.3	Full	500	0.0	0.0
Lane 4	850	1.6	972[1]	0.874	100	24.9	LOS C	43.2	306.6	Full	500	0.0	0.0
Lane 5	63	0.0	225	0.281	100	66.3	LOS E	3.8	26.8	Short	75	0.0	NA
Approach	2749	1.5		0.874		25.4	LOS C	48.6	345.3				
East: Hawthorn Road (E)													
Lane 1	149	0.7	406	0.368	100	47.3	LOS D	8.3	58.1	Full	500	0.0	0.0
Lane 2	74	0.0	119	0.617	100	78.4	LOS E	5.2	36.4	Short	100	0.0	NA
Approach	223	0.5		0.617		57.6	LOS E	8.3	58.1				
North: Springvale Road (N)													
Lane 1	726	1.6	870	0.834	100	32.3	LOS C	39.7	281.6	Full	500	0.0	0.0
Lane 2	711	2.0	853	0.834	100	32.4	LOS C	39.6	282.0	Full	500	0.0	0.0
Lane 3	625	2.0	750[1]	0.834	100	31.5	LOS C	31.9	226.9	Full	500	0.0	0.0
Lane 4	120	2.4	133	0.904	100	84.5	LOS F	8.8	63.2	Short	70	0.0	NA
Approach	2181	1.9		0.904		35.0	LOS D	39.7	282.0				
West: Hawthorn Road (W)													
Lane 1	357	5.0	520	0.687	100	46.0	LOS D	16.2	118.3	Full	500	0.0	0.0
Lane 2	159	5.0	275	0.578	100	56.3	LOS E	8.9	64.6	Short	30	0.0	NA
Approach	516	5.0		0.687		49.2	LOS D	16.2	118.3				
Intersection	5669	1.9		0.904		32.5	LOS C	48.6	345.3				

Level of Service (LOS) Method: Delay (HCM 2000).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

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

Hawthorn Road/ Mahoneys Road

AM Peak



LANE SUMMARY

Site: Existing AM Peak

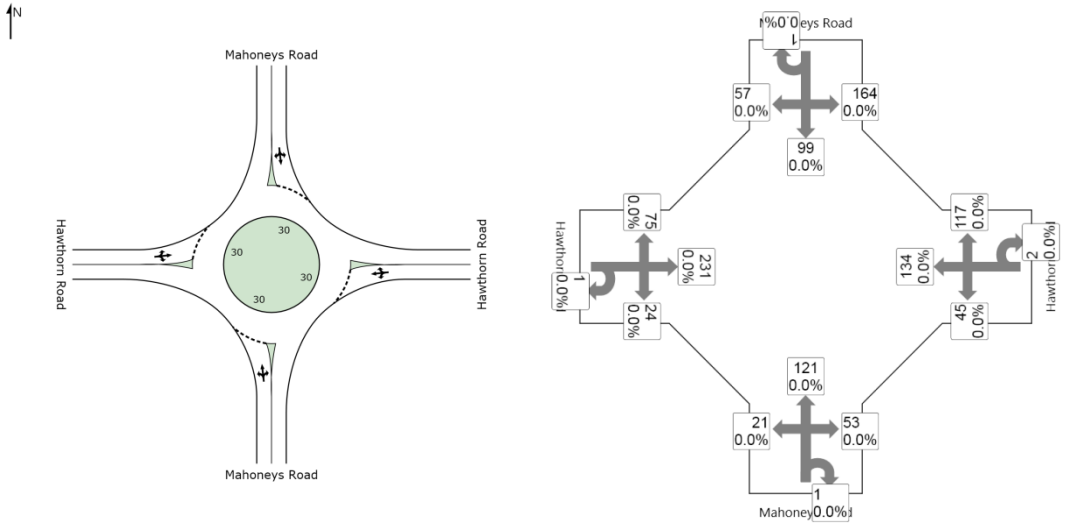
Hawthorn Road/Mahoneys Road Intersection
Existing AM Peak
Roundabout

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Mahoneys Road																
Lane 1	35	116	73	223	0.0	1070	0.208	100	8.8	LOS A	1.3	9.0	500	–	0.0	0.0
Approach	35	116	73	223	0.0		0.208		8.8	LOS A	1.3	9.0				
East: Hawthorn Road																
Lane 1	74	222	112	407	0.0	1124	0.362	100	8.4	LOS A	2.5	17.2	500	–	0.0	0.0
Approach	74	222	112	407	0.0		0.362		8.4	LOS A	2.5	17.2				
North: Mahoneys Road																
Lane 1	84	241	84	409	0.0	1229	0.333	100	7.4	LOS A	2.2	15.2	500	–	0.0	0.0
Approach	84	241	84	409	0.0		0.333		7.4	LOS A	2.2	15.2				
West: Hawthorn Road																
Lane 1	45	160	34	239	0.0	1186	0.202	100	6.9	LOS A	1.2	8.2	500	–	0.0	0.0
Approach	45	160	34	239	0.0		0.202		6.9	LOS A	1.2	8.2				
Intersection				1279	0.0		0.362		7.9	LOS A	2.5	17.2				

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

PM Peak



LANE SUMMARY

Site: Existing PM Peak

Hawthorn Road/Mahoneys Road Intersection
Existing PM Peak
Roundabout

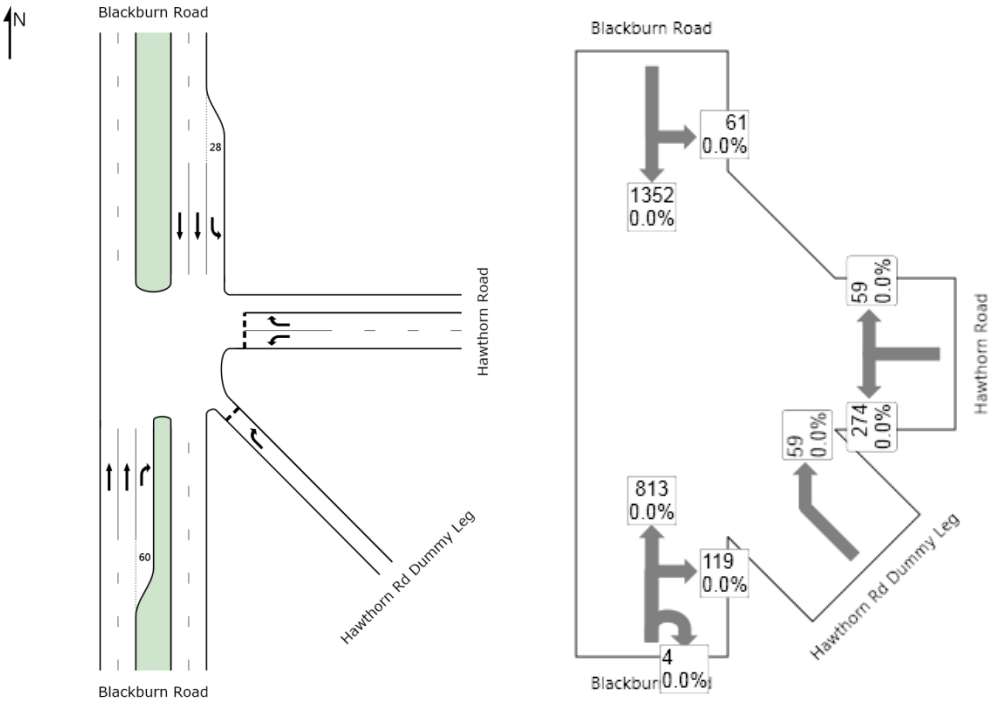
Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Mahoneys Road																
Lane 1	22	127	57	206	0.0	1166	0.177	100	7.8	LOS A	1.0	7.1	500	–	0.0	0.0
Approach	22	127	57	206	0.0		0.177		7.8	LOS A	1.0	7.1				
East: Hawthorn Road																
Lane 1	47	141	125	314	0.0	1296	0.242	100	8.1	LOS A	1.5	10.4	500	–	0.0	0.0
Approach	47	141	125	314	0.0		0.242		8.1	LOS A	1.5	10.4				
North: Mahoneys Road																
Lane 1	173	104	61	338	0.0	1157	0.292	100	7.8	LOS A	1.9	13.0	500	–	0.0	0.0
Approach	173	104	61	338	0.0		0.292		7.8	LOS A	1.9	13.0				
West: Hawthorn Road																
Lane 1	79	243	26	348	0.0	1184	0.294	100	6.7	LOS A	1.8	12.8	500	–	0.0	0.0
Approach	79	243	26	348	0.0		0.294		6.7	LOS A	1.8	12.8				
Intersection				1206	0.0		0.294		7.6	LOS A	1.9	13.0				

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

Hawthorn Road/ Blackburn Road

AM Peak



LANE SUMMARY **Site: Existing AM Peak**

Blackburn Road/Hawthorn Road Intersection
Existing AM Peak
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Blackburn Road																
Lane 1	0	428	0	428	0.0	1950	0.219	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	428	0	428	0.0	1950	0.219	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	0	129	129	0.0	250	0.517	100	29.7	LOS D	2.2	15.5	60	Turn Bay	0.0	0.0
Approach	0	856	129	985	0.0		0.517		3.9	NA	2.2	15.5				
South East: Hawthorn Rd Dummy Leg																
Lane 1	0	0	62	62	0.0	416	0.149	100	13.4	LOS B	0.5	3.5	10	–	0.0	0.0
Approach	0	0	62	62	0.0		0.149		13.4	LOS B	0.5	3.5				
East: Hawthorn Road																
Lane 1	288	0	0	288	0.0	335	0.861	100	37.3	LOS E	6.3	44.2	700	–	0.0	0.0
Lane 2	0	0	62	62	0.0	263	0.236	100	22.9	LOS C	0.8	5.8	500	–	0.0	0.0
Approach	288	0	62	351	0.0		0.861		34.8	LOS D	6.3	44.2				
North: Blackburn Road																
Lane 1	64	0	0	64	0.0	1857	0.035	100	8.2	LOS A	0.0	0.0	28	Turn Bay	0.0	0.0
Lane 2	0	712	0	712	0.0	1950	0.365	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	712	0	712	0.0	1950	0.365	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	64	1423	0	1487	0.0		0.365		0.4	NA	0.0	0.0				
Intersection				2885	0.0		0.861		6.0	NA	6.3	44.2				

Level of Service (LOS) Method: Delay (HCM 2000).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
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 lanes.
SIDRA Standard Delay Model used.

AM Peak - Modified Conditions

The intersection analysis above indicates that the left turn from Hawthorn Road to Springvale Road experiences average delays of 37 seconds and operates with a DOS of 0.86. However this does not correlate to the onsite observations where vehicles were able to turn left with relative ease.

A signalised pedestrian crossing on Blackburn Road is located to the north of Hawthorn Road. The crossing was activated 10 times in the AM peak hour with each phase taking approximately 30 seconds. During this period, left turn traffic from Hawthorn Road was operating under free flow conditions as was the right turn into the Hawthorn Road. Some right turn vehicles from Hawthorn Road also took advantage of the break in southbound traffic flow and two vehicles typically stored in the central median each time the pedestrian crossing was activated. In order to assess the capacity benefit that the pedestrian crossing provided, basic capacity calculations were undertaken based on the gap acceptance parameters, as shown below.

AM Peak Additional Capacity Assessment

Movement	Follow up headway	Capacity / Pedestrian Cycle	Peak hour Additional Capacity	Existing SIDRA Capacity	Adjusted SIDRA Capacity
Left Turn Out	2.5 sec	12 vehicles / pedestrian cycle	120 vehicles	355 vehs/h	475 vehs/h
Right Turn Out	4 sec	2 vehicles / pedestrian cycle	20 vehicles	263 vehs/h	283 vehs/h
Right Turn In	2.5 sec	12 vehicles / pedestrian cycle	120 vehicles	250 vehs/h	270 vehs/h

To account for the additional capacity of the movement, gap acceptance parameters have been adjusted through a trial and error process until the movement capacity equals the adjusted SIDRA capacity documented above.

The resultant gap acceptance parameters are as follows:

Movement	Gap	Follow up headway
Left Turn Out	3.5	2.15
Right Turn Out	4.35	2.5
Right Turn In	4.35	2.5

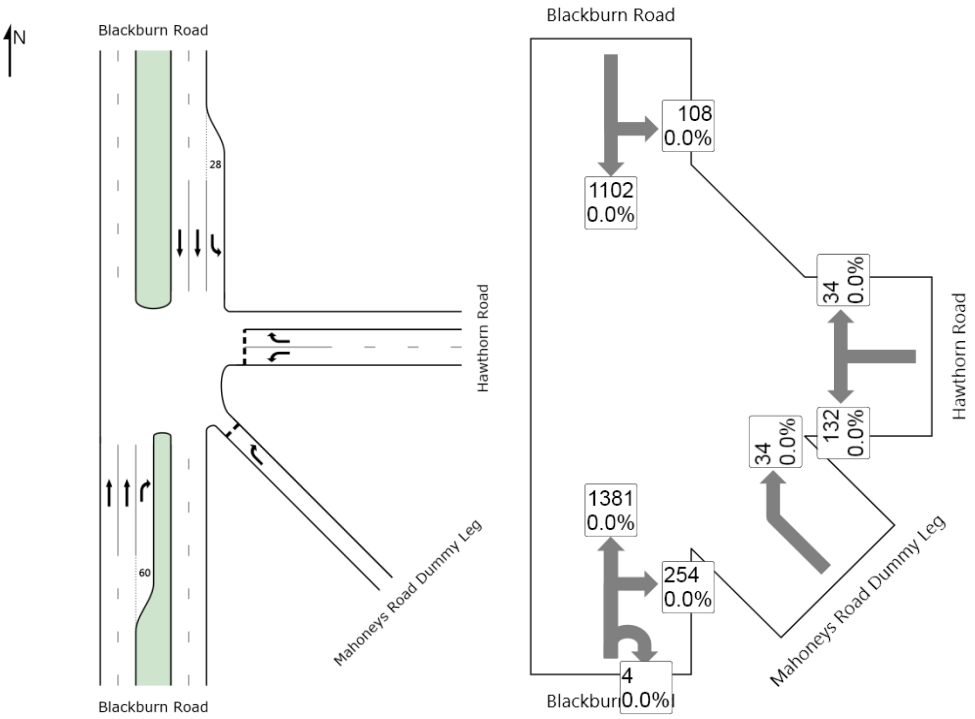
LANE SUMMARY — **Site: Existing AM Peak - Adjusted**

Blackburn Road/Hawthorn Road Intersection
Existing AM Peak
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Blackburn Road																
Lane 1	0	428	0	428	0.0	1950	0.219	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	428	0	428	0.0	1950	0.219	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	0	129	129	0.0	270	0.480	100	26.8	LOS D	2.0	13.8	60	Turn Bay	0.0	0.0
Approach	0	856	129	985	0.0		0.480		3.5	NA	2.0	13.8				
South East: Hawthorn Rd Dummy Leg																
Lane 1	0	0	62	62	0.0	435	0.143	100	12.9	LOS B	0.5	3.3	7	–	0.0	0.0
Approach	0	0	62	62	0.0		0.143		12.9	LOS B	0.5	3.3				
East: Hawthorn Road																
Lane 1	288	0	0	288	0.0	471	0.613	100	19.9	LOS C	3.1	21.6	500	–	0.0	0.0
Lane 2	0	0	62	62	0.0	283	0.220	100	21.2	LOS C	0.8	5.3	500	–	0.0	0.0
Approach	288	0	62	351	0.0		0.613		20.2	LOS C	3.1	21.6				
North: Blackburn Road																
Lane 1	64	0	0	64	0.0	1857	0.035	100	8.2	LOS A	0.0	0.0	28	Turn Bay	0.0	0.0
Lane 2	0	712	0	712	0.0	1950	0.365	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	712	0	712	0.0	1950	0.365	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	64	1423	0	1487	0.0		0.365		0.4	NA	0.0	0.0				
Intersection				2885	0.0		0.613		4.1	NA	3.1	21.6				

PM Peak



LANE SUMMARY **Site: Existing PM Peak**

Blackburn Road/Hawthorn Road Intersection
Existing AM Peak
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Blackburn Road																
Lane 1	0	727	0	727	0.0	1950	0.373	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	727	0	727	0.0	1950	0.373	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	0	272	272	0.0	341	0.797	100	34.4	LOS D	5.7	39.8	60	Turn Bay	0.0	0.0
Approach	0	1454	272	1725	0.0		0.797		5.4	NA	5.7	39.8				
South East: Mahoneys Road Dummy Leg																
Lane 1	0	0	36	36	0.0	137	0.261	100	34.5	LOS D	0.8	5.7	10	–	0.0	0.0
Approach	0	0	36	36	0.0		0.261		34.5	LOS D	0.8	5.7				
East: Hawthorn Road																
Lane 1	139	0	0	139	0.0	449	0.310	100	16.4	LOS C	1.2	8.2	700	–	0.0	0.0
Lane 2	0	0	36	36	0.0	369	0.097	100	17.0	LOS C	0.3	2.3	500	–	0.0	0.0
Approach	139	0	36	175	0.0		0.310		16.5	LOS C	1.2	8.2				
North: Blackburn Road																
Lane 1	114	0	0	114	0.0	1857	0.061	100	8.2	LOS A	0.0	0.0	28	Turn Bay	0.0	0.0
Lane 2	0	580	0	580	0.0	1950	0.297	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	580	0	580	0.0	1950	0.297	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	114	1160	0	1274	0.0		0.297		0.7	NA	0.0	0.0				
Intersection				3209	0.0		0.797		4.5	NA	5.7	39.8				

Level of Service (LOS) Method: Delay (HCM 2000).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
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 lanes.
SIDRA Standard Delay Model used.

PM Peak - Modified Conditions

The intersection analysis above indicates that the right turn into Hawthorn Road from Blackburn Road experiences average delays of 34 seconds and operates with a DOS of 0.80. However this does not correlate to the onsite observations where vehicles were able to turn right with relative ease.

The signalised pedestrian crossing was activated 18 times in the PM peak hour with each phase taking approximately 30seconds. During this period, left turn traffic from Hawthorn Road was operating under free flow conditions as was the right turn into the Hawthorn Road. Some right turn vehicles from Hawthorn Road also took advantage of the break in southbound traffic flow and two vehicles typically stored in the central median each time the pedestrian crossing was activated. In order to assess the capacity benefit that the pedestrian crossing provided, basic capacity calculations were undertaken based on the gap acceptance parameters, as shown below.

Additional Capacity Assessment

Movement	Follow up headway	Capacity / Pedestrian Cycle	Peak hour Additional Capacity (18 cycles)	Existing SIDRA Capacity	Adjusted SIDRA Capacity
Left Turn Out	2.5 sec	12 vehicles / pedestrian cycle	216 vehicles	449 vehs/h	665 vehs/h
Right Turn Out	4 sec	2 vehicles / pedestrian cycle	36 vehicles	137 vehs/h	173 vehs/h
Right Turn In	2.5 sec	12 vehicles / pedestrian cycle	216 vehicles	341 vehs/h	557 vehs/h

To account for the additional capacity of the movement, gap acceptance parameters have been adjusted through a trial and error process until the movement capacity equals the adjusted SIDRA capacity documented above.

The resultant gap acceptance parameters are as follows:

Movement	Gap	Follow up headway
Left Turn Out	3.4	2.0
Right Turn Out	4.75	2.5
Right Turn In	3.55	2.2

LANE SUMMARY

Site: Existing PM Peak - Adjusted

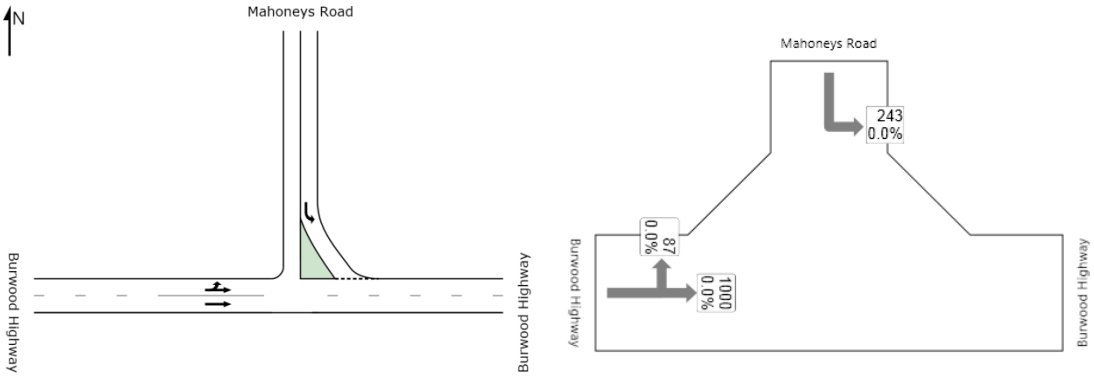
Blackburn Road/Hawthorn Road Intersection
Existing AM Peak
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Blackburn Road																
Lane 1	0	727	0	727	0.0	1950	0.373	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	727	0	727	0.0	1950	0.373	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	0	272	272	0.0	551	0.493	100	16.4	LOS C	2.3	16.1	60	Turn Bay	0.0	0.0
Approach	0	1454	272	1725	0.0		0.493		2.6	NA	2.3	16.1				
South East: Mahoneys Road Dummy Leg																
Lane 1	0	0	36	36	0.0	175	0.204	100	28.6	LOS D	0.7	4.7	7	–	0.0	0.0
Approach	0	0	36	36	0.0		0.204		28.6	LOS D	0.7	4.7				
East: Hawthorn Road																
Lane 1	139	0	0	139	0.0	664	0.209	100	13.0	LOS B	0.8	5.3	700	–	0.0	0.0
Lane 2	0	0	36	36	0.0	334	0.107	100	18.5	LOS C	0.4	2.7	500	–	0.0	0.0
Approach	139	0	36	175	0.0		0.209		14.1	LOS B	0.8	5.3				
North: Blackburn Road																
Lane 1	114	0	0	114	0.0	1857	0.061	100	8.2	LOS A	0.0	0.0	28	Turn Bay	0.0	0.0
Lane 2	0	580	0	580	0.0	1950	0.297	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	580	0	580	0.0	1950	0.297	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	114	1160	0	1274	0.0		0.297		0.7	NA	0.0	0.0				
Intersection				3209	0.0		0.493		2.8	NA	2.3	16.1				

Mahoneys Road/ Burwood Highway

AM Peak



LANE SUMMARY

Site: Existing AM Peak

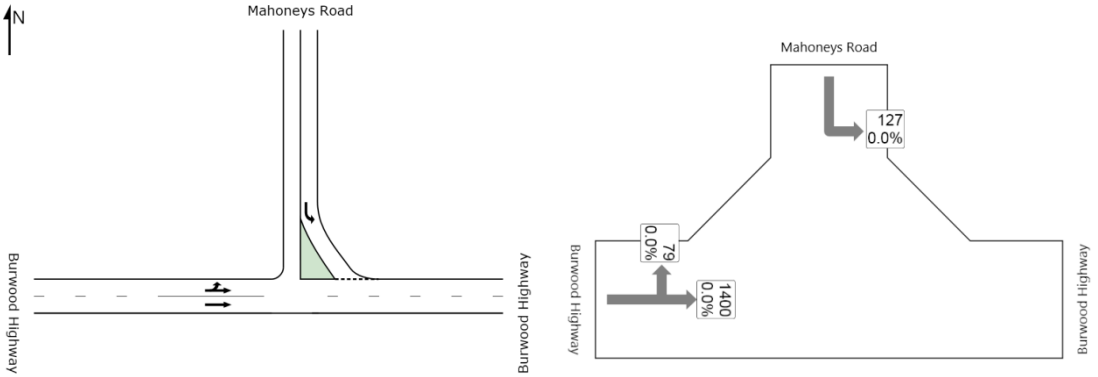
Burwood Highway/Mahoneys Road Intersection
Existing AM Peak
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
North: Mahoneys Road																
Lane 1	256	0	0	256	0.0	339	0.756	100	30.0	LOS D	5.1	35.6	500	–	0.0	0.0
Approach	256	0	0	256	0.0		0.756		30.0	LOS D	5.1	35.6				
West: Burwood Highway																
Lane 1	92	478	0	570	0.0	1934	0.295	100	1.3	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	574	0	574	0.0	1950	0.295	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	92	1053	0	1144	0.0		0.295		0.7	NA	0.0	0.0				
Intersection				1400	0.0		0.756		6.0	NA	5.1	35.6				

Level of Service (LOS) Method: Delay (HCM 2000).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
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 lanes.
SIDRA Standard Delay Model used.

PM Peak



LANE SUMMARY

Site: Existing PM Peak

Burwood Highway/Mahoneys Road Intersection
Existing PM Peak
Giveway / Yield (Two-Way)

Lane Use and Performance

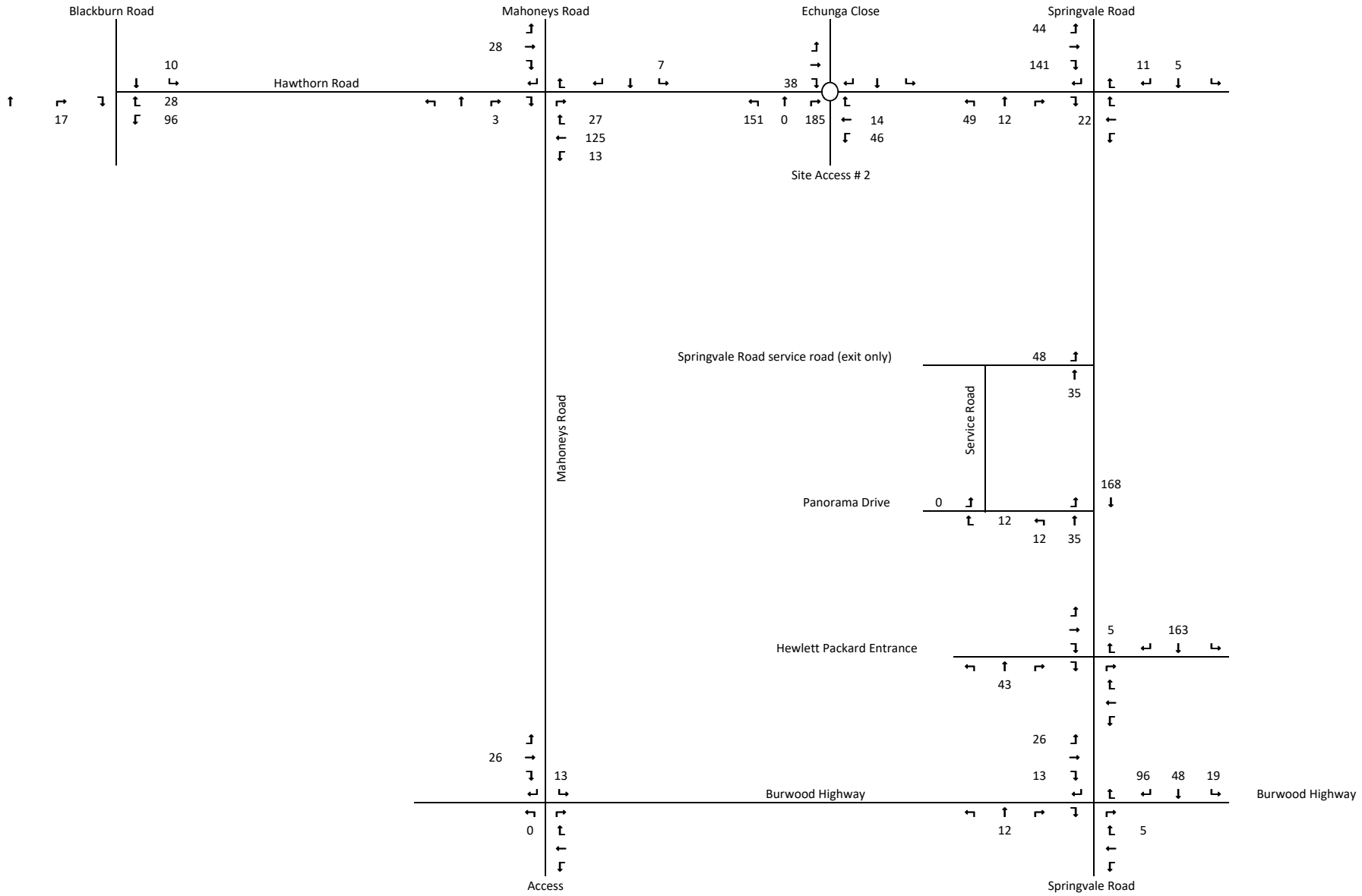
	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
North: Mahoneys Road																
Lane 1	134	0	0	134	0.0	214	0.624	100	33.0	LOS D	2.5	17.8	500	–	0.0	0.0
Approach	134	0	0	134	0.0		0.624		33.0	LOS D	2.5	17.8				
West: Burwood Highway																
Lane 1	83	693	0	776	0.0	1940	0.400	100	0.9	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	781	0	781	0.0	1950	0.400	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	83	1474	0	1557	0.0		0.400		0.4	NA	0.0	0.0				
Intersection				1691	0.0		0.624		3.0	NA	2.5	17.8				

Level of Service (LOS) Method: Delay (HCM 2000).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
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 lanes.
SIDRA Standard Delay Model used.

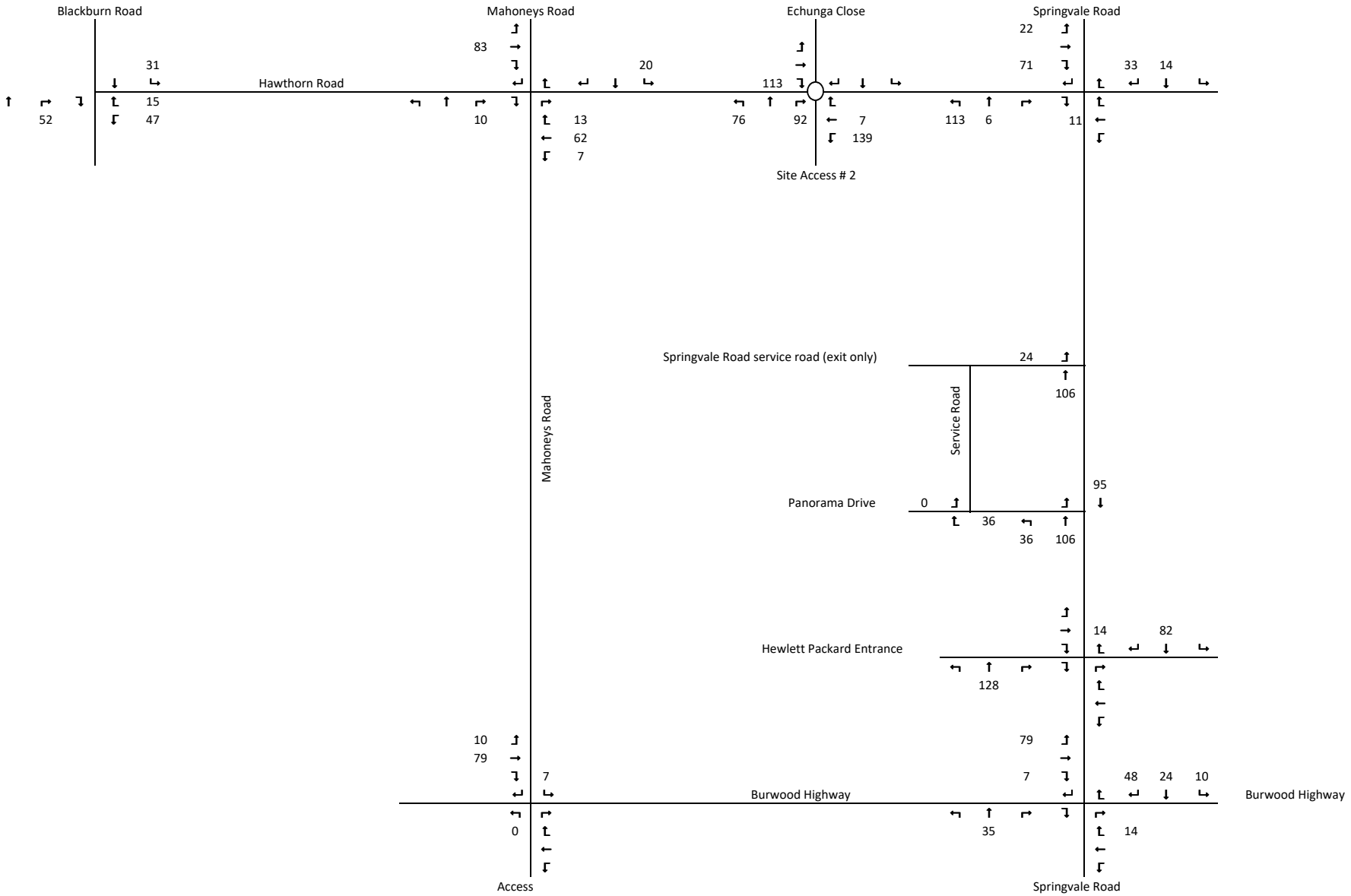
Appendix C

Site Generated Traffic Volumes

Traffic Distribution AM Peak



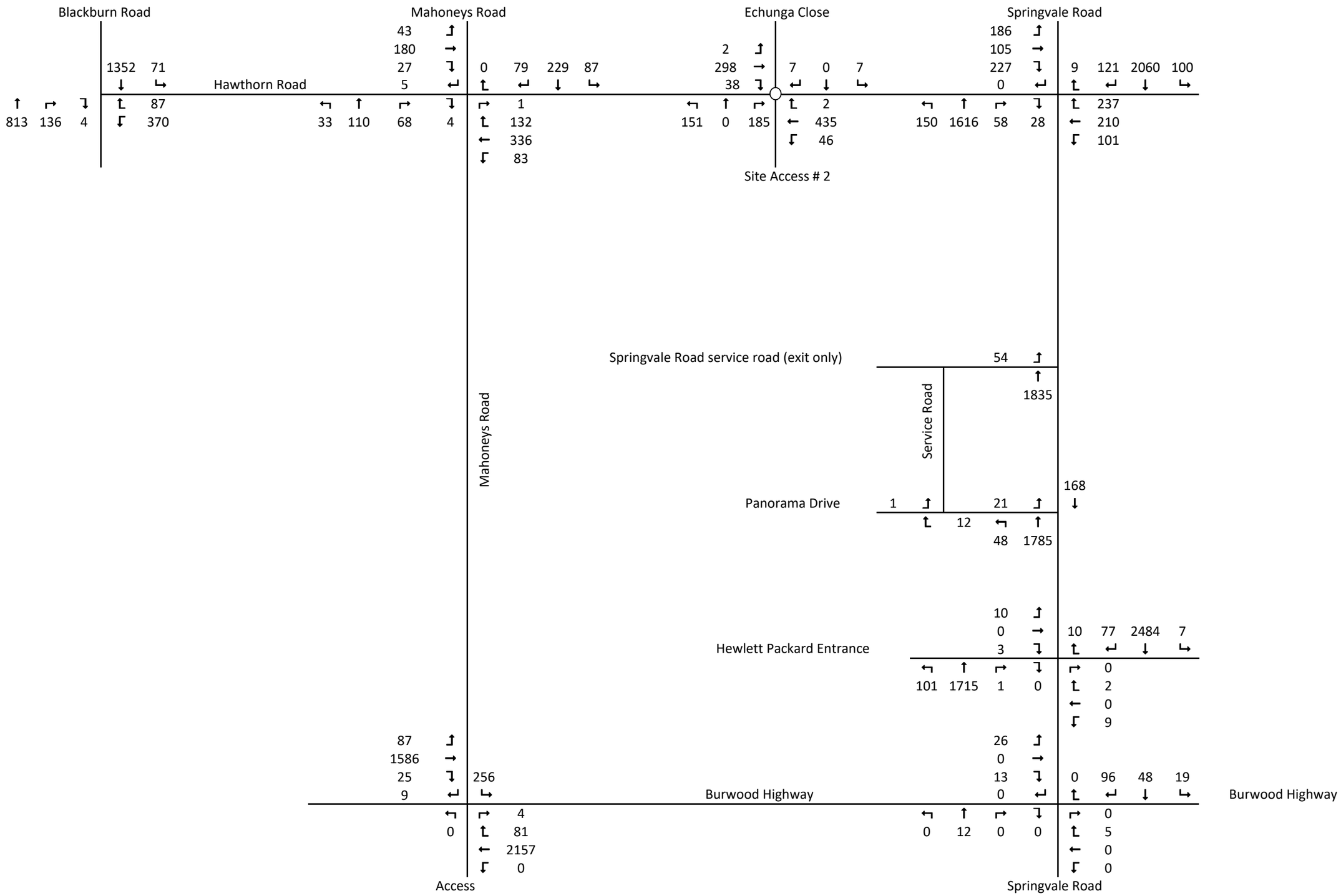
Traffic Distribution PM Peak



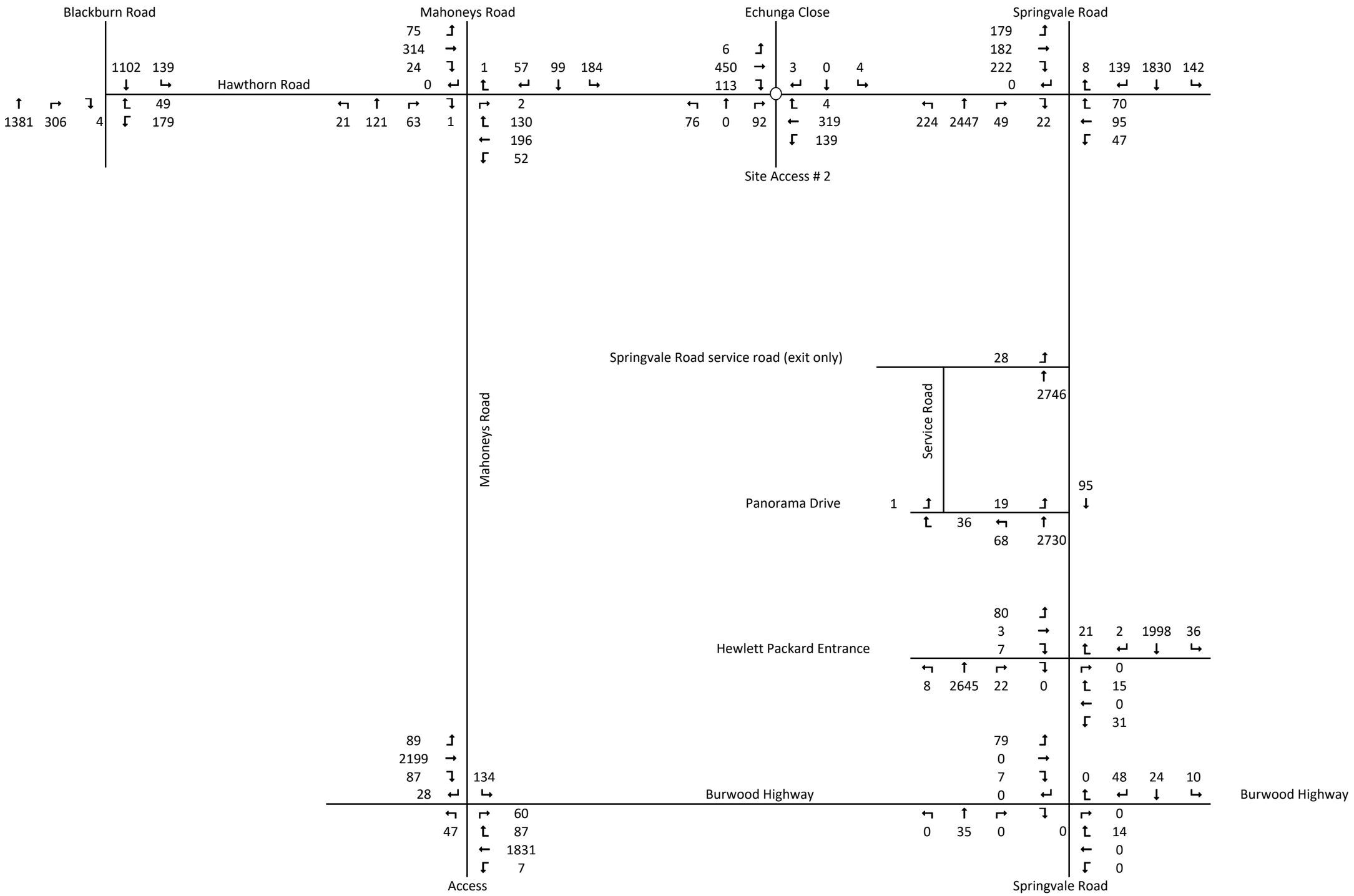
Appendix D

Post Development Traffic Volumes

Post Development AM Peak



Post Development PM Peak

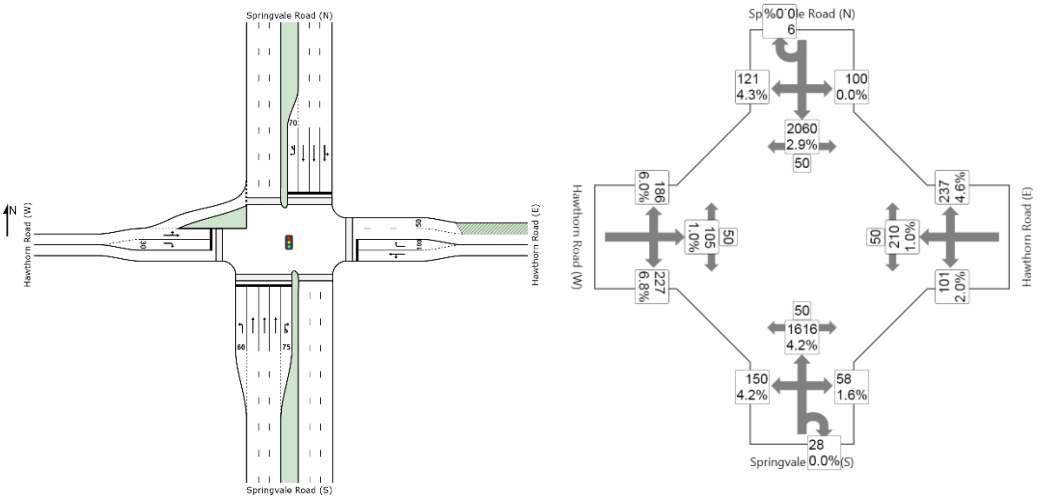


Appendix E

SIDRA Analysis: Post Development Operating Conditions

Hawthorn Road/ Springvale Road

AM Peak



PHASING SUMMARY

Site: Hawthorn Road / Springvale Road - Post Dev AM

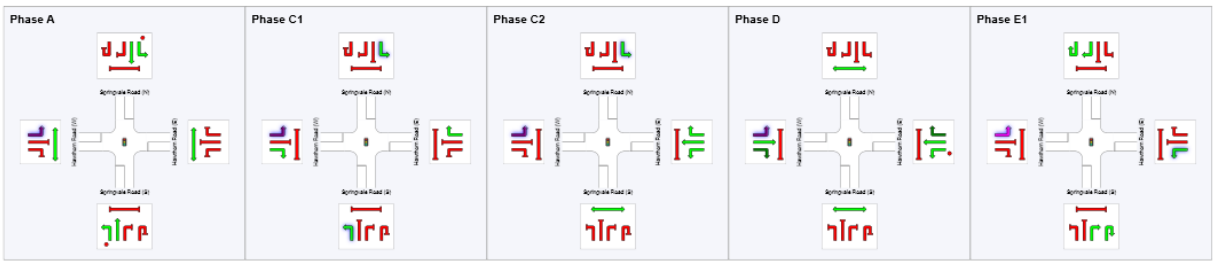
Hawthorn Road / Springvale Road
Signals - Fixed Time Coordinated Cycle Time = 130 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Phase times determined by the program
Sequence: Two-Phase
Movement Class: All Movement Classes
Input Sequence: A, C1, C2, C3, D, E1, E2, E3
Output Sequence: A, C1, C2, D, E1

Phase Timing Results

Phase	A	C1	C2	D	E1
Reference Phase	Yes	No	No	No	No
Phase Change Time (sec)	0	59	78	81	114
Green Time (sec)	53	13	***	27	10
Yellow Time (sec)	4	4	4	4	4
All-Red Time (sec)	2	2	2	2	2
Phase Time (sec)	59	19	3	33	16
Phase Split	45 %	15 %	2 %	25 %	12 %

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



LANE SUMMARY

Site: Hawthorn Road / Springvale Road - Post Dev AM

Hawthorn Road / Springvale Road
Signals - Fixed Time Coordinated Cycle Time = 130 seconds (Practical Cycle Time)Variable Sequence Analysis applied. The results are given for the selected output sequence.

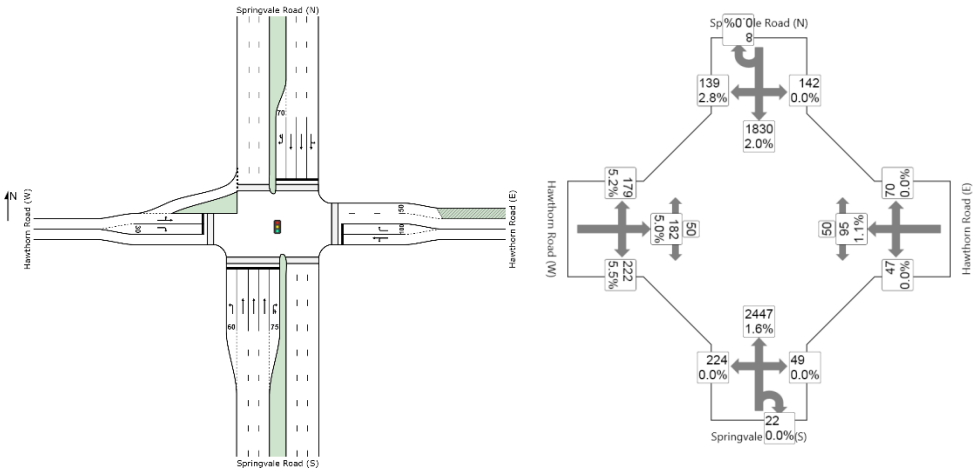
Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV						Veh	Dist				
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Springvale Road (S)													
Lane 1	158	4.2	915	0.173	100	17.1	LOS B	3.3	23.7	Short	60	0.0	NA
Lane 2	541	4.2	689[1]	0.786	100	30.8	LOS C	25.2	182.5	Full	500	0.0	0.0
Lane 3	608	4.2	774	0.786	100	32.0	LOS C	30.6	222.0	Full	500	0.0	0.0
Lane 4	552	4.2	703[1]	0.786	100	31.1	LOS C	26.1	189.5	Full	500	0.0	0.0
Lane 5	91	1.1	128	0.707	100	73.9	LOS E	6.0	42.1	Short	75	0.0	NA
Approach	1949	4.1		0.786		32.1	LOS C	30.6	222.0				
East: Hawthorn Road (E)													
Lane 1	327	1.3	452	0.724	100	47.8	LOS D	18.6	131.5	Full	500	0.0	0.0
Lane 2	249	4.6	494	0.505	100	38.6	LOS D	11.9	86.4	Short	100	0.0	NA
Approach	577	2.7		0.724		43.8	LOS D	18.6	131.5				
North: Springvale Road (N)													
Lane 1	800	2.5	797	1.003	100	78.2	LOS E	68.3	488.8	Full	500	0.0	3.0
Lane 2	782	2.9	780	1.003	100	81.3	LOS F	69.5	498.9	Full	500	0.0	4.8
Lane 3	692	2.9	690[1]	1.003	100	88.6	LOS F	60.1	431.2	Full	500	0.0	0.0
Lane 4	137	4.0	136	1.007	100	111.5	LOS F	11.8	85.1	Short	70	0.0	NA
Approach	2411	2.9		1.007		84.1	LOS F	69.5	498.9				
West: Hawthorn Road (W)													
Lane 1	306	4.2	598[1]	0.512	100	25.8	LOS C	12.5	90.3	Full	500	0.0	0.0
Lane 2	239	6.8	243[1]	0.982	100	84.5	LOS F	17.1	126.7	Short	30	0.0	NA
Approach	545	5.3		0.982		51.5	LOS D	17.1	126.7				
Intersection	5482	3.5		1.007		58.1	LOS E	69.5	498.9				

Level of Service (LOS) Method: Delay (HCM 2000).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

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

PM Peak



PHASING SUMMARY

Site: Hawthorn Road / Springvale Road - Post Dev PM

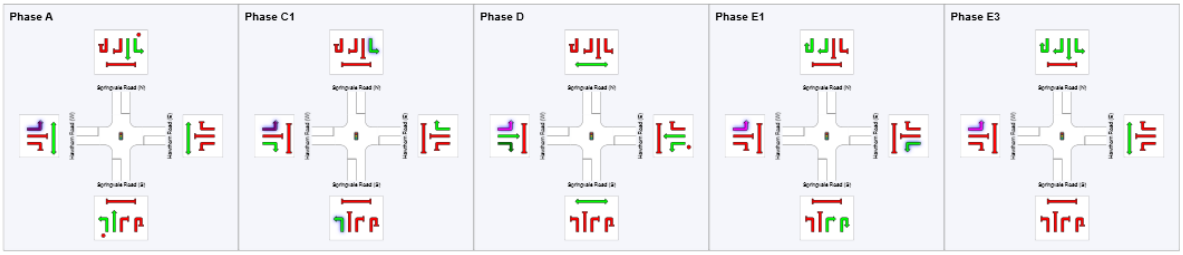
Hawthorn Road / Springvale Road
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Phase times determined by the program
Sequence: Two-Phase
Movement Class: All Movement Classes
Input Sequence: A, C1, C2, C3, D, E1, E2, E3
Output Sequence: A, C1, D, E1, E3

Phase Timing Results

Phase	A	C1	D	E1	E3
Reference Phase	Yes	No	No	No	No
Phase Change Time (sec)	0	73	85	121	135
Green Time (sec)	67	6	30	8	***
Yellow Time (sec)	4	4	4	4	4
All-Red Time (sec)	2	2	2	2	2
Phase Time (sec)	73	12	36	14	5
Phase Split	52 %	9 %	26 %	10 %	4 %

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



LANE SUMMARY

Site: Hawthorn Road / Springvale Road - Post Dev PM

Hawthorn Road / Springvale Road
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Practical Cycle Time)Variable Sequence Analysis applied. The results are given for the selected output sequence.

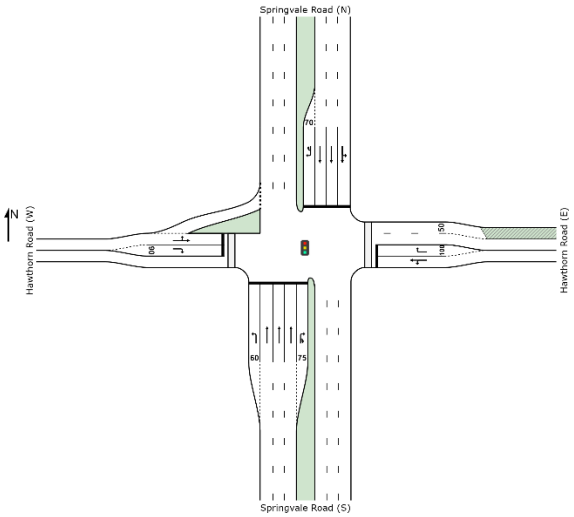
Lane Use and Performance

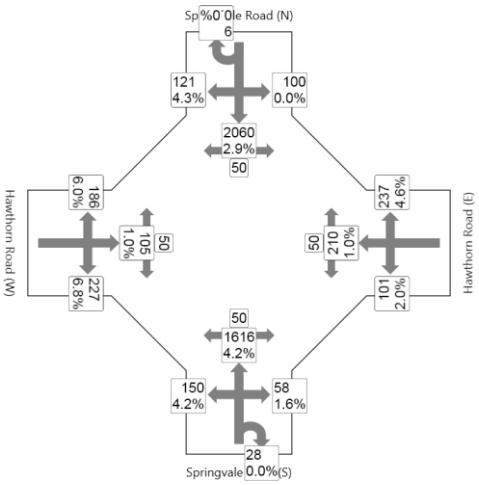
	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV						Veh	Dist				
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Springvale Road (S)													
Lane 1	236	0.0	968	0.243	100	17.4	LOS B	5.3	36.9	Short	60	0.0	NA
Lane 2	769	1.6	765[1]	1.006	100	88.9	LOS F	68.0	482.5	Full	500	0.0	1.8
Lane 3	928	1.6	923	1.006	100	77.2	LOS E	87.6	621.6	Full	500	0.0	24.8
Lane 4	878	1.6	874[1]	1.006	100	80.6	LOS F	80.6	571.8	Full	500	0.0	17.2
Lane 5	75	0.0	96	0.777	100	83.1	LOS F	5.5	38.3	Short	75	0.0	NA
Approach	2886	1.5		1.006		76.6	LOS E	87.6	621.6				
East: Hawthorn Road (E)													
Lane 1	149	0.7	422	0.354	100	46.3	LOS D	8.2	57.5	Full	500	0.0	0.0
Lane 2	74	0.0	80	0.926	100	94.6	LOS F	5.9	41.3	Short	100	0.0	NA
Approach	223	0.5		0.926		62.3	LOS E	8.2	57.5				
North: Springvale Road (N)													
Lane 1	740	1.6	1010	0.733	100	21.2	LOS C	30.9	219.2	Full	500	0.0	0.0
Lane 2	726	2.0	990	0.733	100	20.9	LOS C	30.8	219.4	Full	500	0.0	0.0
Lane 3	610	2.0	832[1]	0.733	100	19.0	LOS B	22.3	158.6	Full	500	0.0	0.0
Lane 4	155	2.6	166	0.931	100	89.5	LOS F	12.2	87.1	Short	70	0.0	NA
Approach	2231	1.9		0.931		25.3	LOS C	30.9	219.4				
West: Hawthorn Road (W)													
Lane 1	380	5.1	568	0.669	100	50.4	LOS D	19.7	143.8	Full	500	0.0	0.0
Lane 2	234	5.5	284	0.823	100	68.8	LOS E	14.3	104.8	Short	30	0.0	NA
Approach	614	5.2		0.823		57.4	LOS E	19.7	143.8				
Intersection	5954	2.0		1.006		54.9	LOS D	87.6	621.6				

Level of Service (LOS) Method: Delay (HCM 2000).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

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

AM Peak (Mitigated Works)





PHASING SUMMARY

Site: Hawthorn Road / Springvale Road - Post Dev AM - Mitigated

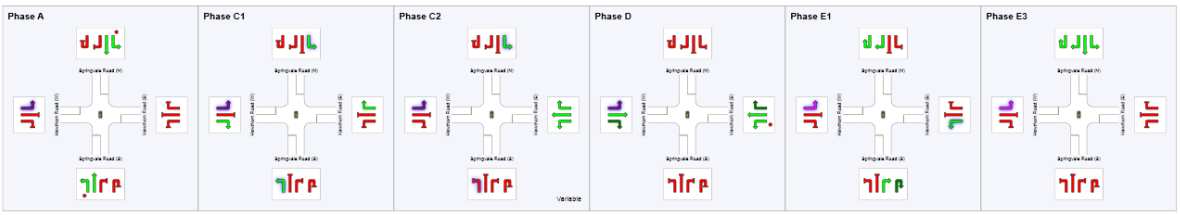
Hawthorn Road / Springvale Road
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Phase times determined by the program
Sequence: Two-Phase
Movement Class: All Movement Classes
Input Sequence: A, C1, C2, C3, D, E1, E2, E3
Output Sequence: A, C1, C2, D, E1, E3

Phase Timing Results

Phase	A	C1	C2	D	E1	E3
Reference Phase	Yes	No	No	No	No	No
Phase Change Time (sec)	0	65	87	93	120	135
Green Time (sec)	59	16	***	21	9	***
Yellow Time (sec)	4	4	4	4	4	4
All-Red Time (sec)	2	2	2	2	2	2
Phase Time (sec)	65	22	6	27	15	5
Phase Split	46 %	16 %	4 %	19 %	11 %	4 %

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



LANE SUMMARY

Site: Hawthorn Road / Springvale Road - Post Dev AM - Mitigated

Hawthorn Road / Springvale Road
Signals - Fixed Time Coordinated Cycle Time = 140 seconds (Practical Cycle Time)Variable Sequence Analysis applied. The results are given for the selected output sequence.

Lane Use and Performance

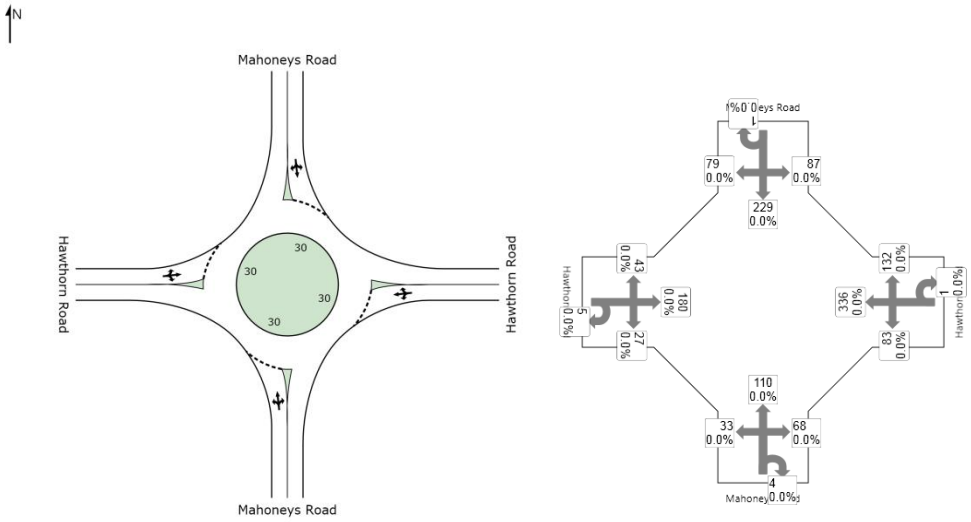
	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total	HV						Veh	Dist				
	veh/h	%	veh/h	v/c	%	sec			m		m	%	%
South: Springvale Road (S)													
Lane 1	158	4.2	966	0.163	100	15.9	LOS B	3.1	22.6	Short	60	0.0	NA
Lane 2	540	4.2	708[1]	0.763	100	30.1	LOS C	25.4	184.3	Full	500	0.0	0.0
Lane 3	610	4.2	800	0.763	100	32.0	LOS C	31.6	229.2	Full	500	0.0	0.0
Lane 4	551	4.2	722[1]	0.763	100	30.4	LOS C	26.4	191.4	Full	500	0.0	0.0
Lane 5	91	1.1	107	0.844	100	84.6	LOS F	6.7	47.6	Short	75	0.0	NA
Approach	1949	4.1		0.844		32.2	LOS C	31.6	229.2				
East: Hawthorn Road (E)													
Lane 1	327	1.3	379	0.863	100	64.8	LOS E	23.1	163.5	Full	500	0.0	0.0
Lane 2	249	4.6	476	0.524	100	43.7	LOS D	13.1	95.6	Short	100	0.0	NA
Approach	577	2.7		0.863		55.7	LOS E	23.1	163.5				
North: Springvale Road (N)													
Lane 1	792	2.5	893	0.886	100	44.7	LOS D	53.7	384.0	Full	500	0.0	0.0
Lane 2	775	2.9	875	0.886	100	44.9	LOS D	52.9	379.4	Full	500	0.0	0.0
Lane 3	707	2.9	798[1]	0.886	100	44.4	LOS D	46.6	334.2	Full	500	0.0	0.0
Lane 4	137	4.0	177	0.775	100	77.5	LOS E	9.8	70.9	Short	120	0.0	NA
Approach	2411	2.9		0.886		46.5	LOS D	53.7	384.0				
West: Hawthorn Road (W)													
Lane 1	306	4.2	548	0.559	100	29.5	LOS C	13.6	98.9	Full	500	0.0	0.0
Lane 2	239	6.8	268	0.890	100	59.4	LOS E	14.7	108.7	Short	90	0.0	NA
Approach	545	5.3		0.890		42.6	LOS D	14.7	108.7				
Intersection	5482	3.5		0.890		42.0	LOS D	53.7	384.0				

Level of Service (LOS) Method: Delay (HCM 2000).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

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

Hawthorn Road/ Mahoneys Road

AM Peak



LANE SUMMARY

Site: Post Development AM Peak

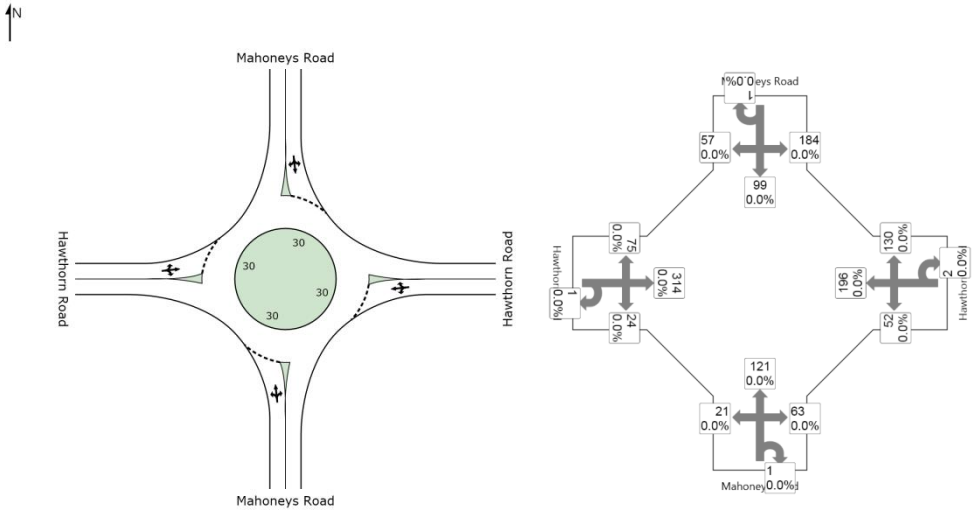
Hawthorn Road/Mahoneys Road Intersection
Post Development AM Peak
Roundabout

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Mahoneys Road																
Lane 1	35	116	76	226	0.0	919	0.246	100	9.9	LOS A	1.7	11.6	500	–	0.0	0.0
Approach	35	116	76	226	0.0		0.246		9.9	LOS A	1.7	11.6				
East: Hawthorn Road																
Lane 1	87	354	140	581	0.0	1133	0.513	100	8.5	LOS A	4.0	28.0	500	–	0.0	0.0
Approach	87	354	140	581	0.0		0.513		8.5	LOS A	4.0	28.0				
North: Mahoneys Road																
Lane 1	92	241	84	417	0.0	1192	0.350	100	7.6	LOS A	2.3	16.3	500	–	0.0	0.0
Approach	92	241	84	417	0.0		0.350		7.6	LOS A	2.3	16.3				
West: Hawthorn Road																
Lane 1	45	189	34	268	0.0	1154	0.233	100	7.0	LOS A	1.4	9.9	500	–	0.0	0.0
Approach	45	189	34	268	0.0		0.233		7.0	LOS A	1.4	9.9				
Intersection				1493	0.0		0.513		8.2	LOS A	4.0	28.0				

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

PM Peak



LANE SUMMARY

Site: Post Development PM Peak

Hawthorn Road/Mahoneys Road Intersection
Post Development PM Peak
Roundabout

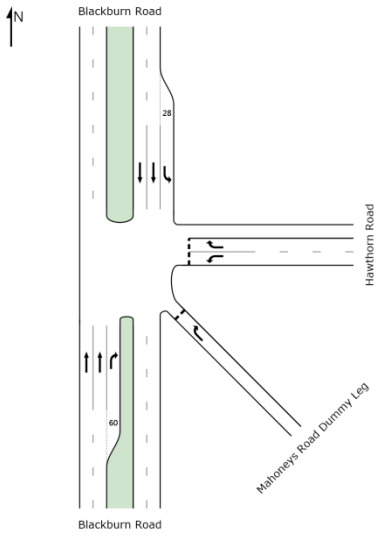
Lane Use and Performance

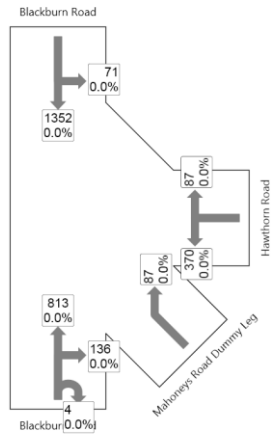
	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Mahoneys Road																
Lane 1	22	127	67	217	0.0	1096	0.198	100	8.5	LOS A	1.2	8.2	500	–	0.0	0.0
Approach	22	127	67	217	0.0		0.198		8.5	LOS A	1.2	8.2				
East: Hawthorn Road																
Lane 1	55	206	139	400	0.0	1305	0.306	100	7.8	LOS A	2.0	14.2	500	–	0.0	0.0
Approach	55	206	139	400	0.0		0.306		7.8	LOS A	2.0	14.2				
North: Mahoneys Road																
Lane 1	194	104	61	359	0.0	1067	0.336	100	8.3	LOS A	2.3	15.8	500	–	0.0	0.0
Approach	194	104	61	359	0.0		0.336		8.3	LOS A	2.3	15.8				
West: Hawthorn Road																
Lane 1	79	331	26	436	0.0	1164	0.374	100	6.8	LOS A	2.5	17.5	500	–	0.0	0.0
Approach	79	331	26	436	0.0		0.374		6.8	LOS A	2.5	17.5				
Intersection				1412	0.0		0.374		7.8	LOS A	2.5	17.5				

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
Roundabout Capacity Model: SIDRA Standard.
SIDRA Standard Delay Model used.

Hawthorn Road/ Blackburn Road

AM Peak





LANE SUMMARY

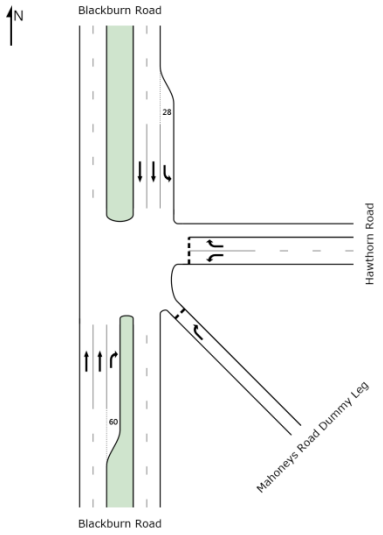
Site: Post Dev AM Peak - Adjusted

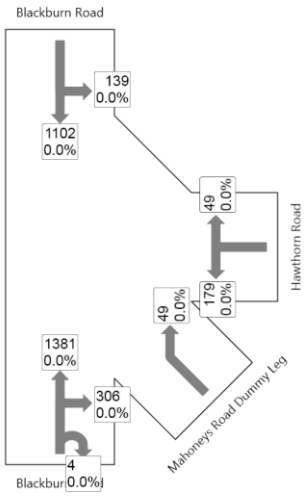
Blackburn Road/Hawthorn Road Intersection
Existing AM Peak
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Blackburn Road																
Lane 1	0	428	0	428	0.0	1950	0.219	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	428	0	428	0.0	1950	0.219	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	0	147	147	0.0	266	0.554	100	28.8	LOS D	2.4	16.9	60	Turn Bay	0.0	0.0
Approach	0	856	147	1003	0.0		0.554		4.2	NA	2.4	16.9				
South East: Hawthorn Rd Dummy Leg																
Lane 1	0	0	92	92	0.0	572	0.160	100	11.3	LOS B	0.6	4.0	7	–	0.0	0.0
Approach	0	0	92	92	0.0		0.160		11.3	LOS B	0.6	4.0				
East: Hawthorn Road																
Lane 1	389	0	0	389	0.0	468	0.832	100	27.4	LOS D	6.3	44.1	500	–	0.0	0.0
Lane 2	0	0	92	92	0.0	281	0.326	100	23.0	LOS C	1.2	8.5	500	–	0.0	0.0
Approach	389	0	92	481	0.0		0.832		26.5	LOS D	6.3	44.1				
North: Blackburn Road																
Lane 1	75	0	0	75	0.0	1857	0.040	100	8.2	LOS A	0.0	0.0	28	Turn Bay	0.0	0.0
Lane 2	0	712	0	712	0.0	1950	0.365	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	712	0	712	0.0	1950	0.365	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	75	1423	0	1498	0.0		0.365		0.4	NA	0.0	0.0				
Intersection				3074	0.0		0.832		6.1	NA	6.3	44.1				

PM Peak





LANE SUMMARY

Site: Post Dev PM Peak - Adjusted

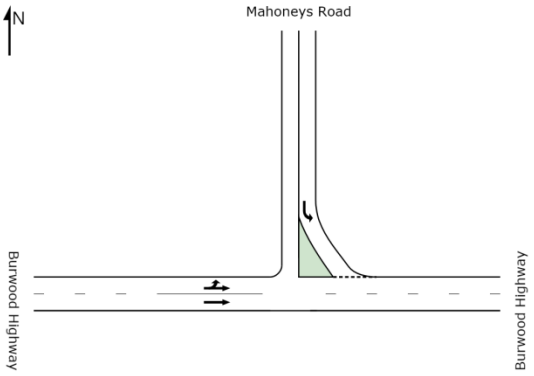
Blackburn Road/Hawthorn Road Intersection
Existing AM Peak
Giveway / Yield (Two-Way)

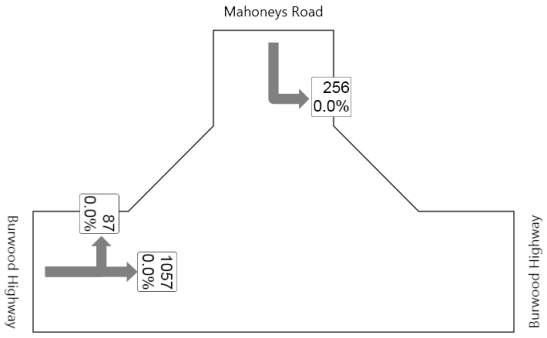
Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Blackburn Road																
Lane 1	0	727	0	727	0.0	1950	0.373	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	727	0	727	0.0	1950	0.373	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	0	326	326	0.0	533	0.613	100	18.3	LOS C	3.3	22.8	60	Turn Bay	0.0	0.0
Approach	0	1454	326	1780	0.0		0.613		3.4	NA	3.3	22.8				
South East: Mahoneys Road Dummy Leg																
Lane 1	0	0	52	52	0.0	175	0.294	100	31.0	LOS D	1.0	7.2	7	–	0.0	5.8
Approach	0	0	52	52	0.0		0.294		31.0	LOS D	1.0	7.2				
East: Hawthorn Road																
Lane 1	188	0	0	188	0.0	653	0.289	100	13.7	LOS B	1.2	8.1	700	–	0.0	0.0
Lane 2	0	0	52	52	0.0	326	0.158	100	19.0	LOS C	0.6	4.0	500	–	0.0	0.0
Approach	188	0	52	240	0.0		0.289		14.8	LOS B	1.2	8.1				
North: Blackburn Road																
Lane 1	146	0	0	146	0.0	1857	0.079	100	8.2	LOS A	0.0	0.0	28	Turn Bay	0.0	0.0
Lane 2	0	580	0	580	0.0	1950	0.297	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 3	0	580	0	580	0.0	1950	0.297	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	146	1160	0	1306	0.0		0.297		0.9	NA	0.0	0.0				
Intersection				3378	0.0		0.613		3.7	NA	3.3	22.8				

Mahoneys Road/ Burwood Highway

AM Peak





LANE SUMMARY

Site: Post Development AM Peak

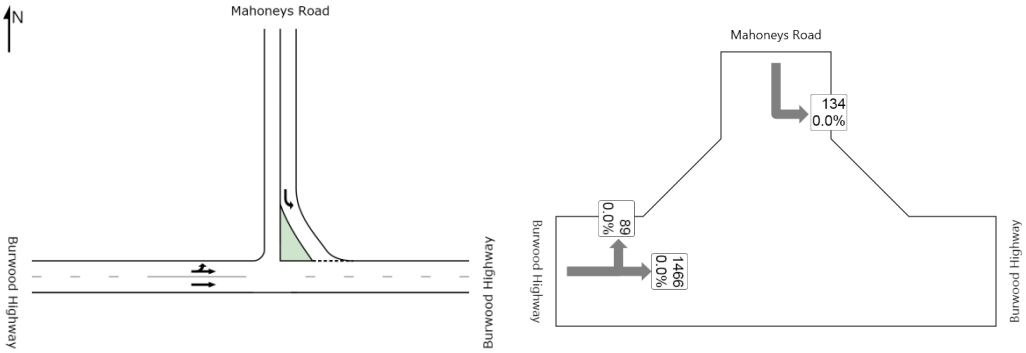
Burwood Highway/Mahoneys Road Intersection
Post Development AM Peak
Giveway / Yield (Two-Way)

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
North: Mahoneys Road																
Lane 1	269	0	0	269	0.0	309	0.873	100	42.9	LOS E	7.6	53.3	500	–	0.0	0.0
Approach	269	0	0	269	0.0		0.873		42.9	LOS E	7.6	53.3				
West: Burwood Highway																
Lane 1	92	508	0	600	0.0	1935	0.310	100	1.2	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	604	0	604	0.0	1950	0.310	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	92	1113	0	1204	0.0		0.310		0.6	NA	0.0	0.0				
Intersection				1474	0.0		0.873		8.4	NA	7.6	53.3				

Level of Service (LOS) Method: Delay (HCM 2000).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
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 lanes.
SIDRA Standard Delay Model used.

PM Peak



LANE SUMMARY

Site: Post Development PM Peak

Burwood Highway/Mahoneys Road Intersection
Post Development PM Peak
Giveway / Yield (Two-Way)

Lane Use and Performance

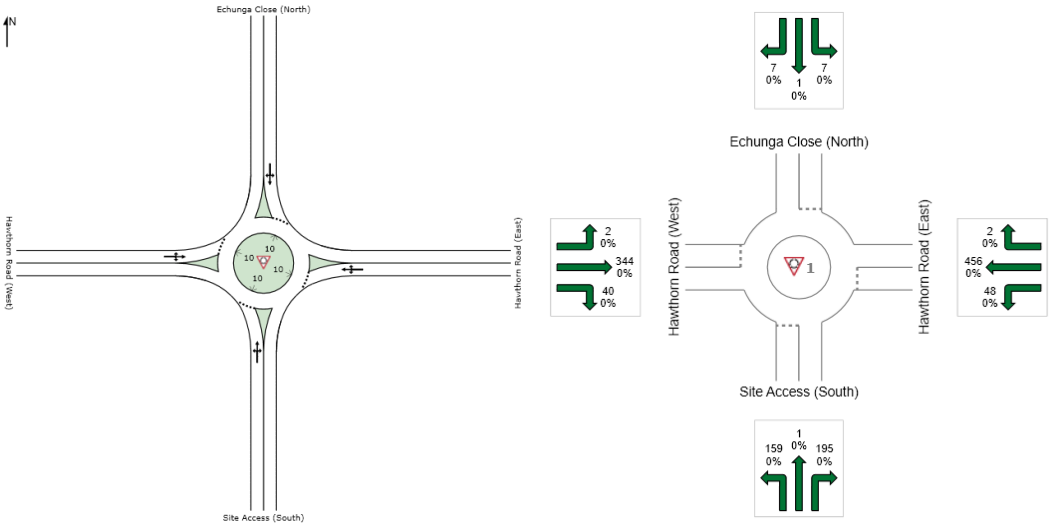
	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
North: Mahoneys Road																
Lane 1	141	0	0	141	0.0	189	0.748	100	43.4	LOS E	3.4	23.7	500	–	0.0	0.0
Approach	141	0	0	141	0.0		0.748		43.4	LOS E	3.4	23.7				
West: Burwood Highway																
Lane 1	94	722	0	816	0.0	1939	0.421	100	0.9	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	821	0	821	0.0	1950	0.421	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	94	1543	0	1637	0.0		0.421		0.5	NA	0.0	0.0				
Intersection				1778	0.0		0.748		3.9	NA	3.4	23.7				

Level of Service (LOS) Method: Delay (HCM 2000).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
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 lanes.
SIDRA Standard Delay Model used.

Appendix F

SIDRA Analysis: Post Development Hawthorn Road Site Access Point

AM Peak



LANE SUMMARY

Site: Hawthorn Road / Site Access / Echunga Close - AM Peak

Hawthorn Road / Site Access / Echunga Close - AM Peak
Roundabout

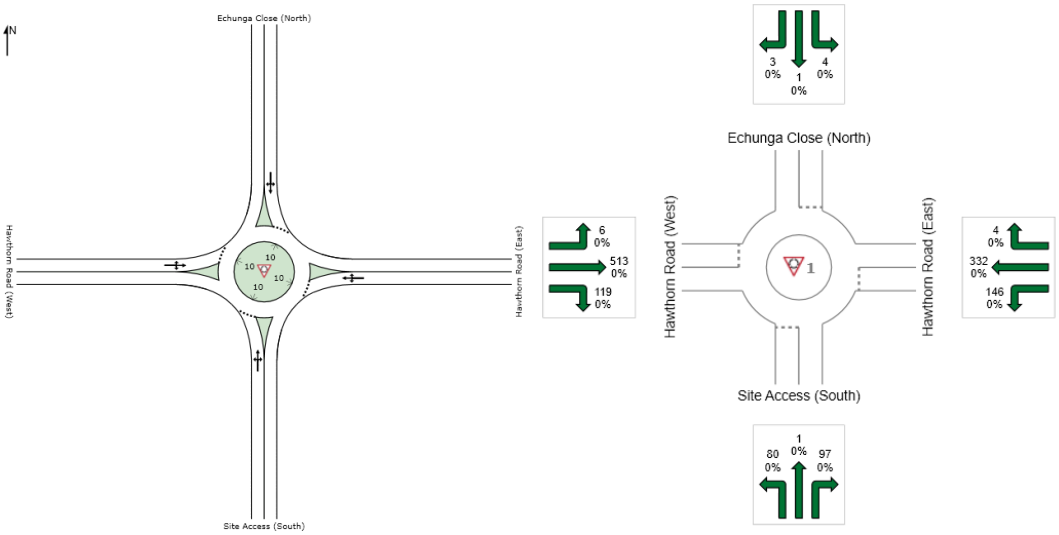
Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Site Access (South)													
Lane 1[d]	374	0.0	872	0.429	100	9.0	LOS A	2.8	19.7	Full	500	0.0	0.0
Approach	374	0.0		0.429		9.0	LOS A	2.8	19.7				
East: Hawthorn Road (East)													
Lane 1[d]	533	0.0	1433	0.372	100	3.9	LOS A	2.7	19.2	Full	500	0.0	0.0
Approach	533	0.0		0.372		3.9	LOS A	2.7	19.2				
North: Echunga Close (North)													
Lane 1[d]	16	0.0	773	0.020	100	8.4	LOS A	0.1	0.8	Full	500	0.0	0.0
Approach	16	0.0		0.020		8.4	LOS A	0.1	0.8				
West: Hawthorn Road (West)													
Lane 1[d]	406	0.0	1100	0.369	100	5.3	LOS A	2.6	18.4	Full	500	0.0	0.0
Approach	406	0.0		0.369		5.3	LOS A	2.6	18.4				
Intersection	1328	0.0		0.429		5.8	LOS A	2.8	19.7				

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

d Dominant lane on roundabout approach

PM Peak



LANE SUMMARY

Site: Hawthorn Road / Site Access / Echunga Close - PM Peak

Hawthorn Road / Site Access / Echunga Close - PM Peak
Roundabout

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Site Access (South)													
Lane 1[d]	187	0.0	953	0.197	100	7.5	LOS A	1.1	7.9	Full	500	0.0	0.0
Approach	187	0.0		0.197		7.5	LOS A	1.1	7.9				
East: Hawthorn Road (East)													
Lane 1[d]	507	0.0	1251	0.405	100	4.5	LOS A	2.9	20.6	Full	500	0.0	0.0
Approach	507	0.0		0.405		4.5	LOS A	2.9	20.6				
North: Echunga Close (North)													
Lane 1[d]	8	0.0	658	0.013	100	9.4	LOS A	0.1	0.5	Full	500	0.0	0.0
Approach	8	0.0		0.013		9.4	LOS A	0.1	0.5				
West: Hawthorn Road (West)													
Lane 1[d]	672	0.0	1310	0.513	100	5.0	LOS A	4.5	31.2	Full	500	0.0	0.0
Approach	672	0.0		0.513		5.0	LOS A	4.5	31.2				
Intersection	1375	0.0		0.513		5.2	LOS A	4.5	31.2				

Level of Service (LOS) Method: Delay (HCM 2000).
Roundabout LOS Method: Same as Signalised Intersections.
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
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.

d Dominant lane on roundabout approach

Appendix G

Internal road layout concept design and swept path assessments

PROPOSED DEVELOPMENT

HAWTHORN

HAWTHORN LINK ROAD

ROAD

ROAD

1A

MAGNOLIA DRIVE

1

2

TISANE AVENUE

PROPOSED LANEWAY

PROPOSED DEVELOPMENT
(HERITAGE)

AVENUE

BULKARA

2

PROPOSED DEVELOPMENT

FUTURE DEVELOPMENT

SPRINGVALE

SPRINGVALE ROAD

N

MAP REF 62/D5

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PRELIMINARY PLAN

FOR DISCUSSION PURPOSES
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WARNING

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APPROVED BY C. COATH	DATE ISSUED 30 JANUARY 2017

SCALE
A3

0 12.5 25 CUSTOM 1250

CAD FILE NO.
V103782-01-P1.dgn

PROPOSED DEVELOPMENT
104-168 HAWTHORN ROAD,
FOREST HILL
OVERALL LAYOUT PLAN

DRAWING NO. V103782-01-01 SHEET 01 OF 11 ISSUE P1

MAGNOLIA DRIVE

PROPOSED DEVELOPMENT

25.0 NO STOPPING

18.0 NO STOPPING

LANEWAY

PROPOSED

TISANE AVENUE

20.0 NO STOPPING

25.5 NO STOPPING

5.5

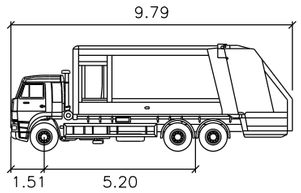
3.7

5.5

2.3

1.5

PROPOSED DEVELOPMENT
(HERITAGE)



9.8m JJ RICHARDS WASTE VEHICLE

meters

Width	: 2.49
Track	: 2.48
Lock to Lock Time	: 6.0
Steering Angle	: 32.7

SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 500mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 10km/h

N

MAP REF 62/D5

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APPROVED BY	C. COATH
DATE ISSUED	30 JANUARY 2017
SCALE	A3 — 0 5 10 — 1:500
CAD FILE NO.	V103782-01-P1.dgn

PROPOSED DEVELOPMENT
104-168 HAWTHORN ROAD,
FOREST HILL
LANEWAY SWEPT PATHS

DRAWING NO. V103782-01-02 SHEET 02 OF 11 ISSUE P1

PROPOSED DEVELOPMENT

MAGNOLIA DRIVE

NO STOPPING

3.7 5.5 2.3 1.5

NO STOPPING

HAWTHORN LINK DRIVE

1.5 1.7 2.3 3.5 3.5 2.3 1.7 2.5

NO STOPPING ALONG SITE FRONTAGE AS SHOWN

PROPOSED DEVELOPMENT

PROPOSED DEVELOPMENT (HERITAGE)

NO STOPPING

1.5 3.0 3.75 3.75 2.0 1.5

2.5 2.0

BULKARA AVENUE

2.5 2.0 7.5 3.0 1.5

NO STOPPING

PROPOSED DEVELOPMENT

N

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SCALE A3 0 5 10 1:500

CAD FILE NO. V103782-01-P1.dgn

PROPOSED DEVELOPMENT
104-168 HAWTHORN ROAD,
FOREST HILL
INTERNAL ROAD LAYOUT

DRAWING NO. V103782-01-03 SHEET 03 OF 11 ISSUE P1

PROPOSED DEVELOPMENT

NO STOPPING

MAGNOLIA DRIVE

NO STOPPING

HAWTHORN LINK DRIVE

PROPOSED DEVELOPMENT

NO STOPPING ALONG SITE FRONTAGE AS SHOWN

PROPOSED DEVELOPMENT
(HERITAGE)

NO STOPPING

AVENUE

BULKARA

NO STOPPING

PROPOSED DEVELOPMENT

N

MAP REF 62/D5

5.20

0.95 3.05

B99 6.3mR metres

Width	: 1.94
Track	: 1.77
Lock to Lock Time	: 6.0
Steering Angle	: 34.0

9.79

1.51 5.20

9.8m JJ RICHARDS WASTE VEHICLE

meters

Width	: 2.49
Track	: 2.48
Lock to Lock Time	: 6.0
Steering Angle	: 32.7

SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 500mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 10-25km/h (VARIES)

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SCALE A3 0 5 10 1:500

CAD FILE NO. V103782-01-P1.dgn

PROPOSED DEVELOPMENT
104-168 HAWTHORN ROAD,
FOREST HILL
INTERNAL ROAD LAYOUT SWEPT PATHS

DRAWING NO. V103782-01-04 SHEET 04 OF 11 ISSUE P1

PROPOSED DEVELOPMENT

NO STOPPING

MAGNOLIA DRIVE

NO STOPPING

HAWTHORN LINK DRIVE

PROPOSED DEVELOPMENT

NO STOPPING ALONG SITE FRONTAGE AS SHOWN

PROPOSED DEVELOPMENT
(HERITAGE)

NO STOPPING

AVENUE

BULKARA

NO STOPPING

PROPOSED DEVELOPMENT

N

MAP REF 62/D5

5.20

0.95 3.05

B99 6.3mR metres

Width	: 1.94
Track	: 1.77
Lock to Lock Time	: 6.0
Steering Angle	: 34.0

9.79

1.51 5.20

9.8m JJ RICHARDS WASTE VEHICLE

meters

Width	: 2.49
Track	: 2.48
Lock to Lock Time	: 6.0
Steering Angle	: 32.7

SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 500mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 10-25km/h (VARIES)

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SCALE A3 0 5 10 1:500

CAD FILE NO. V103782-01-P1.dgn

PROPOSED DEVELOPMENT
104-168 HAWTHORN ROAD,
FOREST HILL
INTERNAL ROAD LAYOUT SWEPT PATHS

DRAWING NO. V103782-01-05 SHEET 05 OF 11 ISSUE P1

PROPOSED DEVELOPMENT
(HERITAGE)

AVENUE

BULKARA

PROPOSED
PARKLAND

NO STOPPING

NO STOPPING

NO STOPPING

PROPOSED DEVELOPMENT

BULKARA

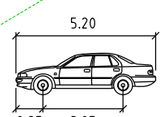
AVENUE

FU

SWEPT PATH KEY

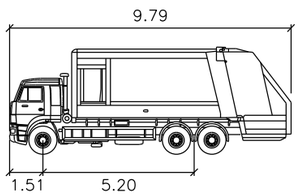
- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 500mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 10-25km/h (VARIES)



B99 6.3mR metres

Width	: 1.94
Track	: 1.77
Lock to Lock Time	: 6.0
Steering Angle	: 34.0



9.8m JJ RICHARDS WASTE VEHICLE

meters

Width	: 2.49
Track	: 2.48
Lock to Lock Time	: 6.0
Steering Angle	: 32.7

N

MAP REF 62/D5

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SCALE A3 0 5 10 1:500

CAD FILE NO. V103782-01-P1.dgn

PROPOSED DEVELOPMENT
104-168 HAWTHORN ROAD,
FOREST HILL
BULKARA AVENUE SWEPT PATHS

DRAWING NO. V103782-01-06 SHEET 06 OF 11 ISSUE P1

RESIDENTIAL

HAWTHORN

ECHUNGA CLOSE

RESIDENTIAL

ROAD

PROPOSED DEVELOPMENT

HAWTHORN LINK DRIVE

PROPOSED DEVELOPMENT

N

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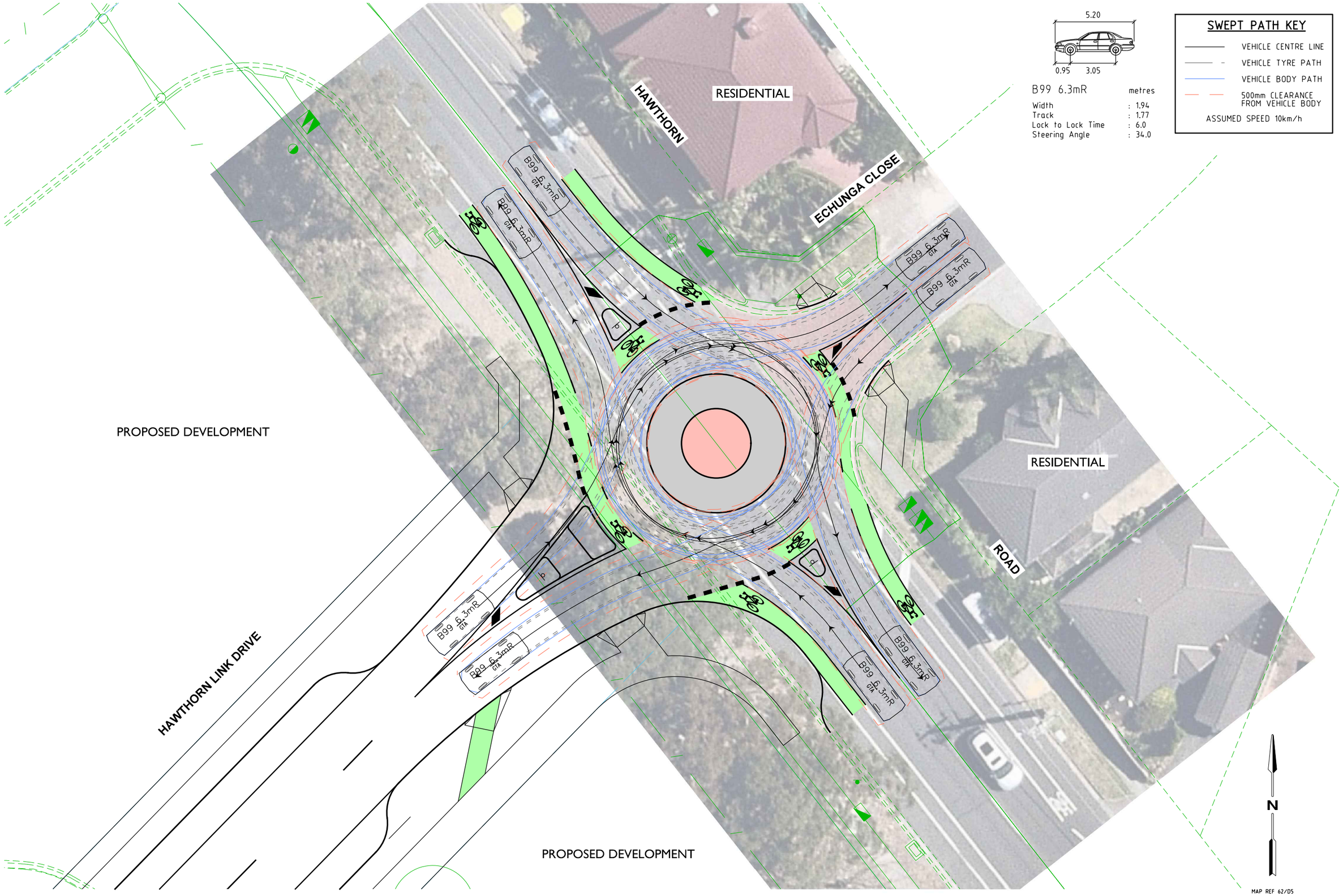
SCALE A3 0 2.5 5 1:250

CAD FILE NO. V103782-01-P1.dgn

PROPOSED DEVELOPMENT
104-168 HAWTHORN ROAD,
FOREST HILL
HAWTHORN ROAD ROUNDABOUT CONCEPT DESIGN

DRAWING NO. V103782-01-07 SHEET 07 OF 11 ISSUE P1



5.20

0.95 3.05

B99 6.3mR

	metres
Width	: 1.94
Track	: 1.77
Lock to Lock Time	: 6.0
Steering Angle	: 34.0

SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 500mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 10km/h

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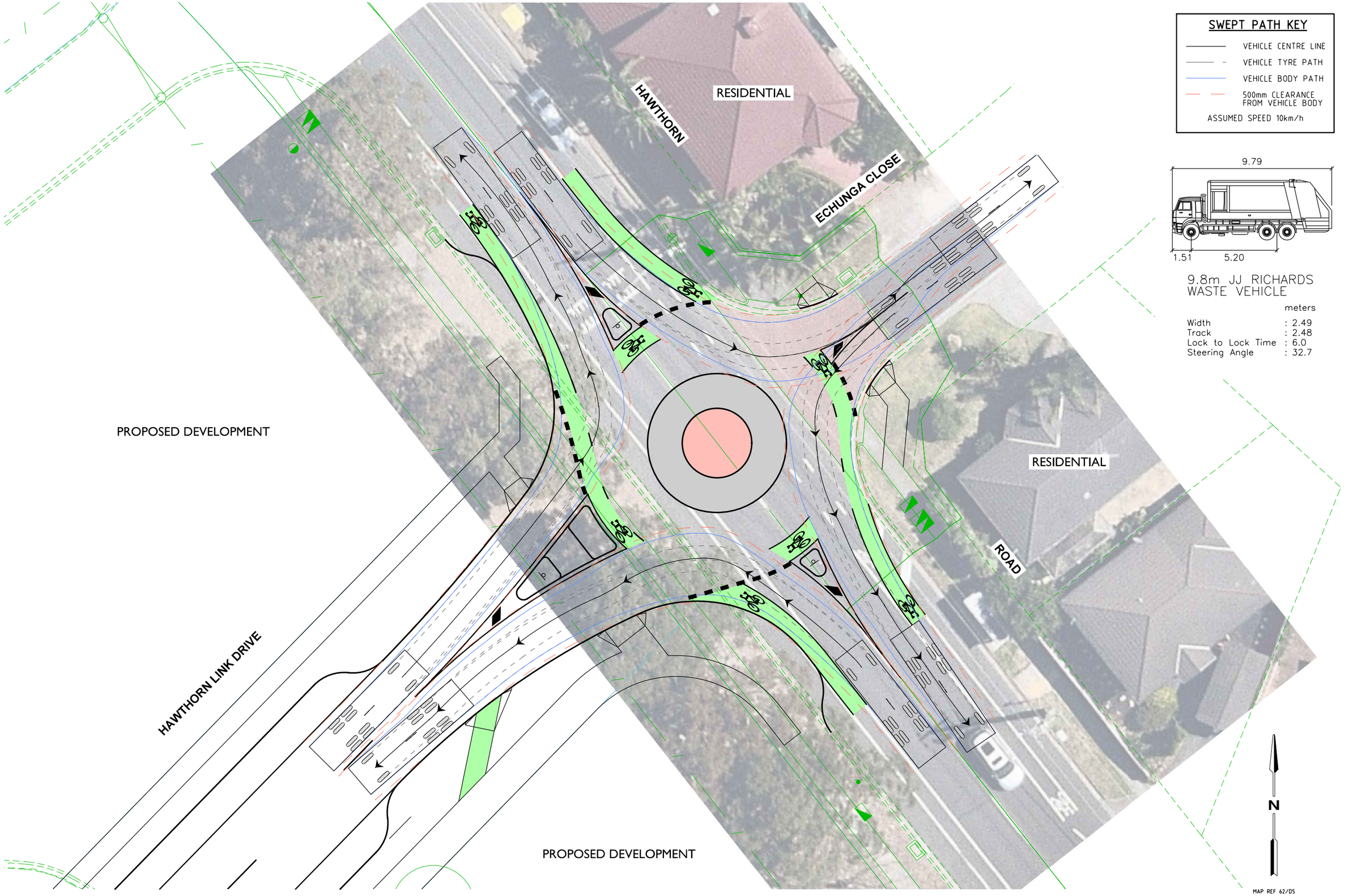
APPROVED BY	C. COATH
DATE ISSUED	30 JANUARY 2017
SCALE	A3 — 0 2.5 5 — 1:250
CAD FILE NO.	V103782-01-P1.dgn

PROPOSED DEVELOPMENT
104-168 HAWTHORN ROAD,
FOREST HILL
ROUNDABOUT CONCEPT DESIGN - SWEPT PATHS

DRAWING NO. V103782-01-08 SHEET 08 OF 11 ISSUE P1



SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 500mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 10km/h

9.8m JJ RICHARDS WASTE VEHICLE

	meters
Width	: 2.49
Track	: 2.48
Lock to Lock Time	: 6.0
Steering Angle	: 32.7

PLOTTED BY : Tom.Napiorkowski ON 30/01/2017 AT 1:20:25 PM

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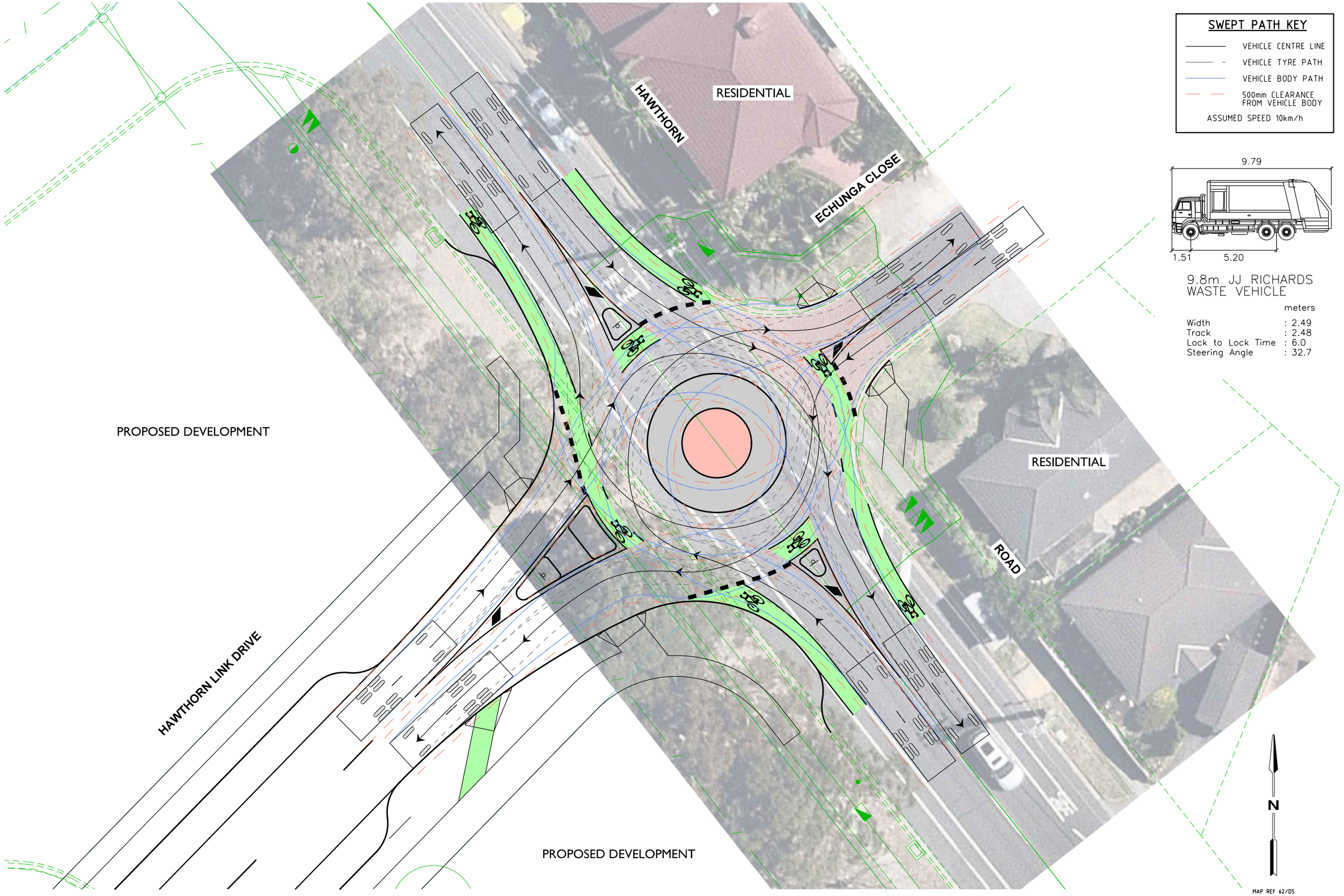
DESIGNED T. NAPIORKOWSKI	DESIGN CHECK A. DELL'ISOLA
APPROVED BY C. COATH	DATE ISSUED 30 JANUARY 2017

SCALE A3 0 2.5 5 1:250

CAD FILE NO. V103782-01-P1.dgn

PROPOSED DEVELOPMENT
104-168 HAWTHORN ROAD,
FOREST HILL
ROUNDABOUT CONCEPT DESIGN - SWEPT PATHS

DRAWING NO. V103782-01-09 SHEET 09 OF 11 ISSUE P1



SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 500mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 10km/h

9.8m JJ RICHARDS WASTE VEHICLE

	meters
Width	: 2.49
Track	: 2.48
Lock to Lock Time	: 6.0
Steering Angle	: 32.7

PLOTTED BY : Tom.Napiorkowski ON 30/01/2017 AT 1:20:26 PM

nearmap.com

PRELIMINARY PLAN
FOR DISCUSSION PURPOSES ONLY SUBJECT TO CHANGE WITHOUT NOTIFICATION

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

DESIGNED T. NAPIORKOWSKI	DESIGN CHECK A. DELL'ISOLA
APPROVED BY C. COATH	DATE ISSUED 30 JANUARY 2017

SCALE A3 0 2.5 5 1:250

CAD FILE NO. V103782-01-P1.dgn

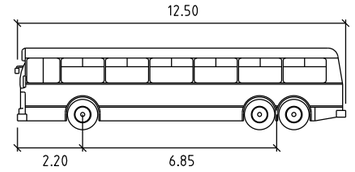
PROPOSED DEVELOPMENT
104-168 HAWTHORN ROAD,
FOREST HILL
ROUNDABOUT CONCEPT DESIGN - SWEPT PATHS

DRAWING NO. V103782-01-10 SHEET 10 OF 11 ISSUE P1

SWEPT PATH KEY

- VEHICLE CENTRE LINE
- VEHICLE TYRE PATH
- VEHICLE BODY PATH
- 500mm CLEARANCE FROM VEHICLE BODY

ASSUMED SPEED 25km/h



BUS	metres
Width	: 2.50
Track	: 2.50
Lock to Lock Time	: 6.0
Steering Angle	: 36.6

HAWTHORN

RESIDENTIAL

ECHUNGA CLOSE

BUS AUSTROADS 2013 (AU)

BUS AUSTROADS 2013 (AU)

PROPOSED DEVELOPMENT

RESIDENTIAL

ROAD

HAWTHORN LINK DRIVE

PROPOSED DEVELOPMENT

N

MAP REF 62/D5

PLOTTED BY : Tom.Napiorkowski ON 30/01/2017 AT 1:20:27 PM

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PRELIMINARY PLAN
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SCALE A3 0 2.5 5 1:250

CAD FILE NO. V103782-01-P1.dgn

PROPOSED DEVELOPMENT
104-168 HAWTHORN ROAD,
FOREST HILL
ROUNDABOUT CONCEPT DESIGN - SWEPT PATHS

DRAWING NO. V103782-01-11 SHEET 11 OF 11 ISSUE P1

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