TraffixGroup

Traffic Engineers and Transport Planners

Traffic Engineering Assessment

Estate Development Plan
at
Gungahlin Town Centre East Estate

Prepared For

Indesco Pty Ltd

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Table of Contents

1 Introduction 1
1.1 Site Location 1
2 Existing Conditions 2
2.1 Road Hierarchy 2
2.2 Surrounding Road Network 4
2.3 Road Capacity 5
2.4 Public Transport 6
2.5 Accident Records 7
3 Proposed Development 8
3.1 Development 8
3.2 Land Use 9
3.3 Road Network 10
3.4 Access 11
3.5 Heavy Vehicle Access 11
3.6 Parking 13
3.7 Walking and Cycling 14
3.8 Public Transport 15
4 Traffic Generation and Distribution 16
4.1 Road Capacity 18
5 Impacts 19
5.1 Proposed Road Hierarchy 19
5.2 Intersection Vehicle and Pedestrian Performance 19
5.2.1 Intersection Analysis 19
5.3 Other Intersections 22
5.3.1 The Valley Avenue / Gozzard Street 22
5.3.2 Hibberson Street / Hinder Street 22
5.3.3 Anthony Rolfe Avenue / Hinder Street 22
5.3.4 Efkarpidis Street / Hinder Street 22
5.3.5 Anthony Rolfe Avenue / Manning Clark Crescent 22
6 Conclusions 23

List of Figures

Figure 1: Site Location 2
Figure 2: Gungahlin Precinct Code - Road Hierarchy Map 3

Figure 3: Gungahlin ACTION Bus Routes 6
Figure 4: GTC East 5 Year Crash Location and Frequency 8
Figure 5: Proposed Development 10
Figure 6: Proposed Road Network 11
Figure 7: Gungahlin Precinct Code – Heavy Vehicle Routes 12
Figure 8: Proposed Shared Path Network 14
Figure 9: Proposed Public Transport and Off Road Movement Plan 15
Figure 10: 2031 AM Two Hour Peak Zenith Model Output 16
Figure 11: 2031 AM Peak Zenith Output 17
Figure 12: Proposed Road Hierarchy Plan 19
Figure 13: Proposed Intersection Configuration 21

List of Tables

Table 1: Street Hierarchy for New Estates in Residential Zones and CZ5 3
Table 2: Street Hierarchy for New Estates in Commercial zones (excluding CZ5) 3
Table 3: Characteristics of Surrounding Road Network 4
Table 4: Calculated Road Capacities 5
Table 5: Utilisation of Existing Capacity 5
Table 6: Gungahlin ACTION Bus Routes 6
Table 7: Gungahlin Crash Statistics 7
Table 8: Gungahlin Town Centre East Development 8
Table 9: Street Hierarchy for Estates in Residential Zones and CZ5 13
Table 10: Daily Traffic Volume Comparison 17
Table 11: Adopted Daily Traffic Volumes 18
Table 12: Calculated Road Capacities for Proposed and Existing Roads 18
Table 13: Level of Service Criteria for Intersections 20
Table 14: Post Development Intersection Performance 21

List of Appendices

Appendix A: Post-Development SIDRA Results

1 Introduction

Traffix Group has been engaged by Indesco to undertake a traffic study for the Estate Development Plan (EDP) for Gungahlin Town Centre ('GTC') East Estate. The proposed development consists of 220,021m^2 of office space, 31,425m^2 for retail space, 48,610m^2 for other land uses and 1,070 residential units.

This report has been primarily based on a previous report entitled 'Gungahlin Town Centre East – EDP Traffic Report' by Indesco that was completed in June, 2015.

This report provides a detailed traffic engineering assessment of the generation and distribution of traffic and investigations into key intersections and their performance.

This traffic study has been based on the following information and guidelines:

- Proposed development prepared by Indesco,
- Traffic generation as per the Zenith model (2031) as developed for Capital Metro by Arup,
- RMS Technical Direction 2013/14 (May 2013),
- Road hierarchy classification based on the ACT Planning and Land Authority (ACTPLA) *Estate Development Code* (October 2013), and
- ACT Planning and Land Authority (ACTPLA) *Estate Development Code* (October 2014).

The purpose of this report is to provide an appreciation of the future development of GTC East and the resulting traffic impacts.

1.1 Site Location

Gungahlin Town Centre (GTC) East is located approximately 13km to the north of Canberra CBD and is within the suburb of Gungahlin. It is surrounded by the suburbs of Ngunnawal, Palmerston, Franklin, Harrison, Throsby, Forde and Amaroo.

The site comprises Sections 11, 28 29, 229, 230, 231, 233, 235 and 246 Gungahlin. It is the eastern portion of the Gungahlin Town Centre. Kate Crace Street forms the western boundary, Anthony Rolfe Avenue the northern boundary, Manning Clark Crescent and Hamer Street the eastern boundary and the Mulanggari Grasslands Nature Reserve the southern boundary.

Also included in the site is a small area of land bounded by The Valley Avenue, Gozzard Street and the Mullangarri Nature Reserve to the west of Kate Crace Street and the area bounded by Hinder Street, Hibberson Street, Kate Crace Street and Anthony Rolfe Avenue. To the west of Kate Crace Street is the existing Town Centre and east of the site are the existing suburbs of Franklin and Gungahlin. The estate is shown in Figure 1 below.

GTC East has a total land area of approximately 38 hectares. The land to the north of GTC East contains existing residential development, existing and future Commercial and Mixed Use. The land to the east consists of recently completed residential land within the Gungahlin and Franklin suburbs. The land to the west of the site contains existing and future commercial development with the land to the west of the 'western' leg of the site containing existing residential development.

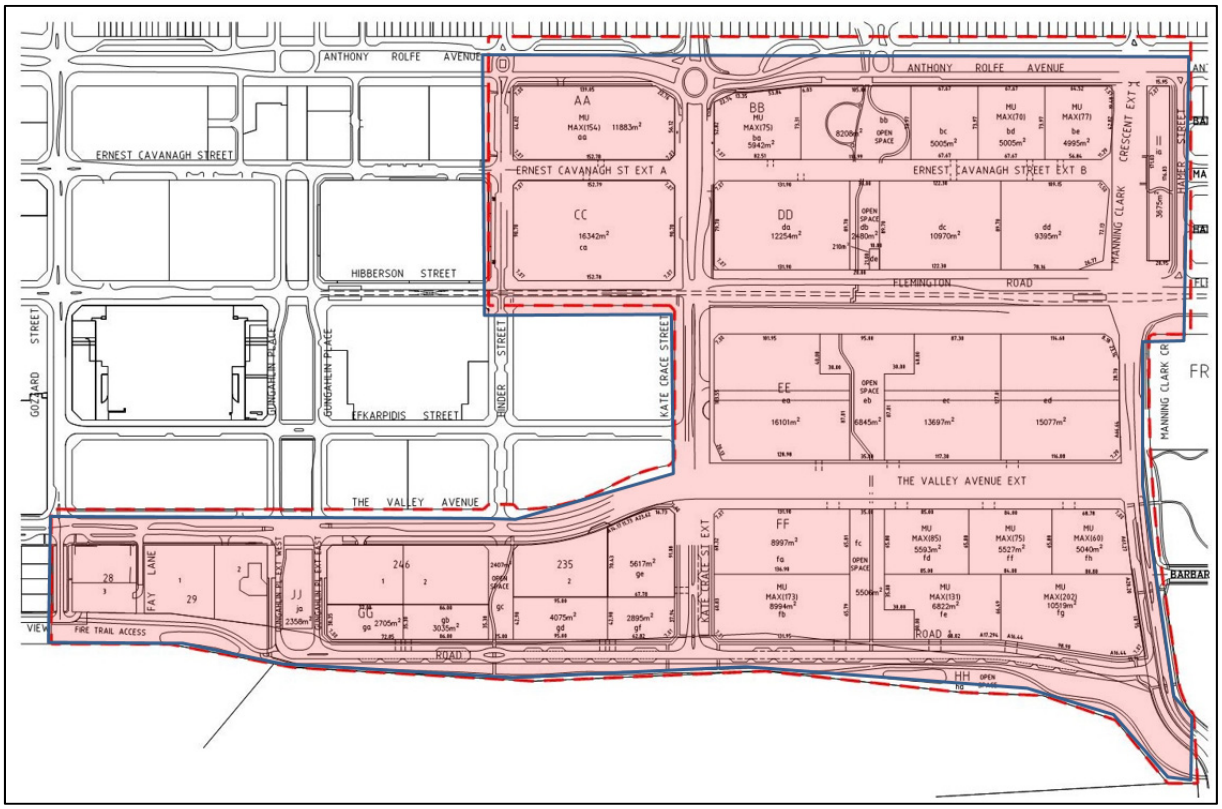


Figure 1: Site Location

2 Existing Conditions

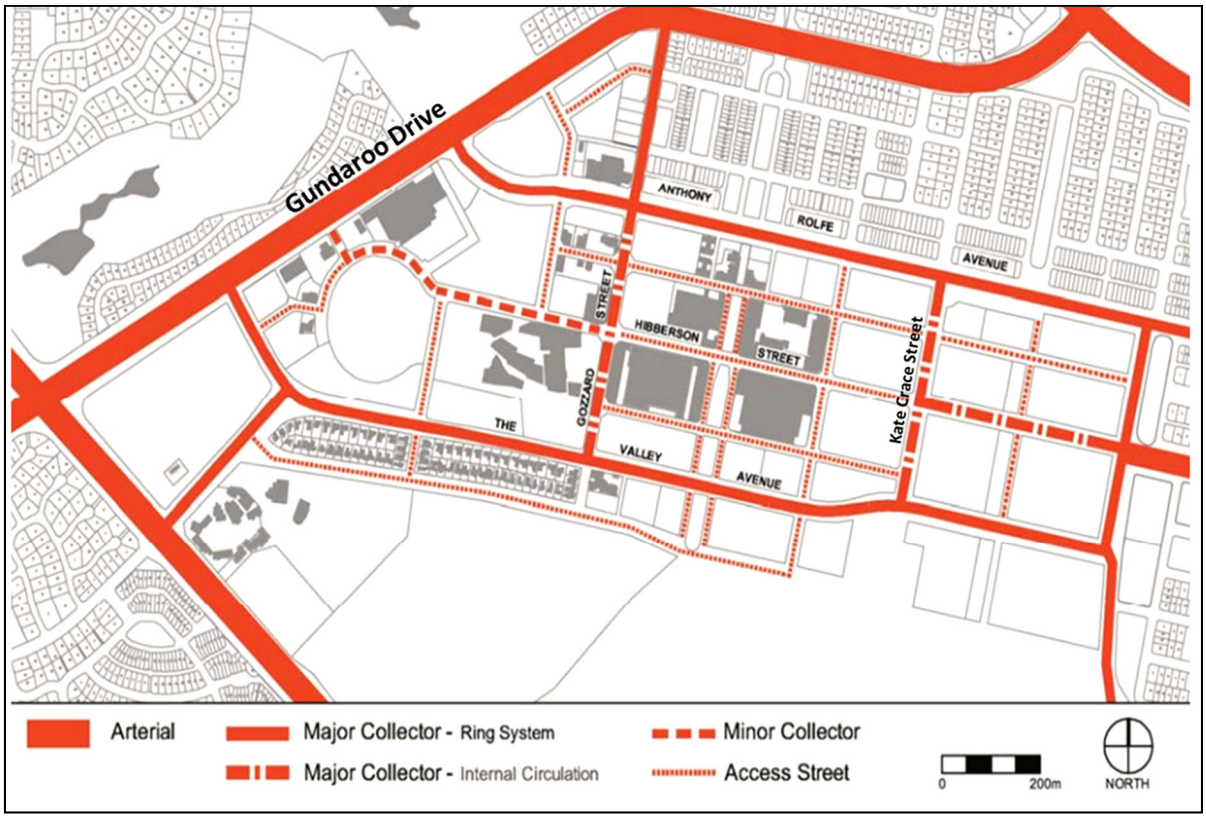
2.1 Road Hierarchy

The street hierarchy for the GTC has been established within the Gungahlin Precinct Code, as shown below in Figure 2. The road system is based on a 'ring' arrangement to divert through traffic around the Town Centre.

The function of each road classification is broadly defined in the Estate Development Code.

Access Streets have been defined as streets where the speed and traffic volumes are low and also where pedestrian and cycle movements are facilitated. Access Streets A and B are distinguished on the basis of traffic volumes. Within the Gungahlin Town Centre (GTC), traffic volumes are higher than in residential areas and all access streets will be Access Street B.

Collector Roads have higher traffic volumes and a greater emphasis on distributing through traffic from access streets to the arterial road network. Major and minor collector roads are distinguished on the basis of traffic volumes. Within the GTC East all collector roads have been designed as Major Collectors (refer to Figure 2).



Source: Gungahlin Precinct Code

Figure 2: Gungahlin Precinct Code - Road Hierarchy Map

For new estates, the road hierarchy is established from calculated traffic volumes within the Estate Development Code, as summarised in Table 1 and Table 2 below. For existing roads, the road hierarchy is primarily based on the function that they perform rather than on the existing traffic volumes. Furthermore, road classification is not a direction indicator of road capacity. The capacity of roads is determined using Austroads Guidelines, as described later in the report.

Table 1: Street Hierarchy for New Estates in Residential Zones and CZ5

Street Type and Function	Type	Design Speed (km/h)	Traffic Volume (vpd)
Access Streets	Access Street A	60	0 – 300
	Access Street B	60	301 – 1000
Collector Roads	Minor Collector	60	1001 – 3000
	Major Collector	70	3001 – 6000

Table 2: Street Hierarchy for New Estates in Commercial zones (excluding CZ5)

Street Type and Function	Type	Design Speed (km/h)	Traffic Volume (vpd)
Access Streets	Access Street	60	0 – 1000
Collector Road	Minor Collector	60	1001 – 3000
	Major Collector	70	3001 – 6000

2.2 Surrounding Road Network

Automatic tube count data was provided by TAMS which consisted of traffic volumes, average and 85 percentile speeds and speed limits, refer to Table 3.

Table 3: Characteristics of Surrounding Road Network

Street	Characteristics
The Valley Avenue	The Valley Avenue is a two-way two lane major collector road. The posted speed limit is 60 km/h. The observed 85% speeds were 62.6 km/h westbound and 66.2 km/h eastbound. Traffic surveys undertaken in 2013 showed weekday average traffic volumes of 4,026 vpd and 3,600 vpd for the westbound and eastbound directions. On street parking is not allowed for this street.
Hibberson Street	Hibberson Street is a two-way two lane access street. The posted speed limit for this road is 40 km/h. The observed 85% speeds were 35.6 km/h for both westbound and eastbound. Traffic surveys undertaken in 2011 showed weekday average traffic volumes of 4,401 westbound and 3,399 eastbound. On street parking spaces are available on this street.
Anthony Rolfe Avenue	Anthony Rolfe Avenue is a two-way two lane divided major collector road. The posted speed limit for this road is 60 km/h. Traffic surveys undertaken in 2013 demonstrated weekday average traffic volumes of 2,237 vpd westbound and 3,010 vpd eastbound. Parking bays are provided for in the service roads feeding into this street.
Kate Crace Street	Kate Crace Street is a two-way two lane major collector road. The posted speed limit for this road is 50 km/h. The observed 85% speeds were 50.2 km/h westbound and 55.6 km/h eastbound. Traffic surveys undertaken in 2013 demonstrated weekday average traffic volumes of 2,862 and 2,312. On street parking is allowed for this street.
Hinder Street	Hinder Street is a two-way two lane access street. The posted speed limit for this street is 40 km/h. The observed 85% speeds were 34.8 km/h for the northbound and 31.6 km/h for the southbound direction. Traffic surveys undertaken in 2011 showed weekday average traffic volumes of 2,153 and 1,530. There are on-street parking spaces available on this street.
Gungahlin Place	Gungahlin Place is composed of two one-way single lane access streets. The posted speed limit for this street is 40 km/h. The observed 85% speeds were 50.6 km/h for the northbound and 31.6 km/h for the southbound direction. Traffic surveys undertaken in 2011 showed weekday average traffic volumes of 1,883 and 1,261. There are on-street parking spaces available on this street.
Efkarpidis Street	Efkarpidis Street is a two lane two way local access street. The posted speed limit for this street is 40 km/h. The observed 85% speeds were 49.8 km/h for the westbound direction and 49.2 km/h for the eastbound direction. Traffic surveys undertaken in 2011 showed weekday average traffic

Street	Characteristics
	volumes of 1,527 westbound and 854 eastbound. There are on-street parking spaces available on this street.
Flemington Road	Flemington Road is an arterial road with posted speed limit of 70 km/h. There are on-street parking spaces available on the service roads feeding into Flemington Road.
Manning Clark Crescent (section between Flemington Road and Mulangarri Grasslands)	Manning Clark Crescent is a major collector road with posted speed limit of 60 km/h. On street parking in indented bays is available on this road.

2.3 Road Capacity

In several cases, the traffic volumes observed on the surrounding road network exceed the maximum volumes provided within the Estate Development Code for each road classification. While the function of the existing roads is established by the road hierarchy, the capacity of each road has been calculated separately based on Austroads Guide to Traffic Engineering Practice: Roadway Capacity and Table 15 Link Properties from Environment and Sustainable Development Directorate's (ESDD) Strategic Model Calibration Report 2014, refer to Table 4. The capacity and existing traffic volumes have been tabulated in Table 5.

This demonstrates that the existing road network within the Gungahlin Town Centre is operating below capacity.

Table 4: Calculated Road Capacities

Road	Speed (km/h)	Hourly Capacity per Lane (vph)	Daily Capacity per Lane (vpd)
The Valley Avenue	60	700	7,000
Kate Crace Road	50	600	6,000
Efkarpidis Street	40	500	5,000
Hinder Street	40	500	5,000

Table 5: Utilisation of Existing Capacity

Road	Two Way Daily Capacity (vpd)	Existing Volume (vpd)	Utilisation of Capacity (%)
The Valley Avenue	14,000	7,626	54%
Kate Crace Road	12,000	5,174	43%
Efkarpidis Street	10,000	2,381	24%
Hinder Street	10,000	3,683	37%

2.4 Public Transport

The site is well serviced by ACTION buses with the following routes traversing the study area enumerated in Table 6 and shown in Figure 3.

Table 6: Gungahlin ACTION Bus Routes

Route	Route Description
200	Red Rapid 200 travels between Gungahlin and Fyshwick via the City | Russell | Barton and Kingston. Buses depart every 10 minutes between 7am and 8:30am and every 15 minutes between 8:30am and 7pm weekdays
259 / 255	Gungahlin to Kingston Railway Station
252 / 251	Kingston Railway Station to Belconnen
59	Amaro to Gungahlin Marketplace
57	City | Northbourne Avenue | Flemington Road | Franklin | Gungahlin Marketplace
56	Gungahlin Marketplace | Palmerston | Mitchell | City
55	Gungahlin Marketplace | Forde | Bonner
54	Gungahlin | Crace | Belconnen
52	Belconnen | Federation Square | Ngunnawal | Gungahlin Marketplace

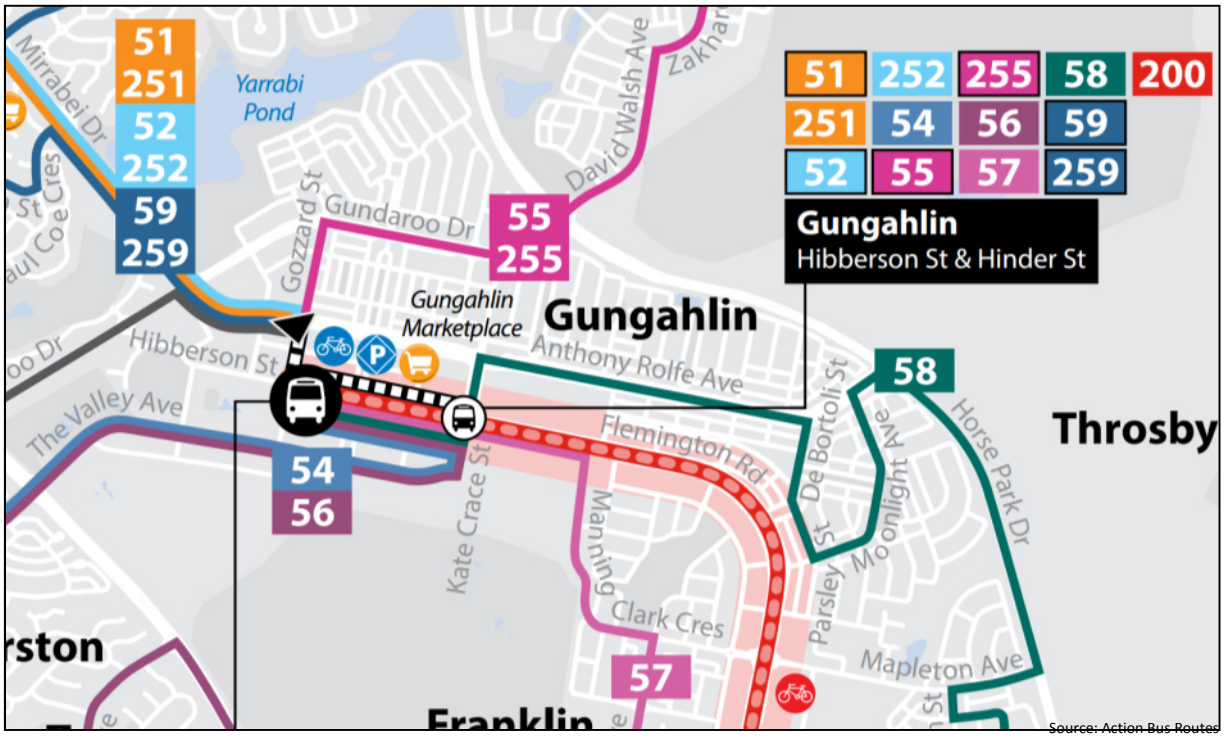


Figure 3: Gungahlin ACTION Bus Routes

2.5 Accident Records

Crash history reports were obtained from Roads ACT for a five year period (2009 – 2014) for Kate Crace Street, The Valley Avenue, Anthony Rolfe Avenue, Hibberson Street, Efkarpidis Street, Manning Clark Crescent and Hinder Street with the summarised results in Table 7 and Figure 4.

Table 7: Gungahlin Crash Statistics

Road	Detail
Gungahlin Place	• 74 crashes involving 147 vehicles • Two crashes needed medical attention
Flemington Road	• 45 crashes involving 83 vehicles. • 7 crashes needed medical attention
The Valley Avenue	• 7 crashes involving 13 vehicles
Anthony Rolfe Avenue	• 94 crashes involving 183 vehicles • 10 crashes needed medical attention
Kate Crace Street	• 50 crashes involving 93 vehicles • 5 crashes needed medical attention
Hibberson Street	• 102 crashes involving 202 vehicles • 12 crashes needed medical attention
Efkarpidis Street	• 59 crashes involving 20 vehicles. • 9 crashes needed medical attention
Manning Clark Crescent	• 8 crashes involving 14 vehicles • One crash needed medical attention and one crash victim was admitted to hospital
Hinder Street	• 144 crashes involving 294 vehicles • 18 crashes needed medical attention

An analysis of the crash data is provided below:

- The most common crash category was crash type 101 (cross traffic or through and through crashes with vehicles from adjacent direction in an intersection) rear end type which accounted for 54% of all crashes.
- 65 crashes resulted in injuries requiring medical treatment (no fatalities).
- More than 70% of the crashes occurred during fine weather conditions.

It is noted that there are high accident rates at intersections on Hibberson Street and Hinder Street within GTC East. Whilst these existing conditions are outside the scope of the Gungahlin Town Centre East EDP, it is also noted that the introduction of light rail and associated closure of Hibberson Street

from Kate Crace Street to Gungahlin Place should significantly alleviate this issue. For further discussion on the proposed road network, refer to Section 3.

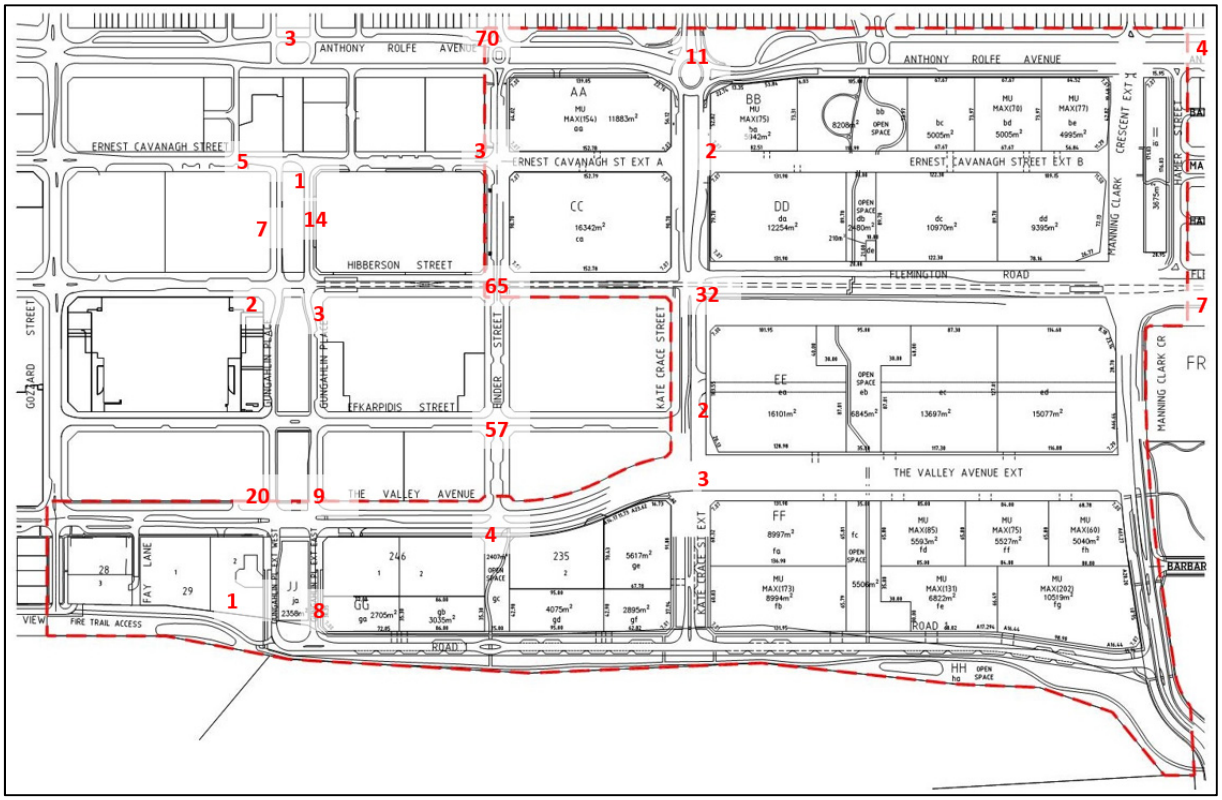


Figure 4: GTC East 5 Year Crash Location and Frequency

3 Proposed Development

3.1 Development

Gungahlin Town Centre East is zoned for CF Community Facilities, CZ1 and CZ2 Business Zones and CZ5 Mixed Use zone. The development is made up of 213,077m^2 for office space, 22,110m^2 for retail space, residential space (1,282 dwellings) and 39,136m^2 for other land uses. Table 8 shows a breakdown of the developments that are proposed in the GTC East EDP in more detail.

Table 8: Gungahlin Town Centre East Development

Block	Area (m^2)	Development Type			
		Office (m^2)	Retail (m^2)	Other (m^2)	Dwellings
aa	11,883	9,820	500		122
ba	5,942	4500	500		70
bc	5,005	6,600	3,300	3,300	
bd	5,005	2,000	2,200		70
be	4,996	2,000	2,200		77
ca	16,342	15,200	7,600	7,600	

Block	Area (m^2)	Development Type			
		Office (m^2)	Retail (m^2)	Other (m^2)	Dwellings
da	12,254	32,650	600		
dc	10,970	28,900	510		
dd	9,395	30,720	560		
ea	16,101	22,540	500		
ec	13,697	17,360	420	5,920	
ed	15,077	17,360	420	5,920	
fa	8,997	6,600	3,300	3,300	
fb	8,994	3,300		2,970	173
fd	5,593	2,100			85
fe	6,822	2,552			131
ff	5,527	2,070			75
fg	10,519	3,944			202
fh	5,040	1,890			60
ga	2,705	1,350	1,350	2,700	
gb	3,035	1,565	1,565	3,000	
gd	4,075	2,000	2,000	4,000	
ge	5,617	2,000	2,500	6,700	
gf	2,895	1,000	1,400	3,200	
bb	8,208				
db	2,481				
eb	6,845				
fc	5,506				
gc	2,407				
ha	24,889				
ia	3,675				
ja	2,358				
Total	**252,822**	**220,021**	**31,425**	**48,610**	**1,065**

3.2 Land Use

The proposed zoning of GTC East has been illustrated in Figure 5 and in EDP Drawing UD-LUP-13 'Land Use Plan'. Areas south of the Valley Avenue will be zoned Mixed Use while areas fronting the Flemington Road section between Manning Clark Crescent and Kate Crace Street will be Business Zones. Areas adjoing the Ernest Cavanagh Street section from Hinder Street to Manning Clark Crescent will either be Core, Business, Mixed Use and Community Facility Zones. GTC East will also

provide a north to south pedestrian linkage via an open space spine from Anthony Rolfe Avenue to Road 1. This will be located on the eastern side of GTC East.

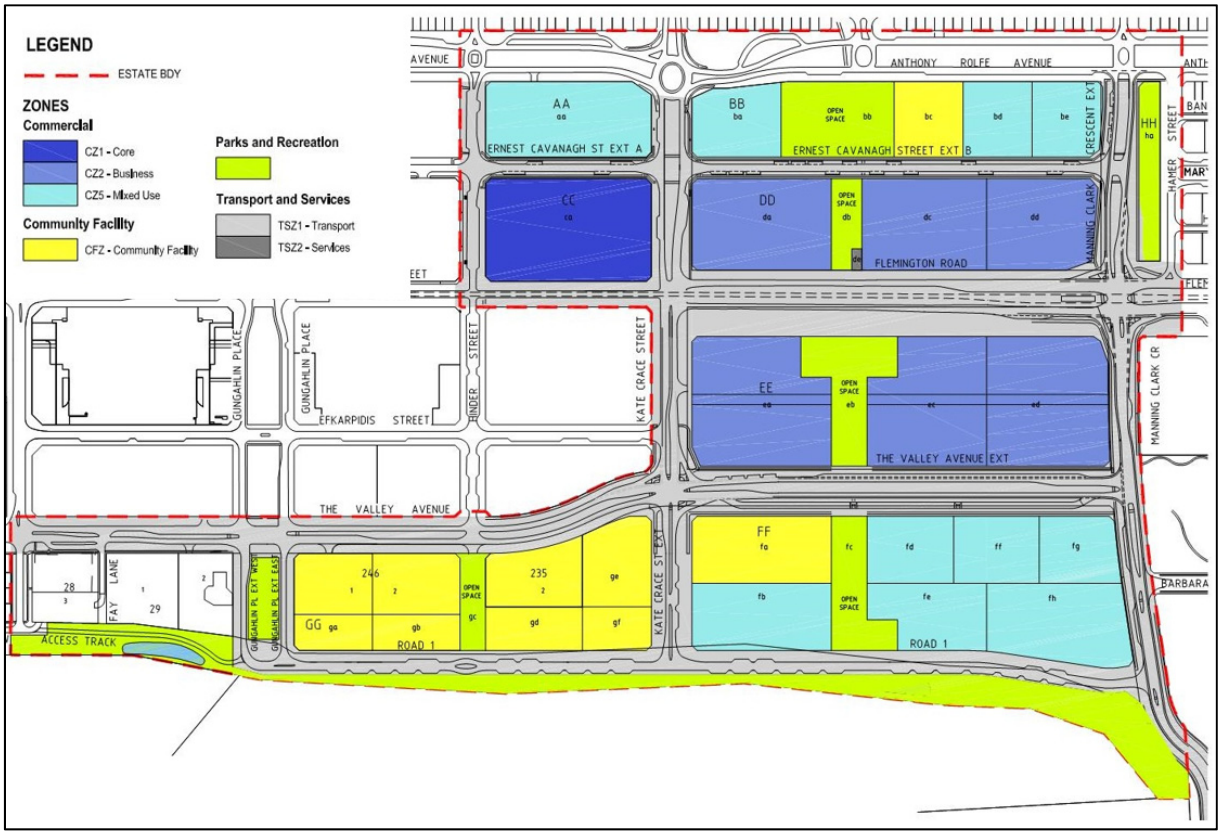


Figure 5: Proposed Development

3.3 Road Network

The GTC East EDP proposes a new southern road, "Road 1" and the extension of Kate Crace Street, Gungahlin Place and Ernest Cavanagh Street. The proposed road network is shown in Figure 6.

The Valley Avenue and Manning Clark Crescent are also proposed to be extended; however, this will form part of a separate Development Application being undertake as a Capital Works Project.

The Capital Metro Authority (CMA) propose to close Hibberson Street to vehicles between Gungahlin Place and Kate Crace Street with the introduction of light rail. CMA also propose to signalise the Hibberson Street intersections with Hinder Street and Kate Crace Street.

Figure 6: Proposed Road Network

3.4 Access

An analysis of future traffic flows and transport arrangements in GTC East (no direct vehicle access to Flemington Road and Anthony Rolfe Avenue) resulted in the following access recommendations:

- Blocks ga, gb, gd, gf, fb, fe and fg will have full access on Road 1;
- Block ge will have full access on Kate Crace Street extension;
- Blocks ea, ec and ed will have left in left out access on The Valley Avenue;
- Blocks fa, fd and ff will have a service road feeding into The Valley Avenue. Block ea will also have a left in left out access off Kate Crace Street; and
- Blocks aa, ca, ba, bc, bd, be, da, dc and dd will have full access on Ernest Cavanagh Street Extension.

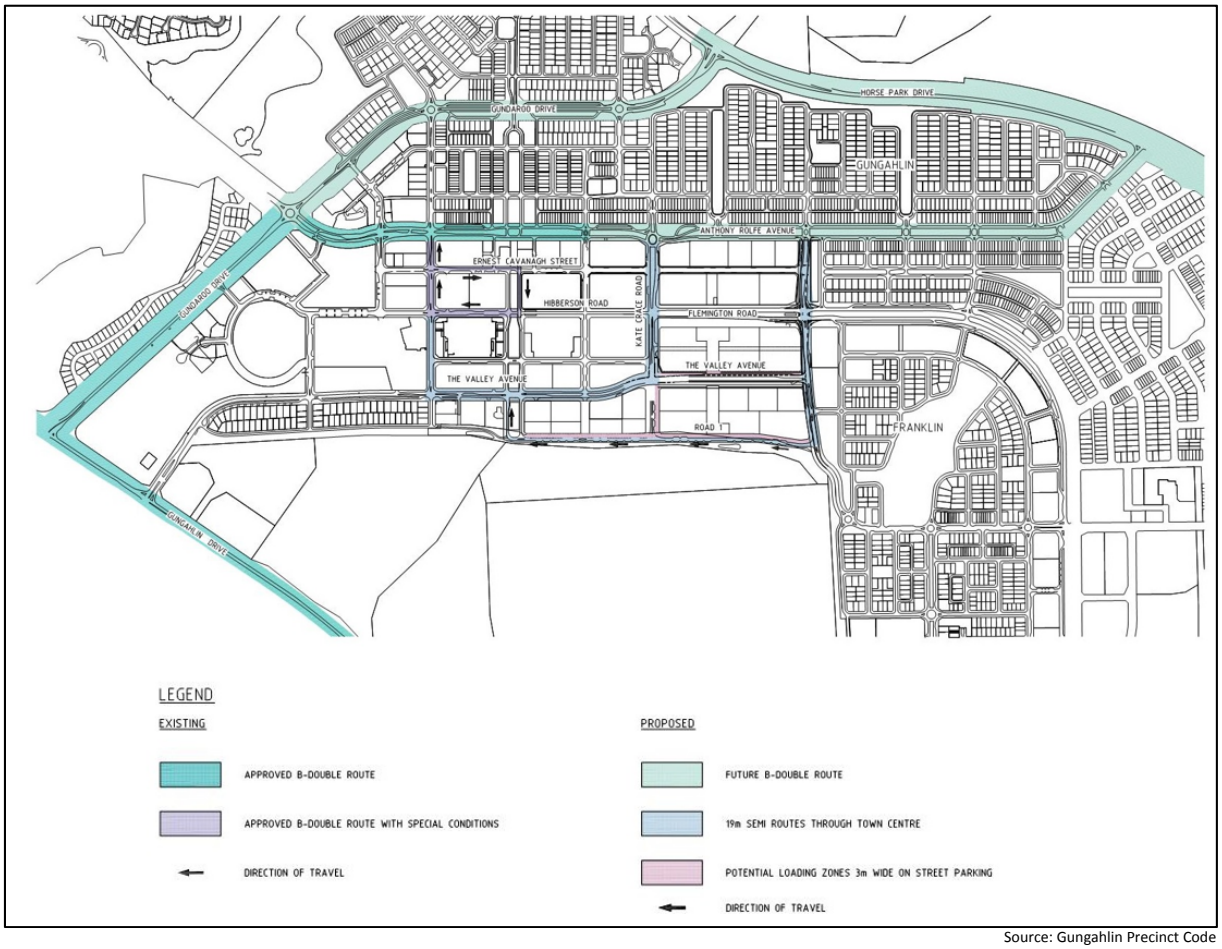
3.5 Heavy Vehicle Access

The heavy vehicle routes have been illustrated in Figure 7 and in EDP Drawing ENG-HVP-040 'Heavy Vehicle Route Plan'. The map outlines the routes (including direction of travel) for approved b-double route with special conditions, future B-double route and 19m semi routes through the Town Centre.

Loading and unloading of heavy vehicles would be fully accommodated within each development. The following roads are the proposed heavy vehicle routes:

- Gungahlin Place northbound
- Gozzard Street
- Anthony Rolfe Avenue
- Ernest Cavanagh Street
- Hibberson Street
- Kate Crace Road
- The Valley Avenue
- Road 1

Due to the commercial land uses, parking bays in Road 1 and The Valley Avenue will be 3m wide, which will allow loading zones for smaller delivery vehicles.



Source: Gungahlin Precinct Code

Figure 7: Gungahlin Precinct Code – Heavy Vehicle Routes

3.6 Parking

Future developments of proposed blocks are expected to provide for their parking requirements within their site and will adhere to the following parking rates stated in the ACTPLA Parking and Vehicular Access Guide as follows.

Table 9: Street Hierarchy for Estates in Residential Zones and CZ5

Development Type	Parking Provision Rates
Residential	CZ2 zones in town centres do not have minimum parking requirements CZ5 zones use the following parking rates: • 1 space per single bedroom unit • A minimum average provision of 1.5 spaces per two bedroom dwelling, provided that each two bedroom dwelling is allocated a minimum of one (1) parking space and each two (2) bedroom dwelling is allocated no more than two (2) parking spaces; • or • Two (2) parking spaces per two bedroom dwelling; • and • Two (2) parking spaces for each dwelling with three or more bedrooms; • plus • One (1) visitor space per four (4) dwellings or part thereof where a compound comprises four (4) or more dwellings
Office	CZ2 and CZ5 zones - 2.5 spaces/100m^2 GFA
Retail / Other	CZ2 zone - 4 spaces/100m^2 GFA CZ5 zones – 5 spaces/100m^2 GFA

The design of GTC East Estate allowed for a number of on-street indented parking bays to provide short term parking opportunites for visitors to the various developments:

- 20 parking spaces on both sides of Ernest Cavanagh Street extension section between Hinder Street and Kate Crace Street;
- 18 parking spaces north side and 20 parking spaces south side of Ernest Cavanagh Street extension between Kate Crace Street and Manning Clark Street extension;
- Approximately 45 parking spaces north side of The Valley Avenue;
- 8 parking spaces north side and 22 parking spaces south side of Road 1 section from Gungahlin Place extension and Kate Crace Street extension; and
- 8 parking spaces north side and 28 parking spaces south side of Road 1 section from Kate Crace Street extension to Manning Clark Crescent.

3.7 Walking and Cycling

The design of GTC East estate aims to augment the existing walking and cycling infrastructure as seen in Figure 8 (EDP-ENG-PT-100 'Shared Path Network') and Figure 9 (EDP-ENG-PT-095 'Public Transport Network & Off Road Movement Systems Plan')numerated below:

- Provision of new on-road cycle lanes on the north side of The Valley Avenue from Gungahlin Place to Manning Clark Crescent
- Provision of new off road shared paths:
    - On the south side of Road 1 from Gozzard Avenue to Manning Clark Crescent;
    - On the west side of Kate Crace Street extension; and
    - On the north to south green strip from Road 1 to Anthony Rolfe Avenue

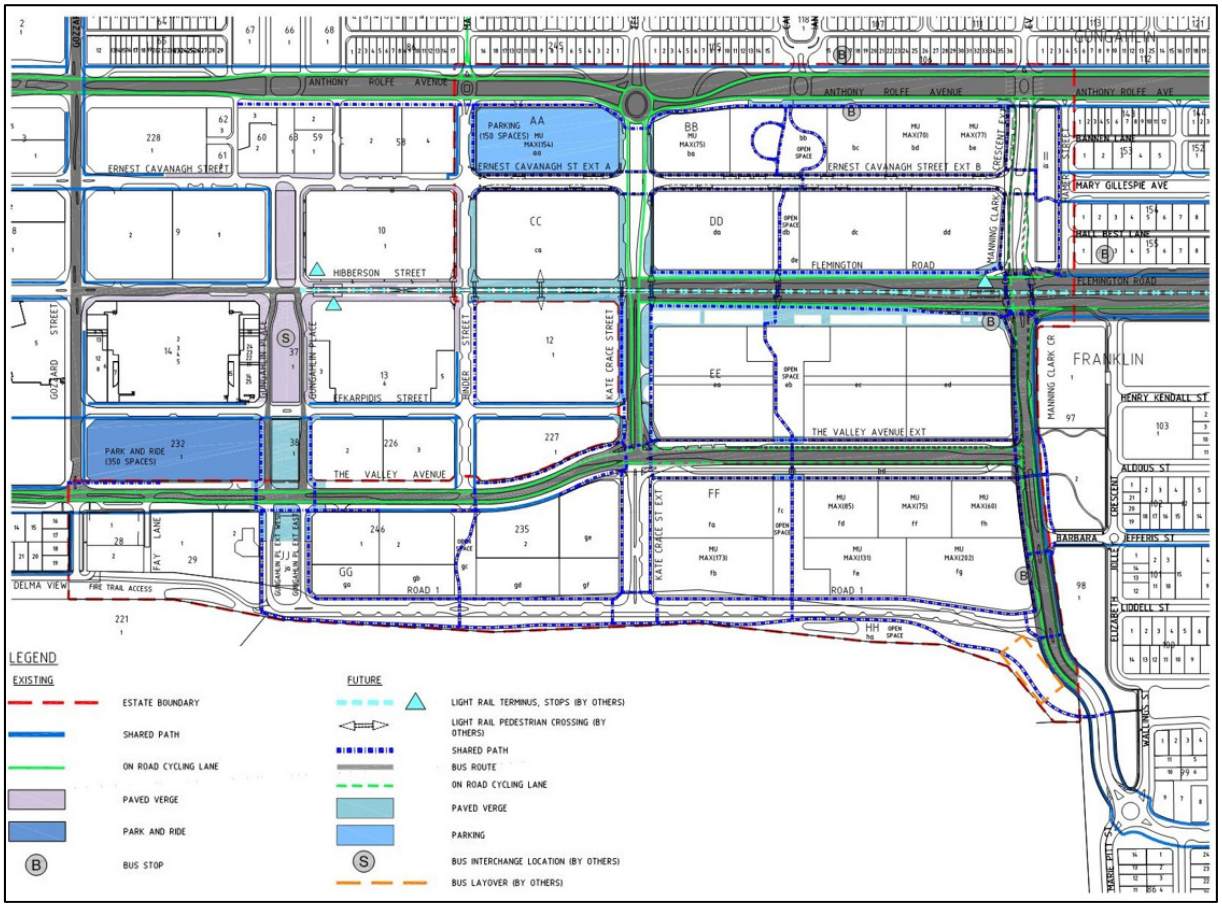


Figure 8: Proposed Shared Path Network

3.8 Public Transport

The design of GTC East takes into account the operation of the light rail along Flemington Road and Hibberson Street up to Gungahlin Pace. As can be seen in Figure 9 and EDP Drawing ENG-PT-095 'Public Transport Network & Off Road Movement Systems Plan', new bus routes are proposed along Gungahlin Place, The Valley Avenue and Manning Clark Crescent Extension.

There is an existing park and ride facility on Block 1 Section 232 Gungahlin. A temporary park and ride facility has also been constructed on Block aa Section AA. This EDP proposed a permanent public parking provision on Block aa Section AA in accordance with the Gungahlin Precinct Code.

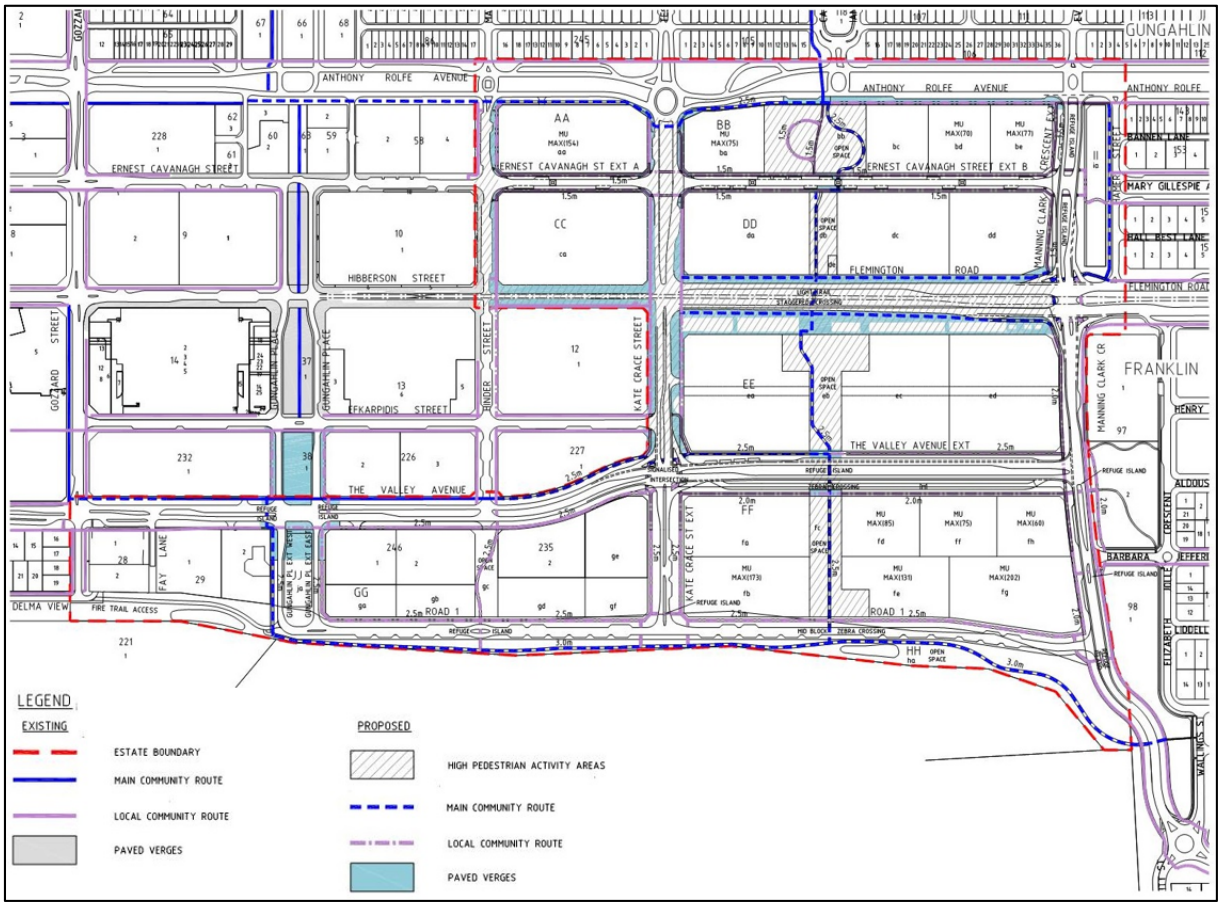
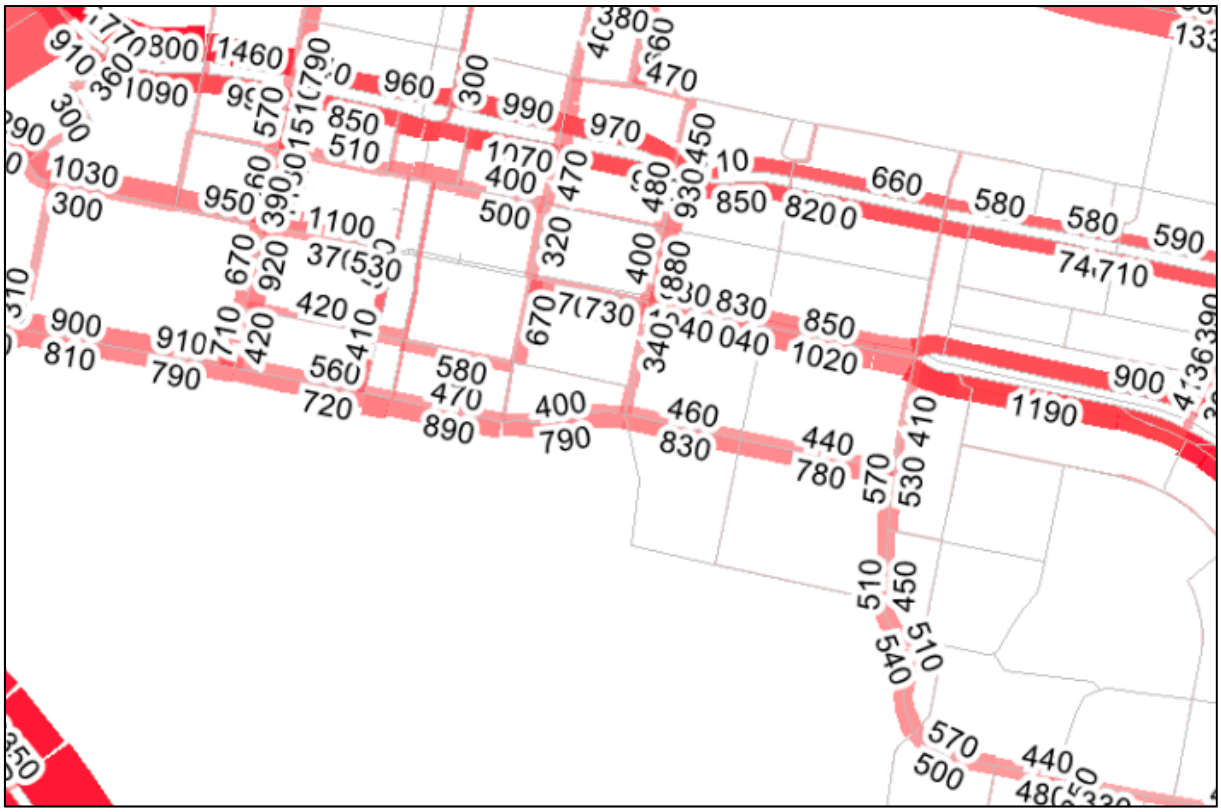


Figure 9: Proposed Public Transport and Off Road Movement Plan

4 Traffic Generation and Distribution

Indesco have provided Traffix Group with outputs for a Zenith Model (2031) around the Gungahlin Town Centre that includes the GTC East development that was obtained from Capital Metro Authority in consultation with Arup and Veitch Lister Consulting. This model includes the light rail operating between Gungahlin and Civic. The output extract for the Zenith Model are shown below in Figure 10.



Source: Capital Metro

Figure 10: 2031 AM Two Hour Peak Zenith Model Output

A zonal land use model was developed by Arup to model employment and residential densities based on the Territory Plan with input from the LDA in relation to land release forecasts. Arup and the LDA confirmed that development of GTC East was included in these assumptions.

This study used a factor of 0.65 to convert the two hour peak into the one hour peak from the Zenith Model Output. Figure 11 below shows the summary for the peak hour vehicle trips as generated by the Zenith Mode.

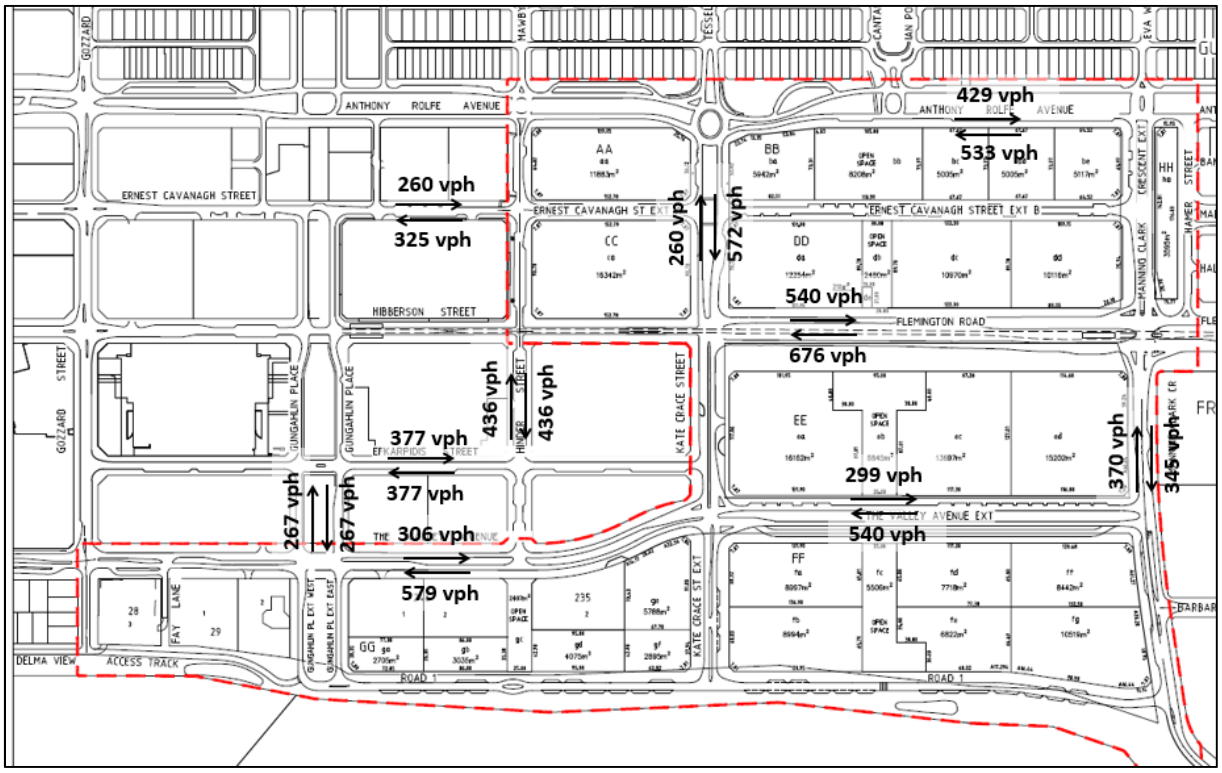


Figure 11: 2031 AM Peak Zenith Output

The daily traffic volume was conservatively estimated by adding the directional peak hour volumes together and multiplying by ten. A comparison is shown below in Table 10.

Table 10: Daily Traffic Volume Comparison

Road	Measured Volumes (2011-2013)	Zenith Model (2031) (vpd)	Variance (%)
The Valley Avenue	7,626	8,850	16%
Anthony Rolfe Avenue	5,247	9,620	83%
Flemington Road	7,800	12,160	56%
Kate Crace Street	5,174	8,320	61%
Hinder Street	3,683	8,720	137%
The Valley Avenue Extension	N/A	8,390	N/A
Ernest Cavanagh Street Extension	N/A	N/A	N/A
Road 1	N/A	N/A	N/A

As shown in the table above, traffic volumes are shown to have grown significantly from the measured volumes to the Zenith model (2031). The volumes shown in the Zenith model generally appropriate given the magnitude of development proposed in the area.

It should be noted that the Zenith (2031) outputs did not include Road 1 and Ernest Cavanagh Extension in the outputs. On this basis, approximately 20% of the traffic that is utilising The Valley

Avenue Extension will be redistributed to Road 1 and the volume of traffic utilising the existing section of Ernest Cavanagh Street will be assumed to be similar to the extension.

Table 11: Adopted Daily Traffic Volumes

Road	Measured Volumes (2011-2013)	Adopted Numbers (2031) (vpd)	Variance (%)
The Valley Avenue	7,626	8,850	16%
Anthony Rolfe Avenue	5,247	9,620	83%
Flemington Road	7,800	12,160	56%
Kate Crace Street	5,174	8,320	61%
Hinder Street	3,683	8,720	137%
The Valley Avenue Extension	N/A	6,712	N/A
Ernest Cavanagh Street Extension	N/A	5,850	N/A
Road 1	N/A	1,678	N/A

4.1 Road Capacity

The capacity of each road has been calculated separately based on Austroads Guide to Traffic Management Part 3, refer to Table 12.

Table 12: Calculated Road Capacities for Proposed and Existing Roads

Proposed Road Section	Speed	Road Type	Hourly Capacity per lane (vph)	Daily Capacity per lane (vpd)
The Valley Avenue	60	Urban Distributor	700	7,000
Flemington Road	70	Urban Arterial	800	8,000
Kate Crace Road	50	Urban Distributor	600	6,000
Ernest Cavanagh Street	50	Local Street	600	6,000
The Valley Avenue Extension	60	Urban Distributor	700	7,000
Ernest Cavanagh Street Extension A & B	50	Local Street	600	6,000
Road 1	50	Local Street	600	6,000

The proposed and existing roads within the GTC East area will operate above the nominal road classification as described earlier in the report. However, the roads will operate well within their environmental capacity and at acceptable levels for a Town Centre.

5 Impacts

5.1 Proposed Road Hierarchy

An assessment of the daily traffic volumes derived from the Zenith model showed that all roads will operate within their rated capacity in 2031. The proposed road heirachy has been established to be consistent with the road functions as set out in the Gungahlin Precint Code. The proposed road hierarchy is provided in Figure 12 and in EDP Drawing ENG-RHP-035 'Road Hierachy Overall Plan'.

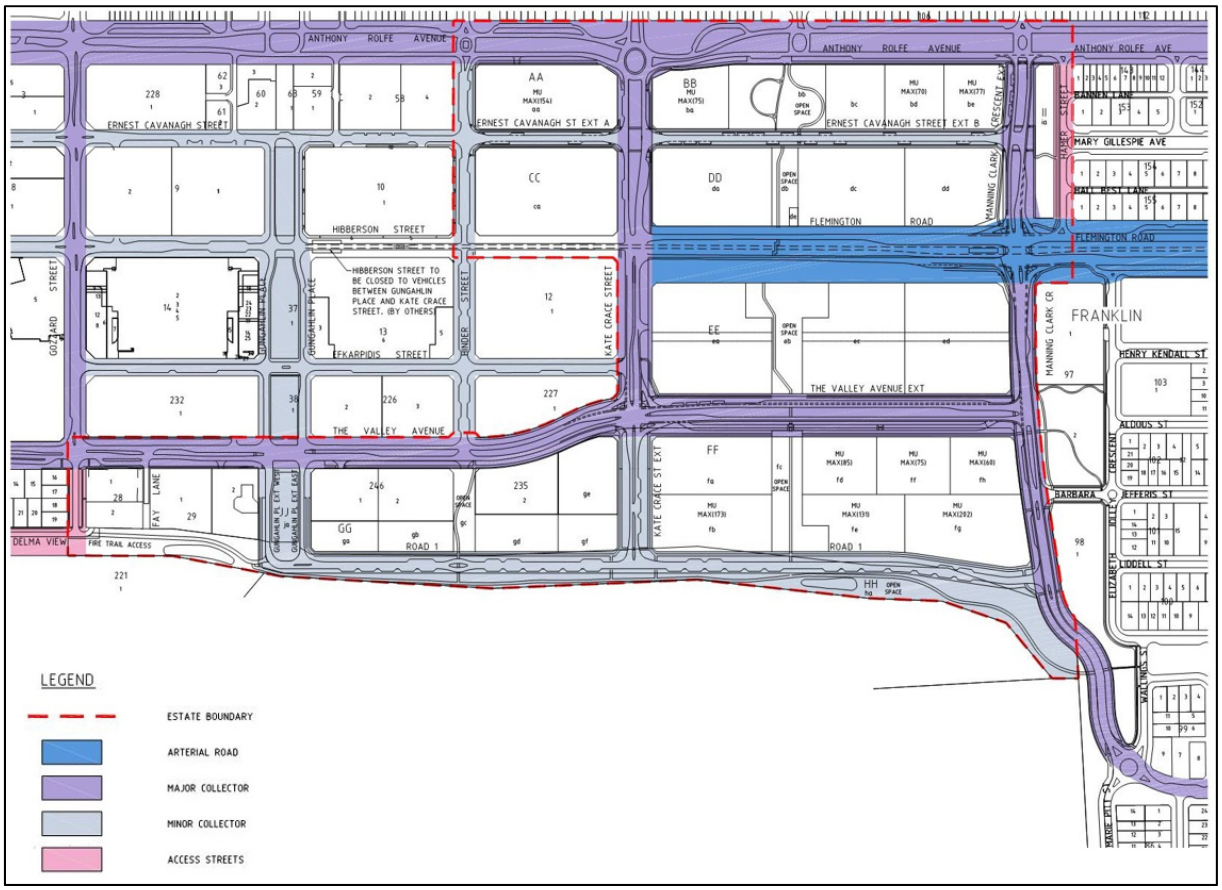


Figure 12: Proposed Road Hierarchy Plan

5.2 Intersection Vehicle and Pedestrian Performance

5.2.1 Intersection Analysis

This study assessed only the new intersections proposed within the GTC East EDP:

- Kate Crace Street/The Valley Avenue: signalised intersection.
- Gungahlin Place/The Valley Avenue: signalised intersection.
- Manning Clark Crescent/Road 1: priority controlled intersection.

The performance of the intersections were assessed using SIDRA. SIDRA is a traffic engineering micro-analytical traffic evaluation tool used for intersection design and analysis. It stands for Signalised and unsignalised Intersection Design and Research Aid and is used for the analysis of

intersection capacity, level of service and performance. This package provides several useful indicators to determine the level of intersection performance. These are known as Level of Service (LOS), Average Delay (seconds) and Maximum Queue Length (metres). The LOS criteria for intersections are shown in Table 13.

Table 13: Level of Service Criteria for Intersections

Level of Service	Average Delay (seconds per vehicle)	Traffic Signals and Roundabout	Give Way and Stop Signs
A	Less than 14	Good operation	Good operation
B	15 to 28	Good with acceptable delays and spare capacity	Acceptable delays and spare capacity
C	29 to 42	Satisfactory	Satisfactory, but accident study required
D	43 to 56	Operating near capacity	Near capacity and accident study required
E	57 to 70	At capacity At signals; incidents will cause excessive delays; roundabouts require other control mode	At capacity; requires other control mode
F	Greater than 71	Unsatisfactory with excessive queuing	Unsatisfactory with excessive queuing; requires other control mode

Intersection configurations for The Valley Avenue/Gungahlin Place signalised intersection, Road 1/Manning Clark Crescent priority control and The Valley Avenue/Kate Crace Street signalised intersection are shown in Figure 13 with results in Table 14.

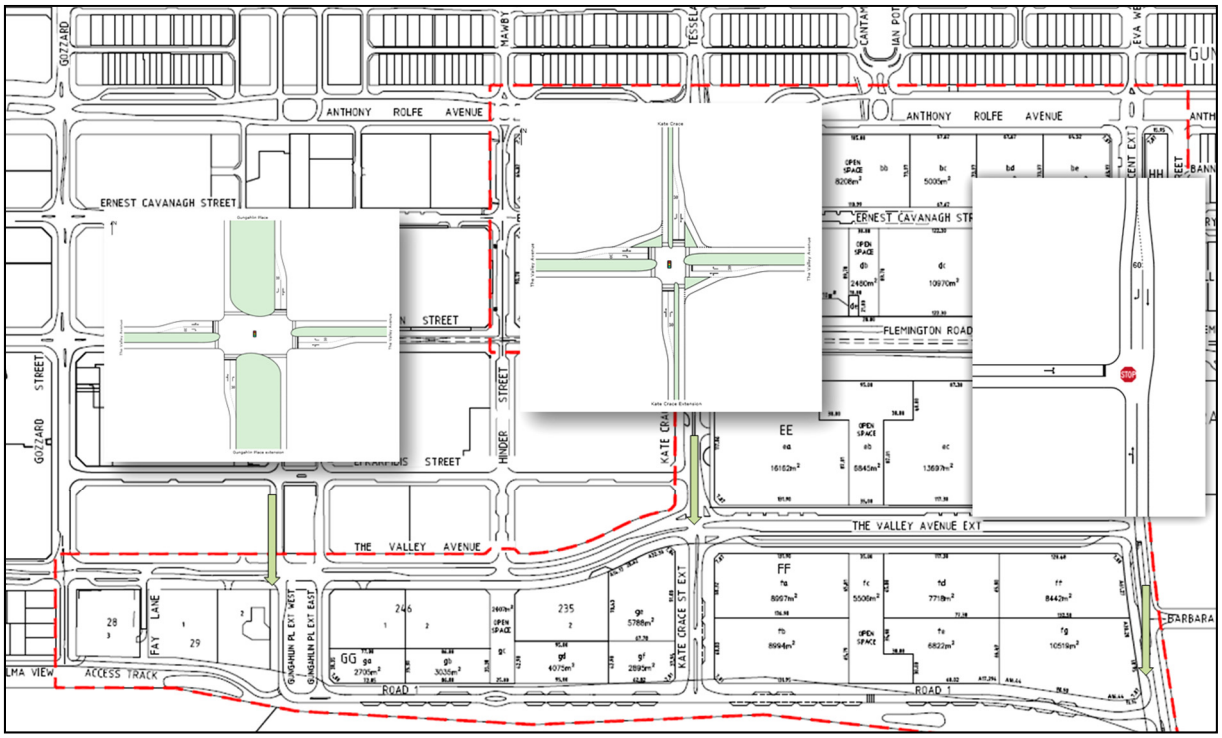


Figure 13: Proposed Intersection Configuration

Analysis of the three (3) intersections shows acceptable Levels of Service.

Table 14: Post Development Intersection Performance

Intersection	Peak Hour	DOS	Delay (s)	LOS
The Valley Avenue / Gungahlin Place Extension	AM Peak	0.798	35.0	C
	AM Peak -50% increase	0.908	55.3	D
The Valley Avenue / Kate Crace Street	AM Peak	0.558	20.8	B
	AM Peak -50% increase	0.643	19.6	B
Manning Clark Crescent / Road 1	AM Peak	0.179	1.5	A
	AM Peak -50% increase	0.264	1.3	A

An assessment of traffic impacts and intersection performance for The Valley Avenue Extension, Ernest Cavanagh Street Extension and Manning Clark Crescent Extension has been undertaken or reviewed by Cardno within the Gungahlin Town Centre East Roads PSP Report, February 2014. This report concludes that the associated intersection configurations have been reviewed and approved by Roads ACT.

An assessment of traffic impacts and intersection performance along the proposed light rail route has been undertaken by Parsons Brinckerhoff (Capital Metro Traffic and Transport Impact Assessment, June 2015). This report notes that overall, negligible impacts will occur across the road network as a result of the project. It is expected that delays will increase at the Hibberson Street intersections with Hinder Street and Kate Crace Street due to the signal priority arrangements.

However the LOS is still modelled at B and C, respectively. Positive impacts are noted for cyclists and pedestrians. Furthermore, the proposed closure of Hibberson Street between Gungahlin Place and Kate Crace Street was modelled to result in reduced traffic volumes along the remaining sections of Hibberson Street.

5.3 Other Intersections

5.3.1 The Valley Avenue / Gozzard Street

The Zenith model (2031) shows that in the vicinity of Gozzard Street, The Valley Avenue will carry a combined 1,255 vehicles during the AM peak. The model also estimates that 455 vehicles will turn into The Valley Avenue during the same peak. A first principles analysis shows that that would be approximately one vehicle every 7.9 seconds. On this basis, it is highly likely that this intersection would need to be signalised in the future as the vehicle volumes from the west are particularly high during the peak and delays would be significant.

5.3.2 Hibberson Street / Hinder Street

The crash analysis that was conducted previously in the report showed that 65 crashes have occurred at this location in the five years. This issue is likely to be resolved due to the removal of vehicle movements into Hibberson Street as a result of the nearby light rail works.

5.3.3 Anthony Rolfe Avenue / Hinder Street

The crash analysis that was conducted previously in the report showed that 70 crashes have occurred at the intersection of Anthony Rolfe Avenue and Hinder Street. As this location is likely to be affected by the light rail works, this issue will require further investigation following the completion of the works and the normalisation of the traffic patterns.

5.3.4 Efkarpidis Street / Hinder Street

Works by Capital Works and CMA propose that the Efkarpidis Street / Kate Crace Street intersection will become left in / left out. This will affect the traffic patterns at Efkarpidis Street / Hinder Street, and it is recommended that a future study be conducted at this location to determine the effect of the nearby intersection works.

5.3.5 Anthony Rolfe Avenue / Manning Clark Crescent

The geometry of the intersection between Anthony Rolfe Avenue and Manning Clarke Crescent is sub-optimal for a high capacity intersection. A separate study is recommended to assess the intersection layout at this location and the implications of the additional traffic volumes as well as the recently approved development application for the Manning Clark Crescent extension.

6 Conclusions

The key findings of the traffic and parking impact assessment are summarised as follows:

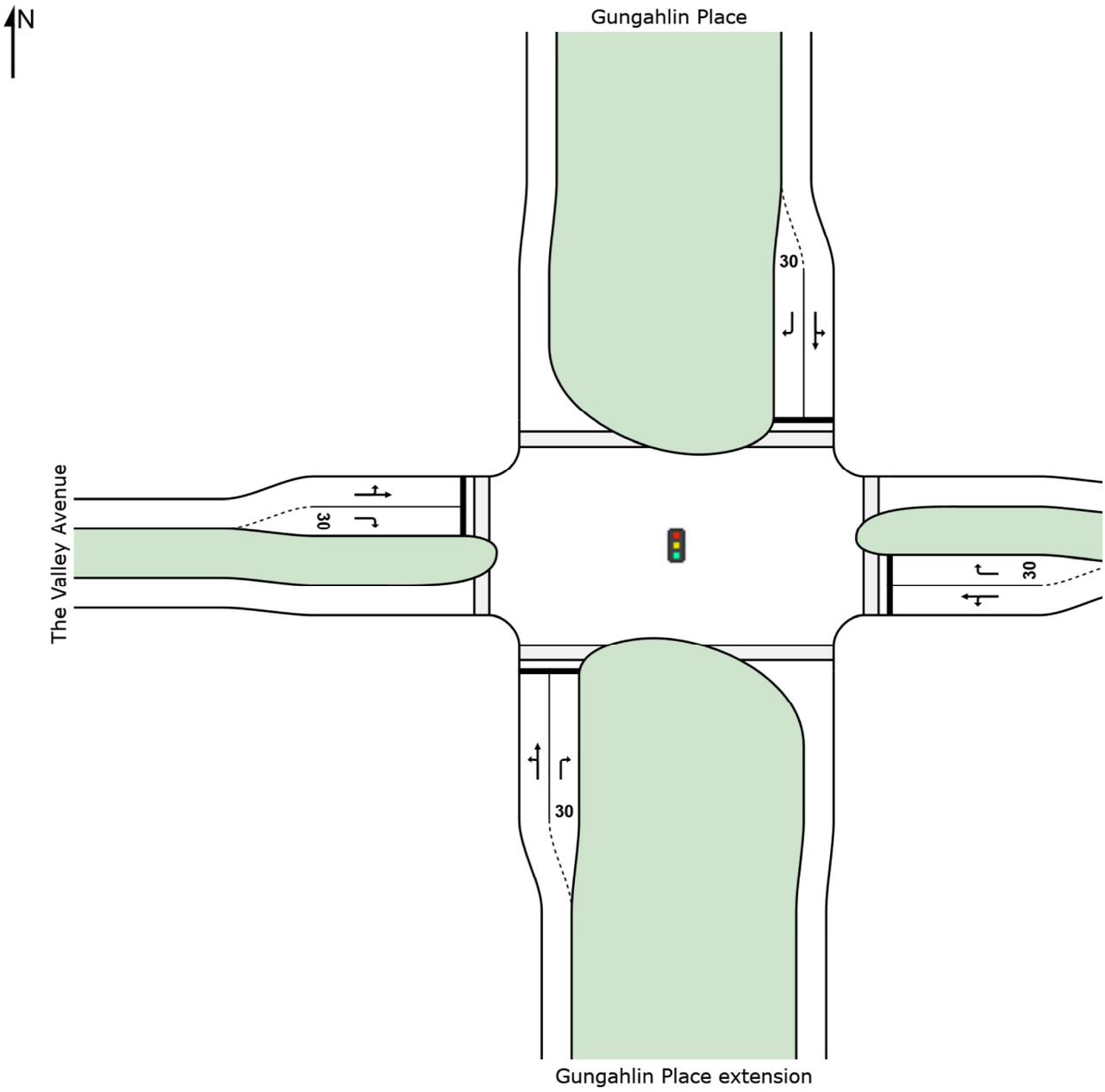
- The three intersections analysed showed acceptable Levels of Service during the peak periods with the addition of the traffic generated by the development.
- The proposed developments in the estate are expected to provide for their parking needs within their individual sites.
- The design of GTC East estate is based on the road hierarchy identified in the Gungahlin Precinct Code.
- The proposed transport network has allowed for the operation of the light rail with its terminus at Hibberson Street and has also identified supporting bus routes.
- Additional pedestrian and cycle infrastructure has been identified to allow for the GTC East developments.

Appendix A:
Post-Development SIDRA Results

SITE LAYOUT

Site: 1 [The Valley Avenue / Gungahlin Place extension]

The Valley Ave / Gungahlin Pl
AM Peak
3021
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 1 [The Valley Avenue / Gungahlin Place extension]

The Valley Ave / Gungahlin Pl
AM Peak
3021
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Gungahlin Place extension											
1	L2	61	0.0	0.430	45.5	LOS D	2.5	17.4	0.99	0.75	32.0
2	T1	1	0.0	0.430	42.2	LOS C	2.5	17.4	0.99	0.75	28.7
3	R2	56	0.0	0.386	45.3	LOS D	2.2	15.6	0.99	0.74	32.0
Approach		118	0.0	0.430	45.4	LOS D	2.5	17.4	0.99	0.75	32.0
East: The Valley Avenue											
4	L2	17	0.0	0.798	35.2	LOS C	15.8	115.5	0.92	0.89	37.5
5	T1	405	5.0	0.798	29.6	LOS C	15.8	115.5	0.92	0.89	40.3
6	R2	162	0.0	0.259	27.1	LOS B	4.7	32.8	0.78	0.76	35.6
Approach		584	3.5	0.798	29.1	LOS C	15.8	115.5	0.88	0.85	38.8
North: Gungahlin Place											
7	L2	109	0.0	0.726	44.1	LOS D	6.6	46.0	1.00	0.90	30.2
8	T1	51	0.0	0.726	40.7	LOS C	6.6	46.0	1.00	0.90	29.4
9	R2	109	0.0	0.503	41.4	LOS C	4.2	29.6	0.98	0.78	30.6
Approach		269	0.0	0.726	42.3	LOS C	6.6	46.0	0.99	0.85	30.2
West: The Valley Avenue											
10	L2	116	0.0	0.772	39.6	LOS C	13.9	100.2	0.99	0.92	32.8
11	T1	236	5.0	0.772	34.1	LOS C	13.9	100.2	0.99	0.92	37.7
12	R2	12	0.0	0.025	30.7	LOS C	0.3	2.4	0.79	0.67	37.2
Approach		364	3.2	0.772	35.7	LOS C	13.9	100.2	0.98	0.91	36.0
All Vehicles		1334	2.4	0.798	35.0	LOS C	15.8	115.5	0.94	0.86	35.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	21.1	LOS C	0.1	0.1	0.73	0.73
P12	South Stage 2	53	18.9	LOS B	0.1	0.1	0.69	0.69
P21	East Stage 1	53	34.3	LOS D	0.1	0.1	0.93	0.93
P22	East Stage 2	53	32.5	LOS D	0.1	0.1	0.90	0.90
P31	North Stage 1	53	26.5	LOS C	0.1	0.1	0.81	0.81
P32	North Stage 2	53	24.1	LOS C	0.1	0.1	0.78	0.78
P41	West Stage 1	53	34.3	LOS D	0.1	0.1	0.93	0.93
P42	West Stage 2	53	34.3	LOS D	0.1	0.1	0.93	0.93
All Pedestrians		421	28.2	LOS C			0.84	0.84

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

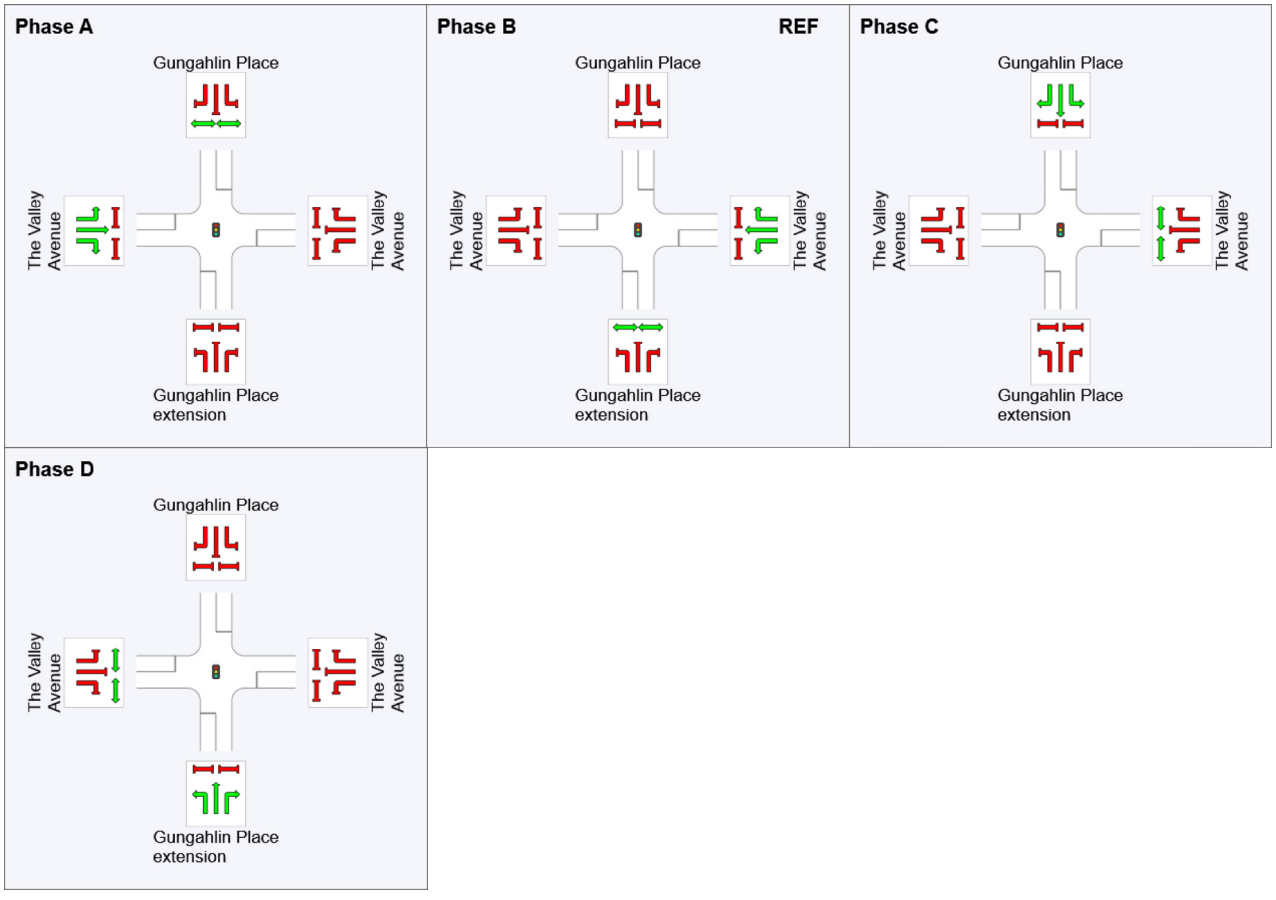
Site: 1 [The Valley Avenue / Gungahlin Place extension]

The Valley Ave / Gungahlin Pl
AM Peak
3021
Signals - Fixed Time Isolated Cycle Time = 80 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Opposed Turns
Movement Class: All Movement Classes
Input Sequence: A, B, C, D
Output Sequence: A, B, C, D

Phase Timing Results

Phase	A	B	C	D
Reference Phase	No	Yes	No	No
Phase Change Time (sec)	56	0	31	45
Green Time (sec)	19	26	9	6
Yellow Time (sec)	3	3	3	3
All-Red Time (sec)	2	2	2	2
Phase Time (sec)	24	31	14	11
Phase Split	30%	39%	18%	14%



MOVEMENT SUMMARY

Site: 1 [The Valley Avenue / Gungahlin Place extension - 50% increase]

The Valley Ave / Gungahlin Pl
AM Peak
3021
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Gungahlin Place extension											
1	L2	61	0.0	0.096	33.1	LOS C	2.4	17.1	0.71	0.71	35.9
2	T1	1	0.0	0.096	29.8	LOS C	2.4	17.1	0.71	0.71	31.7
3	R2	56	0.0	0.386	64.2	LOS E	3.3	22.8	0.99	0.75	27.5
Approach		118	0.0	0.386	47.8	LOS D	3.3	22.8	0.84	0.73	31.3
East: The Valley Avenue											
4	L2	17	0.0	0.908	55.7	LOS D	38.8	283.1	0.92	1.00	31.0
5	T1	608	5.0	0.908	50.1	LOS D	38.8	283.1	0.92	1.00	32.9
6	R2	162	0.0	0.202	29.2	LOS C	6.0	41.7	0.67	0.75	34.9
Approach		787	3.9	0.908	45.9	LOS D	38.8	283.1	0.87	0.95	33.2
North: Gungahlin Place											
7	L2	109	0.0	0.855	68.4	LOS E	10.2	71.6	1.00	1.02	25.1
8	T1	51	0.0	0.855	65.0	LOS E	10.2	71.6	1.00	1.02	24.6
9	R2	109	0.0	0.755	67.4	LOS E	6.8	47.5	1.00	0.89	25.1
Approach		269	0.0	0.855	67.4	LOS E	10.2	71.6	1.00	0.96	25.0
West: The Valley Avenue											
10	L2	116	0.0	0.890	70.5	LOS E	30.0	217.1	1.00	1.09	25.8
11	T1	354	5.0	0.890	64.9	LOS E	30.0	217.1	1.00	1.09	28.7
12	R2	12	0.0	0.023	39.9	LOS C	0.5	3.4	0.76	0.67	34.0
Approach		482	3.7	0.890	65.7	LOS E	30.0	217.1	0.99	1.08	28.0
All Vehicles		1655	2.9	0.908	55.3	LOS D	38.8	283.1	0.93	0.97	29.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	23.5	LOS C	0.1	0.1	0.63	0.63
P12	South Stage 2	53	21.6	LOS C	0.1	0.1	0.60	0.60
P21	East Stage 1	53	54.3	LOS E	0.2	0.2	0.95	0.95
P22	East Stage 2	53	53.3	LOS E	0.2	0.2	0.94	0.94
P31	North Stage 1	53	36.1	LOS D	0.1	0.1	0.78	0.78
P32	North Stage 2	53	33.8	LOS D	0.1	0.1	0.75	0.75
P41	West Stage 1	53	54.3	LOS E	0.2	0.2	0.95	0.95
P42	West Stage 2	53	53.3	LOS E	0.2	0.2	0.94	0.94
All Pedestrians		421	41.3	LOS E			0.82	0.82

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

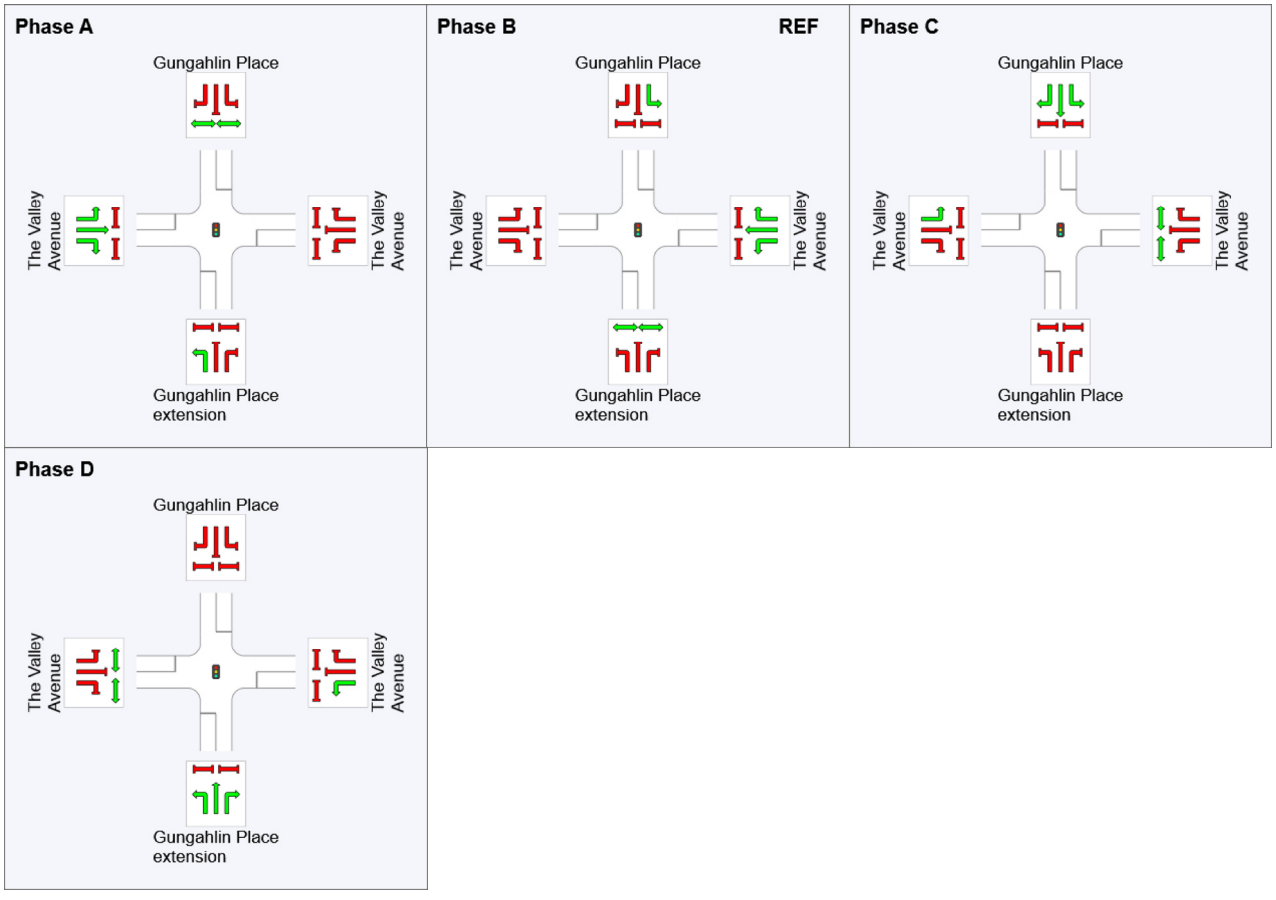
Site: 1 [The Valley Avenue / Gungahlin Place extension - 50% increase]

The Valley Ave / Gungahlin Pl
AM Peak
3021
Signals - Fixed Time Isolated Cycle Time = 120 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Opposed Turns
Movement Class: All Movement Classes
Input Sequence: A, B, C, D
Output Sequence: A, B, C, D

Phase Timing Results

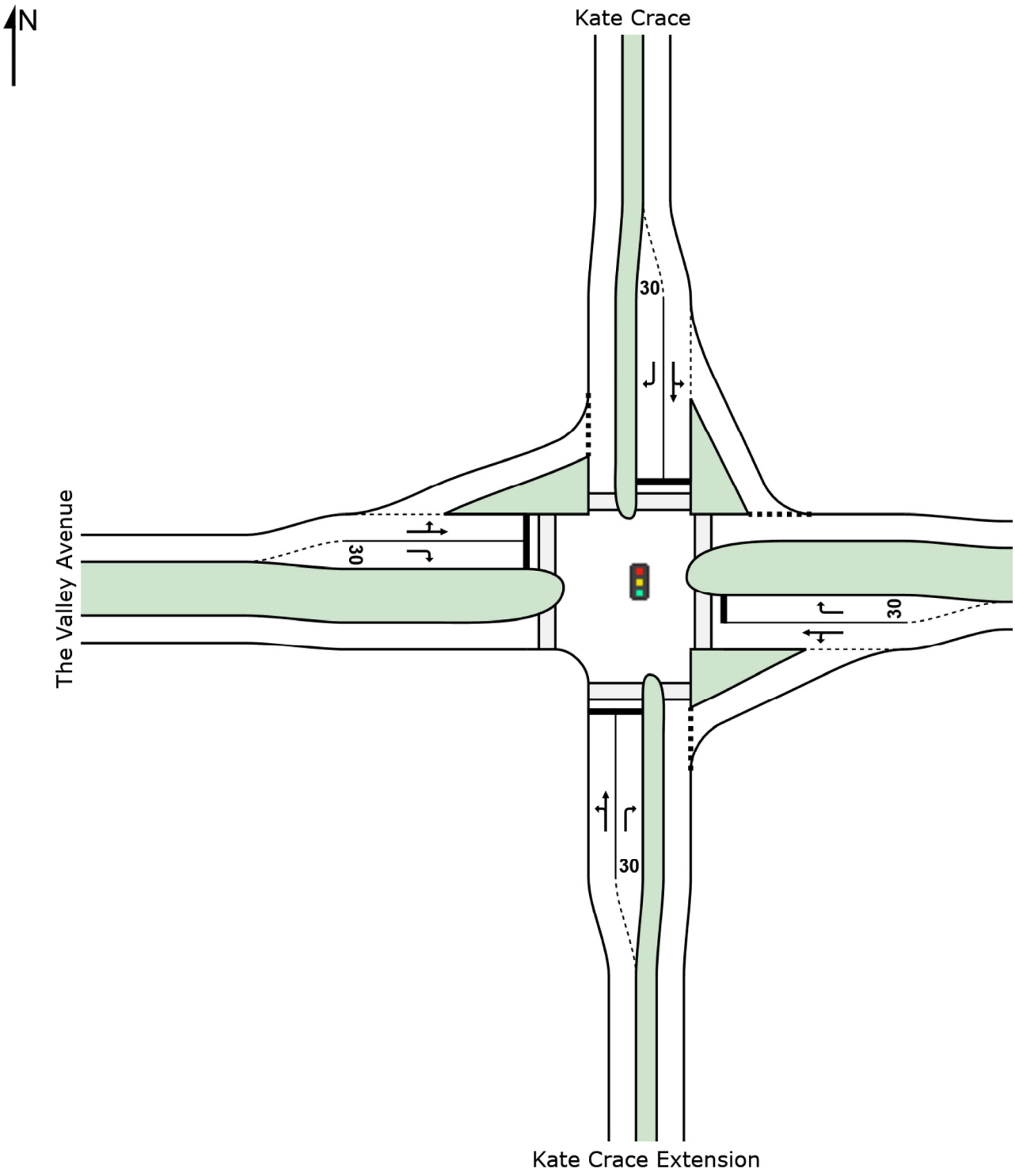
Phase	A	B	C	D
Reference Phase	No	Yes	No	No
Phase Change Time (sec)	83	0	55	69
Green Time (sec)	32	50	9	9
Yellow Time (sec)	3	3	3	3
All-Red Time (sec)	2	2	2	2
Phase Time (sec)	37	55	14	14
Phase Split	31%	46%	12%	12%



SITE LAYOUT

Site: 1 [2031-Kate Crace Street / The Valley Avenue -FINAL]

Kate Crace Street / The Valley Avenue
AM Peak
2031
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 1 [2031-Kate Crace Street / The Valley Avenue -FINAL]

Kate Crace Street / The Valley Avenue
AM Peak
2031
Signals - Fixed Time Isolated Cycle Time = 75 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Kate Crace Extension											
1	L2	29	1.0	0.162	40.0	LOS C	1.1	7.9	0.94	0.71	35.8
2	T1	3	1.0	0.162	34.5	LOS C	1.1	7.9	0.94	0.71	36.4
3	R2	84	1.0	0.427	41.4	LOS C	3.1	21.6	0.98	0.76	35.0
Approach		116	1.0	0.427	40.9	LOS C	3.1	21.6	0.97	0.75	35.2
East: The Valley Avenue											
4	L2	43	5.0	0.196	5.7	LOS A	0.4	3.0	0.07	0.09	58.0
5	T1	297	5.0	0.196	0.1	LOS A	0.4	3.0	0.07	0.09	59.0
6	R2	200	5.0	0.558	35.8	LOS C	6.8	49.9	0.95	0.81	36.9
Approach		540	5.0	0.558	13.7	LOS A	6.8	49.9	0.40	0.35	48.3
North: Kate Crace											
7	L2	106	5.0	0.153	13.4	LOS A	1.8	12.9	0.61	0.68	48.8
8	T1	7	5.0	0.153	7.7	LOS A	1.8	12.9	0.61	0.68	49.5
9	R2	106	5.0	0.554	42.3	LOS C	3.9	28.8	0.99	0.79	34.6
Approach		219	5.0	0.554	27.2	LOS B	3.9	28.8	0.80	0.73	40.8
West: The Valley Avenue											
10	L2	144	5.0	0.535	23.3	LOS B	7.3	53.0	0.89	0.79	44.4
11	T1	144	5.0	0.535	17.6	LOS B	7.3	53.0	0.89	0.79	45.0
12	R2	18	5.0	0.056	32.2	LOS C	0.5	4.0	0.84	0.69	38.3
Approach		306	5.0	0.535	21.2	LOS B	7.3	53.0	0.89	0.78	44.2
All Vehicles		1181	4.6	0.558	20.8	LOS B	7.3	53.0	0.65	0.57	44.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	21.7	LOS C	0.1	0.1	0.76	0.76
P12	South Stage 2	53	20.2	LOS C	0.1	0.1	0.73	0.73
P21	East Stage 1	53	31.8	LOS D	0.1	0.1	0.92	0.92
P22	East Stage 2	53	30.0	LOS C	0.1	0.1	0.90	0.90
P31	North Stage 1	53	21.7	LOS C	0.1	0.1	0.76	0.76
P32	North Stage 2	53	20.2	LOS C	0.1	0.1	0.73	0.73
P41	West Stage 1	53	31.8	LOS D	0.1	0.1	0.92	0.92
P42	West Stage 2	53	30.0	LOS C	0.1	0.1	0.90	0.90
All Pedestrians		421	25.9	LOS C			0.83	0.83

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

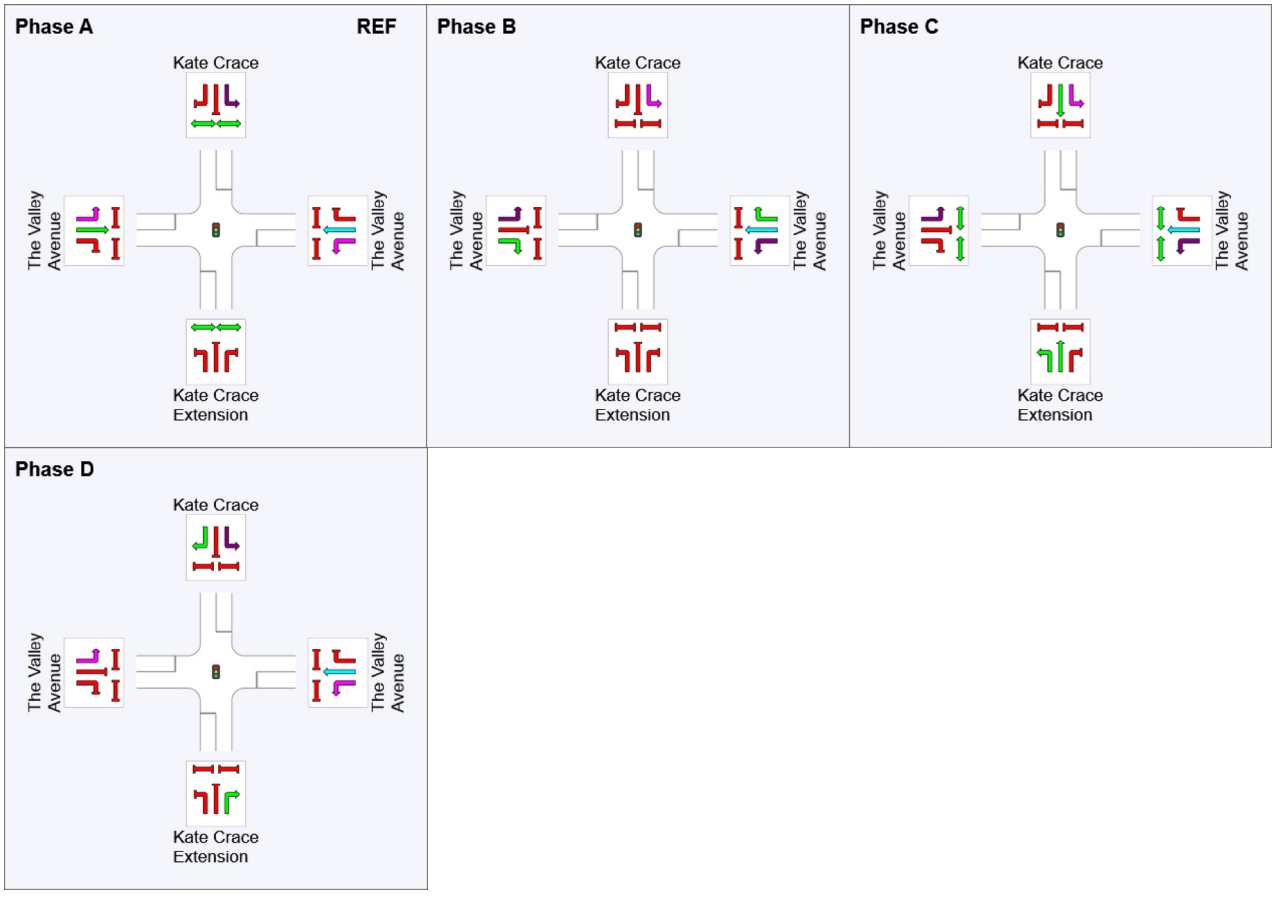
Site: 1 [2031-Kate Crace Street / The Valley Avenue -FINAL]

Kate Crace Street / The Valley Avenue
AM Peak
2031
Signals - Fixed Time Isolated Cycle Time = 75 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Opposed Turns
Movement Class: All Movement Classes
Input Sequence: A, B, C, D
Output Sequence: A, B, C, D

Phase Timing Results

Phase	A	B	C	D
Reference Phase	Yes	No	No	No
Phase Change Time (sec)	0	26	47	61
Green Time (sec)	20	15	8	8
Yellow Time (sec)	4	4	4	4
All-Red Time (sec)	2	2	2	2
Phase Time (sec)	26	21	14	14
Phase Split	35%	28%	19%	19%



MOVEMENT SUMMARY

Site: 1 [2031-Kate Crace Street / The Valley Avenue -FINAL - 50%]

Kate Crace Street / The Valley Avenue
AM Peak
2031
Signals - Fixed Time Isolated Cycle Time = 75 seconds (User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Kate Crace Extension											
1	L2	29	1.0	0.185	41.3	LOS C	1.1	8.1	0.96	0.71	35.3
2	T1	3	1.0	0.185	35.8	LOS C	1.1	8.1	0.96	0.71	35.9
3	R2	84	1.0	0.488	42.8	LOS D	3.1	22.1	0.99	0.77	34.5
Approach		116	1.0	0.488	42.3	LOS C	3.1	22.1	0.98	0.75	34.8
East: The Valley Avenue											
4	L2	43	5.0	0.279	5.7	LOS A	0.7	4.8	0.06	0.06	58.2
5	T1	446	5.0	0.279	0.0	LOS A	0.7	4.8	0.06	0.06	59.3
6	R2	200	5.0	0.643	38.6	LOS C	7.2	52.7	0.98	0.83	35.9
Approach		689	5.0	0.643	11.6	LOS A	7.2	52.7	0.33	0.29	49.8
North: Kate Crace											
7	L2	106	5.0	0.161	13.5	LOS A	1.7	12.5	0.63	0.69	48.8
8	T1	7	5.0	0.161	7.8	LOS A	1.7	12.5	0.63	0.69	49.5
9	R2	106	5.0	0.633	44.2	LOS D	4.1	29.8	1.00	0.82	34.0
Approach		219	5.0	0.633	28.2	LOS B	4.1	29.8	0.81	0.75	40.4
West: The Valley Avenue											
10	L2	144	5.0	0.582	25.0	LOS B	9.9	71.9	0.88	0.80	43.7
11	T1	216	5.0	0.582	19.4	LOS B	9.9	71.9	0.88	0.80	44.3
12	R2	18	5.0	0.063	34.2	LOS C	0.6	4.1	0.86	0.69	37.5
Approach		378	5.0	0.582	22.2	LOS B	9.9	71.9	0.87	0.79	43.7
All Vehicles		1402	4.7	0.643	19.6	LOS B	9.9	71.9	0.60	0.53	44.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate per ped
P11	South Stage 1	53	18.8	LOS B	0.1	0.1	0.71	0.71
P12	South Stage 2	53	17.4	LOS B	0.1	0.1	0.68	0.68
P21	East Stage 1	53	31.8	LOS D	0.1	0.1	0.92	0.92
P22	East Stage 2	53	30.9	LOS D	0.1	0.1	0.91	0.91
P31	North Stage 1	53	18.8	LOS B	0.1	0.1	0.71	0.71
P32	North Stage 2	53	17.4	LOS B	0.1	0.1	0.68	0.68
P41	West Stage 1	53	31.8	LOS D	0.1	0.1	0.92	0.92
P42	West Stage 2	53	30.9	LOS D	0.1	0.1	0.91	0.91
All Pedestrians		421	24.7	LOS C			0.81	0.81

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

PHASING SUMMARY

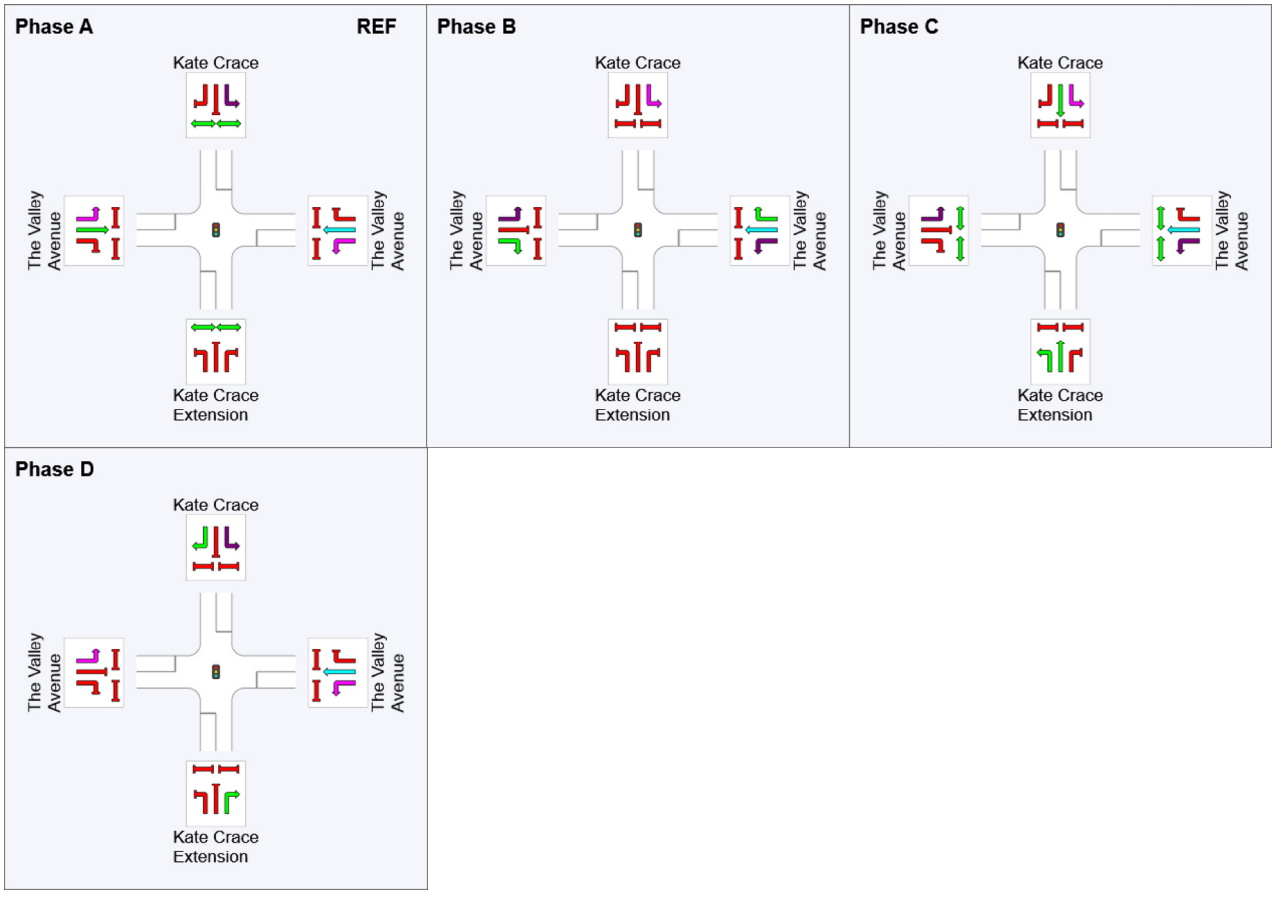
Site: 1 [2031-Kate Crace Street / The Valley Avenue -FINAL - 50%]

Kate Crace Street / The Valley Avenue
AM Peak
2031
Signals - Fixed Time Isolated Cycle Time = 75 seconds (User-Given Cycle Time)

Phase times determined by the program
Sequence: Opposed Turns
Movement Class: All Movement Classes
Input Sequence: A, B, C, D
Output Sequence: A, B, C, D

Phase Timing Results

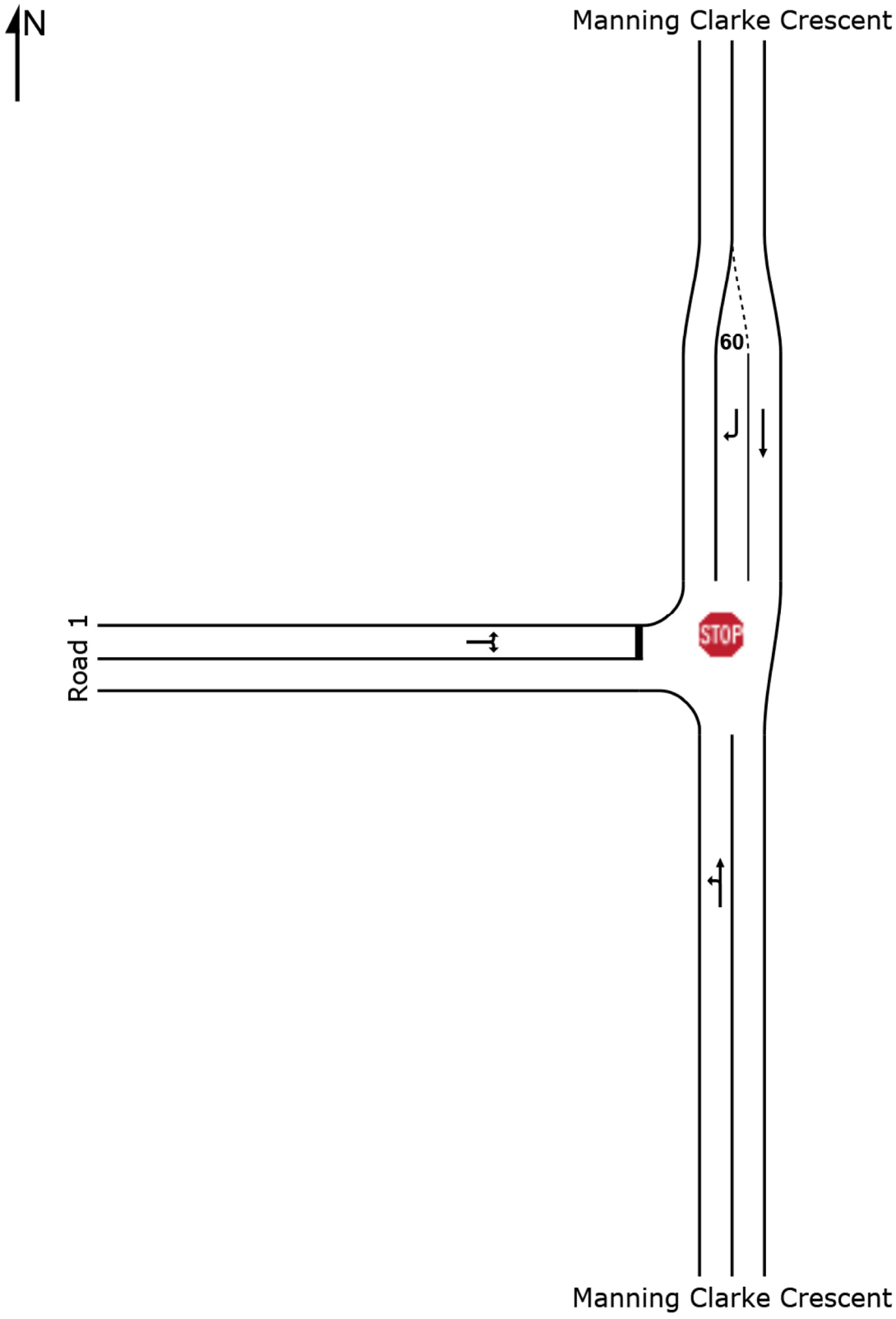
Phase	A	B	C	D
Reference Phase	Yes	No	No	No
Phase Change Time (sec)	0	30	49	62
Green Time (sec)	24	13	7	7
Yellow Time (sec)	4	4	4	4
All-Red Time (sec)	2	2	2	2
Phase Time (sec)	30	19	13	13
Phase Split	40%	25%	17%	17%



SITE LAYOUT

Site: 1 [Road 1 / Manning Clarke Cr -AM]

Post Development
2021
Stop (Two-Way)



MOVEMENT SUMMARY

Site: 1 [Road 1 / Manning Clarke Cr -AM]

Post Development
2021
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Manning Clarke Crescent											
1	L2	18	0.0	0.179	5.6	LOS A	0.0	0.0	0.00	0.03	58.1
2	T1	331	0.0	0.179	0.0	LOS A	0.0	0.0	0.00	0.03	59.7
Approach		348	0.0	0.179	0.3	NA	0.0	0.0	0.00	0.03	59.6
North: Manning Clarke Crescent											
8	T1	301	5.0	0.159	0.0	LOS A	0.0	0.0	0.00	0.00	60.0
9	R2	60	5.0	0.048	6.8	LOS A	0.2	1.5	0.42	0.62	51.8
Approach		361	5.0	0.159	1.1	NA	0.2	1.5	0.07	0.10	58.4
West: Road 1											
10	L2	56	5.0	0.075	9.8	LOS A	0.3	2.1	0.44	0.89	50.6
12	R2	7	5.0	0.075	15.4	LOS B	0.3	2.1	0.44	0.89	50.1
Approach		63	5.0	0.075	10.4	LOS A	0.3	2.1	0.44	0.89	50.6
All Vehicles		773	2.7	0.179	1.5	NA	0.3	2.1	0.07	0.14	58.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

MOVEMENT SUMMARY

Site: 1 [Road 1 / Manning Clarke Cr -AM - 50%]

Post Development
2021
Stop (Two-Way)

Movement Performance - Vehicles												
Mov ID	OD Mov	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Manning Clarke Crescent											
1	L2	18	0.0	0.264	5.6	LOS A	0.0	0.0	0.00	0.02	58.1
2	T1	496	0.0	0.264	0.0	LOS A	0.0	0.0	0.00	0.02	59.8
Approach		514	0.0	0.264	0.2	NA	0.0	0.0	0.00	0.02	59.7
North: Manning Clarke Crescent											
8	T1	452	5.0	0.239	0.0	LOS A	0.0	0.0	0.00	0.00	59.9
9	R2	60	5.0	0.059	7.6	LOS A	0.2	1.8	0.51	0.69	51.3
Approach		512	5.0	0.239	0.9	NA	0.2	1.8	0.06	0.08	58.8
West: Road 1											
10	L2	56	5.0	0.104	11.0	LOS A	0.4	2.7	0.56	0.94	49.4
12	R2	7	5.0	0.104	24.0	LOS B	0.4	2.7	0.56	0.94	48.9
Approach		63	5.0	0.104	12.5	LOS A	0.4	2.7	0.56	0.94	49.3
All Vehicles		1088	2.6	0.264	1.3	NA	0.4	2.7	0.06	0.10	58.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.