

Castle Hill Glen Pty Ltd

Rogans Hill Park

Transport Impact Assessment

Final | 30 January 2024

This report takes into account the particular instructions and requirements of our client. It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 294523-00

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1. Introduction

Castle Hill Glen Pty Ltd has commissioned Arup to undertake a transport impact assessment as part of the Planning Proposal for the Rogans Hill Park development at 2 Glen Road, Castle Hill (the site).

The project involves the re-development of 1020 Melia Court, Castle Hill for a Planning Proposal Application to The Hills Shire Council. The site is to be developed for a mix of low and medium density residential buildings (185 dwellings) including a new public park, series of open spaces and public domain upgrades. The site layout is pictured below in Figure 1.

The project includes:

- A publicly accessible park, 'Rogans Hill Park', that is designed to provide a natural play area and outdoor fitness opportunities.
- Six (6) residential flat buildings, with heights ranging from three to six storeys, containing 147 apartment units.
- 38 terraces, each spanning between two and three stories.
- A series of connected biodiversity corridors connecting the existing Blue Gum High Forest and water sensitive urban design infrastructure (WSUD) that provide new opportunities for habitat for local flora and fauna.
- A central loop road to enhance accessibility and circulation to each public and communal space.



Figure 1: Rogans Hill Park

1.1 Scope of works

This report includes an assessment of the following items:

- Existing transport conditions.
- Nearby public transport services.
- Forecast traffic generation.
- Road network impacts.
- Parking provisions.
- Access arrangements.

2. Existing transport conditions

2.1 Site location

The site is located within The Hills Shire Council local government area. The site is located approximately 1.5 kilometres east of the Castle Hill strategic centre and approximately 23 kilometres northwest of the Sydney CBD, as shown in Figure 2.

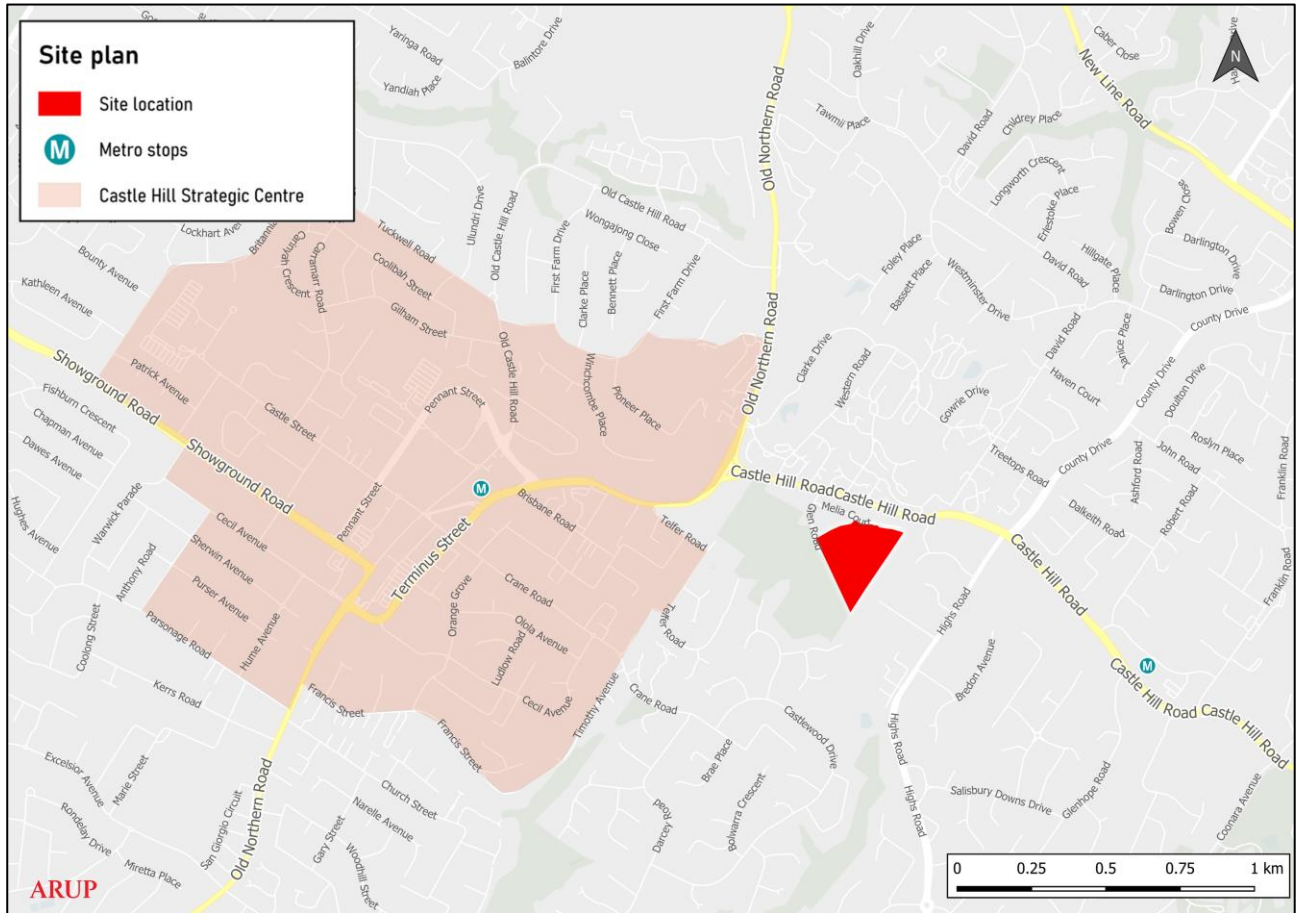


Figure 2: Site location

2.2 Road network

The surrounding road network is shown in Figure 3.

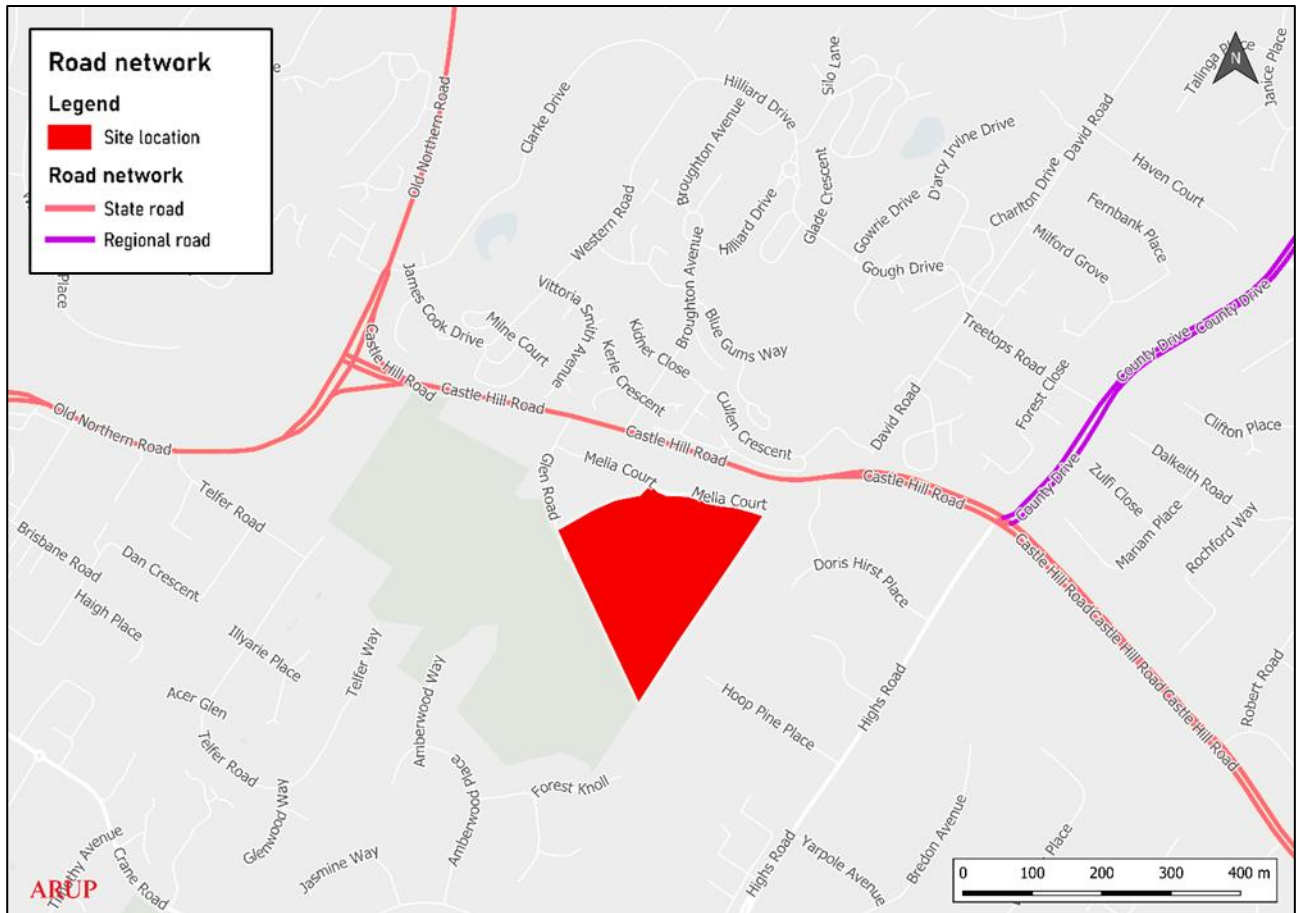


Figure 3: Surrounding road network

Key roads surrounding the site include:

- **Glen Road** is a local road providing access to the site. The site is accessible at the end of Glen Road, which features a cul-de-sac. Unrestricted parking is currently permitted on both sides of the road and is primarily used by existing residents. The road carriageway of Glen Road is generally narrow and vehicles are unable to pass each other where there are vehicles parked on both sides of the road. However, existing traffic volumes on Glen Road are very low at up to 24 vehicles in both directions during the AM and PM peak hours.



Figure 4: Glen Road, facing south (Google Maps, 2021)

- **Castle Hill Road** is a state road and connects Glen Road to the wider arterial road network. Castle Hill Road leads to Pennant Hills Road to the east and Old Northern Road to the west. Right turns are not permitted from Castle Hill Road to Glen Road on weekdays during the AM and PM peak hours (6am – 10am and 3pm – 7pm). Due to this restriction, vehicles approaching the site from the west would be required to undertake a detour (discussed further in Section 4.5.4).



Figure 5: Castle Hill Road at Glen Road, facing east (Google Maps, 2022)

- **Old Northern Road** is a state road to the west of the site. Old Northern Road connects Dural and Wisemans Ferry to the north with Castle Hill and Baulkham Hills to the south.



Figure 6: Old Northern Road north of Castle Hill Road, facing north (Google Maps, 2022)

- **County Drive** is a regional road which leads north to Cherrybrook and connects to New Line Road.



Figure 7: County Drive north of Castle Hill Road, facing south (Google Maps, 2022)

2.3 Walking environment

Footpaths are not provided on Glen Road. Footpaths are provided on both sides of Castle Hill Road. Signalised pedestrian crossings are provided at the Castle Hill Road / Glen Road intersection, which facilitate access to nearby bus stops on Castle Hill Road. These walking conditions are displayed below in Figure 8 and Figure 9.



Figure 8: Glen Road, facing north from site entry (Google Maps, 2021)



Figure 9: Castle Hill Road / Glen Road intersection (Google Maps, 2022)

Public transport services are accessible via walking from the site. These services include several bus stops located within a 5-minute walk from the site. Castle Hill and Cherrybrook metro stations are also accessible by walking and are located within a 20-minute walk from the site.

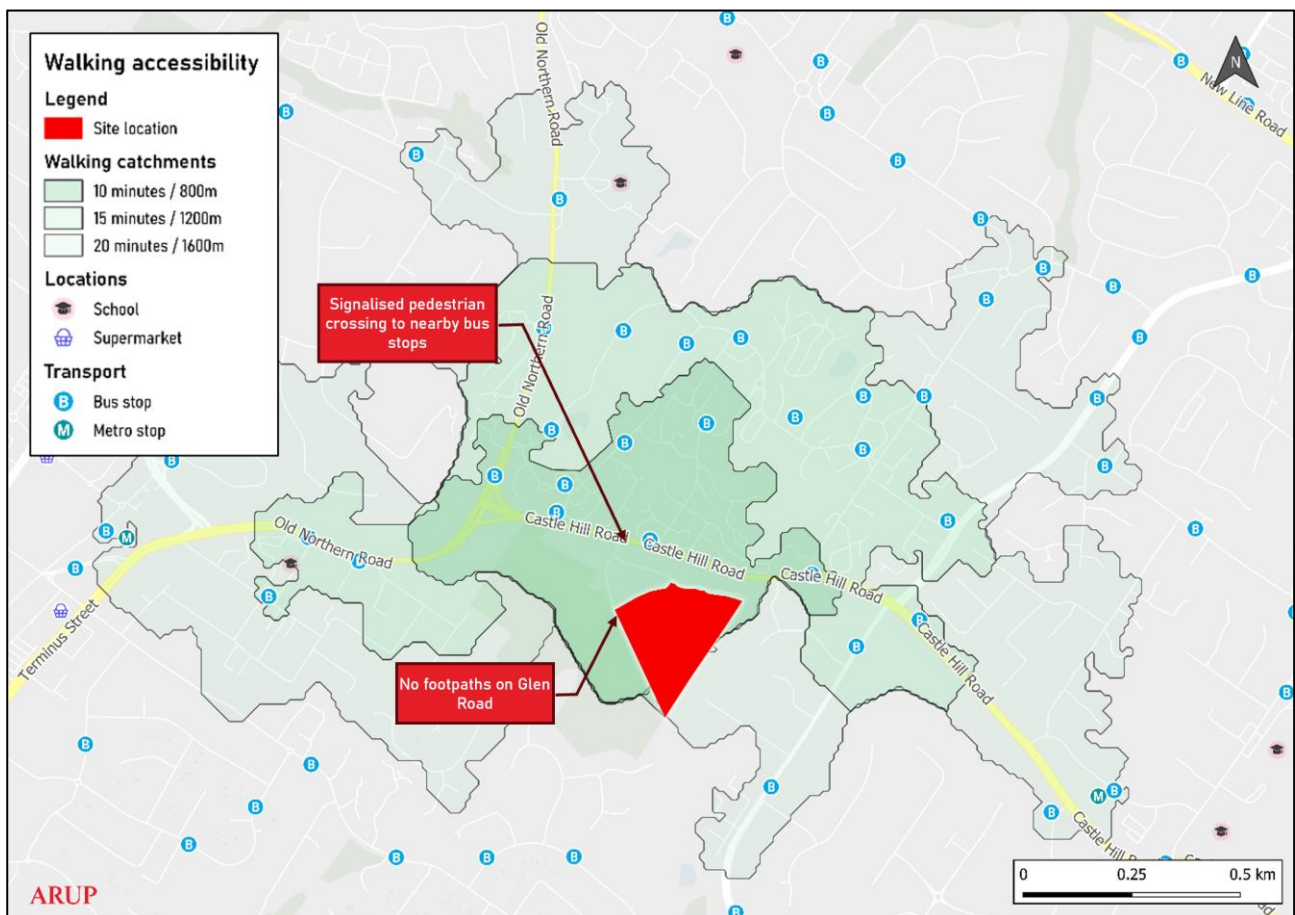


Figure 10: Walking accessibility map

2.4 Cycling environment

Near the site, the existing cycling network includes a shared path on Castle Hill Road connecting to Cherrybrook metro station as shown in Figure 11. This path starts from David Road (approximately 350 metres east of the Castle Hill Road / Glen Road intersection). Otherwise, the cycling network is generally underdeveloped.

Castle Hill, Castle Towers retail complex and Castle Hill and Cherrybrook metro stations are all accessible within a 10-minute cycle from the proposed site via shared paths or surrounding roads as shown in Figure 12.

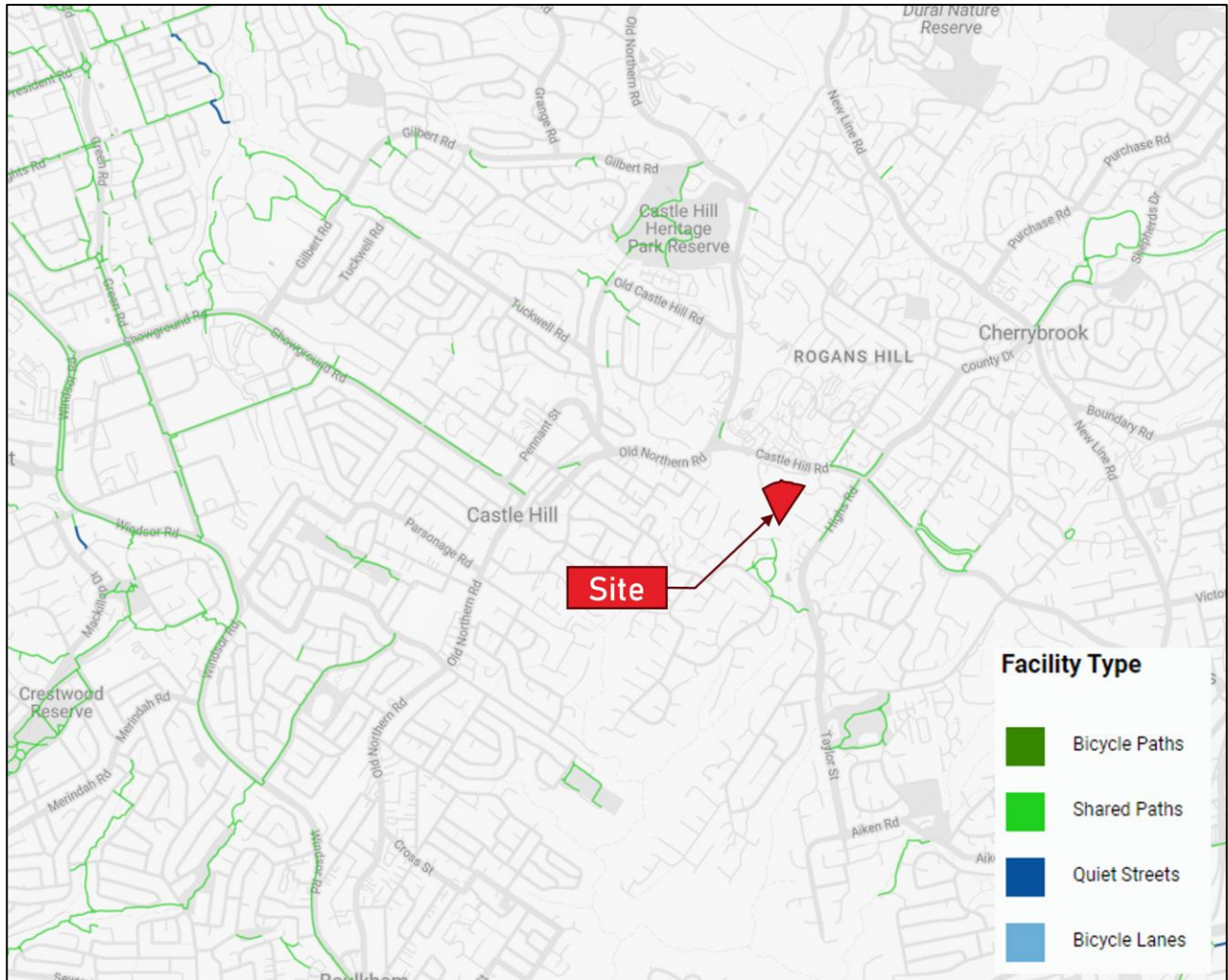


Figure 11: Cycling facilities near the site (Transport for NSW Cycleway Finder, 2023)

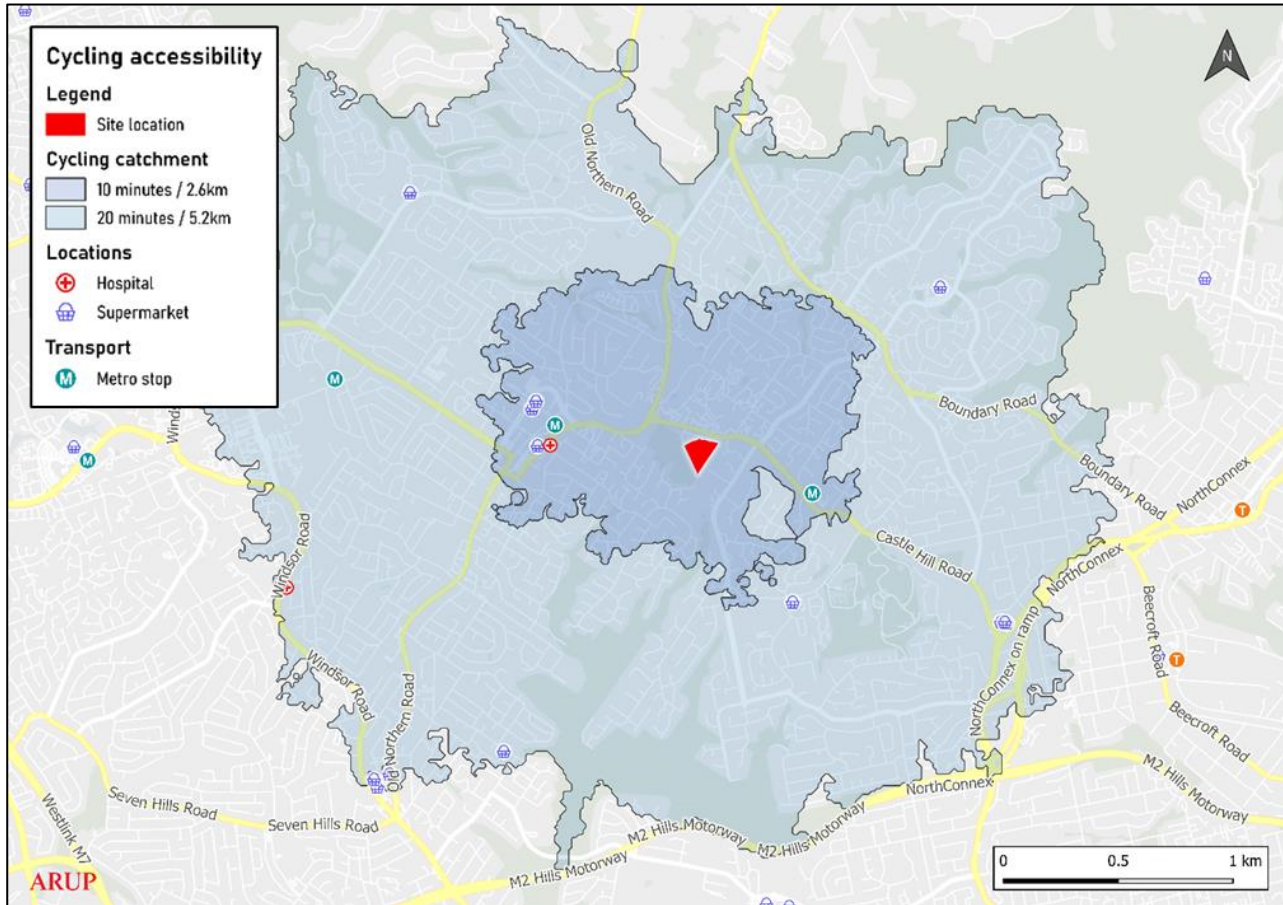


Figure 12: Cycling accessibility map

2.5 Public transport

2.5.1 Bus

The site is serviced by bus services within the Region 4 tranche (currently operated by Hillsbus).

Bus stops are located on Castle Hill Road, approximately 300 to 350 metres walking distance from the site as shown in Figure 10. These bus stops service four bus routes in either direction and provide direct connectivity to key destinations including Castle Hill, Epping, Pennant Hills and Parramatta (outlined in Table 1 and Figure 13).

Table 1: Bus routes and frequencies

Bus stop	Bus route	AM peak no. services (7:45 – 8:45am)	PM peak no. services (4:45 – 5:45pm)
Castle Hill Road at Broughton Avenue	600 Parramatta to Hornsby	5	5
	626 Kellyville to Pennant Hills via Cherrybrook	2	2
	633 Rouse Hill to Pennant Hills via Kellyville & Castle Hill	2	3
	651 Rouse Hill Station to Epping via Castle Hill	2	2
Castle Hill Road before Old Northern Road	600 Hornsby to Parramatta	7	6
	626 Pennant Hills to Kellyville via Cherrybrook	2	2
	633 Pennant Hills to Rouse Hill via Kellyville & Castle Hill	2	2
	651 Epping to Rouse Hill Station via Castle Hill	2	2

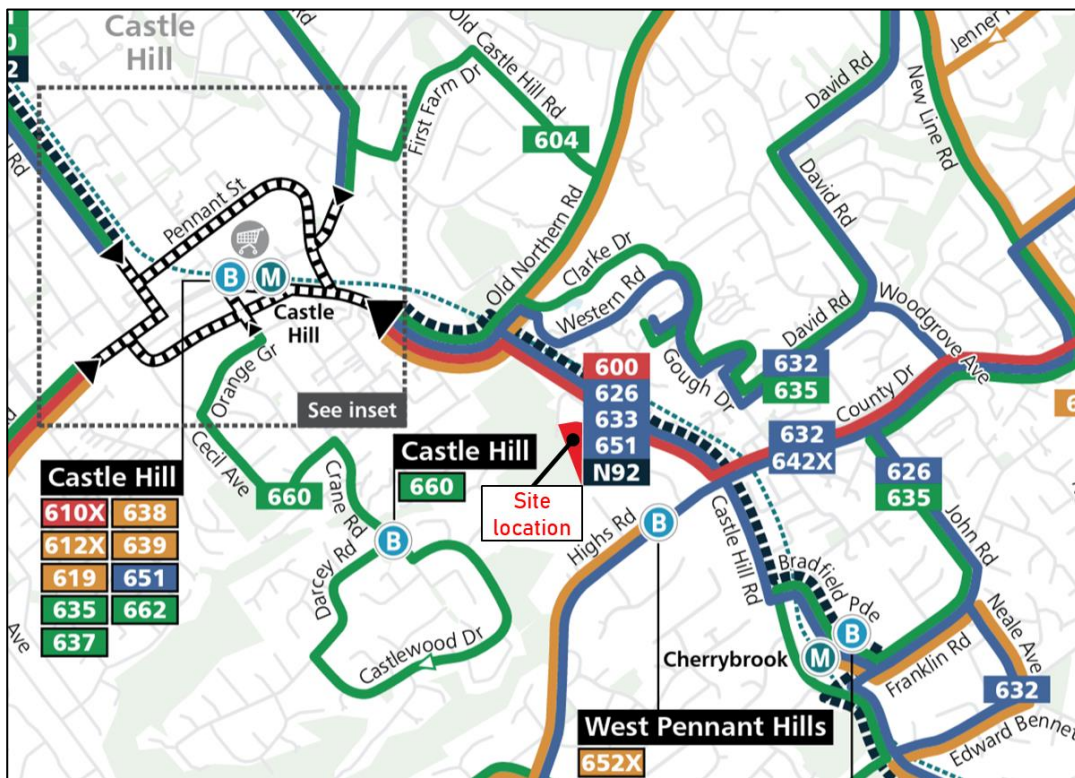


Figure 13: Hillsbus Region 4 bus network map (Hillsbus, 2023)

2.5.2 Metro

The Sydney Metro Northwest line commenced operation in 2019 and is the key rail service accessible from the proposed site. The site is located approximately 1.2 kilometres east of the Castle Hill metro station and 1.2 kilometres west of the Cherrybrook metro station. These stations are serviced by high frequency rail services, providing commuters with a convenient transport mode for local and regional trips. Metro services arrive at these stations once every four minutes during peak periods and once every ten minutes during off-peak periods.



Figure 14: Sydney Metro network map (Meadows Consulting, 2023)

2.6 Nearby land use developments

2.6.1 Cherrybrook Station Precinct

In December 2022, the rezoning proposal for the ‘Cherrybrook Station Government Land State Significant Precinct’ (Cherrybrook Station Precinct) was approved by Department of Planning and Environment (DPE). The Cherrybrook Station Precinct is centred around Cherrybrook Station, approximately 1.1 kilometres east of the site (shown in Figure 15).

Per the *Cherrybrook Station Place Strategy* (Department of Planning and Environment, 2022), the precinct would provide for an additional 3,200 residential dwellings and 50 new jobs by 2036, new open spaces and a public domain that enables safety and accessibility for all modes of transport.



Figure 15: Cherrybrook Station Precinct (DPE, 2022)

The transport impacts of the Cherrybrook Station Precinct were assessed in the *Cherrybrook Station Government Land SSP Traffic and Transport Assessment* (SCT, 2022) and *Cherrybrook Station Precinct Traffic and Transport Study* (Bitzios, 2022). The assessments identified that a range of intersection upgrades along Castle Hill Road (west of County Drive) would be required over the medium-term to accommodate traffic associated with the Cherrybrook Station Precinct and nearby projects.

The assessment also estimated the future 2026 and 2036 traffic volumes on Castle Hill Road between Old Northern Road and County Drive. This assessment estimated that the compound annual growth rate (CAGR) between 2026 background traffic and 2036 cumulative traffic (with the Cherrybrook Station Precinct and nearby projects) is approximately 1% per year in the AM and PM peak hours.

Table 2: Traffic growth on Castle Hill Road between Old Northern Road and County Drive

Year	Peak hour	Background traffic (Scenario FY0)	Cumulative traffic with Cherrybrook Station Precinct and nearby projects (Scenario FY3)
2026	AM	3,850	3,897
	PM	4,130	4,169
2036	AM	4,087	4,292 (1.09% CAGR)
	PM	4,401	4,550 (0.97% CAGR)

2.6.2 Castle Hill Precinct

In 2023, the *Castle Hill Precinct Plan* (The Hills Shire Council, 2023) was released for public exhibition. The plan sets the framework for reinforcing Castle Hill as a vibrant regional destination and expanding the mix of uses within the strategic centre, including increased housing capacity and more employment opportunities. The plan aims to accommodate an additional 6,760 dwellings and 11,405 jobs in Castle Hill by 2036.

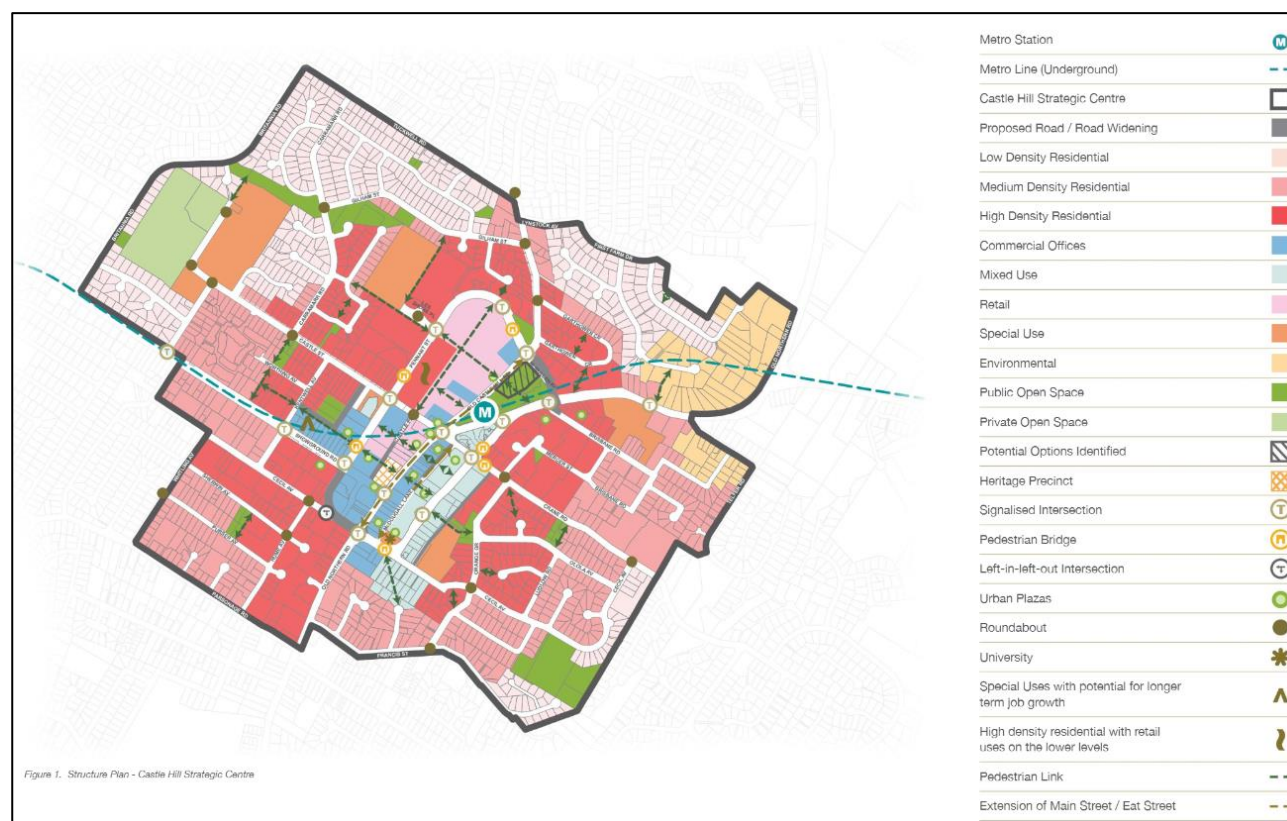


Figure 16: Castle Hill Precinct Plan (The Hills Shire Council, 2023)

The plan notes that a mix of policy measures (such as reduced parking rates within the strategic centre), improved pedestrian connectivity, modal shift to public transport and upgrades to roads within the strategic centre would be required to ensure acceptable operation of the road network in the future.

As of October 2023, information on the transport impacts of the Castle Hill Precinct is not publicly available. Therefore, the Castle Hill Precinct has not been quantitatively considered in this assessment.

3. The proposal

The proposal involves the re-development of 1020 Melia Court, Castle Hill to a mix of low and medium density residential buildings (185 dwellings) including a new public park, series of open spaces and public domain upgrades. The project includes:

- A publicly accessible park ‘Rogans Hill Park’ that is designed to provide a natural play area and outdoor fitness opportunities.
- Six (6) residential flat buildings, with heights ranging from three to six storeys and containing 147 apartment units, and 38 terraces, each spanning between two and three stories.

3.1 Local Planning Directions

Ministerial Direction 5.1 of the Local Planning Directions, issued under Section 9.1(2) of the *Environmental Planning and Assessment Act 1979*, outlines several objectives to ensure that urban structures, building forms, land use locations, development designs, subdivision and street layouts support the integration of land use and transport.

These objectives, as well as how the proposal is consistent with these objectives, is shown in Table 3.

Table 3: Alignment with Ministerial Direction 5.1

Planning objective	Alignment
Improving access to housing, jobs and services by walking, cycling and public transport	Consistent as the site is located within a 5-minute walk from bus stops, which provide direct connections to jobs and services at Castle Hill, Epping, Pennant Hills and Parramatta. Rail services at the Castle Hill and Cherrybrook metro stations are also accessible within a 20-minute walk, 10-minute cycle or via bus services.
Increasing the choice of available transport and reducing dependence on cars	Consistent as the site is located within a 5-minute walk from bus stops, which provide connections to jobs and services at Castle Hill, Epping, Pennant Hills and Parramatta. Rail services at the Castle Hill and Cherrybrook metro stations are also accessible within a 20-minute walk or 10-minute cycle or via bus services. The proposal is located within the Sydney Metro Northwest corridor and would therefore provide a lower rate of parking spaces (discussed further in Section 4.2.1). The reduced parking provision is expected to reduce trips by car. Footpaths would also be provided throughout the site to encourage walking as the preferred travel mode for internal trips.
Reducing travel demand including the number of trips generated by development and the distances travelled, especially by car	Consistent as the proposal is located within the Sydney Metro Northwest corridor and would therefore provide a lower rate of parking spaces (discussed further in Section 4.2.1). The reduced parking provision is expected to reduce trips by car.
Supporting the efficient and viable operation of public transport services	The proposal is not expected to impact the efficient and viable operation of public transport services.
Providing for the efficient movement of freight	Consistent as the internal road network of the proposal will facilitate freight/service vehicle access.

4. Transport impact assessment

4.1 Internal road network and access

The proposed layout of the internal road network is shown in Figure 17. A two-way private access road would serve as the single entry and exit point into the site. A one-way anticlockwise circulation loop road would provide access to the buildings and terraces. Five access points are proposed to off-street parking within the basement car parks.

A two-way fire trail is also proposed along the southern frontage of the development and terraces. This fire trail would be used by fire trucks only and would be sized to accommodate medium rigid vehicles.

Footpaths would be provided throughout the site to encourage walking as the preferred travel mode for internal trips.



Figure 17: Indicative road network within the development

The development would be accessed via Glen Road. As discussed in Section 2.2, unrestricted parking is currently permitted on both sides of the road. The road carriageway of Glen Road is generally narrow and vehicles are unable to pass each other where there are vehicles parked on both sides of the road. Therefore, to accommodate additional traffic generated by the development, kerbside restrictions should be considered at regular intervals on both sides of Glen Road to allow vehicles passing, such as by providing ‘no parking’ restrictions.

4.2 Parking

4.2.1 Parking requirements – HDCP

The Hills Development Control Plan (HDCP) outlines the minimum parking requirements for developments within The Hills Shire local government area. The relevant car parking rates are summarised in Table 4.

Table 4: Minimum car parking provision (HDCP)

Land use class	Land use	Required minimum provision
Residential	Residential flat buildings, dwellings in shop top housing and mixed use developments within the Sydney Metro Northwest Corridor	1 space per unit 1 visitor space per 5 units

It is noted that the site is located within the Sydney Metro Northwest Corridor (as defined by DPE) as shown in Figure 18. Therefore, the minimum parking rates for developments within the Sydney Metro Northwest Corridor are applicable to the site.

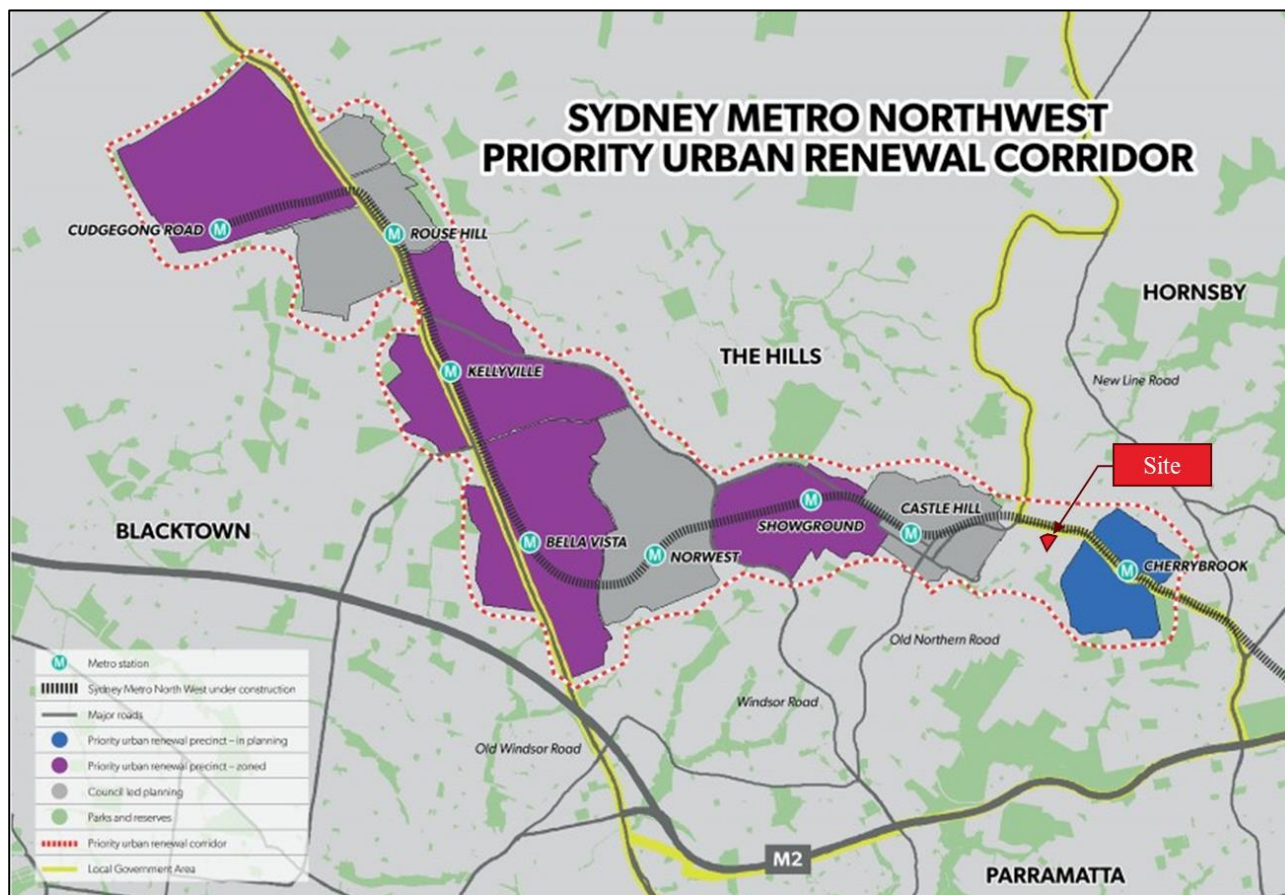


Figure 18: Sydney Metro Northwest Corridor (DPE, 2023)

The HDCP also states that:

- Motorcycle parking is to be provided for all developments with on-site parking of more than 50 car parking spaces, at a rate of 1 motorcycle parking space for every 50 car parking spaces or part thereof.
- A minimum provision of one designated carwash bay space per residential multi-unit development is required. The carwash bay can either be a designated car space separate to that of total car spaces calculated, or can be a visitor space when not utilised by visitors.

It should be noted that two car parking spaces are proposed for each terrace. Therefore, separate motorcycle parking and car wash bays are not proposed for the terraces.

Bicycle parking rates are not required in the HDCP for residential uses. Notwithstanding, a total of 30 bicycle parking spaces are proposed for the units in the basements.

By utilising the parking rates specified in the HDCP, the total required parking spaces and proposed provision as part of the development are summarised in Table 5 and Table 6. The proposed parking provision meets the minimum requirements in the HDCP.

Table 5: Minimum and proposed car parking provision (HDCP)

Building type	Yield	Required car parking spaces	Required visitor car parking spaces	Total required car parking spaces	Proposed parking spaces
1 bedroom unit	44	44	30	177	189
2 bedroom unit	73	73			
3 bedroom unit	30	30			
Terraces	38	38	8	46	76
Total		185	38	223	265

Table 6: Minimum and proposed motorcycle parking and car wash bay provision (HDCP)

Parking type	Yield	Required parking spaces	Proposed parking spaces
Motorcycle parking	177 car parking spaces (excluding terraces)	4	8
Car wash bay	6 residential multi-unit developments (excluding terraces)	6	6

4.2.2 Parking requirements – TfNSW Guide to Traffic Generating Developments

As a comparison, the rates provided in the Transport for NSW (TfNSW) *Guide to Traffic Generating Developments* (RTA, 2002) have also been reviewed. The relevant minimum car parking rates are summarised in Table 7.

Table 7: Minimum car parking provision (Guide to Traffic Generating Developments)

Land use	Required minimum provision
High-density residential flat buildings (metropolitan sub-regional centres)	0.6 spaces per 1 bedroom unit 0.9 spaces per 2 bedroom unit 1.4 spaces per 3 bedroom unit 1 visitor space per 5 units
Medium density residential flat buildings (terraces)	1 space per unit Additional 1 space per 2x 3 bedroom unit 1 visitor space per 5 units

By utilising the parking rates specified in the guide, the total required parking spaces are summarised in Table 8. The proposed parking provision meets the minimum requirements in the guide, which are generally similar to the requirements specified in the HDCP.

Table 8: Minimum and proposed car parking provision (Guide to Traffic Generating Developments)

Building type	Yield	Required car parking spaces	Required visitor car parking spaces	Total required car parking spaces	Proposed parking spaces
1 bedroom unit	44	26	30	164	189
2 bedroom unit	73	66			
3 bedroom unit	30	42			
Terraces	38	57	8	65	76
Total		191	38	229	265

4.3 Loading and waste collection

4.3.1 Waste collection

For the units, waste collection is proposed to be centralised at one basement collection area for all buildings as shown in Figure 19. A strata-managed service is proposed to run a weekly bin carting service to consolidate waste into the collection area. The waste collection area and circulation roadways to the collection area would be sized to accommodate heavy rigid vehicle movements.

For the terraces, waste collection would occur at the kerbside outside each terrace. A rear-lift waste collection vehicle would travel on the loop road to collect waste, which would be sized to accommodate medium rigid vehicle movements.

4.3.2 Loading and servicing

Typical deliveries undertaken by up to a medium rigid vehicle would be facilitated at the kerbside at specific locations along the loop road as shown in Figure 19. The basement collection area would provide a heavy rigid vehicle bay for larger vehicle deliveries.

The design of the loop road would be refined in the development application stage and will accommodate the turning paths of a medium rigid vehicle.

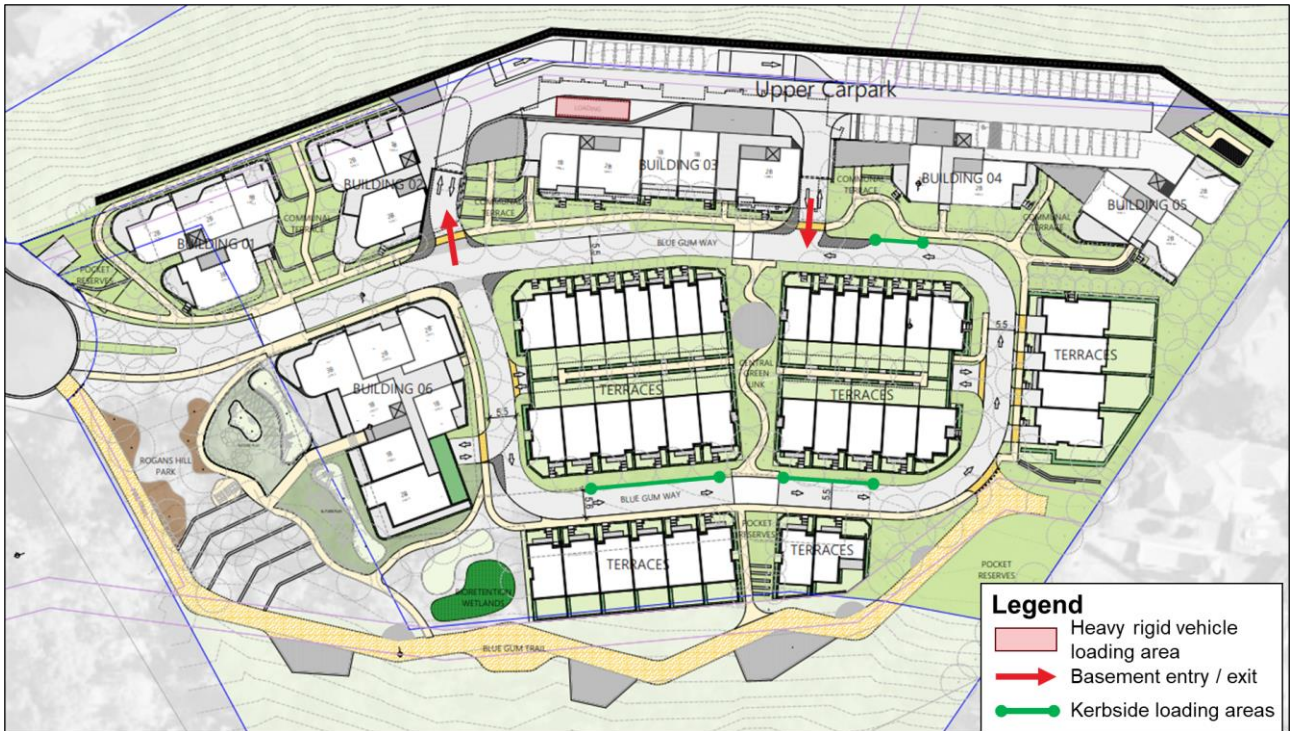


Figure 19: Loading areas

4.4 Fire truck access

In the case of a fire event, fire trucks will have access along a fire trail along the southern frontage of the site, pictured below in Figure 20. Only fire trucks will be permitted to use this trail. The design of the fire trail would be refined in the development application stage and will accommodate the turning paths of a medium rigid vehicle.



Figure 20: Site fire access

4.5 Road network

This section investigates the likely impacts the site would have on the key intersection at Castle Hill Road / Glen Road. The road network analysis has assumed the existing intersection configuration as of April 2023 and examines the following scenarios:

- Existing 2023 scenario
- Existing 2023 with the proposal (with the addition of traffic generation of the development)
- Future 2033 scenario without the proposal (+10 years)
- Future 2033 scenario with the proposal

4.5.1 Existing traffic volumes

An intersection count survey was commissioned for this study at the Castle Hill Road / Glen Road intersection. The survey was undertaken on Thursday 16 March 2023, from 7am to 9am and 4pm to 6pm.

Based on the traffic surveys, the following peak hours (highest overall traffic volume through the intersection) were identified:

- AM Peak – 7:45am to 8:45am
- PM Peak – 4:45pm to 5:45pm

For the purposes of this study, the above peak hour times were used for traffic modelling.

Existing traffic volumes on Glen Road are very low at up to 24 vehicles in both directions during the AM and PM peak hours. Traffic volumes on Castle Hill Road are relatively high, with up to approximately 1,730 vehicles in the eastbound direction and 2,200 vehicles in the westbound direction during peak hours.

4.5.2 Future 2033 traffic volumes without the proposal

To estimate future background traffic volumes in 2033 without the proposal, a background traffic growth rate was assumed. As discussed in Section 2.6.1, the *Cherrybrook Station Government Land SSP Traffic and Transport Assessment* estimated the future 2026 and 2036 traffic volumes on Castle Hill Road between Old Northern Road and County Drive. This assessment estimated that the compound annual growth rate between 2026 background traffic and 2036 cumulative traffic (with the Cherrybrook Station Precinct and nearby projects) is approximately 1% per year in the AM and PM peak hours.

As a comparison, historical traffic volumes on New Line Road (approximately 2 kilometres north of the site) were extracted from Transport for NSW's Traffic Volume Viewer (Station ID 74228) between 2009 and 2023. A summary of the average annual daily two-way traffic volumes on New Line Road is shown in Figure 21. Traffic volumes between 2009 and 2023 have generally remained similar on New Line Road, with very low overall growth of 0.05%. A decrease in traffic is observed in 2020 and 2021, which is likely due to the COVID-19 pandemic.

Therefore, to conservatively account for expected future traffic growth in the surrounding area, a background traffic growth rate of 1% per year has been assumed for this study.

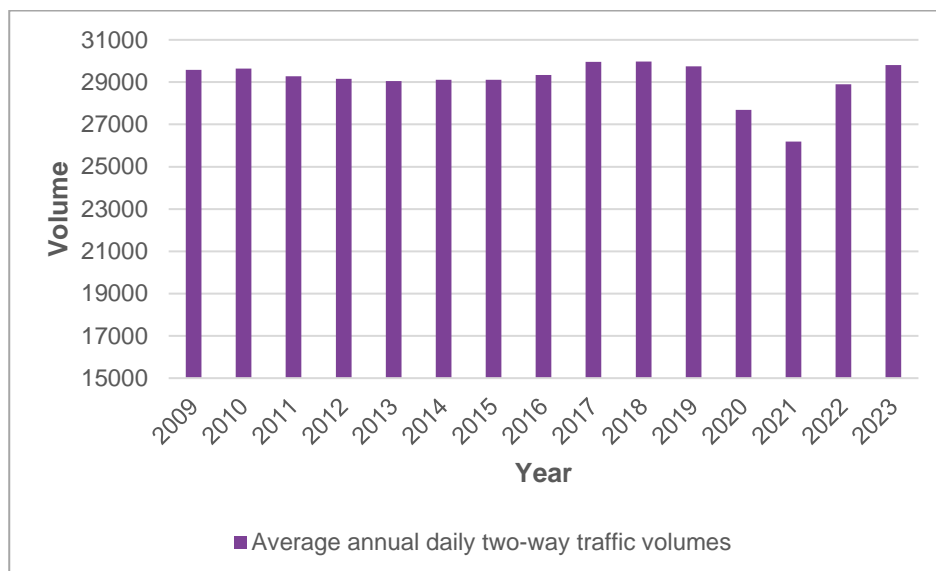


Figure 21: Historical traffic volumes on New Line Road, 100 metres south of Tennyson Close (Station ID 74228)

4.5.3 Traffic generation of the proposal

The *Guide to Traffic Generating Developments* provides indicative traffic generation rates for residential land uses. Using these rates, the following AM and PM peak hour trips generated by the proposal were calculated and summarised in Table 9.

It should be noted that the more recent traffic generation rates outlined in the TfNSW *TDT 2013/04a* (RMS, 2013) were not used as:

- Rates were not provided for terraces; and
- Rates for high density residential flat dwellings were derived from surveys on developments greater than six storeys, which are not assumed to be representative of the proposal.

Table 9: Vehicle trips generated by the proposal

Land use	Yield	Dwelling type	Peak hour trip rate	AM and PM peak hour trips
Terraces	38	Medium density residential flat building <i>Large units and town houses (three or more bedrooms)</i>	0.65 trips per unit ¹	25
Units	147	High density residential flat building <i>Metropolitan sub-regional centres</i>	0.29 trips per unit	43
Total				68

4.5.4 Traffic distribution

As a residential development, the inbound and outbound split of trips was assumed to be 20% inbound and 80% outbound during the AM peak hour, and vice versa during the PM peak hour.

¹ The conservative trip rate has been selected from the provided range (0.5-0.65) for this assessment.

Table 10: Inbound and outbound flows of traffic generation during peak hours

Peak hour period	Inbound	Outbound
AM peak hour	14	54
PM peak hour	54	14

The distribution of trips generated to and from the site has been adopted from the 2023 survey counts as shown in Figure 22.

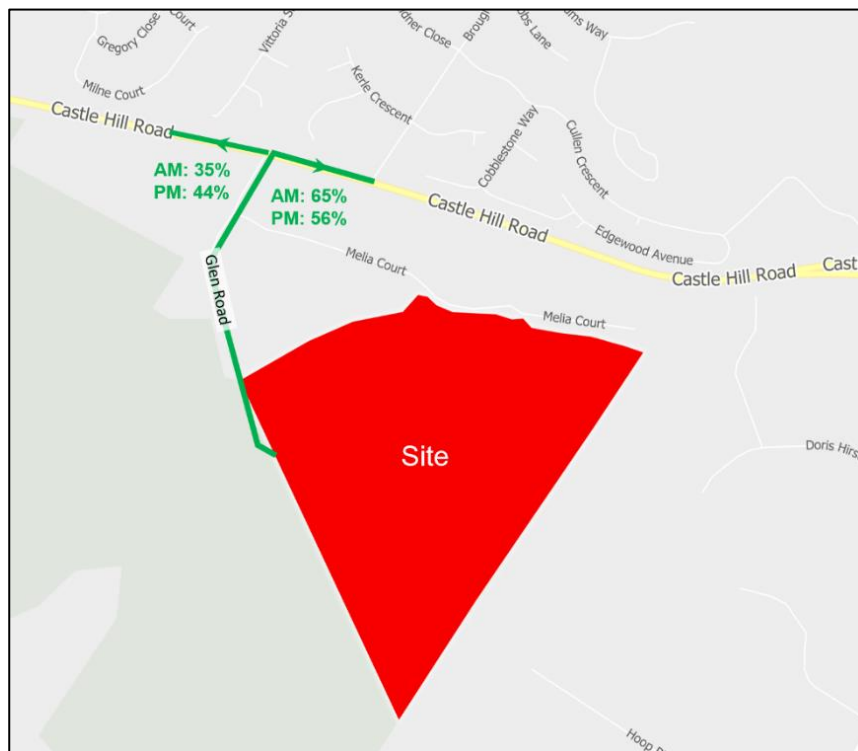


Figure 22: Assumed trip distribution

For inbound trips, it is noted that right turns are not permitted from Castle Hill Road to Glen Road on weekdays during the AM and PM peak hours (6am – 10am and 3pm – 7pm). Due to this restriction, vehicles (except for emergency vehicles) approaching the site from the west would be required to undertake a detour. The assumed detour route is shown in Figure 23 and requires vehicles to travel through the Castle Hill Road / Glen Road intersection and circulate via Robert Road, John Road and County Drive, then turn left from Castle Hill Road into Glen Road. This detour is approximately 3 kilometres long with an estimated travel time of 6 minutes.

Therefore, vehicles undertaking the detour would need to undertake two movements at the Castle Hill Road / Glen Road intersection and have been considered in this assessment.

Table 11: Level of Service criteria for intersections

Level of Service	Average delay (s)	Description
A	Less than 14	Good operation.
B	15 to 28	Good with acceptable delays and spare capacity.
C	29 to 42	Satisfactory.
D	43 to 56	Operating near capacity.
E	57 to 70	At capacity. At signals, incidents will cause excessive delays. Roundabouts require other control mode.
F	Greater than 71	Unsatisfactory with excessive queuing.

Another common measure of intersection performance is the degree of saturation (DoS), which provides an overall measure of the capability of the intersection to accommodate additional traffic. A DoS of 1.0 indicates that an intersection is operating at capacity.

The traffic modelling results for each scenario are summarised in Table 12.

Table 12: Traffic modelling results

Peak Period	Scenario	DoS	Average delay (s)	Level of Service	Max. queue (m)
AM Peak	Existing 2023	0.71	5	A	140m (east approach)
	2023 with proposal	0.72	6	A	145m (east approach)
	Future 2033 without proposal	0.78	6	A	175m (east approach)
	Future 2033 with proposal	0.79	7	A	180m (east approach)
PM Peak	Existing 2023	0.75	4	A	190m (east approach)
	2023 with proposal	0.77	5	A	205m (east approach)
	Future 2033 without proposal	0.83	5	A	255m (east approach)
	Future 2033 with proposal	0.85	6	A	270m (east approach)

In 2023 and 2033, the Castle Hill Road / Glen Road intersection operates at an efficient Level of Service A for both the existing and with proposal scenarios.

Therefore, based on a conservative modelling approach, the development is expected to have a minor impact on the Castle Hill Road / Glen Road intersection during peak periods. Traffic generated by the development is very low when compared to background traffic volumes on Castle Hill Road. This low traffic generation is also expected to only have a minor impact on intersections along the detour route (for vehicles approaching the site from the west during weekday peak hours). Therefore, the road network impacts of the proposal are expected to be minimal.

5. Conclusion

This transport impact assessment has been prepared as part of the Planning Proposal for the Rogans Hill Park development at 2 Glen Road, Castle Hill. The key findings of the assessment are:

- The proposal would include 185 dwellings (consisting of 147 apartments and 38 terraces) as well as community open space.
- The site is located within a 5-minute walk from bus stops, which provide connections to jobs and services at Castle Hill, Epping, Pennant Hills and Parramatta. Rail services at the Castle Hill and Cherrybrook metro stations are also accessible within a 20-minute walk or 10-minute cycle or via bus services.
- The road carriageway of Glen Road is generally narrow and vehicles are unable to pass each other where there are vehicles parked on both sides of the road. Therefore, to accommodate additional traffic generated by the development, kerbside restrictions should be considered at regular intervals on both sides of Glen Road to allow vehicles passing, such as by providing ‘no parking’ restrictions.
- The site is located within the Sydney Metro Northwest Corridor (as defined by DPE) and the proposed parking provision meets the relevant requirements in the HDCP.
- Right turns are not permitted from Castle Hill Road to Glen Road on weekdays during the AM and PM peak hours (6am – 10am and 3pm – 7pm). Due to this restriction, vehicles (except for emergency vehicles) approaching the site from the west would be required to undertake a detour. This detour is approximately 3 kilometres long with an estimated travel time of 6 minutes.
- Based on a conservative modelling approach, the development is expected to have a minor impact on the Castle Hill Road / Glen Road intersection during peak periods. Traffic generated by the development is very low when compared to background traffic volumes on Castle Hill Road. This low traffic generation is also expected to only have a minor impact on intersections along the detour route (for vehicles approaching the site from the west during weekday peak hours). Therefore, the road network impacts of the proposal are expected to be minimal.

Appendix A – SIDRA Modelling Results

SITE LAYOUT

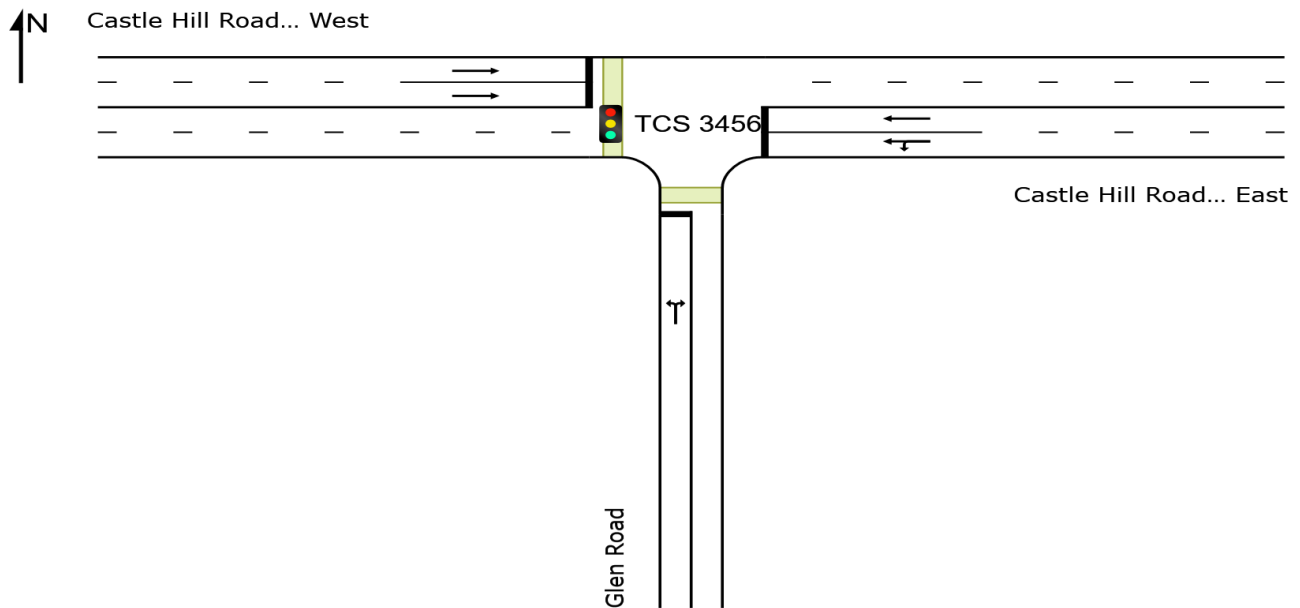
 **Site: TCS 3456 [2023 AM Peak Glen Road / Castle Hill Road
(Site Folder: 2023 AM Peak (Existing))]**

Glen Road | Castle Hill Road Intersection

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated

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



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MOVEMENT SUMMARY

 **Site: TCS 3456 [2023 AM Peak Glen Road / Castle Hill Road (Site Folder: 2023 AM Peak (Existing))]**

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 75 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Glen Road															
1	L2	All MCs	6	0.0	6	0.0	0.077	34.9	LOS C	0.6	4.4	0.90	0.69	0.90	21.3
3	R2	All MCs	12	9.1	12	9.1	* 0.077	34.9	LOS C	0.6	4.4	0.90	0.69	0.90	31.0
Approach			18	5.9	18	5.9	0.077	34.9	LOS C	0.6	4.4	0.90	0.69	0.90	28.2
East: Castle Hill Road East															
4	L2	All MCs	7	28.6	7	28.6	0.709	11.3	LOS A	19.5	140.5	0.58	0.54	0.58	50.5
5	T1	All MCs	1987	3.3	1987	3.3	* 0.709	5.5	LOS A	19.5	140.6	0.58	0.54	0.58	54.7
Approach			1995	3.4	1995	3.4	0.709	5.5	LOS A	19.5	140.6	0.58	0.54	0.58	54.7
West: Castle Hill Road West															
11	T1	All MCs	1823	3.6	1823	3.6	0.648	5.0	LOS A	16.5	117.5	0.53	0.49	0.53	55.2
Approach			1823	3.6	1823	3.6	0.648	5.0	LOS A	16.5	117.5	0.53	0.49	0.53	55.2
All Vehicles			3836	3.5	3836	3.5	0.709	5.4	LOS A	19.5	140.6	0.56	0.52	0.56	54.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options 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.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Glen Road												
P1	Full	1	1	31.7	LOS D	0.0	0.0	0.92	0.92	198.4	200.0	1.01
West: Castle Hill Road West												
P4	Full	4	4	31.7	LOS D	0.0	0.0	0.92	0.92	198.4	200.0	1.01
All Pedestrians		5	5	31.7	LOS D	0.0	0.0	0.92	0.92	198.4	200.0	1.01

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.

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MOVEMENT SUMMARY

 Site: TCS 3456 [2023 PM Peak Glen Road / Castle Hill Road
(Site Folder: 2023 PM Peak (Existing))]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
South: Glen Road															
1	L2	All MCs	4	0.0	4	0.0	0.051	48.1	LOS D	0.4	3.0	0.93	0.67	0.93	17.4
3	R2	All MCs	5	0.0	5	0.0	* 0.051	48.1	LOS D	0.4	3.0	0.93	0.67	0.93	26.7
Approach			9	0.0	9	0.0	0.051	48.1	LOS D	0.4	3.0	0.93	0.67	0.93	23.1
East: Castle Hill Road East															
4	L2	All MCs	12	0.0	12	0.0	0.750	10.4	LOS A	26.9	191.6	0.53	0.49	0.53	51.3
5	T1	All MCs	2309	2.0	2309	2.0	* 0.750	4.9	LOS A	26.9	191.7	0.53	0.49	0.53	55.3
Approach			2321	2.0	2321	2.0	0.750	4.9	LOS A	26.9	191.7	0.53	0.49	0.53	55.2
West: Castle Hill Road West															
11	T1	All MCs	1701	1.5	1701	1.5	0.547	3.4	LOS A	14.1	98.6	0.37	0.34	0.37	56.6
Approach			1701	1.5	1701	1.5	0.547	3.4	LOS A	14.1	98.6	0.37	0.34	0.37	56.6
All Vehicles			4032	1.8	4032	1.8	0.750	4.4	LOS A	26.9	191.7	0.46	0.42	0.46	55.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options 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.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Glen Road												
P1	Full	1	1	44.2	LOS E	0.0	0.0	0.94	0.94	210.8	200.0	0.95
West: Castle Hill Road West												
P4	Full	1	1	44.2	LOS E	0.0	0.0	0.94	0.94	210.8	200.0	0.95
All Pedestrians		2	2	44.2	LOS E	0.0	0.0	0.94	0.94	210.8	200.0	0.95

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.

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MOVEMENT SUMMARY

 Site: TCS 3456 [2023 AM Peak (With Proposal) Glen Road / Castle Hill Road (Site Folder: 2023 AM Peak (With Proposal))]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 75 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Glen Road															
1	L2	All MCs	26	0.0	26	0.0	0.311	36.4	LOS C	2.6	18.6	0.94	0.75	0.94	20.8
3	R2	All MCs	48	4.3	48	4.3	* 0.311	36.4	LOS C	2.6	18.6	0.94	0.75	0.94	30.5
Approach			75	2.8	75	2.8	0.311	36.4	LOS C	2.6	18.6	0.94	0.75	0.94	27.7
East: Castle Hill Road East															
4	L2	All MCs	22	28.6	22	28.6	0.716	11.4	LOS A	19.8	143.3	0.59	0.55	0.59	50.4
5	T1	All MCs	1987	3.3	1987	3.3	* 0.716	5.5	LOS A	19.9	143.6	0.59	0.55	0.59	54.7
Approach			2009	3.6	2009	3.6	0.716	5.6	LOS A	19.9	143.6	0.59	0.55	0.59	54.6
West: Castle Hill Road West															
11	T1	All MCs	1827	3.6	1827	3.6	0.650	5.0	LOS A	16.6	118.2	0.53	0.49	0.53	55.2
Approach			1827	3.6	1827	3.6	0.650	5.0	LOS A	16.6	118.2	0.53	0.49	0.53	55.2
All Vehicles			3912	3.6	3912	3.6	0.716	5.9	LOS A	19.9	143.6	0.57	0.53	0.57	54.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options 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.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Glen Road												
P1	Full	1	1	31.7	LOS D	0.0	0.0	0.92	0.92	198.4	200.0	1.01
West: Castle Hill Road West												
P4	Full	4	4	31.7	LOS D	0.0	0.0	0.92	0.92	198.4	200.0	1.01
All Pedestrians		5	5	31.7	LOS D	0.0	0.0	0.92	0.92	198.4	200.0	1.01

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.

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MOVEMENT SUMMARY

 Site: TCS 3456 [2023 PM Peak (With Proposal) Glen Road / Castle Hill Road (Site Folder: 2023 PM Peak (With Proposal))]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Glen Road															
1	L2	All MCs	11	0.0	11	0.0	0.130	48.9	LOS D	1.1	7.8	0.94	0.71	0.94	17.2
3	R2	All MCs	14	0.0	14	0.0	* 0.130	48.9	LOS D	1.1	7.8	0.94	0.71	0.94	26.5
Approach			24	0.0	24	0.0	0.130	48.9	LOS D	1.1	7.8	0.94	0.71	0.94	23.0
East: Castle Hill Road East															
4	L2	All MCs	68	0.0	68	0.0	0.768	10.6	LOS A	28.7	204.0	0.55	0.52	0.55	50.8
5	T1	All MCs	2309	2.0	2309	2.0	* 0.768	5.1	LOS A	28.7	204.5	0.55	0.51	0.55	55.0
Approach			2378	1.9	2378	1.9	0.768	5.2	LOS A	28.7	204.5	0.55	0.51	0.55	54.9
West: Castle Hill Road West															
11	T1	All MCs	1726	1.5	1726	1.5	0.555	3.5	LOS A	14.4	101.3	0.38	0.35	0.38	56.6
Approach			1726	1.5	1726	1.5	0.555	3.5	LOS A	14.4	101.3	0.38	0.35	0.38	56.6
All Vehicles			4128	1.8	4128	1.8	0.768	4.7	LOS A	28.7	204.5	0.48	0.44	0.48	55.3

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options 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.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Glen Road												
P1	Full	1	1	44.2	LOS E	0.0	0.0	0.94	0.94	210.8	200.0	0.95
West: Castle Hill Road West												
P4	Full	1	1	44.2	LOS E	0.0	0.0	0.94	0.94	210.8	200.0	0.95
All Pedestrians		2	2	44.2	LOS E	0.0	0.0	0.94	0.94	210.8	200.0	0.95

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.

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MOVEMENT SUMMARY

 **Site: TCS 3456 [2033 AM Peak Glen Road / Castle Hill Road (Site Folder: 2033 AM Peak)]**

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 75 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Glen Road															
1	L2	All MCs	7	0.0	7	0.0	0.085	35.0	LOS C	0.7	4.9	0.91	0.69	0.91	21.3
3	R2	All MCs	13	8.3	13	8.3	* 0.085	35.0	LOS C	0.7	4.9	0.91	0.69	0.91	30.9
Approach			20	5.3	20	5.3	0.085	35.0	LOS C	0.7	4.9	0.91	0.69	0.91	28.0
East: Castle Hill Road East															
4	L2	All MCs	8	25.0	8	25.0	0.783	12.0	LOS A	24.4	176.2	0.66	0.61	0.66	49.8
5	T1	All MCs	2196	3.4	2196	3.4	* 0.783	6.2	LOS A	24.5	176.4	0.66	0.61	0.66	54.1
Approach			2204	3.4	2204	3.4	0.783	6.2	LOS A	24.5	176.4	0.66	0.61	0.66	54.1
West: Castle Hill Road West															
11	T1	All MCs	2015	3.6	2015	3.6	0.717	5.5	LOS A	20.2	144.3	0.59	0.55	0.59	54.7
Approach			2015	3.6	2015	3.6	0.717	5.5	LOS A	20.2	144.3	0.59	0.55	0.59	54.7
All Vehicles			4239	3.5	4239	3.5	0.783	6.0	LOS A	24.5	176.4	0.63	0.58	0.63	54.2

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options 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.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Glen Road												
P1	Full	1	1	31.7	LOS D	0.0	0.0	0.92	0.92	198.4	200.0	1.01
West: Castle Hill Road West												
P4	Full	4	4	31.7	LOS D	0.0	0.0	0.92	0.92	198.4	200.0	1.01
All Pedestrians		5	5	31.7	LOS D	0.0	0.0	0.92	0.92	198.4	200.0	1.01

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.

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MOVEMENT SUMMARY

 Site: TCS 3456 [2033 PM Peak Glen Road / Castle Hill Road
(Site Folder: 2033 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Glen Road															
1	L2	All MCs	4	0.0	4	0.0	0.057	48.2	LOS D	0.5	3.3	0.93	0.67	0.93	17.4
3	R2	All MCs	6	0.0	6	0.0	* 0.057	48.2	LOS D	0.5	3.3	0.93	0.67	0.93	26.7
Approach			11	0.0	11	0.0	0.057	48.2	LOS D	0.5	3.3	0.93	0.67	0.93	23.5
East: Castle Hill Road East															
4	L2	All MCs	13	0.0	13	0.0	0.828	11.3	LOS A	35.5	252.9	0.63	0.58	0.63	50.3
5	T1	All MCs	2552	2.0	2552	2.0	* 0.828	5.8	LOS A	35.5	253.0	0.63	0.58	0.63	54.4
Approach			2564	2.0	2564	2.0	0.828	5.8	LOS A	35.5	253.0	0.63	0.58	0.63	54.4
West: Castle Hill Road West															
11	T1	All MCs	1879	1.6	1879	1.6	0.604	3.7	LOS A	16.9	118.9	0.40	0.37	0.40	56.3
Approach			1879	1.6	1879	1.6	0.604	3.7	LOS A	16.9	118.9	0.40	0.37	0.40	56.3
All Vehicles			4454	1.8	4454	1.8	0.828	5.0	LOS A	35.5	253.0	0.54	0.49	0.54	55.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options 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.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Glen Road												
P1	Full	1	1	44.2	LOS E	0.0	0.0	0.94	0.94	210.8	200.0	0.95
West: Castle Hill Road West												
P4	Full	1	1	44.2	LOS E	0.0	0.0	0.94	0.94	210.8	200.0	0.95
All Pedestrians		2	2	44.2	LOS E	0.0	0.0	0.94	0.94	210.8	200.0	0.95

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.

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Project: \\global.arup.com\australasia\SYD\Projects\294000\294523-00 2 Glen Rd\Work\Internal\Traffic Modelling\231024 Glen Rd Castle Hill Road and Northern Road Intersection - Isolated.sip9

MOVEMENT SUMMARY

 Site: TCS 3456 [2033 AM Peak (With Proposal) Glen Road / Castle Hill Road (Site Folder: 2033 AM Peak (With Proposal))]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 75 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV]		Arrival Flows [Total HV]		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh. Dist]		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Glen Road															
1	L2	All MCs	27	0.0	27	0.0	0.319	36.5	LOS C	2.7	19.2	0.94	0.75	0.94	20.7
3	R2	All MCs	49	4.3	49	4.3	* 0.319	36.4	LOS C	2.7	19.2	0.94	0.75	0.94	30.5
Approach			77	2.7	77	2.7	0.319	36.4	LOS C	2.7	19.2	0.94	0.75	0.94	27.6
East: Castle Hill Road East															
4	L2	All MCs	22	28.6	22	28.6	0.790	12.3	LOS A	25.1	181.2	0.67	0.62	0.68	49.4
5	T1	All MCs	2196	3.4	2196	3.4	* 0.790	6.5	LOS A	25.2	181.2	0.67	0.62	0.68	53.9
Approach			2218	3.6	2218	3.6	0.790	6.5	LOS A	25.2	181.2	0.67	0.62	0.68	53.8
West: Castle Hill Road West															
11	T1	All MCs	2019	3.6	2019	3.6	0.719	5.6	LOS A	20.3	145.1	0.59	0.55	0.59	54.7
Approach			2019	3.6	2019	3.6	0.719	5.6	LOS A	20.3	145.1	0.59	0.55	0.59	54.7
All Vehicles			4314	3.6	4314	3.6	0.790	6.6	LOS A	25.2	181.2	0.64	0.59	0.64	53.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options 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.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Glen Road												
P1	Full	1	1	31.7	LOS D	0.0	0.0	0.92	0.92	198.4	200.0	1.01
West: Castle Hill Road West												
P4	Full	4	4	31.7	LOS D	0.0	0.0	0.92	0.92	198.4	200.0	1.01
All Pedestrians		5	5	31.7	LOS D	0.0	0.0	0.92	0.92	198.4	200.0	1.01

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.

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Project: \\global.arup.com\australasia\SYD\Projects\294000\294523-00 2 Glen Rd\Work\Internal\Traffic Modelling\231024 Glen Rd Castle Hill Road and Northern Road Intersection - Isolated.sip9

MOVEMENT SUMMARY

 Site: TCS 3456 [2033 PM Peak (With Proposal) Glen Road / Castle Hill Road (Site Folder: 2033 PM Peak (With Proposal))]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site User-Given Phase Times)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows [Total HV] veh/h %		Arrival Flows [Total HV] veh/h %		Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. Dist] veh m		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Glen Road															
1	L2	All MCs	11	0.0	11	0.0	0.136	49.0	LOS D	1.2	8.2	0.94	0.71	0.94	17.2
3	R2	All MCs	15	0.0	15	0.0	* 0.136	48.9	LOS D	1.2	8.2	0.94	0.71	0.94	26.5
Approach			25	0.0	25	0.0	0.136	48.9	LOS D	1.2	8.2	0.94	0.71	0.94	23.2
East: Castle Hill Road East															
4	L2	All MCs	71	0.0	71	0.0	0.847	11.6	LOS A	38.1	271.1	0.66	0.62	0.66	49.8
5	T1	All MCs	2552	2.0	2552	2.0	* 0.847	6.1	LOS A	38.2	271.8	0.66	0.61	0.66	54.1
Approach			2622	2.0	2622	2.0	0.847	6.2	LOS A	38.2	271.8	0.66	0.61	0.66	54.0
West: Castle Hill Road West															
11	T1	All MCs	1904	1.5	1904	1.5	0.612	3.8	LOS A	17.4	122.1	0.41	0.38	0.41	56.3
Approach			1904	1.5	1904	1.5	0.612	3.8	LOS A	17.4	122.1	0.41	0.38	0.41	56.3
All Vehicles			4552	1.8	4552	1.8	0.847	5.5	LOS A	38.2	271.8	0.56	0.51	0.56	54.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Options 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.

Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).

Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.

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

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

Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		[Ped ped	Dist] m			sec	m	m/sec
South: Glen Road												
P1	Full	1	1	44.2	LOS E	0.0	0.0	0.94	0.94	210.8	200.0	0.95
West: Castle Hill Road West												
P4	Full	1	1	44.2	LOS E	0.0	0.0	0.94	0.94	210.8	200.0	0.95
All Pedestrians		2	2	44.2	LOS E	0.0	0.0	0.94	0.94	210.8	200.0	0.95

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: TCS 3456 [2023 AM Peak Glen Road / Castle Hill Road (Site Folder: 2023 AM Peak (Existing))]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 75 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Four-Phase Leading Right Turns
Input Phase Sequence: A, B
Output Phase Sequence: A, B
Reference Phase: Phase A

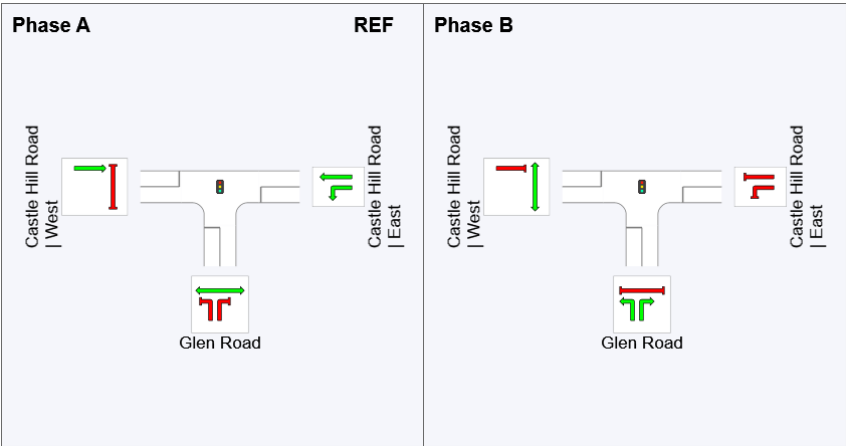
Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	59
Green Time (sec)	56	10
Phase Time (sec)	62	13
Phase Split	83%	17%
Phase Frequency (%)	100.0	50.0 ¹













See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

¹ Phase Frequency has been given with User-Specified Phase Times.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

 Normal Movement	 Permitted/Opposed
 Slip/Bypass-Lane Movement	 Opposed Slip/Bypass-Lane
 Stopped Movement	 Turn On Red
 Other Movement Class (MC) Running	 Undetected Movement
 Mixed Running & Stopped MCs	 Continuous Movement
 Other Movement Class (MC) Stopped	 Phase Transition Applied

PHASING SUMMARY

 **Site: TCS 3456 [2023 PM Peak Glen Road / Castle Hill Road (Site Folder: 2023 PM Peak (Existing))]**

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Four-Phase Leading Right Turns
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Reference Phase: Phase A

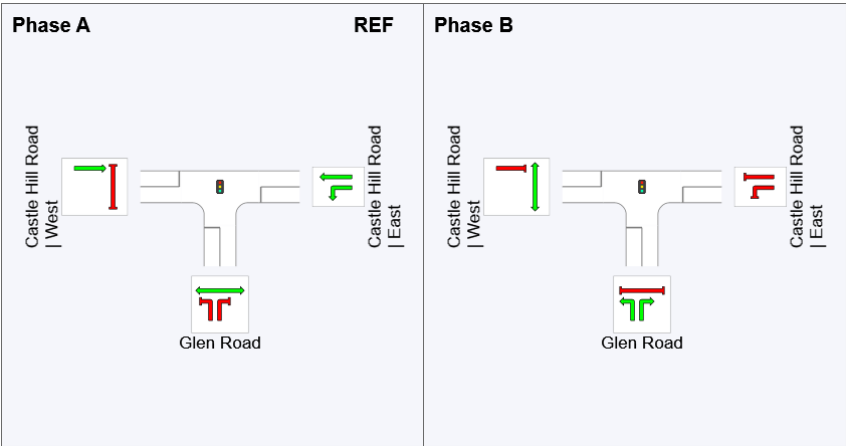
Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	84
Green Time (sec)	81	10
Phase Time (sec)	87	13
Phase Split	87%	13%
Phase Frequency (%)	100.0	50.0 ¹













See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

¹ Phase Frequency has been given with User-Specified Phase Times.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

 Normal Movement	 Permitted/Opposed
 Slip/Bypass-Lane Movement	 Opposed Slip/Bypass-Lane
 Stopped Movement	 Turn On Red
 Other Movement Class (MC) Running	 Undetected Movement
 Mixed Running & Stopped MCs	 Continuous Movement
 Other Movement Class (MC) Stopped	 Phase Transition Applied

PHASING SUMMARY

 Site: TCS 3456 [2023 AM Peak (With Proposal) Glen Road / Castle Hill Road (Site Folder: 2023 AM Peak (With Proposal))]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 75 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Four-Phase Leading Right Turns
Input Phase Sequence: A, B
Output Phase Sequence: A, B
Reference Phase: Phase A

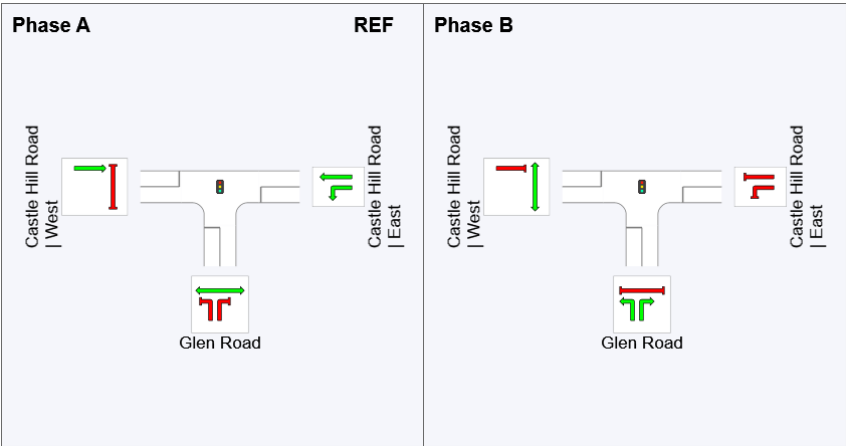
Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	59
Green Time (sec)	56	10
Phase Time (sec)	62	13
Phase Split	83%	17%
Phase Frequency (%)	100.0	50.0 ¹













See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

¹ Phase Frequency has been given with User-Specified Phase Times.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

 Normal Movement	 Permitted/Opposed
 Slip/Bypass-Lane Movement	 Opposed Slip/Bypass-Lane
 Stopped Movement	 Turn On Red
 Other Movement Class (MC) Running	 Undetected Movement
 Mixed Running & Stopped MCs	 Continuous Movement
 Other Movement Class (MC) Stopped	 Phase Transition Applied

PHASING SUMMARY

Site: TCS 3456 [2023 PM Peak (With Proposal) Glen Road / Castle Hill Road (Site Folder: 2023 PM Peak (With Proposal))]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Four-Phase Leading Right Turns
Input Phase Sequence: A, B
Output Phase Sequence: A, B
Reference Phase: Phase A

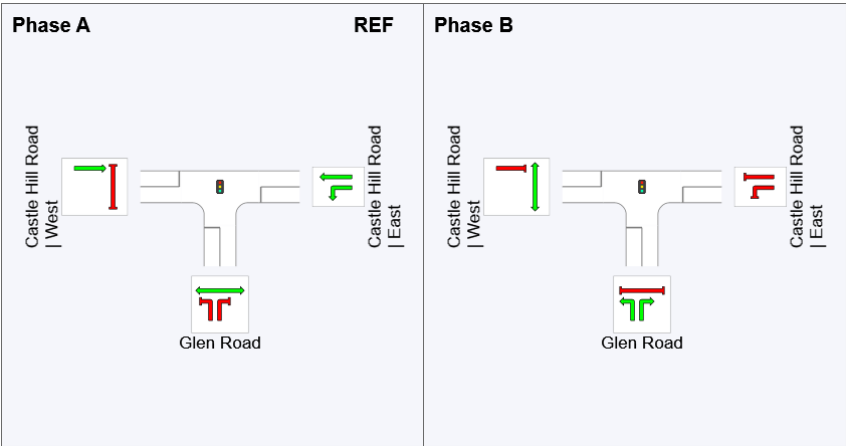
Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	84
Green Time (sec)	81	10
Phase Time (sec)	87	13
Phase Split	87%	13%
Phase Frequency (%)	100.0	50.0 ¹

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

¹ Phase Frequency has been given with User-Specified Phase Times.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

	Normal Movement		Permitted/Opposed
	Slip/Bypass-Lane Movement		Opposed Slip/Bypass-Lane
	Stopped Movement		Turn On Red
	Other Movement Class (MC) Running		Undetected Movement
	Mixed Running & Stopped MCs		Continuous Movement
	Other Movement Class (MC) Stopped		Phase Transition Applied

PHASING SUMMARY

 **Site: TCS 3456 [2033 AM Peak Glen Road / Castle Hill Road (Site Folder: 2033 AM Peak)]**

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 75 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Four-Phase Leading Right Turns
Input Phase Sequence: A, B
Output Phase Sequence: A, B
Reference Phase: Phase A

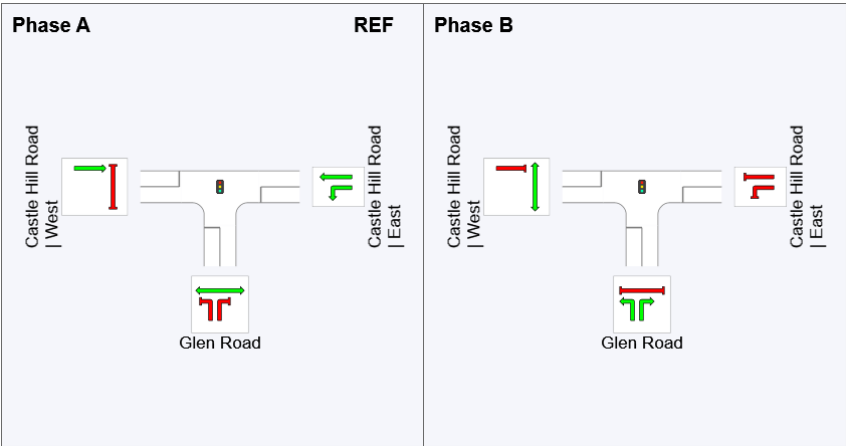
Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	59
Green Time (sec)	56	10
Phase Time (sec)	62	13
Phase Split	83%	17%
Phase Frequency (%)	100.0	50.0 ¹













See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

¹ Phase Frequency has been given with User-Specified Phase Times.


Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

 Normal Movement	 Permitted/Opposed
 Slip/Bypass-Lane Movement	 Opposed Slip/Bypass-Lane
 Stopped Movement	 Turn On Red
 Other Movement Class (MC) Running	 Undetected Movement
 Mixed Running & Stopped MCs	 Continuous Movement
 Other Movement Class (MC) Stopped	 Phase Transition Applied

PHASING SUMMARY

 Site: TCS 3456 [2033 PM Peak Glen Road / Castle Hill Road
(Site Folder: 2033 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog

Phase Times specified by the user

Phase Sequence: Four-Phase Leading Right Turns

Input Phase Sequence: A, B

Output Phase Sequence: A, B

Reference Phase: Phase A

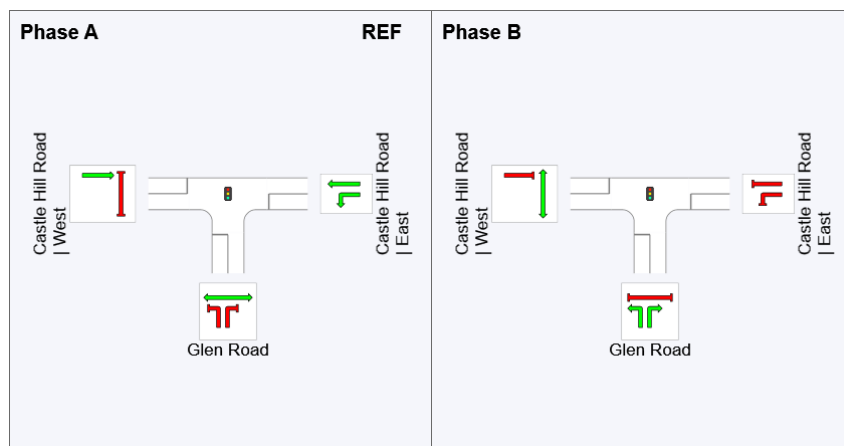
Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	84
Green Time (sec)	81	10
Phase Time (sec)	87	13
Phase Split	87%	13%
Phase Frequency (%)	100.0	50.0 ¹

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.










¹ Phase Frequency has been given with User-Specified Phase Times.

Output Phase Sequence




REF: Reference Phase

VAR: Variable Phase

 Normal Movement	 Permitted/Opposed
 Slip/Bypass-Lane Movement	 Opposed Slip/Bypass-Lane
 Stopped Movement	 Turn On Red
 Other Movement Class (MC) Running	 Undetected Movement
 Mixed Running & Stopped MCs	 Continuous Movement
 Other Movement Class (MC) Stopped	 Phase Transition Applied

PHASING SUMMARY

 Site: TCS 3456 [2033 AM Peak (With Proposal) Glen Road / Castle Hill Road (Site Folder: 2033 AM Peak (With Proposal))]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 75 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Four-Phase Leading Right Turns
Input Phase Sequence: A, B
Output Phase Sequence: A, B
Reference Phase: Phase A

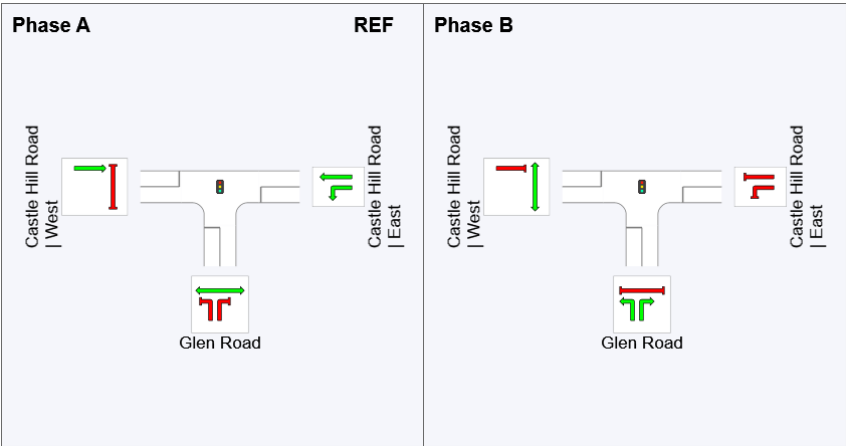
Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	59
Green Time (sec)	56	10
Phase Time (sec)	62	13
Phase Split	83%	17%
Phase Frequency (%)	100.0	50.0 ¹













See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

¹ Phase Frequency has been given with User-Specified Phase Times.


Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

 Normal Movement	 Permitted/Opposed
 Slip/Bypass-Lane Movement	 Opposed Slip/Bypass-Lane
 Stopped Movement	 Turn On Red
 Other Movement Class (MC) Running	 Undetected Movement
 Mixed Running & Stopped MCs	 Continuous Movement
 Other Movement Class (MC) Stopped	 Phase Transition Applied

PHASING SUMMARY

 Site: TCS 3456 [2033 PM Peak (With Proposal) Glen Road / Castle Hill Road (Site Folder: 2033 PM Peak (With Proposal))]

Output produced by SIDRA INTERSECTION Version: 9.1.4.221

Glen Road | Castle Hill Road Intersection
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site User-Given Phase Times)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Four-Phase Leading Right Turns
Input Phase Sequence: A, B
Output Phase Sequence: A, B
Reference Phase: Phase A

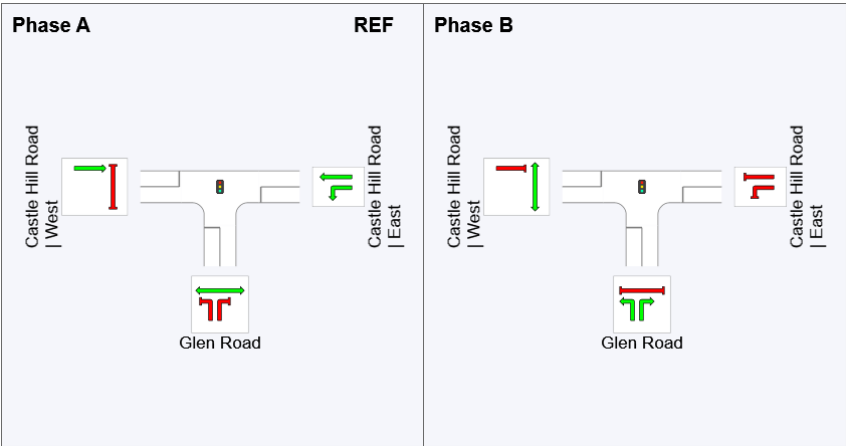
Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	84
Green Time (sec)	81	10
Phase Time (sec)	87	13
Phase Split	87%	13%
Phase Frequency (%)	100.0	50.0 ¹













See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

¹ Phase Frequency has been given with User-Specified Phase Times.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

 Normal Movement	 Permitted/Opposed
 Slip/Bypass-Lane Movement	 Opposed Slip/Bypass-Lane
 Stopped Movement	 Turn On Red
 Other Movement Class (MC) Running	 Undetected Movement
 Mixed Running & Stopped MCs	 Continuous Movement
 Other Movement Class (MC) Stopped	 Phase Transition Applied

