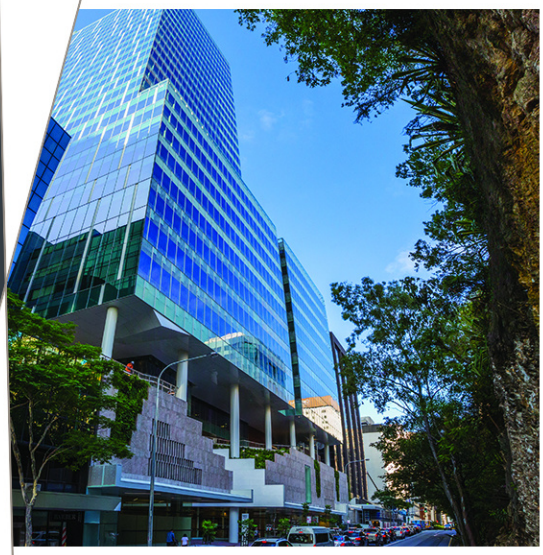
Draft Summary Report

Eastwood Traffic and Parking Study

80018087



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1 Introduction

1.1 Overview

City of Ryde Council (Council) commissioned Cardno to investigate the traffic and parking behaviour in the Eastwood town centre and evaluate the impacts of the proposed modifications to land uses under the existing planning controls. The scope included the development of a purpose-built traffic simulation model to test various road infrastructure options. This report summarises the key findings of the study.

1.2 Study area

The study area extends notionally from Blaxland Road to Shaftesbury Road and from Balaclava Road to Rutledge Street / First Avenue, a shown **Figure 1-1**.

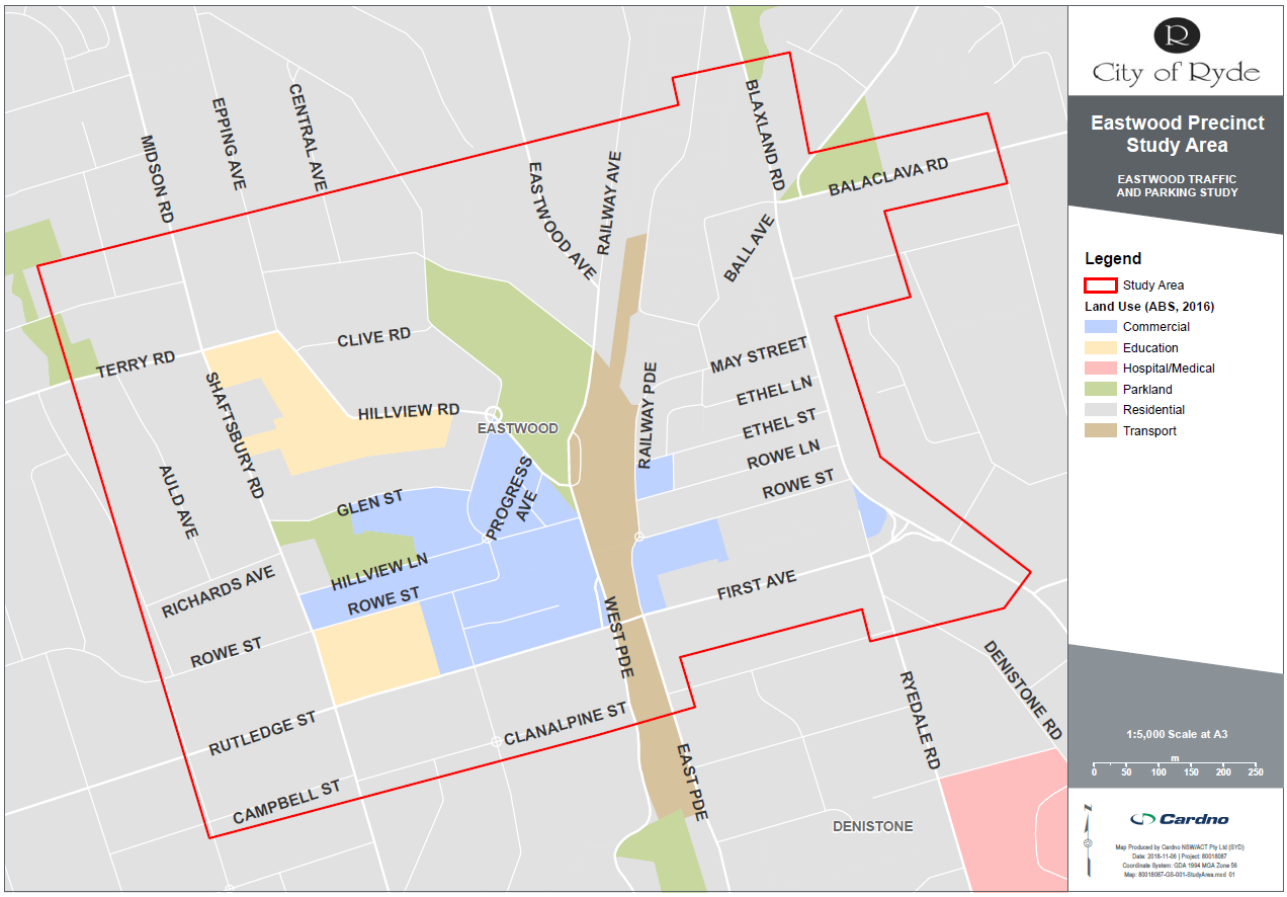


Figure 1-1 Study area

2 Existing Conditions

2.1 Data Collection

Traffic and parking surveys were undertaken on 24 March 2018 (Saturday) and 27 March 2018 (Tuesday). The parking surveys consisted of a detailed inventory of parking supply, hourly occupancy and duration of stay (on-street and off-street locations). The traffic surveys collected traffic counts for the majority of the intersections within the study area and access points to off-street car parks. Travel time and queue length data were also collected to define current congestion patterns and overall traffic operation.

2.2 Existing Conditions - Parking

Cardno has undertaken a parking supply and demand analysis for the Eastwood Town Centre, with consideration of land use context and consequent car parking demand profile.

The parking analysis indicated a total parking supply of 1,962 spaces within the core centre, as follows:

- 423 on-street spaces
- 1,129 off-street bays (public)
- 410 off-street spaces (private)

The western side of the rail line currently contains more parking supply compared to the eastern side (65% - 35% split). This is illustrated in **Figure 2-1**.

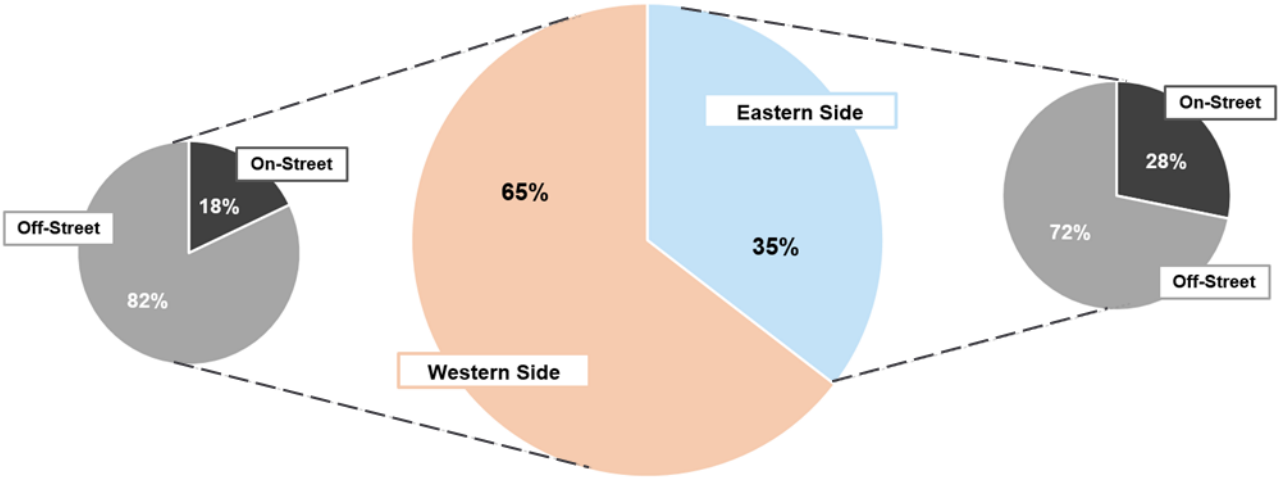


Figure 2-1 Existing Parking Supply Breakdown

The duration of stay results identified a clear distinction between the typical utilisation of on-street and off-street bays. More specifically, on-street bays are predominantly used by short-term visitors (especially on weekdays, with 80% vehicles staying for less than 2 hours) while off-street bays show a more balanced utilisation between short term and long term.

Demand for parking remains high throughout the day and reaches 100% occupancy at some locations during peak periods, predominantly on-street parking areas in proximity to the train station within the 400-metre catchment area. As parking reaches its practical capacity in the areas with high demand, overspill into some surrounding residential neighbourhood occurs. This is reflected in the flattened peak of the surveyed occupancy during the day. This results in additional parking search time and vehicle recirculation in an attempt to locate an available space. This is detrimental to the function of the traffic network.

Based on site visit within 800 metres surrounding Eastwood Station, ample on-street parking capacity beyond the 400-metre catchment was observed.

The shortage of available parking is more prevalent on the eastern side of the study area, where the demand exceeds supply by a considerable margin (estimated to be at least 250 bays during the weekday peak, and 100 bays during the weekend peak). This shortage results in parking overspill into surrounding residential streets and a tendency for visitors to look for parking on the western side of the railway station where the probability of finding a parking space is higher.

2.3 Existing Conditions – Traffic

2.3.1 Base Traffic Model Development

Base traffic simulation models were developed for the study area, allowing the current performance of the road network to be evaluated and quantified. These models were calibrated and validated using the criteria in the Roads and Maritime Services Traffic Modelling Guidelines. All requirements established in these criteria were met, and the model was also independently reviewed and scrutinised, confirming its adequacy to test future land use and road upgrade scenarios.

2.3.2 Peak hours

Analysis of the traffic surveys identified the peak hours for the weekday AM, weekday PM and Saturdays as:

- 8:00 to 9:00 as the AM Peak Hour
- 17:00 to 18:00 as the PM Peak Hour
- 11:00 to 12:00 as the Saturday Peak Hour

2.3.3 Traffic Congestion

The analysis identified traffic congestion spots during the weekday AM and PM peak hours and Saturday mid-day peak. The majority of the congestion hotspots were found along the Shaftsbury Road / Rutledge Street / First Avenue / Blaxland Road corridors. Some localised issues were found within the town centre, namely at pedestrian/vehicle conflict points, often resulting in long queues during the peak periods.

2.3.4 Intersection Level of Service

Traffic networks are typically evaluated using the level of service (LOS) indicator, which is based on the delay experienced by vehicles at each intersection. The LOS can range from A (good operation) to F (exceeding capacity). The LOS for signalised intersections is calculated based on a weighted average of the delay/volumes on all approaches. For priority controlled intersections and roundabouts, the LOS is defined based on the worst approach. The 2018 Base Model results confirmed that a number of intersections, particularly along Shaftsbury Road and Rutledge Road, have a very poor LOS in the AM, PM and Saturday peaks. The LOS results for all assessed intersections and all peak hours is shown in **Figure 2-2**.

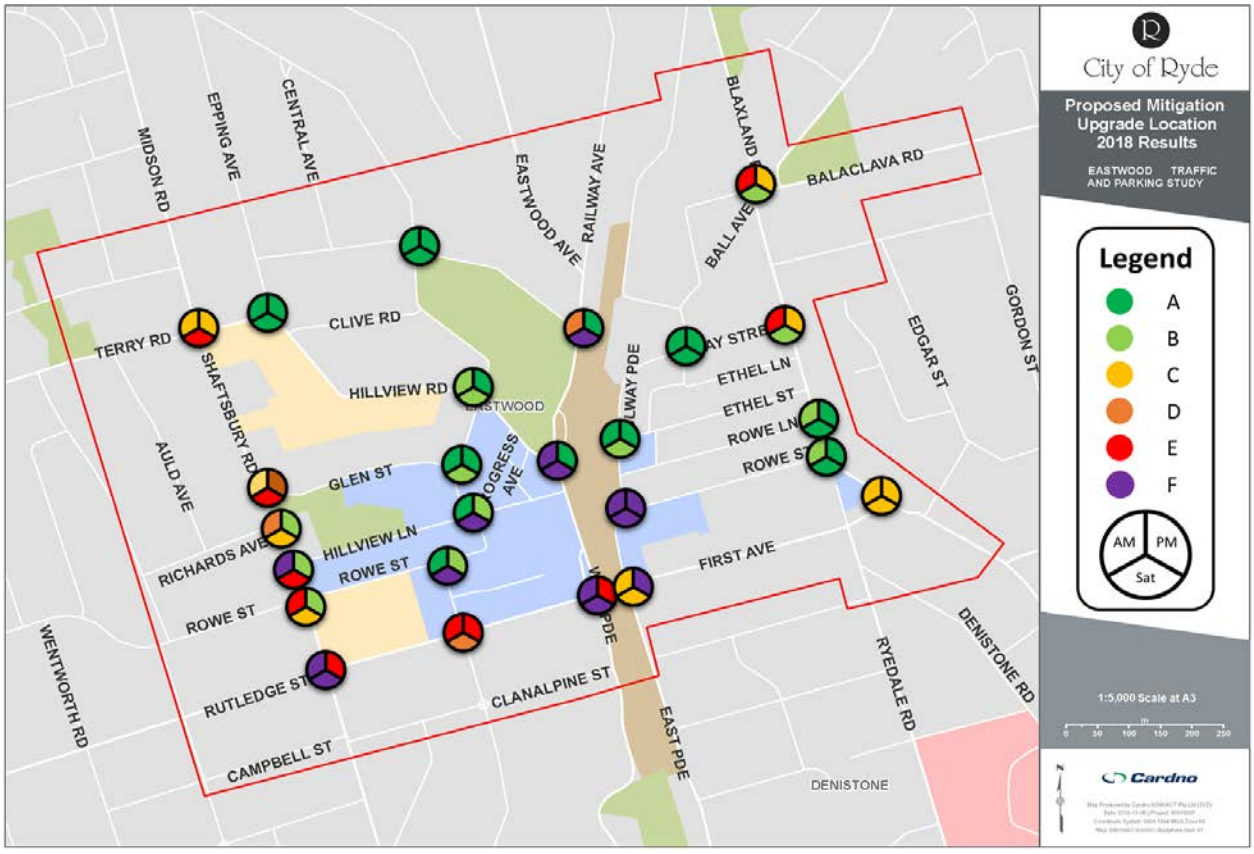


Figure 2-2 Existing Intersection Performance

3 Car Parking

3.1 Commuter Car Park Location

Seven locations were considered for the provision of a new commuter car park facility, all of which are located on publicly owned land (Council or state government owned). These are shown in **Figure 4-1**.

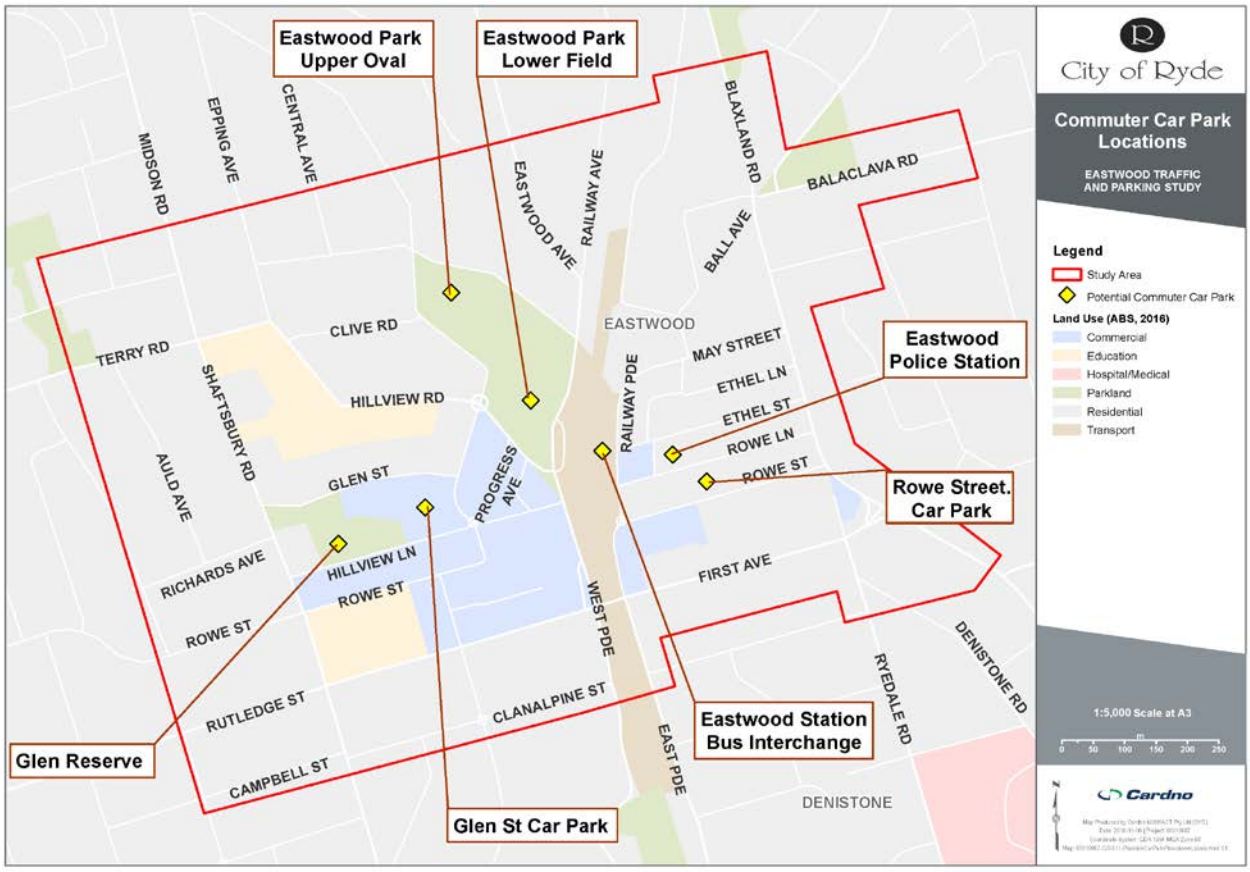


Figure 3-1 Commuter Car Park Locations

The analysis of the potential options took into account the specific site constraints, geometrical restrictions, distance to the train station, etc. More specifically, selecting the location and size of the commuter car park requires the consideration of the following factors:

- The projected parking demand of the centre.
- The quantum of car parking already available in the immediate vicinity
- Ease of access by vehicle and for pedestrians
  - Preferably via the laneway network and major roads on the periphery of the town centre
  - Vehicular access to car parking should limit the use of streets with significant pedestrian activity
- The car park should not interrupt the vitality of the centre
  - Avoid any potential congestion of central roads.
  - The car park should endeavour to be as unobtrusive as possible
- The feasibility of construction at each site
  - Size of the land available
  - Lot configuration and geometry
- Ownership of the site
  - Government agencies would partially or entirely own the site.

3.1.2 Dismissed Options

The factors contributing to the dismissal of some of the options considered are summarised below.

> Eastwood Park (upper oval and lower field):

- Community Consultation identified considerable opposition by Eastwood residents to any large-scale car park located within Eastwood Park. Council's Mayoral minutes for the meeting held on September 26th 2017 document that "the City of Ryde Council is opposed to a car park in any part of Eastwood Park and will not agree to Eastwood Park being used for that purpose."

> Eastwood Station Bus Interchange:

- Vehicular access to this location would significantly increase traffic in the vicinity of the Station, in an area that is already heavily constrained. The additional demand would exacerbate congestion, impact on pedestrian, cycling and bus transport amenity, and reduce safety outcomes.

> Rowe Street Car Park:

- The small size of the lot precludes this location from supporting an even higher amount of parking, beyond the upgrade to the 150 space multi-storey car park. Expansion of the site to the east or west could occur, but land acquisition requirements would make this cost prohibitive.

> Glen Street Car Park

- This option would need to provide at least 450 parking bays to replace the existing bays (which would be lost with the demolition of the existing structure) plus additional car parking to support improved commuter parking.
- The plot area containing the existing car park and adjacent lots is irregularly shaped which reduces the efficiency of the layout that could be considered.
- Due to the seasonal flooding within the Eastwood area, basement levels may be unfeasible, subject to further investigation. Entrance to the proposed car park will likely be on Glen Street, which could result in congestion along the corridor in the future once land uses on both sides of Glen Street are fully developed.

3.1.3 Potential Options

> Eastwood Police Station

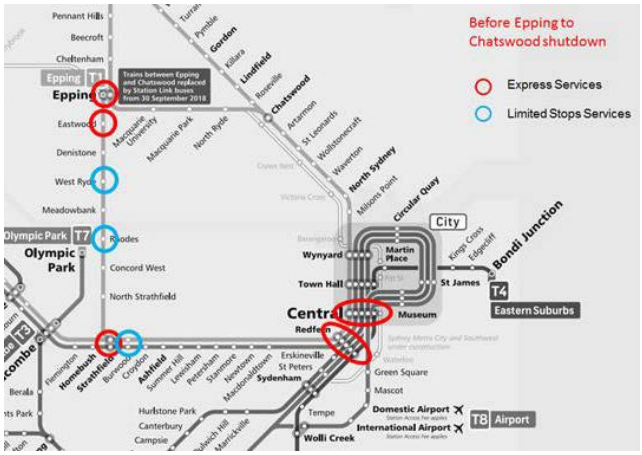
- The Eastwood Police Station is located on Ethel Street, just east of the train station. This lot has an area of 1,888 m². The potential implementation of a commuter car park at this location could be highly advantageous due to the proximity to the Eastwood Train Station and the lot size (bigger than the Rowe Street Car Park site). It can be assumed that the potential conversion of this lot to a commuter car park would generate minimal traffic disruption compared to other options given that the road network surrounding the site allows for various routes to/from the site resulting in improved distribution.
- Given that the site is owned by the State Government, further consultation between Council, Transport for NSW (TfNSW) and NSW Police Force would need to take place to evaluate the suitability of the site as a future commuter car park.

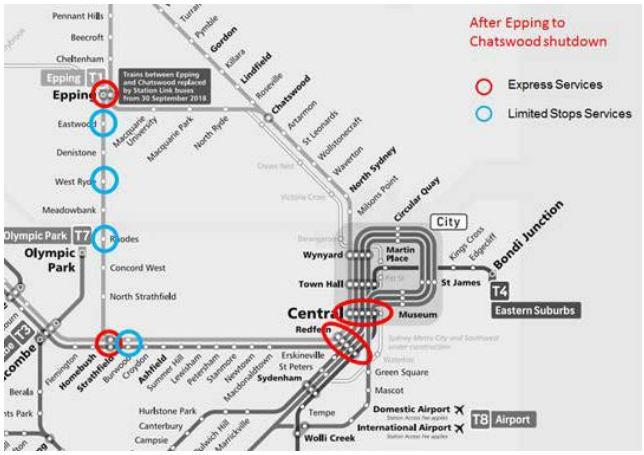
> West Ryde Parking Facility

- A commuter park (at grade) is currently located next to the West Ryde Train Station. A potential expansion of this facility to accommodate a multi-level structure would deliver a considerable amount of parking spaces with an ideal location (adjacent to a train station). This site is currently owned by Rail Corporation.
- Both Eastwood and West Ryde stations are part of the "T1 – Northern Line". Since 30 September 2018, trains between Epping and Chatswood were replaced by buses while the line is upgraded to receive Sydney Metro services in mid-2019. Before this closure, express services to/from the city stopped at Eastwood during weekday peak hours. This is no longer the case as only "limited stops" and "all stops" services stop at both stations currently. The type of services stopping at each of these stations before and after the Epping to Chatswood closure is summarised in the table below.

Table 3-1 Change of services at Eastwood and West Ryde station due to Chatswood Station Closure

		Express Services (peak periods)	Limited Stops Services (peak periods)	All Stops Services
Before Epping to Chatswood closure	Eastwood	✓	✓	✓
	West Ryde	×	✓	✓
After Epping to Chatswood closure	Eastwood	×	✓	✓
	West Ryde	×	✓	✓





- It is unknown if Transport for NSW (TfNSW) is planning to reintroduce express services to the Eastwood station once Sydney Metro starts operating. The option of upgrading the existing at-grade commuter car park at West Ryde would be optimised if it could be combined with the introduction of express services stopping at West Ryde station instead of Eastwood.
- Further investigation to be undertaken between TfNSW and Council to review Opal card data to determine transfer of patrons from Eastwood Station to West Ryde Station to access Express Services and also determine whether West Ryde Station can accommodate the increase in patrons.
- This would effectively encourage some commuters to shift from the constrained area around Eastwood station (from traffic and parking capacity perspectives) to West Ryde. A transport study would be required to evaluate the impacts and feasibility of this option. Some of the aspects to consider include traffic impacts, station capacity to attract more passengers, commuter parking supply, etc.

> Glen Reserve Car Park

- The Glen Reserve land is located west of the existing Glen Street Car Park and is owned by Council. The land ownership presents a benefit compared to the previous two options, which are based on land not owned by the Council.
- Access to this car park would be provided via Shaftesbury Road through an extension of Richards Avenue.
- It should be noted that this location also poses some challenges, namely the distance to the station (over 400m walking distance). The pedestrian infrastructure linking the station and the car park would need to be carefully planned/upgraded to ensure that a safe and convenient walking route would be delivered in conjunction with the commuter car park.

3.2 Retail (Short-Term) Car Park

Given the parking deficit described for the eastern side of the study area, consideration was given to the potential upgrade of the existing at-grade car park at Rowe Street into a multi-storey parking structure. Under this option, the car park capacity would increase from the current 50 spaces to approximately 150 spaces. **Figure 3-2** shows the location of the car park.

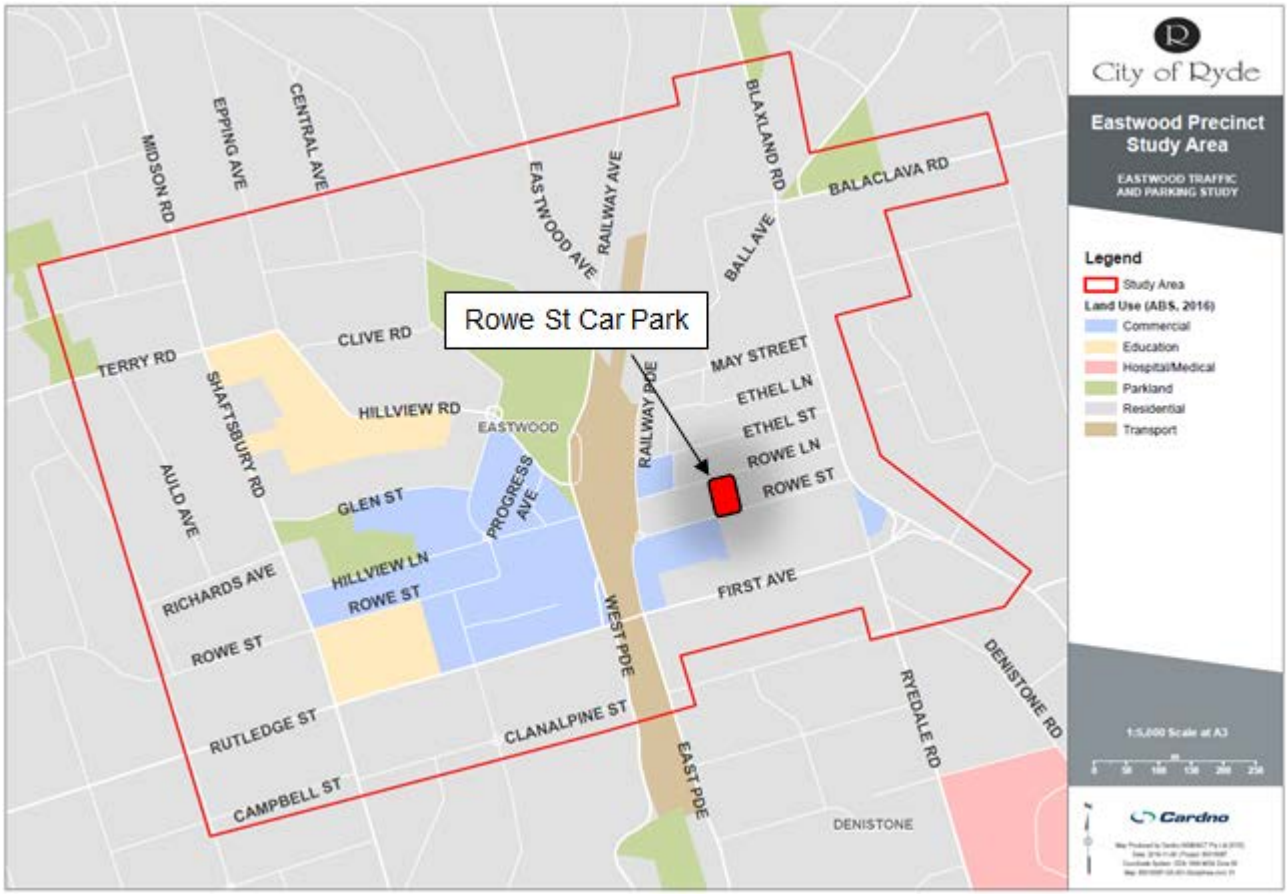


Figure 3-2 Rowe Street Car Park Location

The traffic models were used to evaluate the immediate impacts of the road network associated with this proposal, based on the following assumptions:

- Introducing 100 additional parking spaces;
- Consolidating the access and egress at Rowe Lane to a single exit;
- Retaining the current configuration for the access and egress at Rowe Street.

The assessment focused on the intersections in the vicinity of the Rowe Street Car Park. The results of the evaluation indicated that the proposed Rowe Street car park upgrade would have minimal impacts on the intersections across the Eastern Town Centre (when compared to current intersection operation). No noticeable differences were found in the intersections' level of service and congestion patterns across the Town Centre.

4 Future Land Use

The future land use scenarios involve significant changes to the current land use mix and densities. Most of the land parcels contained within the study area experience some form of redevelopment (with or without changes to the type of land use) and uplift of the current densities.

Figure 4-1 below identifies the land parcels anticipated to experience some land use changes:

- Lodged/Approved Development Applications – shown in yellow*
- Future land use changes based on Eastwood Planning Study, 2016 – shown in green**
- Future land use changes based on Eastwood TMAP Final Report, 2008 – shown in pink**

** assumed to be completed by 2028*
*** assumed to be completed by 2038. The 2028 future year scenario assumed 50% completion*

Figure 4-1 Development Plans for Eastwood Town Centre

Table 4-1 summarises the additional trip generation estimated for the proposed land use changes.

Table 4-1 Trip Generation by Land Use

Land Use Type	AM Peak Hour			PM Peak Hour			SAT Peak Hour		
	Total	In	Out	Total	In	Out	Total	In	Out
Residential	750	150	600	750	450	300	750	375	375
Retail	1006	503	503	2013	1006	1006	2407	1203	1203
Commercial	430	369	61	476	84	392	110	55	55
Community Facility	50	25	25	50	25	25	50	25	25
Existing Glen Street Car Park	35	18	18	35	18	18	35	18	18
Child Care	77	42	35	77	36	41	0	0	0
Proposed Rowe Street Car Park	80	40	40	206	103	103	206	103	103
Total Trips (ultimate - 2038)	**2819**	**1366**	**1453**	**3969**	**1803**	**2166**	**3352**	**1676**	**1676**
2028 Trips	**2115**	**1028**	**1088**	**3001**	**1353**	**1648**	**2573**	**1286**	**1286**
Existing Trips	**1416**	**863**	**552**	**1960**	**819**	**1141**	**1456**	**728**	**728**
Difference (2028 – Existing)	**699**	**165**	**536**	**1041**	**534**	**507**	**1117**	**558**	**558**

The trips generated by the proposed commuter car park on Glen Reserve are discussed in more detail in **Section 5.5**. By 2028, the additional number of vehicle trips anticipated to be generated by the redeveloped land parcels is summarised below:

- 699 additional vehicle trips in the AM peak hour
- 1041 additional vehicle trips in the PM peak hour
- 1117 additional vehicle trips in the Saturday peak hour

5 Traffic Modelling

5.1 Traffic modelling scenarios

Traffic models were developed for the 2028 future year horizon based on the current land use planning controls. The “2028 base” models include the road upgrades assumed to be in place by then. The list of road upgrades to be added was agreed in consultation with Roads and Maritime and Council.

The traffic model assessed the following scenarios:

- 2028 Base (Do Minimum) Case
- 2028 Additional Network Improvement Cases (3 Road Network Options)
- 2028 Car Park Sub-Options (4 Parking Sub-Options)

5.2 2028 Base Road Network Upgrades

The list of road upgrades adopted in the 2028 year horizons (2028 base) include proposed road upgrades along Blaxland Road, parking restrictions along Shaftesbury Road, and access points to proposed developments and parking lots. **Figure 5-1** shows the base 2028 upgrades included in the models.

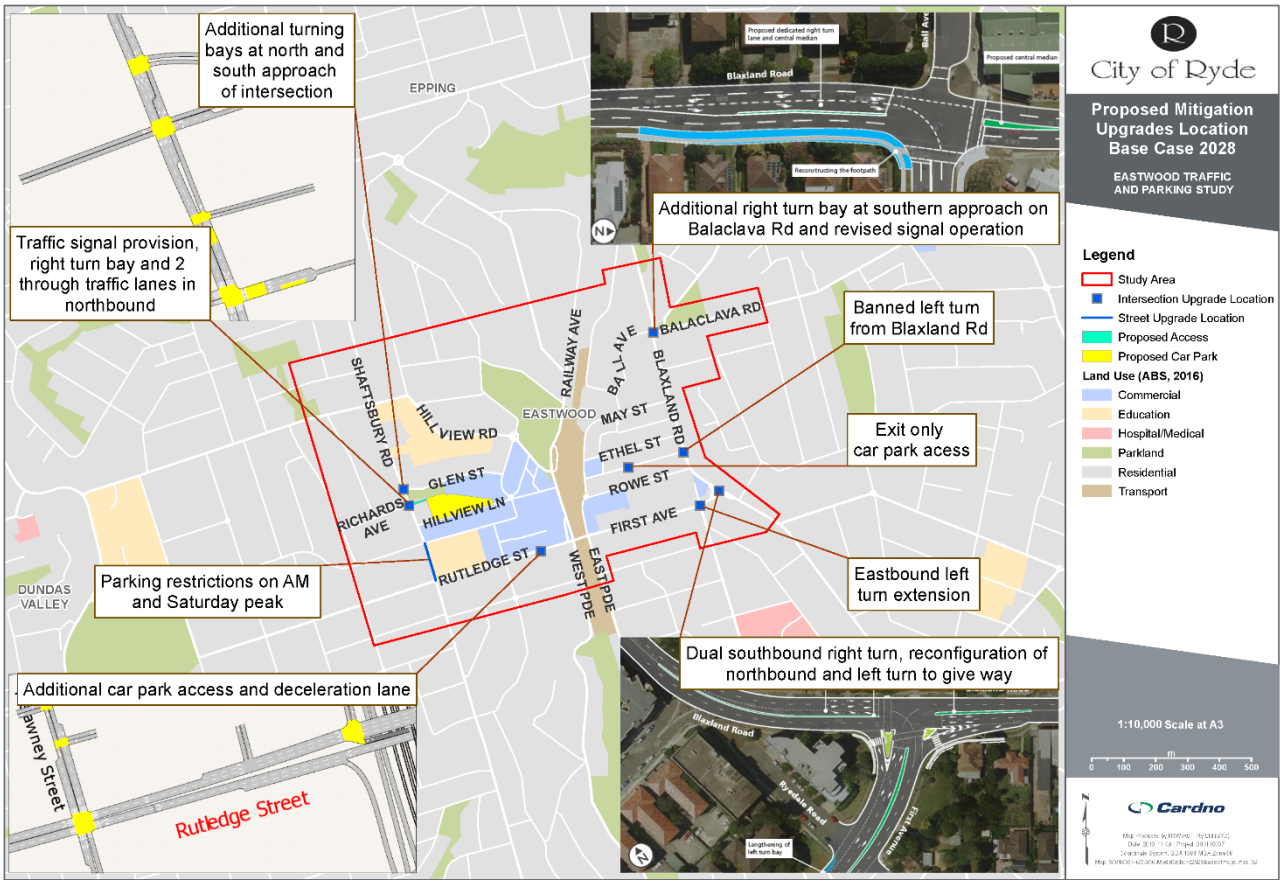


Figure 5-1 Base 2028 Model – Road Upgrades

5.3 2028 Base Models Results

In an urban area, the capacity of a road network can be largely determined by the capacity of the controlling intersections. The key indicator of intersection performance level of service (LoS) is delay, where results are place on a continuum from 'A' to 'F' as shown in **Table 5-1**.

Table 5-1 Level of Service Criteria*

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

**For traffic signals, the average movement delay and level of service over all movements is considered. For roundabouts and priority control intersections the level of service is based on the modelled delay for the most/worst delay movement.*

The 2028 base model was run based on the land uses assumptions described above and their corresponding trip generation, the construction of the Glen Reserve commuter car park, and the list of upgrades summarised above. The intersections' Level of Service results are summarized in **Figure 5-2**.

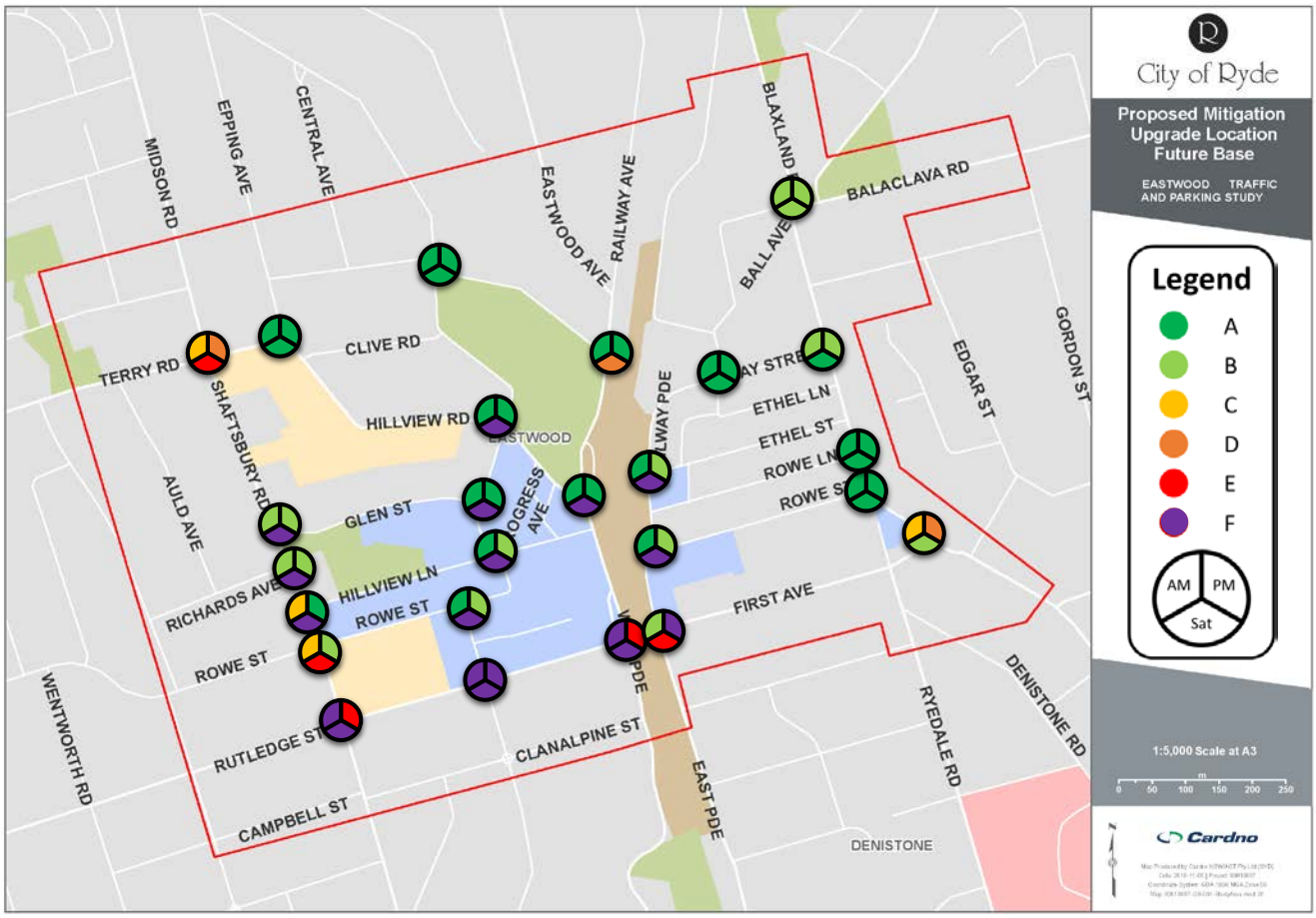


Figure 5-2 Base 2028 Model Results

The results indicate that while the proposed road upgrades provide additional capacity at some locations, the additional trips resulting from the land use changes use that capacity, with one factor effectively balancing the other out.

Overall, the traffic network shows operational deficiencies very similar to those experienced at present in the AM and PM peak hours. While the network absorbs the additional trips, significant delays are experienced on some sections of the study area (predominantly along Rutledge Street and Shaftsbury Road corridors).

The Saturday peak hour is that resulting in the highest number of additional trips (911 trips/hour). As a consequence, the network fails to absorb all trips and significant delays and queues are shown in the model, eventually leading to a “grid-lock effect”. High pedestrian volumes (predominantly along The Avenue) contribute to capacity issues for vehicular traffic and route shift. **Figure 5-3** provides a visualisation of the observed model gridlock in the Saturday peak hour.

Figure 5-3 Base 2028 Saturday – Example of Traffic Network Deficiencies

5.4 2028 Additional Network Improvement Cases (Options 1, 2 and 3)

Based on the initial 2028 Base Model findings and the observed operational deficiencies, it was agreed to proceed to the option testing stage to identify a list of upgrades to the transport network that can help accommodate the proposed changes in land use.

Three future road upgrade scenarios were developed, all of which complement the modifications described for the 2028 base case. That is, the land use assumptions adopted for the 2028 base case were maintained, and the option testing consisted of upgrades/modifications in an attempt to improve the transport network performance.

5.4.1 Option 1

In addition to the improvements adopted under the 2028 Base model, Option 1 includes the following upgrade to the road network:

- **Conversion of the zebra crossing to traffic signals at The Avenue:** Zebra crossings provide priority to pedestrians over vehicular traffic at conflict points. In cases of high pedestrian demand, this can result in extensive delays to vehicular traffic. In such cases, the conversion of zebra crossings to signalised

crossings should be considered to allow more control and a better balance between the time allocated to pedestrians and cars.

Figure 5-4 displays the changes to the road network for Option 1. The upgrade highlighted in red consists of that added as part of Option 1 (in addition to the 2028 base case).

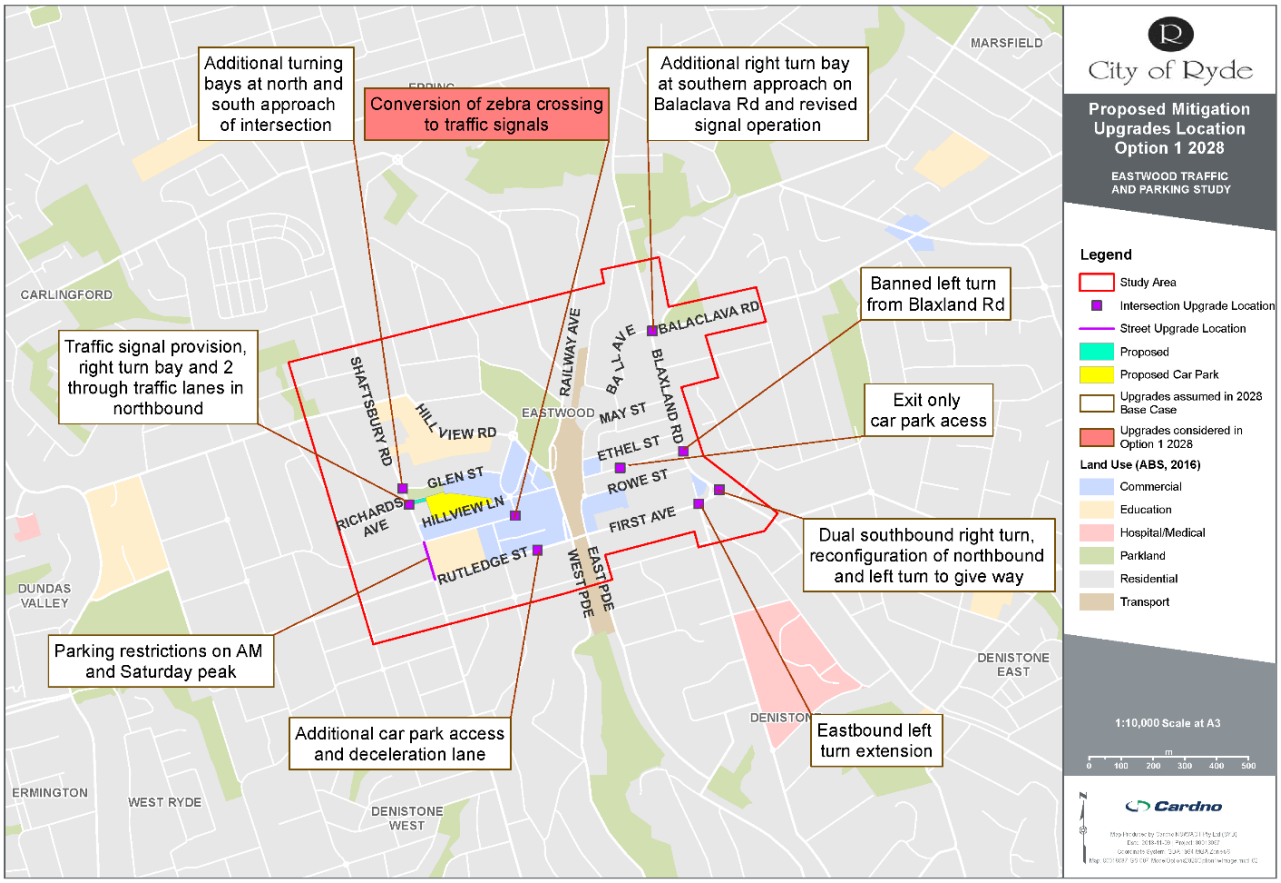


Figure 5-4 Option 1 Road Network Upgrades

The road network performance significantly improves during the Saturday peak hour with the Option 1 upgrade addition. All intersections perform at level of service E or better (compared to a few intersections operating at LOS F in the 2028 base case). Gridlock is no longer observed.

Some noticeable improvements are also experienced in the AM peak scenario. The PM peak shows modest operational improvements.

Despite the improvements described above, the right turning movement from Rutledge Street to Trelawney Street still causes capacity issues along Rutledge Street, with the intersection working at deteriorating levels of service during all three peak hours. The results of Option 1 are shown below in **Figure 5-5**.

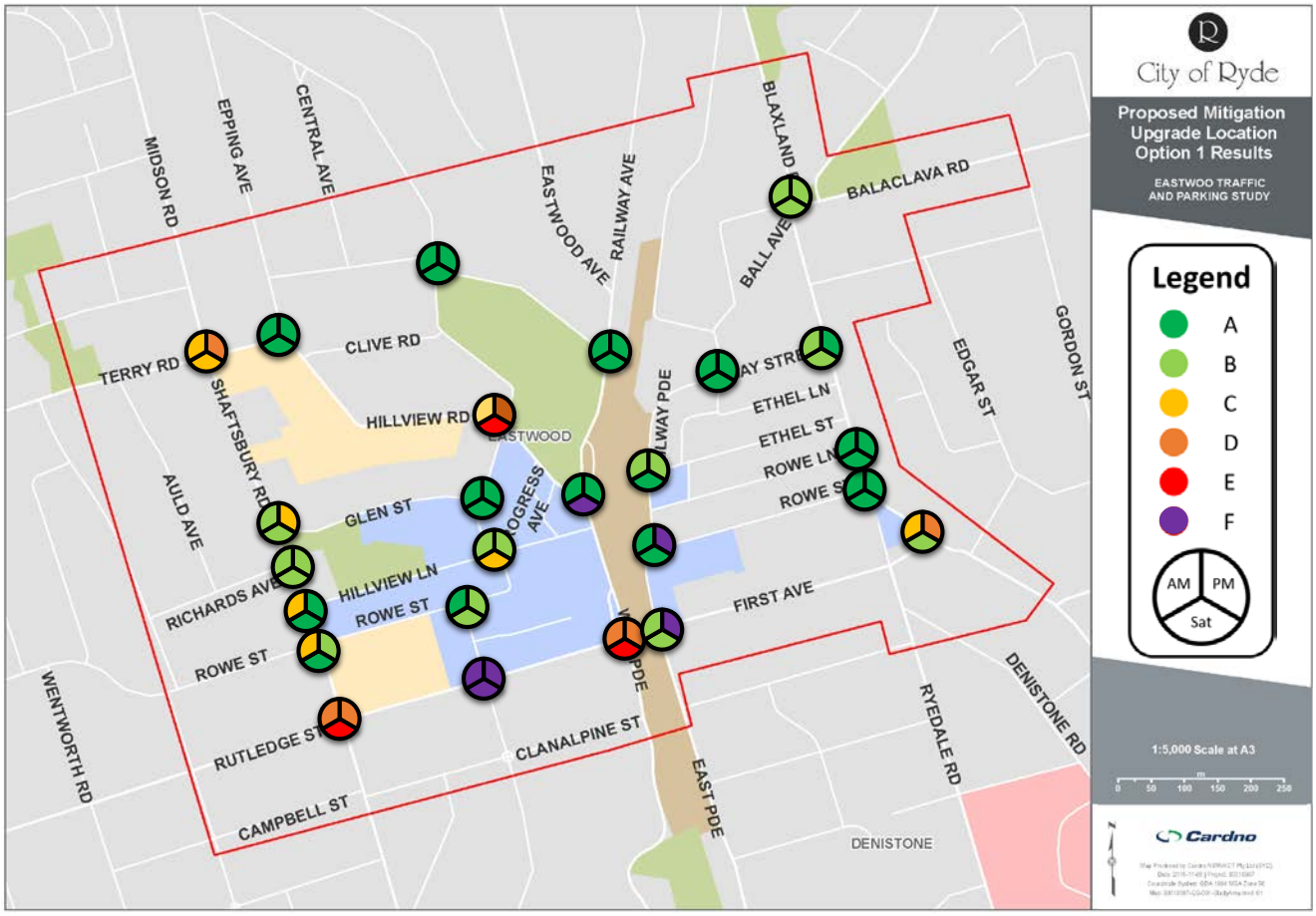


Figure 5-5 Option 1 Results

5.4.2 Option 2

Option 2 focuses on improving the pedestrian infrastructure within the study area. In addition to the modifications adopted under Option 1, it includes the conversion of some sections of the road network to shared zones, no vehicle access to The Avenue and Rowe Street (between Trelawney Street and Hillview Lane) and further pedestrian crossing signalisation. These modifications aim to improve pedestrian mobility within Eastwood. **Figure 5-6** depicts the road network changes for Option 2. The upgrades highlighted in blue consist of those added as part of Option 2 (in addition to the 2028 base case).

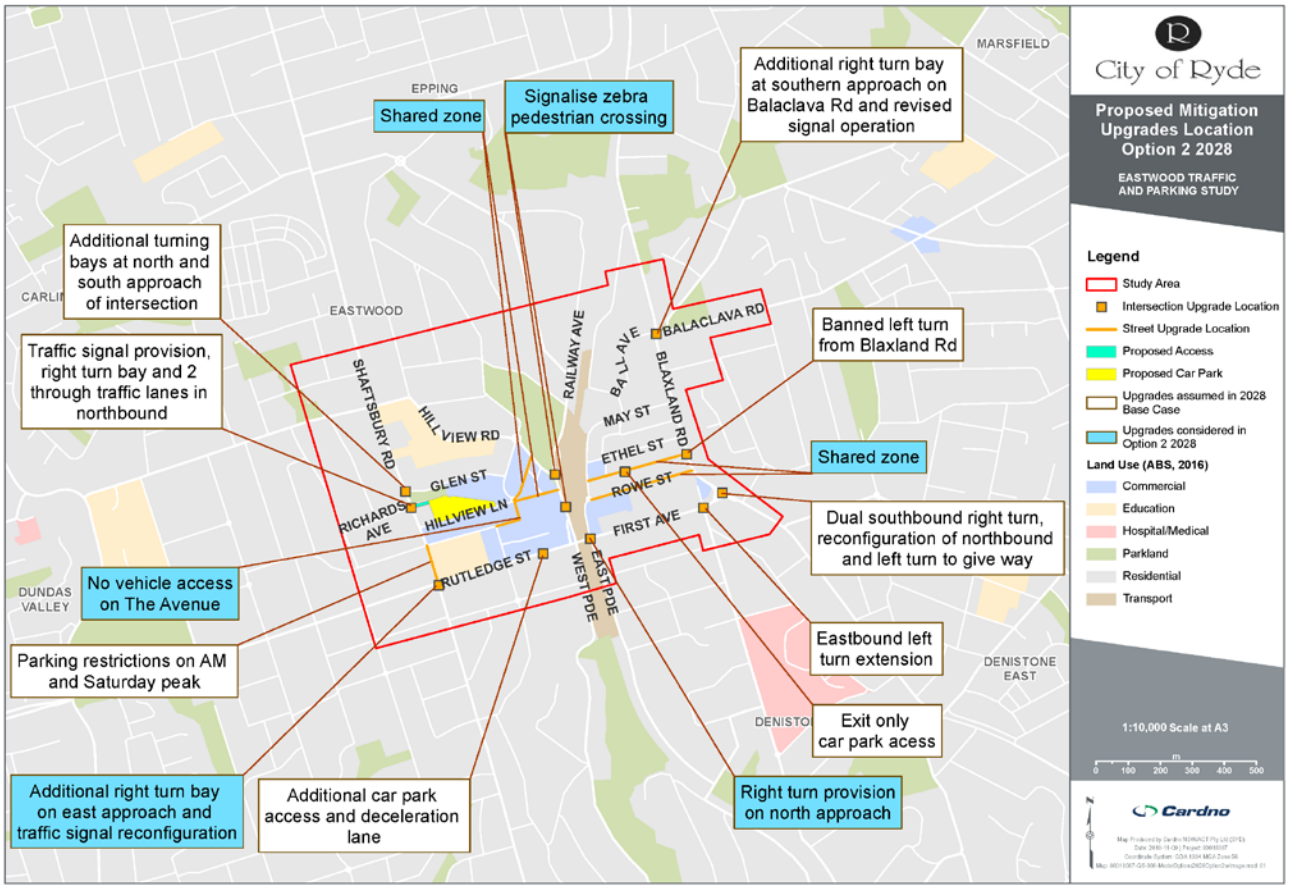


Figure 5-6 Option 2 Road Network Upgrades

Observations of the Option 2 models run results indicate a significant deterioration in the network operation compared to Option 1, especially on the western side of the rail line. This is due to the nature of most of the modifications adopted under Option 2, which achieve an improvement of pedestrian amenity but result in a reduced capacity for vehicular traffic. The primary factor contributing to the poor results observed with Option 2 is the closure of The Avenue, which results in some rerouting (vehicles searching alternative road corridors to complete their trips) but in turn puts additional traffic demand at intersections already operating beyond its practical capacity (namely intersections with Shaftsbury Road / Rutledge Street).

All peak hours tested showed several intersections operating well beyond its practical capacity with queues extending past several adjacent intersections. **Figure 5-7** shows the intersection Level of Service results for the Option 2 models. **Figure 5-8** shows some of the operational issues observed with the Options 2 scenario testing.

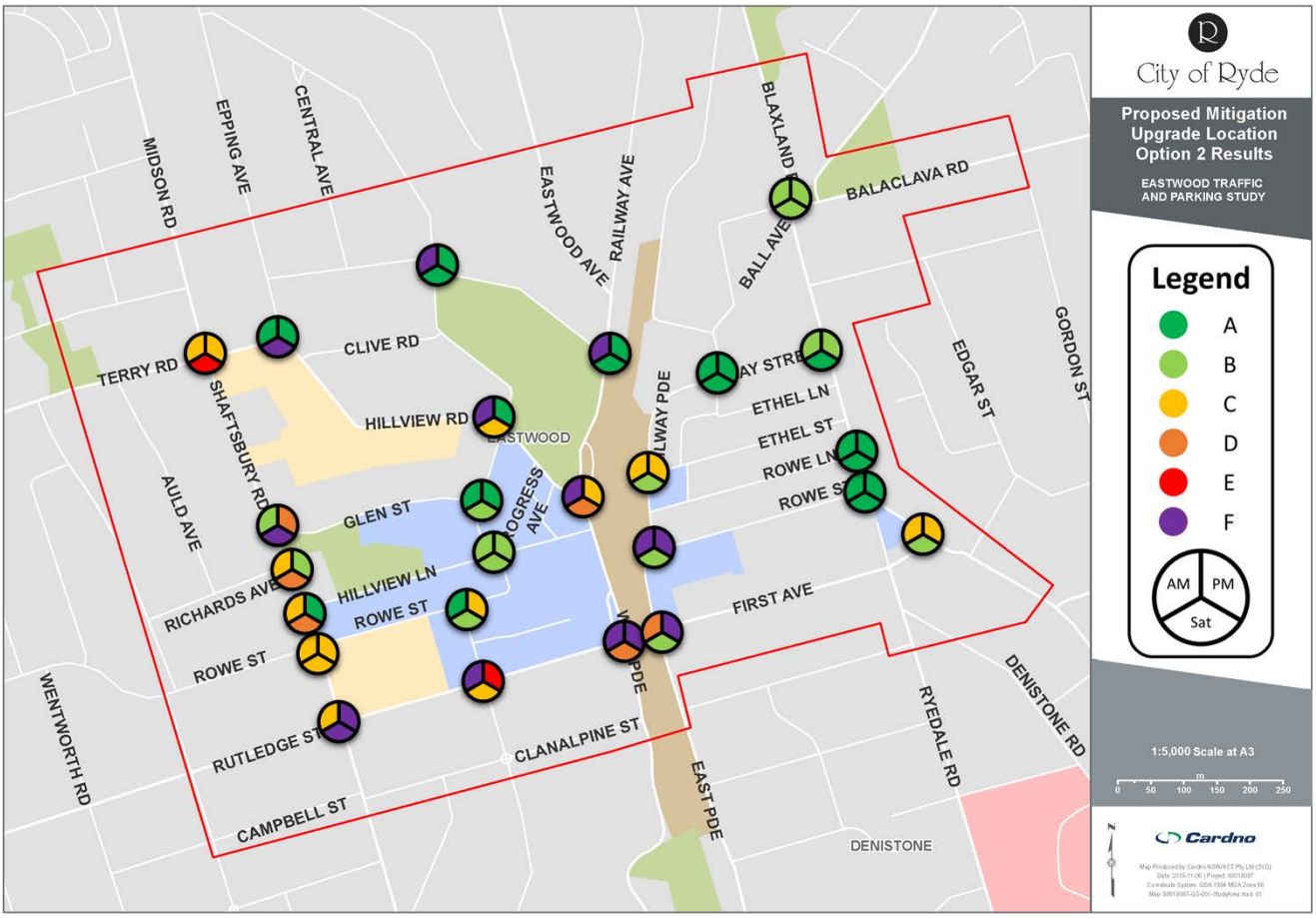


Figure 5-7 Option 2 Results

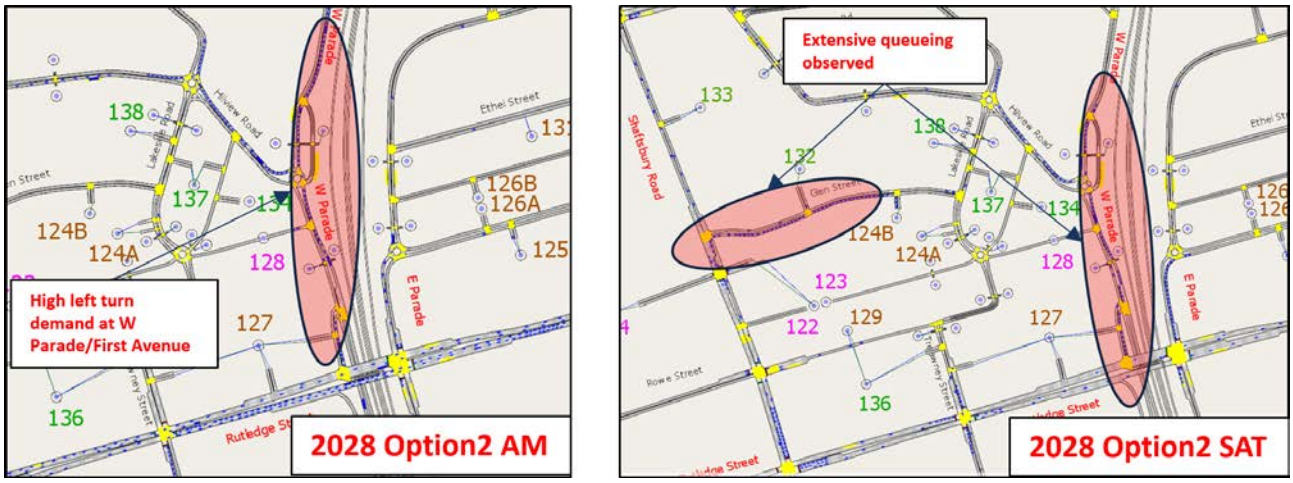


Figure 5-8 2028 Option 2 Scenario – Example of Traffic Network Deficiencies

5.4.3 Option 3 (Preferred Network)

Considering the observations of Base 2028, Option 1, and Option 2 models, Option 3 combines the upgrades that are deemed necessary to achieve optimum level of service and traffic operation across the Eastwood Town Centre road network. These consist of:

- Conversion of the zebra crossing to traffic signals at The Avenue;
- Conversion of two zebra crossings on West Parade to traffic signals;
- Remove two on-street parking spaces along the eastern side of East Parade, north of First Avenue intersection to provide additional capacity at East Parade/First Avenue intersection; and
- New right turn bay (60 metres long) at the eastern approach to the Shaftsbury Road / Rutledge Street intersection (and resulting signal phasing optimisation).

Figure 5-9 summarises the upgrades considered for Option 3.

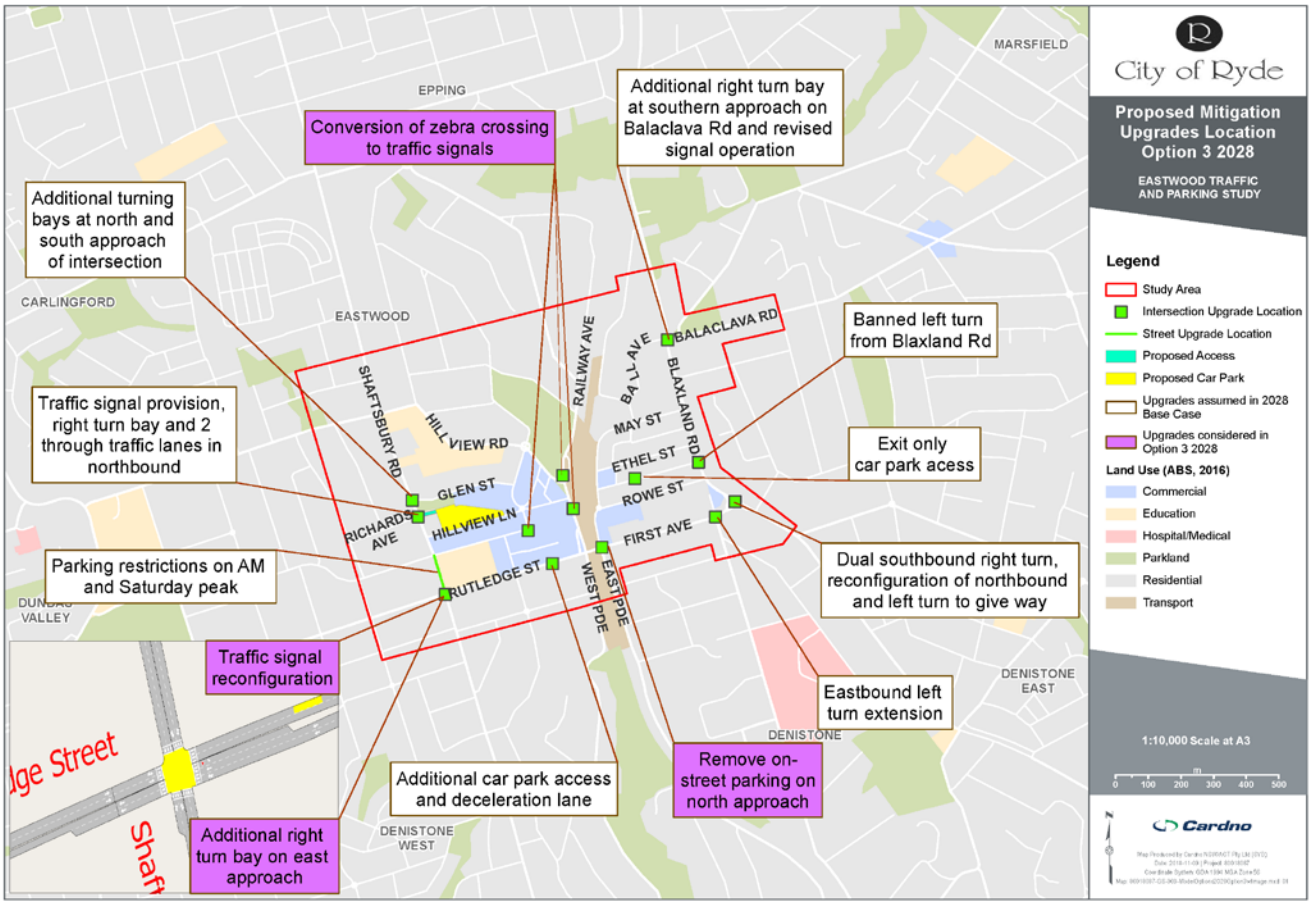


Figure 5-9 Option 3 Road Network Upgrades

The results for Option 3 are presented in **Section 5.5** given that this option was converted into four sub-options, all of which are based on the road upgrades described above. The differences between the four sub-options consist of variations on the type/capacity of parking infrastructure considered.

5.5 2028 Car Park Sub-Options (Options 3A, 3B, 3C and 3D)

Four variations of Option 3 were modelled to test the impact of various options to modify current off-street car parking supply. The four options are described as follows:

- Option 3A: No change; Glen Street Car Park (450 spaces) to remain in its current location (No commuter car parking, no increase in retail parking);
- Option 3B: Relocation of Glen Street Car Park to Glen Reserve (plus 150 additional retail parking spaces) and no provision for commuter parking;
- Option 3C: Glen Street Car Park to remain in its current location plus 230 space Commuter Car Park at Glen Reserve;
- Option 3D: Relocation of Glen Street Car Park to Glen Reserve (plus 150 additional retail parking spaces) plus 230-space Commuter Car Park at Glen Reserve.

Table 5-2 summarises the differences between the four variations and the resulting additional trip generation.

Table 5-2 Option 3 Variations

Option	Additional Trip Generation								
	AM Peak Hour			PM Peak Hour			SAT Peak Hour		
	Total	In	Out	Total	In	Out	Total	In	Out
Option 3A	0	0	0	0	0	0	0	0	0
Option 3B	60	30	30	154	77	77	154	77	77
Option 3C	50	50	0	200	0	200	200	100	100
Option 3D	110	80	30	354	77	277	354	177	177

Under Options 3A and 3C, the existing Glen Street retail car park is assumed to maintain its current location and capacity. Under Options 3B and 3D, the retail car park is assumed to be relocated to Glen Reserve with additional 150 retail parking spaces.

5.5.2 Option 3A

Option 3A does not introduce any new parking supply (commuter or retail) at Glen Reserve but maintains the road upgrades described for all Option 3 scenarios. This would correspond to a scenario in which new commuter parking supply would not be delivered in Eastwood, with one option being the potential expansion of the commuter parking supply in West Ryde (discussed in **Section 3.1.3**).

Figure 5-10 shows the results of the option model runs.

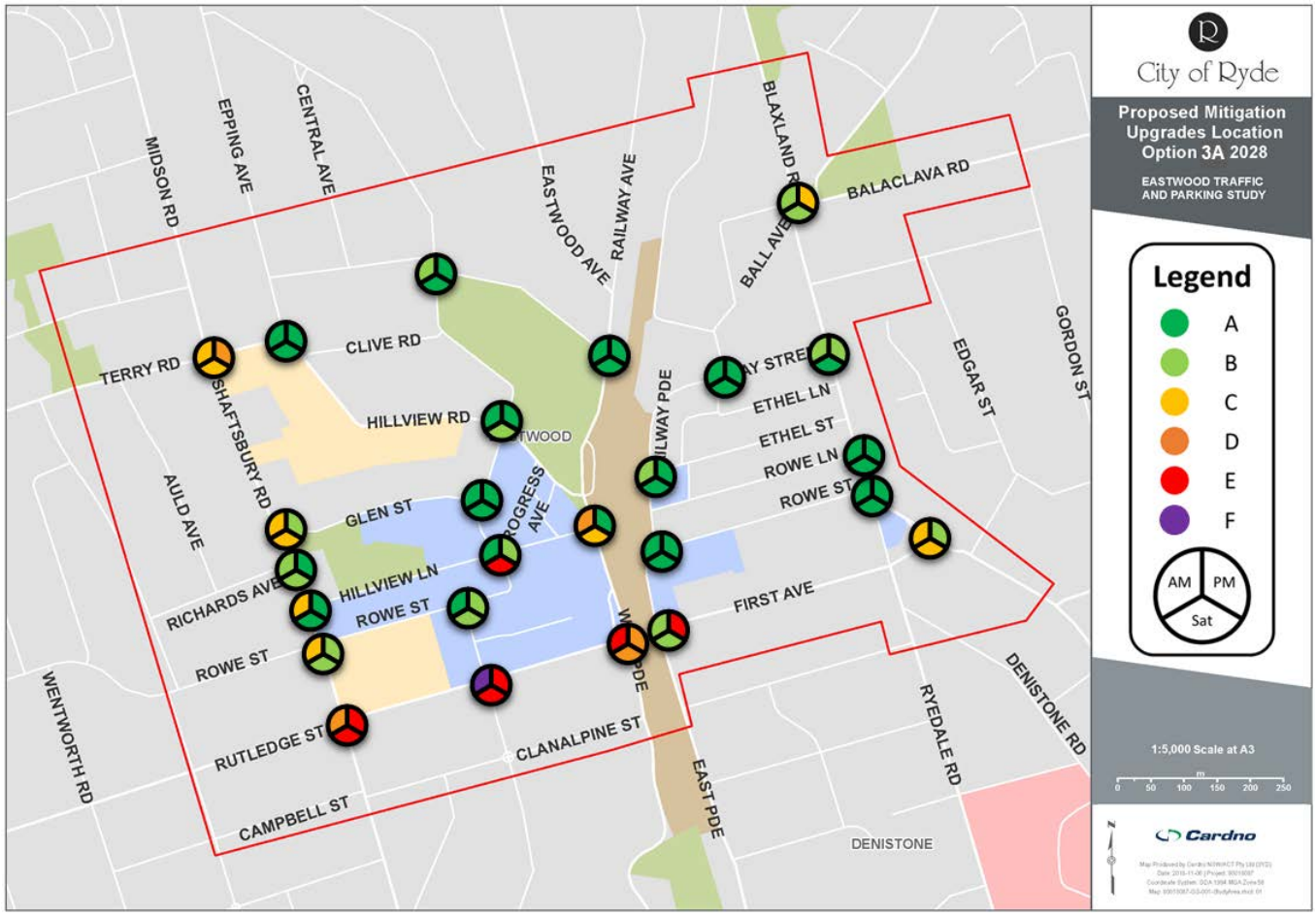


Figure 5-10 Option 3A Results

Modelling results indicate that intersections along Shaftesbury Road operate better in Option 3A than what is observed for Option 2. Intersections in the Western Town Centre along Lakeside Road and Epping Road also perform at more acceptable levels of service than Option 2.

5.5.3 Option 3B

Option 3B assumes a 600-space retail car park on Glen Reserve. This is based on relocating the existing Glen Street car park from its existing location to Glen Reserve.

Figure 5-11 shows the results of the Option 3B models.

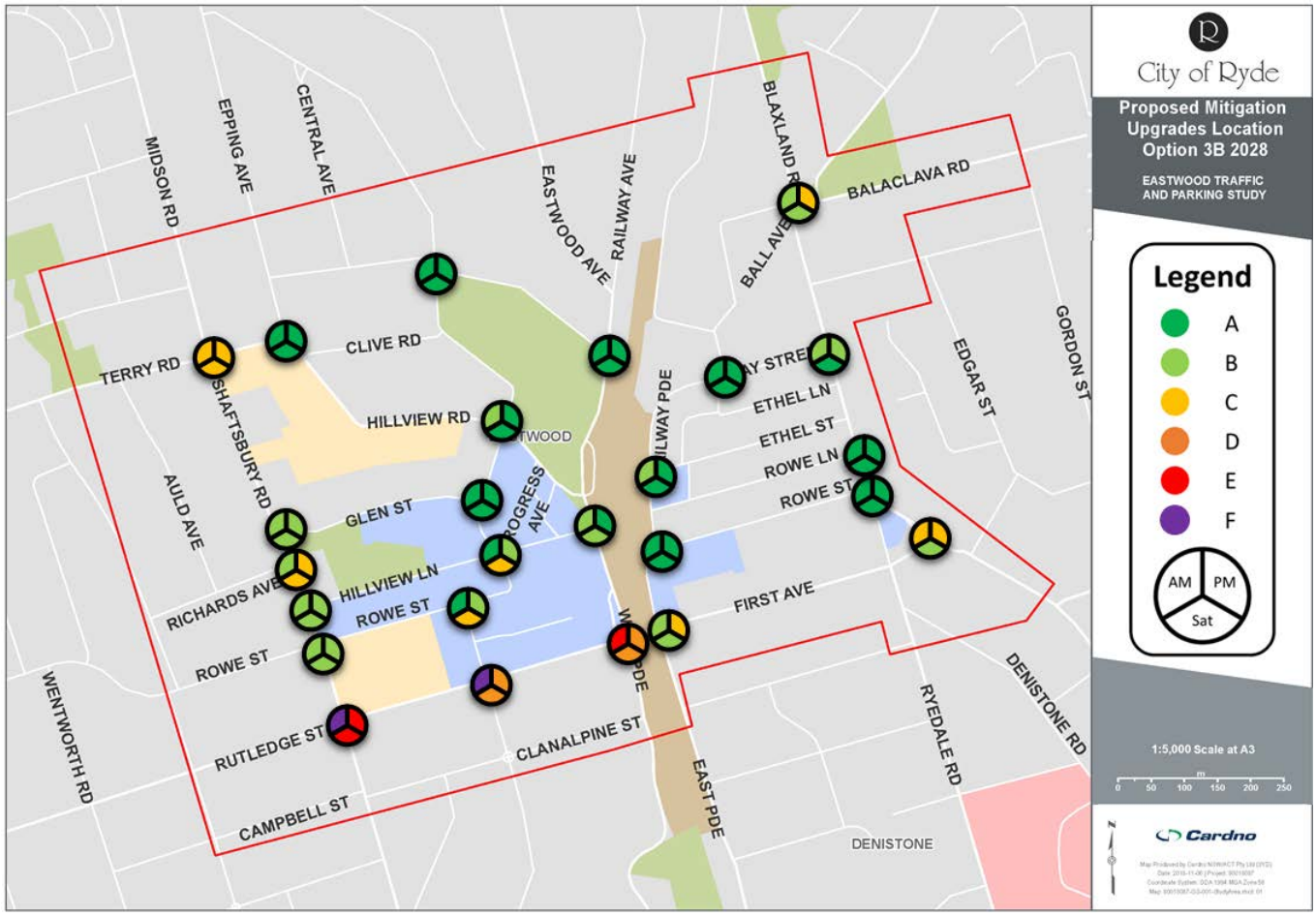


Figure 5-11 Option 3B Results

In comparison to Option 3A, the results of Option 3B show improved traffic operation along the Eastwood town centre, particularly along Rutledge Street with the exception to the Rutledge Street/Shaftesbury Road Intersection. This is due to a reduction in the number of vehicles turning right at Trelawney Street (and turning right at Shaftsbury Road instead to access the relocated car park entrance).

5.5.4 Option 3C

Option 3C was modelled with the commuter car park assumed to be constructed at Glen Reserve with a capacity of 230 spaces. While some congestion is still anticipated in some parts of the network (predominantly along the Rutledge Street corridor), the modelling results demonstrate a significant improvement compared to Option 2 (which included banning traffic along The Avenue). The primary deficiency under Option 3C is the insufficient capacity for traffic to turn right from Rutledge Street to Trelawney Street. This is particularly prevalent on the weekday peak hours. In the Saturday peak, average speed and delays improve significantly compared to weekdays.

The results of the Option 3C models are shown in **Figure 5-12**.

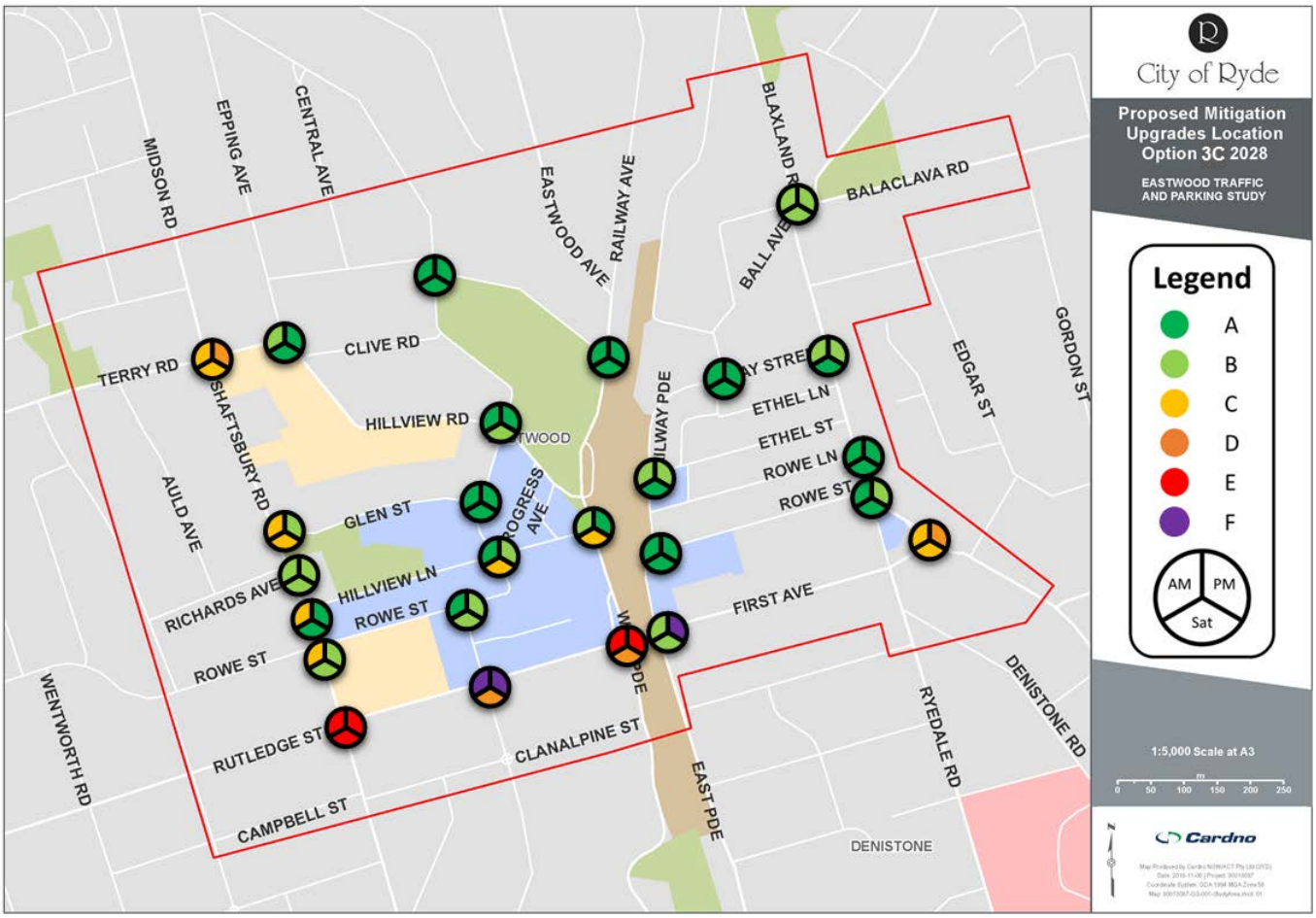


Figure 5-12 Option 3C Results

In comparison to Options 3A and 3B, intersections along Shaftesbury Road operate at a worst levels of service than those reported for Options 3A and 3B. This is mainly due to the additional commuter car park and the resulting trips anticipated on Shaftesbury Road.

5.5.5 Option 3D

Option 3D considers both retail and commuter car parks on Glen Reserve. This results in a total parking supply of approximately 830 parking spaces.

The modelling results show that while Option 3D still operates better than Option 2, it shows some deterioration of traffic operation results when compared to Option 3A, 3B, and 3C. This is predominantly related to the higher number of vehicles travelling along Shaftsbury Road to/from the car park. It should be noted that under this option, some 830 parking bays would be accessed via a single entry/exit point, which contributes to the deficiencies described above. **Figure 5-13** illustrates the intersections' levels of service for Option 3D.

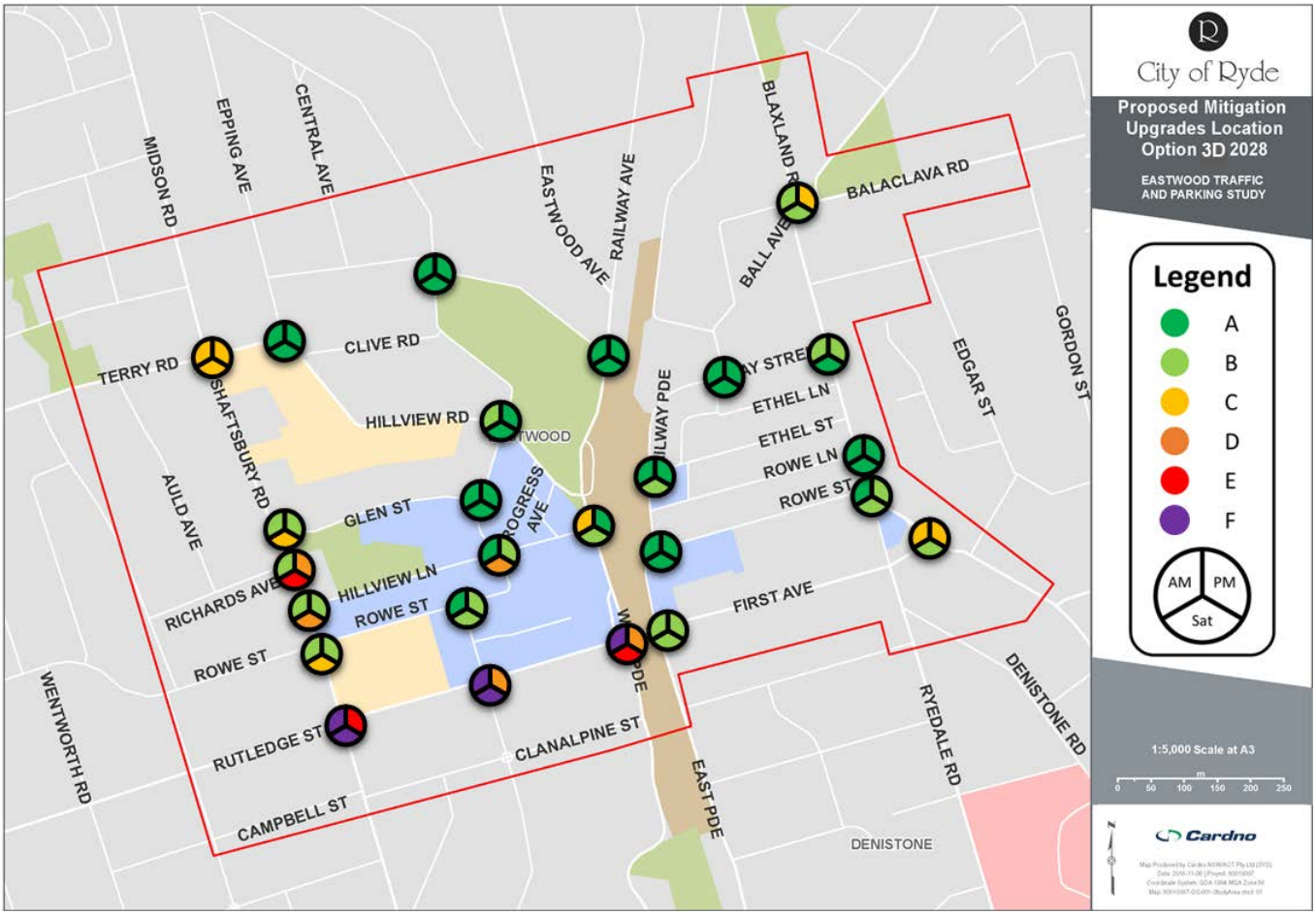


Figure 5-13 Option 3D Results

5.5.6 Options' Comparison and Preferred Option

One of the main benefits experienced with all the variations of Option 3 consists of signalising the pedestrian crossing at The Avenue (instead of closing this section to vehicular traffic as assumed in Option 2). The proposed right turn pocket from Rutledge Street to Shaftsbury Road also provides a significant improvement given that the existing road network only permits "filtered right turns" from Rutledge Street (westbound) to either Trelawney Street or Shaftsbury Road (northbound). This results in a limited number of vehicles being able to undertake these right turn movements and consequent queues affecting capacity for westbound through traffic.

Figures 5-14, 5-15, and **5-16** present a network-wide set of metrics for each of the alternatives to assist in determining the option with the best traffic operation results.

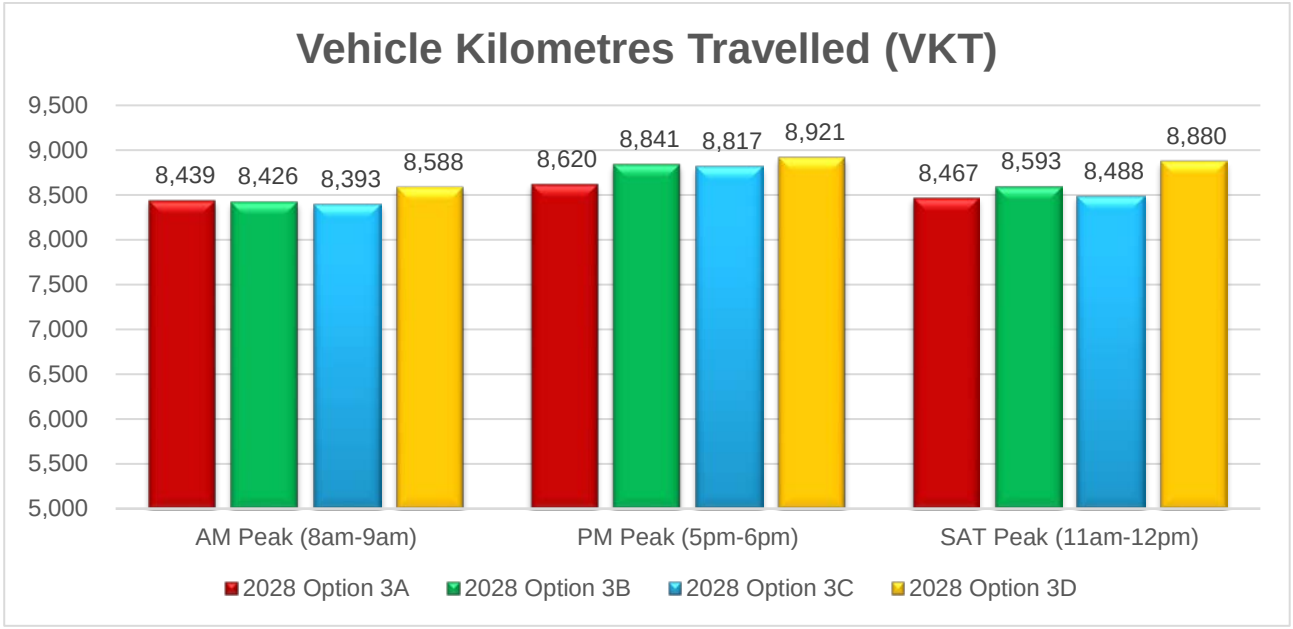


Figure 5-14 Vehicle Kilometres Travelled for Options 3A, 3B, 3C, and 3D

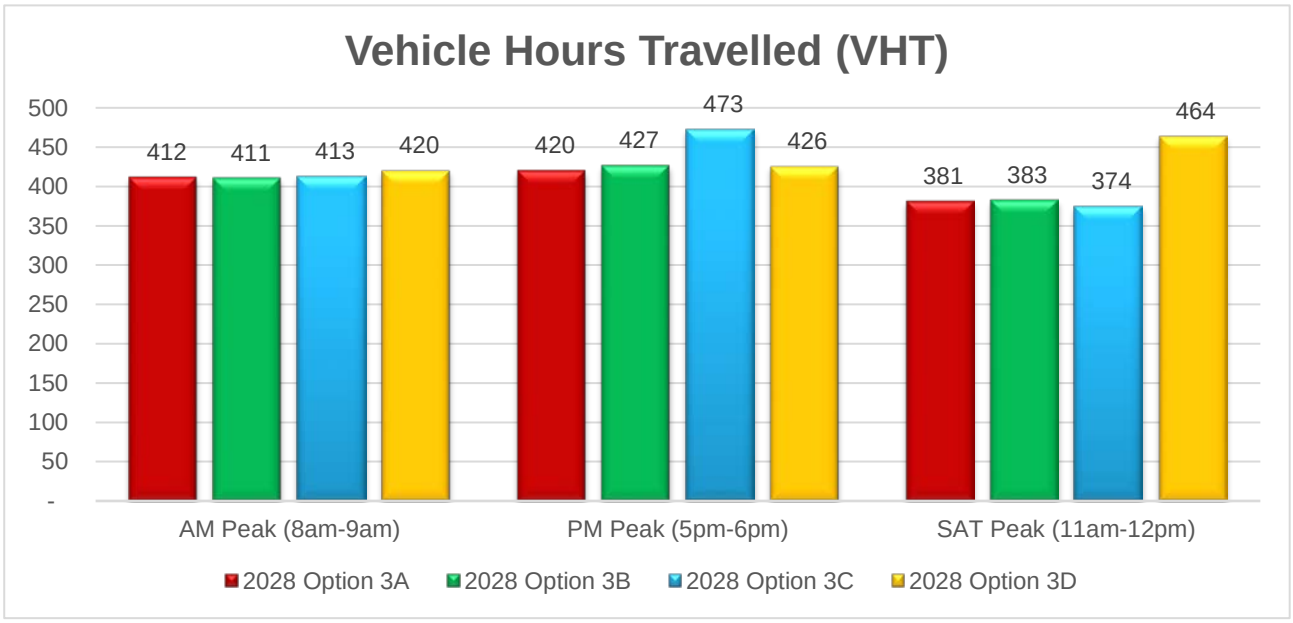


Figure 5-15 Vehicle Hours Travelled for Options 3A, 3B, 3C, and 3D

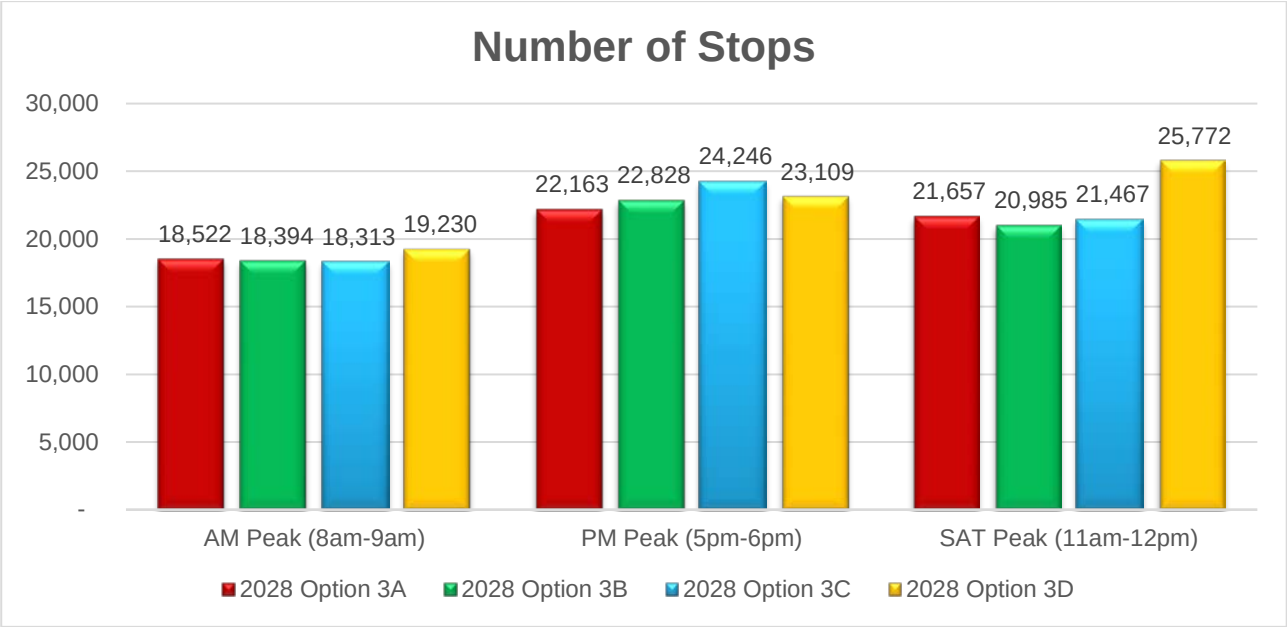


Figure 5-16 Number of Stops for Options 3A, 3B, 3C, and 3D

The results shown in the figures above refer to the overall road network operation and therefore dilute some of the operational benefits/issues at the intersection level. A comparison across these four sub-options is more relevant if conducted at the intersection operational level, especially for the areas surrounding the potential changes to parking infrastructure (Glen Street / Glen Reserve).

Overall, Option 3B shows the best performance metrics of all options assessed. One of the main findings is that the relocation of the existing Glen Street retail car park from its current location to Glen Reserve generates traffic operation benefits given that it results in a decrease in the number of vehicles turning right from Rutledge Street to Trelawney Street (and shifting this right turn demand to Shaftsbury Road where the proposed right turn pockets assists in managing this demand).

The modelling results also indicate that the provision of a commuter car park at Glen Reserve can be accommodated, but there is some deterioration of the traffic operation on Shaftsbury Road, especially if this car park is combined with the relocation of the Glen Street retail car park to this location. Under the scenario of combining the retail and commuter car park at Glen Reserve (total supply of approximately 830 spaces), consideration should be given to the provision of additional access points to/from the site to allow for better traffic distribution.

In summary, Options 3C and 3D, i.e. options that include Commuter car park, generate additional trips to the western side of the study area and contribute to the further deterioration of capacity issues at nearby intersections (predominantly along the Rutledge Street and Shaftsbury Road corridors).

The main difference between Options 3A and 3B consists of maintaining the Glen Street car park at its current location (Option 3A) or relocating it to Glen Reserve (Option 3B). The modelling results indicate that traffic benefits are achieved at the nearby intersections if the car park is relocated. This is due to a reduction in the number of vehicles turning right at Trelawney Street (and turning right at Shaftsbury Road instead to access the relocated car park entrance).

6 Conclusions and Recommendations

- Cardno completed a study to investigate the traffic and parking behaviour in the Eastwood town centre and evaluate the impacts of the proposed modifications to land uses under the existing planning controls;
- Traffic and parking data was collected to help evaluate the existing operation;
- The parking analysis identified a total parking supply of some 1,962 spaces within the study area, the majority of which consist of off-street parking bays;
- The duration of stay results identified that on-street bays are predominantly used by short-term visitors (especially on weekdays, with 80% vehicles staying for less than 2 hours) while off-street bays show a more balanced utilisation between short term and long term;
- Demand for parking remains high throughout the day and reaches 100% occupancy at some locations during peak periods. The shortage of available parking is more prevalent on the eastern side of the study area than that of the western side, where the demand exceeds supply by a considerable margin (at least 250 bays during the weekday peak, and 100 bays during the weekday peak). This results in parking overspill into surrounding residential streets and a tendency for visitors to look for parking on the western side of the railway station where the probability of finding a parking space is greater;
- Traffic simulation models were developed for the study area, allowing the existing performance of the road network to be evaluated and quantified. The analysis identified traffic congestion spots during the weekday AM, PM, and weekend peak hours. The majority of the congestion hotspots were found along the Shaftsbury Road / Rutledge Street / First Avenue / Blaxland Road corridors. Some localised issues were also found within the town centre, namely at conflict points between pedestrians and vehicles, often resulting in long queues during the peak periods;
- Given the parking deficit described for the eastern side of the study area, consideration was given to the potential upgrade of the existing at-grade car park at Rowe Street East into a multi-storey parking structure. Under this option, the car park capacity would increase from the existing 50 spaces to approximately 150 spaces. This option was tested in the traffic models, and it was found that no detrimental impact would be expected for the traffic network;
- Several Council owned sites were considered for the provision of the commuter car park, but it was found that none of these locations presented the ideal context for that use. After dismissing unsuitable locations, the best available option (out of the Council owned locations) is Glen Reserve, but this also presents some issues, namely the distance to the station (over 400m walking distance). The pedestrian infrastructure linking the station and the car park would need to be carefully planned/upgraded to ensure that a safe and convenient walking route would be delivered in conjunction with the commuter car park.
- Other potential locations were considered for the commuter car park:
  - Eastwood Police Station: this site is currently owned by NSW Police Force. The implementation of the commuter car park could be highly advantageous due to the site proximity to Eastwood Station, the lot size, and the anticipated minimal disruption to the Eastwood Eastern Town Centre due to the various routes from/to the site.
  - West Ryde Parking Facility: this existing at-grade commuter park is owned by Rail Corporation. An expansion to this facility to accommodate a proposed multi-level structure would be ideal due to the site being adjacent to the West Ryde train station. This upgrade could be optimised by introducing express services at West Ryde Station after the completion and operation of Sydney Metro.
  - Further investigation for both of those options is recommended by to be undertaken by TfNSW to further understand the impacts of the commuter cark park implementation at either location.
- Traffic models were developed for the 2028 future year horizon based on the current land use planning controls. The “2028 base” models include the proposed commuter car park on Glen Reserve and road upgrades assumed to be in place by then;
- Option testing was completed for the 2028 future year scenario, which revealed that the existing operational deficiencies are likely to be exacerbated by the additional trips generated by the proposed changes to land use. This must be addressed by monitoring the network performance as redevelopment takes place and transport demand patterns and trends evolve. Based on the modelling undertaken to date and land use assumptions, the recommendations for the road network upgrades to be in place by 2028 are as follows:

- Upgrades adopted in 2028 Base Model:
  - Additional northbound right turn bay (88m long) and traffic signal phasing optimisation at the intersection of Blaxland Road / Balaclava Road. This would result in a dual right turn onto Balaclava Road;
  - Double right turn from Blaxland Road into First Avenue by allowing the middle lane to accommodate through and right turn vehicular traffic. A two-lane exit approach will also be required (through network geometry re-configuration) to ensure that this movement is feasible. Traffic operation at the northbound left turn from Blaxland Road into First Avenue is required to be modified from a merge to a give-way;
  - Ban left turn from Blaxland Road to Rowe Lane;
  - Provision of turning bays at north and south approaches of Glen Street / Shaftsbury Road. Glen Street / Shaftsbury Road intersection to remain as give-way. This would require banning some kerbside parking at this location;
  - Extension of the left turn lane from First Avenue to Blaxland Road (50m extension);
  - Eastwood Centre Redevelopment (based on submitted DA plans):
    - all movements permitted to/from Trelawney Street car park (i.e. same as existing);
    - left turn in from Rutledge Street to the new car park access - install new 45m deceleration lane;
    - left turn out to Rutledge Street from the new car park access;
    - West Parade loading dock access moved just north of current location.
  - Rowe Street East car park access:
    - maintain access from Rowe Street;
    - consolidate two access points from Rowe Lane into a single access point and convert it to exit only (i.e. left and right turn out only);
  - Parking restrictions on AM and Sat peaks at Shaftsbury Road between Rowe Street and Hillview Lane (same restrictions as current PM restrictions);
  - Conversion of Richards Avenue / Shaftsbury Road intersection to traffic signals to cater for the new commuter car park. Removal of parking north and south of the intersection to cater for separate right-turn bays and two through traffic lanes northbound.
- Additional upgrades identified as part of the preferred option testing:
  - Short-term measures:
    - Conversion of the zebra crossing at The Avenue to traffic signals;
    - Conversion of the zebra crossings on West Parade to traffic signals;
    - Remove two on-street parking spaces along the eastern side of East Parade, north of First Avenue intersection;
  - Long-term measures:
    - New right turn bay (60 metre long) at the eastern approach to the Shaftsbury Road / Rutledge Street intersection (and consequent signal phasing optimisation)

- Several combinations of infrastructure upgrades were tested in an attempt to optimise transport infrastructure to the future demand. One of the main findings was the importance of signalising the pedestrian crossing at The Avenue. Zebra crossings provide priority to pedestrians over vehicular traffic at conflict points. In cases of high pedestrian demand, this can result in extensive delays to vehicular traffic. In such cases, the conversion of zebra crossings to signalised crossings should be considered to allow more control and a better balance between the time allocated to pedestrians and cars.
- It was found that closing The Avenue to vehicular traffic would result in a significant deterioration of traffic issues due to the lack of alternative routes.
- The proposed right turn pocket from Rutledge Street to Shaftsbury Road also provides a significant improvement given that the existing road network only permits “filtered right turns” from Rutledge Street (westbound) to either Trelawney Street or Shaftsbury Road (northbound). This results in a limited number

of vehicles being able to undertake these right turn movements and consequent queues affecting capacity for westbound through traffic.

- Four options were developed to test various combinations of modifications to parking infrastructure in the study area. These can be summarised as follows:
  - Option 3A: No change; Glen Street Car Park (450 spaces) to remain in its current location (No commuter car parking, no increase in retail parking);
  - Option 3B: Relocation of Glen Street Car Park to Glen Reserve (plus 150 additional retail parking spaces) and no provision for commuter parking;
  - Option 3C: Glen Street Car Park to remain in its current location plus 230 space Commuter Car Park at Glen Reserve;
  - Option 3D: Relocation of Glen Street Car Park to Glen Reserve (plus 150 additional retail parking spaces) plus 230-space Commuter Car Park at Glen Reserve.
- Options 3C and 3D include the provision of a new commuter car park at Glen Reserve. This generates additional trips to the western side of the study area and contributes to the further deterioration of capacity issues at nearby intersections (predominantly along Rutledge Street and Shaftsbury Road corridors).
- Options 3A and 3B do not include the new commuter car park at Glen Reserve. The main difference between Options 3A and 3B consists of maintaining the Glen Street car park at its current location (Option 3A) or relocating it to Glen Reserve (Option 3B). The modelling results indicate that traffic benefits are achieved at the nearby intersections if the car park is relocated. This is due to a reduction in the number of vehicles turning right at Trelawney Street (and turning right at Shaftsbury Road instead to access the relocated car park entrance).
- In summary, the modelling results allowed the identification of the infrastructure upgrades required to be in place by 2028 to help accommodate the proposed land use changes within the study area. Four sub-options were tested to evaluate potential changes to car parking infrastructure, and it was found that Option 3B resulted in the most beneficial outcomes from an operational traffic perspective. This option would require the relocation of the Glen Street car park to Glen Reserve (plus 150 additional retail parking spaces) and no commuter car park at this location.
- It is recommended that consultation with state government agencies takes place in order to evaluate the alternatives for the delivery of a commuter parking facility other than the above mentioned Glen Reserve site. More specifically, two locations were identified to have significant potential in comparison to Council owned sites in Eastwood. These are the lot currently occupied by NSW Police Force and the at-grade commuter car park near the West Ryde station.
- Similarly, further consultation with key stakeholders is recommended to take place in order to obtain a better understanding of proposed upgrades to active transport and public transport infrastructure within the study area (including the proposed bus interchange). In addition, Cardno has been commissioned to undertake a review of cycling infrastructure to complement this study. This will assist in the holistic evaluation of the Eastwood transport network with consideration given to the integration across all transport modes.