Canterbury Bankstown Council

Chester Square Planning Proposal

Transport Strategy and Traffic Impact Assessment

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1 Introduction

Arup was commissioned to undertake microsimulation traffic modelling to understand the potential impacts of a Planning Proposal proposed on the site of the existing Chester Square Shopping Centre. This exercise was requested by the Department of Planning, Industry and Environment (DPIE) to support the gateway determination for the Planning Proposal. The works also aimed to assist Canterbury Bankstown Council (CBC) in confirming the infrastructure requirements to support the proposed development.

The Planning Proposal is located at 1 Leicester Street in Chester Hill (Subject Site), which falls within the Canterbury Bankstown Local Government Area (LGA). The Chester Square Shopping Centre currently supports a range of retail offerings including a full line supermarket, cafes, pharmacy etc. The location of the site is presented on Figure 1 along with the agreed study area which includes a number of surrounding streets that will be impacted by traffic and transport modes generated by the project.

Figure 1: Study area

A Planning Proposal, submitted to Canterbury Bankstown Council (CBC) in 2019 and amended in 2020, seeks to increase planning controls relating to the Floor Space Ratio (FSR) and Height of Building on the Subject Site. If the Planning Proposal is approved, the site will be redeveloped as a mixed-use development which will include an increased retail offering, residential units, commercial uses and community facilities, such as a town square and multi-purpose community facility.

Following an agreement of strategic merit from DPIE, an additional Transport Strategy and Traffic Impact Assessment (TSTIA) was requested. The key aims of this study were to:

- Inform the Urban Design Framework
- Undertake microsimulation modelling of key intersections likely to be impacted by the proposed development
- Define infrastructure requirements to support the proposed development

2 Strategic context

This section summarises the strategic context of Chester Square and the key studies that have been undertaken to support the development of the Planning Proposal.

2.1 Strategic Plans

2.1.1 Future Transport 2056, TfNSW 2018

This strategy outlines a 40-Year vision for the New South Wales transport system. It presents a customer-focused vision built around six key principles and establishes a framework to guide investment in future transport. The Strategy identifies Bankstown as a Strategic Centre.

The Plan identifies a visionary Greater Sydney 2056 indicative future rail network as shown in Figure 2. A potential future metropolitan rail line will run from Liverpool, passing through Chester Hill and continue to a range of destinations including Richmond, Revesby and Regents Park. A new rail connection would support the growth of Chester Hill into a more transit oriented centre.

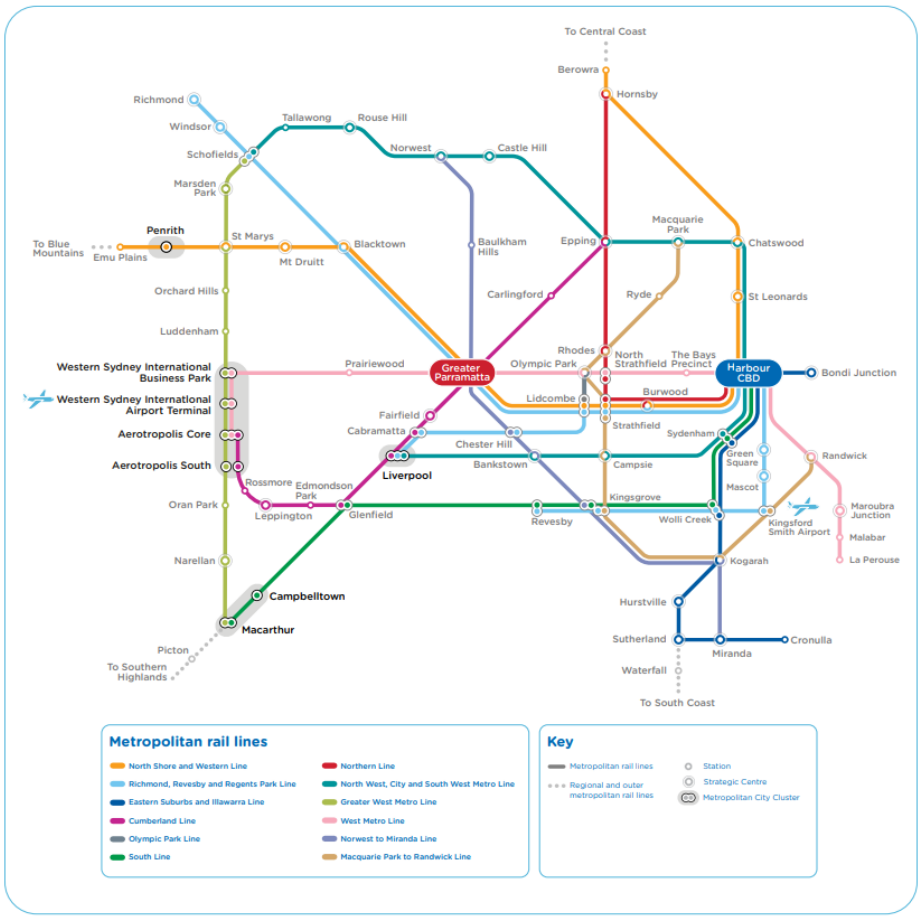


Figure 2: Future Transport 2056 indicative future rail network, TfNSW

2.1.2 Canterbury Bankstown Local Strategic Planning Statement, CBC, 2020

The LSPS is a 20-year plan to guide renewal and growth in the Canterbury-Bankstown Local Government Area (LGA) to accommodate a population of 500,000 by 2036.

CBC outlines clear aspirations to target a more sustainable travel mode share across the LGA by 2036. This is presented in Figure 3, with the aim to reduce private vehicle trips in favour of public transport, walking and cycling.

This document identifies Chester Hill as a Local Centre which provides urban services to a wide catchment along with additional housing. Approaches to parking management are suggested including:

- Maximum parking rates that consider the influence of surrounding public transport services.
- All freight and servicing occurring on site with provisions to enable last mile deliveries from key precincts.
- Prioritising short stay spaces on street to support local businesses.

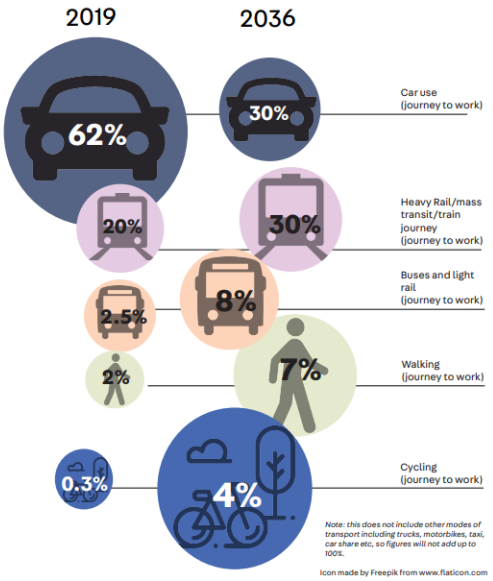


Figure 3: LSPS mode share targets

The Planning Proposal will need to propose a range of measures to ensure the vision for the site aligns with aspirations within the LSPS.

2.1.3 North West Local Area Plan, Bankstown City Council, 2013

The Local Area Plan set out a vision for the North West area, including Chester Hill, and identified changes to the statutory planning framework and infrastructure priorities. The plan was accompanied by a Traffic and Parking Study undertaken by Cardno that presented findings from a strategic review of traffic and transport issues in Chester Hill. While the LSPS replaces the LAP in terms of the Council's strategic planning vision, it remains valid with regard to traffic and transport observations. Several key findings from this study included:

- Parking supply is highly utilised in the midday period. In the evening, parking demand reduces with overall occupancy reaching ~60%.
- Cycling routes are poorly marked and signposted with wayfinding only existing in the vicinity of the Chester Square Shopping Centre.

- Footpaths are provided in the area including crossing points that align with key locations and desire lines.
- Public transport is available in the centre via the bus and rail network; however services are infrequent and are a challenge to access for mobility impaired users.

2.1.4 Safer Roads Proposal: Chester Hill Town Centre, CBC 2021

The Safer Roads Proposal introduced a new 40km/h high pedestrian activity area (HPAA) speed limit through the Chester Hill town centre. The proposal included the installation of a range of supporting treatments to prioritise pedestrian safety as shown in Figure 4 which included:

- 40km/hr High pedestrian activity signage
- Entry thresholds to signalise the start of the HPAA
- Raised threshold with fencing
- Raised pedestrian crossings
- Kerb extensions

All measures proposed in the HPAA were implemented in April 2021

Figure 4: Locations of implemented safety treatments in Chester Hill town centre

2.2 Site specific studies

2.2.1 Planning Proposal (Amended), Sutherland Planning 2020

In 2020, an amended Planning Proposal was submitted to CBC to redevelop the Chester Square Shopping Centre site. The Proposal sought to create a transit oriented mixed-use development with residential housing, commercial and community facilities through an increase to both the FSR and building heights. An impression of the amended project proposal is shown in Figure 5.

Figure 5: Computer generated image of project as viewed facing south-west from the corner of Leicester Street and Priam Street (Sutherland Planning, 2020)

The amended design included the following elements:

- Capacity for 75,684 square metres of gross floor area, comprising approximately 633 apartments (58,043 square metres), and 15,621 square metres of commercial uses, and a 2,020 square metre Council library.
- Basement levels to provide car parking for approximately 690 vehicles for the commercial component and 875 vehicles for the residential component.
- The dedication of a 1.5 metre strip along the southern boundary of the site for the purpose of laneway widening and the enhancement and activation of the laneway.

2.2.2 Traffic Impact Assessment (TIA), Ason Group 2019

The TIA was prepared in 2019 to support the Planning Proposal for the site. The operational impacts were assessed based on existing transport networks in 2019 and future context for a planned opening in 2021. The TIA used trip generation rates from the RMS Guide and Technical Direction and surveys of the Chester

Square Shopping Centre to forecast future traffic demand based on the proposed land uses. Background traffic growth rates were extracted from TfNSW's Strategic Traffic Forecasting Model (STFM).

The assessment concluded that the development does not adversely affect intersections in the study area other than Waldron Road and Priam Street and Chester Hill Road and Waldron Road which already operate with low levels of service. A key recommendation was to replace the roundabout at Waldron Road and Priam Street with signals to improve the operation of the intersection to an acceptable Level of Service C based on SIDRA modelling. Based on these recommendations, the TIA identified that the Planning Proposal was supportable on traffic planning grounds.

2.2.3 Green Travel Plan (GTP), Ason Group 2019

To support the Transport Impact Assessment a Green Travel Plan was produced with the aim of proposing a range of site specific measures to encourage travel by sustainable modes such as walking, cycling and public transport. The measures proposed included:

- Utilisation and extension of existing car sharing schemes in the local area
- Mandatory Travel Plans for all uses including the management and promotion of these plans
- Encouraging flexible working to reduce travel demands at peak times
- High quality end of trip facilities for all uses
- Creating a permeable network for walking to, from and through the site
- Reduced residential parking rates and co-sharing of parking between uses.

2.2.4 Chester Square Planning Proposal Peer Review, GTA, 2020

CBC engaged GTA Consultants (GTA) to independently peer review the Transport Impact Assessment that supported the Chester Square Planning Proposal. In addition, GTA undertook a broader review of the Chester Hill Village Centre from a traffic and transport perspective. Key recommendations from this report included:

- The scale of development proposed on the site will generate a DCP car parking requirement of ~1,400 parking spaces. This could be reduced by implementing sustainable travel initiatives and sharing parking provision between land uses
- The indicative location and quantum of site accesses and supporting traffic modelling did not provide an appropriate level of detail to adequately assess the traffic impact of the Planning Proposal
- SIDRA modelling indicated that upgrading the Priam Street / Waldron Road intersection and lengthening of turning bays, could potentially accommodate expected uplifts in traffic generation relating to the Planning Proposal

- The proposal from the Urban Design Review to pedestrianise Waldron Road did not align with the intended function of this street. Further detailed analysis such as microsimulation traffic modelling would likely be required to support such a proposal.
- The location of the access points would need to be further refined to better understand the likely distribution of traffic around the site.

2.2.5 Traffic Impact Assessment Addendum, Ason Group, 2020

Following the Urban Design Review from Place Design Group and the Traffic and Transport Peer Review by GTA, Ason Group updated the TIA to consider and review recommendations from both these studies. This included sensitivity analysis to test changes to Waldron Road (between Bent Street and Priam Street). Key recommendations relating to this sensitivity test included:

- To improve the public domain along Waldron Road, it was proposed to close Waldron Road to private vehicles between Bent Street and Priam Street. Buses would still be able to use Waldron Road as a through route
- To accommodate re-routed traffic due to the changes to Waldron Road the following upgrades would be required:
    - Upgrade the Waldron Road / Bent Street and Leicester Street / Priam Street intersections to roundabouts.
    - Upgrade the Waldron Road / Priam Street intersection to a priority controlled intersection

2.2.6 Chester Square Urban Design Framework (Draft), SJB, 2022

To support the gateway determination for the Planning Proposal an Urban Design Framework is being developed by SJB. This includes defining a new street hierarchy for the centre that aligns with the NSW Movement and Place Framework. Figure 6 indicates the proposed movement and place street hierarchy for Chester Square.

Figure 6: Draft Movement and Place Street Hierarchy

This hierarchy maintains Waldron Road as the key link within the centre serving a movement function for through traffic whilst supporting active frontages and enabling crossing movements to Chester Hill Train Station. All other streets surrounding the Planning Proposal are proposed to be Local Streets or Civic Spaces that focus on creating environments where place is prioritised combined with improved walking and cycling connections on certain links. The infrastructure upgrades recommended as part of this study have taken into account the proposed movement and place hierarchy for Chester Square.

2.3 Traffic and Transport Objectives

Following a review of the strategic plans that govern Chester Square along with the various assessments undertaken for the Planning Proposal. A number of key traffic and transport objectives for Chester Square have been developed to help achieve CBC's future aspirations for the centre:

- Implement a holistic travel demand management approach to all uses including measures, targets and a monitoring strategy
- Align infrastructure upgrades with the Movement and Place aspirations for the centre
- Balance the functions of Waldron Road to maintain suitable traffic conditions whilst improving street activity and enabling crossing movements
- Create local streets that are low speed and encourage community interaction through walking and cycling

- Encourage the use of public transport through lobbying for increased services and improved connections to Chester Hill Train Station and bus stops
- Use parking management measures to reduce traffic impacts and support future mode share aspirations for the centre
- Develop an integrated approach to loading and servicing which seeks to enable last mile deliveries to the local community

3 Assessment methodology and modelling assumptions

The following section provides an overview of the modelling process undertaken to assess the impacts of the Planning Proposal on the surrounding road network.

3.1 Land use assumptions

The land uses assessed in this study are based on guidance from CBC regarding a floor space ratio for the site of 4:1. A concept plan from the TIA for the Planning Proposal is shown in Figure 7. The preferred concept consists of a mix of residential, retail and commercial land uses and a public library.

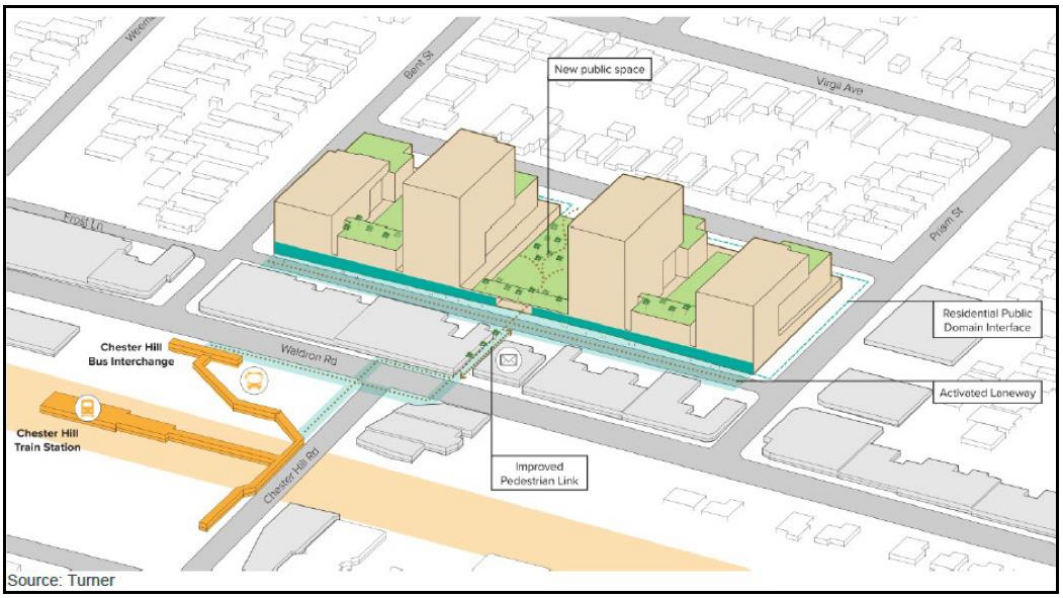


Figure 7: Indicative concept plan for Planning Proposal (Traffic Impact Assessment, Ason Group 2019)

Image does not reflect the supported built form for the Planning Proposal

The existing land use yields on the site and the proposed areas in line with a floor space ratio of 4:1 are presented in Table 1. It should be noted these proposed values differ from those assessed in the TIA due to the inclusion of a multi-purpose community facility and the change to the total FSR for the proposal from 4.53:1 to 4:1 as a result of the outcomes of the draft Urban Design Framework prepared by SJB for Council.

Table 1: Existing and Planning Proposal land use yields

Land Use	Existing Gross Floor Area (m²)	Planning Proposal Gross Floor Area (m²)
Residential	-	49,543 (581 dwellings*)
Commercial	-	1,000
Retail	8,300	14,403
Community facility	-	2,000

*Assumes 85m² GFA per unit

3.2 Trip generation

The trip generation rates used for each land use are presented in Table 2. These rates have been discussed and agreed between Ason Group and CBC for all uses. A summary of how each rate was selected is provided below:

- **Residential** – Derived from a specific selection of High Density Residential sites from Guided to Traffic Generating Developments TDT2013/04a (Rockdale, Parramatta, Liberty Grove) as advised by CBC based on local knowledge. These sites have higher trip generation than the average rate in TDT2013/04a
- **Commercial** - Average Office block rates from the RMS Guide to Traffic Generating Developments TDT2013/04a
- **Retail –** Taken from a survey of the existing Chester Square Shopping Centre (a 5% reduction factor will be applied to retail uses within the Planning Proposal based on the Proponent's Green Travel Plan)
- **Library** – Benchmarked against survey data for a library situated in a Queensland CBD location. Referenced against rates provided in the ITE Trip Generation Manual and San Diego Land Development Code, with the Australian based survey data considered to be more suitable and relevant for this site.

Table 2: Trip generation rates adopted for the assessment

Land Use	AM	PM	Weekend
Residential	0.29 trips per unit	0.24 trips per unit	0.25 trips per unit
Commercial	1.6 trips per 100m² GFA	1.2 trips per 100m² GFA	-
Retail*	0.062 trips per m²	0.097 trips per m²	0.113 trips per m²
Library	0.633 trips per 100m² GFA	0.633 trips per 100m² GFA	0.745 trips per 100m² GFA

*A 5% reduction factor will be applied to the retail trips

3.3 Directional split

The directional split for each use was taken from the TIA and survey data for the library use. The splits are presented in Table 3.

Table 3: Directional split adopted for modelling

Land Use	AM		PM		Weekend	
	In	Out	In	Out	In	Out
Residential	20%	80%	80%	20%	50%	50%
Commercial	80%	20%	20%	80%	NA	NA
Retail	50%	50%	50%	50%	50%	50%
Library	60%	40%	40%	60%	50%	50%

4 Base model development

An AIMSUN microsimulation traffic model was developed for the base year 2019 from inputs outlined in Figure 8. The following sections describe the model development process in further detail.

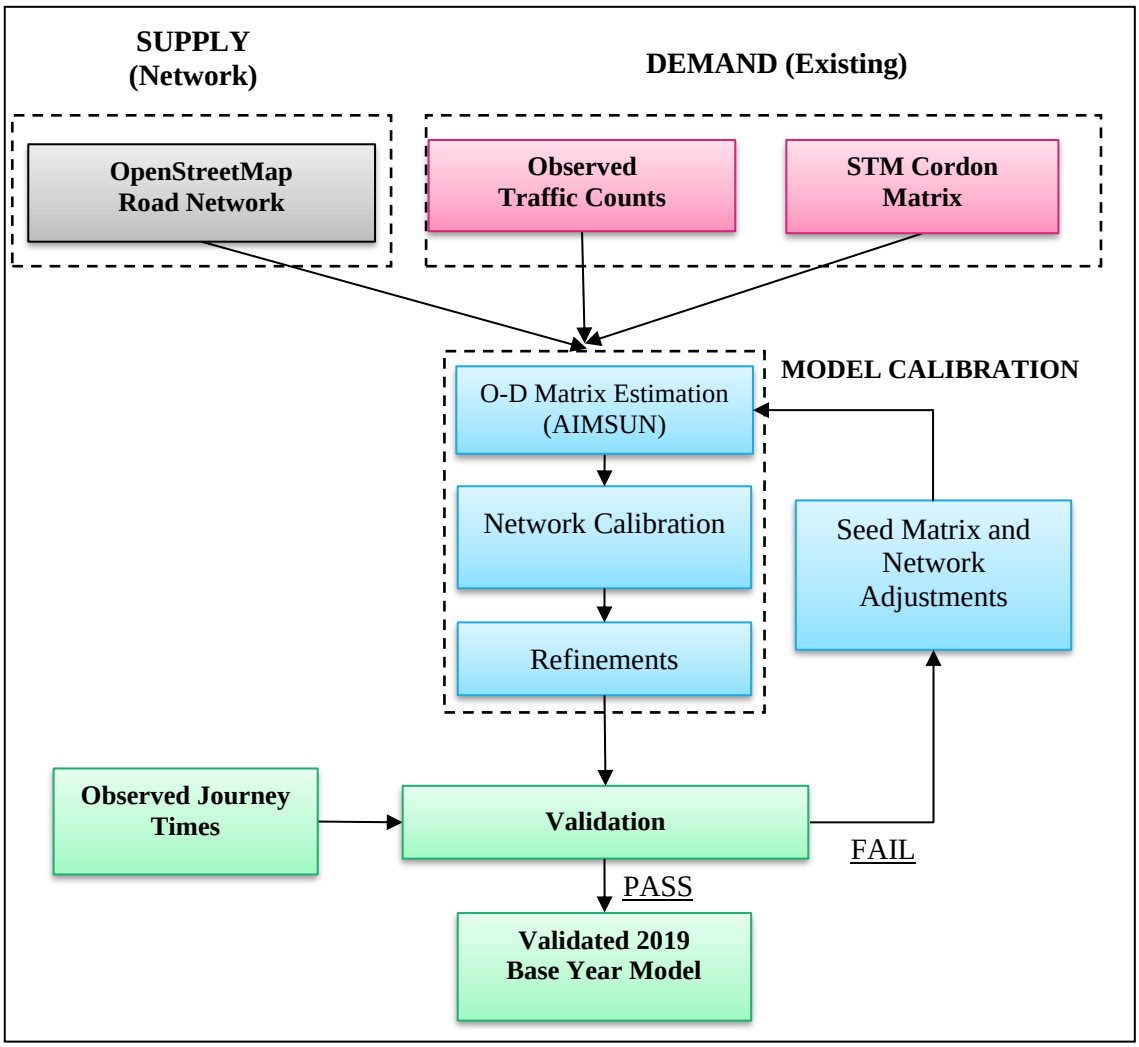


Figure 8: Chester Square Base Year AIMSUN Traffic Modelling Methodology

4.1 Input data

The model inputs include an OpenStreetMap road network of the study area, origin-destination traffic volumes from the Sydney GMA Strategic Traffic Forecasting Model (STM), intersection turning movement traffic counts presented in Figure 9 and observed journey time data from the road network surrounding Chester Square Shopping Centre.

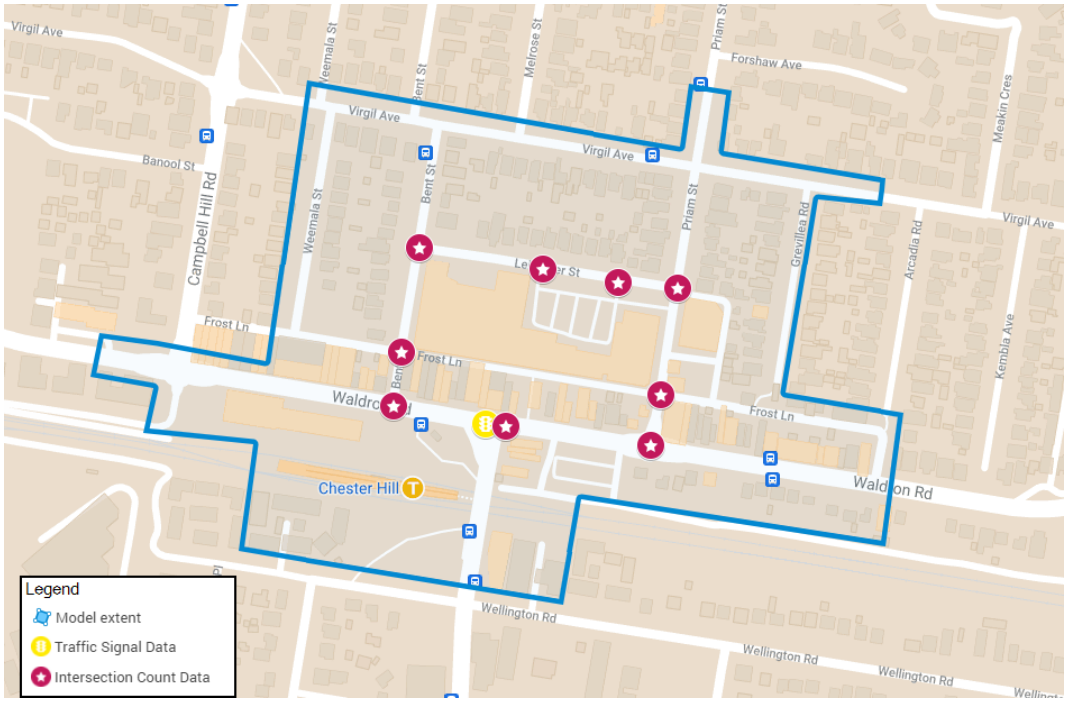


Figure 9: Intersection turning movement count data

Intersection turning movements from surveys undertaken in 2019 were provided by Ason Group for the following locations:

- S01 – Chester Hill Road and Waldron Road
- S02 – Waldron Road and Bent Street
- S03 – Bent Street and Frost Lane
- S04 – Bent Street and Leicester Street
- S05 – Leicester Street and Chester Square Car Park (West)
- S06 – Leicester Street and Chester Square Car Park (East)
- S07 – Priam Street and Leicester Street
- S08 – Priam Street and Frost Lane
- S09 – Waldron Road and Priam Street

Due to the impacts of COVID-19 new data was not able to be collected as part of this study.

4.2 Model extent

Figure 10: AIMSUN base model extent

Figure 10 shows the AIMSUN extent for the base traffic model. 17 centroids have been defined for this model. Three centroids were defined for the Chester Square Shopping Centre:

- Staff parking (accessed via Bent Street)
- Customers underground parking (accessed via Priam Street)
- Customer at grade parking (accessed via Leicester Street)

4.3 Time period

Intersection traffic counts were processed and used to determine the peak hour for the weekday AM period, weekday PM period and weekend. The results are shown in Figure 11, Figure 12 and Figure 13 respectively.

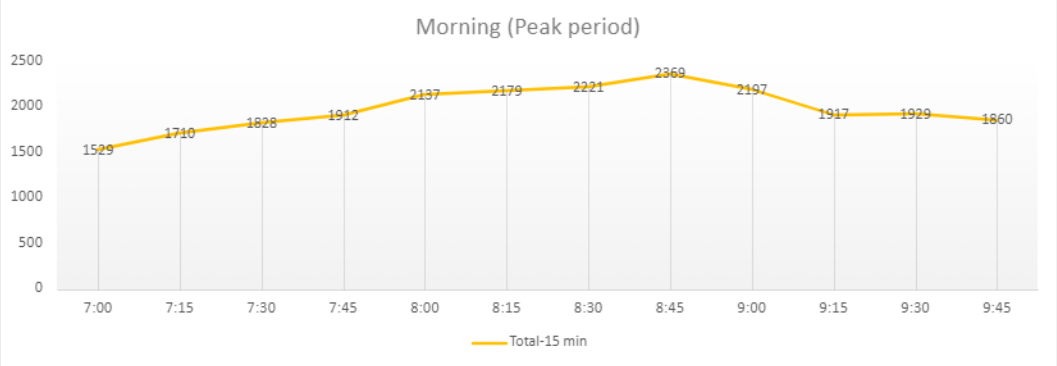


Figure 11: Chester Square site traffic counts identifying weekday AM peak hour period

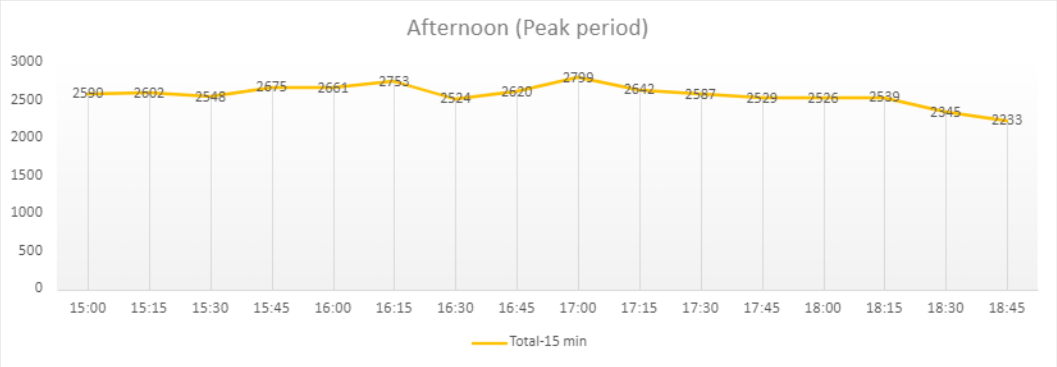


Figure 12: Chester Square site traffic counts identifying weekday PM peak hour period

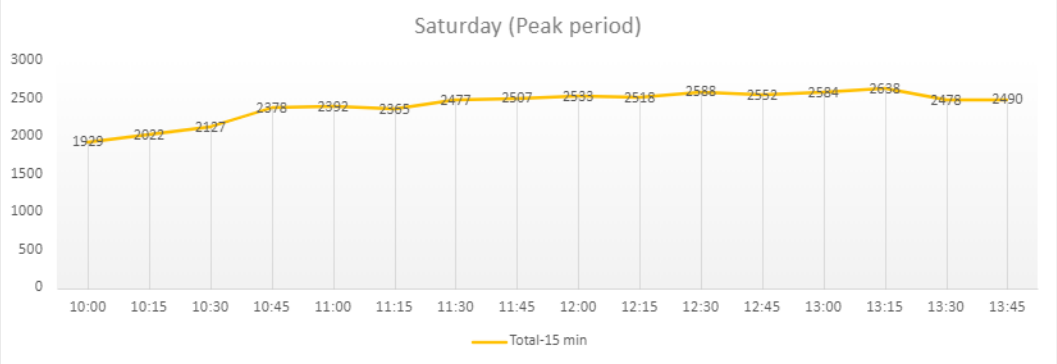


Figure 13: Chester Square site traffic counts identifying weekend peak hour period

The base year model was calibrated and validated for three different time periods:

- **AM period – Weekday**: 07:30 to 09:30 (2 hours)
- **PM period – Weekday**: 15:30 to 17:30 (2 hours)
- **Weekend**: 11:00 to 13:00 (2 hours)

4.4 Calibration and Validation

By reviewing key modelling results, the following highlights the model's ability to replicate observed traffic counts, and hence demonstrates that the model is suitable for testing future upgrade options.

4.4.1 Calibration methodology

Once the AM and PM peak models were developed for the base year (2019), Arup calibrated the models based on the intersection turn movement data.

To evaluate the accuracy of the model in replicating the observed behaviour of the network, Arup used the following measures:

- Percentage Root Mean Square Error (RMSE) of total modelled flows and observed counts.
- Scatter plot of modelled flows and observed counts, with regression statistics (R^2 values)
- Geoff E Havers (GEH) statistic, which is a form of the Chi-squared statistic that incorporates both relative and absolute differences

The percentage RMSE is calculated as:

$$\%RMSE = \frac{\sqrt{\frac{\sum(F_{mod} - F_{obs})^2}{N-1}}}{\left(\frac{\sum F_{obs}}{N}\right)} \times 100$$

where: *Fmod = Modelled flow*

Fobs = Observed counts

N = Number of counts

The GEH is defined as:

$$GEH = \sqrt{\frac{(F_{mod} - F_{obs})^2}{0.5(F_{mod} + F_{obs})}}$$

where: F_{mod} *= Modelled flow*

F_{obs} *= Observed counts*

The calibration criteria and acceptability guidelines for link and turning movement traffic flows have been adopted from the Traffic Modelling Guidelines, Transport for NSW, 2013, summarised in Table 4.

Table 4: Calibration criteria and acceptability guidelines for links and turning movements (Source: Traffic Modelling Guidelines, Transport for NSW, 2013)

Indicator/ measure	Description of criteria	Acceptability Guidelines
Scatter Plot	Coefficient of determination, R^2 greater than 90%	Overall observations
GEH	GEH less than or equal to 5 for individual turns or flows	Greater than or equal to 85%
	GEH greater than 10 for individual turns or flows	Requires explanation in reporting

4.4.2 Calibration results

The model calibration results for the base year model are shown in Table 5.

Table 5: Model calibration results

Period	Hourly Period	GEH < 5 (should be > 95%)	GEH < 10 (should be 100%)	RMSE (should be < 30)	R-Square (should be > 90%)
AM Weekday	07:30 - 08:30	98%	100%	25.64%	99%
	08:30 - 09:30	96%	100%	15.79%	98%
PM Weekday	15:30 - 16:30	96%	100%	16.15%	98%
	16:30 - 17:30	98%	100%	17.38%	98%
Weekend	11:00 - 12:00	100%	100%	16.44%	99%
	12:00 - 13:00	100%	100%	15.35%	99%

4.4.3 Validation observations

The data that was available for validation were observations from a site visit to Chester Square Shopping Centre during the PM period of weekday. Observations were undertaken at approximately 16:30 – 17:30 in June 2019 at the locations identified in Figure 14.

Figure 14: Observation locations from site visit to Chester Square shopping centre

Observations collected as part of the traffic surveys included:

- Queueing on Waldron Road from the Waldron Road / Chester Hill Road signalised intersection
- Average delay experienced by vehicles turning right from Bent Street onto Waldron Road
- A 10-minute turn count at the entrance to Chester Square shopping centre basement carpark off Bent Street and on-grade carpark off Priam Street

4.4.4 Validation results

The PM period model was found to produce similar traffic conditions to those observed on site. Google live traffic data was also referred to as an independent comparison of the model performance. It is noted that the reliance on past data, due to the impacts of COVID-19 when this model development process was being carried out, introduced limitations around the availability of detailed validation data. While the current validation exercise provides some confidence in the model's ability to replicate on-site conditions and performance, further observations should be sought as the model is refined during future stages of the study.

5 Site Access Options

A number of access options were considered to support the scenario development and testing. These differ from those proposed in the TIA and were developed in collaboration within CBC to complement the aspirations within the Urban Design Framework. Locations of all access points shown on figures in this section are considered indicative at this stage.

5.1.1 Site Access Option 1

Option 1 for vehicle access to the Planning Proposal is outlined in Figure 15. This option has access to the retail uses on Leicester Street similar to the existing shopping centre arrangement with an additional access for retail and commercial uses on Bent Street and a residential access on Priam Street.

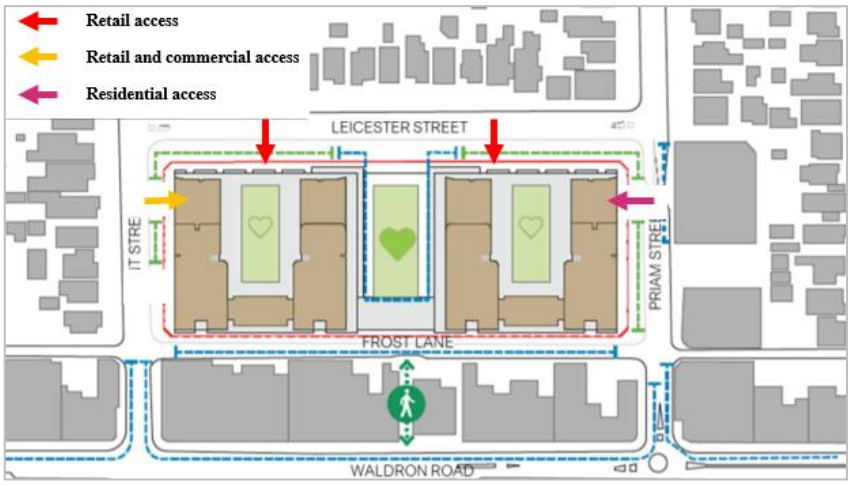


Figure 15: Site Access Option 1

5.1.2 Site Access Option 2

Option 2 for access to the Planning Proposal is outlined in Figure 16.

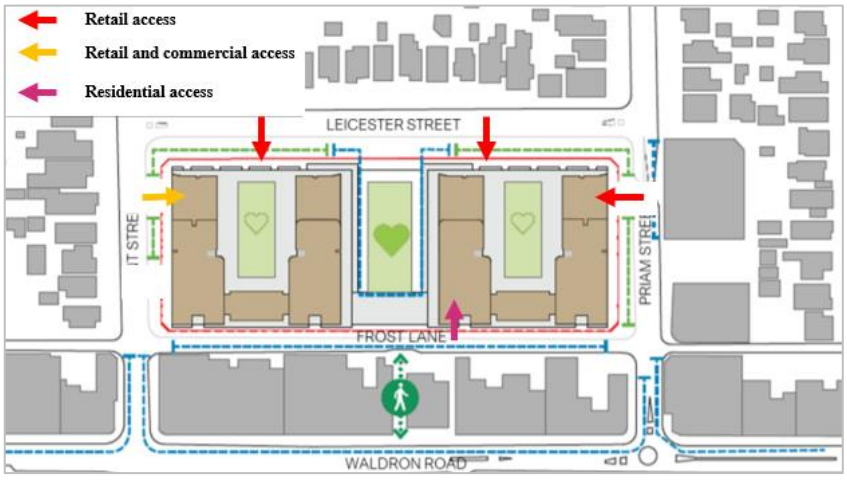


Figure 16: Site Access Option 2

This access option is similar to Option 1, with an additional residential access on Frost Lane and a retail access on Priam Street. The aim of providing an access on Frost Lane is to activate this street and support a laneway environment with slow moving traffic in the future.

5.1.3 Site Access Option 3

Option 3 for access to the Planning Proposal is outlined in Figure 17.

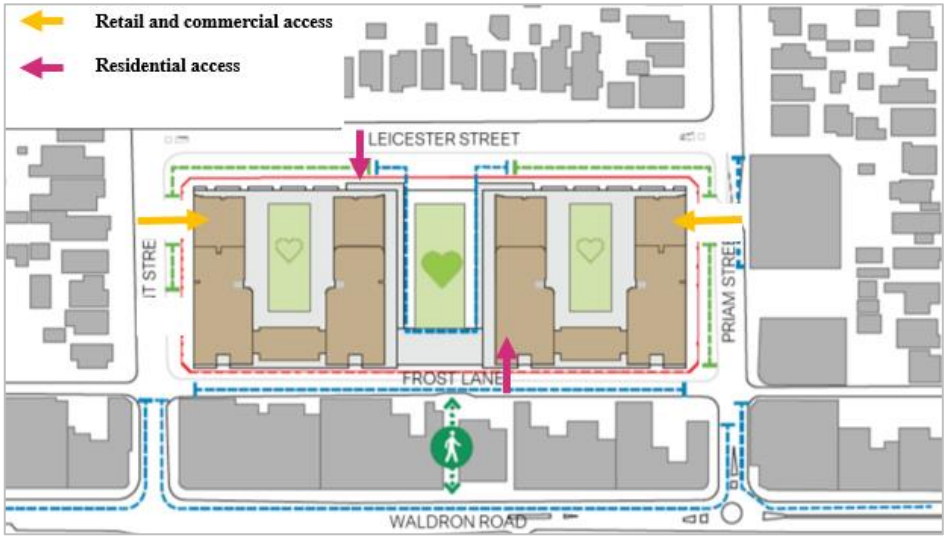


Figure 17: Site Access Option 3

This access option features residential access points on Leicester Street and Frost Lane, with retail / commercial access on Bent Street and Priam Street. It is noted that the location of the access points in Figure 17 is indicative only.

6 Future modelling assessment

This section summarises the future modelling scenarios and results output from the microsimulation model.

6.1 Model Scenarios

In collaboration with CBC and the Proponent a number of future scenarios were agreed to be modelled. The future year selected for all scenarios was 2029. This was deemed to be a year that represented a time when the Planning Proposal would be fully built out when estimating the planning approval and construction phases of the project. Traffic growth rates from strategic model outputs within the TIA were used to uplift background traffic to 2029.

The initial scenarios that were agreed to be modelled are as follows:

- **Scenario 1** – 2029 without Planning Proposal
- **Scenario 2 & 3 –** 2029 with Planning Proposal (Site access Options 1/2) for:
    a) Existing network
    b) Minimum network upgrades (similar to TIA)
    c) Maximum network upgrades

Based on the findings of these initial scenarios, and in consultation with CBC and ASON, an additional iterative modelling assessment was carried out to determine the level of retail land use that could be supported by the road network:

- **Scenario 4 –** 2029 sensitivity tests with different variations of land use within the proposed Planning Proposal controls (FSR 4:1). Site access Option 3 was adopted for this scenario following further discussions with CBC to refine the access strategy for the site. The key aims of this revised access option was to move all retail and commercial traffic to the east-west frontages of the site whilst also providing more options for accessing residential parking.

These scenarios and their corresponding modelling results are discussed in more detail in the sections below.

Traffic network performance for each scenario was generally assessed using vehicle density plots. Vehicle density represents the average number of vehicles per kilometre of lane length over the simulated time period, recording a higher value in locations where traffic is closely spaced (i.e., in a queue) for long periods of time. Vehicle density therefore provides an approximation of the areas where queueing occurred in the model and should be interpreted relative to that of adjacent links. Some level of queueing, and therefore high density, is expected directly upstream of a signalised intersection for example. If the high density is localised and does not extend over multiple adjacent links, the result may suggest overall acceptable performance.

6.2 Traffic Demand

Traffic demand in the future year models was developed based on the following three components:

1. **Base year demand**s: Traffic volumes from the calibrated 2019 base model formed the starting point for the future year demand development process.
2. **Future year background growth**: Growth rates were applied to the base year demands from step 1 to project these forward to a future year of 2029. These growth rates were based on data from the Strategic Traffic Forecasting Model (STFM) provided in ASON's *Appendix E – Traffic and Parking Assessment* document.
3. **Development traffic**: For all 'with Planning Proposal' future year model scenarios, demand associated with the existing development was replaced with those calculated from the trip generation process described in Section 3.

Overall model demand inputs are summarised below in Figure 18. It is noted that these demands represent the average input per hour across the full model run time (3 hours for the AM and PM, 4 hours for the Weekend), whereas the actual inputs exhibit a varying profile across the peak period.

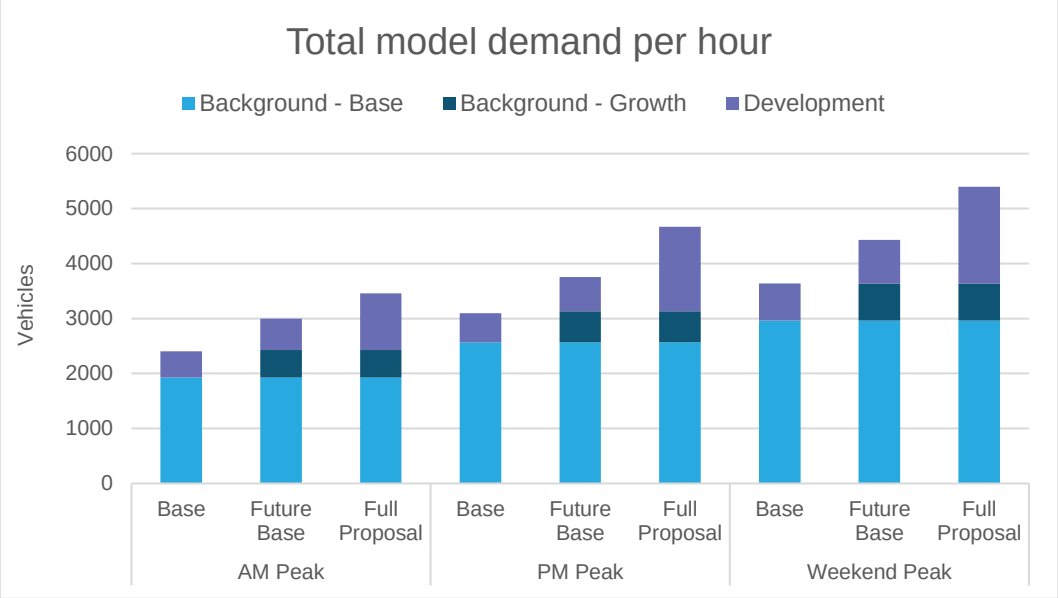


Figure 18: Total model demand per hour

6.3 Scenario 1

As noted in Section 6.1, Scenario 1 represents a 'future base case' scenario, in which 2029 demands (without the Planning Proposal) are tested on the existing road network.

Average density plots for the AM, PM and Weekend peak periods are shown in Figure 19 to Figure 21. Key observations from Scenario 1 include:

- The PM model was observed to be the ‘critical peak’, with the highest levels of density and delay overall. This was followed by the Weekend peak, with the AM peak demonstrating the best level of performance.
- Higher densities were observed around the signalised intersection of Waldron Road and Chester Hill Road, along with the roundabouts at Campbell Hill Road and Priam Street. However, while moderate queueing occurs at these locations at times, they were generally observed to operate without significant issues.

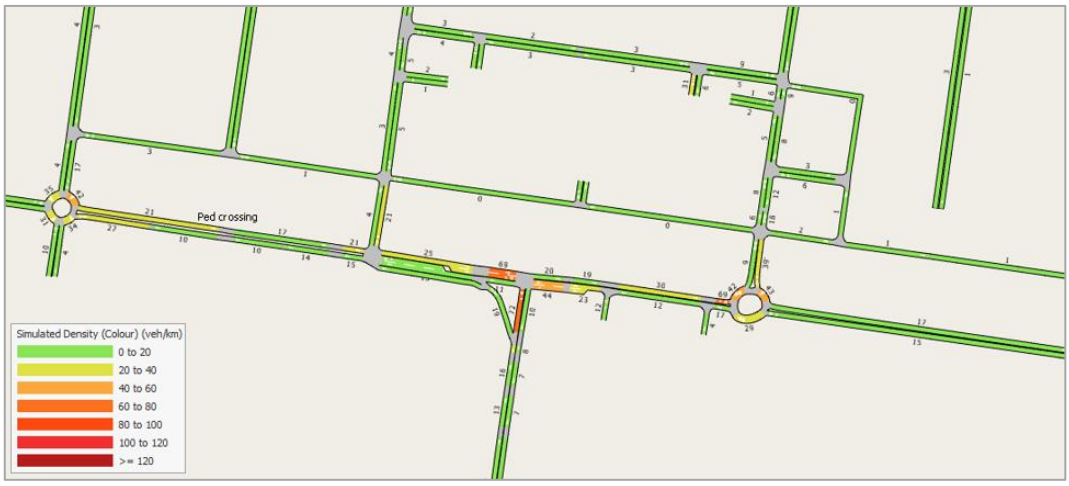


Figure 19: Future base case modelled average density - Weekday AM peak period

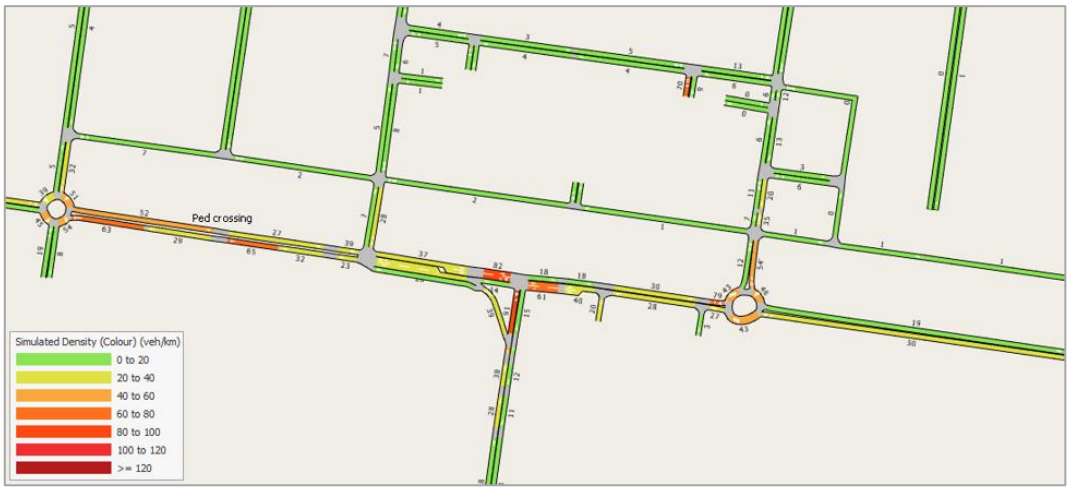


Figure 20: Future base case modelled average density - Weekday PM peak period

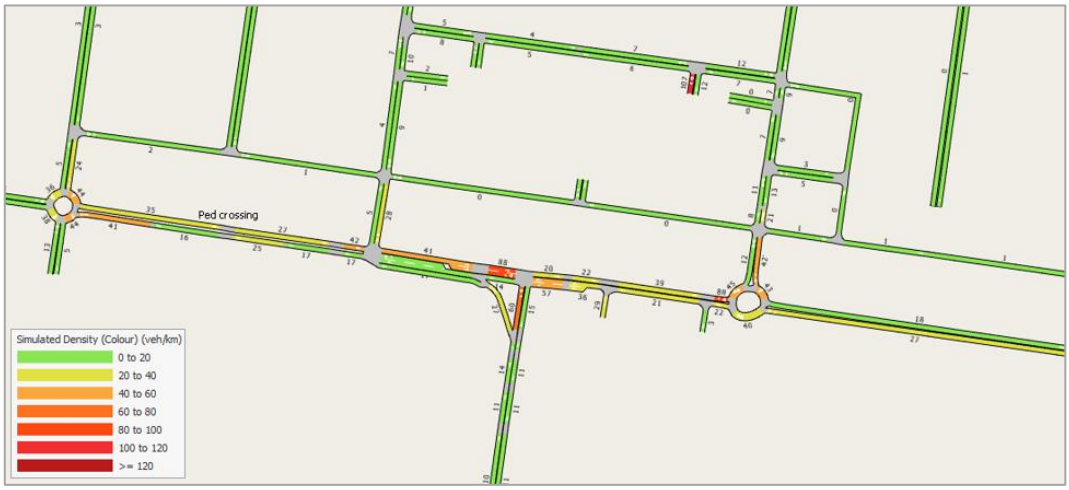


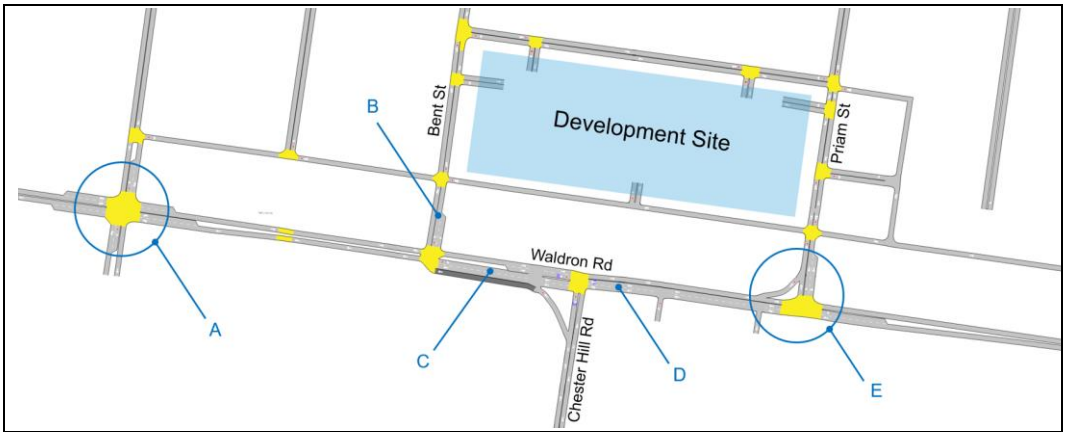
Figure 21: Future base case modelled average density - Saturday midday peak period

6.4 Scenario 2 & 3

Scenarios 2 and 3 refer to initial tests of Site Access Option 1 and 2 respectively. These tests included the full Planning Proposal land use (FSR of 4.53:1). Scenarios 2 and 3 were tested for the base network followed by two different sets of infrastructure upgrades, as described below. These infrastructure upgrades were developed with the aim to reduce congestion observed in previous model runs.

6.4.1 Infrastructure upgrades

Scenarios 2 and 3 were initially tested on the existing road network. Based on the outcome of the initial tests, a 'minimum' set of upgrades, as summarised in Figure 22, was assessed. With the exception of the Waldron Road / Campbell Hill Road intersection conversion, these upgrades broadly align with those included in the ASON Planning Proposal:

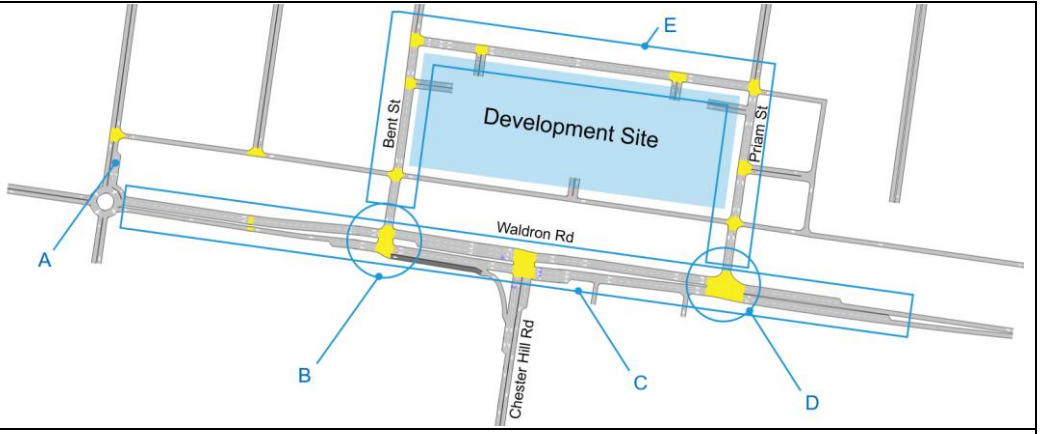


- **A:** Intersection of Campbell Hill Rd / Waldron Rd upgraded from roundabout to a signalised intersection with dual lane approaches / exits.
- **B:** Dual Lane southbound approach to Waldron Road.
- **C:** Westbound right turn lane extended back to Chester Hill Rd intersection.
- **D:** Dual westbound lanes provided on Waldron Rd between Priam St and Chester Hill Rd.
- **E:** Intersection of Waldron Rd / Priam St upgraded from roundabout to signalised intersection. Dual westbound and southbound approaches provided, along with eastbound left turn slip lane.

Figure 22: Scenario 2/3 'minimum' modelled infrastructure upgrades

Finally, Scenarios 2 and 3 were also assessed for the 'maximum' set of network upgrades summarised below in Figure 23.

However, it is recognised that these upgrades are not considered realistic due to constraints on the Waldron Road corridor, impacts to local access, and significant changes to the local character of the area. The upgrades proposed for this scenario would not align with the overall aspirations of the Urban Design Framework and require an unviable amount of infrastructure upgrades.



- **A:** Dual Lane approach to roundabout at Campbell Hill Rd / Waldron Rd
- **B:** Signalisation of Bent St / Waldron Rd intersection
- **C:** Additional Lane per direction for most sections of Waldron Road from Campbell Hill Rd to east of Priam St
- **D:** Signalisation of Priam St / Waldron Rd intersection
- **E:** Converted to one-way (anti-clockwise), dual lane road around the site

Figure 23: Scenario 2/3 'maximum' modelled infrastructure upgrades

6.4.2 Results

Network configuration (a) - Existing network:

Modelling of the existing network configuration with the additional Planning Proposal was found to fail for both Scenarios 2 and 3. Priority controls at both roundabouts on Waldron Road were observed to be the key issues, resulting in significant queueing and eventually network gridlock as reflected in the density plot shown in Figure 24.

Figure 24: Modelled density – 2029 PM peak (existing network with Planning Proposal)

Network configuration (b) – 'Minimum' upgrades:

Scenarios 2 and 3 were tested for a set of upgrades recommended in the Planning Proposal at the time, including conversion of the roundabouts to signalised intersections as shown in Figure 22 above.

Model runs for these scenarios indicated that the network would still not function in the PM or Weekend peak period with these upgrades. The average modelled density for the critical PM peak period, reflecting significant network congestion, is shown in Figure 25 below.

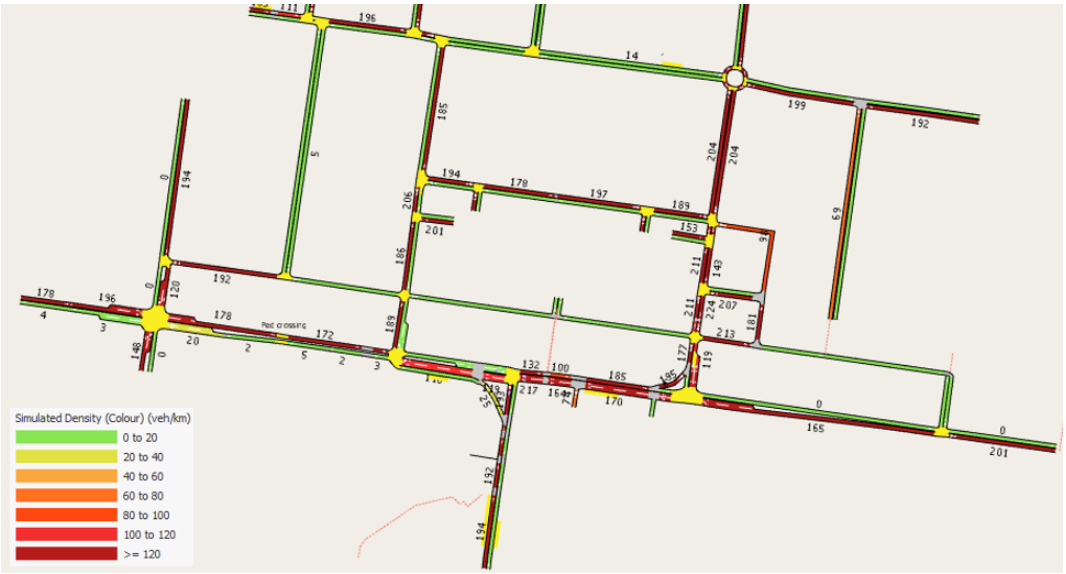


Figure 25: Modelled density – 2029 PM peak ('minimum' upgrades with Planning Proposal)

Network configuration (c) – 'Maximum' upgrades:

Further upgrades were added to the Scenario 2 and 3 models until a functioning network was achieved. As shown in Figure 26, this set of upgrades achieved levels of traffic performance comparable with the future base case modelling (Scenario 1) described in Section 6.3.

However, it is recognised that these upgrades are not considered realistic due to constraints on the Waldron Road corridor, impacts to local access, and significant changes to the local character of the area. The upgrades proposed for this scenario would not align with the overall aspirations of the Urban Design Framework and require an unviable amount of infrastructure upgrades.

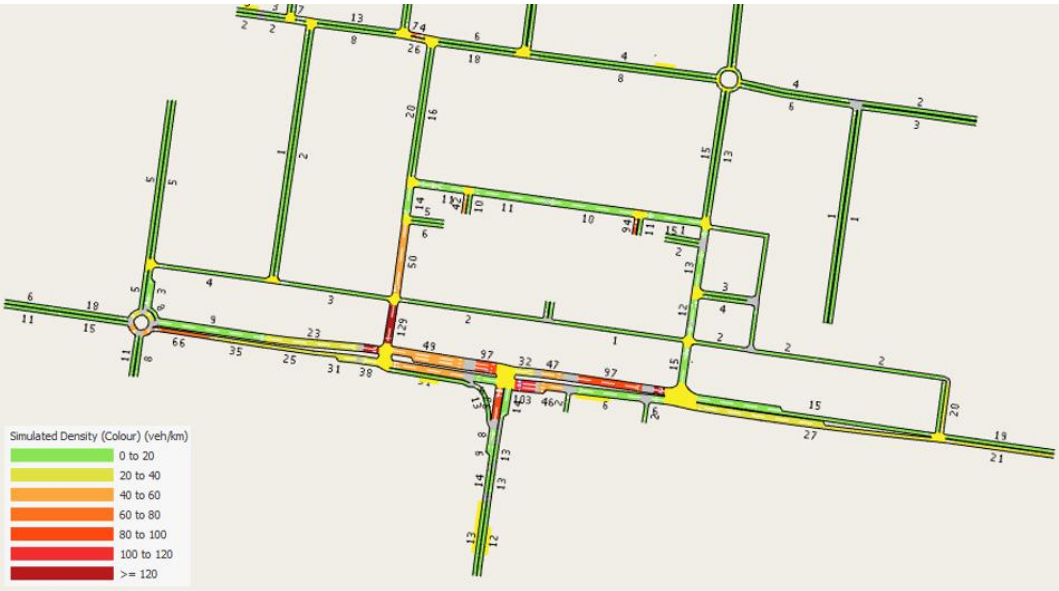


Figure 26: Modelled density – 2029 PM peak ('maximum' upgrades with Planning Proposal)

6.5 Scenario 4

6.5.1 Scenarios

Previous model runs indicated adjustments to proposed land use may need to be considered for the surrounding road network to function satisfactorily. The retail component of the proposal, as described in Section 3, was recognised to be the most traffic-intensive component of the development. A further, iterative modelling assessment was carried out to estimate the level of retail development that could be supported while retaining a reasonable performance on the surrounding road network. A minimum criteria of Level of Service (LOS) D was targeted for key intersections in the surrounding road network. It should be noted for this scenario the overall land use areas for the site were updated to align with new guidance from CBC that the FSR for the Planning Proposal would be 4:1.

The site was tested with reduced levels of retail floorspace (in 1000m^2 increments), with any reduction in retail accompanied by a corresponding increase in residential floorspace. Scenarios tested are listed below in Table 6.

Table 6: Land use assumptions for additional model scenarios

Scenario	Change from Planning Proposal land use yield (GFA m^2)			
	Residential	Retail	Commercial	Library
Sc4.0	Default (as per Table 1)		Default (as per Table 1)	Default (as per Table 1)
Sc4.1	+1,000	-1,000		
Sc4.2	+2,000	-2,000		
Sc4.3	+3,000	-3,000		

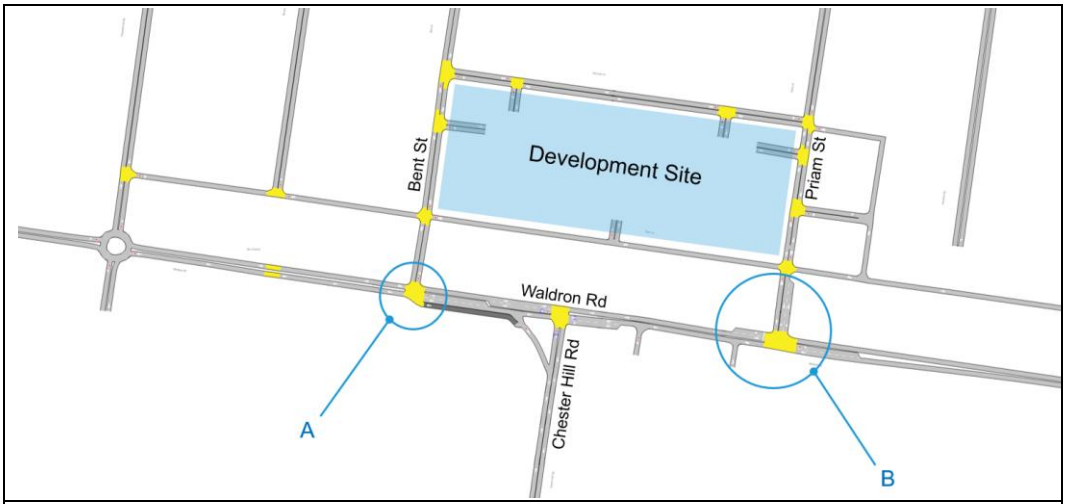
Sc4.6	+6,000	-6,000		

6.5.2 Infrastructure upgrades

Infrastructure upgrades tested for these additional scenarios are summarised below in Figure 22.

A further iteration of network upgrades, aiming to help network function and reduce infrastructure upgrade requirements, was considered for this iterative testing exercise. The northern leg of the Waldron Road / Bent Street intersection is limited to a single lane in each direction due to the presence of a zebra (pedestrian priority) crossing on the Bent Street arm. In addition to safety concerns, maintaining the right turn at this location without the provision of a dedicated lane was observed to cause longer delays due to the priority-controlled configuration of this intersection. Survey data indicated that this right turn is a relatively low volume movement and was not expected to increase significantly based on future year modelling. Therefore, this right turn movement has been banned for the Scenario 4 modelling.

At the Waldron Road / Priam Street intersection, additional dual-lane approaches were provided on the southbound and eastbound approaches, in addition to the dual-lane westbound approach already proposed in the TIA. These upgrades were found to offer significant performance improvements by increasing stopline capacity through this signalised intersection.



- **A:** Southbound approach from Bent St converted to left turn only (i.e. right turn banned).
- **B:** Intersection of Waldron Rd and Priam St upgraded from roundabout to signalised intersection. Dual westbound (1 x through, 1 x right turn), southbound (1 x left turn, 1 x right turn) and eastbound (1 x left turn, 1 x through) approaches provided.

Figure 27: Infrastructure upgrades applied for Scenario 4

6.5.3 Results

The scenarios described in Section 6.5.1 were initially tested for the critical PM peak only. Based on level of service results for the three key intersections along Waldron Road, Scenario 4.2 was identified to represent the maximum level of

retail resulting in an acceptable level of road network performance. This scenario was subsequently tested for the AM and Weekend peak periods. Level of service results for all time periods tested are presented below in Figure 28.

It is noted that, due to the close spacing of intersections, performance at some locations can contribute to the model results at upstream sites. For example, westbound traffic at the Waldron Road / Chester Hill Road intersection was observed to block back to the Waldron Road / Priam Street intersection. This contributed to significant queueing on the westbound approach to the Priam Street intersection (particularly in the higher retail scenarios) and is partly responsible for the high delays shown for that intersection in Figure 28.

Similarly, but to a lesser extent, eastbound queuing approaching the Priam Street intersection was observed to block back to the Chester Hill Road intersection at times. Coordination of these closely spaced signalised intersections will be an important factor for network performance.

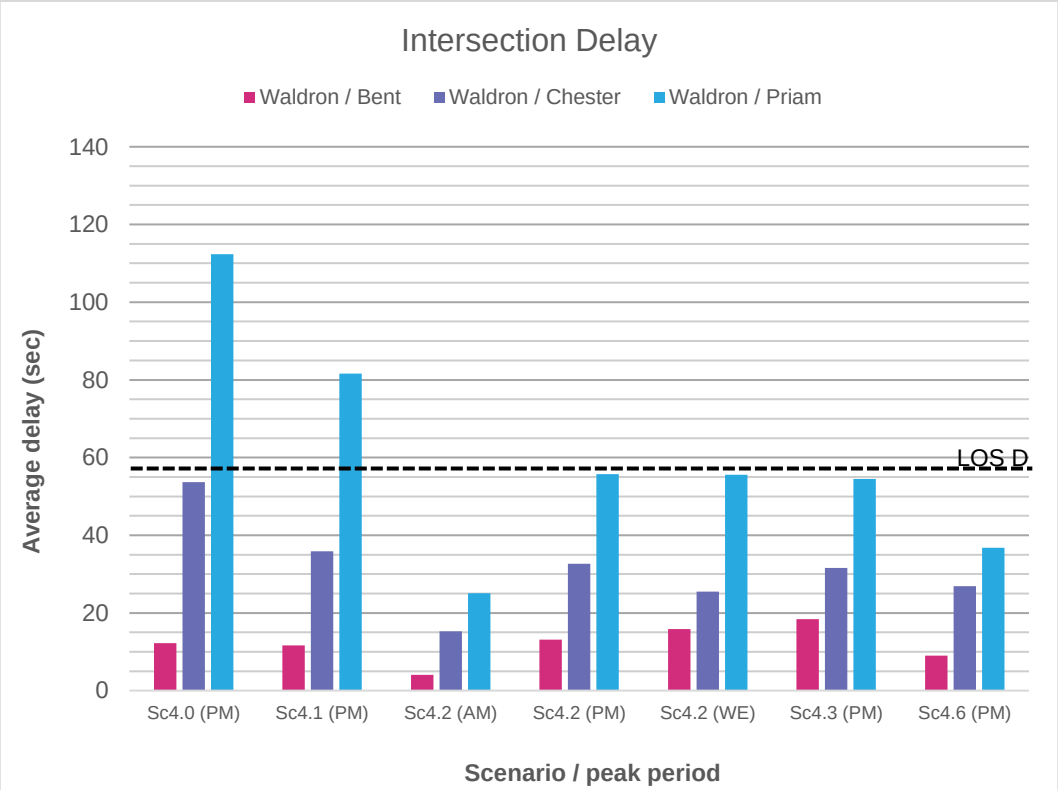


Figure 28: Scenario 4 intersection performance results

Peak period average density plots corresponding to the scenarios listed in Figure 28 are shown below for key scenarios in Figure 29 to Figure 31. The plot for Sc4.0, the highest volume scenario, reflects the higher levels of queueing observed along Priam Street, and back along key north-south roads including Chester Hill Road, Priam Street and Bent Street. Density plots for Sc4.2 (identified as the maximum retail scenario achieving LOS D) and Sc4.6 (minimum retail scenario) reflect the less significant and less frequent build-up of queueing in these locations as retail land use is progressively decreased.

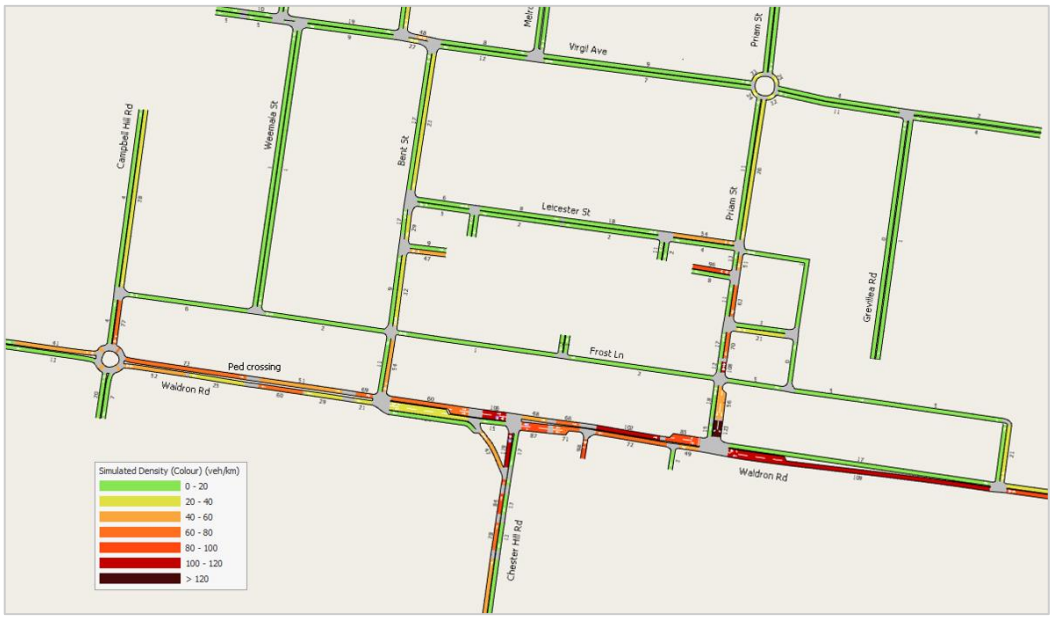


Figure 29: Retail Sc4.0 modelled average density - PM peak period

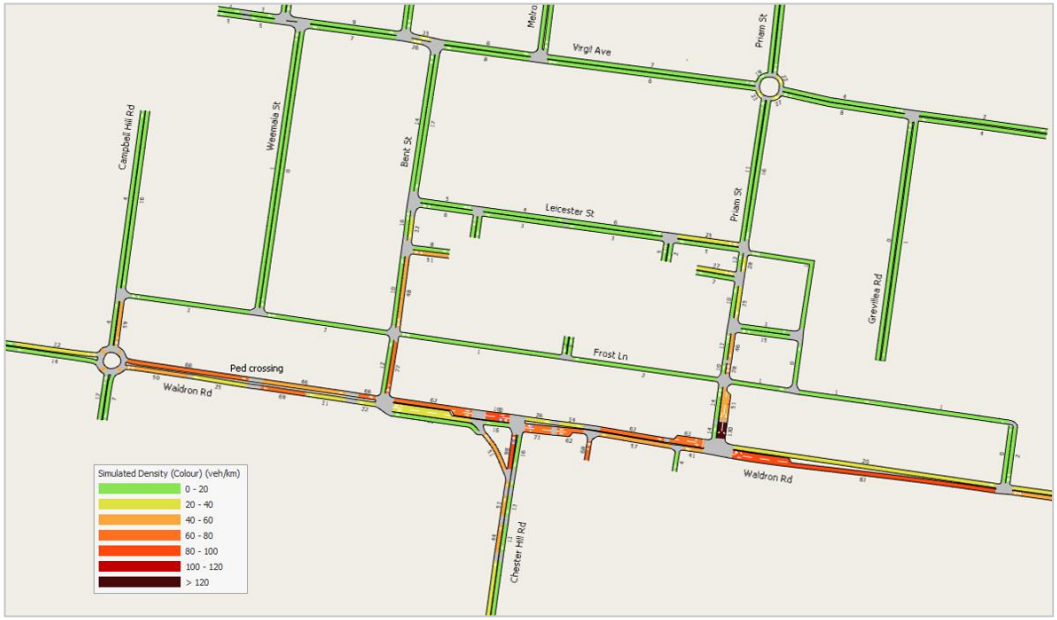


Figure 30: Retail Sc4.2 modelled average density - PM peak period

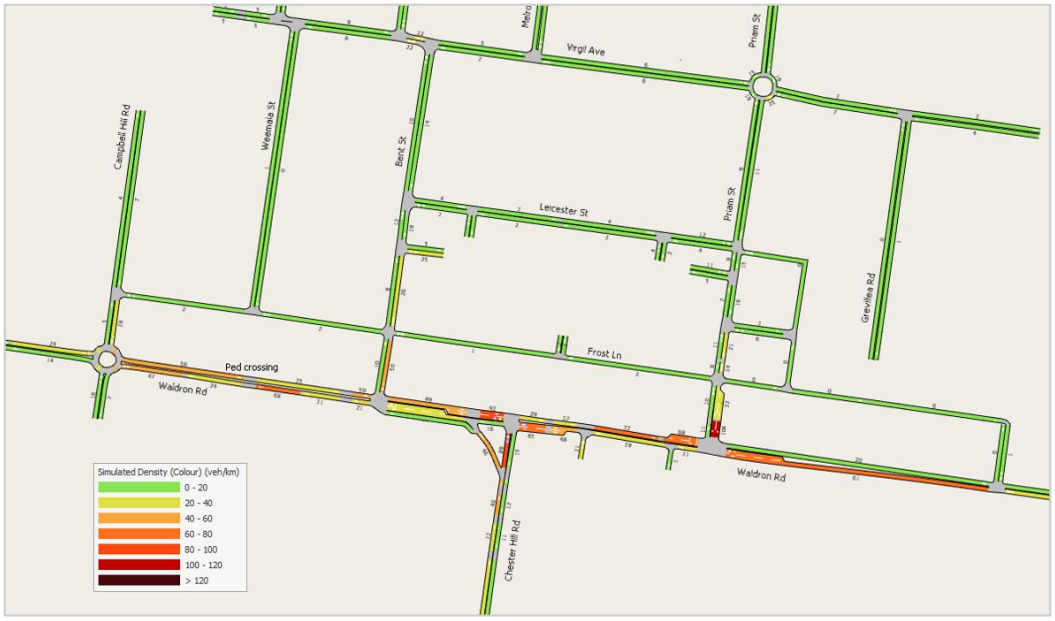


Figure 31: Retail Sc4.6 modelled average density - PM peak period

6.6 Limitations

Traffic modelling assessments typically rely on a variety of assumptions and, as such, the modelling process inherently contains a range of limitations. The following key assumptions and limitations apply to this study:

- Due to the timing of this study, coinciding with COVID-19 traffic impacts, there were some limitations regarding the collection of traffic data inputs for the base model. Turn count data was made available from 2019, but data to inform model validation included only limited (PM peak) onsite observations and Google live traffic data. It is recognised that a more detailed process and review, involving Transport for NSW, may be required during future stages.
- Traffic growth rates from strategic model outputs within the TIA were used to uplift background traffic to 2029. These are understood to have been extracted from TfNSW's Strategic Traffic Forecasting Model (STFM) in 2019. Updated growth rates extracted from STFM may yield different future base demands for all model runs.
- Trip generation relating to the retail uses is currently based on the existing Chester Square Shopping Centre. Many different shop types can be classified as retail uses. Differences in the shop types in the future Planning Proposal may lead to differing trip generation in the future.

7 Recommendations and measures

Traffic modelling suggests that the existing network is expected to operate at an acceptable level of performance when only accounting for general background growth through to 2029. With the addition of traffic associated with the full Planning Proposal at the Chester Square Shopping Centre site, modelled road network performance was predicted to deteriorate to an unacceptable level, recording extensive queueing and delays.

The amount of retail land use is a major contributor to the estimated traffic generation associated with the site. An iterative modelling exercise was undertaken to identify the level of retail that could be supported by the road network. For this assessment, a decrease in retail land use was accompanied with a corresponding increase in residential land use, which is less intensive from a traffic generation perspective. This iterative assessment identified Sc4.2 (a reduction of 2,000m^2 retail GFA compared to the full Planning Proposal) represented the maximum level of retail in which modelled road network performance achieved LOS D at key intersections. The resulting total land use associated with Sc4.2 is summarised below in Table 7.

Table 7: Existing and adjusted Planning Proposal yields (Sc4.2)

Land Use	**Existing Gross Floor Area (m²)**	**Adjusted Planning Proposal Gross Floor Area (m²)**
Residential	-	51,543 (606 dwellings*)
Commercial	-	1,000
Retail	8,300	12,403
Library	-	2,000

*Assumes 85m² GFA per unit

The iterative assessment included the following proposed changes to the road network:

- A loss of approximately 8 on street parking spaces and relocation of a bus zone would be required to accommodate this upgrade.

A concept layout for the recommended upgrade of the Waldron Road / Priam Street is provided in **Appendix A**.

In addition to the land use and infrastructure upgrade recommendations developed from the traffic modelling exercise. We have provided a list of further recommendations that aim to deliver on the Traffic and Transport Objectives outlined in Section 2.3:

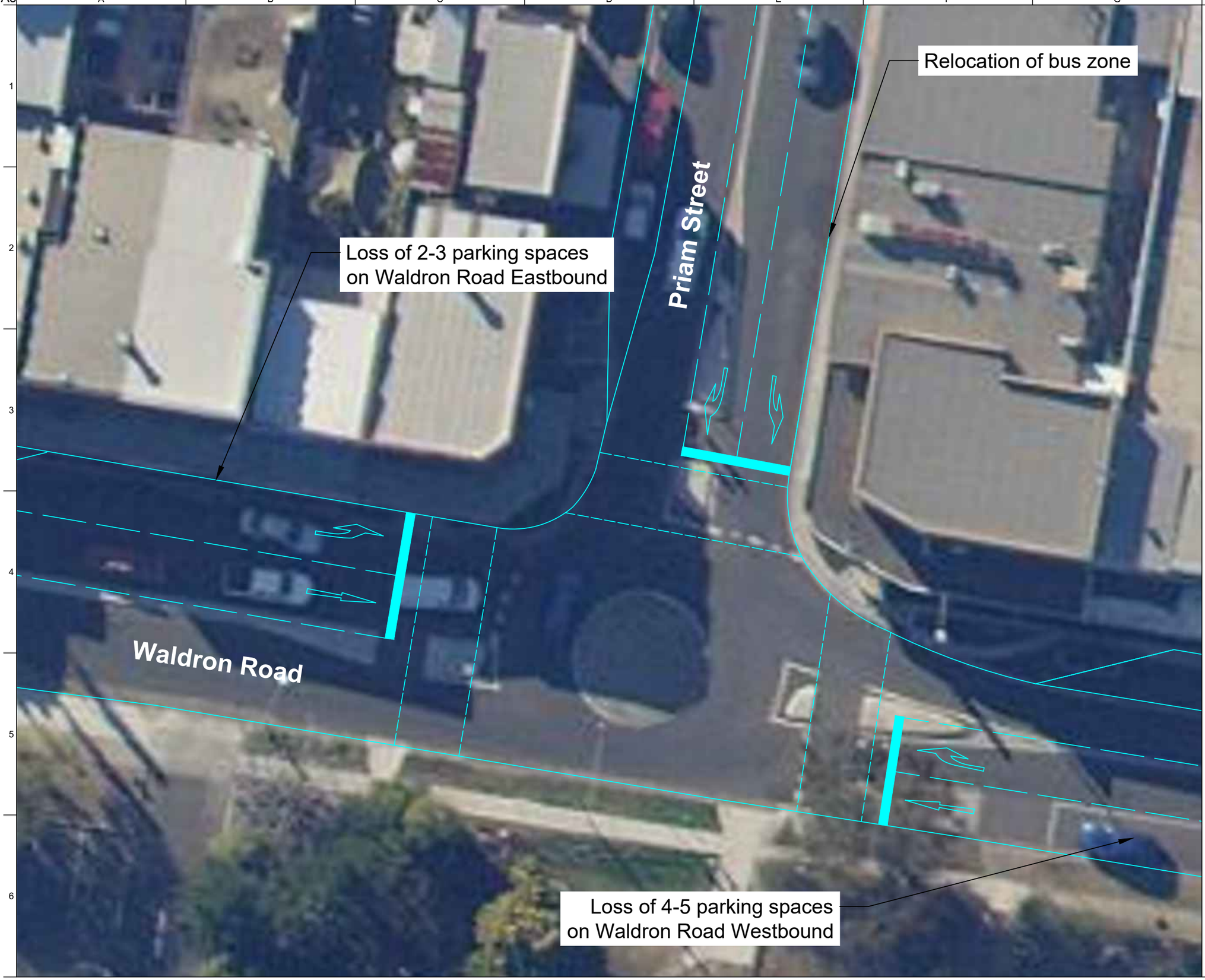
- A Green Travel Plan should be produced for the site that outlines the travel demand management strategy including measures, targets and a monitoring strategy. Managing travel demand relating to the retail uses proposed should be a key objective in this Green Travel Plan.

- Develop site specific parking rates as part of the site specific DCP which consider the constraints of the surrounding road network, public transport provision and future mode share aspirations
- Produce a Delivery and Servicing Plan for the site that considers how loading and servicing demand can be managed at peak times along with providing wider community benefit through last mile deliveries
- Develop street cross sections that outline how changes to the Movement and Place hierarchy of streets can be achieved. Indicative cross sections are outlined in the draft Urban Design Framework being prepared by SJB.
- In future stages of the project TfNSW should be engaged to discuss refinement of the microsimulation modelling including updates to STFM growth rates. These discussions will also consider the wider masterplan for Chester Square and if changes to the road network beyond the current study area could alleviate congestion issues whilst aligning with the future vision for the suburb.

Appendix A

Waldron Road / Priam Street
Concept Layout

A3



Key

1. The base for the drawing was taken from Google Earth and scaled so all dimensions are indicative
2. The layout shown is indicative for the purposes of outlining infrastructure requirements relating to the Planning Proposal. A concept and civil design would need to be undertaken to confirm exact design and costings for the proposed upgrades

Issue	Date	By	Chkd	Appd
A	08/04/22	SO	SO	JT

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Canterbury Bankstown Council

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Chester Square Transport Strategy and Assessment

Drawing Title
Chester Square
Concept Layout
Waldron Road / Priam Street

Scale at A3 1:500

Discipline Transport

Drawing Status
Draft

Job No	Drawing No	Issue
282813	**TP001**	**A**

Do not scale