Ingleburn Traffic and Parking Study

Final Report

Campbelltown City Council

6 December 2022

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EXECUTIVE SUMMARY

Background and Study Purpose

Campbelltown City Council (Council) has developed precinct plan includes for the Ingleburn CBD which takes the total number of dwellings to 3,800 in 2036 and more-than-doubles the total retail and commercial Gross Floor Area (GFA) from 41,600m^2 in 2022 to 92,000m^2 in 2036. The Planning Proposal for the Ingleburn CBD has received Gateway Approval from the Department of Planning, Industry and Environment (DPIE).

Traffic capacity and parking supply and management are key considerations of Council for the Plan and Bitzios Consulting has been commissioned to collect existing usage data and then undertake traffic modelling and parking demand versus supply modelling associated with the Plan. This work has identified the traffic infrastructure upgrades that are required and has identified parking supply and management needs. The need for a proposed multi-deck car park has also been investigated.

Public transport, walking and cycling provisions were also investigated with the existing and already-proposed improvements identified as being satisfactory to cater for demand increases for these modes.

Ingleburn CBD Planning Proposal Traffic and Parking Demands

The peak hour traffic generation of the proposed development has been calculated and has revealed that the AM peak hour will generate an additional 4,030 vehicles to and from the CBD and the PM peak hours will each generate an additional 3,232 vehicles to and from the CBD.

Additional parking demand associated with the proposed development has been estimated to range between 1,415 spaces (based on current, inferred demand per square metre rates from surveys) to 2,139 spaces (if it is assumed that the current parking rates should reflect 100% utilisation).

Intersection Operations and Parking Conditions

A total of 17 intersections have been assessed using year 2022 count data that was verified against historic to ensure that it was not influenced by lingering COVID-19 work-from-home effects. The analysis revealed that all 17 intersections are currently operating well within their capacities however with the Planning Proposal development in the CBD, there will be six (6) of these intersections that need to be upgraded, namely:

- **Intersection 1:** Henderson Road / Macquarie Road roundabout (upgraded to signals)
- **Intersection 2:** Macquarie Road / Cumberland Road / Kings Road roundabout (roundabout upgrade)
- **Intersection 3:** Macquarie Road / Carlisle Street intersection (upgraded to signals)
- **Intersection 7:** Cambridge Street / Cumberland Road intersection (upgraded to signals)
- **Intersection 9:** Oxford Road / Carlisle Street roundabout (upgraded to signals)
- **Intersection 15:** Norfolk Street / Cumberland Road intersection (upgraded to signals)

The parking data analysis for the CBD analysis revealed that on street parking in the surveyed area is at 65% peak occupancy on a Thursday and 45% peak occupancy on a Saturday with public off street parking areas at 67% peak occupancy on a Thursday and 46% peak occupancy on a Saturday. Peak utilisation was between midday and 1:00PM on both days.

The residential development proposed in the CBD is assumed to provide its own on-site parking, except for a few sites already identified as not being able to accommodate a basement. When the parking demands for the proposed retail/commercial development are added to existing retail/commercial demands, and considering three alternative parking utilisation and provision scenarios, there is a future surplus in parking supply expected in all cases. This suggests that a 300-bay multi-deck car park is all that is required to be planned for initially and that progressive management of on-street parking supply will need to evolve over time to manage localised pressures as developments occur, as part of a dynamic management response.

Conclusions and Recommendations

Key conclusions from the study are:

- The assessment of the existing (2022) background traffic found that all intersections operate either at LoS A or B, which is well within the usually accepted intersection delay threshold of LoS C/D
- Considering the whole parking area, the existing (2022) demand profiles for on-street and off-street parking follow a similar pattern. Both area-types reach a peak demand near midday of approximately 65% of capacity on Thursday and 50% on Saturday
- The assessment of the future 2036 traffic demands result in intersection performances beyond usually-acceptable performance measures at six (6) intersections in the study area, with suitable upgrades proposed at these intersections. The upgrades proposed ensure that each intersection operates below its practical capacity at full development (notionally 2036)
- The future parking needs assessment has presented two (2) peak parking demand scenarios for Council's consideration. The observed demand scenarios represent the observed parking occupancy of approximately 67%. The alternative demand scenario represents a hypothetical current occupancy rate of 100%. Each rate is scaled proportionally to the increase in retail and commercial GFA in the future Ingleburn CBD to estimate the future peak parking demands
- The assessment based on the observed peak parking data suggests that Council could provide both the 300 space multi-deck carpark and reduced parking requirement for commercial uses in the Ingleburn CBD's mixed development zone and still maintain a surplus of parking spaces
- The assessment based on the hypothetical peak parking demand suggests that Council would need to provide the full 600 space multi-deck carpark and reduced parking requirement for commercial uses in the Ingleburn CBD's mixed development zone and maintain a surplus of parking spaces
- Noting the discussion on the impacts of COVID-19 on parking demands, it is likely that a significant proportion of the existing Ingleburn CBD parking supply was normally being used for rail commuter parking. Rail patronage has reduced by approximately 50% compared to pre-pandemic levels. Therefore, the sensitivity test presented in the alternative demand scenario is unlikely to represent retail and commercial demands only and should be considered excessively conservative
- The No Basement Parking Sites would require between 94 and 204 parking spaces to be accommodated within the multi-deck carpark. This suggests that the 300 space multideck carpark would be sufficient to meet this requirement.

As development occurs aligned with the Planning Proposal, it is recommended that Council upgrade the following intersections as needed based on where and to what level development progresses:

- Henderson Road / Macquarie Road to a signalised intersection
- The existing Macquarie Road / Cumberland Road / Kings Road roundabout
- Macquarie Road / Carlisle Street to a signalised Intersection
- Cambridge Street / Cumberland Road to a signalised intersection
- Oxford Road / Carlisle Street to a signalised Intersection
- Norfolk Street / Cumberland Road to a signalised intersection

It is also recommended that Council:

- Proceed with the design for a 300 bay multi-deck car park at 30-32 Carlisle Street, with potential for adding additional decks to achieve a 600 bay car park in the future (beyond the life of the Planning Proposal)
- Include provisions for a parking supply rate of 1 space per 50m^{2}GFA for commercial uses within the B4 Mixed-use Development zone within the Ingleburn CBD.

The recommendations are shown in Figure ES1.

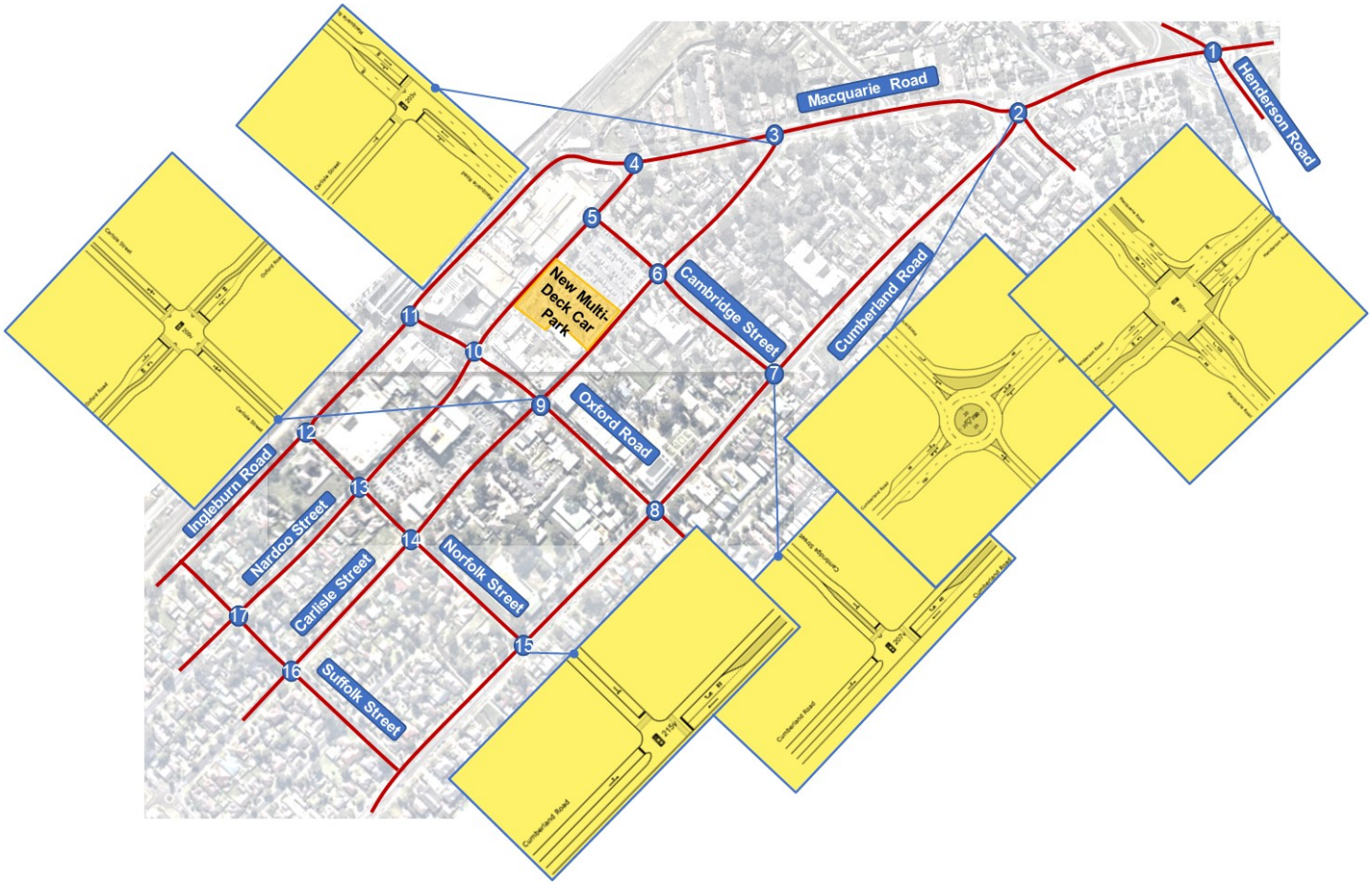

Figure ES1: **Key Recommendations**

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1. INTRODUCTION

1.1 Background

Campbelltown City Council (Council) has developed precinct plan includes for the Ingleburn CBD. The plan takes the total number of dwellings from 400 in 2022 to 3,800 in 2036 and the total retail and commercial Gross Floor Area (GFA) from 41,600m^2 in 2022 to 92,000m^2 in 2036. The Planning Proposal for the Ingleburn CBD has received Gateway Approval from the Department of Planning, Industry and Environment (DPIE).

Council has engaged Bitzios Consulting to prepare a Traffic and Parking Study to support the planning proposal when it is exhibited. The Study has:

- Assessed the existing conditions in terms of traffic demands, parking demands and patterns of usage and an assessment of traffic, pedestrian and cyclist safety issues based on surveys and site observations
- Undertaken traffic modelling and parking demand versus supply modelling for three parking scenarios
- Identified traffic infrastructure upgrades that are required under each scenario for capacity and / or safety reasons and the form and function (including classification) of roads and streets in the study area
- Determined what public transport, walking and cycling improvements are needed to support the growth estimates for each scenario, consistent with parking demand management policies
- Considered alternative methods to manage parking demand and supply including shared parking arrangements, satellite parking and alternative time regulations to manage turnover in high visitor demand areas
- Prepared a concept design for the proposed multi-deck car park to determine the number of spaces able to be supplied and identified the preferred location and form of car park access.

1.2 Study Area

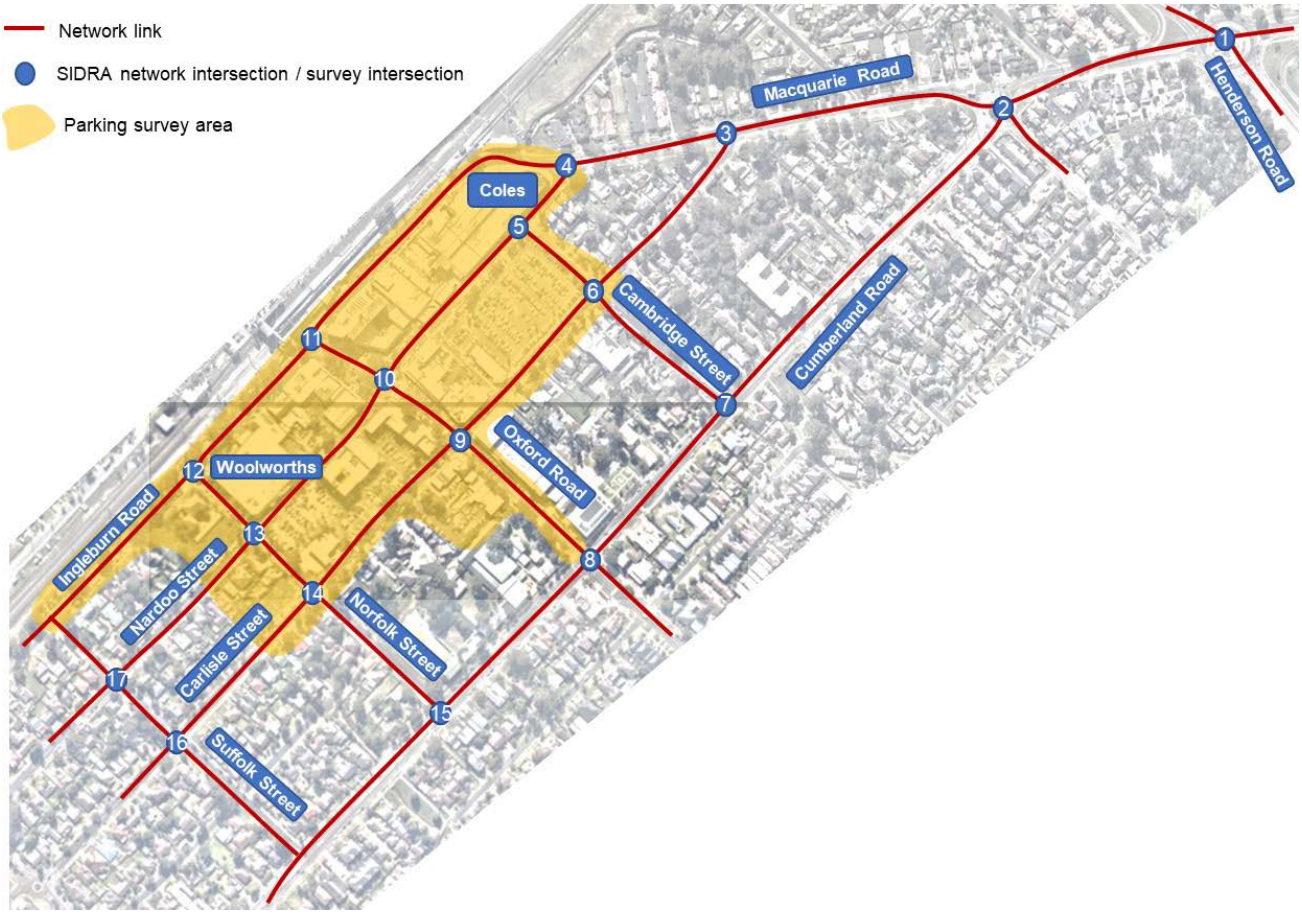
The Ingleburn CBD is located approximately 35km south-west of the Sydney CBD and is a major retail, residential and commercial area within the Campbeltown LGA. The CBD is bordered by the railway line and Ingleburn Road to the north-west, Suffolk Street to the south-west, Cumberland Road to the south-east, and Macquarie Road to the north-east. The CBD contains mostly one-storey and two-storey buildings.

The access to the Ingleburn Railway Station is located at the north-western end of Oxford Road. A rail commuter parking facility for the station is located on the opposite side of the railway line to the CBD and is outside the scope of this assessment. The Ingleburn CBD is serviced by four (4) Sydney Bus routes.

The Traffic and Parking Study focusses on the study area shown in Figure 1.1. This figure also shows the road network and the 17 key intersections being assessed along with the parking survey and assessment area.

Key destinations within the study area include:

- Ingleburn Railway Station
- Ingleburn Town Centre and Nardoo shopping centre
- Ingleburn Village shopping centre
- Oxford Road ‘high street’
- Ingleburn Public School.



Source: Google Maps

Figure 1.1: Study Area

1.3 Scope

This report summarises the findings of the Traffic and Parking Study and is structured as follows:

- **Section 2** contains a review of the existing performance of the 17 key intersections within the study area
- **Section 3** contains an inventory of the existing parking supply and an evaluation of the existing weekday and weekend parking demands
- **Section 4** provides a summary of the proposed Ingleburn CBD development proposal
- **Section 5** shows the future traffic demands on the 17 key intersections within the study area and details the intersection upgrades where they are required to cater for future traffic demands
- **Section 6** summarises the calculations of future parking demands based on proposed CBD growth and compares it to future parking supply. Parking supply management measures are also identified in this section
- **Section 7** provides the study Conclusions and Recommendations.

1.4 Acronyms and Abbreviations

Acronym/Abbreviation	Description
CBD	Central Business District
Council	Campbeltown City Council
DOS	Degree of Saturation. A term used to explain what proportion of an intersection's or a movement's capacity is used by its demand
DPIE	Departments of Planning, Industry and Environment
GFA	Gross Floor Area
LGA	Local Government Area
Sec	Seconds
SIDRA	Intersection performance modelling software
the Study	This Traffic and Parking Study
Veh	Vehicle
Veh/h	Vehicles per Hour

2. EXISTING INTERSECTION PERFORMANCE

2.1 Study Area Network and Intersections

Intersection analysis has been undertaken for the following 17 intersections (also see Figure 1.1):

- **Intersection 1:** Henderson Road / Macquarie Road Roundabout
- **Intersection 2:** Macquarie Road / Cumberland Road / Kings Road Roundabout
- **Intersection 3:** Macquarie Road / Carlisle Street Intersection
- **Intersection 4:** Macquarie Road / Ingleburn Road Intersection
- **Intersection 5:** Macquarie Road / Cambridge Street Intersection
- **Intersection 6:** Carlisle Street / Cambridge Street Roundabout
- **Intersection 7:** Cambridge Street / Cumberland Road Intersection
- **Intersection 8:** Oxford Road / Cumberland Road Signalised Intersection
- **Intersection 9:** Oxford Road / Carlisle Street Roundabout
- **Intersection 10:** Oxford Road / Macquarie Road / Nardoo Street Roundabout
- **Intersection 11:** Oxford Road / Ingleburn Road Roundabout
- **Intersection 12:** Norfolk Street / Ingleburn Road Roundabout
- **Intersection 13:** Norfolk Street / Nardoo Street Roundabout
- **Intersection 14:** Norfolk Street / Carlisle Street Roundabout
- **Intersection 15:** Norfolk Street / Cumberland Road Intersection
- **Intersection 16:** Suffolk Street / Carlisle Street Roundabout
- **Intersection 17:** Suffolk Street / Nardoo Street Roundabout.

2.2 Intersection Count Data

2.2.1 Data Collection Details

Traffic survey data was collected at the 17 key intersections on Thursday 31st March 2022 during the following peak hours:

- **AM Peak Hour (School and commuter):** 8:00am – 9:00am
- **School PM Peak Hour:** 2:30pm – 3:30pm
- **Commuter PM Peak Hour:** 5:00pm – 6:00pm.

A copy of the traffic survey data is provided in **Appendix B** and the peak hour traffic volumes have been presented in a vehicle movement diagram for the entire road network in **Appendix C**.

Intersection count data could not be processed for Intersection 14 due to a camera failure. Traffic volumes for Intersection 14 have been estimated based on the adjacent intersection volumes.

Using the traffic count data from adjacent intersections, mid-block inflows at each intersection were compared to outflows at adjacent intersections for the entire the network. This processed revealed that the intersection flows were well 'balanced' and any differences between intersections were minimal. Detailed SIDRA outputs capturing these midblock flows are included in **Appendix D**.

2.2.2 COVID-19 Influences

Traffic movements in the Greater Sydney area were impacted by to COVID-19 pandemic. To test whether the surveyed traffic volumes represent peak demands outside of COVID-19 influences, the surveyed volumes have been benchmarked against historical traffic count data.

Seven-day 'tube' counts for Henderson Road at the rail overpass were made available by Council and have been included in **Appendix B**. These counts were undertaken between 13th March and 19th March 2017.

Table 2.1 presents a comparison between the 2017 counts and the 2022 surveyed volumes on the north-western approach to the Henderson Road / Macquarie Road roundabout.

Table 2.1: Henderson Road north of Macquarie Road, COVID-19 Influences on Traffic

Peak Hour	2017 Tube Count (two-way)	2022 Intersection Count (two-way)	Difference
AM Peak Hour (8:00am – 9:00am)	1,924	2,190	+266
School PM Peak Hour (2:30pm – 3:30pm)	2,111	2,248	+137
Commuter PM Peak Hour (5:00pm – 6:00pm)	1,768	1,988	+220

As seen in Table 2.1, the surveyed volumes in 2022 are higher than the 2017 data and no correction appears warranted to cater for and lingering COVID-19 influences.

2.3 Methodology

The operational performance of the 17 intersections in the study area's road network have been assessed using *SIDRA Network*. The modelling of all of the intersections together allows for interaction of movements and delays at one intersection to be accounted for at nearby intersections.

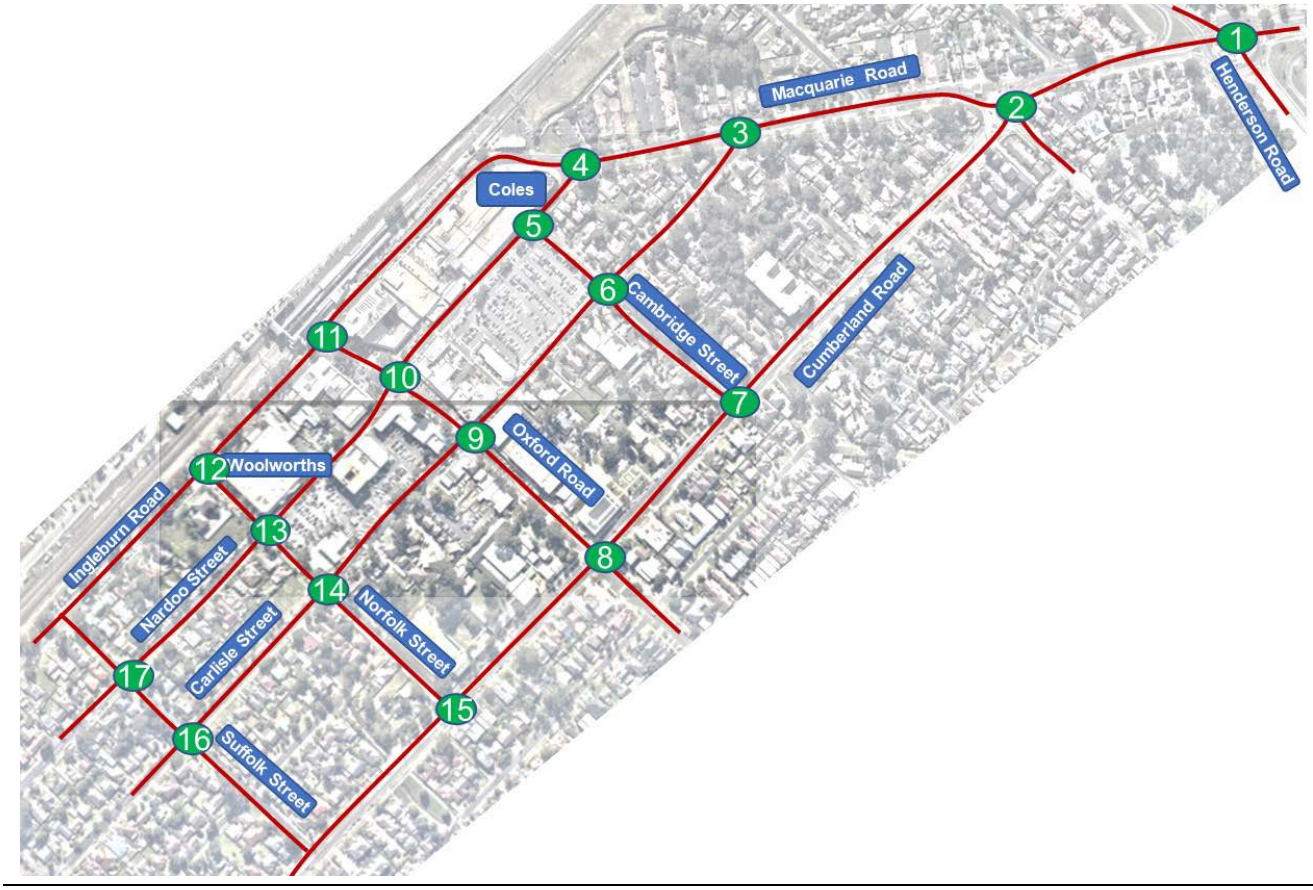
Detailed SIDRA outputs are included in **Appendix D**.

2.4 Year 2022 Intersection Operations Summary

Table 2.2 summarises the Level of Service (LoS) from the existing conditions assessment for each intersection. All intersections operate either at LoS A or B, which is well within the usually accepted intersection delay threshold of LoS C/D.

Table 2.2: Summary of Existing Conditions

ID	Intersection	AM Peak Hour	School PM Peak Hour	Commuter PM Peak Hour
1	Henderson Road / Macquarie Road Roundabout	A	A	A
2	Macquarie Road / Cumberland Road / Kings Road Roundabout	A	A	A
3	Macquarie Road / Carlisle Street Intersection	A	A	A
4	Macquarie Road / Ingleburn Road Intersection	A	A	A
5	Macquarie Road / Cambridge Street Intersection	A	A	A
6	Carlisle Street / Cambridge Street Roundabout	A	A	A
7	Cambridge Street / Cumberland Road Intersection	A	A	A
8	Oxford Road / Cumberland Road Signalised Intersection	B	B	B
9	Oxford Road / Carlisle Street Roundabout	A	A	A
10	Oxford Road / Macquarie Road / Nardoo Street Roundabout	A	A	A
11	Oxford Road / Ingleburn Road Roundabout	A	A	A
12	Norfolk Street / Ingleburn Road Roundabout	A	A	A
13	Norfolk Street / Nardoo Street Roundabout	A	A	A
14	Norfolk Street / Carlisle Street Roundabout	A	A	A
15	Norfolk Street / Cumberland Road Intersection	A	A	A
16	Suffolk Street / Carlisle Street Roundabout	A	A	A
17	Suffolk Street / Nardoo Street Roundabout	A	A	A

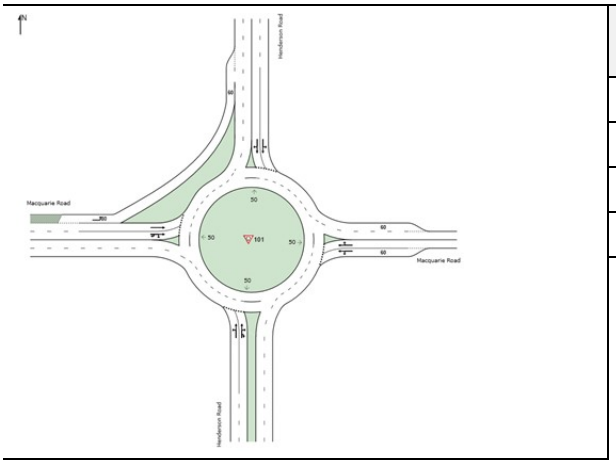


Note: LoS definitions are as per SIDRA default values

2.5 Intersection-Specific Performance Details, 2022

Intersection 1: Henderson Road / Macquarie Road Roundabout

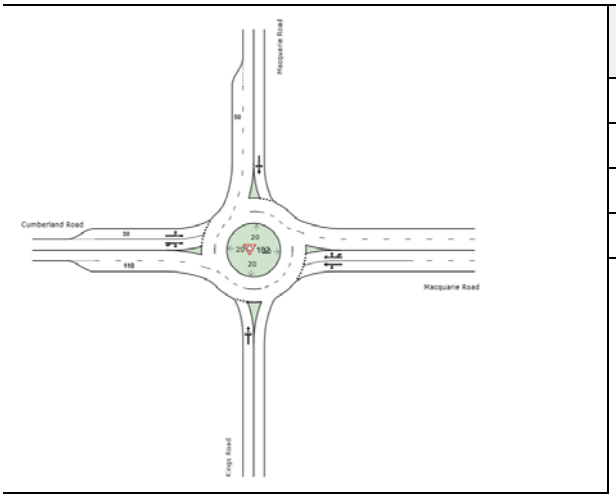
Intersection 1 operates within its practical capacity for a roundabout (DOS < 0.85) in all peaks.



Peak	AM	School PM	Commuter PM
Demand (veh)	2913	3058	2688
Degree of Saturation	0.45	0.53	0.46
Average Delay (secs)	6.2	6.8	6.2
Level of Service	A	A	A

Intersection 2: Macquarie Road / Cumberland Road / Kings Road Roundabout

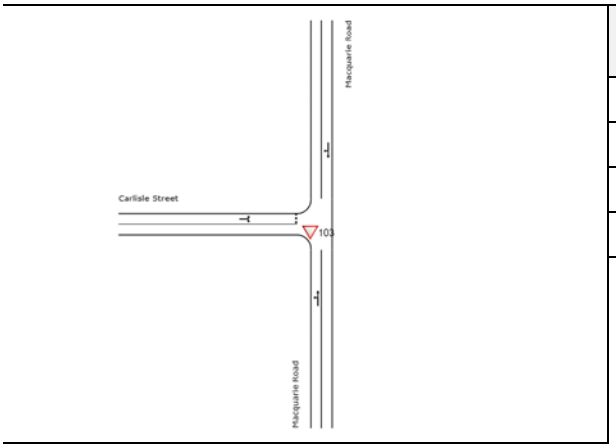
Intersection 2 operates within its practical capacity for a roundabout (DOS < 0.85) in all peaks.



Peak	AM	School PM	Commuter PM
Demand (veh)	1712	1982	1762
Degree of Saturation	0.35	0.47	0.47
Average Delay (secs)	6.7	6.9	6.6
Level of Service	A	A	A

Intersection 3: Macquarie Road / Carlisle Street Intersection

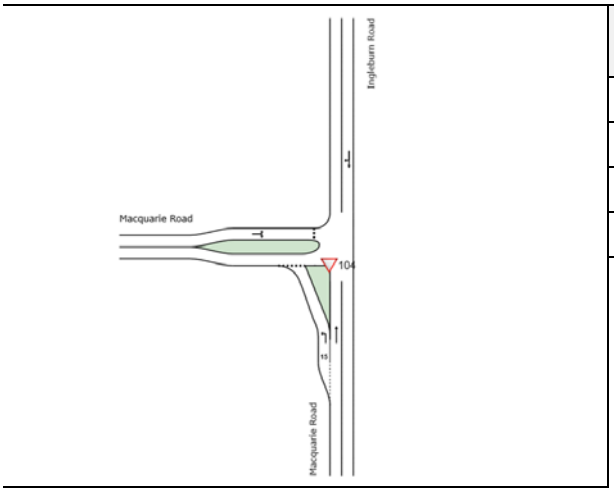
Intersection 3 operates within the practical capacity for a priority-controlled intersection (DOS < 0.80).



Peak	AM	School PM	Commuter PM
Demand (veh)	668	886	799
Degree of Saturation	0.21	0.29	0.26
Average Delay (secs)	2.3	2.9	2.8
Level of Service	N/A	N/A	N/A

Intersection 4: Macquarie Road / Ingleburn Road Intersection

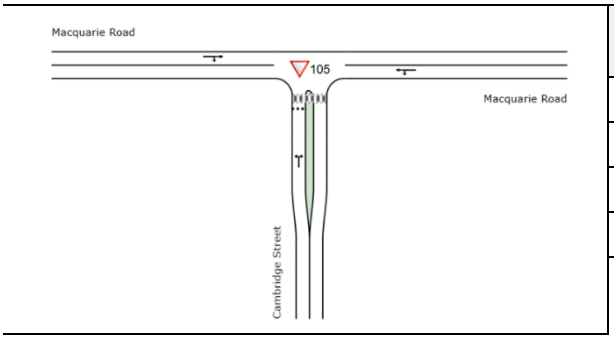
Intersection 4 operates within the practical capacity for a priority-controlled intersection (DOS < 0.80).



Peak	AM	School PM	Commuter PM
Demand (veh)	452	597	514
Degree of Saturation	0.09	0.15	0.14
Average Delay (secs)	3.2	3.4	3.0
Level of Service	N/A	N/A	N/A

Intersection 5: Macquarie Road / Cambridge Street Intersection

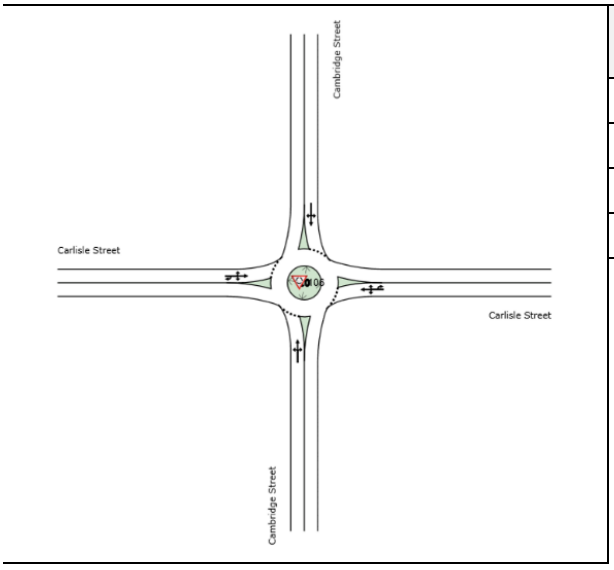
Intersection 5 operates within the practical capacity for a priority-controlled intersection (DOS < 0.80).



Peak	AM	School PM	Commuter PM
Demand (veh)	255	417	341
Degree of Saturation	0.08	0.11	0.09
Average Delay (secs)	1.7	2.6	2.3
Level of Service	NA	NA	NA

Intersection 6: Carlisle Street / Cambridge Street Intersection

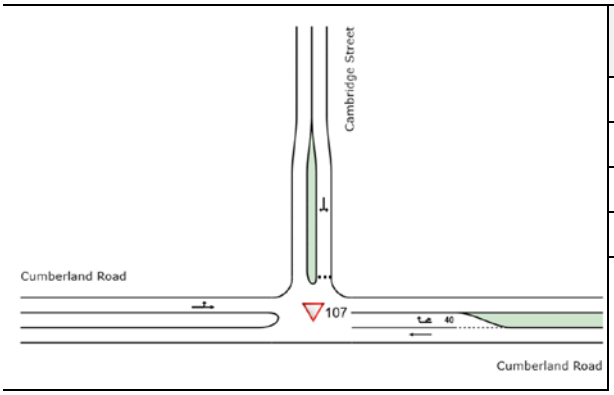
Intersection 6 operates within the practical capacity of a roundabout (DOS < 0.85).



Peak	AM	School PM	Commuter PM
Demand (veh)	331	514	458
Degree of Saturation	0.11	0.18	0.18
Average Delay (secs)	5.5	6.0	6.0
Level of Service	A	A	A

Intersection 7: Cambridge Street / Cumberland Road Intersection

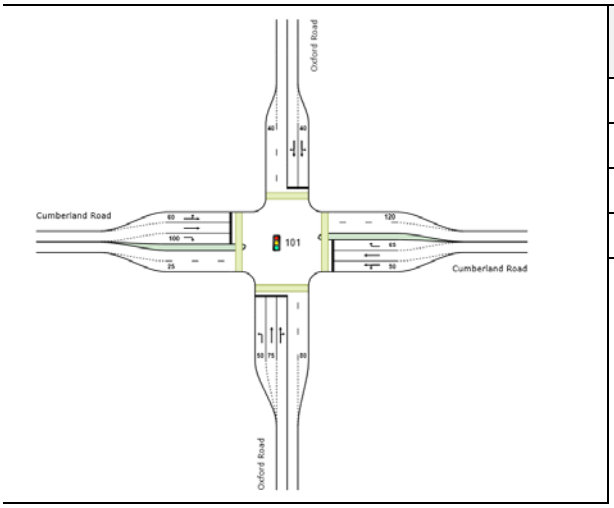
Intersection 7 operates within the practical capacity for a priority-controlled intersection (DOS < 0.80).



Peak	AM	School PM	Commuter PM
Demand (veh)	1,024	1,140	1,059
Degree of Saturation	0.28	0.29	0.25
Average Delay (secs)	1.1	1.4	1.5
Level of Service	NA	NA	NA

Intersection 8: Oxford Road / Cumberland Road Signalised Intersection

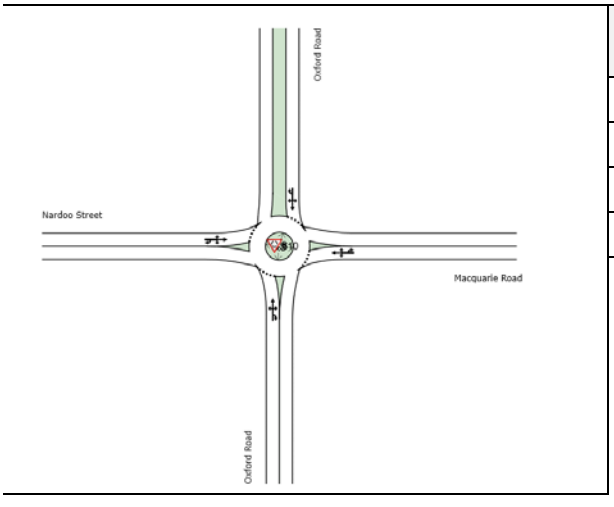
Intersection 8 operates within the practical capacity for a signalised intersection (DOS < 0.90).



Peak	AM	School PM	Commuter PM
Demand (veh)	1,403	1,555	1,352
Degree of Saturation	0.45	0.52	0.52
Average Delay (secs)	11.7	11.6	11.6
Level of Service	B	B	B

Intersection 9: Oxford Road / Carlisle Street Roundabout

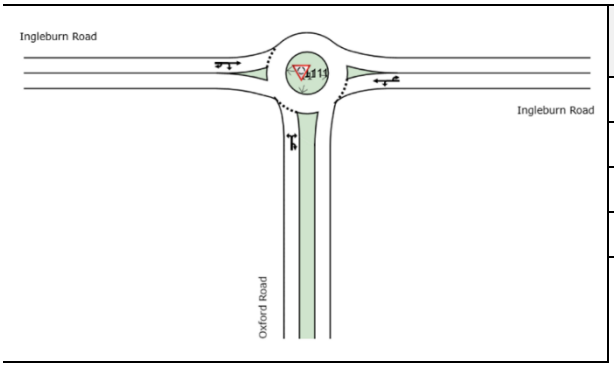
Intersection 9 operates within the practical capacity for a roundabout (DOS < 0.85).



Peak	AM	School PM	Commuter PM
Demand (veh)	556	835	733
Degree of Saturation	0.20	0.26	0.20
Average Delay (secs)	6.3	7.1	6.8
Level of Service	A	A	A

Intersection 10: Oxford Road / Macquarie Road / Nardoo Street Roundabout

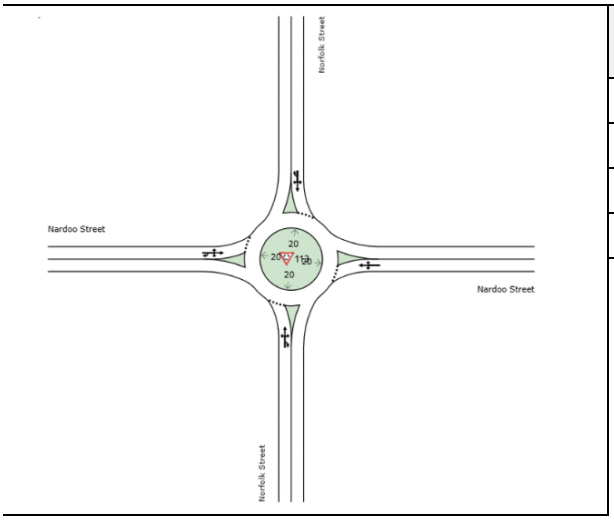
Intersection 10 operates within the practical capacity for a roundabout (DOS < 0.85).



Peak	AM	School PM	Commuter PM
Demand (veh)	368	549	495
Degree of Saturation	0.112	0.160	0.124
Average Delay (secs)	5.9	6.4	6.2
Level of Service	A	A	A

Intersection 11: Oxford Road / Ingleburn Road Roundabout

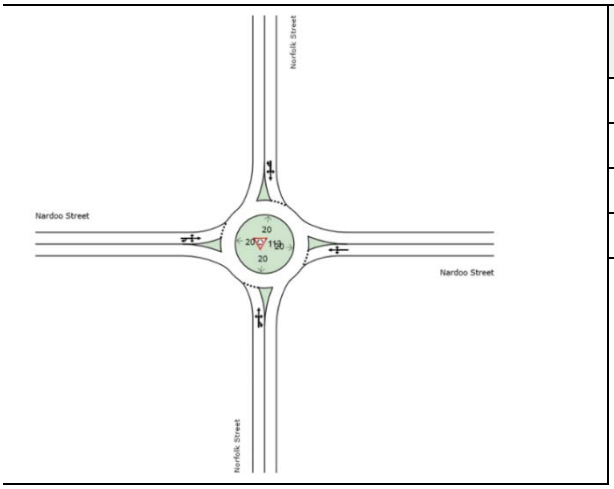
Intersection 11 operates within the practical capacity for a roundabout (DOS < 0.85).



Peak	AM	School PM	Commuter PM
Demand (veh)	331	405	392
Degree of Saturation	0.13	0.13	0.13
Average Delay (secs)	6.4	6.2	6.2
Level of Service	A	A	A

Intersection 12: Norfolk Street / Ingleburn Road Roundabout

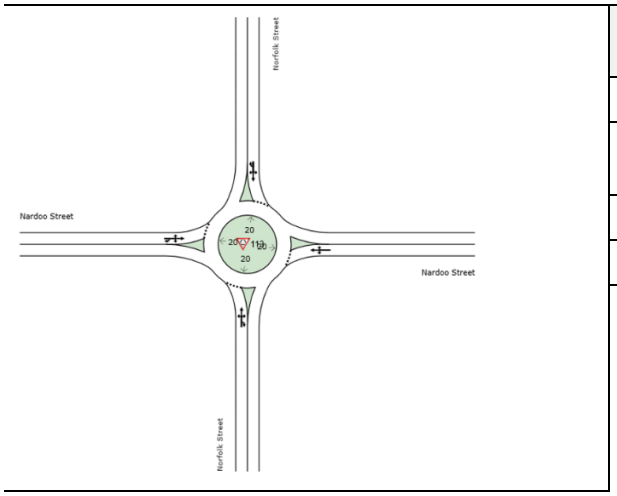
Intersection 12 operates within the practical capacity for a roundabout (DOS < 0.85).



Peak	AM	School PM	Commuter PM
Demand (veh)	220	315	314
Degree of Saturation	0.074	0.108	0.105
Average Delay (secs)	5.2	5.3	5.2
Level of Service	A	A	A

Intersection 13: Norfolk Street / Nardoo Street Roundabout

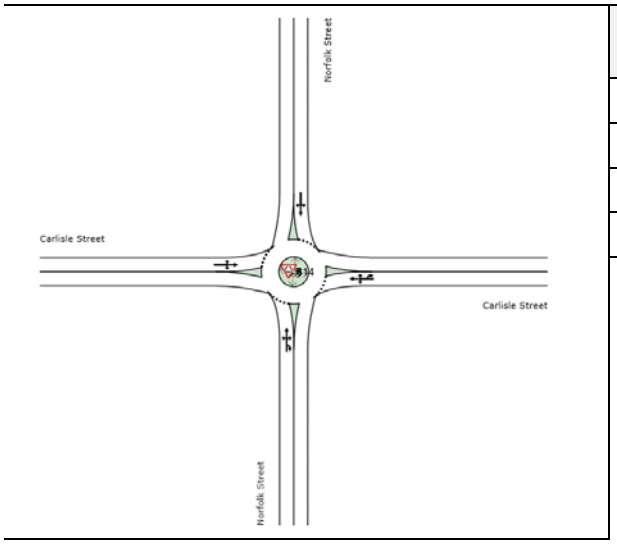
Intersection 13 operates within the practical capacity for a roundabout (DOS < 0.85).



Peak	AM	School PM	Commuter PM
Demand (veh)	196	267	285
Degree of Saturation (DOS)	0.063	0.073	0.076
Average Delay (secs)	5.9	5.2	5.1
Level of Service	A	A	A

Intersection 14: Norfolk Street / Carlisle Street Roundabout

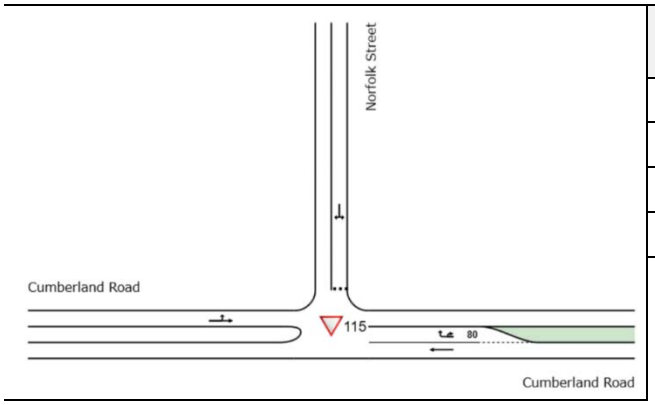
Intersection 14 operates within the practical capacity for a roundabout (DOS < 0.85).



Peak	AM	School PM	Commuter PM
Demand (veh)	355	459	456
Degree of Saturation	0.10	0.18	0.16
Average Delay (secs)	6.0	6.0	5.9
Level of Service	A	A	A

Intersection 15: Norfolk Street / Cumberland Road Intersection

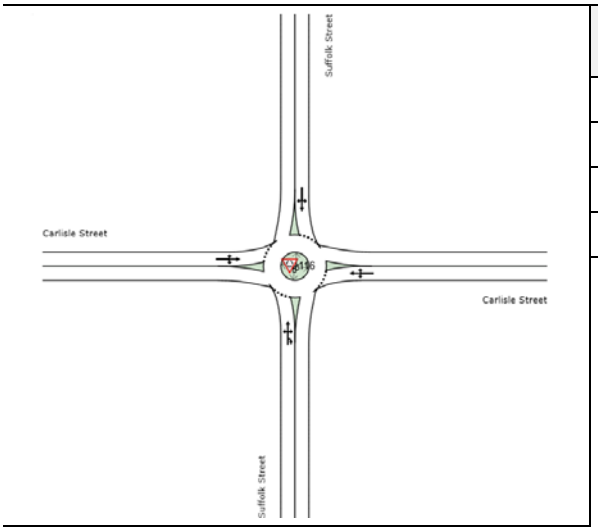
Intersection 15 operates within the practical capacity of a priority-controlled intersection (DOS<0.80).



Peak	AM	School PM	Commuter PM
Demand (veh)	991	1,034	999
Degree of Saturation	0.29	0.25	0.23
Average Delay (secs)	1.5	1.6	1.9
Level of Service	NA	NA	NA

Intersection 16: Suffolk Street / Carlisle Street Roundabout

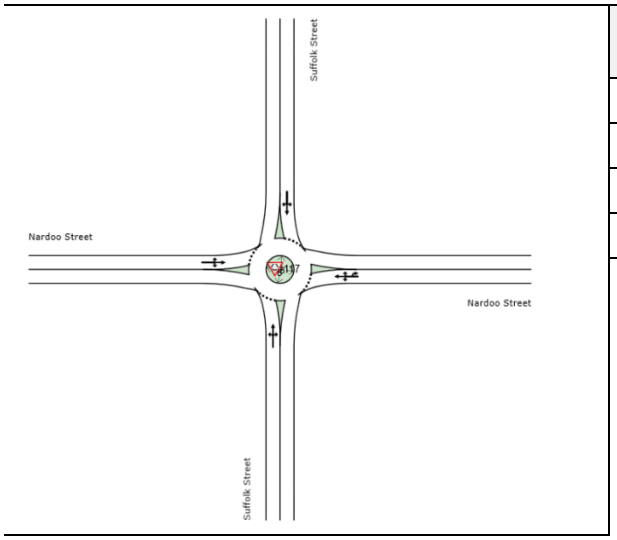
Intersection 16 operates within the practical capacity for a roundabout (DOS < 0.85).



Peak	AM	School PM	Commuter PM
Demand (veh)	193	257	232
Degree of Saturation	0.06	0.12	0.11
Average Delay (secs)	5.1	5.1	5.0
Level of Service	A	A	A

Intersection 17: Suffolk Street / Nardoo Street Roundabout

Intersection 17 operates within the practical capacity for a roundabout (DOS < 0.85).



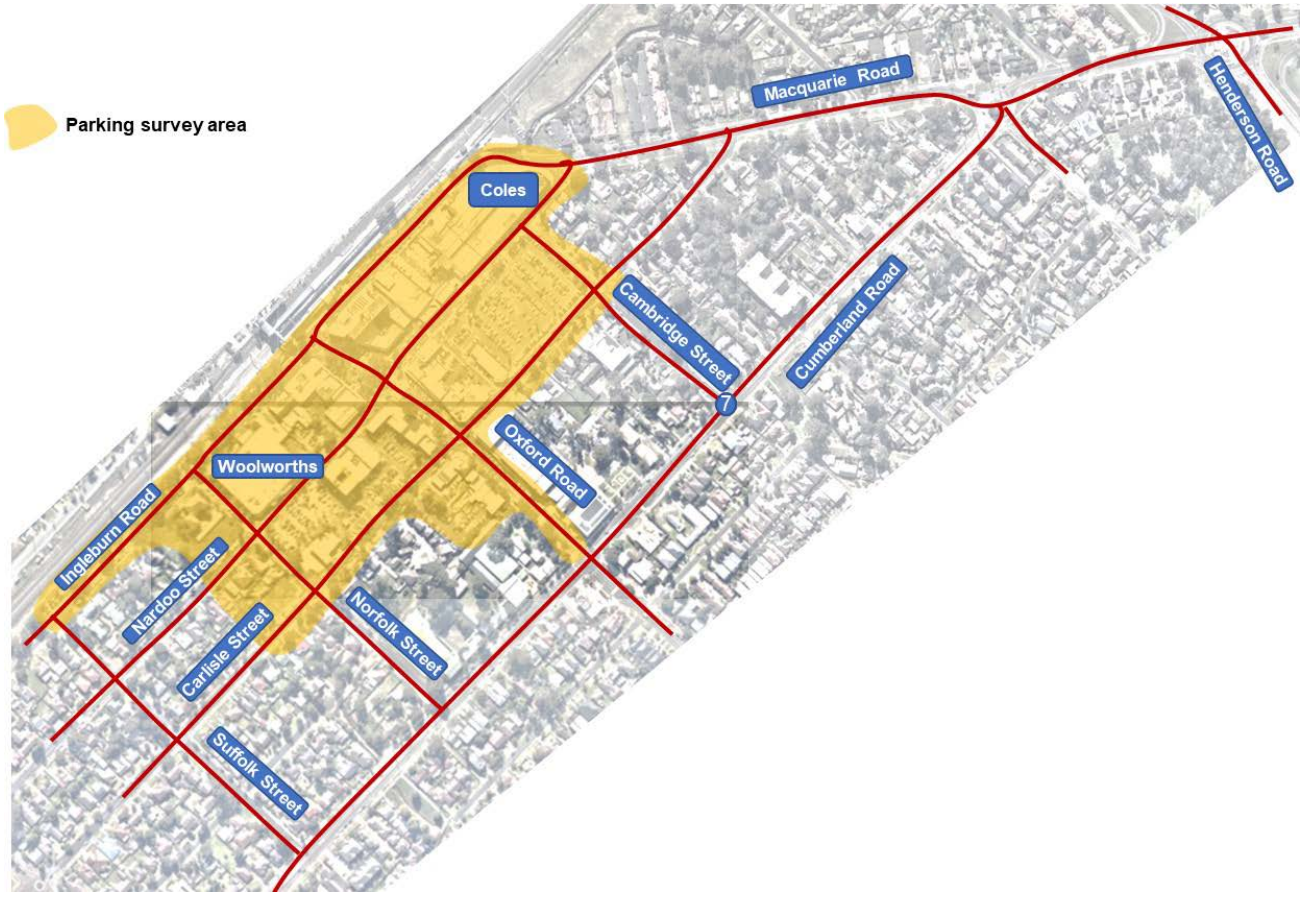
Peak	AM	School PM	Commuter PM
Demand (veh)	134	144	149
Degree of Saturation	0.06	0.05	0.05
Average Delay (secs)	5.1	5.0	5.0
Level of Service	A	A	A

3. EXISTING PARKING INVESTIGATIONS

3.1 Study Area and Parking Surveys

3.1.1 Study Area

The parking investigation study area is shown in Figure 3.1.



Source: Google Maps

Figure 3.1: Parking Study Area

3.1.2 Parking Surveys

Parking occupancy surveys were undertaken by recording the number of parked vehicles each hour within the following periods:

- **Thursday 31st March 2022** 7:00am - 6:00pm
- **Saturday 2nd April 2022** 8:00am - 2:00pm

A copy of the survey data is provided in **Appendix B**.

A parking space inventory was also undertaken.

3.2 Parking Supply and Controls

3.2.1 On-Street Parking

The on-street parking areas have a total parking capacity of 571 spaces with the number of bays by parking control type presented in Table 3.1.

Table 3.1: On-Street Parking Supply and Controls

Parking Type / Control	Parking Spaces	Proportion (%)
Accessible Bay	14	2%
Taxi Bay	7	1%
Loading Zone	2	0%
Emergency Vehicle	3	1%
1/4P	10	2%
1/2P	12	2%
1P	62	11%
2P	235	41%
3P	0	0%
Unrestricted	226	40%
TOTAL	**571**	**100%**

3.2.2 Off-Street Parking

The on-street parking areas have a total parking capacity of 783 spaces with the number of bays by parking control type presented in Table 3.2.

Table 3.2: Off-Street Parking Supply and Controls

Parking Type / Control	Parking Spaces	Proportion (%)
Accessible Bay	18	2%
Taxi Bay	0	0%
Loading Zone	1	0%
Emergency Vehicle	0	0%
1/4P	0	0%
1/2P	3	0%
1P	0	0%
2P	563	72%
3P	13	2%
Unrestricted	185	24%
TOTAL	**783**	**100%**

3.3 On-Street Parking Demands

3.3.1 All Control Types

Table 3.3 presents the average and maximum occupancy for on-street parking spaces on the survey days.

Table 3.3: On-Street Parking Summary, All Controls

Date	*Total Spaces*	Average Spaces Occupied (#)	Average Spaces Occupied (%)	Max Spaces Occupied (#)	Max Spaces Occupied (%)
Thursday 31 March 2022	*571*	84	15%	373	65%
Saturday 2 April 2022	*571*	219	38%	265	46%

Table 3.4 presents the occupancy by hour for on-street parking spaces on the survey days.

Table 3.4: On-Street Parking Occupancy by Hour, All Controls

Date / Time	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM
Thursday 31 March 2022	172	227	324	354	367	373	368	362	348	327	318
Saturday 2 April 2022		146	188	228	225	261	265				

Figure 3.2 presents the occupancy by hour for on-street parking on the survey days.

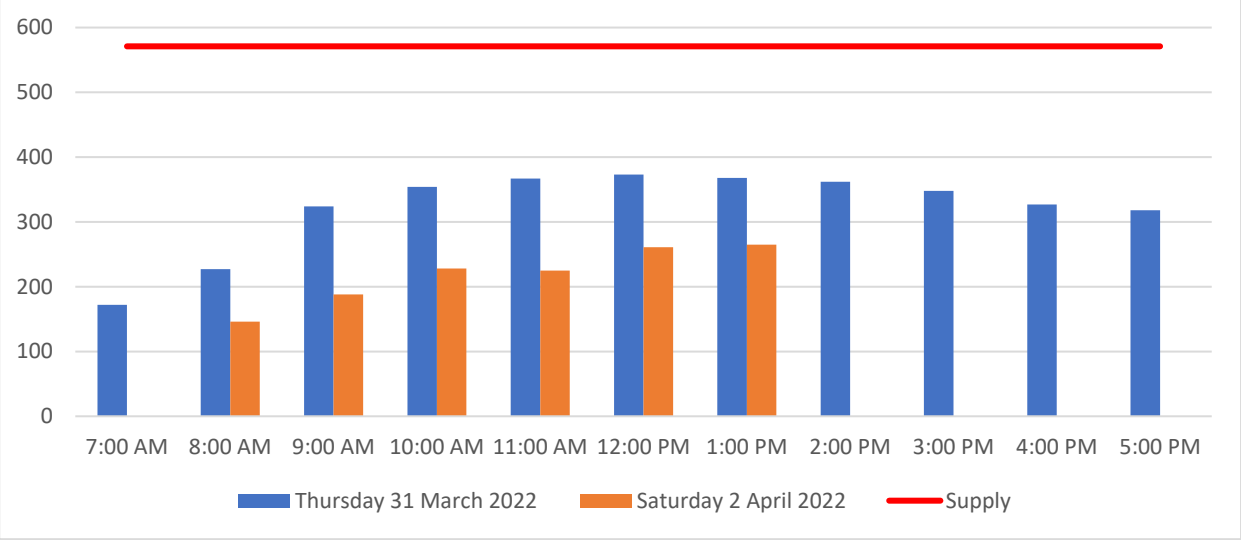


Figure 3.2: On-Street Parking Occupancy by Hour, All Controls

In summary:

- There were 198 unoccupied spaced during the peak occupancy hour on the Thursday
- There were 306 unoccupied spaced during peak occupancy hour on the Saturday
- The parking demands remained between 57% and 65% from 9am to 5pm on the Thursday
- Peak parking demand for both Thursday and Saturday occurred at 12pm.

3.3.2 On-Street Parking Demands by Control Type

Figure 3.3 illustrates the existing parking demand for on-street spaces with a **1/4P control**. Whilst there are only 10 of these bays in the study area, they experienced very low demand on both survey days. These spaces are located adjacent to the railway station and are for drop-off / pick-up.

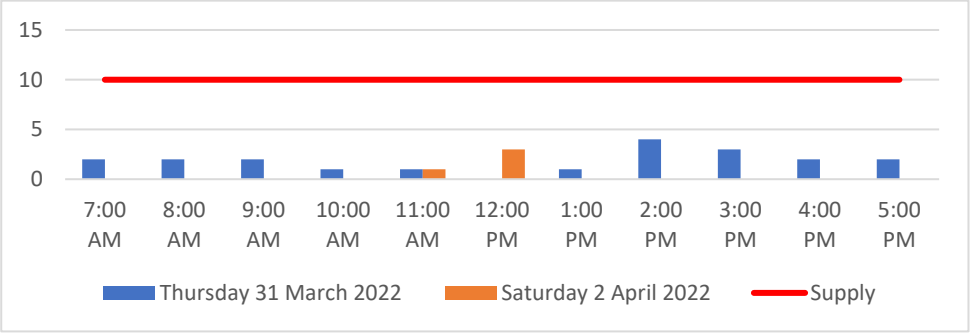


Figure 3.3: 1/4P On-Street Parking Occupancy by Hour

Figure 3.4 illustrates the existing parking demand for on-street spaces with a **1/2P control**. These spaces experienced high demands on both survey days, reaching capacity at 2pm on Thursday. Many of these spaces are located adjacent to shopping centres.

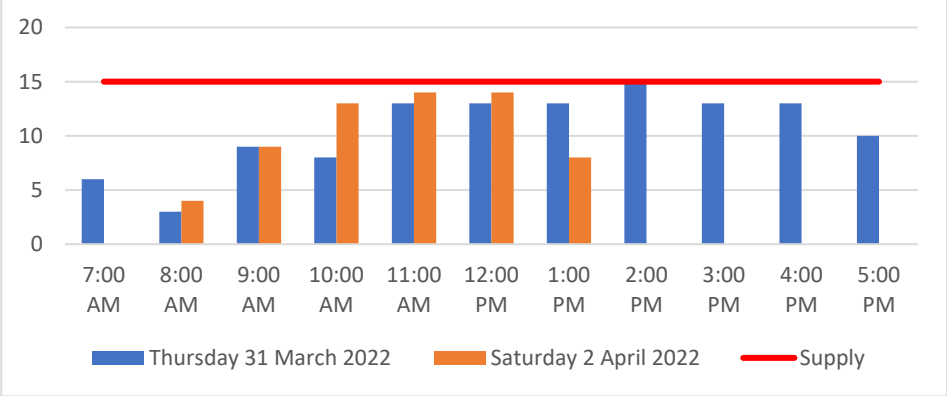


Figure 3.4: 1/2P On-Street Parking Occupancy by Hour

Figure 3.5 illustrates the existing parking demand for on-street spaces with a **1P control**. These spaces experienced moderate demand on both survey days.

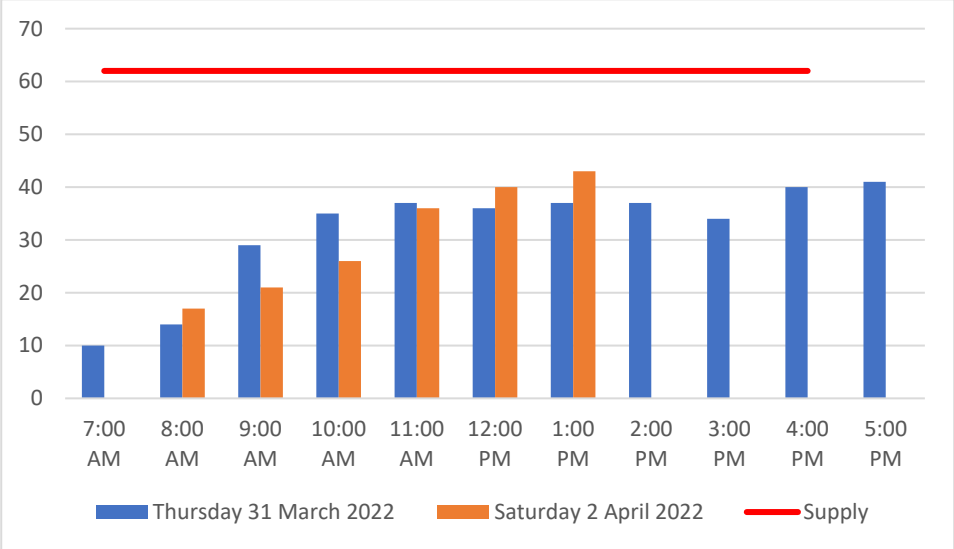


Figure 3.5: 1P On-Street Parking Occupancy by Hour

Figure 3.6 illustrates the existing parking demand for on-street spaces with a **2P control**. These spaces experienced moderate demand on both survey days.

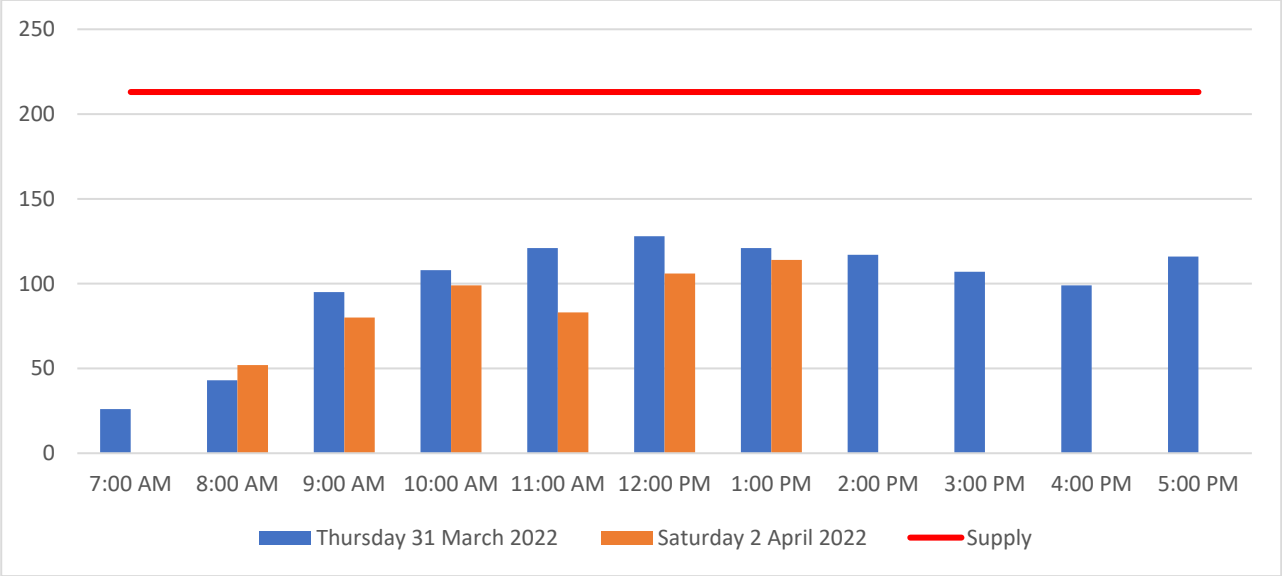


Figure 3.6: 2P On-Street Parking Occupancy by Hour

Figure 3.7 illustrates the existing parking demand for unrestricted on-street spaces, which is 40% of the total on-street parking in the study area. These spaces experienced moderate, constant demand on both survey days. Demands for these spaces proportionally higher at the shoulders of the survey periods and these spaces are likely to be used by staff in the CBD as well as commuters using the adjacent railway station.

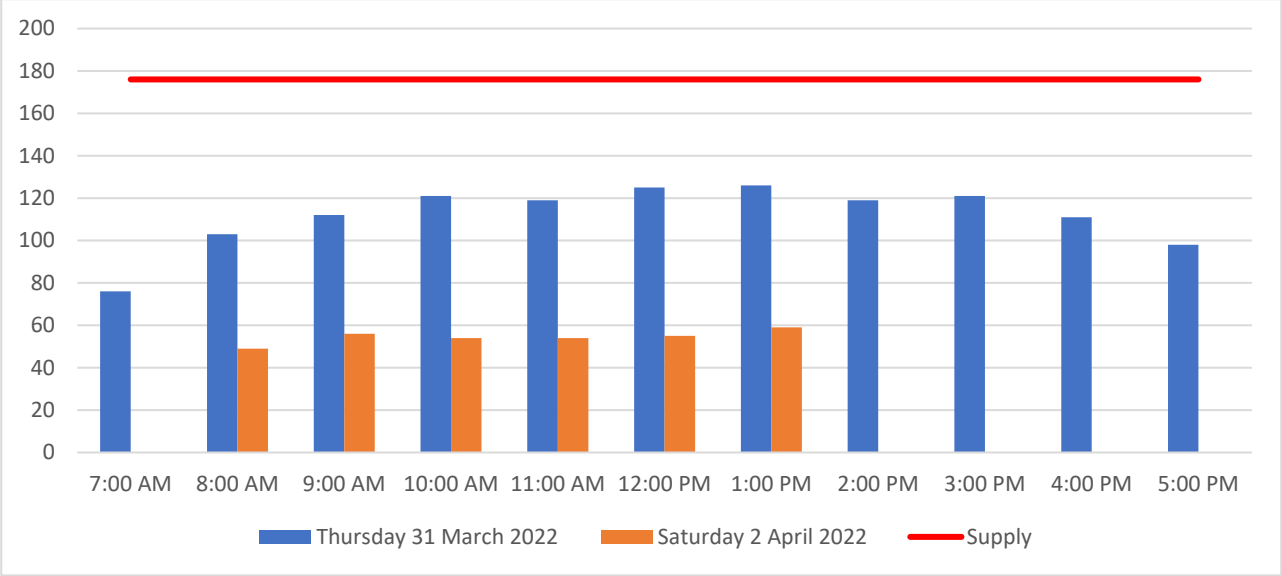


Figure 3.7: Unrestricted On-Street Parking Occupancy by Hour

3.4 Off-Street Parking Demands

3.4.1 All Control Types

Table 3.5 presents the average and maximum occupancy for off-street parking on the survey days.

Table 3.5: Off-Street Parking, All Controls

Date	*Total Spaces*	Average Spaces Occupied (#)	Average Spaces Occupied (%)	Max Spaces Occupied (#)	Max Spaces Occupied (%)
Thursday 31 March 2022	*783*	391	50%	527	67%
Saturday 2 April 2022	*783*	279	36%	358	46%

Table 3.6 presents the occupancy by hour for off-street parking spaces on the survey days.

Table 3.6: Off-Street Parking Occupancy by Hour, All Controls

Date	7:00 AM	8:00 AM	9:00 AM	10:00 AM	11:00 AM	12:00 PM	1:00 PM	2:00 PM	3:00 PM	4:00 PM	5:00 PM
Thursday 31 March 2022	68	163	403	486	508	527	477	453	451	435	330
Saturday 2 April 2022		106	219	303	351	358	337				

Figure 3.8 presents the occupancy by hour for off-street parking on the survey days.

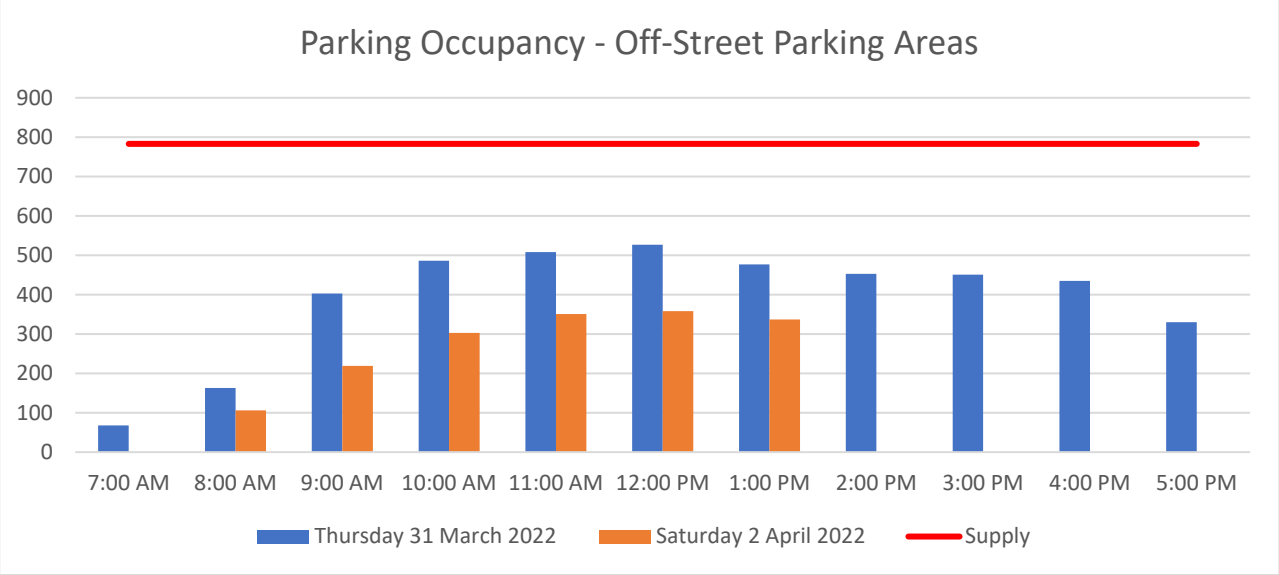


Figure 3.8: Off-Street Parking Occupancy by Hour

In summary:

- There were 256 unoccupied spaces during peak occupancy on the Thursday
- There were 425 unoccupied spaces during peak occupancy on the Saturday
- The parking demands remained between 51% and 67% from 9am to 5pm
- Peak parking demand for both the Thursday and the Saturday occurred at 12pm.

3.4.2 Off-Street Parking Demands by Control Type

There are no 1/4P, 1/2P or 1P bays located off-street. Figure 3.9 illustrates the existing parking demand for off-street spaces with a **2P control**. These spaces experienced moderate demand on both survey days.

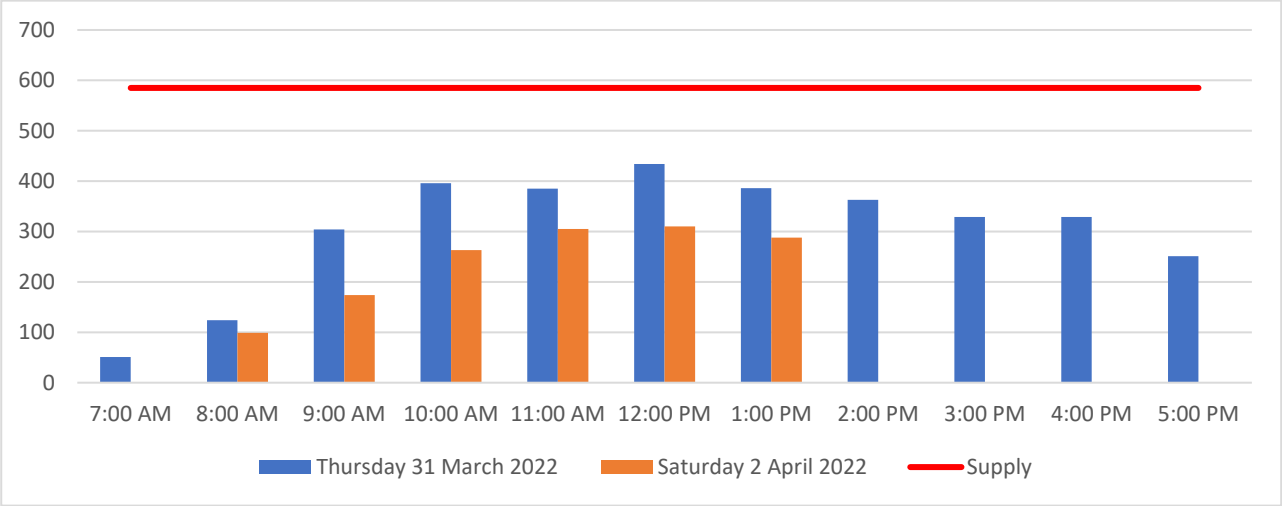


Figure 3.9: 2P Off-Street Parking, Occupancy by Hour

Figure 3.10 illustrates the existing parking demand for off-street spaces with a **3P control**. These spaces experienced high demand on both survey days.

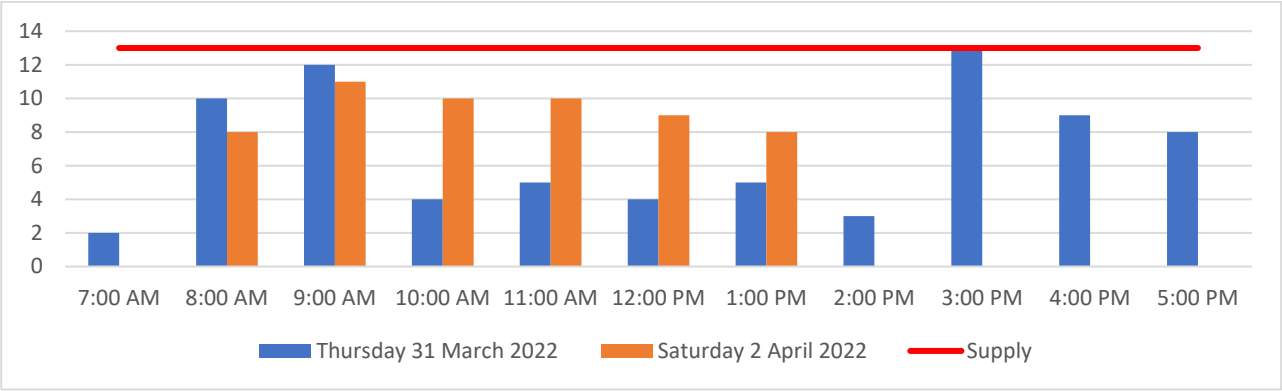


Figure 3.10: 3P Off-Street Parking, Occupancy by Hour

Figure 3.11 illustrates the existing parking demand for unrestricted off-street spaces. These spaces experienced moderate demand on both survey days.

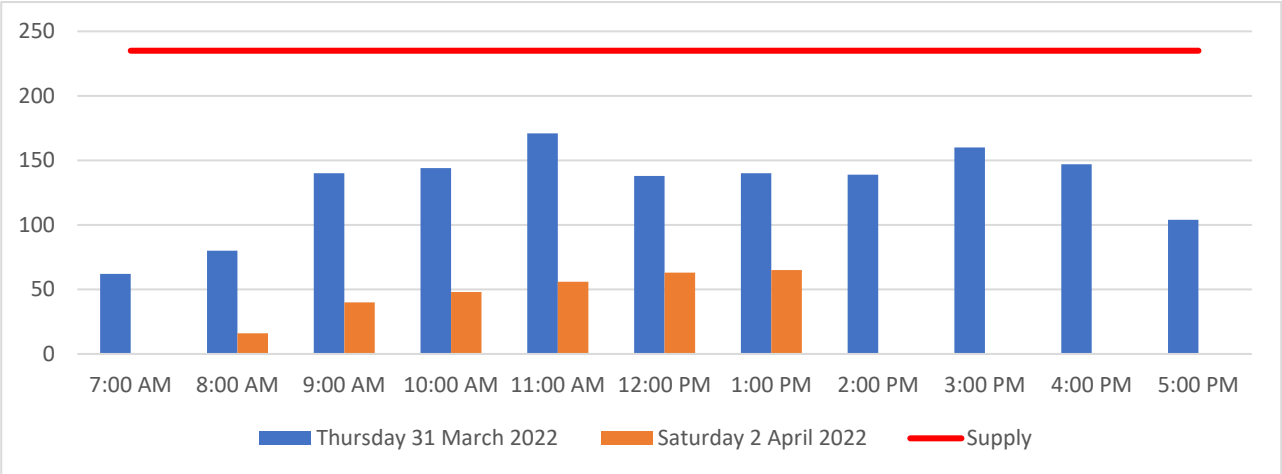


Figure 3.11: Unrestricted Off-Street Parking, Occupancy by Hour

3.5 Parking Demands by Area

3.5.1 Oxford Road

Figure 3.12 illustrates the Oxford Road parking areas. These areas are subdivided into the areas north and south of Carlisle Street. Both areas are flanked by retail and commercial uses.

Figure 3.12: Oxford Road Parking Areas

Figure 3.13 illustrates the existing parking demand for Oxford Road north of Carlisle Street which experienced consistently high demand on both survey days. These spaces are on-street and comprise a mix of 1/2P, 1P and 2P regulations.

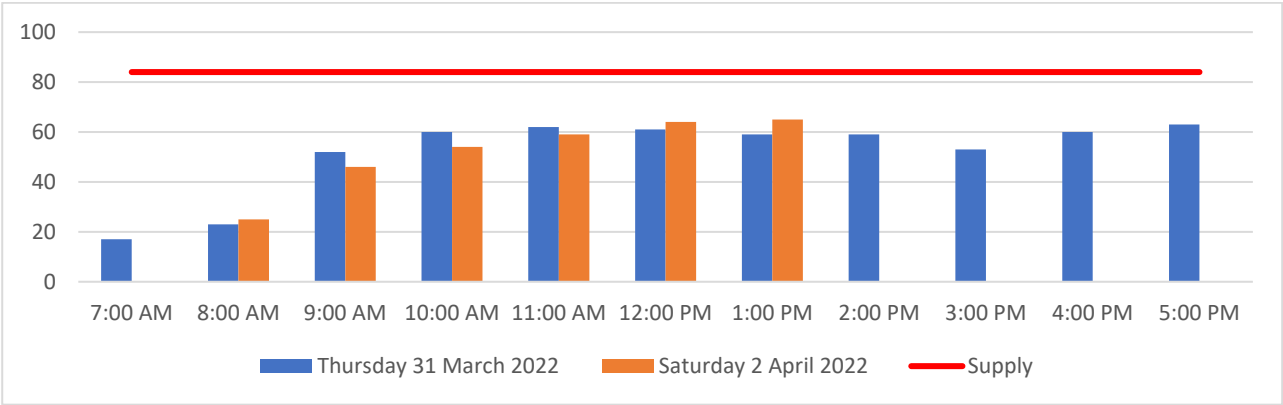


Figure 3.13: Oxford Road Parking Occupancy by Hour (North of Carlisle Street)

Figure 3.14 illustrates the existing parking demand for Oxford Road south of Carlisle Street. These spaces experienced high demand on both survey days, with a peak at midday. These spaces are on-street and mostly 2P spaces.

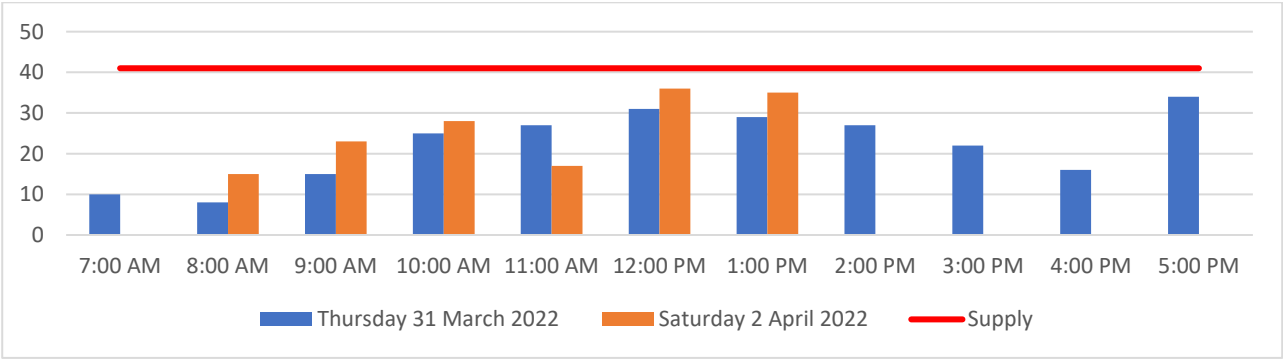


Figure 3.14: Oxford Road Parking Occupancy by Hour (South of Carlisle Street)

3.5.2 Ingleburn Road

Figure 3.15 illustrates the location of the Ingleburn Road parking area. The area contains both on-street and off-street parking. Most of the on-street spaces (52%) have no restrictions while all of the off-street spaces have no restrictions.

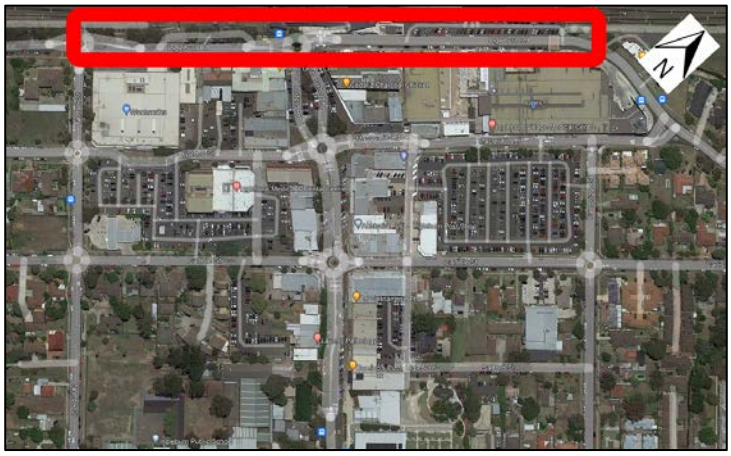


Figure 3.15: Ingleburn Road Parking Areas

Figure 3.16 illustrates the existing parking demand for on-street spaces on Ingleburn Road. These spaces experienced moderate demand on Thursday and low demand on Saturday.

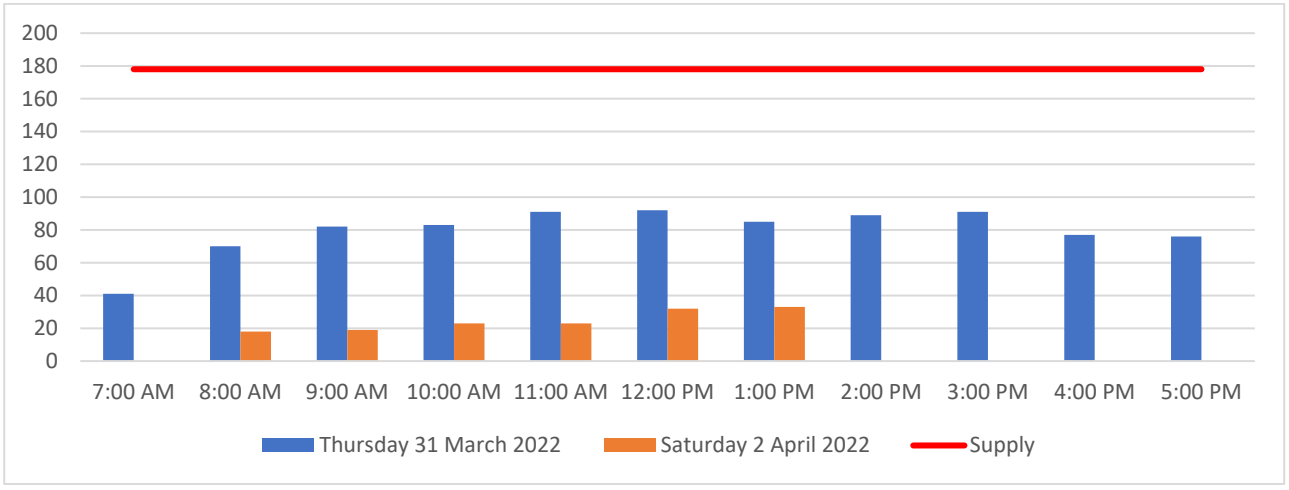


Figure 3.16: Ingleburn Road Off-street Parking Occupancy by Hour

Figure 3.17 illustrates the existing parking demand for off-street spaces on Ingleburn Road. These spaces experienced high demand on Thursday and low demand on Saturday.

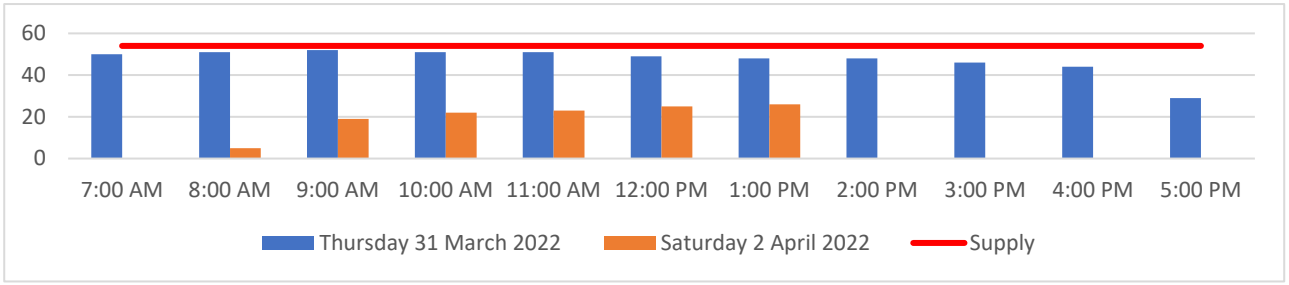


Figure 3.17: Ingleburn Road On-street Parking Occupancy by Hour

It is likely that demand for the Ingleburn Road parking area is driven by rail commuters. The demand profiles suggest that the off-street parking is preferred and fills up first with on-street spaces then used as 'overflow' parking.

3.5.3 Ingleburn Village Parking Area

Figure 3.18 illustrates the location of the Ingleburn Village parking area. The anchor tenant for the Ingleburn Village is Coles and the parking area is operated by Council. The area contains a mix of 2P (53%) and unrestricted (47%) parking controls.

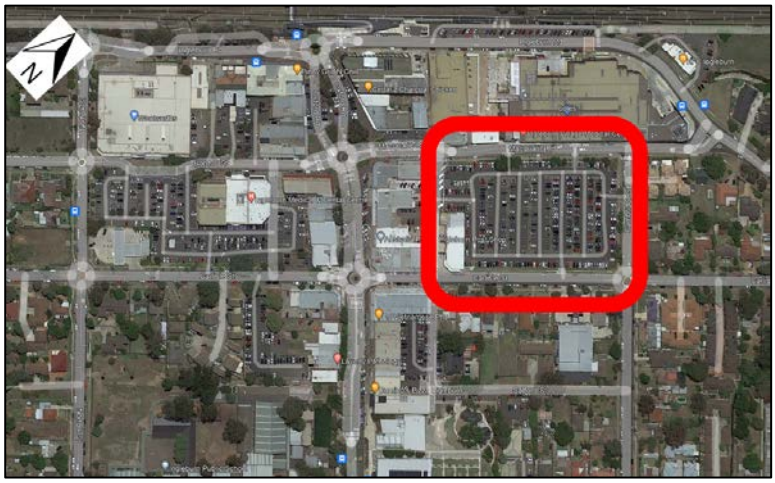


Figure 3.18: Ingleburn Village Parking Areas

Figure 3.19 illustrates the existing parking demand for the Ingleburn Village parking area. The parking area experienced moderate demands on Thursday and lower demands on Saturday.

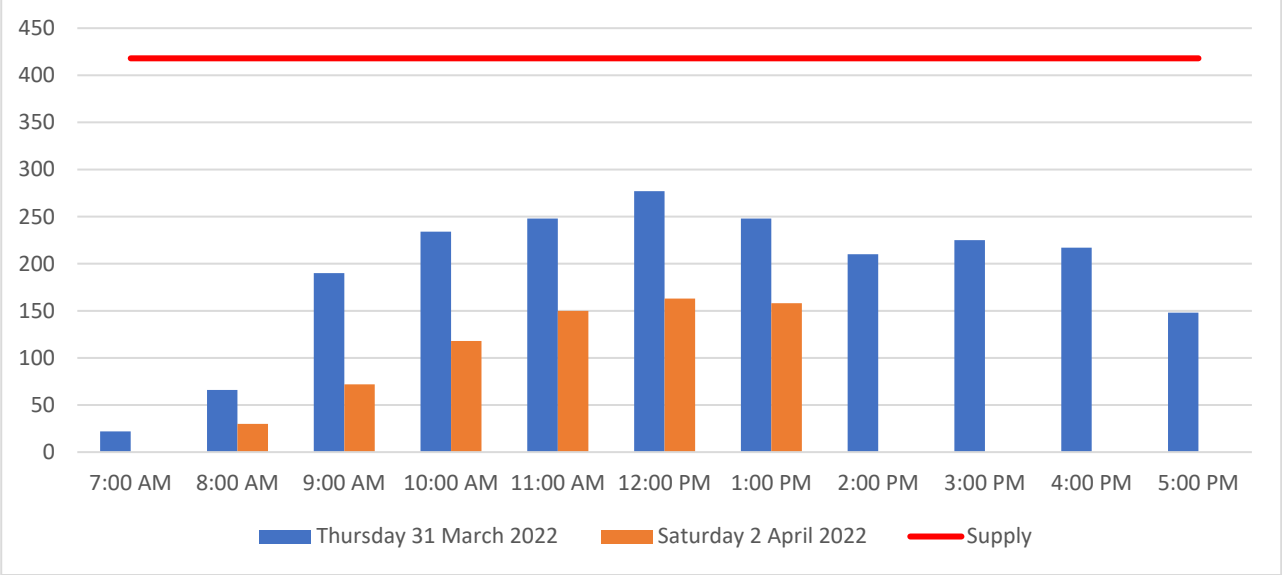


Figure 3.19: Ingleburn Village Parking Occupancy by Hour

3.5.4 Ingleburn Town Centre Parking Area

Figure 3.20 illustrates the location of the Ingleburn Town Centre parking area. The anchor tenant for the Ingleburn Town Centre is Woolworths. The parking area is subdivided into areas east and west of Carlisle Road. There are no pedestrian connections between the eastern parking area and the retail and commercial uses on Oxford Road.

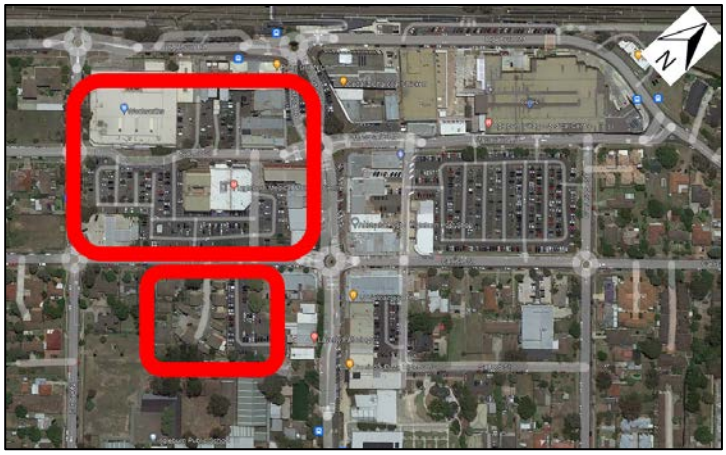


Figure 3.20: Ingleburn Town Centre Parking Areas

Figure 3.21 illustrates the existing parking demand for the Ingleburn Town Centre western parking area. This parking area experienced moderate demands on Thursday and moderate demands on Saturday. This parking area consists of mostly 2P (93%) and 3P (4%) parking spaces.

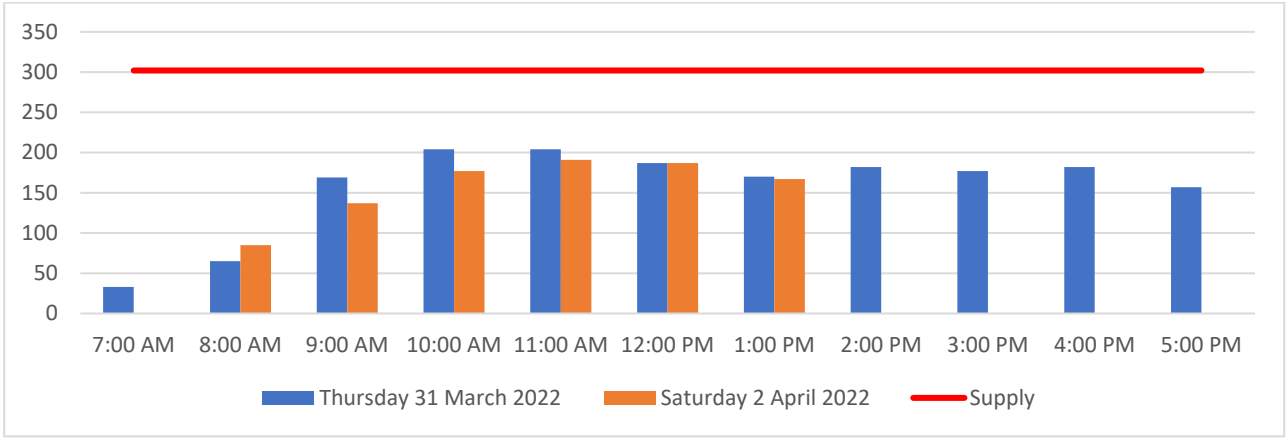


Figure 3.21: Ingleburn Town Centre Parking Occupancy by Hour (West of Carlisle Street)

Figure 3.22 illustrates the existing parking demand for the eastern Ingleburn Town Centre parking area. The parking area experienced very high demands on Thursday and very low demands on Saturday. This parking area is exclusively 2P parking.

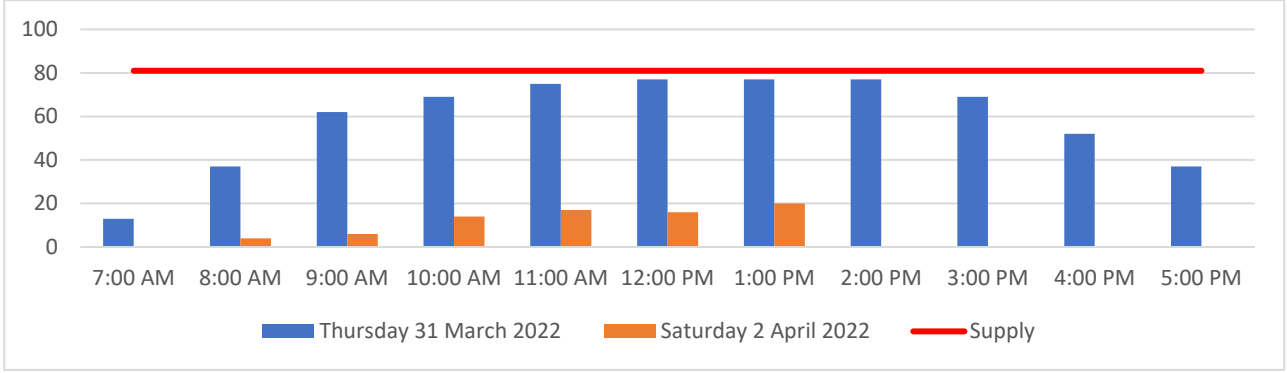


Figure 3.22: Ingleburn Town Centre Parking Occupancy by Hour (East of Carlisle Street)

3.5.5 Macquarie Road

Figure 3.23 illustrates the existing on-street parking demand on Macquarie Road. The parking area consists of 1/2P (43%), 2P (43%) and unrestricted (14%) parking controls.

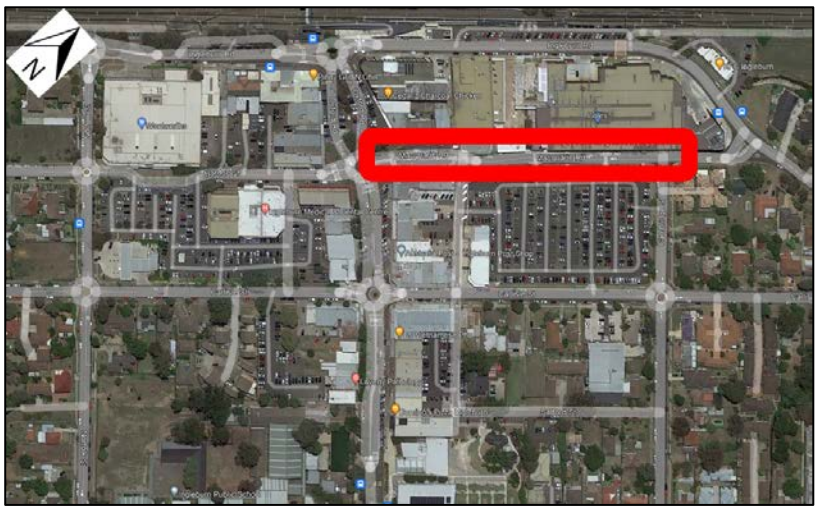


Figure 3.23: Macquarie Road Parking Area

Figure 3.24 illustrates the existing parking demand for the on-street parking spaces on Macquarie Road. The parking area experienced very high demands on Thursday and Saturday.

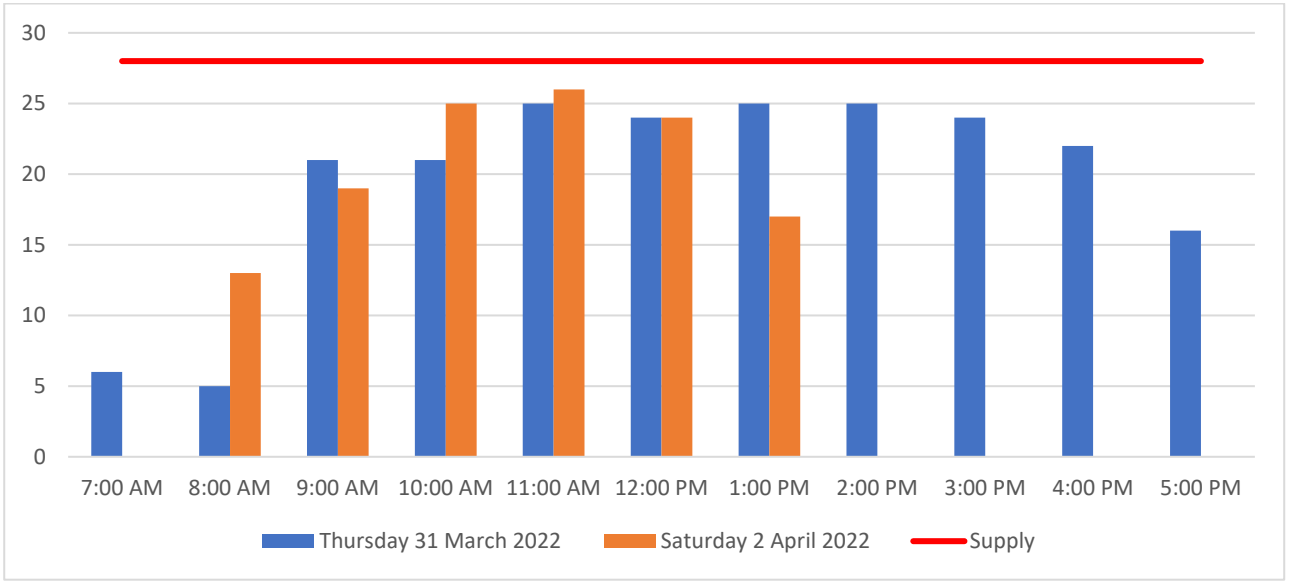


Figure 3.24: Macquarie Road Parking Occupancy by Hour

3.5.6 Nardoo Street

Figure 3.25 illustrates the existing parking demand on-street on Nardoo Street. The parking area consists of 2P (50%) and unrestricted (50%) parking controls.

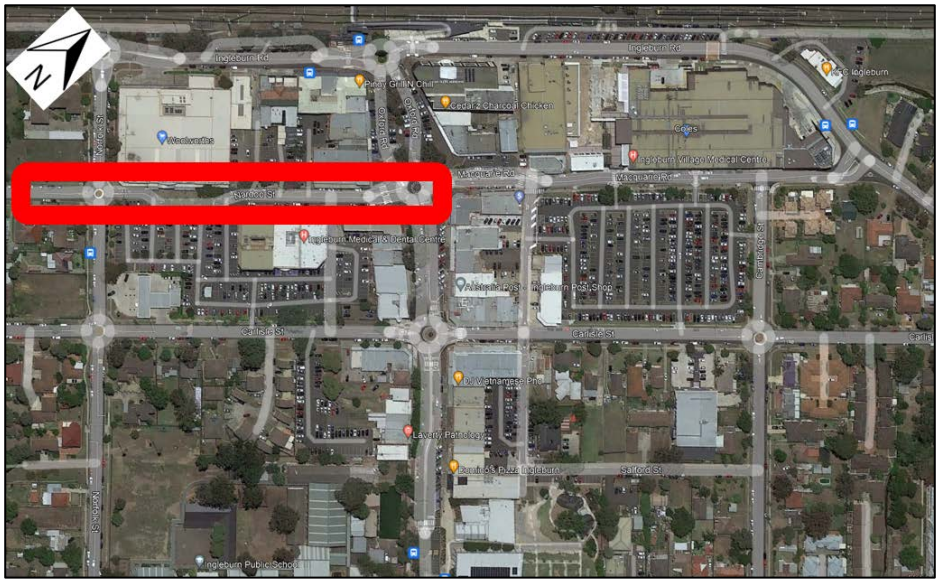


Figure 3.25: Nardoo Street Parking Areas

Figure 3.26 illustrates the existing parking demand for the on-street parking spaces on Nardoo Street. The parking area experienced very high demands on Thursday and moderate demands on Saturday.

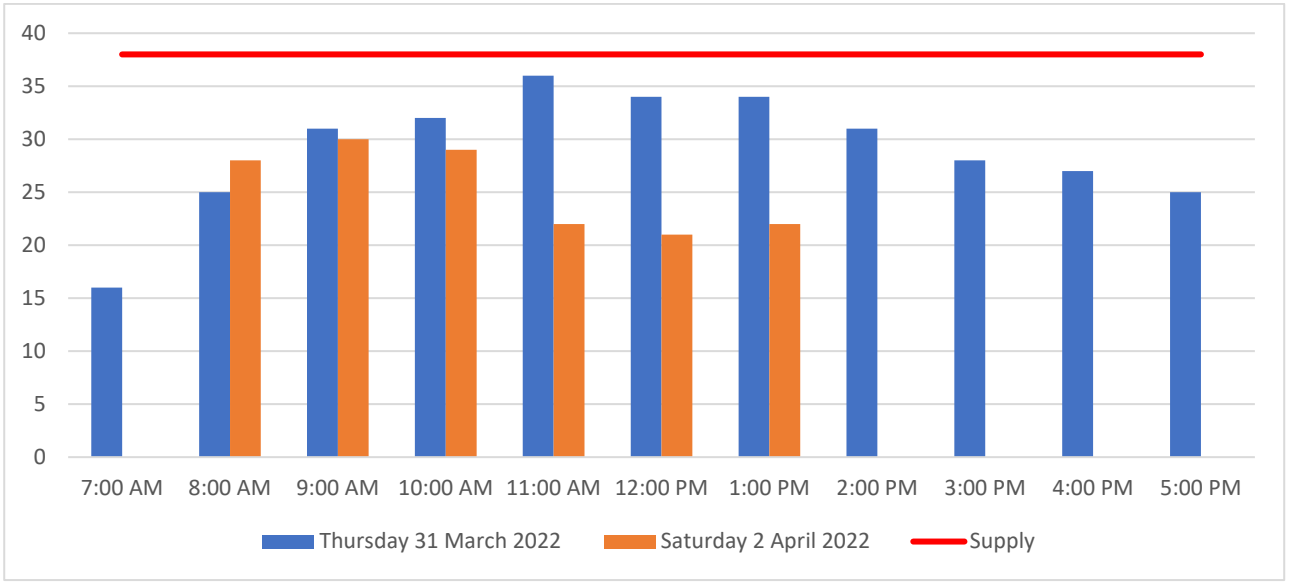


Figure 3.26: Nardoo Street Parking Occupancy by Hour

3.5.7 Carlisle Street

Figure 3.27 illustrates the existing parking demand on-street on Carlisle Street. The parking area has been subdivided into north and south of Oxford Road.

Figure 3.27: Carlisle Street Parking Areas

Figure 3.28 illustrates the existing parking demand for the on-street parking spaces Carlisle Street north of Oxford Road. The parking area experienced moderate demands on both survey days. The parking area consists of 1/2P (4%), 1P (75%) and 2P (13%) parking controls.

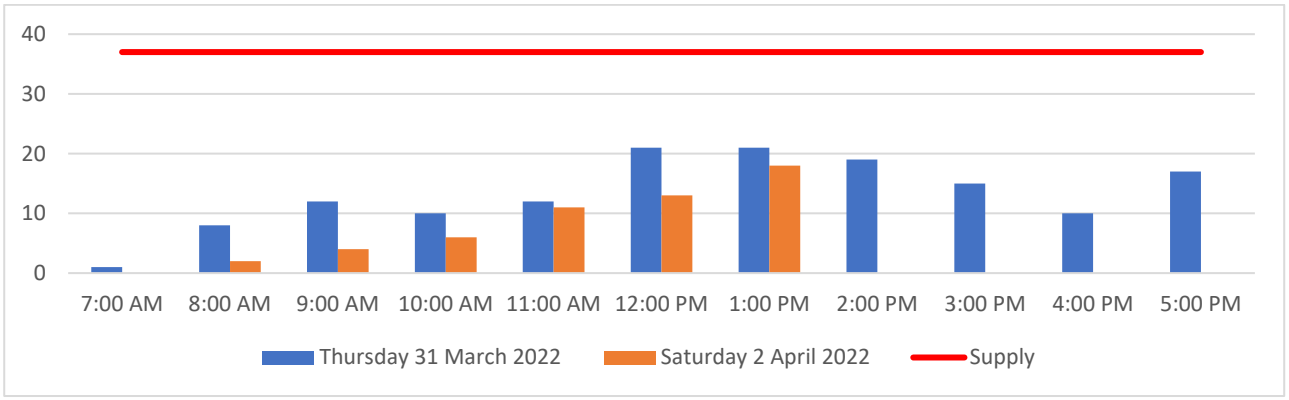


Figure 3.28: Carlisle Street Parking Occupancy by Hour (North of Oxford Road)

Figure 3.29 illustrates the existing parking demand for the on-street parking spaces Carlisle Street south of Oxford Road. The parking area experienced moderate demands on both survey days. The parking area consists of 2P parking controls.

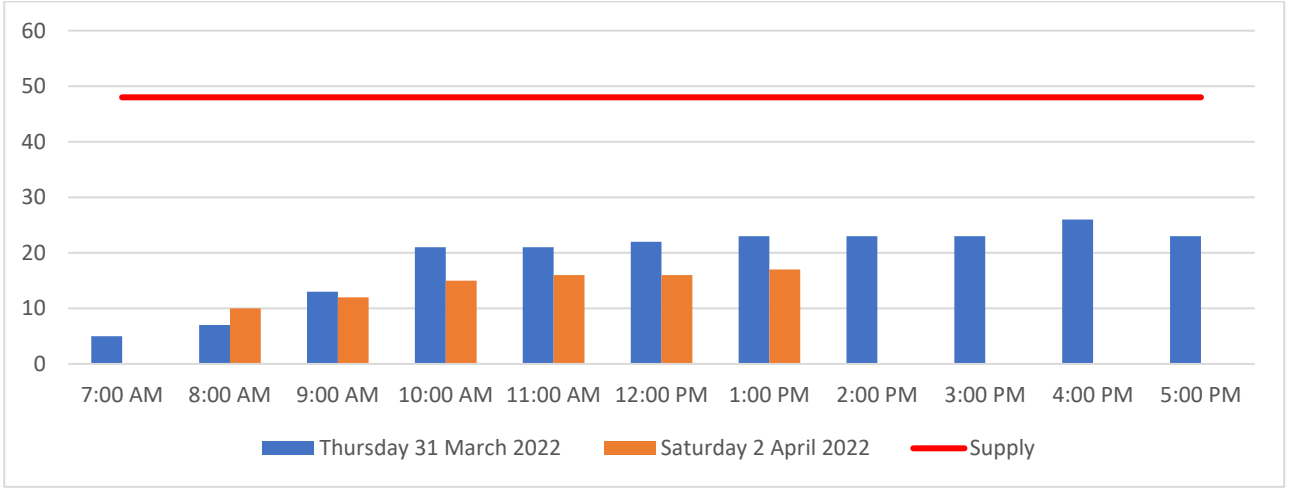


Figure 3.29: Carlisle Street Parking Occupancy by Hour (South of Oxford Road)

3.5.8 Norfolk Street

Figure 3.30 illustrates the on-street parking on Norfolk Street. There are no parking controls on Norfolk Street.

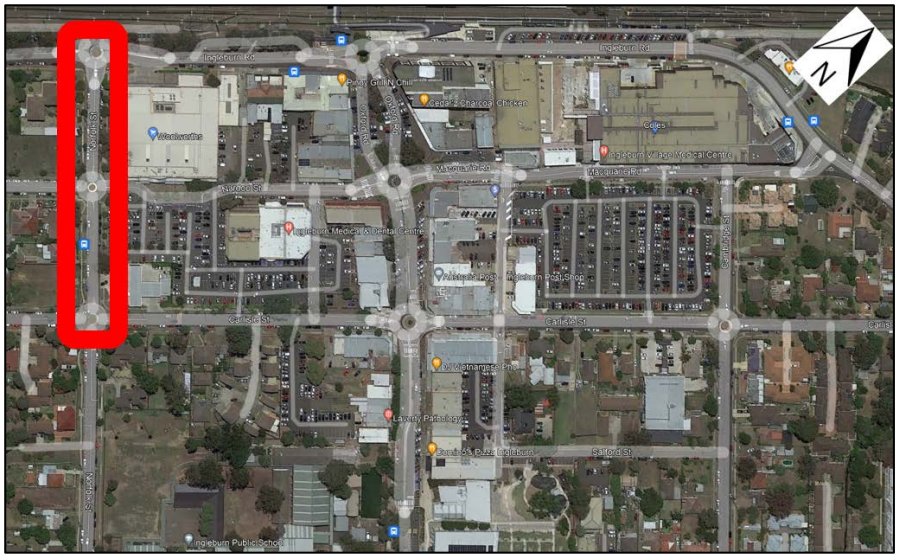


Figure 3.30: Norfolk Street Parking Area

Figure 3.31 illustrates the parking demands on-street on Norfolk Street. The observations are consistent with rail commuter parking demands. This is likely due to the lack of parking controls and the proximity to the Ingleburn Railway Station.

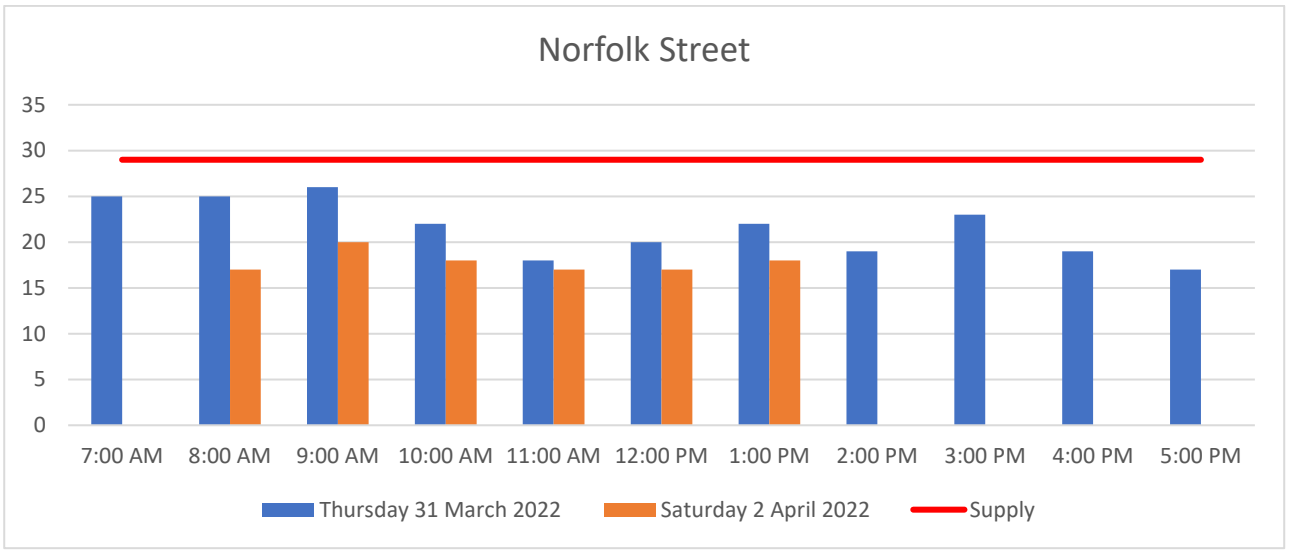


Figure 3.31: Norfolk Street Parking Occupancy by Hour

3.5.9 Cambridge Street

Figure 3.32 illustrates the on-street parking on Cambridge Street. There are no parking controls on Norfolk Street. The parking area consists of 2P (63%) and unrestricted (37%) parking controls.

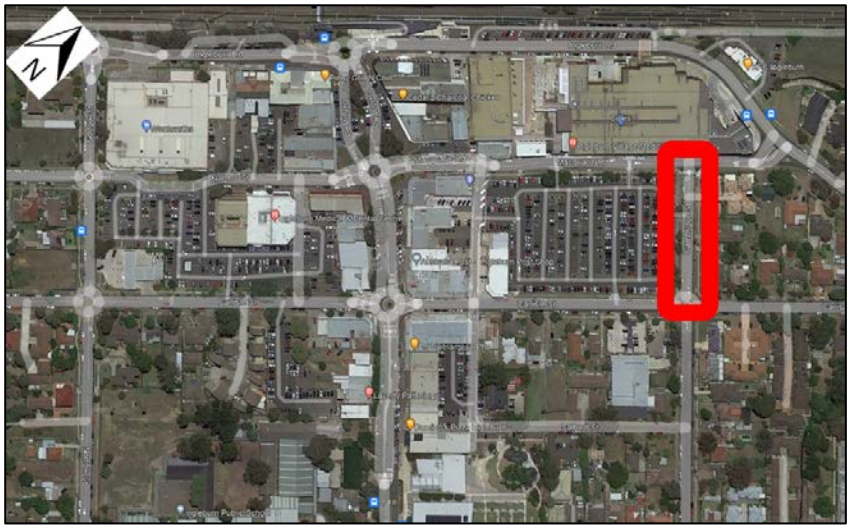


Figure 3.32: Cambridge Street Parking Areas

Figure 3.33 illustrates the existing parking demands are low on both days. It is likely that these spaces are too far from commercial and retail attractors to be attractive.

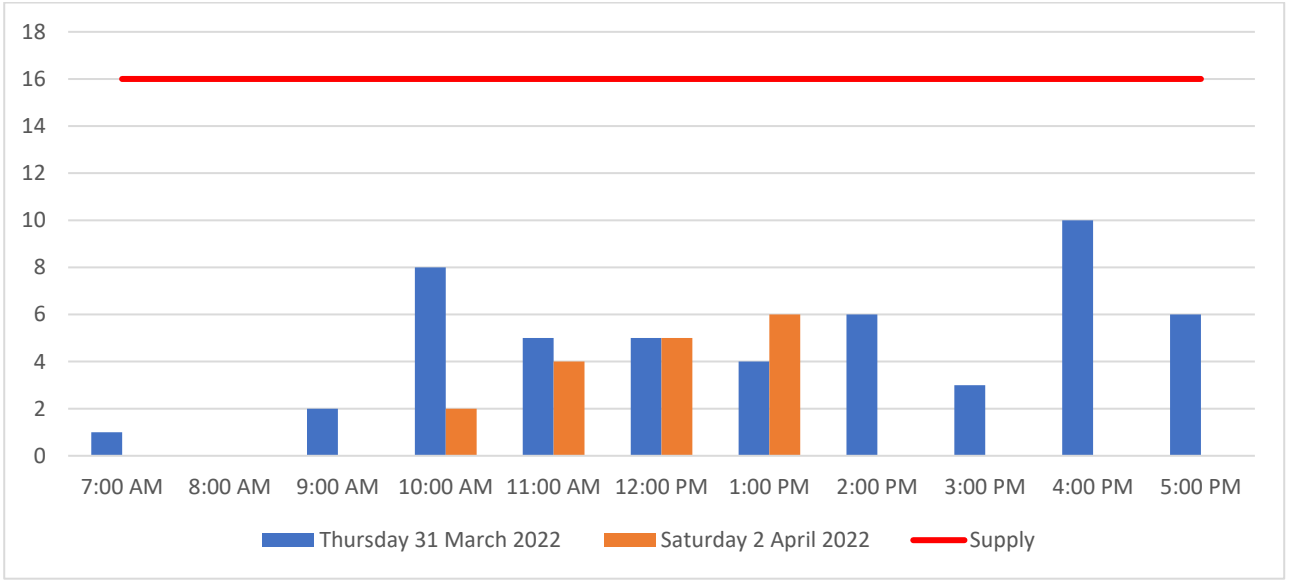


Figure 3.33: Cambridge Street Parking Occupancy by Hour

3.6 Interpretation of Parking Demand Results

The existing parking demands have been interpreted with key findings as follows:

- Considering the whole parking area, the demand profiles for on-street and off-street parking follow a similar pattern. Both area-types reach a peak demand near midday of approximately 65% of capacity on Thursday and 50% on Saturday
- No significant difference of usage percentages was noticed by parking control type. The demands generally follow the overall trends. Exceptions are the 1/4P type control area (with just 10 drop-off / pick-up bays) and unrestricted spaces
- The unrestricted parking areas on Ingleburn Road and Norfolk Street show demands typically associated with rail commuter patterns. These spaces were mostly occupied on Thursday before 7am and remained so after 5pm. Demands for these areas was low on Saturday. The spaces closest to the railway station access were generally occupied first
- The off-street parking areas adjacent to the major shopping centres, being Ingleburn Village and Ingleburn Town Centre, experienced high demands typical of commercial retail uses. These spaces experienced peak demands in the order of 80% or more on Thursdays
- The Ingleburn Village parking area also contains a supply of unrestricted parking spaces. These spaces reached a peak occupancy of 67%. It is expected that these spaces are primarily used by staff of both shopping centres
- On-street parking on Macquarie Road and Nardoo Street, which both front the major shopping centres, experienced demands slightly higher than the adjacent off-street parking areas. This suggests that these areas are utilised for quick trips to the centres and should be considered part of each centres overall supply
- Oxford Road functions as the 'high street' for the Ingleburn CBD. The on-street parking spaces on Oxford Road showed high occupancy levels but below their practical capacity
- On-street parking demands for Carlisle Road and Cambridge Street were moderate to low. These roads are on the fringe of the existing retail and commercial precinct and are not the most convenient options for accessing the precinct
- Overall, the parking system caters for a variety of purposes and durations. The system has spare capacity for all purposes and across all precincts within the study area and adequately meets the existing demands
- From a review of the demand profiles and proximity to attractors it can be concluded that there are generally two (2) user groups and parking demand profiles within the study area – rail commuters demands and commercial parking demands. These user groups tend to park in separate areas as identified in Figure 3.34 below. These areas include both on-street and off-street parking spaces
- The rail commuter parking areas have approximately 261 parking spaces and experienced a peak demand of 161 occupied parking spaces (approximately 62% of capacity)
- The commercial parking areas have approximately 1,093 parking spaces and experienced a peak demand of 739 occupied spaces (approximately 68% of capacity)
- An estimated parking demand rate of 1 space per 65m^2 GFA can be calculated for the commercial parking areas. This rate is based on the peak demand of 68% capacity and an estimated commercial floor area of the existing commercial uses within the study area of approximately 47,000m^2
- An estimated parking supply rate of 1 space per 43m^2 GFA can be calculated for the commercial parking areas. This is based on the total supply of parking in the area and the estimated commercial floor area
- The Campbelltown Development Control Plan (DCP) prescribes a parking rate for commercial uses in a B4 zone of 1 space per 25m^2 GFA on the ground floor and 1 space per 35m^2 GFA on the upper levels.

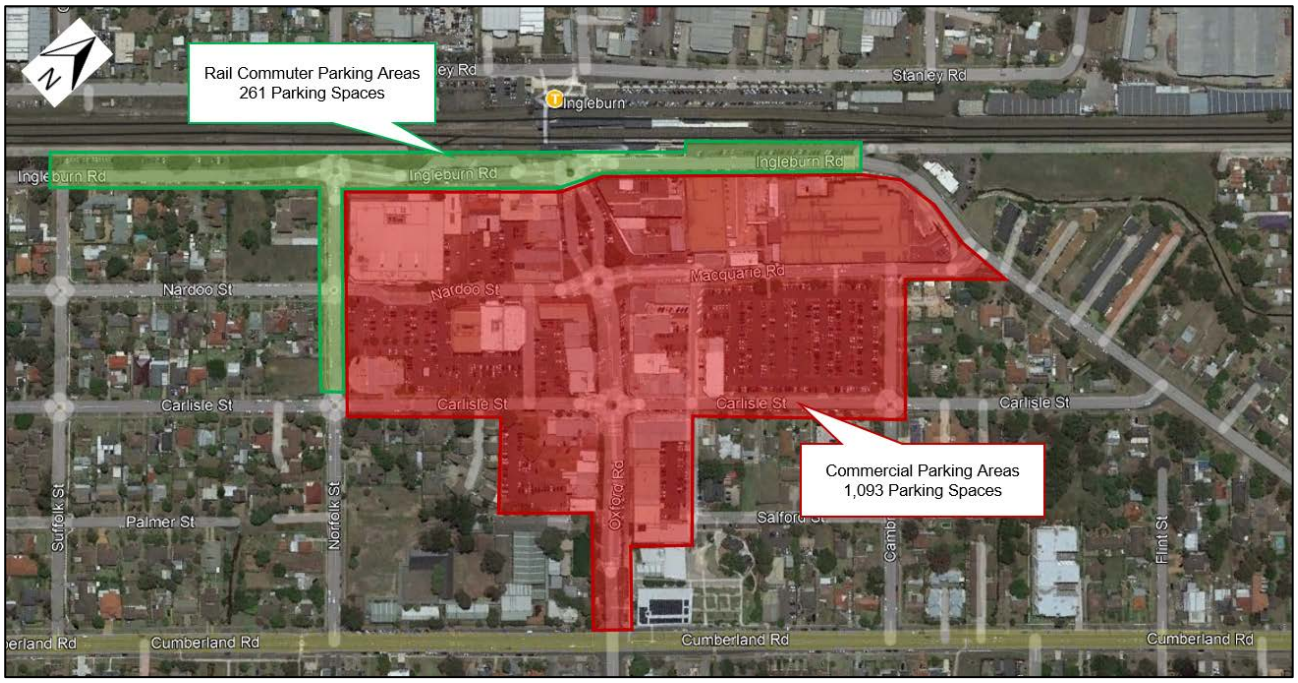


Figure 3.34: Assumed Rail Commuter and Commercial Parking Areas

3.7 Benchmarking for COVID-19 Influences

Parking demands in the Greater Sydney area have been impacted by changes in travel patterns due to COVID-19. To ensure that the surveyed parking demands are representative of 'non-COVID-19' times, the surveyed demands have been benchmarked against historical parking data.

The Ingleburn Town Centre Parking Study was prepared for Council in 2012. The study covered a similar area and scope to the parking survey area for this study. A copy of the study has been included in **Appendix F**.

The study found that both peak and average parking demands were higher in 2012 than in 2022. This change is likely due to the impacts of COVID-19 on travel patterns and specifically attributed to:

- Prevalence of work from home arrangements
- Lower occupation rates of businesses in the Ingleburn CBD
- Overflow parking for the rail commuter parking facilities, noting that the facility has now been expanded.

A review of the monthly rail trips at Ingleburn Station has indicated that patronage has reduced by 48% from March 2019 to March 2022 and reduced by 42% from April 2019 to April 2022. The monthly patronage for Ingleburn Station is illustrated in Figure 3.35.

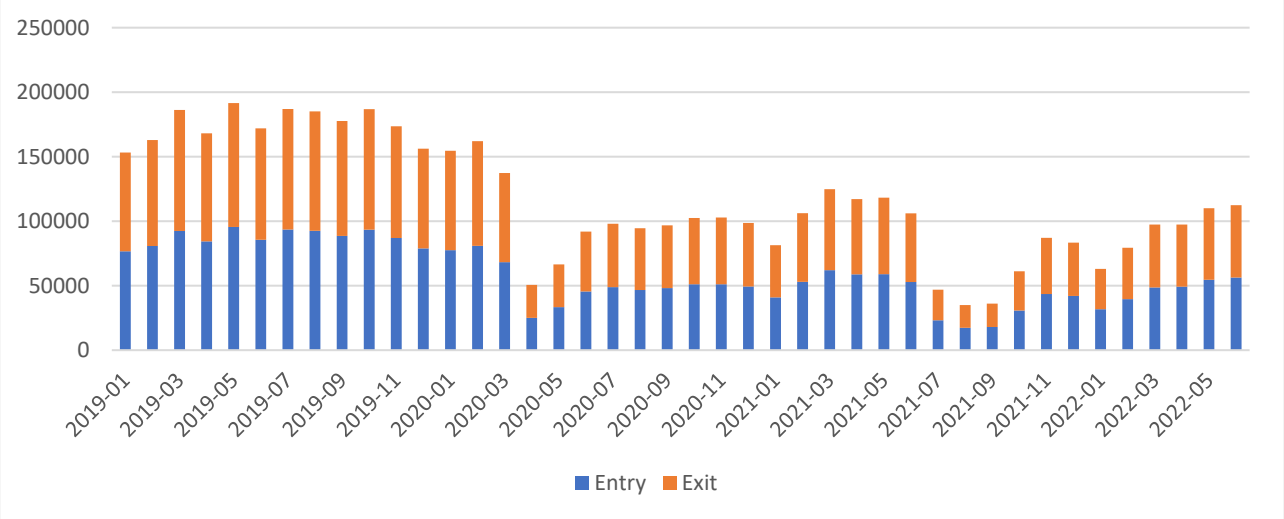


Figure 3.35: Ingleburn Station Monthly Patronage

Considering the data presented in Figure 3.35, it is likely that the significant decrease in rail commuter trips is a key reason for the reduction in overall parking demand in general and in the unrestricted parking areas in particular.

However, considering the relatively high demands for short-term parking, particularly close to the vicinity of the Ingleburn Town Centre shopping centre, the data comparison suggests it is likely that demands for retail and commercial uses were approaching pre-pandemic levels when the surveys were done.

4. INGLEBURN CBD PLANNING PROPOSAL

4.1 Overview

The Planning Proposal for the Ingleburn CBD has received Gateway Determination from the DPIE. The proposed precinct plan takes the total number of dwellings in the CBD from 400 (2022) to 3,800 (2036) and increase the total retail and commercial GFA from 41,600m^2 (2022) to 92,000m^2 (2036).

4.2 Development Areas and Yield Assumptions

The Ingleburn CBD has been divided into four precincts known as Areas 'A', 'B1', 'B2' and 'C' as shown on Figure 4.1. It is proposed that Areas A will remain zoned as R4 High Density Residential. Area B1 and B2 will generally maintain the same land use zoning (B4 Mixed-use Development), with the exception of some areas proposed to be rezoned to public open space. Area C is proposed to be rezoned to R4 High Density Residential.

Figure 4.1: Development Areas

Building heights are proposed to be increased as follows:

- Areas A and B2 will be increased from five (5) storeys to eight (8) storeys
- Areas C and B1 will be increased from three (3) storeys to eight (8) storeys.

Developments within the Mixed-use Development parts B1 and B2 will have the first two (2) storeys as retail and commercial uses, with the remaining levels as residential dwellings.

Council has advised that the following Floor Space Ratios (FSRs) are to be used in calculating the Ingleburn CBD development yield:

- Residential: 2.7:1
- Retail and commercial: 1.7:1.

An average residential unit size of 100m^2 has been assumed for determining the future residential yield. This estimate aligns with the DPIE's Apartment Design Guide assumptions.

Figure 4.2 presents an assessment of how sites may be amalgamated to create 29 developments within the Planning Proposal area and future yields for these sites have been estimated in Table 4.1.

Source: Ingleburn CBD Planning Proposal

Figure 4.2: Amalgamated Development Sites

Table 4.1: Estimated Yield by Development Site

Development Number	Zone	Site Area (m^2)	Residential			Commercial			
			FSR	GFA (m^2)	Units	FSR	Proposed GFA (m^2)	Existing GFA (m^2)	Net GFA (m^2)
1	R4	7475	2.7	20183	202				
2	R4	5068	2.7	13684	137				
3	R4	13105	2.7	35384	354				
4	R4	5002	2.7	13505	135				
5	R4	7372	2.7	19904	199				
6	R4	2705	2.7	7304	73				
7	B4	18321	2	36642	366	1.7	31146	18500	12646
8	B4	3157	2	6314	63	1.7	5367	3200	2167
9	B4		2			1.7			
10	B4	2453	2	4906	49	1.7	4170		4170
11	B4	2367	2	4734	47	1.7	4024		4024
12	R4	2982	2.7	8051	81				
13	R4	4476	2.7	12085	121				
14	B4	2877	2	5754	58	1.7	4891		4891
15	B4	1384	2	2768	28	1.7	2353		2353
16	B4	2243	2	4486	45	1.7	3813	3200	613
17	B4	2844	2	5688	57	1.7	4835	1400	3435
18	B4	6158	2	12316	123	1.7	10469		10469
19	B4	1627	2	3254	33	1.7	2766		2766
20	B4	1344	2	2688	27	1.7	2285	2000	285
21	B4	1529	2	3058	31	1.7	2599	8600	-6001
22	B4	7812	2	15624	156	1.7	13280	4700	8580
23	R4	7209	2.7	19464	195				
24	R4	5527	2.7	14923	149				
25	R4	6723	2.7	18152	182				
26	R4	8923	2.7	24092	241				
27	R4	3530	2.7	9531	95				
28	R4	6364	2.7	17183	172				
29	R4	7492	2.7	20228	202				
30	R4	6700	2.7	18090	180.9				
				Total:	**3,800**		**91,997**	**41,600**	**50,397**

4.3 Future Road and Parking Scenarios

This study has assessed three (3) combined future road and parking scenarios as detailed in Table 4.2. The scenario maps are also included in **Appendix A**.

Table 4.2: Parking Scenarios

Scenario	On-Street Parking	Council Owned Parking	New Privately Owned Basement Parking	Road Closures
A	No change to existing	Loss of all parking shown below. Sufficient levels of parking at the location shown on the map to meet resulting need	No basement parking at the location shown below. Basement parking provided at all other locations at the rate otherwise determined by the study.	None
B	Removed from the locations shown on the map.	Loss of all parking shown below Sufficient storeys of parking at the location shown on the map to meet resulting need	No basement parking at the location shown below. Basement parking provided at all other locations at the rate otherwise determined by the study.	None
C	Removed from the locations shown on the map.	Loss of all parking shown below. Sufficient storeys of parking at the location shown on the map to meet resulting need	No basement parking at the location shown below. Basement parking provided at all other locations at the rate otherwise determined by the study.	Macquarie Road closed between Boots Ln and Cambridge Rd.

Scenario A

Scenario B

Scenario C

For the purposes of intersection analysis, Scenario A and Scenario B are the same and for the parking assessment Scenario B and Scenario C are the same.

4.4 Multideck Carpark

The Ingleburn CBD Planning Proposal includes provision for a 600-space multi-deck carpark to be located at 30-32 Carlisle Street at a cost of approximately $15 million. The purpose of this multideck carpark is to replace the Council-owned at-grade carparks within the Ingleburn CBD.

The multi-deck carpark site is currently occupied by a 440-space at-grade carpark. The intent is for a portion of the existing at-grade carpark to be redeveloped as public open space, as illustrated in Figure 4.3.

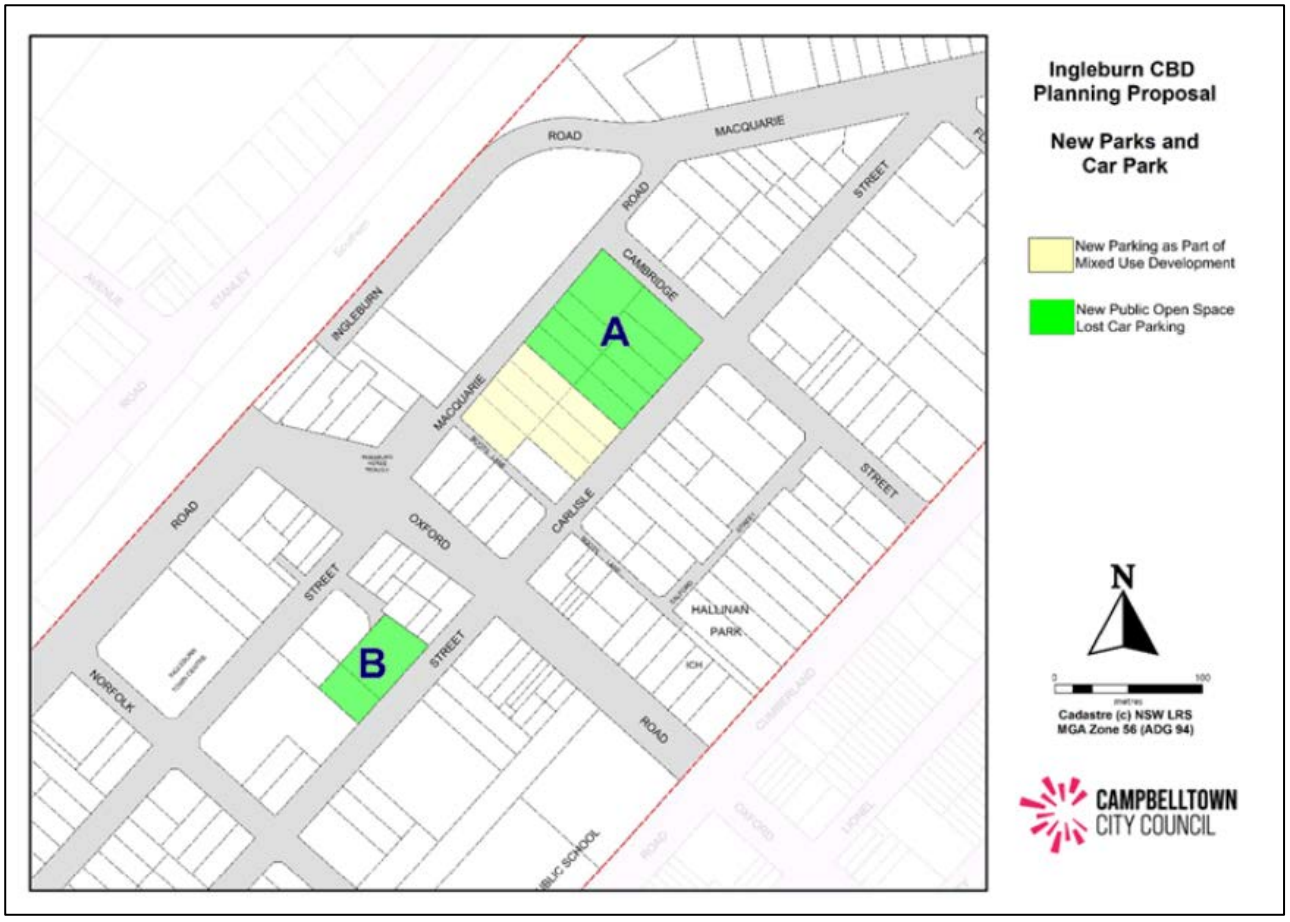


Figure 4.3: New Parks and Carpark

A concept sketch of a typical level in the car park has been included in **Appendix G**.

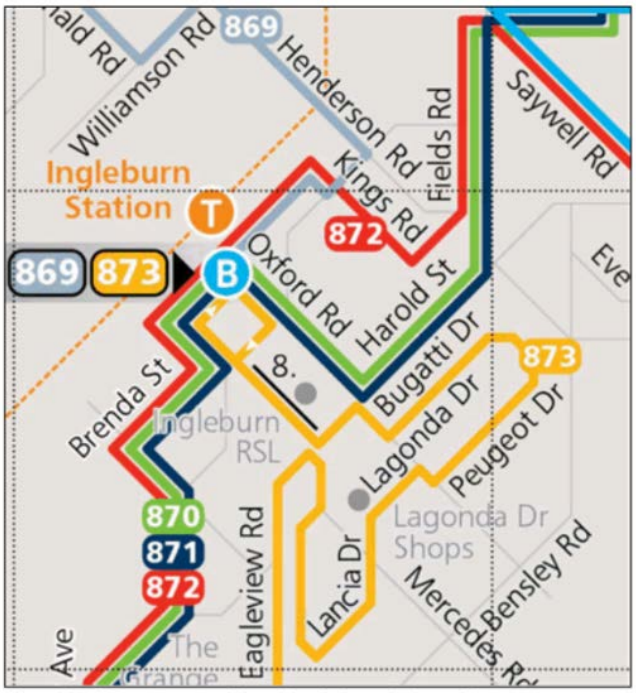
4.5 Public and Active Transport

4.5.1 Public Transport

The Ingleburn CBD is well serviced by public transport. The Ingleburn Railway Station is located to the west of the CBD and the station provides high frequency services to Sydney Airport and the Sydney CBD. Current services are:

- Route 869: Ingleburn to Liverpool via Edmondson Park and Prestons
- Route 870: Campbelltown to Liverpool via Ingleburn, Harrow Road and Glenfield
- Route 871: Campbeltown to Liverpool via Ingleburn, Glenfield and Leacocks Lane
- Route 872: Campbeltown to Liverpool via Ingleburn, Macquarie Fields and Glenfield
- Route 873: Ingleburn to Minto.

Increased service frequencies may be required to support the Ingleburn CBD development. It is recommended that Council continue to engage with TfNSW over time to ensure service frequencies meet demands.



Map 9: Bus routes Map, Ingleburn Town Centre

4.5.2 Active Transport

The NSW Department of Planning and Environment's Ingleburn Precinct study included a proposed Transport and Movement Plan for the Ingleburn CBD (see Figure 4.4). The plan shows three (3) cycling routes including:

- Two (2) regional routes, one (1) on Ingleburn Road and one (1) on Oxford Road
- A local route on Norfolk Street between Ingleburn Road and Cumberland Road.

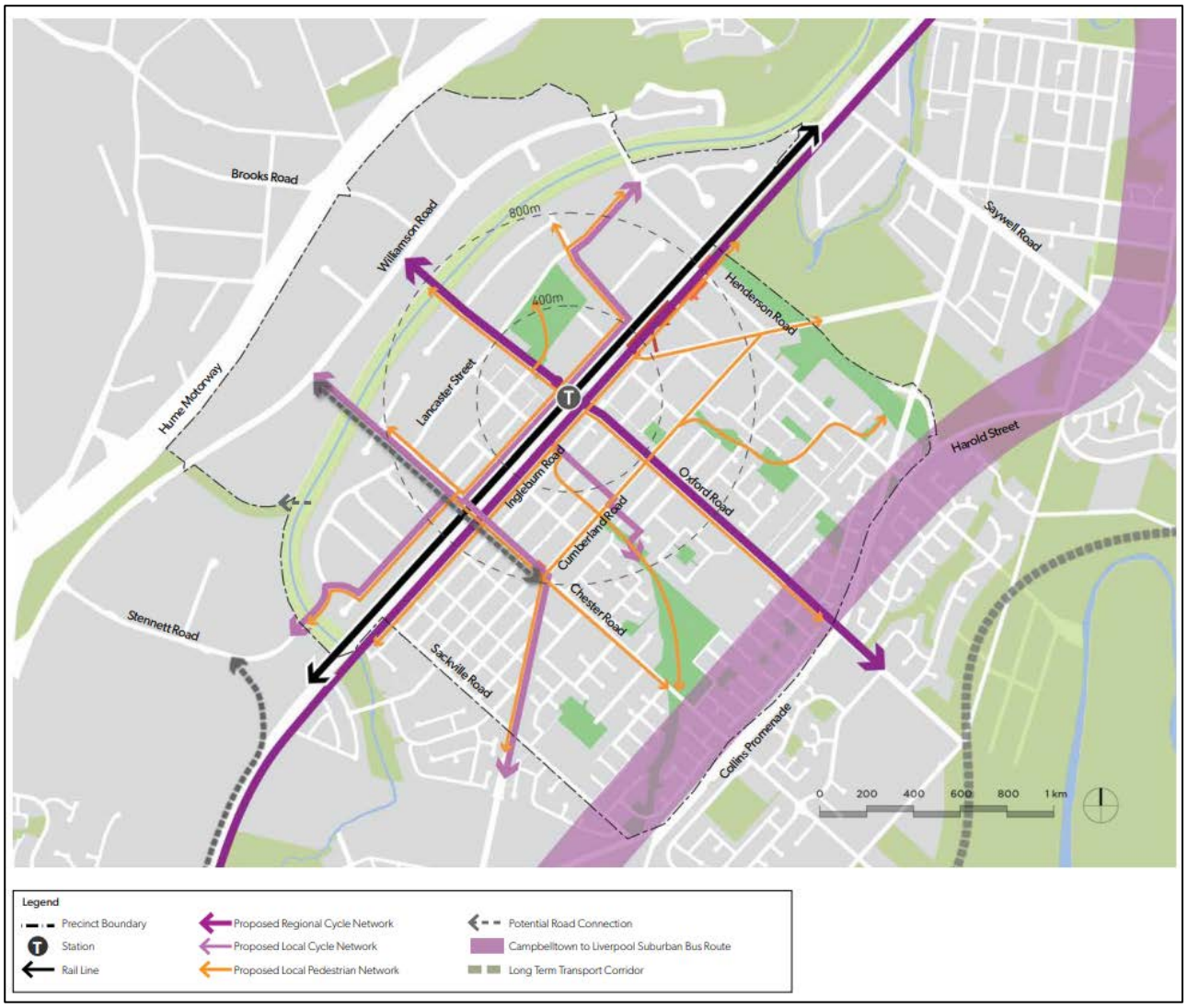
The future routes provide convenient access to the key attractors within the Ingleburn CBD, including the railway station and commercial and community uses on Oxford Road.

There does not appear to be the need for any other major regional facilities as a consequence of the Planning Proposal; however, local routes should continue to be planned and implemented opportunistically over time.

The following paved footpath widths are recommended for the future Ingleburn CBD:

- B4 Mixed-use Development zone – full width paved footpaths
- R4 High Density Residential zones – 2m wide paved footpaths.

These footpaths could be completed piecemeal as future developments are constructed.



Source: DPIE

Figure 4.4: Ingleburn Transport and Movement Plan

5. FUTURE INTERSECTION ASSESSMENT

5.1 Background Traffic Growth Assumptions

The year 2022 background traffic demands for the study area have been documented in Section 2. A review of these traffic demands, and the road network, suggests that the majority of traffic within the study area now is generated by land uses within the CBD and / or related to the 'mature' residential catchments to the north, south and east of the study area.

There are no arterial traffic routes through the study area that would carry significant traffic volumes from future greenfield developments or infill developments. Therefore, all future traffic growth in the study area can reasonably be assumed to be development-related, and no background traffic growth has been applied.

5.2 Development-Generated Traffic

5.2.1 Traffic Generation

The development-generated traffic has been estimated using the industry accepted rates published in the RTA Guide to Traffic Generating Developments and the supplementary RMS Technical Direction-Updated Traffic Surveys. Table 5.1 lists the peak hour traffic generation rates used for the assessment.

Table 5.1: Traffic Generation Rates

Land Use	Peak Hour Rate		Source
	AM	PM	
Centre Uses (Shopping Centre 70,000m^2 +)	4.0 vehicles per 100m^2 GLFA	4.0 vehicles per 100m^2 GLFA	RMS Technical Direction Updated Traffic Surveys
High Density Residential (Regional Average)	0.53 vehicles per dwelling	0.32 vehicles per dwelling	RMS Technical Direction Updated Traffic Surveys

The shopping centre rate has been used to estimate the traffic generated by the approximately 92,000m^2 GFA of retail and commercial uses located in the first two (2) levels of the mixed-use developments considering that the 'CBD' will function as one aggregate retail/commercial area.

The above traffic generation rates have been benchmarked against the existing parking demands estimated in **Section 3**. It was determined that the existing Ingleburn CBD peak parking demand is 1.5 spaces per 100m^2 GFA. Assuming that each parking space was used once during the peak hour, that is: one (1) vehicle entering the space and one (1) vehicle exiting the space, an estimated rate of 3 vehicles per 100m^2 GFA could be assumed for the existing Ingleburn CBD.

It Is likely that the existing trip generation rate is less than the estimated rate. The observed peak parking demands occurred during the middle of the day, not during the road peak hours. Therefore, the selected future rate of 4.0 vehicles per 100m^2 GLFA should be considered suitably conservative for this assessment.

The assessment has used the 'High density residential flat' dwelling rate associated with regional NSW range in lieu of the Sydney range. Ingleburn is located within the Greater Sydney Area, however, most of the sites selected in the RMS Updated Traffic Surveys are located closer to the Sydney CBD. Excluding those sites and using the Regional Rate is appropriate in this case.

Table 5.2 summarises the adopted directional traffic splits which are based on typical industry rates.

Table 5.2: Directional Traffic Splits

Land Use	AM Inbound	AM Outbound	PM Inbound	PM Outbound
Centre Uses	50%	50%	50%	50%
High Density Residential	20%	80%	70%	30%

Estimating future development-generated traffic has considered the net increase in retail and commercial GFA and added this traffic to current traffic demands to determine the (*notional 2036*) design traffic volumes.

The proposed residential development has been added on top, given that existing residential traffic generated by the CBD is very small. The total 'additional to 2022' development-generated traffic is shown in Table 5.3.

Table 5.3: Development-Generated Traffic, Study Area

Land Use	Net Yield	AM Trips	PM Trips
Centre Retail and Commercial	50,397m^2 GFA	2,016 veh/h	2,016 veh/h
High Density Residential	3,800 dwellings	2,014 veh/h	1,216 veh/h

5.2.2 Traffic Distribution

The future development traffic has been assigned to an 'access node' on the road network which corresponds to the location where each development would logically access the road network. These nodes are shown in Figure 5.1 along with the development sites allocated to each node.

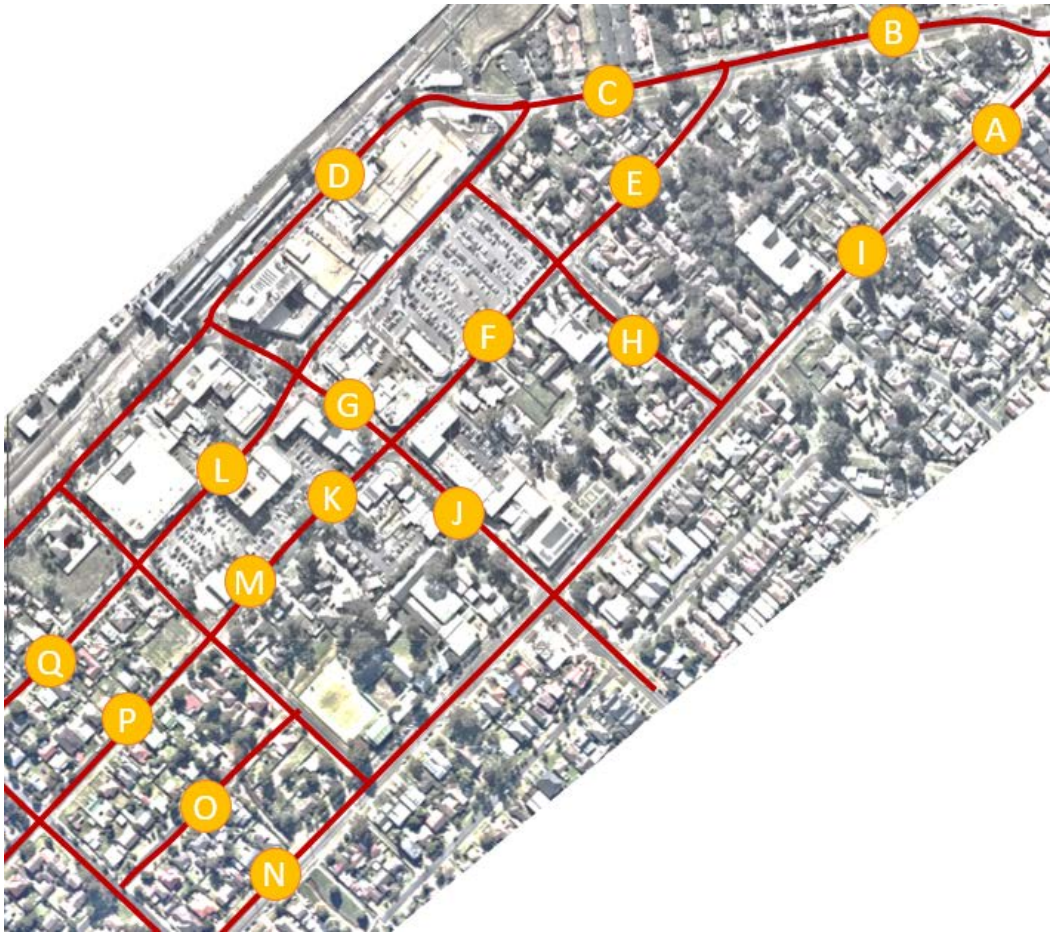


Figure 5.1: Development Access Nodes

The distribution of the traffic to / from the extremities of the study area have been based on the year 2022 traffic distributions. The external distribution percentages at the study area entry and exit points are shown in Figure 5.2.

Figure 5.2: External Traffic Distribution

5.2.3 Traffic Movements

Vehicle movement diagrams for the Planning Proposal development level have been prepared based on the traffic general and traffic distribution assumptions above and included in Appendix C.

Copies of these vehicle movement diagrams have been included an **Appendix C**.

5.3 Intersection Analysis Summary

Table 5.4 shows LoS at the existing intersection configurations under the future (with Planning Proposal development) traffic demands and Table 5.5 shows the DoS. DoS demonstrates if an intersection approach is carrying more demand than its capacity with DoS greater than 1.0. For roundabouts, a DoS greater than 0.85 and for T intersections at DoS greater than 0.80 can highlight a potential capacity issue. LoS however, is related to average delay for signalised intersections and most movement delay for roundabouts and priority intersections. LoS E shows typically-excessive delays and LoS F shows usually unacceptable delays.

Table 5.4: Full Development (2036) Traffic on Existing Configurations by Scenario, LoS

ID	Intersection	AM Peak Hour		School PM Peak Hour		Commuter PM Peak Hour	
		A&B	C	A&B	C	A&B	C
1	Henderson Road/Macquarie Road Roundabout	A	A	C	C	B	B
2	Macquarie Road/Cumberland Road/Kings Road Roundabout	F	F	B	C	F	C
3	Macquarie Road/Carlisle Street Intersection	F	F	F	F	F	F
4	Macquarie Road/Ingleburn Road Intersection	A	A	A	A	A	A
5	Macquarie Road/Cambridge Street Intersection	A	-	A	-	A	-
6	Carlisle Street/Cambridge Street Roundabout	A	A	A	A	A	A
7	Cambridge Street/Cumberland Road Intersection	D	E	C	C	C	C
8	Oxford Road/Cumberland Road Signalised Intersection	B	B	B	B	B	B
9	Oxford Road/Carlisle Street Roundabout	A	A	C	D	A	B
10	Oxford Road/Macquarie Road/Nardoo Street Roundabout	A	A	A	A	A	A
11	Oxford Road/Ingleburn Road Roundabout	A	A	A	A	A	A
12	Norfolk Street/Ingleburn Road Roundabout	A	A	A	A	A	A
13	Norfolk Street/Nardoo Street Roundabout	A	A	A	A	A	A
14	Norfolk Street/Carlisle Street Roundabout	A	A	A	A	A	A
15	Norfolk Street/Cumberland Road Intersection	F	D	F	E	F	E
16	Suffolk Street/Carlisle Street Roundabout	A	A	A	A	A	A
17	Suffolk Street/Nardoo Street Roundabout	A	A	A	A	A	A

Table 5.5: 2036 Traffic on Existing Configurations by Scenario, DoS

ID	Intersection	AM Peak Hour		School PM Peak Hour		Commuter PM Peak Hour	
		A&B	C	A&B	C	A&B	C
1	Henderson Road/Macquarie Road Roundabout	0.64	0.63	**1.04**	**1.03**	0.83	0.83
2	Macquarie Road/Cumberland Road/Kings Road Roundabout	**1.55**	**1.67**	**1.00**	**1.06**	**1.01**	**1.06**
3	Macquarie Road/Carlisle Street Intersection	**2.15**	**1.92**	**1.91**	**1.88**	**1.67**	**1.69**
4	Macquarie Road/Ingleburn Road Intersection	0.43	0.36	0.29	0.22	0.26	0.20
5	Macquarie Road/Cambridge Street Intersection	0.10	-	0.14	-	0.12	-
6	Carlisle Street/Cambridge Street Roundabout	0.44	0.44	0.73	0.73	0.72	0.72
7	Cambridge Street/Cumberland Road Intersection	0.55	0.60	0.41	0.44	0.37	0.40
8	Oxford Road/Cumberland Road Signalised Intersection	0.75	0.79	0.80	0.82	0.75	0.84
9	Oxford Road/Carlisle Street Roundabout	0.40	0.39	**1.02**	**1.02**	0.75	0.75
10	Oxford Road/Macquarie Road/Nardoo Street Roundabout	0.13	0.08	0.19	0.11	0.16	0.11
11	Oxford Road/Ingleburn Road Roundabout	0.27	0.27	0.27	0.27	0.27	0.27
12	Norfolk Street/Ingleburn Road Roundabout	0.19	0.19	0.23	0.23	0.23	0.23
13	Norfolk Street/Nardoo Street Roundabout	0.17	0.17	0.17	0.16	0.18	0.17
14	Norfolk Street/Carlisle Street Roundabout	0.37	0.36	0.43	0.42	0.42	0.42
15	Norfolk Street/Cumberland Road Intersection	**0.94**	0.80	**0.88**	0.79	**0.95**	**0.84**
16	Suffolk Street/Carlisle Street Roundabout	0.27	0.27	0.28	0.27	0.27	0.27
17	Suffolk Street/Nardoo Street Roundabout	0.15	0.17	0.16	0.15	0.21	0.15

The results indicate that there are minimal operational differences between the Scenario A & B and Scenario C. The same suite of mitigation works is required for all scenarios.

In summary, the 2036 traffic demands result in intersection performances beyond usually-acceptable performance measures at the following intersections (either DoS or LoS):

- **Intersection 1:** Henderson Road / Macquarie Road Roundabout
- **Intersection 2:** Macquarie Road / Cumberland Road / Kings Road Roundabout
- **Intersection 3:** Macquarie Road / Carlisle Street Intersection
- **Intersection 7:** Cambridge Street / Cumberland Road Intersection
- **Intersection 9:** Oxford Road / Carlisle Street Roundabout
- **Intersection 15:** Norfolk Street / Cumberland Road Intersection.

5.4 Intersection Upgrade Needs and Performance Results

The following upgrades are required cater for the future traffic demands:

- **Intersection 1:** Upgrade to a signalised intersection
- **Intersection 2:** Modifications to the exiting roundabout
- **Intersection 3:** Upgrade to signalised intersection
- **Intersection 7:** Upgrade to signalised intersection
- **Intersection 9:** Upgrade to signalised intersection
- **Intersection 15:** Upgrade to signalised intersection.

Figure 5.4 and shows the existing and upgraded configurations for intersections that have been identified for upgrade. A preliminary review of the upgrades using aerial photographs suggests that no third party property is required for any of the proposed upgrades.

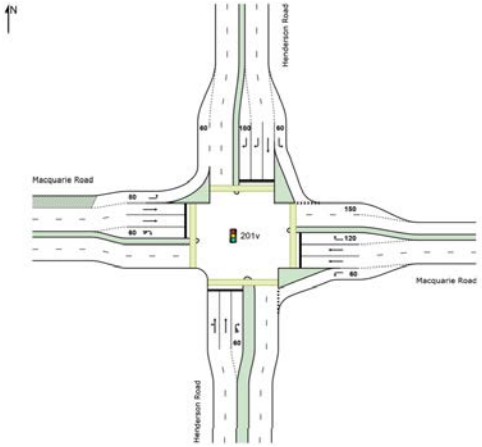
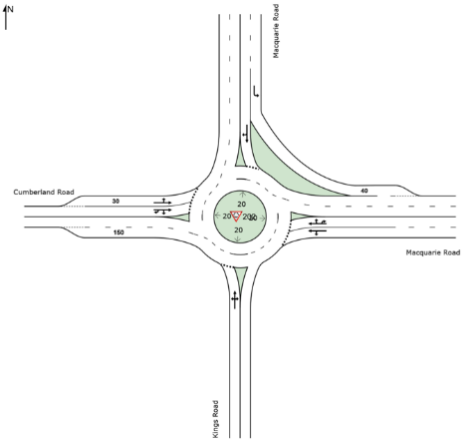
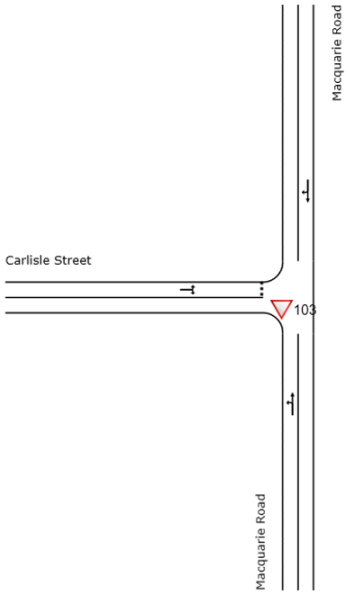
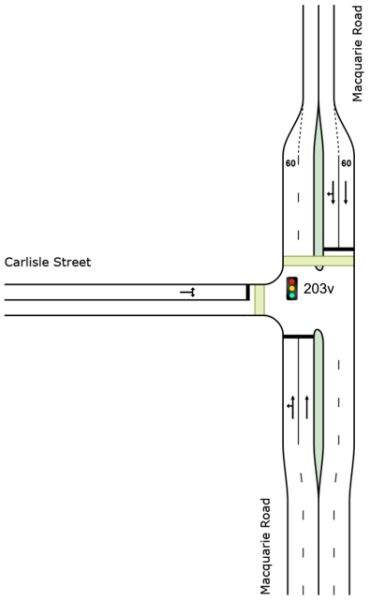
Intersection 1: Henderson Road / Macquarie Road	 **Existing Configuration**	 **Proposed Configuration**
Intersection 2: Macquarie Road / Cumberland Road / Kings Road	 **Existing Configuration**	 **Proposed Configuration**
Intersection 3: Macquarie Road / Carlisle Street	 **Existing Configuration**	 **Proposed Configuration**

Figure 5.3: Intersections 1, 2 and 3 Upgrades

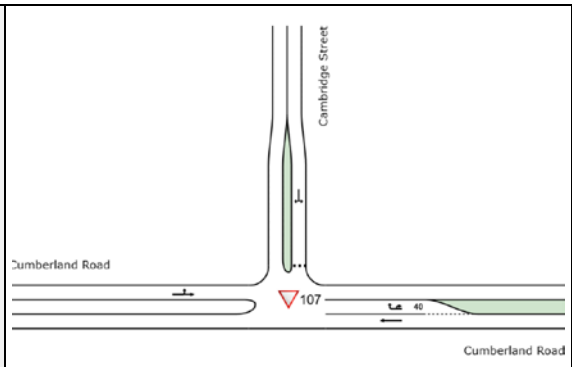
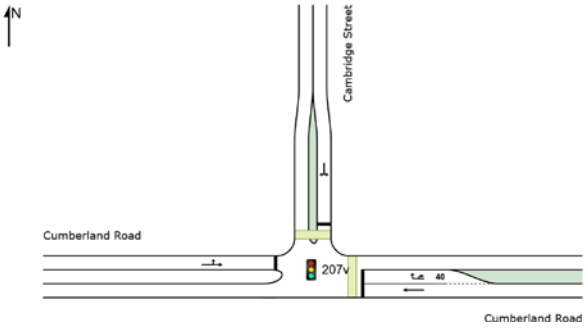
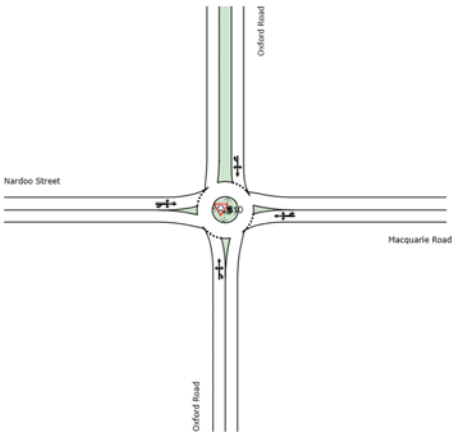
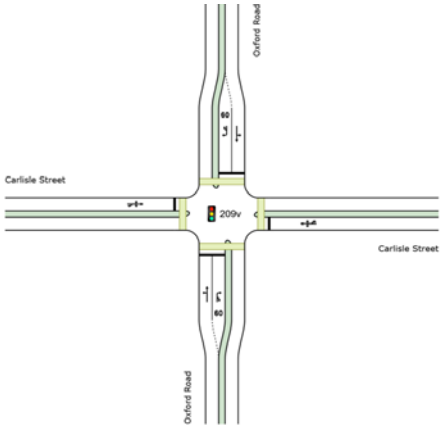
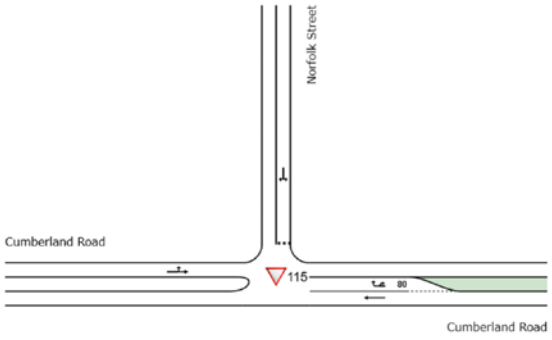
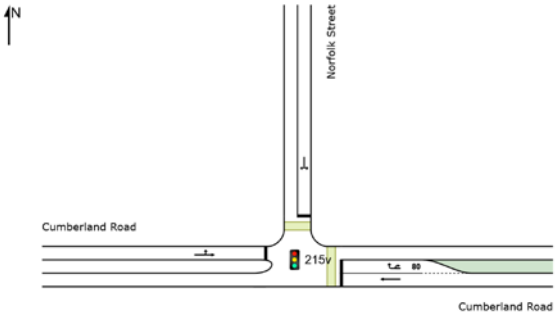
Intersection 7: Cambridge Street / Cumberland Road Intersection	 **Existing Configuration**	 **Proposed Configuration**
Intersection 9: Oxford Road / Carlisle Street	 **Existing Configuration**	 **Proposed Configuration**
Intersection 15: Norfolk Street / Cumberland Road	 **Existing Configuration**	 **Proposed Configuration**

Figure 5.4: Intersections 7, 9 and 15 Upgrades

Table 5.6 illustrates the Level of Service (LoS) and Table 5.7 illustrates the Level of Service (DoS) experienced by the upgraded intersection configurations under the future traffic demands.

Table 5.6: Table Summary of Upgraded Intersection Performance, LoS

ID	Intersection	AM Peak Hour		School PM Peak Hour		Commuter PM Peak Hour	
		A&B	C	A&B	C	A&B	C
1	Henderson Road / Macquarie Road Signalised Intersection	C	C	D	D	D	D
2	Macquarie Road / Cumberland Road / Kings Road Roundabout	A	A	B	B	A	A
3	Macquarie Road / Carlisle Street Signalised Intersection	B	B	B	B	B	B
7	Cambridge Street / Cumberland Road Signalised Intersection	B	B	B	B	A	B
9	Oxford Road / Carlisle Street Signalised Intersection	B	B	B	B	B	B
15	Norfolk Street / Cumberland Road Signalised Intersection	B	B	B	B	B	B

Table 5.7: Summary of Upgraded Intersection Performance, DoS

ID	Intersection	AM Peak Hour		School PM Peak Hour		Commuter PM Peak Hour	
		A&B	C	A&B	C	A&B	C
1	Henderson Road / Macquarie Road Signalised Intersection	0.89	0.89	0.88	0.87	0.89	0.89
2	Macquarie Road / Cumberland Road / Kings Road Roundabout	0.57	0.58	0.71	0.75	0.66	0.69
3	Macquarie Road / Carlisle Street Signalised Intersection	0.52	0.51	0.69	0.68	0.67	0.67
7	Cambridge Street / Cumberland Road Signalised Intersection	0.81	0.81	0.86	0.85	0.69	0.85
9	Oxford Road / Carlisle Street Signalised Intersection	0.52	0.55	0.79	0.76	0.73	0.78
15	Norfolk Street / Cumberland Road Signalised Intersection	0.88	0.84	0.75	0.69	0.74	0.77

In summary, the upgrades proposed ensure that each intersection operates below its practical capacity at full development (notionally 2036). It is acknowledged that Intersection 1 operates at LoS D during the PM peak hour scenarios. This is considered acceptable for this intersection due to the long cycle times.

It is acknowledged that the interface between Intersection 1 and Intersection 2 could create issues for the existing configuration of the Macquarie Road / Gordon Avenue left-in / left-out intersection. These issues should be addressed during detailed design development.

5.5 Upgrade Impacts to On Street Parking

The proposed intersection upgrades would impact the on-street parking supply both within and outside the parking study area. These impacts include:

- The proposed Intersection 1 upgrade would not impact on-street parking within the study area however, it will impact the Macquarie Road eastern approach, resulting in a loss of approximately 13 parking spaces
- The proposed Intersection 2 upgrade would not impact on-street parking within the study area however, it will impact the Macquarie Road western approach, resulting in a loss of approximately 30 parking spaces. Three (3) parking spaces would also be lost on the eastern side of the Cumberland Road approach.
- The proposed Intersection 4 upgrade would not impact on-street parking within the study area however, it will impact the Macquarie Road northern approach, resulting in a loss of approximately 20 parking spaces. The loss of these spaces is consistent with the Scenario B and Scenario C parking restrictions.
- The proposed Intersection 9 upgrade would impact on-street parking within the study area. The upgrade would result in the loss of approximately 14 parking spaces on the Oxford Road south approach and approximately 30 spaces on the Oxford Road north approach.

A total of 44 on-street parking spaces would be removed from the parking study area. It should be noted that these parking spaces would only be removed once the adjacent intersection is upgraded, at which time the fronting lot will likely have been redeveloped.

5.6 Upgrade Timeframes

Table 5.8 provides an estimate of the upgrade timings for each intersection. This estimate has been based on a constant linear increase in traffic demands and does not consider the sequencing of individual development sites. Specific intersection works items may be required before the years shown should development occur faster or in a more locally concentrated form.

Table 5.8: Estimated Upgrade Timings

ID	Intersection	Upgrade Timing Estimate
1	Henderson Road / Macquarie Road Signalised Intersection	2031 - 2036
2	Macquarie Road / Cumberland Road / Kings Road Roundabout	2026 - 2031
3	Macquarie Road / Carlisle Street Signalised Intersection	2026 - 2031
7	Cambridge Street / Cumberland Road Signalised Intersection	2031 - 2036
9	Oxford Road / Carlisle Street Signalised Intersection	2026 - 2031
15	Norfolk Street / Cumberland Road Signalised Intersection	2031 - 2036

6. FUTURE PARKING NEEDS

6.1 Overview

The Ingleburn CBD is anticipated to see a considerable increase in both residential dwellings as well as retail and commercial uses. This section details the future parking needs associated with the retail and commercial uses and it is assumed that the resident parking will be accommodated within each building, as usually required by Council.

The parking assessment has considered the existing parking demands established in **Section 3.3**. These demands, which were calculated in both absolute values and as per square metre rates have been used to estimate the future parking demands for the study area.

Scenario A and Scenarios B and C as detailed in **Section 4.3** have been used as a basis for the assessment and further sensitivity tests of these scenarios have considered:

- The impact of a full or reduced Development Control Plan parking rate for commercial uses
- The impact a full or reduced size multi-deck carpark.

6.2 Future Parking Demand Assumptions

A review of the existing parking demands has been presented in **Section 3.3**. The review considered the peak parking demands for the retail and commercial uses in the study area and compared this to the estimated floor area for existing retail and commercial uses in the study area. From this, an estimated parking rate of 1 space per 65m^2 GFA for retail and commercial uses was calculated.

It should be noted that the surveyed peak (on-street and off-street) parking demands were approximately 67% of the existing parking capacity.

For context, if the existing parking supply for the whole study area was at capacity, this would equate to an estimated parking rate of 1 space per 43m^2 GFA.

This assessment has estimated the future parking demands for the centre based on the existing revealed demand rate of 1 space per 65m^2 GFA. For sensitivity testing, a modified future parking demand has also been calculated using the 'at-capacity' parking rate of 1 space per 43m^2 GFA.

Table 6.1 presents the future peak parking demands for the Ingleburn CBD, by Scenario.

Table 6.1: Future Parking Demands

Parking Demand Scenario	Parking Demand Rate	Future Retail and Commercial Yield	Peak Parking Demands
Estimated Future Parking Demands	1 space per 65m^2 GFA	92,000m^2	1,415 spaces
Modified Future Parking Demands	1 space per 43m^2 GFA		2,139 spaces

6.3 Future Parking Supply Assumptions

6.3.1 Loss of On-street Parking Spaces from Intersection Upgrades

As noted in **Section 5.5**, the proposed intersection upgrades would impact the on-street parking supply both within and outside of the parking study area. These impacts include:

- A total of 44 on-street parking spaces would be removed from the parking study area.
- A total of 66 on-street parking spaces would be removed from outside the parking study area.

Considering these lost on-street parking spaces, the total on-street parking supply for each scenario is:

- **Scenario A:** 248 on-street parking spaces
- **Scenario B and C:** 98 on-street parking spaces.

6.3.2 Parking Supply Rates for Private Developments

The Campbelltown Development Control Plan (DCP) prescribes a parking rate for commercial uses in a B4 zone of 1 space per 25m^2 GFA on the ground floor and 1 space per 35m^2 GFA on the upper levels. As both the ground floor and single upper level of the commercial uses are the same area, this assessment has assumed a consolidated DCP rate of 1 space per 30m^2 GFA.

The DCP rate of 1 space per 30m^2 GFA exceeds the existing parking supply (at capacity) rate for the existing study area of 1 space per 43m^2 GFA. As such, the DCP rate could be considered overly conservative in terms of providing more spaces than are likely to be needed in aggregate, whilst they may be appropriate on a site-specific basis.

A reduced DCP rate has been used in the sensitivity testing. A reduced DCP rate of 1 space per 50m^2 GFA was selected for this purpose.

6.3.3 Council Multi-Deck Carpark

As detailed in Section 4.4, the Ingleburn CBD Planning Proposal includes a 600 space multideck carpark over 30-32 Carlisle Street. The purpose of this multideck carpark is to replace the Council-owned at-grade carparks within the Ingleburn CBD.

Many of the existing retail and commercial developments that use the Council carparks will be redeveloped with their own basement parking. A sensitivity test has been undertaken to determine if the scale of the multideck carpark could be reduced to a 300 space facility.

6.3.4 No Basement Parking Sites

The Ingleburn CBD Planning Proposal identifies two (2) development sites where basement parking cannot be provided due to flooding constraints. These areas are shown on Figure 6.1.

Figure 6.1: No Basement Parking Sites

These 'No Basement Parking' sites correspond to Development Site 16 and Development Site 20 in **Section 4.2.2**. These sites have the following yields:

- 72 apartments
- 6,100m^2 GFA.

Discussions with Council representatives indicate that the residential parking will likely be provided on a podium for each site, with the retail and commercial parking to be provided in the Council Multi-deck Carpark.

Table 6.2 presents the possible parking requirements for the 'No Basement Parking' Sites.

Table 6.2: Possible Parking Requirements for No Basement Parking Sites

Parking Demand Scenario	Parking Demand Rate	Future Retail and Commercial Yield	Peak Parking Demands
Estimated Future Parking Demands	1 space per 65m^2 GFA	6,1000m^2	94 spaces
Modified Future Parking Demands	1 space per 43m^2 GFA		142 spaces
DCP Parking Rates	1 space per 30m^2 GFA		204 spaces
Reduced DCP Parking Rates	1 space per 50m^2 GFA		122 spaces

In summary, the Council Multi-deck Carpark would need to provide between 94 and 204 spaces for the use by the 'No Basement Parking' Sites.

6.3.5 Future Private Off-street Parking Supply

Table 6.3 presents the possible parking requirements for the private basement parking areas based on the DCP and reduced DCP parking rates.

Table 6.3: Future Private Off-street Parking Supply

Parking Demand Scenario	Parking Demand Rate	Future Retail and Commercial Yield	Peak Parking Demands
DCP Parking Rates	1 space per 30m^2 GFA	85,900m^2	2,864 spaces
Reduced DCP Parking Rates	1 space per 50m^2 GFA		1,718 spaces

6.4 Scenario Testing

6.4.1 Scenarios

The future parking assessment has considered the following scenarios:

- Scenario A: No Changes to On-street Parking
  - Scenario A-1: DCP parking rates and 600 space multi-deck carpark
  - Scenario A-2: Reduced DCP parking rates and 600 space multi-deck carpark
  - Scenario A-3: Reduced DCP parking rates and 300 space multi-deck carpark.
- Scenarios B and C: Reduced Supply of On-street Parking
  - Scenarios B and C-1: DCP parking rates and 600 space multi-deck carpark
  - Scenarios B and C-2: Reduced DCP parking rates and 600 space multi-deck carpark
  - Scenarios B and C-3: Reduced DCP parking rates and 600 space multi-deck carpark.

6.4.2 Results

A summary of the results of the future parking scenario needs assessment is presented in Table 6.4.

Table 6.4: Future Parking Demand versus Supply Assessment

Variable	Scenario					
	A-1	A-2	A-3	B & C-1	B & C-2	B & C-3
Demand						
Future Parking Demand (Spaces)	1,415	1,415	1,415	1,415	1,415	1,415
Supply						
On-Street Spaces	248	248	248	98	98	98
Council Multi-deck Carpark Spaces	600	600	300	600	600	300
Council Spaces Sub-total	848	848	548	698	698	398
Private Basement Parking Spaces	2,864	1,718	1,718	2,864	1,718	1,718
Total (Spaces)	3,712	2,566	2,266	3,562	2,416	2,116
Surplus/Deficit						
Surplus Parking Spaces	2,297	1,151	851	2,147	1,001	701
Peak Parking Capacity	38%	55%	62%	40%	59%	67%

In summary, the proposed parking supply exceeds the anticipated demands in all tested scenarios. Therefore, there are no parking related issues that would restrict Council from providing any of the proposed infrastructure or policy measures.

As noted in Section 6.2, the calculated parking demands are based on a peak parking demand of approximately 67% for the existing Ingleburn CBD. The observed peak demand was lower than expected, with Council representatives advising they expected the parking system to be at capacity on the days of the survey. To address these concerns, a further sensitivity test was run using the modified future parking demand noted in Table 6.1. This modified rate represents a 'like-for like' proportional parking supply to the existing Ingleburn CBD. The results of the sensitivity test are presented in Table 6.5.

Table 6.5: Future Parking Demand versus Supply Assessment, Sensitivity Test

Variable	Scenario					
	A-1	A-2	A-3	B & C-1	B & C-2	B & C-3
Demand						
Future Parking Demand (Spaces)	2,139	2,139	2,139	2,139	2,139	2,139
Supply						
On-Street Spaces	248	248	248	98	98	98
Council Multi-deck Carpark Spaces	600	600	300	600	600	300
Council Spaces Sub-total	848	848	548	698	698	398
Private Basement Parking Spaces	2,864	1,718	1,718	2,864	1,718	1,718
Total (Spaces)	3,712	2,566	2,266	3,562	2,416	2,116
Surplus/Deficit						
Surplus Parking Spaces	1,573	427	127	1,423	277	-23
Peak Parking Capacity	58%	83%	94%	60%	89%	101%

In summary, the proposed parking supply is sufficient to meet the modified parking demands in all scenarios, excluding Scenario B & C-3 where a deficit of 23 parking spaces is predicted.

6.4.3 Results Interpretation

The assessment of likely parking demands versus supply associated with the Ingleburn CBD Planning Proposal has revealed:

- The assessment has presented two (2) peak parking demand scenarios for Council's consideration. The demand scenarios presented in Table 6.4 represent the observed parking occupancy documented in Section 3 of approximately 67%. The demand scenario presented in Table 6.5 represents a hypothetical current occupancy rate of 100%. Each rate is scaled proportionally to the increase in retail and commercial GFA in the future Ingleburn CBD to estimate the future peak parking demands
- The assessment based on the observed peak parking data suggests that Council could provide both the 300 space multi-deck carpark and reduced parking requirement for commercial uses in the Ingleburn CBD's mixed development zone and still maintain a surplus of parking spaces
- The assessment based on the hypothetical peak parking demand suggests that Council would need to provide the full 600 space multi-deck carpark and reduced parking requirement for commercial uses in the Ingleburn CBD's mixed development zone and maintain a surplus of parking spaces
- Noting the discussion on the impacts of COVID-19 on parking demands detailed in Section 3.4, it is likely that a significant proportion of the existing Ingleburn CBD parking supply was normally being used for rail commuter parking. Rail patronage has reduced by approximately 50% compared to pre-pandemic levels. Therefore, the sensitivity test presented in Table 6.5 is unlikely to represent retail and commercial demands only and should be considered excessively conservative
- The No Basement Parking Sites would require between 94 and 204 parking spaces to be accommodated within the multi-deck carpark. This suggests that the 300 space multideck carpark would be sufficient to meet this requirement.

Overall, the parking demand versus supply testing revealed that, even if rail commuter demand returned to 'normal':

- A 300 bay multi-deck car park is all that is needed
- A reduced parking rate for new retail / commercial development of 1 space per 50m^2 GFA could be implemented.

It should be noted that future growth in rail commuter parking demands, beyond returning to pre-COVID levels, has not been considered as part of this study. Future rail parking demands can only be forecast by strategic transport modelling undertaken by TfNSW. Importantly, no additional rail commuter parking demands would be generated by this planning proposal. All future developments considered in this study are within a convenient five- (5) or 10-minute walking catchment of the Ingleburn Railway Station and will not generate vehicle trips or parking demands for the station.

It is recommended the Council and TfNSW continue to monitor the parking demands at Ingleburn Railway Station and respond accordingly.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 Key Conclusions

The key conclusions drawn from the assessment of the Ingleburn CBD Planning Proposal and its intersection upgrade and parking needs are:

- The assessment of the existing (2022) background traffic found that all intersections operate either at LoS A or B, which is well within the usually accepted intersection delay threshold of LoS C/D.
- Considering the whole parking area, the existing (2022) demand profiles for on-street and off-street parking follow a similar pattern. Both area-types reach a peak demand near midday of approximately 65% of capacity on Thursday and 50% on Saturday
- No significant difference of usage percentages was noticed by parking control type. The demands generally follow the overall trends. Exceptions are the 1/4P type control area (with just 10 drop-off / pick-up bays) and unrestricted spaces
- The unrestricted parking areas on Ingleburn Road and Norfolk Street show demands typically associated with rail commuter patterns. These spaces were mostly occupied on Thursday before 7am and remained so after 5pm. Demands for these areas was low on Saturday. The spaces closest to the railway station access were generally occupied first
- The off-street parking areas adjacent to the major shopping centres, being Ingleburn Village and Ingleburn Town Centre, experienced high demands typical of commercial retail uses. These spaces experienced peak demands in the order of 80% or more on Thursdays
- The Ingleburn Village parking area also contains a supply of unrestricted parking spaces. These spaces reached a peak occupancy of 67%. It is expected that these spaces are primarily used by staff of both shopping centres
- On-street parking on Macquarie Road and Nardoo Street, which both front the major shopping centres, experienced demands slightly higher than the adjacent off-street parking areas. This suggests that these areas are utilised for quick trips to the centres and should be considered part of each centres overall supply
- Oxford Road functions as the ‘high street’ for the Ingleburn CBD. The on-street parking spaces on Oxford Road showed high occupancy levels but below their practical capacity
- On-street parking demands for Carlisle Road and Cambridge Street were moderate to low. These roads are on the fringe of the existing retail and commercial precinct and are not the most convenient options for accessing the precinct
- Overall, the parking system caters for a variety of purposes and durations. The system has spare capacity for all purposes and across all precincts within the study area and adequately meets the existing demands
- Considering both on-street and off-street demand, an estimated parking rate of 1 space per 65m^2 GFA for retail and commercial uses can be calculated from the existing parking demands. This rate excludes rail commuter and kiss ‘n’ ride demands
- Considering both on-street and off-street demand, an estimated parking rate of 1 space per 43m^2 GFA for retail and commercial uses can be calculated from the existing parking supply. This rate excludes the rail commuter and kiss ‘n’ ride parking spaces
- The Campbelltown Development Control Plan (DCP) prescribes a parking rate for commercial uses in a B4 zone of 1 space per 25 GFA on the ground floor and 1 space per 35 GFA on the upper levels.

- The assessment of the future 2036 traffic demands result in intersection performances beyond usually-acceptable performance measures at the following intersections (either DoS or LoS):
  - **Intersection 1:** Henderson Road / Macquarie Road Roundabout
  - **Intersection 2:** Macquarie Road / Cumberland Road / Kings Road Roundabout
  - **Intersection 3:** Macquarie Road / Carlisle Street Intersection
  - **Intersection 7:** Cambridge Street / Cumberland Road Intersection
  - **Intersection 9:** Oxford Road / Carlisle Street Roundabout
  - **Intersection 15:** Norfolk Street / Cumberland Road Intersection.
- The following upgrades are required cater for the future traffic demands:
  - **Intersection 1:** Upgrade to a signalised intersection
  - **Intersection 2:** Modifications to the exiting roundabout
  - **Intersection 3:** Upgrade to signalised intersection
  - **Intersection 7:** Upgrade to signalised intersection
  - **Intersection 9:** Upgrade to signalised intersection
  - **Intersection 15:** Upgrade to signalised intersection
- The upgrades proposed ensure that each intersection operates below its practical capacity at full development (notionally 2036)
- The future parking needs assessment has presented two (2) peak parking demand scenarios for Council's consideration. The observed demand scenarios represent the observed parking occupancy of approximately 67%. The alternative demand scenario represents a hypothetical current occupancy rate of 100%. Each rate is scaled proportionally to the increase in retail and commercial GFA in the future Ingleburn CBD to estimate the future peak parking demands
- The assessment based on the observed peak parking data suggests that Council could provide both the 300 space multi-deck carpark and reduced parking requirement for commercial uses in the Ingleburn CBD's mixed development zone and still maintain a surplus of parking spaces
- The assessment based on the hypothetical peak parking demand suggests that Council would need to provide the full 600 space multi-deck carpark and reduced parking requirement for commercial uses in the Ingleburn CBD's mixed development zone and maintain a surplus of parking spaces
- Noting the discussion on the impacts of COVID-19 on parking demands, it is likely that a significant proportion of the existing Ingleburn CBD parking supply was normally being used for rail commuter parking. Rail patronage has reduced by approximately 50% compared to pre-pandemic levels. Therefore, the sensitivity test presented in the alternative demand scenario is unlikely to represent retail and commercial demands only and should be considered excessively conservative
- The No Basement Parking Sites would require between 94 and 204 parking spaces to be accommodated within the multi-deck carpark. This suggests that the 300 space multideck carpark would be sufficient to meet this requirement.

7.2 Recommendations

As development occurs aligned with the Planning Proposal, it is recommended that Council upgrade the following intersections as needed based on where and to what level development progresses:

- Henderson Road / Macquarie Road to a signalised intersection
- The existing Macquarie Road / Cumberland Road / Kings Road roundabout
- Macquarie Road / Carlisle Street to a signalised Intersection
- Cambridge Street / Cumberland Road to a signalised intersection
- Oxford Road / Carlisle Street to a signalised Intersection
- Norfolk Street / Cumberland Road to a signalised intersection

It is also recommended that Council:

- Proceed with the design for a 300 bay multi-deck car park at 30-32 Carlisle Street, with potential for adding additional decks to achieve a 600 bay car park in the future (beyond the life of the Planning Proposal)
- Include provisions for a parking supply rate of 1 space per 50m^{2}GFA for commercial uses within the B4 Mixed-use Development zone within the Ingleburn CBD.

The recommendations are shown in Figure 7.1.

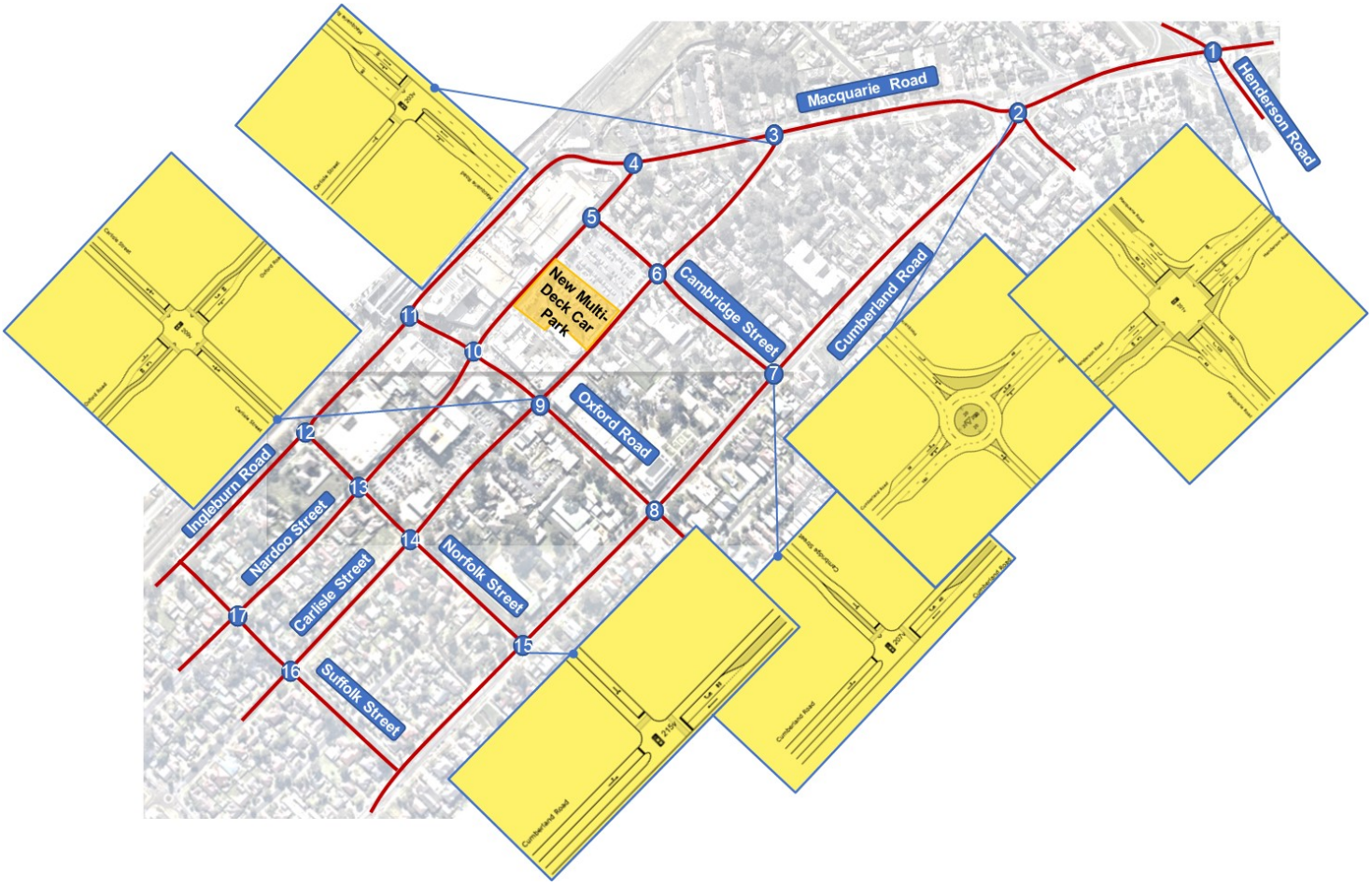


Figure 7.1: Key Recommendations

Appendix A: Proposed Scenario Plans

Appendix B: Traffic and Parking Survey Data

Appendix C: Vehicle Movement Diagrams

Appendix D: 2022 SIDRA Outputs

Appendix E: 2036 SIDRA Outputs

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Appendix F: Ingleburn CBD Parking Study

Appendix G: Multi-deck Carpark Typical Level