Traffix Group

Traffic Engineering Assessment

Proposed Amendment to Development Plan

Croydon Central, Croydon

Prepared for
Haben Property Fund Pty Ltd

December 2024

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Executive Summary

This Traffic Engineering Assessment considers the proposal to amend the approved Development Plan for Croydon Central.

Croydon Central subject to an existing Development Plan under Clause 43.03 – Schedule 6. This was implemented through a Planning Panel Process in 2013. A Development Plan prepared in accordance with this Clause was endorsed by Council on the 31st August, 2017.

The proposal is to amend the approved Development Plan. The amendments relate to Stage 2 of the project, which is the southern part of the site fronting Wicklow Avenue. The overall changes result in:

- An increase in commercial floor area of approximately 890m^2 to 23,348m^2 across the site (around 10% larger than the current approval).
- The addition of 116 apartments within podium levels.
- A similar number of car spaces overall at around 1,283 across all of Croydon Central.

The Stage 2 portion of the site had vehicle access to Kent Avenue and Wicklow Avenue, near Toorak Avenue. Car parking was to be within a two level open and undercroft carpark. The amended DP proposes a basement carpark, however the vehicle access arrangements and locations remain the same, with the only significant change being that right turn movements into the site at the Wicklow Avenue access will no longer be permitted.

The amended DP also includes consolidating the Kent Avenue access points to a smaller number of access points.

From a traffic generation perspective, the total volume of traffic forecast remains similar to that assessed in 2013 (as part of the original Planning Permit) and the approved Development Plan in 2017. This is summarised in the following table.

Characteristic	2013 Planning Permit	2017 DP Approval	2024 Amendment
Floor Area	24,641m^2 retail	22,458m^2 retail	23,348m^2 retail
Car spaces	1,622	1,351	1,283
Total Traffic Generation AM peak PM peak SAT peak	Not assessed 1,760 vph Not assessed	Not assessed in any detail as floor area had reduced from 2013 Planning Permit	998 vph 1,687 vph 2,054 vph

Of note is that the 116 apartments will generate up to 58 vehicles per peak hour, which is not significant in the context of the overall development.

From a traffic engineering perspective, the level of traffic generated and the vehicle access arrangements under the amended Development Plan are consistent.

Since the approval of the 2017 Development Plan, level crossing works have been undertaken to grade-separate the Coolstore Road level crossing and has been largely completed. This project involved elevating the rail line and reconstructing Croydon Station. This changes the road network adjacent to Croydon Central, with the principal changes of direct consequence to Croydon Central being:

- Conversion of the Wicklow Avenue/Kent Avenue roundabout to a signalised intersection.
- Creation of a new signalised intersection on Wicklow Avenue, opposite the main carpark access to Croydon Central approved under the 2017 Development Plan.

This report has assessed the traffic impacts of road network where the LXRP works have been completed.

In this situation, the Wicklow Avenue carpark access would form the fourth leg of the new signalised intersection proposed by LXRP to service the bus loop and commuter carpark under the main station. This access point has been subject to extensive discussion with Council and this access point includes:

- Creation of a central median along Wicklow Avenue.
- Vehicle access for Left-in/left-out and right-out traffic movements.
- A setback of the building along Wicklow Avenue to increase the space available for pedestrians and planting along Wicklow Avenue.
- Truck egress from the Coles loading bay, with trucks limited to the 12.5m long Heavy Rigid Vehicle.

A future planning permit application will explore the options to:

- pedestrian only phase,
- include a raised intersection treatment, and
- a 40km/h speed limit on Wicklow Avenue,

All three of these changes are subject to Department of Transport and Planning approval. The review of the pedestrian only phase contained in this report indicates that it may not be practically possible due to its impact on general traffic movements, however we recommend that this issue is re-explored as part of a planning permit application when the final development yield is known and traffic patterns have adjusted following completion of the LXRP works.

The detailed traffic analysis demonstrates that the expansion of Croydon Central can be accommodated by the local road network.

The two new signalised intersections installed by LXRP along Wicklow Avenue provide a high level of pedestrian connectivity between Croydon Central and Croydon Station. These works mean that the previously proposed mid-block signalised pedestrian crossing of Wicklow Avenue under the 2017 Development Plan is no longer required.

Car parking numbers would be determined at the Planning Permit application stage however the amended Development plan (and this assessment) is based on the statutory car parking requirements of Clause 52.06-5 being met. This is consistent with previous planning for the site.

Bicycle parking numbers are not detailed at this time, which is acceptable given that the approval sort is for a Development Plan (not a detailed Planning Permit). The proposal is for the minimum requirements of Clause 52.34 to be met and our expectation is that at the Planning Permit stage, they would very likely be significantly exceeded.

Loading and waste collection are catered for on-site in locations that are fully separated from the main carpark and vehicle accessways. The on-site loading areas are designed to provide access by trucks up to the 12.5m long Heavy Rigid Vehicle (HRV) to service the Coles Supermarket on the site and smaller waste trucks as appropriate.

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1. Introduction

Traffix Group has been engaged by Haben Property Fund Pty Ltd to undertake a traffic engineering assessment for the proposal to amend the approved Development Plan for Croydon Central, Croydon.

2. Proposal

Croydon Central is subject to a Development Plan Overlay (Schedule 6 to Clause 43.04). A Development Plan prepared for Croydon Central is to be assessed against a series of objectives, with the following related directly to traffic engineering matters:

Access, Traffic and Parking Objectives

- *Measures should be adopted to minimise conflict between vehicles and pedestrian movement within the development and on the adjoining street network.*
- *Measures to improve pedestrian connections are encouraged including access for people with mobility impairment to public areas adjacent to the development, surrounding streets, the railway station and parking areas.*
- *Consideration for bicycle facilities, taxi zones and customer drop-off opportunities.*

Croydon Central has an approved Development Plan endorsed by Council on the 31st August, 2017.

The proposal is to amend the approved Development Plan.

The new Development Plan principally modifies Stage 2 with the objective to facilitate additional retail development and the addition of residential apartments. This traffic assessment considers the traffic impacts at the end of Stage 2.

A copy of the relevant plans is attached at Appendix A.

This report has also had detailed consideration of the planning Coolstore Road level crossing removal and reconstruction of Croydon Station. This project was initiated after the current Development Plan was approved.

2.1. Approved Development Plan

The site is subject to an existing Development Plan under Clause 43.03 – Schedule 6.

The original Development Plan for the site was endorsed on the 31st August, 2017. The endorsement package included a Traffic Report by One Mile Grid (OMG) dated March 2017.

While the Development Plan did not include a high level of detail regarding floor space yields and car parking, the appended Traffic Report did include such detail for the purposes of a traffic assessment (acknowledging that this is Development Plan and not a permit application and the yields are therefore indicative).

A summary of the approved Development Plan (from the endorsed OMG Traffic Report) is provided at Table 1 and is broken down into the two stages of the development proposed.

An extract of the final (end of Stage 2) site layout from the approved Development Plan is provided below. This also includes detail regarding the vehicle access arrangements envisioned for the site.

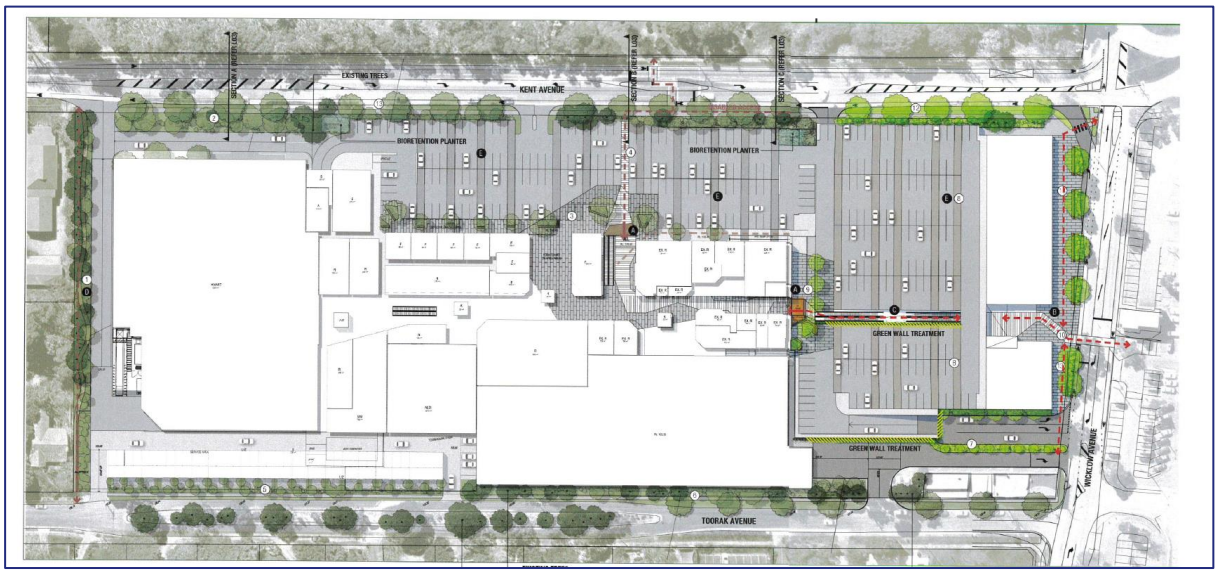

Figure 1: Approved Development Plan – Stage 2 Landscaping Plan

The key features of this approval from a traffic engineering perspective are:

- The consolidation of vehicle access points along Kent Avenue, with three access points proposed.
- An unsignalised, fully directional access point to Wicklow Avenue, near Toorak Avenue.
- A signalised pedestrian crossing of Wicklow Avenue (replacing the existing unsignalised crossing).
- Land on the south-east corner being set aside for a left-turn slip lane from Wicklow Avenue into Toorak Avenue.
- A new loading bay at the south-east corner, entered via Toorak Avenue and exited via a right-only exit to Wicklow Avenue.

Table 1: Development Summary of Approved Development Plan (Source: OMG Traffic Report appended to Approved Development Plan, stamped August 2017)

Characteristics	**Description**		
Uses	**Size/No.**	**Car Parking**	**Notes**
Stage 1			
Three-bedroom Townhouses	20	40 resident 5 visitor	2 car spaces / dwelling 0.125 car spaces / dwelling (for visitors)
Supermarket	6,035m^2	751	4.0 car spaces / 100m^2
Shop/Commercial	12,623m^2		
Car Parking Provision		**796**	Resident spaces provided within garages Retail parking provided at-grade across entire site
Stage 2			
Shop	3,800m^2	555	14.6 car spaces / 100m^2
Total			
Three-bedroom Townhouses	20	40 resident 5 visitor	2 car spaces / dwelling 0.125 car spaces / dwelling (for visitors)
Supermarket	6,035m^2	1,306	5.8 car spaces / 100m^2
Shop/Commercial	16,423m^2		
Car Parking Provision		**1,351**	
Other	**Notes**		
Vehicle Access	3 x fully directional access points to Kent Avenue, including right turn lanes and removal of on-street parking 1 x fully directional carpark access point towards the south-west corner of the site along Wicklow Avenue (including right turn lane) 1 x exit only access point from Wicklow Avenue for loading vehicles 1 x entry point from Toorak Avenue for loading vehicles 1 x entry and 1 x exit point to Toorak Avenue for the townhouses.		
Loading Provision	Loading for Stage 2 proposed on-site at the site's south-western corner, with entry via Toorak Avenue, and exit via Wicklow Avenue. Stage 1 loading area at the northern edge of the site via Kent Avenue.		
Additional Notes	A signalised pedestrian crossing from the station carpark to the main pedestrian entrance to the shopping centre of the Wicklow Avenue frontage. New left turn slip lane at the 'Wicklow Avenue' roundabout. New bicycle lanes on Wicklow Avenue.		

Following the endorsement of the Development Plan, a Planning Permit was issued for the subject site under Permit No. M/2017/456/C (amended 3rd January, 2018), which allowed for

part of Stage 1 and the inclusion of a childcare centre and restricted recreation facility within the former ALDI building (with ALDI moving into the main shopping centre building).

Two key parts of the Stage 1 expansion; further retail space (including a discount department store) and decked carpark on Kent Avenue have not commenced and no Planning Permit has been issued for these works.

2.2. Proposed Amendment

It is proposed to amend the Development Plan, which will alter Stage 2 of the development. This relates to the southern part of the site fronting Wicklow Avenue. A revised Development Plan (dated December, 2024) has been prepared for this application.

In addition to this, the applicant has provided us with an indicative Development Summary (dated 24th January, 2024), which details the proposed yields for each use.

Compared to the current Development Plan, this would allow for the approval of use and development that would include:

- The addition of 116 apartments.
- Increased retail floor space.
- The level of car parking within Stage 2 will be largely unchanged (reduction of 68 spaces), however the carpark layout will be provided within a basement configuration (rather than open and undercroft layout in the approved Development Plan).
- Changes to the Wicklow Avenue access so that vehicles can exit in both directions, but only enter via left turn (compared to fully directional access in the approved scheme).

An extract of the Stage 2 layout of the amended scheme is shown below.

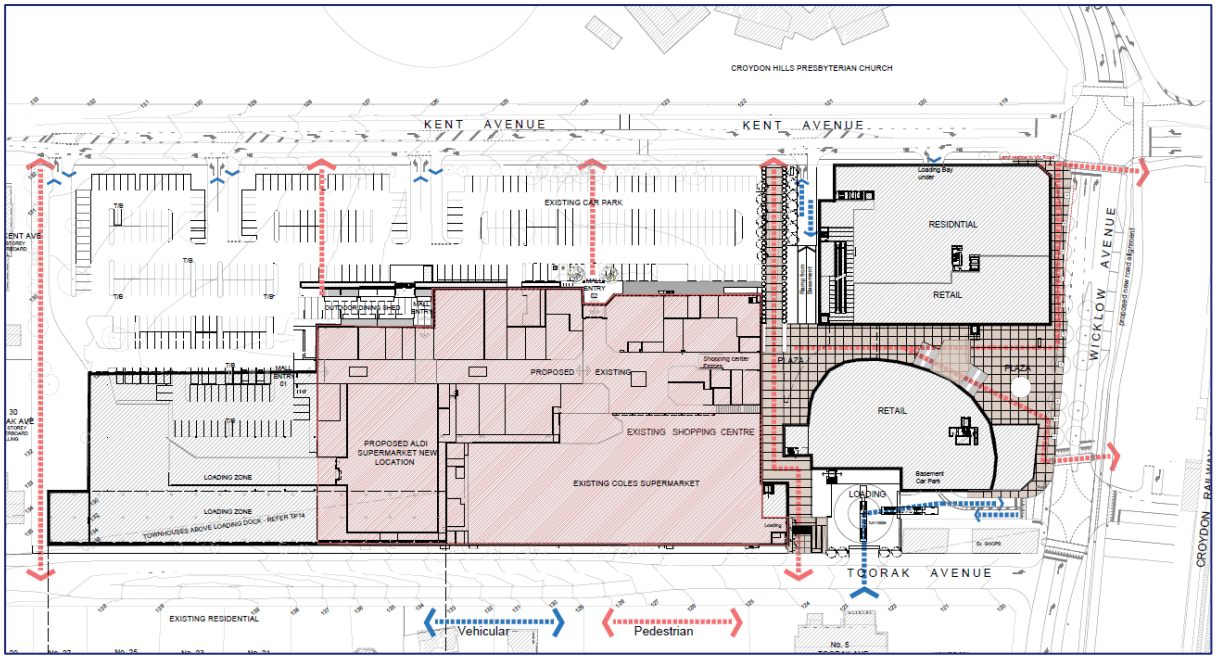

Figure 2: Revised Development Plan - Indicative Site Plan for Stage 2

Table 2: Development Summary of Proposed Amendment to Development Plan

Characteristics	Description		
Uses	**Size/No.**	**Car Parking**	**Notes**
Stage 1 - Unchanged			
Three-bedroom Townhouses	20	40 resident 5 visitor	2 spaces / dwelling 0.125 spaces / dwelling (for visitors)
Supermarket	6,035m^2	751	18,658m^2 total commercial floor space 4.0 car spaces / 100m^2
Shop/Commercial	12,623m^2		
Total		**796**	Resident car spaces provided within garages Retail parking provided at-grade across entire site
Stage 2			
Dwellings: One-Bedroom Two-Bedroom Three-Bedroom	 33 74 9	126 resident	Parking provided at a minimum of: 1 space per one or two-bedroom dwelling 2 spaces per three-bedroom dwelling No visitor parking for Stage 2 apartments
Shop/Commercial	4,690m^2	361	7.7 car spaces / 100m^2
Total		**487**	Car parking underneath the two podiums
Total			
Dwellings: One-Bedroom Two-Bedroom Three-Bedroom	 33 74 29	166 resident 5 visitor	
Supermarket	6,035m^2	1,112	23,348m^2 total commercial floor space 4.8 car spaces / 100m^2
Shop/Commercial	17,313m^2		
Total	136 dwellings 23,348m^2 commercial	**1,283**	
Other	**Notes**		
Vehicle Access	3 x fully directional access points to Kent Avenue, including channelised right turn lane from Kent Avenue at each point 1 x access point to Kent Avenue at the northern boundary of the site, which will be left in and left out only (with the exception of trucks) Loading bay access from Kent Avenue, restricted to left-in, left-out only 1 x access point towards the south-west corner of the site along Wicklow Avenue (includes loading bay exit, which will be restricted to left out only), which will allow left turn entry, and left and right turn exit (i.e. no right turn in) 1 x entry point from Toorak Avenue for loading vehicles		

Characteristics	Description
	1 x entry and 1 x exit point to Toorak Avenue for the townhouses, which will form a clockwise loop
Loading Provision	Loading is proposed on-site at the site's south-western corner, with entry via Toorak Avenue, and exit via Wicklow Avenue. Exit for trucks will be restricted to left out only at Wicklow Avenue. An additional loading bay will be provided along the northern side of the site, which will be accessed via the northmost access point to Kent Avenue. An additional loading bay is provided at the site's south-eastern corner with access via Kent Avenue.
Waste Collection	Waste collection within loading bays

2.3. Comparison of Proposed Schemes

The changes between the approved and amended scheme are set out in Table 3, broken up by Stages. Table 4 details changes between the approved and amended scheme as a whole.

Table 3: Comparison of Approved and Proposed Development Scheme (by Stage)

Use	No.	Car Parking Allocation	Car Parking Rate	No.	Car Parking Allocation	Car Parking Rate	Change / Notes
	Approved Scheme			**Proposed Scheme**			
Stage 1							
Three-bed dwelling	20	40	2/dwelling	20	40	2/dwelling	No change, already built
Visitors	20 (dwelling)	5	0.25/dwelling	20 (dwelling)	5	0.25/dwelling	
Supermarket	6,035m^2	751	4.0 spaces/ 100m^2	6,035m^2	751	4.0 spaces/ 100m^2	
Shop/Commercial	12,623m^2			12,623m^2			
Total Car parking		**796**			**796**		-
Stage 2							
One-bed dwelling	-	-	-	33	Min. 126	Min 1/one or two-bed apt. 2/three-bed apt.	+116 dwellings
Two-bed dwelling	-	-	-	74			
Three-bed dwelling	-	-	-	9			
Visitor	-	-	-	116 (dwelling)	-	-	-
Shop/Commercial	3,800m^2	555	14.6 spaces/ 100m^2	4,690m^2	Min. 361	7.7 spaces/ 100m^2	+890m^2 overall
Total Car Parking		**555**			**487**		**-68 car spaces**

Table 4: Comparison of Approved and Proposed Development Plan (Stages 1 and 2 combined)

Use	No.	Car Parking Allocation	Car Parking Rate	No.	Car Parking Allocation	Car Parking Rate	Change / Notes
	Approved Development Plan			Proposed Development Plan			
Residential							
One-bed dwelling	-	-	-	33	166	1.2 spaces/ dwelling	+116 dwellings
Two-bed dwelling	-	-	-	74			
Three-bed dwelling	20	40	2 spaces/ dwelling	29			
Visitor	20 (dwelling)	5	0.25 spaces/ dwelling	136 (dwelling)	5	0.04 space/ dwelling	No new visitor parking
Subtotal				*136*	*171*		
Commercial							
Supermarket	6,035m^2	1,306	5.8 spaces/ 100m^2	6,035m^2	1,112	4.8 spaces/ 100m^2	+890m^2
Shop	16,423m^2			17,313m^2			
Subtotal	*22,458m^2*	*1,306*		*23,348m^2 *Note*	*1,112*		
Total Car Parking		**1,351**			**1,283**		**-68 car spaces**
Notes: including gym and childcare centre areas							

The main changes between the schemes are as follows:

- The amended scheme includes an additional 116 apartments within the Stage 2 podium
- There is an additional 890m^2 of retail floor area
- A basement carpark will be provided below the Stage 2, with the overall number of car spaces being reduced by 68.
- The proposed access arrangements to the new carpark will be mostly unaltered, however rather than the Wicklow Avenue entry being fully directional, right turn in movements will not be permitted.

2.4. Access Strategy

The access arrangements proposed in the Development Plan amendment are shown below.

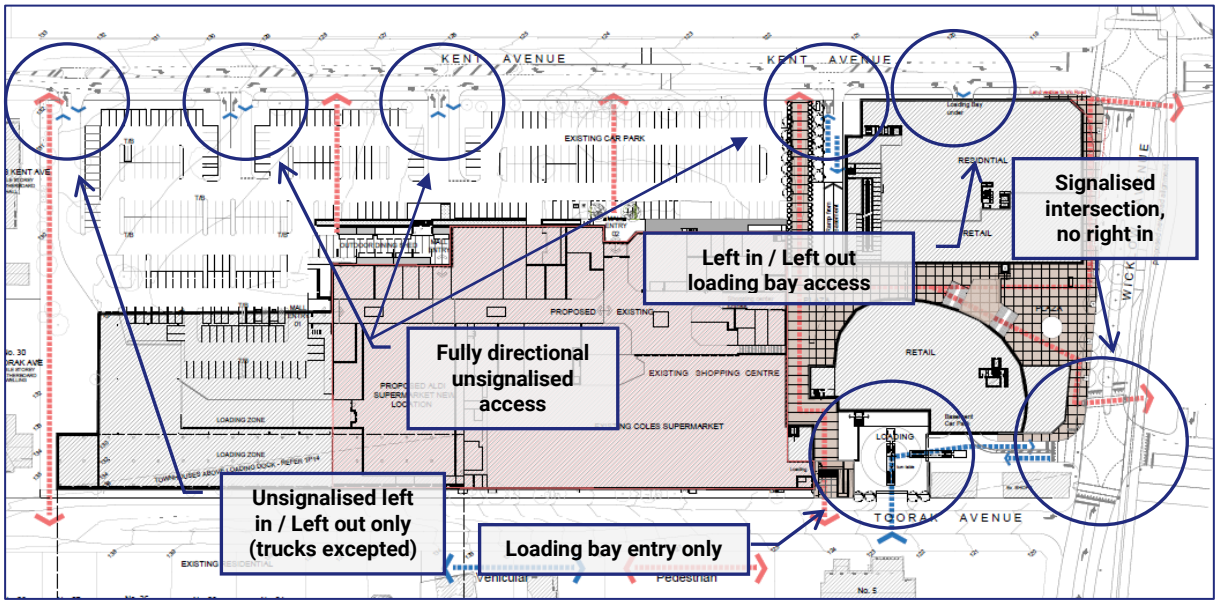

Figure 3: Proposed Access Arrangements of Development Plan

Overall the amended development plan proposes the following access arrangements to the site:

- To Kent Avenue:
  - Three fully directional unsignalised access points
  - A left in/left out access point (with the exception of trucks, which can enter/exit it all directions)
  - A left in / left out loading bay access
- A signalised intersection to Wicklow Avenue, which will allow left turn in, left turn out and right turn out, but no right turn in. This will be incorporated into the Croydon Station carpark intersection.
- An entry only loading bay access from Toorak Avenue.

These arrangements are generally consistent with the approved Development Plan, with the main exception being the Wicklow Avenue access being incorporated into the new signalised intersection with the Croydon Central carpark (following the LXRP works), and the restriction of right turn movements into this access point (fully directional access was to from Wicklow Avenue under the Approved Development Plan).

2.5. Level Crossing Removal

The Croydon Station level crossing (also known as the Coolstore Road crossing) has been scheduled for removal as part of the Level Crossing Removal Project (LXRP). At the time of writing, these works are nearing completing (i.e. the new intersections are operating, the level crossing has been removed and there are only minor landscaping works left to complete). The project will be completed by early 2025.

Figure 4 below illustrates the proposed changes to the road network surrounding the station as a part of the level crossing removal works. A larger version is attached at Appendix B.

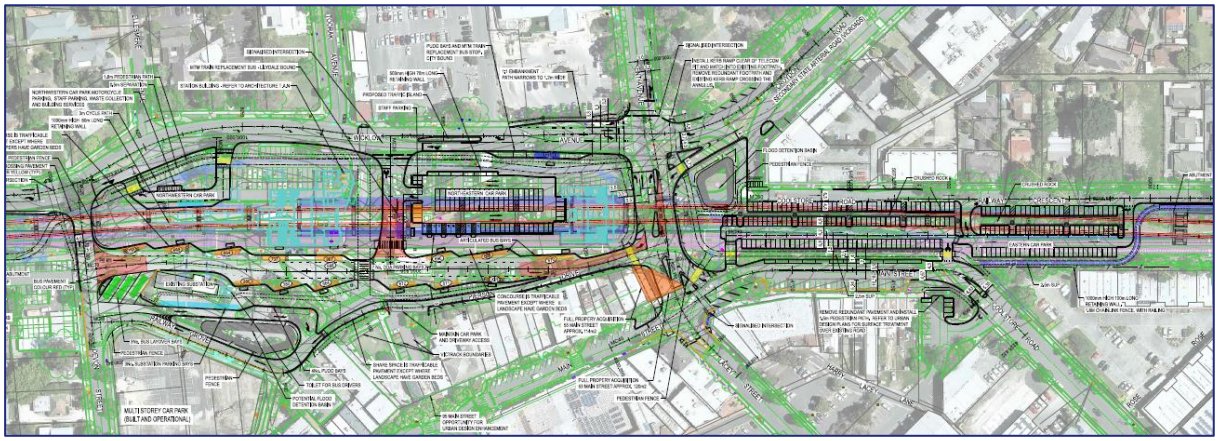

Figure 4: Coolstore Road Level Crossing Removal (source: LXRP)

The key elements of the works are as follows:

- The roundabout at Wicklow Avenue and Kent Avenue will be converted to a signalised intersection, which will also provide a more direct connection to Croydon Main Street under the rail line via Lacy Street, instead of Coolstore Road.
- A new signalised intersection on Wicklow Avenue at the Croydon Station carpark entrance, along with closing the existing access vehicle points to the car parking on the north side of the Station. This carpark access will also connect to a bus only road on its south side.
- The existing pedestrian crossing between Croydon Station and Croydon Central over Wicklow Avenue is not shown as being retained (it would be redundant with the two new sets of traffic signals discussed above).
- Devon Street to connect through to Wicklow Avenue at the western end of the Station, and be constructed as a signalised intersection.

- A new bus interchange will be provided along the south side of the rail line, connecting between Devon Street and Lacey Street (with a connection also to the Croydon Station carpark at its midpoint).

In the context of the subject site, the signalised intersection between Wicklow Avenue and the Croydon Station carpark will be opposite the fully directional Wicklow Avenue access to Croydon Central in the approved (and proposed) Development Plan, meaning that the Stage 2 carpark access/loading bay exit will need to be incorporated into the intersection as the north leg to the signalised intersection.

The approved Development Plan included a new signalised pedestrian crossing of Wicklow Avenue at the midpoint of the site's Wicklow Avenue frontage. With the changes to the station and two new signalised intersections proposed by the LXRP, this signalised pedestrian crossing would be redundant and is not part amended Development Plan.

The changes to the Wicklow Avenue/Kent Avenue intersection will mean that the previously approved left-turn slip lane will not proceed, to be instead replaced by a fully controlled, left turn lane.

Our assessment assumes that this project is complete before Stage 2 of Croydon Central.

3. Background

3.1. Wicklow Avenue Access

Council was initially opposed to vehicle access to the site via Wicklow Avenue, however through numerous discussions between Council and the applicant, an agreement was reached to achieve in-principal support for the Wicklow Avenue site access.

Council outlined the following conditions for its in-principal support in a letter dated 6th June, 2024:

- *Remove the proposed right turn lane from Wicklow Avenue (east approach) into the site and replace with a landscaped median with street tree planting.*
- *Limit the maximum size of trucks accessing the proposed loading dock to 12.5m long Heavy Rigid Vehicles (as previously advised by Traffix is proposed) and alter the design to ensure that these trucks can only exit (not enter) via the signalised intersection.*
- *Provide a raised platform within the signalised intersection to slow vehicles through the intersection and provide further priority, DDA and amenity benefits to pedestrians*[1].
- *Ensure that the property boundary on the northern side of Wicklow Avenue is setback into the site to provide additional space for pedestrian movements and street tree planting*[2].
- *Provide exclusive pedestrian phase at the intersection*[1].
- *Reduce in the signposted speed to 40km/hour*[1].

These changes are shown diagrammatically in the figure below.

1 *Council accepts that these revisions are subject to approval from DTP.*

2 *Council accepts that the Applicant is unable to widen the verge adjacent the existing building in the southwest corner of the site given it does not form part of the subject site. However, Council notes its expectation that if this property were to form part of the site, it would require the property boundary to be setback as shown in Figure 1.*

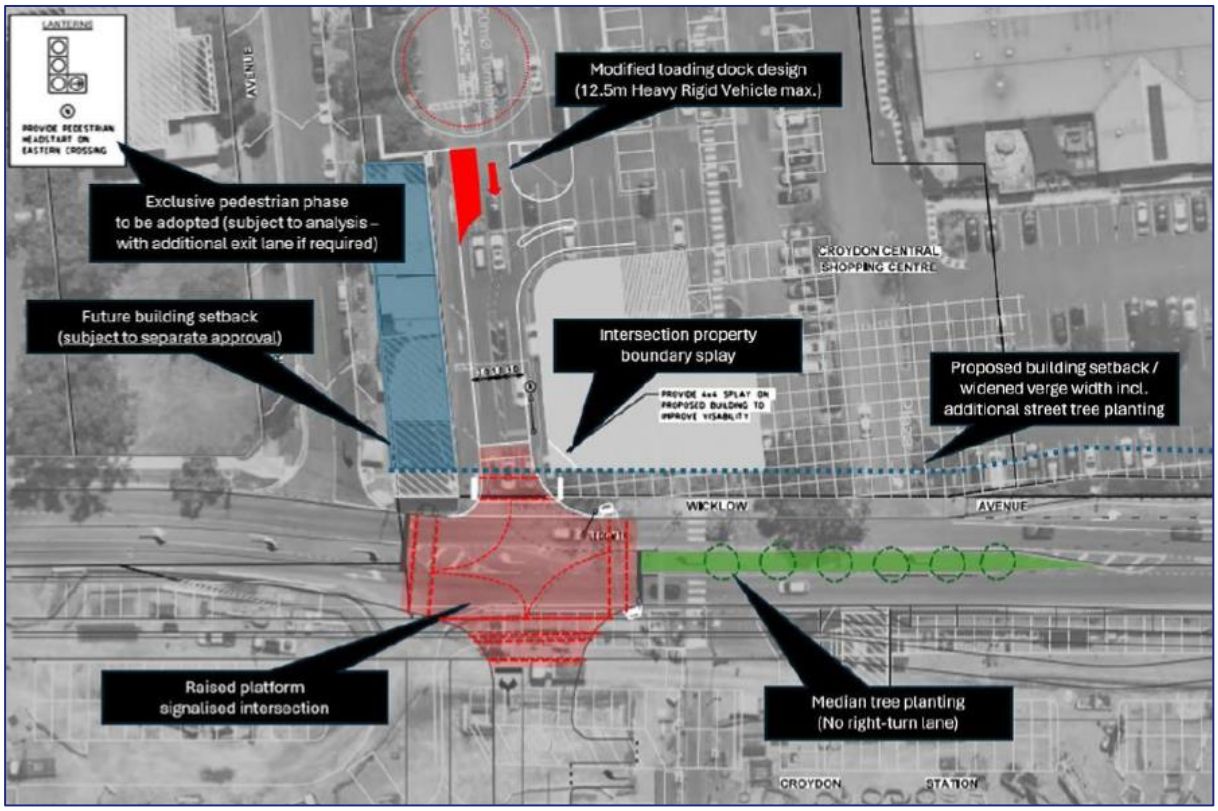

Figure 5: Council's 'Figure 1' Recommended Signalised Intersection Layout

We understand that the applicant generally accepts the above requirements, and an updated Concept Plan in accordance with the above requirements has been prepared by our office, and attached at Appendix A.

The requirements for a raised intersection treatment, exclusive pedestrian only phase and reduced speed limit are also subject to DTP approval (as acknowledged in Council's letter). The applicant will explore all these items with DTP as part of any future planning permit application. Section 5.5.8 of this report explores the feasibility of a pedestrian only in more detail.

In addition to this, Council requested the following:

- *Updated public realm plans showing the anticipated streetscape for Wicklow Avenue, including the revisions outlined in Figure 1 above. It is envisaged these plans would be prepared by Lat37.*
- *Updated traffic analysis of the road network which assesses the traffic redistribution resulting from the removal of the right turn from Wicklow Avenue into the Croydon Central site[3]. This analysis should also consider the feasibility of the exclusive pedestrian phasing*

[3] Council accepts that some intersection performance deterioration may occur at the Kent Avenue / Wicklow Avenue as a result of the removal of the right turn lane from Wicklow Avenue into the Croydon Central site. It is expected that this deterioration will be minor though and that the benefit of the central median / street planting will outweigh the loss of capacity. The traffic analysis does not need to include a with and without the right turn lane scenario and can simply focus on whether acceptable intersection performance is achieved without the proposed right turn lane

(or alternatively additional pedestrian priority) at the new signalised intersection. The analysis shall include the signalised access, the Kent Avenue / Wicklow Avenue signalised intersection, and the Kent Avenue southernmost vehicle access at a minimum. It is envisaged this analysis would be completed by Traffix.

- *An independent road safety review of the proposed network including the revisions outlined in Figure 1 above. This review should seek to identify any safety concerns and/or opportunities to improve the intersection / road design as part of the subsequent design development proposal. This review is principally sought to Council to provide confidence in the proposed design, rather than require revisions to the proposed vehicle access arrangements agreed 'in principle' in this letter. It is expected that this review would be completed by Road Safety Audits Pty Ltd or similar.*
- *Written confirmation that the Applicant accepts that the largest truck that will access the loading dock will be a 12.5m long Heavy Rigid Vehicle. This confirmation is sought as it is a critical requirement for Council to accept the revised design.*

An updated public realm plan has been prepared along with this application. The updated traffic analysis is provided at Section 5.5 of this report. This plan has been informed by an independent Road Safety Audit.

Lastly, as discussed in Section 5.4.1, the largest sized loading vehicle that will access the loading dock will be the 12.5m long Heavy Rigid Vehicle.

3.2. Kent Avenue Access

The Kent Avenue access point has been designed in consultation with Council's representative to achieve an outcome considered acceptable by all parties.

It is proposed to provide:

- 3 fully directional carpark access points to the site,
- a left in/left out access point (with the exception of trucks) at the northern corner of the site.
- A left in/left out loading bay access to Stage 2.

The provision of 3 fully directional access points to the site is consistent with the approved Development Plan, with the other two location primarily accommodating the loading arrangements to the site.

All of these fully directional access points have been designed with full length turn lanes.

Under the approved arrangements, the northmost access point allowed for right turn movements into the site, but did not provide a right turn lane (i.e. turning vehicles would therefore turn from the through lane). It is not possible to provide a right turn lane at this location, as Kent Avenue narrows in width to the north of the site.

Accordingly, a separate location to the south of the northmost access has been provided, which can accommodate a fully length right turn lane.

The provision of 3 separate locations allowing for right turn into and out of the site was considered necessary to ensure that the number of post-development vehicle trips at any

one access point does not exceed capacity. The scenario with only 2 locations allowing right turn movements was modelled in SIDRA, and found to not to provide safe and efficient access (see Section 5.5).

A Functional Layout Plan (FLP) of the Kent Avenue access has been prepared by our office and is attached at Appendix A. Other key elements of the FLP not discussed above include:

- Bicycle lanes will be provided on both sides of Kent Avenue
- The existing mid-block pedestrian crossing is being maintained. The future upgrade of this crossing would be completed by others.
- The bus stops on both sides of Kent Avenue to the immediate north of the Wicklow Avenue intersection will be removed/consolidated. This is due to the fact that the Croydon Station redevelopment provides a new bus interchange just south of this intersection, meaning that these existing stops within 150m of this interchange are now superfluous.

4. Existing Conditions

4.1. Subject Site

The subject site is Croydon Central, a shopping centre located at 5-15 Kent Avenue, Croydon. The table below summarises the key characteristics of the subject site.

Table 5: Subject Site Description

Characteristic	Description
Address	5-15 Kent Avenue, Croydon
Area	Approximately 45,000m^2
Frontages	340m to Kent Avenue, 290m to Toorak Avenue, 120m to Wicklow Avenue
Zoning	Commercial 1 Zone
Activity Centre	Croydon Activity Centre
Current use of site	Croydon Central – A Shopping Centre comprising approximately 11,627m^2 of commercial floor space for a variety of uses including: • Coles (Floor Area: 4,200m^2) • Aldi (Floor Area: 1,550m^2) • Mini Major (Floor Area: 876m^2) • Other Retail (Floor Area: 3,196m^2) • Gym (Floor Area: 350m^2) • Childcare Centre (Floor Area: 970m^2)
Car parking and loading provision	Total of approximately 629 car spaces Loading bay for Coles on the south side of the building Loading bay for Aldi located in the undercroft area at the north of the site
Vehicle access	5 x fully directional two-way crossovers to Kent Avenue 1 x two-way crossover to Wicklow Avenue at mid-point, which bans right turns out movements 1 x entry only crossover to Wicklow Avenue at south-west corner Separate entry and exit crossovers to Toorak Avenue for the townhouses
On-street parking along site frontage	11 x unrestricted car spaces along the site's frontage to Toorak Avenue 23 x unrestricted car spaces along the site's frontage to Kent Avenue
Key external pedestrian connections	Pedestrian path from Wicklow Avenue to the southern side of Croydon Central, linking to an unsignalised pedestrian crossing of Wicklow Avenue to Croydon Station Two separate pedestrian paths from Kent Avenue to the eastern side of the Croydon Central

A locality plan, aerial photograph and land use zoning map is provided at Figure 6 to Figure 8.

Significant nearby land uses include:

- **Croydon Railway Station** located opposite the site on Wicklow Avenue.
- **Croydon Primary School** located opposite the site on Kent Avenue.
- **Croydon Park** located 200m south of the site.
- **Melba Secondary College** located 550m north of the site.

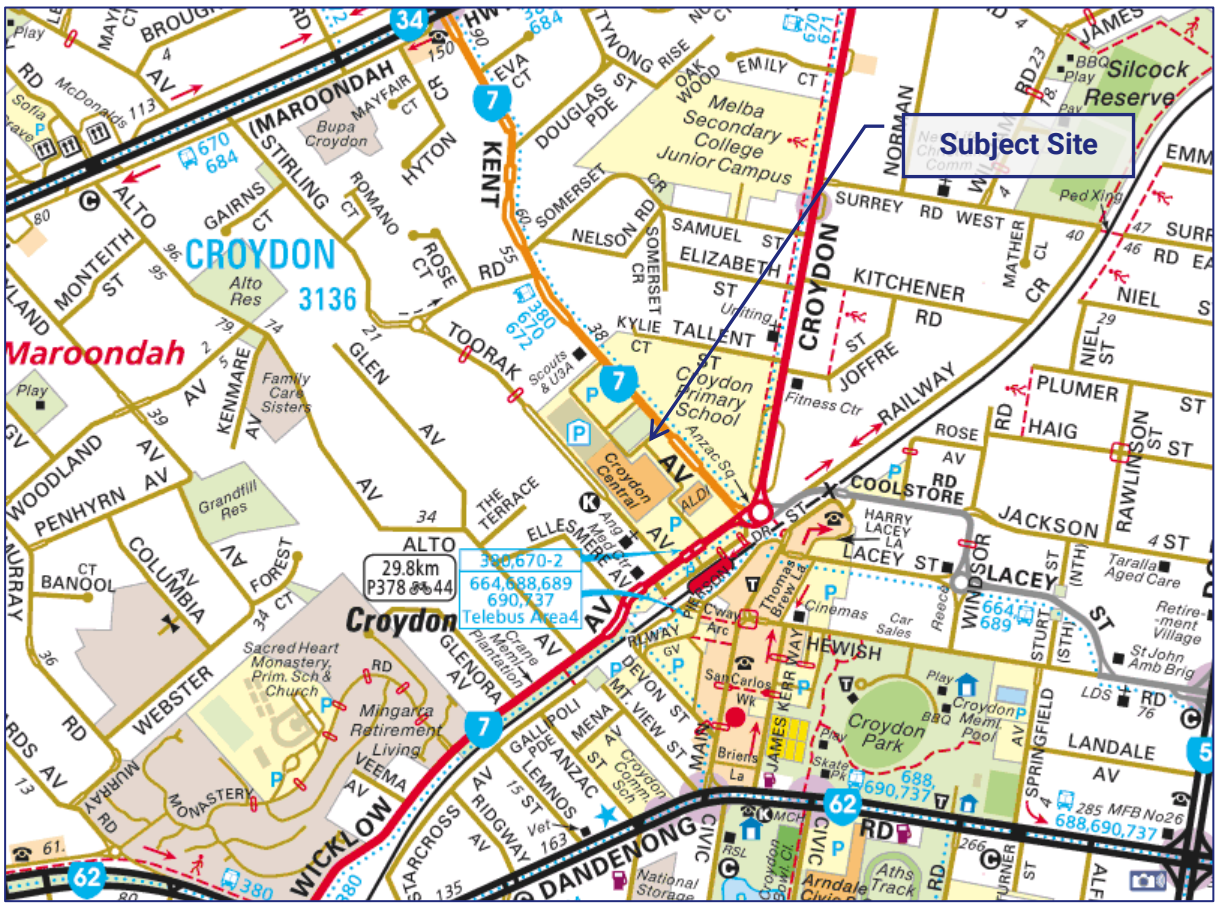

Figure 6: Locality plan (Source: Melway)

Figure 7: Aerial photograph of subject site (Source: Nearmap.com)

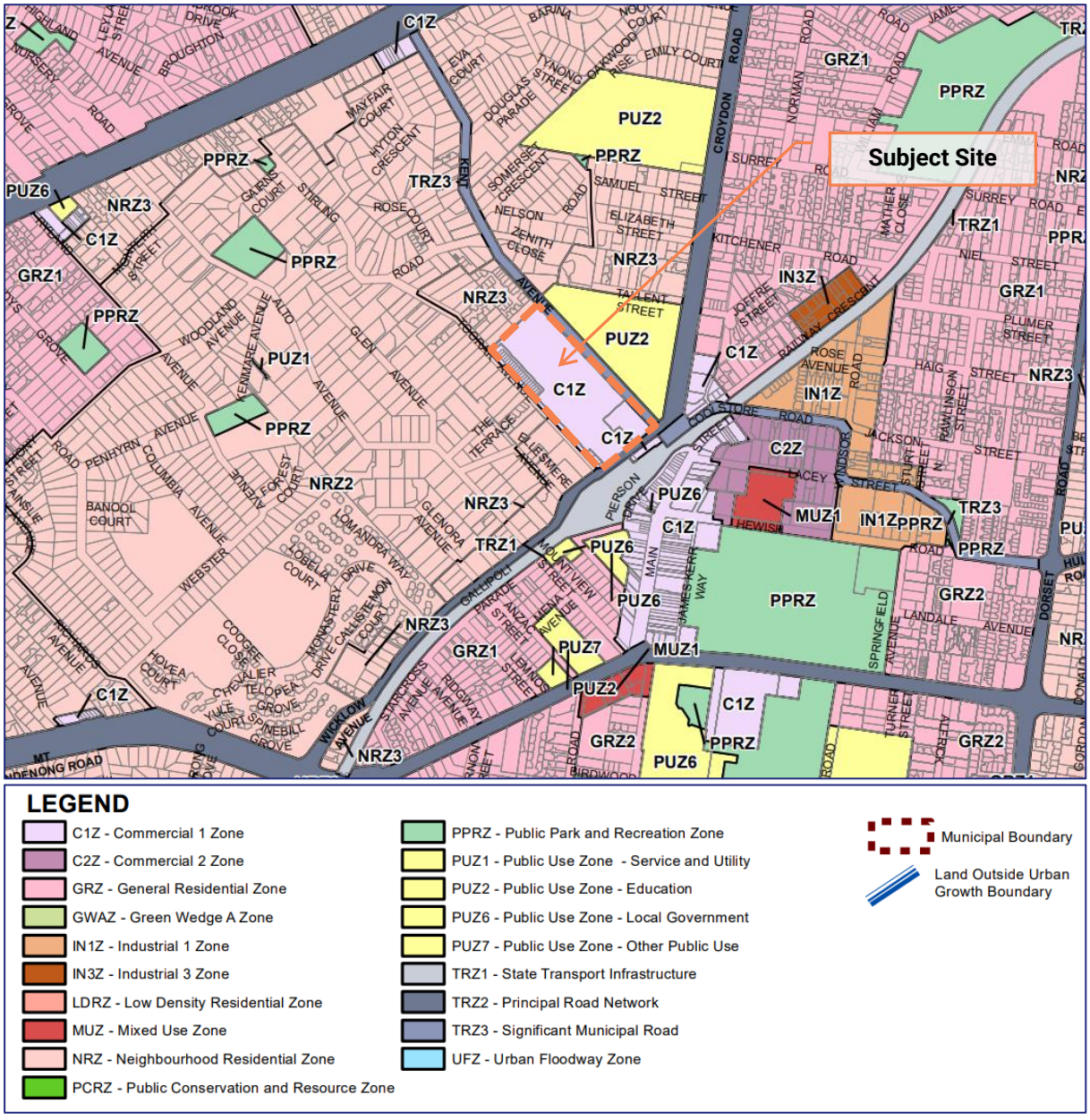

Figure 8: Land use zoning map (Source: Planning Schemes Online)

4.2. Transport Network

4.2.1. Road Network

A summary of the local road network is provided in the table below.

Photos of the surrounding road network are presented following the table.

Table 6: Local Road Network

Road Name	Agency	Classif-ication	Transport Zone	Configuration	Speed Limit	On-Street Parking
Kent Avenue	Council	Council Arterial	TRZ3	Traffic lane in each direction and kerbside parking lane on west side	40km/h 8-9am, 2:30-4pm School Days 60km/h other times	Line marked kerbside parking on west side No stopping on east side
Wicklow Avenue	DTP	Arterial	TRZ2	Traffic Lane in each direction	50km/h (lowers to 40km/h school times near Kent Avenue)	No parking on either side of road
Toorak Avenue	Council	Local Road	No	7.3m carriageway, divided further north	50km/h	Parking only available on eastern side, south of median
Croydon Road	DTP	Arterial	TRZ2	Traffic Lane in each direction	60km/h (lowers to 40km/h school times)	Service road parking only
Coolstore Road	Council	Local Road	TRZ3	Traffic Lane in each direction	60km/h (lowers to 40km/h school times)	Not near the site.

Figure 9: Kent Avenue – view north

Figure 10: Kent Avenue – view south

Figure 11: Wicklow Avenue – view east

Figure 12: Wicklow Avenue – view west

Figure 13: Toorak Avenue – view north

Figure 14: Toorak Avenue – view south

4.2.2. Existing Traffic Conditions

Traffix Group has undertaken AM, PM and Saturday peak period traffic counts on:

- Friday 2nd September, 2022, between 7:30am-9:30am and 3pm-7pm, and
- Saturday 3rd September 2022, between 10am-2pm.

The surveys were completed before the LXRP works commenced. These times correspond to the peak periods for Croydon Central and the nearby road network. These surveys were undertaken at the following locations:

- The 5 separate access points to Croydon Central from Kent Avenue
- The 2 separate access points to Croydon Central from Wicklow Avenue
- The Wicklow Avenue / Kent Avenue / Croydon Road / Coolstore Road roundabout
- The Wicklow Avenue and Toorak Avenue intersection

The results of these traffic surveys are provided at Appendix C.

The peak hour periods (based on both the peak number of movements to/from Croydon Central, and the overall network traffic volumes) were found to be 8:30am-9:30am, 3:45pm-4:45pm and 11:15am-12:15pm in the AM, PM and Saturday peak hours, respectively.

The hourly traffic volume profiles, which detail these peak hours are illustrated at Figure 15 and Figure 16.

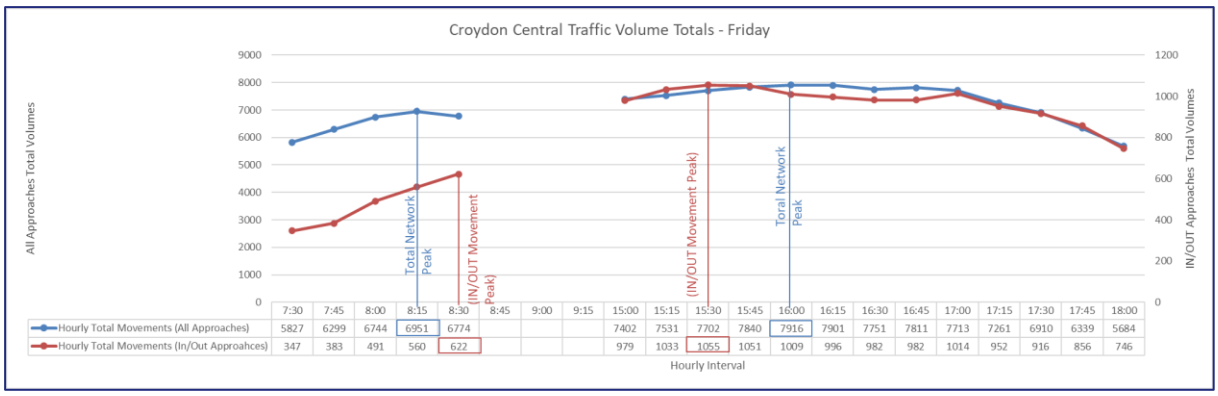

Figure 15: Weekday Traffic Volumes

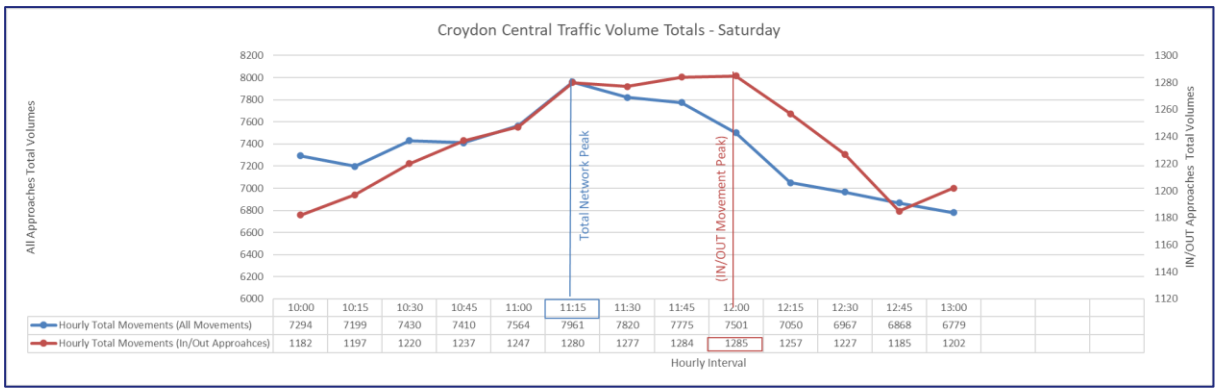

Figure 16: Weekend Traffic Volumes

The below table summarises the total traffic volumes at each access point to Croydon Central during the peak hour periods.

Table 7: Traffic Volumes at Site Access Points

Access Location	AM				PM				Saturday			
	In	Out	Total	%	In	Out	Total	%	In	Out	Total	%
Western Wicklow Ave	24	0	24	4%	64	0	64	6%	62	0	62	5%
Eastern Wicklow Ave	106	71	177	28%	109	159	268	26%	136	141	277	22%
Subtotal				**32%**				**32%**				**37%**
Southern Kent Ave	79	44	123	20%	109	107	216	21%	126	115	241	19%
South Mid Kent Ave	70	54	134	21%	89	105	194	18%	130	104	234	18%
Middle Kent Ave	40	19	59	9%	39	78	117	11%	64	102	166	13%
North Mid Kent Ave	45	5	50	8%	54	7	61	6%	91	24	115	9%
Northern Kent Ave	38	27	65	10%	43	88	131	12%	45	140	185	14%
Subtotal				**68%**				**68%**				**63%**
Total	**402**	**220**	**622**		**507**	**544**	**1,051**		**654**	**626**	**1,280**	

Croydon Central currently provides approximately 11,627m^2 of commercial floor area, including two supermarkets, a childcare centre, a gym, and various other specialty retail and food and drink offerings.

The following traffic generation rates were determined for Croydon Central as a whole for each peak hour period:

- 5.35 vehicle trips per 100m^2 in the AM peak hour
- 9.04 vehicle trips per 100m^2 in the PM peak hour
- 11.01 vehicle trips per 100m^2 in the Saturday peak hour

For reference, the 2013 Cardno Traffic Report for the Development Plan found that Croydon Central generated traffic at a rate of 9.79 vehicle trips per 100m^2 in the PM peak hour (noting that these surveys were from 2011 and are 11 years old and before part of the Stage 1 works were completed). In our view, the above surveys show a comparable result.

4.2.3. Road Safety Review

A review of the State Road Accident Records (Crashstats) has been undertaken in the vicinity of the site for the past 5 years of available data (01/09/2018 to 31/08/2023)[4]. The review area is shown in Figure 17 and summarised in Table 8.

The crash review indicates that there have been 11 casualty crashes within the review area.

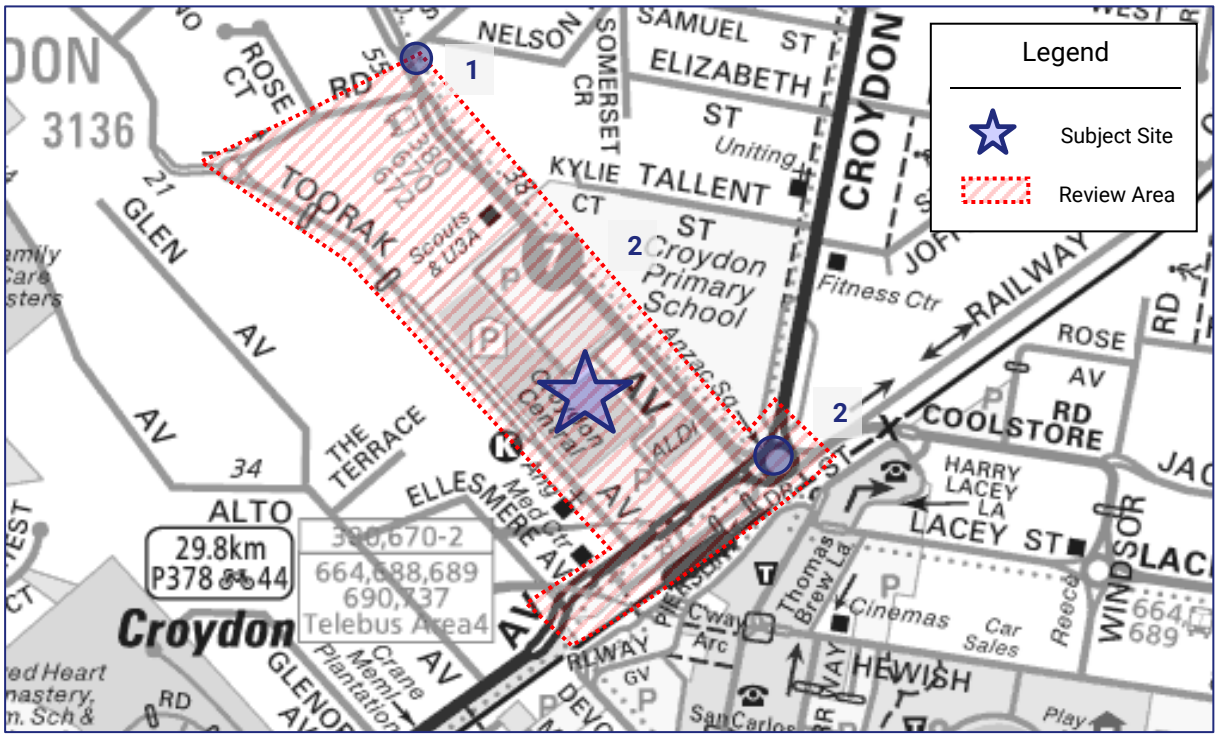

Figure 17: Road safety review area (Source: Melway)

[4] Casualty crash data is contained in the VicRoads' Crashstats Internet Database and includes all reported casualty crashes (i.e. injury crashes), which are classified into Fatal Injury, Serious Injury and Other Injury (i.e. minor injury) crashes. Property damage only or non-injury crashes are not included in the database.

Table 8: Casualty Crash History

No.	Location	Date	Time	Severity	Type (DCA Code)	Type of Accident
1	Kent Avenue 17m north-west of Somerset Crescent	Saturday 03/09/2022	17:00	OI	130	Rear end (vehicles in same lane) involving two south-eastbound vehicles.
2	Kent Avenue / Croydon Road / Coolstore Road intersection	Saturday 11/06/2022	14:10	SI	181	Off right bend into object/ parked vehicle involving a north-eastbound vehicle.
		Wednesday 03/05/2023	10:30	SI	111	Rear far (intersections only) involving a north-eastbound and south-westbound vehicle.
		Monday 02/08/2021	22:03	OI	121	Right through involving a north-eastbound and northbound vehicle.
		Saturday 27/11/2021	08:00	OI	110	Cross traffic (intersections only) involving a north-eastbound and north-westbound vehicle.
		Saturday 12/12/2020	19:09	OI	110	Cross traffic (intersections only) involving a north-westbound and north-eastbound vehicle.
		Saturday 21/12/2019	11:00	OI	100 (P)	Pedestrian near side. Pedestrian hit by north-eastbound vehicle from the right.
		Tuesday 29/06/2021	08:30	SI	100 (P)	Pedestrian near side. Pedestrian hit by north-eastbound vehicle from the right.
		Monday 08/05/2023	18:20	OI	100 (P)	Pedestrian near side. Pedestrian hit by north-eastbound vehicle from the right.
		Friday 10/05/2019	13:40	OI	102 (P)	Far side. Pedestrian hit by north-eastbound vehicle from the left.
		Monday 06/05/2019	17:30	OI	100 (P)	Pedestrian near side. Pedestrian hit by north-eastbound vehicle from the right.

LEGEND:

OI:	Other Injury	SI:	Serious Injury	F:	Fatality
(B):	Bicyclist	(M):	Motorcyclist	(P):	Pedestrian
(C):	Bus/Coach	(RT):	Rigid Truck	(ST):	Semi-trailer

There were 10 casualty crashes at the Croydon Road/Wicklow Avenue/Coolstore Road/Kent Avenue intersection.

As discussed in Section 2.4, this intersection will be upgraded to a signalised intersection as a part of the level crossing removal works. Accordingly, the historical safety performance of this intersection is less relevant into the future.

Importantly, there were no casualty crashes recorded at Kent Avenue or Wicklow Avenue at the access point locations to Croydon Central.

Accordingly, we do not consider that the area surrounding the site is unsafe and there is no crash pattern that would preclude the development of the subject site.

4.3. Car Parking Conditions

Traffix Group has completed parking surveys of the existing Croydon Central carpark to understand the existing car parking demand patterns associated with the site. The surveys were completed at hourly intervals between the following times:

- 8am-8pm on Friday 2nd September, 2022, and
- 8am-8pm on Saturday 3rd September, 2022.

These times correspond to the peak demand times for Croydon Central as suggested by Google analytics data.

A total of 629 car spaces are currently provided within the Croydon Central carpark area, which are mostly subject to 3P restrictions (with a small amount of DDA parking).

Detailed car parking survey results are provided at Appendix E, with the profile of surveyed demands provided in the figure below.

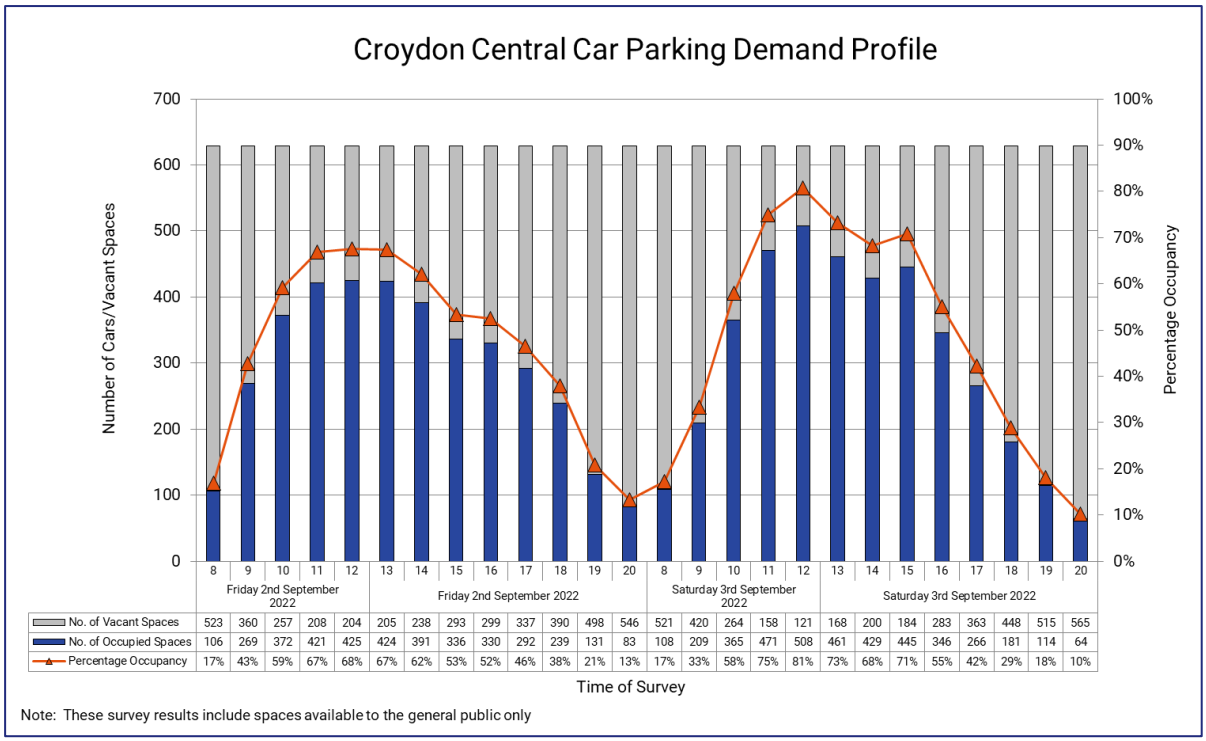

Figure 18: Site car parking demand profile

The surveys indicate that there is a low to high demand for car parking with peak parking demands occurring during the middle of day, and lower demands earlier in the morning and in the evenings. A minimum of 121 vacant spaces were available (81% occupancy), which was recorded at 12noon on Saturday 3rd September, 2022. On this basis, Croydon Central currently provides adequate car parking to meet its peak demands and overflow parking is negligible.

Overall, the 11,627m^2 of commercial space generated a peak car parking requirement for 4.4 car spaces per 100m^2.

4.4. Public Transport

The site has access to public transport services, including train and bus services. The site is directly opposite Croydon Railway Station and bus interchange, which acts as a key transport hub in Maroondah and Melbourne's outer east.

The public transport network surrounding the site is presented at Figure 19 and Table 9 provides a summary of these services.

The site is located within the Principal Public Transport Network (PPTN) area, as illustrated in Figure 20.

Table 9: Summary of public transport services

Service	Between	Operating Times (Frequency)				Via
		Monday-Thursday	Friday	Saturday	Sunday	
Croydon Station - approximately 100m walking distance south of the site						
Bus Route 670	Lilydale & Ringwood	5:40am-10:06pm (15-30mins)	5:40am-5:47am (15-60mins)	7:10am-9:32pm (30-60mins)	8:22am-9:24pm (60-80mins)	Croydon & Chirnside Park
Bus Route 671	Croydon & Chirnside Park	6:18am-7:31pm (30-60mins)	9:00am-5:02pm (60mins)	*Not Operational*		Warrien Road & Patrick Street
Bus Route 672	Croydon & Chirnside Park	6:25am-8:10pm (20-70mins)		8:58am-5:08pm (60mins)	*Not Operational*	Wonga Park & Croydon Hills
NightBus 967	Glen Waverley Station & Croydon Station	*Not Operational*		1:35am-7:03am *(60 mins)*	1:35am-6:52am (20-40mins)	Knox City
Bus Route 380	Ringwood & Croydon	6:00am-11:07pm *(15-60 mins)*		7:15am-9:16pm *(60 mins)*	7:45am-7:17pm *(60 mins)*	Croydon & Ringwood
Bus Route 664	Chirnside Park & Knox City	5:33am -9:49pm (15-30 mins)		7:38am - 10:13pm (20-60 mins)	7:58am - 9:13pm (60 mins)	Croydon & Bayswater

Service	Between	Operating Times (Frequency)				Via
		Monday-Thursday	Friday	Saturday	Sunday	
Bus Route 688	Croydon & Upper Ferntree Gully	5:52am -10:01pm (15-60mins)		7:06am-10:13pm (50-70min)	9:14am-9:27pm (60min)	Olinda & Tremont
Bus Route 689	Croydon & Montrose	6:57am – 6:55pm (40-75 mins)		8:36am – 5:40pm (20-60 mins)	*Not Operational*	Hawthory Road & Durham Road
Bus Route 690	Croydon & Boronia	5:51am-9:30pm (30mins)		7:06am-9:44pm (40 mins)	8:57am-9:25pm (40 mins)	Kilsyth & Canterbury Gardens
Bus Route 737	Croydon & Monash University	6:14am-10:07pm (30-50mins)		6:25am-10:11pm (60-80 mins)	8:14am-10:12pm (60 mins)	Boronia & Knox City Shopping Centre & Glen Waverley
Lilydale Line	Lilydale & CBD	4:41am-1:02am (10-30mins)		3:59am-12:04am (20-30 mins)	4:33am-1:13am (20-30 mins)	Richmond & Ringwood

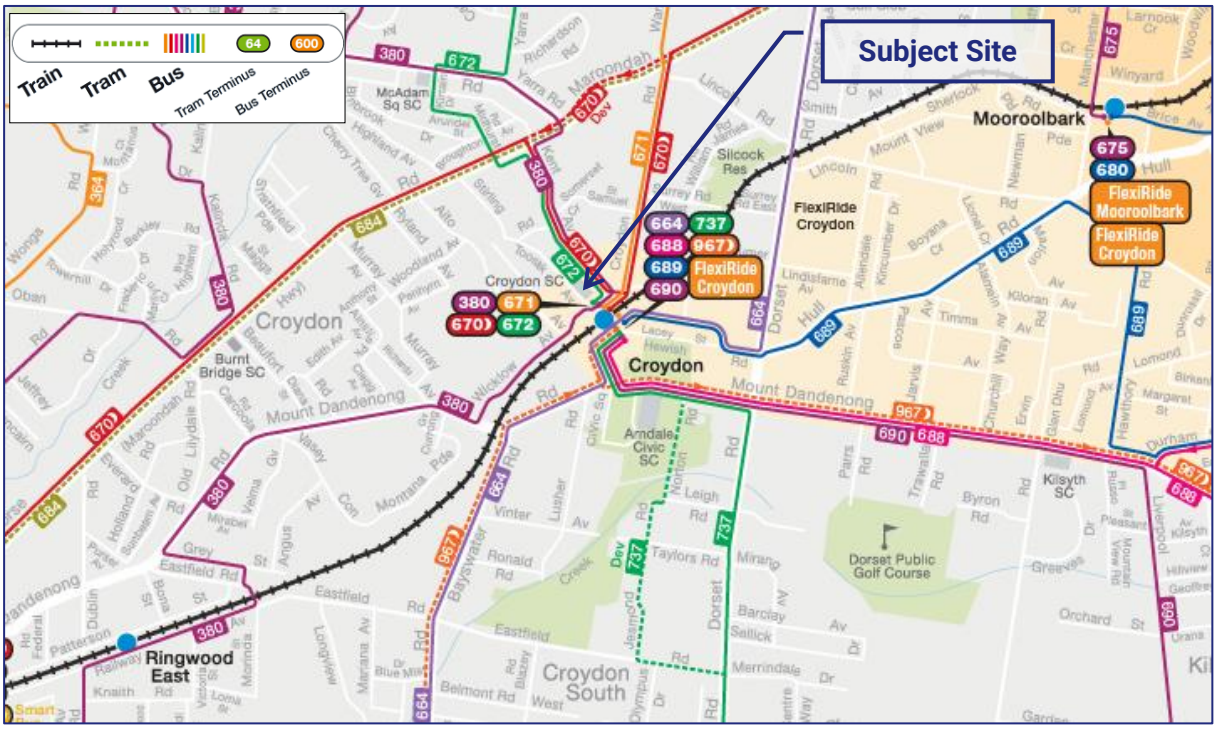

Figure 19: Public transport map (Source: PTV)

Figure 20: Principal Public Transport Network Area (Source: Vicplan)

5. Traffic Engineering Assessment

5.1. Statutory Car Parking Assessment

The proposal is for a Development Plan, not a planning permit application. Accordingly, development yields and final mixes of land uses has not been determined. The Development Plan provides a framework in which future planning permit applications and provides direction about what use and development are appropriate.

For the purposes of this assessment about the likely required car parking numbers, we have assessed the expansion of Croydon Central as falling under the land-use categories of 'dwelling', 'supermarket' and 'shop' under Clause 73.03 of the Planning Scheme.

To assess the development scale and the yield of car parking, we have had reference to the indicative Development Summary provided by the applicant (dated 24th January, 2024).

The Planning Scheme sets out the parking requirements for new developments under Clause 52.06. The purpose of Clause 52.06 is:

- *To ensure that car parking is provided in accordance with the Municipal Planning Strategy and the Planning Policy Framework.*
- *To ensure the provision of an appropriate number of car parking spaces having regard to the demand likely to be generated, the activities on the land and the nature of the locality.*
- *To support sustainable transport alternatives to the motor car.*
- *To promote the efficient use of car parking spaces through the consolidation of car parking facilities.*
- *To ensure that car parking does not adversely affect the amenity of the locality.*
- *To ensure that the design and location of car parking is of a high standard, creates a safe environment for users and enables easy and efficient use.*

The statutory parking requirements are set out at Clause 52.06-5 of the Planning Scheme. Clause 52.06-5 states:

Column A applies unless Column B applies.

Column B applies if:

- *any part of the land is identified as being within the Principal Public Transport Network Area as shown on the Principal Public Transport Network Area Maps (State Government of Victoria, 2018); or*
- *a schedule to the Parking Overlay or another provision of the planning scheme specifies that Column B applies.*

As the site is located with the PPTN, the Column B rates apply.

We would also note that 'Shop' has the same statutory car parking requirement as a range of other commercial uses include food and drink premises, restaurant, bar, medical centre etc. It is also a higher rate than office. Accordingly, assessing the additional commercial space

as shop also covers a wide range of other land uses likely to be found in the future shopping centre.

The statutory car parking assessment of the entire development (Stage 1 and 2) is set out in Table 10 below.

Table 10: Statutory Car Parking Assessment – Column B of Clause 52.06-5

Use	Size / No.	Statutory Parking Rate (Column B)	Parking Req.(1)	Parking Provision	Shortfall / Surplus
One-bedroom dwelling	33	1 car space per one or two bedroom dwelling	33	166	+1
Two-bedroom dwelling	74		74		
Three-bedroom dwelling	29	2 car spaces per three or more bedroom dwelling	58		
Residential Visitor	136 (dwellings)	No car parking required	-	5	+5
Supermarket	6,035m^2	5.0 car spaces per 100m^2 LFA	301	1,112	+206
Shop	17,313m^2	3.5 car spaces per 100m^2 LFA	605		
Total			**1,071**	**1,283**	**+212**

Notes:

1. Clause 52.06-5 specifies that where a car parking calculation results in a requirement that is not a whole number, then number of spaces should be rounded down to the nearest whole number.

The provision of 1,283 car spaces exceeds the statutory car parking requirement by 212 car spaces.

Accordingly, we are satisfied that Croydon Central can provide an appropriate level of car parking in the future. The ultimate number and location of the additional car spaces will be determined at the Planning Permit application stage.

5.2. Bicycle Parking Provision

Clause 52.34 of the Planning Scheme specifies bicycle parking requirements for new developments. The purpose of Clause 52.34 is to:

- *To encourage cycling as a mode of transport.*
- *To provide secure, accessible and convenient bicycle parking spaces and associated shower and change facilities.*

The actual provision of bicycle parking will be determined at the Planning Permit stage, having regard to the final design and the final size and mixture of land uses.

The supermarket and retail uses in the table below are assessed under the broader 'shop' use. Furthermore, there is no requirement for the townhouses as they are less than four storeys.

The statutory bicycle parking requirement of the development under Clause 52.34 is set out in the table below.

Table 11: Statutory Bicycle Parking Assessment - Clause 52.34

Use	Size/No.	Statutory Bicycle Parking Requirement		No. Bicycle spaces required
		Residents or Employees	Visitors or Customers	
Dwelling	136	1 space to each 5 dwellings	1 space to each 10 dwellings	27 resident 14 visitor
Shop	23,348m^2	1 space to each 600m^2 LFA if the LFA exceeds 1000m^2	1 space to each 500m^2 LFA if the LFA exceeds 1000m^2	39 employee 47 customer
TOTAL				**127 spaces**

Based on the above, a total of 127 bicycle spaces are required under Clause 52.34.

Any detailed plans prepared as a part of the Permit Application process should provide bicycle parking in line with these requirements. We expect in practice that these numbers would be minimum numbers, with the likely number of bicycle spaces to be higher.

All bicycle parking would be provided in a convenient location to each relevant use, and should be designed in accordance with the requirements of AS2890.3-2015.

We are satisfied that this can be readily achieved on-site and does not need to be detailed in the Development Plan.

Clause 52.34 also requires consideration of end-of-trip facilities and the design of the bicycle parking spaces. One shower/change room is required for the first 5 staff spaces, and an additional shower/change room is required for every 10 spaces thereafter.

Based on the requirement for 39 staff spaces, a total of 4 shower/change rooms are required for the development, which should be provided on any detailed plans prepared.

5.3. Review of Carpark Layout and Vehicle Access Arrangements

The proposed parking layout and vehicle access arrangements in the Development Plan and the Concept Plans has been assessed under the following guidelines:

- Clause 52.06-9 of the Planning Scheme (Design Standards for car parking),
- AS2890.1-2004 – Part 1: Off-Street Car Parking (where relevant),
- AS2890.2-2018 – Part 2: Off-Street Commercial Vehicle Facilities, and
- AS2890.6-2009 – Part 6: Off-Street Car Parking for People with Disabilities.

When compared to the approved Development Plan, the only change from a vehicle access perspective is the inclusion of an additional access point to Kent Avenue at the south-east corner of the site for loading vehicles, which will be restricted to 8.8m Medium Rigid Vehicles only and will not generate a high volume of traffic.

The remaining accessways and proposed works to Kent Avenue and Wicklow Avenue will be consistent with the approved Development Plan.

The Concept Plans illustrate a high level layout of the new carparks and access arrangements. The key comments on these plans are as follows:

- Internally to the site, the main change to the car parking arrangements is the basement carpark as a part of the Stage 2 works, compared to a ground level and undercroft carpark in the previous scheme.
- The vehicle access points to the Stage 2 carpark are largely unchanged under the amended Development Plan, specifically:
  - The carpark access to Wicklow Avenue towards Toorak Avenue is retained, however, instead of fully direction access, right turn movements into the site will not be permitted.
  - A fully direction carpark access to Kent Avenue in retained, at the location of the existing access.
  - There remains other access points further north along Kent Avenue.
- The residential carpark will have its own separate speed ramp to separate residential and commercial traffic. This ramp connects to the Wicklow Avenue access point.

The internal carpark layout and accessways will be ultimately constructed in accordance with the requirements of the Maroondah Planning Scheme, and Australian Standards, where relevant, with the final design reviewed by the Responsible Authority at the Planning Permit application stage.

5.3.1. External Works Resulting from Level Crossing Removal

The level crossing removal works are discussed in Section 2.4. As a part of these works, the Croydon Railway Station and Wicklow Avenue intersection is being signalised. Given the proximity of the Wicklow Avenue access to Croydon Central, this access point will need to be incorporated into the new signalised intersection.

The approved Development Plan contemplates a signalised pedestrian crossing of Wicklow Avenue. These works are no longer proposed as they are redundant with the changes taking place as part of the level crossing removal project.

5.4. Loading and Waste Collection Arrangements

Clause 65.01 of the Planning Scheme states that the Responsible Authority must consider a number of matters as appropriate including:

- *The adequacy of loading and unloading facilities and any associated amenity, traffic flow and road safety impacts.*

5.4.1. Loading

It is proposed to provide three loading bays on-site as follows:

- The site's south-western corner, with entry via Toorak Avenue, and exit via Wicklow Avenue. This loading bay can accommodate vehicles up to a 12.5m HRV and will include a turntable to rotate the truck into position. Loading vehicles use the carpark exit at the signalised intersection between the site and Wicklow Avenue.

  Loading vehicles will be restricted to left-out movements only. From here loading vehicles will be able to access the surrounding arterial road network, including Maroondah Highway via Kent Avenue.
- The site's south-eastern corner with access via Kent Avenue. This loading bay will be able to accommodate vehicles up to an 8.8m long Medium Rigid Vehicle (MRV) and service the smaller scale retail tenancies and waste collection for the dwellings.
- Along the northern side of the site (not within Stage 2), which will be accessed via the northmost access point to Kent Avenue. This loading bay will be able to accommodate vehicles up to a 19m semi-trailer.

These loading areas are highlighted in the below diagram.

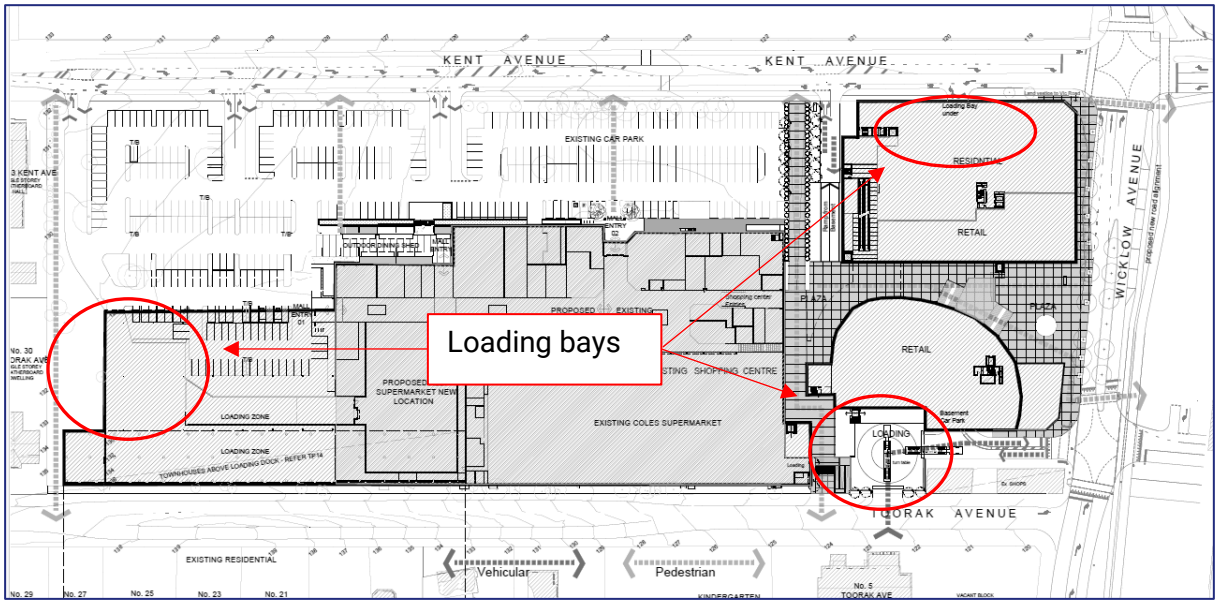

Figure 21: Loading Bay locations (Source: Indicative Stage 2 Plan)

Of the 3 loading bays, the Northern Kent Avenue and Toorak Avenue loading bays maintain the same arrangements as the approved Development Plan, with the only addition being the southern Kent Avenue loading bay.

We are satisfied that the proposed loading arrangements are appropriate and will satisfy the requirements of the likely proposed future development.

We have undertaken a swept path check of the proposed loading bay arrangements from Wicklow Avenue for the 12.5m HRV, and determined that the left-turn out movement (i.e. the movement proposed) can be accommodated in the future signalised intersection of Wicklow Avenue, the railway carpark and the site access under LXRP conditions. A diagram demonstrating this movement is shown below.

Accordingly, we are satisfied that the layout of the loading arrangements is appropriate.

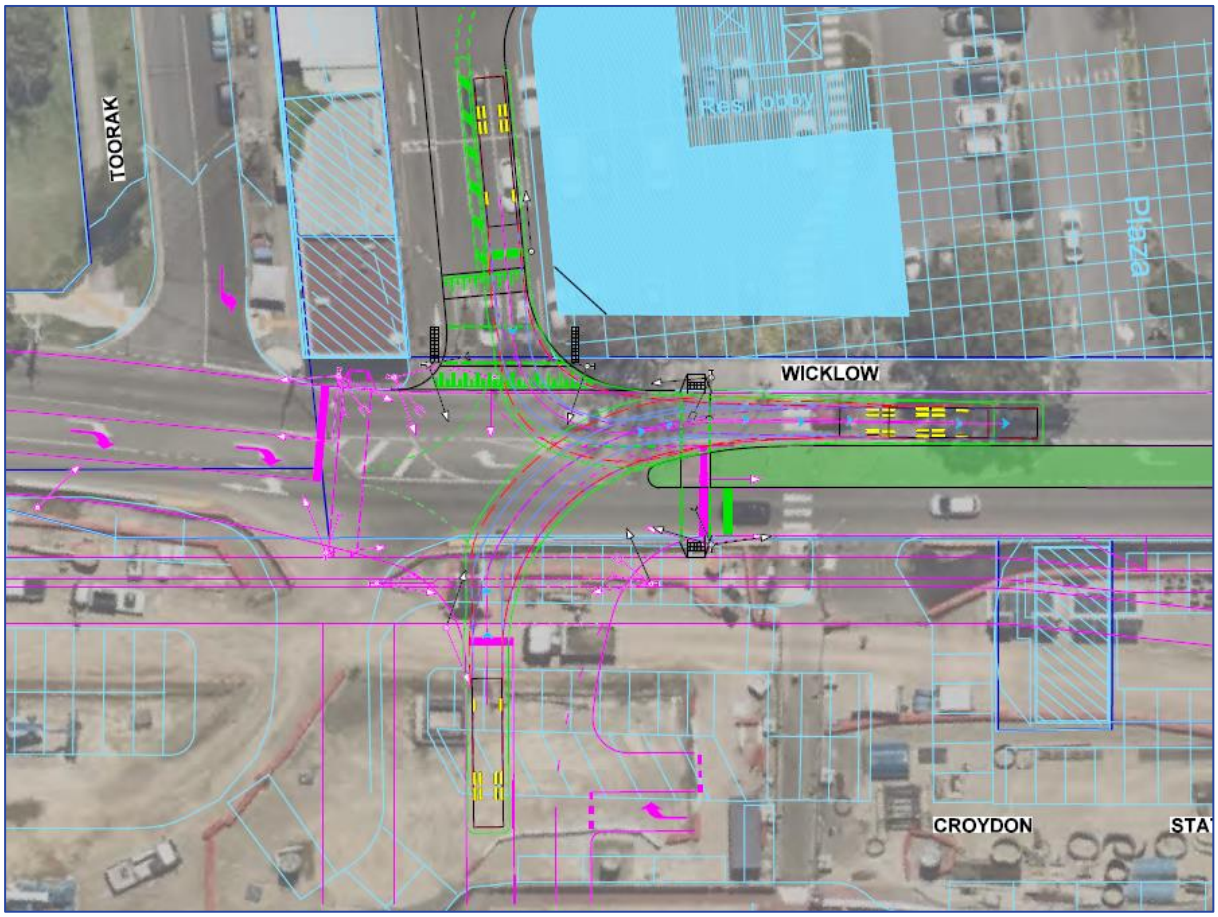

Figure 22: Exit movement from loading bay to Wicklow Avenue

5.4.2. Waste Collection

Waste collection will occur as follows:

- All waste collection to occur via private contractor.
- Residential waste collection will on-site and via a 6.4m long mini waste truck or 8.8m long side/rear lift truck, depending on final location of the bin collection area(s).
- Commercial waste collection will be via:
  - an 8.8m long side/rear lift vehicle from the southern Kent Avenue loading bay, or
  - a 12.5m long waste compactor vehicle from Toorak Avenue loading bay (which would also service Coles).

We are satisfied that the waste collection arrangements are appropriate.

5.5. Traffic Impact Assessment

5.5.1. Traffic Generation

Residential component

The amended Development Plan includes 116 apartments.

There are currently 20 townhouses at the north-western corner of the site. These are constructed and occupied, and their traffic is already accounted for in the traffic surveys. Accordingly, only the 116 new dwellings are considered.

We have conservatively adopted an average traffic generation rate 0.5 vehicle trips per dwelling in each peak hour.

Based on the above, the dwellings are expected to generate 58 vehicle trips in each peak hour.

Commercial component

The surveys undertaken of Croydon Central (outlined in Section 4.2.2) were used to determine the existing traffic generation of the subject site.

This site includes 11,307m^2 of commercial floor area, including two supermarkets, a childcare centre, a gym, and various other retail premises.

The following traffic generation rates were determined for each peak hour period:

- 5.35 vehicle trips per 100m^2 in the AM peak hour
- 9.04 vehicle trips per 100m^2 in the PM peak hour
- 11.01 vehicle trips per 100m^2 in the Saturday peak hour

For reference, the 2013 Cardno Traffic Report found that Croydon Central generated traffic at a rate of 9.79 vehicle trips per 100m^2 in the PM peak hour (2011 surveys). In our view, the above surveys show a comparable result, although part of Stage 1 has been completed since these surveys.

Our experience is that the traffic generation rate of shopping centres on a per m^2 basis generally decreases as the floor area increases. This is consistent with the approach considered by Cardno in the Panel Report for the original Planning Scheme amendment of Croydon Central (dated 12th August, 2013). The figure below illustrates that empirical data relied upon by Cardno in this assessment.

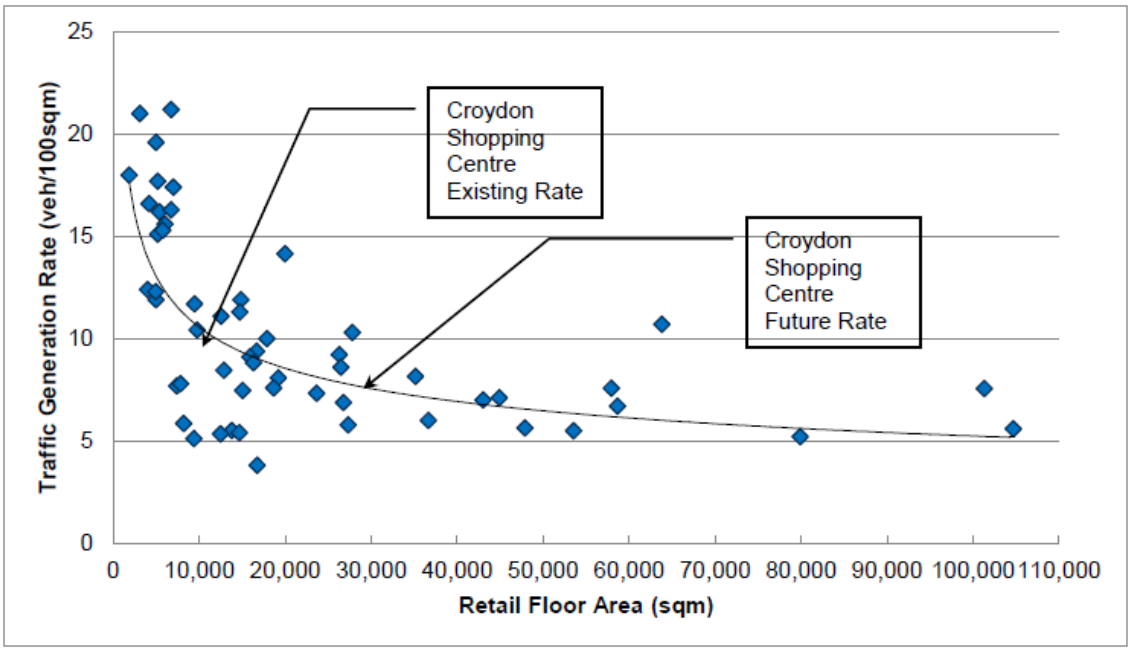

Figure 23: Traffic generation rates of Shopping Centres in Melbourne (Source: Cardno Panel Traffic Report)

Cardno reduced the surveyed traffic generation rate of Croydon Central by approximately 30% to 7.1 trips/100m^2 when assessing the traffic generation of the increased floor area. This rate was applied to the whole centre.

The RMS Guide to Traffic Generating Developments (August 2013 update) includes the following table which also shows the trend downwards of traffic generation with increased floor area in shopping centres.

Range in Total Floor Area (GLFA – m^2)	Peak Hour Generation Rate (vehicles per 100m^2 GLFA)			
	Thursday (V(P)/A)	Friday (V(P)/A)	Saturday PVT (A)	Sunday
0 – 10,000	12.3	12.5	16.3	
10,000 – 20,000	7.6 (6.2)	6.2 (6.7)	7.5 (7.5)	(6.6)
20,000 – 30,000	5.9 (6.0)	5.6 (5.9)	7.5 (7.0)	(6.3)
30,000 – 40,000	4.6	3.7	6.1	
40,000 – 70,000	(4.4)	(4.4)	(5.5)	(4.6)
70,000+	(3.1)	(4.0)	(3.6)	(3.2)

Figure 24: RMS Guide to Traffic Generating Developments (August 2013 survey update)

Currently the existing shopping centre is approximately 11,627m^2 and generates 9.0 vehicle trips per 100m^2 in the PM peak hour.

We consider it appropriate to apply a 40% discount to the surveyed traffic rate for new commercial floor area.

The table below sets out the existing traffic generation, our traffic generation rates and benchmarks them against the RMS and Cardno empirical rates.

Table 12: Shopping Centre Traffic Generation

Time Period	Existing			Future					Comparison Rates	
	Area	Traffic Volume (veh/h)	Traffic Rate (trips/ 100m$^{2)}$	Area	New area Traffic Rate (trips/ 100m$^{2)}$	New Traffic (veh/h)	Total Traffic Volume (veh/h)	Overall Traffic Rate (trips/ 100m$^{2)}$	RMS Rate (trips/ 100m$^{2)}$	Cardno Rate (trips/ 100m$^{2)}$
Weekday AM	11,627m^2	622	5.35	Total 23,348m^2	3.2	376	998	4.3	N/A	N/A
Weekday PM		1,051	9.04	New 11,721m^2	5.4	636	1,687	7.2	6.7	6.8
Sat		1,280	11.01		6.6	774	2,054	8.8	7.5	7.1

We are satisfied that the traffic generation rates adopted are suitably conservative, consistent with current practice and supported by empirical data.

Overall

The table below summarises the future traffic volumes to be generated by the expansion of Croydon Central.

Table 13: Future Total Traffic Volumes

Specification	Volume (veh/h)		
	AM	PM	SAT
Existing	622	1,051	1,280
Future (Stage 1 + 2)			
Residential	58	58	58
Commercial	376	636	774
Subtotal	*434*	*694*	*832*
Total	**998**	**1,687**	**2,054**

5.5.2. Comparison to Original Approval

The Cardno Panel Report that implemented the original Development Plan Overlay assessed the traffic implications of expanding Croydon Central in detail. This included detailed traffic modelling of the expansion.

The Traffic Report appended to the approved 2017 Development Plan did not assess the traffic implications of the DP in detail, given the work already completed by Cardno and the reduced floor area.

The table below compares the key details of these previous assessments to the historical approvals.

Table 14: Review of historical approval and traffic generation

Characteristic	2013 Planning Permit	2017 DP Approval	2024 Amendment
Floor Area	24,641m^2 retail	22,458m^2 retail	23,348m^2 retail
Car spaces	1,622	1,351	1,283
Total Traffic Generation AM peak PM peak SAT peak	 Not assessed 1,760 vph Not assessed	 Not assessed in any detail as floor area had reduced from 2013 Planning Permit	 998 vph 1,687 vph 2,054 vph

In our view, the scale of development set out in the proposed Development Plan is consistent with the current approval.

5.5.3. Passing Trade

It is important to differentiate the characteristics of trips generated by a shopping centre. There are three distinct trip types:

- 'Primary Trips' – where a trip is generated with the destination as the primary purpose for the trip (i.e. new a trip specifically to access the supermarket)
- 'Link-diverted Trips' – where a driver changes their route to visit the supermarket (i.e. changing their route home from work to visit the supermarket).
- 'Non-link-diverted Trips' – where the driver was already travelling past the supermarket while undertaking another trip and stops at the supermarket (i.e. passing trade).

The key distinction is that Primary and Link-Diverted trips represent new trips on the external road network. Non-Link Diverted trips are already on the road network and their impact only needs to be considered as to how they access the subject site as they are not 'new trips'.

The Austroads Guide indicates that:

- 28% of the site generated traffic for a shopping centre of between 3,000-20,000m^2 is a non-link diverted trip.
- 19% of the site generated traffic for a shopping centre of over 20,000m^2 is a non-link diverted trip.

The RTA Guide to Traffic Generating Developments recommends a 20% discount be applied to shopping centres of 10,000-30,000m^2.

The Cardno Panel Report also included analysis of the proportion of diverted trips. The Economics Report prepared at this time (Deep End Services dated 21st December 2011) estimated that 18.3% of trips to the shopping centre would be diverted trips. Based on the above, we have also adopted 18.3% as being the proportion of traffic that will be diverted trips.

5.5.4. Growth

The assessment does not include growth. The DTP Arterial Road volume database indicates that traffic volumes along nearby arterial roads are changing at the following rates:

- Kent Avenue:
  - -0.3% northbound
  - -0.3% southbound
- Wicklow Avenue:
  - -0.5% eastbound
  - -0.5% westbound
- Croydon Road:
  - +0.2% eastbound
  - +0.2% westbound

In this context where traffic growth is well under 1% and generally declining, we are satisfied that assessing a 10-year growth scenario is unnecessary.

5.5.5. Development Traffic Distribution

We have assumed the following in/out splits for traffic accessing the site:

- Commercial traffic will be split 60/40 (in/out) during the AM peak hour, and evenly (i.e. 50/50) during all other peak periods. This is based on the current directional splits surveyed.
- Residential traffic will be split as follows:
  - 20% in and 80% out during the AM peak hour
  - 60% in and 40% out during the PM peak hour
  - 50% in and 50% out during the Saturday peak hour

For the residential traffic, we have assumed that residents will utilise the Wicklow Avenue access point (where possible), as this access connects directly to the residential parking levels via a speed ramp in the concept plans. For entry movements generated from the north/east, residents will enter via the Kent Avenue southern access point, as right turn movements into the site from Wicklow Avenue will not be permitted. Entry movements from the south/west will occur via left turn entry into Wicklow Avenue.

All exit movements are expected to occur from Wicklow Avenue, as both right and left turns will be permitted out of the site.

We do not consider it likely that residential traffic will exit through the commercial carpark to Kent Avenue, as this is a far less direct route.

Residential traffic is distributed based on the following diagram.

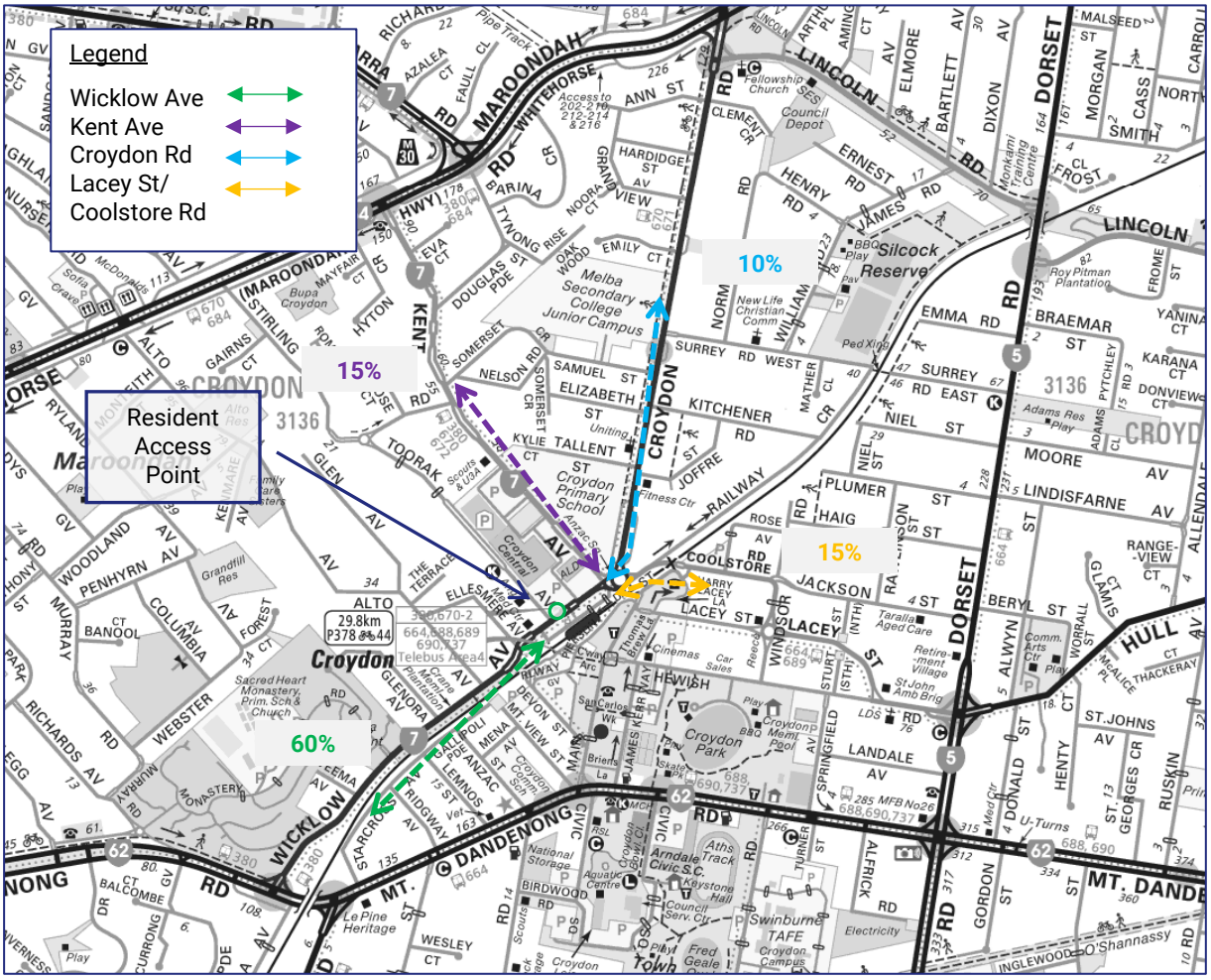

Figure 25: Residential Traffic Distribution (Source of background map: Melway)

The commercial traffic distribution to the wider area is based on the traffic surveys and the observed distribution of existing traffic accessing the centre. The proportion of traffic arriving from the Wicklow Avenue roundabout was estimated based on the proportion of existing traffic using each leg of the roundabout.

The figure below summarises the traffic distribution for the commercial traffic.

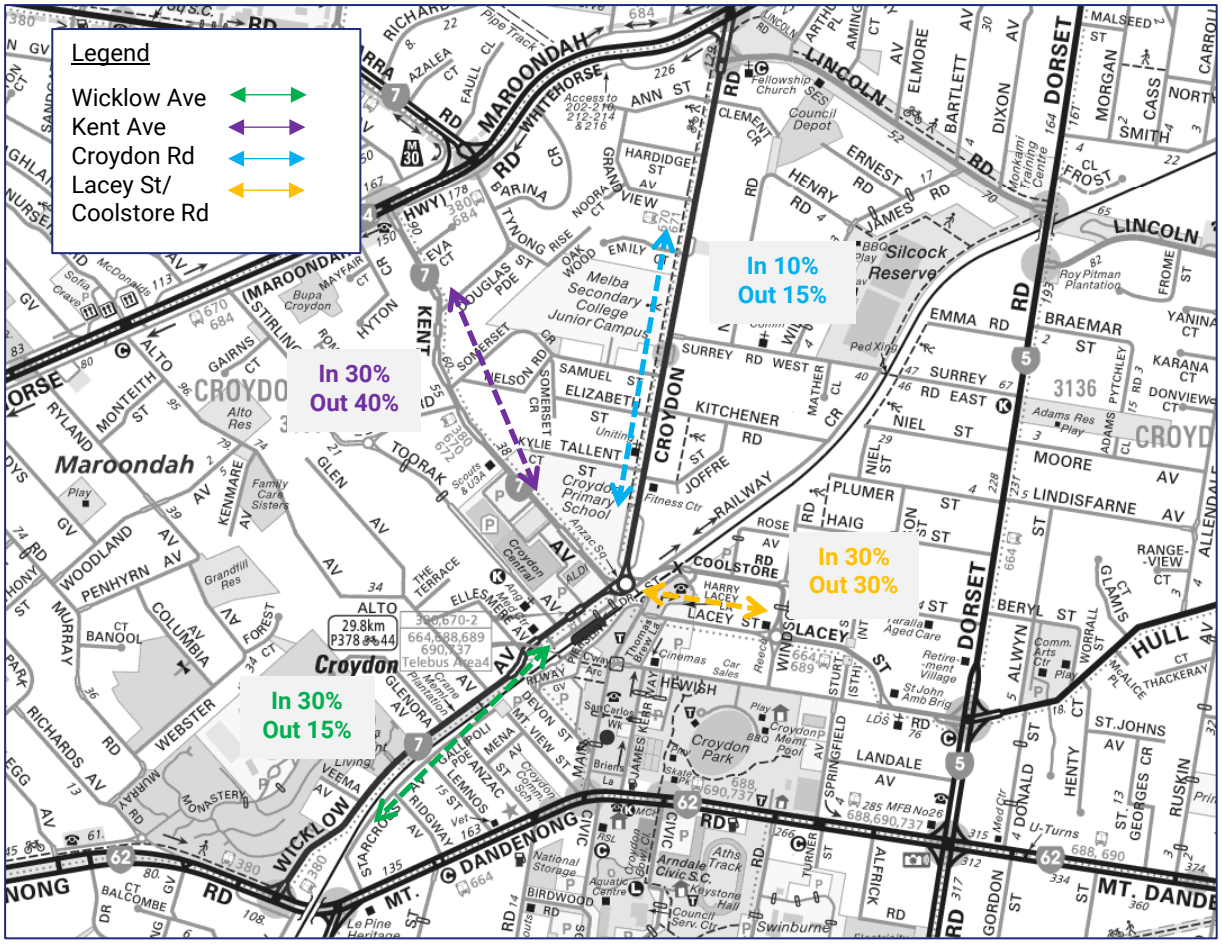

Figure 26: Commercial Traffic Distribution (Source of background map: Melway)

Commercial traffic has the benefit of multiple access points to both Kent Avenue and Wicklow Avenue. This traffic has been assigned based on its existing usage, the weight of future car parking resources at each location and the likely travel routes to the site. Similar to the residential traffic, vehicles arriving from the north/east will be required to enter via Kent Avenue (as right turn entry at Wicklow Avenue is not permitted), and we expect these vehicles to take the shortest route, entering via the southern Kent Avenue Access. Vehicles entering from the south/west will do so via left turn at Wicklow Avenue. Exiting vehicles will be spread across the access points (including Wicklow Avenue, and the 4 Kent Avenue access points), as Wicklow Avenue will allow all exit movements.

5.5.6. Traffic Redistribution

The post-development traffic conditions following the LXRP changes are described in Section 2.4. Under these conditions:

- The roundabout will be converted to a signalised intersection. Traffic using Coolstore Road is redistributed to Lacey Street.
- The Wicklow Avenue access to the shopping centre (the two-way carpark access and loading dock exit) will also be signalised and combined with the station carpark access on the southern leg.
- The traffic that previously accessed the station carpark via the roundabout will be re-directed to the new commuter carpark access point on Wicklow Avenue.
- We have also assumed that all vehicles undertaking a U-turn from the western leg of the Wicklow Avenue / Kent Avenue roundabout is traffic associated with Croydon Central (i.e. traffic using the Wicklow Avenue carpark exit that is forced to turn right). Accordingly, under the post-development conditions (when right turn out movements are permitted), we have re-assigned all of these trips as right turns out of the Wicklow Avenue access.

Under post-development conditions, the number of Kent Avenue access points from the site will also be reduced from 5 to 4, based on the following concept plan.

This is illustrated in the extract from our FLP prepared by our office at Figure 27.

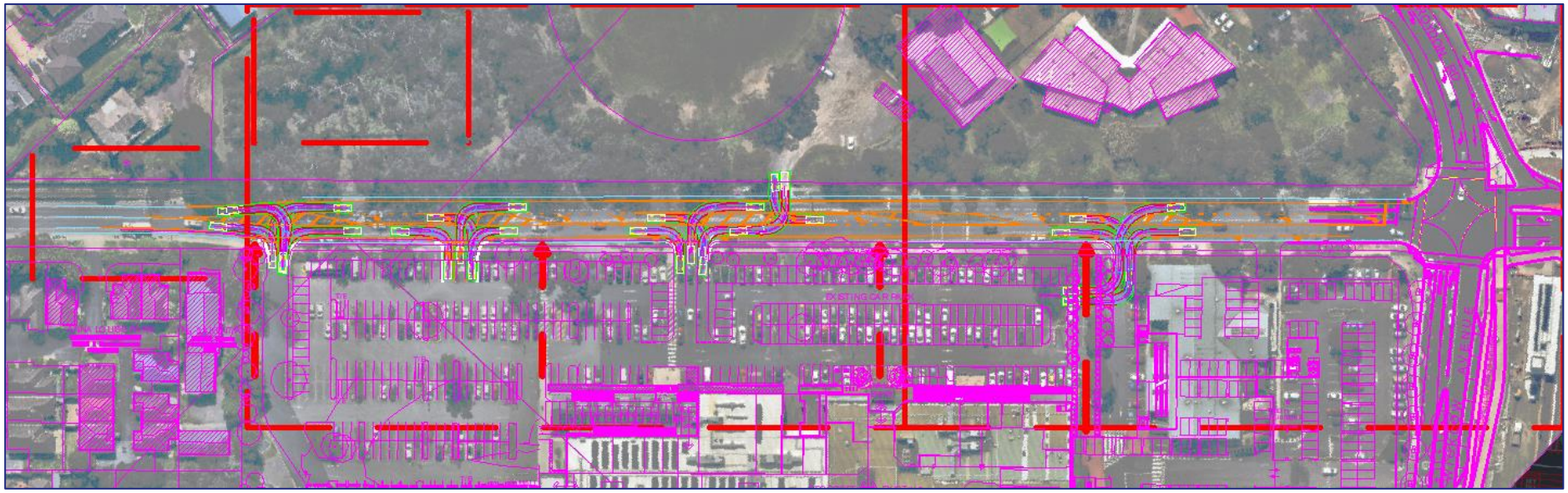

Figure 27: Concept layout plan showing Kent Avenue access changes

We have assumed that:

- The left turning traffic from the two northmost access points in the existing conditions will continue as per existing, with right turning vehicles consolidated to the second from the north point (as the northmost will now be left in and left out only).
- The existing traffic utilising the remaining Kent Avenue access points will be split across all newly consolidated access points, with a portion of the traffic turning right out of the existing southmost Kent Avenue access point also redistributed to the Wicklow Access.
- New development traffic using these access points will be distributed based on convenience, proximity to car parking and existing travel patterns.

Additionally, existing traffic that enters the site via right turn into Wicklow Avenue will instead enter via left turn at the southern Kent Avenue Access point (due to the right turn movements no longer being permitted at this location under the proposed scheme).

Superimposing the traffic generation and distribution outlined in Section 5.5.1 and onto the existing traffic volumes outlined in Section 4.2.2 provides the post-development traffic volumes expected under each future scenario.

The detailed traffic volumes are provided at Appendix C.

5.5.7. Traffic Modelling of Preferred Access Outcome

Scenario of Three Access Points to Kent Avenue

Following discussions with Council's representative, we undertook the exercise of modelling a SIDRA network with only three access points to Kent Avenue (i.e. two fully directional access points and one left in / left out access).

The results of the model found that this resulted in the remaining two fully direction site access points to operate well beyond capacity (with a DoS in the order of 2.0, delays of nearly 10 minutes, and 500m internal queues).

The critical issue is that the plan we discussed forces all right-in traffic on Kent Avenue accessing Stage 1 into one entry and then overlaps them with all traffic trying to turn right-out of Stage 1. To provide the on-road bicycle lanes, the wide median allowing staged turn movements was also removed. Both these changes curtailed the ability for drivers to turn right out onto Kent Avenue.

The combination of all the right turning traffic into/out of the site results in up to 200 right turn enter and exit movements at a single Kent Avenue access point, which explains why the capacity is exceeded.

This is explained by the fact that Kent Avenue currently provides 5 fully directional access points to the site, and reducing this to two points, while also adding additional traffic as a result of the redevelopment concentrates too high a level of traffic into a too little a number of locations.

Accordingly, we consider that three separate fully directional access points are required to serve the site. This is also consistent with the approved Development Plan, albeit that the location of the fully directional access point is shifted south to ensure that a full right turn

lane can be provided. We consider this a better outcome than having traffic turning directly into the site from the through lane (and blocking other traffic), as was previously approved.

Proposed Access Arrangements

As discussed above, we have undertaken a detailed SIDRA assessment based on the provision of 3 fully directional access points to Kent Avenue (and a left in/left out access at the northern corner of the site).

The figure below shows the SIDRA model used.

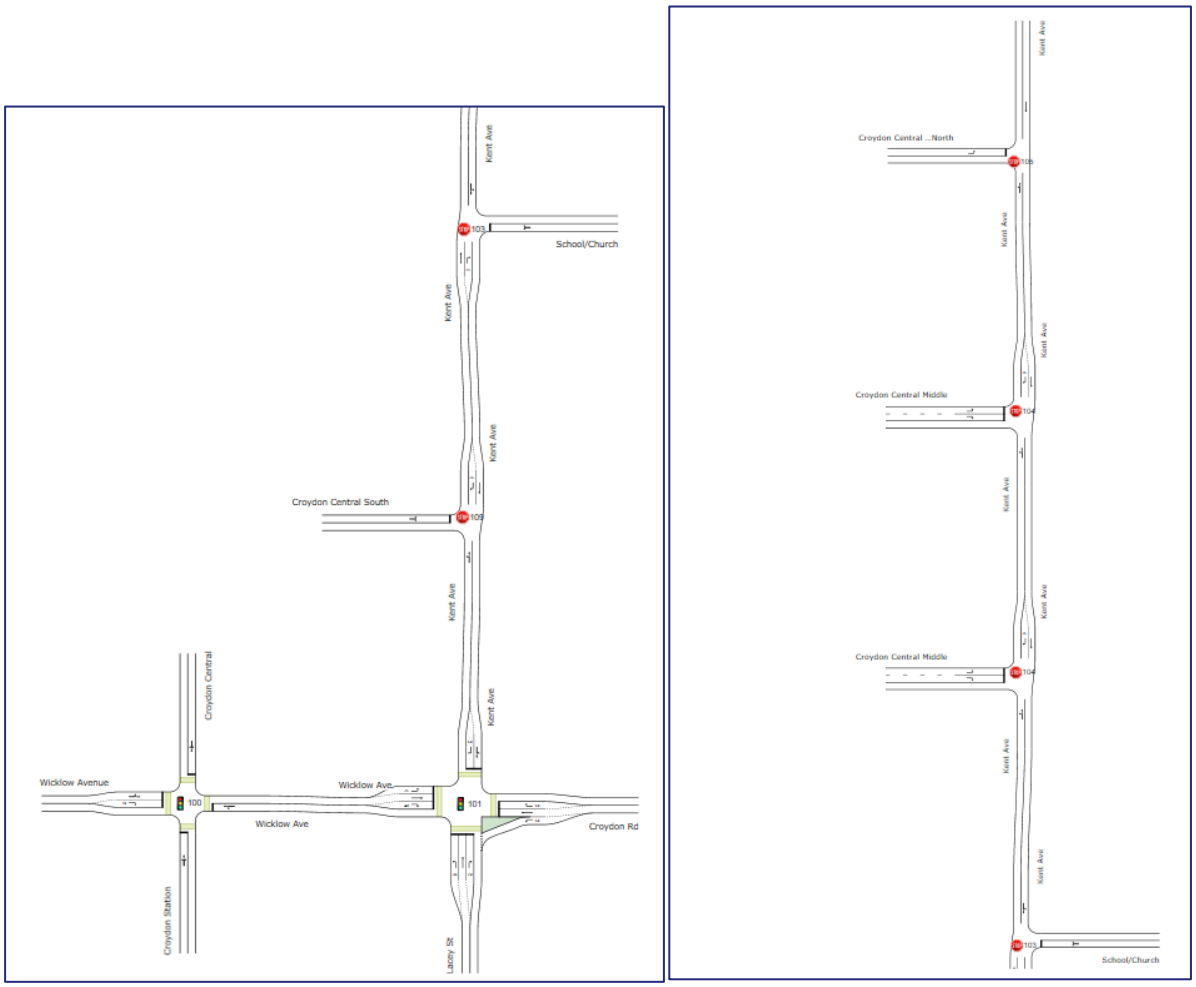

Figure 28: Post-development model under LXRP layout

The following outlines the key assumptions used to build the SIDRA model:

- The PM and Saturday Peak hour periods were considered the critical times, as during these times the traffic levels on the road network and traffic generation by the site was much higher than the AM peak.
- The model does include the three other carpark access points along Kent Avenue as per the proposed Development Plan layout, however they just are not show above.
- The Kent Avenue southern access points have all been modelled as a single movement (i.e. not staged like the original OMG functional layout plans).

- The modelling assumed that the traffic movements out of the Croydon Station access and Croydon Central access would share the same phase.
- The loading bay exit to Wicklow Avenue shares the northern leg of the intersection with the remaining development traffic.
- Toorak Avenue was excluded from the analysis on the basis that it is left-in/left-out and therefore creating minimal impact on traffic flow along Wicklow Avenue.
- The traffic signals at the Wicklow Avenue Shopping Centre Access are linked to the Wicklow Avenue/Kent Avenue/Croydon Road/Lacey Road intersection. SIDRA determined the network cycle time and individual phase times, however individual phases were detailed. The signal phasing plans are included in the SIDRA outputs.

Regarding the redistribution of traffic because of the road network changes by LXRP, the modelling assumed that:

- All traffic using Coolstore Road would transfer to Lacey Street and aside from this, there would not be a significant redistribution of traffic through the Wicklow Avenue/Kent Avenue/Croydon Road intersection.
- All traffic using the existing Croydon Station carpark on the north side of the station would use the new (and only) access point to Wicklow Avenue.
- U-turns at the roundabout to/from Wicklow Avenue were associated with Croydon Central, and reassigned to be right out movements from the Wicklow Avenue carpark access.

The traffic volumes used in the analysis are presented at Appendix C.

The detailed SIDRA results are at Appendix D.

Figure 29 to Figure 30 illustrate the lane degree of saturation for the post-development scenario under the LXRP road layout.

Table 15 provides a summary of the DoS of each intersection in the road network during the peak hour periods.

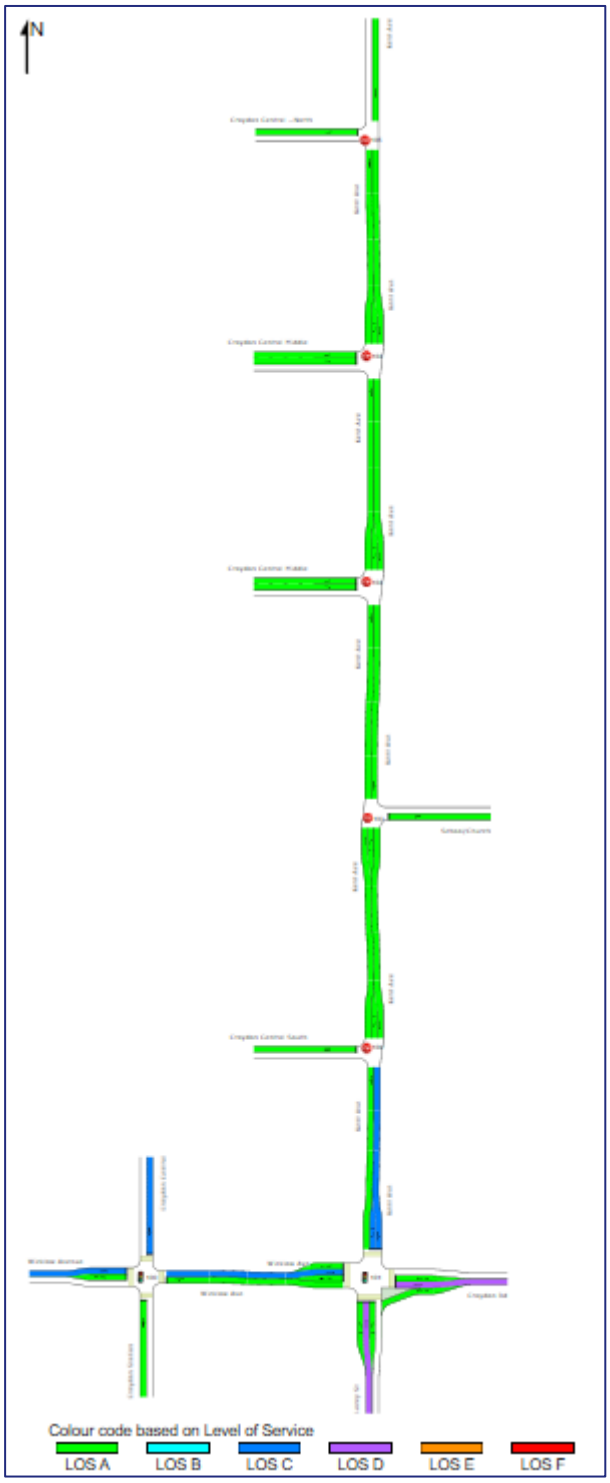

Figure 29: PM Peak hour post-development performance

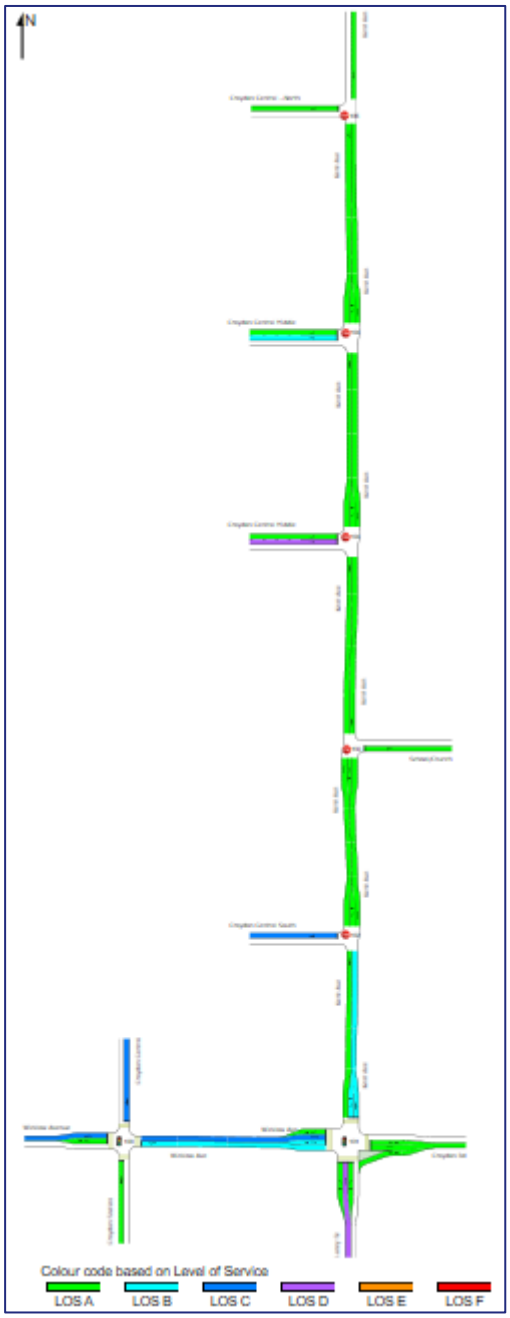

Figure 30: Saturday Peak hour post-development performance

Table 15: Post-Development Condition Performance

Approach	Intersection DoS	
	PM	SAT
Wicklow Ave / Kent Avenue / Croydon Road / Lacey Street	0.938	0.904
Wicklow Ave / Croydon Central Access	0.795	0.773
Kent Ave / South Access	0.575	0.751
Kent Ave / Church Access	0.281	0.376
Kent Ave / Mid Access	0.580	0.847
Kent Ave / North Access	0.360	0.663
Kent Ave / Far North Access	0.370	0.382

The above assessment indicates that the road network operates within its capacity at all times, with the highest LoS being D, which occurs during the PM and Saturday peak at the Kent Avenue / Wicklow Avenue / Lacey Avenue intersection. This intersection still operates to an 'Acceptable' level.

Importantly, all site access points operate within their capacity, having a minimum LoS of C (i.e. 'Good').

Accordingly, we are satisfied that the proposed revision of the Development Plan will allow for use and development that will ensure that the road network will operate at an acceptable level following the completion of Stage 2.

5.5.8. Potential Changes to Wicklow Avenue Signal Phasing

As discussed in Section 3, Council has raised the possibility of implementing a pedestrian only phase at the Wicklow Avenue / Site Access intersection. For this scenario, we have assumed second exit lane could be included out of Croydon Central. This would provide separated left and right turn exit lanes and improve the efficiency of the intersection. The objective of this change would be to 'free up' signal time to allow pedestrians to run in their own phase without unreasonably impacting on through-traffic movements.

We have undertaken a SIDRA assessment of the critical peak hour periods (i.e. the PM and Saturday peak hours) to determine the impact of including this pedestrian phase.

Figure 31 and Figure 32 illustrate the lane degree of saturation for the post-development scenario with the dedicated pedestrian phasing.

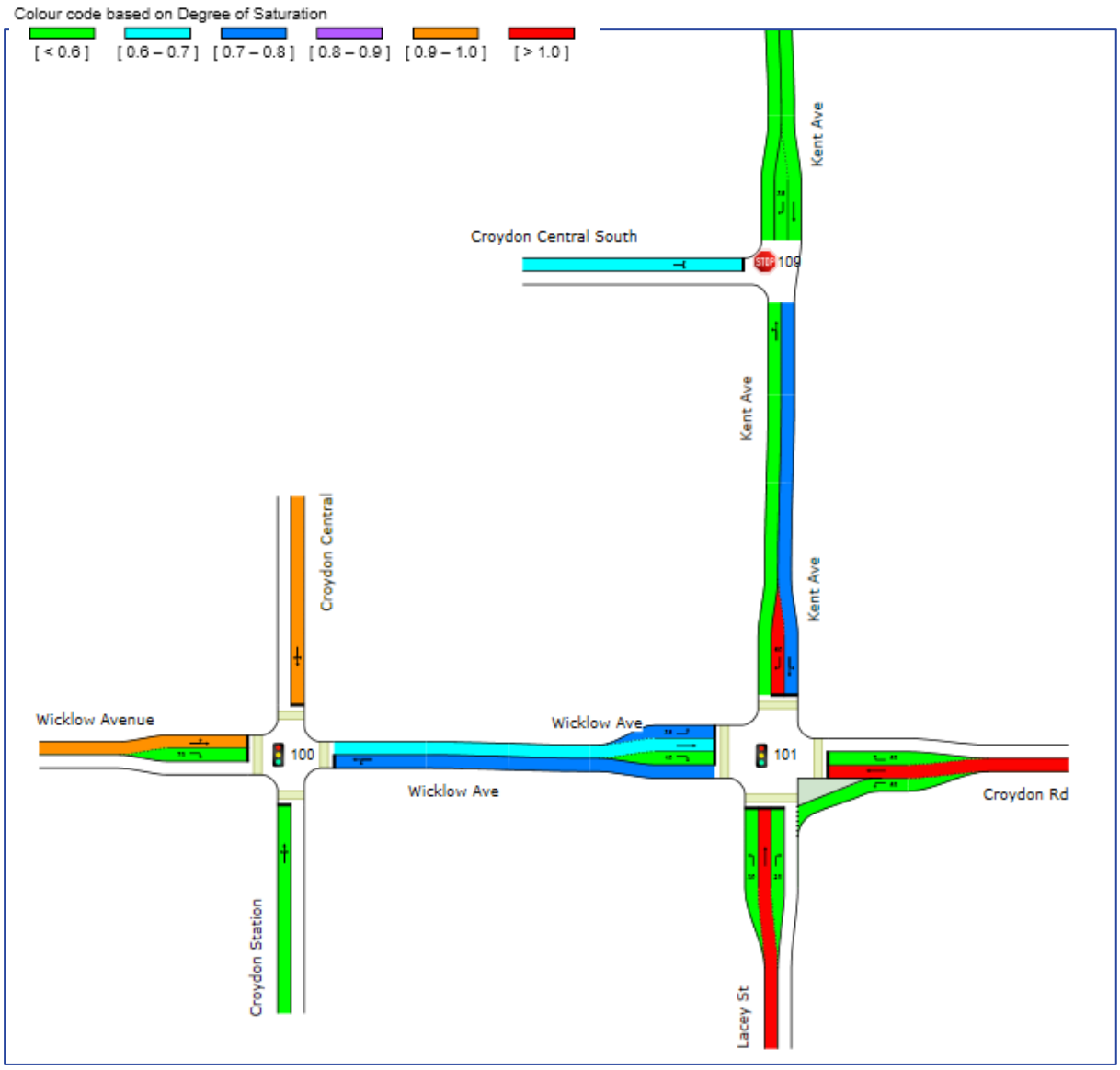

Figure 31: PM Peak hour post-development performance (with pedestrian phase)

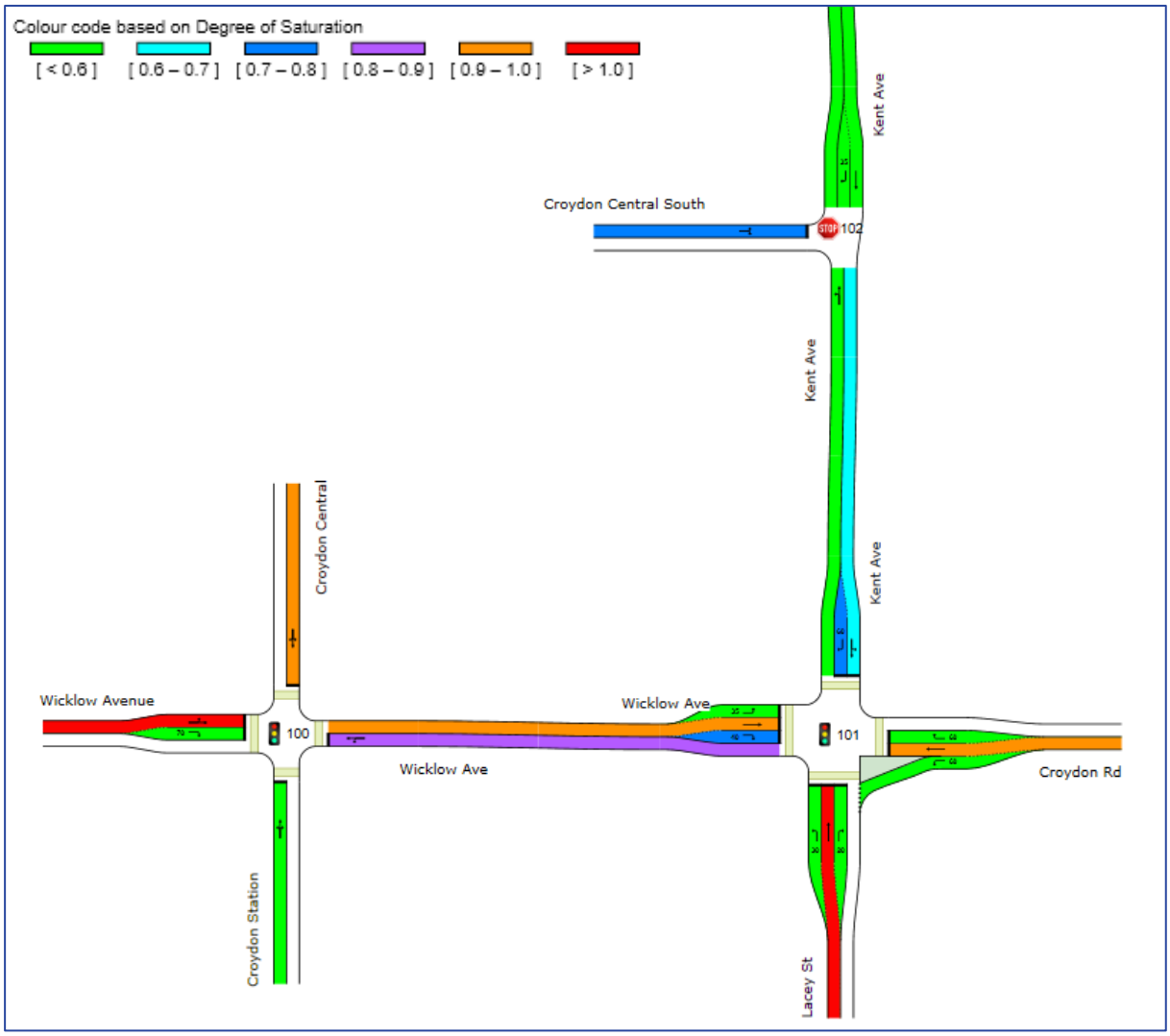

Figure 32: Saturday Peak hour post-development performance (with pedestrian phase)

The proposed changes impact the performance of the through lanes on Wicklow Avenue, with the intersections exceeding the practical capacity during both peak hours. The highest DoS is 1.022 at the Wicklow Ave / Kent Ave / Croydon Road intersection during the Saturday peak hour. This is still only just above capacity.

Accordingly, based on current modelling, a separate pedestrian only phase may not be the best overall transport network come due to impacts on road-based traffic, including public transport movements accessing the bus interchange.

At the future permit application stage, the intersection performance and signal phasing of the Wicklow Avenue / Site Access should be re-explored. At this point, the exact development yield will be known, and the LXRP works will have been completed and traffic patterns in the area will have adjusted to the substantial changes to the road network.

Therefore, at the permit application stage, a more accurate assessment can be conducted and a pedestrian only phase may be more feasible. Our recommendation is that this option be reviewed again at the permit application stage.

6. Review of DPO Requirements

Schedule 6 to the Development Plan Overlay applies to the subject site.

The following responses are provided with respect to the Access, Traffic and Parking objectives specified within Schedule 6 to the Development Plan Overlay.

Table 16: Review of DPO Requirements

Access, Traffic and Parking Objectives of the DPO	Response
• *Measures should be adopted to minimise conflict between vehicles and pedestrian movement within the development and on the adjoining street network.*	The Development Plan contemplates a central pedestrian plaza, connecting Croydon Central to a pedestrian crossing of Wicklow Avenue to Croydon Station. This is the primary pedestrian space created by the Development Plan. Loading bays and truck movements are largely separated from pedestrian movements internally within the site. This is a particular improvement compared to the existing Coles loading dock. The network changes created by the reconstruction of Croydon Station and the signalisation of the Wicklow Avenue roundabout and Wicklow Avenue site access point provide improved pedestrian connections to the Station compared to existing conditions. Signalising the Wicklow Avenue site access point also provides a safer pedestrian crossing of this access point. These points becomes far more relevant during the planning permit phase, when the internal carpark layouts and pedestrian access arrangements internally become a key issue for the carpark design. We are satisfied that the revised Development Plan provides appropriate direction to achieve these objectives.
• *Measures to improve pedestrian connections are encouraged including access for people with mobility impairment to public areas adjacent to the development, surrounding streets, the railway station and parking areas.*	
• *Consideration for bicycle facilities, taxi zones and customer drop-off opportunities.*	The concept plans include extending the bicycle lanes on Kent Avenue past the shopping centre. Internally, the design of bicycle facilities is a matter largely for detailed design at the planning permit application stage. Similarly, the Taxi Zones and customer drop-off areas would be part of the detailed design stage.

7. Review of DTP Preliminary Comments

We understand that the Council's representative has had an initial discussion with the Department of Transport and Planning (DTP). DTP asked whether the removal of the Wicklow Avenue access point would be a feasible option for the amended Development Plan.

Currently 32% of all traffic accessing Croydon Central uses Wicklow Avenue, which is a significant volume of traffic.

This carpark is proposed to accommodate up to 487 car spaces.

Under the post-development traffic conditions, there are between 368-649 vehicles her hour to/from the Wicklow Avenue site access point (see Appendix C for more details). Of these movements 260-424 vehicle movements are generated to/from the west.

If the Wicklow Avenue access point was to be closed, then all traffic travelling from the west would be required to enter via one of the Kent Avenue access points, meaning that there would be 260-424 additional vehicle trips re-directed through the Wicklow Avenue / Kent Avenue / Croydon Road / Lacey Street intersection that would otherwise not travel in this direction.

The SIDRA output presented at Section 5.5.7 demonstrated that the post-development DoS of this intersection will be 0.904-0.938 during the peak hour periods. Adding up to 424 further trips to this intersection would to push this intersection well beyond its capacity, significantly reducing its operating efficiency, and resulting in large delays and queuing.

If the Wicklow Avenue site access point is removed, all vehicles in the 487 vehicle carpark would be concentrated to a single access point (i.e. the southern Kent Avenue access), and in this instance, the queues and delays for vehicles turning out of this carpark is also expected to increase significantly.

This site is a large shopping centre with two arterial road frontages. Eliminating one frontage as an access point would holistically result in a worse outcome for the road network than spreading the traffic across multiple access points.

Accordingly, we do not consider that the removal of the Wicklow Avenue access point is a desirable outcome.

8. Conclusions

Having undertaken a detailed traffic engineering assessment for the proposed amendment to the Development Plan at Croydon Central, Croydon, we are of the opinion that:

a) the revised development plans provides for an appropriate framework that will guide future planning permit applications and will ensure that acceptable outcomes are achieved with regard to traffic and parking matters,

b) the proposed vehicle access arrangements to Croydon Central are generally consistent with the approved Development Plan,

c) it is necessary to have 3 fully directional access points to Kent Avenue to ensure that the traffic is adequately spread as it enters and exits the site,

d) under these arrangements, the traffic that is likely to be generated by the used and development contemplated by the revised Development Plan can be accommodated by the local road network,

e) the proposed vehicle access arrangements are acceptable and can accommodate the development traffic likely to be generated by the use and development of the land, with or without the leveling crossing removal,

f) the introduction of a pedestrian only phase at the Wicklow Avenue / site access point should be revisited at the permit application stage, when the specific details of the development are settled on,

g) the creation of two new sets of traffic signals on Croydon Road (as per LXRP upgrade) provides two safe pedestrian crossing points that directly link the site to the reconstructed Croydon Station and bus interchange, and these crossing points make the previously proposed mid-block signalised pedestrian crossing of Wicklow Avenue (part of the 2017 Development Plan) redundant,

h) at the permit application phase, the option for a pedestrian-only signal phase at the Wicklow Avenue access point should be re-examined,

i) the amended Development Plan contemplates that car parking will be provided in accordance statutory requirements of Clause 52.06-5, and the final yield of car parking would be determined at the Planning Permit application stage,

j) bicycle parking would be provided at least at the statutory requirements of Clause 52.34,

k) loading and waste collection will be adequately accommodated on-site in a way that is consistent with the current approval and in a form that is well separated from the public carpark and pedestrian movements,

l) the traffic engineering requirements of the Development Plan Overlay have been met, and

m) there are no traffic engineering reasons why the proposed amendment to the Development Plan for Croydon Central, Croydon should not be approved.