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**Kingsway Shopping
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Traffic Impact Assessment

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May 2024

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Kingsway Shopping Centre Traffic Impact Assessment

Lofte Property

WSP

Lvl 3, Mia Yellagonga Tower 2, 5 Spring St

Perth WA 6000

PO Box 7181

Cloisters Square WA 6850

Tel: +61 8 9489 9700

Fax: +61 8 9489 9777

wsp.com

Rev	Date	Details
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	Name	Date	Signature
Prepared by:	Pavan Macherla	22 May 2024	
Reviewed by:	Jacob Martin	22 May 2024	
Approved by:	Leigh Dawson	22 May 2024	

WSP acknowledges that every project we work on takes place on First Peoples lands.
We recognise Aboriginal and Torres Strait Islander Peoples as the first scientists and engineers and pay our respects to Elders past and present.

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1 Introduction

WSP has been commissioned by Tah Land Pty Ltd (the 'Client') to prepare a Transport Impact Assessment (TIA) to support a proposal for short stay accommodation and cafe/restaurant uses within the Kingsway City Shopping Centre (the 'Site') at 182 Wanneroo Road, Madeley in the City of Wanneroo.

This report describes the results of multi-modal transport impact and parking assessment for the proposed development. Focusing on traffic operations, circulation, and car parking utilisation, and including intersection operations with the boundary road network.

This report has been prepared in accordance with the Western Australia Planning Commission (WAPC) *Transport Assessment Guidelines for Developments: Volume 4 - Individual Developments (2016)*.

2 Site conditions

2.1 Site Location

Kingsway City Shopping Centre is located to the north-east of the Wanneroo Road / Hepburn Avenue intersection and bounded by these two roads, as shown in Figure 2.1.



Figure 2.1 Site location

2.2 Existing and surrounding land uses

The Site is currently occupied by the Kingsway City Shopping Centre which comprises a variety of retail, food & beverage and other commercial uses. It is identified in the *East Wanneroo Structure Plan (Cell 6)* as the Landsdale District Shopping Centre, with adjacent land use types including 'Community Purpose', 'Public Open Space' and 'Residential' at densities between R25 and R60, as shown in Figure 2.2. It is also guided by the Kingsway City Agreed Structure Plan No.59.

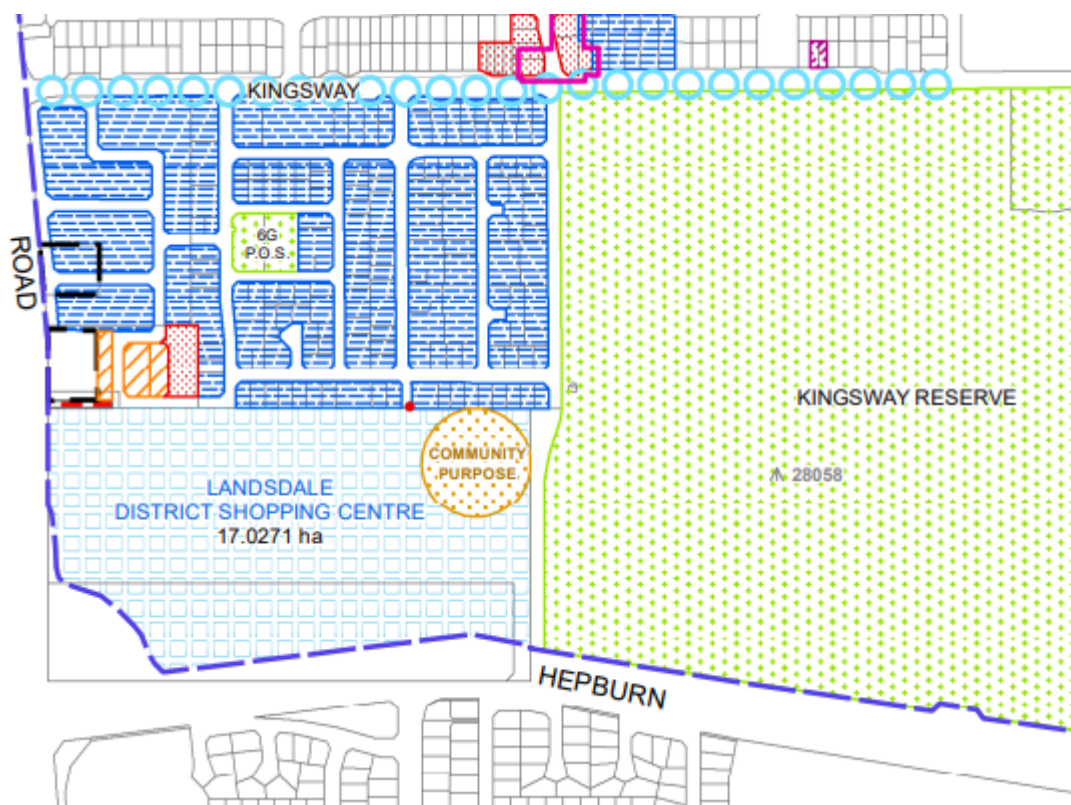


Figure 2.2 Surrounding land uses

2.3 Existing Road Network

The existing boundary road network is classified in the Main Roads Functional Hierarchy as follows:

- **Primary Distributor (Wanneroo Road):** Provide for major regional and inter-regional traffic movement and carry large volumes of generally fast moving traffic. Some are strategic freight routes and all are State Roads. They are managed by Main Roads Western Australia.
- **Distributor A (Hepburn Avenue):** Roads that carry traffic between industrial, commercial and residential areas and generally connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining property. They are managed by local government.
- **Local Distributor (Giralt Road):** Carry traffic within a cell and link District Distributors at the boundary to access roads. The route of the Local Distributor discourages through traffic so that the cell formed by the grid of District Distributors only carries traffic belonging to or serving the area. These roads should accommodate buses but discourage trucks. They are managed by the local government.

The layout and classification of the roads surrounding the site is presented in Figure 2.3.

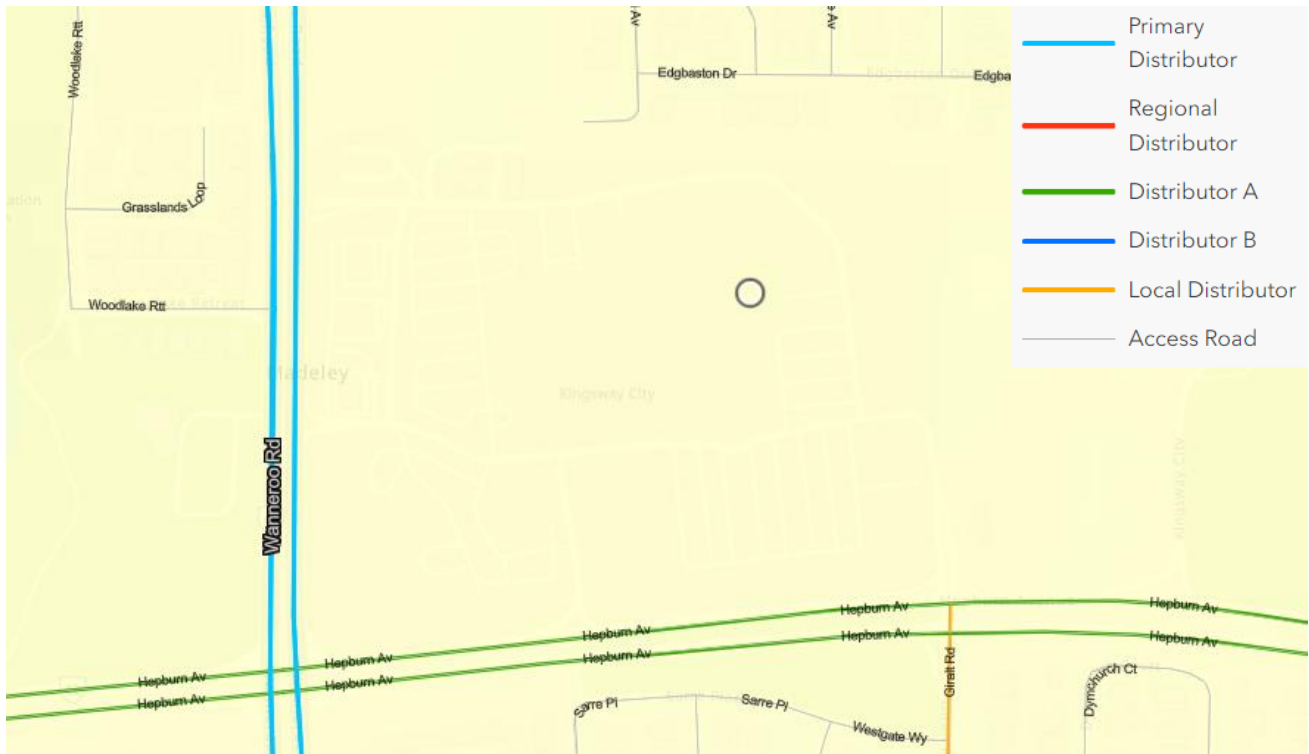


Figure 2.3 Existing road network

The characteristics of the existing roads in the vicinity of the Site are describes as follows:

- **Wanneroo Road** is located on the western boundary of the site. The general road form includes two 7.4m carriageways with channelised right and left turn pockets within a 40m road reserve. It has a posted speed limit of 70km/hr. It is classified as a Primary Distributor under the Main Roads Functional Hierarchy.
- **Hepburn Avenue** is located on the southern boundary of the site. The general road form includes two 9.0m carriageways with 1.6m sealed shoulders and channelised right / left turn pockets within a 55m road reserve. It has a posted speed limit of 70km/hr. It is classified as a Distributor A under the Main Roads Functional Hierarchy.
- **Giralt Road** connects to the eastern Site access at an existing signalised intersection on Hepburn Avenue. The general road form consists of a 10m carriageway with a painted 2m median within a 30m road reserve. It has a posted speed limit of 50km/hr. It is classified as an access road under the Main Roads Functional Hierarchy.

2.4 Existing Public Transport Facilities

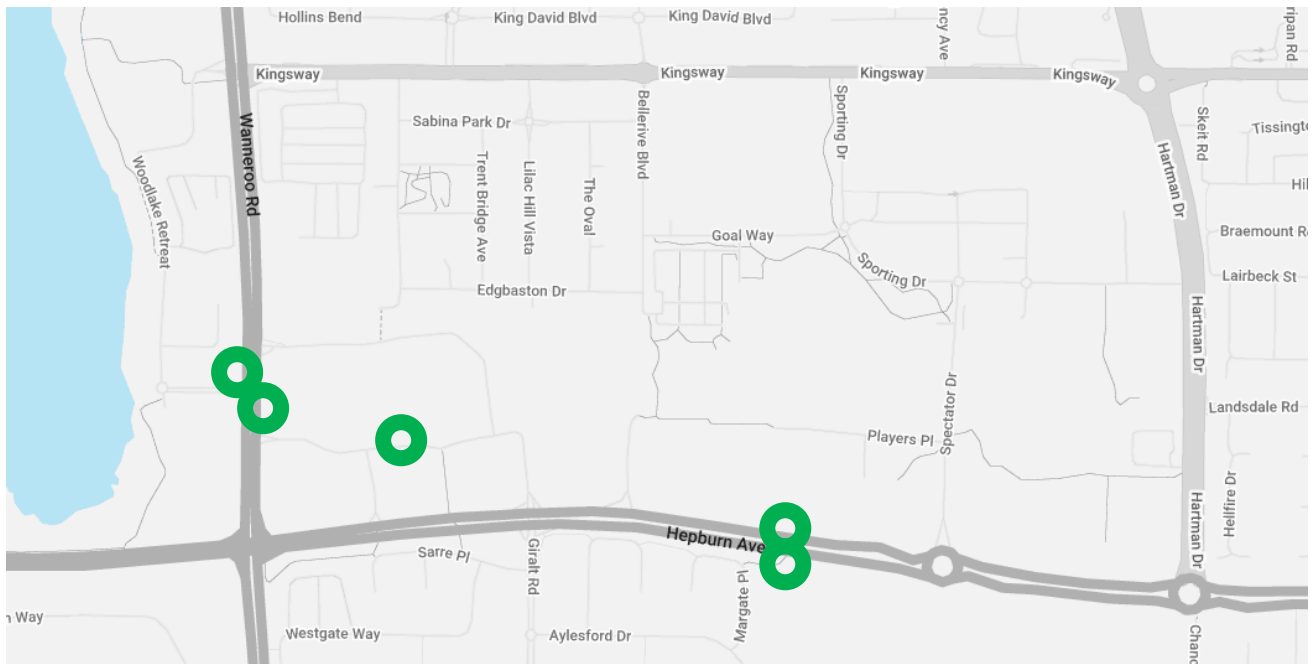


Figure 2.4 Local bus stops

The Site is served by five Transperth bus Routes, via stops located within the Site (Routes 385/386 and 448) or along Wanneroo Road (Routes 389 and 450). These routes are summarised as follows (Table 2.1).

Table 2.1 Existing Public Transport Services

Route	Route Description	Peak hour frequency	Off peak frequency	Saturday midday
385/386	Perth – Kingsway Shopping Centre via Girrawheen	10min (tidal) 30min (contraflow)	30 min	30 min
389	Perth – Wanneroo (along Wanneroo Road)	10-20 min	30-40 min	60 min
448	Warwick - Kingsway Shopping Centre	20 min	60 min	60 min
450	Warwick – Landsdale Via Kingsway Shopping Centre	20-30 min	30 min	30 min

Route 385 operates as a peak period limited stop service duplicating the Route 386 alignment. For this reason, the combined Route 385/386 service can be considered to have a peak hour frequency of 10 minutes in the tidal direction (into the Perth CBD in the morning and outbound in the afternoon), but only every 30 minutes in the opposite direction and throughout the day.

The orientation of routes through the Madeley area shows the prominence of Kingsway Shopping Centre in the urban fabric – with the Site operating both as a key stop and as a terminus. Public transport is therefore considered to be particularly good (for an outer suburban location).

2.5 Existing Pedestrian and Cycle Networks

Pedestrian facilities are available along all main roads corridors, with crossing points and external connections at key crossover locations and in the vicinity of the bus stop on Wanneroo Road (Figure 2.5).

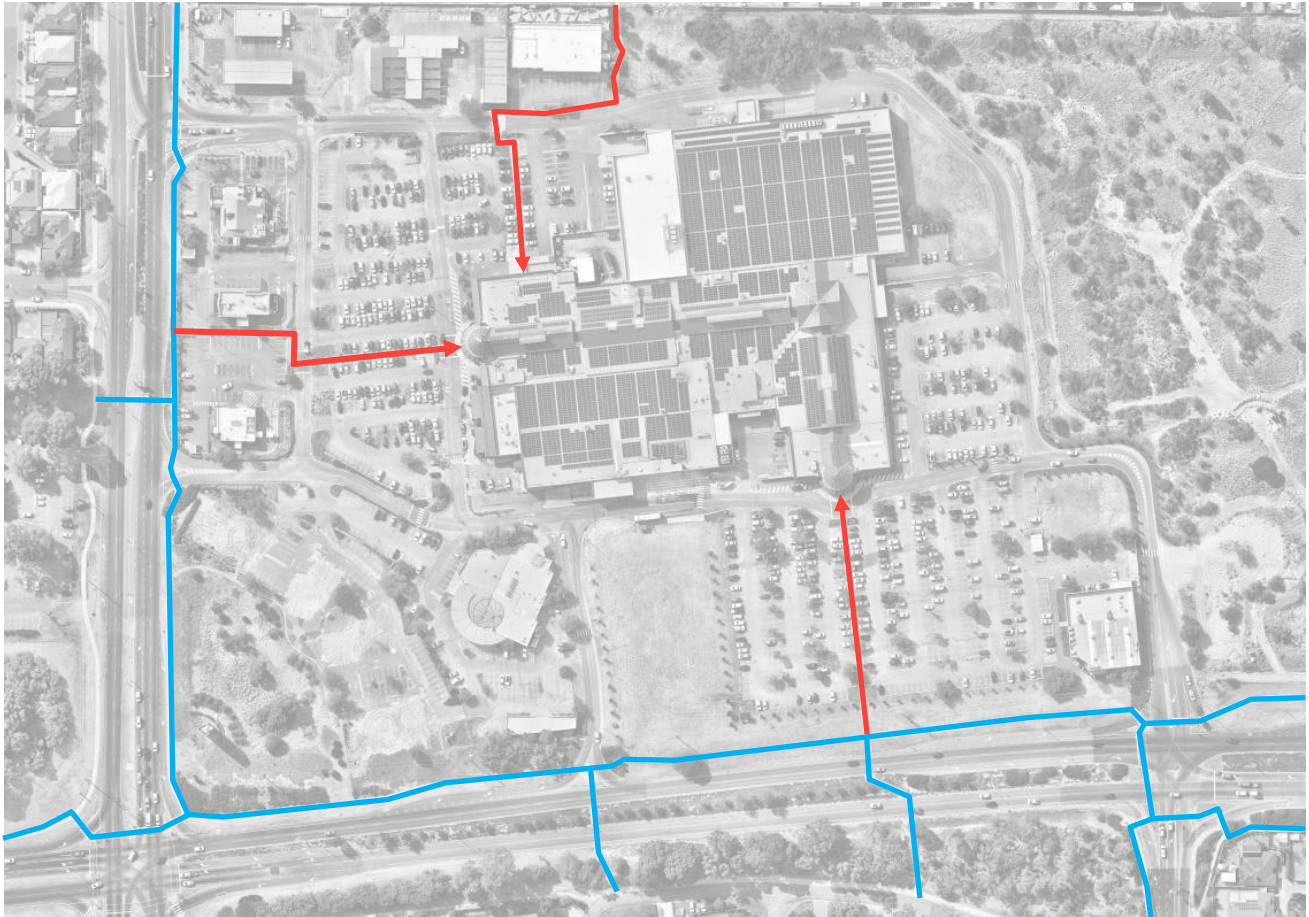


Figure 2.5 Pedestrian/cycling connectivity to Kingsway City Shopping Centre

Currently, direct access to the northern residential cell is provided via a pedestrian connection across the boundary to Old Trafford Lane. This facility links to the childcare centre at the northern edge of the Site, and continues through the Shopping Centre car park to the western Kingsway City Shopping Centre entrance.

2.6 Existing Parking

A total of 1,409 bays are provided in the form of at-grade parking within the Site. This parking has been assessed against current demands using a sophisticated analysis method, using daily and hourly door counts as well as sample accumulation surveys to define design day function and anticipated parking demand.

2.6.1 Survey methodology

Parking occupancy information has been gathered over the two (2) survey dates using a video count to develop a parking accumulation for the representative peak period. Surveys were conducted over the following periods:

- Friday 19 April 2024 (5:00am to 3:00pm)
- Saturday 20 April 2024 (5:00am to 3:00pm)

Video counts of vehicles entering and exiting from the four access points allowed for an overall count of vehicles on-site during these periods.

The collated survey results for the two (2) survey periods are shown below, Figure 2.6.

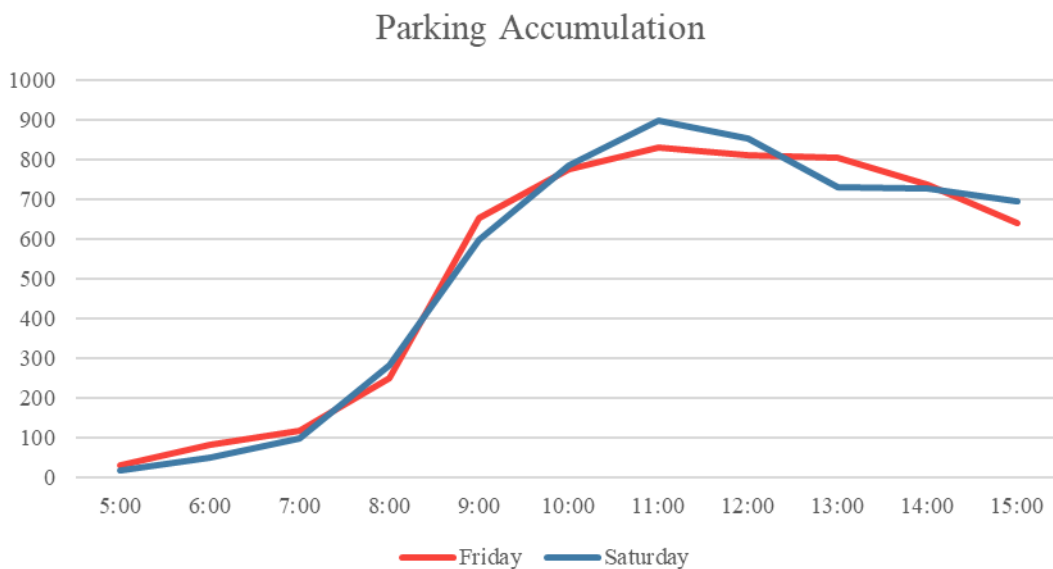


Figure 2.6 Observed parking accumulation (Friday 19 April, 2024 and Saturday 20 April, 2024)

2.6.2 Patronage comparison

To place the above observations into context, door counts for the Kingsway City Shopping Centre have been obtained from centre management. This information allows for a daily track of visitors for an entire year, placing the specific surveyed days within a continuum of demand across the year.

Analysis of the door counts provides a large volume of data regarding patronage trends. In particular, it depicts the variation in patronage throughout the year, distinctly showing weekly cycles including the Thursday peak trading and Sunday low-trading days. Additional seasonal peaks are visible in April (Easter), in addition to the main pre-Christmas shopping season in December.

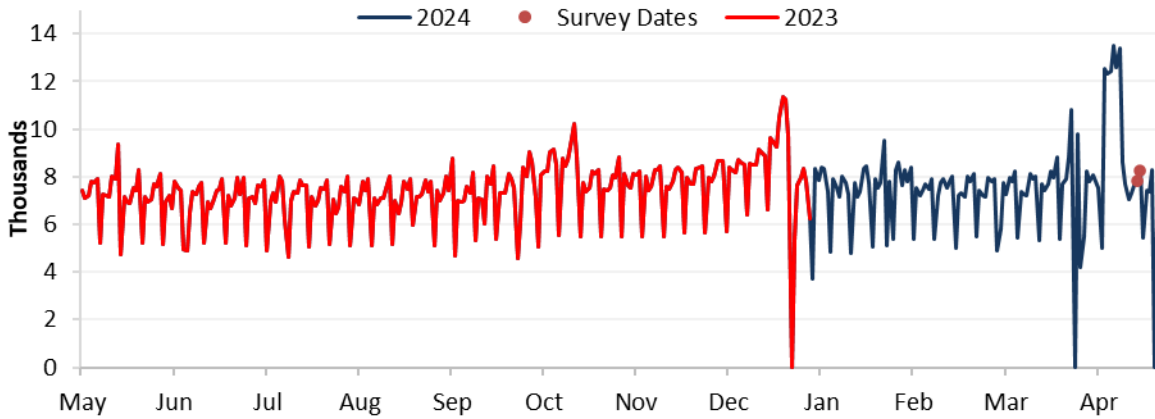


Figure 2.7 Annual door counts (1 May 2023 to 28 April 2024)

Hourly trends in arrivals have also been extracted from door counts to determine a peak for the Centre. This allows for an adjustment of daily traffic to the critical parking peak (around midday). Information provided by the Centre indicates that the two hours around midday accounts for about 22% of weekday traffic, 27% of Saturday traffic and 38% of Sunday traffic. These factors can therefore be applied to daily volumes to estimate parking intensity.

The peak demand during parking occupancy surveys, adjusted midday door counts and derived parking ratio are described in Table 2.2.

Table 2.2 Comparison of parking occupancy and door counts

Survey Period	Peak Hour Parking Occupancy	Daily Door Count	Adjusted Midday Door Count	Parking Ratio (patrons per occupied space)
Friday 19 April 2024	830	7,846	1,761	1:2.1
Saturday 20 April 2024	902	8,281	2,096	1:2.3
Average Surveyed	866	8,064	1,929	1:2.2

Door count information has been analysed to determine the relative patronage for the surveyed days based upon door count data, in comparison to the busiest day of the year. The surveyed dates represented the 134th and 66th busiest days of the year, with the adjusted midday door count positioned at 190th and 67th busiest of the year, respectively.

2.6.3 Design day calculation

To determine a design day, the adjusted midday patronage was sorted and graphed, as shown in Figure 2.8. Best practice identifies the ‘knee’ of the graph as a suitable design day. This reflects the fact that the busiest days of the year (Christmas and Easter, particularly) do not have a representative demand profile through the day; the Centre is likely to have extended trading hours and customers arrive more consistently throughout the day.

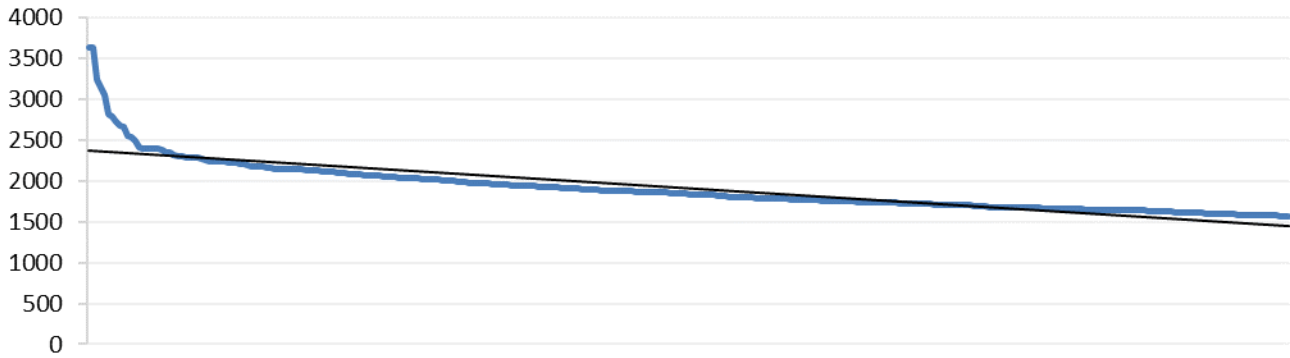


Figure 2.8 Adjusted midday counts - busiest day to least busy day for the period (May 1, 2023 to April 28, 2024)

As shown in the graph above, the vast majority of days lie on a straight line, with only a few exceptions identified. This is the ‘knee’ of the curve. A zoomed in view of the top 50 days shows that this point occurs around the 14th busiest day of the year. This can be considered as the design day for the purpose of parking demand assessment.

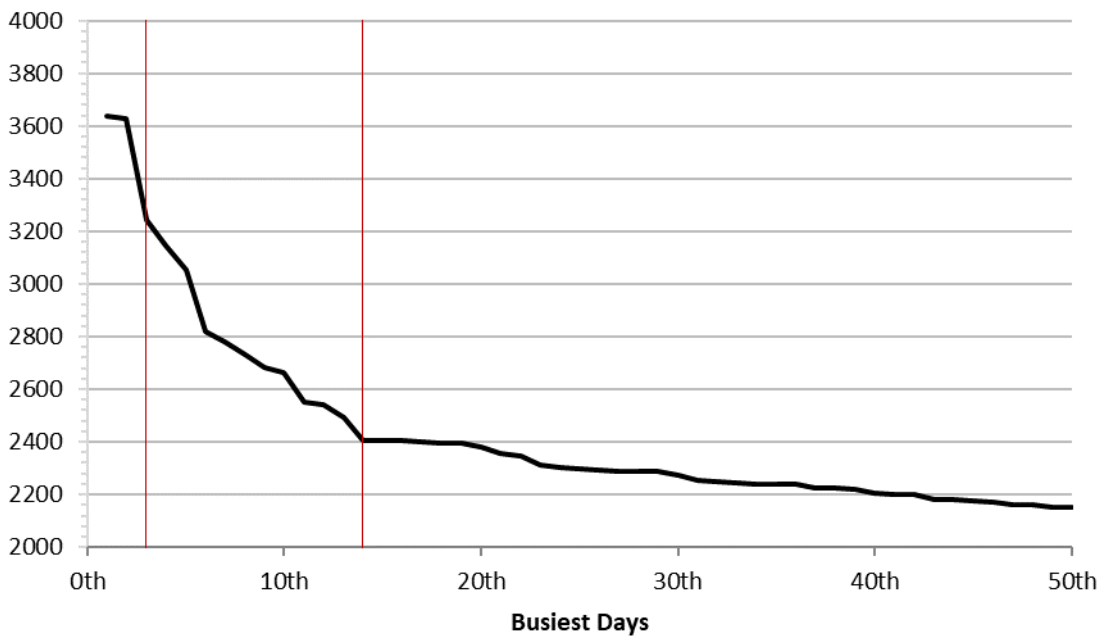


Figure 2.9 Adjusted midday counts (top 50 busiest days)

2.6.4 Demand day parking

Using the information obtained from the survey data, which shows that peak demand for parking is related to the adjusted midday door counts at a ratio of 1:2.2 and assuming this linear relationship holds for the design day, approximately **1,080 parking bays** would be required for the existing Site.

Given that the Kingsway City Shopping Centre has an existing supply of **1,437** on-site bays, this represents a considerable surplus over existing requirements.

2.6.5 Comparison to policy rates

The current City of Wanneroo minimum parking requirements for Shopping Centres as described in the District Planning Scheme No. 2 (DPS2) are considerably higher than those recommended by the Department of Transport in the *Parking Guidelines for Large Shopping Centres*.

For this Centre, comprising approximately 23,200sq.m of retail/commercial space (and including all uses within this broad category), DPS2 requires **1,525 bays** (700 bays for the first 10,000sq.m and 6.25 bays per 100sq.m thereafter). This exceeds the calculated design day requirement considerably (40% above demand).

The Department of Transport defines an appropriate *maximum* parking supply for large Shopping Centres (greater than 10,000sq.m) of 4.2 bays per 100sq.m. This would equate to **975 bays** (marginally lower than the calculated design day demand).

2.6.6 Theoretical Parking Demand

The existing land uses have been assessed using a bespoke parking model to develop a theoretical demand profile for the Centre. This has been built using standard best practice parking generation and hourly profiles extracted from ITE’s *Parking Generation (4th ed.)* and Urban Land Institute’s *Shared Parking*. The individual land uses (including those within the shopping centre itself) have been aggregated into the following summary. Note that uses have been categorised to correspond with available parking data, and therefore may not align with PLUC codes.

Table 2.3 Existing land uses for parking assessment

Land Use	Category	Area / Units
Shopping Retail	Retail	15,430 sq.m NLA
Service Retail (banks, travel agencies, hair & beauty etc.)	Retail	1,800 sq.m NLA
Petrol Station	Retail	8 pumps
Childcare	Office	~100 places
Gym	Entertainment	2,300 sqm NLA
Medical/ Vet Clinic	Office	1,630 sq.m NLA
Government Office	Office	190 sq.m NLA
Fast Food Restaurant	Restaurant	~400 seats
Family Restaurant	Restaurant	~230 seats

The hourly demand profiles from each of the land uses have been combined to create demand profiles for parking analysis.

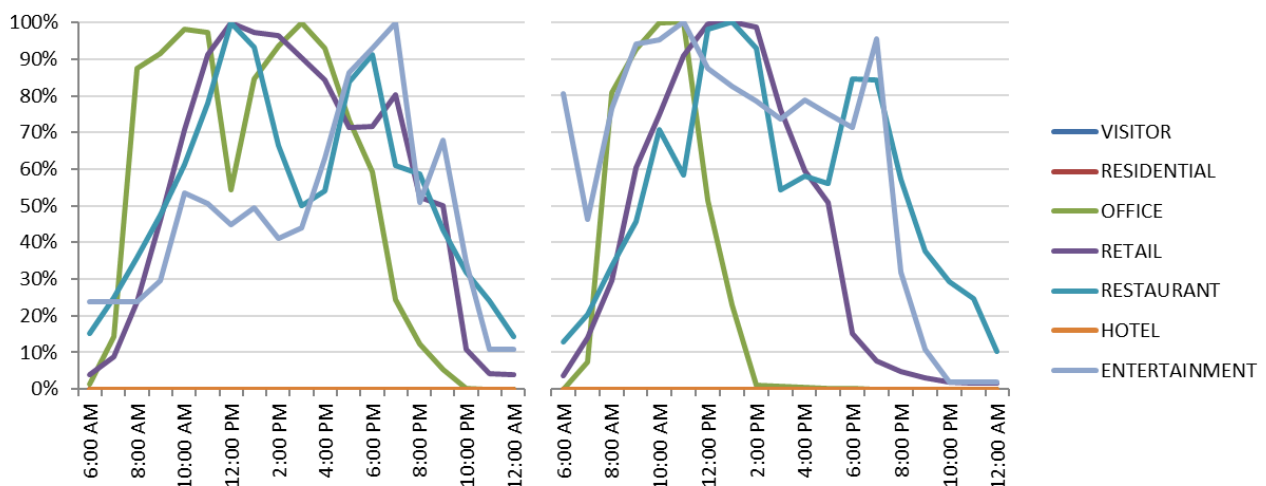


Figure 2.10 Land use parking profiles by category – weekdays (left) and weekends (right)

The parking generation for the identified land uses applied to each hour of the day results in the following theoretical parking demand for the existing Site.

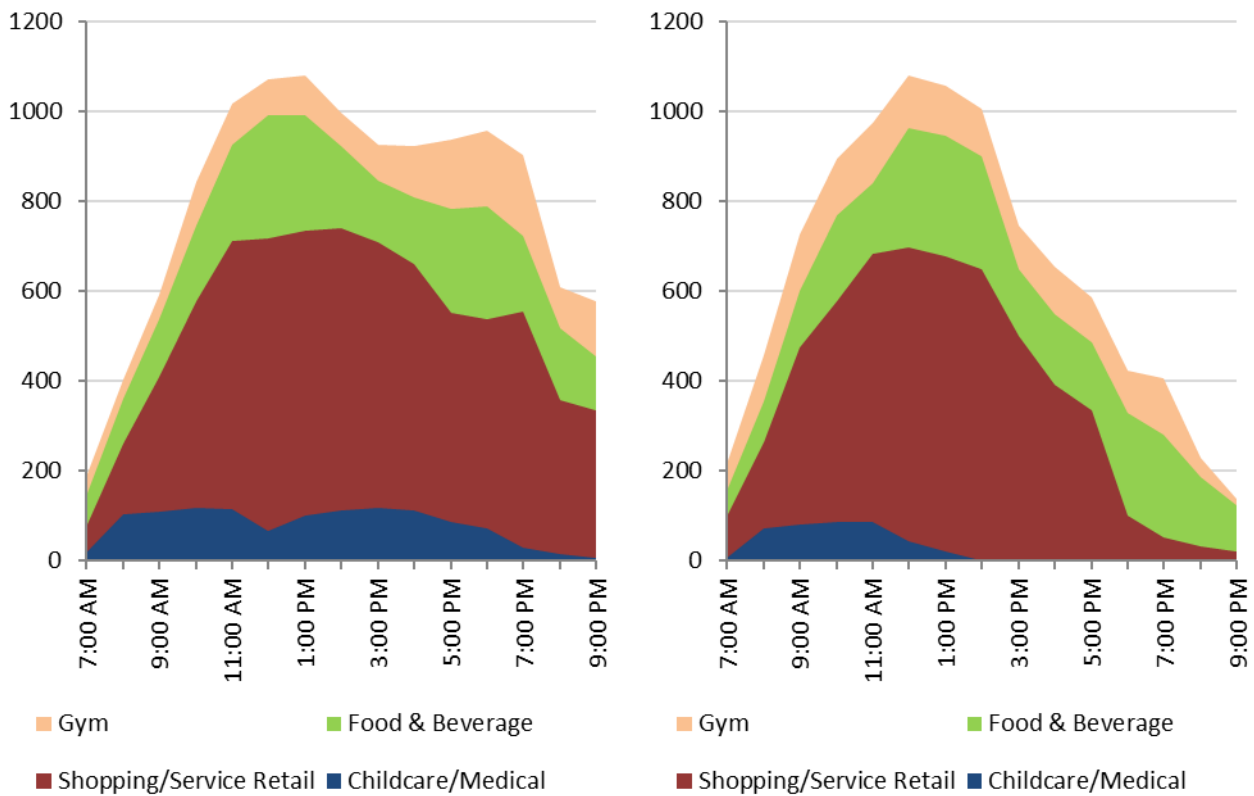


Figure 2.11 Theoretical existing parking demand by hour – weekdays (left) and weekends (right)

The modelled profiles have been calibrated to align with the calculated design day peak parking for the Centre (**1,080 bays** on the 14th busiest day of the year) and so are considered to be a reasonable tool to assess the impact of the proposal on parking supply (see Section 3.4).

2.6.7 Staff parking demands

The theoretical demand model also estimates staff parking proportions based on standard best-practice guidance, as shown in Figure 2.12.



Figure 2.12 Theoretical employee/visitor parking demand split by hour – weekdays (left) and weekends (right)

This can be compared against the outcomes from a staff parking survey completed on Monday 21 March 2024, which suggested a peak staff occupancy of between 261 and 345 bays across the Centre (24-32%). The results from the demand model again show very close alignment to observations, and so may be considered representative for the purpose of future projection.

2.7 Existing Traffic Volumes

The existing traffic volumes sourced from Main Roads WA traffic map are summarised in Table 2.4.

Table 2.4 Existing AADT traffic volumes

Road Name	Year	Average Weekday traffic volumes
Thomas Road	2020/2021	35,700
Hepburn Avenue	2018/2019	22,200
Giralt Road	2023	18,700

Traffic generated by the Shopping Centre itself is estimated to be in the order of 20,000 vehicle movements per day (10,000 in and 10,000 out), spread across four separate access points, as follows (Table 2.5).

Table 2.5 Existing daily trip generation for the Site by entry

Access	Weekday Daily	Weekday PM Peak	Weekend Peak
Wanneroo Road North	9,500	770	980
Wanneroo Road South	1,620	150	180
Hepburn Avenue / Giralt Road (Hepburn Avenue East)	6,200	600	830
Hepburn Avenue West	2,870	250	310

2.8 Changes to Surrounding Area

No significant changes to the road network or public transport services is anticipated in the vicinity of the development within a 10-year horizon. However, provision for future upgrade of the Wanneroo Road / Hepburn Avenue intersection in the form of an interchange has been captured in the land ceded to Main Roads WA at the south-western corner of the Site.

The need for improvements to cycling facilities in the vicinity of the Site (along the Wanneroo Road Primary Route and Hepburn Avenue Secondary Route) is recognised in the City of Wanneroo *Bicycle Network Plan* and DoT's *Long Term Cycle Network*. The timing and extent of these upgrades are not known at this time.

3 Proposed Development

3.1 Proposed Land Uses

The proposed development comprises the construction of 135 short-stay serviced apartments and 6 food and beverage tenancies at the western edge of the Shopping Centre Site. This development will also require removal of existing parking spaces and the reconfiguration of the existing car park and service/loading area to the south-west of the Aldi loading dock.

A portion of the existing Site has also been identified for construction of the future Wanneroo Road / Hepburn Avenue interchange and has been ceded to Main Roads WA for this purpose. The total parking supply retained on-site will ultimately comprise **1,285 bays**.

Table 3.1 Summary of land use changes

Land Use	Area / Units	Location
Short-stay apartments	135 units	Levels 1-7
Non-traffic generating amenities - Gym - Conference room - Meeting room		Level 1
Food & Beverage tenancies (6)	846sq.m	Ground Floor

The ground floor plan of the site is as shown in Figure 3.1. This replaces an existing car park at the western end of the Shopping Centre, and requires reconfiguration of retained car parking to better manage function. Changes to the existing loading dock area have also been captured to accommodate the proposed development needs.

Development plans are also provided in **Appendix A**.

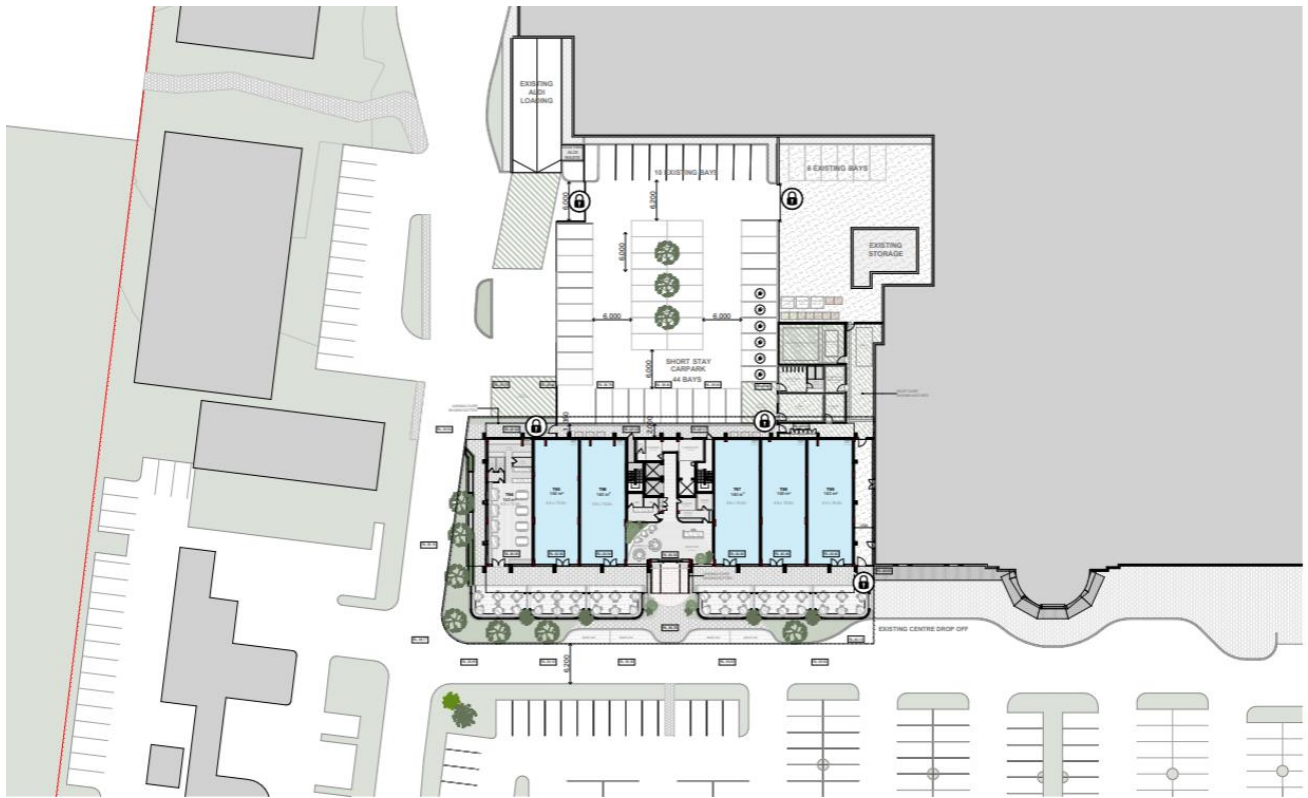


Figure 3.1 Proposed ground floor layout

3.2 Access Arrangements

3.2.1 Development access changes

The access arrangements to the overall Site are not affected by the proposed development in any way, with all access and circulation consistent with current operation. However, a modified parking arrangement has been proposed which includes 54 secured parking bays for the use of short-stay residents and changes to the loading dock access.

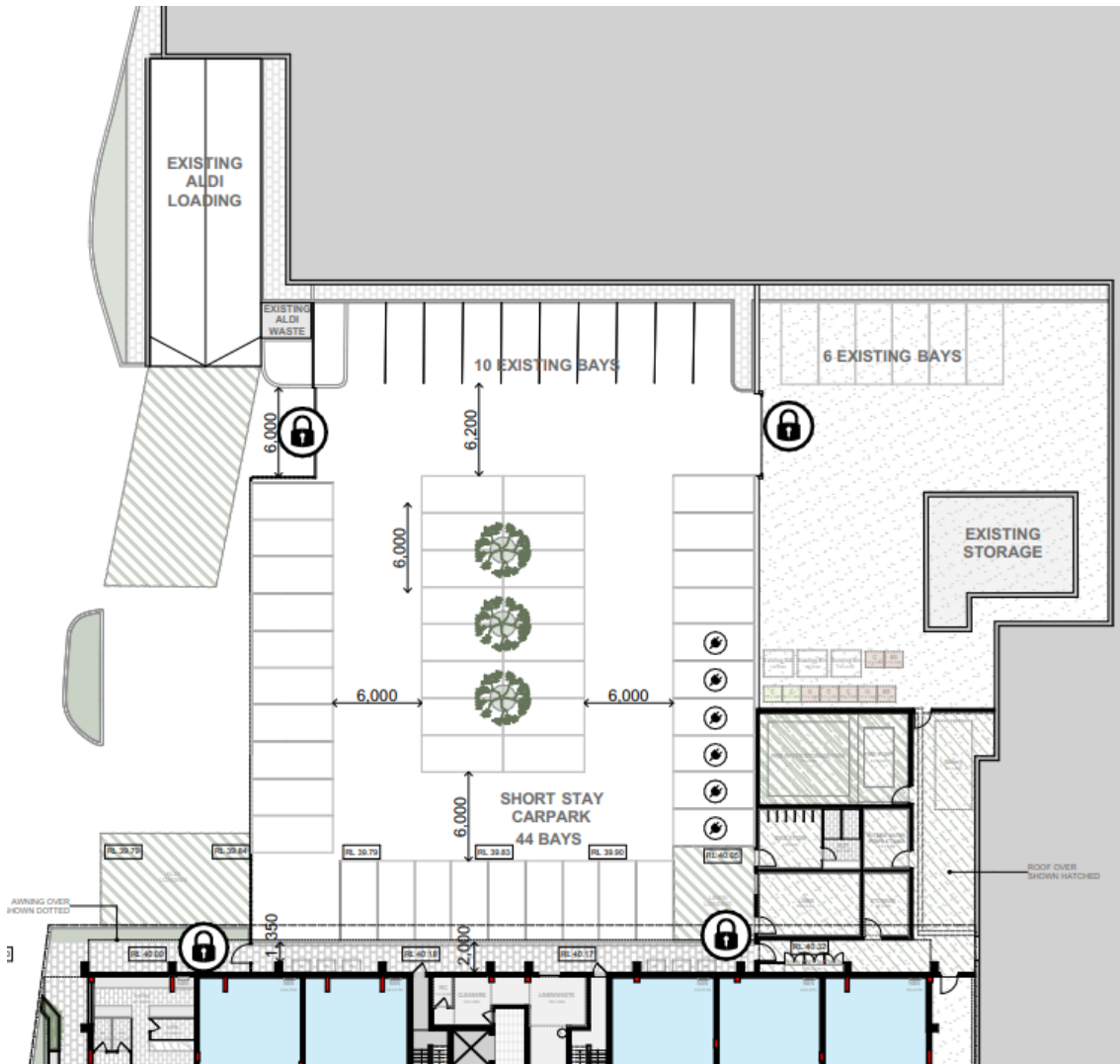


Figure 3.2 Proposed car park access arrangement

Gated access is proposed to the parking and F&B back of house area to maintain security for short-stay residents. It is anticipated that this will be provided in the form of a remote or swipe access control at the entry points, along with an intercom arrangement.

The pedestrian route from the western edge of the Site currently runs through the car park and around the edge of the loading dock. This facility will be converted to a secured link along the back of food & beverage tenancies to allow for servicing and waste transport. An alternative path is to be provided to direct pedestrian movements along the frontage and through to the western entrance to the Shopping Centre.

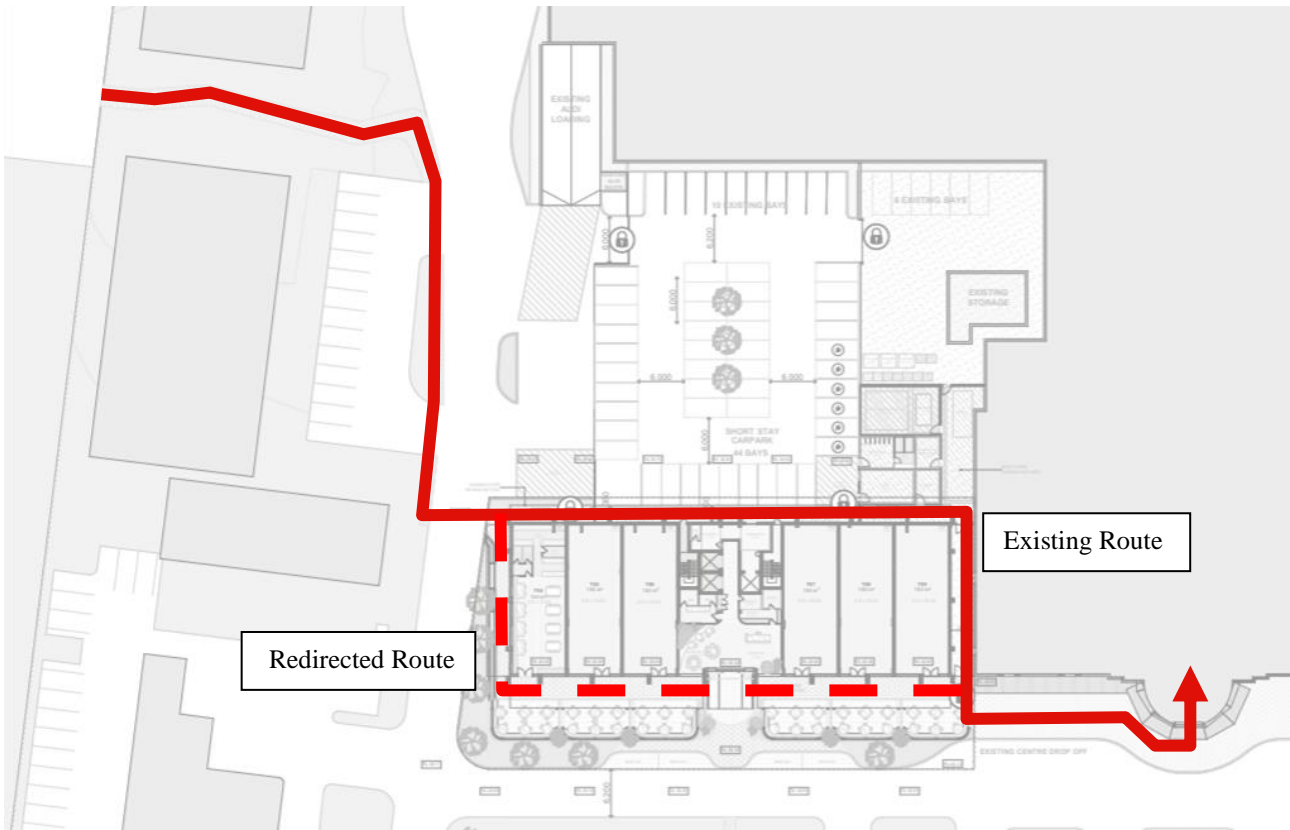


Figure 3.3 Effect of proposal on pedestrian movements

3.2.2 Retained Shopping Centre access intersections

A total of four access points are available to facilitate traffic movements to/from the Site, including:

- Wanneroo Road / Kingsway - north access
- Wanneroo Road / Kingsway - south access
- Hepburn Avenue / Giralt Road / Kingsway - east access
- Hepburn Avenue / Kingsway - west access

These are shown graphically in the following aerial images, with additional information, including phasing arrangements for the two signalised intersection provided in Section 4.6.



Figure 3.4 Wanneroo Road / Kingsway - north access



Figure 3.5 Wanneroo Road / Kingsway - south access



Figure 3.6 Hepburn Avenue / Giralt Road / Kingsway - east access



Figure 3.7 Hepburn Avenue / Kingsway - west access

3.3 Provision for Service Vehicles

The introduction of the secured short-stay car park and minor modification of the existing loading area has been assessed using swept path analysis for the three critical design vehicles:

- 10.5m front-lift waste collection vehicle; and
- 12.5m HRV service vehicle (fruit & veg truck)
- 19m AV service vehicle (Aldi truck)

The outcomes of this swept analysis are shown below, Figure 3.8 through Figure 3.10.



Figure 3.8 Swept path for Aldi delivery truck (19m AV) – inbound and outbound

The above swept path shows that the orientation of the short-stay parking does not compromise Aldi delivery access and egress paths from the existing dock.



Figure 3.9 Swept path for delivery truck (12.5m HRV) – inbound and outbound

The above swept path shows that while access and egress for a 12.5m HRV is feasible within the modified loading dock, the area must be maintained clear of bins and parking. This will require ongoing management through a service/delivery plan.

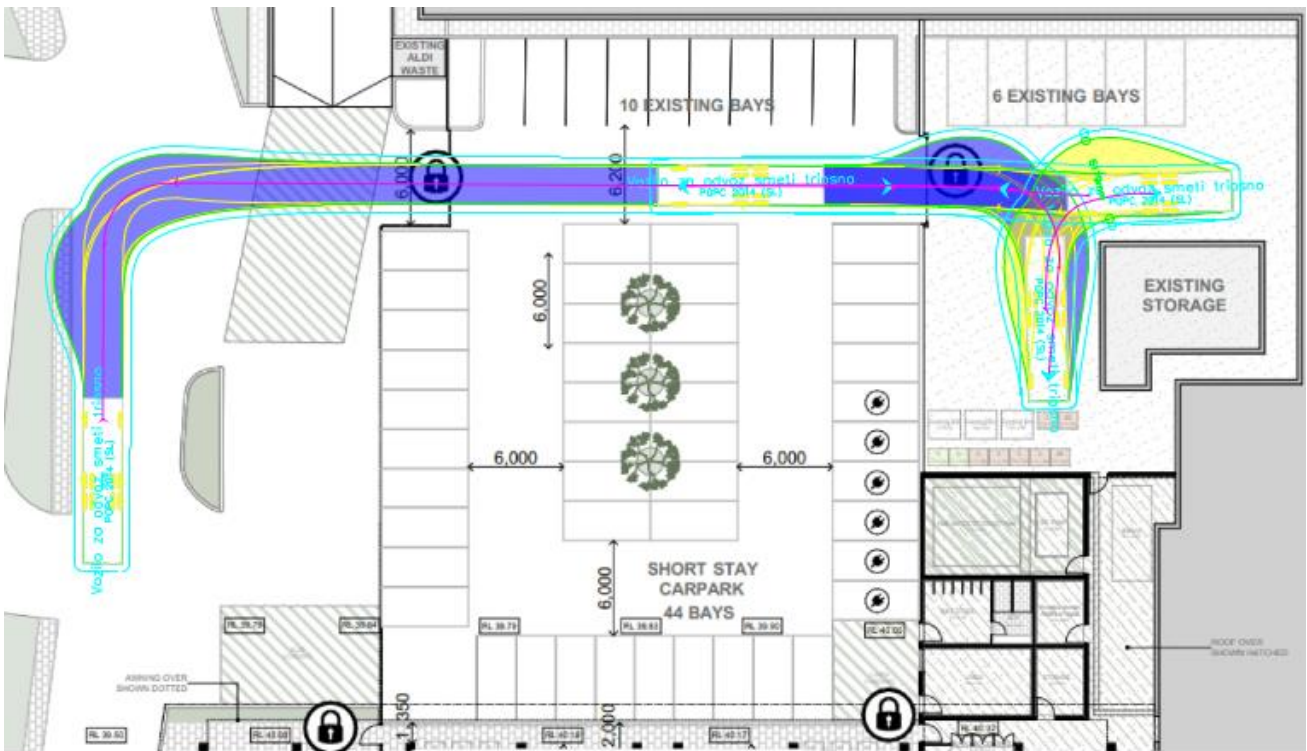


Figure 3.10 Swept path for waste truck (10.5m) – inbound and outbound

The above swept path shows that movements by the waste collection vehicle are feasible within the modified loading dock.

3.4 Car Parking

The construction of the proposed F&B and short-stay accommodation is expected to reduce on-site supply by approximately 43 bays. To determine whether the retained parking is sufficient for the Centre post-development, the theoretical car parking assessment completed for the existing development has been extended to include the proposed uses. This method has been used as it considers the temporal use of parking for the food and beverage tenancies, as well as the dedicated parking required in secured facilities for the short-stay apartments (54 bays). Electric vehicle charging is supported within the secure car park, through the provision of 6 EV bays.

While this dedicated supply is considered to be sufficient for the majority of the year, there will be times where high short-stay occupancy results in parking demand that is higher than this supply. At such times, there will be ample parking in the publicly accessible Centre supply – as such this should not be considered a critical limitation of the Plan.

The anticipated parking demand profiles for the F&B and serviced apartment offerings are shown below (Figure 3.11). The high midday utilisation for the hotel use reflects the use of parking for the purpose of service, cleaning and maintenance. This assumption may be marginally conservative given the nature of serviced apartments which generally require less frequent attendance than high-turnover hotel rooms.



Figure 3.11 Development land use parking profiles by category – weekdays (left) and weekends (right)

Combining the proposed development demands with existing uses results in the following projected parking demand by land use category (Figure 3.12).

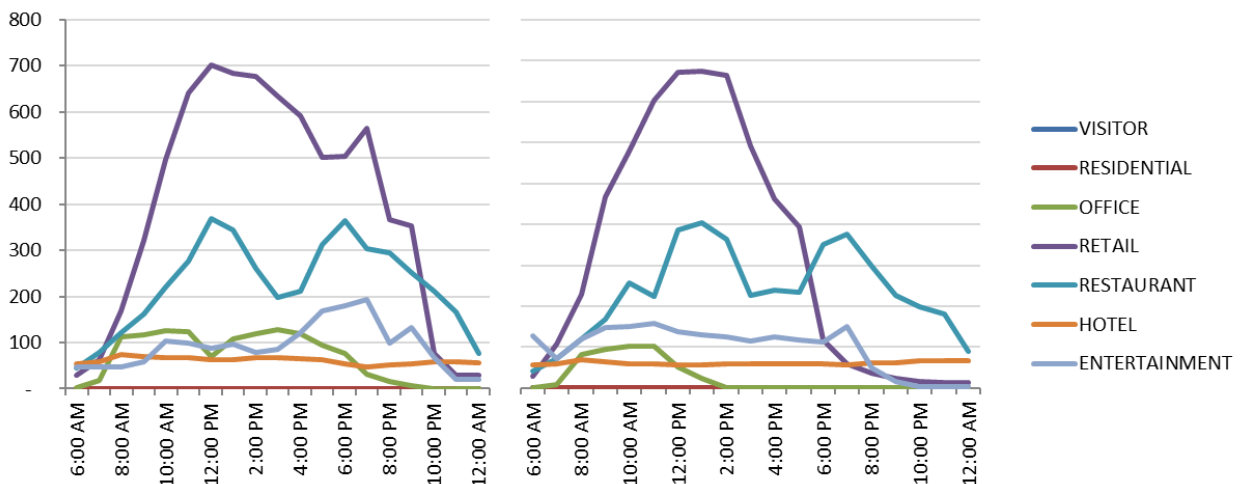


Figure 3.12 Post-development land use parking demand by category – weekdays (left) and weekends (right)

This results in the following concurrent use profile for parking across the entirety of the Centre (including all on-site parking bays).

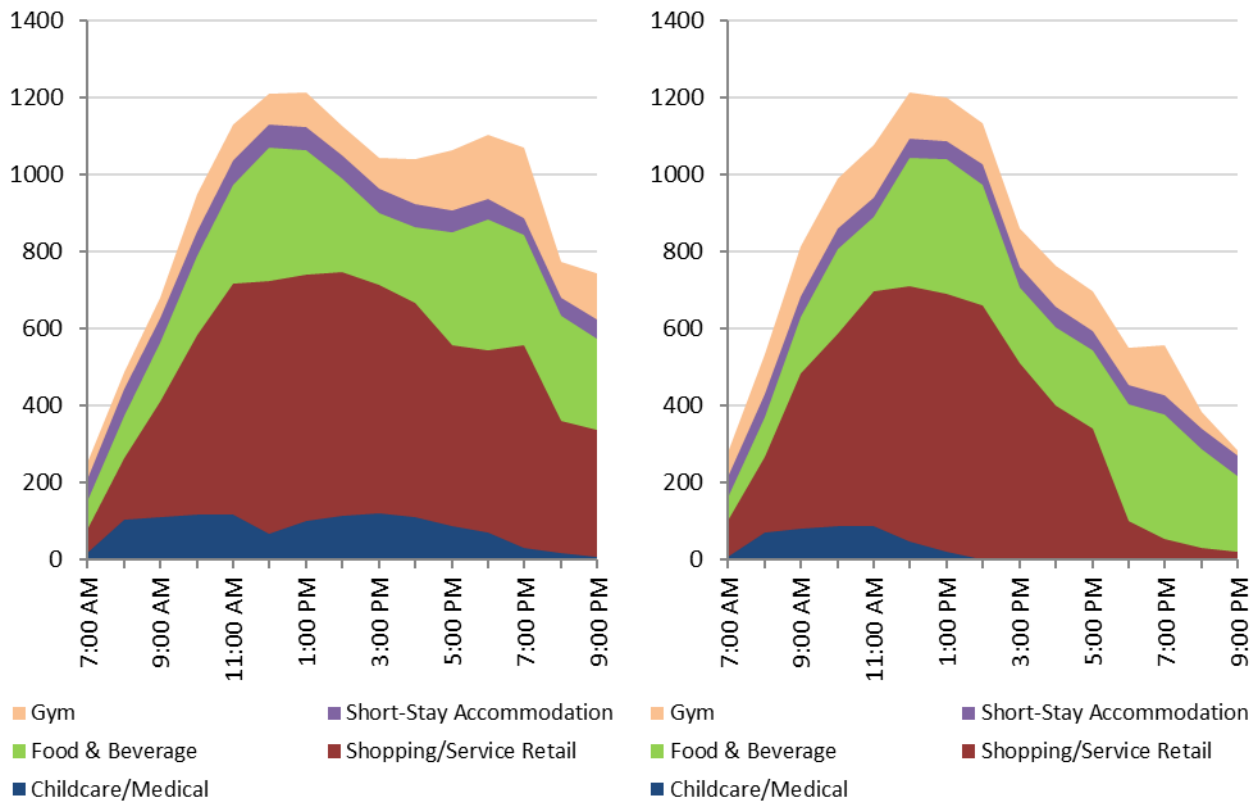


Figure 3.13 Theoretical post-development parking demand by hour – weekdays (left) and weekends (right)

These results represent an *increase* in peak midday parking demand of about 133 bays (in the order of 11% over existing usage). Given that the calculated design day parking demand is **1,080 bays**, this indicates a future demand of **1,213 bays** on the representative design day. The retained supply of **1,285 parking bays** is considered to be sufficient, resulting in an **effective surplus of 72 bays**.

3.5 Bike Parking

Bicycle parking is specifically provided in secure facilities for use by F&B staff of the proposed development (in addition to existing facilities across the Centre). A total of 6 bike racks are proposed, capable of accommodating up to **60 staff** at a 10% cycling mode share.

4 Traffic Analysis

To identify the sufficiency of the existing road network, and to assess the potential requirements for modification to key intersections, WSP has completed a series of SIDRA intersection models.

These have been undertaken using the SIDRA 9.1 network package for all four access intersections:

- Wanneroo Road / Kingsway - north access
- Wanneroo Road / Kingsway - south access
- Hepburn Avenue / Giralt Road / Kingsway - east access
- Hepburn Avenue / Kingsway - west access

Peak times selected are 4:30 PM to 5:30 PM for the weekday peak and 12:00 PM – 1:00 PM for the Saturday Peak.

The following model scenarios have been assessed:

- 2024 background traffic
- 2024 background traffic + development
- 2034 background traffic (at 2% p.a. growth) + development

4.1 Analysis Assumptions

The following assumptions for the trip generation and SIDRA assessment are summarised below:

- Heavy vehicle volumes were adopted from Main Roads WA traffic map.
- Turning volumes were derived from Main Roads WA traffic map and SCATS data.
- A review of the historical data in the vicinity of the Site shows a static or negative growth, and this is expected to hold true in future years. As such, it is assumed that the surrounding road network will not exhibit any significant growth during peak periods over the 10-year horizon. Background traffic volumes are therefore considered to represent a reasonable estimate of future demand.
- Nevertheless, a conservative 2% growth scenario has been included to consider the impact of regional traffic increases on access function. Any impacts identified in this scenario should not be considered as a result of the proposed development.

4.2 Trip Generation

Trip generation was calculated for the proposed development utilising trip generation rates using a combination of *RTA NSW trip generation rates*, *the Institute of Transportation Engineers (ITE) “Trip Generation” 10th Ed* and *the WAPC Transport Impact Assessment Guidelines – Volumes 5*.

For the purpose of trip generation, the short-stay accommodation is assumed to operate in a similar manner to high-density residential. This is considered to be conservative, given the intensity of use during peak periods is higher for residential developments than hotels.

Table 4.1 shows the trip generation rate during the Weekday PM and Weekend peak.

Table 4.1 Trip Generation Rates

Land Use	Source	Unit	Weekday PM Peak	Daily	Weekend Peak
Restaurants	RTA	100m ²	5	60	5
Short-Stay Accommodation	RTA	Units	0.3	3.0	0.3

The above represents a total additional trip generation as follows:

- Weekday PM peak: $5 \times 8.48 + 0.3 \times 135 = 83$ trips
- Weekday Daily: $60 \times 8.48 + 3.0 \times 135 = 914$ trips
- Weekend peak: $5 \times 8.48 + 0.3 \times 135 = 83$ trips

This is an increase of about 4.5-5% over existing generation.

4.3 Trip Distribution and Assignment

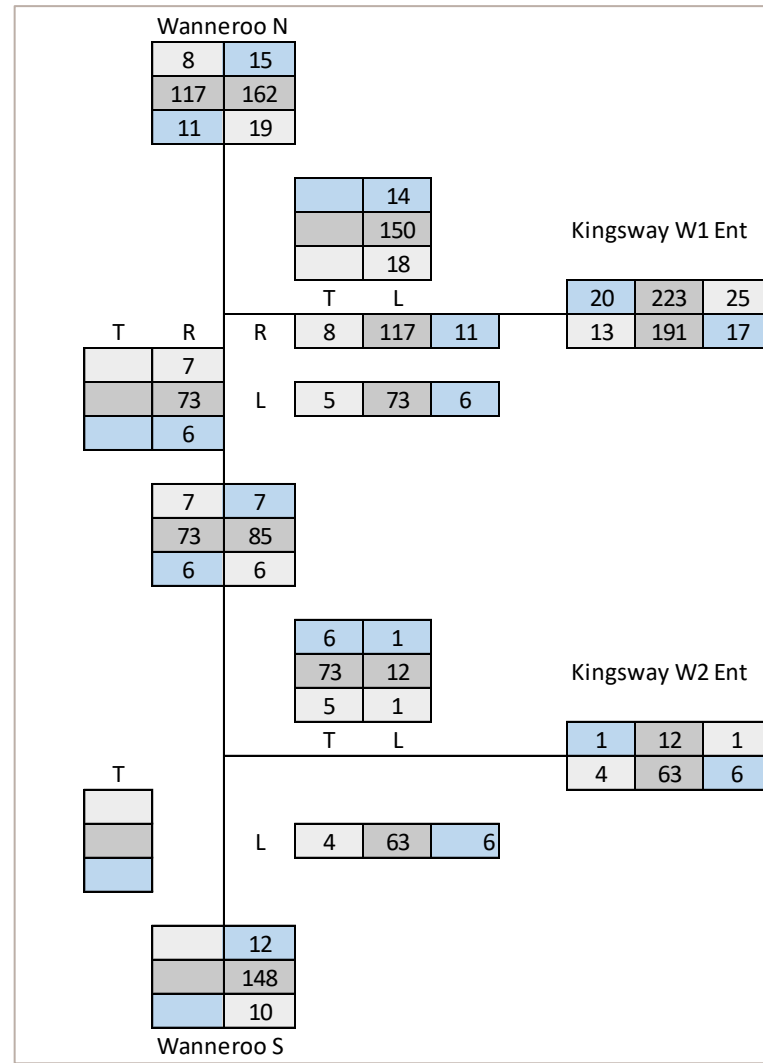
The above trips would be distributed across the access points and boundary roads generally in accordance with existing behaviour. While it is acknowledged that the development location is on the western side of the Site, a high proportion of trips are anticipated to access the development to/from Hepburn Avenue. This movement can be most easily accommodated via the two access points on Hepburn Avenue.

Daily and weekday periods are assumed to have an even split for inbound and outbound movements. However, the PM peak movements have been weighted according to ITE in/out distributions as follows:

- Residential trips: 66% inbound / 34% outbound
- Restaurant trips: 60% inbound / 40% outbound

4.4 Traffic Volumes

The above assumptions resolve into the following Development Traffic Model (for new uses only) as shown in Figure 4.1. The Background Traffic and Background + Development Models are also provided in Figure 4.2 and Figure 4.3, respectively.



Total Trip Generation

IN	OUT	
52	31	Weekday PM Peak
457	457	Weekday Daily
42	41	Saturday Peak

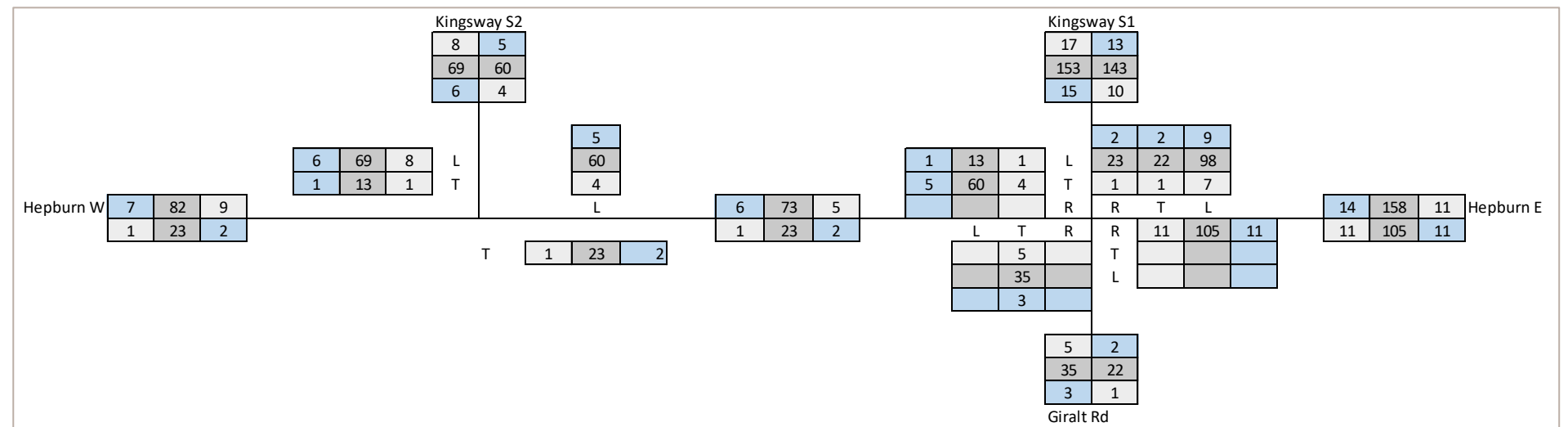
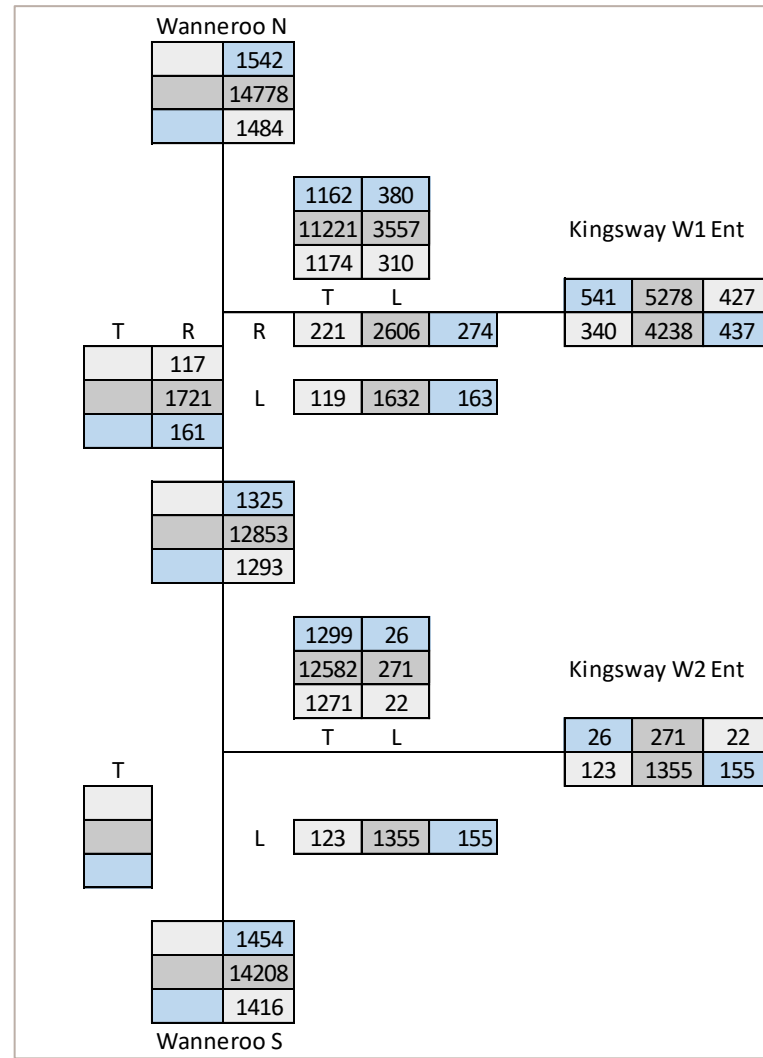


Figure 4.1 Development traffic distribution



Total Trip Generation

	IN	OUT	
	858	895	Weekday PM Peak
	10400	9842	Weekday Daily
	1146	1150	Saturday Peak

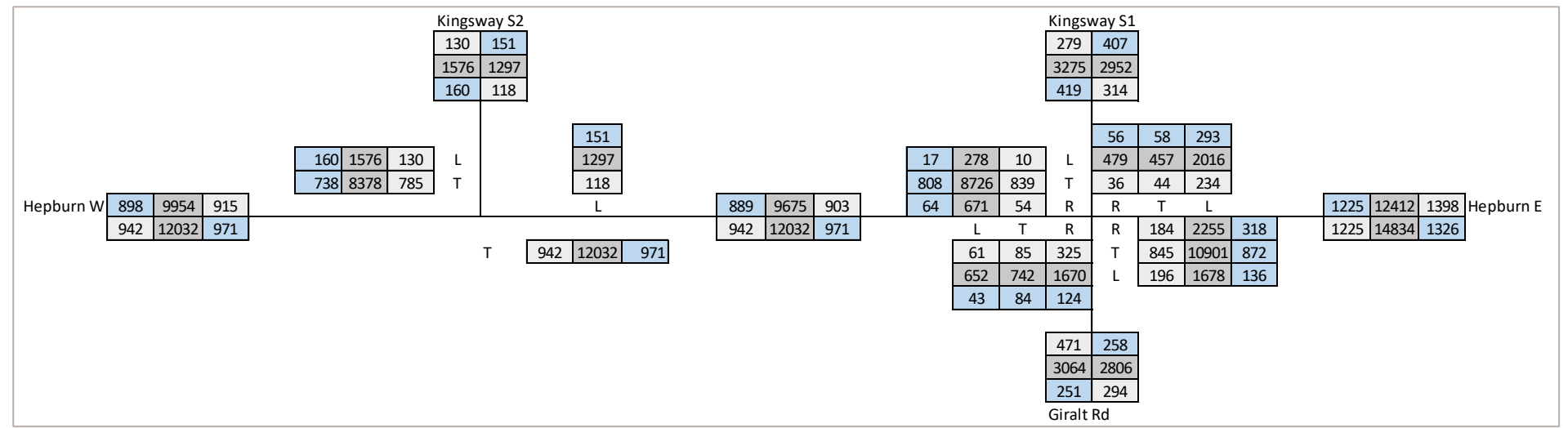
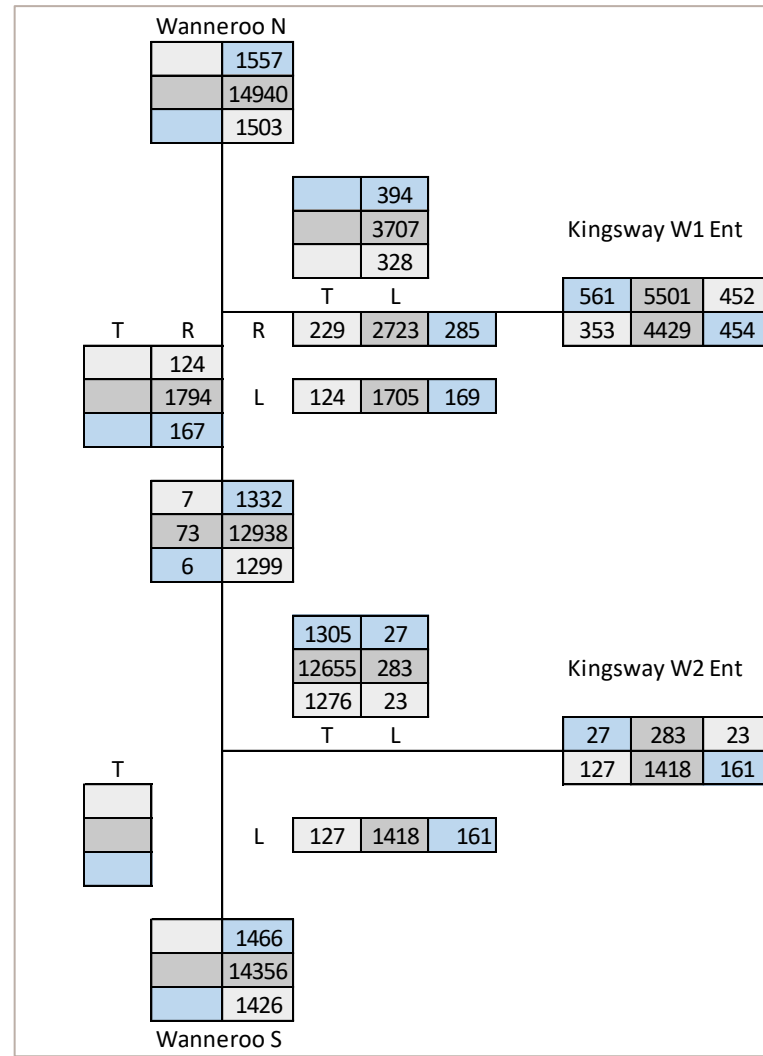


Figure 4.2 Background 2024 traffic distribution



Total Trip Generation

	IN	OUT	
	910	926	Weekday PM Peak
	10857	10299	Weekday Daily
	1188	1191	Saturday Peak

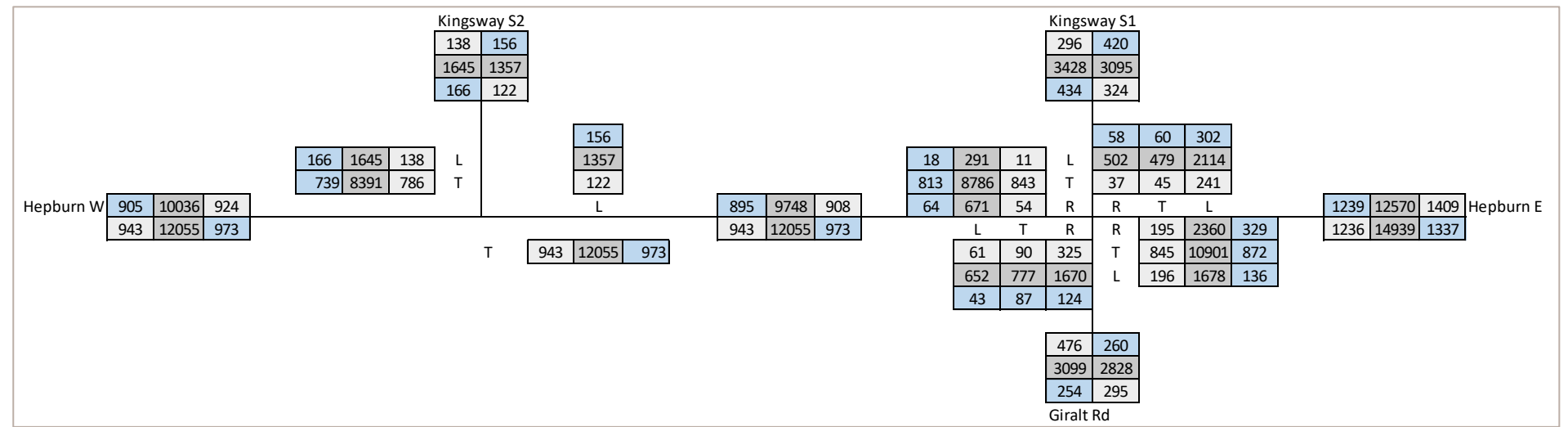
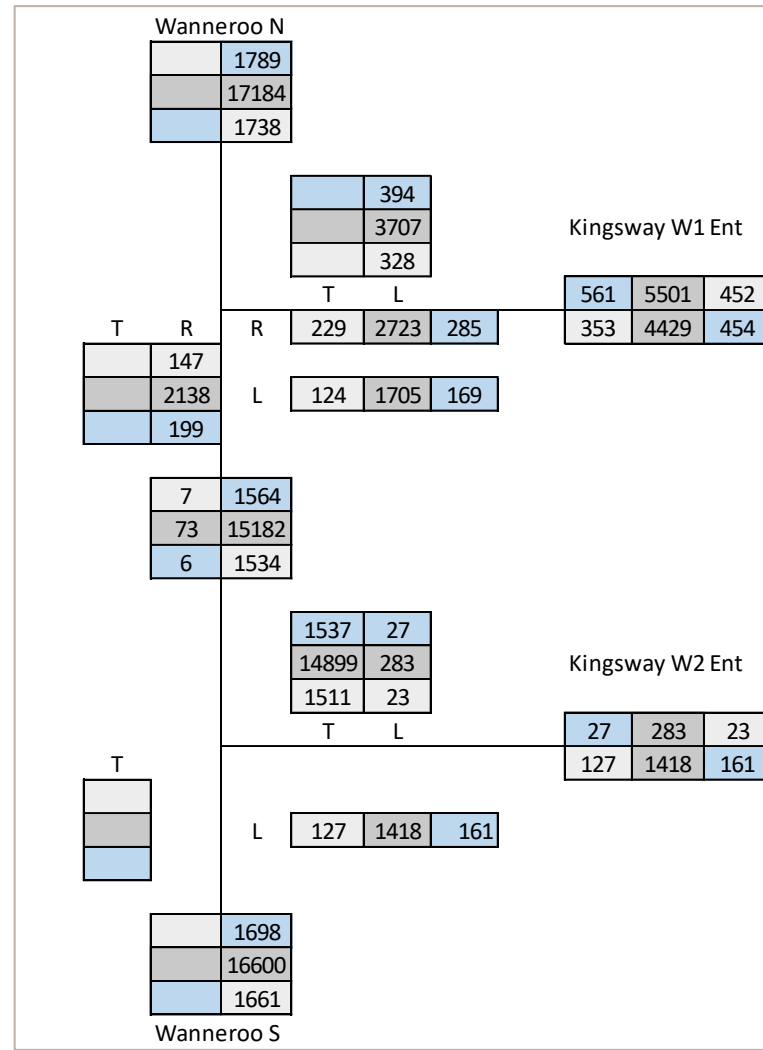


Figure 4.3 Background 2024 + Development traffic distribution



Total Trip Generation

IN	OUT	
910	926	Weekday PM Peak
10857	10299	Weekday Daily
1188	1191	Saturday Peak

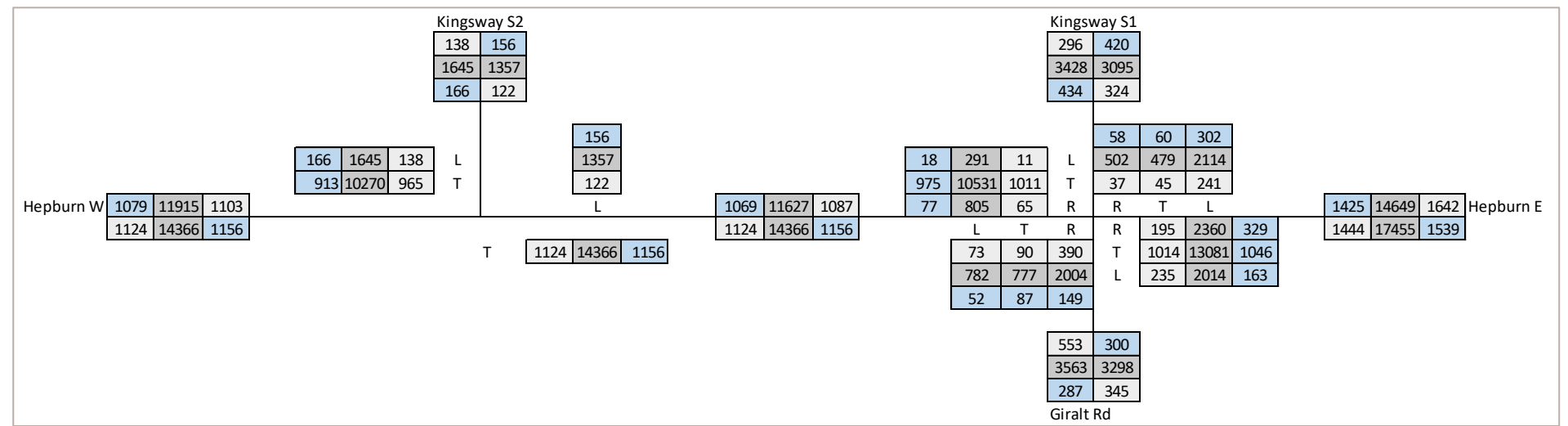


Figure 4.4 Projected 2034 Background + Development traffic distribution

4.5 Intersection Performance

Analysis of the traffic impacts of the proposed development has been carried out for the following intersections:

- Wanneroo Road / Kingsway - north access
- Wanneroo Road / Kingsway - south access
- Hepburn Avenue / Giralt Road / Kingsway - east access
- Hepburn Avenue / Kingsway - west access

The identified intersections have been analysed using the SIDRA analysis program. This program calculates the performance of intersections based on input parameters, including geometry and traffic volumes. As an output SIDRA provides values for the Degree of Saturation (DOS), queue lengths, delays, level of service, and 95th Percentile Queue. These parameters are defined as follows:

- Degree of Saturation (DOS): is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The theoretical intersection capacity is exceeded for an un-signalized intersection where $DOS > 0.80$
- 95% Queue: is the statistical estimate of the queue length up to or below which 95% of all observed queues would be expected.
- Average Delay: is the average of all travel time delays for vehicles through the intersection. An unsignalised intersection can be considered to be operating at capacity where the average delay exceeds 40 seconds for any movement; and
- Level of Service (LOS): is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. The different levels of service can generally be described as shown in Table 4.2.

Table 4.2 Level of Service (LoS) Performance Criteria

LoS	Description	Signalised intersection	Unsignalised intersection
A	Free-flow operations (best condition)	≤10 sec	≤10 sec
B	Reasonable free-flow operations	10-20 sec	10-15 sec
C	At or near free-flow operations	20-35 sec	15-25 sec
D	Decreasing free-flow levels	35-55 sec	25-35 sec
E	Operations at capacity	55-80 sec	35-50 sec
F	A breakdown in vehicular flow (worst condition)	≥80 sec	≥50 sec

A LOS exceeding these values indicates that the approach exceeds practical capacity; users of the intersection are likely to experience unsatisfactory queuing and delays during the peak hour periods.

4.6 SIDRA Analysis

4.6.1 Wanneroo Road / Kingsway - north access

Figure 4.5 shows the SIDRA layout as modelled for this location, along with existing signal phasing.

Signal phase times for all scenarios have been tested first under existing average phase times, and then using SIDRA's optimisation function.

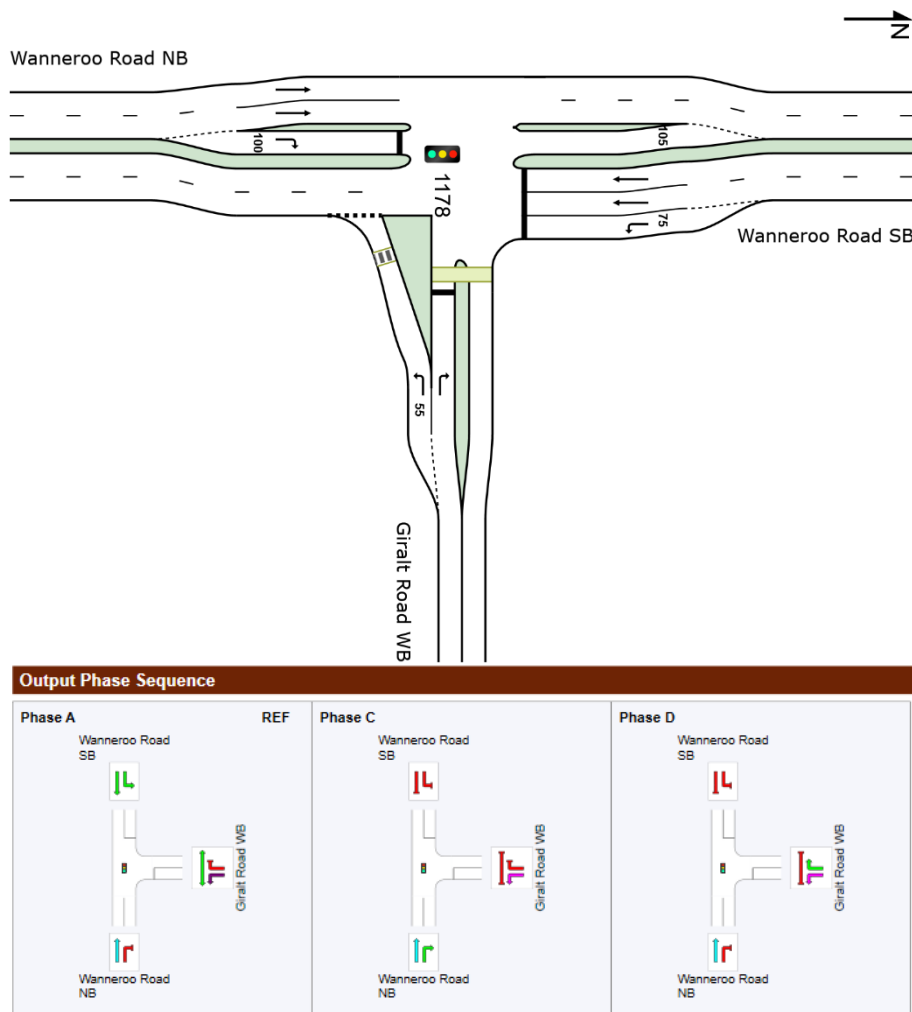


Figure 4.5 Wanneroo Road / Kingsway north access – layout and signal phasing

4.6.2 Wanneroo Road / Kingsway - south access

Figure 4.5 shows the SIDRA layout as modelled for this location.

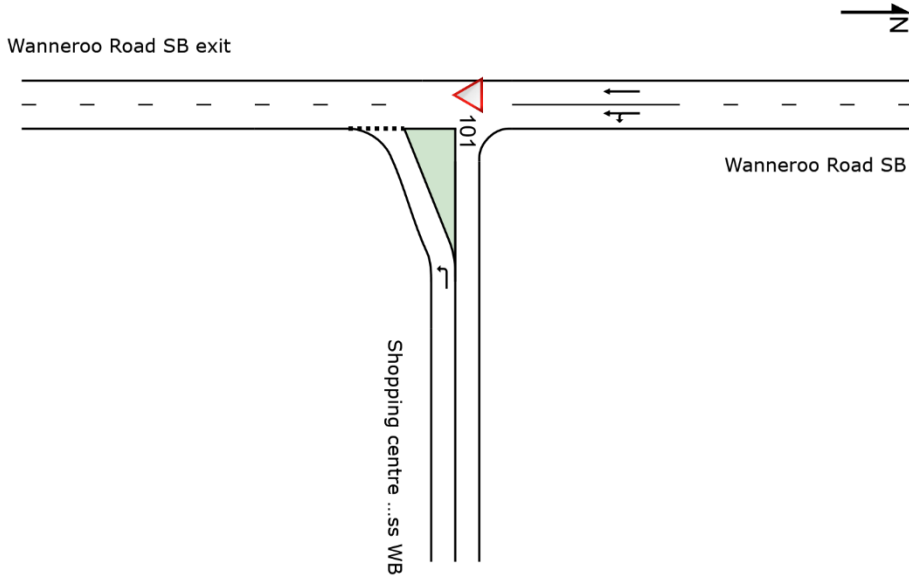


Figure 4.6 Wanneroo Road / Kingsway south access – layout

4.6.3 Hepburn Avenue / Kingsway - west access

Figure 4.5 shows the SIDRA layout as modelled for this location.

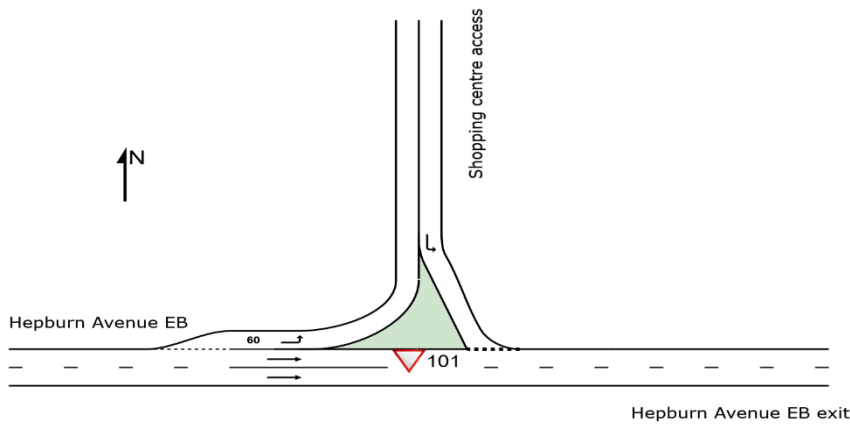


Figure 4.7 Hepburn Avenue / Kingsway west access - layout

4.6.4 Hepburn Avenue / Giralt Road / Kingsway - east access

Figure 4.5 shows the SIDRA layout as modelled for this location, along with existing signal phasing.

Signal phase times for all scenarios have been tested first under existing average phase times, and then using SIDRA's optimisation function.

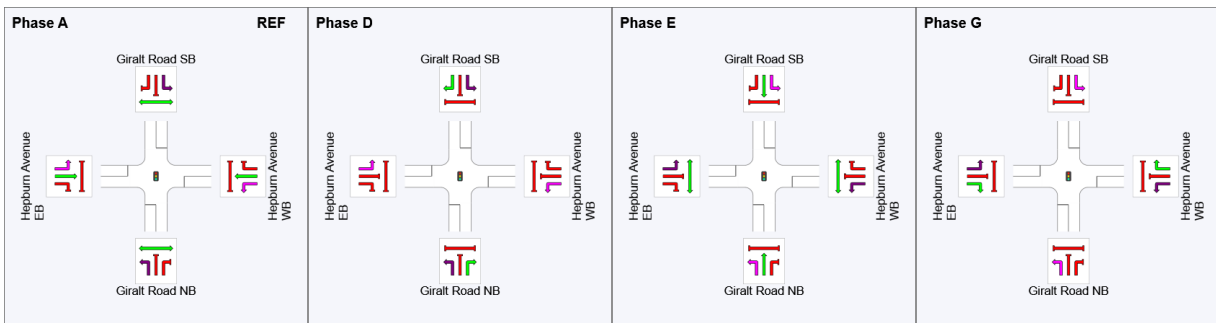
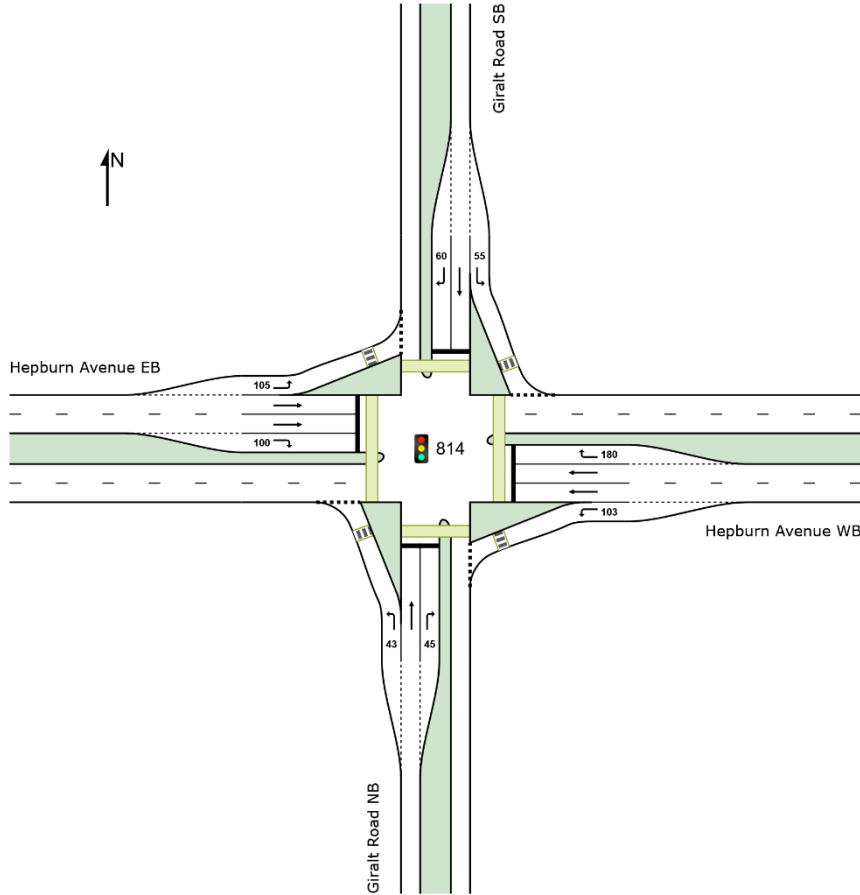


Figure 4.8 Hepburn Avenue / Giralt Road / Kingsway east access - layout and signal phasing

4.7 SIDRA Results

SIDRA modelling outputs have been included at **Appendix B** in full detail.

4.7.1 *2024 base and 2024 + development scenarios*

All sites operate at an acceptable level of service for the 2024 and 2024 + development scenarios.

Of the four access intersections, the Hepburn Avenue / Giralt Road / Kingsway east access sees the greatest delay, related directly to the high volumes of background traffic during the weekday PM peak.

Nevertheless, all approaches operate at a LoS D or better for the base 2024 scenario with only the Shopping Centre access Level of Service worsening appreciably for the 'with development' scenario (to LoS E).

4.7.2 *2034 + development scenario*

The significant background traffic growth included in this scenario has a predictably negative impact on the operation of the Hepburn Avenue / Giralt Road / Kingsway east access signalised intersection, resulting in a reduction in performance to LoS F for several turning movements including the Hepburn Avenue east approach through movement.

However, overall intersection average delay is still only predicted to be 77 seconds for the critical Weekday PM Peak, and the resulting queueing would not negatively impact upstream intersections.

The growth rates modelled for this scenario are very conservative in the context of historic patterns and so this outcome is considered to be acceptable.

5 Conclusion

This report has been prepared in accordance with the Western Australia Planning Commission (WAPC) *Transport Assessment Guidelines for Developments: Volume 4 - Individual Development*.

The following conclusions have been made in regard to the proposed development:

- The proposed development comprises short-stay accommodation and food & beverage uses co-located with the existing Kingsway City Shopping Centre (the Landsdale District Centre), in the jurisdiction of the City of Wanneroo.
- Vehicular access points are unchanged, consisting of two signalised intersections and two left-in/left-out intersections with access to Wanneroo Road and Hepburn Avenue.
- Existing cycling and pedestrian access is provided via shared paths along the boundary roads, with additional direct connection to the residential cell to the north. The Department of Transport's *Long Term Cycling Network* plan and City of Wanneroo *Bicycle Network Plan* identify potential future upgrades to Hepburn Avenue and Wanneroo Road.
- The site has good access to local public transport, with several bus services terminating within the environs of the Site.
- The proposed development will result in a reduction of car parking on-site to **1,285 bays** (including 54 bays restricted to short-stay apartments). The impact of the proposed development has been assessed in detail and would satisfy the Centre's parking needs on the identified design day (the 14th busiest day of the year) with a functional surplus on that day of **72 bays**.
- Service/delivery and waste vehicles will access the existing loading dock through the secured car park, via the internal circulation roads. Aldi service requirements have also been addressed and existing function retained.
- The proposed access points have been assessed using a SIDRA network model to ensure the impacts of queuing and delays do not adversely impact the operation of the adjacent road network.

MOVEMENT SUMMARY

Site: 814 [Hepburn Road/ Giralt Road (Site Folder: 2034 + Dev - Weekend)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
South: Giralt Road NB															
1	L2	All MCs	55	5.0	55	5.0	0.063	15.1	LOS B	1.2	9.2	0.47	0.65	0.47	45.7
2	T1	All MCs	92	0.6	92	0.6	* 0.371	48.7	LOS D	4.6	34.3	0.96	0.75	0.96	33.5
3	R2	All MCs	157	5.0	157	5.0	* 0.890	70.6	LOS E	9.7	75.1	1.00	1.02	1.40	27.1
Approach			303	3.7	303	3.7	0.890	53.9	LOS D	9.7	75.1	0.89	0.87	1.10	31.2
East: Hepburn Avenue WB															
4	L2	All MCs	172	5.0	172	5.0	0.120	17.0	LOS B	1.2	9.5	0.20	0.61	0.20	50.9
5	T1	All MCs	1101	9.5	1101	9.5	* 0.884	48.9	LOS D	33.1	270.3	1.00	1.04	1.18	34.1
6	R2	All MCs	346	0.6	346	0.6	* 0.898	64.2	LOS E	21.4	157.9	1.00	1.01	1.28	28.7
Approach			1619	7.1	1619	7.1	0.898	48.8	LOS D	33.1	270.3	0.92	0.99	1.10	33.9
North: Giralt Road SB															
7	L2	All MCs	318	0.0	318	0.0	0.392	19.5	LOS B	9.8	71.8	0.65	0.75	0.65	44.3
8	T1	All MCs	63	0.6	63	0.6	0.256	47.8	LOS D	3.1	23.2	0.94	0.72	0.94	33.8
9	R2	All MCs	61	0.0	61	0.0	0.329	57.2	LOS E	3.2	23.3	0.97	0.75	0.97	30.5
Approach			442	0.1	442	0.1	0.392	28.8	LOS C	9.8	71.8	0.73	0.75	0.73	40.0
West: Hepburn Avenue EB															
10	L2	All MCs	19	0.6	19	0.6	0.015	16.4	LOS B	0.3	2.1	0.34	0.61	0.34	49.6
11	T1	All MCs	1026	9.5	1026	9.5	0.809	41.0	LOS D	26.6	217.3	0.97	0.91	1.04	37.1
12	R2	All MCs	81	5.0	81	5.0	0.220	48.7	LOS D	3.6	28.2	0.87	0.76	0.87	33.3
Approach			1126	9.0	1126	9.0	0.809	41.2	LOS D	26.6	217.3	0.95	0.90	1.01	37.0
All Vehicles			3491	6.5	3491	6.5	0.898	44.2	LOS D	33.1	270.3	0.90	0.92	1.02	35.3

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

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

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

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

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

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

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Input Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed	
	ped/h	ped/h	sec		[Ped]	[Dist]			sec	m	m/sec	
					ped	m						
South: Giralt Road NB												
P1	Full	50	53	49.3	LOS E	0.2	0.2	0.95	0.95	215.9	200.0	0.93
East: Hepburn Avenue WB												

P2 Full	50	53	49.3	LOS E	0.2	0.2	0.95	0.95	215.9	200.0	0.93
North: Giralt Road SB											
P3 Full	50	53	49.3	LOS E	0.2	0.2	0.95	0.95	215.9	200.0	0.93
West: Hepburn Avenue EB											
P4 Full	50	53	49.3	LOS E	0.2	0.2	0.95	0.95	215.9	200.0	0.93
All Pedestrians	200	211	49.3	LOS E	0.2	0.2	0.95	0.95	215.9	200.0	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 1178 [Wanneroo Road/ Giralt Road (Site Folder: 2024 Base - Weekday)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	[Total HV]	[Total HV]	[Total HV]				[Veh.]	[Dist]				
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Wanneroo Road NB															
2	T1	All MCs	1721	10.3	1721	10.3	0.491	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
3	R2	All MCs	123	0.6	123	0.6	* 0.667	41.7	LOS D	4.5	33.0	1.00	0.85	1.13	34.8
Approach			1844	9.7	1844	9.7	0.667	3.0	LOS A	4.5	33.0	0.07	0.06	0.08	56.9
East: Giralt Road WB															
4	L2	All MCs	125	0.6	125	0.6	0.165	11.2	LOS B	1.7	12.6	0.51	0.69	0.51	49.1
6	R2	All MCs	233	0.6	233	0.6	* 0.735	39.2	LOS D	8.3	61.1	1.00	0.89	1.15	35.9
Approach			358	0.6	358	0.6	0.735	29.4	LOS C	8.3	61.1	0.83	0.82	0.92	39.6
North: Wanneroo Road SB															
7	L2	All MCs	326	0.6	326	0.6	0.364	18.1	LOS B	7.0	51.7	0.67	0.76	0.67	44.9
8	T1	All MCs	1236	10.3	1236	10.3	* 0.733	16.7	LOS B	17.7	145.1	0.86	0.79	0.88	47.2
Approach			1562	8.3	1562	8.3	0.733	17.0	LOS B	17.7	145.1	0.82	0.78	0.84	46.7
All Vehicles			3764	8.2	3764	8.2	0.735	11.3	LOS B	17.7	145.1	0.45	0.43	0.47	50.2

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

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

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

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

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

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

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
						[Ped]	[Dist]					
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
East: Giralt Road WB												
P2	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	196.0	200.0	1.02
All Pedestrians		50	53	29.3	LOS C	0.1	0.1	0.92	0.92	196.0	200.0	1.02

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 101 [Wanneroo Road access (Site Folder: 2024 Base - Weekday)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
 Site Category: (None)
 Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
East: Shopping centre access WB															
4	L2	All MCs	129	0.0	129	0.0	0.166	9.1	LOS A	0.6	4.7	0.58	0.80	0.58	50.6
Approach			129	0.0	129	0.0	0.166	9.1	LOS A	0.6	4.7	0.58	0.80	0.58	50.6
North: Wanneroo Road SB															
7	L2	All MCs	23	0.0	23	0.0	0.388	5.7	LOS A	0.0	0.0	0.00	0.02	0.00	57.1
8	T1	All MCs	1338	10.3	1338	10.3	0.388	0.1	LOS A	0.0	0.0	0.00	0.01	0.00	59.6
Approach			1361	10.1	1361	10.1	0.388	0.2	NA	0.0	0.0	0.00	0.01	0.00	59.6
All Vehicles			1491	9.2	1491	9.2	0.388	1.0	NA	0.6	4.7	0.05	0.08	0.05	58.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
 Vehicle movement LOS values are based on average delay per movement.
 Minor Road Approach LOS values are based on average delay for all vehicle movements.
 NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
 Two-Way Sign Control Capacity Model: SIDRA Standard.
 Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
 Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
 Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Hepburn Avenue access (Site Folder: 2024 Base - Weekday)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
 Site Category: (None)
 Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
North: Shopping centre access															
7	L2	All MCs	124	0.0	124	0.0	0.115	7.3	LOS A	0.5	3.4	0.46	0.66	0.46	51.6
Approach			124	0.0	124	0.0	0.115	7.3	LOS A	0.5	3.4	0.46	0.66	0.46	51.6
West: Hepburn Avenue EB															
10	L2	All MCs	137	0.0	137	0.0	0.074	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	53.4
11	T1	All MCs	826	9.5	826	9.5	0.234	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach			963	8.2	963	8.2	0.234	0.9	NA	0.0	0.0	0.00	0.08	0.00	58.8
All Vehicles			1087	7.2	1087	7.2	0.234	1.6	NA	0.5	3.4	0.05	0.14	0.05	57.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
 Vehicle movement LOS values are based on average delay per movement.
 Minor Road Approach LOS values are based on average delay for all vehicle movements.
 NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
 Two-Way Sign Control Capacity Model: SIDRA Standard.
 Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
 Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
 Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 814 [Hepburn Road/ Giralt Road (Site Folder: 2024 Base - Weekday)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%				[Veh.]	[Dist]				
			veh/h		veh/h	%	v/c	sec		veh	m				km/h
South: Giralt Road NB															
1	L2	All MCs	64	5.0	64	5.0	0.064	11.5	LOS B	1.1	8.3	0.38	0.64	0.38	47.9
2	T1	All MCs	89	0.6	89	0.6	* 0.339	63.6	LOS E	4.5	33.0	0.95	0.74	0.95	33.9
3	R2	All MCs	342	5.0	342	5.0	* 0.868	75.0	LOS E	20.3	156.7	1.00	0.98	1.22	29.6
Approach			496	4.2	496	4.2	0.868	64.7	LOS E	20.3	156.7	0.91	0.89	1.06	31.9
East: Hepburn Avenue WB															
4	L2	All MCs	206	5.0	206	5.0	0.137	7.0	LOS A	1.2	9.1	0.18	0.60	0.18	51.1
5	T1	All MCs	889	9.5	889	9.5	* 0.843	45.7	LOS D	24.8	202.7	1.00	0.99	1.14	34.4
6	R2	All MCs	194	0.6	194	0.6	* 0.825	62.8	LOS E	11.2	83.0	1.00	0.94	1.22	29.0
Approach			1289	7.4	1289	7.4	0.843	42.1	LOS D	24.8	202.7	0.87	0.92	1.00	35.2
North: Giralt Road SB															
7	L2	All MCs	246	0.0	246	0.0	0.346	24.2	LOS C	8.3	61.2	0.69	0.75	0.69	42.0
8	T1	All MCs	46	0.6	46	0.6	0.175	46.1	LOS D	2.2	16.6	0.92	0.69	0.92	34.3
9	R2	All MCs	38	0.0	38	0.0	0.083	39.9	LOS D	1.6	11.5	0.80	0.71	0.80	35.6
Approach			331	0.1	331	0.1	0.346	29.1	LOS C	8.3	61.2	0.74	0.74	0.74	39.9
West: Hepburn Avenue EB															
10	L2	All MCs	11	0.6	11	0.6	0.007	7.9	LOS A	0.1	0.8	0.25	0.59	0.25	51.4
11	T1	All MCs	883	9.5	883	9.5	0.836	45.4	LOS D	24.4	199.4	1.00	0.98	1.13	34.6
12	R2	All MCs	57	5.0	57	5.0	0.253	54.6	LOS D	2.8	21.9	0.94	0.75	0.94	30.9
Approach			951	9.1	951	9.1	0.836	45.5	LOS D	24.4	199.4	0.99	0.96	1.11	34.4
All Vehicles			3066	6.7	3066	6.7	0.868	45.4	LOS D	24.8	202.7	0.90	0.91	1.01	34.8

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

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

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

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

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

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

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
						[Ped]	[Dist]					
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Giralt Road NB												
P1	Full	50	53	49.3	LOS E	0.2	0.2	0.95	0.95	215.9	200.0	0.93
East: Hepburn Avenue WB												

P2 Full	50	53	49.3	LOS E	0.2	0.2	0.95	0.95	215.9	200.0	0.93
North: Giralt Road SB											
P3 Full	50	53	49.3	LOS E	0.2	0.2	0.95	0.95	215.9	200.0	0.93
West: Hepburn Avenue EB											
P4 Full	50	53	49.3	LOS E	0.2	0.2	0.95	0.95	215.9	200.0	0.93
All Pedestrians	200	211	49.3	LOS E	0.2	0.2	0.95	0.95	215.9	200.0	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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Project: U:\ProjectsAU\212xxx\212416_Kingsway_Shopping_C4_WIP\Docs\Traffic Impact Assessment\PS212416 Base (2024).sip9

MOVEMENT SUMMARY

Site: 1178 [Wanneroo Road/ Giralt Road (Site Folder: 2024 Base - Weekend)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
South: Wanneroo Road NB															
2	T1	All MCs	1684	10.3	1684	10.3	0.481	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
3	R2	All MCs	169	0.6	169	0.6	* 0.816	49.3	LOS D	7.3	54.4	1.00	0.96	1.30	32.4
Approach			1854	9.4	1854	9.4	0.816	4.8	LOS A	7.3	54.4	0.09	0.09	0.12	55.3
East: Giralt Road WB															
4	L2	All MCs	172	0.6	172	0.6	0.225	13.3	LOS B	3.0	22.5	0.55	0.71	0.55	47.7
6	R2	All MCs	288	0.6	288	0.6	* 0.782	43.2	LOS D	11.8	87.0	1.00	0.91	1.16	34.5
Approach			460	0.6	460	0.6	0.782	32.1	LOS C	11.8	87.0	0.83	0.84	0.93	38.5
North: Wanneroo Road SB															
7	L2	All MCs	400	0.6	400	0.6	0.469	23.7	LOS C	10.7	79.4	0.73	0.79	0.73	42.9
8	T1	All MCs	1223	10.3	1223	10.3	* 0.793	24.0	LOS C	23.1	189.5	0.91	0.88	0.99	43.6
Approach			1623	7.9	1623	7.9	0.793	23.9	LOS C	23.1	189.5	0.87	0.86	0.93	43.4
All Vehicles			3937	7.8	3937	7.8	0.816	15.9	LOS B	23.1	189.5	0.50	0.49	0.55	47.5

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

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

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

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

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

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

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		[Ped]	[Dist]			sec	m	m/sec
						ped	m					
East: Giralt Road WB												
P2	Full	50	53	34.3	LOS D	0.1	0.1	0.93	0.93	201.0	200.0	1.00
All Pedestrians		50	53	34.3	LOS D	0.1	0.1	0.93	0.93	201.0	200.0	1.00

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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Project: U:\Projects\AU\212xxx\212416_Kingsway_Shopping_C4_WIP\Docs\Traffic Impact Assessment\PS212416 Base (2024).sip9

MOVEMENT SUMMARY

Site: 101 [Wanneroo Road access (Site Folder: 2024 Base - Weekend)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
 Site Category: (None)
 Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
East: Shopping centre access WB															
4	L2	All MCs	163	0.0	163	0.0	0.213	9.3	LOS A	0.8	6.1	0.60	0.81	0.60	50.5
Approach			163	0.0	163	0.0	0.213	9.3	LOS A	0.8	6.1	0.60	0.81	0.60	50.5
North: Wanneroo Road SB															
7	L2	All MCs	27	0.0	27	0.0	0.398	5.7	LOS A	0.0	0.0	0.00	0.02	0.00	57.0
8	T1	All MCs	1367	10.3	1367	10.3	0.398	0.2	LOS A	0.0	0.0	0.00	0.01	0.00	59.6
Approach			1395	10.1	1395	10.1	0.398	0.3	NA	0.0	0.0	0.00	0.01	0.00	59.5
All Vehicles			1558	9.0	1558	9.0	0.398	1.2	NA	0.8	6.1	0.06	0.10	0.06	58.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
 Vehicle movement LOS values are based on average delay per movement.
 Minor Road Approach LOS values are based on average delay for all vehicle movements.
 NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
 Two-Way Sign Control Capacity Model: SIDRA Standard.
 Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
 Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
 Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Hepburn Avenue access (Site Folder: 2024 Base - Weekend)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
 Site Category: (None)
 Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
North: Shopping centre access															
7	L2	All MCs	159	0.0	159	0.0	0.143	7.2	LOS A	0.6	4.3	0.45	0.66	0.45	51.6
Approach			159	0.0	159	0.0	0.143	7.2	LOS A	0.6	4.3	0.45	0.66	0.45	51.6
West: Hepburn Avenue EB															
10	L2	All MCs	168	0.0	168	0.0	0.091	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	53.4
11	T1	All MCs	777	9.5	777	9.5	0.220	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach			945	7.8	945	7.8	0.220	1.1	NA	0.0	0.0	0.00	0.09	0.00	58.6
All Vehicles			1104	6.7	1104	6.7	0.220	1.9	NA	0.6	4.3	0.06	0.18	0.06	57.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
 Vehicle movement LOS values are based on average delay per movement.
 Minor Road Approach LOS values are based on average delay for all vehicle movements.
 NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
 Two-Way Sign Control Capacity Model: SIDRA Standard.
 Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
 Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
 Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 814 [Hepburn Road/ Giralt Road (Site Folder: 2024 Base - Weekend)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%				[Veh.]	[Dist]				
			veh/h		veh/h	%	v/c	sec		veh	m				km/h
South: Giralt Road NB															
1	L2	All MCs	45	5.0	45	5.0	0.048	11.7	LOS B	0.7	5.4	0.43	0.64	0.43	47.7
2	T1	All MCs	88	0.6	88	0.6	* 0.316	38.3	LOS D	3.6	26.6	0.94	0.73	0.94	37.0
3	R2	All MCs	131	5.0	131	5.0	* 0.833	56.9	LOS E	6.5	49.9	1.00	0.97	1.35	30.1
Approach			264	3.5	264	3.5	0.833	42.9	LOS D	6.5	49.9	0.88	0.83	1.06	34.4
East: Hepburn Avenue WB															
4	L2	All MCs	143	5.0	143	5.0	0.101	6.8	LOS A	0.9	6.6	0.22	0.61	0.22	50.9
5	T1	All MCs	918	9.5	918	9.5	* 0.837	37.7	LOS D	21.2	173.4	1.00	0.99	1.16	37.1
6	R2	All MCs	335	0.6	335	0.6	* 0.859	51.0	LOS D	16.4	121.2	1.00	0.99	1.25	32.0
Approach			1396	6.9	1396	6.9	0.859	37.7	LOS D	21.2	173.4	0.92	0.95	1.08	36.7
North: Giralt Road SB															
7	L2	All MCs	308	0.0	308	0.0	0.341	14.2	LOS B	6.5	47.5	0.57	0.72	0.57	47.3
8	T1	All MCs	61	0.6	61	0.6	0.218	37.6	LOS D	2.4	18.0	0.92	0.70	0.92	37.2
9	R2	All MCs	59	0.0	59	0.0	0.357	49.6	LOS D	2.6	19.0	0.98	0.75	0.98	32.5
Approach			428	0.1	428	0.1	0.357	22.4	LOS C	6.5	47.5	0.68	0.72	0.68	43.0
West: Hepburn Avenue EB															
10	L2	All MCs	18	0.6	18	0.6	0.015	9.8	LOS A	0.2	1.6	0.36	0.61	0.36	50.0
11	T1	All MCs	851	9.5	851	9.5	0.775	33.4	LOS C	18.2	148.4	0.97	0.91	1.05	38.8
12	R2	All MCs	67	5.0	67	5.0	0.181	37.5	LOS D	2.5	19.1	0.86	0.74	0.86	35.7
Approach			936	9.0	936	9.0	0.775	33.3	LOS C	18.2	148.4	0.95	0.89	1.03	38.7
All Vehicles			3024	6.3	3024	6.3	0.859	34.6	LOS C	21.2	173.4	0.89	0.89	1.01	37.9

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

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

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

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

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

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

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
						[Ped]	[Dist]					
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Giralt Road NB												
P1	Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	206.0	200.0	0.97
East: Hepburn Avenue WB												

P2 Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	206.0	200.0	0.97
North: Giralt Road SB											
P3 Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	206.0	200.0	0.97
West: Hepburn Avenue EB											
P4 Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	206.0	200.0	0.97
All Pedestrians	200	211	39.3	LOS D	0.1	0.1	0.94	0.94	206.0	200.0	0.97

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 1178 [Wanneroo Road/ Giralt Road (Site Folder: 2024 Base + Dev - Weekday)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
South: Wanneroo Road NB															
2	T1	All MCs	1722	10.3	1722	10.3	0.491	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
3	R2	All MCs	131	0.6	131	0.6	* 0.707	37.5	LOS D	4.2	30.8	1.00	0.87	1.21	36.2
Approach			1853	9.6	1853	9.6	0.707	2.9	LOS A	4.2	30.8	0.07	0.06	0.09	57.0
East: Giralt Road WB															
4	L2	All MCs	131	0.6	131	0.6	0.169	11.6	LOS B	1.7	12.5	0.56	0.70	0.56	48.8
6	R2	All MCs	241	0.6	241	0.6	* 0.784	36.7	LOS D	7.7	57.0	1.00	0.94	1.25	36.8
Approach			372	0.6	372	0.6	0.784	27.9	LOS C	7.7	57.0	0.85	0.86	1.01	40.3
North: Wanneroo Road SB															
7	L2	All MCs	345	0.6	345	0.6	0.416	17.7	LOS B	6.9	51.3	0.72	0.78	0.72	44.8
8	T1	All MCs	1237	10.3	1237	10.3	* 0.784	18.5	LOS B	17.3	142.3	0.91	0.89	1.02	46.0
Approach			1582	8.2	1582	8.2	0.784	18.4	LOS B	17.3	142.3	0.87	0.87	0.96	45.7
All Vehicles			3806	8.1	3806	8.1	0.784	11.8	LOS B	17.3	142.3	0.48	0.47	0.54	49.9

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

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

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

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

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

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

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		[Ped]	[Dist]			sec	m	m/sec
						ped	m					
East: Giralt Road WB												
P2	Full	50	53	24.4	LOS C	0.1	0.1	0.90	0.90	191.0	200.0	1.05
All Pedestrians		50	53	24.4	LOS C	0.1	0.1	0.90	0.90	191.0	200.0	1.05

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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Project: U:\Projects\AU\212xxx\212416_Kingsway_Shopping_C4_WIP\Docs\Traffic Impact Assessment\PS212416 Base (2024).sip9

MOVEMENT SUMMARY

Site: 101 [Wanneroo Road access (Site Folder: 2024 Base + Dev - Weekday)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
 Site Category: (None)
 Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
East: Shopping centre access WB															
4	L2	All MCs	134	0.0	134	0.0	0.171	9.1	LOS A	0.7	4.8	0.59	0.80	0.59	50.6
Approach			134	0.0	134	0.0	0.171	9.1	LOS A	0.7	4.8	0.59	0.80	0.59	50.6
North: Wanneroo Road SB															
7	L2	All MCs	24	0.0	24	0.0	0.389	5.7	LOS A	0.0	0.0	0.00	0.02	0.00	57.1
8	T1	All MCs	1339	10.3	1339	10.3	0.389	0.1	LOS A	0.0	0.0	0.00	0.01	0.00	59.6
Approach			1363	10.1	1363	10.1	0.389	0.2	NA	0.0	0.0	0.00	0.01	0.00	59.6
All Vehicles			1497	9.2	1497	9.2	0.389	1.0	NA	0.7	4.8	0.05	0.08	0.05	58.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
 Vehicle movement LOS values are based on average delay per movement.
 Minor Road Approach LOS values are based on average delay for all vehicle movements.
 NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
 Two-Way Sign Control Capacity Model: SIDRA Standard.
 Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
 Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
 Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Hepburn Avenue access (Site Folder: 2024 Base + Dev - Weekday)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
 Site Category: (None)
 Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
North: Shopping centre access															
7	L2	All MCs	128	0.0	128	0.0	0.119	7.3	LOS A	0.5	3.5	0.46	0.66	0.46	51.6
Approach			128	0.0	128	0.0	0.119	7.3	LOS A	0.5	3.5	0.46	0.66	0.46	51.6
West: Hepburn Avenue EB															
10	L2	All MCs	145	0.0	145	0.0	0.078	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	53.4
11	T1	All MCs	827	9.5	827	9.5	0.235	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach			973	8.1	973	8.1	0.235	0.9	NA	0.0	0.0	0.00	0.08	0.00	58.8
All Vehicles			1101	7.1	1101	7.1	0.235	1.6	NA	0.5	3.5	0.05	0.15	0.05	57.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
 Vehicle movement LOS values are based on average delay per movement.
 Minor Road Approach LOS values are based on average delay for all vehicle movements.
 NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
 Two-Way Sign Control Capacity Model: SIDRA Standard.
 Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
 Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
 Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 814 [Hepburn Road/ Giralt Road (Site Folder: 2024 Base + Dev - Weekday)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%				[Veh.]	[Dist]				
			veh/h		veh/h	%	v/c	sec		veh	m				km/h
South: Giralt Road NB															
1	L2	All MCs	64	5.0	64	5.0	0.064	11.3	LOS B	1.0	7.9	0.39	0.64	0.39	47.9
2	T1	All MCs	95	0.6	95	0.6	* 0.326	54.8	LOS D	4.2	31.3	0.94	0.73	0.94	35.7
3	R2	All MCs	342	5.0	342	5.0	* 0.881	69.8	LOS E	19.1	147.3	1.00	1.01	1.28	30.1
Approach			501	4.2	501	4.2	0.881	59.4	LOS E	19.1	147.3	0.91	0.91	1.10	32.6
East: Hepburn Avenue WB															
4	L2	All MCs	206	5.0	206	5.0	0.138	6.7	LOS A	1.2	9.0	0.19	0.60	0.19	51.1
5	T1	All MCs	889	9.5	889	9.5	* 0.901	51.3	LOS D	25.3	206.8	1.00	1.10	1.28	32.6
6	R2	All MCs	205	0.6	205	0.6	* 0.927	69.4	LOS E	12.2	90.4	1.00	1.08	1.49	27.6
Approach			1301	7.4	1301	7.4	0.927	47.1	LOS D	25.3	206.8	0.87	1.02	1.14	33.6
North: Giralt Road SB															
7	L2	All MCs	254	0.0	254	0.0	0.349	22.9	LOS C	7.8	57.4	0.70	0.75	0.70	42.6
8	T1	All MCs	47	0.6	47	0.6	0.163	40.6	LOS D	2.1	15.2	0.91	0.68	0.91	36.1
9	R2	All MCs	39	0.0	39	0.0	0.087	37.4	LOS D	1.5	10.9	0.81	0.71	0.81	36.4
Approach			340	0.1	340	0.1	0.349	27.0	LOS C	7.8	57.4	0.74	0.73	0.74	40.8
West: Hepburn Avenue EB															
10	L2	All MCs	12	0.6	12	0.6	0.008	8.1	LOS A	0.1	0.8	0.27	0.59	0.27	51.2
11	T1	All MCs	887	9.5	887	9.5	0.899	50.9	LOS D	25.2	205.4	1.00	1.10	1.27	32.7
12	R2	All MCs	57	5.0	57	5.0	0.269	50.4	LOS D	2.6	20.2	0.95	0.75	0.95	31.7
Approach			956	9.1	956	9.1	0.899	50.3	LOS D	25.2	205.4	0.99	1.07	1.24	32.8
All Vehicles			3098	6.6	3098	6.6	0.927	47.9	LOS D	25.3	206.8	0.90	0.99	1.12	33.8

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

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

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

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

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

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

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
						[Ped]	[Dist]					
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Giralt Road NB												
P1	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	210.9	200.0	0.95
East: Hepburn Avenue WB												

P2 Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	210.9	200.0	0.95
North: Giralt Road SB											
P3 Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	210.9	200.0	0.95
West: Hepburn Avenue EB											
P4 Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	210.9	200.0	0.95
All Pedestrians	200	211	44.3	LOS E	0.1	0.1	0.94	0.94	210.9	200.0	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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Project: U:\ProjectsAU\212xxx\212416_Kingsway_Shopping_C4_WIP\Docs\Traffic Impact Assessment\PS212416 Base (2024).sip9

MOVEMENT SUMMARY

Site: 1178 [Wanneroo Road/ Giralt Road (Site Folder: 2024 Base + Dev - Weekend)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
South: Wanneroo Road NB															
2	T1	All MCs	1684	10.3	1684	10.3	0.481	0.3	LOS A	0.0	0.0	0.00	0.00	0.00	59.6
3	R2	All MCs	176	0.6	176	0.6	* 0.834	45.2	LOS D	6.8	50.6	1.00	0.99	1.37	33.7
Approach			1860	9.4	1860	9.4	0.834	4.5	LOS A	6.8	50.6	0.09	0.09	0.13	55.5
East: Giralt Road WB															
4	L2	All MCs	178	0.6	178	0.6	0.228	13.3	LOS B	2.9	21.5	0.59	0.71	0.59	47.7
6	R2	All MCs	300	0.6	300	0.6	* 0.813	40.7	LOS D	11.2	82.7	1.00	0.95	1.24	35.4
Approach			478	0.6	478	0.6	0.813	30.5	LOS C	11.2	82.7	0.85	0.86	1.00	39.2
North: Wanneroo Road SB															
7	L2	All MCs	415	0.6	415	0.6	0.524	23.0	LOS C	10.6	78.0	0.79	0.81	0.79	42.8
8	T1	All MCs	1224	10.3	1224	10.3	* 0.844	27.2	LOS C	23.0	188.7	0.96	1.00	1.15	41.8
Approach			1639	7.8	1639	7.8	0.844	26.1	LOS C	23.0	188.7	0.92	0.95	1.06	42.0
All Vehicles			3977	7.7	3977	7.7	0.844	16.5	LOS B	23.0	188.7	0.52	0.54	0.62	47.0

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

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

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

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

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

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

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Input Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed	
		ped/h	sec		[Ped]	[Dist]			sec	m	m/sec	
		ped/h			ped	m						
East: Giralt Road WB												
P2	Full	50	53	29.3	LOS C	0.1	0.1	0.92	0.92	196.0	200.0	1.02
All Pedestrians		50	53	29.3	LOS C	0.1	0.1	0.92	0.92	196.0	200.0	1.02

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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Project: U:\ProjectsAU\212xxx\212416_Kingsway_Shopping_C4_WIP\Docs\Traffic Impact Assessment\PS212416 Base (2024).sip9

MOVEMENT SUMMARY

Site: 101 [Wanneroo Road access (Site Folder: 2024 Base + Dev - Weekend)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
 Site Category: (None)
 Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
East: Shopping centre access WB															
4	L2	All MCs	169	0.0	169	0.0	0.222	9.4	LOS A	0.9	6.4	0.60	0.82	0.61	50.4
Approach			169	0.0	169	0.0	0.222	9.4	LOS A	0.9	6.4	0.60	0.82	0.61	50.4
North: Wanneroo Road SB															
7	L2	All MCs	28	0.0	28	0.0	0.400	5.7	LOS A	0.0	0.0	0.00	0.02	0.00	57.0
8	T1	All MCs	1374	10.3	1374	10.3	0.400	0.2	LOS A	0.0	0.0	0.00	0.01	0.00	59.6
Approach			1402	10.1	1402	10.1	0.400	0.3	NA	0.0	0.0	0.00	0.01	0.00	59.5
All Vehicles			1572	9.0	1572	9.0	0.400	1.3	NA	0.9	6.4	0.07	0.10	0.07	58.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
 Vehicle movement LOS values are based on average delay per movement.
 Minor Road Approach LOS values are based on average delay for all vehicle movements.
 NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
 Two-Way Sign Control Capacity Model: SIDRA Standard.
 Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
 Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
 Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Hepburn Avenue access (Site Folder: 2024 Base + Dev - Weekend)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
 Site Category: (None)
 Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh. veh	Dist] m				km/h
North: Shopping centre access															
7	L2	All MCs	164	0.0	164	0.0	0.147	7.2	LOS A	0.6	4.4	0.45	0.66	0.45	51.6
Approach			164	0.0	164	0.0	0.147	7.2	LOS A	0.6	4.4	0.45	0.66	0.45	51.6
West: Hepburn Avenue EB															
10	L2	All MCs	175	0.0	175	0.0	0.094	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	53.4
11	T1	All MCs	778	9.5	778	9.5	0.221	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach			953	7.8	953	7.8	0.221	1.1	NA	0.0	0.0	0.00	0.10	0.00	58.6
All Vehicles			1117	6.6	1117	6.6	0.221	2.0	NA	0.6	4.4	0.07	0.18	0.07	57.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
 Vehicle movement LOS values are based on average delay per movement.
 Minor Road Approach LOS values are based on average delay for all vehicle movements.
 NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
 Two-Way Sign Control Capacity Model: SIDRA Standard.
 Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
 Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
 Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 814 [Hepburn Road/ Giralt Road (Site Folder: 2024 Base + Dev - Weekend)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 100 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%				[Veh.]	[Dist]				
			veh/h		veh/h	%	v/c	sec		veh	m				km/h
South: Giralt Road NB															
1	L2	All MCs	45	5.0	45	5.0	0.047	11.8	LOS B	0.7	5.7	0.41	0.64	0.41	47.7
2	T1	All MCs	92	0.6	92	0.6	* 0.363	44.1	LOS D	4.2	31.2	0.96	0.74	0.96	34.9
3	R2	All MCs	131	5.0	131	5.0	* 0.741	57.5	LOS E	6.8	52.2	1.00	0.89	1.17	29.9
Approach			267	3.5	267	3.5	0.741	45.2	LOS D	6.8	52.2	0.88	0.80	0.97	33.7
East: Hepburn Avenue WB															
4	L2	All MCs	143	5.0	143	5.0	0.101	6.7	LOSA	0.9	6.6	0.20	0.60	0.20	51.0
5	T1	All MCs	918	9.5	918	9.5	* 0.813	38.3	LOS D	22.4	183.1	0.98	0.95	1.09	36.9
6	R2	All MCs	346	0.6	346	0.6	* 0.816	50.3	LOS D	17.6	130.1	1.00	0.93	1.15	32.2
Approach			1407	6.9	1407	6.9	0.816	38.1	LOS D	22.4	183.1	0.91	0.91	1.01	36.6
North: Giralt Road SB															
7	L2	All MCs	318	0.0	318	0.0	0.352	14.6	LOS B	7.3	53.9	0.56	0.72	0.56	47.1
8	T1	All MCs	63	0.6	63	0.6	0.251	43.3	LOS D	2.9	21.1	0.94	0.71	0.94	35.2
9	R2	All MCs	61	0.0	61	0.0	0.329	52.7	LOS D	2.9	21.3	0.97	0.75	0.97	31.6
Approach			442	0.1	442	0.1	0.352	24.0	LOS C	7.3	53.9	0.67	0.73	0.67	42.2
West: Hepburn Avenue EB															
10	L2	All MCs	19	0.6	19	0.6	0.015	10.2	LOS B	0.3	2.0	0.36	0.61	0.36	49.7
11	T1	All MCs	856	9.5	856	9.5	0.758	34.9	LOS C	19.6	159.9	0.96	0.88	1.01	38.2
12	R2	All MCs	67	5.0	67	5.0	0.166	39.1	LOS D	2.7	20.5	0.84	0.74	0.84	35.1
Approach			942	9.0	942	9.0	0.758	34.7	LOS C	19.6	159.9	0.94	0.86	0.98	38.1
All Vehicles			3059	6.2	3059	6.2	0.816	35.6	LOS D	22.4	183.1	0.88	0.86	0.95	37.5

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

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

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

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

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

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

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
						[Ped]	[Dist]					
		ped/h	ped/h	sec		ped	m			sec	m	m/sec
South: Giralt Road NB												
P1	Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	210.9	200.0	0.95
East: Hepburn Avenue WB												

P2 Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	210.9	200.0	0.95
North: Giralt Road SB											
P3 Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	210.9	200.0	0.95
West: Hepburn Avenue EB											
P4 Full	50	53	44.3	LOS E	0.1	0.1	0.94	0.94	210.9	200.0	0.95
All Pedestrians	200	211	44.3	LOS E	0.1	0.1	0.94	0.94	210.9	200.0	0.95

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 1178 [Wanneroo Road/ Giralt Road (Site Folder: 2034 + Dev - Weekday)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
South: Wanneroo Road NB															
2	T1	All MCs	2059	10.3	2059	10.3	0.588	0.4	LOS A	0.0	0.0	0.00	0.00	0.00	59.4
3	R2	All MCs	131	0.6	131	0.6	* 0.808	50.6	LOS D	5.7	42.1	1.00	0.94	1.33	32.1
Approach			2189	9.7	2189	9.7	0.808	3.4	LOS A	5.7	42.1	0.06	0.06	0.08	56.5
East: Giralt Road WB															
4	L2	All MCs	131	0.6	131	0.6	0.199	15.7	LOS B	2.6	19.4	0.61	0.72	0.61	46.3
6	R2	All MCs	241	0.6	241	0.6	* 0.804	47.0	LOS D	10.2	75.2	1.00	0.94	1.22	33.5
Approach			372	0.6	372	0.6	0.804	36.0	LOS D	10.2	75.2	0.86	0.86	1.01	37.1
North: Wanneroo Road SB															
7	L2	All MCs	345	0.6	345	0.6	0.348	20.4	LOS C	7.6	56.5	0.61	0.75	0.61	45.3
8	T1	All MCs	1484	10.3	1484	10.3	* 0.840	24.5	LOS C	29.7	243.6	0.91	0.92	1.03	43.6
Approach			1829	8.5	1829	8.5	0.840	23.8	LOS C	29.7	243.6	0.85	0.89	0.95	43.9
All Vehicles			4391	8.4	4391	8.4	0.840	14.6	LOS B	29.7	243.6	0.46	0.47	0.52	48.5

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

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

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

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

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

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

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol.	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	ped/h	sec		[Ped]	[Dist]			sec	m	m/sec
						ped	m					
East: Giralt Road WB												
P2	Full	50	53	34.3	LOS D	0.1	0.1	0.93	0.93	201.0	200.0	1.00
All Pedestrians		50	53	34.3	LOS D	0.1	0.1	0.93	0.93	201.0	200.0	1.00

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 101 [Wanneroo Road access (Site Folder: 2034 + Dev - Weekday)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
 Site Category: (None)
 Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
East: Shopping centre access WB															
4	L2	All MCs	134	0.0	134	0.0	0.210	10.6	LOS B	0.8	5.8	0.66	0.85	0.68	49.6
Approach			134	0.0	134	0.0	0.210	10.6	LOS B	0.8	5.8	0.66	0.85	0.68	49.6
North: Wanneroo Road SB															
7	L2	All MCs	24	0.0	24	0.0	0.460	5.7	LOSA	0.0	0.0	0.00	0.02	0.00	57.0
8	T1	All MCs	1591	10.3	1591	10.3	0.460	0.2	LOSA	0.0	0.0	0.00	0.01	0.00	59.5
Approach			1615	10.1	1615	10.1	0.460	0.3	NA	0.0	0.0	0.00	0.01	0.00	59.5
All Vehicles			1748	9.4	1748	9.4	0.460	1.1	NA	0.8	5.8	0.05	0.07	0.05	58.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
 Vehicle movement LOS values are based on average delay per movement.
 Minor Road Approach LOS values are based on average delay for all vehicle movements.
 NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
 Two-Way Sign Control Capacity Model: SIDRA Standard.
 Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
 Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
 Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Hepburn Avenue access (Site Folder: 2034 + Dev - Weekday)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
 Site Category: (None)
 Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
North: Shopping centre access															
7	L2	All MCs	128	0.0	128	0.0	0.133	7.9	LOS A	0.5	3.9	0.51	0.71	0.51	51.4
Approach			128	0.0	128	0.0	0.133	7.9	LOS A	0.5	3.9	0.51	0.71	0.51	51.4
West: Hepburn Avenue EB															
10	L2	All MCs	145	0.0	145	0.0	0.078	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	53.4
11	T1	All MCs	1016	9.5	1016	9.5	0.288	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach			1161	8.3	1161	8.3	0.288	0.8	NA	0.0	0.0	0.00	0.07	0.00	58.9
All Vehicles			1289	7.5	1289	7.5	0.288	1.5	NA	0.5	3.9	0.05	0.13	0.05	58.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
 Vehicle movement LOS values are based on average delay per movement.
 Minor Road Approach LOS values are based on average delay for all vehicle movements.
 NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
 Two-Way Sign Control Capacity Model: SIDRA Standard.
 Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
 Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
 Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 814 [Hepburn Road/ Giralt Road (Site Folder: 2034 + Dev - Weekday)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 140 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
South: Giralt Road NB															
1	L2	All MCs	77	5.0	77	5.0	0.085	17.2	LOS B	2.1	16.0	0.46	0.66	0.46	44.6
2	T1	All MCs	95	0.6	95	0.6	* 0.428	93.8	LOS F	6.2	45.6	0.98	0.76	0.98	29.5
3	R2	All MCs	411	5.0	411	5.0	* 0.945	114.9	LOS F	34.2	264.2	1.00	1.06	1.31	24.5
Approach			582	4.3	582	4.3	0.945	98.6	LOS F	34.2	264.2	0.92	0.96	1.14	26.9
East: Hepburn Avenue WB															
4	L2	All MCs	247	5.0	247	5.0	0.162	31.0	LOS C	1.9	14.5	0.17	0.60	0.17	51.0
5	T1	All MCs	1067	9.5	1067	9.5	* 0.956	82.3	LOS F	48.4	394.6	1.00	1.17	1.29	26.6
6	R2	All MCs	205	0.6	205	0.6	* 0.973	103.0	LOS F	17.8	131.3	1.00	1.09	1.49	22.0
Approach			1520	7.6	1520	7.6	0.973	76.7	LOS E	48.4	394.6	0.86	1.06	1.13	28.0
North: Giralt Road SB															
7	L2	All MCs	254	0.0	254	0.0	0.444	41.0	LOS D	13.0	95.3	0.82	0.84	0.82	35.3
8	T1	All MCs	47	0.6	47	0.6	0.214	61.6	LOS E	3.0	22.1	0.95	0.71	0.95	30.0
9	R2	All MCs	39	0.0	39	0.0	0.075	45.1	LOS D	1.9	14.2	0.77	0.71	0.77	33.9
Approach			340	0.1	340	0.1	0.444	44.3	LOS D	13.0	95.3	0.83	0.81	0.83	34.2
West: Hepburn Avenue EB															
10	L2	All MCs	12	0.6	12	0.6	0.008	39.7	LOS D	0.1	1.1	0.24	0.58	0.24	50.9
11	T1	All MCs	1064	9.5	1064	9.5	0.903	76.1	LOS E	40.4	329.4	1.00	1.04	1.16	30.1
12	R2	All MCs	68	5.0	68	5.0	0.340	84.2	LOS F	4.4	34.1	0.96	0.76	0.96	27.4
Approach			1144	9.1	1144	9.1	0.903	76.2	LOS E	40.4	329.4	0.99	1.02	1.14	30.1
All Vehicles			3586	6.8	3586	6.8	0.973	77.0	LOS E	48.4	394.6	0.91	1.01	1.11	28.9

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

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

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

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

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

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

* Critical Movement (Signal Timing)

Pedestrian Movement Performance											
Mov ID	Input Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed
		ped/h	sec		[Ped]	[Dist]			sec	m	m/sec
					ped	m					
South: Giralt Road NB											
P1	Full	50	64.3	LOS F	0.2	0.2	0.96	0.96	230.9	200.0	0.87
East: Hepburn Avenue WB											

P2 Full	50	53	64.3	LOS F	0.2	0.2	0.96	0.96	230.9	200.0	0.87
North: Giralt Road SB											
P3 Full	50	53	64.3	LOS F	0.2	0.2	0.96	0.96	230.9	200.0	0.87
West: Hepburn Avenue EB											
P4 Full	50	53	64.3	LOS F	0.2	0.2	0.96	0.96	230.9	200.0	0.87
All Pedestrians	200	211	64.3	LOS F	0.2	0.2	0.96	0.96	230.9	200.0	0.87

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 1178 [Wanneroo Road/ Giralt Road (Site Folder: 2034 + Dev - Weekend)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site

Site Category: (None)

Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
South: Wanneroo Road NB															
2	T1	All MCs	2021	10.3	2021	10.3	0.577	0.4	LOS A	0.0	0.0	0.00	0.00	0.00	59.4
3	R2	All MCs	176	0.6	176	0.6	* 0.857	56.6	LOS E	8.8	64.7	1.00	0.99	1.36	30.5
Approach			2197	9.5	2197	9.5	0.857	4.9	LOS A	8.8	64.7	0.08	0.08	0.11	55.2
East: Giralt Road WB															
4	L2	All MCs	178	0.6	178	0.6	0.268	19.3	LOS B	4.5	33.2	0.67	0.74	0.67	44.3
6	R2	All MCs	300	0.6	300	0.6	* 0.915	61.1	LOS E	16.1	118.7	1.00	1.06	1.42	29.7
Approach			478	0.6	478	0.6	0.915	45.5	LOS D	16.1	118.7	0.88	0.94	1.14	33.9
North: Wanneroo Road SB															
7	L2	All MCs	415	0.6	415	0.6	0.440	26.2	LOS C	11.4	84.5	0.68	0.78	0.68	43.4
8	T1	All MCs	1468	10.3	1468	10.3	* 0.906	39.4	LOS D	40.6	333.1	0.98	1.08	1.21	37.4
Approach			1883	8.2	1883	8.2	0.906	36.5	LOS D	40.6	333.1	0.92	1.01	1.09	38.6
All Vehicles			4558	8.0	4558	8.0	0.915	22.2	LOS C	40.6	333.1	0.51	0.55	0.62	44.4

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

Vehicle movement LOS values are based on average delay per movement.

Intersection and Approach LOS values are based on average delay for all vehicle movements.

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

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

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

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

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

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Input Crossing	Dem. Flow	Aver. Delay	Level of Service	AVERAGE BACK OF QUEUE		Prop. Que	Eff. Stop Rate	Travel Time	Travel Dist.	Aver. Speed	
	ped/h	ped/h	sec		[Ped]	[Dist]			sec	m	m/sec	
					ped	m						
East: Giralt Road WB												
P2	Full	50	53	39.3	LOS D	0.1	0.1	0.94	0.94	206.0	200.0	0.97
All Pedestrians		50	53	39.3	LOS D	0.1	0.1	0.94	0.94	206.0	200.0	0.97

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)

Pedestrian movement LOS values are based on average delay per pedestrian movement.

Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

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MOVEMENT SUMMARY

Site: 101 [Wanneroo Road access (Site Folder: 2034 + Dev - Weekend)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
 Site Category: (None)
 Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
East: Shopping centre access WB															
4	L2	All MCs	169	0.0	169	0.0	0.271	11.2	LOS B	1.1	8.2	0.69	0.89	0.78	49.2
Approach			169	0.0	169	0.0	0.271	11.2	LOS B	1.1	8.2	0.69	0.89	0.78	49.2
North: Wanneroo Road SB															
7	L2	All MCs	28	0.0	28	0.0	0.469	5.7	LOSA	0.0	0.0	0.00	0.02	0.00	57.0
8	T1	All MCs	1618	10.3	1618	10.3	0.469	0.2	LOSA	0.0	0.0	0.00	0.01	0.00	59.5
Approach			1646	10.1	1646	10.1	0.469	0.3	NA	0.0	0.0	0.00	0.01	0.00	59.5
All Vehicles			1816	9.2	1816	9.2	0.469	1.3	NA	1.1	8.2	0.06	0.09	0.07	58.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
 Vehicle movement LOS values are based on average delay per movement.
 Minor Road Approach LOS values are based on average delay for all vehicle movements.
 NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
 Two-Way Sign Control Capacity Model: SIDRA Standard.
 Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
 Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
 Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 101 [Hepburn Avenue access (Site Folder: 2034 + Dev - Weekend)]

Output produced by SIDRA INTERSECTION Version: 9.1.3.210

New Site
 Site Category: (None)
 Give-Way (Two-Way)

Vehicle Movement Performance															
Mov ID	Turn	Mov Class	Demand Flows		Arrival Flows		Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue		Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			[Total HV]	%	[Total HV]	%	v/c	sec		[Veh.]	[Dist]				km/h
			veh/h		veh/h					veh	m				
North: Shopping centre access															
7	L2	All MCs	164	0.0	164	0.0	0.165	7.8	LOS A	0.7	4.9	0.51	0.71	0.51	51.5
Approach			164	0.0	164	0.0	0.165	7.8	LOS A	0.7	4.9	0.51	0.71	0.51	51.5
West: Hepburn Avenue EB															
10	L2	All MCs	175	0.0	175	0.0	0.094	5.6	LOS A	0.0	0.0	0.00	0.53	0.00	53.4
11	T1	All MCs	961	9.5	961	9.5	0.273	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	59.8
Approach			1136	8.0	1136	8.0	0.273	0.9	NA	0.0	0.0	0.00	0.08	0.00	58.7
All Vehicles			1300	7.0	1300	7.0	0.273	1.8	NA	0.7	4.9	0.06	0.16	0.06	57.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
 Vehicle movement LOS values are based on average delay per movement.
 Minor Road Approach LOS values are based on average delay for all vehicle movements.
 NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
 Two-Way Sign Control Capacity Model: SIDRA Standard.
 Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
 Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
 Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
 HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
 Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

APPENDIX C ACOUSTIC REPORT

LOFTE

**KINGSWAY CITY SHOPPING CENTRE
SHORT STAY APARTMENTS**

**DEVELOPMENT APPLICATION
ACOUSTIC REPORT**

MAY 2024

OUR REFERENCE: 32743-1-24084

DOCUMENT CONTROL PAGE

DA ACOUSTIC REPORT
KINGSWAY CITY SHOPPING CENTRE
SHORT STAY APARTMENTS

Job No: 24084

Document Reference: 32743-1-24084

FOR

LOFTE

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APPENDICIES

A	Development Application Plans
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1.0 INTRODUCTION

Herring Storer Acoustics was commissioned to conduct a preliminary review of the proposed development of short stay apartments at Kingsway Shopping Centre, Kingsway.

This report has been based on the Development Application drawings provided.

2.0 PROPOSED DEVELOPMENT

The proposed development site is located at on the north west corner of the Kingsway Shopping Centre building.

The following summarises the development:

Ground Floor

- Commercial Tenancies
- Alfresco areas

Level 1

- Apartments
- Communal areas (conference room, meeting room, gym)
 - o Supermarket
 - o Medical/Gym
 - o Pharmacy/Medical
 - o F&B Retail Tenancies.

Level 2 to 7

- Apartments

3.0 CRITERIA

3.1 BCA PROVISIONS

For Class 2 or 3 buildings, Part F5 of the National Construction Code (NCC), outlines the minimum acoustic isolation of apartments. The following summarises the acoustic criteria:

3.1.1 Walls

Wet to wet	$R_W + C_{tr}$ not less than 50 dB.
Living to living	$R_W + C_{tr}$ not less than 50 dB.
Wet to living construction.	$R_W + C_{tr}$ not less than 50 dB plus discontinuous
Kitchens to living construction.	$R_W + C_{tr}$ not less than 50 dB plus discontinuous
SOU to Lobby	R_W not less than 50 dB.

Note: Where kitchens are part of an open living area, we consider the kitchen to be part of the living area and in these cases a discontinuous construction is required. This also includes cases where kitchens are back-to-back, however, discontinuous construction is only required on one side.

3.1.2 Floors

Floors $R_W + C_{tr}$ not less than 50 dB.

Impact Isolation $L_{n,w}$ not more than 55 dB is recommended.

Note: The impact isolation criteria under the BCA is an $L_{n,w}$ of not more than 62 dB. However, as a member firm of the Association of Australasian Acoustic Consultants, (AAAC) we recommend a criteria of an $L_{n,w}$ of not more than 55 dB be adopted for a development of this type.

3.1.3 Service Risers

to Habitable Rooms $R_W + C_{tr}$ not less than 40 dB.

to Non-Habitable Rooms $R_W + C_{tr}$ not less than 25 dB.

3.1.4 Hydraulics

The above requirements also apply to storm water down pipes.

3.1.5 Doors

Door (Connecting to a lobby) R_W not less than 30 dB.

The development will be designed to comply with the requirements of Part F5 of the BCA.

3.2 ENVIRONMENTAL PROTECTION (NOISE) REGULATIONS 1997

The *Environmental Protection (Noise) Regulations 1997* stipulate the allowable noise levels at any noise sensitive premises from other premises. The allowable or assigned noise levels for noise sensitive premises are determined by the calculation of an influencing factor, which is added to the baseline criteria set out in Table 1 of the Regulations. The baseline assigned noise levels are listed in Table 3.1. For commercial premises, the allowable or assigned noise levels are the same for all hours of the day. Table 3.1 also lists the assigned noise levels for commercial premises.

TABLE 3.1 – ASSIGNED NOISE LEVELS

Premises Noise	Receiving	Time of Day	Assigned Level (dB)		
			L_{A10}	L_{A1}	L_{Amax}
Noise sensitive premises within 15 metres of a dwelling		0700 - 1900 hours Monday to Saturday	45 + IF	55 + IF	65 + IF
		0900 - 1900 hours Sunday and Public Holidays	40 + IF	50 + IF	65 + IF
		1900 - 2200 hours all days	40 + IF	50 + IF	55 + IF
		2200 hours on any day to 0700 hours Monday to Saturday and 0900 hours Sunday and Public Holidays	35 + IF	45 + IF	55 + IF

Note: The L_{A10} noise level is the noise that is exceeded for 10% of the time.
The L_{A1} noise level is the noise that is exceeded for 1% of the time.
The L_{Amax} noise level is the maximum noise level recorded.

It is a requirement that noise from the site be free of annoying characteristics (tonality, modulation and impulsiveness) at other premises, defined below as per Regulation 9.

“impulsiveness” means a variation in the emission of a noise where the difference between L_{Apeak} and $L_{Amax Slow}$ is more than 15dB when determined for a single representative event;

“modulation” means a variation in the emission of noise that –

- (a) is more than 3dB $L_{A Fast}$ or is more than 3dB $L_{A Fast}$ in any one-third octave band;
- (b) is present for more at least 10% of the representative assessment period; and
- (c) is regular, cyclic and audible;

“tonality” means the presence in the noise emission of tonal characteristics where the difference between –

- (a) the A-weighted sound pressure level in any one-third octave band; and
- (b) the arithmetic average of the A-weighted sound pressure levels in the 2 adjacent one-third octave bands,

is greater than 3 dB when the sound pressure levels are determined as $L_{Aeq,T}$ levels where the time period T is greater than 10% of the representative assessment period, or greater than 8 dB at any time when the sound pressure levels are determined as $L_{A Slow}$ levels.

Where the above characteristics are present and cannot be practicably removed, the following adjustments are made to the measured or predicted level at other premises.

TABLE 3.2 – ADJUSTMENTS FOR ANNOYING CHARACTERISTICS

Where tonality is present	Where modulation is present	Where impulsiveness is present
+ 5 dB	+ 5 dB	+ 10 dB

Figure 1 shows the development location and surrounds.

We note that noise emissions from the premises need to comply with the requirements of the *Environmental Protection (Noise) Regulations 1997*. This not only includes noise associated with mechanical services (ie air conditioning and ventilation systems), but also noise from commercial premises within the site.

4.0 BCA REQUIRMENTS

The proposed development will be constructed to comply with the requirements of Part F5 of the NCC.

It is noted that adopting the flooring criteria of not more than 55 $L_{nT,w}$ dB provides greater amenity than basic BCA compliance.

Double door systems between apartments are noted to be proposed to be included in some locations. The wall systems in these locations can be compromised by the door systems, with the NCC/BCA requirements met with a performance solution.

Given that the apartments are short stay, management of any issues that double doors may present can be mitigated.

5.0 NOISE FROM DEVELOPMENT

The main source of noise from the proposed development will be from mechanical services consisting of air-conditioning plant. Noise received at neighbouring premises, and premises within the development, from these items need to comply with the assigned noise levels as determined under the *Environmental Protection (Noise) Regulations 1997*.

The proposed alfresco area will also be required to comply with the Regulations at the apartments above.

5.1 MECHANICAL SERVICES

The main source of noise from the proposed commercial tenancies will be from mechanical services consisting of air-conditioning plant, condenser units, refrigeration plant and the like. Noise received at residence (neighbours and residence within the development) from these items need to comply with the assigned noise levels as determined under the *Environmental Protection (Noise) Regulations 1997*.

As the mechanical services could operate during the night, noise emissions from the development needs to comply with the assigned L_{A10} night period noise level of 45 dB(A) at residential premises. Potentially, noise emissions from mechanical services could be tonal, in which case an +5 dB(A) penalty for a tonal component could be applied to the resultant noise levels. Therefore, the design level at the neighbouring residential premises would be 40 L_{A10} dB.

The location of the mechanical plant for the apartments is proposed to be located on the rooftop, and as such would not be considered onerous to meet the relevant criteria.

Similarly with the balance of the commercial tenancies, being below the apartments, the location of the exhaust systems and mechanical plant will need to be considered primarily in relation to the apartments – however is not considered to be onerous.

5.2 FOOD AND BEVERAGE GROUND FLOOR TENANCIES

The food and beverage tenancies on the ground floor are noted.

The proposed uses of the tenancies are understood to vary, with some tenancies targeting day whereas other would target evening patronage.

Patron noise with alfresco areas are the main areas of concern, as the internal usage can be ameliorated through management/construction (i.e. doors remaining closed, or activities restricted).

The alfresco patron areas are located below the balance of the building, and therefore, are offered significant noise attenuation to the apartments above.

The manner of trade for each of the tenancies will need to be included in any consideration of the noise impact of these spaces and would form part of the development application for each operator.

On the basis of patron noise only within the alfresco area (i.e. any music, being ambient conversation level only), noise levels from the alfresco area patrons have been calculated at a level of 40 dB(A) at the apartments above. This would be compliant with the Regulations at all times.