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Sustainable Transport. Safe Solutions

15 Ikara Ln & 101 Booderee Rd, Yanchep
Proposed ECU Health Centre

TRANSPORT IMPACT ASSESSMENT

Prepared for:
Edith Cowan University

December 2023

15 Ikara Ln & 101 Booderee Rd, Yanchep

Prepared for: Edith Cowan University
Prepared by: Paul Ghantous
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Contents

Figures

Tables

Appendices

1 Introduction

This Transport Impact Assessment has been prepared by Urbii on behalf of Edith Cowan University with regards to the proposed ECU Health Centre, located at 15 Ikara Ln & 101 Booderee Rd, Yanchep.

The subject site is situated on the southern side of Yanchep Beach Road, between Kakadu Road and Booderee Road, as shown in Figure 1. Ikara Lane runs along the rear boundary of the site, connecting between the two side roads.

It is proposed to develop the site into the ECU Health Centre (medical centre). A Development Application is being submitted for the western portion of the site (15 Ikara Lane), with the eastern site already accommodating an existing building.

The aim of this Transport Impact Assessment (TIA) is to assess the impact of the proposal on the existing transport network. The TIA was prepared in accordance with the WAPC *Transport Assessment Guidelines* 2016.

The TIA considers the traffic and parking impacts of both sites, as vehicle access and parking will be shared.

Figure 1: Subject site

2 Existing situation

2.1 Existing site use, access and parking

The subject site comprises two lots. 101 Booderee Road accommodates an existing building with associated car parking (Figure 2). 15 Ikara Lane is a vacant lot on the western boundary of 101 Booderee Road. The Development Application is only for 15 Ikara Lane.

101 Booderee Road features 90-degree car parking accessed directly off Ikara Lane and an internal car park. Vehicle access to 101 Booderee Road is via a crossover on Ikara Lane with an access driveway on the western boundary of 101 Booderee Road.

The subject site is located within the *Lots 1 + 102 Yanchep Beach Road, Yanchep (Jindowie West) Agreed Structure Plan No. 40*. Relevant context plans are included for reference in Appendix A.

Figure 2: Existing site use

The site is surrounded by a mix of residential, community and commercial land uses, refer to Figure 3 for a context plan showing surrounding land use. Yanchep Central Shopping Centre is located nearby to the south-west. There are several community and civic uses to the north of Yanchep Beach Road, including a Police Station, Ambulance Station and Veterinary Hospital. There is an existing National Storage on the eastern boundary of the site. On the western boundary of the site there is an approved commercial development (Appendix A).

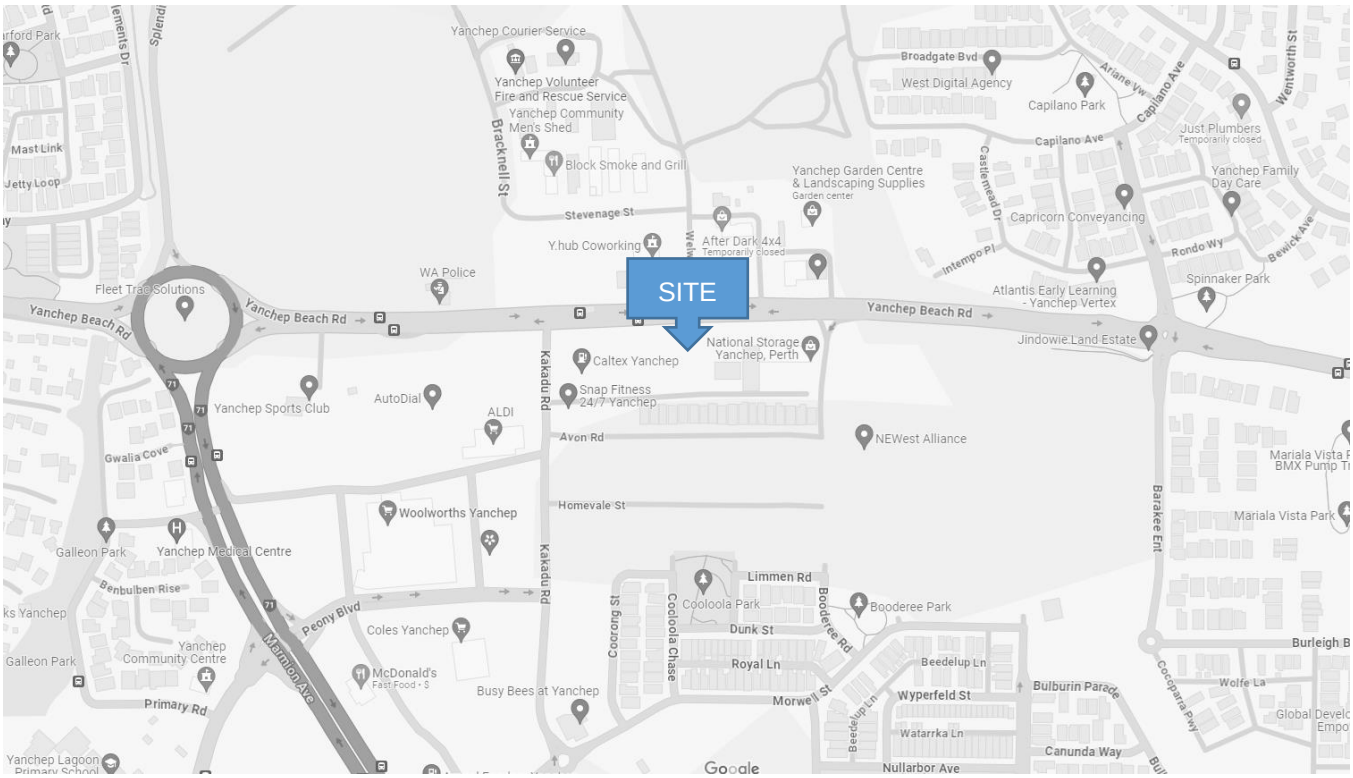


Figure 3: Location context plan

2.2 Surrounding road network and traffic management on roads

Information from online mapping services, Main Roads WA, Local Government, and site visits was collected to assess the existing traffic management on frontage roads.

2.2.1 Yanchep Beach Road (YBR)

Yanchep Beach Road near the subject site is an approximately 10m wide, two-lane single carriageway road. Some localised widening and painted turn pockets are provided at intersections. Paths for walking and cycling are provided on both sides of the road. It is classified as a *Distributor B* road in the Main Roads WA road hierarchy (Figure 6) and currently operates under a posted speed limit of 60km/h (Figure 7). *Distributor B* roads are normally the responsibility of Local Government. They are predominantly for reduced capacity but high traffic volumes travelling between industrial, commercial and residential areas. (Figure 8).

Yanchep Beach Road is designated as an Other Regional Road (Blue road) in the Metropolitan Region Scheme (MRS) (Figure 4).

There is an existing restriction on vehicle access for the subject site along the Yanchep Beach Road frontage (Figure 5). Urbii in conjunction with the project team and ECU, have been in negotiations with the City to seek left-in/left-out access for the proposed development on Yanchep Beach Road.

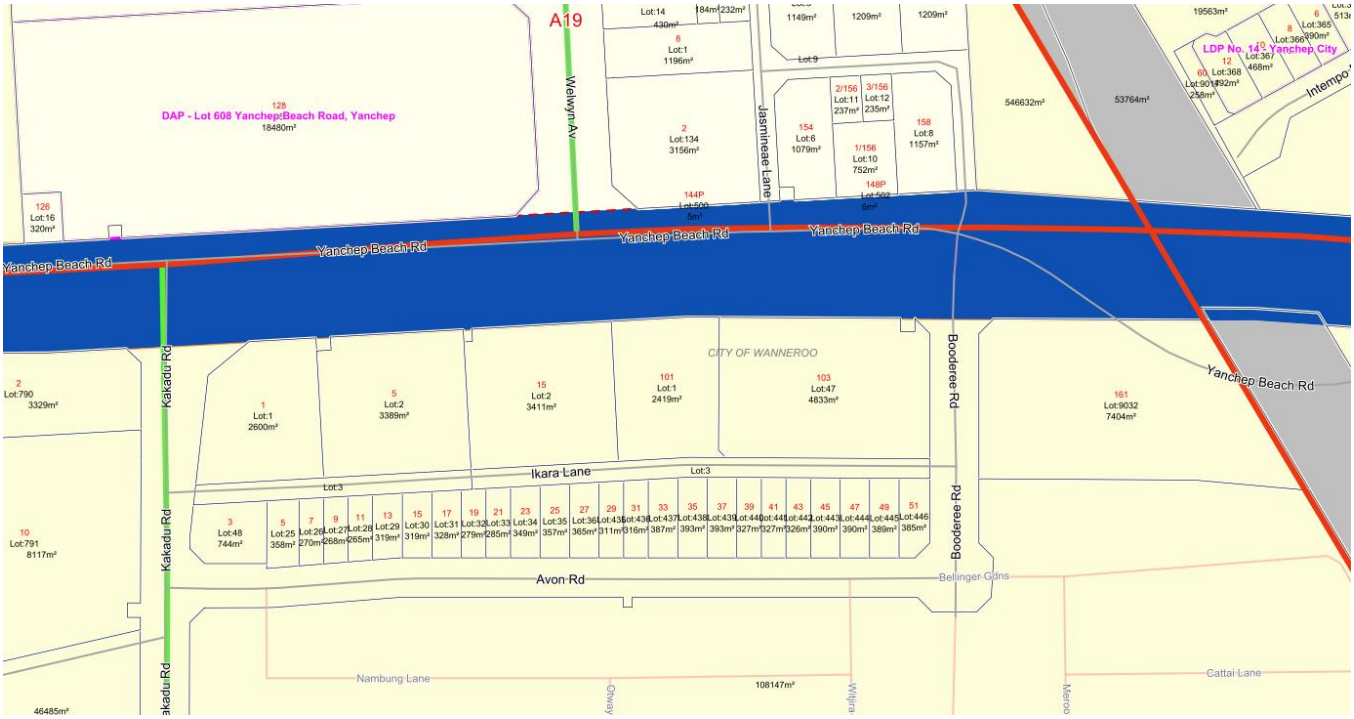


Figure 4: Metropolitan Region Scheme zoning plan

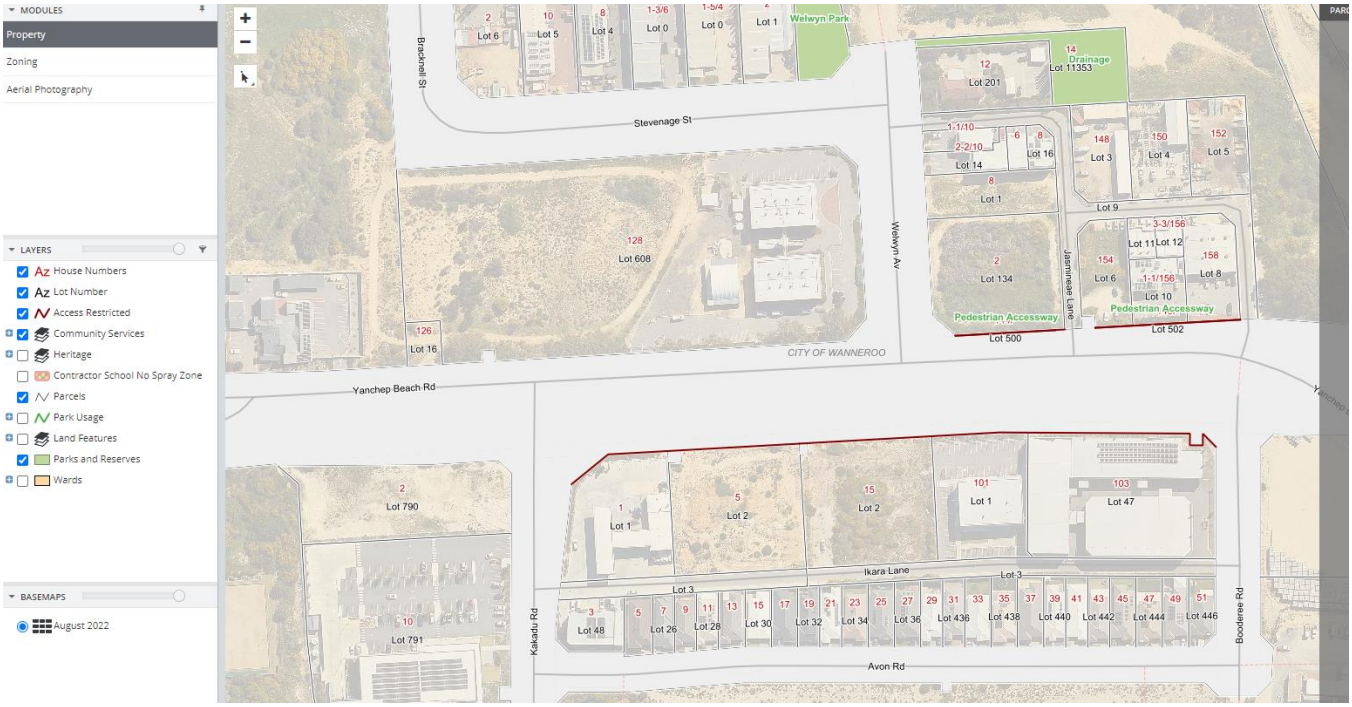


Figure 5: Access restriction on Yanchep Beach Road

2.2.2 Kakadu Road

Kakadu Road near the subject site is an approximately 7m wide, two-lane undivided road. A footpath is provided on the western side of the road. It is classified as an *Access* road in the Main Roads WA road hierarchy (Figure 6) and operates under a default speed limit of 50km/h (Figure 7). *Access* roads are normally the responsibility of Local Government. They are predominantly for the provision of vehicle access to abutting properties (Figure 8).

2.2.3 Booderee Road

Booderee Road near the subject site is an approximately 7m wide, two-lane undivided road. A footpath is provided on the western side of the road. It is classified as an *Access* road in the Main Roads WA road hierarchy (Figure 6) and operates under a default speed limit of 50km/h (Figure 7). *Access* roads are normally the responsibility of Local Government. They are predominantly for the provision of vehicle access to abutting properties (Figure 8).

2.2.4 Ikara Lane

Ikara Lane near the subject site is an approximately 5.8m wide laneway.

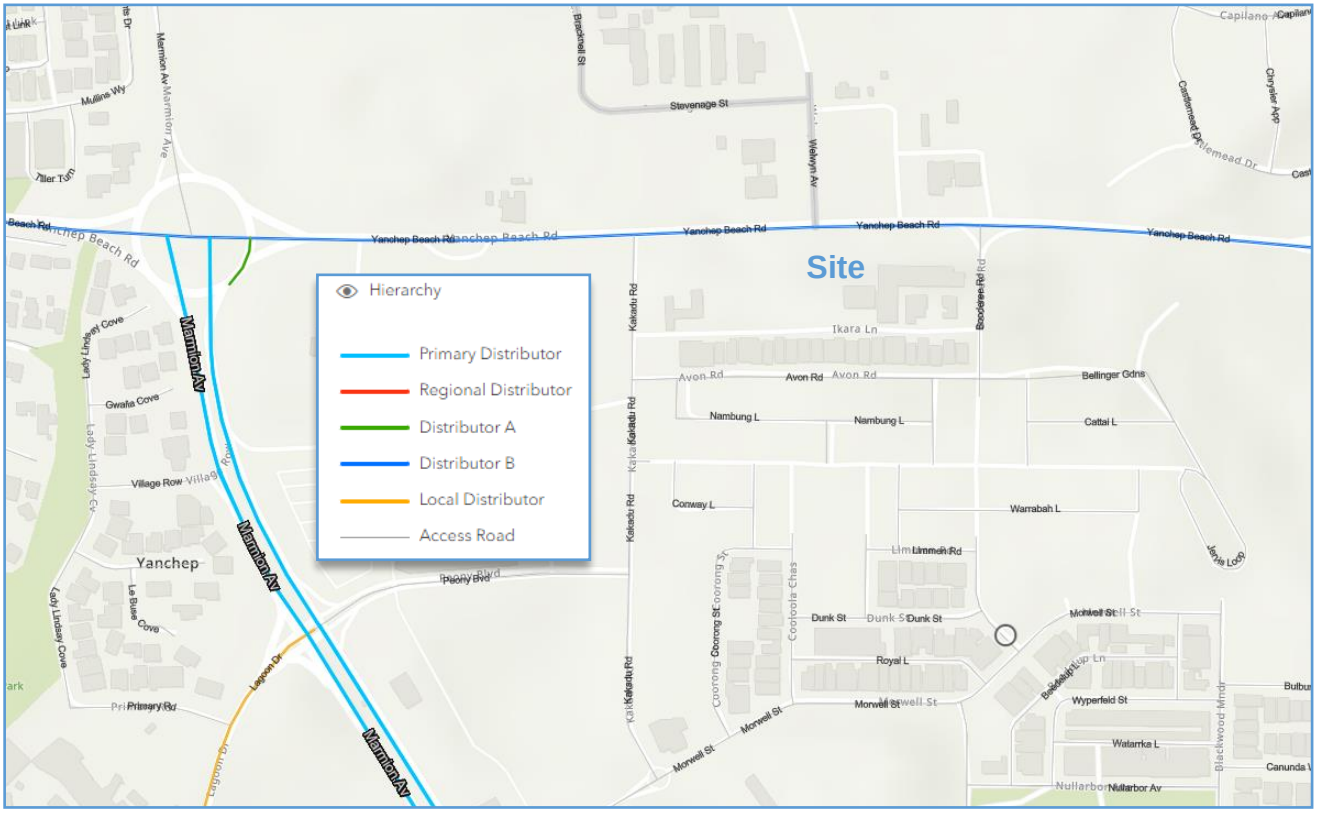


Figure 6: Main Roads WA road hierarchy plan

Source: Main Roads WA Road Information Mapping System (RIM)

Figure 7: Main Roads WA road speed zoning plan

Source: Main Roads WA Road Information Mapping System (RIM)

ROAD HIERARCHY FOR WESTERN AUSTRALIA
ROAD TYPES AND CRITERIA (see Note 1)

CRITERIA	PRIMARY DISTRIBUTOR (PD) (see Note 2)	DISTRICT DISTRIBUTOR A (DA)	DISTRICT DISTRIBUTOR B (DB)	REGIONAL DISTRIBUTOR (RD)	LOCAL DISTRIBUTOR (LD)	ACCESS ROAD (A)
Primary Criteria						
1. Location (see Note 3)	All of WA incl. BUA	Only Built Up Area.	Only Built Up Area.	Only Non Built Up Area. (see Note 4)	All of WA incl. BUA	All of WA incl. BUA
2. Responsibility	Main Roads Western Australia.	Local Government.	Local Government.	Local Government.	Local Government.	Local Government.
3. Degree of Connectivity	High. Connects to other Primary and Distributor roads.	High. Connects to Primary and/or other Distributor roads.	High. Connects to Primary and/or other Distributor roads.	High. Connects to Primary and/or other Distributor roads.	Medium. Minor Network Role Connects to Distributors and Access Roads.	Low. Provides mainly for property access.
4. Predominant Purpose	Movement of inter regional and/or cross town/city traffic, e.g. freeways, highways and main roads.	High capacity traffic movements between industrial, commercial and residential areas.	Reduced capacity but high traffic volumes travelling between industrial, commercial and residential areas.	Roads linking significant destinations and designed for efficient movement of people and goods between and within regions.	Movement of traffic within local areas and connect access roads to higher order Distributors.	Provision of vehicle access to abutting properties
Secondary Criteria						
5. Indicative Traffic Volume (AADT)	In accordance with Classification Assessment Guidelines.	Above 8 000 vpd	Above 6 000 vpd.	Greater than 100 vpd	Built Up Area - Maximum desirable volume 6 000 vpd. Non Built Up Area – up to 100 vpd.	Built Up Area - Maximum desirable volume 3 000 vpd. Non Built Up Area – up to 75 vpd.
6. Recommended Operating Speed	60 – 110 km/h (depending on design characteristics).	60 – 80 km/h.	60 – 70 km/h.	50 – 110 km/h (depending on design characteristics).	Built Up Area 50 - 60 km/h (desired speed) Non Built Up Area 60 – 110 km/h (depending on design characteristics).	Built Up Area 50 km/h (desired speed). Non Built Up Area 50 – 110 km/h (depending on design characteristics).
7. Heavy Vehicles permitted	Yes.	Yes.	Yes.	Yes.	Yes, but preferably only to service properties.	Only to service properties.
8. Intersection treatments	Controlled with appropriate measures e.g. high speed traffic management, signing, line marking, grade separation.	Controlled with appropriate measures e.g. traffic signals.	Controlled with appropriate Local Area Traffic Management.	Controlled with measures such as signing and line marking of intersections.	Controlled with minor Local Area Traffic Management or measures such as signing.	Self controlling with minor measures.
9. Frontage Access	None on Controlled Access Roads. On other routes, preferably none, but limited access is acceptable to service individual properties.	Prefer not to have residential access. Limited commercial access, generally via service roads.	Residential and commercial access due to its historic status Prefer to limit when and where possible.	Prefer not to have property access. Limited commercial access, generally via lesser roads.	Yes, for property and commercial access due to its historic status. Prefer to limit whenever possible. Side entry is preferred.	Yes.
10. Pedestrians	Preferably none. Crossing should be controlled where possible.	With positive measures for control and safety e.g. pedestrian signals.	With appropriate measures for control and safety e.g. median/islands refuges.	Measures for control and safety such as careful siteing of school bus stops and rest areas.	Yes, with minor safety measures where necessary.	Yes.
11. Buses	Yes.	Yes.	Yes.	Yes.	Yes.	If necessary (see Note 5)
12. On-Road Parking	No (emergency parking on shoulders only).	Generally no. Clearways where necessary.	Not preferred. Clearways where necessary.	No – emergency parking on shoulders – encourage parking in off road rest areas where possible.	Built Up Area – yes, where sufficient width and sight distance allow safe passing. Non Built Up Area – no. Emergency parking on shoulders.	Yes, where sufficient width and sight distance allow safe passing.
13. Signs & Linemarking	Centrelines, speed signs, guide and service signs to highway standard.	Centrelines, speed signs, guide and service signs.	Centrelines, speed signs, guide and service signs.	Centrelines, speed signs and guide signs.	Speed and guide signs.	Urban areas – generally not applicable. Rural areas - Guide signs.
14. Rest Areas/Parking Bays	In accordance with Main Roads' *Roadside Stopping Places Policy*.	Not Applicable.	Not Applicable.	Parking Bays/Rest Areas. Desired at 60km spacing.	Not Applicable.	Not Applicable.

Figure 8: Road types and criteria for Western Australia

Source: Main Roads Western Australia D10#10992

As detailed in Figure 9, Kakadu Road and Booderee Road presently form left-in/left-out intersections with Yanchep Beach Road. There is a full-movement T-intersection at Welwyn Avenue and Yanchep Beach Road.

Ikara Lane also forms full-movement T-intersections with Kakadu Road to the west and Booderee Road to the east.

It is noted that the Booderee Road intersection was closed at the time that this traffic study was undertaken, so observed traffic in the local area may be different than usual.

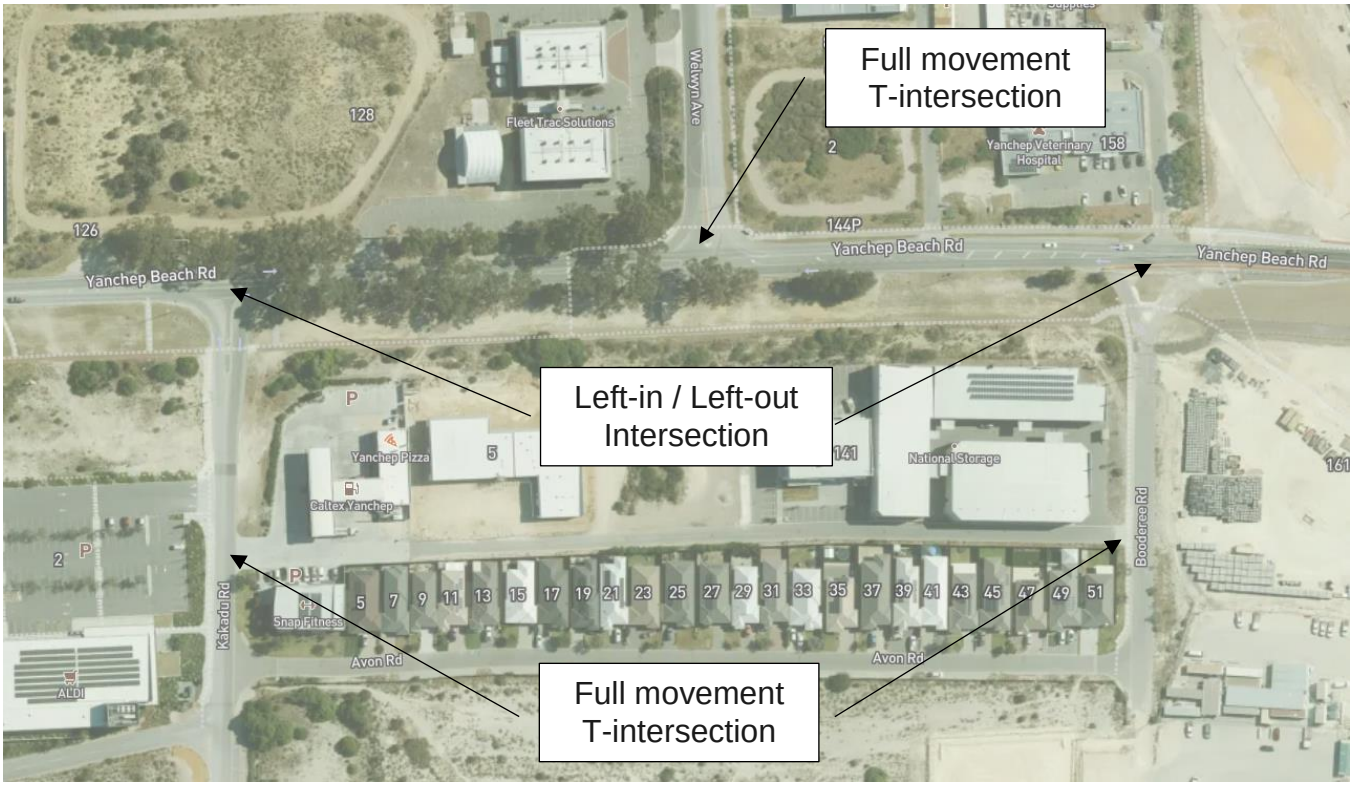


Figure 9: Key local intersections

2.3 Existing traffic volumes on roads and major intersections

Traffic data obtained from Main Roads WA and the City of Wanneroo for the local road network is summarised in Table 1. The peak hours on the local road network occur at 8am to 9am and 3pm to 4pm.

Table 1: Existing traffic volume and speed on local roads

Road	Location	Daily traffic	85th percentile speed
Yanchep Beach Rd	East of Kakadu Rd	14,000 vpd	61.2 km/h

To establish existing base traffic flows on the surrounding road network and nearby intersections, Urbii undertook a drone video survey of turning movements and queuing at the key intersections in the study area.

The drone traffic count survey was undertaken on Monday 6 November 2023 between 8:00am to 9:00am and 3:00pm to 4:00pm.

The base peak hour traffic flows derived for analysis are detailed in Appendix C.

2.4 Existing operation of surrounding intersections

Overall, the surrounding intersections were observed to operate reasonably without significant congestion. During the afternoon peak hour at around 3:00pm, there was some congestion observed around the shopping centre crossover and the intersection of Kakadu Road / Yanchep Beach Road. Queues extended back from the intersection and into the shopping centre on occasion (Figure 10).

Figure 10: Existing traffic queue on Kakadu Rd (Monday 6/11/23 at 3:00pm)

2.5 Heavy vehicles

Yanchep Beach Road forms part of Tandem Drive Network 4 in the Main Roads WA Restricted Access Vehicles (RAVs) network (Figure 11). As detailed in Table 2, the maximum heavy vehicle size currently permitted on this section of Yanchep Beach Road is 27.5m B-Doubles.

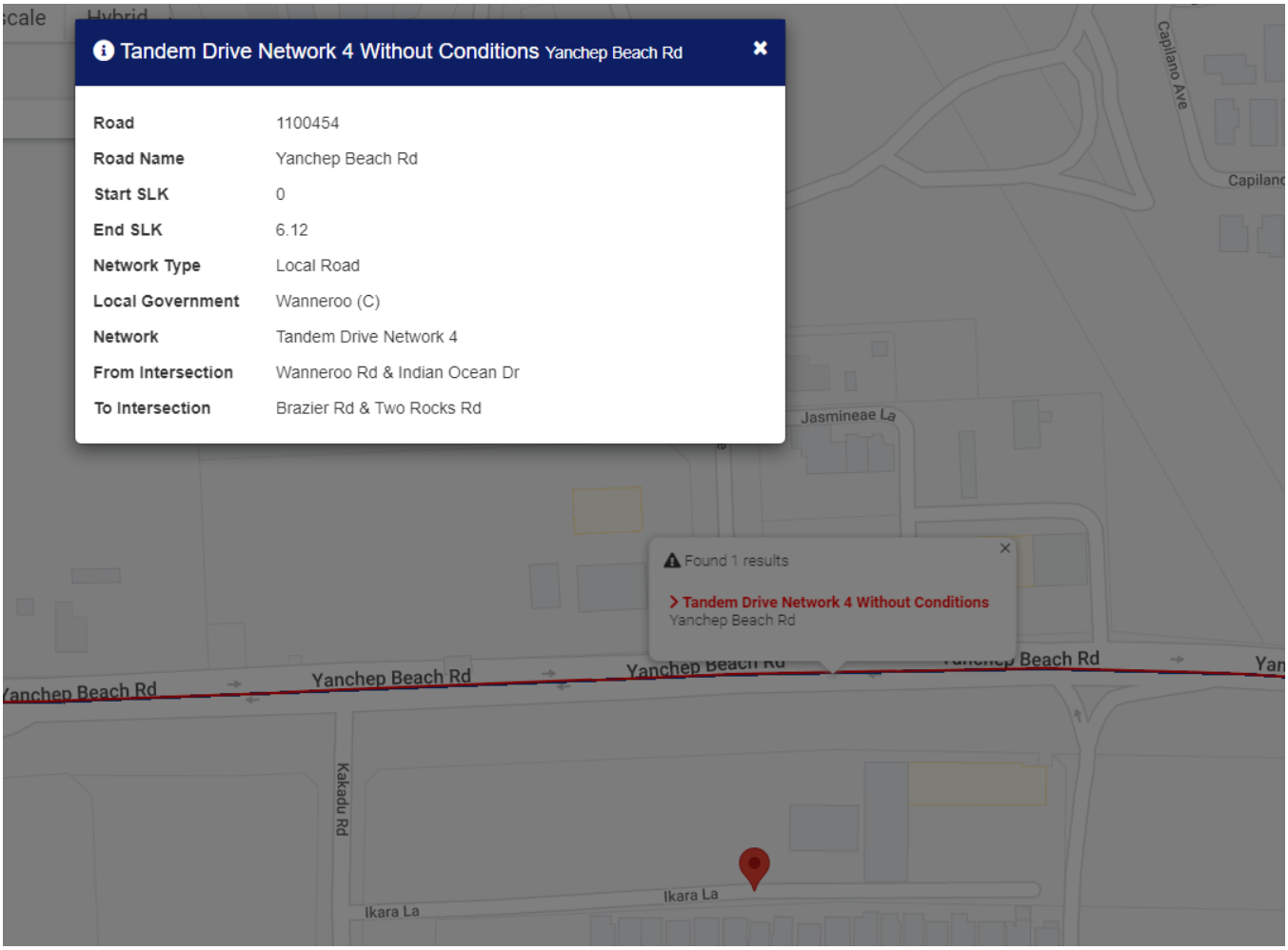
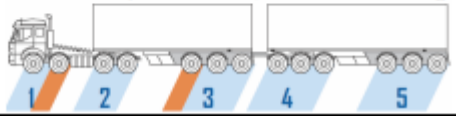


Figure 11: MRWA RAV Network status for Yanchep Beach Road

Table 2: Main Roads WA category 4 RAVs

Category 4 RAVs				
Category	**Vehicle Description**	**Length**	**Max. Mass**	**Approved Network**
4A	A-Double (Prime Mover, Semi Trailer & Dog Trailer) 	≤27.5 m	88.5 t	RAV Network 4

2.6 Public transport access

Information was collected from Transperth and the Public Transport Authority to assess the existing public transport access to and from the site.

The subject site has access to the following nearby bus services, detailed in Table 3:

Table 3: Existing bus services

Service	Route
491	Butler Stn - Yanchep via Marmion Av (Figure 13)

Bus services provide a viable alternative mode of transport for staff and visitors of the proposed development. Bus stops are accessible on Yanchep Beach Road, within 100m walking distance of the subject site (Figure 12).

Bus services provide excellent coverage and connectivity to the rail network.

The Metronet Yanchep Rail Extension and Yanchep Train Station are planned to further improve public transport accessibility in the locality. Further information on these improvements is provided in Section 5 of this report.

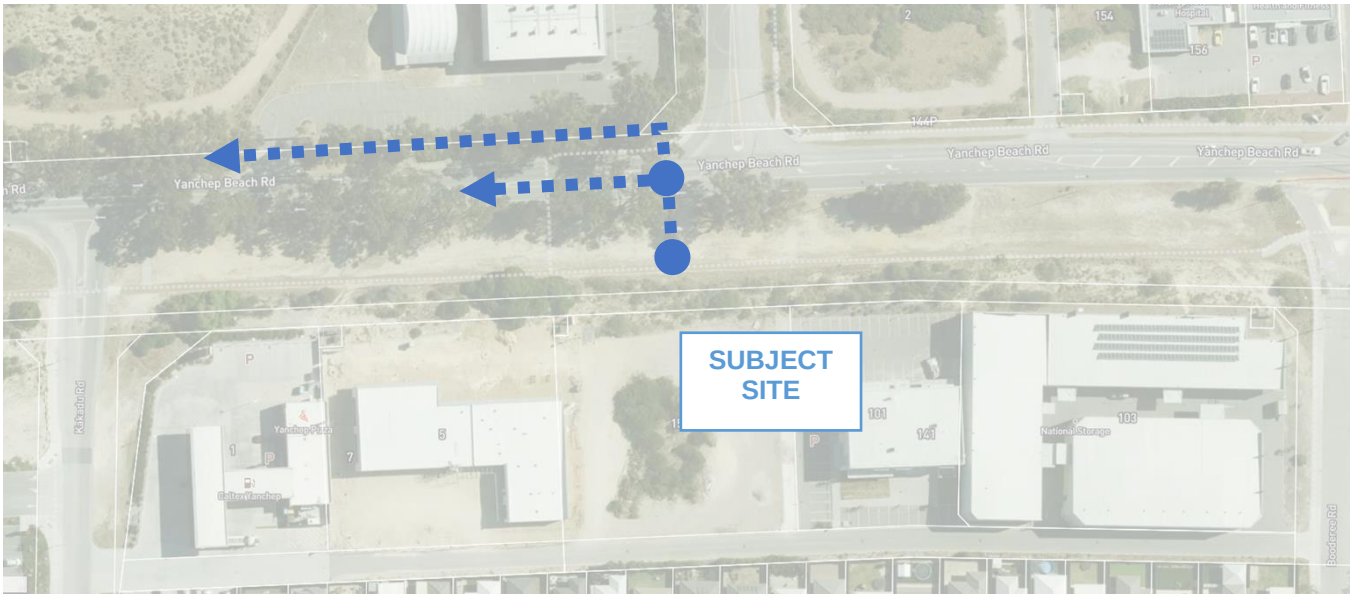


Figure 12: Walking route to bus stops

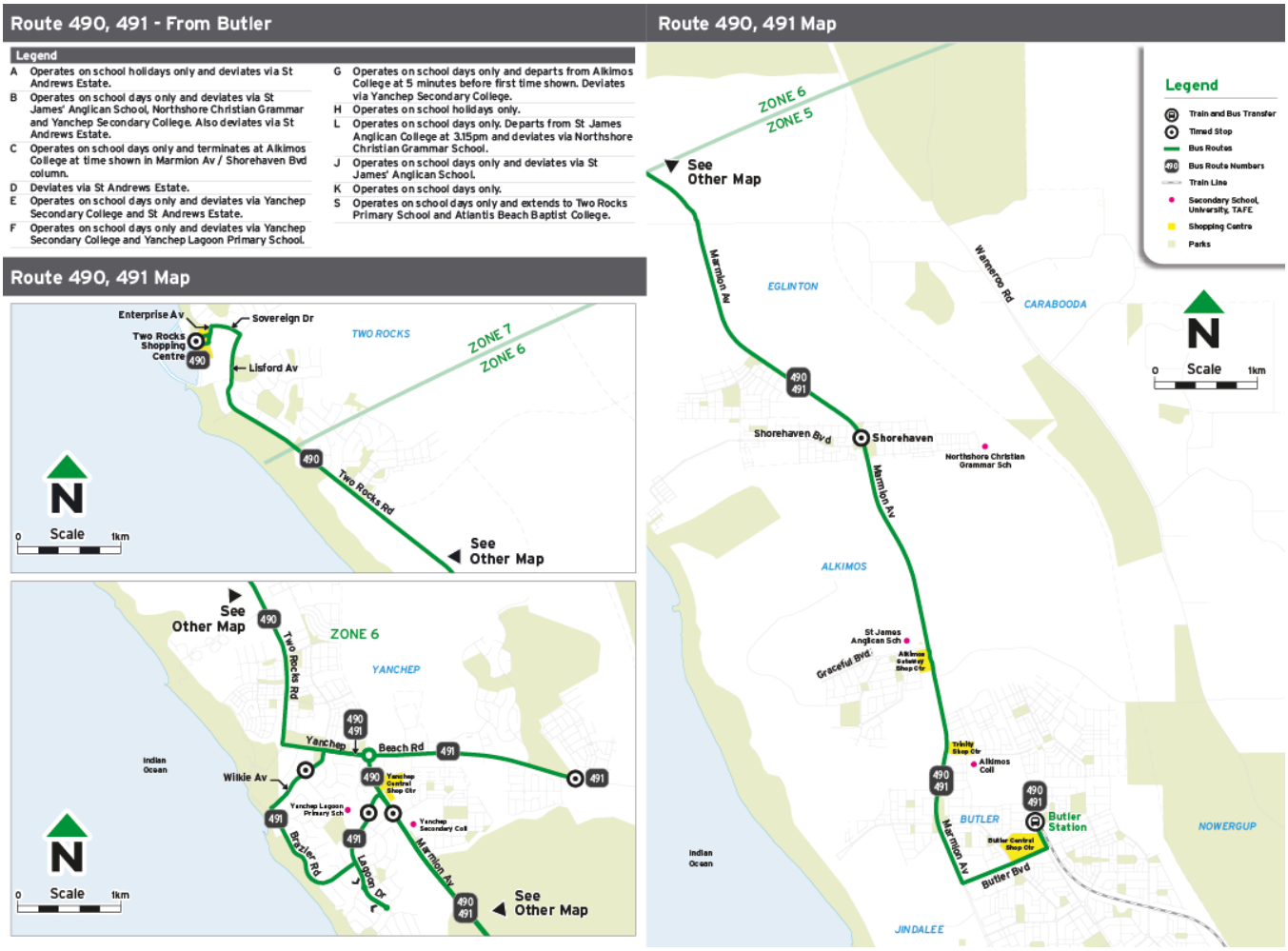


Figure 13: Transperth bus route 491 map

Source: Transperth

2.7 Pedestrian access

Information from online mapping services, Main Roads WA, Local Government, and site visits was collected to assess the pedestrian access for the proposed development.

A shared path for walking and cycling is provided on the southern side of Yanchep Beach Road and a footpath is provided on the northern side. Footpaths are also provided on Kakadu Road and Booderee Road.

Kerb ramps with median refuge islands are provided at local intersection crossings and on Yanchep Beach Road, which promotes improved access for bicycles, wheelchairs and prams.

2.8 Bicycle access

Information from online mapping services, Department of Transport, Local Government, and/or site visits was collected to assess bicycle access for the proposed development.

A shared path for walking, cycling and micromobility is provided on the southern side of Yanchep Beach Road adjacent to the site.

Yanchep Beach Road is identified as a Primary Route in the Perth and Peel Long Term Cycling Network (LTCN). Kakadu Road is identified as a Local Route.

Should the proposed development gain approval for access to Yanchep Beach Road in the future, then the interface between vehicle access driveway(s) and shared path crossings will be an important consideration.

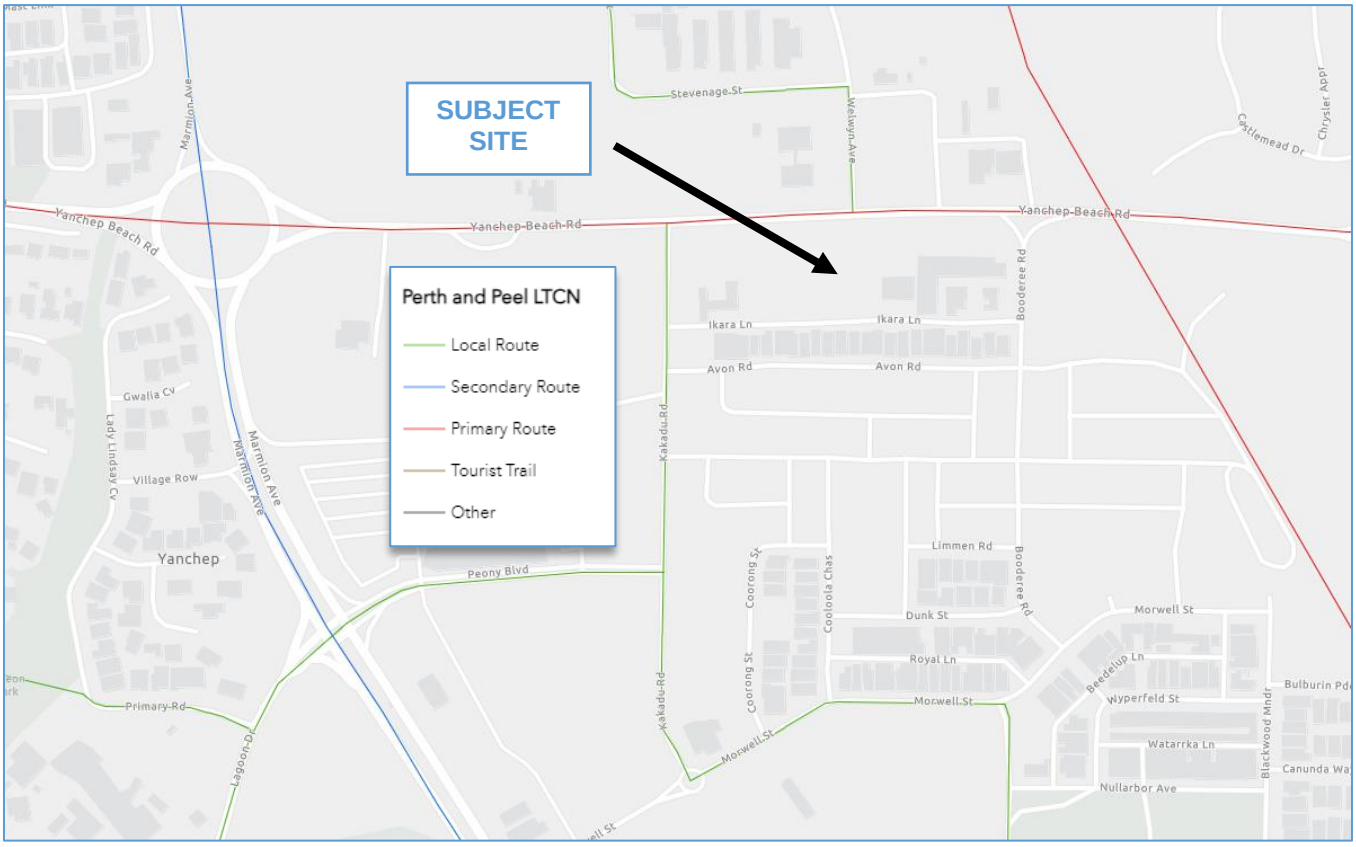


Figure 14: Long Term Cycle Network plan

2.9 Crash data and safety

The five-year crash history in the vicinity of the site was obtained from Main Roads WA. As detailed in Table 4, 5 crashes were recorded in the locality. The crash map is presented in Figure 15. Most crashes were property damage only in severity. The crash data is summarised in Table 4.

Notably, there was one crash involving a person walking near the intersection of Ikara Lane and Kakadu Road.

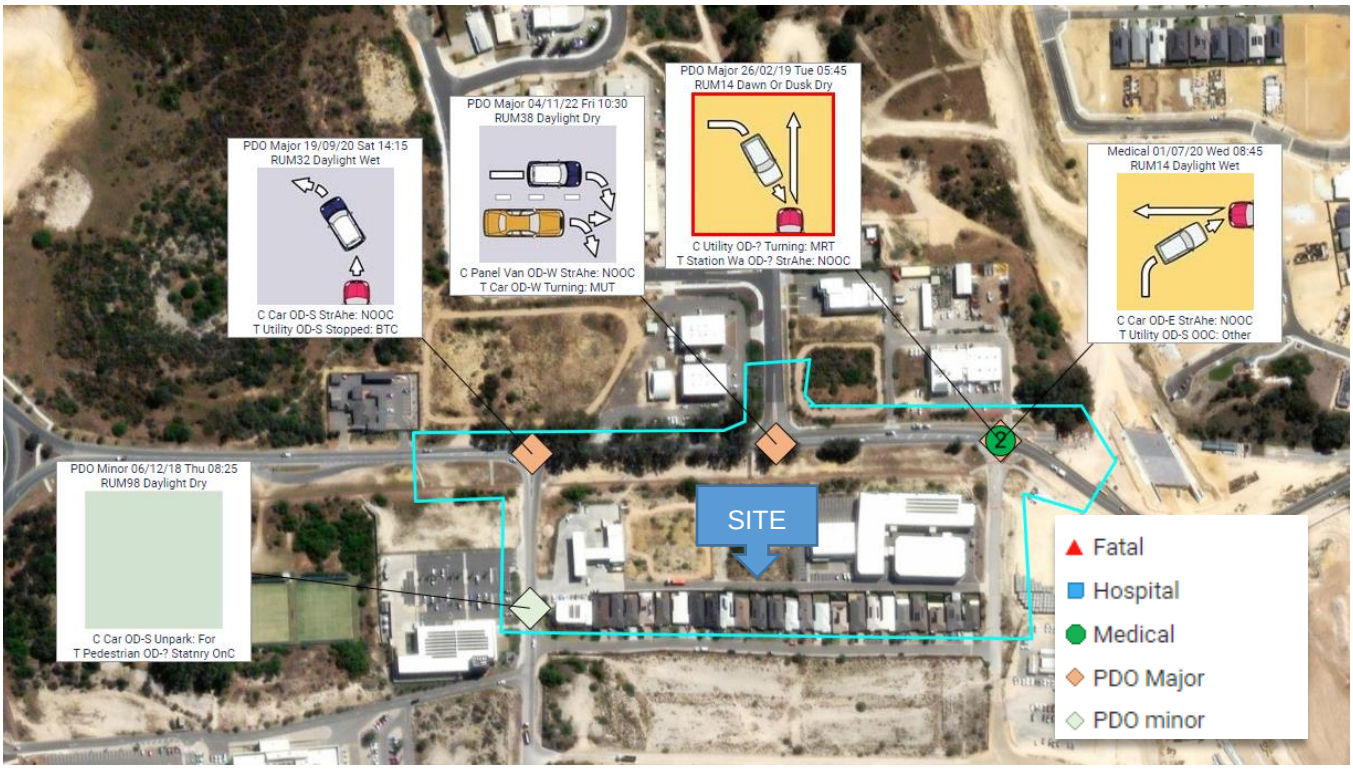


Figure 15: 5-year crash map in the locality (2018-2022)

Source: MRWA crash mapping tool.

Table 4: 5-year crash history in the locality (2018-2022)

Severity	No.	%
Fatal	0	0
Hospital	0	0
Medical	1	20.00
PDO Major	3	60.00
PDO Minor	1	20.00

Year	No.	%
2018	1	20.00
2019	1	20.00
2020	2	40.00
2022	1	20.00

Nature	No.	%
Head On	0	0
Hit Animal	0	0
Hit Object	0	0
Hit Pedestrian	1	20.00
Non Collision	0	0
Not Known	0	0
Rear End	1	20.00
Right Angle	2	40.00
Right Turn Thru	0	0
Sideswipe Opposite Dirn	0	0
Sideswipe Same Dirn	1	20.00

Light	No.	%
Dark - Street Lights Not Provided	0	0
Dark - Street Lights Off	0	0
Dark - Street Lights On	0	0
Dawn Or Dusk	1	20.00
Daylight	4	80.00
Not Known	0	0

Conditions	No.	%
Dry	3	60.00
Not Known	0	0
Wet	2	40.00

Alignment	No.	%
Curve	2	40.00
Not Known	0	0
Straight	3	60.00

Total		5

3 Development proposal

The subject site comprises two lots. 101 Booderee Road accommodates an existing building with associated car parking and is referred to as 'Site A'. 15 Ikara Lane is a vacant lot on the western boundary of 101 Booderee Road and is referred to as 'Site B'. The Development Application being submitted to the City of Wanneroo applies for Site B only.

The existing building on Site A is proposed to be refurbished to deliver 1,106m^2 of medical centre or medical consulting offices. Site B will be constructed as a two-storey building, also delivering 1,707m^2 of medical centre or medical consulting offices.

In total there will be 2,813m^2 GFA of medical centre use on the subject site (Table 5). The development will also result in:

- A total of 123 car parking bays shared across Site A plus Site B, including 6 x ACROD bays;
- 3 x double-side bicycle rails for Site B, providing parking for six bicycles near the building entry;
- A bin store on the ground floor for Site B, with access to Ikara Lane for waste collection; and,
- An End of Trip (EOT) facility on the ground floor for Site B, providing a shower, change room and lockers for staff.

Table 5: Proposed site land use yields

Site	Use	GFA
Site A	Medical Centre	GF: 553m2 FF: 553m2
Site B	Medical Centre	GF: 892m2 FF: 815m2
Total		**2,813m2**

Vehicle access to the site is proposed via the existing crossover on Ikara Lane, which will be widened to the west. ECU are also seeking to obtain access on Yanchep Beach Road, which is being negotiated with the City of Wanneroo.

Waste will be collected via private waste collection service from Ikara Lane. Bins will be transferred from the bin store to Ikara Lane for rear loader waste collection.

People walking and cycling will access the development from the external footpath network adjacent to the site.

The proposed development plans are included for reference in Appendix B.

4 Vehicle access

The proposed vehicular access arrangements have been reviewed for efficient and safe traffic circulation.

The proposed Development Application drawings show one crossover on Ikara Lane, as detailed in Figure 16. This will be shared between the two sites.

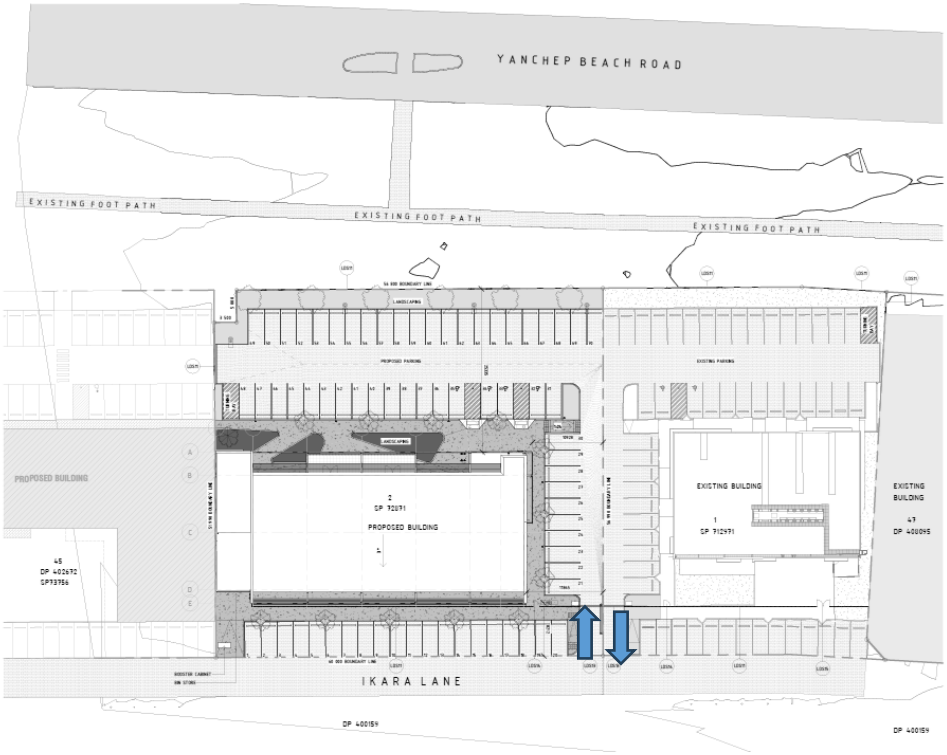


Figure 16: Proposed interim access

It is the intention of ECU to pursue a left-in/left-out access on Yanchep Beach Road. The project team is in discussions with the City of Wanneroo to explore partial lifting of the access restriction on the southern side of Yanchep Beach Road, to facilitate provision of the desired access.

The traffic modelling presented in Section 7.6 of this TIA indicates that provision of a left-in/left-out access on YBR will benefit the local network, as less outbound traffic will be distributed to the southern approach of Kakadu Road / YBR. The traffic analysis indicates that Kakadu Road / YBR is required to be signalised by 2036 and that Welwyn Avenue / YBR should be converted to left-in/left-out.

Permitting a left-in/left-out access for the subject site to YBR will not impede implementation of the required road upgrades. The project team will work with the City of Wanneroo at subsequent design stages to ensure that the proposed YBR access is located appropriately and is designed to relevant standards.

An early concept plan for left-in/left-out access was prepared for discussion purposes. This was a preliminary concept only and the design is expected to evolve at subsequent stages. If the City decides to convert Welwyn Avenue / YBR to left-in/left-out, then the entry and exit movements

for the subject site can be combined within a single, two-way crossover. This will reduce the number of crossing points and interaction with the shared path. It will also allow the subject site exit to be located further away from Kakadu Road.

A Road Safety Audit was undertaken for the early access design concept. The findings of the audit are minor and routine for the concept design stage. There is no fundamental safety issue identified with providing left-in/left-out site access on Yanchep Beach Road in principle.

5 Changes to surrounding transport networks

Information from relevant planning documents, Main Roads WA, Department of Transport and / or information provided by the Local Government Authority, has been reviewed for planned changes to the surrounding transport network.

The City of Wanneroo is preparing a grant submission for the upgrading of Yanchep Beach Road to a four-lane dual carriageway standard. If the City is successful in obtaining the required funding, then the road upgrades may be undertaken as early as 2027/28.

It is expected that construction would first occur at the Marmion Avenue roundabout with significant upgrades needed and then proceed east in a staged manner, likely resulting in activities occurring adjacent to the subject site in 2027.

The intersection of Kakadu Road and Yanchep Beach Road is expected to be converted to a full movement T-intersection with left and right turn pockets on Yanchep Beach Road. However, this will be confirmed as part of traffic modelling and analysis to be undertaken by the City.

The Yanchep Rail Extension is being planned as part of METRONET, as shown in Figure 17. Once the rail extension is constructed and the surrounding vacant lots are developed, the PTA will run extra feeder buses in the locality which will connect to the train station.

Figure 17: Yanchep rail extension plan

Source: Yanchep Rail Extension METRONET

Yanchep Station will be located to the north of the site, with the rail extension and Yanchep Beach Road bridge crossing to the east (Figure 18).

Figure 18: Yanchep Station location and access

Source: Yanchep Rail Extension METRONET

6 Integration with surrounding area

The proposed land uses are consistent with planning for the area and integrate well with the existing transport network.

7 Traffic assessment

7.1 Assessment period

Two time periods are considered in the traffic assessment:

- Weekday AM peak hour: 8:00am to 9:00am.
- Weekday PM peak hour: 3:00pm to 4:00pm.

The analysis was undertaken for the following three scenarios:

- Scenario 1: 2036 (without development traffic).
- Scenario 2: 2036 (with development traffic included but no ECU access to YBR).
- Scenario 3: 2036 (alternative road upgrades with development traffic and ECU access to YBR).

7.2 Existing traffic flows

To establish existing base traffic flows on the surrounding road network and nearby intersections, Urbii undertook a drone video survey of turning movements and queuing at the key intersections in the study area.

The drone traffic count survey was undertaken on Monday 6 November 2023 between 8:00am to 9:00am and 3:00pm to 4:00pm.

As Booderee Road was closed at the time of the traffic surveys, some adjustments were made to estimate traffic with Booderee Road open. As detailed in Figure 19, Kakadu Road is higher in the road hierarchy than Booderee Road, (Neighbourhood Connector versus Access Street). Therefore, only 25% of surveyed traffic on Kakadu Road was reallocated to Booderee Road for the purpose of producing an adjusted 2023 base traffic distribution.

The base peak hour traffic flows derived for analysis are detailed in Appendix C.

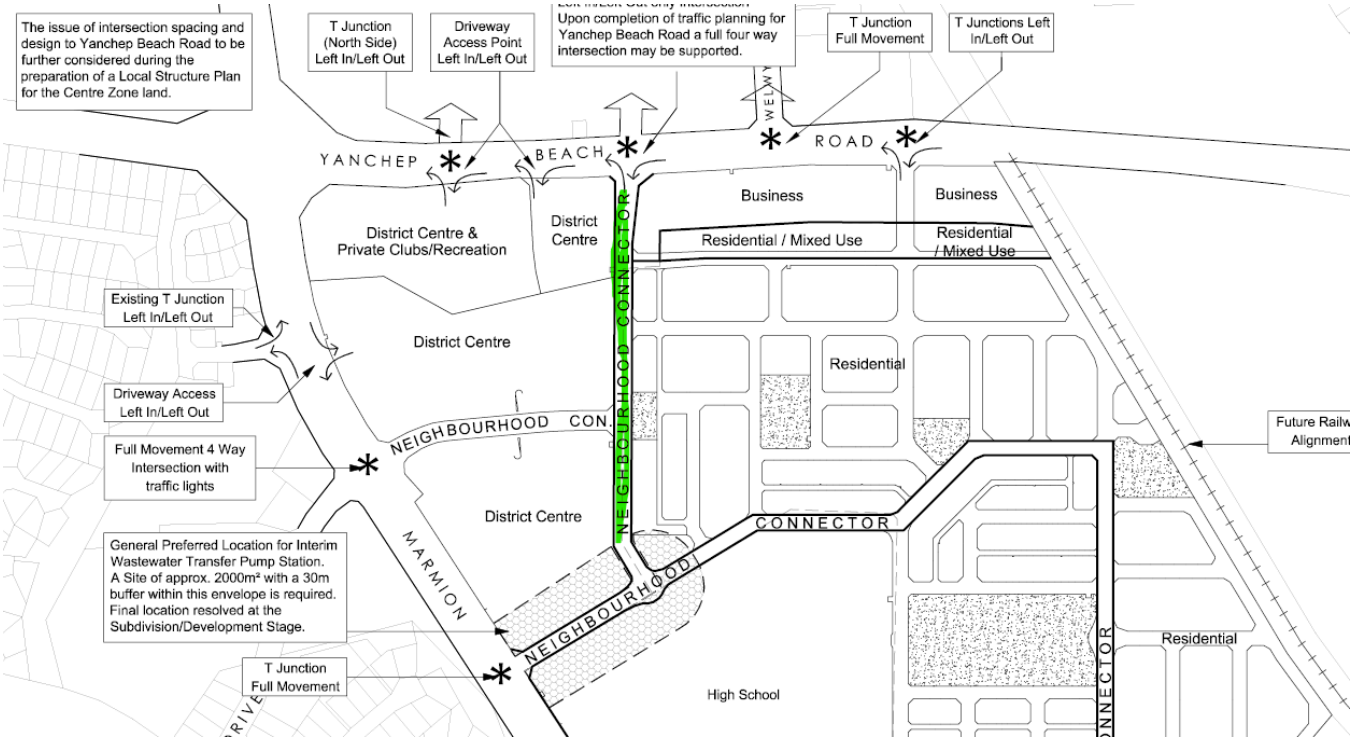


Figure 19: Local Structure Plan road hierarchy

7.3 Traffic generation

The traffic volume that will be generated by the proposed development has been estimated using trip generation rates derived with reference to the following sources:

- Roads and Traffic Authority of New South Wales Guide to Traffic Generating Developments (2002).

The trip generation rates adopted are detailed in Table 6.

Table 6: Adopted trip rates for traffic generation

Land use	Trip rate source	Daily rate	AM rate	PM rate	AM-in	AM-out	PM-in	PM-out
Medical Centre	RTA NSW - Extended Hours Medical Centre	1.04	0.104	0.088	50%	50%	50%	50%

The estimated traffic generation of the proposed development is detailed in Table 7. The proposed development is estimated to generate a total of 2,964 vehicles per day (vpd), with 296 and 252 vehicles per hour (vph) generated during the AM and PM peak hours, respectively.

These trips include both inbound and outbound vehicle movements. It is anticipated that most of the vehicle types would be passenger cars and SUVs.

The floor area of the entire site was rounded up from 2,813m2 to 2,850m2 to allow for minor variations in floor area at subsequent design stages.

Table 7: Traffic generation – Weekday AM and PM peak hours

Land use	Quantity	Daily Trips	AM Trips	PM Trips	AM Peak Trips		PM Peak Trips	
					IN	OUT	IN	OUT
Medical Centre	2850m2	2964	296	252	148	148	126	126

7.4 Trip distribution and assignment

The trip distribution of the proposed development was estimated based on surrounding catchments and road network connections. The trip distribution is presented in Figure 20.

The assumed trip distribution and assignment of trips is also detailed in the traffic volume diagrams in Appendix C.

Figure 20: Assumed trip distribution

7.5 10-year post development forecasting

Forecasting background traffic volumes for the 10 year post development scenario is a complex exercise. Transport demand forecasting is shifting from fixed forecasts to 'scenario modelling.' Scenario modelling recognises that there are multiple known and unknown disrupters to transport behaviour in the coming years, for example:

- Increased work from home activity;
- Increased popularity of micromobility devices such as e-scooters;
- Increased provision of public transport such as light rail and trackless trams;
- Electric Vehicles;
- Autonomous Vehicles; and,
- Government Net Zero emission targets.

To assist with traffic forecasting, reference was made to population growth forecasts for the City of Wanneroo. As shown in Figure 21, City of Wanneroo forecasts an average annual growth rate of 2.69%.

The City of Wanneroo has advised that recent Main Roads ROM modelling indicates that Yanchep Beach Road may carry up to 45,000 vehicles per day (vpd), by 2036.

It was found that applying a compounded traffic growth rate of **8.99% per annum**, in combination with the proposed development traffic, resulted in a comparable traffic forecast of 44,600 vpd on Yanchep Beach Road (west of Kakadu Road).

Population summary

export reset

City of Wanneroo	Forecast year					Change between 2021 and 2041	
Area	2021	2026	2031	2036	2041	Total change	Avg. annual % change
Eglinton	3,848	9,185	16,598	23,835	30,711	+26,863	+10.94
Neerabup - Pinjar - Nowergup - Carabooda	900	1,173	1,802	2,572	5,038	+4,137	+8.99
Two Rocks	3,967	5,599	7,546	10,805	17,122	+13,155	+7.59
Yanchep	11,404	15,326	23,035	33,720	45,663	+34,259	+7.18
Wanneroo	12,497	14,431	23,096	33,023	40,436	+27,939	+6.05
Alkimos	10,523	15,779	21,745	27,946	32,321	+21,798	+5.77
Jindalee	4,082	6,695	9,236	9,611	9,359	+5,277	+4.24
Gnangara - Jandabup - Mariginiup	2,573	2,379	2,297	2,436	5,220	+2,647	+3.60
Ashby - Sinagra	6,136	7,632	8,908	9,760	10,583	+4,447	+2.76
City of Wanneroo	216,435	243,874	285,372	326,532	367,775	+151,340	+2.69

Figure 21: Population forecasts for City of Wanneroo

Additional traffic was assumed for Ikara Lane (east of Kakadu Road) to account for the planned development to the west of the subject site. Some minor traffic increase to the existing ALDI to the west of the site was also assumed.

The forecast intersection and road traffic flows were checked for midblock flows on Kakadu Road and Booderee Road (south of Ikara Lane). The traffic forecast targets are based on the road designation in accordance with Liveable Neighbourhoods. Kakadu Road is constructed to a *Neighbourhood Connector B* standard, which usually has a desirable traffic target of 3,000vpd. Neighbourhood Connector A roads can carry up to 7,000vpd. Access Streets should carry a maximum of 3,000vpd.

The modelling target volume for Kakadu Road was between 3,000vpd to 5,000vpd and the target for Booderee Road was between 2,000vpd to 3,000vpd. The forecast traffic volumes were calibrated to fall within or close to the modelling targets.

Refer to Appendix C for traffic forecasts.

7.6 Analysis of intersections and development access

Reference was made to Austroads guidelines to help identify which modelled intersections should be further assessed in SIDRA. The traffic volume thresholds adopted for further analysis are set out in Figure 22. No SIDRA analysis is required for intersections along Ikara Lane (including the development crossover), as they fall below the thresholds in Figure 22.

Major road type[1]	Major road flow (vph)[2]	Minor road flow (vph)[3]
Two-lane	400	250
	500	200
	650	100
Four-lane	1000	100
	1500	50
	2000	25

Notes:

1. Major road is through road (i.e. has priority).
2. Major road flow includes all major road traffic with priority over minor road traffic.
3. Minor road design volumes include through and turning volumes.

Figure 22: Austroads guidance on the assessment of intersections

Capacity analysis of intersections along Yanchep Beach Road was undertaken using the SIDRA 9 computer software package. SIDRA 9 is an intersection modelling tool commonly used by traffic engineers for all types of intersections.

7.6.1 Scenario 1 and 2 modelling

The modelling for Scenarios 1 and 2 assumes that the Kakadu Road / YBR intersection will be a full-movement Unsignalised T-intersection. This is based on feedback from City of Wanneroo, which is intending to analyse the intersection in this configuration, as part of their funding application for the dual carriageway upgrade of Yanchep Beach Road.

A network model was developed with multiple connected intersections. The same network was assumed for the 2036 analysis with and without the development. The network sites are listed in Table 8. An image of the model network is shown in Figure 23. The full movement T-intersections of Kakadu Rd / YBR and Welwyn Ave / YBR were coded for two-stage right turn movements. A left-in/left-out access arrangement for ECU to and from YBR was included in the network coding as dummy movements, to allow for future testing of this access option. The modelling and analysis for Scenarios 1 and 2 assumes zero function of the ECU access points on YBR.

Table 8: SIDRA network sites

SITES IN NETWORK		
Site ID	CCG ID	Site Name
101	NA	Booderee Rd / YBR
201	NA	Welwyn Ave / YBR - Stage 1
202	NA	Welwyn Ave / YBR - Stage 2
301	NA	ECU Exit / YBR
401	NA	Kakadu Rd / YBR - Stage 1
402	NA	Kakadu Rd / YBR - Stage 2

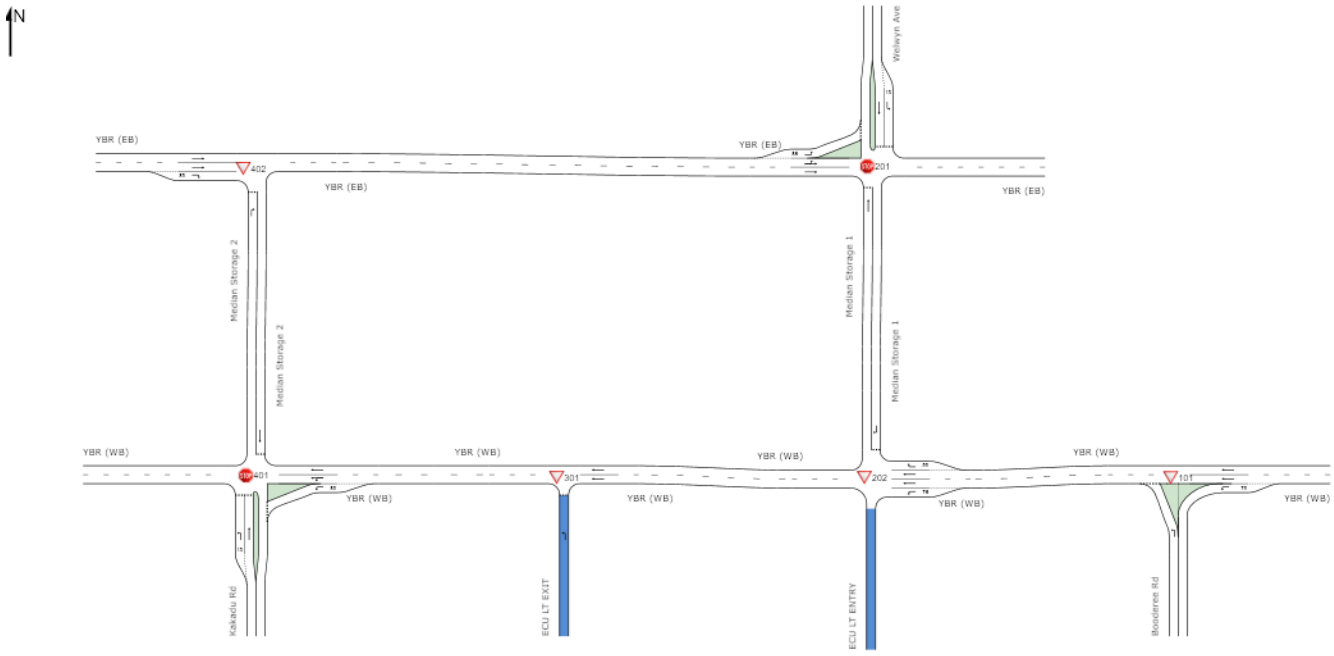


Figure 23: SIDRA network model

The same network model was used for all scenarios with only traffic volumes being changed, for fair and consistent comparison of outputs. A summary of the analysis results is presented in Table 9.

Detailed SIDRA outputs for each intersection are provided in Appendix D.

The results of the SIDRA analysis indicate that the right turn movements from Kakuda Road and from Welwyn Avenue onto Yanchep Beach Road will operate at a level of service F in 2036. The outputs indicate that the intersections will operate significantly over-capacity. This causes instability in the SIDRA network analysis outputs, with minor increases in traffic leading to a disproportionate increase in delays and queuing.

The analysis outputs indicate that the intersections of Kakadu Rd / YBR and Welwyn Ave / YBR cannot operate as Unsignalised, full movement T-intersections if Yanchep Beach Road traffic increases to 45,000vpd. This observation is made with or without the development and is not caused by the proposed development.

7.6.2 Scenario 3 modelling

Due to the poor intersection performance indicated in the Scenario 1 and 2 modelling, an alternative road upgrade option was tested to explore how traffic conditions can be improved in the locality.

As detailed Figure 24, the tested alternative network assumes left-in/left-out intersections for Welwyn Ave / YBR and for a potential ECU access on YBR. The intersection of Kakadu Rd / YBR is assumed to be signalised.

As detailed in Table 9, the alternative road upgrades significantly improved the performance of the network to an acceptable standard. The left-in/left-out access to ECU is easier to implement due to the conversion of Welwyn Ave / YBR to left-in/left-out. ECU access to YBR is beneficial for Kakadu Road, as it reduces the traffic load on the northbound approach of the signalised intersection.

The findings of the traffic modelling will need to be independently tested by the City as part of their own modelling for securing road upgrade funding.

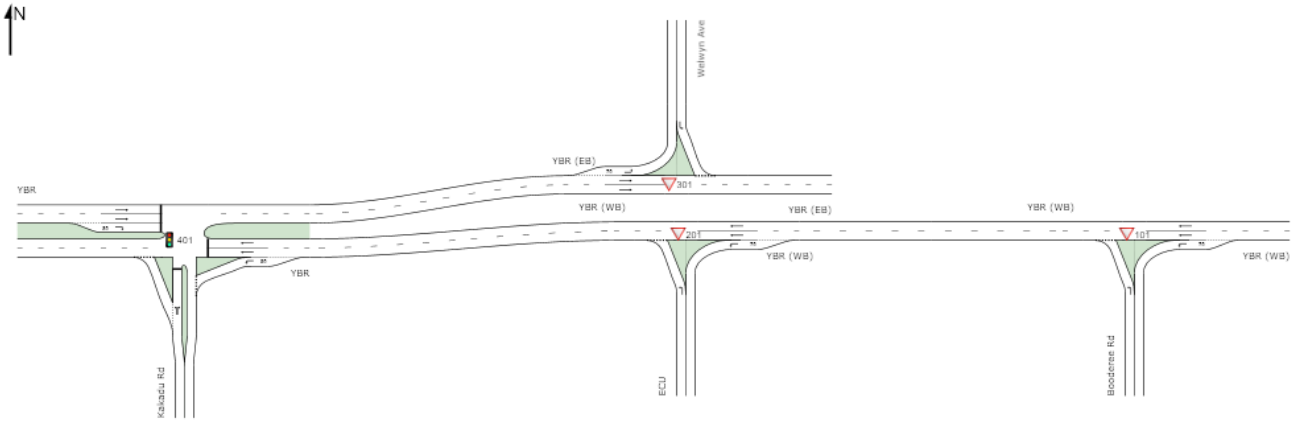


Figure 24: SIDRA network model – alternative road upgrades

Table 9: Summary of SIDRA analysis results

Booderee Rd / YBR				
Scenario	v/c	Ave Delay (sec)	LoS	95% Queue (m)
Scenario 1 AM	0.467	0.9	A	3.1
Scenario 2 AM	0.467	1.1	A	3.5
Scenario 3 AM	0.485	0.9	A	3.3
Scenario 1 PM	0.377	1.4	A	6.3
Scenario 2 PM	0.377	1.6	A	6.9
Scenario 3 PM	0.4	1.4	A	6.9

Welwyn Ave / YBR (Stage 1 for Scenarios 1&2)				
Scenario	v/c	Ave Delay (sec)	LoS	95% Queue (m)
Scenario 1 AM	3.229	44.4	F	196.1
Scenario 2 AM	3.252	44.8	F	196.5
Scenario 3 AM	0.56	0.6	A	2
Scenario 1 PM	4.787	141.1	F	423.3
Scenario 2 PM	4.783	141.1	F	423.1
Scenario 3 PM	0.543	1	A	7.1

Kakadu Rd / YBR (Stage 1 for Scenarios 1&2)				
Scenario	v/c	Ave Delay (sec)	LoS	95% Queue (m)
Scenario 1 AM	3.366	97.9	F	339.3
Scenario 2 AM	5.682	282.1	F	609.9
Scenario 3 AM	0.892	17.8	B	265
Scenario 1 PM	3.142	144.2	F	492.1
Scenario 2 PM	4.284	264.7	F	711.5
Scenario 3 PM	0.889	19	B	200.3

ECU Left-in/Left-out / YBR				
Scenario	v/c	Ave Delay (sec)	LoS	95% Queue (m)
Scenario 1 AM				
Scenario 2 AM				
Scenario 3 AM	0.861	1	A	2.8
Scenario 1 PM				
Scenario 2 PM				
Scenario 3 PM	0.529	0.4	A	1.9

8 Parking demand and supply

8.1 Parking supply

It is proposed to provide total of 123 car parking bays shared across Site A plus Site B, including 6 x ACROD bays.

8.2 Parking demand

Reference was made to the ITE *Parking Generation Manual 5th Edition*, to estimate the parking demand generated by the proposed development.

Reference was made to Land Use 720: *Medical-Dental Office Building* for relevant parking generation rates, which are detailed in Table 10.

The calculated peak parking demand is presented in Table 11. A peak parking demand of 100 bays is estimated for Site A and B combined.

The proposed car parking supply is sufficient to accommodate the needs of the development.

Table 10: ITE parking generation rates

Land use	ITE Land Use	Peak Parking Demand Rate	Measurement
Medical Centre	Medical-dental (720)	3.48	per 100 sqm GFA

Table 11: Peak parking generation for proposed land uses

Land use	ITE Land Use	Quantity	Peak Parking Demand
Medical Centre	Medical-dental (720)	2,850 m2	100

9 Provision for service vehicles

The proposed development will not generate significant delivery and other service vehicle traffic. Small delivery trucks or vans can park in the car park outside of the peak operating hours of the facility.

Waste will be collected via a private rear loader service from Ikara Lane.

10 Public transport assessment

Public transport is accessible via the nearby bus stops on Yanchep Beach Road.

11 Walking assessment

Footpaths are provided along Yanchep Beach Road, Kakadu Road and Booderee Road near the site.

Kerb ramps and refuge islands are provided at walking crossings, including on Yanchep Beach Road.

The WAPC Transport Impact Assessment Guidelines for Developments (2016) provide warrants for installing pedestrian priority crossing facilities. This is based on the volume of traffic as the key factor determining if pedestrians can safely cross a road. The guidelines recommend pedestrian priority crossing facilities be considered once the peak hour traffic exceeds the volumes detailed in Table 12.

The traffic volumes in this table are based on a maximum delay of 45 seconds for pedestrians, equivalent to Level of Service E.

The forecast traffic volumes on Yanchep Beach Road will exceed the threshold for safe pedestrian crossing in 2036. This further supports the idea that the intersection of Kakadu Rd / YBR should be signalised, as this will provide a safe crossing opportunity for people walking and cycling.

Table 12: Traffic volume thresholds for pedestrian crossings

Road cross-section	Maximum traffic volumes providing safe pedestrian gap
2-lane undivided	1,100 vehicles per hour
2-lane divided (with refuge)	2,800 vehicles per hour
4-lane undivided*	700 vehicles per hour
4-lane divided (with refuge)*	1,600 vehicles per hour

12 Cycling assessment

12.1 Bicycle parking and end of trip facilities

A total of 6 bicycle parking spaces are provided for Site B. An End of Trip (EOT) facility is also provided on the ground floor for Site B, providing a shower, change room and lockers for staff. This promotes alternative modes of transport.

12.2 Sustainable transport catchment

As detailed in Figure 25, the subject site is well placed for staff and customers to travel by sustainable modes of transport. A comfortable 8km or 20-25min cycle will provide the development with a large catchment.

This range can be further increased through a combination of micro-mobility and train travel with close access to train stations.

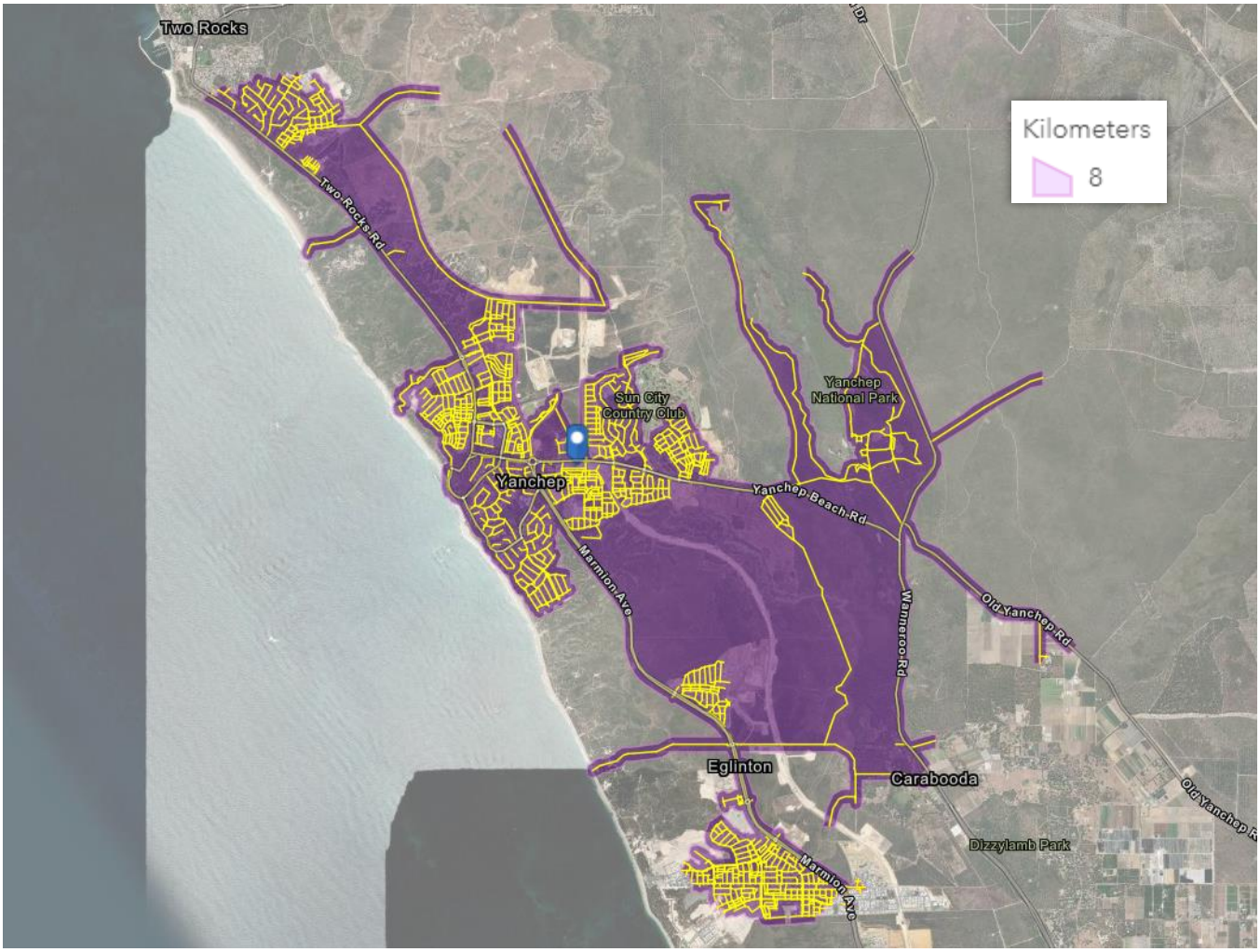


Figure 25: Cycling and micro-mobility catchment

13 Conclusion

This Transport Impact Assessment has been prepared by Urbii on behalf of Edith Cowan University with regards to the proposed ECU Health Centre, located at 15 Ikara Ln & 101 Booderee Rd, Yanchep.

The subject site is situated on the southern side of Yanchep Beach Road, between Kakadu Road and Booderee Road. Ikara Lane runs along the rear boundary of the site, connecting between the two side roads.

It is proposed to develop the site into the ECU Health Centre (medical centre). A Development Application is being submitted for the western portion of the site (15 Ikara Lane), with the eastern site already accommodating an existing building.

The site promotes good connectivity with the existing road, cycling and walking network. There is good access to nearby public transport services, with the Yanchep Station project planned to further improve public transport in the locality.

The City of Wanneroo is in the process of applying for road funding to upgrade Yanchep Beach Road into a 4-lane dual carriageway road. The City is considering retaining the existing full-movement T-intersection arrangement at Welwyn Avenue / YBR. The City is also considering conversion of the left-in/left-out T-intersection of Kakadu Road / YBR into a full movement T-intersection, with left and right turn pockets. The City advised that Main Roads ROM outputs indicate Yanchep Beach Road may carry up to 45,000 vehicles per day by 2036.

The SIDRA analysis undertaken for this TIA indicates that right turn movements from Kakadu Road and Welwyn Avenue will fail during peak hours by 2036, with capacity to undertake the movements severely restricted. This is due to the significant forecast background traffic growth on Yanchep Beach Road and is not caused by the development.

Testing of alternative upgrade options in this TIA indicates that the network will function much better if the intersection of Kakadu Road / YBR was signalised and if Welwyn Avenue / YBR was converted to Left-in/left-out. Under this scenario the network will operate satisfactorily at a good level of service.

The forecast traffic volumes on Yanchep Beach Road also exceed the thresholds for safe pedestrian crossing. Even if refuge islands are provided, there is insufficient gap for people to cross. Therefore, signalising the intersection of Kakadu Road / YBR will also provide the added benefit of a safe crossing for people walking and cycling.

Under the tested alternative road upgrade scenario, it is considered that left-in/left-out access for ECU can be comfortably accommodated on Yanchep Beach Road. The left turn pocket from YBR (westbound) into Kakadu Road does not need to be excessively lengthened. SIDRA analysis confirms there will be no queuing for this movement.

The findings of the traffic modelling will need to be independently tested by the City as part of their own modelling for securing road upgrade funding.

The car parking supply is satisfactory and can accommodate the car parking demand of the proposed development.

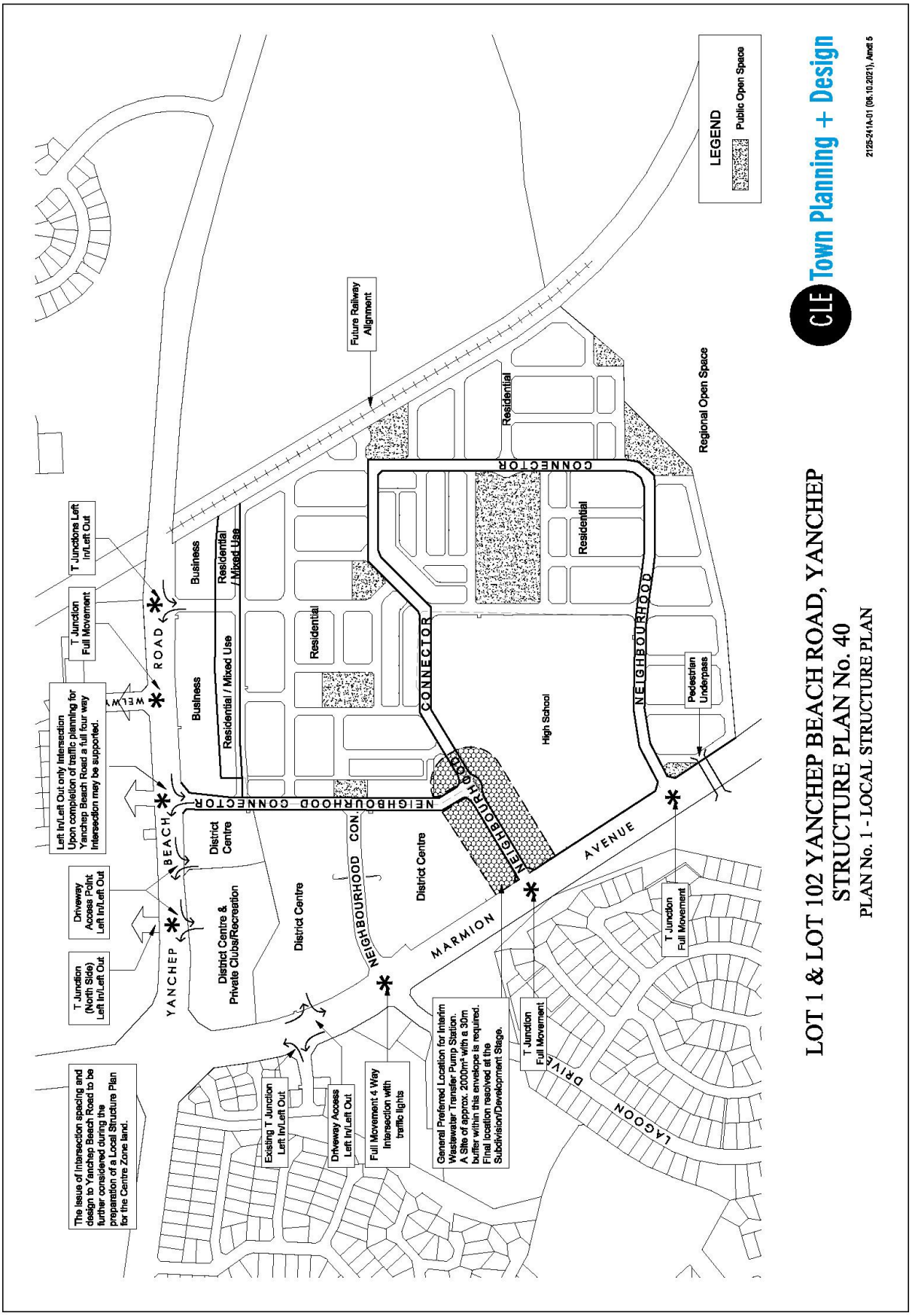
ECU intends to pursue left-in/left-out access on Yanchep Beach Road with the City of Wanneroo. This proposed access does not form part of the current Development Application and it is understood that the access will be sought through a separate process, with a potential Development Application Amendment.

It is concluded that the findings of this Transport Impact Assessment are supportive of the proposed development and are supportive of ECU's intention to pursue left-in/left-out access on Yanchep Beach Road.

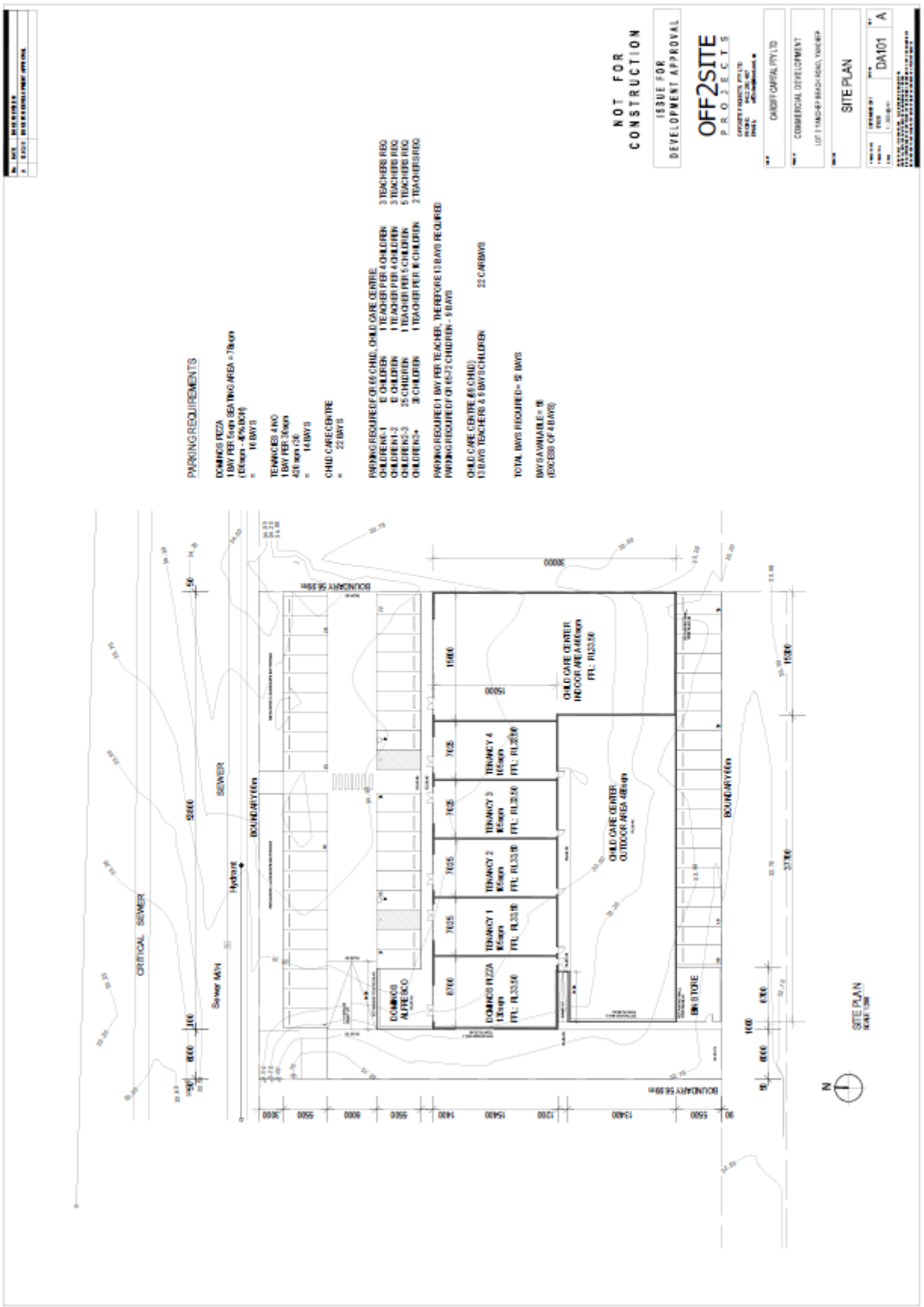
Appendices

Appendix A: Context plans

Structure Plan



Proposed Development to the west of the subject site



Appendix B: Proposed development plan

Appendix C: Traffic volume diagrams

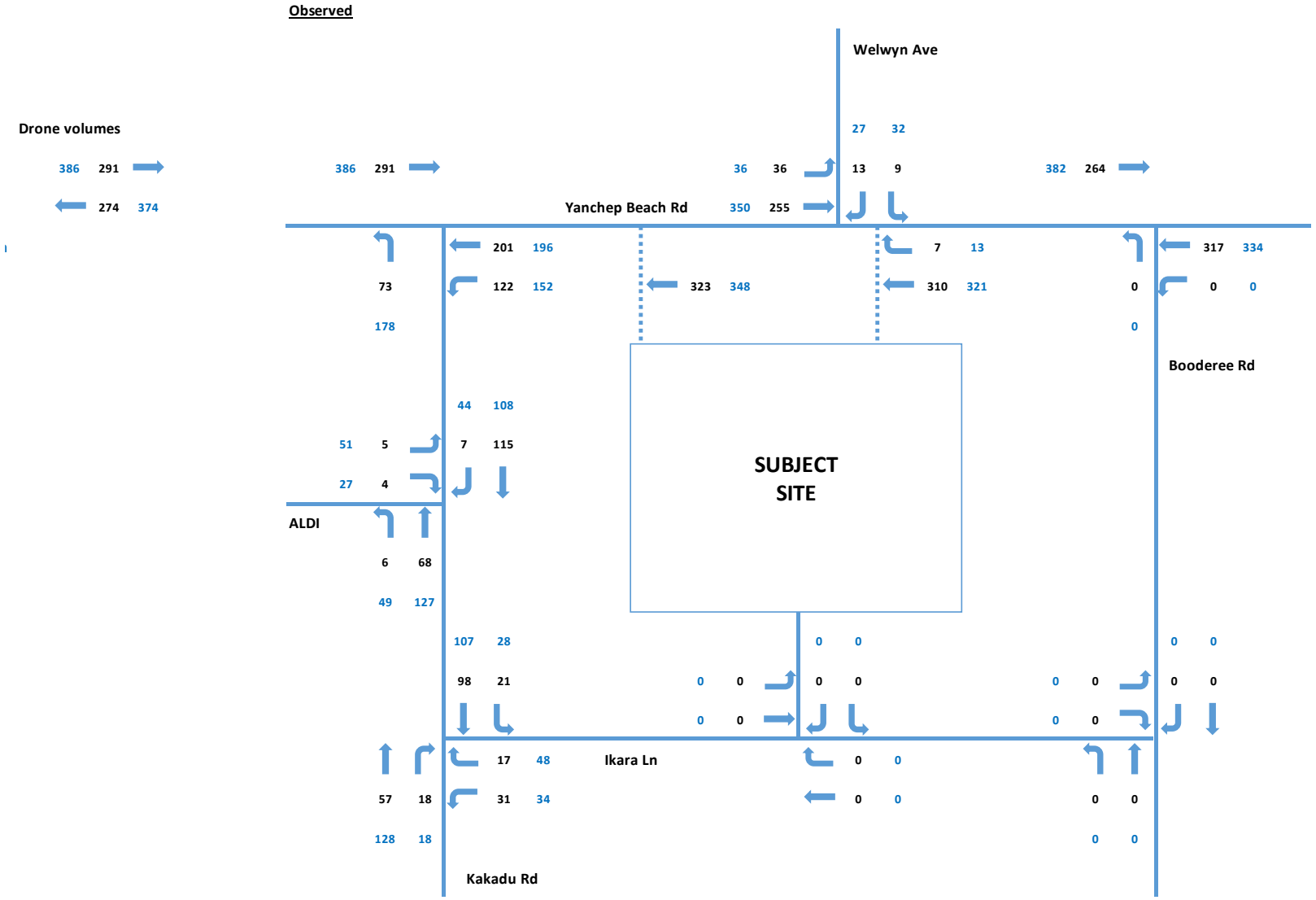


Figure 26: Observed weekday AM and PM peak hour flows (November 2023)

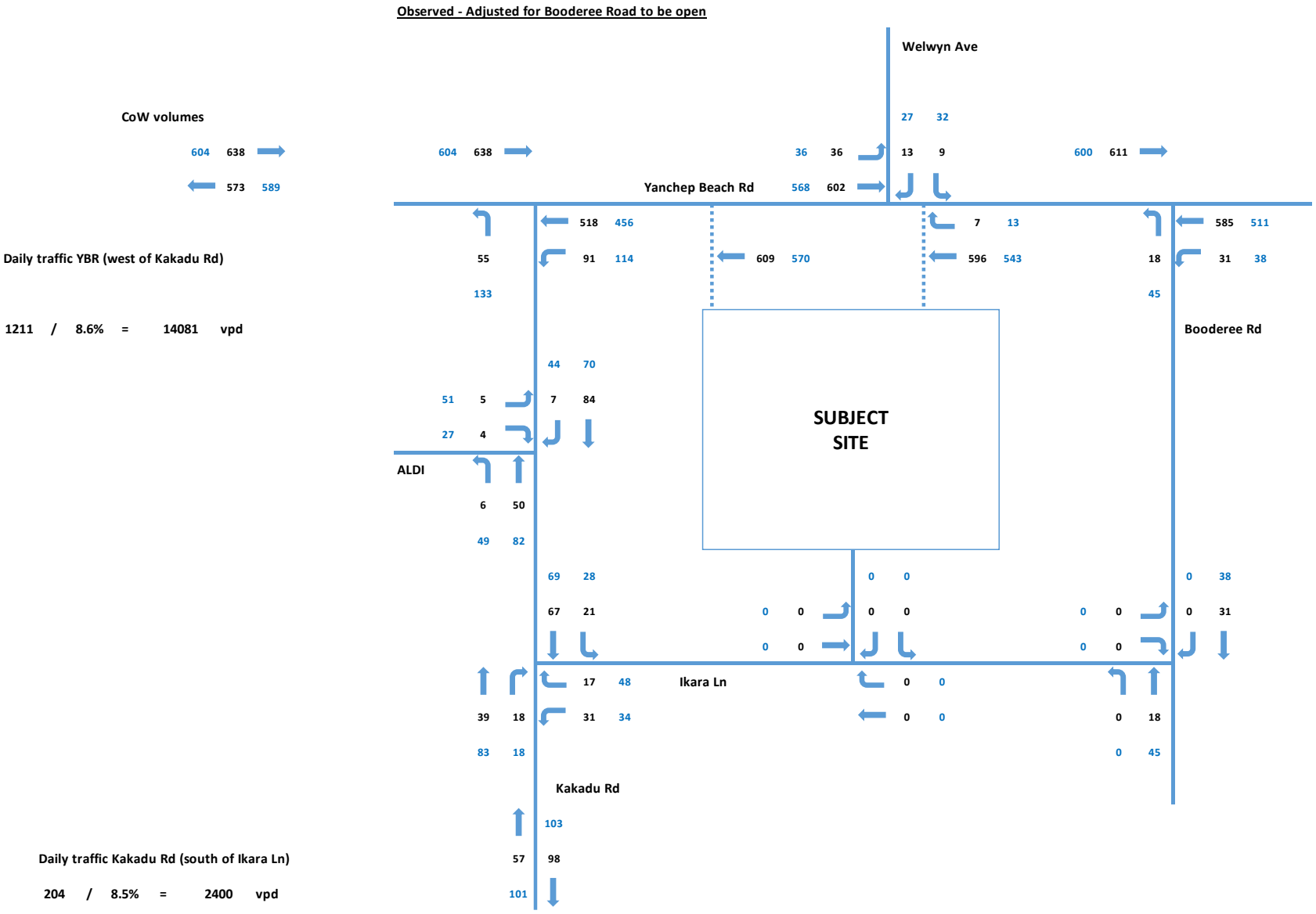


Figure 27: Adjusted 2023 base traffic volumes

Weekday AM and PM peak hour. Traffic flows adjusted to allocate traffic on Booderee Road. Through traffic on Yanchep Beach Road increased to match historic City of Wanneroo traffic data which is higher than observed flows in November 2023.

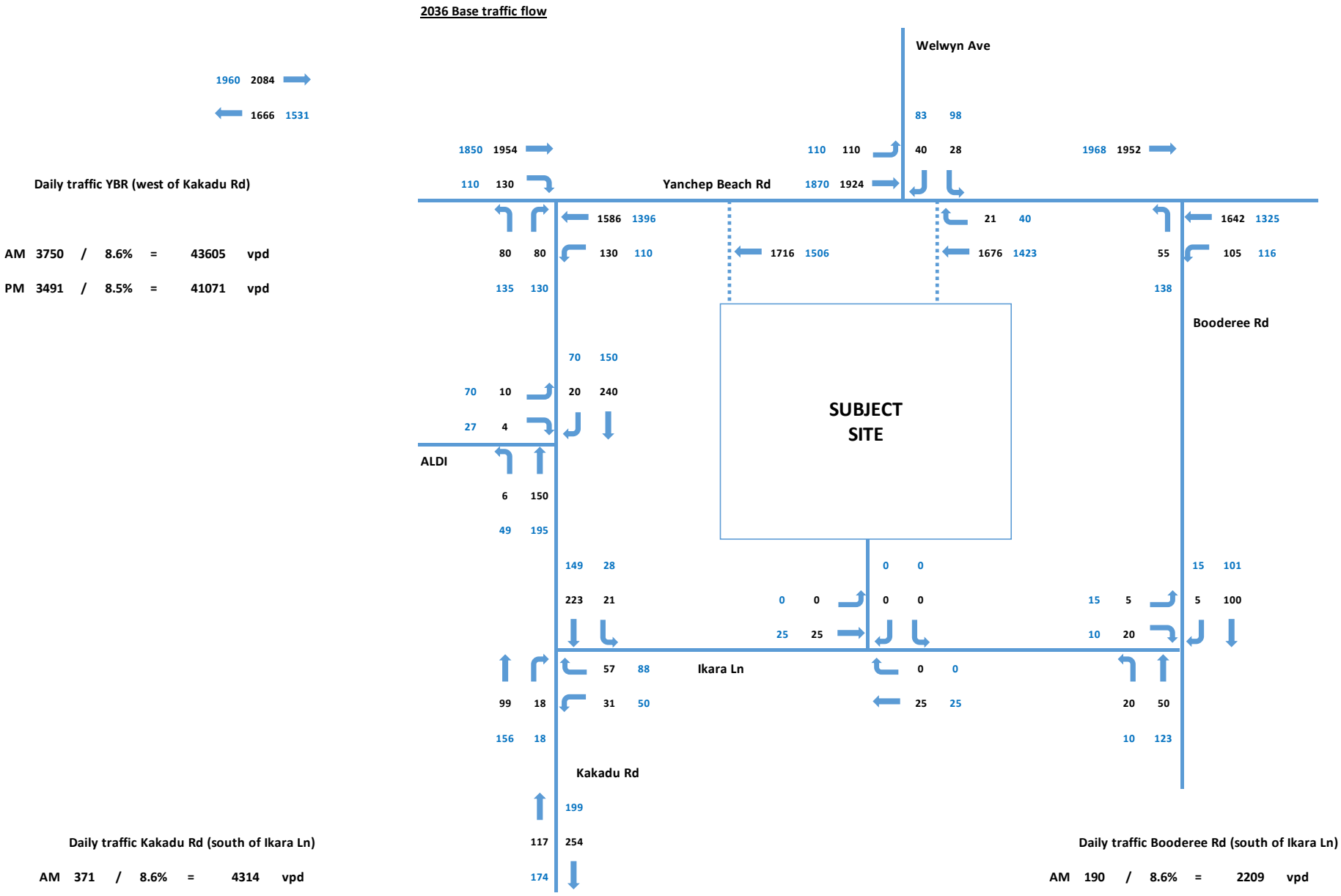


Figure 28: 2036 Base traffic flows AM and PM peak hours

Assume PD year will be 2026

Data year	**2023**	**Growth rate**	**8.99%**	**per annum**
Forecast year	**2036**			
		Compounding Factor	**3.06**	
Years of growth	**13**			

Population summary

export reset

City of Wanneroo	Forecast year					Change between 2021 and 2041	
Area	2021	2026	2031	2036	2041	Total change	Avg. annual % change
Eglinton	3,848	9,185	16,598	23,835	30,711	+26,863	+10.94
Neerabup - Pinjar - Nowergup - Carabooda	900	1,173	1,802	2,572	5,038	+4,137	+8.99
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Wanneroo	12,497	14,431	23,096	33,023	40,436	+27,939	+6.05
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Ashby - Sinagra	6,136	7,632	8,908	9,760	10,583	+4,447	+2.76
City of Wanneroo	**216,435**	**243,874**	**285,372**	**326,532**	**367,775**	**+151,340**	**+2.69**

Table 4: Function and characteristics of local streets

Street type and function	Street characteristics	Street name	Max design speed/ target operating speed (km/hr)	Indicative volume range* (vehicles per day)	Indicative street reserve width (metres)+	Indicative road pavement width (metres)
Neighbourhood connectors Streets with mostly residential frontage that typically provide the lower order sub-arterial network. These streets service and link neighbourhoods and towns.	A two-lane divided street used for higher neighbourhood connector volumes, or for character, stormwater infiltration swales or safety. These are often special streets and their design needs to have particular regard to context, function and adjacent land uses.	**Neighbourhood connector A** (Median)	50/50	7000	24.4 **	2 x 7.1 including parking, on-street bike lane, median plus shared path on one verge.
	A two-lane undivided street for lower volume neighbourhood connectors. Typically can accommodate buses, will have at least one shared path and above 3000 vehicles per day separate on-street bike lane.	**Neighbourhood connector B** (Minor)	50/50	3000	19.4	11.2 including parking, plus shared path on one verge.

Major road type[1]	Major road flow (vph)[2]	Minor road flow (vph)[3]
Two-lane	400	250
	500	200
	650	100
Four-lane	1000	100
	1500	50
	2000	25

Notes:
1. Major road is through road (i.e. has priority).
2. Major road flow includes all major road traffic with priority over minor road traffic.
3. Minor road design volumes include through and turning volumes.

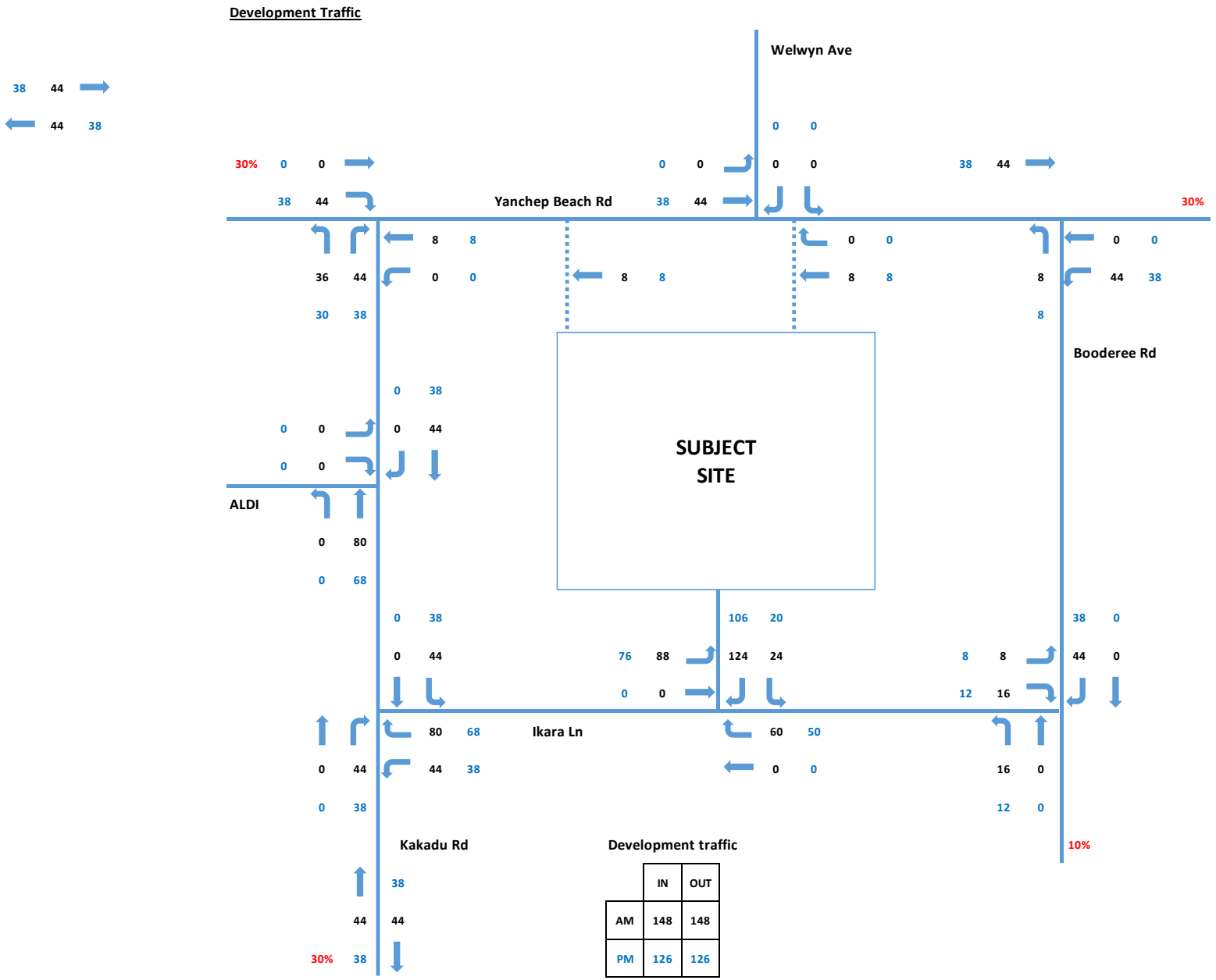

Figure 29: Development traffic distribution AM and PM peak hours

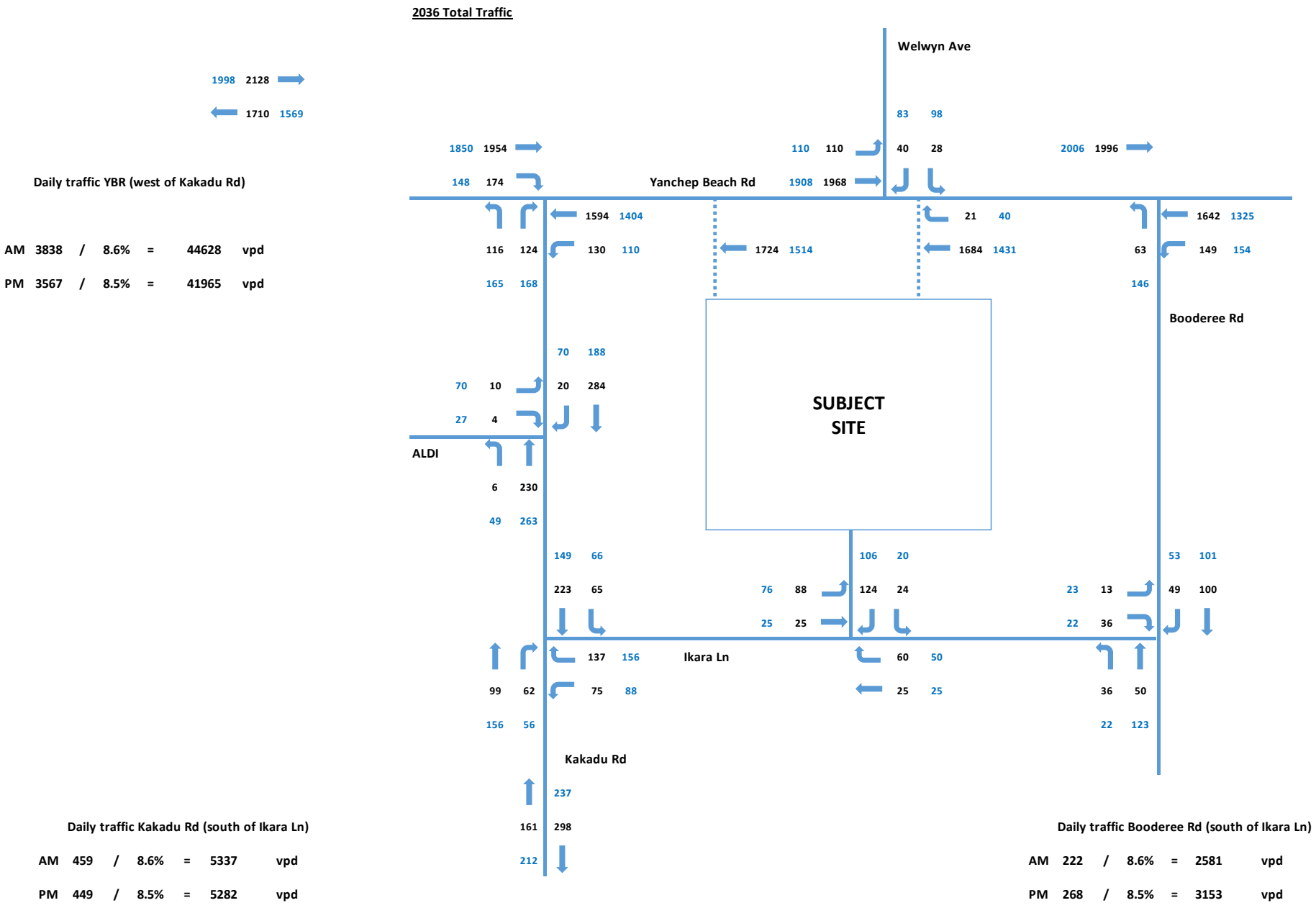

Figure 30: Total 2036 traffic flows (including development) AM and PM peak hours

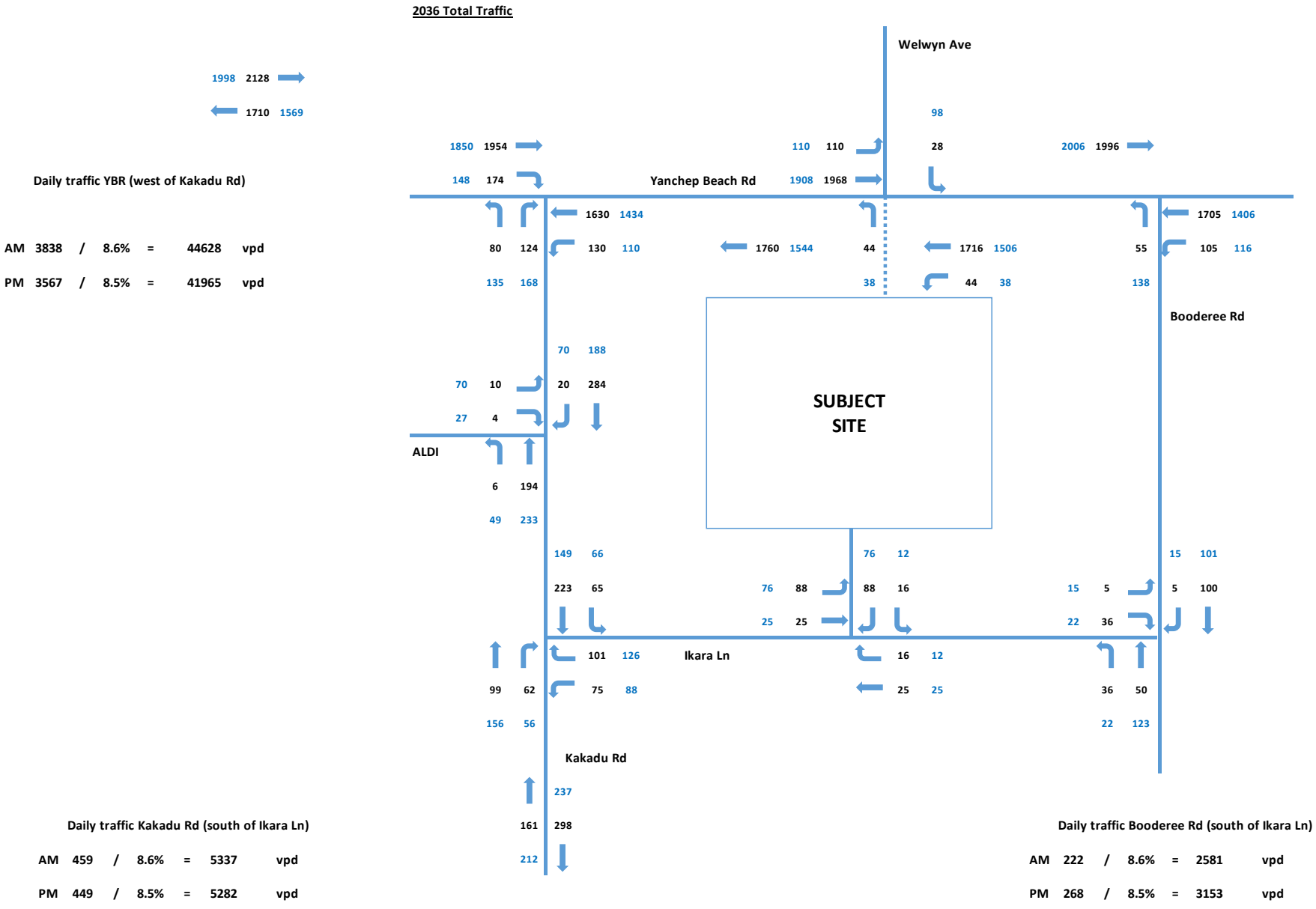

Figure 31: Alternative traffic flows (Scenario 3)

Appendix D: SIDRA analysis outputs

SIDRA outputs are presented in the form of Degree of Saturation, Level of Service, Average Delay and 95% Queue. These characteristics 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 Degree of Saturation ranges from close to zero for varied traffic flow up to one for saturated flow or capacity.
- **Level of Service (LoS):** is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. In general, there are 6 levels of service, designated from A to F, with Level of Service A representing the best operating condition (i.e. free flow) and Level of Service F the worst (i.e. forced or breakdown flow).
- **Average Delay:** is the average of all travel time delays for vehicles through the intersection.
- **95% Queue:** is the queue length below which 95% of all observed queue lengths fall.

Scenario 1: 2036 (without development traffic) AM Peak Hour

MOVEMENT SUMMARY

Site: 101 [Booderee Rd / YBR (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 AM. (Network Folder: General)]

2036 AM Peak Hour
Base Case (No Development)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Booderee Rd														
1	L2	58	10.0	58	10.0	0.116	10.9	LOS B	0.4	3.1	0.71	0.85	0.71	20.4
Approach		58	10.0	58	10.0	0.116	10.9	LOS B	0.4	3.1	0.71	0.85	0.71	20.4
East: YBR (WB)														
2	L2	111	10.0	111	10.0	0.063	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	53.8
3	T1	1728	10.0	1728	10.0	0.467	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	69.6
Approach		1839	10.0	1839	10.0	0.467	0.6	NA	0.0	0.0	0.00	0.03	0.00	68.2
All Vehicles		1897	10.0	1897	10.0	0.467	0.9	NA	0.4	3.1	0.02	0.06	0.02	67.2

MOVEMENT SUMMARY

Site: 201 [Welwyn Ave / YBR - Stage 1 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 AM. (Network Folder: General)]

2036 AM Peak Hour
Base Case (No Development)
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Median Storage 1														
1	T1	22	10.0	22	10.0	0.364	69.2	LOS F	1.0	7.6	0.97	1.03	1.08	17.8
Approach		22	10.0	22	10.0	0.364	69.2	LOS F	1.0	7.6	0.97	1.03	1.08	17.8
North: Welwyn Ave														
2	L2	29	10.0	29	10.0	0.076	14.1	LOS B	0.3	1.9	0.77	0.90	0.77	47.9
3	T1	42	10.0	42	10.0	3.229	2224.6	LOS F	25.8	196.1	1.00	1.65	3.95	0.8
Approach		72	10.0	72	10.0	3.229	1314.4	LOS F	25.8	196.1	0.90	1.34	2.64	1.8
West: YBR (EB)														
4	L2	116	10.0	113	10.0	0.084	6.8	LOS A	0.4	2.7	0.09	0.55	0.09	51.7
5	T1	2025	10.0	1970	10.0	0.532	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.5
Approach		2141	10.0	2082[N1]	10.0	0.532	0.4	LOS A	0.4	2.7	0.00	0.03	0.00	68.2
All Vehicles		2235	10.0	2176[N1]	10.3	3.229	44.4	NA	25.8	196.1	0.04	0.08	0.10	29.5

MOVEMENT SUMMARY

Site: 202 [Welwyn Ave / YBR - Stage 2 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 AM. (Network Folder: General)]

2036 AM Peak Hour
Base Case (No Development)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: YBR (WB)														
4	L2	1	10.0	1	10.0	0.001	6.5	LOS A	0.0	0.0	0.00	0.61	0.00	37.0
1	T1	1764	10.0	1764	10.0	0.477	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.6
2	R2	22	10.0	22	10.0	0.014	6.4	LOS A	0.0	0.0	0.00	0.65	0.00	38.6
Approach		1787	10.0	1787	10.0	0.477	0.1	NA	0.0	0.0	0.00	0.01	0.00	68.8
North: Median Storage 1														
3	R2	42	10.0	13	10.0	0.336	102.1	LOS F	0.9	6.7	0.98	1.03	1.06	0.5
Approach		42	10.0	13[N1]	10.0	0.336	102.1	LOS F	0.9	6.7	0.98	1.03	1.06	0.5
All Vehicles		1829	10.0	1800[N1]	10.2	0.477	0.9	NA	0.9	6.7	0.01	0.02	0.01	62.8

MOVEMENT SUMMARY

Site: 401 [Kakadu Rd / YBR - Stage 1 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 AM. (Network Folder: General)]

2036 AM Peak Hour
Base Case (No Development)
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Kakadu Rd														
1	L2	84	10.0	84	10.0	0.155	10.4	LOS B	0.6	4.2	0.69	0.85	0.69	44.0
2	T1	84	10.0	84	10.0	3.366	2227.7	LOS F	44.6	339.3	1.00	2.56	6.94	0.1
Approach		168	10.0	168	10.0	3.366	1119.0	LOS F	44.6	339.3	0.84	1.71	3.81	1.0
East: YBR (WB)														
3	L2	137	10.0	135	10.0	0.113	7.2	LOS A	0.5	3.6	0.27	0.57	0.27	36.5
4	T1	1669	10.0	1643	10.0	0.444	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.6
Approach		1806	10.0	1777[N1]	10.0	0.444	0.6	LOS A	0.5	3.6	0.02	0.04	0.02	67.8
North: Median Storage 2														
5	T1	137	10.0	137	10.0	0.979	104.9	LOS F	2.0	14.9	1.00	2.50	3.53	3.1
Approach		137	10.0	137	10.0	0.979	104.9	LOS F	2.0	14.9	1.00	2.50	3.53	3.1
All Vehicles		2112	10.0	2083[N1]	10.1	3.366	97.9	NA	44.6	339.3	0.15	0.34	0.56	15.3

MOVEMENT SUMMARY

Site: 402 [Kakadu Rd / YBR - Stage 2 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 AM. (Network Folder: General)]

2036 AM Peak Hour
Base Case (No Development)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Median Storage 2														
1	R2	84	10.0	25	10.0	0.440	75.1	LOS F	1.2	8.9	0.98	1.06	1.12	0.7
Approach		84	10.0	25[N1]	10.0	0.440	75.1	LOS F	1.2	8.9	0.98	1.06	1.12	0.7
West: YBR (EB)														
2	T1	2057	10.0	2057	10.0	0.556	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	69.4
3	R2	137	10.0	137	10.0	0.078	6.5	LOS A	5.5	41.8	0.00	0.65	0.00	56.5
Approach		2194	10.0	2194	10.0	0.556	0.6	NA	5.5	41.8	0.00	0.04	0.00	68.4
All Vehicles		2278	10.0	2219[N1]	10.3	0.556	1.5	NA	5.5	41.8	0.01	0.05	0.01	66.2

Scenario 1: 2036 (without development traffic) PM Peak Hour

MOVEMENT SUMMARY

Site: 101 [Booderee Rd / YBR (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 PM (Network Folder: General)]

2036 PM Peak Hour
Base Case (No Development)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Booderee Rd														
1	L2	145	10.0	145	10.0	0.215	9.0	LOS A	0.8	6.3	0.63	0.81	0.63	22.7
Approach		145	10.0	145	10.0	0.215	9.0	LOS A	0.8	6.3	0.63	0.81	0.63	22.7
East: YBR (WB)														
2	L2	122	10.0	122	10.0	0.070	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	53.8
3	T1	1395	10.0	1395	10.0	0.377	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.7
Approach		1517	10.0	1517	10.0	0.377	0.6	NA	0.0	0.0	0.00	0.05	0.00	67.8
All Vehicles		1662	10.0	1662	10.0	0.377	1.4	NA	0.8	6.3	0.05	0.11	0.06	65.4

MOVEMENT SUMMARY

Site: 201 [Welwyn Ave / YBR - Stage 1 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 PM (Network Folder: General)]

2036 PM Peak Hour
Base Case (No Development)
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h]	HV] %	ARRIVAL FLOWS [Total veh/h]	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh]	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Median Storage 1														
1	T1	42	10.0	42	10.0	0.540	65.4	LOS F	1.6	12.5	0.97	1.11	1.22	18.5
Approach		42	10.0	42	10.0	0.540	65.4	LOS F	1.6	12.5	0.97	1.11	1.22	18.5
North: Welwyn Ave														
2	L2	103	10.0	103	10.0	0.241	14.3	LOS B	0.9	6.8	0.78	0.93	0.85	47.8
3	T1	87	10.0	87	10.0	4.787	3531.8	LOS F	55.7	423.3	1.00	1.93	5.20	0.5
Approach		191	10.0	191	10.0	4.787	1627.3	LOS F	55.7	423.3	0.88	1.39	2.85	1.6
West: YBR (EB)														
4	L2	116	10.0	111	10.0	0.084	6.9	LOS A	0.3	2.7	0.13	0.55	0.13	51.5
5	T1	1968	10.0	1880	10.0	0.508	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.5
Approach		2084	10.0	1990[N1]	10.0	0.508	0.4	LOS A	0.3	2.7	0.01	0.03	0.01	68.2
All Vehicles		2317	10.0	2223[N1]	10.4	4.787	141.1	NA	55.7	423.3	0.10	0.17	0.27	13.5

MOVEMENT SUMMARY

Site: 202 [Welwyn Ave / YBR - Stage 2 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 PM (Network Folder: General)]

2036 PM Peak Hour
Base Case (No Development)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h]	HV] %	ARRIVAL FLOWS [Total veh/h]	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh]	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: YBR (WB)														
4	L2	1	10.0	1	10.0	0.001	6.5	LOS A	0.0	0.0	0.00	0.61	0.00	37.0
1	T1	1498	10.0	1498	10.0	0.405	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.7
2	R2	42	10.0	42	10.0	0.037	6.4	LOS A	0.0	0.0	0.00	0.65	0.00	38.6
Approach		1541	10.0	1541	10.0	0.405	0.2	NA	0.0	0.0	0.00	0.02	0.00	68.1
North: Median Storage 1														
3	R2	87	10.0	18	10.0	0.214	43.4	LOS E	0.6	4.5	0.94	0.98	0.99	1.2
Approach		87	10.0	18[N1]	10.0	0.214	43.4	LOS E	0.6	4.5	0.94	0.98	0.99	1.2
All Vehicles		1628	10.0	1559[N1]	10.4	0.405	0.7	NA	0.6	4.5	0.01	0.03	0.01	63.9

MOVEMENT SUMMARY

Site: 401 [Kakadu Rd / YBR - Stage 1 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 PM (Network Folder: General)]

2036 PM Peak Hour
Base Case (No Development)
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Kakadu Rd														
1	L2	142	10.0	142	10.0	0.213	9.1	LOS A	0.8	6.2	0.63	0.83	0.63	45.3
2	T1	137	10.0	137	10.0	3.142	1979.5	LOS F	64.7	492.1	1.00	4.04	12.02	0.2
Approach		279	10.0	279	10.0	3.142	975.7	LOS F	64.7	492.1	0.81	2.40	6.22	1.2
East: YBR (WB)														
3	L2	116	10.0	111	10.0	0.091	7.1	LOS A	0.4	2.8	0.24	0.56	0.24	36.7
4	T1	1469	10.0	1405	10.0	0.380	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.7
Approach		1585	10.0	1516[N1]	10.0	0.380	0.5	LOS A	0.4	2.8	0.02	0.04	0.02	68.0
North: Median Storage 2														
5	T1	116	10.0	116	10.0	0.505	21.6	LOS C	1.9	14.6	0.91	1.14	1.27	11.2
Approach		116	10.0	116	10.0	0.505	21.6	LOS C	1.9	14.6	0.91	1.14	1.27	11.2
All Vehicles		1980	10.0	1910[N1]	10.4	3.142	144.2	NA	64.7	492.1	0.19	0.45	1.00	11.1

MOVEMENT SUMMARY

Site: 402 [Kakadu Rd / YBR - Stage 2 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 PM (Network Folder: General)]

2036 PM Peak Hour
Base Case (No Development)
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Median Storage 2														
1	R2	137	10.0	43	10.0	0.554	63.2	LOS F	1.6	12.2	0.97	1.12	1.23	0.9
Approach		137	10.0	43[N1]	10.0	0.554	63.2	LOS F	1.6	12.2	0.97	1.12	1.23	0.9
West: YBR (EB)														
2	T1	1947	10.0	1947	10.0	0.526	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	69.5
3	R2	116	10.0	116	10.0	0.126	6.5	LOS A	0.0	0.0	0.00	0.65	0.00	56.4
Approach		2063	10.0	2063	10.0	0.526	0.6	NA	0.0	0.0	0.00	0.04	0.00	68.6
All Vehicles		2200	10.0	2106[N1]	10.4	0.554	1.8	NA	1.6	12.2	0.02	0.06	0.03	65.3

Scenario 2: 2036 (with development traffic) AM Peak Hour

MOVEMENT SUMMARY

Site: 101 [Booderee Rd / YBR (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 AM (WD) (Network Folder: General)]

2036 AM Peak Hour
With Development
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Booderee Rd														
1	L2	66	10.0	66	10.0	0.132	10.9	LOS B	0.5	3.5	0.71	0.85	0.71	20.3
Approach		66	10.0	66	10.0	0.132	10.9	LOS B	0.5	3.5	0.71	0.85	0.71	20.3
East: YBR (WB)														
2	L2	157	10.0	157	10.0	0.090	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	53.8
3	T1	1728	10.0	1728	10.0	0.467	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	69.6
Approach		1885	10.0	1885	10.0	0.467	0.7	NA	0.0	0.0	0.00	0.05	0.00	67.6
All Vehicles		1952	10.0	1952	10.0	0.467	1.1	NA	0.5	3.5	0.02	0.07	0.02	66.5

MOVEMENT SUMMARY

Site: 201 [Welwyn Ave / YBR - Stage 1 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 AM (WD) (Network Folder: General)]

2036 AM Peak Hour
With Development
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Median Storage 1														
1	T1	22	10.0	22	10.0	0.364	69.3	LOS F	1.0	7.7	0.97	1.03	1.08	17.8
Approach		22	10.0	22	10.0	0.364	69.3	LOS F	1.0	7.7	0.97	1.03	1.08	17.8
North: Welwyn Ave														
2	L2	29	10.0	29	10.0	0.076	14.1	LOS B	0.3	1.9	0.77	0.90	0.77	47.9
3	T1	42	10.0	42	10.0	3.252	2244.5	LOS F	25.9	196.5	1.00	1.65	3.96	0.8
Approach		72	10.0	72	10.0	3.252	1326.1	LOS F	25.9	196.5	0.90	1.34	2.65	1.8
West: YBR (EB)														
4	L2	116	10.0	110	10.0	0.082	6.8	LOS A	0.3	2.6	0.09	0.55	0.09	51.7
5	T1	2072	10.0	1970	10.0	0.532	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.5
Approach		2187	10.0	2080[N1]	10.0	0.532	0.4	LOS A	0.3	2.6	0.00	0.03	0.00	68.2
All Vehicles		2281	10.0	2174[N1]	10.5	3.252	44.8	NA	25.9	196.5	0.04	0.08	0.10	29.3

MOVEMENT SUMMARY

Site: 202 [Welwyn Ave / YBR - Stage 2 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 AM (WD) (Network Folder: General)]

2036 AM Peak Hour
With Development
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: YBR (WB)														
4	L2	1	10.0	1	10.0	0.001	6.5	LOS A	0.0	0.0	0.00	0.61	0.00	37.0
1	T1	1773	10.0	1773	10.0	0.479	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.6
2	R2	22	10.0	22	10.0	0.014	6.4	LOS A	0.0	0.0	0.00	0.65	0.00	38.6
Approach		1796	10.0	1796	10.0	0.479	0.1	NA	0.0	0.0	0.00	0.01	0.00	68.8
North: Median Storage 1														
3	R2	42	10.0	13	10.0	0.344	105.6	LOS F	0.9	6.8	0.98	1.03	1.07	0.5
Approach		42	10.0	13[N1]	10.0	0.344	105.6	LOS F	0.9	6.8	0.98	1.03	1.07	0.5
All Vehicles		1838	10.0	1809[N1]	10.2	0.479	0.9	NA	0.9	6.8	0.01	0.02	0.01	62.6

MOVEMENT SUMMARY

Site: 401 [Kakadu Rd / YBR - Stage 1 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 AM (WD) (Network Folder: General)]

2036 AM Peak Hour
With Development
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Kakadu Rd														
1	L2	122	10.0	122	10.0	0.227	11.0	LOS B	0.9	6.6	0.71	0.88	0.76	43.6
2	T1	131	10.0	131	10.0	5.682	4288.8	LOS F	80.2	609.9	1.00	2.61	7.18	0.1
Approach		253	10.0	253	10.0	5.682	2221.2	LOS F	80.2	609.9	0.86	1.78	4.08	0.5
East: YBR (WB)														
3	L2	137	10.0	135	10.0	0.120	7.5	LOS A	0.5	3.8	0.32	0.59	0.32	36.2
4	T1	1678	10.0	1651	10.0	0.446	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.6
Approach		1815	10.0	1786[N1]	10.0	0.446	0.6	LOS A	0.5	3.8	0.02	0.04	0.02	67.8
North: Median Storage 2														
5	T1	183	10.0	183	10.0	1.336	352.4	LOS F	2.0	14.9	1.00	6.37	10.09	1.0
Approach		183	10.0	183	10.0	1.336	352.4	LOS F	2.0	14.9	1.00	6.37	10.09	1.0
All Vehicles		2251	10.0	2222[N1]	10.1	5.682	282.1	NA	80.2	609.9	0.20	0.76	1.31	6.1

MOVEMENT SUMMARY

Site: 402 [Kakadu Rd / YBR - Stage 2 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 AM (WD) (Network Folder: General)]

2036 AM Peak Hour
With Development
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Median Storage 2														
1	R2	131	10.0	23	10.0	0.405	72.6	LOS F	1.1	8.1	0.97	1.05	1.10	0.8
Approach		131	10.0	23[N1]	10.0	0.405	72.6	LOS F	1.1	8.1	0.97	1.05	1.10	0.8
West: YBR (EB)														
2	T1	2057	10.0	2057	10.0	0.556	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	69.4
3	R2	183	10.0	183	10.0	0.105	6.5	LOS A	32.2	244.8	0.00	0.65	0.00	56.5
Approach		2240	10.0	2240	10.0	0.556	0.7	NA	32.2	244.8	0.00	0.05	0.00	68.1
All Vehicles		2371	10.0	2263[N1]	10.5	0.556	1.5	NA	32.2	244.8	0.01	0.06	0.01	66.2

Scenario 2: 2036 (with development traffic) PM Peak Hour

MOVEMENT SUMMARY

Site: 101 [Booderee Rd / YBR (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 PM (WD) (Network Folder: General)]

2036 PM Peak Hour
With Development
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Booderee Rd														
1	L2	154	10.0	154	10.0	0.228	9.1	LOS A	0.9	6.9	0.63	0.82	0.65	22.6
Approach		154	10.0	154	10.0	0.228	9.1	LOS A	0.9	6.9	0.63	0.82	0.65	22.6
East: YBR (WB)														
2	L2	162	10.0	162	10.0	0.093	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	53.8
3	T1	1395	10.0	1395	10.0	0.377	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.7
Approach		1557	10.0	1557	10.0	0.377	0.8	NA	0.0	0.0	0.00	0.06	0.00	67.3
All Vehicles		1711	10.0	1711	10.0	0.377	1.6	NA	0.9	6.9	0.06	0.13	0.06	64.8

MOVEMENT SUMMARY

Site: 201 [Welwyn Ave / YBR - Stage 1 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 PM (WD) (Network Folder: General)]

2036 PM Peak Hour
With Development
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Median Storage 1														
1	T1	42	10.0	42	10.0	0.540	65.5	LOS F	1.6	12.5	0.97	1.11	1.22	18.4
Approach		42	10.0	42	10.0	0.540	65.5	LOS F	1.6	12.5	0.97	1.11	1.22	18.4
North: Welwyn Ave														
2	L2	103	10.0	103	10.0	0.241	14.3	LOS B	0.9	6.8	0.78	0.93	0.85	47.8
3	T1	87	10.0	87	10.0	4.783	3527.8	LOS F	55.7	423.1	1.00	1.93	5.20	0.5
Approach		191	10.0	191	10.0	4.783	1625.5	LOS F	55.7	423.1	0.88	1.39	2.85	1.6
West: YBR (EB)														
4	L2	116	10.0	108	10.0	0.082	6.9	LOS A	0.3	2.6	0.13	0.55	0.13	51.5
5	T1	2008	10.0	1880	10.0	0.508	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.5
Approach		2124	10.0	1989[N1]	10.0	0.508	0.4	LOS A	0.3	2.6	0.01	0.03	0.01	68.2
All Vehicles		2357	10.0	2221[N1]	10.6	4.783	141.1	NA	55.7	423.1	0.10	0.17	0.27	13.5

MOVEMENT SUMMARY

Site: 202 [Welwyn Ave / YBR - Stage 2 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 PM (WD) (Network Folder: General)]

2036 PM Peak Hour
With Development
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
East: YBR (WB)														
4	L2	1	10.0	1	10.0	0.001	6.5	LOS A	0.0	0.0	0.00	0.61	0.00	37.0
1	T1	1506	10.0	1506	10.0	0.407	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.7
2	R2	42	10.0	42	10.0	0.037	6.4	LOS A	0.0	0.0	0.00	0.65	0.00	38.6
Approach		1549	10.0	1549	10.0	0.407	0.2	NA	0.0	0.0	0.00	0.02	0.00	68.1
North: Median Storage 1														
3	R2	87	10.0	18	10.0	0.219	44.5	LOS E	0.6	4.6	0.94	0.98	0.99	1.2
Approach		87	10.0	18[N1]	10.0	0.219	44.5	LOS E	0.6	4.6	0.94	0.98	0.99	1.2
All Vehicles		1637	10.0	1567[N1]	10.4	0.407	0.7	NA	0.6	4.6	0.01	0.03	0.01	63.8

MOVEMENT SUMMARY

Site: 401 [Kakadu Rd / YBR - Stage 1 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 PM (WD) (Network Folder: General)]

2036 PM Peak Hour
With Development
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Kakadu Rd														
1	L2	174	10.0	174	10.0	0.262	9.6	LOS A	1.1	8.3	0.65	0.86	0.71	44.8
2	T1	177	10.0	177	10.0	4.284	3000.1	LOS F	93.6	711.5	1.00	4.10	12.33	0.1
Approach		351	10.0	351	10.0	4.284	1518.3	LOS F	93.6	711.5	0.82	2.49	6.57	0.8
East: YBR (WB)														
3	L2	116	10.0	111	10.0	0.095	7.3	LOS A	0.4	3.0	0.29	0.58	0.29	36.4
4	T1	1478	10.0	1413	10.0	0.382	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.7
Approach		1594	10.0	1524[N1]	10.0	0.382	0.6	LOS A	0.4	3.0	0.02	0.04	0.02	68.0
North: Median Storage 2														
5	T1	156	10.0	156	10.0	0.690	28.4	LOS D	2.0	14.9	0.95	1.39	1.66	9.2
Approach		156	10.0	156	10.0	0.690	28.4	LOS D	2.0	14.9	0.95	1.39	1.66	9.2
All Vehicles		2100	10.0	2030[N1]	10.3	4.284	264.7	NA	93.6	711.5	0.23	0.57	1.28	6.4

MOVEMENT SUMMARY

Site: 402 [Kakadu Rd / YBR - Stage 2 (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 PM (WD) (Network Folder: General)]

2036 PM Peak Hour
With Development
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Median Storage 2														
1	R2	177	10.0	41	10.0	0.529	61.4	LOS F	1.5	11.6	0.97	1.11	1.21	0.9
Approach		177	10.0	41[N1]	10.0	0.529	61.4	LOS F	1.5	11.6	0.97	1.11	1.21	0.9
West: YBR (EB)														
2	T1	1947	10.0	1947	10.0	0.526	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	69.5
3	R2	156	10.0	156	10.0	0.089	6.5	LOS A	1.1	8.5	0.00	0.65	0.00	56.5
Approach		2103	10.0	2103	10.0	0.526	0.7	NA	1.1	8.5	0.00	0.05	0.00	68.3
All Vehicles		2280	10.0	2144[N1]	10.6	0.529	1.8	NA	1.5	11.6	0.02	0.07	0.02	65.3

Scenario 3: 2036 (alternative road upgrades with development traffic) AM Peak Hour

MOVEMENT SUMMARY

Site: 101 [Booderee Rd / YBR (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 AM (WD) (Network Folder: General)]

2036 AM Peak Hour
With Development
Alternative Road Upgrades 1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h]	DEMAND FLOWS HV %	ARRIVAL FLOWS [Total veh/h]	ARRIVAL FLOWS HV %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh]	95% BACK OF QUEUE Dist m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Booderee Rd														
1	L2	58	10.0	58	10.0	0.124	11.5	LOS B	0.4	3.3	0.73	0.86	0.73	19.7
Approach		58	10.0	58	10.0	0.124	11.5	LOS B	0.4	3.3	0.73	0.86	0.73	19.7
East: YBR (WB)														
2	L2	111	10.0	111	10.0	0.063	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	53.8
3	T1	1795	10.0	1795	10.0	0.485	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	69.5
Approach		1905	10.0	1905	10.0	0.485	0.6	NA	0.0	0.0	0.00	0.03	0.00	68.2
All Vehicles		1963	10.0	1963	10.0	0.485	0.9	NA	0.4	3.3	0.02	0.06	0.02	67.2

MOVEMENT SUMMARY

Site: 201 [ECU / YBR (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 AM (WD) (Network Folder: General)]

2036 AM Peak Hour
With Development
Alternative Road Upgrades 1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h]	DEMAND FLOWS HV %	ARRIVAL FLOWS [Total veh/h]	ARRIVAL FLOWS HV %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh]	95% BACK OF QUEUE Dist m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: ECU														
1	L2	46	10.0	46	10.0	0.183	11.2	LOS B	0.4	2.8	0.75	0.87	0.75	14.5
Approach		46	10.0	46	10.0	0.183	11.2	LOS B	0.4	2.8	0.75	0.87	0.75	14.5
East: YBR (WB)														
2	L2	46	10.0	46	10.0	0.026	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	38.9
3	T1	1806	10.0	1806	10.0	0.861	0.6	LOS A	0.0	0.0	0.00	0.00	0.00	65.2
Approach		1853	10.0	1853	10.0	0.861	0.7	NA	0.0	0.0	0.00	0.01	0.00	63.7
All Vehicles		1899	10.0	1899	10.0	0.861	1.0	NA	0.4	2.8	0.02	0.04	0.02	61.5

MOVEMENT SUMMARY

Site: 301 [Welwyn Ave / YBR (Left-in/Left-out) (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 AM (WD) (Network Folder: General)]

2036 AM Peak Hour
With Development
Alternative Road Upgrades 1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
North: Welwyn Ave														
1	L2	29	10.0	29	10.0	0.070	13.0	LOS B	0.3	2.0	0.74	0.87	0.74	45.4
Approach		29	10.0	29	10.0	0.070	13.0	LOS B	0.3	2.0	0.74	0.87	0.74	45.4
West: YBR (EB)														
2	L2	116	10.0	116	10.0	0.066	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	54.0
3	T1	2072	10.0	2072	10.0	0.560	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.4
Approach		2187	10.0	2187	10.0	0.560	0.4	NA	0.0	0.0	0.00	0.03	0.00	68.3
All Vehicles		2217	10.0	2217	10.0	0.560	0.6	NA	0.3	2.0	0.01	0.04	0.01	67.7

MOVEMENT SUMMARY

Site: 401 [Kakadu Rd / YBR (Signals) (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 AM (WD) (Network Folder: General)]

2036 AM Peak Hour
With Development
Alternative Road Upgrades 1
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 70 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Kakadu Rd														
1	L2	84	10.0	84	10.0	0.599	32.0	LOS C	6.6	49.8	0.95	0.95	0.96	25.8
2	R2	131	10.0	131	10.0	*0.599	32.0	LOS C	6.6	49.8	0.95	0.95	0.96	9.2
Approach		215	10.0	215	10.0	0.599	32.0	LOS C	6.6	49.8	0.95	0.95	0.96	17.4
East: YBR														
3	L2	137	10.0	137	10.0	0.103	8.5	LOS A	1.0	7.7	0.30	0.64	0.30	38.2
4	T1	1716	10.0	1716	10.0	*0.892	28.3	LOS C	34.9	265.0	0.95	1.05	1.20	33.7
Approach		1853	10.0	1853	10.0	0.892	26.8	LOS C	34.9	265.0	0.90	1.02	1.13	33.9
West: YBR														
5	T1	2057	10.0	2057	10.0	0.772	5.8	LOS A	21.8	165.5	0.63	0.59	0.63	52.6
6	R2	183	10.0	183	10.0	*0.813	44.7	LOS D	7.0	53.4	1.00	0.93	1.34	22.0
Approach		2240	10.0	2240	10.0	0.813	9.0	LOS A	21.8	165.5	0.66	0.62	0.69	46.2
All Vehicles		4307	10.0	4307	10.0	0.892	17.8	LOS B	34.9	265.0	0.78	0.80	0.90	37.3

Scenario 3: 2036 (alternative road upgrades with development traffic) PM Peak Hour

MOVEMENT SUMMARY

Site: 101 [Booderee Rd / YBR (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 PM (WD) (Network Folder: General)]

2036 PM Peak Hour
With Development
Alternative Road Upgrades 1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h]	HV [ ] %	ARRIVAL FLOWS [Total veh/h]	HV [ ] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh]	Dist [ ] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Booderee Rd														
1	L2	145	10.0	145	10.0	0.231	9.7	LOS A	0.9	6.9	0.66	0.84	0.70	21.8
Approach		145	10.0	145	10.0	0.231	9.7	LOS A	0.9	6.9	0.66	0.84	0.70	21.8
East: YBR (WB)														
2	L2	122	10.0	122	10.0	0.070	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	53.8
3	T1	1480	10.0	1480	10.0	0.400	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.7
Approach		1602	10.0	1602	10.0	0.400	0.6	NA	0.0	0.0	0.00	0.04	0.00	67.9
All Vehicles		1747	10.0	1747	10.0	0.400	1.4	NA	0.9	6.9	0.05	0.11	0.06	65.4

MOVEMENT SUMMARY

Site: 201 [ECU / YBR (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 PM (WD) (Network Folder: General)]

2036 PM Peak Hour
With Development
Alternative Road Upgrades 1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h]	HV [ ] %	ARRIVAL FLOWS [Total veh/h]	HV [ ] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh]	Dist [ ] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: ECU														
1	L2	40	10.0	40	10.0	0.087	8.7	LOS A	0.2	1.9	0.65	0.82	0.65	17.3
Approach		40	10.0	40	10.0	0.087	8.7	LOS A	0.2	1.9	0.65	0.82	0.65	17.3
East: YBR (WB)														
2	L2	40	10.0	40	10.0	0.023	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	38.9
3	T1	1585	10.0	1585	10.0	0.529	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.3
Approach		1625	10.0	1625	10.0	0.529	0.2	NA	0.0	0.0	0.00	0.01	0.00	67.5
All Vehicles		1665	10.0	1665	10.0	0.529	0.4	NA	0.2	1.9	0.02	0.03	0.02	65.6

MOVEMENT SUMMARY

Site: 301 [Welwyn Ave / YBR (Left-in/Left-out) (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 PM (WD) (Network Folder: General)]

2036 PM Peak Hour
With Development
Alternative Road Upgrades 1
Site Category: (None)
Give-Way (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
North: Welwyn Ave														
1	L2	103	10.0	103	10.0	0.221	13.1	LOS B	0.9	7.1	0.75	0.89	0.79	45.3
Approach		103	10.0	103	10.0	0.221	13.1	LOS B	0.9	7.1	0.75	0.89	0.79	45.3
West: YBR (EB)														
2	L2	116	10.0	116	10.0	0.066	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	54.0
3	T1	2008	10.0	2008	10.0	0.543	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.4
Approach		2124	10.0	2124	10.0	0.543	0.4	NA	0.0	0.0	0.00	0.03	0.00	68.3
All Vehicles		2227	10.0	2227	10.0	0.543	1.0	NA	0.9	7.1	0.03	0.07	0.04	66.1

MOVEMENT SUMMARY

Site: 401 [Kakadu Rd / YBR (Signals) (Site Folder: General)]

Network: 1 [U23.060 - ECU Health Centre, Yanchep - 2036 PM (WD) (Network Folder: General)]

2036 PM Peak Hour
With Development
Alternative Road Upgrades 1
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	DEMAND FLOWS [Total veh/h	HV] %	ARRIVAL FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Kakadu Rd														
1	L2	142	10.0	142	10.0	0.598	22.4	LOS C	7.2	54.8	0.89	0.91	0.89	30.7
2	R2	177	10.0	177	10.0	* 0.598	22.5	LOS C	7.2	54.8	0.89	0.91	0.89	12.2
Approach		319	10.0	319	10.0	0.598	22.4	LOS C	7.2	54.8	0.89	0.91	0.89	22.9
East: YBR														
3	L2	116	10.0	116	10.0	0.084	7.9	LOS A	0.6	4.4	0.28	0.64	0.28	39.1
4	T1	1509	10.0	1509	10.0	* 0.880	26.3	LOS C	26.4	200.3	0.97	1.06	1.26	35.0
Approach		1625	10.0	1625	10.0	0.880	25.0	LOS C	26.4	200.3	0.92	1.03	1.19	35.1
West: YBR														
5	T1	1947	10.0	1947	10.0	0.813	11.4	LOS B	24.6	186.9	0.76	0.77	0.85	42.4
6	R2	156	10.0	156	10.0	* 0.889	45.4	LOS D	5.6	42.9	1.00	1.03	1.70	21.8
Approach		2103	10.0	2103	10.0	0.889	13.9	LOS B	24.6	186.9	0.78	0.79	0.91	39.0
All Vehicles		4047	10.0	4047	10.0	0.889	19.0	LOS B	26.4	200.3	0.85	0.89	1.02	35.8

Appendix E: Road Safety Audit

This is provided as a separate report attachment. The findings of the audit are minor and routine for the concept design stage. There is no fundamental issue identified with providing left-in/left-out site access on Yanchep Beach Road in principle.