APPENDIX I
NAIRN DRIVE ACCESS STRATEGY

NAIRN DRIVE
VEHICLE ACCESS STRATEGY

Technical Note: No. 2 **Date:** 9/7/2012
Project No: t10.069
Project: Lot 1507 Eighty Road, Baldivis, LSP

1. INTRODUCTON

Transcore prepared the *Parkland Heights Local Structure Plan, Lot 1507 Eighty Road Baldivis, Transport Assessment* report in July 2011.

The City of Rockingham has subsequently received submissions on the proposed Local Structure Plan (LSP) from stakeholders including Main Roads Western Australia (MRWA).

MRWA advised that Nairn Drive which runs through the middle of the proposed Structure Plan is reserved as an Other Regional Road (ORR) in the Metropolitan Region Scheme (MRS). The proposed Structure Plan has allowed for eight access points on Nairn Drive, in addition to four roundabouts within approximately a 1.6km section. A vehicle access strategy is required to be developed so that the integrity of an ORR is maintained as a regional road.

The City has noted the importance of Nairn Drive as an ORR, providing connectivity to undeveloped land to the south and developing residential estates throughout the Baldivis area. The vehicle access strategy will need to demonstrate that the functionality of Nairn Drive as an ORR will not be impeded by the number of access points the Structure Plan proposes.

The City has therefore requested that the Traffic Report be amended to incorporate a vehicle access strategy addressing the design abutting Nairn Drive.

This technical note is intended to form an addendum to the Transport Assessment report to address this requirement.

It should be noted that the village centre area is excluded from the current LSP application as shown on Figure 14 of the LSP report (see Appendix A of this technical note). It will be subject to a separate planning exercise and that section of Nairn Drive is not addressed in this technical note.

2. NAIRN DRIVE OTHER REGIONAL ROADS RESERVATION

Nairn Drive is covered by an ORR reservation in the MRS, as noted by MRWA. However, this does not mean that there cannot be reasonably frequent vehicle access to Nairn Drive.

Western Australian Planning Commission (WAPC) Plan No. SP694/2 (May 2012) classifies all the ORR roads in the MRS into three categories in relation to the level of access that is permitted:

- Category 1 – frontage access is not allowed (control of access).
- Category 2 – frontage access may be allowed subject to approval.
- Category 3 – road reservation not accurately defined or under review.

Nairn Drive is designated by the WAPC as category 2, so reasonably frequent access to this road is appropriate.

3. LIVEABLE NEIGHBOURHOODS

The WAPC Liveable Neighbourhoods policy document provides comprehensive guidance on the structure planning of future urban areas in Western Australia, including an appropriate hierarchy of roads and guidance on the spacing of side road intersections along each class of road.

As documented in the Transport Assessment report Nairn Drive has been designed as an Integrator A or Integrator B road depending upon the future traffic volumes anticipated on this road. Generally the threshold between Integrator A and Integrator B is at traffic flows of 15,000 vehicles per day.

In Liveable Neighbourhoods the guidance on intersection spacing (see LN Table 5 below) for a 70km/h road recommends a spacing of 190m between left/right staggered intersections (i.e. where drivers on the arterial road encounter a side road on the left then one on the right) and 130m between other side street intersections.

The northern pair of access street intersections on Nairn Drive are configured as a right-left stagger approximately 55m apart. This would not comply with Liveable Neighbourhoods intersection spacing for an Integrator A because the right turn out from the side road would emerge opposite the left turn pocket for the next intersection, if one is provided. To eliminate this issue the LSP proposed that the right turn out from both of these side roads would be prohibited, as shown on Figure 14.

The three access street intersections on Nairn Drive south of the village centre are staggered in right-left and left-right configurations approximately 130m apart. This spacing is sufficient for the right-left staggered intersection but for the left-right staggered pair the right turn pockets would overlap. This issue will be overcome by providing a wider median on this section of Nairn Drive so there is sufficient width for the right turn pockets to overlap.

Liveable Neighbourhoods, Element 2, Table 5:

Table 5 – Junction spacing (measured from road reserve centreline to centreline of terminating street pavements)

Street type	L/R staggers (to avoid overlapping right turns)	R/L staggers To provide for left-turn deceleration lanes arterials and to avoid corner cutting on local streets	Junctions on same side of street
Local streets			
Laneway	NA	NA	
Access street*	20 m	20 m	20 m
Neighbourhood connector	40 m	40 m	40 m
Arterials			
Integrator B	60 m	40 m	40 m
Integrator A – 60 km/hr**	150 m	110 m	110 m
Integrator A – 70 km/hr**	190 m	130 m	130 m

* Laneways junctions are not to be located closer than 20 m from street intersections. There is no minimum spacing requirement between laneway junctions on local streets. Along integrator B streets, laneways should be offset a minimum of 20 m from each other (unless a median renders them left in/ left out). On integrator A streets, laneway junctions should be located no closer than 30 m from unsignalised intersections and 40 m from signalised intersections.

** Design speed used for integrator arterial street spacing is to be based on speed limit at full build out. Refer to Design speed **table 5B**.

Rationale behind Table 5: Junction spacing

L/R stagger spacings have been determined to suit typical deceleration and right-turn vehicle storage requirements at local street junctions along integrator arterials. Distances are determined from Austroads Guide to Traffic Engineering Part 5: Intersections at Grade, Table 5.6 for a design speed equal to the final posted speed limit (**table 5B**). Where medians are wide enough to allow right turns to overlap, the required storage and deceleration may be provided over a shorter distance.

Spacing for R/L staggers and Left in/Left out junctions on the same side of the integrator arterial have been determined to suit the left-turn lane requirements according to Austroads Part 5 Table 5.6 for a design speed equal to the final posted speed (**table 5B**). It should be noted that right-turn lanes are to be provided as a standard feature at junctions along integrator arterials (except for Integrator B's in some main street or commercial centre circumstances). Left-turn lanes may not be required on some junctions along integrator A's and would not typically be required along integrator B's except where turning demand is high).

4. TRAFFIC FLOWS

The plan presented at Figure 20 of the LSP report shows the proposed road hierarchy and future daily traffic volumes in the LSP area. These future traffic volumes make allowance for future urban development in other parts of Baldivis and Karnup south of this area as envisaged by the WAPC *Directions 2031 and Beyond* strategy. These volumes include traffic flows from potential future urban development of land on the southern side of Sixty Eight Road south of the LSP area. It should be noted that this Figure 20 represents the latest version of the LSP plan from April 2012 and therefore supersedes the road hierarchy plan and traffic volumes figures in the Transport Assessment report.


NAIRN DRIVE
ROAD
EIGHTY
ROAD
SIXTY EIGHT
PRIMARY SCHOOL
Source : Transcore Transport Assessment
LEGEND
ROAD HIERARCHY
Integrator A
Integrator B
Neighbourhood Connector A
Neighbourhood Connector B
Access Street B
Access Street C & D
Special Access Street
100 Forecast Traffic Flows
OTHER
Local Structure Plan Boundary
400m Neighbourhood Walkable Catchment
MOVEMENT NETWORK
Lot 1507 Eighty Road, Baldivis
A Rockingham Park Project
0m 75 150
s: 1:7500@A4
d: April 12
j: 00/075
figure 20

To allow intersection analysis of the eight intersections proposed on Nairn Drive in the LSP area (excluding the village centre) in this technical note estimates of future AM and PM peak hour traffic flows at these intersections have been calculated. This calculation is based on these peak hour flows each being typically 10% of the total weekday traffic flows. A 70/30 directional split was also assumed with the peak direction of flow being out of the future residential areas and northbound on Nairn Drive in the AM peak hour and the reverse in the PM peak hour. This traffic flow pattern is based on observed traffic flows at a 2012 traffic count on Baldivis Road south of Safety Bay Road obtained from the City of Rockingham.

5. INTERSECTION ANALYSIS

In an urban environment, such as the future situation on Nairn Drive when this LSP area is developed, congestion on an arterial road like Nairn Drive is primarily related to intersections and driveway operation.

On the sections of Nairn Drive included in the LSP there are no driveways proposed onto Nairn Drive, so the operation of the proposed intersections have been assessed with the projected future AM and PM peak hour traffic flows to determine the level of congestion that would be experienced on this future Other Regional Road.

Future intersection operations have been analysed using the SIDRA intersection analysis software program. SIDRA outputs include Degree of Saturation, Level of Service, Average Delay and 95% Queue. These items are defined as follows:

Degree of Saturation: 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 0% for very low traffic flow up to 100% for saturated flow or capacity.

Level of Service: is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. There are 6 levels of service, designated from A to F, with Level of Service A representing the best operating condition and Level of Service F the worst. In SIDRA intersection analysis the level of service is based on the average delays experienced by each traffic movement.

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.

The SIDRA results are presented in Appendix B for the eight intersections analysed. For ease of reference in this technical note the eight intersecting side streets along Nairn Drive have been given reference numbers as shown on the diagram below.

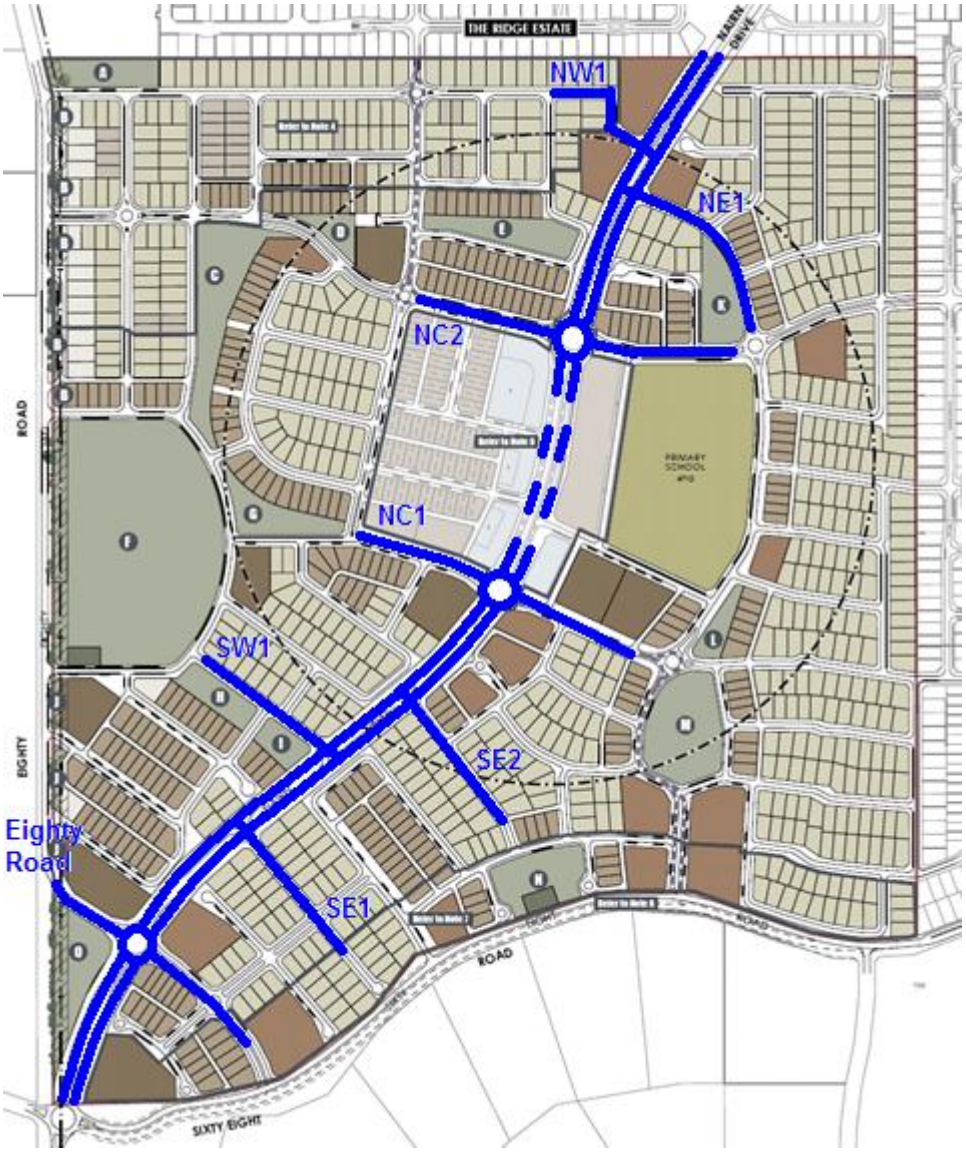


Figure 1. Nairn Drive intersections analysed in SIDRA

The results indicate that all of the Nairn Drive intersection layouts assessed would operate at overall level of service A, B or C in the future AM peak hour and with no movement worse than level of service C, which is considered a good level of service. It should also be noted that every one of the through traffic movements on Nairn Drive at all of these intersections would operate at level of service A, which is the best possible level in this analysis.

SIDRA also calculates the average delay for each movement and for each traffic lane at each intersection. The average delay in the northbound and southbound lanes at the approach to each intersection are summarised in Table 1 below.

Table 1. Nairn Drive Intersection Delays (seconds)

Intersection	Type	AM Peak Hour		PM Peak Hour	
		Northbound	Southbound	Northbound	Southbound
Road NW1	Priority T	0	0	0.1	0
Road NE1	Priority T	0	0.3	0	0.3
Road NC2	Roundabout	7.9	7.4	8.1	7.9
Road NC1	Roundabout	8.4	7.1	7.6	7.3
Road SE2	Priority T	0	0.2	0	0.3
Road SW1	Priority T	0.1	0	0.7	0
Road SE1	Priority T	0	0.1	0	0.1
Eighty Road	Roundabout	7.2	7.3	7.3	7.9
Subtotal north section		7.9	7.7	8.2	8.2
Subtotal south section		15.7	14.7	15.6	15.6
Total intersection delays		**23.6**	**22.4**	**23.8**	**23.8**

The accumulated average delays to Nairn Drive traffic at these intersections is less than 24 seconds per vehicle in each direction during the AM and PM peak hours and would be even less at other times of the day.

The suggestion by MRWA that the LSP proposes too many intersections on Nairn Drive implies that some or all of the proposed access street T-junctions along Nairn Drive should be removed, but from Table 1 it is apparent that this would reduce the average delays to Nairn Drive traffic in each direction by less than one second per vehicle.

The north and south sections of Nairn Drive in the LSP area are approximately 400m and 800m long, respectively, for a total of approximately 1.2km. At 70km/h the travel time to cover this distance would be about 68 seconds, so an increase of less than one second is considered negligible.

6. CONCLUSIONS

Nairn Drive is covered by an Other Regional Roads reservation in the Metropolitan Region Scheme. However, it is not classified as a Category 1 (control of access) regional road; it is classified as Category 2, meaning that frontage access may be allowed subject to approval.

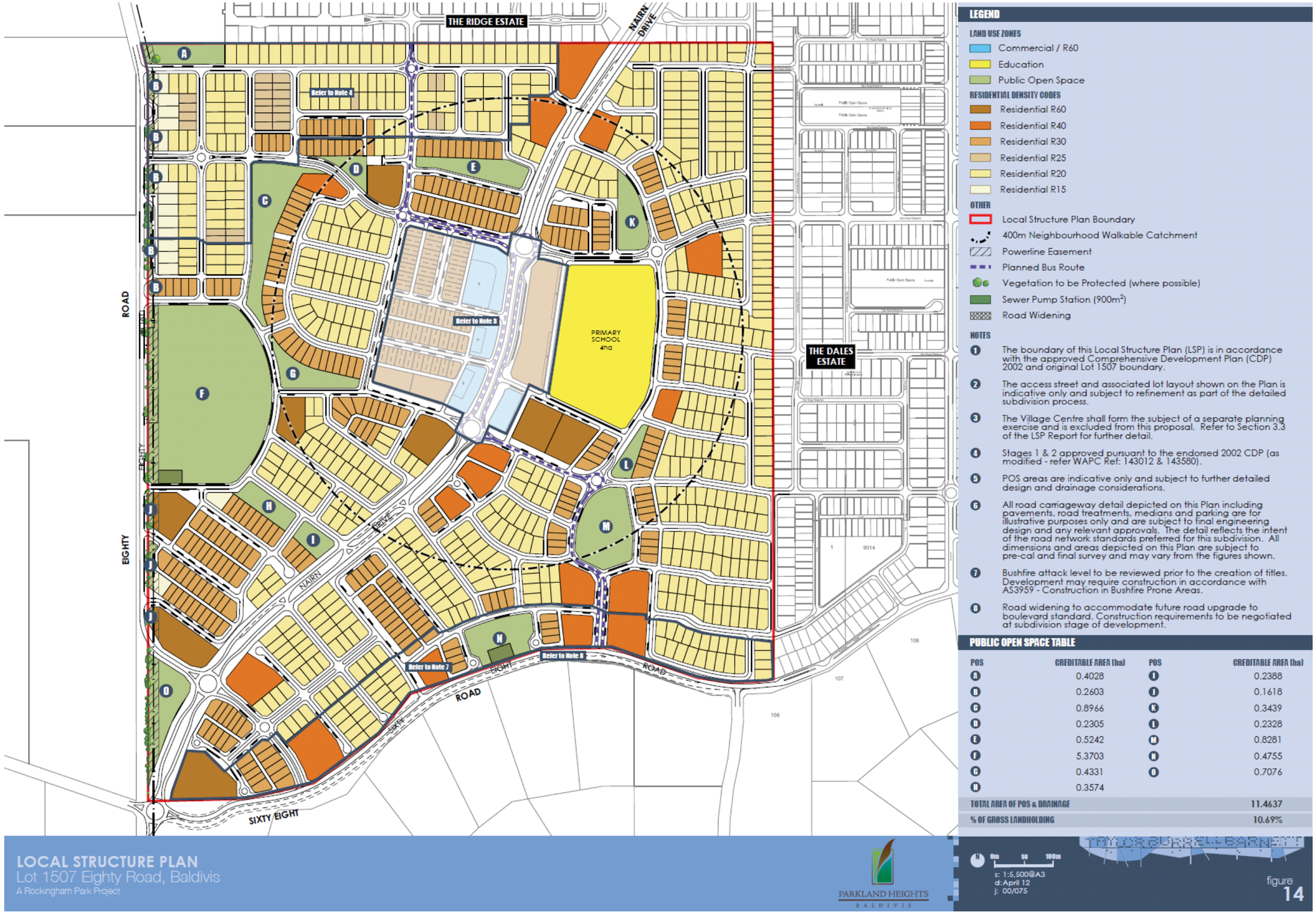
There are eight intersections proposed along 1.2km of Nairn Drive within the LSP area (excluding side roads in the village centre, which is excluded from the current LSP application and will be subject to a separate planning exercise). These include three 4-way roundabouts at neighbourhood connector intersections and five priority-controlled T-junctions (i.e. give way or stop sign control on the side streets).

Under the WAPC Liveable Neighbourhoods policy Nairn Drive would be considered an Integrator A road where the traffic volume is above 15,000 vehicles per day and an Integrator B below this threshold. Liveable Neighbourhoods provides guidance on intersection spacing on this type of road. In two locations on the LSP the proposed intersection spacing is less than that guidance indicates but appropriate treatments have been incorporated on the LSP to overcome these issues. This involves banning the right turns out from the two side roads in the northern section of Nairn Drive and providing a wider median on the southern section of Nairn Drive so there is sufficient width for two right turn pockets to overlap.

The performance of the eight intersections along Nairn Drive in the LSP area has been evaluated for future weekday AM and PM peak hour traffic flows. The analysis indicates that all eight intersections would operate a satisfactory level of service and all through traffic movements on Nairn Drive would operate at level of service A, which is the best possible level of service. The accumulated traffic delays for Nairn Drive traffic at all eight intersections would amount to less than 24 seconds per vehicle in each direction during these peak hours. The five priority-controlled T-junctions together would generate less than one second of this delay, so any benefits for Nairn Drive traffic flow by removing these intersections would be negligible, whereas these connections significantly improve permeability, connectivity and accessibility for the nearby local road network within the LSP area.

APPENDIX A

LOT 1507 EIGHTY ROAD BALDIVIS
LOCAL STRUCTURE PLAN


THE RIDGE ESTATE
NAIRN DRIVE
Refer to Note 4
Refer to Note 8
PRIMARY SCHOOL 4ha
THE DALES ESTATE
ROAD
EIGHTY
NAIRN DRIVE
Refer to Note 7
Refer to Note 8
EIGHTY ROAD
SIXTY EIGHT
LEGEND
LAND USE ZONES
Commercial / R60
Education
Public Open Space
RESIDENTIAL DENSITY CODES
Residential R60
Residential R40
Residential R30
Residential R25
Residential R20
Residential R15
OTHER
Local Structure Plan Boundary
400m Neighbourhood Walkable Catchment
Powerline Easement
Planned Bus Route
Vegetation to be Protected (where possible)
Sewer Pump Station (900m²)
Road Widening
NOTES
1 The boundary of this Local Structure Plan (LSP) is in accordance with the approved Comprehensive Development Plan (CDP) 2002 and original Lot 1507 boundary.
2 The access street and associated lot layout shown on the Plan is indicative only and subject to refinement as part of the detailed subdivision process.
3 The Village Centre shall form the subject of a separate planning exercise and is excluded from this proposal. Refer to Section 3.3 of the LSP Report for further detail.
4 Stages 1 & 2 approved pursuant to the endorsed 2002 CDP (as modified - refer WAPC Ref: 143012 & 143580).
5 POS areas are indicative only and subject to further detailed design and drainage considerations.
6 All road carriageway detail depicted on this Plan including pavements, road treatments, medians and parking are for illustrative purposes only and are subject to final engineering design and any relevant approvals. The detail reflects the intent of the road network standards preferred for this subdivision. All dimensions and areas depicted on this Plan are subject to pre-cal and final survey and may vary from the figures shown.
7 Bushfire attack level to be reviewed prior to the creation of titles. Development may require construction in accordance with AS3959 - Construction in Bushfire Prone Areas.
8 Road widening to accommodate future road upgrade to boulevard standard. Construction requirements to be negotiated at subdivision stage of development.
PUBLIC OPEN SPACE TABLE
POS | CREDITABLE AREA (ha) | POS | CREDITABLE AREA (ha)
A 0.4028 | I 0.2388
B 0.2603 | J 0.1618
C 0.8966 | K 0.3439
D 0.2305 | L 0.2328
E 0.5242 | M 0.8281
F 5.3703 | N 0.4755
G 0.4331 | O 0.7076
H 0.3574
TOTAL AREA OF POS & DRAINAGE 11.4637
% OF GROSS LANDHOLDING 10.69%
LOCAL STRUCTURE PLAN
Lot 1507 Eighty Road, Baldivis
A Rockingham Park Project
PARKLAND HEIGHTS BALDIVIS
0m 50 100m
s: 1:5,500@A3
d:April 12
j: 00/075
figure 14

APPENDIX B

SIDRA INTERSECTION ANALYSIS

Table B1a. SIDRA results – Nairn Drive / Road NW1 – 2031 AM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
4	L	5	0.0	0.558	8.7	LOS A	0.0	0.0	0.00	1.41	53.1
5	T	1069	2.0	0.558	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		1075	2.0	0.558	0.0	NA	0.0	0.0	0.00	0.01	69.9
North: Nairn Dr (N)											
11	T	460	2.0	0.239	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	5	0.0	0.013	17.0	LOS C	0.0	0.3	0.78	0.87	43.8
Approach		465	2.0	0.239	0.2	NA	0.0	0.3	0.01	0.01	69.6
West: NW1 (W)											
1	L	11	0.0	0.028	15.9	LOS C	0.1	0.6	0.77	0.92	38.4
Approach		11	0.0	0.028	15.9	LOS C	0.1	0.6	0.77	0.92	38.4
All Vehicles		1551	2.0	0.558	0.2	NA	0.1	0.6	0.01	0.01	69.4

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	5	1069	0	1075	2.0	1925	0.558	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	5	1069	0	1075	2.0		0.558		0.0	NA	0.0	0.0				
North: Nairn Dr (N)																
Lane 1	0	460	0	460	2.0	1925	0.239	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	5	5	0.0	401	0.013	100	17.0	LOS C	0.0	0.3	90	Turn Bay	0.0	0.0
Approach	0	460	5	465	2.0		0.239		0.2	NA	0.0	0.3				
West: NW1 (W)																
Lane 1	11	0	0	11	0.0	379	0.028	100	15.9	LOS C	0.1	0.6	500	–	0.0	0.0
Approach	11	0	0	11	0.0		0.028		15.9	LOS C	0.1	0.6				
Intersection				1551	2.0		0.558		0.2	NA	0.1	0.6				

Table B1b. SIDRA results – Nairn Drive / Road NW1 – 2031 PM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
4	L	5	0.0	0.241	8.7	LOS A	0.0	0.0	0.00	1.41	53.1
5	T	458	2.0	0.241	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		463	2.0	0.241	0.1	NA	0.0	0.0	0.00	0.02	69.8
North: Nairn Dr (N)											
11	T	1075	2.0	0.558	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	11	0.0	0.009	10.4	LOS B	0.0	0.3	0.47	0.66	50.6
Approach		1085	2.0	0.558	0.1	NA	0.0	0.3	0.00	0.01	69.8
West: NW1 (W)											
1	L	5	0.0	0.005	9.2	LOS A	0.0	0.1	0.44	0.63	43.1
Approach		5	0.0	0.005	9.2	LOS A	0.0	0.1	0.44	0.63	43.1
All Vehicles		1554	2.0	0.558	0.1	NA	0.0	0.3	0.00	0.01	69.6

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	5	458	0	463	2.0	1924	0.241	100	0.1	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	5	458	0	463	2.0		0.241		0.1	NA	0.0	0.0				
North: Nairn Dr (N)																
Lane 1	0	1075	0	1075	2.0	1925	0.558	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	11	11	0.0	1131	0.009	100	10.4	LOS B	0.0	0.3	90	Turn Bay	0.0	0.0
Approach	0	1075	11	1085	2.0		0.558		0.1	NA	0.0	0.3				
West: NW1 (W)																
Lane 1	5	0	0	5	0.0	1046	0.005	100	9.2	LOS A	0.0	0.1	500	–	0.0	0.0
Approach	5	0	0	5	0.0		0.005		9.2	LOS A	0.0	0.1				
Intersection				1554	2.0		0.558		0.1	NA	0.0	0.3				

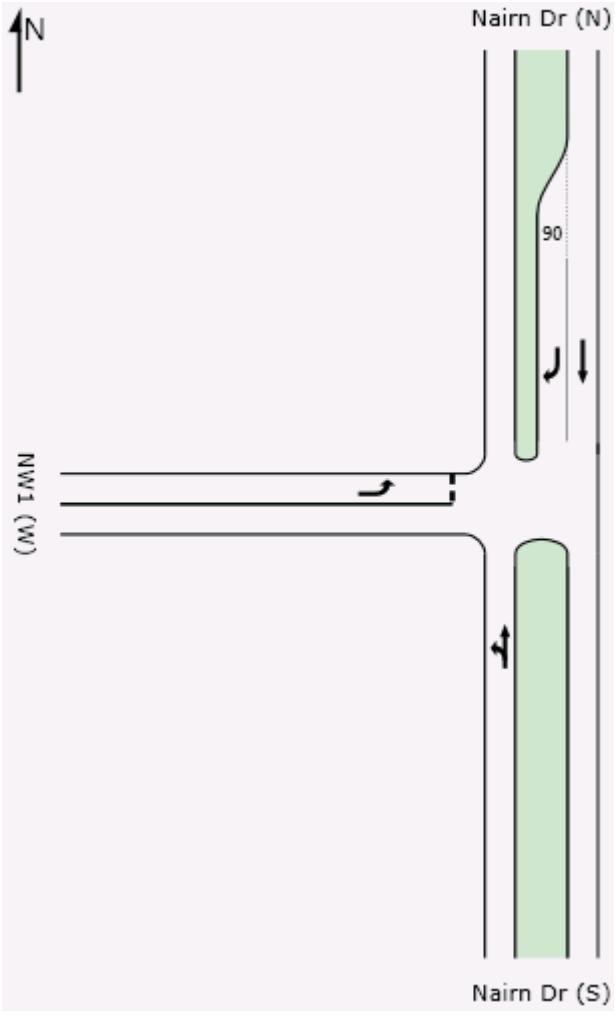


Figure B1. Intersection layout analysed in SIDRA

Table B2a. SIDRA results – Nairn Drive / Road NE1 – 2031 AM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
11	T	1069	2.0	0.556	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	5	0.0	0.005	10.4	LOS B	0.0	0.1	0.47	0.64	50.6
Approach		1075	2.0	0.556	0.1	NA	0.0	0.1	0.00	0.00	69.9
East: NE1 (E)											
1	L	8	0.0	0.008	9.2	LOS A	0.0	0.2	0.44	0.64	43.1
Approach		8	0.0	0.008	9.2	LOS A	0.0	0.2	0.44	0.64	43.1
North: Nairn Dr (N)											
4	L	16	0.0	0.239	8.7	LOS A	0.0	0.0	0.00	1.41	53.1
5	T	444	2.0	0.239	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		460	1.9	0.239	0.3	NA	0.0	0.0	0.00	0.05	69.3
All Vehicles		1543	2.0	0.556	0.2	NA	0.0	0.2	0.00	0.02	69.5

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	0	1069	0	1069	2.0	1925	0.556	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	5	5	0.0	1136	0.005	100	10.4	LOS B	0.0	0.1	90	Turn Bay	0.0	0.0
Approach	0	1069	5	1075	2.0		0.556		0.1	NA	0.0	0.1				
East: NE1 (E)																
Lane 1	8	0	0	8	0.0	1056	0.008	100	9.2	LOS A	0.0	0.2	500	–	0.0	0.0
Approach	8	0	0	8	0.0		0.008		9.2	LOS A	0.0	0.2				
North: Nairn Dr (N)																
Lane 1	16	444	0	460	1.9	1923	0.239	100	0.3	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	16	444	0	460	1.9		0.239		0.3	NA	0.0	0.0				
Intersection				1543	2.0		0.556		0.2	NA	0.0	0.2				

Table B2b. SIDRA results – Nairn Drive / Road NE1 – 2031 PM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
11	T	458	2.0	0.238	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	8	0.0	0.021	17.1	LOS C	0.1	0.5	0.78	0.91	43.7
Approach		466	2.0	0.238	0.3	NA	0.1	0.5	0.01	0.02	69.3
East: NE1 (E)											
1	L	5	0.0	0.013	15.4	LOS C	0.0	0.3	0.76	0.87	38.8
Approach		5	0.0	0.013	15.4	LOS C	0.0	0.3	0.76	0.87	38.8
North: Nairn Dr (N)											
4	L	38	0.0	0.559	8.7	LOS A	0.0	0.0	0.00	1.41	53.1
5	T	1037	2.0	0.559	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		1075	1.9	0.559	0.3	NA	0.0	0.0	0.00	0.05	69.3
All Vehicles		1546	1.9	0.559	0.4	NA	0.1	0.5	0.01	0.04	69.1

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	0	458	0	458	2.0	1925	0.238	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	8	8	0.0	401	0.021	100	17.1	LOS C	0.1	0.5	90	Turn Bay	0.0	0.0
Approach	0	458	8	466	2.0		0.238		0.3	NA	0.1	0.5				
East: NE1 (E)																
Lane 1	5	0	0	5	0.0	394	0.013	100	15.4	LOS C	0.0	0.3	500	–	0.0	0.0
Approach	5	0	0	5	0.0		0.013		15.4	LOS C	0.0	0.3				
North: Nairn Dr (N)																
Lane 1	38	1037	0	1075	1.9	1923	0.559	100	0.3	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	38	1037	0	1075	1.9		0.559		0.3	NA	0.0	0.0				
Intersection				1546	1.9		0.559		0.4	NA	0.1	0.5				

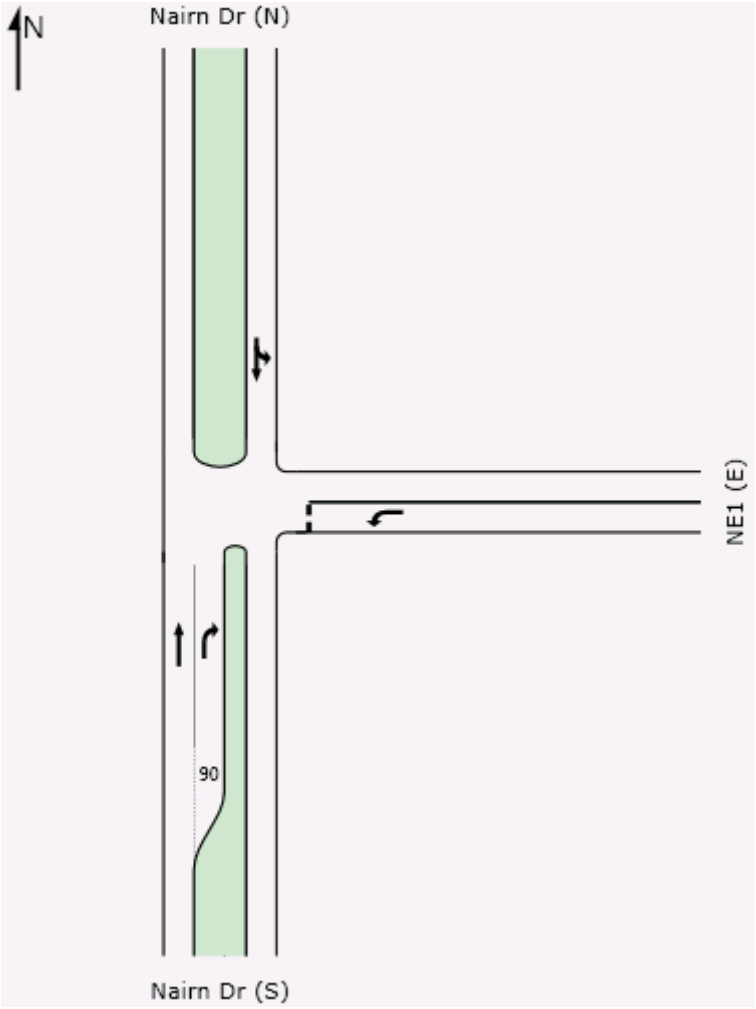


Figure B2. Intersection layout analysed in SIDRA

Table B3a. SIDRA results – Nairn Drive / Road NC2 – 2031 AM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
1	L	14	1.0	0.693	7.3	LOS A	6.4	45.6	0.46	0.57	53.2
2	T	981	2.0	0.693	7.7	LOS A	6.4	45.6	0.46	0.54	54.1
3	R	37	1.0	0.693	12.1	LOS B	6.4	45.6	0.46	0.78	49.7
Approach		1032	2.0	0.693	7.9	LOS A	6.4	45.6	0.46	0.55	53.9
East: NC2 (E)											
4	L	35	1.0	0.113	6.7	LOS A	0.5	3.7	0.45	0.58	44.5
5	T	37	1.0	0.113	4.4	LOS A	0.5	3.7	0.45	0.47	43.4
6	R	58	1.0	0.113	12.5	LOS B	0.5	3.7	0.45	0.77	42.2
Approach		129	1.0	0.113	8.7	LOS A	0.5	3.7	0.45	0.63	43.1
North: Nairn Dr (N)											
7	L	13	1.0	0.293	6.7	LOS A	1.5	10.9	0.19	0.54	55.0
8	T	411	2.0	0.293	7.2	LOS A	1.5	10.9	0.19	0.50	56.3
9	R	25	1.0	0.293	11.5	LOS B	1.5	10.9	0.19	0.86	49.8
Approach		448	1.9	0.293	7.4	LOS A	1.5	10.9	0.19	0.52	55.9
West: NC2 (W)											
10	L	39	1.0	0.111	12.1	LOS B	0.7	5.2	0.85	0.80	41.4
11	T	23	1.0	0.111	9.7	LOS A	0.7	5.2	0.85	0.77	40.0
12	R	5	1.0	0.111	17.8	LOS B	0.7	5.2	0.85	0.86	39.1
Approach		67	1.0	0.111	11.7	LOS B	0.7	5.2	0.85	0.79	40.7
All Vehicles		1677	1.8	0.693	8.0	LOS A	6.4	45.6	0.40	0.56	52.7

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	14	981	37	1032	2.0	1489	0.693	100	7.9	LOS A	6.4	45.6	500	–	0.0	0.0
Approach	14	981	37	1032	2.0		0.693		7.9	LOS A	6.4	45.6				
East: NC2 (E)																
Lane 1	35	37	58	129	1.0	1142	0.113	100	8.7	LOS A	0.5	3.7	500	–	0.0	0.0
Approach	35	37	58	129	1.0		0.113		8.7	LOS A	0.5	3.7				
North: Nairn Dr (N)																
Lane 1	13	411	25	448	1.9	1528	0.293	100	7.4	LOS A	1.5	10.9	500	–	0.0	0.0
Approach	13	411	25	448	1.9		0.293		7.4	LOS A	1.5	10.9				
West: NC2 (W)																
Lane 1	39	23	5	67	1.0	609	0.111	100	11.7	LOS B	0.7	5.2	500	–	0.0	0.0
Approach	39	23	5	67	1.0		0.111		11.7	LOS B	0.7	5.2				
Intersection				1677	1.8		0.693		8.0	LOS A	6.4	45.6				

Table B3b. SIDRA results – Nairn Drive / Road NC2 – 2031 PM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
1	L	33	1.0	0.373	6.9	LOS A	2.2	15.3	0.30	0.55	54.1
2	T	420	2.0	0.373	7.4	LOS A	2.2	15.3	0.30	0.51	55.3
3	R	86	1.0	0.373	11.7	LOS B	2.2	15.3	0.30	0.81	49.6
Approach		539	1.8	0.373	8.1	LOS A	2.2	15.3	0.30	0.56	54.3
East: NC2 (E)											
4	L	15	1.0	0.118	11.2	LOS B	0.8	5.5	0.83	0.79	41.9
5	T	37	1.0	0.118	8.9	LOS A	0.8	5.5	0.83	0.75	40.6
6	R	25	1.0	0.118	17.0	LOS B	0.8	5.5	0.83	0.85	39.6
Approach		77	1.0	0.118	12.0	LOS B	0.8	5.5	0.83	0.79	40.4
North: Nairn Dr (N)											
7	L	29	1.0	0.694	7.3	LOS A	6.2	44.3	0.43	0.56	53.4
8	T	957	2.0	0.694	7.7	LOS A	6.2	44.3	0.43	0.53	54.3
9	R	58	1.0	0.694	12.0	LOS B	6.2	44.3	0.43	0.79	49.7
Approach		1044	1.9	0.694	7.9	LOS A	6.2	44.3	0.43	0.55	54.0
West: NC2 (W)											
10	L	17	1.0	0.042	7.0	LOS A	0.2	1.4	0.50	0.59	44.5
11	T	23	1.0	0.042	4.7	LOS A	0.2	1.4	0.50	0.49	43.4
12	R	5	1.0	0.042	12.8	LOS B	0.2	1.4	0.50	0.78	42.3
Approach		45	1.0	0.042	6.5	LOS A	0.2	1.4	0.50	0.56	43.7
All Vehicles		1705	1.8	0.694	8.1	LOS A	6.2	44.3	0.41	0.56	53.0

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	33	420	86	539	1.8	1444	0.373	100	8.1	LOS A	2.2	15.3	500	–	0.0	0.0
Approach	33	420	86	539	1.8		0.373		8.1	LOS A	2.2	15.3				
East: NC2 (E)																
Lane 1	15	37	25	77	1.0	654	0.118	100	12.0	LOS B	0.8	5.5	500	–	0.0	0.0
Approach	15	37	25	77	1.0		0.118		12.0	LOS B	0.8	5.5				
North: Nairn Dr (N)																
Lane 1	29	957	58	1044	1.9	1504	0.694	100	7.9	LOS A	6.2	44.3	500	–	0.0	0.0
Approach	29	957	58	1044	1.9		0.694		7.9	LOS A	6.2	44.3				
West: NC2 (W)																
Lane 1	17	23	5	45	1.0	1065	0.042	100	6.5	LOS A	0.2	1.4	500	–	0.0	0.0
Approach	17	23	5	45	1.0		0.042		6.5	LOS A	0.2	1.4				
Intersection				1705	1.8		0.694		8.1	LOS A	6.2	44.3				

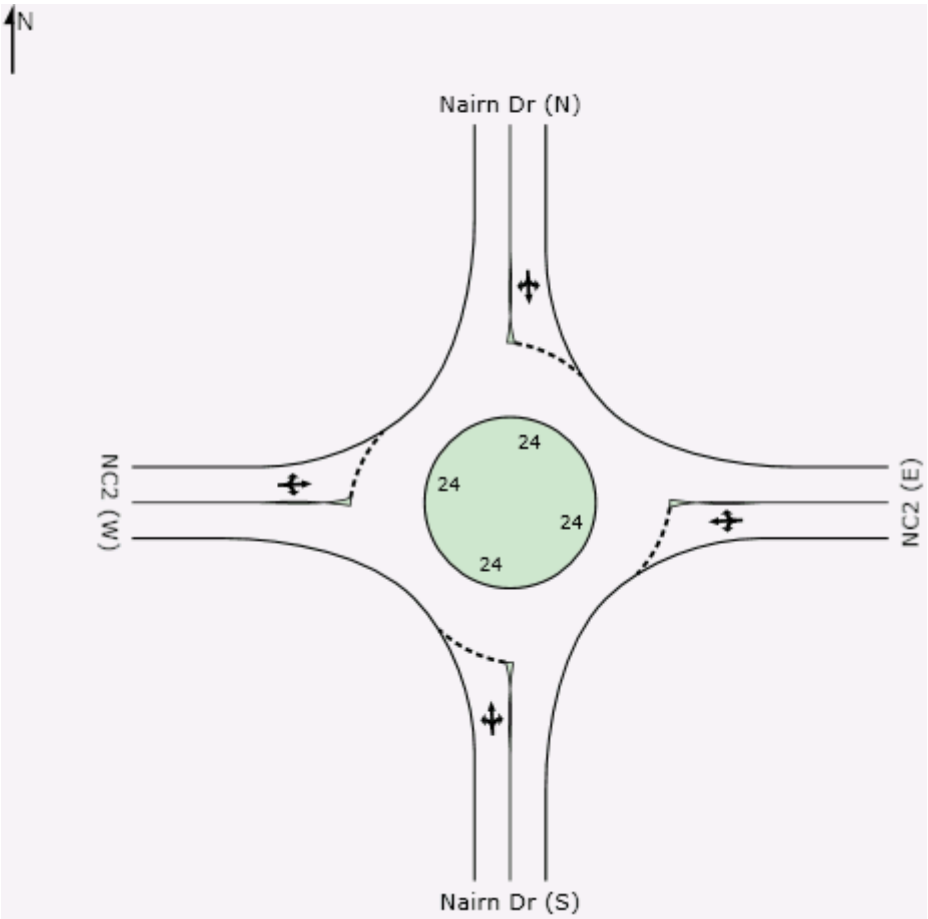


Figure B3. Intersection layout analysed in SIDRA

Table B4a. SIDRA results – Nairn Drive / Road NC1 – 2031 AM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
1	L	5	1.0	0.660	7.8	LOS A	5.5	39.2	0.57	0.64	52.5
2	T	869	2.0	0.660	8.3	LOS A	5.5	39.2	0.57	0.62	53.2
3	R	16	1.0	0.660	12.6	LOS B	5.5	39.2	0.57	0.81	49.7
Approach		891	2.0	0.660	8.4	LOS A	5.5	39.2	0.57	0.62	53.2
East: NC1 (E)											
4	L	15	1.0	0.190	6.7	LOS A	0.9	6.4	0.45	0.57	44.3
5	T	21	1.0	0.190	4.3	LOS A	0.9	6.4	0.45	0.46	43.1
6	R	187	1.0	0.190	12.4	LOS B	0.9	6.4	0.45	0.73	41.7
Approach		223	1.0	0.190	11.3	LOS B	0.9	6.4	0.45	0.70	42.0
North: Nairn Dr (N)											
7	L	116	1.0	0.317	6.7	LOS A	1.8	13.1	0.20	0.53	54.9
8	T	363	2.0	0.317	7.1	LOS A	1.8	13.1	0.20	0.49	56.2
9	R	11	1.0	0.317	11.5	LOS B	1.8	13.1	0.20	0.84	49.7
Approach		489	1.7	0.317	7.1	LOS A	1.8	13.1	0.20	0.51	55.8
West: NC1 (W)											
10	L	26	1.0	0.114	12.0	LOS B	0.8	5.5	0.86	0.80	41.2
11	T	22	1.0	0.114	9.7	LOS A	0.8	5.5	0.86	0.78	39.9
12	R	20	1.0	0.114	17.8	LOS B	0.8	5.5	0.86	0.85	39.0
Approach		68	1.0	0.114	13.0	LOS B	0.8	5.5	0.86	0.81	40.1
All Vehicles		1672	1.7	0.660	8.6	LOS A	5.5	39.2	0.46	0.60	51.3

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	5	869	16	891	2.0	1349	0.660	100	8.4	LOS A	5.5	39.2	500	–	0.0	0.0
Approach	5	869	16	891	2.0		0.660		8.4	LOS A	5.5	39.2				
East: NC1 (E)																
Lane 1	15	21	187	223	1.0	1174	0.190	100	11.3	LOS B	0.9	6.4	500	–	0.0	0.0
Approach	15	21	187	223	1.0		0.190		11.3	LOS B	0.9	6.4				
North: Nairn Dr (N)																
Lane 1	116	363	11	489	1.7	1544	0.317	100	7.1	LOS A	1.8	13.1	500	–	0.0	0.0
Approach	116	363	11	489	1.7		0.317		7.1	LOS A	1.8	13.1				
West: NC1 (W)																
Lane 1	26	22	20	68	1.0	600	0.114	100	13.0	LOS B	0.8	5.5	500	–	0.0	0.0
Approach	26	22	20	68	1.0		0.114		13.0	LOS B	0.8	5.5				
Intersection				1672	1.7		0.660		8.6	LOS A	5.5	39.2				

Table B4b. SIDRA results – Nairn Drive / Road NC1 – 2031 PM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
1	L	13	1.0	0.283	6.9	LOS A	1.5	11.0	0.29	0.56	54.3
2	T	363	2.0	0.283	7.4	LOS A	1.5	11.0	0.29	0.52	55.4
3	R	23	1.0	0.283	11.7	LOS B	1.5	11.0	0.29	0.84	49.7
Approach		399	1.9	0.283	7.6	LOS A	1.5	11.0	0.29	0.54	55.1
East: NC1 (E)											
4	L	6	1.0	0.132	9.6	LOS A	0.8	5.5	0.72	0.73	42.7
5	T	21	1.0	0.132	7.3	LOS A	0.8	5.5	0.72	0.68	41.3
6	R	80	1.0	0.132	15.4	LOS B	0.8	5.5	0.72	0.82	40.2
Approach		107	1.0	0.132	13.5	LOS B	0.8	5.5	0.72	0.79	40.5
North: Nairn Dr (N)											
7	L	162	1.0	0.640	6.8	LOS A	5.4	38.4	0.26	0.53	54.5
8	T	847	2.0	0.640	7.3	LOS A	5.4	38.4	0.26	0.49	55.7
9	R	24	1.0	0.640	11.6	LOS B	5.4	38.4	0.26	0.81	49.7
Approach		1034	1.8	0.640	7.3	LOS A	5.4	38.4	0.26	0.50	55.3
West: NC1 (W)											
10	L	12	1.0	0.038	6.7	LOS A	0.2	1.2	0.45	0.56	44.7
11	T	22	1.0	0.038	4.4	LOS A	0.2	1.2	0.45	0.45	43.6
12	R	8	1.0	0.038	12.5	LOS B	0.2	1.2	0.45	0.77	42.4
Approach		42	1.0	0.038	6.7	LOS A	0.2	1.2	0.45	0.55	43.6
All Vehicles		1582	1.8	0.640	7.8	LOS A	5.4	38.4	0.30	0.53	53.5

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	13	363	23	399	1.9	1411	0.283	100	7.6	LOS A	1.5	11.0	500	–	0.0	0.0
Approach	13	363	23	399	1.9		0.283		7.6	LOS A	1.5	11.0				
East: NC1 (E)																
Lane 1	6	21	80	107	1.0	813	0.132	100	13.5	LOS B	0.8	5.5	500	–	0.0	0.0
Approach	6	21	80	107	1.0		0.132		13.5	LOS B	0.8	5.5				
North: Nairn Dr (N)																
Lane 1	162	847	24	1034	1.8	1615	0.640	100	7.3	LOS A	5.4	38.4	500	–	0.0	0.0
Approach	162	847	24	1034	1.8		0.640		7.3	LOS A	5.4	38.4				
West: NC1 (W)																
Lane 1	12	22	8	42	1.0	1118	0.038	100	6.7	LOS A	0.2	1.2	500	–	0.0	0.0
Approach	12	22	8	42	1.0		0.038		6.7	LOS A	0.2	1.2				
Intersection				1582	1.8		0.640		7.8	LOS A	5.4	38.4				

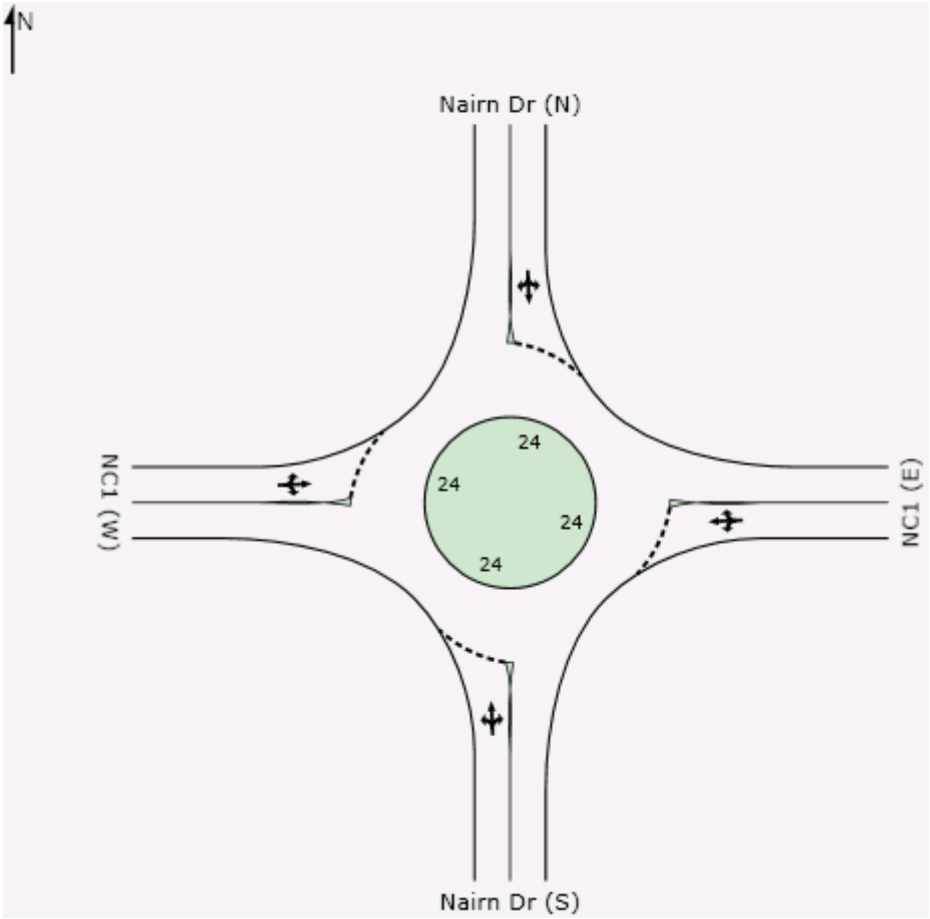


Figure B4. Intersection layout analysed in SIDRA

Table B5a. SIDRA results – Nairn Drive / Road SE2 – 2031 AM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
11	T	882	2.0	0.458	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	5	0.0	0.005	10.4	LOS B	0.0	0.1	0.42	0.65	50.8
Approach		887	2.0	0.458	0.1	NA	0.0	0.1	0.00	0.00	69.9
South East: Median (RT Stage 2)											
32	R	22	0.0	0.052	8.7	LOS A	0.2	1.0	0.71	0.79	24.7
Approach		22	0.0	0.052	8.7	LOS A	0.2	1.0	0.71	0.79	24.7
East: SE2 (E)											
1	L	13	0.0	0.035	9.3	LOS A	0.1	0.9	0.42	0.67	43.2
3	R	22	0.0	0.035	8.7	LOS A	0.1	0.9	0.42	0.65	43.1
Approach		35	0.0	0.035	8.9	LOS A	0.1	0.9	0.42	0.66	43.1
North: Nairn Dr (N)											
4	L	11	0.0	0.197	8.7	LOS A	0.0	0.0	0.00	1.41	53.1
5	T	367	2.0	0.197	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		378	1.9	0.197	0.2	NA	0.0	0.0	0.00	0.04	69.4
All Vehicles		1322	1.9	0.458	0.5	NA	0.2	1.0	0.02	0.04	68.3

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	0	882	0	882	2.0	1925	0.458	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	5	5	0.0	966	0.005	100	10.4	LOS B	0.0	0.1	90	Turn Bay	0.0	0.0
Approach	0	882	5	887	2.0		0.458		0.1	NA	0.0	0.1				
South East: Median (RT Stage 2)																
Lane 1	0	0	22	22	0.0	426	0.052	100	8.7	LOS A	0.2	1.0	6	–	0.0	0.0
Approach	0	0	22	22	0.0		0.052		8.7	LOS A	0.2	1.0				
East: SE2 (E)																
Lane 1	13	0	22	35	0.0	983	0.035	100	8.9	LOS A	0.1	0.9	500	–	0.0	0.0
Approach	13	0	22	35	0.0		0.035		8.9	LOS A	0.1	0.9				
North: Nairn Dr (N)																
Lane 1	11	367	0	378	1.9	1923	0.197	100	0.2	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	11	367	0	378	1.9		0.197		0.2	NA	0.0	0.0				
Intersection				1322	1.9		0.458		0.5	NA	0.2	1.0				

Table B5b. SIDRA results – Nairn Drive / Road SE2 – 2031 PM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
11	T	378	2.0	0.196	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	13	0.0	0.030	15.8	LOS C	0.1	0.7	0.71	0.89	44.9
Approach		391	1.9	0.196	0.5	NA	0.1	0.7	0.02	0.03	68.9
South East: Median (RT Stage 2)											
32	R	9	0.0	0.010	3.1	LOS A	0.0	0.2	0.42	0.42	33.4
Approach		9	0.0	0.010	3.1	LOS A	0.0	0.2	0.42	0.42	33.4
East: SE2 (E)											
1	L	5	0.0	0.030	13.6	LOS B	0.1	0.7	0.66	0.86	40.0
3	R	9	0.0	0.030	13.0	LOS B	0.1	0.7	0.66	0.82	39.2
Approach		15	0.0	0.030	13.2	LOS B	0.1	0.7	0.66	0.83	39.6
North: Nairn Dr (N)											
4	L	25	0.0	0.459	8.7	LOS A	0.0	0.0	0.00	1.41	53.1
5	T	857	2.0	0.459	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		882	1.9	0.459	0.3	NA	0.0	0.0	0.00	0.04	69.4
All Vehicles		1297	1.9	0.459	0.5	NA	0.1	0.7	0.02	0.05	68.6

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	0	378	0	378	2.0	1925	0.196	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	13	13	0.0	426	0.030	100	15.8	LOS C	0.1	0.7	90	Turn Bay	0.0	0.0
Approach	0	378	13	391	1.9		0.196		0.5	NA	0.1	0.7				
South East: Median (RT Stage 2)																
Lane 1	0	0	9	9	0.0	966	0.010	100	3.1	LOS A	0.0	0.2	6	–	0.0	0.0
Approach	0	0	9	9	0.0		0.010		3.1	LOS A	0.0	0.2				
East: SE2 (E)																
Lane 1	5	0	9	15	0.0	492	0.030	100	13.2	LOS B	0.1	0.7	500	–	0.0	0.0
Approach	5	0	9	15	0.0		0.030		13.2	LOS B	0.1	0.7				
North: Nairn Dr (N)																
Lane 1	25	857	0	882	1.9	1923	0.459	100	0.3	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	25	857	0	882	1.9		0.459		0.3	NA	0.0	0.0				
Intersection				1297	1.9		0.459		0.5	NA	0.1	0.7				

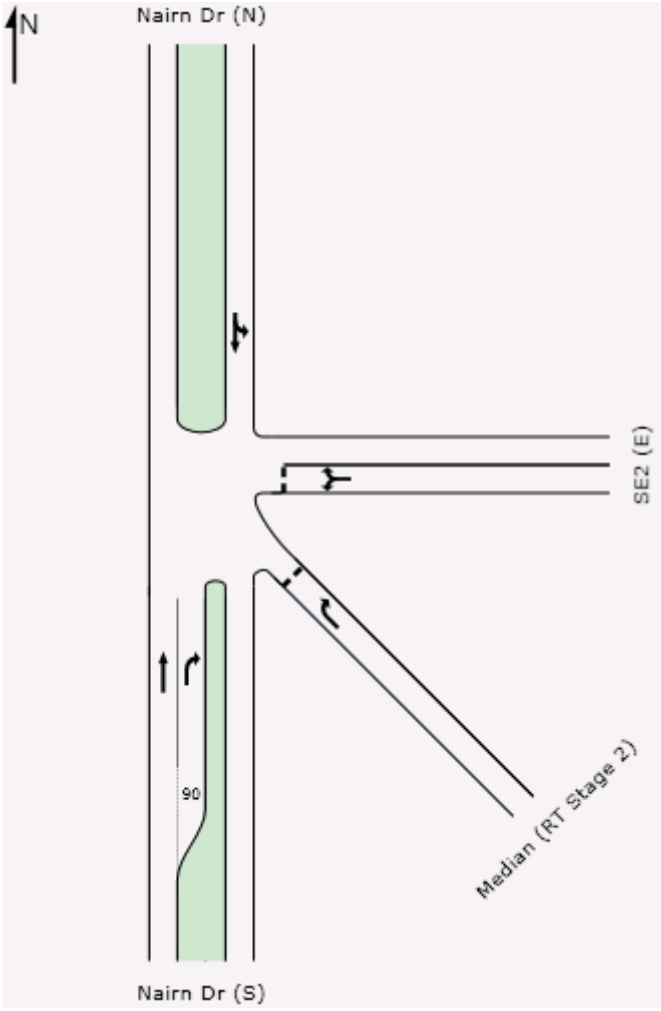


Figure B5. Intersection layout analysed in SIDRA

Note: The diagonal link shown is not an actual road link, it is a technique used in SIDRA analysis to model the right turn from the side road in two stages (first to the median then into the westbound traffic flow)

Table B6a. SIDRA results – Nairn Drive / Road SW1 – 2031 AM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
4	L	15	0.0	0.458	8.7	LOS A	0.0	0.0	0.00	1.41	53.1
5	T	866	2.0	0.458	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		881	2.0	0.458	0.1	NA	0.0	0.0	0.00	0.02	69.7
North: Nairn Dr (N)											
11	T	363	2.0	0.189	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	9	0.0	0.022	15.8	LOS C	0.1	0.5	0.71	0.87	45.0
Approach		373	1.9	0.189	0.4	NA	0.1	0.5	0.02	0.02	69.1
North West: Median (RT Stage 2)											
32	R	34	0.0	0.034	3.1	LOS A	0.1	0.8	0.42	0.44	33.4
Approach		34	0.0	0.034	3.1	LOS A	0.1	0.8	0.42	0.44	33.4
West: SW1 (W)											
1	L	28	0.0	0.129	14.2	LOS B	0.5	3.2	0.69	0.89	39.6
3	R	34	0.0	0.129	13.7	LOS B	0.5	3.2	0.69	0.89	38.7
Approach		62	0.0	0.129	13.9	LOS B	0.5	3.2	0.69	0.89	39.2
All Vehicles		1349	1.8	0.458	0.9	NA	0.5	3.2	0.05	0.07	66.9

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	15	866	0	881	2.0	1924	0.458	100	0.1	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	15	866	0	881	2.0		0.458		0.1	NA	0.0	0.0				
North: Nairn Dr (N)																
Lane 1	0	363	0	363	2.0	1925	0.189	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	9	9	0.0	427	0.022	100	15.8	LOS C	0.1	0.5	90	Turn Bay	0.0	0.0
Approach	0	363	9	373	1.9		0.189		0.4	NA	0.1	0.5				
North West: Median (RT Stage 2)																
Lane 1	0	0	34	34	0.0	983	0.034	100	3.1	LOS A	0.1	0.8	6	–	0.0	0.0
Approach	0	0	34	34	0.0		0.034		3.1	LOS A	0.1	0.8				
West: SW1 (W)																
Lane 1	28	0	34	62	0.0	480	0.129	100	13.9	LOS B	0.5	3.2	500	–	0.0	0.0
Approach	28	0	34	62	0.0		0.129		13.9	LOS B	0.5	3.2				
Intersection				1349	1.8		0.458		0.9	NA	0.5	3.2				

Table B6b. SIDRA results – Nairn Drive / Road SW1 – 2031 PM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
4	L	34	0.0	0.211	8.7	LOS A	0.0	0.0	0.00	1.39	53.1
5	T	372	2.0	0.211	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		405	1.8	0.211	0.7	NA	0.0	0.0	0.00	0.12	68.4
North: Nairn Dr (N)											
11	T	848	2.0	0.441	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	22	0.0	0.024	10.6	LOS B	0.1	0.6	0.44	0.69	50.6
Approach		871	1.9	0.441	0.3	NA	0.1	0.6	0.01	0.02	69.4
North West: Median (RT Stage 2)											
32	R	15	0.0	0.032	8.0	LOS A	0.1	0.6	0.69	0.75	25.6
Approach		15	0.0	0.032	8.0	LOS A	0.1	0.6	0.69	0.75	25.6
West: SW1 (W)											
1	L	13	0.0	0.029	9.4	LOS A	0.1	0.8	0.43	0.67	43.1
3	R	15	0.0	0.029	8.9	LOS A	0.1	0.8	0.43	0.66	43.1
Approach		27	0.0	0.029	9.1	LOS A	0.1	0.8	0.43	0.66	43.1
All Vehicles		1318	1.9	0.441	0.7	NA	0.1	0.8	0.02	0.07	68.0

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	34	372	0	405	1.8	1919	0.211	100	0.7	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	34	372	0	405	1.8		0.211		0.7	NA	0.0	0.0				
North: Nairn Dr (N)																
Lane 1	0	848	0	848	2.0	1925	0.441	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	22	22	0.0	933	0.024	100	10.6	LOS B	0.1	0.6	90	Turn Bay	0.0	0.0
Approach	0	848	22	871	1.9		0.441		0.3	NA	0.1	0.6				
North West: Median (RT Stage 2)																
Lane 1	0	0	15	15	0.0	457	0.032	100	8.0	LOS A	0.1	0.6	6	–	0.0	0.0
Approach	0	0	15	15	0.0		0.032		8.0	LOS A	0.1	0.6				
West: SW1 (W)																
Lane 1	13	0	15	27	0.0	954	0.029	100	9.1	LOS A	0.1	0.8	500	–	0.0	0.0
Approach	13	0	15	27	0.0		0.029		9.1	LOS A	0.1	0.8				
Intersection				1318	1.9		0.441		0.7	NA	0.1	0.8				

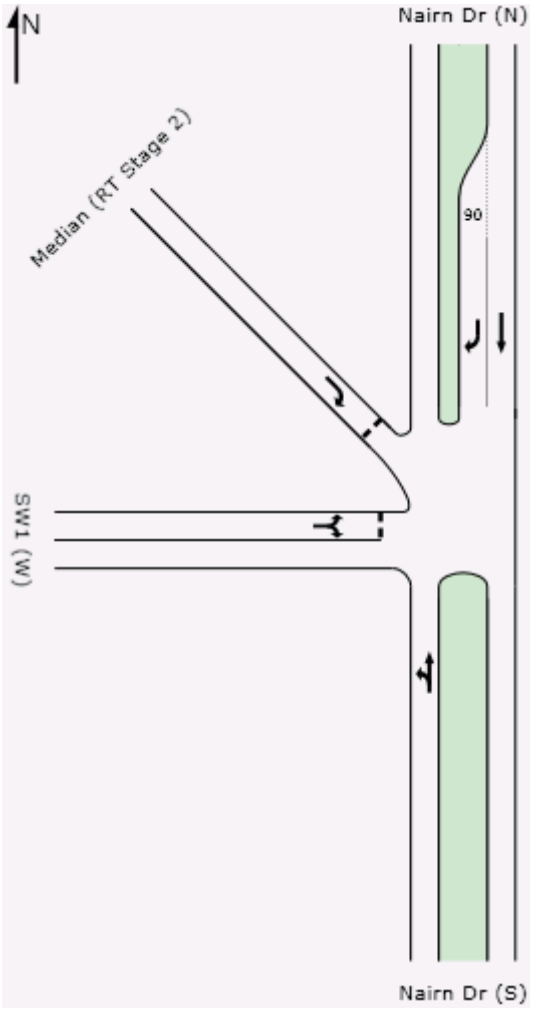


Figure B6. Intersection layout analysed in SIDRA

Note: The diagonal link shown is not an actual road link, it is a technique used in SIDRA analysis to model the right turn from the side road in two stages (first to the median then into the westbound traffic flow)

Table B7a. SIDRA results – Nairn Drive / Road SE1 – 2031 AM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
11	T	886	2.0	0.460	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	5	0.0	0.005	10.4	LOS B	0.0	0.1	0.42	0.65	50.8
Approach		892	2.0	0.460	0.1	NA	0.0	0.1	0.00	0.00	69.9
South East: Median (RT Stage 2)											
32	R	15	0.0	0.035	8.7	LOS A	0.1	0.7	0.71	0.78	24.7
Approach		15	0.0	0.035	8.7	LOS A	0.1	0.7	0.71	0.78	24.7
East: SE1 (E)											
1	L	5	0.0	0.020	9.2	LOS A	0.1	0.5	0.42	0.65	43.2
3	R	15	0.0	0.020	8.7	LOS A	0.1	0.5	0.42	0.64	43.1
Approach		20	0.0	0.020	8.8	LOS A	0.1	0.5	0.42	0.64	43.1
North: Nairn Dr (N)											
4	L	6	0.0	0.196	8.7	LOS A	0.0	0.0	0.00	1.41	53.1
5	T	372	2.0	0.196	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		378	2.0	0.196	0.1	NA	0.0	0.0	0.00	0.02	69.7
All Vehicles		1304	1.9	0.460	0.3	NA	0.1	0.7	0.02	0.03	68.9

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	0	886	0	886	2.0	1925	0.460	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	5	5	0.0	966	0.005	100	10.4	LOS B	0.0	0.1	90	Turn Bay	0.0	0.0
Approach	0	886	5	892	2.0		0.460		0.1	NA	0.0	0.1				
South East: Median (RT Stage 2)																
Lane 1	0	0	15	15	0.0	423	0.035	100	8.7	LOS A	0.1	0.7	6	–	0.0	0.0
Approach	0	0	15	15	0.0		0.035		8.7	LOS A	0.1	0.7				
East: SE1 (E)																
Lane 1	5	0	15	20	0.0	982	0.020	100	8.8	LOS A	0.1	0.5	500	–	0.0	0.0
Approach	5	0	15	20	0.0		0.020		8.8	LOS A	0.1	0.5				
North: Nairn Dr (N)																
Lane 1	6	372	0	378	2.0	1924	0.196	100	0.1	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	6	372	0	378	2.0		0.196		0.1	NA	0.0	0.0				
Intersection				1304	1.9		0.460		0.3	NA	0.1	0.7				

Table B7b. SIDRA results – Nairn Drive / Road SE1 – 2031 PM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
11	T	380	2.0	0.197	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
12	R	5	0.0	0.012	15.7	LOS C	0.0	0.3	0.71	0.83	45.0
Approach		385	2.0	0.197	0.2	NA	0.0	0.3	0.01	0.01	69.5
South East: Median (RT Stage 2)											
32	R	6	0.0	0.007	3.1	LOS A	0.0	0.1	0.42	0.41	33.4
Approach		6	0.0	0.007	3.1	LOS A	0.0	0.1	0.42	0.41	33.4
East: SE1 (E)											
1	L	5	0.0	0.024	13.7	LOS B	0.1	0.6	0.67	0.85	39.9
3	R	6	0.0	0.024	13.2	LOS B	0.1	0.6	0.67	0.81	39.1
Approach		12	0.0	0.024	13.4	LOS B	0.1	0.6	0.67	0.83	39.5
North: Nairn Dr (N)											
4	L	15	0.0	0.459	8.7	LOS A	0.0	0.0	0.00	1.41	53.1
5	T	867	2.0	0.459	0.0	LOS A	0.0	0.0	0.00	0.00	70.0
Approach		882	2.0	0.459	0.1	NA	0.0	0.0	0.00	0.02	69.7
All Vehicles		1285	1.9	0.459	0.3	NA	0.1	0.6	0.01	0.03	69.1

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	0	380	0	380	2.0	1925	0.197	100	0.0	LOS A	0.0	0.0	500	–	0.0	0.0
Lane 2	0	0	5	5	0.0	426	0.012	100	15.7	LOS C	0.0	0.3	90	Turn Bay	0.0	0.0
Approach	0	380	5	385	2.0		0.197		0.2	NA	0.0	0.3				
South East: Median (RT Stage 2)																
Lane 1	0	0	6	6	0.0	963	0.007	100	3.1	LOS A	0.0	0.1	6	–	0.0	0.0
Approach	0	0	6	6	0.0		0.007		3.1	LOS A	0.0	0.1				
East: SE1 (E)																
Lane 1	5	0	6	12	0.0	481	0.024	100	13.4	LOS B	0.1	0.6	500	–	0.0	0.0
Approach	5	0	6	12	0.0		0.024		13.4	LOS B	0.1	0.6				
North: Nairn Dr (N)																
Lane 1	15	867	0	882	2.0	1924	0.459	100	0.1	LOS A	0.0	0.0	500	–	0.0	0.0
Approach	15	867	0	882	2.0		0.459		0.1	NA	0.0	0.0				
Intersection				1285	1.9		0.459		0.3	NA	0.1	0.6				

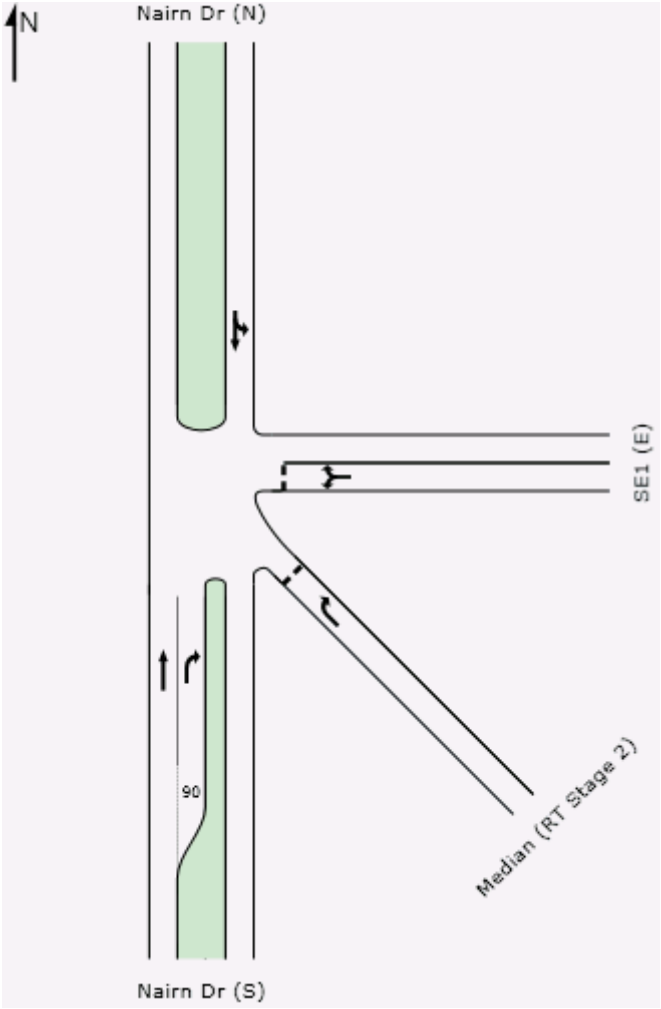


Figure B7. Intersection layout analysed in SIDRA

Note: The diagonal link shown is not an actual road link, it is a technique used in SIDRA analysis to model the right turn from the side road in two stages (first to the median then into the westbound traffic flow)

Table B8a. SIDRA results – Nairn Drive / Eighty Road – 2031 AM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
1	L	139	1.0	0.603	7.8	LOS A	4.9	35.2	0.16	0.56	55.8
2	T	873	2.0	0.603	7.1	LOS A	4.9	35.2	0.16	0.48	56.6
3	R	11	1.0	0.603	11.4	LOS B	4.9	35.2	0.16	0.86	49.8
Approach		1022	1.9	0.603	7.2	LOS A	4.9	35.2	0.16	0.50	56.4
East: Eighty Rd (E)											
4	L	24	1.0	0.038	6.6	LOS A	0.2	1.2	0.42	0.54	44.7
5	T	5	1.0	0.038	5.7	LOS A	0.2	1.2	0.42	0.49	45.0
6	R	14	1.0	0.038	12.3	LOS B	0.2	1.2	0.42	0.74	42.2
Approach		43	1.0	0.038	8.3	LOS A	0.2	1.2	0.42	0.60	43.9
North: Nairn Dr (N)											
7	L	6	1.0	0.254	6.7	LOS A	1.4	9.6	0.21	0.55	54.9
8	T	366	2.0	0.254	7.2	LOS A	1.4	9.6	0.21	0.50	56.1
9	R	5	1.0	0.254	13.5	LOS B	1.4	9.6	0.21	0.85	50.7
Approach		378	2.0	0.254	7.3	LOS A	1.4	9.6	0.21	0.51	56.0
West: Eighty Rd (W)											
10	L	5	1.0	0.085	12.0	LOS B	0.5	3.4	0.69	0.73	50.6
11	T	5	1.0	0.085	10.0	LOS A	0.5	3.4	0.69	0.68	49.6
12	R	60	1.0	0.085	17.7	LOS B	0.5	3.4	0.69	0.80	46.7
Approach		71	1.0	0.085	16.7	LOS B	0.5	3.4	0.69	0.78	47.1
All Vehicles		1514	1.8	0.603	7.7	LOS A	4.9	35.2	0.20	0.51	55.3

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	139	873	11	1022	1.9	1695	0.603	100	7.2	LOS A	4.9	35.2	500	–	0.0	0.0
Approach	139	873	11	1022	1.9		0.603		7.2	LOS A	4.9	35.2				
East: Eighty Rd (E)																
Lane 1	24	5	14	43	1.0	1149	0.038	100	8.3	LOS A	0.2	1.2	500	–	0.0	0.0
Approach	24	5	14	43	1.0		0.038		8.3	LOS A	0.2	1.2				
North: Nairn Dr (N)																
Lane 1	6	366	5	378	2.0	1489	0.254	100	7.3	LOS A	1.4	9.6	500	–	0.0	0.0
Approach	6	366	5	378	2.0		0.254		7.3	LOS A	1.4	9.6				
West: Eighty Rd (W)																
Lane 1	5	5	60	71	1.0	830	0.085	100	16.7	LOS B	0.5	3.4	500	–	0.0	0.0
Approach	5	5	60	71	1.0		0.085		16.7	LOS B	0.5	3.4				
Intersection				1514	1.8		0.603		7.7	LOS A	4.9	35.2				

Table B8b. SIDRA results – Nairn Drive / Eighty Road – 2031 PM peak

Movement Performance - Vehicles

Mov ID	Turn	Demand Flow veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate per veh	Average Speed km/h
South: Nairn Dr (S)											
1	L	60	1.0	0.273	7.7	LOS A	1.5	10.7	0.09	0.57	56.3
2	T	374	2.0	0.273	7.0	LOS A	1.5	10.7	0.09	0.49	57.2
3	R	24	1.0	0.273	11.3	LOS B	1.5	10.7	0.09	0.89	49.8
Approach		458	1.8	0.273	7.3	LOS A	1.5	10.7	0.09	0.52	56.6
East: Eighty Rd (E)											
4	L	11	1.0	0.033	10.6	LOS B	0.2	1.4	0.79	0.69	42.3
5	T	5	1.0	0.033	9.7	LOS A	0.2	1.4	0.79	0.67	42.6
6	R	6	1.0	0.033	16.3	LOS B	0.2	1.4	0.79	0.76	39.9
Approach		22	1.0	0.033	12.0	LOS B	0.2	1.4	0.79	0.71	41.6
North: Nairn Dr (N)											
7	L	14	1.0	0.618	7.4	LOS A	4.9	34.6	0.47	0.60	53.2
8	T	854	2.0	0.618	7.9	LOS A	4.9	34.6	0.47	0.57	54.0
9	R	5	1.0	0.618	14.2	LOS B	4.9	34.6	0.47	0.80	50.5
Approach		873	2.0	0.618	7.9	LOS A	4.9	34.6	0.47	0.57	54.0
West: Eighty Rd (W)											
10	L	5	1.0	0.127	9.0	LOS A	0.6	4.0	0.42	0.61	53.2
11	T	5	1.0	0.127	6.9	LOS A	0.6	4.0	0.42	0.53	52.4
12	R	139	1.0	0.127	14.6	LOS B	0.6	4.0	0.42	0.73	48.9
Approach		149	1.0	0.127	14.2	LOS B	0.6	4.0	0.42	0.72	49.2
All Vehicles		1502	1.8	0.618	8.4	LOS A	4.9	34.6	0.35	0.57	54.0

Lane Use and Performance

	Demand Flows L veh/h	T veh/h	R veh/h	Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Lane Length m	SL Type	Cap. Adj. %	Prob. Block. %
South: Nairn Dr (S)																
Lane 1	60	374	24	458	1.8	1676	0.273	100	7.3	LOS A	1.5	10.7	500	–	0.0	0.0
Approach	60	374	24	458	1.8		0.273		7.3	LOS A	1.5	10.7				
East: Eighty Rd (E)																
Lane 1	11	5	6	22	1.0	678	0.033	100	12.0	LOS B	0.2	1.4	500	–	0.0	0.0
Approach	11	5	6	22	1.0		0.033		12.0	LOS B	0.2	1.4				
North: Nairn Dr (N)																
Lane 1	14	854	5	873	2.0	1412	0.618	100	7.9	LOS A	4.9	34.6	500	–	0.0	0.0
Approach	14	854	5	873	2.0		0.618		7.9	LOS A	4.9	34.6				
West: Eighty Rd (W)																
Lane 1	5	5	139	149	1.0	1178	0.127	100	14.2	LOS B	0.6	4.0	500	–	0.0	0.0
Approach	5	5	139	149	1.0		0.127		14.2	LOS B	0.6	4.0				
Intersection				1502	1.8		0.618		8.4	LOS A	4.9	34.6				

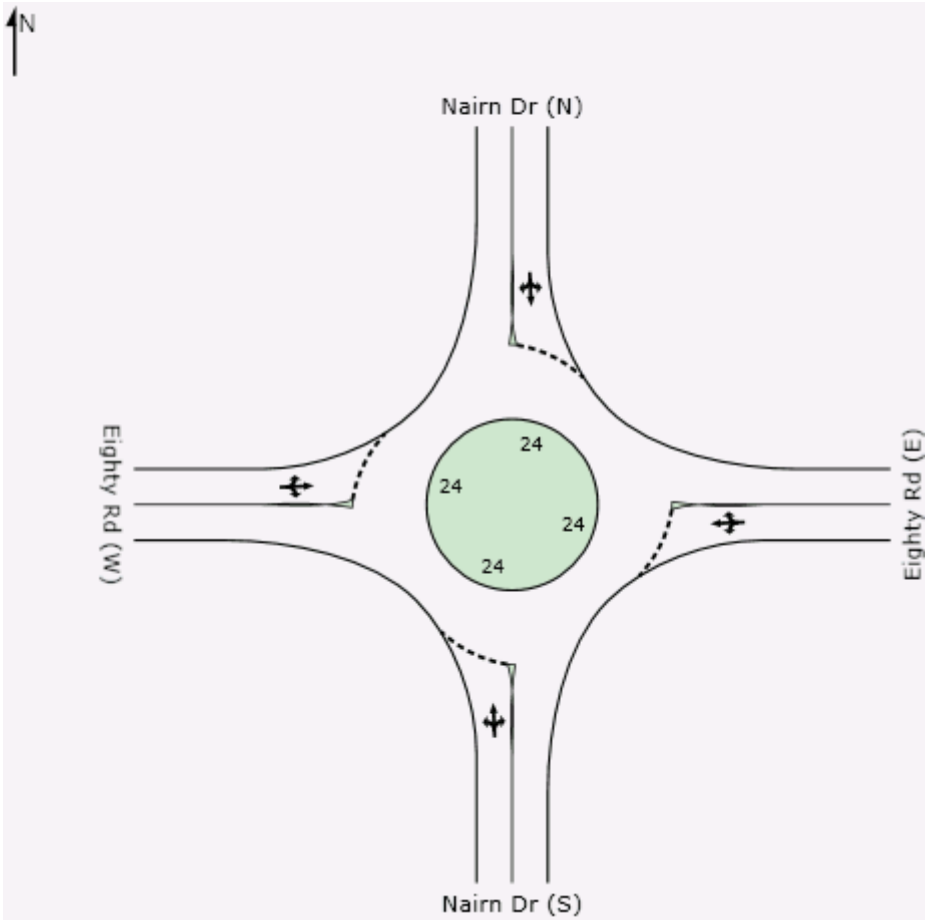


Figure B8. Intersection layout analysed in SIDRA