Transport Impact Assessment

Byford Structure Plan

CW1039600

Prepared for

Shire of Serpentine Jarrahdale

29 June 2020

Cardno

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1 Introduction

1.1 Background

Cardno was commissioned by the Shire of Serpentine to prepare a Transport Impact Assessment for the proposed Byford District Structure Plan (BDSP) ('the Site' or 'the Structure Plan').

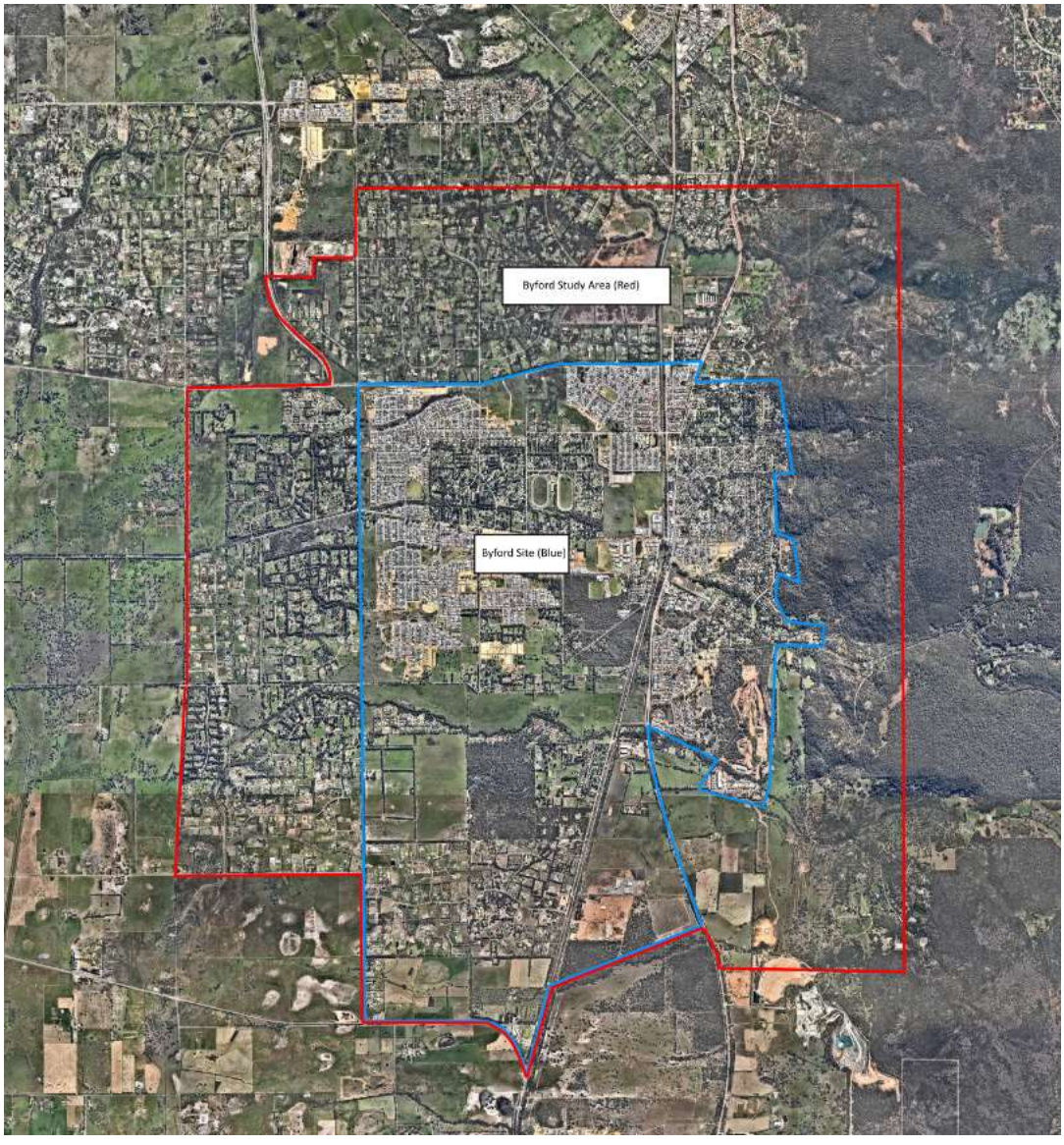
This report has been prepared in accordance with the Western Australian Planning Commission (WAPC) *Transport Impact Assessment Guidelines Volume 2 – Planning Schemes, Structure Plans & Activity Centre Plans (2016).* This report will support the detailed structure planning for the locality by evaluating the sufficiency of existing and proposed intersection treatments across the Structure Plan Area.

1.2 Site Location and Description

The suburbs in the Shire of Serpentine Jarrahdale include Byford, Mundijong, Serpentine, Jarrahdale and Keysbrook. The Site covers in Byford, in the Shire of Serpentine Jarrahdale on the south-eastern edge of Perth with a population of 16,871 as of 2017 and with a density of 9.44 persons per hectare. The land area of Byford is 1,787 hectares, most of which is recent and developing with an industrial area and some commercial use of land.

Figure 1-1 depicts the location of the site and the study area within the structure plan.

Figure 1-1 Study Area

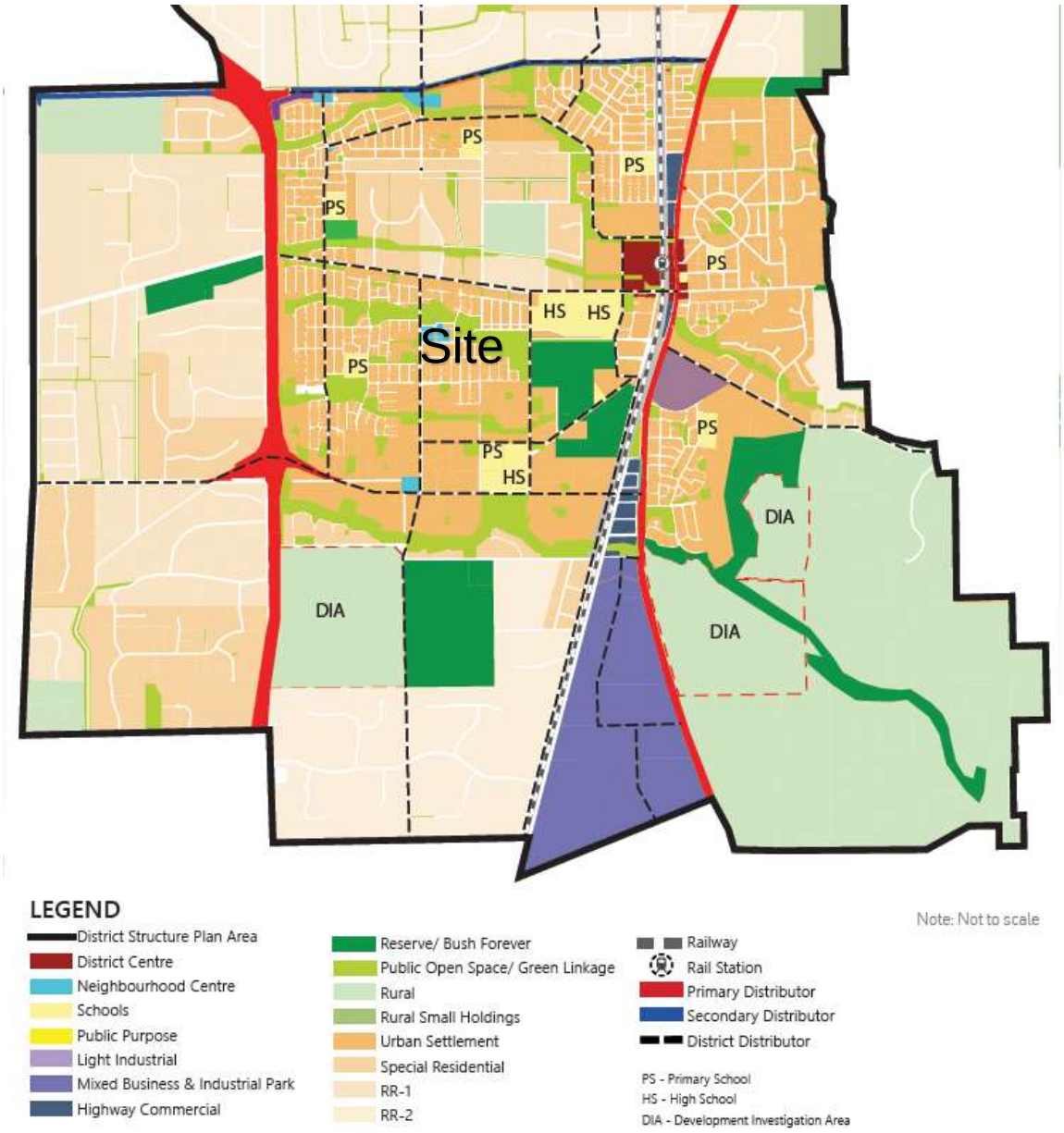


Source: Nearmap

Figure 1-2 shows the Byford structure plan area with the different types of developments including residential, commercial and urban areas.

The structure plan covers an area of 5,530 hectares of which predominant areas are urban or remnant rural residential zoned for future development. The main features in the structure plan area comprise the Byford Town Centre Precinct, Byford Trotting Complex Precinct and Briggs Park Sport and Education Precinct.

Figure 1-2 Structure Plan Location

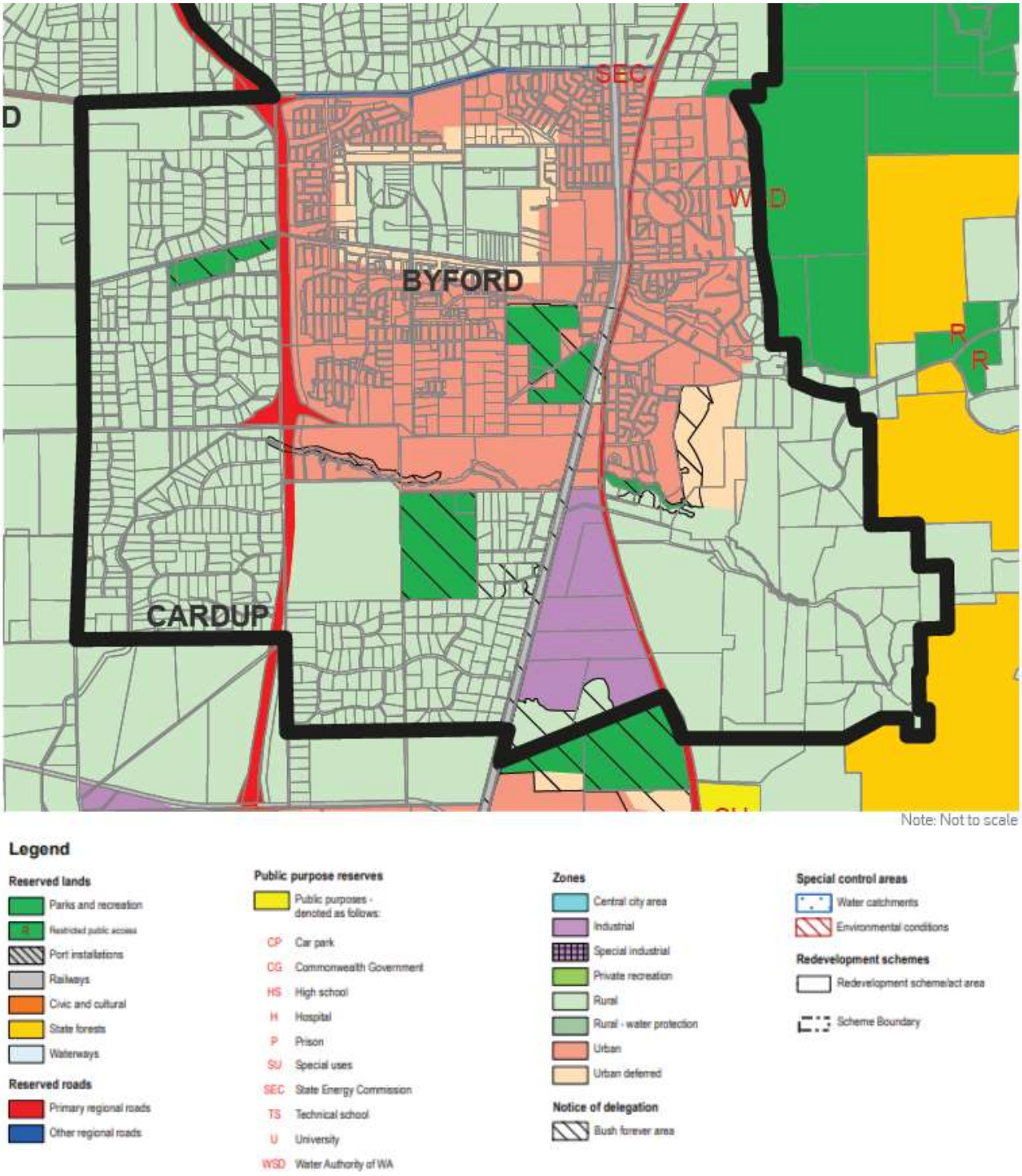


Source: Shire of Serpentine Jarrahdale

1.3 Land Use Proposal

The main areas within the structure plan area are retail and commercial, residential development and rural pursuits with a significant amount of changes proposed for the future. The proposed structure plan comprises mostly of rural and urban areas and some industrial. The Cardup Business Park to the south of the District structure plan area is recognised as a future industrial area in the South Metropolitan Peel Framework. The rural land will be maintained and preserved as existing for various rural industries and food production activities.

Figure 1-3 Existing Situation



Source: Shire of Serpentine Jarrahdale

1.3.2 Key Issues Identified

Some of the main issues and constraints identified are as follows:

- Lack of facilities and connectivity for pedestrians and cyclists.
- Lack of public transport between activity centres and regional destinations.
- Traffic issues that do not assist active transport modes.
- Limited connectivity through rail line

2 Existing Situation

2.1 Existing Land Uses

Current land use consists of medium residential densities R30-R60 within the immediate vicinity of the town centre and local centres.

As evident from **Figure 2-1 and Figure 2-2,** the land within the structure plan is predominantly zoned as urban development, rural living and rural under the local scheme zone as a significant portion of the Shire consists of rural areas.

Retail and commercial activity has been concentrated within the 'old' Byford town centre between Larsen Road and Abernethy Road.

Also existing is an industrial area at the intersection of South Western Highway and Nettleton Road and some commercial land use.

The BDSP covers 5,530 hectares of area of which the land is predominantly urban or remnant rural residential zoned for future urban development.

Figure 2-1 Existing Zoning

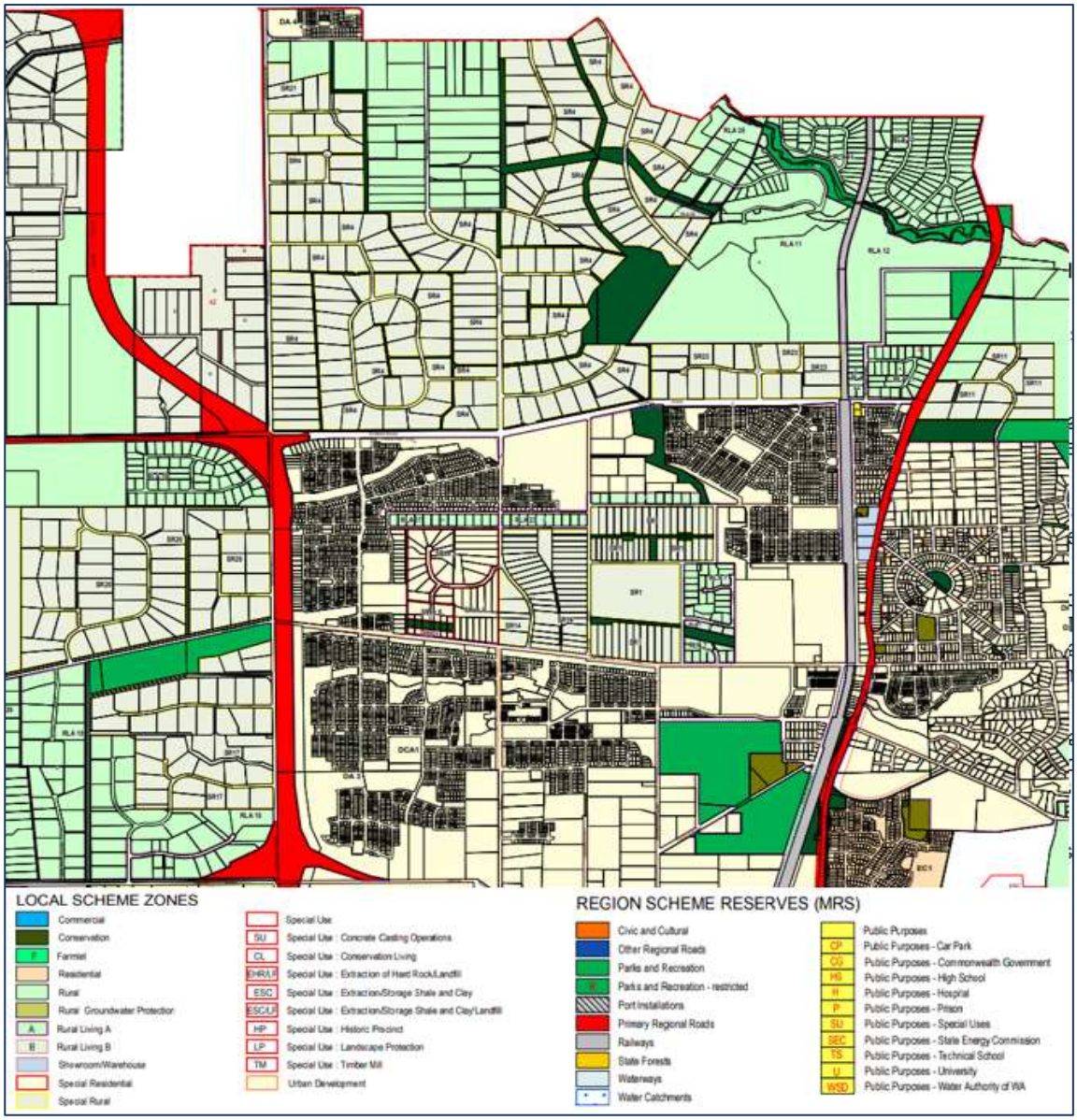
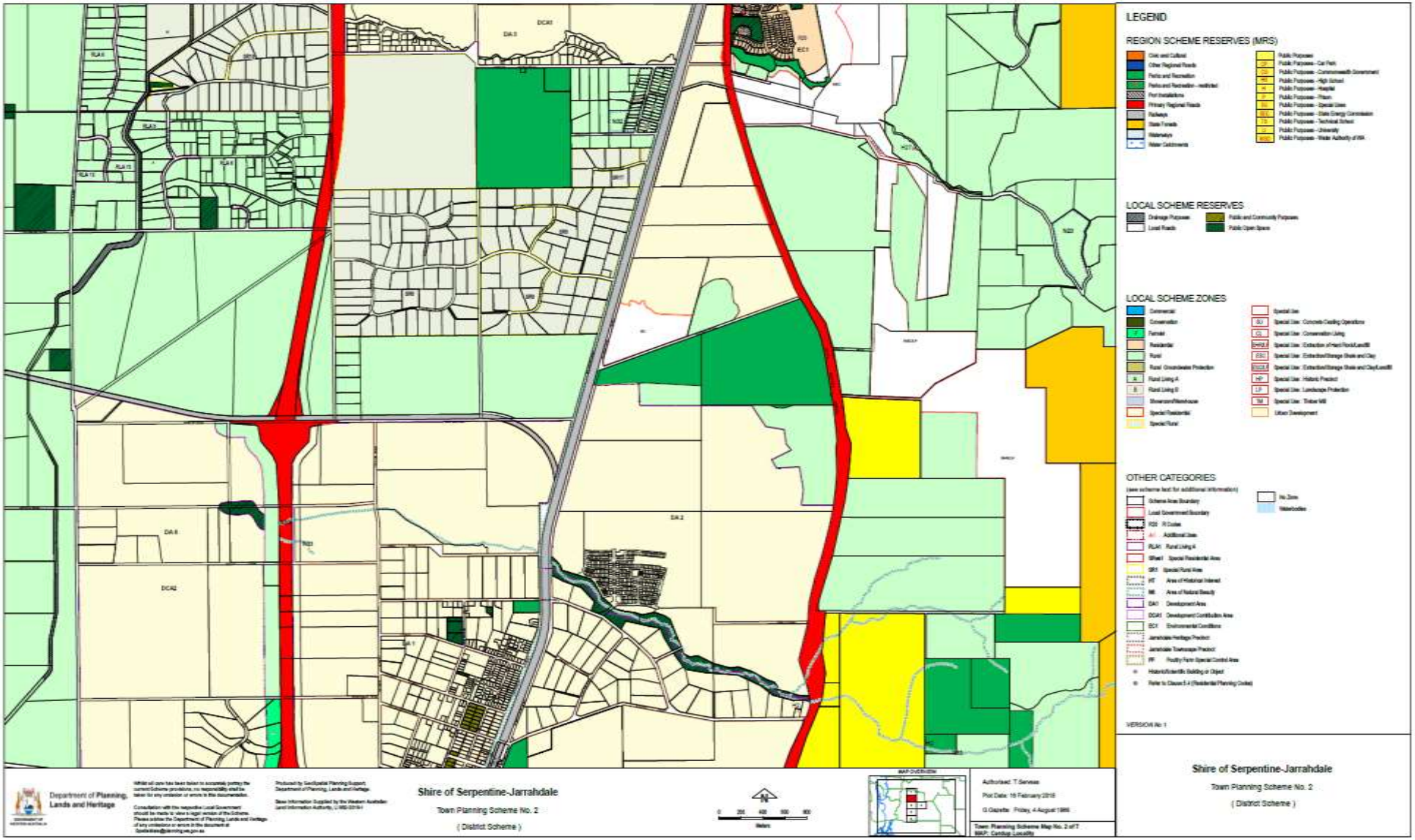


Figure 2-2 Existing Zoning



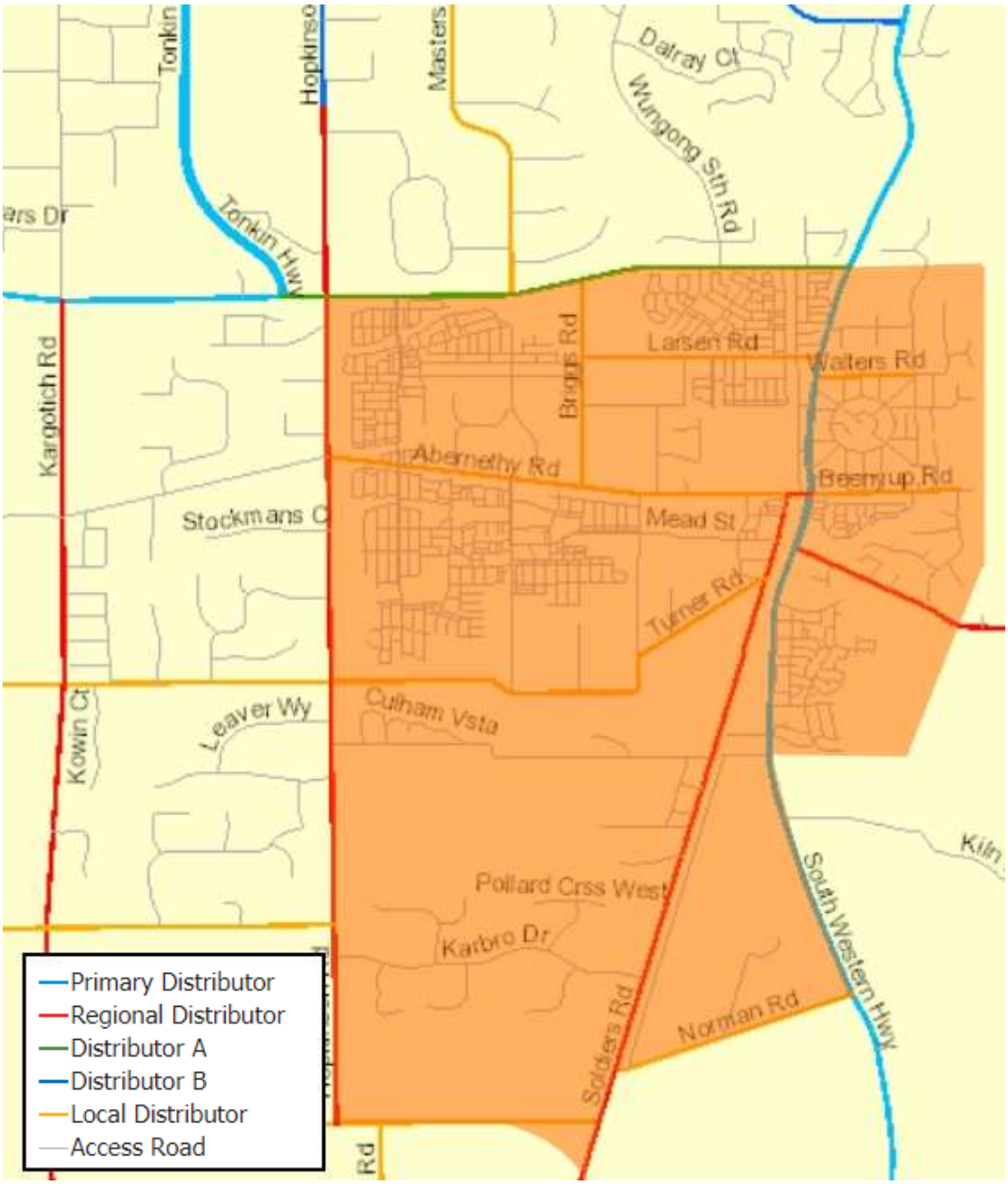
Source: Local Planning Scheme

2.2 Existing Road Network

The existing road network surrounding and within the LSP is shown in **Figure 2-3**. Road classifications are defined in the Main Roads Functional Hierarchy as follows:

- **Primary Distributors (light blue):** Form the regional and inter-regional grid of MRWA traffic routes and carry large volumes of fast-moving traffic. Some are strategic freight routes, and all are National or State roads. They are managed by Main Roads.
- **Regional Distributors (red):** Roads that are not Primary Distributors, but which link significant destinations and are designed for efficient movement of people and goods within and beyond regional areas. They are managed by Local Government.
- **District Distributor A (green):** These carry traffic between industrial, commercial, and residential areas and connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining property. They are managed by Local Government.
- **District Distributor B (dark blue):** Perform a similar function to "District Distributor A" but with reduced capacity due to flow restrictions from access to and roadside parking alongside adjoining property. These are often older roads with traffic demand in excess of that originally intended. District Distributor A and B roads run between land-use cells and not through them, forming a grid that would ideally be around 1.5 kilometres apart. They are managed by Local Government.
- **Local Distributors (orange):** Carry traffic within a cell and link District Distributors at the boundary to access roads. The route of the Local Distributor discourages through traffic so that the cell formed by the grid of District Distributors only carries traffic belonging to or serving the area. These roads should accommodate buses but discourage trucks. They are managed by Local government.
- **Access Roads (grey):** Provide access to abutting properties with amenity, safety and aesthetic aspects having priority over the vehicle movement function. These roads are bicycle and pedestrian friendly. They are managed by Local government.

Figure 2-3 Existing Road Network



Source: Main Roads WA

The following discusses the characteristics of the road network surrounding the Structure Plan:

- **Tonkin Highway** is classified as *Primary Distributor* with a posted speed of 100 km/h. It forms a part of RAV 7 network (north of Welshpool Road East).
- **South Western Highway** lies to the east of the structure plan area and is classified as *Primary Distributor* with a posted speed limit that varies from 70 km/h from Hobbs Dr to Rails Crescent, to 90 km/h from Mitchell Street to Thomas Rd then to 60 km/h from Thomas Road to Abernethy Road.
- **Thomas Road** is an undivided two lane road classified as *Distributor A*, with a posted speed limit of 70 km/h.
- **Hopkinson Road** is classified as *Regional Distributor* with a posted speed limit of 60 km/h from Gloaming way which is a built up area, the speed then increases to
- **Orton Road** is classified as a Local Distributor with a posted speed limit of 50 km/h.

2.3 Existing Traffic Volumes

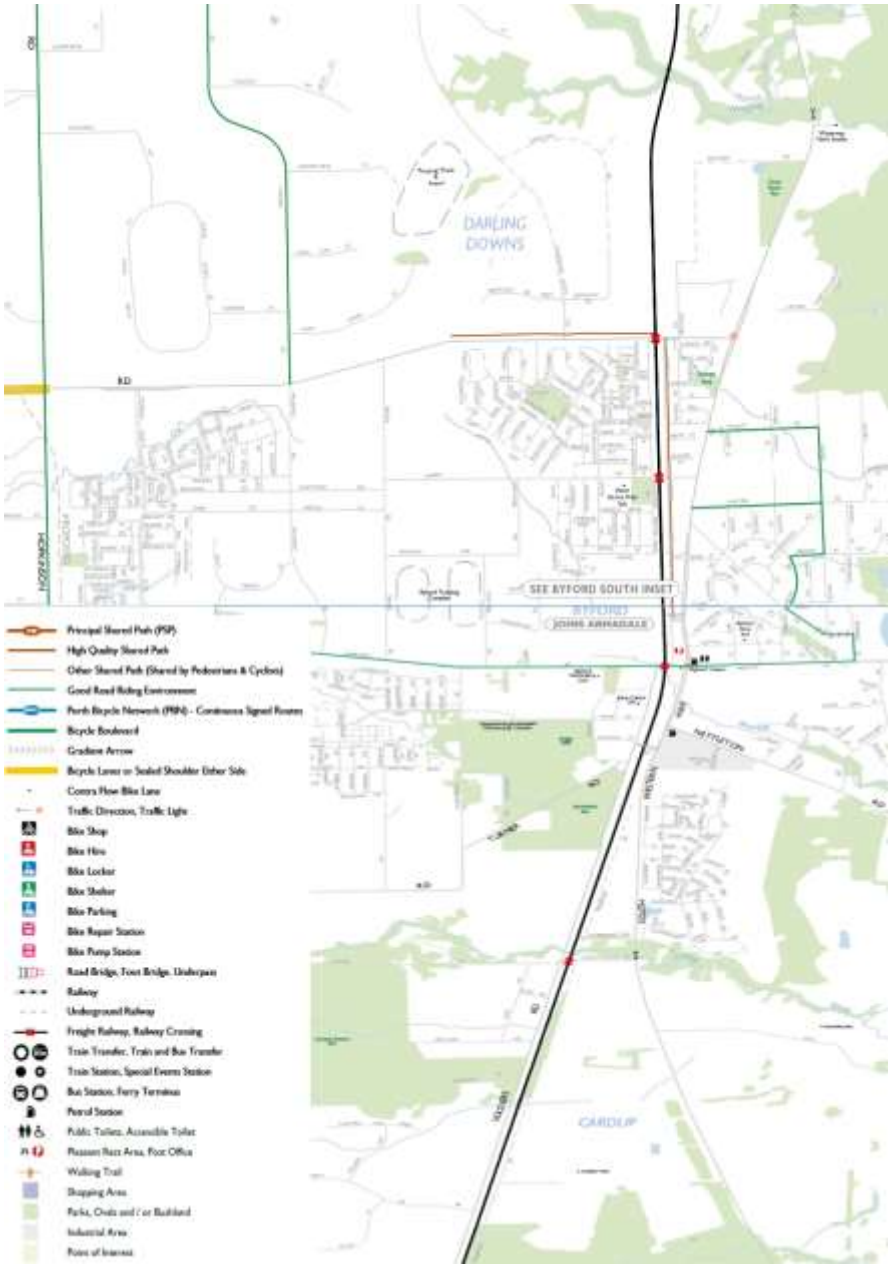
Traffic surveys were conducted on numerous locations within the Byford area. The results of these traffic counts are provided in **Appendix B**.

2.4 Existing Pedestrian/ Cycle Network

Existing pedestrian and cycle network is very limited due to the rural nature of the area. Active modes of transport such as walking and cycling are currently available for short distance journeys within the urban areas. There are several opportunities for network improvements to address existing issues of disconnected streets, lack of footpaths, unsafe routes and long distances.

Figure 2-4 shows the existing pedestrian and cycle facilities within the Study Area.

Figure 2-4 Pedetrian/Cycling Network



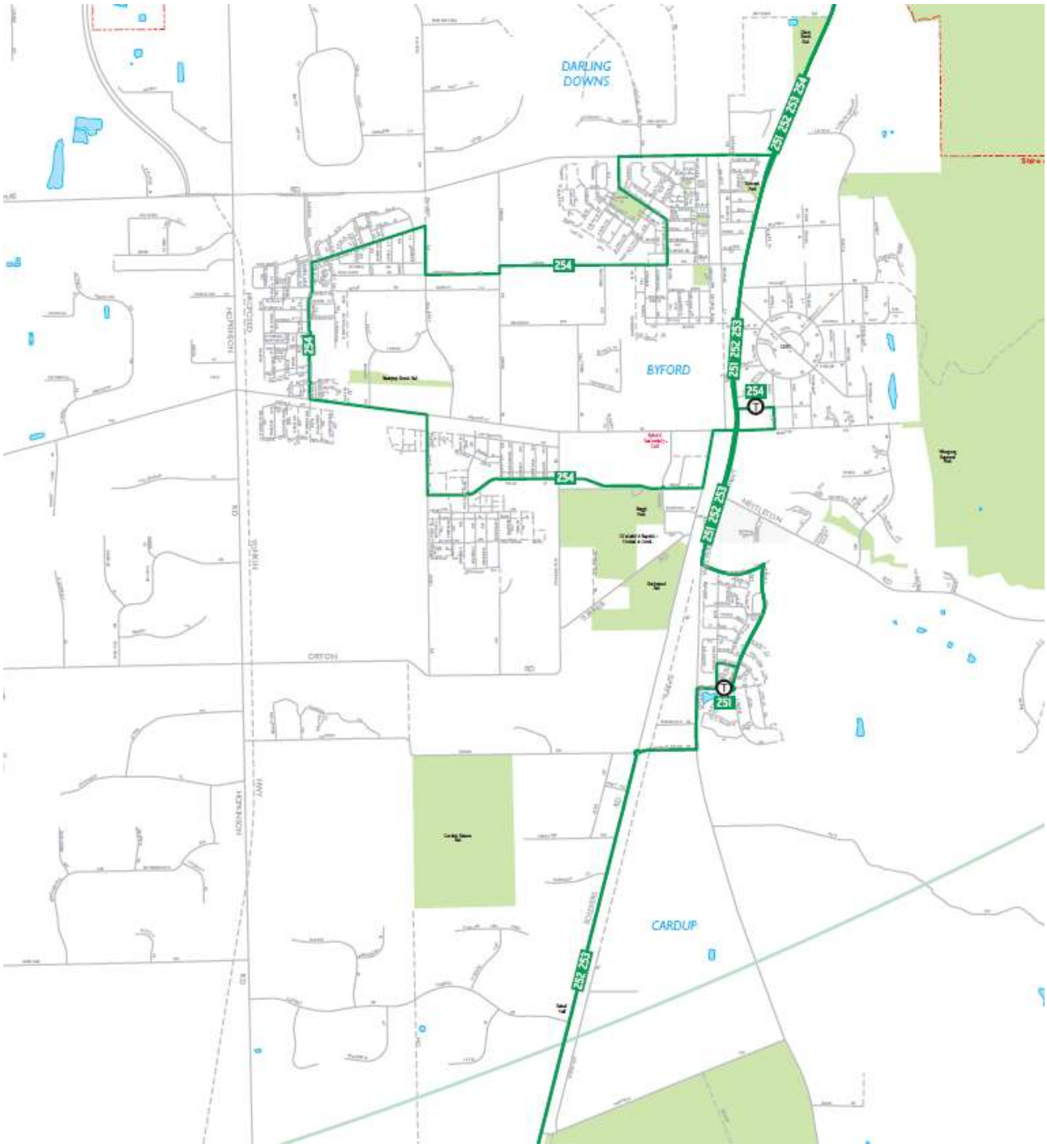
Source: Department of Transport (2016)

2.5 Existing Public Transport Services

The existing public transport services are shown below in **Figure 2-5**. A railway line runs alongside the South Western Highway; however, standard commuter rail services currently terminate at Armadale.

The rail line south of Armadale is used primarily for freight, with a regional rail service provided by the Australind to Perth and Bunbury twice daily.

Figure 2-5 Existing Public Transport Routes



Source: Transperth

Transperth bus Routes 251,252 and 253 connect Kingsbury Drive/Jacaranda Avenue to Armadale Station, while Route 254 connects Clifton Street/South Western Highway to Armadale Station.

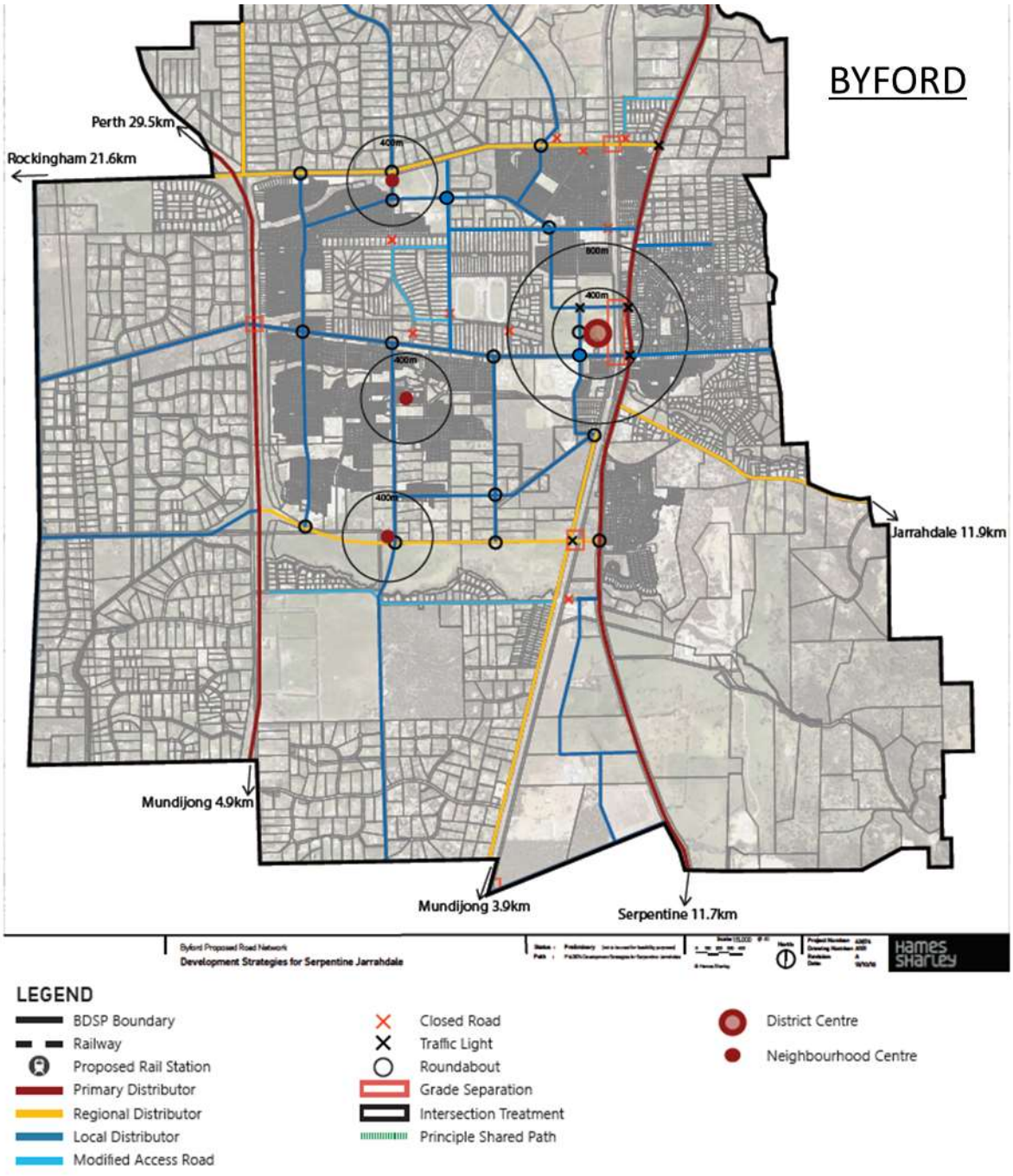
3 Proposed Changes to Transport Networks

3.1 Road Network Changes

The current structure plan provides a list of changes that are proposed for the existing roads. These upgrades have been evaluated through Aimsun mesoscopic modelling and SIDRA analysis and, modifications applied to reflect recommended amendments to the network, as shown in **Figure 3-1** and **Figure 3-2**.

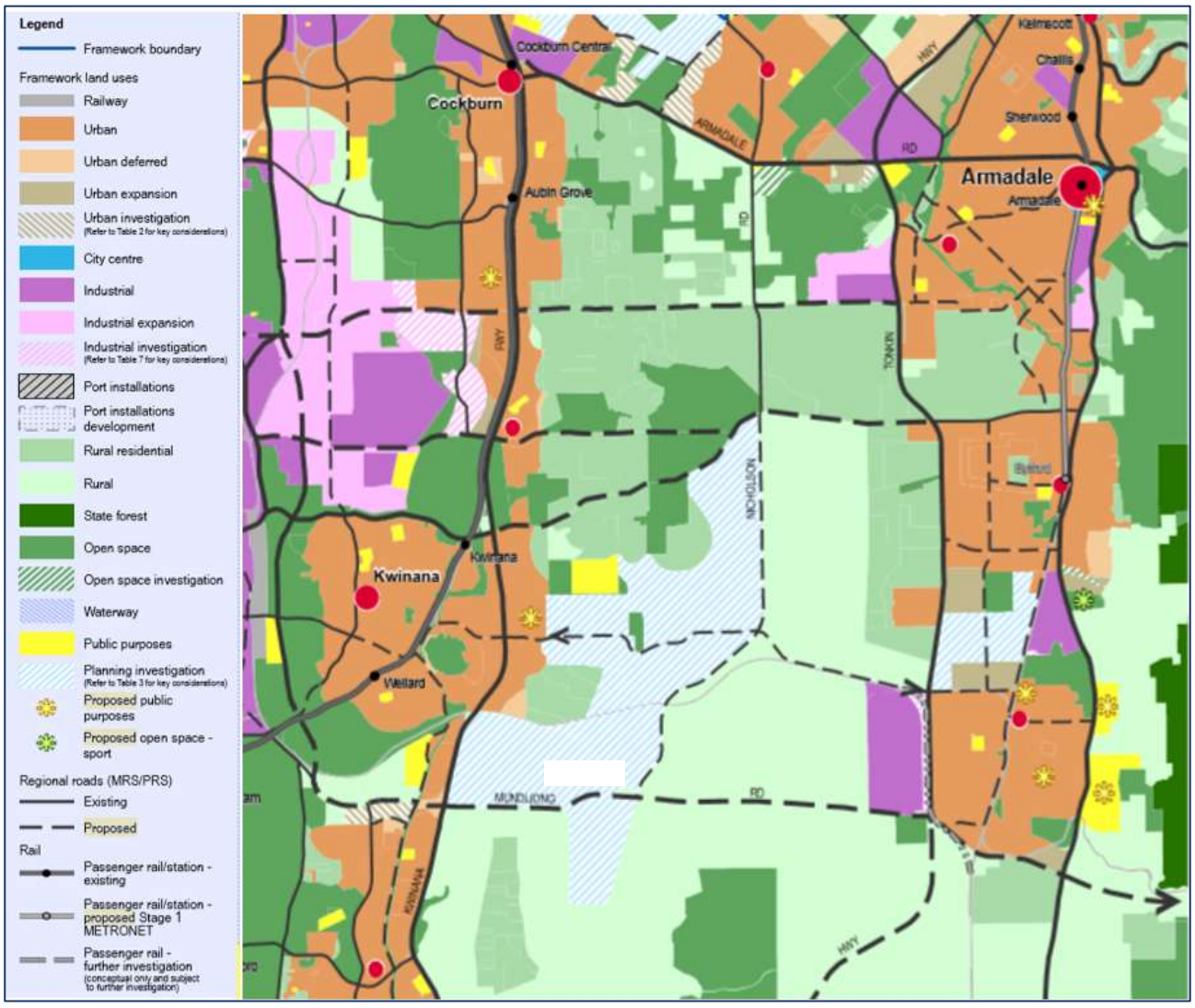
It is understood that intersection controls will continue to be interrogated and modified to suit the changing needs of the network.

Figure 3-1 Road Network Changes



Original Source: Shire of Serpentine Jarrahdale

Figure 3-2 Existing and Proposed Roads



Source: Shire of Serpentine Jarrahdale

The following changes are proposed to the existing road network along with the proposed new roads:

- Extension of Tonkin Highway southward to connect through to Mundijong Road.
- Intersection connection treatments onto Tonkin Highway at Thomas Road and Orton Road.
- Abernethy Road continuation under Tonkin Highway.
- New and upgraded primary distributors and integrator arterial roads.
- Upgrade of Thomas Road and Orton Road.
- Orton Road extension to link South Western Highway.
- Additional north to south distributor roads included in extension/upgrade of Wungong South Road to Wungong Road.

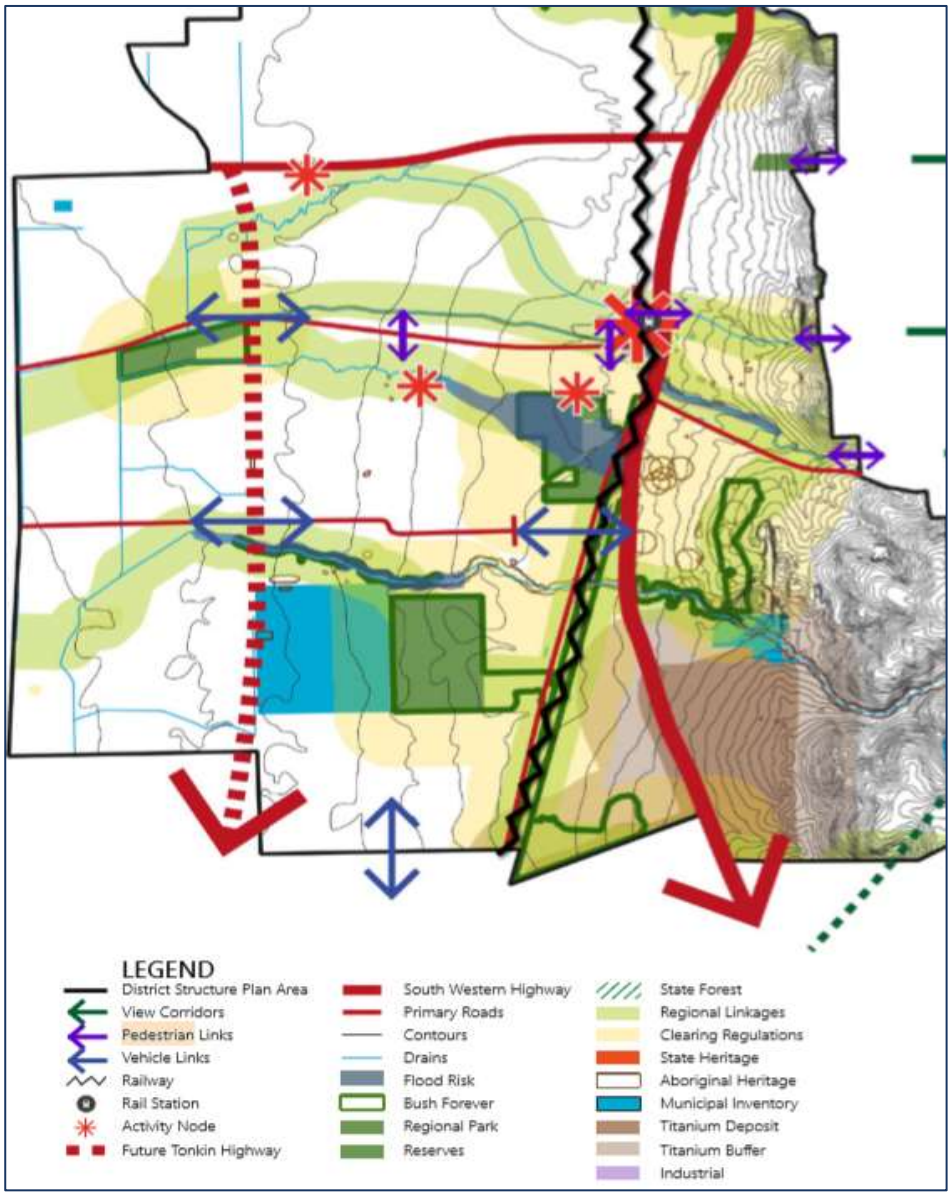
3.2 Pedestrian and Cycle Network Changes

The strategies and opportunities to improve the pedestrian and cycle network include:

- Provision of pedestrian, bridle trail, cycling linkages internally and to the scarp.
- Complete various trails that have not been ceded yet.
- Improved connectivity and greenways for cycling and walking.
- Walking and cycling catchments to the Byford Town Centre Railway Station and neighbourhood centres present opportunities to link to a wider cycle and pedestrian network.

As such, the opportunities and constraints map is explained on **Figure 3-3**.

Figure 3-3 Opportunities and Constraints Map



Source: Shire of Serpentine Jarrahdale

3.3 Public Transport Network Changes

Within the Sub-regional Planning Framework, the proposed public transport includes a network of passenger rail lines and transit corridors. A proposal for the extension of the Armadale line to Byford exists within the BDSP area. This railway facility is also proposed to have a High Frequency Transit Corridors (HFTC) providing public transport connections between activity centres, population catchments, train stations and local bus services.

3.4 Projected Daily Traffic Volumes

Assessment of the impacts of development growth both within and beyond the Byford Structure Plan area has been facilitated through Main Roads' ROM24 strategic model. This model relies on land use projections provided by Local and State Government agencies to generate vehicle trips across the network. Cardno has endeavoured to ensure that the land uses defined in ROM24 within the Study Area are consistent with the Shire's anticipated development horizon.

It is acknowledged that full build-out of this land area may not be achieved within the 2031 horizon, which is the only ROM24 time scale currently supplied by Main Roads WA. As such, the ROM24 outputs used as the basis of this TIA have been used to establish an anticipated development and traffic scenario at the point when build-out of the Shire's development planning has been achieved.

Figure 3-4 shows the 2031 daily vehicle volume output from ROM24 model as provided by Main Roads WA.

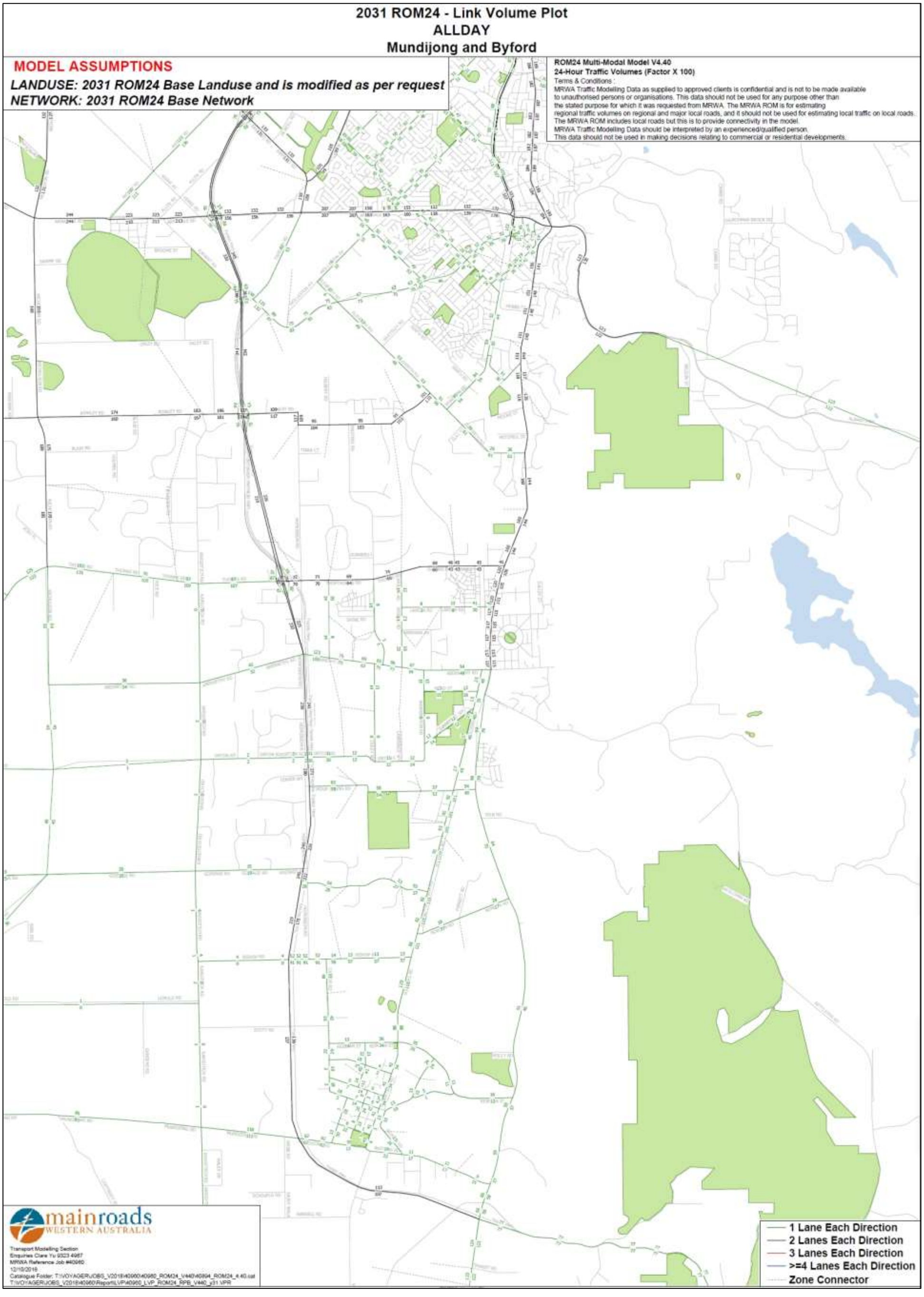
Table 3-1 shows a summary of 2031 daily vehicle volumes from the AIMSUN model.

Table 3-1 Forecast Traffic Volumes from AIMSUN Model (2031 horizon)

Road	Forecast Traffic Volume 2031 (vpd)	Recommended Road Hierarchy	Recommended Road Reserve (m)
Abernethy Road	16,629	Integrator A (<=60 kph)	30
Kardan Blvd	15,683	Neighbourhood Connector A	25-30
Soldiers Road	8,921	Neighbourhood Connector A	20
Orton Road	12,919	Integrator B	30
Doley Road	2,935	Neighbourhood Connector A	30/27.6
Warrington Road	7,238	Neighbourhood Connector B	20
Turner Road	5,272	Access Road	20
Gordin way	4,653	Neighbourhood Connector B	20
Sansimeon Blvd	5,269	Integrator B	30
Indico Parkway	11,668	Integrator B	27.5
Malarkey Road	4,430	Integrator B	30
Caraway Ave	10,638	Access Road	20
Masters Road	7,160	Rural Road	30
Wungong South Road	5,043	Rural Road	25
Thomas Road	31,277	Primary Regional Road	50
George St	9,917	Town Centre Road	20
Clara Street	526	Integrator B Town Centre Road	25
Industrial North-South Road	N/A	Industrial Road	27
Cardup Siding Road	5,449	Access Road	20

** Reduced verge width shall be considered adjacent to public park land*

Figure 3-4 ROM24 Daily Traffic Volumes (2031 horizon)



Source: Main Roads WA

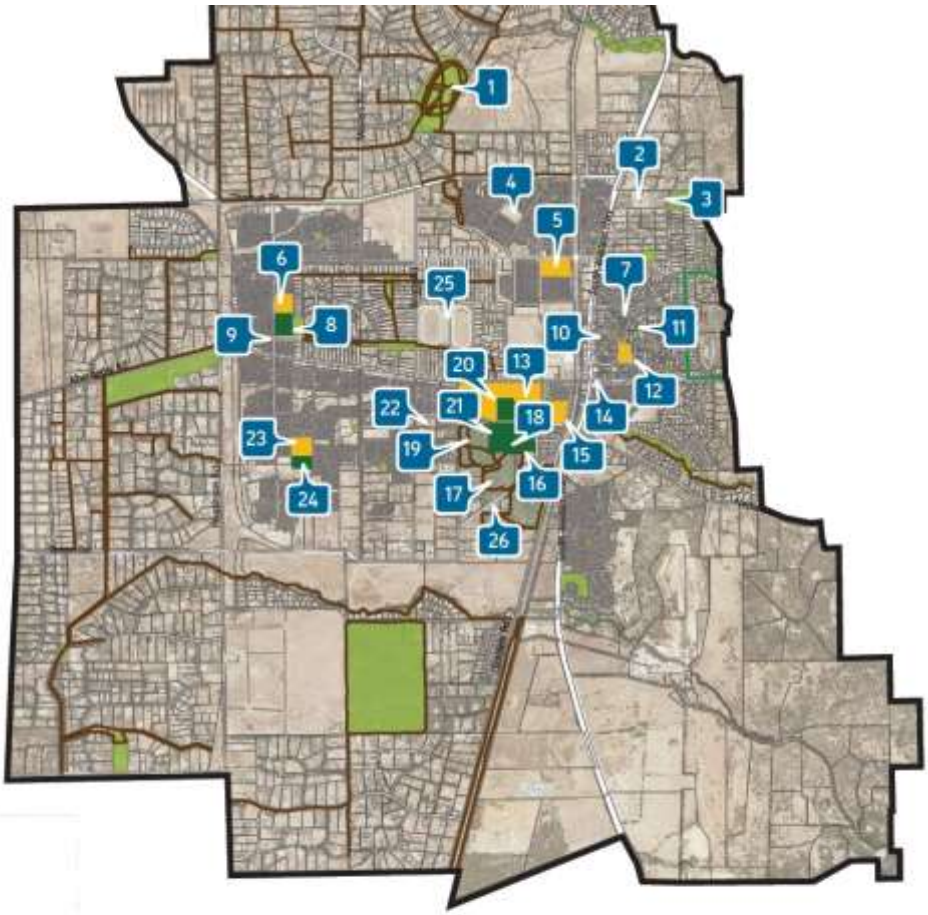
4 Integration with Surrounding Area

4.1 Surrounding Attractors/Generators

The major attractors for people from within the structure plan area include the Darling Downs Equestrian Facility, Byford and Districts Country Club, Serpentine Jarrahdale Community Recreation Centre and other surrounding areas as per **Figure 4-1.**

Major generators within the structure plan include the Mary Grove Primary School, West Byford Primary School, Byford Trotting Complex and other existing infrastructure as per **Figure 4-1.** The Shire also has a well-established focus on equestrian activities, these areas along with the trails act as a major generator.

Figure 4-1 Generators and Attractors



1	Darling Downs Equestrian Facility	14	Byford Hall
2	Byford and Districts Country Club	15	Byford John Calvin School
3	Byford Scout Hall/ Old Rifle Range	16	Byford Cricket Nets and Change Rooms
4	Bill Hicks Facility	17	Briggs Park Pavilion
5	Mary Grove Primary School	18	BMX Track
6	West Byford Primary School	19	Canteen and Storage Facilities
7	Byford Community Kindergarden and Child Health Clinic	20	High School Oval
8	Katrina Reserve	21	Serpentine Jarrahdale Community Recreation Centre
9	Katrina Storage Facility	22	Byford Community Garden
10	Byford Fire Station	23	Woodland Grove Primary School
11	Byford Tennis Courts	24	Woodland Grove
12	Byford Primary School	25	Byford Trotting Complex
13	Byford Secondary College	26	Brickwood Reserve Facility

Source: Shire of Serpentine Jarrahdale

4.2 Proposed Changes to Surrounding Land uses

The structure plan identifies the requirement for development of areas in close proximity of key public transport networks and new nodes of activities. The surrounding area is to remain as rural and urban development whilst increasing the density codes around the town centre.

4.3 Level of Accessibility

The main access to the structure plan area from external attractors is through the connectivity of internal road networks to South Western Highway and Thomas Road, which are classified as Primary Distributor and Distributor A. Access through internal road intersections include:

- Thomas Road and Hopkinson Road
- Orton Road and Hopkinson Road
- Abernethy Road and South Western Highway
- South Western Highway and Cardup Siding Road
- Hopkinson Road and Abernethy Road
- Larsen Road and South Western Highway

For access by public transport, there are bus Routes 251, 252 and 253 run along South Western Highway and through the internal road network to Armadale Station.

Current provision of alternative transport modes such as cycling and walking include a good riding environment and a shared path along South Western Highway.

The proposed Train Station in Byford Town Centre and the associated walking and cycling catchment will further improve accessibility and match the desire lines.

It is expected that the existing road network will be able to cater for the travel desire lines between the structure plan area and the surrounding land uses.

5 Analysis of Transport Network

5.1 Assessment Years and Time Periods

The assessment period is based on the future mesoscopic modelling results which was conducted for 2031.

5.2 Background and Future Traffic Generation Estimation

A mesoscopic traffic model was developed to model the current traffic situation and provide a base to determine the likely future traffic impacts.

A number of data sources were used in the formulation of the mesoscopic model which included traffic, surveys, census data and information provided by local authorities.

The future-year models are based on the traffic growth scenario derived from information provided by the Shire of Serpentine-Jarrahdale and Main Roads (ROM24 outputs) for the 2031 scenario years.

5.3 Intersection Assessment

Based on the results provided by the mesoscopic model, the network in the area of Byford is operating at an acceptable level of service with sufficient capacity to accommodate traffic for the 2018 scenario.

With respect to the 2031 scenario, the mesoscopic model identified a number of intersections which exhibited capacity or delay issues. These intersections have been assessed in SIDRA to determine the minimum extent of upgrades required to ensure that they are operating at an acceptable level of service in 2031.

Table 5-1 provides a summary of the intersections which experienced excessive delays or overcapacity issues as identified by the mesoscopic model in the 2031 scenario.

Table 5-1 Intersections to be Assessed

Number	Intersections	Time Period
1	Tonkin Hwy & Thomas Rd	2031 AM & PM
2	Abernethy Rd & S Western Hwy	2031 PM
3	Abernethy Rd & New Road 4 & Gordin Way	2031 PM
4	Soldiers Rd & New Road 6	2031 AM & PM
5	New Road 5 & Tonkin Hwy	2031 AM & PM

All other intersections assessed through the mesoscopic model were considered to operate at an acceptable level of service for the 2031 scenario.

The following density maps identify locations where peak period demand may create localised capacity constraints, and where upgrades to the network may be required. These locations have been assessed further through SIDRA assessment to ascertain whether further upgrades are required.

Figure 5-1 Simulated 2031 Density Map (AM Peak)

Figure 5-2 Simulated 2031 Density Map (PM Peak)

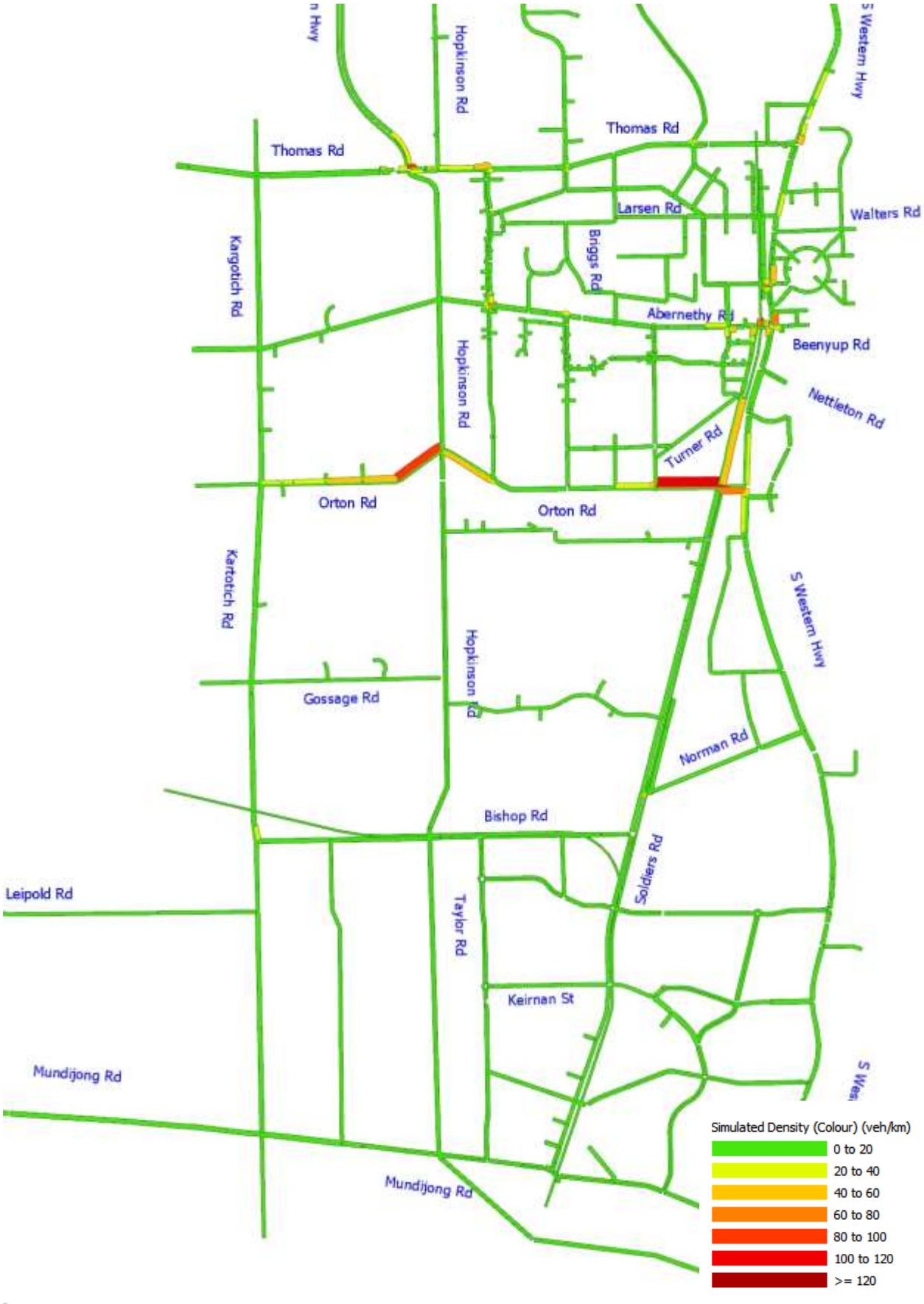
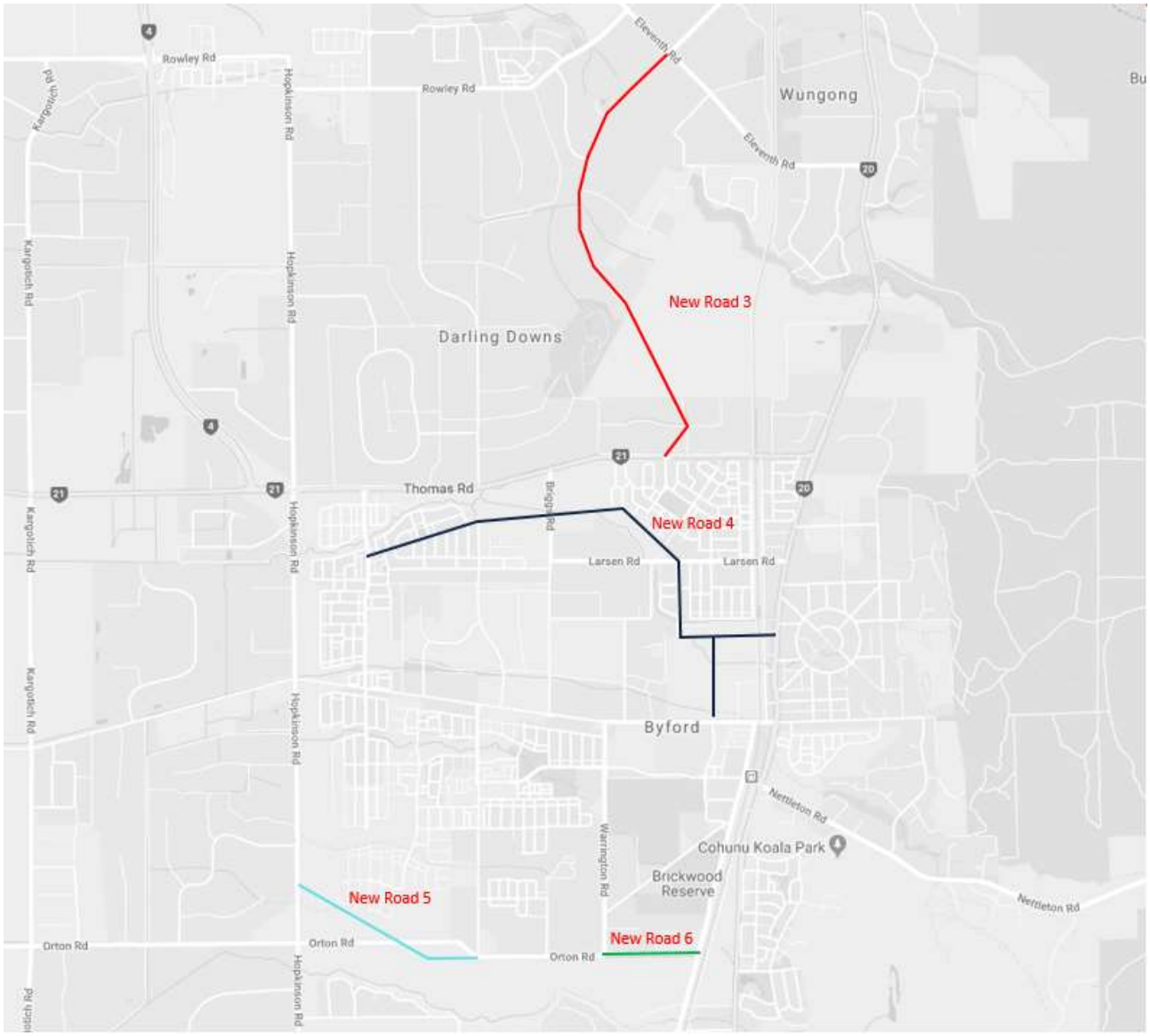


Figure 5-3 indicates the new road locations and the locations of the assessed intersections within the Byford Area.

Figure 5-3 Location of New Links



5.4 Summary of Results

The following map identifies the results of intersection evaluation across the Byford area. Intersections have been classified into 3 groups and shown in **Figure 5-4 and Figure 5-5** below:

1. **Existing Intersection Sufficient:** the existing (2018) geometry has been evaluated through the Aimsun mesoscopic model and shown to be sufficient to accommodate future traffic growth.
2. **Modified Intersection Sufficient:** the Shire's proposed modifications have been evaluated through the Aimsun mesoscopic model and shown to be sufficient to accommodate future traffic growth.
3. **Additional Reconfiguration Required:** The existing and/or proposed intersection form has been evaluated through the Aimsun mesoscopic model and found to experience excessive congestion or delay. These intersections have been re-evaluated in SIDRA and changes identified to improve operation.

Figure 5-4 Intersection Sufficiency Map

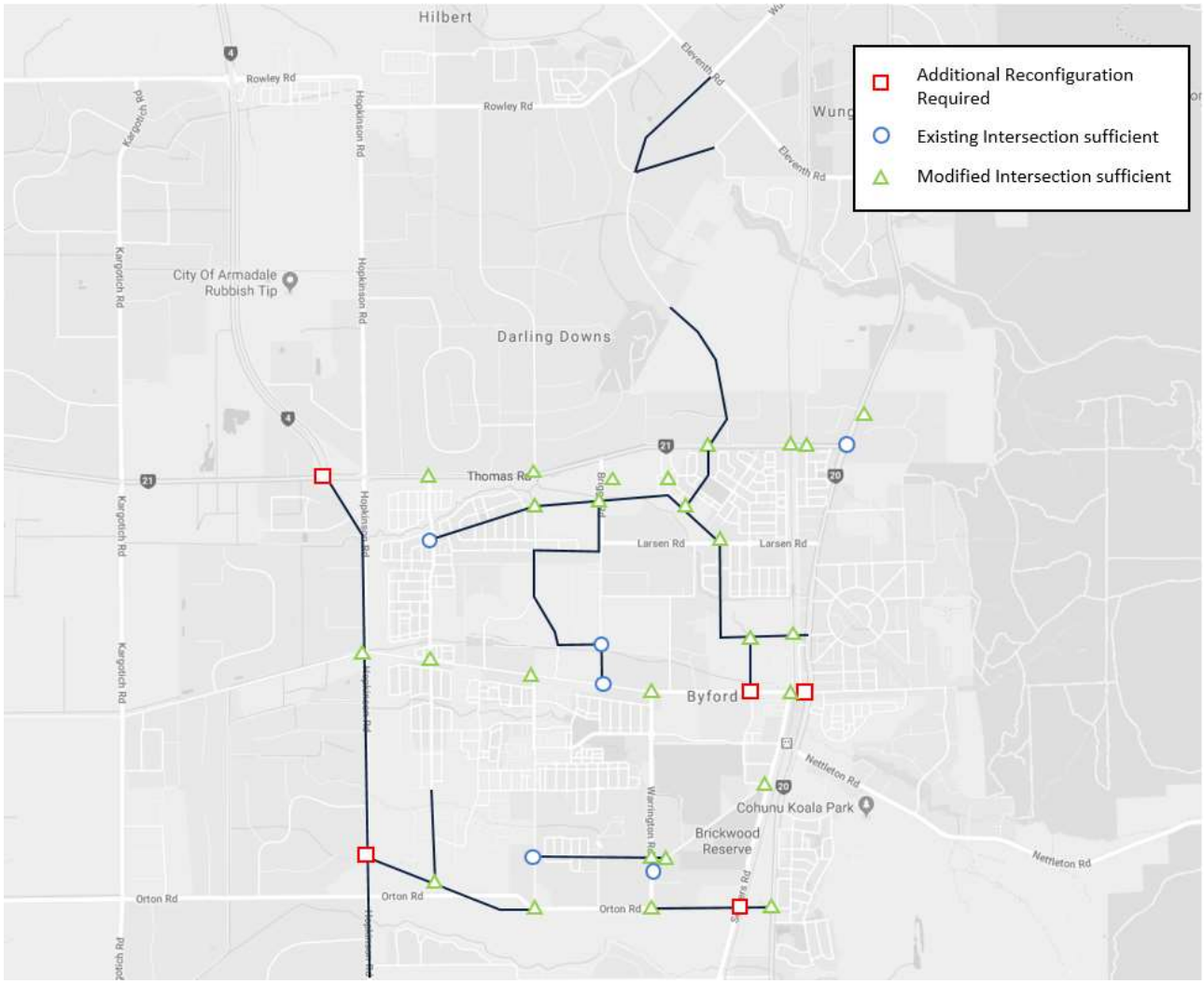
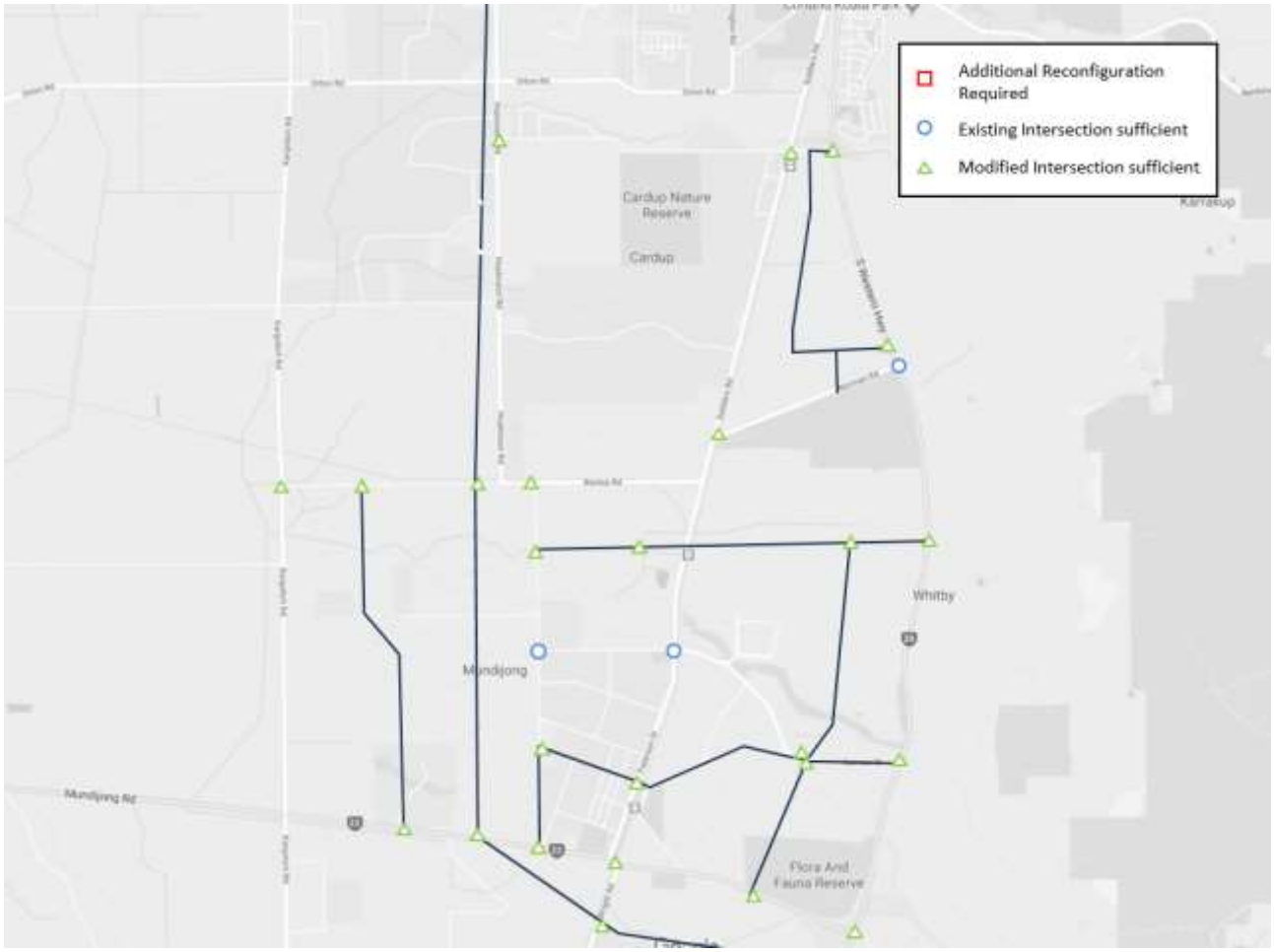


Figure 5-5 Intersection Sufficiency Map



5.5 Intersection Performance

SIDRA results for each approach are presented below in the form of Degree of Saturation (DOS), Average Delay, Level of Service (LOS) and 95th Percentile 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 theoretical intersection capacity is exceeded for an un-signalized intersection where DOS > 0.80;
- **95% Queue**: is the statistical estimate of the queue length up to or below which 95% of all observed queues would be expected;
- **Average Delay**: is the average of all travel time delays for vehicles through the intersection. An unsignalised intersection can be considered to be operated at capacity where the average delay exceeds 40 seconds for any movement; and
- **Level of Service (LOS)**: is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. The different levels of service can generally be described as shown in **Table 5-2.**

Table 5-2 Level of Service (LOS) Performance Criteria

LOS	Description	Signalised Intersection	Unsignalised Intersection
A	Free-flow operations (best condition)	≤10 sec	≤10 sec
B	Reasonable free-flow operations	10-20 sec	10-15 sec
C	At or near free-flow operations	20-35 sec	15-25 sec
D	Decreasing free-flow levels	35-55 sec	5-35 sec
E	Operations at capacity	55-80 sec	35-50 sec
F	A breakdown in vehicular flow (worst condition)	≥80 sec	≥50 sec

5.5.2 Evaluation Process

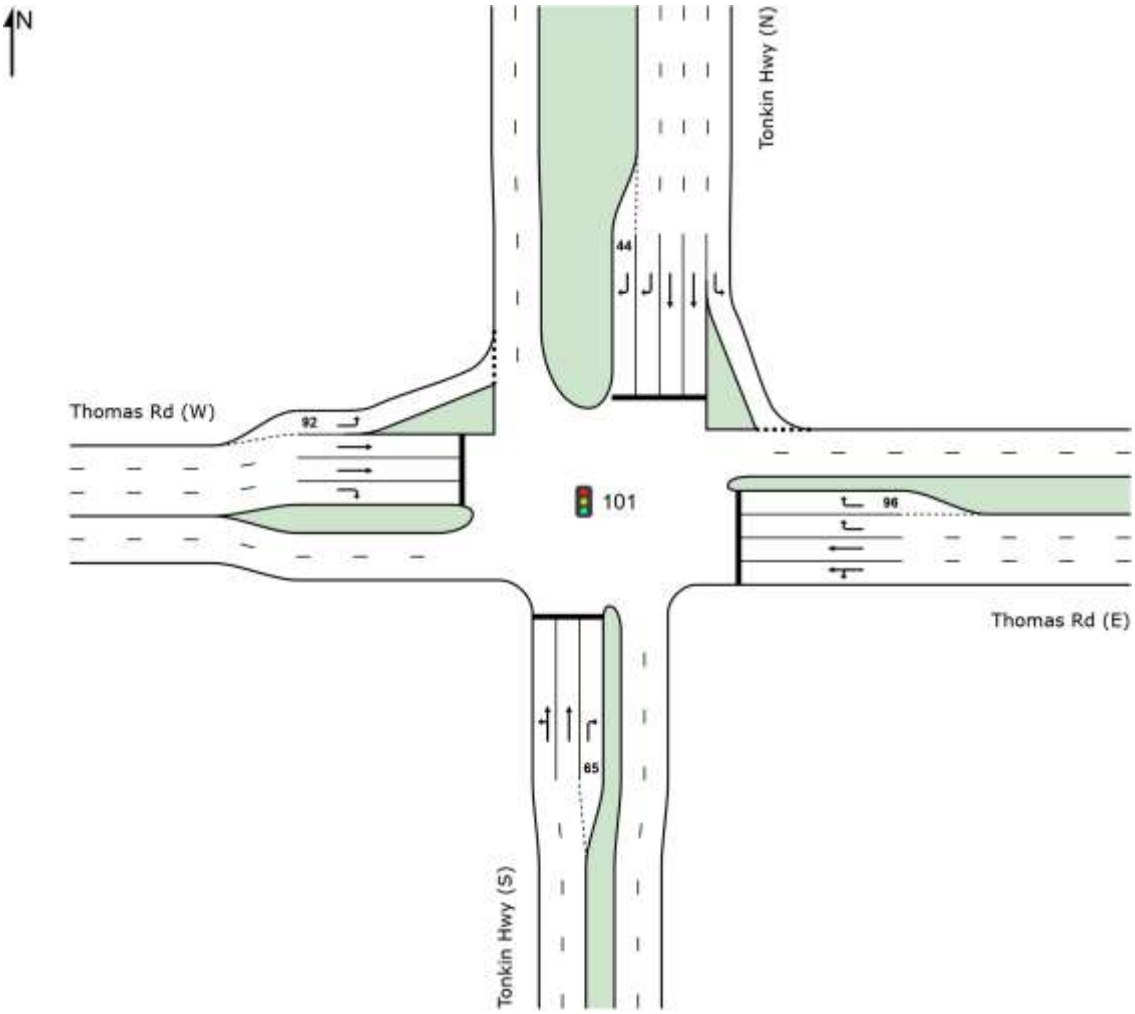
The following process has been used to inform the SIDRA assessment:

- Intersections have been modelled as per their proposed configuration, or where no changes have previously been identified, the existing road form.
- Intersections where Aimsun modelling shows simulated traffic density or approach projected delays are high are considered to be ‘at risk’, and have been reviewed using SIDRA analysis.
- For the purposed of the SIDRA assessment, turning movements with extremely low turning volumes (<5 vph) have been tripled to provide a robust assessment. It is acknowledged that these low volumes are likely an artefact of the coarse road network and zoning structure. However, it can be expected that these turning movement values will not dominate the intersection function.
- SIDRA intersection modelling has been used ***only*** to identify the minimum necessary intervention required from an operational standpoint. Additional measures may be required to ensure intersection geometry meets Austroads guidelines for safety and function.

5.5.3 No. 1 – Tonkin Highway and Thomas Road

The following presents the results of the analysis of the Tonkin Highway/Thomas Road intersection**. Figure 5-6** is a SIDRA layout representation of the intersection which is based on the indicative layouts used in the mesoscopic model.

Figure 5-6 SIDRA Layout for Tonkin Highway/Thomas Road Intersection



The results from the SIDRA analysis are summarised in **Table 5-3** and **Table 5-4**.

Table 5-3 Tonkin Highway/Thomas Road Intersection AM Results 2031

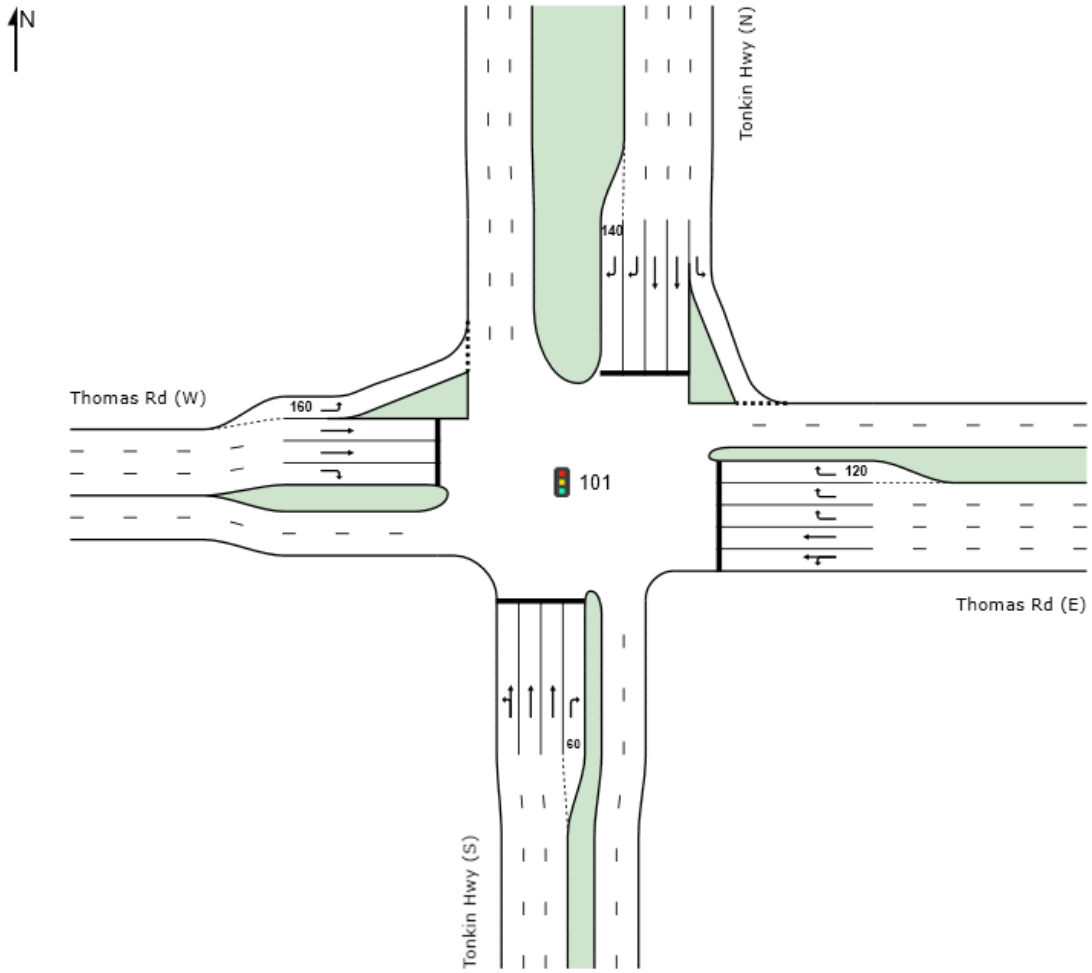
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Tonkin Hwy												
1	L2	394	7.4	0.918	57.6	LOS E	37.2	276.6	1.00	1.08	1.33	30.8
2	T1	670	7.2	0.918	55.2	LOS E	37.2	276.6	1.00	1.13	1.38	31.1
3	R2	17	0.0	0.918	62.2	LOS E	28.7	213.0	1.00	1.16	1.40	30.4
Approach		1081	7.1	0.918	56.1	LOS E	37.2	276.6	1.00	1.11	1.36	31.0
East: New Road 5												
4	L2	16	0.0	1.116	279.6	LOS F	93.7	698.9	1.00	1.97	3.31	10.6
5	T1	109	5.5	1.116	274.0	LOS F	93.7	698.9	1.00	1.97	3.31	10.6
6	R2	490	8.4	1.116	279.6	LOS F	93.7	698.9	1.00	1.97	3.31	10.6
Approach		615	7.6	1.116	278.6	LOS F	93.7	698.9	1.00	1.97	3.31	10.6
North: Tonkin Hwy												
7	L2	299	6.0	1.025	139.2	LOS F	70.2	519.2	1.00	1.63	2.14	18.3
8	T1	394	7.1	1.025	133.6	LOS F	70.2	519.2	1.00	1.63	2.14	18.5
9	R2	107	7.5	1.297	592.3	LOS F	26.1	194.7	1.00	2.32	5.60	5.5
Approach		800	6.8	1.297	197.0	LOS F	70.2	519.2	1.00	1.72	2.61	14.0
West: New Road 5												
10	L2	58	19.0	1.093	241.3	LOS F	36.0	270.4	1.00	1.84	3.19	11.9
11	T1	43	7.0	1.093	235.6	LOS F	36.0	270.4	1.00	1.84	3.19	12.0
12	R2	169	5.3	1.093	241.2	LOS F	36.0	270.4	1.00	1.84	3.19	11.9
Approach		270	8.5	1.093	240.3	LOS F	36.0	270.4	1.00	1.84	3.19	11.9
All Vehicles		2766	7.3	1.297	164.3	LOS F	93.7	698.9	1.00	1.55	2.33	16.0

Table 5-4 Tonkin Highway/Thomas Road Intersection PM Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Tonkin Hwy (S)												
1	L2	50	4.0	0.858	70.4	LOS E	8.7	63.5	1.00	0.92	1.40	32.4
2	T1	243	4.5	0.858	62.4	LOS E	8.9	64.6	1.00	0.92	1.40	36.7
3	R2	11	0.0	0.072	60.0	LOS E	0.6	3.9	0.95	0.68	0.95	34.5
Approach		304	4.3	0.858	63.7	LOS E	8.9	64.6	1.00	0.92	1.38	35.8
East: Thomas Rd (E)												
4	L2	10	10.0	0.777	57.4	LOS E	13.9	101.6	1.00	0.91	1.13	35.7
5	T1	496	5.0	0.777	50.9	LOS D	13.9	101.8	1.00	0.91	1.13	35.6
6	R2	863	0.6	0.855	55.7	LOS E	24.9	175.0	1.00	0.95	1.19	35.1
Approach		1369	2.3	0.855	54.0	LOS D	24.9	175.0	1.00	0.93	1.17	35.3
North: Tonkin Hwy (N)												
7	L2	541	11.8	0.463	12.3	LOS B	8.8	67.7	0.41	0.75	0.41	59.4
8	T1	798	10.0	0.856	50.7	LOS D	23.2	176.3	1.00	0.97	1.20	42.1
9	R2	571	6.5	0.842	40.0	LOS D	9.9	73.0	1.00	0.90	1.23	41.7
Approach		1910	9.5	0.856	36.6	LOS D	23.2	176.3	0.83	0.89	0.99	45.7
West: Thomas Rd (W)												
10	L2	380	4.5	0.369	16.2	LOS B	9.3	67.8	0.56	0.74	0.56	55.3
11	T1	542	6.1	0.836	54.6	LOS D	15.7	115.4	1.00	0.96	1.23	34.4
12	R2	57	1.8	0.114	38.7	LOS D	2.3	16.3	0.79	0.74	0.79	41.5
Approach		979	5.2	0.836	38.8	LOS D	15.7	115.4	0.82	0.86	0.94	40.8
All Vehicles		4562	6.0	0.858	44.1	LOS D	24.9	176.3	0.89	0.90	1.06	40.3

The SIDRA results show that the intersection will operate at an unacceptable level of service with long delays and queues. Significant modifications to the geometry and the signal timing are required to ensure that the intersection operates within an acceptable level of service. **Figure 5-7** shows the reconfigured do-minimum intersection layout.

Figure 5-7 Reconfigured SIDRA Layout for Tonkin Highway/Thomas Road Intersection



The SIDRA results based on this reconfigured intersection layout and signal phasing analysis are summarised in **Table 5-5** and **Table 5-6**. The results show that there will be some slight delays for right turning movements, particularly on the western and northern legs of the intersection. However, these delays are considered to be acceptable as they do not considerably exceed the LOS threshold for unacceptable delays.

For the PM peak period, the intersection is approaching capacity and grade separation could be considered to improve capacity.

Table 5-5 Reconfigured Tonkin Highway/Thomas Road Intersection AM Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Tonkin Hwy (S)												
1	L2	103	6.8	0.892	61.6	LOS E	21.5	160.3	1.00	1.01	1.35	35.1
2	T1	1021	7.8	0.892	53.4	LOS D	21.8	162.5	1.00	1.01	1.35	40.6
3	R2	45	24.4	0.158	47.0	LOS D	1.9	16.0	0.88	0.74	0.88	36.9
Approach		1169	8.4	0.892	53.9	LOS D	21.8	162.5	1.00	1.00	1.33	39.9
East: Thomas Rd (E)												
4	L2	9	0.0	0.600	31.3	LOS C	9.0	66.9	0.94	0.78	0.94	49.3
5	T1	506	6.9	0.600	25.0	LOS C	9.0	67.0	0.94	0.78	0.94	47.5
6	R2	888	3.4	0.680	44.8	LOS D	13.4	96.9	0.97	0.85	0.98	38.9
Approach		1403	4.6	0.680	37.6	LOS D	13.4	96.9	0.96	0.82	0.97	41.7
North: Tonkin Hwy (N)												
7	L2	520	8.3	0.397	11.2	LOS B	6.6	49.6	0.36	0.73	0.36	61.4
8	T1	769	6.6	0.894	53.8	LOS D	22.1	163.4	1.00	1.02	1.35	40.7
9	R2	578	7.6	0.911	69.0	LOS E	17.3	129.4	1.00	1.00	1.50	31.4
Approach		1867	7.4	0.911	46.7	LOS D	22.1	163.4	0.82	0.93	1.12	40.8
West: Thomas Rd (W)												
10	L2	653	8.4	0.747	25.6	LOS C	19.9	149.2	0.86	0.93	1.05	48.0
11	T1	359	7.2	0.876	57.9	LOS E	10.1	74.8	1.00	1.01	1.45	33.4
12	R2	36	5.6	0.336	58.8	LOS E	1.8	13.3	0.99	0.73	0.99	33.6
Approach		1048	7.9	0.876	37.8	LOS D	19.9	149.2	0.91	0.95	1.19	41.2
All Vehicles		5487	7.0	0.911	44.2	LOS D	22.1	163.4	0.91	0.92	1.14	40.9

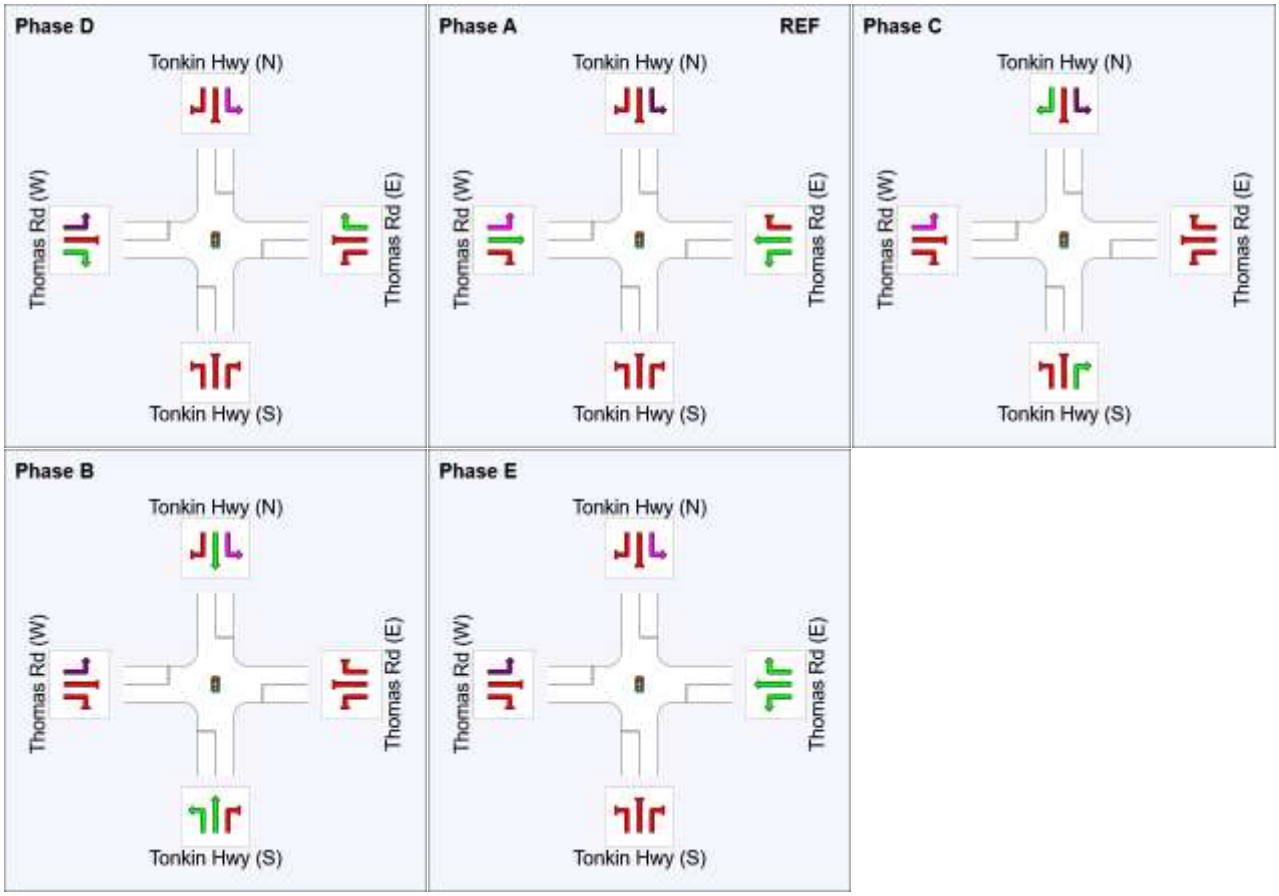
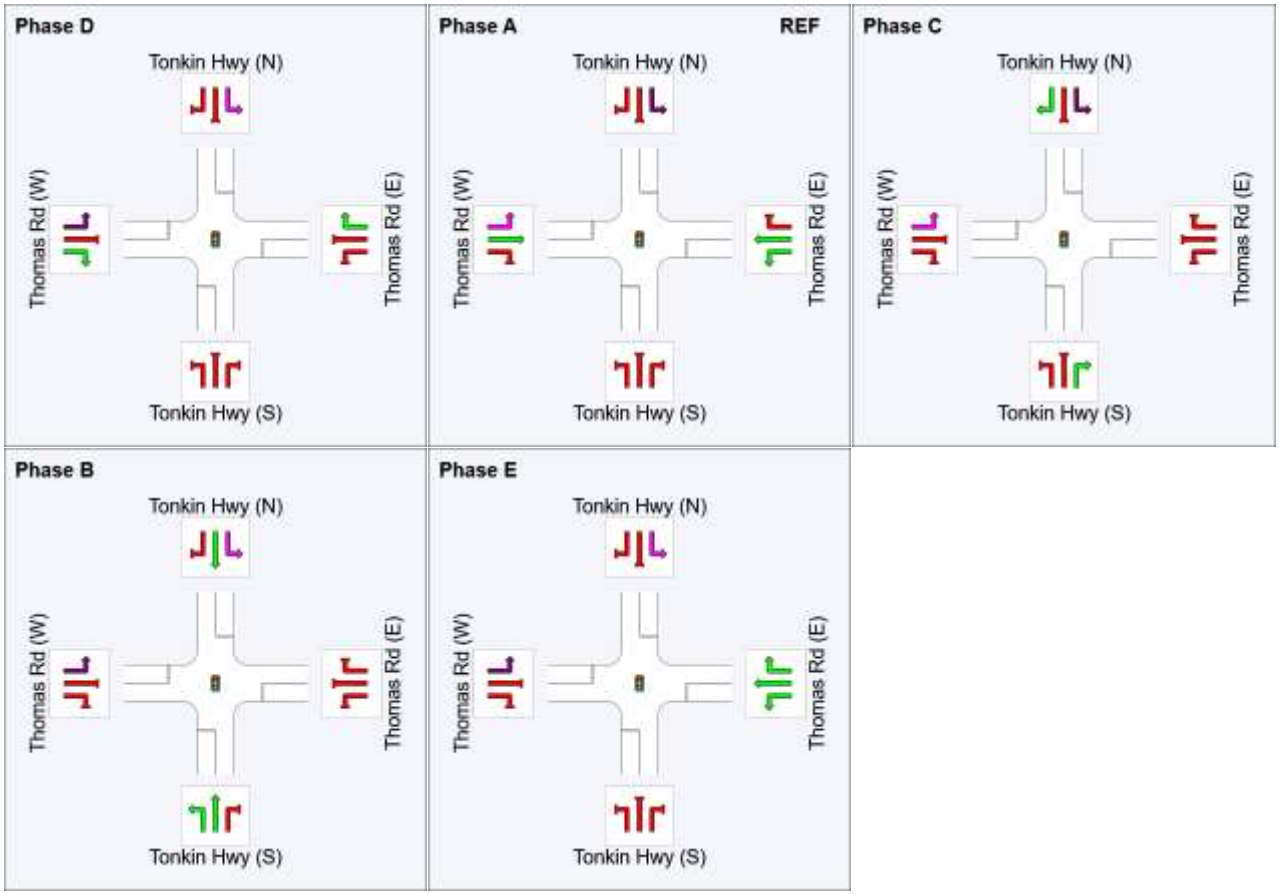


Table 5-6 Reconfigured Tonkin Highway/Thomas Road Intersection PM Results 2031

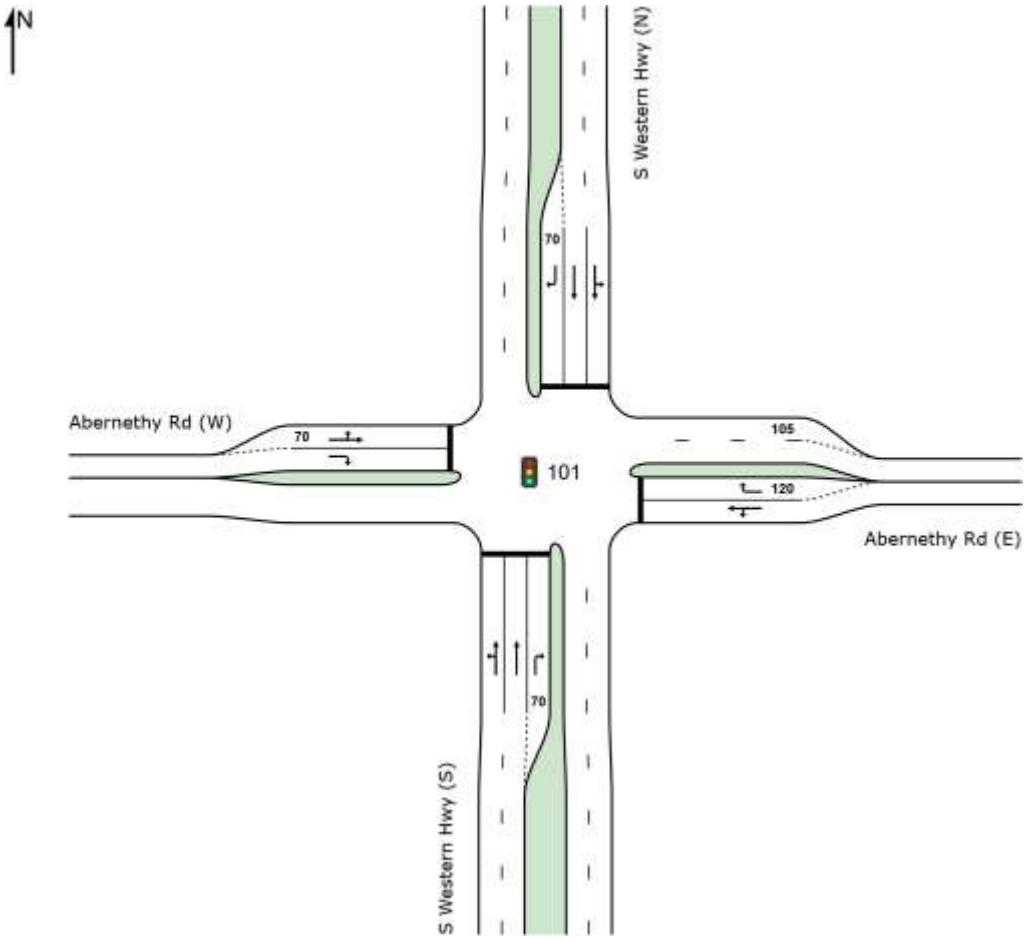
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Tonkin Hwy (S)												
1	L2	50	4.0	0.208	40.1	LOS D	3.7	27.1	0.83	0.72	0.83	43.5
2	T1	243	4.5	0.208	32.1	LOS C	3.8	27.8	0.83	0.67	0.83	52.9
3	R2	11	0.0	0.035	45.8	LOS D	0.5	3.2	0.86	0.68	0.86	40.0
Approach		304	4.3	0.208	33.9	LOS C	3.8	27.8	0.83	0.68	0.83	50.5
East: Thomas Rd (E)												
4	L2	10	10.0	0.610	36.4	LOS D	9.0	65.7	0.95	0.84	1.10	44.9
5	T1	496	5.0	0.610	29.9	LOS C	9.0	65.8	0.95	0.84	1.10	44.7
6	R2	863	0.6	0.819	54.5	LOS D	14.9	105.1	1.00	0.93	1.20	35.5
Approach		1369	2.3	0.819	45.4	LOS D	14.9	105.1	0.98	0.89	1.16	38.4
North: Tonkin Hwy (N)												
7	L2	541	11.8	0.436	12.3	LOS B	8.2	63.4	0.42	0.74	0.42	59.4
8	T1	798	10.0	0.872	49.2	LOS D	21.9	166.8	1.00	0.99	1.27	42.9
9	R2	571	6.5	0.946	79.8	LOS E	18.8	138.9	1.00	1.06	1.69	28.8
Approach		1910	9.5	0.946	47.9	LOS D	21.9	166.8	0.84	0.94	1.16	40.2
West: Thomas Rd (W)												
10	L2	380	4.5	0.324	11.4	LOS B	6.2	45.2	0.43	0.71	0.43	59.6
11	T1	542	6.1	0.963	78.7	LOS E	18.7	137.7	1.00	1.24	1.83	28.2
12	R2	57	1.8	0.518	59.6	LOS E	2.9	20.7	1.00	0.75	1.01	33.7
Approach		979	5.2	0.963	51.4	LOS D	18.7	137.7	0.78	1.01	1.24	35.8
All Vehicles		4562	6.0	0.963	47.0	LOS D	21.9	166.8	0.87	0.92	1.15	39.1



5.5.4 No. 2 – Abernethy Road and South Western Highway

The following presents the results of the analysis of the Abernethy Road/South Western Highway intersection**. Figure 5-8** is a SIDRA layout representation of the intersection which is based on the indicative layouts used in the mesoscopic model.

Figure 5-8 SIDRA Layout for Abernethy Road/South Western Highway Intersection



The SIDRA results based on this intersection layout and signal phasing analysis are summarised in **Table 5-7** and **Table 5-8**.

Table 5-7 Abernethy Road/South Western Highway Intersection AM Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: S Western Hwy (S)												
1	L2	129	10.1	0.803	56.7	LOS E	30.8	228.6	0.96	0.85	0.96	31.6
2	T1	784	6.1	0.803	50.2	LOS D	30.8	228.6	0.94	0.83	0.94	32.7
3	R2	65	4.6	0.266	69.8	LOS E	4.2	30.8	0.91	0.75	0.91	27.6
Approach		978	6.5	0.803	52.3	LOS D	30.8	228.6	0.94	0.83	0.94	32.2
East: Abernethy Rd (E)												
4	L2	74	5.4	0.298	55.9	LOS E	7.7	57.0	0.84	0.73	0.84	31.5
5	T1	59	6.8	0.298	50.2	LOS D	7.7	57.0	0.84	0.73	0.84	32.0
6	R2	137	10.2	0.362	54.4	LOS D	8.2	62.7	0.86	0.78	0.86	31.2
Approach		270	8.1	0.362	53.9	LOS D	8.2	62.7	0.85	0.76	0.85	31.5
North: S Western Hwy (N)												
7	L2	35	14.3	0.627	53.0	LOS D	22.5	167.4	0.89	0.78	0.89	32.9
8	T1	665	6.8	0.627	46.6	LOS D	22.5	167.4	0.87	0.76	0.87	33.9
9	R2	123	3.3	0.498	72.5	LOS E	8.3	59.9	0.95	0.79	0.95	27.1
Approach		823	6.6	0.627	50.7	LOS D	22.5	167.4	0.89	0.77	0.89	32.7
West: Abernethy Rd (W)												
10	L2	209	9.1	0.625	60.9	LOS E	16.9	126.8	0.92	0.82	0.92	29.8
11	T1	56	5.4	0.625	55.2	LOS E	16.9	126.8	0.92	0.82	0.92	30.4
12	R2	116	7.8	0.484	72.5	LOS E	7.8	58.6	0.95	0.79	0.95	27.1
Approach		381	8.1	0.625	63.6	LOS E	16.9	126.8	0.93	0.81	0.93	29.0
All Vehicles		2452	7.0	0.803	53.7	LOS D	30.8	228.6	0.91	0.80	0.91	31.7

Table 5-8 Abernethy Road/South Western Highway Intersection PM Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: S Western Hwy (S)												
1	L2	134	6.0	0.578	47.4	LOS D	18.5	136.1	0.87	0.78	0.87	34.2
2	T1	546	6.2	0.578	41.5	LOS D	18.5	136.1	0.86	0.76	0.86	35.4
3	R2	71	4.2	0.262	62.0	LOS E	4.1	30.0	0.90	0.76	0.90	29.3
Approach		751	6.0	0.578	44.5	LOS D	18.5	136.1	0.87	0.76	0.87	34.5
East: Abernethy Rd (E)												
4	L2	94	6.4	0.459	58.9	LOS E	9.4	69.5	0.91	0.78	0.91	30.6
5	T1	69	5.8	0.459	53.3	LOS D	9.4	69.5	0.91	0.78	0.91	31.2
6	R2	96	6.3	0.228	36.6	LOS D	4.1	30.1	0.80	0.75	0.80	36.9
Approach		259	6.2	0.459	49.1	LOS D	9.4	69.5	0.87	0.76	0.87	32.8
North: S Western Hwy (N)												
7	L2	68	5.9	0.773	51.0	LOS D	27.1	200.6	0.95	0.84	0.95	33.5
8	T1	765	7.1	0.773	43.9	LOS D	27.1	200.6	0.91	0.80	0.91	34.7
9	R2	236	2.5	0.860	69.2	LOS E	15.4	110.3	1.00	0.84	1.02	27.8
Approach		1069	6.0	0.860	50.0	LOS D	27.1	200.6	0.93	0.81	0.94	32.8
West: Abernethy Rd (W)												
10	L2	116	10.3	0.503	59.6	LOS E	10.2	77.0	0.92	0.79	0.92	30.3
11	T1	59	5.1	0.503	53.9	LOS D	10.2	77.0	0.92	0.79	0.92	30.9
12	R2	312	2.9	1.155	349.0	LOS F	56.7	406.9	1.00	1.71	2.97	8.7
Approach		487	4.9	1.155	244.3	LOS F	56.7	406.9	0.97	1.38	2.24	11.7
All Vehicles		2566	5.8	1.155	85.2	LOS F	56.7	406.9	0.91	0.90	1.16	24.7

The SIDRA results show that the western leg of the intersection will experience delays in the PM peak. However, reconfiguring the turning movement arrangement and intersection layout would likely improve the operation of the intersection. **Figure 5-9** shows the updated layout and **Table 5-10** and **Table 5-10** show the results with the modified signal phasing for the PM peak.

Figure 5-9 Reconfigured SIDRA Layout for Abernethy Road/South Western Highway Intersection

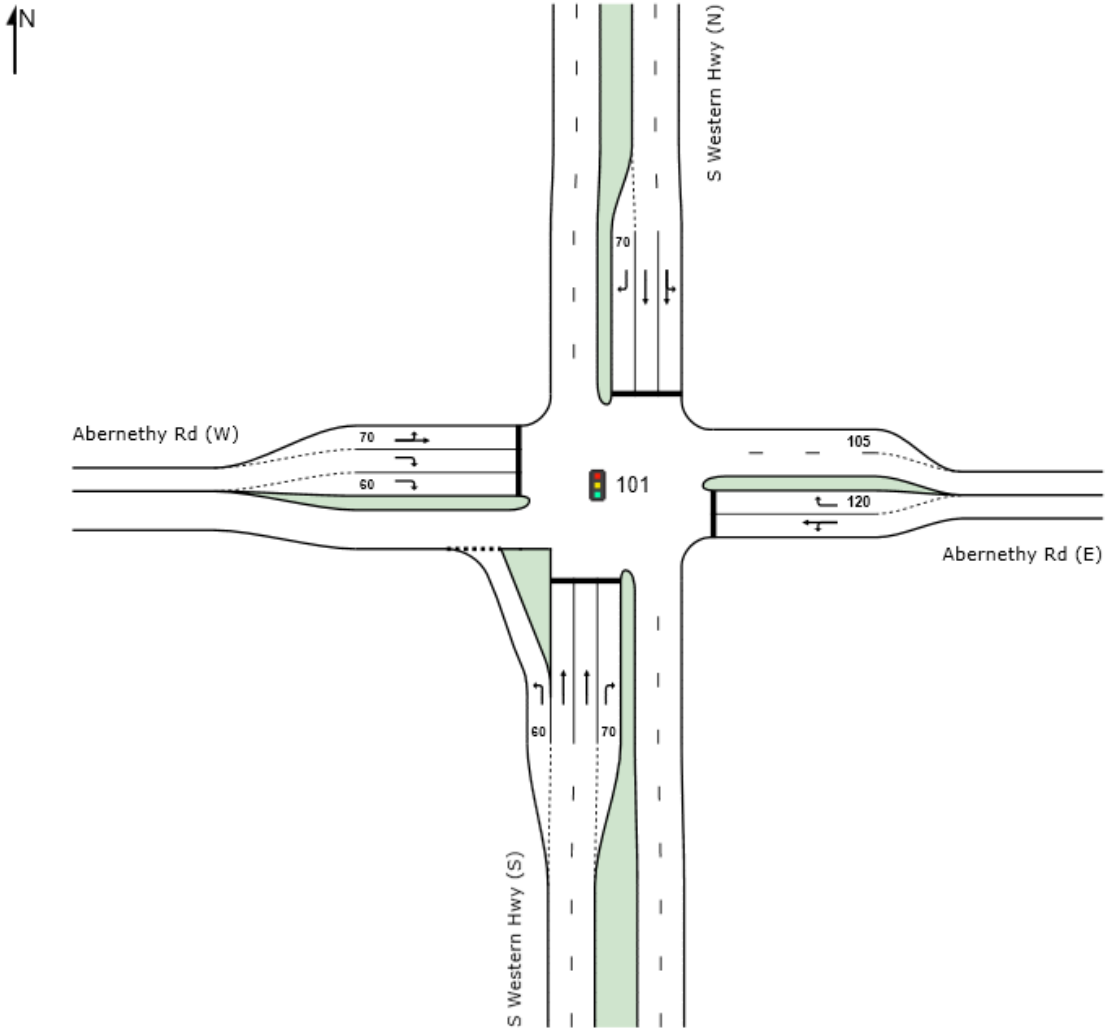


Table 5-9 Abernethy Road/South Western Highway Intersection AM Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: S Western Hwy (S)												
1	L2	129	10.1	0.100	7.2	LOS A	1.2	9.3	0.19	0.60	0.19	52.7
2	T1	784	6.1	0.754	47.6	LOS D	24.3	179.4	0.91	0.79	0.91	33.7
3	R2	65	4.6	0.257	66.9	LOS E	4.1	29.6	0.91	0.75	0.91	28.2
Approach		978	6.5	0.754	43.6	LOS D	24.3	179.4	0.82	0.76	0.82	34.9
East: Abernethy Rd (E)												
4	L2	74	5.4	0.305	54.9	LOS D	7.5	55.5	0.84	0.74	0.84	31.7
5	T1	59	6.8	0.305	49.3	LOS D	7.5	55.5	0.84	0.74	0.84	32.3
6	R2	137	10.2	0.360	52.6	LOS D	8.0	60.6	0.86	0.78	0.86	31.7
Approach		270	8.1	0.360	52.5	LOS D	8.0	60.6	0.85	0.76	0.85	31.9
North: S Western Hwy (N)												
7	L2	35	14.3	0.643	52.8	LOS D	21.9	163.0	0.90	0.79	0.90	33.0
8	T1	665	6.8	0.643	46.4	LOS D	21.9	163.0	0.89	0.77	0.89	34.0
9	R2	123	3.3	0.481	69.5	LOS E	8.0	57.6	0.94	0.79	0.94	27.8
Approach		823	6.6	0.643	50.1	LOS D	21.9	163.0	0.89	0.77	0.89	32.9
West: Abernethy Rd (W)												
10	L2	209	9.1	0.625	59.9	LOS E	16.5	123.6	0.93	0.82	0.93	30.1
11	T1	56	5.4	0.625	54.3	LOS D	16.5	123.6	0.93	0.82	0.93	30.6
12	R2	116	7.8	0.234	66.8	LOS E	3.6	27.0	0.90	0.75	0.90	28.4
Approach		381	8.1	0.625	61.2	LOS E	16.5	123.6	0.92	0.80	0.92	29.6
All Vehicles		2452	7.0	0.754	49.5	LOS D	24.3	179.4	0.86	0.77	0.86	33.0

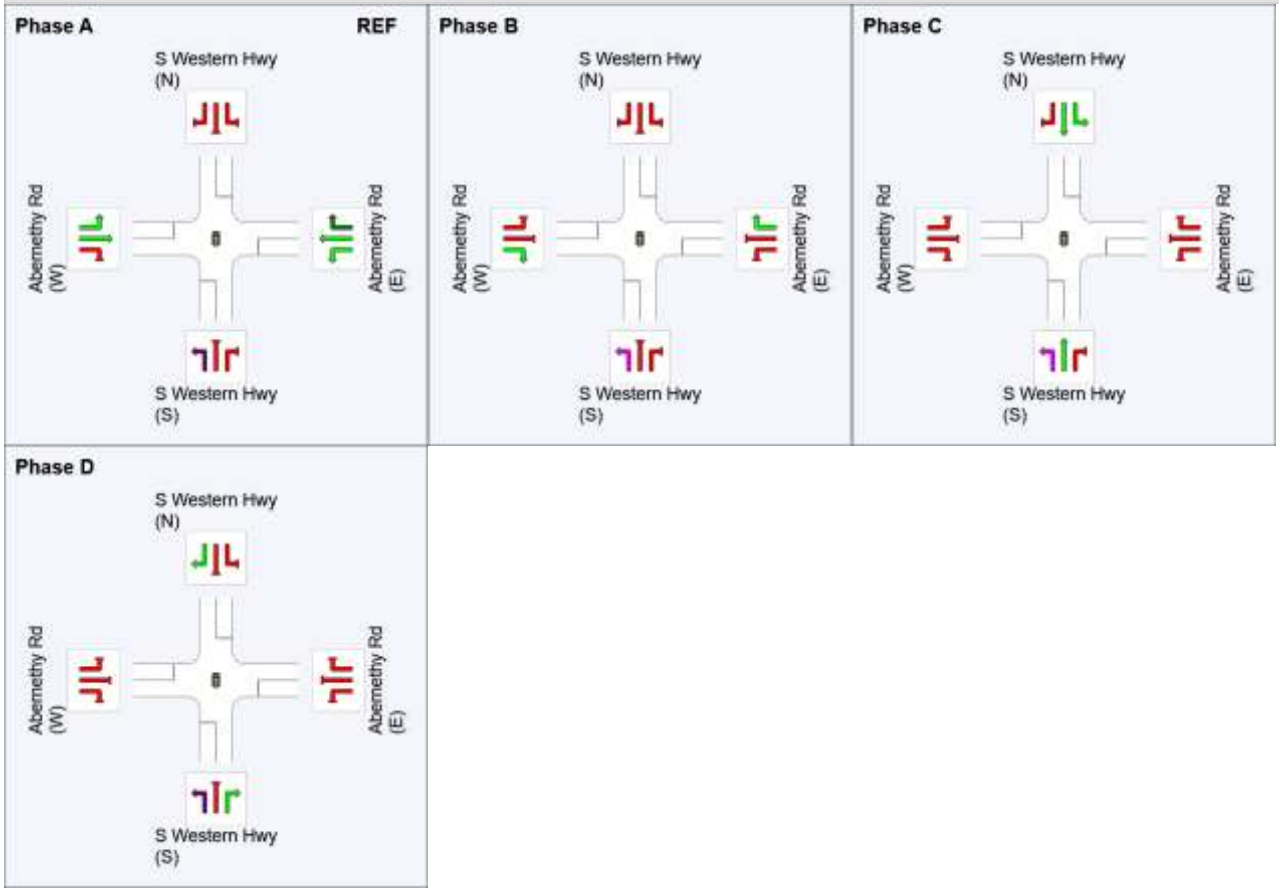
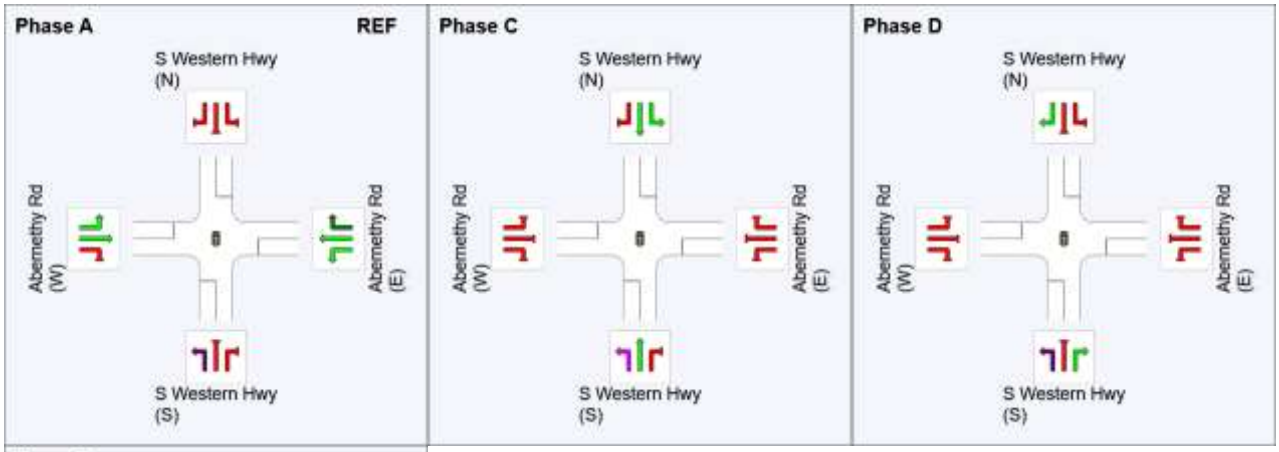


Table 5-10 Abernethy Road/South Western Highway Intersection PM Results 2031

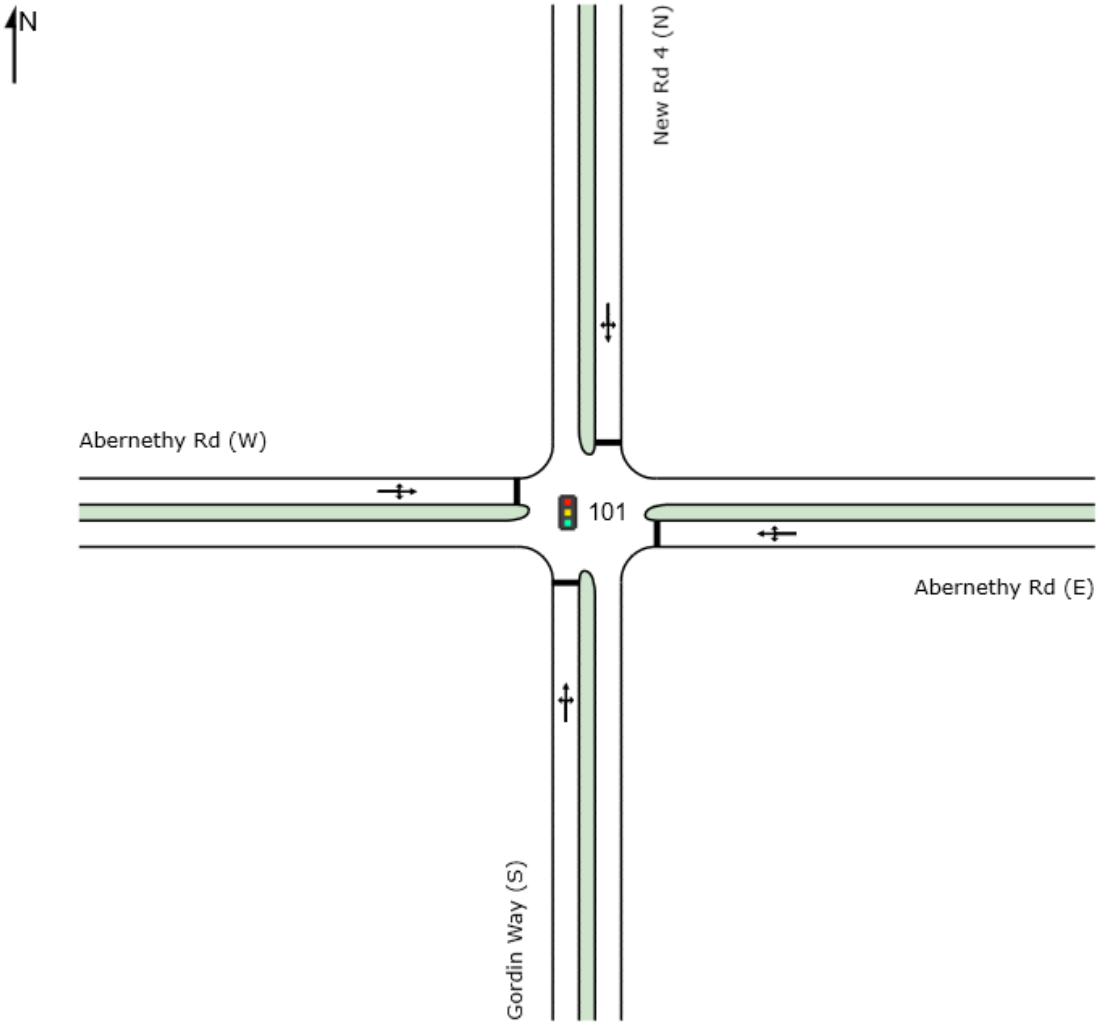
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: S Western Hwy (S)												
1	L2	134	6.0	0.104	9.1	LOS A	1.9	13.9	0.28	0.62	0.28	51.4
2	T1	546	6.2	0.451	39.6	LOS D	13.9	102.8	0.82	0.70	0.82	36.4
3	R2	71	4.2	0.262	62.0	LOS E	4.1	30.0	0.90	0.76	0.90	29.3
Approach		751	6.0	0.451	36.3	LOS D	13.9	102.8	0.73	0.69	0.73	37.5
East: Abernethy Rd (E)												
4	L2	94	6.4	0.459	58.9	LOS E	9.4	69.5	0.91	0.78	0.91	30.6
5	T1	69	5.8	0.459	53.3	LOS D	9.4	69.5	0.91	0.78	0.91	31.2
6	R2	96	6.3	0.228	36.6	LOS D	4.1	30.1	0.80	0.75	0.80	36.9
Approach		259	6.2	0.459	49.1	LOS D	9.4	69.5	0.87	0.76	0.87	32.9
North: S Western Hwy (N)												
7	L2	68	5.9	0.775	51.0	LOS D	27.1	201.1	0.95	0.84	0.95	33.5
8	T1	765	7.1	0.775	43.9	LOS D	27.1	201.1	0.91	0.80	0.91	34.8
9	R2	236	2.5	0.860	69.2	LOS E	15.4	110.3	1.00	0.84	1.02	27.9
Approach		1069	6.0	0.860	50.0	LOS D	27.1	201.1	0.93	0.81	0.94	32.9
West: Abernethy Rd (W)												
10	L2	116	10.3	0.503	59.6	LOS E	10.2	77.0	0.92	0.79	0.92	30.3
11	T1	59	5.1	0.503	53.9	LOS D	10.2	77.0	0.92	0.79	0.92	30.9
12	R2	312	2.9	0.570	65.4	LOS E	9.6	68.9	0.95	0.80	0.95	28.8
Approach		487	4.9	0.570	62.7	LOS E	10.2	77.0	0.94	0.80	0.94	29.4
All Vehicles		2566	5.8	0.860	48.3	LOS D	27.1	201.1	0.87	0.77	0.87	33.3



5.5.5 No. 3 – Abernethy Rd/New Road 4/Gordin Way

The following presents the results of the analysis of the Abernethy Rd/New Road 4/Gordin Way intersection**.** **Figure 5-10** is a SIDRA layout representation of the intersection which is based on the indicative layouts used in the mesoscopic model.

Figure 5-10 SIDRA Layout for Abernethy Rd/New Road 4/Gordin Way Intersection



The SIDRA results based on this intersection layout and signal phasing are summarised in **Table 5-11** and **Table 5-12**.

Table 5-11 Abernethy Rd/New Road 4/Gordin Way Intersection AM Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Gordin Way (S)												
1	L2	29	6.9	0.519	50.2	LOS D	10.3	74.1	0.91	0.77	0.91	33.6
2	T1	168	3.0	0.519	44.6	LOS D	10.3	74.1	0.91	0.77	0.91	34.2
3	R2	11	0.0	0.519	50.0	LOS D	10.3	74.1	0.91	0.77	0.91	33.5
Approach		208	3.4	0.519	45.7	LOS D	10.3	74.1	0.91	0.77	0.91	34.1
East: Abernethy Rd (E)												
4	L2	7	14.3	0.569	48.6	LOS D	11.9	91.0	0.91	0.79	0.91	33.7
5	T1	156	7.1	0.569	42.9	LOS D	11.9	91.0	0.91	0.79	0.91	34.5
6	R2	80	16.3	0.569	48.5	LOS D	11.9	91.0	0.91	0.79	0.91	33.5
Approach		243	10.3	0.569	44.9	LOS D	11.9	91.0	0.91	0.79	0.91	34.2
North: New Rd 4 (N)												
7	L2	13	0.0	0.384	60.8	LOS E	3.8	26.7	0.95	0.74	0.95	30.2
8	T1	32	0.0	0.384	55.3	LOS E	3.8	26.7	0.95	0.74	0.95	30.6
9	R2	26	0.0	0.384	60.7	LOS E	3.8	26.7	0.95	0.74	0.95	30.0
Approach		71	0.0	0.384	58.3	LOS E	3.8	26.7	0.95	0.74	0.95	30.3
West: Abernethy Rd (W)												
10	L2	54	7.4	0.568	48.4	LOS D	12.4	90.1	0.91	0.78	0.91	33.9
11	T1	166	4.2	0.568	42.8	LOS D	12.4	90.1	0.91	0.78	0.91	34.6
12	R2	32	3.1	0.568	48.3	LOS D	12.4	90.1	0.91	0.78	0.91	33.7
Approach		252	4.8	0.568	44.7	LOS D	12.4	90.1	0.91	0.78	0.91	34.3
All Vehicles		774	5.7	0.569	46.3	LOS D	12.4	91.0	0.91	0.78	0.91	33.8

Table 5-12 Abernethy Rd/New Road 4/Gordin Way Intersection PM Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Gordin Way (S)												
1	L2	54	1.9	0.596	67.6	LOS E	14.6	104.0	0.94	0.80	0.94	28.8
2	T1	139	1.4	0.596	62.0	LOS E	14.6	104.0	0.94	0.80	0.94	29.2
3	R2	25	4.0	0.596	67.5	LOS E	14.6	104.0	0.94	0.80	0.94	28.6
Approach		218	1.8	0.596	64.0	LOS E	14.6	104.0	0.94	0.80	0.94	29.0
East: Abernethy Rd (E)												
4	L2	36	0.0	0.637	65.9	LOS E	16.6	123.5	0.94	0.81	0.94	29.2
5	T1	159	5.0	0.637	60.4	LOS E	16.6	123.5	0.94	0.81	0.94	29.6
6	R2	53	18.9	0.637	66.0	LOS E	16.6	123.5	0.94	0.81	0.94	28.8
Approach		248	7.3	0.637	62.4	LOS E	16.6	123.5	0.94	0.81	0.94	29.4
North: New Rd 4 (N)												
7	L2	40	0.0	0.589	68.3	LOS E	13.9	99.2	0.94	0.80	0.94	28.5
8	T1	114	1.8	0.589	62.7	LOS E	13.9	99.2	0.94	0.80	0.94	28.9
9	R2	53	3.8	0.589	68.2	LOS E	13.9	99.2	0.94	0.80	0.94	28.3
Approach		207	1.9	0.589	65.2	LOS E	13.9	99.2	0.94	0.80	0.94	28.7
West: Abernethy Rd (W)												
10	L2	118	11.0	0.734	63.9	LOS E	22.4	164.4	0.96	0.83	0.96	29.5
11	T1	194	2.6	0.734	58.2	LOS E	22.4	164.4	0.96	0.83	0.96	30.1
12	R2	21	0.0	0.734	63.7	LOS E	22.4	164.4	0.96	0.83	0.96	29.5
Approach		333	5.4	0.734	60.6	LOS E	22.4	164.4	0.96	0.83	0.96	29.8
All Vehicles		1006	4.4	0.734	62.7	LOS E	22.4	164.4	0.95	0.81	0.95	29.3

The SIDRA results shows that the intersection will operate at an unacceptable level of service with long delays and queues in the PM peak.

However, this intersection has been proposed to be reconstructed as a roundabout, providing additional capacity for peak period movements. **Figure 5-11** shows a SIDRA depiction of the updated layout. **Table 5-13** and **Table 5-14** show the results of assessment. The results indicate that the reconfigured intersection would function at a high LOS through to the development horizon.

Figure 5-11 Reconfigured SIDRA Layout for Abernethy Rd/New Road 4/Gordin Way Intersection

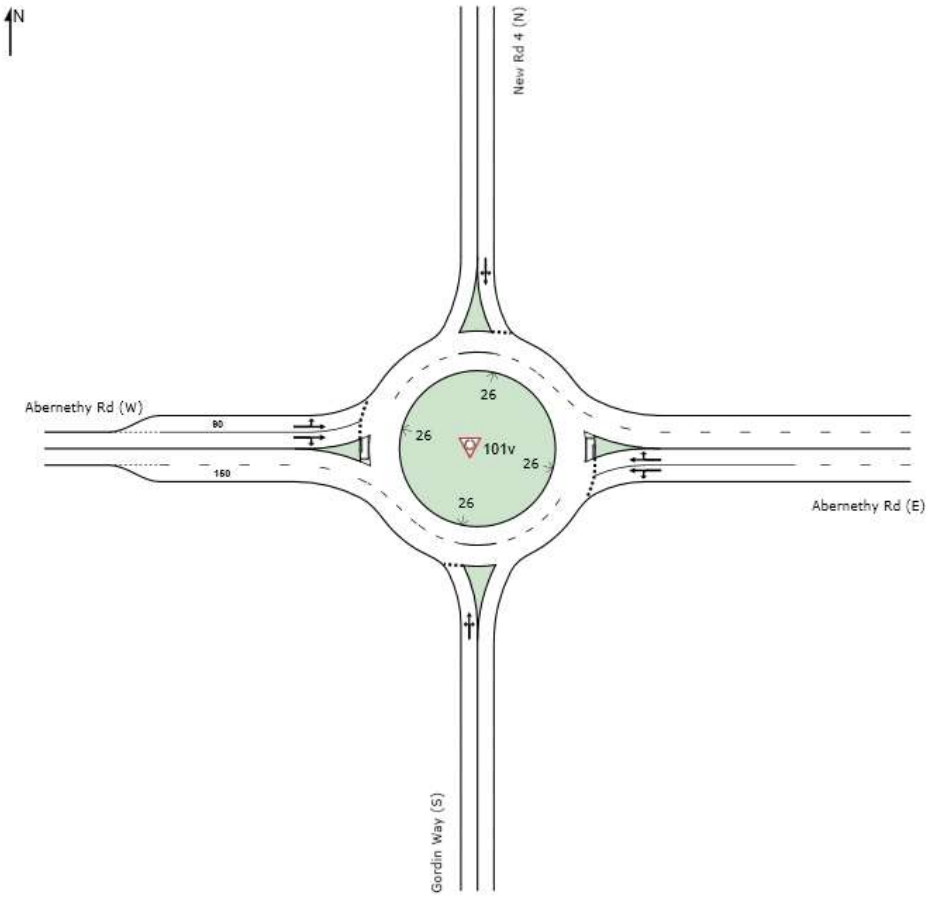


Table 5-13 Reconfigured Abernethy Rd/New Road 4/Gordin Way Intersection AM Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Gordin Way (S)												
1	L2	29	6.9	0.200	5.1	LOS A	1.0	7.1	0.44	0.52	0.44	53.9
2	T1	168	3.0	0.200	5.0	LOS A	1.0	7.1	0.44	0.52	0.44	55.5
3	R2	11	0.0	0.200	10.4	LOS B	1.0	7.1	0.44	0.52	0.44	55.8
Approach		208	3.4	0.200	5.3	LOS A	1.0	7.1	0.44	0.52	0.44	55.3
East: Abernethy Rd (E)												
4	L2	7	14.3	0.083	4.5	LOS A	0.5	3.6	0.27	0.39	0.27	54.2
5	T1	156	7.1	0.088	4.3	LOS A	0.5	4.0	0.26	0.44	0.26	55.5
6	R2	80	16.3	0.088	9.6	LOS A	0.5	4.0	0.25	0.53	0.25	53.9
Approach		243	10.3	0.088	6.0	LOS A	0.5	4.0	0.26	0.47	0.26	54.9
North: New Rd 4 (N)												
7	L2	13	0.0	0.065	4.5	LOS A	0.3	2.2	0.37	0.54	0.37	53.4
8	T1	32	0.0	0.065	4.7	LOS A	0.3	2.2	0.37	0.54	0.37	54.7
9	R2	26	0.0	0.065	9.9	LOS A	0.3	2.2	0.37	0.54	0.37	54.9
Approach		71	0.0	0.065	6.6	LOS A	0.3	2.2	0.37	0.54	0.37	54.6
West: Abernethy Rd (W)												
10	L2	54	7.4	0.100	4.8	LOS A	0.6	4.5	0.45	0.48	0.45	53.9
11	T1	166	4.2	0.100	4.9	LOS A	0.6	4.5	0.46	0.51	0.46	55.1
12	R2	32	3.1	0.100	10.5	LOS B	0.6	4.3	0.47	0.54	0.47	54.6
Approach		252	4.8	0.100	5.6	LOS A	0.6	4.5	0.46	0.51	0.46	54.8
All Vehicles		774	5.7	0.200	5.8	LOS A	1.0	7.1	0.38	0.50	0.38	54.9

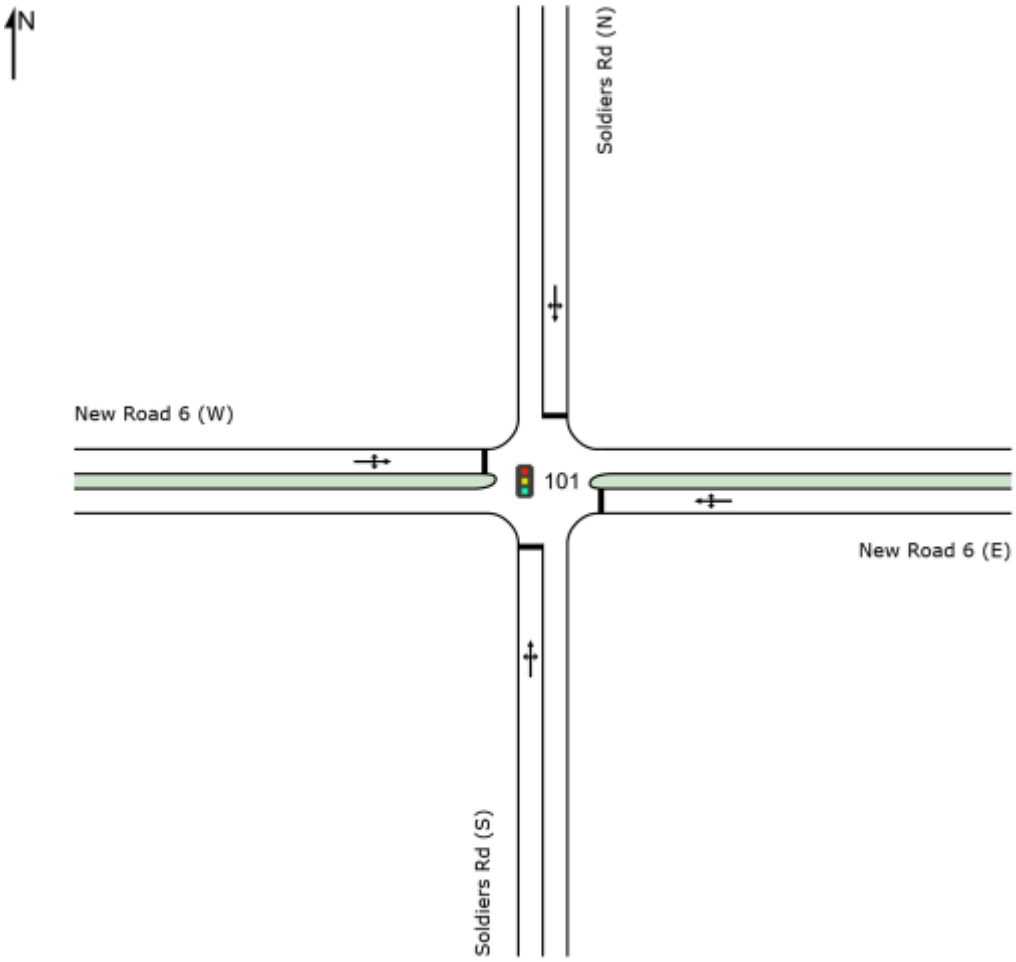
Table 5-14 Reconfigured Abernethy Rd/New Road 4/Gordin Way Intersection PM Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Gordin Way (S)												
1	L2	54	1.9	0.209	5.0	LOS A	1.1	7.7	0.45	0.55	0.45	53.9
2	T1	139	1.4	0.209	5.0	LOS A	1.1	7.7	0.45	0.55	0.45	55.3
3	R2	25	4.0	0.209	10.5	LOS B	1.1	7.7	0.45	0.55	0.45	55.5
Approach		218	1.8	0.209	5.6	LOS A	1.1	7.7	0.45	0.55	0.45	55.0
East: Abernethy Rd (E)												
4	L2	36	0.0	0.092	4.8	LOS A	0.6	4.0	0.40	0.46	0.40	54.1
5	T1	159	5.0	0.097	4.7	LOS A	0.6	4.6	0.40	0.49	0.40	55.0
6	R2	53	18.9	0.097	10.1	LOS B	0.6	4.6	0.39	0.52	0.39	54.0
Approach		248	7.3	0.097	5.9	LOS A	0.6	4.6	0.40	0.49	0.40	54.7
North: New Rd 4 (N)												
7	L2	40	0.0	0.194	4.8	LOS A	1.0	7.3	0.43	0.56	0.43	53.5
8	T1	114	1.8	0.194	5.1	LOS A	1.0	7.3	0.43	0.56	0.43	54.8
9	R2	53	3.8	0.194	10.3	LOS B	1.0	7.3	0.43	0.56	0.43	54.9
Approach		207	1.9	0.194	6.4	LOS A	1.0	7.3	0.43	0.56	0.43	54.6
West: Abernethy Rd (W)												
10	L2	118	11.0	0.129	4.7	LOS A	0.8	6.1	0.42	0.49	0.42	54.1
11	T1	194	2.6	0.129	4.8	LOS A	0.8	6.1	0.44	0.50	0.44	55.4
12	R2	21	0.0	0.129	10.2	LOS B	0.8	5.6	0.44	0.50	0.44	55.3
Approach		333	5.4	0.129	5.1	LOS A	0.8	6.1	0.43	0.49	0.43	54.9
All Vehicles		1006	4.4	0.209	5.7	LOS A	1.1	7.7	0.43	0.52	0.43	54.8

5.5.6 No. 4 – Soldiers Road and New Road 6 (Orton Road)

The following presents the results of the analysis of the Soldiers Road/New Road 6 intersection**. Figure 5-12** is a SIDRA layout representation of the intersection which is based on the indicative layouts used in the mesoscopic model.

Figure 5-12 SIDRA Layout for Soldiers Road/New Road 6 Intersection



The SIDRA results based on this reconfigured intersection layout and signal phasing analysis are summarised in **Table 5-15** and **Table 5-16**.

Table 5-15 Soldiers Road/New Road 6 Intersection AM Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total 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	Aver. No. Cycles	Average Speed km/h
South: Soldiers Rd (S)												
1	L2	171	4.1	1.063	221.9	LOS F	43.2	309.1	1.00	1.42	2.25	13.1
2	T1	81	1.2	1.063	214.9	LOS F	43.2	309.1	1.00	1.42	2.25	13.5
3	R2	49	0.0	1.063	221.5	LOS F	43.2	309.1	1.00	1.42	2.25	13.1
Approach		301	2.7	1.063	219.9	LOS F	43.2	309.1	1.00	1.42	2.25	13.2
East: New Road 6 (E)												
4	L2	80	1.3	1.089	254.1	LOS F	108.3	793.5	1.00	1.84	2.32	11.7
5	T1	520	6.5	1.089	248.5	LOS F	108.3	793.5	1.00	1.84	2.32	11.6
6	R2	63	1.6	1.089	254.0	LOS F	108.3	793.5	1.00	1.84	2.32	11.7
Approach		663	5.4	1.089	249.7	LOS F	108.3	793.5	1.00	1.84	2.32	11.6
North: Soldiers Rd (N)												
7	L2	166	4.8	1.090	262.6	LOS F	58.4	421.5	1.00	1.67	2.43	11.4
8	T1	198	2.5	1.090	255.5	LOS F	58.4	421.5	1.00	1.67	2.43	11.8
9	R2	1	0.0	1.090	262.2	LOS F	58.4	421.5	1.00	1.67	2.43	11.4
Approach		365	3.6	1.090	258.8	LOS F	58.4	421.5	1.00	1.67	2.43	11.6
West: New Road 6 (W)												
10	L2	1	0.0	1.069	227.8	LOS F	52.8	385.5	1.00	1.71	2.26	12.8
11	T1	255	6.3	1.069	222.3	LOS F	52.8	385.5	1.00	1.71	2.26	12.6
12	R2	102	2.0	1.069	227.7	LOS F	52.8	385.5	1.00	1.71	2.26	12.7
Approach		358	5.0	1.069	223.8	LOS F	52.8	385.5	1.00	1.71	2.26	12.6
All Vehicles		1687	4.4	1.090	240.9	LOS F	108.3	793.5	1.00	1.70	2.32	12.1

Table 5-16 Soldiers Road/New Road 6 Intersection PM Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total 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	Aver. No. Cycles	Average Speed km/h
South: Soldiers Rd (S)												
1	L2	160	1.3	1.010	151.0	LOS F	42.3	298.3	1.00	1.20	1.81	17.8
2	T1	71	0.0	1.010	144.0	LOS F	42.3	298.3	1.00	1.20	1.81	18.6
3	R2	133	0.8	1.010	150.6	LOS F	42.3	298.3	1.00	1.20	1.81	17.7
Approach		364	0.8	1.010	149.5	LOS F	42.3	298.3	1.00	1.20	1.81	17.9
East: New Road 6 (E)												
4	L2	109	0.0	0.998	133.7	LOS F	53.5	381.4	1.00	1.31	1.66	19.5
5	T1	307	2.9	0.998	128.1	LOS F	53.5	381.4	1.00	1.31	1.66	19.1
6	R2	62	1.6	0.998	133.6	LOS F	53.5	381.4	1.00	1.31	1.66	19.4
Approach		478	2.1	0.998	130.1	LOS F	53.5	381.4	1.00	1.31	1.66	19.2
North: Soldiers Rd (N)												
7	L2	125	4.8	1.020	163.2	LOS F	33.3	239.3	1.00	1.33	1.94	16.9
8	T1	153	2.0	1.020	156.2	LOS F	33.3	239.3	1.00	1.33	1.94	17.7
9	R2	1	0.0	1.020	162.8	LOS F	33.3	239.3	1.00	1.33	1.94	16.9
Approach		279	3.2	1.020	159.3	LOS F	33.3	239.3	1.00	1.33	1.94	17.3
West: New Road 6 (W)												
10	L2	132	0.0	0.995	131.2	LOS F	51.0	363.3	1.00	1.27	1.65	19.7
11	T1	238	3.8	0.995	125.6	LOS F	51.0	363.3	1.00	1.27	1.65	19.3
12	R2	91	1.1	0.995	131.1	LOS F	51.0	363.3	1.00	1.27	1.65	19.6
Approach		461	2.2	0.995	128.3	LOS F	51.0	363.3	1.00	1.27	1.65	19.5
All Vehicles		1582	2.0	1.020	139.2	LOS F	53.5	381.4	1.00	1.28	1.74	18.6

The SIDRA results shows that the intersection will operate at an unacceptable level of service with long delays and queues. Modifications to the geometry and the signal timing are required to ensure that the intersection operates within an acceptable level of service. **Figure 5-13** shows the reconfigured intersection layout and **Table 5-17** and **Table 5-18** shows the results for the modified signal phasing.

Figure 5-13 Reconfigured SIDRA Layout for Soldiers Road/New Road 6 Intersection

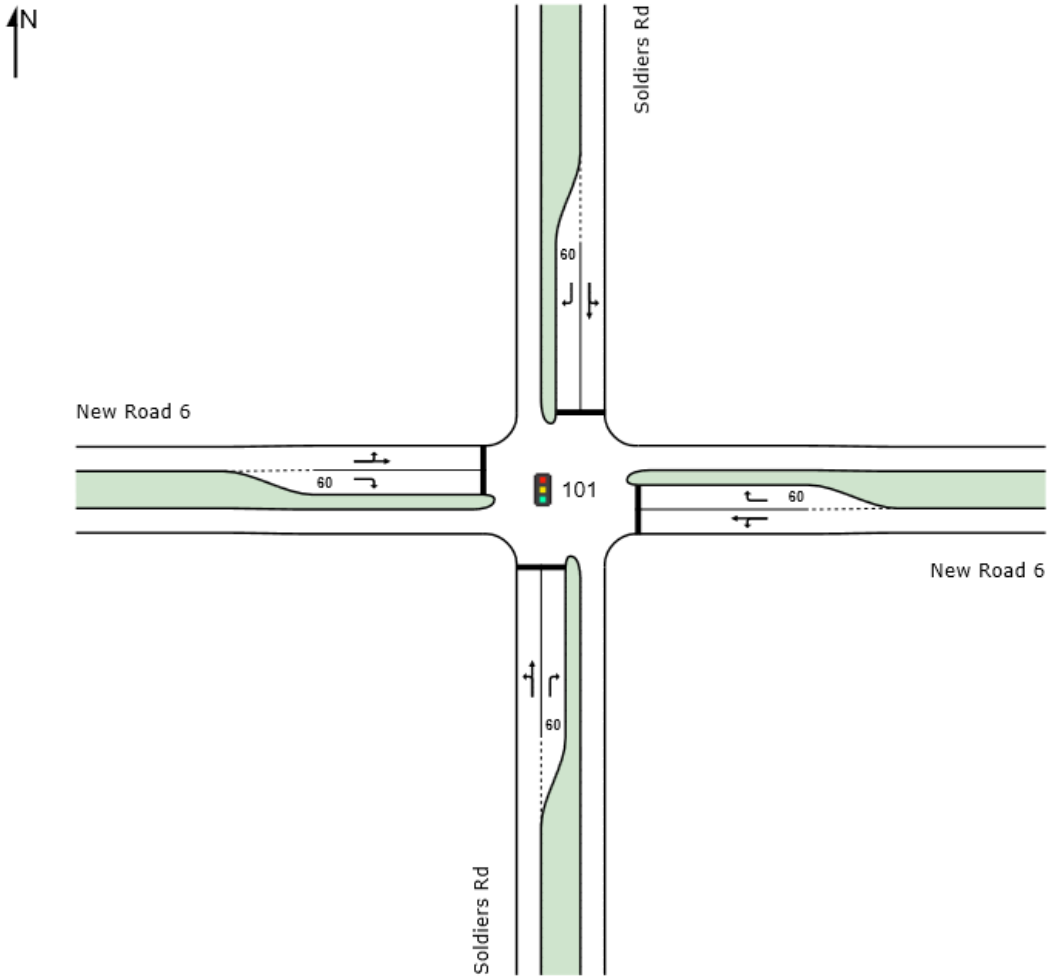
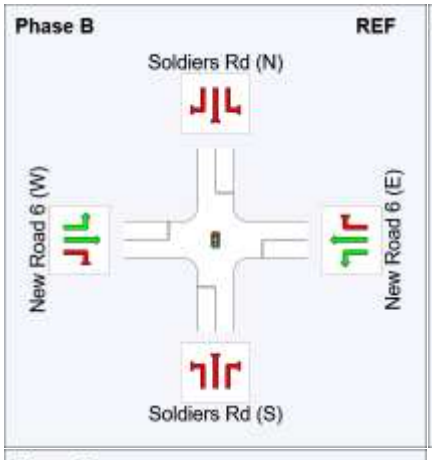
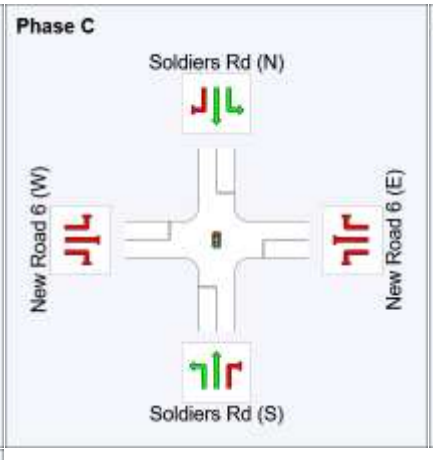
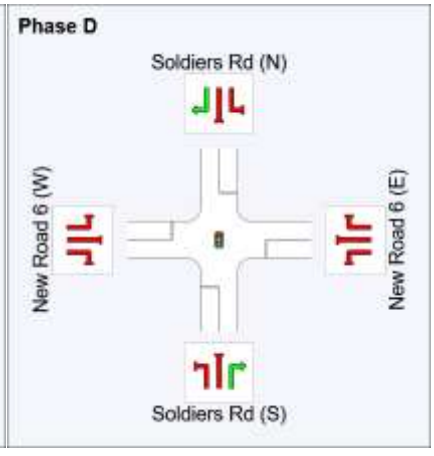


Table 5-17 Reconfigured Soldiers Road/New Road 6 Intersection AM Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Soldiers Rd												
1	L2	171	4.1	0.574	44.1	LOS D	11.6	83.1	0.94	0.81	0.94	34.8
2	T1	81	1.2	0.574	38.5	LOS D	11.6	83.1	0.94	0.81	0.94	35.4
3	R2	49	0.0	0.462	61.0	LOS E	2.6	18.3	1.00	0.74	1.00	29.5
Approach		301	2.7	0.574	45.4	LOS D	11.6	83.1	0.95	0.80	0.95	33.9
East: New Road 6												
4	L2	80	1.3	0.836	40.2	LOS D	29.6	217.4	0.94	0.92	1.04	37.2
5	T1	520	6.5	0.836	34.6	LOS C	29.6	217.4	0.94	0.92	1.04	37.9
6	R2	63	1.6	0.515	60.0	LOS E	3.3	23.7	1.00	0.75	1.00	29.7
Approach		663	5.4	0.836	37.7	LOS D	29.6	217.4	0.94	0.90	1.04	36.9
North: Soldiers Rd												
7	L2	166	4.8	0.823	52.2	LOS D	19.5	140.4	1.00	0.96	1.16	32.6
8	T1	198	2.5	0.823	46.6	LOS D	19.5	140.4	1.00	0.96	1.16	33.2
9	R2	1	0.0	0.009	57.2	LOS E	0.0	0.3	0.96	0.59	0.96	30.4
Approach		365	3.6	0.823	49.2	LOS D	19.5	140.4	1.00	0.96	1.16	32.9
West: New Road 6												
10	L2	49	0.0	0.397	28.9	LOS C	10.9	79.9	0.75	0.67	0.75	42.0
11	T1	255	6.3	0.397	23.4	LOS C	10.9	79.9	0.75	0.67	0.75	42.9
12	R2	102	2.0	0.835	66.1	LOS E	5.9	41.7	1.00	0.94	1.42	28.3
Approach		406	4.4	0.835	34.8	LOS C	10.9	79.9	0.81	0.74	0.92	37.9
All Vehicles		1735	4.3	0.836	40.8	LOS D	29.6	217.4	0.93	0.86	1.02	35.7







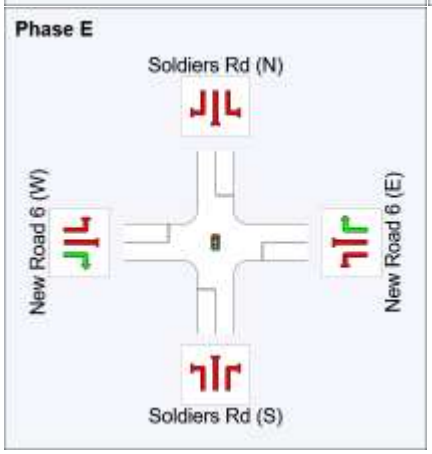
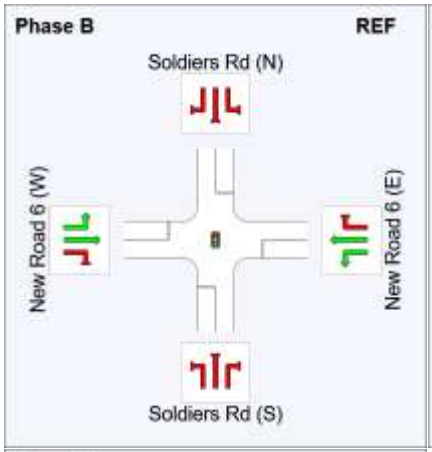
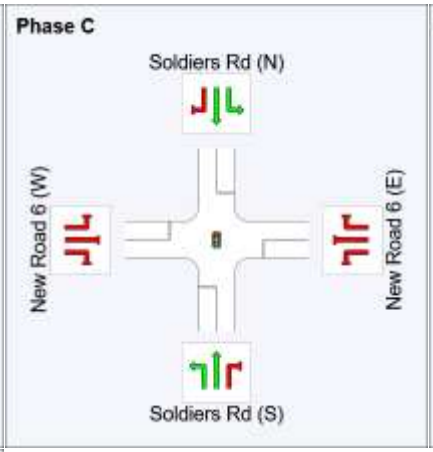
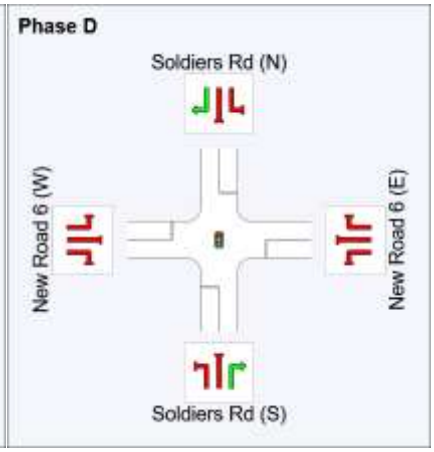


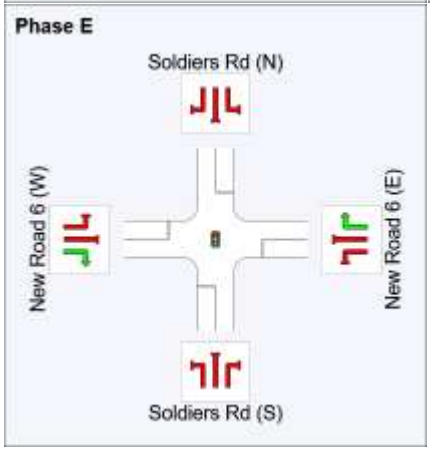
Table 5-18 Reconfigured Soldiers Road/New Road 6 Intersection PM Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: RoadName												
1	L2	160	1.3	0.664	36.0	LOS D	7.8	55.0	0.98	0.85	1.04	37.7
2	T1	71	0.0	0.664	30.5	LOS C	7.8	55.0	0.98	0.85	1.04	38.4
3	R2	133	0.8	0.720	42.5	LOS D	4.9	34.6	1.00	0.87	1.21	34.6
Approach		364	0.8	0.720	37.3	LOS D	7.8	55.0	0.99	0.86	1.10	36.6
East: New Road 6												
4	L2	110	0.9	0.785	34.2	LOS C	14.8	106.4	0.98	0.94	1.13	39.3
5	T1	312	4.5	0.785	28.7	LOS C	14.8	106.4	0.98	0.94	1.13	40.1
6	R2	62	1.6	0.394	40.7	LOS D	2.2	15.4	0.98	0.75	0.98	35.2
Approach		484	3.3	0.785	31.5	LOS C	14.8	106.4	0.98	0.92	1.11	39.2
North: RoadName												
7	L2	125	4.8	0.803	40.2	LOS D	10.3	74.3	1.00	0.97	1.25	36.6
8	T1	153	2.0	0.803	34.6	LOS C	10.3	74.3	1.00	0.97	1.25	37.3
9	R2	1	0.0	0.005	36.7	LOS D	0.0	0.2	0.92	0.59	0.92	36.7
Approach		279	3.2	0.803	37.1	LOS D	10.3	74.3	1.00	0.96	1.25	37.0
West: New Road 6												
10	L2	133	0.8	0.690	30.8	LOS C	11.8	84.6	0.95	0.85	0.99	40.6
11	T1	238	3.8	0.690	25.3	LOS C	11.8	84.6	0.95	0.85	0.99	41.4
12	R2	91	1.1	0.576	41.7	LOS D	3.3	23.1	1.00	0.79	1.06	34.9
Approach		462	2.4	0.690	30.1	LOS C	11.8	84.6	0.96	0.84	1.00	39.7
All Vehicles		1589	2.5	0.803	33.4	LOS C	14.8	106.4	0.98	0.89	1.10	38.3





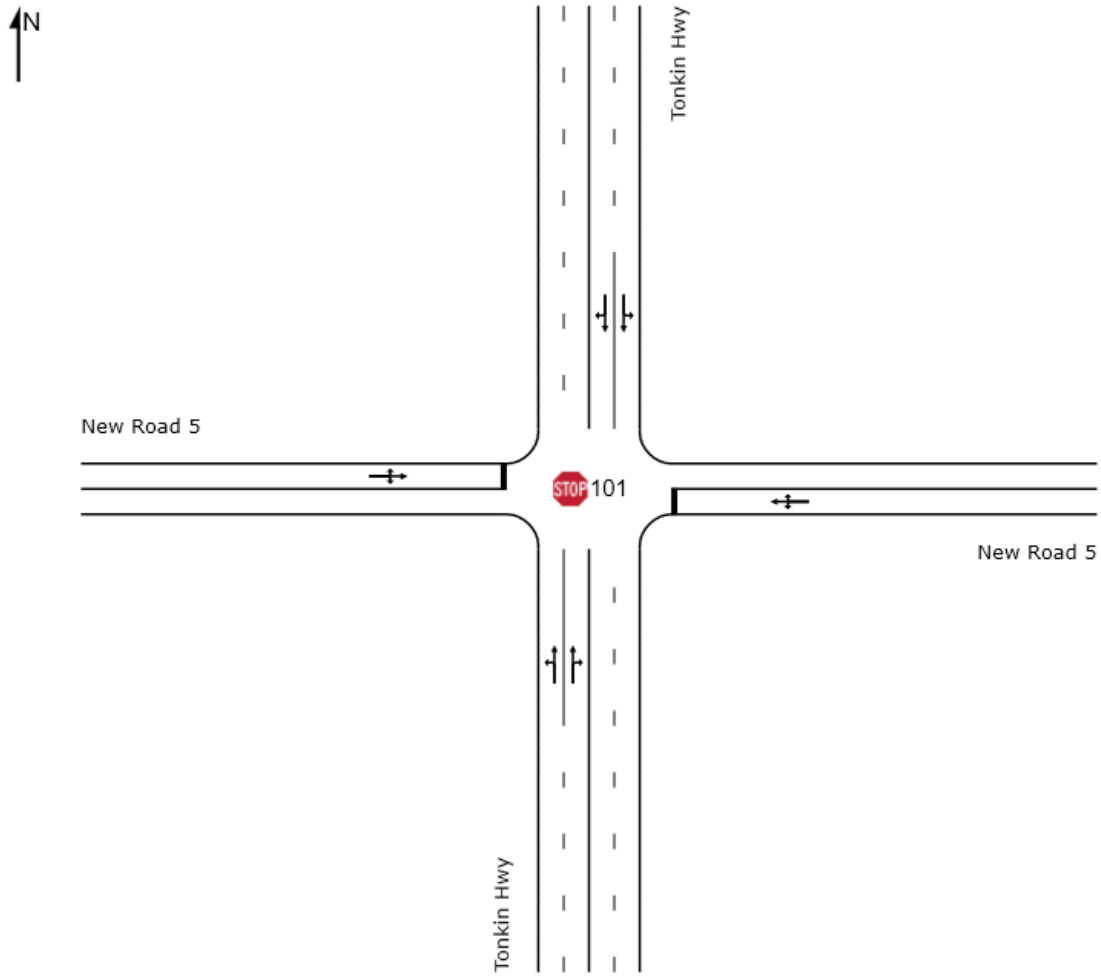




5.5.7 No. 5 – New Road 5 and Tonkin Highway

The following presents the results of the analysis of the New Road 5 and Tonkin Highway intersection**.** **Figure 5-14** is a SIDRA layout representation of the intersection which is based on the indicative layouts used in the mesoscopic model.

Figure 5-14 SIDRA Layout for New Road 6/South Western Highway Intersection



The SIDRA results based on this intersection layout and signal phasing analysis are summarised in **Table 5-19** and **Table 5-20**.

Table 5-19 New Road 5 and Tonkin Highway Intersection AM Results 2031

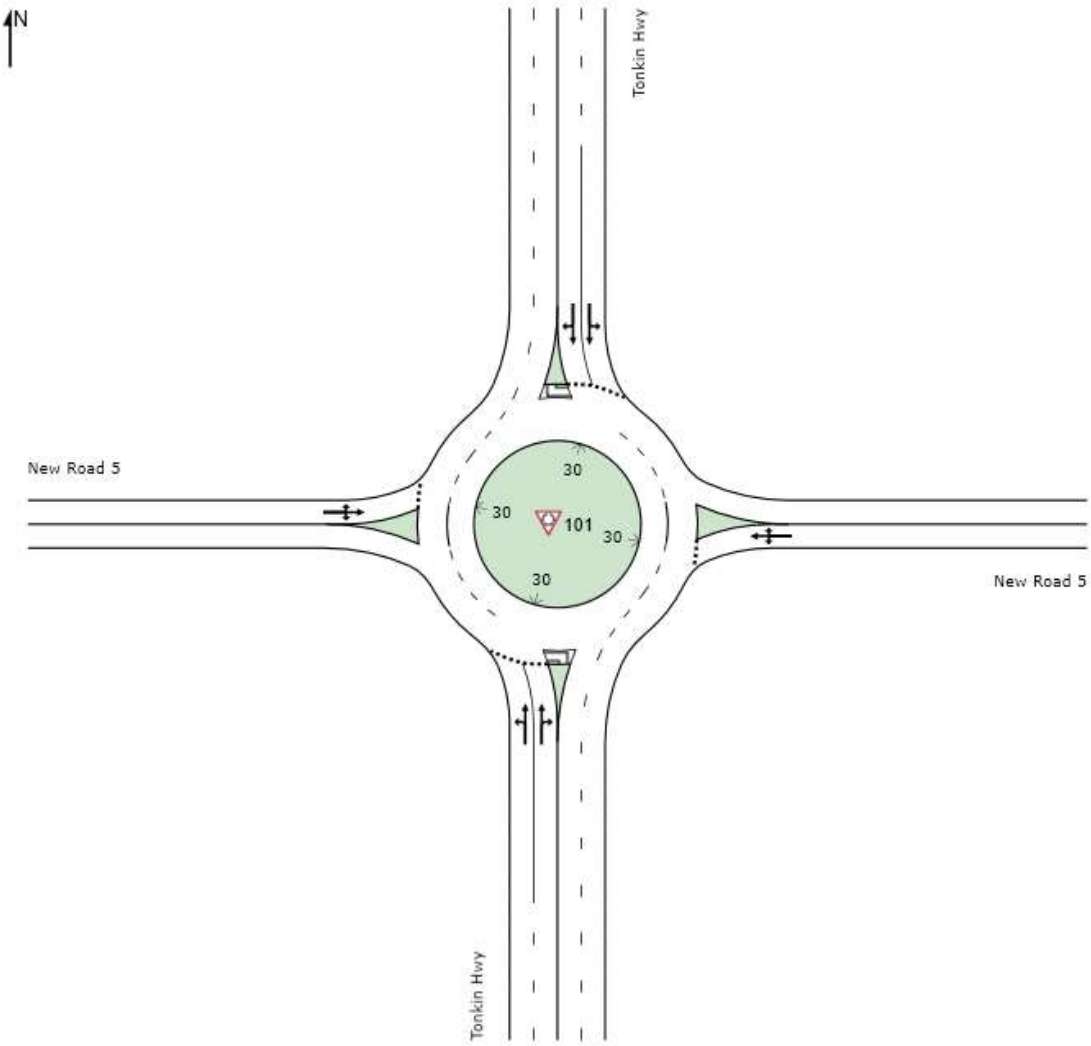
Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Tonkin Hwy												
1	L2	394	7.4	0.305	6.6	LOS A	0.0	0.0	0.00	0.45	0.00	59.9
2	T1	670	7.2	0.305	0.7	LOS A	0.5	3.4	0.06	0.17	0.08	90.2
3	R2	17	0.0	0.305	14.0	LOS B	0.5	3.4	0.08	0.09	0.10	70.1
Approach		1081	7.1	0.305	3.1	NA	0.5	3.4	0.04	0.27	0.05	75.8
East: New Road 5												
4	L2	16	0.0	16.529	27975.3	LOS F	765.4	5708.7	1.00	5.29	19.46	0.1
5	T1	109	5.5	16.529	27983.0	LOS F	765.4	5708.7	1.00	5.29	19.46	0.1
6	R2	490	8.4	16.529	27981.3	LOS F	765.4	5708.7	1.00	5.29	19.46	0.1
Approach		615	7.6	16.529	27981.4	LOS F	765.4	5708.7	1.00	5.29	19.46	0.1
North: Tonkin Hwy												
7	L2	299	6.0	0.337	7.1	LOS A	0.0	0.0	0.00	0.32	0.00	67.7
8	T1	394	7.1	0.337	4.6	LOS A	2.3	16.8	0.17	0.40	0.21	77.1
9	R2	107	7.5	0.337	19.5	LOS C	2.3	16.8	0.84	0.72	1.06	49.7
Approach		800	6.8	0.337	7.6	NA	2.3	16.8	0.20	0.41	0.25	68.5
West: New Road 5												
10	L2	58	19.0	6.380	9719.6	LOS F	302.6	2272.5	1.00	5.67	19.09	0.4
11	T1	43	7.0	6.380	9739.6	LOS F	302.6	2272.5	1.00	5.67	19.09	0.4
12	R2	169	5.3	6.380	9736.3	LOS F	302.6	2272.5	1.00	5.67	19.09	0.4
Approach		270	8.5	6.380	9733.2	LOS F	302.6	2272.5	1.00	5.67	19.09	0.4
All Vehicles		2766	7.3	16.529	7175.0	NA	765.4	5708.7	0.39	1.95	6.28	0.5

Table 5-20 New Road 5 and Tonkin Highway Intersection PM Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total 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	Aver. No. Cycles	Average Speed km/h
South: Tonkin Hwy												
1	L2	131	5.3	0.124	6.9	LOS A	0.0	0.0	0.00	0.37	0.00	65.0
2	T1	95	5.3	0.124	0.0	LOS A	0.0	0.0	0.00	0.37	0.00	70.9
3	R2	37	0.0	0.143	19.5	LOS C	0.5	3.3	0.85	0.94	0.85	44.3
Approach		263	4.6	0.143	6.2	NA	0.5	3.3	0.12	0.45	0.12	62.8
East: New Road 5												
4	L2	36	0.0	6.501	9929.8	LOS F	346.7	2533.9	1.00	6.11	21.75	0.4
5	T1	64	14.1	6.501	9944.4	LOS F	346.7	2533.9	1.00	6.11	21.75	0.4
6	R2	211	3.3	6.501	9943.1	LOS F	346.7	2533.9	1.00	6.11	21.75	0.4
Approach		311	5.1	6.501	9941.8	LOS F	346.7	2533.9	1.00	6.11	21.75	0.4
North: Tonkin Hwy												
7	L2	361	6.4	0.410	7.2	LOS A	0.0	0.0	0.00	0.31	0.00	67.8
8	T1	893	6.2	0.410	3.1	LOS A	1.9	14.2	0.14	0.51	0.15	83.0
9	R2	153	5.2	0.410	9.1	LOS A	1.9	14.2	0.25	0.67	0.26	62.9
Approach		1407	6.1	0.410	4.8	NA	1.9	14.2	0.12	0.48	0.12	76.0
West: New Road 5												
10	L2	5	20.0	8.568	13647.0	LOS F	481.3	3480.6	1.00	6.01	22.80	0.3
11	T1	50	0.0	8.568	13658.0	LOS F	481.3	3480.6	1.00	6.01	22.80	0.3
12	R2	360	4.2	8.568	13655.1	LOS F	481.3	3480.6	1.00	6.01	22.80	0.3
Approach		415	3.9	8.568	13655.3	LOS F	481.3	3480.6	1.00	6.01	22.80	0.3
All Vehicles		2396	5.4	8.568	3659.1	NA	481.3	3480.6	0.38	2.16	6.86	1.0

The SIDRA results shows that the intersection will operate at an unacceptable level of service with long queues and delays on the eastern and western leg of the intersection. Modifications to the geometry are required to ensure that the intersection operates within an acceptable level of service. **Figure 5-15** shows the reconfigured intersection layout Option 1.

Figure 5-15 Reconfigured SIDRA Layout for New Road 5 and Tonkin Highway Intersection Option 1



The SIDRA results based on this reconfigured intersection layout Option 1 – Roundabout are summarised in **Table 5-21** and **Table 5-22**. The results show that the intersection will operate at an acceptable level of service with these upgrade.

Table 5-21 Reconfigured New Road 5 and Tonkin Highway Intersection AM Option 1 Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Tonkin Hwy												
1	L2	394	7.4	0.662	11.8	LOS B	8.6	63.6	1.00	1.03	1.29	50.2
2	T1	670	7.2	0.662	13.3	LOS B	8.6	63.6	1.00	1.09	1.33	50.7
3	R2	17	0.0	0.662	19.4	LOS B	7.5	55.8	1.00	1.12	1.35	50.5
Approach		1081	7.1	0.662	12.8	LOS B	8.6	63.6	1.00	1.07	1.32	50.5
East: New Road 5												
4	L2	16	0.0	0.767	11.6	LOS B	7.8	57.8	0.87	1.12	1.31	47.7
5	T1	109	5.5	0.767	12.0	LOS B	7.8	57.8	0.87	1.12	1.31	48.9
6	R2	490	8.4	0.767	17.8	LOS B	7.8	57.8	0.87	1.12	1.31	49.0
Approach		615	7.6	0.767	16.6	LOS B	7.8	57.8	0.87	1.12	1.31	48.9
North: Tonkin Hwy												
7	L2	299	6.0	0.307	4.6	LOS A	2.3	16.8	0.50	0.50	0.50	54.2
8	T1	394	7.1	0.307	4.7	LOS A	2.3	16.8	0.51	0.53	0.51	55.1
9	R2	107	7.5	0.307	10.5	LOS B	2.1	15.9	0.52	0.54	0.52	54.8
Approach		800	6.8	0.307	5.5	LOS A	2.3	16.8	0.51	0.52	0.51	54.7
West: New Road 5												
10	L2	58	19.0	0.524	12.8	LOS B	3.5	26.5	0.87	1.03	1.11	47.6
11	T1	43	7.0	0.524	12.3	LOS B	3.5	26.5	0.87	1.03	1.11	49.1
12	R2	169	5.3	0.524	17.9	LOS B	3.5	26.5	0.87	1.03	1.11	49.3
Approach		270	8.5	0.524	15.9	LOS B	3.5	26.5	0.87	1.03	1.11	48.9
All Vehicles		2766	7.3	0.767	11.8	LOS B	8.6	63.6	0.82	0.92	1.06	51.1

Table 5-22 Reconfigured New Road 5 and Tonkin Highway Intersection PM Option 1 Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: RoadName												
1	L2	131	5.3	0.116	5.2	LOS A	0.7	5.4	0.57	0.56	0.57	54.0
2	T1	95	5.3	0.116	5.5	LOS A	0.7	5.4	0.58	0.60	0.58	54.5
3	R2	37	0.0	0.116	11.2	LOS B	0.7	5.0	0.58	0.61	0.58	54.7
Approach		263	4.6	0.116	6.2	LOS A	0.7	5.4	0.57	0.58	0.57	54.3
East: RoadName												
4	L2	36	0.0	0.652	15.2	LOS B	4.8	34.9	0.91	1.10	1.33	45.9
5	T1	64	14.1	0.652	16.1	LOS B	4.8	34.9	0.91	1.10	1.33	46.9
6	R2	211	3.3	0.652	21.2	LOS C	4.8	34.9	0.91	1.10	1.33	47.3
Approach		311	5.1	0.652	19.4	LOS B	4.8	34.9	0.91	1.10	1.33	47.0
North: RoadName												
7	L2	361	6.4	0.628	7.3	LOS A	6.7	49.6	0.81	0.76	0.90	52.7
8	T1	893	6.2	0.628	7.9	LOS A	6.7	49.6	0.82	0.82	0.94	53.6
9	R2	153	5.2	0.628	14.3	LOS B	6.5	47.7	0.83	0.86	0.98	53.2
Approach		1407	6.1	0.628	8.5	LOS A	6.7	49.6	0.82	0.81	0.93	53.3
West: RoadName												
10	L2	5	20.0	0.423	5.7	LOS A	2.5	18.0	0.57	0.73	0.57	50.7
11	T1	50	0.0	0.423	5.3	LOS A	2.5	18.0	0.57	0.73	0.57	52.6
12	R2	360	4.2	0.423	11.1	LOS B	2.5	18.0	0.57	0.73	0.57	52.7
Approach		415	3.9	0.423	10.4	LOS B	2.5	18.0	0.57	0.73	0.57	52.7
All Vehicles		2396	5.4	0.652	10.0	LOS A	6.7	49.6	0.76	0.81	0.88	52.4

The SIDRA results based on this reconfigured intersection layout Option 2 – Signal Intersection are summarised in **Table 5-23 and Table 5-24**. The results show that the intersection will operate at an acceptable level of service with these upgrades. **Figure 5-16** shows the reconfigured intersection layout Option 2.

Figure 5-16 Reconfigured Intersection layout Option 2

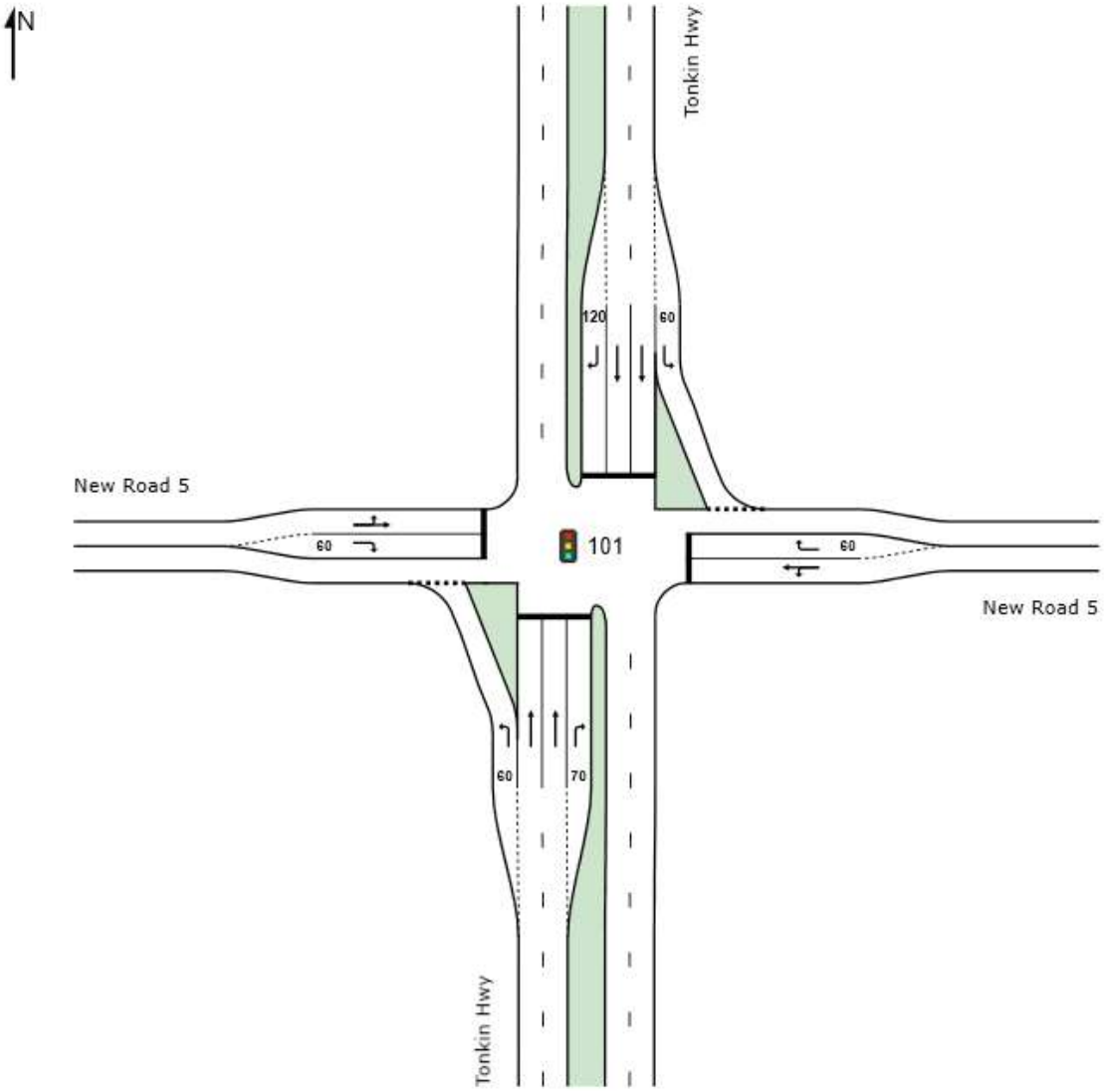
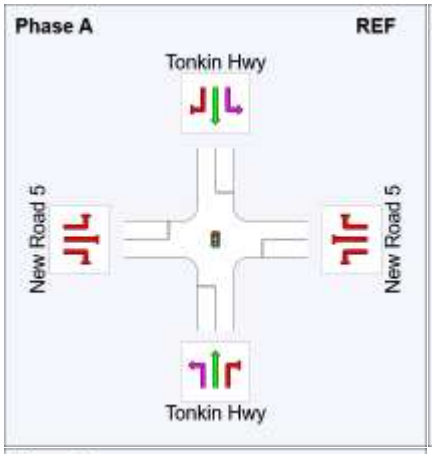
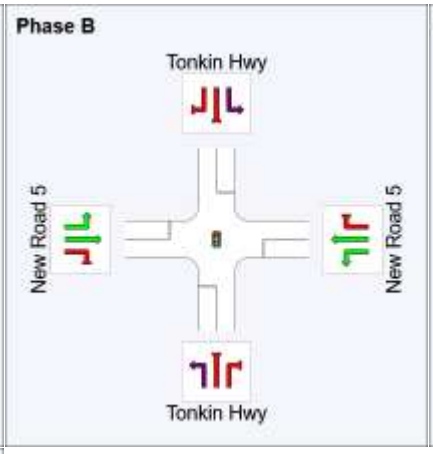
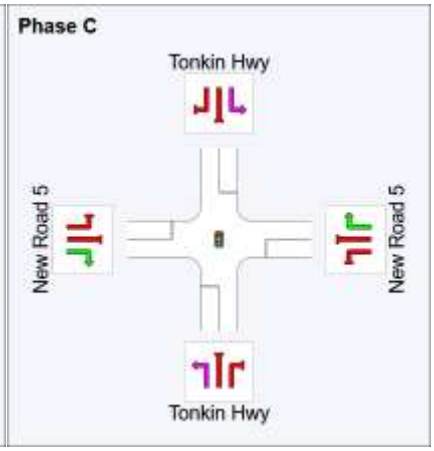


Table 5-23 Reconfigured New Road 5 and Tonkin Highway Intersection PM Option 2 Results 2031

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Tonkin Hwy												
1	L2	394	7.4	0.297	7.9	LOS A	3.7	27.3	0.36	0.66	0.36	52.2
2	T1	670	7.2	0.899	47.3	LOS D	16.1	119.4	1.00	1.13	1.49	33.7
3	R2	17	0.0	0.122	45.0	LOS D	0.7	4.6	0.96	0.69	0.96	34.0
Approach		1081	7.1	0.899	32.9	LOS C	16.1	119.4	0.77	0.95	1.07	38.8
East: New Road 5												
4	L2	16	0.0	0.887	55.7	LOS E	5.8	42.3	1.00	1.04	1.68	32.3
5	T1	109	5.5	0.887	50.2	LOS D	5.8	42.3	1.00	1.04	1.68	32.8
6	R2	490	8.4	0.868	41.9	LOS D	21.4	160.7	0.97	0.99	1.25	35.1
Approach		615	7.6	0.887	43.7	LOS D	21.4	160.7	0.97	1.00	1.34	34.6
North: Tonkin Hwy												
7	L2	299	6.0	0.204	6.5	LOS A	1.4	10.2	0.22	0.62	0.22	53.3
8	T1	394	7.1	0.528	31.8	LOS C	7.1	52.7	0.94	0.77	0.94	39.4
9	R2	107	7.5	0.809	51.8	LOS D	4.7	35.2	1.00	0.93	1.42	31.9
Approach		800	6.8	0.809	25.0	LOS C	7.1	52.7	0.68	0.74	0.74	42.2
West: New Road 5												
10	L2	58	19.0	0.780	51.1	LOS D	4.4	34.6	1.00	0.91	1.35	32.7
11	T1	43	7.0	0.780	45.4	LOS D	4.4	34.6	1.00	0.91	1.35	33.5
12	R2	169	5.3	0.270	25.9	LOS C	4.8	34.9	0.76	0.76	0.76	41.5
Approach		270	8.5	0.780	34.4	LOS C	4.8	34.9	0.85	0.82	0.98	37.9
All Vehicles		2766	7.3	0.899	33.2	LOS C	21.4	160.7	0.80	0.89	1.02	38.5







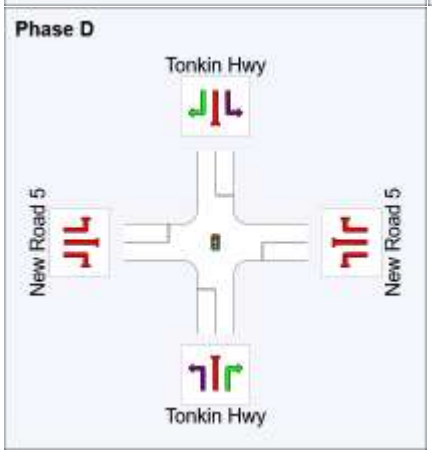
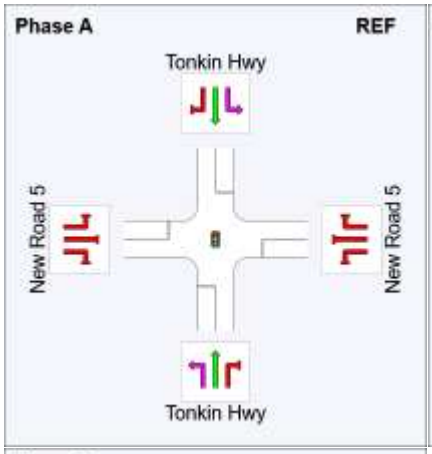
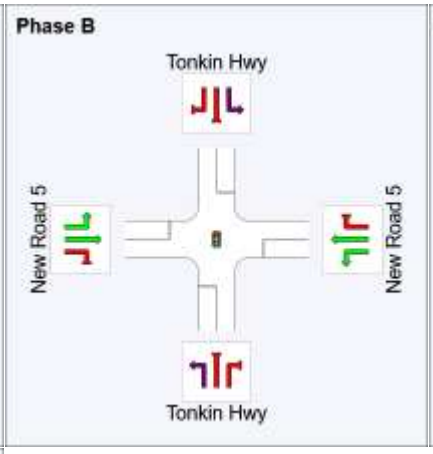
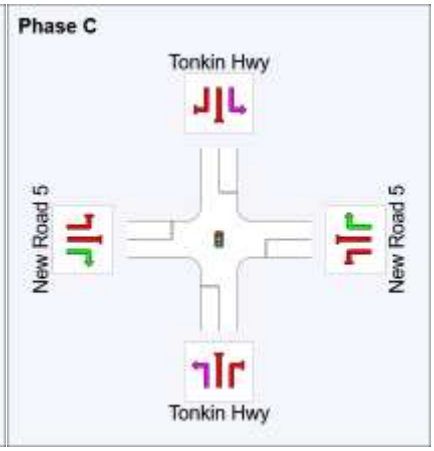


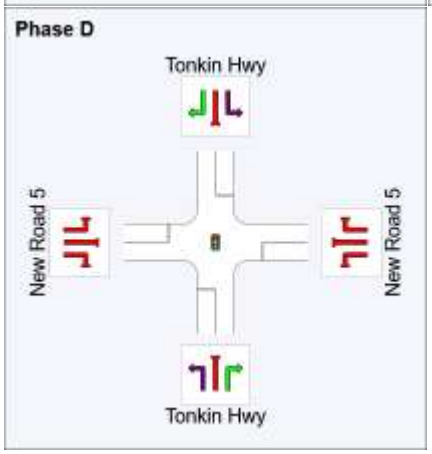
Table 5-24 Reconfigured New Road 5 and Tonkin Highway Intersection PM Option 2 Results 2031

Movement Performance - Vehicles													
Mov ID	Turn	Demand Flows Total	HV	Deg. Satn	Average Delay	Level of Service	95% Back of Queue Vehicles	Distance	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		veh/h	%	v/c	sec		veh	m				km/h
South: Tonkin Hwy												
1	L2	131	5.3	0.098	7.6	LOS A	1.0	7.5	0.30	0.63	0.30	52.5
2	T1	95	5.3	0.088	22.5	LOS C	1.4	9.9	0.76	0.58	0.76	43.8
3	R2	37	0.0	0.199	43.0	LOS D	1.4	9.8	0.95	0.72	0.95	34.6
Approach		263	4.6	0.199	17.9	LOS B	1.4	9.9	0.56	0.62	0.56	45.9
East: New Road 5												
4	L2	36	0.0	0.736	49.7	LOS D	4.3	32.3	1.00	0.87	1.26	33.6
5	T1	64	14.1	0.736	44.1	LOS D	4.3	32.3	1.00	0.87	1.26	34.2
6	R2	211	3.3	0.490	34.7	LOS C	7.3	52.5	0.91	0.80	0.91	37.8
Approach		311	5.1	0.736	38.4	LOS D	7.3	52.5	0.94	0.83	1.02	36.4
North: Tonkin Hwy												
7	L2	361	6.4	0.252	6.7	LOS A	2.0	14.7	0.25	0.63	0.25	53.1
8	T1	893	6.2	0.862	38.0	LOS D	20.5	151.0	0.99	1.04	1.27	36.9
9	R2	153	5.2	0.855	52.4	LOS D	6.9	50.5	1.00	1.00	1.49	31.7
Approach		1407	6.1	0.862	31.5	LOS C	20.5	151.0	0.80	0.93	1.03	39.3
West: New Road 5												
10	L2	5	20.0	0.383	46.5	LOS D	2.2	15.6	0.99	0.74	0.99	34.9
11	T1	50	0.0	0.383	40.8	LOS D	2.2	15.6	0.99	0.74	0.99	35.9
12	R2	360	4.2	0.840	44.4	LOS D	15.6	112.9	1.00	0.97	1.26	34.3
Approach		415	3.9	0.840	44.0	LOS D	15.6	112.9	1.00	0.94	1.23	34.5
All Vehicles		2396	5.4	0.862	33.1	LOS C	20.5	151.0	0.83	0.89	1.01	38.6







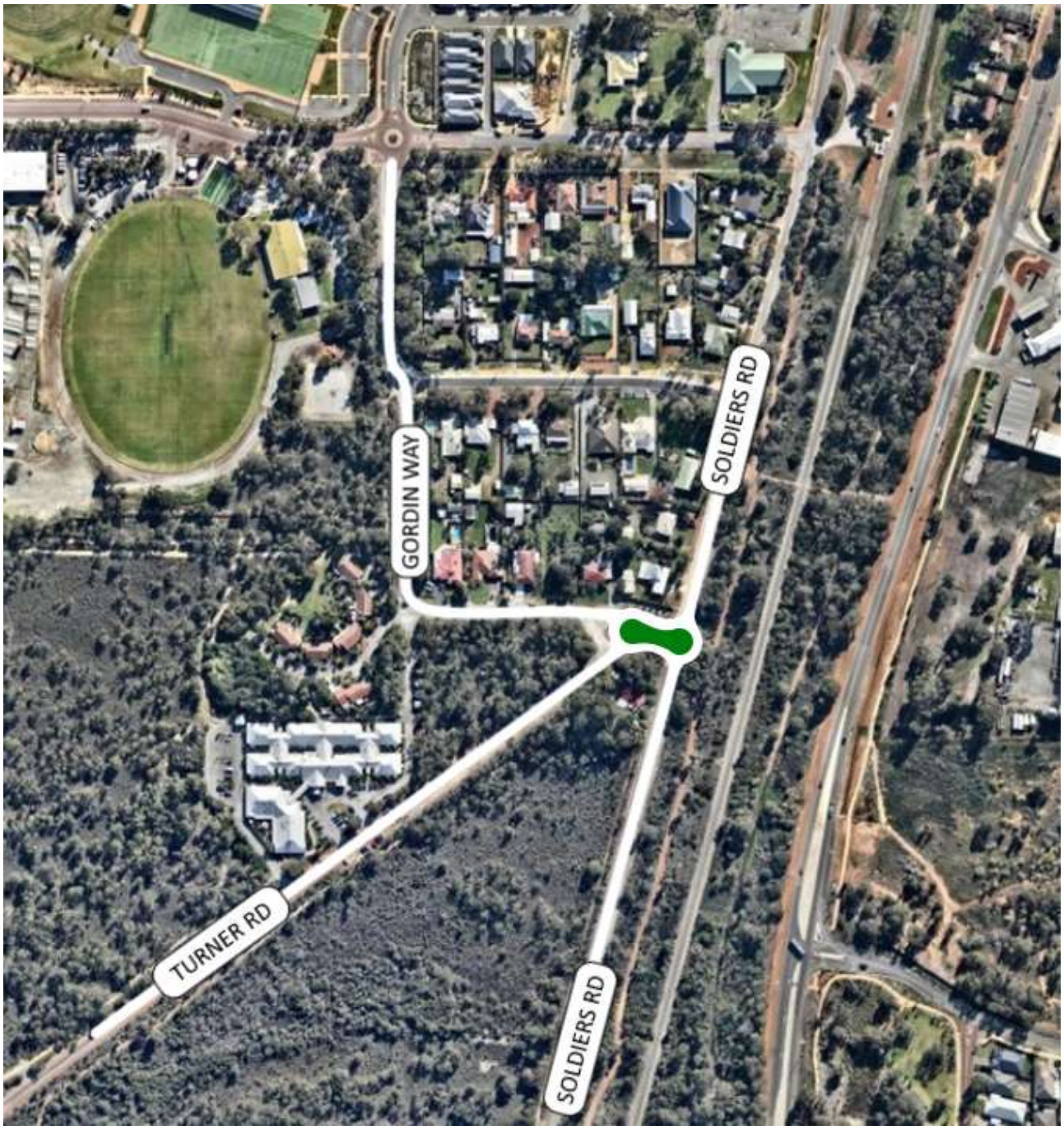


5.5.8 Soldiers Road / Gordin Way / Turner Road

Cardno understands that there is a strong desireline for trips between Mundijong residential cells and the Byford Town Centre. This trip is currently supported by Soldiers Road and Abernethy Road.

However, the close spacing of South Western Highway, George Street, the rail line, Soldiers Road and the Byford Village access road means that this heavy traffic demand puts significant stress on the local road infrastructure.

The following modification to the road network has been considered in this context, and is intended to support a preferred route between the Byford Town Centre and Mundijong along the Gordin Way alignment. In addition, regional traffic would be partially redirected onto South Western Highway through to Abernethy Road.



It is noted that the location of Turner Way imposes a geometric impediment on the types of intersection treatment that may be considered. In this instance, a 'peanut' roundabout provides full turning movement capability and a reasonably high capacity intersection.

Traffic from Soldiers Road south is incentivised to undertake the new 'through' movement to Gordin Way, rather than the wide deviation to stay on Soldiers Road. Traffic from Soldiers Road north is only slightly inconvenienced by the roundabout. This intersection geometry could be designed to support some small truck movements, but any larger vehicles should use South Western Highway.

This geometry can be expected to result the following changes to traffic flow:

- Diversion to **Gordin Way**
  - the majority of traffic headed to the Byford Town Centre,
  - the majority of traffic travelling to and from Soldiers Road (south) to Abernethy Road (west).
- Diversion to **South Western Highway**
  - A small proportion of traffic heading from Soldiers Road (south) to Abernethy Road (east)
  - A minor component of traffic heading from Abernethy Road (east) to Soldiers Road (south)

The extent of this impact is determined by the origin-destination profile of traffic using Soldiers Road across the day. OD modelling and turn count data has been used to provide an indication of the existing directional splits (Table 5-25) for traffic:

Table 5-1 Existing Local Traffic Distribution – Soldiers Road

Direction (from/to)	Soldiers Road Northbound		Soldiers Road Southbound	
	AM Peak	PM Peak	AM Peak	PM Peak
Gordin Way	5%	4%	9%	6%
Soldiers Road	95%	96%	91%	94%
to/from Byford Town Centre	*35%*	*30%*	*35%*	*30%*
to/from Abernethy Road East	*39%*	*41%*	*38%*	*36%*
to/from Abernethy Road West	*21%*	*25%*	*18%*	*28%*

With the potential for the above modifications to redirect traffic, a possible future distribution is described below (Table 5-26). These results are largely consistent with the modelled network scenario, with some minor amendments to reflect the additional turn penalties imposed by the modified intersection form.

Table 5-2 Potential Modified Local Traffic Distribution (Future Network) – Soldiers Road

Direction (from/to)	Soldiers Road Northbound		Soldiers Road Southbound	
	AM Peak	PM Peak	AM Peak	PM Peak
Gordin Way	47%	59%	73%	74%
to/from Byford Town Centre	*22%*	*10%*	*4%*	*8%*
to/from Abernethy Road/Mead Street West	*21%*	*31%*	*63%*	*31%*
to/from San Simeon Boulevard	*4%*	*18%*	*6%*	*35%*
Soldiers Road	23%	21%	23%	23%
to/from Byford Town Centre	*12%*	*8%*	*4%*	*12%*
to/from Abernethy Road East	*10%*	*12%*	*16%*	*10%*
to/from Abernethy Road West	*1%*	*1%*	*3%*	*1%*
South Western Highway	30%	10%	4%	3%

This distribution would result in a significant decrease in traffic on Soldiers Road north of Turner Road, from a projected 5,000vpd (ROM24 for 2031), to less than 2,000vpd. Of this traffic a sizeable portion would be relocated to Gordin Way. However, this would primarily be local traffic accessing the Byford Town Centre.

5.5.9 Byford Town Centre Signalisation

The *Byford Structure Plan* shows a series of new signal-controlled intersections around the Byford District Centre. These intersections have been evaluated as part of this TIA and are shown to be effective at

controlling traffic movements. More importantly, the signalised intersections support pedestrian and cycling movements in this key activated area, creating a safer and more attractive environment for visitors to the Centre.

An alternative arrangement consisting of roundabout intersections would perform a similar function with respect to allowing vehicle turning movements, but without the intrinsic benefits for active transport modes.

As such, the traffic controls identified in the *Byford Structure Plan* are recommended to be retained as part of future development works.

6 Conclusions

Cardno was commissioned by the Shire of Serpentine to prepare a Transport Impact Assessment for the proposed Byford Town Centre Structure Plan ('the Site' or 'the Structure Plan').

The traffic impacts from this Structure Plan have been evaluated in a mesoscopic modelling framework, which classified the network into three categories based on operational performance:

1. The existing intersection forms are considered sufficient to accommodate future growth. These include:
    - Kardan Boulevard/Ballawarra Avenue
    - South West Highway/Thomas Road
    - Abernethy Road/Briggs Road
    - Warrington Road/Turner Road
    - Doley Road/Shepparton Boulevard
2. The proposed intersection forms are considered sufficient to accommodate future growth. These include:
    - Thomas Road/Kardan Boulevard
    - Thomas Road/Masters Road
    - Thomas Road/Plaistowe Boulevard
    - Thomas Road/Alexander Road
    - Thomas Road/George Street
    - Ballawarra Avenue/Malarkey Street
    - Ballawarra Avenue/Briggs Road
    - Ballawarra Avenue/Plaistowe Boulevard
    - Ballawarra Avenue/Larsen Road/Sansimeon Boulevard
    - Abernethy Road/Tonkin Highway
    - Abernethy Road/Kardan Boulevard/Tourmaline Boulevard
    - Abernethy Road/Doley Road
    - Abernethy Road/Warrington Road
    - Turner Road/Warrington Road
    - Orton Road/Warrington Road
    - Orton Road/Doley Road
    - Doley Road/Cardup Siding Road
    - Orton Road/Tourmaline Boulevard
    - South Western Highway/Sansimeon Boulevard

- Sansimeon Boulevard Intersection

3. For a number of key intersections, alternative intersection forms were considered necessary to accommodate future growth. These include:
   - Tonkin Highway/Thomas Road
   - Abernethy Road/Sansimeon Boulevard/Gordin Way
   - Soldiers Road/Orton Road
   - Tonkin Highway/Orton Road
   - South Western Highway/Abernethy Rd

   The minimum intersection form required to accommodate future traffic growth is shown in **Section 5.5**. It is anticipated that additional works will be required to ensure intersection geometry meets Austroads and Main Roads WA guidelines.

Overall, with the reconfigured intersection forms, the SP network is considered to operate satisfactorily in the 2031 future scenario.

Byford Structure Plan

APPENDIX A

WAPC CHECKLIST

Item	Provided	Comments/Proposals
Summary		
Introduction/Background	Included in Section 1	
Structure plan proposal	Included in Section 1	
▪ regional context	Included in Section 1	
▪ proposed land uses	Included in Section 1	
▪ table of land uses and quantities	Included in Section 1	
▪ major attractors/generators	Included in Section 4	
▪ specific issues	N/A	
Existing situation		
▪ existing land uses within structure plan	Included in Section 2	
▪ existing land uses within 800 metres of structure plan area	Included in Section 2	
▪ existing road network within structure plan area	Included in Section 2	
▪ existing pedestrian/cycle networks within structure plan area	Included in Section 2	
▪ existing public transport services within structure plan area	Included in Section 2	
▪ existing road network within 2 (or 5) km of structure plan area	Included in Section 2	
▪ traffic flows on roads within structure plan area (PM and/or AM peak hours)	N/A	
▪ traffic flows on roads within 2 (or 5) km of structure plan area (AM and/or PM peak hours)	Included in Section 2	
▪ existing pedestrian/cycle networks within 800m of structure plan area	Included in Section 2	
▪ existing public transport services within 800m of structure plan area	Included in Section 2	
Proposed internal transport networks		
▪ changes/additions to existing road network or proposed new road network	Included in Section 3	
▪ road reservation widths	N/A	
▪ road cross-sections & speed limits	N/A	
▪ intersection controls	Included in Section 3	
▪ pedestrian/cycle networks and crossing facilities	Included in Section 3	
▪ public transport routes	Included in Section 3	
Changes to external transport networks		
▪ road network	Included in Section 3	
▪ intersection controls	Included in Section 3	
▪ pedestrian/cycle networks and crossing facilities	Included in Section 3	
▪ public transport services	Included in Section 3	
Integration with surrounding area		
▪ trip attractors/generators within 800 metres	Included in Section 4	
▪ proposed changes to land uses within 800 metres	Included in Section 4	
▪ travel desire lines from structure plan to these attractors/generators	N/A	
▪ adequacy of external transport networks	N/A	
▪ deficiencies in external transport networks	N/A	

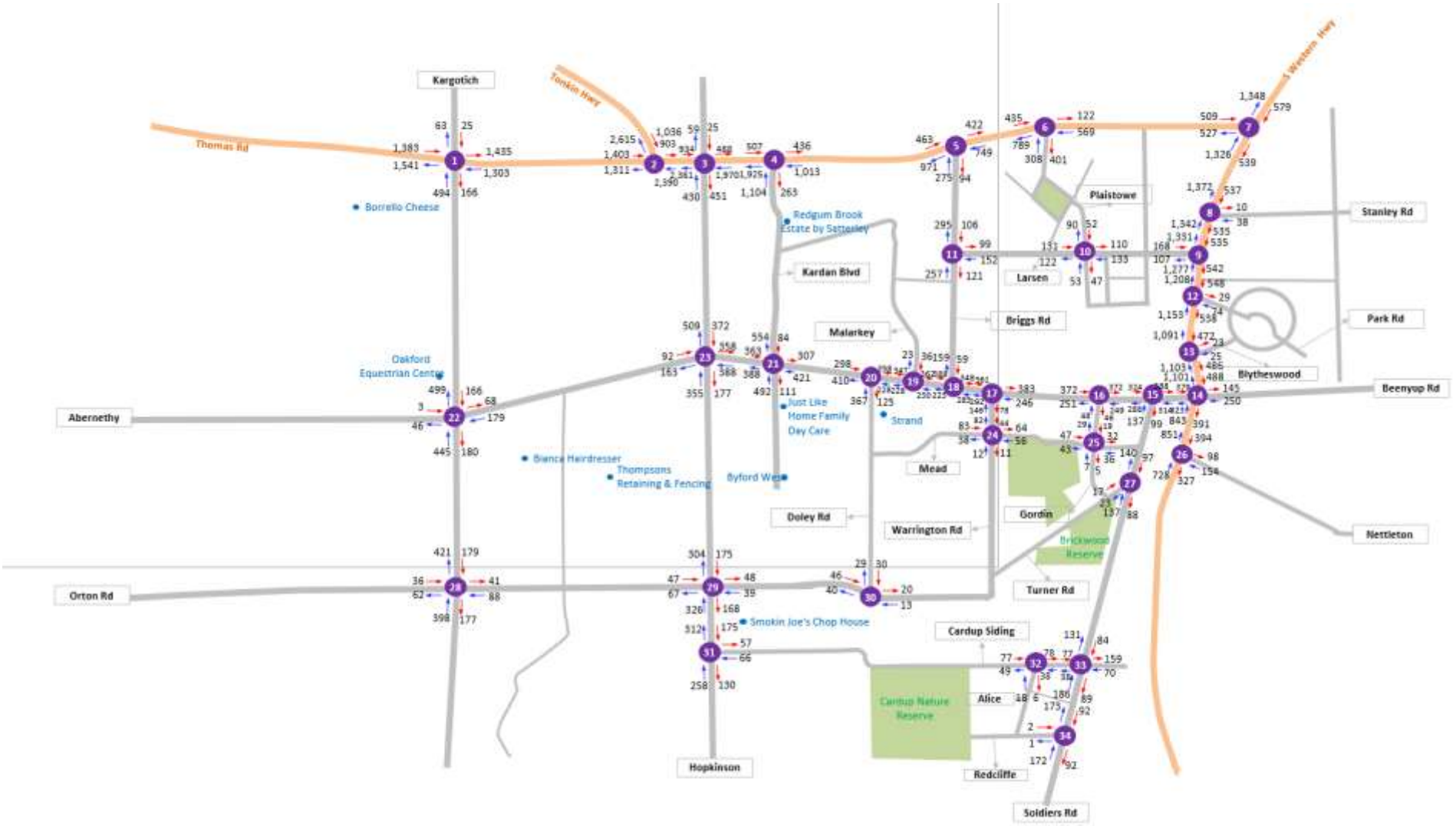
▪ remedial measures to address deficiencies	N/A	
Analysis of internal transport networks		
▪ assessment year(s) and time period(s)	Included in Section 5	
▪ structure plan generated traffic	Included in Section 5	
▪ extraneous (through) traffic	Included in Section 5	
▪ design traffic flows (ie. total traffic)	Included in Section 5	
▪ road cross-sections	N/A	
▪ intersection controls	Included in Section 5	
▪ access strategy	N/A	
▪ pedestrian / cycle networks	Included in Section 3	
▪ safe routes to schools	N/A	
▪ pedestrian permeability & efficiency	Included in Section 3	
▪ access to public transport	Included in Section 3	
Analysis of external transport networks		
▪ extent of analysis	Included in Section 5	
▪ base flows for assessment year(s)	Included in Section 5	
▪ total traffic flows	Included in Section 5	
▪ road cross-sections	N/A	
▪ intersection layouts & controls	Included in Section 5	
▪ pedestrian/cycle networks	Included in Section 3	
Conclusions	Included in Section 6	

Byford Structure Plan

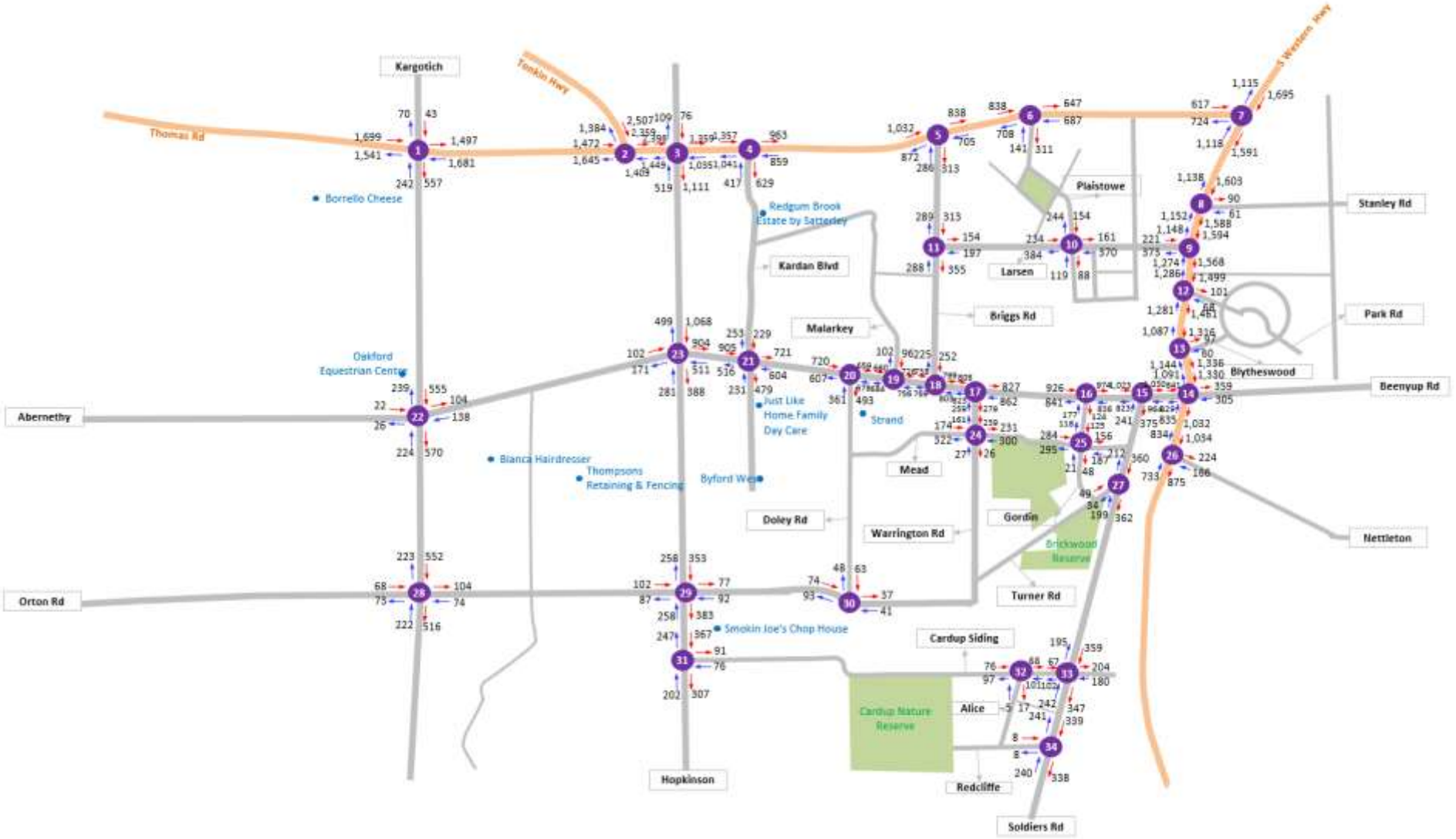
APPENDIX B

EXISTING TRAFFIC VOLUMES

Observed Traffic Volumes – 2018 AM Peak



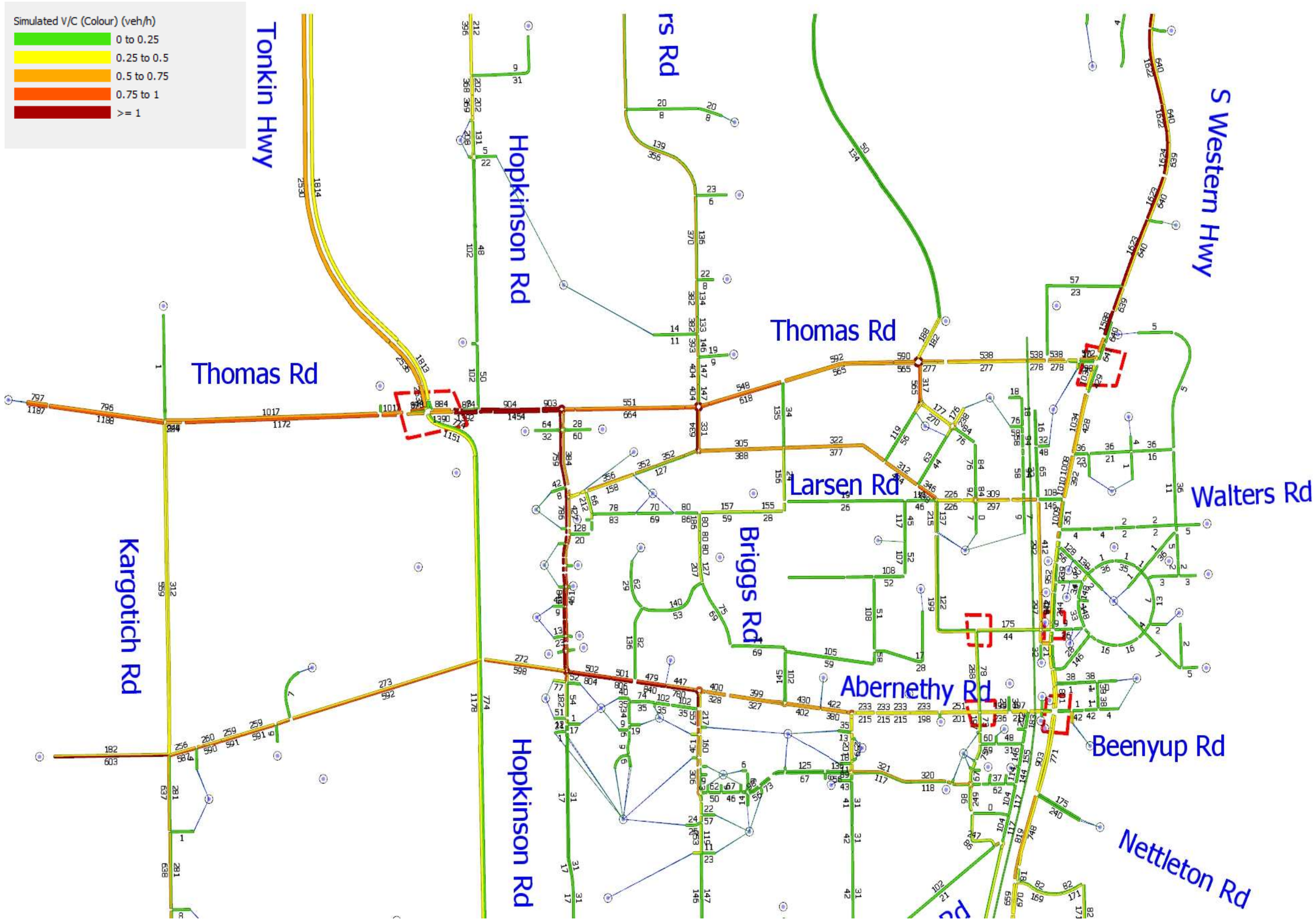
Observed Traffic Volumes – 2018 PM Peak



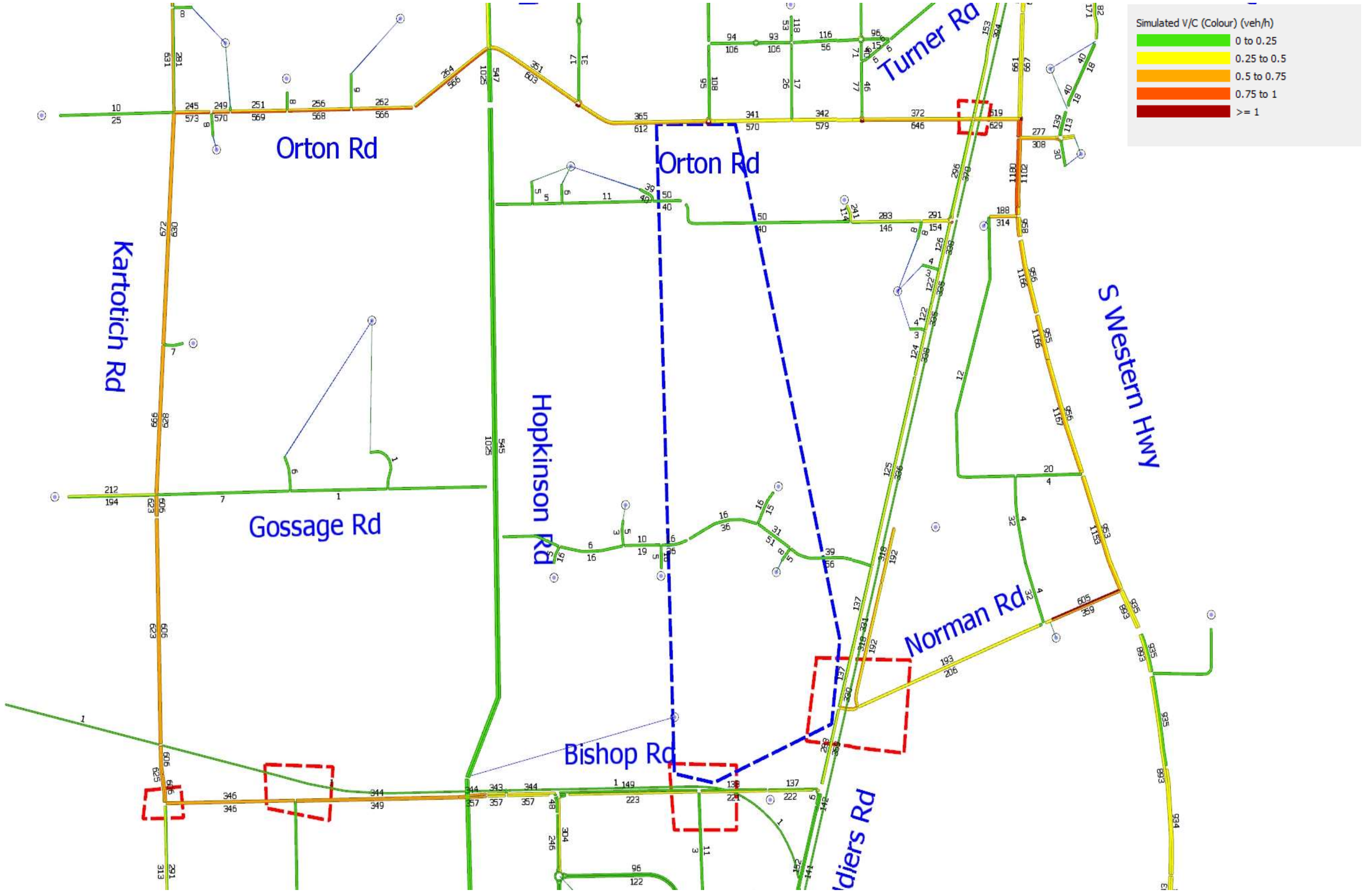
APPENDIX C

FUTURE MODELLED TRAFFIC

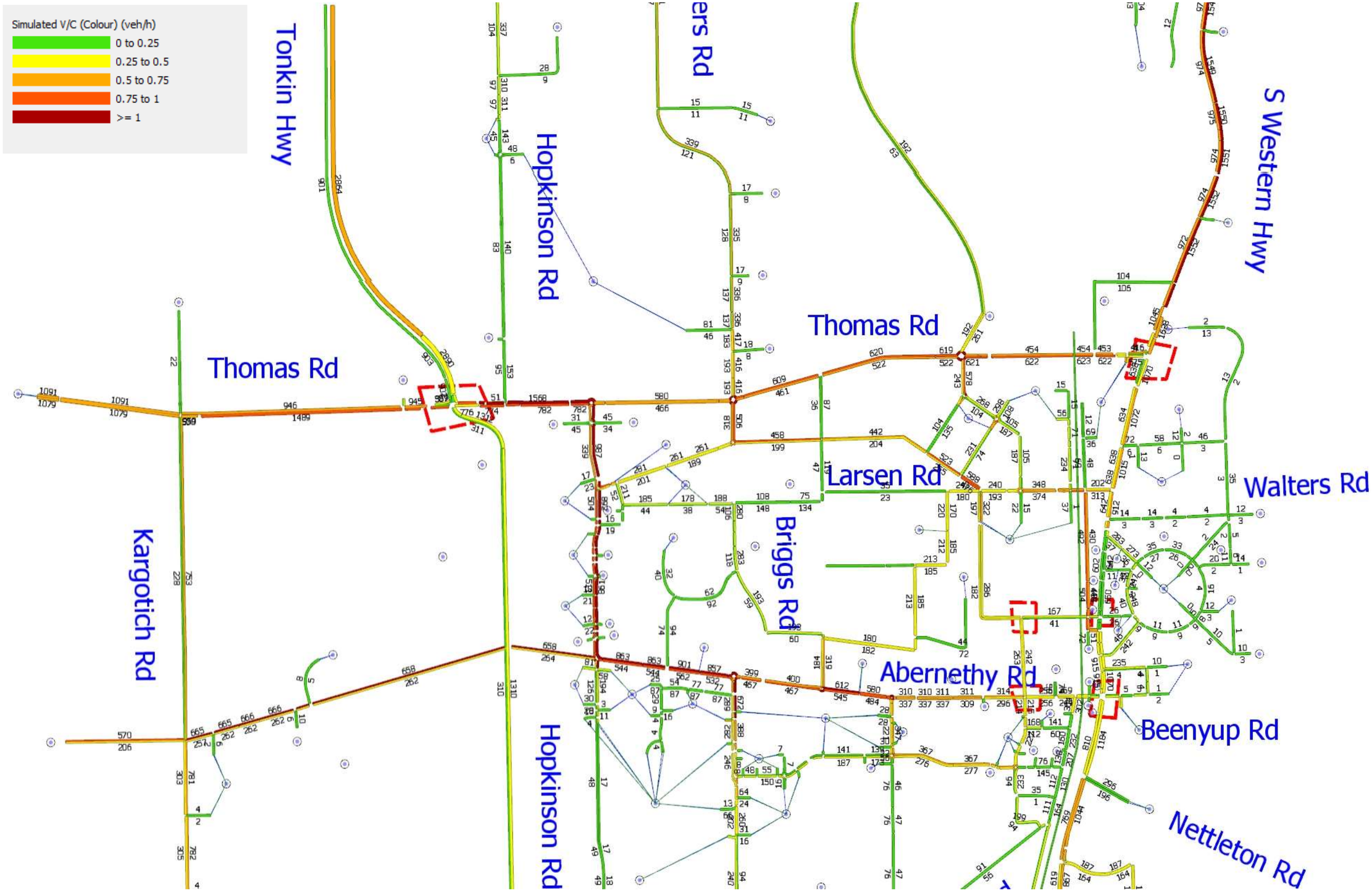
2031 AM Peak – Byford Area (North)



2031 AM Peak – Byford Area (South)



2031 PM Peak – Byford Area (North)



2031 PM Peak – Byford Area (South)