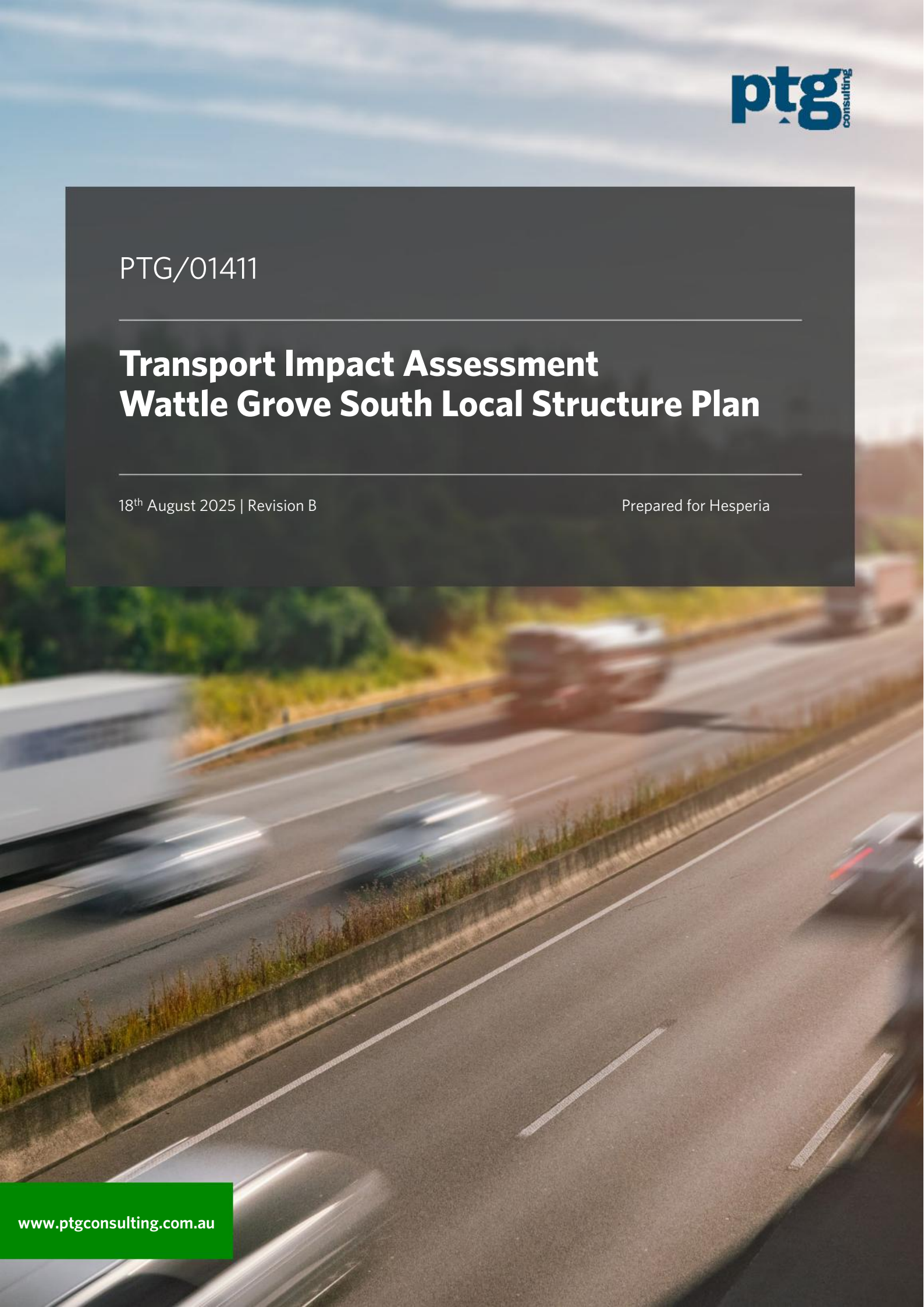

PTG/01411

Transport Impact Assessment
Wattle Grove South Local Structure Plan

18th August 2025 | Revision B

Prepared for Hesperia

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CONTENTS

CONTENTS

REPORT DETAILS

Document Title	Transport Impact Assessment – Wattle Grove South Local Structure Plan
Project Number	PTG/01411
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Client	Hesperia

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Revision Details

Revision No.	Date	Comments	Prepared By	Approved By
A	12/08/2025	For issue	NC/LL	SGL
B	17/08/2025	Minor Update	NC/LL	SGL

1 INTRODUCTION

1.1 Background

PTG Consulting Pty Ltd (PTG) has been commissioned by Hesperia to prepare a Transport Impact Assessment (TIA) for the proposed Wattle Grove South Local Structure Plan (LSP) located in the suburb of Wattle Grove in the City of Kalamunda, WA ("the Site").

This report has been prepared in accordance with the Western Australian Planning Commission (WAPC) Transport Assessment Guidelines for Developments: Volume 2 – Planning Schemes, Structure Plans and Activity Centre Plans (2016) and the Transport Impact Assessment (TIA) Checklist is included at Appendix A – WAPC Checklist.

Specifically, this report aims to assess the operations of the proposed Local Structure Plan (LSP) internally and its connections to the adjacent road network, with a focus on traffic volumes, access and accessibility.

This report also outlines the requirements and opportunities associated with traffic and transport within the development, referencing relevant Council and WAPC policies and guidelines as well as best-practice planning within Western Australia.

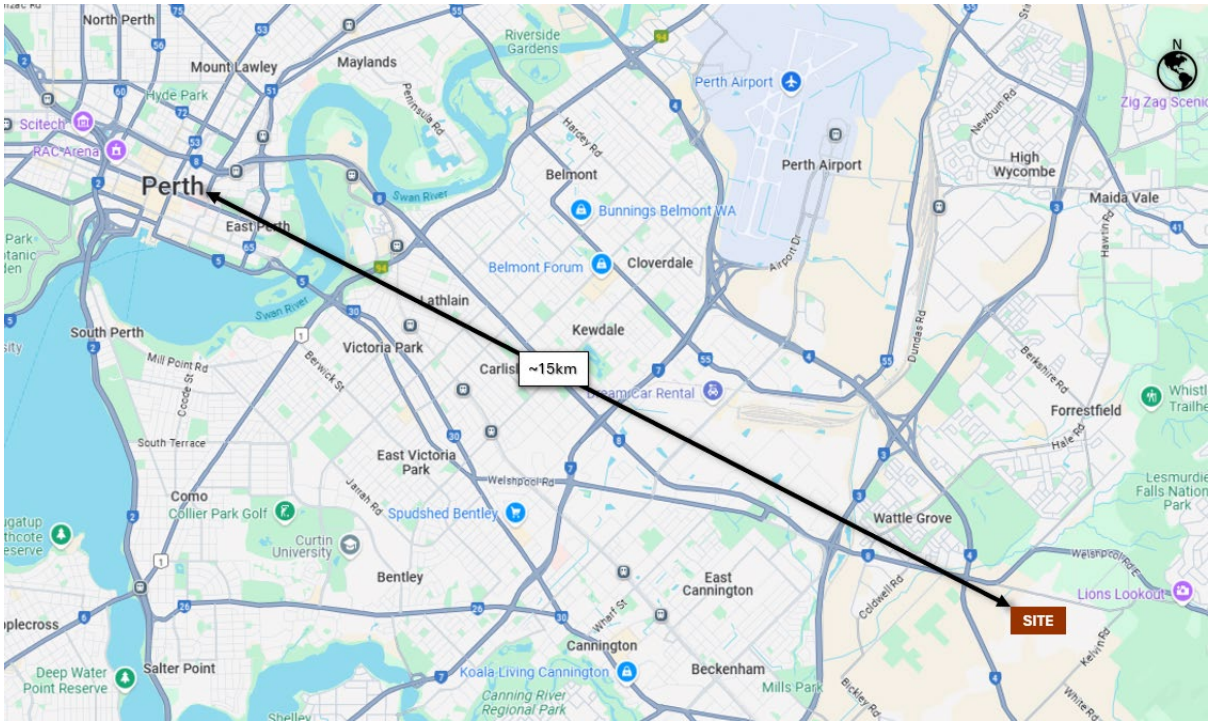
2 STRUCTURE PLAN PROPOSAL

2.1 Regional Context

The Wattle Grove South Local Structure Plan (LSP) site is located within the City of Kalamunda, approximately 15 kilometres southeast of the Perth CBD as shown in **Figure 1**.

The proposed LSP is located on the eastern side of Tonkin Highway, and in area currently developed for large lot rural residential uses and some typical rural fringe uses (e.g. turf farm).

Figure 1 Regional Location



Source: Google Maps

2.2 Site Location

The proposed LSP area is shown in **Figure 2**. The site is bounded by Welshpool Road East and Crystal Brook Road to the north, Tonkin Hwy to the west and Kelvin Road to the east. These roads provide important regional connectivity and access to the site.

Figure 2 Site Location

Source: Metromap

2.3 Proposed Land Uses

Figure 3 shows the conceptual layout plan for the LSP area.

The LSP is estimated to yield approximately 1,646 residential lots and a primary school. No commercial land uses are contemplated in the proposed LSP.

Figure 3 Cell Structure Plan – Wattle Grove South

Source: element

2.4 Table of Land Uses and Quantities

Table 1 provides a summary of the estimated land use yields within the proposed LSP.

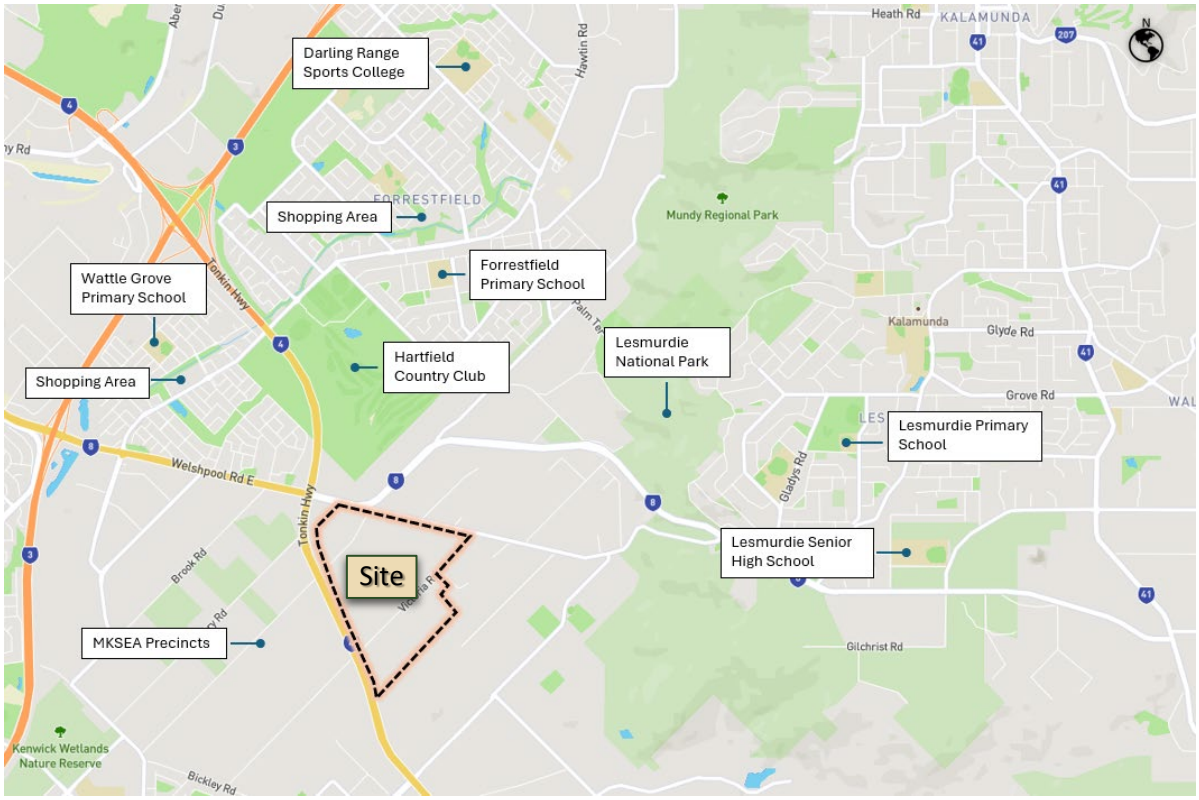
Table 1 Land Uses

Land Uses		Area (ha)	Estimated Yield
Residential Lots	Precinct A	15.39	207 lots
	Precinct B	25.07	306 lots
	Precinct C	18.11	236 lots
	Precinct D	30.01	451 lots
	Precinct E	19.14	261 lots
	Precinct F	12.32	185 lots
	Total	120.04	1,646 lots
Primary School		4.25	500 students

2.5 Major Attractors/Generators

Major attractors and generators within the area surrounding the Site are shown in **Figure 4**

Figure 4 Major Attractors/Generators within the Surrounding Area



2.6 Specific Issues

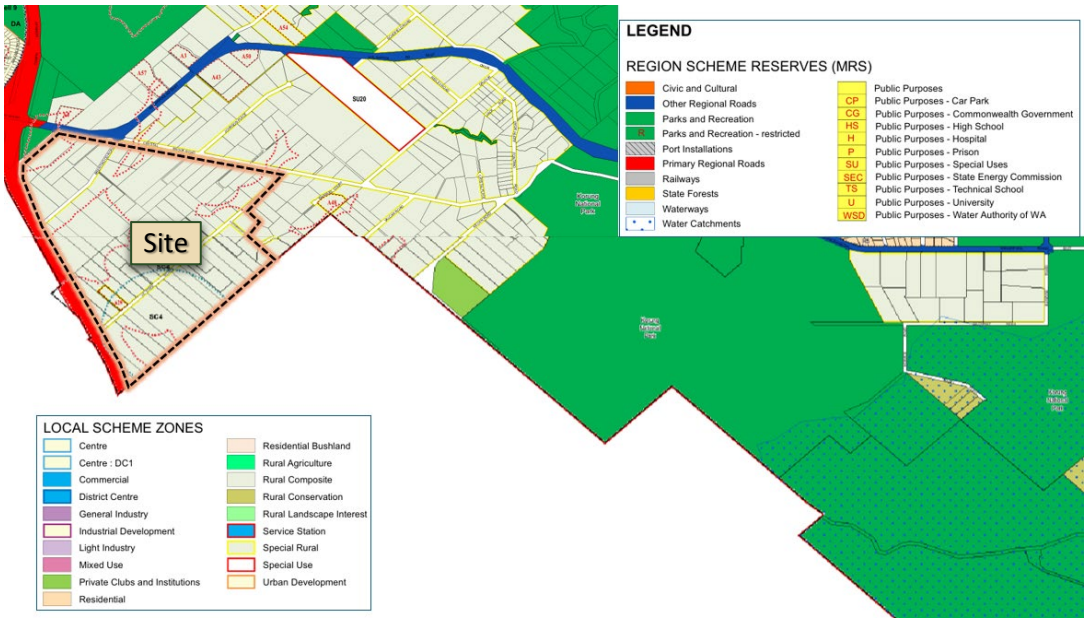
No site-specific issues were identified for the LSP site.

3 EXISTING SITUATION

3.1 Existing Land Uses Within Structure Plan Area

The Site is currently zoned 'Special Rural' in the City of Kalamunda Local Planning Scheme No. 3 (LPS3) as shown in **Figure 5**. Much of the land within this area currently consists of larger semi-rural residential properties and businesses (e.g. turf farm).

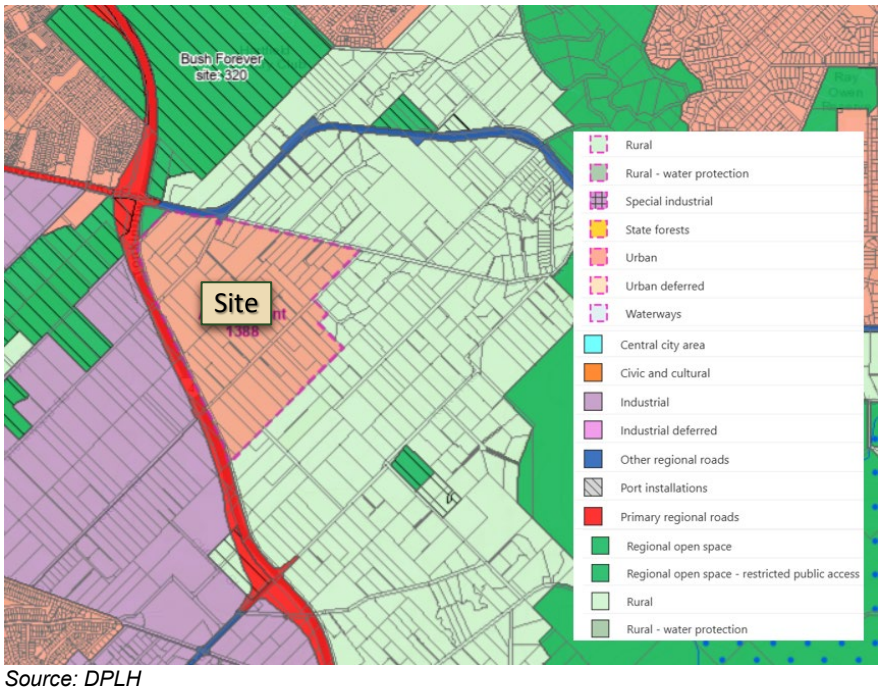
Figure 5 Existing Land Use Zoning



Source: City of Kalamunda Local Planning Scheme No. 3 (LPS3),

The LSP area is currently zoned Rural under the Metropolitan Region Scheme. An amendment to the MRS (1388/57) to rezone approximately 126a in the Wattle Grove locality from the Rural zone to the Urban zone is currently under consideration by the WAPC and is expected to be approved in the near future. **Figure 6** shows the MRS amendment map.

Figure 6 Proposed zoning for MRS 1388/57



Source: DPLH

3.2 Existing Land Uses Within 800 Metres of Structure Plan Area

The Site is surrounded by other rural residential land uses to the north and southeast. To the west, industrial development is occurring within the Maddington -Kenwick Strategic Employment Area (MKSEA).

3.3 Existing Road Network

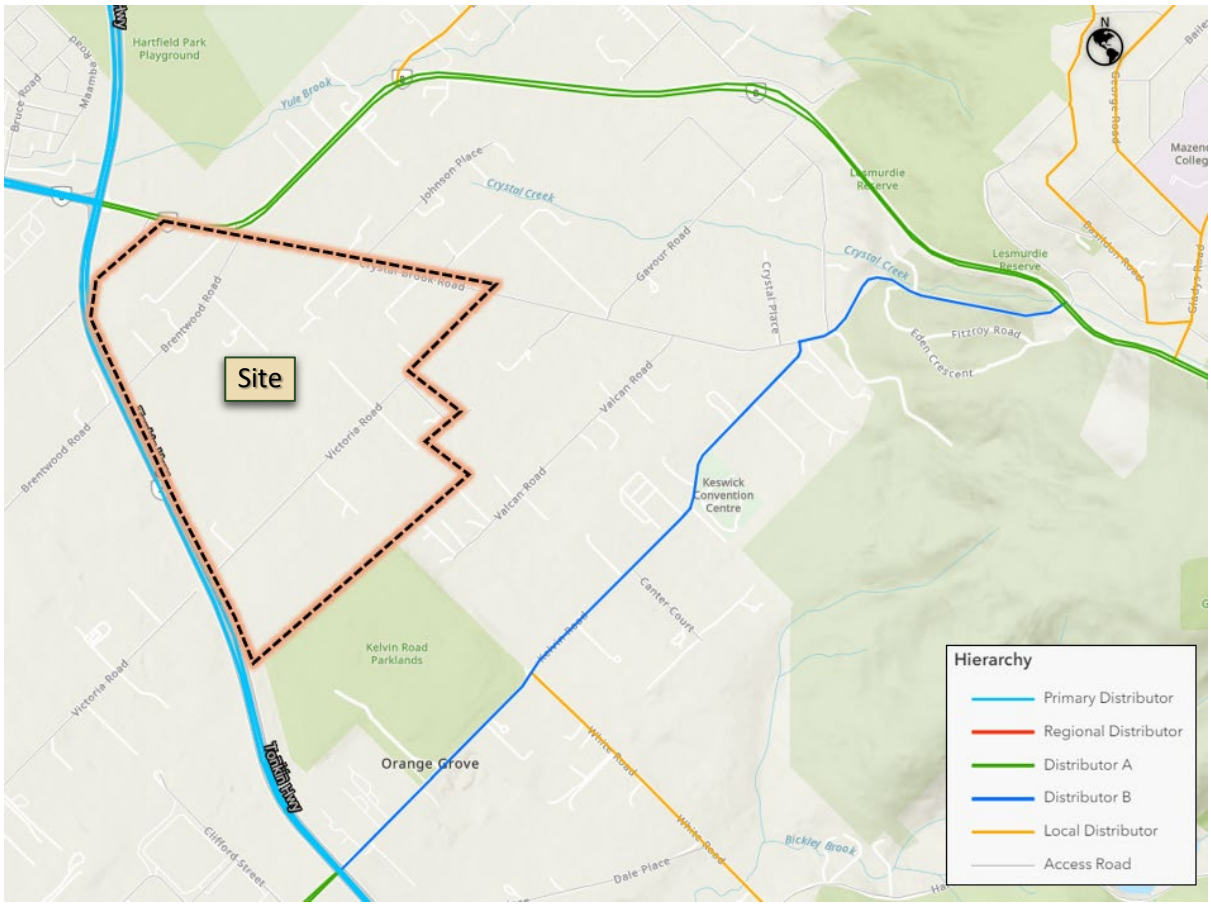
The road network within Western Australia is defined by Main Roads WA Road Hierarchy which describes the function, characteristic and management of each type of road. A description of each road type as per Main Roads WA Road Hierarchy criteria is summarised in **Table 2**.

Table 2 Road Hierarchy Description

Road Type	Description
Primary Distributors	Provide for major regional and inter-regional traffic movement and carry large volumes of generally fast-moving traffic. Some are strategic freight routes, and all are State Roads. They are managed by Main Roads Western Australia.
District Distributor A	Carry traffic between industrial, commercial and residential areas and generally connect to Primary Distributors. These are likely to be truck routes and provide only limited access to adjoining property. They are managed by local government.
District Distributor B	Perform a similar function to type A District Distributors but with reduced capacity due to flow restrictions from access to and roadside parking alongside adjoining property. These are often older roads with a traffic demand in excess of that originally intended. District Distributor A and B roads run between land-use cells and generally not through them, forming a grid which would ideally space them around 1.5 kilometres apart. They are managed by local government.
Regional Distributor	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.
Local Distributor (Urban)	Roads that carry traffic within a cell and link District Distributors or Regional Distributors at the boundary, to access roads. The route of Local Distributors should discourage 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. Urban Local Distributor roads are managed by local government.
Local Distributor (Rural)	Connect to other Rural Distributors and to Rural Access Roads. Not Regional Distributors, but which are designed for efficient movement of people and goods within regional areas. Rural Local Distributor roads are managed by local government.
Access Roads	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 7 shows the road hierarchy network and **Table 3** provides a summary of the road characteristics of the surrounding road network.

Figure 7 Road Hierarchy



Source: MRWA Road Information Mapping System

Table 3 Existing Road Network

Road Name	Hierarchy	Jurisdiction	No. of Lanes	No. of Paths	Approximate Pavement Width (m)	Speed Limit (km/h)
Boundary Road	Access Road	Local Government	2	0	7.8 (mostly unsealed)	50
Brentwood Road	Access Road	Local Government	2	0	6	50
Crystal Brook Road (east of Kelvin Rd)	Distributor B	Local Government	2	1	7.8	60
Crystal Brook Road (west of Kelvin Rd)	Access Road	Local Government	2	1	7.4	70
Kelvin Road	Distributor B	Local Government	2	0	7.5	60(between Crystal Brook Road &White Rd) & 70 (south of White Rd)
Lewis Road	Local Distributor	Local Government	2	1	7.3	70
Tonkin Highway	Primary Distributor	Main Roads	4	0	28 (including 8.6m median & 2.35m sealed shoulder both sides)	100
Victoria Road	Access Road	Local Government	2	0	6	50
Welshpool Road East	Distributor A	Local Government	4	2	20 (including 4.5m median)	80

Source: MRWA Road Information Mapping System

Roads within the LSP area are generally constructed as 'rural' type roads with unsealed shoulders, no kerbing, and open drains adjacent to the carriageway. Crystal Brook Road and Welshpool Road East, along the northern boundary of the LSP, are kerbed with some underground drainage.

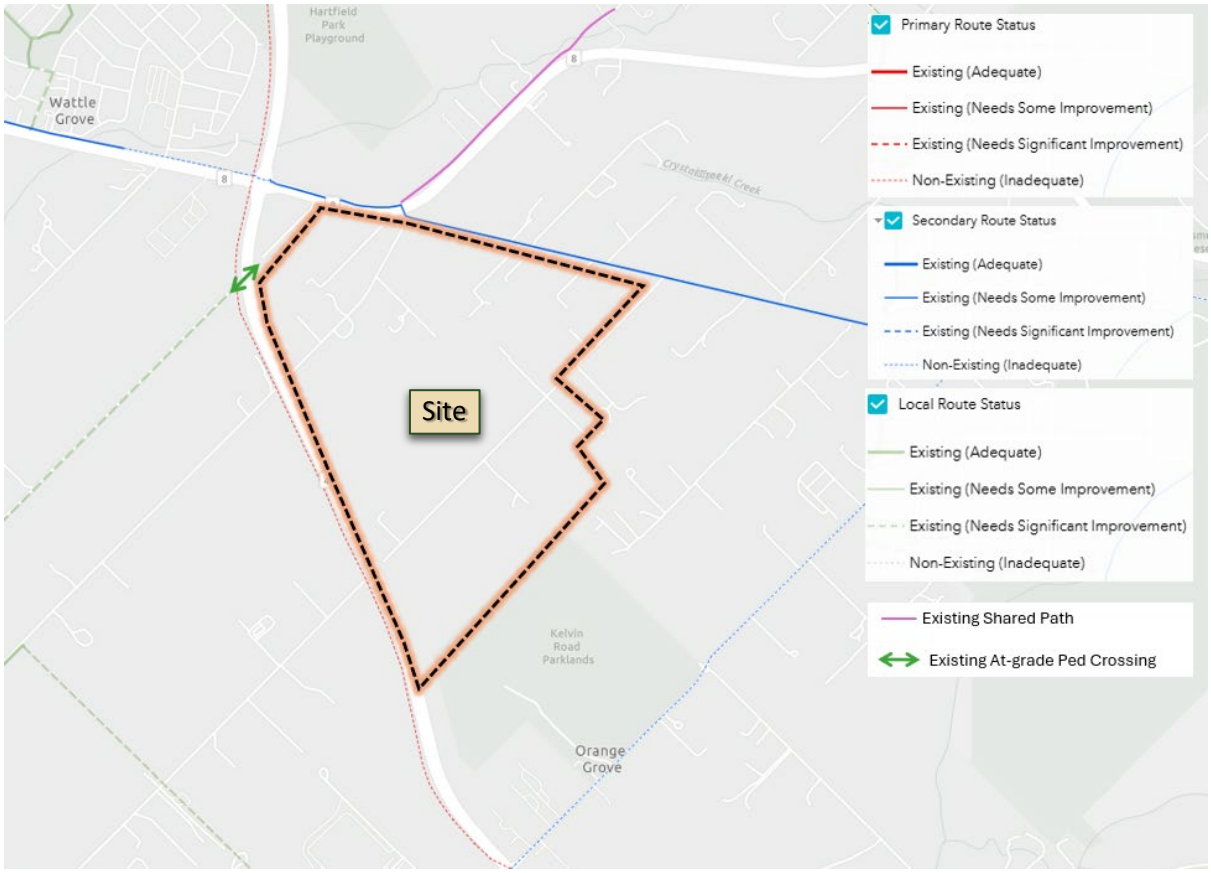
3.4 Existing Pedestrian/Cycle Networks

The LSP area does not contain an existing pedestrian/cycle network.

The existing cycling network extends along Crystal Brook Road and Welshpool Road East. However, there are currently no dedicated local cycling links provided within the LSP boundary. At the western end of Brentwood Road, there is an existing at-grade pedestrian and cycle crossing that provides a low standard connection across Tonkin Highway. There is an existing pedestrian path that runs along Welshpool Road East extending northwards up to Lewis Road. A dedicated footpath is also provided along Lewis Road, connecting to Forrestfield

Crystal Brook Road and Welshpool Road East are classified as a secondary route which needs some improvement in front of the LSP area. **Figure 8** shows the existing cycling network.

Figure 8 Existing Pedestrian/Cycle Network



Source: Department of Transport Bicycle Network Maps

3.5 Existing Public Transport Services

There are no public transport services operating within the LSP area. The closest public transport services operate along Welshpool Road East and Crystal Brook Road, along the northern boundary of the LSP.

- Routes 283 is the closest service available near the LSP which operates between Oats Street Station and Kalamunda Bus Station. The nearest bus stops to the LSP are located around 25 metres east of Brentwood Road and around 40 metres both east and west of Victoria Road on Crystal Brook Road.
- Routes 281 and 282 also run along Welshpool Road East with 281 operating on school days only, primarily for students travelling to Darling Range and Lesmurdie high schools. A pair of bus stops for these routes are located on Welshpool Road East between Boundary Road and Crystal Brook Road.

Public transport facilities in the vicinity of the LSP are illustrated in **Figure 9** and **Figure 10** shows bus stop locations. The service frequencies are summarised in **Table 4**.

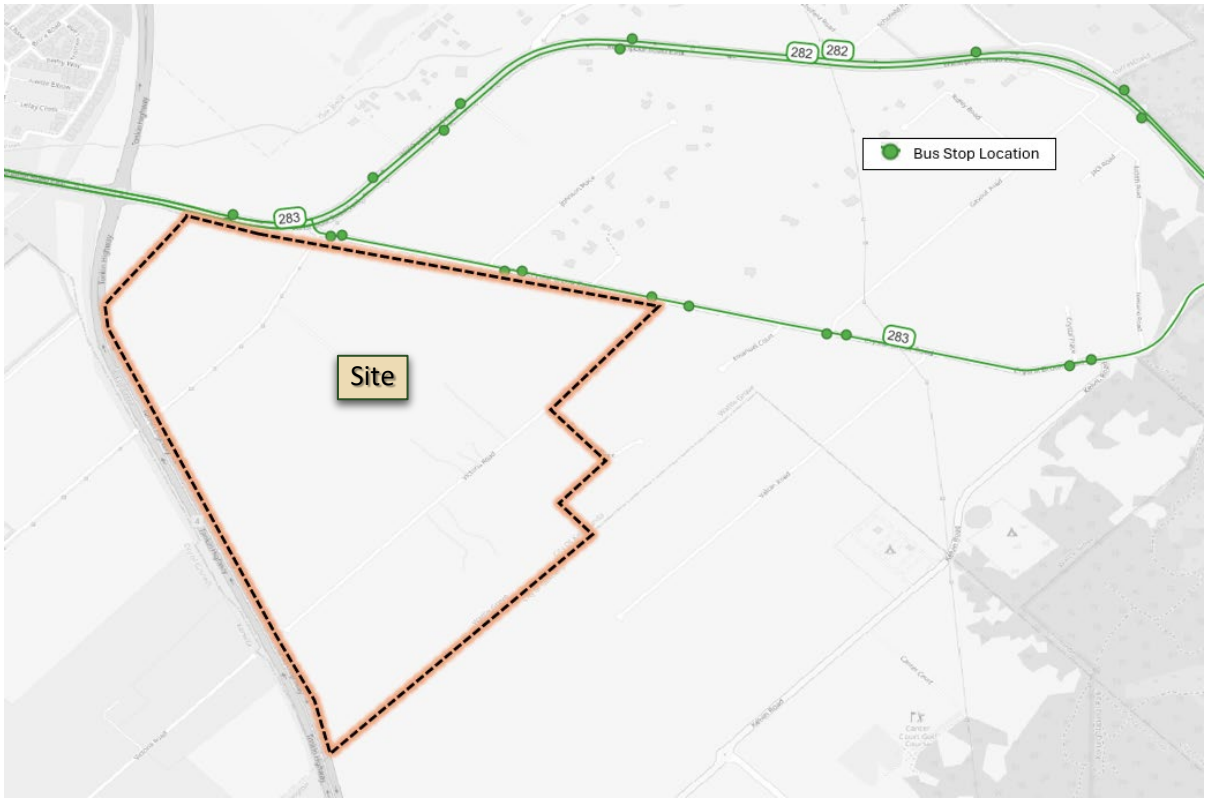
Table 4 - Bus Route Description and Frequency

Bus Route	Route Description	Weekday Frequency	Saturday Frequency
281	Forrestfield – Lesmurdie via Wattle Grove	4 services each way (school days only)	No service
282	Oats Street Stn - Kalamunda Bus Stn via Welshpool Rd & Grove Rd	30 - 60 minutes	120 minutes
283	Oats Street Stn - Kalamunda Bus Stn via Welshpool Rd & Lesmurdie Rd	30 – 60 minutes	120 minutes

Figure 9 Existing Public Transport Services

Source: Transperth

Figure 10 Existing Bus Stop Locations



Source: Transperth

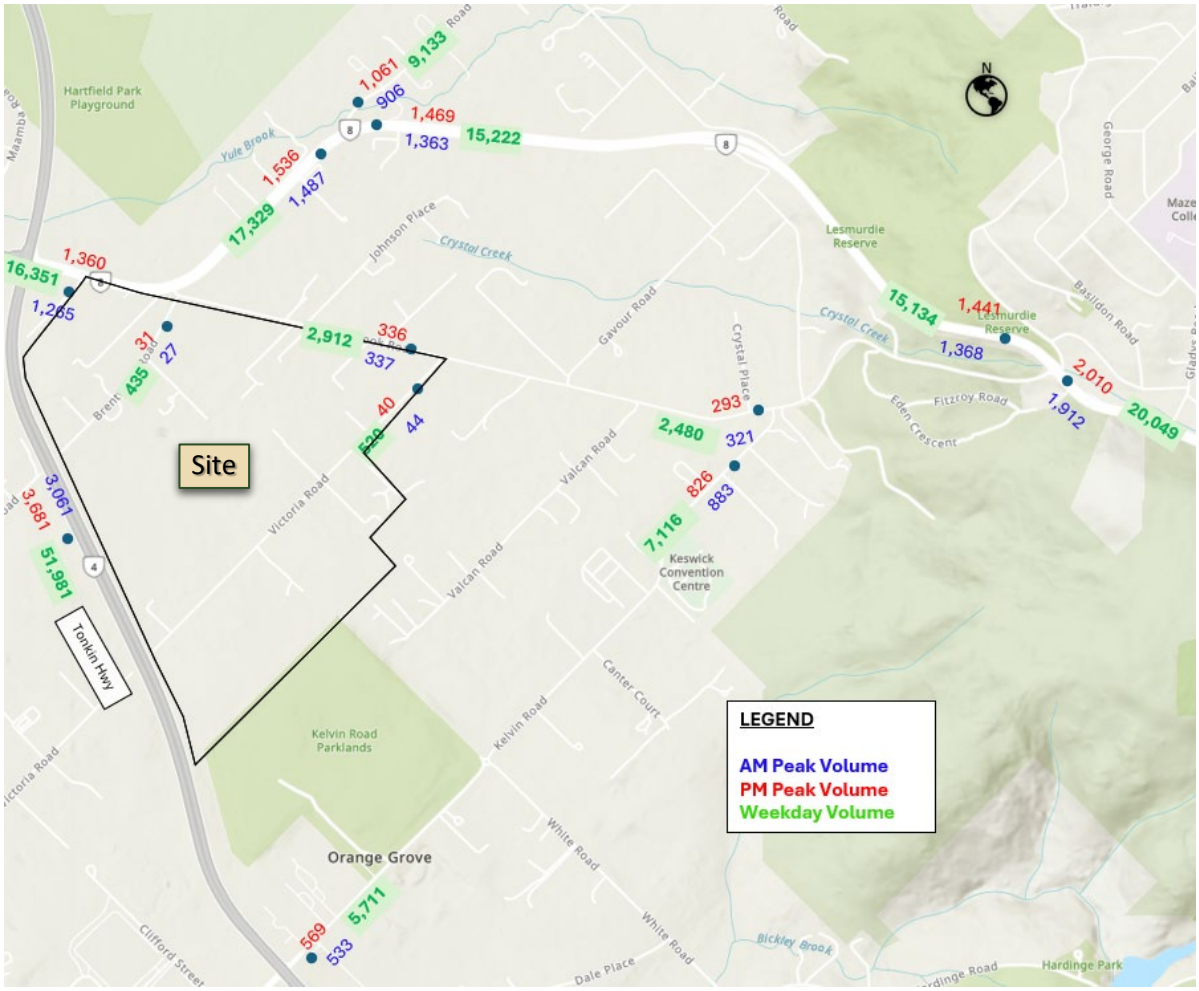
3.6 Existing Traffic Flows

The existing traffic volumes surrounding the LSP area were sourced from the Main Roads WA's Traffic Map database and traffic counts arranged by PTG, and are summarised in **Table 5** and illustrated in **Figure 11**.

Table 5 Existing Traffic Volumes

Road Name	Source	Date	AM Peak (vph)	PM Peak (vph)	Weekday (vpd) (HV%)
Brentwood Rd	PTG Traffic Counts	Dec 2024	27	31	435 (18%)
Crystal Brook Road (West of Kelvin Rd)	PTG Traffic Counts	June 2025	321	293	2,480 (6%)
Crystal Brook Road (West of Victoria Rd)	PTG Traffic Counts	June 2025	337	336	2,912 (5%)
Kelvin Road (North of Tonkin Hwy)	MRWA	2023/24	533	569	5,711 (11.9%)
Kelvin Road (South of Crystal Brook Road)	PTG Traffic Counts	June 2025	883	826	7,116(4%)
Lewis Road (North of Welshpool Rd)	PTG Traffic Counts	June 2025	906	1,061	9,133 (3%)
Tonkin Hwy (South of Welshpool Rd East)	MRWA	2021/22	3,061	3,681	51,981 (13%)
Victoria Rd	PTG Traffic Counts	June 2025	44	40	520 (5%)
Welshpool Rd East (East of Tonkin Hwy)	MRWA	2023/24	1,265	1,360	16,351 (7.1%)
Welshpool Rd East (East of Lewis Rd)	PTG Traffic Counts	June 2025	1,363	1,469	15,222 (5%)
Welshpool Rd East (West of Lewis Rd)	PTG Traffic Counts	June 2025	1,487	1,536	17,329 (5%)
Welshpool Rd East (West of Crystal Brook Road)	PTG Traffic Counts	June 2025	1,368	1,441	15,134(5%)
Welshpool Rd East (East of Crystal Brook Road)	PTG Traffic Counts	June 2025	1,912	2,010	20,049(5%)

Figure 11 Existing Traffic Volumes

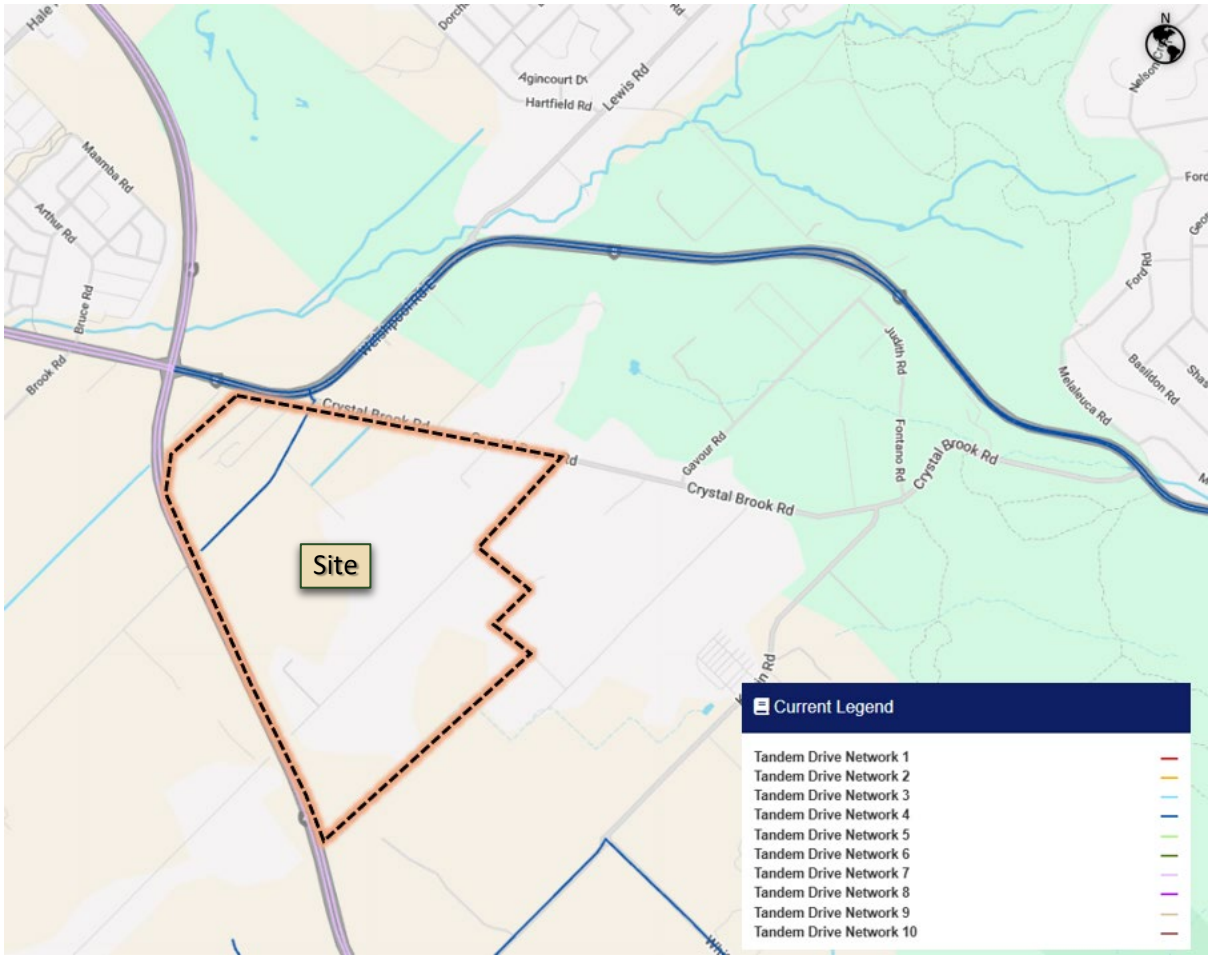


3.7 Existing Restricted Access Vehicle (RAV) Network

The existing RAV network is shown below in **Figure 12**.

Up to RAV 4 sized vehicles are permitted to use Brentwood Road, mainly for access to the existing turf farm business.

Figure 12 RAV Network Map



Source: Main Roads HVS Network Map (2021)

4 PROPOSED INTERNAL TRANSPORT NETWORKS

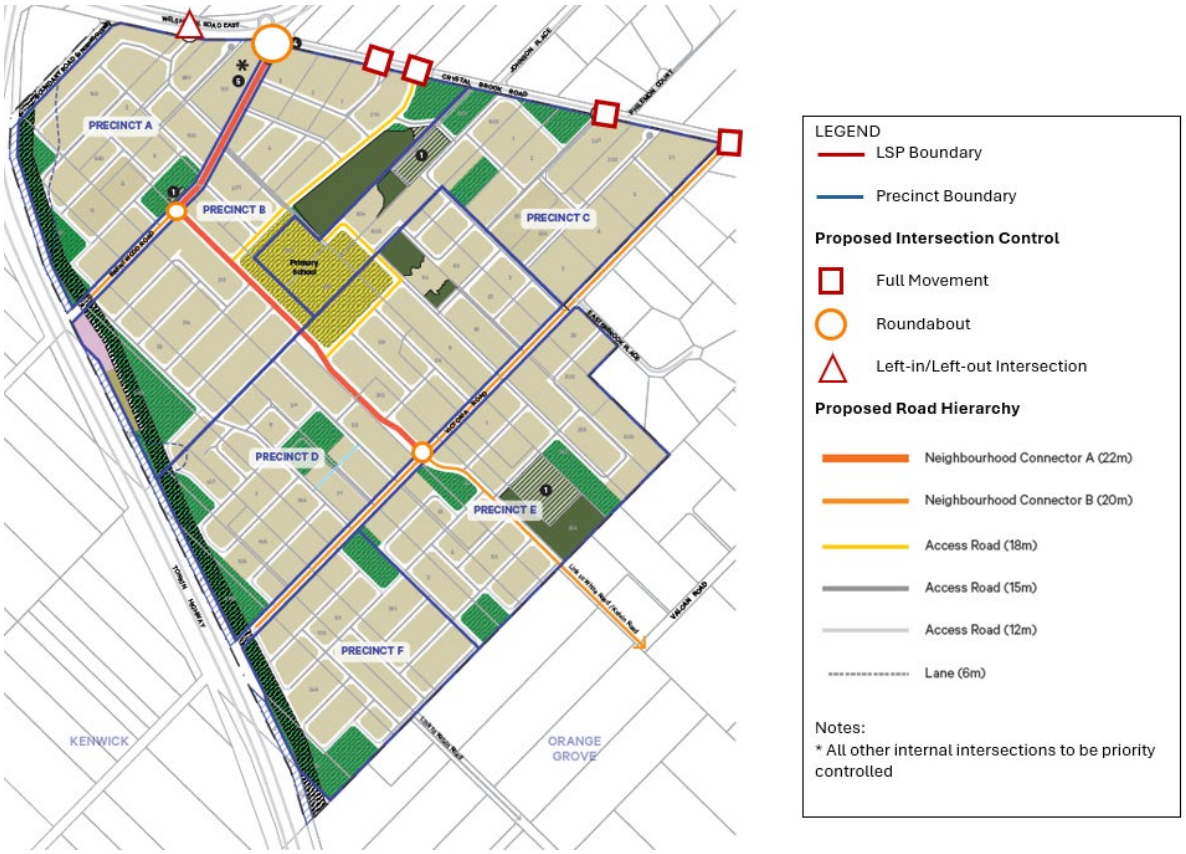
4.1 Connections to External Road Network

The proposed internal road hierarchy and Indicative access points to the external network are shown in **Figure 13 and described** below:

- Connection via existing Victoria Road to Crystal Brook Road;
- Three new priority control intersections on Crystal Brook Road;
- A four-way roundabout at Welshpool Road East/Crystal Brook Road/Brentwood Road intersection to replace the existing staggered T-intersections; and
- A Left-In-Left-Out intersection on Welshpool Road East, between Crystal Brook Road and Boundary Road, to replace an existing full movement crossover into Lot 2 (No. 731) Welshpool Road East.

No connections are proposed to Boundary Road which will be closed to traffic once the adjacent land has been developed as part of this LSP.

Figure 13 Proposed Connections to External Road Network



Source: element

4.2 Road Reservation Widths and Cross Sections

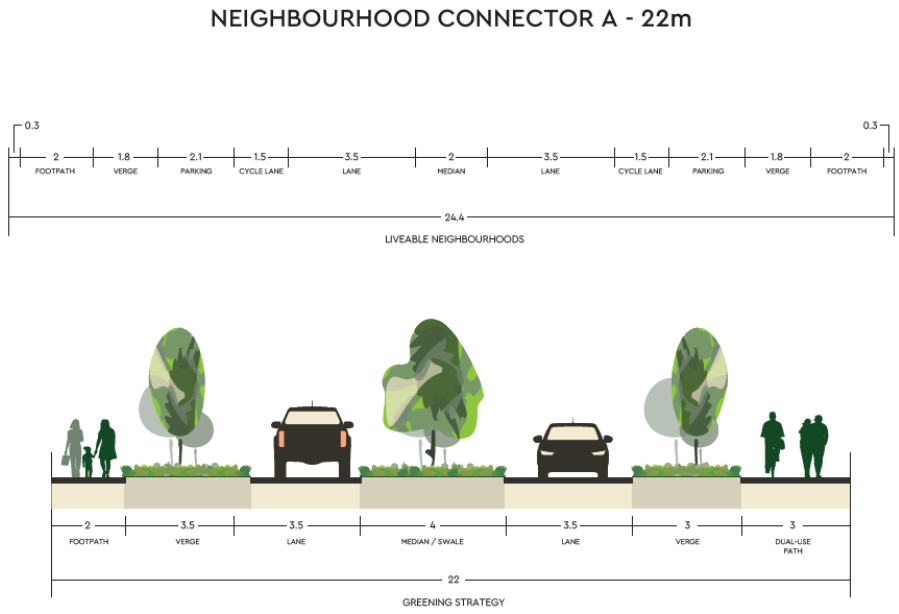
The proposed road hierarchy, road reservation widths and cross sections have been developed to align with Liveable Neighbourhoods (2009), with some modifications as summarised in **Table 6**.

Table 6 Proposed Road Reserve Widths

Road	Traffic Volumes (vpd)	LN Road Reserve	Proposed Road Reserve	Comments on proposed modifications from Liveable Neighbourhoods
Internal Roads				
Brentwood Road NE (Neighbourhood Connector A)	<7,000	24.4m	22m	» Existing road reserve is 20m » Widening of 1.0m on each side is proposed » Cycle lanes shown in LN cross-section proposed to be omitted and replaced by a wider shared path on one verge
Brentwood Road SW (Neighbourhood Connector B)	<3,000vpd	19.4m	20m	» Existing road reserve is 20m
Victoria Road (Neighbourhood Connector B)	<3,000vpd	19.4m	20m	» Existing road reserve is 20m
Proposed north-south Neighbourhood Connector A (Brentwood Road to Victoria Road)	<7,000vpd	24.4m	22m	» Modified cross-section proposed with wider shared path and no cycle lanes » Unprotected cycle lanes are not suitable for students riding to primary school so proposed cross-section will better serve anticipated users
Proposed north-south Neighbourhood Connector B (Victoria Road to southeastern boundary)	<3,000vpd	19.4m	20m	» Provision for increased traffic volumes resulting from future extension to Kelvin Road/White Road intersection (by others)
Access Streets	<3,000vpd	14.2m-24.0m	12m-18m	» Various modified cross-sections are proposed to achieve objectives of greening strategy
External Roads				
Crystal Brook Road (between Brentwood Road and Kelvin Road)	<7,000 vpd	24.4m	20.5m	» Existing road reserve with large trees and open drainage » Median and on-street parking to be omitted from standard cross-section to retain existing layout and trees

The indicative cross sections within the LSP area are shown in **Figure 14** to **Figure 20**. These cross sections are indicative in nature and will be refined during the subdivision stage, within the proposed road reserves.

Figure 14 Indicative Cross-Section – Neighbourhood Connector A



Source: Hesperia

Figure 15 Indicative Cross-Section – Neighbourhood Connector B (20m)

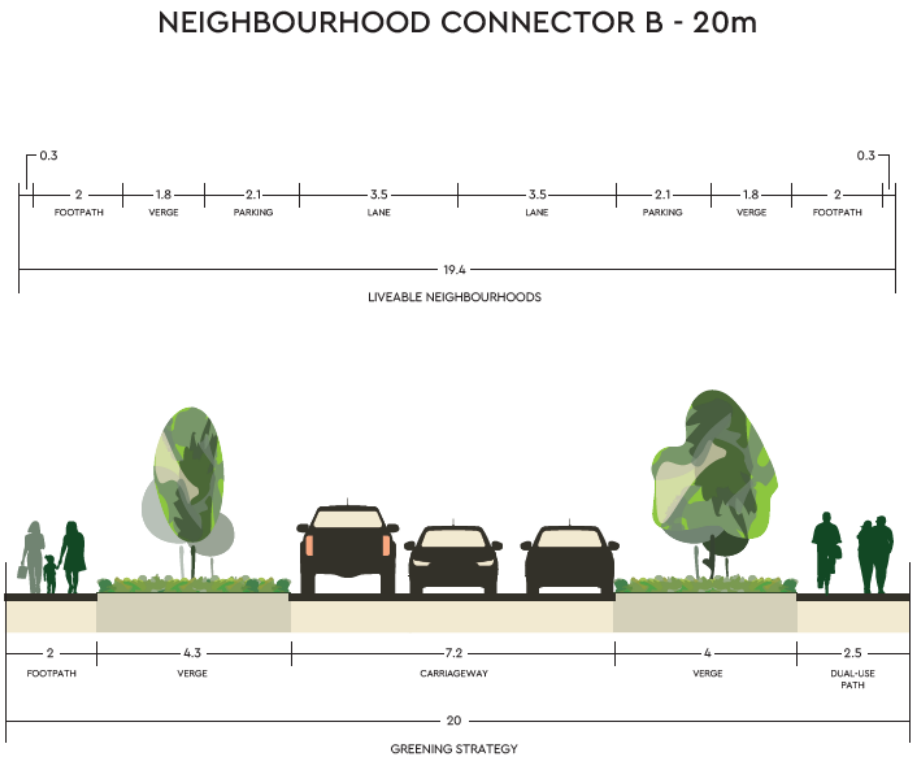


Figure 16 Indicative Cross-Section – Neighbourhood Connector B (19.4m)

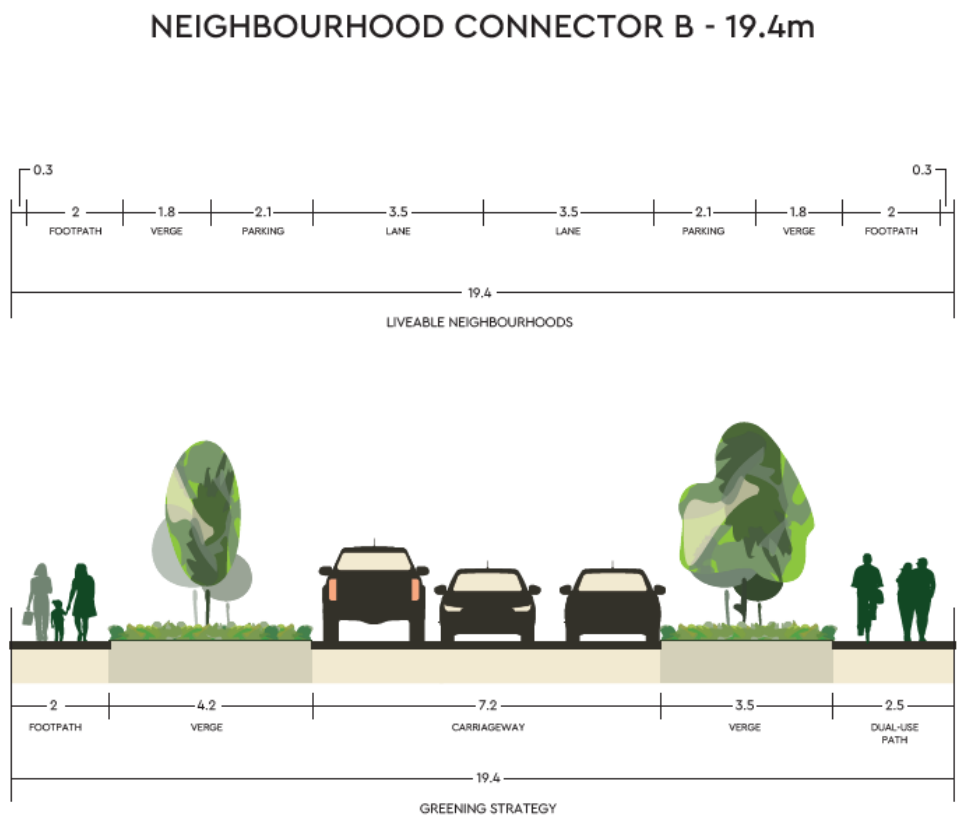


Figure 17 Indicative Cross-Section – Neighbourhood Connector B (18m)

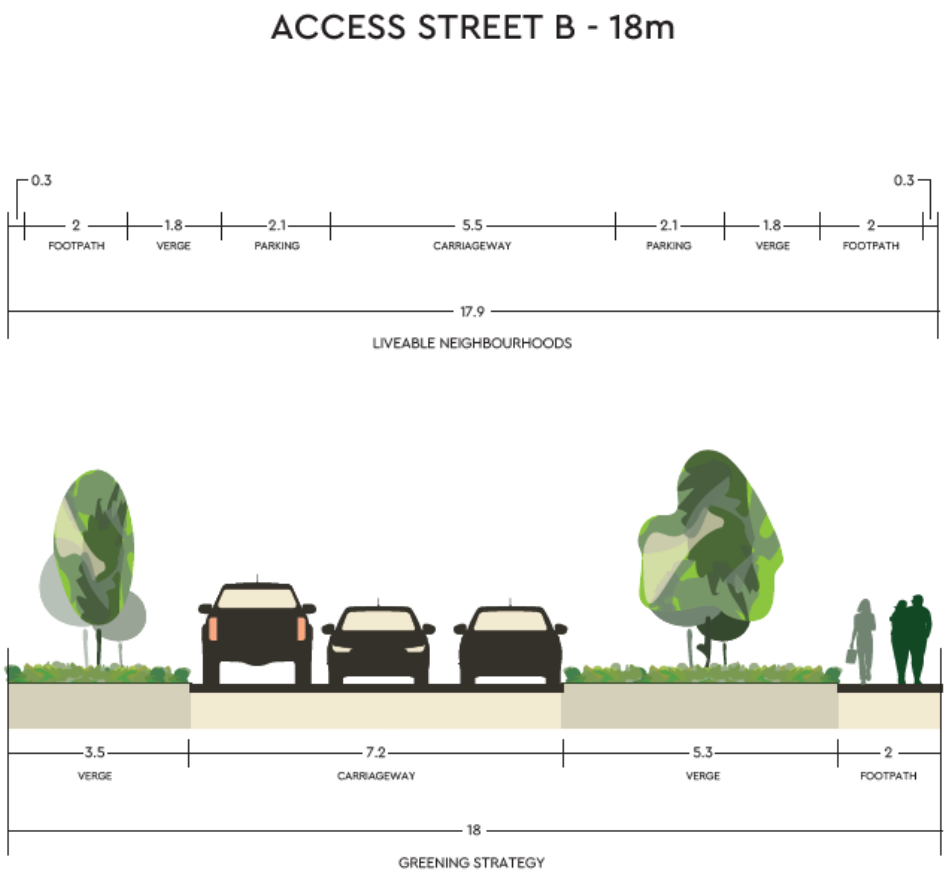


Figure 18 Indicative Cross-Section – Access Street B (17.9m)

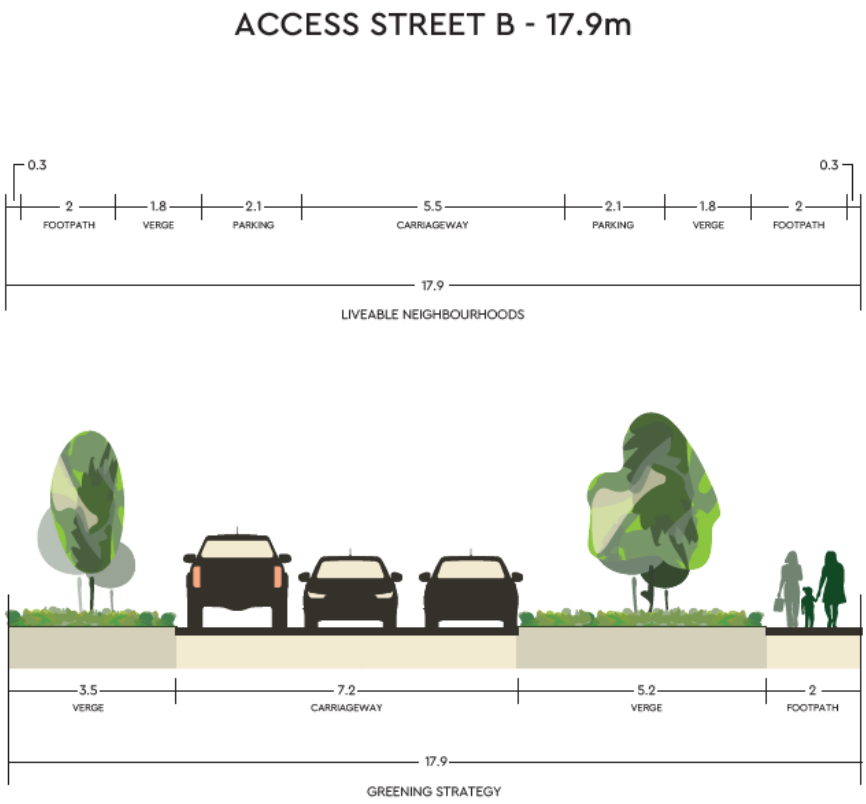


Figure 19 Indicative Cross-Section – Access Street C (15m)

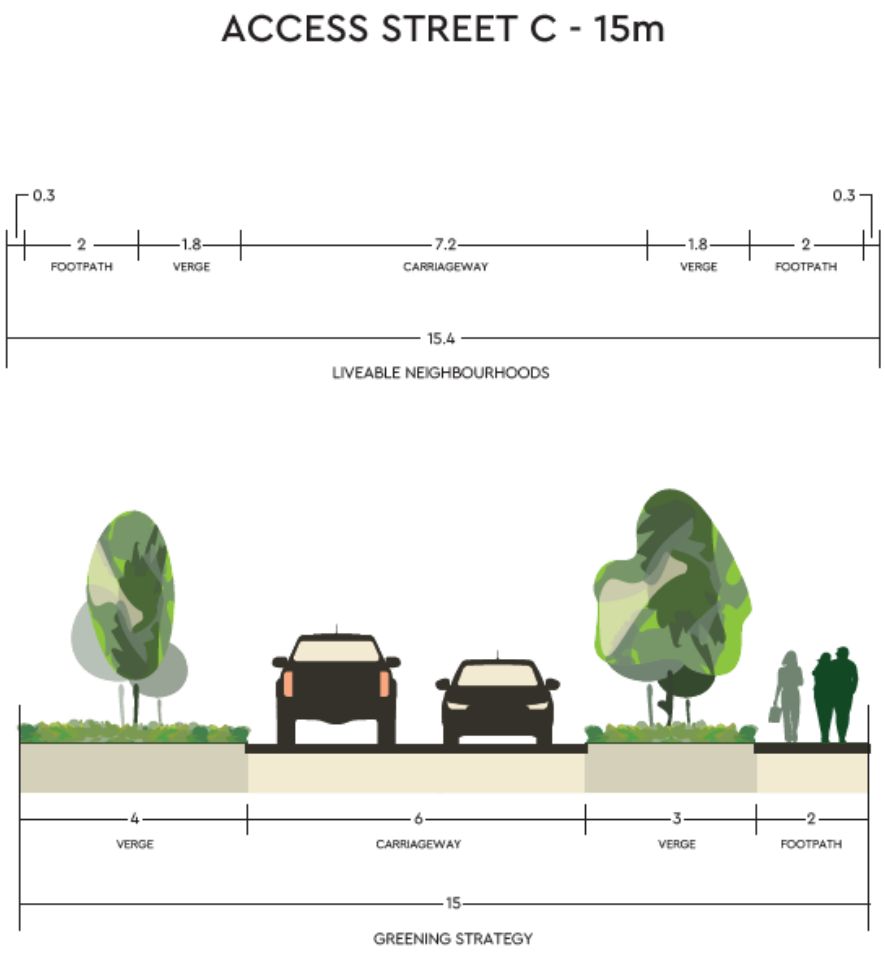
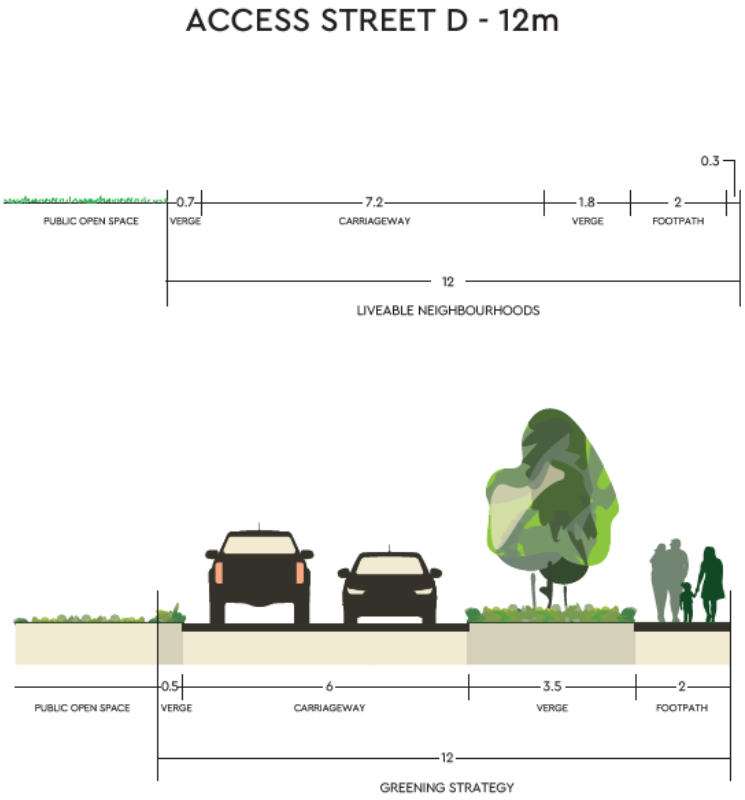


Figure 20 Indicative Cross-Section – Access Street C (12m)



Source: Hesperia

4.3 Intersection Controls

Most intersections within the LSP will be priority controlled consistent with the predominantly residential nature of the development.

Two roundabouts are proposed within the LSP at the intersections of the north-south Neighbourhood Connector with Brentwood Road and Victoria Road.

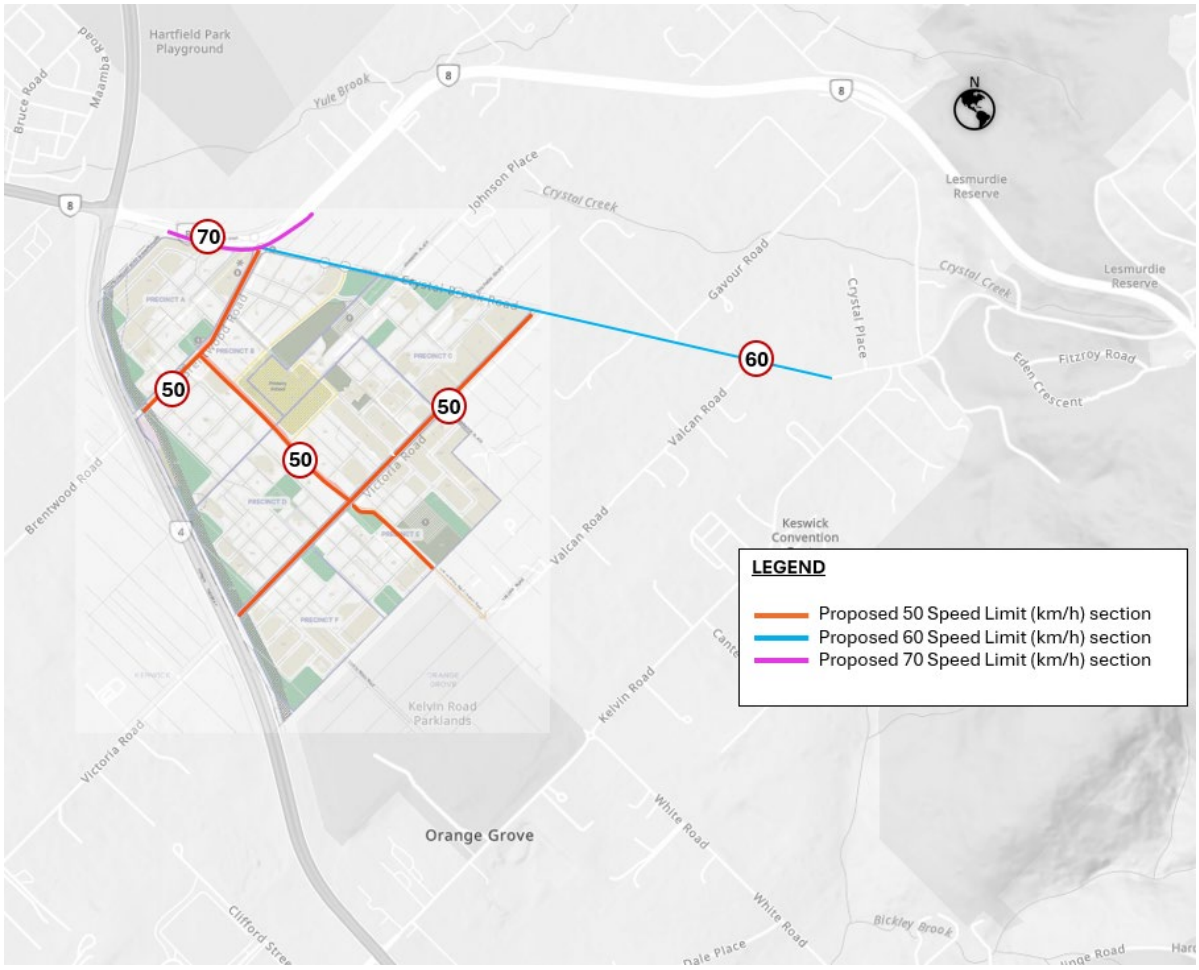
4.4 Speed Limits

The proposed speed limits for internal and external roads are shown in **Figure 21**, with the proposed changes including:

- All internal Neighbourhood Connectors and Access Streets will be subject to the default built-up area speed limit (currently 50km/h);
- Crystal Brook Road should be reduced from 70km/h to 60km/h between Welshpool Road East and Kelvin Road to reflect the urban frontage adjacent to the LSP and the additional turning movements at existing and proposed intersections; and
- Welshpool Road East should be reduced from 80km/h to 70km/h through the Crystal Brook Road/Brentwood Road roundabout intersection.

Any changes to speed limits are subject to assessment by MRWA through the applicable speed zoning processes.

Figure 21 Proposed Speed Limits



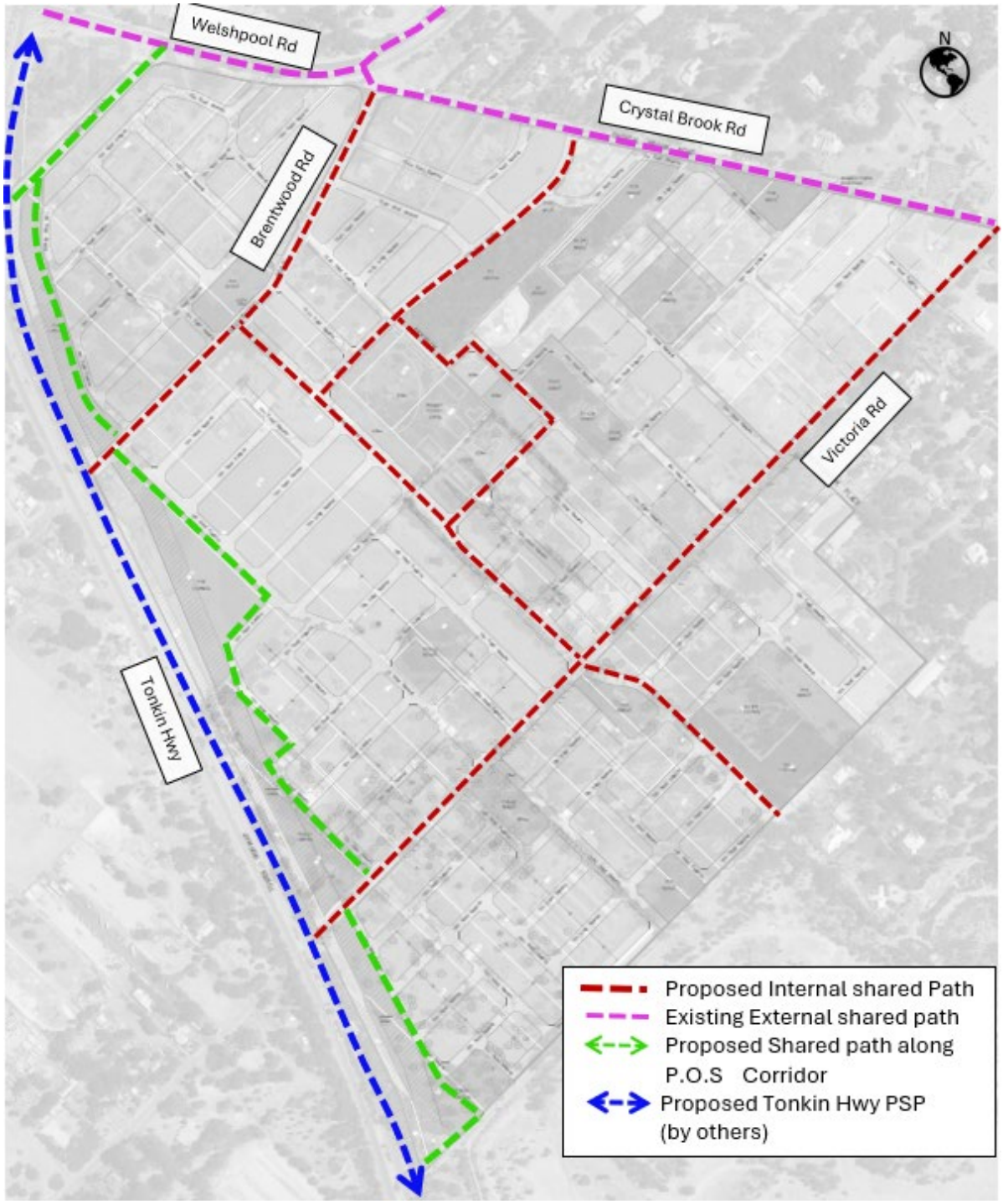
4.5 Pedestrian/Cycle Networks and Crossing Facilities

Proposed pedestrian and cycling facilities within the LSP are shown in **Figure 22**, and includes the following:

- Footpaths are proposed on at least one side of all streets within the LSP area.
- Paths are proposed on both sides of Neighbourhood Connectors, with one path being a 2.5-3.0m wide shared path and the other path being a narrower footpath.
- A shared path route is also proposed along the Public Open Space (POS) corridor adjacent to Tonkin Highway, extending along the full length of the LSP boundary.
- Advice from Main Roads WA (MRWA) indicates that the Tonkin Highway Principal Shared Path (PSP) will be located within the Tonkin Highway Road reserve. Appropriate connections to the PSP will be determined at subdivision stage, in consultation with MRWA.

Appropriate pedestrian crossing locations and connections to existing external paths will be determined during subdivision stage.

Figure 22 Proposed Pedestrian paths



4.6 Public Transport Routes

The PTA provided preliminary comments on the MRS Amendment for Wattle Grove South Precinct. These comments can be summarised as follows:

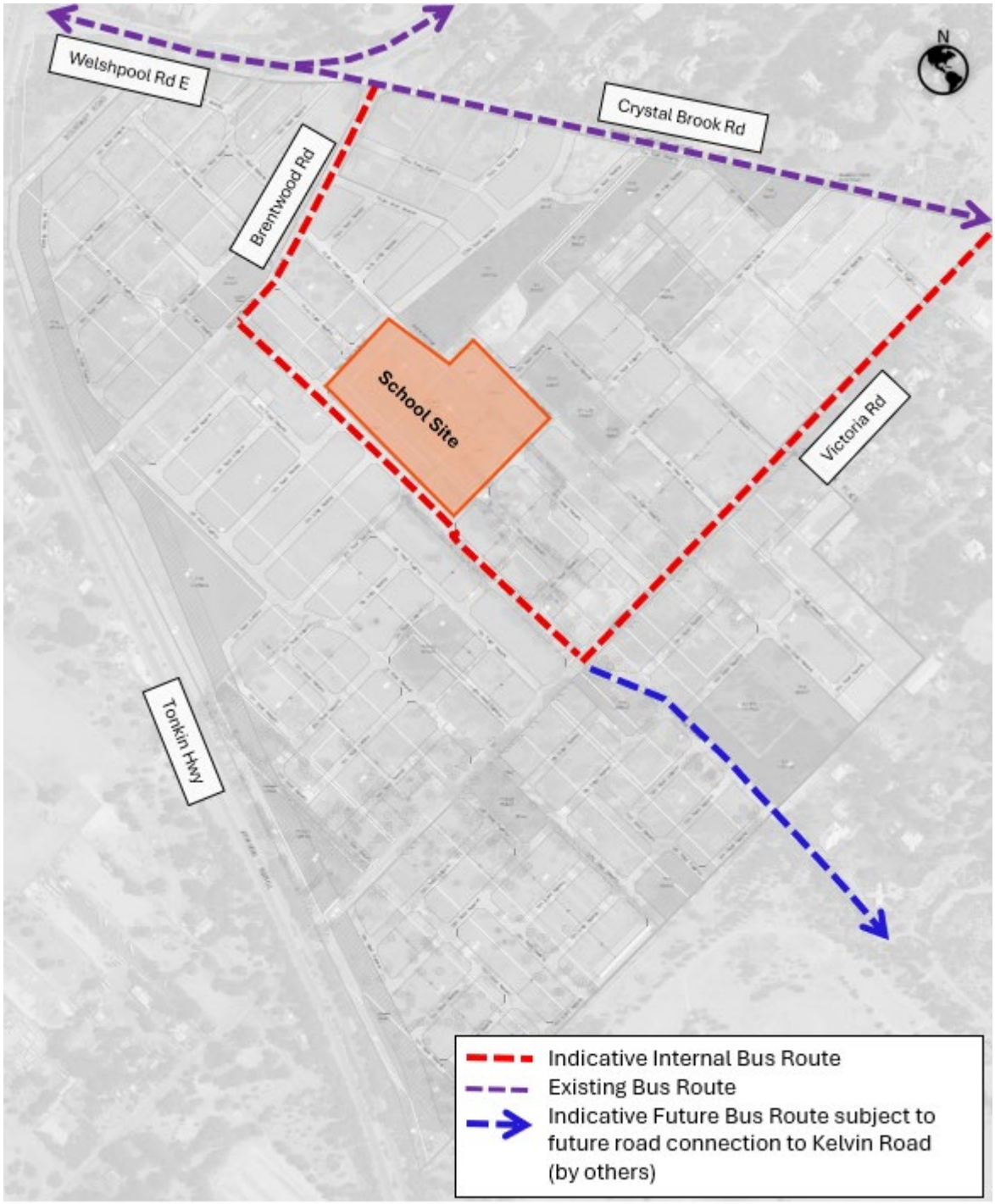
- Transperth does not support urban development in this area as funding is not available for the provision of additional public transport services;
- Transperth does not support the diversion of existing bus routes 282 or 283 through the LSP as the additional journey time will impact existing passengers from the Lesmurdie/Kalamunda area;
- Any public transport serving the LSP would need to be a completely new bus route, for which funding is not available.
- To enable future bus services through the LSP, a central road would need to be provided, connecting Welshpool Road East / Crystal Brook Road to Kelvin Road, allowing for a direct route that covers the catchment while minimising journey times.

To address these comments, provision has been made in the LSP layout for a central Neighbourhood Connector, extending from Brentwood Road to the southeastern boundary of the site. This Neighbourhood Connector will be designed to accommodate buses, with bus stop locations developed in consultation with the PTA.

The LSP also makes provision for the internal Neighbourhood Connector to be extended to the Kelvin Road/White Road intersection in the future. This connection would be the responsibility of the City of Gosnells or future developers of this land. Establishing this connection in the future would allow for an efficient bus connection to Maddington via Kelvin Road.

In the meantime, buses could divert via Victoria Road and Crystal Brook Road to reach Kelvin Road. Ongoing consultation with the PTA is proposed to further refine planning for bus routes to and through the LSP. **Figure 23** shows the indicative internal bus route.

Figure 23 Indicative Internal Bus Route



5 CHANGES TO EXTERNAL TRANSPORT NETWORKS

5.1 Road Network

5.1.1 Tonkin Highway Upgrade

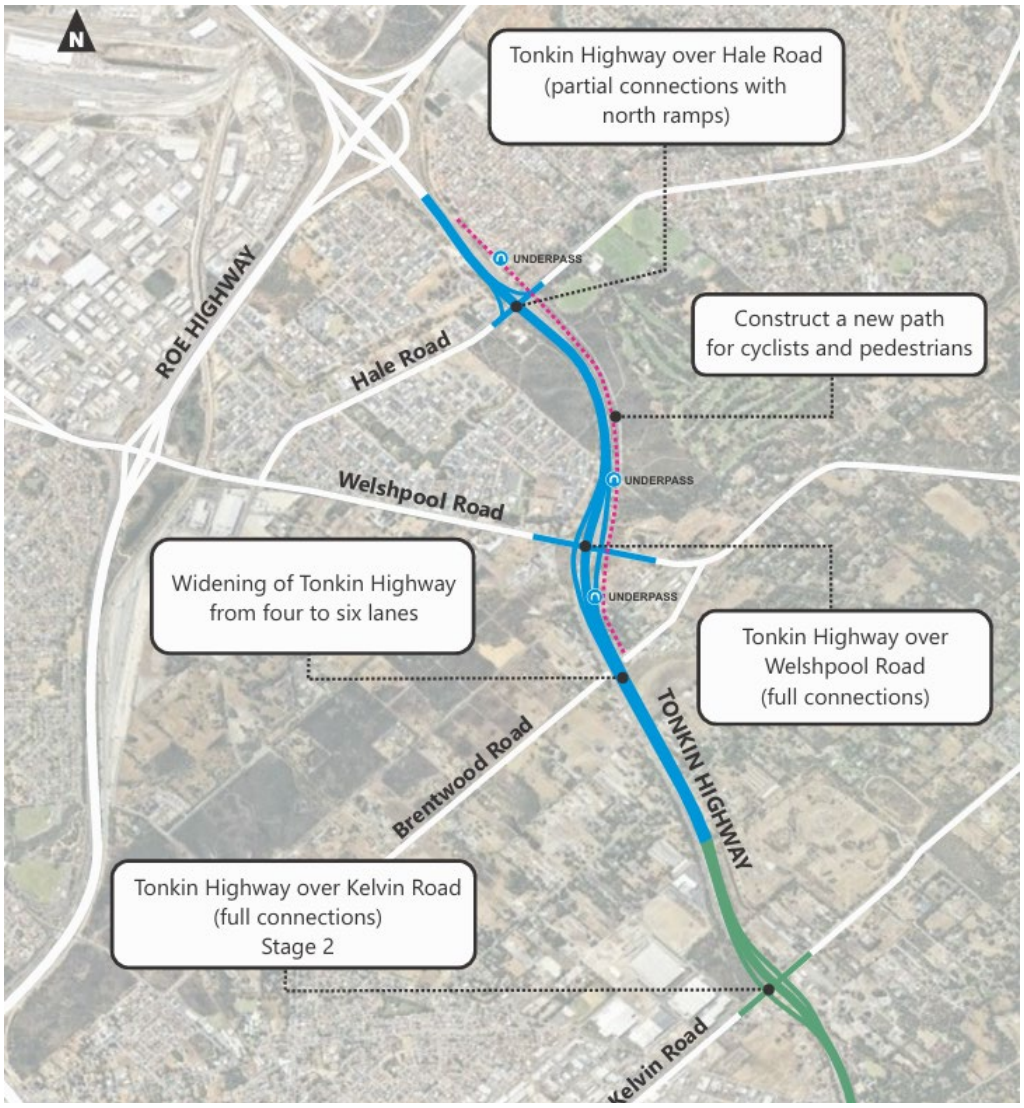
Main Roads WA are planning to upgrade Tonkin Highway from north of Hale Road to south of Kelvin Road as shown in **Figure 24**. The work will include widening Tonkin Highway from four to six lanes and grade-separating the existing intersections with Hale Road, Welshpool Road East and Kelvin Road. Noise walls will also be constructed along the majority of the LSP frontage to manage the impact of traffic noise.

A new principal shared path will be built to the east of Tonkin Highway from Hale Road to Kelvin Road with links to the local cycle network. The existing at-grade pedestrian/cycle crossing at the intersection of Tonkin Hwy/Brentwood Road will be removed as part of the upgrade.

Importantly, the project is expected to help reduce heavy vehicle traffic diverting onto local roads such as Kelvin Road/Crystal Brook Road as trucks and other vehicles will be less inclined to use alternative routes to avoid the current congestion and queuing at the signalised intersections.

According to the Main Roads WA website, Stage 1 is currently programmed to commence construction by the end of 2025, while Stage 2 is still subject to finalisation of environmental approvals.

Figure 24 Tonkin Highway Corridor Project



Source: MRWA

5.1.2 Proposed Changes to Welshpool Road East

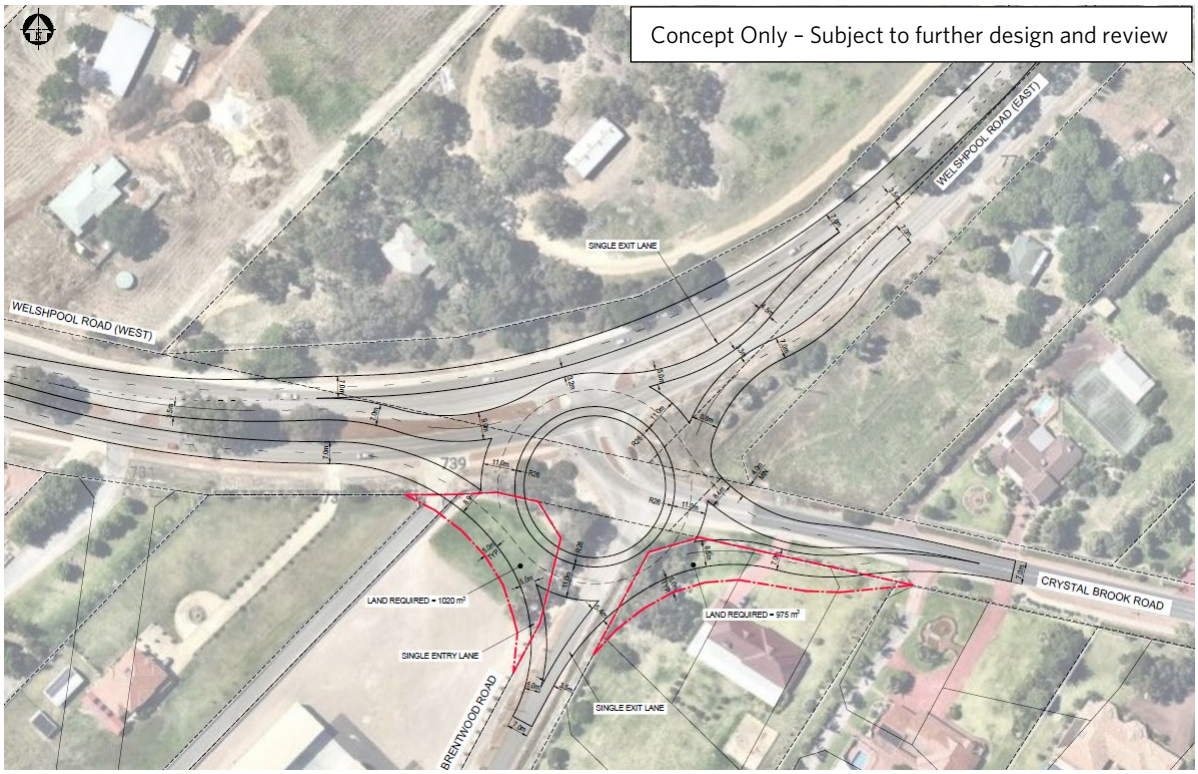
As part of the development of the LSP, some changes are proposed to Welshpool Road East, as shown in **Figure 25** and described below:

- Boundary Road (existing full movement intersection) will be closed to traffic;
- The existing full movement crossover at Lot 2 (No. 731) Welshpool Road East will be converted into a Left-In-Left-Out intersection; and
- The existing staggered T-intersections of Welshpool Road East/Crystal Brook Road/Brentwood Road will be replaced by a four-leg roundabout to accommodate the traffic generated by the LSP. A conceptual roundabout layout for the purpose of defining land requirements has been prepared by TABEC and is shown in **Figure 26**.
- The conceptual layout is subject to further design investigations in collaboration with the City of Kalamunda and MRWA.

No direct property access is proposed along the southern side of Welshpool Road East once the LSP is fully built out. Existing crossovers will be closed or converted as development progresses.

Figure 25 Proposed access arrangements – Welshpool Road East

Figure 26 Concept Layout of Proposed Welshpool Road East / Crystal Brook Road / Brentwood Road Roundabout



Source: TABEC

5.2 Pedestrian/Cycle Networks and Crossing Facilities

As part of the Tonkin Highway Corridor Project, MRWA proposes to construct a new PSP on the east side of Tonkin Highway. Preliminary discussions with the Main Roads project team have indicated that the Tonkin Highway PSP would be constructed within the Tonkin Highway Road reserve and relocation of this path within the LSP boundary is not favoured. Therefore, a separate path within the LSP should be constructed providing connectivity between the PSP and the LSP, as well as facilitating use by internal cycling and walking trips.

The existing at-grade pedestrian/cycle crossing at the intersection of Tonkin Hwy/Brentwood Road will be removed as part of the Tonkin Highway upgrade.

Figure 27 shows the Department of Transport's aspirational future cycling network within the Perth and Peel. The map shows the proposed cycle route hierarchy for the roads surrounding the proposed LSP which is summarised below.

- Tonkin Highway – Primary Route
- Welshpool Road East - Secondary Route
- Crystal Brook Road - Secondary Route
- Kelvin Road - Secondary Route

Figure 27 LTCN Network

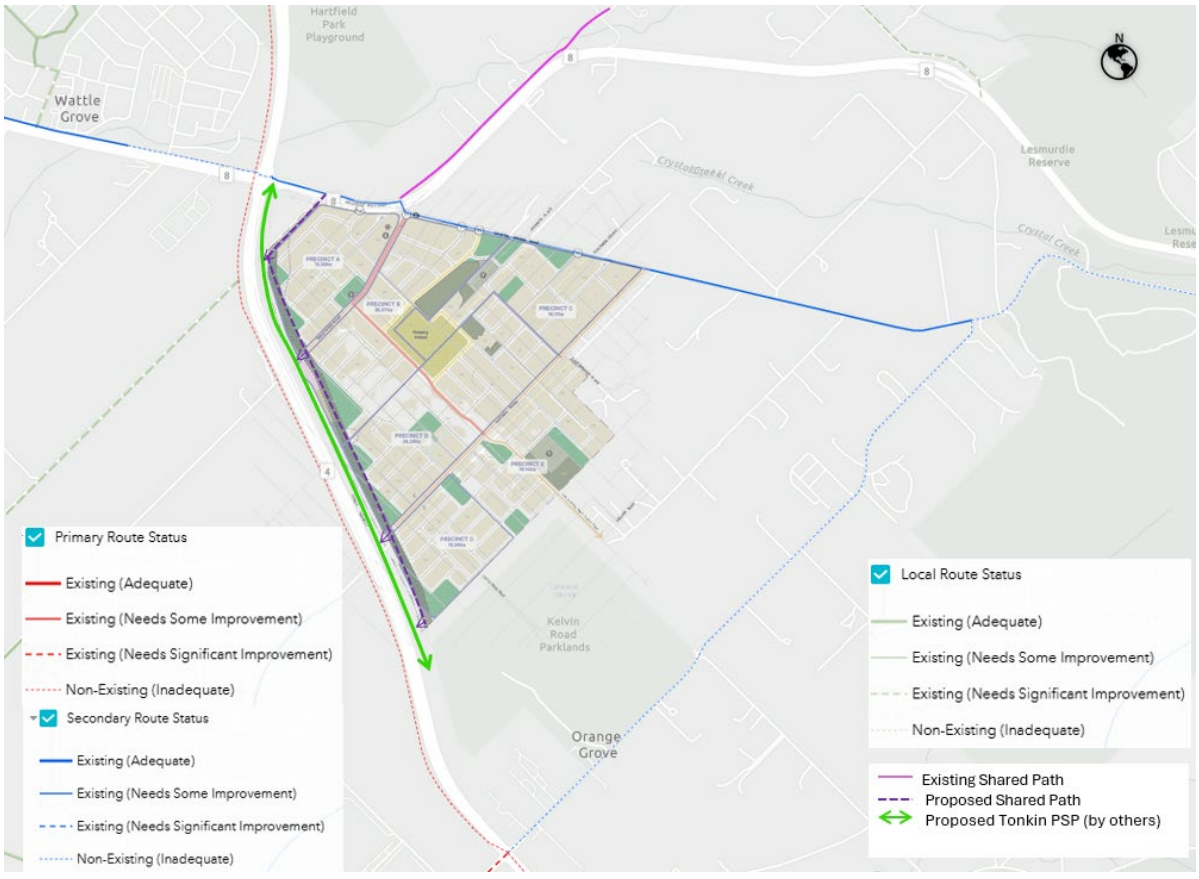
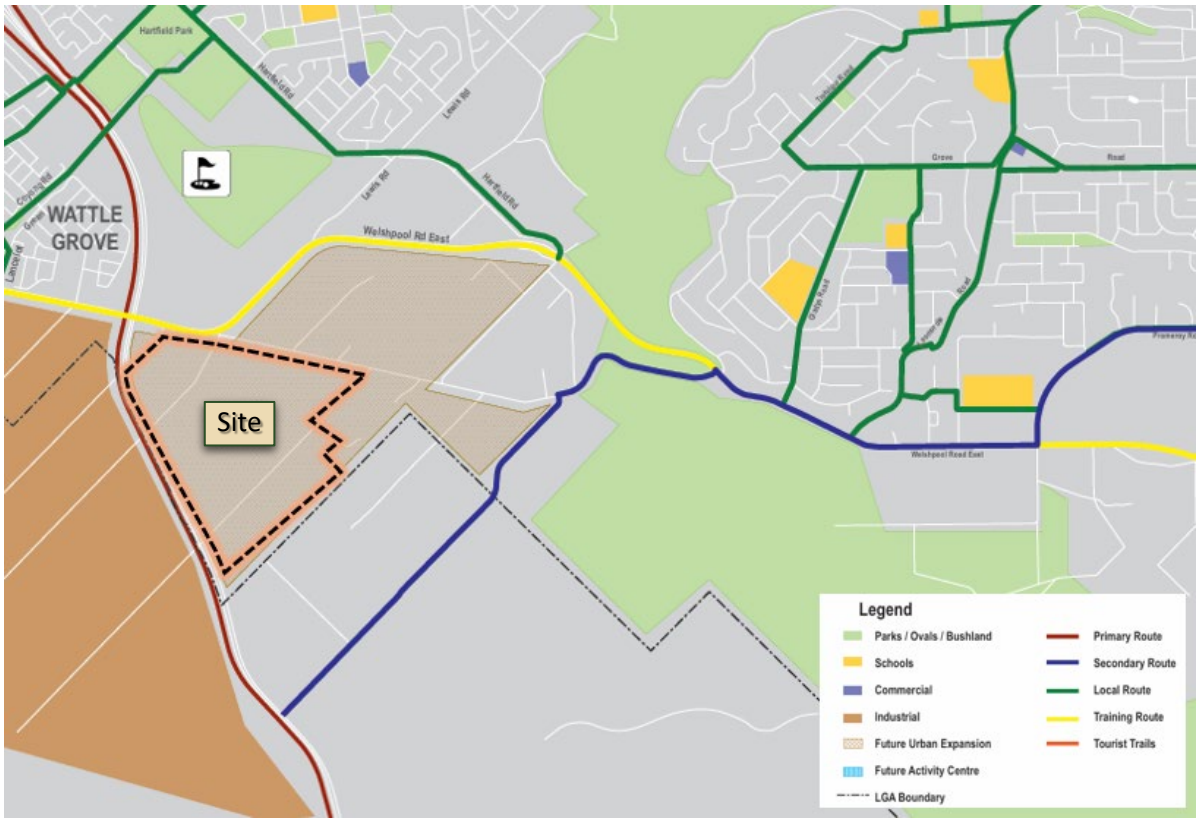


Figure 28 shows the ultimate network plan for the City of Kalamunda Bicycle Plan 2017. No new paths are proposed in the vicinity of the LSP which was to remain rural at the time the Bicycle Plan was prepared. The City of Kalamunda is expected to update the Bicycle Plan later this year.

Figure 28 City of Kalamunda Bicycle Plan 2017 – Proposed Ultimate Cycling Network



Source: City of Kalamunda

5.3 Public Transport Services

PTG has contacted the Public Transport Authority (PTA) and was advised that no significant changes are planned for the existing bus Routes 282 and 283 in the foreseeable future. Route 282 operates along Welshpool Road East while Route 283 serves Crystal Brook Road. Both services are expected to continue operating as they do now, however over time minor adjustments may occur as part of routine network reviews. These minor changes could involve slight increase or decrease in the number of trips driven by factors such as patronage performance and available resources. However, the PTA has indicated that any major changes to the frequency of either service are highly unlikely at this stage. The most recent updates to these routes were implemented in conjunction with the opening of the Thornlie–Cockburn Link, which resulted in some timetable and alignment adjustments.

Route 281 (along Welshpool Rd East) has been identified for longer term changes including it being upgraded to a full-time daily bus route, with the service extended to High Wycombe Station. However, the PTA has advised that there is currently no confirmed timeframe for when this upgrade might be delivered as it remains unfunded at this stage.

6 INTEGRATION WITH SURROUNDING AREA

6.1 Trip Attractors/Generators Within 800 Metres

Significant local attractors/generators within 800m include:

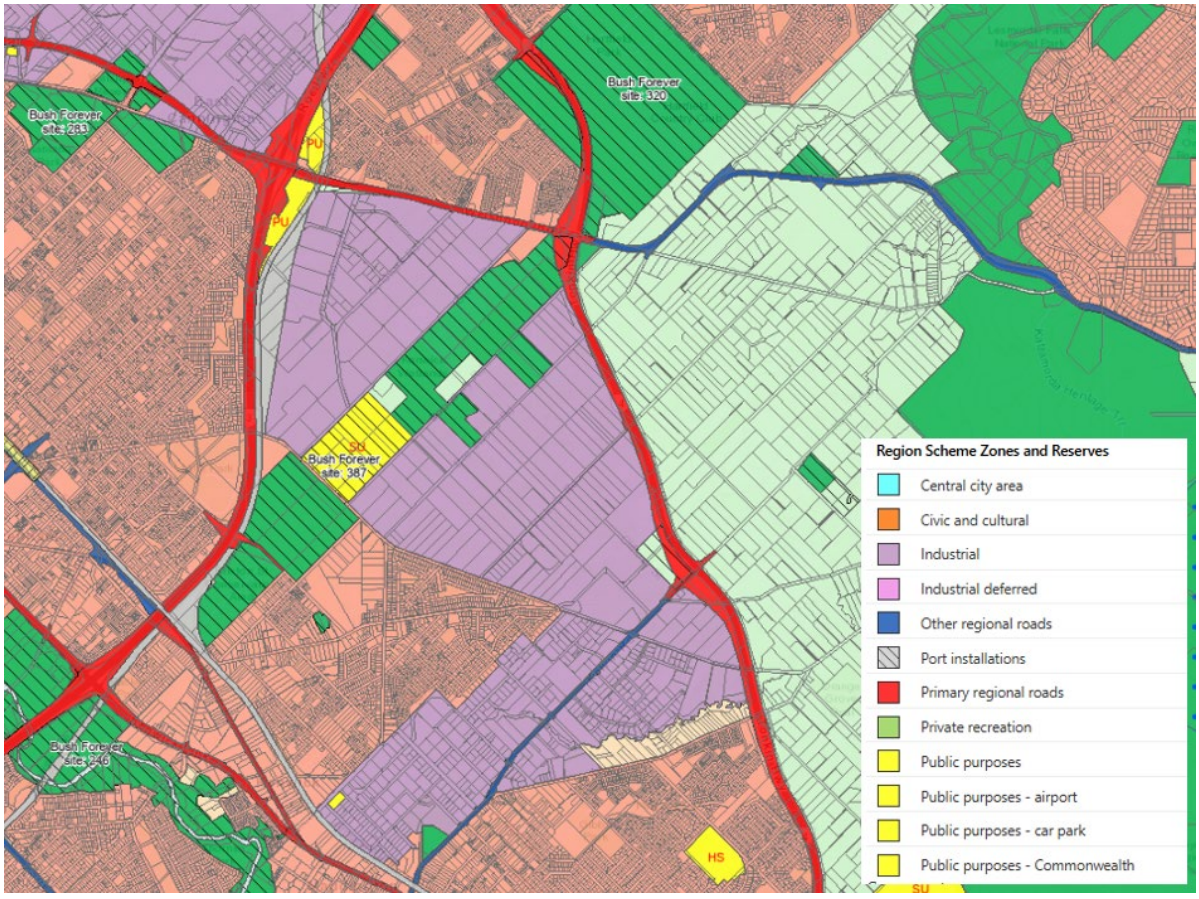
- Maddington-Kenwick Strategic Employment Area (MKSEA), a developing industrial area on the west side of Tonkin Highway.
- Existing residential suburbs of Wattle Grove and Forrestfield.
- Existing shopping centres in Forrestfield and Wattle Grove.
- Secondary schools in Forrestfield and Lesmurdie

6.2 Proposed Changes to Land Uses Within 800 Metres

6.2.1 Maddington-Kenwick Strategic Employment Area (MKSEA)

The most significant land use change occurring near the Site is the ongoing development of the Maddington-Kenwick Strategic Employment Area (MKSEA). As illustrated in **Figure 29**, the MKSEA is situated to the west of Tonkin Highway and is highlighted in purple. While much of this land is still predominantly rural or semi-rural at present, it is progressively being transitioned into a significant industrial precinct. This strategic industrial area is intended to support a range of light and general industrial activities.

Figure 29 Maddington Kenwick Strategic Employment Area



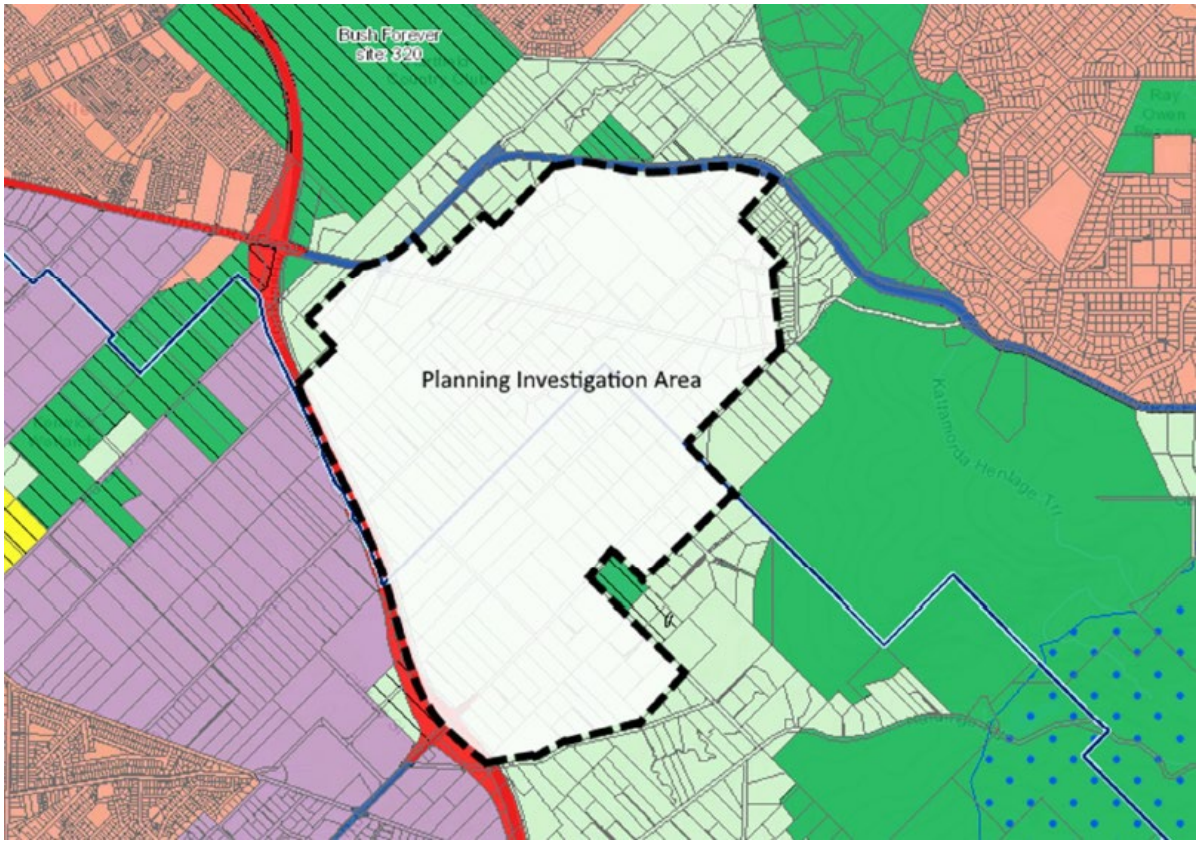
Source: Metropolitan Regional Scheme

6.2.2 Wattle Grove Planning Investigation Area

Wattle Grove South forms part of a larger area identified as Uran Expansion in the North-East and South Metropolitan-Peel Sub-Regional Planning Frameworks. The total area is approximately 504ha, with the LSP forming a small proportion of approximately 106ha. **Figure 30** shows the Planning Investigation area.

In its preliminary comments on the MRS Amendment for Wattle Grove South Precinct, Main Roads identified that the section of Welshpool Road East between Tonkin Highway and Crystal Brook Road will be a critical section of the regional transport network should full urban development eventuate. To ensure adequate provision for this ultimate development scenario, a sensitivity test analysis was undertaken. This is documented in Section 7.8.

Figure 30 Wattle Grove Planning Investigation Area (Urban Expansion)



6.3 Travel Desire Lines from Structure Plan to these Attractors / Generators

The main access point to the LSP is anticipated to be the Welshpool Road East/Crystal Brook Road/Brentwood Road intersection, located on the north western edge of the LSP area. From this intersection, convenient access to Tonkin Highway is available to the west, along with access to Wattle Grove shopping centre, Welshpool/Kewdale employment area and Perth CBD via Welshpool Road East. The closest major shopping centre to the LSP is located at Forrestfield and it is anticipated that Lewis Road will be the main access route to/from this area.

Crystal Brook Road, east of the LSP, is anticipated to attract a smaller proportion of traffic, providing access to Lesmurdie/Kalamunda area or to Maddington via Kelvin Road.

6.4 Adequacy and Deficiencies of the External Transport Networks

Subject to the proposed changes to the External Transport Network outlined in Section 5, the external road network and pedestrian/cycle network are considered adequate to service the LSP.

The existing public transport routes are not considered adequate to service the majority of the LSP area which is located away from existing bus services.

7 ANALYSIS OF TRANSPORT NETWORKS

7.1 Structure Plan Traffic Generation

The trip generation rates for the land uses within the LSP were based on the rates recommended in Transport for NSW (TfNSW) Guide to Transport Impact Assessment - Technical Guidance for Transport Practitioners and WAPC Transport Assessment Guidelines for Developments: Volume 5 Technical Guidance.

Table 7 shows the trip generation rates for the proposed land uses, **Table 8** shows the directional distribution and **Table 9** shows the total traffic generated by the proposed LSP.

Table 7 Trip Generation Rates

Land Use	Source	Yield	AM Peak Rate	PM Peak Rate	Daily Rate
Residential	TfNSW	1,646 dwellings	0.68 trips per dwelling	0.77 trips per dwelling	8.12 trips per dwelling
Primary School	WAPC	500 Students	1 trip per student	1 trip per student	2 trips per student

Table 8 Trip Directionality

Land Use	AM Peak		PM Peak		Daily	
	In	Out	In	Out	In	Out
Residential	25%	75%	65%	35%	50%	50%
Primary School	50%	50%	50%	50%	50%	50%

Table 9 Total Trip Generation

Land Use	AM Peak Trips		PM Peak Trips		Daily Trips	
	IN	OUT	IN	OUT	IN	OUT
Residential	284	843	827	446	6,686	6,686
Primary School	250	250	250	250	500	500
Total Trips	**534**	**1,093**	**1,077**	**696**	**7,186**	**7,186**
	1,627		**1,773**		**14,372**	

For the purpose of this assessment it has been assumed that there would be some trip containment within the LSP area as follows:

- 90% of the primary school students are assumed to reside within the LSP. The remaining 10% are assumed to reside in the surrounding large lot residential areas.
- 10% of the residential trips are assumed to relate to internal trips to the primary school.

Table 10 shows the resultant total traffic generated by the proposed LSP area after applying the above reduction to school and residential trips.

Table 10 Net Trip Generation

Land Use	AM Peak Trips		PM Peak Trips		Daily Trips	
	IN	OUT	IN	OUT	IN	OUT
Residential	254	758	744	403	6,017	6,017
Primary School	25	25	25	25	50	50
Total Trips	**279**	**783**	**769**	**428**	**6,067**	**6,067**
	1,062		**1,197**		**12,134**	

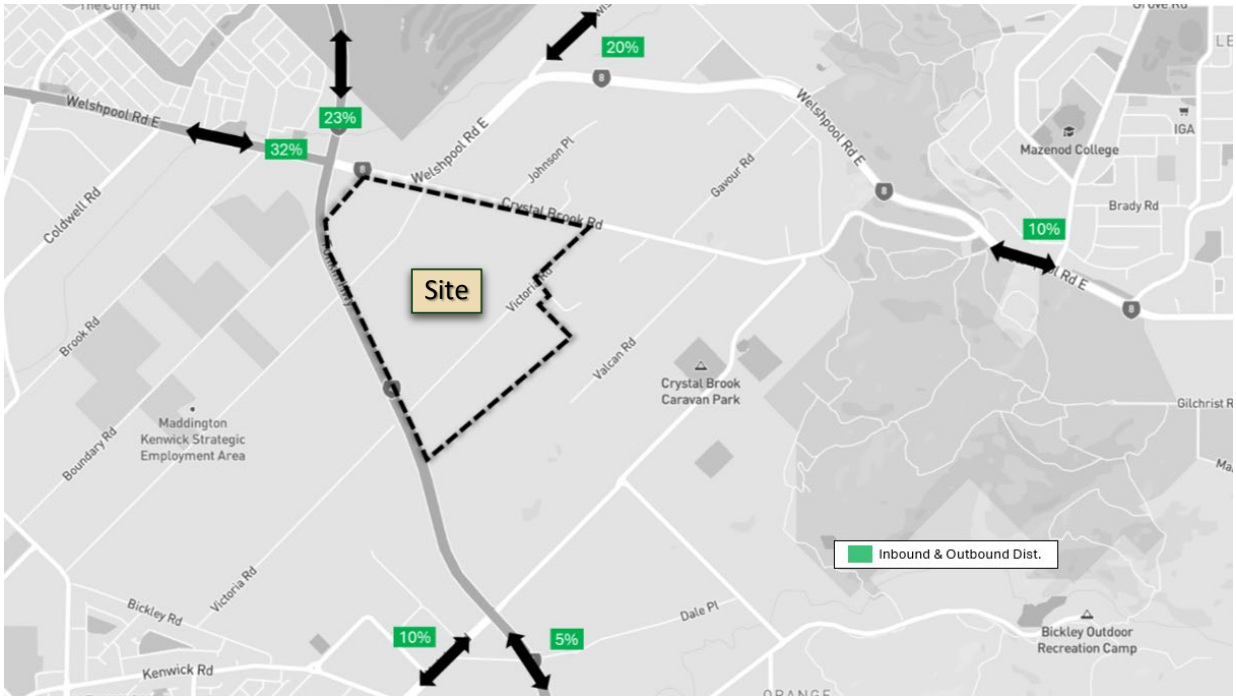
The LSP is estimated to generate a net total of 1,062 vehicle trips during AM peak hour, 1,197 vehicle trips during PM peak hour and 12,134 daily trips.

7.2 Traffic Distribution

Figure 31 shows the trip distribution for the proposed residential cells. The trip distribution is mostly based on ABS journey-to-work data for the area, with some adjustments to reflect the location of nearby high schools and shopping facilities.

The majority of trips are to/from the west on Welshpool Road East, as this is the most convenient link to Tonkin Highway and the wider Perth Road network.

Figure 31 Trip Distribution



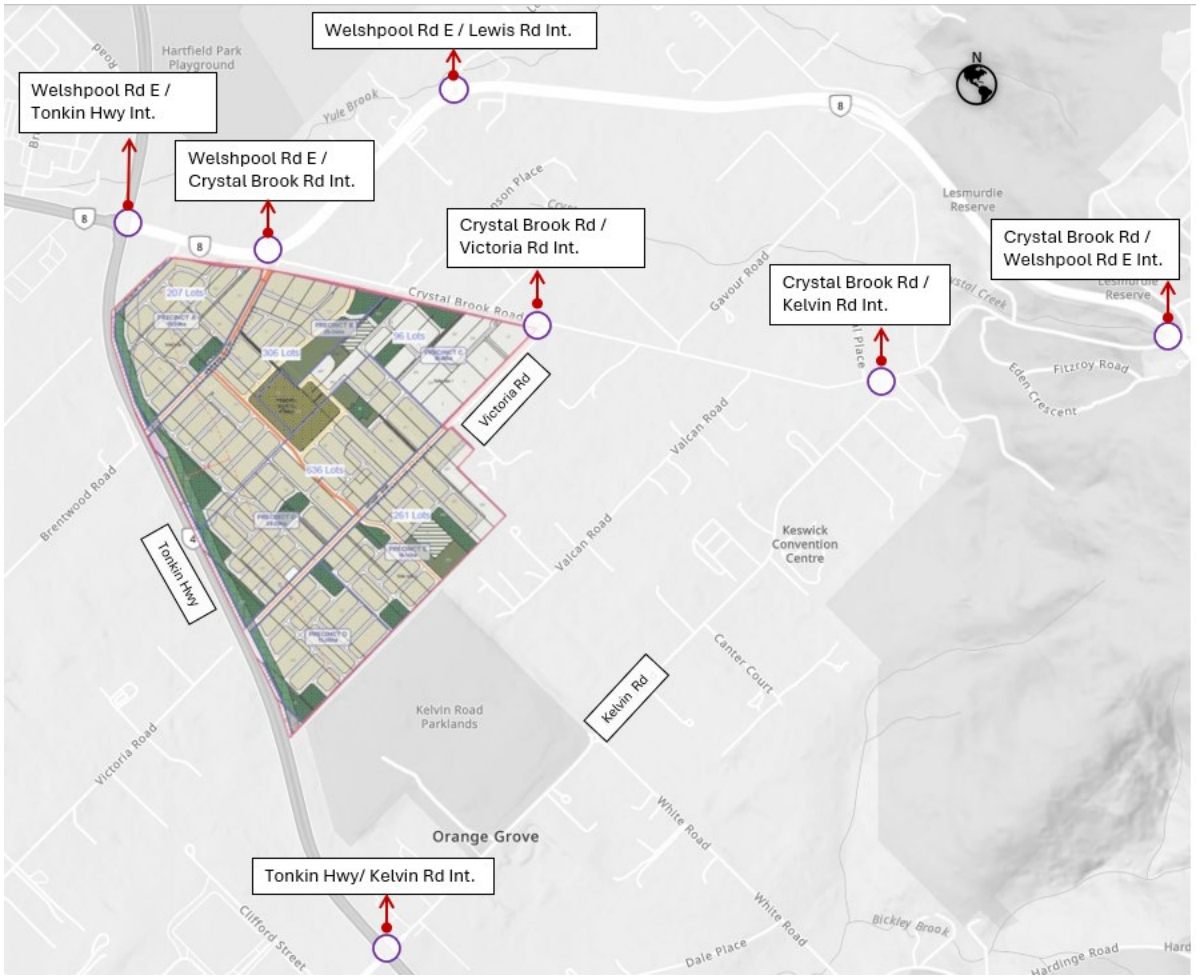
7.3 Extraneous (Through) Traffic

No through traffic is anticipated to use the internal LSP road network.

7.4 Background Traffic

Background traffic data was obtained from 24hr video of surveys of key intersections surrounding the LSP area, undertaken on 3rd December 2024 and 19th June 2025 at the locations shown in **Figure 32.**

Figure 32 Traffic Survey Locations



To determine growth rates for background traffic, MRWA ROM outputs (Job# 41765) were utilised, consistent with the Transport Impact Assessment prepared by Cardno in June 2021 for the Wattle Grove South MRS Amendment. The 2016 and 2041 ROM volumes were compared to calculate a linear growth rate for each intersection approach. These growth rates were then applied to the 2025 background traffic to develop the estimated 2040 background traffic flows used in this assessment.

7.5 Daily Traffic Summary

The estimated daily traffic flows for key road sections within and surrounding the LSP are provided in **Table 11** and in **Figure 33** and **Figure 34** for the external and internal road networks.

Daily traffic volumes on the internal road network are estimated to be within the traffic volume thresholds specified in Liveable Neighbourhoods, based on the intended road classification.

The most significant changes in traffic volume on the external road network will occur on Welshpool Road East between Tonkin Highway and Lewis Road and Crystal Brook Road between Welshpool Road East and Victoria Road. Daily volumes on Crystal Brook Road are estimated to increase to 5,000-7,000vpd between Brentwood Road and Victoria Road and 6,000vpd between Victoria Road and Kelvin Road, compared to approximately 3,000vpd currently. These increases include background traffic growth and are not exclusively the result of traffic generated by the LSP.

To accommodate these volumes in a fully urban environment, Liveable Neighbourhoods would recommend upgrading Crystal Brook Road to a Neighbourhood Connector A (24.4m). However, this section of Crystal Brook Road will not be fully urban as a result of this LSP, with the existing large lot residential lots on the northern side remaining into the future, giving the road environment a semi-rural feel. The existing road reserve is approximately 20.5m wide and contains many existing mature trees, limiting options for improvements within the existing reserve without significant changing the rural feel. Liveable Neighbourhoods notes that, in some circumstances, the median may be omitted from the standard Neighbourhood Connector A cross-section, reducing the overall reserve width to 22.4m. As no on-street parking is proposed on Crystal Brook Road, the necessary road reserve width could be further reduced to 20.5m or less, while still being aligned with the intent of Liveable Neighbourhoods. Based on the above, it is considered that the existing form of Crystal Brook Road could adequately service the projected 2040 traffic, with a reduced speed limit (60km/h) to reflect the increased urbanisation.

Table 11 Estimated Daily Traffic Volumes

Road Name	Location	2025 Daily Traffic (vpd)	2040 Development Traffic (vpd)	2040 Total Traffic (vpd)	Recommended Road Hierarchy Classification
External Road Network					
Welshpool Road East	East of Crystal Brook Rd (West)	17,000	2,750	21,800	Distributor A
Welshpool Road East	West of Crystal Brook Rd (West)	17,000	7,300	27,000	Distributor A
Welshpool Road East	East of Crystal Brook Rd (East)	20,000	1,220	24,500	Distributor A
Welshpool Road East	West of Crystal Brook Rd (East)	15,100	320	17,500	Distributor A
Crystal Brook Road	East of Brentwood Rd	2,900	2,800	6,600	Distributor B
Crystal Brook Road	West of Victoria Rd	2,900	1,400	5,100	Distributor B
Crystal Brook Road	West of Kelvin Rd	2,500	2,150	5,700	Distributor B
Crystal Brook Road	East of Kelvin Rd	5,600	900	7,100	Distributor B
Lewis Rd	North of Welshpool Road East	9,100	2,400	12,500	Distributor A
Kelvin Rd	South of Crystal Brook Rd	7,100	1,250	9,500	Distributor A
Kelvin Rd	East of Tonkin Hwy	6,700	1,250	10,800	Distributor A

Road Name	Location	2025 Daily Traffic (vpd)	2040 Development Traffic (vpd)	2040 Total Traffic (vpd)	Recommended Road Hierarchy Classification
Internal Road Network					
Brentwood Road	South of Welshpool Road East	435	6,500	6,500	Local Distributor
Brentwood Road	South of Neighbourhood Connector	-	1,300	1,300	Access Road
New LILO Access	South of Welshpool Road East	-	700	700	Access Road
Neighbourhood Connector	South of Brentwood Road	-	3,000	3,000	Access Road
New Access Road 2	South of Crystal Brook Road	-	100	100	Access Road
New Access Road 3	South of Crystal Brook Road	-	1,200	1,200	Access Road
New Access Road 4	South of Crystal Brook Road	-	900	900	Access Road
Victoria Rd	South of Crystal Brook Road	520	2,800	3,000	Access Road
Victoria Rd	South of Neighbourhood Connector	-	1,400	1,400	Access Road

Figure 33 Daily Traffic Volume 2040 – External Road Network

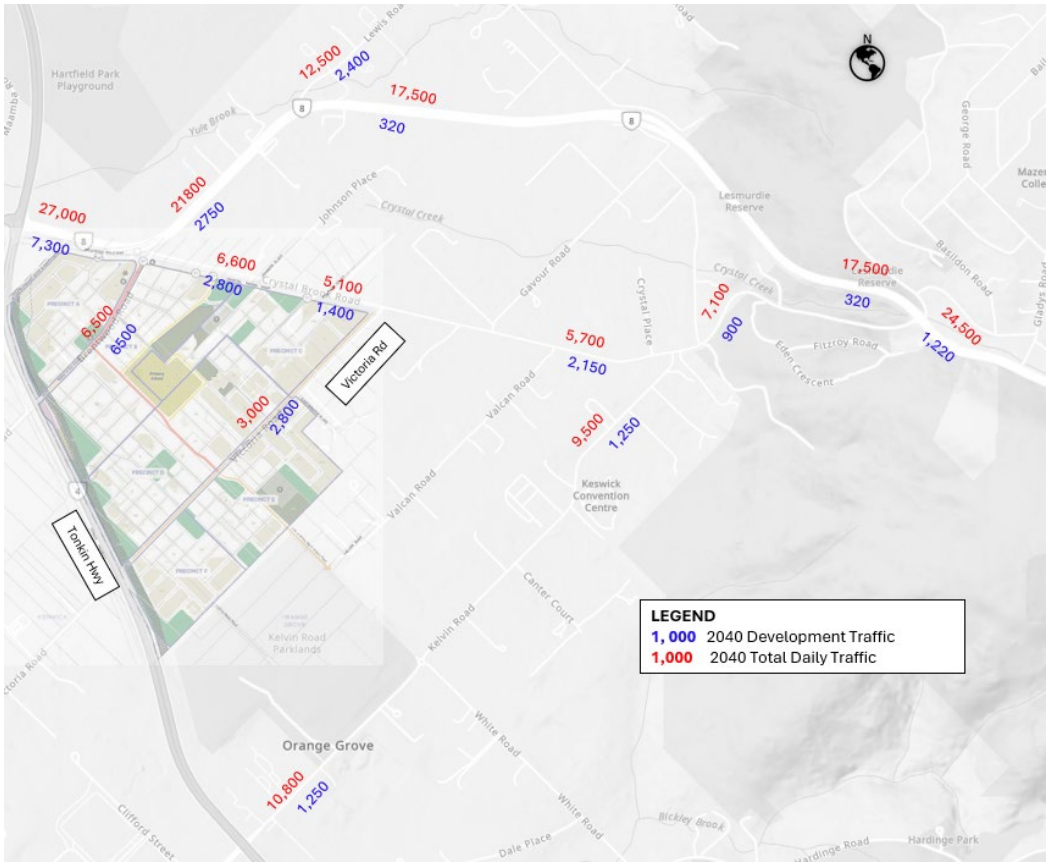
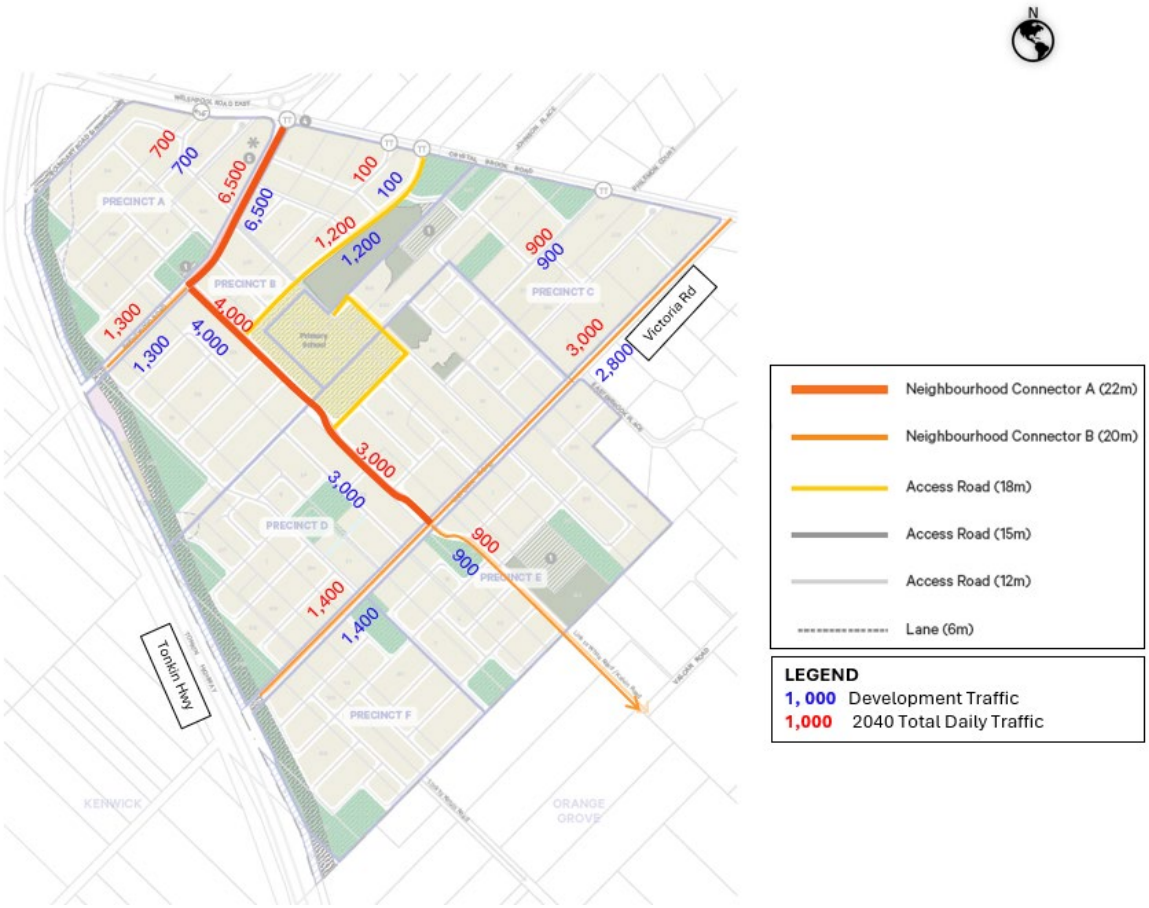


Figure 34 Daily Traffic Volume 2040 – Internal Road Network



7.6 Frontage Access Strategy

Based on the forecast daily volumes, the following frontage access management strategy is proposed:

- Direct property access to/from Welshpool Road East, between Tonkin Highway and Crystal Brook Road/Brentwood Road, will not be permitted.
- Direct property access to/from Crystal Brook Road will be permitted along the frontage of the LSP area. However, the number of crossovers should be minimised by providing side/rear vehicular access to properties where possible. Any lots with direct access to Crystal Brook Road should ensure turning areas are providing within the property to enable vehicles to enter and exit in forward gear.

7.7 Key Intersections Analysis (2040)

7.7.1 Analysis Scenarios

A SIDRA analysis has been undertaken of the following key intersections shown in **Figure 35**:

1. Tonkin Highway/Welshpool Rd East
2. Tonkin Highway/Kelvin Road
3. Welshpool Road East/Crystal Brook Road/Brentwood Road (west intersection)
4. Crystal Brook Road/Kelvin Road
5. Welshpool Road East/Crystal Brook Road (east intersection)
6. Welshpool Road East/Lewis Road
7. Crystal Brook Road/Victoria Road

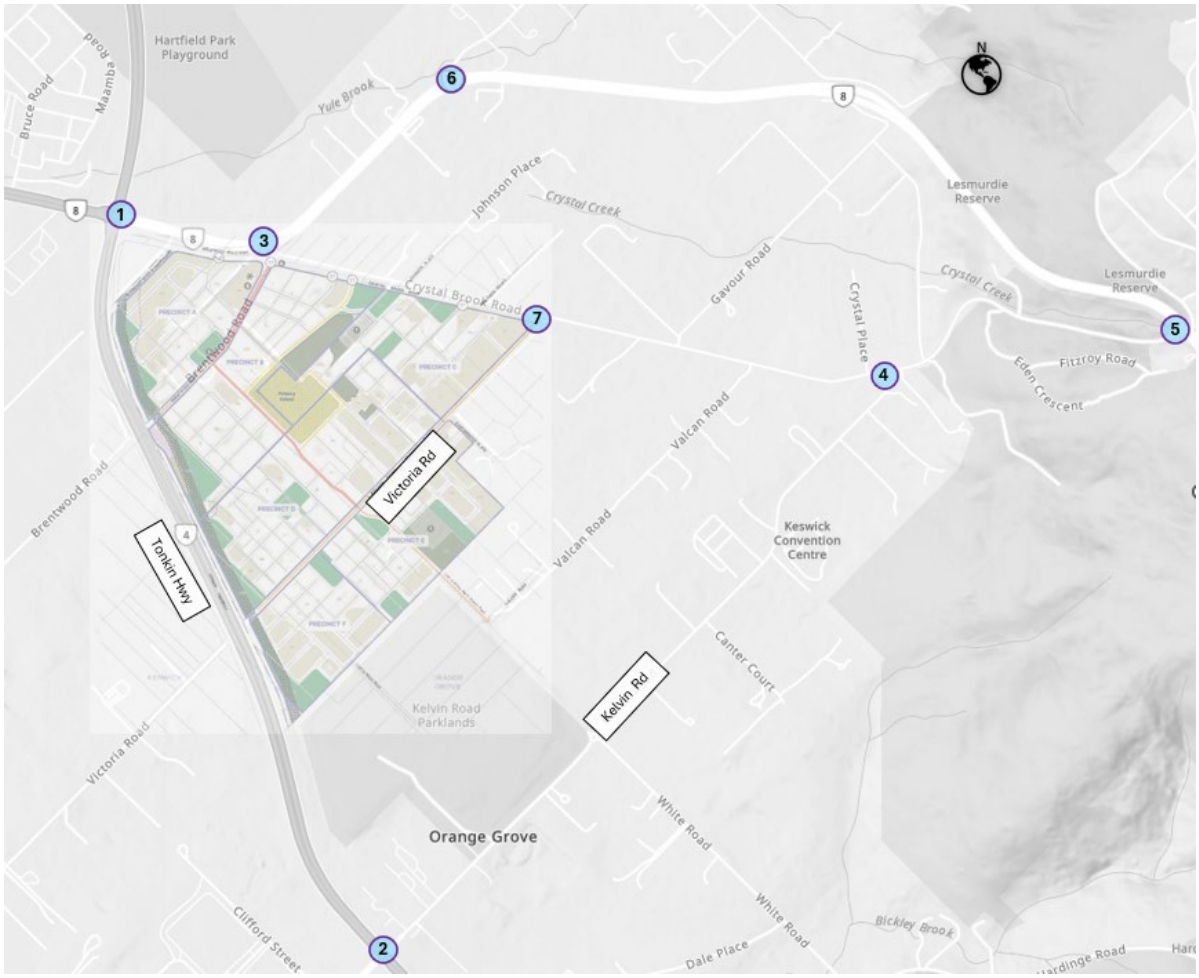
Based on a projected full build-out year of 2040, the following scenarios have been modelled:

- Scenario 1 – 2040 Without Development
- Scenario 2 – 2040 With Development

The assessment has been undertaken for the following peak hours, based on background traffic:

- Weekday AM Peak: 08:00 – 09:00
- Weekday PM Peak: 15:15 – 16:15

Figure 35 Key Intersections



7.7.2 Assessment Parameters

Key assessment parameters and assumptions adopted for the SIDRA analysis are detailed below:

- Linear growth rates were calculated for each intersection approach based on the methodology described in Section 7.4. These growth rates were applied to background traffic volumes to generate the forecast 2040 background traffic volumes.
- The heavy vehicle proportions were based on the 2025 traffic counts and assumed to be the same for the future scenarios.
- All intersections were modelled in accordance with MRWA Operational Modelling Guidelines, generally as isolated sites, with the exception of the Tonkin Highway interchanges and the existing layout of Welshpool Road East/Crystal Brook Road/Brentwood Road staggered T-intersections, which were modelled as networks.
- Dimensions of all intersection elements (e.g., lane width, median width, etc.) were measured from the latest Metromap aerial photos.
- Approach and exit speeds were based on posted speed limits from MRWA Road Information Mapping System.
- Crystal Brook Road/Victoria Road was identified as the intersection along the LSP frontage with the highest volumes. Therefore, the other proposed intersections with lower volumes do not need to be assessed if the results for this intersection are acceptable.

At 2040, the key intersections are assumed to remain in their current form, with the exception of the following changes, based on advice from MRWA:

- Tonkin Highway / Welshpool Road East – grade-separated diamond interchange with signalised ramp intersections.
- Tonkin Highway / Kelvin Road – grade-separated diamond interchange with signalised ramp intersections.

SIDRA layouts for the Tonkin Highway interchanges are based on the concept design and SIDRA layout provided by MRWA to the project team in 2021.

7.7.3 Intersection Performance

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

- **Degree of Saturation (DOS):** is the ratio of the arrival traffic flow to the capacity of the approach during the same period. The Degree of Saturation ranges from close to zero for varied traffic flow, up to one for saturated flow or capacity. The theoretical intersection capacity is exceeded for an un-signalised intersection where DOS > 0.80;
- **95% Percentile Queue Length:** 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 un-signalised intersection can be considered to be operated at capacity where the average delay exceeds 40 seconds for any movement;

Level of Service (LOS): is the qualitative measure describing operational conditions within a traffic stream and the perception by motorists and/or passengers. **Table 12** provides a description of the different levels of service.

Table 12 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

7.7.4 Traffic Volumes

Traffic volumes adopted for the SIDRA analysis are shown in **Figure 36** to **Figure 51**. Separate diagrams indicating development traffic and background traffic are provided in **Appendix C**.

Figure 36 Tonkin Highway / Welshpool Road East – Scenario 1

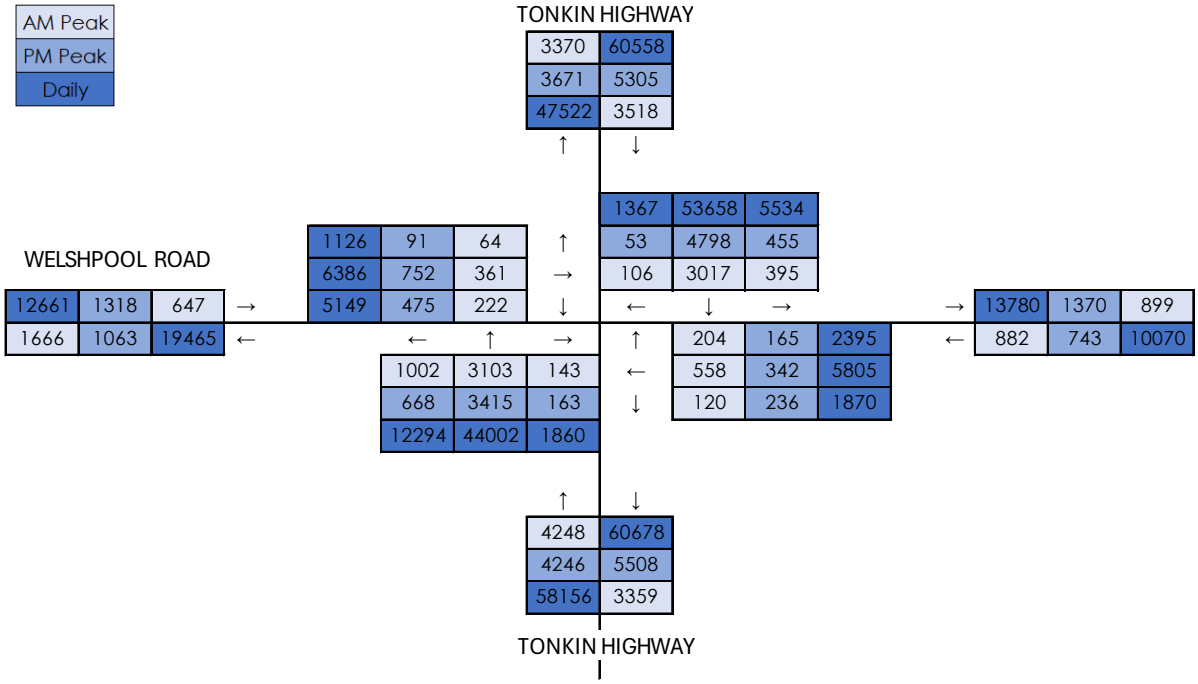


Figure 37 Tonkin Highway / Welshpool Road East – Scenario 2

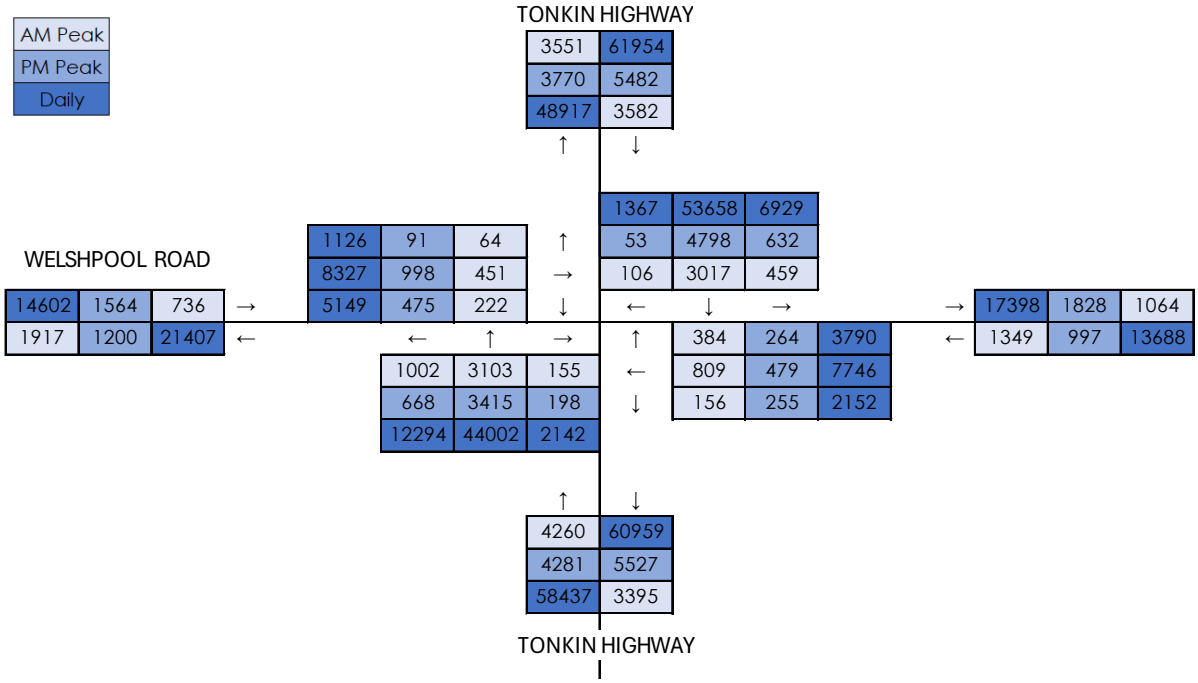


Figure 38 Tonkin Highway / Kelvin Road – Scenario 1

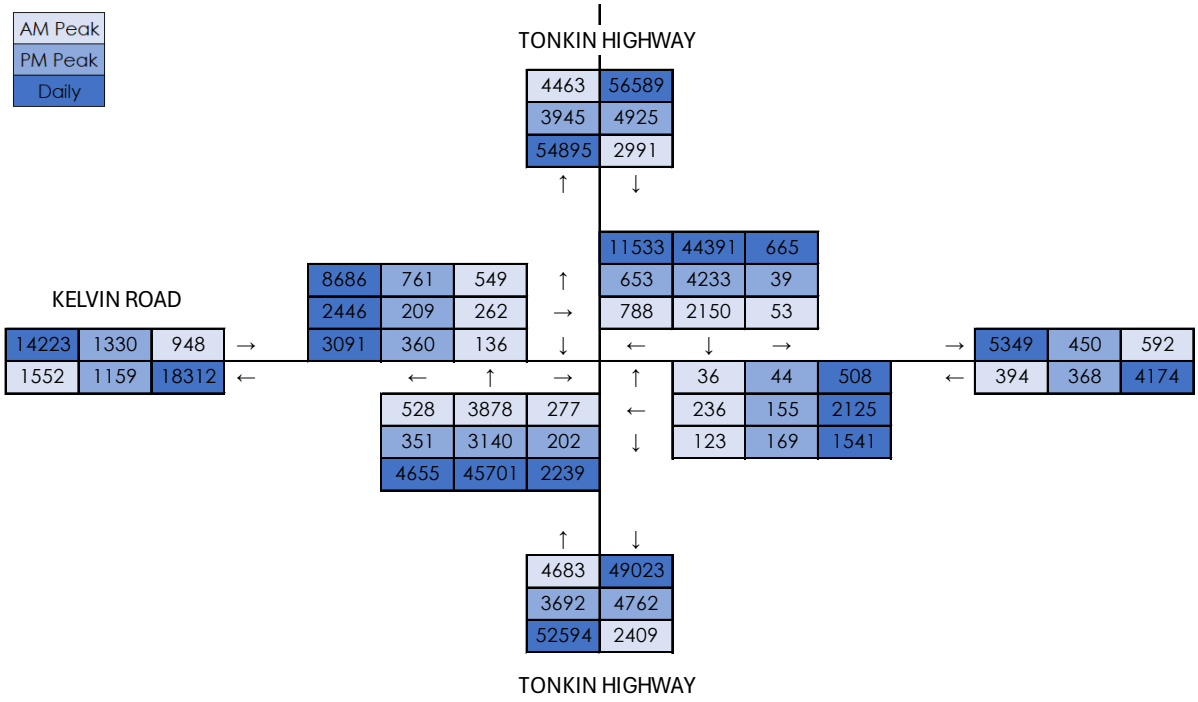


Figure 39 Tonkin Highway / Kelvin Road – Scenario 2

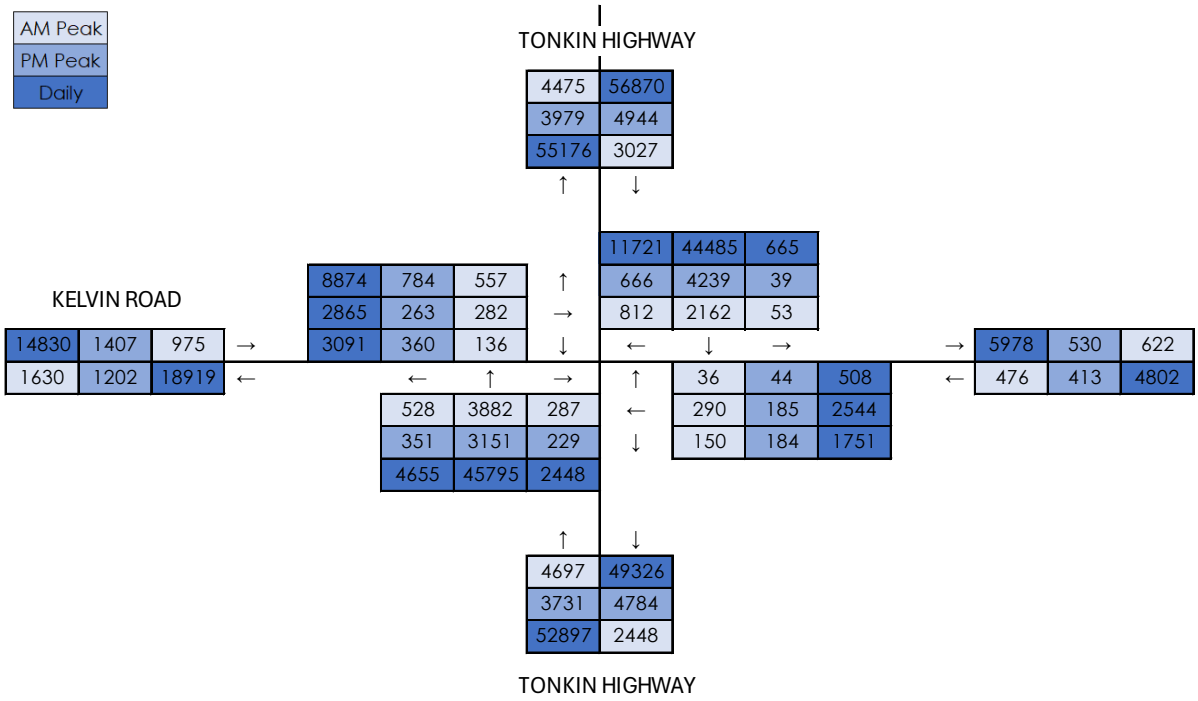


Figure 40 Welshpool Road East/Crystal Brook Road / Brentwood Road (Existing Layout) – Scenario 1

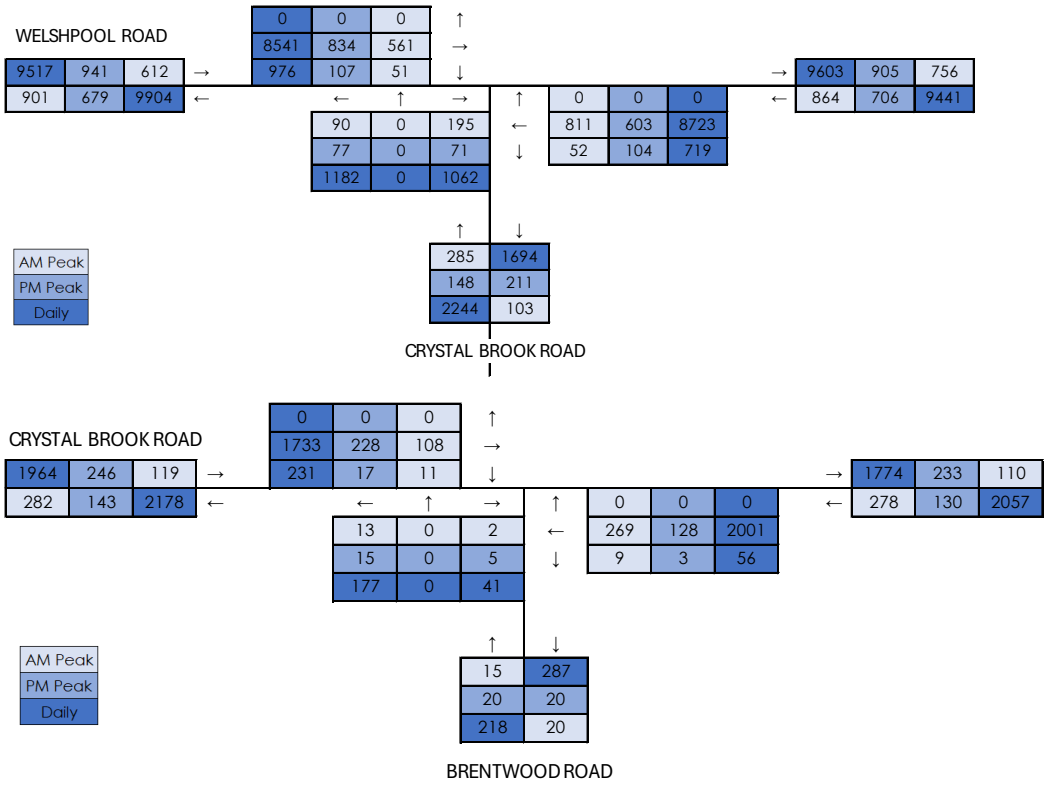


Figure 41 Welshpool Road East/Crystal Brook Road / Brentwood Road (Existing Layout) – Scenario 2

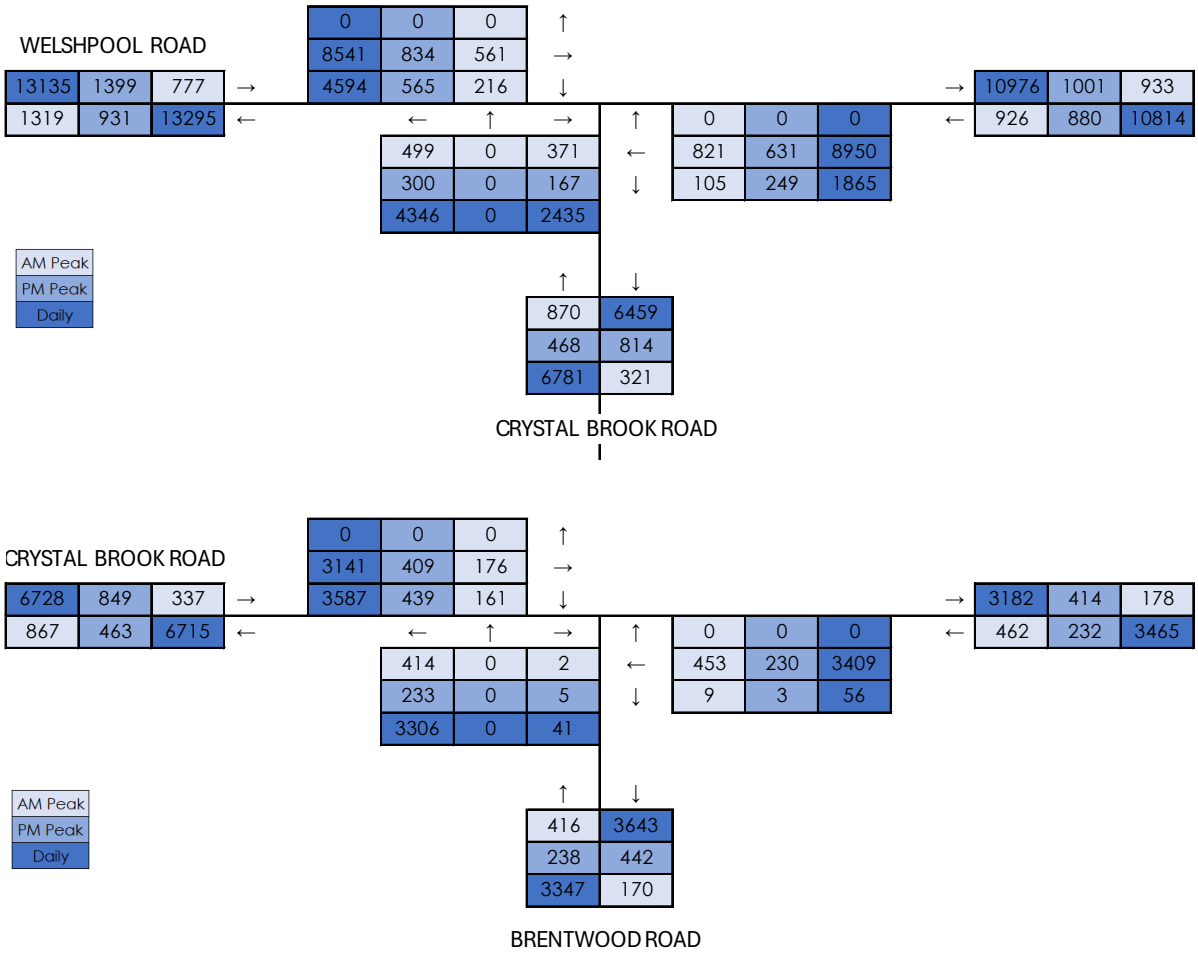


Figure 42 Welshpool Road East/Crystal Brook Road / Brentwood Road (4-way roundabout) – Scenario 1

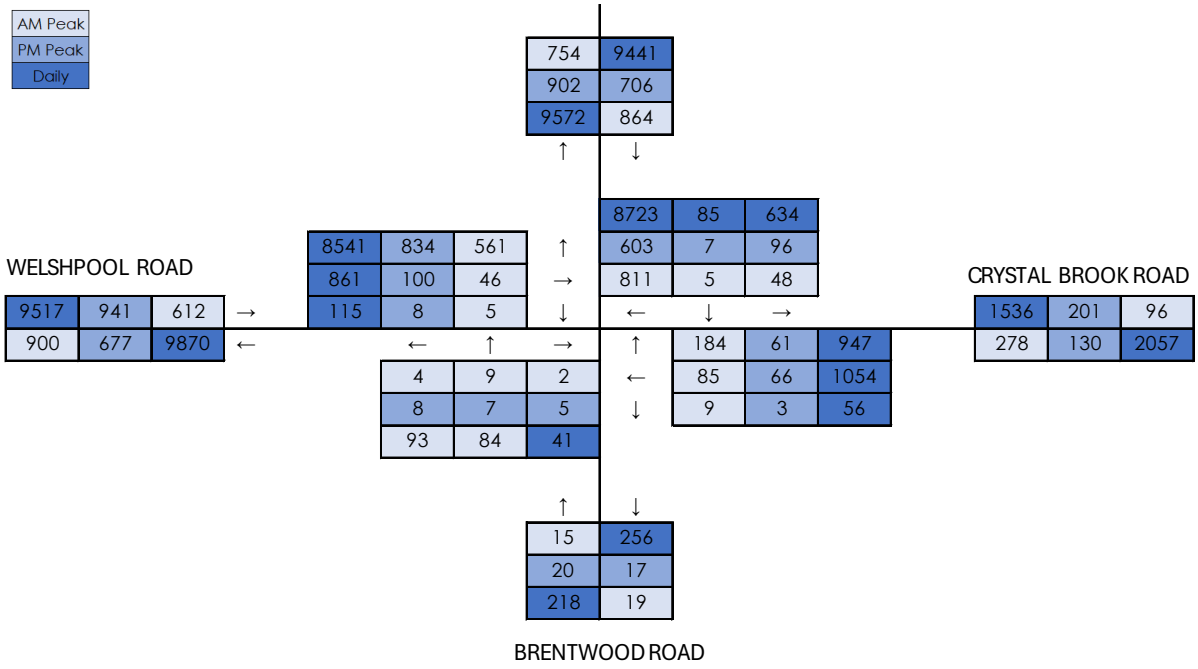


Figure 43 Welshpool Road East/Crystal Brook Road / Brentwood Road (4-way roundabout) – Scenario 2

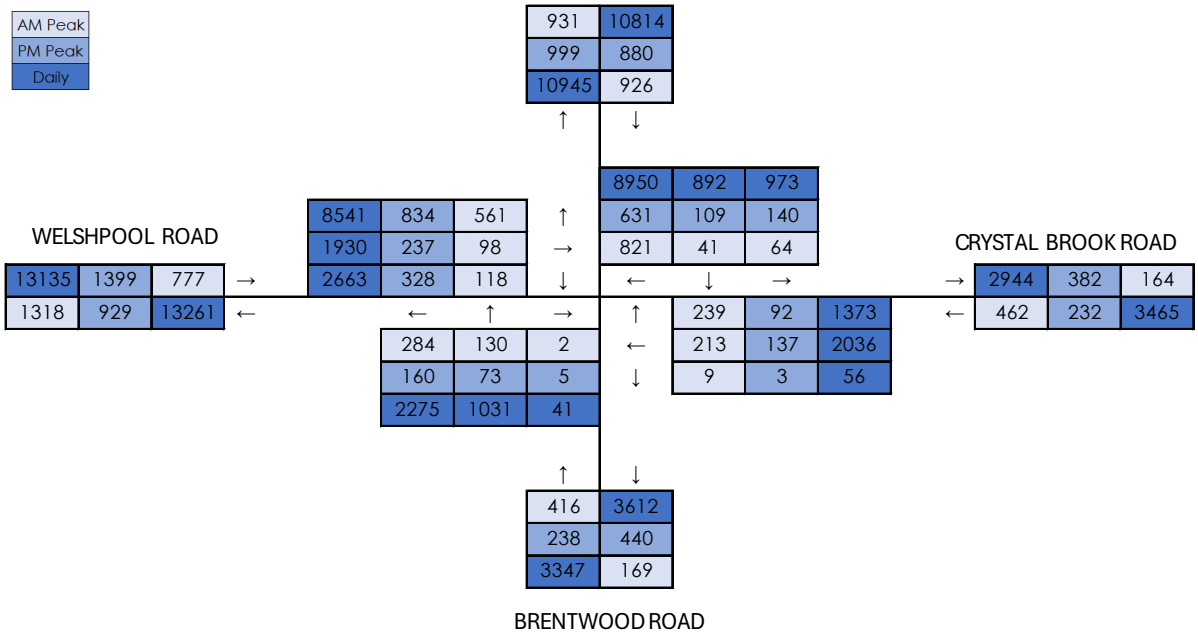


Figure 44 Crystal Brook Road / Kelvin Road – Scenario 1

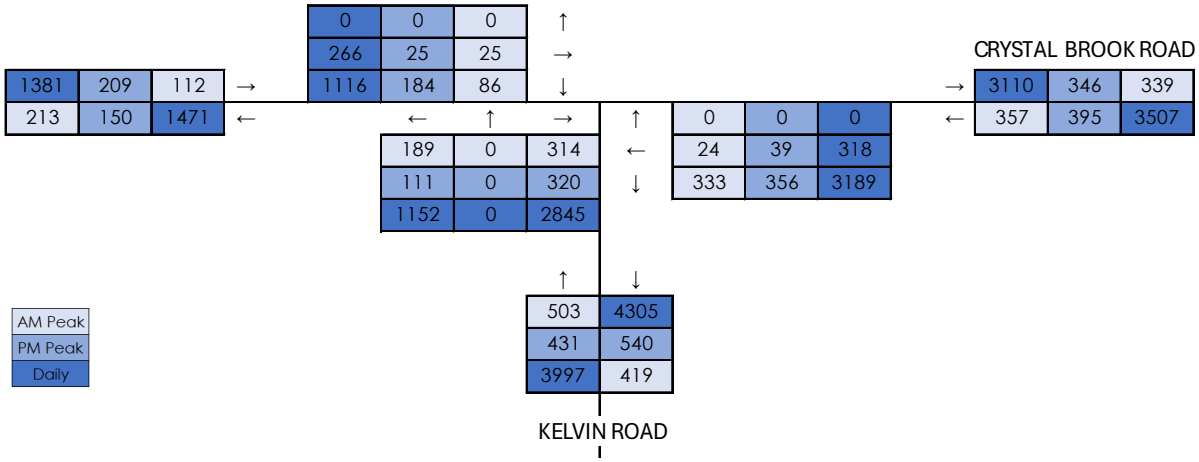


Figure 45 Crystal Brook Road / Kelvin Road – Scenario 2

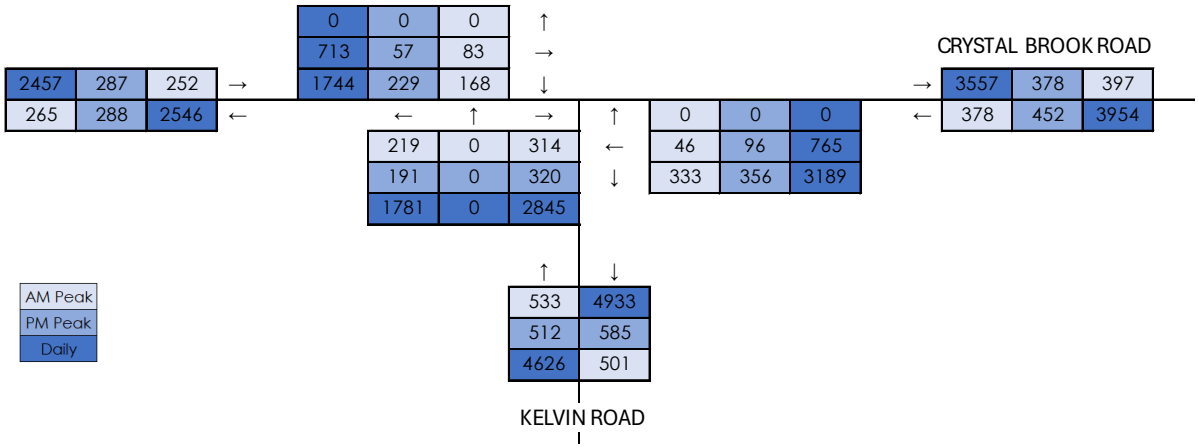


Figure 46 Welshpool Road E / Crystal Brook Road (East) – Scenario 1

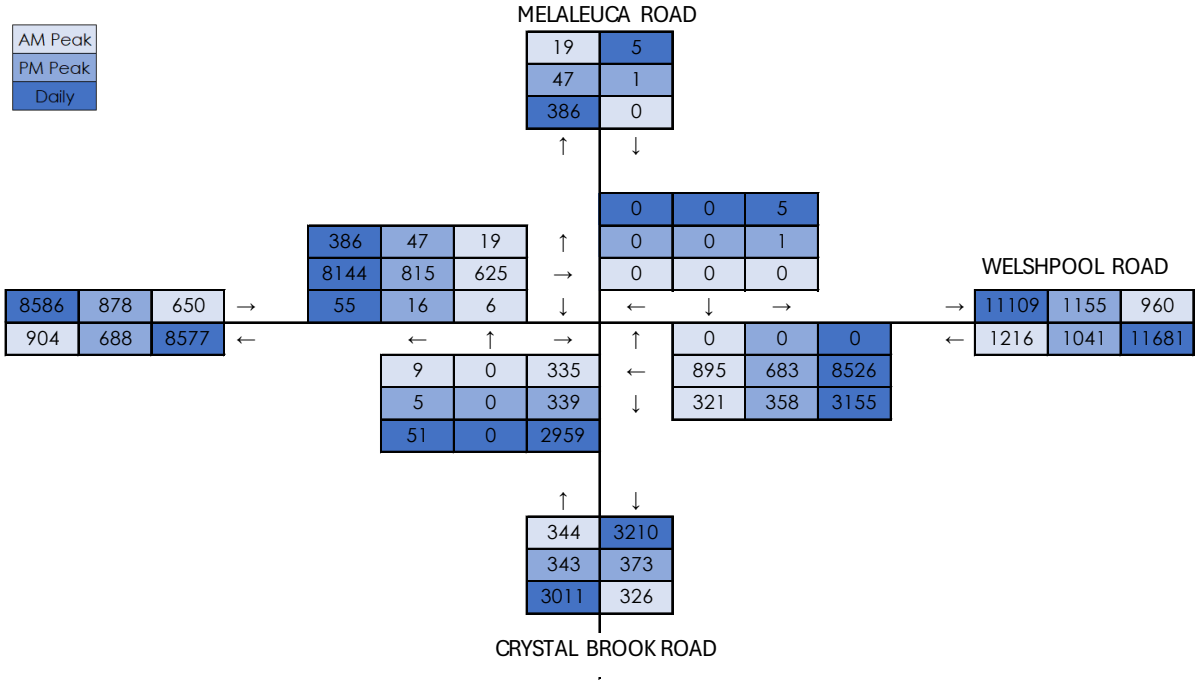


Figure 47 Welshpool Road E / Crystal Brook Road (East) – Scenario 2

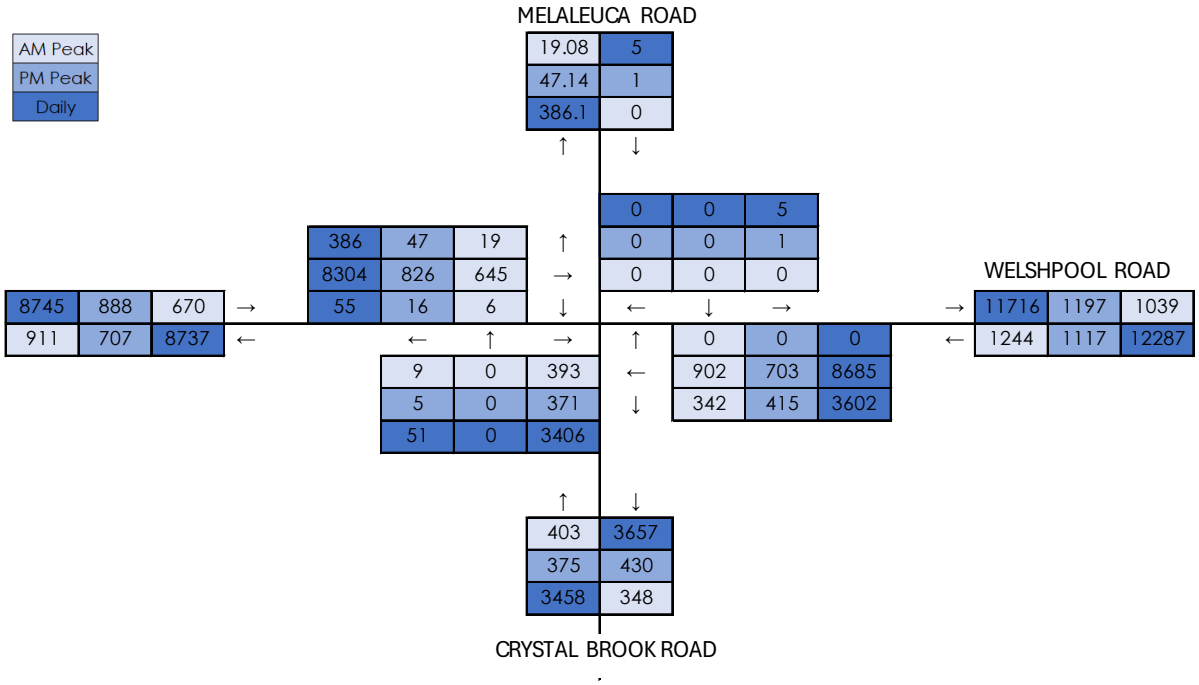


Figure 48 Welshpool Road E / Lewis Road – Scenario 1

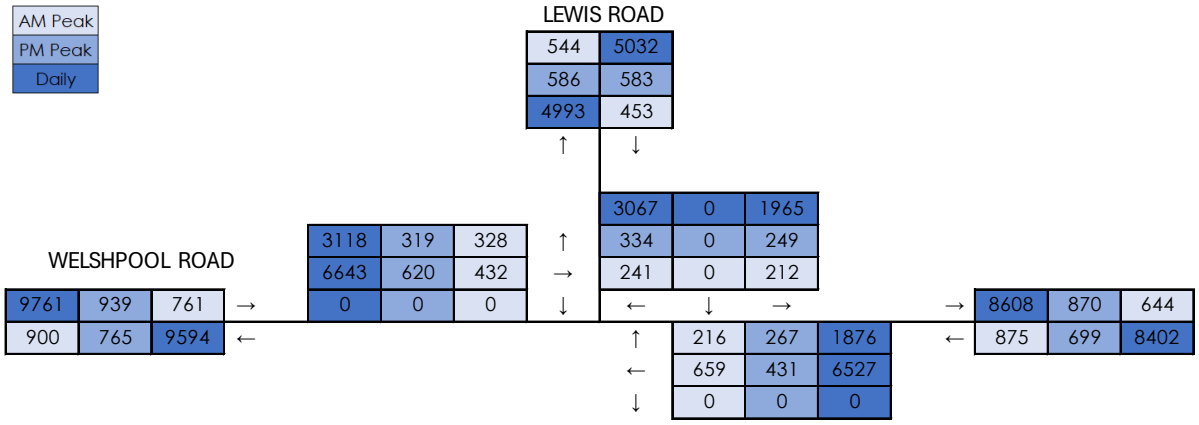


Figure 49 Welshpool Road E / Lewis Road – Scenario 2

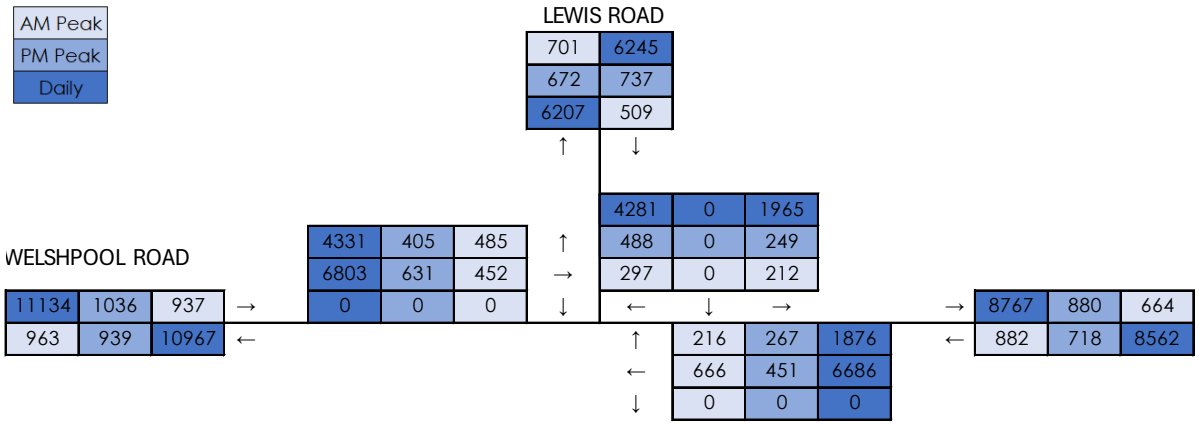


Figure 50 Crystal Brook Road / Victoria Road – Scenario 1

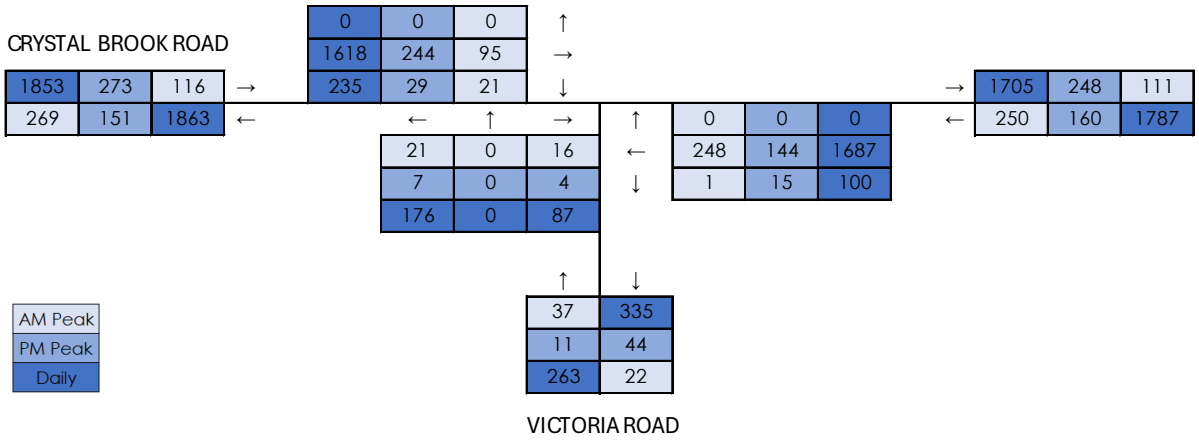
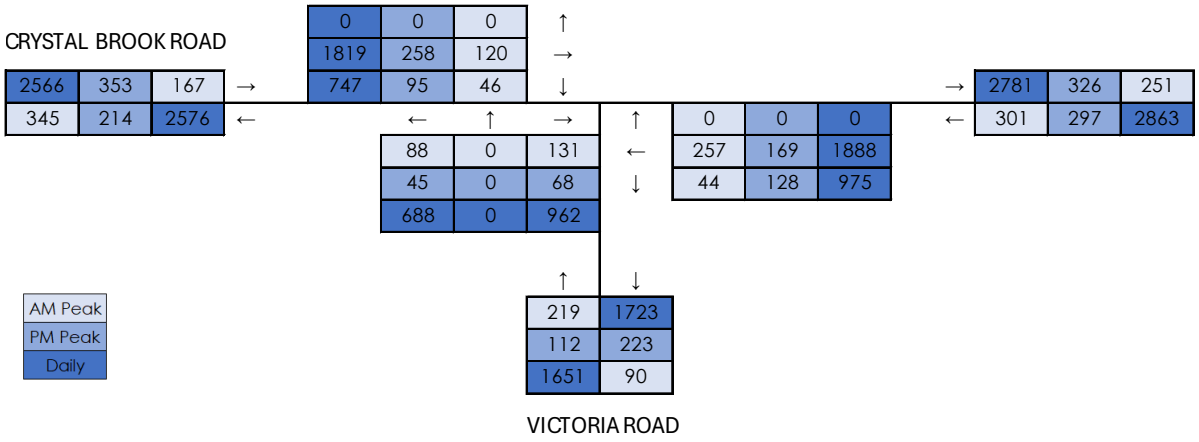


Figure 51 Crystal Brook Road / Victoria Road – Scenario 2



7.7.5 Tonkin Highway / Welshpool Road East

The SIDRA layout adopted for Tonkin Highway / Welshpool Road East intersection is shown in **Figure 52**. The layout is largely based on the concept design and SIDRA layout provided by MRWA in 2021.

The analysis results for the intersection are presented in **Table 13** to **Table 16.** The results indicate that the interchange would operate satisfactorily in both scenarios, with a maximum DOS of 0.82 in the PM Peak and an overall LOS of B.

It is noted that overall DOS for the western ramp is lower in Scenario 2 than in Scenario 1. The LOS and DOS change as the SIDRA software optimises the signal timings based on the input traffic volumes and as a result there will be some fluctuations in the results.

Figure 52 SIDRA Layout – Tonkin Hwy / Welshpool Road East

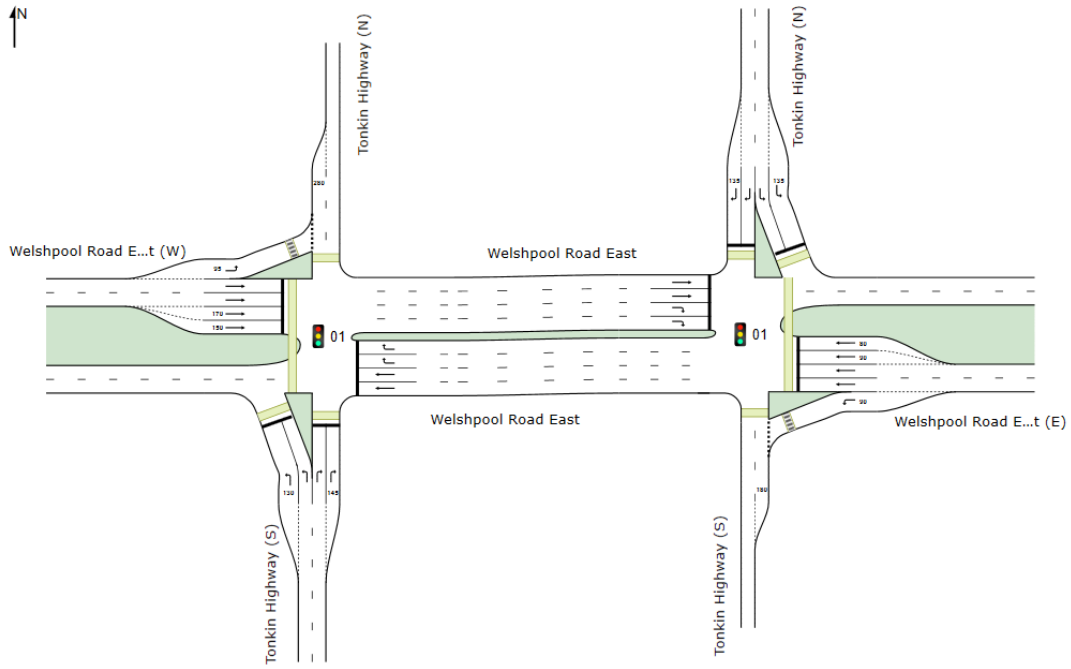


Table 13 SIDRA Results – Tonkin Highway / Welshpool Road East (Western Ramps) – Scenario 1

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Tonkin Highway (S)	L	0.711	18.7	B	49.1	0.827	23.7	C	36.8
	R	0.106	14.4	B	4.6	0.182	16.4	B	4.9
Welshpool Road (E)	T	0.671	7.6	A	22.5	0.351	4.1	A	7.2
	R	0.395	11	B	5.1	0.321	9.1	A	2.5
Welshpool Road (W)	L	0.067	8.8	A	1.6	0.093	8.9	A	1.9
	T	0.457	14.2	B	17.9	0.758	12	B	32.1
All Vehicles		**0.711**	**13.9**	**B**	**49.1**	**0.827**	**13.7**	**B**	**36.8**

Table 14 SIDRA Results –Tonkin Highway / Welshpool Road East (Eastern Ramps) – Scenario 1

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Welshpool Road (E)	L	0.114	8.5	A	2.5	0.254	9.6	A	5.8
	T	0.378	9.2	A	19.2	0.293	7.5	A	10.7
Tonkin Highway (N)	L	0.428	19.7	B	19.3	0.605	19.3	B	19.2
	R	0.13	18.5	B	4.9	0.08	17.3	B	1.9
Welshpool Road (W)	T	0.37	4.3	A	10.6	0.693	8.8	A	29.8
	R	0.462	7.6	A	4.2	0.645	8.7	A	10.9
All Vehicles		**0.462**	**10.2**	**B**	**19.3**	**0.693**	**10.6**	**B**	**29.8**

Table 15 SIDRA Results – Tonkin Highway / Welshpool Road East (Western Ramps) – Scenario 2

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Tonkin Highway (S)	L	0.726	24.1	C	116.8	0.735	30.1	C	96.4
	R	0.118	18.4	B	12.2	0.197	23.8	C	18.1
Welshpool Road (E)	T	0.663	9.2	A	68.8	0.315	3.8	A	19.6
	R	0.723	14.8	B	34.4	0.722	30.6	C	36.2
Welshpool Road (W)	L	0.072	10.1	B	5	0.1	11.1	B	8.1
	T	0.36	14.8	B	41.8	0.564	11.4	B	83.3
All Vehicles		**0.726**	**16.2**	**B**	**116.8**	**0.735**	**16.3**	**B**	**96.4**

Table 16 SIDRA Results –Tonkin Highway / Welshpool Road East (Eastern Ramps) – Scenario 2

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Welshpool Road (E)	L	0.16	9.9	A	11.6	0.257	9.2	A	14.4
	T	0.428	7.7	A	57.3	0.295	8.1	A	38
Tonkin Highway (N)	L	0.639	30.8	C	62	0.735	31.3	C	87
	R	0.173	27.6	C	13	0.07	25.1	C	5.7
Welshpool Road (W)	T	0.314	3.9	A	25.8	0.623	4.3	A	61.8
	R	0.650	14	B	23.9	0.754	8.5	A	20.4
All Vehicles		**0.65**	**12.1**	**B**	**62**	**0.754**	**11.5**	**B**	**87**

7.7.6 Tonkin Highway/Kelvin Road

The SIDRA layout adopted for Tonkin Highway / Kelvin Road intersection is shown in **Figure 53**. The layout is largely based on the concept design and SIDRA layout provided by MRWA in 2021.

The analysis results for the intersection are presented in **Table 17** to **Table 20**. The results indicate that the interchange would operate satisfactorily in both scenarios, with a maximum DOS <0.8 in both peaks and an overall LOS of B.

Figure 53 SIDRA Layout – Tonkin Hwy / Kelvin Road

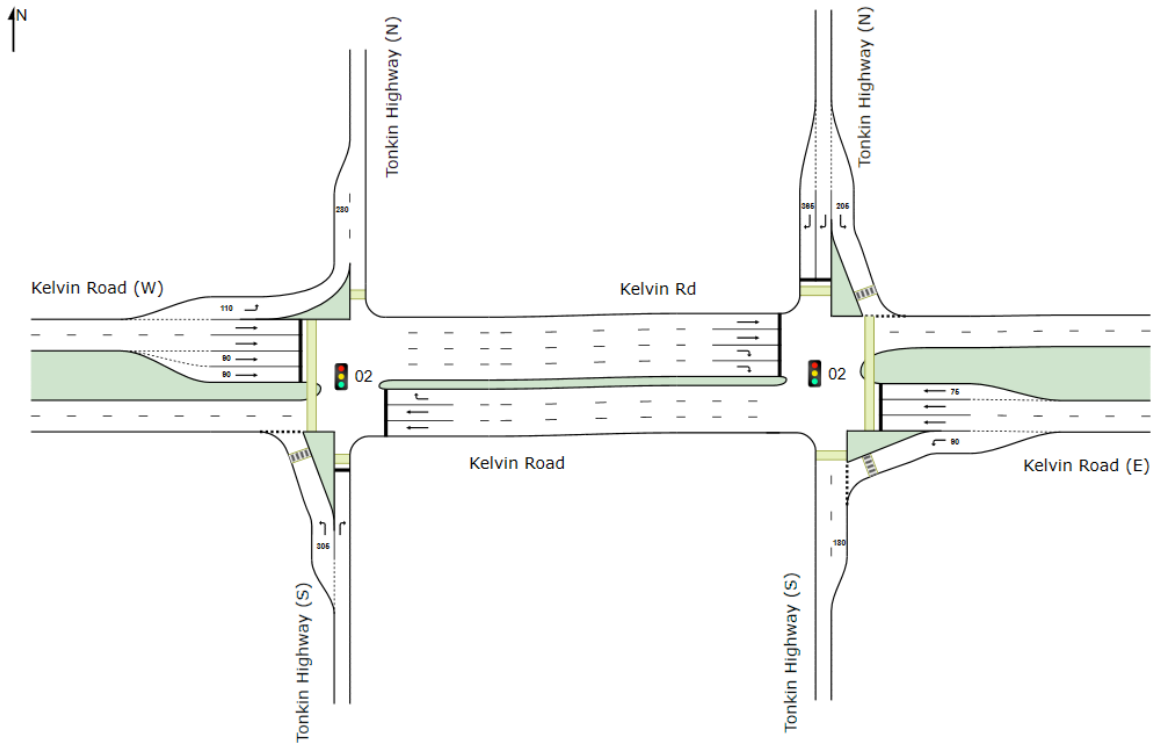


Table 17 SIDRA Results – Tonkin Highway / Kelvin Road (Western Ramps) – Scenario 1

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Tonkin Highway (S)	L	0.702	14.4	B	48.7	0.483	10.6	B	24.9
	R	0.737	29.1	C	35	0.543	26.2	C	23
Kelvin Road (E)	T	0.723	8.7	A	46.2	0.545	5.7	A	25.5
	R	0.24	21.9	C	4.5	0.313	27.8	C	7.4
Kelvin Road (W)	L	0.405	7.3	A	0	0.46	7	A	0
	T	0.429	22.9	C	12.9	0.489	22	C	16.5
All Vehicles		**0.737**	**13.7**	**B**	**48.7**	**0.545**	**12**	**B**	**25.5**

Table 18 SIDRA Results – Tonkin Highway / Kelvin Road (Eastern Ramps) – Scenario 1

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Kelvin Road (E)	L	0.104	7.6	A	2.1	0.151	7.7	A	3
	T	0.222	16.3	B	10.2	0.125	14	B	6.1
Tonkin Highway (N)	L	0.066	9.5	A	2.7	0.054	9	A	1.9
	R	0.635	17.4	B	45.6	0.508	17.5	B	35.5
Kelvin Road (W)	T	0.626	12.9	B	30.1	0.377	8.8	A	13.6
	R	0.281	8	A	2.3	0.512	5.2	A	1
All Vehicles		**0.635**	**14.4**	**B**	**45.6**	**0.512**	**11.7**	**B**	**35.5**

Table 19 SIDRA Results – Tonkin Highway / Kelvin Road (Western Ramps) – Scenario 2

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Tonkin Highway (S)	L	0.723	17	B	101.3	0.485	11.1	B	43.2
	R	0.672	30	C	65.2	0.564	25.5	C	42.1
Kelvin Road (E)	T	0.726	9.7	A	94	0.602	6.8	A	50.3
	R	0.312	28.7	C	10.5	0.324	28.1	C	12.1
Kelvin Road (W)	L	0.41	7.3	A	0	0.474	7	A	0
	T	0.541	29.2	C	27.5	0.536	22.2	C	29.8
All Vehicles		**0.726**	**15.6**	**B**	**101.3**	**0.602**	**12.5**	**B**	**50.3**

Table 20 SIDRA Results – Tonkin Highway / Kelvin Road (Eastern Ramps) – Scenario 2

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Kelvin Road (E)	L	0.125	7.4	A	4.2	0.165	7.7	A	5.5
	T	0.35	21.7	C	30.1	0.144	14.1	B	11.5
Tonkin Highway (N)	L	0.065	9.6	A	5.1	0.055	9	A	3.1
	R	0.756	22	C	107	0.518	17.5	B	59.5
Kelvin Road (W)	T	0.736	16	B	65.9	0.451	9.2	A	28.5
	R	0.368	9.2	A	5.3	0.529	5.2	A	1.7
All Vehicles		**0.756**	**18.1**	**B**	**107**	**0.529**	**11.7**	**B**	**59.5**

7.7.7 Welshpool Road East/Crystal Brook Road/Brentwood Road

7.7.7.1 Existing Layout – Staggered T-intersections

The SIDRA layout adopted for Welshpool Road East / Crystal Brook Road / Brentwood Road intersection is shown in **Figure 54**.

The analysis results for the intersection are presented in **Table 21** and **Table 22**. The results indicate that the existing layout operates satisfactorily in Scenario 1, with a maximum DOS of 0.66 in the AM Peak. In Scenario 2 the right turn onto Welshpool Road East significantly exceeds practical capacity in both peak periods, and the right turn from Welshpool Road East into Crystal Brook Road also exceeds practical capacity in the PM Peak hour.

The next section will review the SIDRA assessment of the proposed upgrade to this intersection.

Figure 54 SIDRA Layout - Welshpool Road East / Crystal Brook Road / Brentwood Road

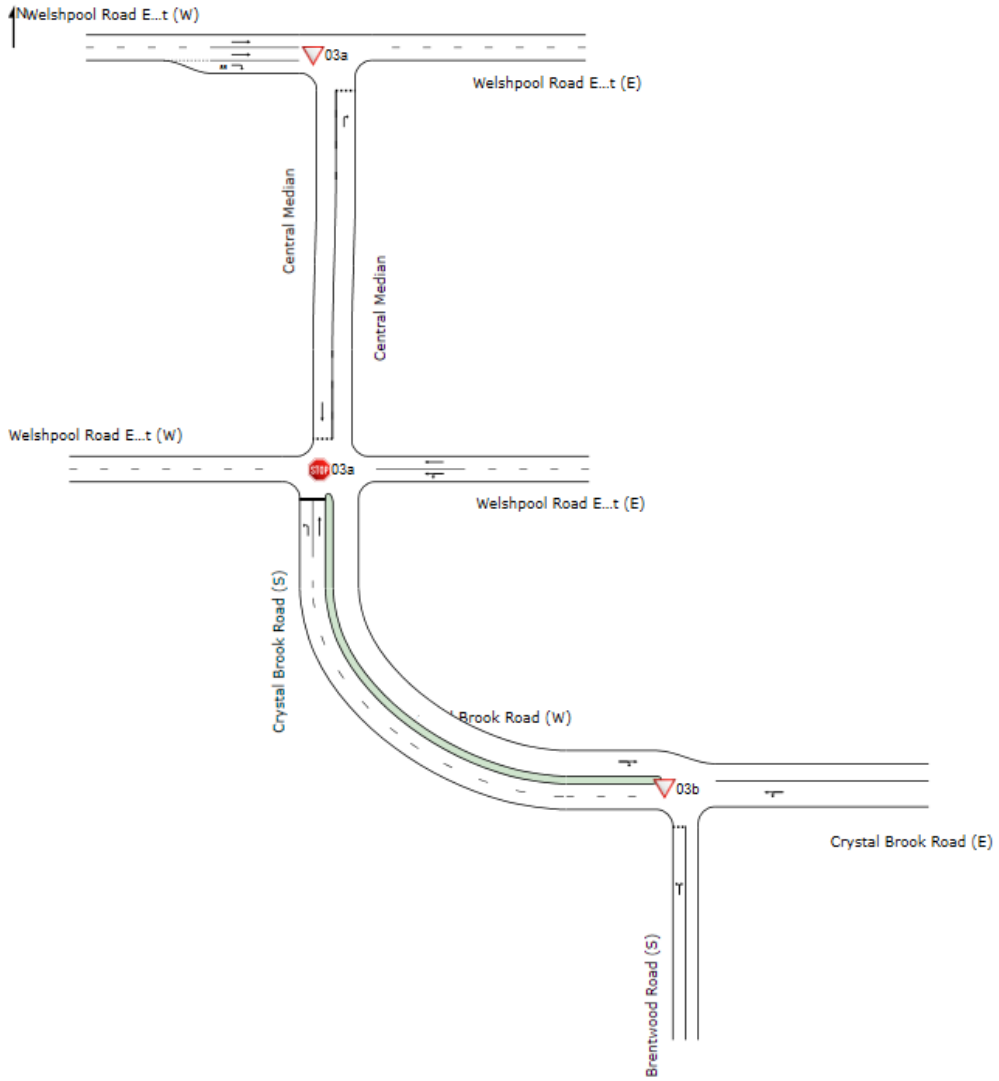


Table 21 SIDRA Results - Welshpool Road East / Crystal Brook Road / Brentwood Road – Scenario 1

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Crystal Brook Road (S)	L	0.107	7.3	A	3.2	0.08	6.8	A	2.6
	R	0.66	27.9	D	17.8	0.287	27.1	D	7.7
Welshpool Road East (E)	L	0.246	7.1	A	0	0.21	7.1	A	0
	T	0.246	0	A	0	0.21	0	A	0
Welshpool Road East (W)	T	0.17	0	A	0	0.236	0	A	0
	R	0.103	13.8	B	2.5	0.166	12.1	B	4.2
Brentwood Road (S)	L	0.017	6.4	A	0.6	0.017	5.3	A	0.5
	R	0.017	6.8	A	0.6	0.017	5.4	A	0.5
Crystal Brook Road (E)	L	0.143	6.6	A	0	0.069	6.4	A	0
	T	0.143	0	A	0	0.069	0	A	0
Crystal Brook Road (W)	T	0.068	0.2	A	0.9	0.136	0.1	A	1.3
	R	0.068	4.1	A	0.9	0.136	3.4	A	1.3

Table 22 SIDRA Results - Welshpool Road East / Crystal Brook Road / Brentwood Road – Scenario 2

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Crystal Brook Road (S)	L	0.575	9.8	A	38.5	0.261	6.1	A	10.3
	R	1.744	701.9	F	49.7	1.254	287.2	F	49.7
Welshpool Road East (E)	L	0.264	7.1	A	0	0.312	7.1	A	0
	T	0.264	0.1	A	0	0.312	0.1	A	0
Welshpool Road East (W)	T	0.17	0	A	0	0.236	0	A	0
	R	0.48	17.9	C	16.6	1.952	874.6	F	1423.9
Brentwood Road (S)	L	0.869	17.9	C	79.3	0.221	6	A	8.6
	R	0.869	21.6	C	79.3	0.221	8.6	A	8.6
Crystal Brook Road (E)	L	0.337	6.7	A	0	0.124	6.4	A	0
	T	0.337	0.1	A	0	0.124	0	A	0
Crystal Brook Road (W)	T	0.297	2.7	A	14	0.501	2.7	A	45.2
	R	0.297	6	A	14	0.501	5.8	A	45.2

7.7.7.2 Proposed Future Layout – Roundabout

To accommodate the traffic generated by the LSP, it is proposed to upgrade this intersection to a four-way roundabout configuration.

Various layouts were tested before arriving at the SIDRA layout shown in **Figure 55**, which is based on the conceptual layout developed by TABEC and shown in **Figure 26**.

Key features of the 4-leg roundabout include:

- A two-lane bypass of the roundabout is provided for eastbound to northbound movements on Welshpool Road East;
- Two approach lanes are provided on Welshpool Road East north leg, with an exclusive right turn lane and a shared left/through/right lane;
- Brentwood Road is linked directly as the fourth leg of the intersection with a single approach lane;
- 2 westbound approach lanes are provided on Crystal Brook Road.

Table 23 shows the SIDRA results for Scenario 2. The results indicate that the proposed roundabout layout will operate satisfactorily with a maximum DOS of 0.63 in the AM Peak and an overall LOS A.

Figure 55 SIDRA Layout - Welshpool Road East / Crystal Brook Road / Brentwood Road (Future Layout)

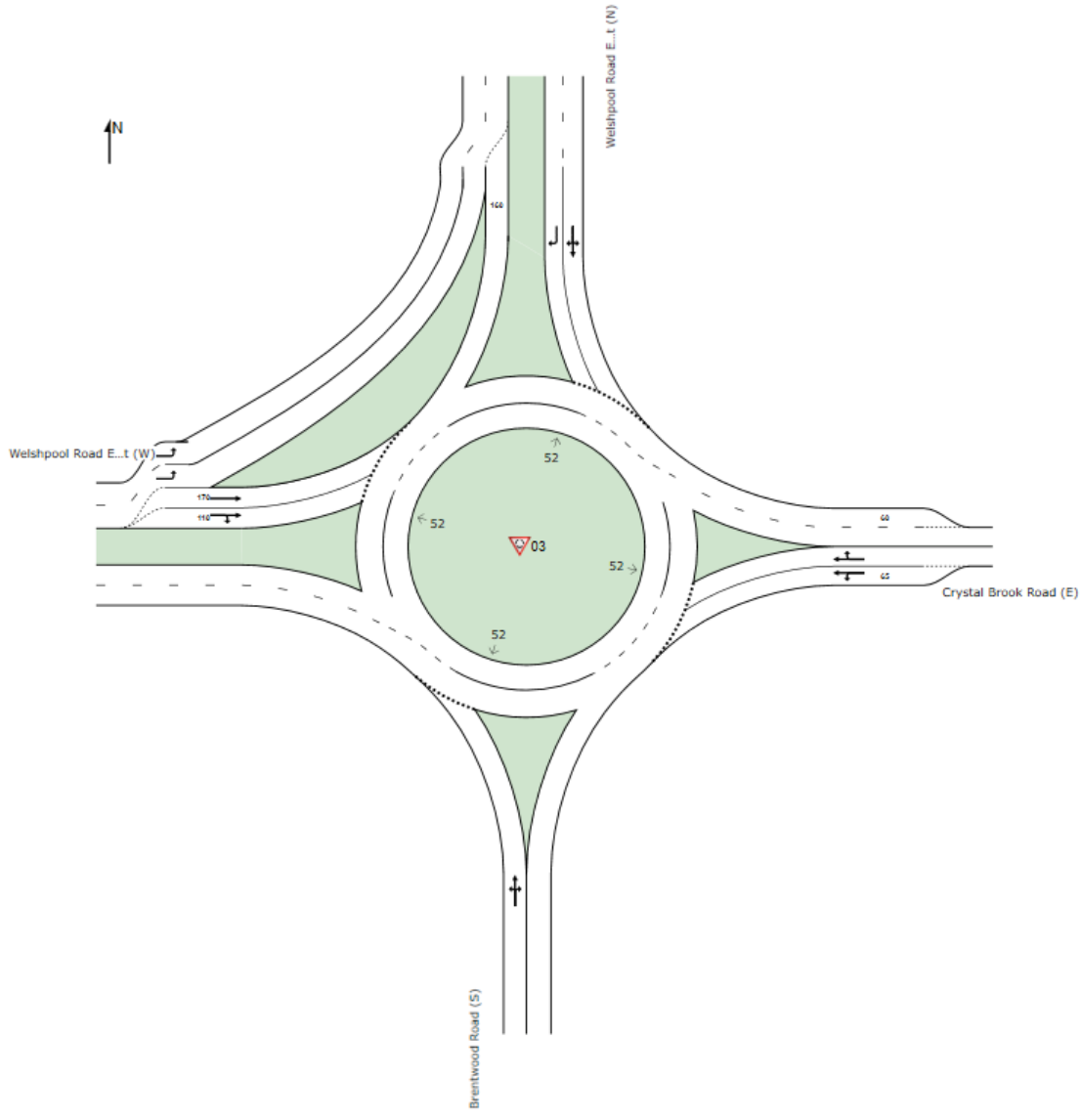


Table 23 SIDRA Results – Welshpool Road East / Crystal Brook Road / Brentwood Road (Future Layout) – Scenario 2

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Brentwood Road (S)	L	0.639	8.3	A	37.8	0.283	3.5	A	9.6
	T	0.639	8.2	A	37.8	0.283	3.6	A	9.6
	R	0.639	14.7	B	37.8	0.283	9	A	9.6
Crystal Brook Road (E)	L	0.246	7.1	A	8.1	0.141	6.1	A	5.5
	T	0.246	6.4	A	8.8	0.141	6.1	A	5.5
	R	0.246	14.4	B	8.8	0.141	15.9	B	4.9
Welshpool Road East (N)	L	0.362	5.7	A	14.7	0.416	6.7	A	16.8
	T	0.362	5.8	A	14.7	0.416	6.7	A	16.8
	R	0.362	13.9	B	14.7	0.416	15.3	B	16.9
Welshpool Road East (W)	L	0.165	5.1	A	0	0.229	5	A	0
	T	0.095	6.2	A	3.8	0.219	5.6	A	7.9
	R	0.095	14	B	3.8	0.219	13.4	B	7.9
All Vehicles		**0.639**	**9.8**	**A**	**37.8**	**0.416**	**3.5**	**A**	**16.9**

7.7.8 Crystal Brook Road/Kelvin Road

The SIDRA layout adopted for Crystal Brook Road / Kelvin Road intersection is shown in **Figure 56**.

The analysis results for the intersection are presented in **Table 24** and **Table 25**. The results indicate that the intersection will operate satisfactorily in both scenarios, with a maximum DOS <0.5 in both peaks and an overall LOS of A.

Figure 56 SIDRA Layout - Crystal Brook Road / Kelvin Road

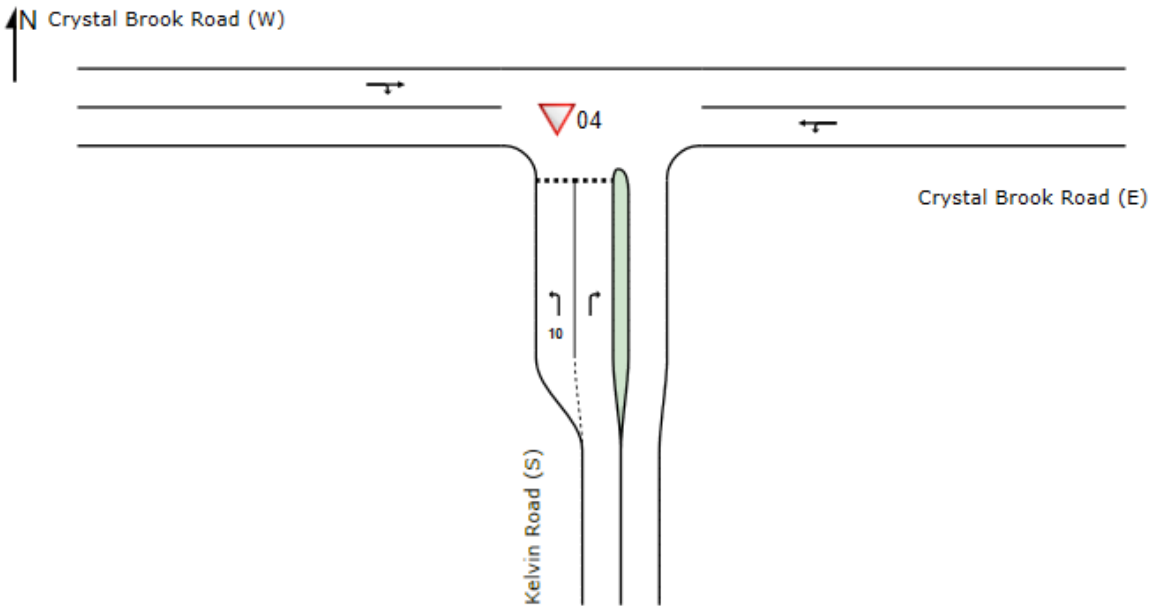


Table 24 SIDRA Results - Crystal Brook Road / Kelvin Road – Scenario 1

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Kelvin Road (S)	L	0.131	5.8	A	4.7	0.075	5.7	A	2.4
	R	0.361	7.8	A	13	0.418	9.1	A	16.6
Crystal Brook Road (E)	L	0.2	5.7	A	0	0.215	5.7	A	0
	T	0.2	0.1	A	0	0.215	0.1	A	0
Crystal Brook Road (W)	T	0.092	1.6	A	3.5	0.191	2	A	7.2
	R	0.092	7.3	A	3.5	0.191	7.7	A	7.2
All Vehicles		**0.361**	**6.3**	**A**	**13**	**0.418**	**6.8**	**A**	**16.6**

Table 25 SIDRA Results - Crystal Brook Road / Kelvin Road – Scenario 2

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Kelvin Road (S)	L	0.155	5.9	A	5.6	0.136	5.9	A	4.5
	R	0.439	9.8	A	17.8	0.495	11.2	B	20.8
Crystal Brook Road (E)	L	0.212	5.7	A	0	0.244	5.7	A	0
	T	0.212	0.1	A	0	0.244	0.1	A	0
Crystal Brook Road (W)	T	0.204	1.8	A	8.4	0.271	2.6	A	11
	R	0.204	7.6	A	8.4	0.271	8.3	A	11
All Vehicles		**0.439**	**6.6**	**A**	**17.8**	**0.495**	**7**	**A**	**20.8**

7.7.9 Welshpool Road East/Crystal Brook Road (east)

The SIDRA layout adopted for Welshpool Road East / Crystal Brook Road (east) intersection is shown in **Figure 57**.

The analysis results for the intersection are presented in **Table 26** and **Table 27**. The results indicate that in Scenario 1 the existing layout is operating close to practical capacity, with the critical right turn movement from Crystal Brook Road operating with an average delay of 25 seconds, LOS D and a DOS of 0.79 in the AM Peak.

In Scenario 2, the additional turning movements generated by the LSP (58vph in the AM Peak) increase the average delay for this movement to 45 seconds in the AM Peak and a DOS of 0.95, exceeding the average delay threshold of 35 seconds for priority intersections as per the WAPC Transport Assessment Guidelines.

Figure 57 SIDRA Layout - Welshpool Road East / Crystal Brook Road (east)

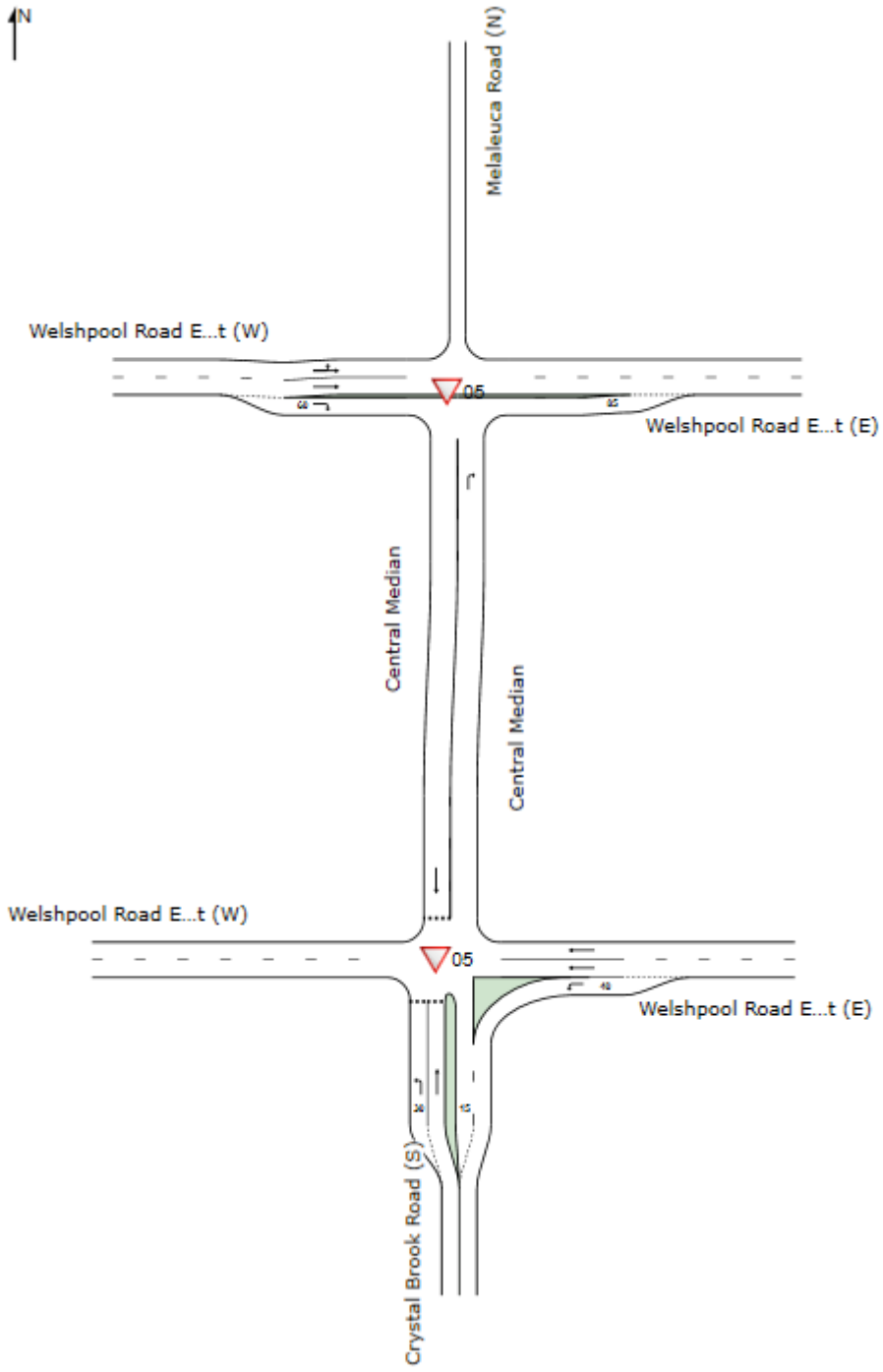


Table 26 SIDRA Results - Welshpool Road East / Crystal Brook Road (east) – Scenario 1

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Crystal Brook Road (S)	L	0.012	8.5	A	0.4	0.005	6.7	A	0.1
	R	0.792	25.4	D	41.3	0.634	17.8	C	28.5
Welshpool Road East (E)	L	0.196	6.8	A	0	0.214	6.8	A	0
	T	0.256	0.1	A	0	0.201	0	A	0
Welshpool Road East (W)	L	0.186	7	A	0	0.246	7	A	0
	T	0.186	1	A	0	0.246	1.1	A	0
	R	0.016	17.4	C	0.4	0.041	18.1	C	1

Table 27 SIDRA Results - Welshpool Road East / Crystal Brook Road (east) – Scenario 2

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Crystal Brook Road (S)	L	0.012	8.5	A	0.4	0.005	6.8	A	0.1
	R	0.951	44.9	E	91.8	0.74	21.1	C	38.4
Welshpool Road East (E)	L	0.208	6.8	A	0	0.248	6.8	A	0
	T	0.258	0.1	A	0	0.207	0	A	0
Welshpool Road East (W)	L	0.192	7	A	0	0.25	7	A	0
	T	0.192	1	A	0	0.25	1.1	A	0
	R	0.016	18.1	C	0.4	0.047	19.8	C	1.1

Due to the location of the intersection on the edge of the Darling Range, in the middle of a long, steep descent on Welshpool Road East, a roundabout is not considered geometrically feasible. Therefore, signalisation of the existing layout was tested as a mitigation measure. The adopted SIDRA layout for traffic signals is shown in **Figure 58** and the results are presented in **Table 28**. The results indicate that the signalised intersection would operate satisfactorily with a DOS of 0.84 in the AM Peak and 0.85 in the PM Peak, which meets the performance requirements in MRWA *Traffic Signals Approval Policy*.

Figure 58 SIDRA Layout - Welshpool Road East / Crystal Brook Road (east) – Signalised Int (Mitigation)- Scenario 2

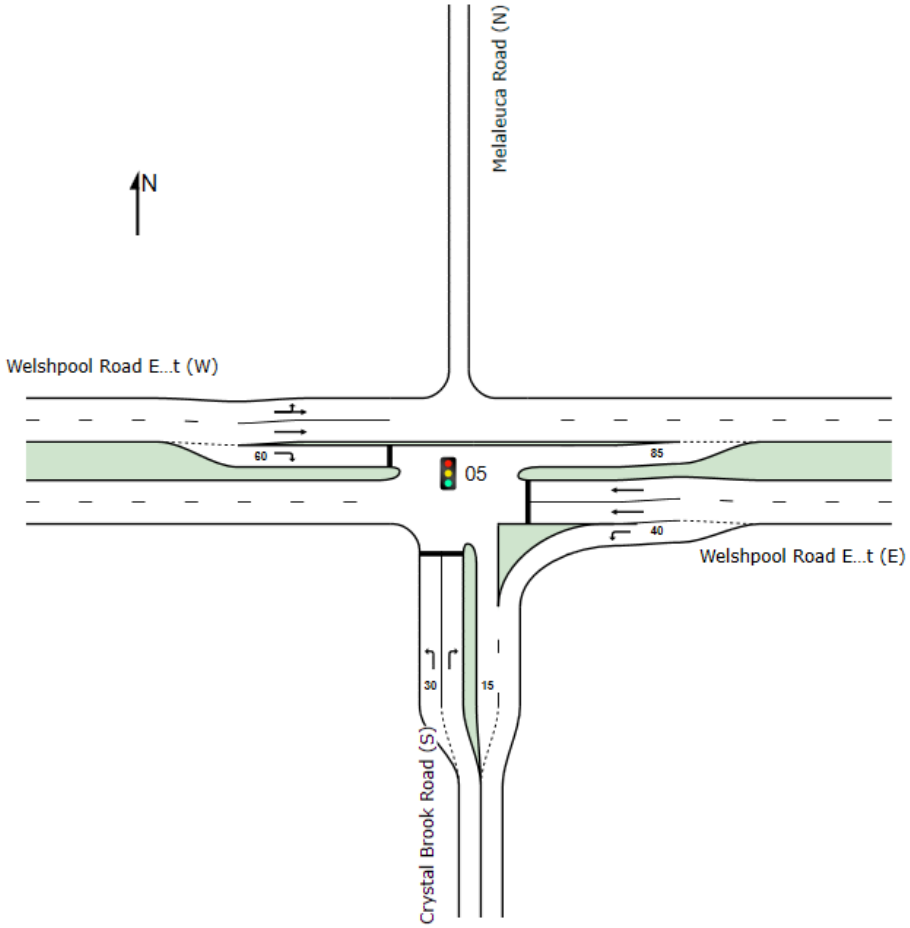


Table 28 SIDRA Results - Welshpool Road East / Crystal Brook Road (east) – Signalised Int. Scenario 2

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Crystal Brook Road (S)	L	0.023	31	C	1.9	0.011	24.8	C	0.7
	R	0.846	44.3	D	108.2	0.855	38.2	D	88
Welshpool Road East (E)	L	0.208	6.8	A	0	0.248	6.8	A	0
	T	0.815	28.4	C	116.2	0.795	23.2	C	80.7
Welshpool Road East (W)	L	0.192	6.9	A	0	0.25	6.8	A	0
	T	0.192	1	A	0	0.25	1	A	0
	R	0.034	35.3	D	1.3	0.087	31	C	3.3
All Vehicles		**0.846**	**20.1**	**C**	**116.2**	**0.855**	**14.7**	**B**	**88**

It is noted that signalisation of this intersection may not be supported by MRWA due to its location midway along a steep descent with loaded RAVs travelling from Brookton Highway to the metropolitan area. If it is determined by MRWA that a signalised intersection is not safe in this location then the existing intersection layout would have to be retained, with only minor improvements which would not materially impact performance of the right turn from Crystal Brook Road.

If the existing layout is retained, and delays for the right turn from Crystal Brook Road increase during the AM Peak hour, it is likely that both background and development traffic will seek alternative routes to achieve network equilibrium – e.g. accessing Welshpool Road East via Tonkin Highway rather than using Kelvin Road. For development traffic it will be convenient for development traffic to use the proposed roundabout at the Welshpool Road East / Crystal Brook Road / Brentwood Road intersection to access the Lesmurdie area and therefore the volume of peak hour LSP traffic using Crystal Brook Road at this intersection is likely to be lower than estimated.

For these reasons, no changes to the intersection are proposed as a result of this LSP.

7.7.10 Welshpool Road East/Lewis Road

The SIDRA layout adopted for Welshpool Road East / Lewis Road intersection is shown in **Figure 59**.

The analysis results for the intersection are presented in **Table 29** and **Table 30**. The results indicate that the existing layout operates satisfactorily in Scenario 1, with a maximum delay of 23 seconds and DOS 0.75 in the PM Peak for the right turn from Lewis Road. In Scenario 2 the increased traffic generated by the LSP (157vph in the PM Peak) results in the right turn onto Welshpool Road East significantly exceeding practical capacity in the PM Peak hour with a DOS exceeding 1.1 and delays of 192 seconds.

Figure 59 SIDRA Layout - Welshpool Road East / Lewis Road

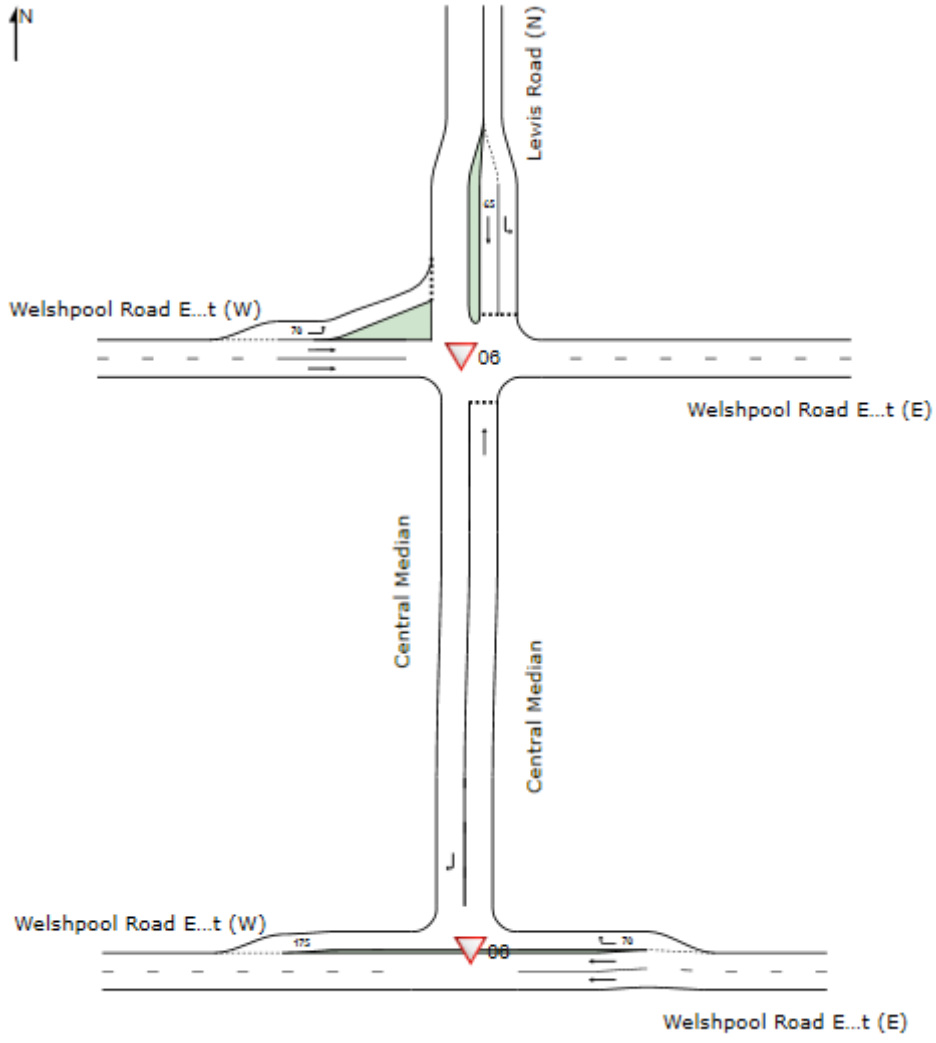


Table 29 SIDRA Results - Welshpool Road East / Lewis Road – Scenario 1

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Welshpool Road East (E)	T	0.196	0	A	0	0.129	0	A	0
	R	0.24	11.5	B	2.8	0.357	14	B	4.8
Lewis Road (N)	L	0.173	7.3	A	2.3	0.226	7.9	A	3.1
	R	0.394	14.3	B	5.4	0.75	23.4	C	15
Welshpool Road East (W)	L	0.319	8.9	A	4.9	0.318	9	A	4.6
	T	0.126	0	A	0	0.177	0	A	0

Table 30 SIDRA Results - Welshpool Road East / Lewis Road – Scenario 2

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Welshpool Road East (E)	T	0.198	0	A	0	0.135	0	A	0
	R	0.245	11.9	B	7	0.362	14.9	B	12.3
Lewis Road (N)	L	0.174	7.4	A	5.8	0.227	8	A	7.7
	R	0.55	17	C	21.6	1.181	192.2	F	418.5
Welshpool Road East (W)	L	0.472	9.7	A	26.8	0.404	9.5	A	18.1
	T	0.132	0	A	0	0.181	0	A	0

As a mitigation measure, both traffic signals and roundabout options have been assessed for Scenario 2. The adopted SIDRA layouts are shown in **Figure 60** and **Figure 61**. The SIDRA results are summarised in **Table 31** and **Table 32**. The SIDRA results indicate that both roundabout and traffic signals will operate satisfactorily in Scenario 2, with a maximum DOS of 0.84 for traffic signals and 0.55 for roundabout layout. As there is minimal demand for pedestrian movements in this area, a roundabout is likely to be the preferred intersection layout in the future. `

Figure 60 SIDRA Layout - Welshpool Road East / Lewis Road – Signalised Int (Mitigation) – Scenario 2

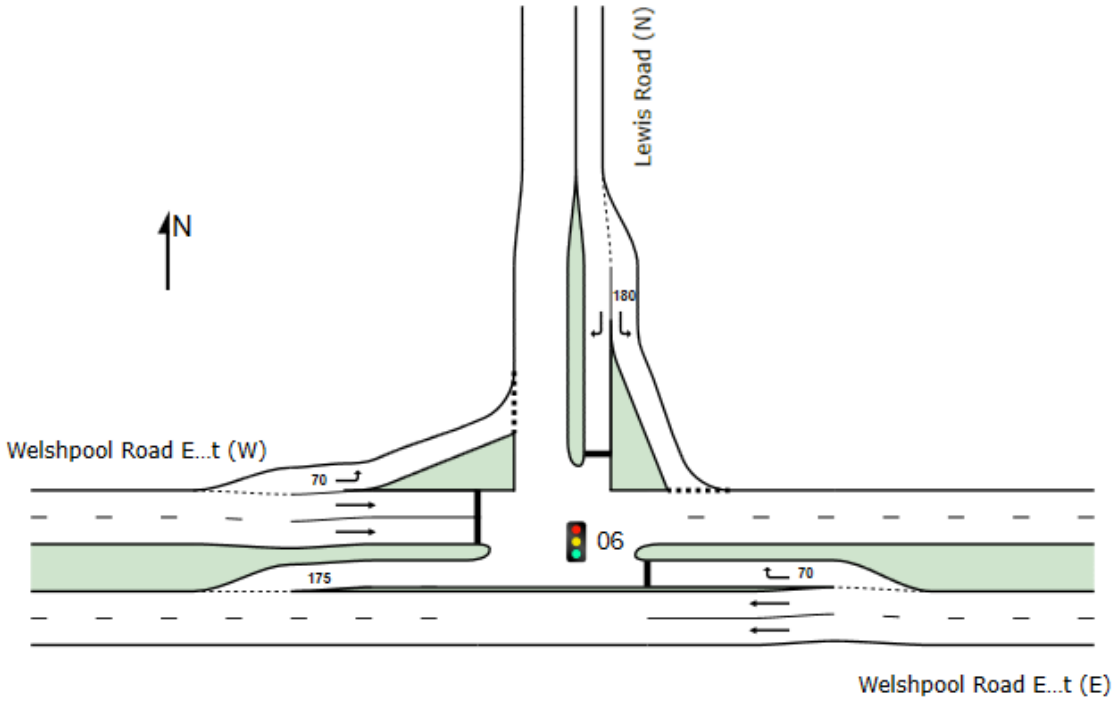


Table 31 SIDRA Results - Welshpool Road East / Lewis Road – Signalised Int (Mitigation) – Scenario 2

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Welshpool Road East (E)	T	0.198	0	A	0	0.135	0	A	0
	R	0.573	38	D	63	0.842	48.5	D	93.7
Lewis Road (N)	L	0.174	8.8	A	15.8	0.214	10.1	B	24.2
	R	0.567	32.8	C	80.3	0.820	38	D	162.1
Welshpool Road East (W)	L	0.405	10.1	B	46.1	0.328	10.7	B	37.3
	T	0.555	29.6	C	66.7	0.802	36.5	D	106.7
All Vehicles		**0.573**	**16.4**	**B**	**80.3**	**0.842**	**24.6**	**C**	**162.1**

Figure 61 SIDRA Layout - Welshpool Road East / Lewis Road – Roundabout (Mitigation) – Scenario 2

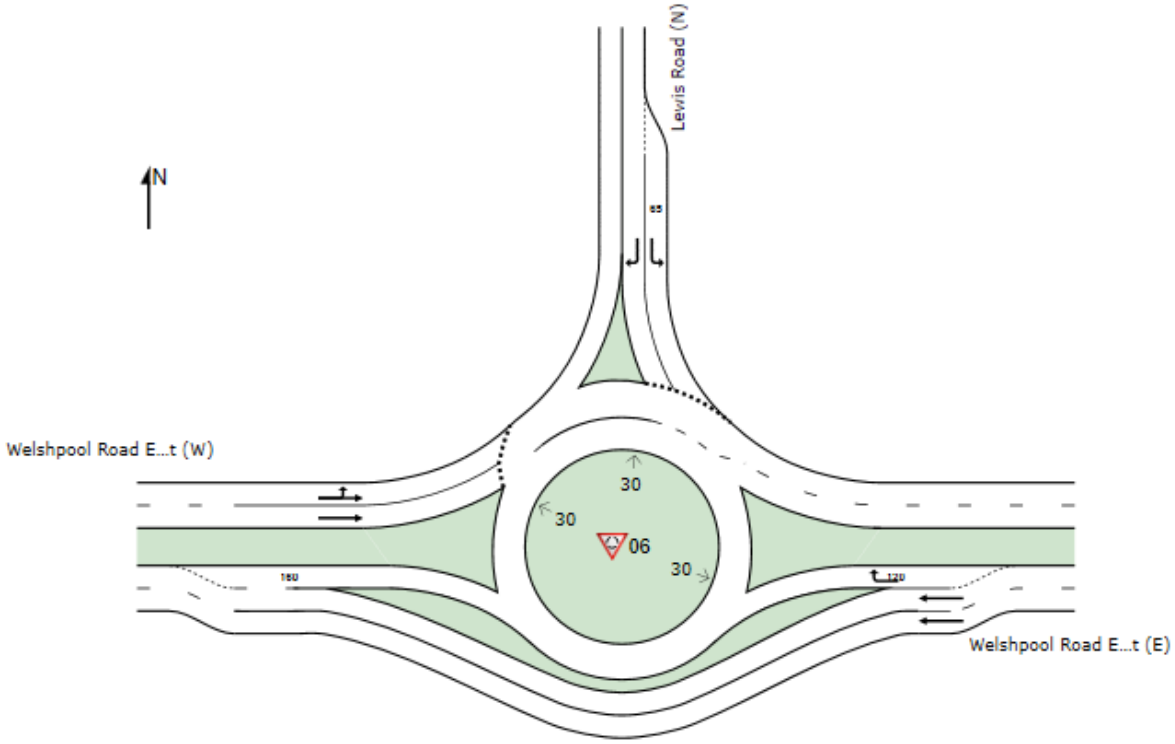


Table 32 SIDRA Results - Welshpool Road East / Lewis Road – Roundabout (Mitigation) – Scenario 2

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Welshpool Road East (E)	T	0.196	5.7	A	0	0.134	5.7	A	0
	R	0.128	11.6	B	0	0.156	11.6	B	0
Lewis Road (N)	L	0.253	7.2	A	10.5	0.366	8.4	A	15.2
	R	0.299	13.7	B	13.6	0.554	15.6	B	32.9
Welshpool Road East (W)	L	0.387	6.9	A	21.5	0.438	7.1	A	24.6
	T	0.387	7.6	A	21.5	0.438	8	A	24.6
All Vehicles		**0.387**	**8**	**A**	**21.5**	**0.554**	**9.3**	**A**	**32.9**

7.7.11 Crystal Brook Road/Victoria Road

The SIDRA layout adopted for Crystal Brook Road / Victoria Road intersection is shown in **Figure 62**.

The analysis results for the intersection are presented in **Table 33** and **Table 34**. The results indicate that the intersection will operate satisfactorily in both scenarios, with a maximum DOS <0.3 in both peaks and an overall LOS of A.

Figure 62 SIDRA Layout - Crystal Brook Road / Victoria Road

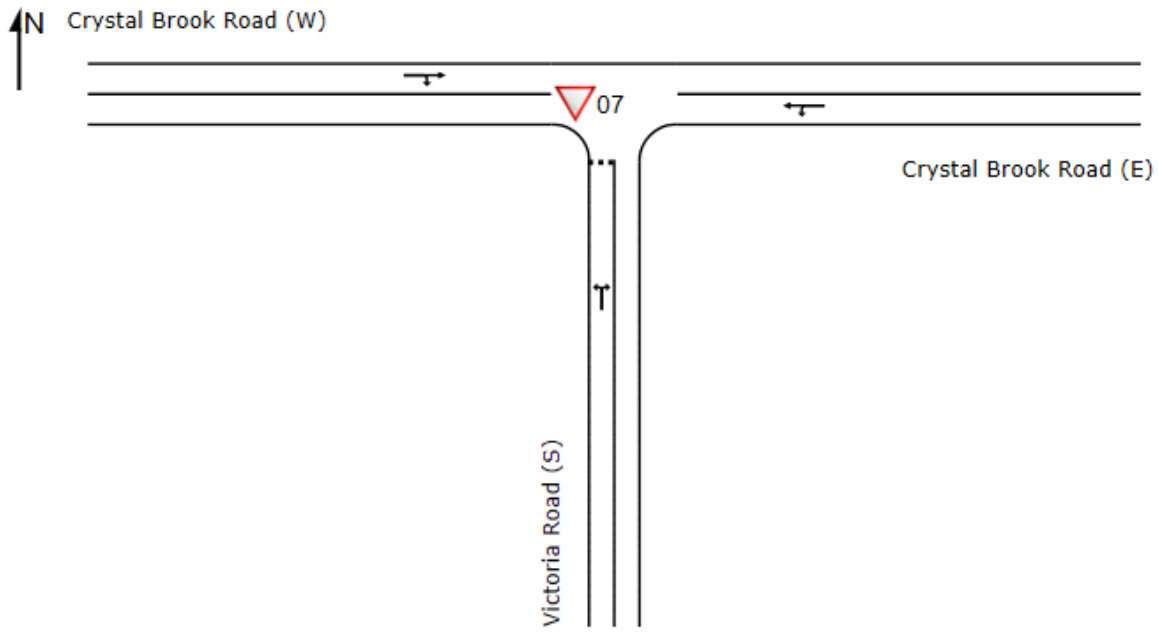


Table 33 SIDRA Results - Crystal Brook Road / Victoria Road – Scenario 1

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Victoria Road (S)	L	0.039	6.7	A	1.1	0.01	6	A	0.3
	R	0.039	7.3	A	1.1	0.01	7.3	A	0.3
Crystal Brook Road (E)	L	0.147	5.6	A	0	0.088	5.6	A	0
	T	0.147	0	A	0	0.088	0	A	0
Crystal Brook Road (W)	T	0.075	0.3	A	1.5	0.168	0.1	A	2.1
	R	0.075	7	A	1.5	0.168	6.6	A	2.1

Table 34 SIDRA Results - Crystal Brook Road / Victoria Road – Scenario 2

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Victoria Road (S)	L	0.259	7	A	8	0.139	6.1	A	3.7
	R	0.259	8.4	A	8	0.139	8.9	A	3.7
Crystal Brook Road (E)	L	0.176	5.6	A	0	0.165	5.6	A	0
	T	0.176	0	A	0	0.165	0	A	0
Crystal Brook Road (W)	T	0.115	0.7	A	3.4	0.248	0.8	A	8
	R	0.115	7.3	A	3.4	0.248	7.6	A	8

7.8 Sensitivity Analysis (Beyond 2040)

7.8.1 Assessment Parameters

As agreed with MRWA in 2021, a sensitivity analysis has been undertaken for the following intersections:

- Tonkin Highway / Welshpool Road East
- Welshpool Road East / Crystal Brook Road

The purpose of this Sensitivity Analysis is to identify whether any future upgrades to these intersections would be required if the full development of the 504ha Planning Investigation Area eventuates. Consideration is also given to the future mid-block capacity requirements of Welshpool Road East, between Tonkin Highway and Crystal Brook Road/Brentwood Road.

This assessment has been based on traffic volume projects provided to the project team by Paul Fourie (dated 5/11/2021, no ROM job number provided) shown in **Figure 63**. These volumes represent a 2041 scenario with the additional traffic generated by the Planning Investigation Area, inclusive of the Wattle Grove South LSP. On current projections, this development is unlikely to occur by 2041.

Similar to the methodology outlined in Section 7.4, linear growth rates were calculated for each intersection approach by comparing the 2016 and 2041 daily ROM volumes. These growth rates were then applied to the 2025 background traffic volumes to calculate the 2041 turning movements. As Brentwood Road is not included in ROM, and existing background traffic volumes are very low, it was decided to adopt the 2040 turning volumes for the Brentwood Road approach and adjust other turning movements to/from Crystal Brook Road accordingly.

Figure 63 ROM Output – Ultimate Scenario Daily Volumes

7.8.2 Traffic Volumes

The adopted peak hour traffic volumes for the sensitivity analysis are shown in **Figure 64**and **Figure 65**.

Figure 64 Tonkin Highway / Welshpool Road East – – Beyond 2040

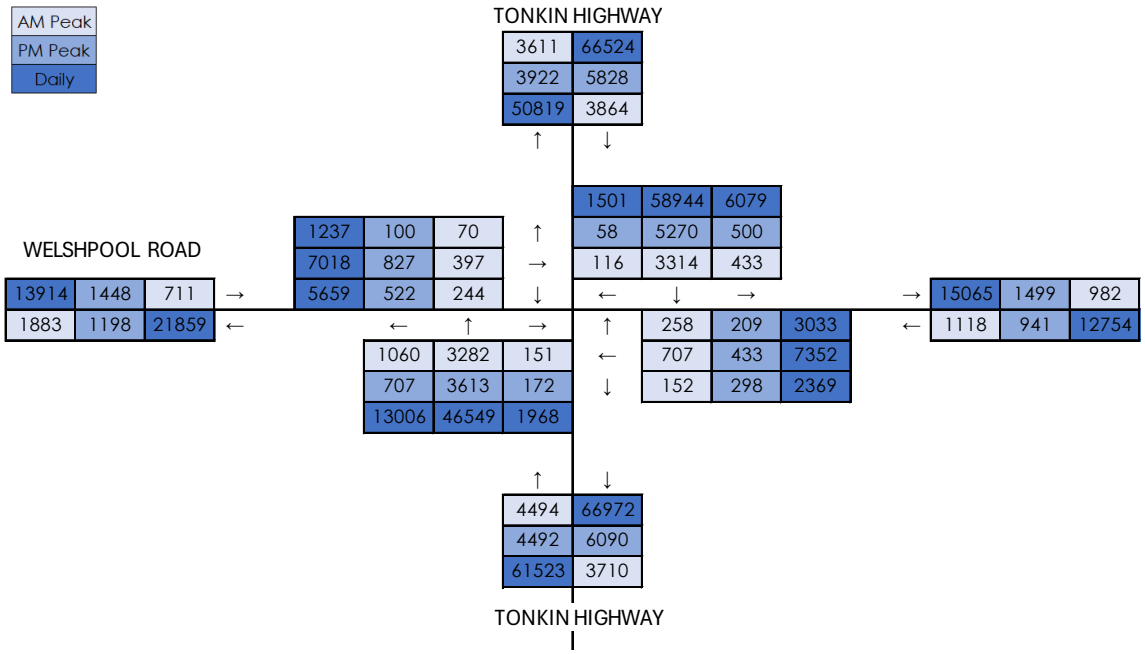
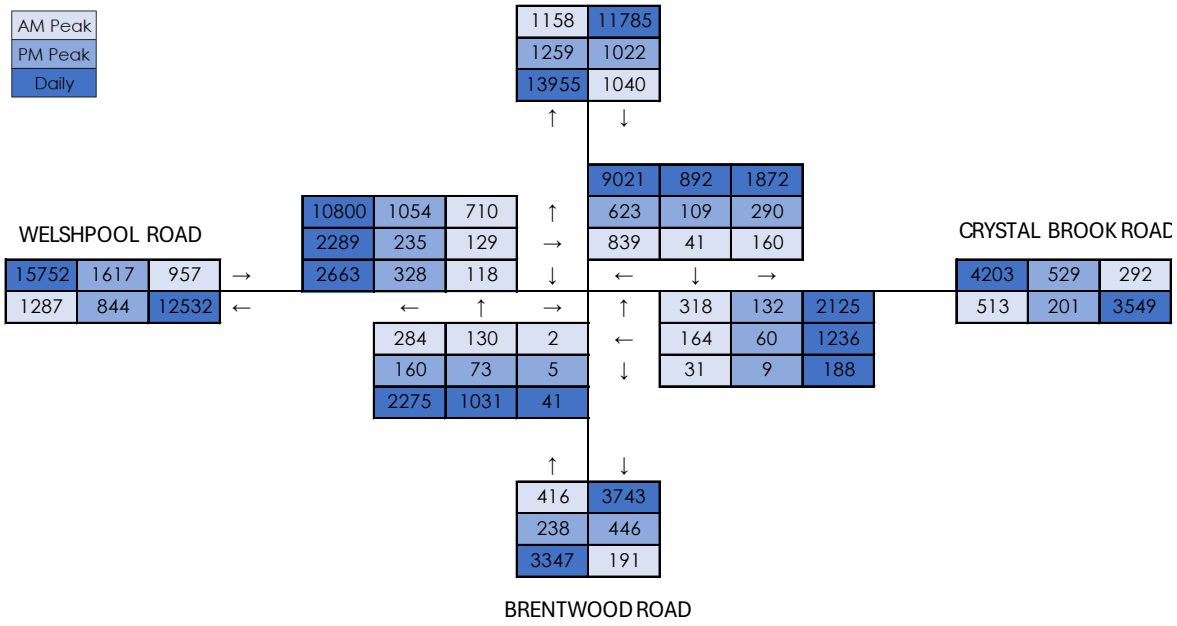


Figure 65 Welshpool Road East/Crystal Brook Road / Brentwood Road (Upgraded Layout) - – Beyond 2040



7.8.3 SIDRA Analysis (Beyond 2040)

7.8.3.1 Tonkin Highway / Welshpool Road East (Beyond 2040)

The intersection layout adopted for the SIDRA analysis is shown in **Figure 52**.

The results of the SIDRA analysis for this intersection are presented in **Table 35** and **Table 36**. The results indicate that the interchange would operate satisfactorily with a maximum DOS of 0.87 in the PM Peak and an overall LOS of B.

Table 35 SIDRA Results – Tonkin Highway / Welshpool Road East (Western Ramps) – Beyond 2040

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Tonkin Highway (S)	L	0.800	22.6	C	99.2	0.876	26.8	C	70
	R	0.119	15.1	B	8.3	0.193	16.4	B	8.5
Welshpool Road (E)	T	0.762	8.3	A	51.7	0.437	4.1	A	15.4
	R	0.486	11.6	B	12	0.436	9.2	A	5.8
Welshpool Road (W)	L	0.074	8.9	A	2.9	0.103	9	A	3.4
	T	0.457	13.4	B	31.2	0.833	13.8	B	64.6
All Vehicles		**0.8**	**15.1**	**B**	**99.2**	**0.876**	**14.9**	**B**	**70**

Table 36 SIDRA Results – Tonkin Highway / Welshpool Road East (Eastern Ramps) – Beyond 2040

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Welshpool Road (E)	L	0.146	8.6	A	5.4	0.34	10.8	B	15.4
	T	0.426	8	A	38	0.371	7.7	A	22.9
Tonkin Highway (N)	L	0.563	22.1	C	38.1	0.665	20	B	35.7
	R	0.17	20.4	C	9.5	0.088	17.3	B	3.5
Welshpool Road (W)	T	0.358	3.6	A	17.1	0.757	9.9	A	57.7
	R	0.547	7.3	A	7.6	0.784	9.8	A	25.3
All Vehicles		**0.563**	**10**	**B**	**38.1**	**0.784**	**11.3**	**B**	**57.7**

7.8.3.2 Welshpool Road East / Crystal Brook Road / Brentwood Road (Beyond 2040)

The intersection layout adopted for the SIDRA analysis is shown in **Figure 55**.

The results of the SIDRA analysis for this intersection are presented in **Table 37**. The results indicate that the proposed roundabout layout will operate satisfactorily with a maximum DOS of 0.72 in the AM Peak and an overall LOS B.

Table 37 SIDRA Results – Welshpool Road East / Crystal Brook Road / Brentwood Road (Future Layout) – Beyond 2040

Intersection Approach	Turn	AM Peak				PM Peak			
		DOS	Delay (s)	LOS	95% Queue (m)	DOS	Delay (s)	LOS	95% Queue (m)
Brentwood Road (S)	L	0.685	10.1	B	45.6	0.289	3.7	A	10.6
	T	0.685	10.6	B	45.6	0.289	4.3	A	10.6
	R	0.685	16.6	B	45.6	0.289	9.2	A	10.6
Crystal Brook Road (E)	L	0.254	7.1	A	8.3	0.098	6.6	A	3.2
	T	0.254	6.4	A	8.3	0.098	6.6	A	3.2
	R	0.297	14.9	B	10.9	0.136	15.2	B	5.1
Welshpool Road East (N)	L	0.416	5.9	A	18.1	0.483	7	A	21.9
	T	0.416	5.9	A	18.1	0.483	7	A	21.9
	R	0.416	14	B	18.1	0.483	15.8	B	22.2
Welshpool Road East (W)	L	0.208	5.1	A	0	0.289	5	A	0
	T	0.114	6.5	A	5.1	0.222	5.8	A	8.4
	R	0.114	14.2	B	5.1	0.222	13.5	B	8.4
All Vehicles		**0.685**	**10.1**	**B**	**45.6**	**0.483**	**8.8**	**A**	**22.2**

7.8.4 Daily Volume Analysis (Beyond 2040)

Daily volumes on Welshpool Road East, between Tonkin Highway and Crystal Brook Road, are estimated by Main Roads to be approximately 28,000vpd (based on application of ROM growth rates) or 44,000 (based on unadjusted ROM outputs).

Both future volume estimates are within the capacity of a four-lane divided carriageway with limited access points, which aligns with the intended future form and function of Welshpool Road East.

7.9 Restricted Access Vehicles (RAV) Network

It is proposed that RAV access to Brentwood Road will be removed as part of the development of the LSP. No other changes to the surrounding RAV network are proposed.

7.10 Pedestrian and Cycling Network

The proposed internal pedestrian and cycling network outlined in Section 4.5 will provide for safe walking and cycling routes within the LSP, especially to/from the proposed primary school.

Beyond the LSP boundary, existing paths provide connectivity to the wider cycling network. The extension of the Tonkin Highway PSP from Hale Road to Kelvin Road, as part of the MRWA Tonkin Highway Upgrade project, will also provide a high-standard, fully separated cycling connection between the LSP and the wider network.

7.11 Public Transport Access

As outlined in Section 4.6, the LSP has been designed to accommodate a centrally-located bus route along Brentwood Road, the proposed north-south Neighbourhood Connector, and Victoria Road, with provision for a future extension (by others) to the Kelvin Road/White Road intersection.

Ongoing consultation with the PTA will be required to confirm the location and timing of bus routes through the LSP.

8 SAFETY ISSUES

8.1 Crash Assessment

A crash assessment for the surrounding road network of the Site has been completed using Main Roads WA Reporting Centre. The assessment covers all the recorded crashes for the 5-year period between 1 January 2020 to 31 December 2024 between SLK 0.21 and SLK 1.07 on Welshpool Road East and between SLK 0.54 and SLK0.96 on Crystal Brook Road.

The crash locations and severity of these crashes for intersection and midblock crashes are illustrated in **Figure 66** while **Table 38** to **Table 42** provides the summary of all crashes that occurred within the vicinity of the Site.

Table 38 Total Crashes

Crash Nature	Fatal	Hospital	Medical	PDO Major	PDO Minor	Total Crashes
Right Turn Thru	-	-	-	-	1	1
Right Angle	-	2	1	1	1	5
Rear End	-	-	2	3	-	5
Sideswipe Same Direction	-	-	-	1	1	2
Hit Object	-	1	-	-	-	1
Unspecified	-	-	-	2	-	2
Total	**-**	**3**	**3**	**7**	**3**	**16**

Table 39 Welshpool Rd East - Crystal Brook Rd Intersection Crashes

Crash Nature	Fatal	Hospital	Medical	PDO Major	PDO Minor	Total Crashes
Right Angle	-	2	1	1	1	5
Unspecified	-	-	-	1	-	1
Total	**-**	**2**	**1**	**2**	**1**	**6**

Table 40 Welshpool Rd East - Boundary Rd Intersection Crashes

Crash Nature	Fatal	Hospital	Medical	PDO Major	PDO Minor	Total Crashes
Right Turn Thru	-	-	-	-	1	1
Total	**-**	**-**	**-**	**-**	**1**	**1**

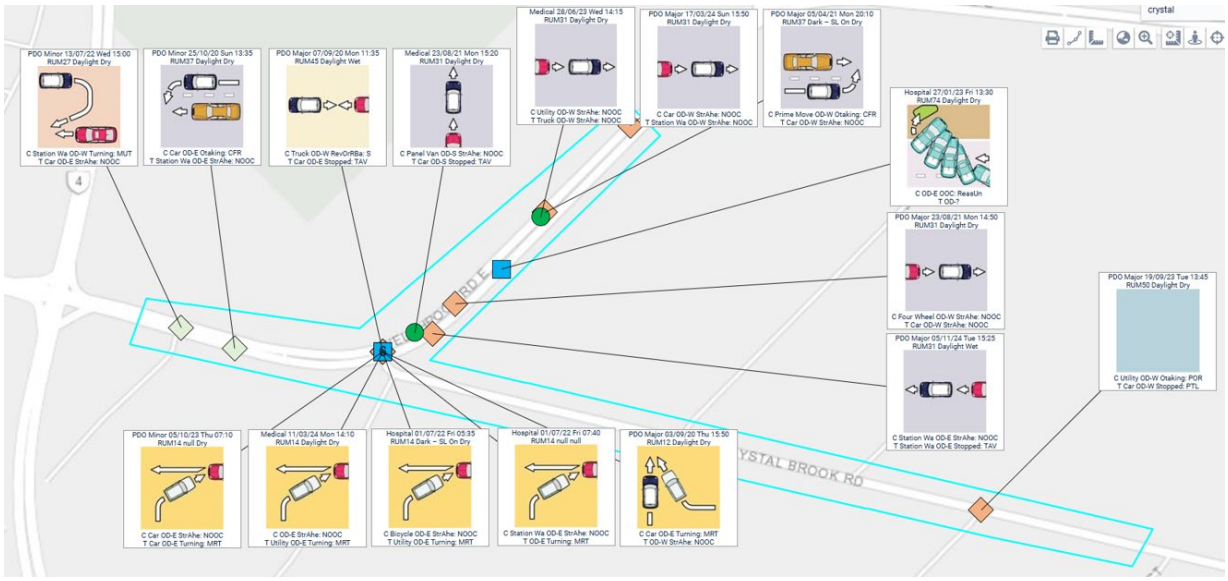
Table 41 Crystal Brook Rd - Victoria Rd Intersection Crashes

Crash Nature	Fatal	Hospital	Medical	PDO Major	PDO Minor	Total Crashes
Unspecified	-	-	-	1	-	1
Total	-	-	-	1	-	1

Table 42 Mid-Block Crashes – Welshpool Road East

Crash Nature	Fatal	Hospital	Medical	PDO Major	PDO Minor	Total Crashes
Rear End	-	-	2	3	-	5
Sideswipe Same Direction	-	-	-	1	1	2
Hit Object	-	1	-	-	-	1
Total	-	1	2	4	1	8

Figure 66 Crash Locations



Source: Main Roads WA Reporting Centre

Crash data is summarised as follows:

- A total of sixteen (16) crashes were recorded within the vicinity of the Site, with no fatal crashes recorded.
- Six (6) crashes were located at the intersection of Welshpool Road East - Crystal Brook Road.
- Eight (8) midblock crashes were recorded along Welshpool Road East (between SLK 0.21 and SLK 1.07) with four (4) crashes resulting in major property damage.
- One (1) intersection crash is recorded at Crystal Brook Road / Victoria Road at the access point to the site;
- One midblock crash that resulted in minor property damage mentioned above were reported on the stretch of road in front of the proposed site access location on Welshpool Road East.

Overall, the recorded crash history does not indicate any significant road safety issues that are likely to be exacerbated by the development of the LSP. The distribution of crashes in the study area generally corresponds to the higher traffic volumes along Welshpool Road East. With the proposed intersection improvements at Welshpool Road East / Crystal Brook Road / Brentwood Road intersection as part of this LSP, the severity of crashes is expected to reduce. Similarly, the rationalisation of access points on Welshpool Road East between Tonkin Highway and Crystal Brook Road is likely to reduce the likelihood and severity of crashes occurring on this road section.

9 SUMMARY

This Transport Impact Assessment has been prepared in accordance with the *WAPC Transport Assessment Guidelines for Developments: Volume 2 – Planning Schemes, Structure Plans and Activity Centre Plans* (2016).

The following conclusions have been made in regard to the proposed Local Structure Plan:

- The proposed LSP is located in a presently rural area of Wattle Grove, bounded by Tonkin Highway, Welshpool Road East, Crystal Brook Road and the City of Kalamunda boundary.
- The proposed LSP is estimated to yield up to 1,646 residential dwellings and a primary school.
- The proposed road network within the LSP has been developed to generally align with the provisions of Liveable Neighbourhoods (2009) with some modifications to reflect existing road reserve widths and greening strategy outcomes.
- Analysis of expected daily traffic volumes on the internal road network indicates that all internal roads are projected to carry traffic volumes within the thresholds specified in Liveable Neighbourhoods.
- Analysis of expected daily traffic volumes on the external road network indicates that:
  - Welshpool Road East, between Tonkin Highway and Crystal Brook Road will increase to approximately 26,400 vehicles per day. This can be accommodated within the existing road layout.
  - Traffic volumes on Crystal Brook Road will increase to between 5,000 and 7,000 vehicles per day, which is within the threshold of a Neighbourhood Connector A in Liveable Neighbourhoods. It is considered that the existing cross-section is capable of accommodating these volumes, enabling the retention of the large trees and rural feel.
- Analysis of the key intersections on the external road network has been undertaken with the following conclusions:
  - Tonkin Highway / Welshpool Road East and Tonkin Highway / Kelvin Road intersections are expected to be able to cater for the proposed traffic generated as part of the LSP.
  - The Welshpool Road East/Crystal Brook Road/Brentwood Road intersection would need upgrades to cater for the traffic generated by the LSP. A four-way roundabout layout with free-flow slip lane for eastbound traffic on Welshpool Road East is recommended as the preferred layout for the upgraded intersection.
  - The Welshpool Road East/Crystal Brook Road (east) intersection is projected to operate close to practical capacity in 2040 as a result of background traffic growth and traffic generated by the LSP. Due to the location of the intersection, it may not be practical to install either a roundabout or traffic signals, therefore no upgrades are recommended. As delays for the critical right turn from Crystal Brook Road increase, it is likely that background and LSP traffic will divert to alternative routes which are available to reach Welshpool Road East.
  - The Welshpool Road East/Lewis Road intersection is projected to exceed practical capacity as a result of background traffic growth and traffic generated by the LSP. Traffic signals and roundabout layouts have been tested, and a roundabout layout is likely to be the preferred option for this intersection in the future.
  - Other key intersections can accommodate the additional traffic generated by the LSP with no need for upgrades.
- At the request of MRWA, a sensitivity analysis was undertaken to determine the impact of potential future development of the wider Planning Investigation Area on Welshpool Road East, between Tonkin Highway and Crystal Brook Road. This sensitivity analysis concluded that the intersection layouts assessed for the LSP are also capable of accommodating the additional traffic generated by the wider area.
- A well-connected pedestrian and cycling network is proposed within the LSP, providing for safe routes to school and for convenient connections to the proposed Tonkin Highway PSP.
- To support the LSP, modifications to bus routes in the area should be investigated in collaboration with the PTA. The LSP will be designed to accommodate a centrally located bus route along Neighbourhood Connector roads, with connectivity to the external road network via Brentwood Road and Victoria Road in the short term. The LSP also makes provision for a possible future connection to the Kelvin Road/White Road intersection by others, which would enable a convenient link for bus services towards Maddington.

Appendix A

WAPC Checklist

APPENDIX A – WAPC CHECKLIST

Item	Status	Comments/Proposal
Summary	Section 9	
Introduction/Background	Section 1	
Structure Plan Proposal		
Regional Context	Section 2	
Proposed Land Uses	Section 2	
Table Of Land Uses and Quantities	Section 2	
Major Attractors/Generators	Section 2	
Specific Issues	Section 2	
Existing Situation		
Existing Land Uses Within Structure Plan	Section 3	
Existing Land Uses Within 800 Metres of Structure Plan Area	Section 3	
Existing Road Network	Section 3	
Existing Pedestrian/Cycle Networks	Section 3	
Existing Public Transport Services	Section 3	
Existing Traffic Flows	Section 3	
Existing Restricted Access Vehicle	Section 3	
Proposed Internal Transport Networks		
Connections to External Road Network	Section 4	
Road Reservation Widths and Cross Sections	Section 4	
Intersection Controls	Section 4	
Speed Limits	Section 4	
Pedestrian/Cycle Networks and Crossing Facilities	Section 4	
Public Transport Routes	Section 4	
Changes to External Transport Networks		
Road Network	Section 5	
Pedestrian/Cycle Networks and Crossing Facilities	Section 5	
Public Transport Services	Section 5	
Integration With Surrounding Area		
Trip Attractors/Generators Within 800 Metres	Section 6	
Proposed Changes to Land Uses Within 800 Metres	Section 6	
Travel Desire Lines from Structure Plan to These Attractors/Generators	Section 6	

Adequacy and Deficiencies of External Transport Networks	Section 6	
Analysis of External Transport Networks		
Structure Plan Generated Traffic	Section 7	
Traffic Distribution	Section 7	
Extraneous Traffic	Section 7	
Background Traffic	Section 7	
Daily Traffic Summary	Section 7	
Frontage Access Strategy	Section 7	
Intersection Performance	Section 7	
Frontage Access Strategy	Section 7	
Key Intersection Analysis	Section 7	
Sensitivity Analysis	Section 7	
Restricted Access Vehicle Network	Section 7	
Pedestrian and Cycling Network	Section 7	
Public Transport Access		
Safety Issues	Section 8	
Summary	Section 9	

Appendix B

Concept LSP Layout

APPENDIX B – CONCEPT LSP LAYOUT

Legend

- Local Structure Plan & MRS Amendment Boundary
- Precinct Boundaries
- High Pressure Gas Pipeline Easment
- Water Corporation Land
- Resource Enhancement Wetland
  (DBCA advice to WAPC 26 August 2021 indicaties values commensurate with Multiple Use Wetland. UFI 8037 and portion of UFI 15257) subject to reclassification with DBCA)
- Residential R20 - R40
- Residential R80
- Light Industry
- Public Purpose - Primary School
- Public Open Space - Conservation
  (As per EPA Assessment Report 1788)
- Public Open Space - Potential Conservation
  (As per EPA Assessment Report 1788 - See Note 1)
- Public Open Space - Recreation
- Existing Road
- Neighbourhood Connector A (22m)
- Neighbourhood Connector B (20m)
- Access Road (18m)
- Access Road (15m)
- Access Road (12m)
- Lane (6m)
- Potential Neighbourhood Activity Centre
- Intersection: Full Movement
- Intersection: Left In/Left Out

Notes

1. Potential Conservation areas to be investigated further and determined by proponents as part of Local Structure Plan Amendments.
2. Landowners are not forced to redevelop their land. It is their individual choice whether they wish to proceed to develop or remain as-is.
3. The location of Public Open Space can potentially be modified by a proponent as part of their final design solution, subject to justification being provided through a Structure Plan amendment and/or subdivision application.
4. Upgrades to Welshpool Road intersection will be required in the future in accordance with the Transport Impact Assessment (PTG 2025) - proposed roundabout, subject to detailed design with City of Kalamunda and Main Roads WA.
5. Opportunity for Neighbourhood Activity Centre in Precinct A – subject to further investigations undertaken by Precinct A landowners.

Local Structure Plan

Wattle Grove

0 20 40m

Date: 7 Aug 2025 Scale: 1:7000@ A3 1:3500 @ A1 File: **20-119 ST1-1** Staff: MR GW Checked: MR

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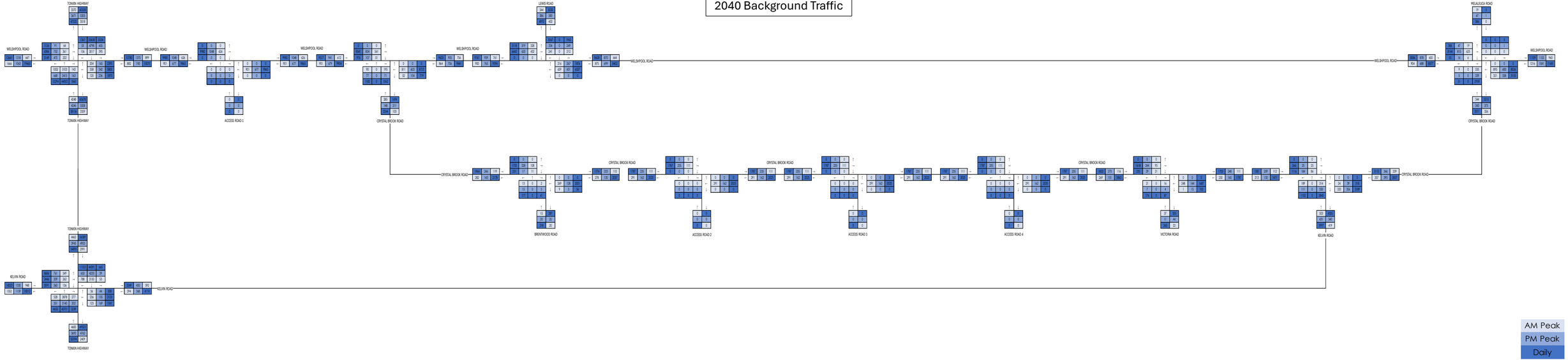
Appendix C

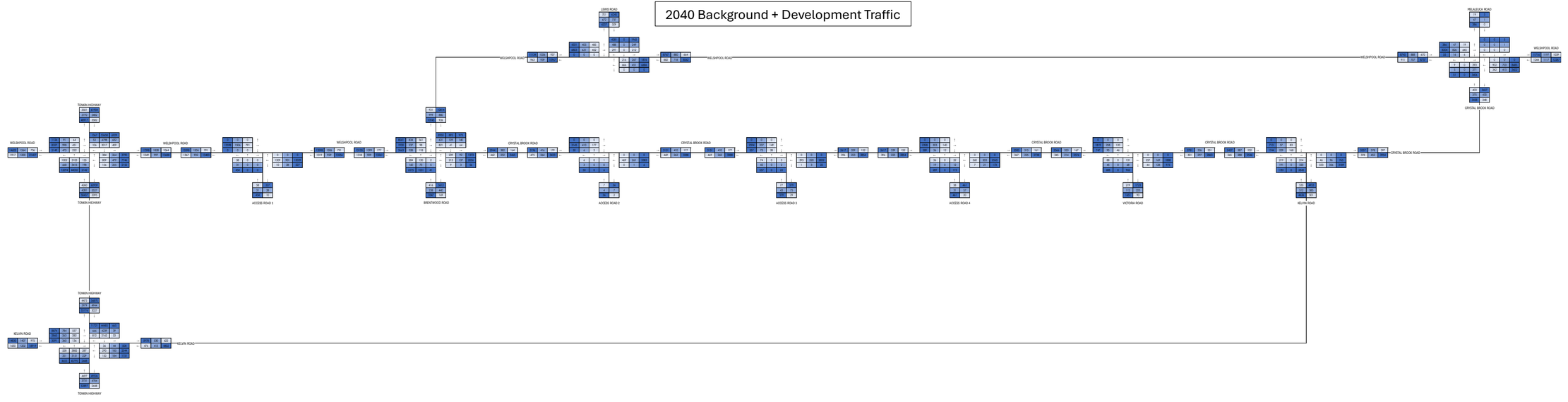
Traffic Volume Diagrams

APPENDIX C – TRAFFIC VOLUME DIAGRAMS

Development Traffic

2040 Background Traffic




2040 Background + Development Traffic
LEWIS ROAD
WELSHPOOL ROAD
TONKIN HIGHWAY
ACCESS ROAD 1
BRENTWOOD ROAD
ACCESS ROAD 2
CRYSTAL BROOK ROAD
ACCESS ROAD 3
ACCESS ROAD 4
VICTORIA ROAD
KELVIN ROAD
MILLIGUGA ROAD
AM Peak
PM Peak
Daily

Appendix D

SIDRA Movement Summaries

APPENDIX D – SIDRA MOVEMENT SUMMARIES

MOVEMENT SUMMARY

Site: 01 [I-1_Tonkin Highway/Welshpool Road East_EB (Site Folder: 2040 AM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-1 (Network Folder: 2040 AM Peak_no dev)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 40 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tonkin Highway (S)															
1	L2	All MCs	1055	8.0	1055	8.0	* 0.711	18.7	LOS B	9.8	80.1	0.88	0.88	0.98	47.6
3	R2	All MCs	151	9.0	151	9.0	0.106	14.4	LOS B	0.9	7.5	0.63	0.71	0.63	45.8
Approach			1205	8.1	1205	8.1	0.711	18.2	LOS B	9.8	80.1	0.85	0.86	0.93	47.5
East: Welshpool Road East															
5	T1	All MCs	699	4.0	699	4.0	* 0.671	7.6	LOS A	4.8	36.8	0.69	0.59	0.72	56.0
6	R2	All MCs	215	6.0	215	6.0	0.395	11.0	LOS B	1.0	8.3	0.44	0.67	0.44	45.6
Approach			914	4.5	914	4.5	0.671	8.4	LOS A	4.8	36.8	0.63	0.61	0.65	53.1
West: Welshpool Road East (W)															
10	L2	All MCs	67	22.0	67	22.0	0.067	8.8	LOS A	0.3	2.7	0.41	0.66	0.41	50.6
11	T1	All MCs	614	9.0	614	9.0	0.457	14.2	LOS B	3.6	29.2	0.87	0.70	0.87	45.7
Approach			681	10.3	681	10.3	0.457	13.7	LOS B	3.6	29.2	0.83	0.70	0.83	46.5
All Vehicles			2800	7.5	2800	7.5	0.711	13.9	LOS B	9.8	80.1	0.77	0.74	0.82	48.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
P1B	Slip/ Bypass	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
North: Tonkin Highway (N)											
P3	Full	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
West: Welshpool Road East (W)											
P4	Full	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
All Pedestrians		4	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 01 [I-1_Tonkin Highway/Welshpool Road East_WB (Site Folder: 2040 AM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-1 (Network Folder: 2040 AM Peak_no dev)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 40 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Welshpool Road East (E)															
4	L2	All MCs	126	12.0	126	12.0	0.114	8.5	LOS A	0.5	4.1	0.37	0.66	0.37	53.6
5	T1	All MCs	802	4.0	802	4.0	0.378	9.2	LOS A	4.1	31.3	0.73	0.60	0.73	52.1
Approach			928	5.1	928	5.1	0.378	9.1	LOS A	4.1	31.3	0.68	0.61	0.68	52.5
North: Tonkin Highway (N)															
7	L2	All MCs	416	16.0	416	16.0	* 0.428	19.7	LOS B	3.6	31.4	0.85	0.79	0.85	45.3
9	R2	All MCs	112	20.0	112	20.0	0.130	18.5	LOS B	0.8	8.0	0.76	0.72	0.76	41.8
Approach			527	16.8	527	16.8	0.428	19.4	LOS B	3.6	31.4	0.83	0.77	0.83	44.8
West: Welshpool Road East															
11	T1	All MCs	531	9.0	531	9.0	0.370	4.3	LOS A	2.1	17.4	0.42	0.35	0.42	61.4
12	R2	All MCs	234	30.0	234	30.0	* 0.462	7.6	LOS A	0.6	6.9	0.26	0.62	0.26	40.4
Approach			764	15.4	764	15.4	0.462	5.3	LOS A	2.1	17.4	0.37	0.43	0.37	53.0
All Vehicles			2220	11.4	2220	11.4	0.462	10.2	LOS B	4.1	31.4	0.61	0.59	0.61	49.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
East: Welshpool Road East (E)											
P2	Full	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
North: Tonkin Highway (N)											
P3	Full	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
P3B	Slip/ Bypass	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
All Pedestrians		4	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 02 [I-2_Tonkin Highway/Kelvin Road_EB (Site Folder: 2040 AM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-2 (Network Folder: 2040 AM Peak_no dev)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 50 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tonkin Highway (S)															
1	L2	All MCs	556	11.0	556	11.0	0.702	14.4	LOS B	9.4	79.5	0.84	0.86	0.89	49.6
3	R2	All MCs	292	4.0	292	4.0	* 0.737	29.1	LOS C	7.5	57.1	0.98	0.90	1.16	33.5
Approach			847	8.6	847	8.6	0.737	19.5	LOS B	9.4	79.5	0.89	0.87	0.98	45.1
East: Kelvin Road															
5	T1	All MCs	1078	8.0	1078	8.0	* 0.723	8.7	LOS A	9.2	75.4	0.83	0.74	0.88	54.2
6	R2	All MCs	38	33.0	38	33.0	0.240	21.9	LOS C	0.6	7.3	0.60	0.66	0.60	33.2
Approach			1116	8.8	1116	8.8	0.723	9.1	LOS A	9.2	75.4	0.82	0.74	0.87	53.1
West: Kelvin Road (W)															
10	L2	All MCs	578	27.0	578	27.0	0.405	7.3	LOS A	0.0	0.0	0.00	0.56	0.00	51.1
11	T1	All MCs	419	12.0	419	12.0	* 0.429	22.9	LOS C	2.5	21.1	0.96	0.74	0.96	37.4
Approach			997	20.7	997	20.7	0.429	13.9	LOS B	2.5	21.1	0.40	0.64	0.40	46.6
All Vehicles			2960	12.8	2960	12.8	0.737	13.7	LOS B	9.4	79.5	0.70	0.74	0.75	47.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
North: Tonkin Highway (N)											
P3	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
West: Kelvin Road (W)											
P4	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
All Pedestrians		3	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 02 [I-2_Tonkin Highway/Kelvin Road_WB (Site Folder: 2040 AM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-2 (Network Folder: 2040 AM Peak_no dev)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 50 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Kelvin Road (E)															
4	L2	All MCs	129	6.0	129	6.0	0.104	7.6	LOS A	0.4	3.4	0.27	0.65	0.27	55.9
5	T1	All MCs	286	8.0	286	8.0	0.222	16.3	LOS B	2.0	16.7	0.82	0.65	0.82	43.3
Approach			416	7.4	416	7.4	0.222	13.6	LOS B	2.0	16.7	0.65	0.65	0.65	48.5
North: Tonkin Highway (N)															
7	L2	All MCs	56	33.0	56	33.0	0.066	9.5	LOS A	0.4	4.3	0.39	0.65	0.39	47.9
9	R2	All MCs	829	22.0	829	22.0	* 0.635	17.4	LOS B	7.9	74.4	0.78	0.82	0.79	42.9
Approach			885	22.7	885	22.7	0.635	16.9	LOS B	7.9	74.4	0.76	0.81	0.77	43.4
West: Kelvin Rd															
11	T1	All MCs	567	12.0	567	12.0	* 0.626	12.9	LOS B	5.9	49.2	0.78	0.67	0.80	49.0
12	R2	All MCs	143	32.0	143	32.0	0.281	8.0	LOS A	0.3	3.7	0.19	0.61	0.19	38.9
Approach			711	16.0	711	16.0	0.626	11.9	LOS B	5.9	49.2	0.66	0.65	0.68	46.5
All Vehicles			2012	17.2	2012	17.2	0.635	14.4	LOS B	7.9	74.4	0.70	0.72	0.71	45.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
East: Kelvin Road (E)											
P2	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
North: Tonkin Highway (N)											
P3	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
All Pedestrians		3	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 03a [I-3a_Welshpool Road East/Crystal Brook Road_EB (Site Folder: 2040 AM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-3 (Network Folder: 2040 AM Peak_no dev)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Central Median															
3	R2	All MCs	205	4.0	205	4.0	0.461	11.1	LOS B	2.2	17.2	0.70	0.94	1.01	46.3
Approach			205	4.0	205	4.0	0.461	11.1	LOS B	2.2	17.2	0.70	0.94	1.01	46.3
West: Welshpool Road East (W)															
11	T1	All MCs	591	11.0	591	11.0	0.170	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
12	R2	All MCs	54	11.0	54	11.0	0.033	7.0	LOS A	0.0	0.0	0.00	0.65	0.00	62.0
Approach			644	11.0	644	11.0	0.170	0.6	NA	0.0	0.0	0.00	0.05	0.00	78.9
All Vehicles			849	9.3	849	9.3	0.461	3.1	NA	2.2	17.2	0.17	0.27	0.24	71.5

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

MOVEMENT SUMMARY

Site: 03a [I-3a_Welshpool Road East/Crystal Brook Road_WB (Site Folder: 2040 AM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-3 (Network Folder: 2040 AM Peak_no dev)]

NA
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Crystal Brook Road (S)															
1	L2	All MCs	95	5.0	95	5.0	0.107	7.3	LOS A	0.4	3.2	0.47	0.93	0.47	52.9
2	T1	All MCs	205	4.0	205	4.0	0.625	16.5	LOS C	2.4	17.4	0.84	1.17	1.36	6.9
Approach			300	4.3	300	4.3	0.625	13.6	LOS B	2.4	17.4	0.72	1.10	1.08	30.6
East: Welshpool Road East (E)															
3	L2	All MCs	55	4.0	55	4.0	0.246	7.1	LOS A	0.0	0.0	0.00	0.08	0.00	77.0
4	T1	All MCs	854	5.0	854	5.0	0.246	0.0	LOS A	0.0	0.0	0.00	0.04	0.00	79.2
Approach			908	4.9	908	4.9	0.246	0.5	NA	0.0	0.0	0.00	0.04	0.00	79.1
North: Central Median															
8	T1	All MCs	54	11.0	54	11.0	0.103	6.8	LOS A	0.3	2.5	0.65	0.81	0.65	9.2
Approach			54	11.0	54	11.0	0.103	6.8	LOS A	0.3	2.5	0.65	0.81	0.65	9.2
All Vehicles			1262	5.0	1262	5.0	0.625	3.9	NA	2.4	17.4	0.20	0.32	0.28	71.7

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

MOVEMENT SUMMARY

Site: 03b [I-3b_Crystal Brook Road/Brentwood Road (Site Folder: 2040 AM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-3 (Network Folder: 2040 AM Peak_no dev)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Brentwood Road (S)															
30	L2	All MCs	14	31.0	14	31.0	0.017	6.4	LOS A	0.1	0.6	0.37	0.55	0.37	43.0
1	R2	All MCs	2	50.0	2	50.0	0.017	6.8	LOS A	0.1	0.6	0.37	0.55	0.37	39.1
Approach			16	33.5	16	33.5	0.017	6.4	LOS A	0.1	0.6	0.37	0.55	0.37	42.0
East: Crystal Brook Road (E)															
10	L2	All MCs	9	14.0	9	14.0	0.143	6.6	LOS A	0.0	0.0	0.00	0.02	0.00	59.1
22	T1	All MCs	283	3.0	283	3.0	0.143	0.0	LOS A	0.0	0.0	0.00	0.02	0.00	69.4
Approach			293	3.4	293	3.4	0.143	0.2	NA	0.0	0.0	0.00	0.02	0.00	68.7
West: Crystal Brook Road (W)															
28	T1	All MCs	114	4.0	114	4.0	0.068	0.2	LOS A	0.1	0.9	0.10	0.11	0.10	68.7
29	R2	All MCs	12	25.0	12	25.0	0.068	4.1	LOS A	0.1	0.9	0.10	0.11	0.10	45.6
Approach			125	5.9	125	5.9	0.068	0.6	NA	0.1	0.9	0.10	0.11	0.10	65.6
All Vehicles			434	5.2	434	5.2	0.143	0.6	NA	0.1	0.9	0.04	0.07	0.04	66.1

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

MOVEMENT SUMMARY

Site: 04 [1-4_Crystal Brook Road/Kelvin Road (Site Folder: 2040 AM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Kelvin Road (S)															
30	L2	All MCs	199	8.0	199	8.0	0.131	5.8	LOS A	0.6	4.7	0.10	0.55	0.10	50.3
32	R2	All MCs	331	5.0	331	5.0	0.361	7.8	LOS A	1.7	13.0	0.45	0.69	0.50	50.0
Approach			529	6.1	529	6.1	0.361	7.0	LOS A	1.7	13.0	0.32	0.64	0.35	50.1
East: Crystal Brook Road (E)															
21	L2	All MCs	351	7.0	351	7.0	0.200	5.7	LOS A	0.0	0.0	0.00	0.54	0.00	51.0
22	T1	All MCs	25	10.0	25	10.0	0.200	0.1	LOS A	0.0	0.0	0.00	0.54	0.00	55.2
Approach			376	7.2	376	7.2	0.200	5.3	NA	0.0	0.0	0.00	0.54	0.00	51.3
West: Crystal Brook Road (W)															
28	T1	All MCs	26	10.0	26	10.0	0.092	1.6	LOS A	0.4	3.5	0.46	0.57	0.46	54.3
29	R2	All MCs	91	6.0	91	6.0	0.092	7.3	LOS A	0.4	3.5	0.46	0.57	0.46	50.8
Approach			117	6.9	117	6.9	0.092	6.0	NA	0.4	3.5	0.46	0.57	0.46	51.6
All Vehicles			1022	6.6	1022	6.6	0.361	6.3	NA	1.7	13.0	0.22	0.59	0.23	50.7

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

MOVEMENT SUMMARY

Site: 05 [I-5_Welshpool Road East/Crystal Brook Road_EB (Site Folder: 2040 AM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-5 (Network Folder: 2040 AM Peak_no dev)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Central Median															
3	R2	All MCs	353	5.0	353	5.0	0.186	3.0	LOS A	0.0	0.0	0.00	0.49	0.00	49.0
Approach			353	5.0	353	5.0	0.186	3.0	NA	0.0	0.0	0.00	0.49	0.00	49.0
West: Welshpool Road East (W)															
10	L2	All MCs	20	0.0	20	0.0	0.186	7.0	LOS A	0.0	0.0	0.00	0.20	0.00	71.5
11	T1	All MCs	658	6.0	658	6.0	0.186	1.0	LOS A	0.0	0.0	0.00	0.18	0.00	75.5
12	R2	All MCs	6	0.0	6	0.0	0.005	7.8	LOS A	0.0	0.2	0.41	0.59	0.41	58.9
Approach			684	5.8	684	5.8	0.186	1.3	NA	0.0	0.2	0.00	0.19	0.00	75.3
All Vehicles			1037	5.5	1037	5.5	0.186	1.9	NA	0.0	0.2	0.00	0.29	0.00	67.7

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

MOVEMENT SUMMARY

Site: 05 [I-5_Welshpool Road East/Crystal Brook Road_WB (Site Folder: 2040 AM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-5 (Network Folder: 2040 AM Peak_no dev)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Crystal Brook Road (S)															
1	L2	All MCs	9	13.0	9	13.0	0.012	8.5	LOS A	0.0	0.4	0.48	0.63	0.48	51.7
2	T1	All MCs	353	5.0	353	5.0	0.792	22.4	LOS C	5.7	41.3	0.91	1.34	2.26	34.8
Approach			362	5.2	362	5.2	0.792	22.0	LOS C	5.7	41.3	0.90	1.32	2.21	35.4
East: Welshpool Road East (E)															
3	L2	All MCs	338	7.0	338	7.0	0.196	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	57.0
4	T1	All MCs	942	5.0	942	5.0	0.256	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
Approach			1280	5.5	1280	5.5	0.256	1.8	NA	0.0	0.0	0.00	0.15	0.00	65.9
North: Central Median															
8	T1	All MCs	6	0.0	6	0.0	0.016	9.6	LOS A	0.1	0.4	0.74	0.80	0.74	44.3
Approach			6	0.0	6	0.0	0.016	9.6	LOS A	0.1	0.4	0.74	0.80	0.74	44.3
All Vehicles			1648	5.4	1648	5.4	0.792	6.3	NA	5.7	41.3	0.20	0.41	0.49	59.3

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

MOVEMENT SUMMARY

Site: 06 [I-6_Welshpool Road East/Lewis Road_EB (Site Folder: 2040 AM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-6 (Network Folder: 2040 AM Peak_no dev)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Central Median															
2	T1	All MCs	227	5.0	227	5.0	0.240	3.7	LOS A	0.9	6.9	0.48	0.64	0.48	53.2
Approach			227	5.0	227	5.0	0.240	3.7	LOS A	0.9	6.9	0.48	0.64	0.48	53.2
North: Lewis Road (N)															
1	L2	All MCs	223	3.0	223	3.0	0.173	7.3	LOS A	0.7	5.7	0.35	0.62	0.35	59.0
8	T1	All MCs	254	4.0	254	4.0	0.394	11.3	LOS B	1.9	13.4	0.68	0.92	0.91	49.1
Approach			477	3.5	477	3.5	0.394	9.4	LOS A	1.9	13.4	0.52	0.78	0.65	54.9
West: Welshpool Road East (W)															
3	L2	All MCs	345	7.0	345	7.0	0.319	8.9	LOS A	1.5	12.3	0.42	0.64	0.42	57.3
4	T1	All MCs	455	7.0	455	7.0	0.126	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach			800	7.0	800	7.0	0.319	3.9	LOS A	1.5	12.3	0.18	0.28	0.18	68.3
All Vehicles			1504	5.6	1504	5.6	0.394	5.6	NA	1.9	13.4	0.34	0.49	0.37	62.5

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

MOVEMENT SUMMARY

Site: 06 [I-6_Welshpool Road East/Lewis Road_WB (Site Folder: 2040 AM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-6 (Network Folder: 2040 AM Peak_no dev)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Welshpool Road East (E)															
11	T1	All MCs	694	7.0	694	7.0	0.196	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
12	R2	All MCs	227	5.0	227	5.0	0.166	7.8	LOS A	0.8	6.1	0.39	0.64	0.39	59.1
Approach			921	6.5	921	6.5	0.196	2.0	NA	0.8	6.1	0.10	0.16	0.10	76.1
North: Central Median															
3	R2	All MCs	254	4.0	254	4.0	0.132	3.0	LOS A	0.0	0.0	0.00	0.51	0.00	54.7
Approach			254	4.0	254	4.0	0.132	3.0	NA	0.0	0.0	0.00	0.51	0.00	54.7
All Vehicles			1175	6.0	1175	6.0	0.196	2.2	NA	0.8	6.1	0.08	0.23	0.08	72.2

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

MOVEMENT SUMMARY

Site: 07 [1-7_Crystal Brook Road/Victoria Road (Site Folder: 2040 AM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Victoria Road (S)															
30	L2	All MCs	22	5.0	22	5.0	0.039	6.7	LOS A	0.1	1.1	0.37	0.61	0.37	50.4
32	R2	All MCs	17	6.0	17	6.0	0.039	7.3	LOS A	0.1	1.1	0.37	0.61	0.37	49.9
Approach			39	5.4	39	5.4	0.039	6.9	LOS A	0.1	1.1	0.37	0.61	0.37	50.2
East: Crystal Brook Road (E)															
21	L2	All MCs	1	0.0	1	0.0	0.147	5.6	LOS A	0.0	0.0	0.00	0.00	0.00	57.4
22	T1	All MCs	261	9.0	261	9.0	0.147	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	59.9
Approach			262	9.0	262	9.0	0.147	0.1	NA	0.0	0.0	0.00	0.00	0.00	59.9
West: Crystal Brook Road (W)															
28	T1	All MCs	100	7.0	100	7.0	0.075	0.3	LOS A	0.2	1.5	0.17	0.20	0.17	58.5
29	R2	All MCs	22	19.0	22	19.0	0.075	7.0	LOS A	0.2	1.5	0.17	0.20	0.17	49.8
Approach			122	9.2	122	9.2	0.075	1.5	NA	0.2	1.5	0.17	0.20	0.17	56.7
All Vehicles			423	8.7	423	8.7	0.147	1.1	NA	0.2	1.5	0.08	0.11	0.08	57.9

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

MOVEMENT SUMMARY

Site: 01 [I-1_Tonkin Highway/Welshpool Road East_EB (Site Folder: 2040 PM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-1 (Network Folder: 2040 PM Peak_no dev)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 30 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tonkin Highway (S)															
1	L2	All MCs	703	13.0	703	13.0	* 0.827	23.7	LOS C	6.6	60.0	1.00	1.04	1.51	43.8
3	R2	All MCs	172	5.0	172	5.0	0.182	16.4	LOS B	1.0	8.1	0.80	0.74	0.80	43.6
Approach			875	11.4	875	11.4	0.827	22.2	LOS C	6.6	60.0	0.96	0.98	1.37	43.8
East: Welshpool Road East															
5	T1	All MCs	416	8.0	416	8.0	0.351	4.1	LOS A	1.4	11.7	0.46	0.37	0.46	61.6
6	R2	All MCs	174	6.0	174	6.0	0.321	9.1	LOS A	0.5	4.1	0.36	0.64	0.36	47.5
Approach			589	7.4	589	7.4	0.351	5.6	LOS A	1.4	11.7	0.43	0.45	0.43	56.7
West: Welshpool Road East (W)															
10	L2	All MCs	96	13.0	96	13.0	0.093	8.9	LOS A	0.4	3.1	0.51	0.68	0.51	52.8
11	T1	All MCs	1292	4.0	1292	4.0	* 0.758	12.0	LOS B	6.8	52.4	0.92	0.84	1.09	48.3
Approach			1387	4.6	1387	4.6	0.758	11.8	LOS B	6.8	52.4	0.89	0.83	1.05	48.9
All Vehicles			2852	7.3	2852	7.3	0.827	13.7	LOS B	6.8	60.0	0.82	0.80	1.02	47.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
P1B	Slip/ Bypass	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
North: Tonkin Highway (N)											
P3	Full	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
West: Welshpool Road East (W)											
P4	Full	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
All Pedestrians		4	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 01 [I-1_Tonkin Highway/Welshpool Road East_WB (Site Folder: 2040 PM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-1 (Network Folder: 2040 PM Peak_no dev)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 30 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Welshpool Road East (E)															
4	L2	All MCs	248	4.0	248	4.0	0.254	9.6	LOS A	1.2	9.5	0.57	0.72	0.57	55.5
5	T1	All MCs	534	8.0	534	8.0	0.293	7.5	LOS A	2.1	17.4	0.73	0.59	0.73	54.6
Approach			782	6.7	782	6.7	0.293	8.2	LOS A	2.1	17.4	0.68	0.63	0.68	55.0
North: Tonkin Highway (N)															
7	L2	All MCs	479	9.0	479	9.0	* 0.605	19.3	LOS B	3.6	31.3	0.94	0.84	1.04	47.1
9	R2	All MCs	56	19.0	56	19.0	0.080	17.3	LOS B	0.3	3.1	0.81	0.70	0.81	42.9
Approach			535	10.0	535	10.0	0.605	19.1	LOS B	3.6	31.3	0.93	0.83	1.02	46.8
West: Welshpool Road East															
11	T1	All MCs	963	4.0	963	4.0	* 0.693	8.8	LOS A	6.4	48.6	0.85	0.78	0.95	54.2
12	R2	All MCs	500	8.0	500	8.0	0.645	8.7	LOS A	2.1	17.8	0.47	0.71	0.51	47.4
Approach			1463	5.4	1463	5.4	0.693	8.8	LOS A	6.4	48.6	0.72	0.75	0.80	51.7
All Vehicles			2780	6.6	2780	6.6	0.693	10.6	LOS B	6.4	48.6	0.75	0.73	0.81	51.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
East: Welshpool Road East (E)											
P2	Full	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
North: Tonkin Highway (N)											
P3	Full	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
P3B	Slip/ Bypass	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
All Pedestrians		4	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 02 [I-2_Tonkin Highway/Kelvin Road_EB (Site Folder: 2040 PM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-2 (Network Folder: 2040 PM Peak_no dev)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 50 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tonkin Highway (S)															
1	L2	All MCs	369	25.0	369	25.0	0.483	10.6	LOS B	3.9	40.6	0.60	0.75	0.60	48.8
3	R2	All MCs	213	4.0	213	4.0	* 0.543	26.2	LOS C	4.9	37.6	0.93	0.81	0.93	35.3
Approach			582	17.3	582	17.3	0.543	16.3	LOS B	4.9	40.6	0.72	0.77	0.72	44.9
East: Kelvin Road															
5	T1	All MCs	851	5.0	851	5.0	* 0.545	5.7	LOS A	5.3	41.6	0.64	0.55	0.64	58.8
6	R2	All MCs	46	41.0	46	41.0	0.313	27.8	LOS C	0.9	12.1	0.71	0.69	0.71	30.4
Approach			897	6.9	897	6.9	0.545	6.8	LOS A	5.3	41.6	0.65	0.56	0.65	56.1
West: Kelvin Road (W)															
10	L2	All MCs	801	11.0	801	11.0	0.460	7.0	LOS A	0.0	0.0	0.00	0.56	0.00	55.6
11	T1	All MCs	599	3.0	599	3.0	* 0.489	22.0	LOS C	3.6	27.0	0.96	0.76	0.96	38.1
Approach			1400	7.6	1400	7.6	0.489	13.4	LOS B	3.6	27.0	0.41	0.65	0.41	49.5
All Vehicles			2879	9.3	2879	9.3	0.545	12.0	LOS B	5.3	41.6	0.55	0.64	0.55	49.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
North: Tonkin Highway (N)											
P3	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
West: Kelvin Road (W)											
P4	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
All Pedestrians		3	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 02 [I-2_Tonkin Highway/Kelvin Road_WB (Site Folder: 2040 PM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-2 (Network Folder: 2040 PM Peak_no dev)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 50 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Kelvin Road (E)															
4	L2	All MCs	178	7.0	178	7.0	0.151	7.7	LOS A	0.6	4.9	0.29	0.65	0.29	55.6
5	T1	All MCs	209	5.0	209	5.0	0.125	14.0	LOS B	1.3	9.9	0.76	0.59	0.76	45.8
Approach			387	5.9	387	5.9	0.151	11.1	LOS B	1.3	9.9	0.54	0.62	0.54	51.5
North: Tonkin Highway (N)															
7	L2	All MCs	41	45.0	41	45.0	0.054	9.0	LOS A	0.2	3.1	0.33	0.64	0.33	45.8
9	R2	All MCs	687	17.0	687	17.0	* 0.508	17.5	LOS B	6.1	58.0	0.75	0.79	0.75	42.7
Approach			728	18.6	728	18.6	0.508	17.0	LOS B	6.1	58.0	0.73	0.79	0.73	43.0
West: Kelvin Rd															
11	T1	All MCs	433	3.0	433	3.0	0.377	8.8	LOS A	2.9	22.1	0.56	0.46	0.56	54.1
12	R2	All MCs	379	9.0	379	9.0	* 0.512	5.2	LOS A	0.2	1.7	0.04	0.59	0.04	50.1
Approach			812	5.8	812	5.8	0.512	7.2	LOS A	2.9	22.1	0.32	0.52	0.32	52.1
All Vehicles			1927	10.7	1927	10.7	0.512	11.7	LOS B	6.1	58.0	0.52	0.64	0.52	48.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
East: Kelvin Road (E)											
P2	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
North: Tonkin Highway (N)											
P3	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
All Pedestrians		3	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 03a [I-3a_Welshpool Road East/Crystal Brook Road_EB (Site Folder: 2040 PM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-3 (Network Folder: 2040 PM Peak_no dev)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Central Median															
3	R2	All MCs	75	8.0	75	8.0	0.287	16.2	LOS C	1.0	7.7	0.79	0.93	0.92	39.6
Approach			75	8.0	75	8.0	0.287	16.2	LOS C	1.0	7.7	0.79	0.93	0.92	39.6
West: Welshpool Road East (W)															
11	T1	All MCs	878	5.0	878	5.0	0.236	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
12	R2	All MCs	113	6.0	113	6.0	0.066	6.9	LOS A	0.0	0.0	0.00	0.64	0.00	62.0
Approach			991	5.1	991	5.1	0.236	0.8	NA	0.0	0.0	0.00	0.07	0.00	78.5
All Vehicles			1065	5.3	1065	5.3	0.287	1.9	NA	1.0	7.7	0.06	0.13	0.06	75.5

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

MOVEMENT SUMMARY

Site: 03a [I-3a_Welshpool Road East/Crystal Brook Road_WB (Site Folder: 2040 PM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-3 (Network Folder: 2040 PM Peak_no dev)]

NA
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Crystal Brook Road (S)															
1	L2	All MCs	81	11.0	81	11.0	0.080	6.8	LOS A	0.3	2.6	0.38	0.94	0.38	50.3
2	T1	All MCs	75	8.0	75	8.0	0.152	10.9	LOS B	0.5	3.8	0.64	1.11	0.64	10.4
Approach			156	9.6	156	9.6	0.152	8.7	LOS A	0.5	3.8	0.51	1.02	0.51	42.3
East: Welshpool Road East (E)															
3	L2	All MCs	109	4.0	109	4.0	0.210	7.1	LOS A	0.0	0.0	0.00	0.19	0.00	73.3
4	T1	All MCs	635	7.0	635	7.0	0.210	0.0	LOS A	0.0	0.0	0.00	0.08	0.00	78.4
Approach			744	6.6	744	6.6	0.210	1.1	NA	0.0	0.0	0.00	0.10	0.00	77.9
North: Central Median															
8	T1	All MCs	113	6.0	113	6.0	0.166	5.2	LOS A	0.6	4.2	0.58	0.77	0.58	11.6
Approach			113	6.0	113	6.0	0.166	5.2	LOS A	0.6	4.2	0.58	0.77	0.58	11.6
All Vehicles			1013	7.0	1013	7.0	0.210	2.7	NA	0.6	4.2	0.14	0.31	0.14	73.0

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

MOVEMENT SUMMARY

Site: 03b [I-3b_Crystal Brook Road/Brentwood Road (Site Folder: 2040 PM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-3 (Network Folder: 2040 PM Peak_no dev)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Brentwood Road (S)															
30	L2	All MCs	16	20.0	16	20.0	0.017	5.3	LOS A	0.1	0.5	0.24	0.51	0.24	43.5
1	R2	All MCs	5	0.0	5	0.0	0.017	5.4	LOS A	0.1	0.5	0.24	0.51	0.24	50.9
Approach			21	15.0	21	15.0	0.017	5.3	LOS A	0.1	0.5	0.24	0.51	0.24	46.1
East: Crystal Brook Road (E)															
10	L2	All MCs	3	0.0	3	0.0	0.069	6.4	LOS A	0.0	0.0	0.00	0.01	0.00	65.5
22	T1	All MCs	135	7.0	135	7.0	0.069	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	69.6
Approach			138	6.8	138	6.8	0.069	0.2	NA	0.0	0.0	0.00	0.01	0.00	69.4
West: Crystal Brook Road (W)															
28	T1	All MCs	240	4.0	240	4.0	0.136	0.1	LOS A	0.2	1.3	0.06	0.06	0.06	69.3
29	R2	All MCs	18	31.0	18	31.0	0.136	3.4	LOS A	0.2	1.3	0.06	0.06	0.06	45.3
Approach			258	5.9	258	5.9	0.136	0.3	NA	0.2	1.3	0.06	0.06	0.06	66.9
All Vehicles			417	6.7	417	6.7	0.136	0.5	NA	0.2	1.3	0.05	0.07	0.05	65.8

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

MOVEMENT SUMMARY

Site: 04 [1-4_Crystal Brook Road/Kelvin Road (Site Folder: 2040 PM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Kelvin Road (S)															
30	L2	All MCs	117	3.0	117	3.0	0.075	5.7	LOS A	0.3	2.4	0.12	0.54	0.12	51.6
32	R2	All MCs	337	5.0	337	5.0	0.418	9.1	LOS A	2.1	16.6	0.54	0.81	0.70	49.1
Approach			454	4.5	454	4.5	0.418	8.3	LOS A	2.1	16.6	0.43	0.74	0.55	49.7
East: Crystal Brook Road (E)															
21	L2	All MCs	375	5.0	375	5.0	0.215	5.7	LOS A	0.0	0.0	0.00	0.52	0.00	51.7
22	T1	All MCs	41	3.0	41	3.0	0.215	0.1	LOS A	0.0	0.0	0.00	0.52	0.00	55.4
Approach			416	4.8	416	4.8	0.215	5.1	NA	0.0	0.0	0.00	0.52	0.00	52.1
West: Crystal Brook Road (W)															
28	T1	All MCs	26	18.0	26	18.0	0.191	2.0	LOS A	0.9	7.2	0.51	0.64	0.51	53.6
29	R2	All MCs	194	6.0	194	6.0	0.191	7.7	LOS A	0.9	7.2	0.51	0.64	0.51	50.3
Approach			220	7.4	220	7.4	0.191	7.0	NA	0.9	7.2	0.51	0.64	0.51	50.6
All Vehicles			1089	5.2	1089	5.2	0.418	6.8	NA	2.1	16.6	0.28	0.64	0.33	50.8

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

MOVEMENT SUMMARY

Site: 05 [I-5_Welshpool Road East/Crystal Brook Road_EB (Site Folder: 2040 PM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-5 (Network Folder: 2040 PM Peak_no dev)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Central Median															
3	R2	All MCs	357	5.0	357	5.0	0.186	3.3	LOS A	0.0	0.0	0.00	0.49	0.00	48.9
Approach			357	5.0	357	5.0	0.186	3.3	NA	0.0	0.0	0.00	0.49	0.00	48.9
West: Welshpool Road East (W)															
10	L2	All MCs	49	0.0	49	0.0	0.246	7.0	LOS A	0.0	0.0	0.00	0.22	0.00	71.1
11	T1	All MCs	858	5.0	858	5.0	0.246	1.1	LOS A	0.0	0.0	0.00	0.19	0.00	75.6
12	R2	All MCs	17	14.0	17	14.0	0.015	8.5	LOS A	0.1	0.5	0.43	0.62	0.43	58.8
Approach			924	4.9	924	4.9	0.246	1.5	NA	0.1	0.5	0.01	0.20	0.01	75.2
All Vehicles			1281	4.9	1281	4.9	0.246	2.0	NA	0.1	0.5	0.01	0.28	0.01	69.0

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

MOVEMENT SUMMARY

Site: 05 [I-5_Welshpool Road East/Crystal Brook Road_WB (Site Folder: 2040 PM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-5 (Network Folder: 2040 PM Peak_no dev)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Crystal Brook Road (S)															
1	L2	All MCs	5	0.0	5	0.0	0.005	6.7	LOS A	0.0	0.1	0.40	0.56	0.40	56.6
2	T1	All MCs	357	5.0	357	5.0	0.634	14.5	LOS B	3.9	28.5	0.81	1.11	1.49	40.9
Approach			362	4.9	362	4.9	0.634	14.4	LOS B	3.9	28.5	0.80	1.10	1.47	41.2
East: Welshpool Road East (E)															
3	L2	All MCs	377	5.0	377	5.0	0.214	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	57.7
4	T1	All MCs	719	6.0	719	6.0	0.201	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach			1096	5.7	1096	5.7	0.214	2.4	NA	0.0	0.0	0.00	0.20	0.00	65.1
North: Central Median															
8	T1	All MCs	17	14.0	17	14.0	0.041	9.6	LOS A	0.1	1.0	0.70	0.82	0.70	39.6
Approach			17	14.0	17	14.0	0.041	9.6	LOS A	0.1	1.0	0.70	0.82	0.70	39.6
All Vehicles			1475	5.6	1475	5.6	0.634	5.4	NA	3.9	28.5	0.21	0.43	0.37	59.9

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

MOVEMENT SUMMARY

Site: 06 [I-6_Welshpool Road East/Lewis Road_EB (Site Folder: 2040 PM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-6 (Network Folder: 2040 PM Peak_no dev)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Central Median															
2	T1	All MCs	281	3.0	281	3.0	0.357	5.6	LOS A	1.7	12.1	0.60	0.80	0.74	51.5
Approach			281	3.0	281	3.0	0.357	5.6	LOS A	1.7	12.1	0.60	0.80	0.74	51.5
North: Lewis Road (N)															
1	L2	All MCs	262	5.0	262	5.0	0.226	7.9	LOS A	1.0	7.7	0.44	0.67	0.44	57.8
8	T1	All MCs	352	6.0	352	6.0	0.750	20.7	LOS C	5.1	37.3	0.89	1.23	2.00	39.3
Approach			614	5.6	614	5.6	0.750	15.3	LOS C	5.1	37.3	0.70	0.99	1.34	48.6
West: Welshpool Road East (W)															
3	L2	All MCs	336	3.0	336	3.0	0.318	9.0	LOS A	1.5	11.4	0.45	0.67	0.45	58.6
4	T1	All MCs	653	5.0	653	5.0	0.177	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach			988	4.3	988	4.3	0.318	3.1	LOS A	1.5	11.4	0.15	0.23	0.15	71.1
All Vehicles			1883	4.5	1883	4.5	0.750	7.4	NA	5.1	37.3	0.40	0.56	0.63	61.1

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

MOVEMENT SUMMARY

Site: 06 [I-6_Welshpool Road East/Lewis Road_WB (Site Folder: 2040 PM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-6 (Network Folder: 2040 PM Peak_no dev)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Welshpool Road East (E)															
11	T1	All MCs	454	7.0	454	7.0	0.129	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
12	R2	All MCs	281	3.0	281	3.0	0.257	8.4	LOS A	1.1	8.6	0.49	0.69	0.49	58.4
Approach			735	5.5	735	5.5	0.257	3.2	NA	1.1	8.6	0.19	0.27	0.19	73.5
North: Central Median															
3	R2	All MCs	352	6.0	352	6.0	0.187	2.7	LOS A	0.0	0.0	0.00	0.50	0.00	53.3
Approach			352	6.0	352	6.0	0.187	2.7	NA	0.0	0.0	0.00	0.50	0.00	53.3
All Vehicles			1086	5.6	1086	5.6	0.257	3.1	NA	1.1	8.6	0.13	0.34	0.13	67.5

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

MOVEMENT SUMMARY

Site: 07 [1-7_Crystal Brook Road/Victoria Road (Site Folder: 2040 PM Peak_no dev)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Victoria Road (S)															
30	L2	All MCs	7	0.0	7	0.0	0.010	6.0	LOS A	0.0	0.3	0.29	0.55	0.29	52.1
32	R2	All MCs	4	0.0	4	0.0	0.010	7.3	LOS A	0.0	0.3	0.29	0.55	0.29	51.8
Approach			12	0.0	12	0.0	0.010	6.5	LOS A	0.0	0.3	0.29	0.55	0.29	52.0
East: Crystal Brook Road (E)															
21	L2	All MCs	16	0.0	16	0.0	0.088	5.6	LOS A	0.0	0.0	0.00	0.06	0.00	57.0
22	T1	All MCs	152	4.0	152	4.0	0.088	0.0	LOS A	0.0	0.0	0.00	0.06	0.00	59.4
Approach			167	3.6	167	3.6	0.088	0.5	NA	0.0	0.0	0.00	0.06	0.00	59.2
West: Crystal Brook Road (W)															
28	T1	All MCs	257	8.0	257	8.0	0.168	0.1	LOS A	0.3	2.1	0.08	0.10	0.08	59.1
29	R2	All MCs	31	19.0	31	19.0	0.168	6.6	LOS A	0.3	2.1	0.08	0.10	0.08	50.3
Approach			287	9.2	287	9.2	0.168	0.8	NA	0.3	2.1	0.08	0.10	0.08	58.1
All Vehicles			466	7.0	466	7.0	0.168	0.9	NA	0.3	2.1	0.06	0.10	0.06	58.3

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

MOVEMENT SUMMARY

Site: 01 [I-1_Tonkin Highway/Welshpool Road East_EB (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-1 (Network Folder: 2040 AM Peak)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 60 seconds (Network User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tonkin Highway (S)															
1	L2	All MCs	1055	8.0	1055	8.0	* 0.726	24.1	LOS C	14.3	116.8	0.90	0.87	0.95	44.5
3	R2	All MCs	163	9.0	163	9.0	0.118	18.4	LOS B	1.5	12.2	0.64	0.72	0.64	41.7
Approach			1218	8.1	1218	8.1	0.726	23.3	LOS C	14.3	116.8	0.86	0.85	0.91	44.3
East: Welshpool Road East															
5	T1	All MCs	963	4.0	963	4.0	0.663	9.2	LOS A	9.0	68.8	0.67	0.58	0.67	53.7
6	R2	All MCs	404	6.0	404	6.0	* 0.723	14.8	LOS B	4.1	34.4	0.65	0.77	0.70	42.3
Approach			1367	4.6	1367	4.6	0.723	10.8	LOS B	9.0	68.8	0.66	0.64	0.68	49.7
West: Welshpool Road East (W)															
10	L2	All MCs	67	22.0	67	22.0	0.072	10.1	LOS B	0.5	5.0	0.40	0.66	0.40	50.0
11	T1	All MCs	708	9.0	708	9.0	0.360	14.8	LOS B	5.1	41.8	0.75	0.62	0.75	45.0
Approach			776	10.1	776	10.1	0.360	14.4	LOS B	5.1	41.8	0.72	0.62	0.72	45.7
All Vehicles			3361	7.2	3361	7.2	0.726	16.2	LOS B	14.3	116.8	0.75	0.71	0.77	46.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
P1B	Slip/ Bypass	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
North: Tonkin Highway (N)											
P3	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
West: Welshpool Road East (W)											
P4	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
All Pedestrians		4	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 01 [I-1_Tonkin Highway/Welshpool Road East_WB (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-1 (Network Folder: 2040 AM Peak)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 60 seconds (Network User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Welshpool Road East (E)															
4	L2	All MCs	164	12.0	164	12.0	0.160	9.9	LOS A	1.4	11.6	0.41	0.68	0.41	52.8
5	T1	All MCs	1256	4.0	1256	4.0	0.428	7.7	LOS A	7.5	57.3	0.58	0.50	0.58	54.4
Approach			1420	4.9	1420	4.9	0.428	7.9	LOS A	7.5	57.3	0.56	0.52	0.56	54.0
North: Tonkin Highway (N)															
7	L2	All MCs	483	16.0	483	16.0	* 0.639	30.8	LOS C	7.0	62.0	0.95	0.84	1.00	39.8
9	R2	All MCs	112	20.0	112	20.0	0.173	27.6	LOS C	1.4	13.0	0.83	0.74	0.83	34.8
Approach			595	16.8	595	16.8	0.639	30.2	LOS C	7.0	62.0	0.93	0.82	0.97	39.2
West: Welshpool Road East															
11	T1	All MCs	638	9.0	638	9.0	0.314	3.9	LOS A	3.2	25.8	0.34	0.29	0.34	62.0
12	R2	All MCs	234	30.0	234	30.0	* 0.650	14.0	LOS B	2.2	23.9	0.57	0.76	0.66	36.1
Approach			872	14.6	872	14.6	0.650	6.6	LOS A	3.2	25.8	0.40	0.42	0.43	52.0
All Vehicles			2886	10.3	2886	10.3	0.650	12.1	LOS B	7.5	62.0	0.59	0.55	0.61	48.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
East: Welshpool Road East (E)											
P2	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
North: Tonkin Highway (N)											
P3	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
P3B	Slip/ Bypass	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
All Pedestrians		4	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 02 [I-2_Tonkin Highway/Kelvin Road_EB (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-2 (Network Folder: 2040 AM Peak)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 60 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tonkin Highway (S)															
1	L2	All MCs	556	11.0	556	11.0	0.723	17.0	LOS B	12.0	101.3	0.87	0.88	0.92	48.0
3	R2	All MCs	302	4.0	302	4.0	* 0.672	30.0	LOS C	8.5	65.2	0.96	0.85	1.01	33.0
Approach			858	8.5	858	8.5	0.723	21.6	LOS C	12.0	101.3	0.90	0.87	0.95	43.7
East: Kelvin Road															
5	T1	All MCs	1160	8.0	1160	8.0	* 0.726	9.7	LOS A	11.5	94.0	0.82	0.73	0.85	52.9
6	R2	All MCs	38	33.0	38	33.0	0.312	28.7	LOS C	0.9	10.5	0.72	0.68	0.72	30.1
Approach			1198	8.8	1198	8.8	0.726	10.3	LOS B	11.5	94.0	0.81	0.73	0.85	51.7
West: Kelvin Road (W)															
10	L2	All MCs	586	27.0	586	27.0	0.410	7.3	LOS A	0.0	0.0	0.00	0.56	0.00	51.1
11	T1	All MCs	440	12.0	440	12.0	* 0.541	29.2	LOS C	3.3	27.5	0.99	0.78	1.01	33.2
Approach			1026	20.6	1026	20.6	0.541	16.7	LOS B	3.3	27.5	0.42	0.65	0.43	44.6
All Vehicles			3082	12.6	3082	12.6	0.726	15.6	LOS B	12.0	101.3	0.71	0.74	0.74	46.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
North: Tonkin Highway (N)											
P3	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
West: Kelvin Road (W)											
P4	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
All Pedestrians		3	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 02 [I-2_Tonkin Highway/Kelvin Road_WB (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-2 (Network Folder: 2040 AM Peak)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 60 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Kelvin Road (E)															
4	L2	All MCs	158	6.0	158	6.0	0.125	7.4	LOS A	0.5	4.2	0.23	0.64	0.23	56.1
5	T1	All MCs	343	8.0	343	8.0	0.350	21.7	LOS C	3.7	30.1	0.88	0.70	0.88	38.4
Approach			501	7.4	501	7.4	0.350	17.2	LOS B	3.7	30.1	0.67	0.68	0.67	45.2
North: Tonkin Highway (N)															
7	L2	All MCs	56	33.0	56	33.0	0.065	9.6	LOS A	0.4	5.1	0.36	0.65	0.36	47.8
9	R2	All MCs	855	22.0	855	22.0	* 0.756	22.0	LOS C	11.3	107.0	0.81	0.89	0.95	38.8
Approach			911	22.7	911	22.7	0.756	21.3	LOS C	11.3	107.0	0.79	0.88	0.91	39.6
West: Kelvin Rd															
11	T1	All MCs	599	12.0	599	12.0	* 0.736	16.0	LOS B	7.9	65.9	0.84	0.72	0.87	45.7
12	R2	All MCs	143	32.0	143	32.0	0.368	9.2	LOS A	0.5	5.3	0.22	0.61	0.22	38.1
Approach			742	15.9	742	15.9	0.736	14.7	LOS B	7.9	65.9	0.72	0.70	0.75	44.0
All Vehicles			2154	16.8	2154	16.8	0.756	18.1	LOS B	11.3	107.0	0.74	0.77	0.80	42.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
East: Kelvin Road (E)											
P2	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
North: Tonkin Highway (N)											
P3	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
All Pedestrians		3	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 03a [I-3a_Welshpool Road East/Crystal Brook Road_EB (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-3 (Network Folder: 2040 AM Peak)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Central Median															
3	R2	All MCs	391	4.0	222	4.0	0.499	11.6	LOS B	2.6	19.6	0.71	0.96	1.08	45.8
Approach			391	4.0	222	4.0	0.499	11.6	LOS B	2.6	19.6	0.71	0.96	1.08	45.8
West: Welshpool Road East (W)															
11	T1	All MCs	591	11.0	591	11.0	0.170	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
12	R2	All MCs	227	11.0	227	11.0	0.181	7.0	LOS A	0.0	0.0	0.00	0.65	0.00	61.9
Approach			818	11.0	818	11.0	0.181	2.0	NA	0.0	0.0	0.00	0.18	0.00	76.3
All Vehicles			1208	8.7	1040	10.2	0.499	4.0	NA	2.6	19.6	0.15	0.35	0.23	69.8

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

MOVEMENT SUMMARY

Site: 03a [I-3a_Welshpool Road East/Crystal Brook Road_WB (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-3 (Network Folder: 2040 AM Peak)]

NA
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Crystal Brook Road (S)															
1	L2	All MCs	525	5.0	525	5.0	0.575	9.8	LOS A	4.9	38.5	0.64	1.04	0.98	49.9
2	T1	All MCs	391	4.0	391	4.0	1.744	690.3	LOS F	6.9	49.7	1.00	7.03	26.34	0.2
Approach			916	4.6	916	4.6	1.744	300.0	LOS F	6.9	49.7	0.80	3.60	11.80	3.6
East: Welshpool Road East (E)															
3	L2	All MCs	111	4.0	111	4.0	0.264	7.1	LOS A	0.0	0.0	0.00	0.15	0.00	74.7
4	T1	All MCs	864	5.0	864	5.0	0.264	0.1	LOS A	0.0	0.0	0.00	0.06	0.00	78.6
Approach			975	4.9	975	4.9	0.264	0.9	NA	0.0	0.0	0.00	0.07	0.00	78.4
North: Central Median															
8	T1	All MCs	227	11.0	227	11.0	0.480	10.9	LOS B	2.2	16.6	0.79	0.98	1.16	6.0
Approach			227	11.0	227	11.0	0.480	10.9	LOS B	2.2	16.6	0.79	0.98	1.16	6.0
All Vehicles			2118	5.4	2118	5.4	1.744	131.3	NA	6.9	49.7	0.43	1.69	5.23	13.3

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

MOVEMENT SUMMARY

Site: 03b [I-3b_Crystal Brook Road/Brentwood Road (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-3 (Network Folder: 2040 AM Peak)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Brentwood Road (S)															
30	L2	All MCs	436	31.0	436	31.0	0.869	17.9	LOS C	7.7	79.3	0.91	1.59	2.38	34.0
1	R2	All MCs	2	50.0	2	50.0	0.869	21.6	LOS C	7.7	79.3	0.91	1.59	2.38	34.8
Approach			438	31.1	438	31.1	0.869	17.9	LOS C	7.7	79.3	0.91	1.59	2.38	34.0
East: Crystal Brook Road (E)															
10	L2	All MCs	9	14.0	9	14.0	0.337	6.7	LOS A	0.0	0.0	0.00	0.01	0.00	59.0
22	T1	All MCs	477	3.0	477	3.0	0.337	0.1	LOS A	0.0	0.0	0.00	0.01	0.00	69.4
Approach			486	3.2	486	3.2	0.337	0.2	NA	0.0	0.0	0.00	0.01	0.00	68.9
West: Crystal Brook Road (W)															
28	T1	All MCs	185	4.0	185	4.0	0.297	2.7	LOS A	1.6	14.0	0.54	0.59	0.54	60.9
29	R2	All MCs	169	25.0	169	25.0	0.297	6.0	LOS A	1.6	14.0	0.54	0.59	0.54	42.0
Approach			355	14.0	355	14.0	0.297	4.3	NA	1.6	14.0	0.54	0.59	0.54	50.1
All Vehicles			1279	15.8	1279	15.8	0.869	7.4	NA	7.7	79.3	0.46	0.71	0.97	47.4

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

MOVEMENT SUMMARY

Site: 03 [I-3_Welshpool Road East/Crystal Brook Road/ Brentwood Road (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

NA
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Brentwood Road (S)															
4	L2	All MCs	299	31.0	299	31.0	0.639	8.3	LOS A	3.7	37.8	0.76	0.94	1.09	46.8
2	T1	All MCs	137	31.0	137	31.0	0.639	8.2	LOS A	3.7	37.8	0.76	0.94	1.09	47.7
6	R2	All MCs	2	50.0	2	50.0	0.639	14.7	LOS B	3.7	37.8	0.76	0.94	1.09	40.7
Approach			438	31.1	438	31.1	0.639	8.3	LOS A	3.7	37.8	0.76	0.94	1.09	47.0
East: Crystal Brook Road (E)															
7	L2	All MCs	9	14.0	9	14.0	0.246	7.1	LOS A	1.1	8.1	0.63	0.58	0.63	52.0
8	T1	All MCs	224	3.0	224	3.0	0.246	6.4	LOS A	1.2	8.8	0.63	0.60	0.63	61.1
6	R2	All MCs	252	3.0	252	3.0	0.246	14.4	LOS B	1.2	8.8	0.61	0.75	0.61	55.7
Approach			485	3.2	485	3.2	0.246	10.5	LOS B	1.2	8.8	0.62	0.68	0.62	58.0
North: Welshpool Road East (N)															
7	L2	All MCs	67	4.0	67	4.0	0.362	5.7	LOS A	1.9	14.7	0.38	0.63	0.38	57.9
8	T1	All MCs	43	4.0	43	4.0	0.362	5.8	LOS A	1.9	14.7	0.38	0.63	0.38	52.0
9	R2	All MCs	864	5.0	864	5.0	0.362	13.9	LOS B	1.9	14.7	0.39	0.65	0.39	58.0
Approach			975	4.9	975	4.9	0.362	12.9	LOS B	1.9	14.7	0.39	0.64	0.39	57.7
West: Welshpool Road East (W)															
10	L2	All MCs	591	11.0	591	11.0	0.165	5.1	LOS A	0.0	0.0	0.00	0.48	0.00	65.6
2	T1	All MCs	103	11.0	103	11.0	0.095	6.2	LOS A	0.5	3.8	0.40	0.52	0.40	59.7
3	R2	All MCs	124	11.0	124	11.0	0.095	14.0	LOS B	0.5	3.8	0.40	0.63	0.40	51.1
Approach			818	11.0	818	11.0	0.165	6.6	LOS A	0.5	3.8	0.11	0.51	0.11	62.0
All Vehicles			2716	10.7	2716	10.7	0.639	9.8	LOS A	3.7	37.8	0.41	0.66	0.46	56.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 04 [1-4_Crystal Brook Road/Kelvin Road (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Kelvin Road (S)															
30	L2	All MCs	231	8.0	231	8.0	0.155	5.9	LOS A	0.7	5.6	0.14	0.54	0.14	50.2
32	R2	All MCs	331	5.0	331	5.0	0.439	9.8	LOS A	2.3	17.8	0.57	0.85	0.77	48.6
Approach			561	6.2	561	6.2	0.439	8.2	LOS A	2.3	17.8	0.39	0.72	0.51	49.3
East: Crystal Brook Road (E)															
21	L2	All MCs	351	7.0	351	7.0	0.212	5.7	LOS A	0.0	0.0	0.00	0.51	0.00	51.2
22	T1	All MCs	48	10.0	48	10.0	0.212	0.1	LOS A	0.0	0.0	0.00	0.51	0.00	55.5
Approach			399	7.4	399	7.4	0.212	5.0	NA	0.0	0.0	0.00	0.51	0.00	51.7
West: Crystal Brook Road (W)															
28	T1	All MCs	87	10.0	87	10.0	0.204	1.8	LOS A	1.0	8.4	0.50	0.58	0.50	54.6
29	R2	All MCs	177	6.0	177	6.0	0.204	7.6	LOS A	1.0	8.4	0.50	0.58	0.50	51.1
Approach			264	7.3	264	7.3	0.204	5.7	NA	1.0	8.4	0.50	0.58	0.50	52.2
All Vehicles			1224	6.8	1224	6.8	0.439	6.6	NA	2.3	17.8	0.29	0.62	0.34	50.7

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

MOVEMENT SUMMARY

Site: 05 [I-5_Welshpool Road East/Crystal Brook Road_EB (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-5 (Network Folder: 2040 AM Peak)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Central Median															
3	R2	All MCs	414	5.0	414	5.0	0.218	3.1	LOS A	0.0	0.0	0.00	0.49	0.00	49.0
Approach			414	5.0	414	5.0	0.218	3.1	NA	0.0	0.0	0.00	0.49	0.00	49.0
West: Welshpool Road East (W)															
10	L2	All MCs	20	0.0	20	0.0	0.192	7.0	LOS A	0.0	0.0	0.00	0.20	0.00	71.6
11	T1	All MCs	679	6.0	679	6.0	0.192	1.0	LOS A	0.0	0.0	0.00	0.18	0.00	75.5
12	R2	All MCs	6	0.0	6	0.0	0.005	8.1	LOS A	0.0	0.2	0.45	0.61	0.45	58.7
Approach			705	5.8	705	5.8	0.192	1.3	NA	0.0	0.2	0.00	0.18	0.00	75.3
All Vehicles			1119	5.5	1119	5.5	0.218	1.9	NA	0.0	0.2	0.00	0.30	0.00	66.9

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

MOVEMENT SUMMARY

Site: 05 [I-5_Welshpool Road East/Crystal Brook Road_WB (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-5 (Network Folder: 2040 AM Peak)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Crystal Brook Road (S)															
1	L2	All MCs	9	13.0	9	13.0	0.012	8.5	LOS A	0.0	0.4	0.49	0.63	0.49	51.6
2	T1	All MCs	414	5.0	414	5.0	0.951	41.8	LOS E	12.7	91.8	0.98	1.96	4.45	25.5
Approach			423	5.2	423	5.2	0.951	41.1	LOS E	12.7	91.8	0.97	1.93	4.36	26.0
East: Welshpool Road East (E)															
3	L2	All MCs	360	7.0	360	7.0	0.208	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	57.0
4	T1	All MCs	949	5.0	949	5.0	0.258	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.8
Approach			1309	5.5	1309	5.5	0.258	1.9	NA	0.0	0.0	0.00	0.16	0.00	65.7
North: Central Median															
8	T1	All MCs	6	0.0	6	0.0	0.016	10.0	LOS A	0.1	0.4	0.75	0.82	0.75	44.0
Approach			6	0.0	6	0.0	0.016	10.0	LOS A	0.1	0.4	0.75	0.82	0.75	44.0
All Vehicles			1739	5.4	1739	5.4	0.951	11.5	NA	12.7	91.8	0.24	0.59	1.06	54.0

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

MOVEMENT SUMMARY

Site: 05 [I-5_Welshpool Road East/Crystal Brook Road (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 60 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Crystal Brook Road (S)															
1	L2	All MCs	9	13.0	9	13.0	0.023	31.0	LOS C	0.2	1.9	0.74	0.66	0.74	43.0
3	R2	All MCs	414	5.0	414	5.0	* 0.846	44.3	LOS D	13.9	108.2	1.00	1.00	1.30	37.9
Approach			423	5.2	423	5.2	0.846	44.0	LOS D	13.9	108.2	0.99	0.99	1.29	35.0
East: Welshpool Road East (E)															
3	L2	All MCs	360	7.0	360	7.0	0.208	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	57.0
4	T1	All MCs	949	5.0	949	5.0	* 0.815	28.4	LOS C	14.9	116.2	0.98	0.96	1.18	48.3
Approach			1309	5.5	1309	5.5	0.815	24.0	LOS C	14.9	116.2	0.71	0.86	0.86	48.1
West: Welshpool Road East (W)															
10	L2	All MCs	20	0.0	20	0.0	0.192	6.9	LOS A	0.0	0.0	0.00	0.17	0.00	70.6
11	T1	All MCs	679	6.0	679	6.0	0.192	1.0	LOS A	0.0	0.0	0.00	0.17	0.00	75.9
12	R2	All MCs	6	0.0	6	0.0	* 0.034	35.3	LOS D	0.2	1.3	0.93	0.65	0.93	40.6
Approach			705	5.8	705	5.8	0.192	1.5	LOS A	0.2	1.3	0.01	0.17	0.01	75.2
All Vehicles			2438	5.6	2438	5.6	0.846	20.1	LOS C	14.9	116.2	0.56	0.68	0.69	50.0

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 06 [I-6_Welshpool Road East/Lewis Road_EB (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-6 (Network Folder: 2040 AM Peak)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Central Median															
2	T1	All MCs	227	5.0	227	5.0	0.245	3.8	LOS A	1.0	7.0	0.50	0.65	0.50	53.0
Approach			227	5.0	227	5.0	0.245	3.8	LOS A	1.0	7.0	0.50	0.65	0.50	53.0
North: Lewis Road (N)															
1	L2	All MCs	223	3.0	223	3.0	0.174	7.4	LOS A	0.8	5.8	0.36	0.62	0.36	58.9
8	T1	All MCs	313	4.0	313	4.0	0.550	14.0	LOS B	3.0	21.6	0.78	1.03	1.26	45.8
Approach			536	3.6	536	3.6	0.550	11.3	LOS B	3.0	21.6	0.60	0.86	0.88	52.6
West: Welshpool Road East (W)															
3	L2	All MCs	511	7.0	511	7.0	0.472	9.7	LOS A	3.4	26.8	0.49	0.68	0.57	57.0
4	T1	All MCs	476	7.0	476	7.0	0.132	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach			986	7.0	986	7.0	0.472	5.0	LOS A	3.4	26.8	0.25	0.35	0.29	66.1
All Vehicles			1749	5.7	1749	5.7	0.550	6.8	NA	3.4	26.8	0.39	0.55	0.50	61.0

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

MOVEMENT SUMMARY

Site: 06 [I-6_Welshpool Road East/Lewis Road_WB (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-6 (Network Folder: 2040 AM Peak)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Welshpool Road East (E)															
11	T1	All MCs	701	7.0	701	7.0	0.198	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
12	R2	All MCs	227	5.0	227	5.0	0.177	8.1	LOS A	0.8	6.4	0.44	0.67	0.44	58.8
Approach			928	6.5	928	6.5	0.198	2.0	NA	0.8	6.4	0.11	0.16	0.11	76.0
North: Central Median															
3	R2	All MCs	313	4.0	313	4.0	0.163	3.0	LOS A	0.0	0.0	0.00	0.51	0.00	54.7
Approach			313	4.0	313	4.0	0.163	3.0	NA	0.0	0.0	0.00	0.51	0.00	54.7
All Vehicles			1241	5.9	1241	5.9	0.198	2.3	NA	0.8	6.4	0.08	0.25	0.08	71.4

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

MOVEMENT SUMMARY

Site: 06 [I-6_Welshpool Road East/Lewis Road (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Welshpool Road East (E)															
11	T1	All MCs	701	7.0	701	7.0	0.198	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
12	R2	All MCs	227	5.0	227	5.0	* 0.573	38.0	LOS D	8.1	63.0	0.94	0.82	0.94	39.9
Approach			928	6.5	928	6.5	0.573	9.3	LOS A	8.1	63.0	0.23	0.20	0.23	64.1
North: Lewis Road (N)															
1	L2	All MCs	223	3.0	223	3.0	0.174	8.8	LOS A	2.1	15.8	0.32	0.67	0.32	58.2
3	R2	All MCs	313	4.0	313	4.0	* 0.567	32.8	LOS C	10.4	80.3	0.89	0.82	0.89	42.6
Approach			536	3.6	536	3.6	0.567	22.8	LOS C	10.4	80.3	0.65	0.76	0.65	48.0
West: Welshpool Road East (W)															
3	L2	All MCs	511	7.0	511	7.0	0.405	10.1	LOS B	5.8	46.1	0.40	0.71	0.40	56.5
4	T1	All MCs	476	7.0	476	7.0	* 0.555	29.6	LOS C	8.4	66.7	0.93	0.77	0.93	48.6
Approach			986	7.0	986	7.0	0.555	19.5	LOS B	8.4	66.7	0.65	0.74	0.65	52.4
All Vehicles			2451	6.1	2451	6.1	0.573	16.4	LOS B	10.4	80.3	0.49	0.54	0.49	55.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 06 [I-6_Welshpool Road East/Lewis Road (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

NA
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Welshpool Road East (E)															
11	T1	All MCs	701	7.0	701	7.0	0.196	5.7	LOS A	0.0	0.0	0.00	0.47	0.00	66.2
12	R2	All MCs	227	5.0	227	5.0	0.128	11.6	LOS B	0.0	0.0	0.00	0.70	0.00	59.0
Approach			928	6.5	928	6.5	0.196	7.2	LOS A	0.0	0.0	0.00	0.53	0.00	64.2
North: Lewis Road (N)															
1	L2	All MCs	223	3.0	223	3.0	0.253	7.2	LOS A	1.4	10.5	0.60	0.64	0.60	60.8
3	R2	All MCs	313	4.0	313	4.0	0.299	13.7	LOS B	1.8	13.6	0.61	0.70	0.61	54.8
Approach			536	3.6	536	3.6	0.299	11.0	LOS B	1.8	13.6	0.60	0.68	0.60	57.1
West: Welshpool Road East (W)															
3	L2	All MCs	511	7.0	511	7.0	0.387	6.9	LOS A	2.7	21.5	0.48	0.56	0.48	59.9
4	T1	All MCs	476	7.0	476	7.0	0.387	7.6	LOS A	2.7	21.5	0.51	0.54	0.51	62.4
Approach			986	7.0	986	7.0	0.387	7.2	LOS A	2.7	21.5	0.50	0.55	0.50	61.1
All Vehicles			2451	6.1	2451	6.1	0.387	8.0	LOS A	2.7	21.5	0.33	0.57	0.33	61.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 07 [1-7_Crystal Brook Road/Victoria Road (Site Folder: 2040 AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Victoria Road (S)															
30	L2	All MCs	93	5.0	93	5.0	0.259	7.0	LOS A	1.0	8.0	0.47	0.70	0.47	49.9
32	R2	All MCs	138	6.0	138	6.0	0.259	8.4	LOS A	1.0	8.0	0.47	0.70	0.47	49.3
Approach			231	5.6	231	5.6	0.259	7.8	LOS A	1.0	8.0	0.47	0.70	0.47	49.5
East: Crystal Brook Road (E)															
21	L2	All MCs	46	0.0	46	0.0	0.176	5.6	LOS A	0.0	0.0	0.00	0.09	0.00	56.6
22	T1	All MCs	271	9.0	271	9.0	0.176	0.0	LOS A	0.0	0.0	0.00	0.09	0.00	59.1
Approach			317	7.7	317	7.7	0.176	0.9	NA	0.0	0.0	0.00	0.09	0.00	58.7
West: Crystal Brook Road (W)															
28	T1	All MCs	126	7.0	126	7.0	0.115	0.7	LOS A	0.4	3.4	0.27	0.31	0.27	57.6
29	R2	All MCs	48	19.0	48	19.0	0.115	7.3	LOS A	0.4	3.4	0.27	0.31	0.27	49.2
Approach			175	10.3	175	10.3	0.115	2.5	NA	0.4	3.4	0.27	0.31	0.27	55.0
All Vehicles			722	7.7	722	7.7	0.259	3.5	NA	1.0	8.0	0.22	0.34	0.22	54.6

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

MOVEMENT SUMMARY

Site: 01 [I-1_Tonkin Highway/Welshpool Road East_EB (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-1 (Network Folder: 2040 PM Peak)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 60 seconds (Network User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tonkin Highway (S)															
1	L2	All MCs	703	13.0	703	13.0	* 0.735	30.1	LOS C	10.6	96.4	0.96	0.89	1.08	40.7
3	R2	All MCs	208	5.0	208	5.0	0.197	23.8	LOS C	2.3	18.1	0.78	0.75	0.78	37.1
Approach			912	11.2	912	11.2	0.735	28.6	LOS C	10.6	96.4	0.92	0.86	1.01	40.2
East: Welshpool Road East															
5	T1	All MCs	560	8.0	560	8.0	0.315	3.8	LOS A	2.3	19.6	0.30	0.26	0.30	62.2
6	R2	All MCs	278	6.0	278	6.0	* 0.722	30.6	LOS C	4.4	36.2	0.93	0.92	1.21	32.1
Approach			838	7.3	838	7.3	0.722	12.7	LOS B	4.4	36.2	0.51	0.48	0.60	47.4
West: Welshpool Road East (W)															
10	L2	All MCs	96	13.0	96	13.0	0.100	11.1	LOS B	1.0	8.1	0.48	0.68	0.48	51.5
11	T1	All MCs	1551	4.0	1551	4.0	0.564	11.4	LOS B	10.9	83.3	0.72	0.62	0.72	49.1
Approach			1646	4.5	1646	4.5	0.564	11.3	LOS B	10.9	83.3	0.71	0.63	0.71	49.4
All Vehicles			3396	7.0	3396	7.0	0.735	16.3	LOS B	10.9	96.4	0.71	0.65	0.76	45.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
P1B	Slip/ Bypass	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
North: Tonkin Highway (N)											
P3	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
West: Welshpool Road East (W)											
P4	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
All Pedestrians		4	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 01 [I-1_Tonkin Highway/Welshpool Road East_WB (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-1 (Network Folder: 2040 PM Peak)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 60 seconds (Network User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Welshpool Road East (E)															
4	L2	All MCs	268	4.0	268	4.0	0.257	9.2	LOS A	1.9	14.4	0.37	0.68	0.37	56.0
5	T1	All MCs	782	8.0	782	8.0	0.295	8.1	LOS A	4.6	38.0	0.57	0.48	0.57	53.6
Approach			1051	7.0	1051	7.0	0.295	8.4	LOS A	4.6	38.0	0.52	0.53	0.52	54.6
North: Tonkin Highway (N)															
7	L2	All MCs	665	9.0	665	9.0	* 0.735	31.3	LOS C	10.1	87.0	0.97	0.89	1.09	40.9
9	R2	All MCs	56	19.0	56	19.0	0.070	25.1	LOS C	0.6	5.7	0.78	0.70	0.78	36.5
Approach			721	9.8	721	9.8	0.735	30.8	LOS C	10.1	87.0	0.95	0.88	1.07	40.7
West: Welshpool Road East															
11	T1	All MCs	1259	4.0	1259	4.0	0.623	4.3	LOS A	8.1	61.8	0.46	0.41	0.46	61.2
12	R2	All MCs	500	8.0	500	8.0	* 0.754	8.5	LOS A	2.4	20.4	0.28	0.68	0.35	47.7
Approach			1759	5.1	1759	5.1	0.754	5.5	LOS A	8.1	61.8	0.41	0.49	0.43	56.6
All Vehicles			3531	6.6	3531	6.6	0.754	11.5	LOS B	10.1	87.0	0.55	0.58	0.59	50.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
East: Welshpool Road East (E)											
P2	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
North: Tonkin Highway (N)											
P3	Full	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
P3B	Slip/ Bypass	1	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12
All Pedestrians		4	24.3	LOS C	0.0	0.0	0.90	0.90	178.1	200.0	1.12

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 02 [I-2_Tonkin Highway/Kelvin Road_EB (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-2 (Network Folder: 2040 PM Peak)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 50 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tonkin Highway (S)															
1	L2	All MCs	369	25.0	369	25.0	0.485	11.1	LOS B	4.1	43.2	0.62	0.76	0.62	48.5
3	R2	All MCs	241	4.0	241	4.0	* 0.564	25.5	LOS C	5.4	42.1	0.93	0.81	0.93	35.8
Approach			611	16.7	611	16.7	0.564	16.8	LOS B	5.4	43.2	0.74	0.78	0.74	44.6
East: Kelvin Road															
5	T1	All MCs	896	5.0	896	5.0	* 0.602	6.8	LOS A	6.4	50.3	0.72	0.62	0.72	56.9
6	R2	All MCs	46	41.0	46	41.0	0.324	28.1	LOS C	0.9	12.1	0.71	0.69	0.71	30.5
Approach			942	6.8	942	6.8	0.602	7.9	LOS A	6.4	50.3	0.72	0.62	0.72	54.6
West: Kelvin Road (W)															
10	L2	All MCs	825	11.0	825	11.0	0.474	7.0	LOS A	0.0	0.0	0.00	0.56	0.00	55.6
11	T1	All MCs	656	3.0	656	3.0	* 0.536	22.2	LOS C	3.9	29.8	0.96	0.77	0.97	38.0
Approach			1481	7.5	1481	7.5	0.536	13.8	LOS B	3.9	29.8	0.43	0.66	0.43	49.1
All Vehicles			3034	9.1	3034	9.1	0.602	12.5	LOS B	6.4	50.3	0.58	0.67	0.58	49.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
North: Tonkin Highway (N)											
P3	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
West: Kelvin Road (W)											
P4	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
All Pedestrians		3	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 02 [I-2_Tonkin Highway/Kelvin Road_WB (Site Folder: 2040 PM Peak)]

Network: N101 [I-2 (Network Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 50 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Kelvin Road (E)															
4	L2	All MCs	194	7.0	194	7.0	0.165	7.7	LOS A	0.7	5.5	0.29	0.66	0.29	55.5
5	T1	All MCs	241	5.0	241	5.0	0.144	14.1	LOS B	1.5	11.5	0.77	0.59	0.77	45.6
Approach			435	5.9	435	5.9	0.165	11.3	LOS B	1.5	11.5	0.55	0.62	0.55	51.3
North: Tonkin Highway (N)															
7	L2	All MCs	41	45.0	41	45.0	0.055	9.0	LOS A	0.2	3.1	0.33	0.64	0.33	45.8
9	R2	All MCs	701	17.0	701	17.0	* 0.518	17.5	LOS B	6.3	59.5	0.76	0.80	0.76	42.7
Approach			742	18.5	742	18.5	0.518	17.1	LOS B	6.3	59.5	0.73	0.79	0.73	43.0
West: Kelvin Rd															
11	T1	All MCs	518	3.0	518	3.0	0.451	9.2	LOS A	3.8	28.5	0.61	0.51	0.61	53.6
12	R2	All MCs	379	9.0	379	9.0	* 0.529	5.2	LOS A	0.2	1.7	0.04	0.59	0.04	50.1
Approach			897	5.5	897	5.5	0.529	7.5	LOS A	3.8	28.5	0.37	0.54	0.37	52.0
All Vehicles			2074	10.3	2074	10.3	0.529	11.7	LOS B	6.3	59.5	0.54	0.65	0.54	48.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
East: Kelvin Road (E)											
P2	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
North: Tonkin Highway (N)											
P3	Full	1	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15
All Pedestrians		3	19.4	LOS B	0.0	0.0	0.88	0.88	173.2	200.0	1.15

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 03a [I-3a_Welshpool Road East/Crystal Brook Road_EB (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-3 (Network Folder: 2040 PM Peak)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Central Median															
3	R2	All MCs	176	8.0	140	8.0	0.539	20.6	LOS C	2.3	18.2	0.85	1.04	1.31	36.2
Approach			176	8.0	140	8.0	0.539	20.6	LOS C	2.3	18.2	0.85	1.04	1.31	36.2
West: Welshpool Road East (W)															
11	T1	All MCs	878	5.0	878	5.0	0.236	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
12	R2	All MCs	595	6.0	595	6.0	0.348	6.9	LOS A	178.9	1423.9	0.00	0.64	0.00	61.8
Approach			1473	5.4	1473	5.4	0.348	2.8	NA	178.9	1423.9	0.00	0.26	0.00	74.3
All Vehicles			1648	5.7	1613	5.8	0.539	4.4	NA	178.9	1423.9	0.07	0.33	0.11	70.1

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

MOVEMENT SUMMARY

Site: 03a [I-3a_Welshpool Road East/Crystal Brook Road_WB (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-3 (Network Folder: 2040 PM Peak)]

NA
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Crystal Brook Road (S)															
1	L2	All MCs	316	11.0	316	11.0	0.261	6.1	LOS A	1.3	10.3	0.28	0.94	0.28	51.0
2	T1	All MCs	176	8.0	176	8.0	1.254	266.6	LOS F	6.6	49.7	1.00	3.15	10.58	0.4
Approach			492	9.9	492	9.9	1.254	99.2	LOS F	6.6	49.7	0.53	1.73	3.96	10.7
East: Welshpool Road East (E)															
3	L2	All MCs	262	4.0	262	4.0	0.312	7.1	LOS A	0.0	0.0	0.00	0.45	0.00	65.8
4	T1	All MCs	664	7.0	664	7.0	0.312	0.1	LOS A	0.0	0.0	0.00	0.08	0.00	78.3
Approach			926	6.2	926	6.2	0.312	2.1	NA	0.0	0.0	0.00	0.18	0.00	75.9
North: Central Median															
8	T1	All MCs	595	6.0	595	6.0	1.952	867.7	LOS F	3.4	24.9	1.00	10.85	39.43	0.1
Approach			595	6.0	595	6.0	1.952	867.7	LOS F	3.4	24.9	1.00	10.85	39.43	0.1
All Vehicles			2013	7.0	2013	7.0	1.952	281.6	NA	6.6	49.7	0.43	3.71	12.62	5.9

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

MOVEMENT SUMMARY

Site: 03b [I-3b_Crystal Brook Road/Brentwood Road (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-3 (Network Folder: 2040 PM Peak)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Brentwood Road (S)															
30	L2	All MCs	245	20.0	245	20.0	0.221	6.0	LOS A	1.0	8.6	0.39	0.59	0.39	42.9
1	R2	All MCs	5	0.0	5	0.0	0.221	8.6	LOS A	1.0	8.6	0.39	0.59	0.39	50.4
Approach			251	19.6	251	19.6	0.221	6.1	LOS A	1.0	8.6	0.39	0.59	0.39	43.1
East: Crystal Brook Road (E)															
10	L2	All MCs	3	0.0	3	0.0	0.124	6.4	LOS A	0.0	0.0	0.00	0.01	0.00	65.5
22	T1	All MCs	242	7.0	242	7.0	0.124	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	69.7
Approach			245	6.9	245	6.9	0.124	0.1	NA	0.0	0.0	0.00	0.01	0.00	69.6
West: Crystal Brook Road (W)															
28	T1	All MCs	431	4.0	290	5.3	0.501	2.7	LOS A	4.8	45.2	0.52	0.54	0.64	60.9
29	R2	All MCs	462	31.0	339	37.6	0.501	5.8	LOS A	4.8	45.2	0.52	0.54	0.64	41.2
Approach			893	18.0	629	22.7	0.501	4.4	NA	4.8	45.2	0.52	0.54	0.64	48.4
All Vehicles			1388	16.3	1125	20.1	0.501	3.8	NA	4.8	45.2	0.38	0.43	0.45	50.3

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

MOVEMENT SUMMARY

Site: 03 [I-3_Welshpool Road East/Crystal Brook Road/ Brentwood Road (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

NA
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Brentwood Road (S)															
4	L2	All MCs	168	20.0	168	20.0	0.283	3.5	LOS A	1.1	9.6	0.56	0.45	0.56	50.9
2	T1	All MCs	77	20.0	77	20.0	0.283	3.6	LOS A	1.1	9.6	0.56	0.45	0.56	51.7
6	R2	All MCs	5	0.0	5	0.0	0.283	9.0	LOS A	1.1	9.6	0.56	0.45	0.56	52.5
Approach			251	19.6	251	19.6	0.283	3.6	LOS A	1.1	9.6	0.56	0.45	0.56	51.2
East: Crystal Brook Road (E)															
7	L2	All MCs	3	0.0	3	0.0	0.141	6.1	LOS A	0.7	5.5	0.66	0.54	0.66	51.9
8	T1	All MCs	144	7.0	144	7.0	0.141	6.1	LOS A	0.7	5.5	0.66	0.55	0.66	60.4
6	R2	All MCs	97	7.0	97	7.0	0.141	15.9	LOS B	0.6	4.9	0.66	0.81	0.66	54.2
Approach			244	6.9	244	6.9	0.141	10.0	LOS B	0.7	5.5	0.66	0.65	0.66	57.6
North: Welshpool Road East (N)															
7	L2	All MCs	147	4.0	147	4.0	0.416	6.7	LOS A	2.1	16.8	0.56	0.68	0.56	58.9
8	T1	All MCs	115	4.0	115	4.0	0.416	6.7	LOS A	2.1	16.8	0.56	0.68	0.56	52.7
9	R2	All MCs	664	7.0	664	7.0	0.416	15.3	LOS B	2.1	16.9	0.57	0.73	0.59	57.2
Approach			926	6.2	926	6.2	0.416	12.9	LOS B	2.1	16.9	0.57	0.72	0.58	56.9
West: Welshpool Road East (W)															
10	L2	All MCs	878	5.0	878	5.0	0.229	5.0	LOS A	0.0	0.0	0.00	0.48	0.00	67.6
2	T1	All MCs	249	6.0	249	6.0	0.219	5.6	LOS A	1.0	7.9	0.26	0.47	0.26	62.1
3	R2	All MCs	345	6.0	345	6.0	0.219	13.4	LOS B	1.0	7.9	0.26	0.62	0.26	51.5
Approach			1473	5.4	1473	5.4	0.229	7.1	LOS A	1.0	7.9	0.10	0.51	0.10	61.9
All Vehicles			2894	7.0	2894	7.0	0.416	8.9	LOS A	2.1	16.9	0.34	0.58	0.34	58.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 04 [1-4_Crystal Brook Road/Kelvin Road (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Kelvin Road (S)															
30	L2	All MCs	201	3.0	201	3.0	0.136	5.9	LOS A	0.6	4.5	0.21	0.55	0.21	51.4
32	R2	All MCs	337	5.0	337	5.0	0.495	11.2	LOS B	2.7	20.8	0.62	0.94	0.94	47.8
Approach			538	4.3	538	4.3	0.495	9.2	LOS A	2.7	20.8	0.47	0.79	0.67	49.1
East: Crystal Brook Road (E)															
21	L2	All MCs	375	5.0	375	5.0	0.244	5.7	LOS A	0.0	0.0	0.00	0.46	0.00	52.2
22	T1	All MCs	101	3.0	101	3.0	0.244	0.1	LOS A	0.0	0.0	0.00	0.46	0.00	55.9
Approach			476	4.6	476	4.6	0.244	4.5	NA	0.0	0.0	0.00	0.46	0.00	52.9
West: Crystal Brook Road (W)															
28	T1	All MCs	60	18.0	60	18.0	0.271	2.6	LOS A	1.4	11.0	0.56	0.67	0.56	53.7
29	R2	All MCs	241	6.0	241	6.0	0.271	8.3	LOS A	1.4	11.0	0.56	0.67	0.56	50.3
Approach			301	8.4	301	8.4	0.271	7.2	NA	1.4	11.0	0.56	0.67	0.56	50.9
All Vehicles			1315	5.3	1315	5.3	0.495	7.0	NA	2.7	20.8	0.32	0.65	0.40	50.8

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

MOVEMENT SUMMARY

Site: 05 [I-5_Welshpool Road East/Crystal Brook Road_EB (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-5 (Network Folder: 2040 PM Peak)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Central Median															
3	R2	All MCs	391	5.0	391	5.0	0.204	3.5	LOS A	0.0	0.0	0.00	0.49	0.00	48.9
Approach			391	5.0	391	5.0	0.204	3.5	NA	0.0	0.0	0.00	0.49	0.00	48.9
West: Welshpool Road East (W)															
10	L2	All MCs	49	0.0	49	0.0	0.250	7.0	LOS A	0.0	0.0	0.00	0.22	0.00	71.1
11	T1	All MCs	869	5.0	869	5.0	0.250	1.1	LOS A	0.0	0.0	0.00	0.19	0.00	75.6
12	R2	All MCs	17	14.0	17	14.0	0.015	8.7	LOS A	0.1	0.5	0.45	0.64	0.45	58.7
Approach			936	4.9	936	4.9	0.250	1.5	NA	0.1	0.5	0.01	0.20	0.01	75.2
All Vehicles			1326	4.9	1326	4.9	0.250	2.1	NA	0.1	0.5	0.01	0.29	0.01	68.6

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

MOVEMENT SUMMARY

Site: 05 [I-5_Welshpool Road East/Crystal Brook Road_WB (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-5 (Network Folder: 2040 PM Peak)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Crystal Brook Road (S)															
1	L2	All MCs	5	0.0	5	0.0	0.005	6.8	LOS A	0.0	0.1	0.40	0.56	0.40	56.6
2	T1	All MCs	391	5.0	391	5.0	0.737	17.6	LOS C	5.3	38.4	0.87	1.25	1.92	38.2
Approach			396	4.9	396	4.9	0.737	17.4	LOS C	5.3	38.4	0.86	1.24	1.90	38.6
East: Welshpool Road East (E)															
3	L2	All MCs	437	5.0	437	5.0	0.248	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	57.6
4	T1	All MCs	740	6.0	740	6.0	0.207	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach			1177	5.6	1177	5.6	0.248	2.6	NA	0.0	0.0	0.00	0.21	0.00	64.7
North: Central Median															
8	T1	All MCs	17	14.0	17	14.0	0.047	11.1	LOS B	0.1	1.1	0.73	0.84	0.73	38.6
Approach			17	14.0	17	14.0	0.047	11.1	LOS B	0.1	1.1	0.73	0.84	0.73	38.6
All Vehicles			1589	5.5	1589	5.5	0.737	6.4	NA	5.3	38.4	0.22	0.47	0.48	58.7

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

MOVEMENT SUMMARY

Site: 05 [I-5_Welshpool Road East/Crystal Brook Road (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 50 seconds (Site Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Crystal Brook Road (S)															
1	L2	All MCs	5	0.0	5	0.0	0.011	24.8	LOS C	0.1	0.7	0.76	0.64	0.76	47.0
3	R2	All MCs	391	5.0	391	5.0	* 0.855	38.2	LOS D	11.4	88.0	1.00	1.04	1.39	38.9
Approach			396	4.9	396	4.9	0.855	38.0	LOS D	11.4	88.0	1.00	1.03	1.38	37.3
East: Welshpool Road East (E)															
3	L2	All MCs	437	5.0	437	5.0	0.248	6.8	LOS A	0.0	0.0	0.00	0.57	0.00	57.6
4	T1	All MCs	740	6.0	740	6.0	* 0.795	23.2	LOS C	9.9	80.7	0.99	0.96	1.24	49.7
Approach			1177	5.6	1177	5.6	0.795	17.1	LOS B	9.9	80.7	0.62	0.81	0.78	52.4
West: Welshpool Road East (W)															
10	L2	All MCs	49	0.0	49	0.0	0.250	6.8	LOS A	0.0	0.0	0.00	0.18	0.00	69.4
11	T1	All MCs	869	5.0	869	5.0	0.250	1.0	LOS A	0.0	0.0	0.00	0.17	0.00	75.4
12	R2	All MCs	17	14.0	17	14.0	* 0.087	31.0	LOS C	0.4	3.3	0.92	0.69	0.92	40.3
Approach			936	4.9	936	4.9	0.250	1.8	LOS A	0.4	3.3	0.02	0.18	0.02	73.9
All Vehicles			2508	5.2	2508	5.2	0.855	14.7	LOS B	11.4	88.0	0.46	0.61	0.59	54.8

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 06 [I-6_Welshpool Road East/Lewis Road_EB (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-6 (Network Folder: 2040 PM Peak)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Central Median															
2	T1	All MCs	281	3.0	281	3.0	0.362	5.8	LOS A	1.7	12.3	0.60	0.81	0.76	51.4
Approach			281	3.0	281	3.0	0.362	5.8	LOS A	1.7	12.3	0.60	0.81	0.76	51.4
North: Lewis Road (N)															
1	L2	All MCs	262	5.0	262	5.0	0.227	8.0	LOS A	1.0	7.7	0.44	0.67	0.44	57.8
8	T1	All MCs	514	6.0	514	6.0	1.181	189.4	LOS F	57.3	418.5	1.00	4.13	13.58	8.6
Approach			776	5.7	776	5.7	1.181	128.1	LOS F	57.3	418.5	0.81	2.96	9.14	15.0
West: Welshpool Road East (W)															
3	L2	All MCs	426	3.0	426	3.0	0.404	9.5	LOS A	2.4	18.1	0.49	0.70	0.55	58.4
4	T1	All MCs	664	5.0	664	5.0	0.181	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach			1091	4.2	1091	4.2	0.404	3.7	LOS A	2.4	18.1	0.19	0.27	0.21	69.8
All Vehicles			2147	4.6	2147	4.6	1.181	48.9	NA	57.3	418.5	0.47	1.31	3.51	33.0

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

MOVEMENT SUMMARY

Site: 06 [I-6_Welshpool Road East/Lewis Road_WB (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-6 (Network Folder: 2040 PM Peak)]

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Welshpool Road East (E)															
11	T1	All MCs	475	7.0	475	7.0	0.135	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
12	R2	All MCs	281	3.0	281	3.0	0.287	9.1	LOS A	1.3	9.7	0.55	0.74	0.57	57.5
Approach			756	5.5	756	5.5	0.287	3.4	NA	1.3	9.7	0.21	0.28	0.21	73.4
North: Central Median															
3	R2	All MCs	514	6.0	435	6.0	0.231	2.8	LOS A	0.0	0.0	0.00	0.50	0.00	53.3
Approach			514	6.0	435	6.0	0.231	2.8	NA	0.0	0.0	0.00	0.50	0.00	53.3
All Vehicles			1269	5.7	1191	6.1	0.287	3.2	NA	1.3	9.7	0.13	0.36	0.13	66.7

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

MOVEMENT SUMMARY

Site: 06 [I-6_Welshpool Road East/Lewis Road (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 80 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Welshpool Road East (E)															
11	T1	All MCs	475	7.0	475	7.0	0.135	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
12	R2	All MCs	281	3.0	281	3.0	* 0.842	48.5	LOS D	12.2	93.7	1.00	0.96	1.28	36.1
Approach			756	5.5	756	5.5	0.842	18.1	LOS B	12.2	93.7	0.37	0.36	0.47	55.0
North: Lewis Road (N)															
1	L2	All MCs	262	5.0	262	5.0	0.214	10.1	LOS B	3.1	24.2	0.38	0.68	0.38	56.5
3	R2	All MCs	514	6.0	514	6.0	* 0.820	37.7	LOS D	20.6	162.1	0.97	0.93	1.11	39.9
Approach			776	5.7	776	5.7	0.820	28.4	LOS C	20.6	162.1	0.77	0.85	0.87	44.3
West: Welshpool Road East (W)															
3	L2	All MCs	426	3.0	426	3.0	0.328	10.6	LOS B	4.9	37.3	0.38	0.70	0.38	57.4
4	T1	All MCs	664	5.0	664	5.0	* 0.802	36.5	LOS D	13.7	106.7	1.00	0.94	1.17	44.5
Approach			1091	4.2	1091	4.2	0.802	26.4	LOS C	13.7	106.7	0.76	0.85	0.87	48.8
All Vehicles			2622	5.0	2622	5.0	0.842	24.6	LOS C	20.6	162.1	0.65	0.70	0.75	48.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

MOVEMENT SUMMARY

Site: 06 [I-6_Welshpool Road East/Lewis Road (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

NA
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Welshpool Road East (E)															
11	T1	All MCs	475	7.0	475	7.0	0.134	5.7	LOS A	0.0	0.0	0.00	0.47	0.00	66.2
12	R2	All MCs	281	3.0	281	3.0	0.156	11.6	LOS B	0.0	0.0	0.00	0.70	0.00	59.7
Approach			756	5.5	756	5.5	0.156	7.9	LOS A	0.0	0.0	0.00	0.56	0.00	63.6
North: Lewis Road (N)															
1	L2	All MCs	262	5.0	262	5.0	0.366	8.4	LOS A	2.0	15.2	0.70	0.74	0.71	59.2
3	R2	All MCs	514	6.0	514	6.0	0.554	15.6	LOS B	4.2	32.9	0.77	0.84	0.91	53.2
Approach			776	5.7	776	5.7	0.554	13.1	LOS B	4.2	32.9	0.75	0.80	0.84	55.0
West: Welshpool Road East (W)															
3	L2	All MCs	426	3.0	426	3.0	0.438	7.1	LOS A	3.2	24.6	0.55	0.57	0.55	60.7
4	T1	All MCs	664	5.0	664	5.0	0.438	8.0	LOS A	3.2	24.6	0.58	0.57	0.58	62.7
Approach			1091	4.2	1091	4.2	0.438	7.6	LOS A	3.2	24.6	0.57	0.57	0.57	61.9
All Vehicles			2622	5.0	2622	5.0	0.554	9.3	LOS A	4.2	32.9	0.46	0.64	0.48	60.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: Same as Signalised Intersections.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 07 [1-7_Crystal Brook Road/Victoria Road (Site Folder: 2040 PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Victoria Road (S)															
30	L2	All MCs	47	0.0	47	0.0	0.139	6.1	LOS A	0.5	3.7	0.43	0.66	0.43	51.2
32	R2	All MCs	72	0.0	72	0.0	0.139	8.9	LOS A	0.5	3.7	0.43	0.66	0.43	51.0
Approach			119	0.0	119	0.0	0.139	7.8	LOS A	0.5	3.7	0.43	0.66	0.43	51.1
East: Crystal Brook Road (E)															
21	L2	All MCs	135	0.0	135	0.0	0.165	5.6	LOS A	0.0	0.0	0.00	0.26	0.00	55.3
22	T1	All MCs	178	4.0	178	4.0	0.165	0.0	LOS A	0.0	0.0	0.00	0.26	0.00	57.6
Approach			313	2.3	313	2.3	0.165	2.4	NA	0.0	0.0	0.00	0.26	0.00	56.6
West: Crystal Brook Road (W)															
28	T1	All MCs	272	8.0	272	8.0	0.248	0.8	LOS A	0.9	8.0	0.29	0.32	0.29	57.6
29	R2	All MCs	100	19.0	100	19.0	0.248	7.6	LOS A	0.9	8.0	0.29	0.32	0.29	49.1
Approach			372	11.0	372	11.0	0.248	2.6	NA	0.9	8.0	0.29	0.32	0.29	55.0
All Vehicles			803	6.0	803	6.0	0.248	3.3	NA	0.9	8.0	0.20	0.35	0.20	55.0

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

MOVEMENT SUMMARY

Site: 01 [I-1_Tonkin Highway/Welshpool Road East_EB (Site Folder: 2041 Sensitivity Test AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-1 (Network Folder: 2041 Sensitivity Test AM Peak)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 40 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tonkin Highway (S)															
1	L2	All MCs	1116	8.0	1116	8.0	* 0.800	22.6	LOS C	12.1	99.2	0.94	0.96	1.18	45.3
3	R2	All MCs	159	9.0	159	9.0	0.119	15.1	LOS B	1.0	8.3	0.66	0.72	0.66	45.0
Approach			1275	8.1	1275	8.1	0.800	21.7	LOS C	12.1	99.2	0.91	0.93	1.12	45.3
East: Welshpool Road East															
5	T1	All MCs	866	4.0	866	4.0	* 0.762	8.3	LOS A	6.7	51.7	0.78	0.69	0.83	54.9
6	R2	All MCs	272	6.0	272	6.0	0.486	11.6	LOS B	1.4	12.0	0.51	0.69	0.51	45.1
Approach			1138	4.5	1138	4.5	0.762	9.1	LOS A	6.7	51.7	0.71	0.69	0.75	52.2
West: Welshpool Road East (W)															
10	L2	All MCs	74	22.0	74	22.0	0.074	8.9	LOS A	0.3	2.9	0.41	0.66	0.41	50.6
11	T1	All MCs	675	9.0	675	9.0	0.457	13.4	LOS B	3.9	31.2	0.85	0.69	0.85	46.7
Approach			748	10.3	748	10.3	0.457	12.9	LOS B	3.9	31.2	0.81	0.69	0.81	47.3
All Vehicles			3161	7.3	3161	7.3	0.800	15.1	LOS B	12.1	99.2	0.81	0.78	0.91	47.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
P1B	Slip/ Bypass	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
North: Tonkin Highway (N)											
P3	Full	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
West: Welshpool Road East (W)											
P4	Full	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
All Pedestrians		4	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 01 [I-1_Tonkin Highway/Welshpool Road East_WB (Site Folder: 2041 Sensitivity Test AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N102 [I-1 (Network Folder: 2041 Sensitivity Test AM Peak)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 40 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Welshpool Road East (E)															
4	L2	All MCs	160	12.0	160	12.0	0.146	8.6	LOS A	0.6	5.4	0.38	0.67	0.38	53.6
5	T1	All MCs	1016	4.0	1016	4.0	0.426	8.0	LOS A	5.0	38.0	0.70	0.58	0.70	53.9
Approach			1176	5.1	1176	5.1	0.426	8.1	LOS A	5.0	38.0	0.65	0.60	0.65	53.8
North: Tonkin Highway (N)															
7	L2	All MCs	456	16.0	456	16.0	* 0.563	22.1	LOS C	4.3	38.1	0.92	0.81	0.94	44.0
9	R2	All MCs	122	20.0	122	20.0	0.170	20.4	LOS C	1.0	9.5	0.82	0.73	0.82	40.1
Approach			578	16.8	578	16.8	0.563	21.7	LOS C	4.3	38.1	0.90	0.80	0.91	43.5
West: Welshpool Road East															
11	T1	All MCs	577	9.0	577	9.0	0.358	3.6	LOS A	2.1	17.1	0.38	0.32	0.38	62.6
12	R2	All MCs	257	30.0	257	30.0	* 0.547	7.3	LOS A	0.7	7.6	0.25	0.63	0.27	40.7
Approach			834	15.5	834	15.5	0.547	4.7	LOS A	2.1	17.1	0.34	0.41	0.34	53.7
All Vehicles			2587	11.1	2587	11.1	0.563	10.0	LOS B	5.0	38.1	0.61	0.58	0.61	50.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
East: Welshpool Road East (E)											
P2	Full	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
North: Tonkin Highway (N)											
P3	Full	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
P3B	Slip/ Bypass	1	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19
All Pedestrians		4	14.5	LOS B	0.0	0.0	0.85	0.85	168.3	200.0	1.19

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 03 [I-3_Welshpool Road East/Crystal Brook Road/ Brentwood Road (Site Folder: 2041 Sensitivity Test AM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

NA
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Brentwood Road (S)															
4	L2	All MCs	299	31.0	299	31.0	0.685	10.1	LOS B	4.4	45.6	0.81	1.02	1.24	45.7
2	T1	All MCs	137	31.0	137	31.0	0.685	10.6	LOS B	4.4	45.6	0.81	1.02	1.24	46.5
6	R2	All MCs	2	50.0	2	50.0	0.685	16.6	LOS B	4.4	45.6	0.81	1.02	1.24	39.9
Approach			438	31.1	438	31.1	0.685	10.3	LOS B	4.4	45.6	0.81	1.02	1.24	45.9
East: Crystal Brook Road (E)															
7	L2	All MCs	33	14.0	33	14.0	0.254	7.1	LOS A	1.1	8.3	0.63	0.59	0.63	52.0
8	T1	All MCs	173	3.0	173	3.0	0.254	6.4	LOS A	1.1	8.3	0.63	0.59	0.63	61.8
6	R2	All MCs	335	3.0	335	3.0	0.297	14.9	LOS B	1.4	10.9	0.63	0.78	0.63	54.9
Approach			540	3.7	540	3.7	0.297	11.7	LOS B	1.4	10.9	0.63	0.71	0.63	56.7
North: Welshpool Road East (N)															
7	L2	All MCs	168	4.0	168	4.0	0.416	5.9	LOS A	2.3	18.1	0.43	0.63	0.43	58.5
8	T1	All MCs	43	4.0	43	4.0	0.416	5.9	LOS A	2.3	18.1	0.43	0.63	0.43	52.5
9	R2	All MCs	883	5.0	883	5.0	0.416	14.0	LOS B	2.3	18.1	0.45	0.65	0.45	58.1
Approach			1095	4.8	1095	4.8	0.416	12.5	LOS B	2.3	18.1	0.44	0.65	0.44	57.9
West: Welshpool Road East (W)															
10	L2	All MCs	747	11.0	747	11.0	0.208	5.1	LOS A	0.0	0.0	0.00	0.48	0.00	65.6
2	T1	All MCs	136	11.0	136	11.0	0.114	6.5	LOS A	0.6	5.1	0.47	0.55	0.47	59.1
3	R2	All MCs	124	11.0	124	11.0	0.114	14.2	LOS B	0.6	5.1	0.47	0.62	0.47	51.4
Approach			1007	11.0	1007	11.0	0.208	6.4	LOS A	0.6	5.1	0.12	0.51	0.12	62.4
All Vehicles			3080	10.4	3080	10.4	0.685	10.1	LOS B	4.4	45.6	0.42	0.67	0.49	56.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

MOVEMENT SUMMARY

Site: 01 [I-1_Tonkin Highway/Welshpool Road East_EB (Site Folder: 2041 Sensitivity Test PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-1 (Network Folder: 2041 Sensitivity Test PM Peak)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 30 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Tonkin Highway (S)															
1	L2	All MCs	744	13.0	744	13.0	* 0.876	26.8	LOS C	7.7	70.0	1.00	1.14	1.72	42.3
3	R2	All MCs	181	5.0	181	5.0	0.193	16.4	LOS B	1.1	8.5	0.81	0.74	0.81	43.5
Approach			925	11.4	925	11.4	0.876	24.7	LOS C	7.7	70.0	0.96	1.06	1.54	42.4
East: Welshpool Road East															
5	T1	All MCs	517	8.0	517	8.0	0.437	4.1	LOS A	1.8	15.4	0.48	0.40	0.48	61.7
6	R2	All MCs	220	6.0	220	6.0	0.436	9.2	LOS A	0.7	5.8	0.40	0.65	0.40	47.5
Approach			737	7.4	737	7.4	0.437	5.6	LOS A	1.8	15.4	0.46	0.47	0.46	56.6
West: Welshpool Road East (W)															
10	L2	All MCs	105	13.0	105	13.0	0.103	9.0	LOS A	0.4	3.4	0.52	0.68	0.52	52.8
11	T1	All MCs	1420	4.0	1420	4.0	* 0.833	13.8	LOS B	8.4	64.6	0.94	0.92	1.24	46.1
Approach			1525	4.6	1525	4.6	0.833	13.5	LOS B	8.4	64.6	0.91	0.90	1.19	46.9
All Vehicles			3187	7.2	3187	7.2	0.876	14.9	LOS B	8.4	70.0	0.82	0.85	1.12	46.5

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
P1B	Slip/ Bypass	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
North: Tonkin Highway (N)											
P3	Full	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
West: Welshpool Road East (W)											
P4	Full	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
All Pedestrians		4	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 01 [I-1_Tonkin Highway/Welshpool Road East_WB (Site Folder: 2041 Sensitivity Test PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

Network: N101 [I-1 (Network Folder: 2041 Sensitivity Test PM Peak)]

NA
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Coordinated Cycle Time = 30 seconds (Network Practical Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
East: Welshpool Road East (E)															
4	L2	All MCs	314	4.0	314	4.0	0.340	10.8	LOS B	2.0	15.4	0.67	0.75	0.67	54.7
5	T1	All MCs	676	8.0	676	8.0	0.371	7.7	LOS A	2.7	22.9	0.75	0.61	0.75	54.3
Approach			989	6.7	989	6.7	0.371	8.7	LOS A	2.7	22.9	0.73	0.66	0.73	54.5
North: Tonkin Highway (N)															
7	L2	All MCs	526	9.0	526	9.0	* 0.665	20.0	LOS B	4.2	35.7	0.96	0.88	1.13	46.7
9	R2	All MCs	61	19.0	61	19.0	0.088	17.3	LOS B	0.4	3.5	0.81	0.70	0.81	42.9
Approach			587	10.0	587	10.0	0.665	19.7	LOS B	4.2	35.7	0.94	0.86	1.10	46.5
West: Welshpool Road East															
11	T1	All MCs	1052	4.0	1052	4.0	0.757	9.9	LOS A	7.5	57.7	0.89	0.84	1.06	52.8
12	R2	All MCs	549	8.0	549	8.0	* 0.784	9.8	LOS A	3.0	25.3	0.60	0.78	0.72	46.4
Approach			1601	5.4	1601	5.4	0.784	9.9	LOS A	7.5	57.7	0.79	0.82	0.94	50.4
All Vehicles			3178	6.7	3178	6.7	0.784	11.3	LOS B	7.5	57.7	0.80	0.78	0.90	50.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Override Site Data tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Green.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Tonkin Highway (S)											
P1	Full	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
East: Welshpool Road East (E)											
P2	Full	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
North: Tonkin Highway (N)											
P3	Full	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
P3B	Slip/ Bypass	1	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22
All Pedestrians		4	9.6	LOS A	0.0	0.0	0.80	0.80	163.4	200.0	1.22

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 03 [I-3_Welshpool Road East/Crystal Brook Road/ Brentwood Road (Site Folder: 2041 Sensitivity Test PM Peak)]

Output produced by SIDRA INTERSECTION Version: 9.1.6.228

NA
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Brentwood Road (S)															
4	L2	All MCs	168	20.0	168	20.0	0.289	3.7	LOS A	1.2	10.6	0.58	0.48	0.58	50.8
2	T1	All MCs	77	20.0	77	20.0	0.289	4.3	LOS A	1.2	10.6	0.58	0.48	0.58	51.6
6	R2	All MCs	5	0.0	5	0.0	0.289	9.2	LOS A	1.2	10.6	0.58	0.48	0.58	52.4
Approach			251	19.6	251	19.6	0.289	4.0	LOS A	1.2	10.6	0.58	0.48	0.58	51.1
East: Crystal Brook Road (E)															
7	L2	All MCs	9	0.0	9	0.0	0.098	6.6	LOS A	0.4	3.2	0.63	0.60	0.63	52.1
8	T1	All MCs	63	7.0	63	7.0	0.098	6.6	LOS A	0.4	3.2	0.63	0.60	0.63	60.8
6	R2	All MCs	139	7.0	139	7.0	0.136	15.2	LOS B	0.6	5.1	0.64	0.77	0.64	53.9
Approach			212	6.7	212	6.7	0.136	12.3	LOS B	0.6	5.1	0.64	0.71	0.64	55.7
North: Welshpool Road East (N)															
7	L2	All MCs	305	4.0	305	4.0	0.483	7.0	LOS A	2.8	21.9	0.59	0.69	0.63	59.8
8	T1	All MCs	115	4.0	115	4.0	0.483	7.0	LOS A	2.8	21.9	0.59	0.69	0.63	53.3
9	R2	All MCs	656	7.0	656	7.0	0.483	15.8	LOS B	2.8	22.2	0.61	0.76	0.67	57.0
Approach			1076	5.8	1076	5.8	0.483	12.4	LOS B	2.8	22.2	0.60	0.73	0.65	57.3
West: Welshpool Road East (W)															
10	L2	All MCs	1109	5.0	1109	5.0	0.289	5.0	LOS A	0.0	0.0	0.00	0.48	0.00	67.6
2	T1	All MCs	247	6.0	247	6.0	0.222	5.8	LOS A	1.1	8.4	0.30	0.48	0.30	61.9
3	R2	All MCs	345	6.0	345	6.0	0.222	13.5	LOS B	1.1	8.4	0.30	0.63	0.30	51.3
Approach			1702	5.3	1702	5.3	0.289	6.9	LOS A	1.1	8.4	0.10	0.51	0.10	62.5
All Vehicles			3240	6.7	3240	6.7	0.483	8.8	LOS A	2.8	22.2	0.34	0.59	0.36	59.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Options tab).
Roundabout LOS Method: SIDRA Roundabout LOS.
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
Roundabout Capacity Model: SIDRA Standard.
Delay Model: SIDRA Standard (Control Delay: Geometric Delay is included).
Queue Model: SIDRA queue estimation methods are used for Back of Queue and Queue at Start of Gap.
Gap-Acceptance Capacity Formula: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.
Arrival Flows used in performance calculations are adjusted to include any Initial Queued Demand and Upstream Capacity Constraint effects.

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