Client
Victorian Planning Authority

Date
10 July 2023

Planning

Transport

Urban Design

Waste Management

Officer South Employment Precinct Structure Plan

Integrated Transport Assessment

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Project
Integrated Transport Assessment

Prepared for
Victorian Planning Authority

Our reference
18212T

Directory path Y:\18001-18500\18212T - Officer South Employment - Integrated Transport Assessment\Work\Reports\18212-REP01-F05.docx

Version	Date	Issue	Prepared by	Checked by
D01	7 November 2022	For Client Comment	MR	AW
F01	20 December 2022	Final	MR/AW	AW
F02	28 February 2023	Final V2	MR/AW	AW
F03	6 March 2023	Final V3	MR/AW	AW
F04	9 March 2023	Final V4	MR/AW	AW
F05	10 July 2023	Final V5	MR/AW	AW

This report and its contents have been prepared in support of the Officer South Employment Precinct Structure Plan and any associated Contributions Plan. The analysis contained within the report cannot be readily relied upon to inform detailed intersection design in relation to approvals with the Department of Transport and Planning unless agreed otherwise.

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1. Introduction

1.1. Background

The Officer South Employment precinct is located approximately 45km southeast of Melbourne's central business district within Melbourne's South East Growth Corridor. In accordance with Government strategic planning policy directions, the precinct will deliver a State Significant Industrial Precinct and Regionally Significant Commercial Precinct.

The Officer South Employment (OSE) Precinct Structure Plan (PSP) will guide the development of the precinct and is currently being prepared by the Victorian Planning Authority (VPA) in working partnership with Cardinia Shire Council, State Government Agencies and service authorities.

On completion the PSP is expected to provide some 22,000 jobs and deliver some 1,600 new homes.

1.2. Purpose of the Report

Ratio Consultants (Ratio) has been engaged to undertake an Integrated Transport Assessment (ITA) which will form one part of a suite of technical assessments that will assist the VPA in developing the PSP and facilitating the subsequent Planning Scheme Amendment.

This report sets out the ITA methodology and subsequent findings.

1.3. Reference Documents

In preparing this report, reference has been made to a number of data sources including the following:

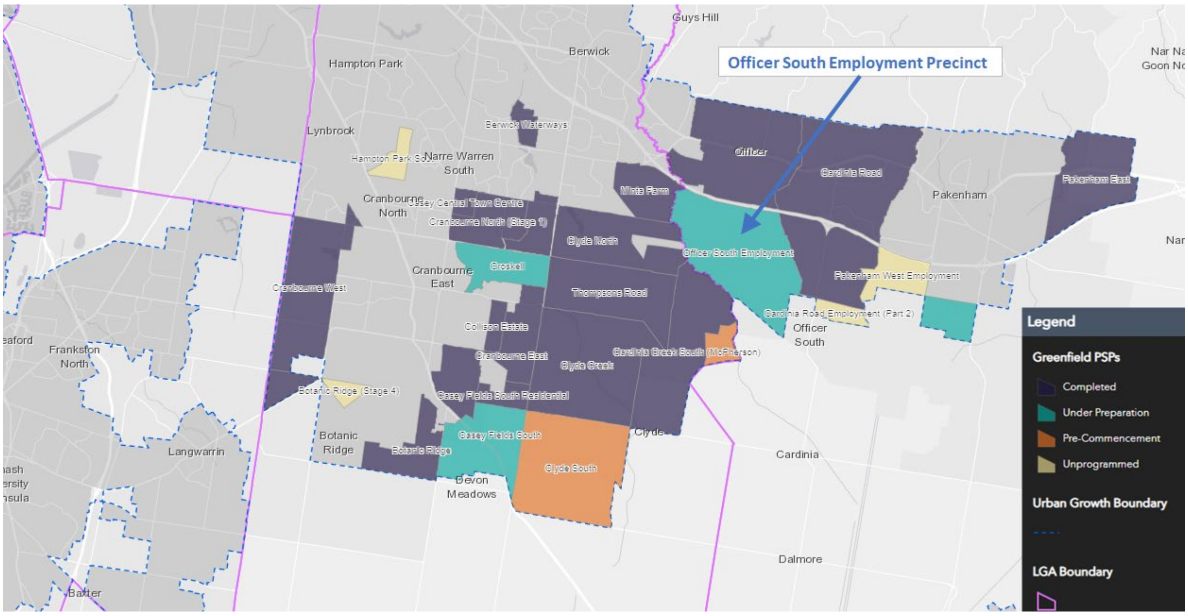
- Various VPA plans for the OSE PSP as referenced throughout this report;
- VPA PSP Guidelines – PSP Note – Our Roads: Connecting People (August 2011);
- The VPA Benchmark Infrastructure Report, prepared by Cardno Victoria Pty Ltd (Final, dated 11 April 2019);
- Officer South Employment PSP – Transport Modelling Assessment Report prepared by GHD Pty Ltd (dated 7 November 2022);
- VicRoads, Guidance for Planning Road Networks in Growth Areas, Working Document 2015 (currently under review); and
- Other data sources as nominated throughout this report.

2. Existing and Future Road Network

2.1. Site Location

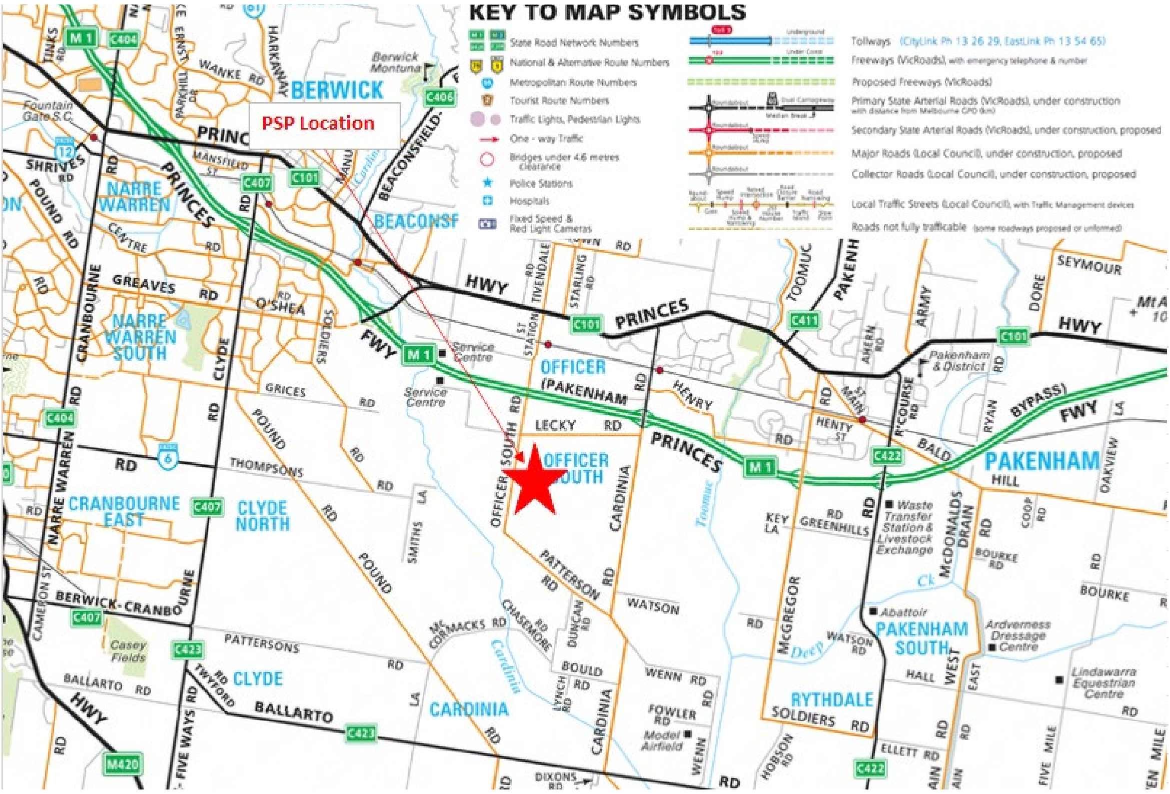
The location of the Officer South Employment Precinct PSP in relation to the wider South East Growth Corridor is illustrated in Figure 2.1, and the location of the precinct within the context of the existing road network is shown in Figure 2.2:

Figure 2.1: Officer South Employment Precinct Location



Source:
https://planvic.maps.arcgis.com/apps/webappviewer/index.html?id=536f9e451be0496c89548ae04013d76b

Figure 2.2: PSP Location



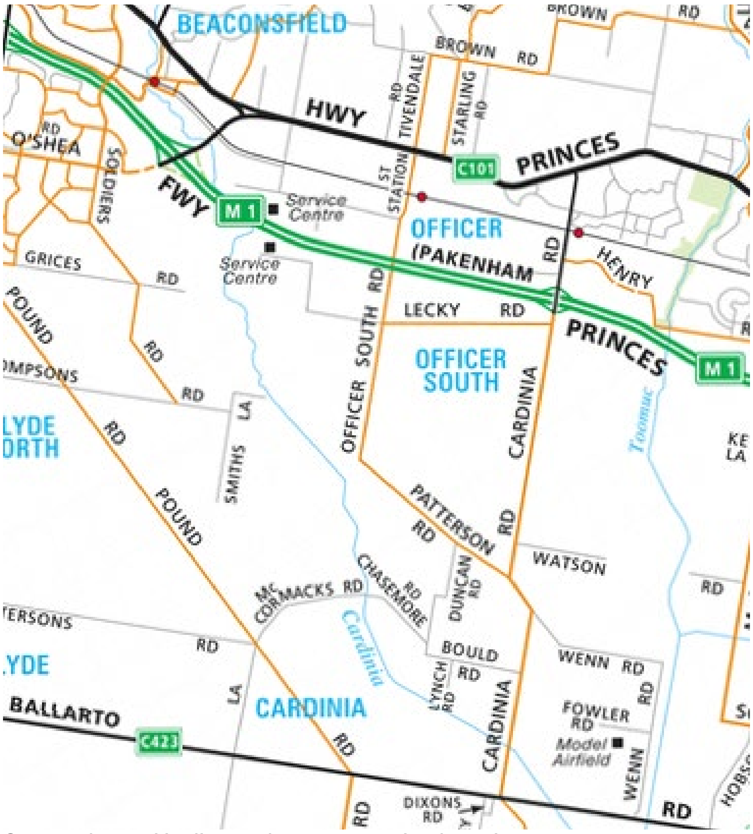
As outlined above, the PSP area is bound by Cardinia Creek to the west, the Princes Freeway to the north, Lower Gum Scrub Creek to the east and the Urban Growth Boundary to the south.

Officer South Road runs north-south through the PSP area, which will also be traversed in the future in the east-west direction by the extensions of Thompsons Road and Grices Road/Lecky Road. The PSP area will also connect to the Princess Freeway in the north via a planned fully directional Freeway Interchange with Officer South Road.

2.2. Existing Road Network

The precinct location within the context of the existing road network is outlined in Figure 2.3:

Figure 2.3: Existing Road Network Surrounding the Precinct



Source: https://online.melway.com.au/melway/

The existing roads in the immediate vicinity of the precinct area and the estimated existing daily traffic volumes are outlined in Table 2.1:

Table 2.1: Existing Daily Traffic Volumes

Road	Traffic Count Location	Daily Traffic Volume (vehicles per day (vpd))
Officer South Road	South of the Princess Freeway	3,300
Lecky Road	East of Officer South Road	2,100
Patterson Road	East of Officer South Road	2,300

Source: Officer South Employment PSP – Transport Modelling Assessment Report prepared by GHD Pty Ltd (dated 28 October 2022).

It is recognised that the traffic data is limited in the vicinity of the PSP area given that the area is currently largely a greenfield area.

2.3. Anticipated Ultimate (2051) Road Network

The envisaged ultimate future Arterial Road network in the immediate vicinity of the PSP area has been informed by the South East Growth Corridor Plan which is the overarching broad strategic master plan for Officer South and the surrounding precincts. The key elements of this network are shown as Figure 2.4.

Figure 2.4: Envisaged Future Arterial Road Network

Source: https://vpa-web.s3.amazonaws.com/wp-content/uploads/2021/06/Officer-South-Employment-PSP-Vision-and-Purpose-Webinar-Summary-July-2020.pdf

As outlined in Figure 2.4 and noted previously, Officer South Road is envisaged to connect to the Princess Freeway via a fully directional diamond interchange. Officer South Road and Thompsons Road are envisaged to ultimately be a 6-lane Arterial Roads whilst Grices Road/Lecky Road is ultimately envisaged to be a 4-lane Arterial Road. Road bridges are also envisaged on the east-west Arterial Roads across Cardinia Creek and Lower Gum Scrub Creek. Stephens Road was contemplated as a potential local connector road link to the Officer PSP.

The envisaged future arterial road network was tested through traffic modelling (see Chapters 6 and 7) to determine its suitability to meet the needs of the South East Growth Corridor at full development.

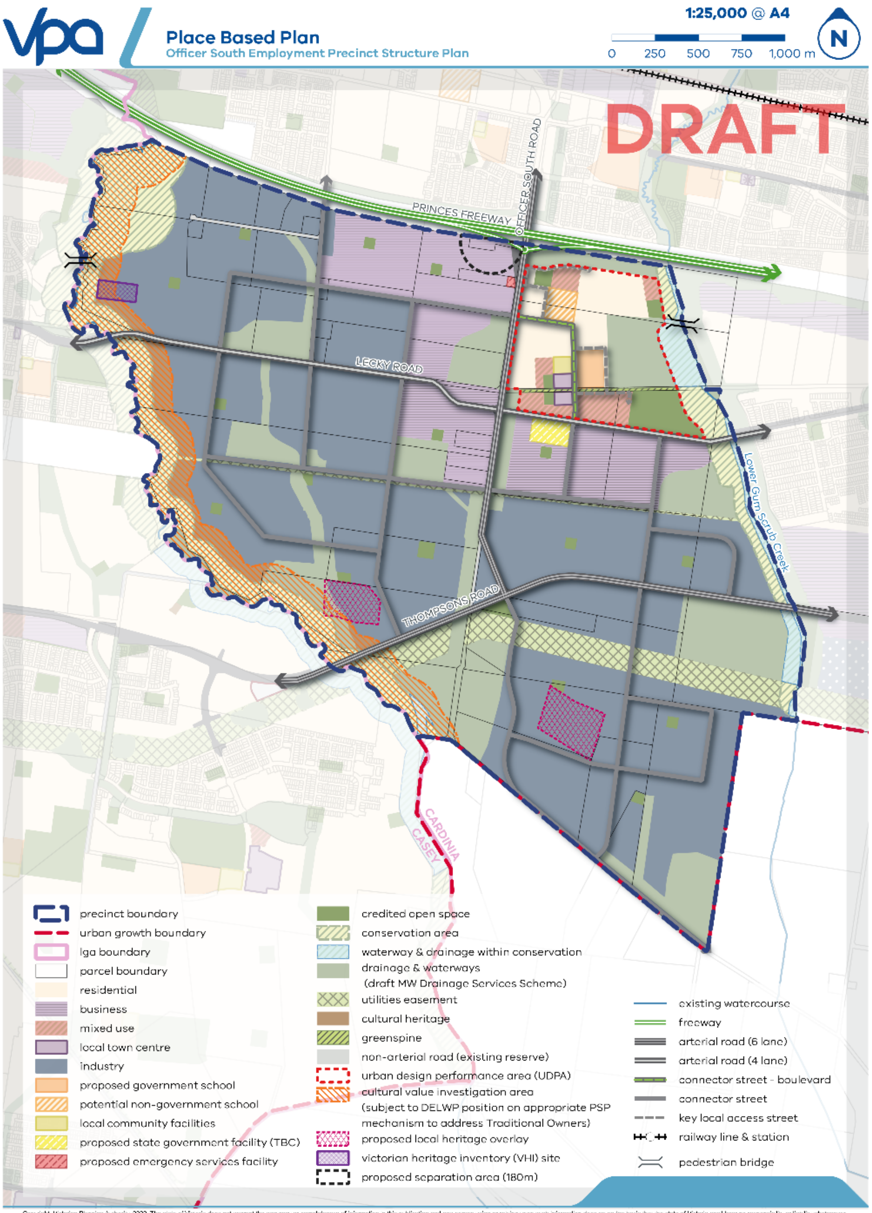
3. PSP Overview

3.1. PSP Layout and Land Uses

The draft Place Base Plan for the PSP was provided by the VPA and is illustrated in Figure 3.1.

It should be noted that various earlier (superseded) versions of this working draft plan are presented within this report, which show slight variations in land use arrangement and transport networks.

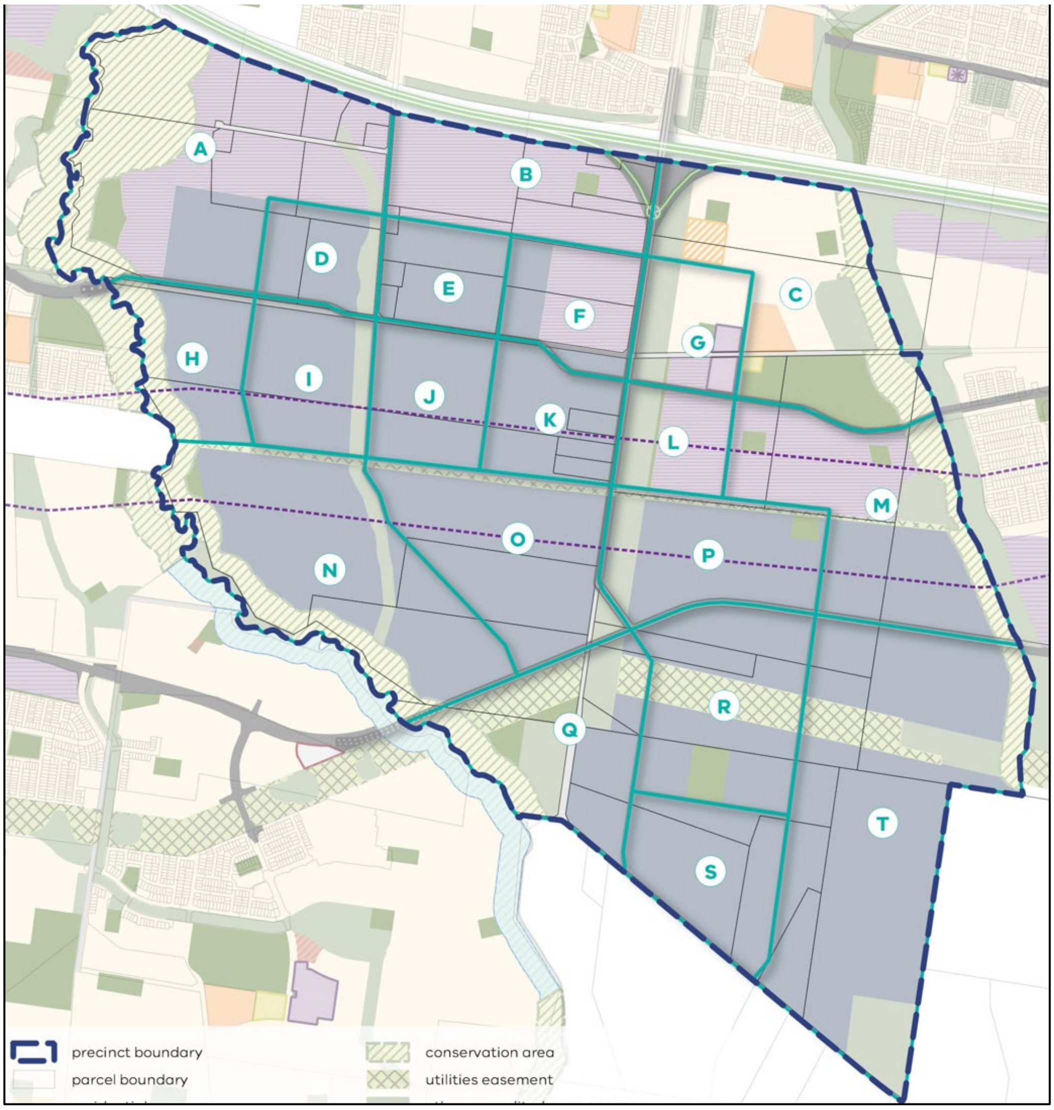
Figure 3.1: Draft PSP Place Based Plan



The 1,069 Hectare (Ha) PSP area will primarily consist of industrial uses supplemented by commercial and residential uses. A Local Town Centre (LTC), local community facilities, and schools are also proposed in the northern-eastern section of the PSP area.

A breakdown of the land uses planned within the precinct was provided by the VPA and is summarised in Figure 3.2 and Table 3.1:

Figure 3.2: PSP Land Use Zone Structure[1]



[1] This is an earlier superseded version of the Place Based Plan. These zone structures have been assessed to be appropriate for application to the slightly modified land use configuration of the draft Place Based Plan.

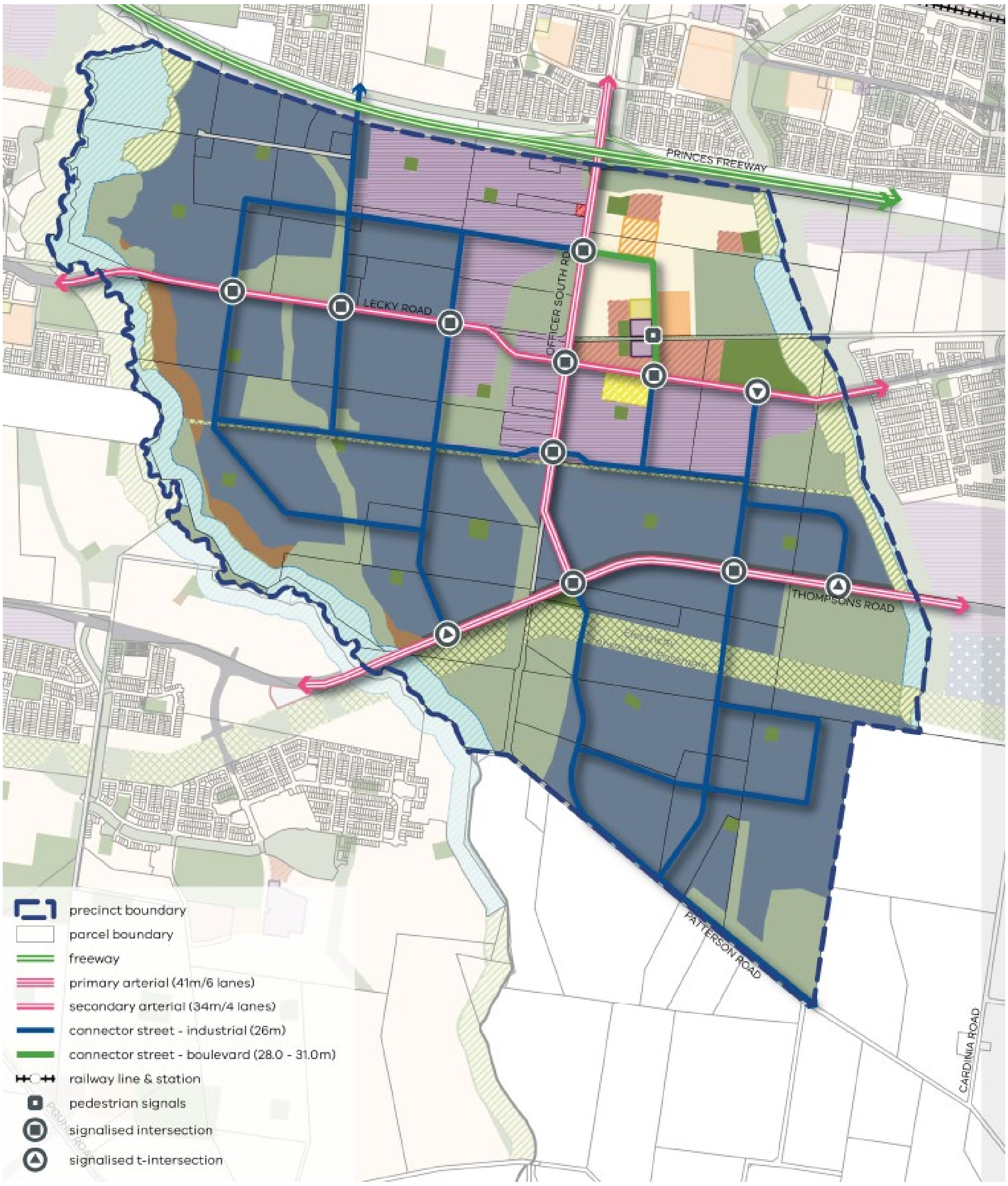
Table 3.1: PSP Land Use by Zone

Zone	Land Use Area (Ha)					
	Business	Industrial	LTC/Mixed Use	School	Residential	Community Facilities
A		64.09				
B	44.05	1.88				0.25
C	0.91		7.96	5.01	16.95	
D		11.87				
E	0.03	22.41				
F	16.45	0.01				
G			7.05	1.49	11.82	1.0
H		13.33				
I		21.92				
J		28.27				
K	17.77	0.10				
L	15.35					3.00
M	24.18	24,01				
N		45.94				
O	1.37	47.53				
P	2.32	35.56				
Q		3.55				
R		46.15				
S		36.75				
T		77.63				
Total	**122.43**	**481.00**	**15.01**	**6.50**	**28.77**	**4.24**

3.2. Transport Network Overview

The draft Road Network Plan for the PSP was provided by the VPA and used as the basis for testing. This draft network illustrated in Figure 3.3:

Figure 3.3: Draft PSP Road Network Plan



As outlined in Figure 3.3, the precinct will connect to the Princes Freeway to the north via a new diamond interchange with Officer South Road. East-west connectivity will be provided via Grices Road/Lecky Road and Thompsons Road and the associated bridge crossing across the Cardinia Creek along the Eastern precinct boundary. East-west connectivity will also be provided via bridge crossings across Gum Scrub Creek.

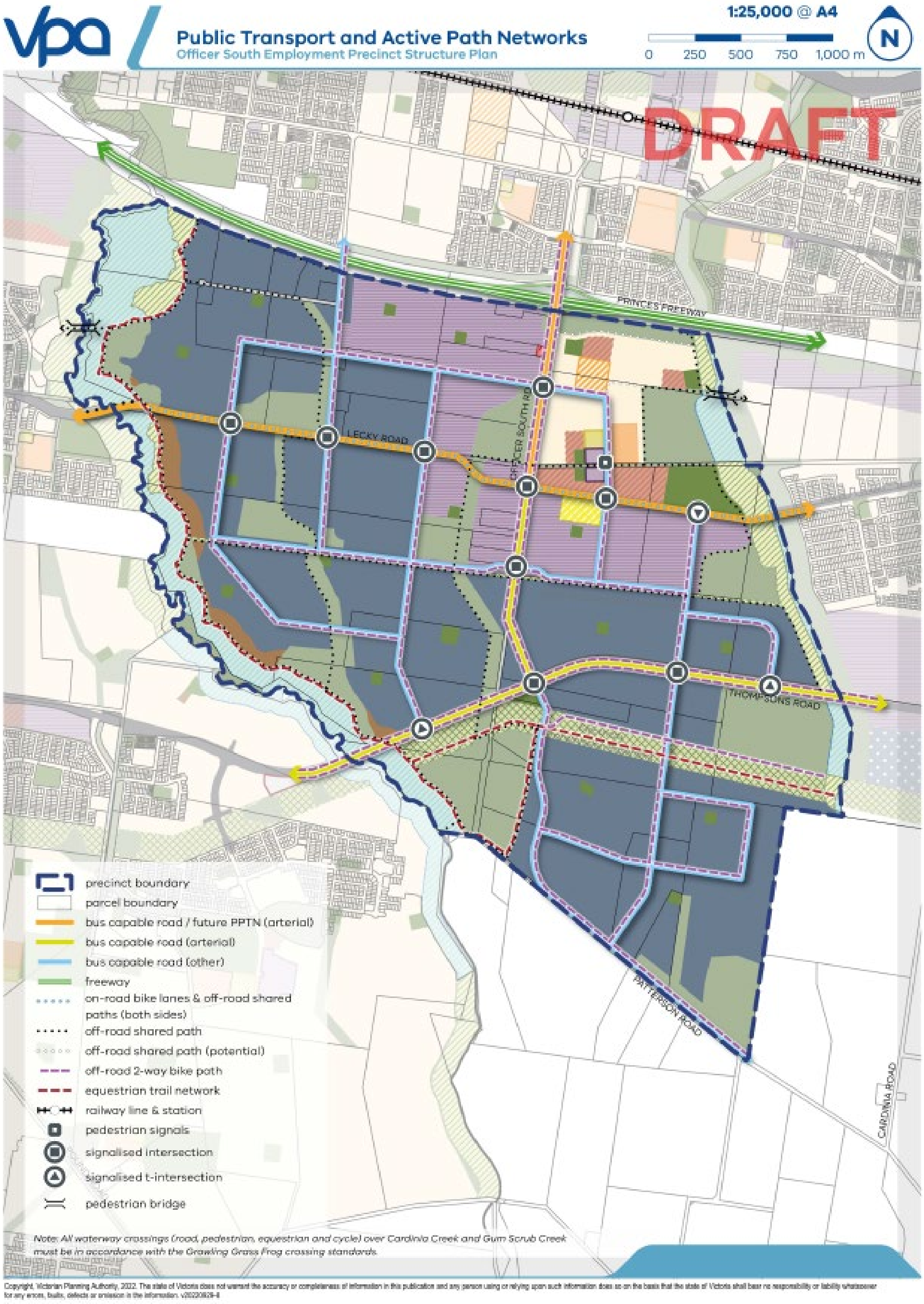
Both Officer South Road and Thompsons Road will ultimately be Primary (6 lane) Arterial Roads, and Grices Road/Lecky Road will ultimately be a Secondary (4 lane) Arterial Road. The precinct road network will take the form of a series of Connector Streets that will connect to the Arterial Road network via twelve signalised intersections to facilitate movement to/from/within the precinct.

The residential precinct in the north eastern corner of the PSP will include a boulevard connector as the town's main street.

3.3. Public Transport and Active Path Networks

The draft Public Transport and Active Path Networks Plan for the PSP was provided by the VPA and is illustrated in Figure 3.4.

Figure 3.4: Public Transport and Active Paths Networks Plan



The precinct includes the provision of a series of on and off-road bike paths, bus capable roads, and crossing opportunities for pedestrians at signalized intersections and pedestrian bridges. Footpaths will also be provided on both sides of all Arterial Roads and Connector Streets within the PSP area.

Although not shown on PSP plans, all Local Access Streets will also include footpaths on both sides of the road.

4. PSP Road Network

4.1. Road Network Principles

The PSP road network has been developed pursuant to the Victoria Planning Provisions and in accordance with Department of Transport (DoT) and Growth Area planning principles. It features a tiered road network to support longer distance travel and enables appropriate access to abutting land uses.

The broad approach is to provide:

— Alternating Primary and Secondary Arterials in an approximate 2.5km grid layout;

— Primary Arterial connections to the freeway network; and

— A regularly spaced network of Connector Roads that provides multiple options for traffic flows to balance themselves across the network.

4.2. Road Network Hierarchy

The draft Road Network Plan for the PSP was previously outlined in Figure 3.3. As discussed previously the precinct will connect to the Princes Freeway to the north via a new diamond interchange with Officer South Road. East-west connectivity will be provided via Grices Road/Lecky Road and Thompsons Road and the associated new bridge crossing across the Cardinia Creek and Lower Gum Scrub Creek.

All Connector Streets and Arterial Roads within the precinct area are anticipated to be bus capable roads and include facilities for cycling within the road reserve.

In addition to the twelve signalised intersections outlined in Figure 3.3, one set of pedestrian signals are envisaged within the LTC in the vicinity of Lecky Road.

4.3. Anticipated Road Cross Sections and Intersection Layouts

Benchmark Road Cross Sections

The VPA has a series of benchmark road cross sections that are applied to PSPs in greenfield areas. The cross sections applicable to the OSE PSP are outlined as follows:

The proposed Industrial Connector and Boulevard Connector Street cross sections provide a two-way bus capable carriageway, an off-road two-way bike path, footpaths on either side of the carriageway along with on-street parking on both side of the carriageway.

In addition, the VPA PSP Guidelines – PSP Note – Our Roads: Connecting People (August 2011) notes that Connector Streets should generally provide for up to approximately 7,000 vpd and when volumes exceed this, additional links to the Arterial Road Network may be required. The Guidelines further note that Connector Streets should be designed to prioritise the needs of pedestrians and cyclists.

The proposed Primary and Secondary Arterial Road cross sections allow for 2-3 traffic lanes in each direction, off-road two-way bike paths on either side of the carriageway, and footpaths on either side of the carriageway.

The VPA PSP Guidelines – PSP Note – Our Roads: Connecting People (August 2011) notes that Secondary Arterial Roads should generally provide for some 12,000-40,000 vpd whilst Primary Arterial Roads should provide for more than 30,000 vpd. The Guidelines further note that priority should be given to the movement of goods and people on Arterial Roads.

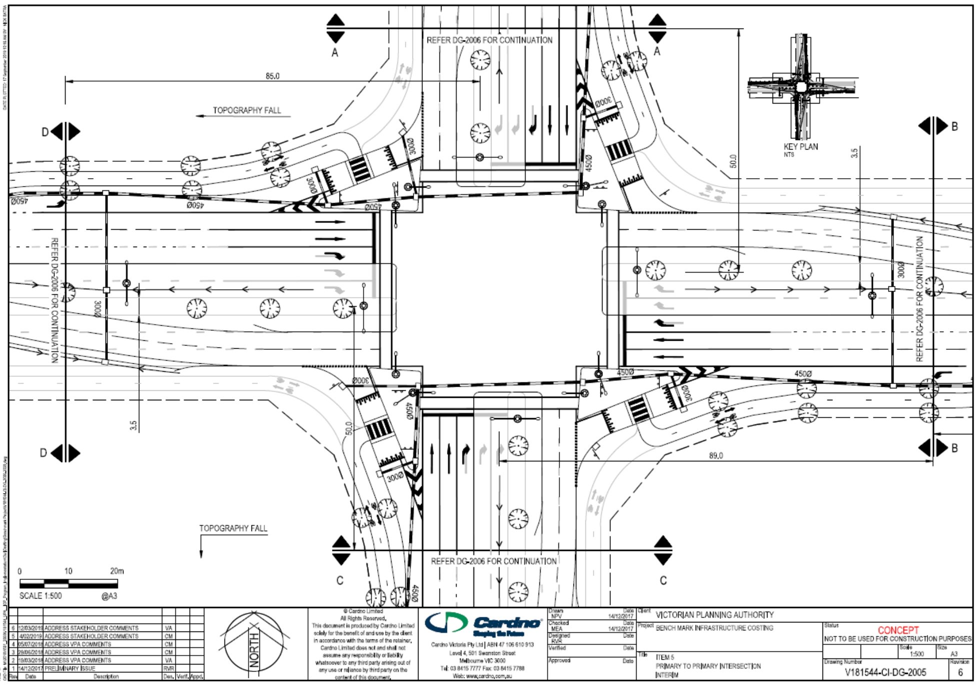
Benchmark Intersection Designs

In association with the DoT and Growth Area Councils, VPA has developed a suite of typical signalised designs in its planning for Arterial/Arterial and Arterial/Connector intersections. The default designs are included in the VicRoads Guidance for Planning Road Networks in Growth Areas handbook (2015, currently under review) and include minor variations to reflect the type and volume of traffic generated by different land uses.

The default designs have been used as the basis for standardised cost estimation of PSP intersections, which are funded by Infrastructure Contributions Plans (ICPs). The standardised costs and associated intersection designs are set out in VPA's Benchmark Infrastructure Report (2019) (the Benchmark report).

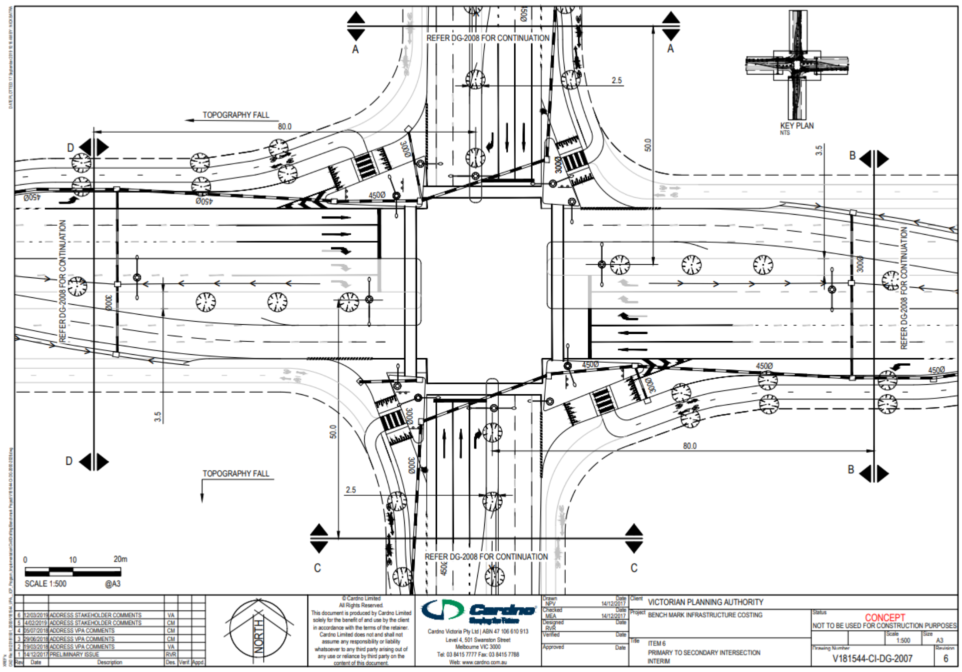
In the case of Arterial/Connector Road intersections, the Benchmark report includes only residential Connector Road designs. For OSE PSP which includes residential and commercial/industrial land uses, the Growth Areas handbook Arterial/Industrial Connector (High Turning Volumes) typical layout has been adopted as the default drawing. The layouts of the relevant designs from the Benchmark report and VicRoads are reproduced below.

Figure 4.1: Primary Arterial to Primary Arterial Benchmark Intersection Layout



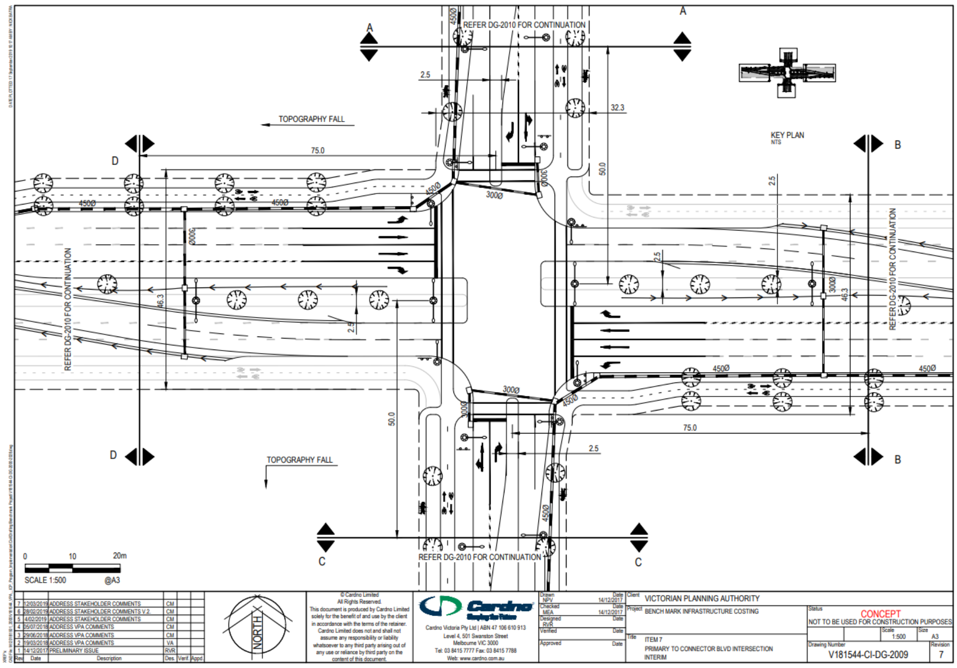
The above outlined benchmark design includes the provision of left-turn slip lanes on all the approaches to the intersection. The ultimate provisions also allow for double-right turn lanes on all approaches to the intersection.

Figure 4.2: Primary Arterial to Secondary Arterial Benchmark Intersection Layout



The above outlined benchmark design includes the provision of left-turn slip lanes on all the approaches to the intersection. The ultimate provisions also allow for double-right turn lanes on the Primary Arterial Road approaches and a single right turn lane on the Secondary Arterial Road approaches to the intersection.

Figure 4.3: Primary Arterial to Boulevard Connector Street Benchmark Intersection Layout



The above outlined benchmark design does not include left-tun slip lanes on any of the approaches to the intersection. In addition, the ultimate intersection provisions allow for one right turn lane on all the intersection approaches and a shared through/left-tun lane on the Boulevard Connector Street intersection approaches.

Figure 4.4: Secondary Arterial to Boulevard Connector Street Benchmark Intersection Layout

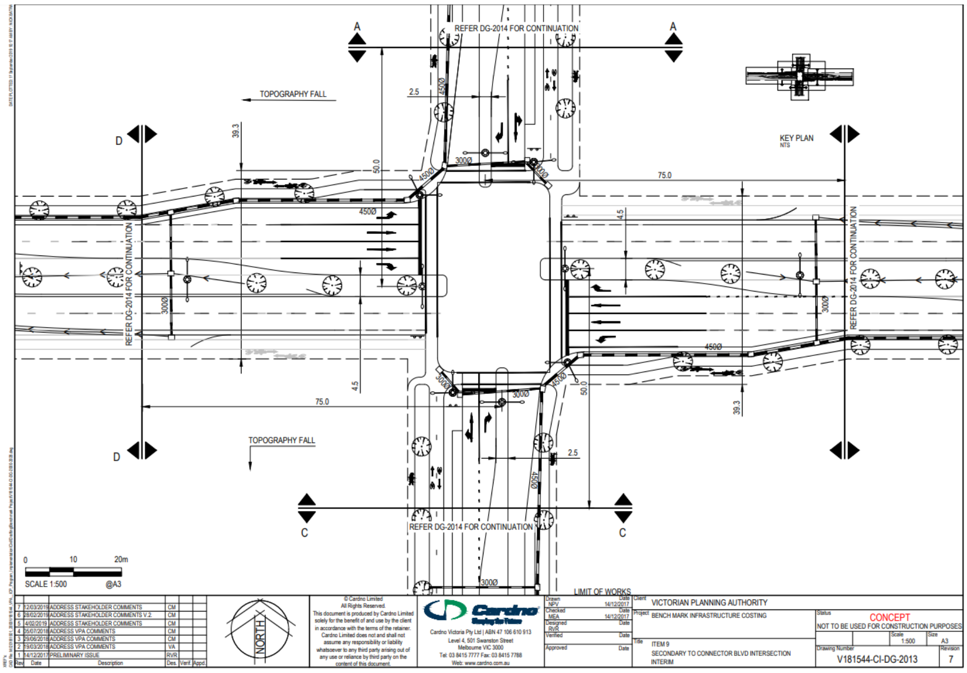
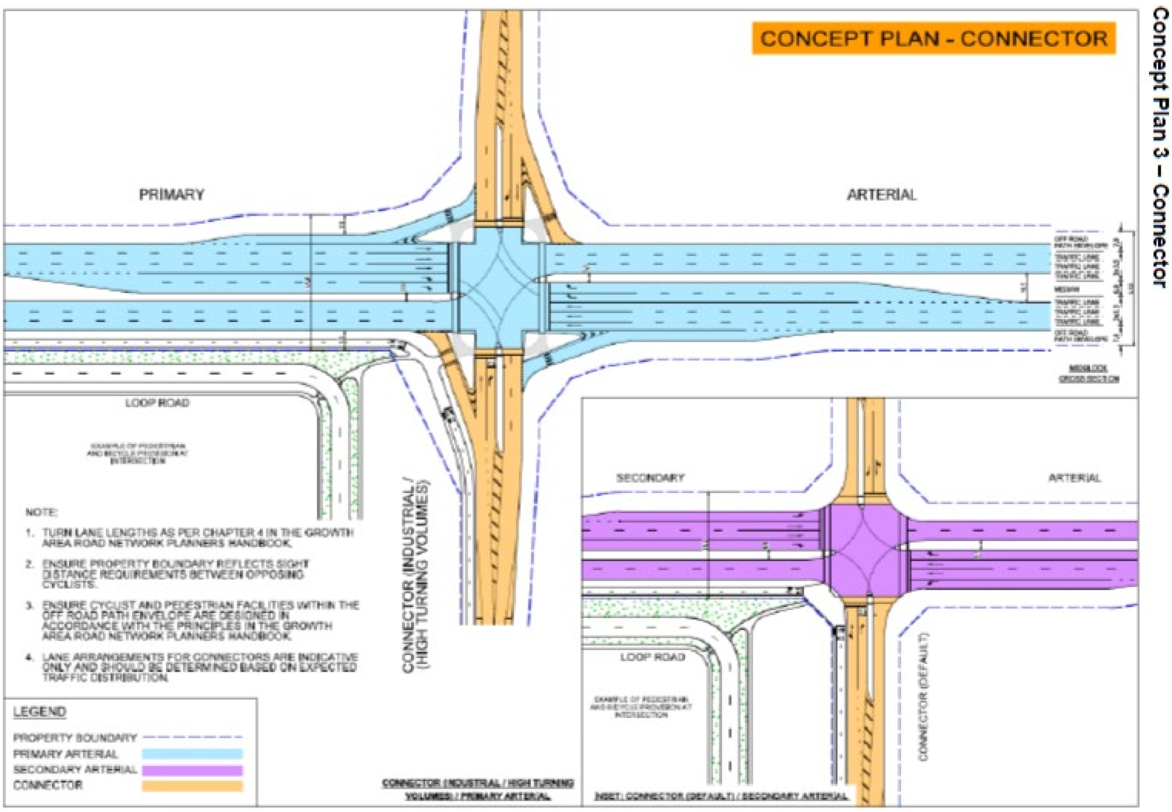


Figure 4.5: Arterial/Industrial Connector (High Turning Volumes) Layout (VicRoads)



The residential and industrial default intersection drawings are deemed to be applicable in most situations where growth area road network planning principles (outlined at Chapter 4.1

earlier) have been applied. The default designs do not apply in all situations, as discussed in more detail at Chapter 7.3.

The key difference between the industrial connector intersection (Figure 4.5) and the residential connector intersections (Figure 4.3 and Figure 4.4) is that left-turn slip lanes are provided on all approaches to the intersection. The arterial road approaches in the industrial connector example also include provision for double right turn lanes, whereas the residential layouts provide for only one.

5. PSP Sustainable Transport Infrastructure

5.1. PSP Sustainable Transport Infrastructure Plan

The sustainable transport infrastructure elements of the OSE PSP are outlined in the Public Transport and Active Path Networks Plan (refer to Figure 3.4). This plan notes that all Arterial Roads and Connector Streets within the PSP area are expected to be bus capable with Lecky Road and Officer South Road, north of Lecky Road, forming part of the future Principal Public Transport Network (PPTN).

Dedicated bike lanes or off-road 2-way bike lanes and footpaths (both sides of the carriageway) are also proposed along all the Connector Streets and Arterial Roads within the PSP area.

Figure 3.4 also shows the provision of off-road shared paths adjacent to open spaces and waterways. An equestrian trail is also included adjacent to Cardinia Creek and the utilities easement located to the south of Thompsons Road.

5.2. Walking Network Review

The VPA PSP Guidelines – PSP Note – Our Roads: Connecting People (August 2011) notes that pedestrian outcomes for a PSP transport network include:

- Continuous footpaths on both sides of all streets and roads;
- Regular crossing points, shade and rest points;
- Provision for users of all abilities;
- Pedestrian priority in areas of high foot traffic, (e.g. town centres - also known as activity centres and schools); and
- An attractive appearance to improve amenity and encourage walking.

As previously outlined in Figure 3.4, footpaths are proposed on both sides of the carriageway on all Arterial Roads and Connector Streets within the PSP area. In addition, off-road shared paths are proposed adjacent to open spaces and waterways. The provision of two pedestrian bridges will also allow for good connectivity to surrounding off-road shared paths. Although not shown on the PSP plans, footpaths are also included on both sides of Local Access Streets.

Furthermore, signalised intersections along the Arterial Road frontages will include pedestrian crossing facilities. In addition, a set of pedestrian signals is proposed within the LTC area.

The proposed pedestrian provisions suitably address the pedestrian outcomes sought by the VPA PSP Guidelines – PSP Note – Our Roads: Connecting People, and further accord with the DoT's recent Movement and Place thinking which centres around recognising that streets not only keep people and goods moving, but they are also places for people to live, work and enjoy.

The provision of Boulevard Connector Streets/Connector Streets which include footpaths on both sides of the carriageway balance the primary industrial/business land use needs of the OSE PSP with pedestrian movement and connectivity throughout the PSP area.

5.3. Cycling Network Review

The VPA PSP Guidelines – PSP Note – Our Roads: Connecting People (August 2011) notes that cyclist outcomes for a PSP transport network include:

- Provide for commuter and recreational cycling as appropriate;
- Bicycle priority treatments over motorised traffic where appropriate;
- Dedicated bicycle facilities on all Connector Streets and Arterial Roads to facilitate travel by cyclists; and
- Safe road crossing facilities.

Figure 3.4 includes dedicated bike lanes or off-road 2-way bike lanes along all the Connector Streets and Arterial Roads within the PSP area, furthermore Figure 3.4 shows the provision of off-road shared paths adjacent to open spaces and waterways which all connect to the on-road bicycle provisions thereby meeting the above outlined cyclist outcomes.

5.4. Public Transport Provisions Review

The State Government's PPTN reflects the routes where high-quality public transport services are or will be provided. The PPTN is a statutory land use planning tool that supports the integrated land use and transport planning and aims to provide certainty to the community about the locations that are, or will be, serviced by high-quality public transport.

Within the OSE PSP Grices Road/Lecky Road and Officer South Road, north of Grices Road/Lecky Road are identified in the South East Growth Corridor Plan as future PPTN routes.

Thompsons Road and Officer South Road (north of Thompsons Road) are not currently identified as part of the PPTN or as strategically significant future public transport routes by the DoT. However as Primary Arterial Roads they will be bus capable and therefore would provide opportunity for the provision of future high-frequency public transport services.

6. Anticipated Future Traffic Volumes

6.1. Overview

To confirm the appropriateness of the PSP road network and the associated Infrastructure Contributions Plan (ICP) items, the VPA commissioned strategic transport modelling for the precinct to assess the future transport demands based on land use and infrastructure upgrade predictions. This modelling was completed by GHD Pty Ltd with the process and findings documented in the Officer South Employment PSP – Transport Modelling Assessment report, final report, dated 7 November 2022, (the GHD Modelling report).

The forecast traffic volumes from this modelling were used to confirm the appropriateness of the PSP road network and the associated ICP intersections.

This section summarises the traffic generation assessments with the appropriateness of the PSP road network and the associated ICP discussed in Section 7.

6.2. Strategic Modelling Review

Ratio was provided with a copy of the GHD Modelling report which documents the strategic modelling undertaken by GHD. This modelling utilised the State Government's Victorian Integrated Transport Model (VITM) to assess future transport demands using land use and infrastructure upgrade predictions for the precinct and surrounding areas.

The land uses and road network within VITM were updated and refined by GHD based on information provided by the VPA for the PSP area. These changes included the following:

- Disaggregation of the zone structure for the PSP area;
- Updates to the future modelled land use yields for the PSP area; and
- Updates to the PSP area road network.

The above outlined changes are documented in detail in the GHD Modelling report and summarised in the following sub section:

6.2.1 VITM Overview

The VITM is a State Government tool developed by the DoT to assist in the planning of road and public transport infrastructure for Victoria. It is a multimodal strategic model that uses future population, employment, and land use data projections to forecast travel behaviour and the impacts of changes to the road and public transport networks.

The model is a link-based transport model which is implemented within the CUBE Voyager software environment.

It is a four-step strategic model, with each step summarised as follows:

1. **Traffic Generation:** the model generates trips between origins and destinations based on land use inputs and other demographic inputs.

2. **Traffic Distribution:** the generated trips are distributed between origins and destinations (journeys) based on their relative generation and attraction potential.
3. **Mode Choice:** transport mode apportions are allocated to journeys based on relative attractiveness.
4. **Assignment:** The journeys are allocated to the transport network.

Further detail on the structure and use of VITM is provided in the GHD Modelling report.

6.2.2 VITM Limitations

It is highlighted that VITM is a strategic-level model, and as such, is a simplified representation of the real world and should be used as a guidance tool. VITM therefore provides a coarse but strategic understanding of how user demands will change into the future, including potential mode shifts, and the likely potential performance of the resulting transport network, as well as comparisons of potential infrastructure options.

VITM's strengths are therefore in its ability to indicate changes brought about by the implementation of transport infrastructure schemes, land use changes or policy driver measures, and the use of outputs in a sensible and pragmatic manner.

The outputs of the transport model must be interpreted in accordance with the design of the model, taking into account the complexity of the model and its probable robustness. The benefit of using VITM is that once it is validated for an existing situation, it can be used to forecast the effects of a variety of future land uses, transport infrastructure and/or policy changes on travel.

6.2.3 VITM Inputs

The VITM inputs for the precinct (including households, jobs and education enrolments) are detailed in the GHD Modelling report. The modelled zone structure and road network are outlined in Figure 6.1 and Figure 6.2:

Figure 6.1: VITM Zone Structure

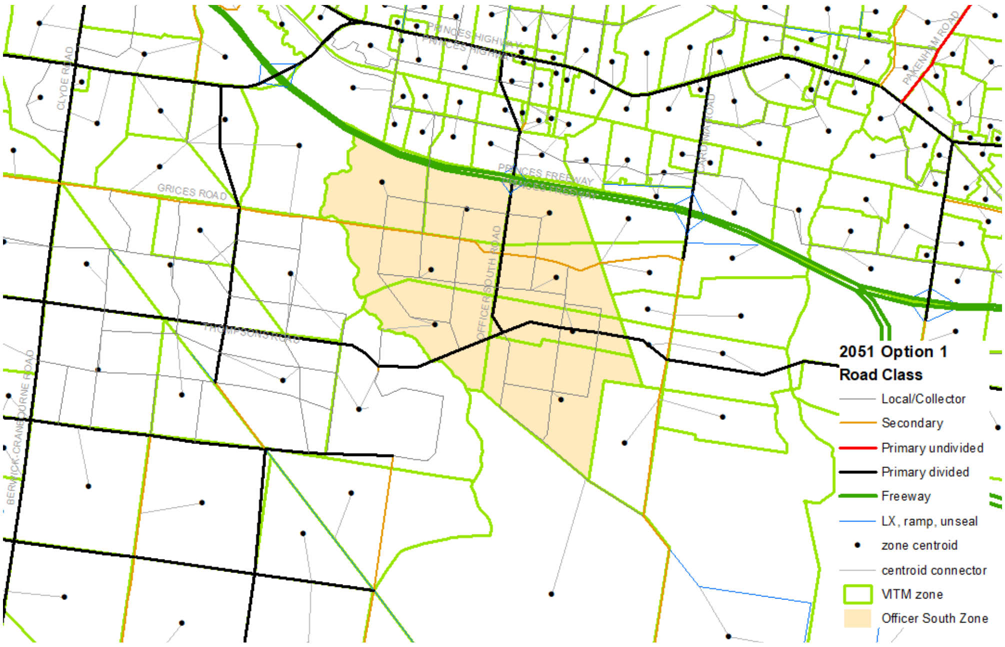


Figure 6.2: VITM Road Network

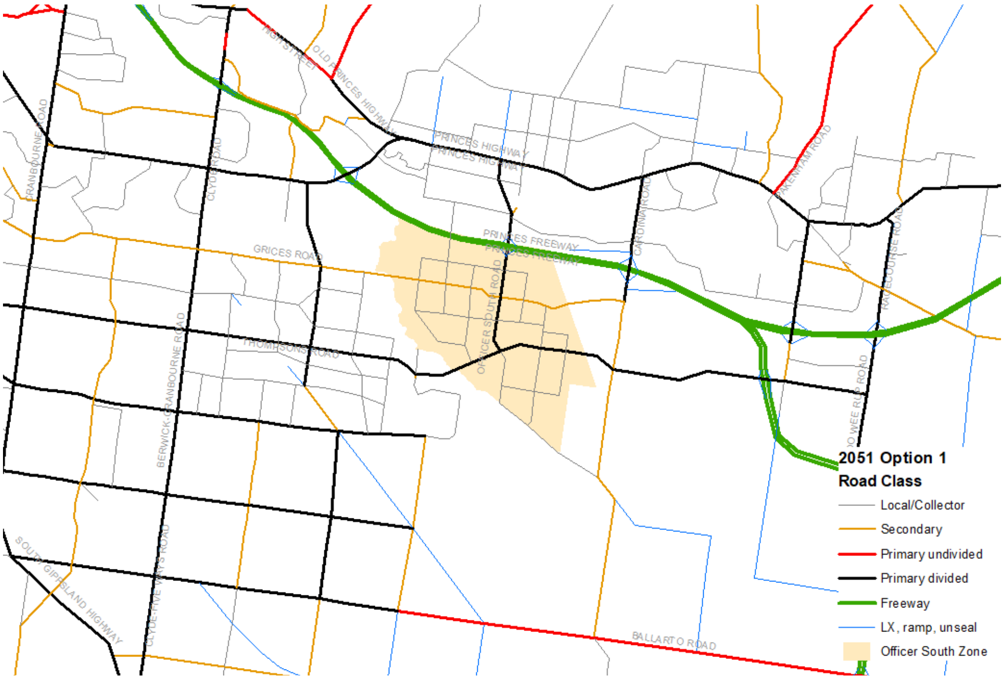


Figure 6.1 and Figure 6.2 show that VITM road network and zone structure have been refined to include the Connector Street network within the OSE PSP area and that the modelled zone centroid connectors are located to load trips onto the Connector Street network directly.

6.2.4 VITM Outputs

Daily Volume Outputs

The resulting ultimate (year 2051) VITM daily volume outputs, which represent full build out of the South East Growth Corridor including the OSE precinct and expected transport infrastructure improvements are outlined in Figure 6.3:

Figure 6.3: VITM 2051 Daily Traffic Volume Outputs

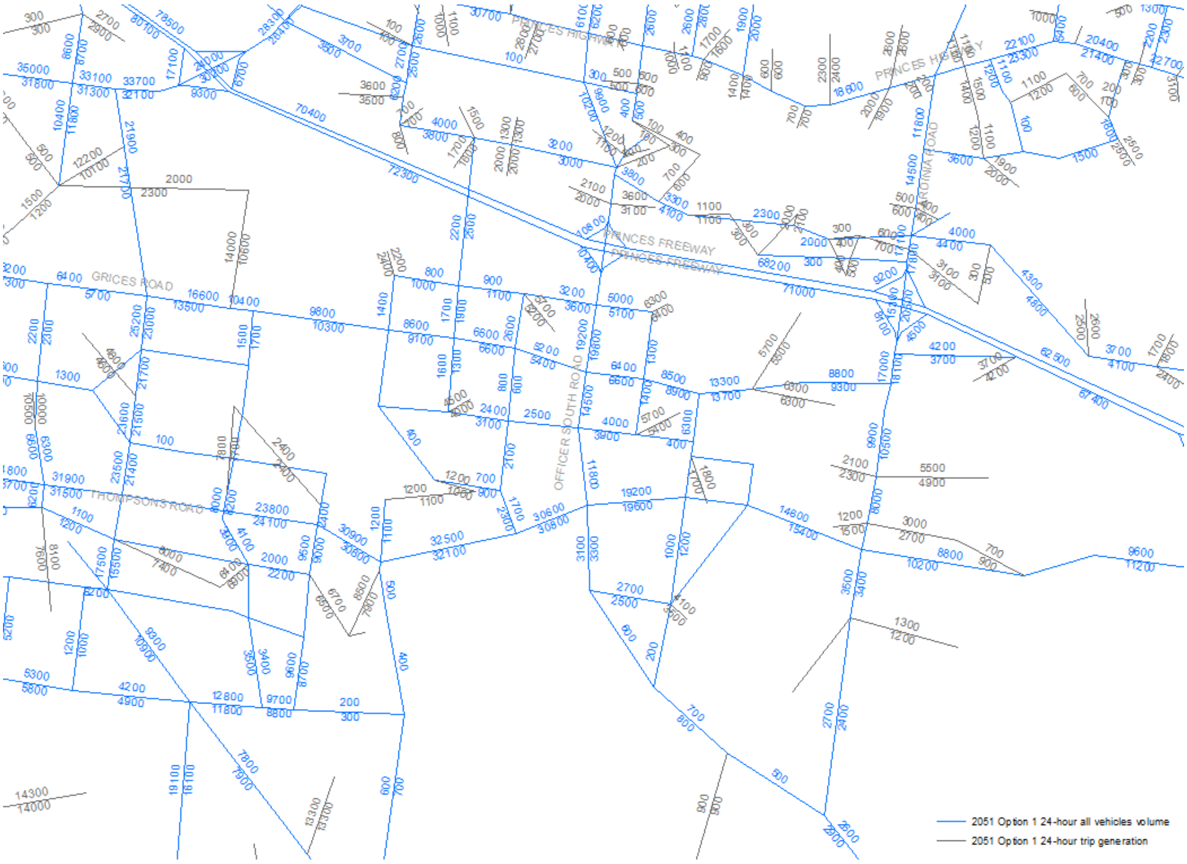


Figure 6.3 indicates that east-west movements within the PSP area favour the use of Thompsons Road (Primary Arterial Road) over Lecky Road (Secondary Arterial) given the Primary Arterial status of Thompsons Road and its continuation further east than Lecky Road/Grices Road.

Table 6.1: Existing Road Network and Daily Traffic Volumes

Road	Two-Way Volume (vpd)			
	East of PSP Area	East of Officer South Road	West of PSP Area	West of Officer South Road
Thompsons Road	30,000	38,800	61,700	61,400
Lecky Road	27,000	13,000	20,100	20,100
% Difference	10%	66%	67%	67%

It is noted that the strategic nature of VITM lends to a greater concentration of traffic towards Thompsons Road even though Lecky Road is more centralised within the PSP area, and that the Princes Freeway also provides a key east-west connection to the north of the study area. In practise, if oversaturated conditions are experienced on Thompsons Road, it is likely that some east-west traffic will re-distribute to Lecky Road/Grices Road and the Princes Freeway.

It is further highlighted that the macro level placement of centroid connectors concentrates traffic onto points on the Connector Street network, rather than dispersing it to more accurately represent how traffic loads onto the network from individual development sites.

2-Hour Peak VITM Outputs

The AM 2-hour peak VITM volumes are outlined in Figure 6.4, and the inbound/outbound trips and the associated directional distributions along key routes are summarised in Table 6.2. These volumes represent inbound and outbound trips at the boundaries of the OSE precinct.

Figure 6.4: VITM 2051 2-Hour AM Peak Traffic Volume Outputs

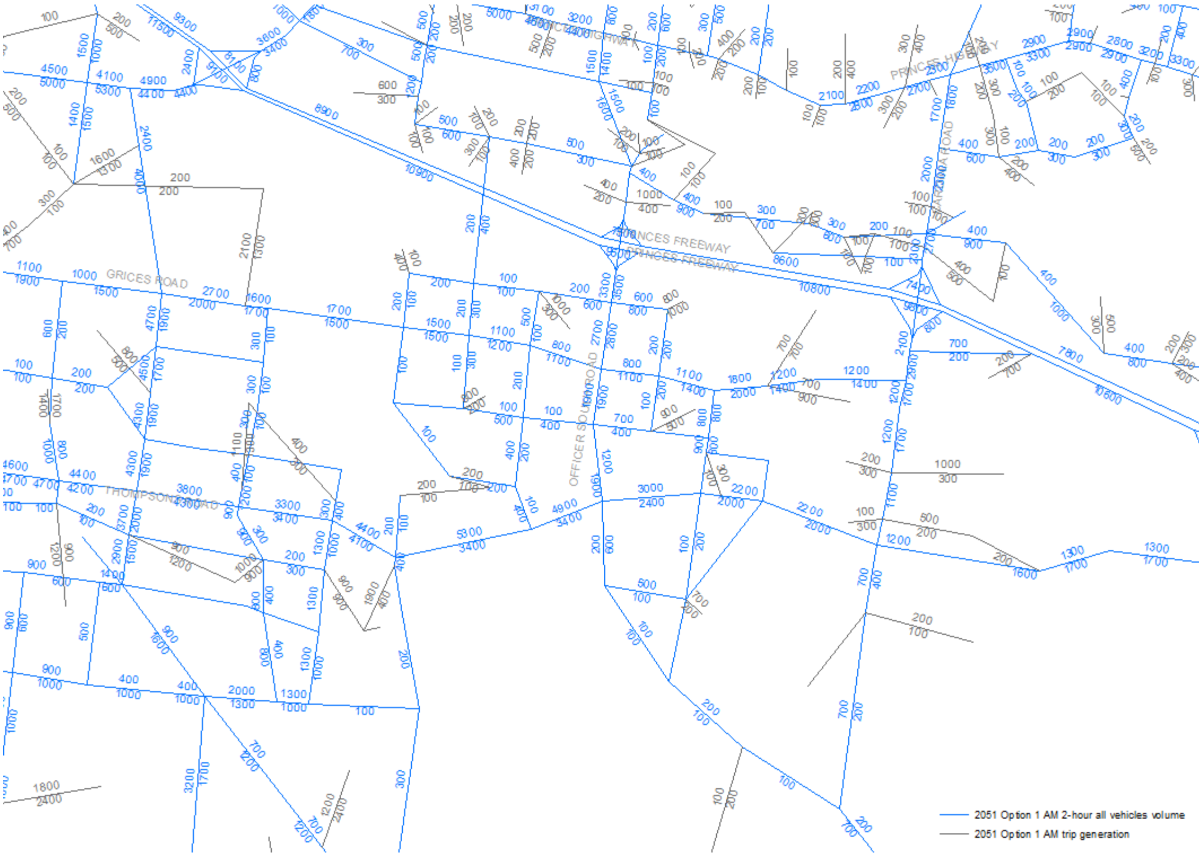
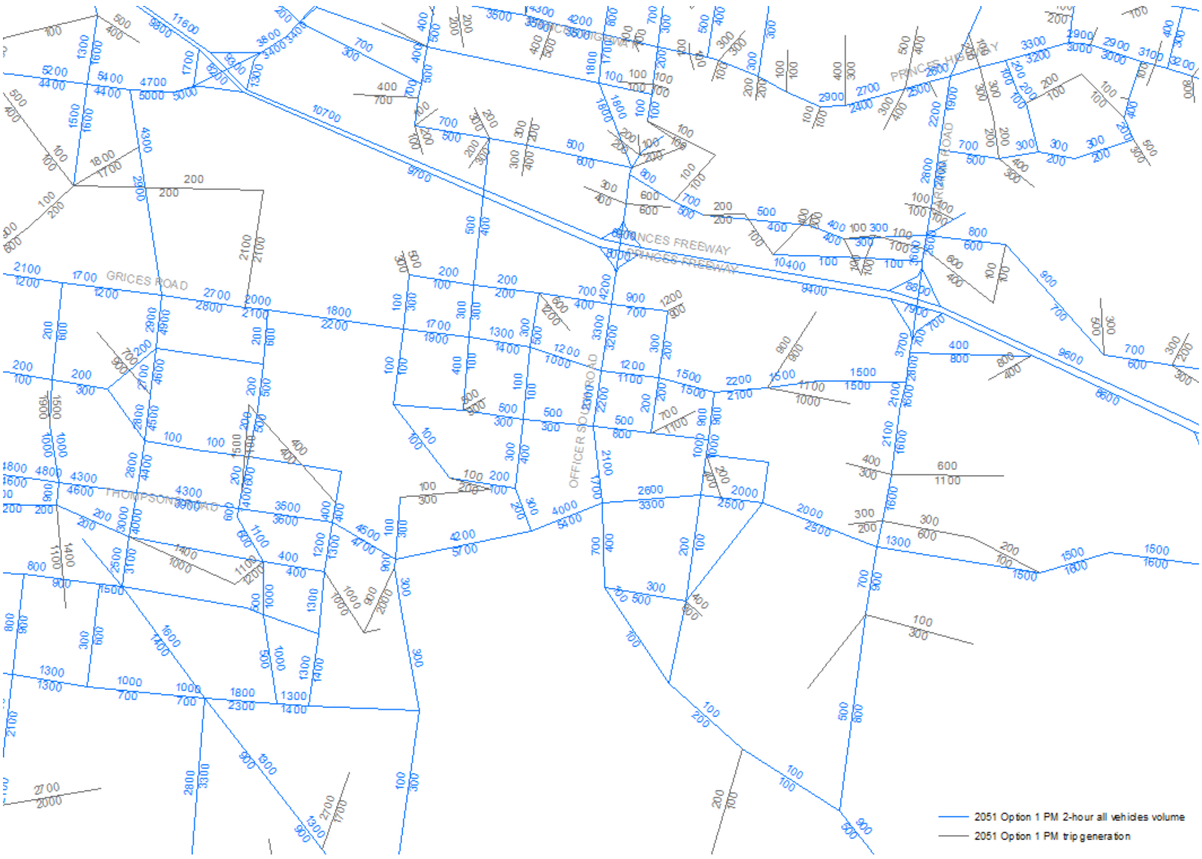


Table 6.2: VITM AM 2-hour Peak Volume Analysis

Location	VITM Volume Output			Directional Splits		
	Inbound	Outbound	Total	Inbound	Outbound	Total
East via Thompsons Road	2,000	2,200	4,200	15%	17%	16%
West via Thompsons Road	4,400	4,100	8,500	32%	31%	32%
East via Lecky Road	2,000	1,800	3,800	15%	14%	14%
West via Lecky Road	1,700	1,500	3,200	12%	11%	12%
North via Officer South Road	3,500	3,300	6,800	26%	25%	25%
South via Officer South Road	100	200	300	1%	2%	1%
Total	13,700	13,100	26,800	100%	100%	100%

The PM 2-hour peak VITM volumes are outlined in Figure 6.5, and the inbound/outbound trips and the associated directional distributions along key routes are summarised in Table 6.3. These volumes again represent inbound and outbound trips at the boundaries of the OSE precinct.

Figure 6.5: VITM 2051 2-Hour PM Peak Traffic Volume Outputs



The PSP inbound/outbound trips and the associated directional distributions along key routes are summarised in Table 6.3:

Table 6.3: VITM PM 2-hour Peak Volume Analysis

Location	VITM Volume Output			Directional Splits		
	Inbound	Outbound	Total	Inbound	Outbound	Total
East via Thompsons Road	2,500	2,000	4,500	17%	13%	15%
West via Thompsons Road	4,500	4,700	9,200	31%	31%	31%
East via Lecky Road	2,100	2,200	4,300	14%	14%	14%
West via Lecky Road	1,800	2,200	4,000	12%	14%	13%
North via Officer South Road	3,600	4,200	7,800	24%	27%	26%
South via Officer South Road	200	100	300	1%	1%	1%
Total	14,700	15,400	30,100	100%	100%	100%

It is highlighted that in both the AM and PM peaks that VITM distributes more trips to/from the west along Thompsons Road rather than to/from the north along Officer South Road towards the Officer South Road/Princess Freeway Interchange.

7. Road Network Capacity Assessment

7.1. Overview

The transport elements of the PSP were previously outlined in Section 3. The following subsections discuss the appropriateness of the PSP road network from a capacity perspective.

The PSP roads and the road reservation widths are planned to serve several roles including safe and efficient movement of people and goods by road-based transport modes and access to abutting land use. The OSE PSP road network should be planned in recognition of these roles in order to meet the needs of all users including pedestrians and cyclists, public transport services, private passenger vehicles and heavy vehicles.

7.2. Suitability of the Road Network

The VPA PSP Note "Our Roads: Connecting People" notes that Connector Streets should provide for up to approximately 7,000 vpd and when volumes exceed this, additional links to the Arterial Road network may be required. The traffic generated by the sub precincts within the PSP was divided by the proposed number of Connector Streets to give the average daily volume carried by each Connector Street (at the OSE PSP boundary).

Table 7.1 presents this analysis. The sub-precincts used for the purpose of this analysis are shown as Figure 7.1.

Table 7.1: Connector Street Volumes by Sub-Precinct

Sub Precinct	VITM 2051 Daily Traffic Volumes by Sub Precinct (from Figure 6.3)	Proposed Number of Connector Streets (External Connections)	Average Daily Volume per Connector Street
1	4,600	2	2,300
2	10,900	3	3,630
3	12,700	2	6,350
4	13,000	5	2,600
5	11,100	5	2,220
6	11,100	2	5,550

Figure 7.1: Sub-Precincts for Assessment of Connector Streets

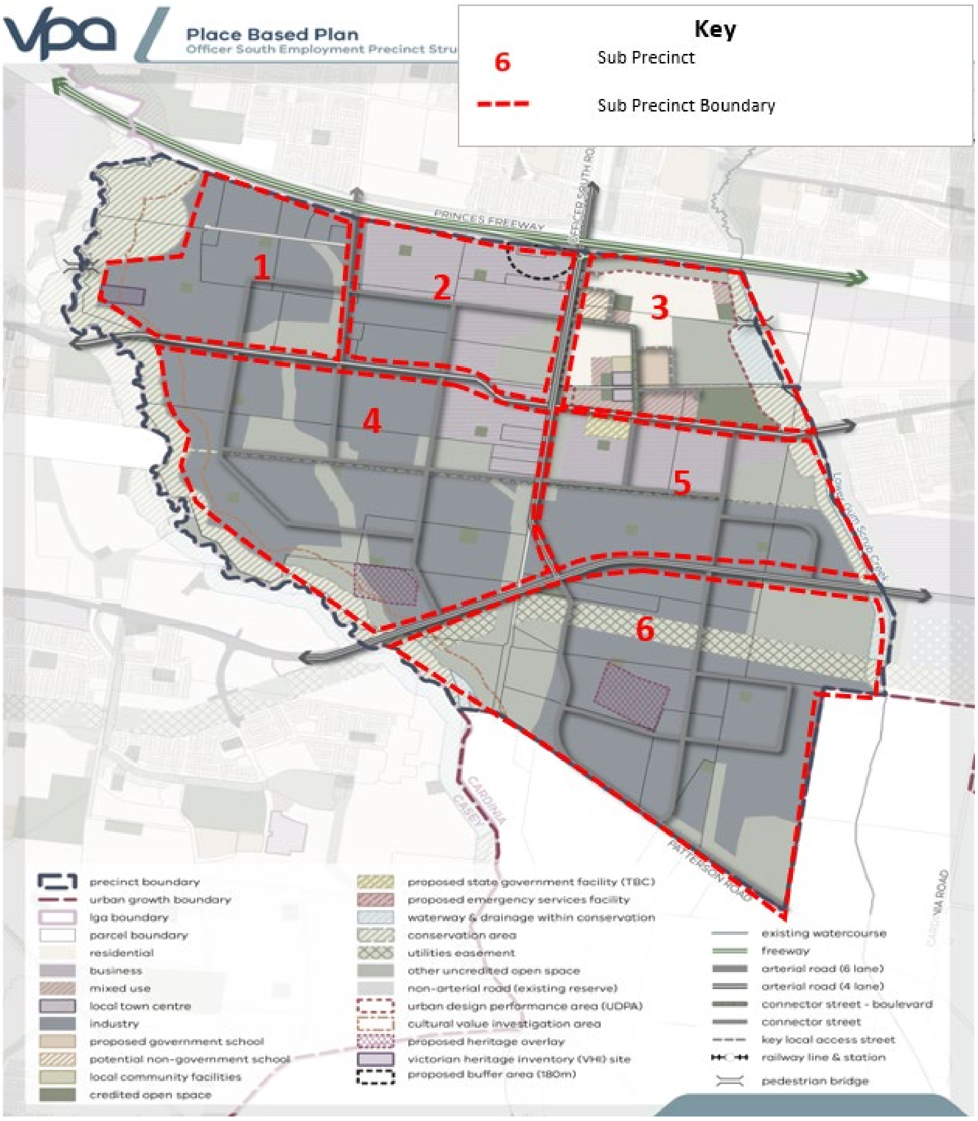


Table 7.1 demonstrates that the Connector Streets in all sub precincts carry less than the typical 7,000 vpd threshold.

7.3. Suitability of the Proposed ICP Intersections

In accordance with the VicRoads handbook referenced at Chapter 4, default layouts are generally adopted for planning PSP signalised intersections. In the OSE PSP, four intersections have been identified as requiring a more nuanced assessment that considers local network context and likely unbalanced traffic flows. These intersections are shown below in Figure 7.2 and include:

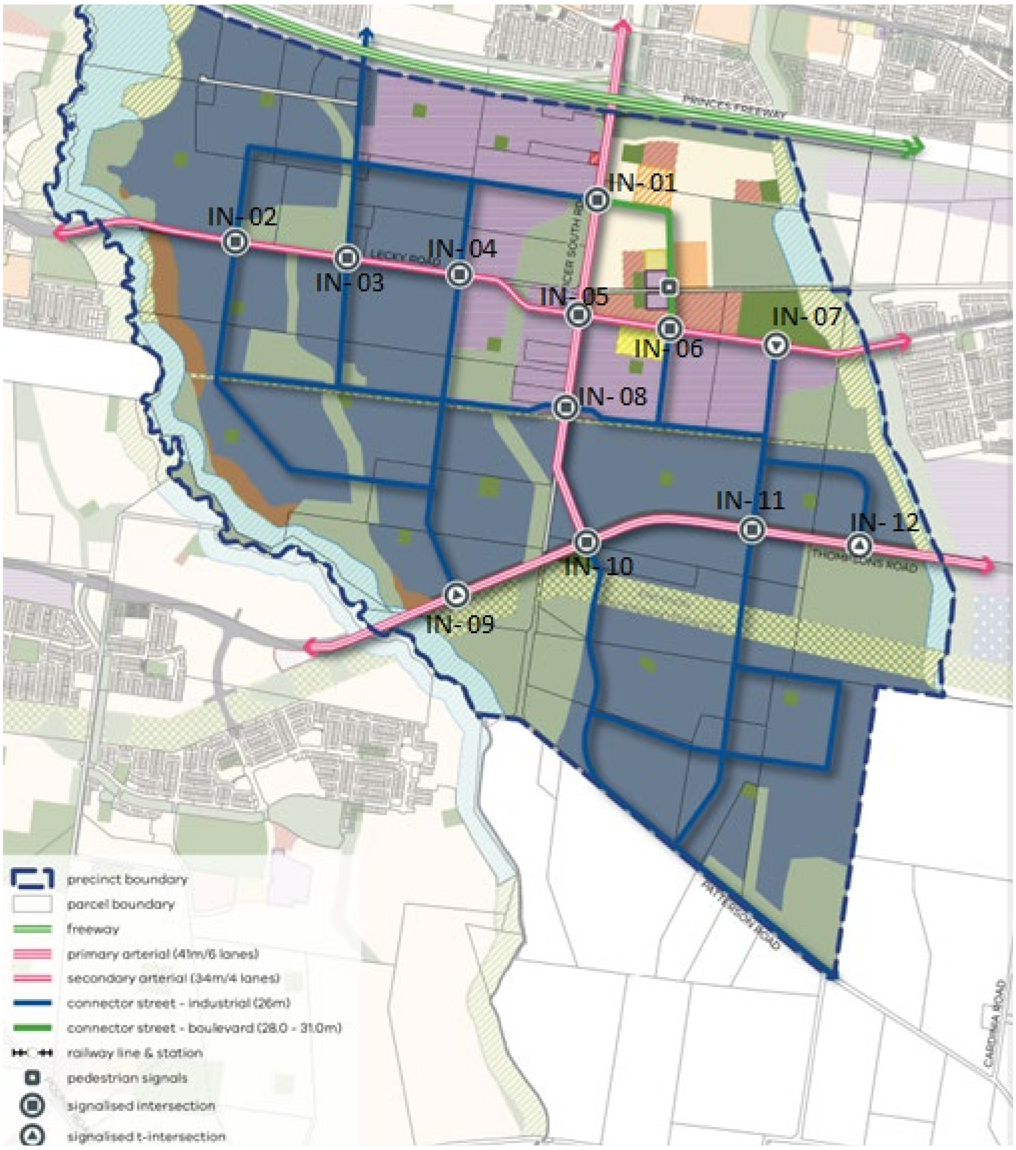
— IN-01 – located close to freeway interchange;

— IN-05 – expected unbalanced flows resulting from proximity to freeway interchange;

— IN-10 – arterial road/connector road interface with unbalanced flows; and

— IN-06 – Town Centre access intersection.

Figure 7.2: Location of the OSE PSP ICP Intersections



The assessment process and the resulting outcomes for the nominated intersections are discussed as follows:

Assessment Methodology

The above-mentioned intersections were assessed by deriving ultimate (2051) AM and PM commuter peak hour traffic volumes for the intersections and then testing the intersection layout requirements needed to cater for the expected traffic volumes. The VITM peak turning volumes for intersections were factored from two hours to one hour using a factor of 0.55.

The following assumptions were also applied:

- A negligible level of background traffic given the location of the PSP area on the fringe of Urban Growth Boundary and the makeup of the surrounding road network (noting that adjacent growth areas are also serviced with connections to the Princess Freeway negating the need for traffic from these areas having to use the Officer South Road/Princess Freeway interchange).
- 15% of traffic movements through the intersections were heavy vehicles (to account for access to Business and Industrial uses within the OSE PSP area).

- The tested signalised intersections were all modelled with a cycle time of 120s.

SIDRA Intersection Software

SIDRA Intersection software was used to determine the intersection requirements. It is a micro-analytical software tool used as an aid for the evaluation and design of intersections.

It is commonly used to test intersection capacity, Level of Service (LOS) and performance. A commonly used measure of intersection performance is the Degree of Saturation (DOS). The DOS represents the flow-to-capacity ratio for the most critical movement on each leg of the intersection. For signalised intersections, a DOS of around 0.95 has been considered the typical "acceptable" limit, beyond which queues and delays increase disproportionately.[2]

Although operating conditions with a DOS of close to 1.00 are undesirable, it is acknowledged that this level of congestion is typical of many urban intersections during the AM and PM commuter peak hours.

SIDRA was used to assess the intersection layout requirements of the assessed intersections. Initially the intersections were assessed using the Benchmark ICP intersection layouts, if the DOS was found to be greater than 1.00 the layout of the intersection was altered until it returned to less than 1.00. The results of the SIDRA modelling and the resulting intersection layout recommendations are outlined in the following sections.

The intersections were modelled with split phasing in some cases and overlapping (concurrent) right turns in other cases, whichever proved to be the most efficient in each time-period. The modelled layouts of the intersections would allow either split or concurrent phasing and it is recommended that this be allowed for in the designs.

IN-01 Officer South Road / Connector Street Intersection

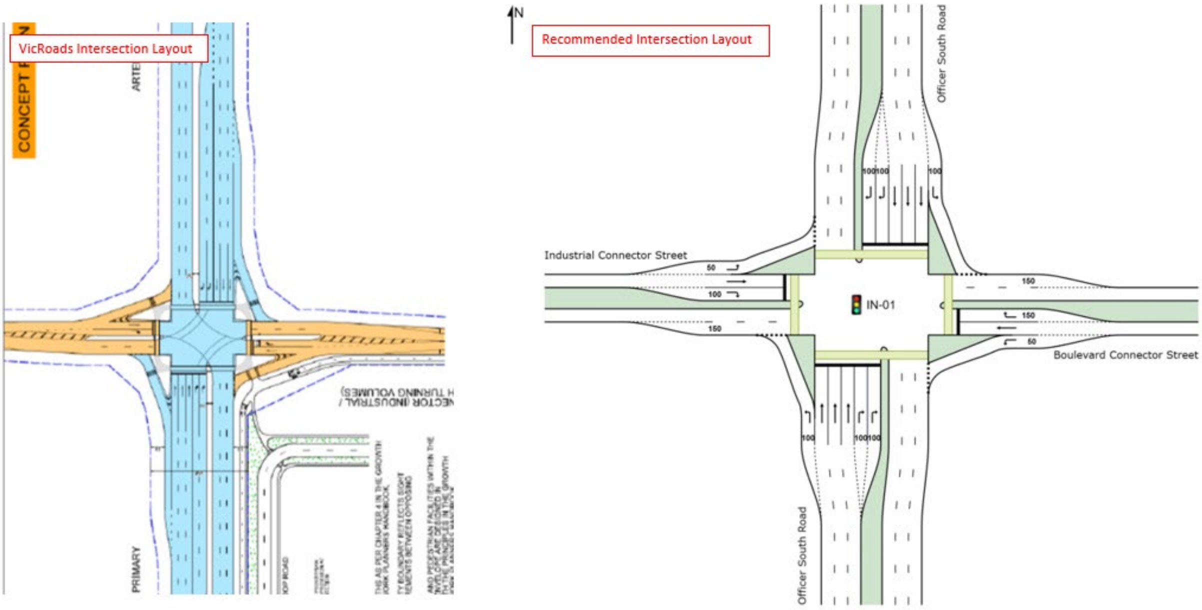
The tested AM and PM commuter traffic volumes are included in Appendix A.

The adopted intersection layout alongside the ICP Benchmark Intersection is outlined in Figure 7.3:

[2] SIDRA adopts the following criteria it its Level of Service assessment:

Level of Service (LOS)		Intersection Degree of Saturation (DOS)		
		Unsignalised Intersection	Signalised Intersection	Roundabout
A	Excellent	<=0.60	<=0.60	<=0.60
B	Very Good	0.60-0.70	0.60-0.70	0.60-0.70
C	Good	0.70-0.80	0.70-0.90	0.70-0.85
D	Acceptable	0.80-0.90	0.90-0.95	0.85-0.95
E	Poor	0.90-1.00	0.95-1.00	0.95-1.00
F	Very Poor	>=1.00	>=1.00	>=1.00

Figure 7.3: IN-01 Officer South Road / Connector Street Intersection Layout Requirements



Based on the layouts shown in Figure 7.4 no departures from the VicRoads intersection for Primary Arterial / Industrial or High Turning Volume Connector Street intersection are recommended.

The full results of the SIDRA modelling and the modelled intersection layout are included in Appendix A and are summarised below in Table 7.2:

Table 7.2: IN-01 Officer South Road / Connector Street Intersection – SIDRA Outputs

Approach	Movement	AM Peak Hour			PM Peak Hour		
		DOS	Average Delay (s)	95th Percentile Queue Length (m)	DOS	Average Delay (s)	95th Percentile Queue Length (m)
Officer South Road (South)	Left	0.022	9	2	0.028	8	2
	Through	0.629	34	157	0.691	27	212
	Right	0.312	58	31	0.659	68	44
Boulevard Connector Street (East)	Left	0.157	11	23	0.161	11	20
	Through	0.037	37	6	0.038	42	5
	Right	0.708	51	127	0.678	55	99
Officer South Road (North)	Left	0.126	8	8	0.232	8	20
	Through	0.716	36	186	0.577	25	164
	Right	0.680	61	74	0.662	68	45
Industrial Connector Street (West)	Left	0.139	17	18	0.679	25	114
	Through	0.066	62	3	0.251	63	11
	Right	0.024	67	1	0.095	68	4
Intersection		0.716	36	186	0.691	29	212

The intersection is expected to operate a “good” to “very good” level during the AM and PM peak periods.

Whilst the 95th percentile queue (value below which 95 percent of all observed cycle queue lengths fall, or 5 percent of all observed queue lengths exceed) for the movement towards the Princes Freeway in the PM was modelled to be 212m, the average associated delay of 27s indicates that on average, vehicles will clear the intersection within one cycle.

It is noted that the modelled queue in the left turn lane on the Industrial Connector (West) approach is 114m and exceeds the 50m length of the lane, in the PM peak only.

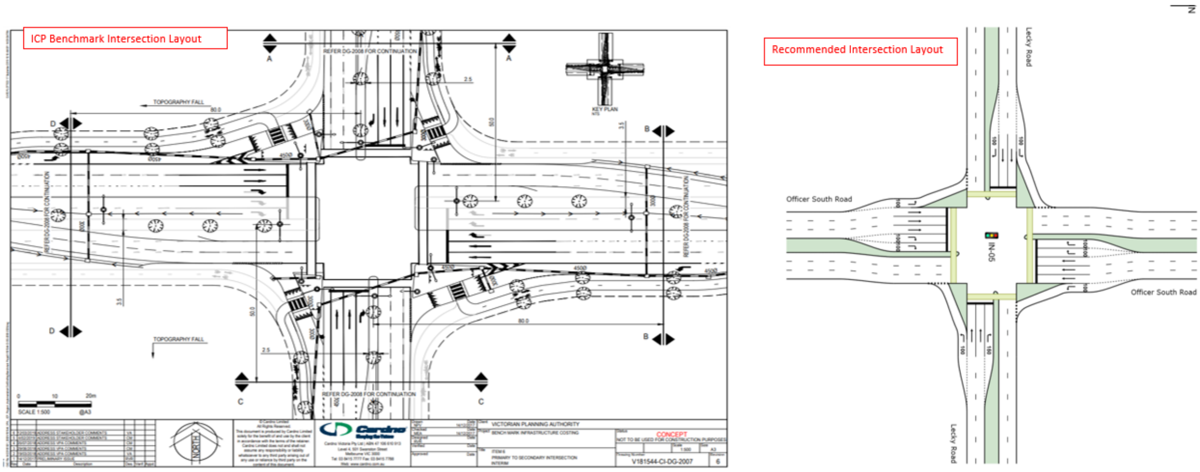
This lane could be lengthened to contain this queue however this is not seen as essential. The left turn movement is the dominant movement on this approach (making up 92% of the volume). It has a modelled volume of 356 vehicles per hour (vph) compared to the expected volume of 23 vph in the adjacent through lane and 8 vph in the right turn lane. The impact of the 95th percentile queue from the left turn extending into the adjacent through lane is expected to be minimal, meaning there is limited benefit in extending the left turn lane.

IN-05 Officer South Road / Lecky Road Intersection

The tested AM and PM commuter traffic volumes are included in Appendix A.

The adopted intersection layout alongside the ICP Benchmark Intersection is outlined in Figure 7.4:

Figure 7.4: IN-05 Officer South Road / Lecky Road Intersection Layout Requirements



Based on the layouts shown in Figure 7.4 no departures are recommended from the ICP Benchmark intersection for Primary Arterial / Secondary Arterial Road intersection.

The full results of the SIDRA modelling and the modelled intersection layout are included in Appendix A and are summarised below in Table 7.3:

Table 7.3: IN-05 Officer South Road / Lecky Road Intersection – SIDRA Outputs

Approach	Movement	AM Peak Hour			PM Peak Hour		
		DOS	Average Delay (s)	95th Percentile Queue Length (m)	DOS	Average Delay (s)	95th Percentile Queue Length (m)
Officer South Road (South)	Left	0.015	9	2	0.022	9	2
	Through	0.677	45	126	0.840	50	208
	Right	0.104	58	9	0.228	63	16
Lecky Road (East)	Left	0.041	10	5	0.051	10	6
	Through	0.339	47	45	0.242	40	39
	Right	0.763	55	144	0.851	63	172
Officer South Road (North)	Left	0.188	8	14	0.259	8	30
	Through	0.745	47	145	0.658	41	140
	Right	0.725	65	72	0.845	74	67
Lecky Road (West)	Left	0.287	19	56	0.519	27	113
	Through	0.278	46	37	0.407	47	55
	Right	0.021	43	3	0.042	50	5
Intersection		0.763	43	145	0.851	44	208

The above SIDRA results indicate that the intersection is expected to operate an “good” level during the commuter peak hours.

It is noted that turn lane 95th percentile queues extend beyond lane lengths in the following locations/times:

— Right turn queues on Lecky Road east in the AM and PM peak; and

— Left turn queues on Lecky Road west in the PM peak.

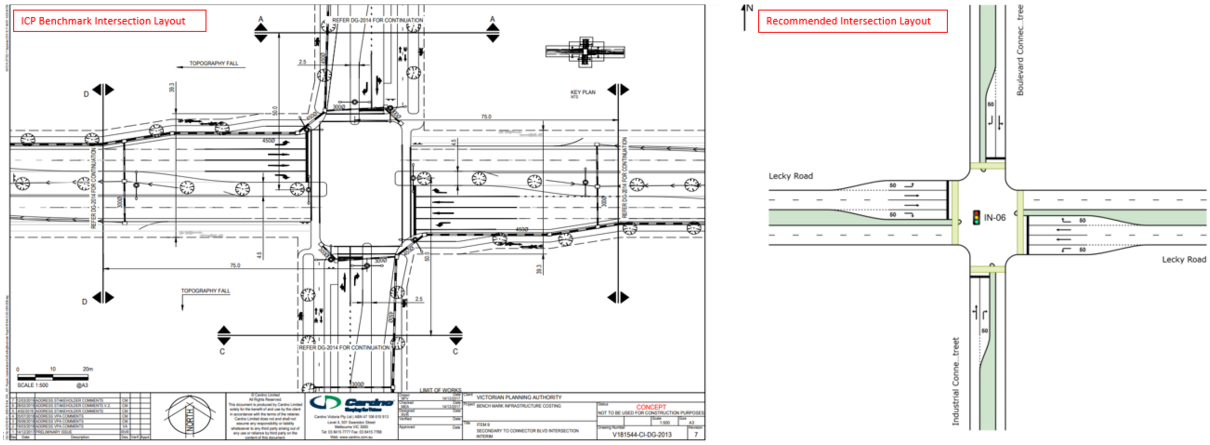
At all the above times, adjacent through lane queue lengths are substantially less than adjacent through lane lengths such that turning vehicles can overspill into the adjacent through lane with no impact on intersection performance. As such there is no benefit to increasing turn lanes to match predicted queue lengths.

IN-06 Lecky Road / Connector Street Intersection

The tested AM and PM commuter traffic volumes are included in Appendix A.

The adopted intersection layout alongside the ICP Benchmark Intersection is outlined in Figure 7.5:

Figure 7.5: IN-06 Lecky Road / Connector Street Intersection Layout Requirements



Based on the layouts shown in Figure 7.5, no departures from the ICP Benchmark are recommended.

The full results of the SIDRA modelling and the modelling intersection layout are included in Appendix A and summarised below in Table 7.4:

Table 7.4: IN-06 Lecky Road / Connector Street Intersection – SIDRA Outputs

Approach	Movement	AM Peak Hour			PM Peak Hour		
		DOS	Average Delay (s)	95th Percentile Queue Length (m)	DOS	Average Delay (s)	95th Percentile Queue Length (m)
Industrial Connector Street (South)	Left	0.044	51	5	0.080	51	9
	Through	0.044	46	5	0.080	47	9
	Right	0.343	63	22	0.492	58	49
Lecky Road (East)	Left	0.128	27	26	0.117	32	22
	Through	0.375	23	90	0.491	30	110
	Right	0.368	61	32	0.501	60	50
Boulevard Connector Street (North)	Left	0.238	44	36	0.258	45	40
	Through	0.238	40	36	0.258	41	40
	Right	0.007	60	1	0.004	53	1
Lecky Road (West)	Left	0.001	25	1	0.025	31	5
	Through	0.277	22	64	0.460	30	107
	Right	0.046	58	4	0.058	56	6
Intersection		0.375	28	90	0.501	35	110

The above SIDRA results indicate that the intersection is expected to operate an "excellent" level during the AM and PM commuter peak hours.

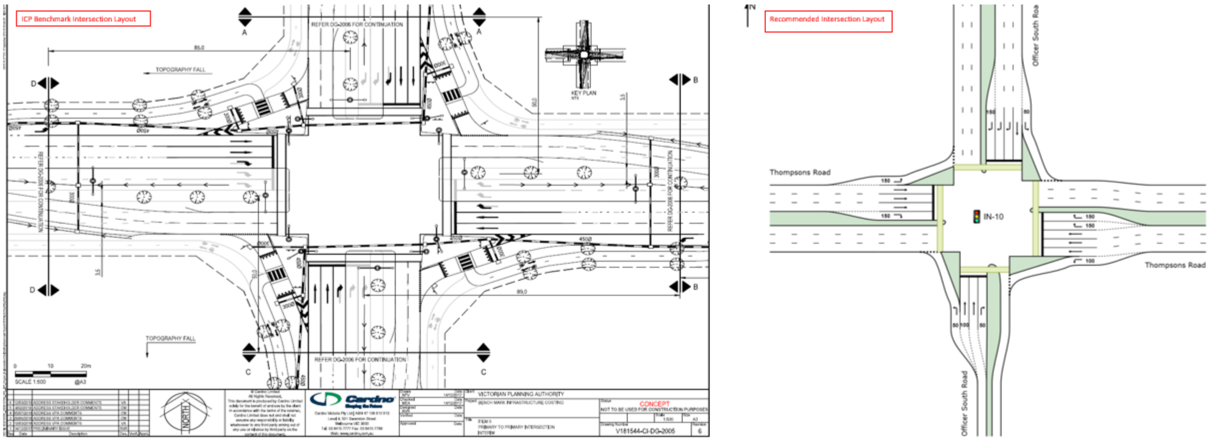
All 95th percentile queues are contained within the lane lengths at this intersection in the AM and PM peaks.

IN-10 Officer South Road / Thompsons Road Intersection

The tested AM and PM commuter traffic volumes are included in Appendix A.

The adopted intersection layout alongside the ICP Benchmark Intersection is outlined in Figure 7.6:

Figure 7.6: IN-10 Officer South Road / Thompsons Road Intersection Layout Requirements



Based on the layouts shown in Figure 7.6 the recommended departures from the ICP Benchmark intersection for Primary Arterial / Primary Arterial intersection are outlined as follows:

1. Reduced capacity (number of lanes) for movements into and out of the Officer South Road (south) approach to the intersection. This leg of the intersection carries lower traffic volumes and is an Industrial Connector Street (as opposed to a Primary Arterial Road which is assumed in the benchmark design).
2. Allocating the road space on the Officer South Road (north) approach to give three lanes to the right turn movement and one lane each to the through and left movements. This reflects the high demand for movement from north to west and the relatively low demand for movement from north to south and east.

The proposed arrangement makes efficient use of the three departure lanes that are available on Thompsons Road westbound, whilst keeping the overall number of approach lanes (5) below what is typically provided on a primary arterial (6). It also keeps the typical cross-section of Officer South Road (south) to one lane in each direction (no downstream merge).

The full results of the SIDRA modelling and the modelled intersection layout are included in Appendix A and summarised below in Table 7.5:

Table 7.5: IN-10 Officer South Road / Thompsons Road Intersection – SIDRA Outputs

Approach	Movement	AM Peak Hour			PM Peak Hour		
		DOS	Average Delay (s)	95th Percentile Queue Length (m)	DOS	Average Delay (s)	95th Percentile Queue Length (m)
Officer South Road (South)	Left	0.004	21	1	0.009	25	2
	Through	0.203	47	24	0.542	50	67
	Right	0.003	51	1	0.003	51	1
Thompsons Road (East)	Left	0.001	8	1	0.001	8	0
	Through	0.851	42	280	0.832	40	260
	Right	0.185	70	7	0.262	70	11
Officer South Road (North)	Left	0.041	14	5	0.051	18	9
	Through	0.364	47	47	0.260	45	34
	Right	0.710	59	99	0.975	106	214
Thompsons Road (West)	Left	0.643	8	89	0.670	11	138
	Through	0.778	35	226	0.951	72	416
	Right	0.571	71	23	0.614	72	25
Intersection		0.851	37	280	0.975	57	416

The intersection is expected to operate a “good” level of service in the AM and a “poor” level of service in the PM, with a DoS just below the capacity of the intersection.

The DoS condition > 0.95 occurs only in the PM peak and affects two movements (the right turn from Officer South Road (North) and the through movement from Thompsons Road (West)). These movements operate with average delays of 106 seconds/vehicle and 72seconds/vehicle, so are clearing the intersection in 1-2 cycles on average.

A larger intersection layout was tested and offers some benefits to vehicle performance including a change from DoS 0.975 to 0.915 and a reduction in average delay of approximately 11 seconds across the whole intersection. These are relatively small changes and there are disbenefits including increased crossing time for pedestrians, as well as the cost and an extent of construction to provide additional lanes on both approach and departure legs. On that basis, further changes are not recommended to the above design.

The modelled queue in the right turn lane from Officer South Road (North) is 214m, which exceeds the length of the 150m short lane, in the PM peak only. This lane could be extended however this is not seen as essential given that this is a short lane adjacent to two other full length right turn lanes. Lengthening the lane to 215m was tested and made no difference to delay or DoS performance.

8. Summary and Conclusions

8.1. Overview

The Officer South Employment precinct is located approximately 45km southeast of Melbourne’s central business district within Melbourne’s South East Growth Corridor. In accordance with Government strategic planning policy directions, the precinct will deliver a State Significant Industrial Precinct and Regionally Significant Commercial precinct.

The Officer South Employment (OSE) Precinct Structure Plan (PSP) will guide the development of the precinct and is currently being prepared by the Victorian Planning Authority (VPA) in working partnership with Cardinia Shire Council, State Government Agencies and service authorities.

On completion the PSP is expected to provide some 22,000 jobs and deliver some 1,600 new homes.

Ratio Consultants (Ratio) has been engaged to undertake an ITA, the details of which are included in this report, which will form one part of a suite of technical assessments that will assist the VPA in developing the PSP.

8.2. Draft Public Transport and Active Path Networks Plan Review

The draft Public Transport and Active Path Networks Plan for the PSP includes the provision of a series of on and off-road bike paths, bus capable roads, and crossing opportunities for pedestrians at signalized intersections and pedestrian bridges. Footpaths will also be provided on both sides of all Arterial Roads and Connector Streets within the PSP area.

Walking Network Review

The walking network outlined in the draft Public Transport and Active Path Networks Plan includes the provision of Boulevard Connector Streets/Connector Streets which include footpaths on both sides of the carriageway. A series of shared paths is also provided, which suitably balances the primary industrial/business land use needs of the OSE PSP with pedestrian movement and connectivity throughout the PSP area. The pedestrian provisions outlined on the Plan are considered appropriate for the PSP purposes.

Cycling

The draft Public Transport and Active Path Networks Plan also includes dedicated bike lanes or off-road 2-way bike lanes along all the Connector Streets and Arterial Roads within the PSP area, furthermore the Plan shows the provision of off-road shared paths adjacent to open spaces and waterways which all connect to the on-road bicycle provisions. The cyclist provisions outlined on the Plan are considered appropriate for the PSP purposes.

Public Transport

Within the OSE PSP area, Lecky Road and Officer South Road, north of Leaky Road are nominated PPTN routes. Officer South Road, south of Lecky Road and Thompsons Road are however not nominated PPTN routes.

Consideration should be given to nominating the Officer South Road (south to Thompsons Road) and Thompsons Road as part of the PPTN given that the OSE PSP will deliver a State Significant Industrial Precinct and a Regionally Significant Commercial precinct to allow for the provision of high-quality public transport throughout the OSE PSP area.

8.3. Draft PSP Road Network Plan Review

In order to confirm the appropriateness of the PSP road network and the associated ICP items, the VPA commissioned strategic transport modelling and traffic analysis for the precinct to assess the future traffic volumes generated by the precinct.

It was found that the draft PSP Road Network Plan includes an appropriate number of Connector Streets to cater for the traffic volumes expected to be generated by the PSP.

At the request of the VPA, the form of four ICP intersections were also assessed to determine if departures from the ICP Benchmark and VicRoads Intersection designs were needed to cater for the ultimate expected peak hour traffic volumes. The tested intersections and the recommended departures from the Benchmark ICP intersection layouts are summarised as follows:

Table 8.1: Summary of Departures from the Benchmark ICP and VicRoads Intersection Layouts

Intersection	Departures from the Benchmark ICP and VicRoads Layouts
IN-01 Officer South Road / Connector Street	No departures from the VicRoads layout are recommended.
IN-05 Officer South Road / Lecky Road	No departures from the ICP Benchmark are recommended.
IN-06 Lecky Road / Connector Street	No departures from the ICP Benchmark are recommended.
IN-10 Officer South Road / Thompsons Road	1. Reduced capacity (number of lanes) into and out of Officer South Road (south) approach, reflecting the lower volumes and classification of this road. 2. Allocating the road space on the Officer South Road (north) approach to give three lanes to the right turn movement and one lane each to the through and left movements. This reflects the high demand for movement from north to west and the relatively low demand for the other movements.

It is highlighted that Ratio was requested to review the appropriateness of four ICP intersections only. In accordance with the VicRoads handbook referenced at Chapter 4, default layouts are generally adopted for planning PSP signalised intersections. In the OSE PSP, one intersection was identified as benefiting from an alternative layout (within the same overall land footprint) that considers local network context and the expected pattern of traffic movements.

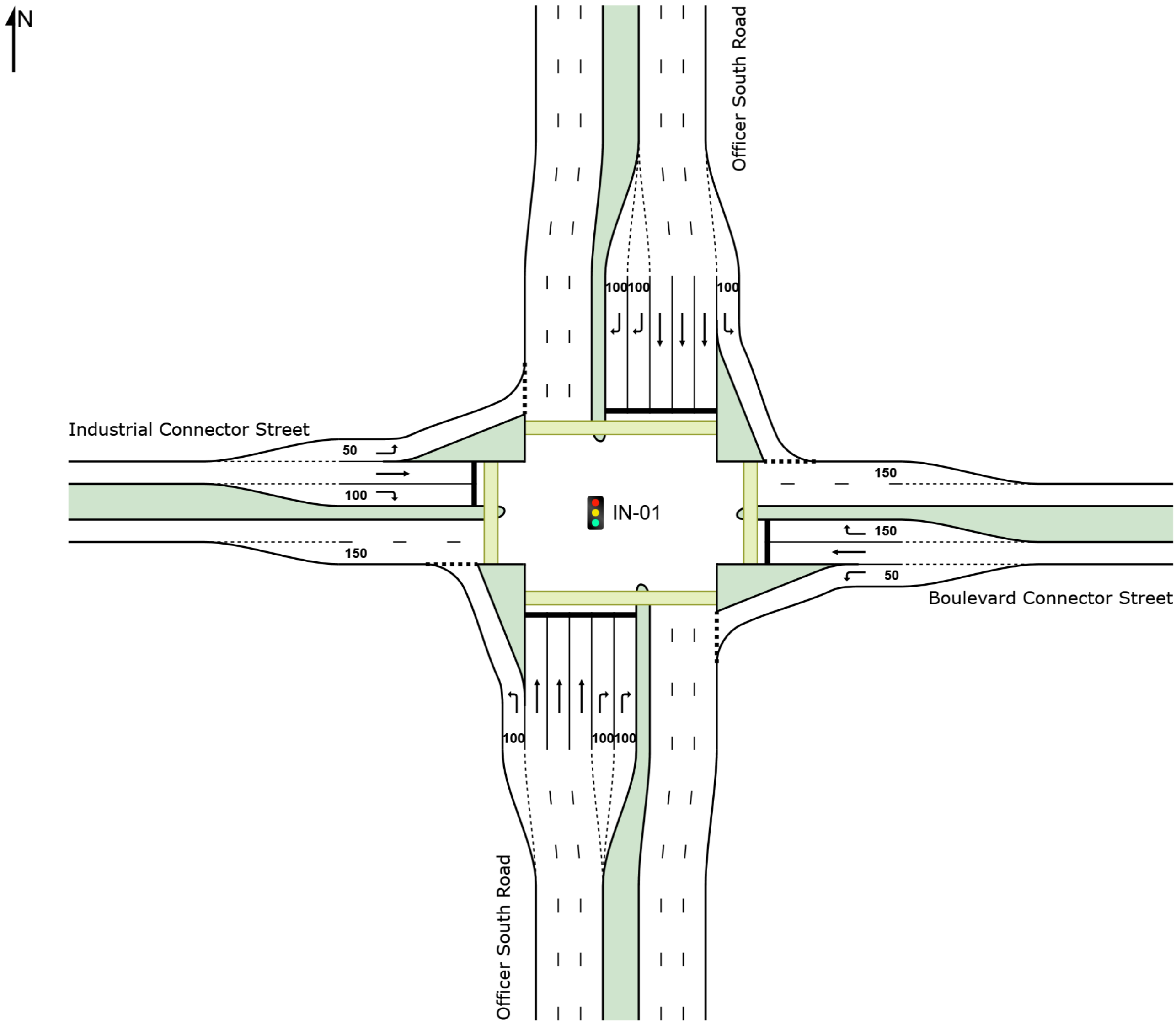
Appendix A - SIDRA Outputs

SITE LAYOUT

Site: IN-01 [IN-01 Officer South Rd/ Connector Street - AM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

AM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: IN-01 [IN-01 Officer South Rd/ Connector Street - AM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

AM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Officer South Road														
1	L2	28	15.0	28	15.0	0.022	8.5	LOS A	0.2	1.9	0.20	0.62	0.20	55.3
2	T1	1233	15.0	1233	15.0	0.629	34.3	LOS C	19.9	157.2	0.89	0.78	0.89	42.3
3	R2	141	10.0	141	10.0	0.312	57.5	LOS E	4.1	31.4	0.94	0.76	0.94	31.8
Approach		1402	14.5	1402	14.5	0.629	36.1	LOS D	19.9	157.2	0.88	0.77	0.88	41.2
East: Boulevard Connector Street														
4	L2	163	10.0	163	10.0	0.157	11.4	LOS B	3.1	23.3	0.39	0.66	0.39	50.2
5	T1	17	10.0	17	10.0	0.037	36.6	LOS D	0.7	5.7	0.78	0.56	0.78	37.9
6	R2	307	10.0	307	10.0	* 0.708	50.9	LOS D	16.7	127.1	0.97	0.86	0.99	32.9
Approach		487	10.0	487	10.0	0.708	37.2	LOS D	16.7	127.1	0.77	0.78	0.78	37.4
North: Officer South Road														
7	L2	185	10.0	185	10.0	0.126	7.5	LOS A	1.0	7.6	0.16	0.63	0.16	56.2
8	T1	1378	15.0	1378	15.0	* 0.716	35.5	LOS D	23.6	186.3	0.92	0.81	0.92	41.7
9	R2	297	15.0	297	15.0	* 0.680	61.3	LOS E	9.4	74.4	0.99	0.82	1.02	30.7
Approach		1860	14.5	1860	14.5	0.716	36.8	LOS D	23.6	186.3	0.86	0.79	0.86	40.5
West: Industrial Connector Street														
10	L2	92	15.0	92	15.0	0.139	16.7	LOS B	2.3	18.0	0.51	0.68	0.51	46.1
11	T1	6	10.0	6	10.0	* 0.066	61.5	LOS E	0.4	2.7	0.98	0.64	0.98	30.2
12	R2	2	15.0	2	15.0	0.024	66.6	LOS E	0.1	0.9	0.97	0.61	0.97	28.5
Approach		100	14.7	100	14.7	0.139	20.4	LOS C	2.3	18.0	0.54	0.68	0.54	44.1
All Vehicles		3849	13.9	3849	13.9	0.716	36.2	LOS D	23.6	186.3	0.84	0.78	0.85	40.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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 (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Officer South Road												
P1	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	231.5	230.4	1.00
East: Boulevard Connector Street												
P2	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	221.3	217.2	0.98

North: Officer South Road												
P3	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	231.5	230.4	1.00
West: Industrial Connector Street												
P4	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	221.3	217.2	0.98
All Pedestrians		200	200	54.3	LOS E	0.2	0.2	0.95	0.95	226.4	223.8	0.99

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.

PHASING SUMMARY

Site: IN-01 [IN-01 Officer South Rd/ Connector Street - AM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

AM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

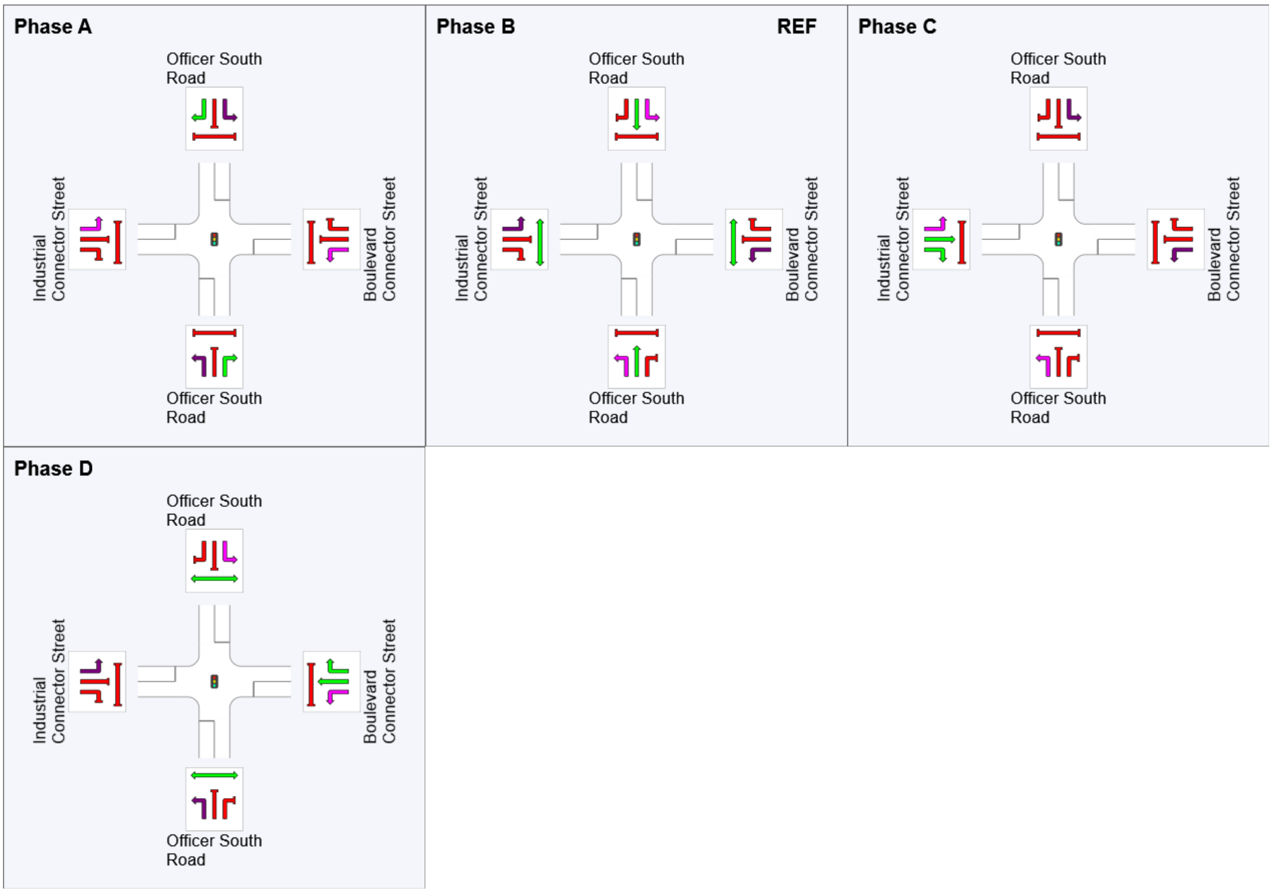
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Phase Timing Summary

Phase	A	B	C	D
Phase Change Time (sec)	97	0	49	61
Green Time (sec)	17	43	6	30
Phase Time (sec)	23	49	12	36
Phase Split	19%	41%	10%	30%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

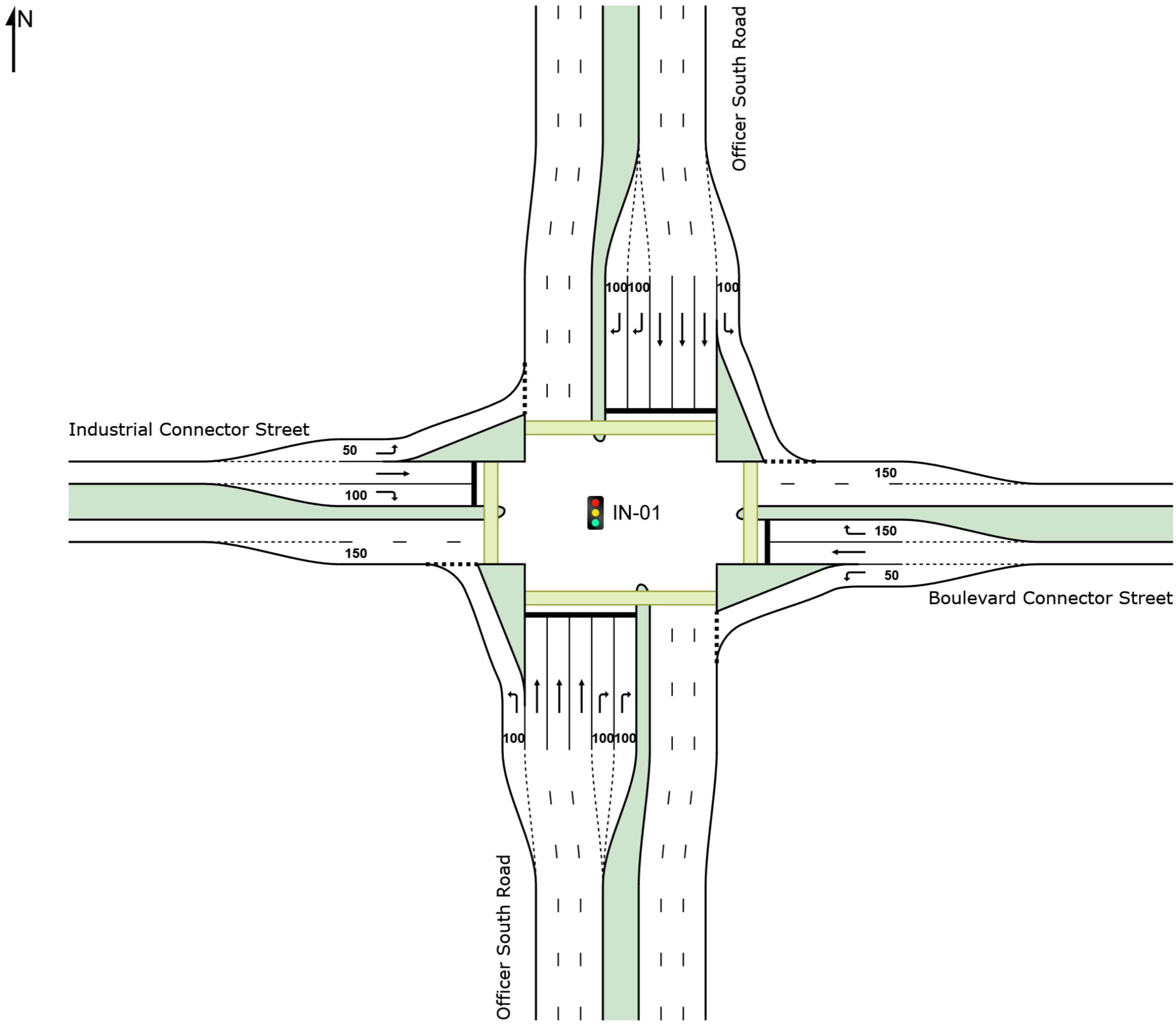
Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: IN-01 [IN-01 Officer South Rd/ Connector Street - PM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

PM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: IN-01 [IN-01 Officer South Rd/ Connector Street - PM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

PM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance														
Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Officer South Road														
1	L2	39	15.0	39	15.0	0.028	7.9	LOS A	0.3	2.0	0.17	0.61	0.17	55.7
2	T1	1713	15.0	1713	15.0	* 0.691	26.5	LOS C	26.9	212.3	0.84	0.75	0.84	46.5
3	R2	175	10.0	175	10.0	0.659	67.5	LOS E	5.8	43.9	1.00	0.80	1.05	29.2
Approach		1927	14.5	1927	14.5	0.691	29.9	LOS C	26.9	212.3	0.84	0.75	0.84	44.3
East: Boulevard Connector Street														
4	L2	146	10.0	146	10.0	0.161	10.8	LOS B	2.6	19.8	0.37	0.66	0.37	50.7
5	T1	14	10.0	14	10.0	0.038	41.6	LOS D	0.7	5.0	0.83	0.59	0.83	36.0
6	R2	235	10.0	235	10.0	* 0.678	54.8	LOS D	13.1	99.2	0.98	0.84	1.00	31.8
Approach		395	10.0	395	10.0	0.678	38.1	LOS D	13.1	99.2	0.75	0.76	0.76	37.0
North: Officer South Road														
7	L2	337	10.0	337	10.0	0.232	8.0	LOS A	2.7	20.2	0.21	0.64	0.21	55.8
8	T1	1471	15.0	1471	15.0	0.577	24.9	LOS C	20.7	163.9	0.78	0.70	0.78	47.5
9	R2	170	15.0	170	15.0	* 0.662	67.7	LOS E	5.6	44.5	1.00	0.80	1.05	29.1
Approach		1978	14.1	1978	14.1	0.662	25.7	LOS C	20.7	163.9	0.71	0.70	0.71	46.1
West: Industrial Connector Street														
10	L2	356	15.0	356	15.0	0.679	25.0	LOS C	14.5	114.2	0.80	0.82	0.80	41.7
11	T1	23	10.0	23	10.0	* 0.251	63.2	LOS E	1.4	10.5	0.99	0.70	0.99	29.8
12	R2	8	15.0	8	15.0	0.095	67.8	LOS E	0.5	3.7	0.98	0.66	0.98	28.3
Approach		387	14.7	387	14.7	0.679	28.2	LOS C	14.5	114.2	0.82	0.81	0.82	40.3
All Vehicles		4687	14.0	4687	14.0	0.691	28.7	LOS C	26.9	212.3	0.77	0.73	0.78	43.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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 (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Officer South Road												
P1	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	231.5	230.4	1.00
East: Boulevard Connector Street												
P2	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	221.3	217.2	0.98

North: Officer South Road											
P3 Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	231.5	230.4	1.00
West: Industrial Connector Street											
P4 Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	221.3	217.2	0.98
All Pedestrians	200	200	54.3	LOS E	0.2	0.2	0.95	0.95	226.4	223.8	0.99

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.

PHASING SUMMARY

Site: IN-01 [IN-01 Officer South Rd/ Connector Street - PM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

PM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

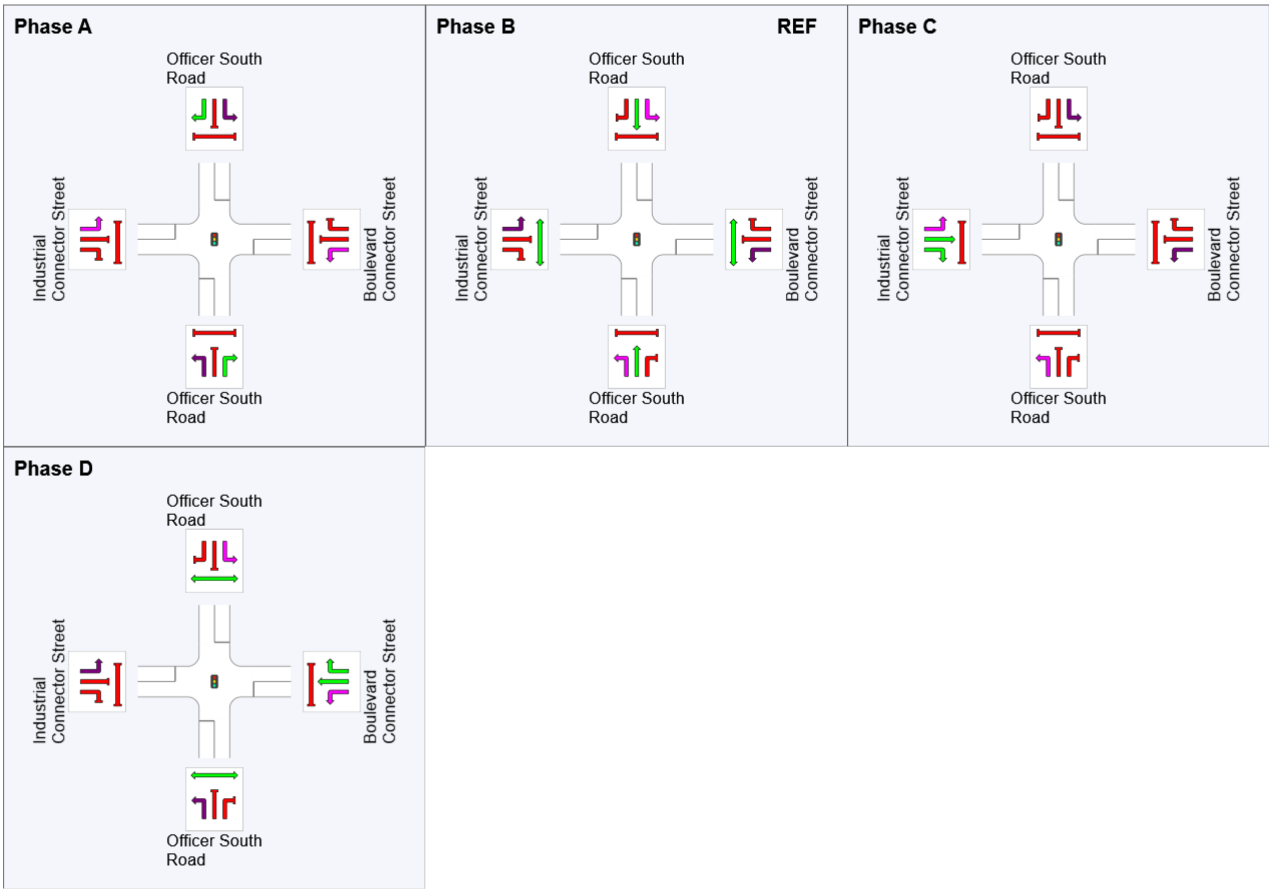
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Phase Timing Summary

Phase	A	B	C	D
Phase Change Time (sec)	104	0	62	74
Green Time (sec)	10	56	6	24
Phase Time (sec)	16	62	12	30
Phase Split	13%	52%	10%	25%

See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

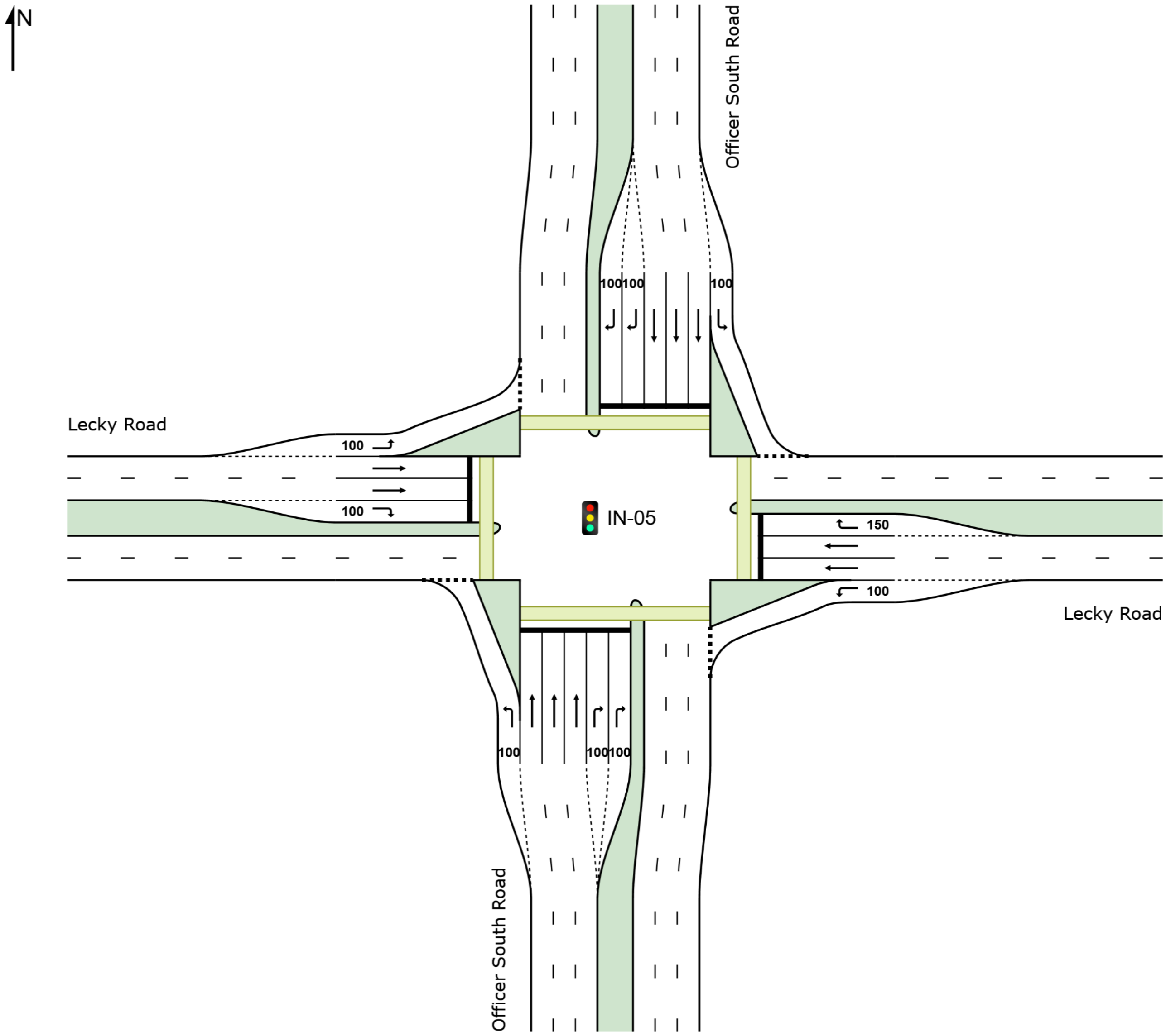
Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: IN-05 [IN-05 Officer South Rd/ Lecky Road - AM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

AM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: IN-05 [IN-05 Officer South Rd/ Lecky Road - AM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

AM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Officer South Road														
1	L2	19	15.0	19	15.0	0.015	9.1	LOS A	0.2	1.6	0.25	0.62	0.25	54.2
2	T1	894	15.0	894	15.0	0.677	44.8	LOS D	16.0	126.2	0.96	0.82	0.96	37.8
3	R2	45	10.0	45	10.0	0.104	57.7	LOS E	1.2	9.0	0.92	0.71	0.92	32.0
Approach		958	14.8	958	14.8	0.677	44.7	LOS D	16.0	126.2	0.95	0.81	0.95	37.7
East: Lecky Road														
4	L2	46	15.0	46	15.0	0.041	10.0	LOS B	0.6	4.7	0.29	0.64	0.29	53.5
5	T1	221	15.0	221	15.0	* 0.339	46.6	LOS D	5.7	45.2	0.92	0.73	0.92	37.3
6	R2	320	15.0	320	15.0	* 0.763	54.6	LOS D	18.2	144.2	0.99	0.89	1.06	32.7
Approach		587	15.0	587	15.0	0.763	48.1	LOS D	18.2	144.2	0.91	0.81	0.94	35.4
North: Officer South Road														
7	L2	253	15.0	253	15.0	0.188	7.7	LOS A	1.8	14.4	0.19	0.64	0.19	55.4
8	T1	984	15.0	984	15.0	* 0.745	47.2	LOS D	18.4	145.2	0.98	0.87	1.03	36.9
9	R2	304	15.0	304	15.0	* 0.725	65.1	LOS E	9.1	72.1	1.00	0.86	1.11	29.8
Approach		1541	15.0	1541	15.0	0.745	44.3	LOS D	18.4	145.2	0.86	0.83	0.91	37.2
West: Lecky Road														
10	L2	252	15.0	252	15.0	0.287	18.6	LOS B	7.1	56.2	0.56	0.73	0.56	47.6
11	T1	181	15.0	181	15.0	0.278	46.0	LOS D	4.6	36.5	0.90	0.71	0.90	37.5
12	R2	9	15.0	9	15.0	0.021	42.9	LOS D	0.4	3.1	0.78	0.67	0.78	36.5
Approach		442	15.0	442	15.0	0.287	30.3	LOS C	7.1	56.2	0.70	0.72	0.70	42.6
All Vehicles		3528	14.9	3528	14.9	0.763	43.3	LOS D	18.4	145.2	0.87	0.81	0.90	37.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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 (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Officer South Road												
P1	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	231.5	230.4	1.00
East: Lecky Road												
P2	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	223.9	220.5	0.98
North: Officer South Road												

P3 Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	231.5	230.4	1.00
West: Lecky Road											
P4 Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	223.9	220.5	0.98
All Pedestrians	200	200	54.3	LOS E	0.2	0.2	0.95	0.95	227.7	225.5	0.99

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.

PHASING SUMMARY

Site: IN-05 [IN-05 Officer South Rd/ Lecky Road - AM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

AM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

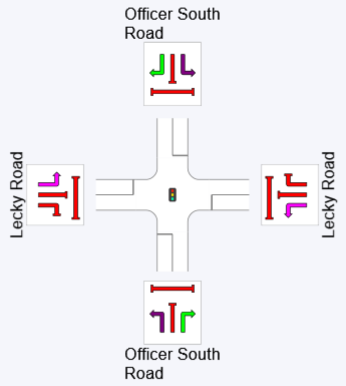
Phase Timing Summary

Phase	A	B	C	D
Phase Change Time (sec)	99	0	35	71
Green Time (sec)	15	29	30	22
Phase Time (sec)	21	35	36	28
Phase Split	18%	29%	30%	23%

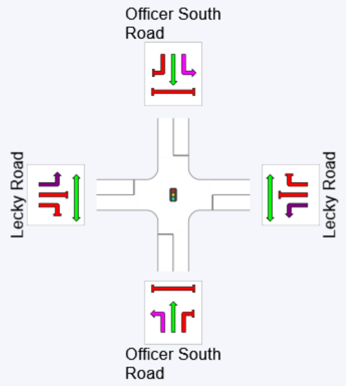
See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence

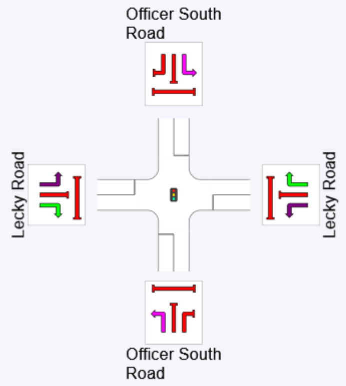
Phase A



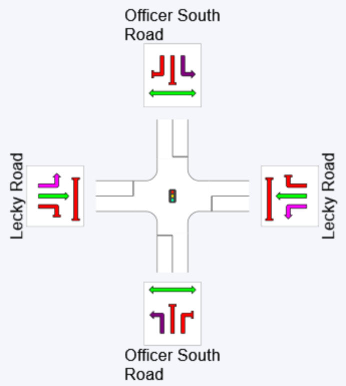
Phase B REF



Phase C



Phase D



REF: Reference Phase
VAR: Variable Phase

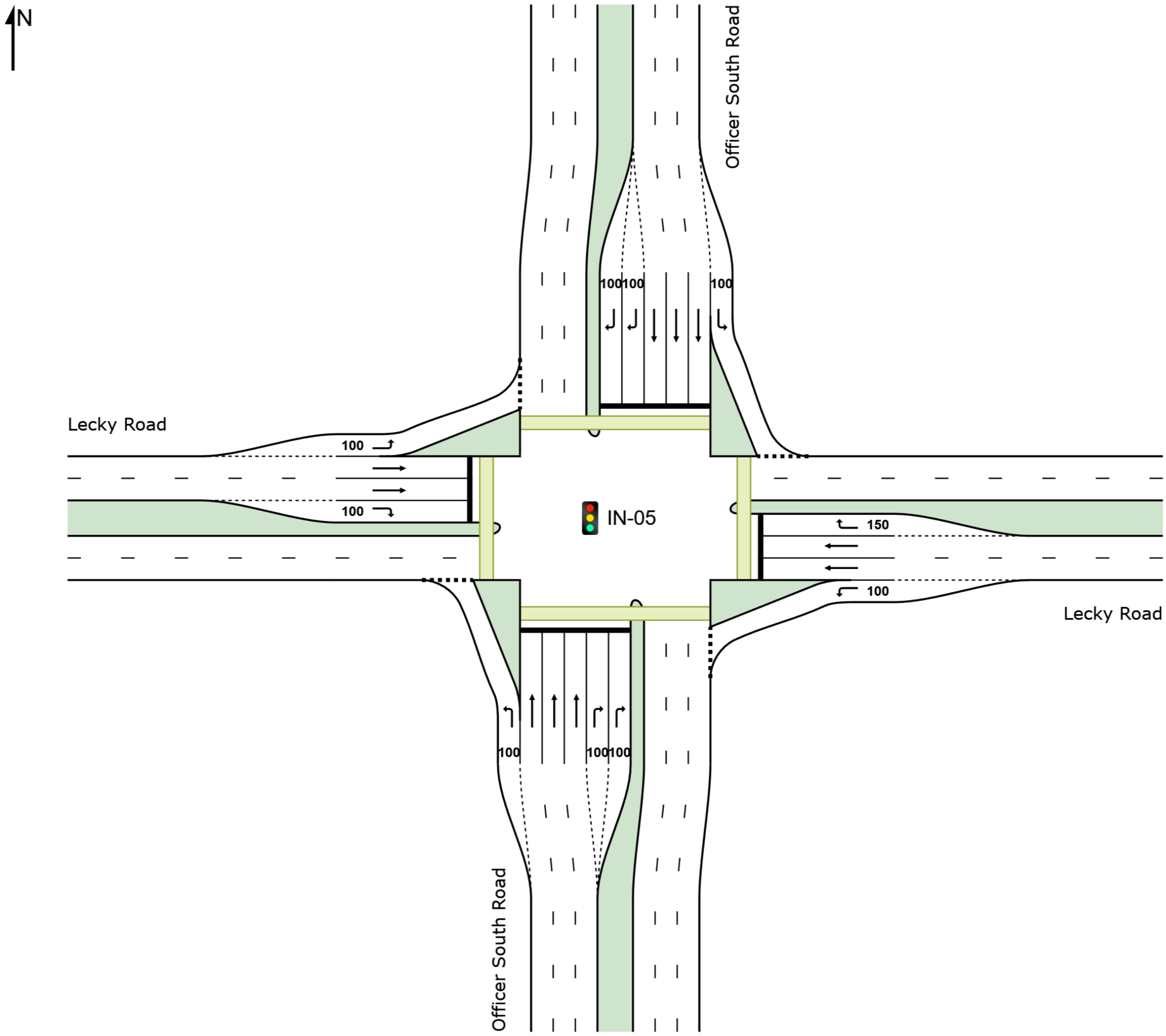
	Normal Movement		Permitted/Opposed
	Slip/Bypass-Lane Movement		Opposed Slip/Bypass-Lane
	Stopped Movement		Turn On Red
	Other Movement Class (MC) Running		Undetected Movement
	Mixed Running & Stopped MCs		Continuous Movement
	Other Movement Class (MC) Stopped		Phase Transition Applied

SITE LAYOUT

Site: IN-05 [IN-05 Officer South Rd/ Lecky Road - PM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

PM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: IN-05 [IN-05 Officer South Rd/ Lecky Road - PM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

PM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Officer South Road														
1	L2	28	15.0	28	15.0	0.022	8.7	LOS A	0.3	2.2	0.23	0.62	0.23	54.5
2	T1	1290	15.0	1290	15.0	* 0.840	50.1	LOS D	26.3	207.7	1.00	0.97	1.14	35.9
3	R2	70	15.0	70	15.0	0.228	63.4	LOS E	2.0	15.6	0.96	0.73	0.96	30.2
Approach		1388	15.0	1388	15.0	0.840	49.9	LOS D	26.3	207.7	0.98	0.95	1.11	35.8
East: Lecky Road														
4	L2	56	15.0	56	15.0	0.051	10.1	LOS B	0.7	5.9	0.29	0.64	0.29	53.5
5	T1	208	15.0	208	15.0	0.242	39.6	LOS D	4.9	38.9	0.85	0.68	0.85	40.1
6	R2	345	15.0	345	15.0	* 0.851	62.5	LOS E	21.8	172.0	1.00	0.95	1.20	30.6
Approach		609	15.0	609	15.0	0.851	49.8	LOS D	21.8	172.0	0.88	0.83	1.00	34.8
North: Officer South Road														
7	L2	338	15.0	338	15.0	0.259	8.4	LOS A	3.3	26.4	0.25	0.65	0.25	54.8
8	T1	1019	15.0	1019	15.0	0.658	41.0	LOS D	17.6	139.1	0.94	0.81	0.94	39.4
9	R2	260	15.0	260	15.0	* 0.845	74.0	LOS E	8.5	66.9	1.00	0.95	1.37	27.8
Approach		1617	15.0	1617	15.0	0.845	39.5	LOS D	17.6	139.1	0.80	0.80	0.86	39.0
West: Lecky Road														
10	L2	374	15.0	374	15.0	0.519	26.6	LOS C	14.3	112.7	0.75	0.80	0.75	43.1
11	T1	265	15.0	265	15.0	* 0.407	47.3	LOS D	7.0	55.0	0.93	0.75	0.93	37.0
12	R2	13	15.0	13	15.0	0.042	50.2	LOS D	0.6	5.0	0.85	0.68	0.85	34.0
Approach		652	15.0	652	15.0	0.519	35.5	LOS D	14.3	112.7	0.83	0.78	0.83	40.2
All Vehicles		4266	15.0	4266	15.0	0.851	43.7	LOS D	26.3	207.7	0.88	0.85	0.96	37.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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 (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Officer South Road												
P1	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	231.5	230.4	1.00
East: Lecky Road												
P2	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	223.9	220.5	0.98
North: Officer South Road												

P3 Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	231.5	230.4	1.00
West: Lecky Road											
P4 Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	223.9	220.5	0.98
All Pedestrians	200	200	54.3	LOS E	0.2	0.2	0.95	0.95	227.7	225.5	0.99

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.

PHASING SUMMARY

Site: IN-05 [IN-05 Officer South Rd/ Lecky Road - PM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

PM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

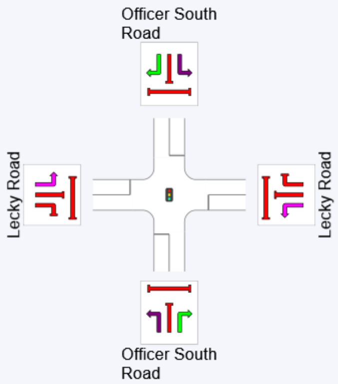
Phase Timing Summary

Phase	A	B	C	D
Phase Change Time (sec)	103	0	40	68
Green Time (sec)	11	34	22	29
Phase Time (sec)	17	40	28	35
Phase Split	14%	33%	23%	29%

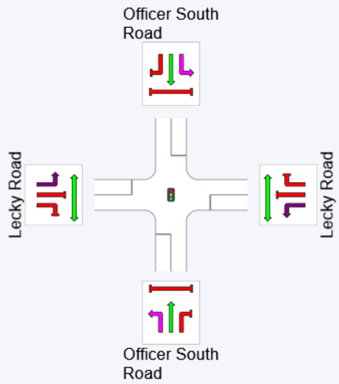
See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence

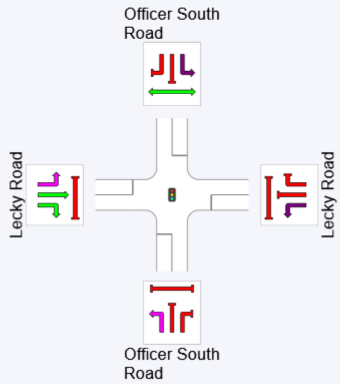
Phase A



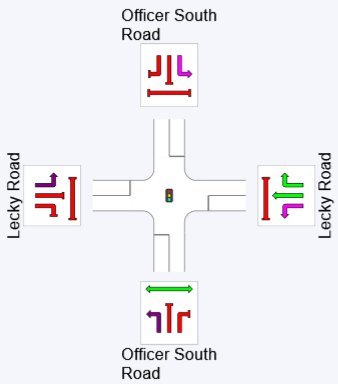
Phase B REF



Phase C



Phase D



REF: Reference Phase
VAR: Variable Phase

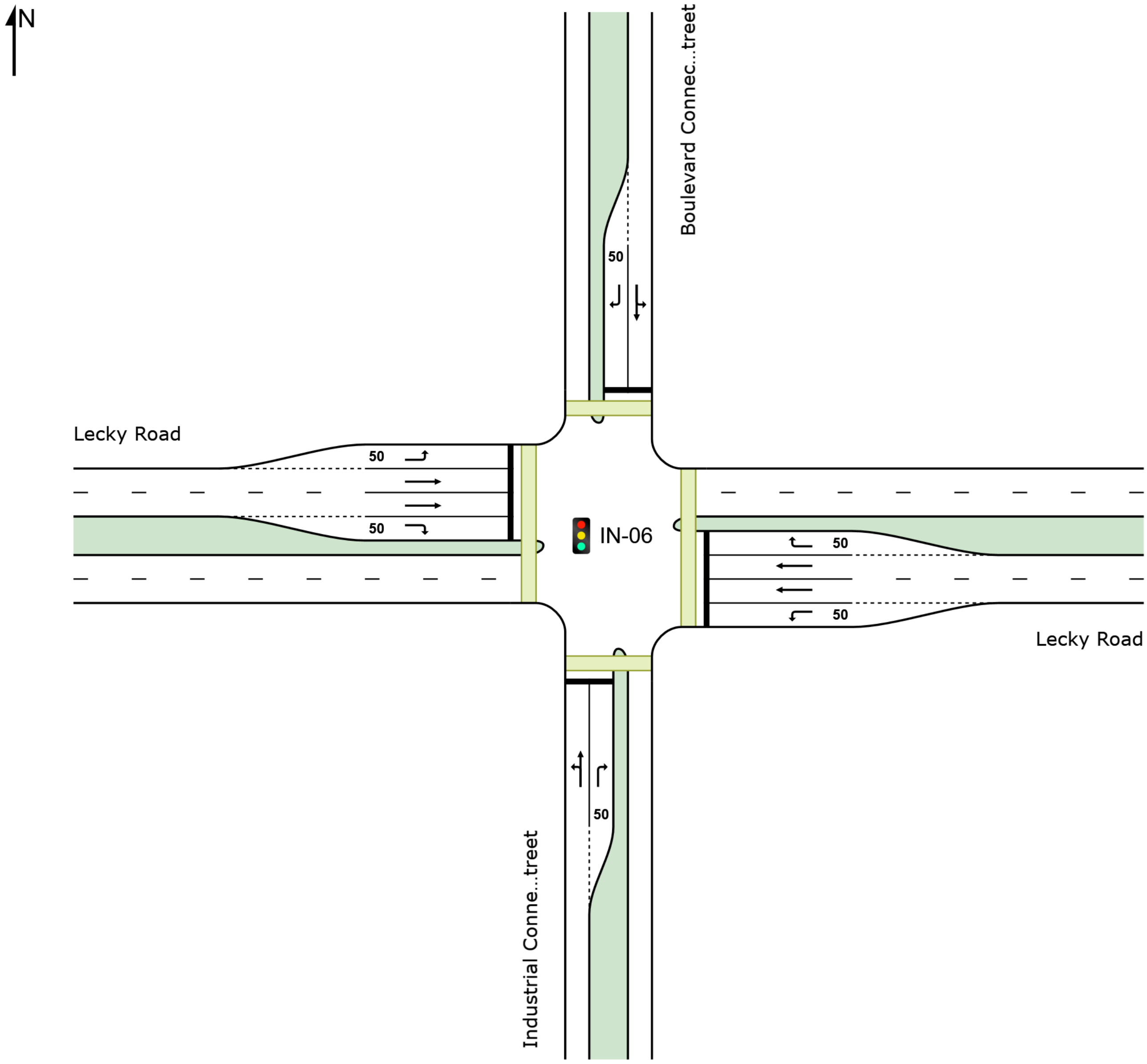
Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: IN-06 [IN-06 Lecky Rd/ Connector Street - AM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

AM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: IN-06 [IN-06 Lecky Rd/ Connector Street - AM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

AM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Industrial Connector Street														
1	L2	1	15.0	1	15.0	0.044	50.9	LOS D	0.6	4.7	0.87	0.62	0.87	31.4
2	T1	11	15.0	11	15.0	0.044	46.2	LOS D	0.6	4.7	0.87	0.62	0.87	30.6
3	R2	48	15.0	48	15.0	* 0.343	63.3	LOS E	2.8	22.0	0.98	0.75	0.98	27.6
Approach		60	15.0	60	15.0	0.343	60.0	LOS E	2.8	22.0	0.96	0.72	0.96	28.2
East: Lecky Road														
4	L2	97	15.0	97	15.0	0.128	27.0	LOS C	3.3	25.8	0.62	0.73	0.62	40.5
5	T1	587	15.0	587	15.0	* 0.375	23.1	LOS C	11.4	90.0	0.70	0.61	0.70	48.5
6	R2	72	15.0	72	15.0	* 0.368	61.1	LOS E	4.0	31.8	0.96	0.77	0.96	29.4
Approach		756	15.0	756	15.0	0.375	27.3	LOS C	11.4	90.0	0.72	0.64	0.72	44.6
North: Boulevard Connector Street														
7	L2	83	15.0	83	15.0	0.238	44.3	LOS D	4.5	35.9	0.85	0.75	0.85	32.2
8	T1	13	15.0	13	15.0	* 0.238	39.6	LOS D	4.5	35.9	0.85	0.75	0.85	31.3
9	R2	1	15.0	1	15.0	0.007	59.6	LOS E	0.1	0.4	0.93	0.59	0.93	28.4
Approach		97	15.0	97	15.0	0.238	43.8	LOS D	4.5	35.9	0.85	0.74	0.85	32.0
West: Lecky Road														
10	L2	1	15.0	1	15.0	0.001	25.4	LOS C	0.0	0.2	0.56	0.61	0.56	41.2
11	T1	443	15.0	443	15.0	0.277	22.0	LOS C	8.0	63.6	0.67	0.57	0.67	49.2
12	R2	9	15.0	9	15.0	0.046	58.0	LOS E	0.5	3.8	0.91	0.68	0.91	30.1
Approach		453	15.0	453	15.0	0.277	22.8	LOS C	8.0	63.6	0.67	0.57	0.67	48.6
All Vehicles		1366	15.0	1366	15.0	0.375	28.4	LOS C	11.4	90.0	0.72	0.63	0.72	43.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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 (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Industrial Connector Street												
P1	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	218.8	213.9	0.98
East: Lecky Road												
P2	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	226.4	223.8	0.99
North: Boulevard Connector Street												

P3	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	218.8	213.9	0.98
West: Lecky Road												
P4	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	226.4	223.8	0.99
All Pedestrians		200	200	54.3	LOS E	0.2	0.2	0.95	0.95	222.6	218.9	0.98

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.

PHASING SUMMARY

Site: IN-06 [IN-06 Lecky Rd/ Connector Street - AM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

AM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

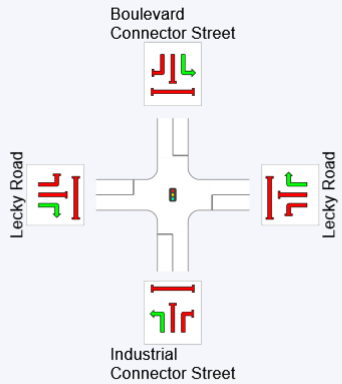
Phase Timing Summary

Phase	A	B	C	D
Phase Change Time (sec)	100	0	60	76
Green Time (sec)	14	54	10	18
Phase Time (sec)	20	60	16	24
Phase Split	17%	50%	13%	20%

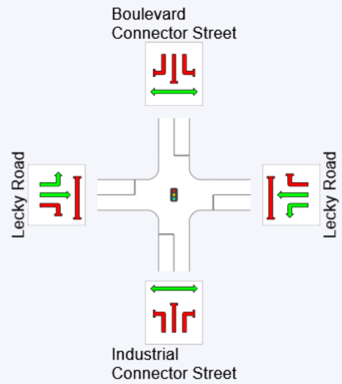
See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence

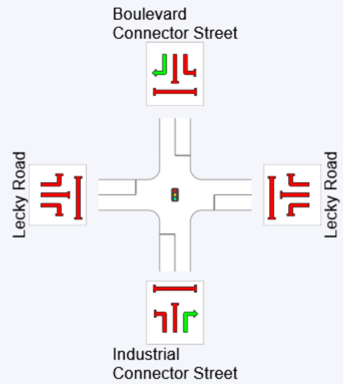
Phase A



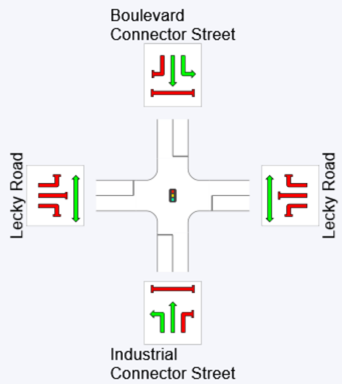
Phase B REF



Phase C



Phase D



REF: Reference Phase
VAR: Variable Phase

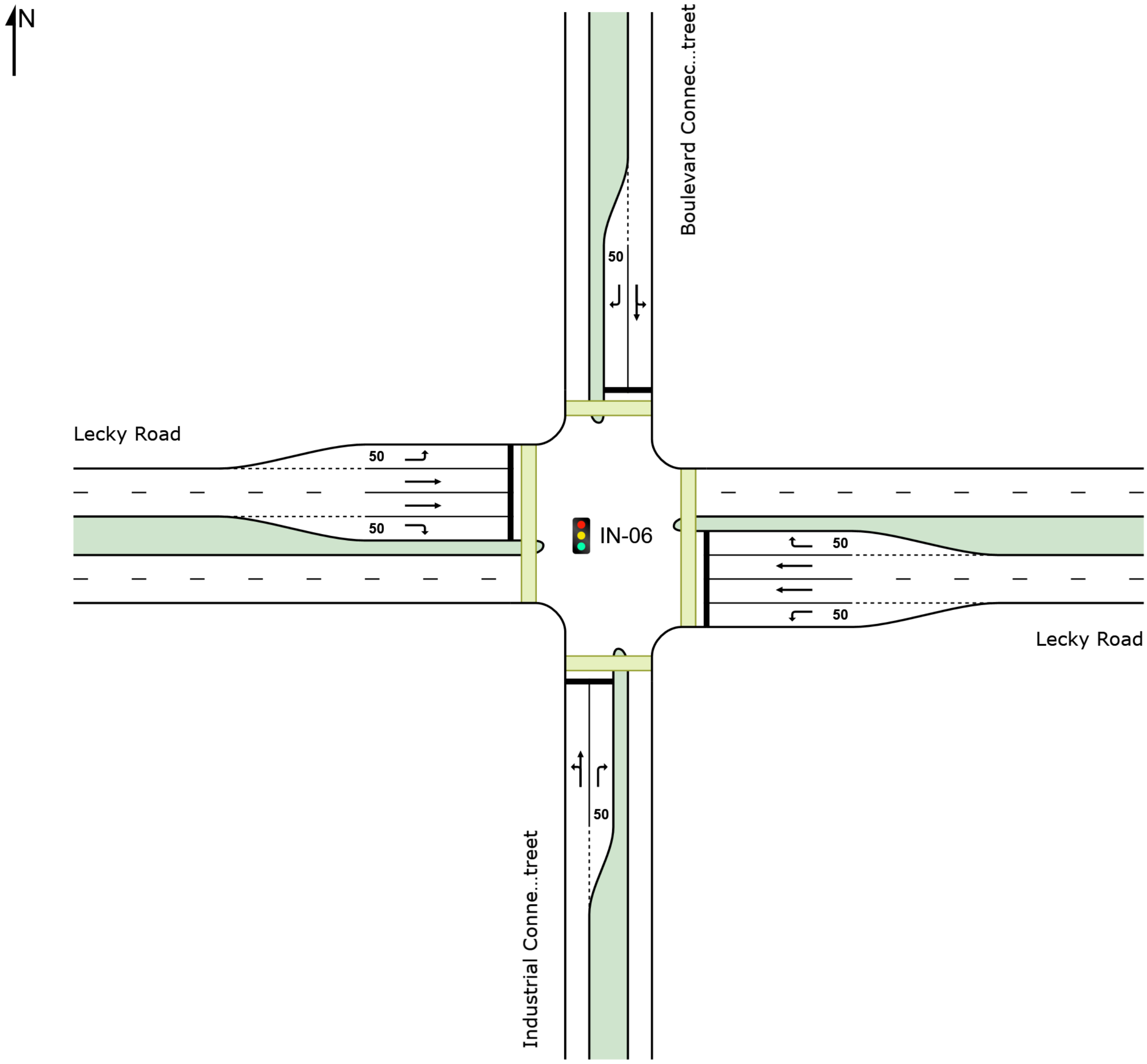
Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: IN-06 [IN-06 Lecky Rd/ Connector Street - PM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

PM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: IN-06 [IN-06 Lecky Rd/ Connector Street - PM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

PM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	INPUT VOLUMES HV] %	DEMAND FLOWS [Total veh/h	DEMAND FLOWS HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	95% BACK OF QUEUE Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Industrial Connector Street														
1	L2	3	15.0	3	15.0	0.080	51.4	LOS D	1.1	8.7	0.88	0.65	0.88	31.2
2	T1	19	15.0	19	15.0	0.080	46.7	LOS D	1.1	8.7	0.88	0.65	0.88	30.4
3	R2	110	15.0	110	15.0	* 0.492	58.3	LOS E	6.2	48.7	0.97	0.79	0.97	28.7
Approach		132	15.0	132	15.0	0.492	56.5	LOS E	6.2	48.7	0.96	0.76	0.96	29.0
East: Lecky Road														
4	L2	75	15.0	75	15.0	0.117	32.0	LOS C	2.8	22.1	0.68	0.73	0.68	38.3
5	T1	609	15.0	609	15.0	* 0.491	29.5	LOS C	13.9	109.6	0.79	0.68	0.79	44.7
6	R2	112	15.0	112	15.0	* 0.501	60.3	LOS E	6.3	49.7	0.97	0.79	0.97	29.6
Approach		796	15.0	796	15.0	0.501	34.0	LOS C	13.9	109.6	0.81	0.70	0.81	41.1
North: Boulevard Connector Street														
7	L2	89	15.0	89	15.0	0.258	45.3	LOS D	5.0	39.5	0.86	0.75	0.86	31.9
8	T1	15	15.0	15	15.0	* 0.258	40.6	LOS D	5.0	39.5	0.86	0.75	0.86	31.1
9	R2	1	15.0	1	15.0	0.004	52.9	LOS D	0.1	0.4	0.88	0.59	0.88	29.9
Approach		105	15.0	105	15.0	0.258	44.7	LOS D	5.0	39.5	0.86	0.75	0.86	31.8
West: Lecky Road														
10	L2	16	15.0	16	15.0	0.025	30.9	LOS C	0.6	4.5	0.65	0.68	0.65	38.8
11	T1	617	15.0	617	15.0	0.460	29.6	LOS C	13.5	106.7	0.80	0.69	0.80	44.7
12	R2	13	15.0	13	15.0	0.058	56.1	LOS E	0.7	5.3	0.90	0.69	0.90	30.6
Approach		646	15.0	646	15.0	0.460	30.1	LOS C	13.5	106.7	0.79	0.69	0.79	44.1
All Vehicles		1679	15.0	1679	15.0	0.501	35.0	LOS C	13.9	109.6	0.82	0.70	0.82	40.1

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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 (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	AVERAGE BACK OF QUEUE Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Industrial Connector Street												
P1	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	218.8	213.9	0.98
East: Lecky Road												
P2	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	226.4	223.8	0.99
North: Boulevard Connector Street												

P3	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	218.8	213.9	0.98
West: Lecky Road												
P4	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	226.4	223.8	0.99
All Pedestrians		200	200	54.3	LOS E	0.2	0.2	0.95	0.95	222.6	218.9	0.98

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.

PHASING SUMMARY

Site: IN-06 [IN-06 Lecky Rd/ Connector Street - PM Peak [Typical Layout] (Site Folder: Officer South Employment PSP)]

PM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

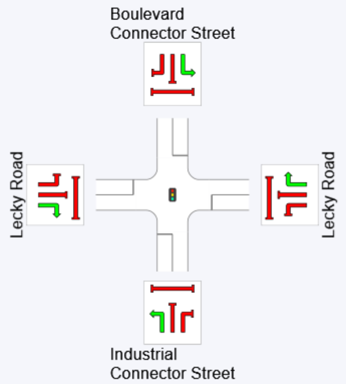
Phase Timing Summary

Phase	A	B	C	D
Phase Change Time (sec)	98	0	52	74
Green Time (sec)	16	46	16	18
Phase Time (sec)	22	52	22	24
Phase Split	18%	43%	18%	20%

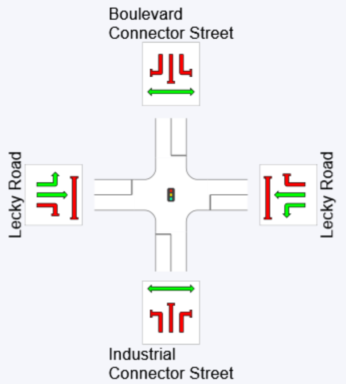
See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence

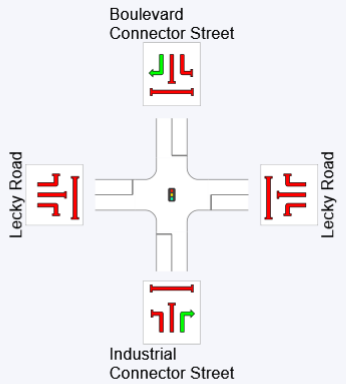
Phase A



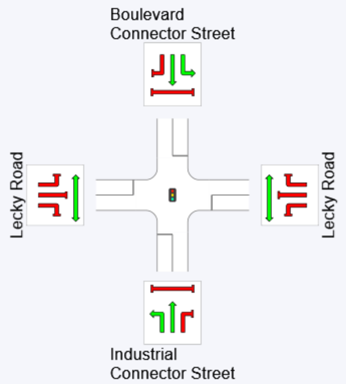
Phase B REF



Phase C



Phase D



REF: Reference Phase
VAR: Variable Phase

Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

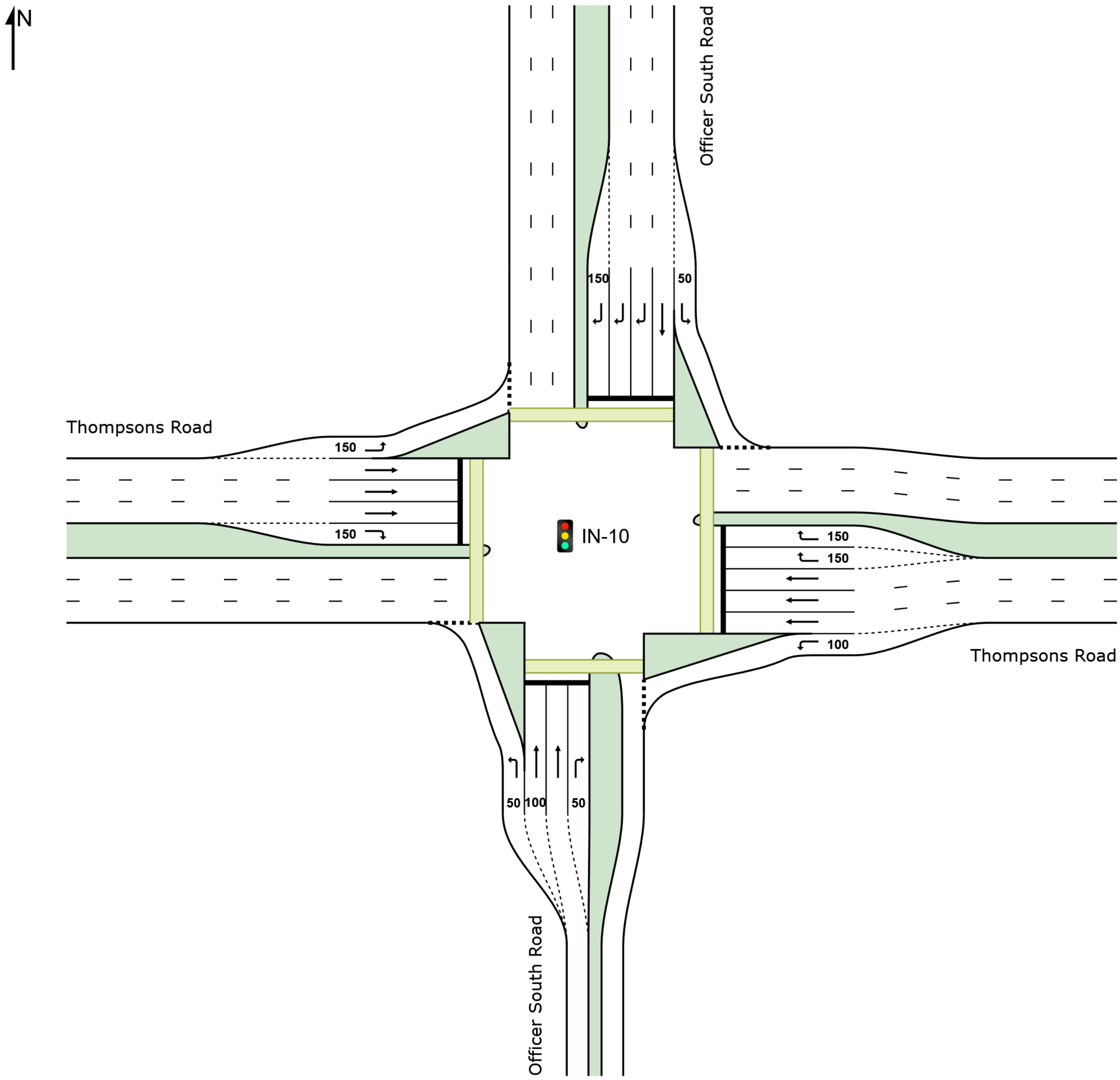
Organisation: RATIO CONSULTANTS PTY LTD | Licence: PLUS / 1PC | Processed: Monday, 10 July 2023 3:29:02 PM
Project: Y:\18001-18500\18212T - Officer South Employment - Integrated Transport Assessment\Work\Analysis\SIDRA\18212T - ICP Intersection tests V2.4 120 cycle.sip9

SITE LAYOUT

Site: IN-10 [IN-10 Officer South Rd/Thompsons Road - AM Peak [Hybrid Triple] (Site Folder: Officer South Employment PSP)]

AM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: IN-10 [IN-10 Officer South Rd/Thompsons Road - AM Peak [Hybrid Triple] (Site Folder: Officer South Employment PSP)]

AM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Officer South Road														
1	L2	3	0.0	3	0.0	0.004	21.2	LOS C	0.1	0.6	0.54	0.62	0.54	48.7
2	T1	132	0.0	132	0.0	* 0.203	46.9	LOS D	3.4	23.6	0.90	0.69	0.90	37.2
3	R2	1	0.0	1	0.0	0.003	50.7	LOS D	0.0	0.3	0.85	0.60	0.85	35.2
Approach		136	0.0	136	0.0	0.203	46.3	LOS D	3.4	23.6	0.89	0.69	0.89	37.4
East: Thompsons Road														
4	L2	1	0.0	1	0.0	0.001	7.8	LOS A	0.0	0.1	0.19	0.59	0.19	59.1
5	T1	1814	15.0	1814	15.0	* 0.851	41.7	LOS D	35.5	280.1	0.98	0.96	1.08	39.2
6	R2	31	15.0	31	15.0	0.185	69.6	LOS E	0.9	7.3	0.99	0.69	0.99	28.8
Approach		1846	15.0	1846	15.0	0.851	42.1	LOS D	35.5	280.1	0.98	0.96	1.08	38.9
North: Officer South Road														
7	L2	35	15.0	35	15.0	0.041	13.5	LOS B	0.7	5.2	0.39	0.66	0.39	50.9
8	T1	130	0.0	130	0.0	0.364	46.7	LOS D	6.7	47.1	0.92	0.74	0.92	37.3
9	R2	655	15.0	655	15.0	* 0.710	58.7	LOS E	12.5	98.9	0.99	0.86	1.05	31.5
Approach		820	12.6	820	12.6	0.710	54.9	LOS D	12.5	98.9	0.96	0.83	1.00	32.9
West: Thompsons Road														
10	L2	914	15.0	914	15.0	0.643	8.3	LOS A	11.3	89.4	0.34	0.69	0.34	54.9
11	T1	1658	15.0	1658	15.0	0.778	34.7	LOS C	28.6	226.1	0.94	0.85	0.96	42.3
12	R2	53	0.0	53	0.0	* 0.571	71.4	LOS E	3.3	23.0	1.00	0.76	1.05	29.3
Approach		2625	14.7	2625	14.7	0.778	26.2	LOS C	28.6	226.1	0.73	0.79	0.74	45.5
All Vehicles		5427	14.1	5427	14.1	0.851	36.5	LOS D	35.5	280.1	0.85	0.85	0.90	40.6

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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 (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Officer South Road												
P1	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	223.6	220.2	0.98
East: Thompsons Road												
P2	Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	231.5	230.4	1.00

North: Officer South Road											
P3 Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	229.0	227.1	0.99
West: Thompsons Road											
P4 Full	50	50	54.3	LOS E	0.2	0.2	0.95	0.95	229.0	227.1	0.99
All Pedestrians	200	200	54.3	LOS E	0.2	0.2	0.95	0.95	228.3	226.2	0.99

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.

PHASING SUMMARY

Site: IN-10 [IN-10 Officer South Rd/Thompsons Road - AM Peak [Hybrid Triple] (Site Folder: Officer South Employment PSP)]

AM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Green Split Priority has been specified
Phase Sequence: Leading Right Turn
Reference Phase: Phase B
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

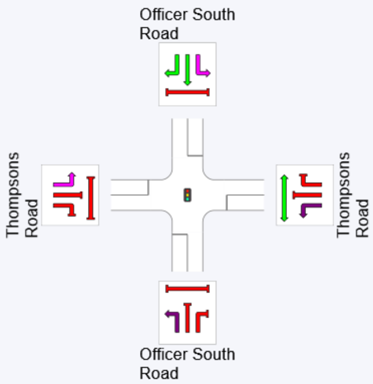
Phase Timing Summary

Phase	A	B	C	D
Phase Change Time (sec)	92	0	26	38
Green Time (sec)	22	20	6	48
Phase Time (sec)	28	26	12	54
Phase Split	23%	22%	10%	45%

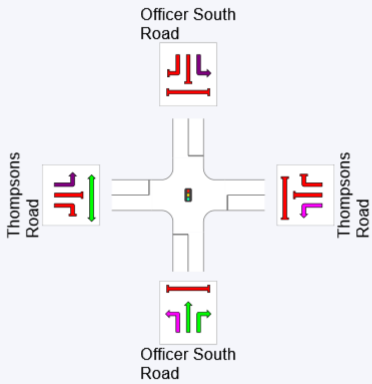
See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence

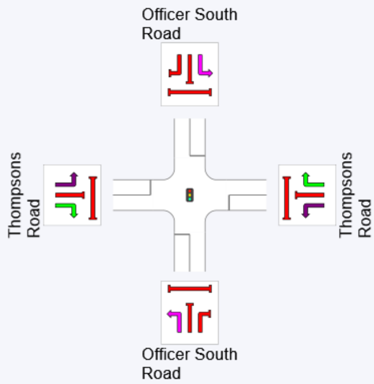
Phase A



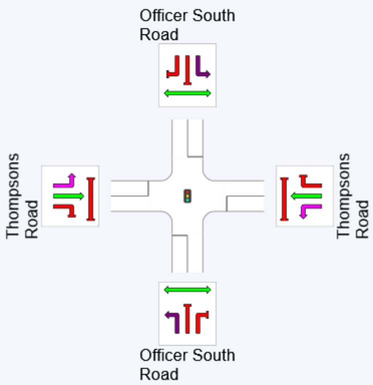
Phase B REF



Phase C



Phase D



REF: Reference Phase
VAR: Variable Phase

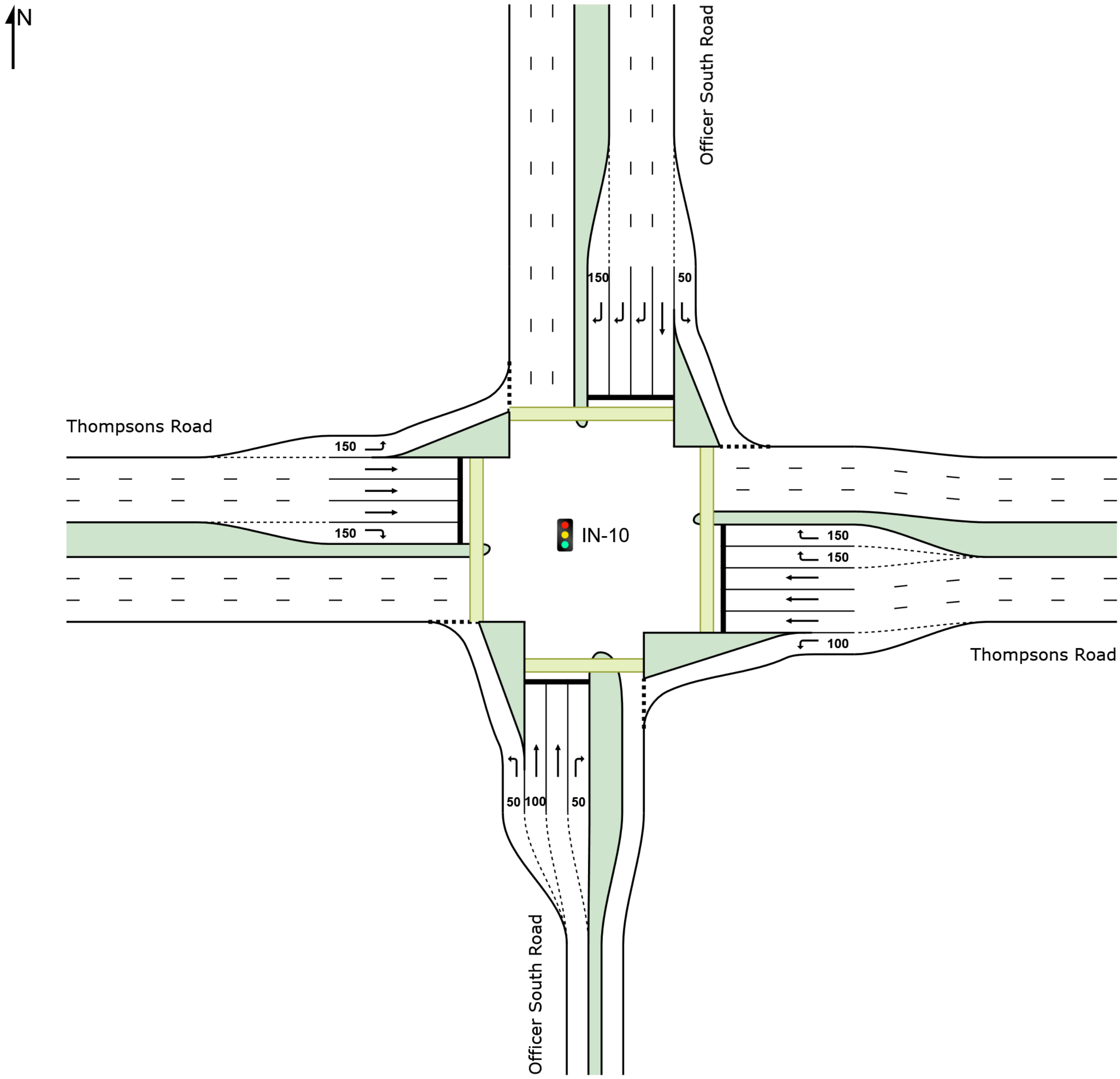
Normal Movement	Permitted/Opposed
Slip/Bypass-Lane Movement	Opposed Slip/Bypass-Lane
Stopped Movement	Turn On Red
Other Movement Class (MC) Running	Undetected Movement
Mixed Running & Stopped MCs	Continuous Movement
Other Movement Class (MC) Stopped	Phase Transition Applied

SITE LAYOUT

Site: IN-10 [IN-10 Officer South Rd/Thompsons Road - PM Peak [Hybrid Triple] (Site Folder: Officer South Employment PSP)]

PM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

Layout pictures are schematic functional drawings reflecting input data. They are not design drawings.



MOVEMENT SUMMARY

Site: IN-10 [IN-10 Officer South Rd/Thompsons Road - PM Peak [Hybrid Triple] (Site Folder: Officer South Employment PSP)]

PM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Officer South Road														
1	L2	7	0.0	7	0.0	0.009	24.6	LOS C	0.2	1.5	0.59	0.64	0.59	46.6
2	T1	352	0.0	352	0.0	* 0.542	50.2	LOS D	9.6	67.3	0.97	0.79	0.97	36.0
3	R2	1	0.0	1	0.0	0.003	50.7	LOS D	0.0	0.3	0.85	0.60	0.85	35.2
Approach		360	0.0	360	0.0	0.542	49.7	LOS D	9.6	67.3	0.96	0.79	0.96	36.2
East: Thompsons Road														
4	L2	1	0.0	1	0.0	0.001	7.6	LOS A	0.0	0.0	0.17	0.59	0.17	59.3
5	T1	1736	15.0	1736	15.0	0.832	40.0	LOS D	32.9	259.6	0.97	0.93	1.05	39.9
6	R2	44	15.0	44	15.0	0.262	70.2	LOS E	1.3	10.5	0.99	0.71	0.99	28.7
Approach		1781	15.0	1781	15.0	0.832	40.8	LOS D	32.9	259.6	0.97	0.93	1.05	39.5
North: Officer South Road														
7	L2	43	15.0	43	15.0	0.051	17.5	LOS B	1.0	8.1	0.48	0.67	0.48	48.3
8	T1	97	0.0	97	0.0	0.260	44.7	LOS D	4.9	34.1	0.89	0.71	0.89	38.0
9	R2	941	15.0	941	15.0	* 0.975	105.5	LOS F	27.1	213.9	1.00	1.18	1.76	22.5
Approach		1081	13.7	1081	13.7	0.975	96.5	LOS F	27.1	213.9	0.97	1.12	1.63	23.9
West: Thompsons Road														
10	L2	895	15.0	895	15.0	0.670	10.4	LOS B	17.4	137.1	0.47	0.74	0.47	53.2
11	T1	1922	15.0	1922	15.0	* 0.951	71.6	LOS E	52.6	415.6	1.00	1.22	1.41	29.8
12	R2	57	0.0	57	0.0	* 0.614	71.8	LOS E	3.5	24.8	1.00	0.78	1.09	29.2
Approach		2874	14.7	2874	14.7	0.951	52.5	LOS D	52.6	415.6	0.83	1.06	1.11	34.5
All Vehicles		6096	13.7	6096	13.7	0.975	56.7	LOS E	52.6	415.6	0.91	1.02	1.18	33.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site 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 (Geometric Delay is included).
Queue Model: SIDRA Standard.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

* Critical Movement (Signal Timing)

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Effective Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
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Project: Y:\18001-18500\18212T - Officer South Employment - Integrated Transport Assessment\Work\Analysis\SIDRA\18212T - ICP Intersection tests V2.4 120 cycle.sip9

PHASING SUMMARY

Site: IN-10 [IN-10 Officer South Rd/Thompsons Road - PM Peak [Hybrid Triple] (Site Folder: Officer South Employment PSP)]

PM Peak Hour
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated   Cycle Time = 120 seconds (Site User-Given Cycle Time)

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Phase Timing Summary

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Phase Time (sec)	29	26	12	53
Phase Split	24%	22%	10%	44%

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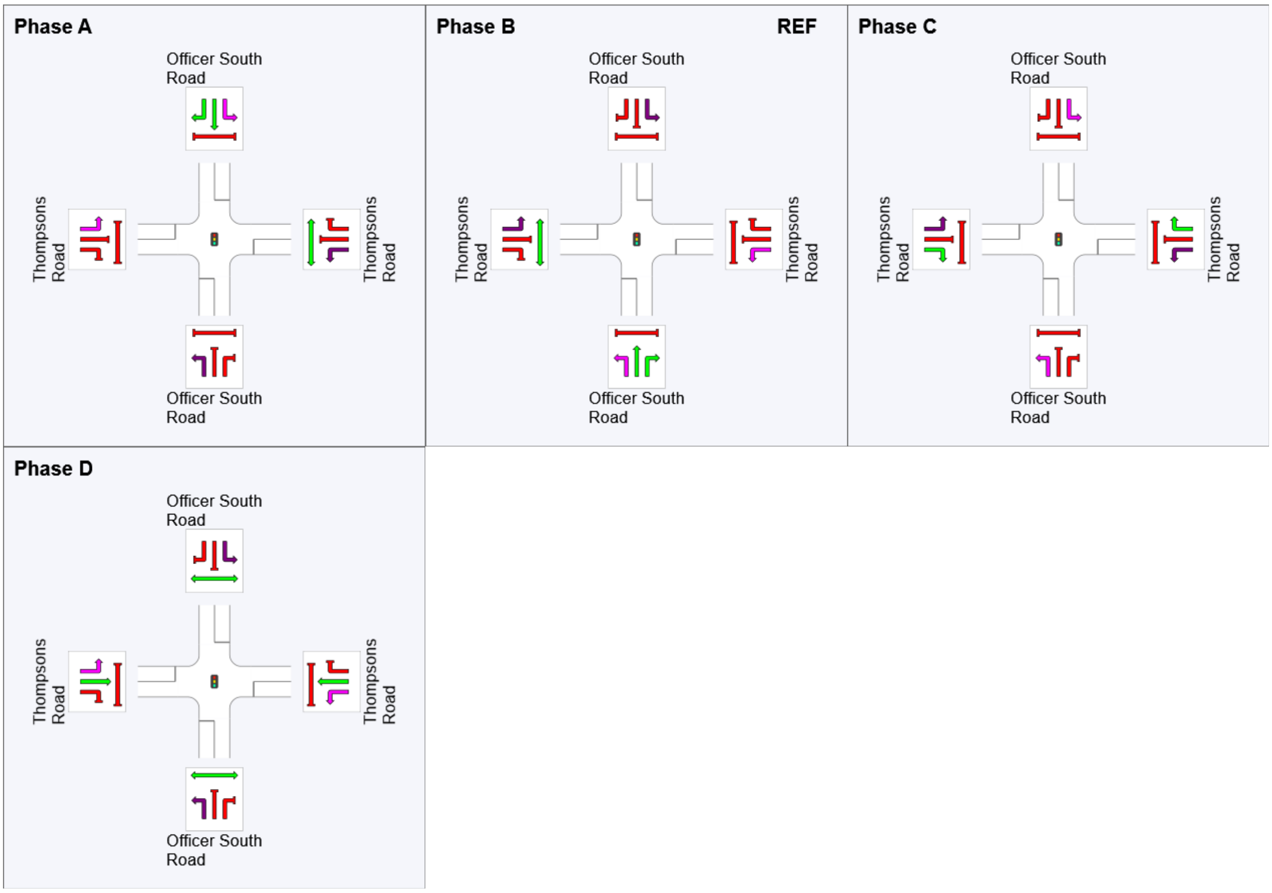
Output Phase Sequence



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VAR: Variable Phase

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