Amendment C193yran – Yarra Ranges Shire

Kinley Estate Development Proposal
Transport Review Statement

Prepared by: Chris Coath of GTA Consultants (VIC) Pty Ltd for Russell Kennedy Lawyers

Instructed by: Mr Andrew Sherman, Russell Kennedy Lawyers

Hearing Date: 31/05/2021 – 10/06/2021 Report Date: 21/05/2021

Reference: V159104 Report Issue #: A

GTAconsultants now Stantec

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on 21/05/2021

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Issue #: A

GTA consultants now Stantec

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EXPERT WITNESS DETAILS

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Qualifications

Bachelor of Engineering (Civil) (Honours), Monash University, 2002

Memberships and Affiliations:

- Engineers Australia, Chartered Professional Engineer (MIEAUST CPEng)
- Victorian Planning and Environmental Law Association (VPELA), Member

Experience & Area of Expertise

I have over 19 years of experience in traffic engineering and transport planning in Victoria.

My experience encompasses an extensive range of car parking strategies, land use planning and design, integrated transport plans, traffic and transport planning, masterplan development, traffic engineering impact assessments, transport research and expert presentations at VCAT, ACAT and Planning Panel hearings.

I have extensive experience in managing a variety of large projects. I have been intimately involved in the preparation of a number of major developments including the Melbourne Convention Centre and South Wharf Precinct.

My work in the preparation of city and town centre parking strategies includes the management of kerb space to ensure competing activity centre demands (parking, pedestrians, cyclists, public transport and loading/servicing) are balanced to achieve resource efficiency, urban design, place making and economic prosperity objectives.

I am a Chartered Professional Engineer with Engineers Australia.

Further details of my experience are provided in Appendix A.

Relationship to Client

I have no ongoing private or business relationship with the client and have been retained to provide expert witness services at this hearing for a mutually agreed fee.

Assistance

This evidence was prepared with the assistance of:

- Neale McCracken (Associate, GTA)
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1. INTRODUCTION

1.1. Background

The Minister for Planning directed the Victorian Planning Authority (VPA), under Section 36 of the Victorian Planning Authority Act 2017, to lead the preparation and finalisation of the Lilydale Quarry precinct (known as Kinley Estate) and associated draft Planning Scheme Amendment C193yran. The Minister has also appointed the VPA Priority Projects Standing Advisory Committee, to independently review the Amendment.

GTA Consultants (GTA, now Stantec) was commissioned by Council in 2016 in an advisory role in review of the transport assessment work undertaken by the Proponent's transport engineer, Cardno.

I have now been retained by Russell Kennedy Lawyers to provide expert witness services in review of the transport assessment reports prepared as part of the planning scheme amendment.

Submissions have been received on the proposed amendment including those in support and many with concerns relating to specific items, some of a transport nature.

1.2. Summary of GTA Consultants Peer Review

As part of the review of Planning Scheme Amendment documents prepared by the proponent, I prepared a "Peer Review of Transport Related Matters" in December 2020 to assist Council in making its submissions to the Amendment. The following provides a summary of the findings of that review.

- *"It is agreed that this development has the opportunity to draw on state and local policy and create an integrated development that connects with the surrounding employment, shopping, education and transport infrastructure.*
- *The proposed road hierarchy and associated road cross sections align with typical Victorian Planning Authority standards and appropriately provide quality walking and cycling elements that, where possible, are separated from vehicle movements.*
- *The adoption of standard Planning Scheme rates at this time would be considered appropriate in order to identify the indicative future parking requirements of the site. Detailed parking requirements for individual land uses should be calculated as part of specific planning permit applications for individual land uses.*
- *The trip generation rates for the majority of uses appear reasonable and could be considered to be fit for purpose.*
- *The adopted traffic distributions are generally considered to be fit for purpose with the exception of the distribution of traffic along John Street to the west of Hutchinson Street which requires further consideration.*
- *Site access intersections are generally identified to operate appropriately, however updated intersection operational analysis should be undertaken to coordinate cycle lengths with nearby external intersections.*
- *The works proposed at surrounding external intersections do not appear, in many instances, to mitigate the impact of the development on the external road network. As such it is recommended that further works and/or additional analysis be considered at the following intersections:*

- *Victoria Road / Maroondah Highway / Mooroolbark Road*
- *Mooroolbark Road / Hull Road*
- *Swansea Road / Hull Road*
- *Anderson Street / Hardy Street*
- *Maroondah Highway / John Street*
- *Hull Road / Lakeside Drive (x2)*
- *Hutchinson Street / Lilydale Market Place*
- *Hutchinson Street / Lilydale High School*

- *The signalisation of the intersection of Maroondah Highway and Hutchinson Street must be included as a project to be funded by the proposed development rather than expecting that this will be undertaken by others.*
- *The Schedule to the CDZ provides the opportunity for the matters raised in the above review of the Transport Impact Assessment to be dealt with prior to the finalisation of the agreement of necessary transport mitigation measures, however it is recommended that a requirement be put in place for the site wide transport mitigation measures, particularly to the external road network be agreed separately and more holistically.*
- *The Approach to Development Contributions report in isolation appears reasonable in its inclusion of the proposed works identified by the Cardno Traffic Impact Assessment Report, however as identified, the following matters require further resolution:*
  - *The required inclusion of the signalisation of intersection of Maroondah Highway and Hutchinson Street as the responsibility of the Kinley Estate development, and*
  - *The extent of other mitigation works to surrounding intersections.*
- *Further analysis and justification should be provided as part of the Traffic Impact Assessment Report to support the identified timing / triggers identified in the Approach to Development Contributions report."*

1.3. Summary of Third-Party Submissions

A range of submissions were received as part of the Amendment exhibition process.

From a transport perspective, a number of these submissions were supportive of the road works and transport infrastructure works that were proposed as part of the development, in particular the improvement works to the intersection of Mooroolbark Road and Hull Road and the development of a new railway station.

A number of submissions however raised concerns regarding a number of transport matters as summarised in the following:

- The extent of transport infrastructure works would not be sufficient to adequately mitigate the impacts of the development on the surrounding road network.
- The timing of transport infrastructure works would be required earlier than proposed by the Development Contributions Plan.

- Suitable access would not be able to be achieved to the proposed commercial site on the corner of Maroondah Highway and Mooroolbark Road bringing into question the suitability of a commercial development in this location.

These matters will be further discussed throughout this report.

1.4. Instructions & Scope of Report

This evidence report sets out an assessment of matters pertaining to the discipline of traffic and transport planning. Prior to preparing this evidence I was briefed by Andrew Sherman regarding the proposal via oral and written instructions.

This report is specifically focussed on the key matters raised as part of my earlier peer review of the package of Planning Scheme Amendment documents which is summarised in Section 1.2 above. These key matters could be generally grouped into the following topics which will form the basis for the assessment contained within this report.

- Traffic generation characteristics of the site
- Traffic distribution characteristics of the proposed development
- Suitability of proposed access arrangements for the site and mitigating works at surrounding intersections
- Suitability of the proposed Development Contributions Plan prepared for the site, and
- Suitability of the proposed Comprehensive Development Zone schedule.

Further, as requested by the Standing Advisory Committee the following elements have been considered:

"17. Council and the Proponent must address the following through expert evidence:

a) likely traffic volumes expected as a result of Lilydale Bypass and/or Healesville Bypass, particularly at the following intersections:

(i) Maroondah Highway/Mooroolbark Road /Victoria Street

(ii) Mooroolbark Road /Hull Road

(iii) Maroondah Highway/Anderson Street

(iv) Anderson St/Hardy Street

b) any additional works that may be required to bring these intersections to an acceptable operating capacity if the Bypasses are not built."

1.5. References

In preparing this evidence, reference has been made to the following:

- Yarra Ranges Planning Scheme
- Australian Standard/ New Zealand Standard, Parking Facilities (AS2890)
- Briefing material provided to me by Russell Kennedy Lawyers, including:
  - Integrated Transport Plan Lilydale Quarry Urban Renewal, Cardno, 30 October 2020
  - Supporting Traffic Impact Assessment Lilydale Quarry Urban Renewal, Cardno, 30 October 2020

  - Lilydale Quarry Comprehensive Development Plan, Urbis, October 2020
  - Lilydale Quarry Approach to Development Contributions, Urban Enterprise, October 2020
  - Former Lilydale Quarry: Planning Scheme Amendment Planning Report, Urbis, October 2020
  - Draft Schedule 1 to Clause 37.02 Comprehensive Development Zone
- various technical data as referenced in this report
- an inspection of the site and its surrounds
- other documents as nominated.

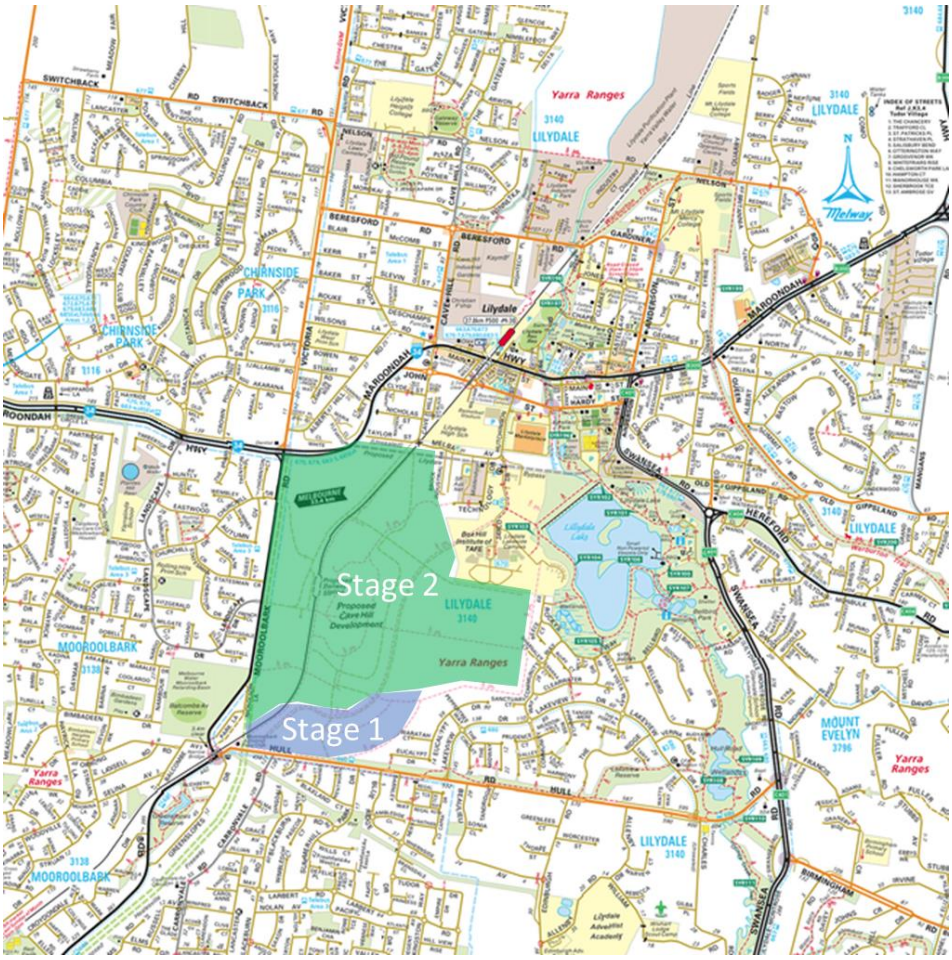
2. AMENDMENT CONTEXT

2.1. Subject Site Context

The subject site is a 144-hectare tract of land occupied by the former Lilydale Quarry. The site is located approximately 32km from Melbourne CBD (Old GPO) and Lilydale Main Street is approximately 1km from the proposed northern entrance to the site. The site forms Stage 2 of the overall Lilydale Quarry redevelopment, with Stage 1 having undergone a Planning Scheme Amendment (C139) and now includes 177 residential lots and 2 super lots (2,658sqm and 5,027sqm) which are intended for multi unit development[1].

The subject site (Stage 2) and the approved Stage 1 subdivision are each shown in Figure 2.1.

Figure 2.1: Subject Site Location in Lilydale Locality



Source: Melway Publishing Pty Ltd, edited by GTA

[1] Source: Endorsed Functional Layout Plan dated 11 May 2021.

2.2. Strategic Context

2.2.1. Lilydale Structure Plan

A new Lilydale Structure Plan is currently being prepared by Council to update the 2006 version. The plan is at the stage of receiving community feedback on the background analysis.

The updated structure plan seeks to capture the strategic level of change currently being planned for Lilydale, including:

- The redevelopment of the former Lilydale Quarry site
- The level crossing removal works
- The expected growth of Box Hill Institute, and
- Council's Civic Centre redevelopment

Key issues from a transport perspective that will be addressed by the new Structure Plan include:

- Council's position on the Lilydale Bypass, noting that an Issues and Opportunities Paper[2] puts up two alternatives for a strategic traffic bypass of the Lilydale Town Centre. This includes the planned arterial bypass route and an alternative route via John Street and Hardy Street.
- Residential growth and the location and density of where the growth will occur and how the increase in population puts additional demands on the existing transport networks, which drives the need for infrastructure change or improvement.
- Main Street improvements to make it a more pedestrian-friendly environment, with improved cycling paths and facilities, together with better connectivity with minor streets and parkland.

2.2.2. Level Crossing Removal Works

The relocation of Lilydale Train Station to south of Maroondah Highway is identified in the 2006 Lilydale Structure Plan. The level crossing removal involves the construction of a rail over road bridge at Maroondah Highway. Other infrastructure improvements include:

- Improved intermodal facilities via a new bus interchange and car passenger pick-up/drop off area around the new station at William Street West and William Street East.
- Increased height clearance at the John Street rail bridge (over John Street) to accommodate buses, removing this large vehicle pinch-point on the road network.

The proposed layout is shown in Figure 2.2.

[2] https://www.yarraranges.vic.gov.au/files/assets/public/webdocuments/build-develop/build-develop-other/lilydale_major_activity_centre_structure_plan_-_issues_and_opportunites_paper_june_2020.pdf accessed by GTA in May 2021

Figure 2.2: Lilydale Level Crossing Removal Project

Source: https://levelcrossings.vic.gov.au/projects/maroondah-highway-lilydale

2.2.3. Lilydale Bypass / Healesville Arterial

The Lilydale Bypass has been planned since the 1970s and has been the subject of several planning studies and local appeals over the years. A strategic bypass of Lilydale is key to the realisation of Lilydale Main Street as a safer walking environment with increased street front activation.

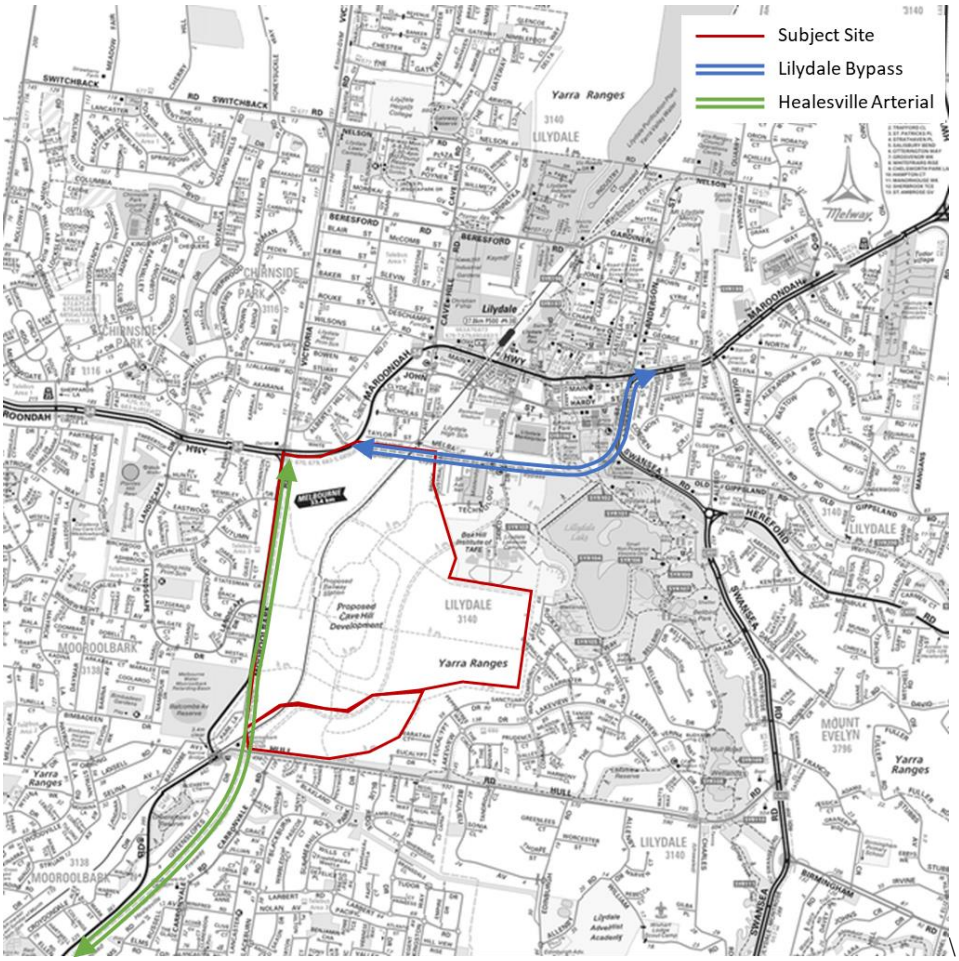
Lilydale Bypass forms part of a longer proposed arterial road alignment, the Healesville Arterial. This planned road originally stretched from Springvale Road through to Coldstream; however, a study by VicRoads in 2009 identified that the reserve between Springvale Road and Boronia Road in Vermont was no longer needed and has recently been recategorised as public open space. The remaining section between Boronia Road and Lilydale is still a road reserve to which a public acquisition overlay applies (PAO11 within the Yarra Ranges Planning Scheme). The Lilydale Bypass and Healesville Arterial are each shown in Figure 2.3 in the context of the subject site.

As noted above, the renewal of the Lilydale Structure Plan is moving toward a resolution for Council in consideration of two bypass options:

- to either support the bypass on the route to which public acquisition overlays apply, including consideration of an elevated structure linking Maroondah Highway to Swansea Road with no side road access and an option that includes an at grade connection at the intersection of Hutchinson Street and Jarlo Drive; or
- consider upgrading of John Street and Hardy Street as the major connection between Maroondah Highway and Swansea Road/Anderson Street.

There is no planned date by which the bypass will be in place with its delivery being the responsibility of the Department of Transport.

Figure 2.3: Lilydale Bypass and Healesville Arterial Road Alignments



Source: Melway Publishing Pty Ltd, edited by GTA

2.3. Local Transport Context

2.3.1. Road Network

Roads

The subject site is bound by several key local roads and the state arterial road network. These include:

- Maroondah Highway to the northwest – a state arterial road (RDZ1)
- Mooroolbark Road to the west – a state arterial road (RDZ1)
- Hull Road to the south – a major local road (RDZ2) noting this is a state arterial road to the west of Mooroolbark Road
- The road reservation for the future Lilydale Bypass to the north (PAO9 and PAO10), and
- The road reservation for the future Healesville Arterial to the south (PAO11).

Other key roads in the wider vicinity include:

- Anderson Street and Swansea Road to the east – state arterial roads (RDZ1), and
- John Street and Hardy Street to the north of the site – major local roads linking Maroondah Highway to Anderson Street.

Intersections

Key intersections in the wider vicinity include:

- Maroondah Highway / Hutchinson Street (unsignalised)
- Maroondah Highway / John Street (unsignalised)
- Maroondah Highway / Anderson Street (signalised)
- John Street/Hardy Street / Hutchinson Street (signalised)
- Hardy Street / Anderson Street (signalised)
- Anderson Street / Council Offices (signalised, linked to Hardy Street/Anderson Street)
- Maroondah Highway / Mooroolbark Road / Victoria Road (signalised)
- Mooroolbark Road / Hull Road (signalised), and
- Swansea Road / Hull Road (signalised).

Site Access

Vehicle access to the site is proposed at four (4) locations:

- Hull Road / Honour Avenue (approved Stage 1 access)
- Two intersections at Mooroolbark Road, and
- via Jarlo Drive (extension of Honour Avenue through the subject site and the Box Hill Institute Lilydale Campus).

Traffic Collisions and Road Safety

A review of the Department of Transport (DOT) collision statistics for the intersections noted above is presented in the following. This has covered the most recently available 5-year period. The key outcomes are noted in Table 2.1 below.

Table 2.1: Summary of Traffic Collisions

Location	Severity			Total
	Fatal	Serious	Other	
Maroondah Hwy / Hutchinson St	1	-	1	2
Maroondah Hwy / John St	-	-	1	1
John St / Hutchinson St	-	1	2	3
Anderson St / Hardy St / Council Offices	-	2	3	5
Total	1	3	7	11

One crash resulted in a fatality at the Maroondah Highway/Hutchinson Street intersection. This was as the result of a vehicle emerging from the northern service road opening, colliding with a motorcycle travel through on Maroondah Highway.

Having visited the intersection during peak hour operations, I am of the view that relatively minor works would result in fewer vehicle-to-vehicle conflict points, improved legibility and an improved road safety environment for all road users. The works include:

- Closing the northern service road opening
- Closing the southern service road connections to Hutchinson Street and creating service road openings onto Maroondah Highway.

This is further discussed later in this report.

2.3.2. Public Transport

The key public transport focus for the subject site is a new rail station, referred to as "Kinley Station" in the most recent work undertaken by Value Advisory Partners on behalf of the Proponent. There is no specified year for delivery of this station; however, it is noted that Value Advisory Partners adopt a 2030 delivery date for the purposes of their economic assessment.

In the wider area, the relocation of Lilydale rail station to the south of Maroondah Highway will remove the Maroondah Highway level crossing, resulting in improved journey time reliability. The relocated station will be provided with an improved bus interchange and car pick-up/drop-off intermodal facilities. A rail bridge over Maroondah Highway is still required to connect to a train storage facility to the north.

There are a range of bus services that currently operate along key roads that bound the subject site. It is proposed to connect the bus network to the new rail station at a public transport interchange. The connector road network within the subject site will be bus capable. It is important that bus headways are in the order of 15 minutes or better to provide a reliable, efficient means of travel that will realistically result in reduced car use.

Accordingly, I consider that the proposed development will be highly accessible by public transport.

2.3.3. Walking and Cycling

Footway and cycling connections to the subject site are poor and would have to be improved as part of the proposals to develop the site. Externally, while there are a number of cycling trails, these are of a recreational nature rather than for commuting purposes insofar as their relationship to the subject site.

Development proposals include a network of internal pedestrian paths, shared paths and bicycle tracks to support active travel. Upon review, it is proposed to provide good cycling permeability across the subject site via a network of local cycling paths on connector roads and a rail trail cycling path parallel to the Lilydale rail line reserve. The severing effects of the rail line for pedestrian permeability are mitigated by a series of three (3) grade-separated pedestrian crossing locations.

Pedestrian and cycle paths will connect to external facilities in the surrounding area, including the Lilydale Lakeview Estate, the Box Hill Institute Lilydale Campus and various shared paths that are proposed along key roads, as shown in the Comprehensive Development Plan.

These proposals will contribute to a high-quality walking and cycling environment for the site.

3. TRAFFIC GENERATION CHARACTERISTICS

3.1. Overview

Traffic generation rates have been derived for each of the proposed land uses within the site as summarised within Table 5.7 of the Cardno Traffic Impact Assessment. The table is reproduced below as Figure 3.1 for reference.

Figure 3.1: Cardno Proposed Traffic Generation Rates

Table 5-7 Kinley Development Trip Generation Rates

Development Use		AM Peak Hour Generation	PM Peak Hour Generation
Low Density (Conventional Dwellings)		0.7 trips per dwelling	0.7 trips per dwelling
Large Medium Density		0.65 trips per dwelling	0.65 trips per dwelling
Medium Density (Townhouses)		0.5 trips per dwelling	0.5 trips per dwelling
High Density (Apartments)		0.3 trips per dwelling	0.3 trips per dwelling
Potential Future Train Station (Car Parking)		0.5 trips per space	0.5 trips per space
Proposed Government Specialist School		0.4 trips per student	0.2 trips per student
Town Centre	Civic Institution	N/A	N/A
	Retail Opportunity	10% of 8 trips per 100m² LFA	8 trips per 100m² LFA
	Office Commercial	1.5 trips per 100m² NFA	1.5 trips per 100m² NFA
Mixed Use Commercial (Super Lot)		2.2 trips per 100m² GFA	2.2 trips per 100m² GFA
Open Space		N/A	N/A

3.2. Residential

There are a number of components which make up the residential traffic generation considerations as follows:

- The appropriateness of traffic generation surveys undertaken at the adjacent Lakeview Estate by Cardno
- Internal and external traffic factors
- Transit Orientated Development considerations
- Low density, medium density and high-density dwelling typology

Having regard to the combination of these considerations, the residential traffic generation rates adopted by Cardno, could be considered appropriate and fit for purpose.

3.3. Mixed Use Commercial Super Lot

The report indicates that the commercial development located on the corner of Maroondah Highway and Mooroolbark Road will be serviced by left in left out access to Maroondah Highway as well as an internal access road within the development. The trip generation rates adopted appear reasonable.

It is however understood that the Department of Transport has raised concerns regarding the proposed access strategy to the arterial road network, including proximity to the Lilydale Bypass and the gradient of Maroondah Highway in proximity to the Mooroolbark Road intersection. Satisfactory resolution of the proposed access strategy is required as the implication of access arrangements for this specific land parcel will have flow on effects to the distribution of traffic for the site and the level of traffic accessing the site through other site access intersections.

This is further discussed later in this report.

3.4. Potential Future Train Station

A traffic generation rate of 0.5 vehicle movements per parking space is considered reasonable and consistent with recent surveys undertaken by GTA now Stantec.

3.5. Proposed Government Specialist School

It is noted that the Cardno report talks to the nature of the surrounds and the abundance of local schooling options which would give rise to the proposed school serving a very local catchment that would be made up of many non-vehicular trips.

However, the nature of the school being a 'specialist' school (rather than a primary school as previously described) may give rise to a different demographic of students and a broader catchment to that described by Cardno.

This would likely result in a higher traffic generation rate to that adopted within the Cardno report. The Cardno report identifies a traditional generation rate in the order of 0.75 trips per student, however, reduces this to a rate in the order of 0.4 trips per student during the AM peak and lower during the PM peak.

While some reductions to the standard trip generation rates could be expected, the extent adopted by the Cardno report for the 'Specialist School' may not be appropriate. It is however also important that a double counting of trips with those generated by residential dwellings does not occur.

Given the elements of uncertainty that may exist around the ultimate future configuration of a school (specialist or primary school), it would be recommended that further consideration be given to the appropriateness of these rates.

3.6. Town Centre

The trip generation rates adopted for the town centre (Civic, Retail & Commercial) appear reasonable and representative of the extent of traffic likely to be generated by the land uses to the external road network.

3.7. Recreational Reserve

The assumption that the recreational reserve will mainly attract traffic outside of peak times is considered reasonable.

3.8. Summary

Overall, the trip generation rates for the majority of uses presented in the report appear reasonable and could be considered to be fit for purpose. While further considerations are required for the Specialty School use as identified above (and should be addressed as part of the satisfying the requirements of the Schedule to the Comprehensive Development Zone), the impacts of changes to these traffic generation rates are likely to be minor in the context of the overall site traffic generations and would be unlikely to alter the findings of the further analysis contained within this report.

4. TRAFFIC DISTRIBUTIONS

4.1. Overview

The distribution of traffic within the Cardno Traffic Impact Assessment has been undertaken having regard for different trip types likely to be generated by the development establishing the overall distribution of traffic along key arterial roads.

The adopted distributions are not dis-similar to the proportions of key turning volumes at key intersections in the vicinity of the site, and as such are generally considered to be fit for purpose.

An anomaly in the distribution of traffic however may appear in the distribution of traffic along John Street to the west of Hutchinson Street. The assignment of traffic onto the existing road network results in additional traffic using John Street to reach Maroondah Highway and travel to/from destinations generally west of the subject site. This is in preference to assigning this traffic directly to the nearest arterial road network via Hutchinson Street. Further the Cardno assessment does not go onto consider the impacts of the distribution of traffic along John Street to and from the west.

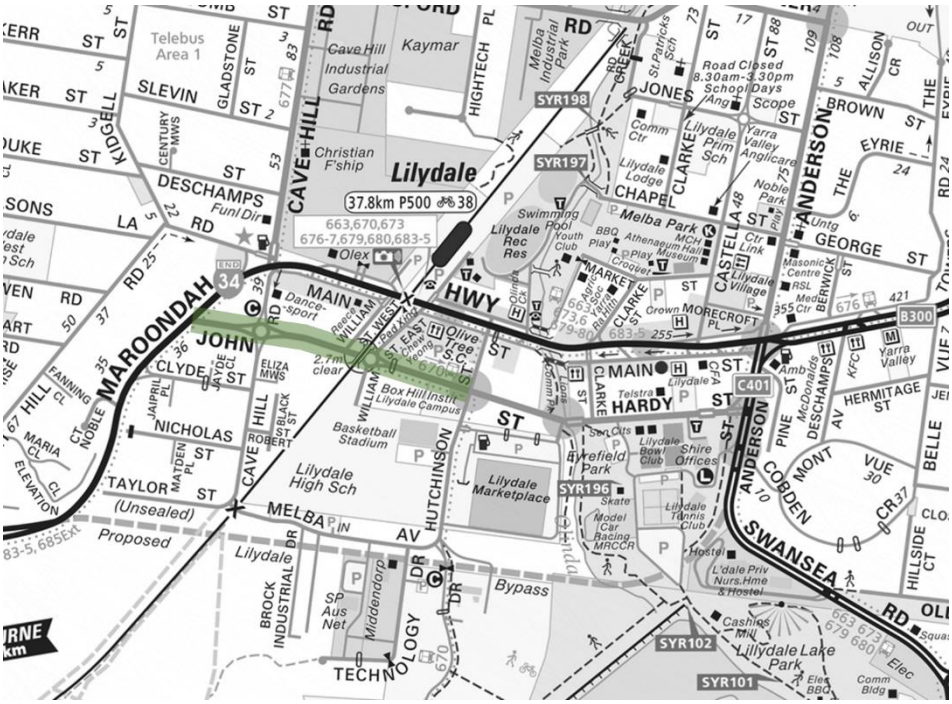
In considering the distribution of traffic along John Street the following discussions are provided in respect of the current and future context of this road.

4.2. John Street Context

4.2.1. Road Characteristics

John Street is a 2-lane, 2-way major local road managed by Yarra Ranges Council. The speed limit is 50km/h along the extent assessed in this section of the evidence (see Figure 4.1). The street has a commercial function east of Cave Hill Road and a residential function between Cave Hill Road and Maroondah Highway. Median turn lanes are provided at key locations and on-street parking is provided at various locations along its length.

Figure 4.1: John Street Context (extent shown in green)



Source: Melway Publishing Pty Ltd, edited by GTA

4.2.2. Policy Context – Intent and Implications for John Street

Lilydale Major Activity Centre Structure Plan 2006 (Clause 22.07-4)

The current structure plan identifies issues in several streets, including John Street that disincentivises pedestrian activity. The John Street/ Hutchinson Street intersection is highlighted as problematic with a "poor layout and excessive traffic congestion".

The 2006 Structure Plan notes the further intensification of retail activity on sites abutting John Street offers the opportunity to strengthen the linkages between the Town Centre and the Market precincts and to reinforce the emergence of a vibrant and cohesive retail hub west of Olinda Creek.

The proposed solution that is offered is that the gradual redevelopment of sites within this precinct provides considerable scope to create a more attractive streetscape that encourages increased levels of pedestrian activity in John Street/Hardy Street.

The increased use of John Street as a through traffic route threatens or at least weakens these opportunities and is thus inconsistent with the 2006 Structure Plan.

2008 Lilydale Urban Improvement Project (Clause 22.07-4)

This document was developed to respond to the intent of the 2006 Structure Plan and provide further defining detail where needed. In relation to John Street, the Urban Improvement Project makes the following recommendations:

- Promote uses which increase activity on the street
- Provide wider pedestrian paths by removing grassed nature strips and replacing with paved surfacing, and

- Limit the number of driveway crossovers and establish a rear laneway for vehicle access.

Further through traffic is not likely to directly threaten the ability to improve John Street in the manner noted above as the activity centre develops, however, increased traffic conflicts with the intent of the improvements which is to create a more pedestrian streetscape.

Lilydale Major Activity Centre Structure Plan Issues & Opportunities Paper, 2020

This paper on the renewal of the Lilydale Structure Plan is centred on the future of Lilydale with and without the Lilydale Bypass.

The issues and opportunities paper notes the following:

- John Street and Hutchinson Street along with Main Street could become the focus for land use change and intensification offering the opportunity to deliver a high-quality walkable town centre rather than just one 'main street'.
- John Street is identified as an Active Street (street where walking and cycling are prioritised)
- The relocated train station may place additional pressure on John Street and Hutchinson Street where traffic demand will need to be balanced with the amenity of the street network.

The issues and opportunities paper also notes that John Street could be considered to be part of an alternative bypass of Lilydale (in the absence of the formal Lilydale Bypass), together with other road improvements, to deliver the intended streetscape improvements along Main Street.

While under consideration, I consider this options paper to be more of an advocacy piece for the bypass, to test public opinion. It presents a binary choice regarding urban realm improvements that are desired for Main Street – either the bypass is built, or alternatives are sought. This is a reasonable rationale for council to adopt and is a different set of considerations from the current scenario or any interim scenario which retains Main Street as the arterial road through the area. In the alternative bypass scenario, John Street would become an arterial road, however it does not have this designation at present.

4.2.3. Road Network Configuration

While Melway maps identify John Street as a major local road, it is not in a Road Zone 1 or 2 in the Yarra Ranges Planning Scheme. This stretch of John Street is entirely within a Residential Growth Zone to the west of Cave Hill Road and is within a mix of Residential Growth and Commercial zonings to the east of Cave Hill Road. John Street is ultimately planned as a second "main street" for Lilydale.

There is no guidance within the provisions of the Planning Scheme on what an appropriate level of traffic is for a main street road typology. At one end of the scale, the physical capacity of a two-lane road is in the order of 18,000 vehicles per day[3]. At the other end of the scale is the environment-based function of roads, for which the desirable limit on vehicles is normally significantly less than the road's physical capacity. Arriving at a definition of acceptability is open to interpretation when considering midblock road link capacity in isolation of other factors.

While somewhat subjective, the combination of factors including the presence of public transport routes, school crossings and the intended densification of the neighbourhood and activation of the street frontages indicates Council's desire for John Street to serve a different function than a traffic through route.

[3] 900 vehicles per lane per hour (1,800 vehicles per hour for two lanes) adopting a daily to peak hour factor of 10%.

Network topography is an important consideration. In this case, traffic is ultimately being assigned to the arterial road network. Industry practice would dictate that traffic associated with strategic developments should rely on strategic road infrastructure. This means traffic should be directed to the closest connection to the arterial road network and capacity should not be created on minor roads and intersections to enable strategic traffic to use those minor roads. In this case, the nearest connection to the arterial road network is at the Maroondah Highway and Hutchinson Street intersection.

Ultimately the physical capacity of a street is more often dictated by nodes (intersections) rather than the links (midblock cross-sections). While link capacities can be useful in a planning sense, the operation of intersections is preferred in engineering terms, if this information is available. In this regard, the transport work prepared by Cardno on behalf of the Proponent does not comment on the operation of the Maroondah Highway and John Street intersection. The SIDRA assessment conducted by my office, as discussed later in this report, indicates this intersection is over capacity at present – a situation which will be exacerbated by the significant additional traffic associated with the subject site.

4.2.4. Level Crossing Removal Project

Construction of the new Lilydale Station, south of Maroondah Highway, has begun. The relocated station will provide bus services with stopping points on either side of the new station at William Street West and William Street East. There are currently no bus routes on John Street. The introduction of buses will require the current low clearance under the John Street bridge to be increased to accommodate these larger vehicles.

Public transport journeys start and end with a walk, or perhaps a bike ride. Significantly increased vehicle activity along a frontage road that connects to a public transport interchange is inconsistent with encouraging public transport uptake, particularly when the arterial road is being substantially relieved due to a level crossing removal.

Primarily though, the removal of the Lilydale level crossing will lead to more efficient reliable journeys along this road corridor. If anything, this increases Main Street (Maroondah Highway) as an efficient arterial road and therefore increases its traffic carrying capacity that could draw traffic from alternative routes currently being used (such as John Street). Adding traffic to John Street in preference to Main Street is inconsistent with the outcomes of the level crossing removal which plans to reduce the speed limit to 40km/hr and increase the use on John Street by buses and associated increases in pedestrian and cyclist activity.

4.2.5. Implications of Increased Rail Underpass Height Clearance

To date, the existing low clearance at the John Street rail underpass (2.7m) has served as a physical barrier to large vehicles and the adverse amenity and road safety implications that come with large and heavy vehicles using local roads. The relocation of Lilydale Station involves raising the John Street Bridge to accommodate bus services. This notionally increases the possibility that large vehicles could use this route as an alternative to Main Street; however, the LXRP is removing the major obstacle to efficient, reliable road transport journey times – the level crossing – making it unlikely that a through route via John Street will be attractive to larger vehicles passing through the area.

4.2.6. Safe Routes to Schools

Lilydale High School is located south of John Street. Increased traffic volumes are not conducive to a safe walking or cycling environment to or from a school, particularly as the school is on the other side of John Street from Lilydale Station and the town centre, which will be significant trips attractors for the school.

4.2.7. Pedestrian and Cyclist Infrastructure

The proposed cycling trail parallel to the rail reserve from the Kinley Estate will become part of the Warburton-Carrum Shared Path and is planned to pass to the west side of Lilydale High School. These users will need to cross John Street to continue the trail through to the new station precinct and north to either Warburton or along the new Yarra Valley trail. Once these trails are completed it is likely to attract increased cycling use, thereby increasing cycling and pedestrian activity at John Street and within the new station precinct.

4.3. Appropriateness of John Street use

The proposal to add traffic to John Street to accommodate the traffic impacts of the development proposal is inconsistent with the role of John Street at present and in the short term (school route and public transport route). It is also inconsistent with the longer-term objectives that John Street serves as a second "main street" for Lilydale.

It is industry practice that strategic developments should primarily rely on the highest order roads that are reasonably available. If vehicle capacity is to be added to the road network, it is reasonable to add it at arterial roads, fulfilling their primary movement function, rather than adding vehicle capacity to minor roads and intersections, where to do so would be at odds with their amenity-based function.

Therefore, in a "competition" that concerns where to add new intersection capacity, the intersection at Maroondah Highway/John Street comes second to the higher-order intersection at Maroondah Highway/Hutchinson Street. Further, the reassignment of traffic around the John Street/Hutchinson Street intersection may result in a different intersection geometry outcome – as the reassigned development traffic switches from left and right turns into simply north-south through movements.

While Council has considered traffic diversion options to enable the urban realm improvement of Main Street, including the Lilydale Bypass and an alternative bypass via John Street, it is clear the alternative option is being considered as part of an either/or outcome. It is clear from Council's planning documentation that the Lilydale Bypass is the preferred outcome, not to increase traffic along John Street.

Until such time as John Street is designated as an arterial road, and as an arterial road is located close by at Main Street, there is no reason to deviate from the current road hierarchy and add traffic capacity to enable minor roads to carry more traffic. Any capacity improvements should be made to arterial road connections to increase the ability to move traffic volumes on and off the arterial road (Main Street) in a safe and efficient manner.

5. INTERSECTION MITIGATION

5.1. Preamble

The Cardno Traffic Impact Assessment report provides analysis of a suite of intersections including site access points and surrounding external intersections.

As part of this report commentary, in the following, is provided on each of these intersections.

Specific analysis has been undertaken of intersections to the north of the proposed development to assist in providing further commentary upon the interactions of the proposed development with the Lilydale Town Centre and Council controlled roads in this area. This specific analysis has focussed on the following intersections:

- Hutchinson Street / John Street
- Maroondah Highway / Hutchinson Street
- Maroondah Highway / John Street, and
- Anderson Street / Hardy Street and Anderson Street / Council Site Access.

Analysis of these intersections is contained throughout the following sections with full SIDRA Intersection results contained within Appendix B.

5.2. Appropriate Intersection Operation

Prior to discussing the operation of intersections, it is first necessary to agree on the appropriate intersection operating conditions.

The key metrics by which to judge the performance of intersections is typically identified to be the Degree of Saturation (DoS), 95th Percentile Queue and Average Delay.

Intersection Level of Service (LoS) is linked to DoS. The acceptable LoS/DoS thresholds vary for signalised, unsignalised and roundabout controlled intersections, as shown in Table 5.1.

Table 5.1: SIDRA Intersection Criteria for Level of Service Assessment

Level of Service		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	>=1.0	>=1.0	>=1.0

As it relates to signalised intersections, these ranges are consistent with those identified in the Cardno Traffic Impact Assessment report (Table 6-1).

The Cardno Traffic Impact Assessment report further comments:

"It is considered acceptable for some critical movements in an intersection to operate in the range of 0.9 to 1.0 during the high peak periods, reflecting actual conditions in a significant proportion of inner-city signalised intersections".

The Cardno Integrated Transport Plan also identifies the following as appropriate limits for intersection operation.

"As detailed in the DoT Supplement to Austroads Guide to Traffic Management Part 3: Traffic Studies and Analysis, in evaluating intersection performance during capacity analysis and design the target maximum Degree of Saturation (DoS) of the critical (maximum) movement is:

- *0.90 (desirable) and 0.95 (maximum) for signalised intersections; and*
- *0.80 (desirable) and 0.85 (maximum) for un-signalised intersections, including roundabouts."*

While it is recognised that some inner-city intersections operate with existing conditions at a DoS level of 1.0, reflecting the intersection operating at capacity, this is not considered to represent an appropriate design objective or scenario[4].

The limits as specified by Austroads indicate that a DoS level below 1.0 should be adopted as the maximum operating conditions of an intersection. Beyond this level queuing and delays begin to increase disproportionately.

It is recognised that the future operation of intersections must be considered in the context of the existing operating conditions, for which it is reasonable to expect future development to provide mitigating works to return intersections back to their existing operating levels. In some instances, existing capacity can be utilised to support new development.

This must however be reasonably balanced to ensure that the concept of development contributions is considered and fairly met. These concepts of development contributions include:

- Need: Does the proposed development generate a need for mitigating works to be undertaken
- Nexus: Is there a logical link between the works and the development
- Equity: Is it fair in the context of the surrounds and other development for the works to be attributed to the particular development.

As such key questions that must be asked in considering the intersection operation and proposed mitigating works include:

- Are the mitigation measures appropriate and can they be supported by Council (e.g. removing parking to create additional traffic capacity and what is the subsequent impact to surrounding land holders of this decision)?
- Do the proposed works have the necessary effect?
- Do the proposed works go far enough in mitigating the impacts created by the proposed development?

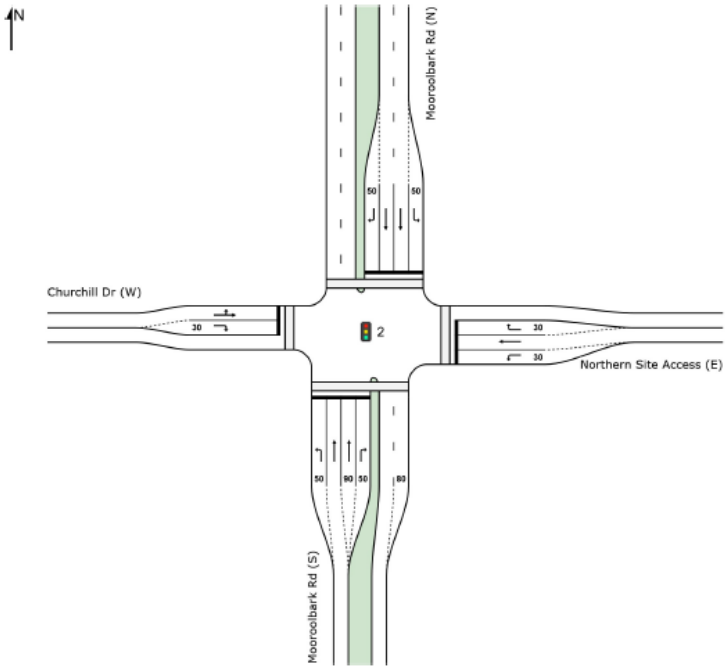
[4] It is recognised that in such instance the onus should not necessarily be placed on a developer to return the intersection to below this level if these existing conditions are beyond this level.

5.3. Site Access Intersections

5.3.1. Mooroolbark Road / Site Access / Churchill Drive

This intersection is proposed to form a signalised cross intersection. The proposed post development configuration is shown in Figure 5.1 for reference.

Figure 5.1: Mooroolbark Rd / Site Access / Churchill Dr Post Development Intersection Layout



The SIDRA Intersection results prepared by Cardno indicate that this intersection would operate within appropriate limits.

It is however noted that the signal cycle time is not consistent between the Maroondah Highway / Mooroolbark Road intersection (AM - 130 sec, PM – 100 sec) and the new site access intersections along Mooroolbark Road (85 to 90 sec). It would be expected that the Department of Transport would require consistent cycle times to be adopted to ensure these intersections can be coordinated.

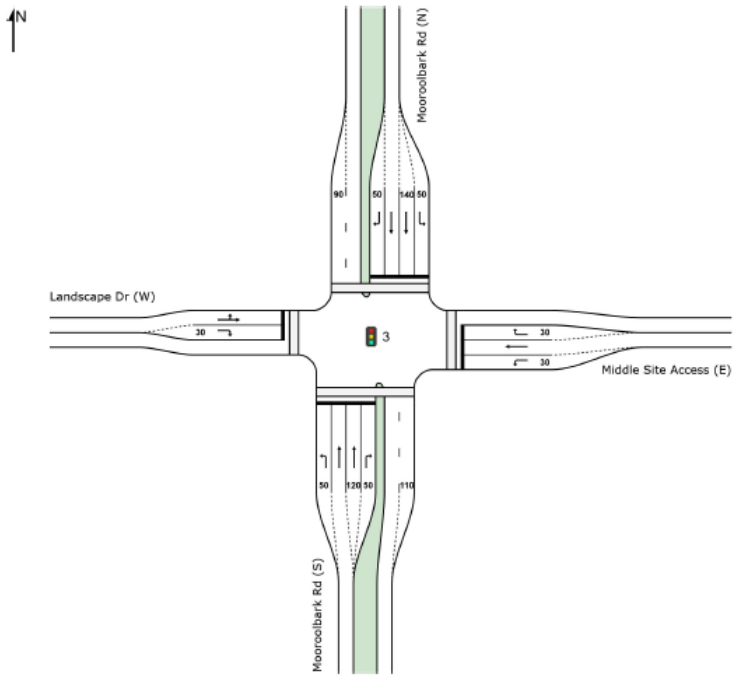
While a longer cycle time would typically reduce the DoS on primary movements, increases to queuing and delays can occur. Updated intersection operational analysis should be undertaken to confirm the continued suitability of these intersections and the interaction of queuing along Mooroolbark Road.

Notwithstanding, it is likely that the scale of this site access intersection would be suitable for the volume of traffic expected to be carried.

5.3.2. Mooroolbark Road / Site Access / Landscape Drive

This intersection is proposed to form a signalised cross intersection. The proposed post development configuration is shown in Figure 5.2.

Figure 5.2: Mooroolbark Rd / Site Access / Landscape Dr Post Development Intersection Layout



The SIDRA Intersection results prepared by Cardno indicate that this intersection would operate within appropriate limits.

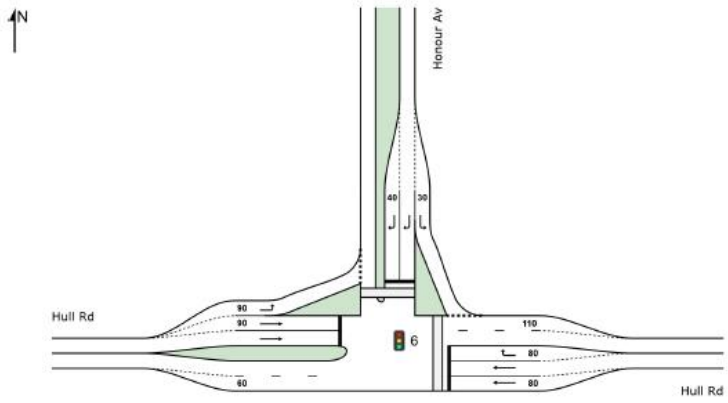
As per discussions regarding Churchill Drive, similar signal cycle time issues occur and require rectification.

Notwithstanding, it is likely that the scale of this site access intersection would be suitable for the volume of traffic expected to be carried.

5.3.3. Honour Avenue / Hull Road

This intersection is proposed to form a signalised T-Intersection. The proposed post development configuration is shown in Figure 5.3.

Figure 5.3: Honour Ave / Hull Rd Post Development Intersection Layout



The SIDRA Intersection results prepared by Cardno indicate that this intersection would operate within appropriate limits.

It is however noted that the signal cycle time is not consistent between the Hull Road / Mooroolbark Road intersection (AM – 70, PM – 115 sec) and the new site access intersection along Hull Road (60 sec). It would be expected that the Department of Transport would require consistent cycle times to be adopted to ensure these intersections can be coordinated given the spacing between these intersections.

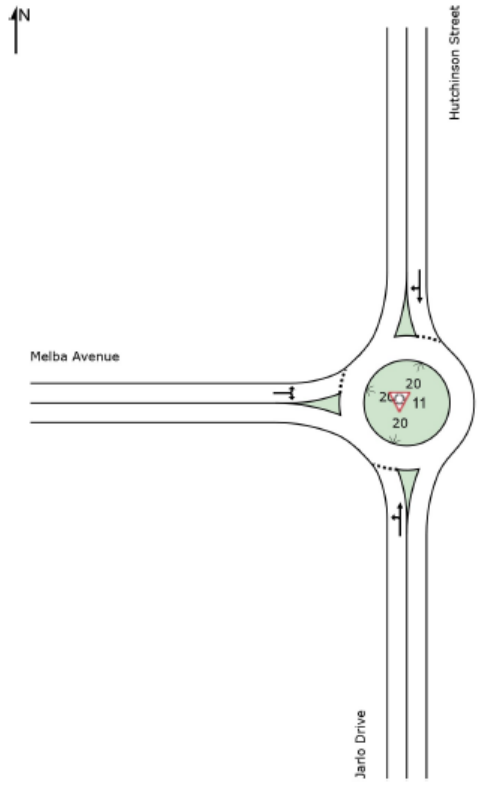
While a longer cycle time would typically reduce the DoS on primary movements, increases to queuing and delays can occur. Updated intersection operational analysis should be undertaken to confirm the continued suitability of these intersections and the interaction of queuing along Hull Road.

It is additionally noted that the presence of the 60m short departure lane on the western departure is likely causing upstream inefficiencies in lane utilisation. An extension to this short lane departure would likely more evenly distribute traffic amongst the lanes, increasing the efficiency of the intersection.

5.3.4. Hutchinson Street / Jarlo Drive / Melba Avenue

This intersection is proposed to form a roundabout controlled T intersection. The proposed post development configuration is shown in Figure 5.4.

Figure 5.4: Hutchinson St / Jarlo Dr / Melba Ave Proposed Post Development Intersection Layout



The SIDRA Intersection results prepared by Cardno indicate that this intersection would operate within appropriate limits and is considered satisfactory. Minimal queuing and delay are experienced on all approaches.

It is also understood that this intersection has been designed within the boundaries required to facilitate a future more significant intersection with the Lilydale Bypass at this location. The timing of the bypass currently remains unknown.

5.4. External Intersections

5.4.1. Hutchinson Street / John Street

The intersection of Hutchinson Street and John Street represents a key northern access point to the surrounding road network for the Kinley Estate.

The intersection is currently a signalised cross intersection, with full turning movements available. The existing layout of this intersection is shown through an aerial photograph in Figure 5.5.

To further assess the suitability of the mitigating works proposed at this intersection by Cardno, this intersection has been recreated in SIDRA Intersection as shown in Figure 5.6. The existing conditions operating results are shown in Table 5.2. This model has adopted the same input traffic volumes to that used by Cardno in their modelling.

Figure 5.5: Hutchinson St / John St Intersection Layout – Aerial Photograph

Figure 5.6: Hutchinson St / John St Intersection Layout – Existing Conditions

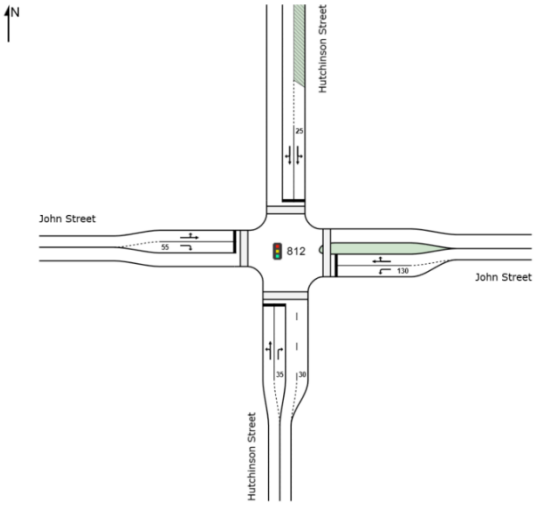


Table 5.2: Hutchinson St / John St Results – Existing Conditions

Location	Approach	DOS	Average Delay (sec)	95th Percentile Queue (m)
Existing Conditions AM Peak	Hutchinson Street (South)	0.75	36 sec	85m
	John Street (East)	0.76	41 sec	105m
	Hutchinson Street (North)	0.56	44 sec	55m
	John Street (West)	0.49	34 sec	90m
	Intersection	**0.76**	**38 sec**	**105m**
Existing Conditions PM Peak	Hutchinson Street (South)	0.53	34 sec	70m
	John Street (East)	0.78	47 sec	99m
	Hutchinson Street (North)	0.37	38 sec	33m
	John Street (West)	0.71	31 sec	134m
	Intersection	**0.78**	**36 sec**	**134m**

The results outlined in Table 5.2 indicate that the intersection operates under "good" conditions, with average queuing and delay.

The results achieved as a part of this assessment are broadly comparable to the results achieved in the Cardno report. Default SIDRA parameters have been adopted to create this intersection.

With the addition of development generated traffic volumes (adopted from the Cardno Traffic Impact Assessment report) the existing intersection layout will operate beyond its capacity with DoS levels exceeding acceptable limits. The results of the 'post development' traffic assessment at the intersection of Hutchinson Street / John Street are shown in Table 5.3.

Table 5.3: Hutchinson St / John St Results – Post Development Existing Layout

Location	Approach	DOS	Average Delay (sec)	95th Percentile Queue (m)
Post Development AM Peak	Hutchinson Street (South)	0.93	46 sec	279m
	John Street (East)	0.97	52 sec	149m
	Hutchinson Street (North)	0.96	71 sec	123m
	John Street (West)	0.98	76 sec	162m
	Intersection	**0.98**	**57 sec**	**279m**
Post Development PM Peak	Hutchinson Street (South)	0.98	52 sec	236m
	John Street (East)	1.15	127 sec	163m
	Hutchinson Street (North)	1.03	70 sec	122m
	John Street (West)	1.07	107 sec	212m
	Intersection	**1.15**	**85 sec**	**236m**

The results of the above assessment indicate that the addition of the traffic generated by the development pushes the operation of the Hutchinson Street / John Street intersection over capacity in the PM peak hour and operating under 'poor' conditions in the AM peak hour.

The results of the above assessment indicate that mitigating works are required at this location.

Mitigating works were proposed in the Cardno report at the intersection of Hutchinson Street / John Street to accommodate the increase in traffic volumes experienced. These mitigating works consisted of:

- Extension of the northern approach short lane from 25m to 50m
- Extension of the western approach right turn lane from 55m to 70m
- Addition of a 35m long right turn lane from the east, and
- Extension of the southern right turn lane from 30m to 60m.

The mitigating works proposed have been broadly replicated in the below assessment, noting that refinements have been made where it was discovered that minimal benefit was being achieved from the proposed works.

The proposed works will require agreement from Council to a loss of on-street parking in order to be able to deliver the capacity improvements to the intersection that are required.

The layout evaluated as a part of the 'post development' traffic assessment at the intersections of Hutchinson Street / John Street is shown in Figure 5.7, with the results of the assessment outlined in Table 5.4

Figure 5.7: Hutchinson St / John St Intersection Layout – Post Development Revised Layout

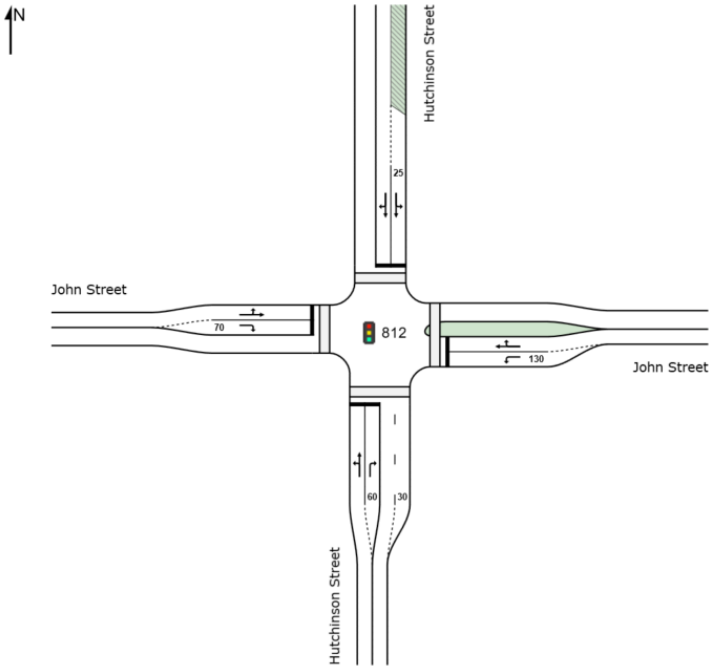


Table 5.4: Hutchinson St / John St Results – Post Development Revised Layout

Location	Approach	DOS	Average Delay (sec)	95th Percentile Queue (m)
Post Development AM Peak	Hutchinson Street (South)	0.92	35s	201m
	John Street (East)	0.92	33s	86m
	Hutchinson Street (North)	0.88	37s	68m
	John Street (West)	0.89	42s	85m
	Intersection	**0.92**	**36s**	**201m**
Post Development PM Peak	Hutchinson Street (South)	0.96	51s	260m
	John Street (East)	0.98	55s	101m
	Hutchinson Street (North)	0.96	51s	111m
	John Street (West)	0.98	65s	178m
	Intersection	**0.98**	**56s**	**260m**

With these proposed works, the SIDRA Intersection analysis indicates that the intersection operation returns to a DoS level below 1.0. The operating conditions of the intersection however would remain above the desired maximum levels of 0.9 – 0.95 for a signalised intersection. Further the intersection works do not return the operation of the intersection back to pre-development conditions.

Long queues are expected to be created on the southern intersection approach (Hutchinson Street); however delays are identified to remain reasonable.

Having consideration for the road reserve constraints at this location, and that delays across the intersection are not significantly increased this could be considered to represent an acceptable outcome (even though DoS levels are not returned).

5.4.2. Maroondah Highway / Hutchinson Street

The Cardno report identifies that "*It is understood that the Maroondah Highway / Hutchinson Road intersection will ultimately be upgraded to a signalised intersection as part of the Yarra Ranges Shire's Lilydale Integrated Transport Plan*". As such intersection analysis has been undertaken on the basis that this intersection will be signalised in future years.

It is however unclear from the Cardno report who will be responsible for the signalisation of this intersection.

The absence of the works at this intersection from the Lilydale Quarry Comprehensive Development Plan and Approach to Development Contributions reports indicates the Proponent does not intend to fund the signalisation of this intersection.

This intersection provides an important link between the Kinley Estate and the surrounding arterial road network.

While the Integrated Transport Plan identifies a strategic intent that this intersection would be signalised in future years, such 'need' to signalise this intersection would appear to be borne from the creation of a significant north-south road serving the Kinley Estate and creating suitable capacity for vehicles generated by the Kinley Estate to access the arterial road network.

On this basis intersection analysis for this intersection has been recreated and further tested in the following.

The intersection of Maroondah Highway / Hutchinson Street is currently an unsignalised cross intersection, with full turning movements available. It is noted that in the existing arrangement, the northern leg is a service road access point. This northern leg was not included as a part of the Cardno assessment, with no traffic volumes provided in the report. Whilst not ideal, this is considered acceptable, as the volumes to/from this location are expected to be minor. Further the interaction of the service road running along the southern side of Maroondah Highway has not been included within the Cardno model.

For the purpose of this assessment a standard T-Intersection design has been assumed in order to replicate the Cardno modelling. The existing layout of this intersection is shown through an aerial photograph in Figure 5.8, along with the layout assessed in SIDRA Intersection shown in Figure 5.9. The results of the assessment are shown in Table 5.5.

Figure 5.8: Maroondah Hwy / Hutchinson St Intersection Layout – Aerial Photograph

Figure 5.9: Maroondah Hwy / Hutchinson St Intersection Layout – Existing Conditions

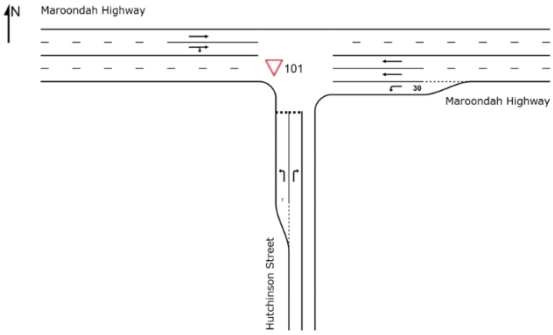


Table 5.5: Maroondah Hwy / Hutchinson St Results – Existing Conditions

Location	Approach	DOS	Average Delay (sec)	95th Percentile Queue (m)
Existing Conditions AM Peak	Hutchinson Street (South)	0.19	16 sec	4m
	Maroondah Highway (East)	0.24	1 sec	0m
	Maroondah Highway (West)	0.27	3 sec	14m
	Intersection	**0.27**	**2 sec**	**14m**
Existing Conditions PM Peak	Hutchinson Street (South)	0.25	22 sec	5m
	Maroondah Highway (East)	0.24	1 sec	0m
	Maroondah Highway (West)	0.30	2 sec	12m
	Intersection	**0.30**	**2 sec**	**12m**

The results outlined in Table 5.5 indicate that the existing intersection operates satisfactorily, with limited queuing and delay.

This assessment adopts a 20% 'bunching' factor to the through movements in both directions on Maroondah Highway. This assumption was made after the completion of the site inspection, where platooned traffic was

observed, and relied upon by vehicles turning into and out of Hutchinson Street. The assumed bunching factor was required to be adopted in order to replicate the SIDRA Intersection results identified by Cardno.

The existing conditions results achieved as a part of this assessment are comparable to the results achieved in the Cardno report.

With the addition of development generated traffic volumes (adopted from the Cardno Traffic Impact Assessment report) the existing intersection layout will operate beyond its capacity with DoS levels exceeding acceptable limits.

The results of the 'post development' traffic assessment at the intersection of Maroondah Highway / Hutchinson Street in its existing configuration are shown in Table 5.6.

Table 5.6: Maroondah Hwy / Hutchinson St Results – Post Development Existing Layout

Location	Approach	DOS	Average Delay (sec)	95th Percentile Queue (m)
Post Development AM Peak	Hutchinson Street (South)	2.22	446 sec	327m
	Maroondah Highway (East)	0.25	1 sec	0m
	Maroondah Highway (West)	0.38	3 sec	12m
	Intersection	**2.22**	**60m**	**327m**
Post Development PM Peak	Hutchinson Street (South)	5.16	1,692 sec	523m
	Maroondah Highway (East)	0.25	1 sec	0m
	Maroondah Highway (West)	0.51	3 sec	16m
	Intersection	**5.16**	**181 sec**	**523m**

The results of the above assessment indicate that the addition of the traffic generated by the development pushes the operation of the Maroondah Highway / Hutchinson Street intersection well over capacity. This is primarily due to the increase in right turning traffic out of Hutchinson Street, which is required to pick a gap in both streams of traffic.

The results of the above assessment indicate that mitigating works are required at this location in order to support the development generated traffic volumes.

As assumed by the Cardno report the intersection has then been analysed as a signalised intersection adopting the post development traffic volumes as set out by Cardno. The proposed signalised layout of the intersection as modelled is shown in Figure 5.10.

The intersection operation results, as outlined in Table 5.7, indicate that a signalised intersection operates under "good" conditions, with appropriate delays and queuing.

Figure 5.10:Maroondah Hwy / Hutchinson St Intersection Layout – Post Development Revised Layout

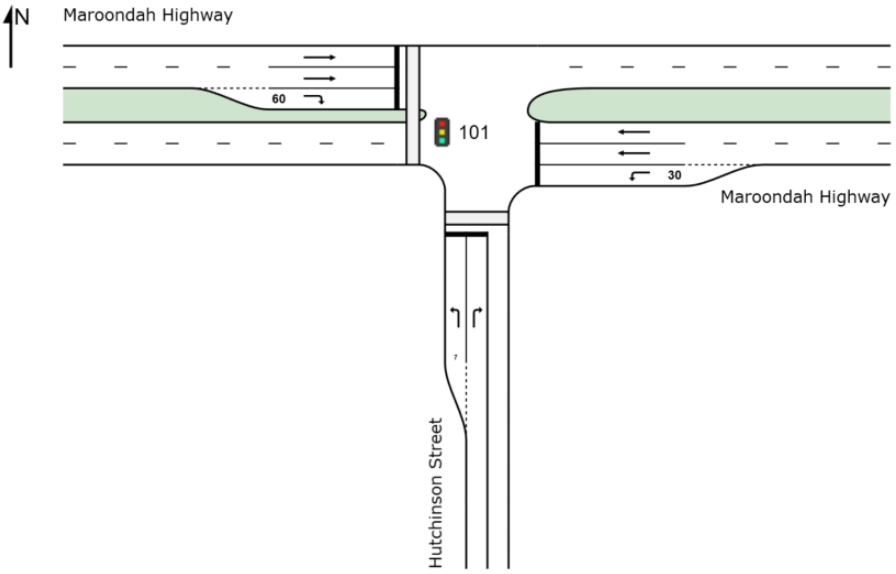


Table 5.7: Maroondah Hwy / Hutchinson St Results – Post Development Revised Layout

Location	Approach	DOS	Average Delay (sec)	95th Percentile Queue (m)
Post Development AM Peak	Hutchinson Street (South)	0.55	39s	56m
	Maroondah Highway (East)	0.56	20s	168m
	Maroondah Highway (West)	0.56	17s	70m
	Intersection	**0.56**	**21s**	**168m**
Post Development PM Peak	Hutchinson Street (South)	0.56	40s	45m
	Maroondah Highway (East)	0.58	21s	175m
	Maroondah Highway (West)	0.56	16s	93m
	Intersection	**0.58**	**21s**	**175m**

On the basis of the above it is clear that the traffic generated by the proposed Kinley Estate will create a need for the signalisation of the intersection of Maroondah Highway and Hutchinson Street.

As such it is recommended that the signalisation of this intersection must be included as part of the mitigating works proposed by the Kinley Estate to provide suitable capacity for the development to access the surrounding arterial road network.

The importance of this connection for the Kinley Estate is further emphasised with, as discussed above, the proposed Level Crossing removal works and relocation of the Lilydale Railway Station (to a location between John Street and Maroondah Highway) which will result in a likely changing function of John Street with a greater pedestrian and bus focus particularly around the station precinct which will lessen the capacity and attractiveness of vehicles travelling along John Street in order to access Maroondah Highway.

Further to the above, should this intersection not be signalised, this would likely alter the distribution of traffic at the intersection of Hutchinson Street and John Street. Subsequently the extent of mitigating works at the

intersection of Hutchinson Street and John Street and intersections further abroad (Maroondah Highway / John Street and Hardy Street / Anderson Street) would likely be required to be altered to that identified by Cardno.

5.4.3. Maroondah Highway / John Street

The intersection of Maroondah Highway and John Street has not been assessed as part of the Cardno Traffic Impact Assessment report.

On the basis of the significant distribution of development traffic along John Street to and from Maroondah Highway by Cardno (in the order of 350 vehicles per hour during the AM peak and 400 vehicles per hour during the PM peak), an assessment of the Intersection of John Street and Maroondah Highway is warranted to be undertaken.

The intersection of Maroondah Highway and John Street is currently an unsignalized T-Intersection, with full turning movements available.

For the purposes of modelling this intersection in SIDRA Intersection, a 20% bunching factor was applied to the through movements in both directions on Maroondah Highway. This assumption was made after the completion of the site inspection, where platooned traffic was observed, and relied upon by vehicles turning into and out of John Street.

The existing layout of this intersection is shown through an aerial photograph in Figure 5.11, adjacent to the layout assessed in SIDRA Intersection shown in Figure 5.12. The results of the assessment are shown in Table 5.8.

Figure 5.11:Maroondah Hwy / John St Intersection Layout – Aerial Photograph

Figure 5.12:Maroondah Hwy / John St Intersection Layout – Existing Conditions

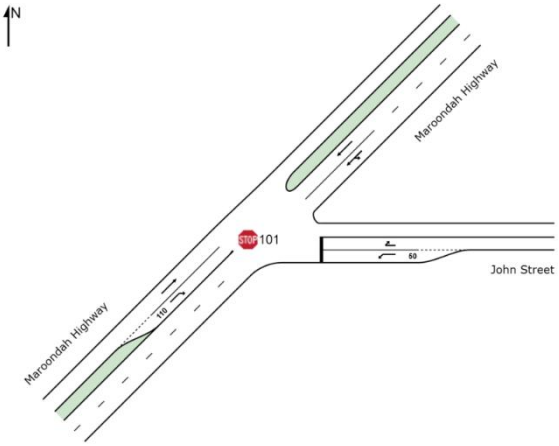


Table 5.8: Maroondah Hwy / John St Results – Existing Conditions

Location	Approach	DOS	Average Delay (sec)	95th Percentile Queue (m)
Existing Conditions AM Peak	John Street (East)	1.00	32 sec	25m
	Maroondah Highway (North-East)	0.34	0 sec	0m
	Maroondah Highway (South-West)	1.82	520 sec	2,184m
	Intersection	**1.82**	**303 sec**	**2,184m**
Existing Conditions PM Peak	John Street (East)	0.89	28 sec	32m
	Maroondah Highway (North-East)	0.30	0 sec	0m
	Maroondah Highway (South-West)	1.30	288 sec	1,748m
	Intersection	**1.30**	**166 sec**	**1,748m**

The results outlined in Table 5.8 indicate that based on the adopted existing conditions Cardno traffic volumes the intersection currently operates over capacity in both AM and PM scenarios, with inadequate gaps available for vehicles to turn right into Hutchinson Street from Maroondah Highway.

The following is also noted:

- The Cardno traffic volumes identify the existing intersection experiences a significant volume of vehicles turning right into John Street, with 582 vehicles in the AM peak and 497 vehicles in the PM peak.
- The level crossing to the east of the intersection is likely to provide some additional capacity to that modelled, with gaps in traffic created due to the boom gates. The removal of the level crossing will however likely diminish the length of gaps available for drivers.
- Given the use of previously established Cardno traffic volumes to prepare this model, this model could not be considered to represent a 'calibrated' model however forms a basis to compare before and after operations of the intersection.

The 'post development' traffic volumes as specified by Cardno have been assessed with the existing intersection layouts to determine where any mitigation works are required.

The results of the 'post development' traffic assessment at the intersection of Maroondah Highway and John Street are shown in Table 5.9.

Table 5.9: Maroondah Hwy / John St Results – Post Development Existing Layout

Location	Approach	DOS	Average Delay (sec)	95th Percentile Queue (m)
Post Development AM Peak	John Street (East)	1.00	52 sec	105m
	Maroondah Highway (North-East)	0.40	0 sec	0m
	Maroondah Highway (South-West)	3.02	1,323 sec	3,966m
	Intersection	**3.02**	**702 sec**	**3,966m**
Post Development PM Peak	John Street (East)	1.00	41 sec	91m
	Maroondah Highway (North-East)	0.366	0 sec	0m
	Maroondah Highway (South-West)	2.24	922 sec	3,933m
	Intersection	**2.24**	**520 sec**	**3,933m**

While it is recognised that the SIDRA Intersection analysis identifies the intersection as operating over capacity in its current form, the intersection analysis indicates that the proposed development traffic volumes would have a significant impact on the intersection of Maroondah Highway and John Street almost doubling DoS levels on Maroondah Highway.

On this basis, it would be reasonable to require intersection mitigation works to be undertaken to facilitate the additional traffic being generated by the Kinley Estate along John Street.

However, for the various reasons outlined earlier within this report it is understood that it is Council's preference to not improve the operation of this intersection (which would further encourage the use of John Street) rather it would be preferred for traffic travelling to the north of Kinley Estate to access the arterial road network through the nearest connection, being the intersection of Maroondah Highway and Hutchinson Street.

Sensitivity Analysis

Having regard to the recommendation above to distribute traffic away from John Street, sensitivity analysis has been prepared on the intersection of Maroondah Highway and Hutchinson Street and the intersection of Hutchinson Street and John Street in order to test their suitability to accommodate the additional development generated traffic previously distributed to John Street.

The results of the revised traffic assessment at the intersection of Maroondah Highway and Hutchinson Street are shown in Table 5.10.

Table 5.10: Maroondah Hwy / Hutchinson St Results – Post Development Traffic Redistribution

Location	Approach	DOS	Average Delay (sec)	95th Percentile Queue (m)
Post Development AM Peak	Hutchinson Street (South)	0.68	34s	92m
	Maroondah Highway (East)	0.66	24s	201m
	Maroondah Highway (West)	0.66	21s	76m
	Intersection	**0.68**	**25s**	**201m**
Post Development PM Peak	Hutchinson Street (South)	0.73	36s	67m
	Maroondah Highway (East)	0.71	26s	218m
	Maroondah Highway (West)	0.71	20s	113m
	Intersection	**0.73**	**25s**	**218m**

The above results indicate that with the additional traffic proposed to be utilising the intersection of Maroondah Highway and Hutchinson Street, the intersection will still operate under 'good' conditions, with additional capacity available.

The redistribution of traffic resulted in some minor modifications to the existing intersection geometry being required at the intersection of Hutchinson Street and John Street (being the loss of some three (3) parking spaces on the northern intersection approach). The revised layout is shown in Figure 5.13 with the results of the revised traffic assessment at the intersection shown in Table 5.11.

Figure 5.13:Hutchinson St / John St Intersection Layout – Post Development Traffic Redistribution

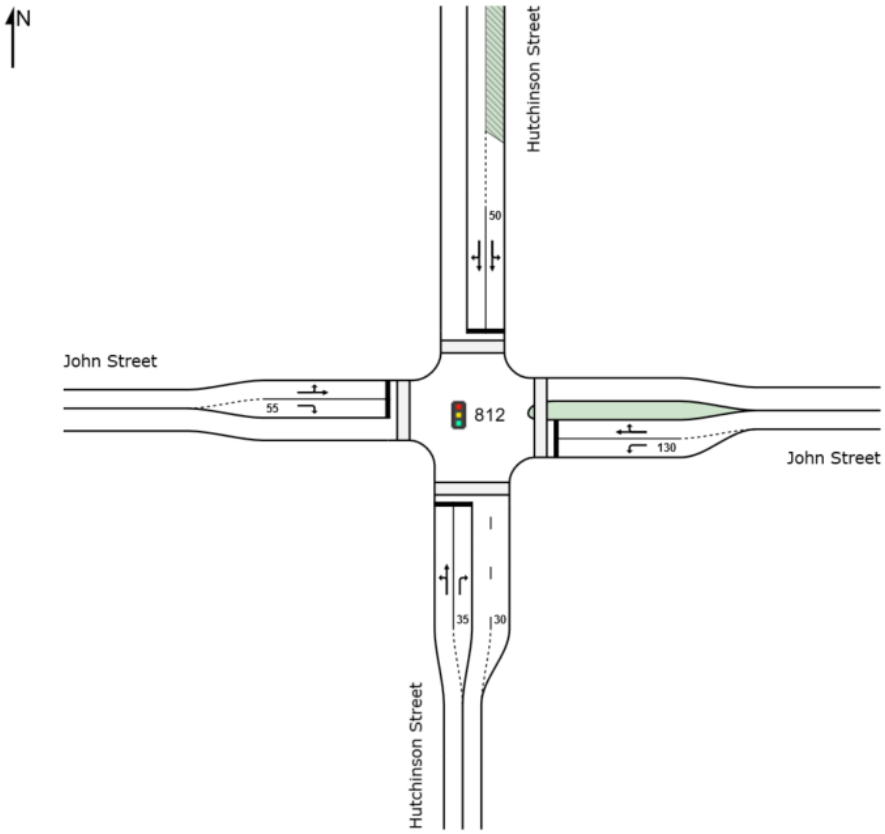


Table 5.11: Hutchinson St / John St Results – Post Development Traffic Redistribution

Location	Approach	DOS	Average Delay (sec)	95th Percentile Queue (m)
Post Development AM Peak	Hutchinson Street (South)	0.95	42s	239m
	John Street (East)	0.89	35s	91m
	Hutchinson Street (North)	0.91	44s	113m
	John Street (West)	0.94	51s	106m
	Intersection	**0.95**	**42s**	**239m**
Post Development PM Peak	Hutchinson Street (South)	0.93	44s	231m
	John Street (East)	0.98	56s	101m
	Hutchinson Street (North)	0.98	57s	187m
	John Street (West)	0.95	50s	165m
	Intersection	**0.98**	**50s**	**231m**

Ultimately it would appear that a redistribution of traffic along Hutchinson Street would not further adversely impact the operation of this intersection.

5.4.4. Anderson Street / Hardy Street

The intersection of Anderson Street / Hardy Street will operate as a primary access point for traffic travelling to / from the north-east of the Kinley Estate.

The intersection is currently a signalised T-intersection, with full turning movements available. It is noted that to the immediate south of the site is another signalised T-Intersection, which provides access to the Yarra Ranges Council office. These two sets of traffic signals are jointly controlled through a common control group signal phasing. It is noted that in the assessment conducted by Cardno, the intersection of Anderson Street / Hardy Street was assessed in isolation, with the Council site access point not included in the assessment. Given the proximity of the two intersections to each other, and the common control group phasing, it was deemed that assessing the two intersections together as a network was more appropriate.

The existing layout of these intersections is shown through an aerial photograph in Figure 5.14, adjacent to the layout assessed in SIDRA Intersection shown in Figure 5.15. The results of the assessment are shown in Table 5.12.

Figure 5.14: Anderson St / Hardy St / Council Site Access Intersection Layout – Aerial Photograph

Figure 5.15: Anderson St / Hardy St / Council Site Access Intersection Layout – Existing Conditions

Table 5.12: Anderson St / Hardy St & Anderson St / Council Site Access Results – Existing Conditions

Location	Intersection	Approach	DOS	Average Delay (sec)	Average Queue (m)
Existing Conditions AM Peak	Anderson Street / Hardy Street	Anderson Street (South)	0.77	2s	16m
		Anderson Street (North)	0.82	22s	74m
		Hardy Street (West)	0.73	54s	64m
		Intersection	**0.82**	**18s**	**74m**
	Anderson Street / Council Site Access	Anderson Street (South)	0.86	36s	197m
		Anderson Street (North)	0.35	1s	18m
		Council Entrance (West)	0.09	40s	3m
		Intersection	**0.86**	**21s**	**197m**
Existing Conditions PM Peak	Anderson Street / Hardy Street	Anderson Street (South)	0.73	2 sec	19m
		Anderson Street (North)	0.64	24 sec	106m
		Hardy Street (West)	0.85	48 sec	143m
		Intersection	**0.85**	**24 sec**	**143m**
	Anderson Street / Council Site Access	Anderson Street (South)	0.86	44 sec	171m
		Anderson Street (North)	0.47	12 sec	17m
		Council Entrance (West)	0.85	60 sec	11m
		Intersection	**0.86**	**20 sec**	**171m**

The results outlined in Table 5.12 indicate that the intersection operates under “acceptable” conditions.

It is noted that the assessment conducted in the Cardno report found that the intersection was over capacity during the post development scenario, with no mitigating works proposed.

With the addition of development generated traffic volumes (adopted from the Cardno Traffic Impact Assessment report) to the SIDRA Intersection model described above, the existing intersection layout will continue operate under “acceptable” conditions, however reaching capacity limits.

The results of the ‘post development’ traffic assessment at the intersections of Anderson Street / Hardy Street and Anderson Street / Council Site Access is shown in Table 5.13.

Table 5.13: Anderson St / Hardy St & Anderson St / Council Site Access Results – Post Development Existing Layout

Location	Intersection	Approach	DOS	Average Delay (sec)	Average Queue (m)
Post Development AM Peak	Anderson Street / Hardy Street	Anderson Street (South)	0.77	2 sec	16m
		Anderson Street (North)	0.89	28 sec	93m
		Hardy Street (West)	0.78	55 sec	71m
		Intersection	**0.89**	**21 sec**	**93m**
	Anderson Street / Council Site Access	Anderson Street (South)	0.86	36 sec	197m
		Anderson Street (North)	0.35	1 sec	18m
		Council Entrance (West)	0.09	40 sec	3m
		Intersection	**0.86**	**21 sec**	**197m**
Post Development PM Peak	Anderson Street / Hardy Street	Anderson Street (South)	0.76	2 sec	21m
		Anderson Street (North)	0.90	32 sec	84m
		Hardy Street (West)	0.87	52 sec	166m
		Intersection	**0.90**	**28 sec**	**166m**
	Anderson Street / Council Site Access	Anderson Street (South)	0.95	68 sec	227m
		Anderson Street (North)	0.47	0 sec	13m
		Council Entrance (West)	0.85	60 sec	11m
		Intersection	**0.95**	**30 sec**	**227m**

The results in Table 5.13 indicate that the intersection is performing at its theoretical capacity with the addition of the site generated traffic volumes. The following elements are noted:

- The existing conditions operation of the network of signals is operating at a high (but acceptable) DoS, irrespective of any site generated traffic volumes.
- The intersection is accommodating significant traffic volumes in its existing operations, with ~800 vehicles travelling north and southbound in both peak periods, ~600 left turn vehicles from the south in the AM peak hour and ~600 right turn vehicles from the west in the PM peak hour.
- An increase in queuing is experienced under the post development scenario, however with the context of the existing operation, this is a marginal increase.
- The post development assessment achieves an acceptable result.

Considering the above factors and results the post development operation could be considered to represent an acceptable result however noting that capacity does not exist to facilitate additional growth. This further highlights the earlier comments that capacity constraints exist to accommodate traffic exiting to the north of the Kinley Estate necessitating the need for the development to contribute toward creating capacity in the area.

5.4.5. Swansea Road / Hull Road

Upgrades proposed to mitigate traffic impacts caused by the proposed development at the intersection of Hull Road and Swansea Road include the conversion of the existing dedicated left turn lane on the western approach to a left / through lane and the review and alteration of the signal phasing and/or timing.

As proposed by Cardno, the existing arrangement of the intersection is shown in Figure 5.16 with the proposed post development in Figure 5.17.

Figure 5.16:Swansea Rd / Hull Rd Existing Conditions Intersection Layout

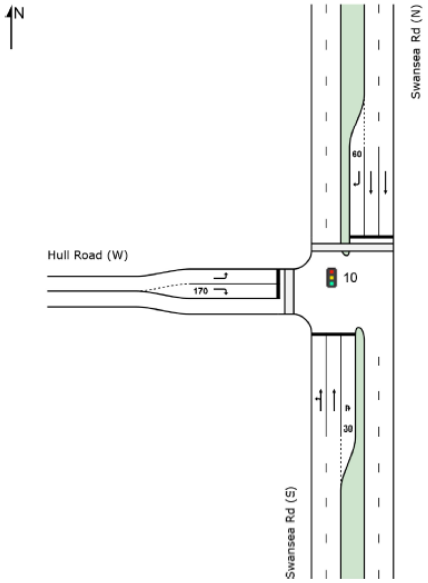
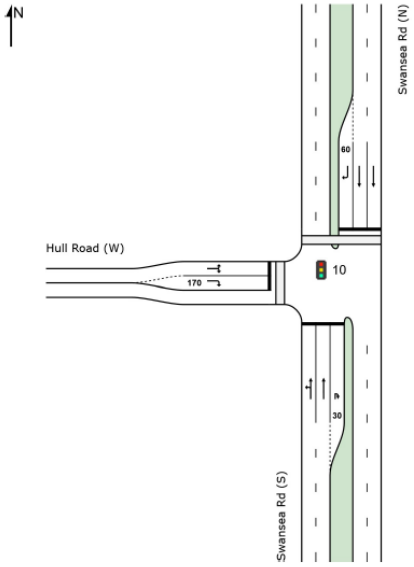


Figure 5.17:Swansea Rd / Hull Rd Proposed Post Development Intersection Layout



The existing intersection operates within its capacity limits however following the development of the Kinley Estate this intersection (with the proposed mitigating works) will operate above its capacity limit of 0.95 with significant increases to queues and delays on all approaches. This includes the extension of queuing within short turn lanes beyond the length of these lanes impacting the operation of through traffic vehicles.

As such the impacts to this intersection could not be considered to have been mitigated through the works proposed. Further consideration should be given to the opportunity to extend turn lanes on all intersection approaches to better accommodate queue lengths within the short turn lanes in order to mitigate the development impacts. It is also expected that additional efficiencies could be gained through phasing efficiencies, such as the use of the C1 & C2 variable phases for either scenario.

Any proposed changes to cycle times at this intersection should also consider any flow on adverse impacts to the operation of linked traffic signals at the intersection of Swansea Road and Birmingham Road.

5.4.6. Victoria Road / Maroondah Highway / Mooroolbark Road

A suite of upgrades is proposed to mitigate traffic impacts caused by the proposed development at the intersection of Victoria Road, Maroondah Highway and Mooroolbark Road.

These works include the provision of a full-length left turn lane on the southern approach, the extension of the existing right-turn lane on the southern approach, a full-length departure lane on the southern leg, the extension of the existing short departure lane on the eastern leg, provision of double right turns on the western approach and alterations to the signal phasing and/or timing.

The existing arrangement of the intersection is shown in Figure 5.18 with the proposed post-development in Figure 5.19.

Figure 5.18:Mooroolbark Rd / Hull Rd Existing Conditions Intersection Layout

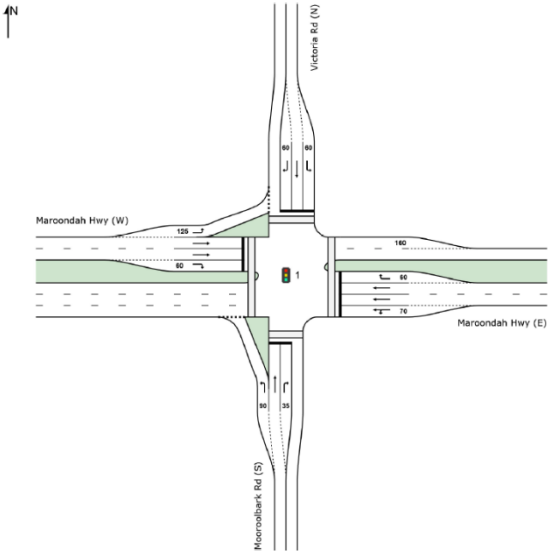
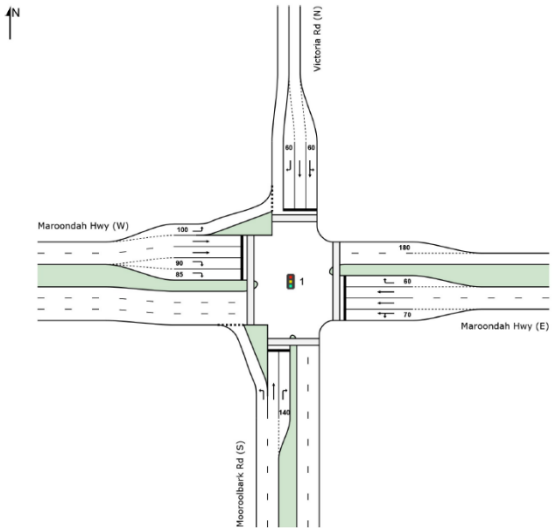


Figure 5.19:Mooroolbark Rd / Hull Rd Proposed Post Development Intersection Layout



The existing intersection currently operates at or close to capacity. The mitigating works seek to return the intersection to a DoS below 1.0 however does not return many approaches of the intersection to its current level of operation. Queuing is increased significantly on many approaches.

Improvements to the intersection could be achieved through lengthening short turn lanes and short departure lanes on the eastern Maroondah Highway intersection approach, given that blockage is occurring on this approach, causing a reduction in capacity. It is however recognised that topography constraints may exist which limit the ability to achieve such changes.

Additional improvements could be achieved through an extension to the right turn lane on the northern approach, given the significant queuing for this movement. Capacity exists within the road reserve to extend this right turn lane.

The suitability of the mitigating works at this intersection are deferred to DoT given that both Maroondah Highway and Mooroolbark Road fall under their control.

5.4.7. Mooroolbark Road / Hull Road

Upgrades proposed to mitigate traffic impacts caused by the proposed development at the intersection of Mooroolbark Road and Hull Road include the provision of an extended right turn lane on the northeast (Hull Road) approach, an additional short through traffic lane on the northeast (Hull Road) approach and departure, an additional right turn lane on the northwest (Mooroolbark Road) approach, an extended left turn

lane and conversion to a shared left/through lane on the southwest (Hull Road) approach and review and alteration of the signal phasing and/or timing.

The existing arrangement of the intersection is shown in Figure 5.20 with the proposed post-development in Figure 5.21.

Figure 5.20:Mooroolbark Rd / Hull Rd Existing Conditions Intersection Layout

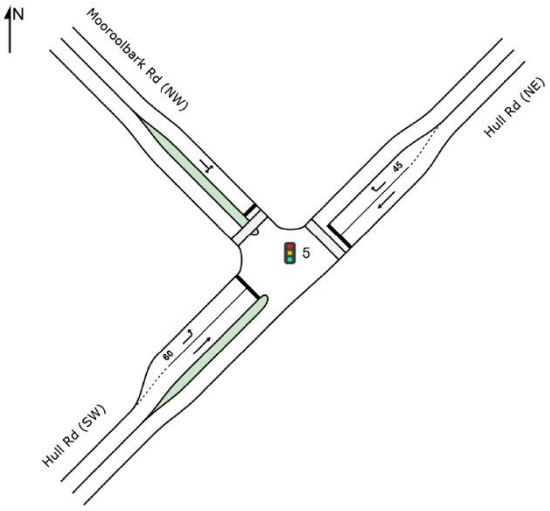
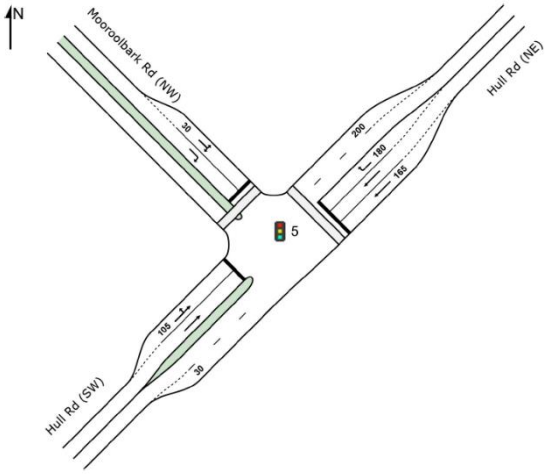


Figure 5.21:Mooroolbark Rd / Hull Rd Proposed Post Development Intersection Layout



While it is acknowledged that this intersection currently exceeds its operational capacity on some approaches and that significant improvements and investment has been considered for this intersection, this intersection will in the future operate with DoS levels exceeding 1.0 on all approaches in both the AM and PM peak hour periods. As such the extent of mitigating works could not be considered to be appropriate at this time.

It is recognised that additional turning lanes cannot be simply added to the intersection due to constraints created by the rail line however the further extensions to short lanes on all approaches and departures should be considered to better mitigate the impacts at this intersection. These extensions of short lanes could provide greater value to increase the utilisation of these lanes and in turn, improve the operation of the overall intersection. It is expected that the greatest benefit can be achieved by extending the south-west departure short lane and then north-west left & right turn approach lanes.

5.4.8. Anderson Street / Maroondah Highway

No works are proposed to be undertaken at this intersection. The results of the modelling exercise undertaken indicate that the intersection is operating close to its capacity in both the existing AM and PM peak hours. A minor increase in site generated traffic volumes at this location has resulted in the intersection DoS remaining at 0.92 in the AM peak hour and increasing from 0.93 to 0.97 in the PM peak hour.

While the operation of this intersection has become more congested in its post development state, DoS levels remain generally within appropriate limits along with limited increases to queuing and delays. It is noted that minor refinements to signal phasing may be able to achieve a DoS of below 0.95.

As such the post development operation of this intersection could be considered acceptable at this time.

5.5. Commentary on Minor Intersections on Hull Road

The distribution of traffic generated by the proposed development on to the surrounding road network will result in an uplift in traffic along the Hull Road corridor. This corridor contains a number of unsignalised minor intersections which provide access to the Lakeview Estate.

The uplift in traffic volumes along Hull Road is shown in Figure 5.22 and Figure 5.23.

Figure 5.22:AM Peak Hour Site Generated Traffic Volumes on Hull Rd

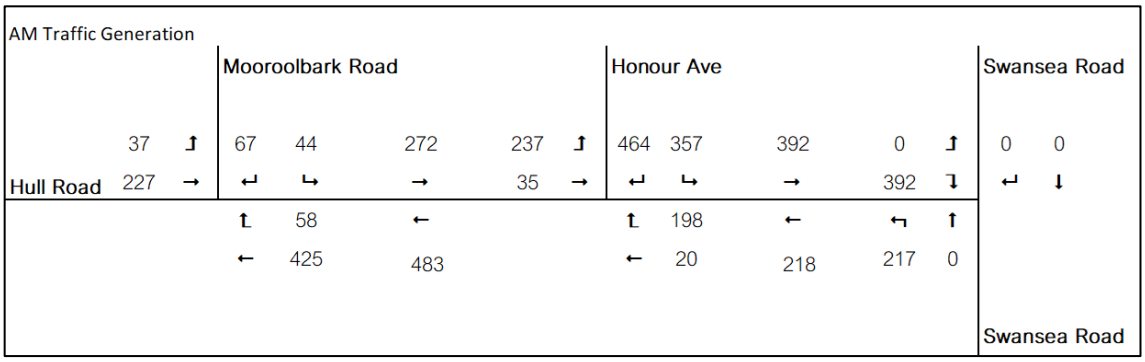
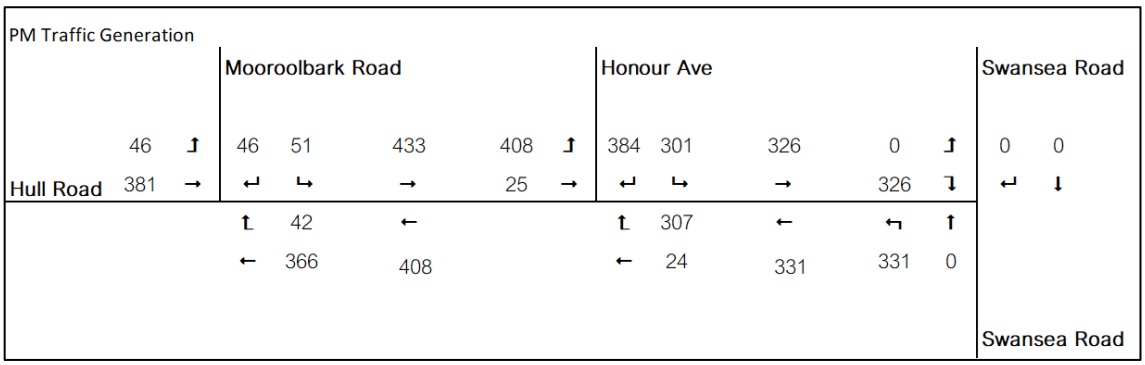


Figure 5.23:PM Peak Hour Site Generated Traffic Volumes on Hull Rd



The site generated traffic volumes will result in a significant uplift in traffic volumes along the Hull Road corridor. The percentage increase in traffic volumes along the corridor is outlined in Figure 5.24 for the AM peak hour and Figure 5.25 for the PM peak hour.

Figure 5.24:AM Peak Hour Increase in Traffic Volumes on Hull Rd

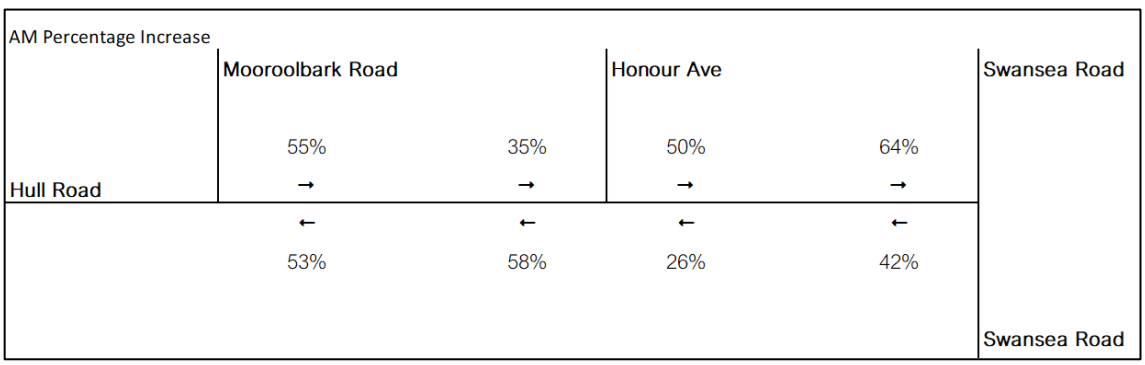


Figure 5.25:PM Peak Hour Increase in Traffic Volumes on Hull Rd

PM Percentage Increase	Mooroolbark Road		Honour Ave		Swansea Road
	55%	95%	71%	61%	
Hull Road	→	→	→	→	
	←	←	←	←	
	84%	83%	67%	59%	
					Swansea Road

The Lakeview Estate contains two primary access points to Hull Road, both of which are between the intersection of Swansea Road and the future Honour Avenue. These intersections are the only points of access for residents of the Lakeview estate to access the arterial road network. This is shown in Figure 5.26.

Figure 5.26:Hull Rd Corridor and Surrounding Road Network.

Given the uplift in traffic that has been outlined above, it would be anticipated that the ability for residents to turn into and out of the Lakeview Drive access points will be impacted. This will be particularly prevalent at the western access point. Whilst full turning movements are available at both intersections, the western access point does not have adequate width for right turning vehicles out of Lakeview Drive to store in the median, with vehicles required to complete the turn in one movement.

As such it is recommended that further assessment be required to determine the level of impact on the proposed intersections, and whether any mitigating works are required.

5.6. Summary of Intersection Mitigation Outcomes

Having regard to the above the following outcomes of the assessment of traffic impacts at site access points and surrounding intersections are provided:

- Intersections to the north of the Kinley Estate (intersection of Maroondah Highway / John Street, intersection of Maroondah Highway / Hutchinson Street and intersection of Hardy Street / Anderson Street) do not currently have suitable capacity to accommodate the traffic volumes expected to be generated by the development.

- As such it is clear that the development generates a need to create capacity improvements to the north of the site in order to facilitate development traffic accessing the arterial road network.
- The signalisation of the intersection of Maroondah Highway and Hutchinson Street would represent the closest access to the arterial road network and analysis indicates that it could suitably accommodate the development traffic volumes.
- The signalisation of the intersection Maroondah Highway and Hutchinson Street should therefore be included as part of the mitigating works required to be undertaken by the development in order to facilitate suitable site access.
- Additional mitigating works should be considered at the following intersections in order to suitably mitigate the impacts of development traffic. These further works would be likely to represent further extension to short turn lanes and downstream short lanes to improve lane utilisation throughout the intersections.
    - Maroondah Highway, Mooroolbark Road and Victoria Road
    - Mooroolbark Road and Hull Road, and
    - Hull Road and Swansea Road.
- Further consideration should be given to the impacts of development traffic growth on the intersections of Lakeview Drive with Hull Road.

These items could be identified in the Comprehensive Development Plan and included as specific items for consideration as part of the Schedule to the Comprehensive Development Zone.

6. PROPOSED DEVELOPMENT CONTRIBUTIONS

6.1. Summary of Approach

The Approach to Development Contributions report prepared by Urban Enterprise identifies the proposed mitigation measures identified by the Cardno Traffic Impact Assessment Report.

The report identifies the apportionment of these works to be solely the responsibility of the Kinley Estate development.

The report also identifies triggers for the provision of identified transport related infrastructure.

6.2. Appropriateness of Approach to Developer Contributions

The Approach to Development Contributions report in isolation appears reasonable in its inclusion of the proposed works identified by the Cardno Traffic Impact Assessment Report.

However as identified in earlier discussions, the following matters require further resolution which will ultimately impact the outcomes of the Approach to Development Contributions report:

- The required inclusion of the signalisation of the intersection of Maroondah Highway and Hutchinson Street as the responsibility of the Kinley Estate development
- The extent of other mitigation works to surrounding intersections, and
- The timing of infrastructure works.

These items are further discussed below.

6.2.1. Signalisation of the Intersection of Maroondah Highway and Hutchinson Street

As identified throughout this report the Kinley Estate development generates a need for the signalisation of the intersection of Maroondah Highway and Hutchinson Street. On this basis works associated with this intersection should be included within any infrastructure agreement prepared for the site.

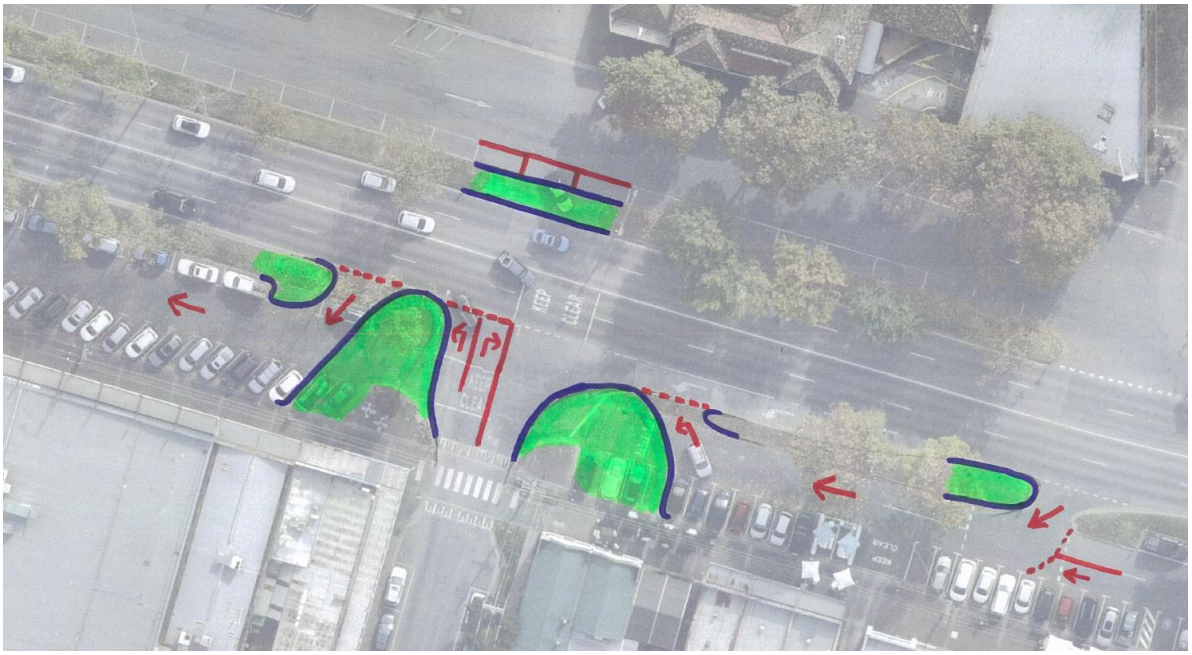
A plan has been prepared by my office of an indicative layout of this intersection in order to scope the scale of works involved. This plan has been attached as Appendix C.

It is recognised that other permutations of this intersection layout could exist which could balance the use of road reserve to the north and south of Maroondah Highway, however for the purpose of initiating the discussion of the inclusion of this intersection within any infrastructure agreement the attached layout (Appendix C) has been prepared.

With respect of the cost of intersection works a high-level opinion of probable cost prepared by my office for the proposed intersection signalisation is in the range of $1.05M to $1.65M[5].

It is however recognised that some immediate improvements could be made to the intersection of Maroondah Highway and Hutchinson Street to improve the safety of the intersection and address past crash history. These works could be considered independent of the need to signalise this intersection to provide suitable capacity for the Kinley Estate. Figure 6.1 below provides a sketch of these works.

Figure 6.1: Maroondah Hwy / Hutchinson St Intersection Safety Improvements



With respect of the cost of intersection works, a high-level opinion of probable cost prepared by my office for these intersection works is in the range of $115K to $180K[4].

[5] Assumptions and exclusions:

- Design and documentation fees or authority fees, charges, levies and overview including insurances and bank guarantees have been included as per VPA recommended percentages.
- Cost of protection and/or relocation of underground services during construction is excluded.
- A 30% contingency has been applied to the engineer's opinion of probable costs based on the information from Concept Functional layout only without a site inspection.
- This engineer's opinion of probable cost is based on the drawings listed above and further changes may arise following subsequent additional investigations and detailed design development.
- Specific construction works including rock boring, rock blasting or rock excavation and removal have been excluded as geotechnical conditions are yet to be confirmed.
- This estimate also excludes allowance for abnormal weather conditions.
- GST is excluded.
- Land acquisition is excluded.
- Price escalation is excluded.
- The above opinion of probable costs should be considered current to the date of the document only. GTA Consultants cannot provide any form of assurance that the costings provided will not change due to changes in design and/or future costs of materials. The future outcome may vary, and this variation may be material. This potential for variation should be considered in any circumstances where the costings are to be used for high level budgeting purposes, even in the short term. Any party requiring detailed costing for quoting or construction purposes should seek a detailed cost estimate from a suitably qualified quantity surveyor.

Therefore, on the basis that the ultimate intersection works are undertaken upfront (i.e. signalisation) rather than initial safety improvements being made prior to signalisation, it could be fair that a contribution to the future upgrading of the intersection be proportioned as follows:

- Developer – 90%
- Road Authority – 10%

6.2.2. Other Mitigating Works

The extent of additional mitigating works to return other intersections back to appropriate operating conditions as described above should be determined through the preparation of the Precinct Integrated Traffic and Transport Management Plan as required to be prepared by the Schedule to the Comprehensive Development Zone.

As discussed in the following section, the Precinct Integrated Traffic and Transport Management Plan, at least as it relates to external network impacts, should be prepared at the outset on a site wide basis to capture the overall impacts and inform the finalisation of the infrastructure agreement.

6.2.3. Timing of Infrastructure Works

The Approach to Development Contributions Plan report and the Comprehensive Development Plan identify timing triggers associated with the delivery of transport infrastructure items. These triggers are more detailed than advice provided within the Traffic Impact Assessment report and do not appear to be substantiated by suitable traffic modelling or transport advice.

Further traffic analysis and justification should be required to be provided as part of the Traffic Impact Assessment Report to support the identified timing / triggers, in particular where they relate to the delivery of infrastructure on a number of lots basis.

This is required to confirm that the interim conditions and proposed levels of development can be accommodated within the staged infrastructure works.

Specifically, I am concerned around the timing of the delivery of site access points to Mooroolbark Road and the required interim use of Taylors Road for up to 330 dwellings which ultimately will result in the use of Cave Hill Road or Melba Avenue in order to funnel vehicles back to John Street which, as discussed above, has existing and future capacity limits.

7. SCHEDULE TO THE COMPREHENSIVE DEVELOPMENT ZONE

7.1. Summary of Transport Related Requirements of Schedule

The proposed Schedule 1 to Clause 37.02 Comprehensive Development Zone (CDZ) sets out various requirements including the need to obtain a planning permit, which may be obtained in Stages.

A permit application is required to include "*A Precinct Integrated Traffic and Transport Management Plan that promotes walking, cycling and public transport*".

The plan is to identify:

- *"Location of proposed roads, pedestrian, cyclist and vehicle access points:*
- *Details of how the objectives of the Former Lilydale Quarry Integrated Transport Plan, October 2020 have been addressed.*
- *An assessment of the impact of traffic generated by the precinct upon the surrounding road network.*
- *Address internal road design requirements.*
- *Predicted traffic volumes.*
- *An assessment of potential traffic mitigation works and traffic management measures that may be required within and external to the site, including the staging of the measures and external works.*
- *Details of proposed connections to the surrounding road network, where relevant*
- *Details of internal and external intersections, performance and treatments.*
- *Details of the location of and linkages to public transport*
- *An assessment of car parking demand*
- *An assessment of public transport services in the locality, existing stops and any additional stops or infrastructure prepared in consultation with the relevant Victorian public transport authority.*
- *Details of cycling and pedestrian infrastructure, including links to significant destinations and the potential future train station."*

The Schedule also identifies that an Infrastructure Contributions Agreement must be put in place prior to the granting of a permit to subdivide or construct a building or construct or carry out works.

7.2. Suitability of the Schedule

These requirements of the Schedule to the CDZ provide the opportunity for the matters raised throughout this report to be dealt with prior to the finalisation of the agreement of necessary transport mitigation measures.

The Schedule requires a transport management plan to be prepared on a precinct-by-precinct basis. This could result in a diminished ability to resolve the external transport infrastructure impacts identified in this evidence statement. I therefore recommend that an overarching and holistic assessment to the effect of a "Masterplan Integrated Transport Management Plan" be prepared and agreed to prior to the subdivision of any land covered by the CDZ.

This will ensure that the extent of mitigation works are agreed up front and the focus of precinct plans (subject to the development scale remaining in line with that agreed) can be primarily focussed upon the internal operations of the site.

Specific commentary could also be added to the requirements of the *Precinct Integrated Traffic and Transport Management Plan* for specific focus and inclusion of analysis and works as noted throughout this evidence statement.

8. OTHER MATTERS

8.1. Lilydale Bypass Traffic Volumes

As part of the Standing Advisory Committee's directions, it has been requested that advice be provided in respect of the traffic volumes associated with the Lilydale Bypass and Healesville Bypass as follows:

"*Likely traffic volumes expected as a result of Lilydale Bypass and/or Healesville Bypass, particularly at the following intersections:*

1. *Maroondah Highway/Mooroolbark Road /Victoria Street*
2. *Mooroolbark Road /Hull Road*
3. *Maroondah Highway/Anderson Street*
4. *Anderson St/Hardy Street"*

Specific modelling has not been undertaken in connection with these proceedings to determine future changes associated with these network infrastructure changes.

Reference is however made to a previous 2014 report "Network Modelling of Options for the Lilydale/Mooroolbark Area" prepared by GTA Consultants for Yarra Ranges Council which investigated a number of scenarios relating to the future bypass infrastructure.

This report, which informed the Lilydale Integrated Transport Plan (ITP) used the Victorian Integrated Transport Model (VITM) modelling at the year 2046 to assess the impact of a number of road network scenario options on the transport network. Two of the scenarios were generally considered to best demonstrate the impact of the construction of the Lilydale Bypass. These scenarios are shown in the following images, with "Option 1" consisting of the road network without the bypass, and "Option 2" with the Lilydale Bypass and Healesville Bypass in place.

Figure 8.1: Bypass Modelling – Option 1

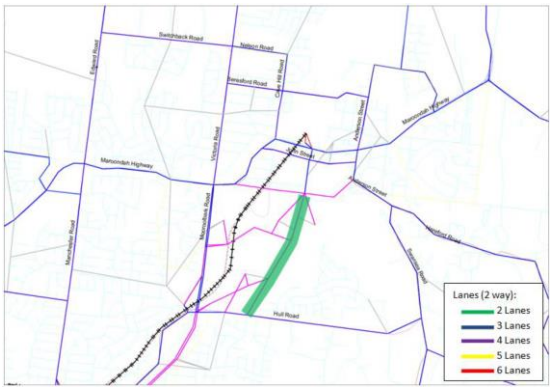
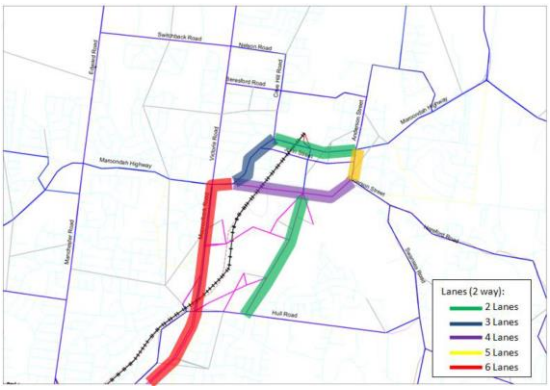


Figure 8.2: Bypass Modelling – Option 2



Screenline traffic volumes were identified within this report at various points within the road network. Those screenline volumes that best relate to the intersections identified in the Standing Advisory Committee's directions are provided in Table 8.1 along with the percentage difference between the two options displayed.

Table 8.1: Traffic Volume Data with and without Lilydale Bypass

Intersection	Approach	Direction	AM Peak			PM Peak		
			Option 1	Option 2	% Change [1]	Option 1	Option 2	% Change
Maroondah Highway / Mooroolbark Road / Victoria Street	Mooroolbark Road (South)	Northbound	666	1,210	182%	456	1,779	390%
		Southbound	423	1,673	395%	867	1,209	139%
	Maroondah Highway (East)	Westbound	1,081	568	53%	1,023	140	14%
		Eastbound	756	141	19%	848	571	67%
	Victoria Road (North)	Northbound	420	365	87%	769	669	87%
		Southbound	402	563	140%	420	435	104%
Mooroolbark Road / Hull Road	Hull Road (East)	Westbound	742	713	96%	714	754	106%
		Eastbound	646	729	113%	750	650	87%
	Hull Road (West)	Westbound	960	705	73%	681	347	51%
		Eastbound	620	280	45%	869	637	73%
Maroondah Highway / Anderson Street	Anderson Road (South)	Northbound	1,085	1,498	138%	895	1,497	167%
		Southbound	915	1,287	141%	1,081	1,509	140%
	Maroondah Highway (West)	Westbound	1,376	876	64%	1,110	428	39%
		Eastbound	1,016	284	28%	1,381	967	70%
Anderson St / Hardy Street	Anderson Road (North)	Northbound	1,085	1,498	138%	895	1,497	167%
		Southbound	915	1,287	141%	1,081	1,509	140%
	Hardy Street (West)	Westbound	193	1	0%	218	0	5%
		Eastbound	153	0	1%	265	14	0%

Table 8.1 shows that the Lilydale Bypass would perform its intended function by generally drawing traffic that currently uses local routes (or Lilydale Main Street) onto the planned higher-order arterial road network. It is noted that the model shows effectively no traffic using Hardy Street – this is a feature of strategic modelling and in this case can be considered to simply demonstrate the principle that the proposed bypass route would draw traffic onto arterial roads in preference to local streets.

8.2. Commercial Development Site

I have been instructed to provide an opinion from a transport perspective on the appropriateness of locating a commercial development site in the south-east corner of the Maroondah Highway / Mooroolbark Road intersection.

It is understood that access is proposed directly from the westbound carriageway of Maroondah Highway (via a left-in/out access point and via a proposed internal connector road that connects to Mooroolbark Road).

To date, I have not provided an opinion on the acceptability of the direct access from Maroondah Highway. My advice to date has been that the Proponent should make allowance for all traffic to access this parcel of land via the internal connector road network. The reason being that there is a risk that the Department of Transport has indicated they would be unwilling to approve an access point at Maroondah Highway.

Notwithstanding, my opinion on the acceptability of the proposed direct access is set out in two parts, dealing with the proposed access turning movements:

- Left-out movement – I would expect there to be limited capacity for a left-out movement in this location due to the vehicles queuing back from downstream signalised intersection. This movement also creates some safety issues as follows:
    - It may result in vehicles crossing all 3 lanes of Maroondah Highway to reach the right-turn lane heading north onto Mooroolbark Road. This would require all 3 lanes of Maroondah Highway to be clear, which could result in increased risk-taking behaviour by drivers when gaps in traffic are hard to come by in peak traffic conditions.
    - It may result in increased u-turning manoeuvres at the Maroondah Highway/Mooroolbark Road intersection as drivers that have entered from the east seek to head back east via the same access point. U-turning manoeuvres are viewed as undesirable in traffic engineering and should not be encouraged, particularly where alternatives can be planned.

  Accordingly, I am of the opinion that the left-out movement is not acceptable.
- Left-in movement – A well-designed left-turning treatment will not have much, if any effect on the progression of traffic along Maroondah Highway. It involves vehicles diverging from a stream of traffic moving in the same direction at the same speed and therefore does not create additional conflict points. The design by Cardno set out in their Traffic Impact Assessment Report has regard for the future planning and design of the Lilydale Bypass and Healesville Arterial at the Maroondah Highway / Mooroolbark Road intersection. The proposed layout appears to be able to be accommodated in the existing and proposed ultimate road configurations. The proposed left-turn lane into the subject land is positioned clear of the left-turn lane into Mooroolbark Road. There are numerous instances of successive left-turn lanes along Maroondah Highway and in the wider Metropolitan area. These can be legibly signed, and I am not aware of any particular safety concerns with the premise of this arrangement.
  The ability to accommodate a left turn lane however may be dependent upon whether further extension to the left-turn lane into Mooroolbark Road is required as suggested in earlier sections of this report.
  In terms of capacity, the provision of a left-turn lane into the subject land in advance of the Maroondah Highway/Mooroolbark Road intersection would reduce the amount of traffic travelling through this intersection and would therefore be beneficial to road network operations in this regard.
  Accordingly, I am of the opinion that there are no significant adverse outcomes associated with a left-in movement in this location subject to suitably designed left turn deceleration lanes being able to be achieved at this location (noting that mitigating works to the intersection of Maroondah Highway and Mooroolbark Road intersection must take precedence over achieving site access to this parcel of land that could otherwise be accessed from the internal road network the Kinley Estate).

While my comments above indicate acceptability for a left-in movement from Maroondah Highway, the majority of traffic accessing a commercial development in this location is likely to use Mooroolbark Road. The road network should be planned accordingly.

9. CONCLUSIONS

9.1. Summary of Opinion

Based on the analysis and discussions presented within this evidence, the following provides a summary of my opinion on key matters:

- The trip generation rates for the majority of uses appear reasonable and could be considered to be fit for purpose, however further consideration should be given to the rate applied for a "Special School" use.
- The adopted traffic distributions are generally considered to be fit for purpose with the exception of the distribution of traffic along John Street to the west of Hutchinson Street.
- The proposal to add traffic to John Street to accommodate the traffic impacts of the development proposal is inconsistent with the role of John Street and would be best distributed more directly to the nearest arterial road connection being along Hutchinson Street to Maroondah Highway.
- Site access intersections are generally identified to operate appropriately, however updated intersection operational analysis should be undertaken to coordinate cycle lengths with nearby external intersections.
- The development generates a need to create capacity improvements to the north of the site in order to facilitate development traffic accessing the arterial road network.
- The signalisation of the intersection of Maroondah Highway and Hutchinson Street would represent the closest access to the arterial road network and analysis indicates that it could suitably accommodate the development traffic volumes.
- The signalisation of the intersection of Maroondah Highway and Hutchinson Street should therefore be included as part of the mitigating works required to be undertaken by the development in order to facilitate suitable site access.
- Additional mitigating works as discussed throughout this report should be considered at the following intersections in order to suitably mitigate the impacts of development traffic:
    - Maroondah Highway, Mooroolbark Road and Victoria Road
    - Mooroolbark Road and Hull Road, and
    - Hull Road and Swansea Road.
- Further consideration should be given to the impacts of development traffic growth on the intersections of Lakeview Drive with Hull Road.
- The Schedule to the CDZ provides the opportunity for the matters raised in the above review of the Transport Impact Assessment to be dealt with prior to the finalisation of the agreement of necessary transport mitigation measures, however it is recommended that a requirement be put in place for the site wide transport mitigation measures, particularly to the external road network be agreed separately and more holistically.
- The preparation and finalisation of an infrastructure agreement for the site must have regard for the following items, which should also be identified in the Comprehensive Development Plan and The Comprehensive Development Zone:

- The required inclusion of the signalisation of intersection of Maroondah Highway and Hutchinson Street as the primary responsibility of the Kinley Estate development,
- The extent of additional mitigation works required at other surrounding intersections as noted throughout this report.
- Justification of the timing infrastructure provisions proposed.

9.2. Other Statements

1. No opinion provided in this evidence is provisional.
2. No questions or statements outside of my expertise have been addressed in this evidence.
3. This evidence is not incomplete or inaccurate.

Declaration

I have made all the inquiries that I believe are desirable and appropriate and that no matters of significance that I regard as relevant have, to my knowledge, been withheld from the Panel.

Chris Coath
Director

21 May 2021

A.CURRICULUM VITAE

A

CHRIS COATH

Director

BE (Hons), Civil,
Monash University 2002
MIEAust, CPEng, NER, APEC Engineer, IntPE(Aus),
Engineers Australia

MY STORY

I am a Director of GTA Consultants with over 19 years' professional experience at GTA Consultants. My breadth of knowledge covers the transport planning spectrum and includes experience working for the public and private sector across all states of Australia (and beyond).

A focus of my work is preparing city strategies which ensure competing activity centre and precinct transport demands (parking, pedestrians, cyclists, public transport and loading/servicing) are balanced to achieve human-centred outcomes which consider resource efficiency, urban design, place-making and economic prosperity objectives.

Most specifically I have developed specialist knowledge of all facets of parking systems and have a passion for the creation of best-practice parking strategies and policies which respond to and shape the needs of current and future drivers.

My contribution to the transport industry includes regular research, paper preparations, conference attendance and contributions to transport text book publications. As a leader in the field I present expert testimony on transport and parking matters before Planning Tribunals and Planning Panels.

'Creating transport solutions with a human-centred focus to deliver resource efficiency, urban design, place-making and economic prosperity outcomes'

SELECTED PROJECT EXPERIENCE

Activity Centre Car Parking Strategy and Policy
Role: Project Lead and Director

Development and implementation of car parking strategies to manage existing and future car parking resources within activity centres, modelling of future car parking demands and creation of new planning policies.

- Box Hill Metropolitan Activity Centre Parking Strategy, Vic
- Footscray Central Activities Area Parking Study, Vic
- Brunswick Major Activity Centre Car Parking Strategy, Vic
- Gold Coast 2018 Commonwealth Games Parking Schemes, Qld
- Rosny Park and Bellerive Parking Asset Management Strategy, Tas
- Newcastle Parking Strategy, NSW
- Woden, Mawson and Belconnen Parking Strategies, ACT
- Bendigo CBD Parking Precinct Plan, Vic.

Campus Planning and Strategy
Role: Project Director and Manager

Development of integrated transport and parking strategies for campuses and precincts. These have included transport planning and analysis, multi modal needs, parking strategies, logistics planning, loading and design.

- Melbourne Convention and Exhibition Centre and South Wharf Precinct, Vic
- Melbourne Arts Precinct including Arts Centre Melbourne, Melbourne Recital Centre and Melbourne Theatre Company, Vic
- Melbourne Park Stage 3 Logistic Hub, Vic
- Monash University, Vic
- Deakin University, Vic
- University of Canberra, ACT
- Parliamentary Zone and Surrounds, ACT
- Latrobe Regional Hospital, Vic
- The Malt District, Vic.

SKILLS & EXPERTISE

- CBD and Town Centre Strategies and Policies
- Campus Planning and Strategies
- Pay Parking Technology
- Parking Detection and Directional Systems
- Resident Permit Systems
- Parking Management Plans
- Economic Impacts of Parking
- Modelling of Existing and Future Parking Demands
- Modelling of Paid Parking Systems (Revenue and Cost)
- Establishment of Appropriate Development Parking Rates
- Parking Enforcement Operations
- Car Parking Design
- Car Parking Signage and Line marking (incl. Electronic Variable Message Signage)

MEMBERSHIPS AND AFFILIATIONS

Member of Institute of Engineers Australia (IEAust)

Member of Transport Australia society (TAs)

Member of Victorian Planning and Environmental Law Association (VPELA)

GTAconsultants now Stantec

* [non GTA project]

ADDITIONAL RELEVANT EXPERIENCE

Paid Parking and Technology
Role: Project Director

Development of paid parking strategies for Local Government and private sector clients including consideration of pricing strategies, technology applications, demand elasticities, revenue generation and cash flow modelling. This included providing strategic direction and leadership including facilitation of Council Executive and Councillor workshops.

Locations have included:

- Ku-ring-gai City Council, NSW
- Liverpool City Centre, NSW
- Coburg Major Activity Centre, Vic
- University of Canberra, ACT
- Evandale and Bundall, Qld
- Mornington Peninsula Shire Council, Vic
- Torquay, Vic
- Bangkok Intelligent Parking System Study, Thailand
- Moreland City Council, Vic
- Crown Casino Car Parking Management Plan and Car Parking Automation Control, Vic
- Melbourne City Council Parking Meter and Pay Parking Policy, Vic.

Parking Policy Reviews and Research
Role: Project Lead

Creation of policy and management strategies to manage specific user group needs and priorities.

- Gold Coast City Council Permit Parking Review, Qld
- City of Yarra Permit Parking Scheme, Vic
- Review of Parking Enforcement Camera Operations for the City Maribyrnong, Vic
- Carlton Parking and Access Strategy, Vic.

Master Planning and Structure Planning
Role: Project Director

Creation of transport outcomes for areas with a focus on multi-modal access, enhancing sustainable outcomes and integration with industry experts to achieve a holistic urban planning response.

- Keystone Business Park, Armstrong Creek, Vic
- Victoria Street East and Doonside Street Precinct, Priority Development Panel, Vic
- Bacchus Marsh Structure Plan, Vic
- Swan Street Structure Plan, Vic
- Woden Town Centre Transport Master Planning, ACT.

ACHIEVEMENTS

"Car Parking: Human Centred", AITPM National Conference 2018, Chris Coath & Ali Yousif

"Activity Centre Planning – Parking Precinct Stations", AITPM National Conference 2017, Chris Coath & Will Fooks

"Parking Limitation Policies – The Influence of Car Parking Provision on Travel Modes", AITPM National Conference 2016, Chris Coath & Alexander Sheko

"Traffic and Parking Assessments", Planning Institute of Australia, PLANET Course, 2012-2017

"Parking Overlay – Setting a New Base", AITPM Technical Seminar, July 2012, Chris Coath

"Car Parking Strategy", RMIT, Integrated Transport Planning Lecture 2014, Chris Coath

"Expert Reports: What to Look For", VPELA Young Professionals Development Series 2015, Chris Coath

"Parking: A Basis or Burden to Liveable and Accessible Communities", AITPM National Conference 2011, Chris Coath

B. SIDRA INTERSECTION RESULTS

B

USER REPORT FOR SITE

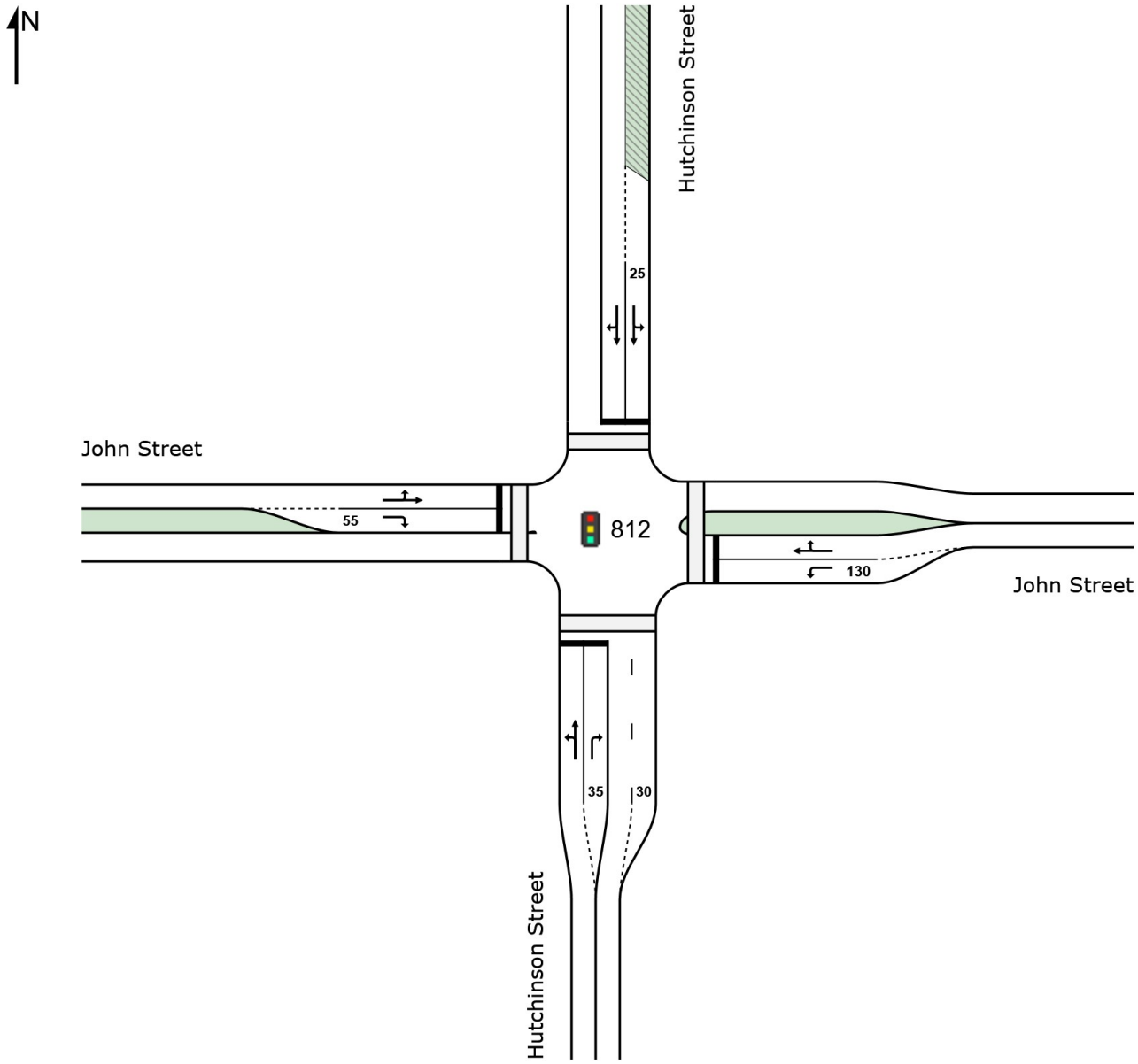
Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 812 [John Street/Hutchinson Street (PJ 2020, AM)]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 110 seconds (Site User-Given Phase Times)

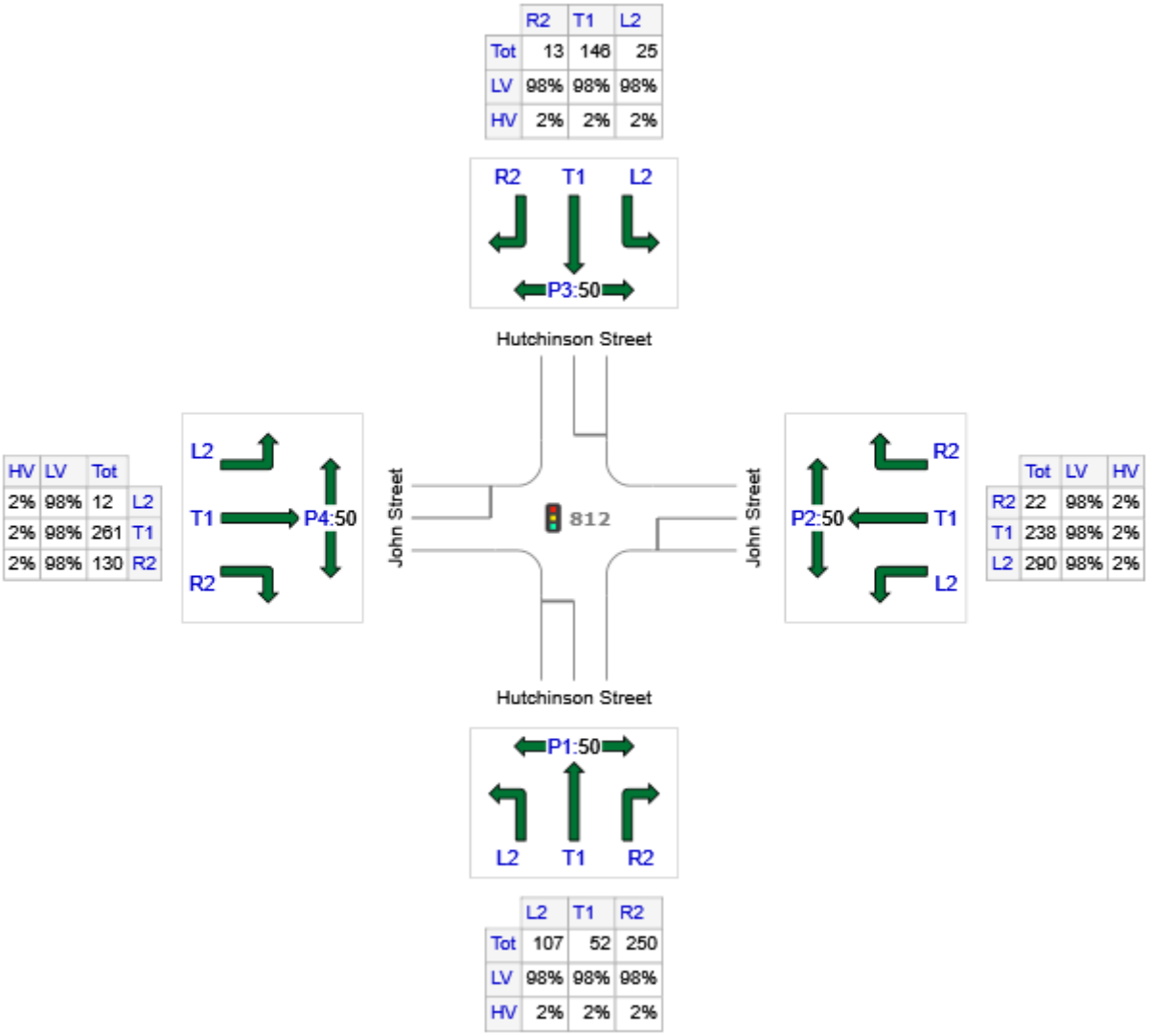
Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Site Layout


N
Hutchinson Street
25
John Street
55
812
130
John Street
35
30
Hutchinson Street

Input Volumes

Volume Display Method: Total and %



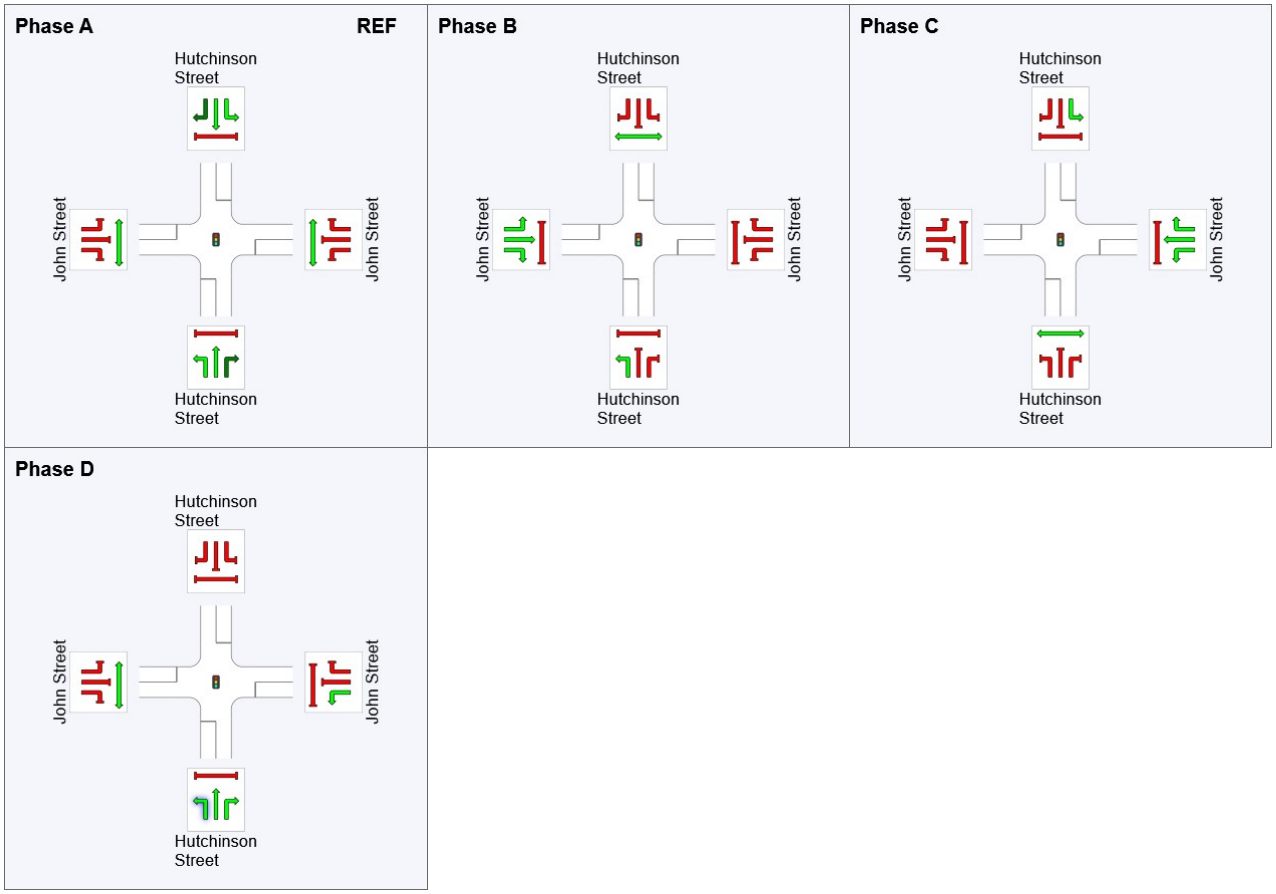
	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	409	401	8
E: John Street	550	539	11
N: Hutchinson Street	184	180	4
W: John Street	403	395	8
Total	1546	1515	31

Phase Timing Summary

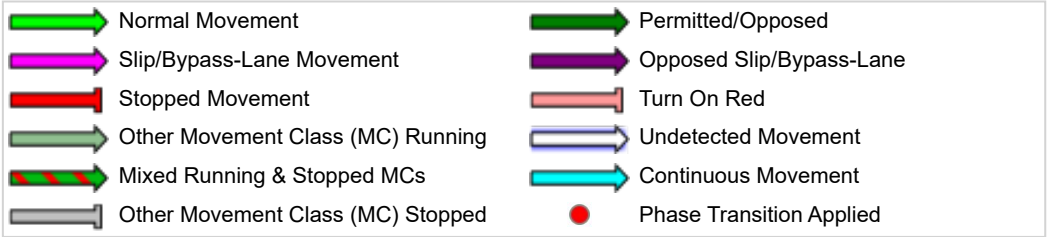
Phase	A	B	C	D
Phase Change Time (sec)	0	22	62	89
Green Time (sec)	17	34	21	15
Phase Time (sec)	23	40	27	20
Phase Split	21%	36%	25%	18%

See the Phase Information section in the Detailed Output 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, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	167	2.0	647	0.259	100	29.4	LOS C	6.3	44.7	Full	500	0.0	0.0
Lane 2	263	2.0	353[1]	0.746	100	39.6	LOS D	11.9	85.0	Short	35	0.0	NA
Approach	431	2.0		0.746		35.6	LOS D	11.9	85.0				
East: John Street													
Lane 1	305	2.0	639	0.478	100	34.3	LOS C	12.7	90.6	Short	130	0.0	NA
Lane 2	274	2.0	360	0.760	100	48.9	LOS D	14.7	104.8	Full	155	0.0	0.0
Approach	579	2.0		0.760		41.2	LOS D	14.7	104.8				
North: Hutchinson Street													
Lane 1	41	2.0	308	0.132	24[6]	25.6	LOS C	1.0	7.4	Short (P)	25	0.0	NA
Lane 2	153	2.0	276[1]	0.556	100	48.8	LOS D	7.8	55.3	Full	110	0.0	0.0
Approach	194	2.0		0.556		44.0	LOS D	7.8	55.3				
West: John Street													
Lane 1	287	2.0	582	0.494	100	33.6	LOS C	12.6	89.7	Full	200	0.0	0.0
Lane 2	137	2.0	557	0.246	100	35.1	LOS D	5.5	39.0	Short	55	0.0	NA
Approach	424	2.0		0.494		34.1	LOS C	12.6	89.7				
Intersection	1627	2.0		0.760		38.2	LOS D	14.7	104.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects

USER REPORT FOR SITE

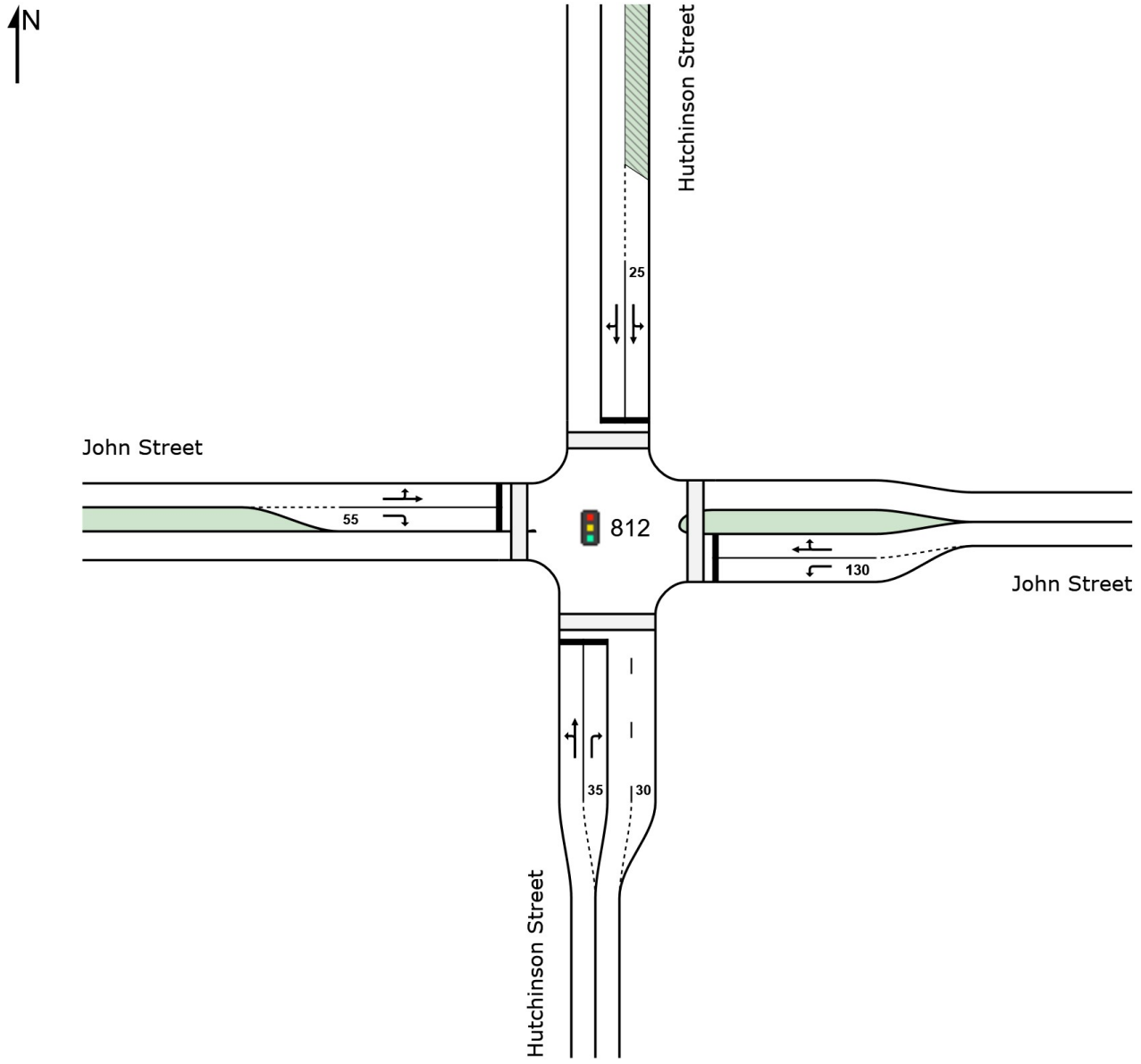
Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 812 [John Street/Hutchinson Street (PJ 2020, PM)]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 110 seconds (Site User-Given Phase Times)

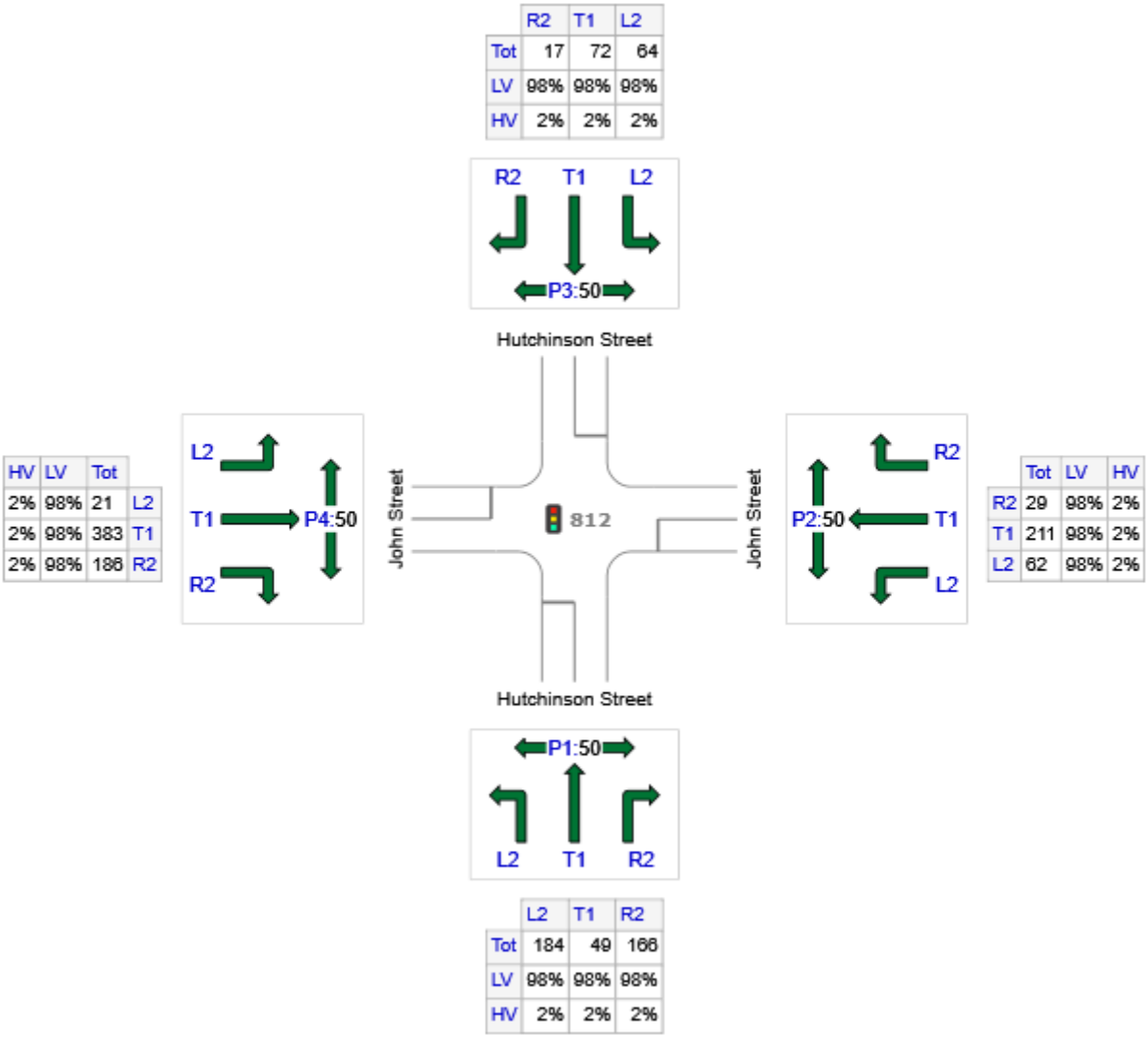
Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Site Layout



Input Volumes

Volume Display Method: Total and %



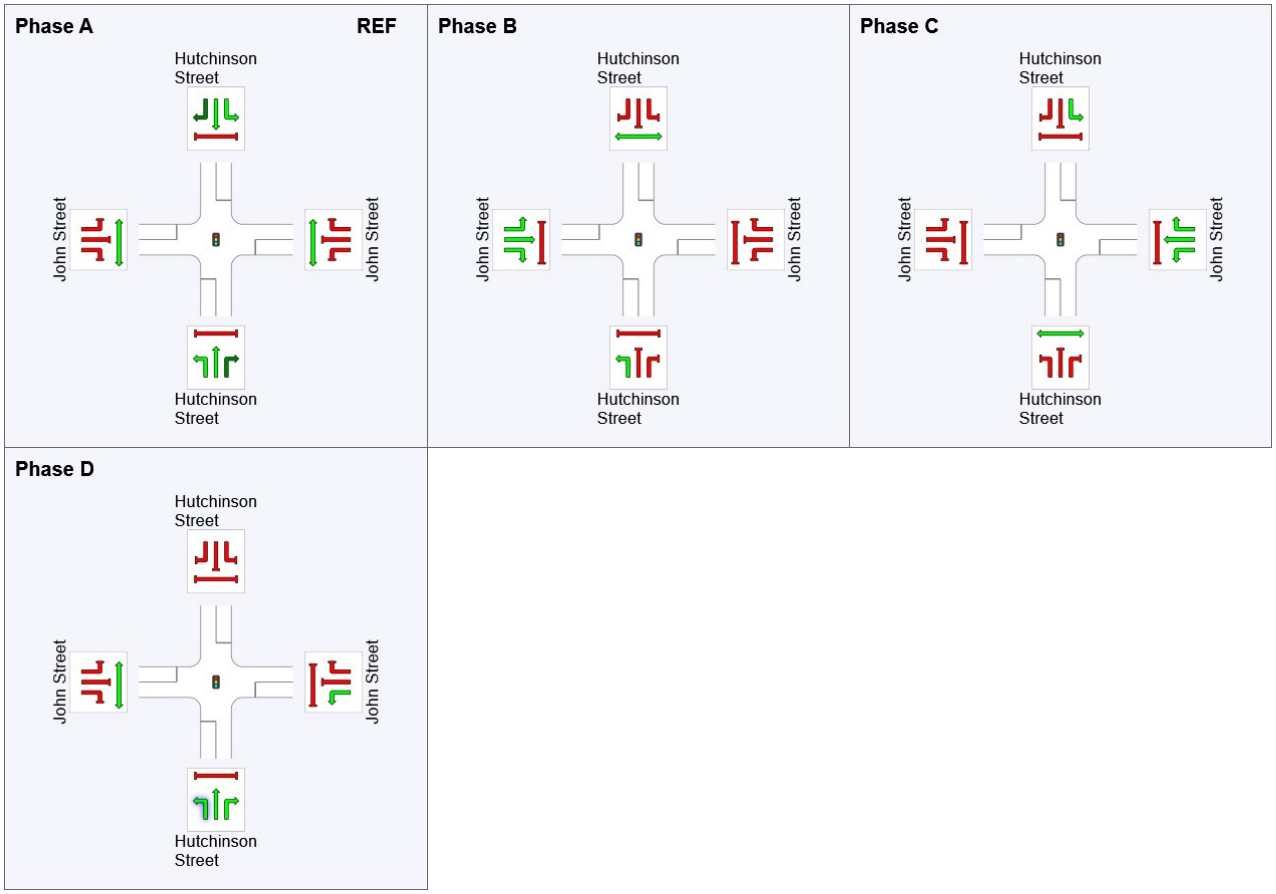
	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	399	391	8
E: John Street	302	296	6
N: Hutchinson Street	153	150	3
W: John Street	590	578	12
Total	1444	1415	29

Phase Timing Summary

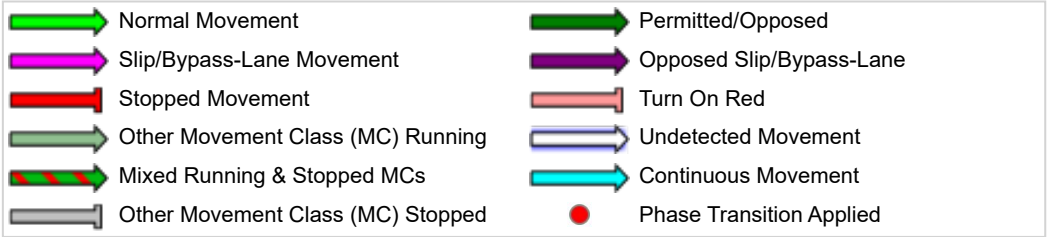
Phase	A	B	C	D
Phase Change Time (sec)	0	20	65	90
Green Time (sec)	15	40	19	14
Phase Time (sec)	20	46	25	19
Phase Split	18%	42%	23%	17%

See the Phase Information section in the Detailed Output 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, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	245	2.0	462[1]	0.530	100	32.2	LOS C	9.9	70.1	Full	500	0.0	0.0
Lane 2	175	2.0	387	0.451	100	37.6	LOS D	7.5	53.1	Short	35	0.0	NA
Approach	420	2.0		0.530		34.5	LOS C	9.9	70.1				
East: John Street													
Lane 1	65	2.0	590	0.111	100	32.2	LOS C	2.4	17.3	Short	130	0.0	NA
Lane 2	253	2.0	325	0.777	100	51.4	LOS D	13.9	98.9	Full	155	0.0	0.0
Approach	318	2.0		0.777		47.5	LOS D	13.9	98.9				
North: Hutchinson Street													
Lane 1	67	2.0	508	0.133	36[5]	22.1	LOS C	1.8	12.6	Short (P)	25	0.0	NA
Lane 2	94	2.0	254	0.369	100	49.7	LOS D	4.7	33.5	Full	110	0.0	0.0
Approach	161	2.0		0.369		38.1	LOS D	4.7	33.5				
West: John Street													
Lane 1	425	2.0	596[1]	0.714	100	31.2	LOS C	18.8	133.5	Full	200	0.0	0.0
Lane 2	196	2.0	655	0.299	100	31.4	LOS C	7.5	53.2	Short	55	0.0	NA
Approach	621	2.0		0.714		31.2	LOS C	18.8	133.5				
Intersection	1520	2.0		0.777		36.3	LOS D	18.8	133.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
5 Lane under-utilisation found by the program

USER REPORT FOR SITE

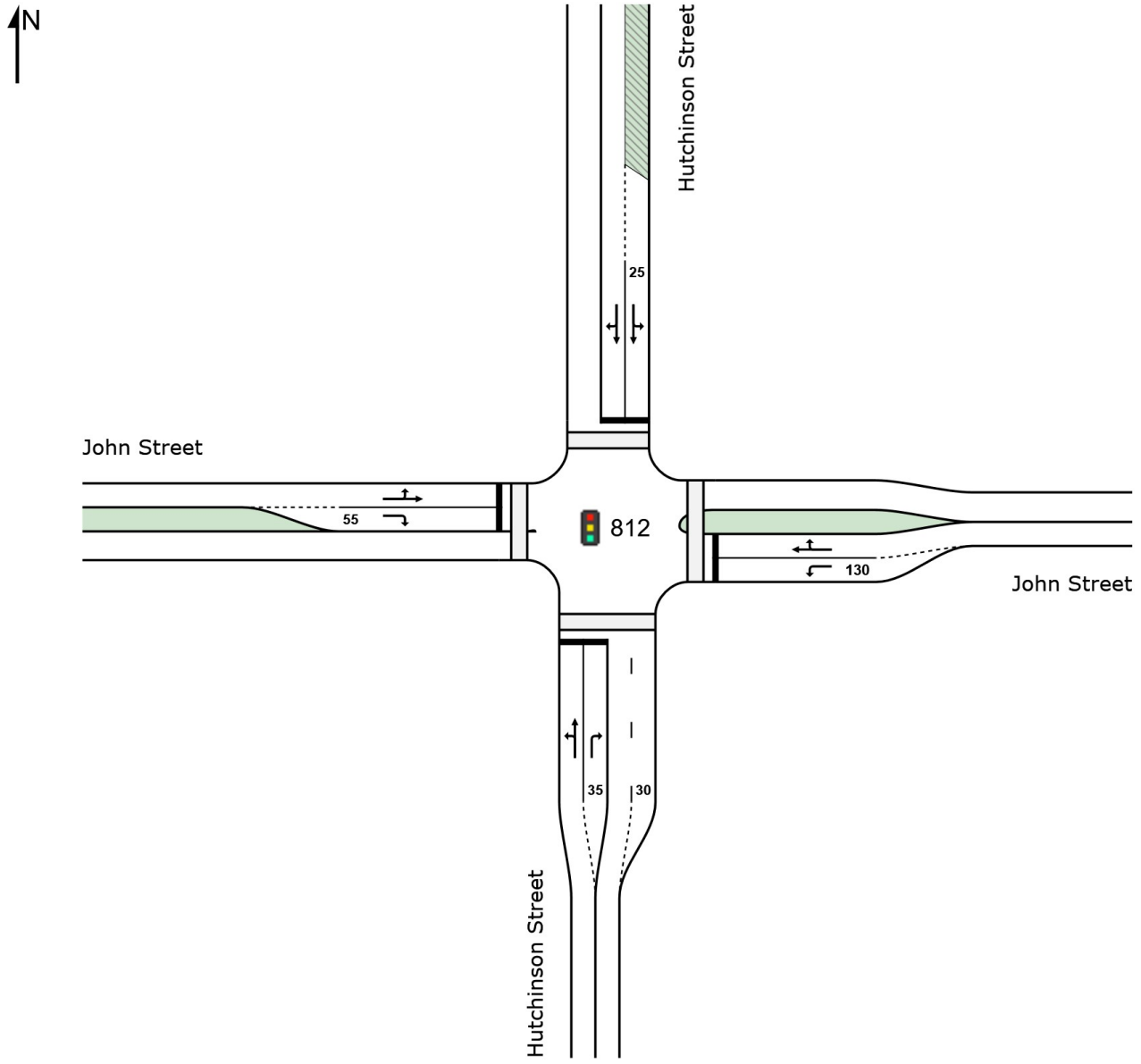
Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 812 [John Street/Hutchinson Street (AP 2020, AM)]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 120 seconds (Site User-Given Cycle Time)

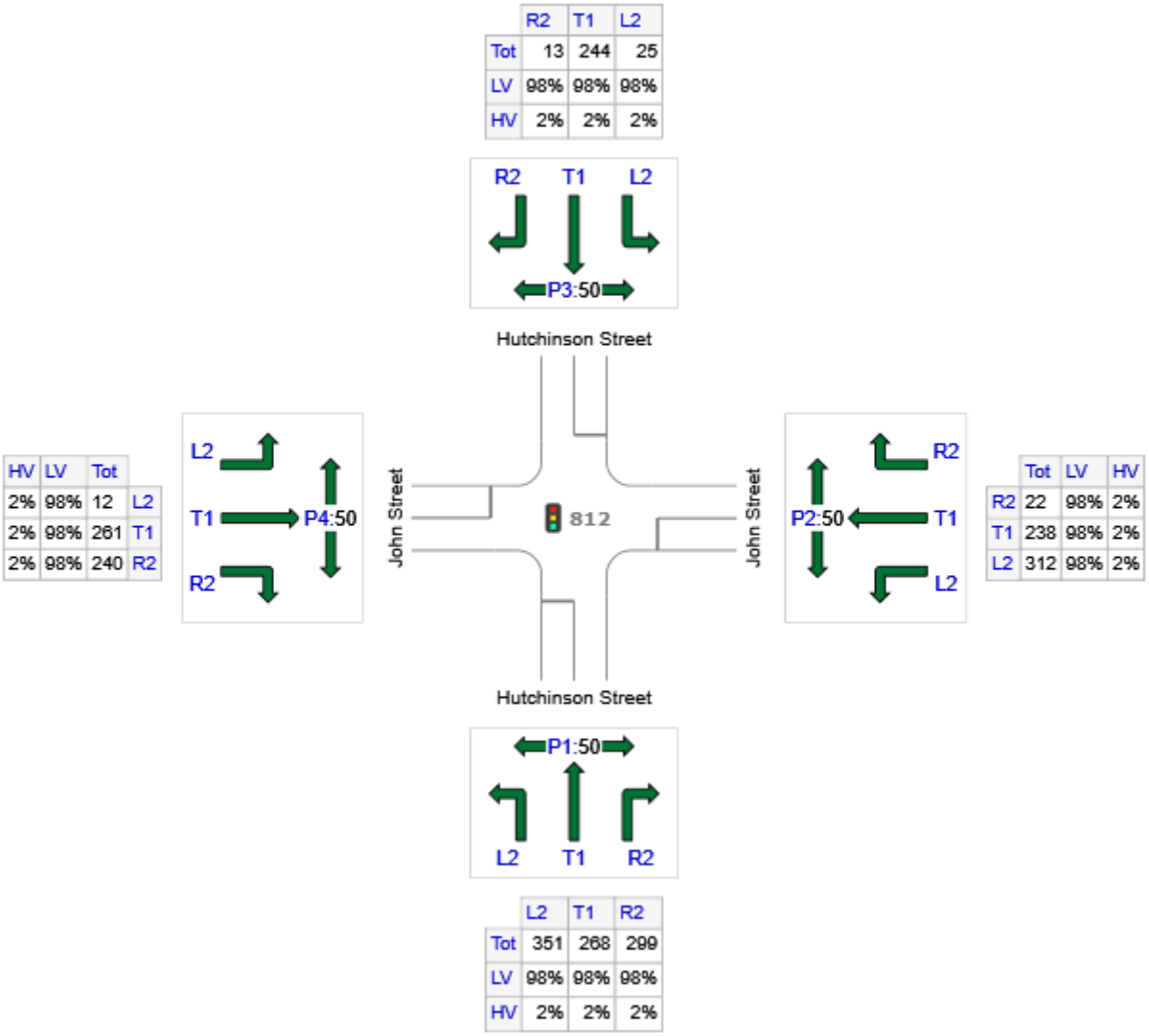
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Site Layout



Input Volumes

Volume Display Method: Total and %



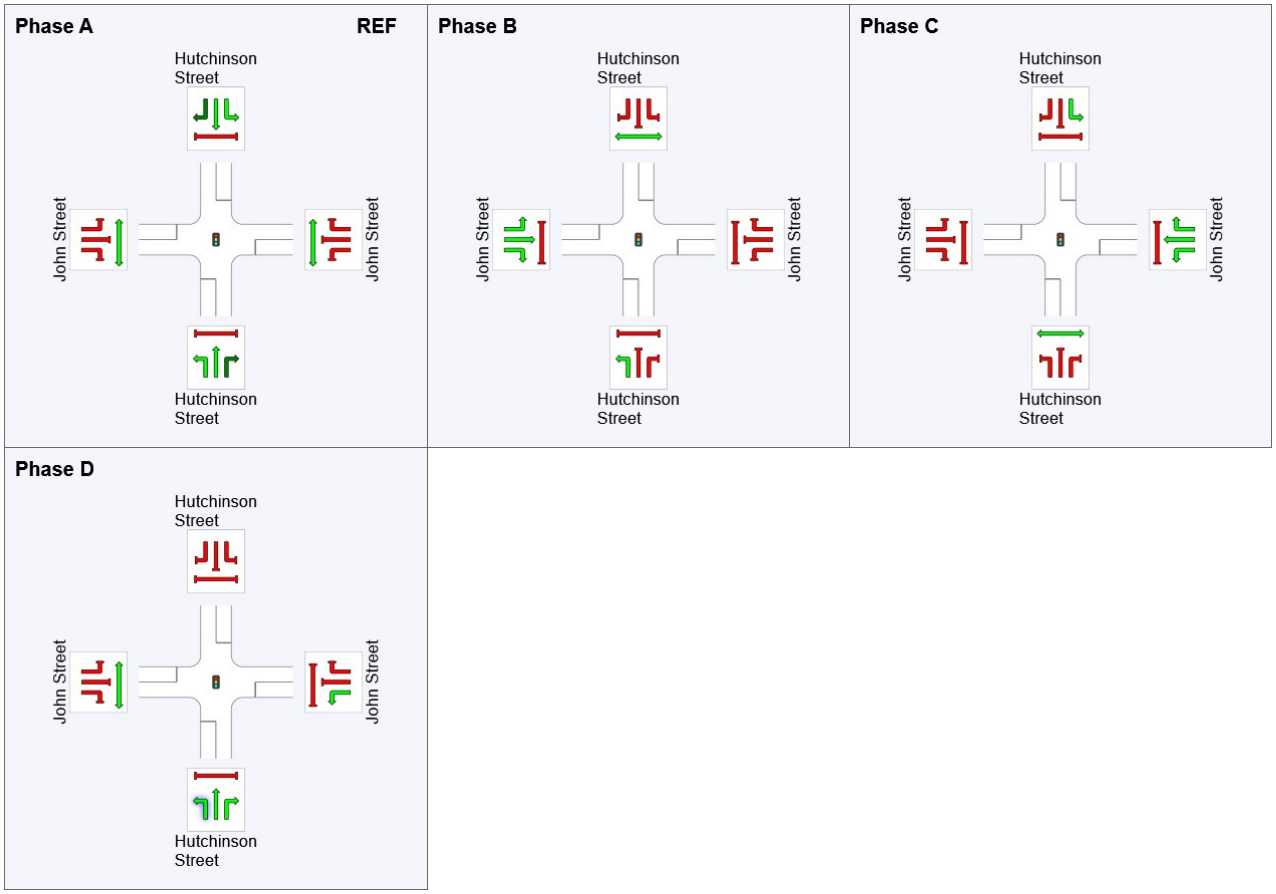
	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	918	900	18
E: John Street	572	561	11
N: Hutchinson Street	282	276	6
W: John Street	513	503	10
Total	2285	2239	46

Phase Timing Summary

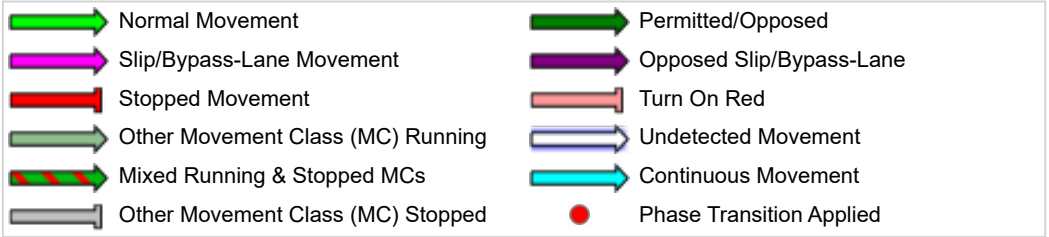
Phase	A	B	C	D
Phase Change Time (sec)	0	23	51	75
Green Time (sec)	18	22	18	39
Phase Time (sec)	24	28	24	44
Phase Split	20%	23%	20%	37%

See the Phase Information section in the Detailed Output 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, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	652	2.0	703[1]	0.927	100	49.9	LOS D	39.2	279.1	Full	500	0.0	0.0
Lane 2	315	2.0	368[1]	0.855	100	38.2	LOS D	13.9	99.1	Short	35	0.0	NA
Approach	966	2.0		0.927		46.1	LOS D	39.2	279.1				
East: John Street													
Lane 1	328	2.0	901	0.364	100	24.1	LOS C	11.6	82.6	Short	130	0.0	NA
Lane 2	274	2.0	283	0.967	100	85.2	LOS F	21.0	149.4	Full	155	0.0	1.7
Approach	602	2.0		0.967		51.9	LOS D	21.0	149.4				
North: Hutchinson Street													
Lane 1	63	2.0	277	0.226	24[6]	30.7	LOS C	2.2	15.4	Short (P)	25	0.0	NA
Lane 2	234	2.0	245[1]	0.956	100	82.5	LOS F	17.3	123.3	Full	110	0.0	15.3
Approach	297	2.0		0.956		71.6	LOS E	17.3	123.3				
West: John Street													
Lane 1	287	2.0	293[1]	0.980	100	90.1	LOS F	22.7	161.8	Full	200	0.0	0.0
Lane 2	253	2.0	316[1]	0.799	100	59.9	LOS E	15.2	108.1	Short	55	0.0	NA
Approach	540	2.0		0.980		75.9	LOS E	22.7	161.8				
Intersection	2405	2.0		0.980		57.4	LOS E	39.2	279.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects

USER REPORT FOR SITE

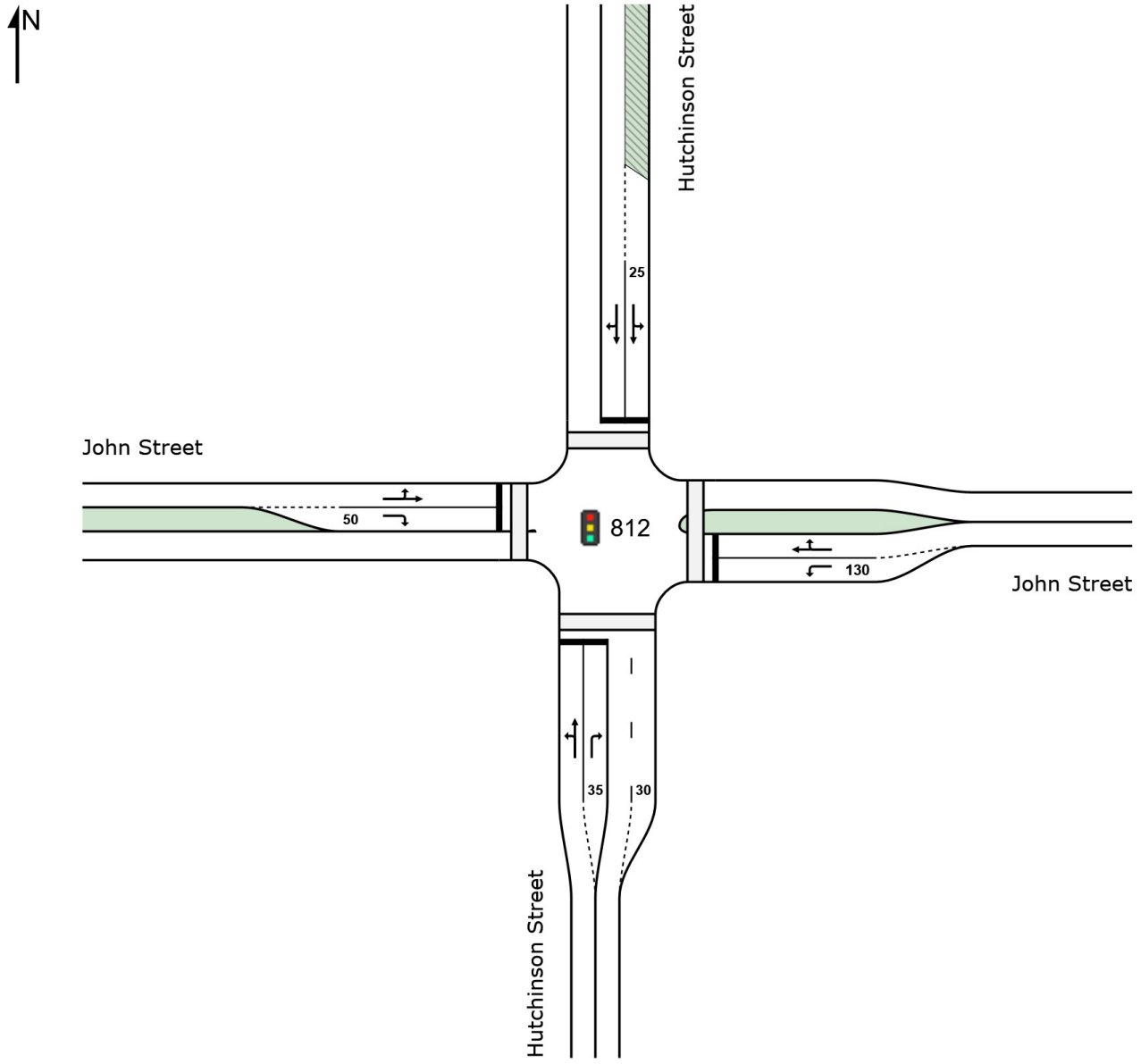
Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 812 [John Street/Hutchinson Street (AP 2020, PM)]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 60 seconds (Site Optimum Cycle Time - Minimum Delay)

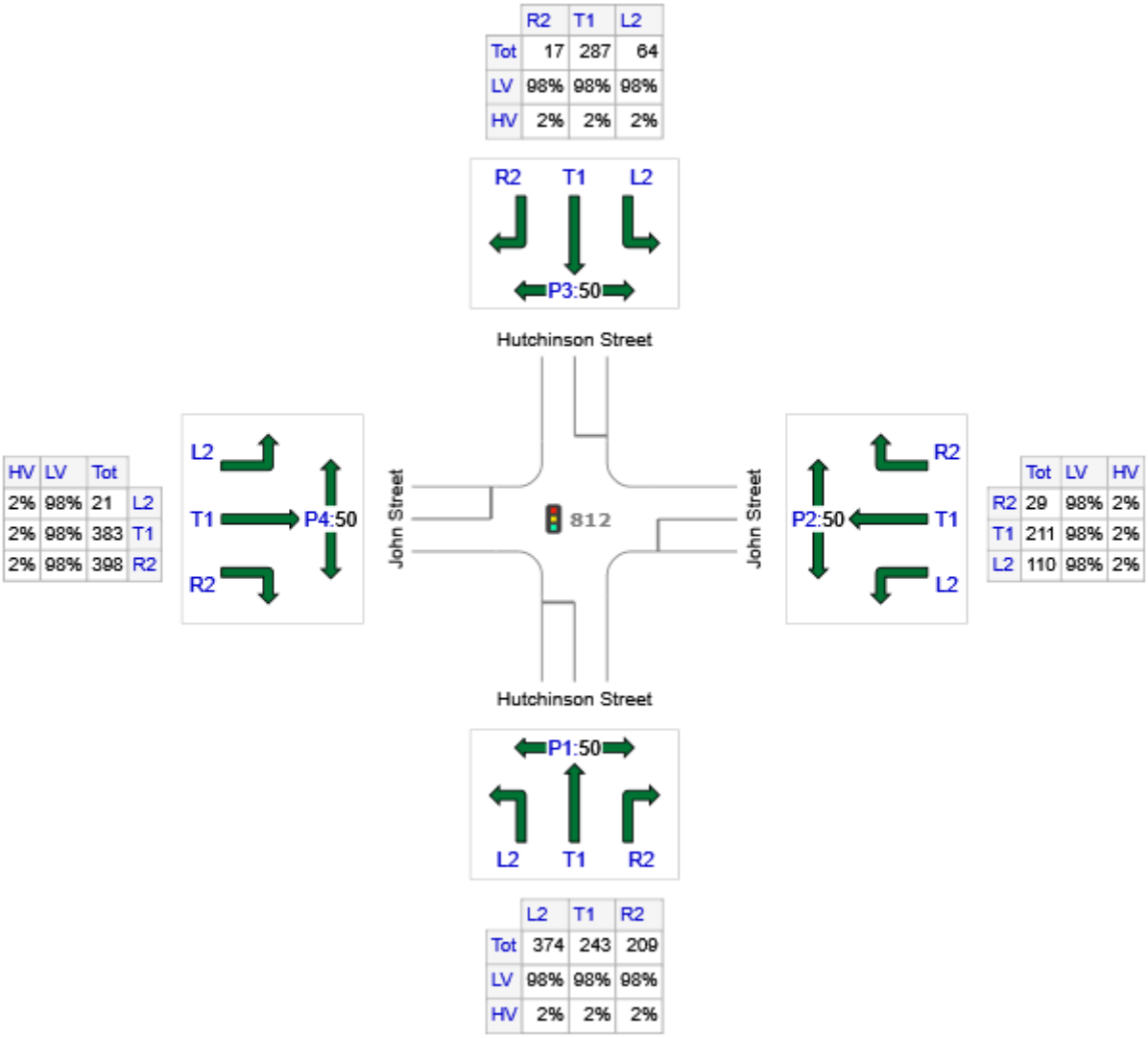
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Site Layout



Input Volumes

Volume Display Method: Total and %



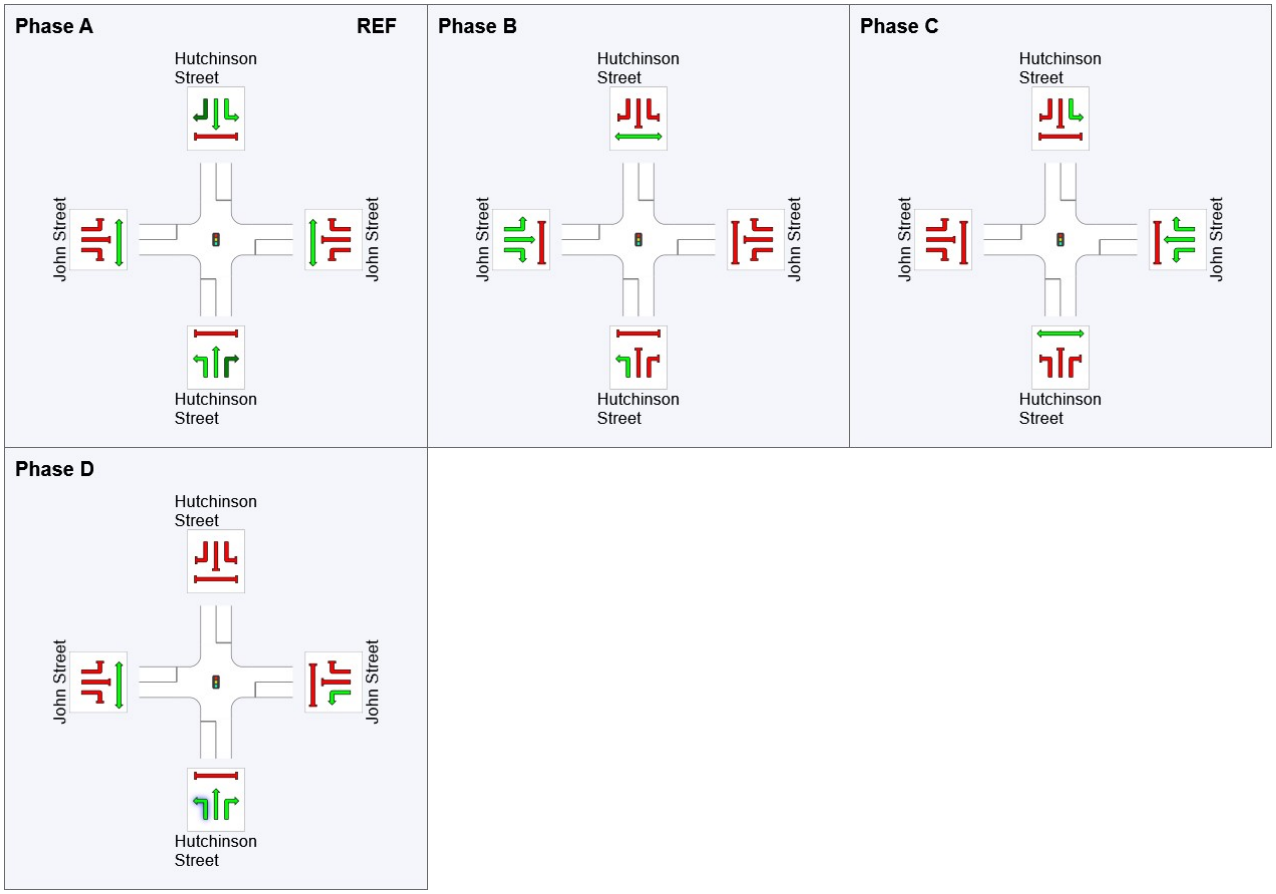
	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	826	809	17
E: John Street	350	343	7
N: Hutchinson Street	368	361	7
W: John Street	802	786	16
Total	2346	2299	47

Phase Timing Summary

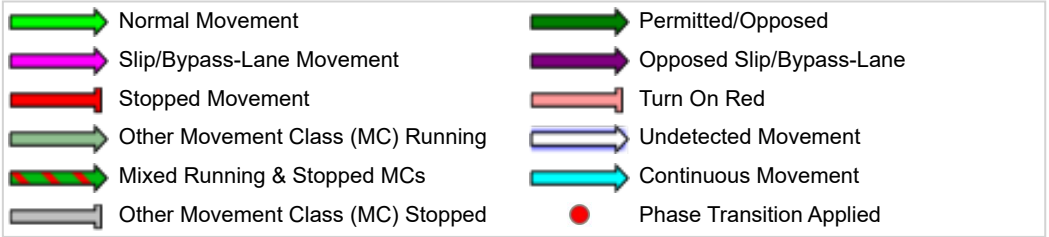
Phase	A	B	C	D
Phase Change Time (sec)	0	16	35	48
Green Time (sec)	11	13	7	6
Phase Time (sec)	17	19	13	11
Phase Split	28%	32%	22%	18%

See the Phase Information section in the Detailed Output 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, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	649	2.0	660[1]	0.984	100	61.6	LOS E	33.1	235.8	Full	500	0.0	0.0
Lane 2	220	2.0	285	0.771	100	25.2	LOS C	5.5	39.1	Short	35	0.0	NA
Approach	869	2.0		0.984		52.4	LOS D	33.1	235.8				
East: John Street													
Lane 1	116	2.0	511	0.227	100	22.8	LOS C	2.7	19.0	Short	130	0.0	NA
Lane 2	253	2.0	220	1.150	100	174.7	LOS F	22.9	163.3	Full	155	0.0	9.7
Approach	368	2.0		1.150		126.9	LOS F	22.9	163.3				
North: Hutchinson Street													
Lane 1	97	2.0	395	0.244	24[6]	14.8	LOS B	1.4	10.2	Short (P)	25	0.0	NA
Lane 2	291	2.0	281[1]	1.033	100	88.1	LOS F	17.2	122.4	Full	110	0.0	14.7
Approach	387	2.0		1.033		69.8	LOS E	17.2	122.4				
West: John Street													
Lane 1	425	2.0	406	1.047	100	95.3	LOS F	27.1	192.6	Full	200	0.0	10.2[8]
Lane 2	419	2.0	391	1.073	100	118.7	LOS F	29.8	211.9	Short	50	0.0	NA
Approach	844	2.0		1.073		106.9	LOS F	29.8	211.9				
Intersection	2469	2.0		1.150		84.9	LOS F	33.1	235.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects
8 Probability of Blockage has been set on the basis of a queue that overflows from a short lane.

USER REPORT FOR SITE

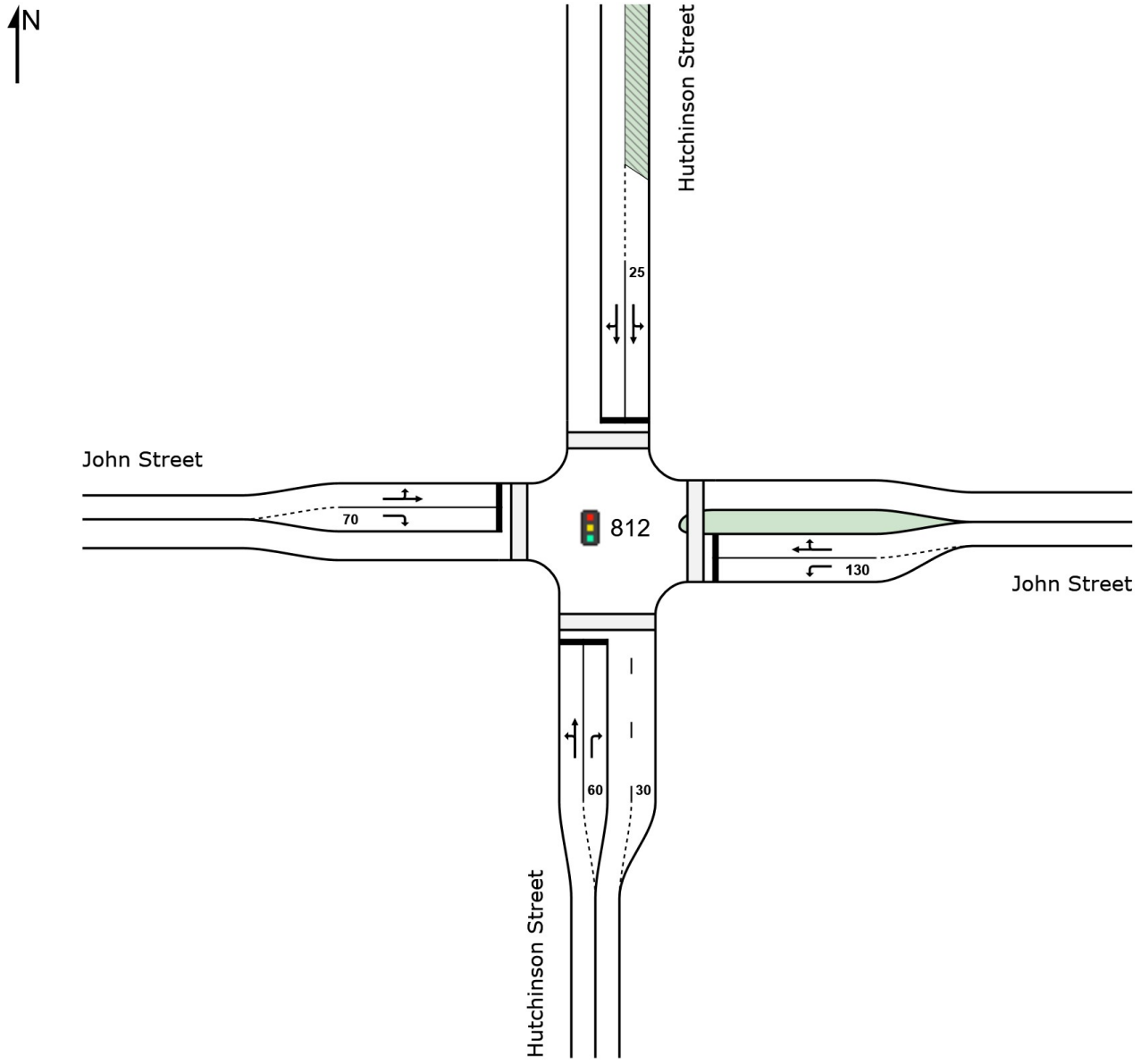
Project: 210507_V159104_FutureLayoutFutureVolumes2020 GTA **Template: GTA Appendix Site**

Site: 812 [John Street/Hutchinson Street (2020, AM)]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 70 seconds (Site Optimum Cycle Time - Minimum Delay)

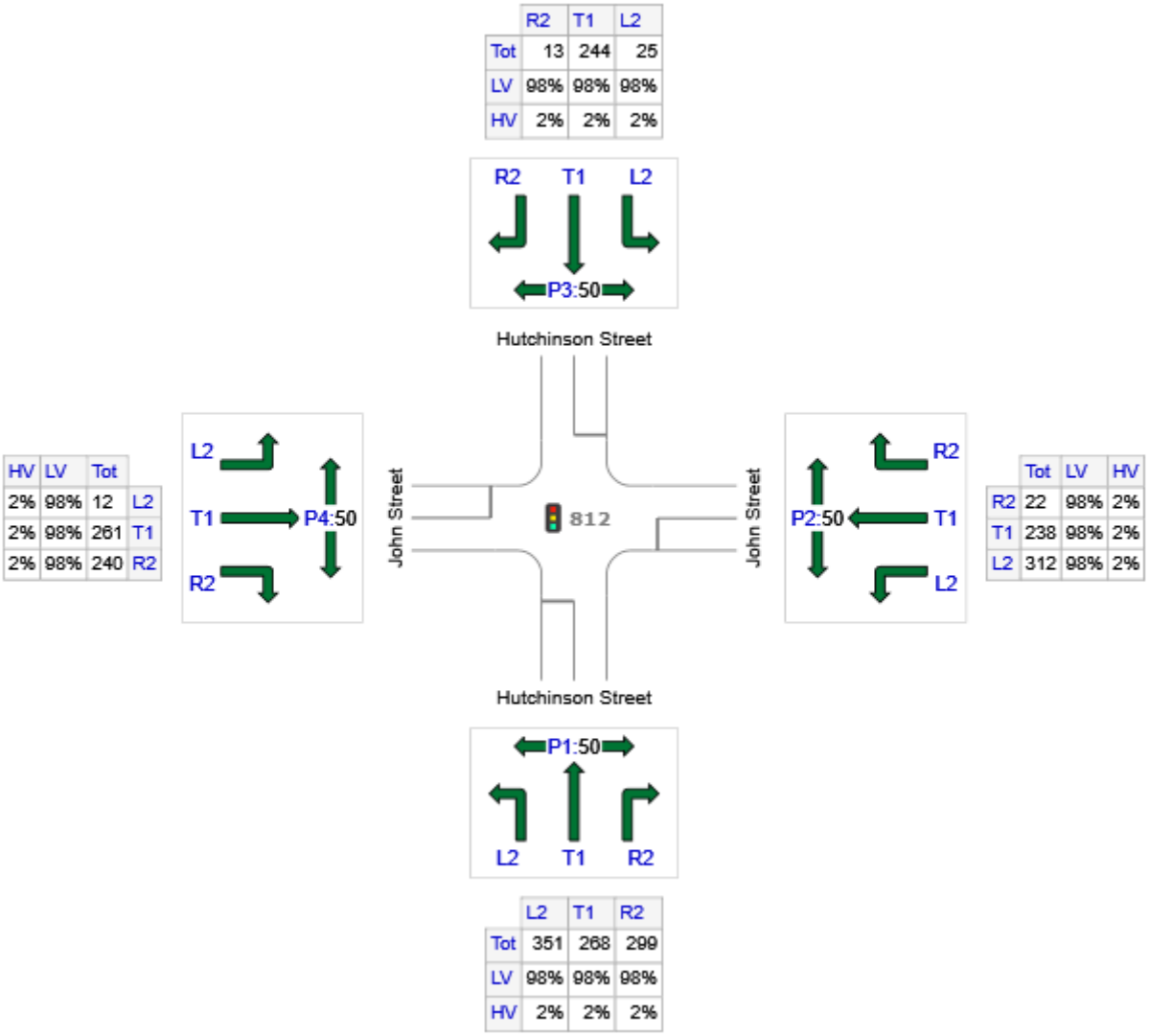
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Site Layout



Input Volumes

Volume Display Method: Total and %



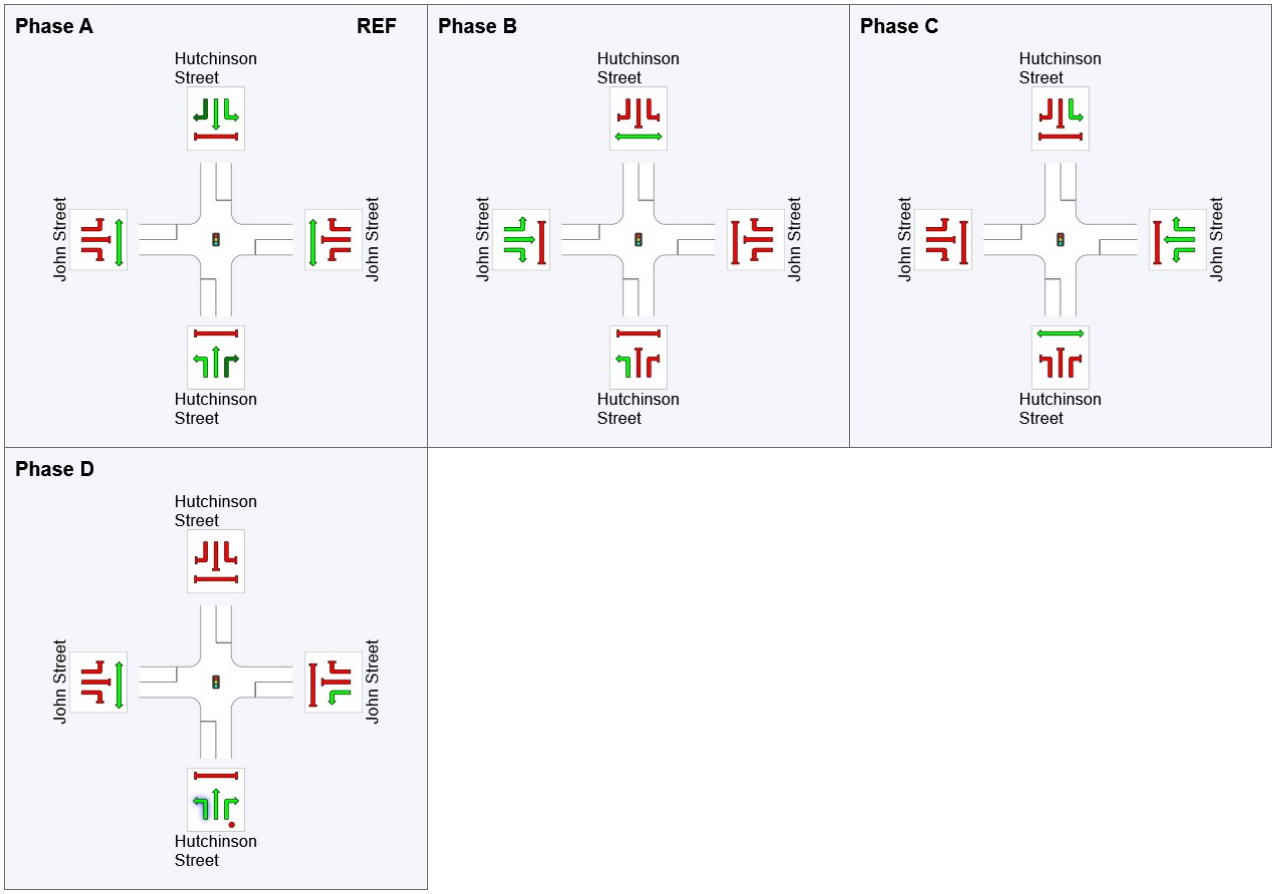
	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	918	900	18
E: John Street	572	561	11
N: Hutchinson Street	282	276	6
W: John Street	513	503	10
Total	2285	2239	46

Phase Timing Summary

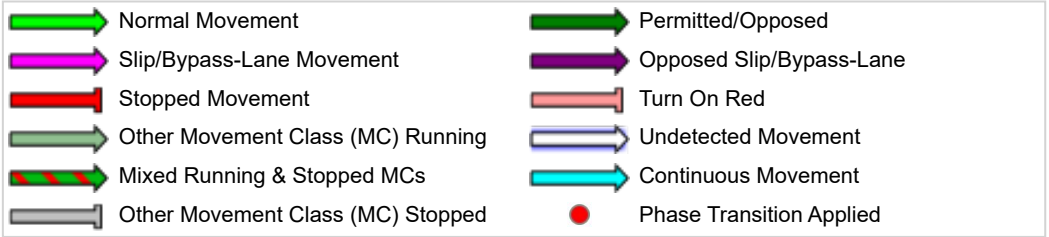
Phase	A	B	C	D
Phase Change Time (sec)	0	16	34	51
Green Time (sec)	11	12	11	13
Phase Time (sec)	17	18	17	18
Phase Split	24%	26%	24%	26%

See the Phase Information section in the Detailed Output 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, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	Demand Flows		Cap.	Deg. Satn	Lane Util.	Average Delay	Level of Service	95% Back of Queue		Lane Config	Lane Length	Cap. Adj.	Prob. Block.
	Total veh/h	HV %	veh/h	v/c	%	sec		Veh	Dist m		m	%	%
South: Hutchinson Street													
Lane 1	652	2.0	708[1]	0.920	100	40.6	LOS D	28.3	201.2	Full	500	0.0	0.0
Lane 2	315	2.0	447	0.704	100	23.8	LOS C	8.3	59.2	Short	60	0.0	NA
Approach	966	2.0		0.920		35.1	LOS D	28.3	201.2				
East: John Street													
Lane 1	328	2.0	721	0.456	100	21.4	LOS C	8.3	59.3	Short	130	0.0	NA
Lane 2	274	2.0	296	0.923	100	47.3	LOS D	12.1	85.9	Full	155	0.0	0.0
Approach	602	2.0		0.923		33.2	LOS C	12.1	85.9				
North: Hutchinson Street													
Lane 1	64	2.0	306	0.208	24[6]	17.6	LOS B	1.1	7.9	Short (P)	25	0.0	NA
Lane 2	233	2.0	265[1]	0.879	100	42.7	LOS D	9.5	67.6	Full	120	0.0	0.0
Approach	297	2.0		0.879		37.3	LOS D	9.5	67.6				
West: John Street													
Lane 1	287	2.0	322	0.893	100	42.3	LOS D	12.0	85.2	Full	185	0.0	0.0
Lane 2	253	2.0	309	0.818	100	40.8	LOS D	9.6	68.2	Short	70	0.0	NA
Approach	540	2.0		0.893		41.6	LOS D	12.0	85.2				
Intersection	2405	2.0		0.923		36.4	LOS D	28.3	201.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects

USER REPORT FOR SITE

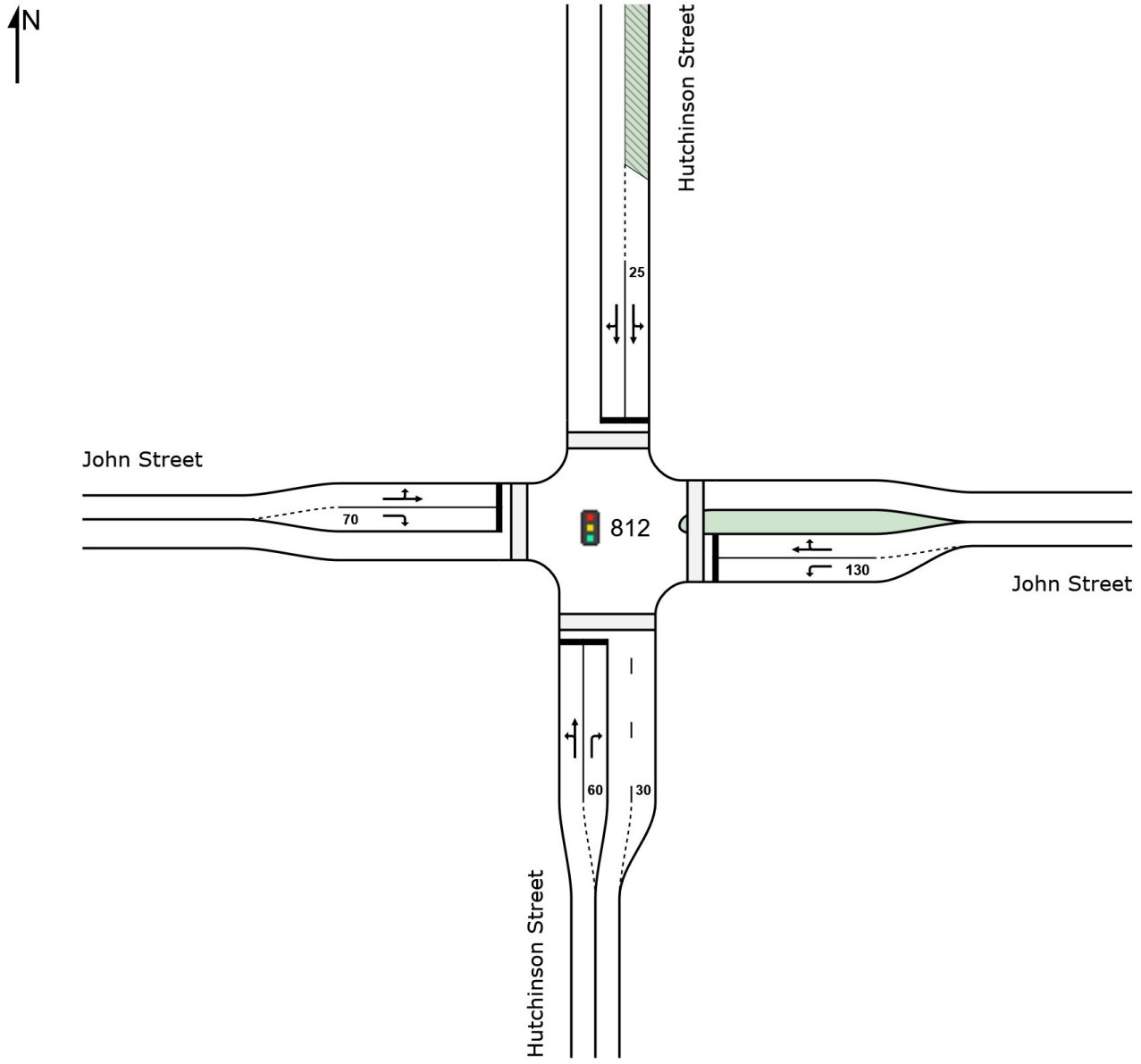
Project: 210507_V159104_FutureLayoutFutureVolumes2020 **Template: GTA Appendix Site GTA**

Site: 812 [John Street/Hutchinson Street (2020, PM)]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

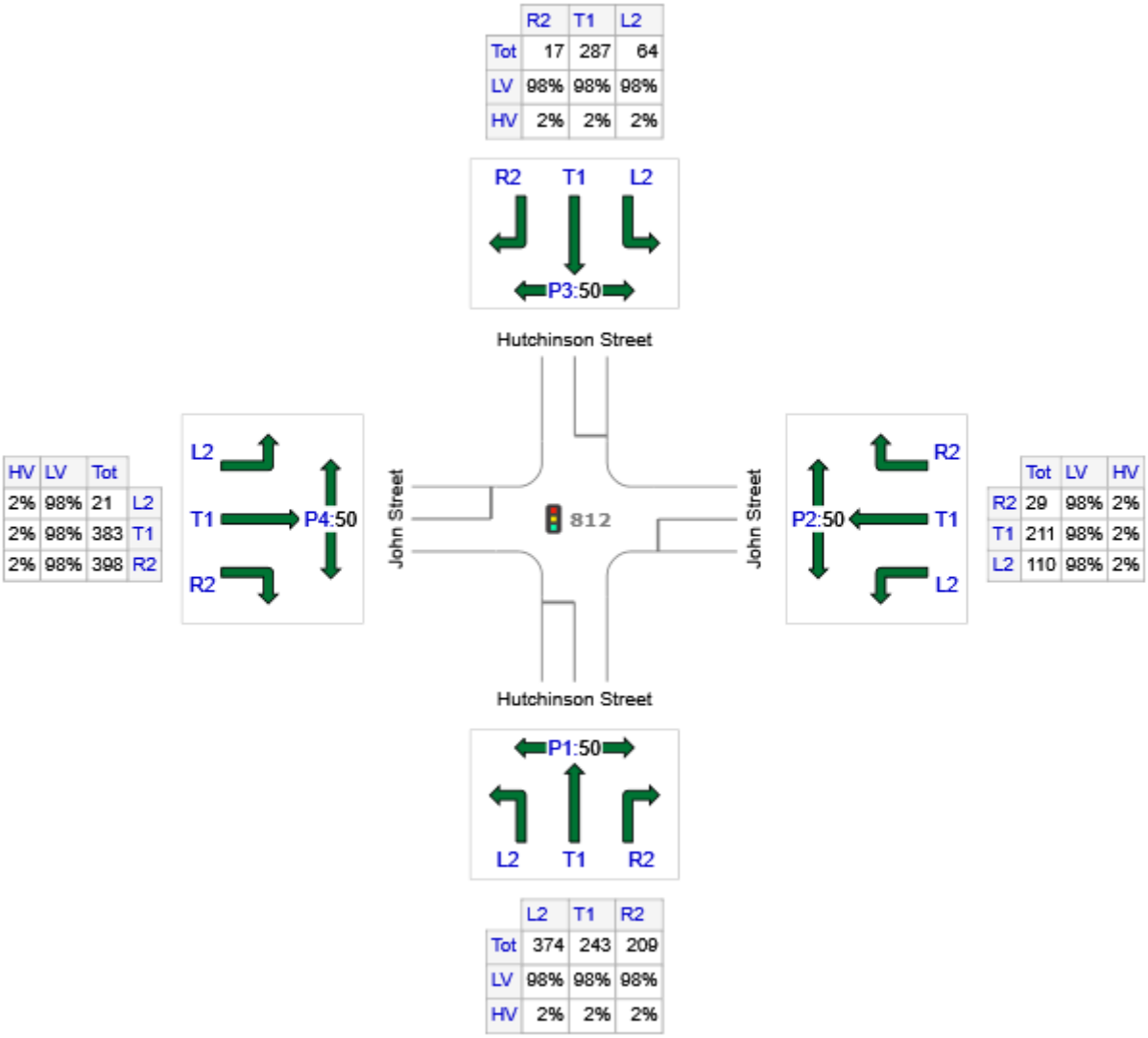
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Site Layout



Input Volumes

Volume Display Method: Total and %



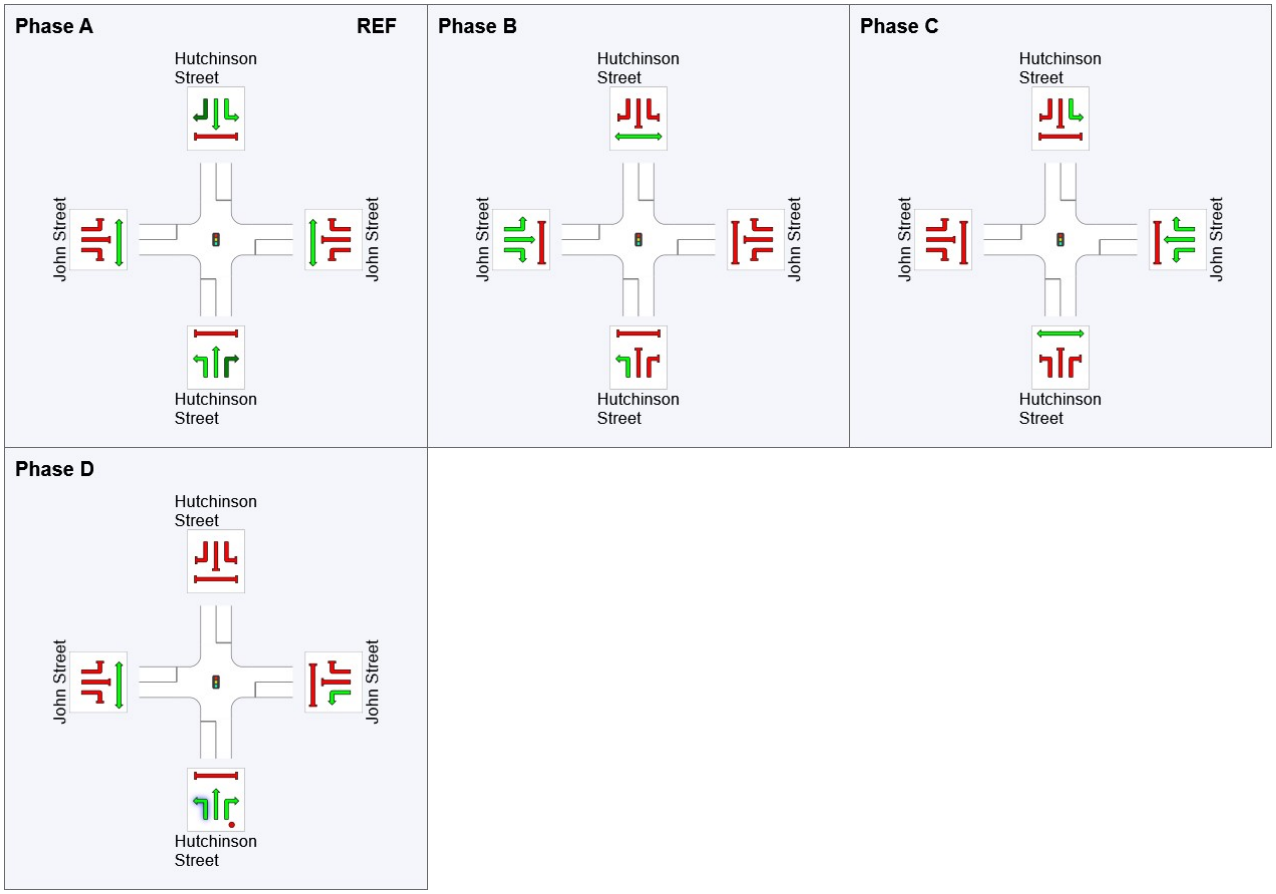
	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	826	809	17
E: John Street	350	343	7
N: Hutchinson Street	368	361	7
W: John Street	802	786	16
Total	2346	2299	47

Phase Timing Summary

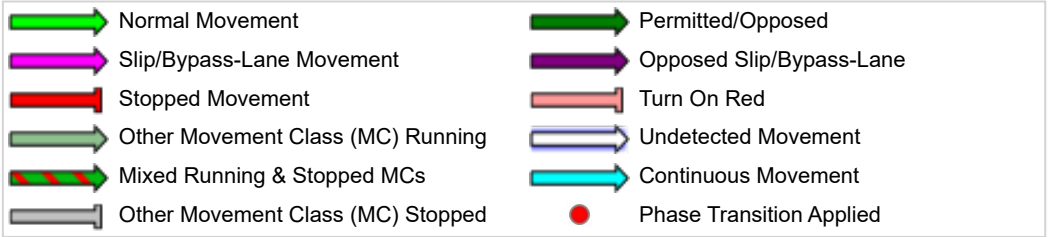
Phase	A	B	C	D
Phase Change Time (sec)	0	22	47	64
Green Time (sec)	17	19	11	10
Phase Time (sec)	23	25	17	15
Phase Split	29%	31%	21%	19%

See the Phase Information section in the Detailed Output 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, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	649	2.0	674[1]	0.963	100	59.1	LOS E	36.5	259.8	Full	500	0.0	0.0
Lane 2	220	2.0	355	0.619	100	25.7	LOS C	6.3	44.6	Short	60	0.0	NA
Approach	869	2.0		0.963		50.7	LOS D	36.5	259.8				
East: John Street													
Lane 1	116	2.0	563	0.206	100	26.5	LOS C	3.4	23.9	Short	130	0.0	NA
Lane 2	253	2.0	259	0.976	100	67.6	LOS E	14.3	101.5	Full	155	0.0	0.0
Approach	368	2.0		0.976		54.7	LOS D	14.3	101.5				
North: Hutchinson Street													
Lane 1	100	2.0	442	0.227	24[6]	17.4	LOS B	1.8	13.1	Short (P)	25	0.0	NA
Lane 2	287	2.0	299[1]	0.961	100	63.3	LOS E	15.6	111.3	Full	120	0.0	0.0
Approach	387	2.0		0.961		51.4	LOS D	15.6	111.3				
West: John Street													
Lane 1	425	2.0	446	0.953	100	57.7	LOS E	23.1	164.6	Full	185	0.0	1.3[8]
Lane 2	419	2.0	428	0.979	100	72.6	LOS E	25.0	177.6	Short	70	0.0	NA
Approach	844	2.0		0.979		65.1	LOS E	25.0	177.6				
Intersection	2469	2.0		0.979		56.3	LOS E	36.5	259.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects
8 Probability of Blockage has been set on the basis of a queue that overflows from a short lane.

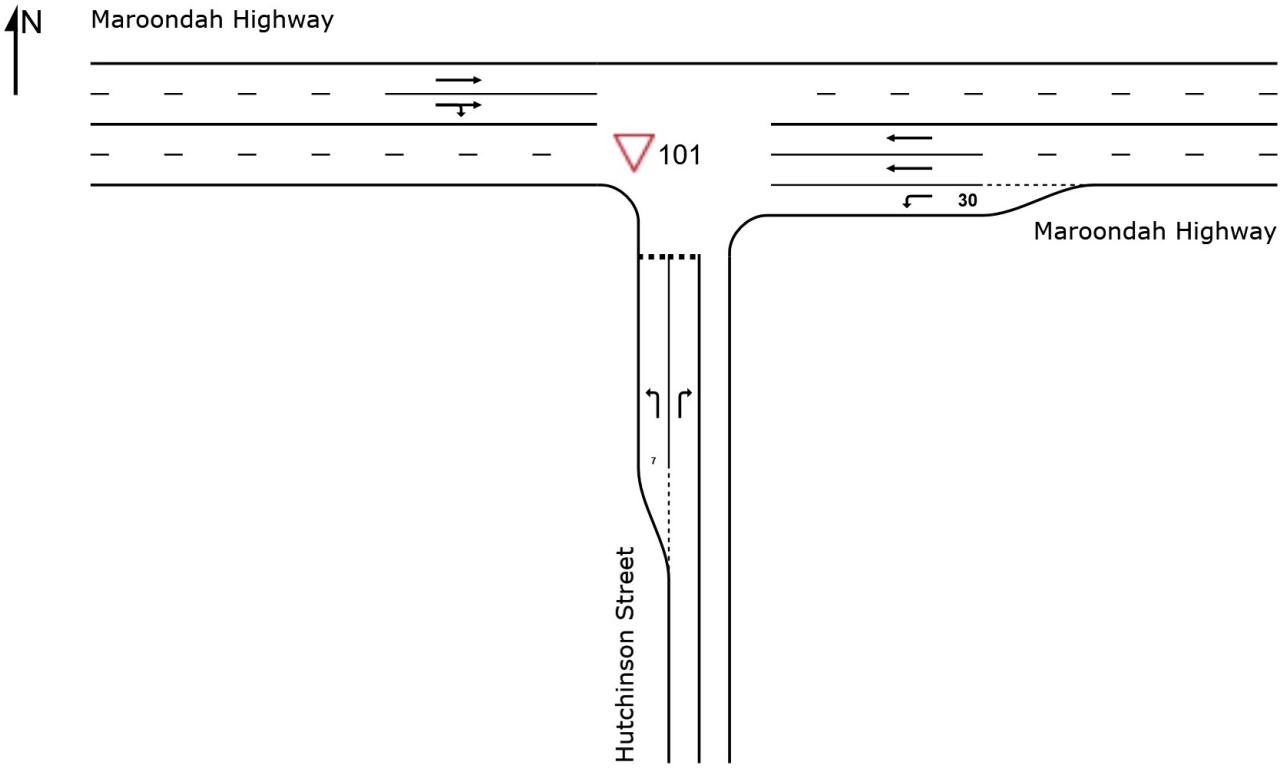
USER REPORT FOR SITE

Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 101 [Hutchinson St/Maroondah Hwy (PJ 2020, AM)]

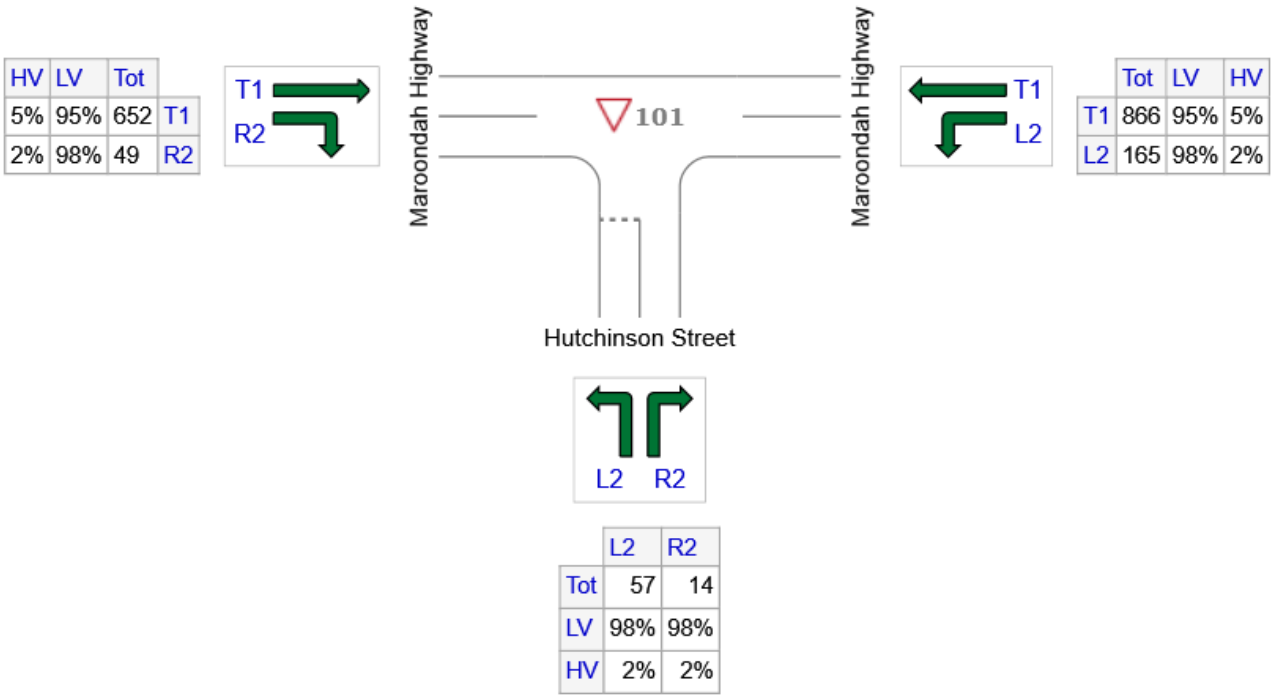
New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	71	70	1
E: Maroondah Highway	1031	984	47
W: Maroondah Highway	701	667	34
Total	1803	1721	82

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	60	2.0	845	0.071	100	6.9	LOS A	0.3	2.0	Short	7	0.0	NA
Lane 2	15	2.0	77	0.191	100	52.5	LOS F	0.6	4.0	Full	500	0.0	0.0
Approach	75	2.0		0.191		15.9	LOS C	0.6	4.0				
East: Maroondah Highway													
Lane 1	174	2.0	1831	0.095	100	4.6	LOS A	0.0	0.0	Short	30	0.0	NA
Lane 2	456	5.0	1889	0.241	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	456	5.0	1889	0.241	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1085	4.5		0.241		0.8	NA	0.0	0.0				
West: Maroondah Highway													
Lane 1	500	5.0	1889	0.265	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	238	4.4	900	0.265	100	10.3	LOS B	1.9	13.8	Full	500	0.0	0.0
Approach	738	4.8		0.265		3.3	NA	1.9	13.8				
Intersection	1898	4.5		0.265		2.4	NA	1.9	13.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

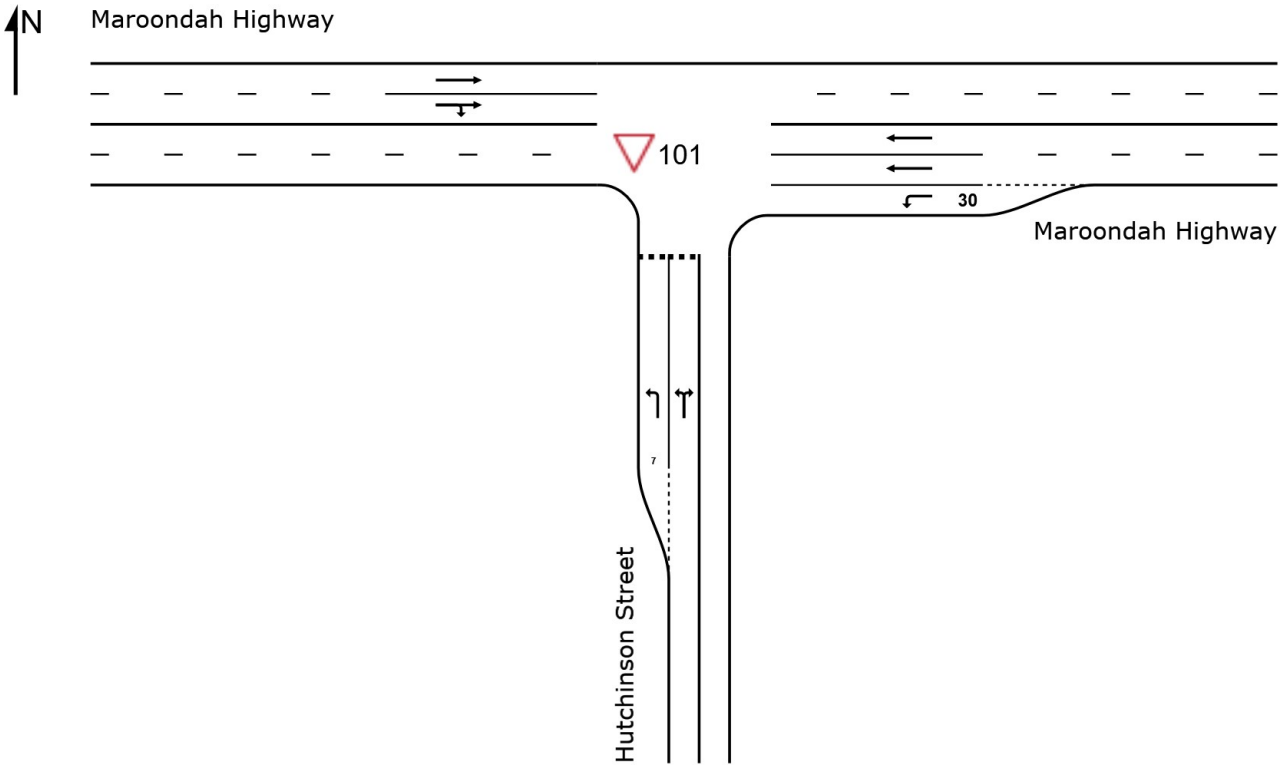
USER REPORT FOR SITE

Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 101 [Hutchinson St/Maroondah Hwy (PJ 2020, PM)]

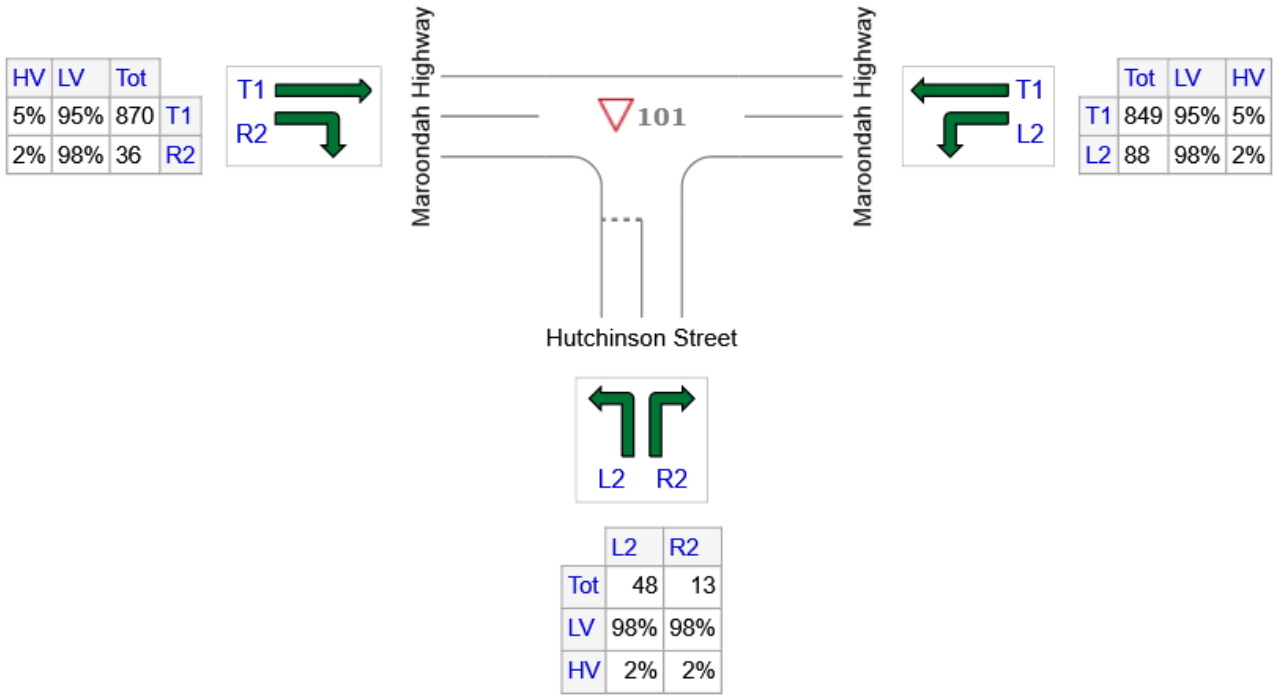
New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	61	60	1
E: Maroondah Highway	937	893	44
W: Maroondah Highway	906	862	44
Total	1904	1814	90

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	51	2.0	854	0.059	24[5]	6.8	LOS A	0.2	1.7	Short	7	0.0	NA
Lane 2	14	2.0	55	0.250	100	76.6	LOS F	0.7	5.2	Full	500	0.0	0.0
Approach	64	2.0		0.250		21.7	LOS C	0.7	5.2				
East: Maroondah Highway													
Lane 1	93	2.0	1831	0.051	100	4.6	LOS A	0.0	0.0	Short	30	0.0	NA
Lane 2	447	5.0	1889	0.237	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	447	5.0	1889	0.237	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	986	4.7		0.237		0.5	NA	0.0	0.0				
West: Maroondah Highway													
Lane 1	563	5.0	1889	0.298	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	391	4.7	1313	0.298	100	5.1	LOS A	1.7	12.3	Full	500	0.0	0.0
Approach	954	4.9		0.298		2.1	NA	1.7	12.3				
Intersection	2004	4.7		0.298		1.9	NA	1.7	12.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

5 Lane under-utilisation found by the program

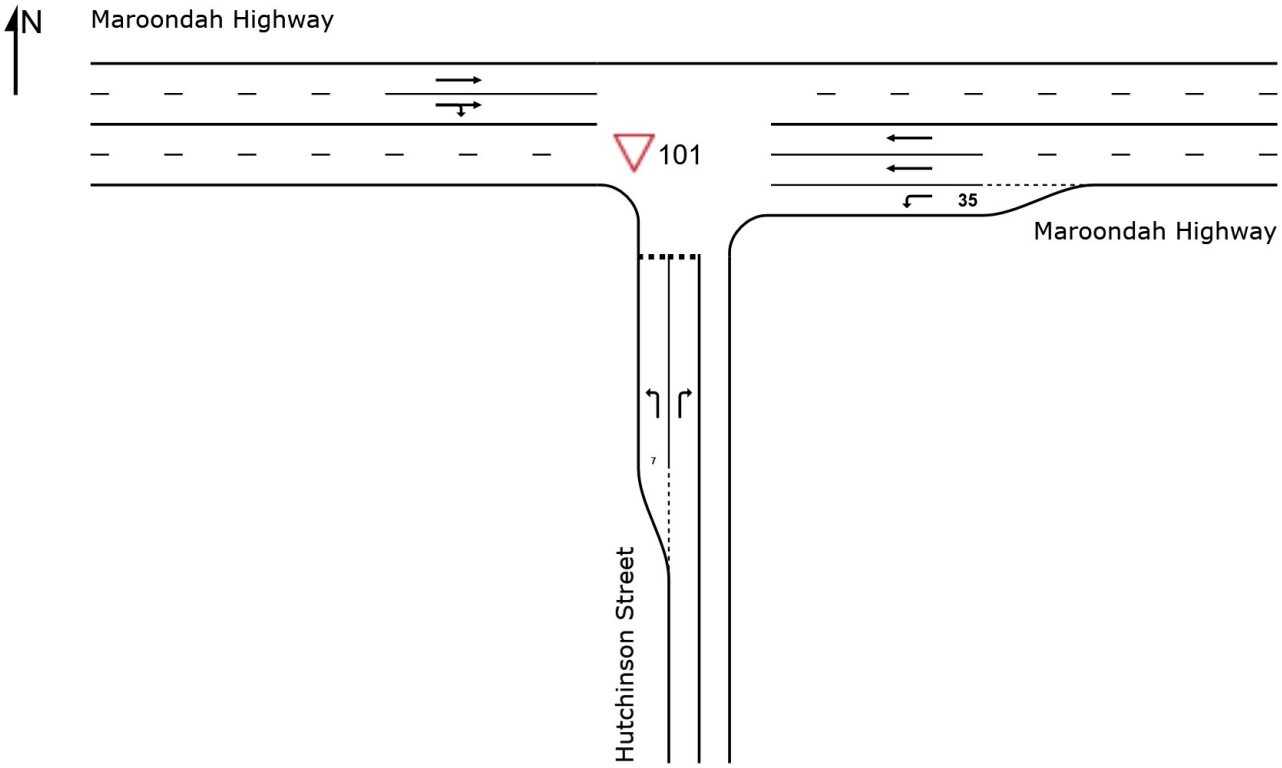
USER REPORT FOR SITE

Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 101 [Hutchinson St/Maroondah Hwy (AP 2020, AM)]

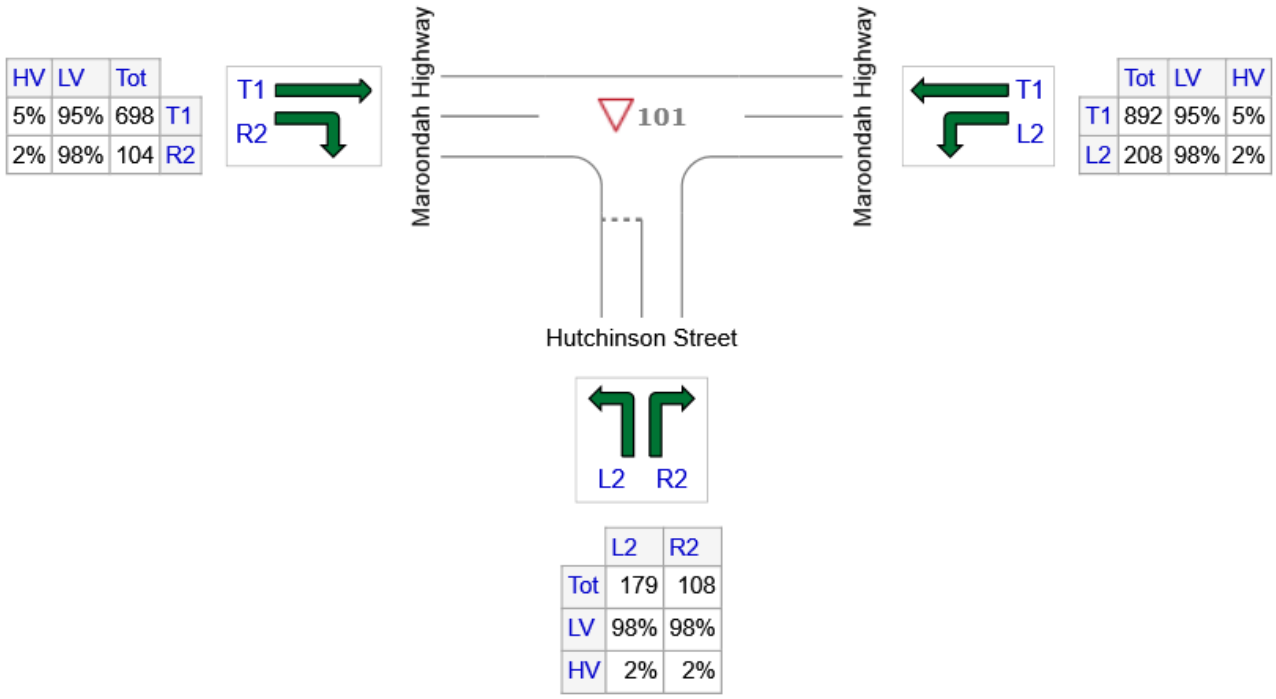
New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	287	281	6
E: Maroondah Highway	1100	1051	49
W: Maroondah Highway	802	765	37
Total	2189	2098	91

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	188	2.0	832	0.227	100	7.3	LOS A	1.0	7.0	Short	7	0.0	NA
Lane 2	114	2.0	51	2.221	100	1173.8	LOS F	45.9	326.7	Full	500	0.0	0.0
Approach	302	2.0		2.221		446.3	LOS F	45.9	326.7				
East: Maroondah Highway													
Lane 1	219	2.0	1831	0.120	100	4.6	LOS A	0.0	0.0	Short	35	0.0	NA
Lane 2	469	5.0	1889	0.249	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	469	5.0	1889	0.249	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1158	4.4		0.249		0.9	NA	0.0	0.0				
West: Maroondah Highway													
Lane 1	712	5.0	1889	0.377	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	132	2.5	351	0.377	100	19.0	LOS C	1.7	11.9	Full	500	0.0	0.0
Approach	844	4.6		0.377		3.0	NA	1.7	11.9				
Intersection	2304	4.2		2.221		60.1	NA	45.9	326.7				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

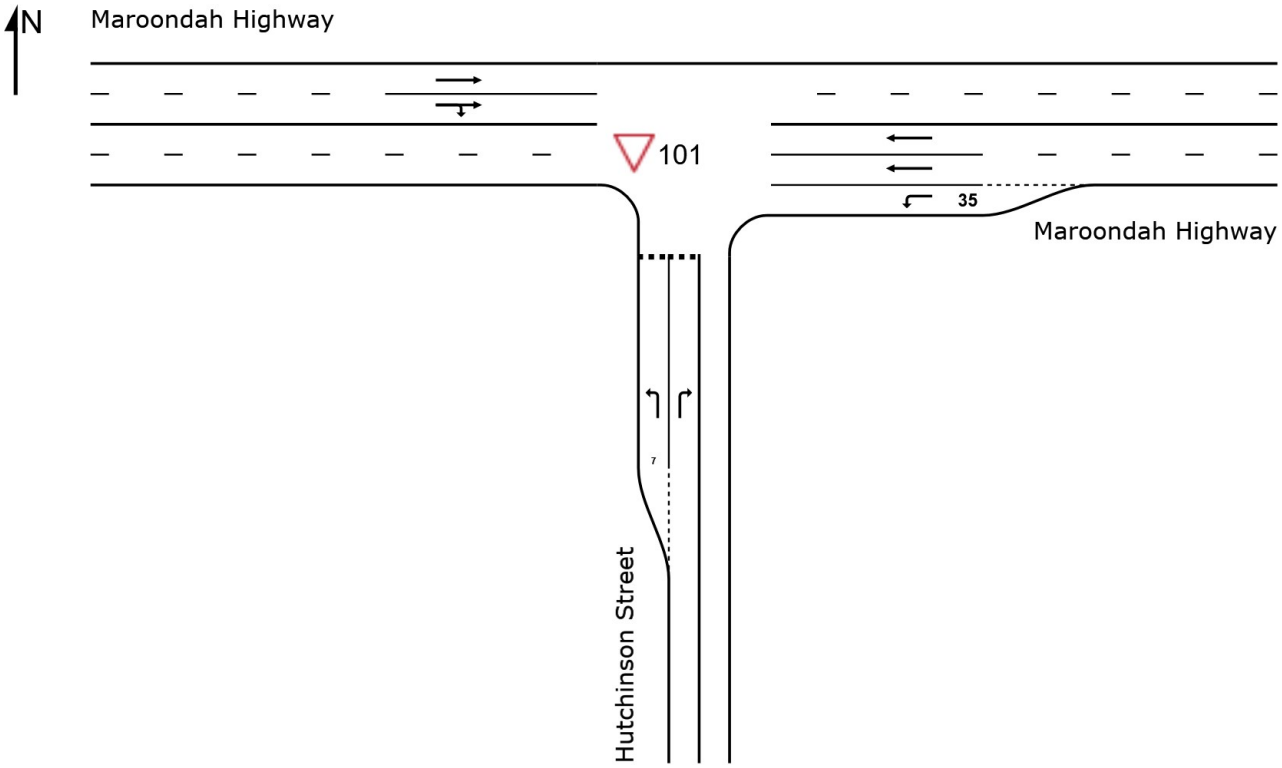
USER REPORT FOR SITE

Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 101 [Hutchinson St/Maroondah Hwy (AP 2020, PM)]

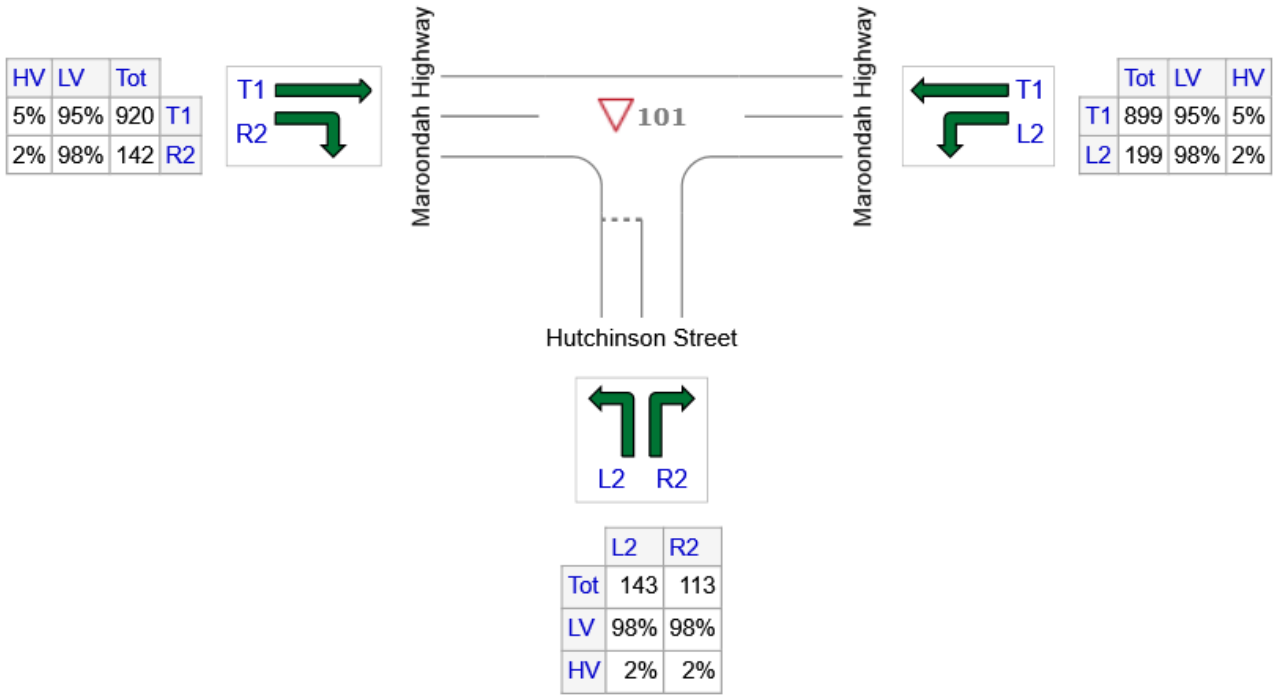
New Site
Site Category: (None)
Giveway / Yield (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	256	251	5
E: Maroondah Highway	1098	1049	49
W: Maroondah Highway	1062	1013	49
Total	2416	2313	103

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	151	2.0	828	0.182	100	7.3	LOS A	0.8	5.4	Short	7	0.0	NA
Lane 2	119	2.0	23	5.157	100	3824.2	LOS F	73.5	523.2	Full	500	0.0	6.4
Approach	269	2.0		5.157		1692.1	LOS F	73.5	523.2				
East: Maroondah Highway													
Lane 1	209	2.0	1831	0.114	100	4.6	LOS A	0.0	0.0	Short	35	0.0	NA
Lane 2	473	5.0	1889	0.251	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 3	473	5.0	1889	0.251	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1156	4.5		0.251		0.9	NA	0.0	0.0				
West: Maroondah Highway													
Lane 1	958	5.0	1889	0.507	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	160	2.2	315	0.507	100	21.5	LOS C	2.3	16.0	Full	500	0.0	0.0
Approach	1118	4.6		0.507		3.2	NA	2.3	16.0				
Intersection	2543	4.3		5.157		181.1	NA	73.5	523.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

USER REPORT FOR SITE

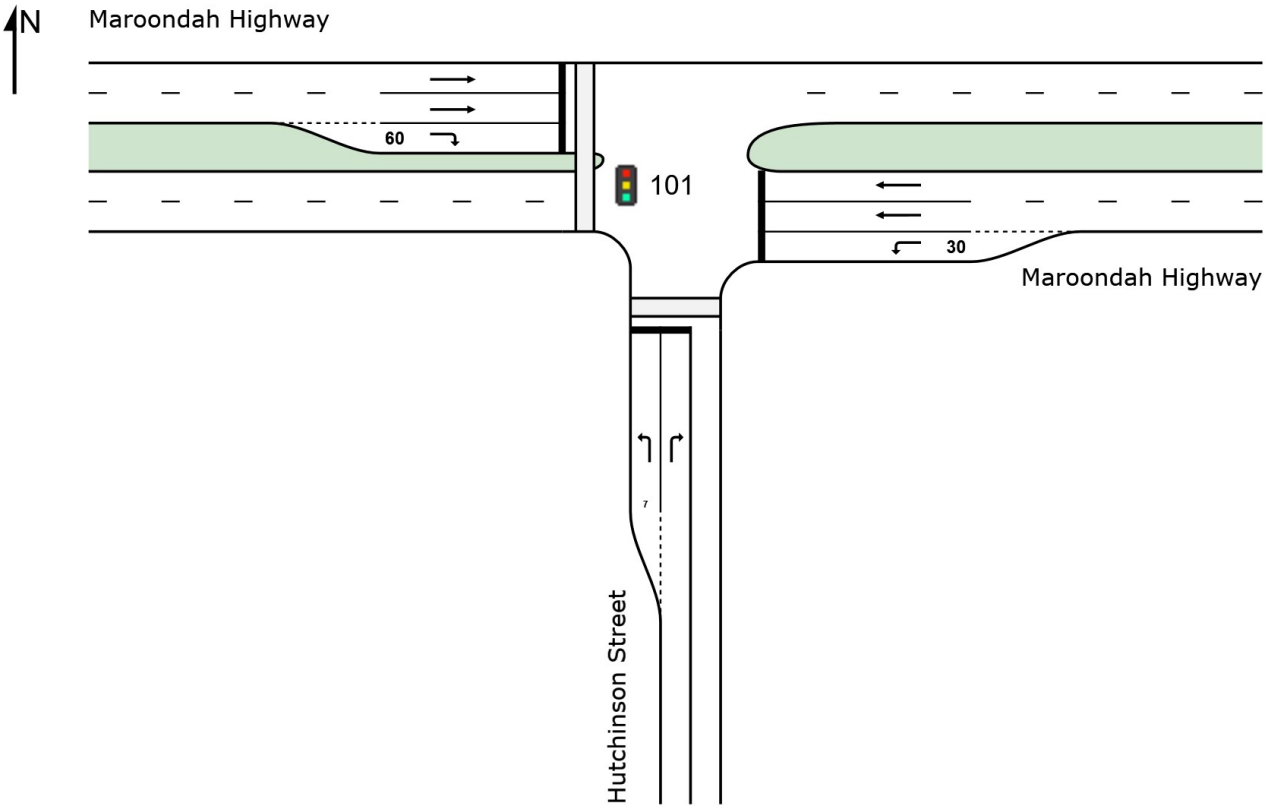
Project: 210507_V159104_FutureLayoutFutureVolumes2020 CARDNO Layout **Template: GTA Appendix Site**

Site: 101 [Hutchinson St/Maroondah Hwy (2020, AM) - Signals]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 130 seconds (Site User-Given Cycle Time)

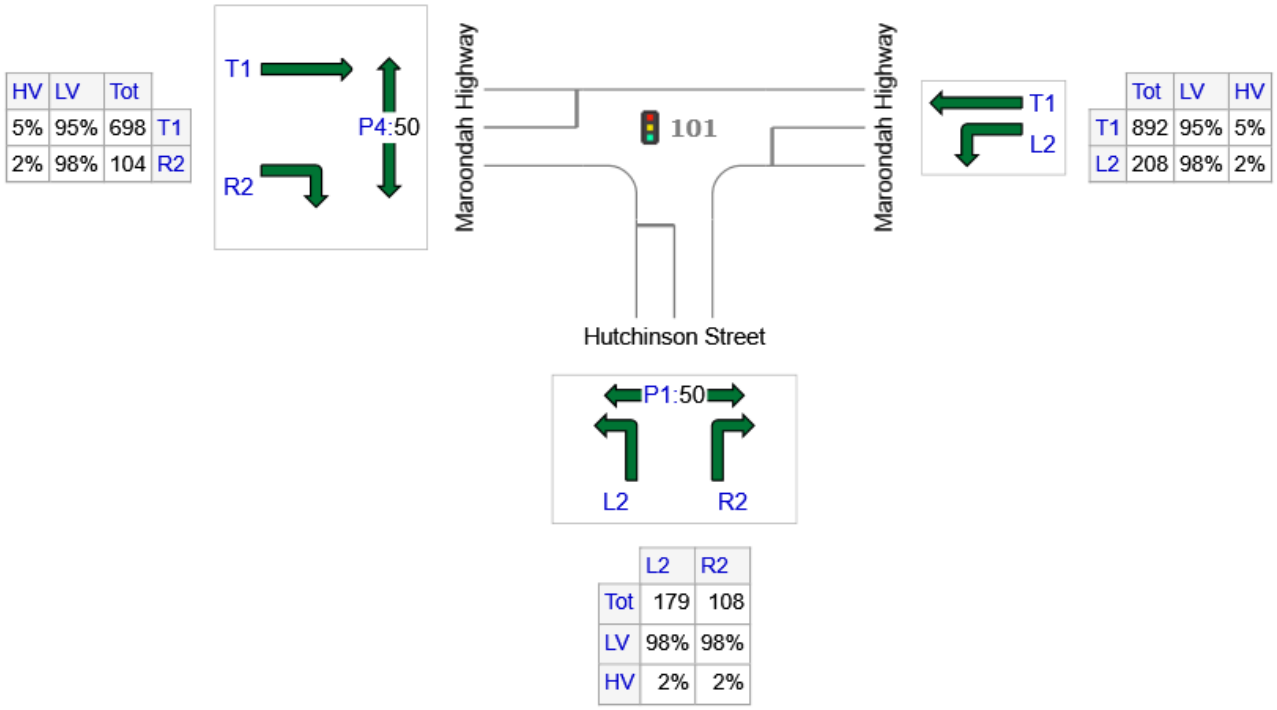
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout



Input Volumes

Volume Display Method: Total and %



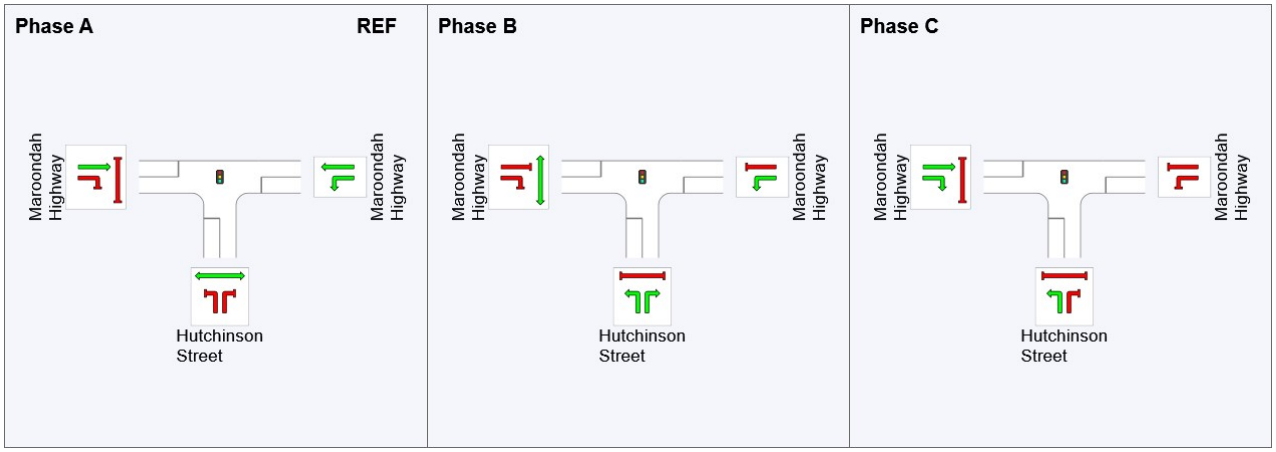
	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	287	281	6
E: Maroondah Highway	1100	1051	49
W: Maroondah Highway	802	765	37
Total	2189	2098	91

Phase Timing Summary

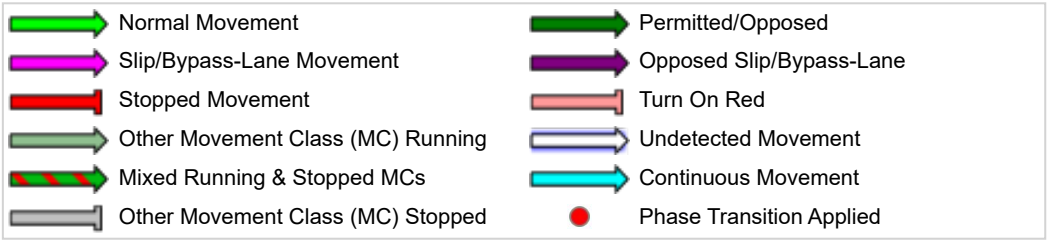
Phase	A	B	C
Phase Change Time (sec)	0	72	110
Green Time (sec)	66	32	14
Phase Time (sec)	72	38	20
Phase Split	55%	29%	15%

See the Phase Information section in the Detailed Output 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, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	188	2.0	496[1]	0.380	100	33.3	LOS C	7.9	56.2	Short	7	0.0	NA
Lane 2	114	2.0	206[1]	0.552	100	47.9	LOS D	5.8	41.2	Full	120	0.0	0.0
Approach	302	2.0		0.552		38.8	LOS D	7.9	56.2				
East: Maroondah Highway													
Lane 1	219	2.0	1465	0.149	100	8.6	LOS A	3.1	21.8	Short	30	0.0	NA
Lane 2	403	5.0	722[1]	0.559	100	21.2	LOS C	15.7	115.0	Full	500	0.0	0.0
Lane 3	536	5.0	959	0.559	100	23.3	LOS C	23.0	167.8	Full	500	0.0	0.0
Approach	1158	4.4		0.559		19.8	LOS B	23.0	167.8				
West: Maroondah Highway													
Lane 1	367	5.0	1249	0.294	100	9.7	LOS A	9.6	69.8	Full	500	0.0	0.0
Lane 2	367	5.0	1249	0.294	100	9.7	LOS A	9.6	69.8	Full	500	0.0	0.0
Lane 3	109	2.0	197	0.555	100	66.8	LOS E	6.8	48.5	Short	60	0.0	NA
Approach	844	4.6		0.555		17.1	LOS B	9.6	69.8				
Intersection	2304	4.2		0.559		21.3	LOS C	23.0	167.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

USER REPORT FOR SITE

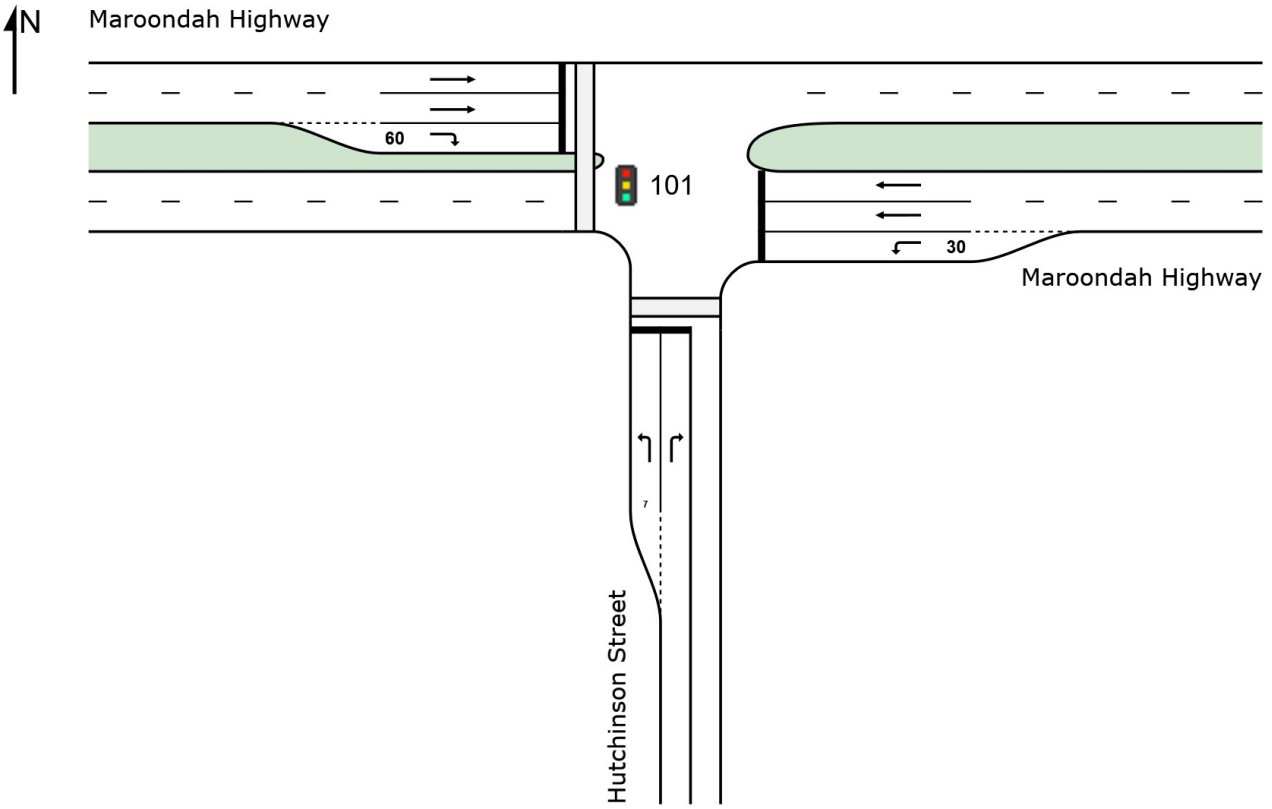
Project: 210507_V159104_FutureLayoutFutureVolumes2020 CARDNO Layout **Template: GTA Appendix Site**

Site: 101 [Hutchinson St/Maroondah Hwy (2020, PM) - Signals]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 130 seconds (Site User-Given Cycle Time)

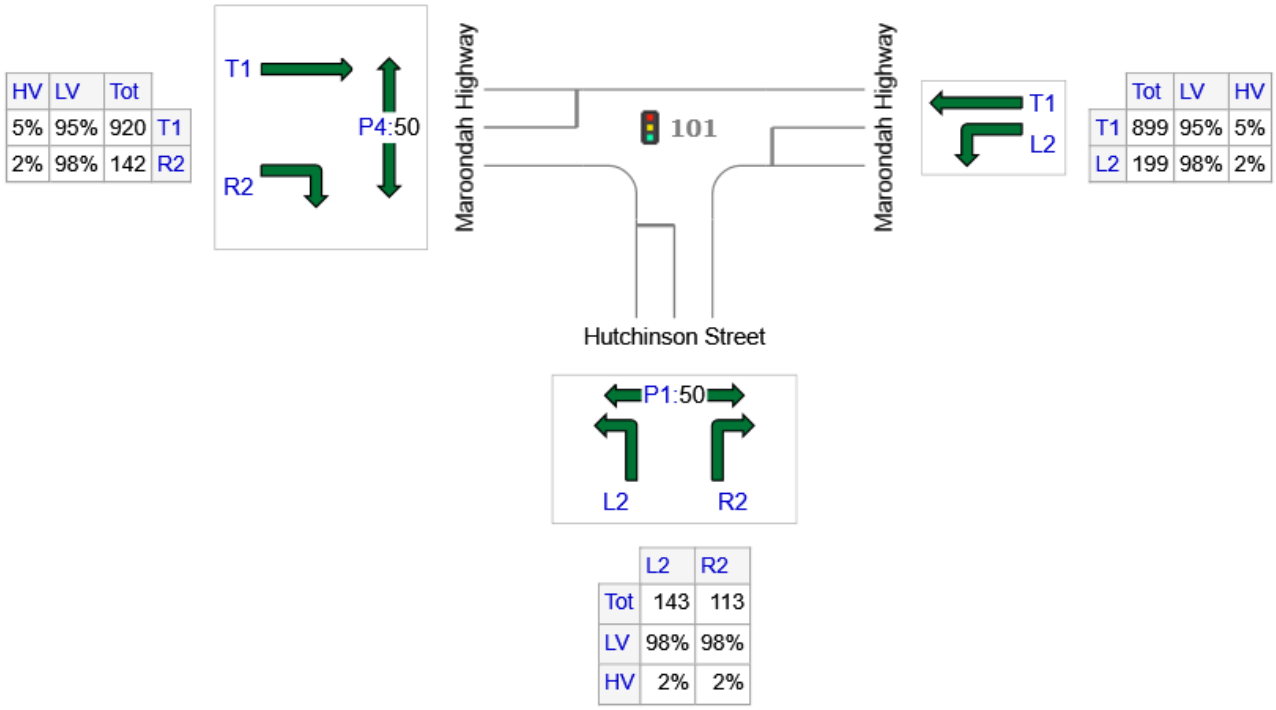
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout



Input Volumes

Volume Display Method: Total and %



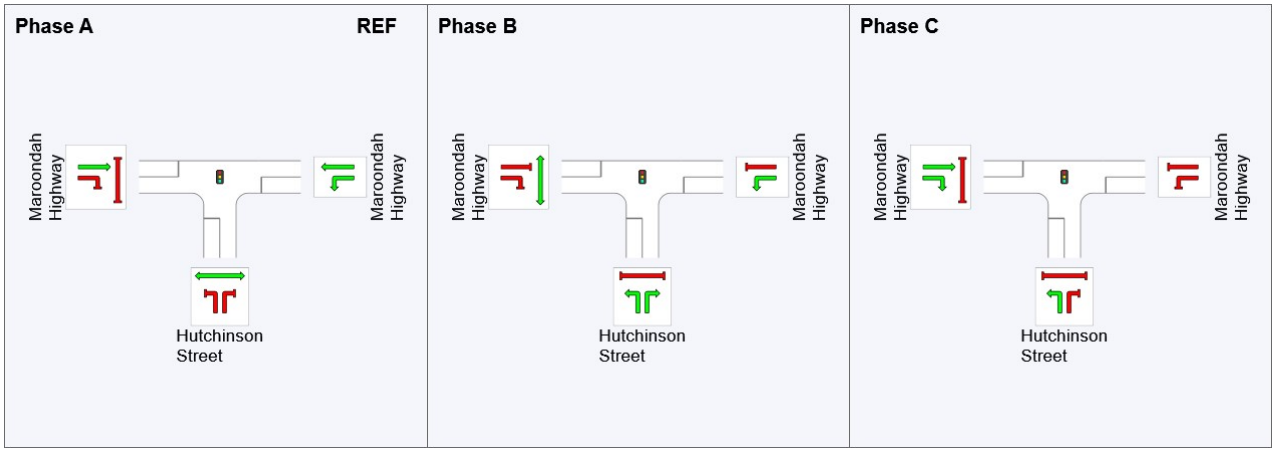
	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	256	251	5
E: Maroondah Highway	1098	1049	49
W: Maroondah Highway	1062	1013	49
Total	2416	2313	103

Phase Timing Summary

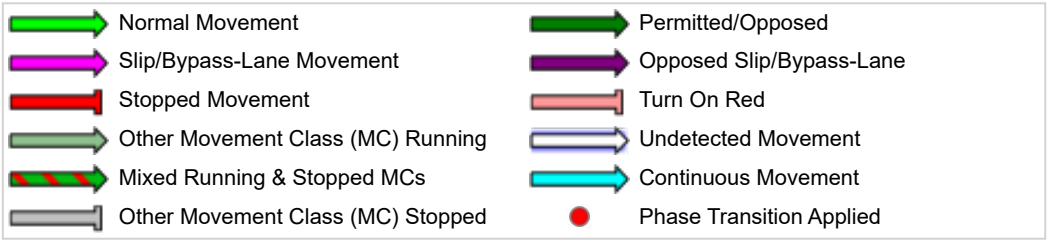
Phase	A	B	C
Phase Change Time (sec)	0	70	105
Green Time (sec)	64	29	19
Phase Time (sec)	70	35	25
Phase Split	54%	27%	19%

See the Phase Information section in the Detailed Output 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, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	151	2.0	484[1]	0.311	100	31.2	LOS C	6.0	42.6	Short	7	0.0	NA
Lane 2	119	2.0	212[1]	0.562	100	50.9	LOS D	6.3	44.8	Full	120	0.0	0.0
Approach	269	2.0		0.562		39.9	LOS D	6.3	44.8				
East: Maroondah Highway													
Lane 1	209	2.0	1394	0.150	100	9.9	LOS A	3.5	24.7	Short	30	0.0	NA
Lane 2	408	5.0	704[1]	0.579	100	22.6	LOS C	16.5	120.4	Full	500	0.0	0.0
Lane 3	538	5.0	930	0.579	100	24.9	LOS C	23.9	174.5	Full	500	0.0	0.0
Approach	1156	4.5		0.579		21.4	LOS C	23.9	174.5				
West: Maroondah Highway													
Lane 1	484	5.0	1293	0.374	100	9.1	LOS A	12.7	92.9	Full	500	0.0	0.0
Lane 2	484	5.0	1293	0.374	100	9.1	LOS A	12.7	92.9	Full	500	0.0	0.0
Lane 3	149	2.0	268	0.559	100	62.3	LOS E	9.0	64.2	Short	60	0.0	NA
Approach	1118	4.6		0.559		16.3	LOS B	12.7	92.9				
Intersection	2543	4.3		0.579		21.1	LOS C	23.9	174.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

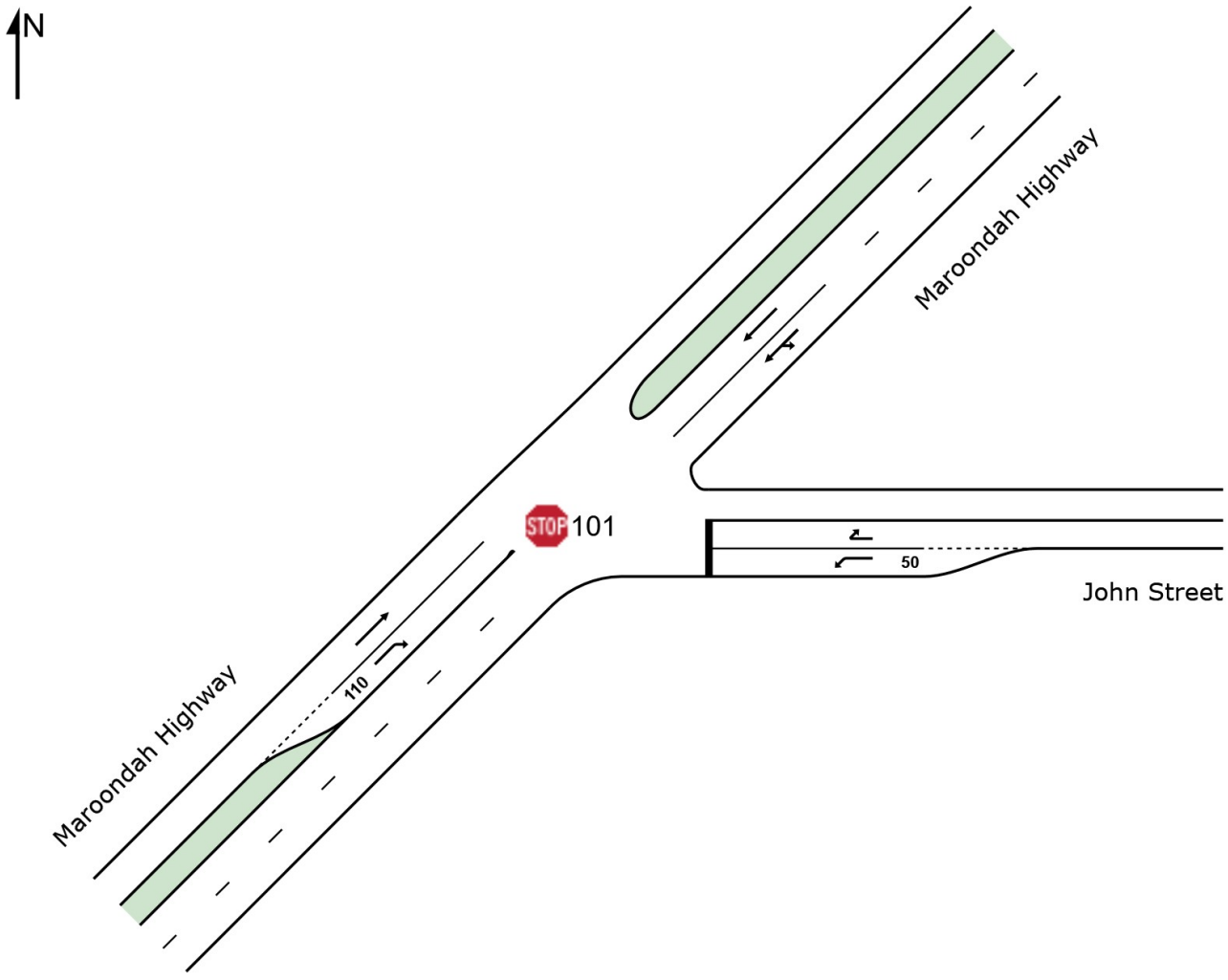
USER REPORT FOR SITE

Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 101 [Maroondah Hwy/John St (PJ 2020, AM)]

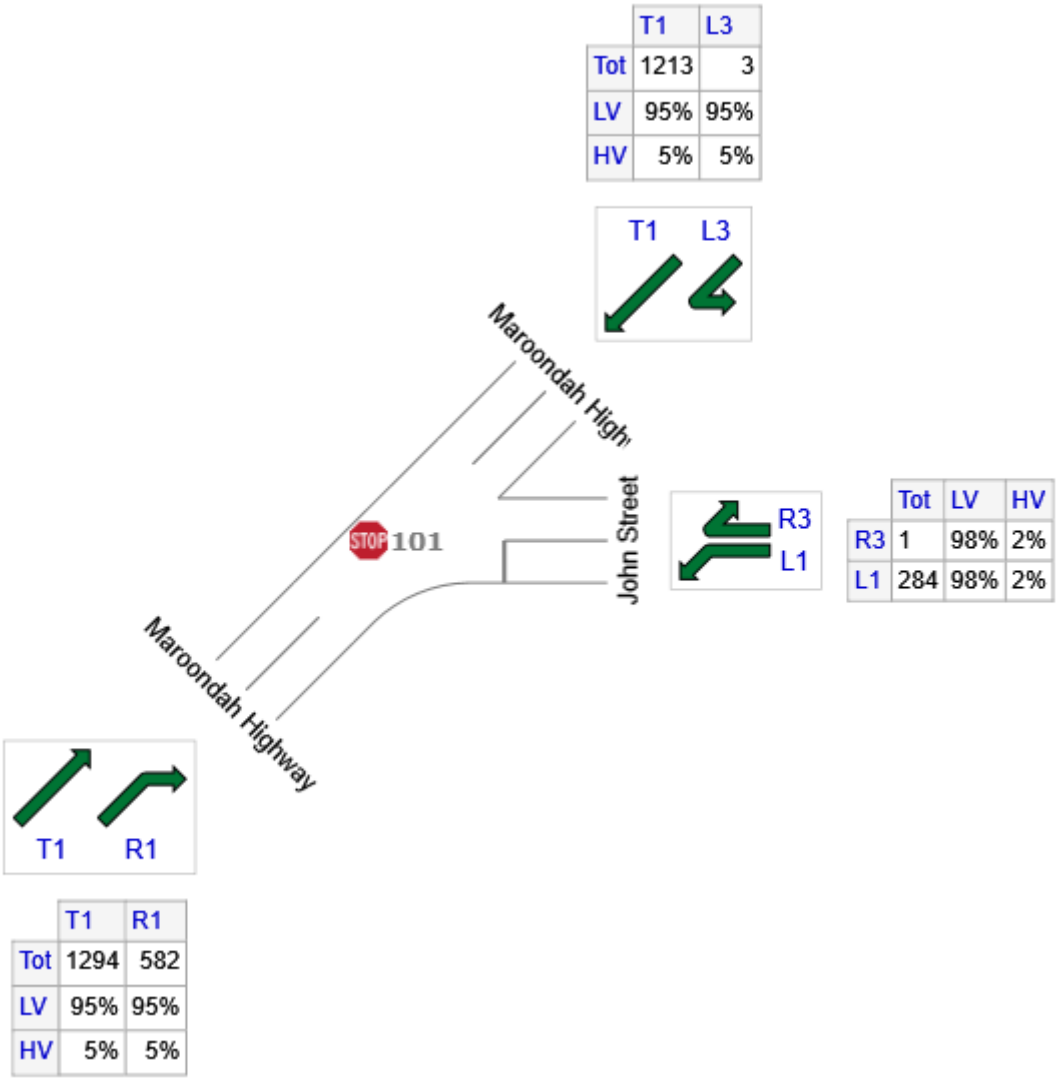
New Site
Site Category: (None)
Stop (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
E: John Street	285	279	6
NE: Maroondah Highway	1216	1155	61
SW: Maroondah Highway	1876	1782	94
Total	3377	3217	160

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: John Street													
Lane 1	299	2.0	566	0.528	100	16.4	LOS C	3.5	25.0	Short	50	0.0	NA
Lane 2	1	2.0	1	1.000[4]	100	4504.0	LOS F	2.3	16.4	Full	500	0.0	0.0
Approach	300	2.0		1.000		32.1	LOS D	3.5	25.0				
NorthEast: Maroondah Highway													
Lane 1	640	5.0	1906	0.336	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	640	5.0	1908	0.336	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1280	5.0		0.336		0.1	NA	0.0	0.0				
SouthWest: Maroondah Highway													
Lane 1	1362	5.0	923[15]	1.475	100	444.2	LOS F	299.2	2184.1	Full	500	0.0	100.0
Lane 2	613	5.0	337	1.818	100	754.1	LOS F	180.0	1314.4	Short	110	0.0	NA
Approach	1975	5.0		1.818		540.4	NA	299.2	2184.1				
Intersection	3555	4.7		1.818		302.9	NA	299.2	2184.1				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

4 x = 1.00 due to minimum capacity
15 Continuous lane capacity reduced due to overflow of an opposed movement in an adjacent short lane.

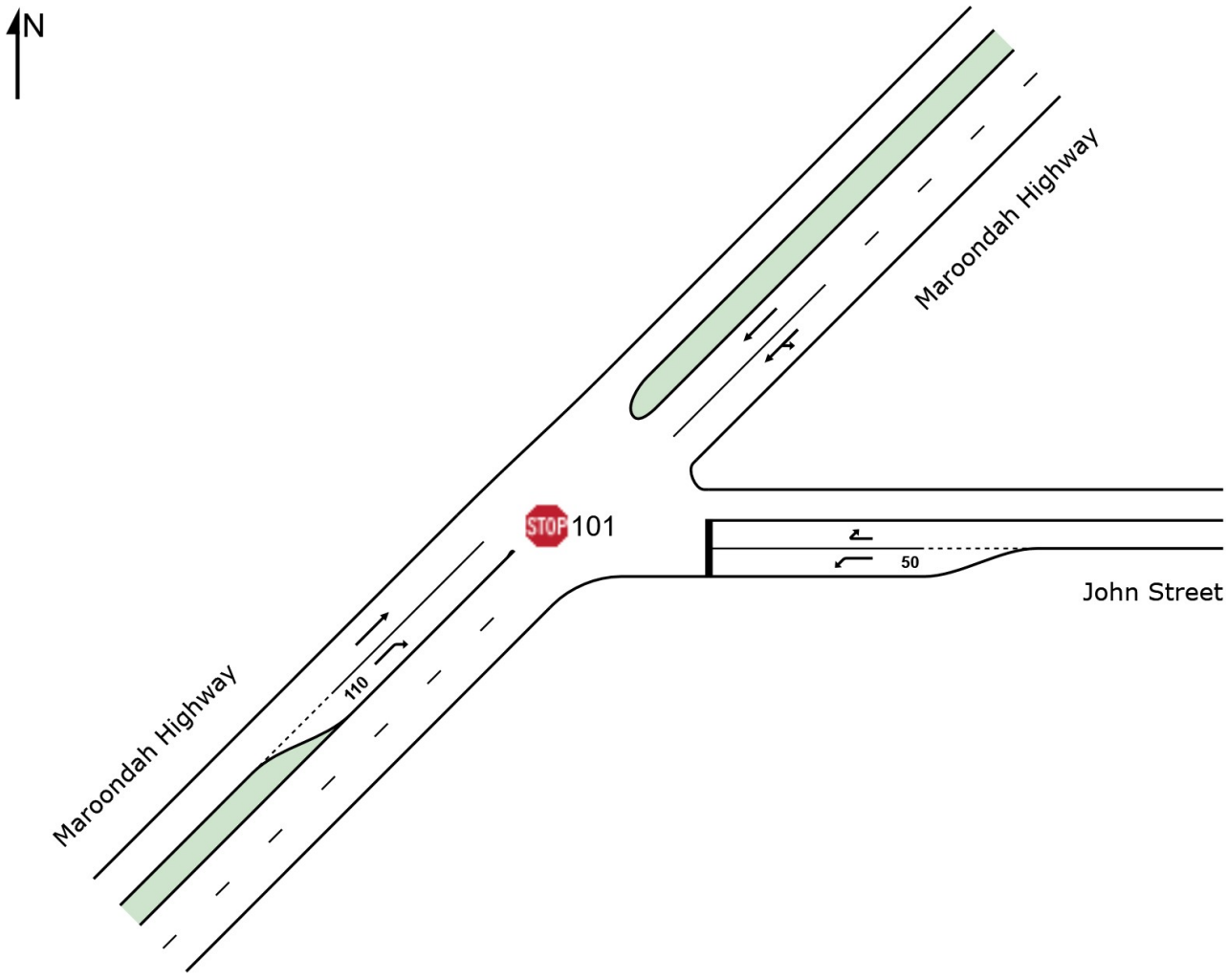
USER REPORT FOR SITE

Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 101 [Maroondah Hwy/John St (PJ 2020, PM)]

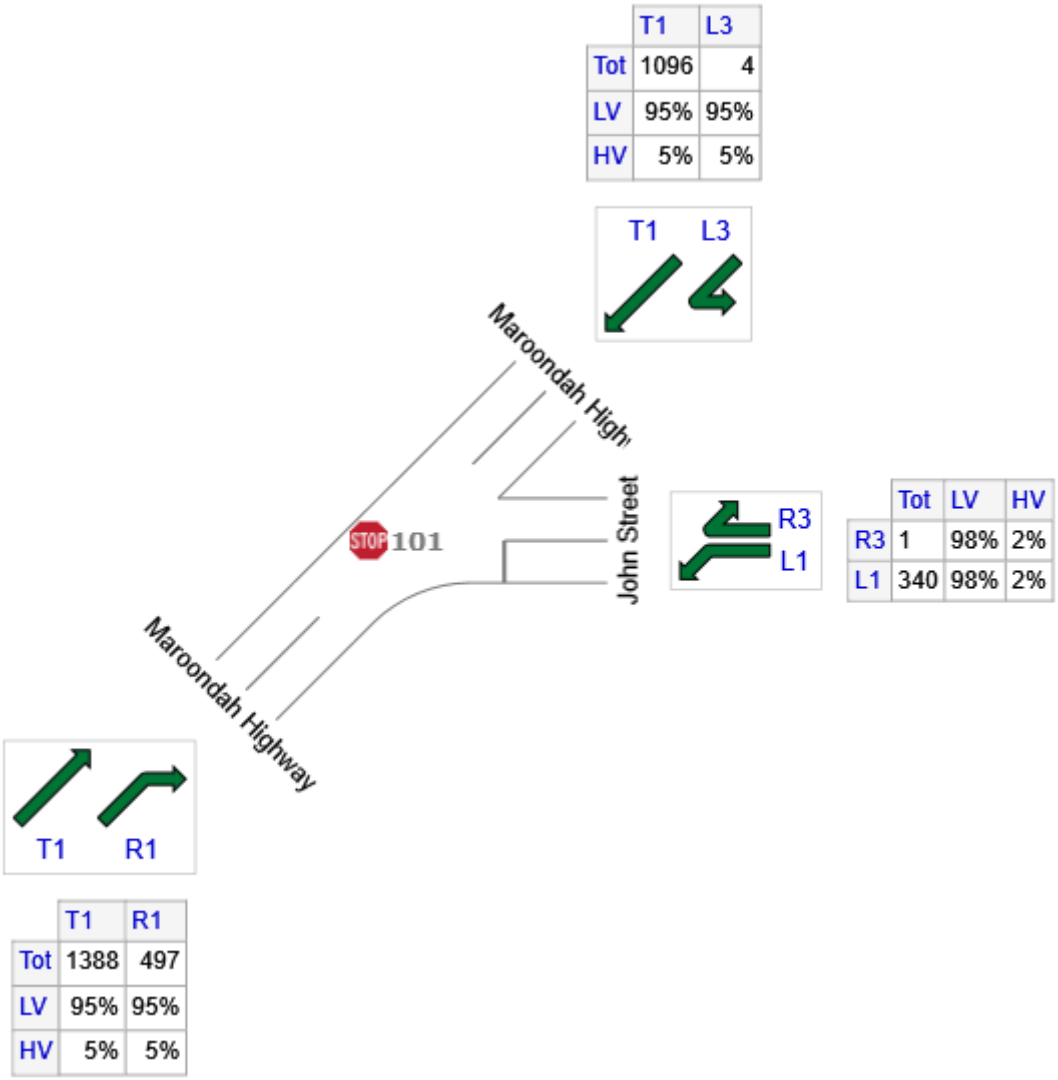
New Site
Site Category: (None)
Stop (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
E: John Street	341	334	7
NE: Maroondah Highway	1100	1045	55
SW: Maroondah Highway	1885	1791	94
Total	3326	3170	156

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: John Street													
Lane 1	358	2.0	620	0.577	100	16.1	LOS C	4.4	31.5	Short	50	0.0	NA
Lane 2	1	2.0	1	0.891	100	4012.3	LOS F	2.1	14.7	Full	500	0.0	0.0
Approach	359	2.0		0.891		27.8	LOS D	4.4	31.5				
NorthEast: Maroondah Highway													
Lane 1	579	5.0	1905	0.304	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	579	5.0	1908	0.304	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1158	5.0		0.304		0.1	NA	0.0	0.0				
SouthWest: Maroondah Highway													
Lane 1	1461	5.0	1124[15]	1.299	100	286.0	LOS F	239.4	1747.8	Full	500	0.0	100.0
Lane 2	523	5.0	403	1.298	100	291.8	LOS F	83.6	610.6	Short	110	0.0	NA
Approach	1984	5.0		1.299		287.5	NA	239.4	1747.8				
Intersection	3501	4.7		1.299		165.8	NA	239.4	1747.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

15 Continuous lane capacity reduced due to overflow of an opposed movement in an adjacent short lane.

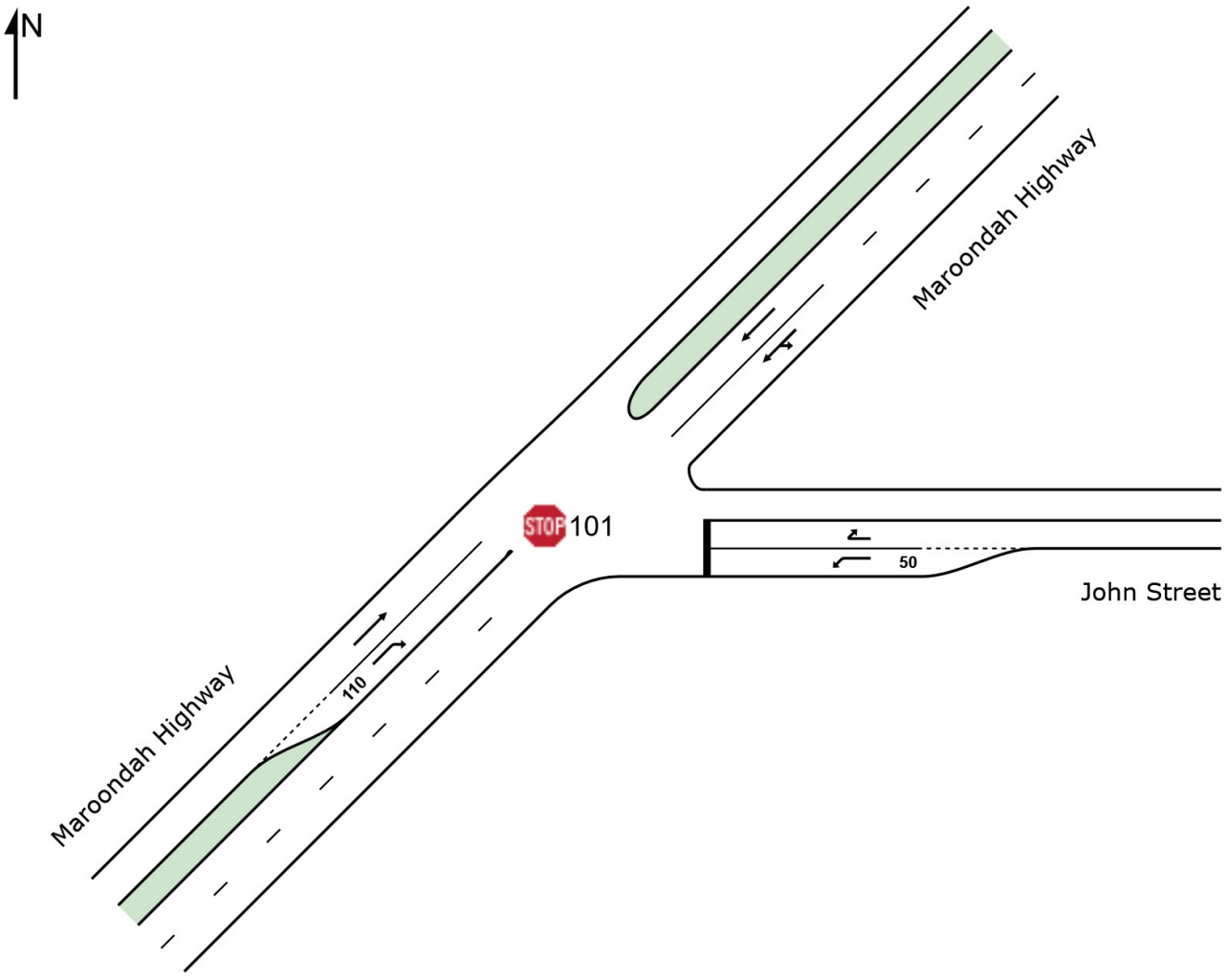
USER REPORT FOR SITE

Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 101 [Maroondah Hwy/John St (AP 2020, AM)]

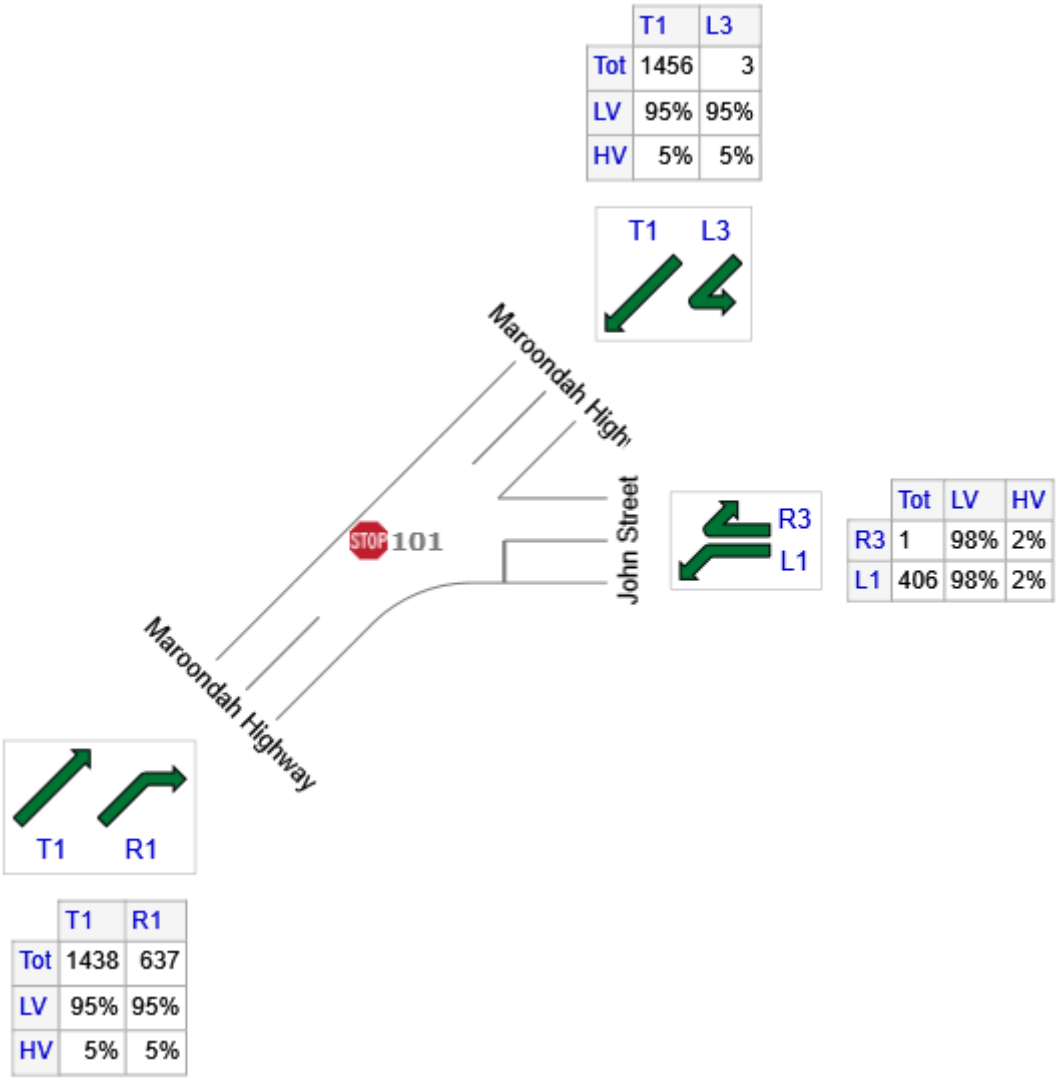
New Site
Site Category: (None)
Stop (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
E: John Street	407	399	8
NE: Maroondah Highway	1459	1386	73
SW: Maroondah Highway	2075	1971	104
Total	3941	3756	185

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: John Street													
Lane 1	427	2.0	463	0.923	100	41.6	LOS E	14.8	105.0	Short	50	0.0	NA
Lane 2	1	2.0	1	1.000[4]	100	3900.0	LOS F	2.0	14.3	Full	500	0.0	0.0
Approach	428	2.0		1.000		51.1	LOS F	14.8	105.0				
NorthEast: Maroondah Highway													
Lane 1	768	5.0	1907	0.403	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	768	5.0	1908	0.403	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1536	5.0		0.403		0.1	NA	0.0	0.0				
SouthWest: Maroondah Highway													
Lane 1	1514	5.0	687[15]	2.204	100	1101.1	LOS F	549.2	4009.4	Full	500	0.0	100.0
Lane 2	671	5.0	222	3.017	100	1832.6	LOS F	291.4	2126.9	Short	110	0.0	NA
Approach	2184	5.0		3.017		1325.6	NA	549.2	4009.4				
Intersection	4148	4.7		3.017		703.3	NA	549.2	4009.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
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SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

4 x = 1.00 due to minimum capacity
15 Continuous lane capacity reduced due to overflow of an opposed movement in an adjacent short lane.

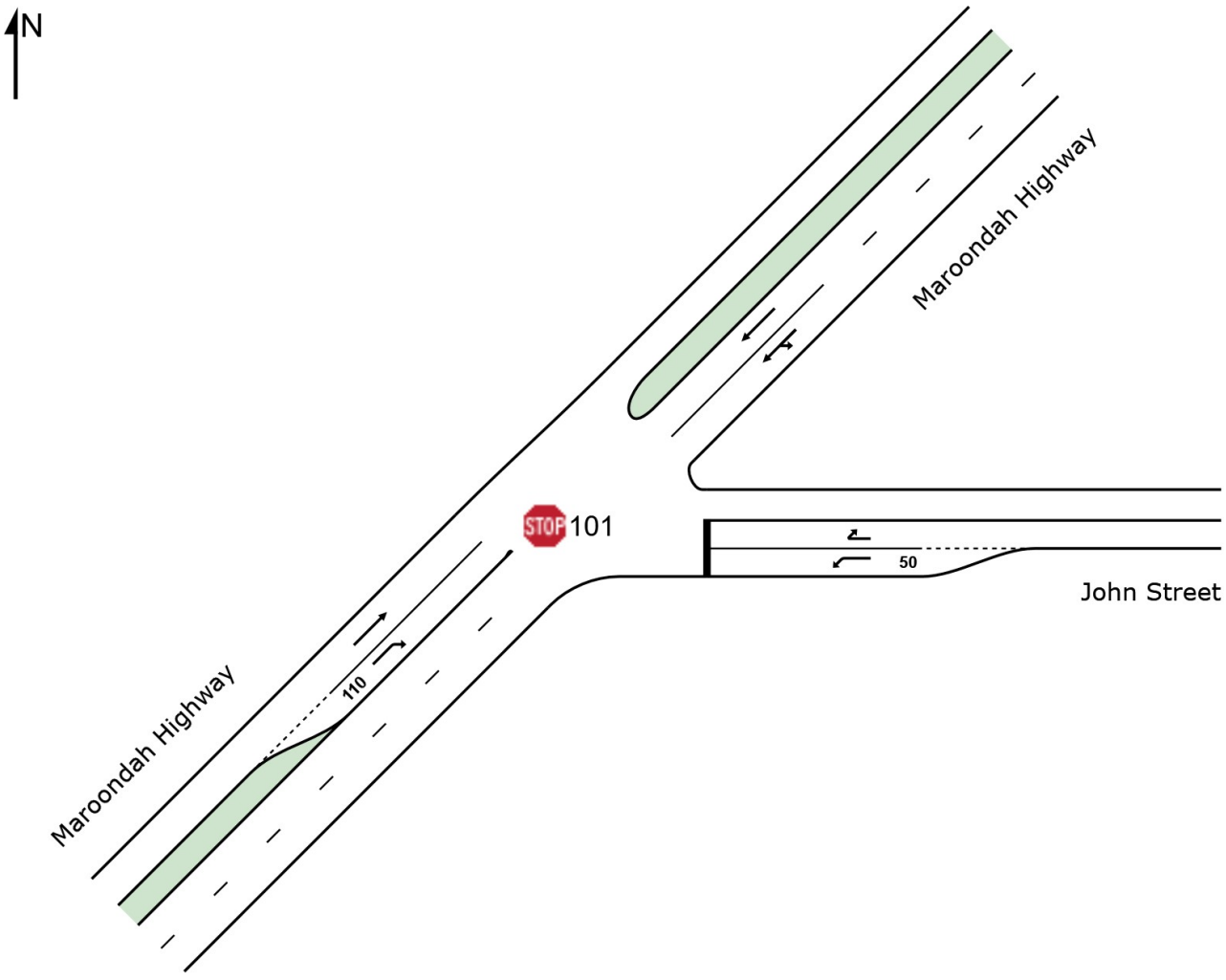
USER REPORT FOR SITE

Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 101 [Maroondah Hwy/John St (AP 2020, PM)]

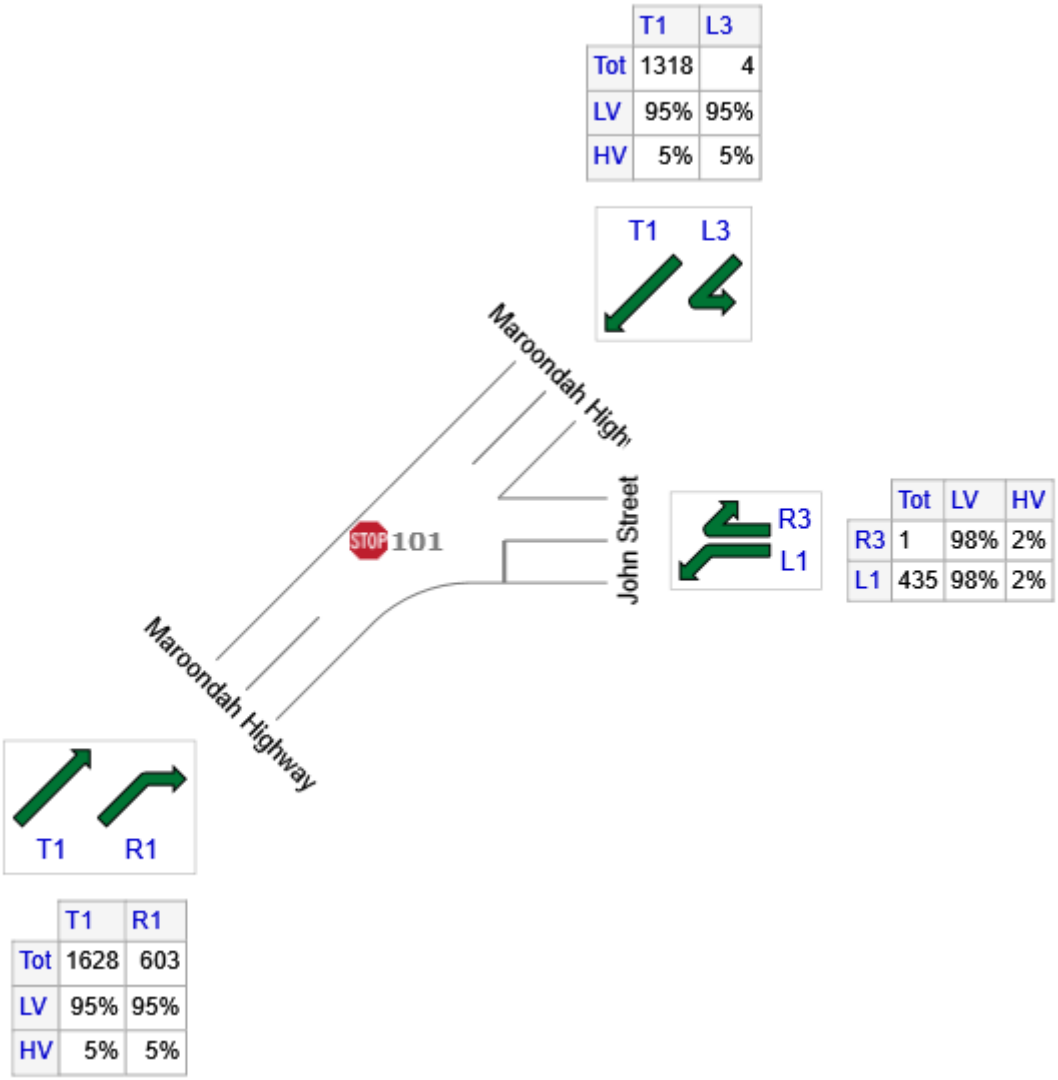
New Site
Site Category: (None)
Stop (Two-Way)

Site Layout



Input Volumes

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
E: John Street	436	427	9
NE: Maroondah Highway	1322	1256	66
SW: Maroondah Highway	2231	2119	112
Total	3989	3803	186

Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
East: John Street													
Lane 1	458	2.0	458	1.000	100	62.1	LOS F	21.9	155.6	Short	50	0.0	NA
Lane 2	1	2.0	1	1.000[4]	100	3609.2	LOS F	1.9	13.3	Full	500	0.0	0.0
Approach	459	2.0		1.000		70.2	LOS F	21.9	155.6				
NorthEast: Maroondah Highway													
Lane 1	695	5.0	1906	0.365	100	0.1	LOS A	0.0	0.0	Full	500	0.0	0.0
Lane 2	696	5.0	1908	0.365	100	0.0	LOS A	0.0	0.0	Full	500	0.0	0.0
Approach	1392	5.0		0.365		0.1	NA	0.0	0.0				
SouthWest: Maroondah Highway													
Lane 1	1714	5.0	700[15]	2.448	100	1319.1	LOS F	669.5	4887.7	Full	500	0.0	100.0
Lane 2	635	5.0	197	3.216	100	2011.9	LOS F	284.3	2075.5	Short	110	0.0	NA
Approach	2348	5.0		3.216		1506.4	NA	669.5	4887.7				
Intersection	4199	4.7		3.216		850.2	NA	669.5	4887.7				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Minor Road Approach LOS values are based on average delay for all lanes.
NA: Intersection LOS and Major Road Approach LOS values are Not Applicable for two-way sign control since the average delay is not a good LOS measure due to zero delays associated with major road lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

4 x = 1.00 due to minimum capacity
15 Continuous lane capacity reduced due to overflow of an opposed movement in an adjacent short lane.

USER REPORT FOR SITE

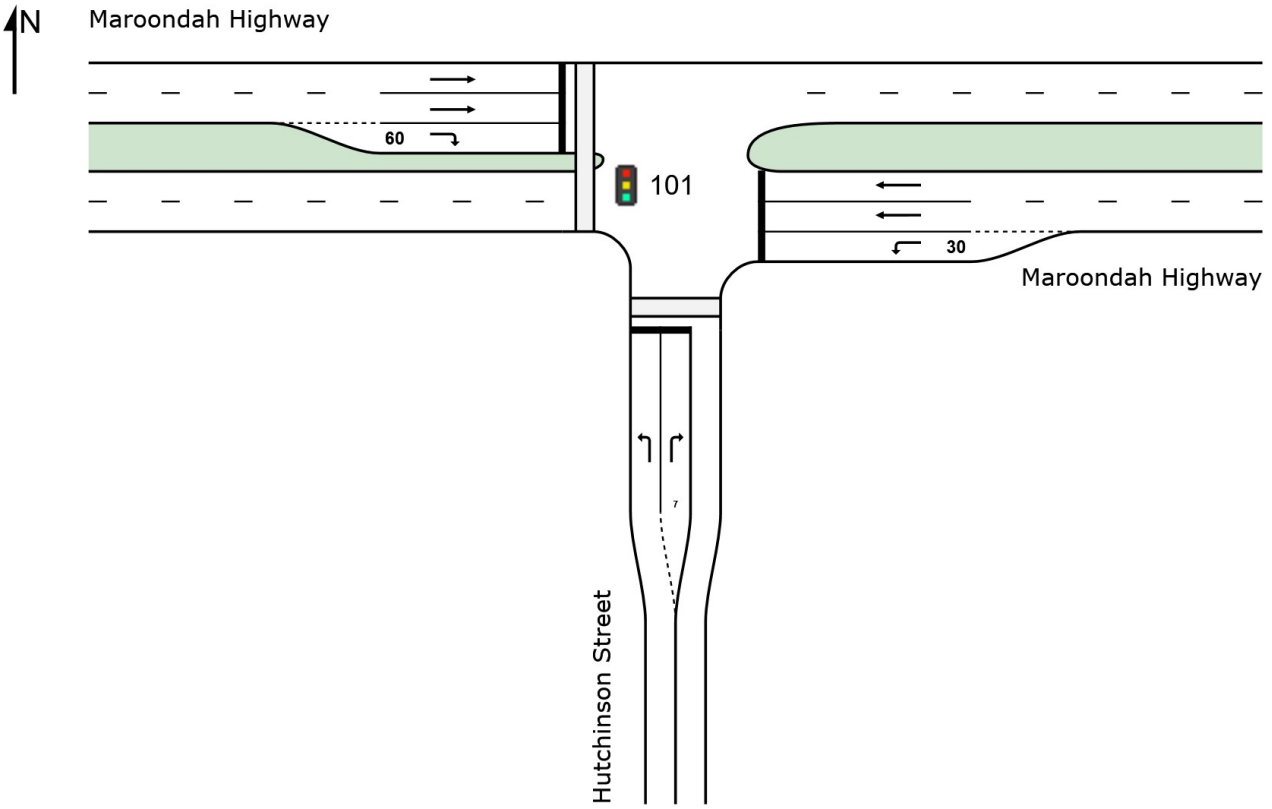
Project: 210507_V159104_FutureLayoutFutureVolumes2020 GTA **Template: GTA Appendix Site**

Site: 101 [Hutchinson St/Maroondah Hwy (2020, AM)]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 130 seconds (Site User-Given Cycle Time)

Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

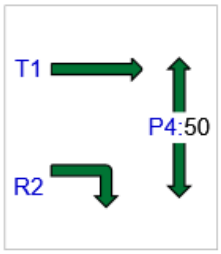
Site Layout

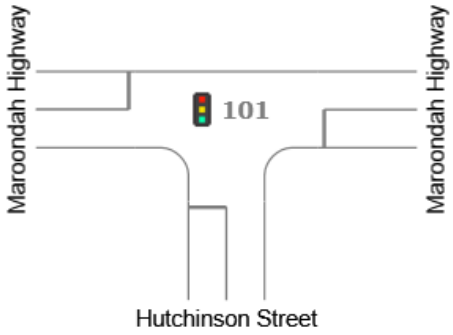


Input Volumes

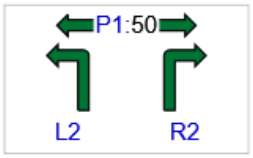
Volume Display Method: Total and %

HV	LV	Tot	
5%	95%	698	T1
2%	98%	159	R2





	Tot	LV	HV
T1	892	95%	5%
L2	263	98%	2%



	L2	R2
Tot	301	108
LV	98%	98%
HV	2%	2%

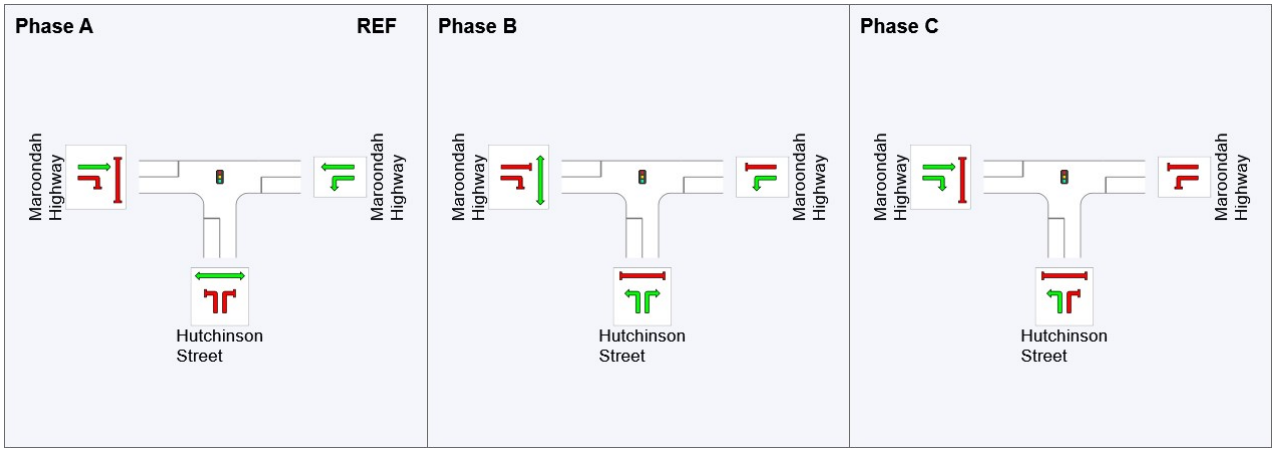
	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	409	401	8
E: Maroondah Highway	1155	1105	50
W: Maroondah Highway	857	819	38
Total	2421	2325	96

Phase Timing Summary

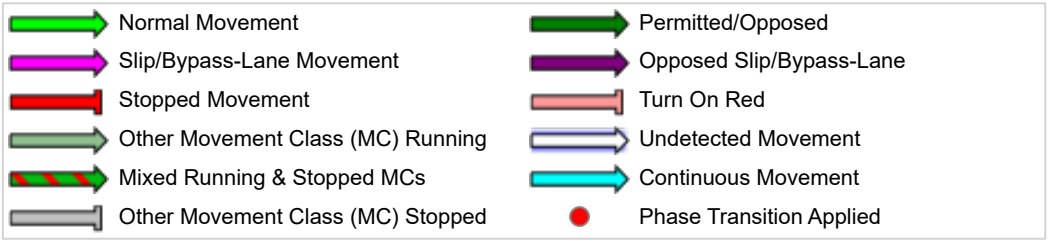
Phase	A	B	C
Phase Change Time (sec)	0	64	106
Green Time (sec)	58	36	18
Phase Time (sec)	64	42	24
Phase Split	49%	32%	18%

See the Phase Information section in the Detailed Output 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, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	317	2.0	643[1]	0.493	100	29.7	LOS C	12.9	91.8	Full	120	0.0	0.0
Lane 2	114	2.0	168[1]	0.679	100	47.2	LOS D	5.8	41.3	Short	7	0.0	NA
Approach	431	2.0		0.679		34.3	LOS C	12.9	91.8				
East: Maroondah Highway													
Lane 1	277	2.0	1408	0.197	100	9.8	LOS A	4.6	33.0	Short	30	0.0	NA
Lane 2	380	5.0	573[1]	0.663	100	26.5	LOS C	16.5	120.4	Full	500	0.0	0.0
Lane 3	559	5.0	843	0.663	100	30.1	LOS C	27.6	201.3	Full	500	0.0	0.0
Approach	1216	4.3		0.663		24.4	LOS C	27.6	201.3				
West: Maroondah Highway													
Lane 1	367	5.0	1191	0.308	100	11.6	LOS B	10.4	76.2	Full	500	0.0	0.0
Lane 2	367	5.0	1191	0.308	100	11.6	LOS B	10.4	76.2	Full	500	0.0	0.0
Lane 3	167	2.0	254	0.660	100	64.6	LOS E	10.4	74.0	Short	60	0.0	NA
Approach	902	4.4		0.660		21.4	LOS C	10.4	76.2				
Intersection	2548	4.0		0.679		25.0	LOS C	27.6	201.3				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

USER REPORT FOR SITE

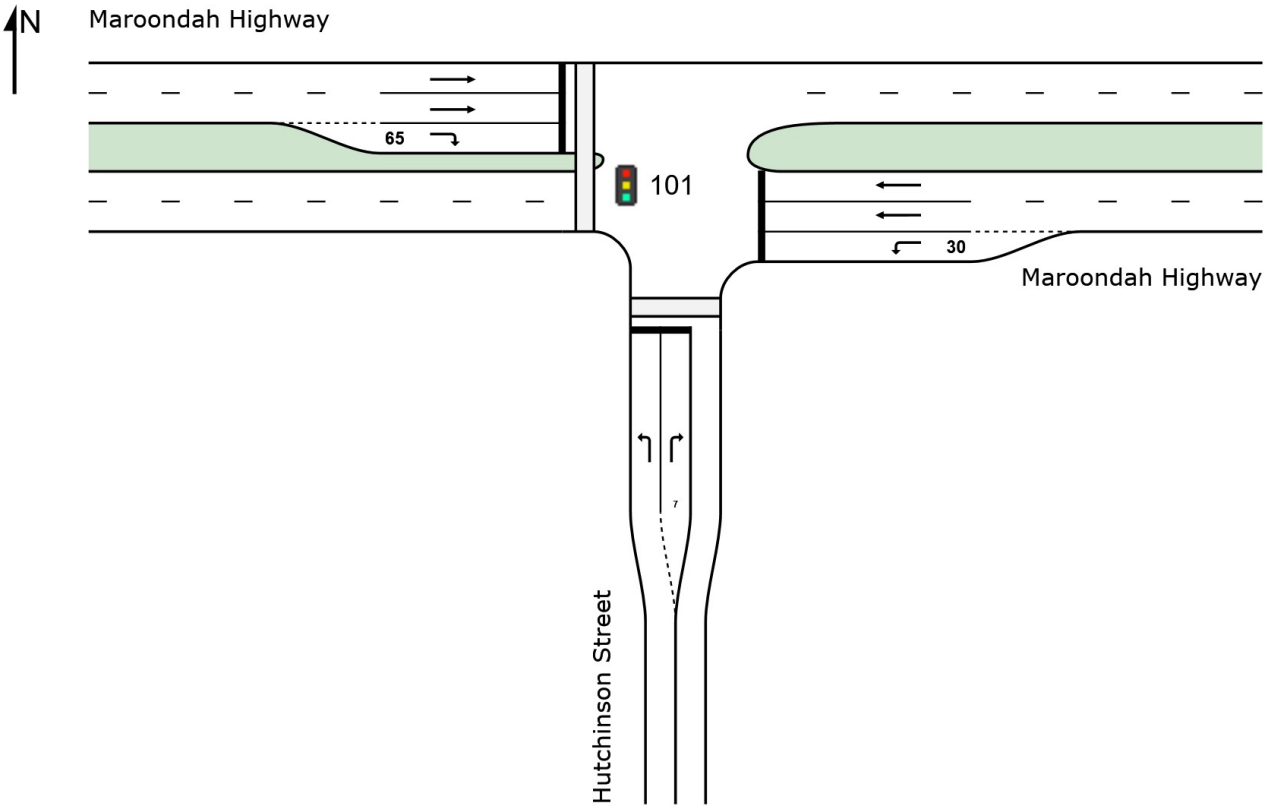
Project: 210507_V159104_FutureLayoutFutureVolumes2020 GTA **Template: GTA Appendix Site**

Site: 101 [Hutchinson St/Maroondah Hwy (2020, PM)]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 130 seconds (Site User-Given Cycle Time)

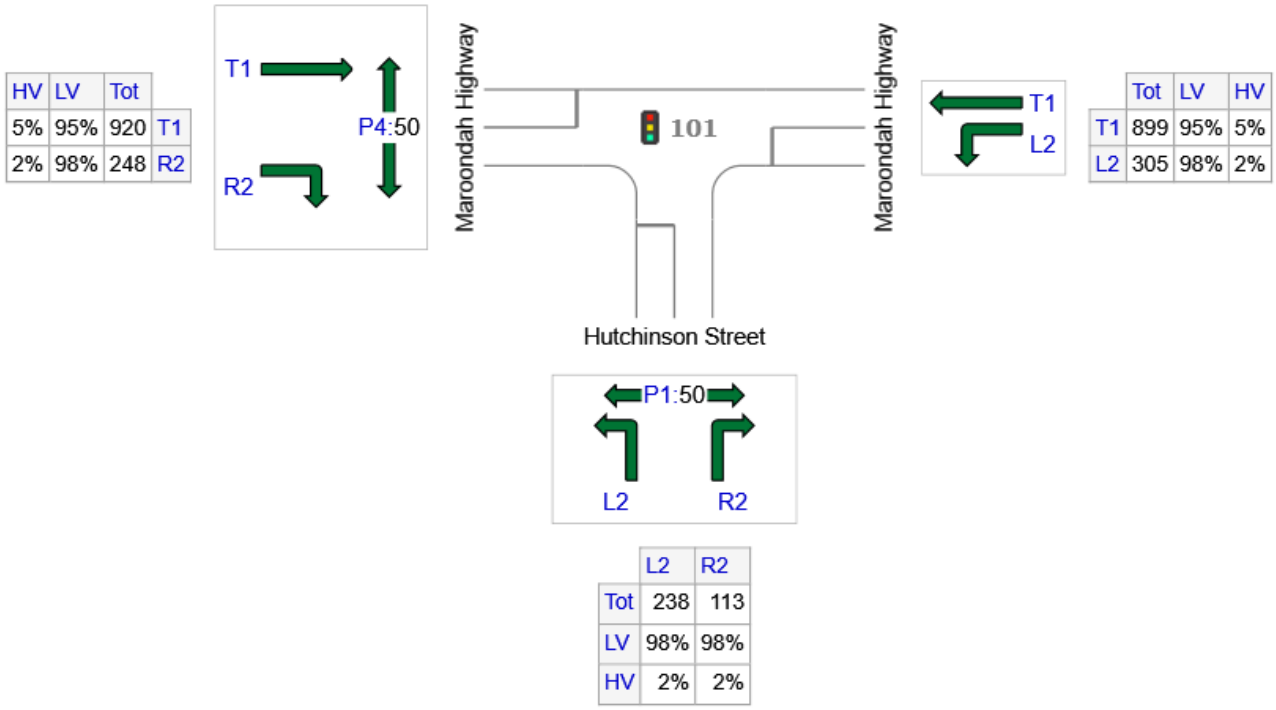
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C
Output Phase Sequence: A, B, C

Site Layout



Input Volumes

Volume Display Method: Total and %



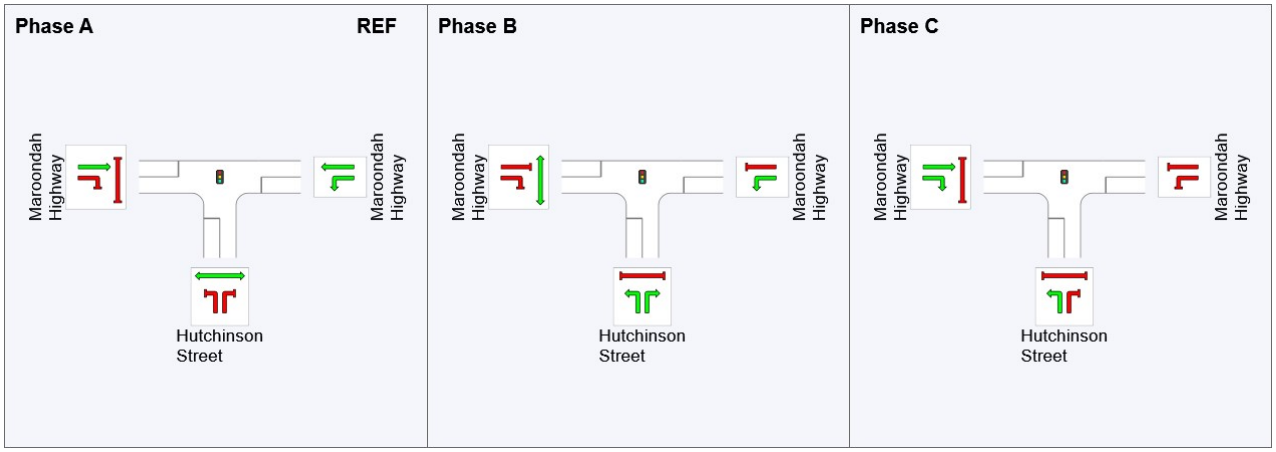
	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	351	344	7
E: Maroondah Highway	1204	1153	51
W: Maroondah Highway	1168	1117	51
Total	2723	2614	109

Phase Timing Summary

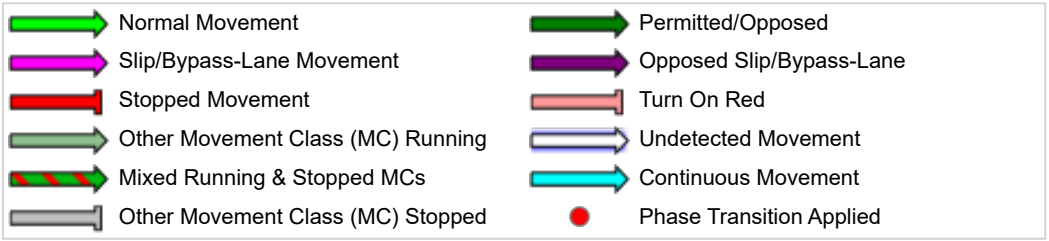
Phase	A	B	C
Phase Change Time (sec)	0	62	98
Green Time (sec)	56	30	26
Phase Time (sec)	62	36	32
Phase Split	48%	28%	25%

See the Phase Information section in the Detailed Output 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, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	251	2.0	626[1]	0.400	100	27.4	LOS C	9.5	67.4	Full	120	0.0	0.0
Lane 2	119	2.0	164[1]	0.726	100	54.2	LOS D	6.6	47.2	Short	7	0.0	NA
Approach	369	2.0		0.726		36.0	LOS D	9.5	67.4				
East: Maroondah Highway													
Lane 1	321	2.0	1296	0.248	100	12.6	LOS B	7.0	50.1	Short	30	0.0	NA
Lane 2	368	5.0	518[1]	0.711	100	27.8	LOS C	16.3	118.9	Full	500	0.0	0.0
Lane 3	578	5.0	814	0.711	100	32.3	LOS C	29.8	217.5	Full	500	0.0	0.0
Approach	1267	4.2		0.711		26.0	LOS C	29.8	217.5				
West: Maroondah Highway													
Lane 1	484	5.0	1278	0.379	100	9.6	LOS A	13.0	95.2	Full	500	0.0	0.0
Lane 2	484	5.0	1278	0.379	100	9.6	LOS A	13.0	95.2	Full	500	0.0	0.0
Lane 3	261	2.0	366	0.713	100	59.3	LOS E	15.8	112.8	Short	65	0.0	NA
Approach	1229	4.4		0.713		20.1	LOS C	15.8	112.8				
Intersection	2866	4.0		0.726		24.8	LOS C	29.8	217.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

USER REPORT FOR SITE

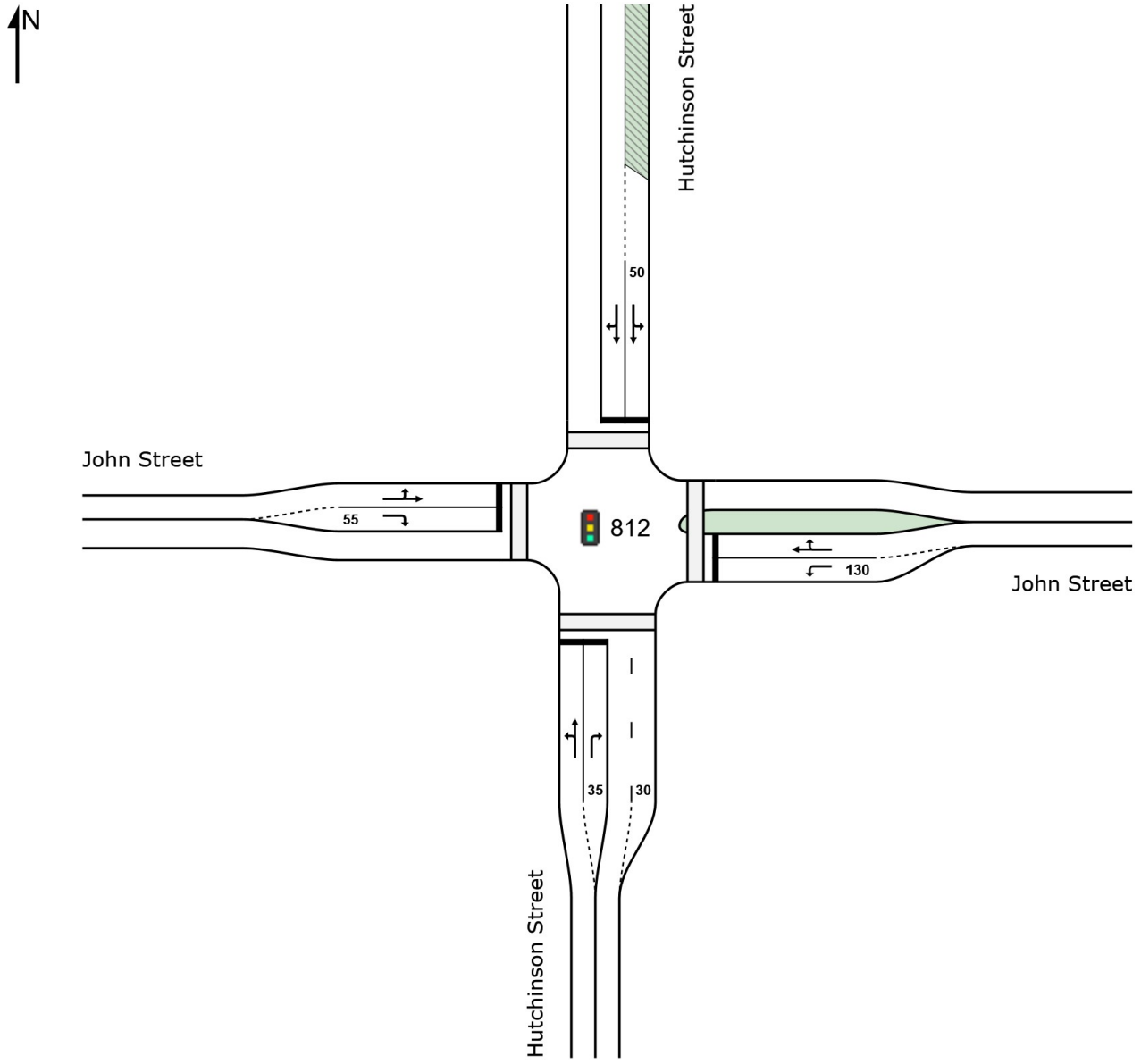
Project: 210507_V159104_FutureLayoutFutureVolumes2020 **Template: GTA Appendix Site GTA**

Site: 812 [John Street/Hutchinson Street (2020, AM) - Revised Volumes]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site Optimum Cycle Time - Minimum Delay)

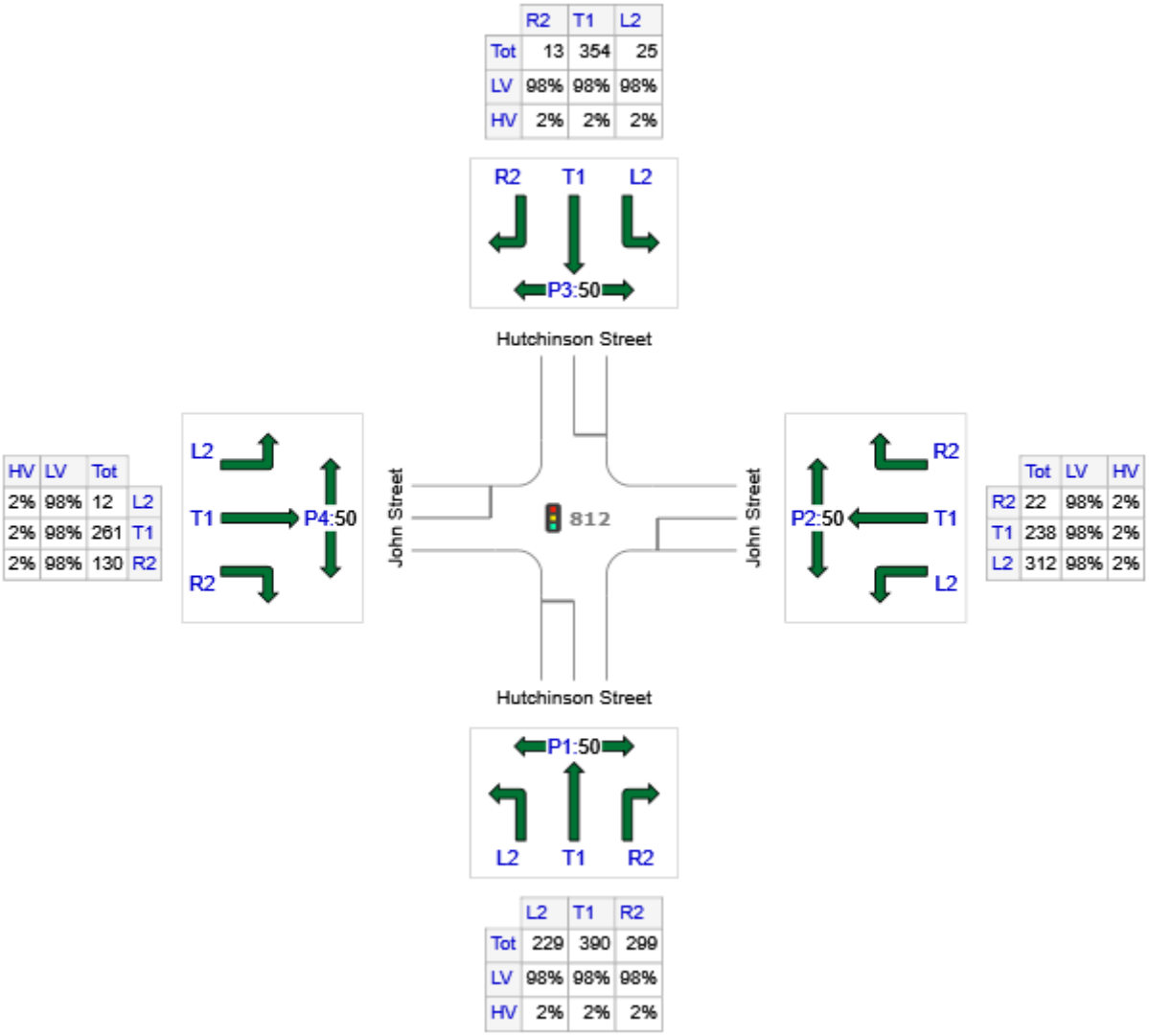
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Site Layout



Input Volumes

Volume Display Method: Total and %



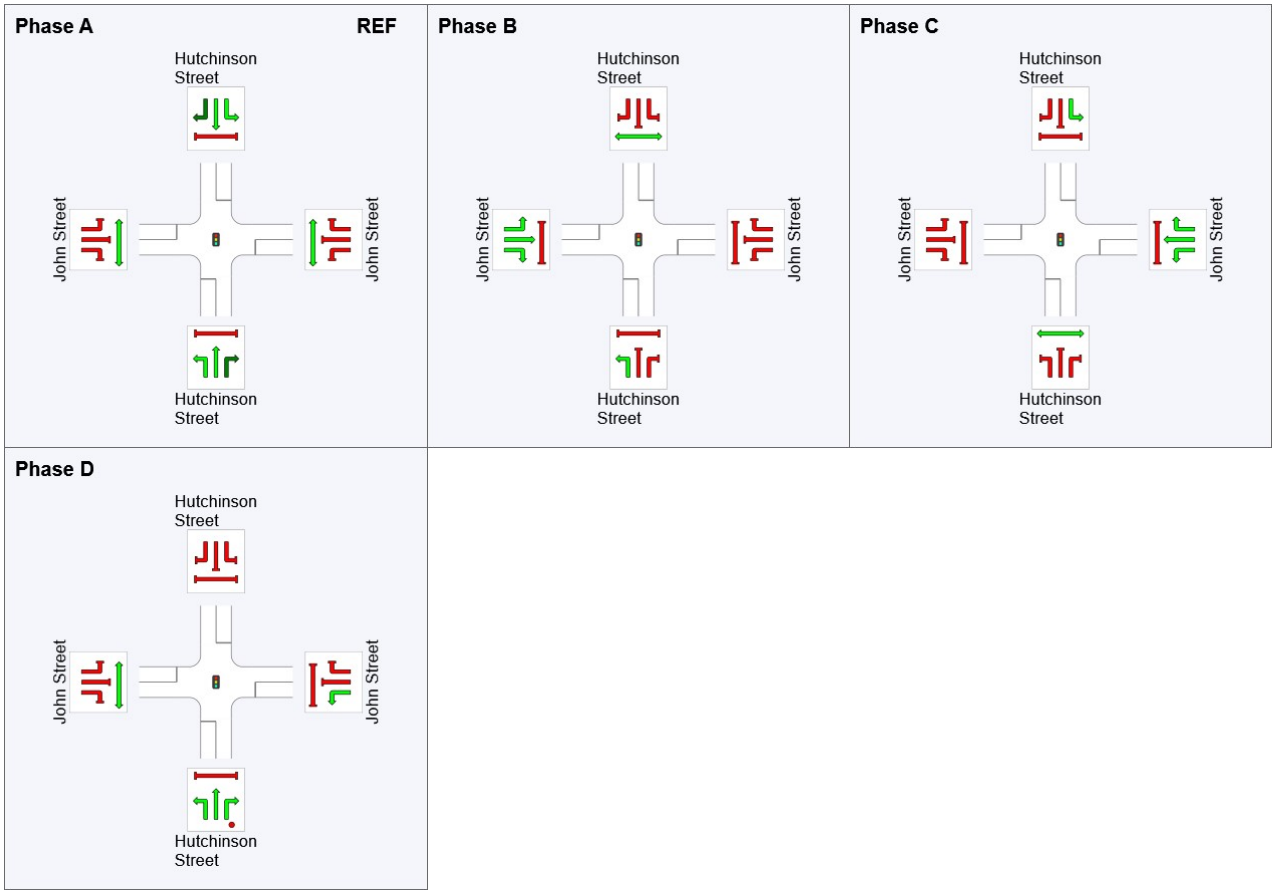
	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	918	900	18
E: John Street	572	561	11
N: Hutchinson Street	392	384	8
W: John Street	403	395	8
Total	2285	2239	46

Phase Timing Summary

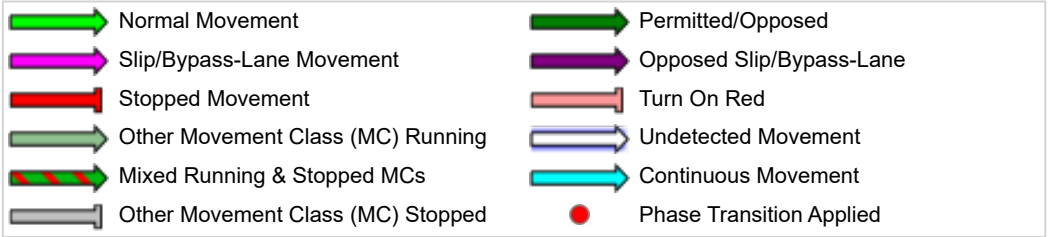
Phase	A	B	C	D
Phase Change Time (sec)	0	21	40	59
Green Time (sec)	16	13	13	15
Phase Time (sec)	22	19	19	20
Phase Split	28%	24%	24%	25%

See the Phase Information section in the Detailed Output 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, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	652	2.0	689[1]	0.946	100	50.1	LOS D	33.5	238.6	Full	500	0.0	0.0
Lane 2	315	2.0	434	0.726	100	25.3	LOS C	8.9	63.6	Short	35	0.0	NA
Approach	966	2.0		0.946		42.0	LOS D	33.5	238.6				
East: John Street													
Lane 1	328	2.0	721	0.456	100	23.7	LOS C	9.5	67.5	Short	130	0.0	NA
Lane 2	274	2.0	307	0.893	100	47.5	LOS D	12.8	91.0	Full	155	0.0	0.0
Approach	602	2.0		0.893		34.5	LOS C	12.8	91.0				
North: Hutchinson Street													
Lane 1	81	2.0	379	0.214	24[6]	21.2	LOS C	1.8	13.0	Short (P)	50	0.0	NA
Lane 2	331	2.0	366[1]	0.906	100	49.2	LOS D	15.9	113.4	Full	120	0.0	0.0
Approach	413	2.0		0.906		43.7	LOS D	15.9	113.4				
West: John Street													
Lane 1	287	2.0	305	0.942	100	56.2	LOS E	14.9	105.7	Full	185	0.0	0.0
Lane 2	137	2.0	293	0.467	100	38.6	LOS D	5.0	35.9	Short	55	0.0	NA
Approach	424	2.0		0.942		50.6	LOS D	14.9	105.7				
Intersection	2405	2.0		0.946		41.9	LOS D	33.5	238.6				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects

USER REPORT FOR SITE

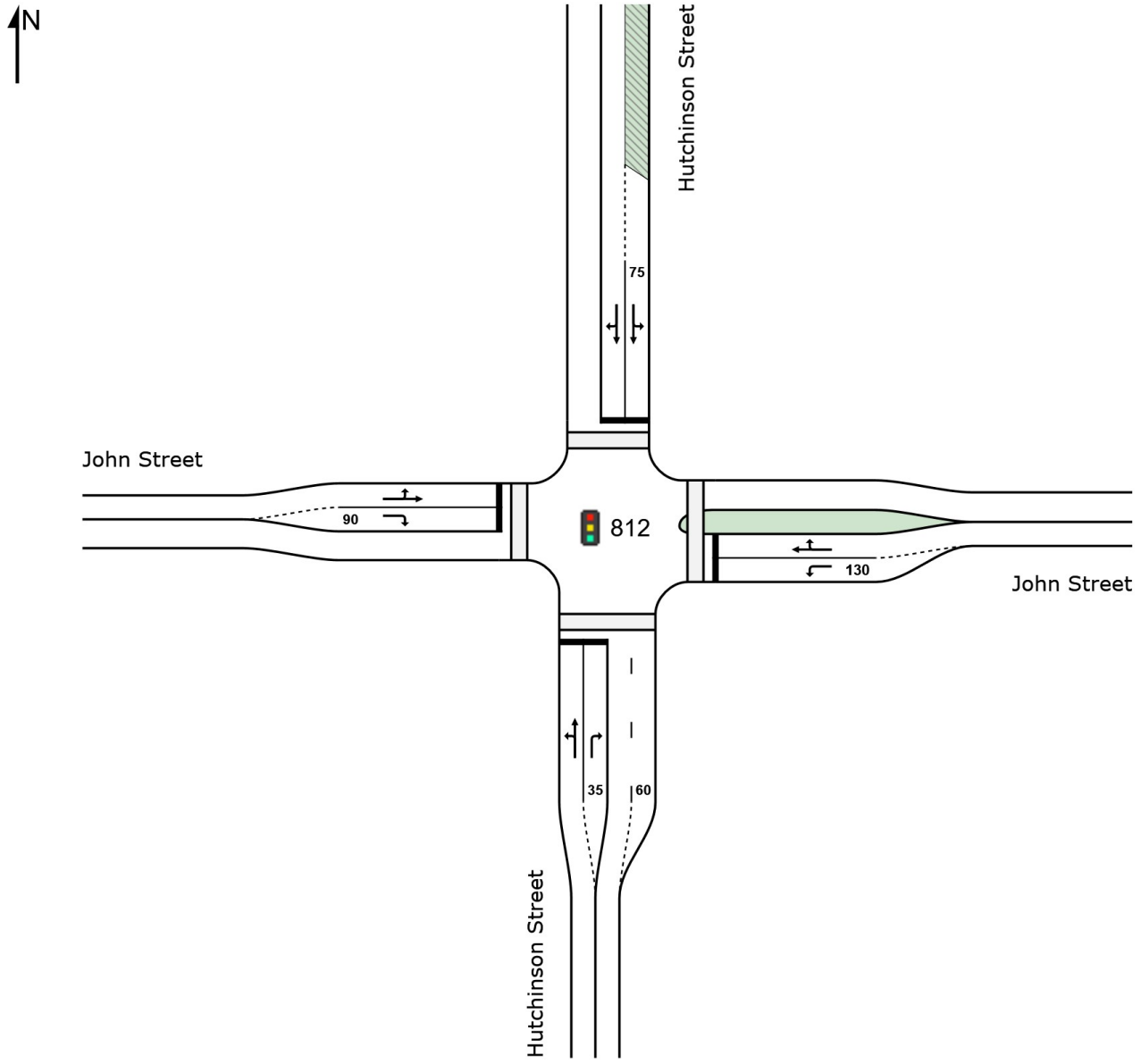
Project: 210507_V159104_FutureLayoutFutureVolumes2020 **Template: GTA Appendix Site GTA**

Site: 812 [John Street/Hutchinson Street (2020, PM) - Revised Volumes]

New Site
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 80 seconds (Site User-Given Phase Times)

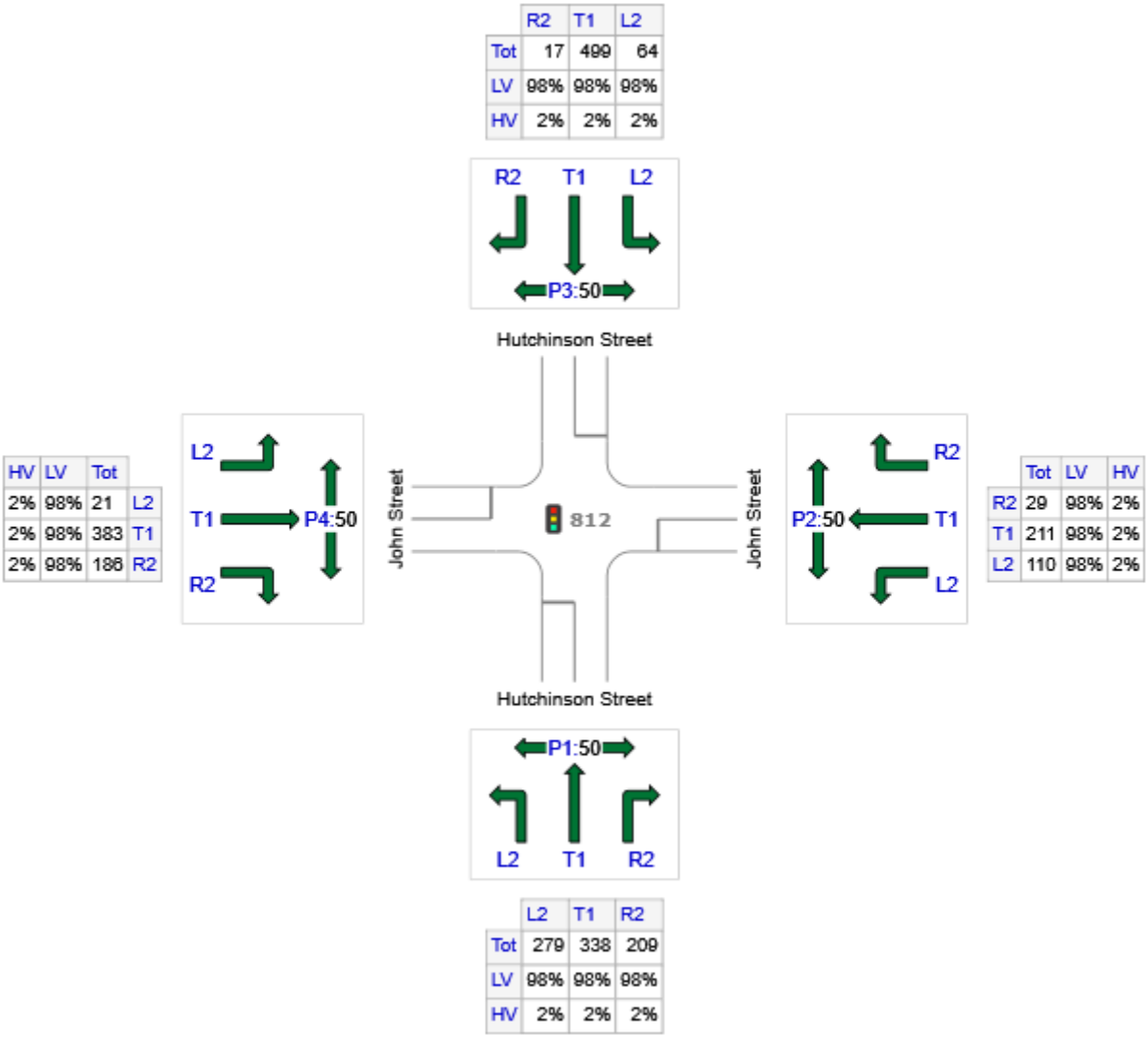
Timings based on settings in the Site Phasing & Timing dialog
Phase Times specified by the user
Phase Sequence: Variable Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C, D
Output Phase Sequence: A, B, C, D

Site Layout



Input Volumes

Volume Display Method: Total and %



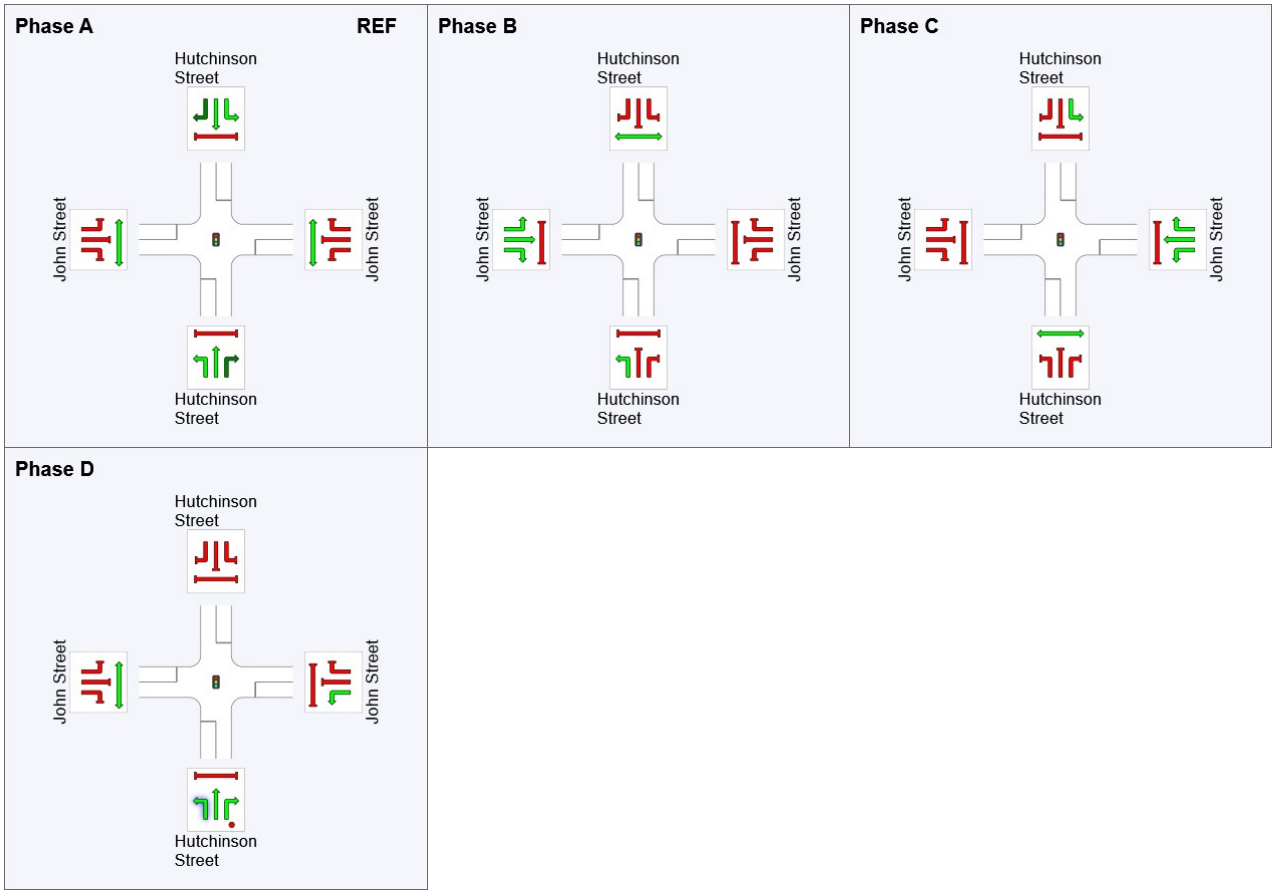
	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Hutchinson Street	826	809	17
E: John Street	350	343	7
N: Hutchinson Street	580	568	12
W: John Street	590	578	12
Total	2346	2299	47

Phase Timing Summary

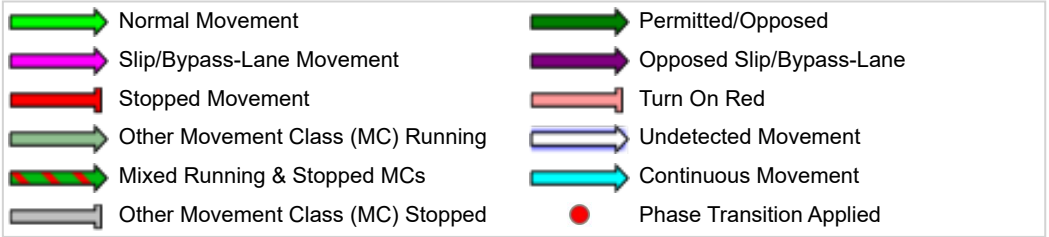
Phase	A	B	C	D
Phase Change Time (sec)	0	26	51	68
Green Time (sec)	21	19	11	7
Phase Time (sec)	27	25	16	12
Phase Split	34%	31%	20%	15%

See the Phase Information section in the Detailed Output 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, Phase Actuation and Phase Frequency values (user-specified or implied) less than 100%.

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase



Lane Use and Performance

	Demand Flows Total veh/h	Demand Flows HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	95% Back of Queue Veh	95% Back of Queue Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Hutchinson Street													
Lane 1	649	2.0	698[1]	0.930	100	46.4	LOS D	32.5	231.4	Full	500	0.0	0.0
Lane 2	220	2.0	245	0.897	100	36.4	LOS D	7.5	53.3	Short	35	0.0	NA
Approach	869	2.0		0.930		43.9	LOS D	32.5	231.4				
East: John Street													
Lane 1	116	2.0	473	0.245	100	30.0	LOS C	3.6	25.8	Short	130	0.0	NA
Lane 2	253	2.0	259	0.976	100	67.6	LOS E	14.3	101.5	Full	155	0.0	0.0
Approach	368	2.0		0.976		55.8	LOS E	14.3	101.5				
North: Hutchinson Street													
Lane 1	173	2.0	498	0.346	35[6]	25.1	LOS C	4.3	30.9	Short (P)	75	0.0	NA
Lane 2	438	2.0	447	0.979	100	69.4	LOS E	26.2	186.7	Full	120	0.0	45.5
Approach	611	2.0		0.979		56.9	LOS E	26.2	186.7				
West: John Street													
Lane 1	425	2.0	446	0.953	100	57.7	LOS E	23.1	164.6	Full	185	0.0	0.0
Lane 2	196	2.0	428	0.457	100	33.4	LOS C	6.7	47.7	Short	90	0.0	NA
Approach	621	2.0		0.953		50.0	LOS D	23.1	164.6				
Intersection	2469	2.0		0.979		50.4	LOS D	32.5	231.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
6 Lane under-utilisation due to downstream effects

USER REPORT FOR NETWORK SITE

Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

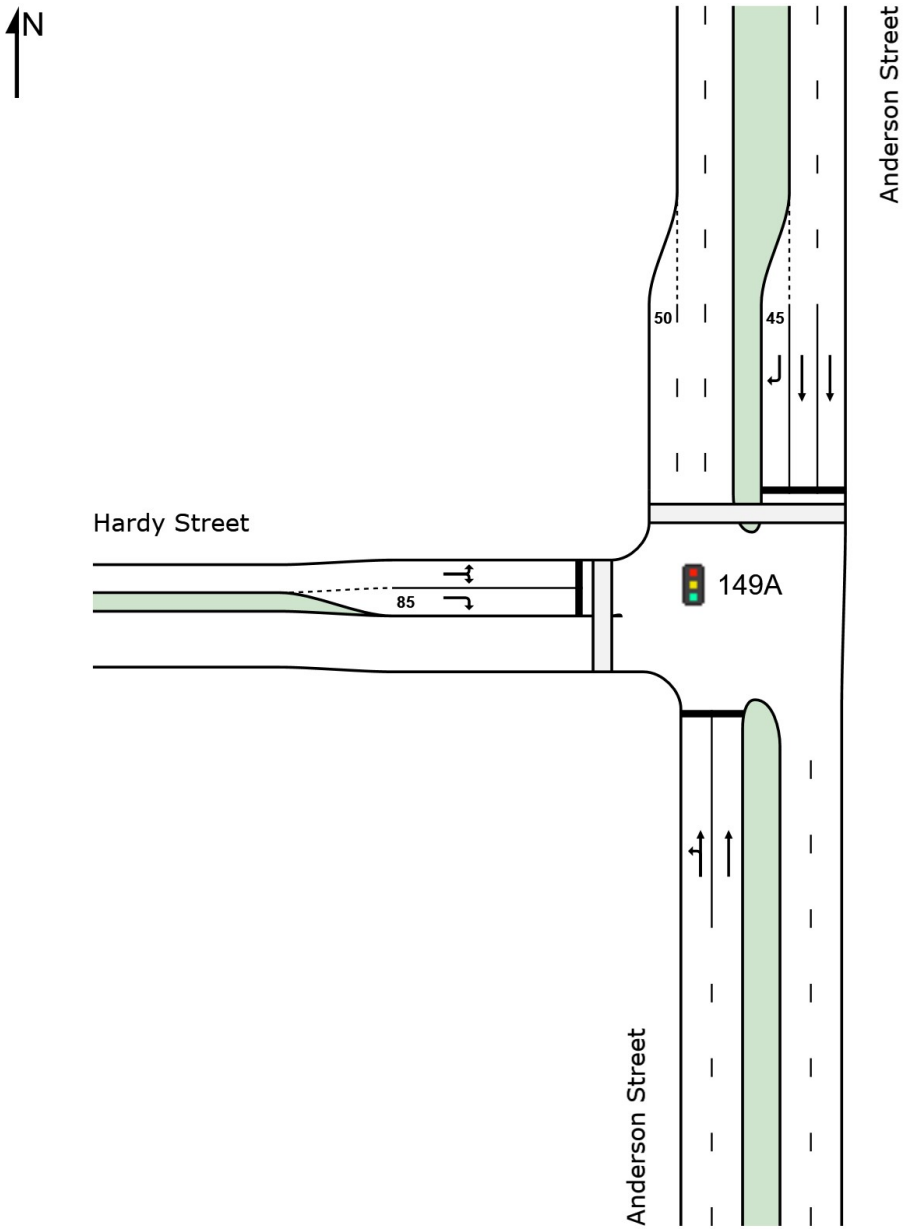
Site: 149A [Hardy St/Anderson St (PJ 2020, AM)]

Network: 7 [HardySt/AndersonSt/ CouncilEntrance (PJ 2020, AM)]

New Site
Site Category: (None)
Signals - Fixed Time Coordinated Cycle Time = 120 seconds (CCG User-Given Phase Times)
Common Control Group: CCG1 [TCS149]

Timings based on settings in the Network Timing dialog
Phase Times specified by the user
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C1, C2
Output Phase Sequence: A, B, C1, C2

Site Layout

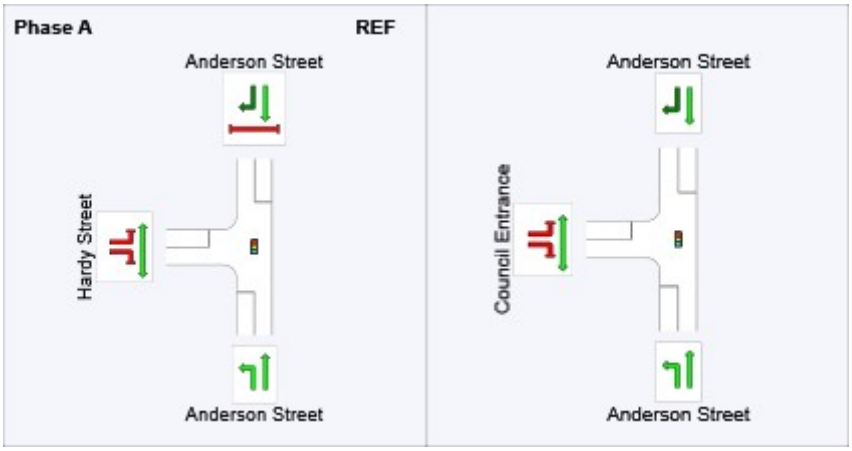


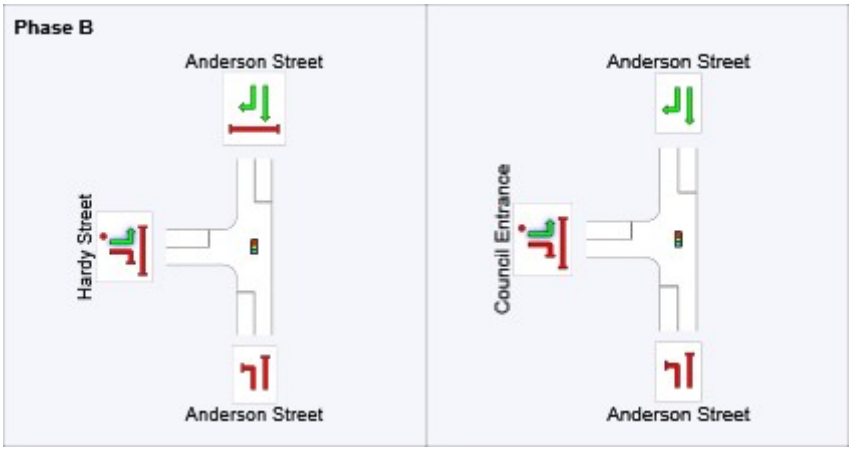
Phase Timing Summary (CCG)

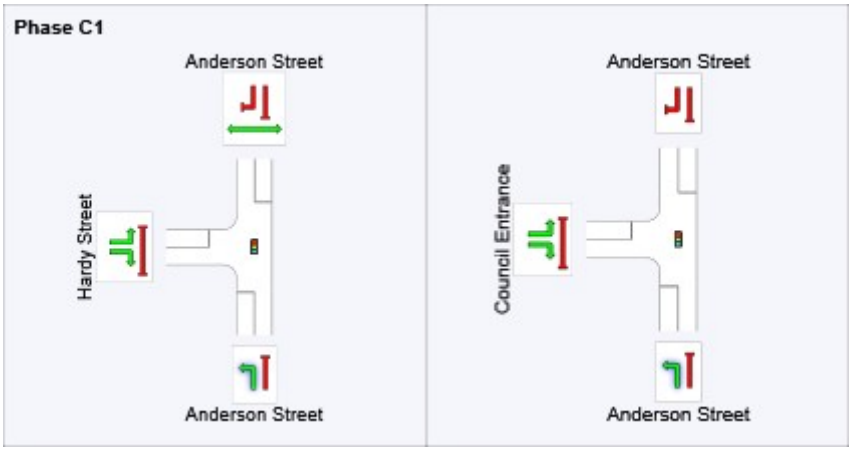
Phase	A	B	C1	C2
Phase Change Time (sec)	0	69	87	97
Green Time (sec)	63	12	4	19
Phase Time (sec)	69	18	8	25
Phase Split	58%	15%	7%	21%

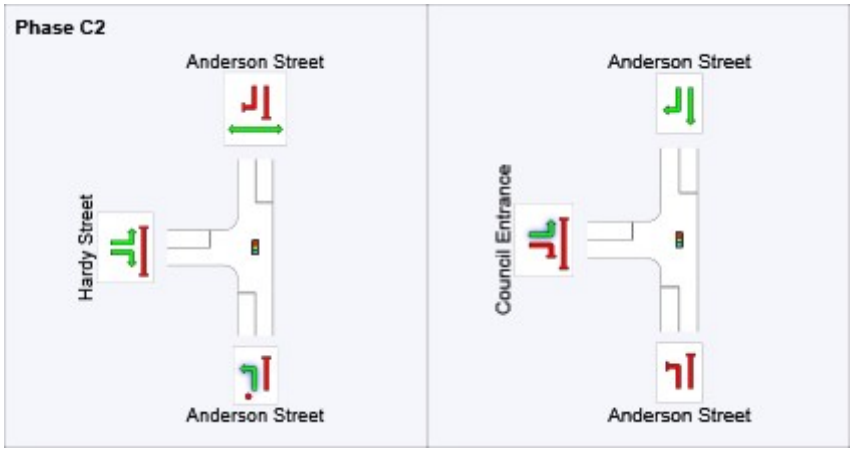
See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency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

Output Phase Sequence (CCG)









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

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Anderson Street															
Lane 1	795	2.7	795	2.7	1031	0.771	100	3.3	LOS A	2.2	15.8	Full	27	0.0	1.1
Lane 2	765	5.0	765	5.0	992	0.771	100	1.0	LOS A	2.2	16.2	Full	27	0.0	3.2
Approach	1560	3.8	1560	3.8		0.771		2.2	LOS A	2.2	16.2				
North: Anderson Street															
Lane 1	425	5.0	425	5.0	1208	0.351	100	10.0	LOS B	6.8	49.4	Full	500	0.0	0.0
Lane 2	372	5.0	372	5.0	1059	0.351	100	10.1	LOS B	6.0	43.5	Full	500	-12.4 N3	0.0
Lane 3	276	2.0	276	2.0	310	0.890	100	78.7	LOS E	13.0	92.5	Short	45	0.0	NA
Approach	1073	4.2	1073	4.2		0.890		27.7	LOS C	13.0	92.5				
West: Hardy Street															
Lane 1	344	2.0	344	2.0	442	0.778	100	54.0	LOS D	9.8	69.8	Full	500	0.0	0.0
Lane 2	276	2.0	276	2.0	355	0.778	100	56.9	LOS E	10.0	71.0	Short	85	-12.4 N3	NA
Approach	620	2.0	620	2.0		0.778		55.3	LOS E	10.0	71.0				
Intersection	3253	3.6	3253	3.6		0.890		20.7	LOS C	13.0	92.5				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N3 Capacity Adjustment due to downstream lane blockage determined by the program.

Site: 149B [Anderson/Council Entrance (PJ 2020, AM)]

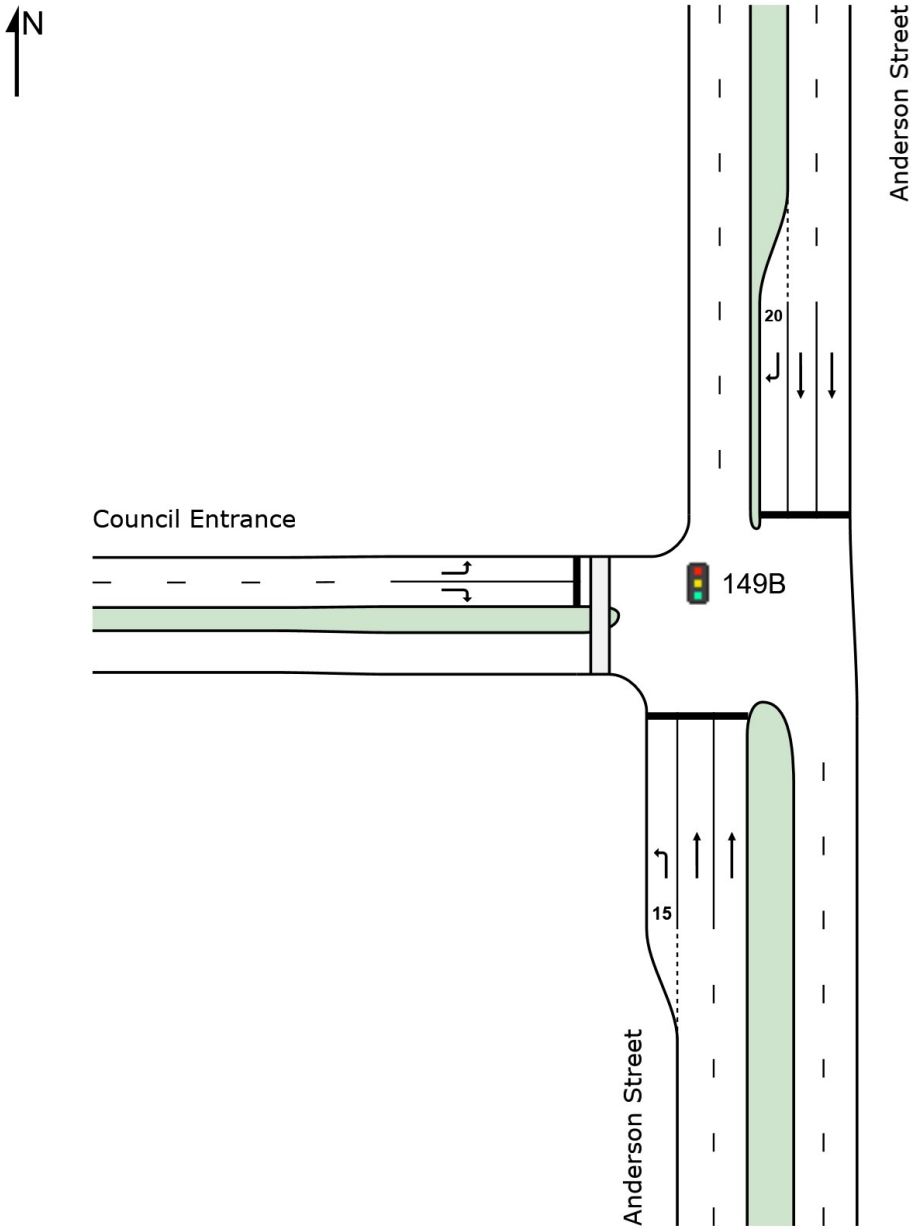
Network: 7 [HardySt/AndersonSt/ CouncilEntrance (PJ 2020, AM)]

New Site
Site Category: (None)
Signals - Fixed Time Coordinated Cycle Time = 120 seconds (CCG User-Given Phase Times)
Common Control Group: CCG1 [TCS149]

Timings based on settings in the Network Timing dialog
Phase Times specified by the user
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C1, C2
Output Phase Sequence: A, B, C1, C2

Some CCG output elements have been omitted as they have already been included under other Sites belonging to the same CCG.

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Anderson Street															
Lane 1	8	2.0	8	2.0	977	0.009	100	12.8	LOS B	0.1	0.6	Short	15	0.0	NA
Lane 2	783	5.0	783	5.0	906[1]	0.864	100	35.6	LOS D	27.0	197.2	Full	500	-1.1[N3]	0.0
Lane 3	762	5.0	762	5.0	881	0.864	100	36.3	LOS D	26.6	194.4	Full	500	-3.2[N3]	0.0
Approach	1553	5.0	1553	5.0		0.864		35.8	LOS D	27.0	197.2				
North: Anderson Street															
Lane 1	585	5.0	585	5.0	1694	0.345	100	0.4	LOS A	1.0	7.1	Full	27	0.0	0.0
Lane 2	570	5.0	570	5.0	1651	0.345	100	0.9	LOS A	2.5	17.9	Full	27	0.0	12.4
Lane 3	9	2.0	9	2.0	620	0.015	100	14.7	LOS B	0.1	0.9	Short	20	0.0	NA
Approach	1164	5.0	1164	5.0		0.345		0.7	LOS A	2.5	17.9				
West: Council Entrance															
Lane 1	16	2.0	16	2.0	570	0.028	100	30.2	LOS C	0.4	2.6	Full	50	-1.1[N3]	0.0
Lane 2	5	2.0	5	2.0	59	0.089	100	69.2	LOS E	0.2	1.4	Full	50	0.0	0.0
Approach	21	2.0	21	2.0		0.089		39.9	LOS D	0.4	2.6				
Intersection	2738	5.0	2738	5.0		0.864		20.9	LOS C	27.0	197.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.

USER REPORT FOR NETWORK SITE

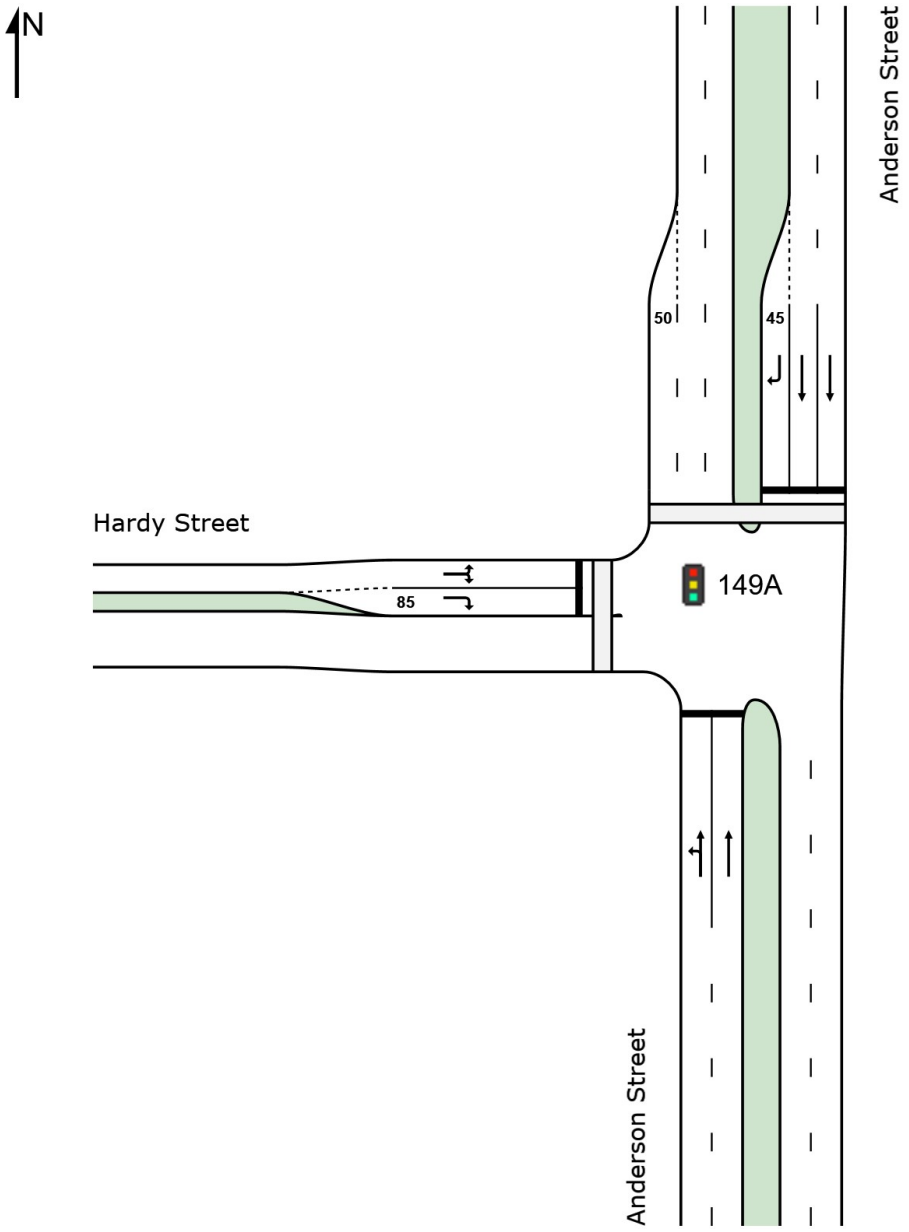
Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 149A [Hardy St/Anderson St (AP 2020, AM)] **Network: 9 [HardySt/AndersonSt/ CouncilEntrance (AP 2020, AM)]**

New Site
Site Category: (None)
Signals - Fixed Time Coordinated Cycle Time = 120 seconds (CCG User-Given Phase Times)
Common Control Group: CCG1 [TCS149]

Timings based on settings in the Network Timing dialog
Phase Times specified by the user
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C1, C2
Output Phase Sequence: A, B, C1, C2

Site Layout

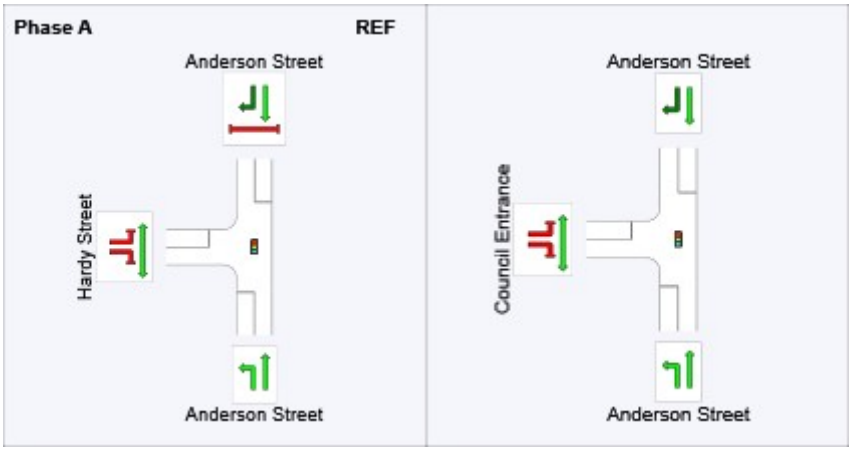


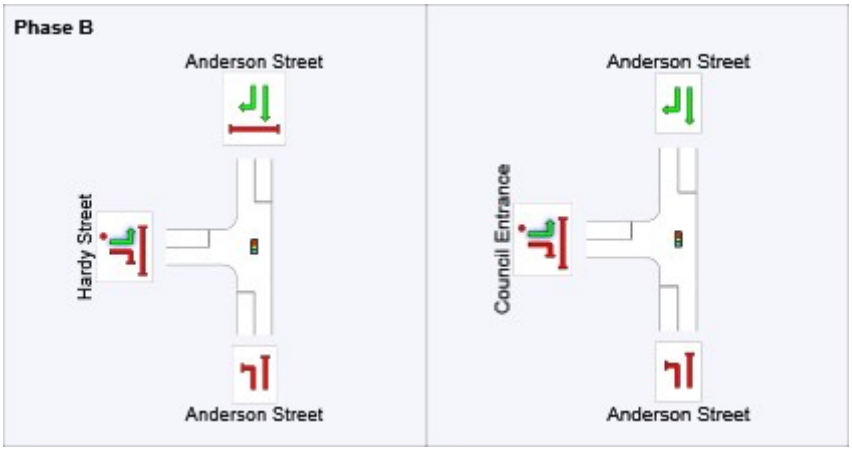
Phase Timing Summary (CCG)

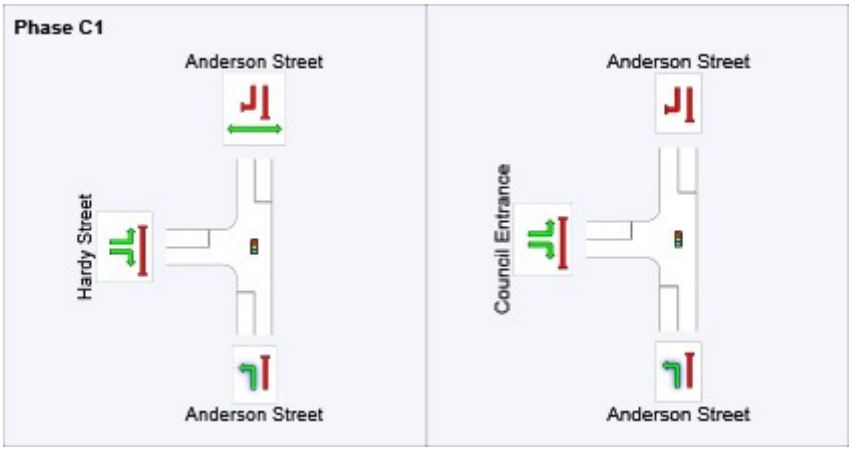
Phase	A	B	C1	C2
Phase Change Time (sec)	0	69	87	97
Green Time (sec)	63	12	4	19
Phase Time (sec)	69	18	8	25
Phase Split	58%	15%	7%	21%

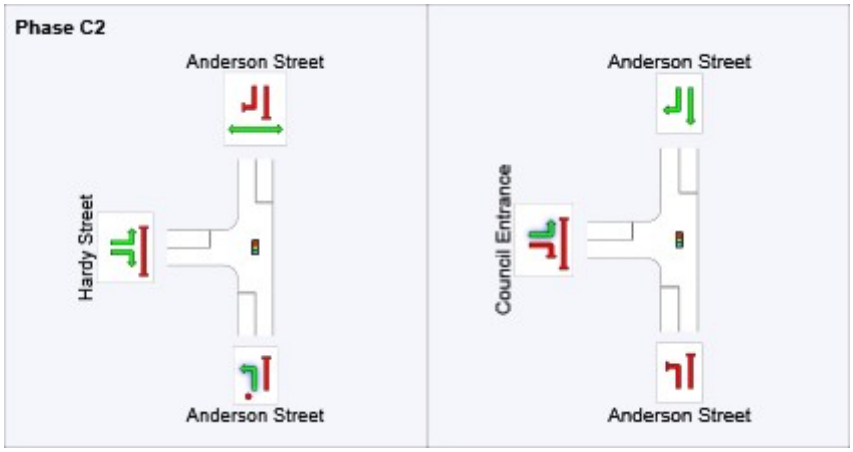
See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency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

Output Phase Sequence (CCG)









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

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Anderson Street															
Lane 1	795	2.7	795	2.7	1031	0.771	100	3.3	LOS A	2.2	15.8	Full	27	0.0	1.1
Lane 2	765	5.0	765	5.0	992	0.771	100	1.0	LOS A	2.2	16.2	Full	27	0.0	3.2
Approach	1560	3.8	1560	3.8		0.771		2.2	LOS A	2.2	16.2				
North: Anderson Street															
Lane 1	426	5.0	426	5.0	1208	0.353	100	10.1	LOS B	6.8	49.6	Full	500	0.0	0.0
Lane 2	371	5.0	371	5.0	1052	0.353	100	10.1	LOS B	5.9	43.4	Full	500	-13.0 N3	0.0
Lane 3	254	2.0	254	2.0	310	0.818	100	59.7	LOS E	10.4	74.2	Short	45	0.0	NA
Approach	1051	4.3	1051	4.3		0.818		22.1	LOS C	10.4	74.2				
West: Hardy Street															
Lane 1	311	2.0	311	2.0	425	0.730	100	54.2	LOS D	8.8	62.5	Full	500	0.0	0.0
Lane 2	258	2.0	258	2.0	353	0.730	100	54.5	LOS D	9.0	63.9	Short	85	-13.0 N3	NA
Approach	568	2.0	568	2.0		0.730		54.3	LOS D	9.0	63.9				
Intersection	3179	3.6	3179	3.6		0.818		18.1	LOS B	10.4	74.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

N3 Capacity Adjustment due to downstream lane blockage determined by the program.

Site: 149B [Anderson/Council Entrance (AP 2020, AM)]

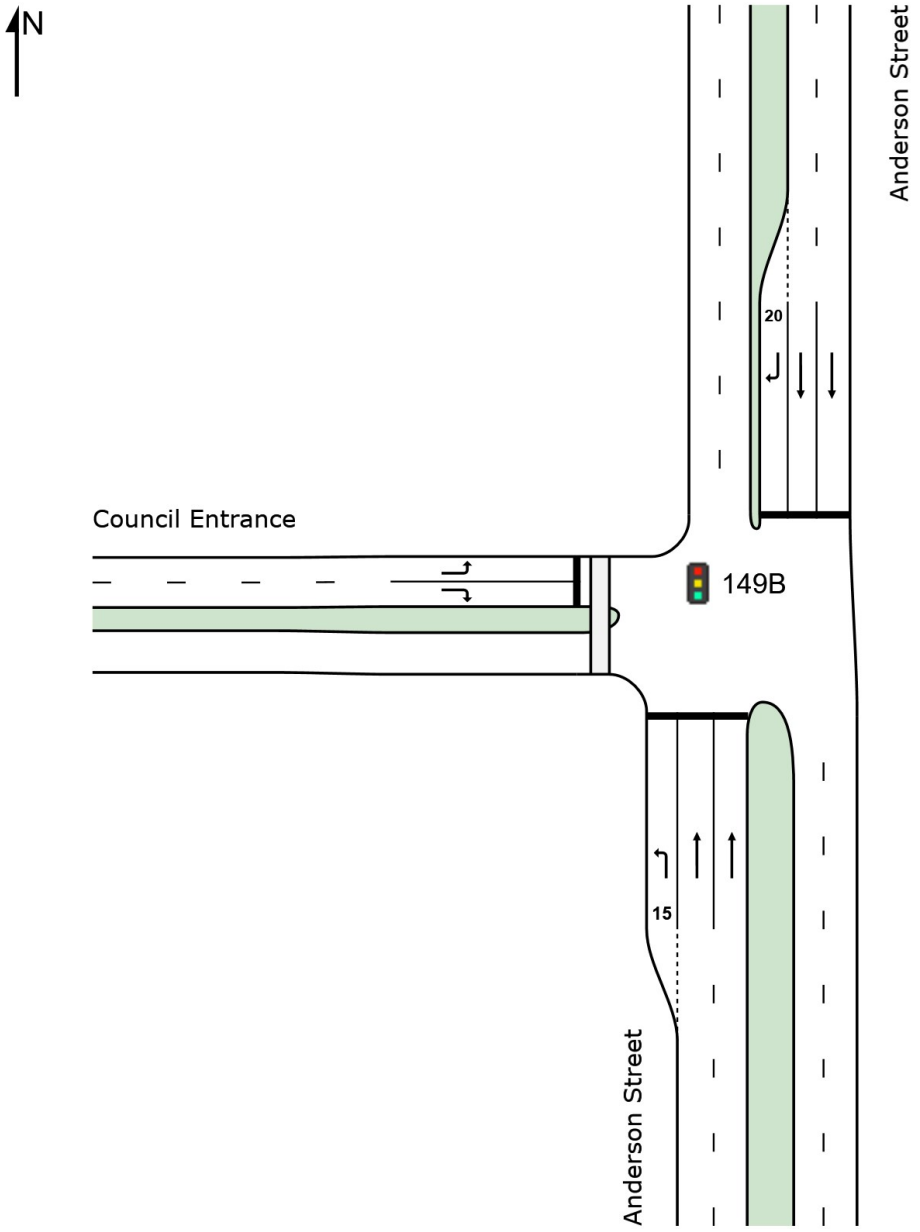
Network: 9 [HardySt/AndersonSt/ CouncilEntrance (AP 2020, AM)]

New Site
Site Category: (None)
Signals - Fixed Time Coordinated Cycle Time = 120 seconds (CCG User-Given Phase Times)
Common Control Group: CCG1 [TCS149]

Timings based on settings in the Network Timing dialog
Phase Times specified by the user
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C1, C2
Output Phase Sequence: A, B, C1, C2

Some CCG output elements have been omitted as they have already been included under other Sites belonging to the same CCG.

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Anderson Street															
Lane 1	8	2.0	8	2.0	977	0.009	100	12.8	LOS B	0.1	0.6	Short	15	0.0	NA
Lane 2	783	5.0	783	5.0	906[1]	0.864	100	35.6	LOS D	27.0	197.2	Full	500	-1.1[N3]	0.0
Lane 3	762	5.0	762	5.0	881	0.864	100	36.3	LOS D	26.6	194.4	Full	500	-3.2[N3]	0.0
Approach	1553	5.0	1553	5.0		0.864		35.8	LOS D	27.0	197.2				
North: Anderson Street															
Lane 1	585	5.0	585	5.0	1694	0.345	100	0.4	LOS A	1.0	7.4	Full	27	0.0	0.0
Lane 2	570	5.0	570	5.0	1651	0.345	100	0.9	LOS A	2.5	18.1	Full	27	0.0	13.0
Lane 3	9	2.0	9	2.0	620	0.015	100	14.7	LOS B	0.1	0.9	Short	20	0.0	NA
Approach	1164	5.0	1164	5.0		0.345		0.8	LOS A	2.5	18.1				
West: Council Entrance															
Lane 1	16	2.0	16	2.0	570	0.028	100	30.2	LOS C	0.4	2.6	Full	50	-1.1[N3]	0.0
Lane 2	5	2.0	5	2.0	59	0.089	100	69.2	LOS E	0.2	1.4	Full	50	0.0	0.0
Approach	21	2.0	21	2.0		0.089		39.9	LOS D	0.4	2.6				
Intersection	2738	5.0	2738	5.0		0.864		20.9	LOS C	27.0	197.2				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.

USER REPORT FOR NETWORK SITE

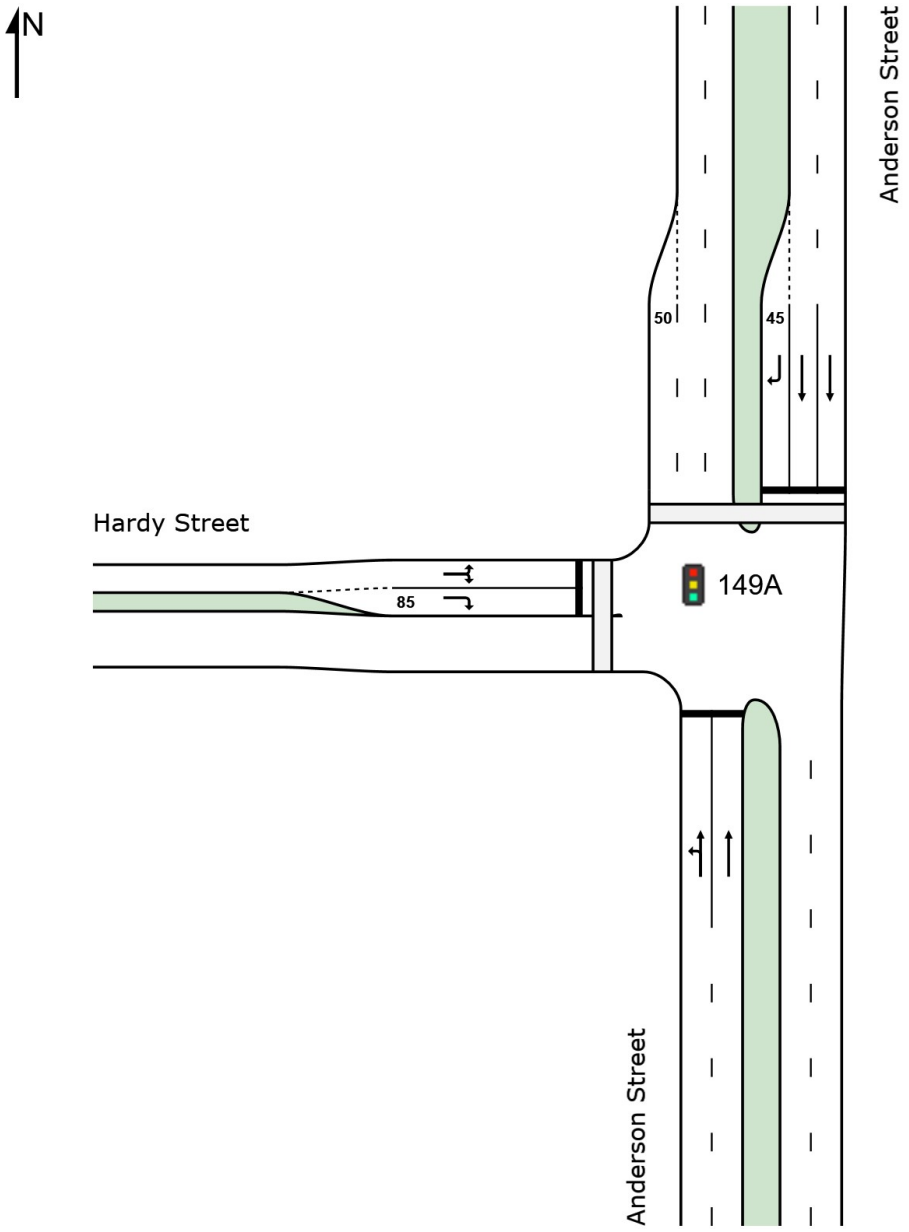
Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 149A [Hardy St/Anderson St (PJ 2020, PM)] **Network: 8 [HardySt/AndersonSt/ CouncilEntrance (PJ 2020, PM)]**

New Site
Site Category: (None)
Signals - Fixed Time Coordinated Cycle Time = 120 seconds (CCG User-Given Phase Times)
Common Control Group: CCG1 [TCS149]

Timings based on settings in the Network Timing dialog
Phase Times specified by the user
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C1, C2
Output Phase Sequence: A, B, C1, C2

Site Layout

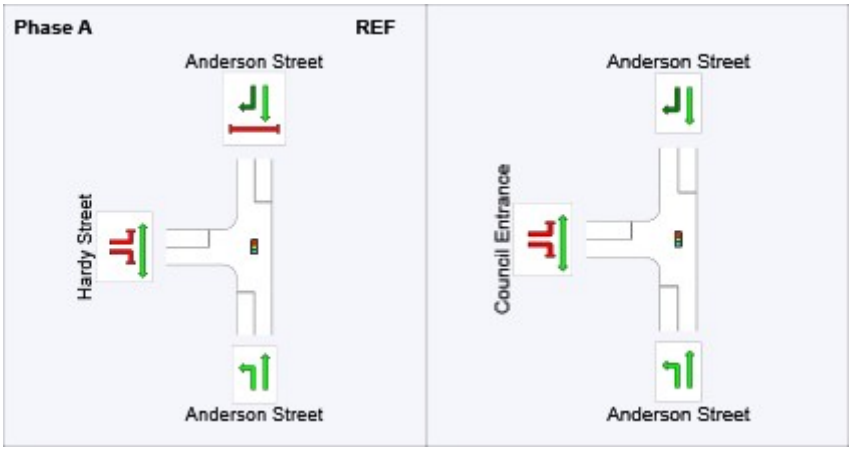


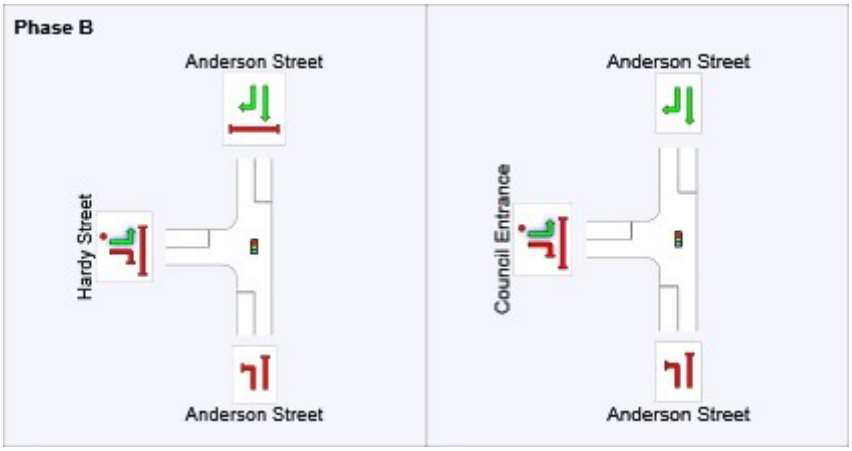
Phase Timing Summary (CCG)

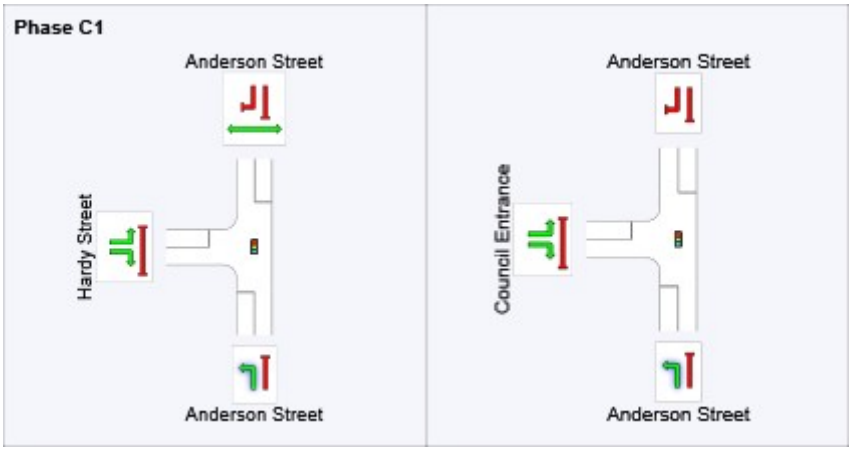
Phase	A	B	C1	C2
Phase Change Time (sec)	0	57	67	74
Green Time (sec)	51	4	3	43
Phase Time (sec)	57	8	6	49
Phase Split	48%	7%	5%	41%

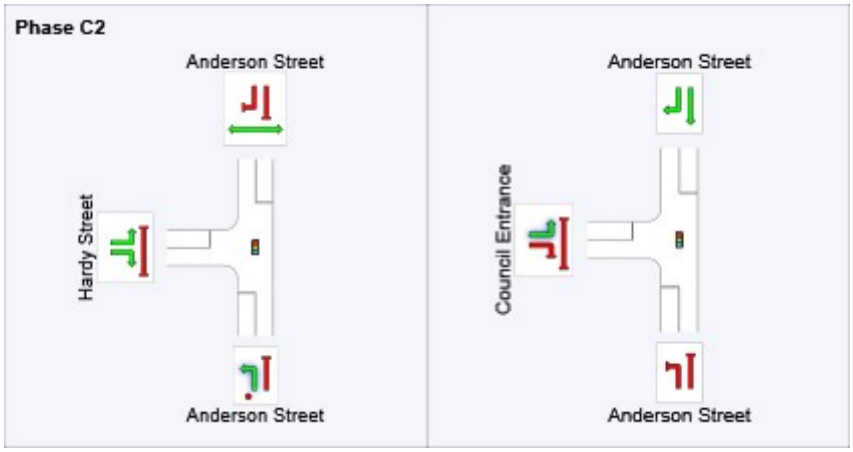
See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency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

Output Phase Sequence (CCG)









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

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Anderson Street															
Lane 1	604	3.4	604	3.4	797	0.758	100	3.6	LOS A	2.9	21.0	Full	27	0.0	26.5
Lane 2	609	5.0	609	5.0	803	0.758	100	1.1	LOS A	1.7	12.3	Full	27	0.0	0.0
Approach	1213	4.2	1213	4.2		0.758		2.3	LOS A	2.9	21.0				
North: Anderson Street															
Lane 1	469	5.0	469	5.0	899	0.522	100	22.8	LOS C	11.5	83.9	Full	500	0.0	0.0
Lane 2	469	5.0	469	5.0	899	0.522	100	22.8	LOS C	11.5	83.9	Full	500	0.0	0.0
Lane 3	201	2.0	201	2.0	225	0.895	100	74.7	LOS E	9.6	68.1	Short	45	0.0	NA
Approach	1139	4.5	1139	4.5		0.895		32.0	LOS C	11.5	83.9				
West: Hardy Street															
Lane 1	654	2.0	654	2.0	748	0.874	100	53.9	LOS D	23.3	166.0	Full	500	0.0	0.0
Lane 2	462	2.0	462	2.0	528[1]	0.874	100	49.3	LOS D	16.0	113.9	Short	85	0.0	NA
Approach	1116	2.0	1116	2.0		0.874		52.0	LOS D	23.3	166.0				
Intersection	3467	3.6	3467	3.6		0.895		28.0	LOS C	23.3	166.0				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.

Site: 149B [Anderson/Council Entrance (PJ 2020, PM)]

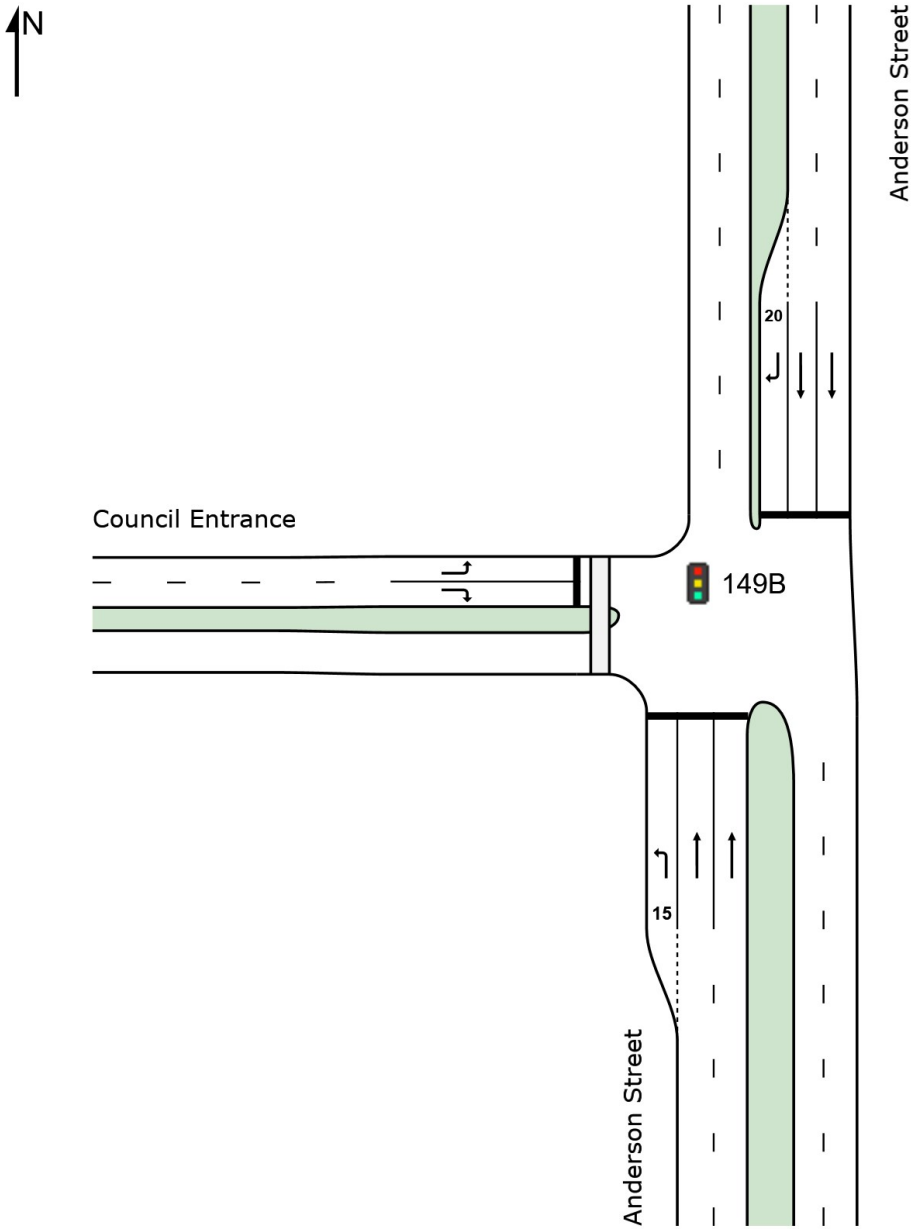
Network: 8 [HardySt/AndersonSt/CouncilEntrance (PJ 2020, PM)]

New Site
Site Category: (None)
Signals - Fixed Time Coordinated Cycle Time = 120 seconds (CCG User-Given Phase Times)
Common Control Group: CCG1 [TCS149]

Timings based on settings in the Network Timing dialog
Phase Times specified by the user
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C1, C2
Output Phase Sequence: A, B, C1, C2

Some CCG output elements have been omitted as they have already been included under other Sites belonging to the same CCG.

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Anderson Street															
Lane 1	3	2.0	3	2.0	778	0.004	100	19.7	LOS B	0.1	0.4	Short	15	0.0	NA
Lane 2	508	5.0	508	5.0	534[1]	0.951	100	71.6	LOS E	24.2	176.8	Full	500	-26.5[N3]	0.0
Lane 3	684	5.0	684	5.0	719	0.951	100	65.5	LOS E	31.1	227.4	Full	500	0.0	0.0
Approach	1195	5.0	1195	5.0		0.951		67.9	LOS E	31.1	227.4				
North: Anderson Street															
Lane 1	814	5.0	814	5.0	1726	0.472	100	0.4	LOS A	1.8	13.2	Full	27	0.0	0.0
Lane 2	793	5.0	793	5.0	1682	0.472	100	0.4	LOS A	1.5	10.8	Full	27	0.0	0.0
Lane 3	4	2.0	4	2.0	874	0.005	100	12.8	LOS B	0.1	0.4	Short	20	0.0	NA
Approach	1612	5.0	1612	5.0		0.472		0.4	LOS A	1.8	13.2				
West: Council Entrance															
Lane 1	21	2.0	21	2.0	576	0.037	100	24.5	LOS C	0.5	3.3	Full	50	-26.5[N3]	0.0
Lane 2	38	2.0	38	2.0	44	0.854	100	78.9	LOS E	1.6	11.3	Full	50	0.0	0.0
Approach	59	2.0	59	2.0		0.854		59.5	LOS E	1.6	11.3				
Intersection	2865	4.9	2865	4.9		0.951		29.8	LOS C	31.1	227.4				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.

USER REPORT FOR NETWORK SITE

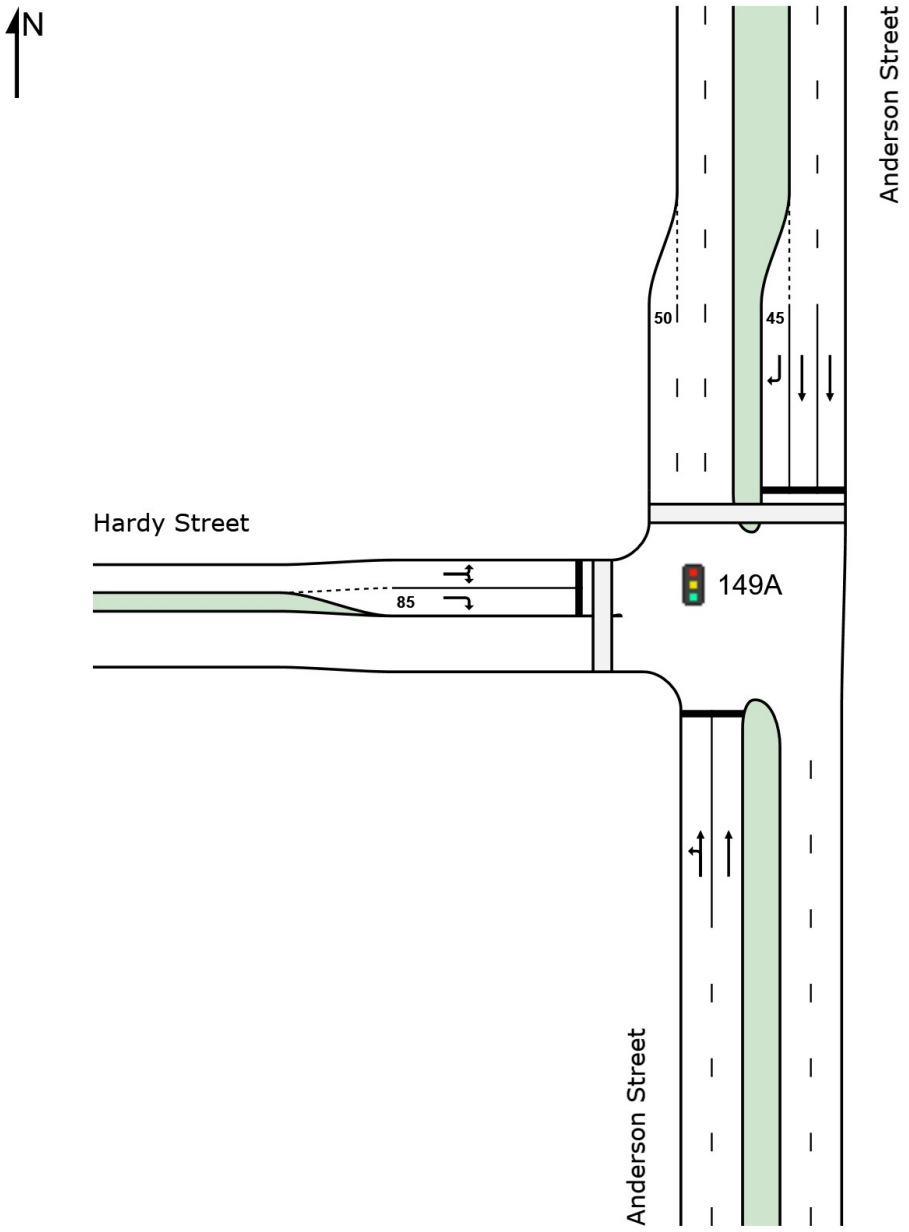
Project: 210506_V159104_SidraModelling_adjusted2020 CARDNO Match **Template: GTA Appendix Site**

Site: 149A [Hardy St/Anderson St (AP 2020, PM)] **Network: 10 [HardySt/AndersonSt/ CouncilEntrance (AP 2020, PM)]**

New Site
Site Category: (None)
Signals - Fixed Time Coordinated Cycle Time = 120 seconds (CCG User-Given Phase Times)
Common Control Group: CCG1 [TCS149]

Timings based on settings in the Network Timing dialog
Phase Times specified by the user
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C1, C2
Output Phase Sequence: A, B, C1, C2

Site Layout

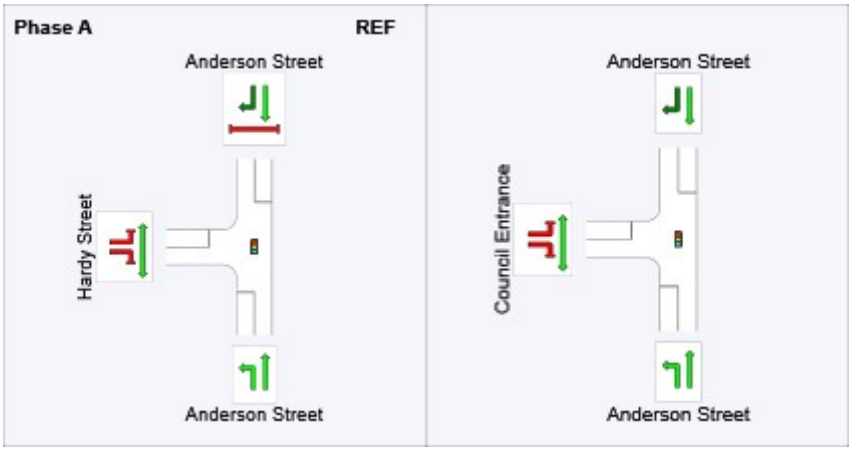


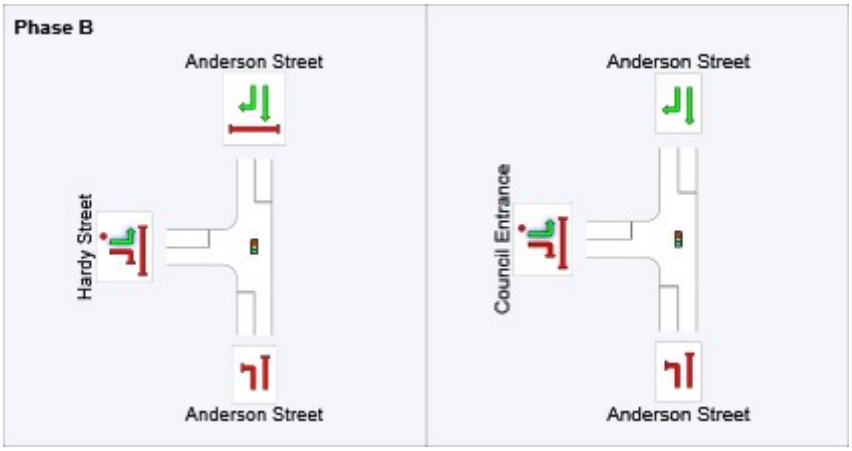
Phase Timing Summary (CCG)

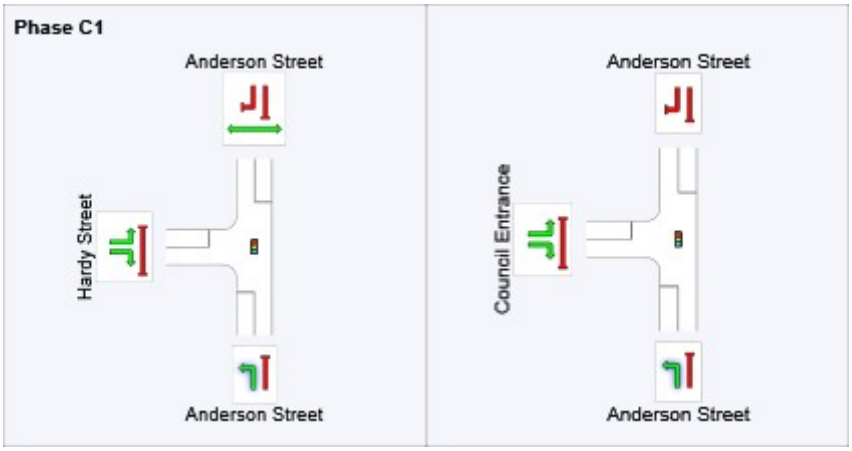
Phase	A	B	C1	C2
Phase Change Time (sec)	0	59	69	75
Green Time (sec)	53	4	3	42
Phase Time (sec)	59	7	6	48
Phase Split	49%	6%	5%	40%

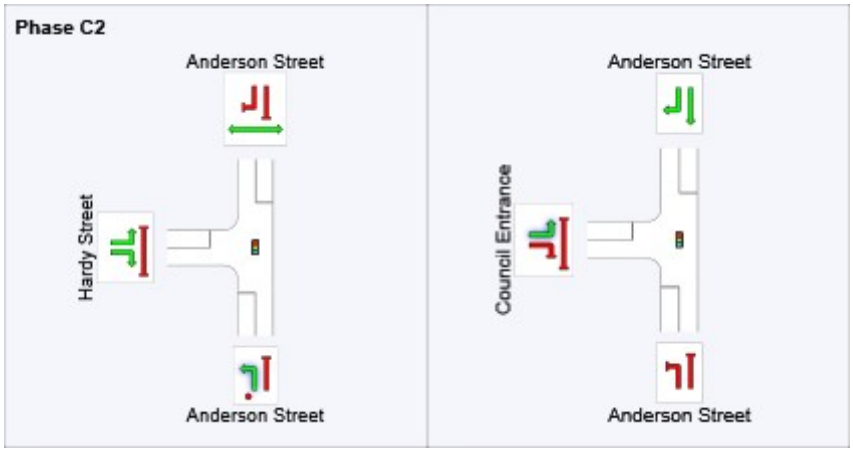
See the Phase Information section in the Detailed Output report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Phase Actuation and Phase Frequency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

Output Phase Sequence (CCG)









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

Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Anderson Street															
Lane 1	604	3.4	604	3.4	828	0.730	100	3.5	LOS A	2.6	18.8	Full	27	0.0	16.6
Lane 2	609	5.0	609	5.0	834	0.730	100	1.1	LOS A	1.5	11.1	Full	27	0.0	0.0
Approach	1213	4.2	1213	4.2		0.730		2.3	LOS A	2.6	18.8				
North: Anderson Street															
Lane 1	559	5.0	559	5.0	880	0.636	100	23.4	LOS C	14.6	106.4	Full	500	-5.4 N3	0.0
Lane 2	379	5.0	379	5.0	595 1	0.636	100	20.0	LOS B	8.4	61.4	Full	500	0.0	0.0
Lane 3	142	2.0	142	2.0	231	0.616	100	33.8	LOS C	4.3	30.3	Short	45	0.0	NA
Approach	1080	4.6	1080	4.6		0.636		23.6	LOS C	14.6	106.4				
West: Hardy Street															
Lane 1	609	2.0	609	2.0	719	0.847	100	49.8	LOS D	20.0	142.6	Full	500	-1.5 N3	0.0
Lane 2	455	2.0	455	2.0	538 1	0.847	100	45.5	LOS D	15.0	107.1	Short	85	0.0	NA
Approach	1064	2.0	1064	2.0		0.847		48.0	LOS D	20.0	142.6				
Intersection	3357	3.6	3357	3.6		0.847		23.6	LOS C	20.0	142.6				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

1 Reduced capacity due to a short lane effect. Short lane queues may extend into the full-length lanes. Some upstream delays at entry to short lanes are not included.
N3 Capacity Adjustment due to downstream lane blockage determined by the program.

Site: 149B [Anderson/Council Entrance (AP 2020, PM)]

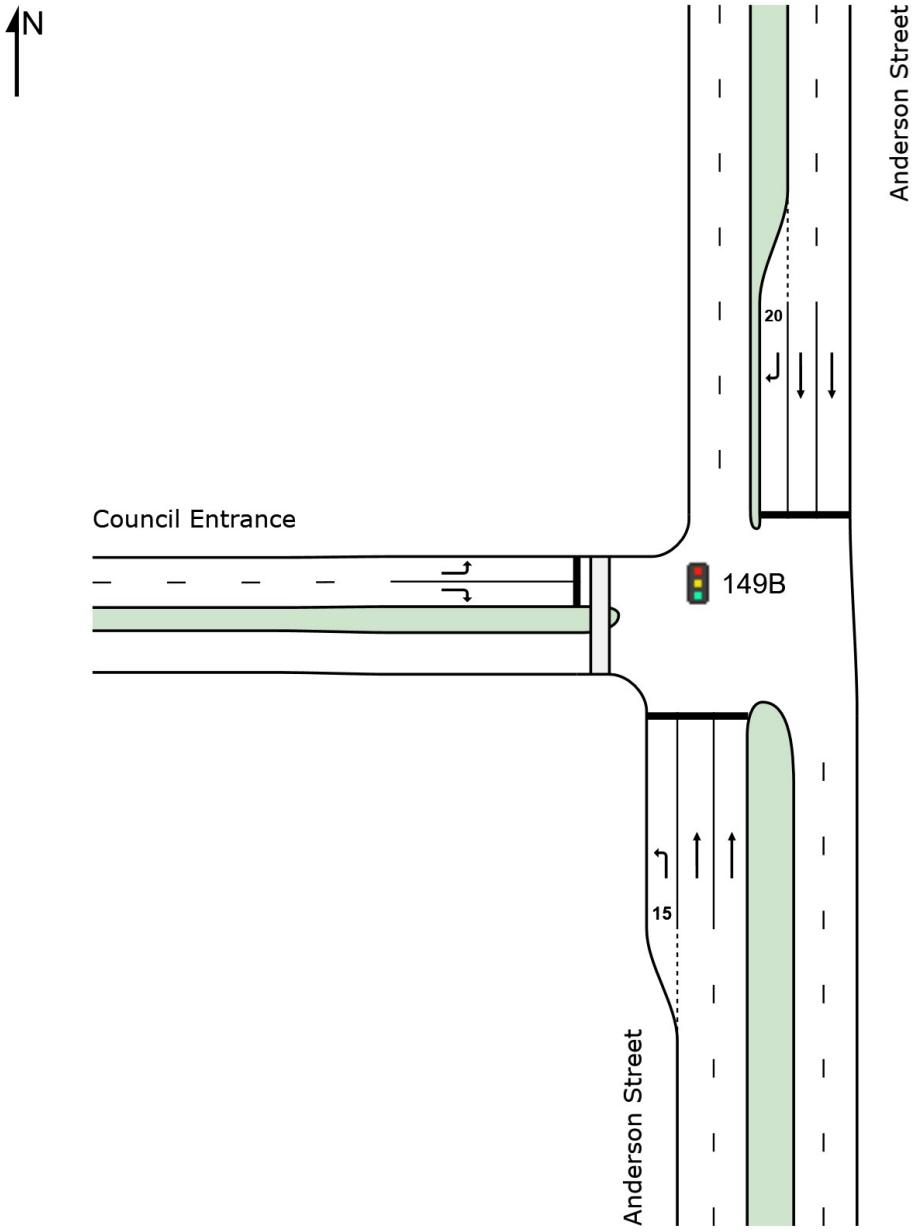
Network: 10 [HardySt/AndersonSt/ CouncilEntrance (AP 2020, PM)]

New Site
Site Category: (None)
Signals - Fixed Time Coordinated Cycle Time = 120 seconds (CCG User-Given Phase Times)
Common Control Group: CCG1 [TCS149]

Timings based on settings in the Network Timing dialog
Phase Times specified by the user
Phase Sequence: CCG Phasing
Reference Phase: Phase A
Input Phase Sequence: A, B, C1, C2
Output Phase Sequence: A, B, C1, C2

Some CCG output elements have been omitted as they have already been included under other Sites belonging to the same CCG.

Site Layout



Lane Use and Performance

	Demand Flows Total veh/h	HV %	Arrival Flows Total veh/h	HV %	Cap. veh/h	Deg. Satn v/c	Lane Util. %	Average Delay sec	Level of Service	Aver. Back of Queue Veh	Dist m	Lane Config	Lane Length m	Cap. Adj. %	Prob. Block. %
South: Anderson Street															
Lane 1	3	2.0	3	2.0	809	0.004	100	19.1	LOS B	0.0	0.4	Short	15	0.0	NA
Lane 2	545	5.0	545	5.0	633[1]	0.861	100	44.7	LOS D	20.3	147.9	Full	500	-16.6[N3]	0.0
Lane 3	647	5.0	647	5.0	751	0.861	100	42.6	LOS D	23.4	170.8	Full	500	0.0	0.0
Approach	1195	5.0	1195	5.0		0.861		43.5	LOS D	23.4	170.8				
North: Anderson Street															
Lane 1	814	5.0	814	5.0	1726	0.472	100	0.6	LOS A	2.3	16.6	Full	27	0.0	5.4
Lane 2	793	5.0	793	5.0	1682	0.472	100	0.4	LOS A	1.7	12.3	Full	27	0.0	0.0
Lane 3	4	2.0	4	2.0	880	0.005	100	11.7	LOS B	0.0	0.3	Short	20	0.0	NA
Approach	1612	5.0	1612	5.0		0.472		0.5	LOS A	2.3	16.6				
West: Council Entrance															
Lane 1	21	2.0	21	2.0	641	0.033	100	25.5	LOS C	0.5	3.3	Full	50	-16.6[N3]	0.0
Lane 2	38	2.0	38	2.0	44	0.854	100	78.9	LOS E	1.6	11.3	Full	50	0.0	0.0
Approach	59	2.0	59	2.0		0.854		59.8	LOS E	1.6	11.3				
Intersection	2865	4.9	2865	4.9		0.861		19.7	LOS B	23.4	170.8				

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Network Data dialog (Network tab).
Lane LOS values are based on average delay per lane.
Intersection and Approach LOS values are based on average delay for all lanes.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

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N3 Capacity Adjustment due to downstream lane blockage determined by the program.

C. MAROONDAH HWY / HUTCHINSON ST INTERSECTION LAYOUT

C

PLOTTED BY : DannyHuynh ON 20/05/2021 AT 3:22:42 PM

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PRELIMINARY PLAN
FOR DISCUSSION PURPOSES ONLY SUBJECT TO CHANGE WITHOUT NOTIFICATION

WARNING
BEWARE OF UNDERGROUND SERVICES
THE LOCATIONS OF UNDERGROUND SERVICES ARE APPROXIMATE ONLY AND THEIR EXACT POSITION SHOULD BE PROVEN ON SITE. NO GUARANTEE IS GIVEN THAT ALL EXISTING SERVICES ARE SHOWN.

DESIGNED D. HUYNH
DESIGN CHECK A. DELL'ISOLA
APPROVED BY C. COATH
DATE ISSUED 20 MAY 2021

SCALE A3 — 0 7.5 15 — CUSTOM 750
CAD FILE NO. V159105-01-P1.dgn

LILYDALE QUARRY DEVELOPMENT
MAROONDAH HWY & HUTCHINSON ST INTERSECTION

CONCEPT LAYOUT

DRAWING NO. V159105-01-01 SHEET 01 OF 01 ISSUE P1

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