Proposed Plan Change 11 to the Waipa District Plan – Bardowie Industrial Precinct

Integrated Transport Assessment

Bardowie Investments Limited

ISSUE 1, 25 JULY 2018

Proposed Plan Change 11 to the Waipa District Plan – Bardowie Industrial Precinct
INTEGRATED TRANSPORT ASSESSMENT

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EXECUTIVE SUMMARY

Bardowie Investments Limited (BIL) propose to develop an area of land as an industrial development. The land is currently a mix of Deferred Industrial Zone and Rural Zone. BIL propose to submit a Plan Change Request to rezone the rural land as industrial/deferred industrial.

The purpose of Proposed Plan Change 11 is to re-zone 56.7 hectares of land at Hautapu to Industrial Zone (referred to as the "Bardowie Industrial Precinct"). 30 hectares of the land is currently zoned Deferred Industrial Zone, with the balance (26.7 hectares) being zoned Rural Zone in the Waipa District Plan. Apart from the land owned and occupied by Shoof International Ltd, the site is predominately used by Fonterra Ltd for spray irrigation of dairy factory wastewater from the nearby Hautapu Dairy Manufacturing Site (and associated rural activities).

This Broad Integrated Transport Assessment (ITA) considers the development of the full Plan Change 11 area and typical industrial activity to understand the effects on the transport network as a result of the Proposed Plan Change 11.

Surrounding Transport Network

The existing transport network surrounding the site is comprised of local roads and a major arterial (State Highway 1B). Existing traffic volumes are within the capacity of the network to handle them and there are no efficiency issues in the area.

There is no relevant public transport network in the area. There is a shared use trail along the rail corridor between SH1B Victoria Road and Laurent Road The trail begins at the intersection of SH1B and Laurent Road and extends all the way south into Cambridge town connecting with the urban walking and cycling network. North of the Waikato Expressway, there are no pedestrian or cycle crossing facilities or footpaths—all walking and cycling traffic is directed towards the off-road trail. The development within the Bardowie Industrial Precinct shall comply with the requirements of the Waipa District Plan and as such include specific provisions for walking, cycling and public transport.

Fonterra uses rail to transport some of the products produced at the Hautapu site and requires access to the rail as part of its operations at the site. South of the Fonterra site the railway is non-functioning; tracks have been removed and a shared walking and cycling trail occupies the rail corridor. Kiwirail have indicated that they wish to maintain the Cambridge branch line designation for a possible future passenger service between Cambridge and Hamilton.

In the five year period 2013-2017 there have been 16 crashes in the area. There have been four crashes at the SH1B Victoria Road/Hautapu Road intersection and one crash at the intersection with Laurent Road. There have been no fatal or serious crashes in the last five years, with 75% of crashes resulting in no injury.

When the Hamilton Section of the Waikato Expressway opens in 2020, SH1B Victoria Road will revert to local road. The road classification is likely to remain as Arterial, with traffic volumes determining the classification of Major Arterial or Minor Arterial in the Waipa District Plan.

Description of the Proposal

The development of the site is to be carried out in three stages. Stages 1 and 2 involves development on the southern half of the 56.7ha site over a period of 5 years. The site will serve a manufacturing company that is relocating from Hamilton and consolidating its operations into the one area, occupying approximately 28.8ha. Stage 3 will service smaller developments, rolled out over a period from about year 5 into year 10. This stage occupies approximately 22.7ha. The remaining 5.2ha of the site is occupied by Shoof International.

The 56.7ha of land rezoned as industrial will generate around 12,000 vehicles per day. This is based on typical industrial trip generation rates of 20 trips/ha/hr for the peak hour and assuming this is approximately 10% of average daily traffic, we estimate the typical trip generation to be approximately 1200veh/hr for the entire site and around 600vph for Stages 1and 2 (28.8ha)

CONCLUSIONS

General

The Proposal contributes to the transportation objectives in the District Plan and Council's strategies. From a transportation perspective, the Proposal is well located to make efficient use of existing infrastructure and reduce adverse effects. It would be desirable for the Plan Change to be consistent with the Hautapu Industrial Structure Plan and District Plan transport rules.

The Proposed Plan Change includes a Structure Plan for the Bardowie Industrial Precinct to support the rezoning to ensure that the development occurs in a coordinated and planned manner. The Bardowie Industrial Precinct Structure Plan provides an opportunity to define:

- Infrastructure standards and requirements not already defined in the plan.
- Staging extents and requirements to ensure coordinated and sustainable delivery
- Layouts to align with desirable connections for all modes and possible future development
- Special rules for flexibility in parking requirements and to support alternative modes.

Mitigation of Effects

Adverse effects can be avoided or remedied through infrastructure and development requirements that can be triggered through plan rules and subdivision conditions. At grade intersections matched with staging will have adequate capacity.

The potential adverse effects relating to transport can be managed through rules, or dealt with by conditions at subdivision or building consent time. The rules or conditions would be likely to require the relevant structure plan infrastructure to be committed or in place prior to development/operation of the stage. That could be achieved by requiring a signed Private Development Agreement prior to development.

RECOMMENDATIONS

The Structure Plan for the Bardowie Industrial Precinct Structure Plan should allow for three stages, as follows:

- STAGE 1:
  - Use the Structure Plan layout to fix the Stage 1 layout and access arrangements, including a right turn bay on Victoria Road to be replaced by traffic signals when demand from subsequent stages requires it.
  - Ensure the Stage 1 access is formed to appropriate industrial collector road standards and supports connectivity for development of Stage 2 and Stage 3, provision of internal roads and suitable future connection to network;
  - Include appropriate pedestrian and cycle access and provide for bus services.
- STAGE 2:
  - Use rules to require a traffic impact assessment prior to development to determine when/whether traffic signals are required (This may not be required until commercial activities are in operation and there is traffic growth on Victoria Road from north of the Hautapu intersection;

- Use the Structure Plan layout to fix the Stage 2 layout and access arrangements, including a right turn bay or traffic signals on Victoria Road when demand from subsequent stages requires it;
- Include appropriate pedestrian and cycle access and provide for bus services;
- Use rules to protect space for pedestrian and cycle facilities and potential relocation of the rail corridor to run alongside the modified Victoria Road (where it would be wider than the existing Laurent Road corridor).

= STAGE 3:

- Use the Structure Plan layout as indicative road layout to illustrate connectivity and rules to require a layout and connections for Stage 3 that:
  - Provides an additional intersection for safe and appropriate connectivity with the surrounding transport network for all modes;
  - Connects with Stages 1 and 2; and,
  - Provides for future access to possible future industrial land.

The structure plan implementation should be supported by a preliminary design for a right turn bay on Victoria Road for the southern access and Waipa DC, NZTA and Kiwirail authorisation of the intersection.

The preliminary form of the Stage 2 access needs to be confirmed prior to construction of the Stage 1 access to avoid services and drainage arrangements conflicting with the future signals. The timing of construction for the signals should be reviewed prior to development in Stage 2.

The form and location of the Stage 3 access and road networks needs to be confirmed prior to development of Stage 3.

1. BACKGROUND

1.1. Description of Proposed Activity

Bardowie Investments Limited (BIL) propose to develop an area of land as an industrial development. The land is currently a mix of Deferred Industrial Zone and Rural Zone. BIL propose to submit a Plan Change Request to rezone the rural land as industrial/deferred industrial.

The purpose of Proposed Plan Change 11 is to re-zone 56.7 hectares of land at Hautapu to Industrial Zone (referred to as the "Bardowie Industrial Precinct"). 30 hectares of the land is currently zoned Deferred Industrial Zone, with the balance (26.7 hectares) being zoned Rural Zone in the Waipa District Plan. Apart from the land owned and occupied by Shoof International Ltd, the site is predominately used by Fonterra Ltd for spray irrigation of dairy factory wastewater from the nearby Hautapu Dairy Manufacturing Site (and associated rural activities).

The Waipa District Plan identifies the entire Bardowie Industrial Precinct (as well as land to the north and east) as being Growth Cell "C8", earmarking it for future industrial development.

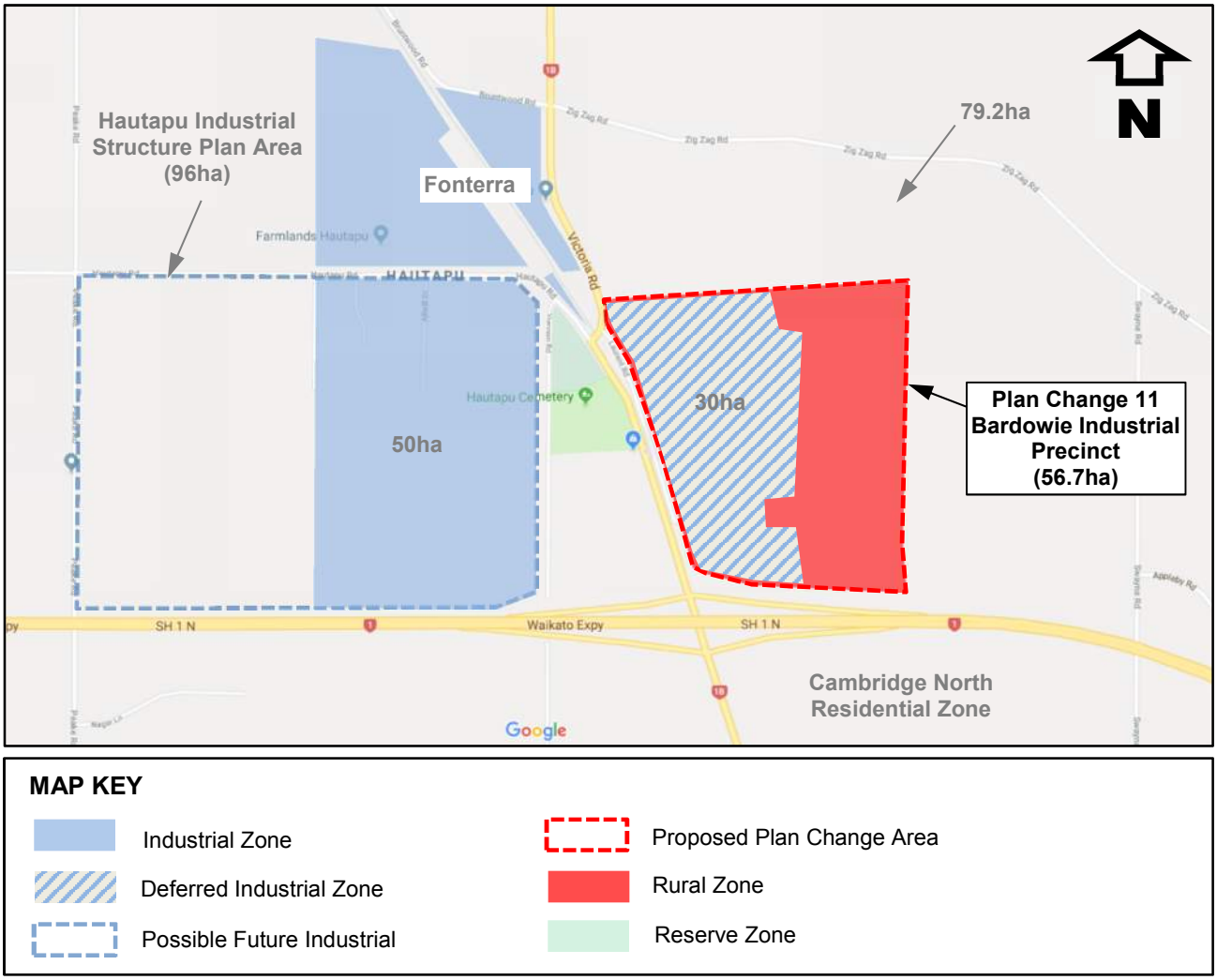


Figure 1: Location Plan

The location plan shows the wider area, adjacent to the Hautapu Industrial Structure Plan zone and south of the existing Fonterra Dairy factory site. The wider area is bounded by Victoria Road (SH1B)/Laurent Road on the western boundary, Swayne Road on the eastern boundary and Waikato Expressway on the southern boundary. The Cambridge North Residential zone is on the southern side of the Waikato Expressway.

This Broad Integrated Transport Assessment (ITA) considers the development of the full Plan Change 11 area and typical industrial activity to understand the effects on the transport network as a result of the proposed Plan Change 11.

1.2. Purpose and Intended Use of Integrated Transport Assessment (ITA).

BIL requires an Assessment of Environmental Effects (AEE), to support the Plan Change. The purpose of this Integrated Transport Assessment (ITA), is to inform the AEE.

The Waipa District Plan Rule 16.4.2.25 requires a Broad Integrated Transport Assessment (ITA) to be prepared for activities that generate more than 250 vehicle movements/day on Major and Minor Arterial Roads (including State Highways). The requirements of the Waipa DP are relevant to the Plan Change process.

The total land area to be re zoned is 56.7 Hectares. Using the typical site coverage and building area for industrial developments[1], the GFA could be approximately 123,000m^2.

Appendix T6 - Integrated Transport Assessment Vehicles per Day Conversion Table indicates that Industrial activities (including warehouses lock-up storage units, contractors and storage yards) (excluding transport depots) with more than 22,500m^2 GFA are likely to result in >1500 vehicles per day (vpd).

The scope of this Broad ITA meets the information requirements in Schedule 4 RMA (http://www.legislation.govt.nz/act/public/1991/0069/latest/DLM242008.html) and Waipa DP Rule 16.4.2.25 Requirements for Broad ITA (refer Appendix 1 for a referenced list of requirements),

This Broad ITA has been prepared by Gray Matter Ltd to support Bardowie Investments limited (BIL) application for Plan Change 11 to the Waipa District Plan. Preliminary traffic assessments have informed the optimisation of proposed intersection arrangements taking into account the intended staged development.

2. EXISTING LAND DATA

2.1. Description of Location

The site is located on the east side of Laurent Road, Cambridge which runs parallel to SH1B Victoria Road, north of the Waikato Expressway interchange.

This area is generally mixed use industrial and rural, buffered from the residential zones and Cambridge township by the Waikato Expressway corridor.

The key relationships are with Cambridge and the Waikato Expressway as shown in the Figure below.

[1] Typical industrial zones have approximately 70% site coverage, of which 35% is typically the building area. This equates to approximately 25% of the land area being taken as the GFA for the development.

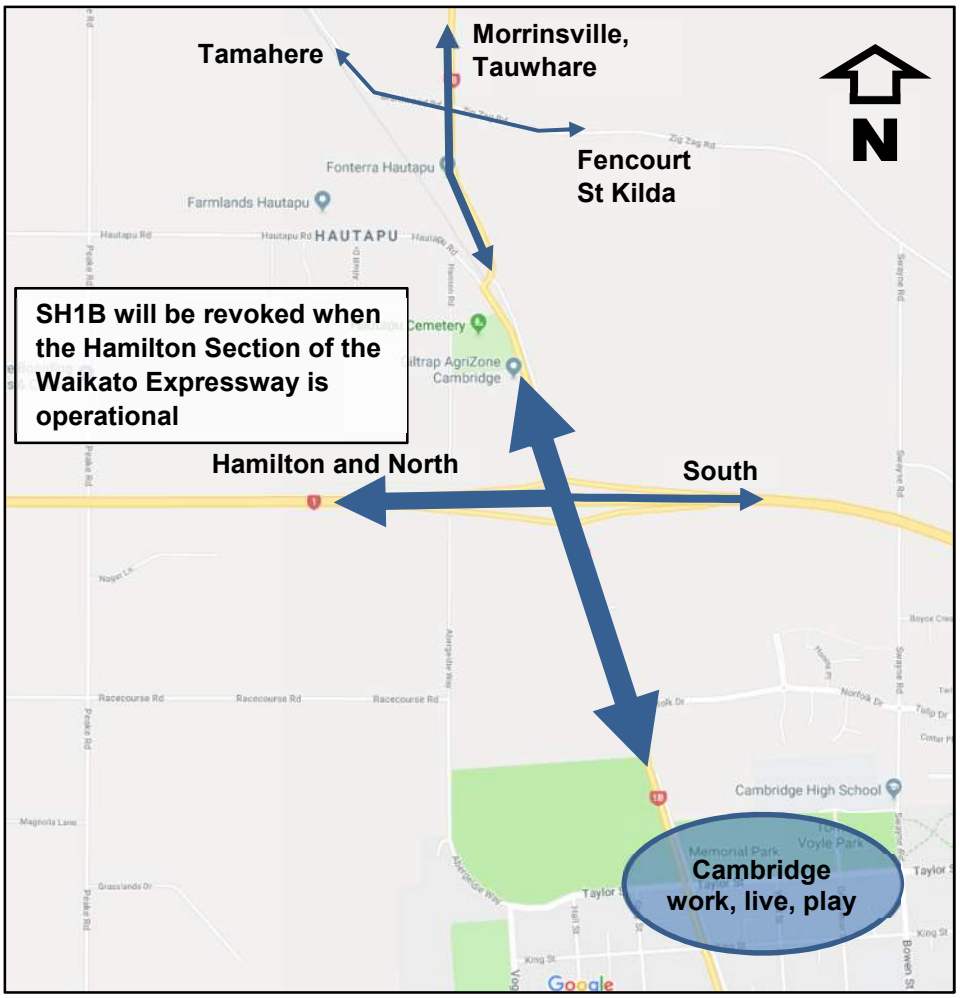


Figure 2: Key relationships with Bardowie Industrial Precinct

Future land use and network connectivity will be dramatically different. The District Plan shows industrial west and east of SH1B and the completion of the Hamilton Section of the Waikato Expressway will supersede SH1B's current role as a primary collector and significant road corridor. The dominant connections will be between the industrial area (east/west/dairy) and the south (Waikato Expressway and Cambridge) as illustrated in the figure below.

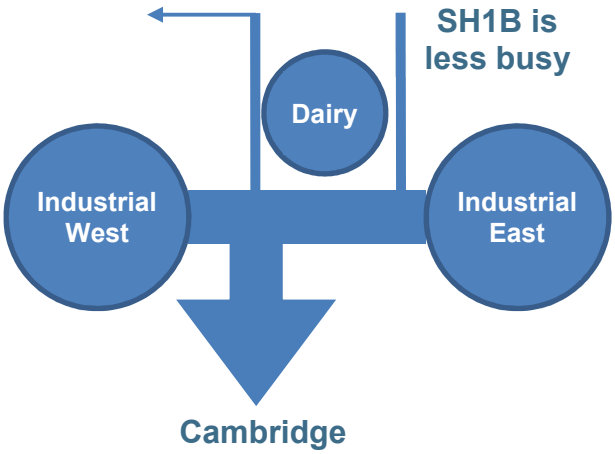


Figure 3: Dominant Connections of Development Cells

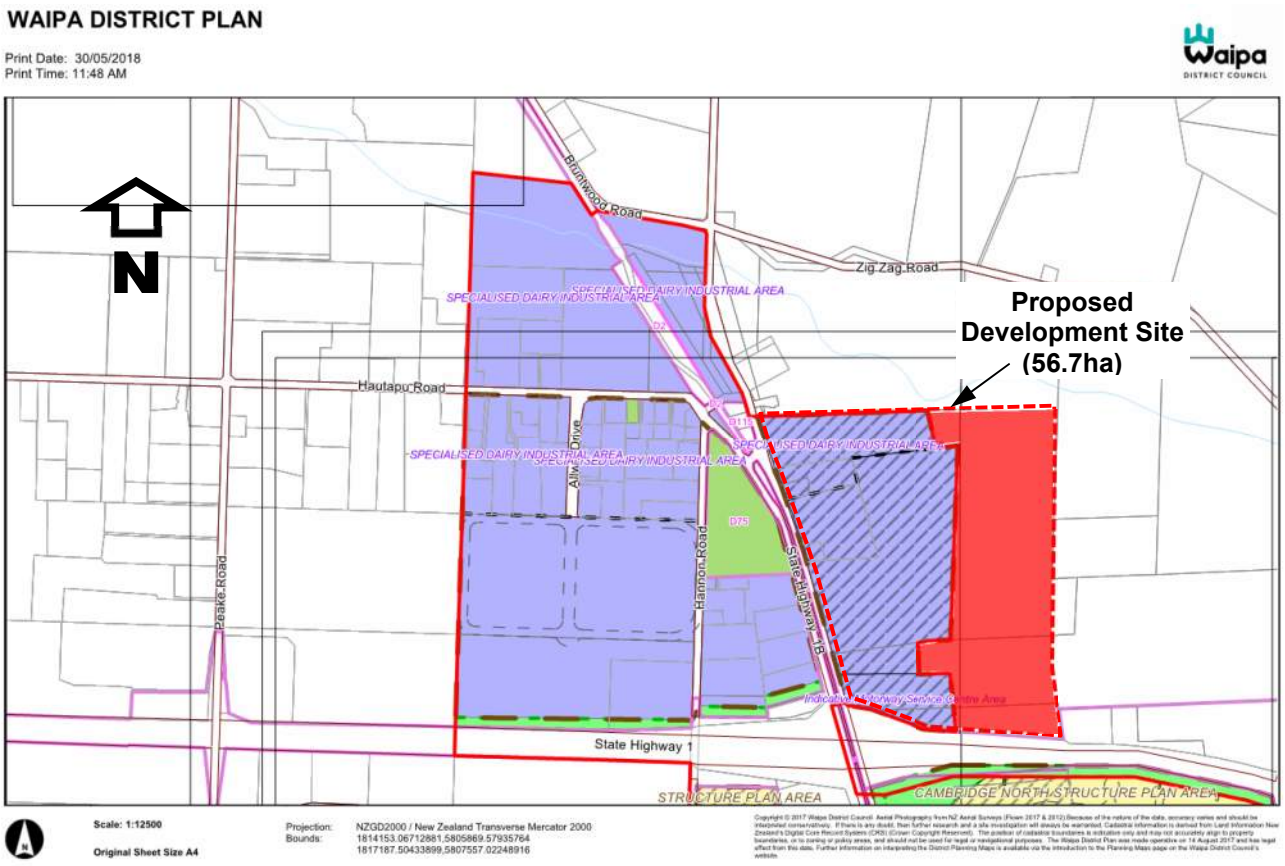


Figure 4: Location and Zoning (Waipa DC Maps Online)

2.2. Site Layout

The site is primarily flat grass farmland with frontage to Laurent Road and SH1B north of the intersection with Hautapu Road. The southern extent of the site borders the Waikato Expressway. Over half of the site is zoned Deferred Industrial, with the eastern side currently zoned Rural (shown red in Figure 2 above).

2.3. Existing Use

The existing use is primarily rural activities, with Shoof International the only existing industrial activity within the site. There are three dwellings within the site, with access via Laurent Road.

2.4. Adjacent and Surrounding Land Use

The land to the north of the site is rural, with three dwellings located on SH1B Victoria Road (opposite the dairy factory) with access onto Victoria Road. East of the site the land is mainly rural, with two dwellings located near Swayne Road. To the west the land use is mainly industrial with some rural use and the Fonterra Hautapu occupies the wedge of land north of Hautapu Road.

SH1B Victoria Road between the Waikato Expressway and Hautapu Road is fronted by industrial activities associated with agricultural industries.

The Cambridge Cemetery is located between SH1B Victoria Road and Hannon Road. Waipa DP zoning maps indicate a future expansion area for the cemetery on the triangle of land immediately north of the existing cemetery land.

Laurent Road is used to access Shoof International, an adjacent residential dwelling and a dairy farm.

The site is adjacent to the Hautapu Industrial Structure Plan area (zoned Future Industrial) and the Hautapu Dairy Manufacturing Site (zoned Special Dairy Industrial Area). State Highway 1B runs in a north-south direction along the eastern side of the existing future industrial zones.

The northern part of the Hautapu Industrial Structure Plan Area (along Hautapu Road) is predominantly small to medium sized industrial activities, whereas the southern part is mainly rural activities. Future development of this area includes the construction of new access roads with the proposed connection shown at the intersection of Allwill Drive and Hautapu Road including a new access to the Fonterra site.

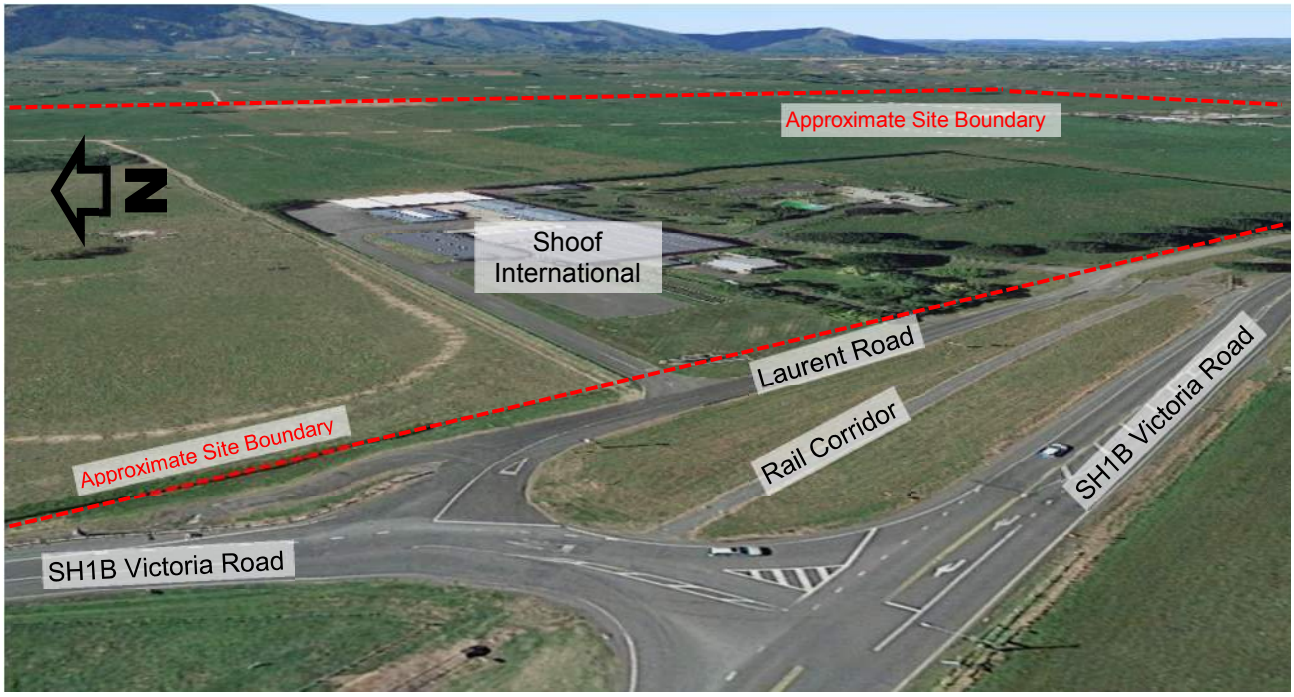


Figure 5: Aerial showing site and surrounding land use (Image from Google)

3. EXISTING TRANSPORT DATA

3.1. Description of Access Arrangements

The site includes multiple parcels of land with accesses located at SH1B Victoria Road (North of Hautapu Road intersection), and Laurent Road. Laurent Road is currently operating with a restriction on the number of heavy vehicle movements to Shoof International.

There are no existing accesses onto SH1B Victoria Road north of Hautapu Road and no direct access to Waikato Expressway.

3.2. Surrounding Road Network

The existing road network surrounding the site is comprised of local roads and a major arterial (State Highway 1B), as summarised in the table below. Existing traffic volumes are within the capacity[2] of the network to handle them and there are no efficiency issues in the area.

To the south of the site is the Waikato Expressway, accessed via SH1B Victoria Road and the Victoria Road interchange, providing connection to the main routes north and south.

[2] A two lane, two-way rural road in level terrain can accommodate 15,200vpd at Level of Service E.

Road Name	Road Hierarchy (Waipa DP)	One Network Road Classification (ONRC)	Current Traffic Volume
Victoria Road (SH1B) = North of Hautapu Road = South of Hautapu Road	 Major Arterial Major Arterial	 Primary Collector Primary Collector	 5,048vpd 7,878vpd
Laurent Road	Local Road	Access Road (Low Volume)	45vpd
Hautapu Road	Local Road	Secondary Collector	2,730vpd

Table 1: Summary of Existing Transport Network

Figure 6: Aerial showing site location adjacent to Waikato Expressway (Image from Google)

SH1B Victoria Road is a State Highway classified by NZ Transport Agency as a primary collector[3]. It is identified as a major arterial in the Waipa District Plan. It is also a Significant Road Corridor as identified in the Regional Policy Statement. SH1B is used as a bypass around Hamilton for trips between areas north of Huntly, travelling to/from areas to the south such as Rotorua and Taupō. It is also used as a collector for trips to/from the rural areas north.

[3] NZTA One Network Road Classification

Figure 7: SH1B Victoria Road, north of Hautapu Road, looking South

NZTA traffic counts[4] show 5,048vpd and 10% heavy vehicles on SH1B Victoria Road north of the intersection with Hautapu Road and 7,878vpd south of Hautapu Road.

At the northern end of the site, SH1B consists of two 3.5m traffic lanes and variable shoulder width of 0.5-2.5m. There is kerb and channel along the Fonterra frontage, past their entrances. There are no footpaths or shared paths along this section of SH1B, north of Hautapu Road.

Figure 8: SH1B Victoria Road, south of Hautapu Road, looking South

[4] All traffic volumes from https://mobileroad.org/desktop.html

SH1B south of Hautapu Road is 80km/h until it reaches the urban zone in Cambridge. At the Hautapu Road intersection and further north past the Fonterra site, the posted speed limit is 70km/h until just north of the Bruntwood Road/Zig Zag Road intersection.

At the southern end of the site, SH1B consists of two 3.5m traffic lanes and variable shoulder width of 1-1.5m. Further north, closer to Hautapu Road, the shoulders decrease in width to approximately 0.5-1.0m. There is no kerb and channel or footpath along this section of SH1B.

Figure 9: Laurent Road, looking South past Shoof International

Laurent Road intersects with SH1B Victoria Road just north of the intersection with Hautapu Road. It is classified as a local road in the Waipa District Plan and a local road (low volume) ONRC. It is a no exit road used to access Shoof International, three private residences and a dairy farm. The first 140m (approx.), south of SH1B Victoria Road is 6.0m wide and surfaced with chip seal and estimated to carry 45vpd. The remainder of the road is unsealed, approximately 4.0m wide and estimated to carry 10vpd.

The posted speed limit on Laurent Road is 80km/h and it is unmarked (beyond the intersection markings).

Figure 10: Hautapu Road, looking South towards the intersection with SH1B Victoria Road

Hautapu Road intersects with SH1B as the priority through road at the T intersection (priority on SH1B south and Hautapu Road). It is classified as a local road in the Waipa District Plan and a secondary collector ONRC.

It has a 70km/h posted speed limit and carries an estimated 2,730vpd. Hautapu Road has an overall road with of approximately 7.5m, consisting of two 3.5m lanes and variable shoulder width. Shoulders are narrow where there is kerb and channel (at the intersection with Hannon Road), and increase to 2.5m or more where parking and turning space is provided in front of the Hautapu Country Store and other activities.

Hautapu Road has kerb and channel up to and along the extent of the Fonterra Site.

3.3. Comment on Public Transport, Walking and Cycling networks

There is no relevant public transport network in the area, but Waipa DC are considering suburban bus services.

There is a shared use trail along the rail corridor between SH1B Victoria Road and Laurent Road The trail begins at the intersection of SH1B and Laurent Road and extends all the way south into Cambridge town connecting with the urban walking and cycling network. North of the Waikato Expressway, there are no pedestrian or cycle crossing facilities or footpaths—all walking and cycling traffic is directed towards the off-road trail.

The existing trail does not feature in Waipa's Cycle Network Strategic Framework[5], but is shown as a shared use path in the Waipa Integrated Transport Strategy.

[5] http://www.waipadc.govt.nz/our-district/MajorProjects/Documents/Waipa%20District%20Cycle%20Network%20Strategic%20Framework%2005.05.16.pdf

3.4. Crash History

In the five year period 2013-2017 there have been 16 crashes in the area. There have been four crashes at the SH1B Victoria Road/Hautapu Road intersection and one crash at the intersection with Laurent Road. There have been no fatal or serious crashes in the last five years, with 75% of crashes resulting in no injury.

At SH1B Victoria Road/Hautapu Road the crashes all involved crossing-turning manoeuvres, with three of the crashes resulting from a southbound vehicle re-ending the queued traffic, pushing the queued vehicle into the intersection. The other crash involved a southbound right-turning vehicle failing to give way to the opposing through traffic which had priority.

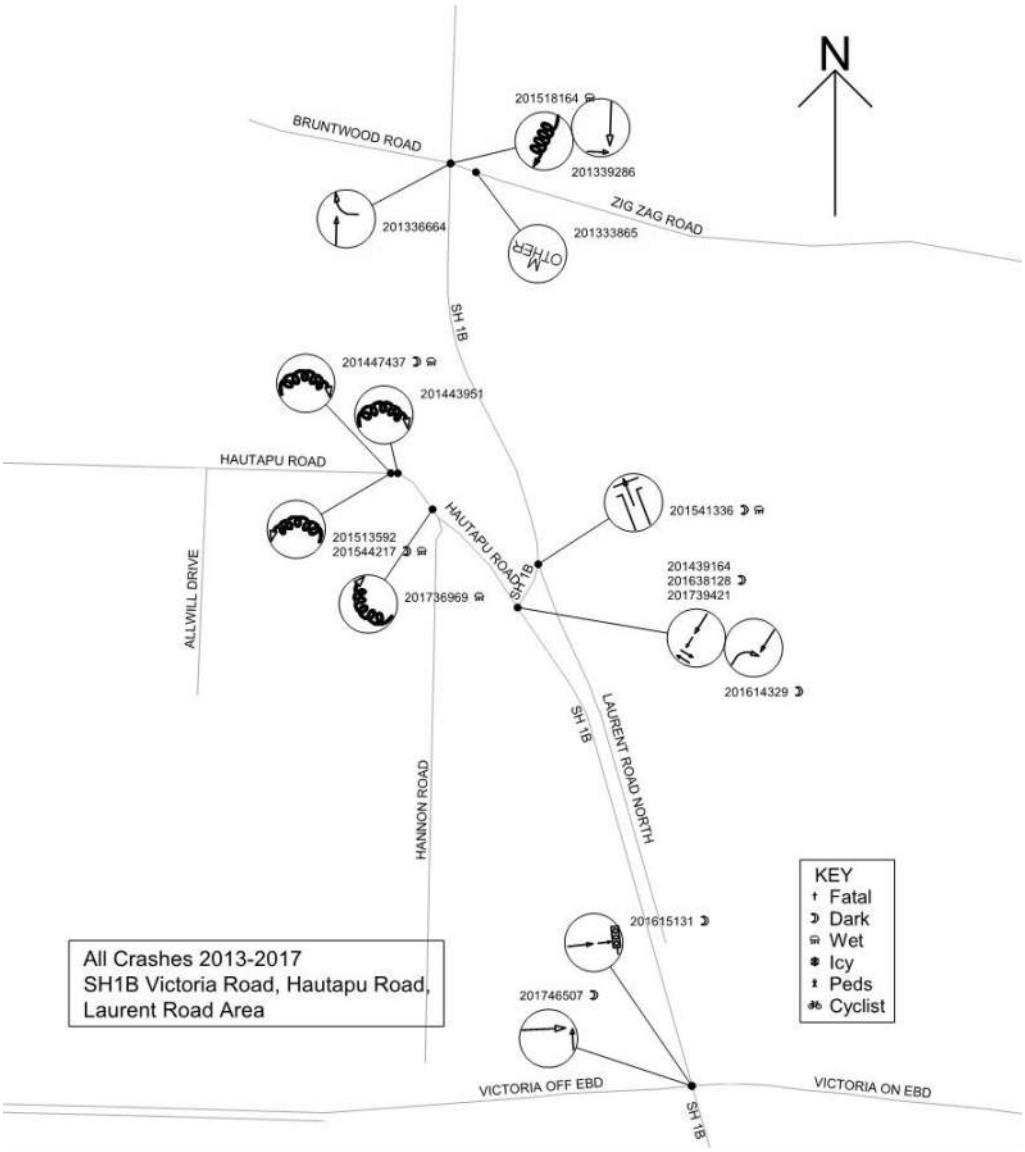


Figure 11: Collision diagram from CAS – All Crashes 2013-2017

3.5. Rail Corridor

The existing rail designation for the Cambridge branch line passes through the Fonterra Dairy Manufacturing Site and follows the grass berm between SH1B Victoria Road and Laurent Road. The rail corridor continues into the northern end of the Cambridge Town Centre, terminating at the end of Whitaker Street (old railway yard).

The Plan Change does not preclude rail although the developer does not expect rail options to suit their target market.

Fonterra uses rail to transport some of the products produced at the Hautapu site and requires access to the rail as part of its operations at the site. South of the Fonterra site the railway is non-functioning; tracks have been removed and a shared walking and cycling trail occupies the rail corridor.

Kiwirail have indicated that they wish to maintain the Cambridge branch line designation for a possible future passenger service between Cambridge and Hamilton.

Recent developments that have included a new connection or changes to an existing connection onto Victoria Road (Norfolk Drive/Victoria Road signalised intersection and Hamilton Road/Victoria Street roundabout) have used a Deed of Grant between Kiwirail and Waipa District Council. This allows Waipa DC access over the rail designation corridor on the basis of a per annum license fee for perpetuity, or until such time that Kiwirail wish to revoke that access.

Kiwirail will be consulted as a key stakeholder for the access options to the Plan Change 11 area.

4. COMMITTED ENVIRONMENTAL CHANGES

4.1. Planned Land Use Changes

Waipa 2050 shows the possible future industrial areas north of the Waikato Expressway. The Proposal sits entirely within the wider area as shown in the figure below as published in Waipa 2050.

The Hautapu Industrial Structure Plan shows future industrial development on the block bounded by Peake Road, Hautapu Road, Hannon Road and Waikato Expressway. The Waipa District Plan shows 50ha of industrial zone within the Hautapu Industrial Structure Plan area (96ha total) and is expected to be developed over the next 30 years or more.

The Hautapu Dairy Manufacturing Site is also specifically identified in the Waipa DP as a Specialised Dairy Industrial Area. There is capacity on this site for future development.

The area to the east of Laurent Road is shown as future industrial, covering at least 136ha, extending to Swayne Road and Zig Zag Road. The Waipa DP shows approximately 30ha of the Laurent Road block zoned as Deferred Industrial Zone.

Figure 12: Waipa District Growth Cells and Stages for Cambridge (Waipa 2050)

4.2. Planned Road Network Changes

The Hautapu Industrial Structure Plan included a proposed layout plan for roads to service the new developments, consisting of a main collector road with access off Hautapu Road and a series of local roads. There are no other planned changes to the existing local road network in the immediate vicinity.

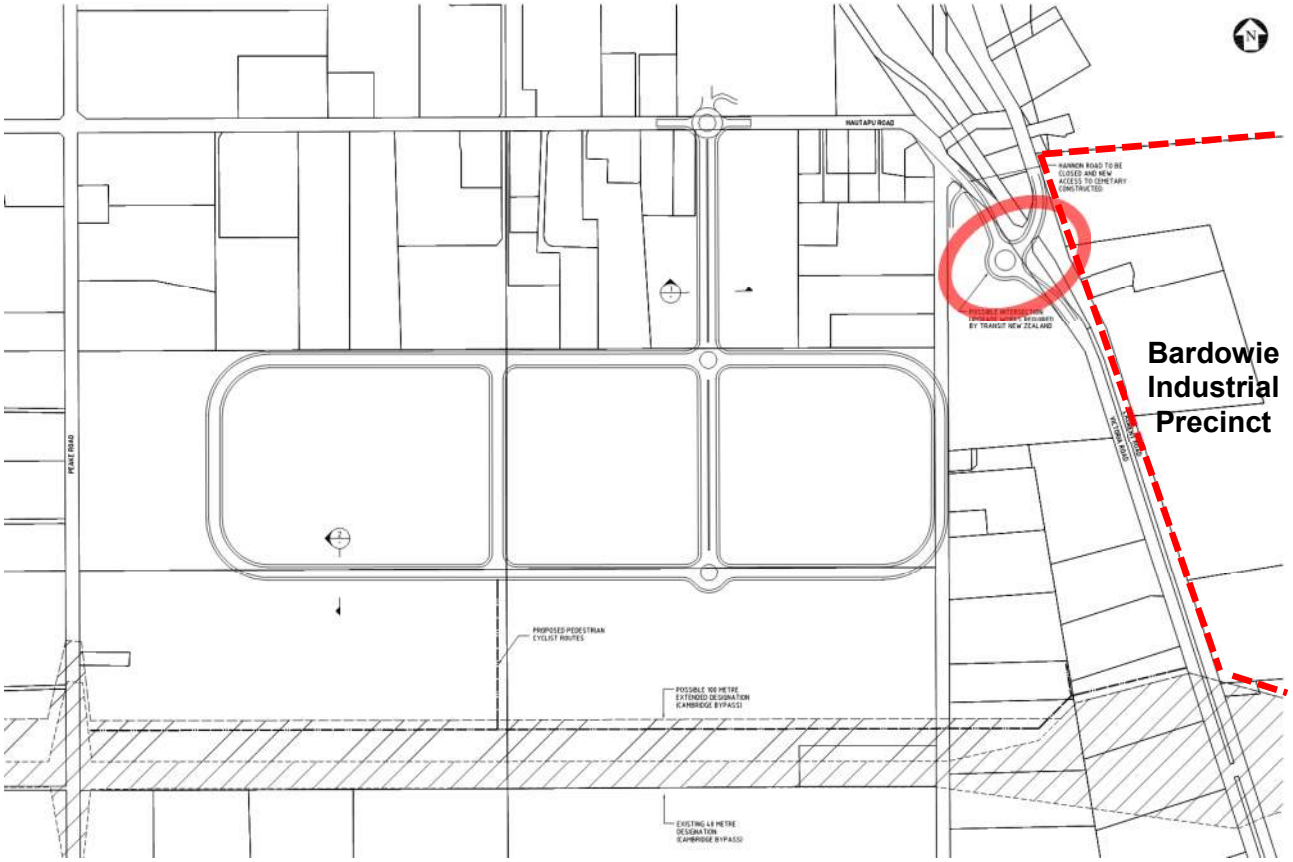


Figure 13: Hautapu Structure Plan Roading Layout (Beca) - showing future Victoria Road intersection

When the Hamilton Section of the Waikato Expressway opens in 2020, SH1B Victoria Road will revert to local road. The road classification is likely to remain as Arterial, with traffic volumes determining the classification of Major Arterial or Minor Arterial in the Waipa District Plan.

Victoria Street (south of the Waikato Expressway) is classified as Minor Arterial.

The future classification of Victoria Road will have an influence on the design standards of any future roads that will connect to it. It is worthwhile allowing for the new roads to be designed to a standard that integrates with future planned changes.

The Cambridge Section of the Waikato Expressway opened in 2016 and resulted in the following outcomes:

- separating inter-regional SH1 traffic from local Cambridge traffic;
- reducing congestion and intersection delays;
- improving safety for local pedestrians, horse riders, cyclists and traffic; and
- reducing traffic noise within the confines of Cambridge.

The Hamilton Section of the Waikato Expressway is expected to further increase the positive effects of these outcomes.

Road Name	Road Hierarchy (Waipa DP)	One Network Road Classification (ONRC)
Victoria Road = North of Hautapu Road = South of Hautapu Road	Major or Minor Arterial Major or Minor Arterial	To be determined – Likely to be Secondary Collector To be determined – Likely to be Arterial
Laurent Road	Local Road	Access Road (Low Volume)
Hautapu Road	Local Road	Secondary Collector

Table 2: Summary of Expected Road Network (2020)

5. EXISTING TRAFFIC AND TRIP GENERATION

5.1. Trip generation of existing use

The existing use and planned future trip generation is summarised in the table below. The typical trip generation for industrial developments is based on 20 trips/ha/hr for peak flow, being approximately 10% of the average daily traffic. This is consistent with other studies in the District and is explained further in Section 7.1 regarding trip generation of the proposed Plan Change 11 area.

Description of Area	Area	Typical industrial Trip Generation
Existing Laurent Road Deferred Industrial Zone	30.8ha	7,000vpd
Existing Hautapu industrial area	50ha	11,000vpd
Laurent Road possible future industrial area	26.7ha	6,000vpd
Hautapu Road possible future industrial area	96ha	20,000vpd
Hautapu Dairy Manufacturing Site (Fonterra)	21ha	2,400vpd (from Fonterra ITA)

Table 3: Typical Industrial Trip Generation based on existing land use

6. DETAILS OF THE PROPOSAL

6.1. Description of the Proposal

BIL intends to apply for a Plan Change Request and subsequently apply for resource consent to establish series of staged developments on the 56.7ha site over a period of approximately 10 years.

This ITA supports the Plan change Request to change 30.8ha of Deferred Industrial zoned land and 25.9 ha of Rural zoned land to Industrial Zone.

The development of the site is to be carried out in three stages. Stages 1 and 2 involves development on the southern half of the 56.7ha site over a period of 5 years. The site will serve a manufacturing company that is relocating from Hamilton and consolidating its operations into the one area, occupying approximately 28.8ha. Stage 3 will service smaller developments, rolled out over a period from about year 5 into year 10. This stage occupies approximately 22.7ha. The remaining 5.2ha of the site is occupied by Shoof International.

6.2. Conceptual Site layout

Figure 14: Conceptual Layout (See also Appendix A) – to illustrate expected connectivity

6.3. Proposal Details

For the purposes of this ITA to support Plan Change 11, we have assumed a typical industrial development on the site to be known as the Bardowie Industrial Precinct. The specific nature of development is undetermined and as such the details of access locations and forms, road layouts, carparking requirements and multimodal access are being developed. However, in terms of accommodating the requirements of the Waipa DP the following are noted:

- Road layouts – there is ample space within the Plan Change 11 area to accommodate the necessary components of the roading network. The existing intersection separation challenges at Laurent/Victoria are minor as can be shown in the other similar intersections along the Victoria Road and Victoria Street corridor. The road standards shall meet or exceed the DP and ITS requirements.

- Carparking – for the purposes of this Transport Assessment to support the Plan Change 11 application, our assumptions are based on a typical building coverage of 25% (GFA/site gross developable area (30% roads, 70% nett developable area)). For example, using typical maximum site coverage of 70% for industrial developments of which 35% is the maximum GFA, we can calculate the area required for carparking. For a 5ha site (gross), the maximum building size is 12,500m^2 requiring 125 carparks (1 per 100m^2 of GFA), taking up approximately 3,125m^2 (25m^2 per space). This type of parking demand and site coverage can be assessed and accommodated on a site-by-site basis.

The buildings expected in Stage 1 are very large (up to 5ha GFA), with low staffing levels (approximately 60 people operating in two shifts – 30 people at a time). Maximum likely demand would be 60 spaces at shift change (1 space per 800m^2 GFA), allowing space for visitors in between. The District Plan requirement would be 500 spaces which is clearly excessive. It would be desirable to allow some flexibility to avoid a surplus of parking for large buildings with low occupancy.

- Multi modes access – the greenfields nature of the site and proximity of existing walking and cycling infrastructure mean that there are few obstacles or limitations on the ability to incorporate safe and efficient access for other transport modes early in the design process.

7. PREDICTED TRAVEL DATA

7.1. Trip generation of The Proposal

The 56.7ha of land rezoned as industrial will generate around 12,000 vehicles per day.

This is based on typical industrial trip generation rates of 20 trips/ha/hr for the peak hour and assuming this is approximately 10% of average daily traffic, we estimate the typical trip generation to be approximately 1,200veh/hr, or 12,000vpd for the entire site.

For consistency and simplicity, we have adopted the trip generation rates used in the Traffic Impact Assessment for Hautapu Future Industrial Zone (Aecom, 2011). These were based on trip rates per hectare as a function of gross site area. The gross site area includes roads, drainage reserves, etc. and it has been assumed that approximately 30% of the land area will be occupied by roads, other infrastructure and reserves.

Building coverage is typically 35% of the remaining 70% of land area, or approximately 25% of the gross land area. This leaves approximately 45% of the land area for landscaping, surface carparking, accessways, servicing areas, etc.

Using a building coverage/GFA of the site of 25% we can covert trip rates from trips/100m^2 GFA to trips/ha. Using the various trip rate sources results in trip rates ranging from 11 trips/ha to over 30 trips/ha. Industrial trip rates are difficult to predict because of the nature and variability of the industrial activities that occur.

In their Traffic Impact Assessment, Aecom considered local traffic surveys of industrial areas to determine a suitable trip rate for Hautapu. They considered a trip rate of 20 trips/ha to be a conservatively high estimate for the potential type of industrial activities anticipated at the site it's scale and suitability for warehousing/distribution. This is predicted to decrease as the area grows.

The figures below (from Aecom's Traffic Impact Assessment) illustrate the traffic generation from the C8 and Hannon Road growth cells superimposed on the base network traffic volumes (from Waikato Regional Traffic Model 2041) for the AM and PM Peak hours.

Overlaying the figures with the predicted traffic generation from the Plan Change 11 area and applying this to only one access (worst case) shows the predicted typical traffic generation from the 56.7ha industrial zone results in lower traffic volumes at the access onto Victoria Road than the Aecom assessment.

With staged development and the opening of the north access point in the future, the traffic volume at the south access is unlikely to reach these levels.

Modelling carried out by Aecom for their Traffic Impact Assessment showed that an intersection at the south access would need to be in the form of a roundabout or signalised intersection to manage

the predicted 6,700vpd on Victoria road in combination with the total traffic from Growth Cell C8 (predicted 12,000vpd).

Aecom also considered the effects on the existing Victoria Road/Hautapu Road intersection and concluded that the intersection is poorly suited to the traffic flows regardless of whether the C8 block is developed. Aecom also noted that development of the C8 block could enable the realignment of the rail designation and hence present an opportunity to improve the safety and efficiency of the Victoria Road/Hautapu Road intersection.

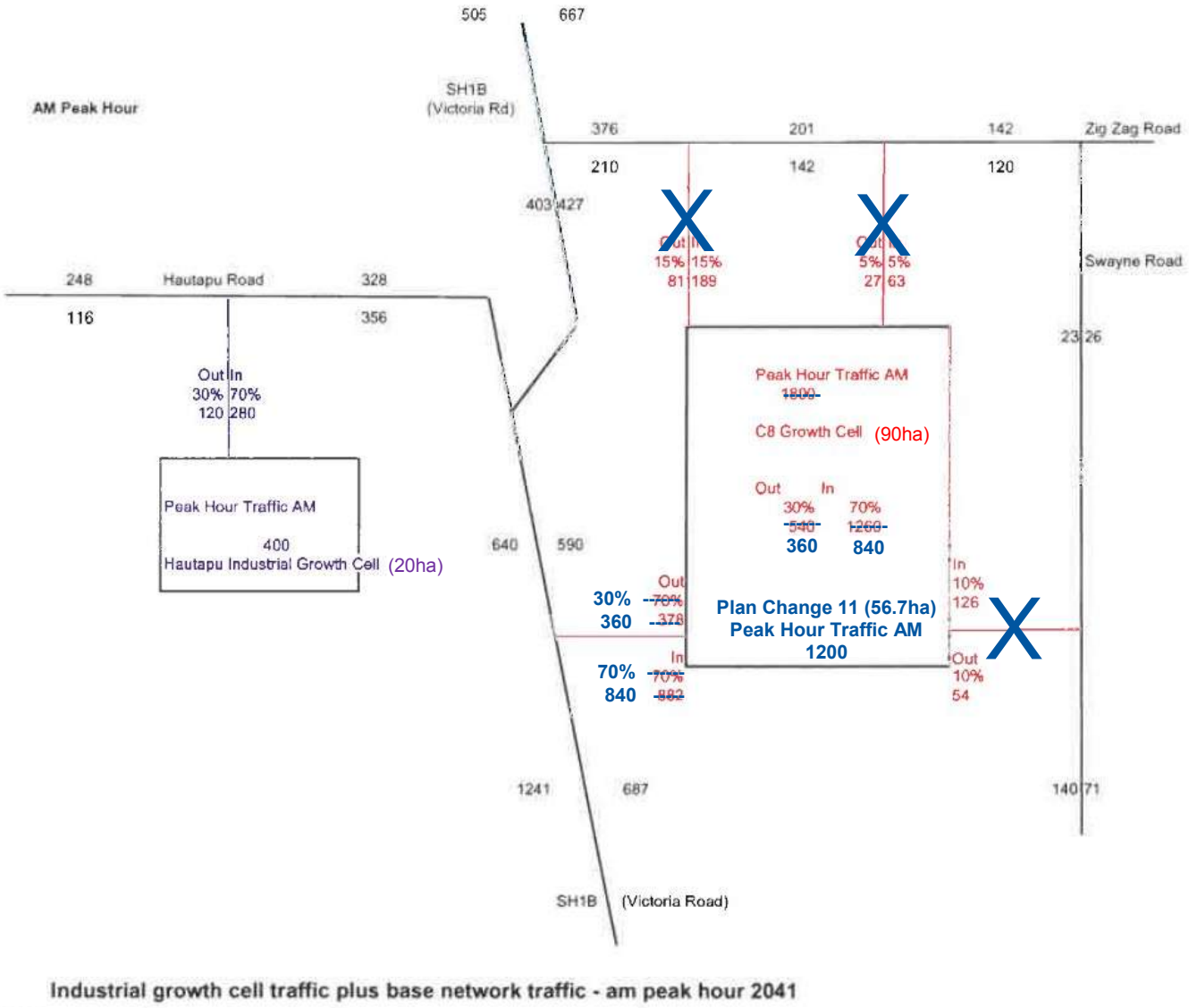


Figure 15: AM Peak Hour Trips for Plan Change 11 area – Figures shown in Blue

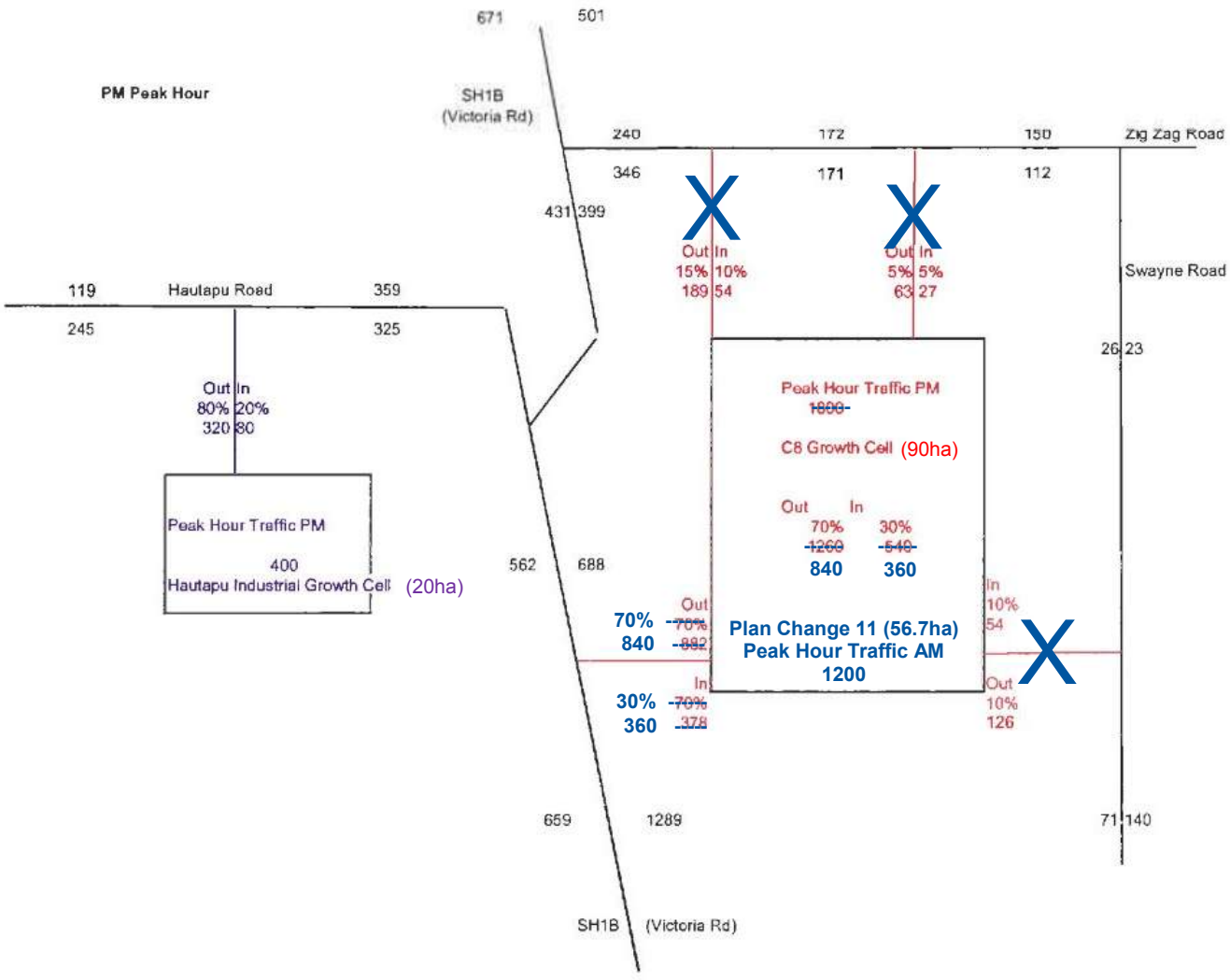


Figure 16: PM Peak Hour Trips for Plan Change 11 area – Figures shown in Blue

Plan Change 11 brings a proportion of the identified growth cell online earlier, adding 26.7ha of industrial zoned land to make the 56.7ha area.

The trip generation for the additional 26.7ha is approximately 5,400vpd.

7.2. Trip distribution of The Proposal

The 12,000vpd generated from the Plan Change 11 area will predominantly have origins and destinations accessed via the State Highway network. It is predicted that most of traffic will travel down SH1B Victoria Road onto the Waikato Expressway via the Victoria Road interchange.

A small proportion of The Proposal's traffic is expected to travel through Cambridge Town Centre (employees and local servicing).

For consistency, we have built on the traffic distribution assumptions from Aecom's Traffic Impact Assessment which identified that whilst employees would be dominantly drawn from the Cambridge area, a substantial number of employees would be drawn from the Hamilton Area. For analysis of the traffic from Growth Cell C8, Aecom assumed that 65% of traffic would be travelling to/from the south and 35% to/from the north. Since the most convenient route to the Hamilton and north will be

via the Waikato Expressway once the Hamilton section opens, we consider 80% / 20% to be appropriate. This is consistent with the approach used in Aecom's traffic assessment. The splits are shown on the figures below.

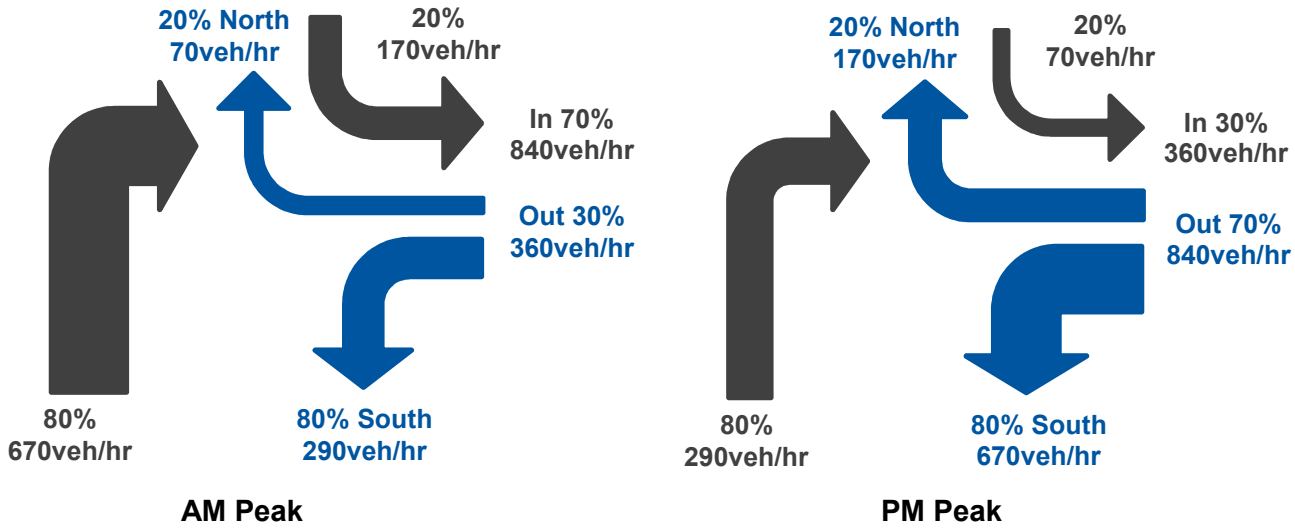


Figure 17: Turning volumes for the Am and PM Peak for a single access to Plan Change 11 area (1200veh/hr)

The above scenario represents a worst case for traffic demand at a single access point onto the road network. As identified by Aecom, the most suitable form of intersection for the volume of traffic is either signalised intersection or a roundabout.

7.3. Consideration of other modes

The Plan Change 11 area is within easy walking distance of the northern residential areas of Cambridge and within easy cycling distance of all of Cambridge. Pedestrians and cyclists are provided for along the length of Victoria Road with an off road shared path up to the intersection with Hautapu Road. There are pedestrian and cyclist crossing facilities at the signalised Waikato Expressway on/off ramp intersections and Norfolk Drive, with basic infrastructure on the lower volume road crossings within the Cambridge urban area.

As described in Section 6 above, the development within the Bardowie Industrial Precinct is likely to occur in three stages, each requiring an access onto the road network. Having two accesses allows for public transport access and efficient circulation of bus services.

The development within the Bardowie Industrial Precinct shall comply with the requirements of the Waipa District Plan and as such include specific provisions for walking, cycling and public transport.

8. COMPLIANCE WITH POLICY AND OTHER FRAMEWORKS

The Proposal

- takes account of the principles and objectives under the Waikato Regional Policy Statement
- are consistent with the relevant Town Centre Concept Plan
- include a demonstration of how provision has been made for passenger transport, walking and cycling

This section:

- outlines national, regional, and local policies and objectives related to transport
- provides comment on the proposed plan change and its consistency with, or support for, the above objectives and policies.

8.1. National Transport Objectives

8.1.1. GPS 2018

The Government Policy Statement (GPS 2018) on land transport takes effect on 1st July 2018. It sets out how the National Land Transport Fund will prioritise spending over the next 10 years. The four strategic priorities for GPS 2018 are safety, access, environment and value for money.

The proposed plan change is not in conflict with the GPS and supports its focus on access by locating industrial activities close to a main transport route (Waikato Expressway).

8.1.2. NZ Transport Agency Documents

NZ Transport Agency is responsible for a number of national plans including the National Land Transport Programme, the Integrated Planning Strategy and is also responsible for the operation of the state highway network. This includes the Waikato Expressway / State Highway 1.

The proposed plan change does not conflict with NZTA strategies and plans.

8.2. Regional Transport Objectives

8.2.1. RPS (Regional Policy Statement)

Waikato's Regional Policy Statement (RPS) sets out policies and objectives that address resource management issues in the region.

The proposed plan change supports the RPS by extending an already identified area for industrial development located in an area with access to strategic transport links, and supporting economic outcomes.

Hautapu is specifically referenced Table 6-2 of the RPS, in relation to industrial land allocation identified in Futureproof, and with the following allocation and staging:

- 2021 – 2021 20 hectares
- 2021 – 2041 40 hectares
- 2041 – 2061 36 hectares
- Total allocation 96 hectares

Note: these RPS figures are regarded as out of date and as a result are currently being reviewed by FutureProof.

8.2.2. RTP 2015-2045 (2018 update)

The Waikato Regional Transport Plan (WRTP 2015-2045) has been updated in 2018. It includes a number of objectives and policies based around three key problems:

- protecting the function of our strategic corridors in the context of growth pressures in and around Hamilton, the North Waikato and in the upper North Island
- tackling our complex road safety problem and the disproportionate number of deaths and serious injuries in the region
- providing for the access and mobility needs of our communities in a changing social, demographic, economic and technological landscape.

The proposed plan change is not in conflict with any WRTP objectives. By expanding an existing area identified for industrial development, it supports objectives related to economic development

related to facilitating freight movements on strategy corridors (Waikato Expressway) and supports future growth areas.

WRPTP 2015-2025 (2018 update)
The Waikato Regional Public Transport Plan (WRPTP 2015-2025) identifies public transport services that will be provided by the Waikato Regional Council over the next 10 years. The goal for public transport is *"A growing and affordable public transport system that contributes to the economic, social and environmental vitality of the region."*

The proposed plan change extends an area of planned industrial development and is not in conflict with the WRPTP.

8.3. Local Transport Objectives

Local transport policies and objectives are outlined in the District Plan, Waipa 2050 and Waipa's Integrated Transport Strategy. These are discussed below.

8.3.1. Waipa 2050 and FutureProof

Waipa 2050 is the region's growth strategy. It identifies anticipated population growth and development of land uses in the area. Waipa 2050 identifies the Hautapu Industrial Area as suitable for industrial development. The Future Proof Strategy identifies the Hautapu area as a strategic node of approximately 90ha in area to be developed between 2017 and 2061.

The location of the proposed development site is adjacent to the identified Hautapu Industrial Area, with similar links to strategic transport corridors. It is not in conflict with the intention / direction of Waipa 2050.

8.3.2. WITS 2010-2040

Waipa's Integrated Transport Strategy (WITS 2010-2040) sets out objectives and actions to support the vision of "access to an affordable, integrated, safe, responsive and sustainable transport system." The following table lists the objectives and comments on the consistency of the proposed plan change with each.

WITS Objective	Proposed Plan Change
To integrate transport and land use planning in a sustainable and co-ordinated manner.	Consistent with objective, in particular, the identified action in WITS to give statutory effect to settlement patterns, including the Hautapu Industrial area.
To adopt a safe road system approach and reduce deaths and serious injuries on Waipa's roads. To ensure an effective and efficient road network in Waipa District. To support and improve the efficient movement of freight to, through and within Waipa district.	Supports these objectives by: = locating industrial development in an area with good links to strategic transport corridors, minimising conflict between industrial residential traffic = utilising an area with both existing and planned industrial development, meaning the nature of traffic is unlikely to be different to that already anticipated.
To promote travel choices (where appropriate) to manage travel demand in the district. To improve passenger transport so that it becomes a viable option for travel between main centres in the District and the Region	Located in area where industrial development is already anticipated and with good transport links. Will have little impact on travel choices, however may provide opportunity to increase use of active modes (e.g. walking and cycling to work).

WITS Objective	Proposed Plan Change
To encourage cycling and walking in Waipa District as safe and convenient modes of transport	

Table 4: Comments on consistency with WITS Objectives

8.4. Waipa Operative District Plan

The site is located next to strategic transport routes, in an area where industrial development exists and is planned.

The District Plan contains objectives, policies and rules that will govern development within the proposed plan change site. There is no reason why development would not support the relevant objectives and policies listed below.

Consistency with the Hautapu Structure Plan is discussed in the next section.

District Plan Objectives (District wide)	Policies	Comments on Proposed Plan Change
Ensuring sustainable, integrated, safe, efficient and affordable multi-modal land transport systems	All new development, subdivision and transport infrastructure shall be designed and developed to contribute to a sustainable, safe, integrated, efficient (including energy efficient network design) and affordable multi-modal land transport system (16.3.1) Policies = Design elements = Ensuring future connections = The timing and availability of planned funding for transport infrastructure	Location of site supports integrated transport system – adjacent to strategic routes (Waikato Expressway) and Victoria interchange, and near railway line. Development provides opportunity to design for good pedestrian / cycle connections, with links to existing infrastructure.
Integrating land use and transport: ensuring a pattern of land uses and a land transport system which is safe, effective and compatible	Land use and transport systems successfully interface with each other through attention to design, safety and amenity. (16.3.2) Policies = Integrating land use and transport = Enhancing pedestrian safety = Safe roads = Managing effects on character and amenity	
Maintaining transport network efficiency	To maintain the ability of the transport network to distribute people and goods safely, efficiently and effectively (16.3.3) Policies = Effects of development or subdivision on the transport network = Location of network utilities	
Provision of vehicle entrances, parking, loading and manoeuvring areas	The provision of adequate and well located vehicle entrances and parking, loading and manoeuvring areas that contribute to both the efficient functioning of the site and the adjacent transport network	Sufficient space for parking, loading and manoeuvring can be provided. Opportunity to optimise transport network internally.

District Plan Objectives (District wide)	Policies	Comments on Proposed Plan Change
	Policies = Location of vehicle entrances = Ensuring adequate parking, loading and manoeuvring areas on site	
Minimising adverse effects of the transport network	The transport network can have effects on the adjacent environment that must be mitigated through design Policies = Natural environment = Noise and vibration	Site can be developed to minimise adverse effects.
District Plan Objectives (specific to the Industrial Zone)	**Policies**	**Comments on Proposed Plan Change**
Hautapu Industrial Structure Plan Area and the Industrial Area east of Victoria Road	Development of the Hautapu Industrial Structure Plan Area and the Industrial Area east of 7.3.4 Victoria Road occurs in a manner that: (b) Enables within the Hautapu Industrial Structure Plan Area the development of a central focal area with a reserve and retail activities and commercial services that principally meet the needs of workers; and (c) Avoids or mitigates any actual or potential adverse effects on surrounding rural properties and public spaces, including the Hautapu Cemetery; and (d) Is co-ordinated with infrastructure provision; and (e) Contributes to the development of a 'gateway' to Cambridge Policies = Central focal area = Infrastructure = Hautapu Industrial east of Victoria Road	Plan change is consistent. Site has adequate capacity to support policies – for example, site can provide central focal area that serves the needs of workers – retail, commercial, reserve.

Table 5: Comments on relevant objectives and policies in Waipa District Plan

8.4.1. Hautapu Structure Plan

A structure plan for the Hautapu area was updated by Beca in 2017. It provides a plan for the Hautapu Industrial area, which is located east of the proposed development addressed in this ITA. The outcomes and the philosophy of the structure plan are relevant to the proposed plan change site.

The key objectives of the structure plan are:

- An industrial area that is readily accessible, visually attractive and which has a character that embodies Cambridge's heritage and landscape (a sense of place);
- Maximisation of multi-purpose reserve network opportunities;

- Low impact design is encouraged (in terms of both stormwater and built form – particularly when viewed from gateway areas);
- A local transport network that is fully integrated with the regional transport network;
- A central focal area for public open space and provision of local commercial amenities;
- Flexibility around the staging and sequencing of development.

The proposal is consistent with and supports the above objectives. It is located adjacent to the Cambridge section of the Waikato Expressway and the Victoria Street interchange, providing excellent links to strategic transport routes. It will be supported by cycling infrastructure, encouraging use of active modes for employees etc. travelling to and from the site from Cambridge. The site provides opportunity for flexibility in staging, low impact design and incorporation of public open space.

9. POTENTIAL TRANSPORTATION EFFECTS

9.1. Basis of Assessment

The likely effects relate to additional traffic and an additional intersection. In total, the plan change area could generate around 12,000vpd. There is some existing traffic, and around half of the traffic would result from the future industrial zone area. The nett increase in traffic would be less than 12,000vpd if that were taken into account, but the total traffic still needs to be dealt with so this assessment is based on around 12,000vpd and 1,200 vph during peaks.

There are no unusual safety problems evident at present.

Heavy vehicle traffic is likely to increase as a proportion of traffic on the surrounding road network.

Victoria Road will become less busy north of Hautapu Road.

Rail is unlikely to operate south of the dairy factory.

The Hautapu West Industrial area will continue to develop.

9.2. Potential Effects and Options to Avoid, Remedy or Mitigate

Potential effects and responses are tabulated below.

Potential Effect	Potential Response
Positive Effects	
Matching employment and population in the Cambridge area reduces the need for travel, mainly to Hamilton: This has positive transport-related effects from reduced travel time, reduced travel costs, and more opportunities for walking, cycling and passenger transport.	Support development in the area. Support walking and cycling connectivity. Support walking and cycling end of journey facilities (e.g. link to Swayne, link at south end). Protect options for passenger transport (e.g. space for bus stops on Victoria Road and in site.
Industrial employment at an existing industrial node provides opportunities for complementary activities to locate near each other. This has positive transport-related effects from reduced travel time, reduced freight costs and more opportunities for walking, cycling. There are also positive effects from more efficient use of existing and new infrastructure. Appropriate zoning reduces the potential for ad-hoc development in less appropriate locations	Support connectivity between east and west industrial areas and dairy factory for all modes (e.g. infrastructure designed to suit heavy vehicles, intersections and crossings that support walking and cycling, direct road link east to west). Support zoning and options for connection into future developable areas.
Industrial activity at an existing grade separated connection to the Waikato Expressway supports efficient access between markets. The location allows efficient inter-regional traffic direct access to arterial networks with less impact of safety and amenity for local networks.	Support convenient connection to and from south.
Opportunity for efficiencies in infrastructure such as - Dual functions such as stormwater treatment in road corridors - Shared access for future development - Shared parking - Reduced impermeable area	Flexibility in parking requirements to match likely demand and take into account shared facilities.
Adverse Effects	
Off-site effects if there is inadequate parking, loading and circulation	Adequate parking loading and access – match District Plan requirements or require specific assessment. The parking requirements will be carefully considered to ensure that parking will be efficient and convenient, avoiding overspill parking, queuing or problems affecting the road network.
Additional stormwater run-off from an excess of hardstanding, etc. due to unnecessary parking.	Allow some flexibility in parking requirement/location to optimise parking.
Additional traffic will increase the localised risk of conflict between road users (vehicle-vehicle, vehicle - cyclist and vehicle-pedestrian).	Appropriate internal road layout, intersection form and design to appropriate standards (Austroads and Regional Infrastructure Technical Specification). Appropriate facilities for vulnerable users.
Additional intersection and use will increase the localised risk of conflict between road users (vehicle-vehicle, vehicle -cyclist and vehicle-pedestrian).	Appropriate intersection form and design to appropriate standards (Austroads and Regional Infrastructure Technical Specification). The final design of the intersection shall minimise the potential for adverse effects.

Potential Effect	Potential Response
	Internal connectivity to reduce need for site traffic to use intersection. Appropriate facilities for vulnerable users.
There will be additional turning movements increasing the potential for crashes and delays.	The 80km/h speed environment lowers the outcome severity of any crashes. Combined with good intersection design principles the conflicts are unlikely to have severe consequences.
There may be extra pedestrians and cyclists accessing the site. Additional pedestrian and cycle traffic increases the risk of crashes with vulnerable users involved.	Continuity of the separated walking and cycling facilities shall be continued into the Bardowie Industrial Precinct. Safe internal circulation.
Construction traffic – dust, noise, vibration, conflict, etc.	Easily managed via a temporary traffic management plan. Corridor Access Request system.

Table 6: Potential transportation effects and potential responses

10. ALTERNATIVES AND OPTIONS FOR TRANSPORT

10.1. Alternatives - Integrated Land Use and Transportation Planning

The foundation for managing transport effects is having the right activities in the right place. Future Proof, the Waikato RPS, Waipa 2050, Cambridge Town Concept Plan and the District Plan identify Hautapu as an industrial node. The RPS provides for up to 96ha industrial (to 2061). The District Plan identifies part of the area for future industrial so some connection to the network would be required.

The broad alternatives available are to:

= Provide for industrial activities:
  - at Hautapu East through industrial zoning
  - Provide for industrial activities elsewhere

= Not zone industrial and rely on consents or no development.

Not zoning results in uncertainty with increased risks from a transport perspective including ad hoc development.

Not zoning at Hautapu would result in missed opportunities for synergy with planned and existing and planned industrial activities, and potentially increase travel distances (home to work trips) or congestion (e.g. crossing to Leamington or though Hamilton).

This would be likely to lead to greater adverse effects on traffic safety and efficiency from more travel on less suitable roads and poor infrastructure planning and coordination resulting in higher mitigation and operational costs.

The preferred approach from a transport perspective is to provide for industrial activities at Hautapu East, consistent with the statutory framework and Waipa's policy and strategy context.

10.2. Alternatives - Land Use and Transport Infrastructure Coordination

Ideally, land use development and the resulting transport demand should be coordinated with infrastructure and services of the right type and capacity at the right time to accommodate it. Planning ahead allows the funding arrangements to be equitable and efficient. Staging can provide

opportunities to optimise cash flow, reduce risks of inappropriate investment because of uncertainty in market conditions, and deal with timing of release/availability of land.

The broad alternatives available are:

- No coordination
- Rules restricting development until planned infrastructure is operational.
- Rules describing how and when and what infrastructure will be implemented.
- Indicative - concept design to illustrate connectivity principles,
- Prescriptive – early commitment to concept design, network layouts, intersection types, etc. (e.g. Structure plan showing proposed road network with the type of intersection decided.
- Highly prescriptive – early commitment to details of transport infrastructure solutions (e.g. preliminary design of agreed solutions as part of plan change).
- A combination of approaches with staging.

Not coordinating infrastructure with development would lead to poor infrastructure planning and coordination resulting in higher mitigation and operational costs.

Applying rules restricting development leads to difficulties where infrastructure changes and funding are not well understood, and could deter development in this location.

Applying rules with minimum parking requirements based on typical industrial demand is likely to result in a significant surplus of parking with consequential costs for infrastructure and run-off.

An indicative approach is generally adequate unless there is uncertainty whether there is sufficient land. The District Plan and Regional Infrastructure Technical Specifications requirements adequately define detailed design once the core requirements are set.

A highly prescriptive or prescriptive approach is desirable where there is little risk of change and development is close enough to make the investment in design worthwhile, but risks inappropriate investment and decisions where there is uncertainty or development is a long time away. Too much detail limits flexibility and can make district plan sections imbalanced.

At Hautapu, there is uncertainty relating to:

- The alignment and timing of development traffic and access to Hautapu West.
- The nature and timing of development traffic for the area north of Shoof.
- When the land north of Shoof may be available for development
- The traffic environment following the opening of the Waikato Expressway Hamilton Section (expected to be operational by 2020).
- Possible long term development expectations for the remainder of the C8 development cell to Swayne Road and Zig Zag Road.

The preferred approach from a transport perspective is to coordinate infrastructure provision with development, using a staged approach:

Stages 1 and 2: Prescriptive intersection and access design and layout (probably shown indicatively, but described sufficiently to direct design)

Additional parking standard of 1 parking space per full-time equivalent employee for single use, single occupancy industrial activities in very large buildings (GFA > 10,000m^2).

Stage 3: Indicative concept plan for connectivity, with:

- A requirement for an at-grade intersection layout (priority, signals or roundabout(s)) to be confirmed through a business case including Waipa DC within a reasonable time.
- Development to be avoided in an area large enough to accommodate the footprint of the largest practicable intersection.

The options for access, internal layout and intersection types are assessed in the following sections. These demonstrate that suitable access solutions are available.

The Plan Change does not preclude rail.

The developer does not expect rail options to suit their target market.

10.3. Access Options

The site will require access to the existing road network via one or more connections. The site has existing road frontages along the western boundary: at the northern end to SH1B Victoria Road (North) and nearer to the southern end to Laurent Road. There is no direct access to the east however it may be possible to allow for connection through the Future Possible Industrial Zone to Swayne Road or Zig Zag Road. This is not part of Bardowie Industrial Precinct but is considered here so as not to preclude future connectivity.

From a road hierarchy perspective, it is desirable for few access points on arterials to reduce disruption to their through movement function. Culs de sac and direct property access are undesirable.

Access to the Bardowie Industrial Precinct is required for:

- Development within each stage – with separate timings for the North and South stages;
- Connections to possible future industrial developments on adjacent land; and
- All modes, with provision to separate walking and cycling traffic from vehicular traffic.

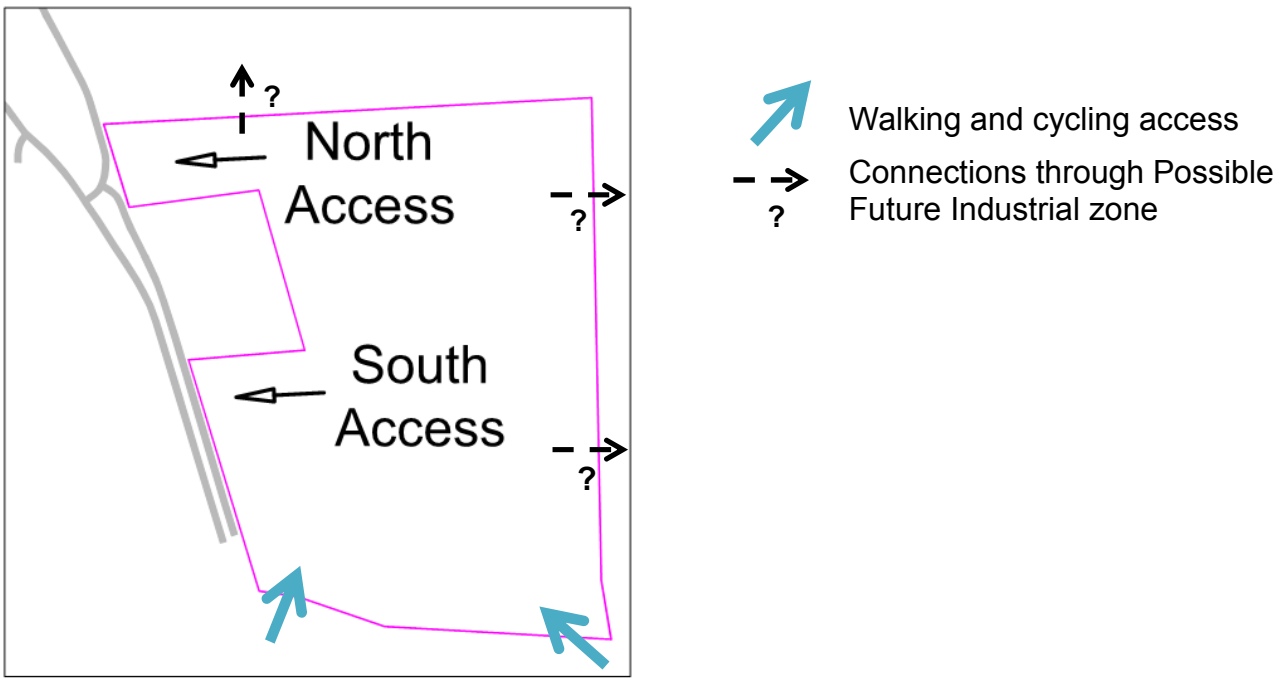


Figure 18: General Access Requirements

The possible connection points include:

- SH1B Victoria Road north of the intersection with Laurent Road;
- Laurent Road;
- SH1B Victoria Road between Waikato Expressway and Hautapu Road; and
- Connection through the future possible industrial zone to Swayne Road or Zig Zag Road (Future).

The staging of development within the Bardowie Industrial Precinct means that the connection to Stages 1 and 2 (South Access) will be required before development in Stage 3 (North Access).

The advantages of dual access points for the Bardowie Industrial Precinct are:

- Staging of developments – the South Access can operate independently of construction and development activities on the northern half of the site.
- Ability to connect developments in the Possible Future Industrial zone, bringing that traffic to Victoria Road and onto the Waikato Expressway, avoiding a long trip via Swayne and Zig Zag;
- Resilience of the road network within the Bardowie Industrial Precinct, in the case of an unexpected event causing road closure and reducing traffic to one access.

The access options are influenced by the internal road layout options as discussed in the following section.

The level of traffic generated on full development at 12,000vpd, with a prospect of additional future traffic, means that at least a collector road connection would ultimately be required. For resilience and to avoid delays, a minimum of two access points would be desirable for the plan change area.

10.4. Layout Options

The internal layout options shall consider the objectives of the development as well as the wider design principles for activity centres, including:

- Reducing demand (understand who/what/how goes where);
- Segregation/isolation (an urban design issue); and
- Management (signs, behaviours, rules, education).

The Waipa DP sets out the minimum requirements for roads within Industrial Zones in Appendix T4 of the Waipa DP as follows:

Type & Description	Road Reserve Width (m)	Carriage-way Width (m)	Lane Width (m)	Cycleway Width	Street Parking Widths	Kerb/Edging Type	Front Berm*	Footpath Width (m)	Utilities Corridor
Collector	25m	13m	2 at 4m	Shared with Footpath	2 at 2.5m	Barrier	One side only	Both sides at 2.1m	Both sides at 2.1m min.
Local: Through Road & Cul de Sac									

Type & Description	Road Reserve Width (m)	Carriage-way Width (m)	Lane Width (m)	Cycleway Width	Street Parking Widths	Kerb/Edging Type	Front Berm*	Footpath Width (m)	Utilities Corridor
>150m length	24m	13m	2 at 4m	Shared with 2.5m Footpath	2 at 2.5m	Barrier	One side only	1 at 2.5m and 1 at 1.5m	Both sides at 2.1m min
<149m length	22m	13m	2 at 4m	Shared with 2.5m Footpath	2 at 2.5m	Barrier	One side only	1 at 2.5m	Both sides at 2.1m min

* Front berm for Tree, Swale, Lighting, Recessed Parking, and Bus Stops.

Table 7: Criteria for Public and Private Roads (Waipa DP Appendix T4)

The internal road layout shall provide good circulation and have resilience to avoid severance of the site in the case of an unexpected event resulting in road closure. Ideally, the internal road network would also accommodate development in a staged approach through the subdivision process.

The cross-section in accordance with the District Plan provisions should not be less than:

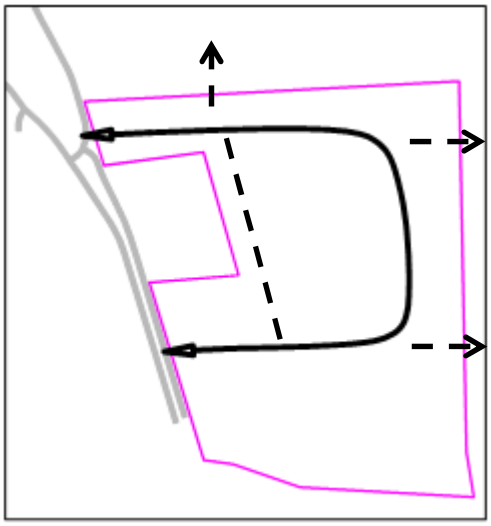
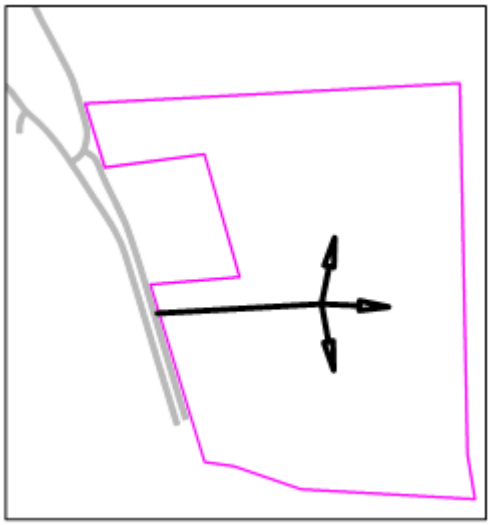
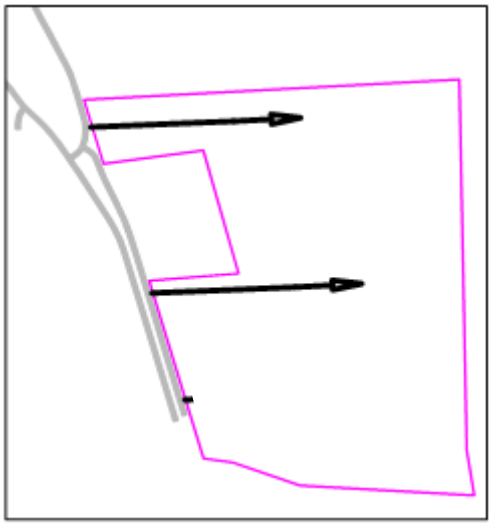
- Minimum of 2 traffic lanes, 4.0m wide;
- 2.1m shared walking and cycling path on one side;
- 2.5m parking shoulders on both sides;
- Utilities corridor on both sides; and
- A front berm on one side (drainage swale, parking or bus bays, and lighting).

This equates to approximately 13m road formation width. The District Plan requires a minimum of 25m road reserve width for an industrial collector road. This allows for a central median for turning and manoeuvring space. There may be a requirement for additional widening and splays at intersections.

The internal road layout options are dependent on support for the preferred access options as discussed in section 10.3.

We have assessed several internal road layout options based on two access locations: one at the north (for Stage 3 of the site development), and at the south (for Stages 1 and 2 of the site development).

These are shown in the comparison table below.

Internal Road Layout Option	Discussion and Conclusion
Internal or perimeter circulation 	= Effective circulation of traffic = Resilience of network = Incorporates continuous utilities corridors = Allows for efficient public transport route = Collector road classification required for connection to SH1B = Local road classification required for connection to Laurent = Possible to be staged = Accommodates future connection to possible Future Industrial zone to east **Conclusion: Flexible, Desirable**
Internal Circulation 	= Poor traffic circulation = Less resilience in network = Not a suitable collector road layout, not suitable for connection to SH1B = Less complex (single connection) = Not easily serviced by public transport **Conclusion: Undesirable**
Culs de sac 	= No circulation of traffic = Poor connectivity = Many connections/disruption points to wider network = Poor serviceability by public transport = Resilience risk diluted = Difficult and unattractive for active modes = Possible internal connections = Limited options for future connection to possible Future Industrial zone to east **Conclusion: Limited, Undesirable**

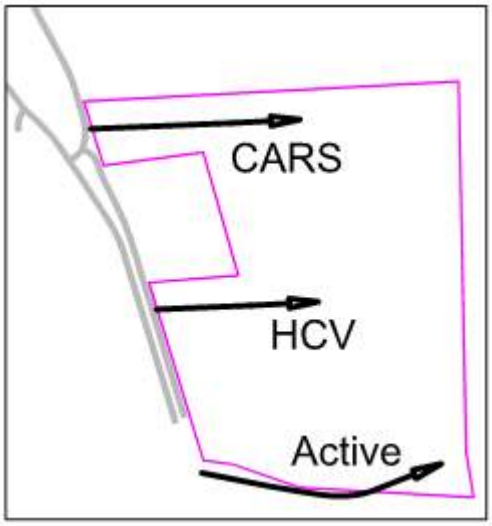
Internal Road Layout Option	Discussion and Conclusion
Split Modes 	= No circulation of traffic = Poor connectivity = Many connections/disruption points to wider network = Operational/enforcement difficulties = Poor serviceability by public transport = Resilience risk diluted = Difficult and unattractive for active modes = Enforcement issues **Conclusion: Restrictive, Undesirable**

Table 8: Comparison of Layout Options

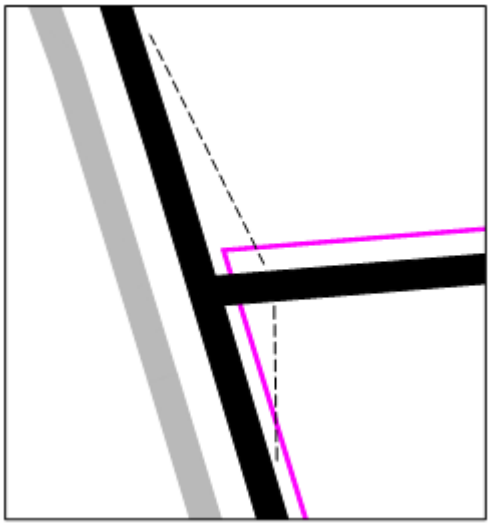
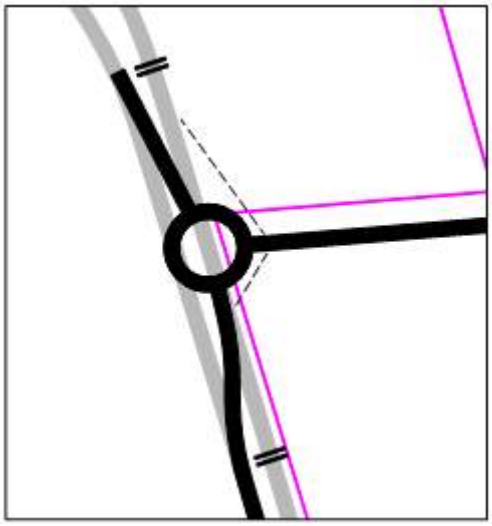
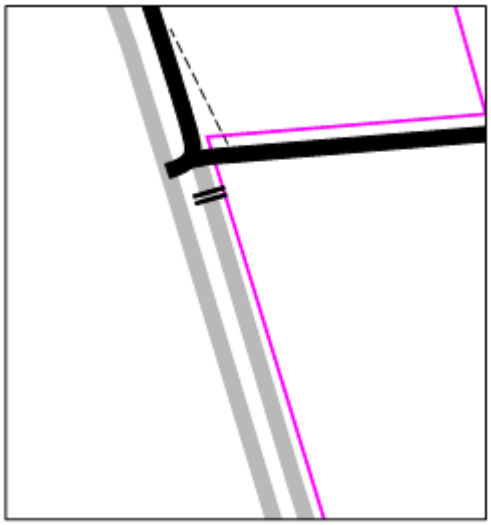
The ideal road layout will be conducive to the planned staging of the development within the site, with the access and internal road for Stages 1 and 2 being at the southern end.

10.5. Form of Access – Options

Options for the form of access are illustrated conceptually below with an evaluation of suitability for each. The southern access point is shown first, to service Stages 1 and 2. The northern access follows for Stage 3.

The access for Stages 1 and 2 would be located alongside the Shoof southern boundary to support future development and provide room for the very long buildings proposed by APL. If directly connected to Victoria Road, protecting Victoria Road's arterial function is important.

The southern access would be dominated by right turn in, left turn out. There would be few right turns out because the Expressway and Cambridge are to the south, reducing when a second access at the north is connected.

South Access Intersection Option	Discussion and Conclusion
Laurent Road Priority T 	= Medium cost = Potential interim solution for Stages 1 and 2 = Requires land within the site for geometrics and visibility = Upgrade of Laurent Road, widening, seal, drainage = Does not address deficiencies at SH1B/Laurent intersection = Long travel distance to access from Waikato Expressway **Conclusion: Undesirable**
SH1B Victoria Road Roundabout 	= High cost = Risk related to interaction with rail corridor land = Possible staging option with priority T onto Victoria Road as interim solution = Avoids use of SH1B/Laurent intersection **Conclusion: Possible, to be considered**
SH1B Victoria Road Priority T Intersection 	= Medium cost = Risk related to interaction with rail corridor land = Deficient separation distance for Laurent Access (Road) = Potential geometric constraints = Reduces amenity of shared walking and cycling path = Similar to Taylor/Victoria intersection:  **Conclusion: Potential staging option, possible long-term solution**

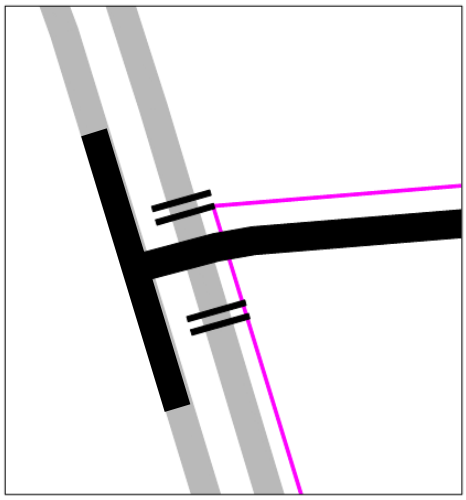
South Access Intersection Option	Discussion and Conclusion
SH1B Victoria Road Signalised Intersection 	= High cost = Risk related to interaction with rail corridor land = May be required to accommodate turning volumes likely for Stage 2 development, combined with increased traffic on Victoria Road = Better pedestrian and cyclist amenity (pedestrian phase) = Similar to Norfolk Drive intersection:  **Conclusion: Potential long-term solution for Stages 1 & 2**

Table 9: Stages 1 and 2 Southern Access Arrangement Options

SIDRA modelling demonstrates that a right turn bay has sufficient capacity at an acceptable peak period level of service (LOS D = <35 seconds average delay) to accommodate industrial traffic from Stages 1 and 2. The need for traffic signals depends on higher traffic flows on Victoria Road and commercial activities. The right turn bay design would probably sit within a flush median to provide continuity with the rest of the corridor.

Layout	Traffic Scenario	Worst approach and LOS[6]	Performance
RIGHT TURN BAY	WRTM 2041 Stage 1 - 12.5ha	Proposed Access LOS C (Right turn out movement LOS E)	
	WRTM 2041 at 50% Stage 2 (Using 50% of passing traffic assumes only part of Hautapu Structure Plan area online)	Proposed Access LOS A (Right turn out movement LOS C)	OK
	WRTM 2041 Stage 2 - 28.8ha	Proposed Access LOS D (Right turn out movement LOS F)	Sensitive to right turn out volumes
	WRTM 2041 Stage 2 - 28.8ha plus commercial	Proposed Access LOS F (Right turn out movement LOS F)	5 minute delays for right turn out 70 second delays for approach

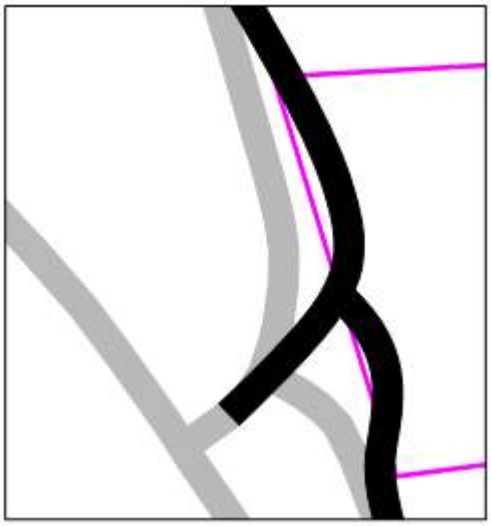
[6] Refer HCM WRTM LOS Criteria in Appendix F

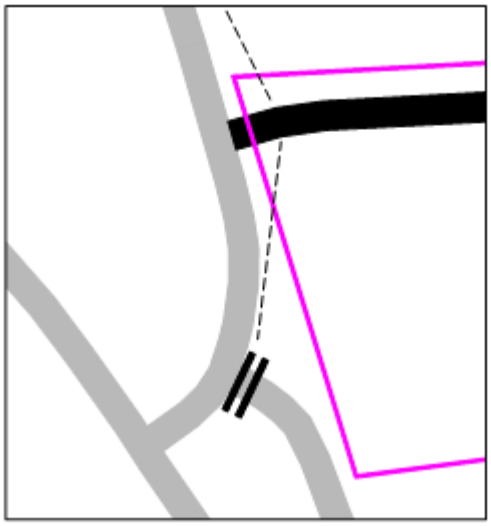
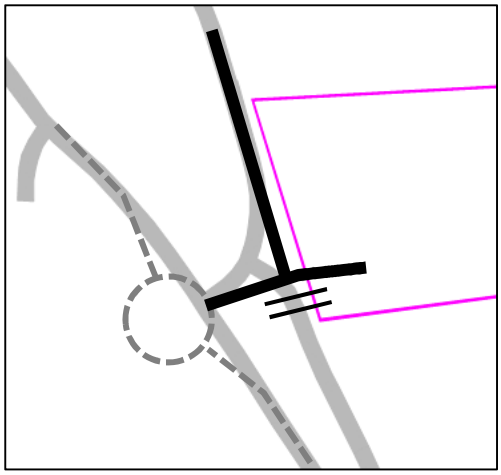
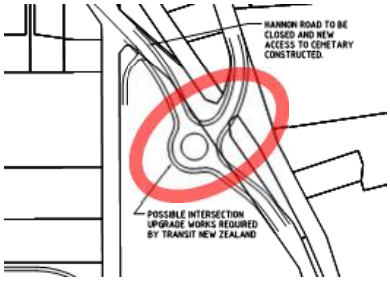
Layout	Traffic Scenario	Worst approach and LOS[6]	Performance
	WRTM 2041 Stage 3 – 56.7ha plus commercial	Proposed Access LOS F (Right turn out movement LOS F)	Extreme delays
TRAFFIC SIGNALS	WRTM 2041 Stage 2 - 28.8ha	Victoria South Approach LOS B (Right turn in movement LOS C)	
	WRTM 2041 Stage 2 - 28.8ha plus commercial	Proposed Access LOS B (Right turn out movement LOS E)	
	WRTM 2041 Stage 3 – 56.7ha plus commercial	Victoria South Approach LOS F (Right turn in movement LOS F)	Very long delays

Table 10: Summary of SIDRA analysis and intersection performance

From the table above, traffic signals will be required by the time Stage 2 (including commercial development) is operational. The right turn bay will be adequate for Stage 1 and the need for traffic signals can be confirmed with a review of traffic conditions and intersection performance prior to development of subsequent stages.

The northern access is more complex and the options considered are tabulated below. The northern access will be needed for Stage 3 and will relieve the southern access for Stages 1 and 2.

North Access Intersection Option	Discussion and Conclusion
Laurent Road Modified Existing Priority Layout 	= Low cost = Interim solution unlikely to be acceptable for higher turning volumes as site development proceeds = Geometric deficiencies (intersection separation, RT Bay taper length) = Requires land within the site = Very low volume now = Not suitable for expected >10,000vpd and high turning volumes = Does not accommodate connection into North of site = Long travel distance to access from Waikato Expressway **Conclusion: Unsuitable**

North Access Intersection Option	Discussion and Conclusion
SH1B Victoria Road Priority T (Laurent Road closed) 	= Low cost = Laurent open until Stage 3 developed, then Shoof use alternate access = Departure from minimum intersection spacing – new intersection approx. 80m from Laurent Road (100m minimum required as per PPM App5B Table App5B/4) = May require extra land for geometrics and visibility = Best serves Stage 3 (northern half of site) = Better separation for integration with HSP intersection **Conclusion: Possible, but less desirable**
Change Priorities 	= After Hamilton Section of Waikato Expressway is open = Best serves Stage 3 (full development) = Assumes lower/lowest traffic volumes on Victoria Road (North) = Integrates with existing Hautapu Industrial Structure Plan roundabout option to west:  = Laurent used for pedestrians/cyclists = Similar to Taylor and Williams:   **Conclusion: Possible, consistent with other intersection forms**

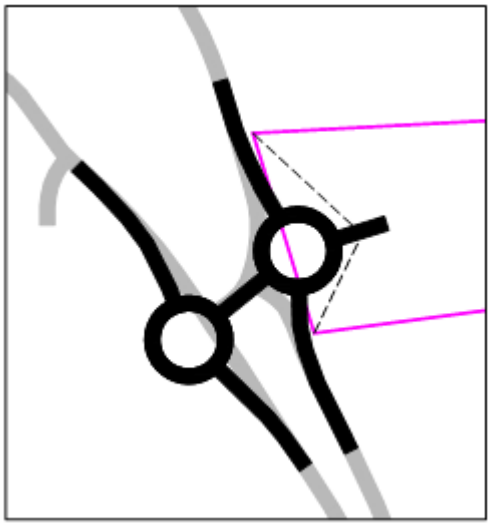
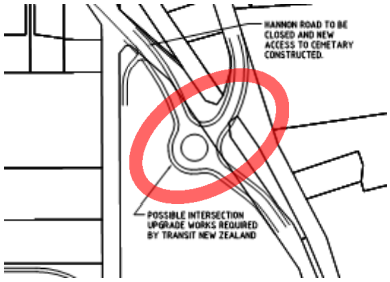
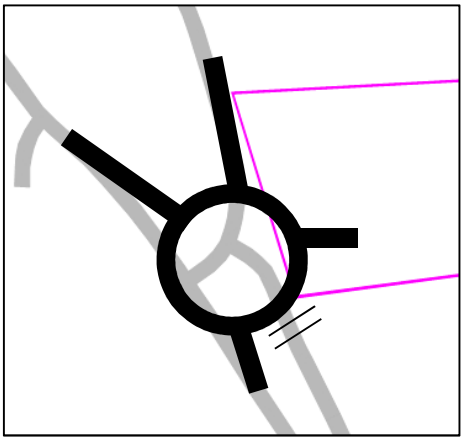
North Access Intersection Option	Discussion and Conclusion
SH1B Victoria Road Double Roundabout 	= High cost = Risk related to interaction with rail corridor land = No staging option = Best serves Stage 3 (full development) and Possible Future Industrial = Requires land within the site for geometrics and visibility = Integrates with existing Hautapu Industrial Structure Plan roundabout option to west:  **Conclusion: Requires further consideration**
Large roundabout straddling rail 	= High cost = Risk related to interaction with rail corridor land and Fonterra storage. = No staging option = Best serves Stage 3 (full development) and Possible Future Industrial = Requires land within the site for geometrics and visibility = Integrates with existing Hautapu Industrial Structure Plan roundabout option to west: **Conclusion: Requires further consideration**

Table 11: Stage 3 Northern Access Arrangement Options

The access forms shall consider the needs of the development, with the staging of options, timing of developer contributions, and connection to and integration with the Possible Future Industrial zone developments.

Connections between adjacent industrial zones and circulation between them will be important drivers for the northern access.

Waipa DC are concerned that a road access close to the existing intersection will compromise options for upgrading the existing Victoria Road/Hautapu Road intersection. The Plan Change therefore leaves Stage 3 access as something to be resolved in the future.

11. CONCLUSIONS

11.1. General

The Proposal contributes to the transportation objectives in the District Plan and Council's strategies. From a transportation perspective, the Proposal is well located to make efficient use of existing infrastructure and reduce adverse effects.

The Proposed Plan Change includes a Structure Plan for the Bardowie Industrial Precinct to support the rezoning to ensure that the development occurs in a coordinated and planned manner. The Bardowie Industrial Precinct Structure Plan provides an opportunity to define:

- Infrastructure standards and requirements not already defined in the plan.
- Staging extents and requirements to ensure coordinated and sustainable delivery
- Layouts to align with desirable connections for all modes to Hautapu West and possible future development adjacent to the site (in relation to the design of the proposed northern intersection onto Victoria Road).
- Special rules to provide:
  - Additional parking standard of 1 parking space per full-time equivalent employee for single use, single occupancy industrial activities in very large buildings (GFA > 10,000m^2).
  - Design principles to support alternative modes, including:
    - Pedestrian and cyclist priority over vehicular access;
    - Cycling connections to alternative roads and sites where practicable;
    - Infrastructure, lighting and landscape design to highlight changes of environment, support low speeds and manage potential conflicts; and
    - Internal layout that matches up with external connections.
  - End of journey facilities to support alternative modes (as part of building design).

11.2. Mitigation of Effects

Adverse effects can be avoided or remedied through infrastructure and development requirements that can be triggered through plan rules and subdivision conditions.

The potential adverse effects relating to transport can be managed through rules, or dealt with by conditions at subdivision or building consent time. The rules or conditions would be likely to require the relevant structure plan infrastructure to be committed or in place prior to development/operation of the stage. That could be achieved by requiring a signed Private Development Agreement prior to development.

12. RECOMMENDATIONS

12.1. Preferred Approach for Transportation

The Structure Plan for the Bardowie Industrial Precinct Structure Plan should allow for three stages, as follows:

- STAGE 1:
  - Use the Structure Plan layout to fix the Stage 1 layout and access arrangements, including a right turn bay on Victoria Road to be replaced by traffic signals when demand from subsequent stages requires it.
  - Ensure the Stage 1 access is formed to appropriate industrial collector road standards and supports connectivity for development of Stage 2 and Stage 3, provision of internal roads and suitable future connection to network;

- Include appropriate pedestrian and cycle access and provide for bus services.

= STAGE 2:

- Use rules to require a traffic impact assessment prior to development to determine when/whether traffic signals are required (This may not be required until commercial activities are in operation and there is traffic growth on Victoria Road from north of the Hautapu intersection);
- Use the Structure Plan layout to fix the Stage 2 layout and access arrangements, including a right turn bay or traffic signals on Victoria Road when demand from subsequent stages requires it;
- Include appropriate pedestrian and cycle access and provide for bus services;
- Use rules to protect space for pedestrian and cycle facilities and potential relocation of the rail corridor to run alongside the modified Victoria Road (where it would require more width than the existing Laurent Road corridor).

= STAGE 3:

- Use rules to require a layout and connections for Stage 3 that:
  - Provides an additional intersection for safe and appropriate connectivity with the surrounding transport network for all modes;
  - Connects with Stages 1 and 2; and,
  - Provides for future access to possible future industrial land and the existing Shoof activities.

12.2. Transport Rules

The plan change should require:

= Support for active modes including bus stops and dedicated off road network facilities for walking and cycling;

- Design principles to support alternative modes, including:
  - Pedestrian and cyclist priority over vehicular access;
  - Cycling connections to alternative roads and sites where practicable;
  - Bus stop(s);
  - Infrastructure, lighting and landscape design to highlight changes of environment, support low speeds and manage potential conflicts; and
  - Internal layout that matches up with external connections.
- Pedestrian crossing facilities for Victoria Road.

= End of journey facilities to support alternative modes (as part of building design).

  - Showers, lockers and bike parking; and

= Additional parking standard of 1 parking space per full-time equivalent employee for single use, single occupancy industrial activities in very large buildings (GFA > 10,000m^2).

12.3. Supporting Investigations

Subsequent actions necessary for implementation of the structure plan include

- A preliminary design for a right turn bay on Victoria Road, developed in consultation with Waipa DC to demonstrate that it can fit within the available land and have that land identified;

- Working with Waipa DC and key stakeholders such as Waikato Regional Council, Fonterra and Kiwirail to identify the optimum intersection form for the Stage 3 northern road access
- Waipa DC (presuming NZTA revoke SH1B) and Kiwirail authorisation, as the controlling authorities for the transport corridors affected, of both intersection arrangements.
- Confirming the preliminary form of the Stage 2 access prior to construction of the Stage 1 access to avoid services and drainage arrangements conflicting with the future signals.
- Confirming the form and location of the Stage 3 access and road networks prior to development of Stage 3.
-

12.4. Suitable Intersection Types

Traffic signals will be required by the time Stage 2 (including commercial development) is fully operational. The right turn bay will be adequate for Stage 1 and the need for traffic signals can be confirmed with a review of traffic conditions and intersection performance prior to development of subsequent stages.

An additional intersection will be necessary for Stage 3. The layout and connectivity for the optimum solution will be determined prior to development in Stage 3 and take into account rail land and Hautapu west demand and connectivity.

An internal collector road network should allow for access for the existing Shoof site, the adjoining site, and the Potential Future Industrial.

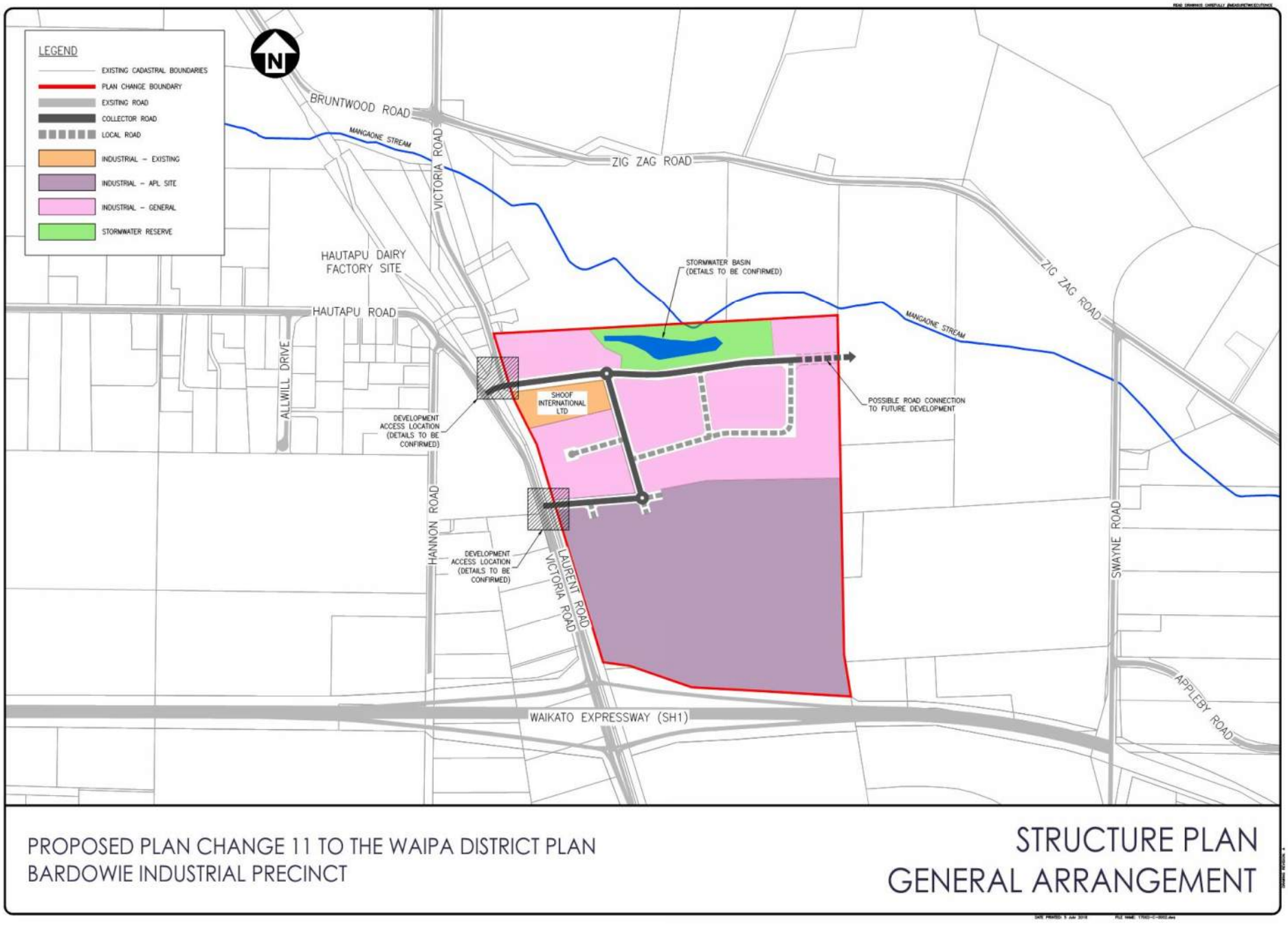
APPENDICES

Appendix A: Broad ITA Requirements

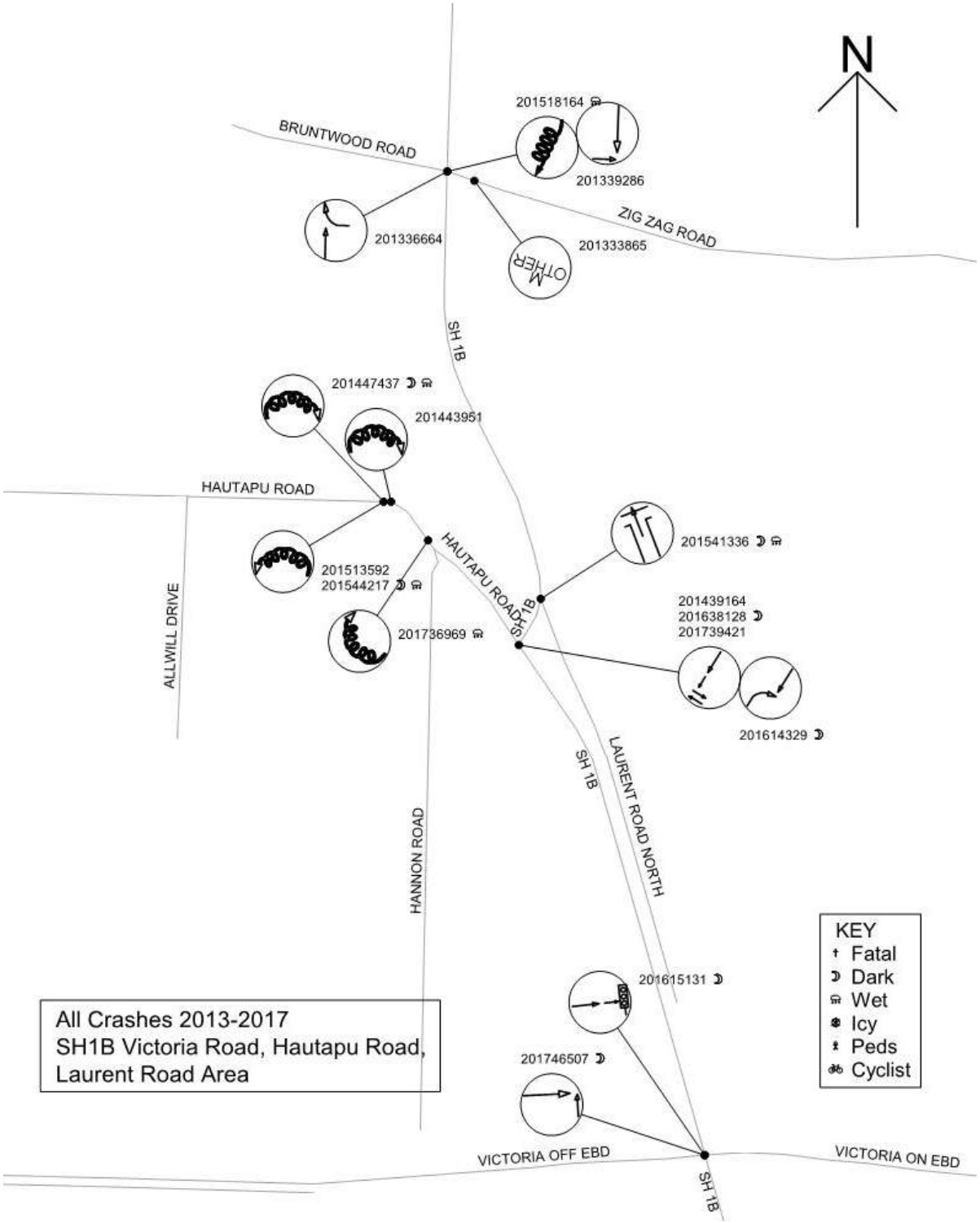
The scope of this Broad ITA meets the information requirements in the Waipa District Plan, Rule 16.4.2.25, comprising (numbers in brackets refer to sections of this ITA):

- Location and scale of activity (Sections 2, 3, 4, 5);
- Effects of vehicle generation on functioning of road, road hierarchy and other users; (Sections 6, 7, 8)
- Vehicle access; (Section 6.3, 6.4, 6.5)
- Number of car parks provided on site: (Section 6.6)
- Provision for multi-modal transport options (Broad ITA only); (Sections 3.3, 8)
- Effects on connectivity (Broad ITA only); (Section 10)
- Vehicle queuing on site; (Section 6.6)
- Infrastructure deficiencies, risks or positive effects identified from consultation with the New Zealand Transport Agency where State Highways may be affected (Broad ITA only) (Section 10).

Appendix B: Conceptual Site Layout


LEGEND
EXISTING CADASTRAL BOUNDARIES
PLAN CHANGE BOUNDARY
EXSITING ROAD
COLLECTOR ROAD
LOCAL ROAD
INDUSTRIAL – EXISTING
INDUSTRIAL – APL SITE
INDUSTRIAL – GENERAL
STORMWATER RESERVE
N
BRUNTWOOD ROAD
MANGAONE STREAM
VICTORIA ROAD
ZIG ZAG ROAD
HAUTAPU DAIRY FACTORY SITE
HAUTAPU ROAD
ALLWILL DRIVE
STORMWATER BASIN (DETAILS TO BE CONFIRMED)
SHOOF INTERNATIONAL LTD
DEVELOPMENT ACCESS LOCATION (DETAILS TO BE CONFIRMED)
POSSIBLE ROAD CONNECTION TO FUTURE DEVELOPMENT
HANNON ROAD
LAURENT ROAD
VICTORIA ROAD
SWAYNE ROAD
APPLEBY ROAD
WAIKATO EXPRESSWAY (SH1)
PROPOSED PLAN CHANGE 11 TO THE WAIPA DISTRICT PLAN
BARDOWIE INDUSTRIAL PRECINCT
STRUCTURE PLAN
GENERAL ARRANGEMENT

Appendix C: Crash Data



CRASH KEY	CRASH ROAD	CRASH DIST	CRASH DIRN	SIDE ROAD	CRASH ID	CRASH DATE	CRASH DOW	CRASH TIME	MVMT DESCR	CAUSES	ROAD WET	LIGHT	WTHRa	JUNC TYPE	TRAF CTRL	CRASH FATAL CNT	CRASH SEV CNT	CRASH MIN CNT	EASTING	NORTHING
1	1B/30/11.952		I	ZIG ZAG ROAD	201336664	6/07/2013	Sat	1140	CAR1 NBD on SH 1B hit CAR2 merging from the right	CAR2 Failed to give way At a priority traffic control, Did not check / notice another party	Dry	Overcast	Fine	X Type Junction	Stop Sign	0	0	0	1815852	5807318
2	1B/30/11.952		I	BRUNTWOOD ROAD	201339286	10/10/2013	Thu	1256	TRUCK1 SBD on SH 1B hit CAR2 crossing at right angle from right	CAR2 Failed to give way At a priority traffic control, another vehicle	Dry	Bright Sun	Fine	X Type Junction	Stop Sign	0	0	0	1815852	5807318
3	1B/30/11.952		I	ZIG ZAG ROAD	201518164	22/11/2015	Sun	800	CAR1 SBD on SH 1B lost control; went off road to right, CAR1 hit Traffic Sign	CAR1 Lost control Under Braking, Suddenly Braked, suddenly swerved to avoid vehicle ENV: road slippery (rain)	Wet	Overcast	Light Rain	X Type Junction	Stop Sign	0	0	1	1815852	5807318
4	ZIG ZAG ROAD	40	E	SH 1B	201333865	5/06/2013	Wed	1624	VAN1 WBD on ZIG ZAG ROAD hit Vehicle while manoeuvring	VAN1 Did not check / notice another party behind ENV: entering or leaving private house / farm	Dry	Overcast	Fine	Driveway	N/A	0	0	0	1815889	5807305
5	HAUTAPU ROAD	100	W	HANNON ROAD	201447437	14/11/2014	Fri	245	CAR1 EBD on HAUTAPU ROAD lost control turning right, CAR1 hit Post Or Pole on right hand bend	CAR1 Entering / On curve	Wet	Dark	Fine	Unknown	Nil	0	0	0	1815765	5806866
6	HAUTAPU ROAD	100	N	HANNON ROAD	201513592	4/05/2015	Mon	654	VAN1 NBD on HAUTAPU ROAD lost control turning left, VAN1 hit Post Or Pole	VAN1 Entering / On curve, lost control when turning	Dry	Overcast	Fine	Unknown	Nil	0	0	1	1815765	5806866
7	HAUTAPU ROAD	100	N	HANNON ROAD	201544217	6/07/2015	Mon	2015	CAR1 NBD on HAUTAPU ROAD lost control turning left, CAR1 hit Fence, Post Or Pole	CAR1 Entering / On curve, lost control when turning	Wet	Dark	Light Rain	Unknown	N/A	0	0	0	1815765	5806866
8	HAUTAPU ROAD	90	W	HANNON ROAD	201443951	20/02/2014	Thu	815	CAR1 EBD on HAUTAPU ROAD lost control turning right, CAR1 hit Parked Vehicle on right hand bend	CAR1 Entering / On curve, lost control when turning	Dry	Bright Sun	Fine	Unknown	Nil	0	0	0	1815775	5806866
9	HAUTAPU ROAD	15	N	HANNON ROAD	201736969	25/03/2017	Sat	1503	CAR1 NBD on HAUTAPU ROAD lost control turning right, CAR1 hit Parked Vehicle on right hand bend	CAR1 Entering / On curve, lost control when turning	Wet	Overcast	Light Rain	Driveway	Nil	0	0	0	1815826	5806813
10	1B/30/12.563		I	LAURENT ROAD NORTH	201541336	2/06/2015	Tue	1937	CAR1 WBD on LAURENT ROAD NORTH missed inters or end of road, CAR1 hit Fence, Guard Rail	CAR1 Entering / On curve, lost control when turning	Wet	Dark	Heavy Rain	T Type Junction	Give Way Sign	0	0	0	1815980	5806733
11	1B/30/12.633		I	HAUTAPU ROAD	201439164	2/06/2014	Mon	1551	CAR1 SBD on SH 1B hit rear end of CAR2 stop/slow for cross traffic	CAR1 following too closely	Dry	Bright Sun	Fine	T Type Junction	Give Way Sign	0	0	0	1815950	5806670
12	1B/30/12.633		I	HAUTAPU ROAD	201638128	29/04/2016	Fri	2120	CAR1 SBD on SH 1B hit rear end of CAR2 stop/slow for cross traffic	CAR1 following too closely, failed to notice car slowing	Dry	Dark	Fine	T Type Junction	Give Way Sign	0	0	0	1815950	5806670
13	1B/30/12.633		I	HAUTAPU ROAD	201614329	31/05/2016	Tue	1820	CAR2 turning right hit by oncoming CAR1 SBD on SH 1B	CAR2 failed to give way when turning to non-turning traffic	Dry	Dark	Fine	T Type Junction	Give Way Sign	0	0	1	1815950	5806670
14	1B/30/12.633		I	HAUTAPU ROAD	201739421	19/03/2017	Sun	1410	SUV1 SBD on SH 1B hit rear end of CAR2 stop/slow for cross traffic	SUV1 failed to notice car slowing	Dry	Bright Sun	Fine	T Type Junction	Give Way Sign	0	0	0	1815950	5806670
15	VICTORIA OFF EBD		I	1B/30/13.382	201615131	26/07/2016	Tue	1720	CAR1 EBD on VICTORIA OFF EBD hit rear end of CAR2 stop/slow for signals	CAR1 failed to notice control	Dry	Twilight	Fine	T Type Junction	Traffic Signal	0	0	1	1816204	5805972
16	VICTORIA ON EBD		I	VICTORIA OFF EBD	201746507	31/07/2017	Mon	705	CAR1 EBD on VICTORIA ON EBD hit CAR2 crossing at right angle from right	CAR2 did not stop at steady amber light, Did not check / notice another party	Dry	Twilight	Fine	X Type Junction	Traffic Signal	0	0	0	1816204	5805972

All Crashes 2013-2017 Surrounding Road Network

Appendix D: Traffic Data

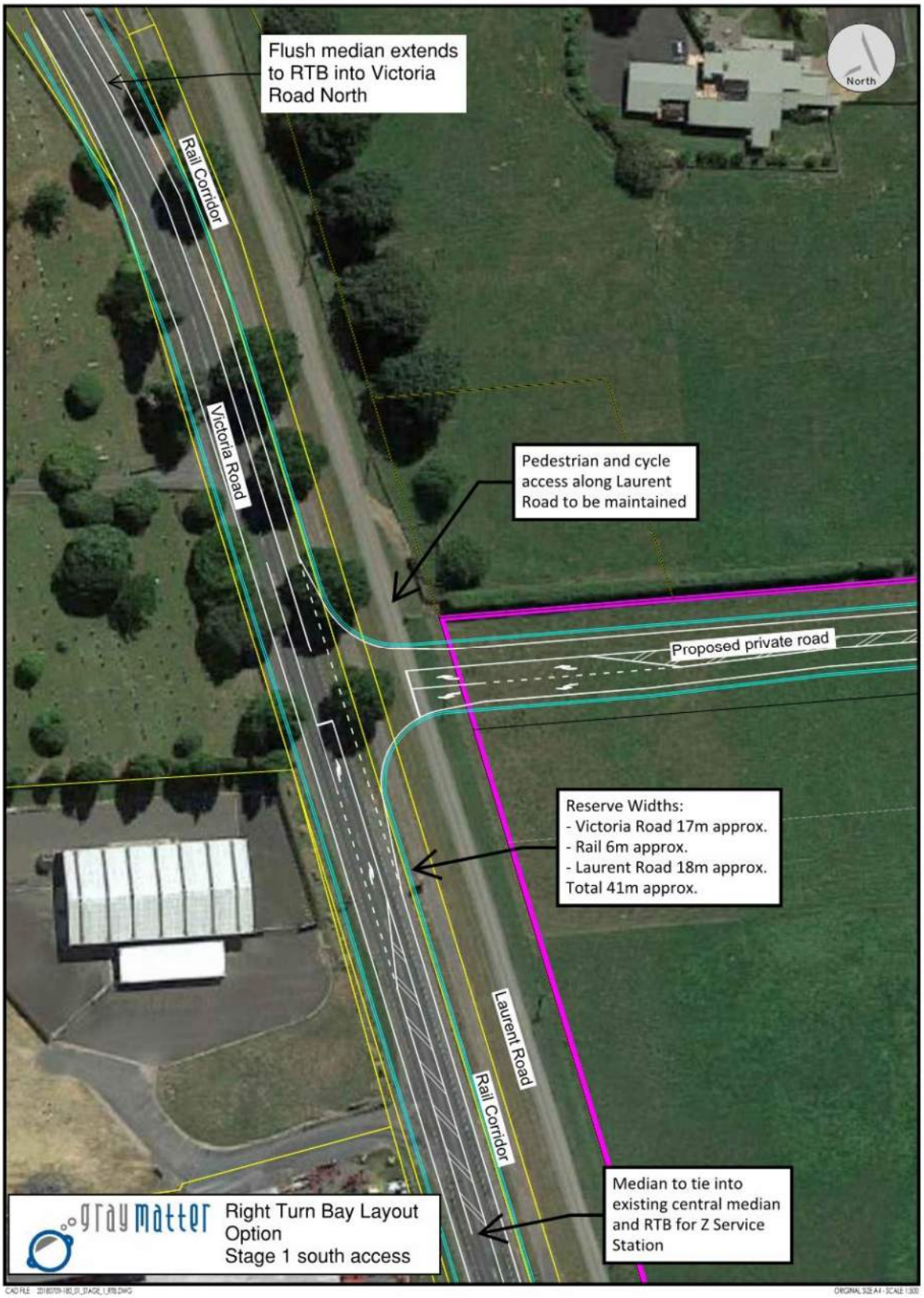
Extracts from mobileroad.org, showing AADT on suurounding road network.


2 Regions
Map
Tools
External
Centreline Data
0 Markers
Instructions
0m left of
HAUTAPU RD/0.030
ADT
2730 (est.) 01/12/2016
WIDTHS
2 lanes, total 7.5m
Carriageway Names
SH 1B TO HANNON RD
Road Id, Cw Id, App Region
2467, 935, Waipa DC Dec'2017

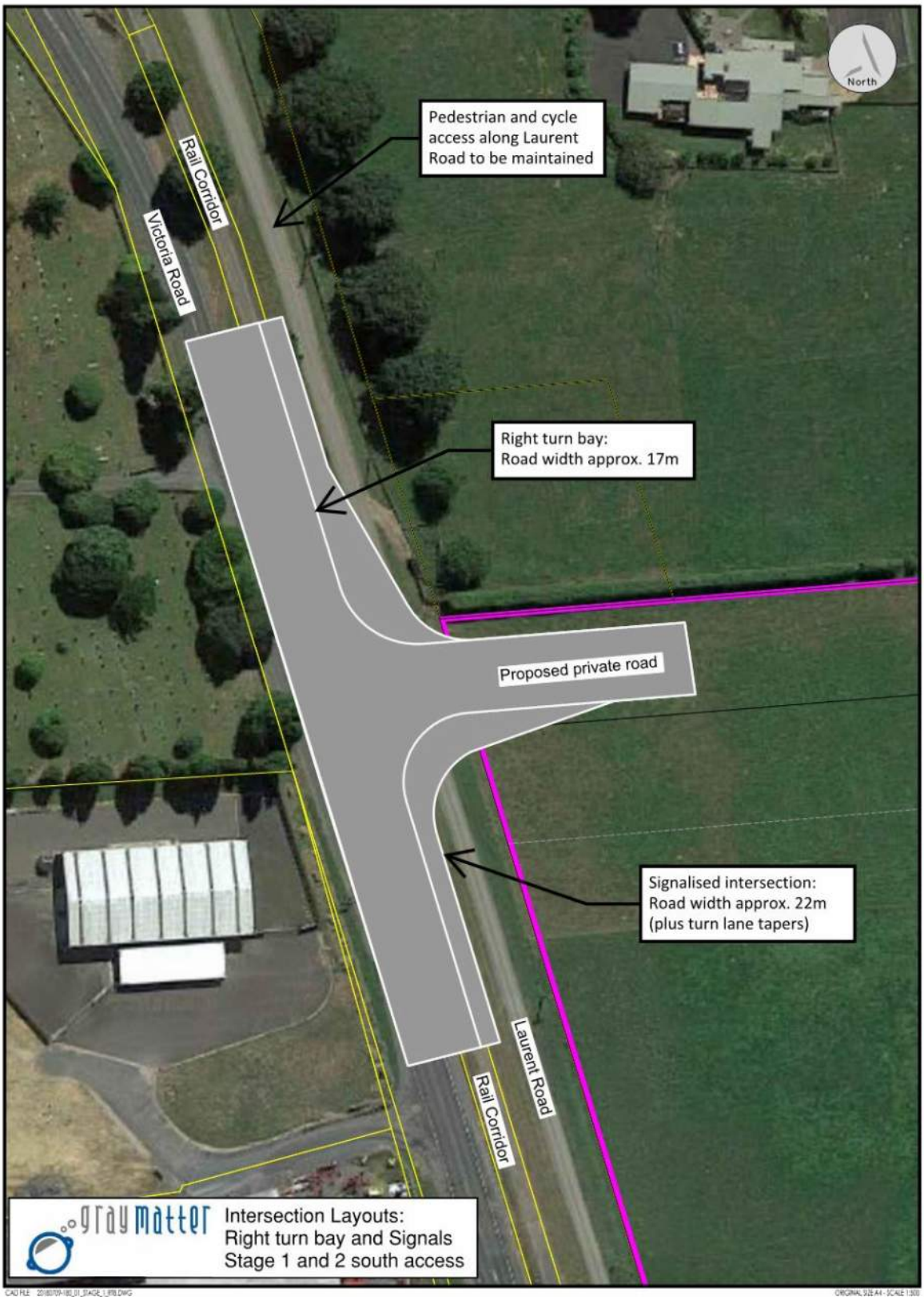

2 Regions
Map
Tools
External
Centreline Data
0 Markers
Instructions
0m left of
01B-0030-B/12.657
ADT
7878 (est) 28/12/2016 13% heavy
ONRC
Primary Collector
Surfacing
SMA Reseal 05/2017 Grade 10 width 12m
Treatment Length
1011 Victoria/Hautapu Int
Widths
2 * 3.5m, total 12.1m
Carriageway Names
HAUTAPU RD TO SH 1 UNDERPASS
Road Id, Cw Id, App Region
2595, 3946, All SH May'2018


2 Regions
Map
Tools
External
Centreline Data
0 Markers
Instructions
0m left of
HANNON RD/0.019
ADT
200 (est.) 01/12/2016
WIDTHS
2 lanes, total 8.5m
Carriageway Names
HAUTAPU RD TO SPEED DERESTRICTION (LHS)
Road Id, Cw Id, App Region
208, 848, Waipa DC Dec'2017

Appendix E: Right Turn Bay Layout Option



Waipa DC have previously considered widening Victoria Street (west) (the major arterial) to provide wider footpaths and cycle facilities. The preferred option would include a relocation of the railway corridor and associated designation to the east.



The preferred option could be staged, with the construction of a right turn bay for the initial traffic generated by Stage 1 development. As Stage 2 comes online, there may be a need to upgrade the intersection to traffic signals to improve the performance of the intersection for both the increased turning volumes and increased through traffic on Victoria Road.

Appendix F: SIDRA Summary Inputs and Outputs

Calculation of Peak Hour trips

WRTM 2041 Peak hour passing trips (Victoria Road) being:

- = 640 northbound, 590 southbound (AM Peak); and
- = 562 northbound, 688 southbound (PM Peak).

Trip generation of Stage 1 and 2 of the Bardowie Precinct:

- = Stage 1 APL at 10 trips per hectare (low employee numbers), 12.5 x 10 = 125 trips
- = Stage 2 APL at 20 trips per hectare, 16.3 x 20 = 326 trip
- = Motel accommodation: 1.4 trips per occupancy unit for 100 units, with 50% of trips being multi-purpose = 70 trips
- = Childcare: 1.4 trips/pupil for 100 pupils, with 50% of trips being multi-purpose = 70 trips
- = Wellness centre: assume 69 trips in peak hour (more off-peak traffic) = 58 trips (equivalent to 11.6 trips per professional for 10 professionals, with 50% of trips being multi-purpose)
- = Total peak hour trips = 650 trips in peak hour (rounded).

(NZ Transport Agency Research Report 453, Trips and Parking Related to Land Use, November 2011)

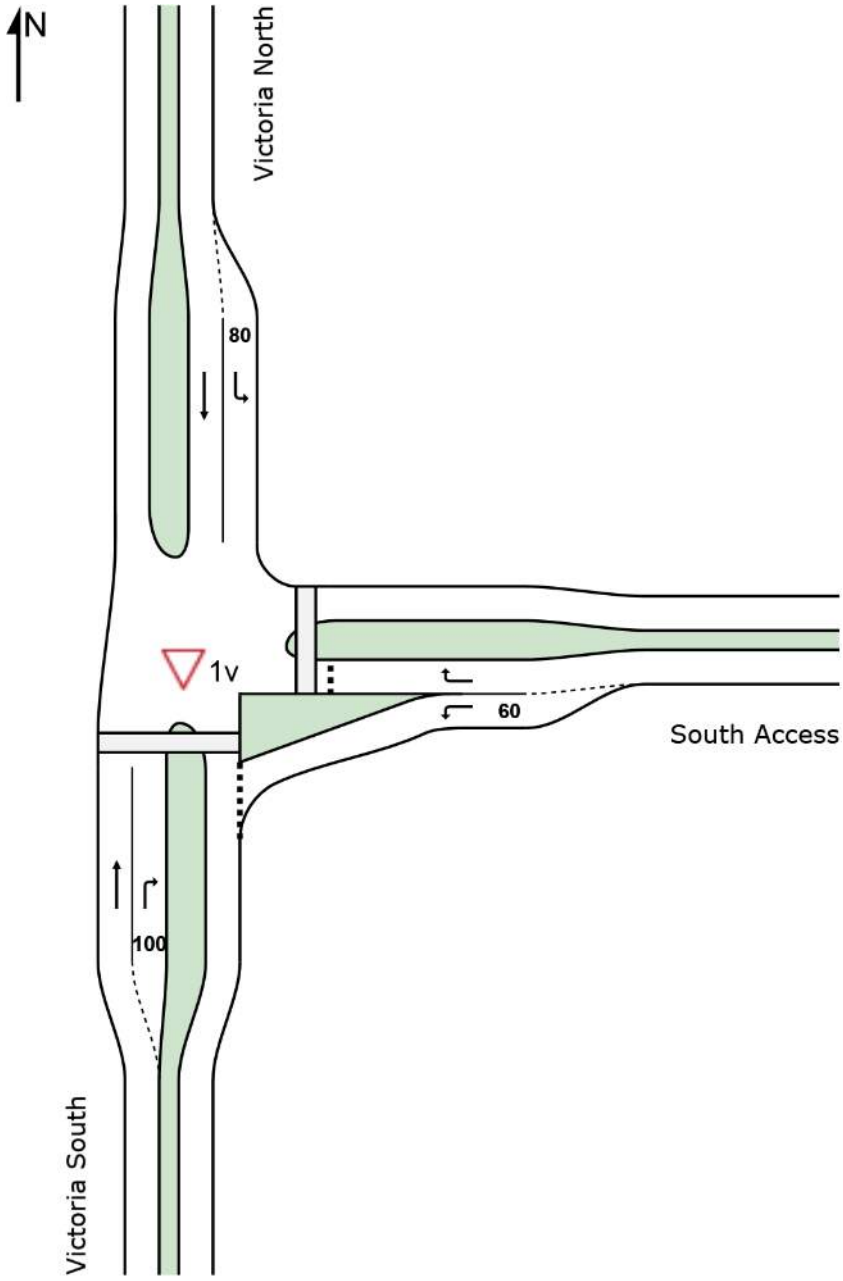
Definitions Of LOS				Table 1
LOS	**Description**	**WRTM Model LOS criteria**		
		Link (vehicles per hour)	**Intersection (average delay/veh)**	
			Priority	**Signal/Rotary**
LOS F	Forced flow. The amount of traffic approaching a point exceeds that which can pass it. Flow break-downs occur, and queuing and delays occur.	In excess of **900-1700** depending on link type	50 sec	80 sec
LOS E	Traffic volumes are at or close to *capacity and there is virtually no freedom* to select desired speed and to manoeuvre within the traffic stream. Flow is unstable and *minor disturbances within the traffic stream will cause break-downs in operation*.	Between **810-1530** depending on link type	35 sec	55 sec
LOS D	Approaching unstable flow where *all drivers are severely restricted* in their freedom to select desired speed and to manoeuvre within the traffic stream. The general level of *comfort and convenience is poor* and small increases in traffic flow will cause operational problems.	Between **675-1275** depending on link type	25 sec	35 sec
LOS C	Stable flow but most drivers *are restricted to some extent* in their freedom to select their desired speed and to manoeuvre within the traffic stream. The general level of *comfort and convenience has declined noticeably*.	Between **450-850** depending on link type	15 sec	20 sec
LOS B	Stable flow where drivers still *have reasonable freedom* to select their desired speed and to manoeuvre within the traffic stream. The general level of comfort and convenience is less than LOS A.	Not Applicable	Not Applicable	
LOS A	Free flow in which drivers are *virtually unaffected* by the presence of others in the traffic stream. Freedom to select desired speeds and to manoeuvre within the traffic stream is extremely high and the general level of *comfort and convenience is excellent*.			

NB The LOS for priority intersections is dictated by the delay on the worst approach and the LOS for roundabouts and signalised intersections is calculated based on the weighted average delay across all approaches.

SITE LAYOUT

Site: 1v [RTB am 2041_St1_12.5ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)



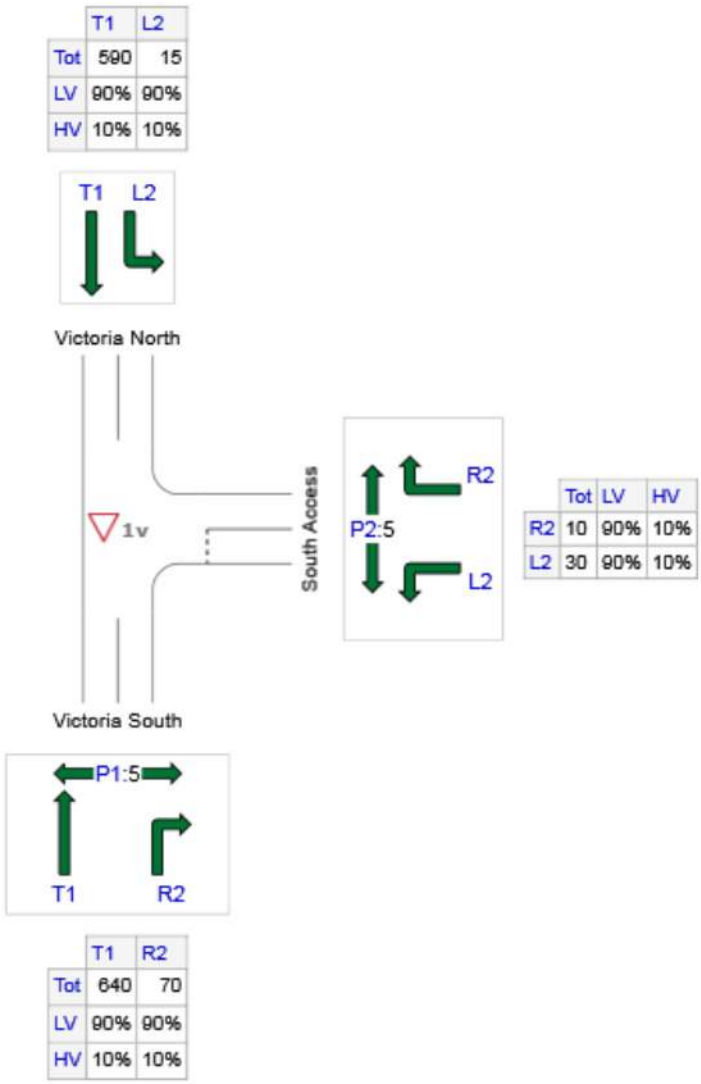
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 1v [RTB am 2041_St1_12.5ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Victoria South	710	639	71
E: South Access	40	36	4
N: Victoria North	605	545	61
Total	1355	1220	136

MOVEMENT SUMMARY

Site: 1v [RTB am 2041_St1_12.5ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Victoria South												
2	T1	674	10.0	0.367	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
3	R2	74	10.0	0.124	9.4	LOS A	0.5	3.5	0.60	0.81	0.60	43.7
Approach		747	10.0	0.367	1.0	NA	0.5	3.5	0.06	0.08	0.06	49.2
East: South Access												
4	L2	32	10.0	0.056	9.0	LOS A	0.2	1.4	0.57	0.75	0.57	44.6
6	R2	11	10.0	0.128	47.7	LOS E	0.4	2.8	0.93	0.97	0.93	30.0
Approach		42	10.0	0.128	18.7	LOS C	0.4	2.8	0.66	0.81	0.66	39.8
North: Victoria North												
7	L2	16	10.0	0.009	4.7	LOS A	0.0	0.0	0.00	0.53	0.00	46.5
8	T1	621	10.0	0.336	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
Approach		637	10.0	0.336	0.2	NA	0.0	0.0	0.00	0.01	0.00	49.8
All Vehicles		1426	10.0	0.367	1.1	NA	0.5	3.5	0.05	0.07	0.05	49.2

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
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.

DELAY (CONTROL)

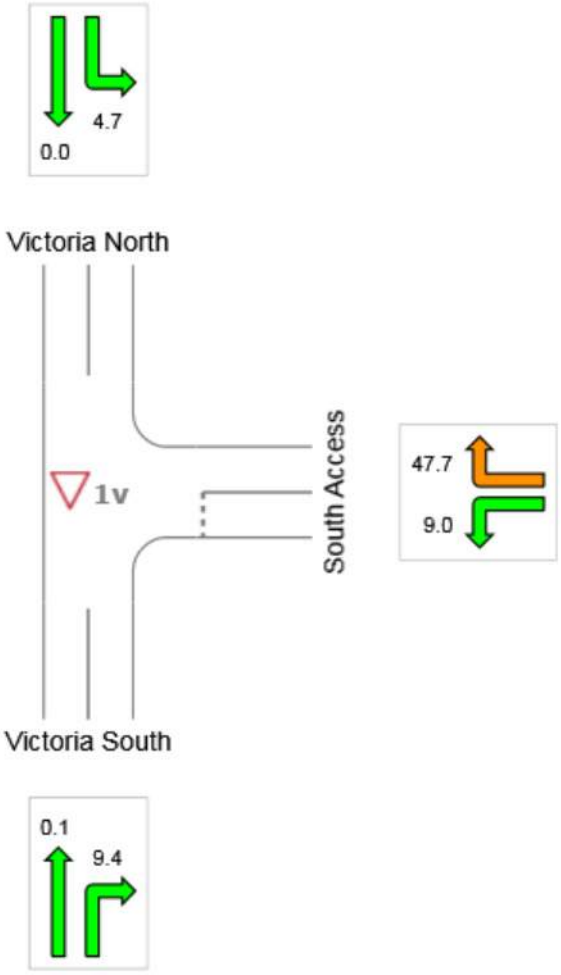
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 1v [RTB am 2041_St1_12.5ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

All Movement Classes

	Approaches			Intersection
	South	East	North	
Delay (Control)	1.0	18.7	0.2	1.1
LOS	NA	C	NA	NA



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

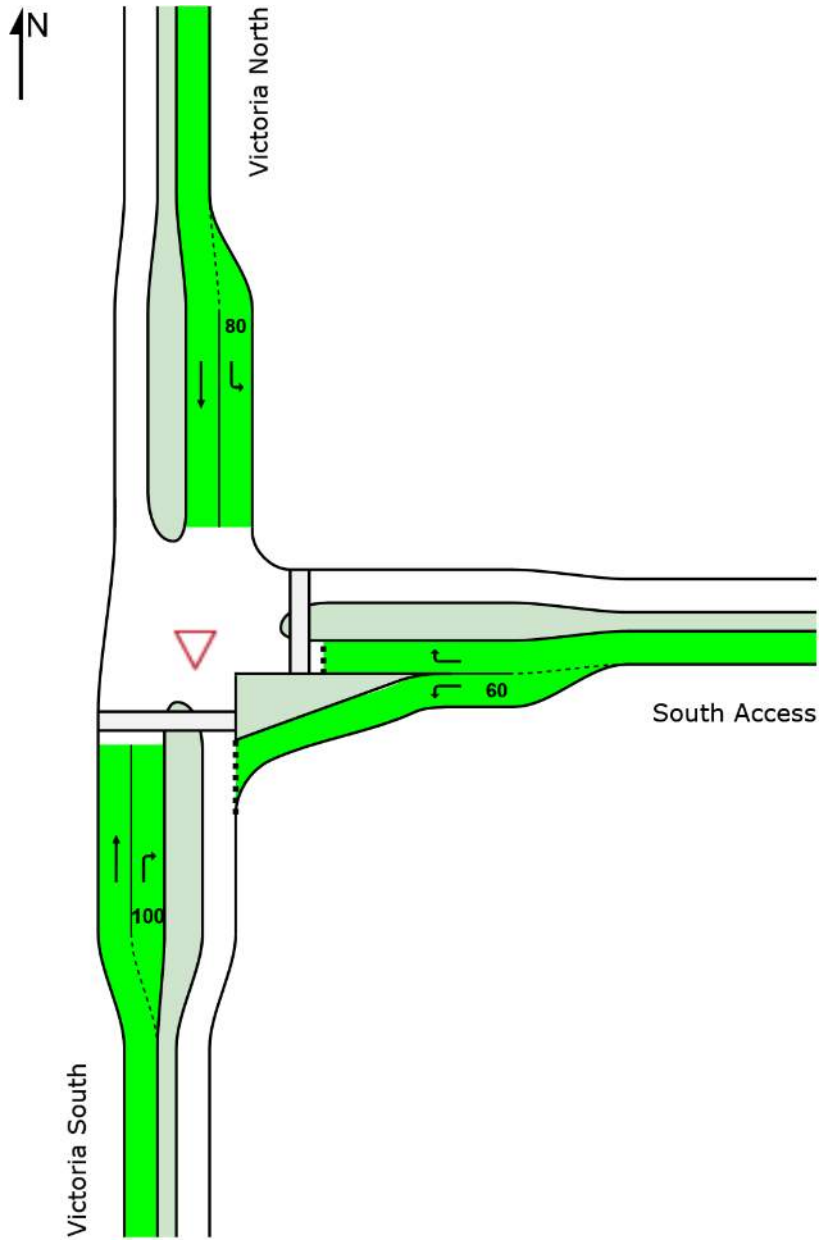
QUEUE DISTANCE (%ILE)

95% Back of Queue Distance per lane (metres)

Site: 1v [RTB am 2041_St1_12.5ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

	Approaches			Intersection
	South	East	North	
Vehicle Queue (%ile)	3	3	0	3



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

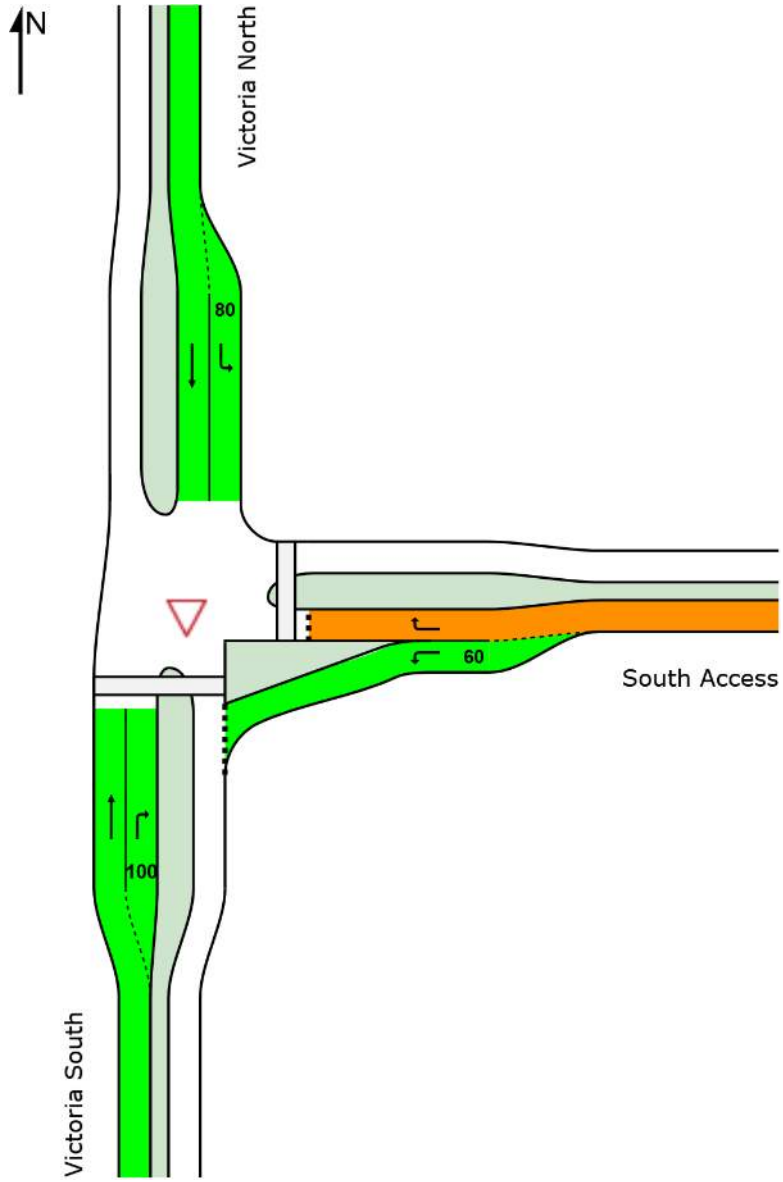
LANE LEVEL OF SERVICE

Lane Level of Service

Site: 1v [RTB am 2041_St1_12.5ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

	Approaches			Intersection
	South	East	North	
LOS	NA	C	NA	NA



Colour code based on Level of Service

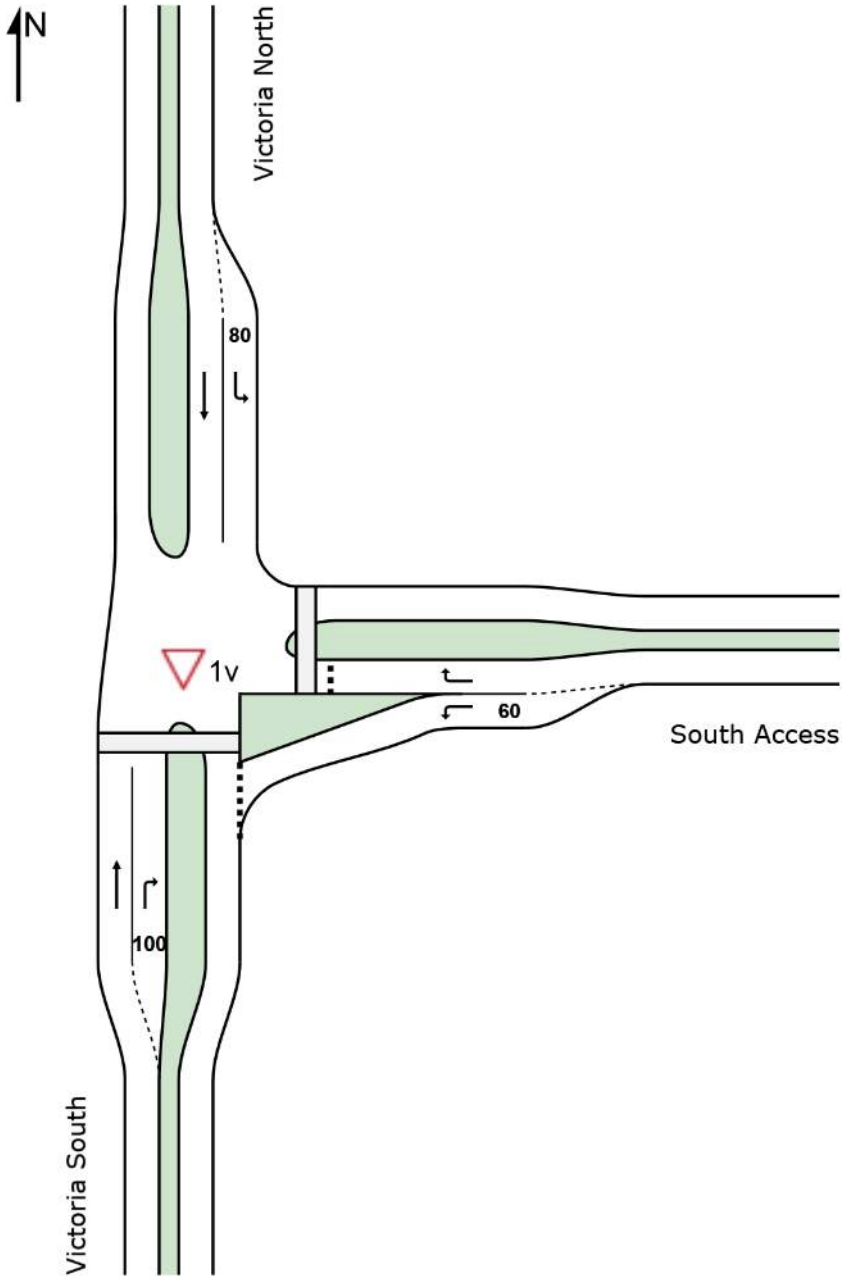
LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

SITE LAYOUT

Site: 1v [RTB am Interim Flows_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)



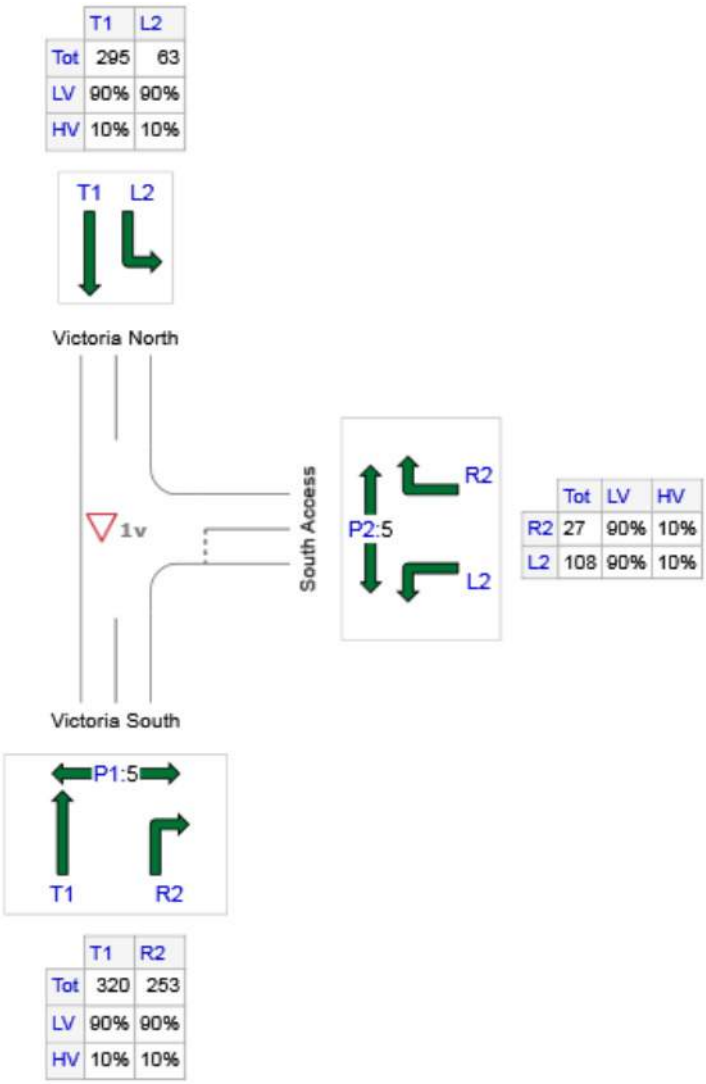
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 1v [RTB am Interim Flows_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Victoria South	573	516	57
E: South Access	135	122	14
N: Victoria North	358	322	36
Total	1066	959	107

MOVEMENT SUMMARY

Site: 1v [RTB am Interim Flows_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Victoria South												
2	T1	337	10.0	0.183	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
3	R2	266	10.0	0.298	7.2	LOS A	1.4	10.5	0.52	0.72	0.54	44.9
Approach		603	10.0	0.298	3.2	NA	1.4	10.5	0.23	0.32	0.24	47.6
East: South Access												
4	L2	114	10.0	0.126	6.3	LOS A	0.5	3.5	0.41	0.61	0.41	46.0
6	R2	28	10.0	0.120	19.1	LOS C	0.4	3.0	0.79	0.90	0.79	39.2
Approach		142	10.0	0.126	8.9	LOS A	0.5	3.5	0.49	0.67	0.49	44.5
North: Victoria North												
7	L2	66	10.0	0.038	4.7	LOS A	0.0	0.0	0.00	0.53	0.00	46.5
8	T1	311	10.0	0.168	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		377	10.0	0.168	0.8	NA	0.0	0.0	0.00	0.09	0.00	49.3
All Vehicles		1122	10.0	0.298	3.1	NA	1.4	10.5	0.19	0.29	0.19	47.7

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
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.

DELAY (CONTROL)

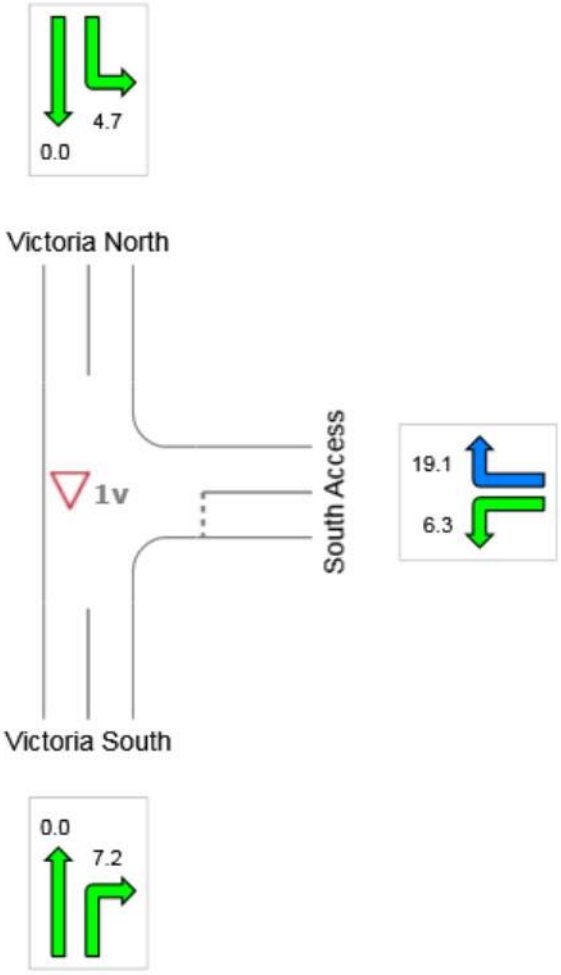
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 1v [RTB am Interim Flows_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

All Movement Classes

	Approaches			Intersection
	South	East	North	
Delay (Control)	3.2	8.9	0.8	3.1
LOS	NA	A	NA	NA



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

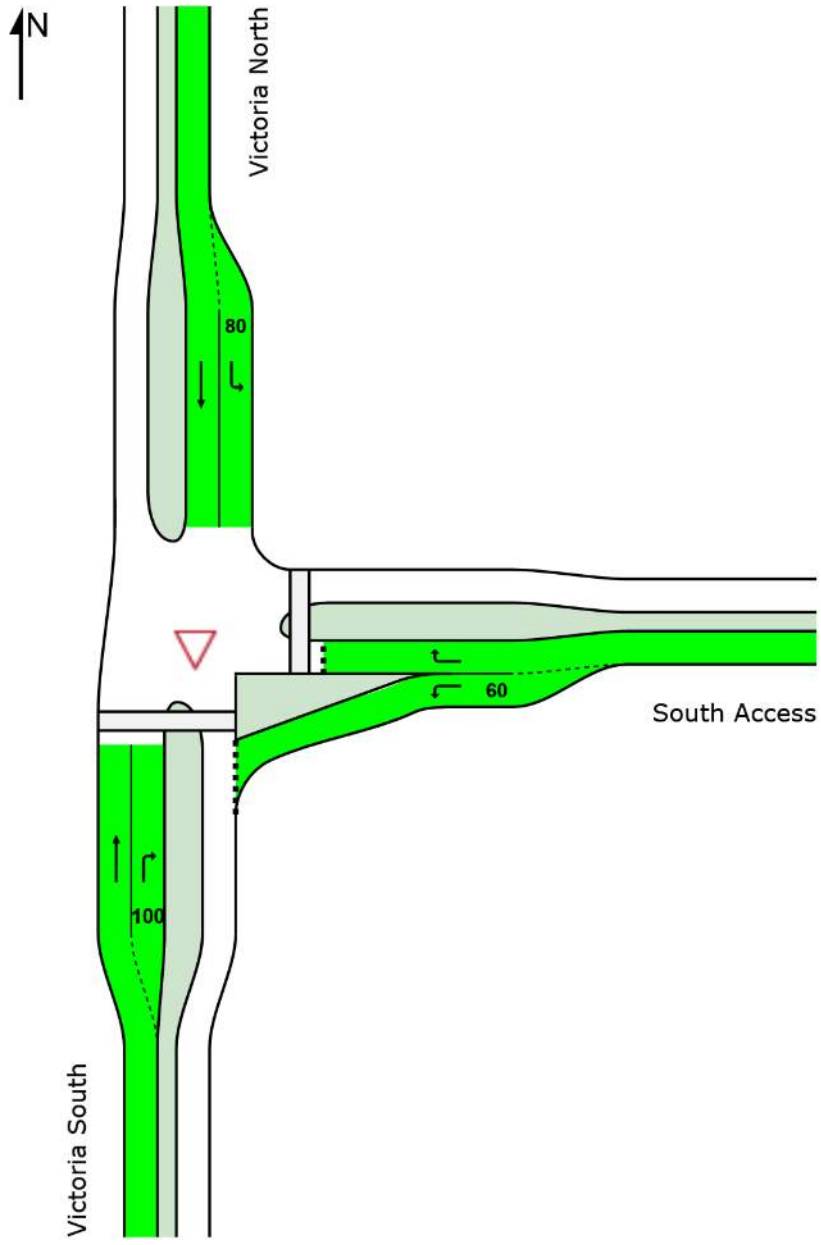
QUEUE DISTANCE (%ILE)

95% Back of Queue Distance per lane (metres)

Site: 1v [RTB am Interim Flows_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

	Approaches			Intersection
	South	East	North	
Vehicle Queue (%ile)	11	4	0	11



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

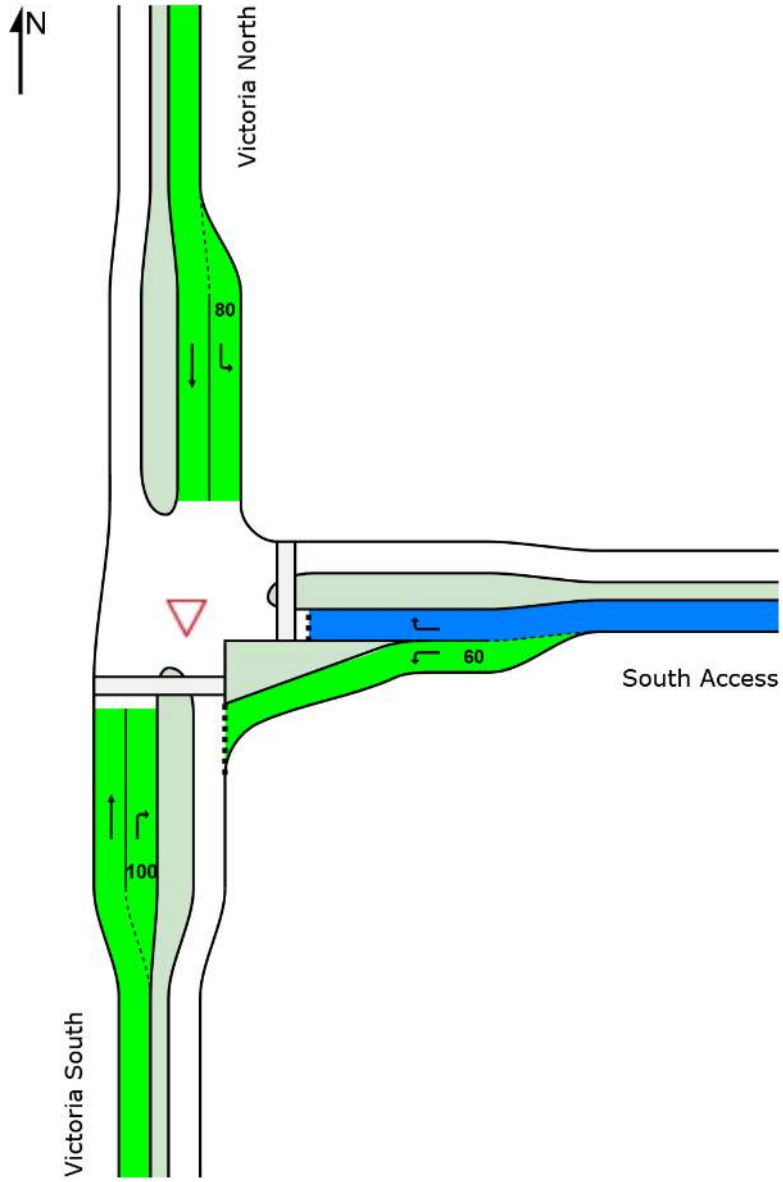
LANE LEVEL OF SERVICE

Lane Level of Service

Site: 1v [RTB am Interim Flows_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

	Approaches			Intersection
	South	East	North	
LOS	NA	A	NA	NA



Colour code based on Level of Service

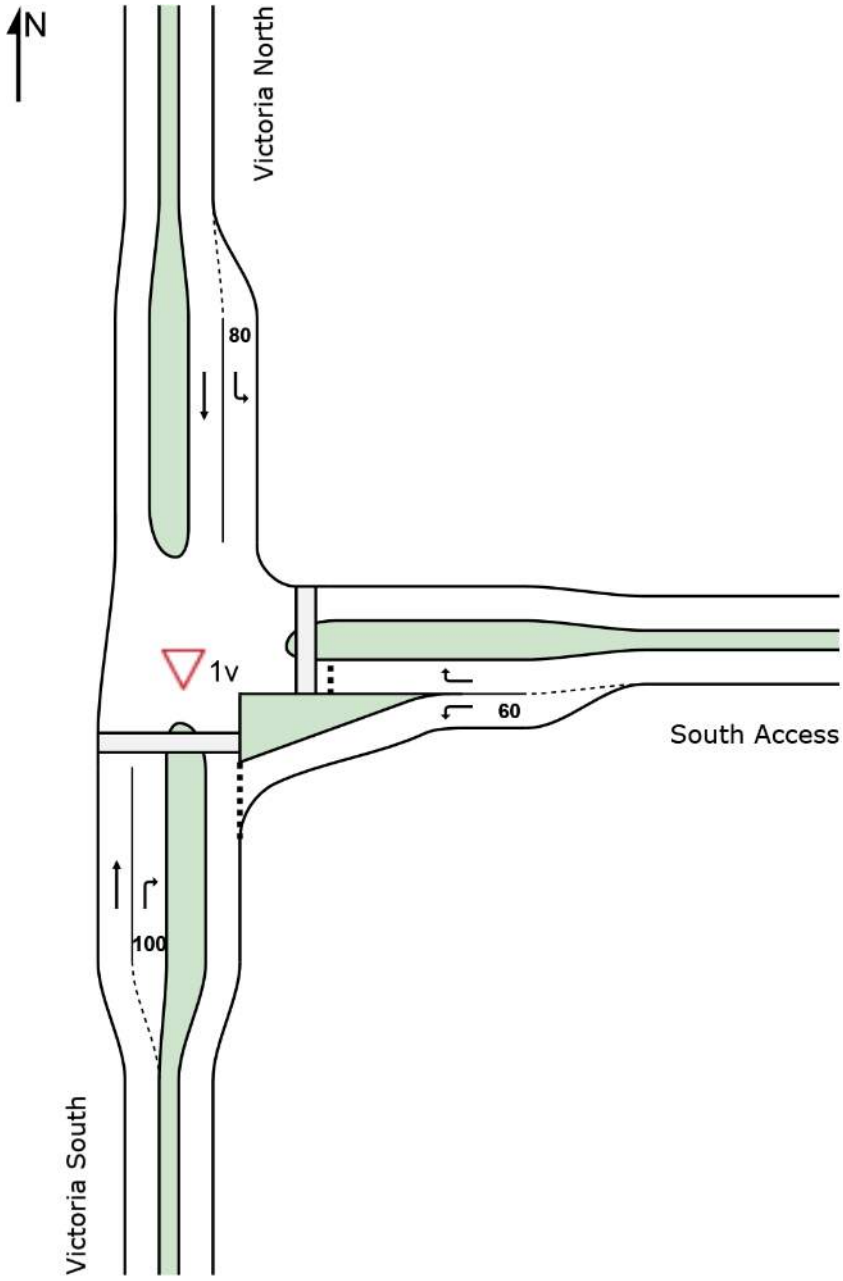
LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

SITE LAYOUT

Site: 1v [RTB am 2041_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)



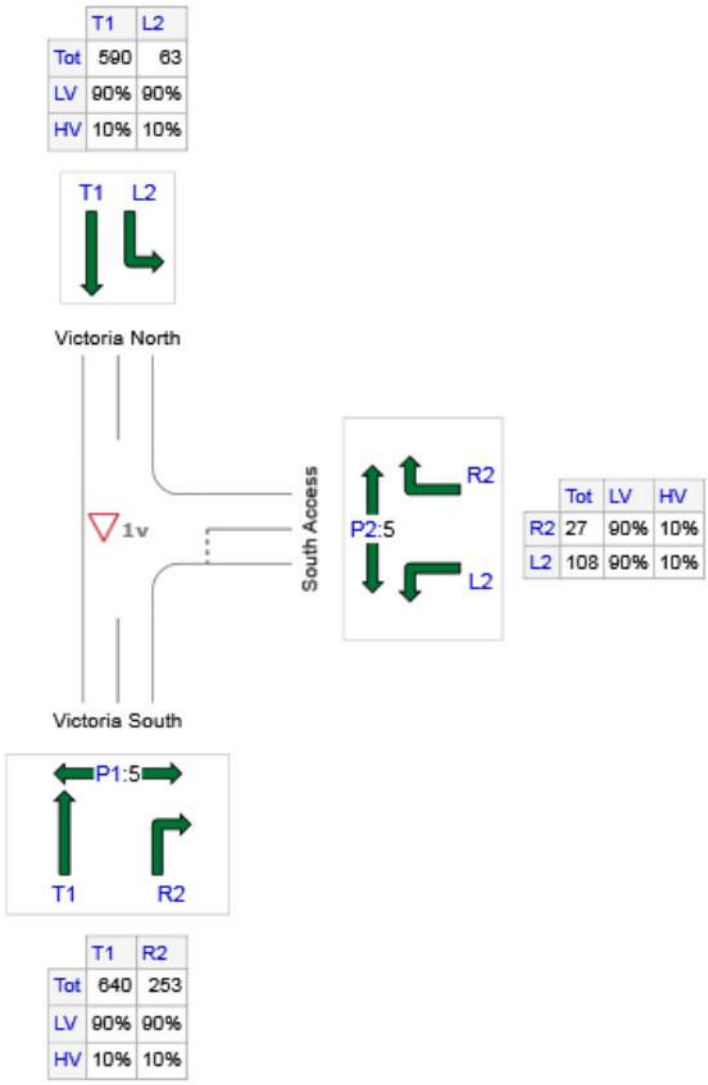
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 1v [RTB am 2041_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Victoria South	893	804	89
E: South Access	135	122	14
N: Victoria North	653	588	65
Total	1681	1513	168

MOVEMENT SUMMARY

Site: 1v [RTB am 2041_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Victoria South												
2	T1	674	10.0	0.368	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
3	R2	266	10.0	0.478	12.9	LOS B	2.6	20.0	0.74	1.01	1.10	41.9
Approach		940	10.0	0.478	3.7	NA	2.6	20.0	0.21	0.29	0.31	47.4
East: South Access												
4	L2	114	10.0	0.202	9.5	LOS A	0.7	5.4	0.61	0.80	0.61	44.3
6	R2	28	10.0	0.548	108.9	LOS F	1.7	13.2	0.98	1.06	1.23	20.0
Approach		142	10.0	0.548	29.4	LOS D	1.7	13.2	0.68	0.85	0.74	35.7
North: Victoria North												
7	L2	66	10.0	0.038	4.7	LOS A	0.0	0.0	0.00	0.53	0.00	46.5
8	T1	621	10.0	0.336	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
Approach		687	10.0	0.336	0.5	NA	0.0	0.0	0.00	0.05	0.00	49.6
All Vehicles		1769	10.0	0.548	4.5	NA	2.6	20.0	0.17	0.24	0.22	46.9

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
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.

DELAY (CONTROL)

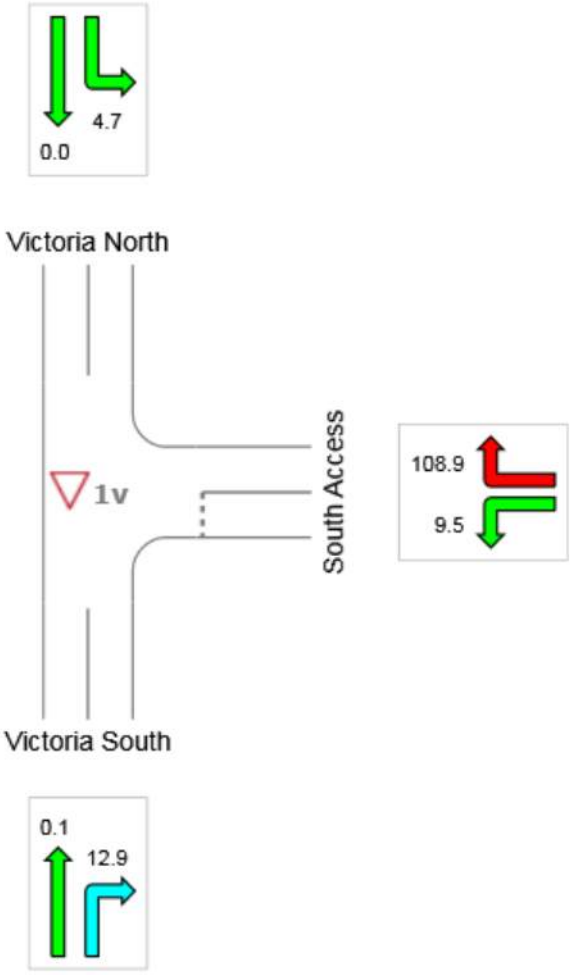
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 1v [RTB am 2041_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

All Movement Classes

	Approaches			Intersection
	South	East	North	
Delay (Control)	3.7	29.4	0.5	4.5
LOS	NA	D	NA	NA



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

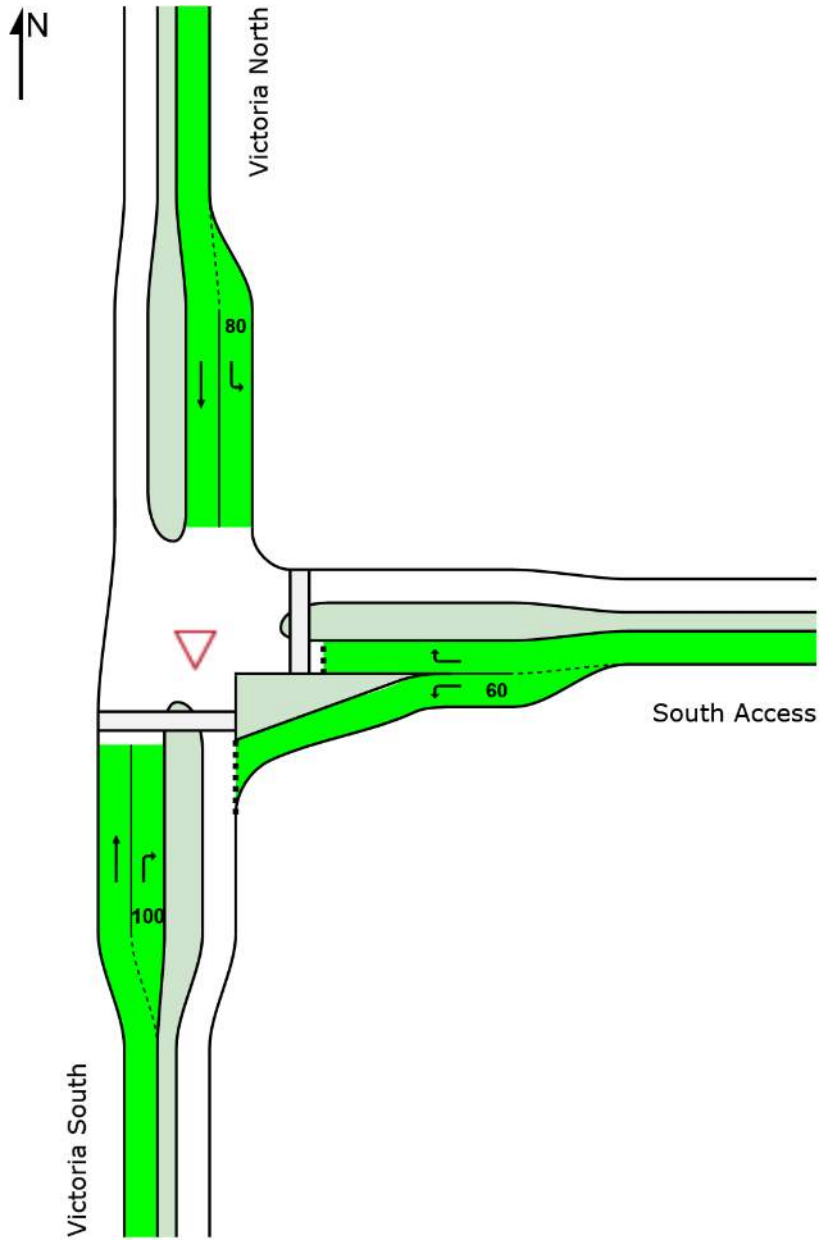
QUEUE DISTANCE (%ILE)

95% Back of Queue Distance per lane (metres)

Site: 1v [RTB am 2041_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

	Approaches			Intersection
	South	East	North	
Vehicle Queue (%ile)	20	13	0	20



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

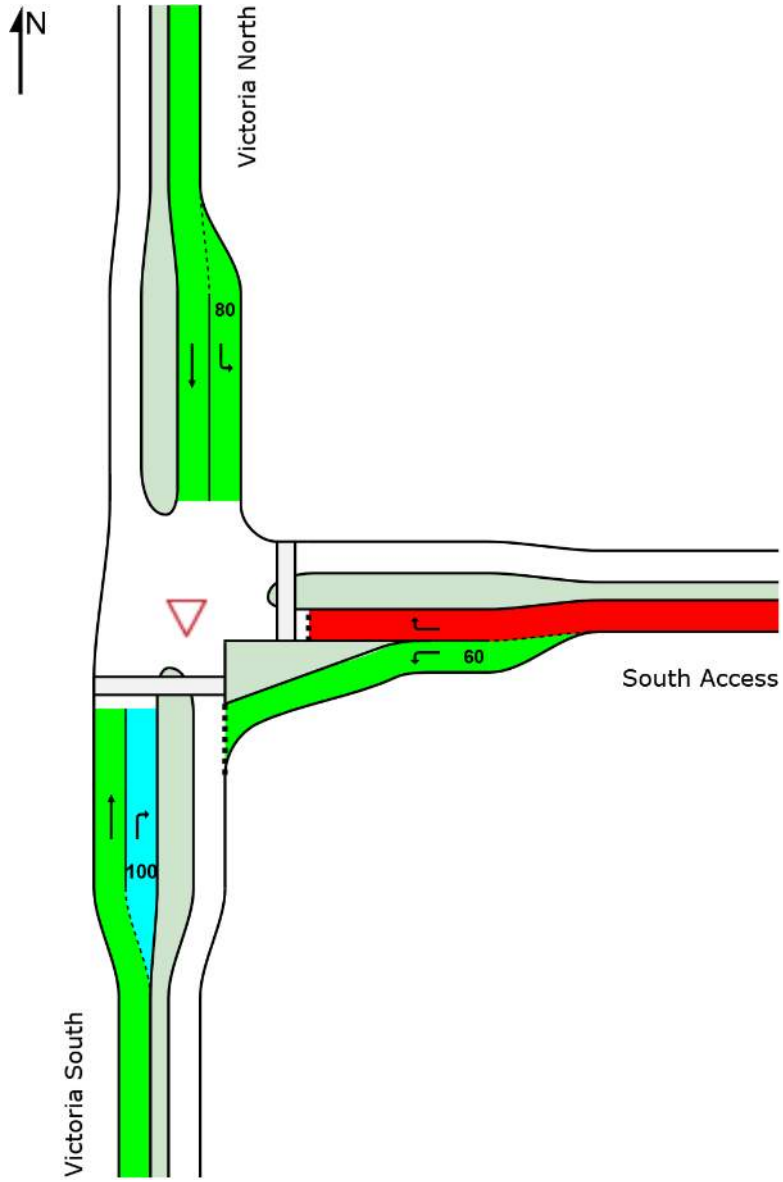
LANE LEVEL OF SERVICE

Lane Level of Service

Site: 1v [RTB am 2041_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

	Approaches			Intersection
	South	East	North	
LOS	NA	D	NA	NA



Colour code based on Level of Service

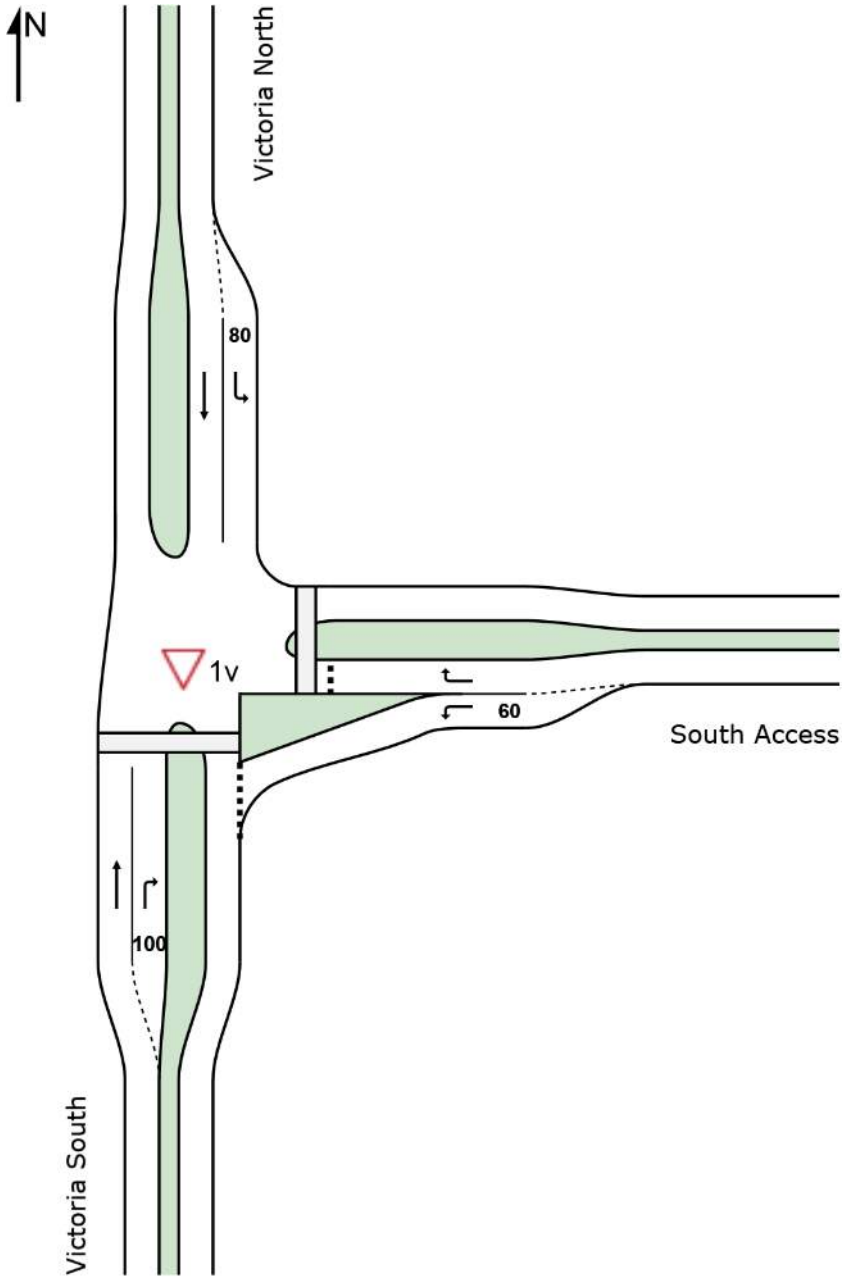
LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

SITE LAYOUT

Site: 1v [RTB am 2041_St2_28.8ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)



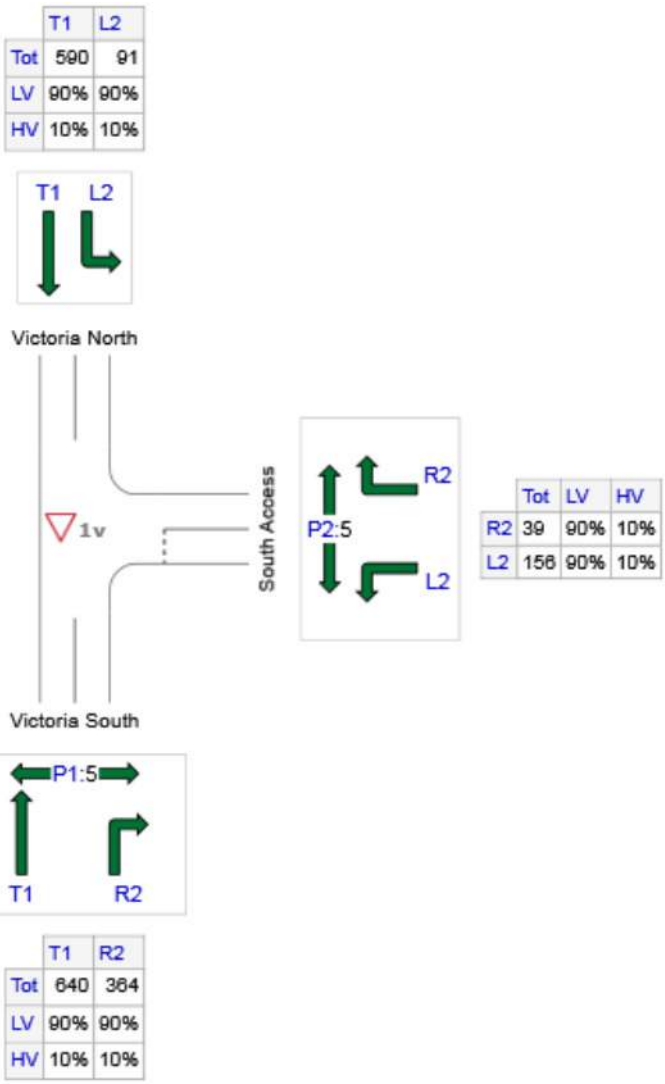
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 1v [RTB am 2041_St2_28.8ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Victoria South	1004	904	100
E: South Access	195	176	20
N: Victoria North	681	613	68
Total	1880	1692	188

MOVEMENT SUMMARY

Site: 1v [RTB am 2041_St2_28.8ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Victoria South												
2	T1	674	10.0	0.366	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
3	R2	383	10.0	0.718	17.9	LOS C	5.6	42.9	0.85	1.28	1.83	39.7
Approach		1057	10.0	0.718	6.5	NA	5.6	42.9	0.31	0.47	0.66	45.7
East: South Access												
4	L2	164	10.0	0.292	10.2	LOS B	1.2	8.9	0.64	0.85	0.75	43.9
6	R2	41	10.0	1.048	305.9	LOS F	5.8	44.2	1.00	1.40	2.53	9.5
Approach		205	10.0	1.048	69.4	LOS F	5.8	44.2	0.71	0.96	1.10	25.6
North: Victoria North												
7	L2	96	10.0	0.055	4.7	LOS A	0.0	0.0	0.00	0.53	0.00	46.5
8	T1	621	10.0	0.336	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
Approach		717	10.0	0.336	0.7	NA	0.0	0.0	0.00	0.07	0.00	49.4
All Vehicles		1979	10.0	1.048	10.9	NA	5.8	44.2	0.24	0.37	0.47	43.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
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.

DELAY (CONTROL)

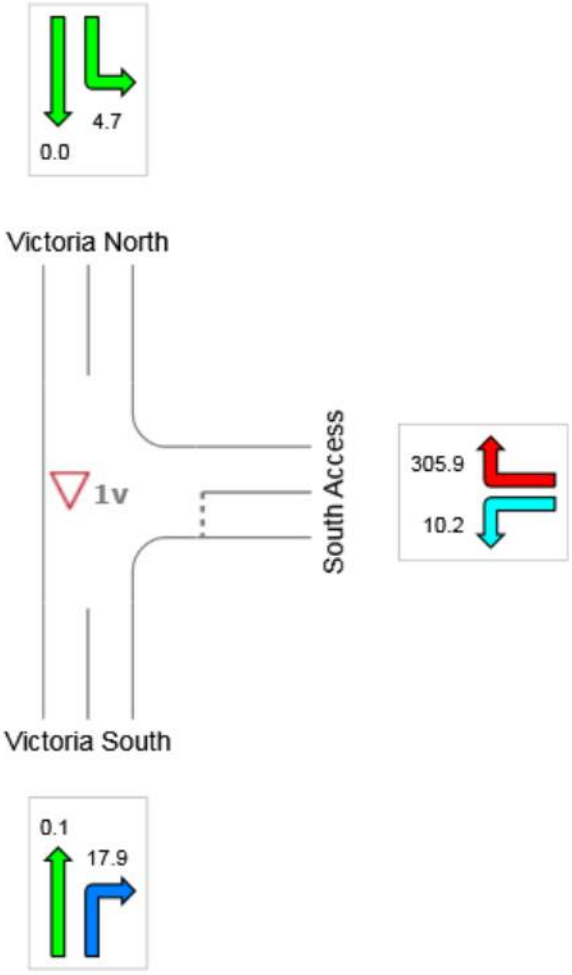
Average control delay per vehicle, or average pedestrian delay (seconds)

▽ Site: 1v [RTB am 2041_St2_28.8ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

All Movement Classes

	Approaches			Intersection
	South	East	North	
Delay (Control)	6.5	69.4	0.7	10.9
LOS	NA	F	NA	NA



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

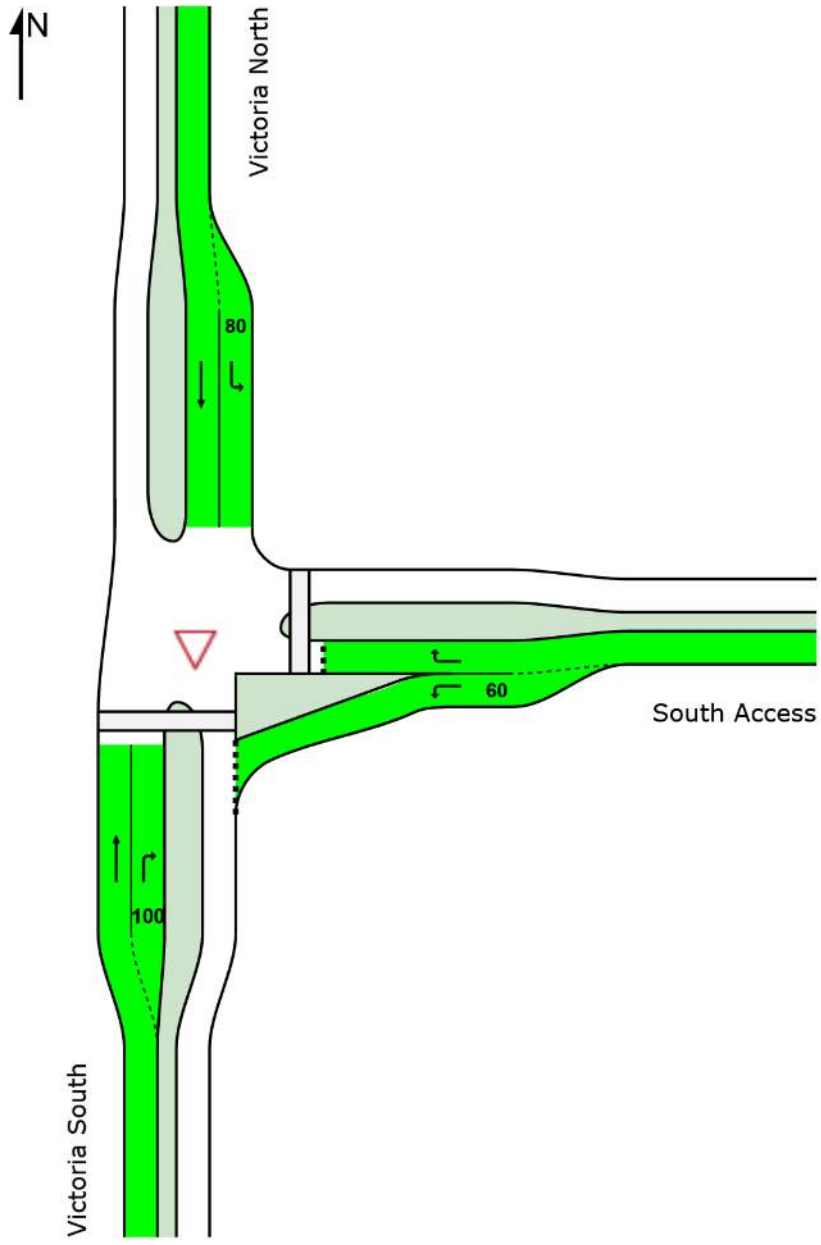
QUEUE DISTANCE (%ILE)

95% Back of Queue Distance per lane (metres)

Site: 1v [RTB am 2041_St2_28.8ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

	Approaches			Intersection
	South	East	North	
Vehicle Queue (%ile)	43	44	0	44



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

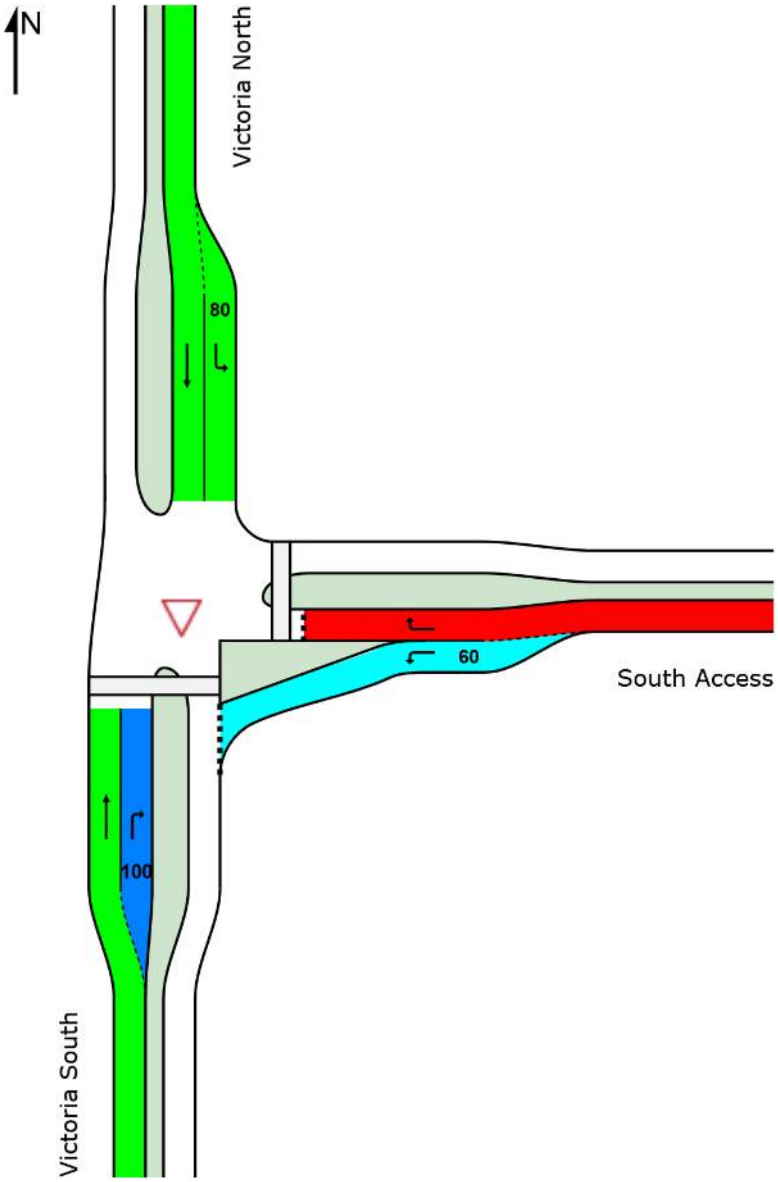
LANE LEVEL OF SERVICE

Lane Level of Service

Site: 1v [RTB am 2041_St2_28.8ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

	Approaches			Intersection
	South	East	North	
LOS	NA	F	NA	NA



Colour code based on Level of Service

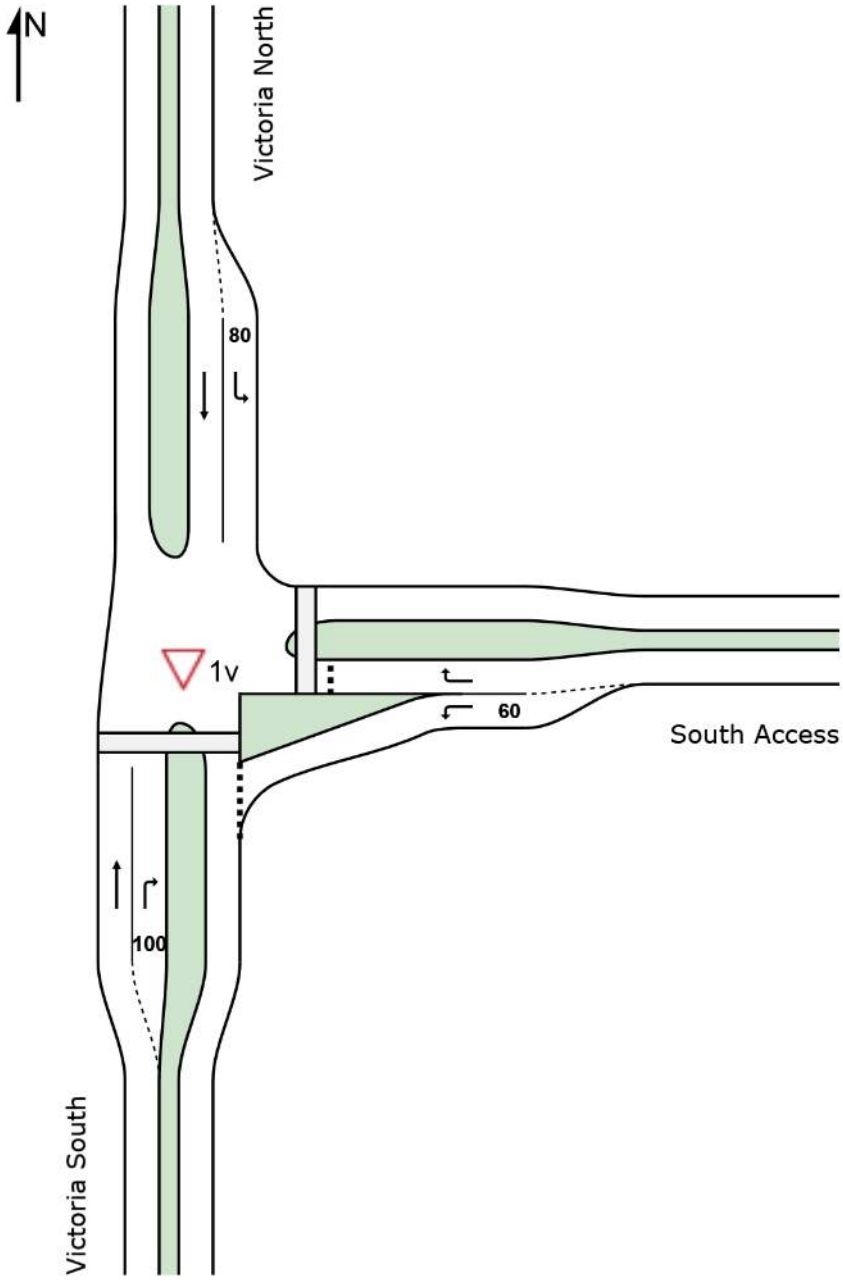
LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

SITE LAYOUT

Site: 1v [RTB am 2041_St3_56.7ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)



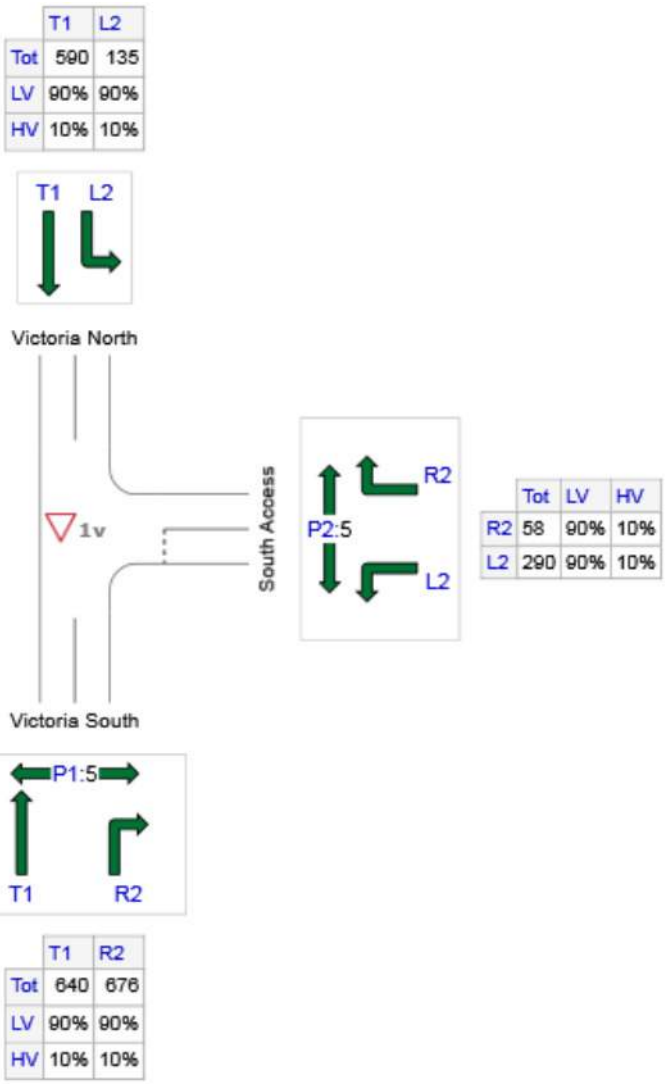
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 1v [RTB am 2041_St3_56.7ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Victoria South	1316	1184	132
E: South Access	348	313	35
N: Victoria North	725	653	73
Total	2389	2150	239

Organisation: GRAY MATTER LTD | Created: Wednesday, 25 July 2018 12:08:04 p.m.
Project: P:\1_Projects\180 Bardowie Investments\180_01 APL Private Plan Change - Bardowie Farm\B_Background\SIDRA Modelling\South Access 25_7_18.sip8

MOVEMENT SUMMARY

Site: 1v [RTB am 2041_St3_56.7ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Victoria South												
2	T1	674	10.0	0.731	12.3	LOS B	10.8	82.2	1.00	0.00	1.98	42.8
3	R2	712	10.0	1.427	402.3	LOS F	143.8	1092.7	1.00	8.62	22.57	7.6
Approach		1385	10.0	1.427	212.6	NA	143.8	1092.7	1.00	4.43	12.56	12.7
East: South Access												
4	L2	305	10.0	0.542	12.7	LOS B	3.1	23.2	0.73	1.03	1.18	42.7
6	R2	61	10.0	3.560	2456.1	LOS F	36.6	278.0	1.00	1.94	4.71	1.4
Approach		366	10.0	3.560	419.9	LOS F	36.6	278.0	0.78	1.18	1.77	7.1
North: Victoria North												
7	L2	142	10.0	0.081	4.7	LOS A	0.0	0.0	0.00	0.53	0.00	46.5
8	T1	621	10.0	0.336	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	49.9
Approach		763	10.0	0.336	0.9	NA	0.0	0.0	0.00	0.10	0.00	49.3
All Vehicles		2515	10.0	3.560	178.6	NA	143.8	1092.7	0.66	2.64	7.17	14.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Minor Road Approach LOS values are based on average delay for all vehicle movements.
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 movements.
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.

DELAY (CONTROL)

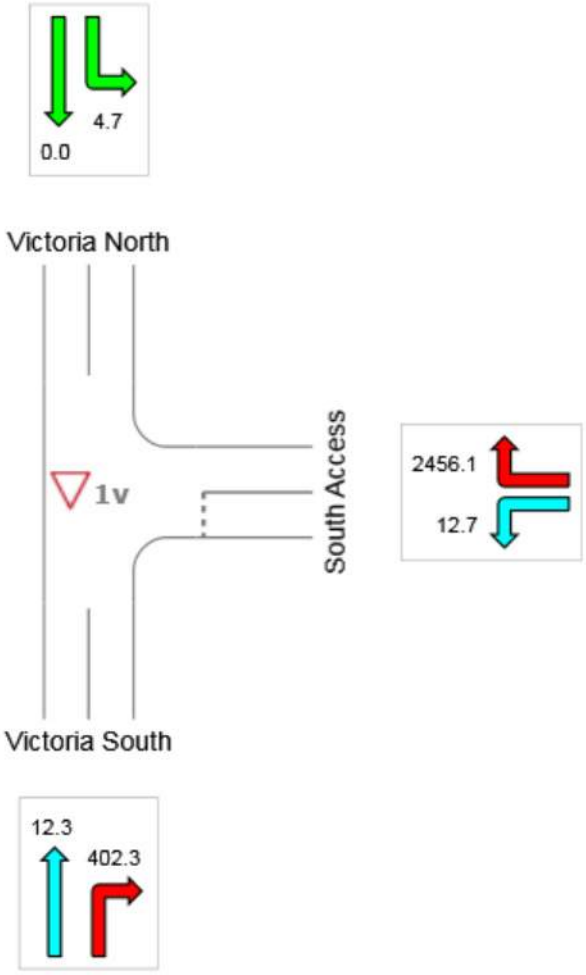
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 1v [RTB am 2041_St3_56.7ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

All Movement Classes

	Approaches			Intersection
	South	East	North	
Delay (Control)	212.6	419.9	0.9	178.6
LOS	NA	F	NA	NA



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

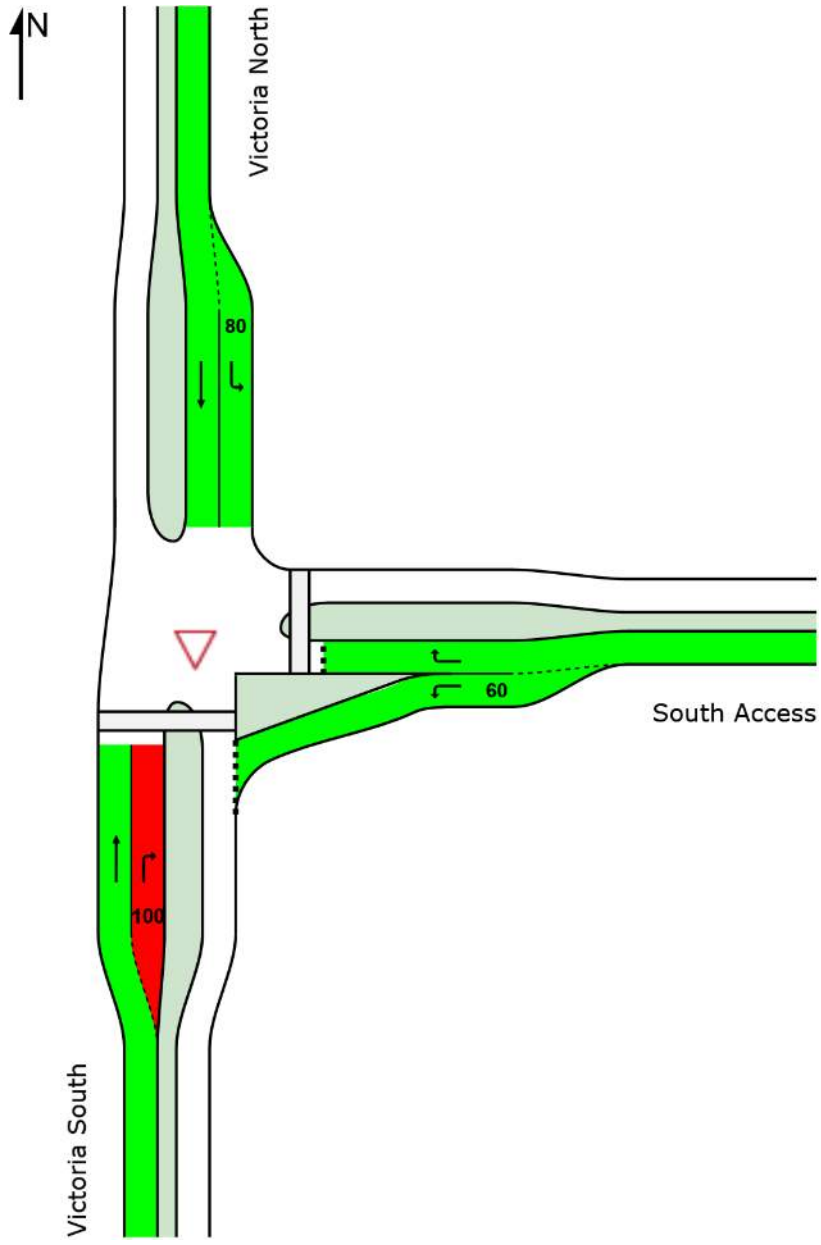
QUEUE DISTANCE (%ILE)

95% Back of Queue Distance per lane (metres)

Site: 1v [RTB am 2041_St3_56.7ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

	Approaches			Intersection
	South	East	North	
Vehicle Queue (%ile)	1093	278	0	1093



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

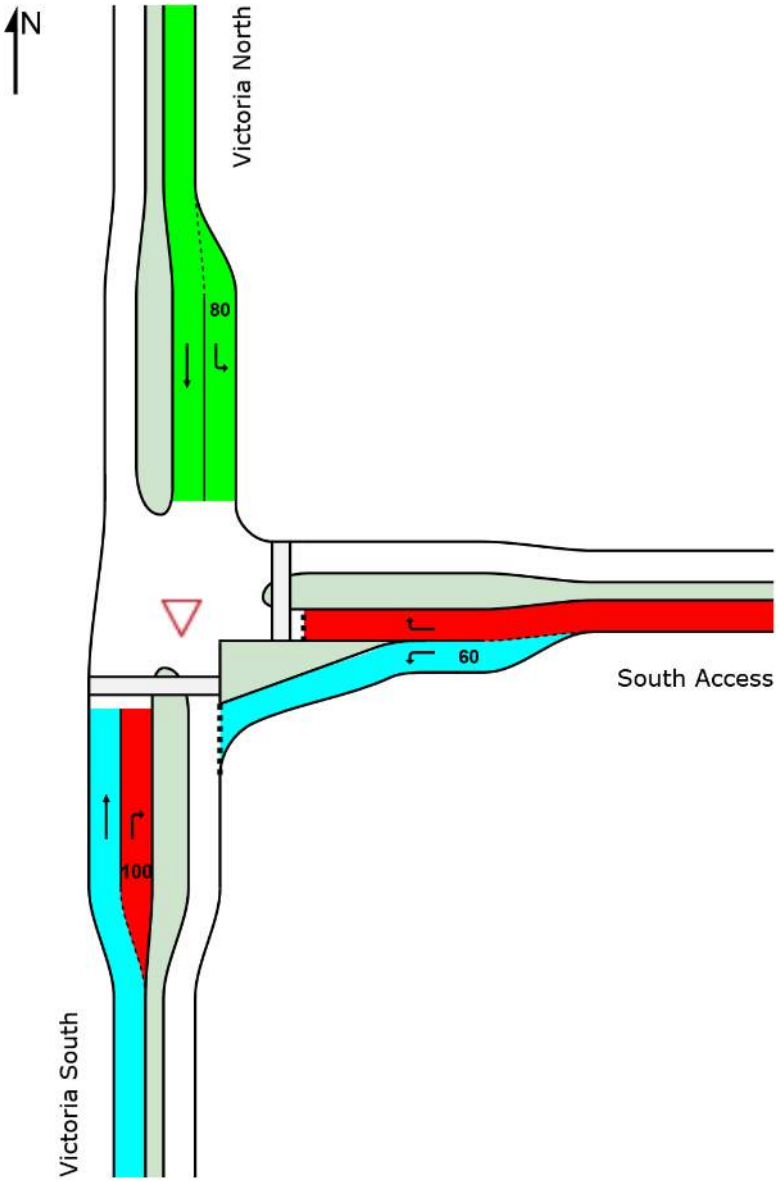
LANE LEVEL OF SERVICE

Lane Level of Service

Site: 1v [RTB am 2041_St3_56.7ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Giveway / Yield (Two-Way)

	Approaches			Intersection
	South	East	North	
LOS	NA	F	NA	NA



Colour code based on Level of Service

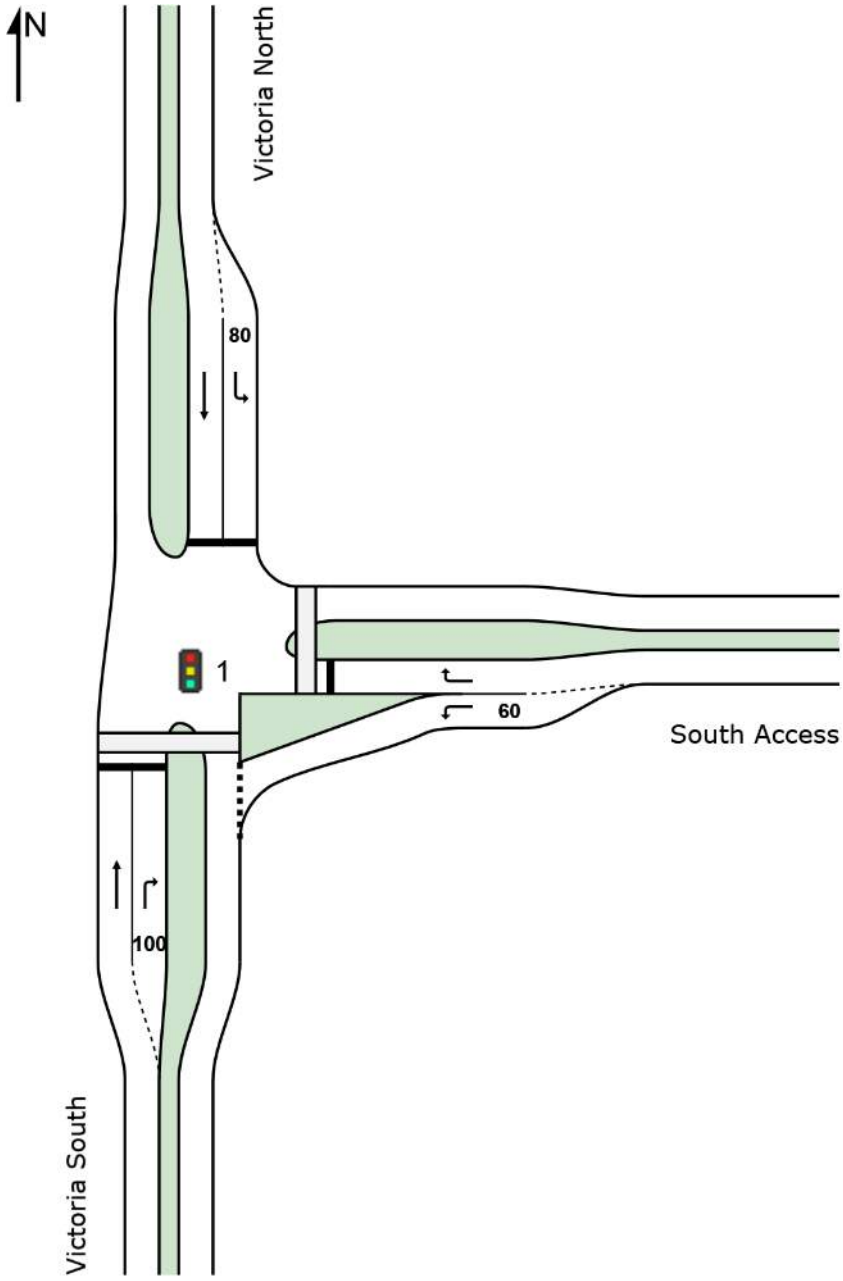
LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

SITE LAYOUT

Site: 1 [Signals am 2041_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated



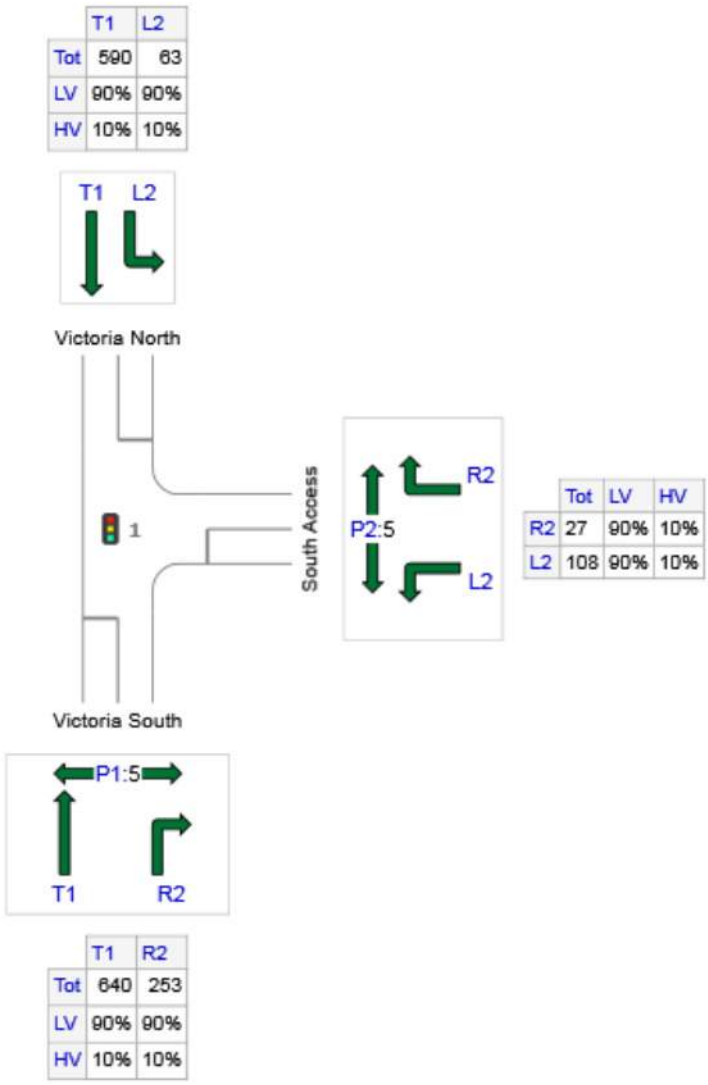
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 1 [Signals am 2041_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Victoria South	893	804	89
E: South Access	135	122	14
N: Victoria North	653	588	65
Total	1681	1513	168

Organisation: GRAY MATTER LTD | Created: Wednesday, 25 July 2018 11:43:25 a.m.
Project: P:\1_Projects\180 Bardowie Investments\180_01 APL Private Plan Change - Bardowie Farm\B_Background\SIDRA Modelling\South Access 25_7_18.sip8

MOVEMENT SUMMARY

Site: 1 [Signals am 2041_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 40 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Victoria South												
2	T1	674	10.0	0.662	7.2	LOS A	9.7	73.6	0.76	0.68	0.77	45.5
3	R2	266	10.0	0.854	29.4	LOS C	6.9	52.6	1.00	1.15	1.65	35.3
Approach		940	10.0	0.854	13.5	LOS B	9.7	73.6	0.83	0.81	1.02	42.1
East: South Access												
4	L2	114	10.0	0.174	8.7	LOS A	1.0	7.5	0.60	0.68	0.60	44.6
6	R2	28	10.0	0.108	21.6	LOS C	0.5	3.9	0.89	0.70	0.89	38.1
Approach		142	10.0	0.174	11.3	LOS B	1.0	7.5	0.66	0.68	0.66	43.2
North: Victoria North												
7	L2	66	10.0	0.072	9.8	LOS A	0.6	4.9	0.52	0.65	0.52	43.6
8	T1	621	10.0	0.610	6.7	LOS A	8.4	64.2	0.73	0.64	0.73	45.8
Approach		687	10.0	0.610	7.0	LOS A	8.4	64.2	0.71	0.64	0.71	45.6
All Vehicles		1769	10.0	0.854	10.8	LOS B	9.7	73.6	0.77	0.74	0.87	43.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	5	14.5	LOS B	0.0	0.0	0.85	0.85
P2	East Full Crossing	5	14.5	LOS B	0.0	0.0	0.85	0.85
All Pedestrians		11	14.5	LOS B			0.85	0.85

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

DELAY (CONTROL)

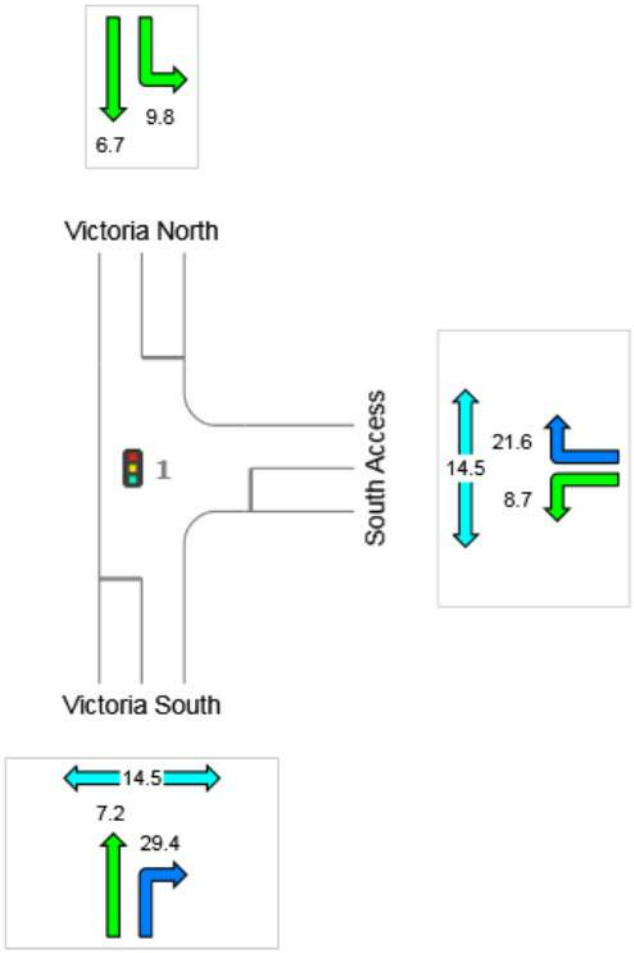
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 1 [Signals am 2041_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 40 seconds (Site Practical Cycle Time)

All Movement Classes

	Approaches			Intersection
	South	East	North	
Delay (Control)	13.5	11.3	7.0	10.8
LOS	B	B	A	B



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Pedestrian Level of Service Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

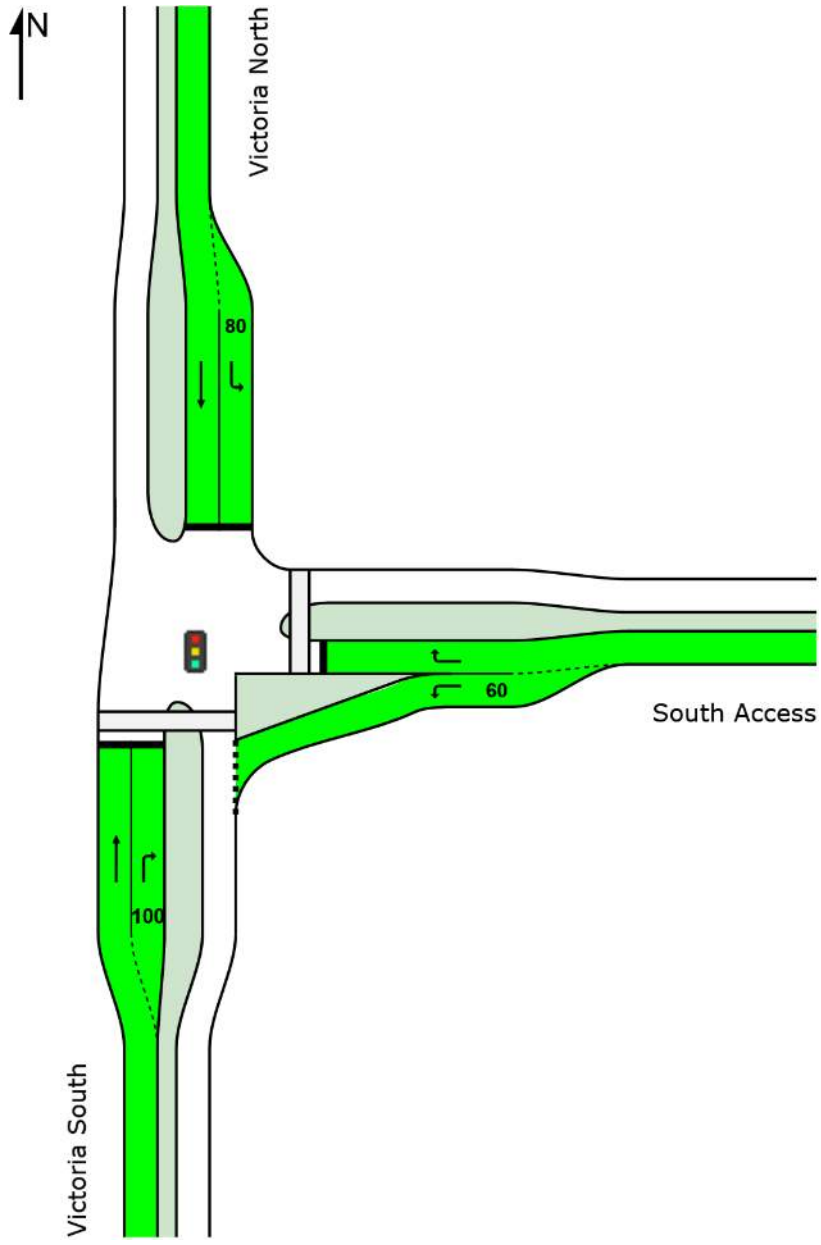
QUEUE DISTANCE (%ILE)

95% Back of Queue Distance per lane (metres)

Site: 1 [Signals am 2041_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 40 seconds (Site Practical Cycle Time)

	Approaches			Intersection
	South	East	North	
Vehicle Queue (%ile)	74	7	64	74



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

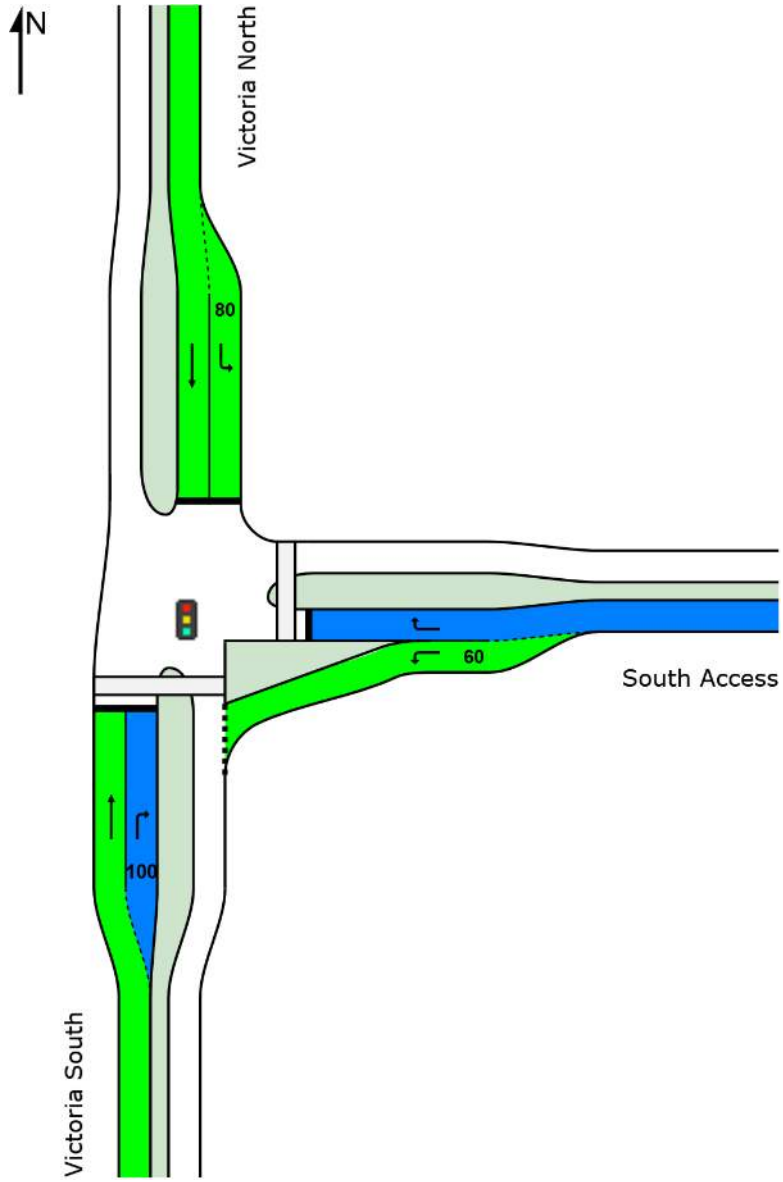
LANE LEVEL OF SERVICE

Lane Level of Service

Site: 1 [Signals am 2041_St2_28.8ha]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 40 seconds (Site Practical Cycle Time)

	Approaches			Intersection
	South	East	North	
LOS	B	B	A	B



Colour code based on Level of Service

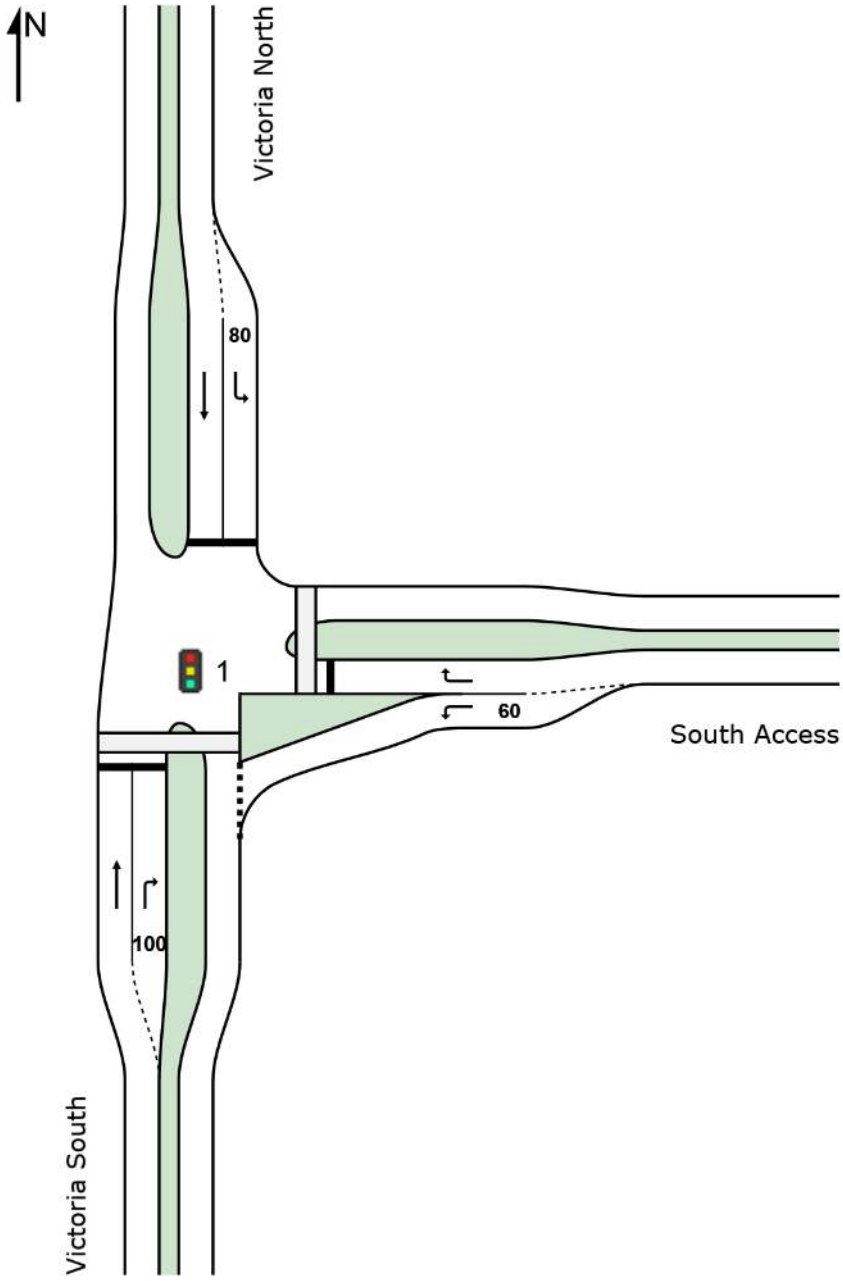
LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

SITE LAYOUT

Site: 1 [Signals am 2041_St2_28.8ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated



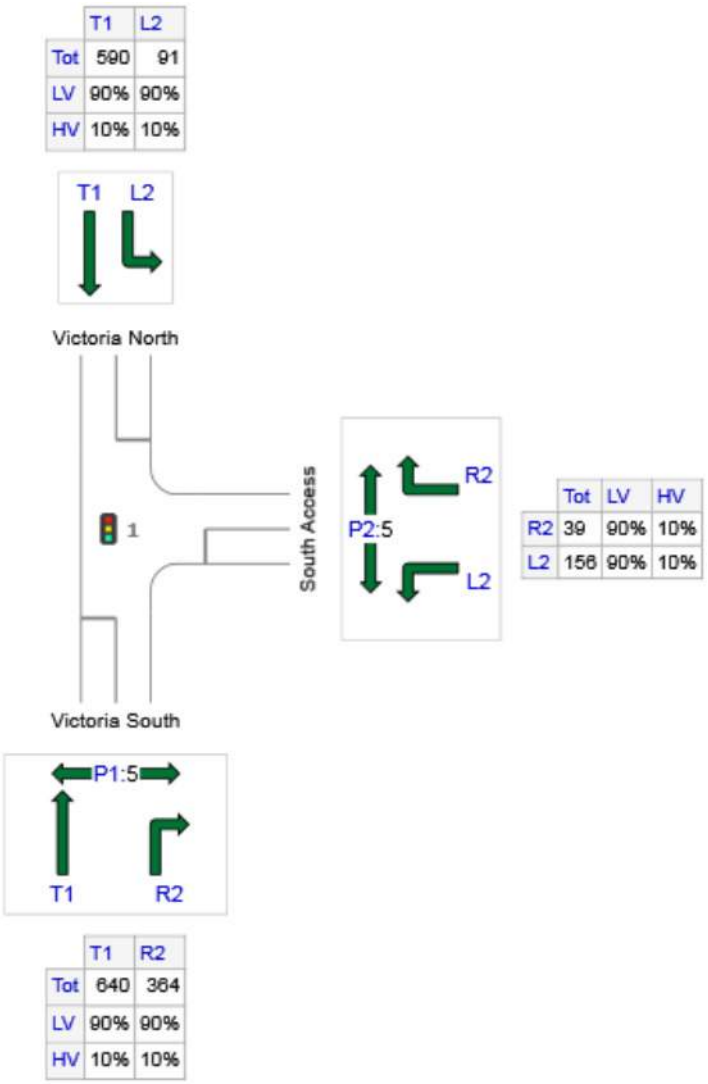
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 1 [Signals am 2041_St2_28.8ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Victoria South	1004	904	100
E: South Access	195	176	20
N: Victoria North	681	613	68
Total	1880	1692	188

Organisation: GRAY MATTER LTD | Created: Wednesday, 25 July 2018 11:43:32 a.m.
Project: P:\1_Projects\180 Bardowie Investments\180_01 APL Private Plan Change - Bardowie Farm\B_Background\SIDRA Modelling\South Access 25_7_18.sip8

MOVEMENT SUMMARY

Site: 1 [Signals am 2041_St2_28.8ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 110 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Victoria South												
2	T1	674	10.0	0.435	2.4	LOS A	9.1	69.2	0.28	0.26	0.28	48.4
3	R2	383	10.0	0.886	47.5	LOS D	24.2	184.2	0.83	1.00	1.15	30.0
Approach		1057	10.0	0.886	18.8	LOS B	24.2	184.2	0.48	0.53	0.60	39.6
East: South Access												
4	L2	164	10.0	0.241	6.2	LOS A	1.5	11.6	0.25	0.58	0.25	46.1
6	R2	41	10.0	0.430	63.1	LOS E	2.3	17.5	1.00	0.73	1.00	26.6
Approach		205	10.0	0.430	17.6	LOS B	2.3	17.5	0.40	0.61	0.40	40.3
North: Victoria North												
7	L2	96	10.0	0.068	6.9	LOS A	1.0	7.7	0.21	0.59	0.21	45.2
8	T1	621	10.0	0.401	2.3	LOS A	8.0	61.0	0.27	0.24	0.27	48.5
Approach		717	10.0	0.401	2.9	LOS A	8.0	61.0	0.26	0.29	0.26	48.0
All Vehicles		1979	10.0	0.886	12.9	LOS B	24.2	184.2	0.39	0.45	0.45	42.4

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	5	49.2	LOS E	0.0	0.0	0.95	0.95
P2	East Full Crossing	5	49.2	LOS E	0.0	0.0	0.95	0.95
All Pedestrians		11	49.2	LOS E			0.95	0.95

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

DELAY (CONTROL)

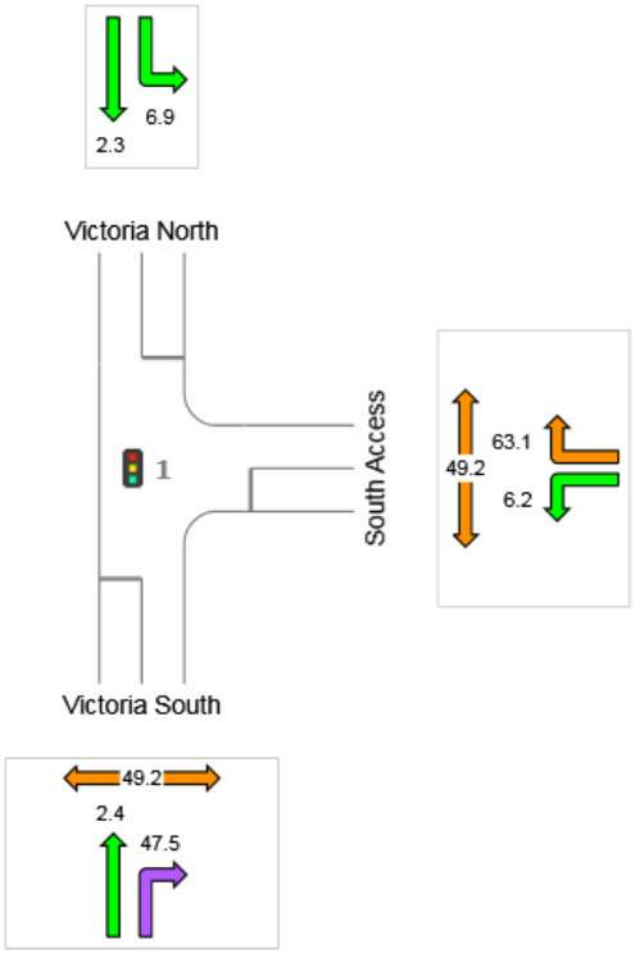
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 1 [Signals am 2041_St2_28.8ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 110 seconds (Site Practical Cycle Time)

All Movement Classes

	Approaches			Intersection
	South	East	North	
Delay (Control)	18.8	17.6	2.9	12.9
LOS	B	B	A	B



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
Pedestrian Level of Service Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

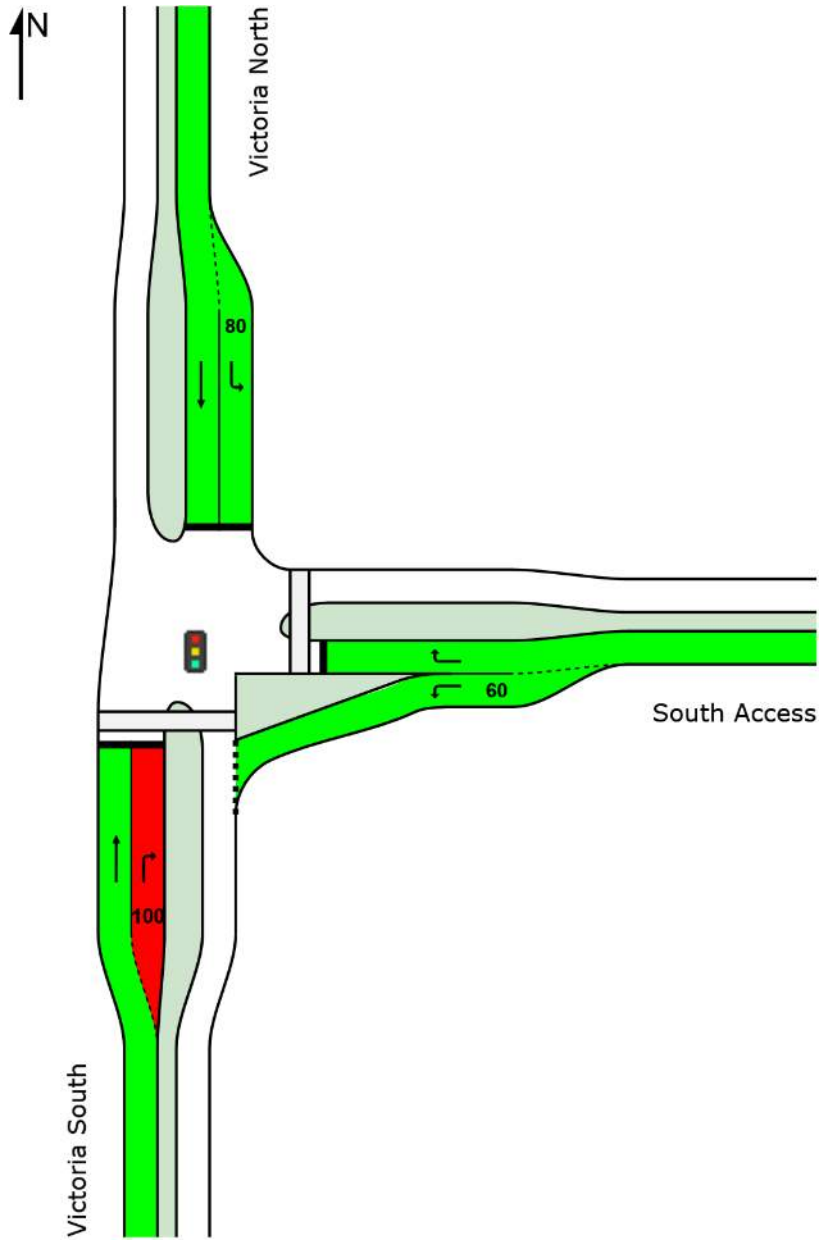
QUEUE DISTANCE (%ILE)

95% Back of Queue Distance per lane (metres)

Site: 1 [Signals am 2041_St2_28.8ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 110 seconds (Site Practical Cycle Time)

	Approaches			Intersection
	South	East	North	
Vehicle Queue (%ile)	184	17	61	184



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

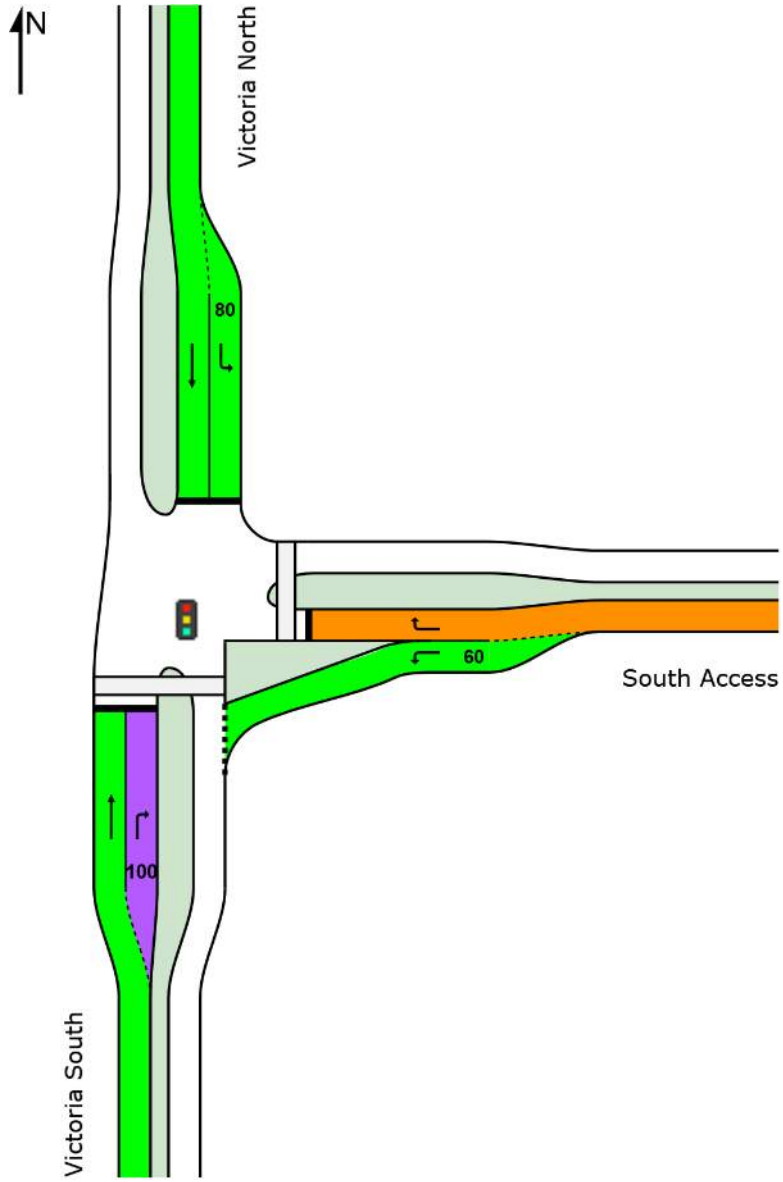
LANE LEVEL OF SERVICE

Lane Level of Service

Site: 1 [Signals am 2041_St2_28.8ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 110 seconds (Site Practical Cycle Time)

	Approaches			Intersection
	South	East	North	
LOS	B	B	A	B



Colour code based on Level of Service

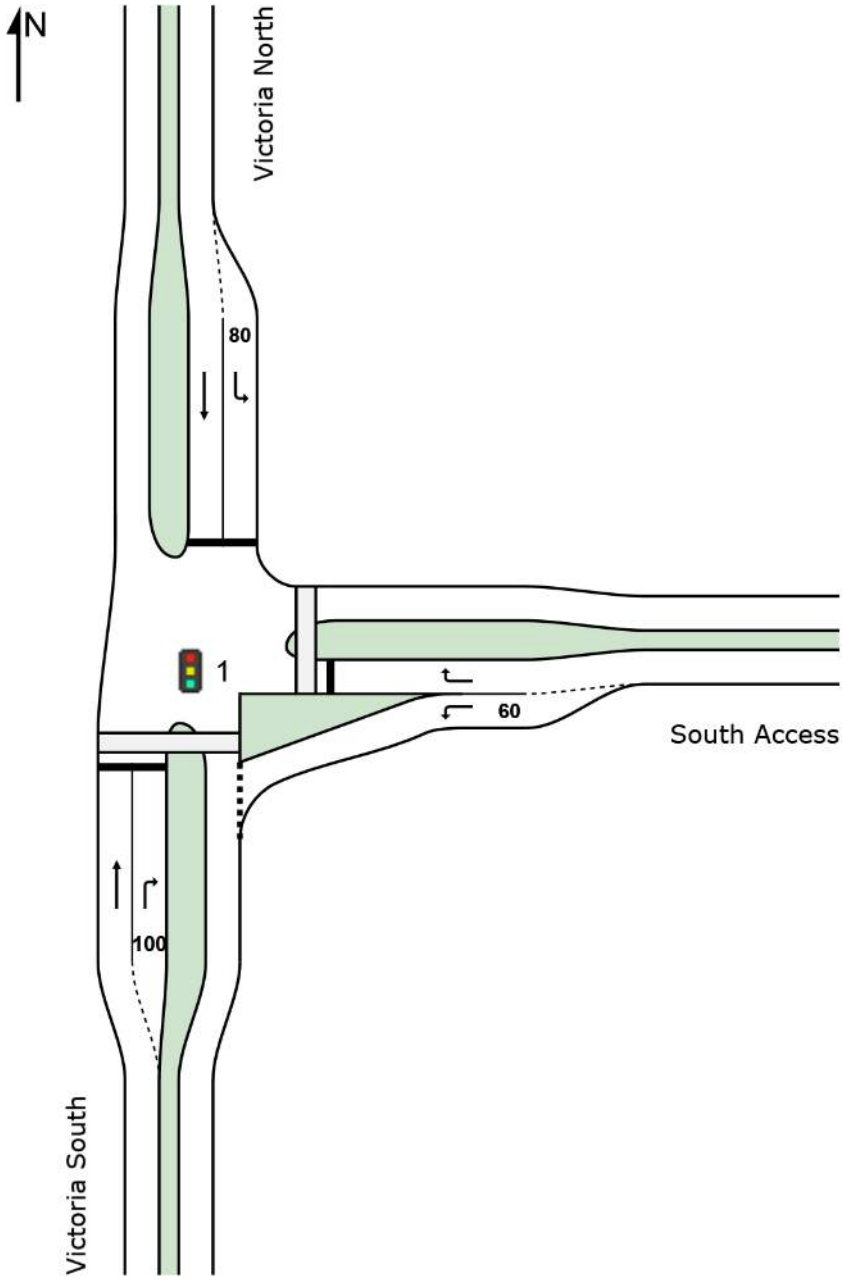
LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
NA (TWSC): Level of Service is not defined for major road approaches or the intersection as a whole for Two-Way Sign Control (HCM LOS rule).
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

SITE LAYOUT

Site: 1 [Signals am 2041_St3_56.7ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated



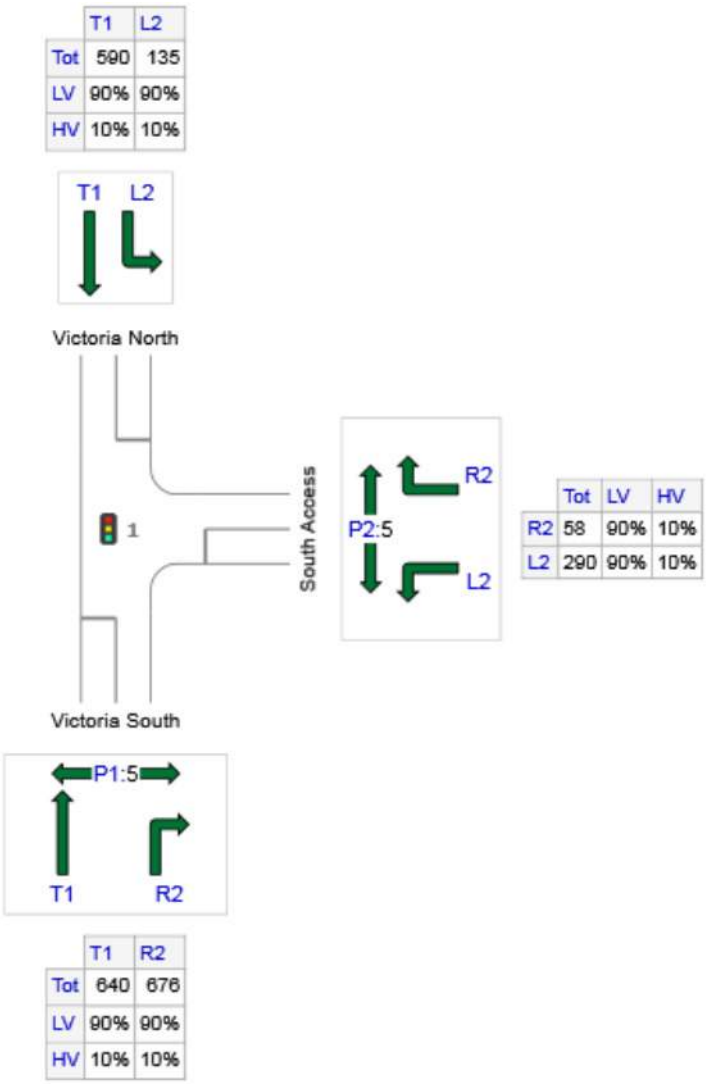
INPUT VOLUMES

Vehicles and pedestrians per 60 minutes

Site: 1 [Signals am 2041_St3_56.7ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated

Volume Display Method: Total and %



	All MCs	Light Vehicles (LV)	Heavy Vehicles (HV)
S: Victoria South	1316	1184	132
E: South Access	348	313	35
N: Victoria North	725	653	73
Total	2389	2150	239

Organisation: GRAY MATTER LTD | Created: Wednesday, 25 July 2018 11:43:38 a.m.
Project: P:\1_Projects\180 Bardowie Investments\180_01 APL Private Plan Change - Bardowie Farm\B_Background\SIDRA Modelling\South Access 25_7_18.sip8

MOVEMENT SUMMARY

Site: 1 [Signals am 2041_St3_56.7ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Victoria South												
2	T1	674	10.0	0.414	1.8	LOS A	9.0	68.6	0.21	0.19	0.21	48.8
3	R2	712	10.0	1.672	687.9	LOS F	189.0	1436.1	1.00	2.14	3.57	4.7
Approach		1385	10.0	1.672	354.2	LOS F	189.0	1436.1	0.61	1.19	1.93	8.5
East: South Access												
4	L2	305	10.0	0.444	6.1	LOS A	3.7	28.5	0.23	0.58	0.23	46.2
6	R2	61	10.0	0.871	94.4	LOS F	5.0	38.4	1.00	0.94	1.45	21.7
Approach		366	10.0	0.871	20.8	LOS C	5.0	38.4	0.36	0.64	0.44	38.9
North: Victoria North												
7	L2	142	10.0	0.095	6.5	LOS A	1.6	12.2	0.17	0.58	0.17	45.4
8	T1	621	10.0	0.381	1.7	LOS A	8.0	60.5	0.20	0.18	0.20	48.9
Approach		763	10.0	0.381	2.6	LOS A	8.0	60.5	0.19	0.25	0.19	48.2
All Vehicles		2515	10.0	1.672	198.9	LOS F	189.0	1436.1	0.45	0.83	1.19	13.3

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
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.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	5	69.1	LOS F	0.0	0.0	0.96	0.96
P2	East Full Crossing	5	69.1	LOS F	0.0	0.0	0.96	0.96
All Pedestrians		11	69.1	LOS F			0.96	0.96

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

DELAY (CONTROL)

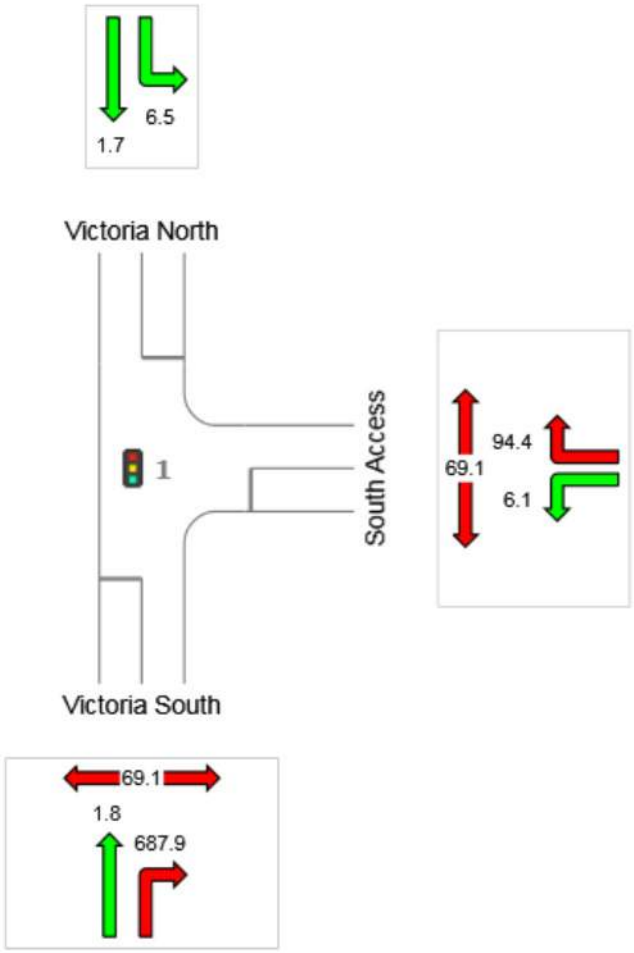
Average control delay per vehicle, or average pedestrian delay (seconds)

Site: 1 [Signals am 2041_St3_56.7ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

All Movement Classes

	Approaches			Intersection
	South	East	North	
Delay (Control)	354.2	20.8	2.6	198.9
LOS	F	C	A	F



Colour code based on Level of Service

LOS A | LOS B | LOS C | LOS D | LOS E | LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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Pedestrian Level of Service Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.

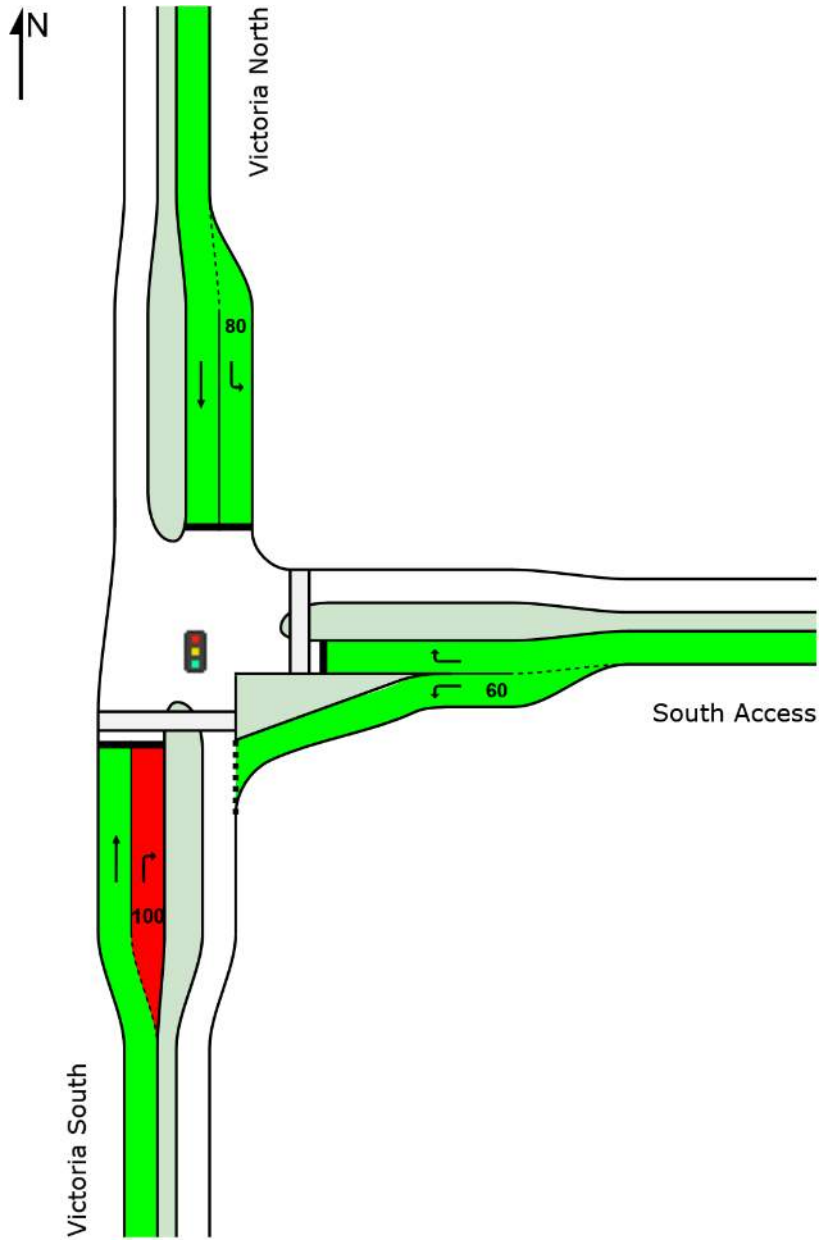
QUEUE DISTANCE (%ILE)

95% Back of Queue Distance per lane (metres)

Site: 1 [Signals am 2041_St3_56.7ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

	Approaches			Intersection
	South	East	North	
Vehicle Queue (%ile)	1436	38	61	1436



Colour code based on Queue Storage Ratio

[< 0.6] [0.6 – 0.7] [0.7 – 0.8] [0.8 – 0.9] [0.9 – 1.0] [> 1.0]

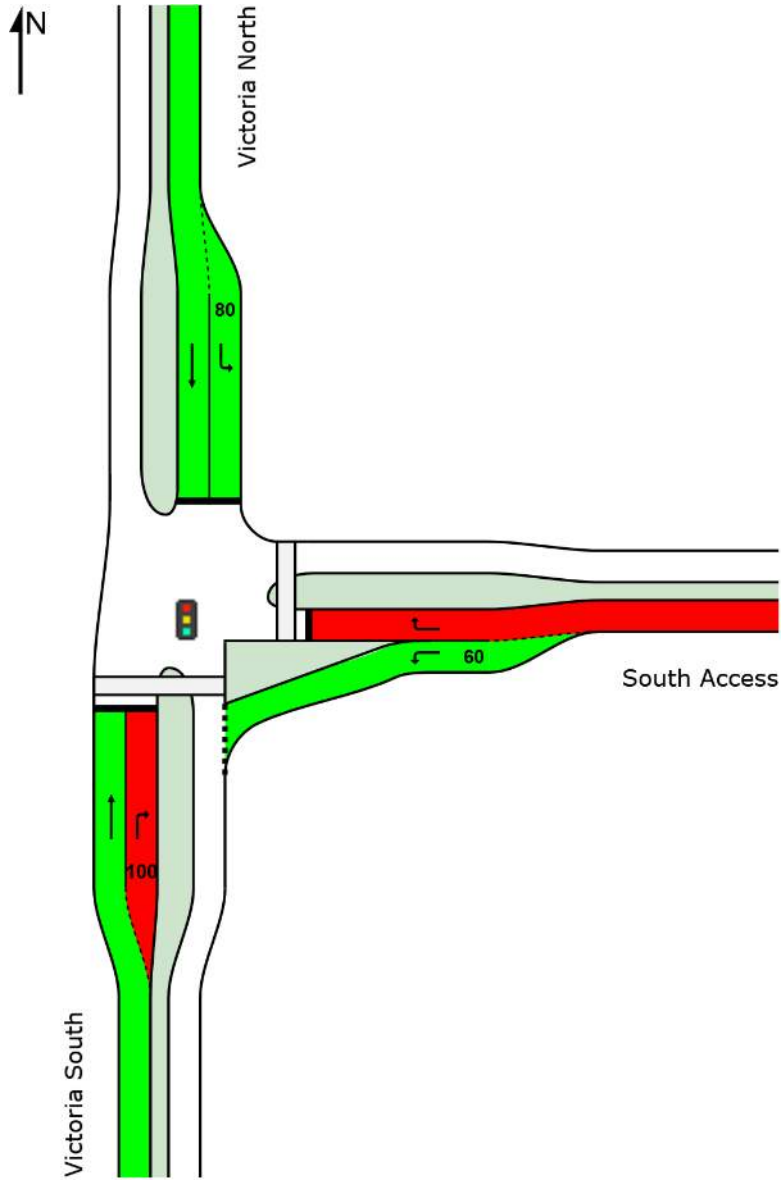
LANE LEVEL OF SERVICE

Lane Level of Service

Site: 1 [Signals am 2041_St3_56.7ha plus commercial]

South access 12.5ha low traffic industrial at 10vph/ha = 125vph
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

	Approaches			Intersection
	South	East	North	
LOS	F	C	A	F



Colour code based on Level of Service

LOS A	LOS B	LOS C	LOS D	LOS E	LOS F

Site Level of Service (LOS) Method: Delay (SIDRA). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
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