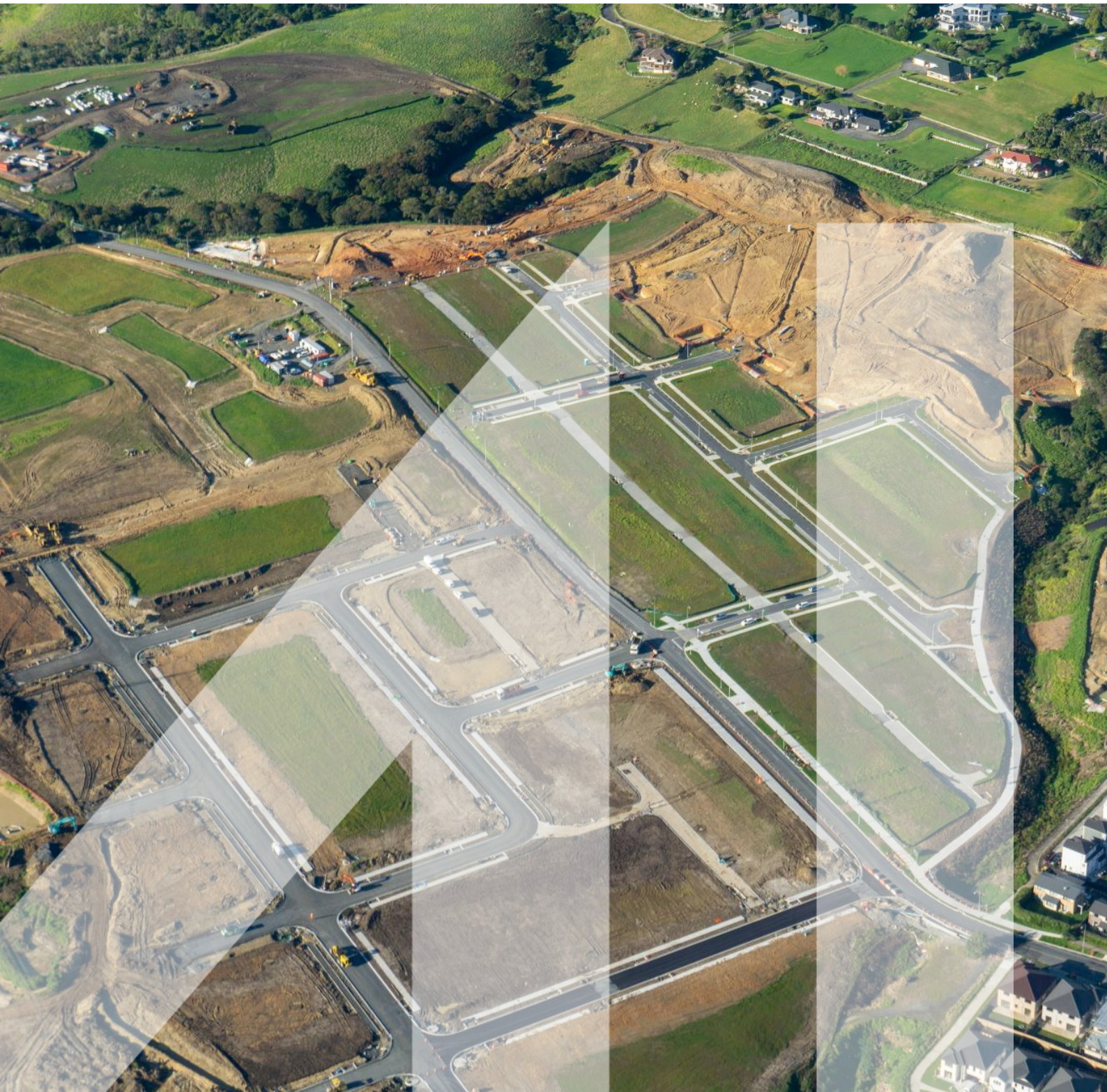
Whenuapai Green Integrated Transport Assessment



Executive Summary

Neil Construction Limited (NCL) commissioned Abley Limited (Abley) to prepare an Integrated Transportation Assessment (ITA) report with respect to a Plan Change at 98-102 Totara Road, Whenuapai in Auckland (the site). The proposal is to rezone the site from Future Urban Zone (FUZ) to Residential – Mixed Housing Urban (MHU) zone, and apply a Precinct across the site to guide future development (the Plan Change).

This ITA has been prepared in general accordance with the guidance specified in the Waka Kotahi NZ Transport Agency Research Report 422 published in 2010. We note that the body of this report should be read in conjunction with additional information that was provided to Auckland Council and Auckland Transport through Clause 23 requests for information, and we emphasise that the body of this report has not been updated to reflect additional assessment provided through our Clause 23 responses. Where our Clause 23 provides information that conflicts with the body of the ITA, for example road cross sections discussed in Section 5 and updated in Appendix C, the information in the Clause 23 response takes precedence. A copy of our responses to Council Clause 23 requests are contained in Appendix C, Appendix D, and Appendix E.

We have assessed the proposed internal transport network, and potential off site transport effects of the Plan Change, and conclude that the site is appropriate for this activity from a transport perspective as:

- the proposed development will be well served by public transport, walking and cycling connections in the near future which are currently being planned by Te Tupu Ngātahi Supporting Growth Alliance (SGA) and Waka Kotahi through the North West Auckland transport upgrades and SH16 Brigham Creek to Waimauku Safety Improvements respectively.
- a Precinct is proposed across the site, which includes provisions to direct transport outcomes for future development including:
  - Location of key roads within the site.
  - Location and form of key intersections on Totara Road, including roundabouts at the northern intersection and the existing Totara Road/Dale Road/McCaw Avenue intersection.
  - Proposed cross sections of key roads within the site.
  - Urbanisation of Totara Road.
  - Provision of bus stops on Totara Road.
  - Two future proofed road connections to Royal New Zealand Air Force (RNZAF) Base Whenuapai and 94 Totara Road.
  - Minor line marking changes to the Brigham Creek Road/Totara Road intersection to enable a shared through/left turn lane for eastbound traffic.
- there is excellent accessibility to key local activities and services by all modes.
- Brigham Creek / Totara Road / Mamari Road intersection performs acceptably with the addition of traffic from the site.
- the site is well-served by SH16 and SH18. While the Plan Change is expected to increase delays at the SH16 / Brigham Creek intersection, alternative routes (such as SH18/Brigham Creek Road and Spedding Road extension) will be available and will likely lead to a degree of rerouting. Further, Waka Kotahi's SH16 Brigham Creek to Waimauku Safety Improvements project and Kumeu State Highway bypass projects will provide relief in the medium to long term.

- SH18/Brigham Creek Road intersection performs well in peak hour, and with the closure of the Sinton Road arm this intersection has significant capacity available to accommodate traffic from the Plan Change.
- the traffic modelling results demonstrates that the Totara Road / Dale Road / McCaw Avenue intersection will operate in free-flowing conditions with the additional generated traffic. The Totara Road / Brigham Creek Road / Mamari Road intersection will operate well within capacity of the intersection.
- the roading upgrades proposed as part of the plan change can accommodate the traffic generated and avoids the need for the Future Development Strategy (FDS) key transport infrastructure prerequisites being in place.

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Quality Assurance Information

Prepared for	Neil Construction Limited
Job Number	TNEGL-J002
Prepared by	Mat Collins, Associate Transport Planner Chris Blackmore, Principal Transport Planner
Reviewed by	Dave Smith, Technical Director

Date issued	Status	Approved by
19 December 2023	For client comment	Dave Smith
1 February 2024	For Council and AT pre-lodgement comment	Mat Collins
17 December 2024	Clause 23 responses added as appendices	Mat Collins

1. Introduction

Neil Construction Limited (NCL) commissioned Abley Limited (Abley) to prepare an Integrated Transportation Assessment (ITA) report with respect to a Plan Change at 98-102 Totara Road, Whenuapai in Auckland (the site). The proposal is to rezone the site from Future Urban Zone (FUZ) to Residential – Mixed Housing Urban (MHU) zone, and apply a Precinct across the site to guide future development (the Plan Change).

The purpose of this ITA is to evaluate the potential transportation related effects of the Plan Change on the future receiving environment.

As the Plan Change is expected to yield 430 dwellings, a full ITA is required. The ITA includes the estimated traffic volumes associated with the likely yield of dwellings in order to understand how the proposal may affect the transport network.

NCL has completed the consent level design of the development as part of the previous Fast Track Consent Application. However, some aspects of the previous design are not appropriate to include within the proposed Precinct Plan, and therefore will be subject to further assessment during future resource consent and Engineering Plan Approval applications, should the Plan Change be approved.

In preparing this review Abley has taken into consideration the following documents:

- The Whenuapai Structure Plan 2016, including the maps and movement network, prepared by Auckland Council.
- The Whenuapai Structure Plan Integrated Transport Assessment (Structure Plan ITA), prepared by Flow, dated August 2016.
- The Whenuapai 3 Precinct Plan (Plan Change 5) Integrated Transport Assessment (PC5 ITA), prepared by Flow, dated June 2017.
- Plan Change 5, 69 and 86 documentation and hearing materials.

The following planning materials were referred to for additional background:

- The Auckland Unitary Plan – Operative in Part (AUPOP).
- The Auckland Regional Land Transport Plan 2021 – 2031 (RLTP).
- The Northwest Area Indicative Strategic Transport Network, prepared by Te Tupu Ngātahi Supporting Growth.
- Auckland Council's Long-Term Plan 2021 – 2031 (LTP).
- Auckland Council's Future Development Strategy 2023 (FDS).

This ITA has been prepared in general accordance with the guidance specified in the Waka Kotahi NZ Transport Agency Research Report 422 published in 2010. We note that the body of this report should be read in conjunction with additional information that was provided to Auckland Council and Auckland Transport through Clause 23 requests for information, and we emphasise that the body of this report has not been updated to reflect additional assessment provided through our Clause 23 responses. Where our Clause 23 provides information that conflicts with the body of the ITA, for example road cross sections discussed in Section 5 and updated in Appendix C, the information in the Clause 23 response takes precedence. A copy of our responses to Council Clause 23 requests are contained in Appendix C, Appendix D, and Appendix E.

2. Planning Background

Whenuapai and other FUZ land in the wider Auckland region is part of Auckland Council's 2023 FDS that focuses on the long-term future of Auckland and how growth should be managed for the next 30 years to ensure sufficient residential and business land is provided. The FDS replaces the 2017 Future Urban Land Supply Strategy (FULSS). The plan change site is located within the Whenuapai North (Stage 1) area under the FDS, which is indicated as being development ready from 2035+. Directly to the south of the plan change site, the land has been urbanised and has been developed or is currently under development.

2.1 Whenuapai Structure Plan

The site falls within the Whenuapai Structure Plan (WSP) area. The WSP is described below in order to build an understanding of the baseline that will inform any transport assessment of the proposal.

The WSP was published and adopted by Auckland Council in September 2016. It outlines the Council's vision for Whenuapai in terms of land use activities, transport networks including public transport, and other elements of infrastructure and urban form. The large area covered by the WSP requires a staged development approach that is intended to be realised through the statutory plan change process. The Structure Plan ITA published by Flow in August 2016 outlines the transport aspects of the WSP, including the density and location of land use activities and their relation to transport facilities, and the proposed transport network in the structure plan area, and how this connects to the wider network.

The Structure Plan ITA identifies the investments in infrastructure that will be necessary to accommodate the growth in demand associated with the WSP as it is enacted. These include walking and cycling facilities, public transport routes and connections, and roading projects within the structure plan area as well as regional projects (associated with other planning programmes) that the structure plan will rely upon. In particular, the ITA outlines likely growth level triggers and the investments required to support those triggers.

The WSP staging plan as per the 2016 Auckland Council documentation is shown in Figure 2.1

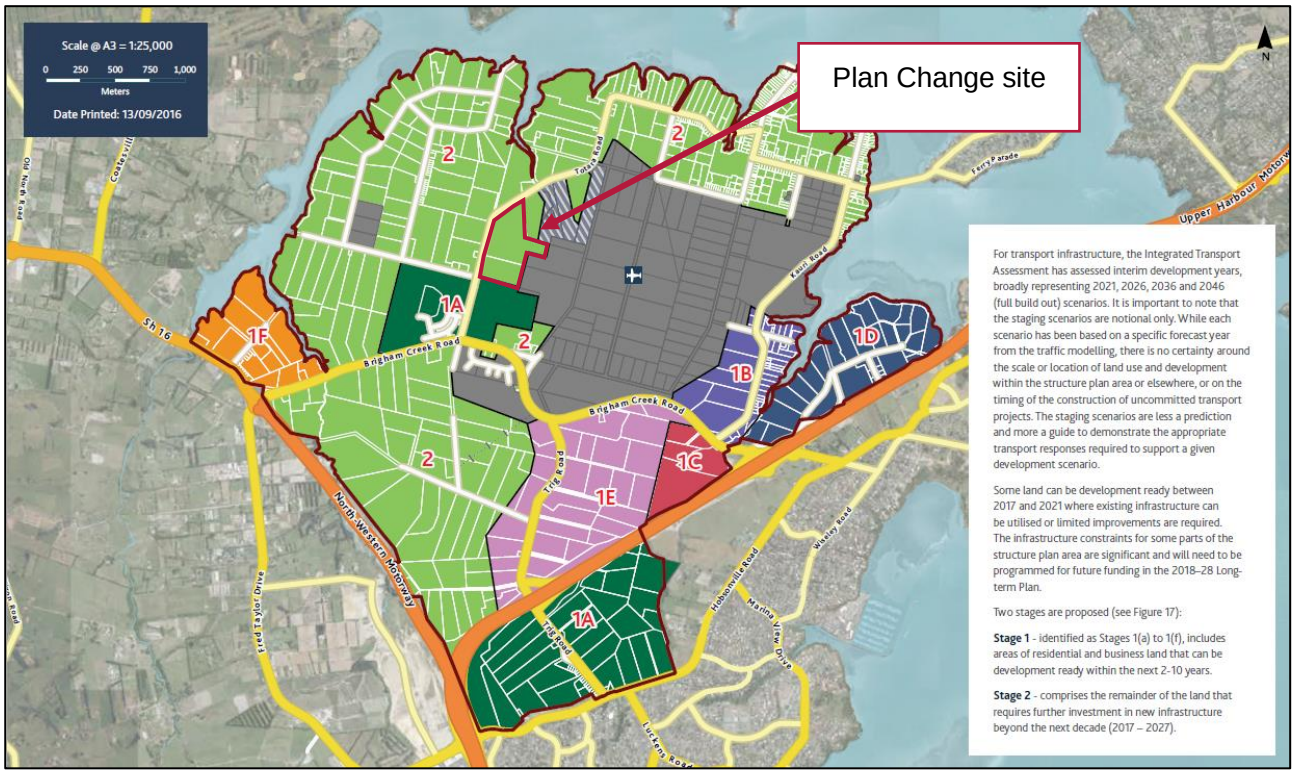


Figure 2.1 Whenuapai Structure Plan Staging (Auckland Council)

The site is located within an area forming part of Stage 2 of the WSP. Stage 2 areas are indicated as being those requiring investment in infrastructure likely to be funded beyond 2027. It is noted that the Totara Road area is indicated in the Structure Plan as 'Medium Density Residential'.

The scenarios identified in the Structure Plan ITA each include:

- A scenario year for background growth based on the Auckland Regional Transport (ART) model;
- Land use assumptions for the scenario for Whenuapai, with the numbers of dwellings including those existing (i.e. outside the FUZ) and consented, such as the dwellings under construction on Totara Road between Brigham Creek Road and Dale Road;
- Development assumptions for adjacent areas, such as the consented Plan Change 14 in Hobsonville, dwellings in Hobsonville Point, Riverhead, Redhills and Kumeu/Huapai, and employment numbers in those areas.
- A list of transport investments that are considered required for the assumed scale of urbanisation.

In order to identify what transport investment needs are likely to be triggered by the future development enabled if the Plan Change is approved, any existing plan changes should be considered as a baseline, and the proposed development levels superimposed on that baseline.

3. Existing Land Use and Transport Environment

3.1 Site location and land use

The site is shown in Figure 3.1. The site is over two parcels of land which are 98-100 Totara Road and 102 Totara Road. The site currently is mostly open pasture with a few dwellings and pockets of vegetation also present.

Approximately 200m and 500m south of the site is existing residential development and the Whenuapai town centre respectively. Adjacent to the site to the east is the RNZAF Base Whenuapai. North and west of the site is zoned as FUZ.

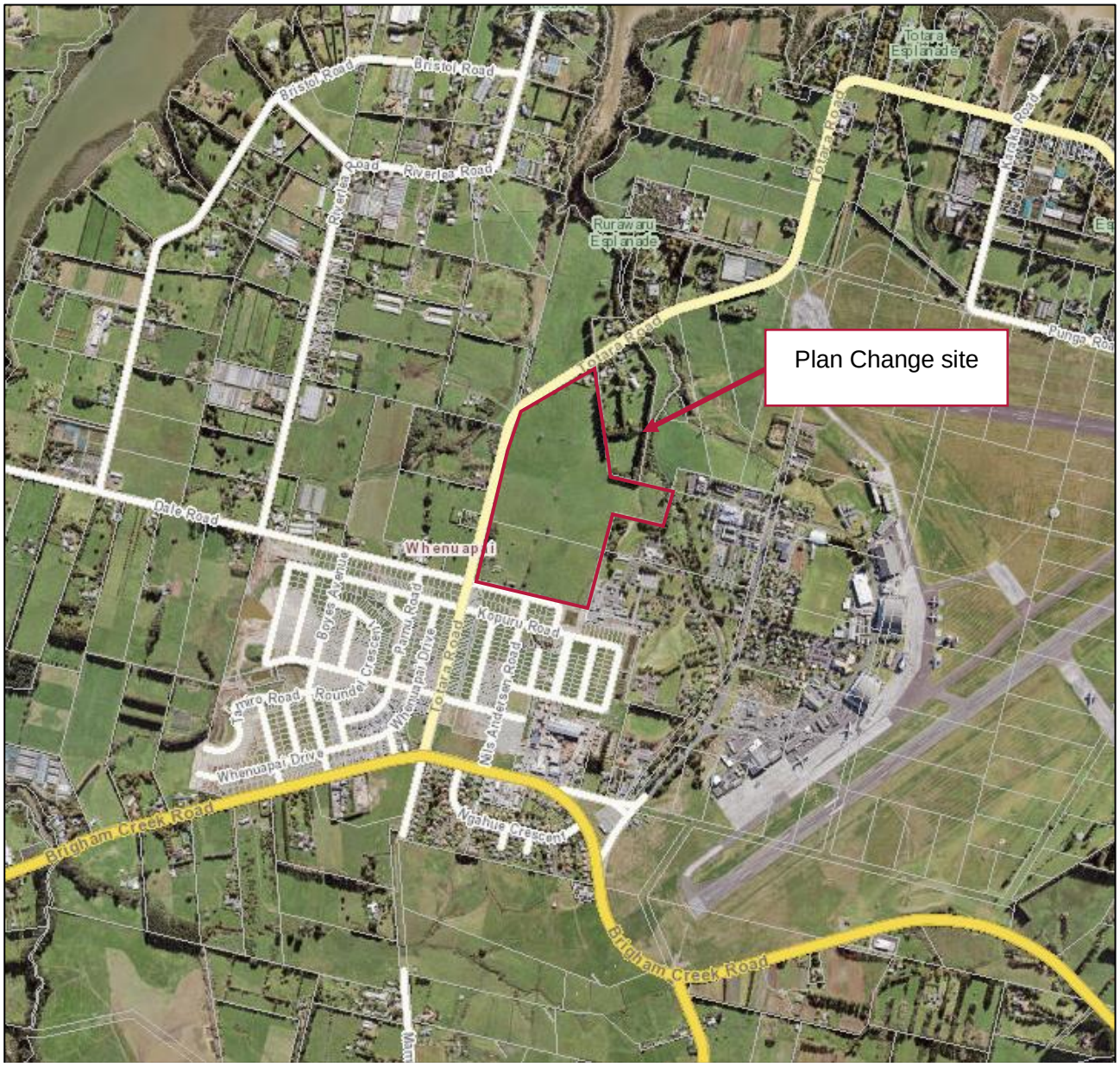


Figure 3.1 Site locality

3.2 Description of site frontage roads

Totara Road

Totara Road is a 3.5km long road which connects to Brigham Creek Road on its southern end and Waimarie Road on its north-eastern end. Totara Road is classified as a collector road within Auckland Council Geomaps, and is not identified as an Arterial Road in the AUPOP.

The cross section of the road differs along the length of the road. For the Brigham Creek Road to Dale Road section, the road is in an urban form and features one 3m wide lane in each direction with a 2.5m wide flush median in the centre of the road. There are 1.4m separated cycleways and 1.8m footpaths along both sides as well. The cycleways terminate at the intersection of Totara and Dale Road. Frequent pedestrian refuge island crossings are present along this section of the road.

Figure 3.2 Totara Road Layout (Urban) (source: Google Maps)

Totara Road between Dale Road and Waimarie Road is currently formed as a rural road. For this section, the road features one 3m wide lane in each direction, with limited shoulders from 2m wide on either side of the road. There are no cycle facilities, and the 1.2m wide footpath is only on one side of the road (on the opposite side to the Plan Change site).

Figure 3.3 Totara Road Layout (Rural) (source: Google Maps)

McCaw Avenue

McCaw Avenue is a local residential road within Auckland Council Geomaps. The carriageway width is 6m which allows for two-way traffic flow but there is no marked centreline on the road nor cycle facilities present. Footpaths are provided on both side of the road which are 1.8m in width. There are frequent

indented parking bays for vehicles and speed tables roughly every 70m within the carriageway to encourage lower speeds.

Figure 3.4 McCaw Avenue Layout (source: Google Maps)

3.3 Nearby intersections

McCaw Avenue, Dale Road and Totara Road

The intersection of McCaw Avenue, Dale Road and Totara Road is formed as a crossroad intersection with Totara Road being the main through road and having priority over the side roads, being McCaw Avenue to the east and Dale Road to the west. The McCaw Avenue approach is controlled via a Give-way control while the Dale Road approach is controlled via a Stop control. The flush median on Totara Road aids turning movements into the side roads.

Brigham Creek Road, Mamari Road and Totara Road

The intersection of Brigham Creek Road, Mamari and Totara Road is a multi-lane signalised intersection with three approach lanes for right, through and left turning movements and two exit lanes on Brigham Creek Road. Both Totara Road and Mamari Road approaches have two approach lanes for through/right turning vehicles and left turning vehicles with one exit lane. Each approach has cycle stop boxes in front of the approach lanes.

3.4 Speed limits

Existing speed limit

The existing speed limits for the roads in the vicinity of the development are:

- Totara Road (between Brigham Creek Road and Dale Road) – 50 km/hr.
- Totara Road (between Dale Road and Waimarie Road) – 80 km/hr.
- McCaw Avenue – 50 km/hr.
- Dale Road – 50 km/hr for the section 45m on approach to the intersection of Dale Road and Totara Road. 80 km/hr further away from the intersection.

Future speed limits

The following speed limits have recently been changed by Auckland Transport as part of Phase 3 of the Safe Speeds programme[1]:

- Totara Road (between Dale Road and 275m north of McKean Road) – The speed is proposed to be reduced from 80 km/hr to 60 km/hr.
- Dale Road – The speed is proposed to be reduced from 80 km/hr to 50 km/hr for the section between Totara Road and Riverlea Road, and from 80 km/hr to 60 km/hr between Riverlea Road and the western end of Dale Road.

3.5 Existing traffic counts

An intersection turning movement traffic count was carried at the intersection of Totara Road and McCaw Avenue on 3rd May 2022. It was found that the morning peak hour for the intersection occurred between 8-9am and the evening peak hour occurred between 4:15-5:15pm. Table 3.1 is a summary of the two-way traffic flows for each leg at the intersection during both peak periods.

Table 3.1 Surveyed traffic volumes of the McCaw Avenue, Dale Road and Totara Road intersection

Road	Morning peak hour (vph) (Surveyed)	Evening peak hour (vph) (Surveyed)
Totara Road (northern leg)	151	149
Totara Road (southern leg)	234	262
McCaw Avenue	14	7
Dale Road	89	136
Total	**488**	**554**

Mobile Roads[2] was used to retrieve the Average Daily Traffic (ADT) of the surrounding roads of the wider network in proximity to the site. These are listed with Table 3.2.

Table 3.2 ADT of the surrounding network

Road	Year	ADT
Totara Road	2020	2,924
Dale Road	2022	1,387
McCaw Road	2020	125
Brigham Creek Road	2022	11,544
Riverlea Road	2020	572

3.6 Current road safety record

A search for reported crashes was carried out for the period 2019 to 2023 (including all available crashes available for 2023) using New Zealand Transport Agency's Crash Analysis System (CAS) on

[1] Safe Speeds Phase three, available online at https://at.govt.nz/projects-roadworks/vision-zero-for-the-greater-good/safe-speeds-programme/safe-speed-programme-to-date
[2] https://www.mobileroad.org/

the surrounding roads, shown in Figure 3.5 and detailed in Appendix A. The following is a summary of findings.

- A total of 13 crashes were recorded.
- One minor injury crash was reported on Brigham Creek Road, east of the Nils Anderson Road intersection, which occurred when a driver hit another driver who was manoeuvring into/out of a parking space.
- The non-injury crashes on Brigham Creek Road were attributed to a range of factors, including loss of control, failure to stop for queued traffic, and lane merges.
- The non-injury crash on Totara Road, along the site frontage, was attributed to a driver under instruction, who misjudged their speed when entering the horizontal curve and crashed into vegetation.

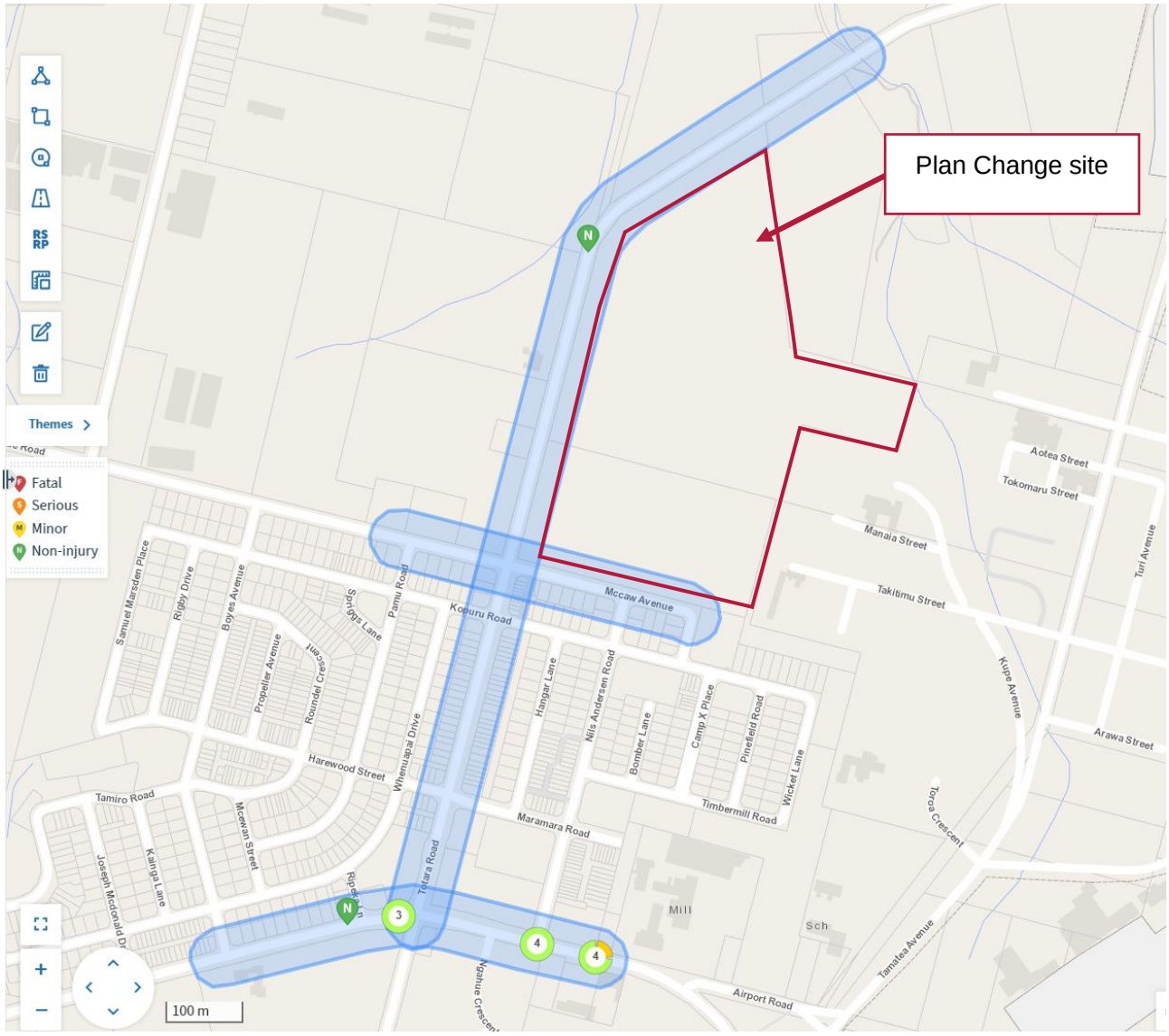


Figure 3.5 CAS search area and crash locations

Based on the above, it can be said that there are no existing crash trends present on the roads, and the assessment does not indicate underlying safety issues in the immediate vicinity of the development site.

3.7 Transport Accessibility

Public transport access

The closest bus stops are located at the intersection of McCaw Avenue and Totara Road, 550m south of the development. It is a 6-minute walk from the edge of the site to the bus stop. There is currently one bus route that operates along this road which is Route 114. The 114 route connects the Westgate bus interchange with Hobsonville Point. The Hobsonville ferry service can be accessed from Hobsonville Point which provides a link to Auckland CBD. The public transport network in the vicinity of the site can be found in Figure **3**.**6**.

At the time of writing this ITA, Auckland Transport had recently announced that the 114 service will be provided at the following frequencies and spans[3]

- weekday services running between 6am and 8pm
- Weekend services running between 7am and 8pm
- 40 minute frequencies during peak times
- 60 minute frequencies during the interpeak and weekends.

[3] Auckland Transport, west and northwestern hours of operation and frequencies, available online at https://at.govt.nz/media/ausngw0x/northwestern-bus-services-hours-of-operations-and-frequencies-table.pdf

Figure 3.6 Public Transport Network[4]

Private vehicle access

The site borders Totara Road which connects to Brigham Creek Road to the south. Brigham Creek Road is an east to west connection that links to State Highway 18 used to travel to the North Shore and Auckland CBD on its eastern end, and State Highway 16 used to travel into the Auckland CBD and Kumeu to the southeast and northwest respectively on its western end. Therefore, the site is well connected to the State Highway network.

Figure 3.7 shows the sites proximity to local destinations. The Whenuapai shopping area is within a 1-2 minute drive, 3 minute cycle ride and 12 minute walk and Whenuapai School is within a 2 minute drive, 5 minute cycle ride and 16 minute walk from the edge of the site on Totara Road.

[4] Auckland Transport, west and northwestern bus routes from 12 November 2023, available online at https://at.govt.nz/media/pqajzhbm/west-and-northwestern-bus-routes-from-12-november-2023.pdf

Figure 3.7 Local Area

Walking and cycling access

In terms of the local area, Totara Road, for the section directly adjacent to the site, currently does not provide any cycle facilities. Footpaths are currently also only present on the western side of the road. The cycling and pedestrian infrastructure on Totara Road south of McCaw Avenue is much better, with footpaths and separated cycle lanes provided on both sides of the road. Therefore, the site is currently not well connected for walking and cycling access and development of the site will require investment into improving the existing facilities for active users on Totara Road adjacent to the site. The required upgrades and new infrastructure will be delivered as part of the plan change .

Regarding the wider network, south of McCaw/Dale Road, Totara Road has protected cycle lanes up until the intersection with Brigham Creek Road. Brigham Creek Road to the East has a shared path continuing to SH18 where it links with Hobsonville. The protected cycleways continue west along Brigham Creek Road, where cyclists can travel along SH18 which connects to further cycling infrastructure (e.g. on-road cycle lanes and shared paths) that lead to the Auckland CBD.

Figure 3.8 shows the cycling facilities in the wider area.

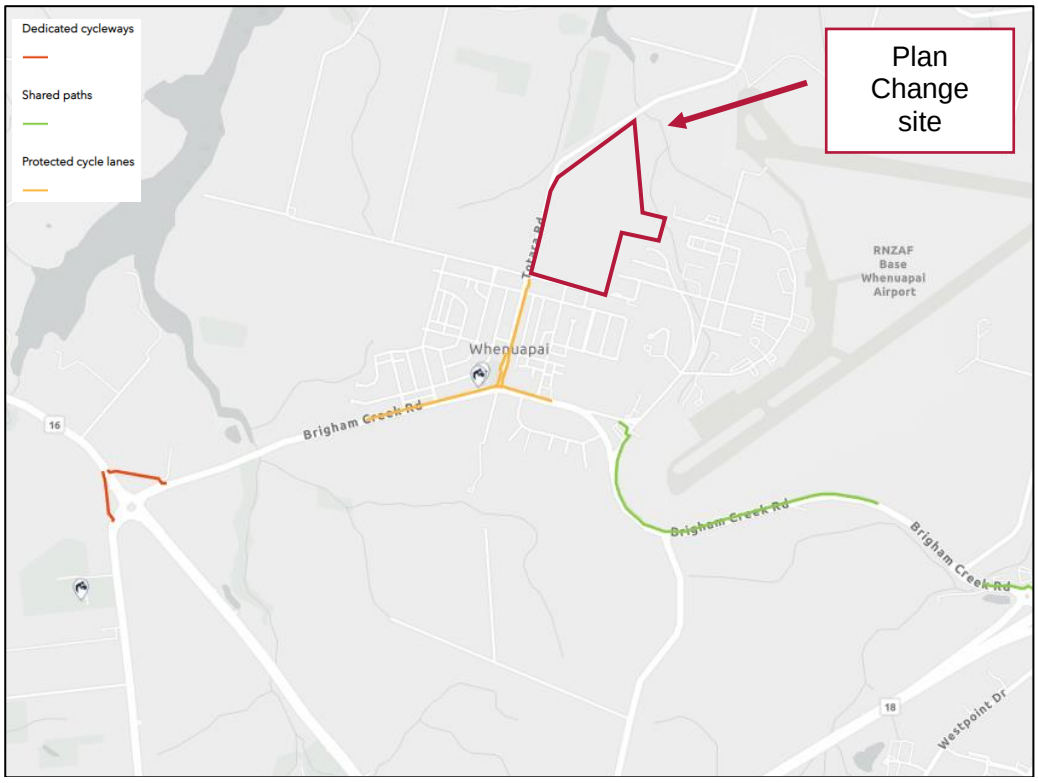


Figure 3.8 Local Cycling Infrastructure

4. Future land use and transport environment

As part of our assessment, we have considered the following future changes in land use and transport:

- Spedding Block Precinct - Plan Change 69.
- SH16 Brigham Creek to Waimauku Safety Improvements – Waka Kotahi.
- North West Auckland Transport Upgrades - Te Tupu Ngātahi Supporting Growth.
- Whenuapai Structure Plan 2016.
- Plan Change 86.

4.1 Spedding Block Precinct - Plan Change 69

The Spedding Block Private Plan Change (PC69) was made operative on 12 March 2023. The PC69 site is located south of Brigham Creek Road to the southwest of Whenuapai. PC69 rezoned approximately 52 hectares of land at 23-27 & 31 Brigham Creek Road and 13 & 15-19 Spedding Road, Whenuapai from Future Urban Zone to Business – Light Industry Zone, and introduced a new Precinct within the AUPOP (Precinct I1616 – Spedding Block). The location of the PC69 site is shown in Figure 4.1.

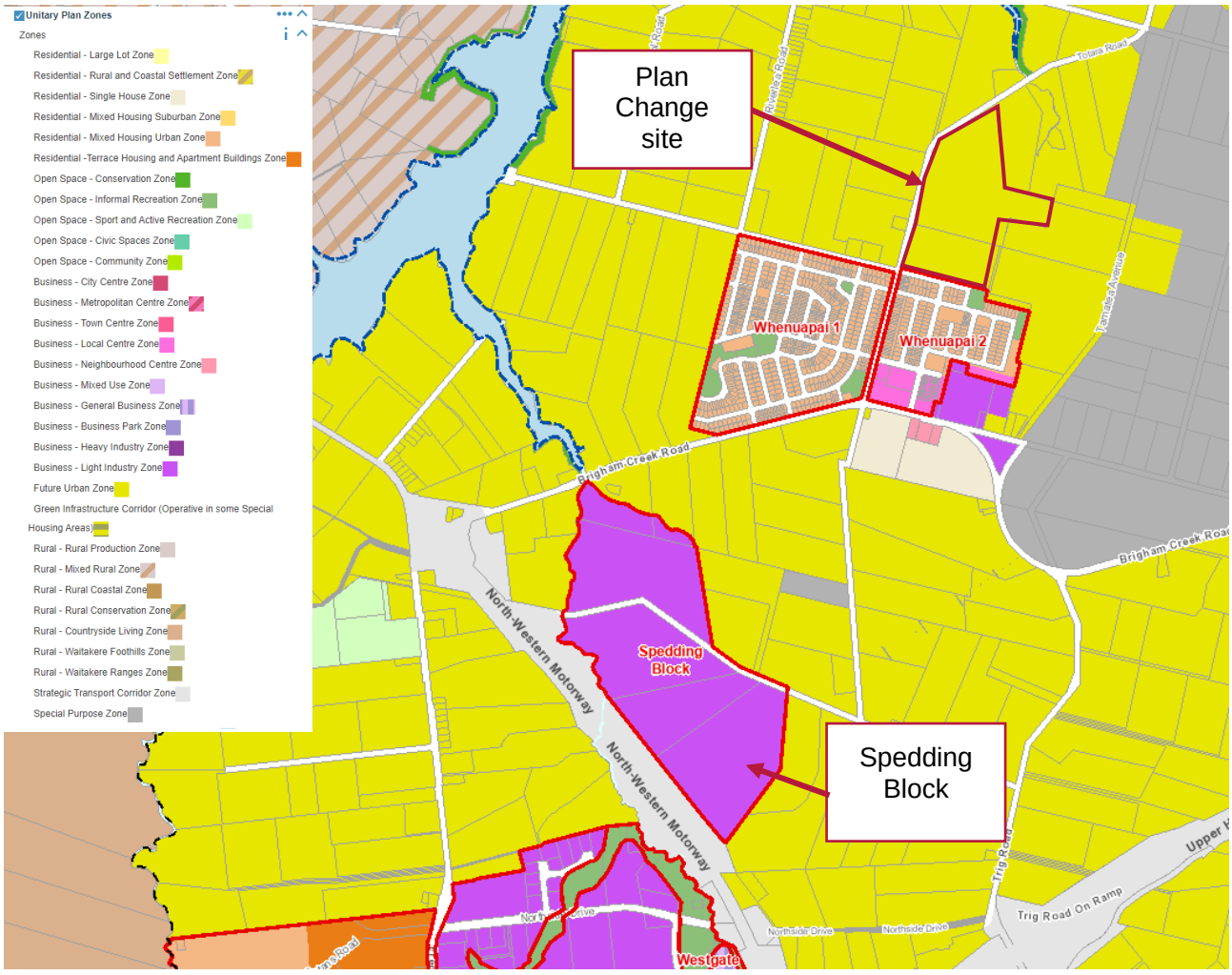


Figure 4.1 Location of Spedding Block Precinct

4.2 SH16 Brigham Creek to Waimauku Safety Improvements

Waka Kotahi have planned safety improvements[5] for the SH16 stretch between Brigham Creek Road and Waimauku. The Brigham Creek Road and SH16 roundabout has been included as part of the planned upgrades. The roundabout upgrade includes an extension of the northbound merge length which will result in a substantial improvement in the capacity and performance of the roundabout especially when northbound flows are high such as in the evening peak period. Other improvements include a signalised crossing, shared path, additional bus stops and a flexible median barrier.

Waka Kotahi is temporarily pausing Stage 2 of the Brigham Creek to Waimauku project for a6 – 12-months in response to a significant increase in forecasted costs. Waka Kotahi advises that material supply issues, labour shortages and rising inflation are contributing to increased project cost estimates, and further work over the following months is necessary prior to being able to confirm decisions about funding and scope[6].

[5] https://www.nzta.govt.nz/projects/sh16-brigham-creek-and-waimauku/
[6] SH16 Brigham Creek to Waimauku July 2023 update, available online at https://createsend.com/t/t-9E901B2B327E9E162540EF23F30FEDED

4.3 North West Auckland Transport Upgrades

Te Tupu Ngātahi Supporting Growth has an indicative strategic transport network for the Northwest area over the next 10 to 30 years as shown in Figure 4.2. Regarding the site, Brigham Creek Road is proposed to be widened to accommodate walking, cycling and public transport facilities. The existing roundabout at the western end will be upgraded to an interchange providing access to a potential future rapid transit network, walking and cycling corridor.

Te Tupu Ngātahi Supporting Growth lodged Notices of Requirement (NoR) for these future upgrades, with the hearing occurring in September – October 2023. At the time of writing this ITA, a decision from Council has not been made. Information in this section has been sourced from the hearing documents[7].

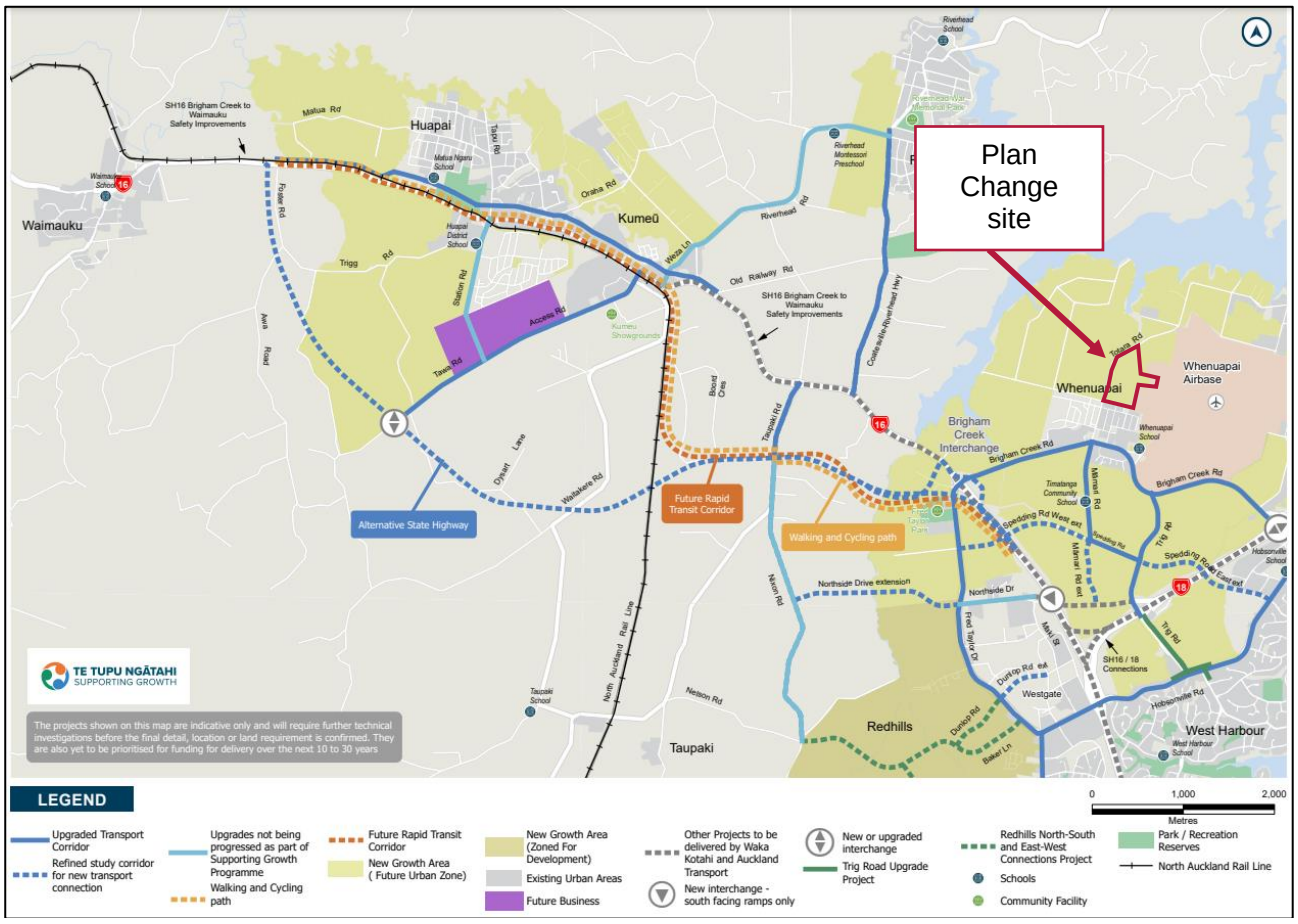


Figure 4.2 North West Auckland strategic connections map

Other key features of the Brigham Creek Road include:

- Increase to four vehicle lanes.
- Walking and cycling facilities on both sides of the road.
- A bus every 7 minutes to and from the Whenuapai town centre in peak times.
- Speed limit reduced to 50km/h.

These upgrades are labelled as greenfield transport infrastructure for Northwest (AT) and Northwest Growth Improvements with the Regional Land Transport Plan (2021-2031). The purpose of the project

[7] Available online at https://1drv.ms/f/s!ApYygguoxj-UgeMuMgTe8br1N3H95g?e=VcVded

is to support high priority greenfield growth areas including Whenuapai and will cost a total of 142 million across a 10 year period (2021/22 – 2030/31).

Of interest to this Plan Change is the NoR for the Brigham Creek/Totara Road intersection, which is shown in Figure 4.3 below. Compared to the existing form of the intersection, the NoR proposes:

- Two lanes in both directions on Brigham Creek Road (the existing intersection only has two lanes on the approach to the intersection, with single lanes beyond this).
- Extending the right turn lane from Brigham Creek Road into Mamari Road by approximately 45m.
- Extending the right turn lane from Brigham Creek Road into Totara Road by approximately 35m.
- Providing a third approach lane on Totara Road, approximately 40m long.
- Providing a third approach lane and extending the middle approach lane on Mamari Road.

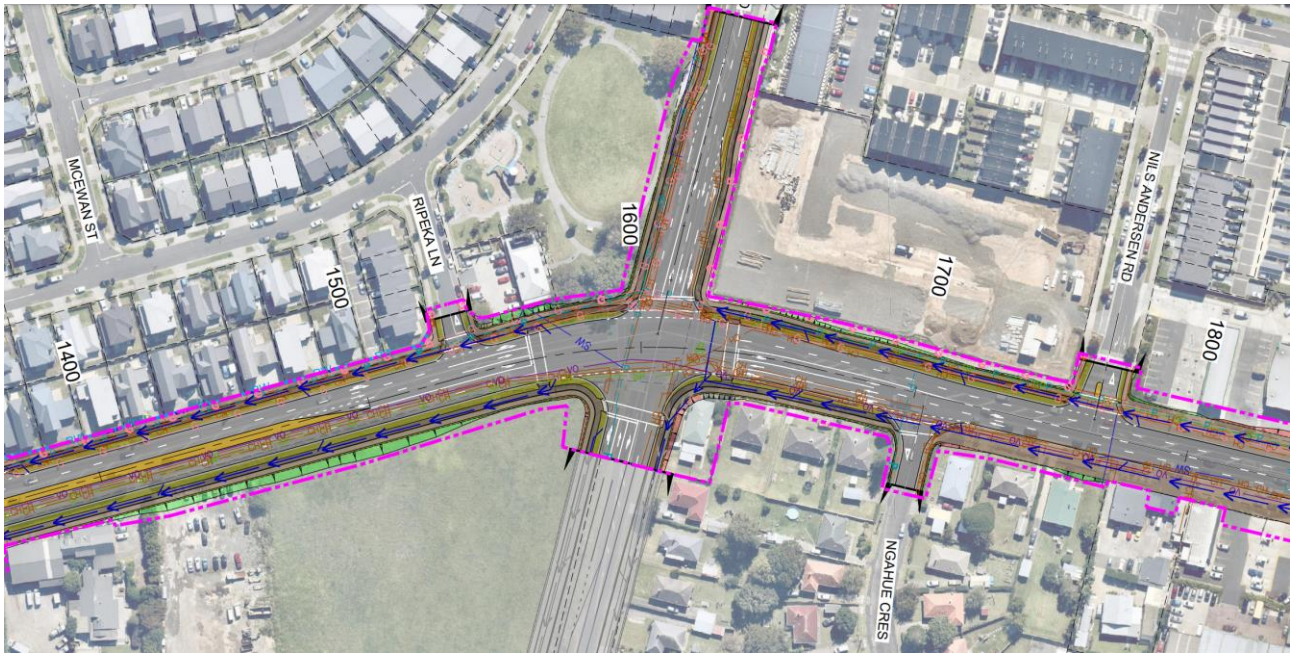


Figure 4.3 Te Tupu Ngātahi Supporting Growth NoR for Brigham Creek Road/Totara Road intersection

4.4 Whenuapai Structure Plan

The WSP was discussed in section 2.1 of this report, and includes the following key transport projects:

- completion of the Western Ring Route to provide an alternative route to State Highway 1.
- Extension of the North Western Cycleway to Westgate.
- a new interchange at the State Highway 16/Brigham Creek Road roundabout.
- a new bus interchange and park and ride facility at Westgate.
- bus shoulder lanes on State Highway 16 south of Westgate.
- additional lanes along parts of State Highway 18.
- Brigham Creek Road improvements including realignment.

- Improvements to State Highway16 between Brigham Creek Road and Waimauku (see section 4.2).
- State Highway 16 and State Highway 18 busways.

Totara Road is outlined to include a bus route travelling past the development site and it is noted that this corridor currently has regular bus services. This is shown in Figure 4.4.

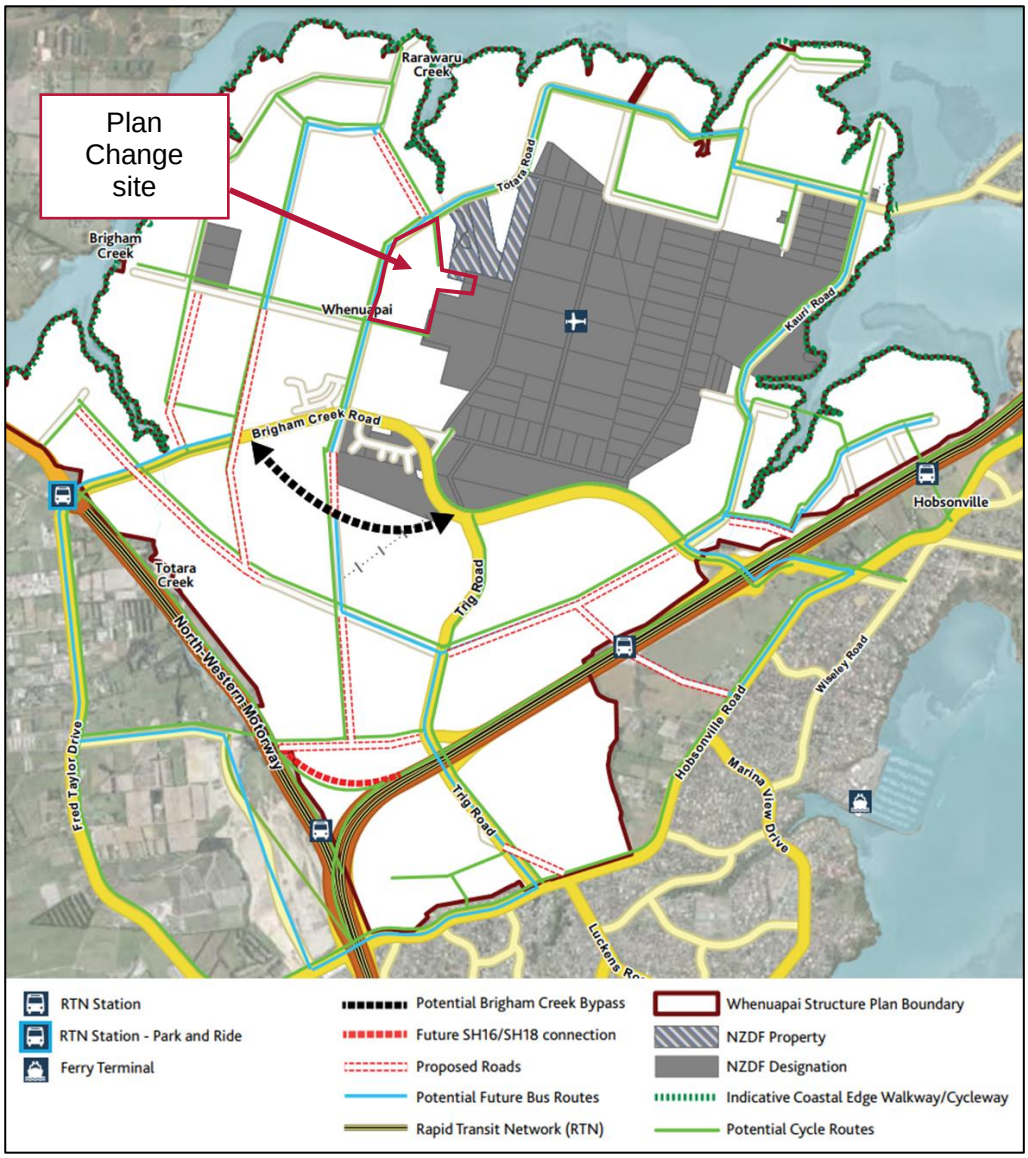


Figure 4.4 Future Public Transport Plan

4.5 Plan Change 86

PC86 seeks to rezone 5.2 Hectares of land at 41 -43 Brigham Creek Road, Whenuapai from Future Urban Zone to Residential - Mixed Housing Urban zone, to enable up to 260 dwellings.

PC86 is currently being processed by Auckland Council and a hearing was held in early November 2023. The s42a report initially recommended approval, however, the Council is now recommending that the plan change be declined due to the applicant not providing the requested information to address the Council's comments. We understand that transport matters were generally resolved between the

applicant and Auckland Transport at the hearing, with Auckland Transport providing support conditional on further amendments to the Precinct Plan[8].

At the time of writing this ITA, the Commissioner's recommendation on PC86 had not been released. Our modelling assessment, discussed in Section 6, includes traffic from Plan Change 86 in our baseline assessment.

[8] SUMMARY HEARING STATEMENT OF KATHERINE JULIE DOROFAEFF ON BEHALF OF AUCKLAND TRANSPORT, Dated 1 November 2023, available online at https://onedrive.live.com/?authkey=%21AJC0UuWr9jQ8Vxg&id=943FC6A80B823296%2130910&cid=943FC6A80B823296

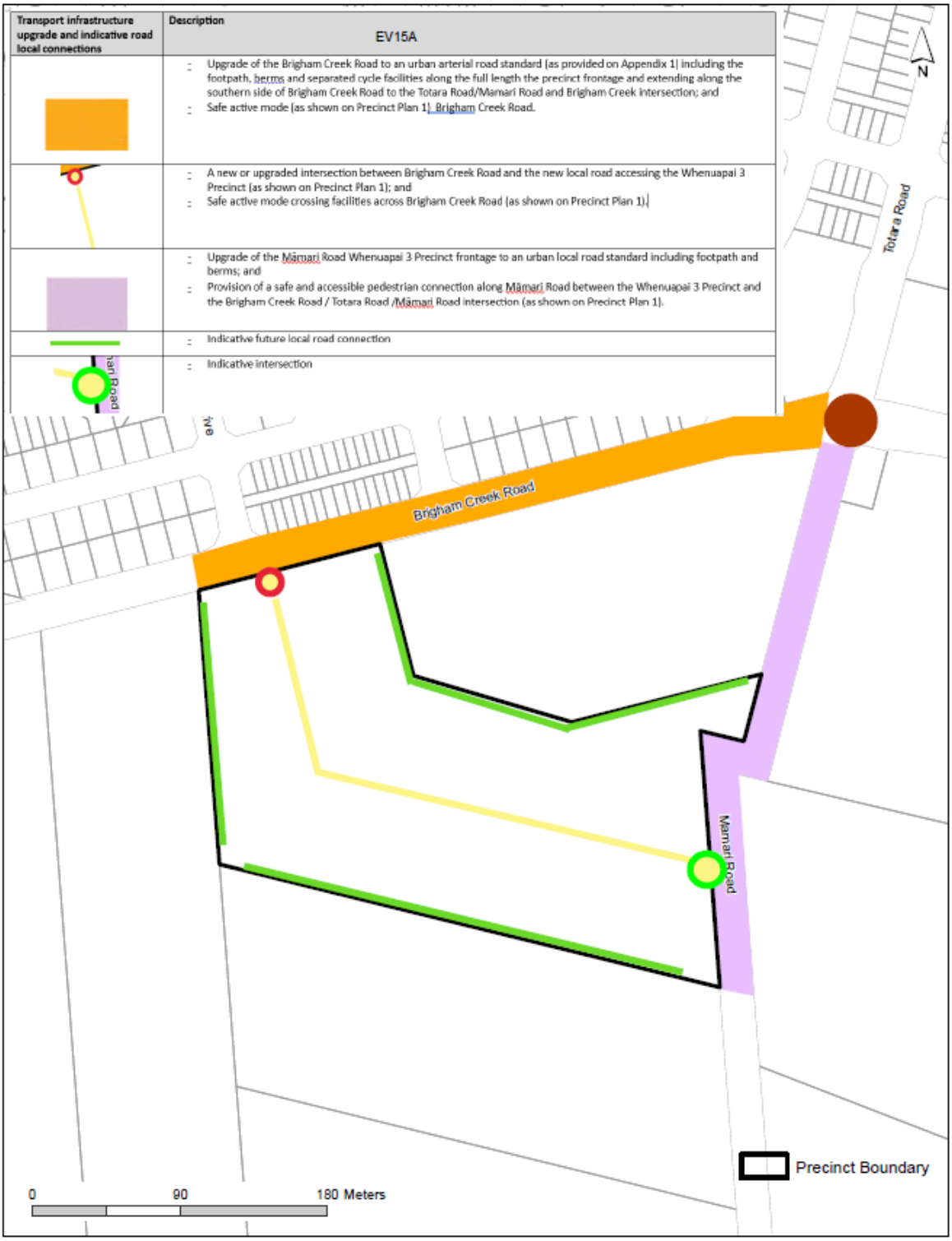


Figure 4.5 – PC86 Proposed Precinct Plan[9]

[9] EV15A CNCL Whenuapai 3 Precinct Plan 1 Hearing document, available online at https://1drv.ms/f/s!ApYygguoxj-UgfE-kLRS5av2NDxXGA?e=12Byyw

5. A description of the Plan Change

The Plan Change includes:

- Rezoning of approximately 16.4 hectares at 98-102 Totara Road in Whenuapai, from Future Urban Zone to Residential – Mixed Housing Urban. It is assumed that this will enable the development of approximately 430 dwellings (subject to future resource consent applications).
- Establishment of a Precinct, including provisions to direct transport outcomes from development including
    - Location of key roads within the site.
    - Location and form of key intersections on Totara Road., including roundabouts at the northern intersection and the existing Totara Road/Dale Road/McCaw Avenue intersection.
    - Proposed cross sections of key roads within the site.
    - Urbanisation of Totara Road.
    - Provision of bus stops on Totara Road.
    - Two future proofed road connections to RNZAF Base Whenuapai and 94 Totara Road.

The proposed layout of the site shown in Figure 5.1.

Figure 5.1 Whenuapai Green Precinct Plan

Road cross sections for key roads are shown in Figure 5.2.

The upgrade to Totara Road is expected to include a reduction of the speed limit from 80km/h to 50km/h, however this will need to be actioned by Auckland Transport (as the Road Controlling Authority) and can be confirmed as part of the Engineering Plan Approval application should the Plan Change be approved.

Other internal roading aspects, such as traffic calming, signage, pedestrian crossings etc. can be confirmed as part of the future Engineering Plan Approval prcess should the Plan Change be approved. Commonly Owned Access Lots (COALs) and vehicle crossings will be assessed as part of future resource consents.

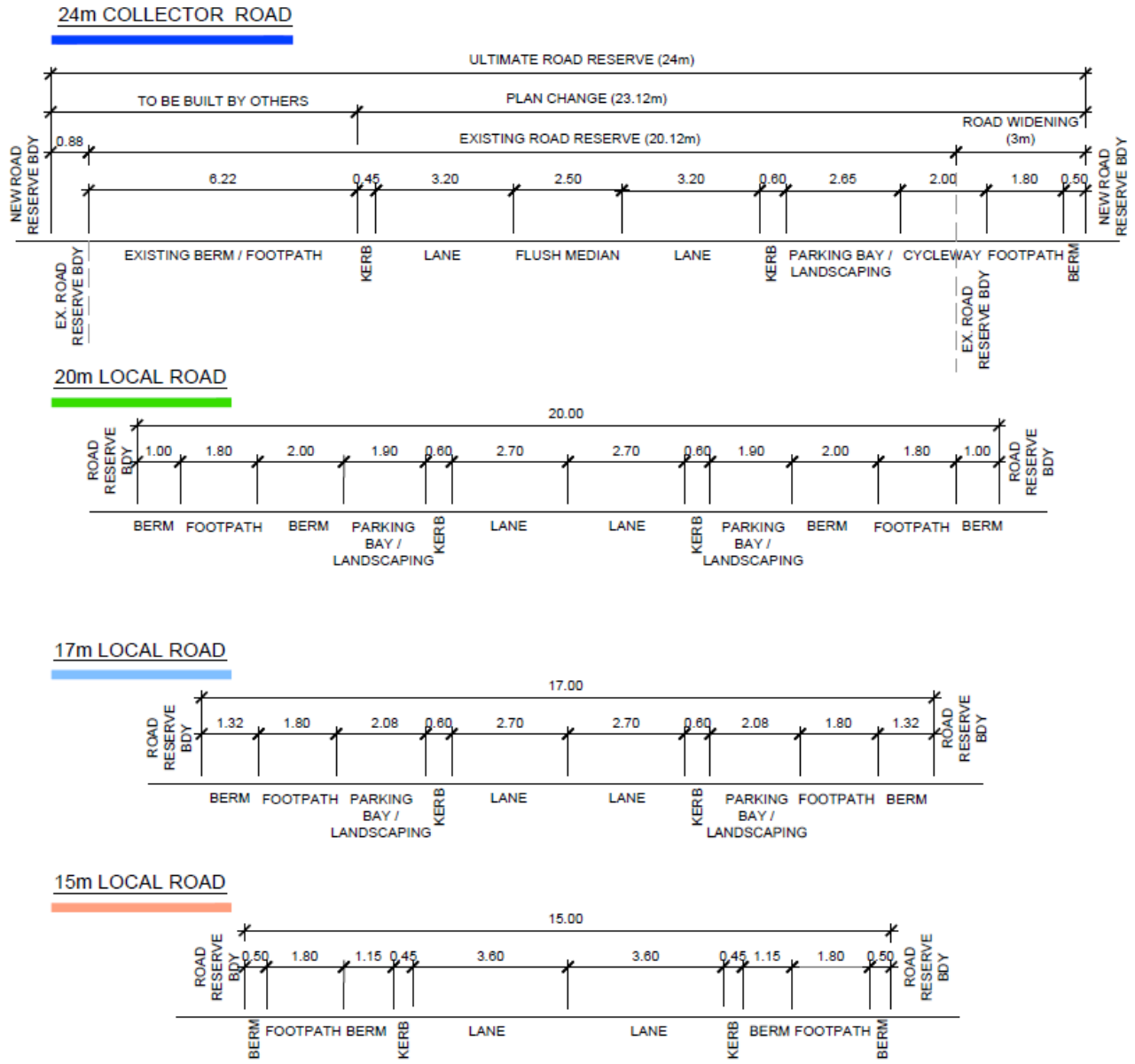


Figure 5.2 Road cross sections, for inclusion in the Precinct Plan

5.1 Potential school site

The previous Fast Track Consent application included land within the site for a future school. While the Plan Change does not include a school, we understand that NCL are continuing to discuss this possibility of this occurring in the future with the Ministry of Education.

During pre-lodgement discussions, Auckland Transport requested Abley to consider how the school might affect the potential transport effects of the Plan Change. We have discussed this in Section 7.

6. Assessment of transport effects

6.1 Enabled development that is included in our assessment

Our traffic modelling includes the following land use assumptions:

- Auckland Forecasting Centre land use scenario version i11.5 – note that this land use version was recommended for use by AFC to align with the modelling undertaken for both Plan Change 69, Plan Change 86 and the Supporting Growth Alliance Northwest Saturn traffic modelling
- Supporting Growth Alliance Northwest Saturn traffic model
- PC69, as adopted by Council
- PC86, adopting vehicle trip generation and distribution assumptions for the PC86 site, as contained in the Evidence in Chief of Todd Langwell from TPC[10].

6.2 Trip Generation

The proposal MHU zone sought is anticipated to have a trip rate of 0.6 vehicle driver trips in morning and evening peak hours and is consistent with the assessment in the 'Whenuapai Plan Change Stage 1 Technical Inputs' report prepared by Flow for Plan Change 5. This trip rate is also consistent with the RTA *Guide to Traffic Generating Developments* being at the upper end of medium density residential flats peak hour trip rate for three bedrooms or more (typically townhouses).

The Plan Change will enable future development of 430 dwellings which will generate 258 trips during peak hour and 2,580 trips per day (assuming peak hour trip rates are 10%).

The modelling undertaken has assumed a conservatively high trip rate of 0.9 vehicle driver trips in the morning and evening peak hours, reflecting that development may occur ahead of the provision of public transport services and active modes network assumed in the Flow Plan Change 5 assessment. This corresponds to a generation of 387 trips during peak hour and 3,870 trips per day (assuming peak hour trip rates are 10%).

6.3 Wider Network

Waka Commuter has been used to understand the distribution of vehicles within the wider network and the existing travel patterns within Whenuapai. Trips that stay local within Whenuapai make up 40% of all trips, with 60% of trips being outside the network. The trip distribution on the wider network has been calculated using the Whenuapai departures based on Statistical Area locations and the likely route used to travel. These have been stated as percentage splits for Kumeu-bound, Northbound and Citybound traffic in Figure 6.1 and Figure 6.2.

Directional split has been assumed to be an approximate 70/30 morning peak and 60/40 evening peak based on industry standard practice. Figure 6.1 and Figure 6.2 show the predicted trip distribution of the development based on a peak hour trip generation rate of 387 trips and the departure patterns within Waka Commuter.

[10] STATEMENT OF EVIDENCE OF TODD JAMES LANGWELL, dated 29 September 2022, available online at https://1drv.ms/f/s!ApYygguoxj-UgfE-kLRS5av2NDxXGA?e=12Byyw

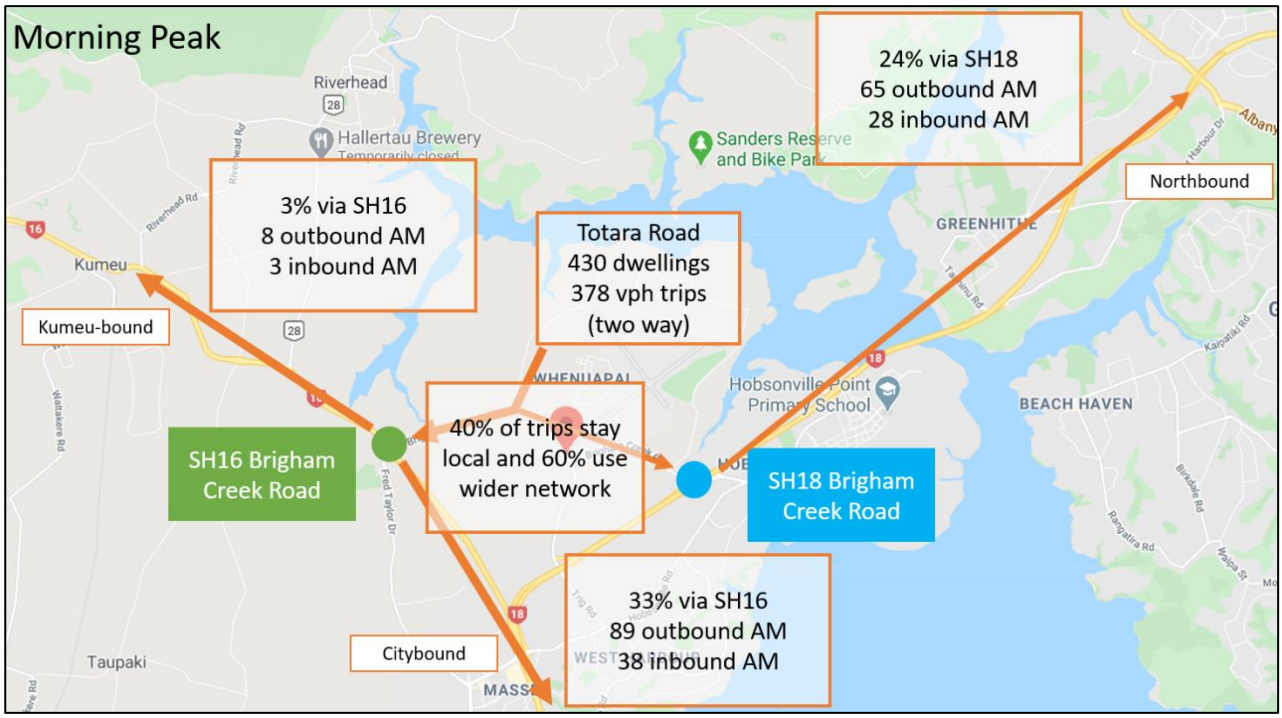


Figure 6.1 Trip distribution of development trips for morning peak

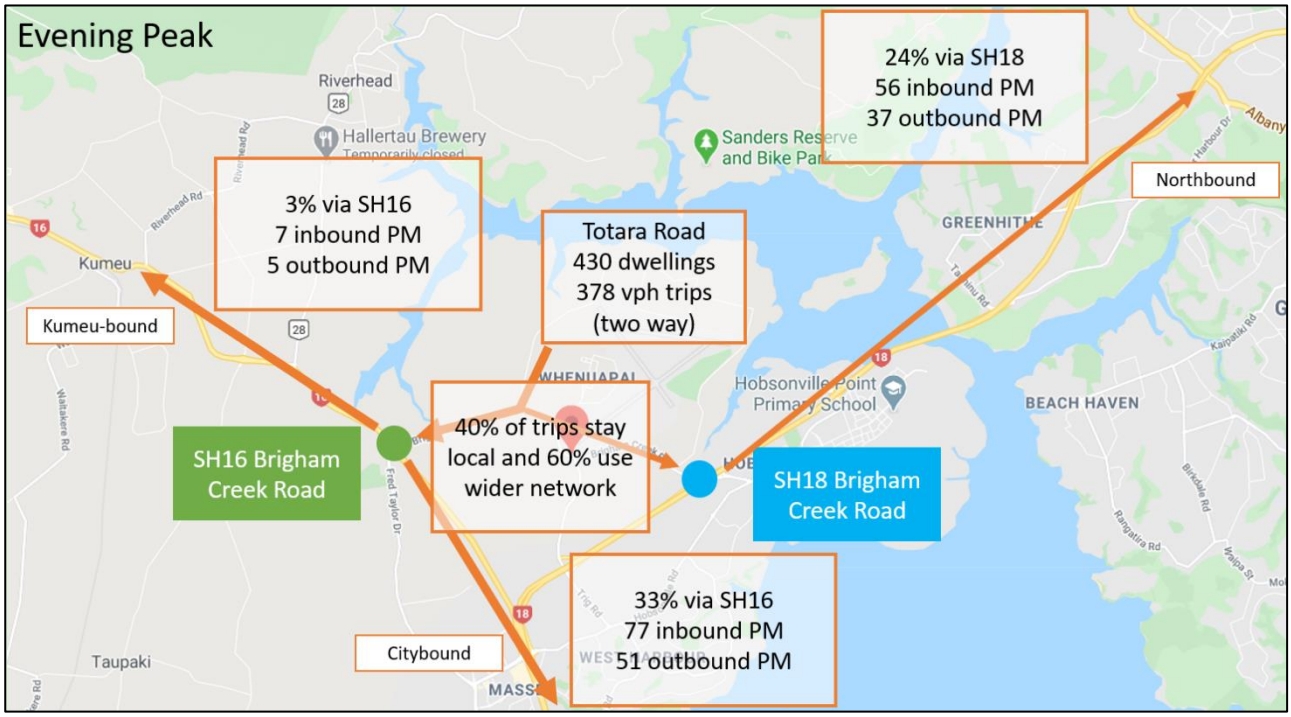


Figure 6.2 Trip distribution of development trips for evening peak

6.4 Supporting Growth Alliance Saturn model

We have used the Supporting Growth Alliance Saturn model to inform our baseline assessment. This model is based on the i11.5 landuse assumptions adopted by the Auckland Forecasting Centre and Auckland Council. The Saturn model does not include PC86 or the plan change, we discuss this further in the following sections.

Of relevance for our assessment:

- Supporting Growth Alliance Saturn model assumes that Sinton Road access at the SH18/Brigham Creek Road roundabout has been closed, with Sinton Road realigned to connect with Kauri Road. We have adopted this in our modelling.
- Supporting Growth Alliance Saturn model includes the Spedding Road link and a second north/south link within the Whenuapai Business area (as defined in the FDS). We have removed these links from our sensitivity modelling, as a conservative approach to demonstrate that the Plan Change does not rely on new links provided by other development. This is discussed further in the section below.
- In terms of the lane layouts of intersections, we do not have visibility over inclusion in the Supporting Growth Alliance Saturn model. Instead, we have modelled intersections as they currently operated, other than Sinton Road as discussed above.

6.5 Assessment approach

The impacts of additional traffic associated with the development are most likely to impact on the following two intersections:

- Totara Road / Dale Road / McCaw Avenue priority (give way) control intersection; and
- Brigham Creek Road / Totara Road / Mamari Road signalised intersection.

Although more remote from the Plan Change site, we have also considered the potential impacts on the following intersections:

- SH16/ / Brigham Creek Road
- SH18 / Brigham Creek Road.

Using outputs from the Supporting Growth Alliance Saturn model, we made the following adaptations to fairly represent the future transport network, should the proposed Plan Change be developed prior to the full Whenuapai Structure Plan transport network being implemented:

- Traffic demands from PC86 as discussed in Section 6.1 have been adopted additively over and above the flows extracted from the Supporting Growth Alliance Saturn model (which assumed FUZ zoning for the PC86 site).
- Half of the traffic volumes assigned to the Spedding Road link have been reallocated to Brigham Creek Road, representing partial development of PC69 and PC86 but not necessarily a full high-capacity link of Spedding Road between Brigham Creek Road and Trig Road.
    - A sensitivity test has also been undertaken where the full Spedding Road volume is reallocated to Brigham Creek Road, representing an interim future scenario where no Spedding Road through link is completed.
- The Supporting Growth Alliance Saturn model includes a single intersection link to represent several intersections to the north-east of Brigham Creek Road / Totara Road / Mamari Road intersection, namely:
    - Totara Road / McCaw Avenue
    - Totara Road / Kopuru Road
    - Totara Road / Maramara Road

- We have therefore adopted one third of the turning movements to represent the turning demands at the Totara Road / Dale Road / McCaw Avenue intersection.

Using these updated future base demands, we have modelled each intersection using SIDRA. The key metrics used to assess the performance of the intersections include the average delay per vehicle and intersection level of service. A general description of level of service is shown in Table 6.1. It is noted that ideally in peak commuter conditions LOS E or better (LOS A-D) is preferable, however LOS F is not atypical in the Auckland urban area during peak hours.

Diagrams of the SIDRA model layouts and outputs are provided in Appendix B.

Table 6.1 Level of Service (LOS) general descriptions

LoS	Average delay per vehicle (d) in seconds		
	Unsignalised intersections	Roundabouts	Signalised intersections
A	d ≤ 10	d ≤ 10	d ≤ 10
B	10 < d ≤ 15	10 < d ≤ 20	10 < d ≤ 20
C	15 < d ≤ 25	20 < d ≤ 35	20 < d ≤ 35
D	25 < d ≤ 35	35 < d ≤ 50	35 < d ≤ 55
E	35 < d ≤ 50	50 < d ≤ 70	55 < d ≤ 80
F	50 < d	70 < d	80 < d

6.6 Totara Road, Dale Road, and McCaw Avenue intersection

Most traffic generated by the development will be travelling through the Totara Road / Dale Road / McCaw Avenue intersection which is located at the southern end of the development site with Totara Road being the primary connection to the wider transport network. This intersection has existing right turn bays installed on a flush median on Totara Road. Through engagement with Auckland Transport, The Neil Group has agreed to upgrade this intersection to a single lane roundabout.

The single lane roundabout form is anticipated to operate with a high level of service and minimal delays on all approaches. Further modelling of this intersection has not been undertaken.

6.7 Totara Road, Brigham Creek Road and Mamari Road intersection

The future 2028 traffic volumes including PC69 and other anticipated development in the local area (which does not include PC86 and the Plan Change) have been taken from the Supporting Growth Alliance Saturn model and adopted as the basis for the assessment here.

Modelling has been undertaken within SIDRA for three different scenarios including:

- 2028 Baseline - future baseline traffic volumes including PC69 and other anticipated development as included in the Supporting Growth Alliance landuse i11.5, and traffic volumes from PC86 sourced from evidence for PC86 prepared by TPC, with 50% of Spedding Road traffic reassigned to Brigham Creek Road (to provide a more realistic representation of demands)
- 2028 Development - the 2028 base traffic volumes with the peak hour trip generation from the Plan Change applied and shown in Table 6.2. To provide a conservative assessment it is assumed that 50% of local traffic generated by the development travels through the signalised intersection

- 2028 Development Sensitivity – the 2028 development scenario with the conservative assumption that the direct Spedding Road link to Brigham Creek Road is not formed.

Note that in NCL's Fast Track consent application for the site, AT requested that minor line marking changes be made to the intersection to provide a shared through/left turn lane on Brigham Creek Road (eastbound) to improve the efficiency of the intersection. We have not included this change within our modelling assessment; however we understand that NCL have agreed to undertake these works should the Plan Change be approved. In this respect, our modelling is conservative.

The SIDRA model traffic volumes have been summarised in Table 6.2. The volumes noted are the demanded volumes, the SIDRA intersection has been configured using a peak period of 30min and a peak flow factor of 0.95. This means that the volumes utilised in the SIDRA intersection model are inflated by around 5% to account for additional vehicle congestion in the peak of the peak hour.

Table 6.2 Totara Road, Mamari Road, Brigham Creek Road intersection modelled traffic volumes

Road	Movement	2028					
		Base		Development		Sensitivity	
		AM	*PM*	*AM*	*PM*	*AM*	*PM*
Mamari Road	Left	29	7	29	7	29	7
	Thru	108	115	114 (+6)	122 (+7)	114 (+6)	122 (+7)
	Right	37	10	37	10	37	10
Brigham Creek Road East	Left	10	34	10	34	10	34
	Thru	445	356	445	356	796 (+351)	556 (+200)
	Right	100	148	133 (+33)	221 (+73)	133 (+33)	221 (+73)
Totara Road	Left	153	107	239 (+86)	148 (+41)	239 (+86)	148 (+41)
	Thru	62	79	71 (+9)	82 (+3)	71 (+9)	82 (+3)
	Right	139	57	254 (+115)	114 (+57)	254 (+115)	114 (+57)
Brigham Creek Road West	Left	120	46	168 (+48)	132 (+86)	168 (+48)	132 (+86)
	Thru	365	255	365	255	611 (+246)	446 (+192)
	Right	3	7	3	7	3	7
	Total	**1573**	**1221**	**1868 (+295)**	**1488 (+266)**	**2464 (+894)**	**1878 (+658)**

The peak hour delays and associated LoS by movement at the Totara Road, Brigham Creek Road and Mamari Road intersection are provided in Appendix B and summarised as follows:

- The intersection performance in the future base and with development traffic is LOS D or better for all intersection approaches which demonstrates that the intersection performs well in the context of urban peak hour operation.
- The sensitivity test demonstrates increased delays in the baseline scenario and the development scenario, however these are within the realms of typical peak hour performance for the urban transport environment in Auckland. In the development scenario the highest delay in the AM peak is less than 90sec, an increase of approximately 10sec vs. the baseline scenario.

It is concluded that the intersection has sufficient capacity to accommodate the proposed development.

6.8 SH16 / Brigham Creek Road

This dual circulating lane roundabout forms the main north-western access between Whenuapai and the wider State Highway network. The future 2028 traffic volumes including PC69 and other anticipated development in the local area (which does not include PC86 and the Plan Change) have been taken from the Supporting Growth Alliance Saturn model and adopted as the basis for the assessment here.

Modelling has been undertaken within SIDRA for two scenarios:

- 2028 Baseline - future baseline traffic volumes including PC69 and other anticipated development as included in the Supporting Growth Alliance landuse i11.5, and traffic volumes from PC86 sourced from evidence for PC86 prepared by TPC
- 2028 Development - the 2028 base traffic volumes with the peak hour trip generation from the site applied and shown in Table 6.2.

The SIDRA model does not presume the completion of the State Highway 16 Brigham Creek to Waimauku Safety Improvements project. Extending the northern leg approach and departure lanes to full-length is expected to have a minor positive impact on intersection capacity and slightly reduce delays but is not anticipated to fundamentally change the findings of this modelling.

The SIDRA model traffic volumes have been summarised in Table 6.2. The volumes noted are the demanded volumes, the SIDRA intersection has been configured using a peak period of 30min and a peak flow factor of 1.0. This means that the volumes utilised in the SIDRA intersection model are not inflated to account for additional vehicle congestion in the peak of the peak hour due to the high level of overall congestion.

Table 6.3 State Highway 16, Brigham Creek Road roundabout modelled traffic volumes

Road	Movement	2028			
		Base		Development	
		AM	*PM*	*AM*	*PM*
SH16 North	Left	593	654	596 (+3)	661 (+7)
	Thru	654	736	654	736
	Right	77	115	77	115
Brigham Creek Road	Left	567	284	656 (+89)	335 (+51)
	Thru	394	104	394	104
	Right	600	504	609 (+9)	508 (+4)
SH16 South	Left	87	96	87	96
	Thru	485	1041	485	1041
	Right	250	388	288 (+38)	465 (+77)
Fred Taylor Drive	Left	62	20	62	20
	Thru	41	1	41	1
	Right	78	34	78	34
Total		**3888**	**3977**	**4027 (+139)**	**4116 (+139)**

The peak hour delays and associated LoS by movement at the State Highway 16 / Brigham Creek Road roundabout are provided in Appendix B and summarised as follows:

- The model is indicating high delays for the Brigham Creek Road approach in the future baseline scenario, In both the AM and PM peaks.
- The delays on the Brigham Creek Road approach are increased in the future development scenario, although all other movements perform well.

While the modelling indicates that the SH16 / Brigham Creek Road will be experiencing large delays in 2028 irrespective of traffic from the Plan Change, the proportional contribution of traffic from the Plan Change site needs to be considered. The Plan Change is anticipated to contribute around 3.5% of morning peak hour 3.4% of evening peak hour movements through the intersection.

We also note the SH18/Brigham Creek Road intersection is estimated to have significant capacity remaining, as discussed in the following section. It is likely that, should the SH16/Brigham Creek Road intersection be heavily congested in the future, some drivers will reroute to SH18 for trips to and from the City Centre/Inner suburbs. We have tested the potential effect of rerouting in the following subsection.

6.9 SH18 / Brigham Creek Road (northern roundabout)

This dual circulating lane roundabout forms the main southern access between Whenuapai and the wider State Highway network. The future 2028 traffic volumes including PC69 and other anticipated development in the local area (which does not include PC86 and the Plan Change) have been taken from the Supporting Growth Alliance Saturn model and adopted as the basis for the assessment here.

It should be noted that the modelled network in the Supporting Growth Alliance Saturn modelling includes the closure of the Sinton Road northern leg of the roundabout. This removes the requirement for the south-eastern circulating lane and introduces the potential for the combined northern and southern roundabouts to be converted to a dog bone-style pair.

Modelling has been undertaken within SIDRA for three scenarios:

- 2028 Baseline - future baseline traffic volumes including PC69 and other anticipated development as included in the Supporting Growth Alliance landuse i11.5, and traffic volumes from PC86 sourced from evidence for PC86 prepared by TPC and the closure of the Sinton Road arm of the intersection.
- 2028 Development - the 2028 base traffic volumes with the peak hour trip generation from the site applied and shown in Table 6.4
- 2028 Development Sensitivity – the 2028 development scenario with the conservative assumption that Brigham Creek Road traffic in excess of the capacity at State Highway 16 instead reroutes to State Highway 18. This is estimated at 431 vehicles in the morning peak, which have been assigned to the Brigham Creek Northwest through movement in the morning peak and the State Highway 18 offramp left turn in the evening peak.

The SIDRA model traffic volumes have been summarised in Table 6.4. The volumes noted are the demanded volumes, the SIDRA intersection has been configured using a peak period of 30min and a peak flow factor of 0.95. This means that the volumes utilised in the SIDRA intersection model are inflated by around 5% to account for additional vehicle congestion in the peak of the peak hour.

Table 6.4 State Highway 18, Brigham Creek Road roundabout modelled traffic volumes

Road	Movement	2028					
		Base		Development		Sensitivity	
		AM	*PM*	*AM*	*PM*	*AM*	*PM*
Brigham Creek Road Northwest	Left	308	152	373 (+65)	189 (+37)	373 (+65)	189 (+37)
	Thru	193	325	193	325	623 (+431)	325
Brigham Creek Road Southeast	Thru	463	425	491 (+28)	480 (+55)	491 (+28)	480 (+55)
	Right	186	70	186	70	186	70
State Highway 18 Offramp	Left	300	249	300	249	300	680 (+431)
	Thru	0	0	0	0	0	0
	Right	432	830	432	830	432	830
	Total	**1882**	**2050**	**1974 (+93)**	**2143 (+93)**	**2385 (+504)**	**2574 (+504)**

The peak hour delays and associated LoS by movement at the State Highway 16 / Brigham Creek Road roundabout are provided in Appendix B and summarised as follows:

- The model indicates that all approaches to the intersection operate with minimal delay in the future baseline and future development scenario, with LOS B or better for both the AM and PM peak periods, indicating that this intersection is anticipated to have significant excess capacity in the future.
- The future sensitivity test, where Plan Change traffic reroutes to SH18/Brigham Creek Road intersection due to delays at the SH16/Brigham Creek intersection indicates negligible effect, with all approaches operating at LOS B or better for both the AM and PM peak periods .
- This demonstrates that this intersection is able to cater to increased travel demands from the Plan Change and can take pressure off the SH16/Brigham Creek Road intersection.

7. Potential school located within the Plan Change

As discussed in Section 5.1, The Neil Group is currently in discussions with the Ministry of Education regarding a potential school within the site. Although this is not proposed as part of the Plan Change application, and will require a separate assessment of transport effects to support a Notice of Requirement, at Auckland Transport's request we have considered how this may affect the transport impacts from the site.

We have assumed that this would be a Primary School with an opening roll of 420 students and a masterplan roll of 900 students. As the existing Whenuapai School is located to the south of the subject site, the school catchment is anticipated to be the future urban zoning surrounding the school, particularly to the north and west of the site. This means that the school would be unlikely to generate many additional traffic movements on the Brigham Creek Road corridor.

7.1 School Trip Generation

The modal split adopted for has been taken from data provided by Auckland Transport from school travel surveys undertaken as part of the TravelWise programme. The dataset is the average modal share for primary schools in 2020 and is shown in Table 7.1.

Table 7.1 Modal Split (based on Auckland TravelWise Schools data from 2020)

Source	Active modes	Public Transport	Vehicle (passenger or drive)	Car/Walk (>400m)	Other
Auckland average Travelwise Primary schools	32%	3%	49%	14%	2%

The number of vehicle trips is estimated based on the anticipated modal split for the school and the average number of students per vehicle.

Table 7.2 Estimated Trip Generation

School start/finish time	Maximum School Roll	Vehicle use	Ave students per vehicle	No. of Vehicles / Trips
Initial School Roll	420	49% drive	1.4	147 / 294
Masterplan School Roll	900	49% drive	1.4	315 / 630

The number of vehicle trips generated by the initial school roll is estimated at 294 trips (147 vehicles) at school start times, as shown in Table 7.2. The number of vehicle trips generated by the masterplan roll with 900 students is estimated to be 630 trips (315 vehicles) in the mornings. Trips are often slightly lower in the afternoons due to extra-curricular activities.

From a first principles basis, establishing a school within the site would have an overall positive effect transport network, by supporting increased walking and cycling trips for school activities and reducing the length of vehicle trips that might otherwise be destined for schools further afield. The school would likely create a degree of localised congestion during school start and finish times, however we consider that this can be acceptably managed as it is at many existing schools in Auckland. We assume that, should a school be established within the site, the resource consent or Notice of Requirement would include a transport assessment, which undertakes an appropriate assessment of affects.

8. Strategic Planning Framework

8.1 Future Development Strategy FDS

Whenuapai is part of Auckland Council's 2023 FDS that focuses on the long-term future of Auckland and how growth should be managed for the next 30 years to ensure sufficient residential and business land is provided. The FDS replaces the 2017 Future Urban Land Supply Strategy (FULSS). The plan change site is located within the Whenuapai North (Stage 1) area under the FDS, which is indicated as being development ready from 2035+.

The FDS identifies key transport infrastructure prerequisites for Whenuapai North (Stage 1), which we have assessed in Table 8.1. We note that the FDS allows for appropriate flexibility (or responsiveness), as required by the National Policy Statement Urban Development (NPS-UD).

In summary, the roading upgrades proposed as part of the plan change can accommodate the traffic generated and avoids the need for the FDS key transport infrastructure prerequisites being in place.

Table 8.1 FDS key transport infrastructure for Whenuapai North (Stage 1)

Transport infrastructure prerequisite	Abley commentary
SH16 to SH18 Connections	We understand that the purpose of this connection is to reduce future pressure on Brigham Creek Road, by providing a direct motorway connection for west to north and north to west movements on the motorway network. Our assessment demonstrates that Brigham Creek Road/Totora Road and SH18/Brigham Creek Road intersections have sufficient capacity to support the plan change, without the SH16 to SH18 Connections.
Brigham Creek Road upgrade	Our assessment demonstrates that the Brigham Creek Road/Totora Road intersection has sufficient capacity to support the plan change. We anticipate that Brigham Creek Road will be progressively upgraded as development fronting the corridor progresses in the future.
Northwest Rapid Transit Upper Harbour (SH18) Rapid Transit	Our assessment has adopted a high peak hour vehicle trip rate of 0.9 veh/hr/dwelling, to reflect that the existing public transport network in Whenuapai does not meet Auckland Transports classification for Frequent or Rapid Transit. Our assessment demonstrates that Brigham Creek Road/Totora Road and SH18/Brigham Creek Road intersections have sufficient capacity to support the plan change, prior to Auckland Transport's provision of Frequent and Rapid Transit for Whenuapai.

8.2 Regional Land Transport Plan (RLTP)

The Regional Land Transport Plan (2021-2031) lists Auckland's directions and focus areas to support the growth of Auckland over 10 years. It is important for the proposed development site to be consistent with the RLTP to support Auckland's overall strategic growth direction for land transport.

The primary directions are as follows:

- Better connected people, places, goods, and services.
- Increase genuine travel choices for a healthy, vibrant and equitable Auckland.
- Maximise safety and environmental protection.

The primary focus areas are as follows:

- Make better use of existing transport networks

- Target new transport investment to the most significant challenges
- Maximise the benefits from transport technology
- Better integrate land use and transport decisions
- Move to a safe transport network, free from death and serious injury
- Develop a sustainable and resilient transport system
- Make walking, cycling and public transport preferred choices for many more Aucklanders

The proposal is to rezone the site from Residential – Future Urban Zone ('FUZ') to Residential – Mixed Housing Urban ('MHU') Zone, and establish apply a Precinct across the site to guide future development. As part of the plan change, an upgrade of Totara Road is proposed to bring it to a standard that will be safer for use by road users and also align it with Auckland Transport's vision for the corridor in the future.

Adequate road space is provided in the cross section of the Totara Road upgrade to allow for the construction of bus stops in the future, which are proposed by NCL. A footpath and separated cycleway are also proposed along the site frontage with Totara Road which will support active travel choice. Therefore, the proposal is considered consistent with the direction and focus of the RLTP.

8.3 Auckland Unitary Plan (Operative in Part) (AUPOP)

Abley has reviewed the plan change against objectives and policies contained in the AUPOP, which relate to transport matters at a plan change level.

The relevant objectives and policies are listed below in Table 8.2 with comments on the consistency of the plan change with respect to each aspect.

Table 8.2 AUPOP Transportation Objective and Policy Assessment

Objective or policy in the AUPOP	Comment
B2 Tāhuhu whakaruruhau ā-taone - Urban growth and form **B2.2. Urban growth and form**	
Objective B2.2.1.(1) A quality compact urban form that enables all of the following: (a) a higher-quality urban environment; (b) greater productivity and economic growth; (c) better use of existing infrastructure and efficient provision of new infrastructure; (d) improved and more effective public transport; (e) greater social and cultural vitality; (f) better maintenance of rural character and rural productivity; and (g) reduced adverse environmental effects.	This ITA demonstrates that the Plan Change will make better use of existing transport infrastructure and efficient provision of new transport infrastructure at the time of development.
Objective B2.2.1.(2) Urban growth is primarily accommodated within the urban area 2016 (as identified in Appendix 1A).	The site is outside of the urban area 2016 (as identified in Appendix 1A).
Objective B2.2.1.(4) Urbanisation is contained within the Rural Urban Boundary, towns, and rural and coastal towns and villages.	The site is within the Rural Urban Boundary.

Objective or policy in the AUPOP	Comment
Objective B2.2.1.(5) The development of land within the Rural Urban Boundary, towns, and rural and coastal towns and villages is integrated with the provision of appropriate infrastructure.	This ITA demonstrates that the Plan Change will provide the required transport infrastructure at the time of development.
Policy B2.2.2.(3) Enable rezoning of future urban zoned land for urbanisation following structure planning and plan change processes in accordance with Appendix 1 Structure plan guidelines.	The site has been subject to a structure planning exercise and this ITA supports the Plan Change application for the site.
Policy B2.2.2.(4) Promote urban growth and intensification within the urban area 2016 (as identified in Appendix 1A), enable urban growth and intensification within the Rural Urban Boundary, towns, and rural and coastal towns and villages, and avoid urbanisation outside these areas.	The site is outside of the urban area 2016 (as identified in Appendix 1A). The site is within the Rural Urban Boundary.
Policy B2.2.2.(7) Enable rezoning of land within the Rural Urban Boundary or other land zoned future urban to accommodate urban growth in ways that do all of the following: (a) support a quality compact urban form; (b) provide for a range of housing types and employment choices for the area; (c) integrate with the provision of infrastructure; and (d) follow the structure plan guidelines as set out in Appendix 1.	This ITA demonstrates that the Plan Change will provide the required transport infrastructure at the time of development. The Plan Change includes a range of new or upgrades of existing infrastructure that is generally consistent with the planned infrastructure for the area that will sufficiently service both the PPC land, and the wider surrounding area into the future, whilst not impeding future infrastructure upgrades.
B2.4. Residential growth	
Objective B2.4.1.(3) Land within and adjacent to centres and corridors or in close proximity to public transport and social facilities (including open space) or employment opportunities is the primary focus for residential intensification.	The Plan Change provides for medium residential activities in an area that is currently served by public transport.
Policy B2.4.2.(3) Provide for medium residential intensities in area that are within moderate walking distance to centres, public transport, social facilities and open space.	The Plan Change provides for medium residential activities in an area that is currently served by public transport and is within moderate walking distance to centres, social facilities and open space
Policy B2.4.2.(6) Ensure development is adequately serviced by existing infrastructure or is provided with infrastructure prior to or at the same time as residential intensification.	This ITA demonstrates that the Plan Change will provide the required transport infrastructure at the time of residential intensification.
E27 Transport	
Objective E27.2.(1) Land use and all modes of transport are integrated in a manner that enables: (a) the benefits of an integrated transport network to be realised; and (b) the adverse effects of traffic generation on the transport network to be managed	This ITA demonstrates that the Plan Change will manage adverse effects on the transport network.
Objective E27.2.(2) An integrated transport network including public transport, walking, cycling, private vehicles and freight, is provided for.	This ITA demonstrates that the Plan Change will provide for an integrated network.

Objective or policy in the AUPOP	Comment
Objective E27.2.(3) Parking and loading supports urban growth and the quality compact urban form.	Future subdivision and land use consentswill address this matter, however this ITA demonstrates that the anticipated development within the site can be accommodated on the local transport network.
Objective E27.2.(4) The provision of safe and efficient parking, loading and access is commensurate with the character, scale and intensity of the zone.	
Objective E27.2.(5) Pedestrian safety and amenity along public footpaths is prioritised.	Pedestrian safety and amenity on Totara Road is prioritised, the Plan Change proposes to urbanise Totara Road to include a footpath and cycleway, bus stops, and a roundabout at the Totara/Dale/McCaw intersections which will improve pedestrian crossing opportunities. Pedestrian safety and amenity within the site can be prioritised. Future subdivision and land use consents can address this matter.
Objective E27.2.(6) Road/rail crossings operate safely with neighbouring land use and development.	Not applicable
Policy E27.3.(1) Require subdivision, use and development to manage adverse effects on and integrate with the transport network by measures such as travel planning, providing alternatives to private vehicle trips, staging development or undertaking improvements to the local transport network	Future subdivision and land use consentswill address this matter, however this ITA demonstrates that the anticipated development within the site can be accommodated on the local transport network.
Policy E27.3.(2) – (29)	The plan change is anticipated to enable development that will be generally consistent with the Standards of Chapter E27 in relation to parking, loading, and access.

9. Conclusions and Recommendations

The transportation assessment of the proposed rezoning of 98-102 Totara Road has focussed on the likely impacts of establishing a medium density residential development. It is concluded that the site is appropriate for this activity from a transport perspective for the following reasons:

- the proposed development will be well served by public transport, walking and cycling connections in the near future which are currently being planned by Te Tupu Ngātahi Supporting Growth Alliance and Waka Kotahi through the North West Auckland transport upgrades and SH16 Brigham Creek to Waimauku Safety Improvements respectively.
- a Precinct is proposed, including provisions to direct transport outcomes from development including:
  - Location of key roads within the site.
  - Location and form of key intersections on Totara Road, including roundabouts at the northern intersection and the existing Totara Road/Dale Road/McCaw Avenue intersection.
  - Proposed cross sections of key roads within the site.
  - Urbanisation of Totara Road.
  - Provision of bus stops on Totara Road.
  - Two future proofed road connections to RNZAF Base Whenuapai and 94 Totara Road.
  - Minor line marking changes to the Brigham Creek Road/Totara Road intersection to enable a shared through/left turn lane for eastbound traffic.
- there is excellent accessibility to key local activities and services by all modes.
- the Brigham Creek / Totara Road / Mamari Road intersection performs acceptably with the addition of traffic from the site.
- the site is well-served by SH16 and SH18. While the Plan Change is expected to increase delays at the SH16 / Brigham Creek intersection, alternative routes (such as SH18/Brigham Creek Road and Spedding Road extension) will be available and will likely lead to a degree of rerouting. Further, Waka Kotahi's SH16 Brigham Creek to Waimauku Safety Improvements project and Kumeu State Highway bypass projects will provide relief in the medium to long term.
- the SH18/Brigham Creek Road intersection performs well in peak hour, and with the closure of the Sinton Road arm this intersection has significant capacity available to accommodate traffic from the Plan Change.
- the traffic modelling results demonstrates that the Totara Road / Dale Road / McCaw Avenue intersection will operate in free-flowing conditions with the additional generated traffic. The Totara Road / Brigham Creek Road / Mamari Road intersection will operate well within in capacity of the intersection.
- the roading upgrades proposed as part of the plan change can accommodate the traffic generated and avoids the need for the FDS key transport infrastructure prerequisites being in place.

Appendix A.
Crash history

Relevant crashes recorded near the site (2019-2023)

Crash road	Year	Description of events	Crash factors	Fatal	Serious injury	Minor injury
BRIGHAM CREEK RD	2019	Van1 WDB on Birgham Creek road hit rear end of Motorcycle2 stopped/moving slowly	MOTORCYCLE2, travelling unreasonably slowly VAN1, emotionally upset/road rage, intentional collision	0	0	0
BRIGHAM CREEK ROAD	2019	Van1 WDB on Brigham Creek Road hit rear end of Car/Wagon2 stop/slow for signals	CAR/WAGON2, alcohol test below limit VAN1, alcohol test below limit, misjudged intentions of another party	0	0	0
BRIGHAM CREEK ROAD	2022	Car/Wagon2 turning right hit by oncoming Car/Wagon1 WDB on BRIGHAM CREEK ROAD	CAR/WAGON1, alcohol test below limit CAR/WAGON2, alcohol suspected, failed to give way turning to non-turning traffic	0	0	0
BRIGHAM CREEK ROAD	2020	Car/Wagon1 EDB on BRIGHAM CREEK ROAD hit Car/Wagon2 merging from the right	CAR/WAGON2, failed to give way entering roadway from driveway	0	0	0
BRIGHAM CREEK ROAD	2021	SUV1 EDB on BRIGHAM CREEK ROAD lost control; went off road to right, SUV1 hit kerb, rubbish bins	SUV1, alcohol test above limit or test refused, other lost control, over the speed limit	0	0	0
BRIGHAM CREEK ROAD	2020	Truck1 WDB on Brigham creek road hit Car/Wagon2 U-turning from same direction of travel	CAR/WAGON2, alcohol test below limit, did not check/notice another party behind TRUCK1, alcohol test below limit	0	0	0
BRIGHAM CREEK ROAD	**2022**	**Car/Wagon1 WDB on BRIGHAM CREEK ROAD hit Car/Wagon2 parking/unparking**	**CAR/WAGON2, did not check/notice another party behind, other inattentive CAR/WAGON1, alcohol test below limit**	**0**	**0**	**1**

BRIGHAM CREEK ROAD	2021	Ute1 EDB on BRIGHAM CREEK ROAD lost control; went off road to right, Ute1 hit rubbish bins, shop	UTE1, alcohol test below limit, too far right	0	0	0
BRIGHAM CREEK ROAD	2023	Car/Wagon1 SDB on BRIGHAM CREEK ROAD missed inters or end of road, Car/Wagon1 hit traffic island	CAR/WAGON1, failed to notice obstruction on roadway, ENV: signs/signals necessary	0	0	0
BRIGHAM CREEK ROAD	2022	Car/Wagon1 WDB on BRIGHAM CREEK ROAD hit rear end of Ute2 stopped/moving slowly , Ute2 hit concrete	CAR/WAGON1, alcohol test below limit, other inattentive UTE2, alcohol test below limit	0	0	0
BRIGHAM CREEK ROAD	2021	Truck1 WDB on BRIGHAM CREEK ROAD hit rear end of Car/Wagon2 stopped/moving slowly	TRUCK1, emotionally upset/road rage CAR/WAGON2, alcohol test below limit, emotionally upset/road rage	0	0	0
BRIGHAM CREEK ROAD	2023	Car/Wagon1 EDB on BRIGHAM CREEK ROAD hit rear end of Ute2 stop/slow for signals	CAR/WAGON1, other inattentive	0	0	0
TOTARA ROAD	2022	Car/Wagon1 NDB on TOTARA ROAD lost control turning right; went off road to left, Car/Wagon1 hit substantial vegetation (causing vehicle damage or stopping the vehicle)	CAR/WAGON1, alcohol test below limit, lost control when turning, new driver/under instruction, other misjudged speed, distance or position, speed entering corner/curve	0	0	0

Appendix B.
SIDRA layouts and results

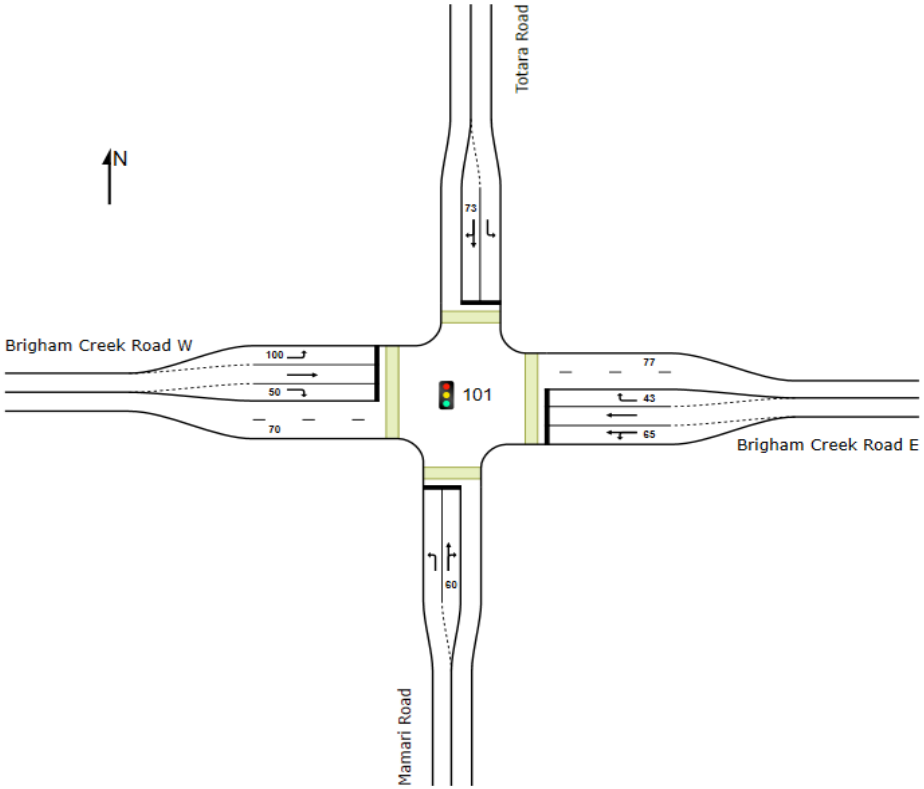
Brigham Creek Road/Totara Road intersection – all scenarios

SITE LAYOUT

Site: 101 [2028 Baseline AM (Site Folder: BC - Totara Baseline)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated

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



Organisation: ABLEY TRANSPORTATION CONSULTANTS LIMITED | Licence: PLUS / 1PC | Created: Friday, 26 January 2024 3:43:53 p.m.
Project: J:\The Neil Group Limited (TNEGL)\TNEGL-J002 98-102 Totara Road Whenuapai Fast Track Consent\Models\Brigham Creek - Totara Signals CB Edits.sip9

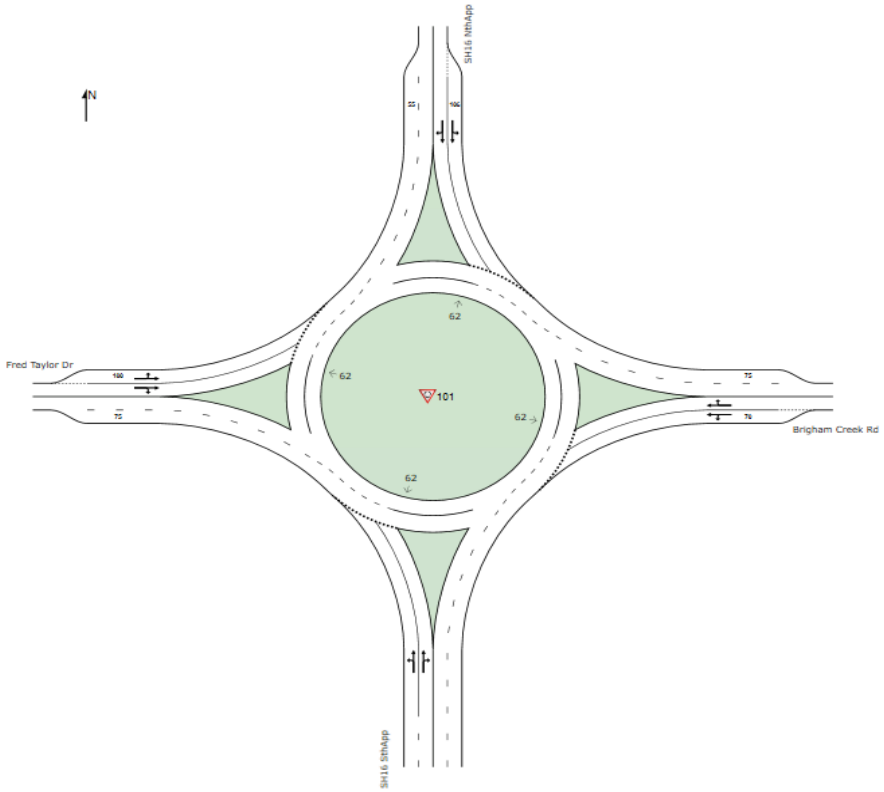
SH16/Brigham Creek Road – all scenarios

SITE LAYOUT

Site: 101 [SH16 2028 Baseline AM (Site Folder: Baseline inc PC86)]

New Site
Site Category: (None)
Roundabout

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



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Project: J:\The Neil Group Limited (TNEGL)\TNEGL-J002 98-102 Totara Road Whenuapai Fast Track Consent\Models\SH16 RA CB Edits.sip9

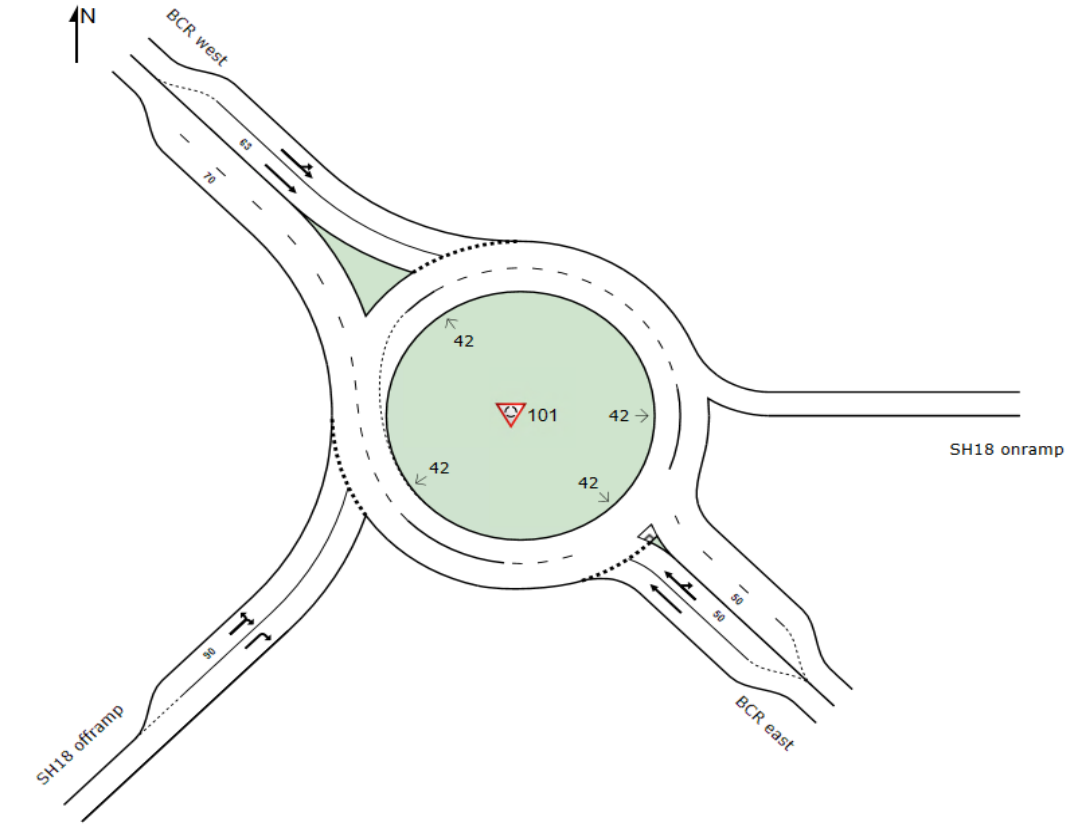
SH18/Brigham Creek Road – all scenarios

SITE LAYOUT

Site: 101 [BCR/SH18 N 2028 baseline AM (Site Folder: Baseline AM)]

2022 base AM
Site Category: (None)
Roundabout

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



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Project: J:\The Neil Group Limited (TNEGL)\TNEGL-J002 98-102 Totara Road Whenuapai Fast Track Consent\Models\SH18 RA CB Edits.sip9

Intersection	Scenario	Peak hour
Brigham Creek Road/Totara Road	Future baseline	AM

MOVEMENT SUMMARY

Site: 101 [2028 Baseline AM (Site Folder: BC - Totara Baseline)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 75 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	31	0.0	31	0.0	0.157	39.2	LOS D	1.1	7.5	0.94	0.71	0.94	27.9
2	T1	All MCs	114	0.0	114	0.0	*0.755	39.5	LOS D	6.0	42.3	1.00	0.92	1.22	28.0
3	R2	All MCs	39	0.0	39	0.0	0.755	44.2	LOS D	6.0	42.3	1.00	0.92	1.22	27.4
Approach			183	0.0	183	0.0	0.755	40.5	LOS D	6.0	42.3	0.99	0.88	1.17	27.9
East: Brigham Creek Road E															
4	L2	All MCs	11	0.0	11	0.0	0.255	25.9	LOS C	3.9	30.5	0.79	0.65	0.79	34.3
5	T1	All MCs	468	15.3	468	15.3	0.642	25.6	LOS C	11.0	86.9	0.88	0.75	0.88	37.7
6	R2	All MCs	105	1.5	105	1.5	*0.724	47.9	LOS D	4.2	29.7	1.00	0.88	1.22	30.3
Approach			584	12.5	584	12.5	0.724	29.6	LOS C	11.0	86.9	0.90	0.77	0.94	36.0
North: Totara Road															
7	L2	All MCs	161	5.9	161	5.9	0.565	37.5	LOS D	5.7	42.0	0.97	0.80	0.97	32.5
8	T1	All MCs	65	0.0	65	0.0	*0.635	32.0	LOS C	7.5	55.1	0.97	0.83	1.01	29.8
9	R2	All MCs	146	8.3	146	8.3	0.635	36.7	LOS D	7.5	55.1	0.97	0.83	1.01	33.2
Approach			372	5.8	372	5.8	0.635	36.2	LOS D	7.5	55.1	0.97	0.82	0.99	32.4
West: Brigham Creek Road W															
10	L2	All MCs	126	10.6	126	10.6	0.128	12.5	LOS B	2.1	16.1	0.49	0.67	0.49	41.7
11	T1	All MCs	384	17.2	384	17.2	*0.715	29.5	LOS C	13.2	105.9	0.95	0.86	1.00	36.6
12	R2	All MCs	3	0.0	3	0.0	0.022	43.1	LOS D	0.1	0.8	0.94	0.62	0.94	27.5
Approach			514	15.5	514	15.5	0.715	25.4	LOS C	13.2	105.9	0.83	0.81	0.87	37.7
All Vehicles			1653	10.5	1653	10.5	0.755	31.0	LOS C	13.2	105.9	0.91	0.81	0.96	34.8

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

* Critical Movement (Signal Timing)

Intersection	Scenario	Peak hour
Brigham Creek Road/Totara Road	Future baseline sensitivity – no Spedding Road link	AM

MOVEMENT SUMMARY

Site: 101 [2028 Baseline AM - No Spedding (Site Folder: BC - Totara Baseline - No Spedding)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 105 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	31	0.0	31	0.0	0.195	55.5	LOS E	1.5	10.6	0.96	0.72	0.96	23.8
2	T1	All MCs	114	0.0	114	0.0	*0.846	58.5	LOS E	8.7	60.7	1.00	0.99	1.31	23.2
3	R2	All MCs	39	0.0	39	0.0	0.846	63.5	LOS E	8.7	60.7	1.00	0.99	1.31	22.9
Approach			183	0.0	183	0.0	0.846	59.1	LOS E	8.7	60.7	0.99	0.95	1.25	23.2
East: Brigham Creek Road E															
4	L2	All MCs	11	0.0	11	0.0	0.323	36.1	LOS D	8.5	66.1	0.69	0.59	0.69	35.0
5	T1	All MCs	838	13.2	838	13.2	*0.813	41.9	LOS D	28.0	217.9	0.86	0.80	0.91	36.3
6	R2	All MCs	105	1.5	105	1.5	*0.760	76.8	LOS E	5.8	41.1	1.00	0.90	1.21	26.8
Approach			953	11.8	953	11.8	0.813	45.6	LOS D	28.0	217.9	0.87	0.81	0.94	34.9
North: Totara Road															
7	L2	All MCs	161	5.9	161	5.9	0.730	56.2	LOS E	8.5	62.7	1.00	0.88	1.12	27.9
8	T1	All MCs	65	0.0	65	0.0	*0.777	50.8	LOS D	11.3	82.8	1.00	0.92	1.15	24.5
9	R2	All MCs	146	8.3	146	8.3	0.777	55.5	LOS E	11.3	82.8	1.00	0.92	1.15	28.4
Approach			372	5.8	372	5.8	0.777	55.0	LOS D	11.3	82.8	1.00	0.90	1.14	27.6
West: Brigham Creek Road W															
10	L2	All MCs	126	10.6	126	10.6	0.113	17.7	LOS B	2.4	18.4	0.40	0.65	0.40	41.9
11	T1	All MCs	643	14.5	643	14.5	0.809	45.0	LOS D	30.0	236.3	0.93	0.88	0.98	35.5
12	R2	All MCs	3	0.0	3	0.0	0.023	69.4	LOS E	0.2	1.1	0.95	0.63	0.95	23.9
Approach			773	13.8	773	13.8	0.809	40.6	LOS D	30.0	236.3	0.85	0.84	0.89	36.4
All Vehicles			2281	10.5	2281	10.5	0.846	46.5	LOS D	30.0	236.3	0.90	0.85	0.98	33.0

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

* Critical Movement (Signal Timing)

Intersection	Scenario	Peak hour
Brigham Creek Road/Totara Road	Future development	AM

MOVEMENT SUMMARY

Site: 101 [2028 Dev AM (Site Folder: BC - Totara with Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	31	0.0	31	0.0	0.167	37.9	LOS D	1.0	7.1	0.95	0.71	0.95	28.4
2	T1	All MCs	120	0.0	120	0.0	*0.839	40.4	LOS D	6.2	43.5	1.00	1.01	1.40	27.7
3	R2	All MCs	39	0.0	39	0.0	0.839	45.2	LOS D	6.2	43.5	1.00	1.01	1.40	27.2
Approach			190	0.0	190	0.0	0.839	41.0	LOS D	6.2	43.5	0.99	0.96	1.33	27.7
East: Brigham Creek Road E															
4	L2	All MCs	11	0.0	11	0.0	0.306	27.7	LOS C	4.0	31.0	0.85	0.69	0.85	33.5
5	T1	All MCs	468	15.3	468	15.3	0.770	29.8	LOS C	11.9	94.1	0.95	0.87	1.05	36.1
6	R2	All MCs	140	1.1	140	1.1	*0.900	52.5	LOS D	5.8	41.3	1.00	1.09	1.63	29.2
Approach			619	11.8	619	11.8	0.900	34.9	LOS C	11.9	94.1	0.96	0.92	1.18	34.3
North: Totara Road															
7	L2	All MCs	251	3.8	251	3.8	0.748	37.2	LOS D	8.9	64.6	1.00	0.90	1.15	32.6
8	T1	All MCs	75	0.0	75	0.0	*0.886	39.8	LOS D	14.1	101.5	1.00	1.09	1.40	27.2
9	R2	All MCs	268	4.5	268	4.5	0.886	44.4	LOS D	14.1	101.5	1.00	1.09	1.40	30.9
Approach			593	3.6	593	3.6	0.886	40.8	LOS D	14.1	101.5	1.00	1.01	1.29	31.2
West: Brigham Creek Road W															
10	L2	All MCs	177	7.6	177	7.6	0.180	12.8	LOS B	3.0	22.1	0.52	0.69	0.52	41.6
11	T1	All MCs	384	17.2	384	17.2	*0.853	37.9	LOS D	14.9	119.9	1.00	1.07	1.28	33.8
12	R2	All MCs	3	0.0	3	0.0	0.020	40.5	LOS D	0.1	0.7	0.94	0.62	0.94	28.4
Approach			564	14.1	564	14.1	0.853	30.1	LOS C	14.9	119.9	0.85	0.95	1.04	35.9
All Vehicles			1966	8.9	1966	8.9	0.900	35.9	LOS D	14.9	119.9	0.94	0.96	1.19	33.2

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

* Critical Movement (Signal Timing)

Intersection	Scenario	Peak hour
Brigham Creek Road/Totara Road	Future development sensitivity – no Spedding Road link	AM

MOVEMENT SUMMARY

Site: 101 [2028 Dev AM - No Spedding (Site Folder: BC - Totara with Development - No Spedding)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 105 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	31	0.0	31	0.0	0.219	57.3	LOS E	1.5	10.8	0.97	0.72	0.97	23.5
2	T1	All MCs	120	0.0	120	0.0	*0.979	81.0	LOS F	10.9	76.0	1.00	1.20	1.70	19.3
3	R2	All MCs	39	0.0	39	0.0	0.979	86.2	LOS F	10.9	76.0	1.00	1.20	1.70	19.1
Approach			190	0.0	190	0.0	0.979	78.2	LOS E	10.9	76.0	1.00	1.12	1.58	19.8
East: Brigham Creek Road E															
4	L2	All MCs	11	0.0	11	0.0	0.371	43.1	LOS D	9.6	74.4	0.75	0.65	0.75	33.3
5	T1	All MCs	838	13.2	838	13.2	*0.934	63.5	LOS E	37.2	289.5	0.92	1.01	1.14	30.8
6	R2	All MCs	140	1.1	140	1.1	*0.900	87.8	LOS F	8.4	59.2	1.00	1.04	1.46	25.4
Approach			988	11.3	988	11.3	0.934	66.7	LOS E	37.2	289.5	0.93	1.01	1.18	29.9
North: Totara Road															
7	L2	All MCs	251	3.8	251	3.8	0.810	55.4	LOS E	13.6	98.3	1.00	0.93	1.17	28.0
8	T1	All MCs	75	0.0	75	0.0	*0.950	68.6	LOS E	22.5	162.3	1.00	1.15	1.45	20.9
9	R2	All MCs	268	4.5	268	4.5	0.950	73.4	LOS E	22.5	162.3	1.00	1.15	1.45	24.9
Approach			593	3.6	593	3.6	0.950	65.2	LOS E	22.5	162.3	1.00	1.06	1.34	25.7
West: Brigham Creek Road W															
10	L2	All MCs	177	7.6	177	7.6	0.155	21.0	LOS C	3.5	25.9	0.42	0.66	0.42	41.8
11	T1	All MCs	643	14.5	643	14.5	0.905	64.9	LOS E	37.5	295.0	1.00	1.08	1.21	30.7
12	R2	All MCs	3	0.0	3	0.0	0.020	71.8	LOS E	0.2	1.1	0.94	0.63	0.94	24.2
Approach			823	13.0	823	13.0	0.905	55.5	LOS E	37.5	295.0	0.87	0.98	1.04	32.5
All Vehicles			2594	9.3	2594	9.3	0.979	63.6	LOS E	37.5	295.0	0.93	1.02	1.20	28.8

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

* Critical Movement (Signal Timing)

Intersection	Scenario	Peak hour
Brigham Creek Road/Totara Road	Future baseline	PM

MOVEMENT SUMMARY

Site: 101 [2028 Baseline PM (Site Folder: BC - Totara Baseline)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 65 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	7	0.0	7	0.0	0.044	35.1	LOS D	0.2	1.6	0.94	0.65	0.94	29.2
2	T1	All MCs	121	0.9	121	0.9	*0.749	35.5	LOS D	4.6	32.4	1.00	0.91	1.26	29.5
3	R2	All MCs	11	0.0	11	0.0	0.749	40.1	LOS D	4.6	32.4	1.00	0.91	1.26	28.9
Approach			139	0.8	139	0.8	0.749	35.8	LOS D	4.6	32.4	1.00	0.90	1.24	29.5
East: Brigham Creek Road E															
4	L2	All MCs	36	0.0	36	0.0	0.314	28.5	LOS C	3.3	26.0	0.88	0.72	0.88	32.6
5	T1	All MCs	375	21.4	375	21.4	*0.792	29.4	LOS C	10.0	82.8	0.97	0.92	1.15	35.5
6	R2	All MCs	155	2.4	155	2.4	*0.802	40.8	LOS D	5.6	39.7	1.00	0.97	1.34	31.5
Approach			566	14.8	566	14.8	0.802	32.5	LOS C	10.0	82.8	0.98	0.92	1.18	34.2
North: Totara Road															
7	L2	All MCs	113	1.9	113	1.9	0.333	30.4	LOS C	3.2	23.0	0.91	0.77	0.91	34.7
8	T1	All MCs	83	0.0	83	0.0	*0.374	24.3	LOS C	4.0	30.1	0.90	0.74	0.90	33.3
9	R2	All MCs	60	18.9	60	18.9	0.374	29.1	LOS C	4.0	30.1	0.90	0.74	0.90	36.1
Approach			256	5.3	256	5.3	0.374	28.1	LOS C	4.0	30.1	0.90	0.75	0.90	34.7
West: Brigham Creek Road W															
10	L2	All MCs	48	11.1	48	11.1	0.054	12.8	LOS B	0.7	5.7	0.51	0.65	0.51	41.6
11	T1	All MCs	268	14.7	268	14.7	0.699	27.7	LOS C	8.5	66.9	0.98	0.88	1.07	36.2
12	R2	All MCs	7	0.0	7	0.0	0.037	33.7	LOS C	0.2	1.5	0.92	0.65	0.92	29.6
Approach			324	13.8	324	13.8	0.699	25.6	LOS C	8.5	66.9	0.91	0.84	0.98	36.8
All Vehicles			1284	11.2	1284	11.2	0.802	30.3	LOS C	10.0	82.8	0.95	0.87	1.08	34.5

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

* Critical Movement (Signal Timing)

Intersection	Scenario	Peak hour
Brigham Creek Road/Totara Road	Future baseline sensitivity – no Spedding Road link	PM

MOVEMENT SUMMARY

Site: 101 [2028 Baseline PM - No Spedding (Site Folder: BC - Totara Baseline - No Spedding)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 85 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	7	0.0	7	0.0	0.049	45.2	LOS D	0.3	2.1	0.95	0.66	0.95	26.2
2	T1	All MCs	121	0.9	121	0.9	*0.840	49.0	LOS D	6.2	43.5	1.00	0.99	1.38	25.6
3	R2	All MCs	11	0.0	11	0.0	0.840	53.7	LOS D	6.2	43.5	1.00	0.99	1.38	25.1
Approach			139	0.8	139	0.8	0.840	49.2	LOS D	6.2	43.5	1.00	0.97	1.36	25.6
East: Brigham Creek Road E															
4	L2	All MCs	36	0.0	36	0.0	0.311	27.8	LOS C	5.9	46.4	0.77	0.66	0.77	33.9
5	T1	All MCs	585	17.7	585	17.7	*0.784	35.4	LOS D	17.3	139.5	0.91	0.85	0.98	36.0
6	R2	All MCs	155	2.4	155	2.4	*0.816	60.6	LOS E	7.1	51.0	1.00	0.96	1.30	28.9
Approach			776	13.8	776	13.8	0.816	40.1	LOS D	17.3	139.5	0.92	0.86	1.04	34.3
North: Totara Road															
7	L2	All MCs	113	1.9	113	1.9	0.402	40.9	LOS D	4.4	31.1	0.95	0.78	0.95	31.5
8	T1	All MCs	83	0.0	83	0.0	*0.457	34.9	LOS C	5.5	41.2	0.94	0.77	0.94	29.3
9	R2	All MCs	60	18.9	60	18.9	0.457	39.7	LOS D	5.5	41.2	0.94	0.77	0.94	32.7
Approach			256	5.3	256	5.3	0.457	38.7	LOS D	5.5	41.2	0.94	0.77	0.94	31.2
West: Brigham Creek Road W															
10	L2	All MCs	48	11.1	48	11.1	0.047	12.1	LOS B	0.8	6.2	0.43	0.63	0.43	41.9
11	T1	All MCs	469	13.2	469	13.2	0.744	35.9	LOS D	17.9	139.4	0.94	0.86	0.98	36.2
12	R2	All MCs	7	0.0	7	0.0	0.038	50.5	LOS D	0.3	2.0	0.92	0.66	0.92	26.9
Approach			525	12.8	525	12.8	0.744	33.9	LOS C	17.9	139.4	0.89	0.83	0.93	36.6
All Vehicles			1696	11.2	1696	11.2	0.840	38.7	LOS D	17.9	139.5	0.92	0.85	1.02	33.8

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

* Critical Movement (Signal Timing)

Intersection	Scenario	Peak hour
Brigham Creek Road/Totara Road	Future development	PM

MOVEMENT SUMMARY

Site: 101 [2028 Dev PM (Site Folder: BC - Totara with Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

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

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	7	0.0	7	0.0	0.047	38.0	LOS D	0.2	1.7	0.94	0.65	0.94	28.3
2	T1	All MCs	128	0.8	128	0.8	*0.851	41.7	LOS D	5.5	38.7	1.00	1.01	1.46	27.6
3	R2	All MCs	11	0.0	11	0.0	0.851	46.3	LOS D	5.5	38.7	1.00	1.01	1.46	27.1
Approach			146	0.7	146	0.7	0.851	41.8	LOS D	5.5	38.7	1.00	1.00	1.44	27.6
East: Brigham Creek Road E															
4	L2	All MCs	36	0.0	36	0.0	0.321	30.4	LOS C	3.6	28.4	0.89	0.72	0.89	31.9
5	T1	All MCs	375	21.4	375	21.4	*0.807	32.6	LOS C	10.8	89.4	0.97	0.94	1.16	34.6
6	R2	All MCs	232	1.6	232	1.6	*0.818	42.1	LOS D	8.8	62.7	1.00	0.98	1.29	31.4
Approach			643	13.1	643	13.1	0.818	35.9	LOS D	10.8	89.4	0.98	0.94	1.19	33.3
North: Totara Road															
7	L2	All MCs	155	1.4	155	1.4	0.492	34.1	LOS C	5.0	35.6	0.95	0.79	0.95	33.5
8	T1	All MCs	86	0.0	86	0.0	*0.574	28.4	LOS C	6.6	48.6	0.95	0.80	0.95	31.3
9	R2	All MCs	120	9.5	120	9.5	0.574	33.1	LOS C	6.6	48.6	0.95	0.80	0.95	34.5
Approach			361	3.7	361	3.7	0.574	32.4	LOS C	6.6	48.6	0.95	0.80	0.95	33.4
West: Brigham Creek Road W															
10	L2	All MCs	139	3.9	139	3.9	0.154	14.8	LOS B	2.6	18.5	0.57	0.69	0.57	40.7
11	T1	All MCs	268	14.7	268	14.7	0.702	29.7	LOS C	9.1	71.7	0.98	0.88	1.07	35.5
12	R2	All MCs	7	0.0	7	0.0	0.026	32.0	LOS C	0.2	1.5	0.87	0.65	0.87	30.2
Approach			414	10.8	414	10.8	0.702	24.8	LOS C	9.1	71.7	0.84	0.81	0.90	37.0
All Vehicles			1565	9.2	1565	9.2	0.851	32.7	LOS C	10.8	89.4	0.94	0.88	1.08	33.8

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

* Critical Movement (Signal Timing)

Intersection	Scenario	Peak hour
Brigham Creek Road/Totara Road	Future development sensitivity – no Spedding Road link	PM

MOVEMENT SUMMARY

Site: 101 [2028 Dev PM - No Spedding (Site Folder: BC - Totara with Development - No Spedding)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 90 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	7	0.0	7	0.0	0.045	46.7	LOS D	0.3	2.1	0.94	0.66	0.94	25.8
2	T1	All MCs	128	0.8	128	0.8	*0.820	50.2	LOS D	6.8	47.6	1.00	0.97	1.31	25.3
3	R2	All MCs	11	0.0	11	0.0	0.820	54.9	LOS D	6.8	47.6	1.00	0.97	1.31	24.9
Approach			146	0.7	146	0.7	0.820	50.3	LOS D	6.8	47.6	1.00	0.95	1.29	25.3
East: Brigham Creek Road E															
4	L2	All MCs	36	0.0	36	0.0	0.348	32.1	LOS C	6.8	53.9	0.80	0.69	0.80	32.6
5	T1	All MCs	585	17.7	585	17.7	*0.877	46.8	LOS D	20.9	168.9	0.94	0.97	1.13	33.0
6	R2	All MCs	232	1.6	232	1.6	*0.890	68.7	LOS E	12.0	85.0	1.00	1.04	1.40	27.7
Approach			853	12.6	853	12.6	0.890	52.2	LOS D	20.9	168.9	0.95	0.98	1.19	31.3
North: Totara Road															
7	L2	All MCs	155	1.4	155	1.4	0.584	44.9	LOS D	6.6	47.0	0.98	0.80	0.98	30.5
8	T1	All MCs	86	0.0	86	0.0	*0.689	40.5	LOS D	9.0	66.2	0.99	0.86	1.06	27.3
9	R2	All MCs	120	9.5	120	9.5	0.689	45.2	LOS D	9.0	66.2	0.99	0.86	1.06	31.0
Approach			361	3.7	361	3.7	0.689	43.9	LOS D	9.0	66.2	0.99	0.84	1.03	30.0
West: Brigham Creek Road W															
10	L2	All MCs	139	3.9	139	3.9	0.136	14.3	LOS B	2.8	20.4	0.50	0.67	0.50	40.9
11	T1	All MCs	469	13.2	469	13.2	0.789	43.3	LOS D	20.1	156.6	0.97	0.92	1.05	34.5
12	R2	All MCs	7	0.0	7	0.0	0.028	51.3	LOS D	0.3	2.0	0.88	0.65	0.88	27.4
Approach			616	10.9	616	10.9	0.789	36.9	LOS D	20.1	156.6	0.86	0.86	0.93	35.7
All Vehicles			1977	9.6	1977	9.6	0.890	45.8	LOS D	20.9	168.9	0.93	0.91	1.09	31.9

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

* Critical Movement (Signal Timing)

Intersection	Scenario	Peak hour
SH16/Brigham Creek Road	Future baseline	AM

MOVEMENT SUMMARY

Site: 101 [SH16 2028 Baseline AM (Site Folder: Baseline inc PC86)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: SH16 SthApp															
1	L2	All MCs	87	10.1	87	10.1	0.350	8.2	LOS A	2.4	17.8	0.79	0.68	0.79	61.2
2	T1	All MCs	485	5.9	485	5.9	0.508	9.0	LOS A	4.6	33.7	0.84	0.70	0.86	60.8
3	R2	All MCs	250	2.6	250	2.6	0.508	16.7	LOS B	4.6	33.7	0.87	0.71	0.91	59.0
Approach			821	5.3	821	5.3	0.508	11.3	LOS B	4.6	33.7	0.84	0.70	0.87	60.3
East: Brigham Creek Rd															
4	L2	All MCs	567	4.1	567	4.1	1.428	406.0	LOS F	113.8	824.2	1.00	4.58	14.82	8.2
5	T1	All MCs	394	1.4	394	1.4	1.774	712.4	LOS F	278.3	2005.7	1.00	7.54	24.50	5.2
6	R2	All MCs	600	4.8	600	4.8	1.774	720.2	LOS F	278.3	2005.7	1.00	7.54	24.50	5.2
Approach			1562	3.7	1562	3.7	1.774	604.2	LOS F	278.3	2005.7	1.00	6.47	20.99	6.0
North: SH16 NthApp															
7	L2	All MCs	593	5.5	593	5.5	0.709	12.0	LOS B	10.1	74.2	0.79	0.81	1.00	60.5
8	T1	All MCs	654	4.7	654	4.7	0.709	15.1	LOS B	10.1	74.2	0.80	0.86	1.08	58.4
9	R2	All MCs	77	9.1	77	9.1	0.709	23.5	LOS C	9.9	72.4	0.81	0.87	1.11	55.4
Approach			1324	5.3	1324	5.3	0.709	14.2	LOS B	10.1	74.2	0.80	0.84	1.05	59.1
West: Fred Taylor Dr															
10	L2	All MCs	62	7.1	62	7.1	0.200	13.5	LOS B	0.8	6.3	0.75	0.85	0.75	59.0
11	T1	All MCs	41	12.8	41	12.8	0.252	11.7	LOS B	1.2	8.9	0.76	0.86	0.76	56.6
12	R2	All MCs	78	0.4	78	0.4	0.252	19.2	LOS B	1.2	8.9	0.76	0.86	0.76	57.5
Approach			181	5.5	181	5.5	0.252	15.5	LOS B	1.2	8.9	0.76	0.86	0.76	57.8
All Vehicles			3888	4.7	3888	4.7	1.774	250.6	LOS F	278.3	2005.7	0.89	3.07	9.01	12.9

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

Intersection	Scenario	Peak hour
SH16/Brigham Creek Road	Future development	AM

MOVEMENT SUMMARY

Site: 101 [SH16 2028 Dev AM (Site Folder: With Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: SH16 SthApp															
1	L2	All MCs	87	10.1	87	10.1	0.364	8.2	LOS A	2.5	18.6	0.79	0.68	0.79	61.1
2	T1	All MCs	485	5.9	485	5.9	0.528	9.1	LOS A	5.0	36.1	0.84	0.70	0.88	60.7
3	R2	All MCs	288	2.2	288	2.2	0.528	16.9	LOS B	5.0	36.1	0.88	0.72	0.94	58.9
Approach			860	5.1	860	5.1	0.528	11.6	LOS B	5.0	36.1	0.85	0.71	0.89	60.1
East: Brigham Creek Rd															
4	L2	All MCs	656	3.5	656	3.5	1.660	612.8	LOS F	169.7	1223.8	1.00	5.66	19.03	5.6
5	T1	All MCs	394	1.4	394	1.4	1.804	739.7	LOS F	286.3	2063.1	1.00	7.62	24.80	5.1
6	R2	All MCs	609	4.8	609	4.8	1.804	747.5	LOS F	286.3	2063.1	1.00	7.62	24.80	5.0
Approach			1659	3.5	1659	3.5	1.804	692.4	LOS F	286.3	2063.1	1.00	6.85	22.52	5.2
North: SH16 NthApp															
7	L2	All MCs	596	5.5	596	5.5	0.743	13.9	LOS B	11.7	85.8	0.83	0.88	1.14	58.8
8	T1	All MCs	654	4.7	654	4.7	0.743	17.4	LOS B	11.7	85.8	0.84	0.92	1.23	56.5
9	R2	All MCs	77	9.1	77	9.1	0.743	25.9	LOS C	11.3	82.3	0.85	0.93	1.26	53.6
Approach			1327	5.3	1327	5.3	0.743	16.3	LOS B	11.7	85.8	0.84	0.90	1.19	57.3
West: Fred Taylor Dr															
10	L2	All MCs	62	7.1	62	7.1	0.206	13.7	LOS B	0.9	6.5	0.75	0.86	0.75	58.8
11	T1	All MCs	41	12.8	41	12.8	0.260	11.9	LOS B	1.3	9.2	0.77	0.86	0.77	56.4
12	R2	All MCs	78	0.4	78	0.4	0.260	19.4	LOS B	1.3	9.2	0.78	0.86	0.78	57.4
Approach			181	5.5	181	5.5	0.260	15.7	LOS B	1.3	9.2	0.77	0.86	0.77	57.6
All Vehicles			4027	4.5	4027	4.5	1.804	293.8	LOS F	286.3	2063.1	0.90	3.31	9.89	11.3

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

Intersection	Scenario	Peak hour
SH16/Brigham Creek Road	Future baseline	PM

MOVEMENT SUMMARY

Site: 101 [SH16 2028 Baseline AM - Lane Upgrades (Site Folder: Baseline inc PC86)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: SH16 SthApp															
1	L2	All MCs	87	10.1	87	10.1	0.440	7.6	LOS A	3.7	27.1	0.84	0.64	0.84	60.6
2	T1	All MCs	485	5.9	485	5.9	0.440	8.5	LOS A	3.7	27.1	0.84	0.66	0.85	61.2
3	R2	All MCs	250	2.6	250	2.6	0.440	17.0	LOS B	3.3	23.9	0.83	0.75	0.86	58.1
Approach			821	5.3	821	5.3	0.440	11.0	LOS B	3.7	27.1	0.84	0.69	0.85	60.2
East: Brigham Creek Rd															
4	L2	All MCs	567	4.1	567	4.1	1.419	396.9	LOS F	112.2	813.2	1.00	4.55	14.71	8.3
5	T1	All MCs	394	1.4	394	1.4	1.763	701.2	LOS F	276.1	1989.7	1.00	7.53	24.45	5.3
6	R2	All MCs	600	4.8	600	4.8	1.763	709.0	LOS F	276.1	1989.7	1.00	7.53	24.45	5.3
Approach			1562	3.7	1562	3.7	1.763	593.7	LOS F	276.1	1989.7	1.00	6.45	20.92	6.1
North: SH16 NthApp															
7	L2	All MCs	593	5.5	593	5.5	0.701	11.2	LOS B	9.4	68.6	0.76	0.80	0.96	61.2
8	T1	All MCs	654	4.7	654	4.7	0.701	14.3	LOS B	9.4	68.6	0.78	0.85	1.04	59.1
9	R2	All MCs	77	9.1	77	9.1	0.701	22.8	LOS C	9.2	67.4	0.78	0.86	1.07	56.0
Approach			1324	5.3	1324	5.3	0.701	13.4	LOS B	9.4	68.6	0.77	0.83	1.00	59.8
West: Fred Taylor Dr															
10	L2	All MCs	62	7.1	62	7.1	0.205	9.4	LOS A	0.9	6.9	0.72	0.79	0.72	62.4
11	T1	All MCs	41	12.8	41	12.8	0.205	10.3	LOS B	0.9	6.9	0.72	0.79	0.72	61.7
12	R2	All MCs	78	0.4	78	0.4	0.242	21.0	LOS C	1.0	6.8	0.74	0.92	0.74	54.5
Approach			181	5.5	181	5.5	0.242	14.6	LOS B	1.0	6.9	0.72	0.85	0.72	58.4
All Vehicles			3888	4.7	3888	4.7	1.763	246.1	LOS F	276.1	1989.7	0.87	3.06	8.96	13.1

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

Intersection	Scenario	Peak hour
SH16/Brigham Creek Road	Future development	PM

MOVEMENT SUMMARY

Site: 101 [SH16 2028 Dev PM (Site Folder: With Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: SH16 SthApp															
1	L2	All MCs	96	22.2	96	22.2	0.670	12.6	LOS B	7.0	53.3	0.93	0.86	1.20	57.1
2	T1	All MCs	1041	6.7	1041	6.7	0.973	26.5	LOS C	34.8	252.6	0.97	1.30	2.12	49.6
3	R2	All MCs	465	1.4	465	1.4	0.973	42.6	LOS D	34.8	252.6	1.00	1.62	2.78	43.9
Approach			1602	6.1	1602	6.1	0.973	30.4	LOS C	34.8	252.6	0.98	1.37	2.25	48.1
East: Brigham Creek Rd															
4	L2	All MCs	335	10.0	335	10.0	1.000	64.8	LOS E	16.8	127.5	1.00	1.62	3.43	32.2
5	T1	All MCs	104	0.2	104	0.2	1.259	253.6	LOS F	88.2	694.9	1.00	3.99	11.59	13.0
6	R2	All MCs	508	17.6	508	17.6	1.259	261.8	LOS F	88.2	694.9	1.00	3.99	11.59	12.8
Approach			947	13.0	947	13.0	1.259	191.2	LOS F	88.2	694.9	1.00	3.15	8.71	16.0
North: SH16 NthApp															
7	L2	All MCs	661	6.7	661	6.7	0.958	41.6	LOS D	34.9	263.3	1.00	1.49	2.68	40.9
8	T1	All MCs	736	17.0	736	17.0	0.958	48.1	LOS D	34.9	263.3	1.00	1.51	2.77	38.0
9	R2	All MCs	115	22.2	115	22.2	0.958	57.9	LOS E	31.1	251.4	1.00	1.51	2.81	36.2
Approach			1512	12.9	1512	12.9	0.958	46.0	LOS D	34.9	263.3	1.00	1.50	2.74	39.0
West: Fred Taylor Dr															
10	L2	All MCs	20	1.5	20	1.5	0.176	31.9	LOS C	0.8	5.6	0.92	0.96	0.92	47.3
11	T1	All MCs	1	45.5	1	45.5	0.170	22.3	LOS C	1.0	6.8	0.94	0.94	0.94	44.3
12	R2	All MCs	34	0.6	34	0.6	0.170	30.2	LOS C	1.0	6.8	0.94	0.94	0.94	48.6
Approach			55	1.8	55	1.8	0.176	30.7	LOS C	1.0	6.8	0.93	0.95	0.93	48.0
All Vehicles			4115	10.1	4115	10.1	1.259	73.1	LOS F	88.2	694.9	0.99	1.82	3.90	31.1

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

Intersection	Scenario	Peak hour
SH18/Brigham Creek Road	Future baseline	AM

MOVEMENT SUMMARY

Site: 101 [BCR/SH18 N 2028 baseline AM (Site Folder: Baseline AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

2022 base AM
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: BCR east															
22	T1	All MCs	487	4.8	487	4.8	0.240	1.1	LOS A	0.0	0.0	0.00	0.27	0.00	47.3
23b	R3	All MCs	196	0.0	196	0.0	0.240	8.5	LOS A	0.0	0.0	0.00	0.40	0.00	45.2
Approach			683	3.4	683	3.4	0.240	3.2	LOS A	0.0	0.0	0.00	0.31	0.00	46.6
NorthWest: BCR west															
27a	L1	All MCs	324	19.1	324	19.1	0.372	3.0	LOS A	1.8	14.8	0.60	0.42	0.60	47.1
28	T1	All MCs	203	5.7	203	5.7	0.372	3.3	LOS A	1.8	14.8	0.57	0.42	0.57	45.4
Approach			527	14.0	527	14.0	0.372	3.1	LOS A	1.8	14.8	0.59	0.42	0.59	46.6
SouthWest: SH18 offramp															
30	L2	All MCs	316	0.7	316	0.7	0.426	4.2	LOS A	2.1	15.3	0.57	0.65	0.59	45.8
32	R2	All MCs	454	4.5	454	4.5	0.426	10.1	LOS B	2.1	15.3	0.56	0.69	0.57	42.0
Approach			770	2.9	770	2.9	0.426	7.7	LOS A	2.1	15.3	0.56	0.67	0.58	43.9
All Vehicles			1981	6.0	1981	6.0	0.426	4.9	LOS A	2.1	15.3	0.38	0.48	0.38	45.5

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

Intersection	Scenario	Peak hour
SH18/Brigham Creek Road	Future development	AM

MOVEMENT SUMMARY

Site: 101 [BCR/SH18 N 2028 dev AM (Site Folder: With PC Development AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

2022 base AM
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: BCR east															
22	T1	All MCs	516	4.5	516	4.5	0.250	1.1	LOS A	0.0	0.0	0.00	0.27	0.00	47.3
23b	R3	All MCs	196	0.0	196	0.0	0.250	8.5	LOS A	0.0	0.0	0.00	0.39	0.00	45.3
Approach			712	3.3	712	3.3	0.250	3.1	LOS A	0.0	0.0	0.00	0.30	0.00	46.7
NorthWest: BCR west															
27a	L1	All MCs	393	15.8	393	15.8	0.417	3.1	LOS A	2.2	17.4	0.62	0.45	0.64	47.0
28	T1	All MCs	203	5.7	203	5.7	0.417	3.5	LOS A	2.2	17.4	0.57	0.44	0.58	45.3
Approach			596	12.4	596	12.4	0.417	3.3	LOS A	2.2	17.4	0.60	0.45	0.62	46.6
SouthWest: SH18 offramp															
30	L2	All MCs	316	0.7	316	0.7	0.430	4.4	LOS A	2.2	15.7	0.58	0.66	0.61	45.7
32	R2	All MCs	454	4.5	454	4.5	0.430	10.2	LOS B	2.2	15.7	0.57	0.70	0.58	42.0
Approach			770	2.9	770	2.9	0.430	7.8	LOS A	2.2	15.7	0.57	0.68	0.59	43.9
All Vehicles			2078	5.7	2078	5.7	0.430	4.9	LOS A	2.2	17.4	0.38	0.49	0.40	45.5

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

Intersection	Scenario	Peak hour
SH18/Brigham Creek Road	Future development sensitivity – redirect from SH16/BCR	AM

MOVEMENT SUMMARY

Site: 101 [BCR/SH18 N 2028 dev AM + SH16 (Site Folder: With PC Development AM - Redirect from SH16)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

2022 base AM
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: BCR east															
22	T1	All MCs	516	4.5	516	4.5	0.250	1.1	LOS A	0.0	0.0	0.00	0.27	0.00	47.3
23b	R3	All MCs	196	0.0	196	0.0	0.250	8.5	LOS A	0.0	0.0	0.00	0.39	0.00	45.3
Approach			712	3.3	712	3.3	0.250	3.1	LOS A	0.0	0.0	0.00	0.30	0.00	46.7
NorthWest: BCR west															
27a	L1	All MCs	393	15.8	393	15.8	0.721	5.8	LOS A	6.5	49.8	0.79	0.82	1.04	46.2
28	T1	All MCs	656	5.9	656	5.9	0.721	5.1	LOS A	6.5	49.8	0.71	0.68	0.86	44.5
Approach			1049	9.6	1049	9.6	0.721	5.4	LOS A	6.5	49.8	0.74	0.73	0.93	45.4
SouthWest: SH18 offramp															
30	L2	All MCs	316	0.7	316	0.7	0.430	4.4	LOS A	2.2	15.7	0.58	0.66	0.61	45.7
32	R2	All MCs	454	4.5	454	4.5	0.430	10.4	LOS B	2.2	15.7	0.57	0.70	0.58	42.0
Approach			770	2.9	770	2.9	0.430	7.9	LOS A	2.2	15.7	0.57	0.68	0.59	43.9
All Vehicles			2531	5.8	2531	5.8	0.721	5.5	LOS A	6.5	49.8	0.48	0.60	0.56	45.2

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

Intersection	Scenario	Peak hour
SH18/Brigham Creek Road	Future baseline	PM

MOVEMENT SUMMARY

Site: 101 [BCR/SH18 N 2028 baseline PM (Site Folder: Baseline PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

2022 base AM
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: BCR east															
22	T1	All MCs	447	13.8	447	13.8	0.195	1.1	LOS A	0.0	0.0	0.00	0.20	0.00	48.2
23b	R3	All MCs	73	33.8	73	33.8	0.195	8.7	LOS A	0.0	0.0	0.00	0.25	0.00	46.4
Approach			520	16.6	520	16.6	0.195	2.2	LOS A	0.0	0.0	0.00	0.21	0.00	47.9
NorthWest: BCR west															
27a	L1	All MCs	160	9.9	160	9.9	0.385	3.6	LOS A	2.1	15.3	0.70	0.48	0.73	46.5
28	T1	All MCs	342	0.8	342	0.8	0.385	4.0	LOS A	2.1	15.3	0.68	0.49	0.70	44.7
Approach			502	3.7	502	3.7	0.385	3.9	LOS A	2.1	15.3	0.69	0.49	0.71	45.5
SouthWest: SH18 offramp															
30	L2	All MCs	263	1.4	263	1.4	0.591	4.9	LOS A	4.0	28.5	0.61	0.73	0.71	44.9
32	R2	All MCs	874	0.8	874	0.8	0.591	10.4	LOS B	4.0	28.5	0.59	0.72	0.65	41.8
Approach			1136	1.0	1136	1.0	0.591	9.2	LOS A	4.0	28.5	0.59	0.73	0.66	42.7
All Vehicles			2158	5.4	2158	5.4	0.591	6.2	LOS A	4.0	28.5	0.47	0.55	0.51	44.4

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

Intersection	Scenario	Peak hour
SH18/Brigham Creek Road	Future development	PM

MOVEMENT SUMMARY

Site: 101 [BCR/SH18 N 2028 dev PM (Site Folder: With PC Development PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

2022 base AM
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: BCR east															
22	T1	All MCs	506	12.2	506	12.2	0.215	1.1	LOS A	0.0	0.0	0.00	0.19	0.00	48.3
23b	R3	All MCs	73	33.8	73	33.8	0.215	8.7	LOS A	0.0	0.0	0.00	0.24	0.00	46.5
Approach			579	14.9	579	14.9	0.215	2.1	LOS A	0.0	0.0	0.00	0.20	0.00	48.0
NorthWest: BCR west															
27a	L1	All MCs	199	7.9	199	7.9	0.417	3.7	LOS A	2.4	17.3	0.72	0.52	0.77	46.5
28	T1	All MCs	342	0.8	342	0.8	0.417	4.2	LOS A	2.4	17.3	0.69	0.52	0.72	44.7
Approach			541	3.4	541	3.4	0.417	4.0	LOS A	2.4	17.3	0.70	0.52	0.74	45.5
SouthWest: SH18 offramp															
30	L2	All MCs	263	1.4	263	1.4	0.603	5.2	LOS A	4.2	29.9	0.64	0.77	0.76	44.7
32	R2	All MCs	874	0.8	874	0.8	0.603	10.8	LOS B	4.2	29.9	0.61	0.75	0.69	41.6
Approach			1136	1.0	1136	1.0	0.603	9.5	LOS A	4.2	29.9	0.62	0.76	0.71	42.5
All Vehicles			2256	5.1	2256	5.1	0.603	6.3	LOS A	4.2	29.9	0.48	0.56	0.53	44.4

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

Intersection	Scenario	Peak hour
SH18/Brigham Creek Road	Future development sensitivity – redirect from SH16/BCR	PM

MOVEMENT SUMMARY

Site: 101 [BCR/SH18 N 2028 dev PM + SH16 (Site Folder: With PC Development PM - Redirect from SH16)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

2022 base AM
Site Category: (None)
Roundabout

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: BCR east															
22	T1	All MCs	506	12.2	506	12.2	0.215	1.8	LOS A	0.0	0.0	0.00	0.19	0.00	48.3
23b	R3	All MCs	73	33.8	73	33.8	0.215	8.7	LOS A	0.0	0.0	0.00	0.24	0.00	46.5
Approach			579	14.9	579	14.9	0.215	2.7	LOS A	0.0	0.0	0.00	0.20	0.00	48.0
NorthWest: BCR west															
27a	L1	All MCs	199	7.9	199	7.9	0.430	3.8	LOS A	2.6	18.6	0.74	0.53	0.80	46.4
28	T1	All MCs	342	0.8	342	0.8	0.430	4.3	LOS A	2.6	18.6	0.71	0.53	0.75	44.5
Approach			541	3.4	541	3.4	0.430	4.1	LOS A	2.6	18.6	0.72	0.53	0.77	45.4
SouthWest: SH18 offramp															
30	L2	All MCs	716	0.5	716	0.5	0.840	9.0	LOS A	10.8	76.0	0.82	1.02	1.28	43.6
32	R2	All MCs	874	0.8	874	0.8	0.840	13.0	LOS B	10.8	76.0	0.72	0.90	0.99	40.4
Approach			1590	0.7	1590	0.7	0.840	11.2	LOS B	10.8	76.0	0.77	0.95	1.12	42.1
All Vehicles			2709	4.3	2709	4.3	0.840	8.0	LOS A	10.8	76.0	0.59	0.71	0.81	43.7

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

Appendix C.
Clause 23 responses – 8 August 2024

Whenuapai Green Plan Change

Clause 23 transport responses

Prepared for	Neil Construction Ltd
Project Number	TNEGL-J002
Revision	B
Issue Date	8 August 2024
Prepared by	Mat Collins, Associate Transportation Engineer; Chris Blackmore, Principal Transportation Planner
Reviewed by	Dave Smith, Technical Director - Transportation Planning

Summary

Neil Construction Limited (NCL) commissioned Abley Limited (Abley) to prepare an Integrated Transportation Assessment (ITA) report with respect to a Plan Change at 98-102 Totara Road, Whenuapai in Auckland (the site). The proposal is to rezone the site from Future Urban Zone (FUZ) to Residential – Mixed Housing Urban (MHU) zone and apply a Precinct across the site to guide future development (the Plan Change).

This technical note provides Abley's responses to Auckland Council (Council) and Auckland Transport (AT) Clause 23 requests for information (RFIs) and comments. In preparing this technical note, we have referred to the following documents:

- Whenuapai Green ITA, prepared by Abley, dated 1 February 2024
- Proposed Private Plan Change - Whenuapai Green - Transport - Clause 23 further information assessment, prepared by Auckland Transport, dated 2 May 2024
- Transport RFIs, prepared by Flow Transportation on behalf of Council, undated.

Where new or updated assessment of transport effects is provided in this technical note, it supersedes assessment presented in our ITA. As a result of the additional assessment, we make the following recommendations:

- We have undertaken further assessment of cumulative traffic effects and determined that the following upgrades should be provided prior to any dwellings being occupied within the site. Refer to our discussion in Section 1.6.
  - Lane marking improvements at Brigham Creek Road and Tōtara Road, to provide a shared through/left lane on the western approach.
  - Brigham Creek Road/Trig Road intersection. Upgrade to a roundabout, in the form proposed by Whenuapai Business Park.
- That the 15m local road cross section contained in **Appendix 1 – Road Function and Design Element Table** of the draft Precinct provisions be removed. Refer to our discussion in Section 2.6.

Contents

Tables

Figures

Appendices

Appendix A. SIDRA outputs incl. Signal phasing and Pedestrian LOS outputs

Appendix B. Tōtara Road / Dale Road / McCaw Avenue intersection concept design

1. Council RFIs

For each Council RFI we have reproduced the request from Council in a separate subsection and provided our response.

1.1 Staging plan

Specific request	Reason for the request
Please provide staging plan of the development and indicative timing.	A staging plan is required to understand how the development may be constructed over time, and how long this may realistically occur over. We note that I1.6.6(a) refers to stages at a high level, but detail is not provided.

Abley response

Geographical staging is not proposed at a Precinct level, this will be determined as part of future resource consent applications for the site. I1.6.6(a) requires that road widening as shown on Precinct Plan 1 must be constructed along all parts of Totara Road that adjoin a particular stage. Regarding Standard I1.6.6(b), these upgrades are not affected by how NCL choose to stage development within the Precinct boundary:

- McCaw Ave / Dale Road / Tōtara Road roundabout: the intersection is at the southern end of the site, and all southbound traffic generated by the site will travel through this intersection, regardless of where development is located within the site.
- Tōtara Road and proposed internal northern road roundabout: the intersection is at the northern end of the site, and can be formed when the northern access to Totara Road is formed.
- Lane marking improvements at Brigham Creek Road and Tōtara Road: the intersection is remote from the site, and all southbound traffic generated by the site will travel through this intersection, regardless of where development is located within the site.

1.2 Precinct provision transport trigger point

Specific request	Reason for the request
Please provide justification of the 150 residential unit trigger point in I1.6.6(b) of the Precinct Provisions.	I1.6.6(b) of the Precinct Provisions provide a trigger point of 150 residential units, where several transport infrastructure upgrades must be provided if it is exceeded. These upgrades would not be required if there are 150 or fewer residential units. This trigger point is not discussed in the ITA report, so it is not clear how this was determined.

Abley response

Regarding the McCaw Ave / Dale Road / Tōtara Road roundabout, Section 6.6. of the ITA discusses this matter. The upgrade of this intersection to a roundabout is not being driven by a need to mitigate adverse safety or efficiency effects, it was an upgrade agreed upon between NCL and AT during the previous Fast Track application for the site, and we consider that this is a “value add” upgrade that generates positive transport safety and efficiency effects.

Regarding the Tōtara Road and the proposed internal northern road, forming this as a roundabout is not being driven by a need to mitigate adverse safety or efficiency effects, it was an intersection form agreed upon between NCL and AT during the previous Fast Track application for the site, and we

consider that this is a “value add” upgrade that generates positive transport safety and efficiency effects.

We have undertaken further assessment of cumulative traffic effects and determined that the following upgrades should be provided prior to any dwellings being occupied within the site. Refer to our further discussion in Section 1.6.

- Lane marking improvements at Brigham Creek Road and Tōtara Road, to provide a shared through/left lane on the western approach.
- Brigham Creek Road/Trig Road intersection. Upgrade to a roundabout prior to any development, to mitigate cumulative effects from Whenuapai Business Park and Whenuapai Green.

1.3 Assessment of stages

Specific request	Reason for the request
Along with staging plans, please provide assessment of transport effects at key stages, including traffic modelling of intersections, as relevant.	The traffic modelling has assumed a 2028 year. If the development staging plan extends past 2028, please assess these for realistic timeframes (ie considering when development is likely to be occupied), including identifying measures to avoid, remedy or mitigate any adverse effects of proposed activities.

Abley response

Staging is not proposed, other than as recommended in this technical note.

In terms of the modelling methodology, in our opinion, the SGA SATURN model for the year 2028 represents a very conservative basis for the assessment of transport effects generated by the Plan Change.

The SGA SATURN model is based on the i11.5 land use forecast, which includes assumptions about population, household, and employment for model zones in Whenuapai (see Figure 1.1 and Table 1.1 to Table 1.3). The i11.5 forecast is derived from the Future Urban Land Supply Strategy (FULSS), now replaced by the Council’s Future Development Strategy (FDS). Our ITA’s Section 8 discusses the FDS and notes that it projects a longer timeframe for urbanisation in Whenuapai compared to the FULSS. Consequently, the SGA SATURN model's forecast does not align with the Council’s current projections.

Additionally, the SGA SATURN model relies on anticipated development rather than enabled development, creating an "expectation" of a future environment that is not reflected in current operative land use zoning. These forecasts surpass what is feasible under the current zoning, which is predominantly Future Urban Zone (see Figure 1.2). Currently, urban zoning is limited to parts of Zone 165 (including Spedding Block Precinct) and parts of Zone 168/172 (including Whenuapai 1 and Whenuapai 2 Precincts). For instance, Table 1 shows that the SATURN model forecasts around 2,250 dwellings in zones 168 and 172 by 2028. Presently, there are about 1,050 urban dwellings in Whenuapai 1 and Whenuapai 2 Precincts, with almost all urban-zoned land already subdivided and developed. The remaining Future Urban Zone land in these zones cannot be subdivided (per Chapter E39 Table E29.4.3.(A29) of the Unitary Plan) and is unlikely to generate significant peak hour traffic.

Therefore, our SGA SATURN model 2028 baseline assessment includes at least 1,200 dwellings that are not currently enabled. Even without detailed analysis, it is evident that the permitted baseline (i.e., traffic-generating activity currently enabled by operative land use zoning in Whenuapai) is much lower than the baseline used in our assessment (the 2028 i11.5 land use forecast). Further to this we have treated Whenuapai Green as additive, by adding Whenuapai Green trips to those forecast in the SATURN model.

In summary, the SGA SATURN model does not reflect the Future Development Strategy and includes urban land uses not currently enabled or proposed under this Plan Change. While the SGA SATURN

model can assist with professional judgment regarding wider transport network effects and potential transport demands for microscopic traffic modelling (such as SIDRA), it does not represent a certain future. Therefore, it should not be the sole basis for assessing the transport effects of the Plan Change.

We believe using the SGA SATURN model beyond 2028 is inappropriate for assessing the Plan Change. Additionally, interpreting the 2028 outputs requires considering the significant conservatism inherent in using this model for such assessments.

Refer to Section 1.6, where we provide further assessment of cumulative traffic effects.

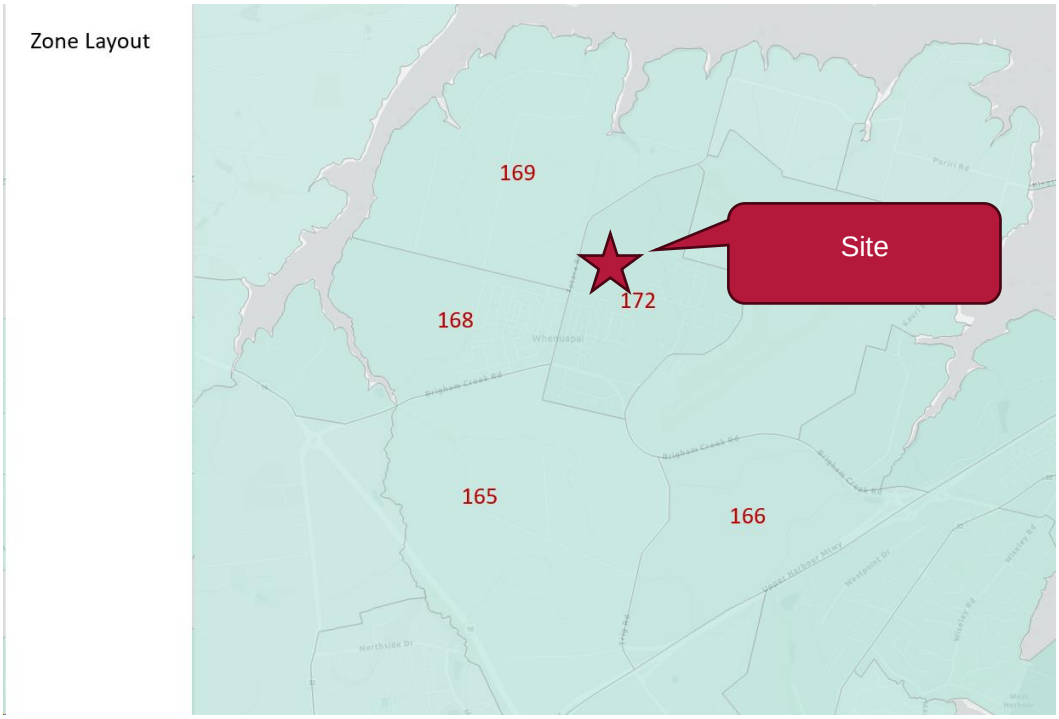


Figure 1.1 Model zones

Table 1.1 i11.5 household forecasts

MSM Zone	2016	2028	2038	2048
165	62	102	384	1,005
166	16	261	252	251
168	47	1,663	2,388	3,031
169	127	318	1,483	3,637
172	153	604	750	1,023
Total	405	2,948	5,257	8,947

Table 1.2 i11.5 population forecasts

MSM Zone	2016	2028	2038	2048
165	177	281	984	2,492
166	54	683	624	598
168	153	4,545	6,210	7,569
169	346	844	3,790	9,014
172	470	1,699	1,995	2,599
Total	1,200	8,052	13,603	22,272

Table 1.3 i11.5 employment forecasts

MSM Zone	2016	2028	2038	2048
165	108	41	1,725	3,612
166	10	1,657	2,333	2,325
168	40	391	520	626
169	171	174	443	855
172	225	258	274	280
Total	554	2521	5,295	7,698

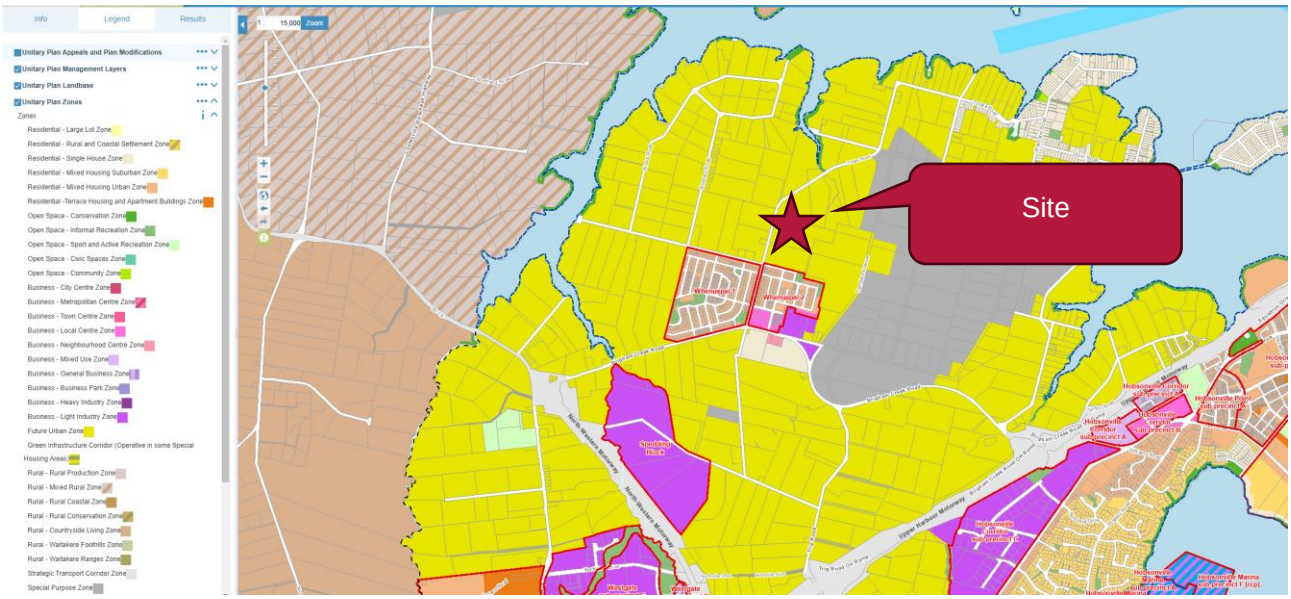


Figure 1.2 Operative landuse zoning

1.4 Crash history

Specific request	Reason for the request
Please undertake a crash history assessment of the roads leading up to the state highway interchanges, where development traffic is anticipated to access the wider network.	Section 3.6 of the ITA includes a crash history assessment for the sections of Brigham Creek Road and Trig Road fronting the site. The ITA does not include a crash assessment of the wider network. The ITA predicts a relatively large increase of trips accessing the external network via the state highway interchanges. The ITA should assess the safety effects of these additional trips.

Abley response

Megamaps Collective and Personal risk

NZTA MegaMaps has been analysed to assess the road safety of Brigham Creek Road and the SH18/Brigham Creek Road interchange. The two types of risk metrics are summarised as follows:

- Collective risk is a measure of the total estimated death and serious injury (DSi) casualty equivalents for a site. It is effectively a measure of the number of deaths and serious injuries that can be expected at a site over the next analysis period (typically five years). At a corridor level, Collective Risk is the total estimated DSi casualty equivalents derived from the intersection and midblock components divided by the length of the corridor. It is expressed as estimated DSi / km.
- Personal risk is a measure of the risk of an individual dying or being seriously injured at a site. It is calculated by dividing Collective Risk by a measure of traffic volume exposure.

Collective and Personal risk metrics are shown in Figure 1.3 and Figure 1.4, and are described below:

- Brigham Creek Road (east of Totara Road) has a Low to Low Medium collective and personal risk score.
- The SH18/Brigham Creek Road interchange has a Low to Low Medium collective and personal risk score, other than
  - the northeast bound onramp, which has a Medium and Medium High collective and personal risk score.
  - the northeast bound offramp, which has a Low Medium and Medium collective and personal risk score.

Other than the northbound SH18 onramp and offramp at Brigham Creek, other roads have low risk rating. We have interrogated the inputs into the risk score calculation for the northbound onramp and offramp, given there were few reported crashes. Megamaps uses a 5 year period of crashes when calculating personal and collective risk, with it currently using the 2017 to 2021 time period (note we have extracted post-2021 crash history later in this response). Figure 1.5 shows the crash data locations that Megamaps is using, which shows the crashes are correctly located around the SH18/Brigham Creek Road roundabout, however these are on the “links” associated with the on and off ramps. We note that the collective and personal risk for Brigham Creek Road through the roundabout are rated low. We therefore consider that Megamaps may be over predicting the risk for the northbound on and off ramps.

Figure 1.3 Collective risk (NZTA MegaMaps)

Figure 1.4 Personal risk (NZTA MegaMaps)

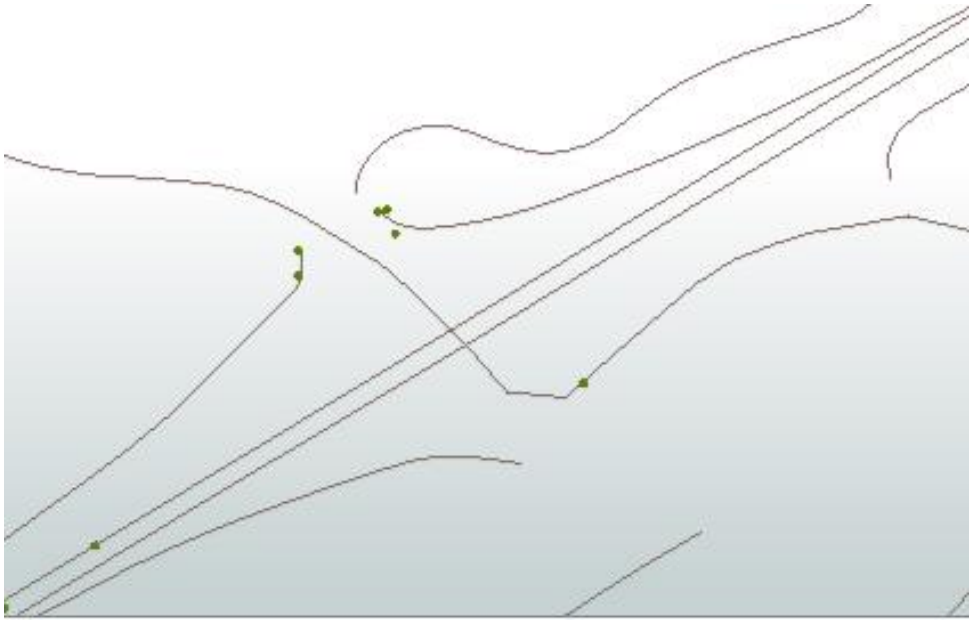


Figure 1.5 Megamaps crash inputs

NZTA CAS records

A search of the NZTA Crash Analysis System (CAS) was undertaken to assess the reported crash history near the SH18 interchange. The search area is shown in Figure 1.6. Over the past five years (2019-2024 inclusive), a total of 14 crashes were reported. All reported crashes occurred on Brigham Creek Road, the Brigham Creek Road On Ramp or the Brigham Creek Road Off Ramp.

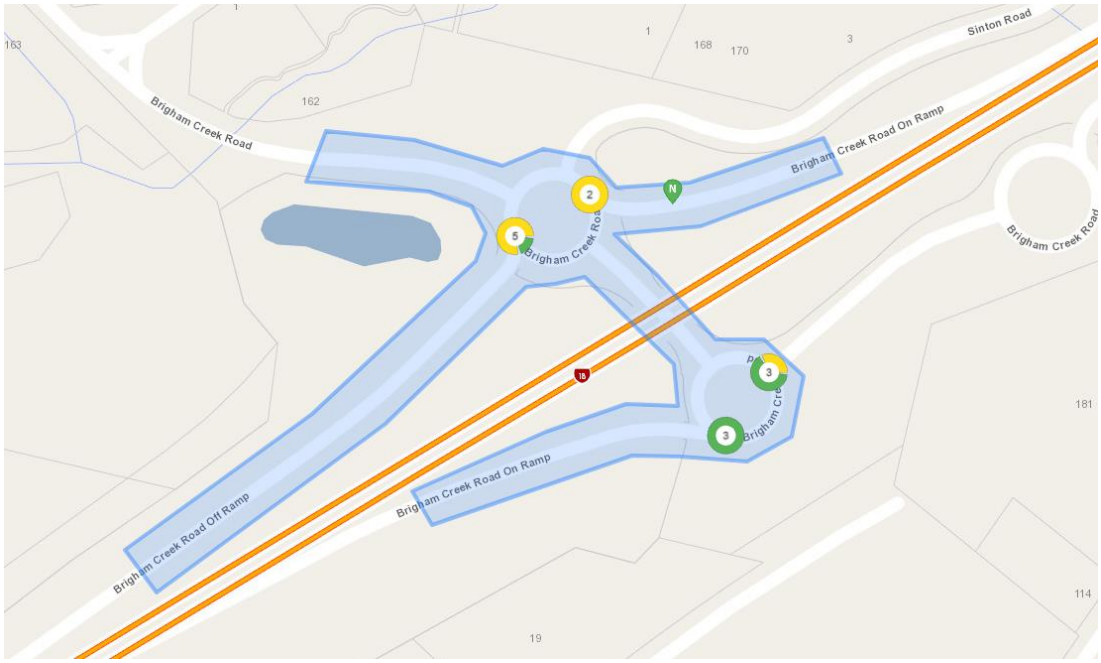


Figure 1.6 CAS Search Area (Source: NZTA Waka Kotahi CAS)

No serious injury or fatal crashes were reported. Key aspects of the minor injury and non-injury reported crashes are included below. A full summary of each crash is provided in Table 1.4.

Minor injury crashes:

- Two reported crashes involved motorcyclists turning left.
- Three reported crashes involved a rear-end collision as drivers slowed for traffic.
- One reported crash involved a head-on collision.
- One reported crash occurred when a cyclist sideswiped a vehicle.

Non-injury crashes:

- One reported crash involved a rear-end collision as the driver slowed for traffic.
- One reported crash occurred when a right turning driver was hit by oncoming traffic.
- Four reported crashes occurred when the drivers lost control of the vehicle while turning right, resulting in the vehicle leaving the road to the left.
- One reported crash occurred when the driver missed the intersection and collided with regulatory signage.

Multiple crash factors occurred across the reported crashes, including head-on collisions, left turning motorcyclists, rear-end collisions and drivers losing control while turning right. All crashes were either non-injury or minor injury. The safety record is consistent with the environment.

Table 1.4 CAS Search Summary

Road	Year	Crash Type	Crash Description
Brigham Creek Road	2021	Minor Injury	Motorcycle1 NDB on BRIGHAM CREEK ROAD OFF RAMP hit Car/Wagon2 merging from the left.
Brigham Creek Road Off Ramp	2019	Non-injury	Car/Wagon2 turning right hit by oncoming Ute1 WDB on Brigham Creek Road.
Brigham Creek Road Off Ramp	2021	Minor Injury	Car/Wagon1 WDB on BRIGHAM CREEK ROAD swinging wide hit Car/Wagon2 head on.
Brigham Creek Road Off Ramp	2023	Minor Injury	Car/Wagon1 EDB on BRIGHAM CREEK ROAD OFF RAMP hit rear end of Van2 stop/slow for cross traffic.
Brigham Creek Road Off Ramp	2023	Minor Injury	Car/Wagon1 NDB on BRIGHAM CREEK ROAD OFF RAMP hit rear end of Car/Wagon2 stop/slow for cross traffic.
Brigham Creek Road	2024	Minor Injury	Car/Wagon1 SDB on BRIGHAM CREEK ROAD sideswiped by Cyclist2 SDB on BRIGHAM CREEK ROAD turning left.
Brigham Creek Road	2021	Minor Injury	Car/Wagon1 SDB on BRIGHAM CREEK ROAD sideswiped by Motorcycle2 SDB on BRIGHAM CREEK ROAD turning left.
Brigham Creek Road On Ramp	2022	Non-injury	SUV1 EDB on BRIGHAM CREEK ROAD ON RAMP lost control; went off road to left, SUV1 hit ditch, power pole.
Brigham Creek Road	2022	Non-injury	Car/Wagon1 WDB on BRIGHAM CREEK ROAD lost control turning right; went off road to left, Car/Wagon1 hit watertable, fence, hedge.
Brigham Creek Road	2023	Non-injury	Car/Wagon1 WDB on BRIGHAM CREEK ROAD missed inters or end of road, Car/Wagon1 hit kerb, fence, traffic sign.
Brigham Creek Road	2023	Non-injury	Car/Wagon1 WDB on BRIGHAM CREEK ROAD lost control turning right; went off road to left, Car/Wagon1 hit kerb, fence, light pole.
Brigham Creek Road	2021	Non-injury	Car/Wagon1 SDB on BRIGHAM CREEK ROAD hit rear end of Car/Wagon2 stop/slow for cross traffic.
Brigham Creek Road	2022	Minor Injury	Car/Wagon1 SDB on BRIGHAM CREEK ROAD hit rear end of Car/Wagon2 stop/slow for cross traffic.
Brigham Creek Road	2023	Non-injury	Car/Wagon1 SDB on BRIGHAM CREEK ROAD lost control turning right; went off road to left, Car/Wagon1 hit light pole.

1.5 Brigham Creek Road NOR

Specific request	Reason for the request
Please comment on the implications for the proposed plan change of the Brigham Creek Road Notice of Requirement not being funded to provide upgrades, but for providing route protection only. Please confirm if any Brigham Creek Road corridor or intersection upgrades are assumed in the SATURN modelling assessment.	We understand that the Notice of Requirements for the corridor upgrades (including Brigham Creek Road) are not funded, and are for route protection only. Therefore, a four lane road on Brigham Creek Road may not be provided by other parties to mitigate the effects of the development. Section 4.3 of the ITA outlines the NOR design of the Brigham Creek/Tōtara Road intersection, which provides widening and additional lanes at the intersection. We acknowledge that the modelling assessment in the ITA assesses the existing layout of the intersection, which therefore assumes the NOR upgrades won't be undertaken for that intersection. Along the Brigham Creek Road corridor, the NOR would allow for four lanes compared to two lanes as per the existing layout. We would like confirmation whether the ITA assumes two lanes or four lanes, and what effects are anticipated.

Abley response

Notice of requirement assumptions

Section 6.7 of our ITA notes that our assessment of the Brigham Creek Road/Tōtara Road intersection is based on the existing intersection arrangement and does not anticipate or rely on the construction of the Brigham Creek Road Notice of Requirement.

In Section 1.6 of this technical note we provide additional modelling for the Brigham Creek Road/Kauri Road and SH18/Brigham Creek Road interchange. This modelling uses the existing transport network layout and does not anticipate or rely on the construction of the Brigham Creek Road Notice of Requirement.

Brigham Creek Road midblock capacity assessment

We have considered the midblock capacity for sections of Brigham Creek Road, based on its existing layout. This is to test whether the traffic generated by the Plan Change can be accommodated by the existing form of Brigham Creek Road, prior to the four-laning that is anticipated by the Brigham Creek Road Notice of Requirement.

We have assessed Brigham Creek Road in two locations:

- Between Trig Road and Tamatea Avenue, as shown in Figure 1.7.
- Between Kauri Road and SH18, as shown in Figure 1.8.

We have referred to the lane-hour capacity assessment method provided in Austroads Guide to Traffic Management Part 3: Traffic Study and Analysis Methods (AGTM03), shown in Figure 1.9.

Using the following values, we have calculated that existing 2 lane sections of Brigham Creek Road have a capacity of approximately 1,300 veh/lane/hr.

- fw = 0.8, allowing for 1m lateral clearance and 3.2m traffic lanes
- E_{HV} = 2, as the lanes are level
- P_{HV} = 11%[1]
- fhv = 0.9
- Capacity = 1,297 veh/lane/hr

[1] Auckland Transport traffic count, 23 February 2022, OBJECTID9574, available online at https://data-atgis.opendata.arcgis.com/datasets/ATgis::average-daily-traffic-counts/explore

The 2030 potential traffic demands on Brigham Creek Road are summarised in Table 1.5 and Table 1.6, utilising the modelling prepared by Whenuapai Business Park as a baseline. Our assessment includes the impacts of existing traffic growth (estimated by Whenuapai Business Park at 2.6%pa), PC69 development, PC86 development, and Whenuapai Business Park development, and indicates that future traffic flows remain well below the calculated 1,297 veh/lane/hour capacity in both directions. This demonstrates there is sufficient capacity on Brigham Creek Road to accommodate the Plan Change without four-laning of Brigham Creek Road.

Figure 1.7 Indicative section 1 used for Brigham Creek Road capacity assessment, east of Tamatea Avenue (sourced from Google Maps)

Figure 1.8 Indicative section 2 used for Brigham Creek Road capacity assessment, east of Kauri Road (sourced from Google Maps)

The capacity of a significant length of a single traffic lane for the prevailing roadway and traffic conditions can be calculated by using Equation 5:

$$C = 1800 f_W f_{HV} \quad 5$$

where

C = capacity in veh/h under prevailing roadway and traffic conditions

f_W = adjustment factor for narrow lanes and lateral clearances, obtained from Table 5.1

f_{HV} = adjustment factor for heavy vehicles

= $1/[1+ P_{HV} (E_{HV} – 1)]$

P_{HV} = the proportion of heavy vehicles in the traffic stream, expressed as a decimal

E_{HV} = the average passenger car equivalents for heavy vehicles obtained from Table 5.2.

Figure 1.9 AGTM03 – Equation 5 single traffic lane capacity

Table 1.5 Brigham Creek Road traffic demand 2030 (between Tamatea Avenue and Trig Road)[2]

Period	Direction	Scenario (veh/hr)		
		Baseline (2024 + 2.6% PA 6 years + PC69 + WBP)	Whenuapai Green	Basecase + Whenuapai Green
AM	NW bound	719	91	810
	SE bound	905	211	1,116
PM	NW bound	985	181	1,166
	SE bound	1,103	121	1,224

[2] Traffic demands referenced from SIDRA model for Brigham Creek Road/Trig Road roundabout (Whenuapai Business Park and Whenuapai Green cumulative effects assessment) contained in Section 1.6 of this technical note.

Table 1.6 Brigham Creek Road traffic demand 2030 (between Kauri Road and SH18)[3]

Period	Direction	Scenario (veh/hr)		
		Baseline (2024 + 2.6% PA 6 years + PC69 + WBP)	Whenuapai Green	Basecase + Whenuapai Green
AM	NW bound	923	31	954
	SE bound	876	72	948
PM	NW bound	871	62	933
	SE bound	1,035	41	1,076

1.6 Brigham Creek Road effects

Specific request	Reason for the request
Please comment on the effects of additional through traffic on Brigham Creek Road, including at key intersections, and identify if there are any safety or operational constraints.	The ITA assesses Brigham Creek Road at the SH16 and SH18 interchanges, and at the Tōtara Road intersection. There are some intersections on Brigham Creek Road which may be close to reaching capacity based on the existing layout (such as Kauri Road), which have not been directly assessed in the ITA. Increases in through traffic may affect safety for turning traffic, and active mode trips, as well as capacity. Section 8.1 of the ITA states: "Our assessment demonstrates that the Brigham Creek Road/Totora Road intersection has sufficient capacity to support the plan change. We anticipate that Brigham Creek Road will be progressively upgraded as development fronting the corridor progresses in the future." We note that this assessment focuses only on the immediate road access onto Brigham Creek Road from Tōtara Road, but it should consider the wider corridor.

Abley response

Regarding midblock sections of Brigham Creek Road, refer to our response in Section 1.5 of this technical note.

To present a robust assessment of transport effects and assess the combined effects from the Whenuapai Business Park and Whenuapai Green Plan Changes, we have developed SIDRA models in conjunction with TEAM Traffic, who are undertaking the assessment of transport effects for the Whenuapai Business Park Plan Change. Whenuapai Green activity is included additively over and above the existing growth, Whenuapai Business Park, PC69, and PC86 activity which forms the baseline.

Network overview diagrams have not been included in Appendix A. We are happy to provide SIDRA model files for review by request.

We have assessed:

- Brigham Creek Road/Totara Road signalised intersection
- Brigham Creek Road/Trig Road intersection

[3] Traffic demands referenced from SIDRA Network model for Brigham Creek Road/SH18 interchange (Whenuapai Business Park and Whenuapai Green cumulative effects assessment) contained in Section 1.6 of this technical note.

- Brigham Creek Road/Kauri Road intersection and SH18/Brigham Creek Road interchange roundabouts (SIDRA network model), including SH18 ramp meters
- SH18/Trig Road interchange, including SH18 ramp meter.

The trip distribution from Whenuapai Green has been revised per the Waka Commuter analysis described in Section 1.8.

As per our ITA, our modelling has assumed a highly conservative peak hour trip rate of 0.9 vehicle movements per hour per household (0.9 v/hr/hh). While not relied on for our assessment of effects, we have also provided modelling of the Brigham Creek Road/Totara Road intersection with a rate of 0.65 vehicle movements per hour per household (0.65 v/hr/hh), for a potential future where there is greater accessibility to Whenuapai Green by walking, cycling and public transport.

Brigham Creek Road/Totara Road intersection

We have undertaken additional SIDRA modelling, including traffic demands from PC69 and PC86 in our baseline assessment. We have included the painting of an additional through arrow eastbound in the current kerbside left turn lane for our "including Whenuapai Green" scenarios. These works can be done without any changes to the geometry including location of kerbs. As such, we recommend that this improvement be provided prior to occupation of any dwellings within Whenuapai Green.

Assuming 0.9 v/hr/hh, delay is expected to reach LOS E in both the morning and evening peak, and maximum queues on the western approach of Brigham Creek Road are expected to increase to 450m in the evening peak. However, this is not atypical congestion for peak hour in Auckland, and additional queueing is not expected to have any further impact on the operation of either the SH16/Brigham Creek Road intersection or the PC69 Spedding Road access intersection compared to the baseline.

The 0.65 v/hr/hh scenario shows minimum effect on intersection performance, with the overall intersection performance during the morning and evening peak remaining at LoS D.

Signal phasing has been modelled in SIDRA as a standard double-diamond type arrangement, with a simplification to allow the very low volume right turn into Mamari Road to filter as part of the main A phase. Although this is not how the SCATS controller will run the phasing, it is seen as an acceptable compromise to replicate the overall effect in SIDRA. The right turn volume is 4-10 vehicles per peak hour and including this as a variable phase demand in SIDRA will result in inaccurate phasing splits being selected by the programme.

Signal cycle times have been maintained at 115s in the AM, with SIDRA optimising for overall minimal delay. The PM peak cycle time increases from 95s in the baseline to between 110-120s when including Whenuapai Green. The increased cycle time is required to meet capacity requirements and is seen as a generally acceptable cycle time in the Auckland context.

Intersection performance is summarised in Table 1.7 and Table 1.8, and further detailed movement and phasing summaries are attached in Appendix A.

Table 1.7 Brigham Creek Road / Totara Road signal performance summary based on 0.9 v/hr/hh

Period	2030 Baseline (2024 + 2.6% PA 6 years + PC69 + WBP)			2030 incl WG (0.9 v/hr/hh)			Difference		
	LoS	Delay	Max Queue	Los	Delay	Max Queue	LoS	Delay	Max Queue
Morning Peak	D	48s	283m	E	72s	397m	D>E	+24s	+114m
Evening Peak	C	34s	186m	E	78s	413m	C>E	+44s	+227m

Table 1.8 Brigham Creek Road / Totara Road signal performance summary based on 0.65 v/hr/hh

Period	2030 Baseline (2024 + 2.6% PA 6 years + PC69 + WBP)			2030 incl WG (0.65 v/hr/hh)			Difference		
	LoS	Delay	Max Queue	Los	Delay	Max Queue	LoS	Delay	Max Queue
Morning Peak	D	48s	283m	E	62s	328m	D>E	+14s	+45m
Evening Peak	C	34s	186m	D	47s	248m	C>D	+12s	+62m

Brigham Creek Road/Trig Road intersection

The intersection layout is adopted as per the Whenuapai Business Park design for the proposed roundabout upgrade. This is shown in Figure 1.10, and NCL confirms that it owns all land that is required to construct this upgrade. Due to this being a future design, calibration of the intersection performance is not possible. In place of on-site calibration, SIDRA recommended default parameters have been used.

The modelled 2030 baseline includes:

- Surveyed 2022 traffic volumes.
- Additional background growth of 2.6%pa out to 2030, adopted from Whenuapai Business Park analysis.
- PC69 and PC86 traffic.
- Whenuapai Business Park traffic.

The “including Whenuapai Green” scenario additively includes trips distributed as per Figure 1.17 and Figure 1.18, which is based on a trip rate of 0.9 v/hr/hh.

Modelling demonstrates this intersection is expected to perform adequately in the peak hours, at LOS B in the morning peak hour and LOS C in the evening peak hour. Additional queue lengths of up to 390m are anticipated in the evening peak on the western approach of Brigham Creek Rd (increased from around 180m in the baseline). This is considered acceptable given the overall operation of the intersection, given that the delays remain low and queue distances are able to be accommodated without impacting adjacent intersections.

The intersection performance summary is shown in Table 1.9.

Table 1.9 Brigham Creek Road / Trig Road roundabout performance summary

Period	2030 Baseline (2024 + 2.6% PA 6 years + PC69 + WBP)			2030 incl WG (0.9 v/hr/hh)			Difference		
	LoS	Delay	Max Queue	Los	Delay	Max Queue	LoS	Delay	Max Queue
Morning Peak	A	7s	37m	A	9s	67m	-	+2s	+30m
Evening Peak	B	16s	180m	C	23s	390m	B>C	+7s	+210m

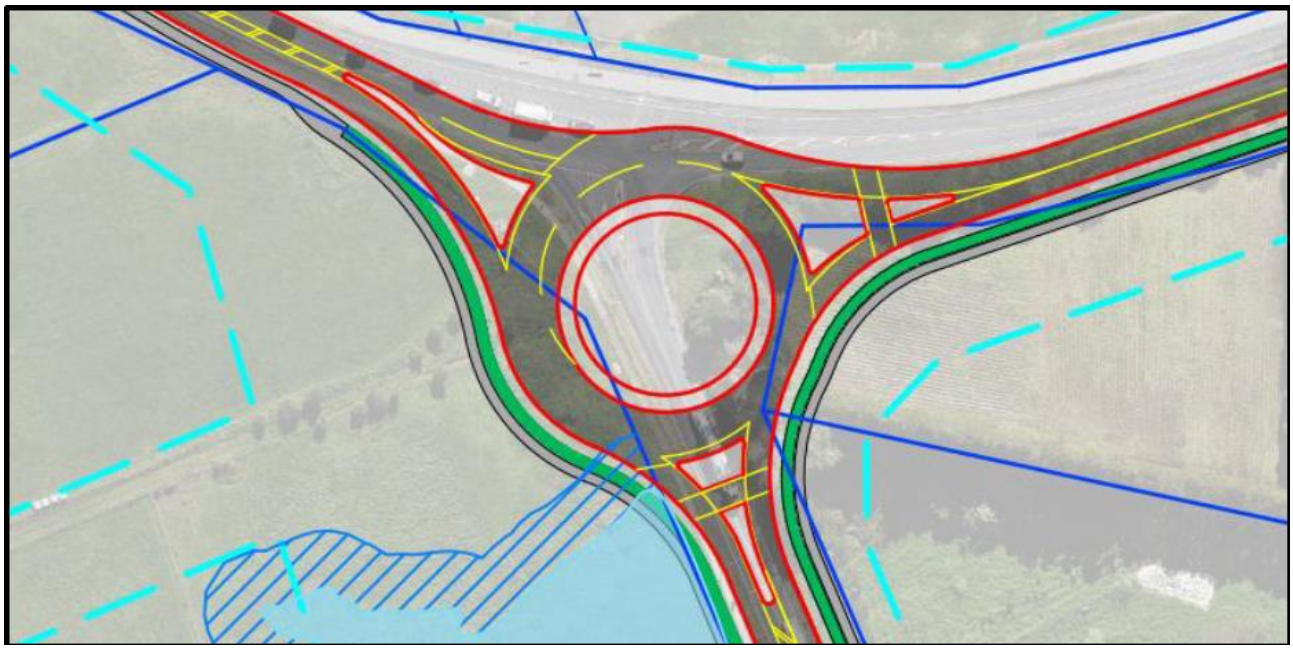


Figure 1.10 Brigham Creek Rd / Trig Rd intersection proposed by WBP

Brigham Creek Road/Kauri Road intersection and SH18/Brigham Creek Road interchange

SIDRA Network modelling demonstrates that additional volumes along Brigham Creek Road resulting from Whenuapai Green activity can be accommodated with the current intersection arrangements. Delay at the eastbound SH18 onramp is expected to reach LOS F in the morning peak and LOS E in the evening peak, and maximum queues from the meter extend back to the northern Brigham Creek roundabout in the morning peak. However, this is not atypical congestion for peak hour in Auckland, and network modelling demonstrates that this does not significantly impact the operation of the roundabout and Kauri Road intersections which operate at similar levels of delay compared to the baseline.

Regarding the prior assumption of the rerouting of Sinton Road from the Brigham Creek Road/SH18 northern roundabout to terminate on Kauri Road – as noted by AT, there is no certainty of timing for this to occur. The revised modelling does not assume any alteration to the operation or routing of Sinton Road, and it continues to operate as it does currently.

Regarding the impact of queueing at the ramp meters on the SH18 access points, ramp operation data provided by JTOC[4] has been used to calibrate lane capacity based on:

- The varying length of red phase time through the peak hour, ranging from 3s to 12s, resulting from the ramp meter adapting to State Highway performance
- The proportion of the peak hour the meters were operational, ranging from less than 20% to more than 80% depending on the specific ramp, direction, and peak
- An estimate of required increases in red phase time in the 2030 future year to maintain State Highway performance, using a conservative growth rate of 2.6%pa.

Due to signal phasing in SIDRA being limited to round increments of 1s, lane capacities have been calibrated to the first principles calculation of one vehicle per lane per cycle. The resulting SIDRA phasing output is included for each ramp, scenario, and period in Appendix A.

The southern roundabout has been included in the SIDRA Network modelling to enable the westbound onramp to be modelled, using the data provided by JTOC. The southern roundabout is modelled using standard SIDRA gap acceptance parameters alongside the current lane geometry. Advanced calibration of current performance, as undertaken with the northern roundabout, was not applied to the southern roundabout as recent video survey footage was not available.

Intersection performance summaries for Brigham Creek Road/Kauri Road, the Brigham Creek Road/SH18 northern roundabout, and the SH18 eastbound onramp are shown in Table 1.10 to Table 1.12, respectively.

Table 1.10 Brigham Creek Road / Kauri Road intersection performance summary

Period	2030 Baseline (2024 + 2.6% PA 6 years + PC69 + WBP)			2030 incl WG (0.9 v/hr/hh)			Difference		
	LoS	Delay	Max Queue	Los	Delay	Max Queue	LoS	Delay	Max Queue
Morning Peak	C	16s	18m	C	20s	21m	-	+4s	+3m
Evening Peak	C	21s	22m	C	24s	26m	-	+3s	+4m

Table 1.11 Brigham Creek Road / SH18 northern roundabout performance summary

Period	2030 Baseline (2024 + 2.6% PA 6 years + PC69 + WBP)			2030 incl WG (0.9 v/hr/hh)			Difference		
	LoS	Delay	Max Queue	Los	Delay	Max Queue	LoS	Delay	Max Queue
Morning Peak	A	6s	30m	A	6s	34m	-	-	+4m
Evening Peak	B	11s	113m	B	13s	141m	-	+2s	+28m

[4] Data for March 2024 received from JTOC staff via email 24/07/2024

Table 1.12 SH18 EB onramp meter performance summary

Period	2030 Baseline (2024 + 2.6% PA 6 years + PC69 + WBP)			2030 incl WG (0.9 v/hr/hh)			Difference		
	LoS	Delay	Max Queue	Los	Delay	Max Queue	LoS	Delay	Max Queue
Morning Peak	D	46s	86m	F	101s	177m	D>F	+55s	+91m
Evening Peak	D	38s	74m	E	67s	122m	D>E	+29s	+48m

SH18/Trig Road interchange

SIDRA Network modelling for Whenuapai Business Park and Whenuapai Green indicated an increase in delays for right turns from the offramp onto Trig Road. We have undertaken further analysis to determine the effects generated by Whenuapai Green.

Two scenarios were tested:

1. Comparison of operating a single-stage give way for the 2030 baseline – including background growth, PC69 and PC86 activity but excluding Whenuapai Business Park – then adding Whenuapai Green, and
2. Comparison of operating a two-stage give way for the 2030 baseline – as per (1) but including Whenuapai Business Park in the baseline – then adding Whenuapai Green. For discussion about the two-stage give way for the right turn at the offramp, refer to the assessment of effects and clause 23 responses that are separately prepared for Whenuapai Business Park by TEAM Traffic.

Scenario 1 performance is shown in Table 1.13, demonstrating that the existing interchange operates acceptably with Whenuapai Green, but excluding Whenuapai Business Park.

Scenario 2 performance is shown in Table 1.14, which adopts the two-stage give way assumption from the clause 23 responses that are separately prepared for Whenuapai Business Park by TEAM Traffic. This demonstrates that the interchange operates acceptably with Whenuapai Green.

Table 1.13 Trig / SH18 offramp Scenario 1 performance summary

Period	2030 Baseline (2024 + 2.6% PA 6 years + PC69) excl WBP			2030 incl WG (0.9 v/hr/hh)			Difference		
	LoS	Delay	Max Queue	Los	Delay	Max Queue	LoS	Delay	Max Queue
Morning Peak	C	19s	14m	D	30s	23m	C>D	+11s	+9m
Evening Peak	C	19s	16m	D	26s	23m	C>D	+7s	+7m

Table 1.14 Trig / SH18 offramp Scenario 2 performance summary

Period	2030 Baseline (2024 + 2.6% PA 6 years + PC69 + WBP)			2030 incl WG (0.9 v/hr/h)			Difference		
	LoS	Delay	Max Queue	Los	Delay	Max Queue	LoS	Delay	Max Queue
Morning Peak	B	11s	5m	B	13s	6m	-	+2s	+1m
Evening Peak	C	21s	24m	D	27s	31m	C>D	+6s	+6m

1.7 Visibility of proposed roads

Specific request	Reason for the request
Please assess the visibility of the proposed local road intersections on Tōtara Road.	A visibility assessment is not provided for proposed local road intersections on Tōtara Road in the ITA. While the local roads are indicative and subject to detailed design, providing a visibility assessment will outline if there are any visibility constraints on Tōtara Road that require consideration (such as limiting an intersection location, changing the alignment of the road, providing visibility setbacks within the site). This needs to consider vertical as well as horizontal alignment.

Abley response

We have assessed priority-controlled intersections for Safe Intersection Sight Distance (SISD), and roundabout intersections for Approach Sight Distance (ASD), using Austroads Guide to Road Design Part 4A: Unsignalised and Signalised Intersections (AGRD4A).

We have also assessed the spacing for the two southern intersections. Refer to our response in Section 2.7 of this technical note.

ASD and SISD from AGRD4A are shown in Figure 1.11 and Figure 1.12 respectively. All assessments have assumed a 2 second reaction time and a design speed of 10km/hr more than the posted speed limit. Therefore:

- For a 60km/hr posted speed limit (with a design speed of 70km/hr), 92m ASD and 151m SISD is required. This represents the speed limit on Totara Road north of McCaw Avenue recently implemented by AT as part of Phase 3 of the Safe Speeds programme[5].
- For a 50km/hr posted speed limit (with a design speed of 60 km/hr), 73m ASD and 123m SISD is required. This represents a potential future speed limit on Totara Road north of McCaw Avenue, acknowledging that as the area urbanises the speed limit will likely be reduced.

Figure 1.13 to Figure 1.16 show that the two priority-controlled intersections exceed SISD requirements, and the northern roundabout exceeds ASD requirements. Further assessment of these intersections will be undertaken during future resource consent and engineering plan approval.

[5] Safe Speeds Phase three, available online at https://at.govt.nz/projects-roadworks/vision-zero-for-the-greater-good/safe-speeds-programme/safe-speed-programme-to-date

Table 3.1: Approach sight distance (ASD) and corresponding minimum crest vertical curve size for sealed roads (S < L)

Design speed (km/h)	Based on approach sight distance for a car[1] h_1 = 1.1, h_2 = 0, d = 0.36[2]					
	R_T = 1.5 sec[3]		R_T = 2.0 sec		R_T = 2.5 sec	
	ASD (m)	K	ASD (m)	K	ASD (m)	K
40	34	5.3	40	7.2	–	–
50	48	10.5	55	13.8	–	–
60	64	18.8	73	24.0	–	–
70	83	31.1	92	38.9	–	–
80	103	48.5	114	59.5	–	–
90	126	72.3	139	87.3	151	104
100	151	104	165	124	179	146
110	–	–	193	171	209	198
120	–	–	224	229	241	264
130	–	–	257	301	275	344
Truck stopping capability provided by the minimum crest curve size[4]	h_1 = 2.4 m, h_2 = 0 m, d = 0.22					

Figure 1.11 ASD, reproduced from AGRD4A

Table 3.2: Safe intersection sight distance (SISD) and corresponding minimum crest vertical curve size for sealed roads (S < L)

Design speed (km/h)	Based on safe intersection sight distance for cars[1] h_1 = 1.1; h_2 = 1.25, d = 0.36[2]; Observation time = 3 sec					
	R_T = 1.5 sec[3]		R_T = 2.0 sec		R_T = 2.5 sec	
	SISD (m)	K	SISD (m)	K	SISD (m)	K
40	67	4.9	73	6	–	–
50	90	8.6	97	10	–	–
60	114	14	123	16	–	–
70	141	22	151	25	–	–
80	170	31	181	35	–	–
90	201	43	214	49	226	55
100	234	59	248	66	262	74
110	–	–	285	87	300	97
120	–	–	324	112	341	124
130	–	–	365	143	383	157

Figure 1.12 SISD, reproduced from AGRD4A

Figure 1.13 Sightline for the southern local road intersection with Totara Road, adapted from Council GIS and Google Streetview

Figure 1.14 Sightline for the northern local road intersection with Totara Road, adapted from Council GIS and Google Streetview

Figure 1.15 Sightline 1 for the northern roundabout with Totara Road, adapted from Council GIS and Google Streetview

Figure 1.16 Sightline 2 for the northern roundabout with Totara Road, adapted from Council GIS and Google Streetview

1.8 Waka Commuter trip proportions

Specific request	Reason for the request
Please comment on the application of the Waka Commuter App information for the proposed plan change land use and compare to other similar residential zones.	Section 6.3 of the ITA assesses that 40% of the vehicle trips generated by the plan change will remain internal to Whenuapai. The 40% of trips adopted from the Waka Commuter App appears to include all modes, including working from home, and (short) walking and cycling trips. The 40% rate can therefore not be applied to vehicle trips only. Further, the data for Whenuapai may be affected by people living and working at the NZDF base.

Abley response

The point raised in this request is correct, the initial analysis utilised the proportion of combined workplace and education trips over all modes. The Waka Commuter analysis informing the trip distribution has been revised as follows:

- Waka Commuter workplace travel indicates that, overall, 59% of trips leave Whenuapai and 41% remain.
- It is assumed that all Bus + Ferry + extra car passengers leave Whenuapai, all active and work from home trips stay within Whenuapai.
- Car trips represent the other 53% leaving trips and 16% remaining trips (i.e. ~68% mode share which matches Waka Commuter app data)
- Therefore, approximately 75% (53% of 69%) of car trips leave Whenuapai under 2018 trip conditions – higher than the estimated 60% that we used in the ITA.

However, if local employment growth is adopted from SATURN, total employment is expected to grow from 665 jobs in 2018 to 2,605 jobs in 2028. Employment growth in the area is a reasonable assumption, given the Spedding Precinct being approved and Whenuapai Business Park going through the Plan Change process. A significant portion of these jobs would be expected to be filled by local residential growth.

As per our ITA, our modelling in Section 1.6 has assumed a highly conservative peak hour trip rate of 0.9 vehicles per hour per household (0.9 v/hr/hh). The vehicle trip generation and distribution are shown in Table 1.15, Figure 1.17 and Figure 1.18.

While not relied on for our assessment of effects, we have also provided trip distribution for a lower 0.65 vehicles per hour per household (0.65 v/hr/hh), for a potential future where there is greater accessibility

to the site by walking, cycling and public transport. We also note that a trip rate of 0.65 is more typical of medium density residential areas. This is shown in Table 1.16, Figure 1.19 and Figure 1.20.

For clarity, unless otherwise stated all modelling results presented utilise the 0.9 v/hr/hh trip rate.

Table 1.15 Trip Distribution Summary (0.9 v/hr/hh)

Access Location	AM Inbound	AM Outbound	PM Inbound	PM Outbound
SH16N via BC/SH16	7	16	14	9
SH16S via Trig	60	140	120	80
SH18E via BC/SH18	31	72	62	41
Local via BC/ Totara	22	9	12	19
Local via wider network	22	9	12	19
Total	142	246	220	168
Total Period for 430HH @ 0.9 v/hr/hh		387		387

Table 1.16 Trip Distribution Summary (0.65 v/hr/hh)

Access Location	AM Inbound	AM Outbound	PM Inbound	PM Outbound
SH16N via BC/SH16	5	12	10	7
SH16S via Trig	43	101	86	58
SH18E via BC/SH18	22	52	44	30
Local via BC/ Totara	16	7	9	13
Local via wider network	16	7	9	13
Total	103	178	159	121
Total Period for 430HH @ 0.65 v/hr/hh		280		280

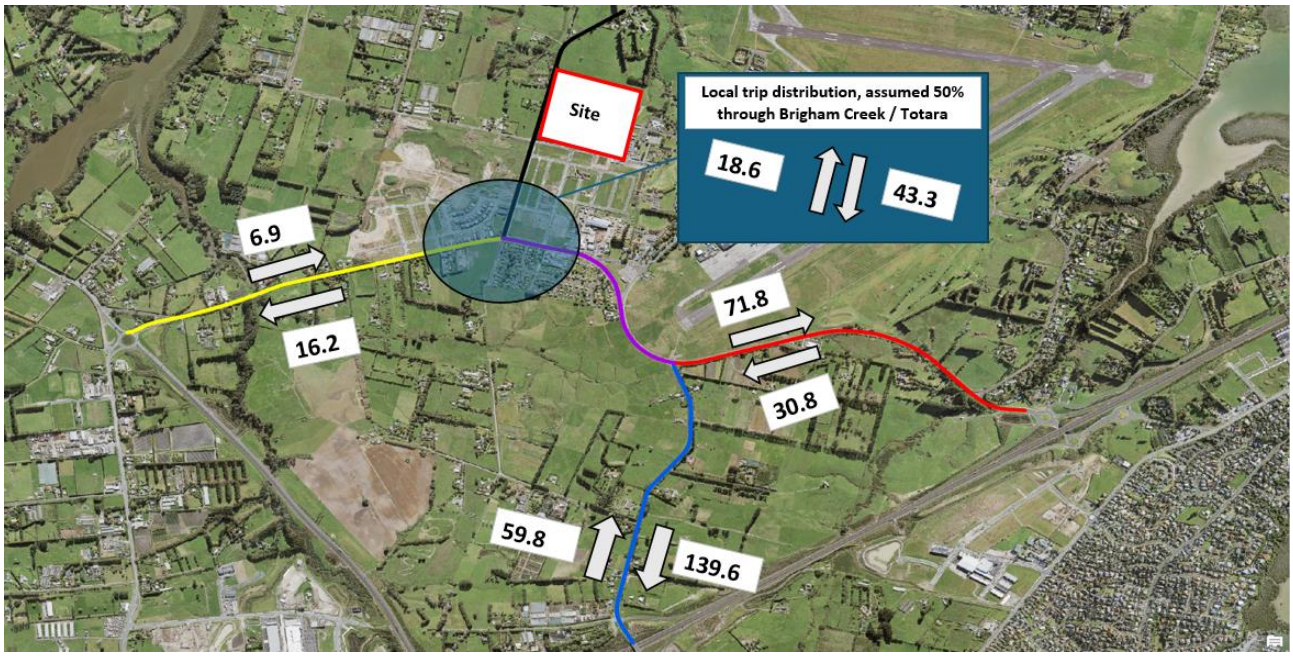


Figure 1.17 Morning peak trip distribution at 0.9 v/hr/hh

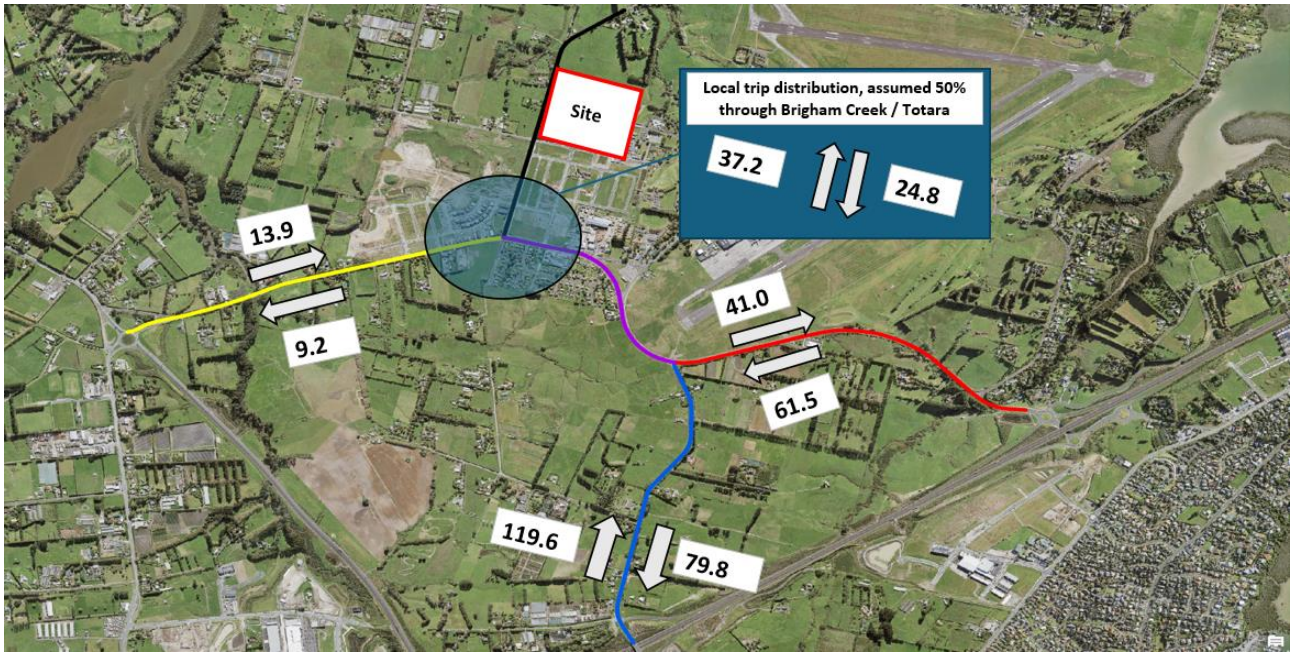


Figure 1.18 Evening peak trip distribution at 0.9 v/hr/hh

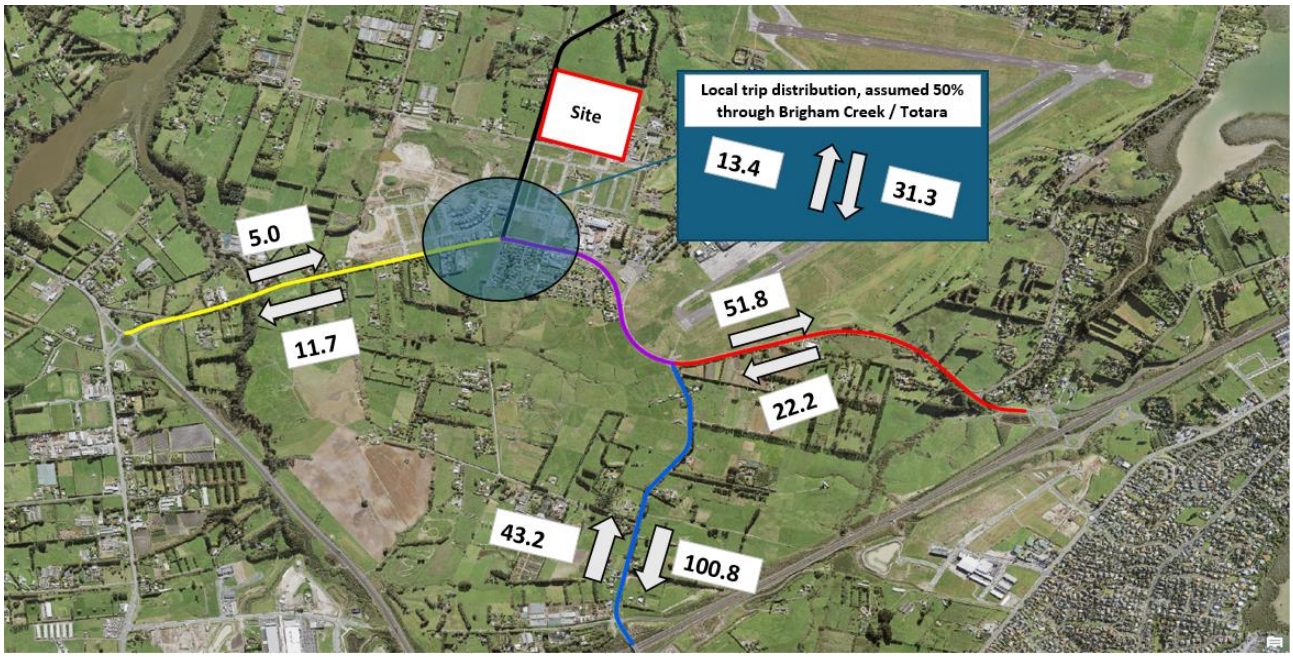


Figure 1.19 Morning peak trip distribution at 0.65 v/hr/hh

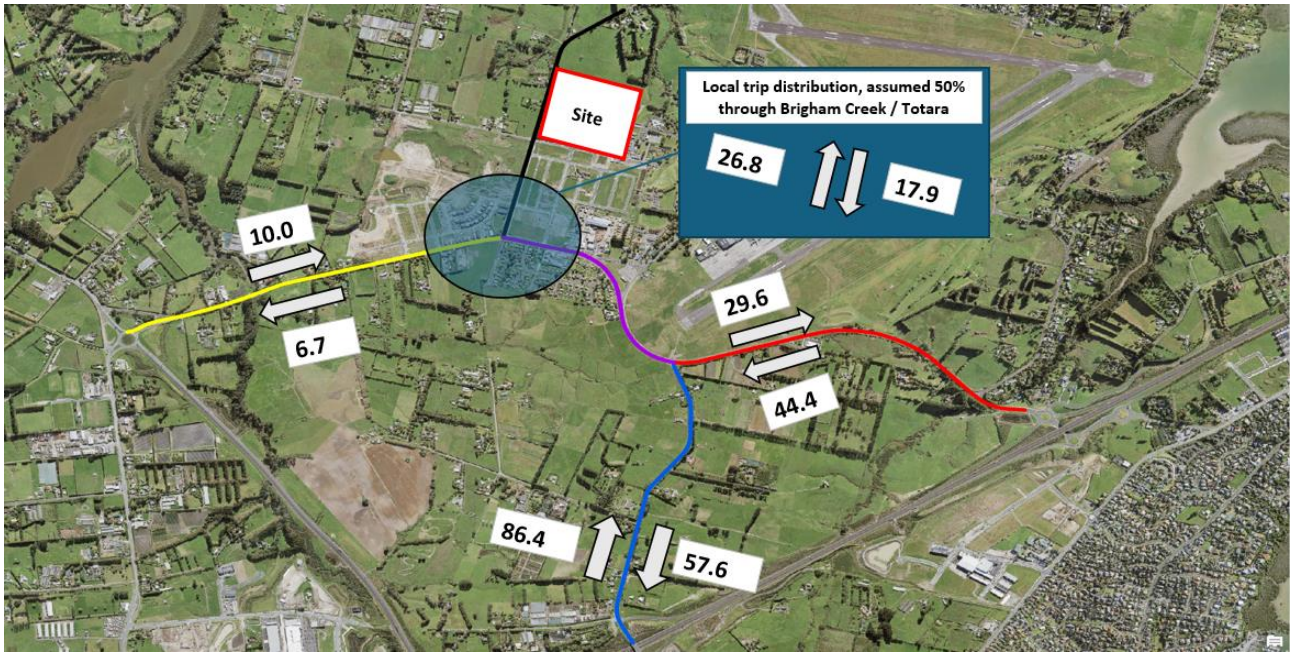


Figure 1.20 Evening peak trip distribution at 0.65 v/hr/hh

1.9 Local trip distribution

Specific request	Reason for the request
Please advise and assess where the local vehicle trips will travel.	Section 6.7 of the ITA assumes that 50% of local vehicle trips will travel through the Brigham Creek Road / Tōtara Road intersection, but it is not stated where the other 50% of these local trips will travel.

Abley response

The balance of local trips (62 two-way trips in the morning and evening peak) are expected to be accessing the employment and commercial activities on either the northern boundary of Brigham Creek Road (east of Totara Road) or the developing employment centred around Trig Road. For both routes, travel via Nils Andersen Road is attractive and bypasses the Brigham Creek Road / Totara Road signals. Some smaller number of trips (assuming partial development of PC69 by 2028) are also expected to access the western side of Brigham Creek Road via Whenuapai Drive, although this is significantly less attractive than how it is coded in the SGA SATURN model.

1.10 State highway interchange modelling

Specific request	Reason for the request
Please model the SH18 interchange to include ramp meter signals, using a network or microsimulation model, eg SIDRA Network, or AIMSUN.	The ITA includes operational assessments of the SH18 interchange. The intersection within the interchanges appear to be modelled in isolation, and do not include ramp meter signals. Ramp meter signals should be included for the interchange on-ramps, as these generate queues that can impact the local road network. Furthermore, each interchange (with ramp meter signals) should be modelled as a network, as interchanges typically operate as a system and there may be queues from one adjacent intersection to the next. These changes would allow the effects and capacity of the interchanges to be assessed fully.

Abley response

Refer to our response in Section 1.6.

1.11 SH18/Sinton Road

Specific request	Reason for the request
Please assess the SH18 / BCR roundabout without assuming that Sinton Road is realigned. Please also advise if you had assumed Kauri Road/BCR Road would be upgraded along with Sinton Road being realigned.	The ITA modelling assumes closure of the Sinton Road arm at the SH18 interchange, however, there is no certainty when this might occur.

Abley response

Refer to our response in Section 1.6, and Brigham Creek Road/SH18 northern roundabout modelling results in Appendix A. Revised SIDRA Network modelling of the Brigham Creek Road/SH18 northern roundabout includes the existing Sinton Road alignment and traffic demands but excludes any changes in landuse on the Sinton Road catchment. In our view the likely driver for realigning Sinton Road (to

intersect with Kauri Road rather than Brigham Creek/SH18 interchange) is the urbanisation of the future Sinton Road catchment. This should form part of the assessment of effects should any rezoning be sought.

1.12 SIDRA outputs & interpretation

Specific request	Reason for the request
Please provide summary table of the SIDRA results showing the average delay, degree of saturation and queue length of the different scenarios and periods for each intersection, and show a difference between the baseline and plan change scenarios. Please also comment on signal phasing and LOS for pedestrians.	The SIDRA movement summary results are provided in Appendix B of the ITA. Section 6 of the ITA comments on the SIDRA results at a high level. Providing a comparison table of the key results for each intersection will provide an 'at a glance' comparison to be made between the different development scenarios compared to the baseline, and allow the traffic effects to be better understood.

Abley response

We have appended a summary table, signal phasing, and Pedestrian LOS outputs for each Sidra model scenario in Appendix A.

1.13 Tōtara Road vehicle access restrictions

Specific request	Reason for the request
Please clarify the suggested "individual" vehicle access restriction requirements on Tōtara Road	Figure 5.1 of the ITA shows 'individual vehicle access restriction' along the Tōtara Road frontage. It is not explained what these restrictions would involve (they may be in the proposed precinct provisions, which we do not have). We note that these access restrictions are not referred to in the Precinct Plan maps or provisions.

Abley response

Whilst we anticipate the future design avoiding vehicle crossings on to Totara Road, we have not proposed it to be restricted as part of the Plan Change Provisions. Future access will be subject to the provisions of E27 Transport and would be assessed at resource consent stage.

1.14 Tōtara Road cycle facilities

Specific request	Reason for the request
Please advise how people cycling northbound on Tōtara Road to and past the site will be catered for	Section 5 of the ITA provides cross-sections of the key roads. The Tōtara Road cross-section (24 m collector road) provides a 2.0 m cycleway on the east side, but no facility on the west side. The facilities on the west side are marked as 'to be built by others'. The proposed 2.0 m cycleway will cater for southbound cyclists on Tōtara Road, but not northbound cyclists.

Abley response

The proposed urbanisation of Tōtara Road is consistent with the approach for other greenfield developments, where the developer forms the berm and carriageway along their frontage, and the berm on the opposite side of the road is formed when the adjoining land is developed.

A cycle transition ramp for northbound cyclists can be incorporated into the upgrade of the Tōtara Road/McCaw Ave/Dale Road intersection if required. This will be assessed at resource consent and engineering plan approval stage.

1.15 Tōtara Road bus stops

Specific request	Reason for the request
Please advise where bus stops will be located and routes for people walking to/from them.	The ITA proposes bus stops on Tōtara Road. Section 8.2 of the ITA states "Adequate road space is provided in the cross section of the Tōtara Road upgrade to allow for the construction of bus stops in the future, which are proposed by NCL". The location for these bus stops is not provided in the ITA. The plan change will need to ensure that people are able to walk safely and conveniently to/ from and within the plan change site. Additional pedestrian connections within the site may be needed.

Abley response

Bus provision is provided for within the Precinct Provisions: Appendix 1 – Road Function and Design Element Table. We consider that bus shelters and pedestrian crossing locations can be satisfactorily addressed through future subdivision and land use consent applications.

1.16 Local road connections

Specific request	Reason for the request
Please advise how the ends of the local roads would be constructed in the interim, given that full connections into 94 Tōtara Road and the RNZAF Base may not be immediately provided in those sites.	The ITA states that "Two future proofed road connections to Royal New Zealand Air Force (RNZAF) Base Whenuapai and 94 Tōtara Road." The local road connection points are shown in Figure 5.1. The connections within those sites may not be provided until those sites are fully developed, so interim solutions such as turning heads could be required in the short to medium term. The future connection to the RNZAF Base may require additional consideration as this is currently closed off to the public, and the Ratara Stream would need to be crossed. While the local roads are indicative and subject to detailed design, understanding the viability of future connections will provide an understanding of whether or not the proposed connections are feasible.

Abley response

There are a range of options for providing temporary or semi-permanent terminations to local roads, prior to extension into adjoining land. This could include, but is not limited to:

- forming a turning head within legal road vested to Auckland Transport; or
- forming a temporary turning head within land owned by NCL, and providing an easement for public access; or
- forming vehicle crossings that are strengthened to accommodate heavy vehicles and are situated to enable an Auckland Council rubbish truck to turn around.

Abley is aware of all three methods having been used in the Auckland context, and we consider that this can be assessed and addressed during future resource consent and engineering plan approval.

2. Auckland Transport RFIs

For each AT RFI we have reproduced the request from AT in a separate subsection and provided our response.

2.1 Future land use and transport environment

Specific request	Reason for the request

Ensure that the ITA addresses the following in considering the likely future land use and transport environment, specifically:
• SH16 Brigham Creek to Waimauku safety improvements - provide a specific update from Waka Kotahi on timelines and confirmation of funding for this. One of the issues with PC69 Spedding Block was the need for these works to occur prior to the PC69 development. Similar issues apply here. If the works do not occur, adding more vehicles to the road network will have adverse effects on the Brigham Creek Road / SH16 intersection
• Supporting Growth NORs - the ITA needs to acknowledge that these NORs are for route protection work and that construction is not funded. A four lane road will not be provided by other parties to mitigate the effects of the development.
• Consideration of other developments:
  ○ Note that PC86 has been considered in section 4.5 of the ITA. This is supported
  ○ Whenuapai Business Park - consider the effects of this proposed development in the modelling. Note that these big developments in the area can be better understood if the same SATURN model is used for each development.
• Future Development Strategy - provide comment on the FDS to give an indication of likely development / infrastructure timeframes and any constraints (focus on the 'when' as there may be a significant gap between development and the infrastructure required to support it).
	To better understand the traffic and other transport effects of the proposal and the ways in which any adverse effects may be mitigated.

Abley response

SH16 Brigham Creek to Waimauku safety improvements

Our ITA discusses this project, and our ITA assessment does not rely on the implementation of this project.

Since the lodgement of the ITA, NZTA has released the State Highway Investment Proposal[6] (SHIP) and the Auckland draft Regional Land Transport Plan has been released for consultation[7].

The SHIP identifies that:

- North-West Alternative Highway (SH16) is proposed for design and consenting, and construction funding between 2030 – 2034.
- SH16 Brigham Creek to Waimauku (Stage 1 and Stage 2) is proposed for design and consenting, property acquisition, and construction funding between 2024 and 2030.

The draft RLTP identifies that:

[6] State Highway Investment Proposal, available online at https://www.nzta.govt.nz/assets/resources/state-highway-investment-proposal-2024-34/state-highway-investment-proposal-2024-34.pdf
[7] Auckland's Regional Land Transport Plan 2024 – 2034 draft, available online at https://at.govt.nz/media/w3go3nfl/draft-regional-land-transport-plan-2024.pdf

- North-West Alternative Highway (SH16) is a discretionary project (ranked 12th equal priority for the State Highway Improvements Activity Class and 85th project priority within the RLTP), with $85mil funding indicated within the 10 year life of the RLTP.
- SH16 Brigham Creek to Waimauku Safety Works is a non-discretionary project with $54mil funding between 2024 to 2027 (Appendix 2 “Safety” Projects).

This provides a degree of certainty that the SH16 Brigham Creek to Waimauku safety improvements will be completed within the next three to four years. Further, there is a clear commitment to progress the North-West Alternative Highway. Further, refer to Section 1.8 where we discuss trip distribution for Whenuapai Green, which indicates a very low number of vehicle movements through the SH16/Brigham Creek Road interchange.

Should additional detail be required, we consider that AT is in a better position to source an update from the NZTA project team.

Supporting Growth NORs

Our ITA and Clause 23 responses do not rely on the construction of any transport upgrades proposed as part of the Supporting Growth NORs. For clarity, Whenuapai Green does not rely on any third party transport infrastructure. NCL propose to deliver the transport infrastructure needed to support Whenuapai Business Park and Whenuapai Green Plan Changes.

Consideration of Whenuapai Business Park

Refer to our additional modelling in Section 1.6, which assesses the cumulative effect of Whenuapai Business Park and Whenuapai Green.

Future Development Strategy

We commented on the FDS in Section 8.1 of our ITA, and our commentary is provided as follows:

- SH16 to SH18 Connections. We understand that the purpose of this connection is to reduce future pressure on Brigham Creek Road, by providing a direct motorway connection for west to north and north to west movements on the motorway network. Our ITA and Clause 23 responses demonstrate that Brigham Creek Road/Totara Road (with one minor improvement), Brigham Creek/Trig Road (upgraded as part of Whenuapai Business Park), Brigham Creek/Kauri Road, SH18/Brigham Creek Road, and SH18/Trig Road intersections/interchanges have sufficient capacity to support the plan change, without the SH16 to SH18 Connections.
- Brigham Creek Road upgrade. Our ITA and Clause 23 responses demonstrate that Brigham Creek Road/Totora Road, Brigham Creek/Trig Road, Brigham Creek/Kauri Road, and SH18/Brigham Creek Road intersections have sufficient capacity to support the plan change, without wider upgrades to Brigham Creek Road.
- Northwest Rapid Transit Upper Harbour (SH18) Rapid Transit. Our assessment has adopted a conservatively high peak hour vehicle trip rate of 0.9 v/hr/hh, to reflect that the existing public transport network in Whenuapai does not meet Auckland Transports classification for Frequent or Rapid Transit. Our ITA and Clause 23 responses demonstrate that the effects of the Plan Change can be accommodated by the existing transport network, along with improvements to the network that will be delivered by NCL.

Campbell Brown provide further comment about the FDS in their Clause 23 response.

2.2 Modelling

Specific request	Reason for the request
What modelling year has been used from SGA Saturn Model? What network improvements are included in the model that may affect traffic volumes on Brigham Creek Road (SH16/18 connections, Mamari Road, Northside Drive connection etc?). Some links are noted in Section 6.4, but it would be useful to understand any other relevant connections The SIDRA results at the SH16 / Brigham Creek Roundabout show long queues. Provide some commentary as to likelihood and reasons for this. Is that reflective of the likely signalised operation proposed as part of PC69? Further, PC69 modelled the roundabout in AIMSUN noting the limitations of SIDRA. The ITA considers that the development is acceptable based on the small percentage of additional traffic using the intersection however as per Laidlaw decision, "whilst we agree with the general principle that an applicant is not required to resolve existing infrastructure problems,	To better understand the traffic and other transport effects of the proposal and the ways in which any adverse effects may be mitigated.

Abley response

The ITA uses the 2028 SGA SATURN Model. Refer to Section 1.3 of this technical note, where we discuss why this is a highly conservative assessment year. We have only used the SGA SATURN Model to inform the turning movement proportions at the Brigham Creek Road/Totara Road intersection.

For the Brigham Creek Road/Totara Road assessment and all other models presented in this Clause 23 response document, our modelling assumed:

- Traffic volumes along Brigham Creek Road, Totara Road and Mamari Road adopted from PC69 modelling, inclusive of PC69 activity.
- Additional vehicle trips on Brigham Creek Road and Mamari Road resulting from PC86 activity adopted additively from PC86 modelling.
- Traffic volumes from Brigham Creek Road/Trig Road east and south adopted from Whenuapai Business Park modelling, noting that the modelling prepared by TEAM Traffic assumes that additional Whenuapai Business Park movements are purely additive.
- Additional trips generated by Whenuapai Green have been conservatively generated at 0.9 v/hr/hh, assumed to be purely additive over and above the volumes and activity listed above.

Our modelling for other intersections, discussed in Section 1.6, does not assume any network improvements, other than those proposed to be delivered by NCL.

Regarding the SH16 / Brigham Creek Roundabout, refer to Section 1.8 where we discuss trip distribution for Whenuapai Green, which indicates a very low number of vehicle movements through the SH16/Brigham Creek Road intersection.

Congestion at the SH16/Brigham Creek Road intersection will result in residents of Whenuapai Green favouring SH18/Brigham Creek and/or SH18 and SH16 via Trig Road. All trips between the site and the North Shore will use SH18, and Trig Road to SH16/Hobsonville Road provides a similar travel distance for trips between the site and the inner west/Central City/south. This degree of route adaptation is entirely reasonable as real time travel information is readily available to confirm the validity of these assumptions, such as Google Maps.

2.3 Public transport and active modes

Specific request	Reason for the request
Indicate where the bus stops are proposed to be located. Consider whether this requires safe crossing facilities to be provided on Tōtara Road for pedestrians / cyclists. Note that for Fast Track application, AT requested two pairs of bus stops on Tōtara Road. The ITA refers to 'provision of bus stops on Tōtara Road' so it is not clear what is proposed,	To better understand the traffic and other transport effects of the proposal and the ways in which any adverse effects may be mitigated.

Abley response

Refer to our response in Section 1.15 of this technical note.

2.4 Vehicle Access Restrictions

Specific request	Reason for the request
Address the need for Vehicle Access Restrictions on Tōtara Road. With the provision of separated cycle facilities on Tōtara Road, safety should be enhanced by avoiding or limiting direct vehicle access from individual sites onto Tōtara Road. This will also assist with the operation of the bus route on Tōtara Road. Previous plans did appear to show that residential sites with frontage to Tōtara Road would get vehicle access via rear lanes.	To better understand the traffic and other transport effects of the proposal and the ways in which any adverse effects may be mitigated. In particular to understand how safe active modes can be better provided for.

Abley response

Refer to our response in Section 1.13 of this technical note.

2.5 Dale / McCaw / Tōtara intersection

Specific request	Reason for the request
Provide more information about the concept design for this intersection to demonstrate that a safe and workable design can be accommodated. While this may have been covered in Fast Track application, concept diagrams should be included in ITA - as it is the current ITA which will inform the plan change and future consenting phases.	To better understand the traffic and other transport effects of the proposal and the ways in which any adverse effects may be mitigated.

Abley response

The concept design for the Tōtara Road / Dale Road / McCaw Avenue intersection is shown below and attached as Appendix B to this technical note.

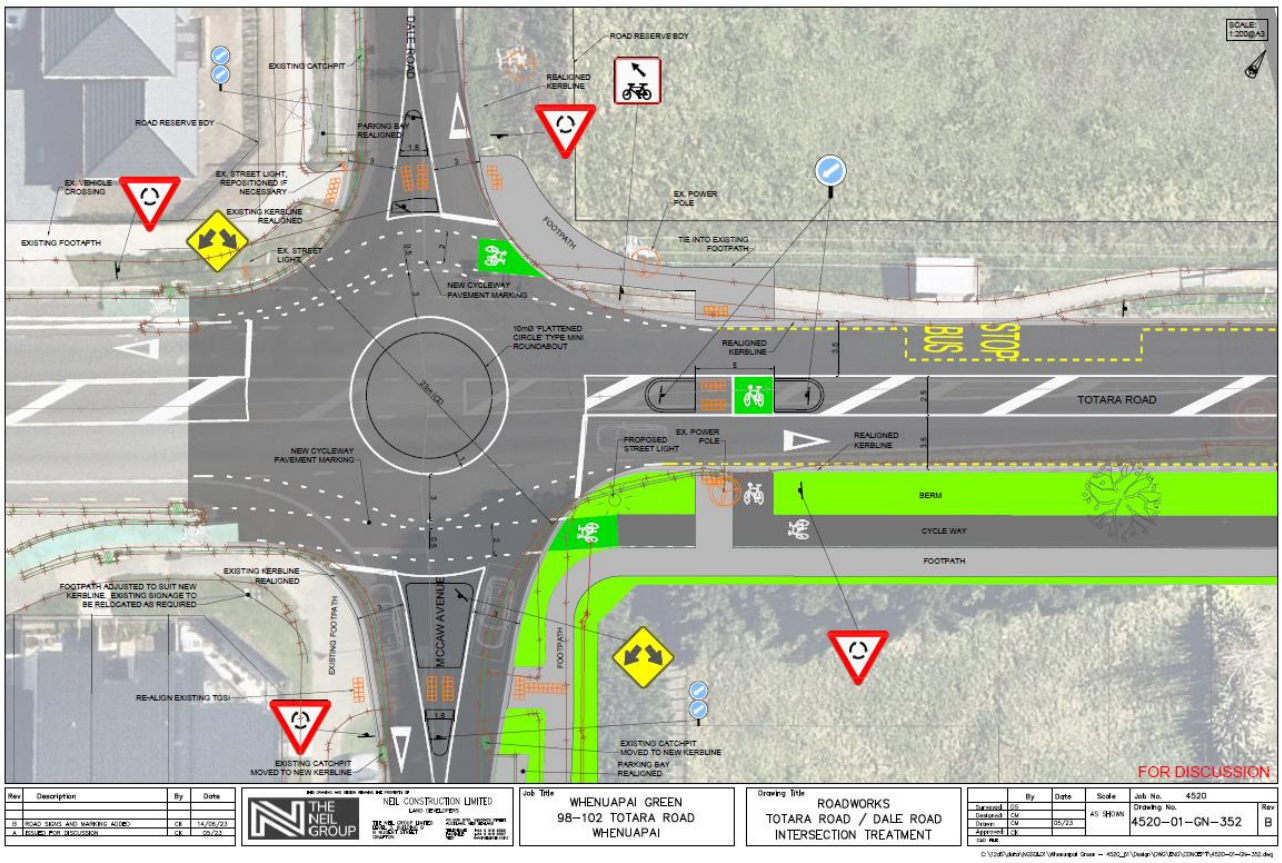


Figure 2.1: Tōtara Road / Dale Road / McCaw Avenue intersection concept design

2.6 Width of local roads

Specific request	Reason for the request
Advise where it is intended to apply the various local road cross sections of 15m, 17m and 20m. Which road widths are proposed for which local roads?	To better understand the traffic and other transport effects of the proposal and the ways in which any adverse effects may be mitigated. In particular to better understand the design and layout of the future road network.

Abley response

The 15m local road cross section contained in **Appendix 1 – Road Function and Design Element Table** of the draft Precinct provisions has been removed, and approval is not sought for the 15m local road under the Plan Change application. Refer to the response from Campbell Brown.

We consider that it is not necessary to identify the 17m local roads and 20m local roads on the Precinct Plan, as this can be addressed during future resource consent and engineering plan approval applications.

2.7 Tōtara Road intersections

Specific request	Reason for the request
Explain why it is proposed to provide two intersections onto Tōtara Road relatively close together. (This refers to the middle two intersections located between the Dale / McCaw / Tōtara intersection, and the northernmost intersection with Tōtara Road.) Assess the safety implications of retaining both intersections.	To better understand the traffic and other transport effects of the proposal and the ways in which any adverse effects may be mitigated.

Abley response

The spacing between the two roads is approximately 80m. This exceeds the spacing between the existing McCaw Avenue and Kopuru Road intersections with Totara Road, immediately south of the Site, which are approximately 70m apart, as shown in Figure 2.2.

We have considered two methods of determining appropriate intersection spacing, from the options presented in Austroads Guide to Road Design Part 4: Intersections and Crossings: General (AGRD-04) – Appendix B.

- B.3 Stopping sight distance.
  - Stopping sight distance is given in AGRD-03 and is equal to approach sight distance (ASD) given in AGRD-04A Table 3.2
  - For a 60 km/hr design speed and a 2 second reaction time, ASD is 73m.
- B.4 Intersection sight distance.
  - Safe intersection sight distance (SISD) is given in AGRD-04A Unsignalised and Signalised Intersections Table 3.2.
  - For a 60 km/hr design speed and a 2 second reaction time, SISD is 123m.

We consider that the intersection spacing is acceptable as it exceeds ASD and is greater than the spacing between McCaw Avenue and Kopuru Road. We note that these intersections will be further assessed during future resource consent and engineering plan approval applications.

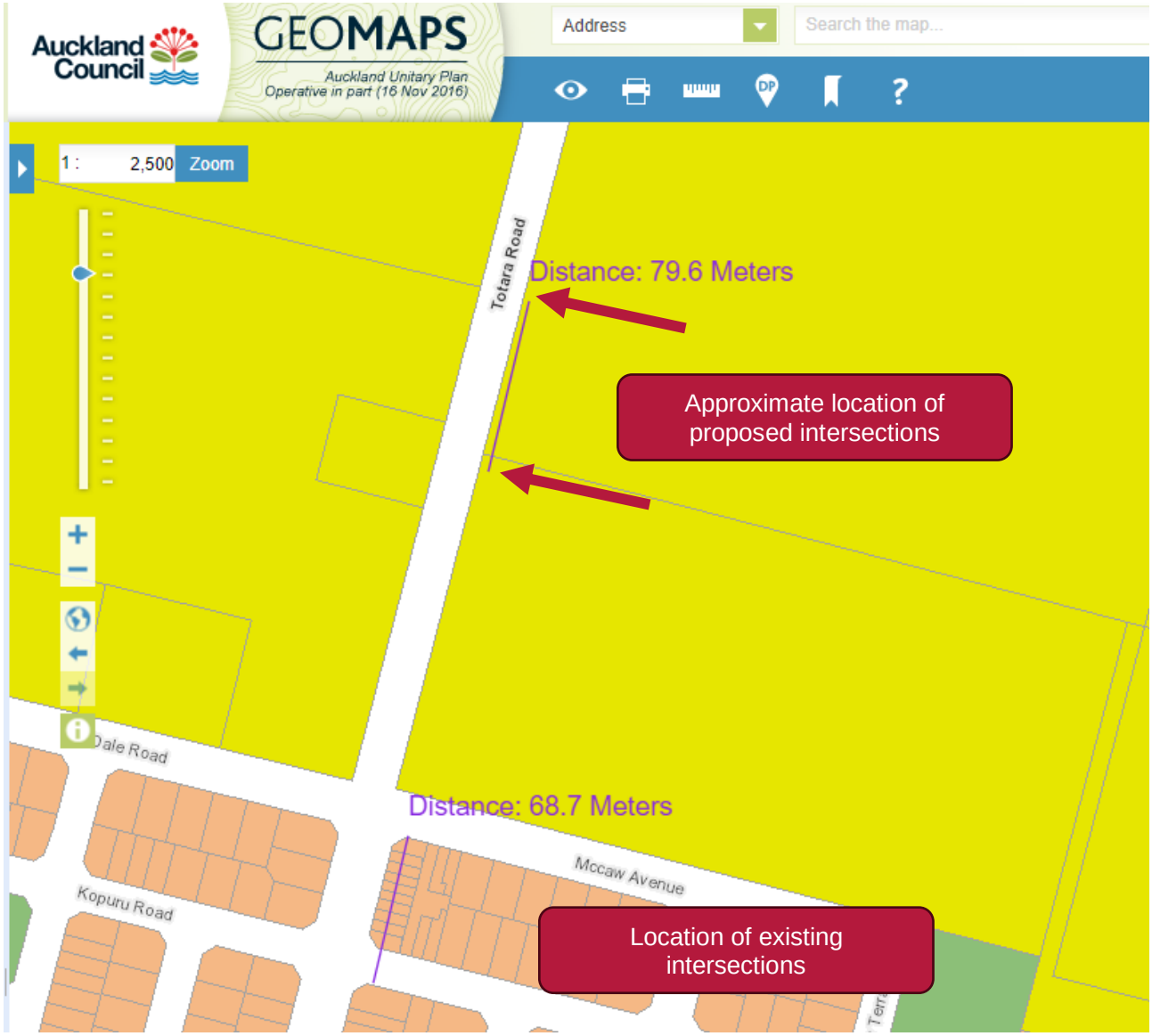


Figure 2.2 Intersection spacing (adapted from Council GEOMAPS).

2.8 Road links to adjacent sites

Specific request	Reason for the request
Explain why an additional road link has not been provided to the adjacent NZDF site - e.g. as per Road 4 on the previous Fast Track proposal. Assess the effect of this on future development opportunities for the adjacent site..	To better understand the traffic and other transport effects of the proposal and the ways in which any adverse effects may be mitigated.

Abley response

The Fast Track application included a third future road connection, shown in the location marked in Figure 2.3. We understand that, after lodgement of the Fast Track application, NZDF has indicated that

the southern link is not required and that the northern link is sufficient. We have assessed the proposed indicative internal road transport network and conclude that it appropriate from a transport perspective for the reasons outlined within the ITA. Note that the Whenuapai Green fast track application was prepared under separate legislation and independently of this private plan change process.

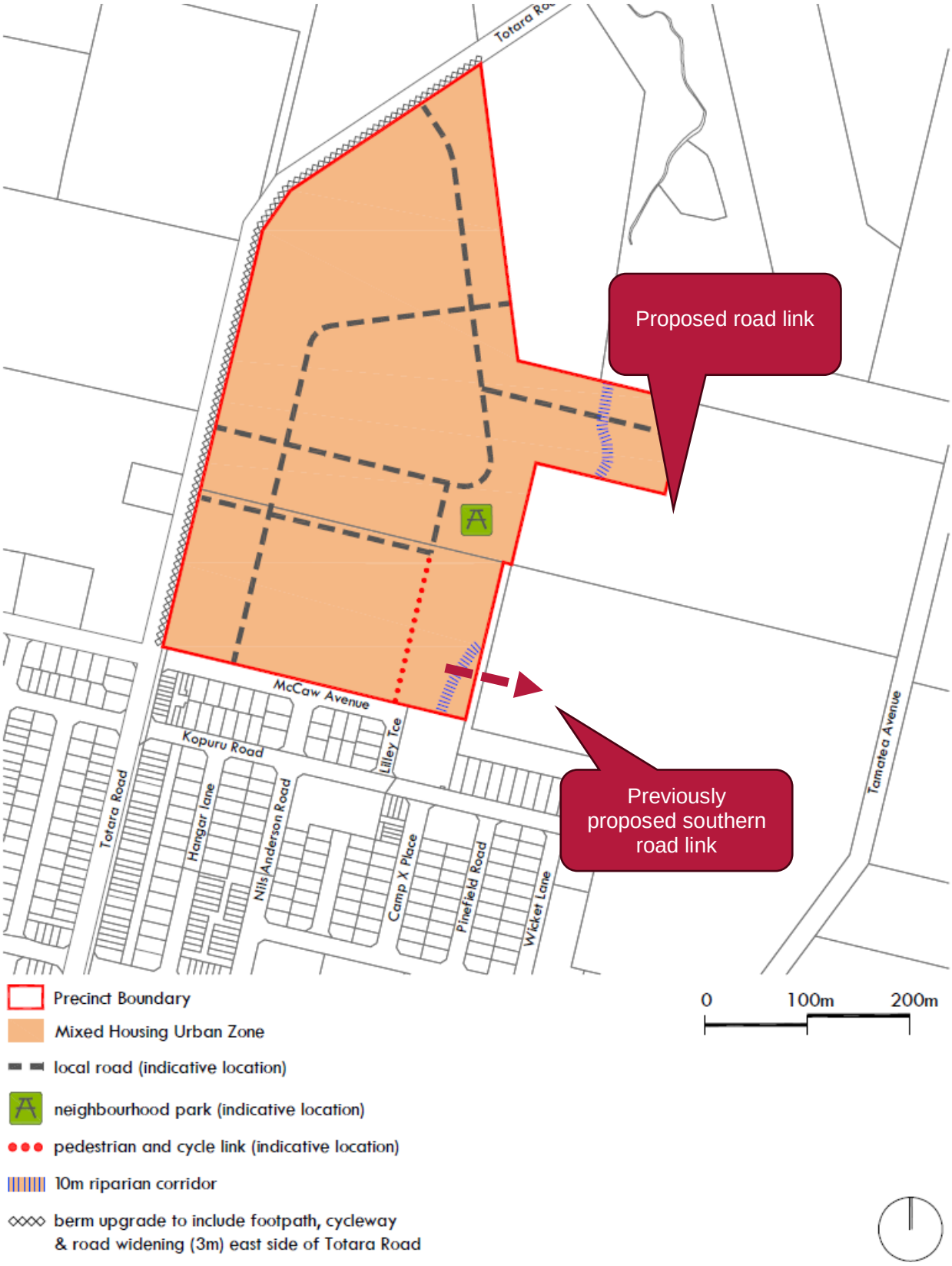


Figure 2.3 Proposed Precinct Plan, showing the location of the previously proposed road link to NZDF land.

3. Auckland Transport comments on the ITA

For each AT comment on the Ableys ITA we have reproduced the request from AT in a separate subsection and provided our response.

3.1 Public transport and active modes

Comment
In addition to bus stops, a bus shelter should be provided at the bus stop proposed for the eastern side of Tōtara Road.

Abley response

Refer to our response to Section 1.15 of this technical note.

3.2 Road design

Comment
Minimum road reserve widths given in the ITA must not be less than those in Auckland Code of Practice for Land Development and Subdivision - Chapter 3: Transport. 15m wide road reserves should not be indicated as acceptance would need to be considered at resource consent / subdivision stage.
AT has previously advised (for Fast Track proposal) that a minimum 1m berm is required. A 0.5m berm is still shown in Figure 5.2 for the 24m collector road.
Proposed amendments to road markings and signal control at Tōtara / BCR intersection will need to be confirmed with AT Network Operations, and the Auckland Transport Operating Centre (ATOC).
Only one of the two roads marked A should have vehicle access to Tōtara Road i.e. one intersection should be removed. The two intersections are considered to be too close together for safety purposes, and are not required for vehicle accessibility. Pedestrian access can be retained. Austroads Guide to Road Design Part 4: Intersections and Crossings: General – Appendix B provides guidance on distance between intersections.

Abley response

Regarding the 15m legal road widths, refer to our response in Section 2.6 of this technical note.

Regarding the berm width for the 24m collector road, **Appendix 1 – Road Function and Design Element Table** of the Precinct provisions takes precedence over the indicative cross sections in the ITA. Detailed cross sections will be provided during future resource consent and engineering plan approval applications.

We acknowledge that any changes to road markings and signals operation at the Brigham Creek Road / Tōtara Road intersection will require ATOC approval. This will be sought during future resource consent and engineering plan approval applications.

Regarding the two local road intersections with Totara Road, refer to our response in Section 1.7 and Section 2.7 of this technical note.

3.3 Road safety

Comment
The ITA (p28/69) states 'The upgrade to Tōtara Road is expected to include a reduction of the speed limit from 80km/h to 50km/h, however this will need to be actioned by Auckland Transport (as the Road Controlling Authority) and can be confirmed as part of the Engineering Plan Approval application should the Plan Change be approved' Note that the existing speed limit is now 60, rather than 80 (this change is noted in Section 3.4 of the ITA). There are factors that would support a further reduction to 50 if residential development occurs on the eastern side as provided for in the plan change. However it has become more difficult to achieve lowering of speed limits. It should not be assumed that it can be confirmed as part of an Engineering Plan Approval. In addition, simply changing the speed limit does not necessarily equate to reduced speeds. Traffic calming and treatments to reduce the operating speeds also need to be considered. The applicant needs to also consider changes to the speed environment to support a credible speed limit.

Abley response

Noted. There are no critical constraints that mean the Site would be undevelopable should the speed limit on Totara Road be retained at 60 km/hr. We will undertake further assessment of the proposed intersection points on Totara Road during subdivision consent, which will include consideration of the current (and if applicable also the likely future) speed limit at that time.

Appendix A.
SIDRA outputs incl. Signal phasing and Pedestrian LOS outputs

2030 Morning Peak Modelling Summary by Scenario

Site	Baseline			2030 incl WG (0.9v/hr/hh)			Difference		
	LoS	Delay	Max Queue	Los	Delay	Max Queue	LoS	Delay	Max Queue
BC / Totara	D	48s	283m	E	72s	397m	D>E	+24s	+114m
BC / Trig	A	7s	37m	A	9s	67m	-	+2s	+30m
BC / Kauri	C	16s	18m	C	20s	21m	-	+4s	+3m
SH18 N RAB	A	6s	30m	A	6s	34m	-	-	+4m
SH18 EB Ramp	D	46s	86m	F	101s	177m	D>F	+55s	+91m
Trig N SC1	B	13s	11m	C	17s	12m	B>C	+4s	+1m
Trig S SC1	C	19s	14m	D	30s	23m	C>D	+11s	+9m
Trig EB Ramp SC1	A	2s	5m	A	2s	5m	-	-	-
Trig N SC2	C	21s	12m	D	30s	15m	C>D	+9s	+3m
Trig S SC2	B	11s	5m	B	13s	6m	-	+2s	+1m
Trig EB Ramp SC2	A	2s	5m	A	2s	5m	-	-	-

2030 Evening Peak Modelling Summary by Scenario

Site	2030 Baseline			2030 incl WG (0.9v/hr/hh			Difference		
	LoS	Delay	Max Queue	Los	Delay	Max Queue	LoS	Delay	Max Queue
BC / Totara	C	34s	186m	E	78s	413m	D>E	+44s	+227m
BC / Trig	B	16s	180m	C	23s	390m	B>C	+7s	+210m
BC / Kauri	C	21s	22m	C	24s	26m	-	+3s	+4m
SH18 N RAB	B	11s	113m	B	13s	141m	-	+2s	+28m
SH18 EB Ramp	D	38s	74m	E	67s	122m	D>E	+29s	+48m
Trig N SC1	C	16s	5m	C	23s	5m	-	+7s	-
Trig S SC1	C	19s	16m	D	26s	23m	C>D	+7s	+7m
Trig EB Ramp SC1	A	2s	3m	A	2s	5m	-	-	-
Trig N SC2	C	25s	6m	E	36s	7m	C>E	+11s	+1m
Trig S SC2	C	21s	24m	D	27s	31m	C>D	+6s	+7m
Trig EB Ramp SC2	A	2s	3m	A	2s	3m	-	-	-

A1. Baseline Morning Peak Results

A1.1 Brigham Creek Road / Totara Road Baseline Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 Baseline AM (Site Folder: BC - Totara Baseline)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	29	0.0	29	0.0	0.140	55.7	LOS E	1.5	10.5	0.93	0.72	0.93	23.7
2	T1	All MCs	1	0.0	1	0.0	*0.149	47.7	LOS D	1.9	13.4	0.91	0.72	0.91	24.9
3	R2	All MCs	37	0.0	37	0.0	0.149	52.3	LOS D	1.9	13.4	0.91	0.72	0.91	24.4
Approach			67	0.0	67	0.0	0.149	53.7	LOS D	1.9	13.4	0.92	0.72	0.92	24.1
East: Brigham Creek Road E															
4	L2	All MCs	5	0.0	5	0.0	0.141	21.8	LOS C	3.7	29.0	0.58	0.49	0.58	36.4
5	T1	All MCs	428	13.2	428	13.2	0.354	19.0	LOS B	10.7	83.0	0.64	0.55	0.64	39.7
6	R2	All MCs	40	1.5	40	1.5	*0.422	65.7	LOS E	2.3	16.5	1.00	0.74	1.00	26.0
Approach			473	12.1	473	12.1	0.422	22.9	LOS C	10.7	83.0	0.67	0.56	0.67	38.0
North: Totara Road															
7	L2	All MCs	191	5.9	191	5.9	0.362	40.0	LOS D	8.5	62.2	0.84	0.78	0.84	32.0
8	T1	All MCs	1	0.0	1	0.0	*0.864	57.3	LOS E	19.9	149.0	1.00	0.99	1.24	22.8
9	R2	All MCs	320	8.3	320	8.3	0.864	62.0	LOS E	19.9	149.0	1.00	0.99	1.24	26.8
Approach			512	7.4	512	7.4	0.864	53.8	LOS D	19.9	149.0	0.94	0.91	1.09	28.5
West: Brigham Creek Road W															
10	L2	All MCs	183	10.5	183	10.5	0.377	32.0	LOS C	6.5	50.3	0.74	0.73	0.74	39.1
11	T1	All MCs	677	14.5	677	14.5	*0.879	65.4	LOS E	36.0	283.1	0.97	0.99	1.11	31.5
12	R2	All MCs	4	0.0	4	0.0	0.010	51.2	LOS D	0.1	0.9	0.66	0.63	0.66	30.8
Approach			864	13.6	864	13.6	0.879	58.3	LOS E	36.0	283.1	0.92	0.93	1.03	32.9
All Vehicles			1916	11.1	1916	11.1	0.879	48.2	LOS D	36.0	283.1	0.86	0.83	0.95	32.3

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
East: Brigham Creek Road E												
P2	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
North: Totara Road												
P3	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
West: Brigham Creek Road W												
P4	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
All Pedestrians		200	200	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97

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.

A1.2 Brigham Creek Road / Trig Road Baseline Morning Peak Movement Summary

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: RoadName															
1a	L1	All MCs	208	5.0	208	5.0	0.288	7.6	LOS A	2.0	14.6	0.77	0.67	0.77	52.1
3	R2	All MCs	16	5.0	16	5.0	0.288	12.7	LOS B	2.0	14.6	0.77	0.67	0.77	51.2
Approach			224	5.0	224	5.0	0.288	7.9	LOS A	2.0	14.6	0.77	0.67	0.77	52.1
East: RoadName															
4	L2	All MCs	91	5.0	91	5.0	0.582	6.2	LOS A	5.0	36.5	0.65	0.62	0.65	50.5
6a	R1	All MCs	548	5.0	548	5.0	0.582	10.1	LOS B	5.0	36.5	0.65	0.62	0.65	49.9
Approach			639	5.0	639	5.0	0.582	9.5	LOS A	5.0	36.5	0.65	0.62	0.65	50.0
NorthWest: RoadName															
27a	L1	All MCs	728	5.0	728	5.0	0.440	3.7	LOS A	3.9	28.2	0.14	0.39	0.14	55.0
29a	R1	All MCs	224	5.0	224	5.0	0.192	7.8	LOS A	1.2	8.5	0.12	0.58	0.12	51.1
Approach			953	5.0	953	5.0	0.440	4.6	LOS A	3.9	28.2	0.13	0.43	0.13	54.0
All Vehicles			1816	5.0	1816	5.0	0.582	6.8	LOS A	5.0	36.5	0.39	0.53	0.39	52.3

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

A1.3 Brigham Creek / Kauri Road Baseline Morning Peak Movement Summary

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: BCR SE															
2	T1	All MCs	925	9.4	925	9.4	0.491	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	49.7
3	R2	All MCs	76	8.1	76	8.1	0.139	11.2	LOS B	0.5	4.0	0.71	0.86	0.71	43.7
Approach			1001	9.3	1001	9.3	0.491	1.0	NA	0.5	4.0	0.05	0.06	0.05	49.2
East: Kauri Rd															
4	L2	All MCs	242	7.0	242	7.0	0.469	15.3	LOS C	2.4	17.9	0.79	1.02	1.16	40.2
6	R2	All MCs	46	12.5	46	12.5	0.200	21.7	LOS C	0.6	4.6	0.80	0.93	0.85	43.1
Approach			288	7.9	288	7.9	0.469	16.3	LOS C	2.4	17.9	0.79	1.01	1.11	41.0
North: BCR NW															
7	L2	All MCs	26	5.6	26	5.6	0.486	5.9	LOS A	0.2	1.8	0.01	0.21	0.01	56.4
8	T1	All MCs	896	6.9	896	6.9	0.486	1.2	LOS A	0.2	1.8	0.01	0.21	0.01	57.5
Approach			922	6.9	922	6.9	0.486	1.3	NA	0.2	1.8	0.01	0.21	0.01	57.5
All Vehicles			2212	8.1	2212	8.1	0.491	3.1	NA	2.4	17.9	0.13	0.25	0.18	50.4

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

A1.4 Brigham Creek Road /SH18 North Roundabout Baseline Morning Peak Movement Summary

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: BCR east															
22	T1	All MCs	809	7.2	809	7.2	0.356	1.0	LOS A	3.4	24.7	0.09	0.19	0.09	42.0
23	R2	All MCs	14	18.2	14	18.2	0.356	7.6	LOS A	3.4	24.7	0.10	0.25	0.10	45.8
23b	R3	All MCs	159	2.4	159	2.4	0.356	8.5	LOS A	3.4	24.7	0.10	0.25	0.10	40.1
Approach			982	6.6	982	6.6	0.356	2.3	LOS A	3.4	24.7	0.10	0.20	0.10	41.8
NorthEast: Sinton Rd															
24b	L3	All MCs	26	0.0	26	0.0	0.139	10.0	LOS A	0.7	5.0	0.81	0.83	0.81	39.2
24	L2	All MCs	29	0.0	29	0.0	0.139	9.6	LOS A	0.7	5.0	0.81	0.83	0.81	39.2
26	R2	All MCs	8	28.6	8	28.6	0.139	17.3	LOS B	0.7	5.0	0.81	0.83	0.81	39.2
Approach			63	3.6	63	3.6	0.139	10.8	LOS B	0.7	5.0	0.81	0.83	0.81	39.2
NorthWest: BCR west															
27	L2	All MCs	7	0.0	7	0.0	0.493	3.2	LOS A	3.4	25.5	0.62	0.37	0.62	45.4
27a	L1	All MCs	761	6.6	761	6.6	0.493	2.8	LOS A	3.4	25.5	0.62	0.37	0.62	39.9
28	T1	All MCs	357	13.7	357	13.7	0.493	3.0	LOS A	3.4	25.5	0.57	0.35	0.57	40.1
Approach			1126	8.8	1126	8.8	0.493	2.9	LOS A	3.4	25.5	0.61	0.36	0.61	40.0
SouthWest: SH18 offramp															
30	L2	All MCs	317	8.5	317	8.5	0.564	11.8	LOS B	4.0	30.1	0.78	0.90	1.04	51.3
31	T1	All MCs	10	0.0	10	0.0	0.564	11.3	LOS B	4.0	30.1	0.78	0.90	1.04	50.6
32a	R1	All MCs	2	0.0	2	0.0	0.564	16.7	LOS B	4.0	30.1	0.78	0.90	1.04	51.3
32	R2	All MCs	361	11.0	361	11.0	0.564	19.0	LOS B	4.0	30.1	0.74	0.89	0.89	48.6
Approach			690	9.7	690	9.7	0.564	15.6	LOS B	4.0	30.1	0.76	0.89	0.96	49.8
All Vehicles			2861	8.1	2861	8.1	0.564	5.9	LOS A	4.0	30.1	0.47	0.45	0.52	44.0

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

A1.5 Brigham Creek Road /SH18 Eastbound Onramp Baseline Morning Peak Movement Summary

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthWest: RoadName															
8	T1	All MCs	978	10.0	978	10.0	*1.031	45.7	LOS D	11.3	85.6	1.00	2.85	8.10	23.0
Approach			978	10.0	978	10.0	1.031	45.7	LOS D	11.3	85.6	1.00	2.85	8.10	23.0
All Vehicles			978	10.0	978	10.0	1.031	45.7	LOS D	11.3	85.6	1.00	2.85	8.10	23.0

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

A1.6 Trig Road / SH18 Onramp Baseline Scenario 1 Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig N Ramp (Site Folder: 2030 Baseline AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 Baseline AM - S 2 Stage (Network Folder: General)]

Trig N Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
1	L2	All MCs	7	5.0	7	5.0	0.262	7.0	LOS A	0.0	0.0	0.00	0.01	0.00	67.3
2	T1	All MCs	486	5.0	486	5.0	0.262	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	78.9
3	R2	All MCs	380	5.0	380	5.0	0.270	7.9	LOS A	1.5	10.9	0.41	0.65	0.41	41.0
Approach			874	5.0	874	5.0	0.270	3.5	NA	1.5	10.9	0.18	0.29	0.18	67.8
North: Trig N															
7	L2	All MCs	133	5.0	133	5.0	0.199	7.7	LOS A	0.0	0.0	0.00	0.23	0.00	71.6
8	T1	All MCs	237	5.0	237	5.0	0.199	0.0	LOS A	0.0	0.0	0.00	0.23	0.00	71.6
9	R2	All MCs	1	5.0	1	5.0	0.001	6.5	LOS A	0.0	0.0	0.45	0.54	0.45	44.6
Approach			371	5.0	371	5.0	0.199	2.8	NA	0.0	0.0	0.00	0.23	0.00	71.3
West: Northside Dr Ext															
10	L2	All MCs	2	5.0	2	5.0	0.025	7.2	LOS A	0.1	0.6	0.71	0.80	0.71	41.4
11	T1	All MCs	3	5.0	3	5.0	0.025	14.0	LOS B	0.1	0.6	0.71	0.80	0.71	36.9
12	R2	All MCs	3	5.0	3	5.0	0.025	16.4	LOS C	0.1	0.6	0.71	0.80	0.71	36.9
Approach			8	5.0	8	5.0	0.025	13.2	LOS B	0.1	0.6	0.71	0.80	0.71	38.6
All Vehicles			1253	5.0	1253	5.0	0.270	3.4	NA	1.5	10.9	0.13	0.27	0.13	68.4

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

A1.7 Trig Road / SH18 Offramp Baseline Scenario 1 Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig S Ramp (Site Folder: 2030 Baseline AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 Baseline AM - S 2 Stage (Network Folder: General)]

Trig S Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
2	T1	All MCs	740	5.0	740	5.0	0.392	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach			740	5.0	740	5.0	0.392	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.7
East: SH18 offramp															
4	L2	All MCs	106	5.0	106	5.0	0.096	10.9	LOS B	0.4	3.0	0.35	0.87	0.35	60.3
6	R2	All MCs	128	5.0	128	5.0	0.473	25.2	LOS D	1.9	13.9	0.86	1.03	1.21	39.1
Approach			235	5.0	235	5.0	0.473	18.8	LOS C	1.9	13.9	0.63	0.96	0.82	50.1
North: Trig N															
8	T1	All MCs	237	5.0	237	5.0	0.125	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach			237	5.0	237	5.0	0.125	0.0	NA	0.0	0.0	0.00	0.00	0.00	79.9
All Vehicles			1212	5.0	1212	5.0	0.473	3.7	NA	1.9	13.9	0.12	0.19	0.16	69.7

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

A1.8 Trig Road / SH18 Onramp Meter Baseline Scenario 1 Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [SH18 Onramp (Site Folder: 2030 Baseline AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 Baseline AM - S 2 Stage (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 7 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
West: Onramp Entry															
11	T1	All MCs	513	5.0	513	5.0	*0.317	1.7	LOS A	0.7	5.0	0.69	0.37	0.69	79.7
Approach			513	5.0	513	5.0	0.317	1.7	LOS A	0.7	5.0	0.69	0.37	0.69	79.7
All Vehicles			513	5.0	513	5.0	0.317	1.7	LOS A	0.7	5.0	0.69	0.37	0.69	79.7

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

A1.9 Trig Road / SH18 Onramp Baseline Scenario 2 Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig N Ramp (Site Folder: 2030 with WBP AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 with WBP AM - S 2 Stage (Network Folder: General)]

Trig N Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
1	L2	All MCs	7	5.0	7	5.0	0.376	7.0	LOS A	0.0	0.0	0.00	0.01	0.00	67.4
2	T1	All MCs	703	5.0	703	5.0	0.376	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	79.0
3	R2	All MCs	380	5.0	380	5.0	0.291	8.3	LOS A	1.6	11.6	0.47	0.68	0.47	40.5
Approach			1091	5.0	1091	5.0	0.376	3.0	NA	1.6	11.6	0.16	0.24	0.16	70.3
North: Trig N															
7	L2	All MCs	151	5.0	151	5.0	0.248	7.7	LOS A	0.0	0.0	0.00	0.21	0.00	72.2
8	T1	All MCs	311	5.0	311	5.0	0.248	0.0	LOS A	0.0	0.0	0.00	0.21	0.00	72.2
9	R2	All MCs	1	5.0	1	5.0	0.001	8.2	LOS A	0.0	0.0	0.57	0.60	0.57	43.7
Approach			462	5.0	462	5.0	0.248	2.6	NA	0.0	0.0	0.00	0.21	0.00	72.0
West: Northside Dr Ext															
10	L2	All MCs	2	5.0	2	5.0	0.043	9.6	LOS A	0.1	0.9	0.83	0.92	0.83	37.9
11	T1	All MCs	3	5.0	3	5.0	0.043	23.5	LOS C	0.1	0.9	0.83	0.92	0.83	31.7
12	R2	All MCs	3	5.0	3	5.0	0.043	27.1	LOS D	0.1	0.9	0.83	0.92	0.83	31.7
Approach			8	5.0	8	5.0	0.043	21.3	LOS C	0.1	0.9	0.83	0.92	0.83	33.9
All Vehicles			1561	5.0	1561	5.0	0.376	2.9	NA	1.6	11.6	0.12	0.23	0.12	70.3

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

A1.10 Trig Road / SH18 Offramp Baseline Scenario 2 Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig S Ramp (Site Folder: 2030 with WBP AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 with WBP AM - S 2 Stage (Network Folder: General)]

Trig S Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
2	T1	All MCs	933	5.0	933	5.0	0.494	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	79.5
Approach			933	5.0	933	5.0	0.494	0.2	NA	0.0	0.0	0.00	0.00	0.00	79.5
East: SH18 offramp															
4	L2	All MCs	106	5.0	106	5.0	0.105	11.4	LOS B	0.4	3.2	0.41	0.88	0.41	60.0
6	R2	All MCs	151	5.0	151	5.0	0.182	10.8	LOS B	0.7	5.3	0.43	0.72	0.43	57.7
Approach			257	5.0	257	5.0	0.182	11.0	LOS B	0.7	5.3	0.42	0.78	0.42	59.0
North: Trig N															
8	T1	All MCs	311	5.0	311	5.0	0.164	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach			311	5.0	311	5.0	0.164	0.0	NA	0.0	0.0	0.00	0.00	0.00	79.9
All Vehicles			1500	5.0	1500	5.0	0.494	2.0	NA	0.7	5.3	0.07	0.13	0.07	74.2

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

A1.11 Trig Road / SH18 Onramp Meter Baseline Scenario 2 Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [SH18 Onramp (Site Folder: 2030 with WBP AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 with WBP AM - S 2 Stage (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 7 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
West: Onramp Entry															
11	T1	All MCs	531	5.0	531	5.0	*0.328	1.7	LOS A	0.7	5.2	0.70	0.37	0.70	79.7
Approach			531	5.0	531	5.0	0.328	1.7	LOS A	0.7	5.2	0.70	0.37	0.70	79.7
All Vehicles			531	5.0	531	5.0	0.328	1.7	LOS A	0.7	5.2	0.70	0.37	0.70	79.7

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

A1.12 Brigham Creek Road /Totara Road Baseline Morning Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 Baseline AM (Site Folder: BC - Totara Baseline)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site Optimum Cycle Time - Minimum Delay)

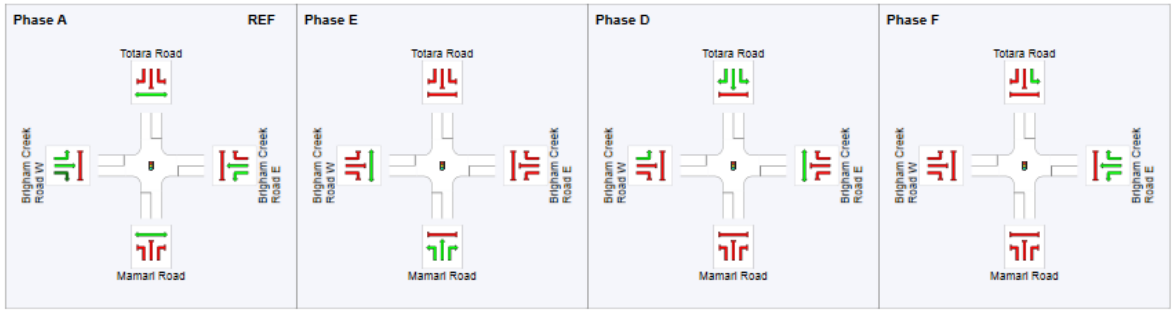
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	50	72	103
Green Time (sec)	44	16	25	6
Phase Time (sec)	50	22	31	12
Phase Split	43 %	19 %	27 %	10 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



A1.13 Brigham Creek Road /SH18 Eastbound Onramp Baseline Morning Peak Phasing Summary

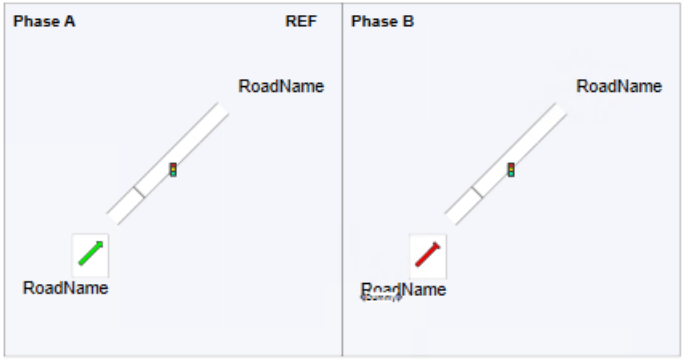
Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	3
Green Time (sec)	3	5
Phase Time (sec)	3	5
Phase Split	38 %	63 %
Phase Frequency (%)	42.9[2]	0.0[2]

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

2 Phase Frequency is implied by a Phase Time specified by the user that is less than the Required Movement Time.

Output Phase Sequence



A2. Baseline Evening Peak Results

A2.1 Brigham Creek Road / Totara Road Baseline Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 Baseline PM (Site Folder: BC - Totara Baseline)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 95 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	7	0.0	7	0.0	0.028	44.0	LOS D	0.3	2.0	0.89	0.65	0.89	26.7
2	T1	All MCs	1	0.0	1	0.0	*0.038	36.8	LOS D	0.4	3.1	0.87	0.66	0.87	27.9
3	R2	All MCs	10	0.0	10	0.0	0.038	41.4	LOS D	0.4	3.1	0.87	0.66	0.87	27.3
Approach			18	0.0	18	0.0	0.038	42.2	LOS D	0.4	3.1	0.88	0.66	0.88	27.1
East: Brigham Creek Road E															
4	L2	All MCs	32	0.0	32	0.0	0.220	20.3	LOS C	5.0	39.3	0.61	0.55	0.61	37.1
5	T1	All MCs	610	17.7	610	17.7	0.553	20.4	LOS C	14.8	119.4	0.72	0.64	0.72	40.2
6	R2	All MCs	87	2.4	87	2.4	*0.770	61.3	LOS E	4.5	32.0	1.00	0.91	1.29	27.4
Approach			730	15.1	730	15.1	0.770	25.3	LOS C	14.8	119.4	0.75	0.67	0.78	37.9
North: Totara Road															
7	L2	All MCs	58	1.9	58	1.9	0.115	32.6	LOS C	2.0	14.3	0.78	0.72	0.78	34.0
8	T1	All MCs	1	0.0	1	0.0	*0.851	50.7	LOS D	12.1	98.3	1.00	1.01	1.32	24.1
9	R2	All MCs	230	18.9	230	18.9	0.851	55.5	LOS E	12.1	98.3	1.00	1.01	1.32	28.0
Approach			289	15.5	289	15.5	0.851	50.9	LOS D	12.1	98.3	0.96	0.95	1.22	29.0
West: Brigham Creek Road W															
10	L2	All MCs	230	11.2	230	11.2	0.351	12.0	LOS B	4.5	34.7	0.69	0.72	0.69	41.2
11	T1	All MCs	551	13.2	551	13.2	*0.819	46.5	LOS D	23.9	186.2	0.96	0.94	1.06	34.3
12	R2	All MCs	11	0.0	11	0.0	0.044	43.3	LOS D	0.4	2.6	0.73	0.67	0.73	30.8
Approach			792	12.4	792	12.4	0.819	36.4	LOS D	23.9	186.2	0.88	0.87	0.95	36.0
All Vehicles			1828	13.9	1828	13.9	0.851	34.3	LOS C	23.9	186.2	0.84	0.80	0.92	35.3

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02
East: Brigham Creek Road E												
P2	Full	50	50	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02
North: Totara Road												
P3	Full	50	50	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02
West: Brigham Creek Road W												
P4	Full	50	50	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02
All Pedestrians		200	200	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02

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.

A2.2 Brigham Creek Road Road / Trig Road Baseline Evening Peak Movement Summary

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: RoadName															
1a	L1	All MCs	240	5.0	240	5.0	0.557	14.5	LOS B	5.4	39.2	1.00	0.91	1.23	47.3
3	R2	All MCs	42	5.0	42	5.0	0.557	19.7	LOS B	5.4	39.2	1.00	0.91	1.23	46.5
Approach			282	5.0	282	5.0	0.557	15.3	LOS B	5.4	39.2	1.00	0.91	1.23	47.1
East: RoadName															
4	L2	All MCs	27	5.0	27	5.0	0.924	26.8	LOS C	24.7	180.0	1.00	1.39	2.13	39.5
6a	R1	All MCs	797	5.0	797	5.0	0.924	30.7	LOS C	24.7	180.0	1.00	1.39	2.13	39.2
Approach			824	5.0	824	5.0	0.924	30.6	LOS C	24.7	180.0	1.00	1.39	2.13	39.2
NorthWest: RoadName															
27a	L1	All MCs	744	5.0	744	5.0	0.480	3.8	LOS A	4.6	33.8	0.27	0.39	0.27	54.4
29a	R1	All MCs	417	5.0	417	5.0	0.329	8.0	LOS A	2.5	18.1	0.24	0.56	0.24	50.7
Approach			1161	5.0	1161	5.0	0.480	5.3	LOS A	4.6	33.8	0.26	0.45	0.26	53.0
All Vehicles			2267	5.0	2267	5.0	0.924	15.8	LOS B	24.7	180.0	0.62	0.85	1.06	46.3

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

A2.3 Brigham Creek Road / Kauri Road Baseline Evening Peak Movement Summary

Vehicle Movement Performance														
Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: BCR SE															
2	T1	All MCs	895	9.4	895	9.4	0.475	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	49.7
3	R2	All MCs	220	8.1	220	8.1	0.569	20.7	LOS C	3.0	22.4	0.88	1.13	1.45	37.9
Approach			1115	9.1	1115	9.1	0.569	4.2	NA	3.0	22.4	0.17	0.22	0.29	46.8
East: Kauri Rd															
4	L2	All MCs	151	7.0	151	7.0	0.406	18.4	LOS C	1.7	12.6	0.84	1.01	1.12	37.7
6	R2	All MCs	22	12.5	22	12.5	0.204	39.6	LOS E	0.5	4.0	0.90	0.97	0.96	35.6
Approach			173	7.7	173	7.7	0.406	21.1	LOS C	1.7	12.6	0.85	1.01	1.10	37.2
North: BCR NW															
7	L2	All MCs	39	5.6	39	5.6	0.580	8.7	LOS A	0.6	4.4	0.03	0.23	0.04	56.3
8	T1	All MCs	1051	6.9	1051	6.9	0.580	1.2	LOS A	0.6	4.4	0.03	0.23	0.04	57.3
Approach			1089	6.9	1089	6.9	0.580	1.5	NA	0.6	4.4	0.03	0.23	0.04	57.2
All Vehicles			2377	8.0	2377	8.0	0.580	4.2	NA	3.0	22.4	0.16	0.28	0.23	49.4

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

A2.4 Brigham Creek Road /SH18 North Roundabout Baseline Evening Peak Movement Summary

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: BCR east															
22	T1	All MCs	843	5.2	843	5.2	0.399	0.9	LOS A	4.1	29.9	0.09	0.21	0.09	41.2
23	R2	All MCs	44	6.1	44	6.1	0.399	7.5	LOS A	4.1	29.9	0.09	0.31	0.09	45.4
23b	R3	All MCs	227	1.8	227	1.8	0.399	8.5	LOS A	4.1	29.9	0.09	0.31	0.09	38.7
Approach			1113	4.5	1113	4.5	0.399	2.7	LOS A	4.1	29.9	0.09	0.24	0.09	41.2
NorthEast: Sinton Rd															
24b	L3	All MCs	16	0.0	16	0.0	0.198	18.1	LOS B	1.1	8.2	0.92	0.92	0.92	32.8
24	L2	All MCs	24	22.2	24	22.2	0.198	20.3	LOS C	1.1	8.2	0.92	0.92	0.92	32.8
26	R2	All MCs	7	0.0	7	0.0	0.198	23.5	LOS C	1.1	8.2	0.92	0.92	0.92	32.8
Approach			48	11.3	48	11.3	0.198	20.0	LOS C	1.1	8.2	0.92	0.92	0.92	32.8
NorthWest: BCR west															
27	L2	All MCs	12	0.0	12	0.0	0.898	14.9	LOS B	15.6	112.7	1.00	1.36	1.97	39.6
27a	L1	All MCs	764	3.9	764	3.9	0.898	14.5	LOS B	15.6	112.7	1.00	1.36	1.97	29.4
28	T1	All MCs	478	5.0	478	5.0	0.898	9.0	LOS A	15.6	112.7	0.86	0.93	1.24	34.5
Approach			1254	4.3	1254	4.3	0.898	12.4	LOS B	15.6	112.7	0.95	1.20	1.70	31.4
SouthWest: SH18 offramp															
30	L2	All MCs	314	5.0	314	5.0	0.725	14.9	LOS B	7.2	51.8	0.87	1.04	1.43	46.4
31	T1	All MCs	20	7.7	20	7.7	0.725	15.1	LOS B	7.2	51.8	0.87	1.04	1.43	48.0
32a	R1	All MCs	1	0.0	1	0.0	0.725	20.0	LOS C	7.2	51.8	0.87	1.04	1.43	46.4
32	R2	All MCs	630	1.1	630	1.1	0.725	20.9	LOS C	7.2	51.8	0.82	0.98	1.20	46.2
Approach			965	2.5	965	2.5	0.725	18.8	LOS B	7.2	51.8	0.84	1.00	1.28	46.3
All Vehicles			3380	4.0	3380	4.0	0.898	11.2	LOS B	15.6	112.7	0.63	0.82	1.04	39.2

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

A2.5 Brigham Creek Road /SH18 Eastbound Onramp Baseline Evening Peak Movement Summary

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthWest: RoadName															
8	T1	All MCs	967	10.0	967	10.0	*1.020	38.4	LOS D	9.7	73.7	1.00	2.65	7.39	25.5
Approach			967	10.0	967	10.0	1.020	38.4	LOS D	9.7	73.7	1.00	2.65	7.39	25.5
All Vehicles			967	10.0	967	10.0	1.020	38.4	LOS D	9.7	73.7	1.00	2.65	7.39	25.5

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

A2.6 Trig Road / SH18 Onramp Baseline Scenario 1 Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig N Ramp (Site Folder: 2030 Baseline PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 Baseline PM - S 2 Stage (Network Folder: General)]

Trig N Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
1	L2	All MCs	7	5.0	7	5.0	0.206	7.0	LOS A	0.0	0.0	0.00	0.01	0.00	67.2
2	T1	All MCs	382	5.0	382	5.0	0.206	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	78.6
3	R2	All MCs	132	5.0	132	5.0	0.150	10.1	LOS B	0.7	4.7	0.60	0.81	0.60	36.8
Approach			521	5.0	521	5.0	0.206	2.7	NA	0.7	4.7	0.15	0.21	0.15	71.5
North: Trig N															
7	L2	All MCs	173	5.0	173	5.0	0.429	7.7	LOS A	0.0	0.0	0.00	0.14	0.00	74.4
8	T1	All MCs	628	5.0	628	5.0	0.429	0.1	LOS A	0.0	0.0	0.00	0.14	0.00	74.4
9	R2	All MCs	2	5.0	2	5.0	0.002	6.0	LOS A	0.0	0.0	0.39	0.53	0.39	44.9
Approach			803	5.0	803	5.0	0.429	1.8	NA	0.0	0.0	0.00	0.14	0.00	74.2
West: Northside Dr Ext															
10	L2	All MCs	1	5.0	1	5.0	0.031	6.4	LOS A	0.1	0.7	0.75	0.86	0.75	40.0
11	T1	All MCs	2	5.0	2	5.0	0.031	17.5	LOS C	0.1	0.7	0.75	0.86	0.75	34.8
12	R2	All MCs	5	5.0	5	5.0	0.031	17.6	LOS C	0.1	0.7	0.75	0.86	0.75	34.8
Approach			8	5.0	8	5.0	0.031	16.2	LOS C	0.1	0.7	0.75	0.86	0.75	35.8
All Vehicles			1333	5.0	1333	5.0	0.429	2.2	NA	0.7	4.7	0.06	0.17	0.06	72.5

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

A2.7 Trig Road / SH18 Offramp Baseline Scenario 1 Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig S Ramp (Site Folder: 2030 Baseline PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 Baseline PM - S 2 Stage (Network Folder: General)]

Trig S Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
2	T1	All MCs	381	5.0	381	5.0	0.202	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach			381	5.0	381	5.0	0.202	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.9
East: SH18 offramp															
4	L2	All MCs	264	5.0	264	5.0	0.404	16.0	LOS C	2.2	15.9	0.66	1.05	0.90	56.4
6	R2	All MCs	133	5.0	133	5.0	0.464	23.5	LOS C	1.9	13.9	0.85	1.02	1.19	39.9
Approach			397	5.0	397	5.0	0.464	18.5	LOS C	2.2	15.9	0.72	1.04	1.00	52.1
North: Trig N															
8	T1	All MCs	628	5.0	628	5.0	0.333	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach			628	5.0	628	5.0	0.333	0.0	NA	0.0	0.0	0.00	0.00	0.00	79.8
All Vehicles			1406	5.0	1406	5.0	0.464	5.2	NA	2.2	15.9	0.20	0.29	0.28	67.2

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

A2.8 Trig Road / SH18 Onramp Meter Baseline Scenario 1 Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [SH18 Onramp (Site Folder: 2030 Baseline PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 Baseline PM - S 2 Stage (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 7 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
West: Onramp Entry															
11	T1	All MCs	304	5.0	304	5.0	*0.188	1.6	LOS A	0.4	2.7	0.65	0.34	0.65	80.3
Approach			304	5.0	304	5.0	0.188	1.6	LOS A	0.4	2.7	0.65	0.34	0.65	80.3
All Vehicles			304	5.0	304	5.0	0.188	1.6	LOS A	0.4	2.7	0.65	0.34	0.65	80.3

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

A2.9 Trig Road / SH18 Onramp Baseline Scenario 2 Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig N Ramp (Site Folder: 2030 with WBP PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 with WBP PM - S 2 Stage (Network Folder: General)]

Trig N Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
1	L2	All MCs	7	5.0	7	5.0	0.269	7.0	LOS A	0.0	0.0	0.00	0.01	0.00	67.3
2	T1	All MCs	501	5.0	501	5.0	0.269	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	78.9
3	R2	All MCs	132	5.0	132	5.0	0.207	12.3	LOS B	0.8	6.1	0.68	0.90	0.68	32.9
Approach			640	5.0	640	5.0	0.269	2.6	NA	0.8	6.1	0.14	0.19	0.14	72.0
North: Trig N															
7	L2	All MCs	191	5.0	191	5.0	0.543	7.8	LOS A	0.0	0.0	0.00	0.12	0.00	74.9
8	T1	All MCs	825	5.0	825	5.0	0.543	0.2	LOS A	0.0	0.0	0.00	0.12	0.00	74.9
9	R2	All MCs	2	5.0	2	5.0	0.002	6.6	LOS A	0.0	0.1	0.45	0.56	0.45	44.5
Approach			1018	5.0	1018	5.0	0.543	1.6	NA	0.0	0.1	0.00	0.12	0.00	74.7
West: Northside Dr Ext															
10	L2	All MCs	1	0.0	1	0.0	0.051	7.1	LOS A	0.2	1.1	0.86	0.93	0.86	36.6
11	T1	All MCs	2	0.0	2	0.0	0.051	28.1	LOS D	0.2	1.1	0.86	0.93	0.86	29.9
12	R2	All MCs	5	0.0	5	0.0	0.051	27.0	LOS D	0.2	1.1	0.86	0.93	0.86	29.9
Approach			8	0.0	8	0.0	0.051	24.8	LOS C	0.2	1.1	0.86	0.93	0.86	31.2
All Vehicles			1666	5.0	1666	5.0	0.543	2.1	NA	0.8	6.1	0.06	0.15	0.06	73.0

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

A2.10 Trig Road / SH18 Offramp Baseline Scenario 2 Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig S Ramp (Site Folder: 2030 with WBP PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 with WBP PM - S 2 Stage (Network Folder: General)]

Trig S Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
2	T1	All MCs	488	5.0	488	5.0	0.259	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach			488	5.0	488	5.0	0.259	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.8
East: SH18 offramp															
4	L2	All MCs	264	5.0	264	5.0	0.578	22.1	LOS C	3.3	24.0	0.83	1.14	1.40	51.8
6	R2	All MCs	144	5.0	144	5.0	0.423	20.2	LOS C	1.8	13.0	0.80	1.00	1.10	43.1
Approach			408	5.0	408	5.0	0.578	21.4	LOS C	3.3	24.0	0.82	1.09	1.29	49.7
North: Trig N															
8	T1	All MCs	825	5.0	825	5.0	0.437	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.6
Approach			825	5.0	825	5.0	0.437	0.0	NA	0.0	0.0	0.00	0.00	0.00	79.6
All Vehicles			1722	5.0	1722	5.0	0.578	5.1	NA	3.3	24.0	0.19	0.26	0.31	67.6

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

A2.11 Trig Road / SH18 Onramp Meter Baseline Scenario 2 Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [SH18 Onramp (Site Folder: 2030 with WBP PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 with WBP PM - S 2 Stage (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 7 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
West: Onramp Entry															
11	T1	All MCs	322	5.0	322	5.0	*0.199	1.6	LOS A	0.4	2.9	0.65	0.35	0.65	80.2
Approach			322	5.0	322	5.0	0.199	1.6	LOS A	0.4	2.9	0.65	0.35	0.65	80.2
All Vehicles			322	5.0	322	5.0	0.199	1.6	LOS A	0.4	2.9	0.65	0.35	0.65	80.2

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

A2.12 Brigham Creek Road / Totara Road Baseline Evening Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 Baseline PM (Site Folder: BC - Totara Baseline)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 95 seconds (Site Optimum Cycle Time - Minimum Delay)

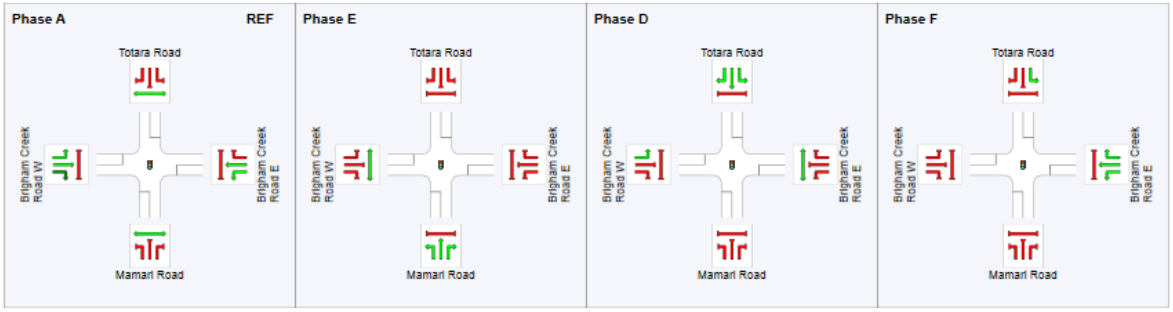
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	40	61	83
Green Time (sec)	34	15	16	6
Phase Time (sec)	40	21	22	12
Phase Split	42 %	22 %	23 %	13 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



A2.13 Brigham Creek Road /SH18 Eastbound Onramp Baseline Evening Peak Phasing Summary

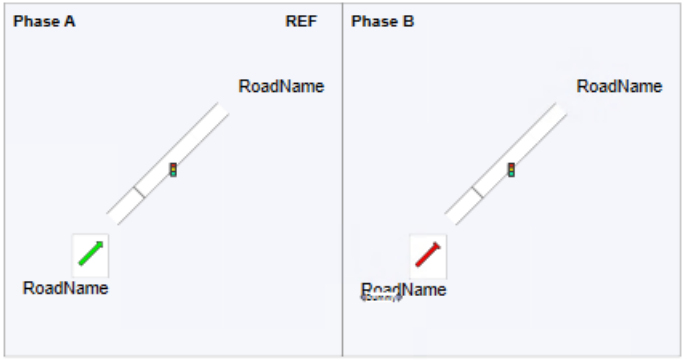
Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	3
Green Time (sec)	3	5
Phase Time (sec)	3	5
Phase Split	38 %	63 %
Phase Frequency (%)	42.9[2]	0.0[2]

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

2 Phase Frequency is implied by a Phase Time specified by the user that is less than the Required Movement Time.

Output Phase Sequence



A3. With Whenuapai Green Morning Peak Results

A3.1 Brigham Creek Road /Totara Road (0.9 trips/hh) With Whenuapai Green Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 WG Development AM Fixed Cycle (Site Folder: BC - Totara including WG Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	29	0.0	29	0.0	0.140	55.7	LOS E	1.5	10.5	0.93	0.72	0.93	23.7
2	T1	All MCs	1	0.0	1	0.0	*0.149	47.7	LOS D	1.9	13.4	0.91	0.72	0.91	24.9
3	R2	All MCs	37	0.0	37	0.0	0.149	52.5	LOS D	1.9	13.4	0.91	0.72	0.91	24.6
Approach			67	0.0	67	0.0	0.149	53.8	LOS D	1.9	13.4	0.92	0.72	0.92	24.2
East: Brigham Creek Road E															
4	L2	All MCs	5	0.0	5	0.0	0.143	22.3	LOS C	3.8	29.6	0.59	0.49	0.59	36.1
5	T1	All MCs	428	13.2	428	13.2	0.361	19.7	LOS B	10.8	84.5	0.65	0.56	0.65	39.4
6	R2	All MCs	132	0.5	132	0.5	*0.927	79.4	LOS E	9.0	63.2	1.00	1.15	1.65	23.8
Approach			565	10.1	565	10.1	0.927	33.6	LOS C	10.8	84.5	0.73	0.70	0.88	34.1
North: Totara Road															
7	L2	All MCs	410	2.7	410	2.7	0.746	47.4	LOS D	20.9	149.8	0.95	0.88	0.98	31.1
8	T1	All MCs	1	0.0	1	0.0	*0.999	118.6	LOS F	32.4	241.6	1.00	1.35	1.88	15.1
9	R2	All MCs	350	7.6	350	7.6	0.999	123.3	LOS F	32.4	241.6	1.00	1.35	1.88	18.9
Approach			761	5.0	761	5.0	0.999	82.4	LOS F	32.4	241.6	0.97	1.09	1.39	23.9
West: Brigham Creek Road W															
10	L2	All MCs	198	9.8	198	9.8	0.419	37.5	LOS D	6.9	52.6	0.78	0.75	0.78	38.9
11	T1	All MCs	677	14.5	677	14.5	*0.977	105.8	LOS F	50.4	397.0	0.98	1.32	1.47	24.0
12	R2	All MCs	4	0.0	4	0.0	0.011	57.6	LOS E	0.1	0.9	0.70	0.63	0.70	29.8
Approach			878	13.4	878	13.4	0.977	90.2	LOS F	50.4	397.0	0.93	1.19	1.31	26.3
All Vehicles			2272	9.4	2272	9.4	0.999	72.4	LOS E	50.4	397.0	0.90	1.02	1.22	26.9

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
East: Brigham Creek Road E												
P2	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
North: Totara Road												
P3	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
West: Brigham Creek Road W												
P4	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
All Pedestrians		200	200	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97

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.

A3.2 Brigham Creek Road /Totara Road (0.65 v/hr/hh) With Whenuapai Green Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 WG Development AM - 0.65/HH Fixed Cycle (Site Folder: BC - Totara including WG Development - 0.65/HH)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Mamari Road															
1	L2	All MCs	29	0.0	29	0.0	0.140	55.7	LOS E	1.5	10.5	0.93	0.72	0.93	23.7
2	T1	All MCs	1	0.0	1	0.0	*0.149	47.7	LOS D	1.9	13.4	0.91	0.72	0.91	24.9
3	R2	All MCs	37	0.0	37	0.0	0.149	52.4	LOS D	1.9	13.4	0.91	0.72	0.91	24.4
Approach			67	0.0	67	0.0	0.149	53.8	LOS D	1.9	13.4	0.92	0.72	0.92	24.1
East: Brigham Creek Road E															
4	L2	All MCs	5	0.0	5	0.0	0.143	22.3	LOS C	3.8	29.6	0.59	0.49	0.59	36.1
5	T1	All MCs	428	13.2	428	13.2	0.361	19.6	LOS B	10.8	84.5	0.65	0.56	0.65	39.4
6	R2	All MCs	107	0.6	107	0.6	*0.961	89.7	LOS F	7.7	54.4	1.00	1.22	1.89	22.2
Approach			540	10.6	540	10.6	0.961	33.5	LOS C	10.8	84.5	0.72	0.69	0.90	34.2
North: Totara Road															
7	L2	All MCs	349	3.2	349	3.2	0.615	44.6	LOS D	16.7	120.3	0.91	0.84	0.91	31.5
8	T1	All MCs	1	0.0	1	0.0	*0.980	100.9	LOS F	29.1	217.2	1.00	1.26	1.74	16.8
9	R2	All MCs	342	7.8	342	7.8	0.980	105.6	LOS F	29.1	217.2	1.00	1.26	1.74	20.6
Approach			692	5.4	692	5.4	0.980	74.8	LOS E	29.1	217.2	0.95	1.05	1.32	25.0
West: Brigham Creek Road W															
10	L2	All MCs	194	10.0	194	10.0	0.398	34.9	LOS C	6.6	50.6	0.76	0.74	0.76	39.1
11	T1	All MCs	677	14.5	677	14.5	*0.928	79.8	LOS E	41.6	327.8	0.97	1.12	1.24	28.5
12	R2	All MCs	4	0.0	4	0.0	0.010	54.4	LOS D	0.1	0.9	0.68	0.63	0.68	30.3
Approach			874	13.5	874	13.5	0.928	69.7	LOS E	41.6	327.8	0.93	1.03	1.14	30.3
All Vehicles			2173	9.8	2173	9.8	0.980	61.8	LOS E	41.6	327.8	0.88	0.94	1.13	29.0

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
East: Brigham Creek Road E												
P2	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
North: Totara Road												
P3	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
West: Brigham Creek Road W												
P4	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
All Pedestrians		200	200	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97

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.

A3.3 Brigham Creek Road /Trig Road With Whenuapai Green Morning Peak Movement Summary

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: RoadName															
1a	L1	All MCs	271	5.0	271	5.0	0.400	8.2	LOS A	3.1	22.3	0.86	0.71	0.86	51.8
3	R2	All MCs	16	5.0	16	5.0	0.400	13.3	LOS B	3.1	22.3	0.86	0.71	0.86	50.9
Approach			287	5.0	287	5.0	0.400	8.4	LOS A	3.1	22.3	0.86	0.71	0.86	51.7
East: RoadName															
4	L2	All MCs	91	5.0	91	5.0	0.718	11.5	LOS B	9.2	66.8	0.88	0.84	1.13	47.3
6a	R1	All MCs	581	5.0	581	5.0	0.718	15.4	LOS B	9.2	66.8	0.88	0.84	1.13	46.9
Approach			671	5.0	671	5.0	0.718	14.8	LOS B	9.2	66.8	0.88	0.84	1.13	46.9
NorthWest: RoadName															
27a	L1	All MCs	804	5.0	804	5.0	0.484	3.7	LOS A	4.7	34.2	0.15	0.38	0.15	54.9
29a	R1	All MCs	371	5.0	371	5.0	0.284	7.8	LOS A	2.0	14.6	0.13	0.58	0.13	51.1
Approach			1175	5.0	1175	5.0	0.484	5.0	LOS A	4.7	34.2	0.14	0.45	0.14	53.6
All Vehicles			2134	5.0	2134	5.0	0.718	8.5	LOS A	9.2	66.8	0.47	0.60	0.55	51.1

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

A3.4 Brigham Creek Road / Kauri Road With Whenuapai Green Morning Peak Movement Summary

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: BCR SE															
2	T1	All MCs	958	9.4	958	9.4	0.508	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	49.7
3	R2	All MCs	76	8.1	76	8.1	0.163	12.6	LOS B	0.6	4.6	0.75	0.88	0.75	42.7
Approach			1033	9.3	1033	9.3	0.508	1.1	NA	0.6	4.6	0.06	0.06	0.06	49.1
East: Kauri Rd															
4	L2	All MCs	242	7.0	242	7.0	0.547	18.2	LOS C	2.8	21.1	0.84	1.08	1.36	37.8
6	R2	All MCs	46	12.5	46	12.5	0.242	26.1	LOS D	0.7	5.5	0.84	0.96	0.94	41.0
Approach			288	7.9	288	7.9	0.547	19.5	LOS C	2.8	21.1	0.84	1.06	1.29	38.6
North: BCR NW															
7	L2	All MCs	26	5.6	26	5.6	0.526	5.9	LOS A	0.3	1.9	0.01	0.21	0.01	56.4
8	T1	All MCs	971	6.9	971	6.9	0.526	1.2	LOS A	0.3	1.9	0.01	0.21	0.01	57.5
Approach			998	6.9	998	6.9	0.526	1.3	NA	0.3	1.9	0.01	0.21	0.01	57.5
All Vehicles			2320	8.1	2320	8.1	0.547	3.5	NA	2.8	21.1	0.14	0.25	0.19	50.1

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

A3.5 Brigham Creek Road /SH18 North Roundabout With Whenuapai Green Morning Peak Movement Summary

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthEast: BCR east															
22	T1	All MCs	842	7.2	842	7.2	0.382	1.0	LOS A	3.6	26.3	0.10	0.18	0.10	42.0
23	R2	All MCs	14	18.2	14	18.2	0.382	7.6	LOS A	3.6	26.3	0.10	0.25	0.10	45.8
23b	R3	All MCs	159	2.4	159	2.4	0.382	8.5	LOS A	3.6	26.3	0.10	0.25	0.10	40.1
Approach			1015	6.6	1015	6.6	0.382	2.3	LOS A	3.6	26.3	0.10	0.19	0.10	41.9
NorthEast: Sinton Rd															
24b	L3	All MCs	26	0.0	26	0.0	0.163	10.4	LOS B	0.7	5.4	0.83	0.85	0.83	38.9
24	L2	All MCs	29	0.0	29	0.0	0.163	10.1	LOS B	0.7	5.4	0.83	0.85	0.83	38.9
26	R2	All MCs	8	28.6	8	28.6	0.163	17.8	LOS B	0.7	5.4	0.83	0.85	0.83	38.9
Approach			63	3.6	63	3.6	0.163	11.2	LOS B	0.7	5.4	0.83	0.85	0.83	38.9
NorthWest: BCR west															
27	L2	All MCs	7	0.0	7	0.0	0.621	3.9	LOS A	4.6	34.2	0.72	0.51	0.80	45.0
27a	L1	All MCs	825	6.6	825	6.6	0.621	3.5	LOS A	4.6	34.2	0.72	0.51	0.80	39.0
28	T1	All MCs	367	13.7	367	13.7	0.621	3.2	LOS A	4.6	34.2	0.59	0.38	0.59	39.9
Approach			1199	8.7	1199	8.7	0.621	3.4	LOS A	4.6	34.2	0.68	0.47	0.74	39.4
SouthWest: SH18 offramp															
30	L2	All MCs	317	8.5	317	8.5	0.571	12.1	LOS B	4.1	30.7	0.79	0.91	1.06	51.0
31	T1	All MCs	10	0.0	10	0.0	0.571	11.5	LOS B	4.1	30.7	0.79	0.91	1.06	50.5
32a	R1	All MCs	2	0.0	2	0.0	0.571	16.9	LOS B	4.1	30.7	0.79	0.91	1.06	51.0
32	R2	All MCs	361	11.0	361	11.0	0.571	19.2	LOS B	4.1	30.7	0.75	0.90	0.91	48.3
Approach			690	9.7	690	9.7	0.571	15.8	LOS B	4.1	30.7	0.77	0.90	0.98	49.5
All Vehicles			2968	8.1	2968	8.1	0.621	6.1	LOS A	4.6	34.2	0.50	0.49	0.58	43.5

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

A3.6 Brigham Creek Road /SH18 Eastbound Onramp With Whenuapai Green Morning Peak Movement Summary

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthWest: RoadName															
8	T1	All MCs	1045	10.0	1045	10.0	*1.101	101.4	LOS F	23.2	176.6	1.00	4.30	13.29	13.0
Approach			1045	10.0	1045	10.0	1.101	101.4	LOS F	23.2	176.6	1.00	4.30	13.29	13.0
All Vehicles			1045	10.0	1045	10.0	1.101	101.4	LOS F	23.2	176.6	1.00	4.30	13.29	13.0

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

A3.7 Trig Road / SH18 Onramp With Whenuapai Green Scenario 1 Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig N Ramp (Site Folder: 2030 Baseline + WG AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 Baseline + WG AM - S 2 Stage (Network Folder: General)]

Trig N Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
1	L2	All MCs	7	5.0	7	5.0	0.295	7.0	LOS A	0.0	0.0	0.00	0.01	0.00	67.4
2	T1	All MCs	549	5.0	549	5.0	0.295	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	78.9
3	R2	All MCs	380	5.0	380	5.0	0.316	8.8	LOS A	1.7	12.4	0.53	0.71	0.53	41.4
Approach			937	5.0	937	5.0	0.316	3.6	NA	1.7	12.4	0.22	0.29	0.22	64.5
North: Trig N															
7	L2	All MCs	133	5.0	133	5.0	0.277	7.7	LOS A	0.0	0.0	0.00	0.16	0.00	54.5
8	T1	All MCs	384	5.0	384	5.0	0.277	0.1	LOS A	0.0	0.0	0.00	0.16	0.00	73.7
9	R2	All MCs	1	5.0	1	5.0	0.001	6.9	LOS A	0.0	0.0	0.47	0.55	0.47	44.4
Approach			517	5.0	517	5.0	0.277	2.0	NA	0.0	0.0	0.00	0.16	0.00	66.4
West: Northside Dr Ext															
10	L2	All MCs	2	5.0	2	5.0	0.034	7.8	LOS A	0.1	0.7	0.78	0.88	0.78	39.6
11	T1	All MCs	3	5.0	3	5.0	0.034	18.8	LOS C	0.1	0.7	0.78	0.88	0.78	35.7
12	R2	All MCs	3	5.0	3	5.0	0.034	21.8	LOS C	0.1	0.7	0.78	0.88	0.78	34.2
Approach			8	5.0	8	5.0	0.034	17.2	LOS C	0.1	0.7	0.78	0.88	0.78	36.6
All Vehicles			1463	5.0	1463	5.0	0.316	3.1	NA	1.7	12.4	0.14	0.25	0.14	64.8

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

A3.8 Trig Road / SH18 Offramp With Whenuapai Green Scenario 1 Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig S Ramp (Site Folder: 2030 Baseline + WG AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 Baseline + WG AM - S 2 Stage (Network Folder: General)]

Trig S Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
2	T1	All MCs	803	5.0	803	5.0	0.425	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.6
Approach			803	5.0	803	5.0	0.425	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.6
East: SH18 offramp															
4	L2	All MCs	106	5.0	106	5.0	0.114	11.9	LOS B	0.5	3.4	0.46	0.90	0.46	59.7
6	R2	All MCs	128	5.0	128	5.0	0.718	44.4	LOS E	3.1	22.8	0.95	1.14	1.75	27.8
Approach			235	5.0	235	5.0	0.718	29.7	LOS D	3.1	22.8	0.73	1.03	1.16	41.7
North: Trig N															
8	T1	All MCs	384	5.0	384	5.0	0.203	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.9
Approach			384	5.0	384	5.0	0.203	0.0	NA	0.0	0.0	0.00	0.00	0.00	79.9
All Vehicles			1421	5.0	1421	5.0	0.718	5.0	NA	3.1	22.8	0.12	0.17	0.19	67.2

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

A3.9 Trig Road / SH18 Onramp Meter With Whenuapai Green Scenario 1 Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [SH18 Onramp (Site Folder: 2030 Baseline + WG AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 Baseline + WG AM - S 2 Stage (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 7 seconds (Site User-Given Phase Times)
This Site is not connected to the Network.

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
West: Onramp Entry															
11	T1	All MCs	513	5.0	513	5.0	*0.317	1.7	LOS A	0.7	5.0	0.69	0.37	0.69	79.7
Approach			513	5.0	513	5.0	0.317	1.7	LOS A	0.7	5.0	0.69	0.37	0.69	79.7
All Vehicles			513	5.0	513	5.0	0.317	1.7	LOS A	0.7	5.0	0.69	0.37	0.69	79.7

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

A3.10 Trig Road / SH18 Onramp With Whenuapai Green Scenario 2 Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig N Ramp (Site Folder: 2030 including WG AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 including WG AM - S 2 stage (Network Folder: General)]

Trig N Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
1	L2	All MCs	7	5.0	7	5.0	0.410	7.0	LOS A	0.0	0.0	0.00	0.01	0.00	67.4
2	T1	All MCs	766	5.0	766	5.0	0.410	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	79.0
3	R2	All MCs	380	5.0	380	5.0	0.345	9.5	LOS A	2.0	14.8	0.58	0.77	0.64	37.9
Approach			1153	5.0	1153	5.0	0.410	3.2	NA	2.0	14.8	0.19	0.26	0.21	69.9
North: Trig N															
7	L2	All MCs	151	5.0	151	5.0	0.326	7.7	LOS A	0.0	0.0	0.00	0.16	0.00	73.8
8	T1	All MCs	457	5.0	457	5.0	0.326	0.1	LOS A	0.0	0.0	0.00	0.16	0.00	73.8
9	R2	All MCs	1	5.0	1	5.0	0.002	8.8	LOS A	0.0	0.0	0.62	0.62	0.62	43.4
Approach			609	5.0	609	5.0	0.326	2.0	NA	0.0	0.0	0.00	0.16	0.00	73.6
West: Northside Dr Ext															
10	L2	All MCs	2	5.0	2	5.0	0.063	10.5	LOS B	0.2	1.2	0.88	0.94	0.88	34.9
11	T1	All MCs	3	5.0	3	5.0	0.063	33.5	LOS D	0.2	1.2	0.88	0.94	0.88	27.8
12	R2	All MCs	3	5.0	3	5.0	0.063	38.7	LOS E	0.2	1.2	0.88	0.94	0.88	27.8
Approach			8	5.0	8	5.0	0.063	29.7	LOS D	0.2	1.2	0.88	0.94	0.88	30.2
All Vehicles			1771	5.0	1771	5.0	0.410	2.9	NA	2.0	14.8	0.13	0.23	0.14	70.6

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

A3.11 Trig Road / SH18 Offramp With Whenuapai Green Scenario 2 Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig S Ramp (Site Folder: 2030 including WG AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 including WG AM - S 2 stage (Network Folder: General)]

Trig S Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
2	T1	All MCs	996	5.0	996	5.0	0.527	0.2	LOS A	0.0	0.0	0.00	0.00	0.00	79.4
Approach			996	5.0	996	5.0	0.527	0.2	NA	0.0	0.0	0.00	0.00	0.00	79.4
East: SH18 offramp															
4	L2	All MCs	106	5.0	106	5.0	0.126	12.4	LOS B	0.5	3.7	0.51	0.92	0.51	59.2
6	R2	All MCs	151	5.0	151	5.0	0.224	12.5	LOS B	0.9	6.4	0.54	0.80	0.54	55.1
Approach			257	5.0	257	5.0	0.224	12.5	LOS B	0.9	6.4	0.52	0.85	0.52	57.4
North: Trig N															
8	T1	All MCs	457	5.0	457	5.0	0.242	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach			457	5.0	457	5.0	0.242	0.0	NA	0.0	0.0	0.00	0.00	0.00	79.8
All Vehicles			1710	5.0	1710	5.0	0.527	2.0	NA	0.9	6.4	0.08	0.13	0.08	74.3

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

A3.12 Trig Road / SH18 Onramp Meter With Whenuapai Green Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [SH18 Onramp (Site Folder: 2030 including WG AM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 including WG AM - S 2 stage (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 7 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
West: Onramp Entry															
11	T1	All MCs	531	5.0	531	5.0	*0.328	1.7	LOS A	0.7	5.2	0.70	0.37	0.70	79.7
Approach			531	5.0	531	5.0	0.328	1.7	LOS A	0.7	5.2	0.70	0.37	0.70	79.7
All Vehicles			531	5.0	531	5.0	0.328	1.7	LOS A	0.7	5.2	0.70	0.37	0.70	79.7

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

A3.13 Brigham Creek Road / Totara Road (0.9 trips/hh) With Whenuapai Green Morning Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 WG Development AM Fixed Cycle (Site Folder: BC - Totara including WG Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site User-Given Cycle Time)

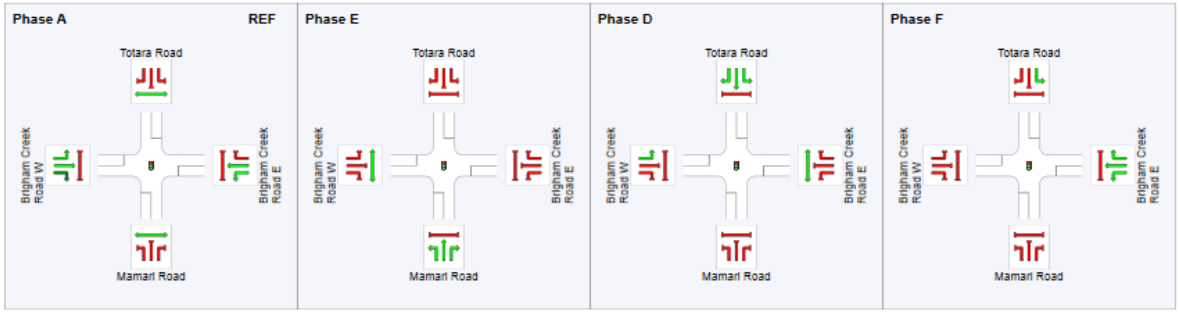
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	46	68	100
Green Time (sec)	40	16	26	9
Phase Time (sec)	46	22	32	15
Phase Split	40 %	19 %	28 %	13 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

A3.14 Brigham Creek Road /Totara Road (0.65 v/hr/hh) With Whenuapai Green Morning Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 WG Development AM - 0.65/HH Fixed Cycle (Site Folder: BC - Totara including WG Development - 0.65/HH)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site User-Given Cycle Time)

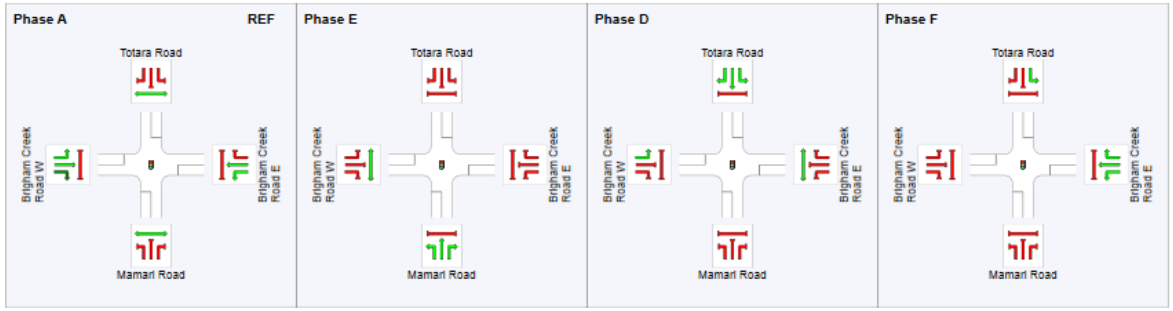
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	48	70	102
Green Time (sec)	42	16	26	7
Phase Time (sec)	48	22	32	13
Phase Split	42 %	19 %	28 %	11 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



A3.15 Brigham Creek Road /SH18 Eastbound Onramp With Whenuapai Green Morning Peak Phasing Summary

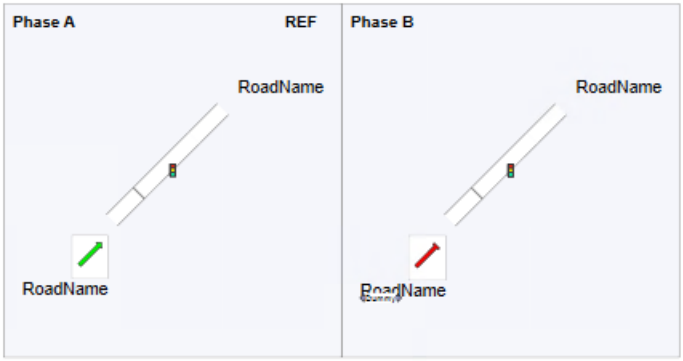
Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	3
Green Time (sec)	3	5
Phase Time (sec)	3	5
Phase Split	38 %	63 %
Phase Frequency (%)	42.9[2]	0.0[2]

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

2 Phase Frequency is implied by a Phase Time specified by the user that is less than the Required Movement Time.

Output Phase Sequence



A4. With Whenuapai Green Evening Peak Results

A4.1 Brigham Creek Road /Totara Road (0.9 trips/hh) With Whenuapai Green Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 WG Development PM Opt Cycle (Site Folder: BC - Totara including WG Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	7	0.0	7	0.0	0.037	60.5	LOS E	0.4	2.7	0.92	0.66	0.92	22.8
2	T1	All MCs	1	0.0	1	0.0	*0.047	51.8	LOS D	0.6	4.2	0.90	0.67	0.90	24.0
3	R2	All MCs	10	0.0	10	0.0	0.047	56.5	LOS E	0.6	4.2	0.90	0.67	0.90	23.6
Approach			18	0.0	18	0.0	0.047	57.8	LOS E	0.6	4.2	0.91	0.67	0.91	23.3
East: Brigham Creek Road E															
4	L2	All MCs	32	0.0	32	0.0	0.227	21.6	LOS C	6.5	53.6	0.52	0.48	0.52	37.9
5	T1	All MCs	665	24.5	665	24.5	0.571	23.0	LOS C	18.0	152.3	0.63	0.57	0.63	40.6
6	R2	All MCs	272	0.8	272	0.8	*1.016	151.3	LOS F	28.2	198.6	1.00	1.38	2.01	16.7
Approach			969	17.0	969	17.0	1.016	59.0	LOS E	28.2	198.6	0.73	0.80	1.02	28.8
North: Totara Road															
7	L2	All MCs	183	0.6	183	0.6	0.275	35.1	LOS D	7.9	55.3	0.75	0.76	0.75	33.3
8	T1	All MCs	1	0.0	1	0.0	*1.004	125.2	LOS F	24.1	194.5	1.00	1.33	1.93	14.2
9	R2	All MCs	247	17.7	247	17.7	1.004	130.0	LOS F	24.1	194.5	1.00	1.33	1.93	17.8
Approach			431	10.4	431	10.4	1.004	89.7	LOS F	24.1	194.5	0.90	1.09	1.43	22.2
West: Brigham Creek Road W															
10	L2	All MCs	241	3.4	241	3.4	0.419	45.7	LOS D	8.0	59.1	0.77	0.75	0.77	38.6
11	T1	All MCs	608	21.3	608	21.3	*0.976	115.0	LOS F	49.9	413.0	0.98	1.32	1.47	23.0
12	R2	All MCs	11	0.0	11	0.0	0.048	64.2	LOS E	0.5	3.3	0.72	0.67	0.72	28.6
Approach			860	16.0	860	16.0	0.976	94.9	LOS F	49.9	413.0	0.92	1.15	1.26	26.0
All Vehicles			2278	15.2	2278	15.2	1.016	78.4	LOS E	49.9	413.0	0.84	0.99	1.19	26.2

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	0.95
East: Brigham Creek Road E												
P2	Full	50	50	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	0.95
North: Totara Road												
P3	Full	50	50	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	0.95
West: Brigham Creek Road W												
P4	Full	50	50	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	0.95
All Pedestrians		200	200	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	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.

A4.2 Brigham Creek Road /Totara Road (0.65 v/hr/hh) With Whenuapai Green Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 WG Development PM - 0.65/HH Opt Cycle (Site Folder: BC - Totara including WG Development - 0.65/HH)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	7	0.0	7	0.0	0.032	52.1	LOS D	0.3	2.4	0.91	0.66	0.91	24.6
2	T1	All MCs	1	0.0	1	0.0	*0.042	43.8	LOS D	0.5	3.6	0.89	0.67	0.89	25.9
3	R2	All MCs	10	0.0	10	0.0	0.042	48.4	LOS D	0.5	3.6	0.89	0.67	0.89	25.5
Approach			18	0.0	18	0.0	0.042	49.6	LOS D	0.5	3.6	0.90	0.66	0.90	25.1
East: Brigham Creek Road E															
4	L2	All MCs	32	0.0	32	0.0	0.209	20.4	LOS C	5.5	43.1	0.56	0.52	0.56	37.4
5	T1	All MCs	610	17.7	610	17.7	0.526	20.5	LOS C	15.6	125.5	0.67	0.59	0.67	40.4
6	R2	All MCs	221	1.0	221	1.0	*0.892	71.5	LOS E	13.7	97.0	1.00	1.05	1.41	25.6
Approach			863	12.8	863	12.8	0.892	33.5	LOS C	15.6	125.5	0.75	0.71	0.85	35.0
North: Totara Road															
7	L2	All MCs	148	0.7	148	0.7	0.245	33.7	LOS C	5.8	40.8	0.77	0.75	0.77	33.7
8	T1	All MCs	1	0.0	1	0.0	*0.917	67.9	LOS E	16.1	129.8	1.00	1.11	1.49	20.8
9	R2	All MCs	242	18.0	242	18.0	0.917	72.7	LOS E	16.1	129.8	1.00	1.11	1.49	24.7
Approach			392	11.4	392	11.4	0.917	58.0	LOS E	16.1	129.8	0.91	0.97	1.22	27.5
West: Brigham Creek Road W															
10	L2	All MCs	251	10.2	251	10.2	0.382	24.8	LOS C	5.7	43.4	0.73	0.75	0.73	40.0
11	T1	All MCs	551	13.2	551	13.2	*0.891	68.9	LOS E	31.9	248.3	0.99	1.07	1.20	30.0
12	R2	All MCs	11	0.0	11	0.0	0.044	53.5	LOS D	0.4	2.9	0.73	0.67	0.73	29.6
Approach			813	12.1	813	12.1	0.891	55.1	LOS E	31.9	248.3	0.90	0.96	1.05	32.5
All Vehicles			2085	12.1	2085	12.1	0.917	46.6	LOS D	31.9	248.3	0.84	0.86	1.00	32.3

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98
East: Brigham Creek Road E												
P2	Full	50	50	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98
North: Totara Road												
P3	Full	50	50	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98
West: Brigham Creek Road W												
P4	Full	50	50	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98
All Pedestrians		200	200	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98

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

A4.3 Brigham Creek Road / Trig Road With Whenuapai Green Evening Peak Movement Summary

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: RoadName															
1a	L1	All MCs	366	5.0	366	5.0	0.594	8.6	LOS A	5.8	42.5	1.00	0.75	1.02	51.3
3	R2	All MCs	42	5.0	42	5.0	0.594	13.8	LOS B	5.8	42.5	1.00	0.75	1.02	50.4
Approach			408	5.0	408	5.0	0.594	9.2	LOS A	5.8	42.5	1.00	0.75	1.02	51.2
East: RoadName															
4	L2	All MCs	27	5.0	27	5.0	0.892	9.3	LOS A	16.4	120.0	1.00	0.87	1.03	48.4
6a	R1	All MCs	862	5.0	862	5.0	0.892	13.2	LOS B	16.4	120.0	1.00	0.87	1.03	48.0
Approach			889	5.0	889	5.0	0.892	13.1	LOS B	16.4	120.0	1.00	0.87	1.03	48.0
NorthWest: RoadName															
27a	L1	All MCs	787	5.0	787	5.0	0.939	40.8	LOS D	53.4	390.0	1.00	1.27	1.51	35.6
29a	R1	All MCs	501	5.0	501	5.0	0.716	21.3	LOS C	22.5	164.3	0.85	0.90	0.93	43.4
Approach			1288	5.0	1288	5.0	0.939	33.2	LOS C	53.4	390.0	0.94	1.13	1.29	38.3
All Vehicles			2585	5.0	2585	5.0	0.939	22.5	LOS C	53.4	390.0	0.97	0.98	1.16	43.0

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

A4.4 Brigham Creek Road / Kauri Road With Whenuapai Green Evening Peak Movement Summary

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: BCR SE															
2	T1	All MCs	959	9.4	959	9.4	0.509	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	49.7
3	R2	All MCs	220	8.1	220	8.1	0.634	24.3	LOS C	3.4	25.5	0.91	1.19	1.61	36.2
Approach			1179	9.2	1179	9.2	0.634	4.7	NA	3.4	25.5	0.17	0.22	0.30	46.4
East: Kauri Rd															
4	L2	All MCs	151	7.0	151	7.0	0.452	20.6	LOS C	1.9	14.0	0.86	1.03	1.20	36.1
6	R2	All MCs	22	12.5	22	12.5	0.236	45.7	LOS E	0.6	4.5	0.92	0.98	1.00	33.6
Approach			173	7.7	173	7.7	0.452	23.8	LOS C	1.9	14.0	0.87	1.03	1.18	35.5
North: BCR NW															
7	L2	All MCs	39	5.6	39	5.6	0.602	8.7	LOS A	0.7	4.8	0.03	0.23	0.04	56.3
8	T1	All MCs	1094	6.9	1094	6.9	0.602	1.2	LOS A	0.7	4.8	0.03	0.23	0.04	57.3
Approach			1133	6.9	1133	6.9	0.602	1.5	NA	0.7	4.8	0.03	0.23	0.04	57.3
All Vehicles			2485	8.0	2485	8.0	0.634	4.5	NA	3.4	25.5	0.16	0.28	0.24	49.0

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

A4.5 Brigham Creek Road /SH18 North Roundabout With Whenuapai Green Evening Peak Movement Summary

Vehicle Movement Performance														
Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
SouthEast: BCR east															
22	T1	All MCs	905	5.2	905	5.2	0.421	1.0	LOS A	4.5	32.6	0.09	0.21	0.09	41.3
23	R2	All MCs	44	6.1	44	6.1	0.421	7.5	LOS A	4.5	32.6	0.09	0.30	0.09	45.5
23b	R3	All MCs	227	1.8	227	1.8	0.421	8.5	LOS A	4.5	32.6	0.09	0.30	0.09	39.0
Approach			1176	4.6	1176	4.6	0.421	2.7	LOS A	4.5	32.6	0.09	0.23	0.09	41.4
NorthEast: Sinton Rd															
24b	L3	All MCs	16	0.0	16	0.0	0.213	19.8	LOS B	1.2	9.0	0.93	0.92	0.93	31.8
24	L2	All MCs	24	22.2	24	22.2	0.213	22.2	LOS C	1.2	9.0	0.93	0.92	0.93	31.8
26	R2	All MCs	7	0.0	7	0.0	0.213	25.3	LOS C	1.2	9.0	0.93	0.92	0.93	31.8
Approach			48	11.3	48	11.3	0.213	21.9	LOS C	1.2	9.0	0.93	0.92	0.93	31.8
NorthWest: BCR west															
27	L2	All MCs	12	0.0	12	0.0	0.933	18.9	LOS B	19.5	140.9	1.00	1.55	2.33	37.5
27a	L1	All MCs	804	3.9	804	3.9	0.933	18.5	LOS B	19.5	140.9	1.00	1.55	2.33	26.4
28	T1	All MCs	483	5.0	483	5.0	0.933	10.3	LOS B	19.5	140.9	0.86	1.00	1.36	33.2
Approach			1299	4.3	1299	4.3	0.933	15.5	LOS B	19.5	140.9	0.95	1.35	1.97	28.8
SouthWest: SH18 offramp															
30	L2	All MCs	314	5.0	314	5.0	0.745	16.2	LOS B	7.8	55.9	0.89	1.08	1.53	45.1
31	T1	All MCs	20	7.7	20	7.7	0.745	16.3	LOS B	7.8	55.9	0.89	1.08	1.53	47.2
32a	R1	All MCs	1	0.0	1	0.0	0.745	21.2	LOS C	7.8	55.9	0.89	1.08	1.53	45.1
32	R2	All MCs	630	1.1	630	1.1	0.745	21.8	LOS C	7.8	55.9	0.83	1.01	1.27	45.3
Approach			965	2.5	965	2.5	0.745	19.9	LOS B	7.8	55.9	0.85	1.03	1.36	45.3
All Vehicles			3487	4.0	3487	4.0	0.933	12.5	LOS B	19.5	140.9	0.63	0.88	1.15	37.4

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

A4.6 Brigham Creek Road /SH18 Eastbound Onramp With Whenuapai Green Evening Peak Movement Summary

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
SouthWest: RoadName															
8	T1	All MCs	1006	10.0	1006	10.0	*1.060	67.8	LOS E	16.0	121.6	1.00	3.43	10.19	17.6
Approach			1006	10.0	1006	10.0	1.060	67.8	LOS E	16.0	121.6	1.00	3.43	10.19	17.6
All Vehicles			1006	10.0	1006	10.0	1.060	67.8	LOS E	16.0	121.6	1.00	3.43	10.19	17.6

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

A4.7 Trig Road / SH18 Onramp With Whenuapai Green Scenario 1 Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig N Ramp (Site Folder: 2030 Baseline + WG PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 Baseline + WG PM - S 2 Stage (Network Folder: General)]

Trig N Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
1	L2	All MCs	7	5.0	7	5.0	0.273	7.0	LOS A	0.0	0.0	0.00	0.01	0.00	67.3
2	T1	All MCs	508	5.0	508	5.0	0.273	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	78.9
3	R2	All MCs	132	5.0	132	5.0	0.171	10.9	LOS B	0.7	5.2	0.63	0.85	0.63	35.2
Approach			647	5.0	647	5.0	0.273	2.3	NA	0.7	5.2	0.13	0.18	0.13	72.8
North: Trig N															
7	L2	All MCs	173	5.0	173	5.0	0.473	7.7	LOS A	0.0	0.0	0.00	0.12	0.00	74.8
8	T1	All MCs	712	5.0	712	5.0	0.473	0.1	LOS A	0.0	0.0	0.00	0.12	0.00	74.8
9	R2	All MCs	2	5.0	2	5.0	0.002	6.7	LOS A	0.0	0.1	0.46	0.56	0.46	44.5
Approach			887	5.0	887	5.0	0.473	1.6	NA	0.0	0.1	0.00	0.13	0.00	74.6
West: Northside Dr Ext															
10	L2	All MCs	1	5.0	1	5.0	0.046	7.4	LOS A	0.1	1.0	0.84	0.92	0.84	37.4
11	T1	All MCs	2	5.0	2	5.0	0.046	25.1	LOS D	0.1	1.0	0.84	0.92	0.84	31.0
12	R2	All MCs	5	5.0	5	5.0	0.046	24.9	LOS C	0.1	1.0	0.84	0.92	0.84	31.0
Approach			8	5.0	8	5.0	0.046	22.7	LOS C	0.1	1.0	0.84	0.92	0.84	32.2
All Vehicles			1543	5.0	1543	5.0	0.473	2.0	NA	0.7	5.2	0.06	0.15	0.06	73.2

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

A4.8 Trig Road / SH18 Offramp With Whenuapai Green Scenario 1 Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig S Ramp (Site Folder: 2030 Baseline + WG PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 Baseline + WG PM - S 2 Stage (Network Folder: General)]

Trig S Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
2	T1	All MCs	507	5.0	507	5.0	0.268	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach			507	5.0	507	5.0	0.268	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.8
East: SH18 offramp															
4	L2	All MCs	264	5.0	264	5.0	0.466	18.0	LOS C	2.6	18.7	0.73	1.09	1.08	54.8
6	R2	All MCs	133	5.0	133	5.0	0.704	41.4	LOS E	3.1	22.8	0.94	1.14	1.72	28.8
Approach			397	5.0	397	5.0	0.704	25.8	LOS D	3.1	22.8	0.80	1.11	1.29	46.4
North: Trig N															
8	T1	All MCs	712	5.0	712	5.0	0.377	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.7
Approach			712	5.0	712	5.0	0.377	0.0	NA	0.0	0.0	0.00	0.00	0.00	79.7
All Vehicles			1616	5.0	1616	5.0	0.704	6.4	NA	3.1	22.8	0.20	0.27	0.32	65.2

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

A4.9 Trig Road / SH18 Onramp Meter With Whenuapai Green Scenario 1 Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [SH18 Onramp (Site Folder: 2030 Baseline + WG PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 Baseline + WG PM - S 2 Stage (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 7 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
West: Onramp Entry															
11	T1	All MCs	304	5.0	304	5.0	*0.188	1.6	LOS A	0.4	2.7	0.65	0.34	0.65	80.3
Approach			304	5.0	304	5.0	0.188	1.6	LOS A	0.4	2.7	0.65	0.34	0.65	80.3
All Vehicles			304	5.0	304	5.0	0.188	1.6	LOS A	0.4	2.7	0.65	0.34	0.65	80.3

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

A4.10 Trig Road / SH18 Onramp With Whenuapai Green Scenario 2 Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig N Ramp (Site Folder: 2030 including WG PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 including WG PM - S 2 Stage (Network Folder: General)]

Trig N Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
1	L2	All MCs	7	5.0	7	5.0	0.336	7.0	LOS A	0.0	0.0	0.00	0.01	0.00	67.4
2	T1	All MCs	627	5.0	627	5.0	0.336	0.0	LOS A	0.0	0.0	0.00	0.01	0.00	79.0
3	R2	All MCs	132	5.0	132	5.0	0.243	14.0	LOS B	1.0	7.3	0.74	0.93	0.81	30.4
Approach			766	5.0	766	5.0	0.336	2.5	NA	1.0	7.3	0.13	0.17	0.14	72.6
North: Trig N															
7	L2	All MCs	191	5.0	191	5.0	0.588	7.8	LOS A	0.0	0.0	0.00	0.11	0.00	75.1
8	T1	All MCs	909	5.0	909	5.0	0.588	0.2	LOS A	0.0	0.0	0.00	0.11	0.00	75.1
9	R2	All MCs	2	5.0	2	5.0	0.003	7.5	LOS A	0.0	0.1	0.52	0.60	0.52	44.1
Approach			1102	5.0	1102	5.0	0.588	1.5	NA	0.0	0.1	0.00	0.11	0.00	74.9
West: Northside Dr Ext															
10	L2	All MCs	1	0.0	1	0.0	0.079	8.2	LOS A	0.2	1.6	0.91	0.96	0.91	32.9
11	T1	All MCs	2	0.0	2	0.0	0.079	41.9	LOS E	0.2	1.6	0.91	0.96	0.91	25.3
12	R2	All MCs	5	0.0	5	0.0	0.079	39.5	LOS E	0.2	1.6	0.91	0.96	0.91	25.3
Approach			8	0.0	8	0.0	0.079	36.2	LOS E	0.2	1.6	0.91	0.96	0.91	26.6
All Vehicles			1876	5.0	1876	5.0	0.588	2.1	NA	1.0	7.3	0.06	0.14	0.06	73.2

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

A4.11 Trig Road / SH18 Offramp With Whenuapai Green Scenario 2 Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [Trig S Ramp (Site Folder: 2030 including WG PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 including WG PM - S 2 Stage (Network Folder: General)]

Trig S Ramp
Site Category: (None)
Stop (Two-Way)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Trig S															
2	T1	All MCs	614	5.0	614	5.0	0.325	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	79.8
Approach			614	5.0	614	5.0	0.325	0.1	NA	0.0	0.0	0.00	0.00	0.00	79.8
East: SH18 offramp															
4	L2	All MCs	264	5.0	264	5.0	0.693	27.7	LOS D	4.2	30.6	0.89	1.20	1.78	48.1
6	R2	All MCs	144	5.0	144	5.0	0.518	25.4	LOS D	2.2	16.1	0.86	1.05	1.29	38.7
Approach			408	5.0	408	5.0	0.693	26.9	LOS D	4.2	30.6	0.88	1.15	1.60	45.7
North: Trig N															
8	T1	All MCs	909	5.0	909	5.0	0.481	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	79.5
Approach			909	5.0	909	5.0	0.481	0.0	NA	0.0	0.0	0.00	0.00	0.00	79.5
All Vehicles			1932	5.0	1932	5.0	0.693	5.7	NA	4.2	30.6	0.19	0.24	0.34	66.4

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

A4.12 Trig Road / SH18 Onramp Meter With Whenuapai Green Scenario 2 Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [SH18 Onramp (Site Folder: 2030 including WG PM)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

Network: N101 [2030 including WG PM - S 2 Stage (Network Folder: General)]

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 7 seconds (Site User-Given Phase Times)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
West: Onramp Entry															
11	T1	All MCs	322	5.0	322	5.0	*0.199	1.6	LOS A	0.4	2.9	0.65	0.35	0.65	80.2
Approach			322	5.0	322	5.0	0.199	1.6	LOS A	0.4	2.9	0.65	0.35	0.65	80.2
All Vehicles			322	5.0	322	5.0	0.199	1.6	LOS A	0.4	2.9	0.65	0.35	0.65	80.2

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

A4.13 Brigham Creek Road / Totara Road (0.9 trips/hh) With Whenuapai Green Evening Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 WG Development PM Opt Cycle (Site Folder: BC - Totara including WG Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

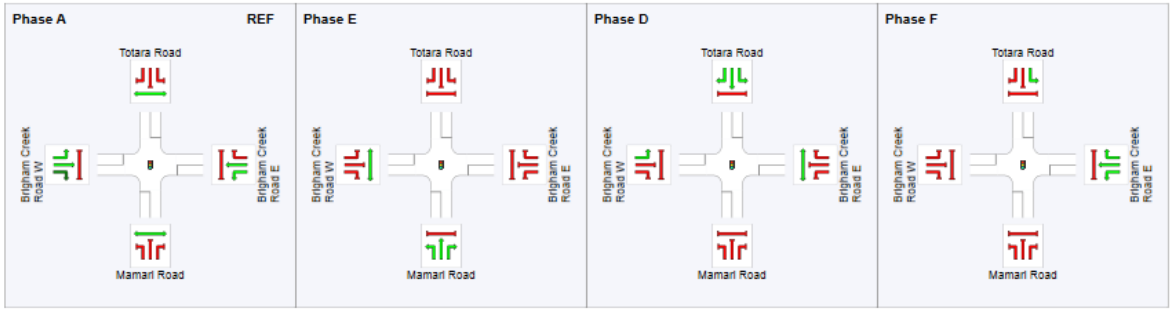
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	49	71	96
Green Time (sec)	43	16	19	23
Phase Time (sec)	49	22	25	29
Phase Split	39 %	18 %	20 %	23 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



A4.14 Brigham Creek Road / Totara Road (0.65 v/hr/hh) With Whenuapai Green Evening Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 WG Development PM - 0.65/HH Opt Cycle (Site Folder: BC - Totara including WG Development - 0.65/HH)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site Optimum Cycle Time - Minimum Delay)

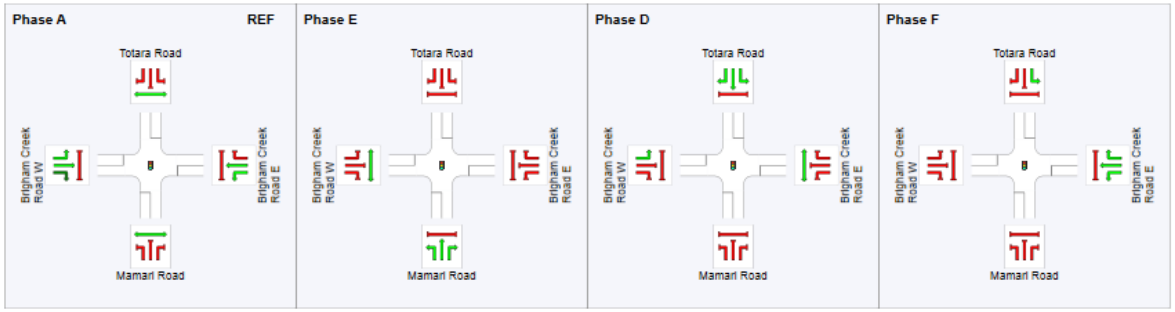
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	43	65	89
Green Time (sec)	37	16	18	15
Phase Time (sec)	43	22	24	21
Phase Split	39 %	20 %	22 %	19 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



A4.15 Brigham Creek Road /SH18 Eastbound Onramp With Whenuapai Green Evening Peak Phasing Summary

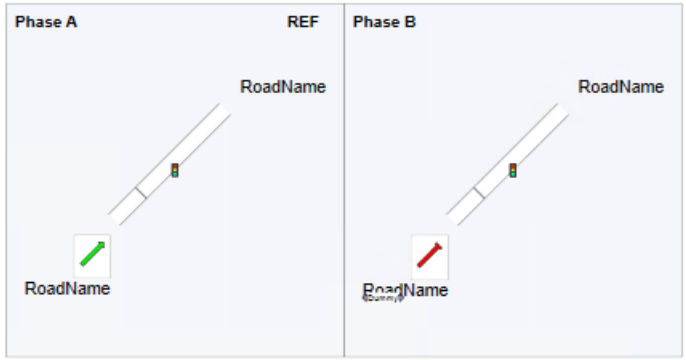
Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	3
Green Time (sec)	3	5
Phase Time (sec)	3	5
Phase Split	38 %	63 %
Phase Frequency (%)	42.9[2]	0.0[2]

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

2 Phase Frequency is implied by a Phase Time specified by the user that is less than the Required Movement Time.

Output Phase Sequence



A4.16 Brigham Creek Road /SH18 Westbound Onramp With Whenuapai Green Evening Peak Phasing Summary

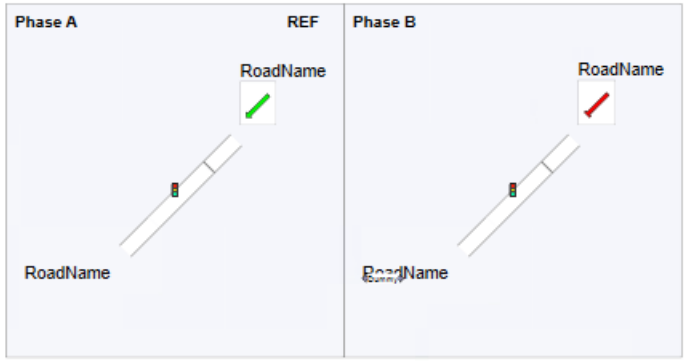
Phase Timing Summary

Phase	A	B
Phase Change Time (sec)	0	3
Green Time (sec)	3	3
Phase Time (sec)	3	3
Phase Split	50 %	50 %
Phase Frequency (%)	42.9[2]	0.0[2]

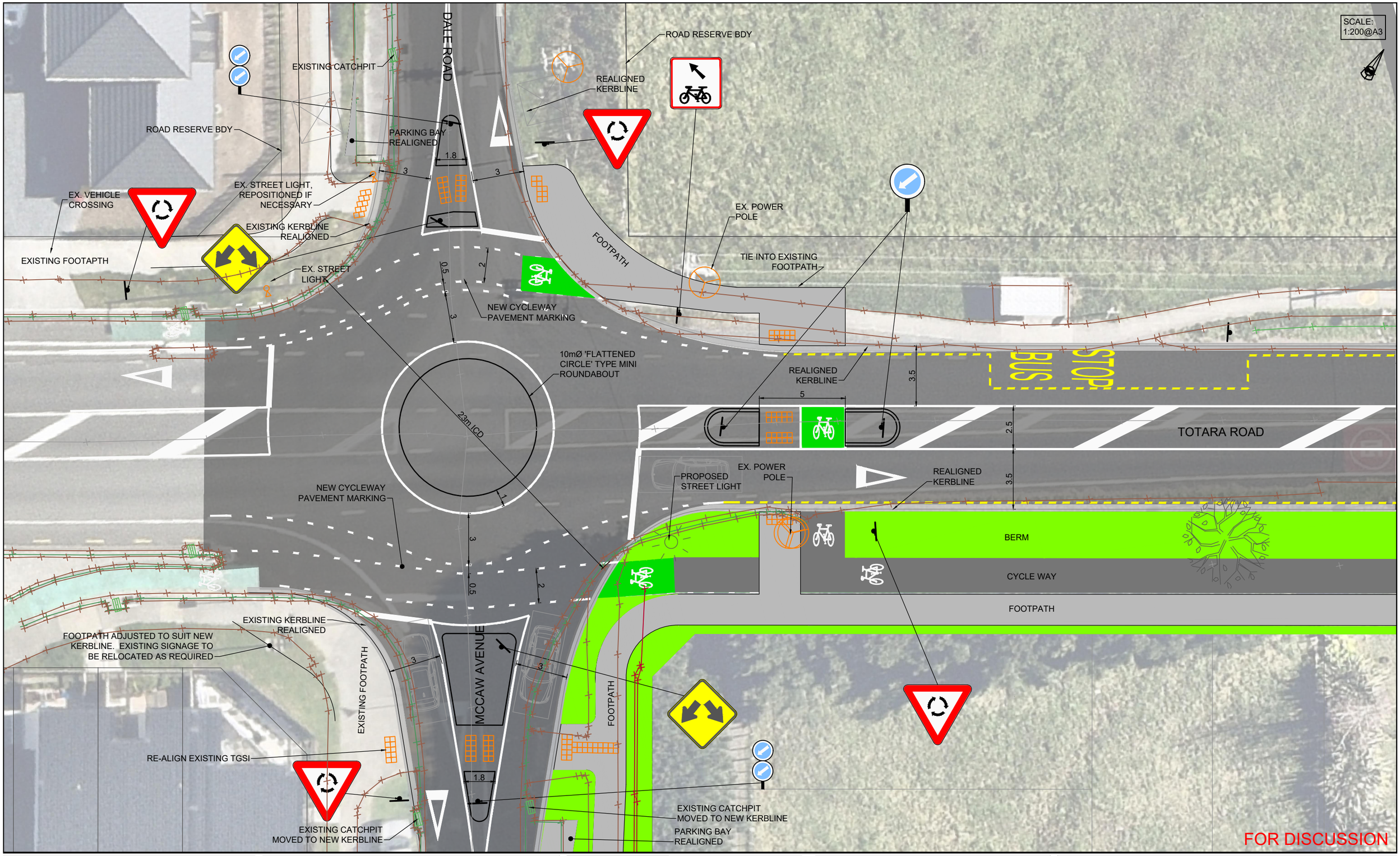
See the Timing Analysis report for more detailed information including input values of Yellow Time and All-Red Time, and information on any adjustments to Intergreen Time, Phase Time and Green Time values in cases of Pedestrian Actuation, Minor Phase Actuation and Phase Frequency values (user-specified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

2 Phase Frequency is implied by a Phase Time specified by the user that is less than the Required Movement Time.

Output Phase Sequence



Appendix B.
Tōtara Road / Dale Road / McCaw Avenue intersection concept design



Rev	Description	By	Date
B	ROAD SIGNS AND MARKING ADDED	CK	14/06/23
A	ISSUED FOR DISCUSSION	CK	05/23

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Job Title
WHENUAPAI GREEN
98–102 TOTARA ROAD
WHENUAPAI

Drawing Title
ROADWORKS
TOTARA ROAD / DALE ROAD
INTERSECTION TREATMENT

	By	Date	Scale	Job No. 4520	
Surveyed:	DS		AS SHOWN	Drawing No. 4520–01–GN–352	Rev B
Designed:	CM				
Drawn:	CM	05/23			
Approved:	CK				
CAD FILE					

C:\12dS\data\NGSQL01\Whenuapai Green – 4520_61\Design\DWG\ENG\CONCEPT\4520–01–GN–352.dwg

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Appendix D.
Clause 23 responses – 24 October 2024

Whenuapai Green Plan Change

Clause 23 transport responses

Prepared for	Neil Construction Ltd
Project Number	TNEGL-J002
Revision	C
Issue Date	24 October 2024
Prepared by	Mat Collins, Associate Transportation Engineer; Chris Blackmore, Principal Transportation Planner
Reviewed by	Mat Collins, Associate Transportation Engineer

Summary

Neil Construction Limited (NCL) commissioned Abley Limited (Abley) to prepare an Integrated Transportation Assessment (ITA) report with respect to a Plan Change at 98-102 Totara Road, Whenuapai in Auckland (the site). The proposal is to rezone the site from Future Urban Zone (FUZ) to Residential – Mixed Housing Urban (MHU) zone and apply a Precinct across the site to guide future development (the Plan Change).

This technical note provides Abley's responses to additional Auckland Council (Council) and Auckland Transport (AT) Clause 23 requests for information (RFIs), dated 3rd October 2024. In preparing this technical note, we have referred to the following documents:

- Whenuapai Green ITA, prepared by Abley, dated 1 February 2024
- Abley Clause 23 transport responses memo, dated 6 August 2024
- Auckland Council and Auckland Transport additional further information request, undated.

Where new or updated assessment of transport effects is provided in this technical note, it supersedes assessment presented in our ITA and Clause 23 transport response memo.

1. Council RFIs

For each Council RFI we have reproduced the request from Council in a separate subsection and provided our response.

1.1 Staging plan

Additional Information under Clause 23(2) Requested

Based on the current wording of the I1.6.6(a), there is concern that sections of Totara Road could be upgraded in isolation, depending on future staging. This could result in disconnected sections of the southbound cycle lane, which would not provide a connected network.

It is suggested that the Precinct provision standard is updated to ensure that if any development fronting Totara Road commences, then the road widening and provision of cycle facilities is provided along the whole plan change frontage, including safe connection for northbound cyclists at the Totara Road / Dale Road / McCaw Avenue intersection, to connect with the internal local road network.

Please assess how cycling connectivity would be provided on Totara Road, should staging not progress from the south to the north.

Abley response

We understand that the proposed Precinct provisions are generally consistent with Whenuapai 1 Precinct 4.2.1.3 and Whenuapai 2 Precinct 3.4.1.3. Refer to the response from Campbell Brown for further discussion of the Precinct provisions.

In the unlikely scenario that development occurs from north to south, while this will initially limit cycling connectivity, this will be addressed as the southern portion of the site is developed. Further, we note that I6.6(b)(2) requires Tōtara Road to be upgraded prior to 150 residential lots being subdivided.

1.2 Crash history

Additional Information under Clause 23(2) Requested

An assessment has been provided using Megamaps Collective and Personal Risk of Brigham Creek Road. A further NZTA CAS assessment has been undertaken for the SH18 / Brigham Creek Road interchange.

It is noted that an assessment is not provided on Brigham Creek Road between Boyes Avenue and the SH16 interchange. While the current trip distribution shows low vehicle volumes travelling through this section of Brigham Creek Road, it is considered there could be more, especially outside of congested peak periods as this provides a more direct route to SH16.

Abley response

Megamaps Collective and Personal risk

NZTA MegaMaps has been analysed to assess the road safety of Brigham Creek Road and the SH18/Brigham Creek Road roundabout. The two types of risk metrics are summarised as follows:

- Collective risk is a measure of the total estimated death and serious injury (DSi) casualty equivalents for a site. It is effectively a measure of the number of deaths and serious injuries that can be expected at a site over the next analysis period (typically five years). At a corridor level, Collective Risk is the total estimated DSi casualty equivalents derived from the intersection and midblock components divided by the length of the corridor. It is expressed as estimated DSi / km.
- Personal risk is a measure of the risk of an individual dying or being seriously injured at a site. It is calculated by dividing Collective Risk by a measure of traffic volume exposure.

Collective and Personal risk metrics are shown in Figure 1.1 and Figure 1.2, and are described below:

- Brigham Creek Road between Totara Road to Joseph McDonald Drive has a Low collective and personal risk score.

- Brigham Creek Road between Joseph McDonald Drive and SH16 has a Medium collective and personal risk score.
- The SH16/Brigham Creek Road interchange has a Low to Low-Medium collective and personal risk score, other than

It is likely that improvements to Brigham Creek Road, proposed as part of the Spedding Block Precinct, will improve safety outcomes. We understand that resource consent for development of the Spedding Block has been lodged with Auckland Council, giving a reasonable degree of confidence that these improvements will precede development within Whenuapai Green.

Figure 1.1 Collective risk (NZTA MegaMaps)

Figure 1.2 Personal risk (NZTA MegaMaps)

NZTA CAS records

A search of the NZTA Crash Analysis System (CAS) was undertaken to assess the reported crash history on Brigham Creek Road and the roundabout connecting it to SH16. The search area is shown in Figure 1.3. Over the past five years (2019-2024 inclusive), a total of 56 crashes were reported. 40 of the crashes were reported within 100 m of the roundabout and 17 along Brigham Creek Road.

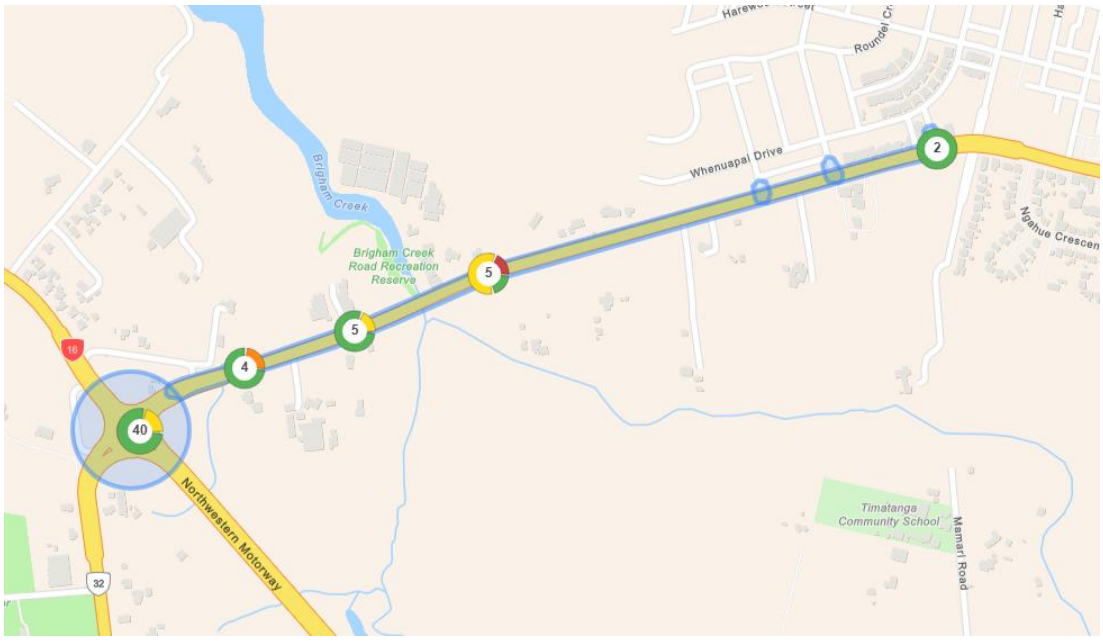


Figure 1.3 CAS Search Area (Source: NZTA Waka Kotahi CAS)

Brigham Creek Road

One serious injury and one fatal crash were reported. Key aspects of the reported crashes are included below. A full summary of each crash is provided in Table 1.1.

Fatal and serious injury crash:

- The fatal injury crash involved a truck hitting a u-turning car, resulting in two fatalities.
- The serious injury crash involved a rear-end collision as the driver slowed for traffic.

Minor injury crashes:

- One reported crash occurred when a truck changing lanes hit a cyclist.
- Three reported crashes involved drivers losing control and running off the road.

Non-injury crashes:

- Five reported crashes involved a rear-end collision as the driver slowed for traffic
- Two reported crashes were head-on crashes, one of which was a result of a vehicle swerving to avoid a vehicle in front suddenly breaking
- Two reported crashes occurred when a vehicle was overtaking or changing lanes
- One reported crash occurred while a vehicle was u-turning
- One reported crash occurred when a truck using a driveway was hit by a van on the road.

Multiple crash factors occurred across the reported crashes, including head-on collisions, rear-end collisions, vehicles manoeuvring and vehicles changing lanes.

It is likely that improvements to Brigham Creek Road, proposed as part of the Spedding Block Precinct, will improve safety outcomes:

- Brigham Road bridge replacement
- Brigham Road/Spedding Road signalised intersection.

We understand that resource consent for development of the Spedding Block has been lodged with Auckland Council, giving a reasonable degree of confidence that these improvements will precede development within Whenuapai Green.

Table 1.1 CAS Search Summary

Road	Date	Crash Type	Description of events
Brigham Creek Road	2020	Non-injury	Truck1 WDB on BRIGHAM CREEK ROAD changing lanes/overtaking to right hit Ute2
Brigham Creek Road	2023	Non-injury	Truck1 NDB on BRIGHAM CREEK ROAD hit rear end of Truck2 stop/slow for queue
Brigham Creek Road	2024	Serious	Car/Wagon1 EDB on BRIGHAM CREEK ROAD hit rear end of Car/Wagon2 stop/slow for queue
Brigham Creek Road	2020	Non-injury	Ute1 WDB on BRIGHAM CREEK ROAD changing lanes to left hit Other2
Brigham Creek Road	2022	Non-injury	Car/Wagon1 EDB on BRIGHAM CREEK ROAD hit Car/Wagon2 headon on straight
Brigham Creek Road	2020	Non-injury	Car/Wagon1 EDB on BRIGHAM CREEK ROAD hit Ute2 U-turning from same direction of travel
Brigham Creek Road	2024	Minor	Car/Wagon1 WDB on BRIGHAM CREEK ROAD lost control; went off road to right
Brigham Creek Road	2022	Non-injury	Ute1 EDB on BRIGHAM CREEK ROAD hit rear end of Truck2 stop/slow for obstruction
Brigham Creek Road	2023	Non-injury	Car/Wagon1 WDB on BRIGHAM CREEK ROAD hit rear end of Car/Wagon2 stop/slow for queue
Brigham Creek Road	2022	Non-injury	Van1 EDB on BRIGHAM CREEK ROAD hit Truck2 doing driveway manoeuvre
Brigham Creek Road	2022	Minor	Truck1 NDB on BRIGHAM CREEK ROAD lost control turning right; went off road to left
Brigham Creek Road	2021	Minor	Truck1 EDB on BRIGHAM CREEK ROAD changing lanes to left hit Cyclist2 (Age 47)
Brigham Creek Road	2023	Non-injury	Truck1 EDB on BRIGHAM CREEK ROAD hit Truck2 headon on straight
Brigham Creek Road	2020	Minor	Car/Wagon1 EDB on BRIGHAM CREEK ROAD lost control; went off road to right, Car/Wagon1 hit fence, tree, substantial vegetation (causing vehicle damage or stopping the vehicle),
Brigham Creek Road	2021	Fatal	Truck1 EDB on BRIGHAM CREEK ROAD hit Car/Wagon2 U-turning from same direction of travel , Car/Wagon2 hit tree

Road	Date	Crash Type	Description of events
Brigham Creek Road	2022	Non-injury	Car/Wagon1 WDB on BRIGHAM CREEK ROAD hit rear end of Ute2 stopped/moving slowly , Ute2 hit concrete
Brigham Creek Road	2021	Non-injury	Truck1 WDB on BRIGHAM CREEK ROAD hit rear end of Car/Wagon2 stopped/moving slowly

Brigham creek Road/SH16 roundabout

There were no serious or fatal crashes reported within 100 m of the roundabout. Key aspects of the reported minor and non-injury crashes are included below. A full summary of each crash is provided in Table 1.2.

Minor injury crashes:

- Three reported crashes were rear-end crashes as motorists slowing for traffic
- Four reported crashes were loss of control going navigating or exiting the roundabout
- One reported crash occurred during a lane change
- One reported crash was a vehicle sideswiping another vehicle
- Three reported crashes involved motorcyclists

Non-injury crashes:

- Six reported crashes were rear-end crashes
- Ten reported crashes were loss of control navigating or exiting the roundabout
- One reported crash involved a motorcyclist
- Four reported crashes occurred while vehicles were merging or overtaking

Multiple crash factors occurred across the reported crashes, including, rear-end collisions, drivers crashing while changing lanes, and drivers losing control while navigating the roundabout. There were no crashes involving cyclists or pedestrians. All crashes were either non-injury or minor injury, and are not atypical of a heavily trafficked roundabout in the Auckland environment.

Table 1.2 CAS Search Summary

Crash road	Date	Crash Type	Description of events
Fred Taylor Drive	2019	Non-injury	Car/Wagon1 NDB on Fred Taylor missed inters or end of road, Car/Wagon1 hit roundabout, light pole
SH 16	2021	Minor	Motorcycle1 NDB on SH 16 lost control turning left; went off road to left, Motorcycle1 hit kerb
SH 16	2019	Minor	Motorcycle1 NDB on SH 16 Fred Taylor Drive Roundabout lost control turning right; went off road to left, Motorcycle1 hit kerb
Brigham Creek Road	2020	Non-injury	Car/Wagon1 SDB on SH 16 lost control turning left; went off road to right, Car/Wagon1 hit light pole
SH 16	2019	Non-injury	Left scene1 DIRN on SH 16 changing lanes to left hit Car/Wagon2

Crash road	Date	Crash Type	Description of events
SH 16	2020	Non-injury	SUV1 SDB on SH 16 hit rear end of Car/Wagon2 stop/slow for cross traffic
SH 16	2023	Minor	Car/Wagon1 SDB on SH 16 hit rear end of Motorcycle2 stop/slow for cross traffic
SH 16	2019	Non-injury	Car/Wagon1 EDB on SH 16 sideswiped by Car/Wagon2 EDB on SH 16 turning left
SH 16	2020	Non-injury	Van1 SDB on SH 16 hit rear end of Car/Wagon2 stop/slow for cross traffic
SH 16	2022	Non-injury	Ute1 SDB on SH 16 lost control turning right but did not leave the road
SH 16	2022	Non-injury	Car/Wagon1 SDB on SH 16 hit Ute2 crossing at right angle from right
Fred Taylor Drive	2022	Non-injury	load or trailer from Truck1 SDB on FRED TAYLOR DRIVE hit VEHB
Fred Taylor Drive	2019	Non-injury	Car/Wagon1 WDB on NORTH-WESTERN MOTORWAY lost control turning left; went off road to right, Car/Wagon1 hit guard rail
North-Western Motorway	2021	Minor	Car/Wagon1 WDB on NORTH-WESTERN MOTORWAY hit rear end of Ute2 stop/slow for queue
North-Western Motorway	2019	Non-injury	Car/Wagon1 NDB on Sh16 hit rear end of Car/Wagon2 stop/slow for queue
North-Western Motorway	2021	Non-injury	Car/Wagon1 NDB on NORTH-WESTERN MOTORWAY missed intersection or end of road, Car/Wagon1 hit substantial vegetation (causing vehicle damage or stopping the vehicle)
North-Western Motorway	2019	Minor	Car/Wagon1 WDB on NORTH-WESTERN MOTORWAY hit rear end of SUV2 stop/slow for cross traffic
North-Western Motorway	2021	Non-injury	Ute1 NDB on NORTH-WESTERN MOTORWAY hit rear end of Car/Wagon2 stop/slow for cross traffic
North-Western Motorway	2019	Non-injury	Car/Wagon1 WDB on State Highway 16 lost control turning left; went off road to left, Car/Wagon1 hit light pole
North-Western Motorway	2022	Non-injury	Car/Wagon1 NDB on NORTH-WESTERN MOTORWAY missed inters or end of road, Car/Wagon1 hit traffic sign, roundabout
North-Western Motorway	2021	Non-injury	Car/Wagon1 NDB on NORTH-WESTERN MOTORWAY lost control turning left; went off road to right, Car/Wagon1 hit light pole
North-Western Motorway	2020	Non-injury	Car/Wagon1 NDB on NORTH-WESTERN MOTORWAY hit Car/Wagon2 reversing along road

Crash road	Date	Crash Type	Description of events
North-Western Motorway	2023	Non-injury	Ute1 NDB on NORTH-WESTERN MOTORWAY missed intersection or end of road, Ute1 hit roundabout, traffic sign, substantial vegetation (causing vehicle damage or stopping the vehicle), light pole
North-Western Motorway	2021	Non-injury	Car/Wagon1 NDB on NORTH-WESTERN MOTORWAY sideswiped by SUV2 NDB on NORTH-WESTERN MOTORWAY turning left
North-Western Motorway	2021	Minor	SUV1 NDB on NORTH-WESTERN MOTORWAY lost control turning left; went off road to right, SUV1 hit light pole, roundabout
North-Western Motorway	2022	Non-injury	Car/Wagon1 WDB on NORTH-WESTERN MOTORWAY hit rear end of Car/Wagon2 stop/slow for cross traffic
North-Western Motorway	2024	Non-injury	Truck1 WDB on NORTH-WESTERN MOTORWAY hit Ute2 merging from the right
North-Western Motorway	2023	Minor	Car/Wagon1 NDB on NORTH-WESTERN MOTORWAY lost control turning left; went off road to right, Car/Wagon1 hit substantial vegetation (causing vehicle damage or stopping the vehicle), parked (occupied) vehicle
Brigham Creek Road	2021	Minor	Car/Wagon1 SDB on BRIGHAM CREEK ROAD changing lanes to left hit SUV2 , SUV2 hit guard rail
Brigham Creek Road	2019	Non-injury	SUV1 WDB on BRIGHAM CREEK ROAD hit rear end of Car/Wagon2 stop/slow for cross traffic
Brigham Creek Road	2021	Non-injury	Motorcycle1 SDB on BRIGHAM CREEK ROAD sideswiped by Left scene2 SDB on BRIGHAM CREEK ROAD turning left
Brigham Creek Road	2020	Non-injury	Car/Wagon1 SDB on SH 16 hit Ute2 merging from the left , Ute2 hit flexible post
Brigham Creek Road	2021	Non-injury	Ute1 WDB on BRIGHAM CREEK ROAD hit Car/Wagon2 crossing at right angle from right
SH 16	2022	Non-injury	Van1 SDB on SH 16 hit Car/Wagon2 crossing at right angle from right
SH 16	2019	Minor	SUV1 SDB on AUCKLAND-KUMEU MOTORWAY, WHENUAPAI, AUCKLAND sideswiped by SUV2 SDB on AUCKLAND-KUMEU MOTORWAY, WHENUAPAI, AUCKLAND turning left
SH 16	2023	Non-injury	Truck1 SDB on SH 16 changing lanes/overtaking to right hit Ute2
SH 16	2019	Non-injury	SUV1 WDB on BRIGHAM CREEK ROAD, WHENUAPAI, AUCKLAND hit rear of Car/Wagon2 WDB on BRIGHAM CREEK ROAD, WHENUAPAI, AUCKLAND turning right from left side

Crash road	Date	Crash Type	Description of events
SH 16	2021	Non-injury	Truck1 SDB on SH 16 lost control turning right; went off road to left
SH 16	2020	Non-injury	Car/Wagon1 SDB on SH 16 hit turning Car/Wagon2
SH 16	2021	Non-injury	Ute1 SDB on SH 16 hit rear of Car/Wagon2 SDB on SH 16 turning right from left side

1.3 Brigham Creek Road effects

Additional Information under Clause 23(2) Requested

The Brigham Creek Road modelling assessment has been updated to include the Totara Road, Trig Road, Kauri Road intersections. Discussion on the SH18 / Brigham Creek Road interchange is provided further below.

It is noted that for the Totara Road intersection, the queue lengths are predicted to increase by 227m and average delays are predicted to increase by 44 seconds in the forecasted 2030 PM peak. These increases will be noticeable by people who use this intersection, and the queues may extend back into local road intersections. It is also noted that some minor lane marking adjustments have been proposed. Have any other further mitigations been considered for this intersection?

Please assess potential impacts of increased queue lengths and delays predicted at the Totara Road / Brigham Creek Road intersection, and whether any mitigation is possible to address these effects.

Abley response

Appendix A contains the Brigham Creek Road / Totara Road intersection modelling results that were provided in our previous Clause 23 transport responses memo, dated 6 August 2024. Note that we have not updated the modelling, it is included to assist Council's review of our following response.

In our view the peak hour performance of the Brigham Creek Road / Totara Road is congested, but not atypical of how the wider arterial network operates during peak hours in Auckland. We have shown the "baseline" and "with development (0.9veh/hr/HH)" approach queues indicatively in Figure 1.4 and Figure 1.5 for the AM and PM peak respectively.

The results show queuing may occur across the following intersections:

- AM peak
  - Totara Road/Maramara Road for the baseline and with development scenarios
  - Brigham Creek Road/Ripeka Lane for the baseline and with development scenarios
  - Brigham Creek Road/Boyes Avenue for the baseline and with development scenarios
  - Brigham Creek Road/Joseph McDonald Drive for with development scenario
- PM peak
  - Totara Road/Maramara Road for the with development scenario
  - Brigham Creek Road/Ngahue Crescent for the baseline and with development scenarios
  - Brigham Creek Road/Ripeka Lane for the baseline and with development scenarios
  - Brigham Creek Road/Boyes Avenue for the with development scenario
  - Brigham Creek Road/Joseph McDonald Drive for with development scenario.

In summary, the Plan Change is only affecting queuing over the Brigham Creek Road/Joseph McDonald Drive intersection, as the baseline queues extend over all other intersections in the AM and/or PM peak. To manage turning movements into and out of the Whenuapai 1 development area,

we suggest that yellow cross hatched road markings are painted on Brigham Creek Road at the Joseph McDonald Drive intersection to discourage queuing over these intersections. For consistency, we also recommend that yellow cross hatched road markings at painted at the Boyes Avenue intersection, given its proximity to the Joseph McDonald Drive intersection.

We suggest the following amendment to the Precinct provisions:

I1.6.6 Staging of Subdivision and Land Use – Transport Upgrades

Purpose: To mitigate the adverse effects of traffic generation on the surrounding road network; and to achieve the integration of land use and transport.

a) *Prior to the Council issuing a certificate under section 224(c) of the Resource Management Act 1991 for subdivision within a particular stage, the road widening shown on Precinct Plan 1 must have been constructed along all parts of Totara Road that immediately adjoin the particular stage.*

b) *The following transport infrastructure upgrades shall be established prior to certificates under section 224(c) being issued for a combined total of more than 150 residential lots or occupation of more than 150 dwellings (whichever occurs first):*

   1. *McCaw Road and Totara Road roundabout*
   2. *Tōtara Road and proposed internal northern road roundabout*

c) *The following transport infrastructure upgrades should be provided prior to any dwelling being occupied within the site:*

   1. *Lane marking improvements at Brigham Creek Road and Totara Road in accordance with Appendix 3.*
   2. *Brigham Creek Road/Trig Road intersection. Upgrade to a roundabout in accordance with the IXXX: Road Function and Design Elements Table 2.*
   3. *Cross hatched line marking improvements at the Brigham Creek Road intersections with Boyes Road and Joseph McDonald Drive to discourage queuing through these intersections.*

Figure 1.4 AM queuing, baseline and with development

Figure 1.5 PM queuing, baseline and with development

1.4 State highway interchange modelling

Additional Information under Clause 23(2) Requested
For the SH18 / Trig Road interchange, the assessment has demonstrated that an upgrade would not be required based on Whenuapai Green alone. However, if the Whenuapai Business Park is included in the modelling, then it has been assumed that an upgrade would be triggered by the Whenuapai Business Park. While the Whenuapai Business Park plan change has not yet been notified, the assessment has shown that the effects of Whenuapai Green does not require an upgrade of this interchange. For the SH18 / Brigham Creek Road interchange, it is noted that the modelled queue lengths extend back into the northern roundabout. These queues could impact on the operation of the northern roundabout from a safety or operational perspective. Please assess the queueing effects of the SH18 / Brigham Creek Road northbound on-ramp, and whether this has any safety or operational effects, and if any mitigation can be provided.

Abley response

The queueing effects at the SH18 / Brigham Creek Road interchange, particularly at the northern SH18 on-ramp, have been fully accounted for in the interchange modelling. The queue lengths reported are the maximum lengths, and due to the operation of metering signals (that is, short cycle times and mostly equal queueing effects by lane) the queueing is not expected to have a significant impact on operation of the roundabout.

In terms of potential mitigation, it is important to note that the future metering settings at both the Trig Road and Brigham Creek Road on-ramps have been modelled conservatively. The metering has been assumed to occur both over a much larger portion of the peak period, and at longer cycle times than occurs currently. This means that the metering system should be able to operate at a higher level of responsiveness than assumed in the modelling, with a corresponding decrease in anticipated queue lengths.

2. Auckland Transport RFIs

For each AT RFI we have reproduced the request from AT in a separate subsection and provided our response.

2.1 Modelling

Additional Information under Clause 23(2) Requested
SH18 / Brigham Creek Road Roundabout
Commute notes that as assessed, Whenuapai Green adds very little traffic to the SH18 / Brigham Creek Road roundabout (as per the trip distributions on Figures 1.17 to 1.20 on pages 27 to 28 of the Abley transport response).
However, it would be useful to understand if this is realistic. A large proportion of the dwellings in Whenuapai which were used to inform the Commuter Waka data are airbase-related. However it is expected that a large proportion of new Whenuapai Green trips would travel to/from other employment centres such as Albany/ Rosedale/ Wairau etc via SH18 and to/from the City Centre/ Rosebank Road/ Newmarket/ Mangere etc via SH16. In particular, regarding access to SH16, it looks as if the number of estimated trips on Trig Road is 'high' while the number of trips on Brigham Creek Road west of Totara Road is 'low'.
Please provide further data to support the distribution. It appears based on existing traffic volumes that vehicles exiting Totara Road in the morning predominantly turn right i.e. toward the SH16/ Brigham Creek Road roundabout while the majority of vehicles turning into Totara Road in the evening turn left in i.e. from the Brigham Creek Road/ Totara Road roundabout (revealing a preference for that route). While it may be a similar distance from the Whenuapai Green site to the SH16 Hobsonville Road onramp versus using the SH16/ Brigham Creek Road roundabout, it is considered that the roundabout route offers the shorter travel time (there is ramp metering at the SH16 Hobsonville Road onramp that delays these vehicles). Please note that current Google Maps travel time data may be affected by intersection works currently occurring on Brigham Creek Road associated with PC69 Spedding Block. Brigham Creek Road is currently operating under a single lane operation with traffic signals which will likely result in overstated travel times toward SH16 (which are just temporary).

Abley response

The modelled trip distribution has been informed by both the SGA NW Saturn simulation models (2028 and 2038) and by applying engineering judgment to current trip patterns, taking into account future changes in the roading network.

Key factors considered in the distribution include:

- **Brigham Creek Road Impacts**: The ongoing construction of access signals for PC69 and the introduction of intersection metering at SH16/Brigham Creek Road are expected to cause significant delays to westbound travel. This contributes to a lower proportion of trips using Brigham Creek Road.
- **Upgrades to Trig Road**: The improvements to Trig Road are expected to make it a more attractive route for accessing SH18, particularly when combined with current capacity constraints of SH16/Brigham Creek Road. These factors are reflected in the SGA NW Saturn model.
- **Local Employment Impact**: With the development of PC69 and the Whenuapai Business Park, a larger share of employment trips is expected to remain within Whenuapai. This will reduce the number of vehicle trips needing to access the State Highway network via SH16 or SH18.

It is important to note that the changes in trip distribution reflect marginal adjustments compared to the baseline. Our modelling does not assume that Whenuapai Green trips will exclusively favour Trig Road over Brigham Creek Road, but rather that trips will distribute across SH16, Trig Road, and

SH18/Brigham Creek Road. Simultaneously, existing road users will adjust their routes based on future network changes, with:

- a higher proportion of travel along Trig Road,
- slightly lower uptake of SH18 / Brigham Creek as it nears capacity, and
- potentially fewer trips attempting to access SH16 / Brigham Creek as operation is maintained at capacity by the metering system.

Overall, these adjustments in routing choices, both for new and existing users, align with where the SGA NW Saturn model shows available capacity within the network.

2.2 Dale / McCaw / Totara intersection

Additional Information under Clause 23(2) Requested

In the previous request, AT asked for more information about the concept design for this intersection to demonstrate that a safe and workable design can be accommodated. In response Abley has provided a concept design for this intersection (section 2.5 and Appendix B).

The roundabout design has been reviewed by relevant Subject Matter Experts within AT. At this stage the design is not satisfactory to AT, with the principal concern being about the design for cycling. Please undertake further design work to demonstrate that a safe and workable design can be accommodated. This can best be progressed by a meeting between Abley and AT subject matter experts. Please contact Katherine Doroaeff via email: Katherine.Dorofaeff@at.govt.nz

Abley response

We note that the proposed improvement to the Tōtara Road / Dale Road / McCaw Avenue intersection is not required to mitigate negative safety or efficiency effects from Whenuapai Green. NCL considers it an opportunity to provide positive safety effects, by encouraging lower vehicle speeds at this existing crossroad intersection.

We will engage with AT via Ms Dorofaeff to refine the design. In our view there is sufficient space within the existing road boundaries to enable a roundabout, acknowledging that this is a retrofit situation and some minor departures from standards that AT would expect for a new build may be required. In our view this can be resolved as part of the future resource consent process and does not preclude the Plan Change being approved.

2.3 Road links to adjacent sites

Additional Information under Clause 23(2) Requested

In response to the previous request, Abley explains (in section 2.8) why an additional road link has not been provided to the adjacent NZDF site - e.g. as per Road 4 on the previous Fast Track proposal. The explanation given is that NZDF has advised that it is not required, and that the northern link is sufficient. No further explanation is given for NZDF reaching this conclusion. Abley also advises that the proposed indicative internal road transport network is considered appropriate from a transport perspective for the reasons outlined within the ITA. However, this portion of AT's initial request has not been answered:

'Assess the effect of this on future development opportunities for the adjacent site'.

Abley response

Refer to responses from Campbell Brown regarding the NZDF site.

Appendix A.
SIDRA outputs incl. Signal phasing and Pedestrian LOS outputs

2030 Morning Peak Modelling Summary by Scenario

Site	Baseline			2030 incl WG (0.9v/hr/hh)			Difference		
	LoS	Delay	Max Queue	Los	Delay	Max Queue	LoS	Delay	Max Queue
BC / Totara	D	48s	283m	E	72s	397m	D>E	+24s	+114m

2030 Evening Peak Modelling Summary by Scenario

Site	2030 Baseline			2030 incl WG (0.9v/hr/hh			Difference		
	LoS	Delay	Max Queue	Los	Delay	Max Queue	LoS	Delay	Max Queue
BC / Totara	C	34s	186m	E	78s	413m	D>E	+44s	+227m

A1. Baseline Morning Peak Results

A1.1 Brigham Creek Road / Totara Road Baseline Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 Baseline AM (Site Folder: BC - Totara Baseline)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	29	0.0	29	0.0	0.140	55.7	LOS E	1.5	10.5	0.93	0.72	0.93	23.7
2	T1	All MCs	1	0.0	1	0.0	*0.149	47.7	LOS D	1.9	13.4	0.91	0.72	0.91	24.9
3	R2	All MCs	37	0.0	37	0.0	0.149	52.3	LOS D	1.9	13.4	0.91	0.72	0.91	24.4
Approach			67	0.0	67	0.0	0.149	53.7	LOS D	1.9	13.4	0.92	0.72	0.92	24.1
East: Brigham Creek Road E															
4	L2	All MCs	5	0.0	5	0.0	0.141	21.8	LOS C	3.7	29.0	0.58	0.49	0.58	36.4
5	T1	All MCs	428	13.2	428	13.2	0.354	19.0	LOS B	10.7	83.0	0.64	0.55	0.64	39.7
6	R2	All MCs	40	1.5	40	1.5	*0.422	65.7	LOS E	2.3	16.5	1.00	0.74	1.00	26.0
Approach			473	12.1	473	12.1	0.422	22.9	LOS C	10.7	83.0	0.67	0.56	0.67	38.0
North: Totara Road															
7	L2	All MCs	191	5.9	191	5.9	0.362	40.0	LOS D	8.5	62.2	0.84	0.78	0.84	32.0
8	T1	All MCs	1	0.0	1	0.0	*0.864	57.3	LOS E	19.9	149.0	1.00	0.99	1.24	22.8
9	R2	All MCs	320	8.3	320	8.3	0.864	62.0	LOS E	19.9	149.0	1.00	0.99	1.24	26.8
Approach			512	7.4	512	7.4	0.864	53.8	LOS D	19.9	149.0	0.94	0.91	1.09	28.5
West: Brigham Creek Road W															
10	L2	All MCs	183	10.5	183	10.5	0.377	32.0	LOS C	6.5	50.3	0.74	0.73	0.74	39.1
11	T1	All MCs	677	14.5	677	14.5	*0.879	65.4	LOS E	36.0	283.1	0.97	0.99	1.11	31.5
12	R2	All MCs	4	0.0	4	0.0	0.010	51.2	LOS D	0.1	0.9	0.66	0.63	0.66	30.8
Approach			864	13.6	864	13.6	0.879	58.3	LOS E	36.0	283.1	0.92	0.93	1.03	32.9
All Vehicles			1916	11.1	1916	11.1	0.879	48.2	LOS D	36.0	283.1	0.86	0.83	0.95	32.3

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

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
East: Brigham Creek Road E												
P2	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
North: Totara Road												
P3	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
West: Brigham Creek Road W												
P4	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
All Pedestrians		200	200	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97

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.

A1.2 Brigham Creek Road /Totara Road Baseline Morning Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 Baseline AM (Site Folder: BC - Totara Baseline)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site Optimum Cycle Time - Minimum Delay)

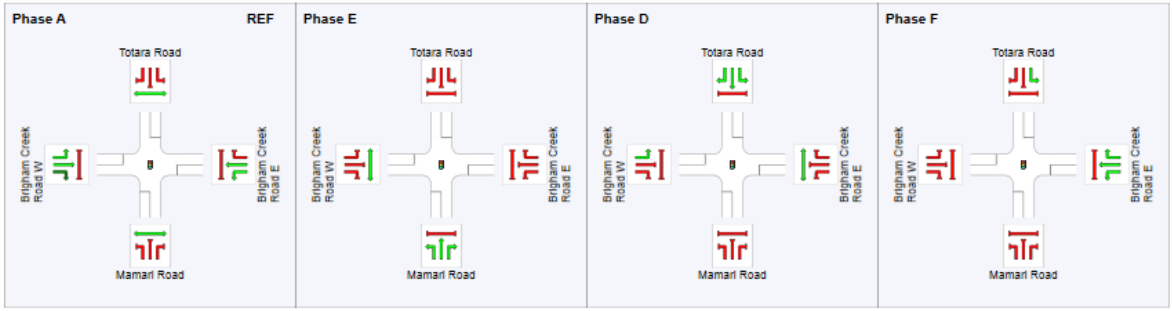
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	50	72	103
Green Time (sec)	44	16	25	6
Phase Time (sec)	50	22	31	12
Phase Split	43 %	19 %	27 %	10 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



A2. Baseline Evening Peak Results

A2.1 Brigham Creek Road / Totara Road Baseline Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 Baseline PM (Site Folder: BC - Totara Baseline)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 95 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	7	0.0	7	0.0	0.028	44.0	LOS D	0.3	2.0	0.89	0.65	0.89	26.7
2	T1	All MCs	1	0.0	1	0.0	*0.038	36.8	LOS D	0.4	3.1	0.87	0.66	0.87	27.9
3	R2	All MCs	10	0.0	10	0.0	0.038	41.4	LOS D	0.4	3.1	0.87	0.66	0.87	27.3
Approach			18	0.0	18	0.0	0.038	42.2	LOS D	0.4	3.1	0.88	0.66	0.88	27.1
East: Brigham Creek Road E															
4	L2	All MCs	32	0.0	32	0.0	0.220	20.3	LOS C	5.0	39.3	0.61	0.55	0.61	37.1
5	T1	All MCs	610	17.7	610	17.7	0.553	20.4	LOS C	14.8	119.4	0.72	0.64	0.72	40.2
6	R2	All MCs	87	2.4	87	2.4	*0.770	61.3	LOS E	4.5	32.0	1.00	0.91	1.29	27.4
Approach			730	15.1	730	15.1	0.770	25.3	LOS C	14.8	119.4	0.75	0.67	0.78	37.9
North: Totara Road															
7	L2	All MCs	58	1.9	58	1.9	0.115	32.6	LOS C	2.0	14.3	0.78	0.72	0.78	34.0
8	T1	All MCs	1	0.0	1	0.0	*0.851	50.7	LOS D	12.1	98.3	1.00	1.01	1.32	24.1
9	R2	All MCs	230	18.9	230	18.9	0.851	55.5	LOS E	12.1	98.3	1.00	1.01	1.32	28.0
Approach			289	15.5	289	15.5	0.851	50.9	LOS D	12.1	98.3	0.96	0.95	1.22	29.0
West: Brigham Creek Road W															
10	L2	All MCs	230	11.2	230	11.2	0.351	12.0	LOS B	4.5	34.7	0.69	0.72	0.69	41.2
11	T1	All MCs	551	13.2	551	13.2	*0.819	46.5	LOS D	23.9	186.2	0.96	0.94	1.06	34.3
12	R2	All MCs	11	0.0	11	0.0	0.044	43.3	LOS D	0.4	2.6	0.73	0.67	0.73	30.8
Approach			792	12.4	792	12.4	0.819	36.4	LOS D	23.9	186.2	0.88	0.87	0.95	36.0
All Vehicles			1828	13.9	1828	13.9	0.851	34.3	LOS C	23.9	186.2	0.84	0.80	0.92	35.3

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02
East: Brigham Creek Road E												
P2	Full	50	50	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02
North: Totara Road												
P3	Full	50	50	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02
West: Brigham Creek Road W												
P4	Full	50	50	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02
All Pedestrians		200	200	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02

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.

A2.2 Brigham Creek Road / Totara Road Baseline Evening Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 Baseline PM (Site Folder: BC - Totara Baseline)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 95 seconds (Site Optimum Cycle Time - Minimum Delay)

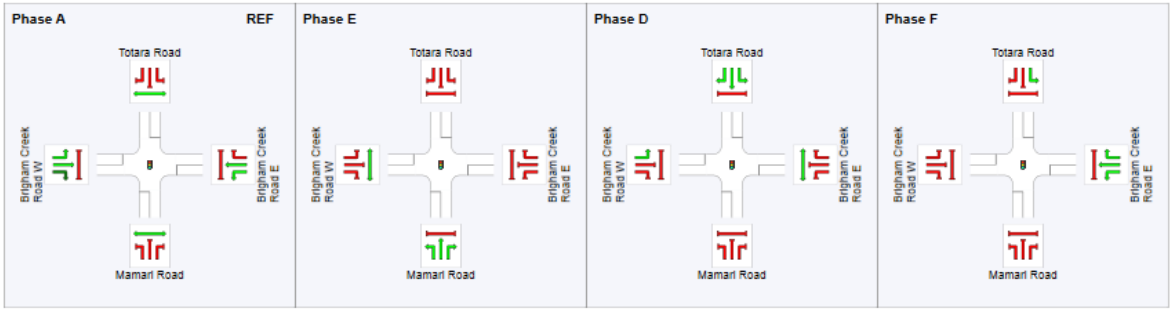
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	40	61	83
Green Time (sec)	34	15	16	6
Phase Time (sec)	40	21	22	12
Phase Split	42 %	22 %	23 %	13 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



A3. With Whenuapai Green Morning Peak Results

A3.1 Brigham Creek Road /Totara Road (0.9 trips/hh) With Whenuapai Green Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 WG Development AM Fixed Cycle (Site Folder: BC - Totara including WG Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	29	0.0	29	0.0	0.140	55.7	LOS E	1.5	10.5	0.93	0.72	0.93	23.7
2	T1	All MCs	1	0.0	1	0.0	*0.149	47.7	LOS D	1.9	13.4	0.91	0.72	0.91	24.9
3	R2	All MCs	37	0.0	37	0.0	0.149	52.5	LOS D	1.9	13.4	0.91	0.72	0.91	24.6
Approach			67	0.0	67	0.0	0.149	53.8	LOS D	1.9	13.4	0.92	0.72	0.92	24.2
East: Brigham Creek Road E															
4	L2	All MCs	5	0.0	5	0.0	0.143	22.3	LOS C	3.8	29.6	0.59	0.49	0.59	36.1
5	T1	All MCs	428	13.2	428	13.2	0.361	19.7	LOS B	10.8	84.5	0.65	0.56	0.65	39.4
6	R2	All MCs	132	0.5	132	0.5	*0.927	79.4	LOS E	9.0	63.2	1.00	1.15	1.65	23.8
Approach			565	10.1	565	10.1	0.927	33.6	LOS C	10.8	84.5	0.73	0.70	0.88	34.1
North: Totara Road															
7	L2	All MCs	410	2.7	410	2.7	0.746	47.4	LOS D	20.9	149.8	0.95	0.88	0.98	31.1
8	T1	All MCs	1	0.0	1	0.0	*0.999	118.6	LOS F	32.4	241.6	1.00	1.35	1.88	15.1
9	R2	All MCs	350	7.6	350	7.6	0.999	123.3	LOS F	32.4	241.6	1.00	1.35	1.88	18.9
Approach			761	5.0	761	5.0	0.999	82.4	LOS F	32.4	241.6	0.97	1.09	1.39	23.9
West: Brigham Creek Road W															
10	L2	All MCs	198	9.8	198	9.8	0.419	37.5	LOS D	6.9	52.6	0.78	0.75	0.78	38.9
11	T1	All MCs	677	14.5	677	14.5	*0.977	105.8	LOS F	50.4	397.0	0.98	1.32	1.47	24.0
12	R2	All MCs	4	0.0	4	0.0	0.011	57.6	LOS E	0.1	0.9	0.70	0.63	0.70	29.8
Approach			878	13.4	878	13.4	0.977	90.2	LOS F	50.4	397.0	0.93	1.19	1.31	26.3
All Vehicles			2272	9.4	2272	9.4	0.999	72.4	LOS E	50.4	397.0	0.90	1.02	1.22	26.9

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
East: Brigham Creek Road E												
P2	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
North: Totara Road												
P3	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
West: Brigham Creek Road W												
P4	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
All Pedestrians		200	200	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97

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.

A3.2 Brigham Creek Road /Totara Road (0.65 v/hr/hh) With Whenuapai Green Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 WG Development AM - 0.65/HH Fixed Cycle (Site Folder: BC - Totara including WG Development - 0.65/HH)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	29	0.0	29	0.0	0.140	55.7	LOS E	1.5	10.5	0.93	0.72	0.93	23.7
2	T1	All MCs	1	0.0	1	0.0	*0.149	47.7	LOS D	1.9	13.4	0.91	0.72	0.91	24.9
3	R2	All MCs	37	0.0	37	0.0	0.149	52.4	LOS D	1.9	13.4	0.91	0.72	0.91	24.4
Approach			67	0.0	67	0.0	0.149	53.8	LOS D	1.9	13.4	0.92	0.72	0.92	24.1
East: Brigham Creek Road E															
4	L2	All MCs	5	0.0	5	0.0	0.143	22.3	LOS C	3.8	29.6	0.59	0.49	0.59	36.1
5	T1	All MCs	428	13.2	428	13.2	0.361	19.6	LOS B	10.8	84.5	0.65	0.56	0.65	39.4
6	R2	All MCs	107	0.6	107	0.6	*0.961	89.7	LOS F	7.7	54.4	1.00	1.22	1.89	22.2
Approach			540	10.6	540	10.6	0.961	33.5	LOS C	10.8	84.5	0.72	0.69	0.90	34.2
North: Totara Road															
7	L2	All MCs	349	3.2	349	3.2	0.615	44.6	LOS D	16.7	120.3	0.91	0.84	0.91	31.5
8	T1	All MCs	1	0.0	1	0.0	*0.980	100.9	LOS F	29.1	217.2	1.00	1.26	1.74	16.8
9	R2	All MCs	342	7.8	342	7.8	0.980	105.6	LOS F	29.1	217.2	1.00	1.26	1.74	20.6
Approach			692	5.4	692	5.4	0.980	74.8	LOS E	29.1	217.2	0.95	1.05	1.32	25.0
West: Brigham Creek Road W															
10	L2	All MCs	194	10.0	194	10.0	0.398	34.9	LOS C	6.6	50.6	0.76	0.74	0.76	39.1
11	T1	All MCs	677	14.5	677	14.5	*0.928	79.8	LOS E	41.6	327.8	0.97	1.12	1.24	28.5
12	R2	All MCs	4	0.0	4	0.0	0.010	54.4	LOS D	0.1	0.9	0.68	0.63	0.68	30.3
Approach			874	13.5	874	13.5	0.928	69.7	LOS E	41.6	327.8	0.93	1.03	1.14	30.3
All Vehicles			2173	9.8	2173	9.8	0.980	61.8	LOS E	41.6	327.8	0.88	0.94	1.13	29.0

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
East: Brigham Creek Road E												
P2	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
North: Totara Road												
P3	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
West: Brigham Creek Road W												
P4	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
All Pedestrians		200	200	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97

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.

A3.3 Brigham Creek Road / Totara Road (0.9 trips/hh) With Whenuapai Green Morning Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 WG Development AM Fixed Cycle (Site Folder: BC - Totara including WG Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site User-Given Cycle Time)

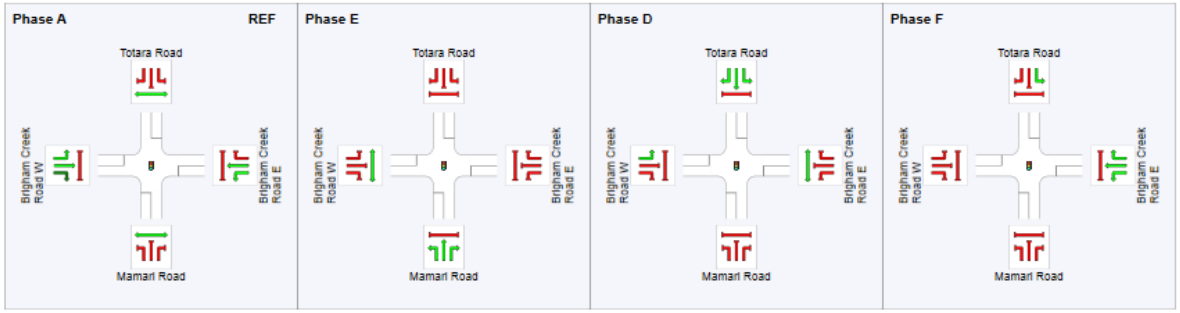
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	46	68	100
Green Time (sec)	40	16	26	9
Phase Time (sec)	46	22	32	15
Phase Split	40 %	19 %	28 %	13 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

A3.4 Brigham Creek Road /Totara Road (0.65 v/hr/hh) With Whenuapai Green Morning Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 WG Development AM - 0.65/HH Fixed Cycle (Site Folder: BC - Totara including WG Development - 0.65/HH)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site User-Given Cycle Time)

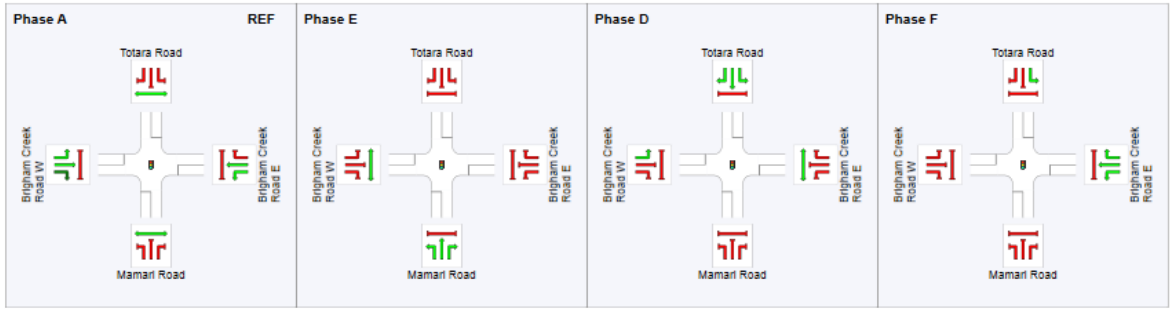
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	48	70	102
Green Time (sec)	42	16	26	7
Phase Time (sec)	48	22	32	13
Phase Split	42 %	19 %	28 %	11 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



A4. With Whenuapai Green Evening Peak Results

A4.1 Brigham Creek Road /Totara Road (0.9 trips/hh) With Whenuapai Green Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 WG Development PM Opt Cycle (Site Folder: BC - Totara including WG Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	7	0.0	7	0.0	0.037	60.5	LOS E	0.4	2.7	0.92	0.66	0.92	22.8
2	T1	All MCs	1	0.0	1	0.0	*0.047	51.8	LOS D	0.6	4.2	0.90	0.67	0.90	24.0
3	R2	All MCs	10	0.0	10	0.0	0.047	56.5	LOS E	0.6	4.2	0.90	0.67	0.90	23.6
Approach			18	0.0	18	0.0	0.047	57.8	LOS E	0.6	4.2	0.91	0.67	0.91	23.3
East: Brigham Creek Road E															
4	L2	All MCs	32	0.0	32	0.0	0.227	21.6	LOS C	6.5	53.6	0.52	0.48	0.52	37.9
5	T1	All MCs	665	24.5	665	24.5	0.571	23.0	LOS C	18.0	152.3	0.63	0.57	0.63	40.6
6	R2	All MCs	272	0.8	272	0.8	*1.016	151.3	LOS F	28.2	198.6	1.00	1.38	2.01	16.7
Approach			969	17.0	969	17.0	1.016	59.0	LOS E	28.2	198.6	0.73	0.80	1.02	28.8
North: Totara Road															
7	L2	All MCs	183	0.6	183	0.6	0.275	35.1	LOS D	7.9	55.3	0.75	0.76	0.75	33.3
8	T1	All MCs	1	0.0	1	0.0	*1.004	125.2	LOS F	24.1	194.5	1.00	1.33	1.93	14.2
9	R2	All MCs	247	17.7	247	17.7	1.004	130.0	LOS F	24.1	194.5	1.00	1.33	1.93	17.8
Approach			431	10.4	431	10.4	1.004	89.7	LOS F	24.1	194.5	0.90	1.09	1.43	22.2
West: Brigham Creek Road W															
10	L2	All MCs	241	3.4	241	3.4	0.419	45.7	LOS D	8.0	59.1	0.77	0.75	0.77	38.6
11	T1	All MCs	608	21.3	608	21.3	*0.976	115.0	LOS F	49.9	413.0	0.98	1.32	1.47	23.0
12	R2	All MCs	11	0.0	11	0.0	0.048	64.2	LOS E	0.5	3.3	0.72	0.67	0.72	28.6
Approach			860	16.0	860	16.0	0.976	94.9	LOS F	49.9	413.0	0.92	1.15	1.26	26.0
All Vehicles			2278	15.2	2278	15.2	1.016	78.4	LOS E	49.9	413.0	0.84	0.99	1.19	26.2

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	0.95
East: Brigham Creek Road E												
P2	Full	50	50	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	0.95
North: Totara Road												
P3	Full	50	50	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	0.95
West: Brigham Creek Road W												
P4	Full	50	50	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	0.95
All Pedestrians		200	200	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	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.

A4.2 Brigham Creek Road /Totara Road (0.65 v/hr/hh) With Whenuapai Green Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 WG Development PM - 0.65/HH Opt Cycle (Site Folder: BC - Totara including WG Development - 0.65/HH)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	7	0.0	7	0.0	0.032	52.1	LOS D	0.3	2.4	0.91	0.66	0.91	24.6
2	T1	All MCs	1	0.0	1	0.0	*0.042	43.8	LOS D	0.5	3.6	0.89	0.67	0.89	25.9
3	R2	All MCs	10	0.0	10	0.0	0.042	48.4	LOS D	0.5	3.6	0.89	0.67	0.89	25.5
Approach			18	0.0	18	0.0	0.042	49.6	LOS D	0.5	3.6	0.90	0.66	0.90	25.1
East: Brigham Creek Road E															
4	L2	All MCs	32	0.0	32	0.0	0.209	20.4	LOS C	5.5	43.1	0.56	0.52	0.56	37.4
5	T1	All MCs	610	17.7	610	17.7	0.526	20.5	LOS C	15.6	125.5	0.67	0.59	0.67	40.4
6	R2	All MCs	221	1.0	221	1.0	*0.892	71.5	LOS E	13.7	97.0	1.00	1.05	1.41	25.6
Approach			863	12.8	863	12.8	0.892	33.5	LOS C	15.6	125.5	0.75	0.71	0.85	35.0
North: Totara Road															
7	L2	All MCs	148	0.7	148	0.7	0.245	33.7	LOS C	5.8	40.8	0.77	0.75	0.77	33.7
8	T1	All MCs	1	0.0	1	0.0	*0.917	67.9	LOS E	16.1	129.8	1.00	1.11	1.49	20.8
9	R2	All MCs	242	18.0	242	18.0	0.917	72.7	LOS E	16.1	129.8	1.00	1.11	1.49	24.7
Approach			392	11.4	392	11.4	0.917	58.0	LOS E	16.1	129.8	0.91	0.97	1.22	27.5
West: Brigham Creek Road W															
10	L2	All MCs	251	10.2	251	10.2	0.382	24.8	LOS C	5.7	43.4	0.73	0.75	0.73	40.0
11	T1	All MCs	551	13.2	551	13.2	*0.891	68.9	LOS E	31.9	248.3	0.99	1.07	1.20	30.0
12	R2	All MCs	11	0.0	11	0.0	0.044	53.5	LOS D	0.4	2.9	0.73	0.67	0.73	29.6
Approach			813	12.1	813	12.1	0.891	55.1	LOS E	31.9	248.3	0.90	0.96	1.05	32.5
All Vehicles			2085	12.1	2085	12.1	0.917	46.6	LOS D	31.9	248.3	0.84	0.86	1.00	32.3

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98
East: Brigham Creek Road E												
P2	Full	50	50	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98
North: Totara Road												
P3	Full	50	50	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98
West: Brigham Creek Road W												
P4	Full	50	50	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98
All Pedestrians		200	200	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98

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

A4.3 Brigham Creek Road / Totara Road (0.9 trips/hh) With Whenuapai Green Evening Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 WG Development PM Opt Cycle (Site Folder: BC - Totara including WG Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

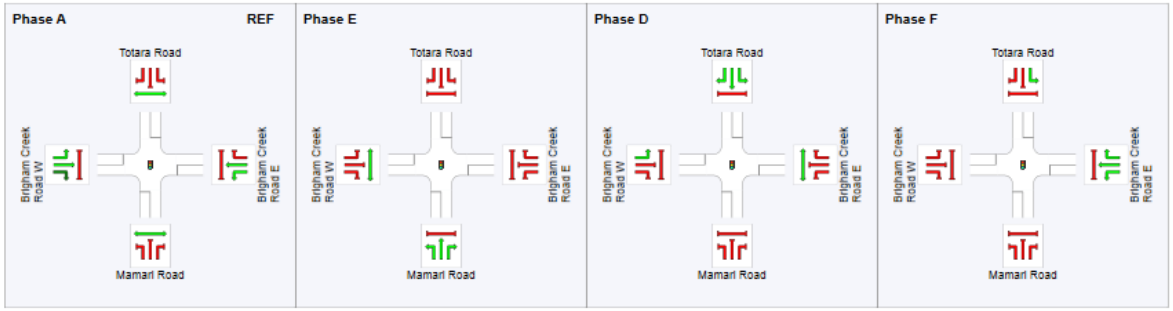
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	49	71	96
Green Time (sec)	43	16	19	23
Phase Time (sec)	49	22	25	29
Phase Split	39 %	18 %	20 %	23 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



A4.4 Brigham Creek Road / Totara Road (0.65 v/hr/hh) With Whenuapai Green Evening Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 WG Development PM - 0.65/HH Opt Cycle (Site Folder: BC - Totara including WG Development - 0.65/HH)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site Optimum Cycle Time - Minimum Delay)

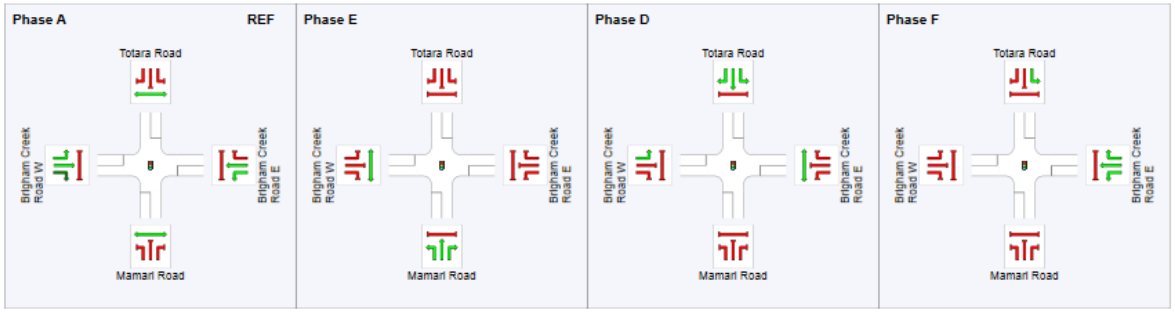
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	43	65	89
Green Time (sec)	37	16	18	15
Phase Time (sec)	43	22	24	21
Phase Split	39 %	20 %	22 %	19 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



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Appendix E.
Clause 23 responses – 25 November 2024

Whenuapai Green Plan Change

Clause 23 transport responses

Prepared for	Neil Construction Ltd
Project Number	TNEGL-J002
Revision	D
Issue Date	25 November 2024
Prepared by	Mat Collins, Associate Transportation Engineer; Chris Blackmore, Principal Transportation Planner
Reviewed by	Mat Collins, Associate Transportation Engineer

Summary

Neil Construction Limited (NCL) commissioned Abley Limited (Abley) to prepare an Integrated Transportation Assessment (ITA) report with respect to a Plan Change at 98-102 Totara Road, Whenuapai in Auckland (the site). The proposal is to rezone the site from Future Urban Zone (FUZ) to Residential – Mixed Housing Urban (MHU) zone and apply a Precinct across the site to guide future development (the Plan Change).

This technical note provides Abley's responses to additional Auckland Council (Council) and Auckland Transport (AT) Clause 23 requests for information (RFIs), received via email on Monday, 25 November 2024. In preparing this technical note, we have referred to the following documents:

- Whenuapai Green ITA, prepared by Abley, dated 1 February 2024
- Abley Clause 23 transport responses memo, dated 8 August 2024
- Abley Clause 23 transport responses memo, dated 24 October 2024.

Where new or updated assessment of transport effects is provided in this technical note, it supersedes assessment presented in our ITA and Clause 23 transport response memo.

1. Council RFIs

For each Council RFI we have reproduced the request from Council in a separate subsection and provided our response.

1.1 Crash history

Additional Information under Clause 23(2) Requested

The applicant has identified safety issues on Brigham Creek Road between Totara Road and SH16 and advised that resource consent for development of the Spedding Block has been lodged with Auckland Council, giving a reasonable degree of confidence that these improvements will precede development within Whenuapai Green.

It would be useful to know the likelihood and timing for the construction of these upgrades? If there is any uncertainty about the Spedding Block upgrades, then we wonder whether the applicant needs to introduce any other triggers for those upgrades.

Abley response

We consider that the upgrades proposed as part of the Spedding Block are not required to mitigate any safety effects generated by Whenuapai Green.

1.2 Brigham Creek Road effects

Additional Information under Clause 23(2) Requested

The applicant has proposed yellow cross hatched road markings on Brigham Creek Road at the Joseph McDonald Drive intersection to discourage queuing over these intersections. This suggestion has been included in the updated Precinct provisions. We note that this is prescribing a detailed design outcome, and would be subject to Auckland Transport approval. Any potential future upgrades of Brigham Creek Road (such as the 4 lane NOR design) may make this redundant, but it would still be within the Precinct provisions. We suggest this suggested mitigation requires Auckland Transport approval. (Refer AT comment below)

The modelling of Brigham Creek Road / Totara Road shows that the modelled operation of the intersection would increase from 88% to 98-100% degree of saturation in the morning peak period, and 85% to 92-102% in the evening peak period with the plan change traffic included. This shows that the proposed development enabled by the plan change would result in the intersection operating at/beyond its theoretical capacity. Mitigation that increases the capacity of the intersection may be required. The suggested yellow hatched markings would not mitigate these operational impacts at the intersection, which will impact bus services, as well as freight and other traffic.

However, we note that the original ITA indicates that capacity improvements could be made by changing the road markings, such that the eastbound left turn lane on Brigham Creek Road is marked as a left/through lane. It appears that the modelling provided does not include this layout.

We recommend that this modelling assessment is provided, to show whether or not it could improve the performance of the intersection. Subject to the results of this modelling, we can consider if further mitigations may be required.

Abley response

We confirm that our modelling is based on a shared left turn / through lane on Brigham Creek Road (western approach). We note that the modelled results are based on 0.9 veh/hr/household, which is conservative. Using a 0.65 veh/hr/household rate, which is more realistic for medium density residential, the intersection performance improves (although is still congested, with the northern approach having a 0.98 degree of saturation during the AM peak).

Appendix A contains the Brigham Creek Road / Totara Road intersection modelling results for the 0.65 veh/hr/household scenario that were provided in our previous Clause 23 transport responses memo. Note that we have not updated the modelling, it is included to assist Council's review of our response to this RFI.

In our view, this level of congestion is not out of the ordinary for the Auckland network and no further mitigations, other than what are already proposed, are required.

1.3 State highway interchange modelling

Additional Information under Clause 23(2) Requested
The response has provided further clarification about the assumptions used for the ramp meter signal modelling. This states that the assumptions are conservative, and the queue lengths at the SH18 /Brigham Creek Road northbound on-ramp would be shorter if different settings were assumed. Based on previous information responses, the red phase time of the on-ramps throughout the peak ranges from 3 to 12 seconds, which adapts to the State Highway performance. While the queues from the on-ramp may not extend back into the roundabout based on average signal timing settings, there could be queueing impacts when higher red phase times are triggered based on State Highway performance. We note this has potential safety implications if the queues extend back into the roundabout while drivers are attempting to circulate. Please assess the safety effects of queueing at the SH18 / Brigham Creek Road that may occur at busy times from the northbound on-ramp, and if any mitigation can be provided / is required.

Abley response

Whenuapai Green is adding approximately 70 movements to the approach, which averages at around 1 per minute in the peak hour. Our modelling is based on an 8 second delay running for the full peak hour, for the “baseline” and “with development” cases.

Our analysis of the signal data from ATOC shows that the on-ramp signal currently averages 7.7 seconds of red time and operates for 48% of the 8am – 9am peak hour (i.e. for approximately 30mins of the 8am morning peak hour). We therefore consider that our assessment is suitably conservative, and that queuing can be managed through future operation to contain the queue within the onramp.

There may be transient impacts on the roundabout during the peak of the worst traffic days, however this is likely under any use scenario and is not atypical of an interchange on the Auckland transport network.

2. Auckland Transport RFIs

For each AT RFI we have reproduced the request from AT in a separate subsection and provided our response.

2.1 Cross hatched line marking improvements at the Brigham Creek Road intersections

Additional Information under Clause 23(2) Requested
AT matters are mostly satisfied. However, it is noted that AT recommend on-going discussion regarding the Dale / McCaw / Totara intersection modelling. With regard to the yellow hatched line markings, the Flow Traffic comments above, and the Precinct Provision Wording, AT note the following: In response to a further information request from the Council's transport consultant (Flow), about how queueing effects could be mitigated, the following transport upgrade requirement has been added to IX.6.6(3): *'Cross hatched line marking improvements at the Brigham Creek Road intersections with Boyes Road and Joseph McDonald Drive to discourage queuing through these intersections.'* AT does not support this level of detail being included in the upgrade requirements where not meeting it would be a non-complying activity - rather it could be addressed in an assessment matter to be considered at resource consent stage. AT would have to agree that the cross-hatching is an appropriate response.

Abley response

Noted. We consider that the need for hatching, or otherwise, can be confirmed through future resource consent process, and agree that it should be deleted from IX.6.6(3).

Appendix A.
SIDRA outputs incl. Signal phasing and Pedestrian LOS outputs

2030 Morning Peak Modelling Summary by Scenario

Site	Baseline			2030 incl WG (0.65v/hr/hh)			Difference		
	LoS	Delay	Max Queue	Los	Delay	Max Queue	LoS	Delay	Max Queue
BC / Totara	D	48s	283m	E	62s	328m	D>E	+14s	+45m

2030 Evening Peak Modelling Summary by Scenario

Site	2030 Baseline			2030 incl WG (0.65v/hr/hh			Difference		
	LoS	Delay	Max Queue	Los	Delay	Max Queue	LoS	Delay	Max Queue
BC / Totara	C	34s	186m	D	47s	248m	C>D	+13s	+62m

A1. Baseline Morning Peak Results

A1.1 Brigham Creek Road / Totara Road Baseline Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 Baseline AM (Site Folder: BC - Totara Baseline)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	29	0.0	29	0.0	0.140	55.7	LOS E	1.5	10.5	0.93	0.72	0.93	23.7
2	T1	All MCs	1	0.0	1	0.0	*0.149	47.7	LOS D	1.9	13.4	0.91	0.72	0.91	24.9
3	R2	All MCs	37	0.0	37	0.0	0.149	52.3	LOS D	1.9	13.4	0.91	0.72	0.91	24.4
Approach			67	0.0	67	0.0	0.149	53.7	LOS D	1.9	13.4	0.92	0.72	0.92	24.1
East: Brigham Creek Road E															
4	L2	All MCs	5	0.0	5	0.0	0.141	21.8	LOS C	3.7	29.0	0.58	0.49	0.58	36.4
5	T1	All MCs	428	13.2	428	13.2	0.354	19.0	LOS B	10.7	83.0	0.64	0.55	0.64	39.7
6	R2	All MCs	40	1.5	40	1.5	*0.422	65.7	LOS E	2.3	16.5	1.00	0.74	1.00	26.0
Approach			473	12.1	473	12.1	0.422	22.9	LOS C	10.7	83.0	0.67	0.56	0.67	38.0
North: Totara Road															
7	L2	All MCs	191	5.9	191	5.9	0.362	40.0	LOS D	8.5	62.2	0.84	0.78	0.84	32.0
8	T1	All MCs	1	0.0	1	0.0	*0.864	57.3	LOS E	19.9	149.0	1.00	0.99	1.24	22.8
9	R2	All MCs	320	8.3	320	8.3	0.864	62.0	LOS E	19.9	149.0	1.00	0.99	1.24	26.8
Approach			512	7.4	512	7.4	0.864	53.8	LOS D	19.9	149.0	0.94	0.91	1.09	28.5
West: Brigham Creek Road W															
10	L2	All MCs	183	10.5	183	10.5	0.377	32.0	LOS C	6.5	50.3	0.74	0.73	0.74	39.1
11	T1	All MCs	677	14.5	677	14.5	*0.879	65.4	LOS E	36.0	283.1	0.97	0.99	1.11	31.5
12	R2	All MCs	4	0.0	4	0.0	0.010	51.2	LOS D	0.1	0.9	0.66	0.63	0.66	30.8
Approach			864	13.6	864	13.6	0.879	58.3	LOS E	36.0	283.1	0.92	0.93	1.03	32.9
All Vehicles			1916	11.1	1916	11.1	0.879	48.2	LOS D	36.0	283.1	0.86	0.83	0.95	32.3

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

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
East: Brigham Creek Road E												
P2	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
North: Totara Road												
P3	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
West: Brigham Creek Road W												
P4	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
All Pedestrians		200	200	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97

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.

A1.2 Brigham Creek Road /Totara Road Baseline Morning Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 Baseline AM (Site Folder: BC - Totara Baseline)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site Optimum Cycle Time - Minimum Delay)

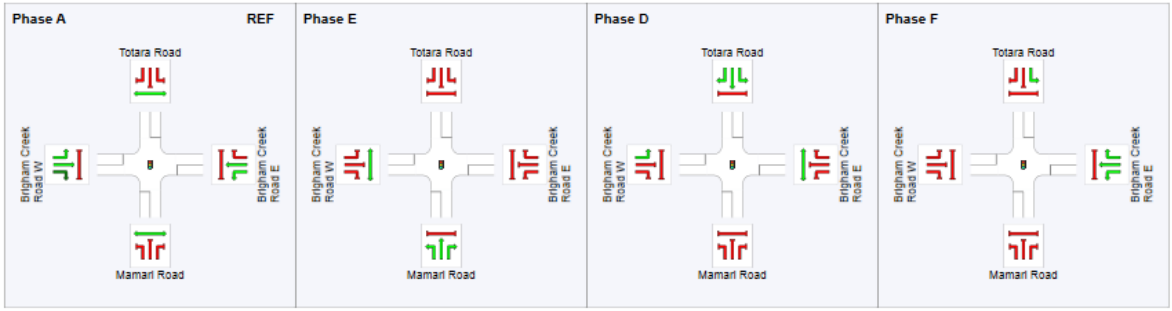
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	50	72	103
Green Time (sec)	44	16	25	6
Phase Time (sec)	50	22	31	12
Phase Split	43 %	19 %	27 %	10 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



A2. Baseline Evening Peak Results

A2.1 Brigham Creek Road / Totara Road Baseline Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 Baseline PM (Site Folder: BC - Totara Baseline)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 95 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	7	0.0	7	0.0	0.028	44.0	LOS D	0.3	2.0	0.89	0.65	0.89	26.7
2	T1	All MCs	1	0.0	1	0.0	*0.038	36.8	LOS D	0.4	3.1	0.87	0.66	0.87	27.9
3	R2	All MCs	10	0.0	10	0.0	0.038	41.4	LOS D	0.4	3.1	0.87	0.66	0.87	27.3
Approach			18	0.0	18	0.0	0.038	42.2	LOS D	0.4	3.1	0.88	0.66	0.88	27.1
East: Brigham Creek Road E															
4	L2	All MCs	32	0.0	32	0.0	0.220	20.3	LOS C	5.0	39.3	0.61	0.55	0.61	37.1
5	T1	All MCs	610	17.7	610	17.7	0.553	20.4	LOS C	14.8	119.4	0.72	0.64	0.72	40.2
6	R2	All MCs	87	2.4	87	2.4	*0.770	61.3	LOS E	4.5	32.0	1.00	0.91	1.29	27.4
Approach			730	15.1	730	15.1	0.770	25.3	LOS C	14.8	119.4	0.75	0.67	0.78	37.9
North: Totara Road															
7	L2	All MCs	58	1.9	58	1.9	0.115	32.6	LOS C	2.0	14.3	0.78	0.72	0.78	34.0
8	T1	All MCs	1	0.0	1	0.0	*0.851	50.7	LOS D	12.1	98.3	1.00	1.01	1.32	24.1
9	R2	All MCs	230	18.9	230	18.9	0.851	55.5	LOS E	12.1	98.3	1.00	1.01	1.32	28.0
Approach			289	15.5	289	15.5	0.851	50.9	LOS D	12.1	98.3	0.96	0.95	1.22	29.0
West: Brigham Creek Road W															
10	L2	All MCs	230	11.2	230	11.2	0.351	12.0	LOS B	4.5	34.7	0.69	0.72	0.69	41.2
11	T1	All MCs	551	13.2	551	13.2	*0.819	46.5	LOS D	23.9	186.2	0.96	0.94	1.06	34.3
12	R2	All MCs	11	0.0	11	0.0	0.044	43.3	LOS D	0.4	2.6	0.73	0.67	0.73	30.8
Approach			792	12.4	792	12.4	0.819	36.4	LOS D	23.9	186.2	0.88	0.87	0.95	36.0
All Vehicles			1828	13.9	1828	13.9	0.851	34.3	LOS C	23.9	186.2	0.84	0.80	0.92	35.3

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02
East: Brigham Creek Road E												
P2	Full	50	50	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02
North: Totara Road												
P3	Full	50	50	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02
West: Brigham Creek Road W												
P4	Full	50	50	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02
All Pedestrians		200	200	41.8	LOS E	0.1	0.1	0.94	0.94	195.6	200.0	1.02

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.

A2.2 Brigham Creek Road / Totara Road Baseline Evening Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 Baseline PM (Site Folder: BC - Totara Baseline)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 95 seconds (Site Optimum Cycle Time - Minimum Delay)

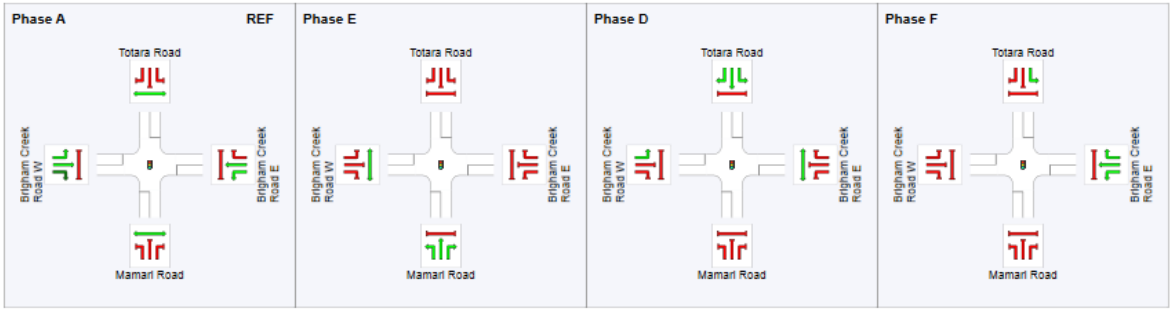
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	40	61	83
Green Time (sec)	34	15	16	6
Phase Time (sec)	40	21	22	12
Phase Split	42 %	22 %	23 %	13 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



A3. With Whenuapai Green Morning Peak Results

A3.1 Brigham Creek Road /Totara Road (0.9 trips/hh) With Whenuapai Green Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 WG Development AM Fixed Cycle (Site Folder: BC - Totara including WG Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	29	0.0	29	0.0	0.140	55.7	LOS E	1.5	10.5	0.93	0.72	0.93	23.7
2	T1	All MCs	1	0.0	1	0.0	*0.149	47.7	LOS D	1.9	13.4	0.91	0.72	0.91	24.9
3	R2	All MCs	37	0.0	37	0.0	0.149	52.5	LOS D	1.9	13.4	0.91	0.72	0.91	24.6
Approach			67	0.0	67	0.0	0.149	53.8	LOS D	1.9	13.4	0.92	0.72	0.92	24.2
East: Brigham Creek Road E															
4	L2	All MCs	5	0.0	5	0.0	0.143	22.3	LOS C	3.8	29.6	0.59	0.49	0.59	36.1
5	T1	All MCs	428	13.2	428	13.2	0.361	19.7	LOS B	10.8	84.5	0.65	0.56	0.65	39.4
6	R2	All MCs	132	0.5	132	0.5	*0.927	79.4	LOS E	9.0	63.2	1.00	1.15	1.65	23.8
Approach			565	10.1	565	10.1	0.927	33.6	LOS C	10.8	84.5	0.73	0.70	0.88	34.1
North: Totara Road															
7	L2	All MCs	410	2.7	410	2.7	0.746	47.4	LOS D	20.9	149.8	0.95	0.88	0.98	31.1
8	T1	All MCs	1	0.0	1	0.0	*0.999	118.6	LOS F	32.4	241.6	1.00	1.35	1.88	15.1
9	R2	All MCs	350	7.6	350	7.6	0.999	123.3	LOS F	32.4	241.6	1.00	1.35	1.88	18.9
Approach			761	5.0	761	5.0	0.999	82.4	LOS F	32.4	241.6	0.97	1.09	1.39	23.9
West: Brigham Creek Road W															
10	L2	All MCs	198	9.8	198	9.8	0.419	37.5	LOS D	6.9	52.6	0.78	0.75	0.78	38.9
11	T1	All MCs	677	14.5	677	14.5	*0.977	105.8	LOS F	50.4	397.0	0.98	1.32	1.47	24.0
12	R2	All MCs	4	0.0	4	0.0	0.011	57.6	LOS E	0.1	0.9	0.70	0.63	0.70	29.8
Approach			878	13.4	878	13.4	0.977	90.2	LOS F	50.4	397.0	0.93	1.19	1.31	26.3
All Vehicles			2272	9.4	2272	9.4	0.999	72.4	LOS E	50.4	397.0	0.90	1.02	1.22	26.9

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

Pedestrian Movement Performance

Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
East: Brigham Creek Road E												
P2	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
North: Totara Road												
P3	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
West: Brigham Creek Road W												
P4	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
All Pedestrians		200	200	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97

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.

A3.2 Brigham Creek Road /Totara Road (0.65 v/hr/hh) With Whenuapai Green Morning Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 WG Development AM - 0.65/HH Fixed Cycle (Site Folder: BC - Totara including WG Development - 0.65/HH)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site User-Given Cycle Time)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total	HV]	Arrival Flows [Total	HV]	Deg. Satn	Aver. Delay	Level of Service	95% Back Of Queue [Veh.	Dist]	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed
			veh/h	%	veh/h	%	v/c	sec		veh	m				km/h
South: Mamari Road															
1	L2	All MCs	29	0.0	29	0.0	0.140	55.7	LOS E	1.5	10.5	0.93	0.72	0.93	23.7
2	T1	All MCs	1	0.0	1	0.0	*0.149	47.7	LOS D	1.9	13.4	0.91	0.72	0.91	24.9
3	R2	All MCs	37	0.0	37	0.0	0.149	52.4	LOS D	1.9	13.4	0.91	0.72	0.91	24.4
Approach			67	0.0	67	0.0	0.149	53.8	LOS D	1.9	13.4	0.92	0.72	0.92	24.1
East: Brigham Creek Road E															
4	L2	All MCs	5	0.0	5	0.0	0.143	22.3	LOS C	3.8	29.6	0.59	0.49	0.59	36.1
5	T1	All MCs	428	13.2	428	13.2	0.361	19.6	LOS B	10.8	84.5	0.65	0.56	0.65	39.4
6	R2	All MCs	107	0.6	107	0.6	*0.961	89.7	LOS F	7.7	54.4	1.00	1.22	1.89	22.2
Approach			540	10.6	540	10.6	0.961	33.5	LOS C	10.8	84.5	0.72	0.69	0.90	34.2
North: Totara Road															
7	L2	All MCs	349	3.2	349	3.2	0.615	44.6	LOS D	16.7	120.3	0.91	0.84	0.91	31.5
8	T1	All MCs	1	0.0	1	0.0	*0.980	100.9	LOS F	29.1	217.2	1.00	1.26	1.74	16.8
9	R2	All MCs	342	7.8	342	7.8	0.980	105.6	LOS F	29.1	217.2	1.00	1.26	1.74	20.6
Approach			692	5.4	692	5.4	0.980	74.8	LOS E	29.1	217.2	0.95	1.05	1.32	25.0
West: Brigham Creek Road W															
10	L2	All MCs	194	10.0	194	10.0	0.398	34.9	LOS C	6.6	50.6	0.76	0.74	0.76	39.1
11	T1	All MCs	677	14.5	677	14.5	*0.928	79.8	LOS E	41.6	327.8	0.97	1.12	1.24	28.5
12	R2	All MCs	4	0.0	4	0.0	0.010	54.4	LOS D	0.1	0.9	0.68	0.63	0.68	30.3
Approach			874	13.5	874	13.5	0.928	69.7	LOS E	41.6	327.8	0.93	1.03	1.14	30.3
All Vehicles			2173	9.8	2173	9.8	0.980	61.8	LOS E	41.6	327.8	0.88	0.94	1.13	29.0

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
East: Brigham Creek Road E												
P2	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
North: Totara Road												
P3	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
West: Brigham Creek Road W												
P4	Full	50	50	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97
All Pedestrians		200	200	51.8	LOS E	0.2	0.2	0.95	0.95	205.6	200.0	0.97

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.

A3.3 Brigham Creek Road / Totara Road (0.9 trips/hh) With Whenuapai Green Morning Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 WG Development AM Fixed Cycle (Site Folder: BC - Totara including WG Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site User-Given Cycle Time)

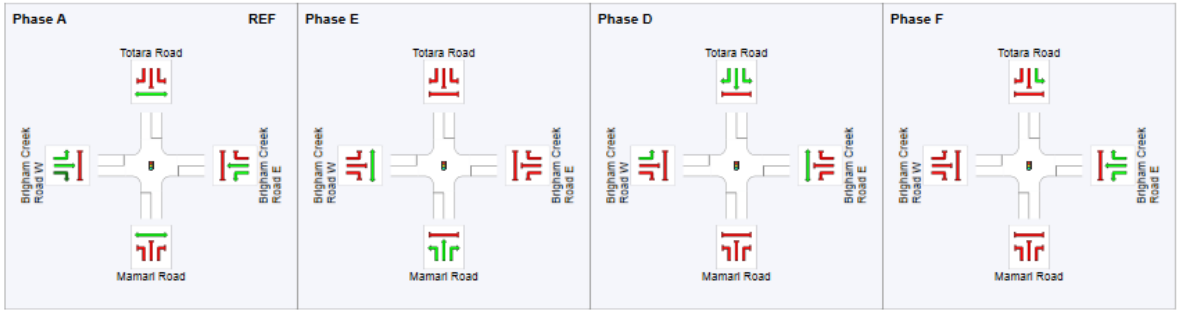
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	46	68	100
Green Time (sec)	40	16	26	9
Phase Time (sec)	46	22	32	15
Phase Split	40 %	19 %	28 %	13 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



REF: Reference Phase
VAR: Variable Phase

A3.4 Brigham Creek Road /Totara Road (0.65 v/hr/hh) With Whenuapai Green Morning Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 WG Development AM - 0.65/HH Fixed Cycle (Site Folder: BC - Totara including WG Development - 0.65/HH)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 115 seconds (Site User-Given Cycle Time)

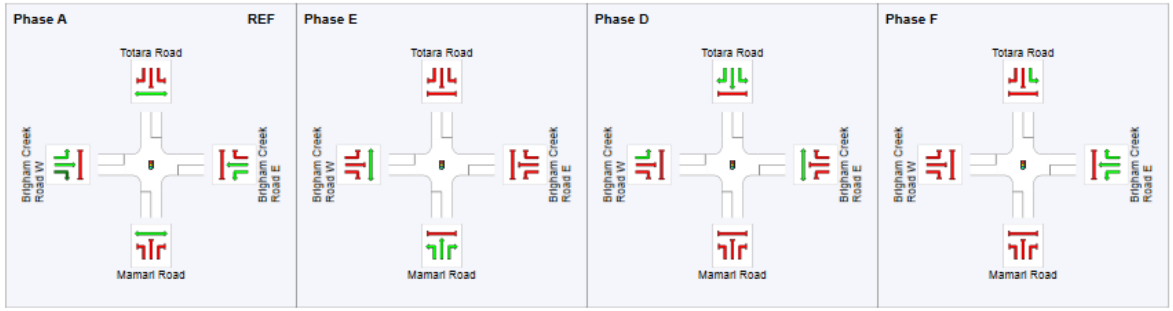
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	48	70	102
Green Time (sec)	42	16	26	7
Phase Time (sec)	48	22	32	13
Phase Split	42 %	19 %	28 %	11 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



A4. With Whenuapai Green Evening Peak Results

A4.1 Brigham Creek Road /Totara Road (0.9 trips/hh) With Whenuapai Green Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 WG Development PM Opt Cycle (Site Folder: BC - Totara including WG Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	7	0.0	7	0.0	0.037	60.5	LOS E	0.4	2.7	0.92	0.66	0.92	22.8
2	T1	All MCs	1	0.0	1	0.0	*0.047	51.8	LOS D	0.6	4.2	0.90	0.67	0.90	24.0
3	R2	All MCs	10	0.0	10	0.0	0.047	56.5	LOS E	0.6	4.2	0.90	0.67	0.90	23.6
Approach			18	0.0	18	0.0	0.047	57.8	LOS E	0.6	4.2	0.91	0.67	0.91	23.3
East: Brigham Creek Road E															
4	L2	All MCs	32	0.0	32	0.0	0.227	21.6	LOS C	6.5	53.6	0.52	0.48	0.52	37.9
5	T1	All MCs	665	24.5	665	24.5	0.571	23.0	LOS C	18.0	152.3	0.63	0.57	0.63	40.6
6	R2	All MCs	272	0.8	272	0.8	*1.016	151.3	LOS F	28.2	198.6	1.00	1.38	2.01	16.7
Approach			969	17.0	969	17.0	1.016	59.0	LOS E	28.2	198.6	0.73	0.80	1.02	28.8
North: Totara Road															
7	L2	All MCs	183	0.6	183	0.6	0.275	35.1	LOS D	7.9	55.3	0.75	0.76	0.75	33.3
8	T1	All MCs	1	0.0	1	0.0	*1.004	125.2	LOS F	24.1	194.5	1.00	1.33	1.93	14.2
9	R2	All MCs	247	17.7	247	17.7	1.004	130.0	LOS F	24.1	194.5	1.00	1.33	1.93	17.8
Approach			431	10.4	431	10.4	1.004	89.7	LOS F	24.1	194.5	0.90	1.09	1.43	22.2
West: Brigham Creek Road W															
10	L2	All MCs	241	3.4	241	3.4	0.419	45.7	LOS D	8.0	59.1	0.77	0.75	0.77	38.6
11	T1	All MCs	608	21.3	608	21.3	*0.976	115.0	LOS F	49.9	413.0	0.98	1.32	1.47	23.0
12	R2	All MCs	11	0.0	11	0.0	0.048	64.2	LOS E	0.5	3.3	0.72	0.67	0.72	28.6
Approach			860	16.0	860	16.0	0.976	94.9	LOS F	49.9	413.0	0.92	1.15	1.26	26.0
All Vehicles			2278	15.2	2278	15.2	1.016	78.4	LOS E	49.9	413.0	0.84	0.99	1.19	26.2

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	0.95
East: Brigham Creek Road E												
P2	Full	50	50	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	0.95
North: Totara Road												
P3	Full	50	50	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	0.95
West: Brigham Creek Road W												
P4	Full	50	50	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	0.95
All Pedestrians		200	200	56.8	LOS E	0.2	0.2	0.95	0.95	210.6	200.0	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.

A4.2 Brigham Creek Road /Totara Road (0.65 v/hr/hh) With Whenuapai Green Evening Peak Movement Summary

MOVEMENT SUMMARY

Site: 101 [2030 WG Development PM - 0.65/HH Opt Cycle (Site Folder: BC - Totara including WG Development - 0.65/HH)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site Optimum Cycle Time - Minimum Delay)

Vehicle Movement Performance

Mov ID	Turn	Mov Class	Demand Flows [Total veh/h	HV] %	Arrival Flows [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% Back Of Queue [Veh. veh	Dist] m	Prop. Que	Eff. Stop Rate	Aver. No. of Cycles	Aver. Speed km/h
South: Mamari Road															
1	L2	All MCs	7	0.0	7	0.0	0.032	52.1	LOS D	0.3	2.4	0.91	0.66	0.91	24.6
2	T1	All MCs	1	0.0	1	0.0	*0.042	43.8	LOS D	0.5	3.6	0.89	0.67	0.89	25.9
3	R2	All MCs	10	0.0	10	0.0	0.042	48.4	LOS D	0.5	3.6	0.89	0.67	0.89	25.5
Approach			18	0.0	18	0.0	0.042	49.6	LOS D	0.5	3.6	0.90	0.66	0.90	25.1
East: Brigham Creek Road E															
4	L2	All MCs	32	0.0	32	0.0	0.209	20.4	LOS C	5.5	43.1	0.56	0.52	0.56	37.4
5	T1	All MCs	610	17.7	610	17.7	0.526	20.5	LOS C	15.6	125.5	0.67	0.59	0.67	40.4
6	R2	All MCs	221	1.0	221	1.0	*0.892	71.5	LOS E	13.7	97.0	1.00	1.05	1.41	25.6
Approach			863	12.8	863	12.8	0.892	33.5	LOS C	15.6	125.5	0.75	0.71	0.85	35.0
North: Totara Road															
7	L2	All MCs	148	0.7	148	0.7	0.245	33.7	LOS C	5.8	40.8	0.77	0.75	0.77	33.7
8	T1	All MCs	1	0.0	1	0.0	*0.917	67.9	LOS E	16.1	129.8	1.00	1.11	1.49	20.8
9	R2	All MCs	242	18.0	242	18.0	0.917	72.7	LOS E	16.1	129.8	1.00	1.11	1.49	24.7
Approach			392	11.4	392	11.4	0.917	58.0	LOS E	16.1	129.8	0.91	0.97	1.22	27.5
West: Brigham Creek Road W															
10	L2	All MCs	251	10.2	251	10.2	0.382	24.8	LOS C	5.7	43.4	0.73	0.75	0.73	40.0
11	T1	All MCs	551	13.2	551	13.2	*0.891	68.9	LOS E	31.9	248.3	0.99	1.07	1.20	30.0
12	R2	All MCs	11	0.0	11	0.0	0.044	53.5	LOS D	0.4	2.9	0.73	0.67	0.73	29.6
Approach			813	12.1	813	12.1	0.891	55.1	LOS E	31.9	248.3	0.90	0.96	1.05	32.5
All Vehicles			2085	12.1	2085	12.1	0.917	46.6	LOS D	31.9	248.3	0.84	0.86	1.00	32.3

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

Pedestrian Movement Performance												
Mov ID	Crossing	Input Vol. ped/h	Dem. Flow ped/h	Aver. Delay sec	Level of Service	AVERAGE BACK OF QUEUE [Ped ped	Dist] m	Prop. Que	Eff. Stop Rate	Travel Time sec	Travel Dist. m	Aver. Speed m/sec
South: Mamari Road												
P1	Full	50	50	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98
East: Brigham Creek Road E												
P2	Full	50	50	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98
North: Totara Road												
P3	Full	50	50	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98
West: Brigham Creek Road W												
P4	Full	50	50	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98
All Pedestrians		200	200	49.3	LOS E	0.1	0.1	0.95	0.95	203.1	200.0	0.98

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

A4.3 Brigham Creek Road / Totara Road (0.9 trips/hh) With Whenuapai Green Evening Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 WG Development PM Opt Cycle (Site Folder: BC - Totara including WG Development)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 125 seconds (Site Optimum Cycle Time - Minimum Delay)

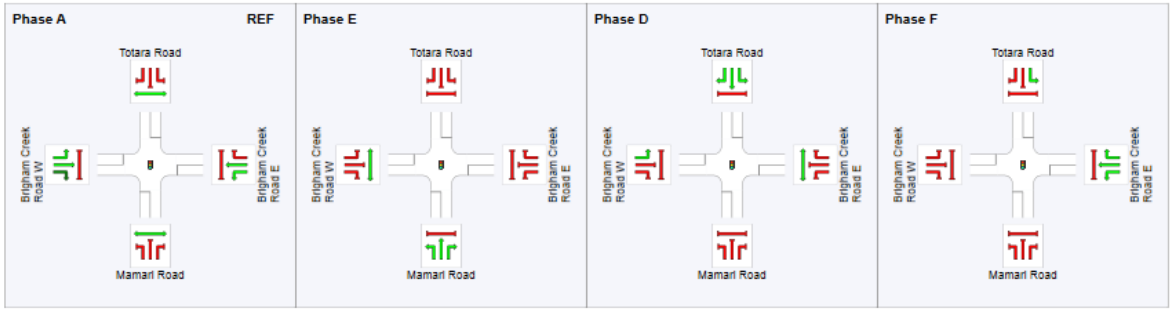
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	49	71	96
Green Time (sec)	43	16	19	23
Phase Time (sec)	49	22	25	29
Phase Split	39 %	18 %	20 %	23 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



A4.4 Brigham Creek Road / Totara Road (0.65 v/hr/hh) With Whenuapai Green Evening Peak Phasing Summary

PHASING SUMMARY

Site: 101 [2030 WG Development PM - 0.65/HH Opt Cycle (Site Folder: BC - Totara including WG Development - 0.65/HH)]

Output produced by SIDRA INTERSECTION Version: 9.1.2.202

New Site
Site Category: (None)
Signals - EQUISAT (Fixed-Time/SCATS) Isolated Cycle Time = 110 seconds (Site Optimum Cycle Time - Minimum Delay)

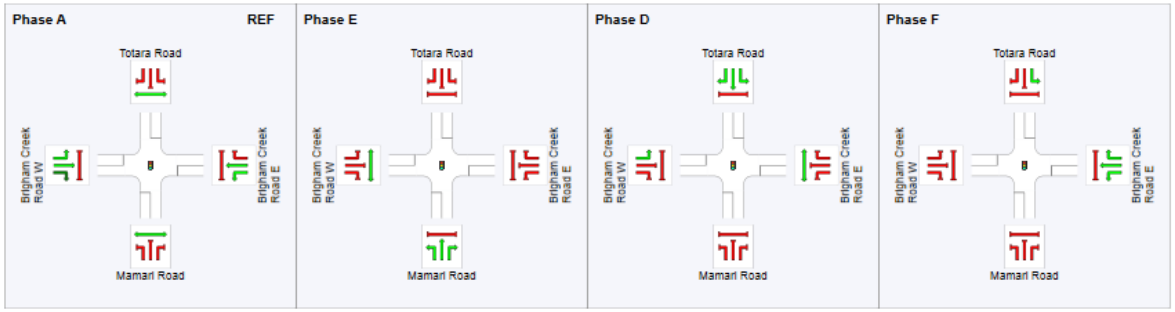
Timings based on settings in the Site Phasing & Timing dialog
Phase Times determined by the program
Phase Sequence: Leading Right Turn
Input Phase Sequence: A, E, D, F
Output Phase Sequence: A, E, D, F
Reference Phase: Phase A

Phase Timing Summary

Phase	A	E	D	F
Phase Change Time (sec)	0	43	65	89
Green Time (sec)	37	16	18	15
Phase Time (sec)	43	22	24	21
Phase Split	39 %	20 %	22 %	19 %
Phase Frequency (%)	100.0	100.0	100.0	100.0

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

Output Phase Sequence



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