Appendix 27

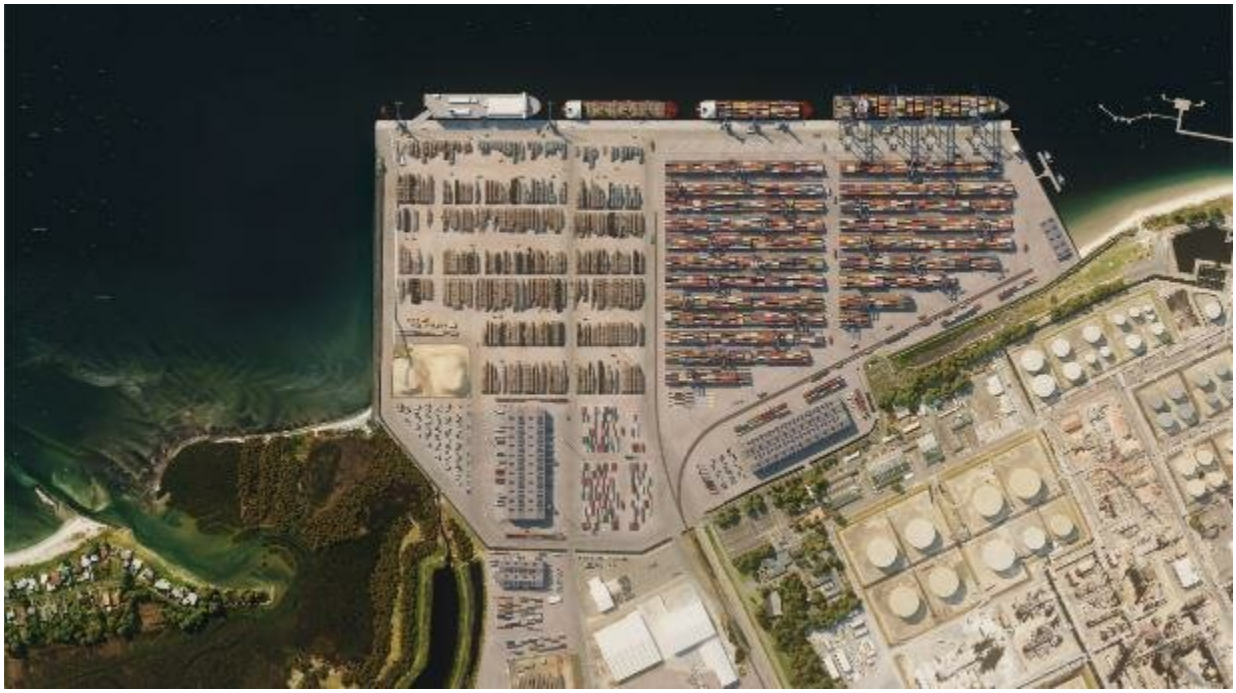
Traffic Impact Assessment

Project Number: 1-19278.01/00006

Traffic Impact Assessment

Northport Development in Whangārei

31 August 2022



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Revision Details

Revision	Details
Version 1	Draft report for the client to review
Version 2	Update to report following Hui outcomes and Government announcements
Version 3	Updates following council review
Version 4	Updates following lawyer review
Version 5	Updates following removal of Berth 0

Contents

Disclaimers and Limitations

This report ('**Report**') has been prepared by WSP exclusively for Northport ('**Client**') in relation to the traffic impact assessment of the road network while taking Northport's proposed expansion into consideration ('**Purpose**') and in accordance with the Agreement with the Client in February 2021. The findings in this Report are based on and are subject to the assumptions specified in the Report. WSP accepts no liability whatsoever for any reliance on or use of this Report, in whole or in part, for any use or purpose other than the Purpose or any use or reliance on the Report by any third party.

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1 Introduction

1.1 Background

WSP was commissioned by Northport to prepare a Traffic Impact Assessment (TIA) as supporting documentation for Northport's Resource Consent Application. Northport is seeking resource consents to enable expansion of their port operations, including container terminal and future cruise ship operations.

The report analyses the current and anticipated heavy and light traffic loadings on the State Highway (SH) 15 link from the SH1 Marsden Roundabout to Northport's premises, taking into consideration the full growth scenario over the next 22 years (2018 to 2040). The traffic assessment over the 22-year period considers SH15 traffic operations beyond the full port growth at year 2033. The effects of the development have been assessed conservatively to year 2040, to test the sensitivity of full port development with uncertainty around underlying traffic growth beyond 2033.

The key intersections affected by the project are shown in **Figure** 1-1 below.

Figure 1-1-1: Locality Plan Showing Key Intersections from Northport to SH1 along SH15

1.2 Report Purpose

The purpose of this TIA is to identify and assess the potential transportation effects of the proposed port development, along with suitable mitigation measures to address or remedy such effects, where necessary, to promote safe and efficient operation of the transport network.

This TIA report considers the following aspects:

- Review of the port development proposal, along with the planned growth in the area and the impact on the existing surrounding transport network and land use.

- Assessment of the level of trip generation associated with the port development; planned residential development over the 20+ year period for the land-uses; and the distribution of trips on the transport network.

- Traffic modelling of affected key intersections to determine their operational capacity in 2040 and identify improvements or control measures to mitigate the impact on the transport network.

- Active modes of transport (walking and cycling) as well as public transportation requirements.

2 Northport Development Proposal

2.1 Overview

This section of the report provides an outline of the proposed development of the port.

2.2 Proposal Details

Northport's proposed reclamation will provide for the expansion of Northport with the development of an additional berth (Berth 5), to the already consented, but currently not constructed, Berth 4. This will provide additional berths for handling import and export commodities.

The port expansion is expected to occur in stages. An overview of Northport's proposed expansion is illustrated in Figure 2-1 . Berths 1 to 3 are existing. Berth 4 is expected to be constructed, followed by Berth 5. Resource consent for Berth 4 has already been granted.

The 2017 network modelling from Stantec has confirmed that in 2043, the population of Marsden/Ruakākā would be 8,348. The interpolation of latest 2020 land use growth by Stantec between year 2018 and 2043 has shown that similar volumes (8416) will be experienced in year 2033. Therefore, to be conservative, we have assumed that full Northport expansion will occur by 2033. For more details on the assumptions, refer to Section 8.1 of this report.

The proposal will also facilitate cruise ships visiting the port. Considering the site is isolated from major town centres, it is expected that cruise visitors will predominantly be transported by bus. However, some visitors may travel by taxis to nearby areas such as Ruakākā.

Figure 2-1: Northport's Proposed Expansion (including Berth Labelling)

3 Strategic Context

3.1 Strategic Context

Northport has significant transportation and infrastructure functions, both in a regional and national context. The importance of ports is specifically recognised in Policy 9 of the New Zealand Coastal Policy Statement (NZCPS) which states:

Recognise that a sustainable national transport system requires an efficient national network of safe ports, servicing national and international shipping, with efficient connections with other transport modes, including by:

( ) ensuring that development in the coastal environment does not adversely affect the efficient and safe operation of these ports, or their connections with other transport modes; and

(a) considering where, how and when to provide in regional policy statements and in plans for the efficient and safe operation of these ports, the development of their capacity for shipping, and their connections with other transport modes.

Northport, and the adjoining land used for the movement and storage of cargo, is identified as Regionally Significant Infrastructure in Appendix 3 of the Regional Policy Statement for Northland (RPS).

Northport is planning to expand the port, to provide for anticipated freight demand and future growth in the region.

3.2 District Planning matters

To incorporate planned residential growth in the area, our network model:

a. Considered land use zoning around SH15, known as Port Marsden Highway (PMH),

b. Considered the Marsden Point/Ruakākā Structure Plan (2009) which provides for a planned new future township development at Ruakākā, and

c. included residential growth forecast from WDC, prepared in 2020[2]. The 2020 forecast assessment did not include all years, so development growth was interpolated using 2018 and 2043 points. For more detailed explanation refer to Section 8.1.1 (c).

3.3 Other Developments - Marsden Cove & Marsden City

The Marsden Cove residential canal development is a comprehensively planned project where one-third of the development is currently complete. Upon completion, Marsden Cove will provide for roughly 1000 new homes, including a mixture of canal-front and standard non-canal-front sections, a retirement village, waterfront apartments, and waterfront retail. Marsden Cove will largely contribute to the growth of Bream Bay and the Whangārei District. A plan of the overall development is shown in Figure 3-1.

[2] WDC Proposed Growth Model as received from Stantec on 28th July 2022

Figure 3-1: Marsden Cove Future Development Plan

The Marsden City proposed development is enabled by Private Plan Change 150 to the Whangarei District Plan. The plan change inserts a special purpose Marsden Town Centre in the Ruakaka / Marsden Point area as shown in Figure 3-2.[3]

Figure 3-2: Location of Marsden City as provided for by Private Plan Change 150

[3] At the time of preparing this report, the decision by Whangarei District Council to approve Private Plan Change 105 with modification is subject to appeal.

4 Existing Transport Network

4.1 Site Location – SH15/Port Marsden Highway (PMH)

SH15/PMH extends from SH1 to the Northport site, which is located approximately 8.50km from the SH1 roundabout and is a 30min drive south of Whangārei. It is located in a rural setting with a rural speed limit of 100km/h for most sections, with only the section east of the Marsden Bay Drive intersection having a lower speed of 70 km/h.

As indicated in Figure 4-1, the PMH is denoted by the yellow SH15 line which directly links from SH1 to the port. Marsden Point Road (a 'Major Arterial' road) provides a direct link from the Ruakākā development to the port. They both connect to the One Tree Point development from PMH and the port. The remaining roads in the locality are classified as 'Secondary Collector' roads, refer to Table 4-1.

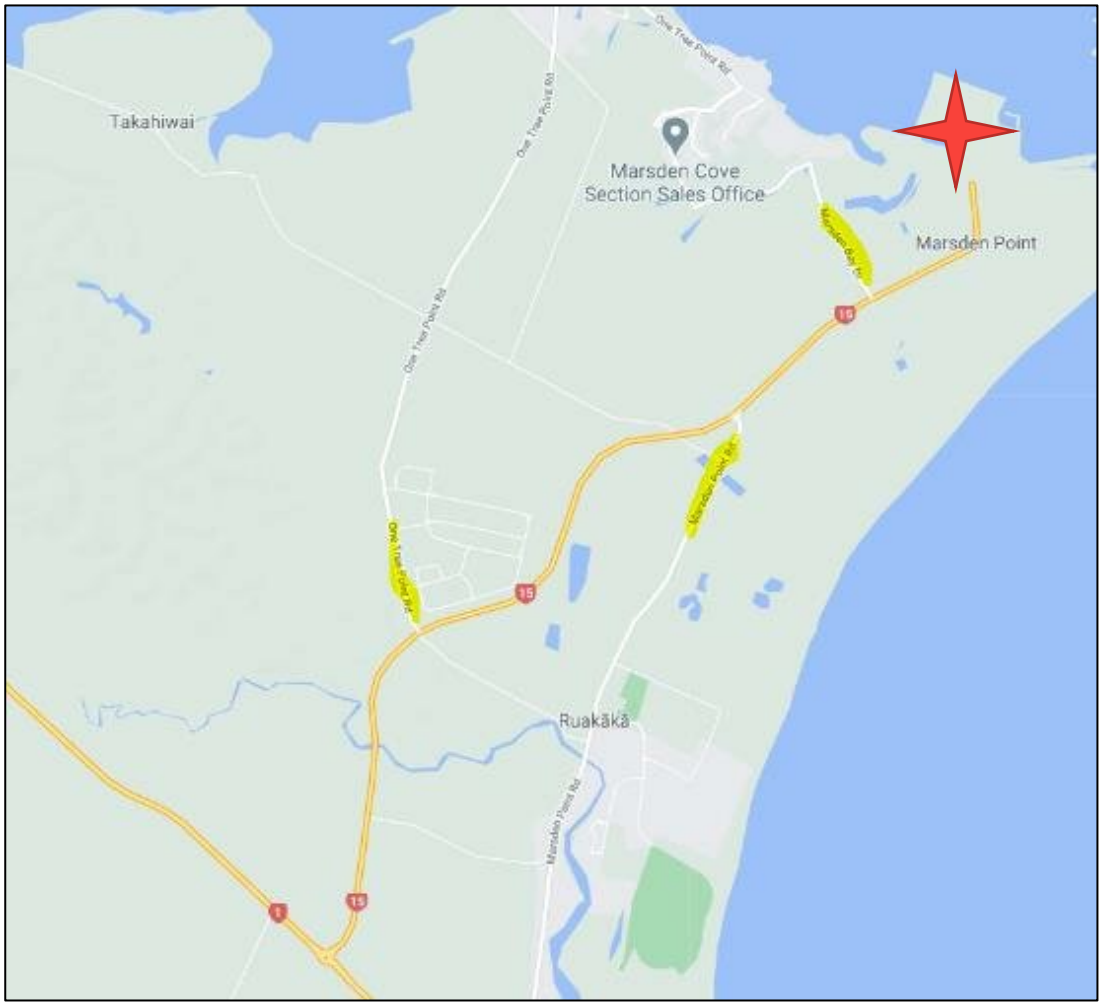


Figure 4-1: Locality Plan Showing Road Hierarchy and Location of Northport Denoted by Red Star

4.2 Road Network

The WDC transport network is classified in the Road Assessment and Maintenance Management (RAMM) database in the following hierarchy based on the One Network Road Classification (ONRC). The local transport network consists of several roads that will provide connections to the site, and key roads considered relevant to the study. Table 4-1 below summarises the Average Daily

Traffic (ADT)[4], speed at the proposed access locations (where applicable), and their role within the road hierarchy as classified in the District Plan.

Table 4-1: Local Transport Network

ROAD NAME	ROAD HIERARCHY	LANES	SPEED (KM/H)	ADT
Port Marsden Highway	Arterial	2	100	4,363
Marsden Point Road	Arterial	2	70	3,177
One Tree Point Road	Primary Collector	2	100	2,496
Marsden Bay Drive	Primary Collector	2	100	1,336
Rama Road	Primary Collector	2	100	281
Salle Road	Secondary Collector	2	100	764
McCathie Road	Secondary Collector	2	100	764
Mair Road	Secondary Collector	2	100	281

Source: NZTA ONRC Map, 2019

4.3 Rail Network

There is no direct rail link from the port at present, however designations have been obtained by KiwiRail for a spur line from Oakleigh, and land acquisition has started The intent is to establish a future rail corridor to Northport. For trip destinations to the south of Auckland, rail will become economical oncethe rail corridor comes on-line and connects to the port. This will help to reduce the heavy vehicle load on the network, by better implementation of a multimodal transportation network.

4.4 Transportation of Northport Cruise Ship Passengers and Staff

With the port development and arrival of passenger cruise ships, there will be additional bus movements on SH15 to and from the port. These are expected to occur outside of peak hours to minimise the impact on PMH traffic. Northport uses a ride share scheme for staff, with use of their company vehicles. This will also help with managing traffic on PMH from Northport operation.

4.5 Pedestrian and Cycle Routes

Within the vicinity of Marsden Point and PMH there are no specific cycle facilities on the key roads. Given the rural environment of PMH and the 100km/h speed limit with a high volume of heavy vehicles, it is not suitable for either pedestrians or cyclists.

4.6 Daily Traffic Volumes

The current traffic loading along PMH was taken from the permanent loop count station between Marsden Point Road and Rama Road. The data was collected between October and December in 2019 (pre-Covid) and distinguishes between Light Vehicles (LV) and Heavy Vehicles (HV). Types of vehicles measured by the traffic counters were categorised, using the Traffic Monitoring for State Highway Version 1.2 document. The results are summarised in Table 4-2 below. The table confirms that during the count period, PMH carried 4,363 vehicles daily, of which 20% were heavy vehicles.

[4]From Mobile Road Estimate 11/01/2019

Table 4-2: Traffic Count Data

				Current Traffic							
Road Name	Displacement	Carriagway No	Carriageway Name	adt	pccar	pclcv	pcmcv	pchcvi	pchcvii	pcbus	pcheavy
015-0111	0-1091m	8802	15A 0000 00.00 - 0000 07.77	4363	76%	4%	4%	3%	12%	0%	20%
015-0111	1091-2620m	2744	15A 0000 00.00 - 0000 07.77	4363	76%	4%	4%	3%	12%	0%	20%
015-0111	2620-5365m	2746	15A 0000 00.00 - 0000 07.77	4363	76%	4%	4%	3%	12%	0%	20%
015-0111	5365-5746m	2747	15A 0000 00.00 - 0000 07.77	4363	76%	4%	4%	3%	12%	0%	20%
015-0111	5746-7074m	2748	15A 0000 00.00 - 0000 07.77	4363	76%	4%	4%	3%	12%	0%	20%
015-0111	7074-7772m	2749	15A 0000 00.00 - 0000 07.77	4363	76%	4%	4%	3%	12%	0%	20%
015-0111	7772-7993m	9426	15A 0000 07.77 - 0000 08.43	4363	76%	4%	4%	3%	12%	0%	20%
015-0111	7993-8433m	2752	15A 0000 07.77 - 0000 08.43	4363	76%	4%	4%	3%	12%	0%	20%

4.7 Northport Logging Truck Slip Lane

South of the main entrance to the port, there is a slip lane present for secondary access/entry for logging trucks and others. This route provides direct access to the descaling area for the log trucks.

Regular access truck operators are provided with swipe access cards to the port, with the weighbridge also accessible along this route. All vehicles exit the port via the main entrance/exit.

A diagram with the movements is provided below. Considering the one-way entry and operation of the slip lane, there are no issues identified for PMH traffic.

Figure 4-2: Logging Truck Movement through Slip Lane at Northport (Image credit: Northport)

4.8 Northport Carpark

Northport has number of carparks located within the port, refer to Figure 4-3 for aerial view of the existing carparks.

Figure 4-3: Logging Truck Movement through Slip Lane at Northport (Image credit: Northport)

4.9 Road Safety - Existing

A search of the Waka Kotahi NZ Transport Agency (Waka Kotahi) Crash Analysis System (CAS) database was undertaken. The data was used to identify reported crashes that have occurred at the intersections along PMH during the past five years between 2016 and 2020. The crash numbers and locations are illustrated in Figure 2-3 and are summarised in Table 2-3 and Table 2-4. Note that the search areas are within a 100m radius of each of the intersections listed below; the study route runs between the SH1/SH15 intersection and the Marsden Bay Drive/SH15 intersection.

- SH1/SH15.
- SH15/Salle Road.
- SH15/McCathie Road.
- SH15/One Tree Point Road.
- SH15/Marsden Point Road.
- SH15/Rama Road.
- SH15/Marsden Bay Drive.
- SH15/Mair Road.

There were 12 reported crashes in this area during the five-year period from 2016 to 2020. The locations and severity of crashes are summarised in Figure 4-4 and Table 4-3. Of the 12 crashes, one resulted in a fatality, and two crashes resulted in minor injury. Crash data have not been updated post 2020 to avoid COVID affected traffic data, as it had significant impact on travel behaviour pattern of traffic.

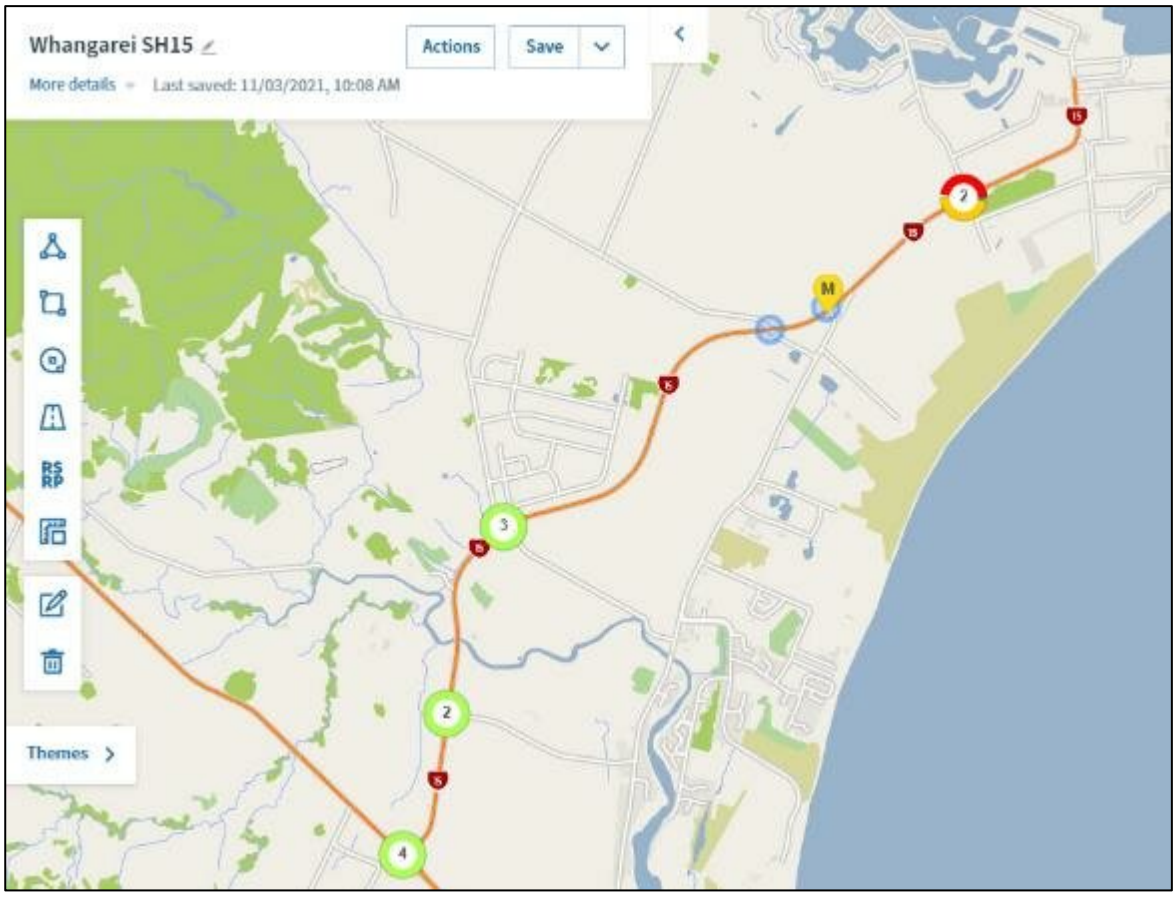


Figure 4-4: Crash Locations

Table 4-3: 2016-2020 Crash Numbers from CAS

CRASH YEAR	Fatal Crash	SERIOUS CRASH	MINOR CRASH	NON-INJURY CRASH	TOTAL
2016				4	4
2017			1	1	2
2018	1		1	1	3
2019				2	2
2020				1	1
Total	**1**	**0**	**2**	**9**	**12**

Table 4-4: Crash Movement Code

ROAD SAFETY REPORT MOVEMENT GROUP	Fatal Crash	MINOR CRASH	NON-INJURY CRASH	TOTAL
Bend-Lost control/Head on			3	3
Crossing/Turning		1		1
Miscellaneous			3	3
Rear end/obstruction			3	3
Straight-Lost control/Head on	1	1		2
Total	**1**	**2**	**9**	**12**

4.9.1 Crash Analysis Findings

The one fatal injury crash was at the Rama Rd/SH15 intersection. The Traffic Crash Report noted that a vehicle was travelling north towards the Channel Infrastructure terminal and started fishtailing. The driver lost control and spun 180 degrees going backwards into the front of a truck travelling west on the PMH/SH15. The weather condition was heavy rain.

One of the minor injury crashes was to the west of the Rama Rd/SH15 intersection, where a learner driver (travelling eastbound) lost control and crashed off the road. The other minor injury crash was at the Marsden Point Road intersection, where a vehicle turned right out of Marsden Point Road onto SH15 and collided into the side of an eastbound through vehicle on SH15.

5 Transportation Assessment Methodologies

5.1 Safety

Safety effects of the Project have been assessed using the crash prediction models from the Waka Kotahi Crash Estimation Compendium, and the recorded injury crash rate from the Waka Kotahi Crash Analysis System (CAS).

Safety of the current intersection has been assessed based on the recorded crashes over the past 5-year period extracted from the Waka Kotahi CAS. The 5-year period used in this assessment was from 2016 to 2020. This data was used to avoid the COVID period traffic data, which is not reflective of normal traffic operation.

5.2 Route efficiency

Route efficiency (travel times) on all approaches to the intersection was assessed using SIDRA Intersection software (version 9) and Tracks model for network. The methodology used, and assumptions made are discussed in detail in Section 8.1.1 of this report.

5.3 Road freight performance

Road freight performance is generally the same as general vehicular traffic performance, so has been assessed in the same way. The only differences between the performance of these larger vehicles and general vehicular traffic are:

- Negotiation of the roundabout – heavy vehicles have larger turning radii, so will negotiate the intersection at lower speeds and with larger turning paths than cars, and
- Over-dimension vehicles – require wider and higher clearance from obstructions than general traffic.

6 Transport Network Improvements

6.1 Rail Network Improvements

The Marsden Ruakākā Structure Plan has identified that a fully functional freight line between the port and Auckland is considered vital to future industrial growth in the area. The first stage of this project, the land acquisition and designation process for the 16km long rail corridor, is well underway. Designations have been obtained by KiwiRail.

Government's recent announcement to include rail funding as part of the National Land Transport Fund (NLTF), supports the Structure Plan outcomes, as it promotes the integration of a multimodal transportation network that better supports both the local and national economy. In June 2021, the Government's New Zealand Upgrade Programme allocated funding to the implementation of the rail link to Northport – the Oakleigh to Marsden Point Rail Link.

The proposed Oakleigh to Marsden Point Rail Link departs from the existing North Auckland Line (NAL) at Oakleigh, approximately 25km south of Whangārei City, and travels eastwards for approximately 16km to link with the port at Marsden Point.

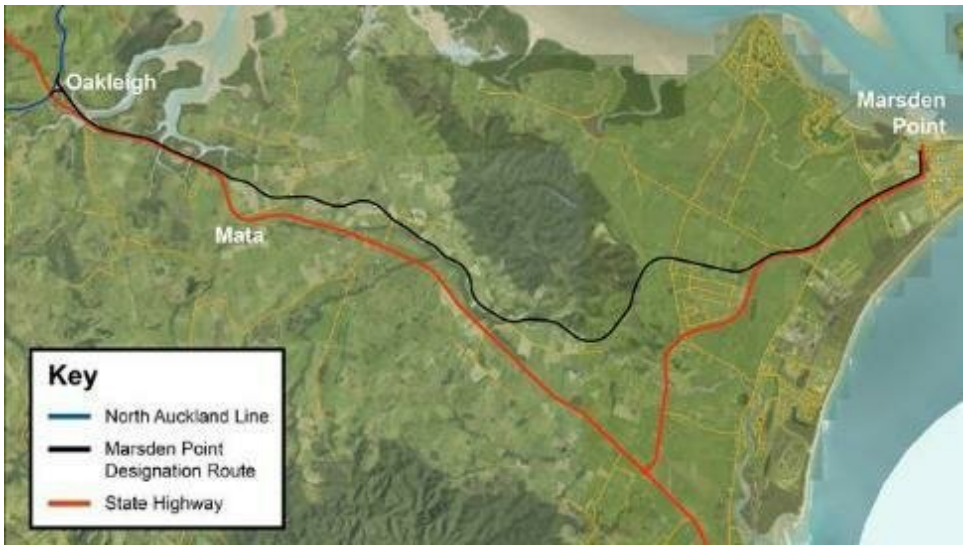


Figure 6-1: Proposed Oakleigh to Marsden Point rail link[5].

[5] https://www.kiwirail.co.nz/what-we-do/projects/northland-rail-rejuvenation/

7 Assessment of Effects on the PMH Network

7.1 Full Port Development Traffic Assessment Assumptions

Full Northport expansion traffic (i.e. traffic associated with the operation of Berths 1-5, including traffic associated with cruise ship visits) for the next 20+ years have been calculated using data provided by Northport and are shown in Appendix A. It is expected that cruise ships will make use of the port facility from year 5 (2023), reaching a maximum number of arrivals by year 10 (2028). No additional bus numbers are expected beyond Year 2028.

Northport has confirmed that it currently has 300 staff members (permanent and subcontracted), and expect to increase to 400 staff members at full expansion. At full expansion, the total additional port traffic on PMH is expected to be 806 trips per day and the additional 100 staff members at full port expansion will contribute 142 trips per day.

The ratio of total additional port staff to additional port traffic is approximately 18%. In 2018, the total port traffic was approximately 64% (2,802/4,363) of total PMH traffic. This ratio is expected to reduce significantly in the future following the planned residential development surrounding PMH. It is estimated that the ratio of total port traffic to total PMH traffic will be approximately 30% in year 2033 (3,290/10944) and 26% in year 2040 (3,608/13,666).

The logging related traffic are large contributors of the port traffic. The logging industry is heavily dependent on two primary factors (other than demand), accessibility to, and maturity of, trees for felling.

Accessibility to trees is directly influenced by the condition of haulage tracks, which at certain times of the year become untraversable due to the wet conditions. The associated seasonal influence generates peaks and troughs throughout the year when considering the supply of logs, however, this is generally considered to be of a short-term influence.

Maturity of trees has a longer-term influence, in that the timeframe associated with trees reaching maturity is measured in terms of years. The peaks and troughs have a much greater impact, which according to the Northport Wood Availability Forecast (2018), suggests a reduction in the availability of logs, followed by a longer-term increase in supply.

Due to this the Northport “other truck” numbers vary for the assessed 20+ year period, and are zero or even negative in some instances, due to the reduction in their operations (i.e. such as in year 5 (2023) and year 10 (2028)).

7.2 Affected Road Network and Intersection Safety

The proposed port development is expected to primarily affect the intersections identified below on PMH. A review of the Marsden Point-Ruakākā Structure Plan growth for the corridor has indicated that while the area will be developed, there are no new intersections proposed for the PMH network, as shown in Figure 7-1. The key intersections are listed below, and their performance is discussed in the next section.

- SH1/SH15 (PMH) roundabout.
- SH15/Salle Road intersection.
- SH15/One Tree Point/McCathie Road intersection.
- SH 15/Marsden Point Road Intersection.
- SH15/Marsden Bay Drive/Rama Road Intersection.
- SH15/Mair Road Intersection.

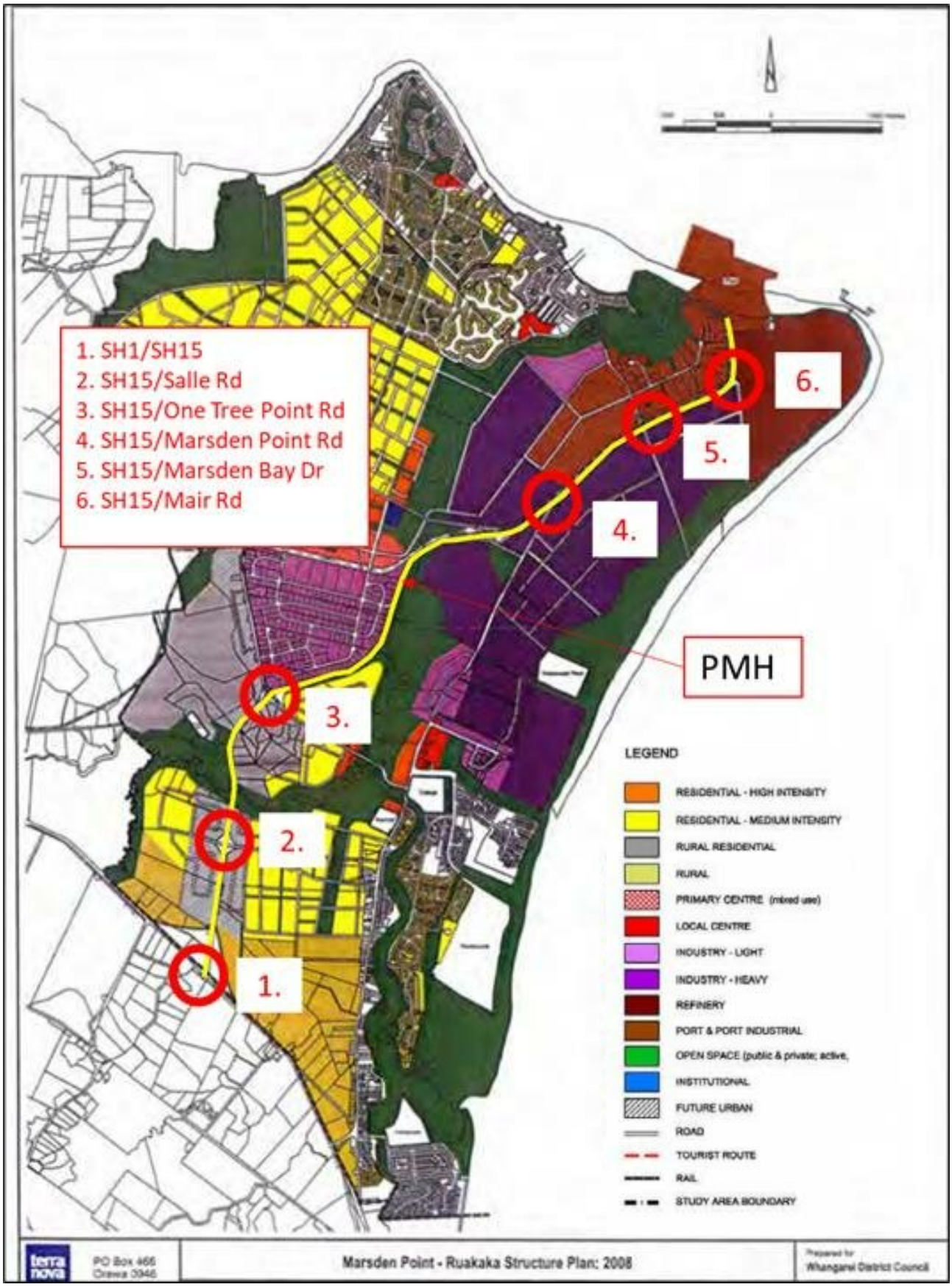


Figure 7-1: Future Land Development Plan with Key Intersections

A visibility assessment was also carried out for the key intersections identified above to ensure there are no sightline safety issues for the intersections along PMH. The assessment considered

the visibility on all approaches of these intersections to ensure any deficiencies are identified. The findings of the assessment are summarised in Table 7-1 to Table 7-6.

The assessment has identified no immediate visibility or sightline concerns that would need to be addressed to improve safety at the key intersections.

The intersections had adequate shoulder width to allow through traffic to bypass any turning traffic, where no dedicated lane was present on PMH (i.e. as noted for the SH15/Salle Road Intersection).

Table 7-1: Sightline/Safety Assessment Data for SH1/SH15

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
1. SH1/SH15	North (SH1)		> 500 m	More than sufficient sight distance	None

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
1. SH1/SH15	South (SH1)		> 500 m	More than sufficient sight distance	None
	East (SH15)		Approximately 300 m	More than sufficient sight distance. There is approximately 300 m of sight distance available, when measured along the road reserve. This is deemed	None

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
1. SH1/SH15				conservative, as the adjoining paddocks allow for greater sight distances.	
	West (SH15)		Approximately 300 m	More than sufficient sight distance. There is approximately 300 m of sight distance available, when measured along the road reserve. This is deemed conservative, as the adjoining paddocks allow for greater sight distances.	None

Table 7-2: Sightline/Safety Assessment Data for SH15/Salle Road

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
2. SH15/Salle Rd	North (SH15)		> 500 m	More than sufficient sight distance.	Vehicles were observed to be yielding in the live lane (SH15), when waiting for a gap in through traffic to turn onto Salle Road. There is sufficient width along the sealed shoulder of vehicles to pass. Also the turning volumes were low and there was good visibility.

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
2. SH15/Salle Rd	South (SH15)		Approximately 450 m	More than sufficient sight distance.	None (other than the Northbound issue mentioned)
	East (Salle Rd)		Approximately 300 m	More than sufficient sight distance. There is approximately 300 m of sight distance available, when measured along the road reserve.	None

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
2. SH15/Salle Rd	West (Salle Rd)		Approximately 300 m	More than sufficient sight distance. There is approximately 300 m of sight distance available, when measured along the road reserve.	None

Table 7-3: Sightline/Safety Assessment Data for SH15/One Tree Point/McCathie Road

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
3. SH15/One Tree Point Rd/McCathie Rd	Northeast (SH15)		Approximately 350 m	More than sufficient sight distance. There is approximately 350 m of sight distance available, when measured along the road reserve.	Simple intersection overcomplicated with vehicle movements being unnecessarily complex for traffic crossing SH15 from One Tree Point Rd to McCathie Rd and vice versa.

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
3. SH15/One Tree Point Rd/McCathie Rd3. SH15/One Tree Point Rd/McCathie Rd	North (One Tree Point Rd)		Approximately 200 m	More than sufficient sight distance. There is approximately 200 m of sight distance available, when measured along the road reserve. This is deemed conservative, as the adjoining paddocks allow for greater sight distances.	None

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
3. SH15/One Tree Point Rd/McCathie Rd	South (One Tree Point Rd)		Approximately 120 m	There is approximately 120 m of sight distance available, when measured along the road reserve. This is deemed conservative, as the adjoining paddocks allow for greater sight distances.	Simple intersection overcomplicated with vehicle movements being unnecessarily complex for traffic crossing SH15 from One Tree Point Rd to McCathie Rd and vice versa.

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
3. SH15/One Tree Point Rd/McCathie Rd	Southwest (SH15)		Approximately 180 m	More than sufficient sight distance. There is approximately 180 m of sight distance available, when measured along the road reserve. This is deemed conservative, as the adjoining paddocks allow for greater sight distances.	Simple intersection overcomplicated with vehicle movements being unnecessarily complex for traffic crossing SH15 from One Tree Point Rd to McCathie Rd and vice versa.

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
3. SH15/One Tree Point Rd/McCathie Rd	East (McCathie Rd)		Approximately 130 m	There is approximately 130 m of sight distance available, when measured along the road reserve. This is deemed appropriate given the hill on the southern side of this road.	None

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
3. SH15/One Tree Point Rd/McCathie Rd	West (McCathie Rd)		Approximately 120 m	There is approximately 120 m of sight distance available, when measured along the road reserve. This is deemed appropriate given the hill on the southern side of this road.	Simple intersection overcomplicated with vehicle movements being unnecessarily complex for traffic crossing SH15 from One Tree Point Rd to McCathie Rd and vice versa.

Table 7-4: Sightline/Safety Assessment Data for SH15/Marsden Point Road

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
4. SH15/Marsden Point Rd	Northeast (SH15)		Approximately 250 m	More than sufficient sight distance. There is approximately 250 m of sight distance available, when measured along the road reserve. This is deemed conservative, as the adjoining paddocks allow for greater sight distances.	None

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
4. SH15/Marsden Point Rd	Southwest (SH15)		> 500 m	More than sufficient sight distance	None
	South (Marsden Point Rd)		Approximately 130 m	There is approximately 130 m of sight distance available, when measured along the road reserve. This is deemed conservative, as the adjoining paddocks allow for greater sight distances.	None

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
4. SH15/Marsden Point Rd	North (Marsden Point Rd)		Approximately 100 m	There is approximately 100 m of sight distance available, when measured along the road reserve. This is deemed conservative, as the adjoining paddocks allow for greater sight distances.	None

Table 7-5: Sightline/Safety Assessment Data for SH15/Marsden Bay Drive/Rama Road

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
5. SH15/Marsden Bay Dr/ Rama Rd	East (SH15)		Approximately 400 m	More than sufficient sight distance	None

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
5. SH15/Marsden Bay Dr/ Rama Rd	West (SH15)		Approximately 360 m	More than sufficient sight distance	None
	North (Marsden Bay Dr)		Approximately 180 m	There is approximately 180 m of sight distance available, when measured along the road reserve. This is deemed conservative, as the adjoining paddocks allow for greater sight distances.	None

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
5. SH15/Marsden Bay Dr/ Rama Rd	South (Marsden Bay Dr)		Approximately 160 m	There is approximately 160 m of sight distance available, when measured along the road reserve. This is deemed conservative, as the adjoining paddocks allow for greater sight distances.	None
	North (Rama Rd)		> 500 m	More than sufficient sight distance	None

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
5. SH15/Marsden Bay Dr/ Rama Rd	South (Rama Rd)		> 500 m	More than sufficient sight distance	None

Table 7-6: Sightline/Safety Assessment Data for SH15/Mair Road

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
6. SH15/Mair Rd	North (SH15)		Approximately 160 m	There is approximately 160 m of sight distance available, when measured along the road reserve. This is deemed appropriate considering the vegetation growth to the North of this road.	None

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
6. SH15/Mair Rd	West (SH15)		Approximately 200 m	There is approximately 200 m of sight distance available, when measured along the road reserve. This is deemed appropriate considering the vegetation growth to the North of this road.	None
	North (Mair Rd)		Approximately 80 m	There is approximately 80 m of sight distance available, when measured along the road reserve. This is deemed appropriate considering the vegetation growth and infrastructure to the West of this road.	None

Intersection	Approach	Sight Distance - Photo	Measurement (Straight line along road reserve)	Sight Distance Comments	General Comments
6. SH15/Mair Rd	South (Mair Rd)		Approximately 100 m	There is approximately 100 m of sight distance available, when measured along the road reserve. This is deemed appropriate considering the vegetation growth and infrastructure to the West of this road.	None

7.3 Road Safety - Estimated

To assess the anticipated future changes in crash risk, an assessment was carried out using typical crash rate data for reported injury crashes (per year), along this section of the network. For the five key intersections, the existing crash rate was calculated to be **0.6 reported injury crashes per year.**

To ascertain the relevant intersection crash criticality for a similar intersection, the crash compendium formula[7] was used. It was found that the calculated crash rate for an existing intersection of a similar nature would be 2.70. This suggests that the typical crash rate formula used provides an overestimate, when compared to the reported crash rate. The factor by which this is overestimated, is 4.5. This means that the actual crash numbers are **lower** than the estimated typical rates by 2.10 injury crashes per year across all five intersections.

Port expansion induced traffic will increase the total injury crash rate for the PMH corridor by **0.01 reported injury crashes per year**. The above increase is considered very minor i.e. less than one additional injury crash over the next 20 years on PMH. The detailed assessment is provided in Appendix A.

7.4 HV and Port Traffic

Following the anticipated residential development of Marsden Point in the WDC forecast plan, the percentage contribution of heavy vehicles on the PMH is expected to reduce after port expansion. This is mostly due to local residential traffic growth contributing a significant increase in small vehicles. At present, the percentage of heavy vehicles on the PMH is approximately 20%. This is expected to reduce to 14% heavy vehicles and 1.33% buses, giving a total HV percentage of 15.33% after full port expansion.

7.5 Northport Carpark

Northport will provide enough parking within the port to ensure that additional port expansion traffic parking does not adversely affect traffic operations on PMH near the port.

7.6 Cruise Ship Tourists

Tourists are expected to begin traveling through the port within the next five years as cruise ships begin to use Whangārei as a destination location. Despite some short-term disruption from COVID, the number of cruise ships is expected to reach a consistent 30 ships per annum within the next 20 years, averaging 1,500 people per ship. It is assumed that most cruise ship visitors will be transported by bus to their respective destination.

7.7 Recreation and Access Around Port

Northport has commissioned a separate report to assess the recreation effects associated with its proposed development (refer Rob Greenaway & Associates Recreation Effects Assessment). This report considers the effects of recreational traffic, and in particular, traffic accessing the remaining beach area and a pocket park to the east of Northport. As the recreational activity is expected to occur outside of peak periods and on weekends, it is not expected to affect PMH traffic or port operation.

[7] Based on Waka Kotahi Crash Estimation Compendium for High-Speed (Rural) Priority and T-Junctions (Section 6.3)

8 Future Traffic Demand and Network Performance

8.1 Traffic Model

WSP engaged Stantec, an independent professional services company, to update the Whangārei Tracks Network Model for the planned residential growth shown on the Structure Plan and apply additional traffic from the port to that model. The modelling output is used to understand the current and future traffic conditions and the impact of the Northport Development on the surrounding road network. The updated Tracks model results are summarised and provided in Appendix A.

8.1.1 Traffic Model Methodology and Assumptions

The impact of the proposed development on the network was based on a two-tiered model. A Tracks model had already been undertaken for this network and was updated for this assessment to confirm the future expected traffic volumes with planned land growth but without port expansion, then followed by loading the model with future port expansion traffic. The key intersections were modelled in SIDRA to assess the future performance of the network at an intersection level along PMH. A summary of the methodology and assumptions for the analysis is provided below.

To assess the worst-case scenario, this analysis assumes that port traffic operation will occur during the same peak periods as normal traffic, i.e. 8.00am to 9.00am for the AM Peak and 4.00pm to 5.00pm for the PM Peak. Port peak operation occurs outside the normal peak traffic periods (refer to section 8.1.3 below), therefore the model results are conservative.

b) The Tracks Network Model for the route was updated by Stantec using the latest 2018 census data.
c) The growth was checked for a 20+ year period for any traffic increases due to port development.
d) The 2017 network modelling from Stantec has confirmed that in 2043, the population of Marsden/Ruakākā would be 8,348. The interpolation of latest 2020 land use growth by Stantec between year 2018 and 2043 has shown that similar volumes (8416) will be experienced in year 2033, refer to Table 8-1 below. The Tracks Network Model was therefore updated for 2033, both with and without port growth.

Table 8-1: Interpolation of 2017 and 2020 Growth Studies

2017 Growth Study				
Year	2013	2023	2043	
Marsden/Ruakākā	3,456	5,514	8,348	
Total	74,649	81,016	98,852	
2020 Growth Study		Interpolated		
Year	2018	2033	2043	2051
Marsden/Ruakākā	4,302	8,416	11,159	13,140
Total	93,700	115,694	130,357	141,448

e) Stantec has also advised that based on the 2020 Land Use Growth rate, the annual residential traffic growth rate is at most 3% per annum beyond 2033.

f) The port growth modelling looked at the base year (2018), Year 5 (2023), Year 15 (2033) and Year 22 (2040). The port development growth (AM/PM peak) data confirmed an increase of 433 vehicles per hour (vph) at each peak by Year 2033. The Tracks Network Model was updated with the additional peak traffic at Year 2033. The modelling confirmed an additional 436 port trips during the AM Peak based on an 80/20 inbound/outbound split, and an additional 440 trips during the PM Peak with a 23/77 inbound/outbound split.

g) For the 2033 Tracks Network Model, it was assumed that all of the port development will be completed with the additional trips already being added to the model network. No additional port traffic growth is expected beyond 2033 for the 2040 assessment. This was deemed a conservative estimate.

h) The key intersections on the network are noted below (also see Figure 1-1):

- SH1/SH15
- SH15/Salle Road
- SH15/One Tree Point Road/McCathie Road
- SH 15/Marsden Point Road Intersection
- SH15/Marsden Bay Drive/Rama Road

i) Tracks modelling was used to check the key intersection performance up to 2033 for local traffic plus additional port traffic. Turning volumes from the model were used, and the key intersections modelled in SIDRA, with uniform growth of 3% per annum (local growth) applied up to 2040 (seven years).

j) The SIDRA model was tested for both the AM Peak (8am to 9am) and PM Peak (4pm to 5pm) with port traffic.

k) In absence of peak traffic count data, SIDRA default Peak Flow Factor (95%) was used for this analysis.

l) For conservative analysis, side roads were modelled as single approach lanes, despite some of them having a wide enough approach for two vehicles to queue side by side, except for Marsden Drive intersection.

m) Originally full port expansion included Berth 0 which would have 400 additional personnel for naval and maintenance staff. Berth 0 is not part of the current proposal by Northport, therefore the revised assessment excludes Berth 0. The 400-port traffic equates to approximately 3% of PMH traffic and therefore the peak SIDRA models data for Year 2033 and Year 2040 containing additional port traffic have been reduced accordingly.

8.1.2 Traffic Model Scenarios

The Whangārei Traffic Model has been run with the following four scenarios, with each scenario including traffic models for the AM and PM peak hours:

- Scenario 1: 2033 Base Model – Residential growth without additional port traffic.
- Scenario 2: 2040 Base Model – Residential growth without additional port traffic.
- Scenario 3: 2033 Future Model – Residential growth with additional port traffic.
- Scenario 4: 2040 Future Model – Residential growth with additional port traffic.

Scenarios 1 and 2 are models with the existing road network and no port expansion. Scenarios 3 and 4 are future models at 2033 and 2040 with traffic from the fully developed Northport Development and the proposed road network (Figure 1-1). Comparisons have been made to these scenarios to determine the traffic effects generated from the Northport Development at key intersections along PMH.

8.1.3 *Current Northport and PMH Traffic Operation – Peak Flow Verification*

8.1.3.1 Short-Term Data

To better understand the traffic operation of Northport, a brief three-day 24-hour video count was undertaken between Monday to Wednesday starting 08 March 2021. The count identified the different vehicle types and number of vehicles entering and exiting the port.

The Northport traffic profile confirmed the AM peak to be 7.00 to 8.00am and the evening peak 6.00 to 7.00pm. Monday and Friday are excluded from traffic counting for their variability in traffic behaviour, so the two-day average had an AM peak of 366 and PM peak value of 208. Refer to Table 8-2 for further details.

Given the small data set and the seasonal nature of the port traffic, for this analysis both the AM and PM peaks were averaged, at 272 vehicles for the port at either peak. This value was also cross checked using PMH data to confirm modelling assumptions.

Table 8-2: Northport's 2-Day Average Traffic Data

Traffic Date:	2-day Average																	
	Light Vehicles		Medium Vehicles		Heavy Vehicles										Total Vehicles			
					Logging Trucks		Container Trucks		ISO Pod Trucks		Other Trucks		HCV Total					
Time Frame	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	In	Out	Total (In+Out)	
00:00-00:59	2	3	0	0	0	0	0	0	0	0	1	0	1	0	3	3	6	
01:00-01:59	2	2	0	0	2	0	0	0	0	0	0	0	3	0	5	2	7	
02:00-02:59	2	1	0	0	5	0	0	0	0	0	2	0	7	0	9	1	10	
03:00-03:59	14	3	0	0	10	0	0	0	0	0	1	1	11	1	25	4	29	
04:00-04:59	9	4	0	0	26	16	0	0	0	0	6	3	32	20	41	24	65	
05:00-05:59	18	7	0	0	30	28	0	0	1	0	6	3	36	31	54	38	92	
06:00-06:59	174	20	9	0	34	31	1	0	3	0	4	5	41	36	224	56	279	2 day Avg.
07:00-07:59	200	53	12	9	38	35	1	3	2	2	7	6	47	45	259	108	366	272
08:00-08:59	74	16	5	4	31	36	1	0	1	3	8	8	41	47	120	67	187	
09:00-09:59	54	17	6	4	33	28	0	1	1	1	9	7	43	36	103	57	160	
10:00-10:59	23	29	6	4	41	30	1	1	1	2	4	8	48	40	77	73	150	
11:00-11:59	36	27	6	6	33	34	0	0	2	1	9	6	44	42	85	74	160	
12:00-12:59	29	31	4	4	33	29	1	1	1	0	6	8	40	38	73	73	147	
13:00-13:59	32	35	4	4	40	26	1	0	2	1	9	8	51	35	87	74	161	
14:00-14:59	22	35	4	5	37	36	0	0	1	1	6	7	45	44	71	84	155	
15:00-15:59	14	40	4	3	31	34	0	1	0	0	7	7	38	42	56	85	141	
16:00-16:59	10	90	3	4	24	38	0	0	0	1	4	5	28	44	42	138	179	
17:00-17:59	19	92	4	3	8	18	0	0	0	0	2	4	10	22	33	117	150	
18:00-18:59	53	126	5	13	0	7	0	0	0	0	2	3	2	10	60	148	208	
19:00-19:59	17	52	5	8	0	1	0	0	0	0	1	0	1	1	23	61	84	
20:00-20:59	12	12	0	2	0	0	0	0	0	0	1	1	1	1	13	15	28	
21:00-21:59	5	9	0	0	0	0	0	0	0	0	1	1	1	1	7	11	17	
22:00-22:59	5	4	0	0	0	0	0	0	0	0	2	1	2	1	7	5	11	
23:00-23:59	6	3	0	0	0	0	0	0	0	0	1	1	1	1	7	5	12	
TOTAL	831	710	77	75	453	427	7	6	15	10	99	96	574	539	1482	1324		

Northport Peak	HCV In %	39%	Total Northport ADT	2806
	HCV Out %	41%	PMH	4363
PMH Peak	This data confirms that Northport peak is outside PMH normal traffic peak		Northport Traffic Percentage on PMH	64%

Value used in Growth Table	
AM	PM
276	276

8.1.3.2 Long-Term Data

The peak periods for PMH were identified and confirmed using a telemetry site (permanent traffic counter) at the SH15/Rama Road intersection. The data used for the identification and verification, was a two-year Pre-COVID average for 2018 and 2019. Given the variability with traffic behaviour during the COVID lockdown period, the use of recent traffic data has been avoided.

As illustrated in Figure 8-1 below, the AM peak occurred at 8.00am and PM peak occurred at 5.00pm. The AM peak was shown to have a value of 407 vehicles and PM peak was 377 vehicles. This suggests an average peak of 392 vehicles for both the AM and PM peaks.

Applying a 63% port traffic contribution (as identified from count data), then port traffic for each peak equates to 247 vph(both in and out).

8.1.3.3 Model Applied Assumption

The peak value used to estimate future traffic is 276 vph.

The short-term and long-term data interpretations confirm that the estimate of 276 vph is comparable to actual traffic counts. It is also further noted that the estimate is deemed conservative when compared with PMH average of 247 vph for each peak (Long-term data interpretation).

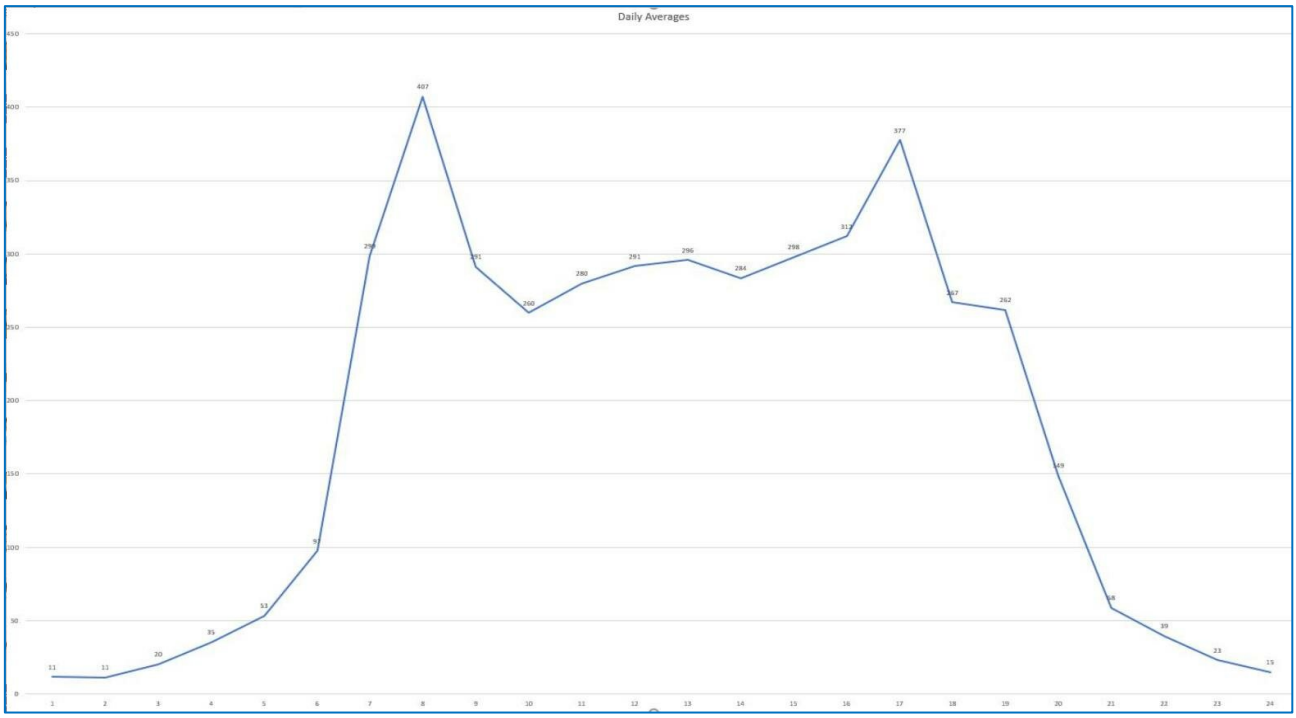


Figure 8-1: 2-Year Average Hourly Traffic Volumes Recorded at SH15/Rama Road Intersection in 2018 and 2019

8.1.4 PMH Mid-Block Capacity

An assessment was carried out to check if the port expansion traffic would cause mid-block capacity issues on PMH. PMH is a regional arterial road with one lane each way and is expected to be urban in future. The capacity of this road network is between 15,000 to 18,000 vehicles per day. The Mobile Road traffic data for PMH indicates an Annual Average Daily Traffic (AADT) of 4,363 vehicles per day (2018). The regional land development model has identified that the population in Port Marsden area is expected to grow at 6% per annum for the next 15 years and thereafter the growth rate would be 3%. For a conservative analysis, we have assumed the traffic growth rate on PMH to be same as the population growth.

The traffic volume at 2033 (with the uniform growth rate) is 10,456 and adding the estimated additional port traffic at 2033 of 806, results in a total PMH traffic count of 10,944 vehicles per day. With increased residential growth the total PMH traffic increases to 13.666 vehicles in 2040.

The anticipated traffic in 2040 on PMH, suggests that the single lane highway (urban regional arterial) will still operate within its daily expected capacity. The detailed calculation is provided in Appendix A.

8.1.5 Future Traffic Volumes

The future traffic volumes used in this TIA are obtained from the Whangārei Traffic Model.

The Whangārei Traffic Model is demand driven and the modelled traffic volumes will not be restricted by road capacity.

The link traffic volumes obtained from the Whangārei Traffic Model are used in SIDRA (Version 9) to analyse the performance of the key intersections.

Due to the limitation of the Whangārei Traffic Model as mentioned above, the traffic volumes extracted from the Whangārei Traffic Model represent the expected traffic situations. The Whangārei model has only been updated to Year 2033 and it is assumed that the full port expansion development has occurred at that point. The 2033 peak traffic demand has been further grown at 3% per annum for seven years to establish 2040 future demand, both with

and without full port expansions. The traffic demand with and without full port expansion and differences for the AM and PM Peaks at 2033 and 2040 are provided in Appendix A.

Northport traffic data for the full port development growth has shown that this will likely result in a 148 vehicle increase on the network during both the AM and PM Peaks. This equates to an additional 150 trips in the AM Peak and 154 vehicles in the PM Peak. This includes 300 port operational staff on the network. The full analysis of trip generation for port traffic is provided in Appendix A.

The Whangārei Network modelling results for the SH1/SH15 intersection showed no capacity or intersection Level of Service (LOS) performance issues with port expansion traffic in 2033. This is confirmed by SIDRA modelling, showing the intersection performing at LOS B during both peaks. The assessment criteria for different levels of service for different intersection controls, based on control delay and capacity are shown below in Table 8-3.

Table 8-3: Northport's 2-Day Average Traffic Data

Level of Service for v/c ≤ 1.0	Average delay per vehicle in seconds (d)			Level of Service for v/c > 1.0
	Signals	"SIDRA Roundabout LOS" method (1)	Sign Control (*Default for roundabouts*) (1)	All Intersection Types
A	d ≤ 10	d ≤ 10	d ≤ 10	F
B	10 < d ≤ 20	10 < d ≤ 20	10 < d ≤ 15	F
C	20 < d ≤ 35	20 < d ≤ 35	15 < d ≤ 25	F
D	35 < d ≤ 55	35 < d ≤ 50	25 < d ≤ 35	F
E	55 < d ≤ 80	50 < d ≤ 70	35 < d ≤ 50	F
F	80 < d	70 < d	50 < d	F

8.2 SIDRA Model

SIDRA is used to analyse the performance of the five key intersections (identified in Figure 1-1) around PMH. Intersection turning volumes are extracted from the Whangārei Traffic Model as shown in the previous section and used in the SIDRA models for the intersections below for both the AM and PM Peaks:

Existing key Intersections modelled are:

- SH1/SH15
- SH15/Salle Road
- SH15/One Tree Point Road/McCathie Road
- SH 15/Marsden Point Road
- SH15/Marsden Bay Drive/Rama Road

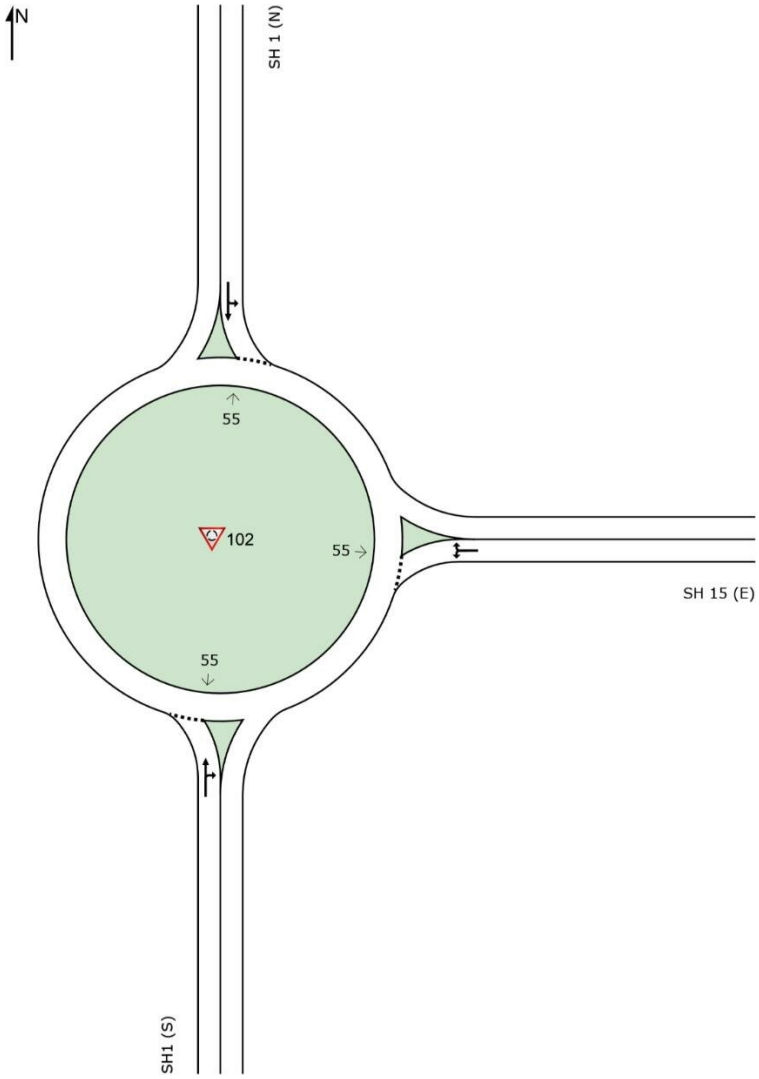
A high-level assessment was also carried out for the SH15/Mair Road intersection.

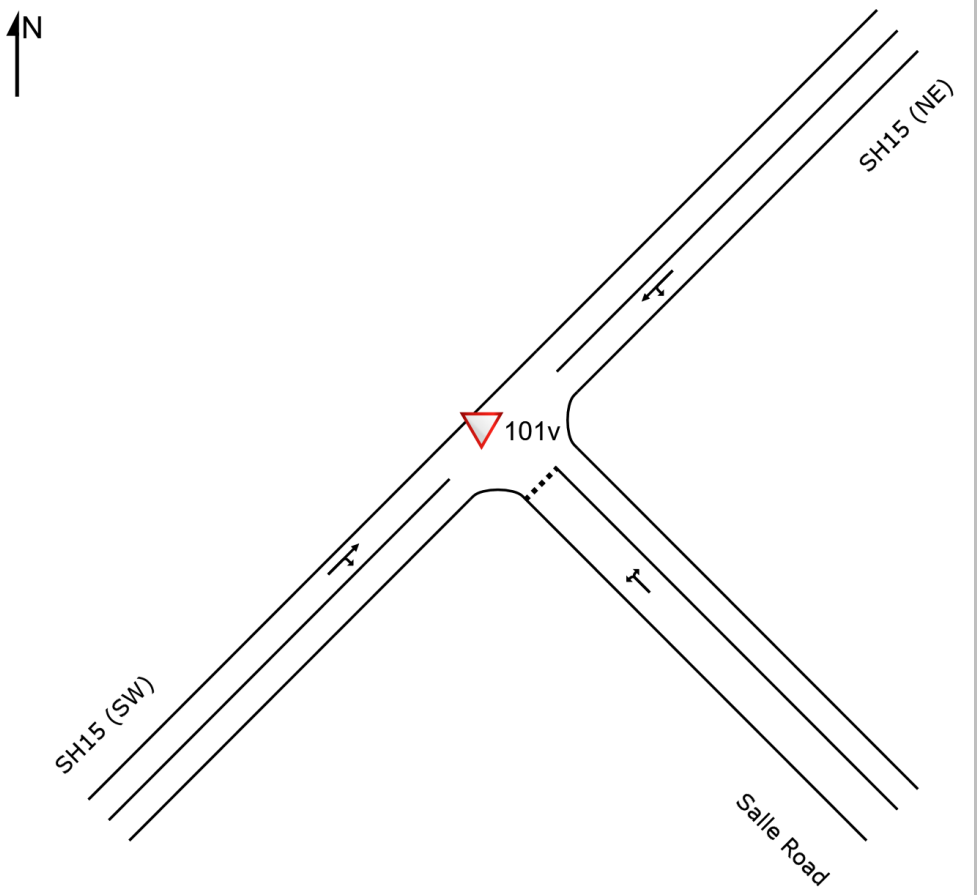
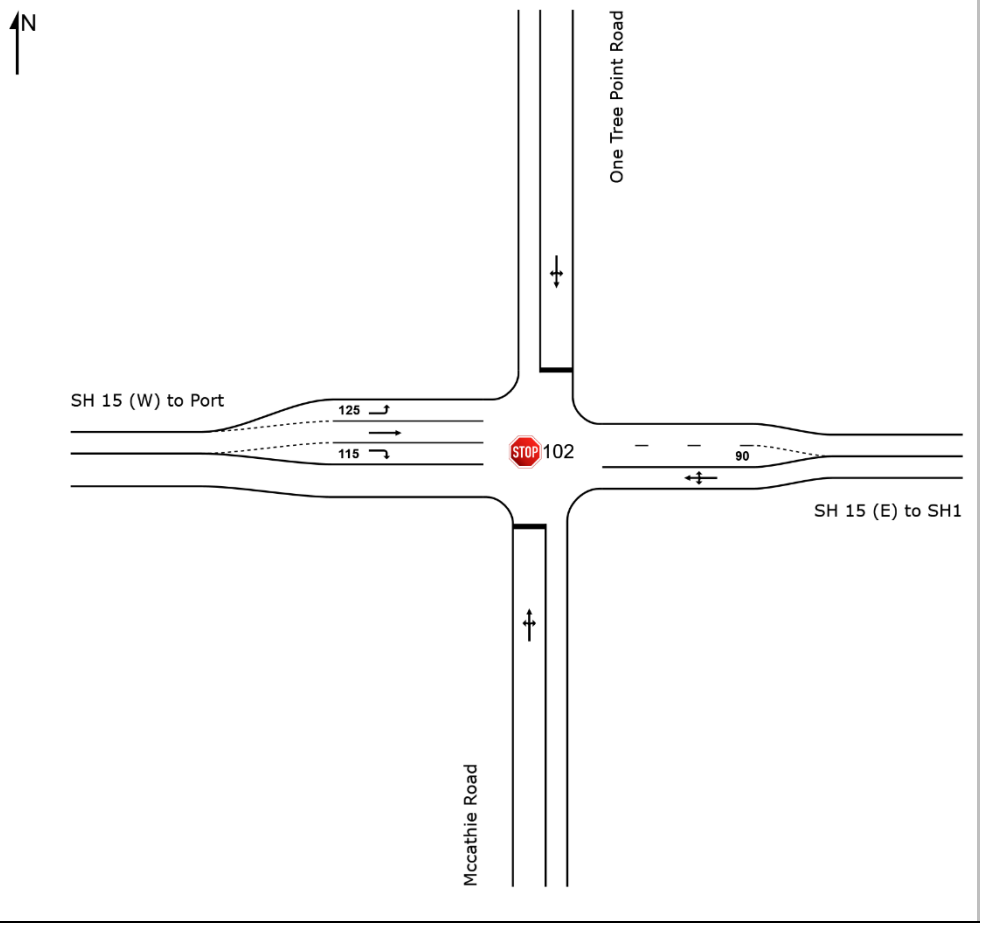
8.2.1 SIDRA Model Layouts

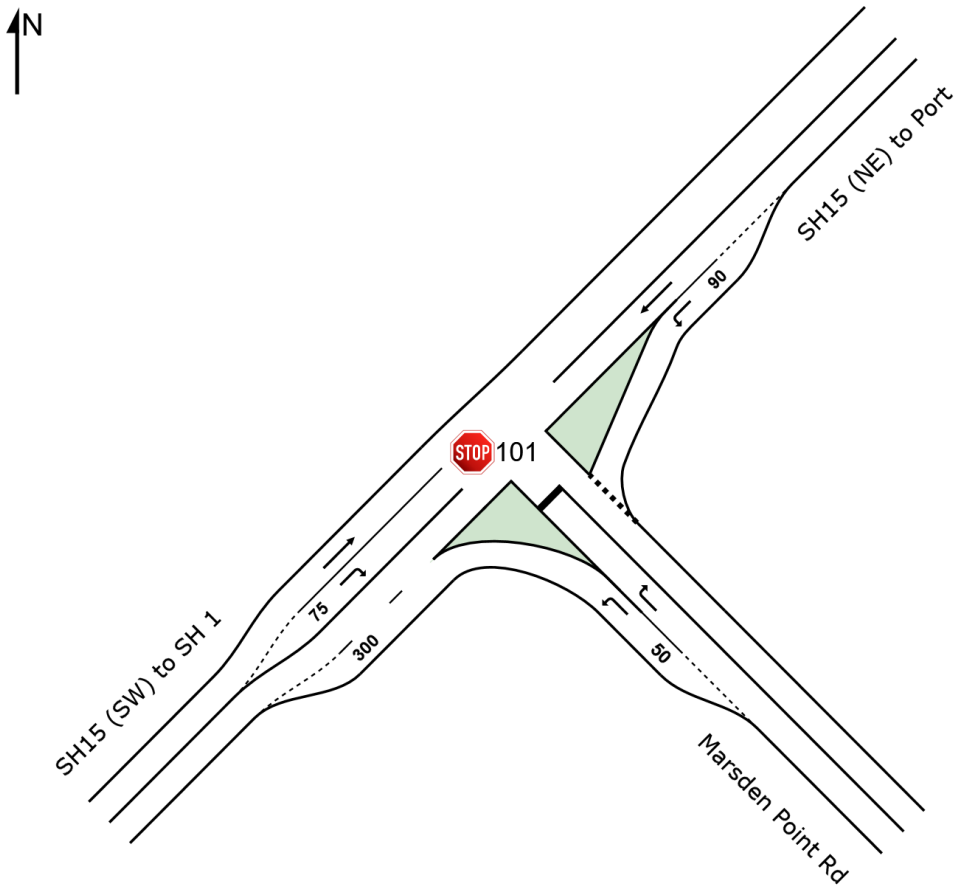
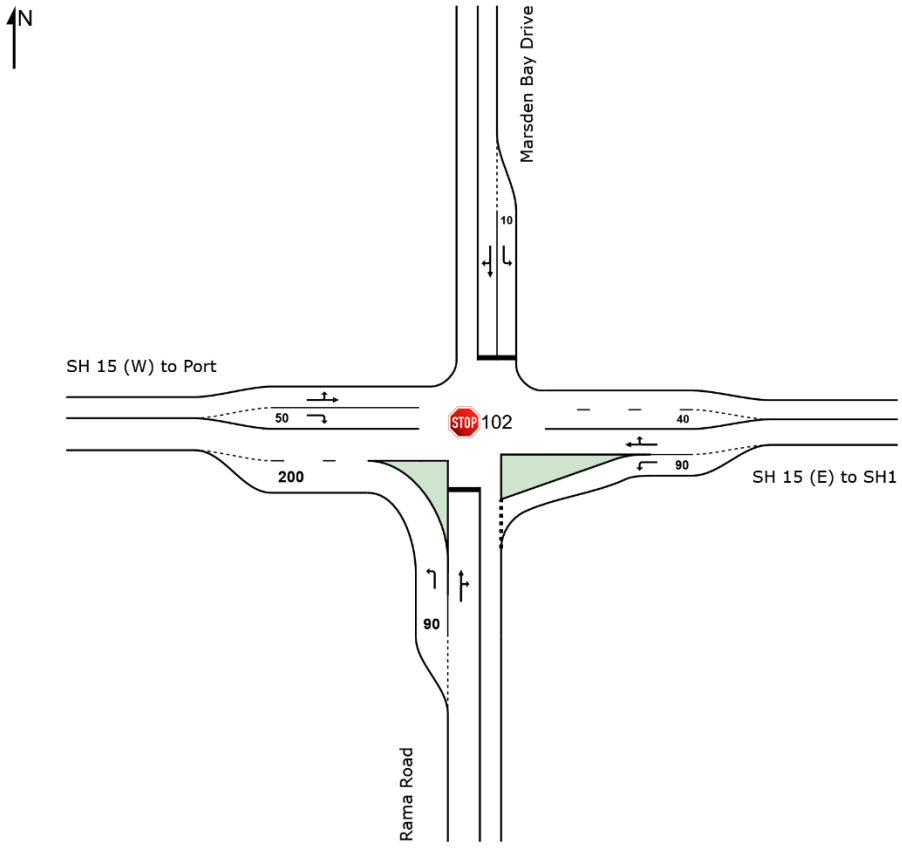
The SIDRA model layouts of the five intersections listed above are shown in

4.

Table 8-4: SIDRA Model Layouts for Existing Intersections

Intersection	Layout
SH1 /SH15 (PMH) Intersection	

Intersection	Layout
SH15/Salle Road Intersection	
SH15/One Tree Point Rd/McCathie Road Intersection	

Intersection	Layout
SH15/Marsden Point Road Intersection	
SH15/Marsden Bay Drive/Rama Road Intersection	

8.2.2 Intersection Performance Assessment – Route Efficiency

The capacity and performance of the key intersections surrounding the PMH network have been modelled for the scenarios discussed in the previous section. The outcomes of the modelling are summarised in Table 8-5 to Table 8-25. Detailed modelling outputs are included in Appendix B. The results show that all intersections will perform well during both peak periods with full port expansion at Year 2033 albeit with SH15/Rama Road intersection approaching capacity.

8.2.2.1 SH1/SH15 Roundabout Intersection (With and Without Port Expansion at 2033 & 2040)

The modelled results for SH1/SH15 Roundabout for 2040 show that the intersection will operate beyond capacity without the port expansion during the AM Peak, and almost at capacity during the PM Peak, on some approaches. With full port expansion, the roundabout intersection in 2040 is expected to function better compared to the without-port expansion scenario (Do-Minimum) – refer to Table 8-7 and Table 8-8 for AM and PM peak results. This is due to reasons outlined below. The 2033 model for the intersection shows that it operates without any issues with and without port traffic at 2033 - refer to Table 8-5 and Table 8-6 for AM and PM peak results..

When taking port growth into consideration, the intersection performs better in 2040. The port expansion leads to an increase in local employment, which provides more origin/destination trips generated within Marsden/Ruakākā area with more people living and working locally. This means that there is a reduction in the number of trips entering or leaving the area via the SH1/SH15 intersection.

Table 8-5: SH1/SH15 Roundabout Intersection - 2033 AM Peak Model Output Comparisons

Approach & Movement	Year 2033 with planned land use growth (No Northport Expansion)			2033 Year with planned land use growth + (Full Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
SH 1 (South) Approach	17.5	0.81	B	11.9	0.68	B
SH 15 (East) Approach	14.7	0.67	B	12.9	0.58	B
SH1 (North) Approach	4.8	0.54	A	5.2	0.61	A
Y Intersection Total	**12.3**	**0.81**	**B**	**9.7**	**0.68**	**A**

Table 8-6: SH1/SH15 Roundabout Intersection - 2033 PM Peak Model Output Comparisons

Approach & Movement	Year 2033 with planned land use growth (No Northport Expansion)			2033 Year with planned land use growth + (Full Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
SH 1 (South) Approach	10.1	0.62	B	10.6	0.62	B
SH 15 (East) Approach	16.6	0.67	B	15.1	0.67	B
SH1 (North) Approach	4.9	0.72	A	4.7	0.59	A
Intersection Total	9.6	0.72	A	9.8	0.67	A

Table 8-7: SH1/SH15 Roundabout Intersection - 2040 AM Peak Model Output Comparisons

Approach & Movement	Year 2040 with planned land use growth (No Northport Expansion)			2040 Year with planned land use growth + (Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
SH 1 (South) Approach	212.9	1.20	F	40.4	0.97	D
SH 15 (East) Approach	26.3	0.89	C	18.4	0.78	B
SH1 (North) Approach	15.0	0.65	A	7.3	0.77	A
Intersection Total	80.7	1.20	F	21.4	0.97	C

Table 8-8: SH1/SH15 Roundabout Intersection - 2040 PM Peak Model Output Comparisons

Approach & Movement	Year 2040 with planned land use growth (No Northport Expansion)			2040 Year with planned land use growth + (Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
SH 1 (South) Approach	20.3	16.8	C	24.7	0.88	C
SH 15 (East) Approach	80.0	1.02	F	33.4	0.93	C
SH1 (North) Approach	7.6	0.90	A	5.2	0.73	A
Intersection Total	31.1	1.02	C	19.9	0.93	B

8.2.2.2 SH15/Salle Road Intersection (With and without Port Expansion at 2033 & 2040)

The results in to Table 8-10 for PMH confirm there are no issues during both peaks at the PMH/Salle Road intersection with additional port traffic in 2033 and 2040.

Table 8-9: SH15/Salle Road Intersection - 2033 AM Peak Model Output Comparisons

Approach & Movement	Year 2033 with planned land use growth (No Northport Expansion)			2033 Year with planned land use growth + (Full Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Salle Road (South) Approach	10.1	0.24	B	9.3	0.18	A
SH 15 (North East) Approach	5.4	0.33	A	5.4	0.29	A
SH15 (South West) Approach	5.7	0.28	A	5.7	0.35	A
Intersection Total	6.2	0.33	N/A	6.0	0.35	N/A

Table 8-10: SH15/Salle Road Intersection - 2033 PM Peak Model Output Comparisons

Approach & Movement	Year 2033 with planned land use growth (No Northport Expansion)			2033 Year with planned land use growth + (Full Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Salle Road (South) Approach	9.1	0.19	A	9.8	0.21	A
SH 15 (North East) Approach	5.4	0.27	A	5.4	0.32	A
SH15 (South West) Approach	5.7	0.36	A	5.7	0.29	A
Intersection Total	**6.0**	**0.36**	N/A	**6.1**	**0.32**	N/A

Table 8-11: SH15/Salle Road Intersection - 2040 AM Peak Model Output Comparisons

Approach & Movement	Year 2040 with planned land use growth (No Northport Expansion)			2040 Year with planned land use growth + (Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Salle Road (South) Approach	12.6	0.35	B	10.8	0.26	B
SH 15 (North East) Approach	5.4	0.40	A	5.4	0.35	A
SH15 (South West) Approach	5.8	0.33	A	5.7	0.43	A
Intersection Total	**14.8**	**0.40**	N/A	**6.2**	**0.43**	N/A

Table 8-12: SH15/Salle Road Intersection - 2040 PM Peak Model Output Comparisons

Approach & Movement	Year 2040 with planned land use growth (No Northport Expansion)			2040 Year with planned land use growth + (Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Salle Road (South) Approach	10.4	16.8	B	11.8	0.31	B
SH 15 (North East) Approach	5.4	1.02	A	5.4	0.38	A
SH15 (South West) Approach	5.7	0.90	A	5.7	0.35	A
Intersection Total	**6.2**	**0.43**	N/A	**6.4**	**0.38**	N/A

8.2.2.3 SH15/One Tree Point Road/McCathie Road Intersection (With and without Port Expansion at 2033 & 2040)

Following the full port expansion in 2033, the intersection has no issues, but will experience long delays in 2040 for some approaches even without port expansion. The One Tree Point approach of the intersection will only experience long delays and perform beyond capacity with LOS F in 2040 – refer to Table 8-15 and Table 8-16 for the peaks.

The modelling also shows that in 2033 the intersection is performing acceptably with Level of Service at LOS C with port expansion. Beyond that period of 2033, i.e. by 2040, it would require intervention to upgrade the intersection to prioritise movement of additional traffic expected on One Tree Point Road from local land use growth.

Table 8-13: SH15/One Tree Point Road/McCathie Road Intersection - 2033 AM Peak Model Output Comparisons

Approach & Movement	Year 2033 with planned land use growth (No Northport Expansion)			2033 Year with planned land use growth + (Full Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
McCathie Road (South) Approach	12.3	0.07	B	16.1	0.09	C
SH 15 - Towards SH1 (East) Approach	2.1	0.10	A	3.5	0.14	A
One Tree Point Road (North) Approach	19.9	0.81	C	22.6	0.79	C
SH 15 - Towards Port (West) Approach	3.6	0.12	A	2.5	0.17	A
Intersection Total	11.5	0.81	N/A	10.2	0.79	N/A

Table 8-14: SH15/One Tree Point Road/McCathie Road Intersection - 2033 PM Peak Model Output Comparisons

Approach & Movement	Year 2033 with planned land use growth (No Northport Expansion)			2033 Year with planned land use growth + (Full Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Rama Road (South) Approach	14.4	0.09	B	14.7	0.09	B
SH 15 - Towards SH1 (East) Approach	7.3	0.29	B	0.9	0.16	A
Marsden Bay Drive (North) Approach	21.8	0.76	C	19.0	0.68	C
SH 15 - Towards Port (West) Approach	5.1	0.22	A	4.0	0.15	A
Intersection Total	13.3	0.76	N/A	8.5	0.68	N/A

Table 8-15: SH15/One Tree Point Road/McCathie Road Intersection - 2040 AM Peak Model Output Comparisons

Approach & Movement	Year 2040 with planned land use growth (No Northport Expansion)			2040 Year with planned land use growth + (Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
McCathie Road (South) Approach	13.5	0.10	B	19.3	0.14	C
SH 15 - Towards SH1 (East) Approach	2.1	0.12	A	4.1	0.17	A
One Tree Point Road (North) Approach	115.3	1.10	F	162.0	1.15	F
SH 15 - Towards Port (West) Approach	3.6	0.14	A	2.5	0.21	A
Intersection Total	57.0	1.10	N/A	59.6	1.15	N/A

Table 8-16: SH15/One Tree Point Road/McCathie Road Intersection - 2040 PM Peak Model Output Comparisons

Approach & Movement	Year 2040 with planned land use growth (No Northport Expansion)			2040 Year with planned land use growth + (Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
McCathie Road (South) Approach	16.8	0.14	C	17.1	0.13	C
SH 15 - Towards SH1 (East) Approach	9.5	0.39	A	1.0	0.19	A
One Tree Point Road (North) Approach	126.9	1.10	F	49.1	0.98	E
SH 15 - Towards Port (West) Approach	5.1	0.27	A	4.0	0.18	A
Intersection Total	43.7	1.10	N/A	18.5	0.98	N/A

8.2.2.4 SH15/Marsden Point Road Intersection (With and without Port Expansion at 2033 & 2040)

The intersection experiences no issues in 2033 with full port expansion, refer to Table 8-17 and Table 8-18. The results in show that during morning peak the Marsden Point Road approach of the SH15/Marsden Point Road intersection will operate over capacity in 2040 with port expansion. This approach will operate at LOS F in 2040 due to the large volume of right turning traffic (343 vehicles) during the AM Peak.

The model also shows that in 2033 the intersection is performing acceptably, albeit with Marsden Point Road operating at LOS D with port expansion. Beyond 2033, it would require intervention to upgrade the intersection for the additional right turning traffic expected on Marsden Point Road in the morning peak.

Table 8-17: SH15/Marsden Point Road Intersection - 2033 AM Peak Model Output Comparisons

Approach & Movement	Year 2033 with planned land use growth (No Northport Expansion)			2033 Year with planned land use growth + (Full Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Marsden Point Road (South East) Approach	14.3	0.40	B	29.5	0.82	D
SH 15 – Towards Port (North East) Approach	4.3	0.13	A	3.6	0.12	A
SH15 – Towards SH1 (South West) Approach	0.1	0.10	A	0.1	0.18	A
Intersection Total	**6.6**	**0.40**	N/A	**11.7**	**0.82**	N/A

Table 8-18: SH15/Marsden Point Road Intersection - 2033 PM Peak Model Output Comparisons

Approach & Movement	Year 2033 with planned land use growth (No Northport Expansion)			2033 Year with planned land use growth + (Full Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Marsden Point Road (South East) Approach	14.0	0.36	B	20.1	0.49	C
SH 15 – Towards Port (North East) Approach	4.5	0.19	A	4.2	0.27	A
SH15 – Towards SH1 (South West) Approach	0.1	0.06	A	0.1	0.09	A
Intersection Total	**6.6**	**0.36**	N/A	**6.6**	**0.49**	N/A

Table 8-19: SH15/Marsden Point Road Intersection - 2040 AM Peak Model Output Comparisons

Approach & Movement	Year 2040 with planned land use growth (No Northport Expansion)			2040 Year with planned land use growth + (Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Marsden Point Road (South East) Approach	17.7	0.55	C	238	1.23	F
SH 15 – Towards Port (North East) Approach	4.3	0.16	A	3.6	0.15	A
SH15 – Towards SH1 (South West) Approach	0.1	0.12	A	0.1	0.21	A
Intersection Total	**7.8**	**0.55**	N/A	**85.5**	**1.23**	N/A

Table 8-20: 2040 SH15/Marsden Point Road Intersection - 2040 PM Peak Model Output Comparisons

Approach & Movement	Year 2040 with planned land use growth (No Northport Expansion)			2040 Year with planned land use growth + (Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Marsden Point Road (South East) Approach	17.2	0.50	C	31.8	0.74	D
SH 15 – Towards Port (North East) Approach	4.5	0.23	A	4.2	0.33	A
SH15 – Towards SH1 (South West) Approach	0.1	0.08	A	0.1	0.11	A
Intersection Total	**7.5**	**0.50**	N/A	**8.9**	**0.74**	N/A

8.2.2.5 SH15/Marsden Bay Drive/Rama Road Intersection (With and without Port Expansion at 2033 & 2040)

The results in

3 and show that during both peaks, the Marsden Bay Drive approach of the SH15/Marsden Bay Drive intersection will operate over capacity in 2040 with full port expansion. This approach will operate at LOS F in 2040. The model also shows that in 2033 with full port expansion, this approach of the intersection is performing at LOS E in the AM Peak (See Table 8-21). This confirms that at completion of the port expansion, the intersection will be approaching capacity with degree of saturation of 0.91.

This was sensitivity tested to confirm at what volumes the intersection will reach capacity i.e. when the Degree of Saturation is approximately 1. Based on the modelled Do-Minimum volume of 2018, and full port growth volumes at year 2033, it was confirmed that there is a uniform traffic growth rate of approximately 9% per annum for the AM peak over the 15-year period. Applying this growth rate on the AM 2018 Do-Minimum (base) case has confirmed that the intersection is likely to reach capacity when the intersection volume reaches approximately 1,300 vehicles during AM peak hour. The model has estimated that this is likely to occur in 2035 for AM peak, - refer to Table 8-25.

Table 8-21: SH15/Marsden Bay Drive/Rama Road Intersection - 2033 AM Peak Model Output Comparisons

Approach & Movement	Year 2033 with planned land use growth (No Northport Expansion)			2033 Year with planned land use growth + (Full Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Rama Road (South) Approach	14.1	0.01	B	24.8	0.02	C
SH 15 - Towards SH1 (East) Approach	1.1	0.11	A	2.0	0.17	A
Marsden Bay Drive (North) Approach	15.9	0.44	C	42.7	0.91	E
SH 15 - Towards Port (West) Approach	0.7	0.22	A	0.5	0.37	A
Intersection Total	5.2	0.44	N/A	12.0	0.91	N/A

Table 8-22: SH15/Marsden Bay Drive/Rama Road Intersection - 2033 PM Peak Model Output Comparisons

Approach & Movement	Year 2033 with planned land use growth (No Northport Expansion)			2033 Year with planned land use growth + (Full Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Rama Road (South) Approach	17.4	0.04	C	13.7	0.12	B
SH 15 - Towards SH1 (East) Approach	2.4	0.28	A	3.5	0.45	A
Marsden Bay Drive (North) Approach	16.6	0.19	C	29.9	0.36	D
SH 15 - Towards Port (West) Approach	2.5	0.18	A	1.5	0.20	A
Intersection Total	4.0	0.28	N/A	5.3	0.45	N/A

Table 8-23: SH15/Marsden Bay Drive/Rama Road Intersection - 2040 AM Peak Model Output Comparisons

Approach & Movement	Year 2040 with planned land use growth (No Northport Expansion)			2040 Year with planned land use growth + (Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Rama Road (South) Approach	16.5	0.01	C	37.0	0.05	E
SH 15 - Towards SH1 (East) Approach	1.3	0.14	A	3.0	0.22	A
Marsden Bay Drive (North) Approach	22.2	0.65	C	202.6	1.39	F
SH 15 - Towards Port (West) Approach	0.8	0.27	A	0.5	0.45	A
Intersection Total	7.1	0.65	N/A	49.6	1.39	N/A

Table 8-24: 2040 SH15/Marsden Bay Drive/Rama Road Intersection - 2040 PM Peak Model Output Comparisons

Approach & Movement	Year 2040 with planned land use growth (No Northport Expansion)			2040 Year with planned land use growth + (Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Rama Road (South) Approach	21.6	0.05	C	19.9	0.27	C
SH 15 - Towards SH1 (East) Approach	2.9	0.35	A	4.8	0.57	A
Marsden Bay Drive (North) Approach	22.4	0.31	C	90.5	0.85	F
SH 15 - Towards Port (West) Approach	2.6	0.22	A	1.5	0.25	A
Intersection Total	4.8	0.35	N/A	10.4	0.85	N/A

Table 8-25: SH15/Marsden Bay Drive/Rama Road Intersection Sensitivity Capacity Check – 2034 & 2035 Year AM Peak Model Output Comparisons

Approach & Movement	**Year 2034 with planned land use growth** (Full Northport Expansion)			**Year 2035** with planned land use growth (Full Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	Demand Flow (Veh)	Ave Delay (s)	DOS (v/c)	Demand Flow (Veh)
Rama Road (South) Approach	23.4	0.03	8	23.6	0.03	8
SH 15 - Towards SH1 (East) Approach	1.6	0.18	290	1.7	0.18	289
Marsden Bay Drive (North) Approach	45.9	0.94	342	53.3	0.98	355
SH 15 - Towards Port (West) Approach	0.8	0.38	668	0.8	0.38	672
Intersection Total	12.9	0.94	1308	15.2	0.98	1324

8.2.2.6 Mair Road/SH15 Intersection Performance Findings

Mair Road provides secondary access to Channel Infrastructure's Marsden Point terminal. Due to the short right turn bay (60m) on PMH, the critical delay at this intersection will be for

the right turning movement from PMH/SH15 to Mair Road, to ensure the queue does not extend to the through lane.

Northport has advised that there are very few trucks accessing the Mair Road intersection - an estimated maximum of six to eight trucks during the peak hours. This equates to a peak arrival rate of one truck arriving every 7.5 minutes which would allow ample time for a truck to find a gap in traffic for the right turn movement before the next truck arrives. The impact of the port traffic is expected to be minimal at this intersection.

The recent cessation of refinery functions at the Channel Infrastructure site, and the change to a dedicated import terminal is expected to have minimal impact on this assessment. If anything, the number and frequency of truck movements associated with terminal operations are anticipated to be less than for refining, so the above assessment is considered conservative.

8.2.3 Sensitivity Analysis for Peak Spreading of Port Traffic

The above intersection analysis is considered highly conservative, as it assumes that port traffic will operate at the same time as the normal traffic peaks. The 2040 volumes are established assuming that full port expansion will be completed by 2033 to avoid the need for updating the full network model. It is conceivable that full port expansion may not occur until closer to 2040. This assessment assumes that full port expansion will be at full operational capacity in 2033 i.e. day one. In practicality, it is likely to take between 5 to 10 years for the port facility to be at full operational capacity from end of development.

Northport noted that their truck operations vary both throughout the day and the year, however truck movements generally commenced during the early hours of the morning (4 am) and some at midday.

The worst-case scenario is based on residential and township land use development from the Whangarei District Council's Growth Forecast Plan for Marsden Point-Ruakākā, and the full Northport expansion traffic in 2033 on PMH. Both scenarios are variable as they are based on a number of external factors, such as population growth, international cruise ship demand and export logging timber demand. The current pandemic has shown, that long term growth is difficult to predict in this environment for these variable factors. Sensitivity analysis is therefore most appropriate for this "what if" scenario.

A sensitivity test was carried out for the worst-case (highly conservative) scenario to assess the level of port traffic reduction needed along the PMH corridor to ensure the critical intersections identified above, do not exceed capacity in 2040 during peak periods.

The sensitivity analysis has confirmed that a 20% reduction of through port traffic during both the AM and PM Peaks would ensure that the key intersections perform at an acceptable LOS D in 2040. This will guarantee that the overall intersection delay for key intersections along the PMH corridor does not exceed 35 seconds. This reduction can be achieved if the measures identified in Section 8 are implemented.

The sensitivity results for a 20% reduction of through port traffic on PMH in 2040 for key intersections are shown in Table 8-26 to Table 8-28 below.

Table 8-26: 2040 SH15/One Tree Point/McCathie Road Intersection – Both Peak Model Comparison with 20% Port Traffic Reductions

Approach & Movement	Year 2040 - AM with planned land use growth + (Northport Expansion)			2040 Year - PM with planned land use growth + (Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
McCathie Road (South) Approach	15.6	0.11	C	14.6	0.10	B
SH 15 - Towards SH1 (East) Approach	3.9	0.14	A	1.1	0.16	A
One Tree Point Road (North) Approach	34.1	0.93	D	24.6	0.84	C
SH 15 - Towards Port (West) Approach	2.9	0.15	A	4.4	0.18	A
Intersection Total	15.9	0.93	N/A	11.3	0.84	N/A

Table 8-27: 2040 SH15/Marsden Point Road Intersection – Both Peak Model Comparison with 20% Port Traffic Reductions

Approach & Movement	Year 2040 - AM with planned land use growth + (Northport Expansion)			2040 Year - PM with planned land use growth + (Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Marsden Point Road (South East) Approach	34.6	0.89	D	23.4	0.61	C
SH 15 – Towards Port (North East) Approach	3.8	0.12	A	4.5	0.33	A
SH15 – Towards SH1 (South West) Approach	0.1	0.16	A	0.1	0.09	A
Intersection Total	15.8	0.89	N/A	7.9	0.61	N/A

Table 8-28: 2040 SH15/Marsden Bay Drive/Rama Road Intersection – Both Peak Model Comparison with 20% Port Traffic Reductions

Approach & Movement	Year 2040 - AM with planned land use growth + (Northport Expansion)			2040 Year - PM with planned land use growth + (Northport Expansion)		
	Ave Delay (s)	DOS (v/c)	LOS	Ave Delay (s)	DOS (v/c)	LOS
Rama Road (South) Approach	21.7	0.02	C	14.0	0.15	B
SH 15 - Towards SH1 (East) Approach	2.2	0.16	A	4.1	0.47	A
Marsden Bay Drive (North) Approach	30.4	0.84	D	33.6	0.46	D
SH 15 - Towards Port (West) Approach	0.6	0.34	A	1.8	0.20	A
Intersection Total	10.4	0.84	N/A	6.5	0.47	N/A

8.2.4 With Cruise Ships

As described in Section 5.5, cruise ships are not expected immediately (due to the influences of COVID). However, this will likely commence presently, at least within the next five years. It is anticipated that with full port developments, 30 cruise ships per annum are expected to dock at this port. Most passengers disembarking are expected to travel from the port using buses to their destination such as Whangārei or further north. The network model has already taken these buses into consideration, and they equate to 1.33% of heavy vehicles in the network by year 2040.

8.2.5 Mid-block Assessment

A review of the mid-block sections between intersections of PMH has confirmed that there is only one instance of a premise located within a block of shops that will attract traffic (the PORTHOUSE Bar and Eatery, located at 163 SH15A in Ruakākā). We have specifically examined this site and the road corridor within the vicinity of this block of shops has wide shoulders. This enables any right turning vehicle on PMH does not affect the through movement, i.e. through vehicles can bypass a waiting vehicle at the centreline.

Considering the rural high-speed environment with high volumes of heavy vehicles on PMH, there are no cycle or pedestrian facilities present along this route. This is not expected to change until the area is further urbanised and speed limits are reduced along this corridor. A single petrol station is located on PMH near Marsden Point Road intersection with wide shoulders. From a safety perspective, no issues have been identified within the mid-block section of this current corridor.

9 Future Infrastructure Requirements

The port traffic assessment has shown that the full port expansion over the 20-year period is likely to result in up to an additional 148 vehicles per hour entering and leaving through the main gate at the port during each peak period.

As the port traffic peak times are variable, this assessment assumes the worst-case scenario of port peak operations occurring during the normal traffic AM and PM peaks on PMH.

For the worst-case scenario, the SIDRA analysis shows that all key intersections are expected to continue to operate at an acceptable level with full development[8] by 2033. The Marsden Bay Drive approach of the intersection will be operating at LOS F for the AM peak only.

In the longer term, intersection performance will deteriorate, with the anticipated increased residential growth beyond the full port growth at 2033 (as modelled).

Traffic volumes need to be above 900 to 1,000 vehicles per hour before improvements need to be contemplated.

Without port expansion: The SIDRA results have shown that by 2040 the SH1/SH15 roundabout intersection will operate beyond capacity.

With port expansion: Continuing residential growth beyond 2033 with full port growth at 2033 has shown to adversely impact the following intersections by 2040:

- SH15/One Tree Point Road Intersection
- SH15/Marsden Point Road Intersection
- SH15/Marsden Bay Drive Intersection

Based on recorded data, intersection safety has not been an issue recently. This suggests that drivers are able to undertake manoeuvres safely.

As noted in Section 8.2.2.5, the sensitivity analysis of the Marsden Bay Drive intersection has confirmed it will be approaching capacity when peak hour intersection volumes reach approximately 1,300 vehicles. The assessment has shown that between Do-Minimum 2018 volumes and estimated full port expansion volumes in 2033, there is an equivalent 9% uniform traffic growth per annum. Applying the 9% growth per annum to the Do-Minimum traffic model, this intersection will reach the full demand capacity (1,300 vph) 17 years after the Do-Minimum year i.e. 2035 - refer to Table 8-25. This capacity for AM peak at SH15/Marsden Point Road intersection is approximately 1,100 vehicles per hour and for SH15/One Tree Point Road intersection is 1,250 vehicles per hour.

The model results have confirmed that AM peak is the critical peak for the three key intersections on PMH identified above. Further sensitivity testing at these three key intersections for the AM peak have been carried out to establish the Northport traffic threshold to ensure the intersection operates at an acceptable Level of Service “D” in 2040. The results are summarised in Table 9-1. The result shows that to maintain a Level of Service D during the critical AM PMH peak hour the total inbound (vehicles arriving Northport) and outbound (vehicles exiting Northport) traffic on PMH should not exceed 700 and 200 vehicle per hour, respectively.

A large proportion (70%, or nearly 400) of the Northport traffic arrives from Ruakākā via Marsden Point Road so hourly inbound volumes on PMH west of Marsden Point Road intersection, such as at SH15/One Tree Point Road intersection, should not exceed 300 vehicles.

[8] Refer to Section 6.1. Traffic Model for further details.

As the Channel Infrastructure site near Northport has recently changed to a storage and transfer depot, this assessment conservatively assumes that all traffic east of Marsden Bay Drive intersection on PMH will be Northport related traffic.

Table 9-1: AM Peak Hour Northport Trigger Volumes on PMH at 2040

Critical Intersections	Northport Inbound AM Peak Hour Trigger Volumes	Northport Outbound AM Peak Hour Trigger Volumes
SH15/Marsden Bay Drive Intersection	700	200
SH15/Marsden Point Road Intersection	700	200
SH15/One Tree Point Road Intersection	300	200

The trigger volumes for 2040 are based on forecast background residential growth of 21% beyond 2033 i.e. 3% linear annual residential growth over 7 years. The intersections may still operate within capacity at the Northport trigger volumes if background residential growth is not as high as projected.

The intersection trigger points for network upgrade on PMH are not dependent on time or year, but rather traffic volumes. Should the future background residential growth rate be lower than those assumed in 2033, this will mean more capacity for PMH. It was assumed that Northport will be fully operational from day one at year 2033, whereas it is more likely that it could take between 5 to 10 years for the port to be fully operational following full port expansion, so our assumptions are very conservative.

Based on the analysis findings above, it is recommended that Northport should only review port traffic volumes against the trigger volumes in Table 9.1 when the total volumes at these critical intersections are approaching capacity i.e. between 1,100 to 1,300 vehicles per hour at the respective intersection.

10 Port Mitigation Measures

This assessment has been very conservative in using the worst-case scenario model, assuming that Northport peak coincides with the general traffic peak on PMH. This is unlikely to be the case as discussed in Section 8.1.3.1. It is also assumed that full port expansion will be completed by 2033, introducing the full port traffic earlier than what is likely to occur: it could take between 5 to 10 years after that date for the port to reach full operational capacity, as operations 'scale up'.

To minimise the impact of the port related traffic on the PMH for the worst-case scenario, Northport would need to implement traffic management and mitigation measures. The sensitivity analysis of the peak hour traffic has shown that a minimum 20% reduction of port through traffic is needed on PMH to ensure the critical intersections perform at an acceptable LOS "D" in Year 2040.

Our assessment has shown that in 2040, should the worst-case scenario (PMH and Northport peak were to overlap) occur, then Northport would need to limit their morning peak hour volumes to a maximum of:

- 700 inbound vehicles per hour; and
- 200 outbound vehicles per hour, reducing to 300 vehicle per hour on PMH west of Marsden Point Road.

It is recommended that Northport should only review port traffic volumes against the trigger volumes on PMH when the total volumes at the critical intersections noted below are approaching capacity i.e. 1,100 to 1,300 vehicles per hour for respective intersection.

- SH15/One Tree Point Road Intersection
- SH15/Marsden Point Road Intersection
- SH15/Marsden Bay Drive Intersection

Northport may be able to use management and mitigation measures to ensure its traffic contribution to PHM remain below the trigger points set out in Table 9.1. If this is achieved, upgrades to the three identified intersections would not be required due to port traffic.

The management and mitigation measures could include the following actions:

- Avoid the port peak coinciding with the network peak (particularly the AM peak), this could include:
  - Implementing a vehicle booking system for container trucks to distribute the traffic load over the Port's operating hours (24 hours a day) as much as possible.
  - Encouraging the supply chain to operate 7 days a week to reduce truck movements during the weekdays when the network is busy.
  -
- Reduce traffic volumes to the port:
  - Northport has approximately 300 staff, which is expected to increase to 400 by 2040. It needs to encourage mode sharing of staff transport to and from work. It is understood that Northport is currently using a carpooling system where staff members with a company vehicle located furthest away from the port will collect and drop off staff members located along their driving route. This minimises the need for each staff member to bring a vehicle to work. This can be further improved by providing a bus shuttle system for all their staff in the area.

- Once the railway line comes on-line, move some of the port cargo via rail – this is currently modelled at 8%, with an increase in rail freight being desirable, given its direct impact on alleviating road congestion, maintenance, percentage heavy vehicles, and reduction in carbon emissions (70 % less emissions per tonne of freight)[9].
- Cruise ship passengers should be transported by buses and should disembark during off-peak periods only.

If however, the total traffic volumes at the three critical intersections identified above are approaching capacity, AND Northport is unable to implement steps to manage port-related traffic volumes to below the trigger volumes (set out in Table 9-1), then it is expected that an unacceptable level of service will result. To avoid that outcome, and assuming that the critical intersections have not been upgraded by third parties, including WDC and Waka Kotahi, then in our view Northport would appropriately need to contribute to funding upgrades to the three identified critical intersections. Those upgrades are likely to include fundamental changes such as conversion to roundabout or signalisation.

10.1 Construction Traffic Impact and Mitigation

The construction of Northport's proposed expansion is expected to be carried out predominantly using water-based methods. There will be some temporary impacts associated with land-based works, which will include minor increases in HCV volumes carting construction supplies to and from site.

Any traffic effects arising during the construction period can be suitably mitigated through the development of a suitable Construction Traffic Management Plan (CTMP). We recommend that the CTMP be prepared in accordance with the Waka Kotahi Code of Practice for Temporary Traffic Management (CoPTTM) and include the following:

- Methods to manage the effects of temporary traffic management activities on traffic;
- Measures to manage the safety of all transport users;
- The estimated numbers, frequencies, routes and timing of construction traffic movements, including any specific non-working or non-movement hours to manage vehicular traffic or to manage traffic congestion;
- Site access routes and access points for heavy vehicles, the size and location of parking areas for plant, construction vehicles and the vehicles of workers and visitors;
- Identification of detour routes and other methods for the safe management and maintenance of traffic flows, including cyclists, on existing roads;
- Methods to maintain vehicle access to property where practicable, or to provide alternative access arrangements when it will not be;
- The management approach to loads on heavy vehicles, including covering loads of fine material, the use of wheel-wash facilities at site exit points and the timely removal of any material deposited or spilled on public roads;
- Methods that will be undertaken to communicate traffic management measures to affected road users such as residents/public/emergency services.

[9] https://www.kiwirail.co.nz/what-we-do/projects/northland-rail-rejuvenation/

11 Conclusions

The assessment in this report has shown that expansion of the port, and intensification of residential development in the wider Marsden Point – Ruakaka area, is anticipated within wider transport planning documents and strategies and the WDC District Plan.

The study has identified the following:

- The supporting road network accessing the port currently operates within its traffic carrying capacity for both intersections and mid-blocks, with intersections performing with good levels of service.

- PMH is a regional arterial road with one lane each way and it is expected to be urban in future. The capacity of this road network is between 15,000 to 18,000 vehicles per day.

- With full port expansion MPH has adequate capacity at midblock sections with PMH volumes reaching 13,666 vehicles in 2040.

- The safety and sightline assessment of the key intersection has identified no existing safety issues along the PMH and side roads.

- The crash risk assessment has shown that port expansion induced traffic will increase total injury crash rate for the PMH corridor by 0.01 reported injury crashes per year. This increase is considered less than minor i.e. less than one additional injury crash over next 20 years on PMH. The detailed assessment is provided in Appendix A.

- It is anticipated that with full port developments, 30 cruise ships per annum are expected to dock at this port.

- Most passengers disembarking is expected to travel from the port using buses to their destination such as Whangārei or further north. The network model has already taken these buses into consideration, and they equate to 1.33% of heavy vehicles in the network by year 2040.

- There is a proposal by Northport to develop beach area and a pocket park to the east of Northport for recreation purposes. As the recreational activity is expected to occur on weekends and outside of peak periods, recreational traffic is not expected to affect PMH traffic or port operation.

11.1 Operational Traffic Effects and Recommendations

- Operational effects of full Northport expansion at critical intersections of PMH identified below are expected to be no more than minor until the peak hourly intersection volumes reaches 1,350 per hour.

    - (A) SH15/One Tree Point Road Intersection
    - (B) SH15/Marsden Point Road Intersection
    - (C) SH15/Marsden Bay Drive Intersection

- Some approaches of the intersection then operate at LOS “F” in year 2040 refer to result in Tables 8-15, 8-16, 8-19, 8-23 & 24.

- The assessment has shown that to maintain acceptable LOS “D” at these critical intersections without any future network upgrade would require Northport to keep their

operational traffic volumes to the trigger threshold volumes identified below at these intersections.

  - (A) Inbound: 300 Veh/hr & Outbound: 200 Veh/hr.
  - (B) Inbound: 700 Veh/hr & Outbound: 200 Veh/hr.
  - (C) Inbound: 700 Veh/hr & Outbound: 200 Veh/hr.

- It is recommended that Northport should only review port traffic volumes against the trigger volumes in Table 9.1 when the total volumes at the critical intersections are approaching capacity i.e. 1,100 to 1,300 vehicles per hour at their respective intersection.

- There is plenty of scope for port operations to utilise available road network capacity at off-peak times, by increasing movements in the periods before and after the daytime peak periods and encouraging fright companies to operate the full 7 days the port will be operational.

- It is recommended that as the future road network reaches near capacity volumes, Northport implement some or all of the following mitigation measures to maintain their operational traffic on PMH to below the threshold trigger volumes at critical intersections:

  - Implement best practice mode share or shuttle bus arrangements for their staff to travel to and from work.
  - Implement a booking system for container trucks at the port, shifting the time of truck movements to off-peak and improving transfer times for trucks

- Freight growth has been fully assessed without rail until year 10 (2028), where after an 8% contribution was taken into consideration. There is land designated for rail, however, no rail link is currently available.

- Once the rail link is installed, it will allow for some of the truck movements to be replaced by train, with the percentage contribution stimulated by demand. If rail does not come to fruition at assumed period, then the trigger threshold volumes may occur earlier than currently forecasted (2035) for the current worst-case scenario of Northport peak coincides with the general traffic peak on PMH peak.

- If the anticipated background residential traffic growth for Marsden/Ruakākā occurs at slower pace than those assumed in the model from WDC forecast, then trigger threshold for Northport is expected to occur later than assumed.

- The proposed development traffic generation facilitated by the port expansion and improvements to the strategic transport hub can be supported from a transportation effects perspective.

- Following full Northport expansion, if the mitigation measures identified above are implemented to keep the Northport traffic on PMH below the trigger threshold volumes when the critical intersections hourly volumes reach capacity as shown below then there are no transportation-related effects or other matters precluding the grant of consents for the proposal.

  - SH15/One Tree Point Road Intersection – approximately 1,250 vehicle per hour.

  - SH15/Marsden Point Road Intersection – approximately 1,100 vehicle per hour.

  - SH15/Marsden Bay Drive Intersection – approximately 1,300 vehicles per hour.

- If road network reaches capacity volumes AND Northport is unable to implement other mitigations to keep its vehicle movements below the threshold volumes, THEN Northport to contribute to funding of fundamental intersection upgrades (e.g. Roundabout or signal) at the three critical intersections to achieve an acceptable intersection LOS “D” or less.

11.2 Construction Traffic Effects and Recommendations

Construction traffic effects are no more than minor due to:

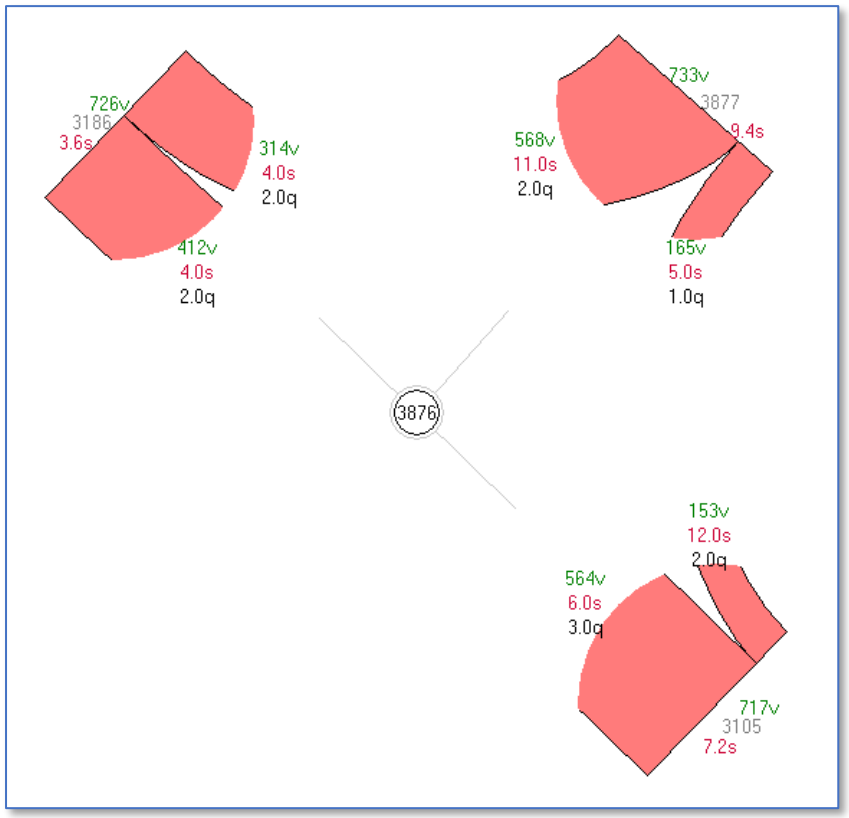
- Construction traffic effects are standard and minimised through mostly water-based construction.
- Construction traffic effects include minor increases in HCV volumes carting construction materials to site. These are standard construction effects.

Construction effects can be mitigated through a Construction Traffic Management Plan (CTMP), which the contractor will need to prepare and submit to Waka Kotahi for approval.

Appendix A
Traffic and Crash Data

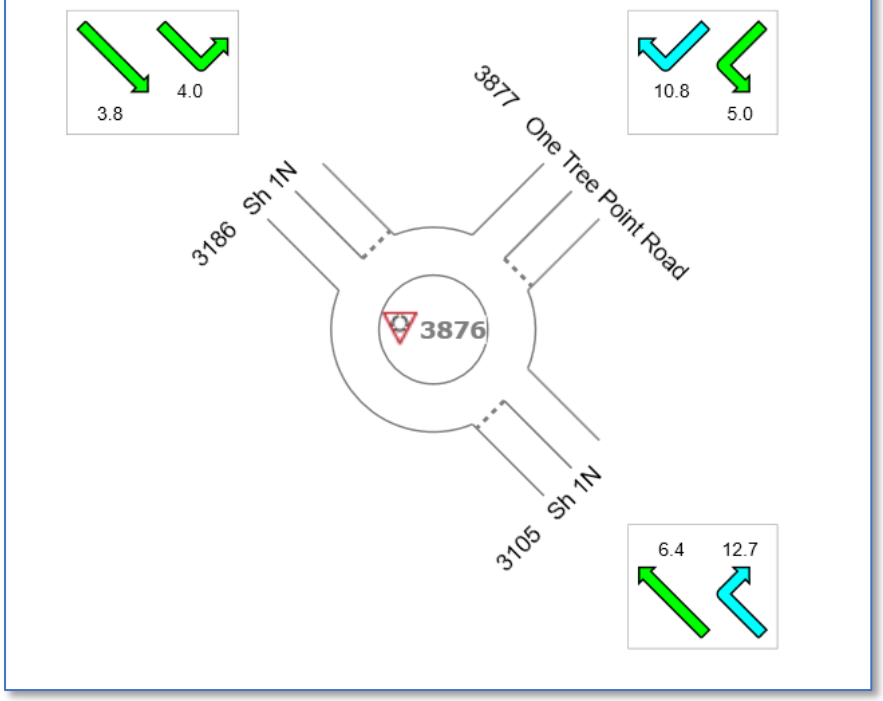
2033 AM (8 – 9am) Peak Future: No Northport Expansion

SH1 Roundabout

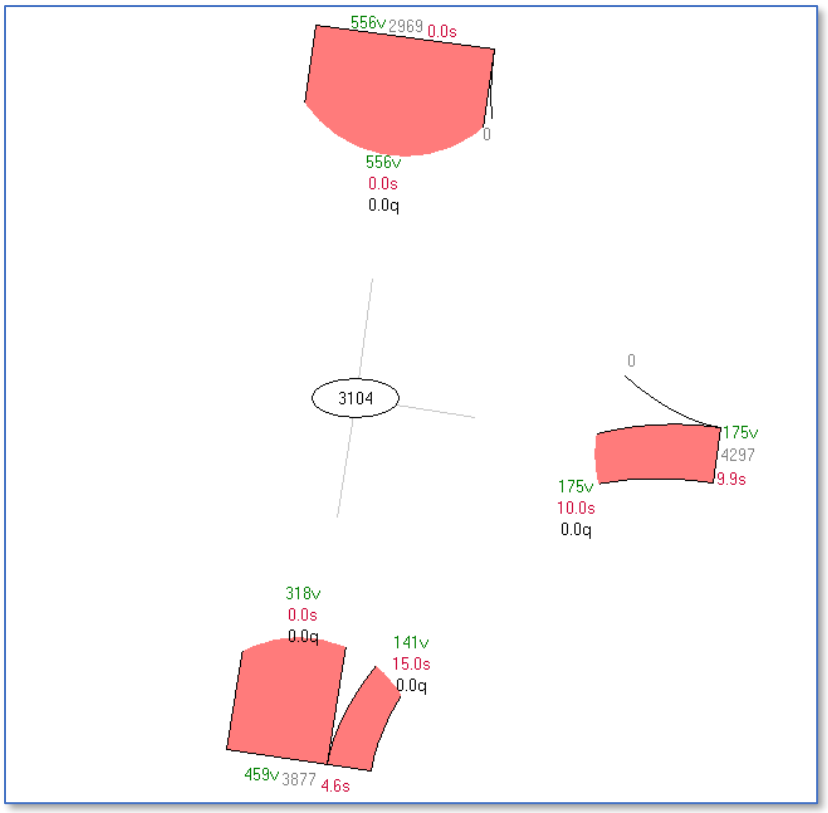


All Movement Classes

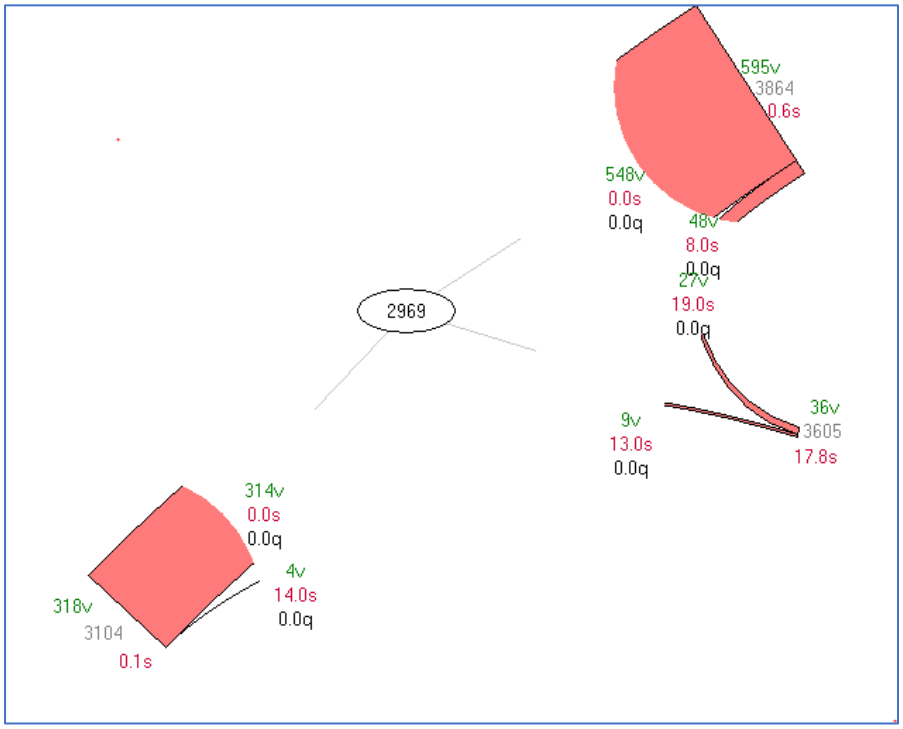
	Approaches			Intersection
	Southeast	Northeast	Northwest	
Delay (Control)	8.0	9.6	3.9	7.2
LOS	A	A	A	A



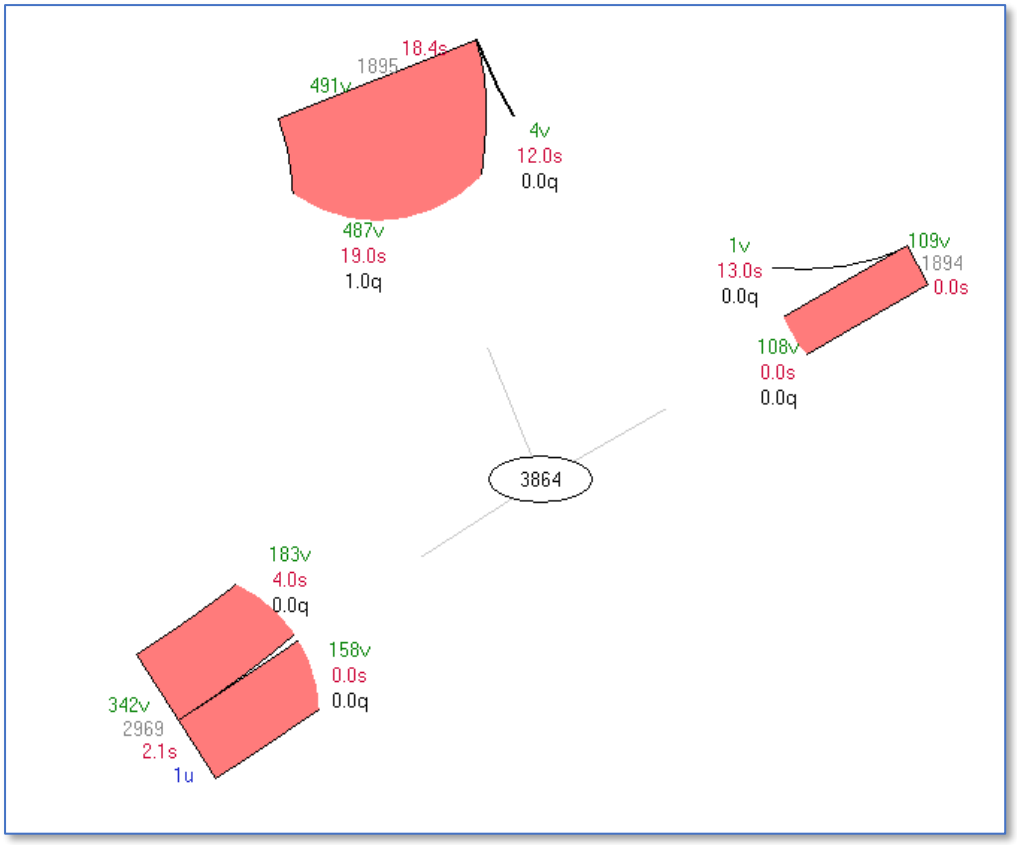
Salle Road



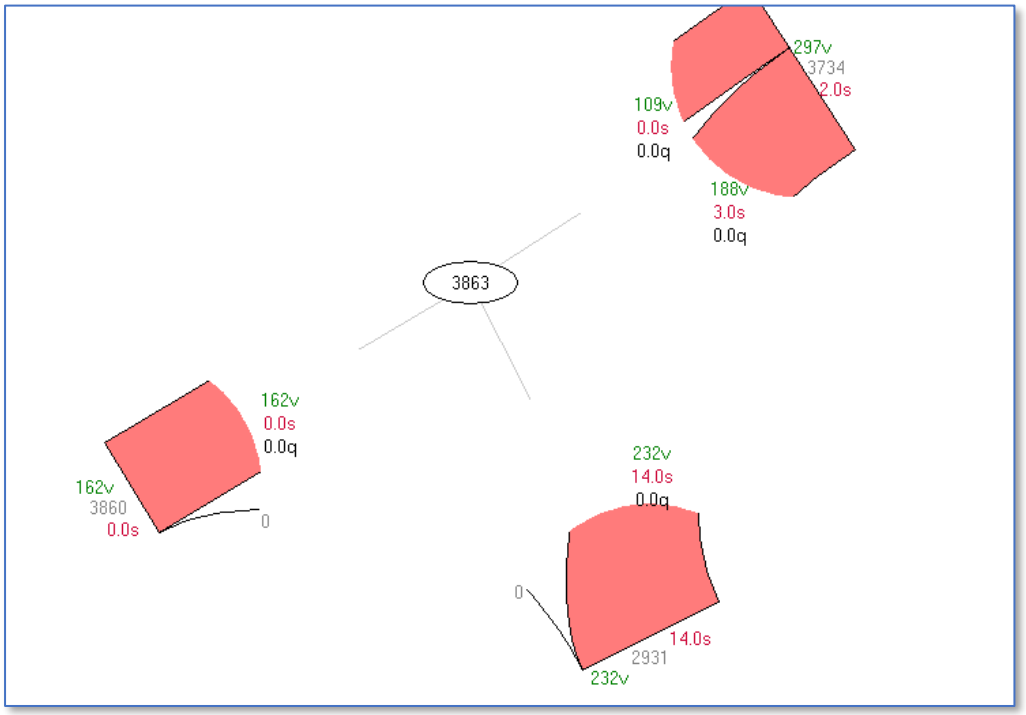
McCathie Road



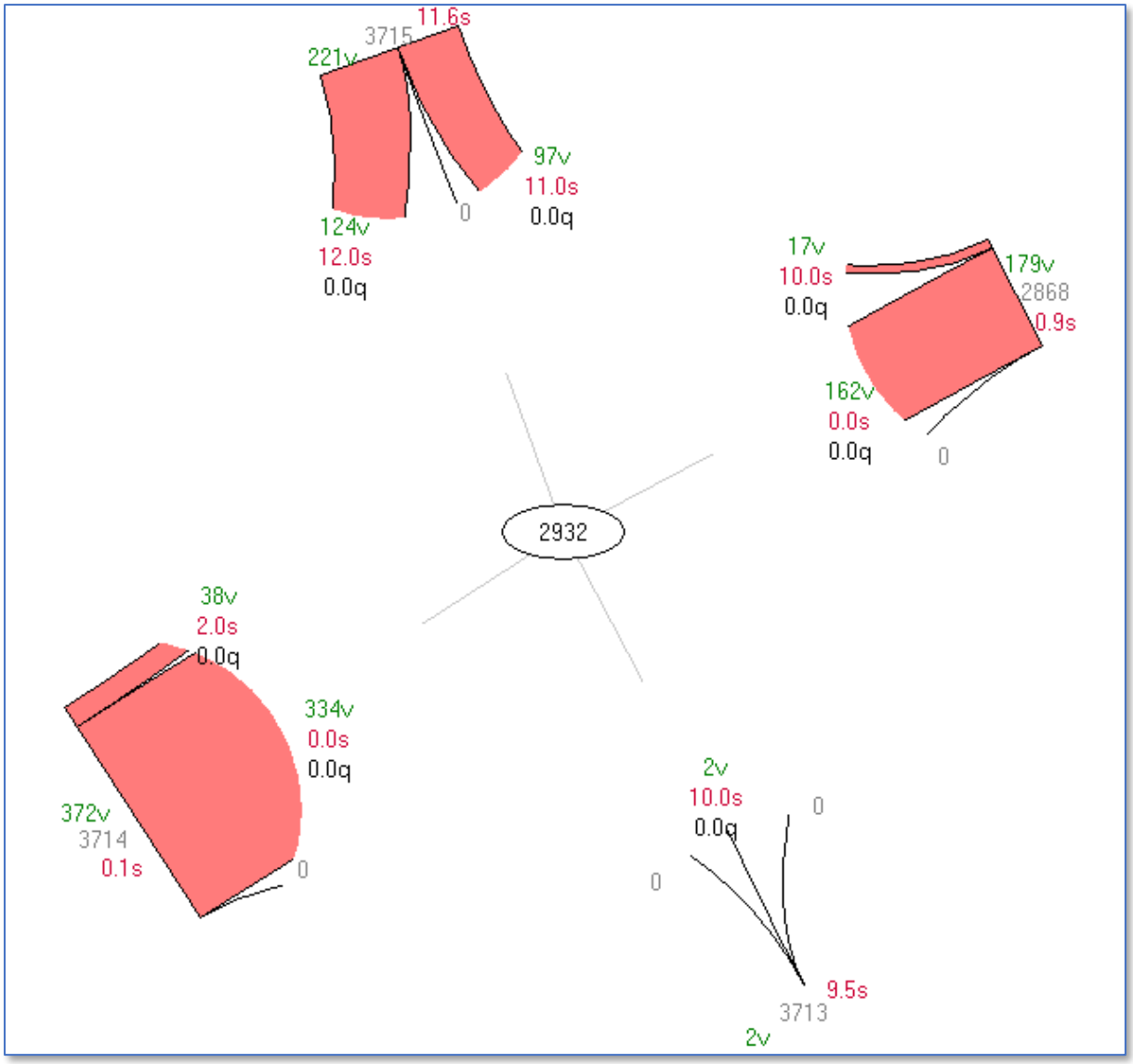
One Tree Point Road



Marsden Point Road

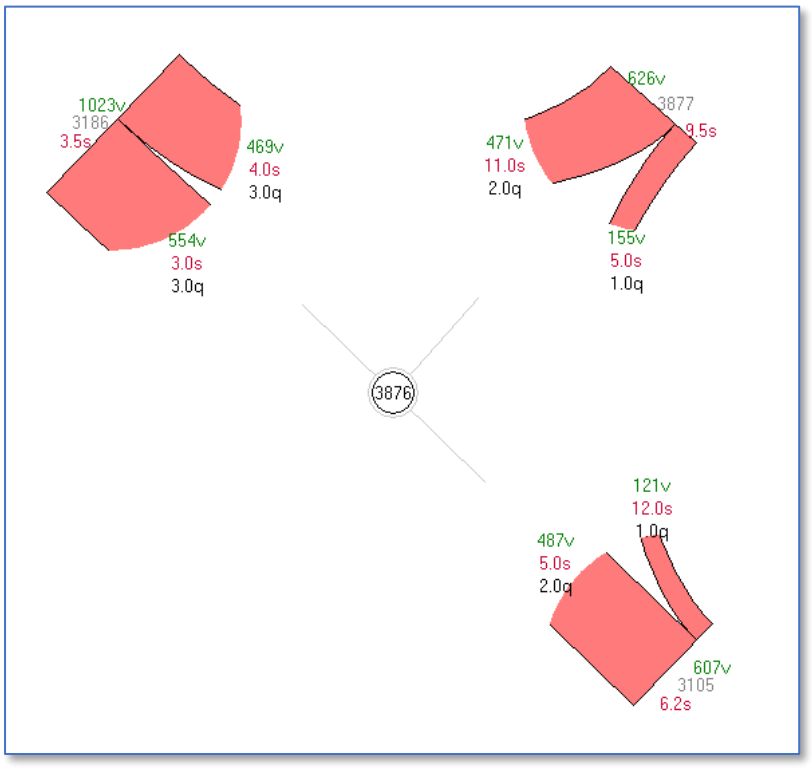


Rama Rd / Marsden Bay Drive



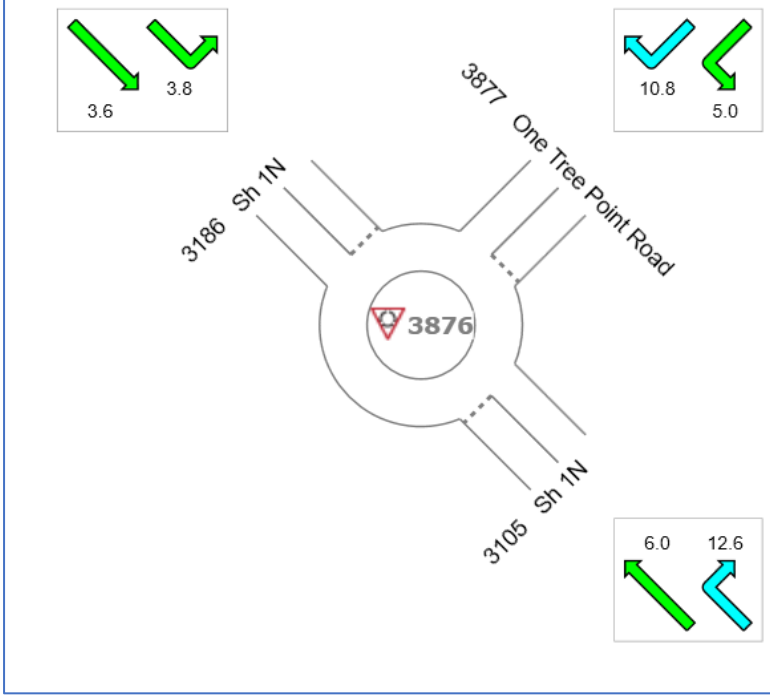
2033 PM (4 – 5pm) Peak Future: No Northport Expansion

SH1 Roundabout

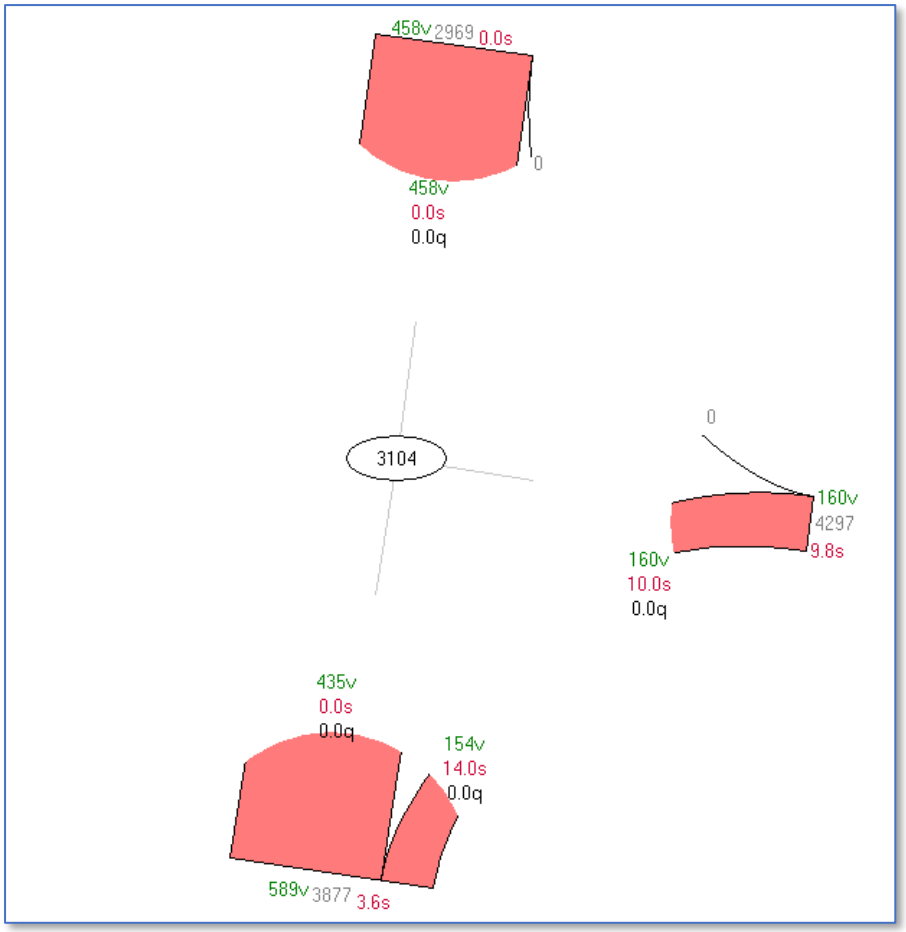


All Movement Classes

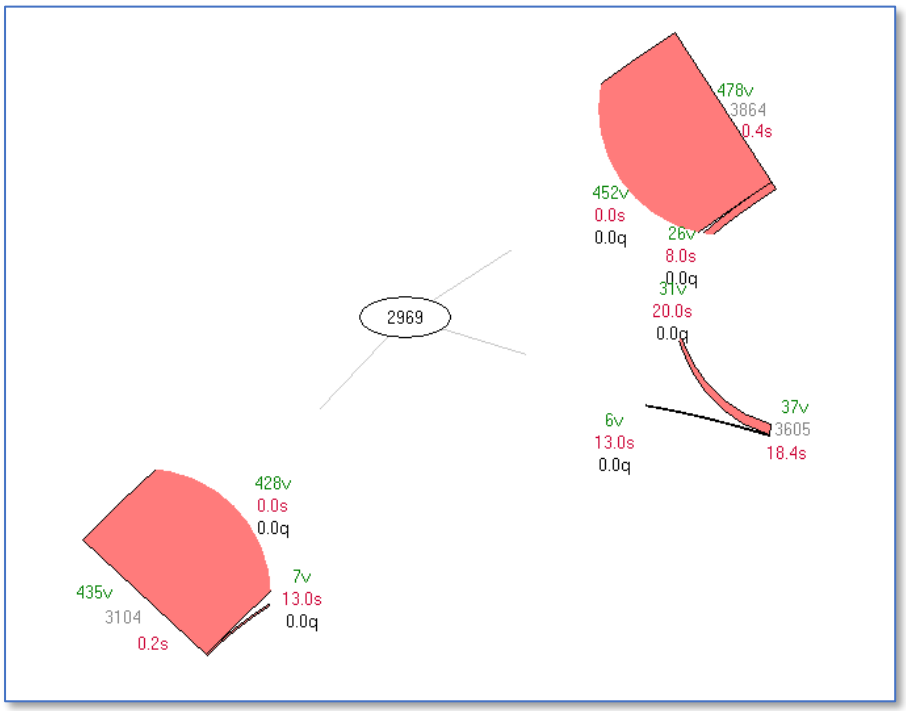
	Approaches			Intersection
	Southeast	Northeast	Northwest	
Delay (Control)	7.5	9.5	3.7	6.9
LOS	A	A	A	A



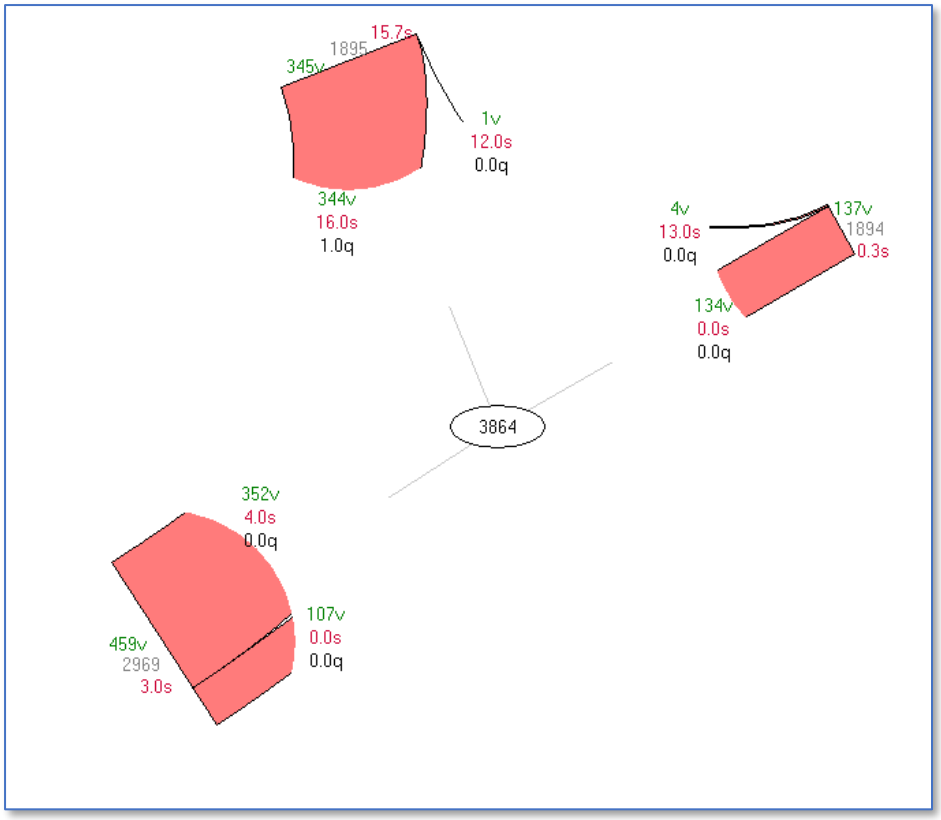
Salle Road



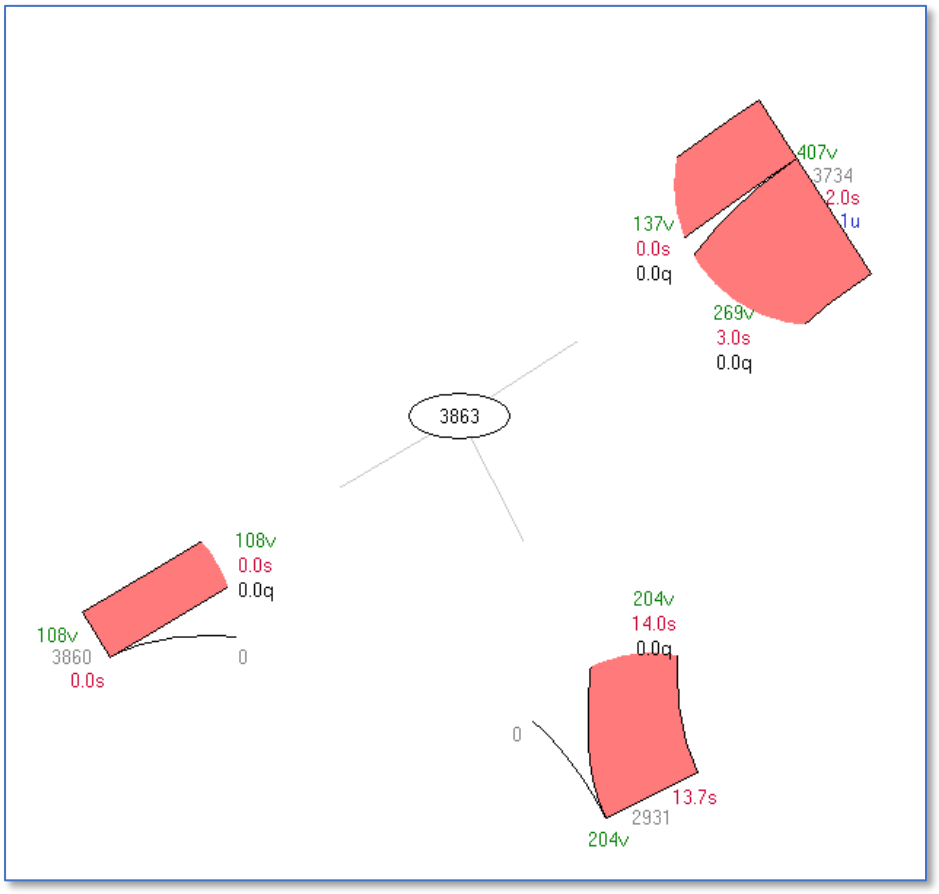
McCathie Road



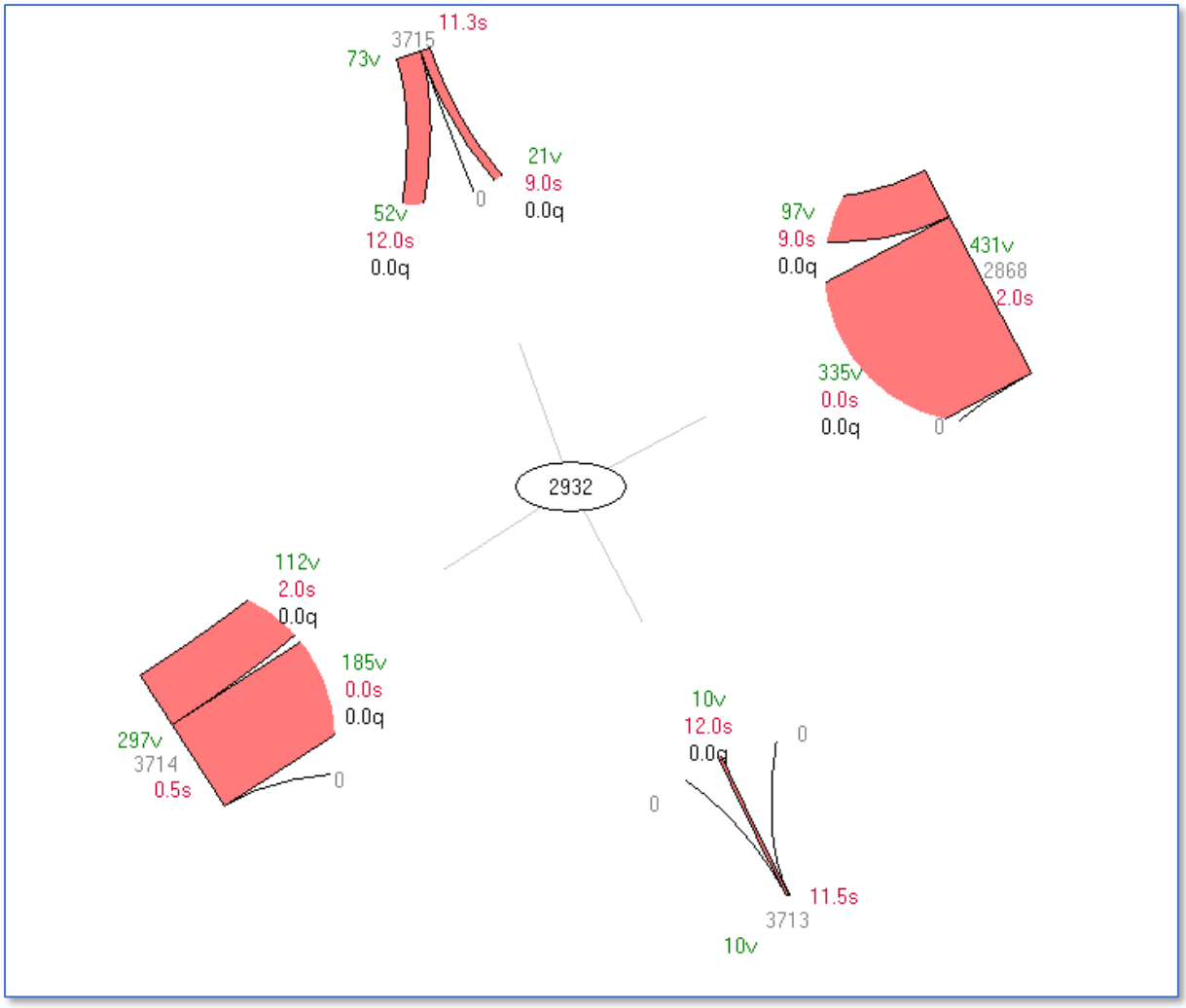
One Tree Point Road



Marsden Point Road

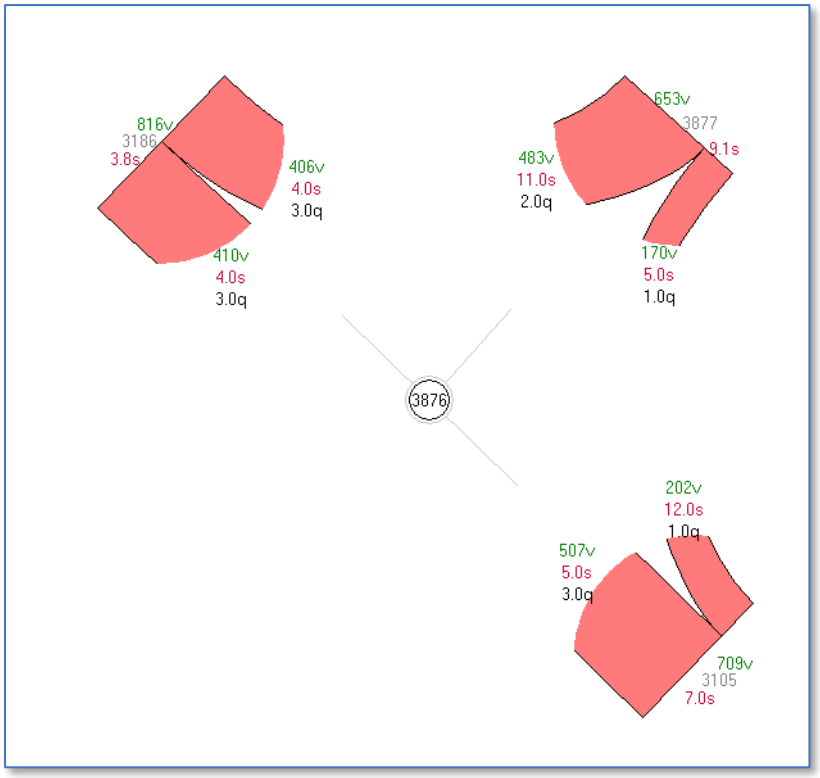


Rama Rd / Marsden Bay Drive

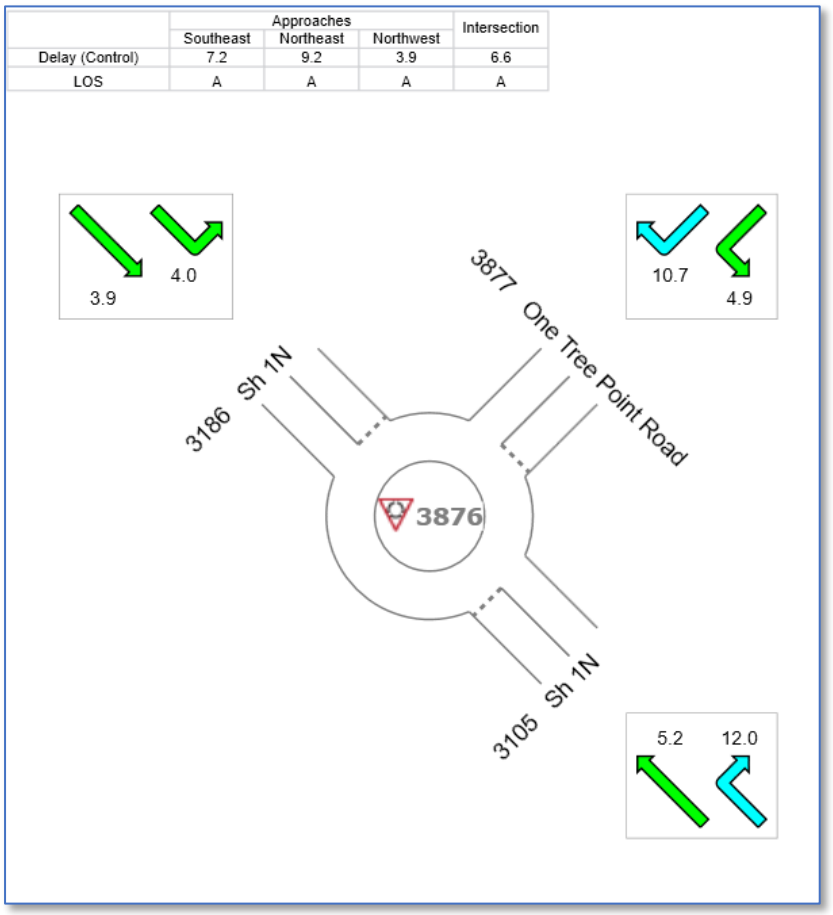


2033 AM Peak (8-9am) Future: With Full Northport

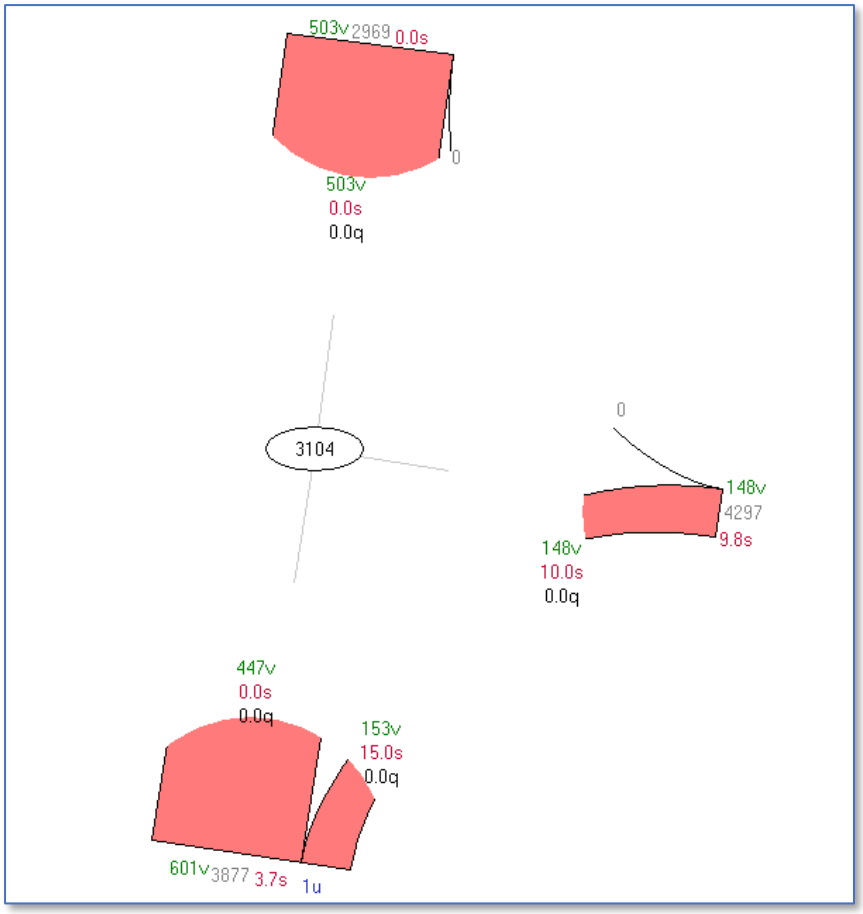
SH1 Roundabout



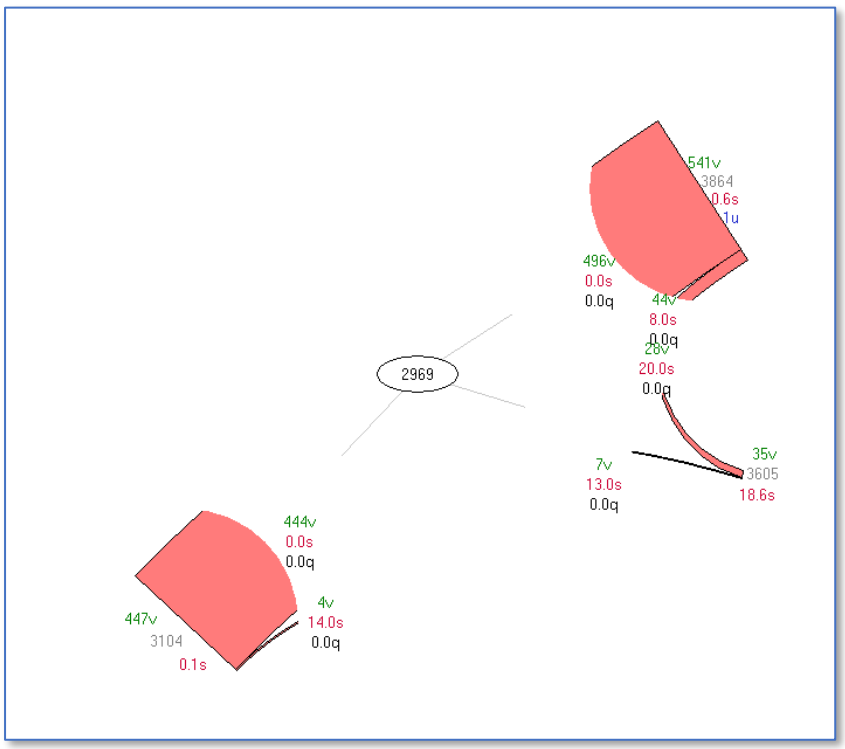
	Approaches			Intersection
	Southeast	Northeast	Northwest	
Delay (Control)	7.2	9.2	3.9	6.6
LOS	A	A	A	A



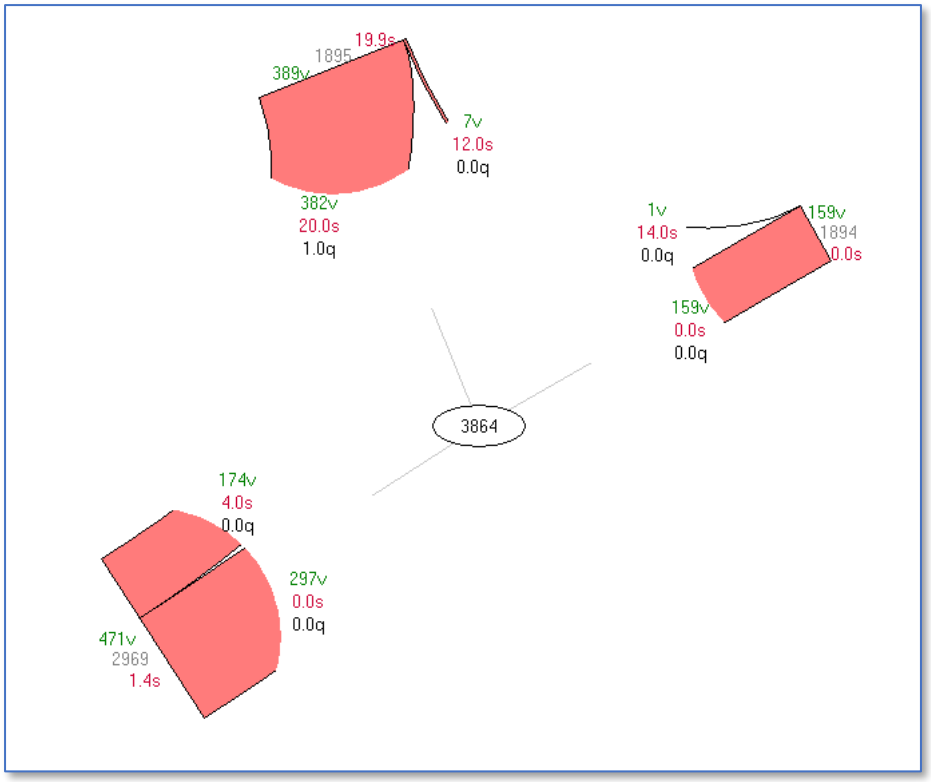
Salle Road



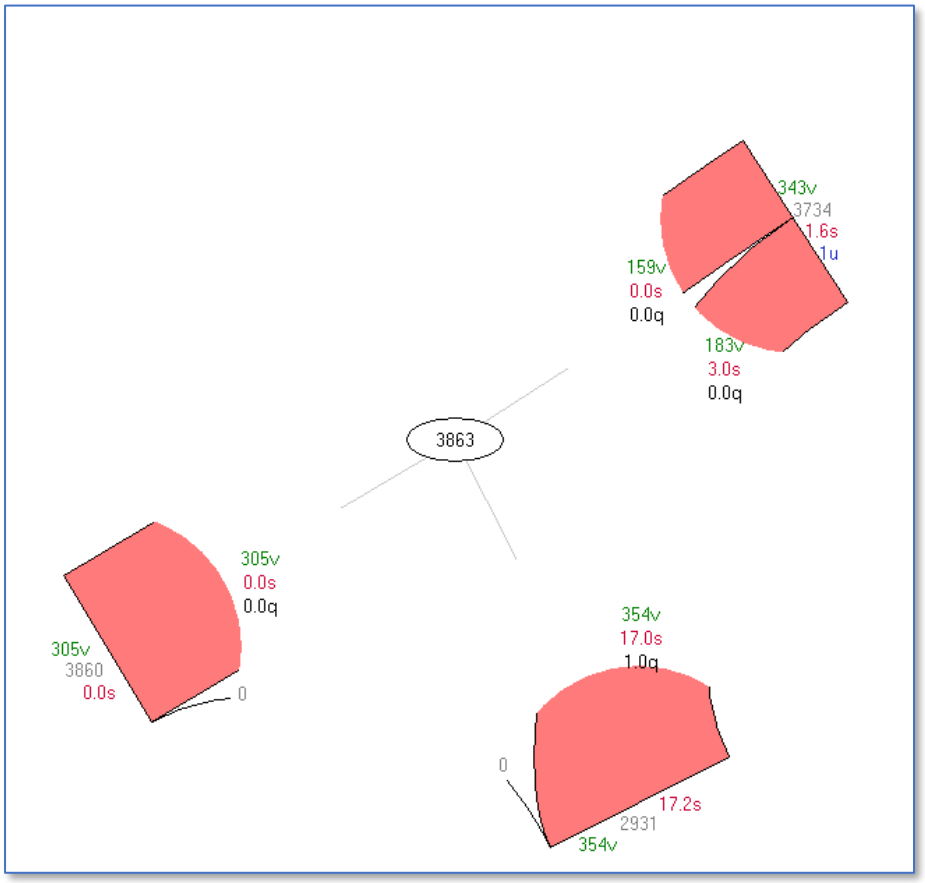
McCathie Road



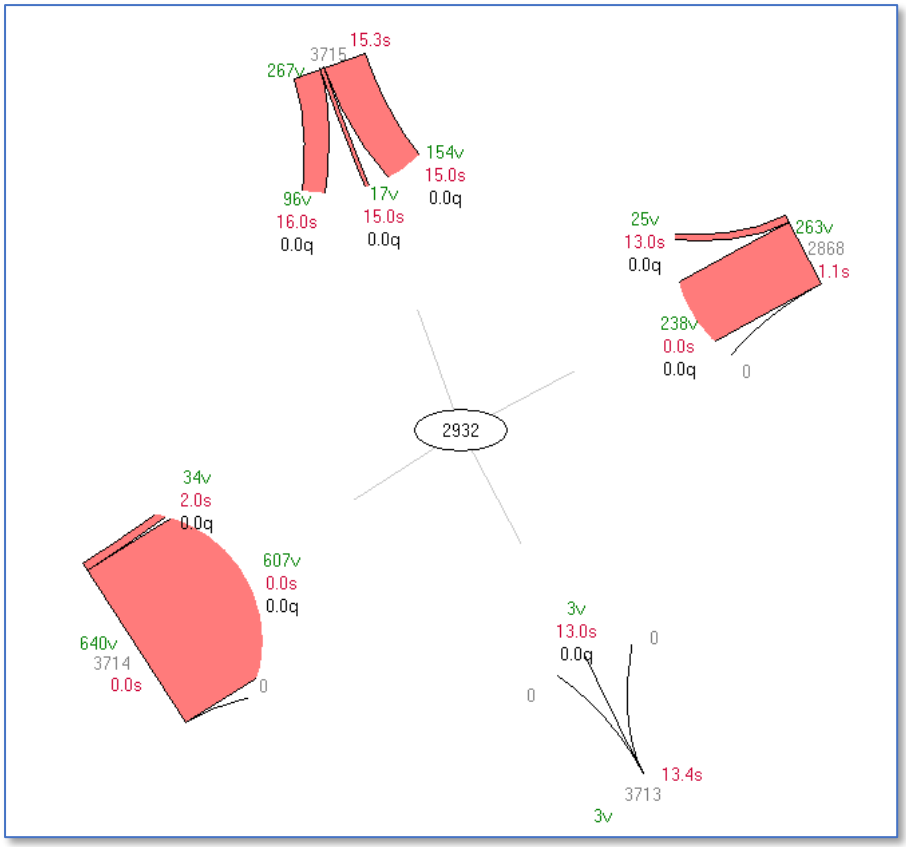
One Tree Point Road



Marsden Point Road



Rama Road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154v
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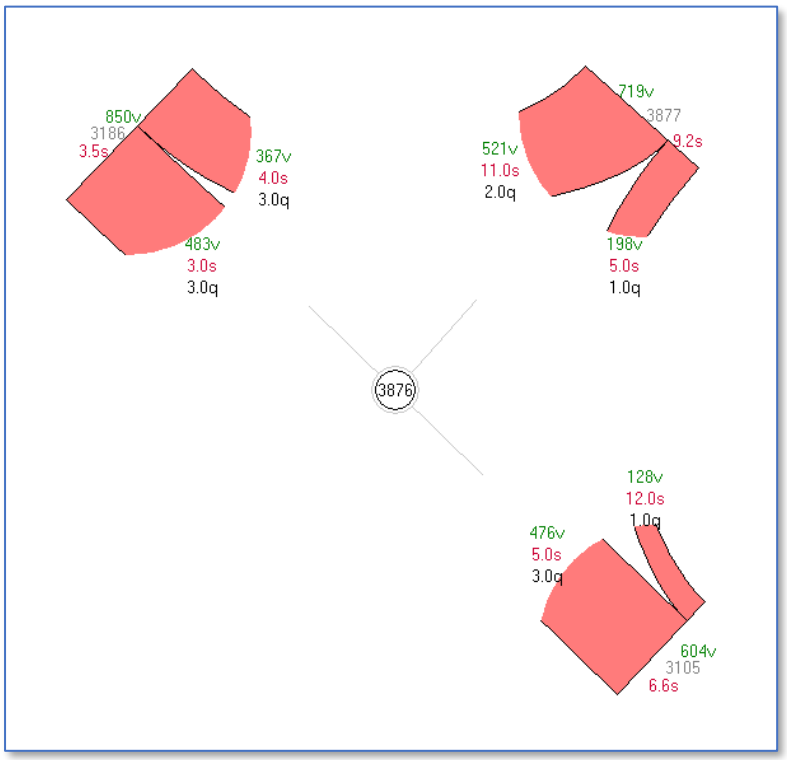
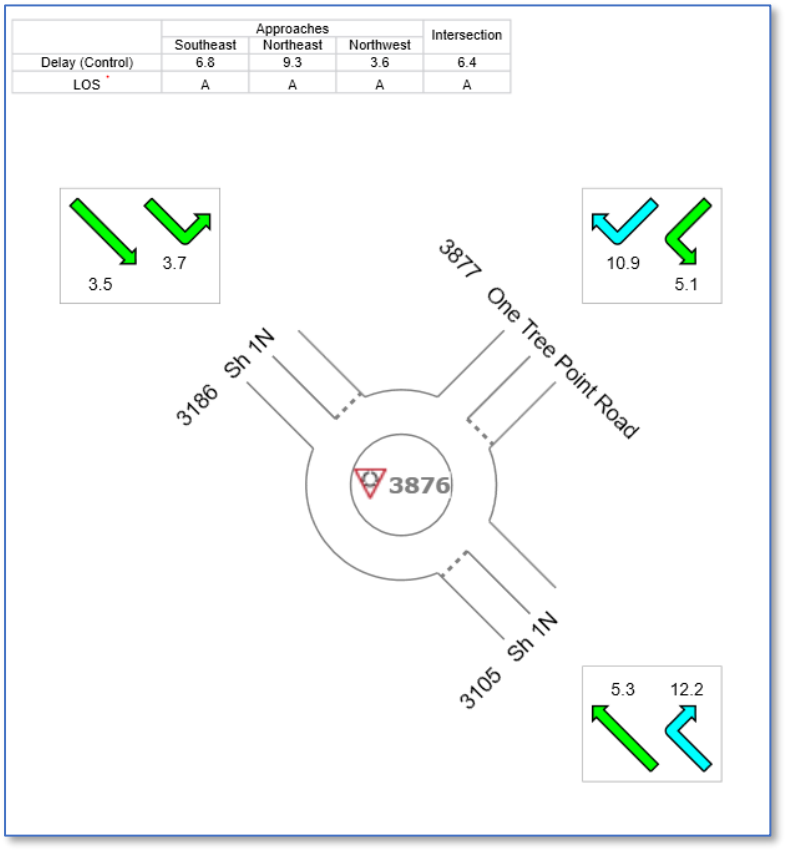
0.0q
96v
16.0s
0.0q
17v
15.0s
0.0q
25v
13.0s
0.0q
263v
2868
1.1s
238v
0.0s
0.0q
0
2932
34v
2.0s
0.0q
607v
0.0s
0.0q
640v
3714
0.0s
0
3v
13.0s
0.0q
0
0
13.4s
3713
3v

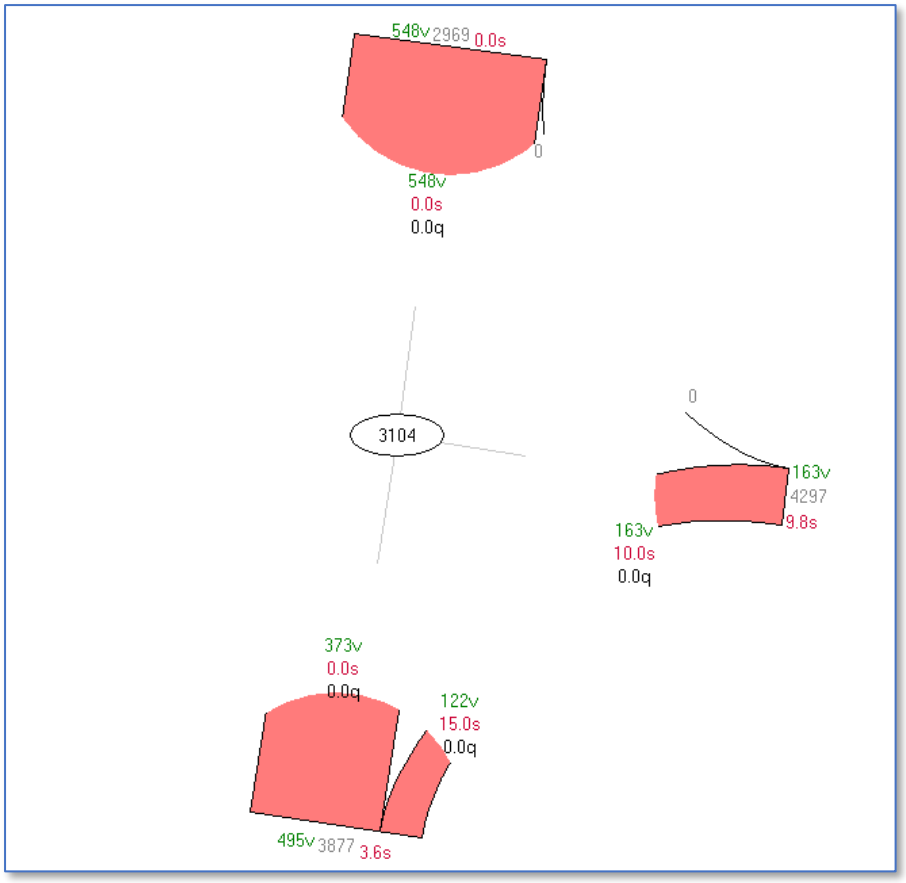
2033 PM Peak (4-5pm) Future: With Full Northport

SH1 Roundabout

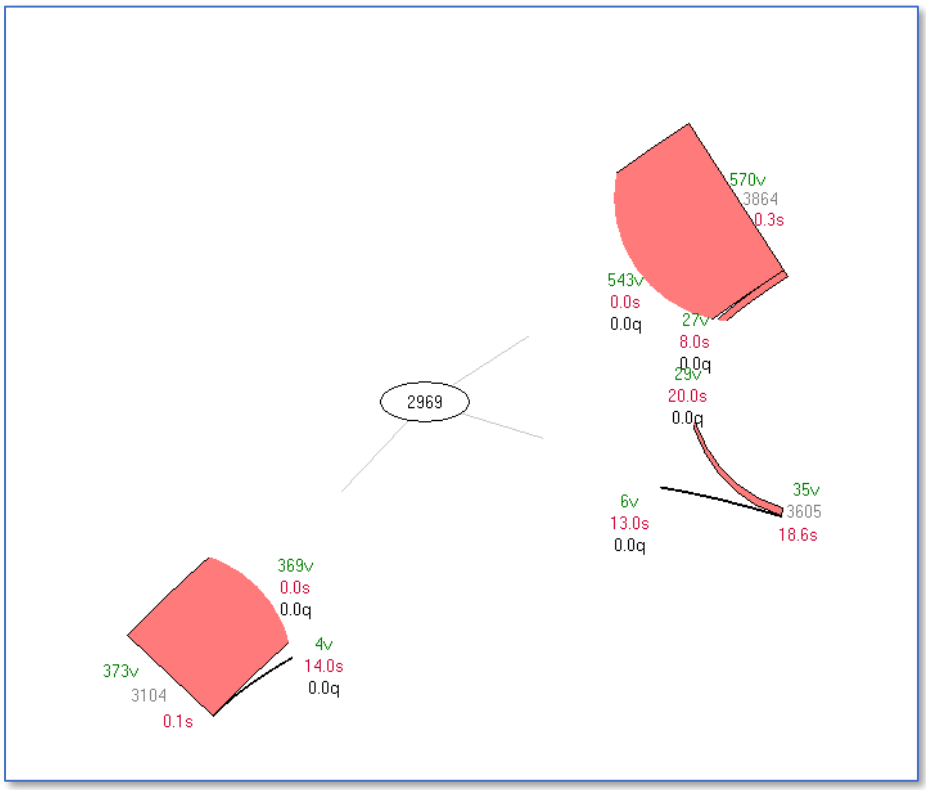




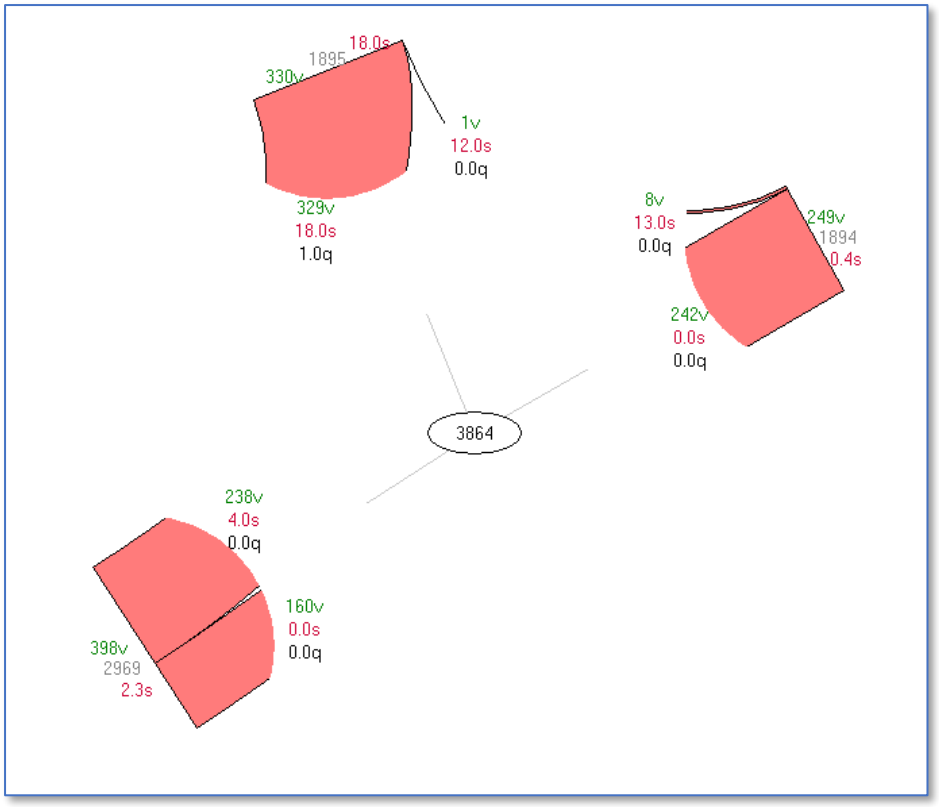
Salle Road



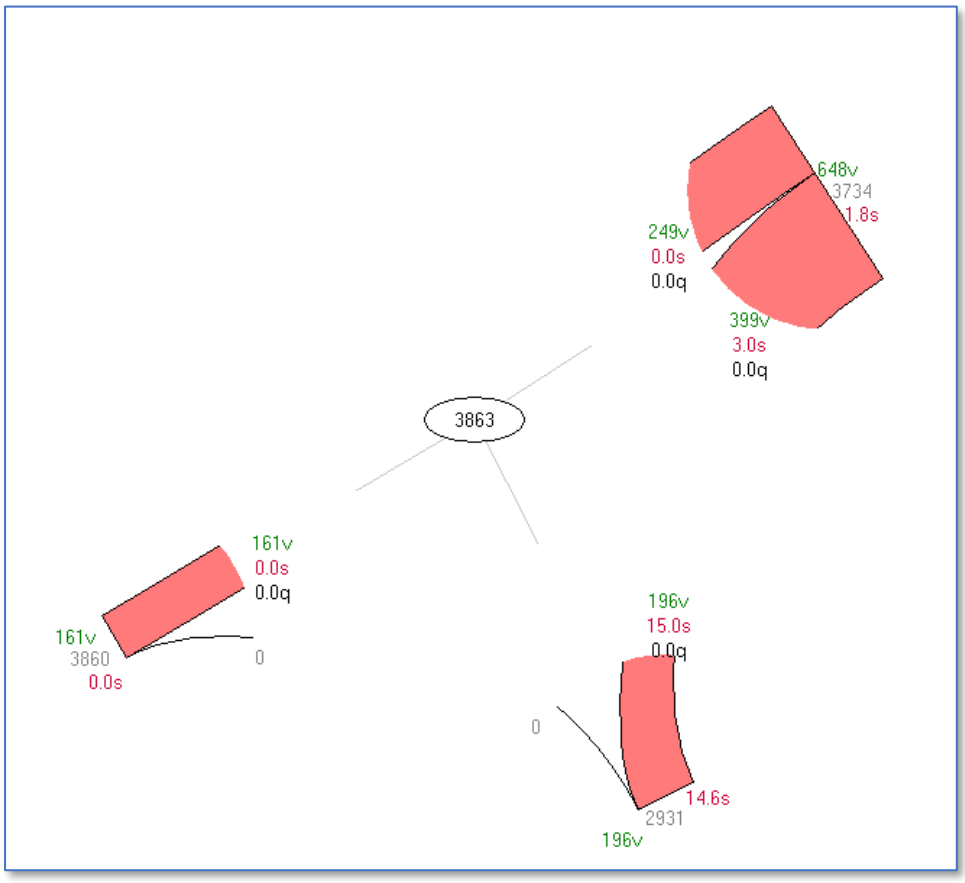
McCathie Road



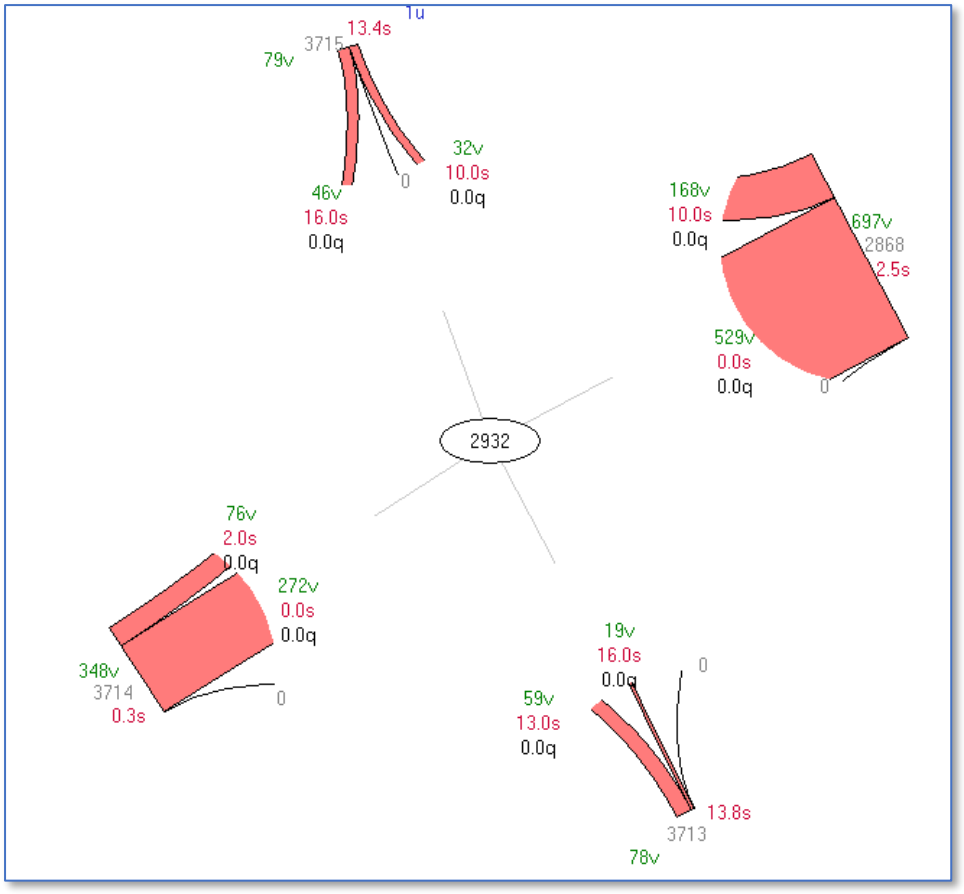
One Tree Point Road



Marsden Point Road



Rama Road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46v
16.0s
0.0q
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0.0q
697v
2868
2.5s
529v
0.0s
0.0q
0
2932
76v
2.0s
0.0q
272v
0.0s
0.0q
348v
3714
0.3s
0
19v
16.0s
0.0q
0
59v
13.0s
0.0q
13.8s
3713
78v

Break down		2018			Year 5				Year 10				Year 20			
Cause	Vehicle type	Notes - Number	Calc	Number	Notes	Notes - Number	Calc	Number	Notes	Notes - Number	calc	10	Notes	Notes - Number	calc	Number
General Port Staff	CAR	300	300*2*52*5	156000	-300 current staff (at 1 per vehicle)(2)(7dii) (per working day), therefore no increase in traffic. - Multiplied by two for traffic in both directions - Multiplied by 52 * 5 work days to get yearly traffic	300	(300-300)*2*52*5	0	- 60 staff (at 1 per vehicle)(2ai)(1c) (per working day) -plus prior staff -Multiplied by 2 for both directions - Multiplied by 52 * 5 work days to get yearly traffic	360	(360-300)*2*52*5	31200	-40 Staff (at 1 per vehicle) (2ii)(1c) (per working day) -plus prior staff -Multiplied by 2 for both directions - Multiplied by 52 * 5 work days to get yearly traffic	400	(400-360)*2*52*5	20800
Car import	Car carrier (8 cars at a time)	0	(0*0.6/8)*2	0	No cars for first 5 years	0	0	0	60% of 160,000 cars imported - Multiplied by 2 for traffic empty trucks entering	160000	((160,000-0)*0.6/8)*2	24000	No additional cars	160000	((160,000-160,000)*0.6/8)*2	0
	HCV carrier (one at a time)	0	0	0	No HCV for first 5 years	0	0	0	- 5,000 HCV by road per year - Multiply by 2 for empty trucks entering port	5000	(5000-0)*2	10000	No additional HCV - Multiply by 2 for empty trucks entering port	5000	(5000-5000)*2	0
Non-Container cargo trucks	Trucks (28 tonne of cargo per truck)	3386730	2*(3,386,730/28)	241910	2018 Vol:3,386,730; 2025 vol: 2,700,151 tonnes of cargo From 4Ai1 projected using Northport Wood Availability Forecast 2018 Figure 16. - Multiplied by 2 for trips in and out	2700151	2*((2,700,151-3,386,730)/28	-49042	1,748,798 tonnes of cargo From 4Ai1 projected using Northport Wood Availability Forecast 2018 Figure 16. - Multiplied by 2 for trips in and out	1748798	2*((1,748,798-2,700,151)/28)	-67954	2,257,561 tonnes of cargo From 4Ai1 projected using Northport Wood Availability Forecast 2018 Figure 16. -Multiplied by 2 for trips in and out	2257561	2*((2,257,561-1,748,798)/28)	36342
Cruise Ships	Busses (30 seater) 1/3	0	2*(1500/3)*0	0	20 cruise ships (1500 Passengers) -Multiplied by 2 for trips in and out	20	2*(1500/3)*(20-0)	20000	30 cruise ships (1500 passengers) -Multiplied by 2 for trips in and out	30	2*(1500/3)*(30-20)	10000	30 cruise ships (1500 passengers) -Multiplied by 2 for trips in and out	30	2*(1500/3)*(30-30)	0
	Busses (10 seater) 1/6	0	2*(1500/6)*0	0	20 cruise ships (1500 Passengers) -Multiplied by 2 for trips in and out	20	2*(1500/6)*(20-0)	10000	30 cruise ships (1500 passengers) -Multiplied by 2 for trips in and out	30	2*(1500/6)*(30-20)	5000	30 cruise ships (1500 passengers) -Multiplied by 2 for trips in and out	30	2*(1500/6)*(30-30)	0
	Taxi 1/6	0	2*(1500/6)*0	0	20 cruise ships (1500 Passengers) -Multiplied by 2 for trips in and out	20	2*(1500/6)*(20-0)	10000	30 cruise ships (1500 passengers) -Multiplied by 2 for trips in and out	30	2*(1500/6)*(30-20)	5000	30 cruise ships (1500 passengers) -Multiplied by 2 for trips in and out	30	2*(1500/6)*(30-30)	0
Rail	Trucks removed	0	0	0	No rail	0	0	0	8% containers by rail	8%	Total container trucks*0.08	-2679	8% containers by rail	8%	Total container trucks*0.08	-15174
Cement	Truck	9200	2*9200	18400	9200 TEU yearly - Multiplied by 2 for in and out movements - One TEU per truck	9200	2*(9200-9200)	0	9200 TEU yearly - Multiplied by 2 for in and out movements - One TEU per truck	9200	2*(9200-9200)	0	9200 TEU yearly - Multiplied by 2 for in and out movements - One TEU per truck	9200	2*(9200-9200)	0
Containers	Truck North (37%)	12849	12849*037*0.556	2644	- 47,040*0.37*0.556 - As per calculations sheet	47040	(47,040-12849)*037*0.556	7034	- 100,000*0.37*0.556 - As per calculations sheet	100000	(100,000-47,040)*0.37*0.556	10895	- 400,000*0.37*0.556 - As per calculations sheet	400000	(400,000-100,000)*0.37*0.556	61716
	Truck South (63%)	12849	12849*0.63*0.677	5481	- 47,040*0.63*0.677 - As per calculations sheet	47040	(47,040-12849)*0.63*0.677	14583	- 100,000*0.63*0.677 - As per calculations sheet	100000	(100,000-47040)*0.63*0.677	22588	- 400,000*0.63*0.677 - As per calculations sheet	400000	(400,000-100,000)*0.63*0.677	127953
Ship Maintenance and Navy Personnel	CAR	0	0*2*52*5	0	-400 for berth 0 (at 1 per vehicle)(7e)(7dii) (per working day) - Multiplied by 2 for both directions - Multiplied by 52*5 work days to get yearly traffic	0	0*2*52*5	0	-400 for berth 0 (at 1 per vehicle)(7e)(7dii) (per working day) - Multiplied by 2 for both directions - Multiplied by 52*5 work days to get yearly traffic	0	0*2*52*5	0	-400 for berth 0 (at 1 per vehicle)(7e)(7dii) (per working day) -Multiplied by 2 for both directions - Multiplied by 52*5 work days to get yearly traffic	0	0*2*52*5	0

Yearly	Container Trucks	8125			Container Trucks	21617			Container Trucks	30804			Container Trucks	174495		
	Car/HCV carrier	0			Car/HCV carrier	0			Car/HCV carrier	34000			Car/HCV carrier	0		
	Other trucks (Not containers)	260310			Other trucks (Not containers)	-49042			Other trucks (Not containers)	-67954			Other trucks (Not containers)	36342		
	30 seat bus	0			30 seat bus	20000			30 seat bus	10000			30 seat bus	0		
	10 seat bus	0			10 seat bus	10000			10 seat bus	5000			10 seat bus	0		
	Cars	156000			Cars	10000			Cars	36200			Cars	20800		
			Average Hourly flow	AM/PM Traffic Volume			Average Hourly flow	AM/PM Traffic Volume			Average Hourly flow	AM/PM Traffic Volume			Average Hourly flow	AM/PM Traffic Volume
Daily	Container Trucks	23	2	2	Container Trucks	60	5	5	Container Trucks	85	8	8	Container Trucks	479	40	40
	Car/HCV carrier	0	0	0	Car/HCV carrier	0	0	0	Car/HCV carrier	94	8	8	Car/HCV carrier	0	0	0
	Other trucks (Not containers)	714	60	60	Other trucks (Not containers)	-135	-12	-12	Other trucks (Not containers)	-187	-16	-16	Other trucks (Not containers)	100	9	9
	30 seat bus	0	0	0	30 seat bus	55	5	5	30 seat bus	28	3	3	30 seat bus	0	0	0
	10 seat bus	0	0	0	10 seat bus	28	3	3	10 seat bus	14	2	2	10 seat bus	0	0	0
	Cars	428	36	214	Cars	28	3	14	Cars	100	9	50	Cars	57	5	29
			Peak Flow	276			Peak Flow (Difference)	15			Peak Flow (Difference)	55			Peak Flow (Difference)	78

Peak Flows and Differences		
Year	**Peak Flow**	**Peak AM/PM Flow Increase**
2018	**278**	
Year 5	**293**	15
Year 10	**348**	55
Year 20	**426**	78
		148

Assumptions:

Average hourly flow associated with port based on 12 hrs of

Daylight hrs assumed to be 12 hrs.

		Total Daily Volumes used to determine Peak Flows			
		2018	**Year 5**	**Year 10**	**Year 20**
Daily	Container Trucks	23	83	168	647
	Car/HCV carrier	0	0	94	94
	Other trucks (Not containers)	714	579	392	492
	30 seat bus	0	55	83	83
	10 seat bus	0	28	42	42
	Cars	428	456	556	613
	AADT Total	1165	1201	1335	1971
	AADT Increase from base 2018		36	170	**806**
			Yr 15 (2033)	**488**	

Intersection	Name	Crash No. over 5 yrs	Crash Rate/Yr (all crashes)	Injury Crash Rate/Yr	Int. Type
1	SH1/SH15	4	0.8	0	Priority T
2	SH15/Salle Rd	2	0.4	0	Priority T
3	SH15/One Tree Point Rd/Mccathie Rd	3	0.6	0	Priority X
4	SH15/Marsden Point Rd	1	0.2	0.2	Priority T
5	SH15/Marsden Bay Dr/Rama Rd	2	0.4	0.4	Priority X
				0.60	

Table 17: General high-speed cross roads and T-junctions ≥ 80km/h coefficients (reference 8).

Intersection type	b_0	b_1	b_2
Priority – cross	3.74×10^{-4}	0.39	0.50
Priority – T	3.52×10^{-4}	0.18	0.57
Traffic signals – cross	3.15×10^{-4}	0.52	0.19
Traffic signals – T	4.41×10^{-2}	0.37	-0.10

Existing (Mobile Road)	Q1 (Major)	Q2 (Minor)	b0	b1	b2	(Crash Compendium)
Int. 1	15,360	4,363	3.52E-04	0.18	0.57	
Int. 2	4,363	764	3.52E-04	0.18	0.57	
Int. 3	4,363	2,496	3.74E-04	0.39	0.50	
Int. 4	4,363	3,177	3.52E-04	0.18	0.57	
Int. 5	4,363	1,336	3.74E-04	0.39	0.50	

$A_T = b_0 \times Q_{Major}^{b1} \times Q_{Minor}^{b2}$

ROAD NAME	ROAD HIERARCHY	LANES	SPEED (KM/H)	ADT
Port Marsden Highway	Arterial	2	100	4,363
Marsden Point Road	Arterial	2	70	3,177
One Tree Point Road	Primary Collector	2	100	2,496
Marsden Bay Drive	Primary Collector	2	100	1,336
Rama Road	Primary Collector	2	100	281
Salle Road	Secondary Collector	2	100	764
McCathie Road	Secondary Collector	2	100	764
Mair Road	Secondary Collector	2	100	281

Source: NZTA ONRC Map, 2019

Difference in peak between Port and no port expansion for both AM & PM at 2033	Q1 (Major)	Q2 (Minor)	A_T (EXISTING)	A_T (NEW)	NEW 5-yr	EXISTING 5-yr	Increase (yearly)
Int. 1	-56	23.6	0.4	0.4	2	2.06	0.00
Int. 2	42	-16.8	0.1	0.1	1	0.67	0.00
Int. 3	87	-99	1.1	1.1	5	5.34	-0.005
Int. 4	144	96	0.3	0.3	2	1.52	0.00
Int. 5	140	73.2	0.8	0.8	4	3.91	0.013
			2.70	2.71			
				diff existing actual and rate per year		-2.10	0.01

Notes:

(1) Actual crash numbers are lower than estimated typical rates (by 2.10 crashes per year across all 5 interssections)

(2) Port expansion induced traffic will increases total crash rate by 0.01 crashes every year across the network (is sum of all 5 intersections)

Typical Calculated (A_T)/Actual Crash Factor 4.5

Assumption
1. PMH: 6% growth/annum for 15 yrs (2018 to 2033) based on Stantec historic growth model
2. SH1: 2% growth based on Whangarei growth
3. Side roads on PMH - assumes 6% growth
4. Applied 3% growth from 2033 to 2040 for 7 yrs
5. Only the AM & PM peak volumes were added to base volumes to assess demand in different years
6. Berth 0 traffic corresponds to approximately 3% of PMH traffic at Year 2033 and 2040 (as highlighed below in yellow)

2018	2033	2040
4,363	10,456	12,860
Additional Port Traffic	488	806
Total with Full Port	**10,944**	**13,666**
Capacity of Urban Regional Arterial (Single lane - bothway)		**15K to 18K**
At Year 2040 - PMH operates within capacity		

		Trips/day	%
	300 staff	428	
PMH	4,363		10%
Total Northport vs Total Traffic on PMH	2806		64%
Yr 2040 - 100 additional staff	100 staff	142	
Total staff increase from 2018 vs 2040 to total Northport traffic Increase	806		18%

2017 growth study

	2013	2023	2043
Marsden/Ruakaka	3456	5514	8348
Total	74649	81016	98852

2020 growth study

	2018	Interpolated 2033	2043	2051
Marsden/Ruakaka	4302	*8416*	11159	13140
Total	93700	*115694*	130357	141448

Year	**2018**	**2033**	15
Value	4302	8416	4114
		Growth/yr	274
		%age	6%

Year	**2033**	**2040**
Total Port Traffic	3,294	3,612
	30.10%	26.43%
Change b/w PMH traffic reduction with Berth 0 and without Berth 0	**3.4%**	**2.9%**

Estimated Resident Population (ERP)

export reset

Whangarei District Council

Year (ending June 30)	Number	Change in number	Change in percent
1996	68,400	--	--
1997	69,000	+600	+0.9
1998	69,700	+700	+1.0
1999	69,800	+100	+0.1
2000	70,000	+200	+0.3
2001	70,000	--	--
2002	71,300	+1,300	+1.8
2003	72,700	+1,400	+1.9
2004	74,100	+1,400	+1.9
2005	75,300	+1,200	+1.6
2006	76,500	+1,200	+1.6
2007	77,800	+1,300	+1.7
2008	78,800	+1,000	+1.3
2009	79,900	+1,100	+1.4
2010	81,200	+1,300	+1.6
2011	82,100	+900	+1.1
2012	82,800	+700	+0.8
2013	83,700	+900	+1.1
2014	85,400	+1,700	+2.0
2015	87,200	+1,800	+2.1
2016	89,300	+2,100	+2.4
2017	91,800	+2,500	+2.7
2018	94,100	+2,300	+2.4
2019	96,000	+1,900	+2.0
2020	98,300	+2,300	+2.3

Source: Statistics New Zealand, Subnational Population Estimates - information releases for June 30th June 2020. Compiled and presented in profile.id by .id (informed decisions).

Appendix B
SIDRA Model Results

Option (Full Port Expansion)

2033 AM Results – SH1/SH15 Intersection

MOVEMENT SUMMARY

Site: 102 [SH1_SH15 RAB_AM_2033_Port Expansion (Site Folder: General)]

New Site
Site Category: (None)
Roundabout
Flow Scale Analysis: Constant Scale Factor = 97.0 %

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1 (S)														
2	T1	507	15.0	518	15.0	0.683	9.6	LOS A	8.6	68.2	0.94	0.93	1.15	59.2
3	R2	202	15.0	206	15.0	0.683	17.5	LOS B	8.6	68.2	0.94	0.93	1.15	56.9
Approach		709	15.0	724	15.0	0.683	11.9	LOS B	8.6	68.2	0.94	0.93	1.15	58.6
East: SH 15 (E)														
4	L2	170	16.0	174	16.0	0.579	7.1	LOS A	5.6	44.9	0.80	0.80	0.86	56.2
6	R2	483	16.0	493	16.0	0.579	14.9	LOS B	5.6	44.9	0.80	0.80	0.86	56.3
Approach		653	16.0	667	16.0	0.579	12.9	LOS B	5.6	44.9	0.80	0.80	0.86	56.3
North: SH 1 (N)														
7	L2	406	15.0	415	15.0	0.608	5.2	LOS A	6.2	49.3	0.68	0.51	0.68	60.5
8	T1	410	15.0	419	15.0	0.608	5.2	LOS A	6.2	49.3	0.68	0.51	0.68	63.5
Approach		816	15.0	833	15.0	0.608	5.2	LOS A	6.2	49.3	0.68	0.51	0.68	62.0
All Vehicles		2178	15.3	2224	15.3	0.683	9.7	LOS A	8.6	68.2	0.80	0.73	0.89	59.0

2033 PM Results – SH1/SH15 Intersection

MOVEMENT SUMMARY

Site: 102 [SH1_SH15 RAB_PM_2033_Port Expansion (Site Folder: General)]

New Site
Site Category: (None)
Roundabout
Flow Scale Analysis: Constant Scale Factor = 97.0 %

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1 (S)														
2	T1	476	15.0	486	15.0	0.615	8.9	LOS A	6.9	54.6	0.93	0.86	1.08	59.8
3	R2	128	15.0	131	15.0	0.615	16.7	LOS B	6.9	54.6	0.93	0.86	1.08	57.5
Approach		604	15.0	617	15.0	0.615	10.6	LOS B	6.9	54.6	0.93	0.86	1.08	59.3
East: SH 15 (E)														
4	L2	198	16.0	202	16.0	0.668	9.4	LOS A	8.0	63.6	0.89	0.92	1.09	55.0
6	R2	521	16.0	532	16.0	0.668	17.2	LOS B	8.0	63.6	0.89	0.92	1.09	55.0
Approach		719	16.0	734	16.0	0.668	15.1	LOS B	8.0	63.6	0.89	0.92	1.09	55.0
North: SH 1 (N)														
7	L2	367	15.0	375	15.0	0.586	4.6	LOS A	6.2	49.0	0.55	0.45	0.55	61.2
8	T1	483	15.0	493	15.0	0.586	4.7	LOS A	6.2	49.0	0.55	0.45	0.55	64.3
Approach		850	15.0	868	15.0	0.586	4.7	LOS A	6.2	49.0	0.55	0.45	0.55	62.9
All Vehicles		2173	15.3	2219	15.3	0.668	9.8	LOS A	8.0	63.6	0.77	0.72	0.88	59.1

2033 AM Results – SH15/Salle Road Intersection

MOVEMENT SUMMARY

▽ Site: 101v [SH15_Salle Rd_AM_2033_Port Expansion (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)
Flow Scale Analysis: Constant Scale Factor = 97.0 %

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Salle Road														
21	L2	148	8.0	151	8.0	0.178	9.2	LOS A	0.7	5.2	0.55	0.79	0.55	54.9
23	R2	1	8.0	1	8.0	0.178	26.2	LOS D	0.7	5.2	0.55	0.79	0.55	54.5
Approach		149	8.0	152	8.0	0.178	9.3	LOS A	0.7	5.2	0.55	0.79	0.55	54.9
NorthEast: SH15 (NE)														
24	L2	1	16.0	1	16.0	0.291	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	56.2
25	T1	503	16.0	514	16.0	0.291	5.4	LOS A	0.0	0.0	0.00	0.57	0.00	56.7
Approach		504	16.0	515	16.0	0.291	5.4	NA	0.0	0.0	0.00	0.57	0.00	56.7
SouthWest: SH15 (SW)														
31	T1	447	16.0	456	16.0	0.352	5.4	LOS A	0.0	0.0	0.00	0.58	0.00	56.4
32	R2	153	16.0	156	16.0	0.352	6.5	LOS A	0.0	0.0	0.00	0.58	0.00	55.5
Approach		600	16.0	613	16.0	0.352	5.7	NA	0.0	0.0	0.00	0.58	0.00	56.2
All Vehicles		1253	15.0	1279	15.0	0.352	6.0	NA	0.7	5.2	0.06	0.60	0.06	56.2

2033 PM Results – SH15/Salle Road Intersection

MOVEMENT SUMMARY

▽ Site: 101v [SH15_Salle Rd_PM_2033_Port Expansion (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)
Flow Scale Analysis: Constant Scale Factor = 97.0 %

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Salle Road														
21	L2	163	8.0	166	8.0	0.209	9.7	LOS A	0.8	6.1	0.57	0.82	0.57	54.6
23	R2	1	8.0	1	8.0	0.209	23.4	LOS C	0.8	6.1	0.57	0.82	0.57	54.1
Approach		164	8.0	167	8.0	0.209	9.8	LOS A	0.8	6.1	0.57	0.82	0.57	54.6
NorthEast: SH15 (NE)														
24	L2	1	16.0	1	16.0	0.317	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	56.2
25	T1	548	16.0	560	16.0	0.317	5.4	LOS A	0.0	0.0	0.00	0.57	0.00	56.7
Approach		549	16.0	561	16.0	0.317	5.4	NA	0.0	0.0	0.00	0.57	0.00	56.7
SouthWest: SH15 (SW)														
31	T1	373	16.0	381	16.0	0.290	5.4	LOS A	0.0	0.0	0.00	0.58	0.00	56.5
32	R2	122	16.0	125	16.0	0.290	6.5	LOS A	0.0	0.0	0.00	0.58	0.00	55.5
Approach		495	16.0	505	16.0	0.290	5.7	NA	0.0	0.0	0.00	0.58	0.00	56.2
All Vehicles		1208	14.9	1233	14.9	0.317	6.1	NA	0.8	6.1	0.08	0.61	0.08	56.2

2033 AM Results – SH15/One Tree Point Road Intersection

MOVEMENT SUMMARY

Site: 102 [Mccathie and One Tree Road Intersection_AM_2033_Port Expansion (Site Folder: General)]

New Site
Site Category: Existing Design
Stop (Two-Way)
Flow Scale Analysis: Constant Scale Factor = 97.0 %

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Mccathie Road														
1	L2	7	8.0	7	8.0	0.094	9.6	LOS A	0.3	2.5	0.53	0.96	0.53	50.7
2	T1	1	8.0	1	8.0	0.094	21.0	LOS C	0.3	2.5	0.53	0.96	0.53	50.7
3	R2	27	8.0	28	8.0	0.094	17.9	LOS C	0.3	2.5	0.53	0.96	0.53	50.8
Approach		35	8.0	36	8.0	0.094	16.3	LOS C	0.3	2.5	0.53	0.96	0.53	50.7
East: SH 15 (E) to SH1														
4	L2	44	16.0	45	16.0	0.027	6.6	LOS A	0.0	0.0	0.00	0.61	0.00	55.3
5	T1	137	16.0	140	16.0	0.080	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	70.0
6	R2	22	16.0	22	16.0	0.024	8.8	LOS A	0.1	0.8	0.52	0.68	0.52	53.1
Approach		203	16.0	207	16.0	0.080	2.4	NA	0.1	0.8	0.06	0.21	0.06	64.1
North: One Tree Point Road														
7	L2	7	8.0	7	8.0	0.811	19.0	LOS C	7.2	53.8	0.84	1.36	2.16	46.6
8	T1	22	8.0	22	8.0	0.811	24.3	LOS C	7.2	53.8	0.84	1.36	2.16	46.6
9	R2	360	8.0	368	8.0	0.811	23.0	LOS C	7.2	53.8	0.84	1.36	2.16	46.4
Approach		389	8.0	397	8.0	0.811	23.0	LOS C	7.2	53.8	0.84	1.36	2.16	46.4
West: SH 15 (W) to Port														
10	L2	174	16.0	178	16.0	0.282	6.6	LOS A	0.1	0.5	0.01	0.23	0.01	58.7
11	T1	297	16.0	303	16.0	0.282	0.0	LOS A	0.1	0.5	0.01	0.23	0.01	66.9
12	R2	4	16.0	4	16.0	0.282	7.8	LOS A	0.1	0.5	0.01	0.23	0.01	58.6
Approach		475	16.0	485	16.0	0.282	2.5	NA	0.1	0.5	0.01	0.23	0.01	63.6
All Vehicles		1102	12.9	1125	12.9	0.811	10.1	NA	7.2	53.8	0.33	0.65	0.79	55.9

2033 PM Results – SH15/One Tree Point Road Intersection

MOVEMENT SUMMARY

Site: 102 [Mccathie and One Tree Road Intersection_PM_2033_Port Expansion (Site Folder: General)]

New Site
Site Category: Existing Design
Stop (Two-Way)
Flow Scale Analysis: Constant Scale Factor = 97.0 %

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Mccathie Road														
1	L2	6	8.0	6	8.0	0.087	10.4	LOS B	0.3	2.4	0.55	0.96	0.55	51.7
2	T1	1	8.0	1	8.0	0.087	20.7	LOS C	0.3	2.4	0.55	0.96	0.55	51.7
3	R2	29	8.0	30	8.0	0.087	15.8	LOS C	0.3	2.4	0.55	0.96	0.55	51.7
Approach		36	8.0	37	8.0	0.087	15.0	LOS C	0.3	2.4	0.55	0.96	0.55	51.7
East: SH 15 (E) to SH1														
4	L2	14	16.0	14	16.0	0.009	6.6	LOS A	0.0	0.0	0.00	0.61	0.00	55.3
5	T1	242	16.0	247	16.0	0.140	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
6	R2	8	16.0	8	16.0	0.008	8.2	LOS A	0.0	0.3	0.47	0.62	0.47	53.5
Approach		264	16.0	270	16.0	0.140	0.6	NA	0.0	0.3	0.01	0.05	0.01	68.3
North: One Tree Point Road														
7	L2	1	8.0	1	8.0	0.691	13.8	LOS B	4.7	35.4	0.75	1.21	1.49	49.2
8	T1	14	8.0	14	8.0	0.691	19.3	LOS C	4.7	35.4	0.75	1.21	1.49	49.2
9	R2	329	8.0	336	8.0	0.691	18.7	LOS C	4.7	35.4	0.75	1.21	1.49	48.9
Approach		344	8.0	351	8.0	0.691	18.7	LOS C	4.7	35.4	0.75	1.21	1.49	49.0
West: SH 15 (W) to Port														
10	L2	238	16.0	243	16.0	0.242	6.6	LOS A	0.1	0.6	0.02	0.37	0.02	57.4
11	T1	160	16.0	163	16.0	0.242	0.1	LOS A	0.1	0.6	0.02	0.37	0.02	65.1
12	R2	4	16.0	4	16.0	0.242	8.4	LOS A	0.1	0.6	0.02	0.37	0.02	57.2
Approach		402	16.0	410	16.0	0.242	4.0	NA	0.1	0.6	0.02	0.37	0.02	60.2
All Vehicles		1046	13.1	1068	13.1	0.691	8.4	NA	4.7	35.4	0.28	0.58	0.52	57.3

2033 AM Results – SH15/Marsden Point Road Intersection

MOVEMENT SUMMARY

Site: 101 [SH15_Marsden Point Rd_AM_2033_Port Expansion (Site Folder: General)]

New Site
Site Category: (None)
Stop (Two-Way)
Flow Scale Analysis: Constant Scale Factor = 97.0 %

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Marsden Point Rd														
21	L2	1	8.0	1	8.0	0.001	7.0	LOS A	0.0	0.0	0.00	0.57	0.00	58.8
23	R2	354	8.0	361	8.0	0.816	29.6	LOS D	8.8	65.5	0.88	1.44	2.42	43.1
Approach		355	8.0	362	8.0	0.816	29.5	LOS D	8.8	65.5	0.88	1.43	2.41	43.1
NorthEast: SH15 (NE) to Port														
24	L2	183	16.0	187	16.0	0.112	6.9	LOS A	0.0	0.0	0.00	0.56	0.00	56.7
25	T1	159	16.0	162	16.0	0.092	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach		342	16.0	349	16.0	0.112	3.7	NA	0.0	0.0	0.00	0.30	0.00	62.1
SouthWest: SH15 (SW) to SH 1														
31	T1	305	16.0	311	16.0	0.176	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
32	R2	1	16.0	1	16.0	0.001	8.3	LOS A	0.0	0.0	0.43	0.56	0.43	53.9
Approach		306	16.0	312	16.0	0.176	0.1	NA	0.0	0.0	0.00	0.00	0.00	69.8
All Vehicles		1003	13.2	1024	13.2	0.816	11.7	NA	8.8	65.5	0.31	0.61	0.86	55.4

2033 PM Results – SH15/Marsden Point Road Intersection

MOVEMENT SUMMARY

Site: 101 [SH15_Marsden Point Rd_PM_2033_Port Expansion (Site Folder: General)]

New Site
Site Category: (None)
Stop (Two-Way)
Flow Scale Analysis: Constant Scale Factor = 97.0 %

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Marsden Point Rd														
21	L2	1	8.0	1	8.0	0.001	7.2	LOS A	0.0	0.0	0.00	0.57	0.00	58.8
23	R2	196	8.0	200	8.0	0.486	20.2	LOS C	2.7	20.1	0.75	1.11	1.13	48.3
Approach		197	8.0	201	8.0	0.486	20.1	LOS C	2.7	20.1	0.75	1.11	1.13	48.3
NorthEast: SH15 (NE) to Port														
24	L2	399	16.0	407	16.0	0.244	6.9	LOS A	0.0	0.0	0.00	0.56	0.00	56.7
25	T1	249	16.0	254	16.0	0.144	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach		648	16.0	662	16.0	0.244	4.3	NA	0.0	0.0	0.00	0.35	0.00	61.1
SouthWest: SH15 (SW) to SH 1														
31	T1	161	16.0	164	16.0	0.093	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
32	R2	1	16.0	1	16.0	0.002	11.0	LOS B	0.0	0.1	0.58	0.64	0.58	51.8
Approach		162	16.0	165	16.0	0.093	0.1	NA	0.0	0.1	0.00	0.00	0.00	69.8
All Vehicles		1007	14.4	1028	14.4	0.486	6.7	NA	2.7	20.1	0.15	0.44	0.22	59.2

2033 AM Results – SH15/Marsden Drive Intersection

MOVEMENT SUMMARY

Site: 102 [Marsden Bay Drive and Rama Road Intersection_AM_2033_Port Expansion (Site Folder: General)]

New Site
Site Category: Existing Design
Stop (Two-Way)
Flow Scale Analysis: Constant Scale Factor = 97.0 %

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Rama Road														
1	L2	1	8.0	1	8.0	0.001	7.5	LOS A	0.0	0.0	0.00	0.57	0.00	58.8
2	T1	3	8.0	3	8.0	0.023	27.5	LOS D	0.1	0.6	0.84	1.00	0.84	43.7
3	R2	1	8.0	1	8.0	0.023	32.0	LOS D	0.1	0.6	0.84	1.00	0.84	43.6
Approach		5	8.0	5	8.0	0.023	24.4	LOS C	0.1	0.6	0.67	0.91	0.67	46.1
East: SH 15 (E) to SH1														
4	L2	1	16.0	1	16.0	0.001	6.9	LOS A	0.0	0.0	0.00	0.56	0.00	56.8
5	T1	238	16.0	243	16.0	0.170	1.0	LOS A	0.5	3.7	0.19	0.07	0.19	67.5
6	R2	25	16.0	26	16.0	0.170	11.4	LOS B	0.5	3.7	0.19	0.07	0.19	58.9
Approach		264	16.0	270	16.0	0.170	2.0	NA	0.5	3.7	0.19	0.07	0.19	66.5
North: Marsden Bay Drive														
7	L2	154	4.0	157	4.0	0.257	13.9	LOS B	1.0	7.6	0.64	1.02	0.70	53.4
8	T1	17	4.0	17	4.0	0.908	69.0	LOS F	7.2	52.3	0.98	1.48	3.12	29.9
9	R2	154	4.0	157	4.0	0.908	68.5	LOS F	7.2	52.3	0.98	1.48	3.12	29.8
Approach		325	4.0	332	4.0	0.908	42.7	LOS E	7.2	52.3	0.82	1.26	1.97	37.7
West: SH 15 (W) to Port														
10	L2	34	16.0	35	16.0	0.372	6.7	LOS A	0.0	0.0	0.00	0.03	0.00	60.6
11	T1	607	16.0	620	16.0	0.372	0.1	LOS A	0.0	0.0	0.00	0.03	0.00	69.3
12	R2	1	16.0	1	16.0	0.001	7.6	LOS A	0.0	0.0	0.36	0.52	0.36	54.5
Approach		642	16.0	656	16.0	0.372	0.5	NA	0.0	0.0	0.00	0.03	0.00	68.7
All Vehicles		1236	12.8	1262	12.8	0.908	12.0	NA	7.2	52.3	0.26	0.37	0.56	56.1

2033 PM Results – SH15/Marsden Drive Intersection

MOVEMENT SUMMARY

Site: 102 [Marsden Bay Drive and Rama Road Intersection_PM_2033_Port Expansion (Site Folder: General)]

New Site
Site Category: Existing Design
Stop (Two-Way)
Flow Scale Analysis: Constant Scale Factor = 97.0 %

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Rama Road														
1	L2	59	8.0	60	8.0	0.032	8.2	LOS A	0.0	0.0	0.00	0.57	0.00	58.8
2	T1	19	8.0	19	8.0	0.123	30.3	LOS D	0.4	2.8	0.86	1.00	0.86	43.0
3	R2	1	8.0	1	8.0	0.123	27.3	LOS D	0.4	2.8	0.86	1.00	0.86	42.8
Approach		79	8.0	81	8.0	0.123	13.7	LOS B	0.4	2.8	0.22	0.68	0.22	53.8
East: SH 15 (E) to SH1														
4	L2	1	16.0	1	16.0	0.001	6.9	LOS A	0.0	0.0	0.00	0.56	0.00	56.8
5	T1	529	16.0	540	16.0	0.453	1.5	LOS A	2.9	23.3	0.37	0.18	0.46	65.8
6	R2	168	16.0	172	16.0	0.453	9.6	LOS A	2.9	23.3	0.37	0.18	0.46	57.6
Approach		698	16.0	713	16.0	0.453	3.4	NA	2.9	23.3	0.37	0.18	0.46	63.6
North: Marsden Bay Drive														
7	L2	32	4.0	33	4.0	0.032	10.0	LOS A	0.1	0.9	0.38	0.86	0.38	56.2
8	T1	1	4.0	1	4.0	0.360	40.0	LOS E	1.3	9.4	0.92	1.04	1.10	37.5
9	R2	46	4.0	47	4.0	0.360	43.6	LOS E	1.3	9.4	0.92	1.04	1.10	37.4
Approach		79	4.0	81	4.0	0.360	29.9	LOS D	1.3	9.4	0.70	0.97	0.81	43.3
West: SH 15 (W) to Port														
10	L2	76	16.0	78	16.0	0.204	6.6	LOS A	0.0	0.0	0.00	0.14	0.00	59.7
11	T1	272	16.0	278	16.0	0.204	0.0	LOS A	0.0	0.0	0.00	0.14	0.00	68.1
12	R2	1	16.0	1	16.0	0.001	9.4	LOS A	0.0	0.0	0.55	0.58	0.55	53.7
Approach		349	16.0	356	16.0	0.204	1.5	NA	0.0	0.0	0.00	0.14	0.00	66.0
All Vehicles		1205	14.7	1230	14.7	0.453	5.3	NA	2.9	23.3	0.27	0.25	0.34	61.6

2040 AM Results – SH1/SH15 Intersection (21% Growth)

MOVEMENT SUMMARY

Site: 102 [SH1_SH15 RAB_AM_2040_Port Expansion (Site Folder: General)]

New Site
Site Category: (None)
Roundabout
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1 (S)														
2	T1	507	15.0	626	15.0	0.965	38.1	LOS D	33.1	261.4	1.00	1.67	2.81	41.8
3	R2	202	15.0	250	15.0	0.965	46.0	LOS D	33.1	261.4	1.00	1.67	2.81	40.6
Approach		709	15.0	876	15.0	0.965	40.4	LOS D	33.1	261.4	1.00	1.67	2.81	41.4
East: SH 15 (E)														
4	L2	170	16.0	210	16.0	0.785	12.6	LOS B	12.7	101.0	1.00	1.05	1.40	52.5
6	R2	483	16.0	597	16.0	0.785	20.5	LOS C	12.7	101.0	1.00	1.05	1.40	52.6
Approach		653	16.0	807	16.0	0.785	18.4	LOS B	12.7	101.0	1.00	1.05	1.40	52.6
North: SH 1 (N)														
7	L2	406	15.0	502	15.0	0.769	7.3	LOS A	11.4	90.3	0.89	0.71	0.98	59.3
8	T1	410	15.0	507	15.0	0.769	7.3	LOS A	11.4	90.3	0.89	0.71	0.98	62.1
Approach		816	15.0	1008	15.0	0.769	7.3	LOS A	11.4	90.3	0.89	0.71	0.98	60.7
All Vehicles		2178	15.3	2691	15.3	0.965	21.4	LOS C	33.1	261.4	0.96	1.13	1.70	50.6

2040 PM Results – SH1/SH15 Intersection (21% Growth)

MOVEMENT SUMMARY

Site: 102 [SH1_SH15 RAB_PM_2040_Port Expansion (Site Folder: General)]

New Site
Site Category: (None)
Roundabout
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: SH1 (S)														
2	T1	476	15.0	588	15.0	0.875	23.0	LOS C	18.8	148.8	1.00	1.31	1.92	50.1
3	R2	128	15.0	158	15.0	0.875	30.8	LOS C	18.8	148.8	1.00	1.31	1.92	48.5
Approach		604	15.0	746	15.0	0.875	24.7	LOS C	18.8	148.8	1.00	1.31	1.92	49.8
East: SH 15 (E)														
4	L2	198	16.0	245	16.0	0.925	27.7	LOS C	25.8	205.1	1.00	1.47	2.32	43.8
6	R2	521	16.0	644	16.0	0.925	35.6	LOS D	25.8	205.1	1.00	1.47	2.32	43.8
Approach		719	16.0	888	16.0	0.925	33.4	LOS C	25.8	205.1	1.00	1.47	2.32	43.8
North: SH 1 (N)														
7	L2	367	15.0	453	15.0	0.730	5.2	LOS A	9.5	75.0	0.74	0.50	0.74	60.0
8	T1	483	15.0	597	15.0	0.730	5.2	LOS A	9.5	75.0	0.74	0.50	0.74	63.0
Approach		850	15.0	1050	15.0	0.730	5.2	LOS A	9.5	75.0	0.74	0.50	0.74	61.7
All Vehicles		2173	15.3	2685	15.3	0.925	19.9	LOS B	25.8	205.1	0.90	1.05	1.59	51.2

2040 AM Results – SH15/Salle Road Intersection (21% Growth)

MOVEMENT SUMMARY

▽ Site: 101v [SH15_Salle Rd_AM_2040_Port Expansion (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Salle Road														
21	L2	148	8.0	183	8.0	0.259	10.6	LOS B	1.1	7.9	0.61	0.86	0.67	53.8
23	R2	1	8.0	1	8.0	0.259	44.2	LOS E[11]	1.1	7.9	0.61	0.86	0.67	53.3
Approach		149	8.0	184	8.0	0.259	10.8	LOS B	1.1	7.9	0.61	0.86	0.67	53.8
NorthEast: SH15 (NE)														
24	L2	1	16.0	1	16.0	0.353	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	56.1
25	T1	503	16.0	621	16.0	0.353	5.4	LOS A	0.0	0.0	0.00	0.57	0.00	56.7
Approach		504	16.0	623	16.0	0.353	5.4	NA	0.0	0.0	0.00	0.57	0.00	56.7
SouthWest: SH15 (SW)														
31	T1	447	16.0	552	16.0	0.426	5.5	LOS A	0.0	0.0	0.00	0.58	0.00	56.4
32	R2	153	16.0	189	16.0	0.426	6.5	LOS A	0.0	0.0	0.00	0.58	0.00	55.5
Approach		600	16.0	741	16.0	0.426	5.7	NA	0.0	0.0	0.00	0.58	0.00	56.1
All Vehicles		1253	15.0	1548	15.0	0.426	6.2	NA	1.1	7.9	0.07	0.61	0.08	56.0

2040 PM Results – SH15/Salle Road Intersection (21% Growth)

MOVEMENT SUMMARY

▽ Site: 101v [SH15_Salle Rd_PM_2040_Port Expansion (Site Folder: General)]

New Site
Site Category: (None)
Give-Way (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Salle Road														
21	L2	163	8.0	201	8.0	0.309	11.6	LOS B	1.3	10.0	0.66	0.90	0.79	53.0
23	R2	1	8.0	1	8.0	0.309	37.6	LOS E[11]	1.3	10.0	0.66	0.90	0.79	52.6
Approach		164	8.0	203	8.0	0.309	11.8	LOS B	1.3	10.0	0.66	0.90	0.79	53.0
NorthEast: SH15 (NE)														
24	L2	1	16.0	1	16.0	0.384	6.7	LOS A	0.0	0.0	0.00	0.57	0.00	56.1
25	T1	548	16.0	677	16.0	0.384	5.4	LOS A	0.0	0.0	0.00	0.57	0.00	56.6
Approach		549	16.0	678	16.0	0.384	5.4	NA	0.0	0.0	0.00	0.57	0.00	56.6
SouthWest: SH15 (SW)														
31	T1	373	16.0	461	16.0	0.351	5.4	LOS A	0.0	0.0	0.00	0.58	0.00	56.4
32	R2	122	16.0	151	16.0	0.351	6.5	LOS A	0.0	0.0	0.00	0.58	0.00	55.5
Approach		495	16.0	612	16.0	0.351	5.7	NA	0.0	0.0	0.00	0.58	0.00	56.2
All Vehicles		1208	14.9	1492	14.9	0.384	6.4	NA	1.3	10.0	0.09	0.62	0.11	55.9

2040 AM Results – SH15/One Tree Point Road Intersection (21% Growth)

MOVEMENT SUMMARY

Site: 102 [Mccathie and One Tree Road Intersection_AM_2040_Port Expansion (Site Folder: General)]

New Site
Site Category: Existing Design
Stop (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Mccathie Road														
1	L2	7	8.0	9	8.0	0.145	9.8	LOS A	0.5	3.8	0.62	0.96	0.62	48.7
2	T1	1	8.0	1	8.0	0.145	27.5	LOS D	0.5	3.8	0.62	0.96	0.62	48.7
3	R2	27	8.0	33	8.0	0.145	21.7	LOS C	0.5	3.8	0.62	0.96	0.62	48.7
Approach		35	8.0	43	8.0	0.145	19.5	LOS C	0.5	3.8	0.62	0.96	0.62	48.7
East: SH 15 (E) to SH1														
4	L2	44	16.0	54	16.0	0.033	6.6	LOS A	0.0	0.0	0.00	0.61	0.00	55.3
5	T1	137	16.0	169	16.0	0.097	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
6	R2	22	16.0	27	16.0	0.034	9.7	LOS A	0.1	1.1	0.57	0.73	0.57	52.4
Approach		203	16.0	251	16.0	0.097	2.5	NA	0.1	1.1	0.06	0.21	0.06	63.9
North: One Tree Point Road														
7	L2	7	8.0	9	8.0	1.183	188.5	LOS F[11]	56.9	425.4	1.00	3.92	12.37	14.6
8	T1	22	8.0	27	8.0	1.183	195.1	LOS F[11]	56.9	425.4	1.00	3.92	12.37	14.6
9	R2	360	8.0	445	8.0	1.183	193.6	LOS F[11]	56.9	425.4	1.00	3.92	12.37	14.5
Approach		389	8.0	481	8.0	1.183	193.6	LOS F[11]	56.9	425.4	1.00	3.92	12.37	14.5
West: SH 15 (W) to Port														
10	L2	174	16.0	215	16.0	0.342	6.6	LOS A	0.1	0.7	0.01	0.23	0.01	58.7
11	T1	297	16.0	367	16.0	0.342	0.0	LOS A	0.1	0.7	0.01	0.23	0.01	66.9
12	R2	4	16.0	5	16.0	0.342	8.3	LOS A	0.1	0.7	0.01	0.23	0.01	58.6
Approach		475	16.0	587	16.0	0.342	2.5	NA	0.1	0.7	0.01	0.23	0.01	63.6
All Vehicles		1102	12.9	1361	12.9	1.183	70.5	NA	56.9	425.4	0.39	1.55	4.40	28.9

2040 PM Results – SH15/One Tree Point Road Intersection (21% Growth)

MOVEMENT SUMMARY

Site: 102 [Mccathie and One Tree Road Intersection_PM_2040_Port Expansion (Site Folder: General)]

New Site
Site Category: Existing Design
Stop (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Mccathie Road														
1	L2	6	8.0	7	8.0	0.127	10.8	LOS B	0.5	3.4	0.62	0.98	0.62	50.1
2	T1	1	8.0	1	8.0	0.127	26.8	LOS D	0.5	3.4	0.62	0.98	0.62	50.1
3	R2	29	8.0	36	8.0	0.127	18.4	LOS C	0.5	3.4	0.62	0.98	0.62	50.1
Approach		36	8.0	44	8.0	0.127	17.4	LOS C	0.5	3.4	0.62	0.98	0.62	50.1
East: SH 15 (E) to SH1														
4	L2	14	16.0	17	16.0	0.010	6.6	LOS A	0.0	0.0	0.00	0.61	0.00	55.3
5	T1	242	16.0	299	16.0	0.169	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
6	R2	8	16.0	10	16.0	0.011	8.8	LOS A	0.0	0.3	0.52	0.65	0.52	53.1
Approach		264	16.0	326	16.0	0.169	0.7	NA	0.0	0.3	0.02	0.05	0.02	68.3
North: One Tree Point Road														
7	L2	1	8.0	1	8.0	0.992	47.9	LOS E[11]	18.8	140.3	0.99	2.13	5.32	32.9
8	T1	14	8.0	17	8.0	0.992	56.5	LOS F[11]	18.8	140.3	0.99	2.13	5.32	32.9
9	R2	329	8.0	406	8.0	0.992	55.8	LOS F[11]	18.8	140.3	0.99	2.13	5.32	32.8
Approach		344	8.0	425	8.0	0.992	55.8	LOS F[11]	18.8	140.3	0.99	2.13	5.32	32.8
West: SH 15 (W) to Port														
10	L2	238	16.0	294	16.0	0.294	6.6	LOS A	0.1	0.8	0.02	0.37	0.02	57.4
11	T1	160	16.0	198	16.0	0.294	0.1	LOS A	0.1	0.8	0.02	0.37	0.02	65.1
12	R2	4	16.0	5	16.0	0.294	9.1	LOS A	0.1	0.8	0.02	0.37	0.02	57.2
Approach		402	16.0	497	16.0	0.294	4.1	NA	0.1	0.8	0.02	0.37	0.02	60.2
All Vehicles		1046	13.1	1292	13.1	0.992	20.7	NA	18.8	140.3	0.36	0.89	1.78	48.1

2040 AM Results – SH15/Marsden Point Road Intersection (21% Growth)

MOVEMENT SUMMARY

Site: 101 [SH15_Marsden Point Rd_AM_2040_Port Expansion (Site Folder: General)]

New Site
Site Category: (None)
Stop (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Marsden Point Rd														
21	L2	1	8.0	1	8.0	0.001	7.1	LOS A	0.0	0.0	0.00	0.57	0.00	58.8
23	R2	354	8.0	437	8.0	1.226	238.7	LOS F[11]	61.9	462.7	1.00	3.93	12.13	12.3
Approach		355	8.0	439	8.0	1.226	238.0	LOS F[11]	61.9	462.7	1.00	3.92	12.09	12.4
NorthEast: SH15 (NE) to Port														
24	L2	183	16.0	226	16.0	0.136	6.9	LOS A	0.0	0.0	0.00	0.56	0.00	56.7
25	T1	159	16.0	196	16.0	0.111	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach		342	16.0	423	16.0	0.136	3.7	NA	0.0	0.0	0.00	0.30	0.00	62.1
SouthWest: SH15 (SW) to SH 1														
31	T1	305	16.0	377	16.0	0.213	0.1	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
32	R2	1	16.0	1	16.0	0.002	8.8	LOS A	0.0	0.0	0.47	0.58	0.47	53.5
Approach		306	16.0	378	16.0	0.213	0.1	NA	0.0	0.0	0.00	0.00	0.00	69.8
All Vehicles		1003	13.2	1239	13.2	1.226	85.5	NA	61.9	462.7	0.35	1.49	4.28	26.0

2040 PM Results – SH15/Marsden Point Road Intersection (21% Growth)

MOVEMENT SUMMARY

Site: 101 [SH15_Marsden Point Rd_PM_2040_Port Expansion (Site Folder: General)]

New Site
Site Category: (None)
Stop (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Marsden Point Rd														
21	L2	1	8.0	1	8.0	0.001	7.3	LOS A	0.0	0.0	0.00	0.57	0.00	58.8
23	R2	196	8.0	242	8.0	0.741	31.9	LOS D	5.4	40.1	0.90	1.28	1.99	41.9
Approach		197	8.0	243	8.0	0.741	31.8	LOS D	5.4	40.1	0.89	1.28	1.98	42.0
NorthEast: SH15 (NE) to Port														
24	L2	399	16.0	493	16.0	0.296	6.9	LOS A	0.0	0.0	0.00	0.56	0.00	56.6
25	T1	249	16.0	308	16.0	0.174	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach		648	16.0	801	16.0	0.296	4.3	NA	0.0	0.0	0.00	0.35	0.00	61.0
SouthWest: SH15 (SW) to SH 1														
31	T1	161	16.0	199	16.0	0.113	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
32	R2	1	16.0	1	16.0	0.003	12.9	LOS B	0.0	0.1	0.67	0.69	0.67	50.5
Approach		162	16.0	200	16.0	0.113	0.1	NA	0.0	0.1	0.00	0.00	0.00	69.8
All Vehicles		1007	14.4	1244	14.4	0.741	9.0	NA	5.4	40.1	0.17	0.47	0.39	57.1

2040 AM Results – SH15/Marsden Bay Drive Intersection (21% Growth)

MOVEMENT SUMMARY

Site: 102 [Marsden Bay Drive and Rama Road Intersection_AM_2040_Port Expansion (Site Folder: General)]

New Site
Site Category: Existing Design
Stop (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Rama Road														
1	L2	1	8.0	1	8.0	0.001	7.5	LOS A	0.0	0.0	0.00	0.57	0.00	58.8
2	T1	3	8.0	4	8.0	0.049	41.2	LOS E[11]	0.1	1.1	0.91	1.00	0.91	37.1
3	R2	1	8.0	1	8.0	0.049	51.1	LOS F[11]	0.1	1.1	0.91	1.00	0.91	37.0
Approach		5	8.0	6	8.0	0.049	36.4	LOS E[11]	0.1	1.1	0.73	0.91	0.73	40.1
East: SH 15 (E) to SH1														
4	L2	1	16.0	1	16.0	0.001	6.9	LOS A	0.0	0.0	0.00	0.56	0.00	56.8
5	T1	238	16.0	294	16.0	0.219	1.9	LOS A	0.8	6.7	0.26	0.07	0.27	66.2
6	R2	25	16.0	31	16.0	0.219	14.2	LOS B	0.8	6.7	0.26	0.07	0.27	58.0
Approach		264	16.0	326	16.0	0.219	3.0	NA	0.8	6.7	0.26	0.07	0.27	65.3
North: Marsden Bay Drive														
7	L2	154	4.0	190	4.0	0.402	17.7	LOS C	1.8	13.2	0.77	1.07	1.03	50.8
8	T1	17	4.0	21	4.0	1.394	417.2	LOS F[11]	35.0	253.1	1.00	2.78	9.34	7.6
9	R2	116	4.0	143	4.0	1.394	416.7	LOS F[11]	35.0	253.1	1.00	2.78	9.34	7.6
Approach		287	4.0	355	4.0	1.394	202.6	LOS F[11]	35.0	253.1	0.88	1.86	4.88	14.0
West: SH 15 (W) to Port														
10	L2	34	16.0	42	16.0	0.450	6.7	LOS A	0.0	0.0	0.00	0.03	0.00	60.6
11	T1	607	16.0	750	16.0	0.450	0.2	LOS A	0.0	0.0	0.00	0.03	0.00	69.1
12	R2	1	16.0	1	16.0	0.001	7.9	LOS A	0.0	0.0	0.40	0.52	0.40	54.4
Approach		642	16.0	793	16.0	0.450	0.5	NA	0.0	0.0	0.00	0.03	0.00	68.6
All Vehicles		1198	13.1	1480	13.1	1.394	49.6	NA	35.0	253.1	0.27	0.48	1.23	35.2

2040 PM Results – SH15/Marsden Bay Drive Intersection (21% Growth)

MOVEMENT SUMMARY

Site: 102 [Marsden Bay Drive and Rama Road Intersection_PM_2040_Port Expansion (Site Folder: General)]

New Site
Site Category: Existing Design
Stop (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Rama Road														
1	L2	59	8.0	73	8.0	0.038	8.7	LOS A	0.0	0.0	0.00	0.57	0.00	58.8
2	T1	19	8.0	23	8.0	0.269	53.2	LOS F[11]	0.8	6.1	0.94	1.02	1.03	34.0
3	R2	1	8.0	1	8.0	0.269	46.9	LOS E[11]	0.8	6.1	0.94	1.02	1.03	33.9
Approach		79	8.0	98	8.0	0.269	19.9	LOS C	0.8	6.1	0.24	0.68	0.26	49.7
East: SH 15 (E) to SH1														
4	L2	1	16.0	1	16.0	0.001	6.9	LOS A	0.0	0.0	0.00	0.56	0.00	56.8
5	T1	529	16.0	654	16.0	0.569	2.6	LOS A	5.1	40.4	0.47	0.21	0.71	64.3
6	R2	168	16.0	208	16.0	0.569	11.5	LOS B	5.1	40.4	0.47	0.21	0.71	56.5
Approach		698	16.0	862	16.0	0.569	4.7	NA	5.1	40.4	0.46	0.21	0.71	62.2
North: Marsden Bay Drive														
7	L2	32	4.0	40	4.0	0.041	10.3	LOS B	0.2	1.1	0.42	0.88	0.42	55.9
8	T1	1	4.0	1	4.0	0.847	135.9	LOS F[11]	3.8	27.8	0.99	1.19	1.92	18.4
9	R2	46	4.0	57	4.0	0.847	145.3	LOS F[11]	3.8	27.8	0.99	1.19	1.92	18.4
Approach		79	4.0	98	4.0	0.847	90.5	LOS F[11]	3.8	27.8	0.76	1.06	1.31	25.2
West: SH 15 (W) to Port														
10	L2	76	16.0	94	16.0	0.247	6.6	LOS A	0.0	0.0	0.00	0.14	0.00	59.7
11	T1	272	16.0	336	16.0	0.247	0.1	LOS A	0.0	0.0	0.00	0.14	0.00	68.0
12	R2	1	16.0	1	16.0	0.002	10.5	LOS B	0.0	0.1	0.60	0.62	0.60	52.9
Approach		349	16.0	431	16.0	0.247	1.5	NA	0.0	0.1	0.00	0.14	0.00	66.0
All Vehicles		1205	14.7	1489	14.7	0.847	10.4	NA	5.1	40.4	0.34	0.28	0.52	56.7

Sensitivity of Option (Full Port - 20% Port Traffic Reduction)

2040 AM – SH15/One Tree Point Road Int. (20% of Port Traffic Reduction)

MOVEMENT SUMMARY

Site: 102 [Mccathie and One Tree Road Int._AM_2040_Port Expansion_20% Reduction_Sensitivity (Site Folder: General)]

Site Category: -
Stop (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Mccathie Road														
1	L2	7	8.0	9	8.0	0.113	9.6	LOS A	0.4	3.1	0.53	0.96	0.53	50.7
2	T1	1	8.0	1	8.0	0.113	21.8	LOS C	0.4	3.1	0.53	0.96	0.53	50.7
3	R2	27	8.0	33	8.0	0.113	17.8	LOS C	0.4	3.1	0.53	0.96	0.53	50.8
Approach		35	8.0	43	8.0	0.113	16.3	LOS C	0.4	3.1	0.53	0.96	0.53	50.7
East: SH 15 (E) to SH1														
4	L2	44	16.0	52	16.0	0.031	6.6	LOS A	0.0	0.0	0.00	0.61	0.00	55.3
5	T1	137	16.0	134	16.0	0.077	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	70.0
6	R2	22	16.0	26	16.0	0.028	8.9	LOS A	0.1	0.9	0.53	0.69	0.53	53.0
Approach		203	16.0	212	16.0	0.077	2.7	NA	0.1	0.9	0.06	0.23	0.06	63.4
North: One Tree Point Road														
7	L2	7	8.0	9	8.0	0.983	43.2	LOS E[11]	19.8	147.9	0.98	2.09	4.97	35.4
8	T1	22	8.0	27	8.0	0.983	49.7	LOS E[11]	19.8	147.9	0.98	2.09	4.97	35.4
9	R2	360	8.0	445	8.0	0.983	48.1	LOS E[11]	19.8	147.9	0.98	2.09	4.97	35.2
Approach		389	8.0	481	8.0	0.983	48.1	LOS E[11]	19.8	147.9	0.98	2.09	4.97	35.2
West: SH 15 (W) to Port														
10	L2	174	16.0	204	16.0	0.292	6.6	LOS A	0.1	0.6	0.01	0.26	0.01	58.5
11	T1	297	16.0	291	16.0	0.292	0.0	LOS A	0.1	0.6	0.01	0.26	0.01	66.5
12	R2	4	16.0	5	16.0	0.292	7.9	LOS A	0.1	0.6	0.01	0.26	0.01	58.3
Approach		475	16.0	500	16.0	0.292	2.8	NA	0.1	0.6	0.01	0.26	0.01	62.9
All Vehicles		1102	12.9	1235	12.6	0.983	20.9	NA	19.8	147.9	0.42	0.99	1.97	47.9

2040 PM – SH15/One Tree Point Road Int. (20% of Port Traffic Reduction)

MOVEMENT SUMMARY

Site: 102 [Mccathie and One Tree Road Int._PM_2040_Port Expansion_20% Reduction_Sensitivity (Site Folder: General)]

New Site
Site Category: Existing Design
Stop (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Mccathie Road														
1	L2	6	8.0	7	8.0	0.103	10.3	LOS B	0.4	2.8	0.55	0.96	0.55	51.7
2	T1	1	8.0	1	8.0	0.103	22.4	LOS C	0.4	2.8	0.55	0.96	0.55	51.7
3	R2	29	8.0	36	8.0	0.103	15.6	LOS C	0.4	2.8	0.55	0.96	0.55	51.8
Approach		36	8.0	44	8.0	0.103	14.9	LOS B	0.4	2.8	0.55	0.96	0.55	51.7
East: SH 15 (E) to SH1														
4	L2	14	16.0	17	16.0	0.010	6.6	LOS A	0.0	0.0	0.00	0.61	0.00	55.3
5	T1	242	16.0	237	16.0	0.134	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
6	R2	8	16.0	10	16.0	0.010	8.5	LOS A	0.0	0.3	0.50	0.64	0.50	53.3
Approach		264	16.0	265	16.0	0.134	0.8	NA	0.0	0.3	0.02	0.06	0.02	67.9
North: One Tree Point Road														
7	L2	1	8.0	1	8.0	0.855	19.2	LOS C	8.9	66.7	0.87	1.46	2.54	45.4
8	T1	14	8.0	17	8.0	0.855	25.9	LOS D	8.9	66.7	0.87	1.46	2.54	45.4
9	R2	329	8.0	406	8.0	0.855	25.2	LOS D	8.9	66.7	0.87	1.46	2.54	45.1
Approach		344	8.0	425	8.0	0.855	25.2	LOS D	8.9	66.7	0.87	1.46	2.54	45.1
West: SH 15 (W) to Port														
10	L2	238	16.0	294	16.0	0.270	6.6	LOS A	0.1	0.7	0.02	0.40	0.02	57.1
11	T1	160	16.0	157	16.0	0.270	0.1	LOS A	0.1	0.7	0.02	0.40	0.02	64.7
12	R2	4	16.0	5	16.0	0.270	8.4	LOS A	0.1	0.7	0.02	0.40	0.02	56.9
Approach		402	16.0	456	16.0	0.270	4.4	NA	0.1	0.7	0.02	0.40	0.02	59.5
All Vehicles		1046	13.1	1190	12.8	0.855	11.4	NA	8.9	66.7	0.34	0.73	0.94	54.5

2040 AM – SH1/Marsden Point Road Int. (20% of Port Traffic Reduction)

MOVEMENT SUMMARY

Site: 101 [SH15_Marsden Point Rd_AM_2040_Port Expansion_20% Reduction_Sensitivity (Site Folder: General)]

New Site
Site Category: (None)
Stop (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Marsden Point Rd														
21	L2	1	8.0	1	8.0	0.001	7.0	LOS A	0.0	0.0	0.00	0.57	0.00	58.8
23	R2	354	8.0	437	8.0	0.949	47.7	LOS E[11]	18.3	136.5	0.96	1.94	4.25	35.6
Approach		355	8.0	439	8.0	0.949	47.5	LOS E[11]	18.3	136.5	0.96	1.94	4.24	35.6
NorthEast: SH15 (NE) to Port														
24	L2	183	16.0	179	16.0	0.108	6.9	LOS A	0.0	0.0	0.00	0.56	0.00	56.7
25	T1	159	16.0	156	16.0	0.088	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	70.0
Approach		342	16.0	335	16.0	0.108	3.7	NA	0.0	0.0	0.00	0.30	0.00	62.1
SouthWest: SH15 (SW) to SH 1														
31	T1	305	16.0	299	16.0	0.169	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
32	R2	1	16.0	1	16.0	0.001	8.2	LOS A	0.0	0.0	0.42	0.56	0.42	53.9
Approach		306	16.0	300	16.0	0.169	0.1	NA	0.0	0.0	0.00	0.00	0.00	69.8
All Vehicles		1003	13.2	1074	12.7	0.949	20.6	NA	18.3	136.5	0.39	0.89	1.73	48.8

2040 PM – SH1/Marsden Point Road Int. (20% of Port Traffic Reduction)

MOVEMENT SUMMARY

Site: 101 [SH15_Marsden Point Rd_PM_2040_Port Expansion_20% Reduction_Sensitivity (Site Folder: General)]

New Site
Site Category: (None)
Stop (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
SouthEast: Marsden Point Rd														
21	L2	1	8.0	1	8.0	0.001	7.2	LOS A	0.0	0.0	0.00	0.57	0.00	58.8
23	R2	196	8.0	242	8.0	0.614	23.5	LOS C	4.0	29.7	0.81	1.18	1.46	46.3
Approach		197	8.0	243	8.0	0.614	23.4	LOS C	4.0	29.7	0.81	1.18	1.45	46.4
NorthEast: SH15 (NE) to Port														
24	L2	399	16.0	493	16.0	0.296	6.9	LOS A	0.0	0.0	0.00	0.56	0.00	56.6
25	T1	249	16.0	244	16.0	0.138	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	69.9
Approach		648	16.0	737	16.0	0.296	4.6	NA	0.0	0.0	0.00	0.38	0.00	60.4
SouthWest: SH15 (SW) to SH 1														
31	T1	161	16.0	158	16.0	0.089	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	70.0
32	R2	1	16.0	1	16.0	0.003	12.1	LOS B	0.0	0.1	0.63	0.67	0.63	51.0
Approach		162	16.0	159	16.0	0.089	0.1	NA	0.0	0.1	0.00	0.01	0.00	69.7
All Vehicles		1007	14.4	1140	14.3	0.614	8.0	NA	4.0	29.7	0.17	0.49	0.31	57.8

2040 AM – SH1/Marsden Drive Int. (20% of Port Traffic Reduction)

MOVEMENT SUMMARY

Site: 102 [Marsden Bay Dr_Rama Rd Int._AM_2040_Port Expansion_20% Reduction_Sensitivity (Site Folder: General)]

New Site
Site Category: Existing Design
Stop (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Rama Road														
1	L2	1	8.0	1	8.0	0.001	7.5	LOS A	0.0	0.0	0.00	0.57	0.00	58.8
2	T1	3	8.0	4	8.0	0.026	25.9	LOS D	0.1	0.6	0.82	1.00	0.82	44.5
3	R2	1	8.0	1	8.0	0.026	31.1	LOS D	0.1	0.6	0.82	1.00	0.82	44.3
Approach		5	8.0	6	8.0	0.026	23.3	LOS C	0.1	0.6	0.66	0.91	0.66	46.7
East: SH 15 (E) to SH1														
4	L2	1	16.0	1	16.0	0.001	6.9	LOS A	0.0	0.0	0.00	0.56	0.00	56.8
5	T1	238	16.0	218	16.0	0.163	1.2	LOS A	0.5	4.2	0.23	0.09	0.23	66.9
6	R2	25	16.0	31	16.0	0.163	11.2	LOS B	0.5	4.2	0.23	0.09	0.23	58.6
Approach		264	16.0	250	16.0	0.163	2.5	NA	0.5	4.2	0.23	0.09	0.23	65.7
North: Marsden Bay Drive														
7	L2	154	4.0	190	4.0	0.297	13.8	LOS B	1.3	9.4	0.63	1.03	0.74	53.4
8	T1	17	4.0	21	4.0	0.945	74.8	LOS F[11]	9.3	67.1	0.98	1.62	3.70	28.6
9	R2	144	4.0	178	4.0	0.945	74.3	LOS F[11]	9.3	67.1	0.98	1.62	3.70	28.5
Approach		315	4.0	389	4.0	0.945	44.8	LOS E[11]	9.3	67.1	0.81	1.34	2.25	36.9
West: SH 15 (W) to Port														
10	L2	34	16.0	42	16.0	0.362	6.7	LOS A	0.0	0.0	0.00	0.04	0.00	60.6
11	T1	607	16.0	595	16.0	0.362	0.1	LOS A	0.0	0.0	0.00	0.04	0.00	69.2
12	R2	1	16.0	1	16.0	0.001	7.5	LOS A	0.0	0.0	0.34	0.52	0.34	54.6
Approach		642	16.0	639	16.0	0.362	0.6	NA	0.0	0.0	0.00	0.04	0.00	68.5
All Vehicles		1226	12.9	1284	12.3	0.945	14.4	NA	9.3	67.1	0.29	0.45	0.73	54.0

2040 PM – SH1/Marsden Drive Int. (20% of Port Traffic Reduction)

MOVEMENT SUMMARY

Site: 102 [Marsden Bay Dr_Rama Rd Int._PM_2040_Port Expansion_20% Reduction_Sensitivity (Site Folder: General)]

New Site
Site Category: Existing Design
Stop (Two-Way)
Design Life Analysis (Final Year): Results for 7 years

Vehicle Movement Performance

Mov ID	Turn	INPUT VOLUMES [Total veh/h	HV] %	DEMAND FLOWS [Total veh/h	HV] %	Deg. Satn v/c	Aver. Delay sec	Level of Service	95% BACK OF QUEUE [Veh. veh	Dist] m	Prop. Que	Effective Stop Rate	Aver. No. Cycles	Aver. Speed km/h
South: Rama Road														
1	L2	59	8.0	73	8.0	0.038	8.1	LOS A	0.0	0.0	0.00	0.57	0.00	58.8
2	T1	19	8.0	23	8.0	0.156	31.7	LOS D	0.5	3.6	0.87	1.00	0.88	42.3
3	R2	1	8.0	1	8.0	0.156	28.1	LOS D	0.5	3.6	0.87	1.00	0.88	42.2
Approach		79	8.0	98	8.0	0.156	14.0	LOS B	0.5	3.6	0.22	0.68	0.22	53.6
East: SH 15 (E) to SH1														
4	L2	1	16.0	1	16.0	0.001	6.9	LOS A	0.0	0.0	0.00	0.56	0.00	56.8
5	T1	529	16.0	519	16.0	0.476	1.9	LOS A	3.6	28.7	0.43	0.22	0.56	64.9
6	R2	168	16.0	208	16.0	0.476	9.9	LOS A	3.6	28.7	0.43	0.22	0.56	57.0
Approach		698	16.0	728	16.0	0.476	4.1	NA	3.6	28.7	0.43	0.22	0.56	62.4
North: Marsden Bay Drive														
7	L2	32	4.0	40	4.0	0.038	9.9	LOS A	0.1	1.0	0.37	0.87	0.37	56.2
8	T1	1	4.0	1	4.0	0.467	45.8	LOS E[11]	1.8	12.8	0.94	1.06	1.22	35.0
9	R2	46	4.0	57	4.0	0.467	50.8	LOS F[11]	1.8	12.8	0.94	1.06	1.22	34.9
Approach		79	4.0	98	4.0	0.467	34.2	LOS D	1.8	12.8	0.71	0.98	0.88	41.2
West: SH 15 (W) to Port														
10	L2	76	16.0	94	16.0	0.207	6.6	LOS A	0.0	0.0	0.00	0.16	0.00	59.4
11	T1	272	16.0	267	16.0	0.207	0.1	LOS A	0.0	0.0	0.00	0.16	0.00	67.7
12	R2	1	16.0	1	16.0	0.001	9.2	LOS A	0.0	0.0	0.54	0.58	0.54	53.8
Approach		349	16.0	362	16.0	0.207	1.8	NA	0.0	0.0	0.00	0.16	0.00	65.3
All Vehicles		1205	14.7	1285	14.5	0.476	6.5	NA	3.6	28.7	0.31	0.30	0.40	60.1

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