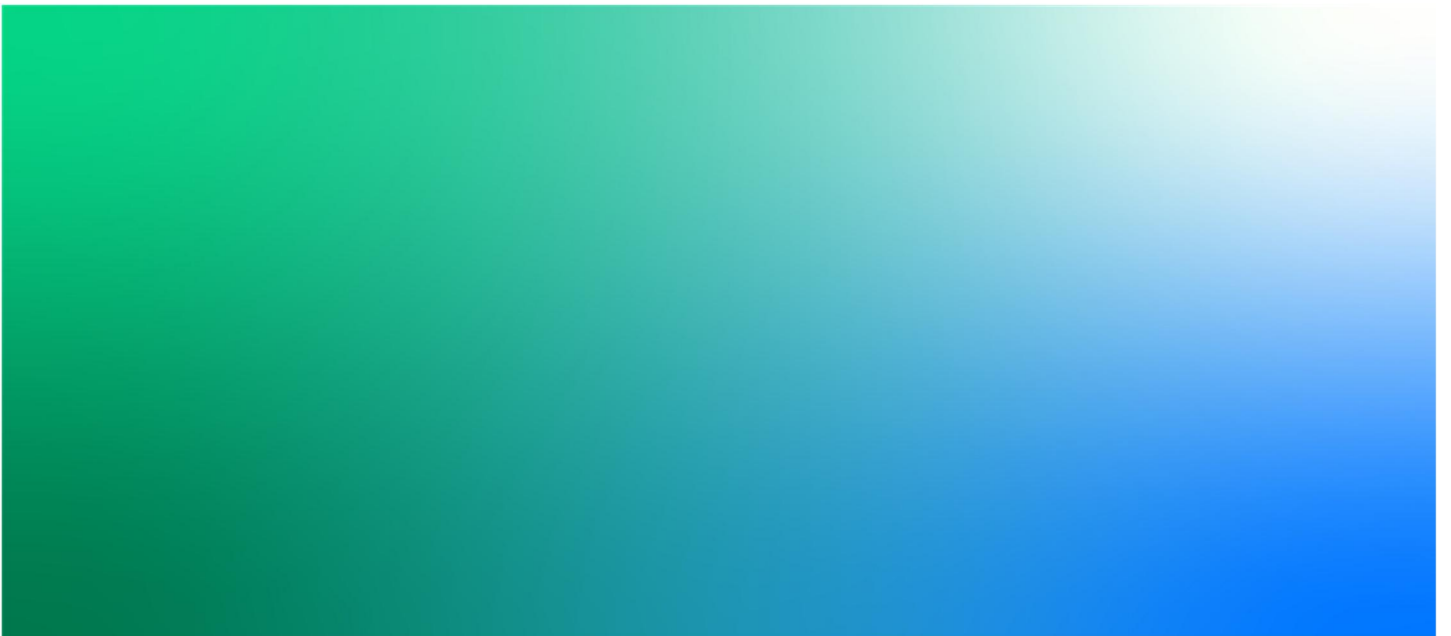


Weigh Right

Mackays Transport Assessment

12 October 2020

Waka Kotahi NZ Transport Agency



Weigh Right

Project No: IZ105201
 Document Title: Mackays Transport Assessment
 Revision: 1
 Document Status: Final
 Date: 12 August 2020
 Client Name: Waka Kotahi NZ Transport Agency
 Project Manager: Ashley Rideout
 Author: Chris Groom
 File Name: Mackays transport assessment.docx

Jacobs New Zealand Limited

Level 8, 1 Grey Street,
 PO Box 10-283
 Wellington, 6143
 New Zealand
 T +64 4 473 4265
 F +64 4 473 3369
www.jacobs.com

© Copyright 2019 Jacobs New Zealand Limited. The concepts and information contained in this document are the property of Jacobs. Use or copying of this document in whole or in part without the written permission of Jacobs constitutes an infringement of copyright.

Limitation: This document has been prepared on behalf of, and for the exclusive use of Jacobs' client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this document by any third party.

Document history and status

Revision	Date	Description	Author	Checked	Reviewed	Approved
1	13/07/20	Draft for client feedback	CG/DN	AGP	AGP	
2	12/10/20	Update based on client feedback	CG			

Contents

Executive Summary	4
1. Introduction	5
2. Existing Land Uses and Transport Environment	7
2.1 Existing and Surrounding Land Uses	7
2.2 Road Network.....	8
2.3 Pedestrians, Cyclists and Horse Riders.....	9
2.4 Public Transportation.....	9
2.5 Traffic Flows.....	10
2.6 Road Safety	11
3. Future Transport Environment	14
3.1 Transmission Gully	14
3.2 New link road.....	15
3.3 Future traffic flows	16
4. Proposal	17
4.1 Facility.....	17
4.2 Weigh in Motion System	17
5. Assessment of Transport Effects.....	18
5.1 Traffic Generation.....	18
5.1.1 Operational Traffic	18
5.1.2 Intersection Modelling.....	18
5.1.3 SIDRA Network Layouts.....	19
5.1.4 Level of Service Results.....	21
5.1.5 Average Delay Results	23
5.1.6 Construction Traffic.....	25
5.2 Road Safety	25
5.2.1 Current Road Safety.....	25
5.2.2 Stopping Sight Distance.....	26
5.2.3 Intersection Angle	26
5.2.4 Walking, Cycling and Bridleway Crossing.....	27
6. Compliance with Current Policy	29
6.1 Wellington Regional Land Transport Plan.....	29
6.2 Kapiti Coast Operative District Plan 1999.....	29
7. Conclusion	30

Appendix A. Crash report

Important note about your report

The sole purpose of this report and the associated services performed by Jacobs is to provide a Transportation Assessment of the proposed Commercial Vehicle Safety Centre development near the State Highway 1 Mackays Interchange, Kapiti Coast. This is to be in accordance with the scope of services set out in the contract between Jacobs and Waka Kotahi NZ Transport Agency ("the Client"). That scope of services, as described in this report, was developed with the Client.

In preparing this report, Jacobs has relied upon, and presumed accurate, any information (or confirmation of the absence thereof) provided by the Client and / or from other sources. Except as otherwise stated in the report, Jacobs has not attempted to verify the accuracy or completeness of any such information. If the information is subsequently determined to be false, inaccurate, or incomplete, then it is possible that our observations and conclusions as expressed in this report may change.

Jacobs derived the data in this report from information sourced from the Client (if any) and / or available in the public domain at the time or times outlined in this report. The passage of time, manifestation of latent conditions or impacts of future events may require further examination of the project and subsequent data analysis, and re-evaluation of the data, findings, observations, and conclusions expressed in this report. Jacobs has prepared this report in accordance with the usual care and thoroughness of the consulting profession, for the sole purpose described above and by reference to applicable standards, guidelines, procedures, and practices at the date of issue of this report. For the reasons outlined above, however, no other warranty or guarantee, whether expressed or implied, is made as to the data, observations, and findings expressed in this report, to the extent permitted by law.

This report should be read in full and no excerpts are to be taken as representative of the findings. No responsibility is accepted by Jacobs for use of any part of this report in any other context.

This report has been prepared on behalf of, and for the exclusive use of, the Client, and is subject to, and issued in accordance with, the provisions of the contract between Jacobs and the Client. Jacobs accepts no liability or responsibility whatsoever for, or in respect of, any use of, or reliance upon, this report by any third party.

Executive Summary

Jacobs New Zealand Limited has been engaged by the Waka Kotahi NZ Transport Agency (the Client) to complete a Transportation Assessment for their proposal to establish a new Commercial Vehicle Safety Centre (CVSC) in Mackays. The proposed CVSC location is on the new link road between the Mackays Crossing and Paekakariki Interchanges with the interchanges being built as part of the Transmission Gully Motorway

The Transport Assessment (TA) has assessed the existing land uses and transport network in the vicinity of the Mackays CVSC. The additional vehicle trips generated during the operation and construction of the CVSC have also been assessed and compared to the baseline traffic volumes with Transmission Gully. Finally, a check against relevant transportation policies was carried out to determine the proposals compliance.

While it was found that the proposed access way complies with the necessary design standards, it is recommended that the angle of the proposed accessway should be changed to improve sightlines and inter-visibility for drivers accessing/egressing the site with other road users.

The Weigh Right Programme itself is considered to have a very high policy alignment with the Client's strategic objectives in providing an efficient freight network, a reduction in carbon emissions and ensuring a safer transport system. With the application of an approved Construction Traffic Management Plan and with the recommended design improvements, it is concluded that there is sufficient capacity at the Mackays and Paekakariki Interchanges to accommodate the expected vehicle movements to and from the CVSC site with no discernible transport related effects arising.

1. Introduction

Jacobs has been engaged by the Client to complete a TA for their proposal to establish a new CVSC near the Mackays Crossing Interchange, on the Kapiti Coast. The proposed CVSC would be located on the new link road between the Mackays Crossing and Paekakariki Interchanges which is being built as part of the Transmission Gully Motorway. The new CVSC will serve commercial vehicles travelling on the Kapiti Expressway, Transmission Gully and the Coastal Highway.

The location of the proposed development is shown in Figure 1-1 and Figure 1-2 below.



Figure 1-1: Site Location relative to existing road network (source: Google Maps)

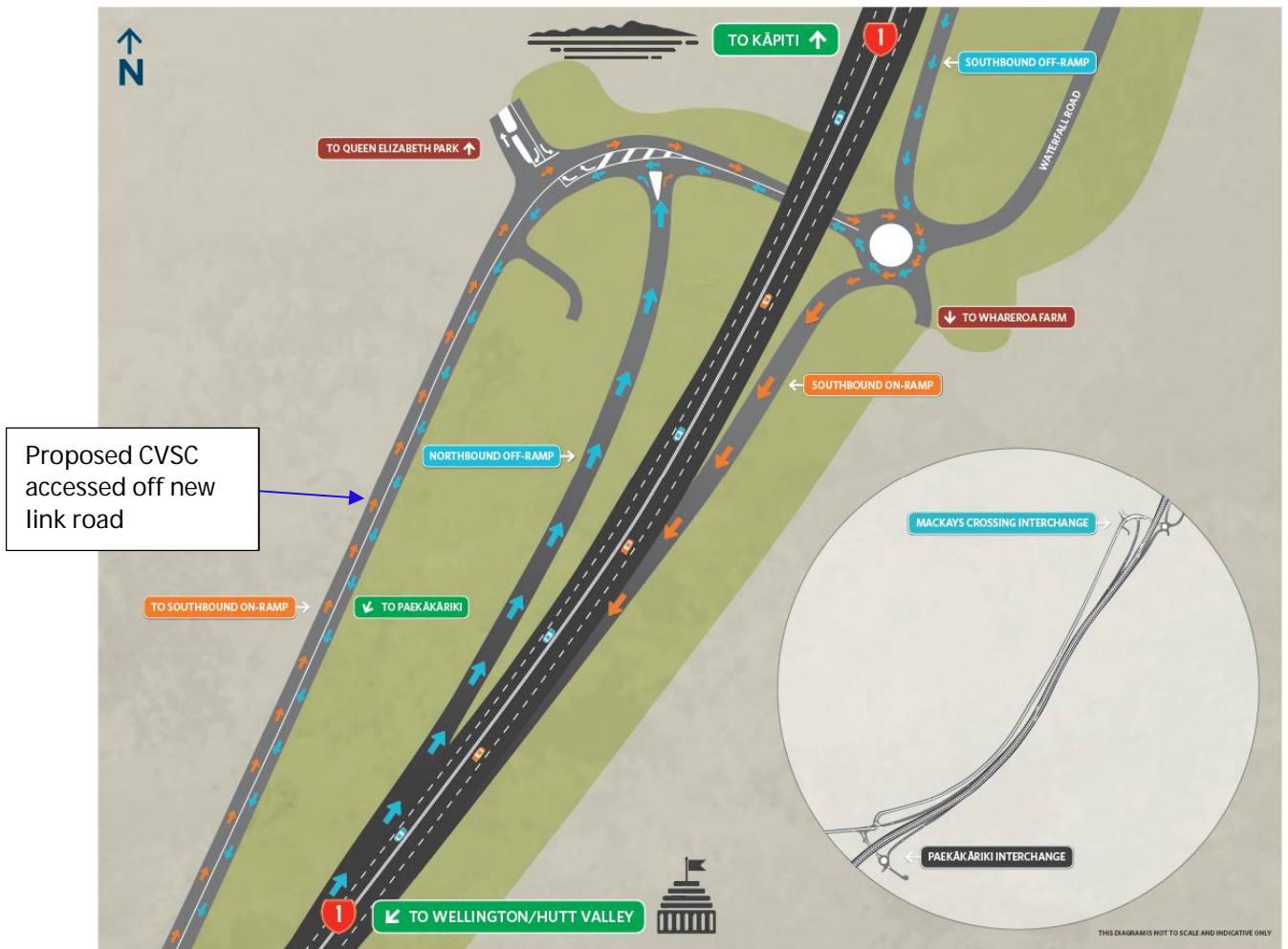


Figure 1-2: Map showing access to proposed CVSC site (source: Transmission Gully Project)

The purpose of this assessment is to assess the potential transport related effects of the construction and operation of the proposed Mackays Crossing CVSC. This report describes the transport environment surrounding the site, the transport components of the proposed development and assesses the proposal against the relevant transport policies.

It should be noted that the site is in a rural location it will not be reliant on public transport or walking and cycling connections. Accordingly, it has been determined that a TA report is more appropriate than a full Integrated Transportation Assessment. The TA undertaken has however been prepared in accordance with the ITA Guidelines provided in NZTA's research report 422 and the industry recognised Integrated Transport Assessment Guidelines provided by Auckland Transport.

2. Existing Land Uses and Transport Environment

2.1 Existing and Surrounding Land Uses

The site for the proposed CVSC is 22 hectares in size and is currently used for storing aggregate for the Transmission Gully road construction. No other private land is required for this proposal, the Variable Message Signs (VMS) will be located on State Highway corridor.

The proposed CVSC site is located in a rural area that is 1km north of Paekakariki and 3.5km south of Raumati (Figure 2-1). Immediately surrounding the site is the State Highway to the east, railway line to the west and rural land to the south. In the wider area is Queen Elizabeth Park and Whareroa Farm which are both regional parks.

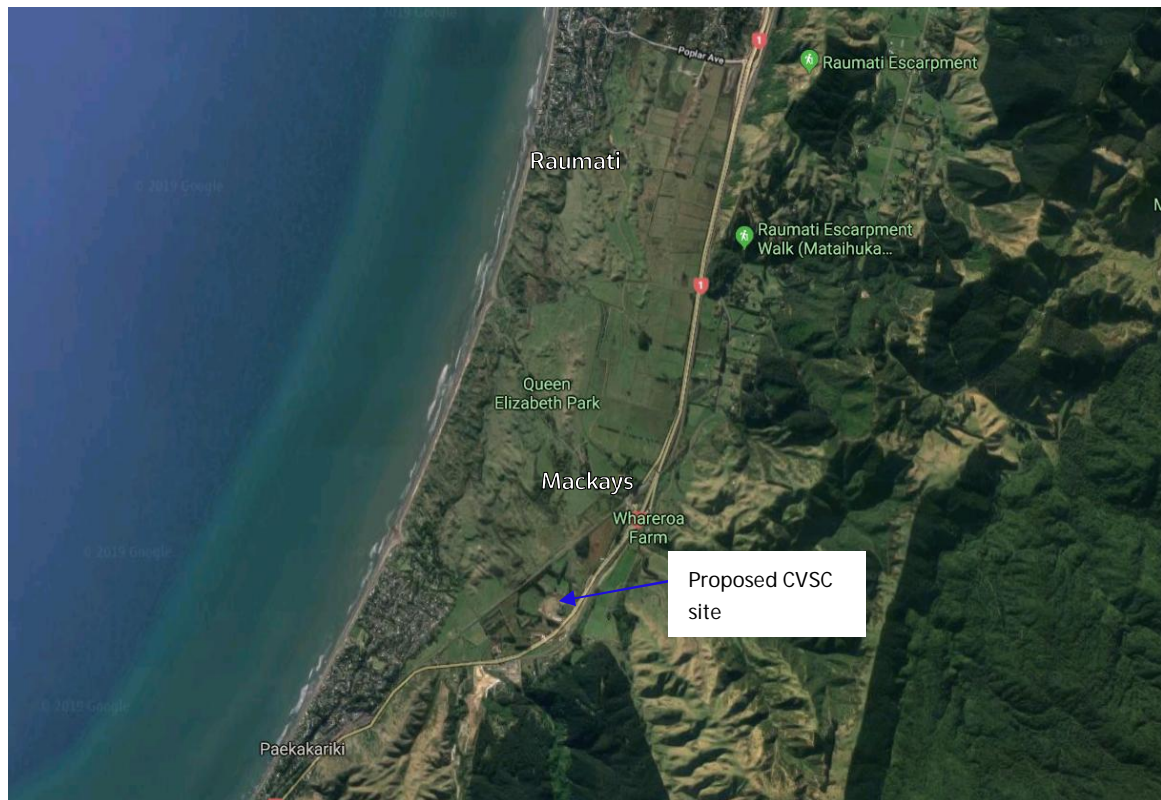


Figure 2-1: Aerial view of Mackays Crossing (source: Google maps)

2.2 Road Network

The current road network surrounding the proposed CVSC site as defined by the Transport Agency's One Network Road Classification (ONRC) is shown in the map below Figure 2-2. This map does not include the changes to the Paekakariki and Mackays Crossing interchanges as part of the Transmission Gully project.

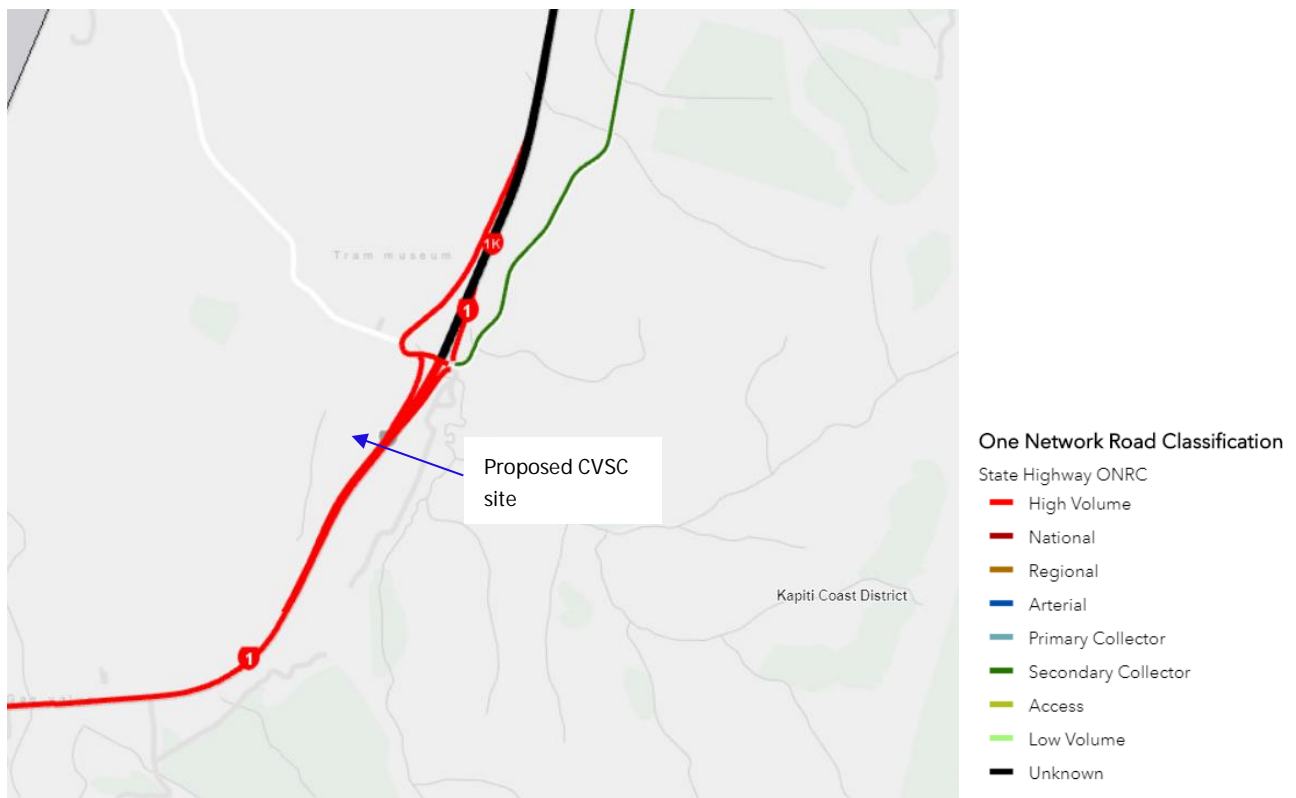


Figure 2-2: Current road hierarchy surrounding the

State Highway 1 south Mackays Crossing interchange is classified as a high volume road. North of Mackays Crossing interchange is the new Kapiti Expressway which has not yet been classified but would also be a high volume road. This is because State Highway 1 carries the majority of through traffic between Kapiti, Porirua and Wellington. Emerald Glen Road is classified as a secondary collector which is accessed off the Mackays Crossing interchange.

State Highway 1 has a speed limit of 100km/hr, the Mackays Crossing interchange has a speed limit of 60km/hr with Emerald Glen Road also having a speed limit of 60km/hr.

2.3 Pedestrians, Cyclists and Horse Riders

To the north of the site is off-road walking and cycling trails within the Whareroa Farm and Queen Elizabeth Park recreational areas (Figure 2-3). It is expected that cyclists and horse riders will use the new link road to access Whareroa Farm and Queen Elizabeth Park. There is no footpath provided on State Highway 1 and therefore it is expected that pedestrians will use the walking trails within Queen Elizabeth Park for trips between Paekakariki and Raumati South.

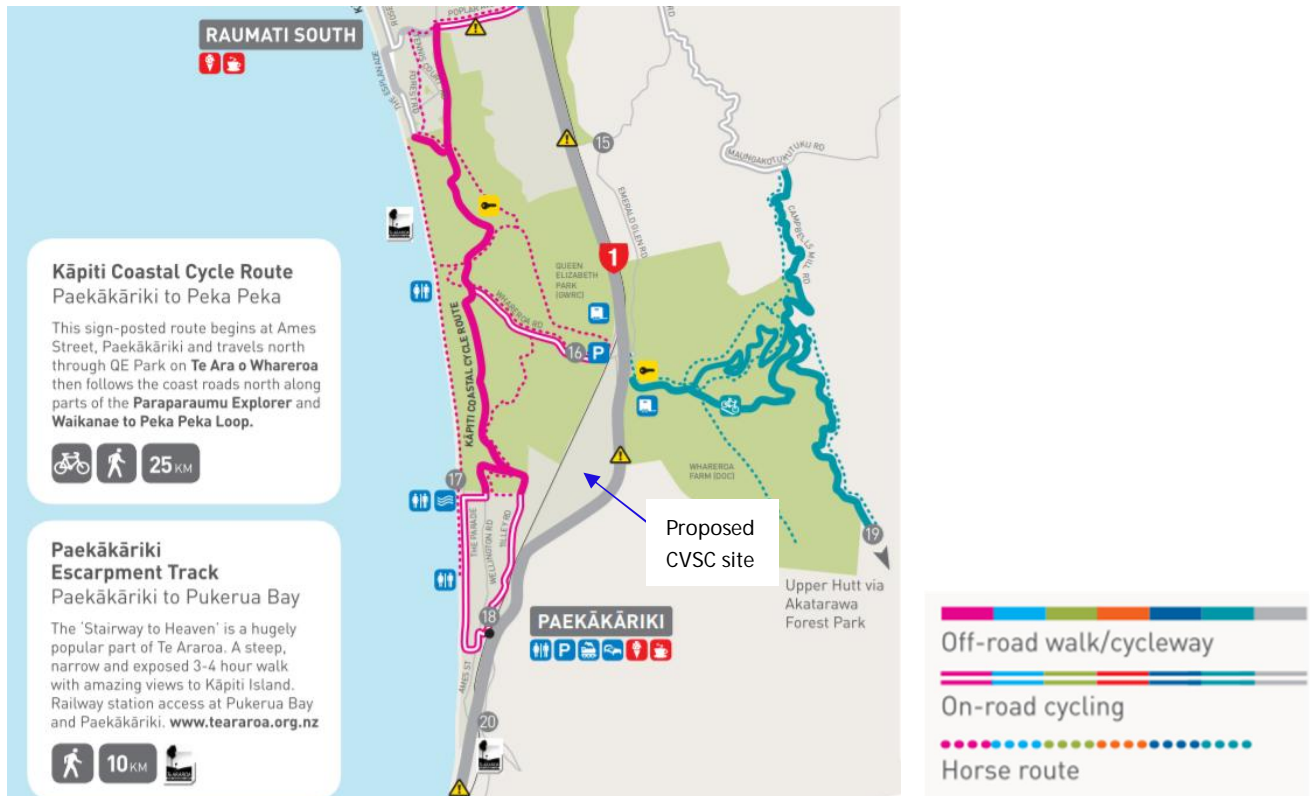


Figure 2-3: Kapiti Coast Stride 'n' Ride map (source: Kapiti Coast District Council)

2.4 Public Transportation

Due to its rural location there are no bus services in the vicinity of the proposed CVSC site. The Kapiti Train Line runs along the western boundary of the site however the nearest train station is 1 km to the south in Paekakariki.

2.5 Traffic Flows

Table 2-1 shows that traffic flows on State Highway 1 at Mackays Crossing. The traffic count data was sourced from the Transport Agency’s TMS system using the peak flow report for site id 01N01036. Due to the Transmission Gully construction work, the most recent and representative traffic count available was measured during March 2017.

The traffic count confirms that State Highway 1 has high traffic volumes and a large proportion of the measured volumes being Heavy Commercial Vehicles (HCVs). This is principally because of State Highway 1’s strategic function, being the main connection between the Wellington Region and the rest of the North Island. The volume of predicted traffic upon the opening of Transmission Gully has been reviewed as part of this assessment and is included in Section 4.2 of this report.

	ADT	% HCV	AM Peak Hour	Interpeak Hour	PM Peak Hour
SH1 at Mackays Crossing	25,632	10.2%	1531	1833	2118

Table 2-1: Current traffic volumes on State Highway 1 at Mackays Crossing

The traffic count data also records the number of HCVs per hour. The highest volume of HCVs occurs during the afternoon peak (13:00 to 14:00) with 175 HCVs being counted (Figure 2-4).

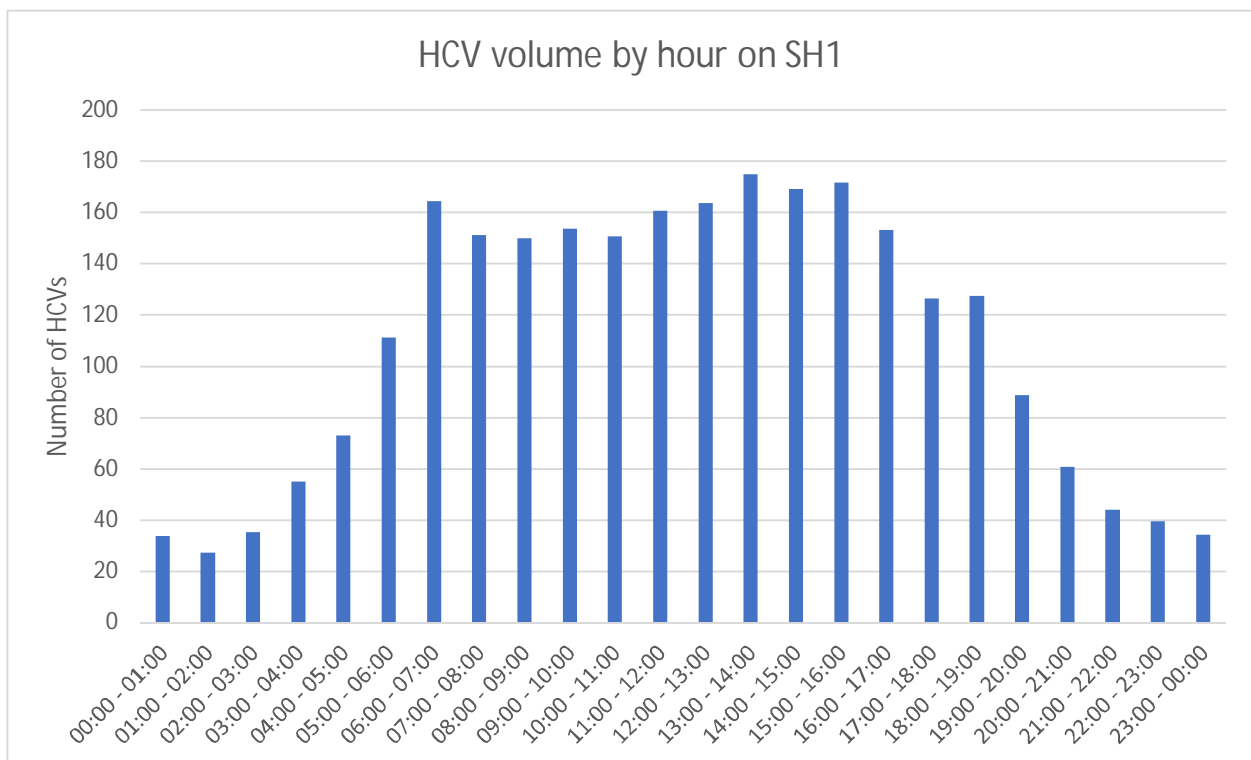


Figure 2-4: Volume of HCVs on State Highway 1 near Mackays Crossing

2.6 Road Safety

Using the KiwiRap collective risk indicator, the Mackays section of State Highway 1 has a low medium risk rating while the Paekakariki section has a medium high-risk rating (Figure 2-5). Transmission Gully is expected to improve the risk rating of the Paekakariki section of state highway by moving traffic onto the inland route which has a safer road alignment. The collective risk of a corridor is calculated by adding together the intersection and mid-block serious crashes and dividing by the total corridor length.

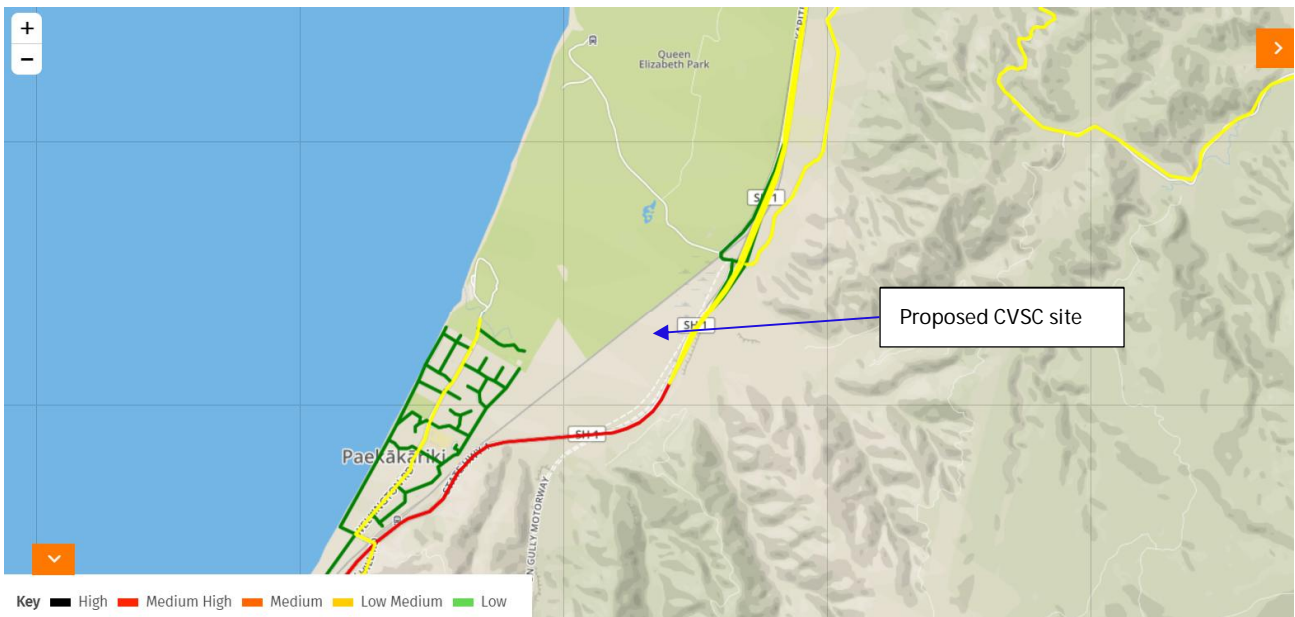


Figure 2-5: Collective risk map (source: KiwiRAP urban)

Looking at personal risk, the Mackays section of State Highway 1 has a low risk rating and the Paekakariki section has a low medium risk rating (Figure 2-6). Personal risk is the level of risk of death or serious injury per 100 million vehicle kilometres travelled along the corridor.

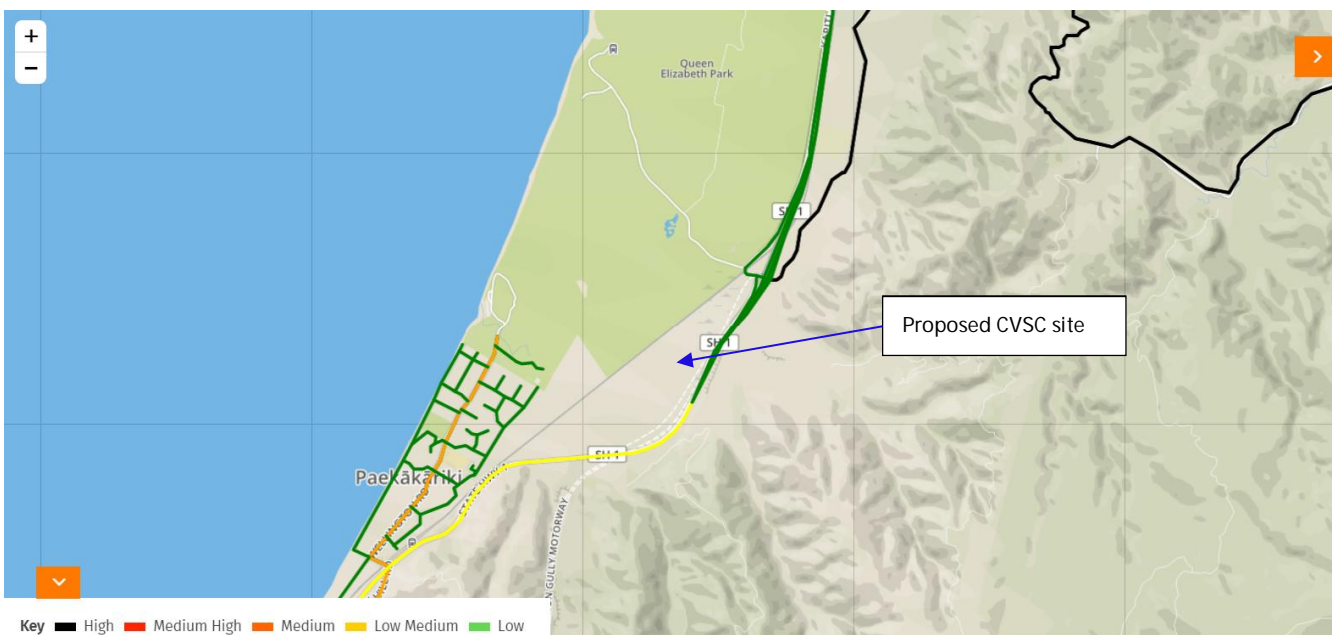


Figure 2-6: Personal risk map (source: KiwiRAP urban)

A review of the Clients Crash Analysis System (for the five-year period between 2015 and 2020 inclusive) confirmed that there has been a total of seven recorded crashes at the Mackays Crossing Interchange. The severity of the recorded crashes is understood to have involved:

- § Two severe injury crashes;
- § One minor injury crash; and
- § Four non-injury crashes.

For the severe crashes one crash involved a motorcycle losing control when turning right and the Mackays Crossing interchange roundabout. The other severe crash involved a vehicle losing control at Mackays Crossing Interchange roundabout whilst attempting to evade police.

The location where the crashes are recorded are as follows:

- § Four crashes on SH1;
- § Two crashes on the SH1 interchange; and
- § One crash in an off-street parking area.

Using the Clients crash type categories (Figure 2-7), the crashes surrounding the Mackays Crossing interchange can be categorised as follows:

- Two lost control when turning type crashes;
- One cutting in or changing lanes type crash;
- One stopped or slowing for queue type crash;
- One out of control on roadway type crash;
- One off roadway type crash; and
- One other type crash.

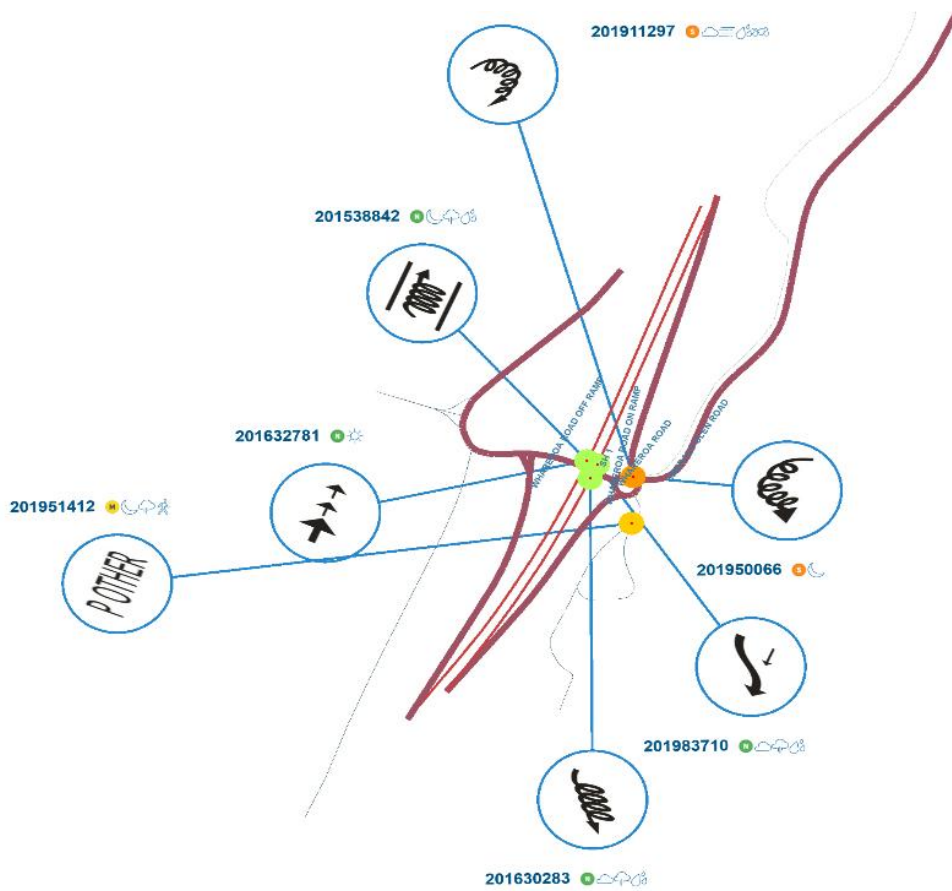


Figure 2-7: Reported crashes 2015 – 2020 at Mackays Crossing Interchange

3. Future Transport Environment

3.1 Transmission Gully

Transmission Gully is a new motorway which is currently being built that will provide the primary route for through traffic between Kapiti, Porirua and Wellington. Transmission Gully joins onto the existing SH1 at a new interchange at Paekakariki and an upgraded interchange at Mackays (Figure 3-1). For the Mackays Interchange the road layout changes will be a new link road that provides access to the Mackays area from the SH1 coastal route. The proposed CVSC site will be accessed of this link road which can be accessed from the Kapiti Expressway, Transmission Gully and State Highway coastal route.

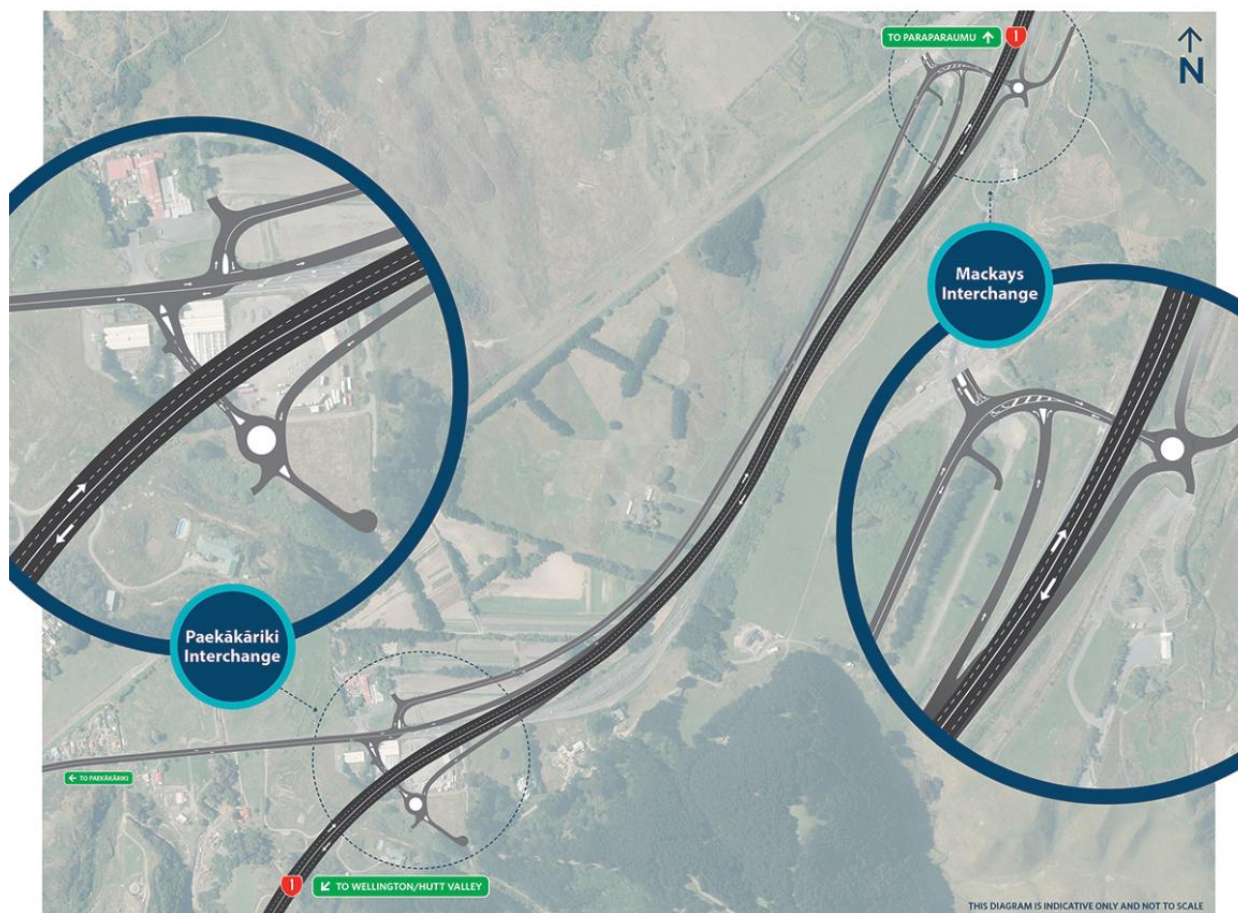
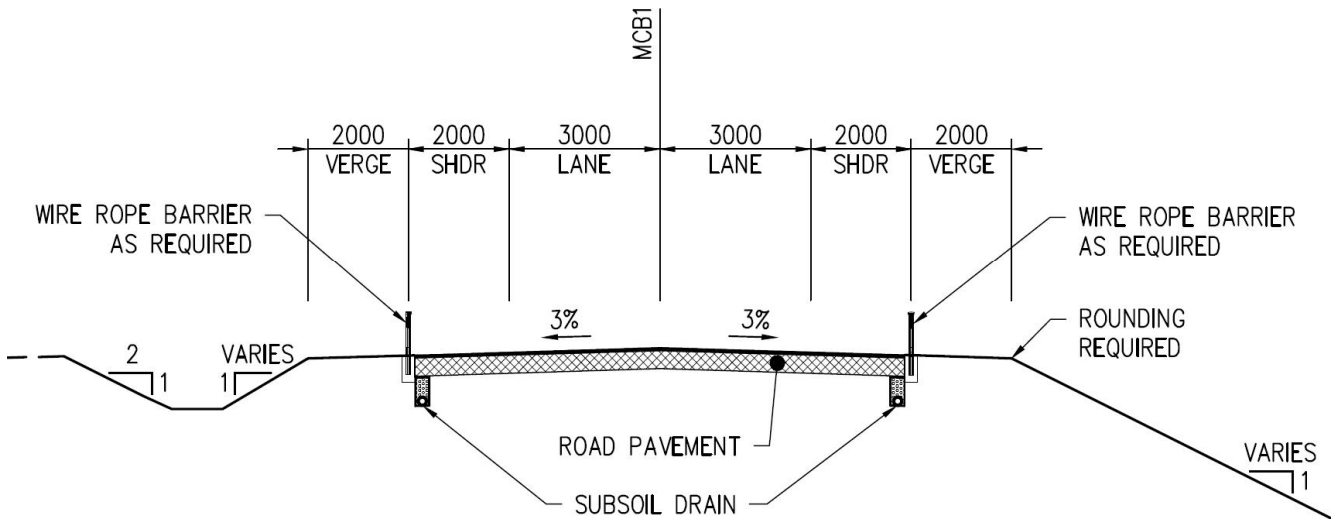


Figure 3-1: Transmission Gully interchanges at Paekakariki and Mackays

3.2 New link road

The link road between the Mackays Crossing and Paekakariki interchanges will have one 3m wide traffic lane in each direction with a 2m wide shoulder. Wire rope barriers will be installed along the edges of the link road to reduce the risk of run off type crashes. No footpath will be provided as part of the link road design due to the rural setting and lack of footpaths on the adjoining roads.



3.3 Future traffic flows

The baseline version of the North Wellington Saturn Model was used to determine the traffic volumes in 2020 once Transmission Gully opens. The table below shows the traffic flows for the State Highways at the Mackays Crossing and Paekakariki Interchanges (Table 3-1).

		Morning peak		Afternoon peak	
		Light vehicles	Heavy vehicles	Light vehicles	Heavy vehicles
Transmission Gully	Northbound	492	53	1309	83
Transmission Gully	Southbound	991	56	558	49
State Highway 1 north of Mackays Crossing Interchange	Northbound	741	82	1592	108
State Highway 1 north of Mackays Crossing Interchange	Southbound	1161	71	800	63
State Highway 1 coastal route	Northbound	204	27	259	26
State Highway 1 coastal route	Southbound	163	16	213	14

Table 3-1: Modelled traffic flows with Transmission Gully in 2020

4. Proposal

4.1 Facility

The proposed layout of the Mackays CVSC is shown in Figure 4-1 below.

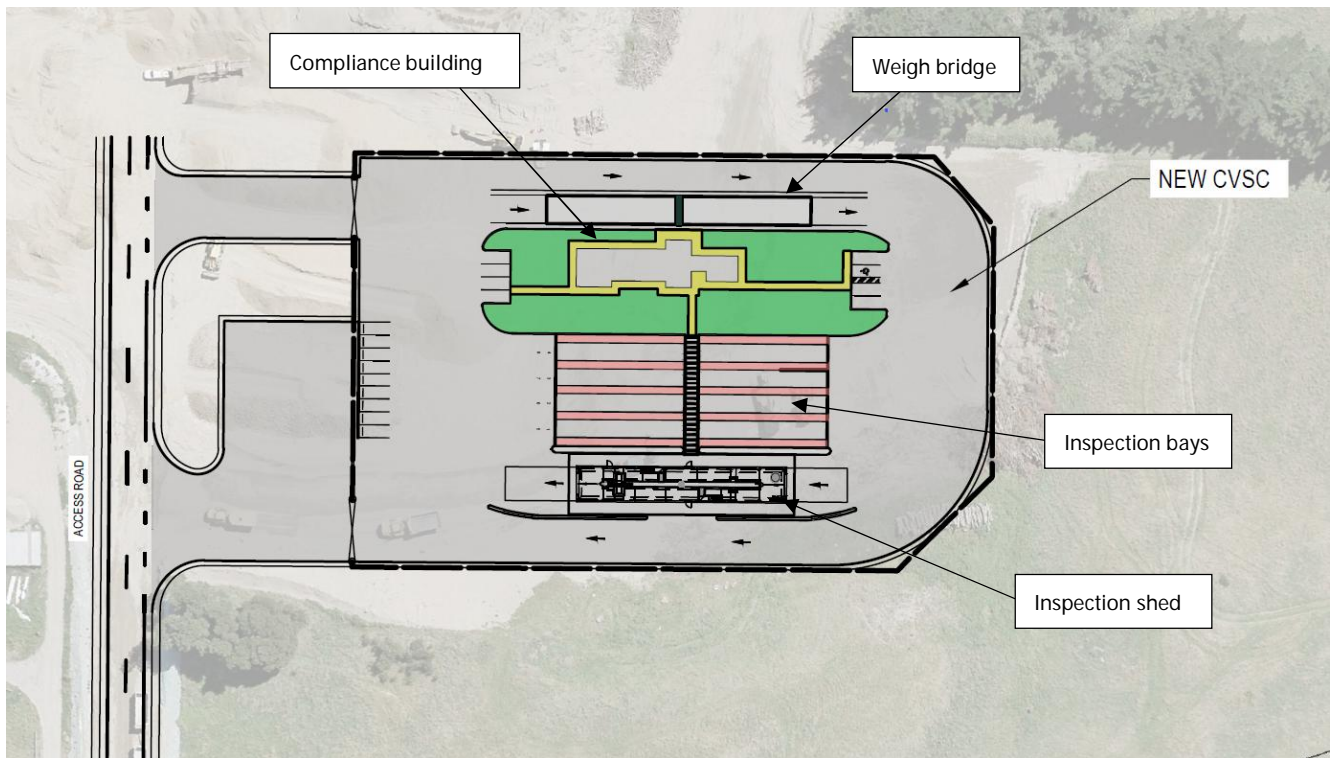


Figure 4-1: Proposed layout of CVSC

The key features of the CVSC include:

- An inspection shed;
- A weigh bridge;
- Compliance building;
- Eight inspection bays; and
- 17 staff parking space.

4.2 Weigh in Motion System

As part of the development of the Mackays CVSC the Client plans to install weigh in motion sensors on the sections of State Highway 1 with approaches to the site. These sensors will be imbedded in the road to weigh trucks as they pass over them and compare this result to the legal weight limit of the vehicle type. The weight limit information is gathered using an automated number plate recognition camera which identifies the trucks license plate and then checks this against a national database. If a truck is recorded as being over the weight limit of the registered permit, its license plate number is displayed on a variable message sign (VMS) which requests that the driver pull in to the CVSC for further inspection. This system reduces the number of trucks that would need to enter the CVSC as most of the time only those trucks which flag the system are pulled in.

5. Assessment of Transport Effects

5.1 Traffic Generation

5.1.1 Operational Traffic

The development of the CVSC is expected to generate two types of trips onto the SH1 Mackays Crossing and Paekakariki Interchanges. The first type of trips is light vehicles from police staff and visitors driving to the CVSC site and the second is heavy commercial vehicle (HCV) trips from vehicles flagged by the weigh in motion system.

It is expected that up to ten police staff will operate the CVSC site when the Police are running a road safety campaign, it is understood that day to day operations of the CVSC site will require a lower number of staff. CVSC staff are likely to travel to the site during off peak times due to road policing being shift based work which can operate outside of normal business hours. It is expected that all CVSC staff will arrive to the site by private vehicle due to the rural location of the site and the lack of public transport services.

For the weigh right programme, it is assumed that between 4 to 6% of trucks would be flagged by the weigh in motion sensors and would be required to stop at the facility. For this TA it has been conservatively assessed that when the CVSC is in operation, 5% of passing heavy commercial vehicles could be flagged by the sensors.

There are three approaches to the CVSC which will have weigh in motion sensors and VMS signs. These are State Highway 1 coastal route northbound, State Highway 1 Mackays Crossing southbound and Transmission Gully northbound. Using the expected future traffic flows, it is estimated that around 8 HCVs would be pulled into the CVSC during the peak hours.

It is understood that the maximum number of HCVs that would be pulled into the CVSC during an hour period would be around 40 vehicles. This is based on inspections taking between 10 to 30 minutes with there being space at the weigh station for 10 HCVs at any point in time. Therefore, it is understood that when operating the site, the Police will turn off the VMS signs if the site is full.

Day to day operations of the site will use the weigh in motion sensors to select heavy vehicles for inspection. Police will intermittently instruct all trucks to stop at the CVSC if running other road safety programmes such as drive licence checks or driver fatigue checks. An all truck stop operation would have the highest level of traffic movements generated to the site and is therefore expected to be closely managed by the Police.

5.1.2 Intersection Modelling

The proposed CVSC site will result in trucks which are flagged by the weigh in motion system making turns that they would not otherwise make. However, the trucks that would be flagged by the weigh in motion system are existing road users and therefore the CVSC does not increase the total number of truck trips on the State Highway network.

To understand any potential effects that truck movements into the CVSC could have on the Mackays and Paekakariki interchanges, SIDRA intersection models were developed. This involved creating base models for the two interchanges which replicate the expected level of service once Transmission Gully opens. Next two scenarios were tested; one scenario involves 5% of trucks on the state highway network being pulled into the CVSC site and the second scenario involves 20% of trucks being pulled into the CVSC. The second scenario is a sensitivity test which has a higher volume of trucks being pulled into the CVSC than is expected to occur during typical day to day operations of the site.

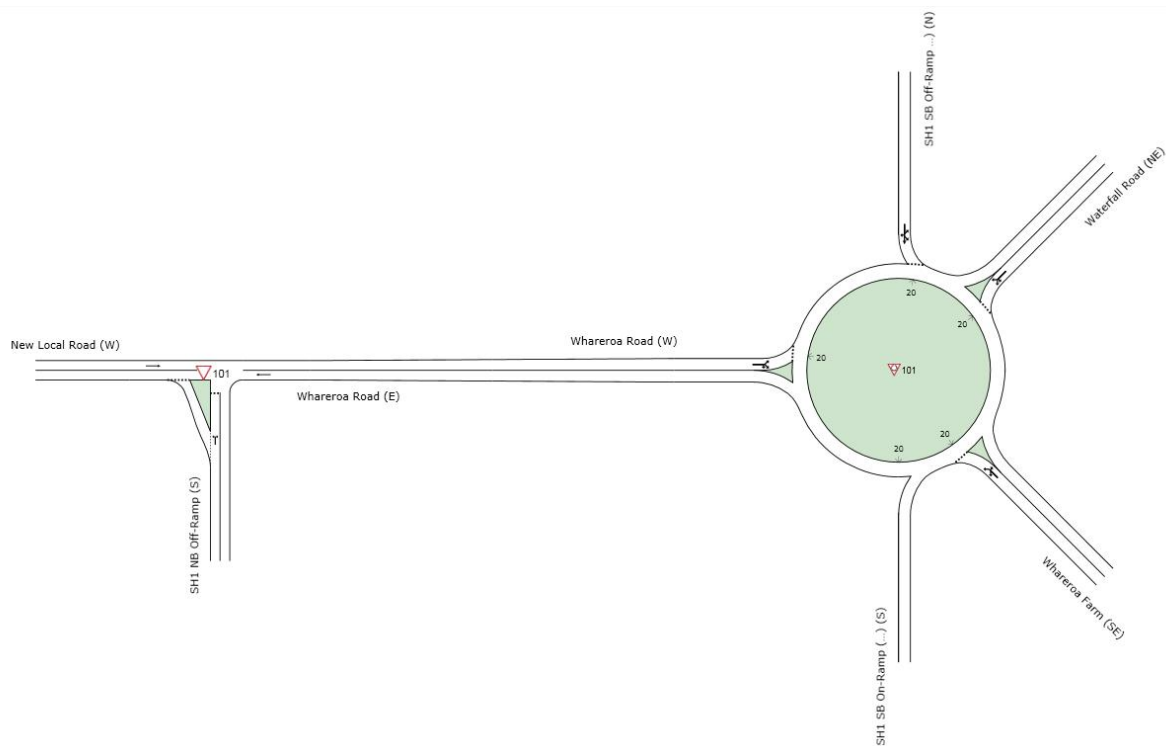
The modelling assumptions are listed below;

- Traffic flows were obtained from the Northern Wellington Saturn Model November 2019 update which includes Transmission Gully

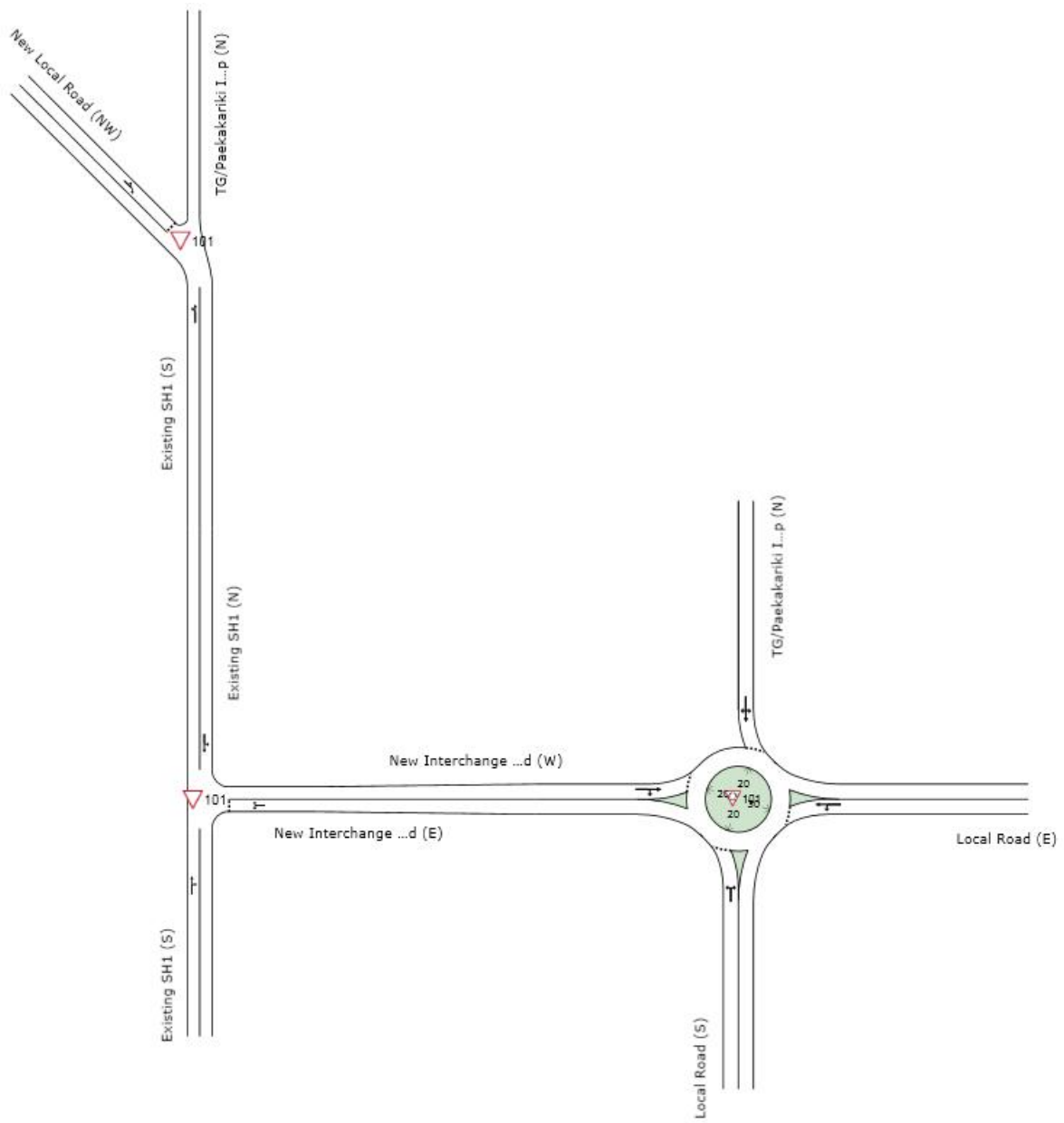
- Transmission Gully construction drawings were used to inform the SIDRA network
- Traffic lane widths and gradients have been set to default SIDRA settings
- The default peak flow period of 30 minutes and a peak flow factor of 95% was used
- SIDRA default roundabout island diameters and circulating traffic lane widths were used
- The baseline models were calibrated and validated by comparing the results to the Transmission Gully Operation Readiness SIDRA Traffic Modelling report, 2020 that was prepared by Aurecon for the Transport Agency

5.1.3 SIDRA Network Layouts

State Highway 1/Mackays Interchange



State Highway 1/Paekakariki Interchange



5.1.4 Level of Service Results

The modelling results indicate that the operation of the proposed Mackays CVSC would not change the Level of Service (LOS) at the Mackays Crossing and Paekakariki Interchanges from the baseline (Table 5-1 to 5-4). This is because for the baseline model has a LOS A for all approaches and the scenario models also have a LOS A.

SIDRA uses the Highway Capacity Manual definitions of LOS whereupon a LOS A confirms that traffic would be in free flow conditions with an average vehicle delay of less than 10 seconds.

	Baseline	Scenario 1: 5% trucks	Scenario 2: 20% trucks
T-junction			
Off ramp	LOS A	LOS A	LOS A
Whareroa Road	LOS A	LOS A	LOS A
New Local Road	LOS A	LOS A	LOS A
Roundabout			
Whareroa Farm	LOS A	LOS A	LOS A
Waterfall Road	LOS A	LOS A	LOS A
Off-ramp	LOS A	LOS A	LOS A
Whareroa Road	LOS A	LOS A	LOS A

Table 5-1: State Highway 1/Mackays Interchange Level of Service Results for the Morning Peak

	Baseline	Scenario 1: 5% trucks	Scenario 2: 20% trucks
T-junction			
Off ramp	LOS A	LOS A	LOS A
Whareroa Road	LOS A	LOS A	LOS A
New Local Road	LOS A	LOS A	LOS A
Roundabout			
Whareroa Farm	LOS A	LOS A	LOS A
Waterfall Road	LOS A	LOS A	LOS A
Off-ramp	LOS A	LOS A	LOS A
Whareroa Road	LOS A	LOS A	LOS A

Table 5-2: State Highway 1/Mackays Interchange Level of Service Results for the Afternoon Peak

	Baseline	Scenario 1: 5% trucks	Scenario 2: 20% trucks
T-junction			
Existing SH1	LOS A	LOS A	LOS A
New Local Road	LOS A	LOS A	LOS A

Table 5-3: State Highway 1/Paekakariki Interchange Level of Service Results for the Morning Peak

	Baseline	Scenario 1: 5% trucks	Scenario 2: 20% trucks
T-junction			
Existing SH1	LOS A	LOS A	LOS A
New Local Road	LOS A	LOS A	LOS A

Table 5-4: State Highway 1/ Paekakariki Interchange Level of Service Results for the Afternoon Peak

5.1.5 Average Delay Results

For average delay the modelling results show an insignificant increase in delay between the baseline model and the scenario models (Table 5-5 to 5-8). For the State Highway 1/ Mackays Interchange during the morning peak the largest increase in delay is the southbound off ramp approach to the roundabout. At this approach the base model has an average delay of 6.2 sec compared to 6.5 sec for the scenario 1 model and 7.1 sec for the scenario 2 model. For the State Highway 1/ Paekakariki Interchange during the morning peak the largest increase in delay is at the new local road approach to the T-junction. The baseline model has an average delay of 5.9 sec compared to 6.0 sec for the scenario 1 model and 6.3 sec for the scenario 2 model.

	Baseline	Scenario 1: 5% trucks	Scenario 2: 20% trucks
T-junction			
Off ramp	4.9 sec	5.0 sec	5.1 sec
Whareroa Road	0.0 sec	0.0 sec	0.0 sec
New Local Road	0.0 sec	0.0 sec	0.0 sec
Roundabout			
Whareroa Farm	3.9 sec	3.9 sec	4.1 sec
Waterfall Road	5.2 sec	5.3 sec	5.4 sec
Off-ramp	6.2 sec	6.5 sec	7.1 sec
Whareroa Road	7.0 sec	7.0 sec	7.0 sec

Table 5-5: State Highway 1/Mackays Interchange Average Delay Results for the Morning Peak

	Baseline	Scenario 1: 5% trucks	Scenario 2: 20% trucks
T-junction			
Off ramp	4.9 sec	5.0 sec	5.2 sec
Whareroa Road	0.0 sec	0.0 sec	0.0 sec
New Local Road	0.0 sec	0.0 sec	0.0 sec
Roundabout			
Whareroa Farm	3.9 sec	4.0 sec	4.1 sec
Waterfall Road	5.3 sec	5.3 sec	5.5 sec
Off-ramp	6.3 sec	6.5 sec	7.1 sec
Whareroa Road	7.0 sec	7.0 sec	7.0 sec

Table 5-6: State Highway 1/Mackays Interchange Average Delay Results for the Afternoon Peak

	Baseline	Scenario 1: 5% trucks	Scenario 2: 20% trucks
T-junction			
Existing SH1	1.1 sec	1.1 sec	1.2 sec
New Local Road	5.9 sec	6.0 sec	6.3 sec

Table 5-7: State Highway 1/Paekakariki Interchange Average Delay Results for the Morning Peak

	Baseline	Scenario 1: 5% trucks	Scenario 2: 20% trucks
T-junction			
Existing SH1	1.0 sec	1.1 sec	1.1 sec
New Local Road	6.0 sec	6.2 sec	6.6 sec

Table 5-8: State Highway 1/ Paekakariki Interchange Average Delay Results for the Afternoon Peak

5.1.6 Construction Traffic

The construction activities involved in developing the CVSC include:

- § Clearing and levelling the site;
- § Installing static weigh bridge plates;
- § Sealing driveway, circulation lanes, offload area and inspection bays;
- § Constructing inspection shed and compliance building; and
- § Installing the weigh in motion sensors and VMS signs (proposed to be completed as part of Transmission Gully construction works).

During the construction phase, all CVSC construction traffic movements will be controlled by an approved Construction Traffic Management Plan (CTMP). The section of State Highway 1 around the Mackays Crossing Interchange is already under temporary traffic management and a temporary speed limit restriction due to Transmission Gully construction work.

Construction traffic volumes are not expected to be any greater than the normal operating conditions of the CVSC, therefore with the application of an approved CTMP, the construction traffic demands can be easily accommodated on the local transport network.

5.2 Road Safety

To assess any potential impacts on road safety from the proposed CVSC site both the current crash history and the CVSC plans were reviewed. This is intended to be a high-level assessment against Austroad guidelines and does not replace a formal road safety audit which is to be completed at a later stage.

5.2.1 Current Road Safety

The recorded crash history surrounding the Mackays Interchange does not indicate that there is a current safety issue with the road network. This is because the majority of recorded crashes occurred on State Highway 1 which is a high-volume road which has been under temporary traffic management for Transmission Gully construction work.

5.2.2 Stopping Sight Distance

The proposed access road to the CVSC has a sight line distance of 100m. This sight line distance was assessed against the stopping sight distance (SSD) in the Austroads Guide to Road Design Part 3 Geometric Design¹. SSD is the distance that a normally alert driver, travelling at the design speed on a wet road would travel before reaching a hazard on the road ahead. The calculation for SSD is shown below;

$$SSD = \frac{R_T V}{3.6} + \frac{V^2}{254(d + 0.01a)}$$

where

- R_T = reaction time (sec)
- V = operating speed (km/h)
- d = coefficient of deceleration (longitudinal friction factor)
- a = longitudinal grade (% , + for upgrades and – for downgrades)

A standard reaction time of 2.5 seconds was used, the operating speed is the posted speed limit plus 10km/hr, the coefficient for deceleration is 0.36 and the gradient is 0%. This gives a minimum stopping sight distance of 80m which is less than the actual sight line distance provided at the CVSC access road.

5.2.3 Intersection Angle

The access road to the proposed CVSC meets the new link road at an angle of 104 degrees. Austroads Guide to Road Design, Part 4A Unsignalised and Signalised Intersections² contains the recommendation that road centrelines should be designed to intersect at between 70 and 110 degrees (Figure 5-1). At larger angles visibility for vehicles which need to give way becomes increasingly restricted because the driver needs to significantly change their driving position to view approaching traffic. The proposed CVSC meets the recommendation contained in Austroads however consideration should be given to aligning the access road to intersect with the new link road as close to 90 degrees as possible.

¹ <https://austroads.com.au/publications/road-design/agrd03>, page 128

² <https://austroads.com.au/publications/road-design/agrd04a>, page 129

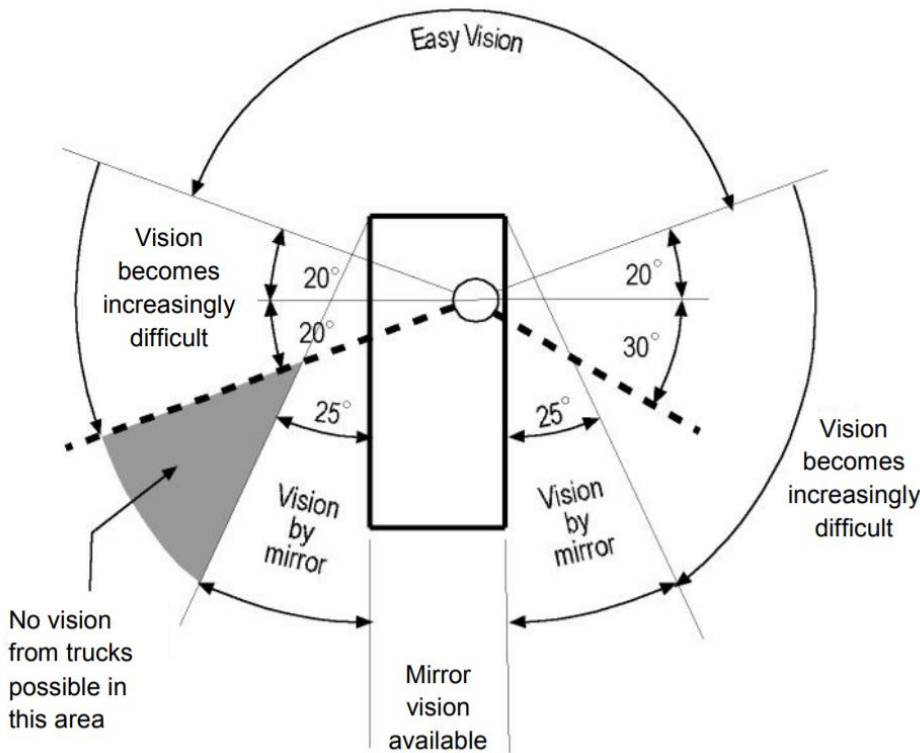


Figure 5-1: Visibility angles and sight restrictions due to vehicle design

5.2.4 Walking, Cycling and Bridleway Crossing

Currently people walking, cycling and riding horses use Whareroa Road, which has a shared path, to travel between Queen Elizabeth Park and Whareroa Farm. The proposed Mackays CVSC would increase traffic volumes using Whareroa Road and therefore an assessment of pedestrian crossing level of service (LOS) has been completed. The Client's Pedestrian Planning and Design Guidelines³ calculates pedestrian level of service based on the delay for crossing pedestrians and traffic volume. The traffic volume on the Mackays Interchange southbound off ramp is expected to be 50 vehicles per hour during the morning and afternoon peaks. With the proposed Mackays CVSC site it is expected that the traffic volume would increase to 60-100 vehicles per hour in the morning and afternoon peaks. The mean pedestrian delay was calculated using the Client's Guidelines for the Selection of Pedestrian Facilities⁴. For both the baseline with Transmission Gully and scenario with the Mackays CVSC the mean pedestrian delay was calculated as being 2 seconds. Under both the baseline situation and Mackays CVSC, pedestrians crossing the off ramp would have an excellent level of service (Figure 5-2).

³ <https://www.nzta.govt.nz/assets/resources/pedestrian-planning-guide/docs/pedestrian-planning-guide.pdf>

⁴ <https://www.nzta.govt.nz/assets/resources/pedestrian-planning-guide/docs/guidelines-selection-of-pedestrian-facilities.pdf>

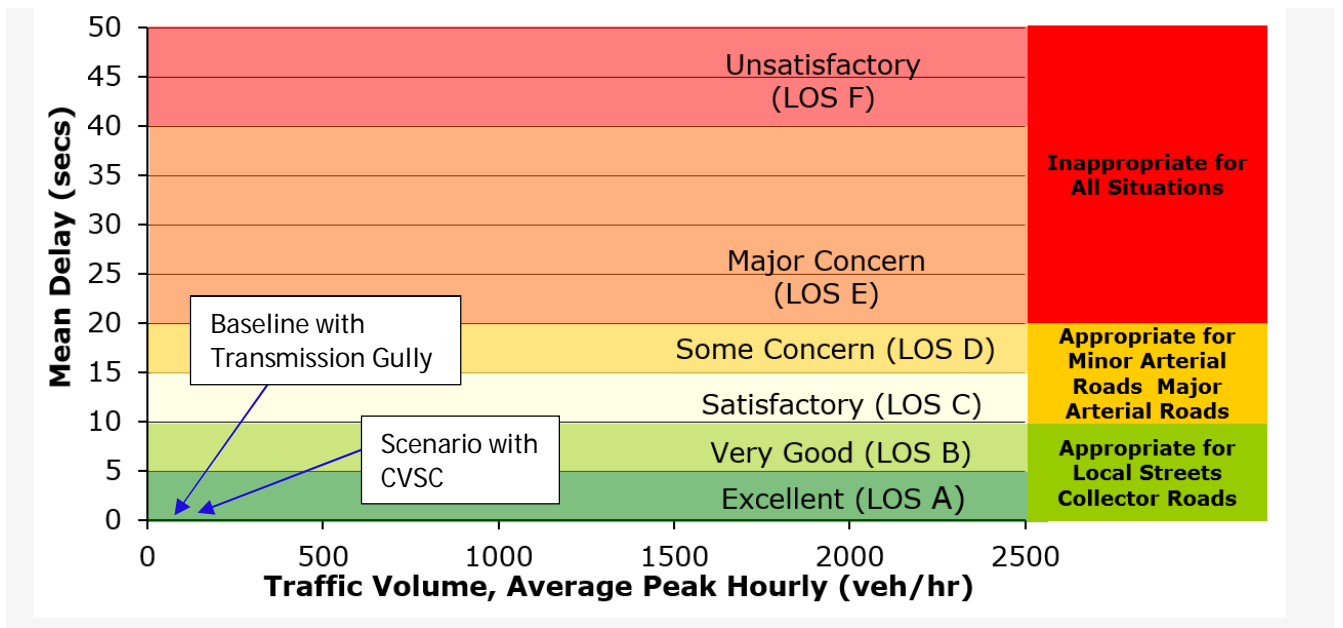


Figure 5-2: Pedestrian level of service graph from Pedestrian Planning and Design Guidelines

6. Compliance with Current Policy

6.1 Wellington Regional Land Transport Plan

The Weigh Right Programme is considered to have a very high policy alignment with the Wellington Regional Land Transport Plan 2015 and 2018 update. This is because two of the strategic objectives are to provide an efficient freight network and to ensure a safer regional transport system. The implementation of the Weigh Right Programme would reduce delays for HCVs that are compliant with weight limits would improve the performance of the freight network.

For road safety, over weight trucks present an increased risk to road users and therefore improved enforcement of the legal weight limits would help to improve wider road safety.

6.2 Kapiti Coast Operative District Plan 1999

The proposed Mackays CVSC complies with the relevant provisions in Part J: Parking, Loading and Access of the District Plan as shown in Table 6-1.

Reference	Standard	Proposal
J.1 Parking standards	2 parking spaces per 3 employees. The proposed CVSC site would have up to 10 staff which requires a minimum of 7 parking spaces	The proposed CVSC site has 17 marked light vehicle parking spaces
J.4.1(i) Access to be provided	For sites containing non-residential activities and which provide more than 6 carparks, two-way accesses shall be a minimum of 6m wide	The proposed accessway is 6m wide and allows for two-way access to the CVSC
J.4.1(ii) Vehicular access locations	No part of a crossing point shall be located within 30 metres of an intersection	The nearest intersection to the proposed CVSC site is 800m to the south
J.4.1(vi)(a) Vehicular access locations	The minimum sight distance between the access and the road shall be 85m for commercial activities	The unobstructed sight distance at the proposed CVSC accessway is 100m

Table 6-1: Part J: Parking, Loading and Access of the District Plan

7. Conclusion

This assessment concludes that the proposed Mackays CVSC would likely have only a minor effect on the surrounding transport network. This is because the modelling results indicate that there is sufficient capacity at the Mackays and Paekakariki Interchanges to accommodate the trips generated to the CVSC site.

No existing road safety issue was identified from the crash history of the Mackays Interchange and the proposed CVSC access road complies with Austroads guidelines. However, it is recommended that the access road to intersect with the new link road as close to 90 degrees as possible.

The Mackays CVSC and the wider Weigh Right Programme was assessed as having a high policy alignment due to the potential to improve freight efficiency and overall road safety.

Appendix A. Crash report

Plain English report

7 results from your query.

1-7 of 7

<u>Crash road</u>	<u>* Distance</u>	<u>Direction</u>	<u>Reference station</u>	<u>Route position</u>	<u>Side road</u>	<u>Easting</u>	<u>Northing</u>	<u>Longitude</u>	<u>Latitude</u>	<u>ID</u>	<u>Date</u>	<u>Day of week</u>	<u>Time</u>	Description of events	Crash factors	<u>Surface condition</u>
OFF ROAD - WHAREROA FARM						1766890	5462498	174.983490	-40.971622	201951412	23/02/2019	Sat	23:45	Car/Wagon1 NDB on Whareroa Farm car park hit Pedestrian2 (Age 28)	CAR/WAGON1, alcohol test below limit, other did not see or look for other party, PEDESTRIAN2, miscellaneous pedestrian, other driver or passenger boarding/leaving vehicle	Dry
SH 1	4m	N				1766861	5462580	174.983124	-40.970892	201983710	23/10/2019	Wed	13:30	Car/Wagon1 SDB on SH 1 changing lanes to left hit Van2, Car/Wagon1 hit armco (w-section steel), wire rope barrier	VAN2, alcohol test below limit, incorrect merging/diverging manoeuvre CAR/WAGON1, alcohol test below limit, attention diverted by cell phone, incorrect merging/diverging manoeuvre	Wet
SH 1N	0m					1766853	5462581	174.983017	-40.970890	201538842	17/04/2015	Fri	23:41	Car/Wagon1 NDB on SH 1N lost control but did not leave the road, Car/Wagon1 hit non specific guard rail	CAR/WAGON1, other fatigue, ENV: slippery road due to rain	Wet
SH 1N	60m	S				1766836	5462522	174.982834	-40.971424	201630283	03/01/2016	Sun	13:45	Car/Wagon1 SDB on SH 1N lost control; went off road to left, Car/Wagon1 hit non specific pole, non specific traffic sign	CAR/WAGON1, inappropriate speed for weather conditions, lost control - road conditions, mixed treads/space savers, ENV: heavy rain	Wet
SH 1N	0m					1766853	5462581	174.983017	-40.970890	201632781	07/02/2016	Sun	12:03	Car/Wagon1 NDB on SH 1N hit rear end of Car/Wagon2 stop/slow for queue	CAR/WAGON1, following too closely, wrong pedal/foot slipped	Dry
WHAREROA ON SBD		I		WHAREROA ROAD		1766897	5462567	174.983551	-40.971004	201911297	19/01/2019	Sat	12:10	Motorcycle1 EDB on WHAREROA ROAD ON RAMP, PAKAKARIKI, KAPITI COAST lost control turning right	MOTORCYCLE1, lost control under acceleration	Wet

Mackays Transport Assessment

<u>Crash road</u>	<u>Distance</u>	<u>Direction</u>	<u>Reference station</u>	<u>Route position</u>	<u>Side road</u>	<u>Easting</u>	<u>Northing</u>	<u>Longitude</u>	<u>Latitude</u>	<u>ID</u>	<u>Date</u>	<u>Day of week</u>	<u>Time</u>	<u>Description of events</u>	<u>Crash factors</u>	<u>Surface condition</u>
WHAREROA ROAD OFF RAMP		I			WHAREROA ROAD	1766901	5462571	174.983597	-40.970959	201950066	26/01/2019	Sat	01:24	Car/Wagon1 SDB on State Highway One lost control turning right but did not leave the road, Car/Wagon1 hit retaining wall, non specific traffic sign	CAR/WAGON1, alcohol test above limit or test refused, evading enforcement, speed entering corner/curve	Dry

Appendix B. Movement Summary – SH1/Mackays Crossing Interchange

Baseline: Northbound Off-Ramp Morning Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1 NB Off-Ramp (S)												
1	L2	63	0.0	0.106	4.7	LOS A	0.4	2.8	0.15	0.52	0.15	46.8
3	R2	74	0.0	0.106	5.1	LOS A	0.4	2.8	0.15	0.52	0.15	45.9
Approach		137	0.0	0.106	4.9	LOS A	0.4	2.8	0.15	0.52	0.15	46.3
East: Whareroa Road (E)												
5	T1	53	0.0	0.027	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		53	0.0	0.027	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
West: New Local Road (W)												
11	T1	105	0.0	0.054	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		105	0.0	0.054	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
All Vehicles		295	0.0	0.106	2.3	NA	0.4	2.8	0.07	0.24	0.07	48.2

Mackays Transport Assessment

Baseline: Southbound Off-Ramp Morning Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows		Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
		Total veh/h	HV %				Vehicles veh	Distance m				
SouthEast: Whareroa Farm (SE)												
21b	L3	11	0.0	0.019	4.0	LOS A	0.1	0.6	0.34	0.44	0.34	46.8
21a	L1	11	0.0	0.019	3.4	LOS A	0.1	0.6	0.34	0.44	0.34	47.9
23	R2	1	0.0	0.019	8.2	LOS A	0.1	0.6	0.34	0.44	0.34	48.4
Approach		22	0.0	0.019	3.9	LOS A	0.1	0.6	0.34	0.44	0.34	47.4
NorthEast: Waterfall Road (NE)												
24	L2	1	0.0	0.019	3.7	LOS A	0.1	0.6	0.34	0.48	0.34	46.4
24a	L1	11	0.0	0.019	3.4	LOS A	0.1	0.6	0.34	0.48	0.34	47.1
26a	R1	11	0.0	0.019	7.2	LOS A	0.1	0.6	0.34	0.48	0.34	47.2
Approach		22	0.0	0.019	5.2	LOS A	0.1	0.6	0.34	0.48	0.34	47.1
North: SH1 SB Off-Ramp (Entry) (N)												
7b	L3	11	0.0	0.044	3.9	LOS A	0.2	1.4	0.32	0.54	0.32	45.6
7a	L1	11	0.0	0.044	3.3	LOS A	0.2	1.4	0.32	0.54	0.32	46.6
8	T1	1	0.0	0.044	3.6	LOS A	0.2	1.4	0.32	0.54	0.32	46.9
9	R2	32	0.0	0.044	8.1	LOS A	0.2	1.4	0.32	0.54	0.32	47.1
Approach		54	0.0	0.044	6.2	LOS A	0.2	1.4	0.32	0.54	0.32	46.7
West: Whareroa Road (W)												
10a	L1	11	0.0	0.103	2.5	LOS A	0.6	4.0	0.02	0.60	0.02	46.4
12a	R1	11	0.0	0.103	6.4	LOS A	0.6	4.0	0.02	0.60	0.02	46.5
12	R2	158	0.0	0.103	7.3	LOS A	0.6	4.0	0.02	0.60	0.02	47.0
Approach		179	0.0	0.103	7.0	LOS A	0.6	4.0	0.02	0.60	0.02	46.9
All Vehicles		277	0.0	0.103	6.4	LOS A	0.6	4.0	0.13	0.57	0.13	46.9

Mackays Transport Assessment

Baseline: Northbound Off-Ramp Afternoon Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows		Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
		Total veh/h	HV %				Vehicles veh	Distance m				
South: SH1 NB Off-Ramp (S)												
1	L2	63	0.0	0.115	4.7	LOS A	0.4	3.0	0.16	0.52	0.16	46.8
3	R2	84	0.0	0.115	5.2	LOS A	0.4	3.0	0.16	0.52	0.16	45.9
Approach		147	0.0	0.115	4.9	LOS A	0.4	3.0	0.16	0.52	0.16	46.3
East: Whareroa Road (E)												
5	T1	53	0.0	0.027	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		53	0.0	0.027	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
West: New Local Road (W)												
11	T1	105	0.0	0.054	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		105	0.0	0.054	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
All Vehicles		305	0.0	0.115	2.4	NA	0.4	3.0	0.08	0.25	0.08	48.1

Mackays Transport Assessment

Baseline: Southbound Off-Ramp Afternoon Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
SouthEast: Whareroa Farm (SE)												
21b	L3	11	0.0	0.019	4.0	LOS A	0.1	0.6	0.35	0.44	0.35	46.7
21a	L1	11	0.0	0.019	3.4	LOS A	0.1	0.6	0.35	0.44	0.35	47.8
23	R2	1	0.0	0.019	8.2	LOS A	0.1	0.6	0.35	0.44	0.35	48.4
Approach		22	0.0	0.019	3.9	LOS A	0.1	0.6	0.35	0.44	0.35	47.3
NorthEast: Waterfall Road (NE)												
24	L2	1	0.0	0.019	3.8	LOS A	0.1	0.6	0.35	0.49	0.35	46.3
24a	L1	11	0.0	0.019	3.4	LOS A	0.1	0.6	0.35	0.49	0.35	47.0
26a	R1	11	0.0	0.019	7.3	LOS A	0.1	0.6	0.35	0.49	0.35	47.1
Approach		22	0.0	0.019	5.3	LOS A	0.1	0.6	0.35	0.49	0.35	47.1
North: SH1 SB Off-Ramp (Entry) (N)												
7b	L3	11	0.0	0.045	3.9	LOS A	0.2	1.5	0.33	0.54	0.33	45.5
7a	L1	11	0.0	0.045	3.3	LOS A	0.2	1.5	0.33	0.54	0.33	46.5
8	T1	1	0.0	0.045	3.6	LOS A	0.2	1.5	0.33	0.54	0.33	46.9
9	R2	32	0.0	0.045	8.1	LOS A	0.2	1.5	0.33	0.54	0.33	47.1
Approach		54	0.0	0.045	6.3	LOS A	0.2	1.5	0.33	0.54	0.33	46.7
West: Whareroa Road (W)												
10a	L1	11	0.0	0.109	2.5	LOS A	0.6	4.2	0.02	0.60	0.02	46.4
12a	R1	11	0.0	0.109	6.4	LOS A	0.6	4.2	0.02	0.60	0.02	46.5
12	R2	168	0.0	0.109	7.3	LOS A	0.6	4.2	0.02	0.60	0.02	46.9
Approach		189	0.0	0.109	7.0	LOS A	0.6	4.2	0.02	0.60	0.02	46.9
All Vehicles		287	0.0	0.109	6.5	LOS A	0.6	4.2	0.13	0.57	0.13	46.9

Mackays Transport Assessment

Scenario 1: Northbound Off-Ramp Morning Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: SH1 NB Off-Ramp (S)												
1	L2	66	4.8	0.110	4.7	LOS A	0.4	2.9	0.16	0.52	0.16	46.7
3	R2	74	0.0	0.110	5.2	LOS A	0.4	2.9	0.16	0.52	0.16	45.8
Approach		140	2.3	0.110	5.0	LOS A	0.4	2.9	0.16	0.52	0.16	46.3
East: Whareroa Road (E)												
5	T1	57	7.4	0.031	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		57	7.4	0.031	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
West: New Local Road (W)												
11	T1	109	3.8	0.058	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		109	3.8	0.058	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
All Vehicles		306	3.8	0.110	2.3	NA	0.4	2.9	0.07	0.24	0.07	48.2

Mackays Transport Assessment

Scenario 1: Southbound Off-Ramp Morning Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Whareroa Farm (SE)												
21b	L3	11	0.0	0.019	4.0	LOS A	0.1	0.6	0.35	0.44	0.35	46.7
21a	L1	11	0.0	0.019	3.4	LOS A	0.1	0.6	0.35	0.44	0.35	47.8
23	R2	1	0.0	0.019	8.2	LOS A	0.1	0.6	0.35	0.44	0.35	48.4
Approach		22	0.0	0.019	3.9	LOS A	0.1	0.6	0.35	0.44	0.35	47.3
NorthEast: Waterfall Road (NE)												
24	L2	1	0.0	0.019	3.8	LOS A	0.1	0.6	0.35	0.49	0.35	46.3
24a	L1	11	0.0	0.019	3.4	LOS A	0.1	0.6	0.35	0.49	0.35	47.0
26a	R1	11	0.0	0.019	7.3	LOS A	0.1	0.6	0.35	0.49	0.35	47.1
Approach		22	0.0	0.019	5.3	LOS A	0.1	0.6	0.35	0.49	0.35	47.0
North: SH1 SB Off-Ramp (Entry) (N)												
7b	L3	11	0.0	0.050	3.9	LOS A	0.2	1.7	0.33	0.54	0.33	45.5
7a	L1	11	0.0	0.050	3.3	LOS A	0.2	1.7	0.33	0.54	0.33	46.5
8	T1	1	0.0	0.050	3.6	LOS A	0.2	1.7	0.33	0.54	0.33	46.9
9	R2	36	11.8	0.050	8.3	LOS A	0.2	1.7	0.33	0.54	0.33	46.9
Approach		58	7.3	0.050	6.5	LOS A	0.2	1.7	0.33	0.54	0.33	46.6
West: Whareroa Road (W)												
10a	L1	11	0.0	0.107	2.5	LOS A	0.6	4.2	0.02	0.60	0.02	46.4
12a	R1	11	0.0	0.107	6.4	LOS A	0.6	4.2	0.02	0.60	0.02	46.5
12	R2	162	2.6	0.107	7.3	LOS A	0.6	4.2	0.02	0.60	0.02	46.9
Approach		183	2.3	0.107	7.0	LOS A	0.6	4.2	0.02	0.60	0.02	46.9
All Vehicles		285	3.0	0.107	6.5	LOS A	0.6	4.2	0.13	0.57	0.13	46.9

Scenario 1: Northbound Off-Ramp Afternoon Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: SH1 NB Off-Ramp (S)												
1	L2	67	6.3	0.120	4.7	LOS A	0.5	3.2	0.17	0.52	0.17	46.7
3	R2	84	0.0	0.120	5.2	LOS A	0.5	3.2	0.17	0.52	0.17	45.8
Approach		152	2.8	0.120	5.0	LOS A	0.5	3.2	0.17	0.52	0.17	46.2
East: Whareroa Road (E)												
5	T1	56	5.7	0.030	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		56	5.7	0.030	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
West: New Local Road (W)												
11	T1	108	2.9	0.057	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		108	2.9	0.057	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
All Vehicles		316	3.3	0.120	2.4	NA	0.5	3.2	0.08	0.25	0.08	48.1

Mackays Transport Assessment

Scenario 1: Southbound Off-Ramp Afternoon Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
SouthEast: Whareroa Farm (SE)												
21b	L3	11	0.0	0.019	4.1	LOS A	0.1	0.6	0.36	0.44	0.36	46.7
21a	L1	11	0.0	0.019	3.5	LOS A	0.1	0.6	0.36	0.44	0.36	47.8
23	R2	1	0.0	0.019	8.3	LOS A	0.1	0.6	0.36	0.44	0.36	48.4
Approach		22	0.0	0.019	4.0	LOS A	0.1	0.6	0.36	0.44	0.36	47.3
NorthEast: Waterfall Road (NE)												
24	L2	1	0.0	0.019	3.8	LOS A	0.1	0.6	0.36	0.49	0.36	46.3
24a	L1	11	0.0	0.019	3.5	LOS A	0.1	0.6	0.36	0.49	0.36	47.0
26a	R1	11	0.0	0.019	7.3	LOS A	0.1	0.6	0.36	0.49	0.36	47.1
Approach		22	0.0	0.019	5.3	LOS A	0.1	0.6	0.36	0.49	0.36	47.0
North: SH1 SB Off-Ramp (Entry) (N)												
7b	L3	11	0.0	0.049	4.0	LOS A	0.2	1.7	0.34	0.54	0.34	45.5
7a	L1	11	0.0	0.049	3.3	LOS A	0.2	1.7	0.34	0.54	0.34	46.5
8	T1	1	0.0	0.049	3.6	LOS A	0.2	1.7	0.34	0.54	0.34	46.9
9	R2	35	9.1	0.049	8.3	LOS A	0.2	1.7	0.34	0.54	0.34	46.9
Approach		57	5.6	0.049	6.5	LOS A	0.2	1.7	0.34	0.54	0.34	46.6
West: Whareroa Road (W)												
10a	L1	11	0.0	0.112	2.5	LOS A	0.6	4.4	0.02	0.60	0.02	46.4
12a	R1	11	0.0	0.112	6.4	LOS A	0.6	4.4	0.02	0.60	0.02	46.5
12	R2	172	1.8	0.112	7.3	LOS A	0.6	4.4	0.02	0.60	0.02	46.9
Approach		193	1.6	0.112	7.0	LOS A	0.6	4.4	0.02	0.60	0.02	46.9
All Vehicles		294	2.2	0.112	6.5	LOS A	0.6	4.4	0.13	0.57	0.13	46.9

Mackays Transport Assessment

Scenario 2: Northbound Off-Ramp Morning Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: SH1 NB Off-Ramp (S)												
1	L2	75	15.5	0.121	4.9	LOS A	0.5	3.4	0.19	0.52	0.19	46.5
3	R2	74	0.0	0.121	5.3	LOS A	0.5	3.4	0.19	0.52	0.19	45.8
Approach		148	7.8	0.121	5.1	LOS A	0.5	3.4	0.19	0.52	0.19	46.2
East: Whareroa Road (E)												
5	T1	67	21.9	0.039	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		67	21.9	0.039	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
West: New Local Road (W)												
11	T1	120	12.3	0.066	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		120	12.3	0.066	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
All Vehicles		336	12.2	0.121	2.3	NA	0.5	3.4	0.08	0.23	0.08	48.2

Mackays Transport Assessment

Scenario 2: Southbound Off-Ramp Morning Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
SouthEast: Whareroa Farm (SE)												
21b	L3	11	0.0	0.019	4.2	LOS A	0.1	0.6	0.38	0.45	0.38	46.7
21a	L1	11	0.0	0.019	3.6	LOS A	0.1	0.6	0.38	0.45	0.38	47.8
23	R2	1	0.0	0.019	8.4	LOS A	0.1	0.6	0.38	0.45	0.38	48.3
Approach		22	0.0	0.019	4.1	LOS A	0.1	0.6	0.38	0.45	0.38	47.3
NorthEast: Waterfall Road (NE)												
24	L2	1	0.0	0.019	3.9	LOS A	0.1	0.6	0.38	0.50	0.38	46.3
24a	L1	11	0.0	0.019	3.6	LOS A	0.1	0.6	0.38	0.50	0.38	47.0
26a	R1	11	0.0	0.019	7.4	LOS A	0.1	0.6	0.38	0.50	0.38	47.1
Approach		22	0.0	0.019	5.4	LOS A	0.1	0.6	0.38	0.50	0.38	47.0
North: SH1 SB Off-Ramp (Entry) (N)												
7b	L3	11	0.0	0.065	4.0	LOS A	0.3	2.5	0.36	0.56	0.36	45.4
7a	L1	11	0.0	0.065	3.4	LOS A	0.3	2.5	0.36	0.56	0.36	46.5
8	T1	1	0.0	0.065	3.7	LOS A	0.3	2.5	0.36	0.56	0.36	46.8
9	R2	46	31.8	0.065	8.7	LOS A	0.3	2.5	0.36	0.56	0.36	46.6
Approach		68	21.5	0.065	7.1	LOS A	0.3	2.5	0.36	0.56	0.36	46.4
West: Whareroa Road (W)												
10a	L1	11	0.0	0.116	2.5	LOS A	0.7	4.9	0.02	0.60	0.02	46.4
12a	R1	11	0.0	0.116	6.4	LOS A	0.7	4.9	0.02	0.60	0.02	46.5
12	R2	173	8.5	0.116	7.4	LOS A	0.7	4.9	0.02	0.60	0.02	46.8
Approach		194	7.6	0.116	7.0	LOS A	0.7	4.9	0.02	0.60	0.02	46.8
All Vehicles		306	9.6	0.116	6.7	LOS A	0.7	4.9	0.15	0.57	0.15	46.8

Mackays Transport Assessment

Scenario 2: Northbound Off-Ramp Afternoon Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
South: SH1 NB Off-Ramp (S)												
1	L2	81	22.1	0.136	5.0	LOS A	0.5	4.0	0.19	0.52	0.19	46.5
3	R2	84	0.0	0.136	5.3	LOS A	0.5	4.0	0.19	0.52	0.19	45.8
Approach		165	10.8	0.136	5.2	LOS A	0.5	4.0	0.19	0.52	0.19	46.1
East: Whareroa Road (E)												
5	T1	66	20.6	0.039	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		66	20.6	0.039	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
West: New Local Road (W)												
11	T1	119	11.5	0.066	0.0	LOS A	0.0	0.0	0.00	0.00	0.00	50.0
Approach		119	11.5	0.066	0.0	NA	0.0	0.0	0.00	0.00	0.00	50.0
All Vehicles		351	12.9	0.136	2.4	NA	0.5	4.0	0.09	0.25	0.09	48.1

Mackays Transport Assessment

Scenario 2: Southbound Off-Ramp Afternoon Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows		Deg. Satn	Average Delay	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed
		Total veh/h	HV %	v/c	sec		Vehicles veh	Distance m				km/h
SouthEast: Whareroa Farm (SE)												
21b	L3	11	0.0	0.019	4.2	LOS A	0.1	0.6	0.38	0.45	0.38	46.6
21a	L1	11	0.0	0.019	3.6	LOS A	0.1	0.6	0.38	0.45	0.38	47.7
23	R2	1	0.0	0.019	8.4	LOS A	0.1	0.6	0.38	0.45	0.38	48.3
Approach		22	0.0	0.019	4.1	LOS A	0.1	0.6	0.38	0.45	0.38	47.2
NorthEast: Waterfall Road (NE)												
24	L2	1	0.0	0.019	3.9	LOS A	0.1	0.6	0.38	0.50	0.38	46.3
24a	L1	11	0.0	0.019	3.6	LOS A	0.1	0.6	0.38	0.50	0.38	47.0
26a	R1	11	0.0	0.019	7.5	LOS A	0.1	0.6	0.38	0.50	0.38	47.1
Approach		22	0.0	0.019	5.5	LOS A	0.1	0.6	0.38	0.50	0.38	47.0
North: SH1 SB Off-Ramp (Entry) (N)												
7b	L3	11	0.0	0.064	4.0	LOS A	0.3	2.5	0.36	0.56	0.36	45.4
7a	L1	11	0.0	0.064	3.4	LOS A	0.3	2.5	0.36	0.56	0.36	46.4
8	T1	1	0.0	0.064	3.7	LOS A	0.3	2.5	0.36	0.56	0.36	46.8
9	R2	45	30.2	0.064	8.8	LOS A	0.3	2.5	0.36	0.56	0.36	46.6
Approach		67	20.3	0.064	7.1	LOS A	0.3	2.5	0.36	0.56	0.36	46.4
West: Whareroa Road (W)												
10a	L1	11	0.0	0.121	2.5	LOS A	0.7	5.1	0.02	0.60	0.02	46.4
12a	R1	11	0.0	0.121	6.4	LOS A	0.7	5.1	0.02	0.60	0.02	46.5
12	R2	182	7.5	0.121	7.4	LOS A	0.7	5.1	0.02	0.60	0.02	46.9
Approach		203	6.7	0.121	7.0	LOS A	0.7	5.1	0.02	0.60	0.02	46.8
All Vehicles		315	8.7	0.121	6.7	LOS A	0.7	5.1	0.14	0.57	0.14	46.8

Appendix C. Movement Summary – SH1/Paekakariki Interchange

Baseline: Northbound On-Ramp Morning Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows		Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
		Total veh/h	HV %				Vehicles veh	Distance m				
South: Existing SH1 (S)												
1a	L1	105	0.0	0.220	4.5	LOS A	0.0	0.0	0.00	0.14	0.00	48.3
2	T1	322	0.0	0.220	0.0	LOS A	0.0	0.0	0.00	0.14	0.00	49.2
Approach		427	0.0	0.220	1.1	NA	0.0	0.0	0.00	0.14	0.00	49.0
NorthWest: New Local Road (NW)												
27b	L3	53	0.0	0.103	6.5	LOS A	0.4	2.6	0.37	0.61	0.37	46.0
29a	R1	63	0.0	0.103	5.3	LOS A	0.4	2.6	0.37	0.61	0.37	45.5
Approach		116	0.0	0.103	5.9	LOS A	0.4	2.6	0.37	0.61	0.37	45.7
All Vehicles		543	0.0	0.220	2.1	NA	0.4	2.6	0.08	0.24	0.08	48.3

Baseline: Northbound On-Ramp Afternoon Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Flows		Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
		Total veh/h	HV %				Vehicles veh	Distance m				
South: Existing SH1 (S)												
1a	L1	105	0.0	0.236	4.5	LOS A	0.0	0.0	0.00	0.13	0.00	48.3
2	T1	354	0.0	0.236	0.0	LOS A	0.0	0.0	0.00	0.13	0.00	49.3
Approach		459	0.0	0.236	1.0	NA	0.0	0.0	0.00	0.13	0.00	49.1
NorthWest: New Local Road (NW)												
27b	L3	53	0.0	0.106	6.7	LOS A	0.4	2.6	0.39	0.63	0.39	46.0
29a	R1	63	0.0	0.106	5.4	LOS A	0.4	2.6	0.39	0.63	0.39	45.4
Approach		116	0.0	0.106	6.0	LOS A	0.4	2.6	0.39	0.63	0.39	45.7
All Vehicles		575	0.0	0.236	2.0	NA	0.4	2.6	0.08	0.23	0.08	48.3

Mackays Transport Assessment

Scenario 1: Northbound On-Ramp Morning Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Existing SH1 (S)												
1a	L1	106	1.0	0.221	4.5	LOS A	0.0	0.0	0.00	0.14	0.00	48.3
2	T1	322	0.0	0.221	0.0	LOS A	0.0	0.0	0.00	0.14	0.00	49.2
Approach		428	0.2	0.221	1.1	NA	0.0	0.0	0.00	0.14	0.00	49.0
NorthWest: New Local Road (NW)												
27b	L3	57	7.4	0.109	6.7	LOS A	0.4	2.8	0.38	0.62	0.38	45.9
29a	R1	63	0.0	0.109	5.3	LOS A	0.4	2.8	0.38	0.62	0.38	45.4
Approach		120	3.5	0.109	6.0	LOS A	0.4	2.8	0.38	0.62	0.38	45.7
All Vehicles		548	1.0	0.221	2.2	NA	0.4	2.8	0.08	0.24	0.08	48.2

Scenario 1: Northbound On-Ramp Afternoon Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Existing SH1 (S)												
1a	L1	106	1.0	0.237	4.5	LOS A	0.0	0.0	0.00	0.13	0.00	48.3
2	T1	354	0.0	0.237	0.0	LOS A	0.0	0.0	0.00	0.13	0.00	49.3
Approach		460	0.2	0.237	1.1	NA	0.0	0.0	0.00	0.13	0.00	49.1
NorthWest: New Local Road (NW)												
27b	L3	58	9.1	0.114	6.9	LOS A	0.4	3.0	0.40	0.63	0.40	45.9
29a	R1	63	0.0	0.114	5.5	LOS A	0.4	3.0	0.40	0.63	0.40	45.4
Approach		121	4.3	0.114	6.2	LOS A	0.4	3.0	0.40	0.63	0.40	45.6
All Vehicles		581	1.1	0.237	2.1	NA	0.4	3.0	0.08	0.23	0.08	48.3

Mackays Transport Assessment

Scenario 2: Northbound On-Ramp Morning Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
							Vehicles veh	Distance m				
South: Existing SH1 (S)												
1a	L1	111	4.8	0.225	4.5	LOS A	0.0	0.0	0.00	0.14	0.00	48.2
2	T1	322	0.0	0.225	0.0	LOS A	0.0	0.0	0.00	0.14	0.00	49.2
Approach		433	1.2	0.225	1.2	NA	0.0	0.0	0.00	0.14	0.00	49.0
NorthWest: New Local Road (NW)												
27b	L3	69	24.2	0.126	7.1	LOS A	0.5	3.6	0.40	0.63	0.40	45.7
29a	R1	63	0.0	0.126	5.3	LOS A	0.5	3.6	0.40	0.63	0.40	45.4
Approach		133	12.7	0.126	6.3	LOS A	0.5	3.6	0.40	0.63	0.40	45.5
All Vehicles		565	3.9	0.225	2.4	NA	0.5	3.6	0.09	0.26	0.09	48.1

Scenario 2: Northbound On-Ramp Afternoon Peak

Movement Performance - Vehicles												
Mov ID	Turn	Demand Total veh/h	Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue		Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
							Vehicles veh	Distance m				
South: Existing SH1 (S)												
1a	L1	111	4.8	0.241	4.5	LOS A	0.0	0.0	0.00	0.13	0.00	48.3
2	T1	354	0.0	0.241	0.0	LOS A	0.0	0.0	0.00	0.13	0.00	49.3
Approach		464	1.1	0.241	1.1	NA	0.0	0.0	0.00	0.13	0.00	49.0
NorthWest: New Local Road (NW)												
27b	L3	76	30.6	0.140	7.5	LOS A	0.5	4.2	0.42	0.65	0.42	45.5
29a	R1	63	0.0	0.140	5.5	LOS A	0.5	4.2	0.42	0.65	0.42	45.3
Approach		139	16.7	0.140	6.6	LOS A	0.5	4.2	0.42	0.65	0.42	45.4
All Vehicles		603	4.7	0.241	2.4	NA	0.5	4.2	0.10	0.25	0.10	48.1